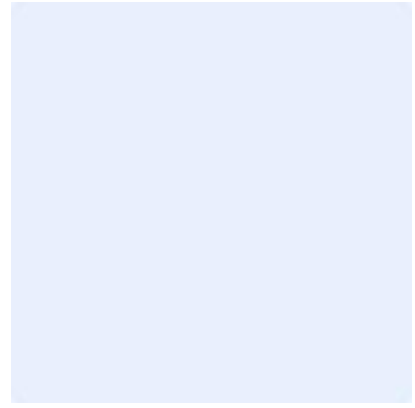




# **ZXMW NR9150 Product Description**

**Digital Microwave Transmission System**

**R7.6**





## ZXMW NR9150 Product Description

| Version | Date | Author | Reviewer | Note |
|---------|------|--------|----------|------|
| ...     | ...  | ...    | ...      | ...  |
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# TABLE OF CONTENTS

|                                                                |           |
|----------------------------------------------------------------|-----------|
| <b>1 Overview .....</b>                                        | <b>12</b> |
| 1.1 Future Oriented NR9150 .....                               | 12        |
| 1.2 NR9150 System Introduction .....                           | 12        |
| 1.2.1 IDU Introduction .....                                   | 12        |
| 1.2.2 ODU Introduction .....                                   | 13        |
| 1.2.3 Coupling unit .....                                      | 18        |
| <b>2 Functions and Features .....</b>                          | <b>19</b> |
| 2.1 Powerful Hardware Platform .....                           | 19        |
| 2.1.1 An Unified Platform for Packet Microwave Radio .....     | 19        |
| 2.1.2 Powerful Switching Capability .....                      | 20        |
| 2.1.3 Flexible Modular Design .....                            | 20        |
| 2.1.4 High Reliability Design .....                            | 20        |
| 2.1.5 Energy Saving Design .....                               | 20        |
| 2.2 Enhanced Radio Features .....                              | 22        |
| 2.2.1 Modem Baseband Signal Processing .....                   | 22        |
| 2.2.2 ATPC (Automatic Transmit Power Control) .....            | 22        |
| 2.2.3 ACM (Adaptive Coding & Modulation) .....                 | 23        |
| 2.2.4 XPIC (CCDP) .....                                        | 24        |
| 2.2.5 MIMO (Multiple Input Multiple Output) .....              | 25        |
| 2.2.6 CA (Carrier Aggregation) .....                           | 27        |
| 2.2.7 CoMP SD (Coordinated Multi-Points Space Diversity) ..... | 28        |
| 2.2.8 MBL (Multi-band Link) .....                              | 29        |
| 2.2.9 CCIC (Co-Channel Interference Cancellation) .....        | 30        |
| 2.2.10 High System Gain Technique .....                        | 31        |
| 2.3 Intelligent Service Processing .....                       | 32        |
| 2.3.1 Native-like TDM function .....                           | 32        |
| 2.3.2 Carrier Grade Ethernet Function .....                    | 32        |
| 2.3.3 IP/MPLS Function .....                                   | 34        |

|        |                                                             |    |
|--------|-------------------------------------------------------------|----|
| 2.3.4  | Segment Routing .....                                       | 35 |
| 2.3.5  | SDN for Deploying an Agile & Flexible Network .....         | 36 |
| 2.3.6  | Low Latency Design .....                                    | 38 |
| 2.3.7  | Load Balance .....                                          | 38 |
| 2.3.8  | Frame Compression .....                                     | 40 |
| 2.3.9  | QoS/HQoS .....                                              | 40 |
| 2.3.10 | Bandwidth Notification Message .....                        | 41 |
| 2.4    | High Accuracy Clock Supply and Synchronization .....        | 42 |
| 2.5    | Protection and Resilience .....                             | 42 |
| 2.6    | Network Security .....                                      | 43 |
| 2.6.1  | Access Control List (ACL) .....                             | 43 |
| 2.6.2  | Broadcast Storm Control .....                               | 43 |
| 2.6.3  | Link Security ID (Radio Link Security Identification) ..... | 44 |
| 2.6.4  | Security Key System .....                                   | 44 |
| 2.6.5  | User Authorization .....                                    | 44 |
| 2.6.6  | Radio Link Encryption .....                                 | 45 |
| 2.6.7  | Anti-Theft .....                                            | 45 |
| 2.7    | Management and Maintenance .....                            | 45 |
| 2.7.1  | Frequency Auto-scanning .....                               | 45 |
| 2.7.2  | Wi-Fi Access .....                                          | 46 |
| 2.7.3  | Smart DCN .....                                             | 46 |
| 2.7.4  | Ethernet OAM .....                                          | 47 |
| 2.7.5  | MPLS OAM .....                                              | 50 |
| 2.7.6  | MPLS-TP OAM .....                                           | 50 |
| 2.7.7  | SR OAM .....                                                | 52 |
| 2.7.8  | SQA (Service Quality Analyzer) .....                        | 52 |
| 2.7.9  | Intelligent License Control .....                           | 53 |
| 2.7.10 | Full Scale Management Solution .....                        | 54 |
| 2.7.11 | TAMP (Traffic Aware Multi-channel Power Saving) .....       | 54 |
| 2.7.12 | TAPC (Traffic Aware Power Control) .....                    | 55 |

|          |                                                  |           |
|----------|--------------------------------------------------|-----------|
| <b>3</b> | <b>Hardware Description .....</b>                | <b>56</b> |
| 3.1      | IDU Structure .....                              | 56        |
| 3.2      | ODU Structure .....                              | 59        |
| 3.3      | Boards and Interfaces .....                      | 60        |
| 3.3.1    | CSA board .....                                  | 60        |
| 3.3.2    | CSA2 board .....                                 | 62        |
| 3.3.3    | CSA4 board .....                                 | 64        |
| 3.3.4    | CSA2 v2 board .....                              | 66        |
| 3.3.5    | MD2 board .....                                  | 67        |
| 3.3.6    | MD2 v2 board .....                               | 69        |
| 3.3.7    | MD4 board .....                                  | 70        |
| 3.3.8    | ME2 board .....                                  | 72        |
| 3.3.9    | IEA board (4×GE(e) + 2×10GE(o)) .....            | 73        |
| 3.3.10   | IEB board (2×GE(o) + 4×10GE(o)) .....            | 74        |
| 3.3.11   | IED board (1×GE (o) + 1x10GE + 1×25GE (o)) ..... | 74        |
| 3.3.12   | IEM2 board (2×10GE(o)) .....                     | 75        |
| 3.3.13   | ITA board (16×E1 (PWE3)) .....                   | 76        |
| 3.3.14   | ITD board (2×STM-1) .....                        | 76        |
| 3.3.15   | FA board .....                                   | 77        |
| <b>4</b> | <b>NMS: Network Management System .....</b>      | <b>78</b> |
| 4.1      | ZENIC ONE System Introduction .....              | 78        |
| 4.2      | Web-based LMT, Easy Maintenance .....            | 79        |
| <b>5</b> | <b>Configuration and Application .....</b>       | <b>81</b> |
| 5.1      | Flexible Radio Configuration .....               | 81        |
| 5.2      | NR9150 Typical Configurations .....              | 82        |
| 5.2.1    | 1+0 Configuration .....                          | 82        |
| 5.2.2    | 1+1 HSB Configuration .....                      | 83        |
| 5.2.3    | 1+1 SD Configuration .....                       | 84        |
| 5.2.4    | 2+0 XPIC Configuration .....                     | 85        |

|          |                                           |            |
|----------|-------------------------------------------|------------|
| 5.2.5    | 2+2 XPIC HSB Configuration .....          | 86         |
| 5.2.6    | 2+2 XPIC SD Configuration .....           | 87         |
| 5.2.7    | 4+0 XPIC Configuration .....              | 88         |
| 5.2.8    | 4+0 CA XPIC configuration .....           | 89         |
| 5.2.9    | 8+0 CA XPIC configuration .....           | 90         |
| 5.2.10   | 4×4 MIMO Configuration .....              | 91         |
| 5.2.11   | 1E+2N MBL Configuration .....             | 92         |
| 5.2.12   | 2E+4N MBL Configuration .....             | 93         |
| <b>6</b> | <b>Performance and Parameters .....</b>   | <b>94</b>  |
| 6.1      | System Integrity .....                    | 94         |
| 6.1.1    | Mechanical Characteristics .....          | 94         |
| 6.1.2    | Operation Parameters .....                | 95         |
| 6.1.3    | Standards Compliance .....                | 96         |
| 6.1.4    | Fault Tolerance MTBF/MTTR .....           | 97         |
| 6.1.5    | General Safety Requirements .....         | 97         |
| 6.2      | Physical Interfaces Definition .....      | 98         |
| 6.2.1    | Service Interface .....                   | 98         |
| 6.2.2    | Management and Auxiliary Interface .....  | 99         |
| 6.3      | Radio Performance .....                   | 99         |
| 6.3.1    | Transmitter Characteristics .....         | 99         |
| 6.3.2    | Receiver Characteristics .....            | 132        |
| 6.4      | System Characteristics .....              | 180        |
| 6.4.1    | Channel Spacing & Modulation Scheme ..... | 180        |
| 6.4.2    | System Transmission Capacity .....        | 182        |
| 6.5      | Clock and Synchronization .....           | 196        |
| <b>7</b> | <b>Abbreviations .....</b>                | <b>197</b> |

# FIGURES

|                                                                                           |    |
|-------------------------------------------------------------------------------------------|----|
| Fig. 1-1 NR9150 (IDU) appearance .....                                                    | 13 |
| Fig. 1-2 SRU2 appearance and interfaces .....                                             | 14 |
| Fig. 1-3 SRU2S appearance and interfaces .....                                            | 14 |
| Fig. 1-4 SRU3D appearance and interfaces .....                                            | 15 |
| Fig. 1-5 HRU2 appearance and interfaces .....                                             | 15 |
| Fig. 1-6 HRU2F V1.0 appearance and interfaces .....                                       | 15 |
| Fig. 1-7 HRU2F V2.0 appearance and interfaces .....                                       | 15 |
| Fig. 1-8 HRU3D appearance and interfaces .....                                            | 16 |
| Fig. 2-1 Unified switching platform .....                                                 | 19 |
| Fig. 2-2 Intelligent cooling system .....                                                 | 21 |
| Fig. 2-3 ATPC Principle Diagram .....                                                     | 23 |
| Fig. 2-4 ACM working scheme (taking QPSK to 2048 QAM for instance) .....                  | 24 |
| Fig. 2-5 XPIC description .....                                                           | 25 |
| Fig. 2-6 2x2 LoS MIMO Basic Principle .....                                               | 26 |
| Fig. 2-7 NR9150 4x4 LoS MIMO schematic diagram of radio part .....                        | 26 |
| Fig. 2-8 2+0 Carrier Aggregation .....                                                    | 27 |
| Fig. 2-9 Traditional Solution vs Carrier Aggregation Solution (4+0 XPIC: 1T1R ODU) .....  | 28 |
| Fig. 2-10 Traditional Solution vs Carrier Aggregation Solution (8+0 XPIC: 2T2R ODU) ..... | 28 |
| Fig. 2-11 2+0 CoMP SD Principle .....                                                     | 29 |
| Fig. 2-12 MBL Solution .....                                                              | 30 |
| Fig. 2-13 CCIC application scenario .....                                                 | 31 |
| Fig. 2-14 SDN framework .....                                                             | 37 |
| Fig. 2-15 Wi-Fi access via smart phone/pad/laptop .....                                   | 46 |
| Fig. 2-16 Full scale and hierarchical Ethernet OAM .....                                  | 48 |
| Fig. 2-17 Intelligent license control schematic .....                                     | 53 |
| Fig. 3-1 Hardware layout .....                                                            | 56 |
| Fig. 3-2 IDU Slot Diagram .....                                                           | 57 |
| Fig. 3-3 IDU block diagram .....                                                          | 59 |
| Fig. 3-4 1T1R ODU block diagram .....                                                     | 60 |

|           |                                                                             |     |
|-----------|-----------------------------------------------------------------------------|-----|
| Fig. 3-5  | 2T2R ODU block diagram .....                                                | 60  |
| Fig. 3-6  | CSA board front panel .....                                                 | 60  |
| Fig. 3-7  | CSA2 board front panel .....                                                | 62  |
| Fig. 3-8  | CSA4 board front panel .....                                                | 64  |
| Fig. 3-9  | CSA2 v2 board front panel .....                                             | 66  |
| Fig. 3-10 | MD2 board front panel .....                                                 | 67  |
| Fig. 3-11 | MD4 board front panel .....                                                 | 70  |
| Fig. 3-12 | ME2 board front panel .....                                                 | 72  |
| Fig. 3-13 | IEA board front panel .....                                                 | 73  |
| Fig. 3-14 | IEB board front panel .....                                                 | 74  |
| Fig. 3-15 | IED board front panel .....                                                 | 74  |
| Fig. 3-16 | IEM2 board front panel .....                                                | 75  |
| Fig. 3-17 | ITA board front panel .....                                                 | 76  |
| Fig. 3-18 | ITD board front panel .....                                                 | 76  |
| Fig. 3-20 | FA board front panel .....                                                  | 77  |
| Fig. 4-1  | Network management solution .....                                           | 78  |
| Fig. 5-1  | 1+0 configuration (1T1R ODU) .....                                          | 83  |
| Fig. 5-2  | 1+1 HSB configuration (1T1R ODU) .....                                      | 84  |
| Fig. 5-3  | 1+1 SD configuration (1T1R ODU) .....                                       | 85  |
| Fig. 5-4  | 2+0 XPIC configuration (2T2R ODU) .....                                     | 86  |
| Fig. 5-5  | 2+2 XPIC HSB configuration (2T2R ODU) .....                                 | 87  |
| Fig. 5-6  | 2+2 XPIC SD configuration (2T2R ODU) .....                                  | 88  |
| Fig. 5-7  | 4+0 XPIC with dual carrier modem unit (2T2R ODU) .....                      | 89  |
| Fig. 5-8  | 4+0 CA XPIC configuration (2T2R ODU) .....                                  | 89  |
| Fig. 5-9  | 8+0 CA XPIC configuration (2T2R ODU) .....                                  | 90  |
| Fig. 5-11 | 4x4 MIMO configuration (2T2R ODU) .....                                     | 91  |
| Fig. 5-12 | Typical MBL configuration: 1+0 E-band with 2+0 normal band (2T2R ODU) ..... | 92  |
| Fig. 5-13 | Typical MBL configuration: 2+0 E-band with 4+0 normal band (2T2R ODU) ..... | 93  |
| Fig. 6-1  | Numerical relation between RSL and output voltage @ RSSI interface .....    | 179 |

## TABLES

|            |                                                               |    |
|------------|---------------------------------------------------------------|----|
| Table 2-1  | Carrier grade Ethernet features .....                         | 32 |
| Table 2-2  | IP/MPLS feature .....                                         | 34 |
| Table 2-3  | Segment Routing features .....                                | 36 |
| Table 2-4  | QoS features .....                                            | 40 |
| Table 2-5  | Protection scheme .....                                       | 43 |
| Table 2-6  | Ethernet service OAM .....                                    | 49 |
| Table 2-7  | Network management features .....                             | 54 |
| Table 3-1  | Boards and slots .....                                        | 57 |
| Table 3-2  | CSA interface description .....                               | 61 |
| Table 3-3  | CSA2 interface description .....                              | 62 |
| Table 3-4  | CSA4 interface description .....                              | 64 |
| Table 3-5  | CSA2 v2 interface description .....                           | 66 |
| Table 3-6  | MD2 interface description .....                               | 68 |
| Table 3-7  | MD2 v2 interface description .....                            | 69 |
| Table 3-8  | MD4 interface description .....                               | 70 |
| Table 3-9  | ME2 interface description .....                               | 72 |
| Table 3-10 | IEA interface description .....                               | 73 |
| Table 3-11 | IEB interface description .....                               | 74 |
| Table 3-12 | IED interface description .....                               | 75 |
| Table 3-13 | IEM2 interface description .....                              | 75 |
| Table 3-14 | ITA interface description .....                               | 76 |
| Table 3-15 | ITD interface description .....                               | 76 |
| Table 5-1  | NR9150 Radio configuration list .....                         | 81 |
| Table 5-2  | 1+0 configuration requirements per site .....                 | 83 |
| Table 5-3  | 1+1 HSB configuration requirements per site .....             | 84 |
| Table 5-4  | 1+1 SD configuration requirements per site via 1T1R ODU ..... | 85 |
| Table 5-5  | 2+0 XPIC configuration requirements per site .....            | 86 |
| Table 5-6  | 2+2 XPIC HSB configuration requirements per site .....        | 87 |
| Table 5-7  | 2+2 XPIC SD configuration requirements per site .....         | 88 |

|            |                                                                        |     |
|------------|------------------------------------------------------------------------|-----|
| Table 5-8  | 4+0 XPIC configuration requirements per site .....                     | 89  |
| Table 5-9  | 4x4 MIMO configuration requirements per site .....                     | 91  |
| Table 5-10 | MBL configuration requirements (1+0 E-band with 2+0 normal band) ..... | 92  |
| Table 5-11 | MBL configuration requirements (2+0 E-band with 4+0 normal band) ..... | 94  |
| Table 6-1  | Dimension and weight .....                                             | 94  |
| Table 6-2  | Power supply .....                                                     | 95  |
| Table 6-3  | Temperature and humidity .....                                         | 95  |
| Table 6-4  | System power consumption per site for reference .....                  | 96  |
| Table 6-5  | Complied standards .....                                               | 96  |
| Table 6-6  | Predicted reliability .....                                            | 97  |
| Table 6-7  | Service interface characteristics .....                                | 98  |
| Table 6-8  | Management and auxiliary interface characteristics .....               | 99  |
| Table 6-9  | IF interface parameters .....                                          | 99  |
| Table 6-10 | Radio frequency adjustment step and stability .....                    | 100 |
| Table 6-11 | ODU Tx/Rx spacing .....                                                | 101 |
| Table 6-12 | Transmit power& ATPC range - SRU2: 6/7/8 GHz .....                     | 102 |
| Table 6-13 | Transmit power& ATPC range - SRU2: 10/11 GHz .....                     | 103 |
| Table 6-14 | Transmit power& ATPC range - SRU2: 13 GHz .....                        | 104 |
| Table 6-15 | Transmit power& ATPC range - SRU2: 15 GHz .....                        | 105 |
| Table 6-16 | Transmit power& ATPC range - SRU2: 18 GHz .....                        | 106 |
| Table 6-17 | Transmit power& ATPC range - SRU2: 23 GHz .....                        | 107 |
| Table 6-18 | Transmit power& ATPC range - SRU2: 26/28 GHz .....                     | 108 |
| Table 6-19 | Transmit power& ATPC range - SRU2: 32/38 GHz .....                     | 108 |
| Table 6-20 | Transmit power& ATPC range - SRU2: 42 GHz .....                        | 109 |
| Table 6-21 | Transmit power& ATPC range - SRU2S: 13 GHz .....                       | 110 |
| Table 6-22 | Transmit power& ATPC range - SRU2S: 15 GHz .....                       | 111 |
| Table 6-23 | Transmit power& ATPC range - SRU2S: 18 GHz .....                       | 112 |
| Table 6-24 | Transmit power& ATPC range - SRU2S: 23 GHz .....                       | 113 |
| Table 6-25 | Transmit power& ATPC range - SRU3D: 6/7/8 GHz .....                    | 113 |
| Table 6-26 | Transmit power& ATPC range - SRU3D: 11 GHz .....                       | 114 |
| Table 6-27 | Transmit power& ATPC range - SRU3D: 13 GHz .....                       | 115 |

|            |                                                                |     |
|------------|----------------------------------------------------------------|-----|
| Table 6-28 | Transmit power& ATPC range - SRU3D: 15 GHz .....               | 116 |
| Table 6-29 | Transmit power& ATPC range - SRU3D: 18 GHz .....               | 117 |
| Table 6-30 | Transmit power& ATPC range - SRU3D: 23GHz .....                | 118 |
| Table 6-31 | Transmit power & ATPC range - HRU2F V1.0: 6/7 GHz .....        | 119 |
| Table 6-32 | Transmit power & ATPC range - HRU2F V1.0: 8/11 GHz .....       | 120 |
| Table 6-33 | Transmit power & ATPC range - HRU2F V2.0: 6/7GHz .....         | 121 |
| Table 6-34 | Transmit power & ATPC range - HRU2F V2.0: 8/11GHz .....        | 122 |
| Table 6-35 | Transmit power & ATPC range - HRU2: 13GHz .....                | 123 |
| Table 6-36 | Transmit power & ATPC range - HRU2: 15GHz .....                | 124 |
| Table 6-37 | Transmit power & ATPC range - HRU2: 18GHz .....                | 124 |
| Table 6-38 | Transmit power & ATPC range - HRU3D: 5 GHz .....               | 125 |
| Table 6-39 | Transmit power & ATPC range - HRU3D: 6/7 GHz .....             | 126 |
| Table 6-40 | Transmit power & ATPC range - HRU3D: 8GHz .....                | 127 |
| Table 6-41 | Transmit power & ATPC range - HRU3D V1.0/V2.0: 11 GHz .....    | 128 |
| Table 6-42 | Transmit power & ATPC range - HRU3D V2.1: 11 GHz .....         | 129 |
| Table 6-43 | Transmit power & ATPC range - HRU3D: 26 GHz .....              | 129 |
| Table 6-44 | Transmit power & ATPC range - HRU3D: 32 GHz .....              | 130 |
| Table 6-45 | Transmit power & ATPC range - HRU3D: 38 GHz .....              | 131 |
| Table 6-46 | RSL threshold @ BER=10-6: SRU2 @G01/G02 mode .....             | 133 |
| Table 6-47 | RSL threshold @ BER=10-6: SRU2S @G01/G02 mode .....            | 137 |
| Table 6-48 | RSL threshold @ BER=10-6: SRU3D @G01/G02 mode .....            | 139 |
| Table 6-49 | RSL threshold @ BER=10-6: HRU2F V1.0 @G01/G02 mode .....       | 142 |
| Table 6-50 | RSL threshold @ BER=10-6: HRU2F V2.0 @G01/G02 mode .....       | 144 |
| Table 6-51 | RSL threshold @ BER=10-6: HRU2 @G01/G02 mode .....             | 146 |
| Table 6-52 | RSL threshold @ BER=10-6: HRU3D @G01/G02 mode .....            | 148 |
| Table 6-53 | RSL threshold @ BER=10-6: SRU2 @C01/C02/L01/L02 mode .....     | 152 |
| Table 6-54 | RSL threshold @ BER=10-6: SRU2 @C02 mode (support ACCP) .....  | 157 |
| Table 6-55 | RSL threshold @ BER=10-6: SRU2S @C01/C02/L01/L02 mode .....    | 158 |
| Table 6-56 | RSL threshold @ BER=10-6: SRU2S @C02 mode (support ACCP) ..... | 159 |
| Table 6-57 | RSL threshold @ BER=10-6: SRU3D @C01/C02/L01/L02 mode .....    | 160 |
| Table 6-58 | RSL threshold @ BER=10-6: SRU3D @C02 mode (support ACCP) ..... | 164 |

|            |                                                                      |     |
|------------|----------------------------------------------------------------------|-----|
| Table 6-59 | RSL threshold @ BER=10-6: HRU2F V1.0 @C01/C02/L01/L02 mode .....     | 167 |
| Table 6-60 | RSL threshold @ BER=10-6: HRU2F V2.0 @C01/C02/L01/L02 mode .....     | 168 |
| Table 6-61 | RSL threshold @ BER=10-6: HRU2F V2.0 @C02 mode (support ACCP) .....  | 170 |
| Table 6-62 | RSL threshold @ BER=10-6: HRU2 @C01/C02/L01/L02 mode .....           | 172 |
| Table 6-63 | RSL threshold @ BER=10-6: HRU3D @C01/C02/L01/L02 mode .....          | 173 |
| Table 6-64 | RSL threshold @ BER=10-6: HRU3D @C02 mode (support ACCP) .....       | 177 |
| Table 6-65 | Highest-order modulation scheme @G01/G02 mode .....                  | 180 |
| Table 6-66 | Highest-order modulation scheme @C01/C02 mode .....                  | 181 |
| Table 6-67 | Highest-order modulation scheme @L01/L02 mode .....                  | 182 |
| Table 6-68 | Typical system transmission capacity per carrier @G01/G02 mode ..... | 183 |
| Table 6-69 | Typical system transmission capacity per carrier @C01 mode .....     | 186 |
| Table 6-70 | Typical system transmission capacity per carrier @C02 mode .....     | 189 |
| Table 6-71 | Typical system transmission capacity per carrier @L01/L02 mode ..... | 193 |
| Table 6-72 | Synchronization features .....                                       | 196 |

# 1 Overview

ZTE NR9000 digital microwave transmission system is introduced in this document. As a small nodal equipment of NR9000 portfolio, NR9150 is described here in detail, which process TDM, Ethernet or MPLS packet transmission with the same platform.

## 1.1 Future Oriented NR9150

With the rapid growth of data traffic, especially in 5G era, a high bandwidth microwave transmission system is needed in the backhaul as well as private network. ZTE released its high capacity and aggregation solution to fit the developmental requirements with carrier grade and packet based microwave equipment—NR9150.

NR9150, the 1U height equipment, provides 3 configurable slots that support hot-swapping boards and offer up to 8/12 radio directions.

The NR9150 is a packet-based solution to offer carrier grade network where the packet based traffic is predominant, giving consideration to support the still present TDM traffic: TDM will be emulated into packet and then transferred along with other packet service.

When combining with ZTE E-band product, NR9150 will offer ultra-high capacity MBL (Multi-band link) solution for 5G mobile backhaul or midhaul.

## 1.2 NR9150 System Introduction

The NR9150 microwave system includes indoor unit (IDU) and outdoor unit (ODU). The ODU is a waterproof unit and can be mounted on antenna in direct or remote way.

### 1.2.1 IDU Introduction

NR9150 indoor unit (IDU) provides core control, baseband processing, switching/cross connection and service access function. As an entire system, it usually connect with single or multiple outdoor radio units (ODU) via intermediate frequency (IF) cables.

Fig. 1-1 NR9150 (IDU) appearance



## 1.2.2 ODU Introduction

ODU is the outdoor unit of the NR9000 split-type system. It delivers power amplification and radio frequency (RF) conversion functions

ZTE propose high performance ODU for NR9000 series IDU:

- SRU2: The 2<sup>nd</sup> generation standard transmit power 1T1R ODU, Operates in the frequency range of 6 to 42 GHz <sup>[Note]</sup>, supports QPSK to 8192 QAM modulation scheme and 7/14/28/40/56/80/112 MHz channel bandwidth <sup>[Note]</sup>. The SRU2 has smaller dimension and less weight, and supports CA (Carrier Aggregation – one SRU2 transmits/receiver two carriers) function.
- SRU2S: The 2<sup>nd</sup> generation standard transmit power 1T1R ODU, Operates in the frequency range of 13/15/18/23 GHz <sup>[Note]</sup>, supports QPSK to 8192 QAM modulation scheme and 7/14/28/40/56/112 MHz channel bandwidth. The SRU2S supports full sub-band coverage of one frequency band, and supports CA (Carrier Aggregation – one SRU2S transmits/receiver two carriers) function.
- SRU3D: The 3<sup>rd</sup> generation standard transmit power 2T2R ODU, based on the 2T2R architecture, operates in 6/7/8/11/13/15/18/23GHz, support QPSK to 16K QAM modulation scheme and 7/14/28/40/56/112/224 MHz channel bandwidth <sup>[Note]</sup>. SRU3D supports CA (Carrier Aggregation – Each SRU3D unit transmits/receiver four carriers) function.
- HRU2: The 2<sup>nd</sup> generation high transmit power 1T1R ODU, operates in 13/15/18 GHz, supports QPSK to 8192 QAM modulation scheme and 7/14/28/40/56/112/224 MHz channel bandwidth <sup>[Note]</sup>, and supports CA (Carrier Aggregation – one HRU2 transmits/receiver two carriers) function.
- HRU2F V1.0: The 2<sup>nd</sup> generation high transmit power 1T1R ODU, operates in 6/7/8/11 GHz, supports QPSK to 4096 QAM modulation scheme and 7/14/28/40/56/80/112 MHz channel bandwidth <sup>[Note]</sup>, and supports CA (Carrier Aggregation – one HRU2F V1.0 transmits/receiver two carriers) function.
- HRU2F V2.0: The 2<sup>nd</sup> generation high transmit power 1T1R ODU, operates in

6/7/8/11 GHz, supports QPSK to 8192 QAM modulation scheme and 7/14/28/40/56/80/112 MHz channel bandwidth <sup>[Note]</sup>, and supports CA (Carrier Aggregation – one HRU2F V2.0 transmits/receiver two carriers) function.

- HRU3D: The 3<sup>rd</sup> generation high transmit power 2T2R ODU, based on the 2T2R architecture, operates in 5/6/7/8/11/26/32/38 GHz<sup>[Note]</sup>, support QPSK to 8192 QAM modulation scheme and 7/14/28/40/56/80/112 MHz channel bandwidth. HRU3D supports CA (Carrier Aggregation – Each HRU3D unit transmits/receiver four carriers) function.

There are three important interfaces on the ODU:

- RF in/out interface (waveguide type) for connecting to antenna.
- IF in/out interface (N type) for connecting to modem board.
- RSSI (Received Signal Strength Indication) interface (BNC type) for testing RF receiver signal level.

Fig. 1-2 SRU2 appearance and interfaces

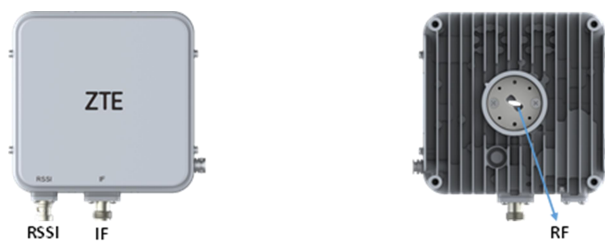


Fig. 1-3 SRU2S appearance and interfaces



Fig. 1-4 SRU3D appearance and interfaces

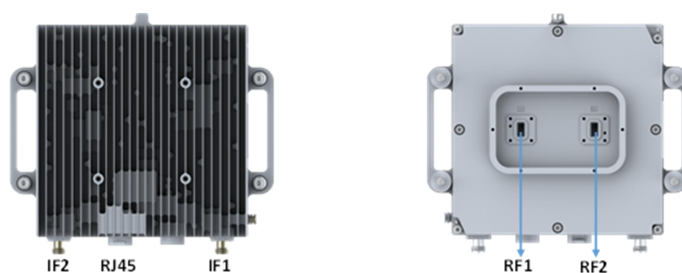


Fig. 1-5 HRU2 appearance and interfaces

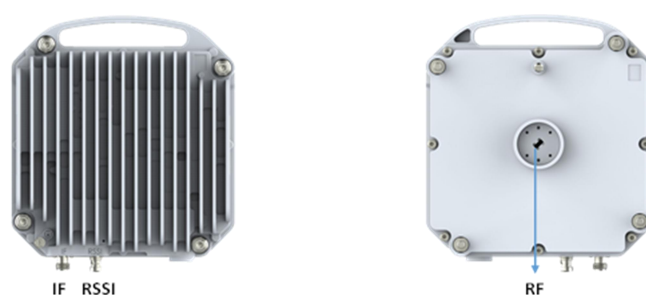


Fig. 1-6 HRU2F V1.0 appearance and interfaces

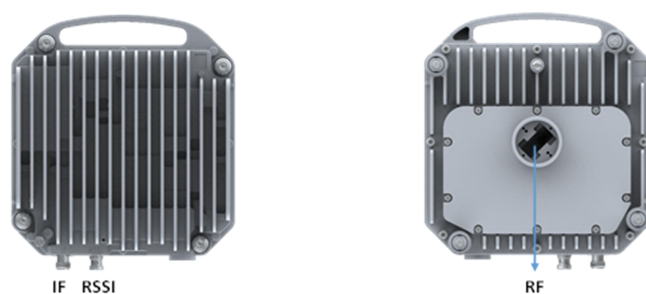


Fig. 1-7 HRU2F V2.0 appearance and interfaces

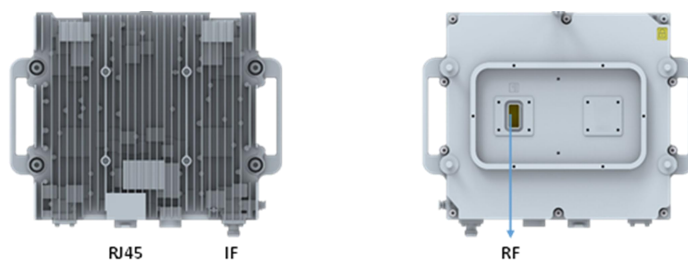
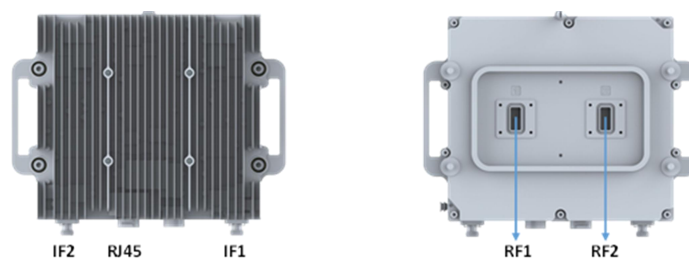


Fig. 1-8 HRU3D appearance and interfaces

**Note:**

## 1. SRU2:

- Modulation
  - ✓ SRU2 V1.0 (6-38GHz): up to 4096 QAM.
  - ✓ SRU2 V1.1 (13-23GHz): up to 8192 QAM.
  - ✓ SRU2 V2.0 (26/28/32/42GHz): up to 4096 QAM.
  - ✓ SRU2 V2.0 (38GHz): up to 8192 QAM.
- Bandwidth
  - ✓ Up to 112MHz.
  - ✓ The 80 MHz bandwidth is supported by 6/11 GHz SRU2.
- Radio mode
  - ✓ 6-23 GHz SRU2 supports G01/G02/C01/C02 mode.
  - ✓ 26-38 GHz SRU2 V1.0 supports G01/G02 mode.
  - ✓ 26-42 GHz SRU2 V2.0 supports G01/G02/C02 mode.

## 2. SRU3D:

- Modulation
  - ✓ SRU3D V1.0 (6-23GHz): up to 8192 QAM
  - ✓ SRU3D V1.1 (13/15/18/23GHz): up to 16k QAM
- Bandwidth
  - ✓ 6-13GHz: up to 112MHz
  - ✓ 15/18/23GHz: up to 224MHz (with ME2)

- ✓ The 80 MHz bandwidth is supported by 6/8/11 GHz.
- Radio mode
  - ✓ 6/7/8/13/15/18/23 GHz: G01/C01/L01, G02/C02/L02
  - ✓ 11GHz: G01/L01, G02/C02/L02
- 3. HRU2:
  - Modulation:
    - ✓ HRU2 V1.0 (13-18GHz): up to 8192 QAM
  - Bandwidth
    - ✓ 13GHz: up to 112MHz
    - ✓ 15/18GHz: up to 224MHz (hardware ready)
  - Radio mode: G01/C01/L01, G02/C02/L02
- 4. HRU2F V1.0:
  - Modulation: up to 4096 QAM
  - Bandwidth:
    - ✓ Supports 7/14/28/40/56/80/112 MHz
    - ✓ The 80 MHz bandwidth is supported by 6/11 GHz HRU2F V1.0.
  - Radio mode: G01/C01/L01, G02/C02/L02
- 5. HRU2F V2.0:
  - Modulation: up to 8192 QAM.
  - Bandwidth:
    - ✓ Supports 7/14/28/40/56/80/112 MHz.
    - ✓ The 80 MHz bandwidth is supported by 6/8/11 GHz HRU2F V2.0.
  - Radio mode: G01/C01/L01, G02/C02/L02.
- 6. HRU3D:
  - Modulation:
    - ✓ HRU3D V1.0 (5-11 GHz): up to 8192 QAM.
    - ✓ HRU3D V1.0 (26/32/38 GHz): up to 4096 QAM.

- ✓ HRU3D V2.0/V2.1 (11 GHz): up to 8192 QAM.
  - Bandwidth:
    - ✓ Up to 112 MHz.
    - ✓ The 80 MHz bandwidth is supported by 5/6/8/11 GHz HRU3D.
  - Radio mode:
    - ✓ 5/6/7/8/26/32/38 GHz HRU3D: G01/C01/L01, G02/C02/L02
    - ✓ 11GHz HRU3D: G01/L01, G02/C02/L02
  - Wideband CA
    - ✓ 11GHz HRU3D V2.0/V2.1 and 26/32/38GHz HRU3D V1.0 support wideband CA.
7. For the release plan of more frequency bands please refer to “ZTE microwave roadmap”.

### 1.2.3 Coupling unit

The branch unit is used for combining signals between multiple carriers or multiple ODUs. ZTE provides diversified branch units, branch unit including: Hybrid, OMT, flat hybrid, flat OMT, DP-HYB for 1T1R ODU, DP-HYB for 2T2R ODU, and DC-HYB etc. branch unit

- Applicable to 1T1R ODU
  - Hybrid, supports 6~42GHz. It is used to combine two co-polarized signals of different frequency points.
  - OMT, supports 6~42GHz. It is used to combine two different polarized signals of the same frequency points.
  - DP-HYB (1T1R ODU), supports 7- 38 GHz, used for signal combination of four 1T1R ODUs (4 carriers, cross-polarization).
- Applicable to 2T2R ODU
  - Flat hybrid, supports 6~23GHz. It is used to combine two channel of one 2T2R ODU (2 carriers, Co-polarization).
  - Flat OMT, supports 6~23GHz. It is used to combine two channel of one 2T2R ODU (2 carriers, cross-polarization).

- DC-HYB, supports 6 - 23 GHz, Used for signal combination of two 2T2R ODUs (4 carriers, Co-polarization).
- DP-HYB (2T2R ODU), supports 6 - 23 GHz, used for signal combination of two 2T2R ODUs (4 carriers, cross-polarization).

## 2 Functions and Features

The main functions and features of NR9150 are described in this chapter.

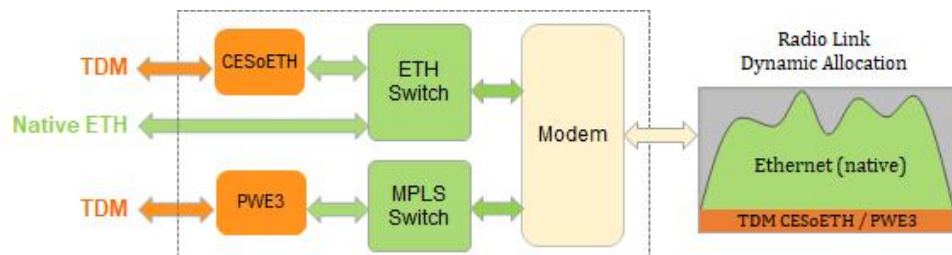
### 2.1 Powerful Hardware Platform

#### 2.1.1 An Unified Platform for Packet Microwave Radio

The functionality of L2/L3/MPLS/SDN can be supported in NR9150. All packet switching is recommended for L3/MPLS based network (4G LTE/5G wireless backhaul or midhaul):

- PWE3 technique emulates the native TDM service that accessed at UNI side into packet streams and then transferred in an MPLS based all packet switching network.
- CESoETH technique emulates the native TDM service that accessed at UNI side into packet streams and then transferred in an ETH based all packet switching network.
- Ethernet service will be transferred in native mode or emulated into MPLS packets.

Fig. 2-1 Unified switching platform



## 2.1.2 Powerful Switching Capability

NR9150 supports packet switching and TDM circuit emulation functions.

The core control units provides 160Gbit/s packet switching capacity for 25GE, several 10GEs and/or GE service access and switching.

## 2.1.3 Flexible Modular Design

Ethernet/TDM traffic board are provided by NR9150, which can meet different transmission requirements via configuring different function boards.

### 1. Flexible Slots Configuration

All the function boards support flexible configuration that bring easy hardware addition or replacement: Slots 2 to slot 4 are available for traffic and modem units.

### 2. Hot-Swappable Boards

The NR9150 provides admirable hot-swapping function. When tributary unit board is broken, it can be replaced by a new board without power off. Furthermore, the traffic will automatically recover without reconfiguration when the board is replaced by a same type board and be installed into the same slot.

During maintenance stage, the broken board will be swapped directly while the license is kept, which can simplify the maintenance process.

## 2.1.4 High Reliability Design

The SRU2/SRU2S/SRU3D/HRU2F V1.0/HRU2F V2.0/HRU2/HRU3D conforms to high standard for the sake of high reliability and availability.

- Ingress protection: IP66.
- Lightning protection: 20 kA (SRU2/SRU3D/HRU2F V1.0)/10 kA (SRU2S/HRU2F V2.0/HRU2/HRU3D), lightning arrester saved.

With the high standard design, the system is able to be applied in various severe environments.

## 2.1.5 Energy Saving Design

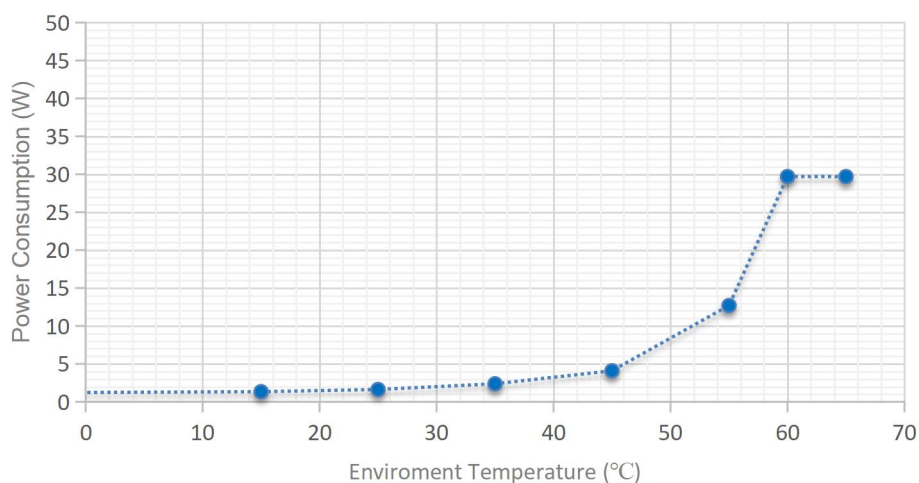
- Intelligent Cooling System

An intelligent fan unit is adopted by NR9150 to reduce the OPEX and noise.

The running speed of fan can be adjusted automatically according to the equipment's temperature, which could reduce the power consumption. The lower temperature it is, the less power it costs. Meanwhile, the noise produced by the running fan is reduced obviously.

Take FA for instance, the relationship between the environment temperature and fan's power consumption in typical configuration is shown in following figure.

Fig. 2-2 Intelligent cooling system



Compared with constant rate fan, ZTE's intelligent cooling system has the following advantages:

- Low power consumption, the OPEX is reduced.
  - Low noise, a comfortable working environment is obtained.
  - Low running speed tendency, the Fan's service life is increased.
  - Green Power Mode
- SRU2/SRU2S/SRU3D/HRU2F V1.0/HRU2F V2.0/HRU2/HRU3D can reduce its power consumption by about 10%.

## 2.2 Enhanced Radio Features

### 2.2.1 Modem Baseband Signal Processing

1. The Adaptive Equalizer, 41-tap and 48-tap fractional-spaced feed-forward filter (FFF), is used to remove inter-symbol interference. This block's adaptation is based on an LMS decision-directed mechanism.
2. LDPC (Low-Density Parity-Checked) and RS (Reed-Solomon) codes based FEC (Forward Error Correction) scheme is used to achieve good performance, high reliability and high efficiency.

### 2.2.2 ATPC (Automatic Transmit Power Control)

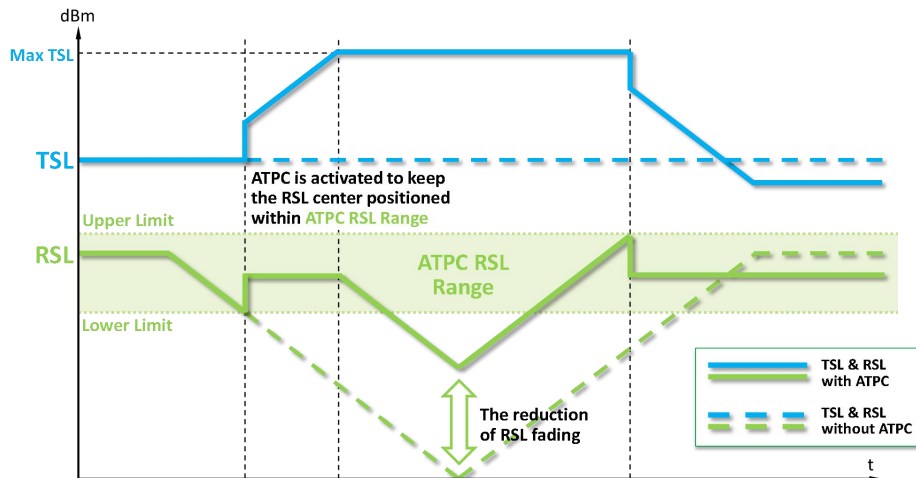
Automatic transmit power control (ATPC) is an automatic transmit power adjustment technology.

ATPC is used to lower the RF transmit power when environmental conditions are good in order to reduce wireless interference. Under fading conditions the transmit power is automatically increased to compensate for far end signal loss and to ensure the link continues to meet the required receiver signal level.

The transmit power at one end of the microwave equipment adaptively changes in accordance with the receiving level of the receiver at the peer end.

- The receiving level range from -30 to -70dBm can be set to determine whether the ATPC function needs to operate.
- The adjustment range of ATPC Tx power is from the minimum Tx power to the maximum Tx power.

Fig. 2-3 ATPC Principle Diagram



### 2.2.3 ACM (Adaptive Coding & Modulation)

The NR9150 supports fixed modulation or Adaptive Coding and Modulation (ACM) mode in all frequencies and Channel Spacing (CS).

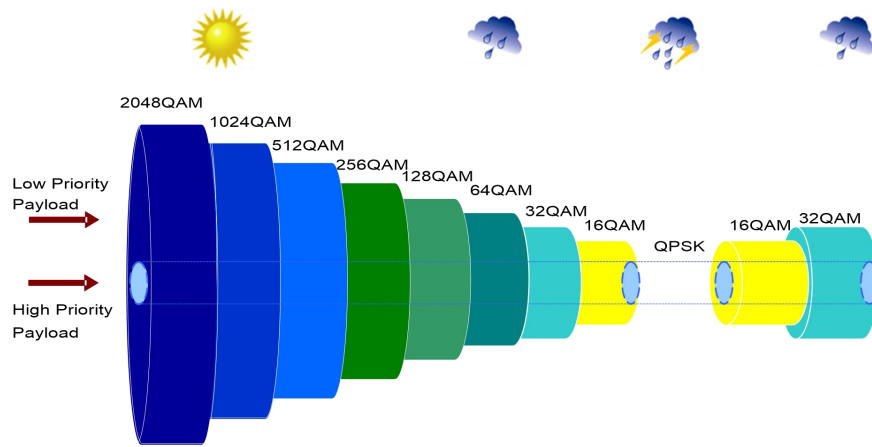
In fixed modulation condition, the radio working status and capacity will not change unless the modulation is changed by manual. Once the signal quality degrading lower than receiver threshold, the link will break down and all the services are affected.

ACM enables the radio capacity to change according to the link quality, which is a perfect way to supply additional best effort traffic under normal weather conditions. When extreme weather conditions, such as a storm, affect the transmission and receipt of data and voice over the wireless network, an ACM-enabled radio system automatically shift down modulation according to MSE (Mean Square Error, that indicates the radio signal quality) and XPD (in case XPIC link) values, which allows the high priority data (e.g. real time data) to continue to run uninterrupted. With ZTE's solution, no bit errors are generated during the modulation change; it is designed for carrier grade networks.

TIPS:

1. The ACM switching is hitless in normal fading condition (the link fading rate is less than 100dB/s, non-fast fading condition).
2. When using 1024QAM and/or higher level modulation scheme, ACM function is recommended.

Fig. 2-4 ACM working scheme (taking QPSK to 2048 QAM for instance)



- Enhanced ACM

When planning ACM-based radio links, enhanced ACM allows the radio maintains the highest level modulation with the lowest transmit power (Tx power). Once fading occurs, the TX power of N9150 will be increased with the decrease of ACM modulation.

- ACM with QoS

Once ACM mechanism is activated, the QoS mechanism will ensure high priority services. For further information about QoS functionality, please refer to section QoS.

The advantages of ZTE's ACM include:

- Maximized spectrum usage
- Hitless modulation/coding changes based on MSE/BLER/XPD. Carried grade modulation changing rate is 10 ms per step.
- Adaptive maximum Tx power per modulation for maximal system gain per working point
- An integrated QoS mechanism that enables intelligent congestion management to ensure that high priority traffic is not affected during link fading.

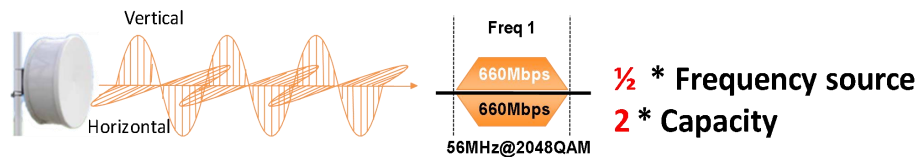
## 2.2.4 XPIC (CCDP)

Co-Channel Dual Polarization (CCDP) with Cross Polarization Interference

Canceller (XPIC) technology is one of the best ways to enhance spectral efficiency. With this function, one frequency point could be used as two carriers to double the throughput.

A high performance dual-polarized antenna should be used to minimize the cross-polarization interference.

Fig. 2-5 XPIC description



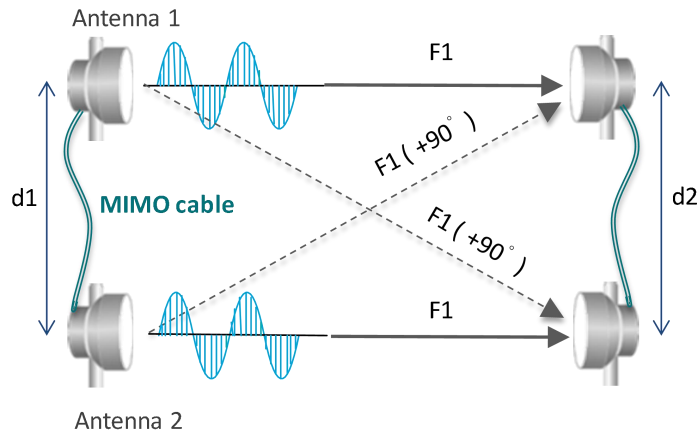
Common scenarios:

- ZTE's XPIC could work alongside with ACM function and 1+1 protection scheme, which can deliver a wireless backhaul solution with enhanced availability, high reliability and high throughput.
- PLA or LAG/enhanced LAG is usually used in XPIC radio link to achieve load balance and high throughput.

### 2.2.5 MIMO (Multiple Input Multiple Output)

There's another technique, MIMO (Multiple Input Multiple Output), to further improve the transmission capacity within limited frequency resource besides XPIC. An NxN MIMO system consists of N transmitters and N receivers, N streams of separate signals could be transmitted with one frequency pair simultaneously. The basic principle of MIMO is to transmit a signal with different paths between transmitters and receivers. For example, in a 2x2 MIMO system, there are two possible paths between one transmitter and two receivers. As shown in following figure, the interfering signal can be cancelled if the difference in propagation between the two paths permits the two received signals to be orthogonal to each other at the receiver modems. For a 2x2 system, this corresponds to a relative phase difference of 90 degrees.

Fig. 2-6 2x2 LoS MIMO Basic Principle

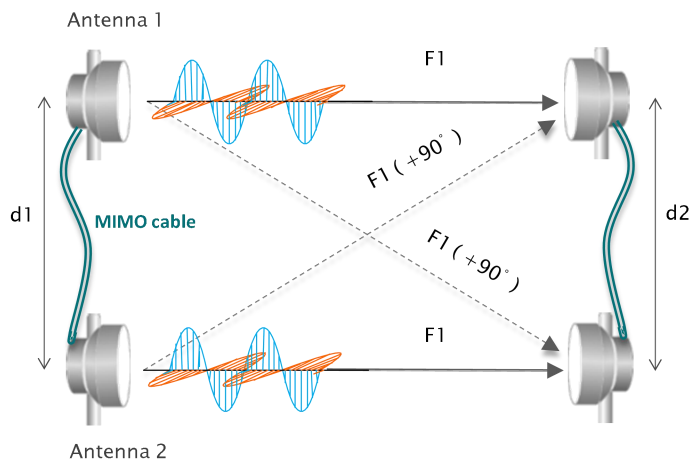


LoS (Line of Sight) MIMO is adopted in microwave radio system. The following advantages could be expected from LoS MIMO:

- Enhance the system throughput – double the throughput within the same frequency pair.
- Improve the system gain – improve the RX threshold for 3 dB in theory, like RX combining technology. In real application, the improvement may be range from 0~2 dB depends on the antenna separation.

NR9150 supports 4x4 MIMO (2x2 MIMO with XPIC) configuration and the schematic diagram is shown in the following figure.

Fig. 2-7 NR9150 4x4 LoS MIMO schematic diagram of radio part



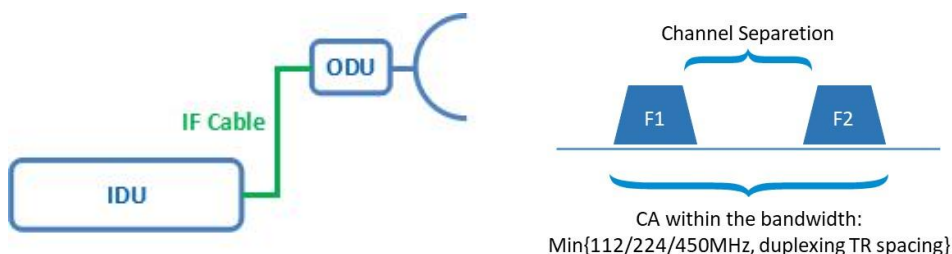
Tips:

1. Disabling ATPC is recommended in MIMO configuration.
2. The single-channel throughput of MIMO configuration is slightly lower than that of SISO configuration.

## 2.2.6 CA (Carrier Aggregation)

As shown in following figure, carrier aggregation enables one hardware channel (one IF interface & cable) transmit/receive two carrier signals.

Fig. 2-8 2+0 Carrier Aggregation



- 11GHz HRU3D V2.0/V2.1 support 14/28/40/56/80/112 MHz bandwidth carrier aggregation within 450 MHz. 26/32/38GHz HRU3D V1.0 support 14/28/40/56/112 MHz bandwidth carrier aggregation within 450 MHz.
  - CA within 450 MHz bandwidth:  $BW + |F2 - F1| \leq \text{Min}\{450 \text{ MHz, duplexing TR spacing}\}$
- Other ODU with ME2 support 14/28/40/56/80/112 MHz bandwidth carrier aggregation within 224 MHz. with MD2/MD2 V2/MD4 support 14/28/40/56 MHz bandwidth carrier aggregation within 112 MHz.
  - CA within 224 MHz bandwidth:  $BW + |F2 - F1| \leq \text{Min}\{224 \text{ MHz, duplexing TR spacing}\}$
  - CA within 112 MHz bandwidth:  $BW + |F2 - F1| \leq \text{Min}\{112 \text{ MHz, duplexing TR spacing}\}$

With the carrier aggregation solution, the hardware and power consumption of the ODU are reduced by 50%. Fewer components make it easier for engineers to install.

Fig. 2-9 Traditional Solution vs Carrier Aggregation Solution (4+0 XPIC: 1T1R ODU)

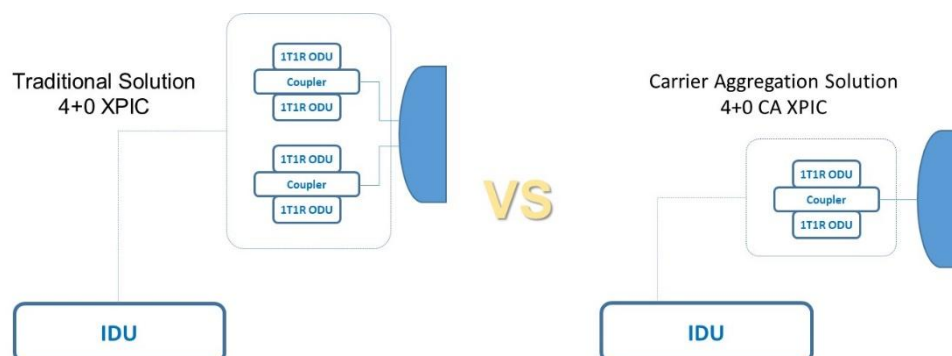
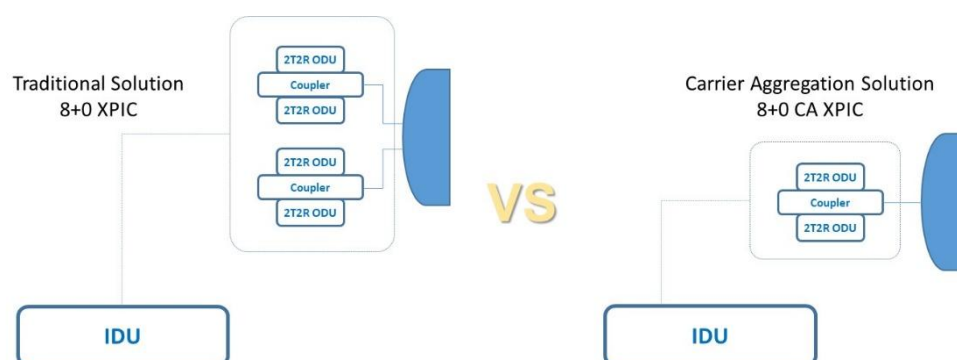


Fig. 2-10 Traditional Solution vs Carrier Aggregation Solution (8+0 XPIC: 2T2R ODU)

**Note:**

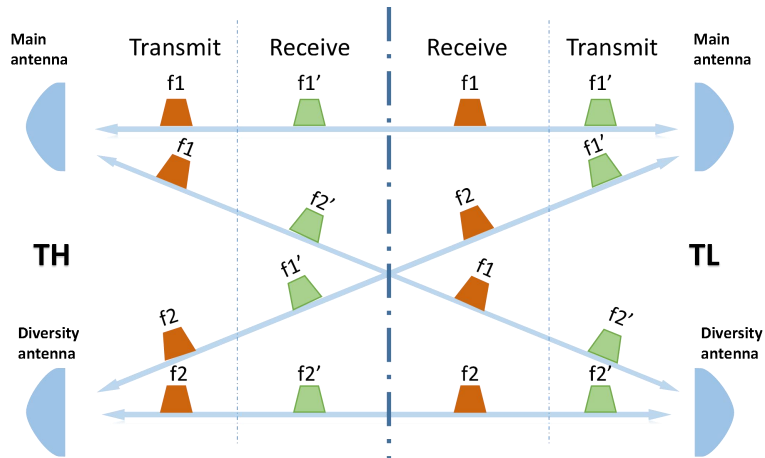
1. Disabling ATPC is recommended at CA configuration.
2. The maximum transmit power of CA is lower than that of non-CA.

## 2.2.7 CoMP SD (Coordinated Multi-Points Space Diversity)

CoMP SD is short for Coordinated Multi-Points Space Diversity. Diversity antennas can be added to N+0 hardware to implement N+0 space diversity protection by enabling the CoMP SD function, there is no need to added IDU/ODU or use specific hardware.

The CoMP SD is supported by the MD2 V2/MD4 with HRU3D.

Fig. 2-11 2+0 CoMP SD Principle



- Transmit Carriers
  - Distributed evenly on the remote main antenna and diversity antenna.
- Receive Carriers
  - All transmit carriers received by each antenna at receive side
- Multi-carrier Separation technology
  - Separate and demodulate multiple carriers in receiving modem

**Note:**

1. CoMP SD is applicable to 7/14/28/40/56MHz bandwidth.
2. CoMP SD will be released in the future version.

## 2.2.8 MBL (Multi-band Link)

MBL is short for multi-band link. E-band and normal band can be combined to improve the transmission distance. By reducing the E-band link availability and transmit high priority traffic on normal band, MBL can reach further transmission distance for high capacity solution.

MBL supports the following highlights:

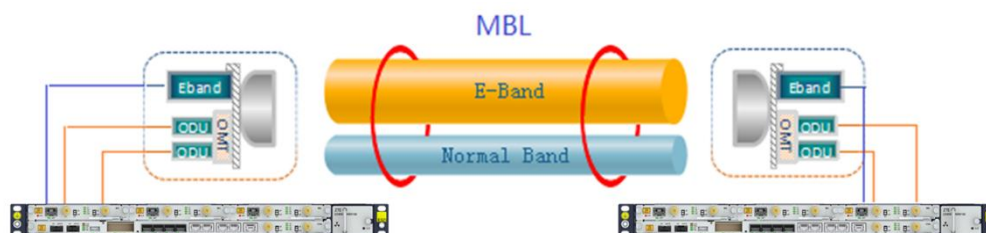
- ✓ E-band link in MBL is used for high throughput application. The radio capacity can be 10Gbps.
- ✓ Normal band in MBL is used for high performance application due to the better rain loss parameter.

- ✓ When E-band link availability degrade to 99.9%, the link distance can be extend to 10km.
- ✓ PLA, ACM and QoS technologies are used for guarantee 99.999% availability for the high priority traffic.

**Note:**

When the product operates in multi-band scenario, the ETH throughput is slightly less than the normal band ETH throughput plus the Eband ETH throughput.

Fig. 2-12 MBL Solution



Enhanced Multi-Band Link (EMBL) operates on the same principle as Multi-Band Link (MBL), but can support different capacities of Multi-Band Link bonding. The MBL supports capacities up to 10Gbps. For capacities exceeding 10Gbps, multi-band link bonding can be utilized by EMBL.

## 2.2.9 CCIC (Co-Channel Interference Cancellation)

In traditional solutions, the same frequency pair cannot be used repeatedly when the link angle is less than  $90^\circ$ . Therefore, many microwave transmission scenarios are limited by frequency resources.

The CCIC (co-channel interference cancellation) technology is used to eliminate interference signals in the same frequency bands in the uplink and downlink. In this way, the same frequency pairs can be reused from a small angle, greatly optimizing spectrum usage.

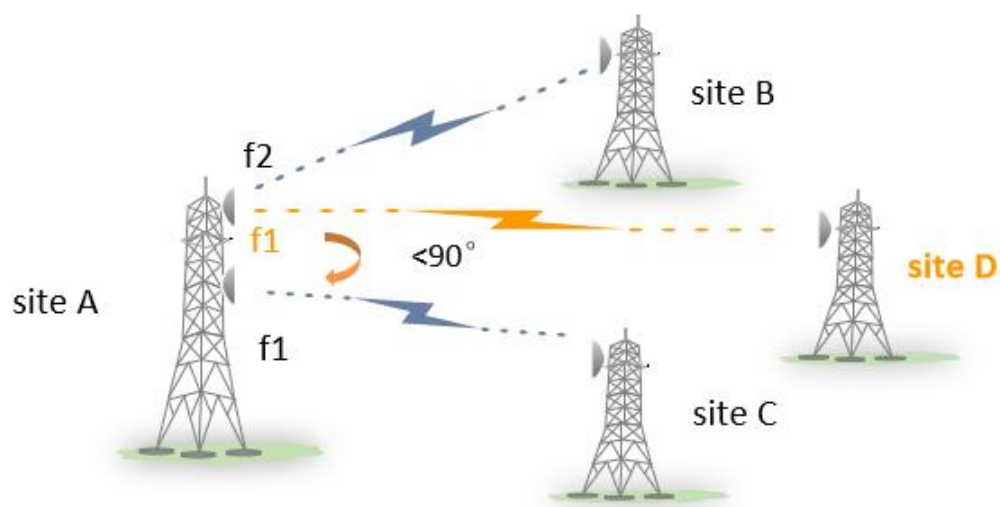
CCIC key specifications:

- Class3 antenna:
  - Modulation scheme: up to 256QAM

- Frequency reuse angle: up to 30°
- Class4 antenna:
  - Modulation scheme: up to 256QAM
  - Frequency reuse angle: up to 15°

The CCIC application scenario is shown in the following figure.

Fig. 2-13 CCIC application scenario



### 2.2.10 High System Gain Technique

System gain is one of the key performance indicators which affect the link distance, antenna size and link availability. Two solutions are used in ZTE microwave radio to improve system gain:

1. Enhanced Tx. Power: HRU2/HRU2F V1.0/HRU2F V2.0/HRU2/HRU3D are high performance ODUs, which provide much higher output power than normal performance ODU to achieve better system gain. While, distortion will be created when the power amplifiers running in their non-linear regions. DPD (Digital Pre-Distortion) is used to increase the efficiency of Power Amplifiers by reducing the distortion.
2. Rx Combining (Receiver Signal Combining). Two signals are received at receiver end in a SD (Space Diversity) link and the better one is chosen as main signal. Actually, the two signals received from two separated

antennas/receivers are independent of each other; both of them can be used as useful signals. Rx Combining, a method of diversity combining, is used to combine the two signals to one and gain better signal quality. Theoretically, the system gain can be increased up to 2.5 dB with Rx combining technique.

## 2.3 Intelligent Service Processing

### 2.3.1 Native-like TDM function

ZTE provides a unique TDM transmission solution: Native-like TDM. Compared with PWE3 TDM, the native-like TDM simplifies TDM configuration, reduces TDM service provisioning difficulty, and simplifies operation and maintenance.

- The native-like TDM is based on CESoETH technology.
- The native-like TDM simulates the operation interface of the traditional Native TDM.

### 2.3.2 Carrier Grade Ethernet Function

The carrier Ethernet services are MEF referenced design, which provides the following Ethernet features.

Table 2-1 Carrier grade Ethernet features

| Item                  | Feature                            | Description                                                                                                                                                    |
|-----------------------|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Standardized Services | E-LINE, E-LAN, E-Tree and E-Access | Comply with MEF6.2, MEF10.3, MEF8, MEF9, MEF14, MEF17, MEF22.1 and MEF33;<br>MEF certificate: MEF CE2.0/CE3.0 (to be done).                                    |
| Scalability           | Maximum Transmit Unit              | Up to 9600 bytes jumbo frame.                                                                                                                                  |
|                       | MAC Address Learning Capacity      | Max. number of supported MAC address: 32K;<br>MAC address learning enable/disable;<br>MAC address learning mode: IVL;<br>MAC address aging time: 60s to 60min. |
|                       | VLAN                               | Support IEEE 802.1p/ 802.1q/802.1ad;<br>Total 4K×4K VLAN IDs by QinQ;                                                                                          |

| Item               | Feature          | Description                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    |                  | VLAN Translation (ingress & egress);<br>Support copy/remap inner VLAN tag priority to outer VLAN.                                                                                                                                                                                                                                                                             |
|                    | Port Mirroring   | Supports port-based mirror function: the packets from input, output or both directions of observed interface are copied intact to the observing interface. It's used for testing or maintenance the traffic without traffic interrupting.                                                                                                                                     |
| Quality of Service | QoS/HQos         | Please refer to "chapter QoS/HQos".                                                                                                                                                                                                                                                                                                                                           |
|                    | Flow Control     | Flow control is used for controlling the data speed per port (priority blind) when congestion occurred, comply with IEEE 802.3 x.                                                                                                                                                                                                                                             |
| Reliability        | LAG/enhanced LAG | 802.3ad/802.1ax ;<br>Widely used for Ethernet port load balance.<br>Supports static (with LACP) and manual (without LACP) aggregation;<br>Load balance is realized by hash algorithm;<br>LAG - based on MAC address, IP address (IPv4/IPv6);<br>Enhanced LAG - based on MAC address, IP address (IPv4/IPv6), MAC/MPLS/IPv4/IPv6 packet identification.<br>LAG 1+1 protection. |
|                    | PLA              | Physical layer aggregation (PLA) is specially used for air interface aggregation and load balance;<br>PLA can divide the one stream into several channels without protocols, which brings high utilization of radio resources.<br>Max. 8+0 link aggregation is supported.                                                                                                     |
|                    | ERPS             | ITU G.8032v2 Ethernet multiple ring protection switching.                                                                                                                                                                                                                                                                                                                     |
|                    | ELD              | Detects Ethernet loops, reports alarms and blocks ports.                                                                                                                                                                                                                                                                                                                      |
|                    | STP/RSTP/MSTP    | STP comply with IEEE 802.1d;<br>RSTP comply with IEEE 802.1w;<br>MSTP comply with IEEE 802.1s.                                                                                                                                                                                                                                                                                |
|                    |                  |                                                                                                                                                                                                                                                                                                                                                                               |
| Service            | ETH OAM          | IEEE 802.3ah EFM;                                                                                                                                                                                                                                                                                                                                                             |

| Item       | Feature | Description                                                          |
|------------|---------|----------------------------------------------------------------------|
| Management |         | IEEE 802.1ag CFM;<br>ITU-T Y.1731 ETH OAM.                           |
|            | RMON    | RFC 2819 - Remote network monitoring<br>management information base. |

### 2.3.3 IP/MPLS Function

MW NR9000 series products supports IP/MPLS forwarding and various IP/MPLS routing protocols and signaling protocols.

Table 2-2 IP/MPLS feature

| Function     | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IP Functions | <ul style="list-style-type: none"> <li>● Supports the following L3 interface <ul style="list-style-type: none"> <li>✓ L3 interface.</li> <li>✓ L3 sub interface (encapsulate 802.1Q or QinQ).</li> <li>✓ VLAN interface.</li> </ul> </li> <li>● Supports the ARP protocol <ul style="list-style-type: none"> <li>✓ Dynamic ARP requests.</li> <li>✓ ARP response.</li> <li>✓ Dynamic ARP aging and aging time configuration.</li> <li>✓ Static ARP configuration.</li> </ul> </li> <li>● Supports IPv4 unicast route forwarding <ul style="list-style-type: none"> <li>✓ IPv4 unicast route line speed forwarding.</li> <li>✓ Best match of the hardware route table.</li> </ul> </li> <li>● ICMP protocol.</li> <li>● TCP/UDP protocol.</li> <li>● Static routing.</li> <li>● OSPF protocol.</li> <li>● IS-IS protocol.</li> <li>● BGP.</li> <li>● VRRP.</li> <li>● BFD for OSPF/IS-IS/BGP/VRRP.</li> <li>● FRR Protection: IP FRR</li> <li>● IGMP Snooping.</li> <li>● PCEP.</li> </ul> |

| Function       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                | <ul style="list-style-type: none"> <li>● BGP-LS.</li> <li>● ECMP: <ul style="list-style-type: none"> <li>✓ Routing protocol ECMP: OSPF ECMP/IS-IS ECMP/BGP ECMP.</li> </ul> </li> <li>● IPv6: IPv6 Static route, OSPF v3, ISIS v6, BGPV v6, Management channel via IPv6.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| MPLS Functions | <ul style="list-style-type: none"> <li>● LDP: Max. 6k tunnels.</li> <li>● SR-BE: Max. 6k tunnels.</li> <li>● SR-TE.</li> <li>● PWE3: ETH/E1/STM-1.</li> <li>● VPLS/H-VPLS/VPWS.</li> <li>● MPLS L3VPN/HoL3VPN: Max. 4k VPN LSP.</li> <li>● LSP/PW Ping/Trace.</li> <li>● MPLS-TE: Max. 6k tunnels. <ul style="list-style-type: none"> <li>✓ RSVP-TE</li> <li>✓ Static MPLS-TE.</li> </ul> </li> <li>● Seamless MPLS: <ul style="list-style-type: none"> <li>✓ BGP-LU: Max. 1k tunnels.</li> <li>✓ BGP-PIC</li> </ul> </li> <li>● BFD for LDP/TE/PW/VPN.</li> <li>● FRR Protection: LDP FRR, MPLS-TE FRR, PW FRR, VPN FRR.</li> <li>● MPLS-TE HSB.</li> <li>● ECMP: <ul style="list-style-type: none"> <li>✓ LDP ECMP/LDP Entropy label.</li> <li>✓ TE tunnel ECMP.</li> </ul> </li> <li>● MPLS-TP OAM (G-ACH+Y.1731).</li> <li>● MPLP-TP Protection: Tunnel/PW APS.</li> </ul> |

### 2.3.4 Segment Routing

SR (Segment Routing) is a source routing concept in which an ingress node selects a path and encodes that into the packet header as an ordered list of segment. SR allows service chaining, the entire path to be exposed to ingress/egress head end router. From the control plane perspective IGP (OSPF/ISIS), BGP, PCE-P and BGP LS are being extended to support Segment routing.

Segment routing highlights:

1. IGP protocol is required only in one IGP domain rather than extra LDP or RSVP, simplifying network protocol.
2. Paths are calculated and maintained in ingress/egress head end router, better for centralized path calculation and distribution via SDN controller.
3. Benefits of combination of SR and SDN, automated traffic engineering and load balance can be realized.
4. The midpoints will not maintain the state of forwarding path, avoiding the conflicts of the mass connection and equipment route table capacity in 5G network.

The following SR MPLS feature can be provided in NR9150:

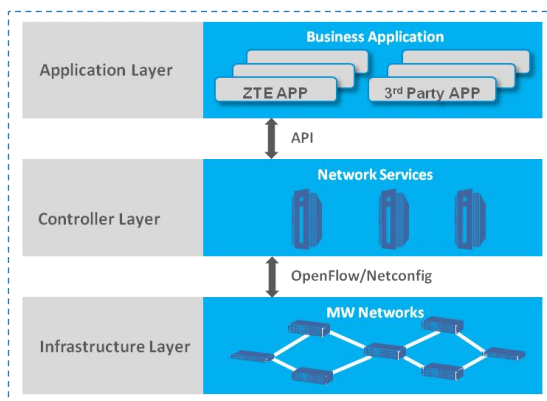
Table 2-3 Segment Routing features

| Function    | Description                                          |
|-------------|------------------------------------------------------|
| SR function | SR extension base IS-IS and OSPF.                    |
|             | SR BE, SR TE and SR Policy.                          |
|             | Prefix SID, Node SID, Adjacency SID and Anycast SID. |
|             | Binding SID.                                         |
|             | Coexistence with LDP.                                |
|             | Interworking with LDP (Mapping Server).              |
|             | TI-LFA FRR protection.                               |
|             | BGP SR (BGP prefix SID).                             |
|             | SR PING/TRACE.                                       |
|             | BFD for SR.                                          |
|             | BGP-LS extension for SR.                             |
|             | PCEP extension for SR.                               |

### 2.3.5 SDN for Deploying an Agile & Flexible Network

Software-Defined Networking (SDN) is an emerging architecture that is dynamic, manageable, cost-effective, and adaptable, making it ideal for the high-bandwidth, dynamic nature of today's applications, which offers a centralized, programmable network to enable cloud and network engineers and administrators to respond quickly to changing business requirements.

Fig. 2-14 SDN framework



ZTE will provide a controller based on a unified and open management and control platform.-ZENIC ONE. This controller is designed for carrier networks and supports the open NBI (Northbound Interface, e.g. RESTCONF) and SBI (Southbound Interface, e.g. NETCONF/PCEP/BGP-LS) to enrich business applications and network services.

Three basic SDN features - topology auto-discovery, E2E packet service instantiation and RF parameter configuration have been test for some famous telecom operators.

1. **Topology Auto-discovery:** ZTE's ZENIC ONE controller can collect, manage and apply the network topologies (physical topology and service topology) it manages, and display them as required by the user via Netcong. For instance, when a node or link fails, the topology view can display the change of physical topology and can also color the faulty link or node.
2. **E2E Service Instantiation:** The end-to-end packet service can be established by the ZENIC ONE controller, including E-LINE, E-LAN, L2VPN and L3VPN.
3. **RF Parameter Configuration:** Through the ONF TR532 south of the interface, the ZENIC ONE controller can configure the microwave radio port parameter, such as frequency, bandwidth and modulation. During the network running, the controller can also query microwave radio parameter configuration through TR532 interface. Operators also can develop other automation APPs basing on TR532.

The SDN energy saving function is enabled for the N+0 microwave link, and the idle link when the transmission traffic is low can be disabled to save energy.

- Save energy parameters
  - Energy-saving time period: For example, when the service transmission requirement at night is low, the energy-saving time can be set at night.
  - Low threshold of service transmission: When the transmission service reaches the low threshold during the energy saving period, the energy saving mode is enabled and the idle link is disabled.
  - High threshold of service transmission: When the transmission service reaches the high threshold during the energy saving period, the energy saving mode is disabled and the idle link is enabled.

### 2.3.6 Low Latency Design

Ultralow latency is a key feature of 5G network, which was researched and defined preliminarily in 3GPP and other standards. It's a big challenge to traditional MW transmission system where there's no low latency technique.

The NR9150 employs high rate switch chip, low latency tunnel design and advanced coding to implement ultra-low latency.

- The NR9150 supports the low-delay channel technology in the specified scenario.
- The advanced coding technology is valid in the L mode.

### 2.3.7 Load Balance

The NR9150 supports Ethernet traffic load balance:

- Ethernet traffic load balance is realized by Physical Layer Aggregation (PLA), Link Aggregation Group (LAG) and Enhanced LAG.
  - PLA can send one Ethernet stream to far end through several radio channels, which is very useful for delivering large streams. It's an intelligent way of increasing bandwidth utilization by adjusting the radio channels' throughputs dynamically according to their forwarding efficiency.
  - LAG can realize multi-channel load balance by hash algorithm based on MAC address, IP address (IPv4/IPv6).

- Enhanced LAG can deliver different streams into different radio channels according to hash algorithm based on MAC/IP address (IPv4/IPv6), port ID, VLAN ID, Ethernet type, MPLS label.

**Note:**

1. LAG/Enhanced LAG will send the same stream through the same radio channel except the channel is failed.
  2. Only one of the above techniques can be applied for the same aggregation group.
  3. The 802.3ad or 802.1ax standard specifies that all ports in a LAG must have the same data rate and must be configured as full duplex.
  4. When using PLA, the ETH throughput per channel is slightly less than the ETH throughput of scenario without PLA.
  5. When the PLA function is configured on the CSA board, the maximum transmission capacity of the PLA group is 5Gbps. When the PLA function is configured on the CSA2/CSA2 v2/CSA4/MD2/MD2 V2/MD4/ME2 board, the maximum transmission capacity of the PLA group is 10Gbps.
- PWE3 TDM traffic load balance is realized by PLA/LAG/enhanced LAG.
    - With PWE3 technique, native TDM is emulated into packet streams and then balanced by PLA/LAG/enhanced LAG
  - ECMP (Equal-cost multi-path): ECMP is a routing strategy where next hop packet forwarding to a single destination can occur over multiple best paths which tie for top place in routing metric calculations. ECMP can substantially increase bandwidth by load-balancing traffic over multiple paths. NR9150 will support:
    - Routing protocol ECMP: OSPF ECMP/IS-IS ECMP/BGP ECMP
    - LDP ECMP/LDP Entropy label
    - TE tunnel ECMP

**Function highlights:**

- Realize high throughput transmission with low capacity radio
- Provide carried grade network within 50ms switching time for Ethernet service
- PLA or LAG/enhanced LAG also provides Ethernet link protection to increase

system reliability

2.3.8 Frame Compression

In order to improve the transmission efficiency and the throughput under the limited radio source, an encapsulation efficiency technology called Frame Compression is adopted by NR9150.

ZTE industry leading frame compression technology increases the effective capacity over the radio link. It supports compression of Layer 2 (MAC address/VLAN tag), Layer 2.5 (MPLS labels) and Layer 3-4 (IPv4/IPv6 address/UDP) header fields. The frame compression is accomplished by identifying packets with a recurring pattern of their header fields. Such fields with recurring values are omitted and replaced with a much shorter compression tag. Original data are stored in compression table together with their compression tag on both sides of the link. A handshake mechanism between the transmitter and the receiver ensures that the compression tables are synchronized on both sides of the link.

The actual increased throughput depends on the packet size and compression scheme.

2.3.9 QoS/HQoS

The Quality of Service (QoS)/Hierarchical Quality of Service (HQoS) indicates the performance of data stream over a network. It promises to provide end-to-end services of high quality for users by resolving network delay and congestion problems. In case of network overload or congestion, QoS ensures high priority traffics. The following features are supported:

Table 2-4 QoS features

| Feature             | Description                                                                                                                                                                                                                                       |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Flow Classification | Common flow classification: DS domain.<br>Ingress priority mapping: DSCP, 802.1P, MPLS EXP/TC                                                                                                                                                     |
|                     | Complex flow classification: ACL traffic classification.<br>Flow classification based on: ingress port, IPv4 ToS/DSCP, IPv6 TC, 802.1p CoS, 802.1q C-VLAN ID/S-VLAN ID, TCP/UDP source / destination port number, source/destination MAC address, |

| Feature                          | Description                                                                                                                                                                                                                                          |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                  | source/destination IP address, Ethernet type and MPLS EXP/TC.                                                                                                                                                                                        |
| Ingress Policy                   | CAR supports: single-rate three-color marker (RFC2697) and two-rate three-color marker (RFC2698), both of them can work at color-blind and color-aware mode.<br>CIR, PIR, CBS and PBS with N×64kbit/s step size.                                     |
| Queue Schedule                   | 8 CoS (class of service) via 8 priority queues: BE, AF1, AF2, AF3, AF4, EF, CS6, and CS7.<br>Schedule scheme: SP, DWRR, SP+DWRR.                                                                                                                     |
| Egress Shaping                   | Queue or egress port based shaping.                                                                                                                                                                                                                  |
| Congestion Management            | Tail drop and WRED (Weighted Random Early Detection).                                                                                                                                                                                                |
| Priorities of Different Services | Priority Trust:<br>Priority field Used by the DS domain:<br>1. 802.1p<br>2. DSCP<br>3. MPLS EXP<br>Remark:<br>Packet priority field remark:<br>1. 802.1p<br>2. DSCP                                                                                  |
| HQoS                             | HQoS is dedicated to offer user level services of sophistication. It supports at least 4 layers of scheduling mechanism with totally 4K queues. Through different layers of scheduling mechanism, HQoS can realize delicacy service quality control. |

### 2.3.10 Bandwidth Notification Message

This feature describes the microwave ACM signaling and Bandwidth Notification Message (BNM) integration, which enables the microwave radio transceivers to report link bandwidth information to an upstream Ethernet switch or router and take action on the signal degradation to reliable quality of service (QoS) management and optimized performance.

In extreme weather conditions, the link bandwidth of an ACM-enabled radio system will change automatically. The Ethernet OAM monitors the microwave link bandwidth, and when a link degradation is detected, the BNM frames carry the current and nominal bandwidth, notifies the router/switch/base station to adjust service policies,

e.g. to reduce the rate of traffic being directed towards the degraded link.

The microwave radio equipment in the network must support ACM and Y.1731 ETH-BN (Ethernet bandwidth notification). The ACM enables the radio capacity to change according to the link quality. The frames with ETH-BN information is defined to carry and report the current and nominal bandwidth from the microwave radio to the other microwave radio or 3<sup>rd</sup> equipment.

## 2.4 High Accuracy Clock Supply and Synchronization

NR9150 supports diversified clock in/out options and provides the mainstream synchronization methods.

The microwave system could synchronize from local crystal oscillator, radio frame and the external clock input. NR9150 could also distribute clock signal to other equipment (base station for instance).

The main features include:

- Sync. E with SSM/expanded SSM protocol provides frequency synchronization.
- Phase/Time synchronization with the combination of 1588v2 and Sync.E (1588v2 TC, Sync. E + 1588v2 OC/BC).
- ACR, DCR or retiming for PWE3 TDM service frequency synchronization.
- Supports priority-based multi clock source protection and 1588v2 BMC algorithm.
- Frequency synchronization has three working modes: locking, maintaining, and free oscillation.
- The clock can maintain at least 24 hours (holdover time) in case losing clock source.

## 2.5 Protection and Resilience

NR9150 provides full-scale hardware and service protection scheme.

Table 2-5 Protection scheme

| Item         | Description                                                                                                                                |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Power Supply | The -48V DC power input ports support hot standby.                                                                                         |
| Radio        | 1+1 HSB/SD/FD.                                                                                                                             |
|              | L1 (Physical layer) link aggregation (PLA) for packet service.                                                                             |
|              | L2 link aggregation group (LAG/LACP) for packet service.                                                                                   |
| Ethernet     | STP/RSTP/MSTP for ordinary Ethernet ring protection.                                                                                       |
|              | ERPS v2 carrier Ethernet multi-ring protection.                                                                                            |
|              | LAG/enhanced LAG offers redundancy connection for Ethernet port protection (available both for ports in one board or in different boards). |
| IP/MPLS      | PW FRR or PW APS for PWE3 TDM (on roadmap).                                                                                                |
|              | IP FRR, LDP FRR, BGP VPN FRR.                                                                                                              |
|              | MPLS-TE FRR/HSB.                                                                                                                           |

TIPS: PW protection will instead of SNCP/N+1 in L3/MPLS switching network.

## 2.6 Network Security

NR9150 can prevent unauthorized logins and operations, ensuring network, radio link and equipment management security.

### 2.6.1 Access Control List (ACL)

Access Control List (ACL) can classify the ingress packets and implements black list management to enhance the network security.

Black list can be created via setting ACL parameters to specify which kind of traffic will be rejected per port. When a black list is enabled, the frames in the black list will be discarded.

### 2.6.2 Broadcast Storm Control

Filters can be created per port to prevent broadcast and multicast storms. Individual filters are used for broadcast and multicast traffic. The limit is specified as fixed rate (frames per second). When the limit is reached, additional frames will be discarded until the frame rate is below the specified threshold. The storm control filters are list

as below.

- Broadcast packet.
- Multicast packet (IP multicast/MAC multicast).
- Unknown cast packet.

### 2.6.3 Link Security ID (Radio Link Security Identification)

Link Security Identification (link security ID) is used to avoid mismatch between two radio links. Two ends of a radio link with different radio link IDs will not communicate each other even if they have other proper configurations. It's a good way of preventing undesired link connection to improve network security, such as the third party malicious data interception. Alarms will be reported and the traffic will be interrupted once link ID differences between local and remote sites are detected.

### 2.6.4 Security Key System

Microwave NEs generate and store root keys and working keys in a secure manner, providing wonderful protection for NE assets and data.

The root key is generated when the system is powered on, with a length of  $\geq 256$  bits and saved in the memory. Each NE has a different root key.

The working key is encrypted and decrypted by the root key. The algorithm is AES256. The working key can be set by the user to ensure its security.

### 2.6.5 User Authorization

- User authentication includes local user name/password authentication and remote authentication. Remote authentication includes:
  - RADIUS (Remote Authentication Dial-In User Service) authentication (RADIUS server is required).
  - TACACS+ (Terminal Access Controller Access Control System) (TACA CS+ server is required).
- Secure communication channels: TLS v1.3, SSH v2, SNMPv3, HTTPS, SFTP.
- User account security, including weak password detect, anti-violence attack, default account delete/disable etc.

### 2.6.6 Radio Link Encryption

Radio link encryption function (on-demand feature) using AES algorithm to encrypt radio data, thus preventing the third parties unauthorized access to microwave transmission network. This function can effectively prevent transmit data to be illegally obtain or modify.

Encryption algorithms include:

- Symmetric key algorithms: 128-bit AES
- Symmetric key algorithms: 192-bit AES
- Symmetric key algorithms: 256-bit AES

### 2.6.7 Anti-Theft

ZTE microwave supports electronic locking function to prevent theft or unauthorized use of the device.

Enable the anti-theft function: Enable the electronic locking function through the GUI of NMS to manage the locking of assets including IDUs and boards.

- The NMS generates a public-private key pair, the NMS sends the public key, operator ID, electronic lock enable status, usage duration, and other information to the NE
- Upon receiving the locking command, the NE writes the electronic lock information into the IDU and board.
- Establish an electronic lock authentication channel between the NE and the NMS to implement anti-theft management.

## 2.7 Management and Maintenance

### 2.7.1 Frequency Auto-scanning

Frequency scanning is a detection technique to help us to find out the interference by scanning the receiver radio signal within the range of frequency sub-band, and troubleshooting the frequency points of interference signals. The higher the receiver

signal level is, the severer the interference will be.

One can benefit from two aspects as follows:

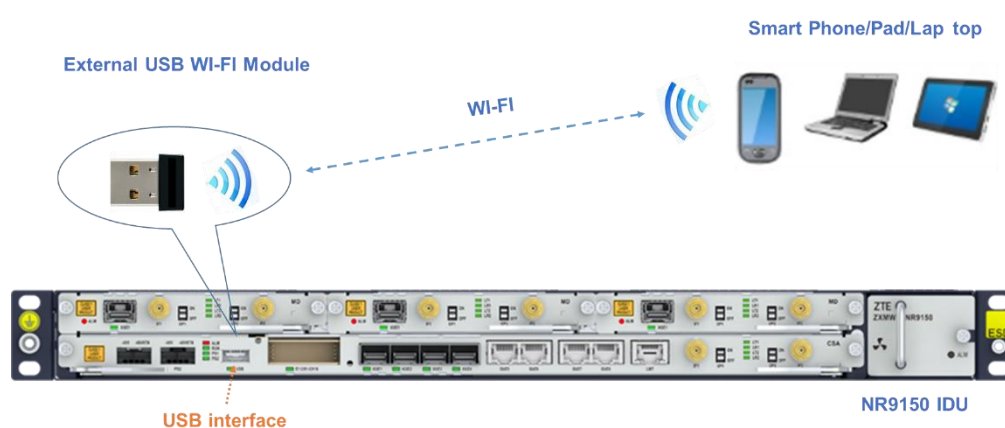
- If the decline of transmission quality caused by poor signals during operation, maintainers can detect the interference frequency source accurately, and avoid interference by rearranging the frequency plan.
- This function is realized by microwave equipment without any expensive frequency scanning instrument such as spectrum analyzer to save the operating cost.

## 2.7.2 Wi-Fi Access

Wi-Fi solution is widely used in wireless interconnection thanks to its cost saving deployment of local area networks (LANs). Specifically, spaces where cables cannot be run, such as outdoor areas, can host wireless LANs as a cost effective solution. Users can access and log the NE via smart phone, Pad or laptop.

The NR9150 product provides Wi-Fi access function, which is implemented by connecting an external USB Wi-Fi module with the USB interface of the IDU.

Fig. 2-15 Wi-Fi access via smart phone/pad/laptop



## 2.7.3 Smart DCN

The DCN (Data Communication Network) channel is a dedicated channel for NE management. DCN channels and service transmission channels are isolated from each other.

When the EMS manages NEs through the traditional DCN channel, the devices in the entire network must be commissioned and configured first.

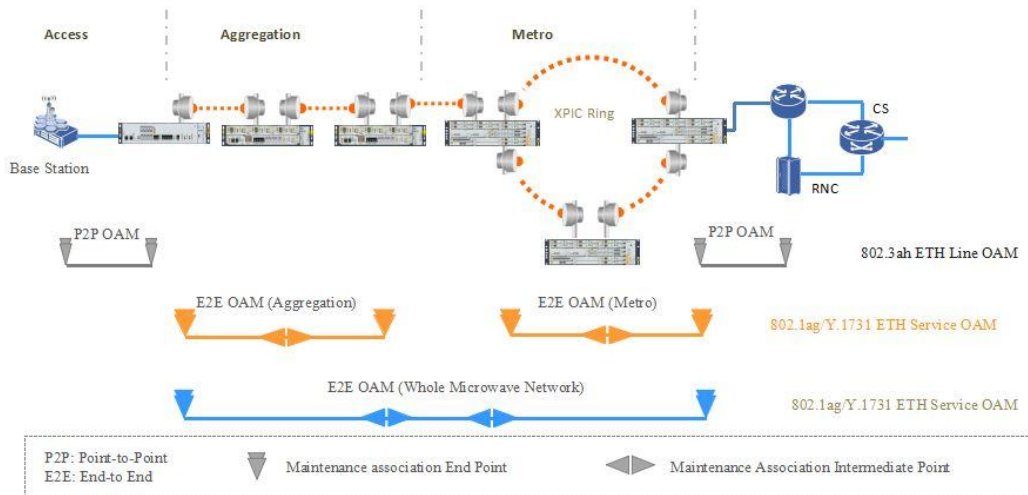
The Smart DCN provides flexible and convenient NE management for the complex L3 network. Compared with traditional DCN channels, the Smart DCN can save IP resources, make site commissioning simpler, make maintenance easier and make applications more flexible.

- Smart DCN uses the IP unnumber technology to allocate the DCN management address to the NE without allocating the interface IP address, thus saving the IP address resources.
- Traditional DCN implement NE management of the entire network, and on-site commissioning, debugging, configuration must be completed first. Smart DCN only needs to complete equipment commissioning, it can automatically create OSPF to connect the layer-3 routes between NEs and implement network-wide management.
- If the traditional DCN is configured incorrectly, the remote site will be disconnected and services cannot be restored remotely. However, the Smart DCN through its exclusive emergency maintenance channel and neighbor configuration query channel, to quickly and remotely restore the neighbor configuration.
- The Smart DCN based on the L3 routing technology does not need to consider Ethernet loops or broadcast storms.

#### **2.7.4 Ethernet OAM**

IEEE 802.3ah complied Ethernet link OAM, IEEE 802.1ag and ITU-T Y.1731 complied Ethernet service OAM is supported by NR9000 product. As shown in following figure, they provide E2E and hierarchical Ethernet OAM for our customer's network.

Fig. 2-16 Full scale and hierarchical Ethernet OAM



- Ethernet Link OAM

Ethernet Link OAM supports fault management on Ethernet links according to IEEE 802.3ah (also called “EFM”) and provides fault management and performance monitoring in the Metro Ethernet Network (MEN) access link. It is used in physical line connection scenario.

**Note:** Ethernet Link OAM is only supported for LAN interfaces.

The three main Ethernet Link OAM areas are supported:

- Link Performance Monitoring.

Link performance monitoring is used for event notification on error frames at both near and far end and is used on NEs in operation. The notifications are based on a threshold crossing within a specific time window.

- Failure Notification

Notifies the Ethernet link failure to the far end that in OAM operation.

- Remote Loopback

Link OAM remote loopback can be used for fault localization and link performance testing on LAN interfaces.

- Ethernet Service OAM

IEEE 802.1ag (also called “CFM”) is a standard defined by IEEE. It defines

protocols and practices for OAM (Operations, Administration, and Maintenance) for paths through 802.1 bridges and local area networks (LANs).

IEEE 802.1ag is largely identical with ITU-T Recommendation Y.1731, which additionally addresses performance management.

The main Ethernet service OAM areas are described below.

Table 2-6 Ethernet service OAM

| Function | Description                                                                                                                                                                              | Standard |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| CC       | Continuity check (CC) in MEN is used for the Ethernet fault checking, which indicates the link status between two MEPs. CC period: 3.33 ms, 10 ms, 100 ms, 1 s, 10 s, 1 min, 10 min.     | 802.1ag  |
| LB       | Loopback (LB) is used for fault confirmation and fault location. The loopback defined in IEEE 802.1ag is a kind of unicast loopback that brings no user service interruption             |          |
| LT       | Link Trace (LT) is used for fault location and route discovery. When this function is enabled, the service route and failure point of the demand link is list.                           |          |
| LM       | Frame Loss Measurement (LM) is used to measure Ethernet end-to-end frame lost ratio, which is lunched by the network manager. NR9150 only supports single-ended LM.                      | Y.1731   |
| DM       | Frame Delay Measurement (DM) is used for on-demand OAM to measure Ethernet end-to-end frame delay and frame delay variation.<br>NR9150 supports Two-way DM and One-way DM.               |          |
| RDI      | Remote Defect Indication (RDI) informs the remote MEP there is a fault occurred at local MEP.                                                                                            |          |
| AIS      | Alarm Indication Signal (AIS) suppresses alarms at the client-layer MEPs after detecting a fault or an AIS condition at the server-layer MEP.                                            |          |
| LCK      | Locked Signal (LCK) suppresses the alarms generated by out-of-service management or testing. The MEPs which received LCK information will ignore the link failure caused by the testing. |          |
| TST      | Testing signal (TST) is used for Ethernet throughput and packet loss rate testing, including in-service or out-of-service testing.                                                       |          |
| R-APS    | Ring-Automatic Protection Switching (R-APS) provides switching signal for G.8032 ring protection.                                                                                        |          |

### 2.7.5 MPLS OAM

MPLS OAM is used for fault and performance monitoring of MPLS networks. MPLS OAM described in this section includes LSP Ping/Traceroute, PW Ping/PWE3 Ping/Traceroute, and BFD:

- LSP Ping/Traceroute: Similar to traditional IP Ping, LSP Ping/Traceroute monitors LSP faults through two types of packets: Echo Request and Echo Reply. LSP Ping detects the bidirectional connectivity of the LSPs to a specified site, while LSP Traceroute detects the bidirectional connectivity of the LSPs to a specified site and the status of intermediate paths to the specified site. In general, LSP Ping is used to discover link faults, while LSP Traceroute is used to locate fault points.
- PWE3 Ping/Traceroute: The principle of PWE3 Ping (also called VCCV-Ping) is the same as that of LSP Ping. The difference lies in that PWE3 Ping forwards MPLS Echo Request packets through a PW and determines whether the entire PW can be used for data forwarding. The principle of PWE3 Traceroute is similar to that of LSP Traceroute, except for a layer of PW label added to a packet (the label is used to check whether the VC ID of the local PE is the same as that of the peer PE).
- BFD: BFD provides a universal, standardized, media-independent, and protocol-independent fast fault detection mechanism. It can quickly detect the faults of the bidirectional forwarding path between two routers for upper-layer protocols, such as the routing protocol and MPLS.

### 2.7.6 MPLS-TP OAM

To meet the high reliability requirements of the carrier-class transmission network, MPLS-TP OAM is optimized and enhanced on the basis of MPLS OAM.

MPLS-TP OAM protocol includes three layers of network models: Section OAM, Tunnel OAM and PW OAM. NR9150 support Tunnel OAM and PW OAM.

1. Section OAM monitors and manages the service forwarding at the SECTION layer.
2. The Tunnel OAM monitors and manages the end-to-end forwarding behavior and fault information of the LER, and the forwarding behavior of the LSP link.

3. PW OAM monitors and manages the end-to-end forwarding behavior and fault information between two PEs (SS-PW or MS-PW), and the link forwarding behavior between any two PEs in MS-PW.

The NR9150 MPLS-TP OAM based on G-Ach (Generic Associated Channel) +Y.1731 PDU extension provides the following fault detection functions:

- Continuity check (CC)
  - Operating In active mode, Loss of Continuity (LOC) between any pair of MEPs in a MEG is checked.
- Alarm Indication Signal (AIS)
  - AIS is used for client-layer alarm suppression.
- Remote Defect Indication (RDI)
  - RDI detects in active mode whether a fault occurs at the peer end.
- Loopback (LB) Detection
  - Operating In on-demand mode, LB is used to verify bidirectional connectivity and locate faults
- Location Tracing (LT)
  - Operating In on-demand mode, LT is used to verify bidirectional connectivity and locate faults.
- Lock (LCK)
  - After the data service is interrupted because the service layer is locked for the purpose of management and maintenance, the MEP at the service layer instructs the peer MEP at the client layer to suppress the LOC alarms from the client layer to avoid unnecessary alarms.
- Customer Signal Failure (CSF) indication
  - If the user layer itself does not support the alarm suppression/fault notification mechanism, a MEP forwards signal fault information of the user layer to the peer MEP through a CSF message, so that user layer fault information is transmitted.
- Packet Loss Measurement (LM)

- LM detects the packet loss performance of connections, and is divided into single-ended LM and dual-ended LM.

**Note:** NR9150 only supports single-ended LM.

- Delay Measurement (DM)
  - DM works in on-demand mode, and is used to measure the delay and delay jitter between two MEPs. It is divided into one-way DM and two-way DM.
- Testing (TST)
  - TST works in on-demand mode and is used to detect the link bandwidth (throughput).
- Automatic Protection Switching (APS)
  - APS is used to transmit fault conditions and protection switching status information between maintenance endpoints to coordinate protection switching operations.

### 2.7.7 SR OAM

- SR PING/TRACE: used for LSP connectivity monitoring and fast fault detection.
- BFD for SR: BFD for SR-BE and BFD for SR-TE LSP.

### 2.7.8 SQA (Service Quality Analyzer)

- Built-in TWAMP (RFC 5357 - A Two Way Active Measurement Protocol) can be used for online IP performance measurement during network stability period. The test mainly includes Lost Packets, Latency/Delay and Packet Delay Variation. With TWAMP available, network providers will be able to better know the exact behavior of their networks and apply resources where improvement is most likely.
- Built-in RFC2544/Y.1564 can be applied for E2E service channel performance test at reference link design in system acceptance period test after link commissioning. The measurement objects are performance indicators, including network Throughput, Frame Loss Rate, Latency/Delay and Jitter.

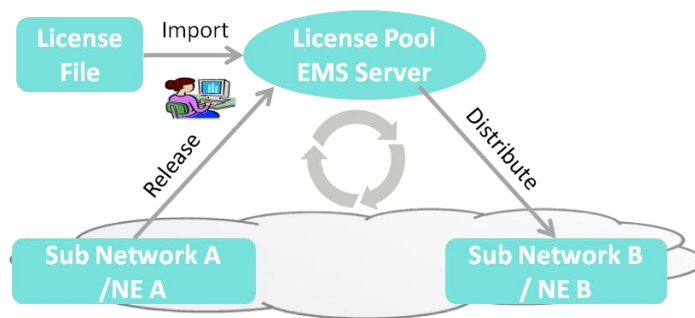
### 2.7.9 Intelligent License Control

All the functions of NR9000 are prepared once the hardware is deployed. Considering a step-by-step and low risk investment, some enhanced functions are controlled by software license. Thus, capital shortage and over investing are avoided.

In order to manage the license, standing on customer site, ZTE creates an industrial leading intelligent license management system, which is a kind of centralized and flexible license control solution with 3 typical features:

- Centralized license pool (License center).
- Bulk import license.
- Transferable license.

Fig. 2-17 Intelligent license control schematic



License file can be imported to the license center (separated server or share EMS server) and act as license pool. After that, the on-line network elements (NEs) will request license from license pool (or release license to license pool) automatically according to link requirement. Manual setting is also supported.

Intelligent license control brings:

- Importing the license in bulk, save time.
- License can be activated automatically, easy maintenance.
- License reusing, reduce CAPEX.
- License transfer, easy site relocation.
- Function adjustment, optimize network performance.

## 2.7.10 Full Scale Management Solution

ZTE offers powerful management system of NE (Networks element) level and Network level. The following features are used in network management:

Table 2-7 Network management features

| Feature                                                         | Description                                                                                                                                                                                                                                             | Benefits                                                                                                 |
|-----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| Management - Data Communication Network (DCN)                   | Provides one LMT interface for local management.<br>ETH interface can be defined as NMS interface for out-band management.<br>Supports L2 DCN (e.g. VLAN) and L3 DCN.<br>Automatic connection of management panel routing/channel with integrated OSPF. | Configuration of Interface IP/VALN and IGP protocol are not necessary, fast and convenient provisioning. |
| NE and Link Auto-discovery (LLDP)-Link Layer Discovery Protocol | The EMS can discover equipment and change network topology automatically.                                                                                                                                                                               | Network construction and management becomes intelligent and easily.                                      |
| System Log                                                      | System log reporting feature                                                                                                                                                                                                                            | Monitoring the system performance and locating the fault                                                 |

- Web-based Local Maintenance Terminal (LMT) offers a convenient and simply configuration method. It's an indispensable part when lack of EMS/NMS.
- ZENIC ONE, ZTE's network management solution, provides simplified network provisioning, configuration error prevention, monitoring and troubleshooting tools that ensure better user experience, minimal network downtime and reduced expenditures on network level maintenance.

**TIPS:** For further information, please refer to "chapter 4 NMS: Network management system" and "ZENIC ONE Production Description".

## 2.7.11 TAMP (Traffic Aware Multi-channel Power Saving)

For microwave and wireless bundled links, ZTE provides an energy-saving feature that dynamically detects traffic load and shuts down idle channels to achieve efficiency.

Traffic Aware Multi-channel Power Saving, commonly abbreviated as TAMP. The TAMP strategy can be manually configured to power-off mode or mute mode. The key processes of TAMP include

- During the energy-saving time period, continuously monitor the bundled links. When the traffic reaches the energy-saving threshold, power-off or mute idle channels.
- When the traffic exceeds the energy-saving threshold, or the energy-saving period expires, the bundled link is powered on or the energy-saving channel is unmuted.

Different ODU architectures, models, frequency bands, and energy saving modes can achieve different energy saving effects.

#### 2.7.12 TAPC (Traffic Aware Power Control)

TAPC is a transmit power control function based on traffic perception. The modulation mode is dynamically adjusted in accordance with the traffic load, and the transmit power is adjusted in accordance with the energy-saving level of the ODU to reduce power consumption.

- Conditions for TAPC Enable
  - Sets the TAPC adjustment time window based on the busy and idle periods.
  - Set the range of TAPC adjustment based on traffic thresholds. Set high and low traffic threshold values as a percentage of the total link traffic.
- Conditions for TAPC Application
  - TAPC is applicable to 1+0 configuration, and N+0(N>1) configuration is unavailable.
  - TAPC needs to combine the ACM function to ensure that the link is not interrupted during the handover process.
  - TAPC and ATPC cannot be used at the same time.

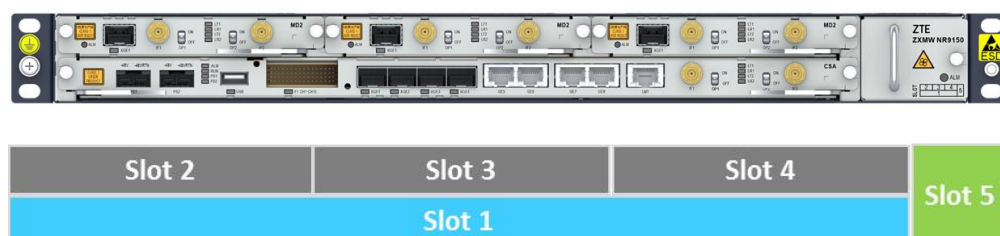
## 3 Hardware Description

The NR9150 adopts split-mount architecture, including indoor unit (IDU) and outdoor unit (ODU).

### 3.1 IDU Structure

The NR9150 IDU comprises a sub-rack and series of boards. The sub-rack is 19 inches in width and 1U in height. The hardware layout is showed in following figure.

Fig. 3-1 Hardware layout



NR9150 can meet different transmission requirements via configuring different function boards. All the function boards support flexible configuration and hot swapping.

NR9150 IDU includes the following board types:

- Core Switch (CS)
- Modem Unit (M)
- Interface TDM (IT)
- Interface ETH (IE)
- Power Supply (PS)
- Fan Unit (F)
- Auxiliary Service Unit (AU) (on roadmap)

Fig. 3-2 IDU Slot Diagram



For the board description and applicable slots, refer to the following table.

Table 3-1 Boards and slots

| Board Type | Board Name | Hardware Description                                                                                                 | Available/Recommended Slots                        |
|------------|------------|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| CS         | CSA        | Core Switch A:<br>1×USB + 1× LMT +<br>4×GE(o)/10GE(o) + 4×GE(e) +<br>16×E1 + 2×IF.                                   | Slot 1                                             |
|            | CSA2       | Core Switch A2:<br>Interface: 1×USB + 1× LMT +<br>4×GE(o)/10GE(o) + 4×GE(e) +<br>1×EDI+1×EDI/SC+1×CLK/MON<br>+ 2×IF. | Slot 1                                             |
|            | CSA2 v2    | Core Switch A2 v2:<br>1×USB + 1× LMT +<br>6×GE(o)/10GE(o) + 4×GE(e) +<br>2×IF.                                       | Slot 1                                             |
|            | CSA4       | Core Switch A4:<br>1×USB + 1× LMT +<br>6×GE(o)/10GE(o) + 4×GE(e) +<br>4×IF.                                          | Slot 1                                             |
| M          | MD2        | Modem Unit D2:<br>2×IF + 1×10GE(o);                                                                                  | Available: Slot 2 to 4<br>Recommended: Slot 3 to 4 |
|            | MD2 v2     | Modem Unit D4:<br>2×IF;                                                                                              | Available: Slot 2 to 4                             |
|            | MD4        | Modem Unit D4:<br>4×IF;                                                                                              | Available: Slot 3 to 4                             |
|            | ME2        | Modem Unit E2:<br>2×IF + 1×10GE(o);                                                                                  | Available: Slot 2 to 4<br>Recommended: Slot 3 to 4 |
| IE         | IEA        | Interface ETH A:<br>4×GE(e) + 2×10GE(o)                                                                              | Available: Slot 2 to 3                             |

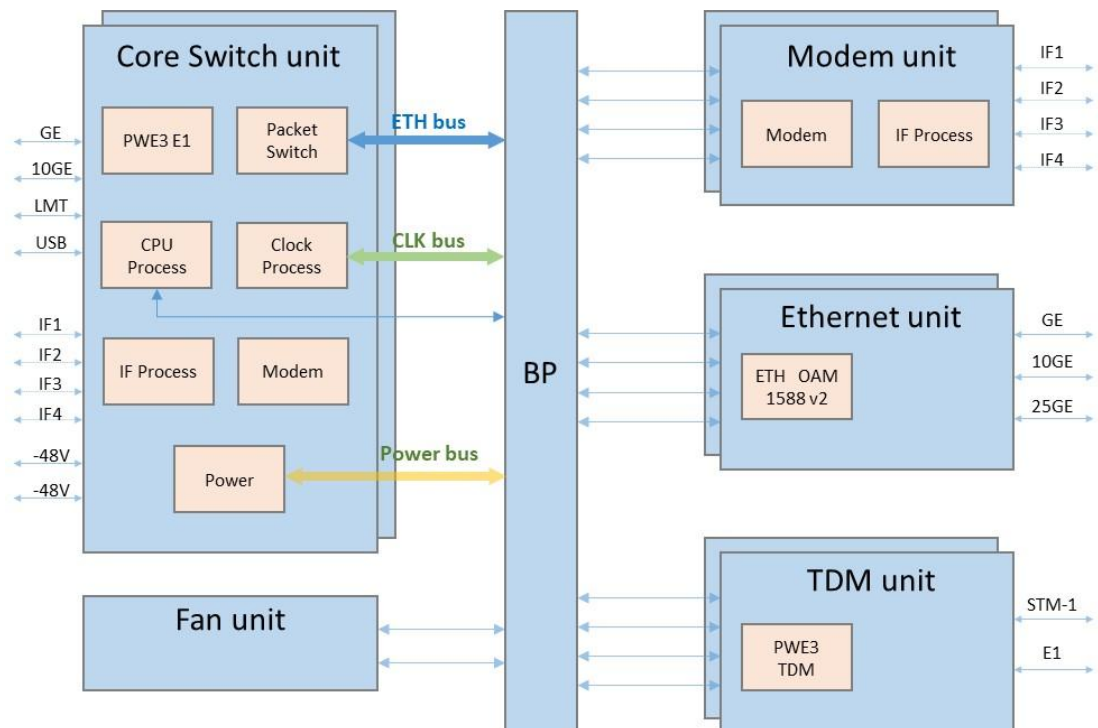
| Board Type | Board Name | Hardware Description                                   | Available/Recommended Slots                   |
|------------|------------|--------------------------------------------------------|-----------------------------------------------|
|            | IEB        | Interface ETH B:<br>4×GE(o)/10GE(o) + 2×GE(o)          | Available: Slot 2 to 4<br>Recommended: Slot 3 |
|            | IED        | Interface ETH D:<br>1×GE(o) + 1×10GE(o) +<br>1×25GE(o) | Slot 2 to 3                                   |
|            | IEM2       | Interface ETH M2 :<br>2×10GE(o)                        | Slot 2 to 3                                   |
| IT         | ITD        | Interface TDM D:<br>PWE3 2×STM-1                       | Slot 2 to 4                                   |
|            | ITA        | Interface TDM A:<br>PWE3 16×E1                         | Slot 2 to 4                                   |
| F          | FA         | Fan Unit A                                             | Slot 5                                        |

TIPS:

1. The product delivery automatically matches the latest boot version, software version, and hardware version.

The communication relationship of the mentioned units is mainly described by the block diagram is shown in following figure.

Fig. 3-3 IDU block diagram



## 3.2 ODU Structure

ODU's function units consist of IF signal input/output interface, RSSI interface, frequency converter, signal amplifier and low-noise amplifier. Only the interfaces are visible.

The block diagram of the ODU is described in following figure.

Fig. 3-4 1T1R ODU block diagram

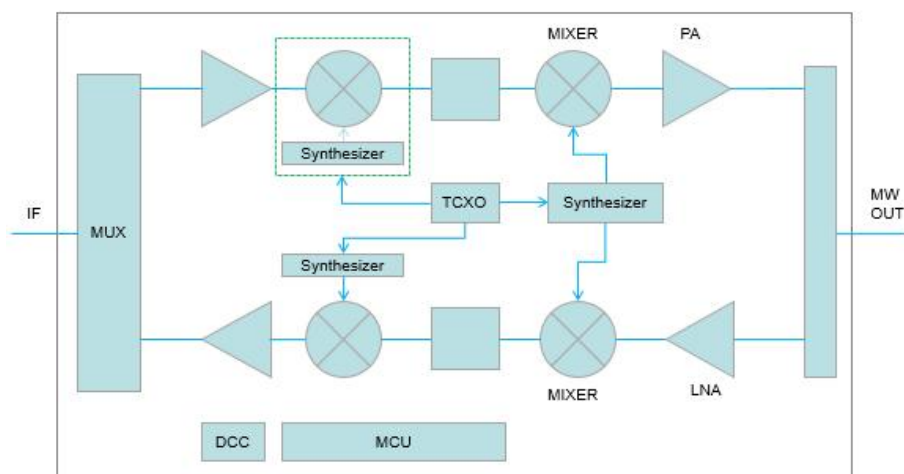
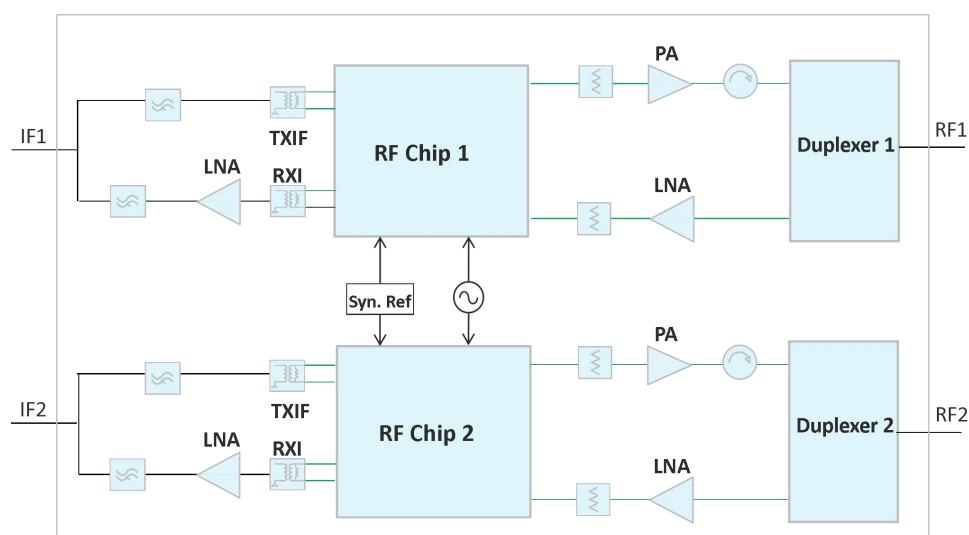


Fig. 3-5 2T2R ODU block diagram



### 3.3 Boards and Interfaces

#### 3.3.1 CSA board

Fig. 3-6 CSA board front panel



Table 3-2 CSA interface description

| Interface    | Type                 | Description                                                                                         |
|--------------|----------------------|-----------------------------------------------------------------------------------------------------|
| XGE1 to XGE4 | SFP+, LC             | GE/10GE combo SFP+ interface. 1000 Base-LX/SX or 10GBase-LR/ER/SR.                                  |
| GE5 to GE8   | RJ-45                | GE interface (10/100/1000 Base-T), can be defined as NMS or GE function via software configuration. |
| LMT          | RJ-45                | Local maintenance and debugging interface (10/100/1000 Base-T).                                     |
| E1           | D type SCSI 64       | 16*E1 interface (support PWE3 only).                                                                |
| IF1, IF2     | Female SMA connector | IF signal interface for channel 1 and channel 2.                                                    |
| OP1, OP2     | Power switch         | ODU power switches for channel 1 and channel 2.                                                     |
| USB          | USB 2.0              | USB interface for USB Wi-Fi module.                                                                 |
| PS1, PS2     | -48V Power connector | Provide -48V DC power for IDU and ODU, PS1 and PS2 are backup for each other.                       |

CSA board is used for system main control, clock procession and service switching. Its specific functions are shown as below:

- Performs system main control, packet switching (L2/L3/MPLS/SR), SDN and system clock synchronization function.
- Enhanced packet function: enhanced LAG, PLA, HQoS, and performance statistic per VLAN Pri/DSCP/Queue.
- Provides -48 V DC power for ODU.
- Provides two IF interfaces and integrates 2+0 XPIC function in single board.
- Can be used in 10Gbps MBL configuration. The XGE interface on the board is used for connecting to the E-band device. CSA supports 1 groups MBL.
- Channel bandwidth: 7/14/28/40/56/80/112 MHz.
- Provides QPSK/ 16 QAM/ 32 QAM/ 64 QAM/ 128 QAM/ 256 QAM/ 512 QAM/ 1024 QAM/ 1024 QAM light/ 2048 QAM/ 4096 QAM/ 8192 QAM modulation/demodulation function.
  - Modulation: codes and modulates the baseband signals to IF signals and sends them to ODU through the IF interface.
  - Demodulation: demodulates and decodes the IF signals coming from

ODU.

- 4x4 MIMO works in QPSK~2048 QAM modulation scheme (1\*CSA plus 1\*MD2 are required).
- Supports ACM, ATPC, XPIC, Rx combining and CA.
- Supports HSB/SD/FD protection inter-board and intra-board.
- Enabling ACM function is suggested when using 1024 QAM and/or higher level modulation scheme.
- Supports under/over-voltage protection and over-current protection at IF interface.
- The maximum IF cable (5D-FB type) length between IDU and ODU is 100 meters (RG-8U IF cable is up to 200 meters; 10D-FB IF cable is up to 300 meters).
- Supports G01/C01/L01, G02/C02/L02 mode

### 3.3.2 CSA2 board

Fig. 3-7 CSA2 board front panel



Table 3-3 CSA2 interface description

| Interface    | Type     | Description                                                                                                                                                     |
|--------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| XGE1 to XGE4 | SFP+, LC | GE/10GE combo SFP+ interface. 1000 Base-LX/SX or 10GBase-LR/ER/SR.                                                                                              |
| GE5 to GE8   | RJ-45    | GE interface (1000 Base-T), can be defined as NMS or GE function via software configuration.                                                                    |
| LMT          | RJ-45    | Local maintenance and debugging interface (10/100/1000 Base-T).                                                                                                 |
| EDI1         | RJ-45    | External alarm interface, 4 ways EDI input/output                                                                                                               |
| EDI2/SC      | RJ-45    | External alarm interface, 2 ways EDI input.<br>Or Service channel delivers user's special traffic through an RJ-45 connector, supports V.28 synchronization and |

| Interface | Type                 | Description                                                                                                                                                                |
|-----------|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|           |                      | asynchronization signal.                                                                                                                                                   |
| CLK/MON   | RJ-45                | Clock and monitoring multiplex interface (software switchable).<br>CLK: 2 MHz/2 Mbps BITS and 1PPS+ToD;<br>MON: Receive RS485 data coming from cabinet's monitor interface |
| IF1, IF2  | Female SMA connector | IF signal interface for channel 1 and channel 2.                                                                                                                           |
| OP1, OP2  | Power switch         | ODU power switches for channel 1 and channel 2.                                                                                                                            |
| USB       | USB 2.0              | USB interface for USB Wi-Fi module.                                                                                                                                        |
| PS1, PS2  | -48V Power connector | Provide -48V DC power for IDU and ODU, PS1 and PS2 are backup for each other.                                                                                              |

CSA2 board is used for system main control, clock procession and service switching. Its specific functions are shown as below:

- Performs system main control, packet switching (L2/L3/MPLS/SR), SDN and system clock synchronization function.
- Enhanced packet function: enhanced LAG, PLA, HQoS, and performance statistic per VLAN Pri/DSCP/Queue.
- Provides -48 V DC power for ODU.
- Provides two IF interfaces and integrates 2+0 XPIC function in single board.
- Can be used in 10Gbps MBL configuration. The XGE interface on the board is used for connecting to the E-band device, CSA2 supports 1 groups MBL.
- Channel bandwidth: 7/14/28/40/56/80/112 MHz.
- Provides QPSK/ 16 QAM/ 32 QAM/ 64 QAM/ 128 QAM/ 256 QAM/ 512 QAM/ 1024 QAM/ 1024 QAM light/ 2048 QAM/ 4096 QAM/ 8192 QAM/ 16K QAM modulation/demodulation function.
  - Modulation: codes and modulates the baseband signals to IF signals and sends them to ODU through the IF interface.
  - Demodulation: demodulates and decodes the IF signals coming from ODU.
- 4x4 MIMO works in QPSK~2048 QAM modulation scheme (1\*CSA2 plus

1\*MD2 are required).

- Supports ACM, ATPC, XPIC, Rx combining and CA.
- Supports HSB/SD/FD protection inter-board and intra-board.
- Enabling ACM function is suggested when using 1024 QAM and/or higher level modulation scheme.
- Supports under/over-voltage protection and over-current protection at IF interface.
- The maximum IF cable (5D-FB type) length between IDU and ODU is 100 meters (RG-8U IF cable is up to 200 meters; 10D-FB IF cable is up to 300 meters).
- Supports G01/C01/L01, G02/C02/L02 mode.

3.3.3 CSA4 board

Fig. 3-8 CSA4 board front panel



Table 3-4 CSA4 interface description

| Interface          | Type                 | Description                                                                                  |
|--------------------|----------------------|----------------------------------------------------------------------------------------------|
| GE1 to GE4         | RJ-45                | GE interface (1000 Base-T), can be defined as NMS or GE function via software configuration. |
| XGE5 to XGE10      | SFP+, LC             | GE/10GE combo SFP+ interface. 1000 Base-LX/SX or 10GBase-LR/ER/SR.                           |
| LMT                | RJ-45                | Local maintenance and debugging interface (10/100/1000 Base-T).                              |
| IF1, IF2, IF3, IF4 | Female SMA connector | IF signal interface for channel 1, channel 2, channel 3 and channel 4.                       |
| USB                | USB 2.0              | USB interface for USB Wi-Fi module.                                                          |
| PS1, PS2           | -48V Power connector | Provide -48V DC power for IDU and ODU, PS1 and PS2 are backup for each other.                |

CSA4 board is used for system main control, clock procession and service switching.

Its specific functions are shown as below:

- Performs system main control, packet switching (L2/L3/MPLS/SR), SDN and system clock synchronization function.
- Enhanced packet function: enhanced LAG, PLA, HQoS, and performance statistic per VLAN Pri/DSCP/Queue.
- Provides -48 V DC power for ODU.
- Provides four IF interfaces and integrates 4+0 XPIC function in single board.
- Can be used in 10Gbps MBL configuration. The XGE interface on the board is used for connecting to the E-band device. CSA4 supports 2 groups MBL.
- Channel bandwidth: 7/14/28/40/56MHz (four carriers) or 80/112MHz (two carriers).
- Provides QPSK/ 16 QAM/ 32 QAM/ 64 QAM/ 128 QAM/ 256 QAM/ 512 QAM/ 1024 QAM/ 1024 QAM light/ 2048 QAM/ 4096 QAM/ 8192 QAM/16K QAM modulation/demodulation function.
  - Modulation: codes and modulates the baseband signals to IF signals and sends them to ODU through the IF interface.
  - Demodulation: demodulates and decodes the IF signals coming from ODU.
- 4x4 MIMO works in QPSK~2048 QAM modulation scheme (only one CSA4 board is required).
- Supports 4+0 CA XPIC in one board.
- Supports ACM, ATPC, XPIC, and Rx combining.
- Supports HSB/SD/FD protection inter-board and intra-board.
- Enabling ACM function is suggested when using 1024 QAM and/or higher level modulation scheme.
- Supports under/over-voltage protection and over-current protection at IF interface.
- The maximum IF cable (5D-FB type) length between IDU and ODU is 100 meters (RG-8U IF cable is up to 200 meters; 10D-FB IF cable is up to 300 meters).

- Supports G02/C02/L02 mode

**Note:**

1. The CSA4 supports four groups 1+0 configuration, or 2 groups PLA configuration.

**3.3.4 CSA2 v2 board**

Fig. 3-9 CSA2 v2 board front panel



Table 3-5 CSA2 v2 interface description

| Interface     | Type                 | Description                                                                                  |
|---------------|----------------------|----------------------------------------------------------------------------------------------|
| GE1 to GE4    | RJ-45                | GE interface (1000 Base-T), can be defined as NMS or GE function via software configuration. |
| XGE5 to XGE10 | SFP+, LC             | GE/10GE combo SFP+ interface. 1000 Base-LX/SX or 10GBase-LR/ER/SR.                           |
| LMT           | RJ-45                | Local maintenance and debugging interface (10/100/1000 Base-T).                              |
| IF1, IF3      | Female SMA connector | IF signal interface for channel 1, channel 2                                                 |
| USB           | USB 2.0              | USB interface for USB Wi-Fi module.                                                          |
| PS1, PS2      | -48V Power connector | Provide -48V DC power for IDU and ODU, PS1 and PS2 are backup for each other.                |

CSA2 v2 board is used for system main control, clock procession and service switching. Its specific functions are shown as below:

- Performs system main control, packet switching (L2/L3/MPLS/SR), SDN and system clock synchronization function.
- Enhanced packet function: enhanced LAG, PLA, HQoS, and performance statistic per VLAN Pri/DSCP/Queue.
- Provides -48 V DC power for ODU.
- Provides two IF interfaces and integrates 2+0 XPIC function in single board.
- Can be used in 10Gbps MBL configuration. The XGE interface on the board is

used for connecting to the E-band device, CSA2 v2 supports 1 groups MBL.

- Channel bandwidth: 7/14/28/40/56/80/112 MHz.
- Provides QPSK/ 16 QAM/ 32 QAM/ 64 QAM/ 128 QAM/ 256 QAM/ 512 QAM/ 1024 QAM/ 1024 QAM light/ 2048 QAM/ 4096 QAM/ 8192 QAM/16K QAM modulation/demodulation function.
  - Modulation: codes and modulates the baseband signals to IF signals and sends them to ODU through the IF interface.
  - Demodulation: demodulates and decodes the IF signals coming from ODU.
- 4x4 MIMO works in QPSK~2048 QAM modulation scheme (will be released in next version).
- Supports 4+0 CA XPIC in one board.
- Supports ACM, ATPC, XPIC, and Rx combining.
- Supports HSB/SD/FD protection inter-board and intra-board.
- Enabling ACM function is suggested when using 1024 QAM and/or higher level modulation scheme.
- Supports under/over-voltage protection and over-current protection at IF interface.
- The maximum IF cable (5D-FB type) length between IDU and ODU is 100 meters (RG-8U IF cable is up to 200 meters; 10D-FB IF cable is up to 300 meters).
- Supports G02/C02/L02 mode

### 3.3.5 MD2 board

Fig. 3-10 MD2 board front panel



Table 3-6 MD2 interface description

| Interface | Type                 | Description                                                                                                                               |
|-----------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| OP1, OP2  | Power switch         | ODU power switches for channel 1 and channel 2.                                                                                           |
| IF1, IF2  | Female SMA connector | IF signal interface for channel 1 and channel 2.                                                                                          |
| XGE1      | SFP+, LC             | 10GE SFP+ interface, 10GBase-LR/ER/SR. Interface for data interconnection between MD2 and E-band device. It is used in MBL configuration. |

The MD2 board provides two IF channels and implements modulation/demodulation function. Its specific functions are described as below:

- Provides -48 V DC power for ODU.
- Provides two IF interfaces and integrates 2+0 XPIC function in single board.
- Can be used in 10Gbps MBL configuration. The XGE interface on the board is used for connecting to the E-band device.
- Channel bandwidth: 7/14/28/40/56/80/112 MHz.
- Provides QPSK/ 16 QAM/ 32 QAM/ 64 QAM/ 128 QAM/ 256 QAM/ 512 QAM/ 1024 QAM/ 1024 QAM light/ 2048 QAM/ 4096 QAM/ 8192 QAM/ 16K QAM modulation/demodulation function.
  - Modulation: codes and modulates the baseband signals to IF signals and sends them to ODU through the IF interface.
  - Demodulation: demodulates and decodes the IF signals coming from ODU.
- 4x4 MIMO works in QPSK~2048 QAM modulation scheme (two MD2 boards (or 1\*CSA/CSA2 plus 1\*MD2) are required).
- Supports ACM, ATPC, XPIC, Rx combining and CA.
- Supports HSB/SD/FD protection inter-board and intra-board.
- Enabling ACM function is suggested when using 1024 QAM and/or higher level modulation scheme.
- Supports under/over-voltage protection and over-current protection at IF interface.
- The maximum IF cable (5D-FB type) length between IDU and ODU is 100

meters (RG-8U IF cable is up to 200 meters; 10D-FB IF cable is up to 300 meters).

- Supports G01/C01/L01, G02/C02/L02 mode

### 3.3.6 MD2 v2 board



Table 3-7 MD2 v2 interface description

| Interface  | Type                 | Description                                                                                                                                  |
|------------|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| IF1, IF3   | Female SMA connector | IF signal interface for channel 1, channel2                                                                                                  |
| XGE1, XGE2 | SFP+, LC             | 10GE SFP+ interface, 10GBase-LR/ER/SR. Interface for data interconnection between MD2 v2 and E-band device. It is used in MBL configuration. |

The MD2 v2 board provides two IF interfaces and implements modulation/demodulation function. Its specific functions are described as below:

- Provides -48 V DC power for ODU.
- Provides two IF interfaces and integrates 2+0 XPIC function in single board.
- Can be used in 10Gbps MBL configuration. The XGE1/XGE2 interfaces on the board are used for connecting to the E-band devices, support Dual-fiber protection to avoid single point fault in MBL 2E scenario. MD2 v2 supports 1 groups MBL.
- Channel bandwidth: 7/14/28/40/56/80/112MHz.
- Provides QPSK/16 QAM/32 QAM/64 QAM/128 QAM/256 QAM/512 QAM/1024 QAM/1024 QAM light/2048 QAM/4096 QAM/8192 QAM/16K QAM modulation/demodulation function.
  - Modulation: codes and modulates the baseband signals to IF signals and sends them to ODU through the IF interface.
  - Demodulation: demodulates and decodes the IF signals coming from ODU.

- 4x4 MIMO (two MD2 v2 boards (or 1\*CSA2 v2 plus 1\*MD2 v2) are required) works in QPSK~2048 QAM modulation scheme (will be released in next version).
- Supports 4+0 CA XPIC in one board.
- Supports ACM, ATPC, XPIC, and Rx combining.
- Supports HSB/SD/FD protection inter-board and intra-board.
- Enabling ACM function is suggested when using 1024 QAM and/or higher level modulation scheme.
- Supports under/over-voltage protection and over-current protection at IF interface.
- The maximum IF cable (5D-FB type) length between IDU and ODU is 100 meters (RG-8U IF cable is up to 200 meters; 10D-FB IF cable is up to 300 meters).
- Supports G02/C02/L02 mode

**Note:**

1. MD2 v2 supports two groups 1+0 configuration, or 1 groups PLA configuration.

**3.3.7 MD4 board**

Fig. 3-11 MD4 board front panel



Table 3-8 MD4 interface description

| Interface           | Type                 | Description                                                          |
|---------------------|----------------------|----------------------------------------------------------------------|
| IF1, IF2 , IF3, IF4 | Female SMA connector | IF signal interface for channel 1, channel 2, channel3 and channel4. |

The MD4 board provides four IF channels and implements modulation/demodulation function. Its specific functions are described as below:

- Provides -48 V DC power for ODU.
- Provides four IF interfaces and integrates 4+0 XPIC function in single board.
- Channel bandwidth: 7/14/28/40/56MHz (four carriers) or 80/112MHz (two carriers).
- Provides QPSK/16 QAM/32 QAM/64 QAM/128 QAM/256 QAM/512 QAM/1024 QAM//1024 QAM light/2048 QAM/4096 QAM/8192 QAM/16K QAM modulation/demodulation function.
  - Modulation: codes and modulates the baseband signals to IF signals and sends them to ODU through the IF interface.
  - Demodulation: demodulates and decodes the IF signals coming from ODU.
- 4x4 MIMO works in QPSK~2048 QAM modulation scheme (only one MD4 board is required).
- Supports 4+0 CA XPIC in one board.
- Supports ACM, ATPC, XPIC, and Rx combining.
- Supports 1+1/2+2 HSB/SD/FD protection inter-board and intra-board.
- Enabling ACM function is suggested when using 1024 QAM and/or higher level modulation scheme.
- Supports under/over-voltage protection and over-current protection at IF interface.
- The maximum IF cable (5D-FB type) length between IDU and ODU is 100 meters (RG-8U IF cable is up to 200 meters; 10D-FB IF cable is up to 300 meters).
- Supports G02/C02/L02 mode

**Note:**

1. The MD4 supports four groups 1+0 configuration, or 2 groups PLA configuration.

3.3.8 ME2 board

Fig. 3-12 ME2 board front panel



Table 3-9 ME2 interface description

| Interface | Type                 | Description                                                                                                                               |
|-----------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| OP1, OP2  | Power switch         | ODU power switches for channel 1 and channel 2.                                                                                           |
| IF1, IF2  | Female connector SMA | IF signal interface for channel 1 and channel 2.                                                                                          |
| XGE1      | SFP+, LC             | 10GE SFP+ interface, 10GBase-LR/ER/SR. Interface for data interconnection between ME2 and E-band device. It is used in MBL configuration. |

The ME2 board provides two IF channels and implements modulation/demodulation function. Its specific functions are described as below:

- Provides -48 V DC power for ODU.
- Provides two IF interfaces and integrates 2+0 XPIC function in single board.
- Can be used in 10Gbps MBL configuration. The XGE interface on the board is used for connecting to the E-band device.
- Channel bandwidth: 7/14/28/40/56/112/224 MHz.
- Provides QPSK/16 QAM/32 QAM/64 QAM/128 QAM/256 QAM/512 QAM/1024 QAM//1024 QAM light/2048 QAM/4096 QAM/8192 QAM modulation/demodulation function.
  - Modulation: codes and modulates the baseband signals to IF signals and sends them to ODU through the IF interface.
  - Demodulation: demodulates and decodes the IF signals coming from ODU.
- Supports ACM, ATPC, XPIC, Rx combining and CA.

- Supports HSB/SD/FD protection inter-board and intra-board.
- Enabling ACM function is suggested when using 1024 QAM and/or higher level modulation scheme.
- Supports under/over-voltage protection and over-current protection at IF interface.
- The maximum IF cable (5D-FB type) length between IDU and ODU is 100 meters (RG-8U IF cable is up to 200 meters; 10D-FB IF cable is up to 300 meters).
- Supports G01 mode, G02/L01/L02 mode will be released in the future version.

**Note:**

1. The ME2 supports combination with SRU3D (15/18/23 GHz).
2. The ME2 combination with SRU3D (13 GHz)/HRU2 (13/15/18 GHz) will be supported in the future.
3. The ME2 has released 224 MHz bandwidth, and other bandwidths will be supported in future releases.
4. When one IF channel on ME2 is configured as 224 MHz bandwidth, the other IF channel on ME2 will be disabled.

### 3.3.9 IEA board (4×GE(e) + 2×10GE(o))

Fig. 3-13 IEA board front panel

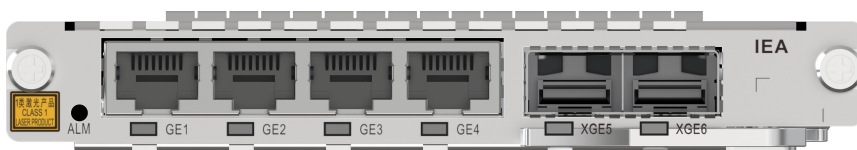


Table 3-10 IEA interface description

| Interface          | Type  | Description                                                        |
|--------------------|-------|--------------------------------------------------------------------|
| GE1, GE2, GE3, GE4 | RJ-45 | GE interface (1000 Base-T)                                         |
| XGE5 to XGE6       | SFP+  | GE/10GE combo SFP+ interface. 1000 Base-LX/SX or 10GBase-LR/ER/SR. |

The IEA board provides GE (electric) and 10GE (optical default) interfaces for Ethernet services access. It can be installed in slot 2 to slot 3. Its specific functions are shown as below:

- IEA provides 4×GE(e) + 2×XGE(o) interfaces.

### 3.3.10 IEB board (2×GE(o) + 4×10GE(o))

Fig. 3-14 IEB board front panel

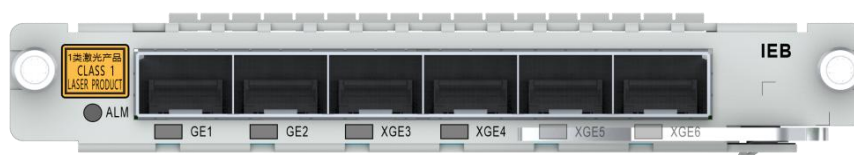


Table 3-11 IEB interface description

| Interface    | Type    | Description                                                        |
|--------------|---------|--------------------------------------------------------------------|
| GE1, GE2,    | SFP, LC | 1000 Base-LX or 1000 Base-SX optical interface.                    |
| XGE3 to XGE6 | SFP+    | GE/10GE combo SFP+ interface. 1000 Base-LX/SX or 10GBase-LR/ER/SR. |

The IEB board provides GE (optical default) and 10GE (optical default) interfaces for Ethernet services access. Its specific functions are shown as below:

- IEB provides 2×GE (o) + 4×XGE (o) interfaces.
- All of the interfaces can be enabled when IEB is installed in slot 2 to slot 3. When IEB is installed in slot 4, max. 2x10GE/GE+4xGE can be enabled.

### 3.3.11 IED board (1×GE (o) + 1x10GE + 1×25GE (o))

Fig. 3-15 IED board front panel



Table 3-12 IED interface description

| Interface | Type     | Description                                                       |
|-----------|----------|-------------------------------------------------------------------|
| GE1       | SFP, LC  | 1000 Base-LX or 1000 Base-SX optical interface.                   |
| XGE2      | SFP+, LC | 10GE combo SFP+ interface. 10GBase-LR/ER/SR.                      |
| XXVG3     | SFP28,LC | 10GE/25GE combo SFP28 interface.10GBase-LR/ER/SR or 25GBase-SR/LR |

The IED board provides GE (optical default), 10G/25G interfaces for Ethernet services access. Its specific functions are shown as below:

- IED provides 1×GE (O) + 1×10GE (O) +1\*25GE interfaces.

### 3.3.12 IEM2 board (2×10GE(o))

Fig. 3-16 IEM2 board front panel



Table 3-13 IEM2 interface description

| Interface  | Type | Description                                  |
|------------|------|----------------------------------------------|
| XGE1, XGE2 | SFP+ | 10GE combo SFP+ interface. 10GBase-LR/ER/SR. |

The IEM2 offers two 10GE interfaces. Its specific functions are as shown below:

- The IEM2 is mainly used for EMBL configuration. The XGE interface on the board is used for connecting to the E-band device.
- One IEM2 supports one EMBL group.

**Note:** IEM2 board will be released in next version.

3.3.13      **ITA board (16\*E1 (PWE3))**

Fig. 3-17    ITA board front panel



Table 3-14    ITA interface description

| Interface     | Type           | Description             |
|---------------|----------------|-------------------------|
| E1 (CH1-CH16) | D type SCSI 64 | Access capacity: 16×E1. |

The ITA can emulate the native E1 service that accessed at UNI side into packet streams (PWE3 based on MPLS switching), or re-create the emulated service from NNI side into native E1. The ITA can be installed in slot 2 to slot 4, and support PWE3 E1 (CH1-CH16) at NNI.

3.3.14      **ITD board (2×STM-1)**

Fig. 3-18    ITD board front panel

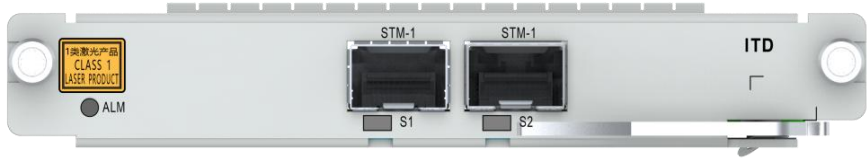


Table 3-15    ITD interface description

| Interface | Type    | Description                     |
|-----------|---------|---------------------------------|
| S1, S2    | SFP, LC | Provides 2 STM-1 SFP interfaces |

The ITD can emulate the native STM-1 service that accessed at UNI side into packet streams (PWE3 based on MPLS switching), or re-create the emulated service from NNI side into native STM-1. The ITD can be installed in slot 2 to slot 4, and support PWE3 STM-1 at NNI.

### 3.3.15 FA board

Fig. 3-20 FA board front panel



The FA board is the system fan control board. It is installed in slot 5. The specific functions of FA includes:

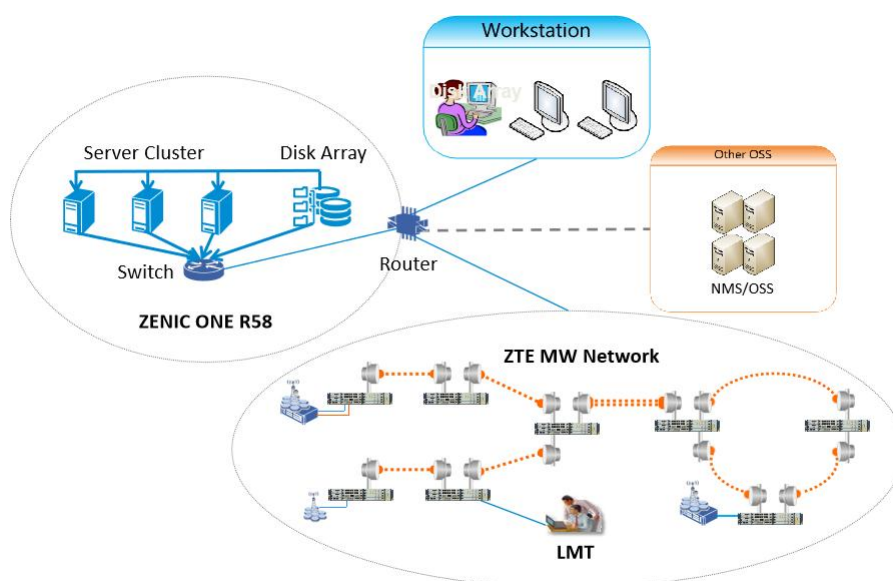
- Driving four high performance fan modules.
- Supports temperature detection and fan speed monitoring.
- Supports intelligent speed adaptation.

## 4 NMS: Network Management System

ZTE provides a unified and intelligent network management system for different management requirement. The following solutions can be used for management:

- Simplified LMT for local Maintenance.
- ZENIC ONE integrates the microwave network SDN management and control.

Fig. 4-1 Network management solution



### 4.1 ZENIC ONE System Introduction

ZENIC ONE is the main SDN controller system for future SDN/NFV network evolution presented by Web GUI. It can integrate network management components, network control components, network acquisition components and network analysis components through micro services, so it has powerful network intelligent operation and maintenance capabilities.

- Based on the micro-service architecture and PaaS platform
- Supports the unified management of traditional transport NEs and new SDN NEs.
- Provides graphic image O&M, network status and service configuration, reduces the O&M skill requirements.

- Supports end-to-end service provisioning
- Supports Network optimal path calculation and traffic tuning
- Intelligent inspection function, guarantee microwave equipment long-term stable running and improve the microwave network service quality.
- Provides high availability and supports bare metal clusters and Virtual Machine (VM) clusters.
- Portal access mode, adopts B/S architecture and supports HTTP/HTTPS protocol.
- Virtualization, all software modules can be deployed on general-purpose X86 physical hosts and virtual hosts, or on private cloud virtualization resource pool platforms.
- Openness southbound interfaces, such as SNMP and FILE(FTP/SFTP), can be integrated seamlessly to 3rd-party NMS to construct flexibly BSS/OSS system for carriers.

## 4.2 Web-based LMT, Easy Maintenance

LMT is a Web-based local maintenance terminal for configuring and maintaining IDU as well as the connected ODUs at local. It is embedded in NR9150 IDU and no additional software installation is required. Users can manage the IDU via the Chrome browser in the PC through the LMT or NMS interface.

LMT provides alarm management, configuration management, performance management, maintenance management, security management, and language management.

For illegal access prevention, LMT user authority is graded to 3 levels:

1. Administrator
2. Operator
3. Browse User

Administrator has the highest authority and browse user is the lowest. The OMC could set different password for each kind of user to ensure the management security. Furthermore, IDU will record and send the log and configure action to the

EMS server.

## 5 Configuration and Application

### 5.1 Flexible Radio Configuration

As nodal equipment, NR9150 supports maximum of 8/12 radio transmission directions with dual carrier modem/four carriers modem unit and can be configured as 2+0 non-protection, 1+1 protection, XPIC, CA, CA+XPIC, MIMO+XPIC, MBL and EMBL, etc.

Table 5-1 NR9150 Radio configuration list

| Item           | Configuration Type              | Max. Groups of Configurations |
|----------------|---------------------------------|-------------------------------|
| Non-protection | 1+0                             | 8/12                          |
|                | 2+0                             | 4/6                           |
|                | 4+0                             | 2/3                           |
|                | 8+0                             | 1/1                           |
| Protection     | 1+1 HSB/SD/FD                   | 4/6                           |
| XPIC           | 2+0 XPIC                        | 4/6                           |
|                | 4+0 XPIC                        | 2/3                           |
|                | 8+0 XPIC                        | 1/1                           |
|                | 2+2 XPIC SD/HSB/FD              | 2/3                           |
|                | 4+4 XPIC SD/HSB/FD              | 1/1                           |
| CA             | 2+0 CA                          | 4/6                           |
|                | 4+0 CA                          | 2/3                           |
|                | 8+0 CA                          | 1/1                           |
| CA + XPIC      | 4+0 CA XPIC                     | 2/3                           |
|                | 8+0 CA XPIC                     | 1/1                           |
| MIMO + XPIC    | 4*4 MIMO                        | 2/3                           |
| MBL            | 1+0 E-band with 2+0 Normal band | 4/2                           |
|                | 2+0 E-band with 4+0 Normal band | 2/2                           |
| EMBL           | 2+0 E-band with 4+0 Normal      | 2/2                           |

| Item | Configuration Type | Max. Groups of Configurations |
|------|--------------------|-------------------------------|
|      | band               |                               |

**Note:**

1. In x/y, "x" means the Max. Groups supported when the board is configured as CSA/CSA2+MD2 or CSA2 v2+MD2 v2. "y" means the Max. Groups supported when the board is configured as CSA4/MD4.
2. The MD4 board has no 10GE interface and does not support MBL function.
3. Max. PLA/LAG groups of per IDU (CSA/CSA2+MD2/ME2 or CSA2 v2+MD2 v2): 4 groups PLA, or 28 groups LAG (each LAG group includes max. 8 members).
4. Max. PLA /LAG groups of per IDU (CSA4+MD4): 6 groups PLA, or 28 groups LAG (each LAG group includes max. 16 members).
5. When 2T2R high Tx power ODUs are selected, the Max. Groups shall depends on the load capability of the power supply.

## 5.2 NR9150 Typical Configurations

NR9150 supports point-to-point, link, tree, and ring networking configurations, as shown in this chapter.

**Note:**

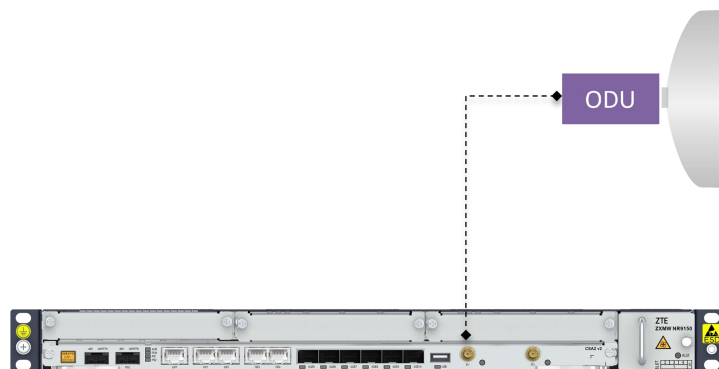
1. The FAN board and the power supply board are required components, and this chapter does not provide details.
1. The ME2 board can be configured if necessary. This chapter focuses on the typical configuration of the CSA/CSA4/MD2/MD2 V2/MD4 boards.
2. The quantity and type of service interface and license depends on the actual requirement, this chapter does not describe them.
3. The quantity of flexible waveguides depends on the installation mode, this chapter does not describe details.

### 5.2.1 1+0 Configuration

NR9150 supports 1+0 or N× (1+0) networking configurations. The basic

configuration 1+0 with dual carrier modem unit and ODU is shown in following figure.

Fig. 5-1 1+0 configuration (1T1R ODU)



In  $N \times (1+0)$  network configuration, the material requirement of a single site is shown following in table.

Table 5-2 1+0 configuration requirements per site

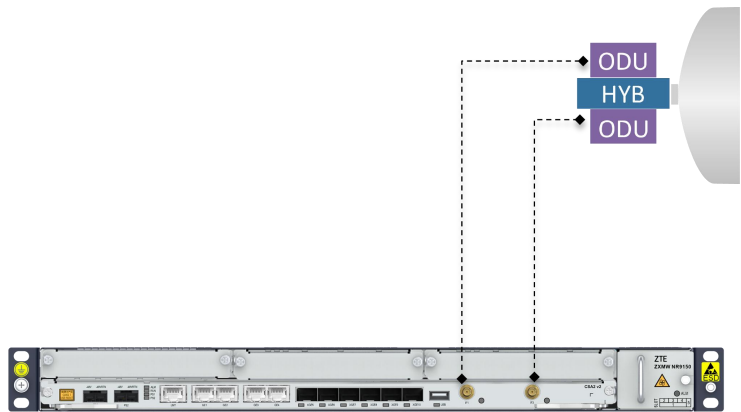
| Components | Configuration Requirements (PCS) |         |
|------------|----------------------------------|---------|
|            | 1+0                              | 2×(1+0) |
| CSA2 v2    | 1                                | 1       |
| ODU (1T1R) | 1                                | 2       |
| Antenna    | 1                                | 2       |
| IF Cable   | 1                                | 2       |

**Note:** The quantity and type of service interface and license depends on the actual requirement.

### 5.2.2 1+1 HSB Configuration

1+1 HSB is 1+1 hardware hot standby protection. In 1+1 HSB configuration, main ODU and standby ODU are installed on the same antenna to provide hardware level protection.

Fig. 5-2 1+1 HSB configuration (1T1R ODU)



In  $N \times (1+1)$  HSB configuration mode, the required material of single site based on dual carrier modem unit and ODU is shown in following table.

Table 5-3 1+1 HSB configuration requirements per site

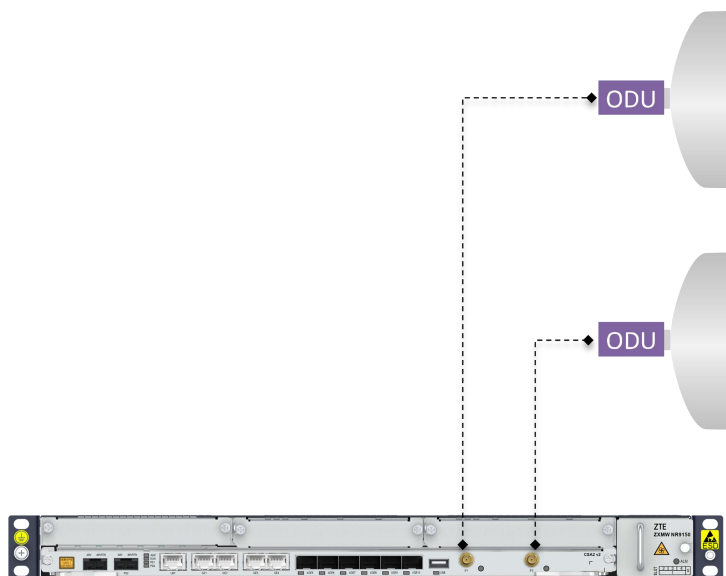
| Components | Configuration Requirements (PCS) |             |
|------------|----------------------------------|-------------|
|            | 1+1 HSB                          | 2×(1+1) HSB |
| CSA2 v2    | 1                                | 1           |
| ODU (1T1R) | 2                                | 4           |
| Antenna    | 1                                | 2           |
| IF Cable   | 2                                | 4           |
| Combiner   | 1                                | 2           |

**Note:** The quantity and type of service interface and license depends on the actual requirement.

5.2.3 1+1 SD Configuration

1+1 SD provides hardware backup and is especially effective at mitigating multipath situations. In the 1+1 SD protection mode, the active ODU and standby ODU are installed on different antennas. This enables the system to receive signals from different radio links at the same time, which provides full-time hardware and wireless link protection. The diagram of 1+1 SD based on dual carrier modem unit and ODU is shown in following figure.

Fig. 5-3 1+1 SD configuration (1T1R ODU)



In  $N \times (1+1)$  SD configuration, the required material of a single site is shown in following table.

Table 5-4 1+1 SD configuration requirements per site via 1T1R ODU

| Components | Configuration Requirements (PCS) |  |
|------------|----------------------------------|--|
|            | 1+1 SD                           |  |
| CSA2 v2    | 1                                |  |
| ODU (1T1R) | 2                                |  |
| Antenna    | 2                                |  |
| IF Cable   | 2                                |  |

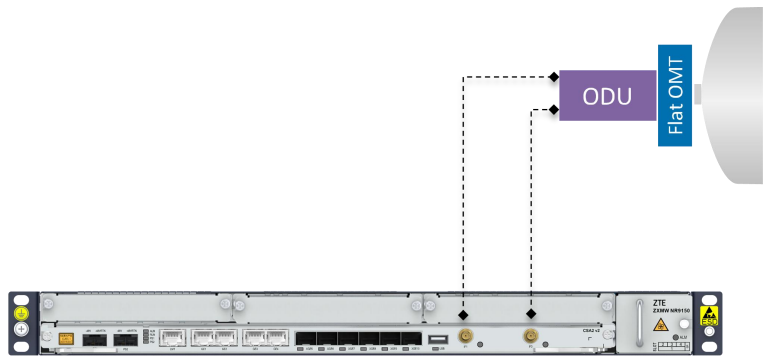
**Note:** The quantity and type of service interface and license depends on the actual requirement.

## 5.2.4 2+0 XPIC Configuration

NR9150 supports 2+0 XPIC,  $2 \times (2+0)$  XPIC and  $N \times (2+0)$  XPIC configurations. With XPIC function, the capacity is doubled.

The diagram of 2+0 XPIC configuration is shown in following figure.

Fig. 5-4 2+0 XPIC configuration (2T2R ODU)



In  $N \times (2+0)$  XPIC configuration mode, required material of single site is shown in following table.

Table 5-5 2+0 XPIC configuration requirements per site

| Components        | Configuration Requirements (PCS) |
|-------------------|----------------------------------|
|                   | 2+0 XPIC                         |
| CSA2 v2           | 1                                |
| 1T1R ODU/2T2R ODU | 2/1                              |
| Antenna           | 1                                |
| IF Cable          | 2                                |
| OMT/flat OMT      | 1                                |

**Note:**

1. The OMT is selected when configuring 1T1R ODU, flat OMT used for 2T2R ODU.

**5.2.5 2+2 XPIC HSB Configuration**

2+2 XPIC HSB means each polarization of 2+0 XPIC is protected with hot standby configuration. Each NR9150 IDU offers 2 group 2+2 XPIC HSB configuration.

In 2+2 XPIC HSB configuration, main ODU and standby ODU are mounted on one combiner/hybrid and then fixed on one antenna. The combiner/hybrid might be a balanced or unbalanced type. DP-HYB can be also used for 2+2 XPIC HSB.

The diagram of 2+2 XPIC HSB configuration is shown in following figure.

Fig. 5-5 2+2 XPIC HSB configuration (2T2R ODU)



In 2+2 XPIC HSB configuration, the required material of single site is shown in following table.

Table 5-6 2+2 XPIC HSB configuration requirements per site

| Components        | XPIC Configuration Requirements (PCS) |
|-------------------|---------------------------------------|
|                   | 2+2 XPIC HSB                          |
| CSA4              | 1                                     |
| 1T1R ODU/2T2R ODU | 4/2                                   |
| Antenna           | 1                                     |
| IF Cable          | 4                                     |
| DP-HYB            | 1                                     |

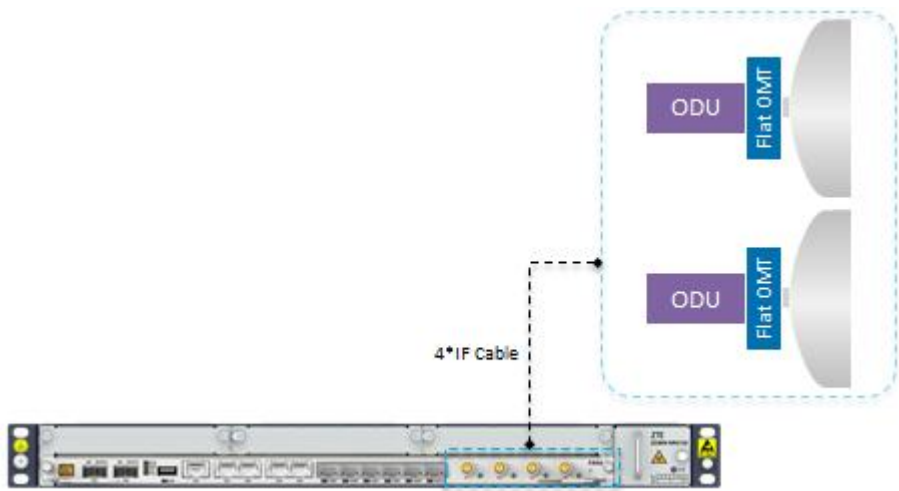
## 5.2.6 2+2 XPIC SD Configuration

2+2 XPIC SD means each polarization of 2+0 XPIC is protected with space diversity configuration. Each NR9150 IDU offers 2 group 2+2 XPIC SD configuration.

In the 2+2 SD protection mode, the active ODUs and standby ODUs are mounted on different antennas. This enables the system to receive signals from different paths at the same time, which provides full-time hardware and wireless link protection.

The diagram of 2+2 XPIC SD configuration based on dual carrier ODU is shown in following figure.

Fig. 5-6 2+2 XPIC SD configuration (2T2R ODU)



In 2+2 XPIC SD configuration mode, the required material of single site is shown in following table.

Table 5-7 2+2 XPIC SD configuration requirements per site

| Components        | Configuration Requirements (PCS) |                  |
|-------------------|----------------------------------|------------------|
|                   | 2+2 XPIC SD                      | 2× (2+2) XPIC SD |
| CSA4              | 1                                | 2                |
| 1T1R ODU/2T2R ODU | 4/2                              | 8/4              |
| Antenna           | 2                                | 4                |
| IF Cable          | 4                                | 8                |
| OMT/flat OMT      | 2/2                              | 4/4              |

**Note:**

1. The OMT is selected when configuring 1T1R ODU, flat OMT used for 2T2R ODU.

**5.2.7 4+0 XPIC Configuration**

NR9150 supports up to 2 group of 4+0 XPIC.

Fig. 5-7 4+0 XPIC with dual carrier modem unit (2T2R ODU)

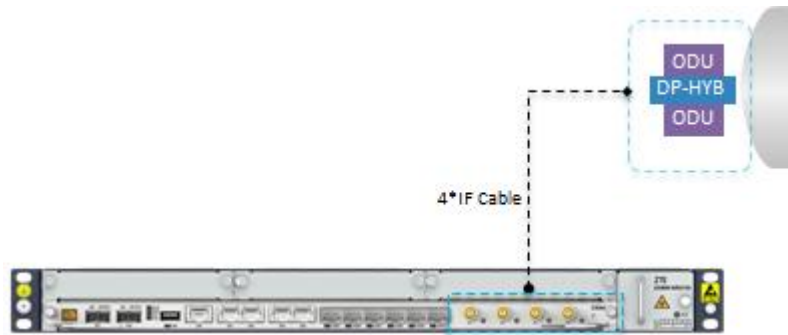


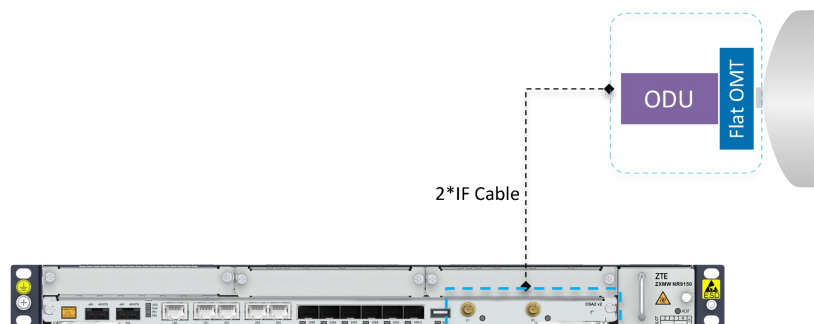
Table 5-8 4+0 XPIC configuration requirements per site

| Components        | 4+ 0 XPIC configuration Requirements (PCS) |
|-------------------|--------------------------------------------|
| CSA4              | 1                                          |
| 1T1R ODU/2T2R ODU | 4/2                                        |
| DP-HYB            | 1                                          |
| Antenna           | 1                                          |
| IF Cable          | 4                                          |

### 5.2.8 4+0 CA XPIC configuration

Carrier aggregation technology through one 4-carrier modem board (or two dual-carrier modem boards) with one SRU3D/HRU3D (or two SRU2/HRU2F V2.0) achieved 4+0 CA XPIC configuration. Therefore, half of the hardware is reduced compared with the traditional 4+0 solution.

Fig. 5-8 4+0 CA XPIC configuration (2T2R ODU)



4+0 XPIC configuration requirements per site

| Components        | 4+ 0 CA XPIC |
|-------------------|--------------|
| CSA2 v2           | 1            |
| 1T1R ODU/2T2R ODU | 2/1          |
| OMT/flat OMT      | 1/1          |
| Antenna           | 1            |
| IF Cable          | 2            |

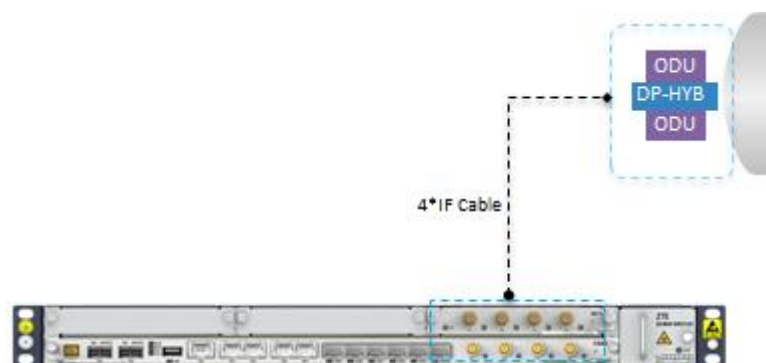
**Note:**

- The OMT is selected when configuring 1T1R ODU, flat OMT used for 2T2R ODU.

## 5.2.9 8+0 CA XPIC configuration

Carrier aggregation technology through two 4-carrier modem boards (or four dual-carrier modem boards) with four SRU2/HRU2F (or two SRU3D/HRU3D) achieved 8+0 CA XPIC configuration. Therefore, half of the hardware is reduced compared with the traditional 8+0 solution.

Fig. 5-9 8+0 CA XPIC configuration (2T2R ODU)



8+0 XPIC configuration requirements per site

| Components        | 8+ 0 CA XPIC |
|-------------------|--------------|
| CSA4+MD4          | 1+1          |
| 1T1R ODU/2T2R ODU | 4/2          |
| DP-HYB            | 1            |
| Antenna           | 1            |

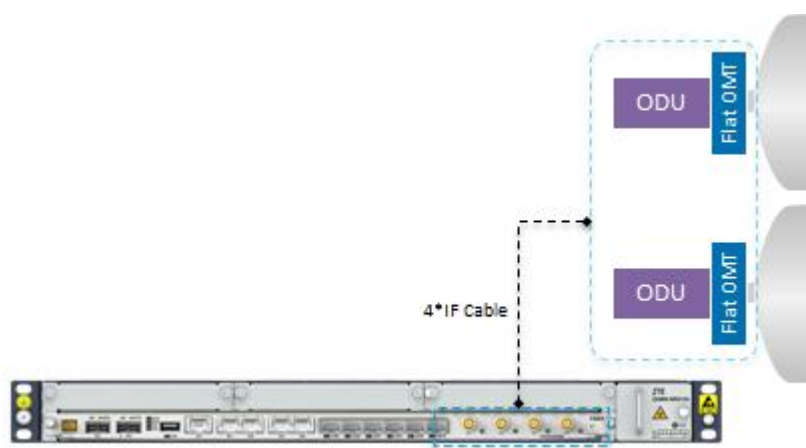
| Components | 8+ 0 CA XPIC |
|------------|--------------|
| IF Cable   | 4            |

### 5.2.10 4x4 MIMO Configuration

NR9150 provides 4x4 MIMO configuration to 4 times the link capacity within one pair of frequency point comparing with 1+0.

The diagram of 4x4 MIMO hardware configuration is shown in following figure.

Fig. 5-11 4x4 MIMO configuration (2T2R ODU)



The required material for 4x4 MIMO configuration in single site is shown in following table.

Table 5-9 4x4 MIMO configuration requirements per site

| Components        | Configuration Requirements (PCS) |
|-------------------|----------------------------------|
| CSA4              | 1                                |
| 1T1R ODU/2T2R ODU | 4/2                              |
| Antenna           | 2                                |
| IF Cable          | 4                                |
| OMT/flat OMT      | 2/2                              |

**Note:**

1. The OMT is selected when configuring 1T1R ODU, flat OMT used for 2T2R ODU.

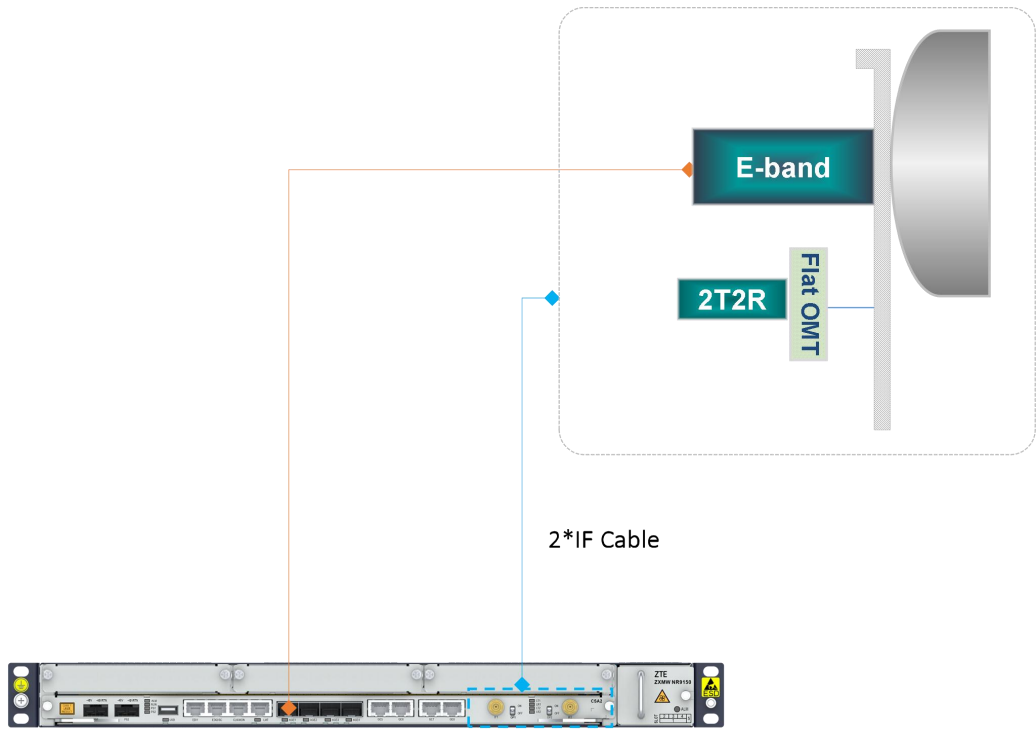
5.2.11 1E+2N MBL Configuration

NR9150 with ER2020E provide multi-band link for providing huge capacity and good reliability transmission pipe in short distance wireless backhaul or transport scenario.

The proposed configuration is 1+0 E-band with 2+0 XPIC normal band in one transmission direction.

For short multi-band link, direct mounting solution is a good selection. Taking 1+0 E-band with 2+0 normal band link for instance, E-band equipment and normal band ODU can be mounted on one UBA antenna directly.

Fig. 5-12 Typical MBL configuration: 1+0 E-band with 2+0 normal band (2T2R ODU)



The required material of the multi-band site (1× (1+0 E-band) + 1 × (2+0 normal band)) is shown in flowing table.

Table 5-10 MBL configuration requirements (1+0 E-band with 2+0 normal band)

| Components        | Configuration Requirements (PCS) |
|-------------------|----------------------------------|
| CSA2 v2           | 1                                |
| 1T1R ODU/2T2R ODU | 2/1                              |
| UBA Antenna       | 1                                |

|               |   |
|---------------|---|
| ER2020E       | 1 |
| IF Cable      | 2 |
| Optical Fiber | 1 |
| OMT/flat OMT  | 1 |

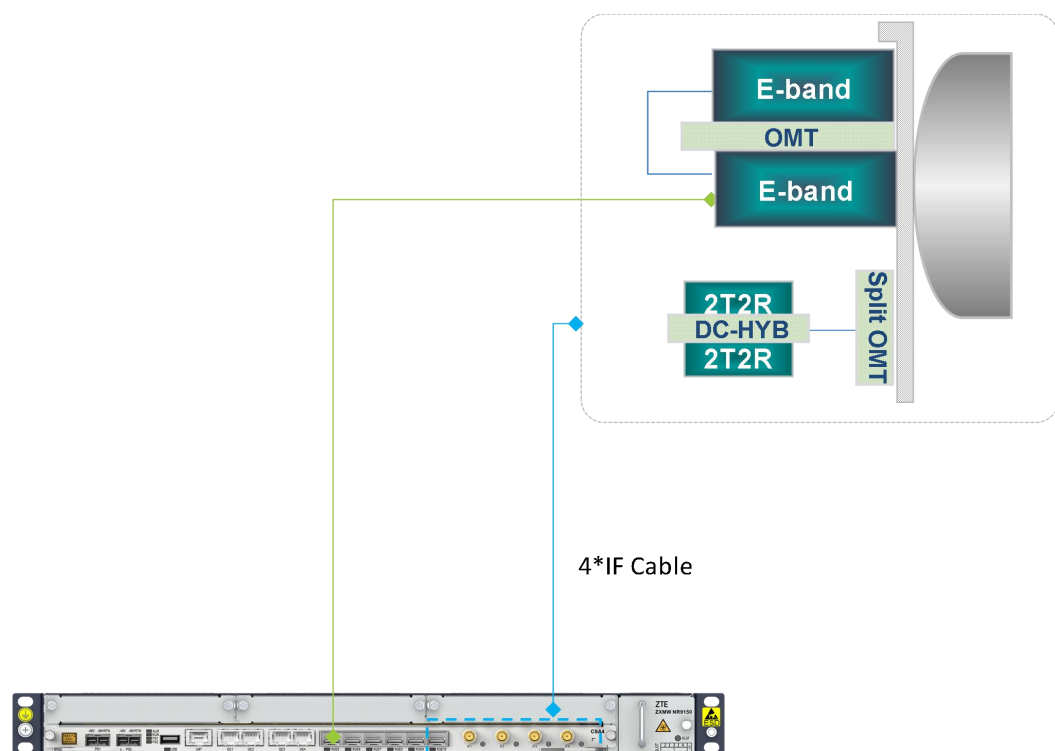
**Note:**

1. The OMT is selected when configuring 1T1R ODU, flat OMT used for 2T2R ODU.

## 5.2.12 2E+4N MBL Configuration

NR9150 will support 2+0 E-band with 4+0 XPIC normal band in one transmission direction, which is called as EMBL (Enhanced multi-band), the maxim capacity can reach up to 25Gbps.

Fig. 5-13 Typical MBL configuration: 2+0 E-band with 4+0 normal band (2T2R ODU)



The required material of the MBL site (1× (2+0 E-band) + 1 × (4+0 normal band)) is shown in flowing table.

Table 5-11 MBL configuration requirements (2+0 E-band with 4+0 normal band)

| Components        | Configuration Requirements (PCS) |
|-------------------|----------------------------------|
| CSA4              | 1                                |
| 1T1R ODU/2T2R ODU | 4/2                              |
| UBA Antenna       | 1                                |
| ER2020E           | 2                                |
| IF Cable          | 4                                |
| Optical Fiber     | 2                                |
| DC-HYB            | 1                                |
| Split OMT         | 1                                |
| Eband OMT         | 1                                |

**Note:**

Flat OMT used for 2T2R ODU.

## 6 Performance and Parameters

Detail parameters of the above features and hardware are specified in this chapter.

### 6.1 System Integrity

These parameters are the basic physical description of the NR9150 system.

#### 6.1.1 Mechanical Characteristics

The following table shows the dimensions and weights of IDU, ODU.

Table 6-1 Dimension and weight

| Item |                  | Dimension (mm)                               | Weight ( $\pm 0.5$ kg) |
|------|------------------|----------------------------------------------|------------------------|
| IDU  |                  | 482.6 (W) $\times$ 43.6 (H) $\times$ 240 (D) | 6.1(Fully equipped)    |
| ODU  | SRU2 (6/7/8 GHz) | 158 (W) $\times$ 158 (W) $\times$ 53.8 (D)   | 1.7                    |
|      | SRU2 (10-42 GHz) | 151 (W) $\times$ 151 (H) $\times$ 52.6 (D)   | 1.5                    |
|      | SRU2S (13 GHz)   | 151 (W) $\times$ 151 (H) $\times$ 52.6 (D)   | 2.1                    |

| Item                    | Dimension (mm)                 | Weight (±0.5 kg) |
|-------------------------|--------------------------------|------------------|
| SRU2S (15/18/23 GHz)    | 151 (W) × 151 (H) × 83.6 (D)   | 2.5              |
| SRU3D (6/7/8/11 GHz)    | 277 (W) × 256 (H) × 55.9 (D)   | 5                |
| SRU3D (13/15/18/23 GHz) | 243 (W) × 243 (H) × 48.5 (D)   | 4.5              |
| HRU2                    | 241.5 (W) × 260 (H) × 75.5 (D) | 4.5              |
| HRU2F V1.0              | 241.5 (W) × 260 (H) × 75.5 (D) | 4.5              |
| HRU2F V2.0              | 277 (W) × 256 (H) × 56.4 (D)   | 5.7              |
| HRU3D (5/6/7/8/11GHz)   | 277 (W) × 256 (H) × 76.4 (D)   | 6.5              |
| HRU3D (32GHz)           | 243 (W) × 243 (H) × 72 (D)     | 4.5              |
| HRU3D (26/38GHz)        | 277 (W) × 256 (H) × 73 (D)     | 5.6              |

## 6.1.2 Operation Parameters

The operation parameters include power supply, temperature, humidity and power consumption.

Table 6-2 Power supply

| Power Module          | Input Voltage                | Description                                                         |
|-----------------------|------------------------------|---------------------------------------------------------------------|
| CSA/CSA2/CSA4/CSA2 v2 | -48 V DC (-38.4 ~ -57.6V DC) | -48V input, the power module is integrated in CSA/CSA2/CSA4/CSA2 v2 |

Table 6-3 Temperature and humidity

| Item                               | IDU          | ODU          |
|------------------------------------|--------------|--------------|
| Short-term Operating Temperature   | -30°C ~ 65°C | -40°C ~ 55°C |
| Long-term Operating Temperature    | -25°C ~ 55°C | -40°C ~ 55°C |
| Transportation/Storage Temperature | -40°C ~ 70°C | -40°C ~ 70°C |
| Humidity                           | < 95% (35°C) | < 100%       |

Alarm: It is prohibited to touch the equipment when the operation environment temperature is higher than +55°C.

Table 6-4 System power consumption per site for reference

| Item                        | Configurations                                               | Power Consumption<br>(reference value) |
|-----------------------------|--------------------------------------------------------------|----------------------------------------|
| Operation Environment: 25°C |                                                              |                                        |
| 1                           | 2+0, 28MHz @ 1024 QAM:<br>1*CSA2+1*FA+2*SRU2 (13 GHz)        | 104 W                                  |
| 2                           | 4+0, 28MHz @ 1024 QAM:<br>1*CSA2+1*MD2+1*FA +4*SRU2 (13 GHz) | 179 W                                  |

### 6.1.3 Standards Compliance

Table 6-5 Complied standards

| Specifications   | IDU                                                                                                                                    | ODU                                                            |
|------------------|----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
| EMC              | EN 301 489-1<br>EN 301 489-4<br>IEC 61000-4-2<br>IEC 61000-4-3<br>IEC 61000-4-4<br>IEC 61000-4-5<br>IEC 61000-4-6<br>EN 55032/CISPR 32 |                                                                |
| Radio            | ETSI EN 302 217-2                                                                                                                      |                                                                |
| Health           | EN 50385                                                                                                                               |                                                                |
| Safety           | IEC 62368-1<br>IEC 60950-22                                                                                                            |                                                                |
| Shell Protection | IEC 60529 IP20                                                                                                                         | IEC 60529 IP66                                                 |
| Operation        | ETSI EN 300 019-1-3<br>ZTE Enterprise Standards: Q/ZX 01397.01                                                                         | ETSI EN 300 019-1-4<br>ZTE Enterprise Standards: Q/ZX 01397.01 |
| Storage          | ETSI EN 300 019-1-1<br>ZTE Enterprise Standards: Q/ZX 01397.01                                                                         | ETSI EN 300 019-1-1<br>ZTE Enterprise Standards: Q/ZX 01397.01 |
| Transport        | ETSI EN 300 019-1-2<br>ETSI EN 300 019-2-2<br>IEC 60721-3-2                                                                            | ETSI EN 300 019-1-2<br>ETSI EN 300 019-2-2<br>IEC 60721-3-2    |

| Specifications               | IDU                                                                                                         | ODU                                                                                                         |
|------------------------------|-------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Earthquake & Vibration       | GR-63-CORE: NEBS Zone4<br>YD5083: 9 degrees<br>NTT: 7 degrees<br>ETSI EN 300 019-1-3<br>ETSI EN 300 019-2-3 | GR-63-CORE: NEBS Zone4<br>YD5083: 9 degrees<br>NTT: 7 degrees<br>ETSI EN 300 019-1-4<br>ETSI EN 300 019-2-4 |
| Noise                        | GR-63-CORE<br>ETSI EN 300 753 Class 3.1/3.2/3.3 office (floor-standing)                                     | ETSI EN 300 753 Class 4.1E                                                                                  |
| RoHS                         | EN IEC 63000<br>IEC 62321<br>IEC 62474                                                                      |                                                                                                             |
| Protection against lightning | IEC 62305-4                                                                                                 |                                                                                                             |

#### 6.1.4 Fault Tolerance MTBF/MTTR

Fault tolerance parameters include Residual Bit Error Ratio (RBER), Mean Time to Repair (MTTR) and Mean Time between Failures (MTBF)

- RBER <  $10^{-12}$  @ (Max. RSL threshold - 10dB) to (Min. RSL threshold + 10dB)
- MTBF ≥ 400,000 hours
- MTTR ≤ 1 hour

Table 6-6 Predicted reliability

| Item         | System      |             |             | ODU (SRU2) |
|--------------|-------------|-------------|-------------|------------|
|              | 1+0         | 2+0 XPIC    | 4+0 XPIC    |            |
| MTBF (hours) | ≥ 480,000   | ≥ 480,000   | 400,000     | 1,200,000  |
| MTBF (years) | ≥ 54.79     | ≥ 54.79     | ≥ 45.66     | 136.98     |
| Availability | ≥ 99.99979% | ≥ 99.99979% | ≥ 99.99975% | 99.9999%   |

#### 6.1.5 General Safety Requirements

All the power supply units have the following safety design:

1. Electrical safety:

- Overvoltage protection: the equipment will not be damaged within the power range -38.4 V DC to -57.6 V DC.
  - Power reverse connection protection, over current protection and IF cable short-circuit protection is supported by NR9150.
  - Over-current protection for power supply unit:  $\leq 30A$ .
2. Structural safety: NR9150 offers error-connection prevention and loose proof design.

## 6.2 Physical Interfaces Definition

### 6.2.1 Service Interface

Table 6-7 Service interface characteristics

| Interface Name  | Capacity/<br>Signal Rate | Interface Type<br>& Standards                                     | Impedance and Others                                                                                                      |
|-----------------|--------------------------|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| 16×E1           | 16×2.048 Mbps            | D type SCSI 64<br>ITU-T G.703<br>ITU-T G.704                      | 75 ohms/120 ohms<br>(switchable).                                                                                         |
| GE (electrical) | 10/100/1000<br>Mbps      | RJ-45<br>1000 Base-T<br>IEEE 802.3ab<br>RFC894                    | TIA/EIA-568-B.1-2001.<br>Rate: 10/100/1000 Mbps.<br>Frame format: Ethernet II<br>(RFC894) and IEEE 802.3/<br>IEEE 802.3u. |
| GE (optical)    | 1000 Mbps                | SFP, LC<br>1000 Base-LX<br>1000 Base-SX<br>IEEE 802.3ab<br>RFC894 | Wave length:<br>1310/1550 nm (single mode).<br>Rate: 1000 Mbps<br>Frame format: Ethernet II<br>(RFC 894) and IEEE 802.3.  |
| 10GE (optical)  | 10 Gbps                  | SFP+, LC<br>10GBase-LR/ER/SR<br>SFF-8431, SFF-8432                | Wave length:<br>1310/1550 nm (single mode).<br>Rate: 10 Gbps.<br>Frame format: Ethernet V2<br>(RFC894) and IEEE 802.3     |

| Interface Name | Capacity/<br>Signal Rate | Interface Type<br>& Standards                      | Impedance and Others                                                                                                                    |
|----------------|--------------------------|----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| 25GE (optical) | 25 Gbps                  | SFP28, LC<br>25GBase-SR/LR<br>SFF-8402<br>SFF-8432 | Wave length:<br>850nm (multi-mode).<br>1310 nm (single mode).<br>Rate: 25 Gbps.<br>Frame format: Ethernet V2<br>(RFC894) and IEEE 802.3 |

**Note:**

1. 10/100 Base-T and 1000 Base-T use super CAT5 twisted pair cables.

## 6.2.2 Management and Auxiliary Interface

Table 6-8 Management and auxiliary interface characteristics

| Interface Name | Capacity<br>/Signal Rate | Interface Type                     | Remarks                                  |
|----------------|--------------------------|------------------------------------|------------------------------------------|
| LMT            | 10/100/1000<br>Mbps      | RJ-45<br>1000 Base-T IEEE<br>802.3 | Local maintenance terminal<br>interface. |
| USB            | ---                      | USB2.0-A                           | Interface for USB Wi-Fi.                 |

## 6.3 Radio Performance

The radio performance relates to the modem unit type and ODU type & frequency band.

### 6.3.1 Transmitter Characteristics

#### 6.3.1.1 IF Parameters

Table 6-9 IF interface parameters

| Item                          | Central Frequency              | Power Level           |
|-------------------------------|--------------------------------|-----------------------|
| IF Signal TX (IDU TX, ODU RX) | 350/630 <sup>[note1]</sup> MHz | 0 dBm to +2 dBm @ IDU |

| Item                          | Central Frequency                                                                                                | Power Level                                        |
|-------------------------------|------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
|                               |                                                                                                                  | -23 dBm to +2 dBm @ ODU                            |
| IF Signal RX (ODU TX, IDU RX) | 140/210 <sup>[note2]</sup> MHz                                                                                   | -30 dBm to -8 dBm @ IDU<br>-13 dBm to -7 dBm @ ODU |
| IF Interface Parameters       | Connector: N type (ODU), SMA type (IDU)<br>Impedance: 50 $\Omega$<br>Return loss: < -15 dB (ODU), < -15 dB (IDU) |                                                    |

**Note1:**

- 350MHz for CSA/CSA2/CSA2 v2/CSA4/MD2/MD2 V2/MD4; 630MHz for ME2

**Note2:**

- 140MHz for CSA/CSA2/CSA2 v2/CSA4/MD2/MD2 V2/MD4(7/14/28/40/56/80/112MHz) and ME2 (7/14/28/40/56/112MHz);
- 210MHz for ME2 (224MHz bandwidth)

**6.3.1.2 RF Parameters**

Table 6-10 Radio frequency adjustment step and stability

| ODU Type              | Frequency Band                       | Step size | Frequency Stability |
|-----------------------|--------------------------------------|-----------|---------------------|
| SRU2                  | 6/7/8 GHz                            | 50 kHz    | ±5 ppm              |
|                       | 10/11/13/15/18/23/26/28/32/38/42 GHz | 250 kHz   |                     |
| SRU2S                 | 13/15/18/23 GHz                      | 250 kHz   |                     |
| SRU3D                 | 6/7/8 GHz                            | 50 kHz    |                     |
|                       | 11/13/15/18/23 GHz                   | 250 kHz   |                     |
| HRU2F V1.0/HRU2F V2.0 | 6/7/8 GHz                            | 50 kHz    |                     |
|                       | 11G                                  | 250 kHz   |                     |
| HRU2                  | 13/15/18 GHz                         | 250 kHz   |                     |
| HRU3D                 | 5/6/7/8 GHz                          | 50 kHz    |                     |
|                       | 11/26/32/38 GHz                      | 250 kHz   |                     |

Table 6-11 ODU Tx/Rx spacing

| Frequency Band | Frequency Range (GHz) | Tx/Rx Spacing (MHz)                                                  | Frequency Plan Standards                                 |
|----------------|-----------------------|----------------------------------------------------------------------|----------------------------------------------------------|
| 5 GHz          | 4.404-5.024           | 300<br>312                                                           | ITU-R F.1099-5                                           |
| 6 GHz          | 5.925-7.105           | 252.04 (L6)<br>260 (L6)<br>266 (L6)<br>340 (U6)                      | ITU-R F.383<br>ITU-R F.384                               |
| 7 GHz          | 7.11-7.9              | 154<br>161<br>168<br>196<br>245                                      | ITU-R F.385<br>Annex 1,3,4                               |
| 8 GHz          | 7.725-8.5             | 119<br>126<br>151.614<br>208<br>266<br>283.5<br>300<br>310<br>311.32 | ITU-R F. 386<br>Annex 1,3,4                              |
| 10 GHz         | 10~10.7               | 350                                                                  | ITU-R F. 1568 Annex 1<br>ITU-R F. 747 Annex 1            |
| 11 GHz         | 10.7-11.7             | 490<br>500<br>530                                                    | ITU-R F. 387                                             |
| 13 GHz         | 12.75-13.25           | 266                                                                  | ITU-R F. 497<br>CEPT/ERC<br>REC T/R 12                   |
| 15 GHz         | 14.4-15.35            | 315<br>420<br>490<br>644<br>728                                      | ITU-R F. 636<br>ECC T/R 12-07E<br>CEPT/ERC<br>REC T/R 12 |

| Frequency Band | Frequency Range (GHz) | Tx/Rx Spacing (MHz)          | Frequency Plan Standards                                   |
|----------------|-----------------------|------------------------------|------------------------------------------------------------|
| 18 GHz         | 17.7-19.7             | 1008<br>1010<br>1120<br>1560 | ITU-R F. 595<br>ECC 12-03<br>CEPT/ERC<br>REC T/R 12        |
| 23 GHz         | 21.2-23.6             | 1008<br>1200<br>1232         | ITU-R F. 637 Annex 1,3,4<br>CEPT/ERC<br>REC T/R 13 Annex A |
| 26 GHz         | 24.549-26.453         | 1008                         | ITU-R F. 748<br>CEPT/ERC<br>REC T/R 13 Annex B             |
| 28 GHz         | 27.52-29.481          | 1008                         | ITU-R F. 748<br>CEPT/ERC<br>REC T/R 13 Annex C             |
| 32 GHz         | 31.815-33.383         | 812                          | ITU-R F. 1520<br>CEPT/ERC<br>REC T/R (01)                  |
| 38 GHz         | 37.016-39.480         | 1260                         | ITU-R F. 749 Annex 1<br>CEPT/ERC<br>REC T/R 12             |
| 42 GHz         | 40.522-43.464         | 1500                         | ITU-R F.2005                                               |

### 6.3.1.3 RF Transmitter Output Power & ATPC Range

RF transmitter output power (Tx. power) and ATPC range depend on the ODU & modem type. The ATPC range can be reached from the maximum Tx. power to the minimum Tx. power.

Table 6-12 Transmit power& ATPC range - SRU2: 6/7/8 GHz

| Frequency Band (GHz)                     | 6/7/8 |          |        |
|------------------------------------------|-------|----------|--------|
| Rated Maximum RF Transmitter Power (dBm) |       |          |        |
| Bandwidth                                | 7/14  | 28/40/56 | 80/112 |
| QPSK                                     | 28    | 28       | 28     |
| 16QAM                                    | 25    | 25       | 25     |

| Frequency Band (GHz)                                                             | 6/7/8   |    |     |
|----------------------------------------------------------------------------------|---------|----|-----|
| 32QAM                                                                            | 25      | 25 | 25  |
| 64QAM                                                                            | 25      | 25 | 25  |
| 128QAM                                                                           | 25      | 25 | 25  |
| 256QAM                                                                           | 24      | 24 | 24  |
| 512QAM                                                                           | 23      | 23 | 23  |
| 1024QAM                                                                          | 22      | 22 | 22  |
| 1024QAM Light                                                                    | 22      | 22 | 22  |
| 2048QAM                                                                          | 22      | 22 | 22  |
| 4096QAM                                                                          | N/A     | 21 | N/A |
| Guaranteed                                                                       | ±2.0 dB |    |     |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |    |     |
| QPSK ~ 4096 QAM                                                                  | -6      |    |     |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |    |     |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |    |     |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |    |     |
| Muted RF Transmitter Power: < -50 dBm                                            |         |    |     |

**Note:** 6GHz SRU2 supports 80MHz bandwidth.

Table 6-13 Transmit power& ATPC range - SRU2: 10/11 GHz

| Frequency Band (GHz)                     | 10   |          |      | 11   |          |        |
|------------------------------------------|------|----------|------|------|----------|--------|
| Rated Maximum RF Transmitter Power (dBm) |      |          |      |      |          |        |
| Bandwidth                                | 7/14 | 28/40/56 | 112  | 7/14 | 28/40/56 | 80/112 |
| QPSK                                     | 26   | 26       | 26   | 26   | 26       | 26     |
| 16QAM                                    | 25   | 25       | 25   | 25   | 25       | 25     |
| 32QAM                                    | 25   | 25       | 25   | 25   | 25       | 25     |
| 64QAM                                    | 24   | 24       | 24   | 24   | 24       | 24     |
| 128QAM                                   | 24   | 24       | 24   | 24   | 24       | 24     |
| 256QAM                                   | 23   | 23       | 23   | 23   | 23       | 23     |
| 512QAM                                   | 22.5 | 22.5     | 22.5 | 22.5 | 22.5     | 22.5   |
| 1024QAM                                  | 21.5 | 21.5     | 21.5 | 21.5 | 21.5     | 21.5   |

| Frequency Band (GHz)                                                             | 10      |      |      | 11   |      |      |
|----------------------------------------------------------------------------------|---------|------|------|------|------|------|
| 1024QAM Light                                                                    | 21.5    | 21.5 | 21.5 | 21.5 | 21.5 | 21.5 |
| 2048QAM                                                                          | 21.5    | 21.5 | 21.5 | 21.5 | 21.5 | 21.5 |
| 4096QAM                                                                          | N/A     | 21   | N/A  | N/A  | 21   | N/A  |
| Guaranteed                                                                       | ±2.0 dB |      |      |      |      |      |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |      |      |      |      |      |
| QPSK ~<br>4096 QAM                                                               | -6      |      |      | 0    |      |      |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |      |      |      |      |      |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |      |      |      |      |      |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |      |      |      |      |      |
| Muted RF Transmitter Power: < -50 dBm                                            |         |      |      |      |      |      |

**Note:** 11GHz SRU2 supports 80MHz bandwidth.

Table 6-14 Transmit power& ATPC range - SRU2: 13 GHz

| Frequency Band<br>(GHz)                  | 13  |     |    |    |    |     |
|------------------------------------------|-----|-----|----|----|----|-----|
| Rated Maximum RF Transmitter Power (dBm) |     |     |    |    |    |     |
| Bandwidth (MHz)                          | 7   | 14  | 28 | 40 | 56 | 112 |
| QPSK                                     | 29  | 29  | 27 | 27 | 27 | 26  |
| 16 QAM                                   | 26  | 25  | 25 | 24 | 24 | 23  |
| 32 QAM                                   | 26  | 25  | 25 | 24 | 24 | 23  |
| 64 QAM                                   | 25  | 25  | 24 | 23 | 23 | 22  |
| 128 QAM                                  | 25  | 25  | 24 | 23 | 23 | 22  |
| 256 QAM                                  | 24  | 24  | 24 | 23 | 23 | 21  |
| 512 QAM                                  | 24  | 24  | 24 | 23 | 23 | 21  |
| 1024 QAM                                 | 22  | 22  | 22 | 21 | 21 | 19  |
| 1024 QAM Light                           | 22  | 22  | 22 | 21 | 21 | 19  |
| 2048 QAM                                 | 22  | 22  | 22 | 21 | 21 | 18  |
| 4096 QAM                                 | N/A | N/A | 21 | 20 | 20 | 17  |
| 8192 QAM                                 | N/A | N/A | 19 | 18 | 18 | N/A |

|                                                                                  |         |     |    |    |    |     |
|----------------------------------------------------------------------------------|---------|-----|----|----|----|-----|
| Guaranteed                                                                       | ±2.0 dB |     |    |    |    |     |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |     |    |    |    |     |
| QPSK ~ 2048 QAM                                                                  | -5      | -5  | -5 | -5 | -5 | -5  |
| 4096 QAM                                                                         | N/A     | N/A | -5 | -5 | -5 | 0   |
| 8192 QAM                                                                         | N/A     | N/A | 0  | 0  | 0  | N/A |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |     |    |    |    |     |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |     |    |    |    |     |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |     |    |    |    |     |
| Muted RF Transmitter Power: < -50 dBm                                            |         |     |    |    |    |     |

Table 6-15 Transmit power&amp; ATPC range - SRU2: 15 GHz

| Frequency Band<br>(GHz)                  | 15      |     |      |      |      |     |
|------------------------------------------|---------|-----|------|------|------|-----|
| Rated Maximum RF Transmitter Power (dBm) |         |     |      |      |      |     |
| Bandwidth (MHz)                          | 7       | 14  | 28   | 40   | 56   | 112 |
| QPSK                                     | 29      | 29  | 27.5 | 27.5 | 27.5 | 26  |
| 16 QAM                                   | 26      | 26  | 26   | 25   | 25   | 23  |
| 32 QAM                                   | 26      | 26  | 26   | 25   | 25   | 23  |
| 64 QAM                                   | 25      | 25  | 25   | 24   | 24   | 22  |
| 128 QAM                                  | 25      | 25  | 25   | 24   | 24   | 22  |
| 256 QAM                                  | 24      | 24  | 24   | 23   | 23   | 21  |
| 512 QAM                                  | 24      | 24  | 24   | 23   | 23   | 21  |
| 1024 QAM                                 | 22      | 22  | 22   | 21   | 21   | 19  |
| 1024 QAM Light                           | 22      | 22  | 22   | 21   | 21   | 19  |
| 2048 QAM                                 | 22      | 22  | 22   | 21   | 21   | 18  |
| 4096 QAM                                 | N/A     | N/A | 21   | 20   | 20   | 17  |
| 8192 QAM                                 | N/A     | N/A | 19   | 18   | 18   | N/A |
| Guaranteed                               | ±2.0 dB |     |      |      |      |     |
| Rated Minimum RF Transmitter Power (dBm) |         |     |      |      |      |     |
| QPSK ~ 2048 QAM                          | -5      | -5  | -5   | -5   | -5   | -5  |

|                                                                                  |     |     |    |    |    |     |
|----------------------------------------------------------------------------------|-----|-----|----|----|----|-----|
| 4096 QAM                                                                         | N/A | N/A | -5 | -5 | -5 | 0   |
| 8192 QAM                                                                         | N/A | N/A | 0  | 0  | 0  | N/A |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |     |     |    |    |    |     |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |     |     |    |    |    |     |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |     |     |    |    |    |     |
| Muted RF Transmitter Power: < -50 dBm                                            |     |     |    |    |    |     |

Table 6-16 Transmit power&amp; ATPC range - SRU2: 18 GHz

| Frequency Band<br>(GHz)                                                          | 18      |      |      |      |      |     |
|----------------------------------------------------------------------------------|---------|------|------|------|------|-----|
| Rated Maximum RF Transmitter Power (dBm)                                         |         |      |      |      |      |     |
| Bandwidth (MHz)                                                                  | 7       | 14   | 28   | 40   | 56   | 112 |
| QPSK                                                                             | 26.5    | 26.5 | 26.5 | 25   | 25   | 24  |
| 16 QAM                                                                           | 24.5    | 24.5 | 24.5 | 23   | 23   | 22  |
| 32 QAM                                                                           | 24.5    | 24.5 | 24.5 | 22   | 22   | 21  |
| 64 QAM                                                                           | 24      | 24   | 24   | 21   | 21   | 19  |
| 128 QAM                                                                          | 24      | 24   | 24   | 21   | 21   | 18  |
| 256 QAM                                                                          | 23.5    | 23.5 | 23.5 | 21   | 21   | 18  |
| 512 QAM                                                                          | 23.5    | 23.5 | 23.5 | 20.5 | 20.5 | 18  |
| 1024 QAM                                                                         | 23      | 23   | 23   | 20.5 | 20.5 | 18  |
| 1024 QAM Light                                                                   | 23      | 23   | 23   | 20.5 | 20.5 | 18  |
| 2048 QAM                                                                         | 23      | 23   | 23   | 20.5 | 20.5 | 18  |
| 4096 QAM                                                                         | N/A     | N/A  | 22   | 19   | 19   | 17  |
| 8192 QAM                                                                         | N/A     | N/A  | 20   | 17   | 17   | N/A |
| Guaranteed                                                                       | ±2.0 dB |      |      |      |      |     |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |      |      |      |      |     |
| QPSK ~ 2048 QAM                                                                  | -5      | -5   | -5   | -5   | -5   | -5  |
| 4096 QAM                                                                         | N/A     | N/A  | -5   | -5   | -5   | 0   |
| 8192 QAM                                                                         | N/A     | N/A  | 0    | 0    | 0    | N/A |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |      |      |      |      |     |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |      |      |      |      |     |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |      |      |      |      |     |

| Frequency Band (GHz)                  | 18 |
|---------------------------------------|----|
| Muted RF Transmitter Power: < -50 dBm |    |

Table 6-17 Transmit power&amp; ATPC range - SRU2: 23 GHz

| Frequency Band (GHz)                                                             | 23      |      |      |    |    |     |
|----------------------------------------------------------------------------------|---------|------|------|----|----|-----|
| Rated Maximum RF Transmitter Power (dBm)                                         |         |      |      |    |    |     |
| Bandwidth (MHz)                                                                  | 7       | 14   | 28   | 40 | 56 | 112 |
| QPSK                                                                             | 26      | 26   | 26   | 25 | 25 | 24  |
| 16 QAM                                                                           | 24      | 24   | 24   | 24 | 24 | 22  |
| 32 QAM                                                                           | 24      | 24   | 24   | 24 | 24 | 21  |
| 64 QAM                                                                           | 23.5    | 23.5 | 23.5 | 22 | 22 | 19  |
| 128 QAM                                                                          | 23.5    | 23.5 | 23.5 | 22 | 22 | 18  |
| 256 QAM                                                                          | 23.5    | 23.5 | 23.5 | 22 | 22 | 18  |
| 512 QAM                                                                          | 23.5    | 23.5 | 23.5 | 22 | 22 | 18  |
| 1024 QAM                                                                         | 22      | 22   | 22   | 20 | 20 | 18  |
| 1024 QAM Light                                                                   | 22      | 22   | 22   | 20 | 20 | 18  |
| 2048 QAM                                                                         | 22      | 22   | 22   | 20 | 20 | 18  |
| 4096 QAM                                                                         | N/A     | N/A  | 21   | 19 | 19 | 17  |
| 8192 QAM                                                                         | N/A     | N/A  | 19   | 17 | 17 | N/A |
| Guaranteed                                                                       | ±2.0 dB |      |      |    |    |     |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |      |      |    |    |     |
| QPSK ~ 2048 QAM                                                                  | -5      | -5   | -5   | -5 | -5 | -5  |
| 4096 QAM                                                                         | N/A     | N/A  | -5   | -5 | -5 | 0   |
| 8192 QAM                                                                         | N/A     | N/A  | 0    | 0  | 0  | N/A |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |      |      |    |    |     |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |      |      |    |    |     |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |      |      |    |    |     |
| Muted RF Transmitter Power: < -50 dBm                                            |         |      |      |    |    |     |

Table 6-18 Transmit power&amp; ATPC range - SRU2: 26/28 GHz

| Frequency Band (GHz)                                                             | 26      |          |     | 28   |          |     |
|----------------------------------------------------------------------------------|---------|----------|-----|------|----------|-----|
| Rated Maximum RF Transmitter Power (dBm)                                         |         |          |     |      |          |     |
| Bandwidth                                                                        | 7/14    | 28/40/56 | 112 | 7/14 | 28/40/56 | 112 |
| QPSK                                                                             | 22      | 22       | 22  | 22   | 22       | 22  |
| 16QAM                                                                            | 21      | 21       | 21  | 21   | 21       | 21  |
| 32QAM                                                                            | 21      | 21       | 21  | 21   | 21       | 21  |
| 64QAM                                                                            | 20      | 20       | 20  | 20   | 20       | 20  |
| 128QAM                                                                           | 20      | 20       | 20  | 20   | 20       | 20  |
| 256QAM                                                                           | 20      | 20       | 20  | 20   | 20       | 20  |
| 512QAM                                                                           | 19      | 19       | 19  | 19   | 19       | 19  |
| 1024QAM                                                                          | 19      | 19       | 19  | 18   | 18       | 18  |
| 1024QAM Light                                                                    | 19      | 19       | N/A | 18   | 18       | N/A |
| 2048QAM                                                                          | 18      | 18       | N/A | 16   | 16       | N/A |
| 4096QAM                                                                          | N/A     | 17       | N/A | N/A  | 15       | N/A |
| Guaranteed                                                                       | ±2.0 dB |          |     |      |          |     |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |          |     |      |          |     |
| QPSK ~ 4096 QAM                                                                  | -3      |          |     | -3   |          |     |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |          |     |      |          |     |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |          |     |      |          |     |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |          |     |      |          |     |
| Muted RF Transmitter Power: < -50 dBm                                            |         |          |     |      |          |     |

Table 6-19 Transmit power&amp; ATPC range - SRU2: 32/38 GHz

| Frequency Band (GHz)                     | 32   |          |     | 38   |    |    |    |     |
|------------------------------------------|------|----------|-----|------|----|----|----|-----|
| Rated Maximum RF Transmitter Power (dBm) |      |          |     |      |    |    |    |     |
| Bandwidth                                | 7/14 | 28/40/56 | 112 | 7/14 | 28 | 40 | 56 | 112 |
| QPSK                                     | 22   | 22       | 22  | 20   | 20 | 20 | 20 | 20  |
| 16QAM                                    | 20   | 20       | 20  | 18   | 18 | 18 | 18 | 18  |
| 32QAM                                    | 20   | 20       | 20  | 18   | 18 | 18 | 18 | 18  |

| Frequency Band (GHz)                                                             | 32      |     |     | 38  |    |    |    |     |
|----------------------------------------------------------------------------------|---------|-----|-----|-----|----|----|----|-----|
| 64QAM                                                                            | 19      | 19  | 19  | 17  | 17 | 17 | 17 | 17  |
| 128QAM                                                                           | 19      | 19  | 19  | 17  | 17 | 17 | 17 | 17  |
| 256QAM                                                                           | 18      | 18  | 18  | 16  | 16 | 16 | 16 | 16  |
| 512QAM                                                                           | 17      | 17  | 17  | 16  | 16 | 16 | 16 | 16  |
| 1024QAM                                                                          | 16      | 16  | 16  | 16  | 16 | 16 | 16 | 16  |
| 1024QAM<br>Light                                                                 | 16      | 16  | N/A | 16  | 16 | 16 | 16 | 16  |
| 2048QAM                                                                          | 15      | 15  | N/A | 15  | 15 | 15 | 15 | 15  |
| 4096QAM                                                                          | N/A     | 14  | N/A | N/A | 14 | 14 | 14 | 14  |
| 8192QAM                                                                          | N/A     | N/A | N/A | N/A | 14 | 14 | 14 | N/A |
| Guaranteed                                                                       | ±2.0 dB |     |     |     |    |    |    |     |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |     |     |     |    |    |    |     |
| QPSK ~<br>8192 QAM                                                               | -3      |     |     | -3  |    |    |    |     |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |     |     |     |    |    |    |     |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |     |     |     |    |    |    |     |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |     |     |     |    |    |    |     |
| Muted RF Transmitter Power: < -50 dBm                                            |         |     |     |     |    |    |    |     |

**Note:** 8K QAM modulation is supported by 38G SRU2 V2.0.

Table 6-20 Transmit power& ATPC range - SRU2: 42 GHz

| Frequency Band (GHz)                     | 42   |          |     |
|------------------------------------------|------|----------|-----|
| Rated Maximum RF Transmitter Power (dBm) |      |          |     |
| Bandwidth                                | 7/14 | 28/40/56 | 112 |
| QPSK                                     | 20   | 20       | 20  |
| 16QAM                                    | 18   | 18       | 18  |
| 32QAM                                    | 18   | 18       | 18  |
| 64QAM                                    | 17   | 17       | 17  |
| 128QAM                                   | 17   | 17       | 17  |
| 256QAM                                   | 16   | 16       | 16  |
| 512QAM                                   | 15   | 15       | 15  |

| Frequency Band (GHz)                                                             | 42      |    |     |
|----------------------------------------------------------------------------------|---------|----|-----|
| 1024QAM                                                                          | 14      | 14 | 14  |
| 1024QAM Light                                                                    | 14      | 14 | N/A |
| 2048QAM                                                                          | 13      | 13 | N/A |
| 4096QAM                                                                          | N/A     | 12 | N/A |
| Guaranteed                                                                       | ±2.0 dB |    |     |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |    |     |
| QPSK ~ 4096 QAM                                                                  | -3      |    |     |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |    |     |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |    |     |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |    |     |
| Muted RF Transmitter Power: < -50 dBm                                            |         |    |     |

Table 6-21 Transmit power&amp; ATPC range - SRU2S: 13 GHz

| Frequency Band (GHz)                     | 13      |     |    |    |    |     |
|------------------------------------------|---------|-----|----|----|----|-----|
| Rated Maximum RF Transmitter Power (dBm) |         |     |    |    |    |     |
| Bandwidth (MHz)                          | 7       | 14  | 28 | 40 | 56 | 112 |
| QPSK                                     | 28      | 28  | 26 | 26 | 26 | 25  |
| 16 QAM                                   | 25      | 24  | 24 | 23 | 23 | 22  |
| 32 QAM                                   | 25      | 24  | 24 | 23 | 23 | 22  |
| 64 QAM                                   | 24      | 24  | 23 | 22 | 22 | 21  |
| 128 QAM                                  | 24      | 24  | 23 | 22 | 22 | 21  |
| 256 QAM                                  | 23      | 23  | 23 | 22 | 22 | 20  |
| 512 QAM                                  | 23      | 23  | 23 | 22 | 22 | 20  |
| 1024 QAM                                 | 21      | 21  | 21 | 20 | 20 | 18  |
| 1024 QAM Light                           | 21      | 21  | 21 | 20 | 20 | 18  |
| 2048 QAM                                 | 21      | 21  | 21 | 20 | 20 | 18  |
| 4096 QAM                                 | N/A     | N/A | 20 | 19 | 19 | 17  |
| 8192 QAM                                 | N/A     | N/A | 18 | 17 | 17 | N/A |
| Guaranteed                               | ±2.0 dB |     |    |    |    |     |
| Rated Minimum RF Transmitter Power (dBm) |         |     |    |    |    |     |
| QPSK ~ 2048 QAM                          | -5      | -5  | -5 | -5 | -5 | -5  |

| Frequency Band (GHz)                                                             | 13  |     |    |    |    |     |
|----------------------------------------------------------------------------------|-----|-----|----|----|----|-----|
| 4096 QAM                                                                         | N/A | N/A | -5 | -5 | -5 | 0   |
| 8192 QAM                                                                         | N/A | N/A | 0  | 0  | 0  | N/A |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |     |     |    |    |    |     |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |     |     |    |    |    |     |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |     |     |    |    |    |     |
| Muted RF Transmitter Power: < -50 dBm                                            |     |     |    |    |    |     |

Table 6-22 Transmit power&amp; ATPC range - SRU2S: 15 GHz

| Frequency Band<br>(GHz)                                                          | 15      |     |      |      |      |     |
|----------------------------------------------------------------------------------|---------|-----|------|------|------|-----|
| Rated Maximum RF Transmitter Power (dBm)                                         |         |     |      |      |      |     |
| Bandwidth (MHz)                                                                  | 7       | 14  | 28   | 40   | 56   | 112 |
| QPSK                                                                             | 28      | 28  | 26.5 | 26.5 | 26.5 | 25  |
| 16 QAM                                                                           | 25      | 25  | 25   | 24   | 24   | 22  |
| 32 QAM                                                                           | 25      | 25  | 25   | 24   | 24   | 22  |
| 64 QAM                                                                           | 24      | 24  | 24   | 23   | 23   | 21  |
| 128 QAM                                                                          | 24      | 24  | 24   | 23   | 23   | 21  |
| 256 QAM                                                                          | 23      | 23  | 23   | 22   | 22   | 20  |
| 512 QAM                                                                          | 23      | 23  | 23   | 22   | 22   | 20  |
| 1024 QAM                                                                         | 21      | 21  | 21   | 20   | 20   | 18  |
| 1024 QAM Light                                                                   | 21      | 21  | 21   | 20   | 20   | 18  |
| 2048 QAM                                                                         | 21      | 21  | 21   | 20   | 20   | 18  |
| 4096 QAM                                                                         | N/A     | N/A | 20   | 19   | 19   | 16  |
| 8192 QAM                                                                         | N/A     | N/A | 18   | 17   | 17   | N/A |
| Guaranteed                                                                       | ±2.0 dB |     |      |      |      |     |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |     |      |      |      |     |
| QPSK ~ 2048 QAM                                                                  | -5      | -5  | -5   | -5   | -5   | -5  |
| 4096 QAM                                                                         | N/A     | N/A | -5   | -5   | -5   | 0   |
| 8192 QAM                                                                         | N/A     | N/A | 0    | 0    | 0    | N/A |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |     |      |      |      |     |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |     |      |      |      |     |

| Frequency Band<br>(GHz)                     | 15 |
|---------------------------------------------|----|
| Minimum Manual Adjustment Step Size: 0.1 dB |    |
| Muted RF Transmitter Power: < -50 dBm       |    |

Table 6-23 Transmit power&amp; ATPC range - SRU2S: 18 GHz

| Frequency Band<br>(GHz)                                                          | 18      |      |      |      |      |     |
|----------------------------------------------------------------------------------|---------|------|------|------|------|-----|
| Rated Maximum RF Transmitter Power (dBm)                                         |         |      |      |      |      |     |
| Bandwidth (MHz)                                                                  | 7       | 14   | 28   | 40   | 56   | 112 |
| QPSK                                                                             | 25.5    | 25.5 | 25.5 | 24   | 24   | 23  |
| 16 QAM                                                                           | 23.5    | 23.5 | 23.5 | 22   | 22   | 21  |
| 32 QAM                                                                           | 23.5    | 23.5 | 23.5 | 21   | 21   | 20  |
| 64 QAM                                                                           | 23      | 23   | 23   | 20   | 20   | 18  |
| 128 QAM                                                                          | 23      | 23   | 23   | 20   | 20   | 17  |
| 256 QAM                                                                          | 22.5    | 22.5 | 22.5 | 20   | 20   | 17  |
| 512 QAM                                                                          | 22.5    | 22.5 | 22.5 | 19.5 | 19.5 | 17  |
| 1024 QAM                                                                         | 22      | 22   | 22   | 19.5 | 19.5 | 17  |
| 1024 QAM Light                                                                   | 22      | 22   | 22   | 19.5 | 19.5 | 17  |
| 2048 QAM                                                                         | 22      | 22   | 22   | 19.5 | 19.5 | 17  |
| 4096 QAM                                                                         | N/A     | N/A  | 21   | 18   | 18   | 15  |
| 8192 QAM                                                                         | N/A     | N/A  | 19   | 16   | 16   | N/A |
| Guaranteed                                                                       | ±2.0 dB |      |      |      |      |     |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |      |      |      |      |     |
| QPSK ~ 2048 QAM                                                                  | -5      | -5   | -5   | -5   | -5   | -5  |
| 4096 QAM                                                                         | N/A     | N/A  | -5   | -5   | -5   | 0   |
| 8192 QAM                                                                         | N/A     | N/A  | 0    | 0    | 0    | N/A |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |      |      |      |      |     |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |      |      |      |      |     |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |      |      |      |      |     |
| Muted RF Transmitter Power: < -50 dBm                                            |         |      |      |      |      |     |

Table 6-24 Transmit power&amp; ATPC range - SRU2S: 23 GHz

| Frequency Band (GHz)                                                             | 23      |      |      |    |    |     |
|----------------------------------------------------------------------------------|---------|------|------|----|----|-----|
| Rated Maximum RF Transmitter Power (dBm)                                         |         |      |      |    |    |     |
| Bandwidth (MHz)                                                                  | 7       | 14   | 28   | 40 | 56 | 112 |
| QPSK                                                                             | 25      | 25   | 25   | 24 | 24 | 23  |
| 16 QAM                                                                           | 23      | 23   | 23   | 23 | 23 | 21  |
| 32 QAM                                                                           | 23      | 23   | 23   | 23 | 23 | 20  |
| 64 QAM                                                                           | 22.5    | 22.5 | 22.5 | 21 | 21 | 18  |
| 128 QAM                                                                          | 22.5    | 22.5 | 22.5 | 21 | 21 | 17  |
| 256 QAM                                                                          | 22.5    | 22.5 | 22.5 | 21 | 21 | 17  |
| 512 QAM                                                                          | 22.5    | 22.5 | 22.5 | 21 | 21 | 17  |
| 1024 QAM                                                                         | 21      | 21   | 21   | 19 | 19 | 17  |
| 1024 QAM Light                                                                   | 21      | 21   | 21   | 19 | 19 | 17  |
| 2048 QAM                                                                         | 21      | 21   | 21   | 19 | 19 | 17  |
| 4096 QAM                                                                         | N/A     | N/A  | 20   | 18 | 18 | 16  |
| 8192 QAM                                                                         | N/A     | N/A  | 18   | 16 | 16 | N/A |
| Guaranteed                                                                       | ±2.0 dB |      |      |    |    |     |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |      |      |    |    |     |
| QPSK ~ 2048 QAM                                                                  | -5      | -5   | -5   | -5 | -5 | -5  |
| 4096 QAM                                                                         | N/A     | N/A  | -5   | -5 | -5 | 0   |
| 8192 QAM                                                                         | N/A     | N/A  | 0    | 0  | 0  | N/A |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |      |      |    |    |     |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |      |      |    |    |     |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |      |      |    |    |     |
| Muted RF Transmitter Power: < -50 dBm                                            |         |      |      |    |    |     |

Table 6-25 Transmit power&amp; ATPC range - SRU3D: 6/7/8 GHz

| Frequency Band (GHz)                     | 6/7/8 |          |        |
|------------------------------------------|-------|----------|--------|
| Rated Maximum RF Transmitter Power (dBm) |       |          |        |
| Bandwidth                                | 7/14  | 28/40/56 | 80/112 |
| QPSK                                     | 28    | 28       | 28     |
| 16QAM                                    | 25    | 25       | 25     |

|                                                                                  |         |    |     |
|----------------------------------------------------------------------------------|---------|----|-----|
| 32QAM                                                                            | 25      | 25 | 25  |
| 64QAM                                                                            | 25      | 25 | 25  |
| 128QAM                                                                           | 25      | 25 | 25  |
| 256QAM                                                                           | 24      | 24 | 24  |
| 512QAM                                                                           | 23      | 23 | 23  |
| 1024QAM                                                                          | 22      | 22 | 22  |
| 1024QAM Light                                                                    | 22      | 22 | 22  |
| 2048QAM                                                                          | 22      | 22 | 22  |
| 4096QAM                                                                          | N/A     | 21 | 21  |
| 8192QAM                                                                          | N/A     | 21 | N/A |
| Guaranteed                                                                       | ±2.0 dB |    |     |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |    |     |
| QPSK ~ 2048 QAM                                                                  | -5      |    |     |
| 4096 QAM                                                                         | 0       |    |     |
| 8192 QAM                                                                         | 5       |    |     |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |    |     |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |    |     |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |    |     |
| Muted RF Transmitter Power: < -50 dBm                                            |         |    |     |

**Note:** 6/8GHz supports 80MHz bandwidth.

Table 6-26 Transmit power& ATPC range - SRU3D: 11 GHz

| Frequency Band (GHz)                     | 11   |          |        |
|------------------------------------------|------|----------|--------|
| Rated Maximum RF Transmitter Power (dBm) |      |          |        |
| Bandwidth                                | 7/14 | 28/40/56 | 80/112 |
| QPSK                                     | 26   | 26       | 26     |
| 16QAM                                    | 25   | 25       | 25     |
| 32QAM                                    | 25   | 25       | 25     |
| 64QAM                                    | 24   | 24       | 24     |
| 128QAM                                   | 24   | 24       | 24     |
| 256QAM                                   | 23   | 23       | 23     |
| 512QAM                                   | 22.5 | 22.5     | 22.5   |

| Frequency Band (GHz)                                                             | 11      |      |      |
|----------------------------------------------------------------------------------|---------|------|------|
| 1024QAM                                                                          | 21.5    | 21.5 | 21.5 |
| 1024QAM Light                                                                    | 21.5    | 21.5 | 21.5 |
| 2048QAM                                                                          | 21.5    | 21.5 | 21.5 |
| 4096QAM                                                                          | N/A     | 21   | 21   |
| 8192QAM                                                                          | N/A     | 21   | N/A  |
| Guaranteed                                                                       | ±2.0 dB |      |      |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |      |      |
| QPSK ~ 2048 QAM                                                                  | -5      |      |      |
| 4096 QAM                                                                         | 0       |      |      |
| 8192 QAM                                                                         | 5       |      |      |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |      |      |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |      |      |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |      |      |
| Muted RF Transmitter Power: < -50 dBm                                            |         |      |      |

**Note:** 11GHz SRU3D V1.0 supports 80MHz bandwidth.

Table 6-27 Transmit power& ATPC range - SRU3D: 13 GHz

| Frequency Band (GHz)                     | 13  |     |    |    |    |     |
|------------------------------------------|-----|-----|----|----|----|-----|
| Rated Maximum RF Transmitter Power (dBm) |     |     |    |    |    |     |
| Bandwidth (MHz)                          | 7   | 14  | 28 | 40 | 56 | 112 |
| QPSK                                     | 29  | 29  | 27 | 27 | 27 | 26  |
| 16 QAM                                   | 26  | 25  | 25 | 24 | 24 | 23  |
| 32 QAM                                   | 26  | 25  | 25 | 24 | 24 | 23  |
| 64 QAM                                   | 25  | 25  | 24 | 23 | 23 | 22  |
| 128 QAM                                  | 25  | 25  | 24 | 23 | 23 | 22  |
| 256 QAM                                  | 24  | 24  | 24 | 23 | 23 | 21  |
| 512 QAM                                  | 24  | 24  | 24 | 23 | 23 | 21  |
| 1024 QAM                                 | 22  | 22  | 22 | 21 | 21 | 19  |
| 1024 QAM Light                           | 22  | 22  | 22 | 21 | 21 | 19  |
| 2048 QAM                                 | 22  | 22  | 22 | 21 | 21 | 19  |
| 4096 QAM                                 | N/A | N/A | 21 | 20 | 20 | 18  |

| Frequency Band (GHz)                                                             | 13      |     |    |    |    |     |
|----------------------------------------------------------------------------------|---------|-----|----|----|----|-----|
| 8192 QAM                                                                         | N/A     | N/A | 19 | 19 | 19 | N/A |
| 16K QAM                                                                          | N/A     | N/A | 19 | 19 | 19 | N/A |
| Guaranteed                                                                       | ±2.0 dB |     |    |    |    |     |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |     |    |    |    |     |
| QPSK ~ 1024 QAM light                                                            | -5      | -5  | -5 | -5 | -5 | -5  |
| 2048 QAM                                                                         | -5      | -5  | -5 | -5 | -5 | 0   |
| 4096 QAM                                                                         | N/A     | N/A | -5 | -5 | -5 | 0   |
| 8192 QAM                                                                         | N/A     | N/A | 0  | 0  | 0  | N/A |
| 16K QAM                                                                          | N/A     | N/A | 0  | 0  | 0  | N/A |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |     |    |    |    |     |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |     |    |    |    |     |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |     |    |    |    |     |
| Muted RF Transmitter Power: < -50 dBm                                            |         |     |    |    |    |     |

**Note:** 13GHz SRU3D V1.0/V1.1 bandwidth up to 112MHz.

Table 6-28 Transmit power& ATPC range - SRU3D: 15 GHz

| Frequency Band<br>(GHz)                  | 15  |     |      |      |      |     |     |
|------------------------------------------|-----|-----|------|------|------|-----|-----|
| Rated Maximum RF Transmitter Power (dBm) |     |     |      |      |      |     |     |
| Bandwidth (MHz)                          | 7   | 14  | 28   | 40   | 56   | 112 | 224 |
| QPSK                                     | 29  | 29  | 27.5 | 27.5 | 27.5 | 26  | 23  |
| 16 QAM                                   | 26  | 26  | 26   | 25   | 25   | 23  | 20  |
| 32 QAM                                   | 26  | 26  | 26   | 25   | 25   | 23  | 20  |
| 64 QAM                                   | 25  | 25  | 25   | 24   | 24   | 22  | 19  |
| 128 QAM                                  | 25  | 25  | 25   | 24   | 24   | 22  | 19  |
| 256 QAM                                  | 24  | 24  | 24   | 23   | 23   | 21  | 18  |
| 512 QAM                                  | 24  | 24  | 24   | 23   | 23   | 21  | 18  |
| 1024 QAM                                 | 22  | 22  | 22   | 21   | 21   | 19  | 17  |
| 1024 QAM Light                           | 22  | 22  | 22   | 21   | 21   | 19  | N/A |
| 2048 QAM                                 | 22  | 22  | 22   | 21   | 21   | 19  | N/A |
| 4096 QAM                                 | N/A | N/A | 21   | 20   | 20   | 18  | N/A |

| Frequency Band<br>(GHz)                                                          | 15      |     |    |    |    |     |     |
|----------------------------------------------------------------------------------|---------|-----|----|----|----|-----|-----|
| 8192 QAM                                                                         | N/A     | N/A | 19 | 19 | 19 | N/A | N/A |
| 16K QAM                                                                          | N/A     | N/A | 19 | 19 | 19 | N/A | N/A |
| Guaranteed                                                                       | ±2.0 dB |     |    |    |    |     |     |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |     |    |    |    |     |     |
| QPSK ~ 1024 QAM<br>light                                                         | -5      | -5  | -5 | -5 | -5 | -5  | 0   |
| 2048 QAM                                                                         | -5      | -5  | -5 | -5 | -5 | 0   | N/A |
| 4096 QAM                                                                         | N/A     | N/A | -5 | -5 | -5 | 0   | N/A |
| 8192 QAM                                                                         | N/A     | N/A | 0  | 0  | 0  | N/A | N/A |
| 16K QAM                                                                          | N/A     | N/A | 0  | 0  | 0  | N/A | N/A |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |     |    |    |    |     |     |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |     |    |    |    |     |     |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |     |    |    |    |     |     |
| Muted RF Transmitter Power: < -50 dBm                                            |         |     |    |    |    |     |     |

**Note:** 15GHz SRU3D V1.0/V1.1 bandwidth up to 224MHz (with ME2).

Table 6-29 Transmit power& ATPC range - SRU3D: 18 GHz

| Frequency Band<br>(GHz)                  | 18   |      |      |      |      |     |     |
|------------------------------------------|------|------|------|------|------|-----|-----|
| Rated Maximum RF Transmitter Power (dBm) |      |      |      |      |      |     |     |
| Bandwidth (MHz)                          | 7    | 14   | 28   | 40   | 56   | 112 | 224 |
| QPSK                                     | 26.5 | 26.5 | 26.5 | 25   | 25   | 24  | 24  |
| 16 QAM                                   | 24.5 | 24.5 | 24.5 | 23   | 23   | 22  | 22  |
| 32 QAM                                   | 24.5 | 24.5 | 24.5 | 22   | 22   | 21  | 21  |
| 64 QAM                                   | 24   | 24   | 24   | 21   | 21   | 19  | 19  |
| 128 QAM                                  | 24   | 24   | 24   | 21   | 21   | 18  | 18  |
| 256 QAM                                  | 23.5 | 23.5 | 23.5 | 21   | 21   | 18  | 18  |
| 512 QAM                                  | 23.5 | 23.5 | 23.5 | 20.5 | 20.5 | 18  | 18  |
| 1024 QAM                                 | 23   | 23   | 23   | 20.5 | 20.5 | 18  | 18  |
| 1024 QAM Light                           | 23   | 23   | 23   | 20.5 | 20.5 | 18  | N/A |
| 2048 QAM                                 | 23   | 23   | 23   | 20.5 | 20.5 | 18  | N/A |

| Frequency Band<br>(GHz)                                                          | 18      |     |    |    |    |     |     |
|----------------------------------------------------------------------------------|---------|-----|----|----|----|-----|-----|
| 4096 QAM                                                                         | N/A     | N/A | 22 | 19 | 19 | 17  | N/A |
| 8192 QAM                                                                         | N/A     | N/A | 21 | 18 | 18 | N/A | N/A |
| 16K QAM                                                                          | N/A     | N/A | 20 | 18 | 18 | N/A | N/A |
| Guaranteed                                                                       | ±2.0 dB |     |    |    |    |     |     |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |     |    |    |    |     |     |
| QPSK ~ 1024 QAM<br>light                                                         | -5      | -5  | -5 | -5 | -5 | -5  | 0   |
| 2048 QAM                                                                         | -5      | -5  | -5 | -5 | -5 | 0   | N/A |
| 4096 QAM                                                                         | N/A     | N/A | -5 | -5 | -5 | 0   | N/A |
| 8192 QAM                                                                         | N/A     | N/A | 0  | 0  | 0  | N/A | N/A |
| 16K QAM                                                                          | N/A     | N/A | 0  | 0  | 0  | N/A | N/A |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |     |    |    |    |     |     |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |     |    |    |    |     |     |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |     |    |    |    |     |     |
| Muted RF Transmitter Power: < -50 dBm                                            |         |     |    |    |    |     |     |

**Note:**

1. 18GHz SRU3D V1.0/V1.1 bandwidth up to 224MHz (with ME2).

Table 6-30 Transmit power&amp; ATPC range - SRU3D: 23GHz

| Frequency Band<br>(GHz)                  | 23   |      |      |    |    |     |     |
|------------------------------------------|------|------|------|----|----|-----|-----|
| Rated Maximum RF Transmitter Power (dBm) |      |      |      |    |    |     |     |
| Bandwidth (MHz)                          | 7    | 14   | 28   | 40 | 56 | 112 | 224 |
| QPSK                                     | 26   | 26   | 26   | 25 | 25 | 24  | 24  |
| 16 QAM                                   | 24   | 24   | 24   | 24 | 24 | 22  | 22  |
| 32 QAM                                   | 24   | 24   | 24   | 24 | 24 | 21  | 21  |
| 64 QAM                                   | 23.5 | 23.5 | 23.5 | 22 | 22 | 19  | 19  |
| 128 QAM                                  | 23.5 | 23.5 | 23.5 | 22 | 22 | 18  | 18  |
| 256 QAM                                  | 23.5 | 23.5 | 23.5 | 22 | 22 | 18  | 18  |
| 512 QAM                                  | 23.5 | 23.5 | 23.5 | 22 | 22 | 18  | 18  |

| Frequency Band<br>(GHz)                                                          | 23      |     |    |    |    |     |     |
|----------------------------------------------------------------------------------|---------|-----|----|----|----|-----|-----|
| 1024 QAM                                                                         | 22      | 22  | 22 | 20 | 20 | 18  | 18  |
| 1024 QAM Light                                                                   | 22      | 22  | 22 | 20 | 20 | 18  | N/A |
| 2048 QAM                                                                         | 22      | 22  | 22 | 20 | 20 | 18  | N/A |
| 4096 QAM                                                                         | N/A     | N/A | 21 | 19 | 19 | 17  | N/A |
| 8192 QAM                                                                         | N/A     | N/A | 20 | 18 | 18 | N/A | N/A |
| 16K QAM                                                                          | N/A     | N/A | 19 | 18 | 18 | N/A | N/A |
| Guaranteed                                                                       | ±2.0 dB |     |    |    |    |     |     |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |     |    |    |    |     |     |
| QPSK ~ 1024 QAM<br>light                                                         | -5      | -5  | -5 | -5 | -5 | -5  | 0   |
| 2048 QAM                                                                         | -5      | -5  | -5 | -5 | -5 | 0   | N/A |
| 4096 QAM                                                                         | N/A     | N/A | -5 | -5 | -5 | 0   | N/A |
| 8192 QAM                                                                         | N/A     | N/A | 0  | 0  | 0  | N/A | N/A |
| 16K QAM                                                                          | N/A     | N/A | 0  | 0  | 0  | N/A | N/A |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |     |    |    |    |     |     |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |     |    |    |    |     |     |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |     |    |    |    |     |     |
| Muted RF Transmitter Power: < -50 dBm                                            |         |     |    |    |    |     |     |

**Note:** 23GHz SRU3D V1.0/V1.1 bandwidth up to 224MHz (with ME2).

Table 6-31 Transmit power & ATPC range - HRU2F V1.0: 6/7 GHz

| Frequency Band<br>(GHz)                  | 6    |          |        | 7    |          |      |
|------------------------------------------|------|----------|--------|------|----------|------|
| Rated Maximum RF Transmitter Power (dBm) |      |          |        |      |          |      |
| Bandwidth (MHz)                          | 7/14 | 28/40/56 | 80/112 | 7/14 | 28/40/56 | 112  |
| QPSK                                     | 32   | 32       | 32     | 32   | 32       | 32   |
| 16 QAM                                   | 32   | 32       | 32     | 32   | 32       | 32   |
| 32 QAM                                   | 32   | 32       | 32     | 32   | 32       | 32   |
| 64 QAM                                   | 31.5 | 31.5     | 31.5   | 31.5 | 31.5     | 31.5 |
| 128 QAM                                  | 31.5 | 31.5     | 31.5   | 31.5 | 31.5     | 31.5 |
| 256 QAM                                  | 30.5 | 30.5     | 30.5   | 30.5 | 30.5     | 30.5 |

| Frequency Band<br>(GHz)                                                          | 6       |      |      | 7    |      |      |
|----------------------------------------------------------------------------------|---------|------|------|------|------|------|
| 512 QAM                                                                          | 30.5    | 30.5 | 30.5 | 30.5 | 30.5 | 30.5 |
| 1024 QAM                                                                         | 30      | 30   | 30   | 30   | 30   | 30   |
| 1024 QAM light                                                                   | 30      | 30   | 30   | 30   | 30   | 30   |
| 2048 QAM                                                                         | 30      | 30   | 30   | 30   | 30   | 30   |
| 4096 QAM                                                                         | N/A     | 29.5 | N/A  | N/A  | 29.5 | N/A  |
| Guaranteed                                                                       | ±2.0 dB |      |      |      |      |      |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |      |      |      |      |      |
| QPSK ~ 4096 QAM                                                                  | 11.5    |      |      |      |      |      |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |      |      |      |      |      |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |      |      |      |      |      |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |      |      |      |      |      |
| Muted RF Transmitter Power: < -50 dBm                                            |         |      |      |      |      |      |

**Note:** 6 GHz HRU2F V1.0 supports 80MHz bandwidth.

Table 6-32 Transmit power & ATPC range - HRU2F V1.0: 8/11 GHz

| Frequency Band (GHz)                     | 8    |          |      | 11   |          |        |
|------------------------------------------|------|----------|------|------|----------|--------|
| Rated Maximum RF Transmitter Power (dBm) |      |          |      |      |          |        |
| Bandwidth (MHz)                          | 7/14 | 28/40/56 | 112  | 7/14 | 28/40/56 | 80/112 |
| QPSK                                     | 32   | 32       | 32   | 30   | 30       | 30     |
| 16 QAM                                   | 32   | 32       | 32   | 29   | 29       | 29     |
| 32 QAM                                   | 32   | 32       | 32   | 29   | 29       | 29     |
| 64 QAM                                   | 31.5 | 31.5     | 31.5 | 28   | 28       | 28     |
| 128 QAM                                  | 31.5 | 31.5     | 31.5 | 28   | 28       | 28     |
| 256 QAM                                  | 30.5 | 30.5     | 30.5 | 26.5 | 26.5     | 26.5   |
| 512 QAM                                  | 30.5 | 30.5     | 30.5 | 26.5 | 26.5     | 26.5   |
| 1024 QAM                                 | 30   | 30       | 30   | 25.5 | 25.5     | 25.5   |
| 1024 QAM light                           | 30   | 30       | 30   | 25.5 | 25.5     | 25.5   |
| 2048 QAM                                 | 30   | 30       | 30   | 25.5 | 25.5     | 25.5   |
| 4096 QAM                                 | N/A  | 29.5     | N/A  | N/A  | 25       | N/A    |

| Frequency Band (GHz)                                                             | 8       | 11 |
|----------------------------------------------------------------------------------|---------|----|
| Guaranteed                                                                       | ±2.0 dB |    |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |    |
| QPSK ~ 4096 QAM                                                                  | 11.5    | 9  |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |    |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |    |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |    |
| Muted RF Transmitter Power: < -50 dBm                                            |         |    |

**Note:** 11 GHz HRU2F V1.0 supports 80MHz bandwidth.

Table 6-33 Transmit power & ATPC range - HRU2F V2.0: 6/7GHz

| Frequency Band<br>(GHz)                  | 6       |      |       |        | 7    |      |       |      |
|------------------------------------------|---------|------|-------|--------|------|------|-------|------|
| Rated Maximum RF Transmitter Power (dBm) |         |      |       |        |      |      |       |      |
| Bandwidth (MHz)                          | 7/14    | 28   | 40/56 | 80/112 | 7/14 | 28   | 40/56 | 112  |
| QPSK                                     | 34      | 34   | 34    | 34     | 34   | 34   | 34    | 34   |
| 16 QAM                                   | 34      | 34   | 34    | 34     | 34   | 34   | 34    | 34   |
| 32 QAM                                   | 34      | 34   | 33    | 33     | 34   | 34   | 33    | 33   |
| 64 QAM                                   | 33      | 33   | 33    | 33     | 33   | 33   | 33    | 33   |
| 128 QAM                                  | 33      | 33   | 33    | 33     | 33   | 33   | 33    | 33   |
| 256 QAM                                  | 32.5    | 32.5 | 32.5  | 32.5   | 32.5 | 32.5 | 32.5  | 32.5 |
| 512 QAM                                  | 32.5    | 32.5 | 32.5  | 32.5   | 32.5 | 32.5 | 32.5  | 32.5 |
| 1024 QAM                                 | 32      | 32   | 32    | 32     | 32   | 32   | 32    | 32   |
| 1024 QAM light                           | 32      | 32   | 32    | 32     | 32   | 32   | 32    | 32   |
| 2048 QAM                                 | 32      | 32   | 32    | 32     | 32   | 32   | 32    | 32   |
| 4096 QAM                                 | N/A     | 31   | 31    | 30.5   | N/A  | 31   | 31    | 30.5 |
| 8192 QAM                                 | N/A     | 30.5 | 30.5  | N/A    | N/A  | 30.5 | 30.5  | N/A  |
| Guaranteed                               | ±2.0 dB |      |       |        |      |      |       |      |
| Rated Minimum RF Transmitter Power (dBm) |         |      |       |        |      |      |       |      |
| QPSK ~ 2048 QAM                          | -5      |      |       |        |      |      |       |      |
| 4096 QAM                                 | 10      |      |       |        |      |      |       |      |

| Frequency Band (GHz)                                                             | 6  | 7 |
|----------------------------------------------------------------------------------|----|---|
| 8192 QAM                                                                         | 15 |   |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |    |   |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |    |   |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |    |   |
| Muted RF Transmitter Power: < -50 dBm                                            |    |   |

**Note:** 6GHz HRU2F V2.0 supports 80MHz bandwidth.

Table 6-34 Transmit power & ATPC range - HRU2F V2.0: 8/11GHz

| Frequency Band<br>(GHz)                                                          | 8       |          |        | 11   |    |       |        |
|----------------------------------------------------------------------------------|---------|----------|--------|------|----|-------|--------|
| Rated Maximum RF Transmitter Power (dBm)                                         |         |          |        |      |    |       |        |
| Bandwidth (MHz)                                                                  | 7/14    | 28/40/56 | 80/112 | 7/14 | 28 | 40/56 | 80/112 |
| QPSK                                                                             | 34      | 34       | 34     | 31   | 31 | 31    | 31     |
| 16 QAM                                                                           | 32.5    | 32.5     | 32.5   | 30   | 30 | 29.5  | 29.5   |
| 32 QAM                                                                           | 32.5    | 32.5     | 32.5   | 30   | 30 | 29.5  | 29.5   |
| 64 QAM                                                                           | 32.5    | 32.5     | 32.5   | 29   | 29 | 29    | 29     |
| 128 QAM                                                                          | 32.5    | 32.5     | 32.5   | 29   | 29 | 29    | 29     |
| 256 QAM                                                                          | 32      | 32       | 32     | 29   | 29 | 29    | 29     |
| 512 QAM                                                                          | 32      | 32       | 32     | 29   | 29 | 29    | 29     |
| 1024 QAM                                                                         | 32      | 32       | 32     | 28   | 28 | 28    | 28     |
| 1024 QAM light                                                                   | 32      | 32       | 32     | 28   | 28 | 28    | 28     |
| 2048 QAM                                                                         | 32      | 32       | 32     | 28   | 28 | 28    | 27     |
| 4096 QAM                                                                         | N/A     | 31       | 31     | N/A  | 27 | 27    | 27     |
| 8192 QAM                                                                         | N/A     | 31       | N/A    | N/A  | 27 | 27    | N/A    |
| Guaranteed                                                                       | ±2.0 dB |          |        |      |    |       |        |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |          |        |      |    |       |        |
| QPSK ~ 2048 QAM                                                                  | -5      |          |        |      |    |       |        |
| 4096 QAM                                                                         | 10      |          |        |      |    |       |        |
| 8192 QAM                                                                         | 15      |          |        |      |    |       |        |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |          |        |      |    |       |        |

| Frequency Band (GHz)                        | 8 | 11 |
|---------------------------------------------|---|----|
| Minimum ATPC Adjustment Step Size: 1 dB     |   |    |
| Minimum Manual Adjustment Step Size: 0.1 dB |   |    |
| Muted RF Transmitter Power: < -50 dBm       |   |    |

Table 6-35 Transmit power &amp; ATPC range - HRU2: 13GHz

| Frequency Band (GHz)                                                             | 13      |          |     |
|----------------------------------------------------------------------------------|---------|----------|-----|
| Rated Maximum RF Transmitter Power (dBm)                                         |         |          |     |
| Bandwidth                                                                        | 7/14    | 28/40/56 | 112 |
| QPSK                                                                             | 29      | 29       | 29  |
| 16 QAM                                                                           | 28      | 28       | 28  |
| 32 QAM                                                                           | 28      | 28       | 28  |
| 64 QAM                                                                           | 27      | 27       | 27  |
| 128 QAM                                                                          | 27      | 27       | 27  |
| 256 QAM                                                                          | 26      | 26       | 26  |
| 512 QAM                                                                          | 26      | 26       | 26  |
| 1024 QAM                                                                         | 25      | 25       | 25  |
| 1024 QAM light                                                                   | 25      | 25       | 25  |
| 2048 QAM                                                                         | 25      | 25       | 25  |
| 4096 QAM                                                                         | N/A     | 24       | N/A |
| 8192 QAM                                                                         | N/A     | 22       | N/A |
| Guaranteed                                                                       | ±2.0 dB |          |     |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |          |     |
| QPSK ~ 8192 QAM                                                                  | 6       |          |     |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |          |     |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |          |     |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |          |     |
| Muted RF Transmitter Power: < -50 dBm                                            |         |          |     |

**Note:** 13GHz HRU2 bandwidth up to 112MHz.

Table 6-36 Transmit power &amp; ATPC range - HRU2: 15GHz

| Frequency Band (GHz)                                                             | 15      |          |     |      |
|----------------------------------------------------------------------------------|---------|----------|-----|------|
| Rated Maximum RF Transmitter Power (dBm)                                         |         |          |     |      |
| Bandwidth                                                                        | 7/14    | 28/40/56 | 112 | 224  |
| QPSK                                                                             | 29      | 29       | 29  | 26   |
| 16 QAM                                                                           | 28      | 28       | 28  | 24   |
| 32 QAM                                                                           | 28      | 28       | 28  | 24   |
| 64 QAM                                                                           | 27      | 27       | 27  | 23   |
| 128 QAM                                                                          | 27      | 27       | 27  | 23   |
| 256 QAM                                                                          | 26      | 26       | 26  | 22.5 |
| 512 QAM                                                                          | 26      | 26       | 26  | 22.5 |
| 1024 QAM                                                                         | 25      | 25       | 25  | 22   |
| 1024 QAM light                                                                   | 25      | 25       | 25  | N/A  |
| 2048 QAM                                                                         | 25      | 25       | 25  | N/A  |
| 4096 QAM                                                                         | N/A     | 24       | N/A | N/A  |
| 8192 QAM                                                                         | N/A     | 22       | N/A | N/A  |
| Guaranteed                                                                       | ±2.0 dB |          |     |      |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |          |     |      |
| QPSK ~ 8192 QAM                                                                  | 6       |          |     |      |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |          |     |      |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |          |     |      |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |          |     |      |
| Muted RF Transmitter Power: < -50 dBm                                            |         |          |     |      |

**Note:** 15GHz HRU2 bandwidth up to 224MHz (224MHz hardware ready).

Table 6-37 Transmit power &amp; ATPC range - HRU2: 18GHz

| Frequency Band (GHz)                     | 18   |          |     |     |
|------------------------------------------|------|----------|-----|-----|
| Rated Maximum RF Transmitter Power (dBm) |      |          |     |     |
| Bandwidth                                | 7/14 | 28/40/56 | 112 | 224 |
| QPSK                                     | 29   | 29       | 29  | 26  |
| 16 QAM                                   | 27   | 27       | 27  | 24  |
| 32 QAM                                   | 27   | 27       | 27  | 24  |

| Frequency Band (GHz)                                                             | 18      |      |      |      |
|----------------------------------------------------------------------------------|---------|------|------|------|
| 64 QAM                                                                           | 26      | 26   | 26   | 23   |
| 128 QAM                                                                          | 26      | 26   | 26   | 23   |
| 256 QAM                                                                          | 25.5    | 25.5 | 25.5 | 22.5 |
| 512 QAM                                                                          | 25.5    | 25.5 | 25.5 | 22.5 |
| 1024 QAM                                                                         | 25      | 25   | 25   | 22   |
| 1024 QAM light                                                                   | 25      | 25   | 25   | N/A  |
| 2048 QAM                                                                         | 25      | 25   | 25   | N/A  |
| 4096 QAM                                                                         | N/A     | 24   | N/A  | N/A  |
| 8192 QAM                                                                         | N/A     | 22   | N/A  | N/A  |
| Guaranteed                                                                       | ±2.0 dB |      |      |      |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |      |      |      |
| QPSK ~ 8192 QAM                                                                  | 6       |      |      |      |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |      |      |      |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |      |      |      |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |      |      |      |
| Muted RF Transmitter Power: < -50 dBm                                            |         |      |      |      |

**Note:** 18GHz HRU2 bandwidth up to 224MHz (224MHz hardware ready).

Table 6-38 Transmit power & ATPC range - HRU3D: 5 GHz

| Frequency Band (GHz)                     | 5    |      |       |        |
|------------------------------------------|------|------|-------|--------|
| Rated Maximum RF Transmitter Power (dBm) |      |      |       |        |
| Bandwidth (MHz)                          | 7/14 | 28   | 40/56 | 80/112 |
| QPSK                                     | 30   | 30   | 30    | 29     |
| 16 QAM                                   | 30   | 30   | 30    | 29     |
| 32 QAM                                   | 30   | 30   | 30    | 29     |
| 64 QAM                                   | 29.5 | 29.5 | 29.5  | 28.5   |
| 128 QAM                                  | 29.5 | 29.5 | 29.5  | 28.5   |
| 256 QAM                                  | 28.5 | 28.5 | 28.5  | 27.5   |
| 512 QAM                                  | 28.5 | 28.5 | 28.5  | 27.5   |
| 1024 QAM                                 | 28   | 28   | 28    | 27     |
| 1024 QAM light                           | 28   | 28   | 28    | 27     |

| Frequency Band (GHz)                                                             | 5       |      |      |      |
|----------------------------------------------------------------------------------|---------|------|------|------|
| 2048 QAM                                                                         | 28      | 28   | 28   | 27   |
| 4096 QAM                                                                         | N/A     | 27.5 | 27.5 | 26.5 |
| 8192 QAM                                                                         | N/A     | 27   | 27   | N/A  |
| Guaranteed                                                                       | ±2.0 dB |      |      |      |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |      |      |      |
| QPSK ~ 1024 QAM                                                                  | -5      |      |      |      |
| 2048 QAM                                                                         | 5       |      |      |      |
| 4096 QAM                                                                         | 10      |      |      |      |
| 8192 QAM                                                                         | 15      |      |      |      |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |      |      |      |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |      |      |      |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |      |      |      |
| Muted RF Transmitter Power: < -50 dBm                                            |         |      |      |      |

Table 6-39 Transmit power &amp; ATPC range - HRU3D: 6/7 GHz

| Frequency Band (GHz)                     | 6    |      |       |        | 7    |      |       |      |
|------------------------------------------|------|------|-------|--------|------|------|-------|------|
| Rated Maximum RF Transmitter Power (dBm) |      |      |       |        |      |      |       |      |
| Bandwidth (MHz)                          | 7/14 | 28   | 40/56 | 80/112 | 7/14 | 28   | 40/56 | 112  |
| QPSK                                     | 34   | 34   | 34    | 34     | 34   | 34   | 34    | 34   |
| 16 QAM                                   | 34   | 34   | 34    | 34     | 34   | 34   | 34    | 34   |
| 32 QAM                                   | 34   | 34   | 33    | 33     | 34   | 34   | 33    | 33   |
| 64 QAM                                   | 33   | 33   | 33    | 33     | 33   | 33   | 33    | 33   |
| 128 QAM                                  | 33   | 33   | 33    | 33     | 33   | 33   | 33    | 33   |
| 256 QAM                                  | 32.5 | 32.5 | 32.5  | 32.5   | 32.5 | 32.5 | 32.5  | 32.5 |
| 512 QAM                                  | 32.5 | 32.5 | 32.5  | 32.5   | 32.5 | 32.5 | 32.5  | 32.5 |
| 1024 QAM                                 | 32   | 32   | 32    | 32     | 32   | 32   | 32    | 32   |
| 1024 QAM light                           | 32   | 32   | 32    | 32     | 32   | 32   | 32    | 32   |
| 2048 QAM                                 | 32   | 32   | 32    | 32     | 32   | 32   | 32    | 32   |
| 4096 QAM                                 | N/A  | 31   | 31    | 30.5   | N/A  | 31   | 31    | 30.5 |
| 8192 QAM                                 | N/A  | 30.5 | 30.5  | N/A    | N/A  | 30.5 | 30.5  | N/A  |

| Frequency Band (GHz)                                                             | 6       | 7 |
|----------------------------------------------------------------------------------|---------|---|
| Guaranteed                                                                       | ±2.0 dB |   |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |   |
| QPSK ~ 2048 QAM                                                                  | -5      |   |
| 4096 QAM                                                                         | 10      |   |
| 8192 QAM                                                                         | 15      |   |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |   |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |   |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |   |
| Muted RF Transmitter Power: < -50 dBm                                            |         |   |

**Note:** 6 GHz HRU3D supports 80MHz bandwidth.

Table 6-40 Transmit power & ATPC range - HRU3D: 8GHz

| Frequency Band (GHz)                     | 8       |          |        |
|------------------------------------------|---------|----------|--------|
| Rated Maximum RF Transmitter Power (dBm) |         |          |        |
| Bandwidth (MHz)                          | 7/14    | 28/40/56 | 80/112 |
| QPSK                                     | 34      | 34       | 34     |
| 16 QAM                                   | 32.5    | 32.5     | 32.5   |
| 32 QAM                                   | 32.5    | 32.5     | 32.5   |
| 64 QAM                                   | 32.5    | 32.5     | 32.5   |
| 128 QAM                                  | 32.5    | 32.5     | 32.5   |
| 256 QAM                                  | 32      | 32       | 32     |
| 512 QAM                                  | 32      | 32       | 32     |
| 1024 QAM                                 | 32      | 32       | 32     |
| 1024 QAM light                           | 32      | 32       | 32     |
| 2048 QAM                                 | 32      | 32       | 32     |
| 4096 QAM                                 | N/A     | 31       | 31     |
| 8192 QAM                                 | N/A     | 31       | N/A    |
| Guaranteed                               | ±2.0 dB |          |        |
| Rated Minimum RF Transmitter Power (dBm) |         |          |        |

| Frequency Band (GHz)                                                             | 8  |
|----------------------------------------------------------------------------------|----|
| QPSK ~ 2048 QAM                                                                  | -5 |
| 4096 QAM                                                                         | 10 |
| 8192 QAM                                                                         | 15 |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |    |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |    |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |    |
| Muted RF Transmitter Power: < -50 dBm                                            |    |

Table 6-41 Transmit power &amp; ATPC range - HRU3D V1.0/V2.0: 11 GHz

| Frequency Band (GHz)                                                             | 11      |    |       |        |
|----------------------------------------------------------------------------------|---------|----|-------|--------|
| Rated Maximum RF Transmitter Power (dBm)                                         |         |    |       |        |
| Bandwidth (MHz)                                                                  | 7/14    | 28 | 40/56 | 80/112 |
| QPSK                                                                             | 31      | 31 | 31    | 31     |
| 16 QAM                                                                           | 30      | 30 | 29.5  | 29.5   |
| 32 QAM                                                                           | 30      | 30 | 29.5  | 29.5   |
| 64 QAM                                                                           | 29      | 29 | 29    | 29     |
| 128 QAM                                                                          | 29      | 29 | 29    | 29     |
| 256 QAM                                                                          | 29      | 29 | 29    | 29     |
| 512 QAM                                                                          | 29      | 29 | 29    | 29     |
| 1024 QAM                                                                         | 28      | 28 | 28    | 28     |
| 1024 QAM light                                                                   | 28      | 28 | 28    | 28     |
| 2048 QAM                                                                         | 28      | 28 | 28    | 27     |
| 4096 QAM                                                                         | N/A     | 27 | 27    | 27     |
| 8192 QAM                                                                         | N/A     | 27 | 27    | N/A    |
| Guaranteed                                                                       | ±2.0 dB |    |       |        |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |    |       |        |
| QPSK ~ 2048 QAM                                                                  | -5      |    |       |        |
| 4096 QAM                                                                         | 10      |    |       |        |
| 8192 QAM                                                                         | 15      |    |       |        |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |    |       |        |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |    |       |        |

|                                             |           |
|---------------------------------------------|-----------|
| <b>Frequency Band (GHz)</b>                 | <b>11</b> |
| Minimum Manual Adjustment Step Size: 0.1 dB |           |
| Muted RF Transmitter Power: < -50 dBm       |           |

Table 6-42 Transmit power &amp; ATPC range - HRU3D V2.1: 11 GHz

| Frequency Band (GHz)                                                             | 11      |          |        |
|----------------------------------------------------------------------------------|---------|----------|--------|
| Rated Maximum RF Transmitter Power (dBm)                                         |         |          |        |
| Bandwidth (MHz)                                                                  | 7/14    | 28/40/56 | 80/112 |
| QPSK                                                                             | 34      | 34       | 33.5   |
| 16 QAM                                                                           | 32.5    | 32.5     | 32.5   |
| 32 QAM                                                                           | 32.5    | 32.5     | 32.5   |
| 64 QAM                                                                           | 32      | 32       | 32     |
| 128 QAM                                                                          | 32      | 32       | 32     |
| 256 QAM                                                                          | 32      | 32       | 32     |
| 512 QAM                                                                          | 31.5    | 31.5     | 31.5   |
| 1024 QAM                                                                         | 31.5    | 31.5     | 31.5   |
| 1024 QAM light                                                                   | 31.5    | 31.5     | 31.5   |
| 2048 QAM                                                                         | 31.5    | 31.5     | 31.5   |
| 4096 QAM                                                                         | N/A     | 30.5     | 30     |
| 8192 QAM                                                                         | N/A     | 30       | N/A    |
| Guaranteed                                                                       | ±2.0 dB |          |        |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |          |        |
| QPSK ~ 2048 QAM                                                                  | -5      |          |        |
| 4096 QAM                                                                         | 10      |          |        |
| 8192 QAM                                                                         | 15      |          |        |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |          |        |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |          |        |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |          |        |
| Muted RF Transmitter Power: < -50 dBm                                            |         |          |        |

Table 6-43 Transmit power &amp; ATPC range - HRU3D: 26 GHz

|                             |           |
|-----------------------------|-----------|
| <b>Frequency Band (GHz)</b> | <b>26</b> |
|-----------------------------|-----------|

| Frequency Band (GHz)                                                             | 26      |      |       |      |
|----------------------------------------------------------------------------------|---------|------|-------|------|
| Rated Maximum RF Transmitter Power (dBm)                                         |         |      |       |      |
| Bandwidth (MHz)                                                                  | 7/14    | 28   | 40/56 | 112  |
| QPSK                                                                             | 26      | 26   | 26    | 26   |
| 16 QAM                                                                           | 24      | 24   | 24    | 24   |
| 32 QAM                                                                           | 24      | 24   | 24    | 24   |
| 64 QAM                                                                           | 23      | 23   | 23    | 23   |
| 128 QAM                                                                          | 22.5    | 22.5 | 22.5  | 22.5 |
| 256 QAM                                                                          | 22.5    | 22.5 | 22.5  | 22.5 |
| 512 QAM                                                                          | 22      | 22   | 22    | 22   |
| 1024 QAM                                                                         | 21      | 21   | 21    | 21   |
| 1024 QAM light                                                                   | 21      | 21   | 21    | 21   |
| 2048 QAM                                                                         | 21      | 21   | 21    | 21   |
| 4096 QAM                                                                         | N/A     | 20   | 20    | N/A  |
| Guaranteed                                                                       | ±2.0 dB |      |       |      |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |      |       |      |
| QPSK ~ 32 QAM                                                                    | -5      | -5   | -5    | -5   |
| 64 QAM                                                                           | -5      | -5   | -5    | 0    |
| 128 QAM                                                                          | -5      | -5   | 0     | 0    |
| 256 QAM                                                                          | -5      | 0    | 0     | 5    |
| 512 QAM                                                                          | -5      | 0    | 5     | 5    |
| 1024~ 2048 QAM                                                                   | 5       | 5    | 10    | 10   |
| 4096 QAM                                                                         | N/A     | 10   | 10    | N/A  |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |      |       |      |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |      |       |      |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |      |       |      |
| Muted RF Transmitter Power: < -50 dBm                                            |         |      |       |      |

Table 6-44 Transmit power &amp; ATPC range - HRU3D: 32 GHz

|                                          |      |          |     |
|------------------------------------------|------|----------|-----|
| Frequency Band (GHz)                     | 32   |          |     |
| Rated Maximum RF Transmitter Power (dBm) |      |          |     |
| Bandwidth (MHz)                          | 7/14 | 28/40/56 | 112 |

| Frequency Band (GHz)                                                             | 32      |    |     |
|----------------------------------------------------------------------------------|---------|----|-----|
| QPSK                                                                             | 24      | 24 | 24  |
| 16 QAM                                                                           | 23      | 23 | 23  |
| 32 QAM                                                                           | 23      | 23 | 23  |
| 64 QAM                                                                           | 22      | 22 | 22  |
| 128 QAM                                                                          | 21      | 21 | 21  |
| 256 QAM                                                                          | 21      | 21 | 21  |
| 512 QAM                                                                          | 21      | 21 | 21  |
| 1024 QAM                                                                         | 20      | 20 | 20  |
| 1024 QAM light                                                                   | 20      | 20 | 20  |
| 2048 QAM                                                                         | 20      | 20 | 20  |
| 4096 QAM                                                                         | N/A     | 19 | N/A |
| Guaranteed                                                                       | ±2.0 dB |    |     |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |    |     |
| QPSK~ 2048 QAM                                                                   | -5      | -5 | -5  |
| 4096 QAM                                                                         | N/A     | 10 | N/A |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |    |     |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |    |     |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |    |     |
| Muted RF Transmitter Power: < -50 dBm                                            |         |    |     |

Table 6-45 Transmit power &amp; ATPC range - HRU3D: 38 GHz

| Frequency Band (GHz)                     | 38   |      |      |      |      |      |
|------------------------------------------|------|------|------|------|------|------|
| Rated Maximum RF Transmitter Power (dBm) |      |      |      |      |      |      |
| Bandwidth (MHz)                          | 7    | 14   | 28   | 40   | 56   | 112  |
| QPSK                                     | 23.5 | 23.5 | 23.5 | 23.5 | 23.5 | 23.5 |
| 16 QAM                                   | 22   | 22   | 22   | 22   | 22   | 22   |
| 32 QAM                                   | 22   | 22   | 22   | 22   | 22   | 22   |
| 64 QAM                                   | 21.5 | 21.5 | 21.5 | 21.5 | 21.5 | 21.5 |
| 128 QAM                                  | 21.5 | 21.5 | 21.5 | 21.5 | 21.5 | 21.5 |
| 256 QAM                                  | 21.5 | 21.5 | 21.5 | 21.5 | 21.5 | 21.5 |
| 512 QAM                                  | 21.5 | 21.5 | 21.5 | 21.5 | 21.5 | 21.5 |

| Frequency Band (GHz)                                                             | 38      |      |      |      |      |      |
|----------------------------------------------------------------------------------|---------|------|------|------|------|------|
| 1024 QAM                                                                         | 20.5    | 20.5 | 20.5 | 20.5 | 20.5 | 20.5 |
| 1024 QAM light                                                                   | 20.5    | 20.5 | 20.5 | 20.5 | 20.5 | 20.5 |
| 2048 QAM                                                                         | 20.5    | 20.5 | 20.5 | 20.5 | 20.5 | 20.5 |
| 4096 QAM                                                                         | N/A     | N/A  | 18   | 18   | 18   | N/A  |
| Guaranteed                                                                       | ±2.0 dB |      |      |      |      |      |
| Rated Minimum RF Transmitter Power (dBm)                                         |         |      |      |      |      |      |
| QPSK ~ 64 QAM                                                                    | -5      | -5   | -5   | -5   | -5   | -5   |
| 128 QAM                                                                          | -5      | -5   | -5   | -5   | -5   | -4   |
| 256 QAM                                                                          | -5      | -5   | -5   | -5   | -4   | -1   |
| 512 QAM                                                                          | -5      | -5   | -4   | -3   | -1   | 2    |
| 1024 QAM                                                                         | -5      | -2   | -2   | 0    | 2    | 5    |
| 1024 QAM light                                                                   | -5      | -2   | -2   | 0    | 2    | 5    |
| 2048 QAM                                                                         | -3      | 0    | 2    | 3    | 5    | 8    |
| 4096 QAM                                                                         | N/A     | N/A  | 3    | 5    | 7    | N/A  |
| ATPC Range: From the minimum transmitter power to the maximum transmitter power. |         |      |      |      |      |      |
| Minimum ATPC Adjustment Step Size: 1 dB                                          |         |      |      |      |      |      |
| Minimum Manual Adjustment Step Size: 0.1 dB                                      |         |      |      |      |      |      |
| Muted RF Transmitter Power: < -50 dBm                                            |         |      |      |      |      |      |

#### 6.3.1.4 Radio Frequency (RF) Spectrum Mask and Spurious Emission

NR9150 complies with ETSI EN 302 217-2 standard for RF spectrum mask and spurious emission.

### 6.3.2 Receiver Characteristics

#### 6.3.2.1 Receiver Signal Level Threshold

The receiver signal level (RSL) threshold or receiver sensitive is not only associated with frequency, modulation scheme and channel spacing, but also related to hardware.

Table 6-46 RSL threshold @ BER=10-6: SRU2 @G01/G02 mode

| Frequency | Modulation Scheme <sup>[note]</sup> | Bandwidth(MHz) <sup>[note]</sup> |       |       |       |       |       |       |
|-----------|-------------------------------------|----------------------------------|-------|-------|-------|-------|-------|-------|
|           |                                     | 7                                | 14    | 28    | 40    | 56    | 80    | 112   |
| 6 GHz     | QPSK                                | -95                              | -92.5 | -89.5 | -88   | -86.5 | -85   | -83   |
|           | 16 QAM                              | -88.5                            | -85.5 | -83   | -81.5 | -80   | -78.5 | -76.5 |
|           | 32 QAM                              | -85.5                            | -82.5 | -79.5 | -78   | -76.5 | -75   | -73.5 |
|           | 64 QAM                              | -82.5                            | -79.5 | -76.5 | -75   | -73.5 | -72   | -70   |
|           | 128 QAM                             | -79.5                            | -76.5 | -73   | -72   | -70   | -68.5 | -66.5 |
|           | 256 QAM                             | -76.5                            | -73.5 | -70   | -69   | -67   | -65.5 | -63.5 |
|           | 512 QAM                             | -73.5                            | -70.5 | -67   | -66   | -64   | -62   | -60   |
|           | 1024 QAM                            | -71                              | -67.5 | -64   | -63   | -61   | -59.5 | -57.5 |
|           | 1024 QAM Light                      | -70                              | -66.5 | -63   | -62   | -60   | -58.5 | -56.5 |
|           | 2048 QAM                            | -67.5                            | -64   | -61   | -60   | -58   | -56   | -54   |
|           | 4096 QAM                            | N/A                              | N/A   | -58   | -57   | -54.5 | N/A   | N/A   |
| 7/8 GHz   | QPSK                                | -95                              | -92.5 | -89.5 | -88   | -86.5 | N/A   | -83   |
|           | 16 QAM                              | -88.5                            | -85.5 | -83   | -81.5 | -80   | N/A   | -76.5 |
|           | 32 QAM                              | -85.5                            | -82.5 | -79.5 | -78   | -76.5 | N/A   | -73.5 |
|           | 64 QAM                              | -82.5                            | -79.5 | -76.5 | -75   | -73.5 | N/A   | -70   |
|           | 128 QAM                             | -79.5                            | -76.5 | -73   | -72   | -70   | N/A   | -66.5 |
|           | 256 QAM                             | -76.5                            | -73.5 | -70   | -69   | -67   | N/A   | -63.5 |
|           | 512 QAM                             | -73.5                            | -70.5 | -67   | -66   | -64   | N/A   | -60   |
|           | 1024 QAM                            | -71                              | -67.5 | -64   | -63   | -61   | N/A   | -57.5 |
|           | 1024 QAM Light                      | -70                              | -66.5 | -63   | -62   | -60   | N/A   | -56.5 |
|           | 2048 QAM                            | -67.5                            | -64   | -61   | -60   | -58   | N/A   | -54   |
|           | 4096 QAM                            | N/A                              | N/A   | -58   | -57   | -54.5 | N/A   | N/A   |
| 10 GHz    | QPSK                                | -94.5                            | -92   | -89   | -87.5 | -86   | N/A   | -82.5 |
|           | 16 QAM                              | -88                              | -85   | -82.5 | -81   | -79.5 | N/A   | -76   |
|           | 32 QAM                              | -85                              | -82   | -79   | -77.5 | -76   | N/A   | -73   |
|           | 64 QAM                              | -82                              | -79   | -76   | -74.5 | -73   | N/A   | -69.5 |
|           | 128 QAM                             | -79                              | -76   | -72.5 | -71.5 | -69.5 | N/A   | -66   |
|           | 256 QAM                             | -76                              | -73   | -69.5 | -68.5 | -66.5 | N/A   | -63   |

| Frequency | Modulation Scheme <sup>[note]</sup> | Bandwidth(MHz) <sup>[note]</sup> |       |       |       |       |       |       |
|-----------|-------------------------------------|----------------------------------|-------|-------|-------|-------|-------|-------|
|           |                                     | 7                                | 14    | 28    | 40    | 56    | 80    | 112   |
|           | 512 QAM                             | -73                              | -70   | -66.5 | -65.5 | -63.5 | N/A   | -59.5 |
|           | 1024 QAM                            | -70.5                            | -67   | -63.5 | -62.5 | -60.5 | N/A   | -57   |
|           | 1024 QAM Light                      | -69.5                            | -66   | -62.5 | -61.5 | -59.5 | N/A   | -56   |
|           | 2048 QAM                            | -67                              | -63.5 | -60.5 | -59.5 | -57.5 | N/A   | -53.5 |
|           | 4096 QAM                            | N/A                              | N/A   | -57.5 | -56.5 | -54   | N/A   | N/A   |
| 11 GHz    | QPSK                                | -94.5                            | -92   | -89   | -87.5 | -86   | -84.5 | -82.5 |
|           | 16 QAM                              | -88                              | -85   | -82.5 | -81   | -79.5 | -78   | -76   |
|           | 32 QAM                              | -85                              | -82   | -79   | -77.5 | -76   | -74.5 | -73   |
|           | 64 QAM                              | -82                              | -79   | -76   | -74.5 | -73   | -71.5 | -69.5 |
|           | 128 QAM                             | -79                              | -76   | -72.5 | -71.5 | -69.5 | -68   | -66   |
|           | 256 QAM                             | -76                              | -73   | -69.5 | -68.5 | -66.5 | -65   | -63   |
|           | 512 QAM                             | -73                              | -70   | -66.5 | -65.5 | -63.5 | -61.5 | -59.5 |
|           | 1024 QAM                            | -70.5                            | -67   | -63.5 | -62.5 | -60.5 | -59   | -57   |
|           | 1024 QAM Light                      | -69.5                            | -66   | -62.5 | -61.5 | -59.5 | -58   | -56   |
|           | 2048 QAM                            | -67                              | -63.5 | -60.5 | -59.5 | -57.5 | -55.5 | -53.5 |
|           | 4096 QAM                            | N/A                              | N/A   | -57.5 | -56.5 | -54   | N/A   | N/A   |
| 13/15 GHz | QPSK                                | -94.5                            | -92   | -89   | -87.5 | -86   | N/A   | -83   |
|           | 16 QAM                              | -88                              | -85   | -82.5 | -81   | -79.5 | N/A   | -76.5 |
|           | 32 QAM                              | -85                              | -82   | -79   | -77.5 | -76   | N/A   | -73.5 |
|           | 64 QAM                              | -82                              | -79   | -76   | -74.5 | -73   | N/A   | -70   |
|           | 128 QAM                             | -79                              | -76   | -72.5 | -71.5 | -69.5 | N/A   | -66   |
|           | 256 QAM                             | -76                              | -73   | -69.5 | -68.5 | -66.5 | N/A   | -63   |
|           | 512 QAM                             | -73                              | -70   | -66.5 | -65.5 | -63.5 | N/A   | -60   |
|           | 1024 QAM                            | -70.5                            | -67   | -63.5 | -62.5 | -60.5 | N/A   | -57.5 |
|           | 1024 QAM Light                      | -69.5                            | -66   | -62.5 | -61.5 | -59.5 | N/A   | -56.5 |
|           | 2048 QAM                            | -67                              | -63.5 | -60.5 | -59.5 | -57.5 | N/A   | -54   |
|           | 4096 QAM                            | N/A                              | N/A   | -57.5 | -56.5 | -54   | N/A   | -51   |
|           | 8192 QAM                            | N/A                              | N/A   | -54   | -53   | -51   | N/A   | N/A   |

| Frequency | Modulation Scheme <sup>[note]</sup> | Bandwidth(MHz) <sup>[note]</sup> |       |       |       |       |     |       |
|-----------|-------------------------------------|----------------------------------|-------|-------|-------|-------|-----|-------|
|           |                                     | 7                                | 14    | 28    | 40    | 56    | 80  | 112   |
| 18/23 GHz | QPSK                                | -94                              | -91.5 | -88.5 | -87   | -85.5 | N/A | -82.5 |
|           | 16 QAM                              | -87.5                            | -84.5 | -82   | -80.5 | -79   | N/A | -76   |
|           | 32 QAM                              | -84.5                            | -81.5 | -78.5 | -77   | -75.5 | N/A | -73   |
|           | 64 QAM                              | -81.5                            | -78.5 | -75.5 | -74   | -72.5 | N/A | -69.5 |
|           | 128 QAM                             | -78.5                            | -75.5 | -72   | -71   | -69   | N/A | -65.5 |
|           | 256 QAM                             | -75.5                            | -72.5 | -69   | -68   | -66   | N/A | -62.5 |
|           | 512 QAM                             | -72.5                            | -69.5 | -66   | -65   | -63   | N/A | -59.5 |
|           | 1024 QAM                            | -70                              | -66.5 | -63   | -62   | -60   | N/A | -57   |
|           | 1024 QAM Light                      | -69                              | -65.5 | -62   | -61   | -59   | N/A | -56   |
|           | 2048 QAM                            | -66.5                            | -63   | -60   | -59   | -57   | N/A | -53.5 |
|           | 4096 QAM                            | N/A                              | N/A   | -57   | -56   | -53.5 | N/A | -50.5 |
|           | 8192 QAM                            | N/A                              | N/A   | -53.5 | -52.5 | -50.5 | N/A | N/A   |
| 26 GHz    | QPSK                                | -93                              | -90.5 | -87.5 | -86   | -84.5 | N/A | -81.5 |
|           | 16 QAM                              | -86.5                            | -83.5 | -81   | -79.5 | -78   | N/A | -75   |
|           | 32 QAM                              | -83.5                            | -80.5 | -77.5 | -76   | -74.5 | N/A | -72   |
|           | 64 QAM                              | -80.5                            | -77.5 | -74.5 | -73   | -71.5 | N/A | -68.5 |
|           | 128 QAM                             | -77.5                            | -74.5 | -71   | -70   | -68   | N/A | -64.5 |
|           | 256 QAM                             | -74.5                            | -71.5 | -68   | -67   | -65   | N/A | -61.5 |
|           | 512 QAM                             | -71.5                            | -68.5 | -65   | -64   | -62   | N/A | -58.5 |
|           | 1024 QAM                            | -69                              | -65.5 | -62   | -61   | -59   | N/A | -56   |
|           | 1024 QAM Light                      | -68                              | -64.5 | -61   | -60   | -58   | N/A | N/A   |
|           | 2048 QAM                            | -65.5                            | -62   | -59   | -58   | -56   | N/A | N/A   |
|           | 4096 QAM                            | N/A                              | N/A   | -56   | -55   | -52.5 | N/A | N/A   |
|           |                                     |                                  |       |       |       |       |     |       |
| 28/32 GHz | QPSK                                | -92.5                            | -90   | -87   | -85.5 | -84   | N/A | -81   |
|           | 16 QAM                              | -86                              | -83   | -80.5 | -79   | -77.5 | N/A | -74.5 |
|           | 32 QAM                              | -83                              | -80   | -77   | -75.5 | -74   | N/A | -71.5 |
|           | 64 QAM                              | -80                              | -77   | -74   | -72.5 | -71   | N/A | -68   |
|           | 128 QAM                             | -77                              | -74   | -70.5 | -69.5 | -67.5 | N/A | -64   |
|           | 256 QAM                             | -74                              | -71   | -67.5 | -66.5 | -64.5 | N/A | -61   |

| Frequency | Modulation Scheme <sup>[note]</sup> | Bandwidth(MHz) <sup>[note]</sup> |       |       |       |       |     |       |
|-----------|-------------------------------------|----------------------------------|-------|-------|-------|-------|-----|-------|
|           |                                     | 7                                | 14    | 28    | 40    | 56    | 80  | 112   |
|           | 512 QAM                             | -71                              | -68   | -64.5 | -63.5 | -61.5 | N/A | -58   |
|           | 1024 QAM                            | -68.5                            | -65   | -61.5 | -60.5 | -58.5 | N/A | -55.5 |
|           | 1024 QAM Light                      | -67.5                            | -64   | -60.5 | -59.5 | -57.5 | N/A | N/A   |
|           | 2048 QAM                            | -65                              | -61.5 | -58.5 | -57.5 | -55.5 | N/A | N/A   |
|           | 4096 QAM                            | N/A                              | N/A   | -55.5 | -54.5 | -52   | N/A | N/A   |
| 38 GHz    | QPSK                                | -92                              | -89.5 | -86.5 | -85   | -83.5 | N/A | -80.5 |
|           | 16 QAM                              | -85.5                            | -82.5 | -80   | -78.5 | -77   | N/A | -74   |
|           | 32 QAM                              | -82.5                            | -79.5 | -76.5 | -75   | -73.5 | N/A | -71   |
|           | 64 QAM                              | -79.5                            | -76.5 | -73.5 | -72   | -70.5 | N/A | -67.5 |
|           | 128 QAM                             | -76.5                            | -73.5 | -70   | -69   | -67   | N/A | -63.5 |
|           | 256 QAM                             | -73.5                            | -70.5 | -67   | -66   | -64   | N/A | -60.5 |
|           | 512 QAM                             | -70.5                            | -67.5 | -64   | -63   | -61   | N/A | -57.5 |
|           | 1024 QAM                            | -68                              | -64.5 | -61   | -60   | -58   | N/A | -55   |
|           | 1024 QAM Light                      | -67                              | -63.5 | -60   | -59   | -57   | N/A | -54   |
|           | 2048 QAM                            | -64.5                            | -61   | -58   | -57   | -55   | N/A | -51.5 |
|           | 4096 QAM                            | N/A                              | N/A   | -55   | -54   | -51.5 | N/A | -48.5 |
|           | 8192QAM                             | N/A                              | N/A   | -51.5 | -50.5 | -48.5 | N/A | N/A   |
| 42 GHz    | QPSK                                | -92                              | -89.5 | -86.5 | -85   | -83.5 | N/A | -80.5 |
|           | 16 QAM                              | -85.5                            | -82.5 | -80   | -78.5 | -77   | N/A | -74   |
|           | 32 QAM                              | -82.5                            | -79.5 | -76.5 | -75   | -73.5 | N/A | -71   |
|           | 64 QAM                              | -79.5                            | -76.5 | -73.5 | -72   | -70.5 | N/A | -67.5 |
|           | 128 QAM                             | -76.5                            | -73.5 | -70   | -69   | -67   | N/A | -63.5 |
|           | 256 QAM                             | -73.5                            | -70.5 | -67   | -66   | -64   | N/A | -60.5 |
|           | 512 QAM                             | -70.5                            | -67.5 | -64   | -63   | -61   | N/A | -57.5 |
|           | 1024 QAM                            | -68                              | -64.5 | -61   | -60   | -58   | N/A | -55   |
|           | 1024 QAM Light                      | -67                              | -63.5 | -60   | -59   | -57   | N/A | N/A   |
|           | 2048 QAM                            | -64.5                            | -61   | -58   | -57   | -55   | N/A | N/A   |
|           | 4096 QAM                            | N/A                              | N/A   | -55   | -54   | -51.5 | N/A | N/A   |

| Frequency                      | Modulation Scheme <sup>[note]</sup> | Bandwidth(MHz) <sup>[note]</sup>                                      |    |    |    |    |    |     |
|--------------------------------|-------------------------------------|-----------------------------------------------------------------------|----|----|----|----|----|-----|
|                                |                                     | 7                                                                     | 14 | 28 | 40 | 56 | 80 | 112 |
| Guaranteed RSL threshold (dBm) |                                     | +2 dB from the typical value.                                         |    |    |    |    |    |     |
| Maximum RSL (dBm)              |                                     | QPSK ~ 256 QAM: -20 @ BER <10-6;                                      |    |    |    |    |    |     |
|                                |                                     | 512 QAM ~ 2048 QAM: -22 @ BER <10-6 (13/15/18/23 GHz);                |    |    |    |    |    |     |
|                                |                                     | 512 QAM ~ 2048 QAM: -23 @ BER <10-6 (6/7/8/10/11/26/28/32/38/42 GHz); |    |    |    |    |    |     |
|                                |                                     | 4096 QAM ~ 8192 QAM: -25 @ BER <10-6;                                 |    |    |    |    |    |     |

**Note:**

1. The 80MHz bandwidth is supported by 6/11GHz SRU2.
2. SRU2 V1.0 (6~23 GHz) @G01/G02 mode: up to 2048 QAM @7/14 MHz, up to 4096 QAM @28/40/56 MHz, up to 2048 QAM @80/112 MHz.
3. SRU2 V1.0 (26~38 GHz) @G01/G02 mode: up to 2048 QAM @7/14 MHz, up to 4096 QAM @28/40/56 MHz, up to 1024 QAM @112 MHz.
4. SRU2 V1.1 (13/15/18/23 GHz) @G01/G02 mode: up to 2048 QAM @7/14 MHz, up to 8192 QAM @28/40/56 MHz, up to 4096 QAM @112 MHz.
5. SRU2 V2.0 (38GHz) @G01/G02 mode: up to 2048 QAM @7/14 MHz, up to 8192 QAM @28/40/56 MHz, up to 4096 QAM @112 MHz.
6. SRU2 V2.0 (26/28/32/42 GHz) @G01/G02 mode: up to 2048 QAM @7/14 MHz, up to 4096 QAM @28/40/56 MHz, up to 1024 QAM @112 MHz

Table 6-47 RSL threshold @ BER=10-6: SRU2S @G01/G02 mode

| Frequency | Modulation Scheme <sup>[note]</sup> | Bandwidth(MHz) <sup>[note]</sup> |     |       |       |       |       |
|-----------|-------------------------------------|----------------------------------|-----|-------|-------|-------|-------|
|           |                                     | 7                                | 14  | 28    | 40    | 56    | 112   |
| 13/15 GHz | QPSK                                | -93.5                            | -91 | -88   | -86.5 | -85   | -82   |
|           | 16 QAM                              | -87                              | -84 | -81.5 | -80   | -78.5 | -75.5 |
|           | 32 QAM                              | -84                              | -81 | -78   | -76.5 | -75   | -72.5 |
|           | 64 QAM                              | -81                              | -78 | -75   | -73.5 | -72   | -69   |
|           | 128 QAM                             | -78                              | -75 | -71.5 | -70.5 | -68.5 | -65   |
|           | 256 QAM                             | -75                              | -72 | -68.5 | -67.5 | -65.5 | -62   |

| Frequency                      | Modulation Scheme <sup>[note]</sup> | Bandwidth(MHz) <sup>[note]</sup>      |       |       |       |       |       |
|--------------------------------|-------------------------------------|---------------------------------------|-------|-------|-------|-------|-------|
|                                |                                     | 7                                     | 14    | 28    | 40    | 56    | 112   |
|                                | 512 QAM                             | -72                                   | -69   | -65.5 | -64.5 | -62.5 | -59   |
|                                | 1024 QAM                            | -69.5                                 | -66   | -62.5 | -61.5 | -59.5 | -56.5 |
|                                | 1024 QAM Light                      | -68.5                                 | -65   | -61.5 | -60.5 | -58.5 | -55.5 |
|                                | 2048 QAM                            | -66                                   | -62.5 | -59.5 | -58.5 | -56.5 | -53   |
|                                | 4096 QAM                            | N/A                                   | N/A   | -56.5 | -55.5 | -53   | -50   |
|                                | 8192 QAM                            | N/A                                   | N/A   | -53   | -52   | -50   | N/A   |
| 18/23 GHz                      | QPSK                                | -93                                   | -90.5 | -87.5 | -86   | -84.5 | -81.5 |
|                                | 16 QAM                              | -86.5                                 | -83.5 | -81   | -79.5 | -78   | -75   |
|                                | 32 QAM                              | -83.5                                 | -80.5 | -77.5 | -76   | -74.5 | -72   |
|                                | 64 QAM                              | -80.5                                 | -77.5 | -74.5 | -73   | -71.5 | -68.5 |
|                                | 128 QAM                             | -77.5                                 | -74.5 | -71   | -70   | -68   | -64.5 |
|                                | 256 QAM                             | -74.5                                 | -71.5 | -68   | -67   | -65   | -61.5 |
|                                | 512 QAM                             | -71.5                                 | -68.5 | -65   | -64   | -62   | -58.5 |
|                                | 1024 QAM                            | -69                                   | -65.5 | -62   | -61   | -59   | -56   |
|                                | 1024 QAM Light                      | -68                                   | -64.5 | -61   | -60   | -58   | -55   |
|                                | 2048 QAM                            | -65.5                                 | -62   | -59   | -58   | -56   | -52.5 |
|                                | 4096 QAM                            | N/A                                   | N/A   | -56   | -55   | -52.5 | -49.5 |
|                                | 8192 QAM                            | N/A                                   | N/A   | -52.5 | -51.5 | -49.5 | N/A   |
| Guaranteed RSL threshold (dBm) |                                     | +2 dB from the typical value.         |       |       |       |       |       |
| Maximum RSL (dBm)              |                                     | QPSK ~ 256 QAM: -20 @ BER <10-6;      |       |       |       |       |       |
|                                |                                     | 512 QAM ~ 2048 QAM: -22 @ BER <10-6 ; |       |       |       |       |       |
|                                |                                     | 4096QAM: -25 @ BER <10-6;             |       |       |       |       |       |

**Note:**

1. SRU2S @G01/G02 mode: up to 2048 QAM @7/14 MHz, up to 8192 QAM @28/40/56 MHz, up to 4096 QAM @112 MHz.

Table 6-48 RSL threshold @ BER=10-6: SRU3D @G01/G02 mode

| Frequency | Modulation Scheme <sup>[note]</sup> | Bandwidth(MHz) <sup>[note]</sup> |       |       |       |       |       |       |     |
|-----------|-------------------------------------|----------------------------------|-------|-------|-------|-------|-------|-------|-----|
|           |                                     | 7                                | 14    | 28    | 40    | 56    | 80    | 112   | 224 |
| 6 GHz     | QPSK                                | -95                              | -92.5 | -89.5 | -88   | -86.5 | -85   | -83   | N/A |
|           | 16 QAM                              | -88.5                            | -85.5 | -83   | -81.5 | -80   | -78.5 | -76.5 | N/A |
|           | 32 QAM                              | -85.5                            | -82.5 | -79.5 | -78   | -76.5 | -75   | -73.5 | N/A |
|           | 64 QAM                              | -82.5                            | -79.5 | -76.5 | -75   | -73.5 | -72   | -70   | N/A |
|           | 128 QAM                             | -79.5                            | -76.5 | -73   | -72   | -70   | -68.5 | -66.5 | N/A |
|           | 256 QAM                             | -76.5                            | -73.5 | -70   | -69   | -67   | -65.5 | -63.5 | N/A |
|           | 512 QAM                             | -73.5                            | -70.5 | -67   | -66   | -64   | -62   | -60   | N/A |
|           | 1024 QAM                            | -71                              | -67.5 | -64   | -63   | -61   | -59.5 | -57.5 | N/A |
|           | 1024 QAM Light                      | -70                              | -66.5 | -63   | -62   | -60   | -58.5 | -56.5 | N/A |
|           | 2048 QAM                            | -67.5                            | -64   | -61   | -60   | -58   | -56   | -54   | N/A |
|           | 4096 QAM                            | N/A                              | N/A   | -58   | -57   | -54.5 | -53   | -51   | N/A |
|           | 8192 QAM                            | N/A                              | N/A   | -54.5 | -53.5 | -51.5 | N/A   | N/A   | N/A |
| 7 GHz     | QPSK                                | -95                              | -92.5 | -89.5 | -88   | -86.5 | N/A   | -83   | N/A |
|           | 16 QAM                              | -88.5                            | -85.5 | -83   | -81.5 | -80   | N/A   | -76.5 | N/A |
|           | 32 QAM                              | -85.5                            | -82.5 | -79.5 | -78   | -76.5 | N/A   | -73.5 | N/A |
|           | 64 QAM                              | -82.5                            | -79.5 | -76.5 | -75   | -73.5 | N/A   | -70   | N/A |
|           | 128 QAM                             | -79.5                            | -76.5 | -73   | -72   | -70   | N/A   | -66.5 | N/A |
|           | 256 QAM                             | -76.5                            | -73.5 | -70   | -69   | -67   | N/A   | -63.5 | N/A |
|           | 512 QAM                             | -73.5                            | -70.5 | -67   | -66   | -64   | N/A   | -60   | N/A |
|           | 1024 QAM                            | -71                              | -67.5 | -64   | -63   | -61   | N/A   | -57.5 | N/A |
|           | 1024 QAM Light                      | -70                              | -66.5 | -63   | -62   | -60   | N/A   | -56.5 | N/A |
|           | 2048 QAM                            | -67.5                            | -64   | -61   | -60   | -58   | N/A   | -54   | N/A |
|           | 4096 QAM                            | N/A                              | N/A   | -58   | -57   | -54.5 | N/A   | -51   | N/A |
|           | 8192 QAM                            | N/A                              | N/A   | -54.5 | -53.5 | -51.5 | N/A   | N/A   | N/A |
| 8 GHz     | QPSK                                | -95                              | -92.5 | -89.5 | -88   | -86.5 | -85   | -83   | N/A |
|           | 16 QAM                              | -88.5                            | -85.5 | -83   | -81.5 | -80   | -78.5 | -76.5 | N/A |
|           | 32 QAM                              | -85.5                            | -82.5 | -79.5 | -78   | -76.5 | -75   | -73.5 | N/A |
|           | 64 QAM                              | -82.5                            | -79.5 | -76.5 | -75   | -73.5 | -72   | -70   | N/A |

| Frequency | Modulation Scheme <sup>[note]</sup> | Bandwidth(MHz) <sup>[note]</sup> |       |       |       |       |       |       |     |
|-----------|-------------------------------------|----------------------------------|-------|-------|-------|-------|-------|-------|-----|
|           |                                     | 7                                | 14    | 28    | 40    | 56    | 80    | 112   | 224 |
|           | 128 QAM                             | -79.5                            | -76.5 | -73   | -72   | -70   | -68.5 | -66.5 | N/A |
|           | 256 QAM                             | -76.5                            | -73.5 | -70   | -69   | -67   | -65.5 | -63.5 | N/A |
|           | 512 QAM                             | -73.5                            | -70.5 | -67   | -66   | -64   | -62   | -60   | N/A |
|           | 1024 QAM                            | -71                              | -67.5 | -64   | -63   | -61   | -59.5 | -57.5 | N/A |
|           | 1024 QAM Light                      | -70                              | -66.5 | -63   | -62   | -60   | -58.5 | -56.5 | N/A |
|           | 2048 QAM                            | -67.5                            | -64   | -61   | -60   | -58   | -56   | -54   | N/A |
|           | 4096 QAM                            | N/A                              | N/A   | -58   | -57   | -54.5 | -53   | -51   | N/A |
|           | 8192 QAM                            | N/A                              | N/A   | -54.5 | -53.5 | -51.5 | N/A   | N/A   | N/A |
| 11 GHz    | QPSK                                | -94.5                            | -92   | -89   | -87.5 | -86   | -84.5 | -82.5 | N/A |
|           | 16 QAM                              | -88                              | -85   | -82.5 | -81   | -79.5 | -78   | -76   | N/A |
|           | 32 QAM                              | -85                              | -82   | -79   | -77.5 | -76   | -74.5 | -73   | N/A |
|           | 64 QAM                              | -82                              | -79   | -76   | -74.5 | -73   | -71.5 | -69.5 | N/A |
|           | 128 QAM                             | -79                              | -76   | -72.5 | -71.5 | -69.5 | -68   | -66   | N/A |
|           | 256 QAM                             | -76                              | -73   | -69.5 | -68.5 | -66.5 | -65   | -63   | N/A |
|           | 512 QAM                             | -73                              | -70   | -66.5 | -65.5 | -63.5 | -61.5 | -59.5 | N/A |
|           | 1024 QAM                            | -70.5                            | -67   | -63.5 | -62.5 | -60.5 | -59   | -57   | N/A |
|           | 1024 QAM Light                      | -69.5                            | -66   | -62.5 | -61.5 | -59.5 | -58   | -56   | N/A |
|           | 2048 QAM                            | -67                              | -63.5 | -60.5 | -59.5 | -57.5 | -55.5 | -53.5 | N/A |
|           | 4096 QAM                            | N/A                              | N/A   | -57.5 | -56.5 | -54   | -52.5 | -50.5 | N/A |
|           | 8192 QAM                            | N/A                              | N/A   | -54   | -53   | -51   | N/A   | N/A   | N/A |
| 13 GHz    | QPSK                                | -94.5                            | -92   | -89   | -87.5 | -86   | N/A   | -83   | N/A |
|           | 16 QAM                              | -88                              | -85   | -82.5 | -81   | -79.5 | N/A   | -76.5 | N/A |
|           | 32 QAM                              | -85                              | -82   | -79   | -77.5 | -76   | N/A   | -73.5 | N/A |
|           | 64 QAM                              | -82                              | -79   | -76   | -74.5 | -73   | N/A   | -70   | N/A |
|           | 128 QAM                             | -79                              | -76   | -72.5 | -71.5 | -69.5 | N/A   | -66   | N/A |
|           | 256 QAM                             | -76                              | -73   | -69.5 | -68.5 | -66.5 | N/A   | -63   | N/A |
|           | 512 QAM                             | -73                              | -70   | -66.5 | -65.5 | -63.5 | N/A   | -60   | N/A |
|           | 1024 QAM                            | -70.5                            | -67   | -63.5 | -62.5 | -60.5 | N/A   | -57.5 | N/A |
|           | 1024 QAM Light                      | -69.5                            | -66   | -62.5 | -61.5 | -59.5 | N/A   | -56.5 | N/A |
|           | 2048 QAM                            | -67                              | -63.5 | -60.5 | -59.5 | -57.5 | N/A   | -54.5 | N/A |

| Frequency | Modulation Scheme <sup>[note]</sup> | Bandwidth(MHz) <sup>[note]</sup> |       |       |       |       |     |       |       |
|-----------|-------------------------------------|----------------------------------|-------|-------|-------|-------|-----|-------|-------|
|           |                                     | 7                                | 14    | 28    | 40    | 56    | 80  | 112   | 224   |
|           | Light                               |                                  |       |       |       |       |     |       |       |
|           | 2048 QAM                            | -67                              | -63.5 | -60.5 | -59.5 | -57.5 | N/A | -54   | N/A   |
|           | 4096 QAM                            | N/A                              | N/A   | -57.5 | -56.5 | -54   | N/A | -51   | N/A   |
|           | 8192 QAM                            | N/A                              | N/A   | -54   | -53   | -51   | N/A | N/A   | N/A   |
|           | 16K QAM                             | N/A                              | N/A   | -50.5 | -49.5 | -47   | N/A | N/A   | N/A   |
| 15 GHz    | QPSK                                | -94.5                            | -92   | -89   | -87.5 | -86   | N/A | -83   | -79   |
|           | 16 QAM                              | -88                              | -85   | -82.5 | -81   | -79.5 | N/A | -76.5 | -72.5 |
|           | 32 QAM                              | -85                              | -82   | -79   | -77.5 | -76   | N/A | -73.5 | -69.5 |
|           | 64 QAM                              | -82                              | -79   | -76   | -74.5 | -73   | N/A | -70   | -66   |
|           | 128 QAM                             | -79                              | -76   | -72.5 | -71.5 | -69.5 | N/A | -66   | -62   |
|           | 256 QAM                             | -76                              | -73   | -69.5 | -68.5 | -66.5 | N/A | -63   | -59   |
|           | 512 QAM                             | -73                              | -70   | -66.5 | -65.5 | -63.5 | N/A | -60   | -56   |
|           | 1024 QAM                            | -70.5                            | -67   | -63.5 | -62.5 | -60.5 | N/A | -57.5 | -53.5 |
|           | 1024 QAM Light                      | -69.5                            | -66   | -62.5 | -61.5 | -59.5 | N/A | -56.5 | N/A   |
|           | 2048 QAM                            | -67                              | -63.5 | -60.5 | -59.5 | -57.5 | N/A | -54   | N/A   |
|           | 4096 QAM                            | N/A                              | N/A   | -57.5 | -56.5 | -54   | N/A | -51   | N/A   |
|           | 8192 QAM                            | N/A                              | N/A   | -54   | -53   | -51   | N/A | N/A   | N/A   |
|           | 16K QAM                             | N/A                              | N/A   | -50.5 | -49.5 | -47   | N/A | N/A   | N/A   |
|           |                                     |                                  |       |       |       |       |     |       |       |
| 18/23 GHz | QPSK                                | -94                              | -91.5 | -88.5 | -87   | -85.5 | N/A | -82.5 | -78.5 |
|           | 16 QAM                              | -87.5                            | -84.5 | -82   | -80.5 | -79   | N/A | -76   | -72   |
|           | 32 QAM                              | -84.5                            | -81.5 | -78.5 | -77   | -75.5 | N/A | -73   | -69   |
|           | 64 QAM                              | -81.5                            | -78.5 | -75.5 | -74   | -72.5 | N/A | -69.5 | -65.5 |
|           | 128 QAM                             | -78.5                            | -75.5 | -72   | -71   | -69   | N/A | -65.5 | -61.5 |
|           | 256 QAM                             | -75.5                            | -72.5 | -69   | -68   | -66   | N/A | -62.5 | -58.5 |
|           | 512 QAM                             | -72.5                            | -69.5 | -66   | -65   | -63   | N/A | -59.5 | -55.5 |
|           | 1024 QAM                            | -70                              | -66.5 | -63   | -62   | -60   | N/A | -57   | -53   |
|           | 1024 QAM Light                      | -69                              | -65.5 | -62   | -61   | -59   | N/A | -56   | N/A   |
|           | 2048 QAM                            | -66.5                            | -63   | -60   | -59   | -57   | N/A | -53.5 | N/A   |
|           | 4096 QAM                            | N/A                              | N/A   | -57   | -56   | -53.5 | N/A | -50.5 | N/A   |
|           |                                     |                                  |       |       |       |       |     |       |       |

| Frequency                      | Modulation Scheme <sup>[note]</sup> | Bandwidth(MHz) <sup>[note]</sup>     |     |       |       |       |     |     |     |
|--------------------------------|-------------------------------------|--------------------------------------|-----|-------|-------|-------|-----|-----|-----|
|                                |                                     | 7                                    | 14  | 28    | 40    | 56    | 80  | 112 | 224 |
|                                | 8192 QAM                            | N/A                                  | N/A | -53.5 | -52.5 | -50.5 | N/A | N/A | N/A |
|                                | 16K QAM                             | N/A                                  | N/A | -50   | -49   | -46.5 | N/A | N/A | N/A |
| Guaranteed RSL threshold (dBm) |                                     | +2 dB from the typical value.        |     |       |       |       |     |     |     |
| Maximum RSL (dBm)              |                                     | QPSK ~ 256 QAM: -20 @ BER <10-6;     |     |       |       |       |     |     |     |
|                                |                                     | 512 QAM ~ 2048 QAM: -22 @ BER <10-6; |     |       |       |       |     |     |     |
|                                |                                     | 4096 QAM~16K QAM: -25 @ BER <10-6;   |     |       |       |       |     |     |     |

**Note:**

1. The 80MHz bandwidth is supported by 6/8/11GHz.
2. The 224 MHz bandwidth is supported by 15/18/23GHz SRU3D with ME2 (G01/G02 mode).
3. 16K QAM modulation is supported by CSA2/CSA2 v2/CSA4/MD2/MD2 V2/MD4 with 13/15/18/23 GHz SRU3D V1.1.
4. SRU3D V1.0 (6~23 GHz) @G01/G02 mode: up to 2048 QAM @7/14 MHz, up to 8192 QAM @28/40/56 MHz, up to 4096 QAM @80/112 MHz.
5. SRU3D V1.1 (13 GHz) @G01/G02 mode: up to 2048 QAM @7/14 MHz, up to 16K QAM @28/40/56 MHz, up to 4096 QAM @112 MHz.
6. SRU3D V1.1 (15/18/23 GHz) @G01/G02 mode: up to 2048 QAM @7/14 MHz, up to 16K QAM @28/40/56 MHz, up to 4096 QAM @112 MHz, up to 1024 QAM @224 MHz.

Table 6-49 RSL threshold @ BER=10-6: HRU2F V1.0 @G01/G02 mode

| Frequency                   | Modulation Scheme <sup>[Note]</sup> | Bandwidth(MHz) |       |       |       |       |       |       |
|-----------------------------|-------------------------------------|----------------|-------|-------|-------|-------|-------|-------|
|                             |                                     | 7              | 14    | 28    | 40    | 56    | 80    | 112   |
| Typical RSL threshold (dBm) |                                     |                |       |       |       |       |       |       |
| 6 GHz                       | QPSK                                | -95            | -92.5 | -89   | -88   | -86   | -84.5 | -82.5 |
|                             | 16 QAM                              | -88.5          | -85.5 | -82.5 | -81.5 | -79.5 | -78   | -76   |
|                             | 32 QAM                              | -85.5          | -82.5 | -79   | -78   | -76   | -74.5 | -73   |
|                             | 64 QAM                              | -82.5          | -79.5 | -76   | -75   | -73   | -71.5 | -69.5 |
|                             | 128 QAM                             | -79            | -76   | -72.5 | -71.5 | -69.5 | -68   | -66   |
|                             | 256 QAM                             | -76            | -73   | -69.5 | -68.5 | -66.5 | -65   | -63   |

| Frequency                | Modulation Scheme <sup>[Note]</sup> | Bandwidth(MHz)                |       |       |       |       |       |       |
|--------------------------|-------------------------------------|-------------------------------|-------|-------|-------|-------|-------|-------|
|                          |                                     | 7                             | 14    | 28    | 40    | 56    | 80    | 112   |
|                          | 512 QAM                             | -73                           | -70   | -66.5 | -65.5 | -63.5 | -61.5 | -59.5 |
|                          | 1024 QAM                            | -70.5                         | -67   | -63.5 | -62.5 | -60.5 | -59   | -57   |
|                          | 1024 QAM Light                      | -69.5                         | -66   | -62.5 | -61.5 | -59.5 | -58   | -56   |
|                          | 2048 QAM                            | -67                           | -63.5 | -60.5 | -59.5 | -57.5 | -55.5 | -53.5 |
|                          | 4096 QAM                            | N/A                           | N/A   | -57.5 | -56.5 | -54   | N/A   | N/A   |
| 7/8 GHz                  | QPSK                                | -95                           | -92.5 | -89   | -88   | -86   | N/A   | -82.5 |
|                          | 16 QAM                              | -88.5                         | -85.5 | -82.5 | -81.5 | -79.5 | N/A   | -76   |
|                          | 32 QAM                              | -85.5                         | -82.5 | -79   | -78   | -76   | N/A   | -73   |
|                          | 64 QAM                              | -82.5                         | -79.5 | -76   | -75   | -73   | N/A   | -69.5 |
|                          | 128 QAM                             | -79                           | -76   | -72.5 | -71.5 | -69.5 | N/A   | -66   |
|                          | 256 QAM                             | -76                           | -73   | -69.5 | -68.5 | -66.5 | N/A   | -63   |
|                          | 512 QAM                             | -73                           | -70   | -66.5 | -65.5 | -63.5 | N/A   | -59.5 |
|                          | 1024 QAM                            | -70.5                         | -67   | -63.5 | -62.5 | -60.5 | N/A   | -57   |
|                          | 1024 QAM Light                      | -69.5                         | -66   | -62.5 | -61.5 | -59.5 | N/A   | -56   |
|                          | 2048 QAM                            | -67                           | -63.5 | -60.5 | -59.5 | -57.5 | N/A   | -53.5 |
|                          | 4096 QAM                            | N/A                           | N/A   | -57.5 | -56.5 | -54   | N/A   | N/A   |
| 11 GHz                   | QPSK                                | -94.5                         | -92   | -88.5 | -87.5 | -85.5 | -84   | -82   |
|                          | 16 QAM                              | -88                           | -85   | -82   | -81   | -79   | -77.5 | -75.5 |
|                          | 32 QAM                              | -85                           | -82   | -78.5 | -77.5 | -75.5 | -74   | -72.5 |
|                          | 64 QAM                              | -82                           | -79   | -75.5 | -74.5 | -72.5 | -71   | -69   |
|                          | 128 QAM                             | -78.5                         | -75.5 | -72   | -71   | -69   | -67.5 | -65.5 |
|                          | 256 QAM                             | -75.5                         | -72.5 | -69   | -68   | -66   | -64.5 | -62.5 |
|                          | 512 QAM                             | -72.5                         | -69.5 | -66   | -65   | -63   | -61   | -59   |
|                          | 1024 QAM                            | -70                           | -66.5 | -63   | -62   | -60   | -58.5 | -56.5 |
|                          | 1024 QAM Light                      | -69                           | -65.5 | -62   | -61   | -59   | -57.5 | -55.5 |
|                          | 2048 QAM                            | -66.5                         | -63   | -60   | -59   | -57   | -55   | -53   |
|                          | 4096 QAM                            | N/A                           | N/A   | -57   | -56   | -53.5 | N/A   | N/A   |
| Guaranteed RSL threshold |                                     | +2 dB from the typical value. |       |       |       |       |       |       |

| Frequency         | Modulation Scheme <sup>[Note]</sup> | Bandwidth(MHz)                                                                       |    |    |    |    |    |     |
|-------------------|-------------------------------------|--------------------------------------------------------------------------------------|----|----|----|----|----|-----|
|                   |                                     | 7                                                                                    | 14 | 28 | 40 | 56 | 80 | 112 |
| (dBm)             |                                     |                                                                                      |    |    |    |    |    |     |
| Maximum RSL (dBm) |                                     | QPSK ~ 256 QAM: -20; 512 QAM ~ 2048 QAM: -23; 4096QAM: -25 @ BER <10 <sup>-6</sup> . |    |    |    |    |    |     |

**Note:**

1. HRU2F V1.0 @G01/G02: up to 2048 QAM @ 7/14 MHz, up to 4096 QAM @ 28/40/56 MHz, up to 2048 QAM @ 80/112 MHz
2. 6/11GHz HRU2F V1.0 support 80MHz bandwidth.

Table 6-50 RSL threshold @ BER=10<sup>-6</sup>: HRU2F V2.0 @G01/G02 mode

| Frequency | Modulation Scheme <sup>[note]</sup> | Bandwidth(MHz) <sup>[note]</sup> |       |       |       |       |       |       |
|-----------|-------------------------------------|----------------------------------|-------|-------|-------|-------|-------|-------|
|           |                                     | 7                                | 14    | 28    | 40    | 56    | 80    | 112   |
| 6 GHz     | QPSK                                | -95                              | -92.5 | -89.5 | -88   | -86.5 | -85   | -83   |
|           | 16 QAM                              | -88.5                            | -85.5 | -83   | -81.5 | -80   | -78.5 | -76.5 |
|           | 32 QAM                              | -85.5                            | -82.5 | -79.5 | -78   | -76.5 | -75   | -73.5 |
|           | 64 QAM                              | -82.5                            | -79.5 | -76.5 | -75   | -73.5 | -72   | -70   |
|           | 128 QAM                             | -79.5                            | -76.5 | -73   | -72   | -70   | -68.5 | -66.5 |
|           | 256 QAM                             | -76.5                            | -73.5 | -70   | -69   | -67   | -65.5 | -63.5 |
|           | 512 QAM                             | -73.5                            | -70.5 | -67   | -66   | -64   | -62   | -60   |
|           | 1024 QAM                            | -71                              | -67.5 | -64   | -63   | -61   | -59.5 | -57.5 |
|           | 1024 QAM Light                      | -70                              | -66.5 | -63   | -62   | -60   | -58.5 | -56.5 |
|           | 2048 QAM                            | -67.5                            | -64   | -61   | -60   | -58   | -56   | -54   |
|           | 4096 QAM                            | N/A                              | N/A   | -58   | -57   | -54.5 | -53   | -51   |
|           | 8192 QAM                            | N/A                              | N/A   | -54.5 | -53.5 | -51.5 | N/A   | N/A   |
| 7 GHz     | QPSK                                | -95                              | -92.5 | -89.5 | -88   | -86.5 | N/A   | -83   |
|           | 16 QAM                              | -88.5                            | -85.5 | -83   | -81.5 | -80   | N/A   | -76.5 |
|           | 32 QAM                              | -85.5                            | -82.5 | -79.5 | -78   | -76.5 | N/A   | -73.5 |
|           | 64 QAM                              | -82.5                            | -79.5 | -76.5 | -75   | -73.5 | N/A   | -70   |
|           | 128 QAM                             | -79.5                            | -76.5 | -73   | -72   | -70   | N/A   | -66.5 |
|           | 256 QAM                             | -76.5                            | -73.5 | -70   | -69   | -67   | N/A   | -63.5 |

| Frequency | Modulation Scheme <sup>[note]</sup> | Bandwidth(MHz) <sup>[note]</sup> |       |       |       |       |       |       |
|-----------|-------------------------------------|----------------------------------|-------|-------|-------|-------|-------|-------|
|           |                                     | 7                                | 14    | 28    | 40    | 56    | 80    | 112   |
|           | 512 QAM                             | -73.5                            | -70.5 | -67   | -66   | -64   | N/A   | -60   |
|           | 1024 QAM                            | -71                              | -67.5 | -64   | -63   | -61   | N/A   | -57.5 |
|           | 1024 QAM Light                      | -70                              | -66.5 | -63   | -62   | -60   | N/A   | -56.5 |
|           | 2048 QAM                            | -67.5                            | -64   | -61   | -60   | -58   | N/A   | -54   |
|           | 4096 QAM                            | N/A                              | N/A   | -58   | -57   | -54.5 | N/A   | -51   |
|           | 8192 QAM                            | N/A                              | N/A   | -54.5 | -53.5 | -51.5 | N/A   | N/A   |
| 8 GHz     | QPSK                                | -95                              | -92.5 | -89.5 | -88   | -86.5 | -85   | -83   |
|           | 16 QAM                              | -88.5                            | -85.5 | -83   | -81.5 | -80   | -78.5 | -76.5 |
|           | 32 QAM                              | -85.5                            | -82.5 | -79.5 | -78   | -76.5 | -75   | -73.5 |
|           | 64 QAM                              | -82.5                            | -79.5 | -76.5 | -75   | -73.5 | -72   | -70   |
|           | 128 QAM                             | -79.5                            | -76.5 | -73   | -72   | -70   | -68.5 | -66.5 |
|           | 256 QAM                             | -76.5                            | -73.5 | -70   | -69   | -67   | -65.5 | -63.5 |
|           | 512 QAM                             | -73.5                            | -70.5 | -67   | -66   | -64   | -62   | -60   |
|           | 1024 QAM                            | -71                              | -67.5 | -64   | -63   | -61   | -59.5 | -57.5 |
|           | 1024 QAM Light                      | -70                              | -66.5 | -63   | -62   | -60   | -58.5 | -56.5 |
|           | 2048 QAM                            | -67.5                            | -64   | -61   | -60   | -58   | -56   | -54   |
|           | 4096 QAM                            | N/A                              | N/A   | -58   | -57   | -54.5 | -53   | -51   |
|           | 8192 QAM                            | N/A                              | N/A   | -54.5 | -53.5 | -51.5 | N/A   | N/A   |
| 11 GHz    | QPSK                                | -94.5                            | -92   | -89   | -87.5 | -86   | -84.5 | -82.5 |
|           | 16 QAM                              | -88                              | -85   | -82.5 | -81   | -79.5 | -78   | -76   |
|           | 32 QAM                              | -85                              | -82   | -79   | -77.5 | -76   | -74.5 | -73   |
|           | 64 QAM                              | -82                              | -79   | -76   | -74.5 | -73   | -71.5 | -69.5 |
|           | 128 QAM                             | -79                              | -76   | -72.5 | -71.5 | -69.5 | -68   | -66   |
|           | 256 QAM                             | -76                              | -73   | -69.5 | -68.5 | -66.5 | -65   | -63   |
|           | 512 QAM                             | -73                              | -70   | -66.5 | -65.5 | -63.5 | -61.5 | -59.5 |
|           | 1024 QAM                            | -70.5                            | -67   | -63.5 | -62.5 | -60.5 | -59   | -57   |
|           | 1024 QAM Light                      | -69.5                            | -66   | -62.5 | -61.5 | -59.5 | -58   | -56   |
|           | 2048 QAM                            | -67                              | -63.5 | -60.5 | -59.5 | -57.5 | -55.5 | -53.5 |

| Frequency                      | Modulation Scheme <sup>[note]</sup> | Bandwidth(MHz) <sup>[note]</sup>                  |     |       |       |     |       |       |
|--------------------------------|-------------------------------------|---------------------------------------------------|-----|-------|-------|-----|-------|-------|
|                                |                                     | 7                                                 | 14  | 28    | 40    | 56  | 80    | 112   |
|                                | 4096 QAM                            | N/A                                               | N/A | -57.5 | -56.5 | -54 | -52.5 | -50.5 |
|                                | 8192 QAM                            | N/A                                               | N/A | -54   | -53   | -51 | N/A   | N/A   |
| Guaranteed RSL threshold (dBm) |                                     | +2 dB from the typical value.                     |     |       |       |     |       |       |
| Maximum RSL (dBm)              |                                     | QPSK ~ 256 QAM: -20 @ BER <10 <sup>-6</sup> ;     |     |       |       |     |       |       |
|                                |                                     | 512 QAM ~ 2048 QAM: -23 @ BER <10 <sup>-6</sup> ; |     |       |       |     |       |       |
|                                |                                     | 4096 QAM~8192 QAM: -25 @ BER <10 <sup>-6</sup> ;  |     |       |       |     |       |       |

**Note:**

- The 80MHz bandwidth is supported by 6/8/11GHz HRU2F V2.0.
- HRU2F V2.0 @G01/G02mode: up to 2048 QAM @7/14 MHz, up to 8192 QAM @28/40/56 MHz, up to 4096 QAM @80/112 MHz.

Table 6-51 RSL threshold @ BER=10<sup>-6</sup>: HRU2 @G01/G02 mode

| Frequency | Modulation Scheme | Bandwidth(MHz) |       |       |       |       |       |       |
|-----------|-------------------|----------------|-------|-------|-------|-------|-------|-------|
|           |                   | 7              | 14    | 28    | 40    | 56    | 112   | 224   |
| 13 GHz    | QPSK              | -94.5          | -92   | -89   | -87.5 | -86   | -83   | N/A   |
|           | 16 QAM            | -88            | -85   | -82.5 | -81   | -79.5 | -76.5 | N/A   |
|           | 32 QAM            | -85            | -82   | -79   | -77.5 | -76   | -73.5 | N/A   |
|           | 64 QAM            | -82            | -79   | -76   | -74.5 | -73   | -70   | N/A   |
|           | 128 QAM           | -79            | -76   | -72.5 | -71.5 | -69.5 | -66   | N/A   |
|           | 256 QAM           | -76            | -73   | -69.5 | -68.5 | -66.5 | -63   | N/A   |
|           | 512 QAM           | -73            | -70   | -66.5 | -65.5 | -63.5 | -60   | N/A   |
|           | 1024 QAM          | -70.5          | -67   | -63.5 | -62.5 | -60.5 | -57.5 | N/A   |
|           | 1024 QAM Light    | -69.5          | -66   | -62.5 | -61.5 | -59.5 | -56.5 | N/A   |
|           | 2048 QAM          | -67            | -63.5 | -60.5 | -59.5 | -57.5 | -54   | N/A   |
|           | 4096 QAM          | N/A            | N/A   | -57.5 | -56.5 | -54   | N/A   | N/A   |
|           | 8192 QAM          | N/A            | N/A   | -54   | -53   | -51   | N/A   | N/A   |
| 15 GHz    | QPSK              | -94.5          | -92   | -89   | -87.5 | -86   | -83   | -79   |
|           | 16 QAM            | -88            | -85   | -82.5 | -81   | -79.5 | -76.5 | -72.5 |

| Frequency                      | Modulation Scheme | Bandwidth(MHz)                       |       |       |       |       |       |       |
|--------------------------------|-------------------|--------------------------------------|-------|-------|-------|-------|-------|-------|
|                                |                   | 7                                    | 14    | 28    | 40    | 56    | 112   | 224   |
|                                | 32 QAM            | -85                                  | -82   | -79   | -77.5 | -76   | -73.5 | -69.5 |
|                                | 64 QAM            | -82                                  | -79   | -76   | -74.5 | -73   | -70   | -66   |
|                                | 128 QAM           | -79                                  | -76   | -72.5 | -71.5 | -69.5 | -66   | -62   |
|                                | 256 QAM           | -76                                  | -73   | -69.5 | -68.5 | -66.5 | -63   | -59   |
|                                | 512 QAM           | -73                                  | -70   | -66.5 | -65.5 | -63.5 | -60   | -56   |
|                                | 1024 QAM          | -70.5                                | -67   | -63.5 | -62.5 | -60.5 | -57.5 | -53.5 |
|                                | 1024 QAM Light    | -69.5                                | -66   | -62.5 | -61.5 | -59.5 | -56.5 | N/A   |
|                                | 2048 QAM          | -67                                  | -63.5 | -60.5 | -59.5 | -57.5 | -54   | N/A   |
|                                | 4096 QAM          | N/A                                  | N/A   | -57.5 | -56.5 | -54   | N/A   | N/A   |
|                                | 8192 QAM          | N/A                                  | N/A   | -54   | -53   | -51   | N/A   | N/A   |
| 18 GHz                         | QPSK              | -94                                  | -91.5 | -88.5 | -87   | -85.5 | -82.5 | -78.5 |
|                                | 16 QAM            | -87.5                                | -84.5 | -82   | -80.5 | -79   | -76   | -72   |
|                                | 32 QAM            | -84.5                                | -81.5 | -78.5 | -77   | -75.5 | -73   | -69   |
|                                | 64 QAM            | -81.5                                | -78.5 | -75.5 | -74   | -72.5 | -69.5 | -65.5 |
|                                | 128 QAM           | -78.5                                | -75.5 | -72   | -71   | -69   | -65.5 | -61.5 |
|                                | 256 QAM           | -75.5                                | -72.5 | -69   | -68   | -66   | -62.5 | -58.5 |
|                                | 512 QAM           | -72.5                                | -69.5 | -66   | -65   | -63   | -59.5 | -55.5 |
|                                | 1024 QAM          | -70                                  | -66.5 | -63   | -62   | -60   | -57   | -53   |
|                                | 1024 QAM Light    | -69                                  | -65.5 | -62   | -61   | -59   | -56   | N/A   |
|                                | 2048 QAM          | -66.5                                | -63   | -60   | -59   | -57   | -53.5 | N/A   |
|                                | 4096 QAM          | N/A                                  | N/A   | -57   | -56   | -53.5 | N/A   | N/A   |
|                                | 8192 QAM          | N/A                                  | N/A   | -53.5 | -52.5 | -50.5 | N/A   | N/A   |
| Guaranteed RSL threshold (dBm) |                   | +2 dB from the typical value.        |       |       |       |       |       |       |
| Maximum RSL (dBm)              |                   | QPSK ~ 256 QAM: -20 @ BER <10-6;     |       |       |       |       |       |       |
|                                |                   | 512 QAM ~ 2048 QAM: -22 @ BER <10-6; |       |       |       |       |       |       |
|                                |                   | 4096 QAM: -25 @ BER <10-6;           |       |       |       |       |       |       |

**Note:**

1. HRU2 13GHz: up to 112MHz bandwidth;

2. HRU2 15/18GHz: up to 224MHz bandwidth (224MHz bandwidth hardware ready).
3. HRU2 @G01/G02mode: up to 2048 QAM @7/14 MHz, up to 8192 QAM @28/40/56 MHz, up to 2048 QAM @112 MHz, up to 1024 QAM @224 MHz.

Table 6-52 RSL threshold @ BER=10<sup>-6</sup>: HRU3D @G01/G02 mode

| Frequency | Modulation Scheme | Bandwidth(MHz) |       |       |       |       |       |       |
|-----------|-------------------|----------------|-------|-------|-------|-------|-------|-------|
|           |                   | 7              | 14    | 28    | 40    | 56    | 80    | 112   |
| 5GHz      | QPSK              | -95            | -92.5 | -89.5 | -88   | -86.5 | -85   | -83   |
|           | 16 QAM            | -88.5          | -85.5 | -83   | -81.5 | -80   | -78.5 | -76.5 |
|           | 32 QAM            | -85.5          | -82.5 | -79.5 | -78   | -76.5 | -75   | -73.5 |
|           | 64 QAM            | -82.5          | -79.5 | -76.5 | -75   | -73.5 | -72   | -70   |
|           | 128 QAM           | -79.5          | -76.5 | -73   | -72   | -70   | -68.5 | -66.5 |
|           | 256 QAM           | -76.5          | -73.5 | -70   | -69   | -67   | -65.5 | -63.5 |
|           | 512 QAM           | -73.5          | -70.5 | -67   | -66   | -64   | -62   | -60   |
|           | 1024 QAM          | -71            | -67.5 | -64   | -63   | -61   | -59.5 | -57.5 |
|           | 1024 QAM Light    | -70            | -66.5 | -63   | -62   | -60   | -58.5 | -56.5 |
|           | 2048 QAM          | -67.5          | -64   | -61   | -60   | -58   | -56   | -54   |
|           | 4096 QAM          | N/A            | N/A   | -58   | -57   | -54.5 | -53   | -51   |
|           | 8192 QAM          | N/A            | N/A   | -54.5 | -53.5 | -51.5 | N/A   | N/A   |
| 6 GHz     | QPSK              | -95            | -92.5 | -89.5 | -88   | -86.5 | -85   | -83   |
|           | 16 QAM            | -88.5          | -85.5 | -83   | -81.5 | -80   | -78.5 | -76.5 |
|           | 32 QAM            | -85.5          | -82.5 | -79.5 | -78   | -76.5 | -75   | -73.5 |
|           | 64 QAM            | -82.5          | -79.5 | -76.5 | -75   | -73.5 | -72   | -70   |
|           | 128 QAM           | -79.5          | -76.5 | -73   | -72   | -70   | -68.5 | -66.5 |
|           | 256 QAM           | -76.5          | -73.5 | -70   | -69   | -67   | -65.5 | -63.5 |
|           | 512 QAM           | -73.5          | -70.5 | -67   | -66   | -64   | -62   | -60   |
|           | 1024 QAM          | -71            | -67.5 | -64   | -63   | -61   | -59.5 | -57.5 |
|           | 1024 QAM Light    | -70            | -66.5 | -63   | -62   | -60   | -58.5 | -56.5 |
|           | 2048 QAM          | -67.5          | -64   | -61   | -60   | -58   | -56   | -54   |
|           | 4096 QAM          | N/A            | N/A   | -58   | -57   | -54.5 | -53   | -51   |

| Frequency | Modulation Scheme | Bandwidth(MHz) |       |       |       |       |       |       |
|-----------|-------------------|----------------|-------|-------|-------|-------|-------|-------|
|           |                   | 7              | 14    | 28    | 40    | 56    | 80    | 112   |
|           | 8192 QAM          | N/A            | N/A   | -54.5 | -53.5 | -51.5 | N/A   | N/A   |
| 7 GHz     | QPSK              | -95            | -92.5 | -89.5 | -88   | -86.5 | N/A   | -83   |
|           | 16 QAM            | -88.5          | -85.5 | -83   | -81.5 | -80   | N/A   | -76.5 |
|           | 32 QAM            | -85.5          | -82.5 | -79.5 | -78   | -76.5 | N/A   | -73.5 |
|           | 64 QAM            | -82.5          | -79.5 | -76.5 | -75   | -73.5 | N/A   | -70   |
|           | 128 QAM           | -79.5          | -76.5 | -73   | -72   | -70   | N/A   | -66.5 |
|           | 256 QAM           | -76.5          | -73.5 | -70   | -69   | -67   | N/A   | -63.5 |
|           | 512 QAM           | -73.5          | -70.5 | -67   | -66   | -64   | N/A   | -60   |
|           | 1024 QAM          | -71            | -67.5 | -64   | -63   | -61   | N/A   | -57.5 |
|           | 1024 QAM Light    | -70            | -66.5 | -63   | -62   | -60   | N/A   | -56.5 |
|           | 2048 QAM          | -67.5          | -64   | -61   | -60   | -58   | N/A   | -54   |
|           | 4096 QAM          | N/A            | N/A   | -58   | -57   | -54.5 | N/A   | -51   |
|           | 8192 QAM          | N/A            | N/A   | -54.5 | -53.5 | -51.5 | N/A   | N/A   |
| 8 GHz     | QPSK              | -95            | -92.5 | -89.5 | -88   | -86.5 | -85   | -83   |
|           | 16 QAM            | -88.5          | -85.5 | -83   | -81.5 | -80   | -78.5 | -76.5 |
|           | 32 QAM            | -85.5          | -82.5 | -79.5 | -78   | -76.5 | -75   | -73.5 |
|           | 64 QAM            | -82.5          | -79.5 | -76.5 | -75   | -73.5 | -72   | -70   |
|           | 128 QAM           | -79.5          | -76.5 | -73   | -72   | -70   | -68.5 | -66.5 |
|           | 256 QAM           | -76.5          | -73.5 | -70   | -69   | -67   | -65.5 | -63.5 |
|           | 512 QAM           | -73.5          | -70.5 | -67   | -66   | -64   | -62   | -60   |
|           | 1024 QAM          | -71            | -67.5 | -64   | -63   | -61   | -59.5 | -57.5 |
|           | 1024 QAM Light    | -70            | -66.5 | -63   | -62   | -60   | -58.5 | -56.5 |
|           | 2048 QAM          | -67.5          | -64   | -61   | -60   | -58   | -56   | -54   |
|           | 4096 QAM          | N/A            | N/A   | -58   | -57   | -54.5 | -53   | -51   |
|           | 8192 QAM          | N/A            | N/A   | -54.5 | -53.5 | -51.5 | N/A   | N/A   |
| 11 GHz    | QPSK              | -94.5          | -92   | -89   | -87.5 | -86   | -84.5 | -82.5 |
|           | 16 QAM            | -88            | -85   | -82.5 | -81   | -79.5 | -78   | -76   |
|           | 32 QAM            | -85            | -82   | -79   | -77.5 | -76   | -74.5 | -73   |

| Frequency | Modulation Scheme | Bandwidth(MHz) |       |       |       |       |       |       |
|-----------|-------------------|----------------|-------|-------|-------|-------|-------|-------|
|           |                   | 7              | 14    | 28    | 40    | 56    | 80    | 112   |
|           | 64 QAM            | -82            | -79   | -76   | -74.5 | -73   | -71.5 | -69.5 |
|           | 128 QAM           | -79            | -76   | -72.5 | -71.5 | -69.5 | -68   | -66   |
|           | 256 QAM           | -76            | -73   | -69.5 | -68.5 | -66.5 | -65   | -63   |
|           | 512 QAM           | -73            | -70   | -66.5 | -65.5 | -63.5 | -61.5 | -59.5 |
|           | 1024 QAM          | -70.5          | -67   | -63.5 | -62.5 | -60.5 | -59   | -57   |
|           | 1024 QAM Light    | -69.5          | -66   | -62.5 | -61.5 | -59.5 | -58   | -56   |
|           | 2048 QAM          | -67            | -63.5 | -60.5 | -59.5 | -57.5 | -55.5 | -53.5 |
|           | 4096 QAM          | N/A            | N/A   | -57.5 | -56.5 | -54   | -52.5 | -50.5 |
|           | 8192 QAM          | N/A            | N/A   | -54   | -53   | -51   | N/A   | N/A   |
| 26 GHz    | QPSK              | -93            | -90.5 | -87.5 | -86   | -84.5 | N/A   | -81.5 |
|           | 16 QAM            | -86.5          | -83.5 | -81   | -79.5 | -78   | N/A   | -75   |
|           | 32 QAM            | -83.5          | -80.5 | -77.5 | -76   | -74.5 | N/A   | -72   |
|           | 64 QAM            | -80.5          | -77.5 | -74.5 | -73   | -71.5 | N/A   | -68.5 |
|           | 128 QAM           | -77.5          | -74.5 | -71   | -70   | -68   | N/A   | -64.5 |
|           | 256 QAM           | -74.5          | -71.5 | -68   | -67   | -65   | N/A   | -61.5 |
|           | 512 QAM           | -71.5          | -68.5 | -65   | -64   | -62   | N/A   | -58.5 |
|           | 1024 QAM          | -69            | -65.5 | -62   | -61   | -59   | N/A   | -56   |
|           | 1024 QAM Light    | -68            | -64.5 | -61   | -60   | -58   | N/A   | -55   |
|           | 2048 QAM          | -65.5          | -62   | -59   | -58   | -56   | N/A   | -52.5 |
|           | 4096 QAM          | N/A            | N/A   | -56   | -55   | -52.5 | N/A   | N/A   |
| 32 GHz    | QPSK              | -92.5          | -90   | -87   | -85.5 | -84   | N/A   | -81   |
|           | 16 QAM            | -86            | -83   | -80.5 | -79   | -77.5 | N/A   | -74.5 |
|           | 32 QAM            | -83            | -80   | -77   | -75.5 | -74   | N/A   | -71.5 |
|           | 64 QAM            | -80            | -77   | -74   | -72.5 | -71   | N/A   | -68   |
|           | 128 QAM           | -77            | -74   | -70.5 | -69.5 | -67.5 | N/A   | -64   |
|           | 256 QAM           | -74            | -71   | -67.5 | -66.5 | -64.5 | N/A   | -61   |
|           | 512 QAM           | -71            | -68   | -64.5 | -63.5 | -61.5 | N/A   | -58   |
|           | 1024 QAM          | -68.5          | -65   | -61.5 | -60.5 | -58.5 | N/A   | -55.5 |

| Frequency                      | Modulation Scheme | Bandwidth(MHz)                                    |       |       |       |       |     |       |
|--------------------------------|-------------------|---------------------------------------------------|-------|-------|-------|-------|-----|-------|
|                                |                   | 7                                                 | 14    | 28    | 40    | 56    | 80  | 112   |
|                                | 1024 QAM Light    | -67.5                                             | -64   | -60.5 | -59.5 | -57.5 | N/A | -54.5 |
|                                | 2048 QAM          | -65                                               | -61.5 | -58.5 | -57.5 | -55.5 | N/A | -52   |
|                                | 4096 QAM          | N/A                                               | N/A   | -55.5 | -54.5 | -52   | N/A | N/A   |
| 38 GHz                         | QPSK              | -92                                               | -89.5 | -86.5 | -85   | -83.5 | N/A | -80.5 |
|                                | 16 QAM            | -85.5                                             | -82.5 | -80   | -78.5 | -77   | N/A | -74   |
|                                | 32 QAM            | -82.5                                             | -79.5 | -76.5 | -75   | -73.5 | N/A | -71   |
|                                | 64 QAM            | -79.5                                             | -76.5 | -73.5 | -72   | -70.5 | N/A | -67.5 |
|                                | 128 QAM           | -76.5                                             | -73.5 | -70   | -69   | -67   | N/A | -63.5 |
|                                | 256 QAM           | -73.5                                             | -70.5 | -67   | -66   | -64   | N/A | -60.5 |
|                                | 512 QAM           | -70.5                                             | -67.5 | -64   | -63   | -61   | N/A | -57.5 |
|                                | 1024 QAM          | -68                                               | -64.5 | -61   | -60   | -58   | N/A | -55   |
|                                | 1024 QAM Light    | -67                                               | -63.5 | -60   | -59   | -57   | N/A | -54   |
|                                | 2048 QAM          | -64.5                                             | -61   | -58   | -57   | -55   | N/A | -51.5 |
|                                | 4096 QAM          | N/A                                               | N/A   | -55   | -54   | -51.5 | N/A | N/A   |
| Guaranteed RSL threshold (dBm) |                   | +2 dB from the typical value.                     |       |       |       |       |     |       |
| Maximum RSL (dBm)              |                   | QPSK ~ 256 QAM: -20 @ BER <10 <sup>-6</sup> ;     |       |       |       |       |     |       |
|                                |                   | 512 QAM ~ 2048 QAM: -23 @ BER <10 <sup>-6</sup> ; |       |       |       |       |     |       |
|                                |                   | 4096 QAM~8192 QAM: -25 @ BER <10 <sup>-6</sup> ;  |       |       |       |       |     |       |

**Note:**

1. HRU3D V2.0/V2.1 is applicable for 11GHz.
2. The 80MHz bandwidth is supported by 5/6/8/11GHz.
3. 5-11GHz HRU3D @G01/G02mode: up to 2048 QAM @7/14 MHz, up to 8192 QAM @28/40/56 MHz, up to 4096 QAM @80/112 MHz.
4. 26/32/38GHz HRU3D @G01/G02mode: up to 2048 QAM @7/14 MHz, up to 4096 QAM @28/40/56 MHz, up to 2048 QAM @112 MHz.

Table 6-53 RSL threshold @ BER=10-6: SRU2 @C01/C02/L01/L02 mode

| Frequency | Modulation Scheme | Bandwidth(MHz) |       |       |       |       |       |       |
|-----------|-------------------|----------------|-------|-------|-------|-------|-------|-------|
|           |                   | 7              | 14    | 28    | 40    | 56    | 80    | 112   |
| 6 GHz     | QPSK              | -94            | -91.5 | -88.5 | -87   | -85.5 | -84   | -82.5 |
|           | 16 QAM            | -88            | -85   | -82   | -80.5 | -79   | -77.5 | -76   |
|           | 32 QAM            | -85            | -82   | -78.5 | -77   | -75.5 | -74   | -73   |
|           | 64 QAM            | -82            | -79   | -75.5 | -74   | -72.5 | -71   | -69.5 |
|           | 128 QAM           | -79            | -76   | -72   | -70.5 | -69   | -67.5 | -66   |
|           | 256 QAM           | -75.5          | -72.5 | -68.5 | -67   | -65.5 | -64   | -63   |
|           | 512 QAM           | -72            | -69   | -65   | -63.5 | -62   | -60.5 | -59.5 |
|           | 1024 QAM          | -68.5          | -65.5 | -62.5 | -61   | -59.5 | -58   | -56.5 |
|           | 1024 QAM Light    | -67.5          | -64.5 | -61.5 | -60   | -58.5 | -57   | -55.5 |
|           | 2048 QAM          | -65.5          | -62.5 | -58.5 | -57   | -55.5 | -54   | -52.5 |
|           | 4096 QAM          | N/A            | N/A   | -56.5 | -55   | -53   | N/A   | N/A   |
| 7/8 GHz   | QPSK              | -94            | -91.5 | -88.5 | -87   | -85.5 | N/A   | -82.5 |
|           | 16 QAM            | -88            | -85   | -82   | -80.5 | -79   | N/A   | -76   |
|           | 32 QAM            | -85            | -82   | -78.5 | -77   | -75.5 | N/A   | -73   |
|           | 64 QAM            | -82            | -79   | -75.5 | -74   | -72.5 | N/A   | -69.5 |
|           | 128 QAM           | -79            | -76   | -72   | -70.5 | -69   | N/A   | -66   |
|           | 256 QAM           | -75.5          | -72.5 | -68.5 | -67   | -65.5 | N/A   | -63   |
|           | 512 QAM           | -72            | -69   | -65   | -63.5 | -62   | N/A   | -59.5 |
|           | 1024 QAM          | -68.5          | -65.5 | -62.5 | -61   | -59.5 | N/A   | -56.5 |
|           | 1024 QAM Light    | -67.5          | -64.5 | -61.5 | -60   | -58.5 | N/A   | -55.5 |
|           | 2048 QAM          | -65.5          | -62.5 | -58.5 | -57   | -55.5 | N/A   | -52.5 |
|           | 4096 QAM          | N/A            | N/A   | -56.5 | -55   | -53   | N/A   | N/A   |
| 10 GHz    | QPSK              | -93.5          | -91   | -88   | -86.5 | -85   | N/A   | -82   |
|           | 16 QAM            | -87.5          | -84.5 | -81.5 | -80   | -78.5 | N/A   | -75.5 |
|           | 32 QAM            | -84.5          | -81.5 | -78   | -76.5 | -75   | N/A   | -72.5 |
|           | 64 QAM            | -81.5          | -78.5 | -75   | -73.5 | -72   | N/A   | -69   |
|           | 128 QAM           | -78.5          | -75.5 | -71.5 | -70   | -68.5 | N/A   | -65.5 |
|           | 256 QAM           | -75            | -72   | -68   | -66.5 | -65   | N/A   | -62.5 |

| Frequency | Modulation Scheme | Bandwidth(MHz) |       |       |       |       |       |       |
|-----------|-------------------|----------------|-------|-------|-------|-------|-------|-------|
|           |                   | 7              | 14    | 28    | 40    | 56    | 80    | 112   |
|           | 512 QAM           | -71.5          | -68.5 | -64.5 | -63   | -61.5 | N/A   | -59   |
|           | 1024 QAM          | -68            | -65   | -62   | -60.5 | -59   | N/A   | -56   |
|           | 1024 QAM Light    | -67            | -64   | -61   | -59.5 | -58   | N/A   | -55   |
|           | 2048 QAM          | -65            | -62   | -58   | -56.5 | -55   | N/A   | -52   |
|           | 4096 QAM          | N/A            | N/A   | -56   | -54.5 | -52.5 | N/A   | N/A   |
| 11 GHz    | QPSK              | -93.5          | -91   | -88   | -86.5 | -85   | -80   | -82   |
|           | 16 QAM            | -87.5          | -84.5 | -81.5 | -80   | -78.5 | -73.5 | -75.5 |
|           | 32 QAM            | -84.5          | -81.5 | -78   | -76.5 | -75   | -70   | -72.5 |
|           | 64 QAM            | -81.5          | -78.5 | -75   | -73.5 | -72   | -66   | -69   |
|           | 128 QAM           | -78.5          | -75.5 | -71.5 | -70   | -68.5 | -63   | -65.5 |
|           | 256 QAM           | -75            | -72   | -68   | -66.5 | -65   | -60   | -62.5 |
|           | 512 QAM           | -71.5          | -68.5 | -64.5 | -63   | -61.5 | -56   | -59   |
|           | 1024 QAM          | -68            | -65   | -62   | -60.5 | -59   | -53.5 | -56   |
|           | 1024 QAM Light    | -67            | -64   | -61   | -59.5 | -58   | -52.5 | -55   |
|           | 2048 QAM          | -65            | -62   | -58   | -56.5 | -55   | -50   | -52   |
|           | 4096 QAM          | N/A            | N/A   | -56   | -54.5 | -52.5 | -47   | N/A   |
| 13/15 GHz | QPSK              | -93.5          | -91   | -88   | -86.5 | -85   | N/A   | -82.5 |
|           | 16 QAM            | -87.5          | -84.5 | -81.5 | -80   | -78.5 | N/A   | -76   |
|           | 32 QAM            | -84.5          | -81.5 | -78   | -76.5 | -75   | N/A   | -73   |
|           | 64 QAM            | -81.5          | -78.5 | -75   | -73.5 | -72   | N/A   | -69.5 |
|           | 128 QAM           | -78.5          | -75.5 | -71.5 | -70   | -68.5 | N/A   | -66   |
|           | 256 QAM           | -75            | -72   | -68   | -66.5 | -65   | N/A   | -62.5 |
|           | 512 QAM           | -71.5          | -68.5 | -64.5 | -63   | -61.5 | N/A   | -59   |
|           | 1024 QAM          | -68            | -65   | -62   | -60.5 | -59   | N/A   | -56.5 |
|           | 1024 QAM Light    | -67            | -64   | -61   | -59.5 | -58   | N/A   | -55.5 |
|           | 2048 QAM          | -65            | -62   | -58   | -56.5 | -55   | N/A   | -53   |
|           | 4096 QAM          | N/A            | N/A   | -56   | -54.5 | -52.5 | N/A   | -49.5 |
| 18/23 GHz | QPSK              | -93            | -90.5 | -87.5 | -86   | -84.5 | N/A   | -82   |

| Frequency | Modulation Scheme | Bandwidth(MHz) |       |       |       |       |     |       |
|-----------|-------------------|----------------|-------|-------|-------|-------|-----|-------|
|           |                   | 7              | 14    | 28    | 40    | 56    | 80  | 112   |
|           | 16 QAM            | -87            | -84   | -81   | -79.5 | -77.5 | N/A | -75.5 |
|           | 32 QAM            | -83.5          | -80.5 | -77   | -75.5 | -74   | N/A | -72   |
|           | 64 QAM            | -80.5          | -77.5 | -74   | -72.5 | -71   | N/A | -68.5 |
|           | 128 QAM           | -77.5          | -74.5 | -70.5 | -69   | -67.5 | N/A | -65   |
|           | 256 QAM           | -74            | -71   | -67   | -65.5 | -64   | N/A | -61.5 |
|           | 512 QAM           | -70.5          | -67.5 | -63.5 | -62   | -60.5 | N/A | -58   |
|           | 1024 QAM          | -67            | -64   | -61   | -59.5 | -58   | N/A | -55.5 |
|           | 1024 QAM Light    | -66            | -63   | -60   | -58.5 | -57   | N/A | -54.5 |
|           | 2048 QAM          | -64            | -61   | -57   | -55.5 | -54   | N/A | -52   |
|           | 4096 QAM          | N/A            | N/A   | -55   | -53.5 | -51.5 | N/A | -48.5 |
| 26 GHz    | QPSK              | -92            | -89.5 | -86.5 | -85   | -83.5 | N/A | -81   |
|           | 16 QAM            | -86            | -83   | -80   | -78.5 | -76.5 | N/A | -74.5 |
|           | 32 QAM            | -82.5          | -79.5 | -76   | -74.5 | -73   | N/A | -71   |
|           | 64 QAM            | -79.5          | -76.5 | -73   | -71.5 | -70   | N/A | -67.5 |
|           | 128 QAM           | -76.5          | -73.5 | -69.5 | -68   | -66.5 | N/A | -64   |
|           | 256 QAM           | -73            | -70   | -66   | -64.5 | -63   | N/A | -60.5 |
|           | 512 QAM           | -69.5          | -66.5 | -62.5 | -61   | -59.5 | N/A | -57   |
|           | 1024 QAM          | -66            | -63   | -60   | -58.5 | -57   | N/A | -54.5 |
|           | 1024 QAM Light    | -65            | -62   | -59   | -57.5 | -56   | N/A | N/A   |
|           | 2048 QAM          | -63            | -60   | -56   | -54.5 | -53   | N/A | N/A   |
|           | 4096 QAM          | N/A            | N/A   | -54   | -52.5 | -50.5 | N/A | N/A   |
| 28 GHz    | QPSK              | -91.5          | -89   | -86   | -84.5 | -83   | N/A | -80.5 |
|           | 16 QAM            | -85.5          | -82.5 | -79.5 | -78   | -76   | N/A | -74   |
|           | 32 QAM            | -82            | -79   | -75.5 | -74   | -72.5 | N/A | -70.5 |
|           | 64 QAM            | -79            | -76   | -72.5 | -71   | -69.5 | N/A | -67   |
|           | 128 QAM           | -76            | -73   | -69   | -67.5 | -66   | N/A | -63.5 |
|           | 256 QAM           | -72.5          | -69.5 | -65.5 | -64   | -62.5 | N/A | -60   |
|           | 512 QAM           | -69            | -66   | -62   | -60.5 | -59   | N/A | -56.5 |
|           | 1024 QAM          | -65.5          | -62.5 | -59.5 | -58   | -56.5 | N/A | -54   |

| Frequency | Modulation Scheme | Bandwidth(MHz) |       |       |       |       |     |       |
|-----------|-------------------|----------------|-------|-------|-------|-------|-----|-------|
|           |                   | 7              | 14    | 28    | 40    | 56    | 80  | 112   |
|           | 1024 QAM Light    | -64.5          | -61.5 | -58.5 | -57   | -55.5 | N/A | N/A   |
|           | 2048 QAM          | -62.5          | -59.5 | -55.5 | -54   | -52.5 | N/A | N/A   |
|           | 4096 QAM          | N/A            | N/A   | -53.5 | -52   | -50   | N/A | N/A   |
| 32 GHz    | QPSK              | -91.5          | -89   | -86   | -84.5 | -83   | N/A | -80.5 |
|           | 16 QAM            | -85.5          | -82.5 | -79.5 | -78   | -76   | N/A | -74   |
|           | 32 QAM            | -82            | -79   | -75.5 | -74   | -72.5 | N/A | -70.5 |
|           | 64 QAM            | -79            | -76   | -72.5 | -71   | -69.5 | N/A | -67   |
|           | 128 QAM           | -76            | -73   | -69   | -67.5 | -66   | N/A | -63.5 |
|           | 256 QAM           | -72.5          | -69.5 | -65.5 | -64   | -62.5 | N/A | -60   |
|           | 512 QAM           | -69            | -66   | -62   | -60.5 | -59   | N/A | -56.5 |
|           | 1024 QAM          | -65.5          | -62.5 | -59.5 | -58   | -56.5 | N/A | -54   |
|           | 1024 QAM Light    | -64.5          | -61.5 | -58.5 | -57   | -55.5 | N/A | N/A   |
|           | 2048 QAM          | -62.5          | -59.5 | -55.5 | -54   | -52.5 | N/A | N/A   |
|           | 4096 QAM          | N/A            | N/A   | -53.5 | -52   | -50   | N/A | N/A   |
| 38 GHz    | QPSK              | -91            | -88.5 | -85.5 | -84   | -82.5 | N/A | -80   |
|           | 16 QAM            | -85            | -82   | -79   | -77.5 | -75.5 | N/A | -73.5 |
|           | 32 QAM            | -81.5          | -78.5 | -75   | -73.5 | -72   | N/A | -70   |
|           | 64 QAM            | -78.5          | -75.5 | -72   | -70.5 | -69   | N/A | -66.5 |
|           | 128 QAM           | -75.5          | -72.5 | -68.5 | -67   | -65.5 | N/A | -63   |
|           | 256 QAM           | -72            | -69   | -65   | -63.5 | -62   | N/A | -59.5 |
|           | 512 QAM           | -68.5          | -65.5 | -61.5 | -60   | -58.5 | N/A | -56   |
|           | 1024 QAM          | -65            | -62   | -59   | -57.5 | -56   | N/A | -53.5 |
|           | 1024 QAM Light    | -64            | -61   | -58   | -56.5 | -55   | N/A | -52.5 |
|           | 2048 QAM          | -62            | -59   | -55   | -53.5 | -52   | N/A | -50   |
|           | 4096 QAM          | N/A            | N/A   | -53   | -51.5 | -49.5 | N/A | -46.5 |
| 42 GHz    | QPSK              | -91            | -88.5 | -85.5 | -84   | -82.5 | N/A | -80   |
|           | 16 QAM            | -85            | -82   | -79   | -77.5 | -75.5 | N/A | -73.5 |
|           | 32 QAM            | -81.5          | -78.5 | -75   | -73.5 | -72   | N/A | -70   |

| Frequency                      | Modulation Scheme | Bandwidth(MHz)                                                        |       |       |       |       |     |       |
|--------------------------------|-------------------|-----------------------------------------------------------------------|-------|-------|-------|-------|-----|-------|
|                                |                   | 7                                                                     | 14    | 28    | 40    | 56    | 80  | 112   |
|                                | 64 QAM            | -78.5                                                                 | -75.5 | -72   | -70.5 | -69   | N/A | -66.5 |
|                                | 128 QAM           | -75.5                                                                 | -72.5 | -68.5 | -67   | -65.5 | N/A | -63   |
|                                | 256 QAM           | -72                                                                   | -69   | -65   | -63.5 | -62   | N/A | -59.5 |
|                                | 512 QAM           | -68.5                                                                 | -65.5 | -61.5 | -60   | -58.5 | N/A | -56   |
|                                | 1024 QAM          | -65                                                                   | -62   | -59   | -57.5 | -56   | N/A | -53.5 |
|                                | 1024 QAM Light    | N/A                                                                   | N/A   | N/A   | N/A   | N/A   | N/A | N/A   |
|                                | 2048 QAM          | N/A                                                                   | N/A   | N/A   | N/A   | N/A   | N/A | N/A   |
|                                | 4096 QAM          | N/A                                                                   | N/A   | N/A   | N/A   | N/A   | N/A | N/A   |
| Guaranteed RSL threshold (dBm) |                   | +2 dB from the typical value.                                         |       |       |       |       |     |       |
| Maximum RSL (dBm)              |                   | QPSK ~ 256 QAM: -20 @ BER <10-6;                                      |       |       |       |       |     |       |
|                                |                   | 512 QAM ~ 2048 QAM: -22 @ BER <10-6 (13/15/18/23 GHz);                |       |       |       |       |     |       |
|                                |                   | 512 QAM ~ 2048 QAM: -23 @ BER <10-6 (6/7/8/10/11/26/28/32/38/42 GHz); |       |       |       |       |     |       |
|                                |                   | 4096 QAM ~ 8192 QAM: -25 @ BER <10-6;                                 |       |       |       |       |     |       |

**Note:**

1. The 80MHz bandwidth is supported by 6/11GHz SRU2.
2. 6-23GHz SRU2 support C01/C02/L01/L02 mode. 26-42GHz SRU2 support C02 mode.
3. SRU2 V1.0 (6~23 GHz) @C01/C02 mode: up to 2048 QAM @7/14 MHz, up to 4096 QAM @28/40/56 MHz, up to 2048 QAM @80/112 MHz.
4. SRU2 V1.1 (13/15/18/23 GHz) @C01/C02 mode: up to 2048 QAM @7/14 MHz, up to 4096 QAM @28/40/56/112 MHz.
5. SRU2 V2.0 (26/28/32GHz) @ C02 mode: up to 2048 QAM @7/14 MHz, up to 4096 QAM @28/40/56 MHz, up to 1024 QAM @112 MHz.
6. SRU2 V2.0 (38GHz) @ C02 mode: up to 2048 QAM @7/14 MHz, up to 4096 QAM @28/40/56/112 MHz.
7. SRU2 V2.0 (42 GHz) @ C02 mode: up to 1024 QAM @7/14/28/40/56/112 MHz.
8. L01/L02 mode: up to 2048 QAM.

## 9. ACCP configuration not applicable for C01/C02 mode

Table 6-54 RSL threshold @ BER=10<sup>-6</sup>: SRU2 @C02 mode (support ACCP)

| Frequency | Modulation Scheme | Bandwidth(MHz) |         |          |
|-----------|-------------------|----------------|---------|----------|
|           |                   | 28_ACCP        | 56_ACCP | 112_ACCP |
| 15 GHz    | QPSK              | -87            | -84.5   | -82      |
|           | 16 QAM            | -81.5          | -78     | -75.5    |
|           | 32 QAM            | -78            | -75     | -72.5    |
|           | 64 QAM            | -74.5          | -71.5   | -68.5    |
|           | 128 QAM           | -71.5          | -68.5   | -65.5    |
|           | 256 QAM           | -68            | -65     | -62      |
|           | 512 QAM           | -65.5          | -63     | -60      |
|           | 1024 QAM          | -62.5          | -60.5   | -57.5    |
|           | 1024 QAM Light    | -62            | -60     | -57      |
|           | 2048 QAM          | -59            | -56.5   | -53.5    |
|           | 4096 QAM          | -56.5          | -53     | -51      |
| 18/23 GHz | QPSK              | -86.5          | -84     | -81.5    |
|           | 16 QAM            | -81            | -77.5   | -75      |
|           | 32 QAM            | -77.5          | -74.5   | -72      |
|           | 64 QAM            | -74            | -71     | -68      |
|           | 128 QAM           | -71            | -68     | -65      |
|           | 256 QAM           | -67.5          | -64.5   | -61.5    |
|           | 512 QAM           | -65            | -62.5   | -59.5    |
|           | 1024 QAM          | -62            | -60     | -57      |
|           | 1024 QAM Light    | -61.5          | -59.5   | -56.5    |
|           | 2048 QAM          | -58.5          | -56     | -53      |
|           | 4096 QAM          | -56            | -52.5   | -50.5    |
| 38 GHz    | QPSK              | -84            | -81.5   | -79      |
|           | 16 QAM            | -78.5          | -75     | -72.5    |
|           | 32 QAM            | -75            | -72     | -69.5    |
|           | 64 QAM            | -71.5          | -68.5   | -65.5    |

| Frequency                      | Modulation Scheme | Bandwidth(MHz)                      |         |          |
|--------------------------------|-------------------|-------------------------------------|---------|----------|
|                                |                   | 28_ACCP                             | 56_ACCP | 112_ACCP |
|                                | 128 QAM           | -68.5                               | -65.5   | -62.5    |
|                                | 256 QAM           | -65                                 | -62     | -59      |
|                                | 512 QAM           | -62.5                               | -60     | -57      |
|                                | 1024 QAM          | -59.5                               | -57.5   | -54.5    |
|                                | 1024 QAM Light    | -59                                 | -57     | -54      |
|                                | 2048 QAM          | -56                                 | -53.5   | -50.5    |
|                                | 4096 QAM          | -53.5                               | -50     | -48      |
| Guaranteed RSL threshold (dBm) |                   | +2 dB from the typical value.       |         |          |
| Maximum RSL (dBm)              |                   | QPSK ~ 256 QAM: -20 @ BER <10-6;    |         |          |
|                                |                   | 512 QAM ~ 2048 QAM: -22 @ BER <10-6 |         |          |
|                                |                   | 4096 QAM: -25 @ BER <10-6;          |         |          |

**Note:**

1. Applicable to 1+0/ACAP/ACCP configuration of C02 mode.
2. The 15/18/23/38GHz band has already released the C02 mode that supports ACCP. Other bands will release the C02 mode that supports ACCP in the next version.

Table 6-55 RSL threshold @ BER=10-6: SRU2S @C01/C02/L01/L02 mode

| Frequency | Modulation Scheme <sup>[note]</sup> | Bandwidth(MHz) <sup>[note]</sup> |       |       |       |       |       |
|-----------|-------------------------------------|----------------------------------|-------|-------|-------|-------|-------|
|           |                                     | 7                                | 14    | 28    | 40    | 56    | 112   |
| 13/15 GHz | QPSK                                | -92.5                            | -90   | -87   | -85.5 | -84   | -81.5 |
|           | 16 QAM                              | -86.5                            | -83.5 | -80.5 | -79   | -77.5 | -75   |
|           | 32 QAM                              | -83.5                            | -80.5 | -77   | -75.5 | -74   | -72   |
|           | 64 QAM                              | -80.5                            | -77.5 | -74   | -72.5 | -71   | -68.5 |
|           | 128 QAM                             | -77.5                            | -74.5 | -70.5 | -69   | -67.5 | -65   |
|           | 256 QAM                             | -74                              | -71   | -67   | -65.5 | -64   | -61.5 |
|           | 512 QAM                             | -70.5                            | -67.5 | -63.5 | -62   | -60.5 | -58   |
|           | 1024 QAM                            | -67                              | -64   | -61   | -59.5 | -58   | -55.5 |
|           | 1024 QAM Light                      | -66                              | -63   | -60   | -58.5 | -57   | -54.5 |
|           | 2048 QAM                            | -64                              | -61   | -57   | -55.5 | -54   | -52   |

| Frequency                      | Modulation Scheme <sup>[note]</sup> | Bandwidth(MHz) <sup>[note]</sup>                  |       |       |       |       |       |
|--------------------------------|-------------------------------------|---------------------------------------------------|-------|-------|-------|-------|-------|
|                                |                                     | 7                                                 | 14    | 28    | 40    | 56    | 112   |
|                                | 4096 QAM                            | N/A                                               | N/A   | -55   | -53.5 | -51.5 | -48.5 |
| 18/23 GHz                      | QPSK                                | -92                                               | -89.5 | -86.5 | -85   | -83.5 | -81   |
|                                | 16 QAM                              | -86                                               | -83   | -80   | -78.5 | -76.5 | -74.5 |
|                                | 32 QAM                              | -82.5                                             | -79.5 | -76   | -74.5 | -73   | -71   |
|                                | 64 QAM                              | -79.5                                             | -76.5 | -73   | -71.5 | -70   | -67.5 |
|                                | 128 QAM                             | -76.5                                             | -73.5 | -69.5 | -68   | -66.5 | -64   |
|                                | 256 QAM                             | -73                                               | -70   | -66   | -64.5 | -63   | -60.5 |
|                                | 512 QAM                             | -69.5                                             | -66.5 | -62.5 | -61   | -59.5 | -57   |
|                                | 1024 QAM                            | -66                                               | -63   | -60   | -58.5 | -57   | -54.5 |
|                                | 1024 QAM Light                      | -65                                               | -62   | -59   | -57.5 | -56   | -53.5 |
|                                | 2048 QAM                            | -63                                               | -60   | -56   | -54.5 | -53   | -51   |
|                                | 4096 QAM                            | N/A                                               | N/A   | -54   | -52.5 | -50.5 | -47.5 |
| Guaranteed RSL threshold (dBm) |                                     | +2 dB from the typical value.                     |       |       |       |       |       |
| Maximum RSL (dBm)              |                                     | QPSK ~ 256 QAM: -20 @ BER <10 <sup>-6</sup> ;     |       |       |       |       |       |
|                                |                                     | 512 QAM ~ 2048 QAM: -22 @ BER <10 <sup>-6</sup> ; |       |       |       |       |       |
|                                |                                     | 4096QAM: -25 @ BER <10 <sup>-6</sup> ;            |       |       |       |       |       |

**Note:**

1. SRU2S @C01/C02 mode: up to 2048 QAM @7/14 MHz, up to 4096 QAM @28/40/56/112 MHz.
2. L01/L02 mode: up to 2048 QAM.
3. ACCP configuration not applicable for C01/C02 mode

Table 6-56 RSL threshold @ BER=10<sup>-6</sup>: SRU2S @C02 mode (support ACCP)

| Frequency | Modulation Scheme | Bandwidth(MHz) |         |          |
|-----------|-------------------|----------------|---------|----------|
|           |                   | 28_ACCP        | 56_ACCP | 112_ACCP |
| 15 GHz    | QPSK              | -86.0          | -83.5   | -81.0    |
|           | 16 QAM            | -80.5          | -77.0   | -74.5    |
|           | 32 QAM            | -77.0          | -74.0   | -71.5    |
|           | 64 QAM            | -73.5          | -70.5   | -67.5    |

| Frequency                      | Modulation Scheme | Bandwidth(MHz)                                 |         |          |
|--------------------------------|-------------------|------------------------------------------------|---------|----------|
|                                |                   | 28_ACCP                                        | 56_ACCP | 112_ACCP |
|                                | 128 QAM           | -70.5                                          | -67.5   | -64.5    |
|                                | 256 QAM           | -67.0                                          | -64.0   | -61.0    |
|                                | 512 QAM           | -64.5                                          | -62.0   | -59.0    |
|                                | 1024 QAM          | -61.5                                          | -59.5   | -56.5    |
|                                | 1024 QAM Light    | -61.0                                          | -59.0   | -56.0    |
|                                | 2048 QAM          | -58.0                                          | -55.5   | -52.5    |
|                                | 4096 QAM          | -55.5                                          | -52.0   | -50.0    |
| 18/23 GHz                      | QPSK              | -85.5                                          | -83.0   | -80.5    |
|                                | 16 QAM            | -80.0                                          | -76.5   | -74.0    |
|                                | 32 QAM            | -76.5                                          | -73.5   | -71.0    |
|                                | 64 QAM            | -73.0                                          | -70.0   | -67.0    |
|                                | 128 QAM           | -70.0                                          | -67.0   | -64.0    |
|                                | 256 QAM           | -66.5                                          | -63.5   | -60.5    |
|                                | 512 QAM           | -64.0                                          | -61.5   | -58.5    |
|                                | 1024 QAM          | -61.0                                          | -59.0   | -56.0    |
|                                | 1024 QAM Light    | -60.5                                          | -58.5   | -55.5    |
|                                | 2048 QAM          | -57.5                                          | -55.0   | -52.0    |
|                                | 4096 QAM          | -55.0                                          | -51.5   | -49.5    |
| Guaranteed RSL threshold (dBm) |                   | +2 dB from the typical value.                  |         |          |
| Maximum RSL (dBm)              |                   | QPSK ~ 256 QAM: -20; 4096QAM: -25 @ BER <10-6; |         |          |
|                                |                   | 512 QAM ~ 2048 QAM: -22 @ BER <10-6            |         |          |
|                                |                   | 4096 QAM: -25 @ BER <10-6;                     |         |          |

**Note:**

1. Applicable to 1+0/ACAP/ACCP configuration of C02 mode.
2. The 15/18/23GHz band has already released the C02 mode that supports ACCP. Other bands will release the C02 mode that supports ACCP in the next version.

Table 6-57 RSL threshold @ BER=10-6: SRU3D @C01/C02/L01/L02 mode

| Frequenc | Modulatio | Bandwidth(MHz) |
|----------|-----------|----------------|
|----------|-----------|----------------|

|       |                | 7     | 14    | 28    | 40    | 56    | 80    | 112   | 224 |
|-------|----------------|-------|-------|-------|-------|-------|-------|-------|-----|
| 6 GHz | QPSK           | -94   | -91.5 | -88.5 | -87   | -85.5 | -84   | -82.5 | N/A |
|       | 16 QAM         | -88   | -85   | -82   | -80.5 | -79   | -77.5 | -76   | N/A |
|       | 32 QAM         | -85   | -82   | -78.5 | -77   | -75.5 | -74   | -73   | N/A |
|       | 64 QAM         | -82   | -79   | -75.5 | -74   | -72.5 | -71   | -69.5 | N/A |
|       | 128 QAM        | -79   | -76   | -72   | -70.5 | -69   | -67.5 | -66   | N/A |
|       | 256 QAM        | -75.5 | -72.5 | -68.5 | -67   | -65.5 | -64   | -63   | N/A |
|       | 512 QAM        | -72   | -69   | -65   | -63.5 | -62   | -60.5 | -59.5 | N/A |
|       | 1024 QAM       | -68.5 | -65.5 | -62.5 | -61   | -59.5 | -58   | -56.5 | N/A |
|       | 1024 QAM Light | -67.5 | -64.5 | -61.5 | -60   | -58.5 | -57   | -55.5 | N/A |
|       | 2048 QAM       | -65.5 | -62.5 | -58.5 | -57   | -55.5 | -54   | -52.5 | N/A |
|       | 4096 QAM       | N/A   | N/A   | -56.5 | -55   | -53   | -51   | -49   | N/A |
| 7 GHz | QPSK           | -94   | -91.5 | -88.5 | -87   | -85.5 | N/A   | -82.5 | N/A |
|       | 16 QAM         | -88   | -85   | -82   | -80.5 | -79   | N/A   | -76   | N/A |
|       | 32 QAM         | -85   | -82   | -78.5 | -77   | -75.5 | N/A   | -73   | N/A |
|       | 64 QAM         | -82   | -79   | -75.5 | -74   | -72.5 | N/A   | -69.5 | N/A |
|       | 128 QAM        | -79   | -76   | -72   | -70.5 | -69   | N/A   | -66   | N/A |
|       | 256 QAM        | -75.5 | -72.5 | -68.5 | -67   | -65.5 | N/A   | -63   | N/A |
|       | 512 QAM        | -72   | -69   | -65   | -63.5 | -62   | N/A   | -59.5 | N/A |
|       | 1024 QAM       | -68.5 | -65.5 | -62.5 | -61   | -59.5 | N/A   | -56.5 | N/A |
|       | 1024 QAM Light | -67.5 | -64.5 | -61.5 | -60   | -58.5 | N/A   | -55.5 | N/A |
|       | 2048 QAM       | -65.5 | -62.5 | -58.5 | -57   | -55.5 | N/A   | -52.5 | N/A |
|       | 4096 QAM       | N/A   | N/A   | -56.5 | -55   | -53   | N/A   | -49   | N/A |
| 8 GHz | QPSK           | -94   | -91.5 | -88.5 | -87   | -85.5 | -84   | -82.5 | N/A |
|       | 16 QAM         | -88   | -85   | -82   | -80.5 | -79   | -77.5 | -76   | N/A |
|       | 32 QAM         | -85   | -82   | -78.5 | -77   | -75.5 | -74   | -73   | N/A |
|       | 64 QAM         | -82   | -79   | -75.5 | -74   | -72.5 | -71   | -69.5 | N/A |
|       | 128 QAM        | -79   | -76   | -72   | -70.5 | -69   | -67.5 | -66   | N/A |
|       | 256 QAM        | -75.5 | -72.5 | -68.5 | -67   | -65.5 | -64   | -63   | N/A |
|       | 512 QAM        | -72   | -69   | -65   | -63.5 | -62   | -60.5 | -59.5 | N/A |
|       | 1024 QAM       | -68.5 | -65.5 | -62.5 | -61   | -59.5 | -58   | -56.5 | N/A |

| Frequency | Modulation Scheme | Bandwidth(MHz) |       |       |       |       |       |       |       |
|-----------|-------------------|----------------|-------|-------|-------|-------|-------|-------|-------|
|           |                   | 7              | 14    | 28    | 40    | 56    | 80    | 112   | 224   |
|           | 1024 QAM Light    | -67.5          | -64.5 | -61.5 | -60   | -58.5 | -57   | -55.5 | N/A   |
|           | 2048 QAM          | -65.5          | -62.5 | -58.5 | -57   | -55.5 | -54   | -52.5 | N/A   |
|           | 4096 QAM          | N/A            | N/A   | -56.5 | -55   | -53   | -51   | -49   | N/A   |
| 11 GHz    | QPSK              | -93.5          | -91   | -88   | -86.5 | -85   | -83.5 | -82   | N/A   |
|           | 16 QAM            | -87.5          | -84.5 | -81.5 | -80   | -78.5 | -77   | -75.5 | N/A   |
|           | 32 QAM            | -84.5          | -81.5 | -78   | -76.5 | -75   | -73.5 | -72.5 | N/A   |
|           | 64 QAM            | -81.5          | -78.5 | -75   | -73.5 | -72   | -70.5 | -69   | N/A   |
|           | 128 QAM           | -78.5          | -75.5 | -71.5 | -70   | -68.5 | -67   | -65.5 | N/A   |
|           | 256 QAM           | -75            | -72   | -68   | -66.5 | -65   | -63.5 | -62.5 | N/A   |
|           | 512 QAM           | -71.5          | -68.5 | -64.5 | -63   | -61.5 | -60   | -59   | N/A   |
|           | 1024 QAM          | -68            | -65   | -62   | -60.5 | -59   | -57.5 | -56   | N/A   |
|           | 1024 QAM Light    | -67            | -64   | -61   | -59.5 | -58   | -56.5 | -55   | N/A   |
|           | 2048 QAM          | -65            | -62   | -58   | -56.5 | -55   | -53.5 | -52   | N/A   |
|           | 4096 QAM          | N/A            | N/A   | -56   | -54.5 | -52.5 | -50.5 | N/A   | N/A   |
| 13 GHz    | QPSK              | -93.5          | -91   | -88   | -86.5 | -85   | N/A   | -82.5 | N/A   |
|           | 16 QAM            | -87.5          | -84.5 | -81.5 | -80   | -78.5 | N/A   | -76   | N/A   |
|           | 32 QAM            | -84.5          | -81.5 | -78   | -76.5 | -75   | N/A   | -73   | N/A   |
|           | 64 QAM            | -81.5          | -78.5 | -75   | -73.5 | -72   | N/A   | -69.5 | N/A   |
|           | 128 QAM           | -78.5          | -75.5 | -71.5 | -70   | -68.5 | N/A   | -66   | N/A   |
|           | 256 QAM           | -75            | -72   | -68   | -66.5 | -65   | N/A   | -62.5 | N/A   |
|           | 512 QAM           | -71.5          | -68.5 | -64.5 | -63   | -61.5 | N/A   | -59   | N/A   |
|           | 1024 QAM          | -68            | -65   | -62   | -60.5 | -59   | N/A   | -56.5 | N/A   |
|           | 1024 QAM Light    | -67            | -64   | -61   | -59.5 | -58   | N/A   | -55.5 | N/A   |
|           | 2048 QAM          | -65            | -62   | -58   | -56.5 | -55   | N/A   | -53   | N/A   |
|           | 4096 QAM          | N/A            | N/A   | -56   | -54.5 | -52.5 | N/A   | -49.5 | N/A   |
| 15 GHz    | QPSK              | -93.5          | -91   | -88   | -86.5 | -85   | N/A   | -82.5 | -78   |
|           | 16 QAM            | -87.5          | -84.5 | -81.5 | -80   | -78.5 | N/A   | -76   | -71.5 |
|           | 32 QAM            | -84.5          | -81.5 | -78   | -76.5 | -75   | N/A   | -73   | -68.5 |

| Frequency | Modulation Scheme | Bandwidth(MHz) |       |       |       |       |     |       |       |
|-----------|-------------------|----------------|-------|-------|-------|-------|-----|-------|-------|
|           |                   | 7              | 14    | 28    | 40    | 56    | 80  | 112   | 224   |
|           | 64 QAM            | -81.5          | -78.5 | -75   | -73.5 | -72   | N/A | -69.5 | -65   |
|           | 128 QAM           | -78.5          | -75.5 | -71.5 | -70   | -68.5 | N/A | -66   | -61.5 |
|           | 256 QAM           | -75            | -72   | -68   | -66.5 | -65   | N/A | -62.5 | -58   |
|           | 512 QAM           | -71.5          | -68.5 | -64.5 | -63   | -61.5 | N/A | -59   | -54.5 |
|           | 1024 QAM          | -68            | -65   | -62   | -60.5 | -59   | N/A | -56.5 | -52   |
|           | 1024 QAM Light    | -67            | -64   | -61   | -59.5 | -58   | N/A | -55.5 | N/A   |
|           | 2048 QAM          | -65            | -62   | -58   | -56.5 | -55   | N/A | -53   | N/A   |
|           | 4096 QAM          | N/A            | N/A   | -56   | -54.5 | -52.5 | N/A | -49.5 | N/A   |
|           | 8192 QAM          | N/A            | N/A   | -52.5 | -51   | -49.5 | N/A | N/A   | N/A   |
| 18 GHz    | QPSK              | -93            | -90.5 | -87.5 | -86   | -84.5 | N/A | -82   | -77.5 |
|           | 16 QAM            | -87            | -84   | -81   | -79.5 | -77.5 | N/A | -75.5 | -71   |
|           | 32 QAM            | -83.5          | -80.5 | -77   | -75.5 | -74   | N/A | -72   | -67.5 |
|           | 64 QAM            | -80.5          | -77.5 | -74   | -72.5 | -71   | N/A | -68.5 | -64   |
|           | 128 QAM           | -77.5          | -74.5 | -70.5 | -69   | -67.5 | N/A | -65   | -60.5 |
|           | 256 QAM           | -74            | -71   | -67   | -65.5 | -64   | N/A | -61.5 | -57   |
|           | 512 QAM           | -70.5          | -67.5 | -63.5 | -62   | -60.5 | N/A | -58   | -53.5 |
|           | 1024 QAM          | -67            | -64   | -61   | -59.5 | -58   | N/A | -55.5 | -51   |
|           | 1024 QAM Light    | -66            | -63   | -60   | -58.5 | -57   | N/A | -54.5 | N/A   |
|           | 2048 QAM          | -64            | -61   | -57   | -55.5 | -54   | N/A | -52   | N/A   |
|           | 4096 QAM          | N/A            | N/A   | -55   | -53.5 | -51.5 | N/A | -48.5 | N/A   |
| 23 GHz    | QPSK              | -93            | -90.5 | -87.5 | -86   | -84.5 | N/A | -82   | -77.5 |
|           | 16 QAM            | -87            | -84   | -81   | -79.5 | -77.5 | N/A | -75.5 | -71   |
|           | 32 QAM            | -83.5          | -80.5 | -77   | -75.5 | -74   | N/A | -72   | -67.5 |
|           | 64 QAM            | -80.5          | -77.5 | -74   | -72.5 | -71   | N/A | -68.5 | -64   |
|           | 128 QAM           | -77.5          | -74.5 | -70.5 | -69   | -67.5 | N/A | -65   | -60.5 |
|           | 256 QAM           | -74            | -71   | -67   | -65.5 | -64   | N/A | -61.5 | -57   |
|           | 512 QAM           | -70.5          | -67.5 | -63.5 | -62   | -60.5 | N/A | -58   | -53.5 |
|           | 1024 QAM          | -67            | -64   | -61   | -59.5 | -58   | N/A | -55.5 | -51   |
|           | 1024 QAM          | -66            | -63   | -60   | -58.5 | -57   | N/A | -54.5 | N/A   |

| Frequency                      | Modulation Scheme | Bandwidth(MHz)                      |     |       |       |       |     |       |     |
|--------------------------------|-------------------|-------------------------------------|-----|-------|-------|-------|-----|-------|-----|
|                                |                   | 7                                   | 14  | 28    | 40    | 56    | 80  | 112   | 224 |
|                                | Light             |                                     |     |       |       |       |     |       |     |
|                                | 2048 QAM          | -64                                 | -61 | -57   | -55.5 | -54   | N/A | -52   | N/A |
|                                | 4096 QAM          | N/A                                 | N/A | -55   | -53.5 | -51.5 | N/A | -48.5 | N/A |
|                                | 8192 QAM          | N/A                                 | N/A | -51.5 | -50   | -48.5 | N/A | N/A   | N/A |
| Guaranteed RSL threshold (dBm) |                   | +2 dB from the typical value.       |     |       |       |       |     |       |     |
| Maximum RSL (dBm)              |                   | QPSK ~ 256 QAM: -20;                |     |       |       |       |     |       |     |
|                                |                   | 512 QAM ~ 2048 QAM: -22 @ BER <10-6 |     |       |       |       |     |       |     |
|                                |                   | 4096 QAM ~ 8K QAM: -25 @ BER <10-6; |     |       |       |       |     |       |     |

**Note:**

1. The 80MHz bandwidth is supported by 6/8/11GHz.
2. The 224MHz bandwidth is supported by 15/18/23GHz SRU3D V1.0/V1.1 with ME2 @ L01/L02mode (hardware ready).
3. C01 mode: up to 2048 QAM @7/14 MHz, up to 4096 QAM @28/40/56/80/112 MHz.
4. C02 mode: up to 2048 QAM @7/14 MHz, up to 8192 QAM @28/40/56 MHz, up to 4096 QAM @80/112 MHz.
5. L01/L02 mode: up to 2048 QAM@7/14/28/40/56/112MHz; up to 1024 QAM@224MHz.
6. ACCP configuration not applicable for C01/C02 mode

Table 6-58 RSL threshold @ BER=10-6: SRU3D @C02 mode (support ACCP)

| Frequency | Modulation Scheme | Bandwidth(MHz) |         |         |         |          |
|-----------|-------------------|----------------|---------|---------|---------|----------|
|           |                   | 28_ACCP        | 40_ACCP | 56_ACCP | 80_ACCP | 112_ACCP |
| 6/8 GHz   | QPSK              | -88.0          | -87.5   | -85.5   | -84     | -83.0    |
|           | 16 QAM            | -82.5          | -80.5   | -79.0   | -78     | -76.5    |
|           | 32 QAM            | -79.0          | -77.5   | -76.0   | -74.5   | -73.5    |
|           | 64 QAM            | -75.5          | -74     | -72.5   | -70.5   | -69.5    |
|           | 128 QAM           | -72.5          | -71     | -69.5   | -68     | -66.5    |
|           | 256 QAM           | -69.0          | -67.5   | -66.0   | -64.5   | -63.0    |

| Frequency | Modulation Scheme | Bandwidth(MHz) |         |         |         |          |
|-----------|-------------------|----------------|---------|---------|---------|----------|
|           |                   | 28_ACCP        | 40_ACCP | 56_ACCP | 80_ACCP | 112_ACCP |
|           | 512 QAM           | -66.5          | -65.5   | -64.0   | -62     | -61.0    |
|           | 1024 QAM          | -63.5          | -62.5   | -61.5   | -59.5   | -58.5    |
|           | 1024 QAM Light    | -63.0          | -62     | -61.0   | -59     | -58.0    |
|           | 2048 QAM          | -60.0          | -59     | -57.5   | -55.5   | -54.5    |
|           | 4096 QAM          | -57.5          | -56.5   | -54.0   | -53     | -52.0    |
| 11 GHz    | QPSK              | -87.0          | -86.5   | -84.5   | -83     | -82.0    |
|           | 16 QAM            | -81.5          | -79.5   | -78.0   | -77     | -75.5    |
|           | 32 QAM            | -78.0          | -76.5   | -75.0   | -73.5   | -72.5    |
|           | 64 QAM            | -74.5          | -73     | -71.5   | -69.5   | -68.5    |
|           | 128 QAM           | -71.5          | -70     | -68.5   | -67     | -65.5    |
|           | 256 QAM           | -68.0          | -66.5   | -65.0   | -63.5   | -62.0    |
|           | 512 QAM           | -65.5          | -64.5   | -63.0   | -61     | -60.0    |
|           | 1024 QAM          | -62.5          | -61.5   | -60.5   | -58.5   | -57.5    |
|           | 1024 QAM Light    | -62.0          | -61     | -60.0   | -58     | -57.0    |
|           | 2048 QAM          | -59.0          | -58     | -56.5   | -54.5   | -53.5    |
|           | 4096 QAM          | -56.5          | -55.5   | -53.0   | -52     | -51.0    |
| 13 GHz    | QPSK              | -87.0          | N/A     | -84.5   | N/A     | -82.0    |
|           | 16 QAM            | -81.5          | N/A     | -78.0   | N/A     | -75.5    |
|           | 32 QAM            | -78.0          | N/A     | -75.0   | N/A     | -72.5    |
|           | 64 QAM            | -74.5          | N/A     | -71.5   | N/A     | -68.5    |
|           | 128 QAM           | -71.5          | N/A     | -68.5   | N/A     | -65.5    |
|           | 256 QAM           | -68.0          | N/A     | -65.0   | N/A     | -62.0    |
|           | 512 QAM           | -65.5          | N/A     | -63.0   | N/A     | -60.0    |
|           | 1024 QAM          | -62.5          | N/A     | -60.5   | N/A     | -57.5    |
|           | 1024 QAM Light    | -62.0          | N/A     | -60.0   | N/A     | -57.0    |
|           | 2048 QAM          | -59.0          | N/A     | -56.5   | N/A     | -53.5    |
|           | 4096 QAM          | -56.5          | N/A     | -53.0   | N/A     | -51.0    |

| Frequency                      | Modulation Scheme | Bandwidth(MHz)                      |         |         |         |          |
|--------------------------------|-------------------|-------------------------------------|---------|---------|---------|----------|
|                                |                   | 28_ACCP                             | 40_ACCP | 56_ACCP | 80_ACCP | 112_ACCP |
| 15 GHz                         | QPSK              | -87.0                               | N/A     | -84.5   | N/A     | -82.0    |
|                                | 16 QAM            | -81.5                               | N/A     | -78.0   | N/A     | -75.5    |
|                                | 32 QAM            | -78.0                               | N/A     | -75.0   | N/A     | -72.5    |
|                                | 64 QAM            | -74.5                               | N/A     | -71.5   | N/A     | -68.5    |
|                                | 128 QAM           | -71.5                               | N/A     | -68.5   | N/A     | -65.5    |
|                                | 256 QAM           | -68.0                               | N/A     | -65.0   | N/A     | -62.0    |
|                                | 512 QAM           | -65.5                               | N/A     | -63.0   | N/A     | -60.0    |
|                                | 1024 QAM          | -62.5                               | N/A     | -60.5   | N/A     | -57.5    |
|                                | 1024 QAM Light    | -62.0                               | N/A     | -60.0   | N/A     | -57.0    |
|                                | 2048 QAM          | -59.0                               | N/A     | -56.5   | N/A     | -53.5    |
|                                | 4096 QAM          | -56.5                               | N/A     | -53.0   | N/A     | -51.0    |
| 18/23 GHz                      | QPSK              | -86.5                               | N/A     | -84.0   | N/A     | -81.5    |
|                                | 16 QAM            | -81.0                               | N/A     | -77.5   | N/A     | -75.0    |
|                                | 32 QAM            | -77.5                               | N/A     | -74.5   | N/A     | -72.0    |
|                                | 64 QAM            | -74.0                               | N/A     | -71.0   | N/A     | -68.0    |
|                                | 128 QAM           | -71.0                               | N/A     | -68.0   | N/A     | -65.0    |
|                                | 256 QAM           | -67.5                               | N/A     | -64.5   | N/A     | -61.5    |
|                                | 512 QAM           | -65.0                               | N/A     | -62.5   | N/A     | -59.5    |
|                                | 1024 QAM          | -62.0                               | N/A     | -60.0   | N/A     | -57.0    |
|                                | 1024 QAM Light    | -61.5                               | N/A     | -59.5   | N/A     | -56.5    |
|                                | 2048 QAM          | -58.5                               | N/A     | -56.0   | N/A     | -53.0    |
|                                | 4096 QAM          | -56.0                               | N/A     | -52.5   | N/A     | -50.5    |
| Guaranteed RSL threshold (dBm) |                   | +2 dB from the typical value.       |         |         |         |          |
| Maximum RSL (dBm)              |                   | QPSK ~ 256 QAM: -20;                |         |         |         |          |
|                                |                   | 512 QAM ~ 2048 QAM: -22 @ BER <10-6 |         |         |         |          |
|                                |                   | 4096 QAM ~ 8K QAM: -25 @ BER <10-6; |         |         |         |          |

**Note:**

1. Applicable to 1+0/ACAP/ACCP configuration of C02 mode
2. The 6/8/11/13/15/18/23 GHz band has already released the C02 mode that supports ACCP.  
Other bands will release the C02 mode that supports ACCP in the next version.

Table 6-59 RSL threshold @ BER=10<sup>-6</sup>: HRU2F V1.0 @C01/C02/L01/L02 mode

| Frequency                   | Modulation Scheme <sup>[note]</sup> | Bandwidth(MHz) |       |       |       |       |       |       |
|-----------------------------|-------------------------------------|----------------|-------|-------|-------|-------|-------|-------|
|                             |                                     | 7              | 14    | 28    | 40    | 56    | 80    | 112   |
| Typical RSL threshold (dBm) |                                     |                |       |       |       |       |       |       |
| 6 GHz                       | QPSK                                | -94            | -91.5 | -88   | -87   | -85   | -83.5 | -82   |
|                             | 16 QAM                              | -88            | -85   | -81.5 | -80.5 | -78.5 | -77   | -75.5 |
|                             | 32 QAM                              | -85            | -81.5 | -78   | -77   | -75   | -73.5 | -72.5 |
|                             | 64 QAM                              | -82            | -78.5 | -75   | -74   | -72   | -70.5 | -69   |
|                             | 128 QAM                             | -78.5          | -75.5 | -71.5 | -70   | -68.5 | -67   | -65.5 |
|                             | 256 QAM                             | -75            | -72   | -68.5 | -67   | -65.5 | -64   | -62.5 |
|                             | 512 QAM                             | -72            | -68.5 | -65   | -63.5 | -62   | -60.5 | -59   |
|                             | 1024 QAM                            | -68.5          | -65.5 | -62   | -60.5 | -59   | -57.5 | -56   |
|                             | 1024 QAM Light                      | -67.5          | -64.5 | -61   | -60   | -58   | -56.5 | -55   |
|                             | 2048 QAM                            | -65            | -62   | -58   | -57   | -55   | -53.5 | -52   |
|                             | 4096 QAM                            | N/A            | N/A   | -56   | -54.5 | -52.5 | N/A   | N/A   |
| 7/8 GHz                     | QPSK                                | -94            | -91.5 | -88   | -87   | -85   | N/A   | -82   |
|                             | 16 QAM                              | -88            | -85   | -81.5 | -80.5 | -78.5 | N/A   | -75.5 |
|                             | 32 QAM                              | -85            | -81.5 | -78   | -77   | -75   | N/A   | -72.5 |
|                             | 64 QAM                              | -82            | -78.5 | -75   | -74   | -72   | N/A   | -69   |
|                             | 128 QAM                             | -78.5          | -75.5 | -71.5 | -70   | -68.5 | N/A   | -65.5 |
|                             | 256 QAM                             | -75            | -72   | -68.5 | -67   | -65.5 | N/A   | -62.5 |
|                             | 512 QAM                             | -72            | -68.5 | -65   | -63.5 | -62   | N/A   | -59   |
|                             | 1024 QAM                            | -68.5          | -65.5 | -62   | -60.5 | -59   | N/A   | -56   |
|                             | 1024 QAM Light                      | -67.5          | -64.5 | -61   | -60   | -58   | N/A   | -55   |
|                             | 2048 QAM                            | -65            | -62   | -58   | -57   | -55   | N/A   | -52   |
|                             | 4096 QAM                            | N/A            | N/A   | -56   | -54.5 | -52.5 | N/A   | N/A   |
| 11 GHz                      | QPSK                                | -93.5          | -91   | -87.5 | -86.5 | -84.5 | -83   | -81.5 |

| Frequency                      | Modulation Scheme <sup>[note]</sup> | Bandwidth(MHz)                                                                       |       |       |       |       |       |       |
|--------------------------------|-------------------------------------|--------------------------------------------------------------------------------------|-------|-------|-------|-------|-------|-------|
|                                |                                     | 7                                                                                    | 14    | 28    | 40    | 56    | 80    | 112   |
|                                | 16 QAM                              | -87.5                                                                                | -84.5 | -81   | -80   | -78   | -76.5 | -75   |
|                                | 32 QAM                              | -84.5                                                                                | -81   | -77.5 | -76.5 | -74.5 | -73   | -72   |
|                                | 64 QAM                              | -81.5                                                                                | -78   | -74.5 | -73.5 | -71.5 | -70   | -68.5 |
|                                | 128 QAM                             | -78                                                                                  | -75   | -71   | -69.5 | -68   | -66.5 | -65   |
|                                | 256 QAM                             | -74.5                                                                                | -71.5 | -68   | -66.5 | -65   | -63.5 | -62   |
|                                | 512 QAM                             | -71.5                                                                                | -68   | -64.5 | -63   | -61.5 | -60   | -58.5 |
|                                | 1024 QAM                            | -68                                                                                  | -65   | -61.5 | -60   | -58.5 | -57   | -55.5 |
|                                | 1024 QAM Light                      | -67                                                                                  | -64   | -60.5 | -59.5 | -57.5 | -56   | -54.5 |
|                                | 2048 QAM                            | -64.5                                                                                | -61.5 | -57.5 | -56.5 | -54.5 | -53   | -51.5 |
|                                | 4096 QAM                            | N/A                                                                                  | N/A   | -55.5 | -54   | -52   | N/A   | N/A   |
| Guaranteed RSL threshold (dBm) |                                     | +2 dB from the typical value.                                                        |       |       |       |       |       |       |
| Maximum RSL (dBm)              |                                     | QPSK ~ 256 QAM: -20; 512 QAM ~ 2048 QAM: -23; 4096QAM: -25 @ BER <10 <sup>-6</sup> . |       |       |       |       |       |       |

**Note:**

1. The 80MHz bandwidth is supported by 6/11GHz HRU2F V1.0
2. HRU2F V1.0 @C01/C02 mode: up to 2048 QAM @ 7/14 MHz, up to 4096 QAM @ 28/40/56 MHz, up to 2048 QAM @ 80/112 MHz.
3. L01/L02 mode: up to 2048 QAM.
4. ACCP configuration not applicable for C01/C02 mode.

Table 6-60 RSL threshold @ BER=10<sup>-6</sup>: HRU2F V2.0 @C01/C02/L01/L02 mode

| Frequency | Modulation Scheme <sup>[note]</sup> | Bandwidth(MHz) <sup>[note]</sup> |       |       |       |       |       |       |
|-----------|-------------------------------------|----------------------------------|-------|-------|-------|-------|-------|-------|
|           |                                     | 7                                | 14    | 28    | 40    | 56    | 80    | 112   |
| 6 GHz     | QPSK                                | -94                              | -91.5 | -88.5 | -87   | -85.5 | -84   | -82.5 |
|           | 16 QAM                              | -88                              | -85   | -82   | -80.5 | -79   | -77.5 | -76   |
|           | 32 QAM                              | -85                              | -82   | -78.5 | -77   | -75.5 | -74   | -73   |
|           | 64 QAM                              | -82                              | -79   | -75.5 | -74   | -72.5 | -71   | -69.5 |
|           | 128 QAM                             | -79                              | -76   | -72   | -70.5 | -69   | -67.5 | -66   |

| Frequency | Modulation Scheme <sup>[note]</sup> | Bandwidth(MHz) <sup>[note]</sup> |       |       |       |       |       |       |
|-----------|-------------------------------------|----------------------------------|-------|-------|-------|-------|-------|-------|
|           |                                     | 7                                | 14    | 28    | 40    | 56    | 80    | 112   |
|           | 256 QAM                             | -75.5                            | -72.5 | -68.5 | -67   | -65.5 | -64   | -63   |
|           | 512 QAM                             | -72                              | -69   | -65   | -63.5 | -62   | -60.5 | -59.5 |
|           | 1024 QAM                            | -68.5                            | -65.5 | -62.5 | -61   | -59.5 | -58   | -56.5 |
|           | 1024 QAM Light                      | -67.5                            | -64.5 | -61.5 | -60   | -58.5 | -57   | -55.5 |
|           | 2048 QAM                            | -65.5                            | -62.5 | -58.5 | -57   | -55.5 | -54   | -52.5 |
|           | 4096 QAM                            | N/A                              | N/A   | -56.5 | -55   | -53   | -51   | -49   |
| 7 GHz     | QPSK                                | -94                              | -91.5 | -88.5 | -87   | -85.5 | N/A   | -82.5 |
|           | 16 QAM                              | -88                              | -85   | -82   | -80.5 | -79   | N/A   | -76   |
|           | 32 QAM                              | -85                              | -82   | -78.5 | -77   | -75.5 | N/A   | -73   |
|           | 64 QAM                              | -82                              | -79   | -75.5 | -74   | -72.5 | N/A   | -69.5 |
|           | 128 QAM                             | -79                              | -76   | -72   | -70.5 | -69   | N/A   | -66   |
|           | 256 QAM                             | -75.5                            | -72.5 | -68.5 | -67   | -65.5 | N/A   | -63   |
|           | 512 QAM                             | -72                              | -69   | -65   | -63.5 | -62   | N/A   | -59.5 |
|           | 1024 QAM                            | -68.5                            | -65.5 | -62.5 | -61   | -59.5 | N/A   | -56.5 |
|           | 1024 QAM Light                      | -67.5                            | -64.5 | -61.5 | -60   | -58.5 | N/A   | -55.5 |
|           | 2048 QAM                            | -65.5                            | -62.5 | -58.5 | -57   | -55.5 | N/A   | -52.5 |
|           | 4096 QAM                            | N/A                              | N/A   | -56.5 | -55   | -53   | N/A   | -49   |
| 8 GHz     | QPSK                                | -94                              | -91.5 | -88.5 | -87   | -85.5 | -84   | -82.5 |
|           | 16 QAM                              | -88                              | -85   | -82   | -80.5 | -79   | -77.5 | -76   |
|           | 32 QAM                              | -85                              | -82   | -78.5 | -77   | -75.5 | -74   | -73   |
|           | 64 QAM                              | -82                              | -79   | -75.5 | -74   | -72.5 | -71   | -69.5 |
|           | 128 QAM                             | -79                              | -76   | -72   | -70.5 | -69   | -67.5 | -66   |
|           | 256 QAM                             | -75.5                            | -72.5 | -68.5 | -67   | -65.5 | -64   | -63   |
|           | 512 QAM                             | -72                              | -69   | -65   | -63.5 | -62   | -60.5 | -59.5 |
|           | 1024 QAM                            | -68.5                            | -65.5 | -62.5 | -61   | -59.5 | -58   | -56.5 |
|           | 1024 QAM Light                      | -67.5                            | -64.5 | -61.5 | -60   | -58.5 | -57   | -55.5 |
|           | 2048 QAM                            | -65.5                            | -62.5 | -58.5 | -57   | -55.5 | -54   | -52.5 |
|           | 4096 QAM                            | N/A                              | N/A   | -56.5 | -55   | -53   | -51   | -49   |

| Frequency                      | Modulation Scheme <sup>[note]</sup> | Bandwidth(MHz) <sup>[note]</sup>     |       |       |       |       |       |       |
|--------------------------------|-------------------------------------|--------------------------------------|-------|-------|-------|-------|-------|-------|
|                                |                                     | 7                                    | 14    | 28    | 40    | 56    | 80    | 112   |
| 11 GHz                         | QPSK                                | -93.5                                | -91   | -88   | -86.5 | -85   | -83.5 | -82   |
|                                | 16 QAM                              | -87.5                                | -84.5 | -81.5 | -80   | -78.5 | -77   | -75.5 |
|                                | 32 QAM                              | -84.5                                | -81.5 | -78   | -76.5 | -75   | -73.5 | -72.5 |
|                                | 64 QAM                              | -81.5                                | -78.5 | -75   | -73.5 | -72   | -70.5 | -69   |
|                                | 128 QAM                             | -78.5                                | -75.5 | -71.5 | -70   | -68.5 | -67   | -65.5 |
|                                | 256 QAM                             | -75                                  | -72   | -68   | -66.5 | -65   | -63.5 | -62.5 |
|                                | 512 QAM                             | -71.5                                | -68.5 | -64.5 | -63   | -61.5 | -60   | -59   |
|                                | 1024 QAM                            | -68                                  | -65   | -62   | -60.5 | -59   | -57.5 | -56   |
|                                | 1024 QAM Light                      | -67                                  | -64   | -61   | -59.5 | -58   | -56.5 | -55   |
|                                | 2048 QAM                            | -65                                  | -62   | -58   | -56.5 | -55   | -53.5 | -52   |
|                                | 4096 QAM                            | N/A                                  | N/A   | -56   | -54.5 | -52.5 | -50.5 | -48.5 |
| Guaranteed RSL threshold (dBm) |                                     | +2 dB from the typical value.        |       |       |       |       |       |       |
| Maximum RSL (dBm)              |                                     | QPSK ~ 256 QAM: -20 @ BER <10-6;     |       |       |       |       |       |       |
|                                |                                     | 512 QAM ~ 2048 QAM: -23 @ BER <10-6; |       |       |       |       |       |       |
|                                |                                     | 4096 QAM: -25 @ BER <10-6;           |       |       |       |       |       |       |

**Note:**

1. The 80MHz bandwidth is supported by 6/8/11GHz HRU2F V2.0.
2. HRU2F V2.0 @C01/C02 mode: up to 2048 QAM @7/14 MHz, up to 4096 QAM @28/40/56/80/112 MHz.
3. L01/L02 mode: up to 2048 QAM.
4. ACCP configuration not applicable for C01/C02 mode.

Table 6-61 RSL threshold @ BER=10-6: HRU2F V2.0 @C02 mode (support ACCP)

| Frequency | Modulation Scheme | Bandwidth(MHz) |         |         |         |          |
|-----------|-------------------|----------------|---------|---------|---------|----------|
|           |                   | 28_ACCP        | 40_ACCP | 56_ACCP | 80_ACCP | 112_ACCP |
| 6 GHz     | QPSK              | -88            | -87.5   | -85.5   | -84     | -83      |
|           | 16 QAM            | -82.5          | -80.5   | -79     | -78     | -76.5    |

| Frequency                      | Modulation Scheme | Bandwidth(MHz)                       |         |         |         |          |
|--------------------------------|-------------------|--------------------------------------|---------|---------|---------|----------|
|                                |                   | 28_ACCP                              | 40_ACCP | 56_ACCP | 80_ACCP | 112_ACCP |
|                                | 32 QAM            | -79                                  | -77.5   | -76     | -74.5   | -73.5    |
|                                | 64 QAM            | -75.5                                | -74     | -72.5   | -70.5   | -69.5    |
|                                | 128 QAM           | -72.5                                | -71     | -69.5   | -68     | -66.5    |
|                                | 256 QAM           | -69                                  | -67.5   | -66     | -64.5   | -63      |
|                                | 512 QAM           | -66.5                                | -65.5   | -64     | -62     | -61      |
|                                | 1024 QAM          | -63.5                                | -62.5   | -61.5   | -59.5   | -58.5    |
|                                | 1024 QAM Light    | -63                                  | -62     | -61     | -59     | -58      |
|                                | 2048 QAM          | -60                                  | -59     | -57.5   | -55.5   | -54.5    |
|                                | 4096 QAM          | -57.5                                | -56.5   | -54     | -53     | -52      |
| 8 GHz                          | QPSK              | -88                                  | -87.5   | -85.5   | -84     | -83      |
|                                | 16 QAM            | -82.5                                | -80.5   | -79     | -78     | -76.5    |
|                                | 32 QAM            | -79                                  | -77.5   | -76     | -74.5   | -73.5    |
|                                | 64 QAM            | -75.5                                | -74     | -72.5   | -70.5   | -69.5    |
|                                | 128 QAM           | -72.5                                | -71     | -69.5   | -68     | -66.5    |
|                                | 256 QAM           | -69                                  | -67.5   | -66     | -64.5   | -63      |
|                                | 512 QAM           | -66.5                                | -65.5   | -64     | -62     | -61      |
|                                | 1024 QAM          | -63.5                                | -62.5   | -61.5   | -59.5   | -58.5    |
|                                | 1024 QAM Light    | -63                                  | -62     | -61     | -59     | -58      |
|                                | 2048 QAM          | -60                                  | -59     | -57.5   | -55.5   | -54.5    |
|                                | 4096 QAM          | -57.5                                | -56.5   | -54     | -53     | -52      |
| Guaranteed RSL threshold (dBm) |                   | +2 dB from the typical value.        |         |         |         |          |
| Maximum RSL (dBm)              |                   | QPSK ~ 256 QAM: -20 @ BER <10-6;     |         |         |         |          |
|                                |                   | 512 QAM ~ 2048 QAM: -23 @ BER <10-6; |         |         |         |          |
|                                |                   | 4096 QAM: -25 @ BER <10-6;           |         |         |         |          |

**Note:**

1. Applicable to 1+0/ACAP/ACCP configuration of C02 mode.
2. The 6/8GHz band has already released the C02 mode that supports ACCP. Other bands will

release the C02 mode that supports ACCP in the next version.

Table 6-62 RSL threshold @ BER=10-6: HRU2 @C01/C02/L01/L02 mode

| Frequency | Modulation Scheme <sup>[note]</sup> | Bandwidth(MHz) <sup>[note]</sup> |       |       |       |       |       |       |
|-----------|-------------------------------------|----------------------------------|-------|-------|-------|-------|-------|-------|
|           |                                     | 7                                | 14    | 28    | 40    | 56    | 80    | 112   |
| 13 GHz    | QPSK                                | -93.5                            | -91   | -88   | -86.5 | -85   | -82.5 | N/A   |
|           | 16 QAM                              | -87.5                            | -84.5 | -81.5 | -80   | -78.5 | -76   | N/A   |
|           | 32 QAM                              | -84.5                            | -81.5 | -78   | -76.5 | -75   | -73   | N/A   |
|           | 64 QAM                              | -81.5                            | -78.5 | -75   | -73.5 | -72   | -69.5 | N/A   |
|           | 128 QAM                             | -78.5                            | -75.5 | -71.5 | -70   | -68.5 | -66   | N/A   |
|           | 256 QAM                             | -75                              | -72   | -68   | -66.5 | -65   | -62.5 | N/A   |
|           | 512 QAM                             | -71.5                            | -68.5 | -64.5 | -63   | -61.5 | -59   | N/A   |
|           | 1024 QAM                            | -68                              | -65   | -62   | -60.5 | -59   | -56.5 | N/A   |
|           | 1024 QAM Light                      | -67                              | -64   | -61   | -59.5 | -58   | -55.5 | N/A   |
|           | 2048 QAM                            | -65                              | -62   | -58   | -56.5 | -55   | -53   | N/A   |
|           | 4096 QAM                            | N/A                              | N/A   | -56   | -54.5 | -52.5 | N/A   | N/A   |
| 15 GHz    | QPSK                                | -93.5                            | -91   | -88   | -86.5 | -85   | -82.5 | -78.5 |
|           | 16 QAM                              | -87.5                            | -84.5 | -81.5 | -80   | -78.5 | -76   | -72   |
|           | 32 QAM                              | -84.5                            | -81.5 | -78   | -76.5 | -75   | -73   | -69   |
|           | 64 QAM                              | -81.5                            | -78.5 | -75   | -73.5 | -72   | -69.5 | -65.5 |
|           | 128 QAM                             | -78.5                            | -75.5 | -71.5 | -70   | -68.5 | -66   | -62   |
|           | 256 QAM                             | -75                              | -72   | -68   | -66.5 | -65   | -62.5 | -58.5 |
|           | 512 QAM                             | -71.5                            | -68.5 | -64.5 | -63   | -61.5 | -59   | -55   |
|           | 1024 QAM                            | -68                              | -65   | -62   | -60.5 | -59   | -56.5 | -52.5 |
|           | 1024 QAM Light                      | -67                              | -64   | -61   | -59.5 | -58   | -55.5 | N/A   |
|           | 2048 QAM                            | -65                              | -62   | -58   | -56.5 | -55   | -53   | N/A   |
|           | 4096 QAM                            | N/A                              | N/A   | -56   | -54.5 | -52.5 | N/A   | N/A   |
| 18 GHz    | QPSK                                | -93                              | -90.5 | -87.5 | -86   | -84.5 | -82   | -78   |
|           | 16 QAM                              | -87                              | -84   | -81   | -79.5 | -77.5 | -75.5 | -71.5 |
|           | 32 QAM                              | -83.5                            | -80.5 | -77   | -75.5 | -74   | -72   | -68   |
|           | 64 QAM                              | -80.5                            | -77.5 | -74   | -72.5 | -71   | -68.5 | -64.5 |

| Frequency                      | Modulation Scheme <sup>[note]</sup> | Bandwidth(MHz) <sup>[note]</sup>     |       |       |       |       |       |       |
|--------------------------------|-------------------------------------|--------------------------------------|-------|-------|-------|-------|-------|-------|
|                                |                                     | 7                                    | 14    | 28    | 40    | 56    | 80    | 112   |
|                                | 128 QAM                             | -77.5                                | -74.5 | -70.5 | -69   | -67.5 | -65   | -61   |
|                                | 256 QAM                             | -74                                  | -71   | -67   | -65.5 | -64   | -61.5 | -57.5 |
|                                | 512 QAM                             | -70.5                                | -67.5 | -63.5 | -62   | -60.5 | -58   | -54   |
|                                | 1024 QAM                            | -67                                  | -64   | -61   | -59.5 | -58   | -55.5 | -51.5 |
|                                | 1024 QAM Light                      | -66                                  | -63   | -60   | -58.5 | -57   | -54.5 | N/A   |
|                                | 2048 QAM                            | -64                                  | -61   | -57   | -55.5 | -54   | -52   | N/A   |
|                                | 4096 QAM                            | N/A                                  | N/A   | -55   | -53.5 | -51.5 | N/A   | N/A   |
| Guaranteed RSL threshold (dBm) |                                     | +2 dB from the typical value.        |       |       |       |       |       |       |
| Maximum RSL (dBm)              |                                     | QPSK ~ 256 QAM: -20 @ BER <10-6;     |       |       |       |       |       |       |
|                                |                                     | 512 QAM ~ 2048 QAM: -22 @ BER <10-6; |       |       |       |       |       |       |
|                                |                                     | 4096 QAM: -25 @ BER <10-6;           |       |       |       |       |       |       |

**Note:**

1. The 224MHz bandwidth is supported by 15/18GHz HRU2 with ME2 @ L01/L02mode (hardware ready).
2. HRU2 @C01 mode: up to 2048 QAM @7/14 MHz, up to 4096 QAM @28/40/56 MHz, up to 2048 QAM @112 MHz.
3. HRU2 @C02 mode: up to 2048 QAM @7/14 MHz, up to 4096 QAM @28/40/56 MHz, up to 2048 QAM @112 MHz.
4. L01/L02 mode: up to 2048 QAM@7/14/28/40/56/112MHz; up to 1024 QAM@224MHz.
5. ACCP configuration not applicable for C01/C02 mode.

Table 6-63 RSL threshold @ BER=10-6: HRU3D @C01/C02/L01/L02 mode.

| Frequency | Modulation Scheme | Bandwidth(MHz) |       |       |       |       |       |       |
|-----------|-------------------|----------------|-------|-------|-------|-------|-------|-------|
|           |                   | 7              | 14    | 28    | 40    | 56    | 80    | 112   |
| 5GHz      | QPSK              | -94            | -91.5 | -88.5 | -87   | -85.5 | -84   | -82.5 |
|           | 16 QAM            | -88            | -85   | -82   | -80.5 | -79   | -77.5 | -76   |
|           | 32 QAM            | -85            | -82   | -78.5 | -77   | -75.5 | -74   | -73   |

| Frequency | Modulation Scheme | Bandwidth(MHz) |       |       |       |       |       |       |
|-----------|-------------------|----------------|-------|-------|-------|-------|-------|-------|
|           |                   | 7              | 14    | 28    | 40    | 56    | 80    | 112   |
|           | 64 QAM            | -82            | -79   | -75.5 | -74   | -72.5 | -71   | -69.5 |
|           | 128 QAM           | -79            | -76   | -72   | -70.5 | -69   | -67.5 | -66   |
|           | 256 QAM           | -75.5          | -72.5 | -68.5 | -67   | -65.5 | -64   | -63   |
|           | 512 QAM           | -72            | -69   | -65   | -63.5 | -62   | -60.5 | -59.5 |
|           | 1024 QAM          | -68.5          | -65.5 | -62.5 | -61   | -59.5 | -58   | -56.5 |
|           | 1024 QAM Light    | -67.5          | -64.5 | -61.5 | -60   | -58.5 | -57   | -55.5 |
|           | 2048 QAM          | -65.5          | -62.5 | -58.5 | -57   | -55.5 | -54   | -52.5 |
|           | 4096 QAM          | N/A            | N/A   | -56.5 | -55   | -53   | -51   | -49   |
| 6 GHz     | QPSK              | -94            | -91.5 | -88.5 | -87   | -85.5 | -84   | -82.5 |
|           | 16 QAM            | -88            | -85   | -82   | -80.5 | -79   | -77.5 | -76   |
|           | 32 QAM            | -85            | -82   | -78.5 | -77   | -75.5 | -74   | -73   |
|           | 64 QAM            | -82            | -79   | -75.5 | -74   | -72.5 | -71   | -69.5 |
|           | 128 QAM           | -79            | -76   | -72   | -70.5 | -69   | -67.5 | -66   |
|           | 256 QAM           | -75.5          | -72.5 | -68.5 | -67   | -65.5 | -64   | -63   |
|           | 512 QAM           | -72            | -69   | -65   | -63.5 | -62   | -60.5 | -59.5 |
|           | 1024 QAM          | -68.5          | -65.5 | -62.5 | -61   | -59.5 | -58   | -56.5 |
|           | 1024 QAM Light    | -67.5          | -64.5 | -61.5 | -60   | -58.5 | -57   | -55.5 |
|           | 2048 QAM          | -65.5          | -62.5 | -58.5 | -57   | -55.5 | -54   | -52.5 |
|           | 4096 QAM          | N/A            | N/A   | -56.5 | -55   | -53   | -51   | -49   |
| 7 GHz     | QPSK              | -94            | -91.5 | -88.5 | -87   | -85.5 | N/A   | -82.5 |
|           | 16 QAM            | -88            | -85   | -82   | -80.5 | -79   | N/A   | -76   |
|           | 32 QAM            | -85            | -82   | -78.5 | -77   | -75.5 | N/A   | -73   |
|           | 64 QAM            | -82            | -79   | -75.5 | -74   | -72.5 | N/A   | -69.5 |
|           | 128 QAM           | -79            | -76   | -72   | -70.5 | -69   | N/A   | -66   |
|           | 256 QAM           | -75.5          | -72.5 | -68.5 | -67   | -65.5 | N/A   | -63   |
|           | 512 QAM           | -72            | -69   | -65   | -63.5 | -62   | N/A   | -59.5 |
|           | 1024 QAM          | -68.5          | -65.5 | -62.5 | -61   | -59.5 | N/A   | -56.5 |
|           | 1024 QAM Light    | -67.5          | -64.5 | -61.5 | -60   | -58.5 | N/A   | -55.5 |

| Frequency | Modulation Scheme | Bandwidth(MHz) |       |       |       |       |       |       |
|-----------|-------------------|----------------|-------|-------|-------|-------|-------|-------|
|           |                   | 7              | 14    | 28    | 40    | 56    | 80    | 112   |
|           | 2048 QAM          | -65.5          | -62.5 | -58.5 | -57   | -55.5 | N/A   | -52.5 |
|           | 4096 QAM          | N/A            | N/A   | -56.5 | -55   | -53   | N/A   | -49   |
| 8 GHz     | QPSK              | -94            | -91.5 | -88.5 | -87   | -85.5 | -84   | -82.5 |
|           | 16 QAM            | -88            | -85   | -82   | -80.5 | -79   | -77.5 | -76   |
|           | 32 QAM            | -85            | -82   | -78.5 | -77   | -75.5 | -74   | -73   |
|           | 64 QAM            | -82            | -79   | -75.5 | -74   | -72.5 | -71   | -69.5 |
|           | 128 QAM           | -79            | -76   | -72   | -70.5 | -69   | -67.5 | -66   |
|           | 256 QAM           | -75.5          | -72.5 | -68.5 | -67   | -65.5 | -64   | -63   |
|           | 512 QAM           | -72            | -69   | -65   | -63.5 | -62   | -60.5 | -59.5 |
|           | 1024 QAM          | -68.5          | -65.5 | -62.5 | -61   | -59.5 | -58   | -56.5 |
|           | 1024 QAM Light    | -67.5          | -64.5 | -61.5 | -60   | -58.5 | -57   | -55.5 |
|           | 2048 QAM          | -65.5          | -62.5 | -58.5 | -57   | -55.5 | -54   | -52.5 |
|           | 4096 QAM          | N/A            | N/A   | -56.5 | -55   | -53   | -51   | -49   |
| 11 GHz    | QPSK              | -93.5          | -91   | -88   | -86.5 | -85   | -83.5 | -82   |
|           | 16 QAM            | -87.5          | -84.5 | -81.5 | -80   | -78.5 | -77   | -75.5 |
|           | 32 QAM            | -84.5          | -81.5 | -78   | -76.5 | -75   | -73.5 | -72.5 |
|           | 64 QAM            | -81.5          | -78.5 | -75   | -73.5 | -72   | -70.5 | -69   |
|           | 128 QAM           | -78.5          | -75.5 | -71.5 | -70   | -68.5 | -67   | -65.5 |
|           | 256 QAM           | -75            | -72   | -68   | -66.5 | -65   | -63.5 | -62.5 |
|           | 512 QAM           | -71.5          | -68.5 | -64.5 | -63   | -61.5 | -60   | -59   |
|           | 1024 QAM          | -68            | -65   | -62   | -60.5 | -59   | -57.5 | -56   |
|           | 1024 QAM Light    | -67            | -64   | -61   | -59.5 | -58   | -56.5 | -55   |
|           | 2048 QAM          | -65            | -62   | -58   | -56.5 | -55   | -53.5 | -52   |
|           | 4096 QAM          | N/A            | N/A   | -56   | -54.5 | -52.5 | -50.5 | -48.5 |
| 26 GHz    | QPSK              | -92            | -89.5 | -86.5 | -85   | -83.5 | N/A   | -81   |
|           | 16 QAM            | -86            | -83   | -80   | -78.5 | -76.5 | N/A   | -74.5 |
|           | 32 QAM            | -82.5          | -79.5 | -76   | -74.5 | -73   | N/A   | -71   |
|           | 64 QAM            | -79.5          | -76.5 | -73   | -71.5 | -70   | N/A   | -67.5 |
|           | 128 QAM           | -76.5          | -73.5 | -69.5 | -68   | -66.5 | N/A   | -64   |

| Frequency | Modulation Scheme | Bandwidth(MHz) |       |       |       |       |     |       |
|-----------|-------------------|----------------|-------|-------|-------|-------|-----|-------|
|           |                   | 7              | 14    | 28    | 40    | 56    | 80  | 112   |
|           | 256 QAM           | -73            | -70   | -66   | -64.5 | -63   | N/A | -60.5 |
|           | 512 QAM           | -69.5          | -66.5 | -62.5 | -61   | -59.5 | N/A | -57   |
|           | 1024 QAM          | -66            | -63   | -60   | -58.5 | -57   | N/A | -54.5 |
|           | 1024 QAM Light    | -65            | -62   | -59   | -57.5 | -56   | N/A | -53.5 |
|           | 2048 QAM          | -63            | -60   | -56   | -54.5 | -53   | N/A | -51   |
|           | 4096 QAM          | N/A            | N/A   | -54   | -52.5 | -50.5 | N/A | N/A   |
| 32 GHz    | QPSK              | -91.5          | -89   | -86   | -84.5 | -83   | N/A | -80.5 |
|           | 16 QAM            | -85.5          | -82.5 | -79.5 | -78   | -76   | N/A | -74   |
|           | 32 QAM            | -82            | -79   | -75.5 | -74   | -72.5 | N/A | -70.5 |
|           | 64 QAM            | -79            | -76   | -72.5 | -71   | -69.5 | N/A | -67   |
|           | 128 QAM           | -76            | -73   | -69   | -67.5 | -66   | N/A | -63.5 |
|           | 256 QAM           | -72.5          | -69.5 | -65.5 | -64   | -62.5 | N/A | -60   |
|           | 512 QAM           | -69            | -66   | -62   | -60.5 | -59   | N/A | -56.5 |
|           | 1024 QAM          | -65.5          | -62.5 | -59.5 | -58   | -56.5 | N/A | -54   |
|           | 1024 QAM Light    | -64.5          | -61.5 | -58.5 | -57   | -55.5 | N/A | -53   |
|           | 2048 QAM          | -62.5          | -59.5 | -55.5 | -54   | -52.5 | N/A | -50.5 |
|           | 4096 QAM          | N/A            | N/A   | -53.5 | -52   | -50   | N/A | N/A   |
| 38 GHz    | QPSK              | -91            | -88.5 | -85.5 | -84   | -82.5 | N/A | -80   |
|           | 16 QAM            | -85            | -82   | -79   | -77.5 | -75.5 | N/A | -73.5 |
|           | 32 QAM            | -81.5          | -78.5 | -75   | -73.5 | -72   | N/A | -70   |
|           | 64 QAM            | -78.5          | -75.5 | -72   | -70.5 | -69   | N/A | -66.5 |
|           | 128 QAM           | -75.5          | -72.5 | -68.5 | -67   | -65.5 | N/A | -63   |
|           | 256 QAM           | -72            | -69   | -65   | -63.5 | -62   | N/A | -59.5 |
|           | 512 QAM           | -68.5          | -65.5 | -61.5 | -60   | -58.5 | N/A | -56   |
|           | 1024 QAM          | -65            | -62   | -59   | -57.5 | -56   | N/A | -53.5 |
|           | 1024 QAM Light    | -64            | -61   | -58   | -56.5 | -55   | N/A | N/A   |
|           | 2048 QAM          | -62            | -59   | -55   | -53.5 | -52   | N/A | N/A   |
|           | 4096 QAM          | N/A            | N/A   | -53   | -51.5 | -49.5 | N/A | N/A   |

| Frequency                      | Modulation Scheme | Bandwidth(MHz)                       |    |    |    |    |    |     |
|--------------------------------|-------------------|--------------------------------------|----|----|----|----|----|-----|
|                                |                   | 7                                    | 14 | 28 | 40 | 56 | 80 | 112 |
| Guaranteed RSL threshold (dBm) |                   | +2 dB from the typical value.        |    |    |    |    |    |     |
| Maximum RSL (dBm)              |                   | QPSK ~ 256 QAM: -20 @ BER <10-6;     |    |    |    |    |    |     |
|                                |                   | 512 QAM ~ 2048 QAM: -23 @ BER <10-6; |    |    |    |    |    |     |
|                                |                   | 4096 QAM: -25 @ BER <10-6;           |    |    |    |    |    |     |

**Note:**

1. HRU3D V2.0/V2.1 is applicable for 11GHz.
2. The 80MHz bandwidth is supported by 5/6/8/11GHz.
3. C01/C02 mode: 5-11GHz up to 2048 QAM @7/14 MHz, up to 4096 QAM @28/40/56/80/112 MHz; 26/32GHz up to 2048 QAM @7/14 MHz, up to 4096 QAM @28/40/56/112MHz; 38GHz up to 2048 QAM @7/14 MHz, up to 4096 QAM @28/40/56, up to 1024QAM @112MHz;
4. L01/L02 mode: 5-32GHz up to 2048 QAM, 38GHz HRU3D up to 1024QAM.
5. ACCP configuration not applicable for C01/C02 mode.

Table 6-64 RSL threshold @ BER=10-6: HRU3D @C02 mode (support ACCP)

| Frequency | Modulation Scheme | Bandwidth(MHz) |         |         |         |          |
|-----------|-------------------|----------------|---------|---------|---------|----------|
|           |                   | 28_ACCP        | 40_ACCP | 56_ACCP | 80_ACCP | 112_ACCP |
| 6 GHz     | QPSK              | -88            | -87.5   | -85.5   | -84     | -83      |
|           | 16 QAM            | -82.5          | -80.5   | -79     | -78     | -76.5    |
|           | 32 QAM            | -79            | -77.5   | -76     | -74.5   | -73.5    |
|           | 64 QAM            | -75.5          | -74     | -72.5   | -70.5   | -69.5    |
|           | 128 QAM           | -72.5          | -71     | -69.5   | -68     | -66.5    |
|           | 256 QAM           | -69            | -67.5   | -66     | -64.5   | -63      |
|           | 512 QAM           | -66.5          | -65.5   | -64     | -62     | -61      |
|           | 1024 QAM          | -63.5          | -62.5   | -61.5   | -59.5   | -58.5    |
|           | 1024 QAM Light    | -63            | -62     | -61     | -59     | -58      |
|           | 2048 QAM          | -60            | -59     | -57.5   | -55.5   | -54.5    |
|           | 4096 QAM          | -57.5          | -56.5   | -54     | -53     | -52      |

| Frequency                      | Modulation Scheme | Bandwidth(MHz)                       |         |         |         |          |
|--------------------------------|-------------------|--------------------------------------|---------|---------|---------|----------|
|                                |                   | 28_ACCP                              | 40_ACCP | 56_ACCP | 80_ACCP | 112_ACCP |
| 8 GHz                          | QPSK              | -88                                  | -87.5   | -85.5   | -84     | -83      |
|                                | 16 QAM            | -82.5                                | -80.5   | -79     | -78     | -76.5    |
|                                | 32 QAM            | -79                                  | -77.5   | -76     | -74.5   | -73.5    |
|                                | 64 QAM            | -75.5                                | -74     | -72.5   | -70.5   | -69.5    |
|                                | 128 QAM           | -72.5                                | -71     | -69.5   | -68     | -66.5    |
|                                | 256 QAM           | -69                                  | -67.5   | -66     | -64.5   | -63      |
|                                | 512 QAM           | -66.5                                | -65.5   | -64     | -62     | -61      |
|                                | 1024 QAM          | -63.5                                | -62.5   | -61.5   | -59.5   | -58.5    |
|                                | 1024 QAM Light    | -63                                  | -62     | -61     | -59     | -58      |
|                                | 2048 QAM          | -60                                  | -59     | -57.5   | -55.5   | -54.5    |
|                                | 4096 QAM          | -57.5                                | -56.5   | -54     | -53     | -52      |
| 11 GHz                         | QPSK              | -87                                  | -86.5   | -84.5   | -83     | -82      |
|                                | 16 QAM            | -81.5                                | -79.5   | -78     | -77     | -75.5    |
|                                | 32 QAM            | -78                                  | -76.5   | -75     | -73.5   | -72.5    |
|                                | 64 QAM            | -74.5                                | -73     | -71.5   | -69.5   | -68.5    |
|                                | 128 QAM           | -71.5                                | -70     | -68.5   | -67     | -65.5    |
|                                | 256 QAM           | -68                                  | -66.5   | -65     | -63.5   | -62      |
|                                | 512 QAM           | -65.5                                | -64.5   | -63     | -61     | -60      |
|                                | 1024 QAM          | -62.5                                | -61.5   | -60.5   | -58.5   | -57.5    |
|                                | 1024 QAM Light    | -62                                  | -61     | -60     | -58     | -57      |
|                                | 2048 QAM          | -59                                  | -58     | -56.5   | -54.5   | -53.5    |
|                                | 4096 QAM          | -56.5                                | -55.5   | -53     | -52     | -51      |
| Guaranteed RSL threshold (dBm) |                   | +2 dB from the typical value.        |         |         |         |          |
| Maximum RSL (dBm)              |                   | QPSK ~ 256 QAM: -20 @ BER <10-6;     |         |         |         |          |
|                                |                   | 512 QAM ~ 2048 QAM: -23 @ BER <10-6; |         |         |         |          |
|                                |                   | 4096 QAM: -25 @ BER <10-6;           |         |         |         |          |

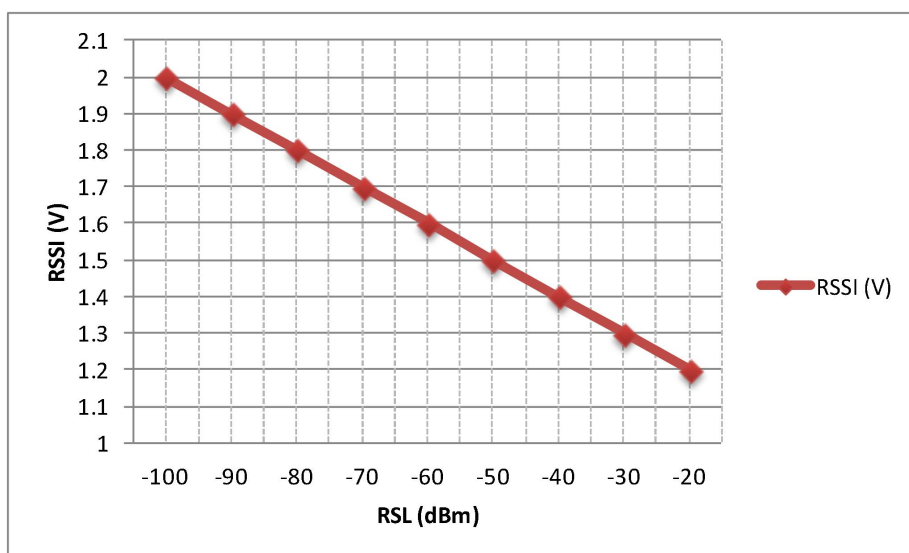
**Note:**

1. Applicable to 1+0/ACAP/ACCP configuration of C02 mode
2. The 6/8/11GHz band has already released the C02 mode that supports ACCP. Other bands will release the C02 mode that supports ACCP in the next version.

### 6.3.2.2 RSSI and RSL

The RSSI (Received Signal Strength Indication) interface allows measuring the RSL with a standard volt-meter through a female BNC connector. The numerical relation between RSL and output voltage @ RSSI interface is shown in following figure.

Fig. 6-1 Numerical relation between RSL and output voltage @ RSSI interface



The tolerance of displayed RSL in LMT/NMS is:

- $-70 \text{ dBm} \leq \text{RSL} \leq -30 \text{ dBm}$ :  $\pm 2 \text{ dB}$  (SRU2/SRU2S/SRU3D),  $\pm 4 \text{ dB}$  (HRU2F V1.0/HRU2F V2.0/HRU3D).
- $-90 \text{ dBm} < \text{RSL} < -70 \text{ dBm}$ ,  $-30 \text{ dBm} < \text{RSL} < -20 \text{ dBm}$ :  $\pm 3 \text{ dB}$  (SRU2/SRU2S/SRU3D),  $\pm 5 \text{ dB}$  (HRU2F V1.0/HRU2F V2.0/HRU3D).

### 6.3.2.3 Frequency Interference Sensitive

NR9150 complies with ETSI EN 302 217-2 standard for the following 3 kinds of frequency interference: co-channel interference, adjacent channel interference and continuous-wave spurious interference.

6.4 System Characteristics

6.4.1 Channel Spacing & Modulation Scheme

NR9150 supports the ACAP, ACCP and CCDP channel allocation of 7 / 14 (13.75) / 28 (27.5) / 40 / 56 (55) / 80 / 112 (110) / 224 MHz channel spacing suggested by the ETSI EN 302 217-2 standard.

NR9150 Provides QPSK/16 QAM/32 QAM/64 QAM/128 QAM/256 QAM/512 QAM/1024 QAM//1024 QAM light/2048 QAM/4096 QAM/8192 QAM/16K QAM modulation/demodulation function.

For different ODU type/frequency band/modem board/radio configuration/radio mode/bandwidth, the supported highest-order modulation scheme are also different.

- ODU type: SRU2, SRU2S, SRU3D, HRU2, HRU2F V1.0, HRU2F V2.0, HRU3D
- ODU frequency band: 5, 6, 7, 8, 10, 11, 13, 15, 18, 23, 26, 28, 32, 38, 42 GHz
- Modem board type: CSA, CSA2, CSA2 v2, CSA4, MD2, MD2 v2, MD4, ME2
- Radio configuration: 1+0, XPIC, MIMO, CA etc.
- Radio mode: G01, C01, L01, G02, C02, L02 mode
- Bandwidth: 7, 14, 28, 40, 56, 80, 112, 224 MHz

The following table shows the highest-order modulation scheme based on different radio configurations, radio modes and bandwidths. The highest-order modulation of different ODU types/frequency bands and different modem boards are not higher than the table below.

Note:

1. The actual occupied bandwidth of radio channel is less than the defined channel spacing.
2. For more the highest-order modulation scheme of 1+0 configurations, refer to note in Chapter 6.

Table 6-65 Highest-order modulation scheme @G01/G02 mode

| Radio Configuration | Highest-order modulation scheme |
|---------------------|---------------------------------|
| 1+0                 | 2048 QAM @ 7/14 MHz             |

| Radio Configuration   | Highest-order modulation scheme                                                              |
|-----------------------|----------------------------------------------------------------------------------------------|
|                       | 16K QAM @ 28/40/56 MHz<br>4096 QAM @ 80/112 MHz<br>1024 QAM @ 224 MHz                        |
| ACCP / XPIC (CCDP)    | 1024 QAM @ 7/14 MHz<br>4096 QAM @ 28/40/56 MHz<br>2048 QAM @ 80/112 MHz<br>512 QAM @ 224 MHz |
| XPIC (CCDP) + ACCP    | 1024 QAM @ 7/14 MHz<br>2048 QAM @ 28/40/56 MHz<br>1024 QAM @ 80/112 MHz<br>512 QAM @ 224 MHz |
| 4*4 MIMO+XPIC         | 2048 QAM @ 28/40/56 MHz<br>1024 QAM @ 112 MHz                                                |
| CA (Within 112M)      | 2048 QAM @ 14 MHz within 112 MHz<br>4096 QAM @ 28/40/56 MHz within 112 MHz                   |
| CA (Within 224M)      | 2048 QAM @ 14/28/40/56 MHz within 224 MHz<br>1024 QAM @ 112 MHz within 224 MHz               |
| CA+XPIC (Within 112M) | 1024 QAM @ 14 MHz within 112 MHz<br>2048 QAM @ 28/40/56 MHz within 112 MHz                   |
| CA+XPIC (Within 224M) | 1024 QAM @ 14/28/40/56 MHz within 224 MHz<br>512 QAM @ 112 MHz within 224 MHz                |

Table 6-66 Highest-order modulation scheme @C01/C02 mode

| Radio Configuration      | Highest-order modulation scheme                                      |
|--------------------------|----------------------------------------------------------------------|
| 1+0                      | 2048 QAM @ 7/14 MHz<br>8192 QAM @ 28/40/56/80/112 MHz                |
| XPIC (CCDP)              | 1024 QAM @ 7/14 MHz<br>2048 QAM @ 28/40/56/80/112 MHz                |
| CA (Within 112MHz)       | 2048 QAM @ 14 MHz within 112 MHz<br>4096 QAM @ 28 MHz within 112 MHz |
| CA+XPIC (Within 112 MHz) | 1024 QAM @ 14 MHz within 112 MHz<br>2048 QAM @ 28 MHz within 112 MHz |
| CA (Within 224 MHz)      | 2048 QAM @ 14/28/40/56 MHz within 224 MHz                            |

| Radio Configuration      | Highest-order modulation scheme           |
|--------------------------|-------------------------------------------|
| CA+XPIC (Within 224 MHz) | 1024 QAM @ 14/28/40/56 MHz within 224 MHz |

Table 6-67 Highest-order modulation scheme @L01/L02 mode

| Radio Configuration   | Highest-order modulation scheme                                               |
|-----------------------|-------------------------------------------------------------------------------|
| 1+0                   | 2048 QAM @ 7/14/28/40/56/80/112 MHz<br>1024 QAM @ 224 MHz                     |
| ACCP / XPIC (CCDP)    | 1024 QAM @ 7/14/28/40/56/80/112 MHz<br>512 QAM @ 224 MHz                      |
| XPIC (CCDP) + ACCP    | 1024 QAM @ 7/14/28/40/56/80/112 MHz<br>512 QAM @ 224 MHz                      |
| CA (Within 112M)      | 1024 QAM @ 14/28/40/56 MHz within 112 MHz                                     |
| CA+XPIC (Within 112M) | 1024 QAM @ 14/28/40/56 MHz within 112 MHz                                     |
| CA (Within 224M)      | 1024 QAM @ 14/28/40/56/112 MHz within 224 MHz                                 |
| CA+XPIC (Within 224M) | 1024 QAM @ 14/28/40/56 MHz within 224 MHz<br>512 QAM @ 112 MHz within 224 MHz |

**Note:**

1. MIMO is not applicable to the L01/L02 mode.

## 6.4.2 System Transmission Capacity

NR9150 supports pure packet and PWE3 TDM service transmission. The transmission capacity depends on the radio modem unit, modulation scheme, and channel bandwidth and frame size.

**Note:**

1. Ethernet throughput is tested according to RFC2544 (frame size: 64 byte ~ 1518 byte) at SISO (Single Input Single Output) mode and frame compression function is disabled.
2. When PLA/MIMO is enabled or the product operates in multi-band scenario, the ETH throughput per channel is not equal to the ETH throughput in this document. For detailed throughput indicators, refer to the "throughput indicator document".
3. The actual throughput of each channel spacing and modulation scheme relates to the average packet size.

4. Ethernet traffic, emulated TDM service and in-band DCN share the radio interface capacity.
5. CSA/CSA2/MD2 boards support G01/C01/L01 and G02/C02/L02 mode, ME2 board support G01 mode, and CSA4/CSA2 v2/MD2 V2/MD4 boards support G02/C02/L02 mode
6. 80MHz bandwidth is supported by 6/11GHz SRU2, 6/8/11GHz SRU3D/HRU2F V2.0, and 5/6/8/11 GHz HRU3D.
7. ME2 with SRU3D (15/18/23 GHz)/HRU2 (15/18 GHz) Supports 224 MHz Bandwidth @G01/L01/G02/L02 mode (ME2 with SRU3D (15/18/23 GHz) @ G01 mode has been released only).
8. 16K QAM modulation is supported by CSA2/CSA2 v2/CSA4/MD2/MD2 V2/MD4 with SRU3D V1.1.
9. ACCP configuration not applicable for C01 mode

Table 6-68 Typical system transmission capacity per carrier @G01/G02 mode

| Channel Spacing (MHz) | Modulation     | Radio Interface Capacity (Mbps) | L1 Ethernet Throughput (Mbps) |
|-----------------------|----------------|---------------------------------|-------------------------------|
| 7M                    | QPSK           | 9                               | 9~12                          |
|                       | 16 QAM         | 19                              | 19~25                         |
|                       | 32 QAM         | 24                              | 24~31                         |
|                       | 64 QAM         | 30                              | 31~39                         |
|                       | 128 QAM        | 36                              | 37~47                         |
|                       | 256 QAM        | 41                              | 42~53                         |
|                       | 512 QAM        | 46                              | 47~60                         |
|                       | 1024 QAM       | 47                              | 48~61                         |
|                       | 1024 QAM Light | 49                              | 49~63                         |
|                       | 2048 QAM       | 50                              | 51~65                         |
| 14M                   | QPSK           | 19                              | 19~24                         |
|                       | 16 QAM         | 40                              | 40~51                         |
|                       | 32 QAM         | 50                              | 50~65                         |
|                       | 64 QAM         | 63                              | 64~82                         |
|                       | 128 QAM        | 75                              | 76~97                         |
|                       | 256 QAM        | 86                              | 87~111                        |

| Channel Spacing<br>(MHz) | Modulation        | Radio Interface<br>Capacity (Mbps) | L1 Ethernet Throughput<br>(Mbps) |
|--------------------------|-------------------|------------------------------------|----------------------------------|
|                          | 512 QAM           | 97                                 | 98~126                           |
|                          | 1024 QAM          | 99                                 | 101~129                          |
|                          | 1024 QAM<br>Light | 103                                | 105~134                          |
|                          | 2048 QAM          | 111                                | 112~143                          |
| 28M                      | QPSK              | 41                                 | 41~53                            |
|                          | 16 QAM            | 83                                 | 84~108                           |
|                          | 32 QAM            | 108                                | 109~139                          |
|                          | 64 QAM            | 134                                | 135~173                          |
|                          | 128 QAM           | 157                                | 159~204                          |
|                          | 256 QAM           | 181                                | 183~234                          |
|                          | 512 QAM           | 204                                | 206~263                          |
|                          | 1024 QAM          | 209                                | 212~270                          |
|                          | 1024 QAM<br>Light | 219                                | 221~283                          |
|                          | 2048 QAM          | 236                                | 239~305                          |
|                          | 4096 QAM          | 246                                | 249~318                          |
|                          | 8192 QAM          | 254                                | 257~328                          |
|                          | 16K QAM           | 277                                | 280~358                          |
| 40M                      | QPSK              | 56                                 | 57~73                            |
|                          | 16 QAM            | 114                                | 115~147                          |
|                          | 32 QAM            | 147                                | 149~190                          |
|                          | 64 QAM            | 181                                | 183~234                          |
|                          | 128 QAM           | 215                                | 218~279                          |
|                          | 256 QAM           | 248                                | 251~320                          |
|                          | 512 QAM           | 267                                | 271~346                          |
|                          | 1024 QAM          | 292                                | 295~377                          |
|                          | 1024 QAM<br>Light | 304                                | 308~394                          |
|                          | 2048 QAM          | 320                                | 324~413                          |
|                          | 4096 QAM          | 331                                | 335~428                          |

| Channel Spacing<br>(MHz) | Modulation        | Radio Interface<br>Capacity (Mbps) | L1 Ethernet Throughput<br>(Mbps) |
|--------------------------|-------------------|------------------------------------|----------------------------------|
|                          | 8192 QAM          | 364                                | 368~470                          |
|                          | 16K QAM           | 397                                | 402~513                          |
| 56M                      | QPSK              | 83                                 | 84~107                           |
|                          | 16 QAM            | 170                                | 172~219                          |
|                          | 32 QAM            | 212                                | 215~274                          |
|                          | 64 QAM            | 271                                | 275~351                          |
|                          | 128 QAM           | 319                                | 323~413                          |
|                          | 256 QAM           | 366                                | 371~473                          |
|                          | 512 QAM           | 395                                | 400~510                          |
|                          | 1024 QAM          | 430                                | 435~555                          |
|                          | 1024 QAM<br>Light | 438                                | 444~567                          |
|                          | 2048 QAM          | 481                                | 487~622                          |
|                          | 4096 QAM          | 512                                | 519~662                          |
|                          | 8192 QAM          | 523                                | 529~675                          |
|                          | 16K QAM           | 569                                | 576~736                          |
| 80M                      | QPSK              | 120                                | 122~155                          |
|                          | 16 QAM            | 245                                | 248~316                          |
|                          | 32 QAM            | 306                                | 310~395                          |
|                          | 64 QAM            | 391                                | 396~506                          |
|                          | 128 QAM           | 460                                | 466~595                          |
|                          | 256 QAM           | 528                                | 534~682                          |
|                          | 512 QAM           | 569                                | 576~736                          |
|                          | 1024 QAM          | 619                                | 627~800                          |
|                          | 1024 QAM<br>Light | 632                                | 640~817                          |
|                          | 2048 QAM          | 694                                | 702~896                          |
|                          | 4096 QAM          | 738                                | 748~954                          |
| 112M                     | QPSK              | 169                                | 171~218                          |
|                          | 16 QAM            | 340                                | 344~439                          |
|                          | 32 QAM            | 426                                | 431~550                          |

| Channel Spacing (MHz) | Modulation     | Radio Interface Capacity (Mbps) | L1 Ethernet Throughput (Mbps) |
|-----------------------|----------------|---------------------------------|-------------------------------|
|                       | 64 QAM         | 543                             | 550~702                       |
|                       | 128 QAM        | 639                             | 647~826                       |
|                       | 256 QAM        | 736                             | 746~952                       |
|                       | 512 QAM        | 832                             | 842~1075                      |
|                       | 1024 QAM       | 878                             | 889~1135                      |
|                       | 1024 QAM Light | 886                             | 897~1145                      |
|                       | 2048 QAM       | 957                             | 969~1237                      |
|                       | 4096 QAM       | 965                             | 977~1247                      |
| 224M                  | QPSK           | 338                             | 340~389                       |
|                       | 16 QAM         | 680                             | 685~782                       |
|                       | 32 QAM         | 852                             | 858~979                       |
|                       | 64 QAM         | 1087                            | 1095~1250                     |
|                       | 128 QAM        | 1278                            | 1287~1468                     |
|                       | 256 QAM        | 1473                            | 1484~1693                     |
|                       | 512 QAM        | 1664                            | 1676~1909                     |
|                       | 1024 QAM       | 1757                            | 1769~2019                     |

**Note:**

- The 224MHz bandwidth is supported by ME2@G01 mode, and the 224MHz bandwidth @G02 mode will be released in future versions.

Table 6-69 Typical system transmission capacity per carrier @C01 mode

| Channel Spacing (MHz) | Modulation | Radio Interface Capacity (Mbps) | L1 Ethernet Throughput (Mbps) |
|-----------------------|------------|---------------------------------|-------------------------------|
| 7M                    | QPSK       | 9                               | 9~12                          |
|                       | 16QAM      | 19                              | 20~25                         |
|                       | 32QAM      | 24                              | 24~31                         |
|                       | 64QAM      | 31                              | 31~40                         |
|                       | 128QAM     | 37                              | 37~48                         |
|                       | 256QAM     | 42                              | 42~54                         |

| Channel Spacing<br>(MHz) | Modulation    | Radio Interface<br>Capacity (Mbps) | L1 Ethernet<br>Throughput (Mbps) |
|--------------------------|---------------|------------------------------------|----------------------------------|
|                          | 512QAM        | 48                                 | 48~62                            |
|                          | 1024QAM       | 53                                 | 54~69                            |
|                          | 1024QAM Light | 55                                 | 56~71                            |
|                          | 2048QAM       | 59                                 | 60~77                            |
| 14M                      | QPSK          | 20                                 | 20~25                            |
|                          | 16QAM         | 40                                 | 41~52                            |
|                          | 32QAM         | 49                                 | 49~63                            |
|                          | 64QAM         | 64                                 | 64~82                            |
|                          | 128QAM        | 75                                 | 76~97                            |
|                          | 256QAM        | 87                                 | 88~112                           |
|                          | 512QAM        | 97                                 | 98~126                           |
|                          | 1024QAM       | 109                                | 110~141                          |
|                          | 1024QAM Light | 112                                | 113~145                          |
|                          | 2048QAM       | 120                                | 122~156                          |
| 28M                      | QPSK          | 44                                 | 45~58                            |
|                          | 16QAM         | 90                                 | 92~117                           |
|                          | 32QAM         | 113                                | 115~146                          |
|                          | 64QAM         | 144                                | 145~186                          |
|                          | 128QAM        | 169                                | 171~218                          |
|                          | 256QAM        | 194                                | 196~251                          |
|                          | 512QAM        | 219                                | 222~283                          |
|                          | 1024QAM       | 238                                | 241~307                          |
|                          | 1024QAM Light | 244                                | 247~316                          |
|                          | 2048QAM       | 269                                | 273~348                          |
|                          | 4096QAM       | 274                                | 278~355                          |
| 40M                      | QPSK          | 62                                 | 63~80                            |
|                          | 16QAM         | 130                                | 131~168                          |
|                          | 32QAM         | 157                                | 159~203                          |
|                          | 64QAM         | 201                                | 204~261                          |
|                          | 128QAM        | 237                                | 240~306                          |
|                          | 256QAM        | 273                                | 277~353                          |

| Channel Spacing (MHz) | Modulation    | Radio Interface Capacity (Mbps) | L1 Ethernet Throughput (Mbps) |
|-----------------------|---------------|---------------------------------|-------------------------------|
|                       | 512QAM        | 309                             | 313~399                       |
|                       | 1024QAM       | 340                             | 345~440                       |
|                       | 1024QAM Light | 345                             | 350~446                       |
|                       | 2048QAM       | 381                             | 386~492                       |
|                       | 4096QAM       | 393                             | 398~508                       |
| 56M                   | QPSK          | 90                              | 91~116                        |
|                       | 16QAM         | 182                             | 184~235                       |
|                       | 32QAM         | 227                             | 230~294                       |
|                       | 64QAM         | 288                             | 292~373                       |
|                       | 128QAM        | 338                             | 342~437                       |
|                       | 256QAM        | 389                             | 394~503                       |
|                       | 512QAM        | 439                             | 444~567                       |
|                       | 1024QAM       | 476                             | 482~616                       |
|                       | 1024QAM Light | 490                             | 496~633                       |
|                       | 2048QAM       | 539                             | 546~697                       |
|                       | 4096QAM       | 550                             | 556~710                       |
| 80M                   | QPSK          | 129                             | 131~167                       |
|                       | 16QAM         | 261                             | 264~337                       |
|                       | 32QAM         | 326                             | 330~421                       |
|                       | 64QAM         | 413                             | 418~534                       |
|                       | 128QAM        | 484                             | 490~626                       |
|                       | 256QAM        | 557                             | 564~720                       |
|                       | 512QAM        | 628                             | 636~812                       |
|                       | 1024QAM       | 682                             | 691~881                       |
|                       | 1024QAM Light | 701                             | 710~906                       |
|                       | 2048QAM       | 772                             | 782~998                       |
|                       | 4096QAM       | 787                             | 797~1017                      |
| 112M                  | QPSK          | 176                             | 178~228                       |
|                       | 16QAM         | 354                             | 359~458                       |
|                       | 32QAM         | 444                             | 449~574                       |
|                       | 64QAM         | 561                             | 568~725                       |

| Channel Spacing (MHz) | Modulation    | Radio Interface Capacity (Mbps) | L1 Ethernet Throughput (Mbps) |
|-----------------------|---------------|---------------------------------|-------------------------------|
|                       | 128QAM        | 659                             | 667~852                       |
|                       | 256QAM        | 757                             | 766~978                       |
|                       | 512QAM        | 851                             | 862~1100                      |
|                       | 1024QAM       | 918                             | 930~1187                      |
|                       | 1024QAM Light | 943                             | 955~1219                      |
|                       | 2048QAM       | 1040                            | 1053~1345                     |
|                       | 4096QAM       | 1062                            | 1075~1372                     |

Table 6-70 Typical system transmission capacity per carrier @C02 mode

| Channel Spacing (MHz) | Modulation    | Radio Interface Capacity (Mbps) | L1 Ethernet Throughput (Mbps) |
|-----------------------|---------------|---------------------------------|-------------------------------|
| 7M                    | QPSK          | 9                               | 9~12                          |
|                       | 16QAM         | 19                              | 20~25                         |
|                       | 32QAM         | 24                              | 24~31                         |
|                       | 64QAM         | 31                              | 31~40                         |
|                       | 128QAM        | 37                              | 37~48                         |
|                       | 256QAM        | 42                              | 42~54                         |
|                       | 512QAM        | 48                              | 48~62                         |
|                       | 1024QAM       | 53                              | 54~69                         |
|                       | 1024QAM Light | 55                              | 56~71                         |
|                       | 2048QAM       | 59                              | 60~77                         |
| 14M                   | QPSK          | 20                              | 20~25                         |
|                       | 16QAM         | 40                              | 41~52                         |
|                       | 32QAM         | 49                              | 49~63                         |
|                       | 64QAM         | 64                              | 64~82                         |
|                       | 128QAM        | 75                              | 76~97                         |
|                       | 256QAM        | 87                              | 88~112                        |
|                       | 512QAM        | 97                              | 98~126                        |
|                       | 1024QAM       | 109                             | 110~141                       |
|                       | 1024QAM Light | 112                             | 113~145                       |
|                       | 2048QAM       | 120                             | 122~156                       |

| Channel Spacing (MHz) | Modulation    | Radio Interface Capacity (Mbps) | L1 Ethernet Throughput (Mbps) |
|-----------------------|---------------|---------------------------------|-------------------------------|
| 28M                   | QPSK          | 44                              | 45~58                         |
|                       | 16QAM         | 90                              | 92~117                        |
|                       | 32QAM         | 113                             | 115~146                       |
|                       | 64QAM         | 144                             | 145~186                       |
|                       | 128QAM        | 169                             | 171~218                       |
|                       | 256QAM        | 194                             | 196~251                       |
|                       | 512QAM        | 219                             | 222~283                       |
|                       | 1024QAM       | 238                             | 241~307                       |
|                       | 1024QAM Light | 244                             | 247~316                       |
|                       | 2048QAM       | 269                             | 273~348                       |
|                       | 4096QAM       | 274                             | 278~355                       |
|                       | 8192QAM       | 304                             | 308~394                       |
| 40M                   | QPSK          | 62                              | 63~80                         |
|                       | 16QAM         | 130                             | 131~168                       |
|                       | 32QAM         | 157                             | 159~203                       |
|                       | 64QAM         | 201                             | 204~261                       |
|                       | 128QAM        | 237                             | 240~306                       |
|                       | 256QAM        | 273                             | 277~353                       |
|                       | 512QAM        | 309                             | 313~399                       |
|                       | 1024QAM       | 340                             | 345~440                       |
|                       | 1024QAM Light | 345                             | 350~446                       |
|                       | 2048QAM       | 381                             | 386~492                       |
|                       | 4096QAM       | 393                             | 398~508                       |
|                       | 8192QAM       | 429                             | 434~555                       |
| 56M                   | QPSK          | 90                              | 91~116                        |
|                       | 16QAM         | 182                             | 184~235                       |
|                       | 32QAM         | 227                             | 230~294                       |
|                       | 64QAM         | 288                             | 292~373                       |
|                       | 128QAM        | 338                             | 342~437                       |
|                       | 256QAM        | 389                             | 394~503                       |
|                       | 512QAM        | 439                             | 444~567                       |

| Channel Spacing<br>(MHz) | Modulation    | Radio Interface<br>Capacity (Mbps) | L1 Ethernet<br>Throughput (Mbps) |
|--------------------------|---------------|------------------------------------|----------------------------------|
|                          | 1024QAM       | 476                                | 482~616                          |
|                          | 1024QAM Light | 490                                | 496~633                          |
|                          | 2048QAM       | 539                                | 546~697                          |
|                          | 4096QAM       | 550                                | 556~710                          |
|                          | 8192QAM       | 621                                | 628~802                          |
| 80M                      | QPSK          | 129                                | 131~167                          |
|                          | 16QAM         | 261                                | 264~337                          |
|                          | 32QAM         | 326                                | 330~421                          |
|                          | 64QAM         | 413                                | 418~534                          |
|                          | 128QAM        | 484                                | 490~626                          |
|                          | 256QAM        | 557                                | 564~720                          |
|                          | 512QAM        | 628                                | 636~812                          |
|                          | 1024QAM       | 682                                | 691~881                          |
|                          | 1024QAM Light | 701                                | 710~906                          |
|                          | 2048QAM       | 772                                | 782~998                          |
|                          | 4096QAM       | 787                                | 797~1017                         |
| 112M                     | QPSK          | 176                                | 178~227                          |
|                          | 16QAM         | 354                                | 359~458                          |
|                          | 32QAM         | 444                                | 449~574                          |
|                          | 64QAM         | 549                                | 556~709                          |
|                          | 128QAM        | 645                                | 653~834                          |
|                          | 256QAM        | 744                                | 753~961                          |
|                          | 512QAM        | 838                                | 849~1083                         |
|                          | 1024QAM       | 903                                | 914~1167                         |
|                          | 1024QAM Light | 915                                | 927~1183                         |
|                          | 2048QAM       | 1010                               | 1022~1305                        |
|                          | 4096QAM       | 1037                               | 1050~1341                        |
| 28M_ACCP                 | QPSK          | 44                                 | 45~58                            |
|                          | 16QAM         | 90                                 | 91~117                           |
|                          | 32QAM         | 113                                | 114~146                          |
|                          | 64QAM         | 143                                | 145~186                          |

| Channel Spacing (MHz) | Modulation    | Radio Interface Capacity (Mbps) | L1 Ethernet Throughput (Mbps) |
|-----------------------|---------------|---------------------------------|-------------------------------|
|                       | 128QAM        | 168                             | 170~218                       |
|                       | 256QAM        | 191                             | 194~247                       |
|                       | 512QAM        | 213                             | 216~275                       |
|                       | 1024QAM       | 232                             | 234~299                       |
|                       | 1024QAM Light | 235                             | 238~303                       |
|                       | 2048QAM       | 258                             | 262~334                       |
|                       | 4096QAM       | 268                             | 272~347                       |
| 40M_ACCP              | QPSK          | 64                              | 65~83                         |
|                       | 16QAM         | 134                             | 136~173                       |
|                       | 32QAM         | 168                             | 170~217                       |
|                       | 64QAM         | 206                             | 209~266                       |
|                       | 128QAM        | 241                             | 244~312                       |
|                       | 256QAM        | 278                             | 281~359                       |
|                       | 512QAM        | 304                             | 308~393                       |
|                       | 1024QAM       | 332                             | 336~429                       |
|                       | 1024QAM Light | 337                             | 341~435                       |
|                       | 2048QAM       | 371                             | 376~480                       |
|                       | 4096QAM       | 387                             | 392~500                       |
| 56M_ACCP              | QPSK          | 93                              | 94~120                        |
|                       | 16QAM         | 187                             | 189~242                       |
|                       | 32QAM         | 234                             | 237~302                       |
|                       | 64QAM         | 289                             | 292~373                       |
|                       | 128QAM        | 338                             | 343~437                       |
|                       | 256QAM        | 386                             | 391~499                       |
|                       | 512QAM        | 430                             | 435~556                       |
|                       | 1024QAM       | 470                             | 476~607                       |
|                       | 1024QAM Light | 477                             | 483~616                       |
|                       | 2048QAM       | 518                             | 525~670                       |
|                       | 4096QAM       | 552                             | 559~714                       |
| 80M_ACCP              | QPSK          | 128                             | 130~166                       |
|                       | 16QAM         | 259                             | 262~335                       |

| Channel Spacing (MHz) | Modulation    | Radio Interface Capacity (Mbps) | L1 Ethernet Throughput (Mbps) |
|-----------------------|---------------|---------------------------------|-------------------------------|
|                       | 32QAM         | 324                             | 328~418                       |
|                       | 64QAM         | 411                             | 416~531                       |
|                       | 128QAM        | 481                             | 487~622                       |
|                       | 256QAM        | 553                             | 560~715                       |
|                       | 512QAM        | 623                             | 631~805                       |
|                       | 1024QAM       | 669                             | 677~864                       |
|                       | 1024QAM Light | 678                             | 687~877                       |
|                       | 2048QAM       | 756                             | 766~977                       |
|                       | 4096QAM       | 790                             | 800~1021                      |
|                       |               |                                 |                               |
| 112M_ACCP             | QPSK          | 180                             | 182~233                       |
|                       | 16QAM         | 363                             | 367~469                       |
|                       | 32QAM         | 453                             | 459~586                       |
|                       | 64QAM         | 574                             | 581~742                       |
|                       | 128QAM        | 673                             | 682~870                       |
|                       | 256QAM        | 768                             | 778~993                       |
|                       | 512QAM        | 852                             | 862~1101                      |
|                       | 1024QAM       | 933                             | 945~1206                      |
|                       | 1024QAM Light | 946                             | 958~1223                      |
|                       | 2048QAM       | 1029                            | 1042~1330                     |
|                       | 4096QAM       | 1079                            | 1092~1394                     |
|                       |               |                                 |                               |

**Note:**

- 8k QAM modulation is supported by 15/23GHz SRU3D.

Table 6-71 Typical system transmission capacity per carrier @L01/L02 mode

| Channel Spacing (MHz) | Modulation | Radio Interface Capacity (Mbps) | L1 Ethernet Throughput (Mbps) |
|-----------------------|------------|---------------------------------|-------------------------------|
| 7M                    | QPSK       | 9                               | 9~11                          |
|                       | 16 QAM     | 19                              | 19~24                         |
|                       | 32 QAM     | 24                              | 24~31                         |
|                       | 64 QAM     | 30                              | 30~39                         |

| Channel Spacing (MHz) | Modulation     | Radio Interface Capacity (Mbps) | L1 Ethernet Throughput (Mbps) |
|-----------------------|----------------|---------------------------------|-------------------------------|
|                       | 128 QAM        | 35                              | 36~46                         |
|                       | 256 QAM        | 40                              | 41~52                         |
|                       | 512 QAM        | 45                              | 46~59                         |
|                       | 1024 QAM       | 46                              | 46~59                         |
|                       | 1024 QAM Light | 48                              | 49~62                         |
|                       | 2048 QAM       | 49                              | 49~63                         |
| 14M                   | QPSK           | 19                              | 19~24                         |
|                       | 16 QAM         | 39                              | 40~51                         |
|                       | 32 QAM         | 49                              | 50~64                         |
|                       | 64 QAM         | 62                              | 63~81                         |
|                       | 128 QAM        | 75                              | 76~97                         |
|                       | 256 QAM        | 85                              | 86~110                        |
|                       | 512 QAM        | 96                              | 97~124                        |
|                       | 1024 QAM       | 97                              | 98~126                        |
|                       | 1024 QAM Light | 101                             | 102~131                       |
|                       | 2048 QAM       | 110                             | 111~142                       |
| 28M                   | QPSK           | 41                              | 41~53                         |
|                       | 16 QAM         | 83                              | 84~107                        |
|                       | 32 QAM         | 107                             | 108~138                       |
|                       | 64 QAM         | 133                             | 134~171                       |
|                       | 128 QAM        | 156                             | 158~202                       |
|                       | 256 QAM        | 180                             | 183~233                       |
|                       | 512 QAM        | 202                             | 204~261                       |
|                       | 1024 QAM       | 207                             | 210~268                       |
|                       | 1024 QAM Light | 216                             | 218~279                       |
|                       | 2048 QAM       | 232                             | 235~300                       |
| 40M                   | QPSK           | 56                              | 56~72                         |
|                       | 16 QAM         | 112                             | 114~145                       |
|                       | 32 QAM         | 145                             | 147~188                       |
|                       | 64 QAM         | 179                             | 181~231                       |
|                       | 128 QAM        | 213                             | 215~275                       |

| Channel Spacing<br>(MHz) | Modulation     | Radio Interface<br>Capacity (Mbps) | L1 Ethernet<br>Throughput (Mbps) |
|--------------------------|----------------|------------------------------------|----------------------------------|
|                          | 256 QAM        | 246                                | 249~318                          |
|                          | 512 QAM        | 265                                | 268~342                          |
|                          | 1024 QAM       | 286                                | 290~370                          |
|                          | 1024 QAM Light | 298                                | 301~385                          |
|                          | 2048 QAM       | 312                                | 316~404                          |
| 56M                      | QPSK           | 82                                 | 83~107                           |
|                          | 16 QAM         | 168                                | 170~217                          |
|                          | 32 QAM         | 210                                | 212~271                          |
|                          | 64 QAM         | 269                                | 272~347                          |
|                          | 128 QAM        | 317                                | 321~410                          |
|                          | 256 QAM        | 364                                | 369~471                          |
|                          | 512 QAM        | 392                                | 397~506                          |
|                          | 1024 QAM       | 426                                | 432~551                          |
|                          | 1024 QAM Light | 433                                | 438~559                          |
|                          | 2048 QAM       | 476                                | 482~616                          |
| 80M                      | QPSK           | 119                                | 121~154                          |
|                          | 16 QAM         | 242                                | 245~313                          |
|                          | 32 QAM         | 303                                | 306~391                          |
|                          | 64 QAM         | 387                                | 392~501                          |
|                          | 128 QAM        | 457                                | 463~591                          |
|                          | 256 QAM        | 525                                | 532~679                          |
|                          | 512 QAM        | 565                                | 572~730                          |
|                          | 1024 QAM       | 614                                | 622~794                          |
|                          | 1024 QAM Light | 624                                | 631~806                          |
|                          | 2048 QAM       | 687                                | 695~887                          |
| 112M                     | QPSK           | 168                                | 170~217                          |
|                          | 16 QAM         | 336                                | 340~435                          |
|                          | 32 QAM         | 420                                | 425~543                          |
|                          | 64 QAM         | 538                                | 545~695                          |
|                          | 128 QAM        | 634                                | 642~820                          |
|                          | 256 QAM        | 733                                | 742~947                          |

| Channel Spacing (MHz) | Modulation     | Radio Interface Capacity (Mbps) | L1 Ethernet Throughput (Mbps) |
|-----------------------|----------------|---------------------------------|-------------------------------|
|                       | 512 QAM        | 826                             | 836~1067                      |
|                       | 1024 QAM       | 861                             | 872~1113                      |
|                       | 1024 QAM Light | 874                             | 885~1130                      |
|                       | 2048 QAM       | 941                             | 953~1216                      |

**Note:**

- The 224MHz bandwidth is supported by ME2 with 15/18/23 GHz SRU3D, and the 224MHz bandwidth will be released in future versions.

## 6.5 Clock and Synchronization

NR9150 supports clock in/out and network synchronization functions, which meets the clock synchronization requirements of the communication network. This functionality has the following features:

Table 6-72 Synchronization features

| Item                                 | Description                                                              |                                                                                                                                                |
|--------------------------------------|--------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Clock Types                          | 1588v2, Sync. E, Sync from/over TDM.                                     |                                                                                                                                                |
| Standard Reference                   | SDH                                                                      | ITU-T G.813,                                                                                                                                   |
|                                      | SyncE                                                                    | ITU-T G.8261, ITU-T G.8262, ITU-T G.8264, ITU-T G.8260                                                                                         |
|                                      | PEC Phase/Time                                                           | ITU-TG.8271, ITU-TG.8271.1, ITU-TG.8271.2, ITU-TG.8273.2, ITU-TG.8273.3, ITU-TG.8273.4, ITU-TG.8273.2, ITU-TG.8275, ITU-TG.8275.1, ITU-TG.8260 |
| Time Source Selection and Protection | SSM/eSSM, BMC algorithm and priority-based multi clock source selection. |                                                                                                                                                |
| Working Mode                         | Lock, free run, and holdover.                                            |                                                                                                                                                |
| Time synchronization precision       | Class C                                                                  |                                                                                                                                                |

## 7 Abbreviations

| Abbreviation | Full Name                                  |
|--------------|--------------------------------------------|
| A            |                                            |
| ACAP         | Adjacent Channel Alternate-Polarized       |
| ACCP         | Adjacent Channel Co-Polarized              |
| ACM          | Adaptive Coding and Modulation             |
| ADM          | Add-Drop MUX                               |
| ARP          | Address Resolution Protocol                |
| B            |                                            |
| BC           | Boundary Clock                             |
| BER          | Bit Error Rate                             |
| BFD          | Bidirectional Forwarding Detection         |
| BITS         | Building Integrated Timing (Supply) System |
| BLER         | Block Error Ratio                          |
| BTS          | 2G base station                            |
| C            |                                            |
| CA           | Carrier Aggregation                        |
| CAR          | Committed Access Rate                      |
| CBS          | Committed Burst Size                       |
| CCDP         | Co-Channel Dual-Polarization               |
| Ch.STM-1     | Channelized STM-1                          |
| CIR          | Committed Information Rate                 |
| CS           | Channel Spacing                            |
| CSA          | Core Switch A                              |
| D            |                                            |
| DEM          | Demodulator                                |
| DEMUX        | Demultiplexer                              |
| DSCP         | Differentiated Services Code Point         |
| DWRR         | Deficit Weighted Round-Robin               |
| DXC          | Digital Cross Connect                      |
| E            |                                            |
| EDI          | External Data Interface                    |

| Abbreviation | Full Name                                        |
|--------------|--------------------------------------------------|
| ELPS         | Ethernet Linear Protection Switching             |
| EMBL         | Enhanced Multi-band Link                         |
| EMC          | Electro Magnetic Compatibility                   |
| EMS          | Element Management System                        |
| ERPS         | Ethernet Ring Protection Switching               |
| ETSI         | European Telecommunications Standards Institute  |
| EVC          | Ethernet Virtual Connection                      |
| F            |                                                  |
| FA           | Fun Unit A                                       |
| FD           | Frequency Diversity                              |
| FE           | Fast Ethernet                                    |
| FEC          | Forward Error Correction                         |
| FRR          | Fast Reroute                                     |
| FTP          | File Transfer Protocol                           |
| G            |                                                  |
| GE           | Gigabit Ethernet                                 |
| H            |                                                  |
| HQoS         | Hierarchical Quality of Service                  |
| HSB          | Hot Standby                                      |
| I            |                                                  |
| ICMP         | Internet Control Message Protocol                |
| IEC          | International Electro Technical Commission       |
| IDU          | Indoor Unit                                      |
| IF           | Intermediate Frequency                           |
| IS-IS        | Intermediate System-to-Intermediate System       |
| ITU          | International Telecommunication Union            |
| ITU-R        | Radio Standardization Sector of ITU              |
| ITU-T        | Telecommunication Standardization Sector of ITU  |
| IVL          | Independent Vlan Learning                        |
| IWF          | Inter-working Function of TDM to Ethernet frames |
| L            |                                                  |

| Abbreviation | Full Name                                                        |
|--------------|------------------------------------------------------------------|
| LAG          | Link Aggregation                                                 |
| LACP         | Link Aggregation Control Protocol                                |
| LDPC         | Low-Density Parity-Checked                                       |
| M            |                                                                  |
| MBL          | Multi-band Link                                                  |
| MD           | Modem Unit D                                                     |
| MDI/MDI-X    | Media Dependent Interface/ Medium Dependent Interface Cross-over |
| MEF          | Metro Ethernet Forum                                             |
| MEN          | Metro Ethernet Network                                           |
| MIMO         | Multiple Input Multiple Output                                   |
| MPLS         | Multi Protocol Label Switching                                   |
| MSP          | Multiplex Section Protection                                     |
| MTBF         | Mean Time Between Failure                                        |
| MUX          | Multiplexing                                                     |
| N            |                                                                  |
| NE           | Network Element                                                  |
| NMS          | Network Management System                                        |
| NNI          | Network Node Interface                                           |
| Node B       | 3G base station                                                  |
| O            |                                                                  |
| OAM          | Operation Administration and Maintenance                         |
| OC           | Ordinary Clock                                                   |
| ODU          | Outdoor Unit                                                     |
| OMT          | Orthogonal Mode Transducer                                       |
| OSPF         | Open Shortest Path First                                         |
| P            |                                                                  |
| PBS          | Peak Burst Size                                                  |
| PIR          | Peak Information Rate                                            |
| PSN          | Packet Switch Network                                            |
| PTP          | Precision Time Protocol                                          |
| Q            |                                                                  |

| Abbreviation | Full Name                               |
|--------------|-----------------------------------------|
| QAM          | Quadrature Amplitude Modulation         |
| QoS          | Quality of Service                      |
| QPSK         | Quadrature Phase Shift Keying           |
| R            |                                         |
| RBER         | Residual Bit Error Ratio                |
| RCU          | Radio Core Unit                         |
| RED          | Random Early Detection                  |
| RF           | Radio Frequency                         |
| RSL          | Receiver threshold                      |
| RS           | Reed-Solomon                            |
| RSTP         | Rapid Spanning Tree Protocol            |
| RSSI         | Received Signal Strength Indication     |
| RTU          | Radio Traffic Unit                      |
| Rx           | Receiver                                |
| S            |                                         |
| SD           | Space Diversity                         |
| SFP          | Small Form-factor Pluggable transceiver |
| SNMP         | Simple Network Management Protocol      |
| SP           | Strict Priority                         |
| SSM          | Synchronization Status Message          |
| SVL          | Shared VLAN Learning                    |
| Sync         | Synchronization                         |
| Sync. E      | Synchronization Ethernet                |
| T            |                                         |
| TBD          | To Be Defined                           |
| TC           | Transparent Clock                       |
| TCP          | Transmission Control Protocol           |
| TDM          | Time-Division Multiplexing              |
| ToD          | Time of Day                             |
| ToS          | Type of Service                         |
| Tx           | Transmitter                             |

| Abbreviation | Full Name                                     |
|--------------|-----------------------------------------------|
| U            |                                               |
| UDP          | User Datagram Protocol                        |
| UNI          | User Network Interface                        |
| USB          | Universal Serial Bus                          |
| V            |                                               |
| VLAN         | Virtual Local Area Network                    |
| X            |                                               |
| XPD          | Cross Polarization Discrimination             |
| XPIC         | Cross-Polarization Interference Counter actor |