



CERTIFICATION TEST REPORT

Report Number. : 4790632108-E8V3

Applicant : SAMSUNG ELECTRONICS CO., LTD.
129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI,
GYEONGGI-DO, 16677, KOREA

Model : SM-A546U, SM-A546U1, SM-S546VL

FCC ID : A3LSMA546U

EUT Description : GSM/WCDMA/LTE 5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax
and NFC

Test Standard(s) : FCC CFR47 PART 96

Date Of Issue:

2023-01-30

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Revision History

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SAMSUNG ELECTRONICS CO., LTD.

EUT DESCRIPTION: GSM/WCDMA/LTE/5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax and NFC.

MODEL NUMBER: SM-A546U, SM-A546U1, SM-S546VL

SERIAL NUMBER: R3CTB0J1HXN, R3CTB0J1CRY (CONDUTED, Original);
R3CTB0J1LBY, R3CTB0J1E2N (RADIATED, Original);
R3CTB0F5QVZ (RADIATED, Spot-Check);

DATE TESTED: 2022-11-01 - 2023-01-17(Original);
2023-01-02 – 2023-01-20 (Spot-Check);

| APPLICABLE STANDARDS | |
|----------------------|--------------|
| STANDARD | TEST RESULTS |
| FCC PART 96 | Complies |

UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Korea, Ltd. By:

Tested By:



Seokhwan Hong
Suwon Lab Engineer
UL Korea, Ltd.

Yeonhee Lim
Suwon Lab Engineer
UL Korea, Ltd.

1.1. INTRODUCTION OF TEST DATA REUSE

This report referenced from the FCC ID: A3LSMA546V WWAN mode.
 And the applicant takes full responsibility that the test data as referenced in this report represent compliance for this FCC ID.

1.2. DIFFERENCE

The A3LSMA546U model shares the same enclosure and circuit board as A3LSMA546V. The WWAN antennas and surrounding circuitry and layout are identical between these two units.

After confirming through preliminary radiated emissions that the performance of the A3LSMA546V remains representative of A3LSMA546U. The test data of A3LSMA546V being submitted for this application to cover WWAN features.

1.3. SPOT CHECK VERIFICATION DATA

(Worst case of the radiated band-edge and radiated spurious emissions)

Comparison of two models, upper deviation is within 3 dB range and all test results are under FCC Technical Limits.

| Band | Test Item | Worst Mode | Frequency | Test Limit | Original model | Spot check model | Deviation | Remark |
|----------------|--------------|------------------------|-------------|------------|---------------------|---------------------|-----------|--------|
| | | | | | SM-A546V Results | SM-A546U Results | | |
| | | | | | FCC ID : A3LSMA546V | FCC ID : A3LSMA546U | | |
| LTE B48 | Fund(Legacy) | 5M_QPSK_FUND (RB 1/12) | 3625.0 MHz | 23.00 dBm | 21.79 dBm | 22.47 dBm | 0.68 dB | |
| | RSE(Legacy) | 5M_QPSK_HARM (RB 1/12) | 7250.0 MHz | -40.00 dBm | -49.60 dBm | -50.00 dBm | -0.40 dB | |
| NR n48 (SA) | Fund(Legacy) | 15M_QPSK_FUND (RB 1/1) | 3692.5 MHz | 23.00 dBm | 21.92 dBm | 21.16 dBm | -0.76 dB | |
| | RSE(Legacy) | 15M_QPSK_HARM (RB 1/1) | 7250.0 MHz | -40.00 dBm | -49.80 dBm | -56.70 dBm | -6.90 dB | |
| NR n48_SRS1 | Fund(Legacy) | 30M_FUND | 3685.0 MHz | 23.00 dBm | 16.19 dBm | 16.35 dBm | 0.16 dB | |
| | RSE(Legacy) | 30M_HARM | 7370.0 MHz | -40.00 dBm | -49.40 dBm | -50.38 dBm | -0.98 dB | |
| NR n48_SRS2 | Fund(Legacy) | 20M_FUND | 3560.0 MHz | 23.00 dBm | 19.48 dBm | 19.44 dBm | -0.04 dB | |
| | RSE(Legacy) | 20M_HARM | 7250.0 MHz | -40.00 dBm | -50.20 dBm | -49.27 dBm | 0.93 dB | |
| NR n48_SRS3 | Fund(Legacy) | 15M_FUND | 3692.5 MHz | 23.00 dBm | 11.13 dBm | 10.33 dBm | -0.80 dB | |
| | RSE(Legacy) | 15M_HARM | 10672.5 MHz | -40.00 dBm | -53.30 dBm | -53.55 dBm | -0.25 dB | |

1.4. REFERENCE DETAIL

Reference application that contains the reused reference data in the individual test reports:

| Equipment Class | Reference FCC ID (Parent) | Application Type | Reference Test report number | Exhibit Type | Variant Test Report Number | Data Re-used |
|-----------------|---------------------------|------------------|---------------------------------|--------------|---------------------------------|--------------|
| PCE | A3LSMA546V | Original Grant | 4790632299-E2 (WWAN) | Test Report | 4790632108-E2 (WWAN) | Partial |
| DTS | A3LSMA546V | Original Grant | 4790632299-E3 (802.11b/g/n/ax) | Test Report | 4790632108-E3 (802.11b/g/n/ax) | All |
| NII | A3LSMA546V | Original Grant | 4790632299-E4 (Bluetooth LE) | Test Report | 4790632108-E4 (Bluetooth LE) | All |
| DSS | A3LSMA546V | Original Grant | 4790632299-E5 (Bluetooth) | Test Report | 4790632108-E5 (Bluetooth) | All |
| NII | A3LSMA546V | Original Grant | 4790632299-E6 (802.11a/n/ac/ax) | Test Report | 4790632108-E6 (802.11a/n/ac/ax) | All |
| DXX | A3LSMA546V | Original Grant | 4790632299-E7 (NFC) | Test Report | 4790632108-E7 (NFC) | All |
| CBE | A3LSMA546V | Original Grant | 4790632299-E8 (CBE) | Test Report | 4790632108-E7 (CBE) | All |

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 96.
3. ANSI TIA-603-E, 2016
4. ANSI C63.26, 2015
5. KDB 971168 D01 Power Meas License Digital Systems v03r01
6. KDB 412172 D01 Determining ERP and EIRP v01r01

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16675, Korea. Line conducted emissions are measured only at the 218 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

| 218 Maeyeong-ro | |
|-------------------------------------|-------------------------------------|
| <input checked="" type="checkbox"/> | Chamber 1(3m semi-anechoic chamber) |
| <input type="checkbox"/> | Chamber 2(3m semi-anechoic chamber) |
| <input type="checkbox"/> | Chamber 3(3m semi-anechoic chamber) |
| <input checked="" type="checkbox"/> | Chamber 4(3m Full-anechoic chamber) |
| <input type="checkbox"/> | Chamber 5(3m Full-anechoic chamber) |

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at <https://www.iasonline.org/wp-content/uploads/2017/05/TL-637-cert-New.pdf>.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$EIRP = \text{PSA reading with EUT worst orientation (dBm)} + \text{Path loss (dB)} - \text{cable loss (between the SG and substitution antenna)} + \text{Substitution Antenna Factor (dBi)}$

$ERP = \text{PSA reading with EUT worst orientation (dBm)} + \text{Path loss (dB)} - \text{cable loss (between the SG and substitution antenna)}$

(Path loss = Signal generator output – PSA reading with substitution antenna)

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| PARAMETER | UNCERTAINTY |
|---------------------------------------|-------------|
| Conducted Disturbance, 0.15 to 30 MHz | 2.80 dB |
| Radiated Disturbance, 30 MHz to 1 GHz | 3.92 dB |
| Radiated Disturbance, 1 GHz to 18 GHz | 5.06 dB |
| Radiated Disturbance, Above 18 GHz | 6.02 dB |

Uncertainty figures are valid to a confidence level of 95%.

4.4. DECISION RULE

Decision rule for statement(s) of conformity is based on Procedure 2, Clause 4.4.3 in IEC Guide 115:2021.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE 5G NR Phone + BT/BLE, DTS/UNII a/b/g/n/ac/ax and NFC. This test report addresses the WWAN operational mode.

| Representative model | Difference | Derivative model | |
|----------------------|------------|------------------|--|
| | | SM-A546U1 | SM-S546VL |
| SM-A546U | Hardware | Same as SM-A546U | Same as SM-A546U |
| | Software | Same as SM-A546U | Different from SM-A546U (Exclude some of the main band) |

Thus, SM-A546U was set for final test.

5.2. DESCRIPTION OF AVAILABLE ANTENNAS

The transmitter has a maximum average radiated EIRP output powers as follows: Radiated samples were set to a higher power than conducted resulting in radiated EIRP greater than conducted measurements.

LTE Band 48

| FCC Part 96 | | | | | | | |
|-------------|-----------------------|-----------------|------------|--------------|---------------|--------------|---------------|
| Band | Frequency Range [MHz] | BandWidth [MHz] | Modulation | Conducted | | Radiated | |
| | | | | Avg [dBm] | Avg [mW] | Avg [dBm] | Avg [mW] |
| Band 48 | 3560 - 3690 | 20 | QPSK | 23.70 | 234.42 | 21.63 | 145.51 |
| | | | 16QAM | 23.25 | 211.35 | 21.17 | 130.92 |
| | | | 64QAM | 21.99 | 158.12 | | |
| | | | 256QAM | 18.99 | 79.25 | | |
| | 3557.5 - 3692.5 | 15 | QPSK | 23.64 | 231.21 | 21.78 | 150.66 |
| | | | 16QAM | 22.85 | 192.75 | 21.42 | 138.68 |
| | | | 64QAM | 21.96 | 157.04 | | |
| | | | 256QAM | 18.99 | 79.25 | | |
| | 3555 - 3695 | 10 | QPSK | 23.63 | 230.67 | 21.59 | 144.21 |
| | | | 16QAM | 22.98 | 198.61 | 21.10 | 128.82 |
| | | | 64QAM | 21.87 | 153.82 | | |
| | | | 256QAM | 19.09 | 81.10 | | |
| | 3552.5 - 3697.5 | 5 | QPSK | 23.80 | 239.88 | 21.79 | 151.01 |
| | | | 16QAM | 22.90 | 194.98 | 21.31 | 135.21 |
| | | | 64QAM | 21.96 | 157.04 | | |
| | | | 256QAM | 18.96 | 78.70 | | |

LTE Band 48 (Uplink CA) A-MPR

| Part 96 | | | |
|------------------|------|----------------|------|
| EIRP Limit (dBm) | 23.0 | ANT Gain (dBi) | -6.5 |

| Frequency Range (MHz) | Bandwidth (MHz) | Modulation | Output Power | | | | Margin |
|-----------------------|-----------------|------------|-------------------------------|------------------|--------------------|-------|--------|
| | | | Conducted Average Power (dBm) | Antenna Gain dBi | EIRP Average Power | | |
| | | | | | dBm | mW | |
| 3550 - 3700 | 40MHz (20+20) | QPSK | 23.94 | -6.5 | 17.44 | 55.46 | -5.56 |
| | | 16QAM | 23.98 | | 17.48 | 55.98 | -5.52 |
| | 35MHz (15+20) | QPSK | 23.81 | | 17.31 | 53.83 | -5.69 |
| | | 16QAM | 23.77 | | 17.27 | 53.33 | -5.73 |
| | 30MHz (10+20) | QPSK | 23.63 | | 17.13 | 51.64 | -5.87 |
| | | 16QAM | 23.81 | | 17.31 | 53.83 | -5.69 |
| | 25MHz (5+20) | QPSK | 23.59 | | 17.09 | 51.17 | -5.91 |
| | | 16QAM | 23.70 | | 17.20 | 52.48 | -5.8 |

Note. The worst-case scenario for all measurements is based on the average conducted output power measurement investigation results It was found that QPSK and 16QAM results were worst case.

NR Band n48

| FCC Part 96 | | | | | | | | | | |
|-------------|-----------------------|-----------------|----------------|--------------|--------------|--------------|---------------|--------------|---------------|--|
| Band | Frequency Range [MHz] | BandWidth [MHz] | Modulation | Mode | Conducted | | Radiated | | | |
| | | | | | Avg [dBm] | Avg [mW] | Avg [dBm] | Avg [mW] | | |
| n48 | 3570 - 3679.98 | 40 | DFT-s OFDM | $\pi/2$ BPSK | 23.61 | 229.66 | | | | |
| | | | | QPSK | 23.60 | 229.32 | 21.25 | 133.35 | | |
| | | | | 16QAM | 22.75 | 188.36 | 20.48 | 111.69 | | |
| | | | | 64QAM | 21.21 | 132.13 | | | | |
| | | | CP-OFDM | QPSK | 22.09 | 161.81 | | | | |
| | | | | DFT-s OFDM | $\pi/2$ BPSK | 23.64 | 231.26 | | | |
| | | | | | QPSK | 23.57 | 227.51 | 20.90 | 123.03 | |
| | | | | | 16QAM | 22.74 | 187.93 | 20.40 | 109.65 | |
| | 64QAM | 21.59 | 144.21 | | | | | | | |
| | 3557.52 - 3692.49 | 15 | DFT-s OFDM | 256QAM | 19.23 | 83.75 | | | | |
| | | | | QPSK | 22.19 | 165.58 | | | | |
| | | | | CP-OFDM | $\pi/2$ BPSK | 23.61 | 229.69 | | | |
| | | | | | QPSK | 23.54 | 225.79 | 21.92 | 155.60 | |
| | | | 16QAM | | 22.85 | 192.75 | 20.49 | 111.94 | | |
| | | | 64QAM | | 21.46 | 139.96 | | | | |
| | | | 3555 - 3694.98 | 10 | DFT-s OFDM | 256QAM | 19.30 | 85.11 | | |
| | | | | | | QPSK | 22.24 | 167.61 | | |
| | CP-OFDM | $\pi/2$ BPSK | | | | 23.66 | 232.47 | | | |
| | | QPSK | | | | 23.61 | 229.72 | 21.91 | 155.24 | |
| | | 16QAM | | | 22.90 | 194.98 | 20.69 | 117.22 | | |
| | | 64QAM | | | 21.56 | 143.22 | | | | |
| | CP-OFDM | 256QAM | | | 19.32 | 85.51 | | | | |
| | | QPSK | | | 22.24 | 167.49 | | | | |

NR Band n48(SRS1)

| FCC Part 96 | | | | | | |
|-------------|-----------------------|-----------------|--------------|--------------|--------------|--------------|
| Band | Frequency Range [MHz] | BandWidth [MHz] | Conducted | | Radiated | |
| | | | Avg [dBm] | Avg [mW] | Avg [dBm] | Avg [mW] |
| n48 | 3570.00 - 3679.98 | 40 | 18.79 | 75.68 | | |
| | 3560.00 - 3690.00 | 20 | 19.05 | 80.35 | 15.66 | 36.81 |
| | 3575.52 - 3692.49 | 15 | 18.51 | 70.96 | | |
| | 3555.00 - 3694.98 | 10 | 18.58 | 72.11 | | |

NR Band n48(SRS2)

| FCC Part 96 | | | | | | |
|-------------|-----------------------|-----------------|--------------|--------------|--------------|--------------|
| Band | Frequency Range [MHz] | BandWidth [MHz] | Conducted | | Radiated | |
| | | | Avg [dBm] | Avg [mW] | Avg [dBm] | Avg [mW] |
| n48 | 3570.00 - 3679.98 | 40 | 18.19 | 65.92 | | |
| | 3560.00 - 3690.00 | 20 | 18.37 | 68.71 | 19.48 | 88.65 |
| | 3575.52 - 3692.49 | 15 | 18.05 | 63.83 | | |
| | 3555.00 - 3694.98 | 10 | 18.22 | 66.37 | | |

NR Band n48(SRS3)

| FCC Part 96 | | | | | | |
|-------------|-----------------------|-----------------|--------------|--------------|--------------|--------------|
| Band | Frequency Range [MHz] | BandWidth [MHz] | Conducted | | Radiated | |
| | | | Avg [dBm] | Avg [mW] | Avg [dBm] | Avg [mW] |
| n48 | 3570.00 - 3679.98 | 40 | 16.41 | 43.75 | | |
| | 3560.00 - 3690.00 | 20 | 16.86 | 48.53 | | |
| | 3575.52 - 3692.49 | 15 | 16.95 | 49.55 | 11.13 | 12.98 |
| | 3555.00 - 3694.98 | 10 | 16.73 | 47.10 | | |

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a internal antenna for the supported bands with a maximum peak gain as follow:

| Frequency (MHz) | Peak Gain (dBi) |
|---|-----------------|
| LTE Band 48/ NR Band n48 3550 ~ 3700 MHz | -6.50 |
| NR Band n48(SRS1) 3550 ~ 3700 MHz | -5.10 |
| NR Band n48(SRS2) 3550 ~ 3700 MHz | -8.50 |
| NR Band n48(SRS3) 3550 ~ 3700 MHz | -8.30 |

5.4. WORST-CASE ORIENTATION

Following modes should be considered as worst-case scenario for all other measurements.

For all LTE Band 48, the worst-case scenario for all measurements is based on the average conducted output power measurement investigation results. Output power measurements were measured on QPSK, 16QAM, 64QAM and 256QAM modulations. However, the out of band emissions and spurious radiation were only performed on bandwidth and RB offset(with RB size 1) with the highest power in QPSK.

For all 5G NR Band n48, the worst-case scenario for all measurements is based on the average conducted output power measurement investigation results. Output power measurements were measured on $\pi/2$ BPSK, QPSK, 16QAM, 64QAM and 256QAM modulations. It was found that QPSK and 16QAM results were worst case.

This device supports SRS (sounding reference signal) 1, 2, 3 mode for NR TDD bands. For each SRS 1, 2 and 3, Conducted power and radiated measurement were performed through FTM mode provide by the customer.

| Highest power setting for each bands | | | | |
|--------------------------------------|-----------------|-----------------|---------|-----------|
| LTE Band | Frequency (MHz) | Bandwidth (MHz) | RB size | RB offset |
| 48 | 3552.5 | 5 | 1 | 12 |
| | 3625.0 | | 1 | 12 |
| | 3697.5 | | 1 | 12 |

| Highest power setting for each bands | | | | |
|--------------------------------------|-----------------|-----------------|---------|-----------|
| NR Band | Frequency (MHz) | Bandwidth (MHz) | RB size | RB offset |
| 48 | 3557.5 | 15 | 1 | 19 |
| | 3625.0 | | 1 | 19 |
| | 3692.5 | | 1 | 19 |

| Highest power setting for each bands | | | | | |
|--------------------------------------|-------------------|-----------------|-----------------|---------|-----------|
| LTE Band | Component Carrier | Frequency (MHz) | Bandwidth (MHz) | RB size | RB offset |
| 48 (Uplink CA) | PCC | 3670.2 | 20 | 1 | 99 |
| | SCC | 3690.0 | 20 | 1 | 0 |

- Radiated spurious emissions

For EIRP testing, the EUT didn't attached with travel adapter. But radiated spurious testing, the EUT attached with travel adapter for the worst case condition. The EUT is continuously communicated with the call box during the tests.

The fundamental and radiated spurious emission were investigated in three orthogonal orientations X, Y and Z, it was determined that below orientation was worst-case orientation for each band.

| Band | ERP/EIRP | | | RSE | | |
|-----------------|----------|---|---|-----|---|---|
| | X | Y | Z | X | Y | Z |
| LTE B48 | O | - | - | - | O | - |
| LTE B48C (ULCA) | - | - | - | - | - | O |
| NR n48 | - | O | - | - | - | O |
| NR n48 SRS1 | O | - | - | - | O | - |
| NR n48 SRS2 | O | - | - | - | O | - |
| NR n48 SRS3 | O | - | - | O | - | - |

Note : For ERP/EIRP testing, the EUT didn't attached with travel adapter. But radiated spurious testing, the EUT attached with travel adapter for the worst case condition. The EUT is continuously communicated with the call box during the tests.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

| Support Equipment List | | | | |
|------------------------|-------------|----------|----------------|--------|
| Description | Manufacture | Model | Serial Number | FCC ID |
| Charger | SAMSUNG | EP-TA800 | R37T7WW84Y9SEA | N/A |
| Data Cable | SAMSUNG | EP-DN980 | GH39-02116A | N/A |

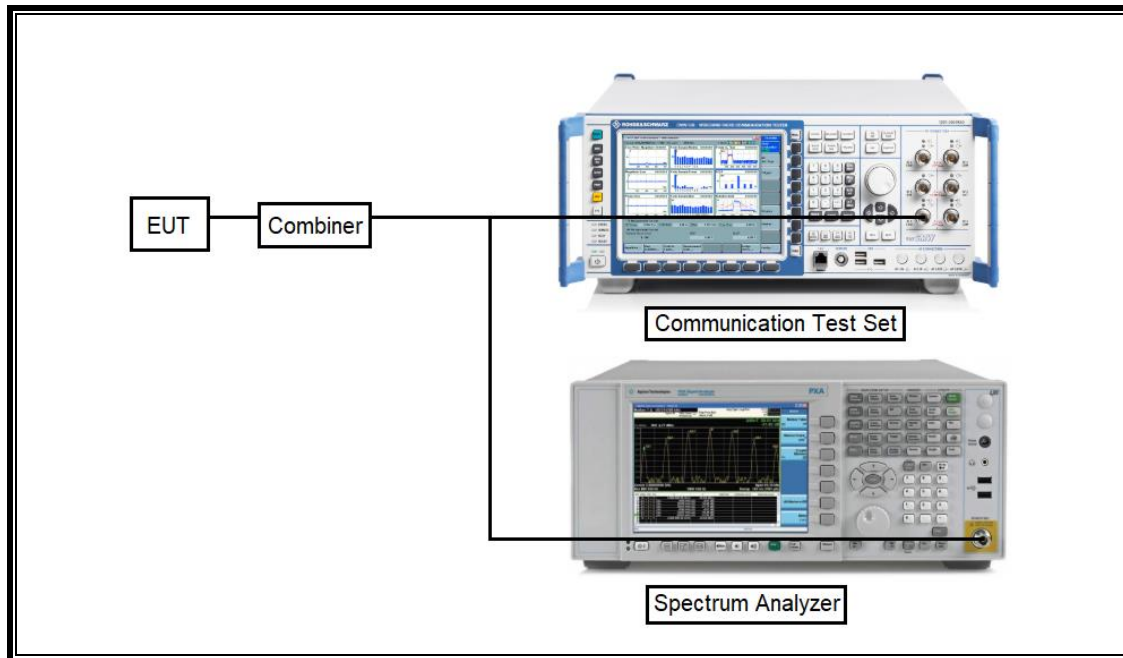
I/O CABLE

| I/O Cable List | | | | | | |
|----------------|----------|----------------------|----------------|------------|------------------|---------|
| Cable No. | Port | # of identical ports | Connector Type | Cable Type | Cable Length (m) | Remarks |
| 1 | DC Power | 1 | C Type | Shielded | 1.0 m | N/A |

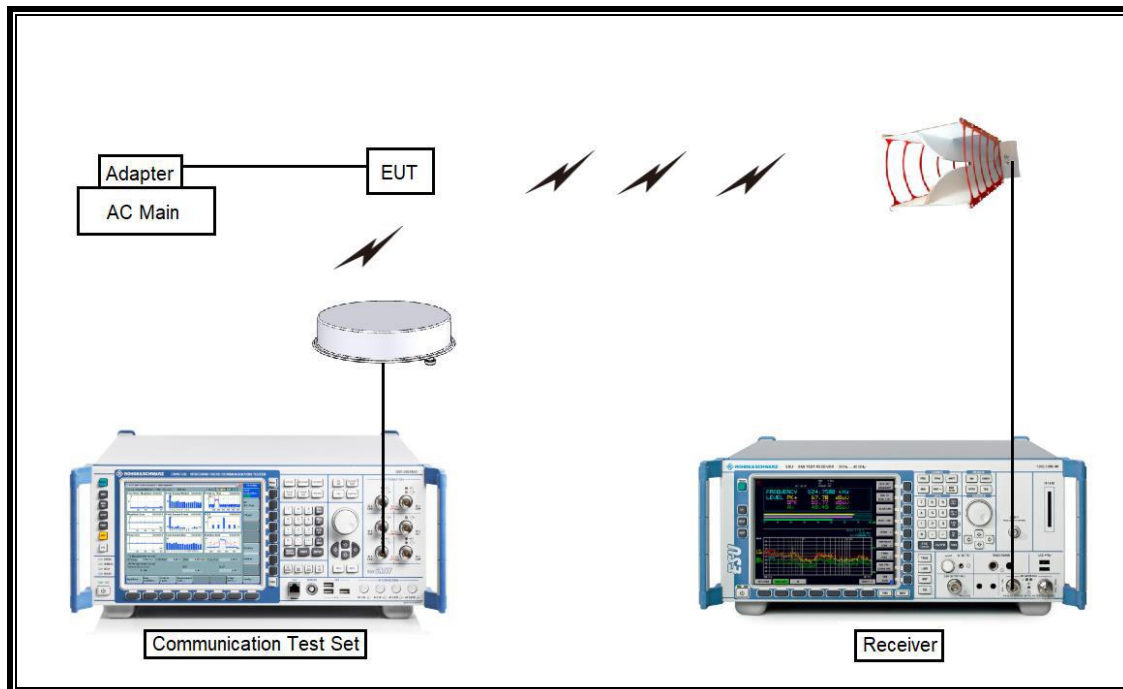
TEST SETUP

The EUT is continuously communicated with the call box during the tests.

SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

| Test Equipment List | | | | |
|---|---------------|------------------------|-------------|------------|
| Description | Manufacturer | Model | S/N | Cal Due |
| Antenna, Tuned Dipole 400-1000 MHz | ETS | 3121D DB4 | 00164753 | 2023-02-08 |
| Directional Antenna | Cobham | FPA3-0.8-6.0R/1329 | 110367-0003 | N/A |
| Directional Antenna | Cobham | FPA3-0.8-6.0R/1329 | 80108-0004 | N/A |
| Antenna, Horn, 40 GHz | ETS | 3116C | 00168645 | 2023-10-13 |
| Preamplifier | ETS | 3116C-PA | 00168841 | 2023-08-04 |
| Antenna, Bilog, 30MHz-1GHz | SCHWARZBECK | VULB9163 | 750 | 2024-08-15 |
| Antenna, Bilog, 30MHz-1GHz | SCHWARZBECK | VULB9163 | 845 | 2024-08-15 |
| Antenna, Bilog, 30MHz-1GHz | SCHWARZBECK | VULB9163 | 749 | 2024-08-15 |
| Antenna, Horn, 18 GHz | ETS | 3115 | 00161451 | 2024-08-21 |
| Antenna, Horn, 18 GHz | ETS | 3117 | 00168717 | 2024-08-21 |
| Communications Test Set | R&S | CMW500 | 169796 | 2024-01-05 |
| DC Power Supply | Agilent / HP | E3640A | MY54226395 | 2023-08-02 |
| Preamplifier, 1000 MHz | Sonoma | 310N | 341282 | 2023-08-02 |
| Preamplifier, 1000 MHz | Sonoma | 310N | 351741 | 2023-08-02 |
| Preamplifier, 18 GHz | Miteq | AFS42-00101800-25-S-42 | 1876511 | 2023-08-02 |
| Preamplifier, 18 GHz | Miteq | AFS42-00101800-25-S-42 | 2029169 | 2023-08-01 |
| Preamplifier, 18 GHz | Miteq | AFS42-00101800-25-S-42 | 1896138 | 2023-08-01 |
| Spectrum Analyzer, 44 GHz | Agilent / HP | N9030A | MY54170614 | 2023-08-03 |
| Spectrum Analyzer, 44 GHz | Agilent / HP | N9030A | MY54490312 | 2023-08-01 |
| EMI Test Receive, 40 GHz | R&S | ESU40 | 100439 | 2023-08-02 |
| EMI Test Receive, 40 GHz | R&S | ESU40 | 100457 | 2023-07-29 |
| High Pass Filter 1.2GHz | Micro-Tronics | HPM50108-02 | G005 | 2023-08-01 |
| High Pass Filter 1.2GHz | Micro-Tronics | HPM50108-02 | G006 | 2023-08-01 |
| High Pass Filter 2.8GHz | Micro-Tronics | HPM50111-02 | 010 | 2023-08-01 |
| High Pass Filter 2.8GHz | Micro-Tronics | HPM50111-02 | 011 | 2023-08-01 |
| High Pass Filter 4GHz | Micro-Tronics | HPM50118-02 | G001 | 2023-08-01 |
| High Pass Filter 4GHz | Micro-Tronics | HPM50118-02 | G002 | 2023-08-01 |
| Attenuator | PASTERNAK | PE7087-10 | A009 | 2023-08-03 |
| Attenuator | PASTERNAK | PE7087-10 | A001 | 2023-08-03 |
| Attenuator | PASTERNAK | PE7087-10 | A008 | 2023-08-03 |
| Attenuator | PASTERNAK | PE7004-10 | 2 | 2023-08-01 |
| Attenuator | PASTERNAK | PE7395-10 | A011 | 2023-08-03 |
| Antenna, Loop, 9kHz-30MHz | R&S | HFH2-Z2 | 100418 | 2023-10-06 |
| Temperature Chamber | ESPEC | SH-642 | 93001109 | 2023-08-01 |
| Power Splitter | MINI-CIRCUITS | WA1534 | UL003 | 2024-01-09 |
| Power Splitter | MINI-CIRCUITS | WA1534 | UL004 | 2024-01-09 |
| UXM 5G Wireless Test Platform | KEYSIGHT | E7515B | MY57510655 | 2024-01-09 |
| UL Software | | | | |
| Description | Manufacturer | Model | Version | |
| Antenna port test software | UL | CLT | Ver 3.4 | |
| Radiated software | UL | UL EMC | Ver 9.5 | |
| Antenna port test software (5G NR FR1) | UL | UL iM | Ver 1.06 | |

7. SUMMARY TABLE

| FCC Part Section | Test Description | Test Limit | Test Condition | Test Result |
|------------------------|---|--|----------------|-------------------------------|
| 2.1049 | Occupied Bandwidth(99%) | N/A | Conducted | Complies |
| 2.1046 | Conducted output power | N/A | | Complies |
| 2.1051 96.41(e)(ii) | Out of band emissions | Section 9.2 & 9.3 | | Complies |
| 2.1055 | Frequency Stability | Fundamental emissions stay within authorized frequency block | | Complies |
| 96.47 | End user device additional requirements (CBSD Protocol) | Section 9.5 | | Not performed ^{Note} |
| 96.41(b) | Equivalent Isotropic Radiated Power | 23 dBm/10 MHz | Radiated | Complies |
| 2.1053 96.41(e) | Radiated Spurious Emission | -40 dBm/MHz | | Complies |

Note. Please refer to CBSD Protocol test report. See the Section 9.5

8. RF OUTPUT POWER

8.1. CONDUCTED AND EIRP VERIFICATION

Rule Part(s)

FCC: §2.1046, §96.41

EIRP Limit

FCC: §96.41(b)

(b) Unless otherwise specified in this section, the maximum effective isotropic radiated power (EIRP) and maximum Power Spectral Density (PSD) of any CBSD and End User Device must comply with the limits shown in the table.

| Device | Maximum EIRP (dBm/10 megahertz) | Maximum PSD (dBm/MHz) |
|-----------------|---------------------------------|-----------------------|
| End User Device | 23 | n/a |

Test Procedure

TIA-603-E Clause 2.2.17
KDB 971168 Section 5.6

$$ERP/EIRP = P_{Meas} + G_T - L_C$$

where:

ERP/EIRP = effective or equivalent radiated power, respectively (expressed in the same units as P_{Meas} , typically dBW or dBm);

P_{Meas} = measured transmitter output power or PSD, in dBm or dBW;

G_T = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);

L_C = signal attenuation in the connecting cable between the transmitter and antenna, in dB.2

RESULTS

EUT includes different power levels for head use configuration and body use configuration and the below tables contain the highest of all configurations average conducted and ERP/EIRP output powers as follows:

LTE Band 48

| BW (MHz) | Mode | RB Allocation | RB offset | Maximum Average Power (dBm) | | | | |
|----------|--------|---------------|-----------|-----------------------------|----------|------------|------|---------------|
| | | | | Measured Pwr (dBm) | | | MPR | Tune-up Limit |
| | | | | 55340 | 55990 | 56640 | | |
| | | | | 3560 MHz | 3625 MHz | 3690 MHz | | |
| 20 MHz | QPSK | 1 | 0 | 23.65 | 22.76 | 23.19 | 0.0 | 24.0 |
| | | 1 | 49 | 23.43 | 23.66 | 22.90 | 0.0 | 24.0 |
| | | 1 | 99 | 23.67 | 23.70 | 22.96 | 0.0 | 24.0 |
| | | 50 | 0 | 22.97 | 22.96 | 22.48 | 1.0 | 23.0 |
| | | 50 | 24 | 22.93 | 23.00 | 22.41 | 1.0 | 23.0 |
| | | 50 | 50 | 22.98 | 22.99 | 22.41 | 1.0 | 23.0 |
| | 100 | 0 | 22.94 | 22.96 | 22.45 | 1.0 | 23.0 | |
| | 16QAM | 1 | 0 | 22.43 | 22.97 | 22.28 | 1.0 | 23.0 |
| | | 1 | 49 | 22.91 | 22.99 | 22.12 | 1.0 | 23.0 |
| | | 1 | 99 | 22.91 | 22.86 | 22.41 | 1.0 | 23.0 |
| | | 50 | 0 | 21.97 | 21.97 | 21.72 | 2.0 | 22.0 |
| | | 50 | 24 | 21.91 | 21.98 | 21.70 | 2.0 | 22.0 |
| | | 50 | 50 | 21.65 | 22.00 | 21.76 | 2.0 | 22.0 |
| | 100 | 0 | 21.59 | 21.99 | 21.78 | 2.0 | 22.0 | |
| | 64QAM | 1 | 0 | 21.85 | 21.96 | 21.44 | 2.0 | 22.0 |
| | | 1 | 49 | 21.82 | 21.84 | 21.59 | 2.0 | 22.0 |
| | | 1 | 99 | 21.99 | 21.86 | 21.80 | 2.0 | 22.0 |
| | | 50 | 0 | 20.91 | 20.96 | 20.92 | 3.0 | 21.0 |
| | | 50 | 24 | 21.00 | 20.99 | 20.92 | 3.0 | 21.0 |
| | | 50 | 50 | 20.95 | 20.98 | 20.91 | 3.0 | 21.0 |
| | 100 | 0 | 20.96 | 20.92 | 20.91 | 3.0 | 21.0 | |
| | 256QAM | 1 | 0 | 18.80 | 18.99 | 18.83 | 5.0 | 19.0 |
| | | 1 | 49 | 18.71 | 18.61 | 18.84 | 5.0 | 19.0 |
| | | 1 | 99 | 18.82 | 18.67 | 18.33 | 5.0 | 19.0 |
| 50 | | 0 | 18.98 | 18.99 | 18.80 | 5.0 | 19.0 | |
| 50 | | 24 | 18.96 | 18.94 | 18.77 | 5.0 | 19.0 | |
| 50 | | 50 | 18.95 | 18.99 | 18.75 | 5.0 | 19.0 | |
| 100 | 0 | 18.96 | 18.94 | 18.76 | 5.0 | 19.0 | | |
| BW (MHz) | Mode | RB Allocation | RB offset | Measured Pwr (dBm) | | | MPR | Tune-up Limit |
| | | | | 55315 | 55990 | 56665 | | |
| | | | | 3557.5 MHz | 3625 MHz | 3692.5 MHz | | |
| | | | | | | | | |
| 15 MHz | QPSK | 1 | 0 | 23.57 | 23.16 | 22.89 | 0.0 | 24.0 |
| | | 1 | 37 | 23.64 | 23.31 | 22.97 | 0.0 | 24.0 |
| | | 1 | 74 | 23.43 | 23.15 | 22.72 | 0.0 | 24.0 |
| | | 36 | 0 | 23.00 | 22.71 | 22.37 | 1.0 | 23.0 |
| | | 36 | 20 | 22.97 | 22.77 | 22.37 | 1.0 | 23.0 |
| | | 36 | 39 | 22.96 | 22.76 | 22.30 | 1.0 | 23.0 |
| | 75 | 0 | 22.94 | 22.71 | 22.29 | 1.0 | 23.0 | |
| | 16QAM | 1 | 0 | 22.81 | 22.35 | 22.07 | 1.0 | 23.0 |
| | | 1 | 37 | 22.53 | 22.48 | 22.06 | 1.0 | 23.0 |
| | | 1 | 74 | 22.85 | 22.56 | 21.84 | 1.0 | 23.0 |
| | | 36 | 0 | 21.98 | 21.86 | 21.51 | 2.0 | 22.0 |
| | | 36 | 20 | 21.66 | 21.97 | 21.57 | 2.0 | 22.0 |
| | | 36 | 39 | 21.95 | 21.97 | 21.60 | 2.0 | 22.0 |
| | 75 | 0 | 21.75 | 21.95 | 21.59 | 2.0 | 22.0 | |
| | 64QAM | 1 | 0 | 21.85 | 21.77 | 21.58 | 2.0 | 22.0 |
| | | 1 | 37 | 21.95 | 21.95 | 21.64 | 2.0 | 22.0 |
| | | 1 | 74 | 21.96 | 21.81 | 21.45 | 2.0 | 22.0 |
| | | 36 | 0 | 20.95 | 20.90 | 20.93 | 3.0 | 21.0 |
| | | 36 | 20 | 20.96 | 20.97 | 20.95 | 3.0 | 21.0 |
| | | 36 | 39 | 20.75 | 20.98 | 20.92 | 3.0 | 21.0 |
| | 75 | 0 | 20.70 | 20.96 | 20.83 | 3.0 | 21.0 | |
| | 256QAM | 1 | 0 | 18.84 | 18.81 | 18.85 | 5.0 | 19.0 |
| | | 1 | 37 | 18.95 | 18.99 | 18.99 | 5.0 | 19.0 |
| | | 1 | 74 | 18.85 | 18.93 | 18.79 | 5.0 | 19.0 |
| 36 | | 0 | 18.95 | 18.98 | 18.85 | 5.0 | 19.0 | |
| 36 | | 20 | 18.91 | 18.96 | 18.82 | 5.0 | 19.0 | |
| 36 | | 39 | 18.93 | 18.96 | 18.79 | 5.0 | 19.0 | |
| 75 | 0 | 18.92 | 18.94 | 18.76 | 5.0 | 19.0 | | |

| BW (MHz) | Mode | RB Allocation | RB offset | Measured Pwr (dBm) | | | MPR | Tune-up Limit |
|----------|-------|---------------|-----------|--------------------|----------|------------|------|---------------|
| | | | | 55290 | 55990 | 56690 | | |
| | | | | 3555 MHz | 3625 MHz | 3695 MHz | | |
| 10 MHz | QPSK | 1 | 0 | 23.45 | 23.63 | 23.20 | 0.0 | 24.0 |
| | | 1 | 25 | 23.53 | 23.54 | 23.13 | 0.0 | 24.0 |
| | | 1 | 49 | 23.56 | 23.53 | 22.92 | 0.0 | 24.0 |
| | | 25 | 0 | 22.85 | 22.87 | 22.62 | 1.0 | 23.0 |
| | | 25 | 12 | 22.85 | 22.89 | 22.61 | 1.0 | 23.0 |
| | | 25 | 25 | 22.86 | 22.87 | 22.54 | 1.0 | 23.0 |
| | | 50 | 0 | 22.95 | 23.00 | 22.54 | 1.0 | 23.0 |
| | 16QAM | 1 | 0 | 22.86 | 22.80 | 22.63 | 1.0 | 23.0 |
| | | 1 | 25 | 22.82 | 22.89 | 22.63 | 1.0 | 23.0 |
| | | 1 | 49 | 22.98 | 22.83 | 22.50 | 1.0 | 23.0 |
| | | 25 | 0 | 21.96 | 21.94 | 21.74 | 2.0 | 22.0 |
| | | 25 | 12 | 21.98 | 21.91 | 21.81 | 2.0 | 22.0 |
| | | 25 | 25 | 21.99 | 21.97 | 21.80 | 2.0 | 22.0 |
| | | 50 | 0 | 21.99 | 22.00 | 21.85 | 2.0 | 22.0 |
| | 64QAM | 1 | 0 | 21.80 | 21.69 | 21.46 | 2.0 | 22.0 |
| | | 1 | 25 | 21.67 | 21.58 | 21.71 | 2.0 | 22.0 |
| | | 1 | 49 | 21.87 | 21.71 | 21.53 | 2.0 | 22.0 |
| | | 25 | 0 | 20.95 | 20.92 | 20.68 | 3.0 | 21.0 |
| | | 25 | 12 | 20.95 | 20.91 | 20.71 | 3.0 | 21.0 |
| | | 25 | 25 | 20.96 | 20.94 | 20.68 | 3.0 | 21.0 |
| | | 50 | 0 | 20.97 | 20.90 | 20.71 | 3.0 | 21.0 |
| 256QAM | 1 | 0 | 18.87 | 18.97 | 18.79 | 5.0 | 19.0 | |
| | 1 | 25 | 18.95 | 18.75 | 18.57 | 5.0 | 19.0 | |
| | 1 | 49 | 18.87 | 18.99 | 18.67 | 5.0 | 19.0 | |
| | 25 | 0 | 18.87 | 18.87 | 18.61 | 5.0 | 19.0 | |
| | 25 | 12 | 18.91 | 18.85 | 18.63 | 5.0 | 19.0 | |
| | 25 | 25 | 18.86 | 18.85 | 18.60 | 5.0 | 19.0 | |
| | 50 | 0 | 18.84 | 18.84 | 18.61 | 5.0 | 19.0 | |
| BW (MHz) | Mode | RB Allocation | RB offset | Measured Pwr (dBm) | | | MPR | Tune-up Limit |
| | | | | 55265 | 55990 | 56715 | | |
| | | | | 3552.5 MHz | 3625 MHz | 3697.5 MHz | | |
| 5 MHz | QPSK | 1 | 0 | 23.66 | 23.66 | 23.66 | 0.0 | 24.0 |
| | | 1 | 12 | 23.80 | 23.56 | 23.28 | 0.0 | 24.0 |
| | | 1 | 24 | 23.69 | 23.50 | 23.20 | 0.0 | 24.0 |
| | | 12 | 0 | 22.91 | 22.60 | 22.73 | 1.0 | 23.0 |
| | | 12 | 7 | 22.83 | 22.66 | 22.75 | 1.0 | 23.0 |
| | | 12 | 13 | 22.93 | 22.70 | 22.77 | 1.0 | 23.0 |
| | | 25 | 0 | 22.90 | 22.75 | 22.74 | 1.0 | 23.0 |
| | 16QAM | 1 | 0 | 22.40 | 22.71 | 22.47 | 1.0 | 23.0 |
| | | 1 | 12 | 22.90 | 22.71 | 22.49 | 1.0 | 23.0 |
| | | 1 | 24 | 22.83 | 22.84 | 22.35 | 1.0 | 23.0 |
| | | 12 | 0 | 21.89 | 21.66 | 21.77 | 2.0 | 22.0 |
| | | 12 | 7 | 21.85 | 21.69 | 21.77 | 2.0 | 22.0 |
| | | 12 | 13 | 21.84 | 21.66 | 21.76 | 2.0 | 22.0 |
| | | 25 | 0 | 21.76 | 21.63 | 21.78 | 2.0 | 22.0 |
| | 64QAM | 1 | 0 | 21.96 | 21.89 | 21.26 | 2.0 | 22.0 |
| | | 1 | 12 | 21.86 | 21.80 | 21.37 | 2.0 | 22.0 |
| | | 1 | 24 | 21.94 | 21.72 | 21.36 | 2.0 | 22.0 |
| | | 12 | 0 | 20.99 | 20.92 | 20.45 | 3.0 | 21.0 |
| | | 12 | 7 | 20.62 | 20.92 | 20.45 | 3.0 | 21.0 |
| | | 12 | 13 | 20.97 | 20.90 | 20.48 | 3.0 | 21.0 |
| | | 25 | 0 | 20.66 | 20.96 | 20.58 | 3.0 | 21.0 |
| 256QAM | 1 | 0 | 18.80 | 18.70 | 18.57 | 5.0 | 19.0 | |
| | 1 | 12 | 18.73 | 18.82 | 18.96 | 5.0 | 19.0 | |
| | 1 | 24 | 18.70 | 18.85 | 18.58 | 5.0 | 19.0 | |
| | 12 | 0 | 18.89 | 18.84 | 18.42 | 5.0 | 19.0 | |
| | 12 | 7 | 18.91 | 18.86 | 18.41 | 5.0 | 19.0 | |
| | 12 | 13 | 18.86 | 18.86 | 18.44 | 5.0 | 19.0 | |
| | 25 | 0 | 18.87 | 18.76 | 18.41 | 5.0 | 19.0 | |

LTE Band 48C (Uplink CA)

OUTPUT POWER FOR LTE BAND 48C (20 MHz + 20 MHz)

| Bandwidth | PCC Frequency (MHz) | SCC1 Frequency (MHz) | PCC RB | PCC RB | SCC1 RB | SCC1 RB | A-MPR Off | | A-MPR On | |
|--------------------------|---------------------|----------------------|--------|--------|---------|---------|-------------------------------|-------|-------------------------------|-------|
| | | | Size | Offset | Size | Offset | Conducted Average Power (dBm) | | Conducted Average Power (dBm) | |
| | | | | | | | QPSK | 16QAM | QPSK | 16QAM |
| 40MHz (20MHz / 20MHz) | 3560 | 3579.8 | 1 | 99 | 1 | 0 | 23.74 | 23.87 | 19.25 | 19.60 |
| | | | 1 | 0 | 1 | 99 | 23.63 | 23.63 | 4.83 | 4.91 |
| | | | 100 | 0 | 100 | 0 | 23.51 | 23.67 | 12.24 | 12.25 |
| | 3615.1 | 3634.9 | 1 | 99 | 1 | 0 | 23.72 | 23.98 | 12.15 | 12.16 |
| | | | 1 | 0 | 1 | 99 | 23.60 | 23.66 | 5.35 | 5.82 |
| | | | 100 | 0 | 100 | 0 | 23.68 | 23.68 | 12.15 | 12.14 |
| | 3670.2 | 3690 | 1 | 99 | 1 | 0 | 23.76 | 23.98 | 19.74 | 19.99 |
| | | | 1 | 0 | 1 | 99 | 23.94 | 23.95 | 5.40 | 5.58 |
| | | | 100 | 0 | 100 | 0 | 23.79 | 23.73 | 12.27 | 12.31 |

OUTPUT POWER FOR LTE BAND 48C (15 MHz + 20 MHz)

| Bandwidth | PCC Frequency (MHz) | SCC1 Frequency (MHz) | PCC RB | PCC RB | SCC1 RB | SCC1 RB | A-MPR Off | | A-MPR On | |
|--------------------------|---------------------|----------------------|--------|--------|---------|---------|-------------------------------|-------|-------------------------------|-------|
| | | | Size | Offset | Size | Offset | Conducted Average Power (dBm) | | Conducted Average Power (dBm) | |
| | | | | | | | QPSK | 16QAM | QPSK | 16QAM |
| 35MHz (15MHz / 20MHz) | 3557.5 | 3574.6 | 1 | 74 | 1 | 0 | 23.81 | 23.75 | 17.31 | 17.93 |
| | | | 1 | 0 | 1 | 99 | 23.69 | 23.71 | 4.83 | 5.30 |
| | | | 75 | 0 | 100 | 0 | 23.68 | 23.66 | 12.22 | 12.24 |
| | 3615.2 | 3632.3 | 1 | 74 | 1 | 0 | 23.69 | 23.77 | 17.17 | 17.19 |
| | | | 1 | 0 | 1 | 99 | 23.60 | 23.74 | 5.34 | 5.28 |
| | | | 75 | 0 | 100 | 0 | 23.58 | 23.55 | 12.06 | 12.02 |
| | 3672.9 | 3690 | 1 | 74 | 1 | 0 | 23.81 | 23.76 | 17.50 | 17.80 |
| | | | 1 | 0 | 1 | 99 | 23.77 | 23.65 | 4.94 | 5.34 |
| | | | 75 | 0 | 100 | 0 | 23.74 | 23.69 | 12.22 | 12.09 |

OUTPUT POWER FOR LTE BAND 48C (10 MHz + 20 MHz)

| Bandwidth | PCC Frequency (MHz) | SCC1 Frequency (MHz) | PCC RB | PCC RB | SCC1 RB | SCC1 RB | A-MPR Off | | A-MPR On | |
|--------------------------|---------------------|----------------------|--------|--------|---------|---------|-------------------------------|-------|-------------------------------|-------|
| | | | Size | Offset | Size | Offset | Conducted Average Power (dBm) | | Conducted Average Power (dBm) | |
| | | | | | | | QPSK | 16QAM | QPSK | 16QAM |
| 30MHz (10MHz / 20MHz) | 3555 | 3569.4 | 1 | 49 | 1 | 0 | 23.57 | 23.81 | 17.29 | 17.46 |
| | | | 1 | 0 | 1 | 99 | 23.53 | 23.50 | 5.18 | 5.21 |
| | | | 50 | 0 | 100 | 0 | 23.63 | 23.54 | 12.38 | 12.26 |
| | 3615.4 | 3629.8 | 1 | 49 | 1 | 0 | 23.42 | 23.70 | 17.15 | 17.22 |
| | | | 1 | 0 | 1 | 99 | 23.19 | 23.63 | 5.05 | 5.11 |
| | | | 50 | 0 | 100 | 0 | 23.47 | 23.44 | 11.98 | 12.09 |
| | 3675.6 | 3690 | 1 | 49 | 1 | 0 | 23.61 | 23.67 | 17.12 | 17.38 |
| | | | 1 | 0 | 1 | 99 | 23.62 | 23.58 | 5.06 | 5.33 |
| | | | 50 | 0 | 100 | 0 | 23.48 | 23.56 | 12.20 | 12.24 |

OUTPUT POWER FOR LTE BAND 48C (5 MHz + 20 MHz)

| Bandwidth | PCC Frequency (MHz) | SCC1 Frequency (MHz) | PCC RB | PCC RB | SCC1 RB | SCC1 RB | A-MPR Off | | A-MPR On | |
|-------------------------|---------------------|----------------------|--------|--------|---------|---------|-------------------------------|-------|-------------------------------|-------|
| | | | Size | Offset | Size | Offset | Conducted Average Power (dBm) | | Conducted Average Power (dBm) | |
| | | | | | | | QPSK | 16QAM | QPSK | 16QAM |
| 25MHz (5MHz / 20MHz) | 3552.5 | 3564.2 | 1 | 24 | 1 | 0 | 23.59 | 23.70 | 18.01 | 18.10 |
| | | | 1 | 0 | 1 | 99 | 23.42 | 23.35 | 5.27 | 5.29 |
| | | | 25 | 0 | 100 | 0 | 23.49 | 23.49 | 11.21 | 11.12 |
| | 3615.6 | 3627.3 | 1 | 24 | 1 | 0 | 23.12 | 23.09 | 17.89 | 17.74 |
| | | | 1 | 0 | 1 | 99 | 23.21 | 23.42 | 5.02 | 5.23 |
| | | | 25 | 0 | 100 | 0 | 23.27 | 23.31 | 11.04 | 10.98 |
| | 3678.3 | 3690 | 1 | 24 | 1 | 0 | 23.33 | 23.51 | 18.17 | 18.63 |
| | | | 1 | 0 | 1 | 99 | 23.58 | 23.57 | 5.11 | 5.28 |
| | | | 25 | 0 | 100 | 0 | 23.56 | 23.62 | 11.11 | 11.14 |

NR Band n48

| BW (MHz) | Modulation | Mode | RB Allocation | RB offset | Measured Pwr (dBm) | | | MPR | Tune-up Limit |
|----------|------------|----------|---------------|-----------|--------------------|-------------|-------------|------|---------------|
| | | | | | 638000 | 641666 | 645332 | | |
| | | | | | 3570 MHz | 3624.99 MHz | 3679.98 MHz | | |
| 40 MHz | DFT-s-OFDM | π/2 BPSK | 1 | 1 | 22.96 | 22.97 | 22.84 | 0.0 | 24.0 |
| | | | 1 | 53 | 22.95 | 23.08 | 23.01 | 0.0 | 24.0 |
| | | | 1 | 104 | 22.87 | 22.95 | 23.05 | 0.0 | 24.0 |
| | | | 50 | 0 | 23.40 | 23.48 | 23.43 | 0.5 | 23.5 |
| | | | 50 | 28 | 23.52 | 23.61 | 23.51 | 0.0 | 24.0 |
| | | | 50 | 56 | 23.29 | 23.46 | 23.44 | 0.5 | 23.5 |
| | | 100 | 0 | 23.43 | 23.46 | 23.47 | 0.5 | 23.5 | |
| | | QPSK | 1 | 1 | 23.04 | 23.01 | 22.87 | 0.0 | 24.0 |
| | | | 1 | 53 | 23.01 | 23.13 | 23.01 | 0.0 | 24.0 |
| | | | 1 | 104 | 22.85 | 22.89 | 23.10 | 0.0 | 24.0 |
| | | | 50 | 0 | 22.91 | 22.98 | 22.93 | 1.0 | 23.0 |
| | | | 50 | 28 | 23.51 | 23.60 | 23.50 | 0.0 | 24.0 |
| | | | 50 | 56 | 22.76 | 22.96 | 22.94 | 1.0 | 23.0 |
| | 100 | 0 | 22.93 | 22.95 | 22.93 | 1.0 | 23.0 | | |
| 16QAM | 1 | 1 | 22.59 | 22.75 | 22.57 | 1.0 | 23.0 | | |
| 64QAM | 1 | 1 | 21.05 | 21.21 | 21.04 | 2.5 | 21.5 | | |
| 256QAM | 1 | 1 | 19.04 | 19.10 | 19.03 | 4.5 | 19.5 | | |
| CP-OFDM | QPSK | 1 | 1 | 22.09 | 22.02 | 21.95 | 1.5 | 22.5 | |
| 20 MHz | DFT-s-OFDM | π/2 BPSK | 1 | 1 | 23.16 | 23.27 | 23.10 | 0.0 | 24.0 |
| | | | 1 | 26 | 23.14 | 23.18 | 23.17 | 0.0 | 24.0 |
| | | | 1 | 49 | 23.11 | 23.05 | 23.15 | 0.0 | 24.0 |
| | | | 25 | 0 | 23.43 | 23.47 | 23.44 | 0.5 | 23.5 |
| | | | 25 | 13 | 23.49 | 23.50 | 23.50 | 0.0 | 24.0 |
| | | | 25 | 26 | 23.47 | 23.41 | 23.48 | 0.5 | 23.5 |
| | | 50 | 0 | 23.45 | 23.41 | 23.46 | 0.5 | 23.5 | |
| | | QPSK | 1 | 1 | 23.17 | 23.23 | 23.13 | 0.0 | 24.0 |
| | | | 1 | 26 | 23.19 | 23.27 | 23.21 | 0.0 | 24.0 |
| | | | 1 | 49 | 23.16 | 23.20 | 23.18 | 0.0 | 24.0 |
| | | | 25 | 0 | 22.93 | 22.97 | 22.94 | 1.0 | 23.0 |
| | | | 25 | 13 | 23.01 | 22.91 | 22.98 | 0.0 | 24.0 |
| | | | 25 | 26 | 22.99 | 22.91 | 22.94 | 1.0 | 23.0 |
| | 50 | 0 | 22.94 | 22.90 | 22.96 | 1.0 | 23.0 | | |
| 16QAM | 1 | 1 | 22.56 | 22.71 | 22.74 | 1.0 | 23.0 | | |
| 64QAM | 1 | 1 | 21.43 | 21.29 | 21.49 | 2.5 | 21.5 | | |
| 256QAM | 1 | 1 | 19.11 | 19.21 | 19.23 | 4.5 | 19.5 | | |
| CP-OFDM | QPSK | 1 | 1 | 22.11 | 22.19 | 22.08 | 1.5 | 22.5 | |

| BW (MHz) | Modulation | Mode | RB Allocation | RB offset | Measured Pwr (dBm) | | | MPR | Tune-up Limit |
|----------|------------|----------|---------------|-----------|--------------------|-------------|-------------|------|---------------|
| | | | | | 637168 | 641666 | 646166 | | |
| | | | | | 3557.52 MHz | 3624.99 MHz | 3692.49 MHz | | |
| 15 MHz | DFT-s-OFDM | π/2 BPSK | 1 | 1 | 23.12 | 23.16 | 23.25 | 0.0 | 24.0 |
| | | | 1 | 19 | 23.09 | 23.23 | 23.11 | 0.0 | 24.0 |
| | | | 1 | 36 | 23.15 | 23.09 | 23.13 | 0.0 | 24.0 |
| | | | 18 | 0 | 23.41 | 23.45 | 23.42 | 0.5 | 23.5 |
| | | | 18 | 10 | 23.48 | 23.52 | 23.49 | 0.0 | 24.0 |
| | | | 18 | 20 | 23.48 | 23.41 | 23.48 | 0.5 | 23.5 |
| | | | 36 | 0 | 23.44 | 23.41 | 23.50 | 0.5 | 23.5 |
| | | QPSK | 1 | 1 | 23.23 | 23.27 | 23.24 | 0.0 | 24.0 |
| | | | 1 | 19 | 23.11 | 23.14 | 23.19 | 0.0 | 24.0 |
| | | | 1 | 36 | 23.19 | 23.13 | 23.13 | 0.0 | 24.0 |
| | | | 18 | 0 | 22.91 | 22.94 | 22.93 | 1.0 | 23.0 |
| | | | 18 | 10 | 22.99 | 23.03 | 22.99 | 0.0 | 24.0 |
| | | | 18 | 20 | 22.87 | 22.90 | 23.00 | 1.0 | 23.0 |
| | | 36 | 0 | 22.94 | 22.99 | 23.00 | 1.0 | 23.0 | |
| 16QAM | 1 | 1 | 22.63 | 22.85 | 22.72 | 1.0 | 23.0 | | |
| 64QAM | 1 | 1 | 21.23 | 21.31 | 21.46 | 2.5 | 21.5 | | |
| 256QAM | 1 | 1 | 19.23 | 19.30 | 19.21 | 4.5 | 19.5 | | |
| CP-OFDM | QPSK | 1 | 1 | 22.16 | 22.24 | 22.24 | 1.5 | 22.5 | |
| BW (MHz) | Modulation | Mode | RB Allocation | RB offset | Measured Pwr (dBm) | | | MPR | Tune-up Limit |
| | | | | | 637000 | 641666 | 646332 | | |
| | | | | | 3555 MHz | 3624.99 MHz | 3694.98 MHz | | |
| 10 MHz | DFT-s-OFDM | π/2 BPSK | 1 | 1 | 23.23 | 23.29 | 23.21 | 0.0 | 24.0 |
| | | | 1 | 12 | 23.15 | 23.17 | 23.05 | 0.0 | 24.0 |
| | | | 1 | 22 | 23.23 | 23.11 | 23.13 | 0.0 | 24.0 |
| | | | 12 | 0 | 23.41 | 23.48 | 23.41 | 0.5 | 23.5 |
| | | | 12 | 6 | 23.49 | 23.55 | 23.49 | 0.0 | 24.0 |
| | | | 12 | 12 | 23.50 | 23.47 | 23.48 | 0.5 | 23.5 |
| | | | 24 | 0 | 23.40 | 23.46 | 23.49 | 0.5 | 23.5 |
| | | QPSK | 1 | 1 | 23.36 | 23.38 | 23.16 | 0.0 | 24.0 |
| | | | 1 | 12 | 23.15 | 23.22 | 23.02 | 0.0 | 24.0 |
| | | | 1 | 22 | 23.22 | 23.25 | 23.15 | 0.0 | 24.0 |
| | | | 12 | 0 | 22.91 | 22.99 | 22.91 | 1.0 | 23.0 |
| | | | 12 | 6 | 23.02 | 22.99 | 23.09 | 0.0 | 24.0 |
| | | | 12 | 12 | 22.99 | 22.98 | 22.96 | 1.0 | 23.0 |
| | | 24 | 0 | 22.98 | 22.88 | 22.97 | 1.0 | 23.0 | |
| 16QAM | 1 | 1 | 22.64 | 22.70 | 22.90 | 1.0 | 23.0 | | |
| 64QAM | 1 | 1 | 21.41 | 21.21 | 21.46 | 2.5 | 21.5 | | |
| 256QAM | 1 | 1 | 19.23 | 19.32 | 19.19 | 4.5 | 19.5 | | |
| CP-OFDM | QPSK | 1 | 1 | 22.08 | 22.24 | 22.22 | 1.5 | 22.5 | |

NR Band n48 (SRS1)

| BW (MHz) | RB Allocation | RB offset | Maximum Average Power (dBm) SRS1 | | | | |
|----------|---------------|-----------|-------------------------------------|-------------|-------------|-----|---------------|
| | | | Measured Pwr (dBm) | | | MPR | Tune-up Limit |
| 100 MHz | 1 | 1 | 640000 | 641666 | 643332 | | |
| | | | 3600 MHz | 3624.99 MHz | 3649.98 MHz | | |
| | | | 18.78 | 18.03 | 17.99 | 0.0 | |
| 90 MHz | 1 | 1 | 639668 | 641666 | 643666 | MPR | 19.0 |
| | | | 3595.02 MHz | 3624.99 MHz | 3654.99 MHz | | |
| | | | 19.01 | 18.60 | 18.23 | | |
| 80 MHz | 1 | 1 | 639334 | 641666 | 644000 | MPR | 19.0 |
| | | | 3590.01 MHz | 3624.99 MHz | 3660 MHz | | |
| | | | 18.93 | 18.39 | 18.45 | | |
| 70 MHz | 1 | 1 | 639000 | 641666 | 344332 | MPR | 19.0 |
| | | | 3585 MHz | 3624.99 MHz | 3664.98 MHz | | |
| | | | 18.77 | 18.10 | 18.53 | | |
| 60 MHz | 1 | 1 | 638668 | 641666 | 644666 | MPR | 19.0 |
| | | | 3580.02 MHz | 3624.99 MHz | 3669.99 MHz | | |
| | | | 18.69 | 18.42 | 18.59 | | |
| 50 MHz | 1 | 1 | 638334 | 641666 | 645000 | MPR | 19.0 |
| | | | 3575.01 MHz | 3624.99 MHz | 3675 MHz | | |
| | | | 18.56 | 18.31 | 18.58 | | |
| 40 MHz | 1 | 1 | 638000 | 641666 | 645332 | MPR | 19.0 |
| | | | 3570 MHz | 3624.99 MHz | 3679.98 MHz | | |
| | | | 18.47 | 18.11 | 18.79 | | |
| 30 MHz | 1 | 1 | 637668 | 641666 | 645666 | MPR | 19.0 |
| | | | 3565.02 MHz | 3624.99 MHz | 3684.99 MHz | | |
| | | | 18.48 | 18.34 | 19.05 | | |
| 20 MHz | 1 | 1 | 637334 | 641666 | 646000 | MPR | 19.0 |
| | | | 3560.01 | 3624.99 MHz | 3690 MHz | | |
| | | | 18.45 | 18.54 | 18.81 | | |
| 15 MHz | 1 | 1 | 637168 | 641666 | 646166 | MPR | 19.0 |
| | | | 3557.52 MHz | 3624.99 MHz | 3692.49 MHz | | |
| | | | 18.51 | 18.31 | 18.44 | | |
| 10 MHz | 1 | 1 | 637000 | 641666 | 646332 | MPR | 19.0 |
| | | | 3555 MHz | 3624.99 MHz | 3694.98 MHz | | |
| | | | 18.53 | 18.58 | 18.26 | | |

NR Band n48 (SRS2)

| BW (MHz) | RB Allocation | RB offset | Maximum Average Power (dBm) SRS2 | | | | |
|----------|---------------|-----------|-------------------------------------|-------------|-------------|-----|---------------|
| | | | Measured Pwr (dBm) | | | MPR | Tune-up Limit |
| 100 MHz | 1 | 1 | 640000 | 641666 | 643332 | | |
| | | | 3600 MHz | 3624.99 MHz | 3649.98 MHz | | |
| | | | 17.69 | 17.74 | 17.67 | | |
| 90 MHz | 1 | 1 | 639668 | 641666 | 643666 | 0.0 | |
| | | | 3595.02 MHz | 3624.99 MHz | 3654.99 MHz | | |
| | | | 17.62 | 17.62 | 17.58 | | |
| 80 MHz | 1 | 1 | 639334 | 641666 | 644000 | 0.0 | |
| | | | 3590.01 MHz | 3624.99 MHz | 3660 MHz | | |
| | | | 17.94 | 17.59 | 17.91 | | |
| 70 MHz | 1 | 1 | 639000 | 641666 | 344332 | 0.0 | |
| | | | 3585 MHz | 3624.99 MHz | 3664.98 MHz | | |
| | | | 17.94 | 17.67 | 17.98 | | |
| 60 MHz | 1 | 1 | 638668 | 641666 | 644666 | 0.0 | |
| | | | 3580.02 MHz | 3624.99 MHz | 3669.99 MHz | | |
| | | | 17.87 | 17.67 | 18.03 | | |
| 50 MHz | 1 | 1 | 638334 | 641666 | 645000 | 0.0 | |
| | | | 3575.01 MHz | 3624.99 MHz | 3675 MHz | | |
| | | | 17.89 | 17.80 | 18.06 | | |
| 40 MHz | 1 | 1 | 638000 | 641666 | 645332 | 0.0 | |
| | | | 3570 MHz | 3624.99 MHz | 3679.98 MHz | | |
| | | | 17.69 | 17.88 | 18.19 | | |
| 30 MHz | 1 | 1 | 637668 | 641666 | 645666 | 0.0 | |
| | | | 3565.02 MHz | 3624.99 MHz | 3684.99 MHz | | |
| | | | 17.48 | 17.96 | 18.29 | | |
| 20 MHz | 1 | 1 | 637334 | 641666 | 646000 | 0.0 | |
| | | | 3560.01 | 3624.99 MHz | 3690 MHz | | |
| | | | 17.41 | 18.04 | 18.37 | | |
| 15 MHz | 1 | 1 | 637168 | 641666 | 646166 | 0.0 | |
| | | | 3557.52 MHz | 3624.99 MHz | 3692.49 MHz | | |
| | | | 17.52 | 17.94 | 18.05 | | |
| 10 MHz | 1 | 1 | 637000 | 641666 | 646332 | 0.0 | |
| | | | 3555 MHz | 3624.99 MHz | 3694.98 MHz | | |
| | | | 17.47 | 18.22 | 18.10 | | |

NR Band n48 (SRS3)

| BW (MHz) | RB Allocation | RB offset | Maximum Average Power (dBm) SRS3 | | | | |
|----------|---------------|-----------|-------------------------------------|-------------|-------------|-----|---------------|
| | | | Measured Pwr (dBm) | | | MPR | Tune-up Limit |
| 100 MHz | 1 | 1 | 640000 | 641666 | 643332 | | |
| | | | 3600 MHz | 3624.99 MHz | 3649.98 MHz | | |
| | | | 16.30 | 16.12 | 15.98 | | |
| 90 MHz | 1 | 1 | 639668 | 641666 | 643666 | 0.0 | |
| | | | 3595.02 MHz | 3624.99 MHz | 3654.99 MHz | | |
| | | | 16.35 | 16.01 | 16.04 | | |
| 80 MHz | 1 | 1 | 639334 | 641666 | 644000 | 0.0 | |
| | | | 3590.01 MHz | 3624.99 MHz | 3660 MHz | | |
| | | | 16.29 | 15.82 | 16.13 | | |
| 70 MHz | 1 | 1 | 639000 | 641666 | 344332 | 0.0 | |
| | | | 3585 MHz | 3624.99 MHz | 3664.98 MHz | | |
| | | | 16.31 | 15.78 | 16.07 | | |
| 60 MHz | 1 | 1 | 638668 | 641666 | 644666 | 0.0 | |
| | | | 3580.02 MHz | 3624.99 MHz | 3669.99 MHz | | |
| | | | 16.20 | 15.73 | 16.18 | | |
| 50 MHz | 1 | 1 | 638334 | 641666 | 645000 | 0.0 | |
| | | | 3575.01 MHz | 3624.99 MHz | 3675 MHz | | |
| | | | 16.28 | 15.68 | 16.15 | | |
| 40 MHz | 1 | 1 | 638000 | 641666 | 645332 | 0.0 | |
| | | | 3570 MHz | 3624.99 MHz | 3679.98 MHz | | |
| | | | 16.33 | 15.80 | 16.41 | | |
| 30 MHz | 1 | 1 | 637668 | 641666 | 645666 | 0.0 | |
| | | | 3565.02 MHz | 3624.99 MHz | 3684.99 MHz | | |
| | | | 16.36 | 15.91 | 16.71 | | |
| 20 MHz | 1 | 1 | 637334 | 641666 | 646000 | 0.0 | |
| | | | 3560.01 | 3624.99 MHz | 3690 MHz | | |
| | | | 16.51 | 15.99 | 16.86 | | |
| 15 MHz | 1 | 1 | 637168 | 641666 | 646166 | 0.0 | |
| | | | 3557.52 MHz | 3624.99 MHz | 3692.49 MHz | | |
| | | | 16.45 | 16.20 | 16.95 | | |
| 10 MHz | 1 | 1 | 637000 | 641666 | 646332 | 0.0 | |
| | | | 3555 MHz | 3624.99 MHz | 3694.98 MHz | | |
| | | | 16.54 | 16.26 | 16.73 | | |

8.2. PEAK TO AVERAGE RATIO

Test Procedure

Per KDB 971168 D01 Power Meas License Digital Systems v03r01;

The transmitter output was connected to a CMW500 Test Set and configured to operate at maximum power. The PAR were measured on the Spectrum Analyzer.

Test Spec

In addition, when the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13 dB.

NOTE

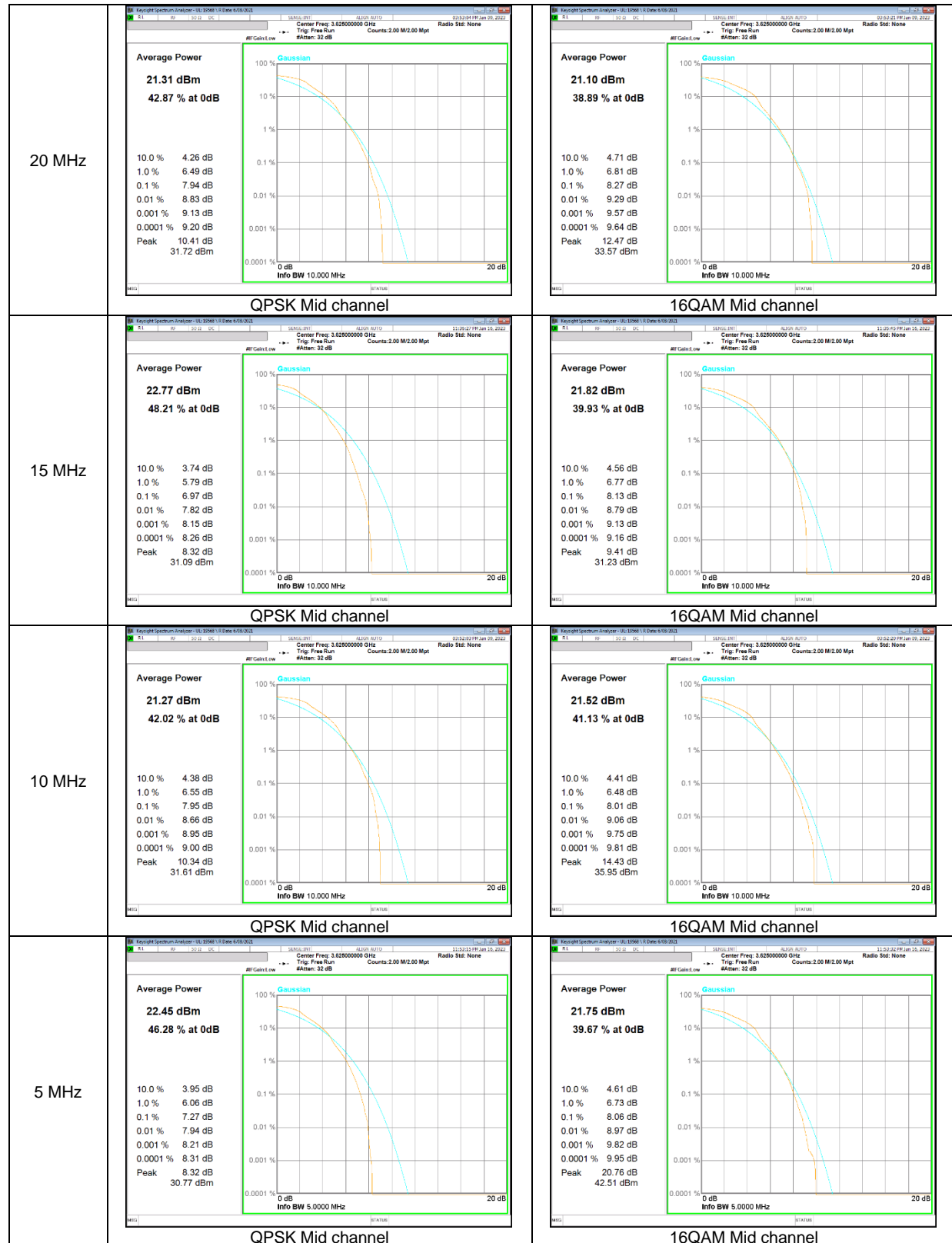
5G NR: All Waveforms (CP-OFDM vs DFT-s_OFDM) and modulations ($\pi/2$ BPSK, QPSK, 16QAM, 64QAM, 256QAM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

RESULTS

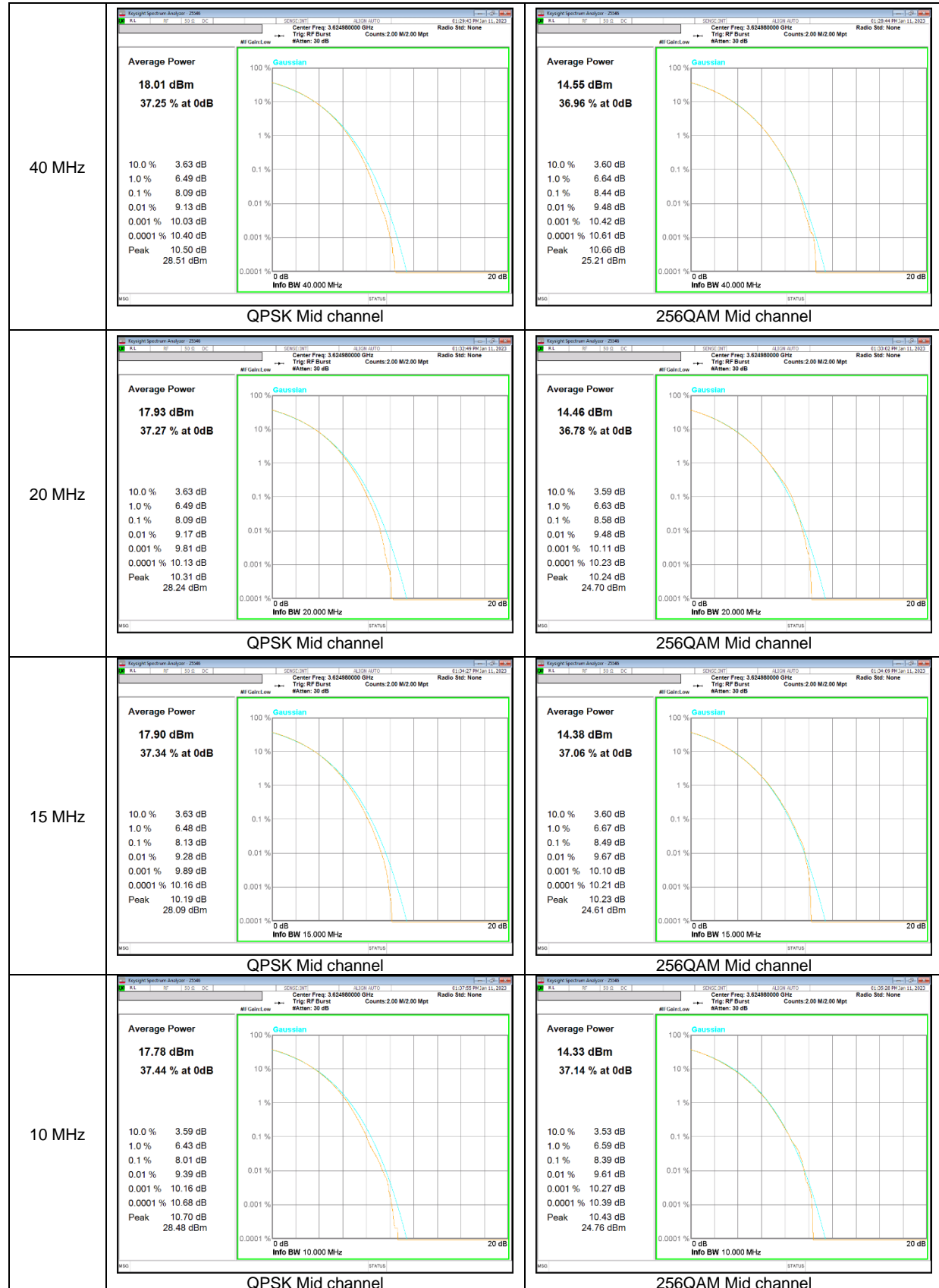
See the following pages.

8.2.1. CONDUCTED PEAK TO AVERAGE RESULT

LTE Band 48



NR Band n48 CP-OFDM



9. LIMITS AND CONDUCTED RESULTS

9.1. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049

LIMITS

For reporting purposes only

TEST PROCEDURE

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the low, middle and high channel in each band. The -26dB bandwidth was also measured and recorded.

(KDB 971168 D01 Power Meas License Digital Systems v03r01)

OCCUPIED BANDWIDTH RESULTS

See the following pages.

- LTE Band 48

| Band | BW | Modulation | f [MHz] | 99% BW (MHz) | -26dB BW (MHz) |
|---------|-----|------------|---------|--------------|----------------|
| LTE B48 | 20M | QPSK | 3625.0 | 17.910 | 19.430 |
| | | 16QAM | | 17.944 | 18.970 |
| | 15M | QPSK | 3625.0 | 13.425 | 14.880 |
| | | 16QAM | | 13.413 | 14.570 |
| | 10M | QPSK | 3625.0 | 8.970 | 9.971 |
| | | 16QAM | | 8.930 | 9.888 |
| | 5M | QPSK | 3625.0 | 4.492 | 5.100 |
| | | 16QAM | | 4.476 | 5.225 |

- LTE Band 48C

| Band | BW | Modulation | f [MHz] | 99% BW (MHz) | -26dB BW (MHz) |
|-------------------|-------|------------|---------|--------------|----------------|
| LTE B48 Uplink CA | 20+20 | QPSK | 3625.0 | 37.421 | 39.140 |
| | | 16QAM | | 37.455 | 39.150 |

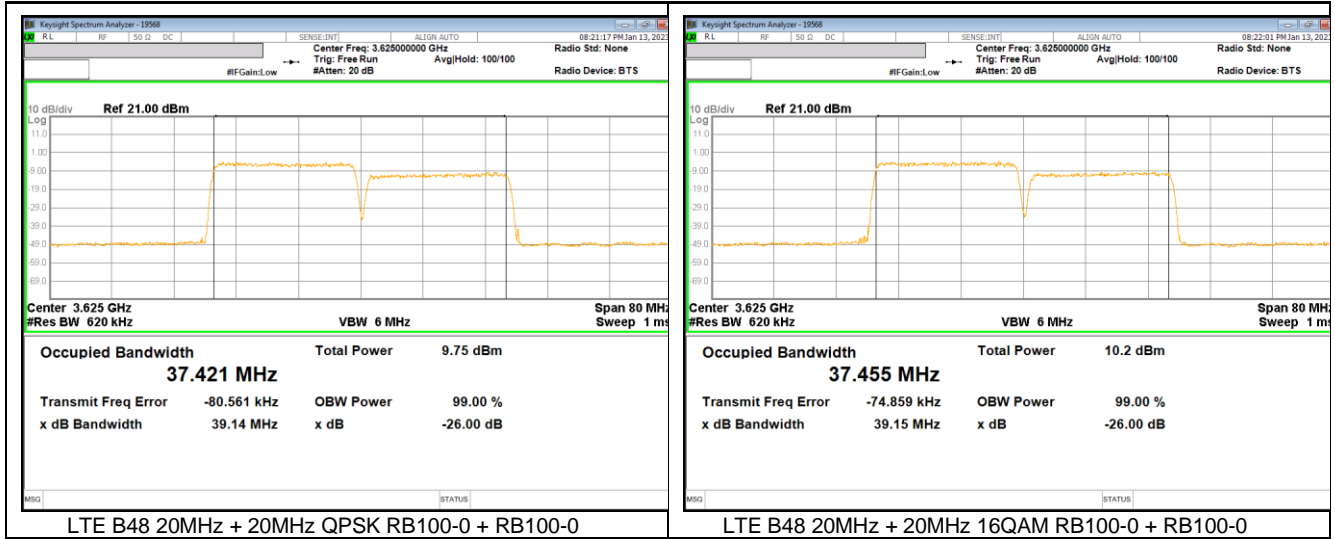
- NR Band n48

| Band | BW | Modulation | f [MHz] | 99% BW (MHz) | -26dB BW (MHz) |
|--------|-----|------------|---------|--------------|----------------|
| NR n48 | 40M | QPSK | 3624.99 | 37.926 | 41.910 |
| | | 16QAM | | 37.962 | 40.100 |
| | 20M | QPSK | 3624.99 | 18.248 | 19.650 |
| | | 16QAM | | 18.241 | 19.880 |
| | 15M | QPSK | 3624.99 | 13.605 | 15.100 |
| | | 16QAM | | 13.603 | 15.050 |
| | 10M | QPSK | 3624.99 | 8.600 | 9.993 |
| | | 16QAM | | 8.568 | 9.598 |

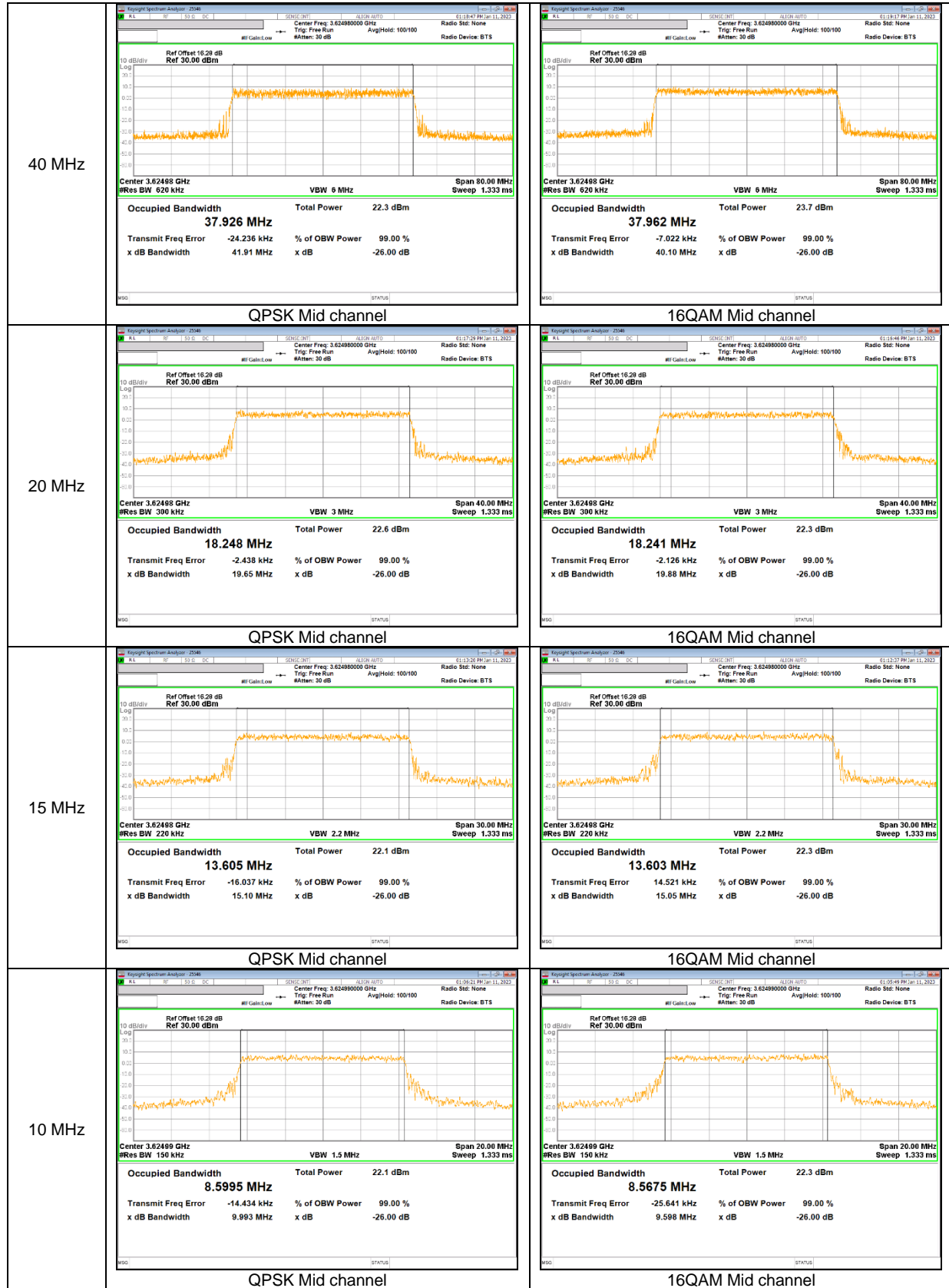
LTE Band 48



LTE Band 48C (ULCA)



NR Band n48 CP-OFDM



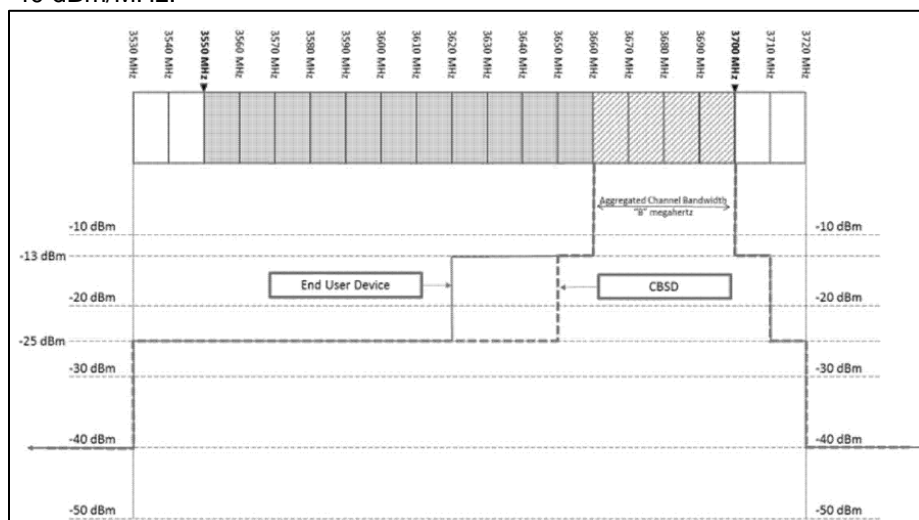
9.2. BAND EDGE EMISSIONS

RULE PART(S)

FCC: §2.1051 and §96.41(e)(ii)

LIMITS

For channel and frequency assignments made by a CBSD to End User Devices, the conducted power of any End User Device emission outside the fundamental emission (whether in or outside of the authorized band) shall not exceed -13 dBm/MHz within 0 to B megahertz (where B is the bandwidth in megahertz of the assigned channel or multiple contiguous channels of the End User Device) above the upper CBSD-assigned channel edge and within 0 to B megahertz below the lower CBSD-assigned channel edge. At all frequencies greater than B megahertz above the upper CBSD assigned channel edge and less than B megahertz below the lower CBSD-assigned channel edge, the conducted power of any End User Device emission shall not exceed -25 dBm/MHz. Notwithstanding the emission limits in this paragraph, the Adjacent Channel Leakage Ratio for End User Devices shall be at least 30 dB. The conducted power of any emissions below 3530 MHz or above 3720 MHz shall not exceed -40 dBm/MHz.



TEST PROCEDURE

Per KDB 971168 D01 Power Meas License Digital Systems v03r01

The transmitter output was connected to a CMW500 Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.

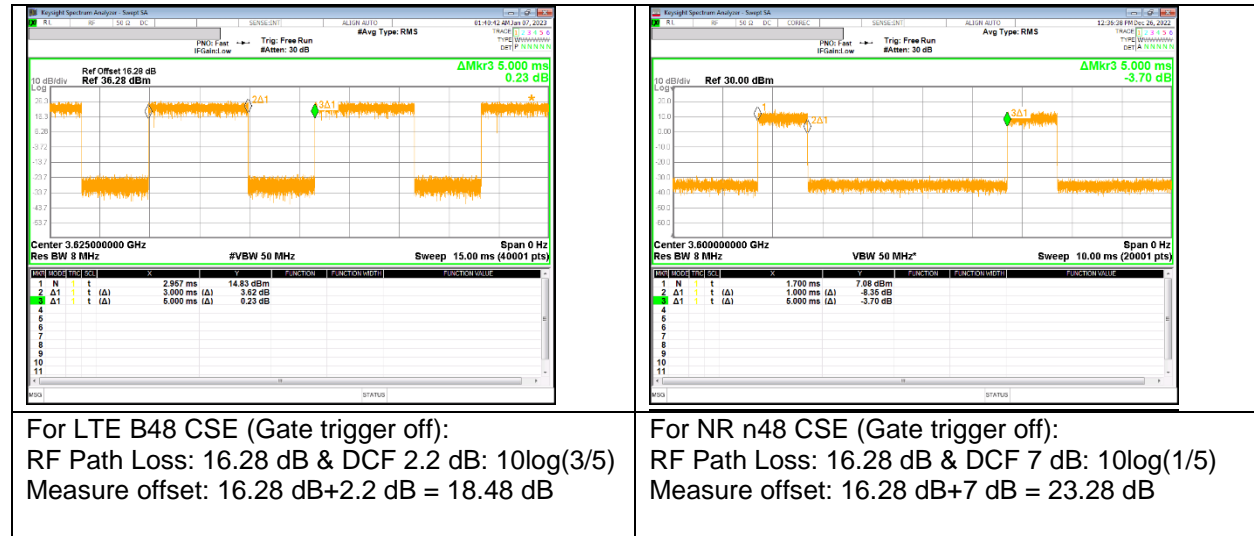
- Set the RBW = $1 \sim 1.5$ % of OBW (Typically limited to a minimum RBW of 1% of the OBW)
- Set VBW $\geq 3 \times$ RBW;
- Set span ≥ 1.5 times the OBW;
- Sweep time = Auto;
- Detector = RMS;
- Ensure that the number of measurement points $\geq 2 \times$ Span/RBW;
- Trace mode = Average (100);

NOTE1 (A-MPR)

[LTE Band 48 and NR Band n48] A-MPR is implemented in this EUT per the A-MPR specification in 3GPP TS 36.101 (Table 6.2.4-22). Conducted output power verification data are shown Appendix A. Also only Emission mask test item were performed A-MPR condition. Also only Emission mask test item were performed A-MPR condition.

[LTE Band 48C] A-MPR is implemented in this EUT per the A-MPR specification in 3GPP TS 36.101 (Table 6.2.4A,10-1, Table 6.2.4A,10-2). Conducted output power verification data are shown Appendix A. Also only Emission mask test item were performed A-MPR condition. Also only Emission mask test item were performed A-MPR condition.

NOTE2



NOTE3

Please refer to section 5.4 for bandwidth and RB setting about LTE, 5G NR bands.

NOTE4

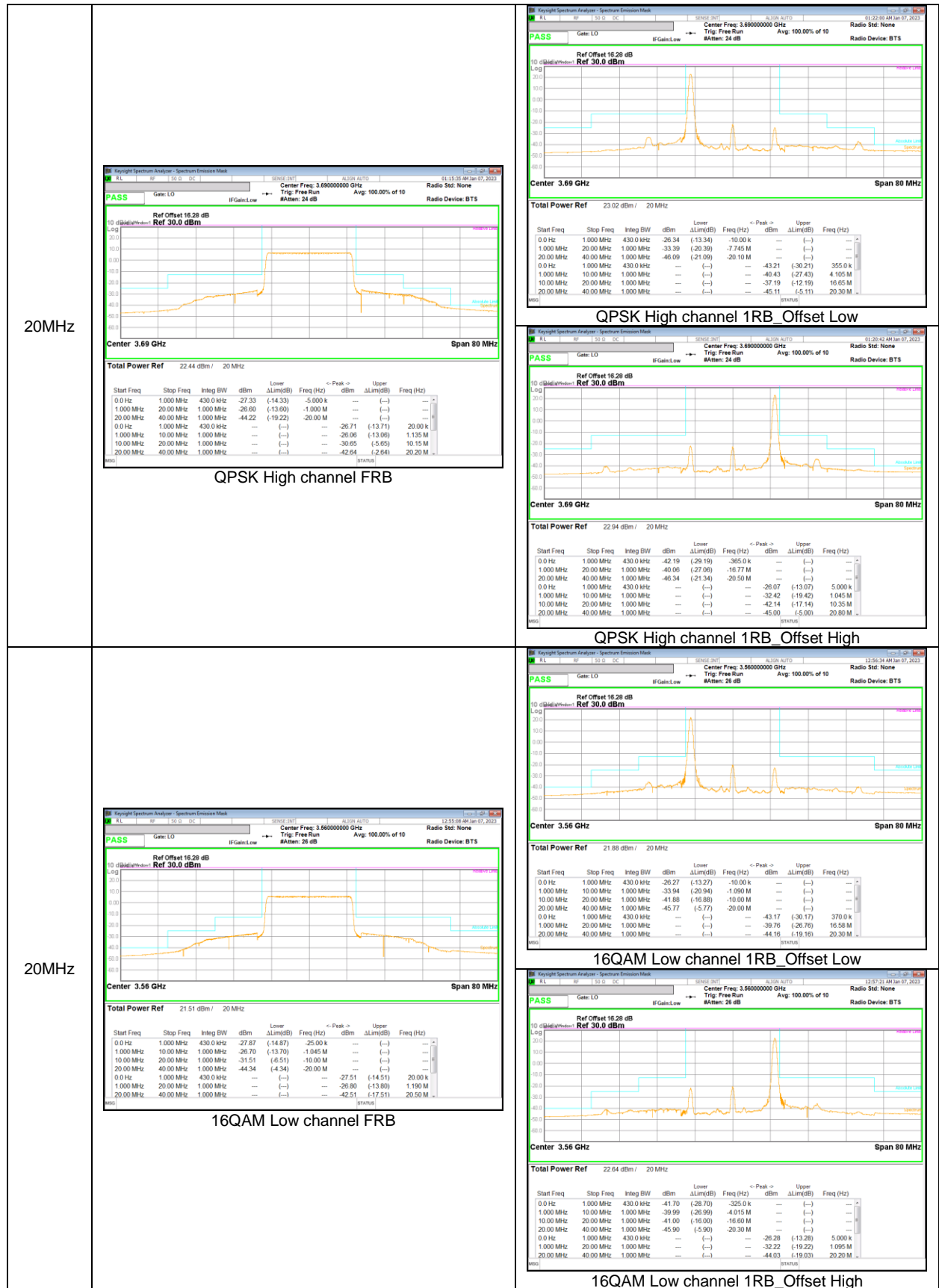
5G NR: All Waveforms (CP-OFDM vs DFT-s_OFDM) and modulations ($\pi/2$ BPSK, QPSK, 16QAM, 64QAM, 256QAM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

RESULTS

See the following pages.

LTE Band 48

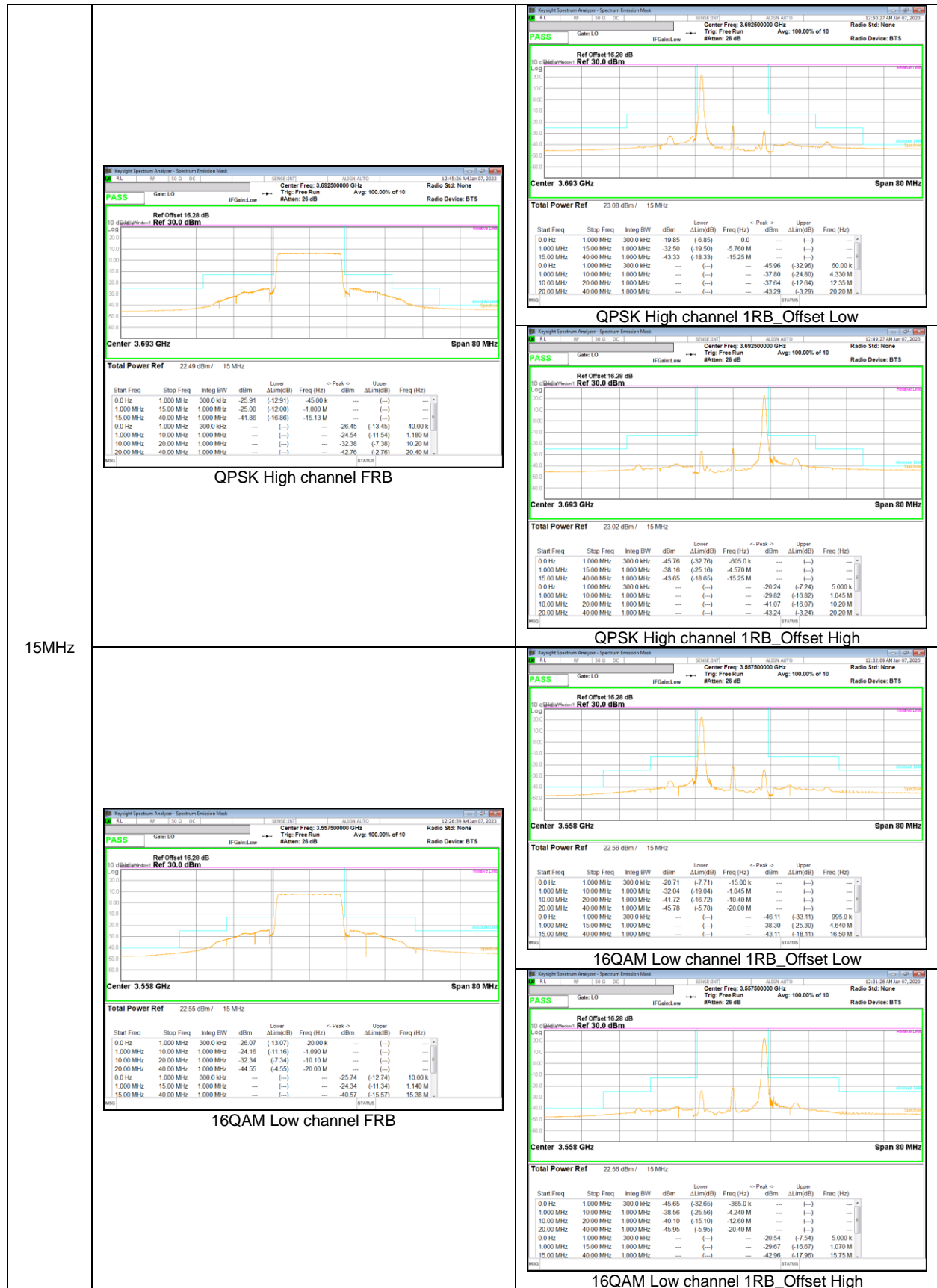








15MHz



15MHz





10MHz

