

FCC Test Report (Part 96 – LTE B48)

Report No.: RFBCLD-WTW-P21060790-1

FCC ID: QI3BEC-MX241NP

Test Model: BEC MX-241NP

Received Date: Jun. 24, 2021

Test Date: Jul. 07 ~ Jul. 09, 2021

Issued Date: Sep. 11, 2021

Applicant: BILLION ELECTRIC CO., LTD.

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
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**FCC Registration /
Designation Number:** 788550 / TW0003



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Release Control Record

| Issue No. | Description | Date Issued |
|------------------------|------------------|---------------|
| RFBCLD-WTW-P21060790-1 | Original release | Sep. 11, 2021 |

1 Certificate of Conformity

Product: 4G LTE CBRS Wi-Fi Router

Brand: BEC, BILLION

Test Model: BEC MX-241NP

Sample Status: Engineering sample

Applicant: BILLION ELECTRIC CO., LTD.

Test Date: Jul. 07 ~ Jul. 09, 2021

Standards: 47 CFR FCC Part 96

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

Prepared by : Celine Chou , **Date:** Sep. 11, 2021
Celine Chou / Senior Specialist

Approved by : Bruce Chen , **Date:** Sep. 11, 2021
Bruce Chen / Senior Engineer

2 Summary of Test Results

| 47 CFR FCC Part 96 | | | |
|--------------------|--------------------------------|--------|---|
| FCC Clause | Test Item | Result | Remarks |
| 2.1046 96.41(b) | Maximum Peak Output Power | Pass | Meet the requirement of limit. |
| 2.1046 96.41(b) | Maximum Power Spectral Density | Pass | Meet the requirement of limit. |
| 96.41(a) 2.1047 | Modulation Characteristics | Pass | Meet the requirement |
| 96.41(g) | Peak to Average Ration | Pass | Meet the requirement of limit. |
| 2.1049 | Emission Bandwidth | Pass | Meet the requirement of limit. |
| 2.1055 | Frequency Stability | Pass | Meet the requirement of limit. |
| 2.1051 96.41(e) | Conducted Spurious Emissions | Pass | Meet the requirement of limit. |
| 2.1053 96.41(e) | Radiated Spurious Emissions | Pass | Meet the requirement of limit. Minimum passing margin is -0.33dB at 7395.00MHz. |

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

| Measurement | Frequency | Expanded Uncertainty (k=2) (\pm) |
|--------------------------------|------------------|--------------------------------------|
| Radiated Emissions up to 1 GHz | 9kHz ~ 30MHz | 3.04 dB |
| | 30MHz ~ 200MHz | 3.59 dB |
| | 200MHz ~ 1000MHz | 3.60 dB |
| Radiated Emissions above 1 GHz | 1GHz ~ 18GHz | 2.29 dB |
| | 18GHz ~ 40GHz | 2.29 dB |

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

| | | | |
|---------------------------------|---------------------------------------|-------------------------------|-------------------------------|
| Product | 4G LTE CBRS Wi-Fi Router | | |
| Brand | BEC, BILLION | | |
| Test Model | BEC MX-241NP | | |
| Sample Status | Engineering sample | | |
| Power Supply Rating | 12Vdc from adapter 56Vdc from POE | | |
| Modulation Type | QPSK, 16QAM | | |
| Operating Frequency | LTE Band 48 (Channel Bandwidth 5MHz) | 3552.5MHz ~ 3697.5MHz | |
| | LTE Band 48 (Channel Bandwidth 10MHz) | 3555.0MHz ~ 3695.0MHz | |
| | LTE Band 48 (Channel Bandwidth 15MHz) | 3557.5MHz ~ 3692.5MHz | |
| | LTE Band 48 (Channel Bandwidth 20MHz) | 3560.0MHz ~ 3690.0MHz | |
| Max. EIRP Power | | QPSK | 16QAM |
| | LTE Band 48 (Channel Bandwidth 5MHz) | 179.887mW (22.55dBm/10MHz) | 190.985mW (22.81dBm/10MHz) |
| | LTE Band 48 (Channel Bandwidth 10MHz) | 163.682mW (22.14dBm/10MHz) | 172.584mW (22.37dBm/10MHz) |
| | LTE Band 48 (Channel Bandwidth 15MHz) | 136.773mW (21.36dBm/10MHz) | 141.579mW (21.51dBm/10MHz) |
| | LTE Band 48 (Channel Bandwidth 20MHz) | 153.815mW (21.87dBm/10MHz) | 160.694mW (22.06dBm/10MHz) |
| Max. EIRP Power (Full power) | | QPSK | 16QAM |
| | LTE Band 48 (Channel Bandwidth 5MHz) | 179.887mW (22.55dBm/10MHz) | 190.985mW (22.81dBm/10MHz) |
| | LTE Band 48 (Channel Bandwidth 10MHz) | 163.682mW (22.14dBm/10MHz) | 172.584mW (22.37dBm/10MHz) |
| | LTE Band 48 (Channel Bandwidth 15MHz) | 142.561mW (21.54dBm/15MHz) | 147.571mW (21.69dBm/15MHz) |
| | LTE Band 48 (Channel Bandwidth 20MHz) | 155.597mW (21.92dBm/20MHz) | 163.682mW (22.14dBm/20MHz) |
| Emission Designator | | QPSK | 16QAM |
| | LTE Band 48 (Channel Bandwidth 5MHz) | 4M49G7D | 4M48D7W |
| | LTE Band 48 (Channel Bandwidth 10MHz) | 8M96G7D | 8M97D7W |
| | LTE Band 48 (Channel Bandwidth 15MHz) | 13M4G7D | 13M4D7W |
| | LTE Band 48 (Channel Bandwidth 20MHz) | 18M0G7D | 18M0D7W |
| Antenna Type | Refer to note | | |
| Antenna Connector | Refer to note | | |
| Accessory Device | Adapter | | |
| Cable Supplied | NA | | |

Note:

1. The EUT consumes power from the following Adapters & POE. (POE for support unit only)

| Adapter 1 | |
|--------------|---------------------------------|
| Brand | BILLION |
| Model | BA018-120120AXU |
| Input Power | 100-240Vac, 50/60Hz, 0.5A |
| Output Power | 12Vdc, 1.2A |
| Power Line | 1.55m non-shielded without core |

| Adapter 2 | |
|--------------|--------------------------------|
| Brand | BILLION |
| Model | PA1015-120HUB120 |
| Input Power | 100-240Vac, 50/60Hz, 0.4A |
| Output Power | 12Vdc, 1.2A |
| Power Line | 1.5m non-shielded without core |

* After pre-test, adapter 1 was chosen for final test and presented in the test report.

| POE | |
|--------------|---------------------------------|
| Brand | BILLION |
| Model | BP035-560063PAX |
| Input Power | 100-240Vac, 50/60Hz, 0.8A |
| Output Power | 56Vdc, 0.625A |
| Power Line | 1.83m non-shielded without core |

2. The following antennas were provided to the EUT.

| No. | Type | Connector | Gain (dBi) |
|-----|--------|-----------|------------|
| 1 | Dipole | SMA Plug | 5.9 |

* The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

3. WLAN 2.4GHz & WWAN technology can transmit at same time.

4. Spurious emission of the simultaneous operation (WLAN 2.4GHz & WWAN) has been evaluated and no non-compliance was found.

3.2 Test Mode Applicability and Tested Channel Detail

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, XYZ axis and antenna ports. The worst case was found when positioned as the table below. Following channel(s) was (were) selected for the final test as listed below:

| Band | Radiated Emission |
|-------------|-------------------|
| LTE Band 48 | X-plane |

LTE Band 48

| Test Item | Available Channel | Tested Channel | Channel Bandwidth | Modulation |
|----------------------------|-------------------|---|-------------------|--------------|
| Maximum Output Power | 55265 to 56715 | 55265 (3552.5MHz), 55990 (3625.0MHz), 56715 (3697.5MHz) | 5MHz | QPSK / 16QAM |
| | 55290 to 56690 | 55290 (3555.0MHz), 55990 (3625.0MHz), 56690 (3695.0MHz) | 10MHz | QPSK / 16QAM |
| | 55315 to 56665 | 55315 (3557.5MHz), 55990 (3625.0MHz), 56665 (3692.5MHz) | 15MHz | QPSK / 16QAM |
| | 55340 to 56640 | 55340 (3560.0MHz), 55990 (3625.0MHz), 56640 (3690.0MHz) | 20MHz | QPSK / 16QAM |
| Modulation characteristics | 55340 to 56640 | 55990 (3625.0MHz) | 20MHz | QPSK / 16QAM |
| Frequency Stability | 55265 to 56715 | 55265 (3552.5MHz), 56715 (3697.5MHz) | 5MHz | 16QAM |
| | 55290 to 56690 | 55290 (3555.0MHz), 56690 (3695.0MHz) | 10MHz | 16QAM |
| | 55315 to 56665 | 55315 (3557.5MHz), 56665 (3692.5MHz) | 15MHz | 16QAM |
| | 55340 to 56640 | 55340 (3560.0MHz), 56640 (3690.0MHz) | 20MHz | 16QAM |
| Occupied Bandwidth | 55265 to 56715 | 55265 (3552.5MHz), 55990 (3625.0MHz), 56715 (3697.5MHz) | 5MHz | QPSK / 16QAM |
| | 55290 to 56690 | 55290 (3555.0MHz), 55990 (3625.0MHz), 56690 (3695.0MHz) | 10MHz | QPSK / 16QAM |
| | 55315 to 56665 | 55315 (3557.5MHz), 55990 (3625.0MHz), 56665 (3692.5MHz) | 15MHz | QPSK / 16QAM |
| | 55340 to 56640 | 55340 (3560.0MHz), 55990 (3625.0MHz), 56640 (3690.0MHz) | 20MHz | QPSK / 16QAM |

| Test Item | Available Channel | Tested Channel | Channel Bandwidth | Modulation |
|---------------------------------|-------------------|---|-------------------|--------------|
| Peak to Average Ratio | 55265 to 56715 | 55265 (3552.5MHz), 55990 (3625.0MHz), 56715 (3697.5MHz) | 5MHz | QPSK / 16QAM |
| | 55290 to 56690 | 55290 (3555.0MHz), 55990 (3625.0MHz), 56690 (3695.0MHz) | 10MHz | QPSK / 16QAM |
| | 55315 to 56665 | 55315 (3557.5MHz), 55990 (3625.0MHz), 56665 (3692.5MHz) | 15MHz | QPSK / 16QAM |
| | 55340 to 56640 | 55340 (3560.0MHz), 55990 (3625.0MHz), 56640 (3690.0MHz) | 20MHz | QPSK / 16QAM |
| Conducted Emission | 55265 to 56715 | 55265 (3552.5MHz), 55990 (3625.0MHz), 56715 (3697.5MHz) | 5MHz | 16QAM |
| | 55290 to 56690 | 55290 (3555.0MHz), 55990 (3625.0MHz), 56690 (3695.0MHz) | 10MHz | 16QAM |
| | 55315 to 56665 | 55315 (3557.5MHz), 55990 (3625.0MHz), 56665 (3692.5MHz) | 15MHz | 16QAM |
| | 55340 to 56640 | 55340 (3560.0MHz), 55990 (3625.0MHz), 56640 (3690.0MHz) | 20MHz | 16QAM |
| Radiated Emission Below 1GHz | 55340 to 56640 | 55990 (3625.0MHz) | 20MHz | 16QAM |
| Radiated Emission Above 1GHz | 55265 to 56715 | 55265 (3552.5MHz), 55990 (3625.0MHz), 56715 (3697.5MHz) | 5MHz | 16QAM |
| | 55340 to 56640 | 55340 (3560.0MHz), 55990 (3625.0MHz), 56640 (3690.0MHz) | 20MHz | 16QAM |

Note:

1. For radiated emission below 1GHz, select the worst radiated emission channel (above 1GHz) for final testing.
2. For radiated emission above 1GHz, according to 3GPP 36.521 Section 6.6.3.1.4, choose the lowest, 5MHz & highest channel bandwidth for final test.
3. The output power for QPSK, 16QAM, and measured value of is 16QAM higher than QPSK mode. Therefore, only Modulation characteristics, occupied bandwidth and Peak to average ratio items had been tested under QPSK, 16QAM modes, the other test items were performed under 16QAM mode only.

Test Condition:

| Test Item | Environmental Conditions | Input Power | Tested By |
|----------------------------|--------------------------|--------------|------------|
| Maximum Output Power | 25deg. C, 63%RH | 120Vac, 60Hz | James Yang |
| Modulation Characteristics | 25deg. C, 63%RH | 120Vac, 60Hz | James Yang |
| Frequency Stability | 25deg. C, 63%RH | 120Vac, 60Hz | James Yang |
| Occupied Bandwidth | 25deg. C, 63%RH | 120Vac, 60Hz | James Yang |
| Peak To Average Ratio | 25deg. C, 63%RH | 120Vac, 60Hz | James Yang |
| Conducted Emission | 25deg. C, 63%RH | 120Vac, 60Hz | James Yang |
| Radiated Emission | 22deg. C, 66%RH | 120Vac, 60Hz | Greg Lin |

3.3 Description of Support Units

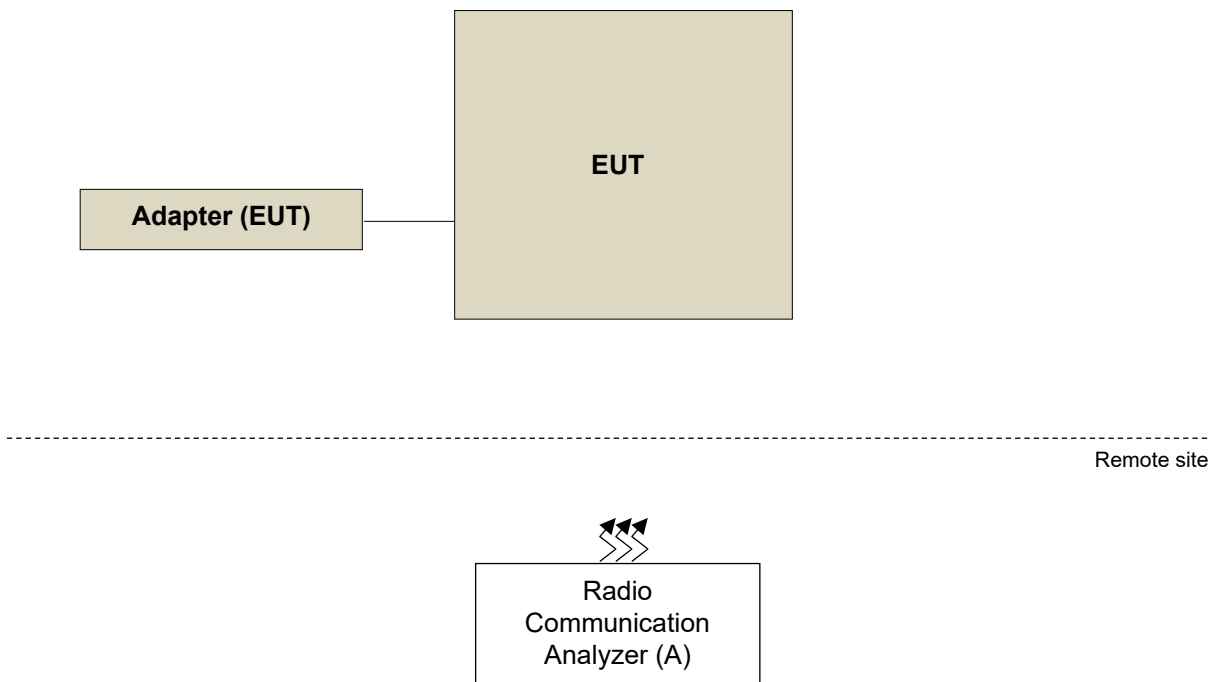
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| ID | Product | Brand | Model No. | Serial No. | FCC ID | Remarks |
|----|------------------------------|---------|-----------|------------|--------|---------|
| A. | Radio Communication Analyzer | Anritsu | MT8821C | 6261806803 | NA | - |

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item A acted as a communication partner to transfer data.

3.3.1 Configuration of System under Test



3.4 General Description of Applied Standards and References

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

Test standard:

FCC 47 CFR Part 2

FCC 47 CFR Part 96

ANSI/TIA/EIA-603-E-2016

All test items have been performed and recorded as per the above standards.

References Test Guidance:

KDB 971168 D01 Power Meas License Digital Systems v03r01

KDB 940660 D01 Part 96 CBRS Eqpt v03

All test items have been performed as a reference to the above KDB test guidance.

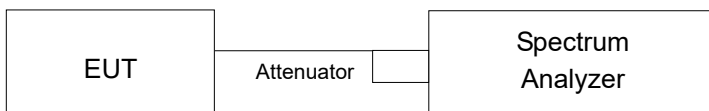
4 Test Types and Results

4.1 Maximum Output Power Measurement

4.1.1 Limits of Maximum Output Power Measurement

| Device | | Maximum EIRP (dBm/10 MHz) |
|-------------------------------------|-----------------|------------------------------|
| <input checked="" type="checkbox"/> | End User Device | 23 |
| <input type="checkbox"/> | Category A CBSD | 30 |
| <input type="checkbox"/> | Category B CBSD | 47 |

4.1.2 Test Setup



4.1.3 Test Instruments

| Description & Manufacturer | Model No. | Serial No. | Cal. Date | Cal. Due |
|--|-------------|---------------|---------------|---------------|
| Spectrum Analyzer KEYSIGHT | N9030B | MY57140953 | Jul. 06, 2021 | Jul. 05, 2022 |
| Radio Communication Analyzer Anritsu | MT8821C | 6201462755 | Feb. 07, 2021 | Feb. 07, 2022 |
| RF cable | JB200 | Cable-OVEN-02 | NA | NA |
| DC-6GHz 20dB 50W Fixed attenuator Woken | MDC9331N-20 | 0724 | Jun. 24, 2020 | Jun. 23, 2022 |
| STANDARD TEMPERATURE & HUMIDITY CHAMBER TERCHY | MHU-225AU | 911033 | Nov. 24, 2020 | Nov. 23, 2021 |
| AC Power Supply Extech | CFW-105 | E000603 | NA | NA |
| Digital Multimeter Fluke | 87-III | 70360742 | Jun. 24, 2021 | Jun. 23, 2022 |

Note: The calibration interval of the above test instruments is 12/24 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.1.4 Test Procedures

Conducted output power measurement

- a. Connect the DUT transmitter output to the spectrum analyzer via coaxial cable while ensuring proper impedance matching.
- b. Set span to at least 1.5 times the OBW.
- c. Set RBW = 1-5% of the OBW, not to exceed 1 MHz.
- d. Set VBW $\geq 3 \times$ RBW.
- e. Set number of points in sweep $\geq 2 \times$ span / RBW.
- f. Sweep time = auto-couple.
- g. Detector = RMS (power averaging).
- h. If the EUT can be configured to transmit continuously (i.e., burst duty cycle $\geq 98\%$), then set the trigger to free run.
- i. If the EUT cannot be configured to transmit continuously (i.e., burst duty cycle $< 98\%$), then use a sweep trigger with the level set to enable triggering only on full power bursts and configure the EUT to transmit at full power for the entire duration of each sweep. Ensure that the sweep time is less than or equal to the transmission burst duration.
- j. Trace average at least 100 traces in power averaging (i.e., RMS) mode.
- k. Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band or channel power measurement function, with the band/channel limits set equal to the OBW band edges. If the instrument does not have a band or channel power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.
- l. For per 10MHz method, channel power integrating bandwidth 10MHz is used for bandwidth 5M, 10M, 15M and 20M. For full power method, channel power integrating bandwidth 10MHz is used for bandwidth 5M, 10M, integrating bandwidth 15MHz is used for bandwidth 15M, integrating bandwidth 20MHz is used for bandwidth 20M.

Maximum EIRP

The relevant equation for determining the maximum ERP or EIRP from the measured RF output power is given in Equation as follows:

$$\text{ERP or EIRP} = P_{\text{Meas}} + G_{\text{T}}$$

where

ERP or EIRP effective radiated power or equivalent isotropically radiated power, respectively
(expressed in the same units as P_{Meas} , e.g., dBm or dBW)

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)

4.1.5 Deviation from Test Standard

No deviation.

4.1.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.1.7 Test Results

Conducted Output Power (dBm/10MHz)

| LTE Band 48 | | | | | | |
|-------------|-----------|-----------------|-----------|--------|-------|--------|
| BW | MCS Index | RB Size | RB Offset | Low | Mid | High |
| | | Channel | | 55340 | 55990 | 56640 |
| | | Frequency (MHz) | | 3560 | 3625 | 3690 |
| 20M | QPSK | 1 | 0 | 15.58 | 14.58 | 13.66 |
| | | 1 | 50 | 15.97 | 14.90 | 13.94 |
| | | 1 | 99 | 15.53 | 14.61 | 13.75 |
| | | 50 | 0 | 15.54 | 14.56 | 13.74 |
| | | 50 | 25 | 15.74 | 14.75 | 13.87 |
| | | 50 | 50 | 15.57 | 14.68 | 13.69 |
| | | 100 | 0 | 13.18 | 13.12 | 12.63 |
| | 16QAM | 1 | 0 | 15.73 | 14.85 | 13.82 |
| | | 1 | 50 | 16.16 | 15.15 | 14.20 |
| | | 1 | 99 | 15.82 | 14.85 | 13.88 |
| | | 50 | 0 | 15.85 | 14.84 | 13.92 |
| | | 50 | 25 | 15.90 | 14.98 | 14.20 |
| | | 50 | 50 | 15.70 | 14.77 | 13.81 |
| | | 100 | 0 | 13.19 | 13.22 | 12.65 |
| BW | MCS Index | Channel | | 55315 | 55990 | 56665 |
| | | Frequency (MHz) | | 3557.5 | 3625 | 3692.5 |
| 15M | QPSK | 1 | 0 | 15.02 | 14.09 | 13.12 |
| | | 1 | 37 | 15.46 | 14.48 | 13.40 |
| | | 1 | 74 | 15.12 | 14.17 | 13.15 |
| | | 36 | 0 | 15.02 | 14.20 | 13.13 |
| | | 36 | 19 | 15.20 | 14.24 | 13.47 |
| | | 36 | 39 | 15.01 | 14.05 | 13.24 |
| | | 75 | 0 | 14.06 | 13.96 | 13.55 |
| | 16QAM | 1 | 0 | 15.21 | 14.29 | 13.41 |
| | | 1 | 37 | 15.61 | 14.69 | 13.60 |
| | | 1 | 74 | 15.21 | 14.31 | 13.31 |
| | | 36 | 0 | 15.28 | 14.26 | 13.34 |
| | | 36 | 19 | 15.37 | 14.46 | 13.62 |
| | | 36 | 39 | 15.21 | 14.34 | 13.31 |
| | | 75 | 0 | 14.13 | 13.97 | 13.52 |

| LTE Band 48 | | | | | | |
|-------------|-----------|-----------------|-----------|--------|-------|--------|
| BW | MCS Index | RB Size | RB Offset | Low | Mid | High |
| | | Channel | | 55290 | 55990 | 56690 |
| | | Frequency (MHz) | | 3555 | 3625 | 3695 |
| 10M | QPSK | 1 | 0 | 15.82 | 15.00 | 14.05 |
| | | 1 | 24 | 16.24 | 15.33 | 14.28 |
| | | 1 | 49 | 15.84 | 14.85 | 13.97 |
| | | 25 | 0 | 15.84 | 14.89 | 14.01 |
| | | 25 | 12 | 15.95 | 15.08 | 14.18 |
| | | 25 | 25 | 15.84 | 14.98 | 13.97 |
| | | 50 | 0 | 15.84 | 14.85 | 13.97 |
| | 16QAM | 1 | 0 | 16.08 | 15.14 | 14.10 |
| | | 1 | 24 | 16.47 | 15.46 | 14.45 |
| | | 1 | 49 | 16.05 | 15.19 | 14.18 |
| | | 25 | 0 | 16.03 | 15.09 | 14.10 |
| | | 25 | 12 | 16.16 | 15.23 | 14.40 |
| | | 25 | 25 | 16.05 | 15.09 | 14.17 |
| | | 50 | 0 | 16.07 | 15.17 | 14.12 |
| BW | MCS Index | Channel | | 55265 | 55990 | 56715 |
| | | Frequency (MHz) | | 3552.5 | 3695 | 3697.5 |
| 5M | QPSK | 1 | 0 | 16.30 | 15.34 | 14.33 |
| | | 1 | 12 | 16.65 | 15.68 | 14.66 |
| | | 1 | 24 | 16.25 | 15.31 | 14.31 |
| | | 12 | 0 | 16.34 | 15.43 | 14.39 |
| | | 12 | 6 | 16.43 | 15.52 | 14.58 |
| | | 12 | 13 | 16.26 | 15.44 | 14.46 |
| | | 25 | 0 | 16.37 | 15.48 | 14.47 |
| | 16QAM | 1 | 0 | 16.55 | 15.36 | 14.53 |
| | | 1 | 12 | 16.91 | 16.08 | 15.05 |
| | | 1 | 24 | 16.54 | 15.44 | 14.67 |
| | | 12 | 0 | 16.57 | 15.37 | 14.45 |
| | | 12 | 6 | 16.63 | 15.52 | 14.53 |
| | | 12 | 13 | 16.44 | 15.36 | 14.35 |
| | | 25 | 0 | 16.47 | 15.50 | 14.48 |

Spectrum Plot of Worst Value

5MHz / 16QAM

Spectrum Analyzer 1
Channel Power

KEYSIGHT Input: RF Input Z: 50 Ω Atten: 30 dB Trig: Free Run Center Freq: 3.555000000 GHz
 Coupling: DC Corrections: Off #PNO: Fast Gate: Off Avg|Hold: >10/10
 Align: Auto Freq Ref: Int (S) #F Gain: Low Radio Std: None
 NFE: Adaptive

Frequency

Center Frequency
3.555000000 GHz

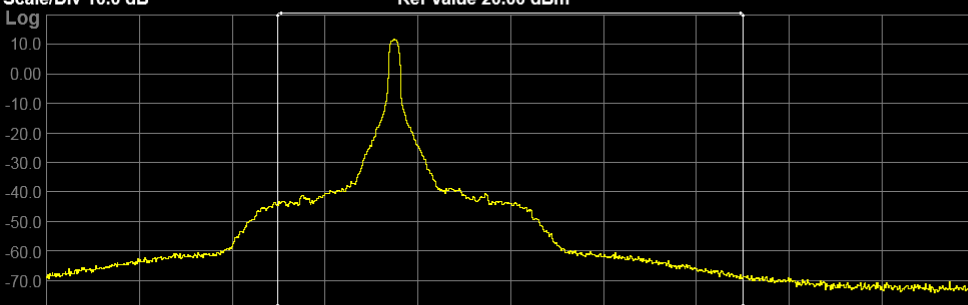
Span
20.000 MHz

CF Step
2.000000 MHz

Auto
Man

Freq Offset
0 Hz

1 Graph Ref Lvl Offset 4.00 dB
Scale/Div 10.0 dB Ref Value 20.00 dBm



Center 3.55500 GHz #Video BW 160.00 kHz* Span 20 MHz
#Res BW 51.000 kHz #Sweep 300 ms (1001 pts)

2 Metrics

| | |
|------------------------------|----------------------|
| Total Channel Power | 16.91 dBm / 10.0 MHz |
| Total Power Spectral Density | 6.905 dBm/MHz |

Windows navigation icons: Home, Back, Forward, Search, Help, and various utility icons.

Maximum EIRP (dBm/ 10MHz)

| LTE Band 48 | | | | | | |
|-------------|-----------|-----------------|-----------|--------|-------|--------|
| BW | MCS Index | RB Size | RB Offset | Low | Mid | High |
| | | Channel | | 55340 | 55990 | 56640 |
| | | Frequency (MHz) | | 3560 | 3625 | 3690 |
| 20M | QPSK | 1 | 0 | 21.48 | 20.48 | 19.56 |
| | | 1 | 50 | 21.87 | 20.80 | 19.84 |
| | | 1 | 99 | 21.43 | 20.51 | 19.65 |
| | | 50 | 0 | 21.44 | 20.46 | 19.64 |
| | | 50 | 25 | 21.64 | 20.65 | 19.77 |
| | | 50 | 50 | 21.47 | 20.58 | 19.59 |
| | | 100 | 0 | 19.08 | 19.02 | 18.53 |
| | 16QAM | 1 | 0 | 21.63 | 20.75 | 19.72 |
| | | 1 | 50 | 22.06 | 21.05 | 20.10 |
| | | 1 | 99 | 21.72 | 20.75 | 19.78 |
| | | 50 | 0 | 21.75 | 20.74 | 19.82 |
| | | 50 | 25 | 21.80 | 20.88 | 20.10 |
| | | 50 | 50 | 21.60 | 20.67 | 19.71 |
| | | 100 | 0 | 19.09 | 19.12 | 18.55 |
| BW | MCS Index | Channel | | 55315 | 55990 | 56665 |
| | | Frequency (MHz) | | 3557.5 | 3625 | 3692.5 |
| 15M | QPSK | 1 | 0 | 20.92 | 19.99 | 19.02 |
| | | 1 | 37 | 21.36 | 20.38 | 19.30 |
| | | 1 | 74 | 21.02 | 20.07 | 19.05 |
| | | 36 | 0 | 20.92 | 20.10 | 19.03 |
| | | 36 | 19 | 21.10 | 20.14 | 19.37 |
| | | 36 | 39 | 20.91 | 19.95 | 19.14 |
| | | 75 | 0 | 19.96 | 19.86 | 19.45 |
| | 16QAM | 1 | 0 | 21.11 | 20.19 | 19.31 |
| | | 1 | 37 | 21.51 | 20.59 | 19.50 |
| | | 1 | 74 | 21.11 | 20.21 | 19.21 |
| | | 36 | 0 | 21.18 | 20.16 | 19.24 |
| | | 36 | 19 | 21.27 | 20.36 | 19.52 |
| | | 36 | 39 | 21.11 | 20.24 | 19.21 |
| | | 75 | 0 | 20.03 | 19.87 | 19.42 |

*Note: EIRP (dBm / 10MHz) = Conducted Output Power (dBm / 10MHz) + Antenna Gain (dBi)

| LTE Band 48 | | | | | | |
|-------------|-----------|-----------------|-----------|--------|-------|--------|
| BW | MCS Index | RB Size | RB Offset | Low | Mid | High |
| | | Channel | | 55290 | 55990 | 56690 |
| | | Frequency (MHz) | | 3555 | 3625 | 3695 |
| 10M | QPSK | 1 | 0 | 21.72 | 20.90 | 19.95 |
| | | 1 | 24 | 22.14 | 21.23 | 20.18 |
| | | 1 | 49 | 21.74 | 20.75 | 19.87 |
| | | 25 | 0 | 21.74 | 20.79 | 19.91 |
| | | 25 | 12 | 21.85 | 20.98 | 20.08 |
| | | 25 | 25 | 21.74 | 20.88 | 19.87 |
| | | 50 | 0 | 21.74 | 20.75 | 19.87 |
| | 16QAM | 1 | 0 | 21.98 | 21.04 | 20.00 |
| | | 1 | 24 | 22.37 | 21.36 | 20.35 |
| | | 1 | 49 | 21.95 | 21.09 | 20.08 |
| | | 25 | 0 | 21.93 | 20.99 | 20.00 |
| | | 25 | 12 | 22.06 | 21.13 | 20.30 |
| | | 25 | 25 | 21.95 | 20.99 | 20.07 |
| | | 50 | 0 | 21.97 | 21.07 | 20.02 |
| BW | MCS Index | Channel | | 55265 | 55990 | 56715 |
| | | Frequency (MHz) | | 3552.5 | 3695 | 3697.5 |
| 5M | QPSK | 1 | 0 | 22.20 | 21.24 | 20.23 |
| | | 1 | 12 | 22.55 | 21.58 | 20.56 |
| | | 1 | 24 | 22.15 | 21.21 | 20.21 |
| | | 12 | 0 | 22.24 | 21.33 | 20.29 |
| | | 12 | 6 | 22.33 | 21.42 | 20.48 |
| | | 12 | 13 | 22.16 | 21.34 | 20.36 |
| | | 25 | 0 | 22.27 | 21.38 | 20.37 |
| | 16QAM | 1 | 0 | 22.45 | 21.26 | 20.43 |
| | | 1 | 12 | 22.81 | 21.98 | 20.95 |
| | | 1 | 24 | 22.44 | 21.34 | 20.57 |
| | | 12 | 0 | 22.47 | 21.27 | 20.35 |
| | | 12 | 6 | 22.53 | 21.42 | 20.43 |
| | | 12 | 13 | 22.34 | 21.26 | 20.25 |
| | | 25 | 0 | 22.37 | 21.40 | 20.38 |

*Note: EIRP (dBm / 10MHz) = Conducted Output Power (dBm / 10MHz) + Antenna Gain (dBi)

Full Conducted Output Power (dBm / 20MHz)

| LTE Band 48 | | | | | | |
|-------------|-----------|-----------------|-----------|-------|-------|-------|
| BW | MCS Index | RB Size | RB Offset | Low | Mid | High |
| | | Channel | | 55340 | 55990 | 56640 |
| | | Frequency (MHz) | | 3560 | 3625 | 3690 |
| 20M | QPSK | 1 | 0 | 15.72 | 14.74 | 13.85 |
| | | 1 | 50 | 16.02 | 15.11 | 14.07 |
| | | 1 | 99 | 15.63 | 14.68 | 13.76 |
| | | 50 | 0 | 15.64 | 14.66 | 13.78 |
| | | 50 | 25 | 15.82 | 14.90 | 14.09 |
| | | 50 | 50 | 15.64 | 14.75 | 13.83 |
| | | 100 | 0 | 15.64 | 14.68 | 13.71 |
| | 16QAM | 1 | 0 | 15.81 | 14.89 | 13.90 |
| | | 1 | 50 | 16.24 | 15.29 | 14.29 |
| | | 1 | 99 | 15.95 | 14.99 | 13.90 |
| | | 50 | 0 | 15.81 | 14.94 | 14.05 |
| | | 50 | 25 | 16.08 | 15.03 | 14.20 |
| | | 50 | 50 | 15.88 | 14.97 | 13.92 |
| | | 100 | 0 | 15.92 | 15.00 | 13.90 |

Full Conducted Output Power (dBm / 15MHz)

| BW | MCS Index | Channel | | 55315 | 55990 | 56665 |
|-----|-----------|-----------------|----|--------|-------|--------|
| | | Frequency (MHz) | | 3557.5 | 3625 | 3692.5 |
| 15M | QPSK | 1 | 0 | 15.17 | 14.19 | 13.34 |
| | | 1 | 37 | 15.64 | 14.59 | 13.61 |
| | | 1 | 74 | 15.19 | 14.28 | 13.26 |
| | | 36 | 0 | 15.23 | 14.19 | 13.20 |
| | | 36 | 19 | 15.35 | 14.42 | 13.60 |
| | | 36 | 39 | 15.18 | 14.18 | 13.23 |
| | | 75 | 0 | 15.21 | 14.16 | 13.34 |
| | 16QAM | 1 | 0 | 15.45 | 14.46 | 13.55 |
| | | 1 | 37 | 15.79 | 14.73 | 13.74 |
| | | 1 | 74 | 15.30 | 14.50 | 13.44 |
| | | 36 | 0 | 15.37 | 14.49 | 13.51 |
| | | 36 | 19 | 15.50 | 14.59 | 13.72 |
| | | 36 | 39 | 15.31 | 14.35 | 13.50 |
| | | 75 | 0 | 15.36 | 14.38 | 13.51 |

Full Conducted Output Power (dBm / 10MHz)

| LTE Band 48 | | | | | | |
|-------------|-----------|-----------------|-----------|--------|-------|--------|
| BW | MCS Index | RB Size | RB Offset | Low | Mid | High |
| | | Channel | | 55290 | 55990 | 56690 |
| | | Frequency (MHz) | | 3555 | 3625 | 3695 |
| 10M | QPSK | 1 | 0 | 15.82 | 15.00 | 14.05 |
| | | 1 | 24 | 16.24 | 15.33 | 14.28 |
| | | 1 | 49 | 15.84 | 14.85 | 13.97 |
| | | 25 | 0 | 15.84 | 14.89 | 14.01 |
| | | 25 | 12 | 15.95 | 15.08 | 14.18 |
| | | 25 | 25 | 15.84 | 14.98 | 13.97 |
| | | 50 | 0 | 15.84 | 14.85 | 13.97 |
| | 16QAM | 1 | 0 | 16.08 | 15.14 | 14.10 |
| | | 1 | 24 | 16.47 | 15.46 | 14.45 |
| | | 1 | 49 | 16.05 | 15.19 | 14.18 |
| | | 25 | 0 | 16.03 | 15.09 | 14.10 |
| | | 25 | 12 | 16.16 | 15.23 | 14.40 |
| | | 25 | 25 | 16.05 | 15.09 | 14.17 |
| | | 50 | 0 | 16.07 | 15.17 | 14.12 |
| BW | MCS Index | Channel | | 55265 | 55990 | 56715 |
| | | Frequency (MHz) | | 3552.5 | 3695 | 3697.5 |
| | | | | | | |
| 5M | QPSK | 1 | 0 | 16.30 | 15.34 | 14.33 |
| | | 1 | 12 | 16.65 | 15.68 | 14.66 |
| | | 1 | 24 | 16.25 | 15.31 | 14.31 |
| | | 12 | 0 | 16.34 | 15.43 | 14.39 |
| | | 12 | 6 | 16.43 | 15.52 | 14.58 |
| | | 12 | 13 | 16.26 | 15.44 | 14.46 |
| | | 25 | 0 | 16.37 | 15.48 | 14.47 |
| | 16QAM | 1 | 0 | 16.55 | 15.36 | 14.53 |
| | | 1 | 12 | 16.91 | 16.08 | 15.05 |
| | | 1 | 24 | 16.54 | 15.44 | 14.67 |
| | | 12 | 0 | 16.57 | 15.37 | 14.45 |
| | | 12 | 6 | 16.63 | 15.52 | 14.53 |
| | | 12 | 13 | 16.44 | 15.36 | 14.35 |
| | | 25 | 0 | 16.47 | 15.50 | 14.48 |

Full EIRP (dBm / 20MHz)

| LTE Band 48 | | | | | | |
|-------------|-----------|-----------------|-----------|-------|-------|-------|
| BW | MCS Index | RB Size | RB Offset | Low | Mid | High |
| | | Channel | | 55340 | 55990 | 56640 |
| | | Frequency (MHz) | | 3560 | 3625 | 3690 |
| 20M | QPSK | 1 | 0 | 21.62 | 20.64 | 19.75 |
| | | 1 | 50 | 21.92 | 21.01 | 19.97 |
| | | 1 | 99 | 21.53 | 20.58 | 19.66 |
| | | 50 | 0 | 21.54 | 20.56 | 19.68 |
| | | 50 | 25 | 21.72 | 20.80 | 19.99 |
| | | 50 | 50 | 21.54 | 20.65 | 19.73 |
| | | 100 | 0 | 21.54 | 20.58 | 19.61 |
| | 16QAM | 1 | 0 | 21.71 | 20.79 | 19.80 |
| | | 1 | 50 | 22.14 | 21.19 | 20.19 |
| | | 1 | 99 | 21.85 | 20.89 | 19.80 |
| | | 50 | 0 | 21.71 | 20.84 | 19.95 |
| | | 50 | 25 | 21.98 | 20.93 | 20.10 |
| | | 50 | 50 | 21.78 | 20.87 | 19.82 |
| | | 100 | 0 | 21.82 | 20.90 | 19.80 |

*Note: Full EIRP (dBm / 20MHz) = Full Conducted Output Power (dBm / 20MHz) + Antenna Gain (dBi)

Full EIRP (dBm / 15MHz)

| BW | MCS Index | Channel | | 55315 | 55990 | 56665 |
|-----|-----------|-----------------|----|--------|-------|--------|
| | | Frequency (MHz) | | 3557.5 | 3625 | 3692.5 |
| 15M | QPSK | 1 | 0 | 21.07 | 20.09 | 19.24 |
| | | 1 | 37 | 21.54 | 20.49 | 19.51 |
| | | 1 | 74 | 21.09 | 20.18 | 19.16 |
| | | 36 | 0 | 21.13 | 20.09 | 19.10 |
| | | 36 | 19 | 21.25 | 20.32 | 19.50 |
| | | 36 | 39 | 21.08 | 20.08 | 19.13 |
| | | 75 | 0 | 21.11 | 20.06 | 19.24 |
| | 16QAM | 1 | 0 | 21.35 | 20.36 | 19.45 |
| | | 1 | 37 | 21.69 | 20.63 | 19.64 |
| | | 1 | 74 | 21.20 | 20.40 | 19.34 |
| | | 36 | 0 | 21.27 | 20.39 | 19.41 |
| | | 36 | 19 | 21.40 | 20.49 | 19.62 |
| | | 36 | 39 | 21.21 | 20.25 | 19.40 |
| | | 75 | 0 | 21.26 | 20.28 | 19.41 |

*Note: Full EIRP (dBm / 15MHz) = Full Conducted Output Power (dBm / 15MHz) + Antenna Gain (dBi)

Full EIRP (dBm / 10MHz)

| LTE Band 48 | | | | | | |
|-------------|-----------|-----------------|-----------|--------|-------|--------|
| BW | MCS Index | RB Size | RB Offset | Low | Mid | High |
| | | Channel | | 55290 | 55990 | 56690 |
| | | Frequency (MHz) | | 3555 | 3625 | 3695 |
| 10M | QPSK | 1 | 0 | 21.72 | 20.90 | 19.95 |
| | | 1 | 24 | 22.14 | 21.23 | 20.18 |
| | | 1 | 49 | 21.74 | 20.75 | 19.87 |
| | | 25 | 0 | 21.74 | 20.79 | 19.91 |
| | | 25 | 12 | 21.85 | 20.98 | 20.08 |
| | | 25 | 25 | 21.74 | 20.88 | 19.87 |
| | | 50 | 0 | 21.74 | 20.75 | 19.87 |
| | 16QAM | 1 | 0 | 21.98 | 21.04 | 20.00 |
| | | 1 | 24 | 22.37 | 21.36 | 20.35 |
| | | 1 | 49 | 21.95 | 21.09 | 20.08 |
| | | 25 | 0 | 21.93 | 20.99 | 20.00 |
| | | 25 | 12 | 22.06 | 21.13 | 20.30 |
| | | 25 | 25 | 21.95 | 20.99 | 20.07 |
| | | 50 | 0 | 21.97 | 21.07 | 20.02 |
| BW | MCS Index | Channel | | 55265 | 55990 | 56715 |
| | | Frequency (MHz) | | 3552.5 | 3695 | 3697.5 |
| 5M | QPSK | 1 | 0 | 22.20 | 21.24 | 20.23 |
| | | 1 | 12 | 22.55 | 21.58 | 20.56 |
| | | 1 | 24 | 22.15 | 21.21 | 20.21 |
| | | 12 | 0 | 22.24 | 21.33 | 20.29 |
| | | 12 | 6 | 22.33 | 21.42 | 20.48 |
| | | 12 | 13 | 22.16 | 21.34 | 20.36 |
| | | 25 | 0 | 22.27 | 21.38 | 20.37 |
| | 16QAM | 1 | 0 | 22.45 | 21.26 | 20.43 |
| | | 1 | 12 | 22.81 | 21.98 | 20.95 |
| | | 1 | 24 | 22.44 | 21.34 | 20.57 |
| | | 12 | 0 | 22.47 | 21.27 | 20.35 |
| | | 12 | 6 | 22.53 | 21.42 | 20.43 |
| | | 12 | 13 | 22.34 | 21.26 | 20.25 |
| | | 25 | 0 | 22.37 | 21.40 | 20.38 |

*Note: Full EIRP (dBm / 10MHz) = Full Conducted Output Power (dBm / 10MHz) + Antenna Gain (dBi)

4.2 Modulation Characteristics Measurement

4.2.1 Limits of Modulation Characteristics

N/A

4.2.2 Test Setup



4.2.3 Test Instruments

Refer to section 4.4.3 to get information of above instrument.

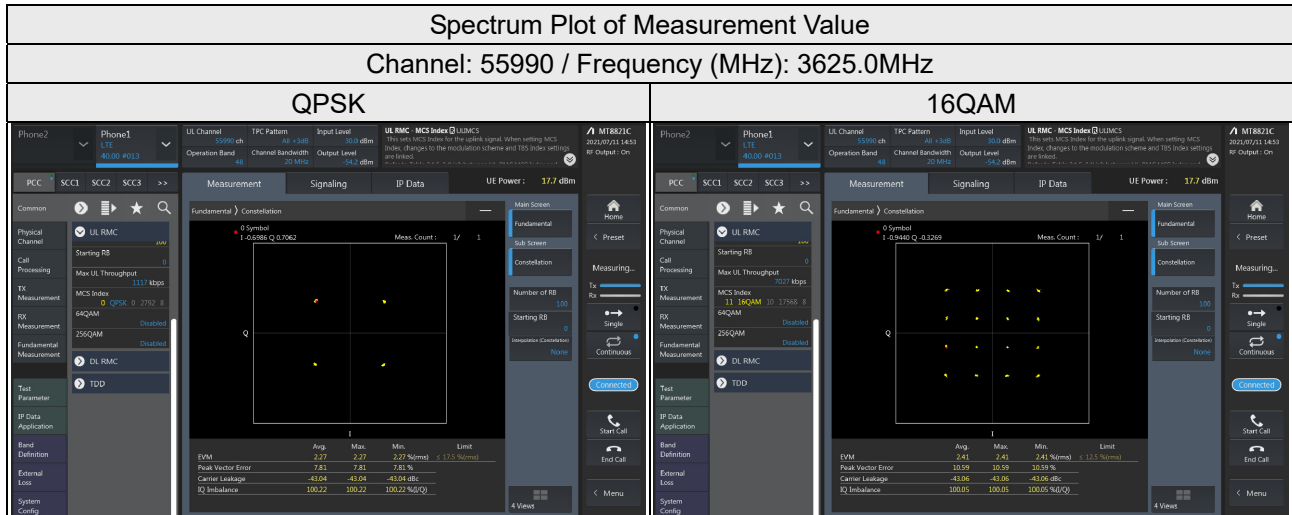
4.2.4 Deviation from Test Standard

No deviation.

4.2.5 EUT Operating Conditions

Connect the EUT to Communication Simulator via the antenna connector, The frequency band is set as EUT supported Modulation and Channels, the EUT output is matched with 50 ohm load, the waveform quality and constellation of the EUT was tested.

4.2.6 Test Results



4.3 Frequency Stability Measurement

4.3.1 Limits of Frequency Stability Measurement

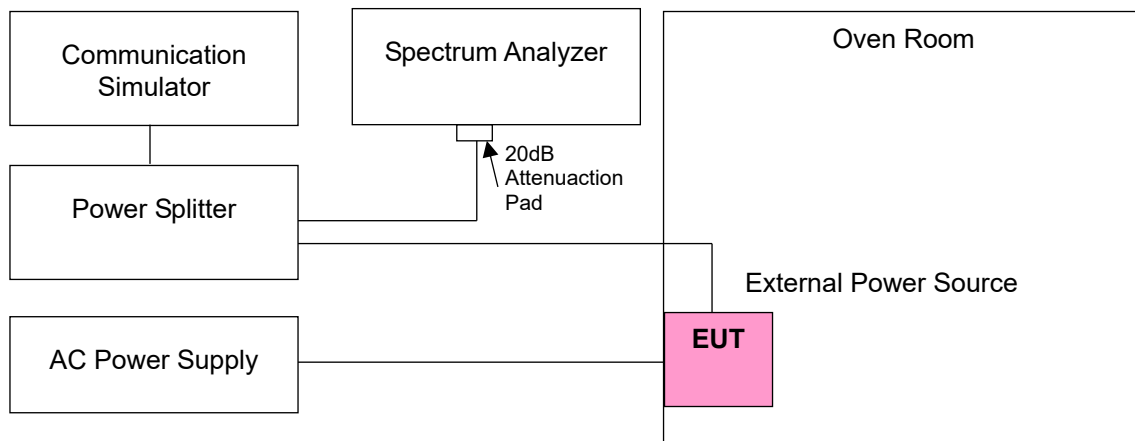
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency band.

4.3.2 Test Procedure

- Device is placed at the oven room. The oven room could control the temperatures and humidity. Power warm up is at least 15 min and power applied should perform before recording frequency error.
- EUT is connected the external power supply to control the DC input power. The test voltage range is from minimum to maximum working voltage. Each step shall be record the frequency error rate.
- The temperature range step is 10 degrees in this test items. All temperature levels shall be hold the ± 0.5 °C during the measurement testing. The each temperature step shall be at least 0.5 hours, consider the EUT could be test under the stability condition.

Note: The frequency error was recorded frequency error from the communication simulator.

4.3.3 Test Setup



4.3.4 Test Results

Frequency Error vs. Voltage

| Voltage (Vac) | LTE Band 48, Channel Bandwidth: 5MHz | | | |
|---------------|--------------------------------------|-----------------------|-----------------|-----------------------|
| | Low Channel | | High Channel | |
| | Frequency (MHz) | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) |
| 120 | 3552.500033 | 0.009 | 3697.500014 | 0.004 |
| 102 | 3552.500015 | 0.004 | 3697.500039 | 0.011 |
| 138 | 3552.500023 | 0.006 | 3697.500030 | 0.008 |

Note: The applicant defined the normal working voltage is from 102Vac to 138Vac.

Frequency Error vs. Temperature

| Temp. (°C) | LTE Band 48, Channel Bandwidth: 5MHz | | | |
|------------|--------------------------------------|-----------------------|-----------------|-----------------------|
| | Low Channel | | High Channel | |
| | Frequency (MHz) | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) |
| 0 | 3552.500023 | 0.006 | 3697.500033 | 0.009 |
| 10 | 3552.500026 | 0.007 | 3697.500021 | 0.006 |
| 20 | 3552.500023 | 0.006 | 3697.500037 | 0.010 |
| 30 | 3552.500023 | 0.006 | 3697.500027 | 0.007 |
| 40 | 3552.499984 | -0.005 | 3697.499971 | -0.008 |

Frequency Error vs. Voltage

| Voltage (Vac) | LTE Band 48, Channel Bandwidth: 10MHz | | | |
|---------------|---------------------------------------|-----------------------|-----------------|-----------------------|
| | Low Channel | | High Channel | |
| | Frequency (MHz) | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) |
| 120 | 3555.000037 | 0.010 | 3695.000025 | 0.007 |
| 102 | 3555.000019 | 0.005 | 3695.000016 | 0.004 |
| 138 | 3555.000032 | 0.009 | 3695.000031 | 0.008 |

Note: The applicant defined the normal working voltage is from 102Vac to 138Vac.

Frequency Error vs. Temperature

| Temp. (°C) | LTE Band 48, Channel Bandwidth: 10MHz | | | |
|------------|---------------------------------------|-----------------------|-----------------|-----------------------|
| | Low Channel | | High Channel | |
| | Frequency (MHz) | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) |
| 0 | 3555.000021 | 0.006 | 3695.000033 | 0.009 |
| 10 | 3555.000022 | 0.006 | 3695.000016 | 0.004 |
| 20 | 3555.000029 | 0.008 | 3695.000023 | 0.006 |
| 30 | 3555.000027 | 0.008 | 3695.000011 | 0.003 |
| 40 | 3554.999966 | -0.010 | 3694.999973 | -0.007 |

Frequency Error vs. Voltage

| Voltage (Vac) | LTE Band 48, Channel Bandwidth: 15MHz | | | |
|---------------|---------------------------------------|-----------------------|-----------------|-----------------------|
| | Low Channel | | High Channel | |
| | Frequency (MHz) | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) |
| 120 | 3557.500015 | 0.004 | 3692.500033 | 0.009 |
| 102 | 3557.500012 | 0.003 | 3692.500022 | 0.006 |
| 138 | 3557.500039 | 0.011 | 3692.500026 | 0.007 |

Note: The applicant defined the normal working voltage is from 102Vac to 138Vac.

Frequency Error vs. Temperature

| Temp. (°C) | LTE Band 48, Channel Bandwidth: 15MHz | | | |
|------------|---------------------------------------|-----------------------|-----------------|-----------------------|
| | Low Channel | | High Channel | |
| | Frequency (MHz) | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) |
| 0 | 3557.500028 | 0.008 | 3692.500036 | 0.010 |
| 10 | 3557.500022 | 0.006 | 3692.500023 | 0.006 |
| 20 | 3557.500021 | 0.006 | 3692.500026 | 0.007 |
| 30 | 3557.500029 | 0.008 | 3692.500021 | 0.006 |
| 40 | 3557.499974 | -0.007 | 3692.499960 | -0.011 |

Frequency Error vs. Voltage

| Voltage (Vac) | LTE Band 48, Channel Bandwidth: 20MHz | | | |
|---------------|---------------------------------------|-----------------------|-----------------|-----------------------|
| | Low Channel | | High Channel | |
| | Frequency (MHz) | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) |
| 120 | 3560.000030 | 0.008 | 3690.000024 | 0.007 |
| 102 | 3560.000034 | 0.010 | 3690.000021 | 0.006 |
| 138 | 3560.000017 | 0.005 | 3690.000029 | 0.008 |

Note: The applicant defined the normal working voltage is from 102Vac to 138Vac.

Frequency Error vs. Temperature

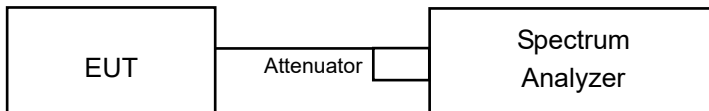
| Temp. (°C) | LTE Band 48, Channel Bandwidth: 20MHz | | | |
|------------|---------------------------------------|-----------------------|-----------------|-----------------------|
| | Low Channel | | High Channel | |
| | Frequency (MHz) | Frequency Error (ppm) | Frequency (MHz) | Frequency Error (ppm) |
| 0 | 3560.000027 | 0.008 | 3690.000036 | 0.010 |
| 10 | 3560.000028 | 0.008 | 3690.000011 | 0.003 |
| 20 | 3560.000019 | 0.005 | 3690.000013 | 0.004 |
| 30 | 3560.000017 | 0.005 | 3690.000039 | 0.011 |
| 40 | 3559.999971 | -0.008 | 3689.999985 | -0.004 |

4.4 Emission Bandwidth Measurement

4.4.1 Limits of Emission Bandwidth Measurement

Reference only

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.1.3 to get information of above instrument.

4.4.4 Test Procedure

Occupied Bandwidth & 26dBc Bandwidth

- a. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be wide enough to see sufficient roll off of the signal to make the measurement.
- b. The nominal RBW shall be in the range of 1% to 5% of the anticipated OBW, and the VBW shall be set $\geq 3 \times$ RBW.
- c. Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation.
NOTE—Step 1), step 2), and step 3) may require iteration to adjust within the specified tolerances.
- d. The dynamic range of the spectrum analyzer at the selected RBW shall be more than 10 dB below the target “-X dB” requirement, i.e., if the requirement calls for measuring the -26 dB OBW, the spectrum analyzer noise floor at the selected RBW shall be at least 36 dB below the reference level.
- e. Set spectrum analyzer detection mode to peak, and the trace mode to max hold.
- f. Determine the reference value by either of the following:
 - a) Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).
 - b) Set the EUT to transmit an unmodulated carrier. Set the spectrum analyzer marker to the level of the carrier.
- g. Determine the “-X dB amplitude” as equal to (Reference Value - X). Alternatively, this calculation can be performed on the spectrum analyzer using the delta-marker measurement function.

4.4.5 Deviation from Test Standard

No deviation.

4.4.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.4.7 Test Result

Occupied Bandwidth

| LTE Band 48, Channel Bandwidth 5MHz | | | |
|--------------------------------------|-----------------|------------------------------|-------|
| Channel | Frequency (MHz) | 99% Occupied Bandwidth (MHz) | |
| | | QPSK | 16QAM |
| 55265 | 3552.5 | 4.49 | 4.48 |
| 55990 | 3625.0 | 4.49 | 4.48 |
| 56715 | 3697.5 | 4.48 | 4.48 |
| LTE Band 48, Channel Bandwidth 10MHz | | | |
| Channel | Frequency (MHz) | 99% Occupied Bandwidth (MHz) | |
| | | QPSK | 16QAM |
| 55290 | 3555.0 | 8.96 | 8.96 |
| 55990 | 3625.0 | 8.96 | 8.95 |
| 56690 | 3695.0 | 8.95 | 8.97 |
| LTE Band 48, Channel Bandwidth 15MHz | | | |
| Channel | Frequency (MHz) | 99% Occupied Bandwidth (MHz) | |
| | | QPSK | 16QAM |
| 55315 | 3557.5 | 13.41 | 13.41 |
| 55990 | 3625.0 | 13.43 | 13.42 |
| 56665 | 3692.5 | 13.43 | 13.41 |
| LTE Band 48, Channel Bandwidth 20MHz | | | |
| Channel | Frequency (MHz) | 99% Occupied Bandwidth (MHz) | |
| | | QPSK | 16QAM |
| 55340 | 3560.0 | 17.99 | 18.02 |
| 55990 | 3625.0 | 17.97 | 18.01 |
| 56640 | 3690.0 | 17.92 | 18.02 |

Spectrum Plot of Worst Value



26dB Bandwidth

| LTE Band 48, Channel Bandwidth 5MHz | | | |
|--------------------------------------|-----------------|----------------------|-------|
| Channel | Frequency (MHz) | 26dB Bandwidth (MHz) | |
| | | QPSK | 16QAM |
| 55265 | 3552.5 | 5.06 | 5.16 |
| 55990 | 3625.0 | 5.07 | 5.16 |
| 56715 | 3697.5 | 5.13 | 5.06 |
| LTE Band 48, Channel Bandwidth 10MHz | | | |
| Channel | Frequency (MHz) | 26dB Bandwidth (MHz) | |
| | | QPSK | 16QAM |
| 55290 | 3555.0 | 9.53 | 9.69 |
| 55990 | 3625.0 | 9.55 | 9.67 |
| 56690 | 3695.0 | 9.56 | 9.82 |
| LTE Band 48, Channel Bandwidth 15MHz | | | |
| Channel | Frequency (MHz) | 26dB Bandwidth (MHz) | |
| | | QPSK | 16QAM |
| 55315 | 3557.5 | 14.34 | 14.35 |
| 55990 | 3625.0 | 14.32 | 14.27 |
| 56665 | 3692.5 | 14.30 | 14.27 |
| LTE Band 48, Channel Bandwidth 20MHz | | | |
| Channel | Frequency (MHz) | 26dB Bandwidth (MHz) | |
| | | QPSK | 16QAM |
| 55340 | 3560.0 | 19.15 | 19.26 |
| 55990 | 3625.0 | 19.09 | 19.09 |
| 56640 | 3690.0 | 19.08 | 19.13 |

Spectrum Plot of Worst Value

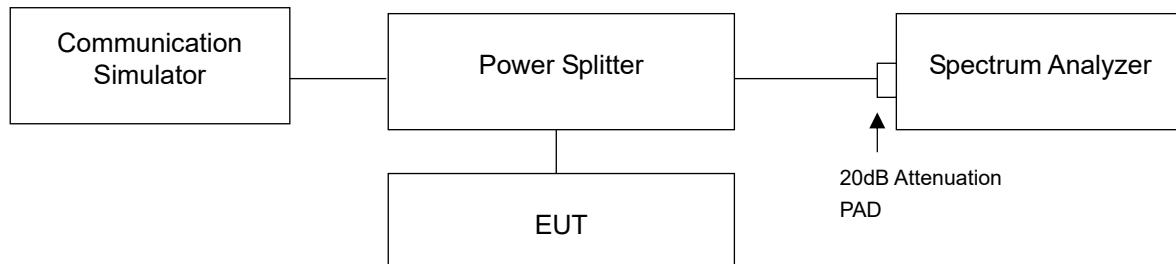


4.5 Peak to Average Ratio Measurement

4.5.1 Limits of Peak to Average Ratio Measurement

In measuring transmissions in this band using an average power technique, the peak to-average ratio (PAR) of the transmission may not exceed 13 dB

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.4.3 to get information of above instrument.

4.5.4 Test Procedures

- Set resolution/measurement bandwidth \geq signal's occupied bandwidth;
- Set the number of counts to a value that stabilizes the measured CCDF curve;
- Record the maximum PAPR level associated with a probability of 0.1%.

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Conditions

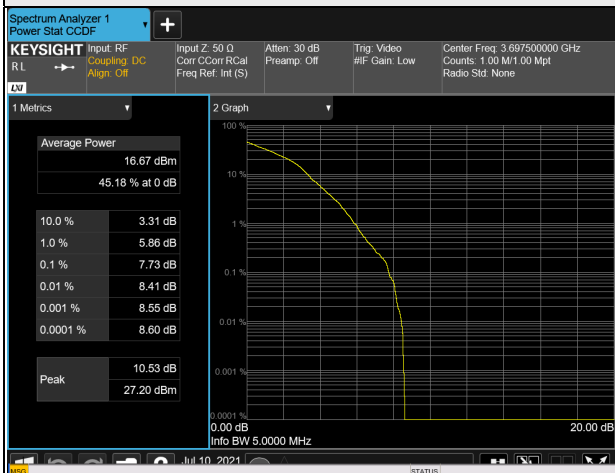
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.5.7 Test Results

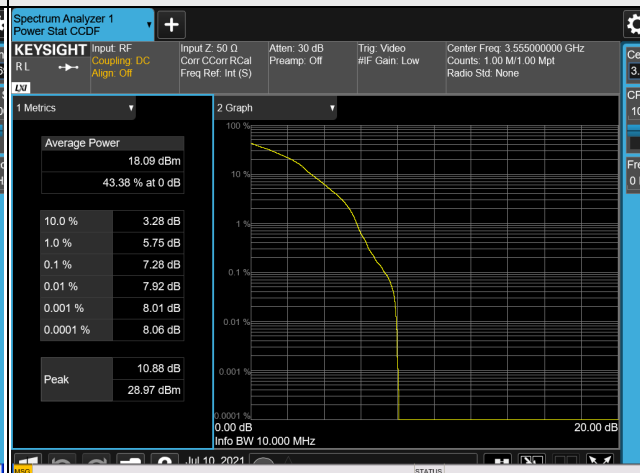
| LTE Band 48, Channel Bandwidth 5MHz | | | |
|--------------------------------------|-----------------|----------------------------|-------|
| Channel | Frequency (MHz) | Peak To Average Ratio (dB) | |
| | | QPSK | 16QAM |
| 55265 | 3552.5 | 6.76 | 7.30 |
| 55990 | 3625.0 | 6.48 | 7.35 |
| 56715 | 3697.5 | 6.68 | 7.73 |
| LTE Band 48, Channel Bandwidth 10MHz | | | |
| Channel | Frequency (MHz) | Peak To Average Ratio (dB) | |
| | | QPSK | 16QAM |
| 55290 | 3555.0 | 6.62 | 7.28 |
| 55990 | 3625.0 | 6.41 | 7.25 |
| 56690 | 3695.0 | 6.63 | 7.25 |
| LTE Band 48, Channel Bandwidth 15MHz | | | |
| Channel | Frequency (MHz) | Peak To Average Ratio (dB) | |
| | | QPSK | 16QAM |
| 55315 | 3557.5 | 6.32 | 7.08 |
| 55990 | 3625.0 | 6.73 | 7.32 |
| 56665 | 3692.5 | 6.86 | 6.81 |
| LTE Band 48, Channel Bandwidth 20MHz | | | |
| Channel | Frequency (MHz) | Peak To Average Ratio (dB) | |
| | | QPSK | 16QAM |
| 55340 | 3560.0 | 7.22 | 6.68 |
| 55990 | 3625.0 | 6.53 | 7.81 |
| 56640 | 3690.0 | 6.65 | 7.29 |

Spectrum Plot of Worst Value

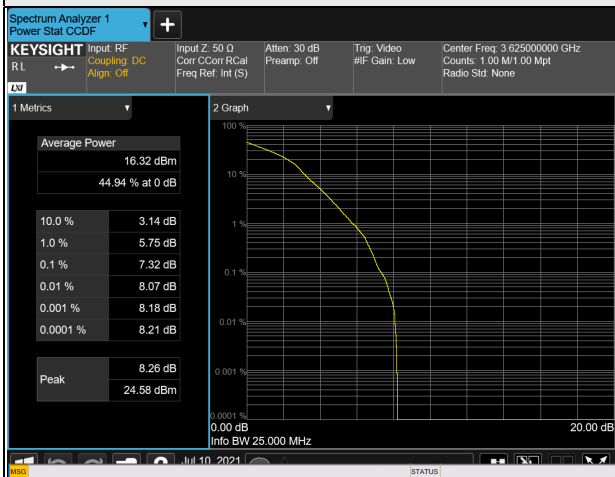
5MHz / 16QAM



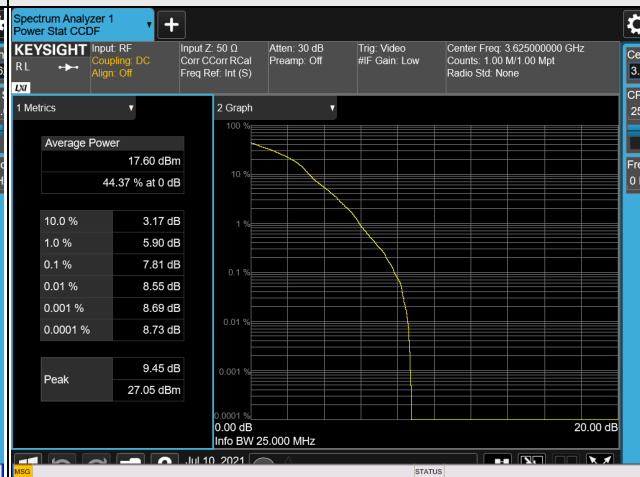
10MHz / 16QAM



15MHz / 16QAM



20MHz / 16QAM

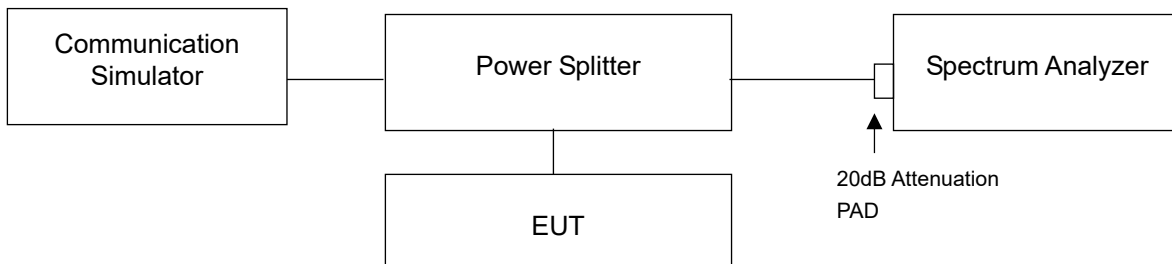


4.6 Conducted Spurious Emissions

4.6.1 Limits of Conducted Spurious Emissions Measurement

| Power of any emissions outside the Fundamental | Limit |
|--|-------------|
| Within 0-10MHz above the Assigned Channel | -13 dBm/MHz |
| Within 0-10MHz below the Assigned Channel | |
| Greater than 10MHz above the Assigned Channel | -25 dBm/MHz |
| Greater than 10MHz below the Assigned Channel | |
| Power of any emission below 3530MHz | -40 dBm/MHz |
| Power of any emission above 3720MHz | |

4.6.2 Test Setup



4.6.3 Test Instruments

Refer to section 4.4.3 to get information of above instrument.

4.6.4 Test Procedure

- The EUT makes a phone call to the communication simulator. All measurements were done at low, middle and high operational frequency range.
- Measuring frequency range are from 9 kHz to 40GHz. 20dB attenuation pad is connected with spectrum. RBW=1MHz and VBW=3MHz is used for conducted emission measurement.
- Measuring frequency band edge, 20dB attenuation pad is connected with spectrum. 1% of the fundamental emission bandwidth is used for conducted emission measurement.
- For 5 MHz channel BW mode, extend the 1% range from 1M to 2M above and below the channel edge and then reduce the limit further by $10 \log(1000/100) = 10\text{dB}$ (i.e. total $-13 + -10 = -23\text{dB}$) to compensate for the integration from 100k to 1M.

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Conditions

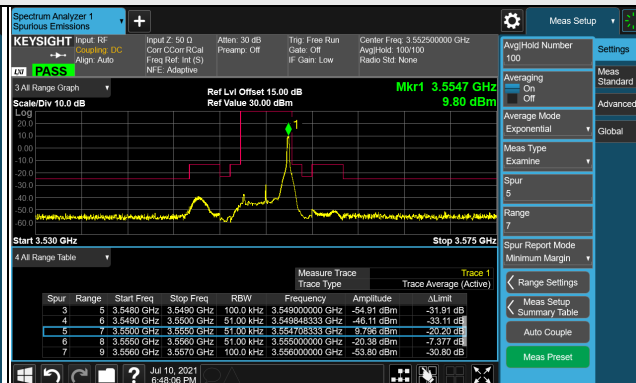
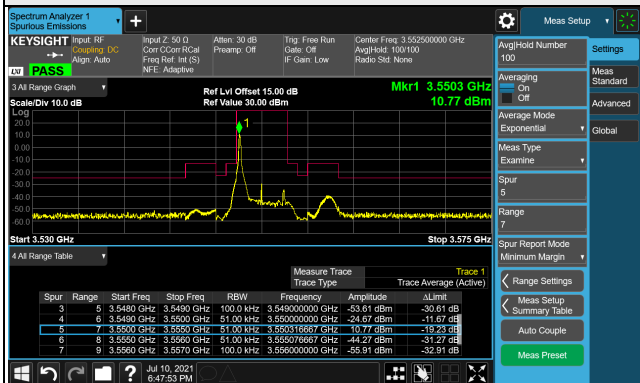
The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.6.7 Test Results

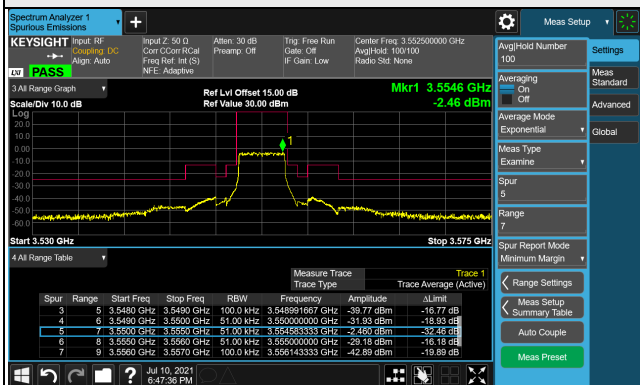
LTE Band 48, Channel Bandwidth 5MHz

Channel 55265 (3552.5MHz)

1RB

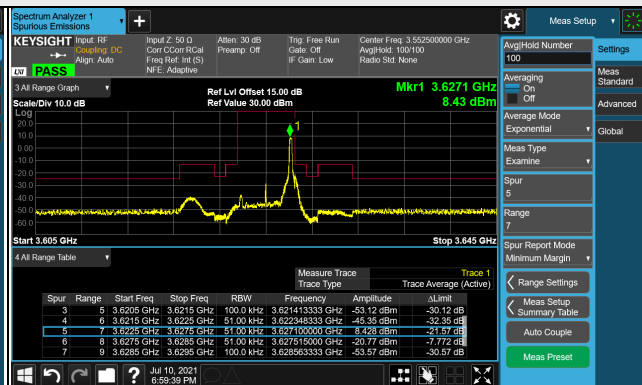
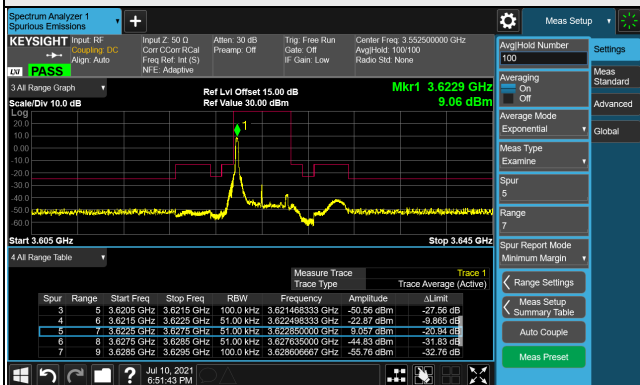


Full RB

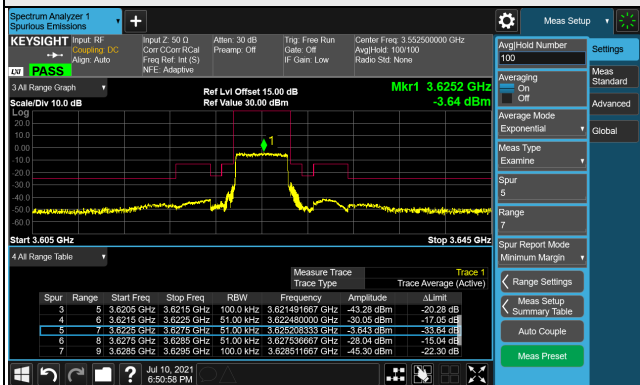


Channel 55990 (3625.0MHz)

1RB

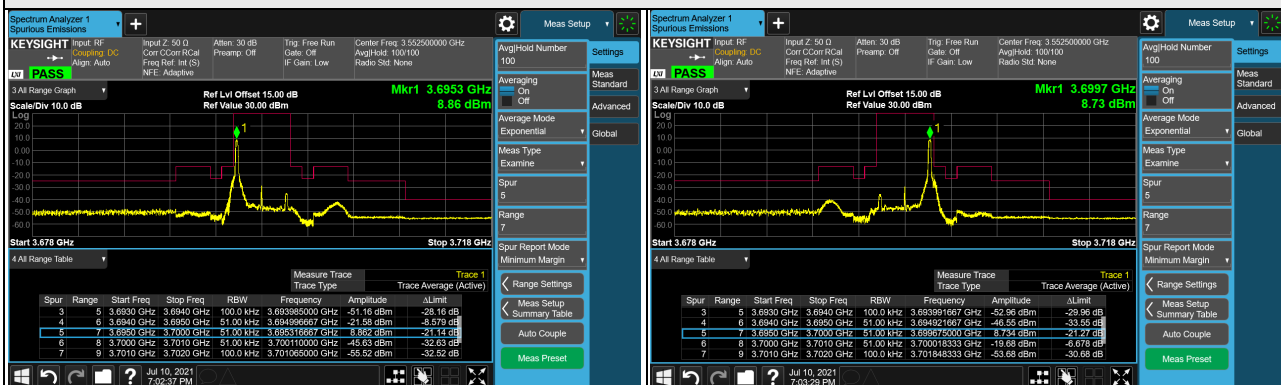


Full RB

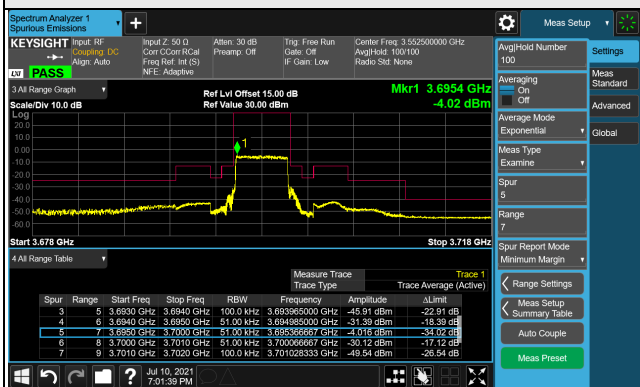


Channel 56715 (3697.5MHz)

1RB



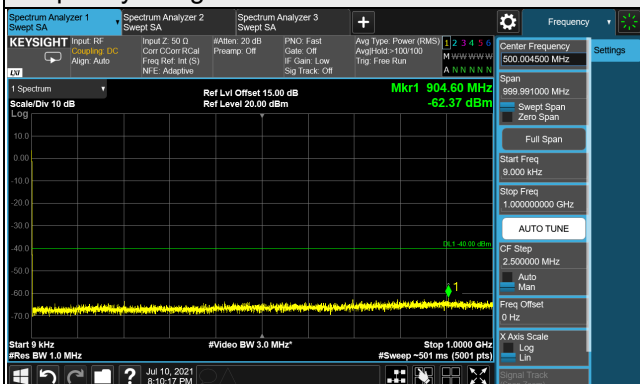
Full RB



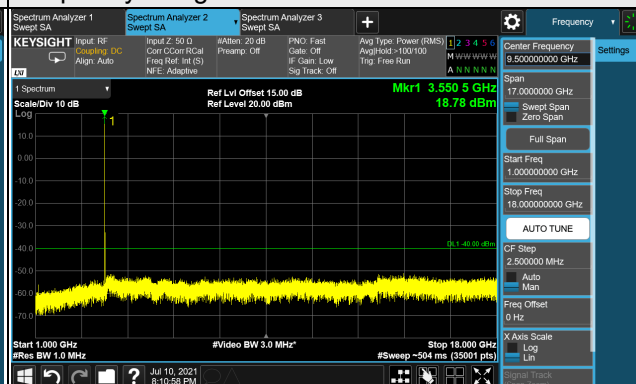
LTE Band 48, Channel Bandwidth 5MHz

Channel 55265 (3552.5MHz)

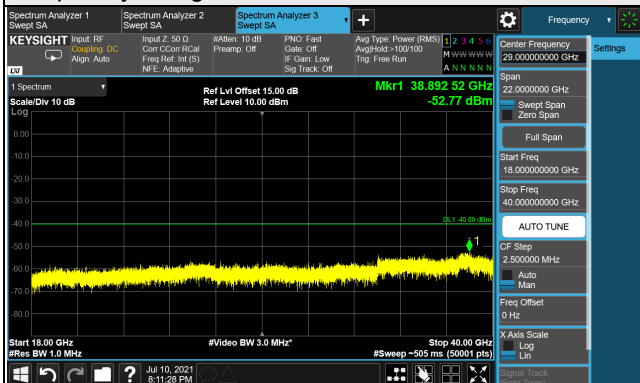
Frequency Range : 9kHz ~ 1GHz



Frequency Range : 1GHz ~ 18GHz



Frequency Range : 18GHz ~ 40GHz

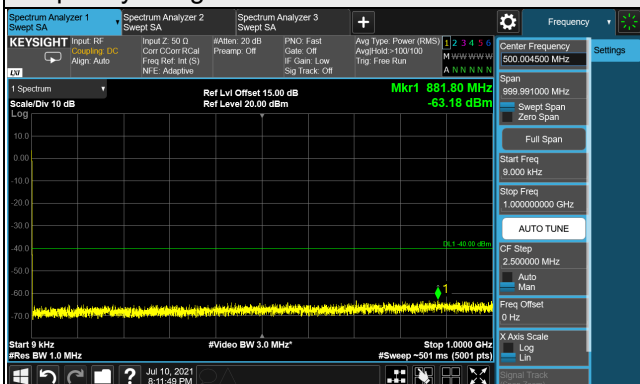


Note: The signal at 9 kHz is IF signal from spectrum analyzer.

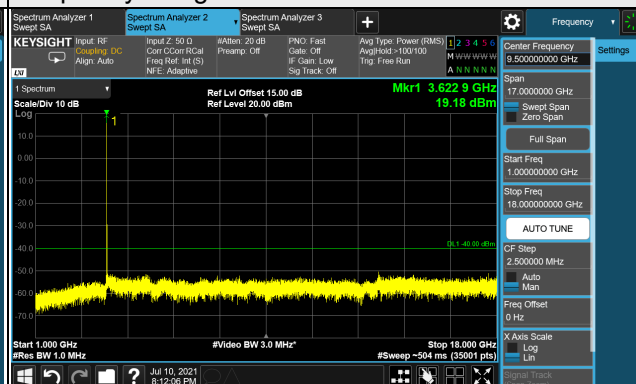
LTE Band 48, Channel Bandwidth 5MHz

Channel 55990 (3625.0MHz)

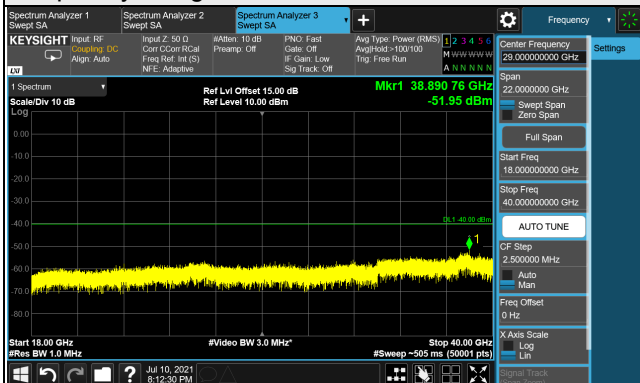
Frequency Range : 9kHz ~ 1GHz



Frequency Range : 1GHz ~ 18GHz



Frequency Range : 18GHz ~ 40GHz

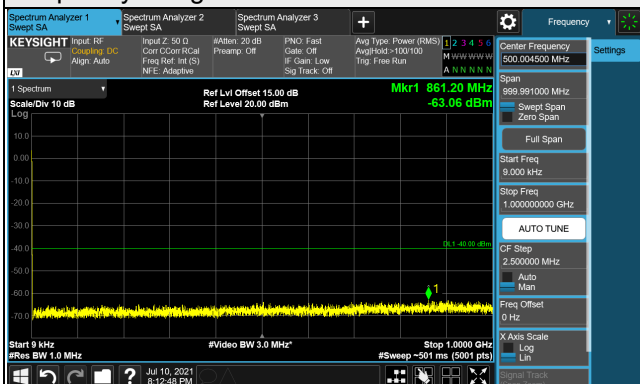


Note: The signal at 9 kHz is IF signal from spectrum analyzer.

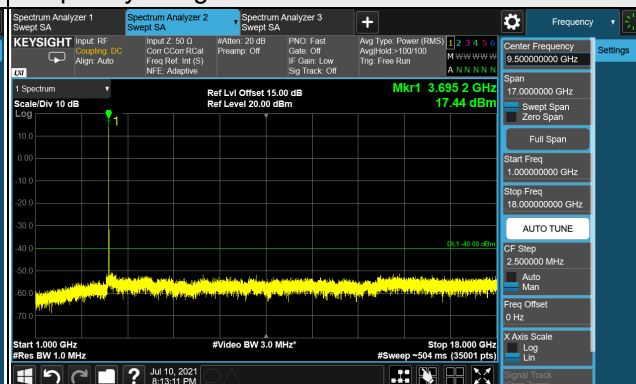
LTE Band 48, Channel Bandwidth 5MHz

Channel 56715 (3697.50MHz)

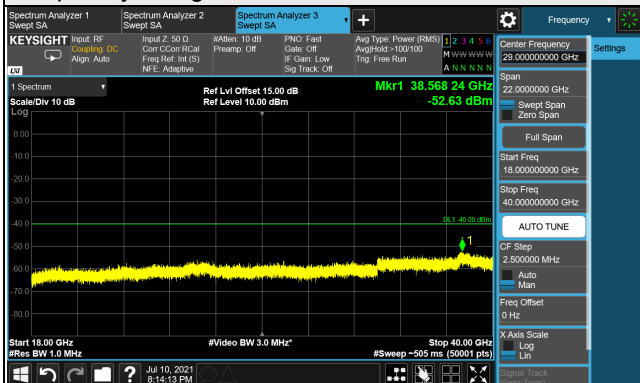
Frequency Range : 9kHz ~ 1GHz



Frequency Range : 1GHz ~ 18GHz



Frequency Range : 18GHz ~ 40GHz



Note: The signal at 9 kHz is IF signal from spectrum analyzer.

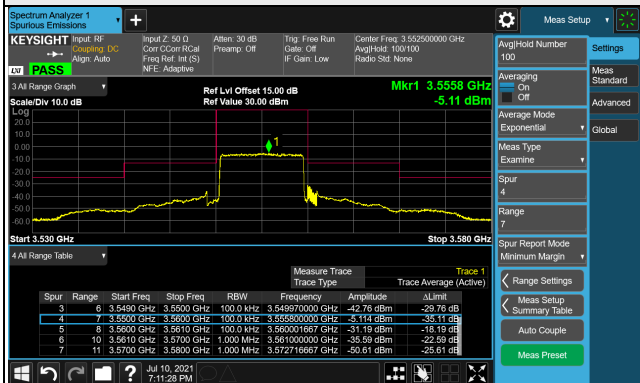
LTE Band 48, Channel Bandwidth 10MHz

Channel 55290 (3555.0MHz)

1RB

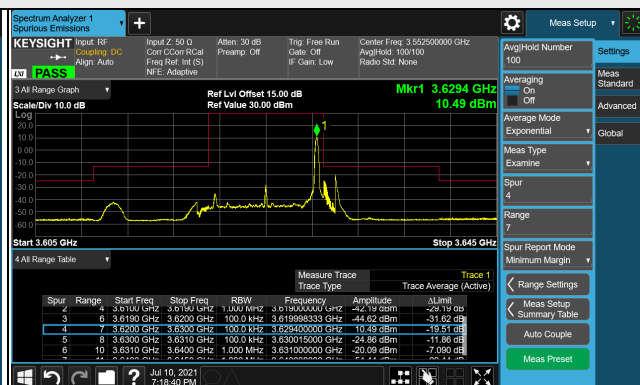
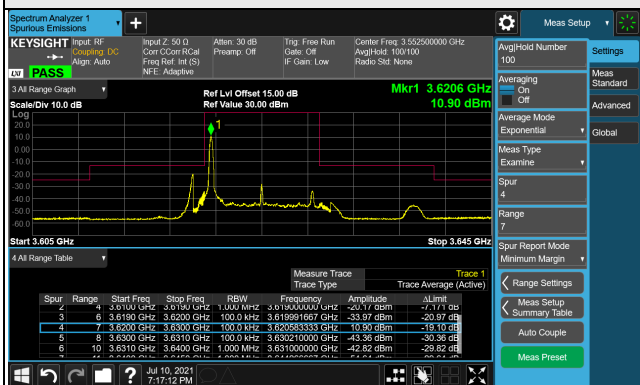


Full RB

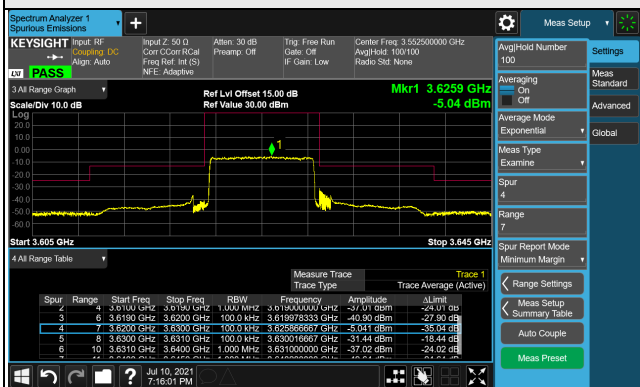


Channel 55990 (3625.00MHz)

1RB

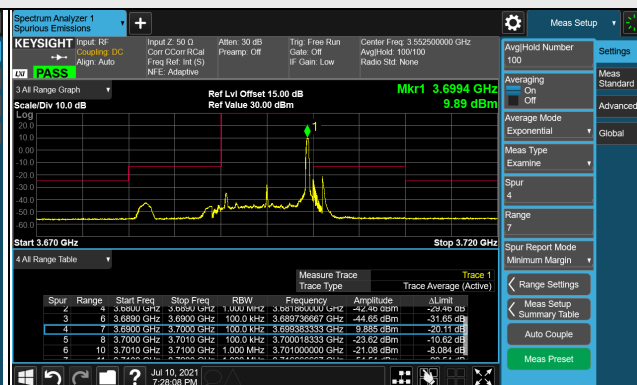
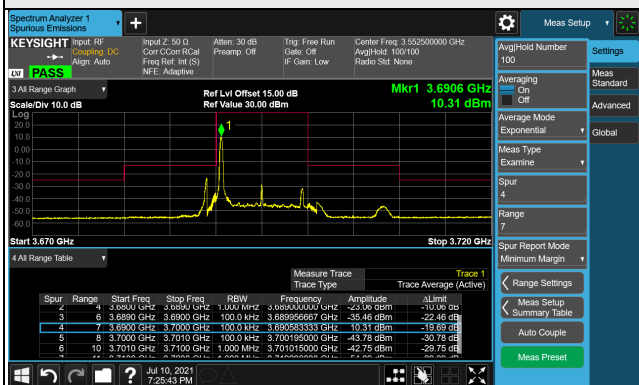


Full RB

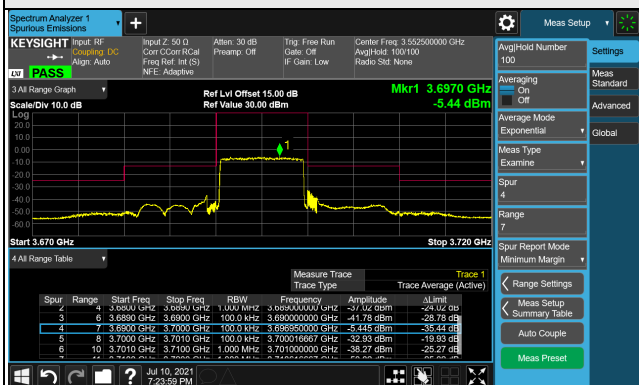


Channel 56690 (3695.0MHz)

1RB



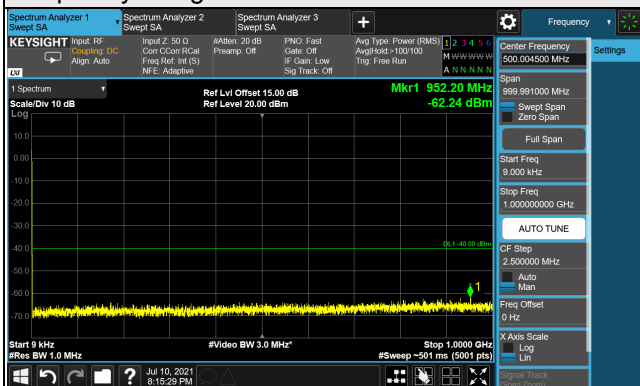
Full RB



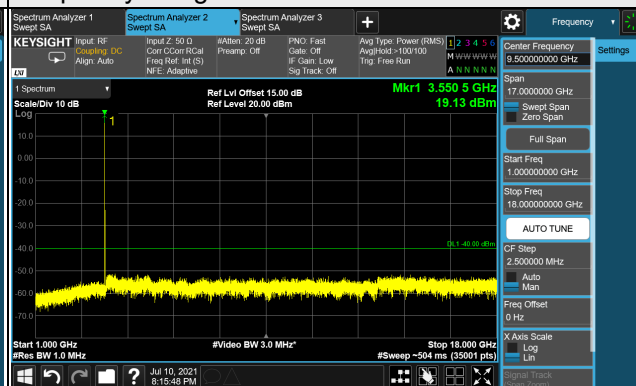
LTE Band 48, Channel Bandwidth 10MHz

Channel 55290 (3555.0MHz)

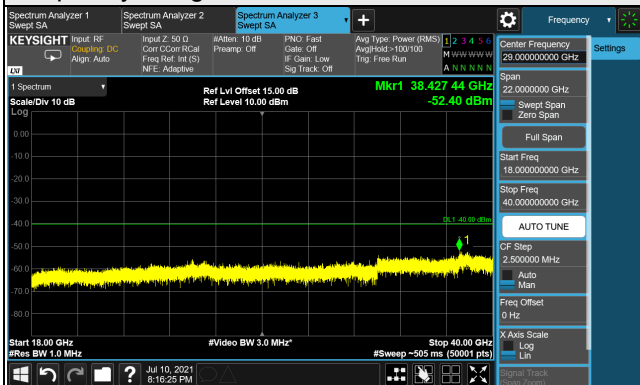
Frequency Range : 9kHz ~ 1GHz



Frequency Range : 1GHz ~ 18GHz



Frequency Range : 18GHz ~ 40GHz

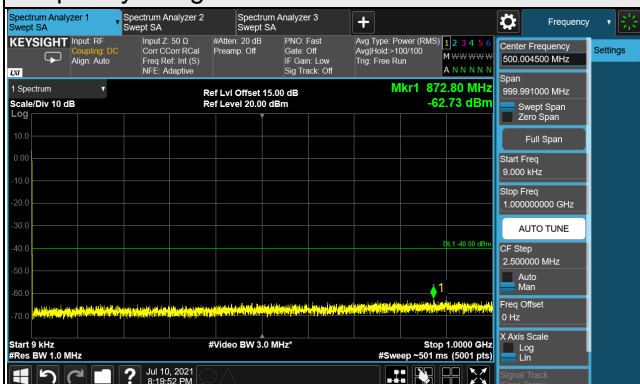


Note: The signal at 9 kHz is IF signal from spectrum analyzer.

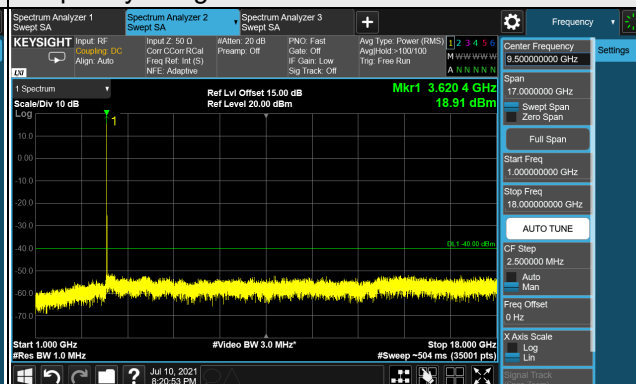
LTE Band 48, Channel Bandwidth 10MHz

Channel 55990 (3625.00MHz)

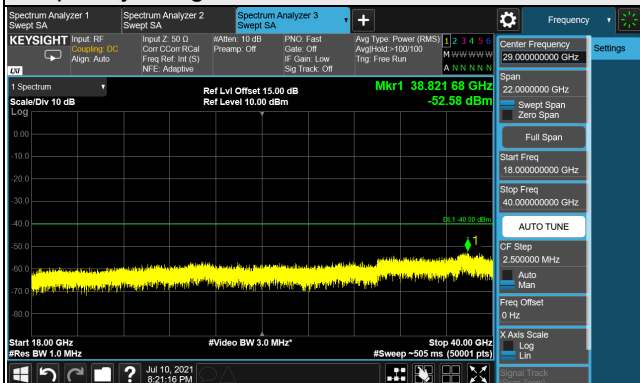
Frequency Range : 9kHz ~ 1GHz



Frequency Range : 1GHz ~ 18GHz



Frequency Range : 18GHz ~ 40GHz

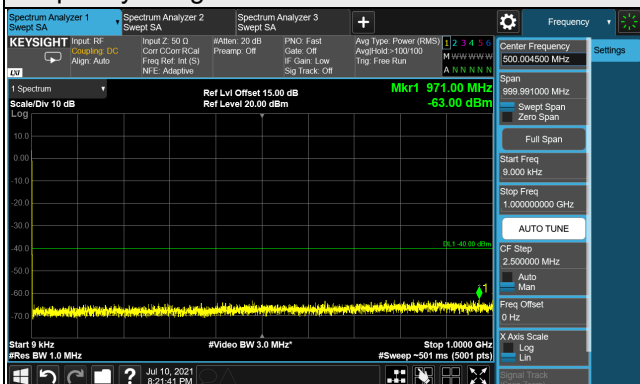


Note: The signal at 9 kHz is IF signal from spectrum analyzer.

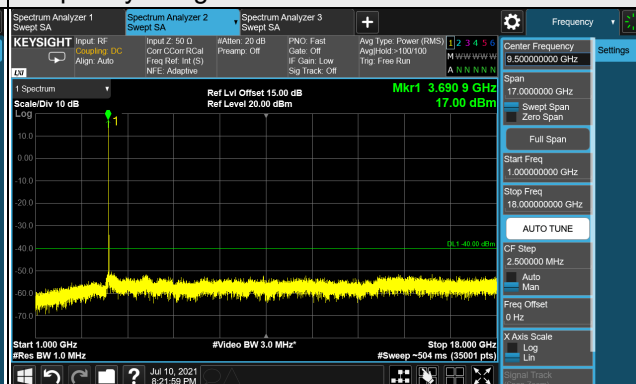
LTE Band 48, Channel Bandwidth 10MHz

Channel 56690 (3695.0MHz)

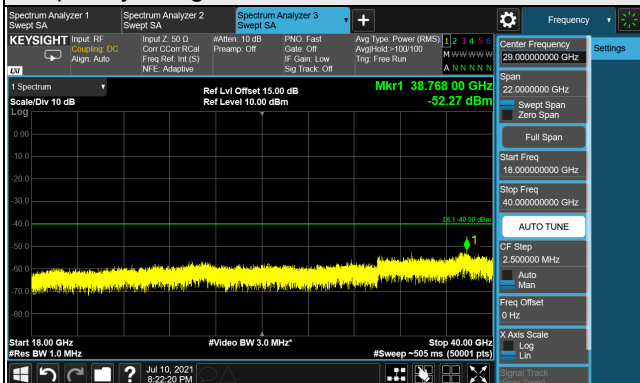
Frequency Range : 9kHz ~ 1GHz



Frequency Range : 1GHz ~ 18GHz



Frequency Range : 18GHz ~ 40GHz

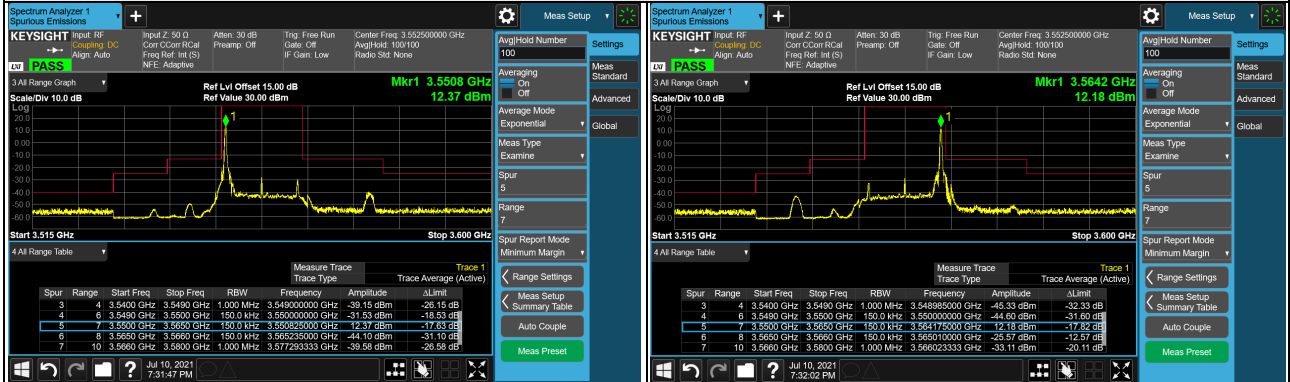


Note: The signal at 9 kHz is IF signal from spectrum analyzer.

LTE Band 48, Channel Bandwidth 15MHz

Channel 55315 (3557.50MHz)

1RB



Full RB

