# FCC PART 24TEST REPORT
## Part 22H Subpart E

**Report Reference No.....:** HK1907111626-3E

**FCC ID.....: ZNFX210LMW**

| | | |
|---|---|---|
| Compiled by<br>( position+printedname+signature)...: | File administrators Gary Qian | Gary Qian |
| Supervised by<br>(position+printedname+signature)....: | Technique principal Eden Hu | Eden Hu |
| Approved by<br>(position+printedname+signature)....: | ManagerJason Zhou | Jason Zhou |
| Date of issue.....: | Oct. 21, 2019 | |

| | |
|---|---|
| **Testing Laboratory Name** .....: | **Shenzhen HUAK Testing Technology Co., Ltd.** |
| Address .....: | 1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Heping Community, Fuhai Street, Bao’an District, Shenzhen,China |
| **Applicant’s name**.....: | **LG Electronics USA, Inc.** |
| Address .....: | 1000 Sylvan Ave., Englewood Cliffs, New Jersey 07632, United States |
| **Test specification** .....: | |
| Standard .....: | **FCC CFR Title 47 Part 2, Part 22H** |
| TRF Originator.....: | Shenzhen HUAK Testing Technology Co., Ltd. |

**Shenzhen HUAK Testing Technology Co., Ltd.All rights reserved.**

This publication may be reproduced in whole or in part for non-commercial purposes as long as the Shenzhen HUAK Testing Technology Co., Ltd.as copyright owner and source of the material. Shenzhen HUAK Testing Technology Co., Ltd.takess no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.

| | |
|---|---|
| **Test item description .....:** | 4G Mobile phone |
| Trade Mark .....: | LG |
| **Manufacturer**.....: | OPTIEMUS ELECTRONICS LIMITED |
| Model/Type reference.....: | LM-X210LMW |
| Listed Models .....: | / |
| Modulation Type .....: | QPSK, 16QAM |
| Rating .....: | DC 3.85V From Battery |
| Hardware version .....: | V2.0 |
| Software version.....: | V2.0 |
| Result.....: | **PASS** |

# TEST REPORT

| Test Report No. : | HK1910182614-3E | Oct. 21, 2019<br>Date of issue |
|---|---|---|

| | | |
|---|---|---|
| Equipment under Test | : | 4G Mobile phone |
| Model /Type | : | LM-X210LMW |
| Listed Models | : | / |
| **Applicant** | : | **LG Electronics USA, Inc.** |
| Address | : | 1000 Sylvan Ave., Englewood Cliffs, New Jersey 07632, United States |
| **Manufacturer** | : | OPTIEMUS ELECTRONICS LIMITED |
| Address | : | D-348, Sector-63, Noida, Uttar Pradesh, Pin Code-201307 |

| **Test Result**: | **PASS** |
|---|---|

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

# Revison History

| Revision | Issue Date | Revisions | Revised By |
|---|---|---|---|
| V1.0 | 2019-10-21 | Initial Issue | James Zhou |
| | | | |
| | | | |

# Contents


1 TEST STANDARDS ..... 5

2 SUMMARY ..... 6

2.1 General Remarks 6
2.2 Product Description 6
2.3 Equipment under Test 6
2.4 Normal Accessory setting 6
2.5 EUT configuration 6
2.6 Related Submittal(s) / Grant (s) 7
2.7 Modifications 7
2.8 GeneralTest Conditions/Configurations 7

3 TEST ENVIRONMENT ..... 8

3.1 Address of the test laboratory 8
3.2 Environmental conditions 8
3.3 Test Description 8
3.4 Equipments Used during the Test 9

4 TEST CONDITIONS AND RESULTS ..... 10

4.1 Output Power 10
4.2 Peak-to-Average Ratio (PAR) 15
4.3 Occupied Bandwidth and Emission Bandwidth 20
4.4 Band Edge compliance 25
4.5 Spurious Emssion on Antenna Port 30
4.6 Radiated Spurious Emssion 43
4.7 Frequency Stability 49

5 TEST SETUP PHOTOS OF THE EUT ..... 52

# 1 TEST STANDARDS

The tests were performed according to following standards:
FCC Part 2:FREQUENCY ALLOCA-TIONS AND RADIO TREATY MAT-TERS; GENERAL RULES AND REG-ULATIONS

FCC Part 22Subpart H:PRIVATE LAND MOBILE RADIO SERVICES.

ANSI/TIA-603-E-2016: Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

ANSI C63.26-2015: IEEE/ANSI Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

FCCKDB971168D01 Power Meas License Digital Systems

# 2 SUMMARY

## 2.1 General Remarks

| | | |
|---|---|---|
| Date of receipt of test sample | : | Jun. 24, 2019 |
| | | |
| | | |
| Testing commenced on | : | Jun. 25, 2019 |
| | | |
| | | |
| Testing concluded on | : | Oct. 21, 2019 |

## 2.2 Product Description

| | |
|---|---|
| Name of EUT | 4G Mobile phone |
| Model/Type reference: | LM-X210LMW |
| List Model: | / |
| Power supply: | DC 3.85V From Battery |
| Adapter Information | N/A |
| Modilation Type | QPSK,16QAM |
| Antenna Type | InternalAntenna |
| Operation Frequency Band | LTE BAND 5 |
| Operation frequency | LTE BAND 5:824~849 MHz |
| LTE Release | R8 |
| Extreme temp. Tolerance | -30°C to +50°C |
| Extreme vol. Limits | 3.465VDC to4.235VDC (nominal: 3.85VDC) |

## 2.3 Equipment under Test

**Power supply system utilised**

| | | | | | |
|---|---|---|---|---|---|
| Power supply voltage | : | ○ | 120V/ 60 Hz | ○ | 115V/60Hz |
| | | ○ | 12 V DC | ○ | 24 V DC |
| | | ● | Other (specified in blank below) | | |

DC 3.85V From Battery

## 2.4 Normal Accessory setting

Fully charged battery was used during the test.

## 2.5 EUT configuration

**The following peripheral devices and interface cables were connected during the measurement:**

● - supplied by the manufacturer

○ - supplied by the lab

| | | | |
|---|---|---|---|
| ○ | Power Cable | Length (m) : | / |
| | | Shield : | / |
| | | Detachable : | / |
| ○ | Multimeter | Manufacturer : | / |
| | | Model No. : | / |

## 2.6 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for**FCC ID: ZNFX210LMW**filing to comply with FCC Part 22H, Rules.

## 2.7 Modifications

No modifications were implemented to meet testing criteria.

## 2.8 GeneralTest Conditions/Configurations

### 2.10.1 TestEnvironment

| EnvironmentParameter | SelectedValuesDuringTests | |
|---|---|---|
| Relative Humidity | Ambient | |
| Temperature | TN | Ambient |
| Voltage | VL | 3.465V |
| | VN | 3.85V |
| | VH | 4.235V |

NOTE:VL=lowerextreme testvoltageVN=nominalvoltage
VH=upperextreme testvoltageTN=normaltemperature

# 3 TEST ENVIRONMENT

## 3.1 Address of the test laboratory

Shenzhen HUAK Testing Technology Co., Ltd.
Add.:1F, B2 Building, JunfengZhongchengZhizao Innovation Park,Heping Community, Fuhai Street, Bao'an District, Shenzhen, China

## 3.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

| | |
|---|---|
| Temperature: | 15-35 ° C |
| | |
| Humidity: | 30-60 % |
| | |
| Atmospheric pressure: | 950-1050mbar |

## 3.3 Test Description

**Band 5 (824~849 MHz)**

| Test Item | FCCRuleNo. | Requirements | Verdict |
|---|---|---|---|
| Effective(Isotropic) RadiatedOutputPower | §2.1046, §22.913(a)(2) | EIRP ≤ 2W | Pass |
| Peak-AverageRatio | §24.232(d) | FCC:Limit≤13dB | Pass |
| ModulationCharacteristics | §2.1047 | Digitalmodulation | Pass |
| Bandwidth | §2.1049 | OBW: Nolimit.<br>EBW: Nolimit. | Pass |
| BandEdgesCompliance | §2.1051, §24.238 | ≤ -13dBm/1%*EBW, In1MHzbandsimmediatelyoutsideandadjacentto Thefrequency block. | Pass |
| SpuriousEmissionatAntennaTerminals | §2.1051, §24.238 | ≤-13dBm/1MHz, from9kHzto10thharmonicsbut outsideauthorized Operatingfrequency ranges. | Pass |
| Field Strengthof Spurious Radiation | Clause 7of KDB971168 D01 v02r02 | ≤ -13dBm/1MHz. | Pass |
| Frequency Stability | §2.1055, §22.355, §24.235 | FCC:withinauthorizedfrequency block. | Pass |
| NOTE 1:For theverdict,the"N/A"denotes"not applicable",the"N/T"denotes "nottested". | | | |

Remark:
1. The measurement uncertainty is not included in the test result.

## 3.4 Equipments Used during the Test

| Test Equipment | Manufacturer | Model No. | Serial No. | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| LISN | R&S | ENV216 | HKE-059 | 2018/12/27 | 2019/12/26 |
| LISN | R&S | ENV216 | HKE-002 | 2018/12/27 | 2019/12/26 |
| Receiver | R&S | ESCI 7 | HKE-010 | 2018/12/27 | 2019/12/26 |
| Spectrum analyzer | R&S | FSP40 | HKE-025 | 2018/12/27 | 2019/12/26 |
| Spectrum analyzer | Agilent | N9020A | HKE-048 | 2018/12/27 | 2019/12/26 |
| RF automatic control unit | Tonscend | JS0806-1 | HKE-060 | 2018/12/27 | 2019/12/26 |
| Loop antenna | Schwarzbeck | FMZB 1519 B | HKE-014 | 2018/12/27 | 2019/12/26 |
| Bilog Broadband Antenna | Schwarzbeck | VULB9163 | HKE-012 | 2018/12/27 | 2019/12/26 |
| Horn antenna | Schwarzbeck | 9120D | HKE-013 | 2018/12/27 | 2019/12/26 |
| High gain antenna | Schwarzbeck | LB-180400KF | HKE-054 | 2018/12/27 | 2019/12/26 |
| Preamplifier | EMCI | EMC051845SE | HKE-015 | 2018/12/27 | 2019/12/26 |
| Preamplifier | Agilent | 83051A | HKE-016 | 2018/12/27 | 2019/12/26 |
| Preamplifier | Schwarzbeck | BBV 9743 | HKE-006 | 2018/12/27 | 2019/12/26 |
| Temperature and humidity meter | Boyang | HTC-1 | HKE-075 | 2018/12/27 | 2019/12/26 |
| High-low temperature chamber | Guangke | HT-80L | HKE-118 | 2018/12/27 | 2019/12/26 |
| High pass filter unit | Tonscend | JS0806-F | HKE-055 | 2018/12/27 | 2019/12/26 |
| RF Cable(below1GHz) | Times | 9kHz-1GHz | HKE-117 | 2018/12/27 | 2019/12/26 |
| RF Cable(above 1GHz) | Times | 1-40G | HKE-034 | 2018/12/27 | 2019/12/26 |
| Power meter | Agilent | E4419B | HKE-085 | 2018/12/27 | 2019/12/26 |
| Power Sensor | Agilent | E9300A | HKE-086 | 2018/12/27 | 2019/12/26 |
| Conducted test software | Tonscend | TS+ Rev 2.5.0.0 | HKE-081 | N/A | N/A |
| Radiated test software | Tonscend | TS+ Rev 2.5.0.0 | HKE-082 | N/A | N/A |
| RF test software | Tonscend | JS1120-B Version 2.6 | HKE-083 | N/A | N/A |
| RF test software | Tonscend | JS1120-4 | HKE-113 | N/A | N/A |
| RF test software | Tonscend | JS1120-3 | HKE-114 | N/A | N/A |
| RF test software | Tonscend | JS1120-1 | HKE-115 | N/A | N/A |
| Wireless Communication Test Set | R&S | CMW500 | HKE-026 | 2018/12/27 | 2019/12/26 |
| Wireless Communication Test Set | R&S | CMU200 | HKE-029 | 2018/12/27 | 2019/12/26 |

# 4 TEST CONDITIONS AND RESULTS

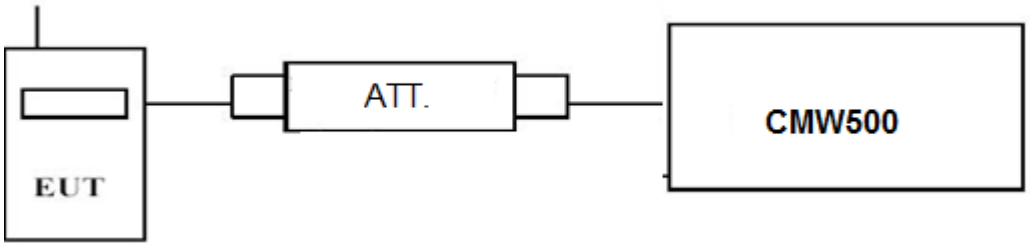
## 4.1 Output Power

### 4.1.1 CoductedOutput Power

**TEST APPLICABLE**

During the process of testing, the EUT was controlled via R&S Digital Radio Communication tester (CMW500) to ensure max power transmission and proper modulation. This result contains output power and EIRP measurements for the EUT. In all cases, output power is within the specified limits.

**TEST CONFIGURATION**




**TEST PROCEDURE**

**Conducted Power Measurement:**

a) Place the EUT on a bench and set it in transmitting mode.
b) Connect a low loss RF cable from the antenna port to a CMW500 by an Att.
c) EUT Communicate with CMW500 then selects a channel for testing.
d) Add a correction factor to the display CMW500, and then test.

**TEST RESULTS**

**compliance ***

*Remark:*

1. *We measured all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 5;*

| *LTE FDD Band 5* | | | | |
|---|---|---|---|---|
| TX Channel Bandwidth | Frequency (MHz) | RB Size/Offset | Burst Average Power [dBm] | |
| | | | QPSK | 16QAM |
| 1.4 MHz | 824.7 | 1 RB low | 23.13 | 22.69 |
| | | 1 RB high | 23.05 | 22.59 |
| | | 50% RB mid | 23.07 | 22.41 |
| | | 100% RB | 23.13 | 23.09 |
| | 836.5 | 1 RB low | 23.22 | 22.37 |
| | | 1 RB high | 23.23 | 22.33 |
| | | 50% RB mid | 23.16 | 22.25 |
| | | 100% RB | 23.13 | 23.10 |
| | 848.3 | 1 RB low | 23.37 | 22.26 |
| | | 1 RB high | 23.73 | 23.31 |
| | | 50% RB mid | 23.72 | 23.28 |
| | | 100% RB | 23.20 | 23.56 |
| 3 MHz | 825.5 | 1 RB low | 23.26 | 21.99 |
| | | 1 RB high | 23.15 | 21.87 |
| | | 50% RB mid | 23.31 | 21.82 |
| | | 100% RB | 21.98 | 21.99 |
| | 836.5 | 1 RB low | 23.21 | 22.00 |
| | | 1 RB high | 23.26 | 21.98 |
| | | 50% RB mid | 23.23 | 22.06 |

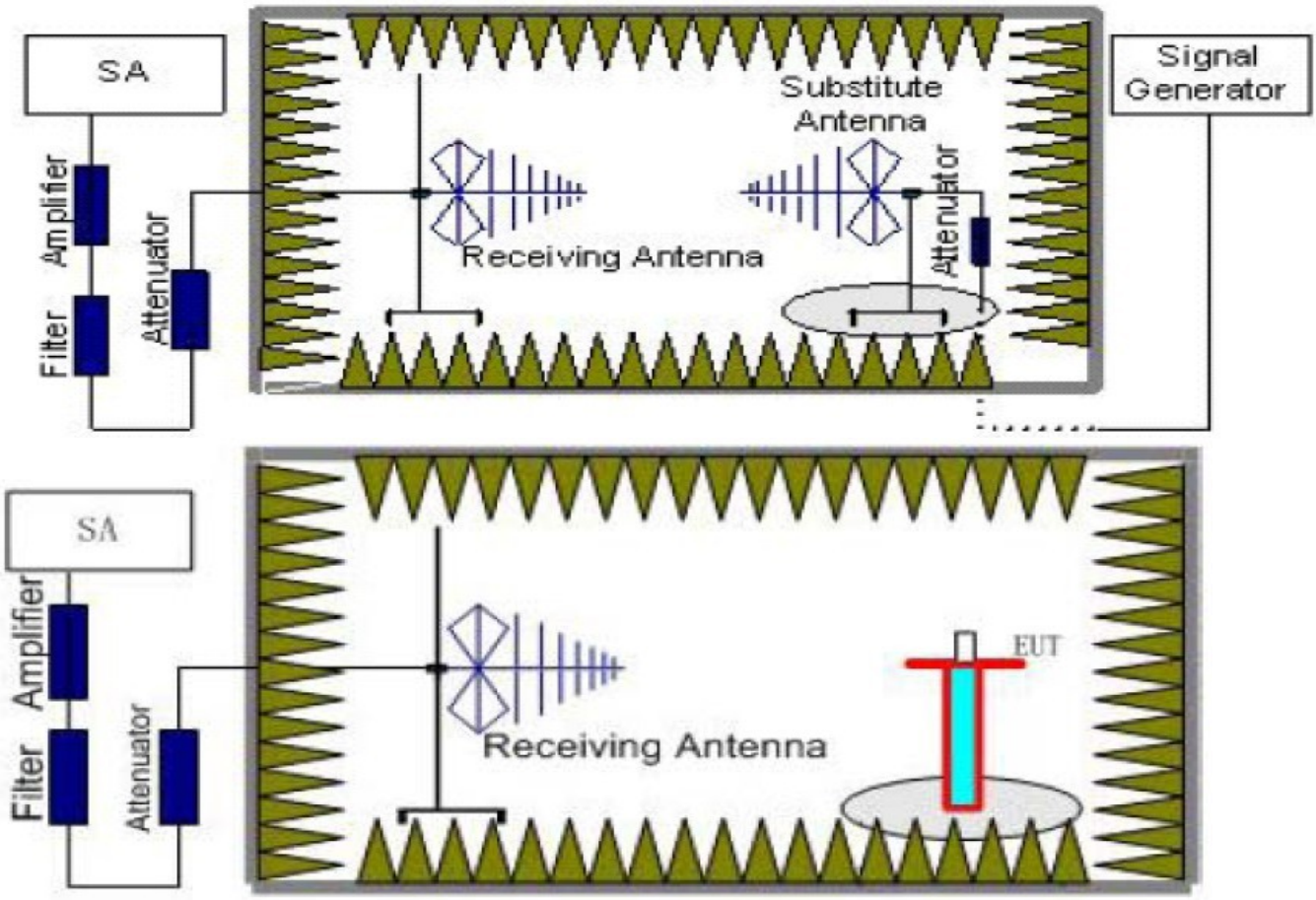
| | | | | |
|---|---|---|---|---|
| | | 100% RB | 22.00 | 22.03 |
| | 847.5 | 1 RB low | 23.38 | 22.38 |
| | | 1 RB high | 23.66 | 22.42 |
| | | 50% RB mid | 22.43 | 22.43 |
| | | 100% RB | 22.41 | 22.21 |
| 5 MHz | 826.5 | 1 RB low | 23.19 | 22.04 |
| | | 1 RB high | 23.12 | 22.13 |
| | | 50% RB mid | 23.13 | 22.15 |
| | | 100% RB | 22.16 | 21.66 |
| | 836.5 | 1 RB low | 23.02 | 21.61 |
| | | 1 RB high | 23.19 | 21.75 |
| | | 50% RB mid | 22.07 | 22.08 |
| | | 100% RB | 22.09 | 22.09 |
| | 846.5 | 1 RB low | 23.34 | 22.64 |
| | | 1 RB high | 23.21 | 22.80 |
| | | 50% RB mid | 23.61 | 22.79 |
| | | 100% RB | 22.58 | 22.56 |
| 10 MHz | 829.0 | 1 RB low | 23.03 | 22.02 |
| | | 1 RB high | 22.92 | 21.91 |
| | | 50% RB mid | 23.17 | 21.99 |
| | | 100% RB | 22.14 | 22.10 |
| | 836.5 | 1 RB low | 23.10 | 22.59 |
| | | 1 RB high | 23.25 | 22.51 |
| | | 50% RB mid | 23.31 | 22.78 |
| | | 100% RB | 22.14 | 22.14 |
| | 844.0 | 1 RB low | 23.31 | 22.14 |
| | | 1 RB high | 23.74 | 22.21 |
| | | 50% RB mid | 23.65 | 22.54 |
| | | 100% RB | 22.28 | 22.27 |

## 4.1.2. Radiated Output Power

**LIMIT**

This is the test for the maximum radiated power from the EUT.
Rule Part 22H.232(b) specifies, "Mobile/portable stations are limited to 7 watts e.i.r.p.

**TEST CONFIGURATION**




**TEST PROCEDURE**

1. EUT was placed on a 1.50 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.50m. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) were measured with peak detector.
2. A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.
3. The EUT is then put into continuously transmitting mode at its maximum power level during the test.Set Test Receiver or Spectrum RBW=1MHz,VBW=3MHz, And the maximum value of the receiver should be recorded as ($P_r$).
4. The EUT shall be replaced by a substitution antenna.In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest isconnected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power ($P_{Mea}$) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded ($P_r$). The power of signal source ($P_{Mea}$) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

5. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss ($P_{cl}$) ,the Substitution Antenna Gain ($G_a$) and the Amplifier Gain ($P_{Ag}$) should be recorded after test.
   The measurement results are obtained as described below: Power(EIRP)=$P_{Mea}$- $P_{Ag}$ - $P_{cl}$+ $G_a$
   We used SMF100A micowave signal generator which signal level can up to 33dBm,so we not used power Amplifier for substituation test; The measurement results are amend as described below:
   Power(EIRP)=$P_{Mea}$- $P_{cl}$+ $G_a$
6. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
7. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP-2.15dBi.

**TEST RESULTS**

**Radiated Measurement:**

*Remark:*

1. *We measured all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 5; recorded worst case for each Channel Bandwidth of LTE FDD Band 5.*
2. *EIRP=$P_{Mea}$(dBm)-$P_{cl}$(dB)+$P_{Ag}$(dB)+$G_a$(dBi)*
3. *We measured both Horizontal and Vertical direction, recorded worst case direction.*

*LTE FDDBand 5_Channel Bandwidth 1.4MHz_QPSK*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | $G_a$ Antenna Gain(dB) | $P_{Ag}$ (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 824.7 | -20.53 | 3.41 | 10.24 | 33.60 | 19.90 | 33.01 | 13.11 | V |
| 836.5 | -21.62 | 3.49 | 10.24 | 33.60 | 18.73 | 33.01 | 14.28 | V |
| 848.3 | -20.96 | 3.55 | 10.23 | 33.60 | 19.32 | 33.01 | 13.69 | V |

*LTE FDDBand 5_Channel Bandwidth 3MHz_QPSK*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | $G_a$ Antenna Gain(dB) | $P_{Ag}$ (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 825.5 | -21.15 | 3.41 | 10.24 | 33.60 | 19.28 | 33.01 | 13.73 | V |
| 836.5 | -21.51 | 3.49 | 10.24 | 33.60 | 18.84 | 33.01 | 14.17 | V |
| 847.5 | -21.23 | 3.55 | 10.23 | 33.60 | 19.05 | 33.01 | 13.96 | V |

*LTE FDD Band 5_Channel Bandwidth 5MHz_QPSK*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | $G_a$ Antenna Gain(dB) | $P_{Ag}$ (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 826.5 | -20.78 | 3.41 | 10.24 | 33.60 | 19.65 | 33.01 | 13.36 | V |
| 836.5 | -21.55 | 3.49 | 10.24 | 33.60 | 18.8 | 33.01 | 14.21 | V |
| 846.5 | -20.88 | 3.55 | 10.23 | 33.60 | 19.4 | 33.01 | 13.61 | V |

*LTE FDD Band 5_Channel Bandwidth 10MHz_QPSK*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | $G_a$ Antenna Gain(dB) | $P_{Ag}$ (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 829.0 | -20.32 | 3.41 | 10.24 | 33.60 | 20.11 | 33.01 | 12.90 | V |
| 836.5 | -21.77 | 3.49 | 10.24 | 33.60 | 18.58 | 33.01 | 14.43 | V |
| 844.0 | -21.39 | 3.55 | 10.23 | 33.60 | 18.89 | 33.01 | 14.12 | V |

*LTE FDD Band 5_Channel Bandwidth 1.4MHz_16QAM*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | $G_a$ Antenna Gain(dB) | $P_{Ag}$ (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 824.7 | -19.95 | 3.41 | 10.24 | 33.6 | 20.48 | 38.45 | 17.97 | V |
| 836.5 | -20.92 | 3.49 | 10.24 | 33.6 | 19.43 | 38.45 | 19.02 | V |
| 848.3 | -21.75 | 3.55 | 10.23 | 33.6 | 18.53 | 38.45 | 19.92 | V |

*LTE FDD Band 5_Channel Bandwidth 3MHz_16QAM*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | $G_a$ Antenna Gain(dB) | $P_{Ag}$ (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 825.5 | -20.72 | 3.41 | 10.24 | 33.6 | 19.71 | 38.45 | 18.74 | V |
| 836.5 | -22.40 | 3.49 | 10.24 | 33.6 | 17.95 | 38.45 | 20.5 | V |
| 847.5 | -19.94 | 3.55 | 10.23 | 33.6 | 20.34 | 38.45 | 18.11 | V |

*LTE FDD Band 5_Channel Bandwidth 5MHz_16QAM*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | $G_a$ Antenna Gain(dB) | $P_{Ag}$ (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 826.5 | -21.11 | 3.41 | 10.24 | 33.6 | 19.32 | 38.45 | 19.13 | V |
| 836.5 | -21.38 | 3.49 | 10.24 | 33.6 | 18.97 | 38.45 | 19.48 | V |
| 846.5 | -19.96 | 3.55 | 10.23 | 33.6 | 20.32 | 38.45 | 18.13 | V |

*LTE FDD Band 5_Channel Bandwidth 10MHz_16QAM*

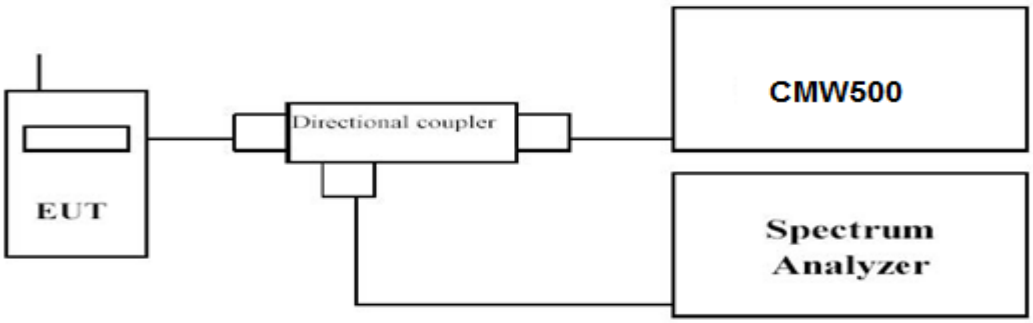
| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | $G_a$ Antenna Gain(dB) | $P_{Ag}$ (dB) | ERP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 829.0 | -20.74 | 3.41 | 10.24 | 33.6 | 19.69 | 38.45 | 18.76 | V |
| 836.5 | -21.38 | 3.49 | 10.24 | 33.6 | 18.97 | 38.45 | 19.48 | V |
| 844.0 | -21.41 | 3.55 | 10.23 | 33.6 | 18.87 | 38.45 | 19.58 | V |

## 4.2 Peak-to-Average Ratio (PAR)

**LIMIT**

The Peak-to-Average Ratio (PAR) of the transmission may not exceed 13 dB.

**TEST CONFIGURATION**




**TEST PROCEDURE**

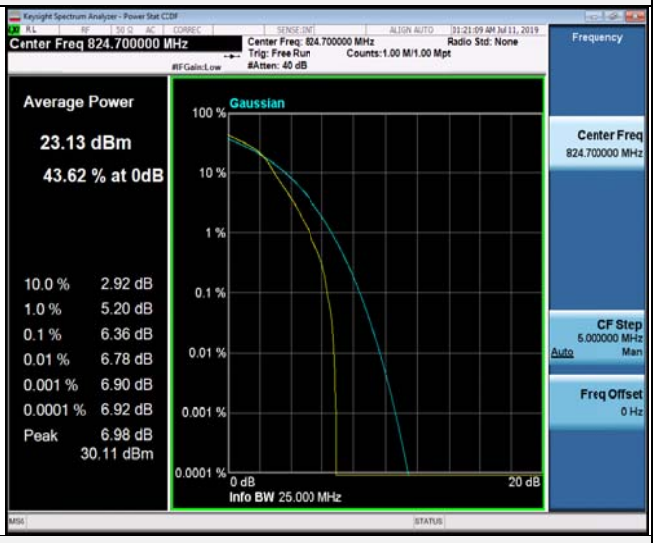
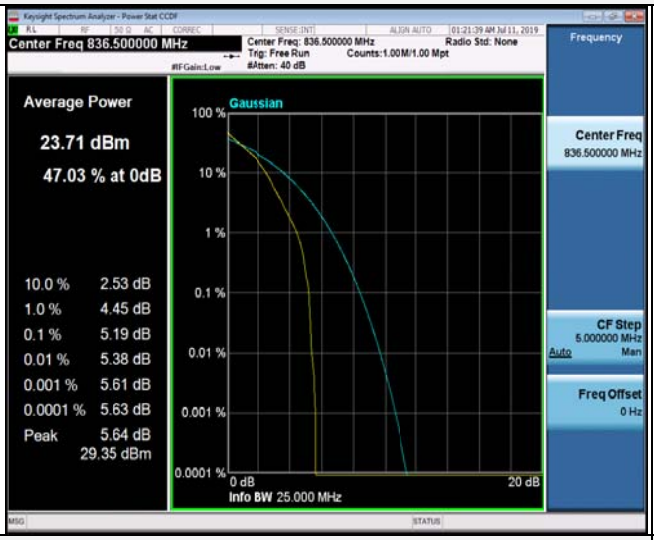
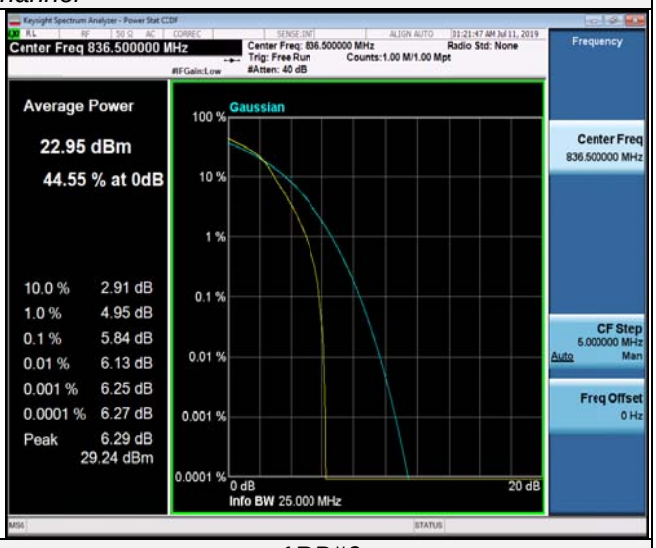
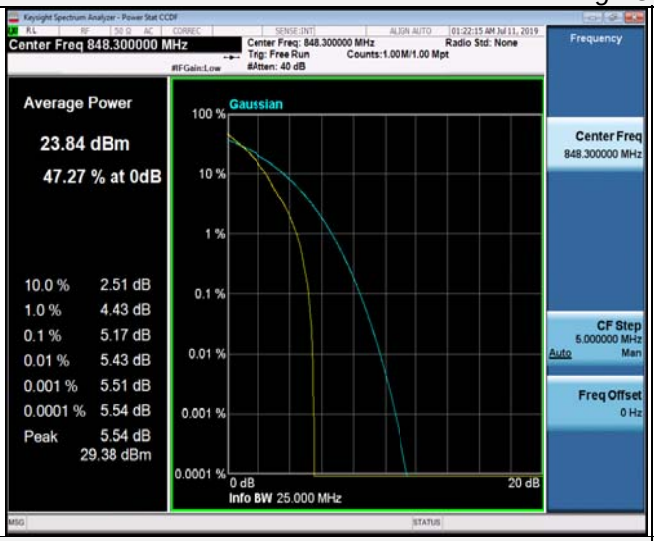
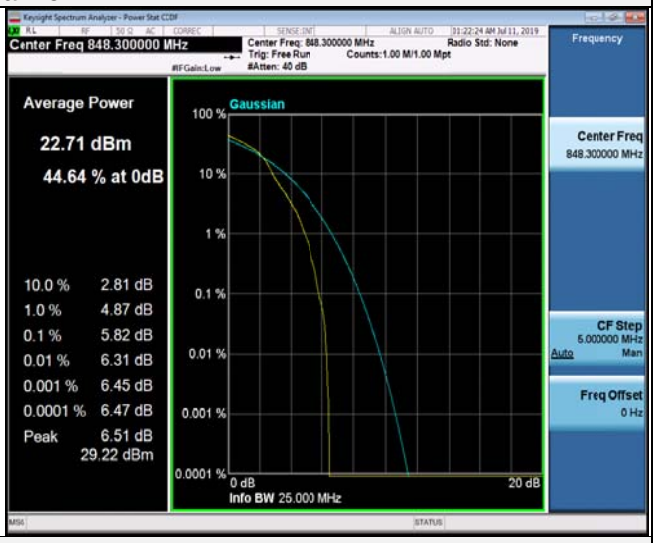
1. Refer to instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function;
2. Set resolution/measurement bandwidth ≥ signal's occupied bandwidth;
3. Set the number of counts to a value that stabilizes the measured CCDF curve;
4. Set the measurement interval as follows:
   1). for continuous transmissions, set to 1 ms,
   2). for burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize and set the measurement interval to a time that is less than or equal to the burst duration.
5. Record the maximum PAPR level associated with a probability of 0.1%.

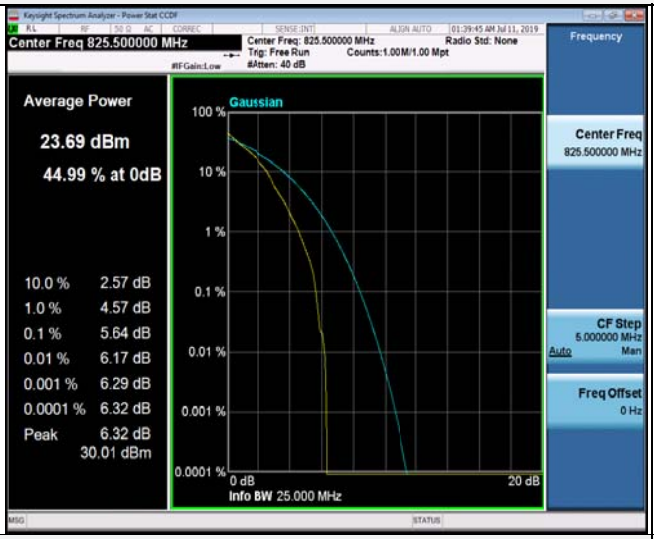
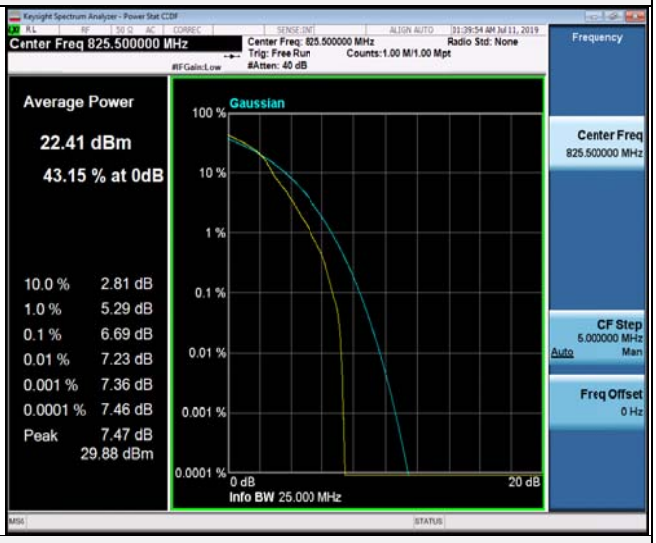
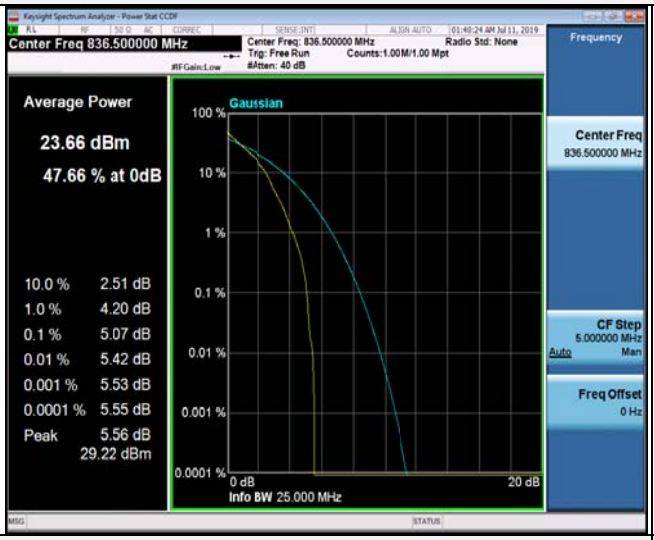
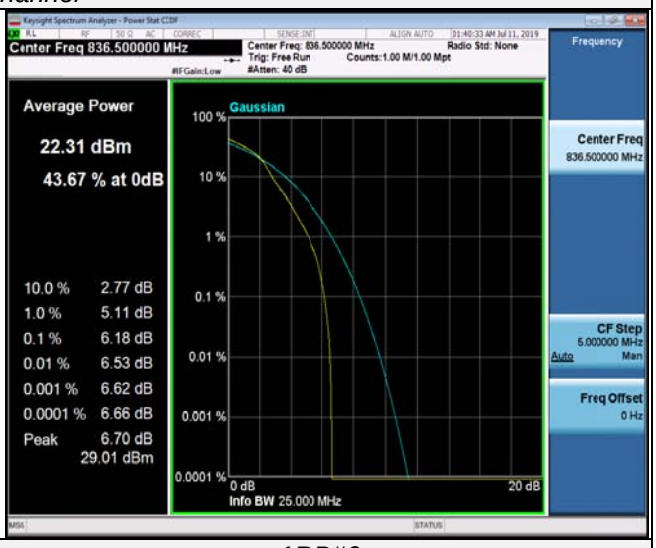
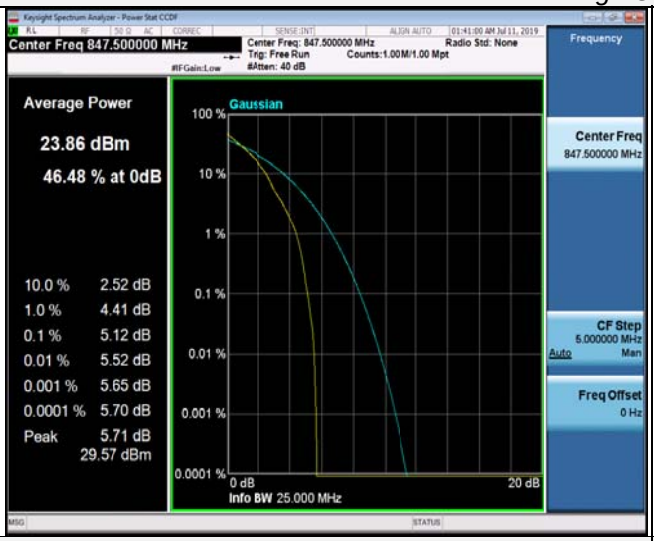
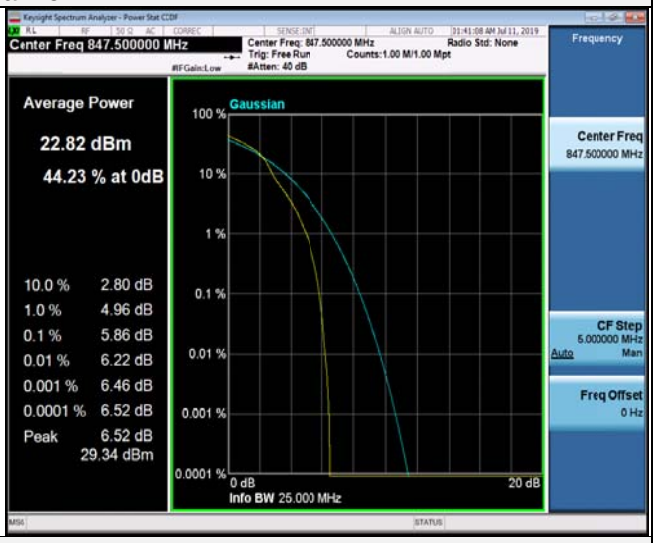
**TEST RESULTS**

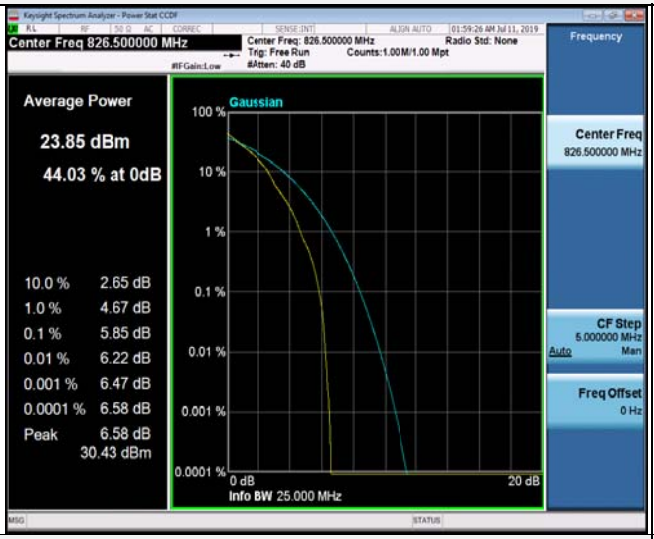
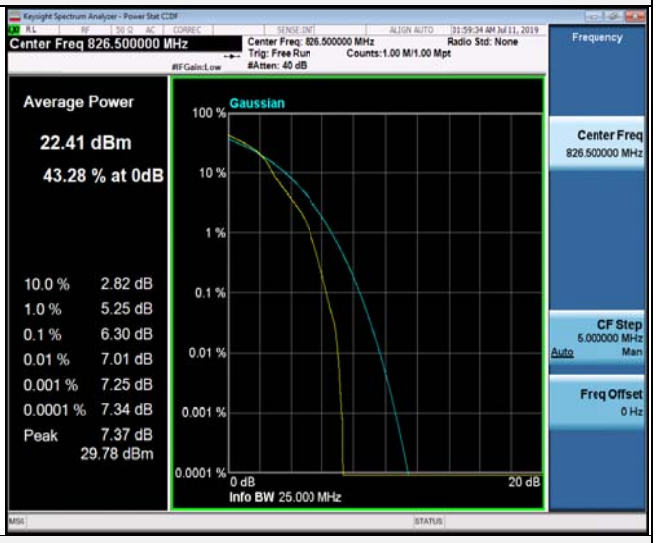
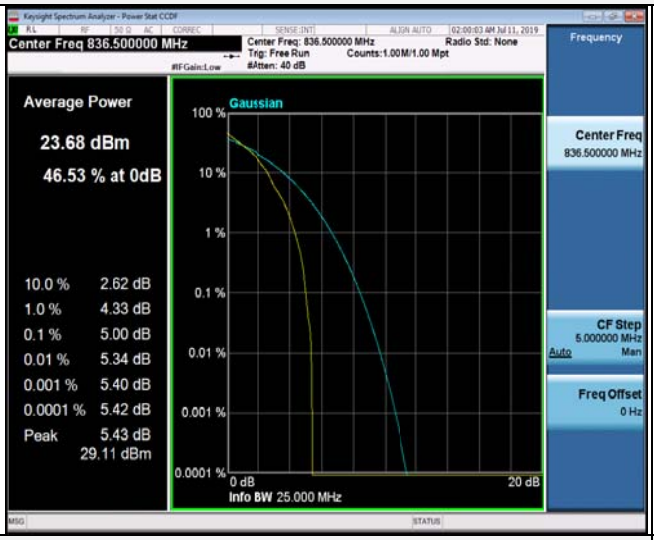
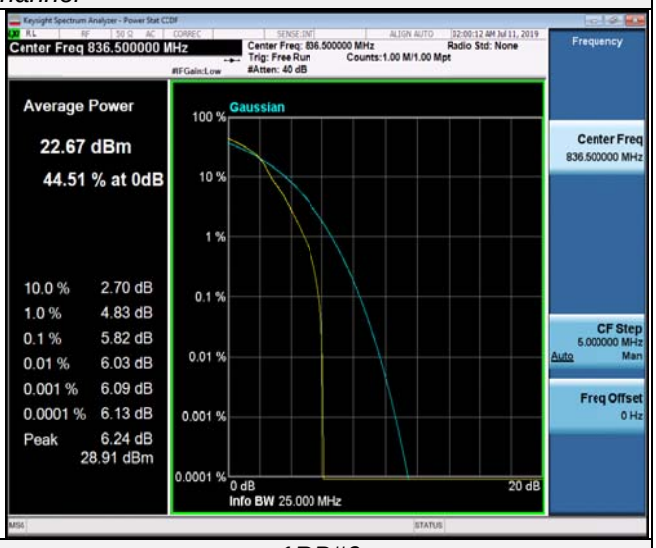
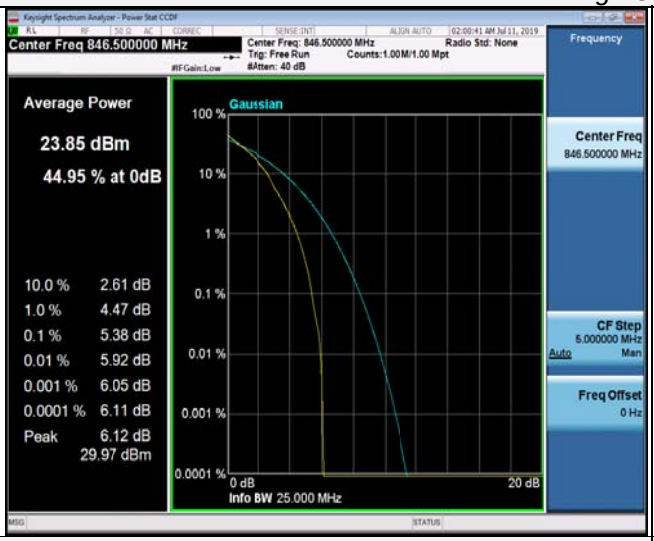
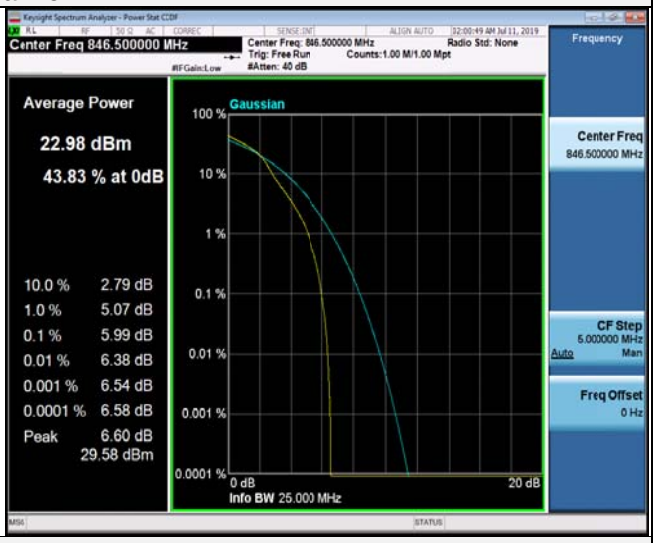
*Remark:*

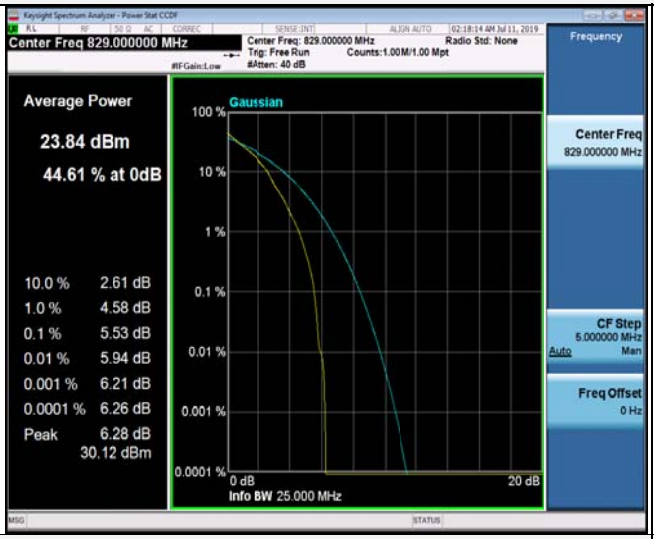
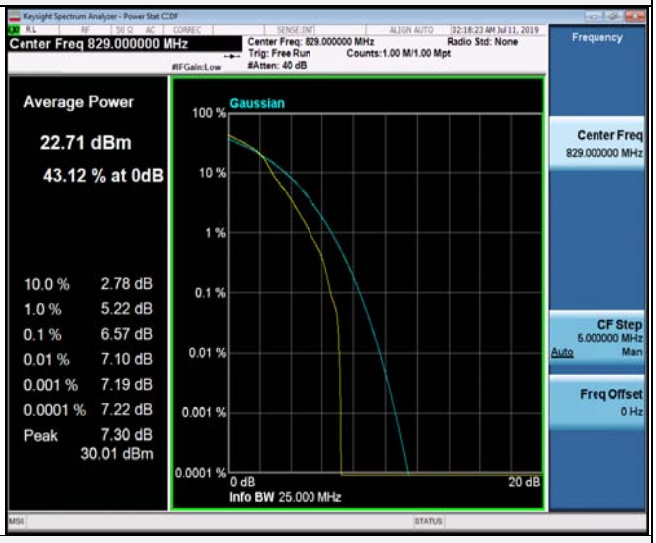
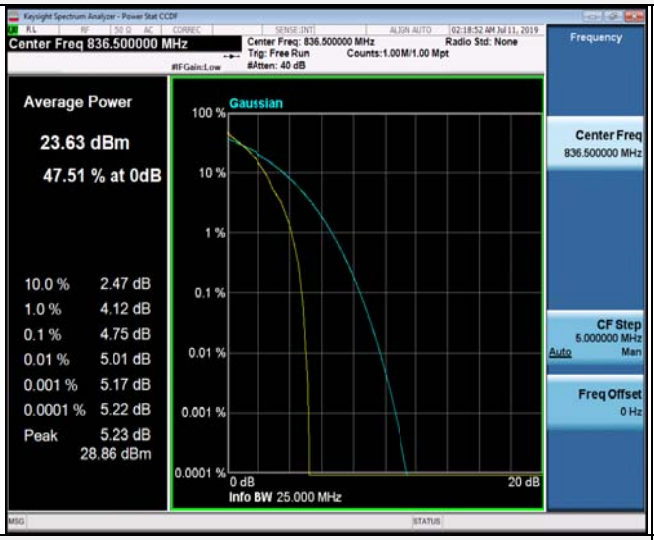
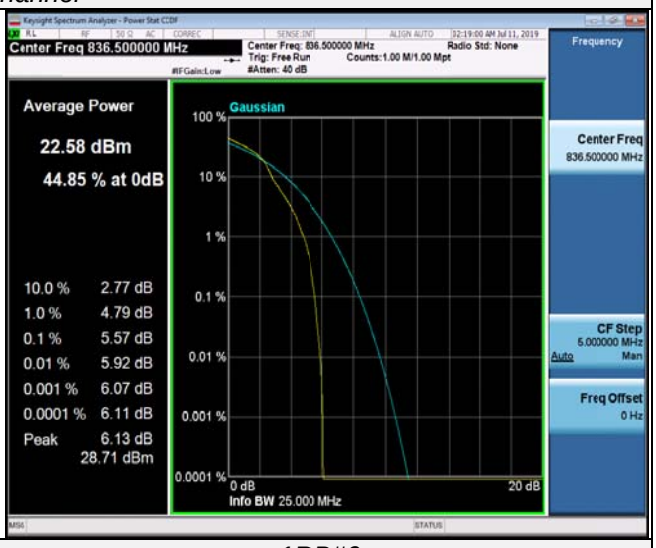
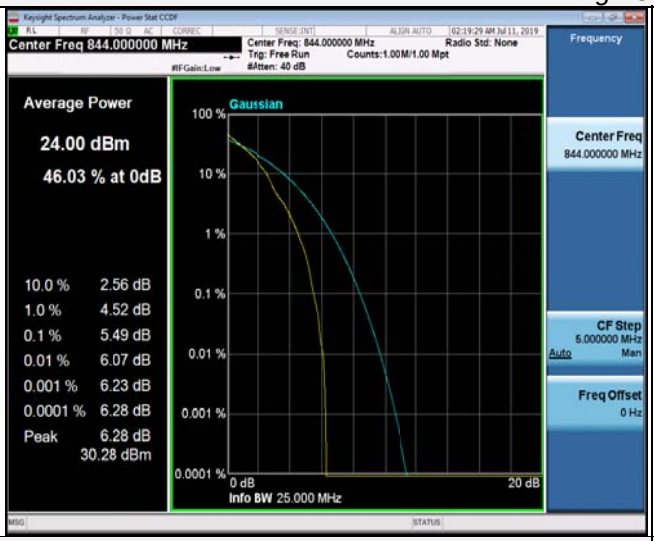
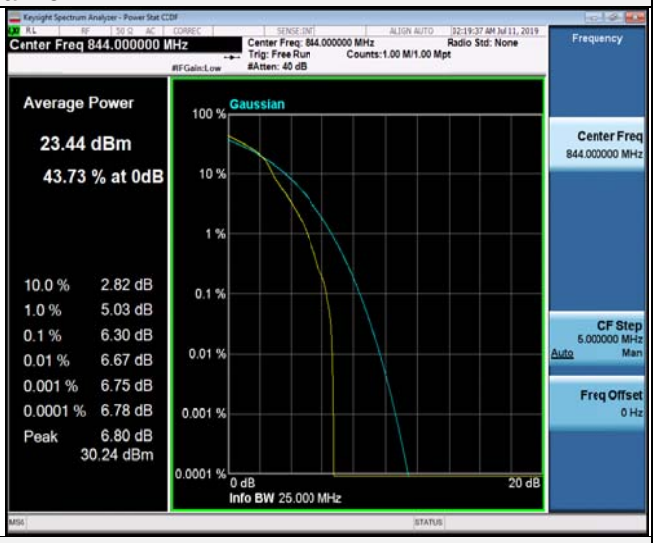
1. *We measured all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 5; recorded worst case for each Channel Bandwidth of LTE FDD Band 5.*

| *LTE FDD Band 5* | | | | |
|---|---|---|---|---|
| TX Channel Bandwidth | Frequency (MHz) | RB Size/Offset | PAPR(dB) | |
| | | | QPSK | 16QAM |
| 1.4 MHz | 824.7 | *1RB#0* | 5.74 | 6.36 |
| | 836.5 | | 5.19 | 5.84 |
| | 848.3 | | 5.17 | 5.82 |
| 3 MHz | 825.5 | *1RB#0* | 5.64 | 6.69 |
| | 836.5 | | 5.07 | 6.18 |
| | 847.5 | | 5.12 | 5.86 |
| 5 MHz | 826.5 | *1RB#0* | 5.85 | 6.30 |
| | 836.5 | | 5.00 | 5.82 |
| | 846.5 | | 5.38 | 5.99 |
| 10 MHz | 829.0 | *1RB#0* | 5.53 | 6.57 |
| | 836.5 | | 4.75 | 5.57 |
| | 844.0 | | 5.49 | 6.30 |

| LTE FDD Band 5– 1.4 MHz Channel BandwidthPAPR | |
|---|---|
| QPSK | 16QAM |
| Low Channel | |
| |  |
| 1RB#0 | 1RB#0 |
| Middle Channel | |
|  |  |
| 1RB#0 | 1RB#0 |
| High Channel | |
|  |  |
| 1RB#0 | 1RB#0 |

| LTE FDD Band 5–3MHz Channel BandwidthPAPR | |
|---|---|
| QPSK | 16QAM |
| Low Channel | |
|  |  |
| 1RB#0 | 1RB#0 |
| Middle Channel | |
|  |  |
| 1RB#0 | 1RB#0 |
| High Channel | |
|  |  |
| 1RB#0 | 1RB#0 |

| LTE FDD Band 5–5MHz Channel BandwidthPAPR | |
|---|---|
| QPSK | 16QAM |
| Low Channel | |
|  |  |
| 1RB#0 | 1RB#0 |
| Middle Channel | |
|  |  |
| 1RB#0 | 1RB#0 |
| High Channel | |
|  |  |
| 1RB#0 | 1RB#0 |

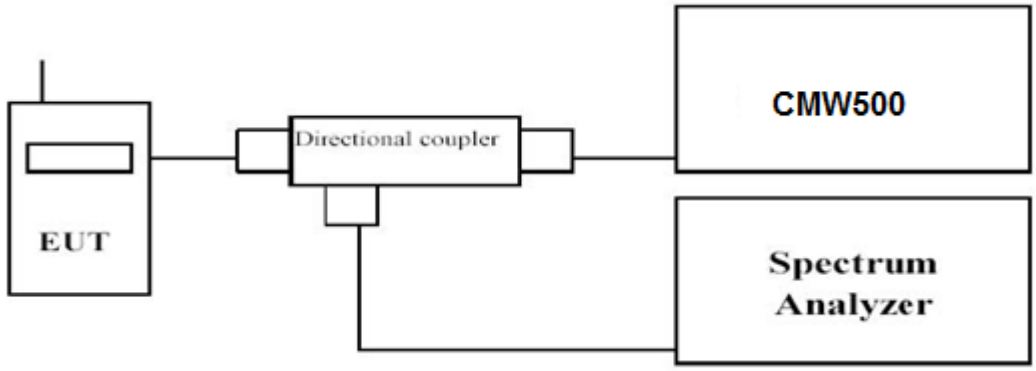
| LTE FDD Band 5–10MHz Channel BandwidthPAPR | |
|---|---|
| QPSK | 16QAM |
| Low Channel | |
|  |  |
| 1RB#0 | 1RB#0 |
| Middle Channel | |
|  |  |
| 1RB#0 | 1RB#0 |
| High Channel | |
|  |  |
| 1RB#0 | 1RB#0 |

## 4.3 Occupied Bandwidth and Emission Bandwidth

**LIMIT**

N/A

**TEST CONFIGURATION**




**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 low, middle and high channel in each band. The -26dBc Emission bandwidth was also measured and recorded.
Set RBWwas set to about 1% of emission BW, VBW≥3 times RBW.
-26dBc display line was placed on the screen (or 99% bandwidth), the occupied bandwidth isthe delta frequency between the two points where the display line intersects the signal trace.

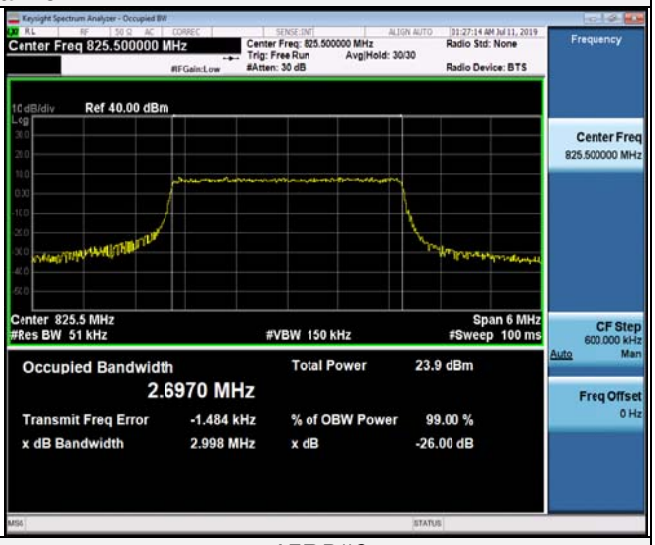
**TEST RESULTS**

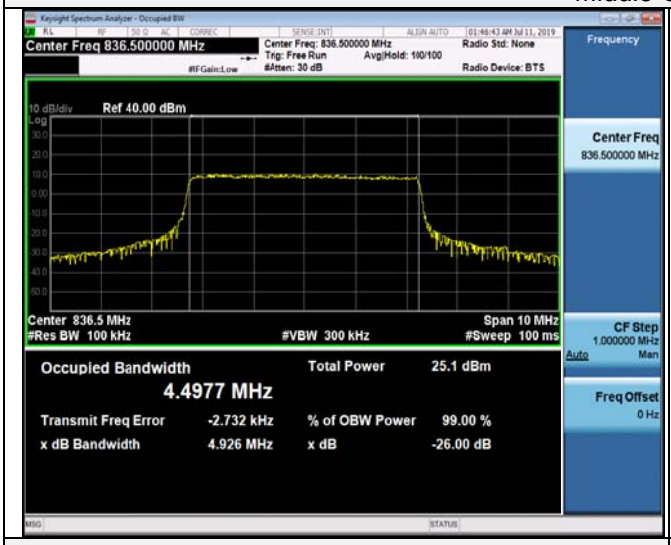
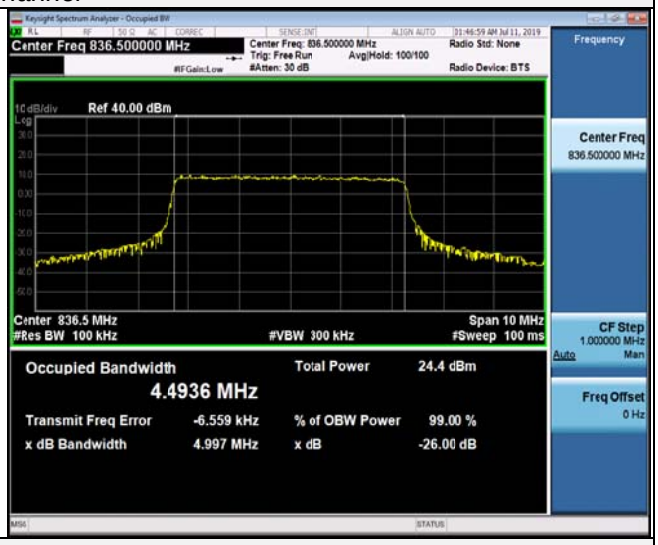
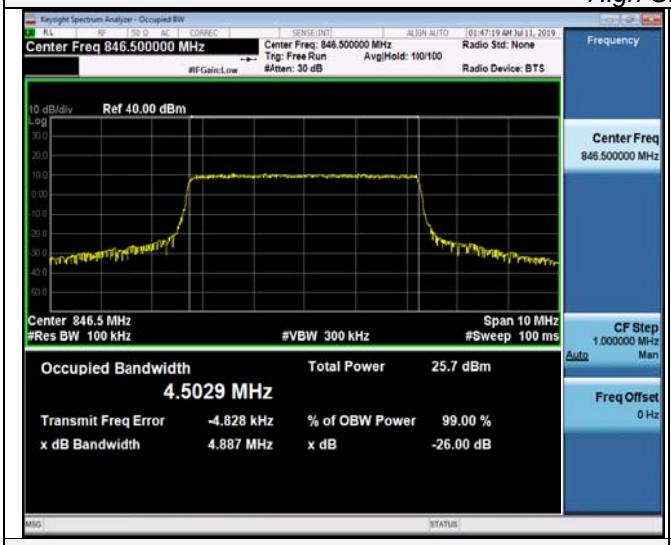
*Remark:*

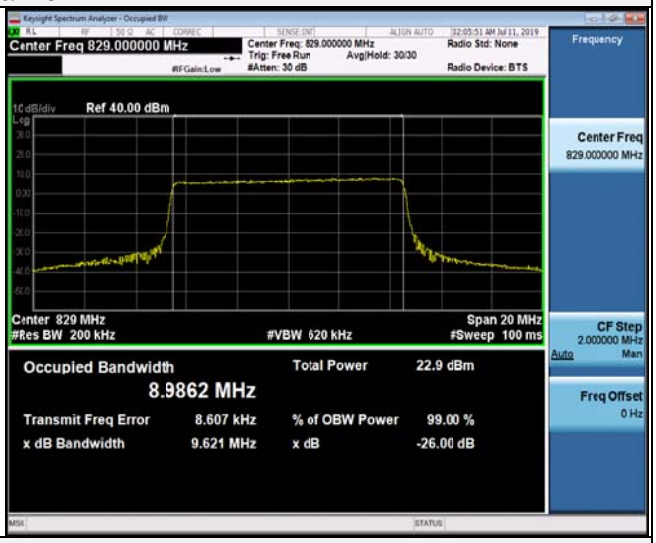
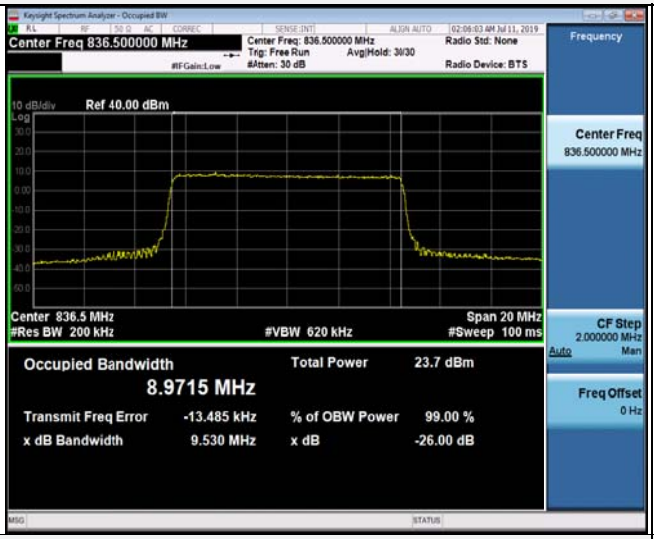
1. *We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 5; recorded worst case for each Channel Bandwidth of LTE FDD Band 5.*

| *LTE FDD Band 5* | | | | | | |
|---|---|---|---|---|---|---|
| TX Channel Bandwidth | RB Size/Offset | Frequency (MHz) | -26dBc Emission bandwidth (MHz) | | 99% Occupied bandwidth (MHz) | |
| | | | QPSK | 16QAM | QPSK | 16QAM |
| 1.4 MHz | *6RB#0* | 824.7 | 1.241 | 1.241 | 1.0890 | 1.0919 |
| | | 836.5 | 1.242 | 1.251 | 1.0882 | 1.0901 |
| | | 848.3 | 1.248 | 1.268 | 1.0951 | 1.0921 |
| 3 MHz | *15RB#0* | 825.5 | 2.994 | 2.998 | 2.7013 | 2.6970 |
| | | 836.5 | 2.953 | 2.978 | 2.6941 | 2.6967 |
| | | 847.5 | 2.996 | 3.024 | 2.7000 | 2.7002 |
| 5 MHz | *25RB#0* | 826.5 | 4.956 | 4.968 | 4.5032 | 4.4990 |
| | | 836.5 | 4.926 | 4.997 | 4.4977 | 4.4936 |
| | | 846.5 | 4.887 | 4.906 | 4.5029 | 4.4990 |
| 10 MHz | *50RB#0* | 829.0 | 9.559 | 9.621 | 8.9796 | 8.9862 |
| | | 836.5 | 9.530 | 9.556 | 8.9715 | 8.9753 |
| | | 844.0 | 9.591 | 9.584 | 9.0004 | 8.9759 |

| LTE FDD Band 5– 1.4 MHz Channel Bandwidth Occupied Bandwidth and Emission Bandwidth | |
|---|---|
| QPSK | 16QAM |
| Low Channel | |
| | |
| 6RB#0 | 6RB#0 |
| Middle Channel | |
| | |
| 6RB#0 | 6RB#0 |
| High Channel | |
| | |
| 6RB#0 | 6RB#0 |

| LTE FDD Band 5–3MHz Channel Bandwidth Occupied Bandwidth and Emission Bandwidth | |
|---|---|
| QPSK | 16QAM |
| Low Channel | |
| |  |
| 15RB#0 | 15RB#0 |
| Middle Channel | |
| | |
| 15RB#0 | 15RB#0 |
| High Channel | |
| | |
| 15RB#0 | 15RB#0 |

| LTE FDD Band 5–5MHz Channel Bandwidth Occupied Bandwidth and Emission Bandwidth | |
|---|---|
| QPSK | 16QAM |
| Low Channel | |
| | = |
| 25RB#0 | 25RB#0 |
| Middle Channel | |
|  |  |
| 25RB#0 | 25RB#0 |
| High Channel | |
|  | |
| 25RB#0 | 25RB#0 |

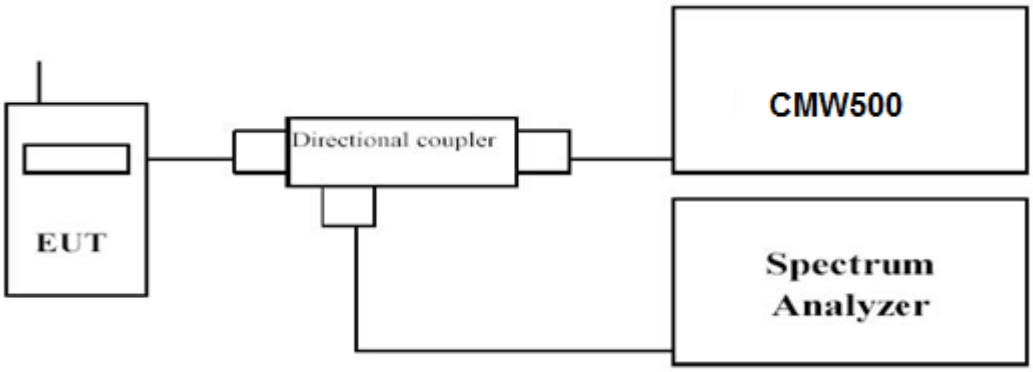
| LTE FDD Band 5–10MHz Channel Bandwidth Occupied Bandwidth and Emission Bandwidth | |
|---|---|
| QPSK | 16QAM |
| Low Channel | |
| |  |
| 50RB#0 | 50RB#0 |
| Middle Channel | |
|  | |
| 50RB#0 | 50RB#0 |
| High Channel | |
| | |
| 50RB#0 | 50RB#0 |

## 4.4 Band Edge compliance

**LIMIT**

Per FCC §24.238 the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10log(P) dB.

**TEST CONFIGURATION**




**TEST PROCEDURE**

1. The transmitter output port was connected to base station.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator, the path loss was compensated to the results for each measurement.
3. Set EUT at maximum power through base station.
4. Select lowestand highest channels for each band and different modulation.
5. Measure Band edge using RMS (Average) detector by spectrum

**TEST RESULTS**

*Remark:*

1. *We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 5; recorded worst case for each Channel Bandwidth of LTE FDD Band 5.*

| LTE FDD Band 5– 1.4 MHz Channel BandwidthBand Edge Compliance | |
|---|---|
| QPSK | 16QAM |
| Low Channel | |
| | |
| 6RB#0 | 6RB#0 |
| High Channel | |
| | |
| 6RB#0 | 6RB#0 |

| LTE FDD Band 5–3MHz Channel BandwidthBand Edge Compliance | |
|---|---|
| QPSK | 16QAM |
| Low Channel | |
| | |
| 15RB#0 | 15RB#0 |
| High Channel | |
| | |
| 15RB#0 | 15RB#0 |

| LTE FDD Band 5–5MHz Channel BandwidthBand Edge Compliance | |
|---|---|
| QPSK | 16QAM |
| Low Channel | |
| | |
| 25RB#0 | 25RB#0 |
| High Channel | |
| | |
| 25RB#0 | 25RB#0 |

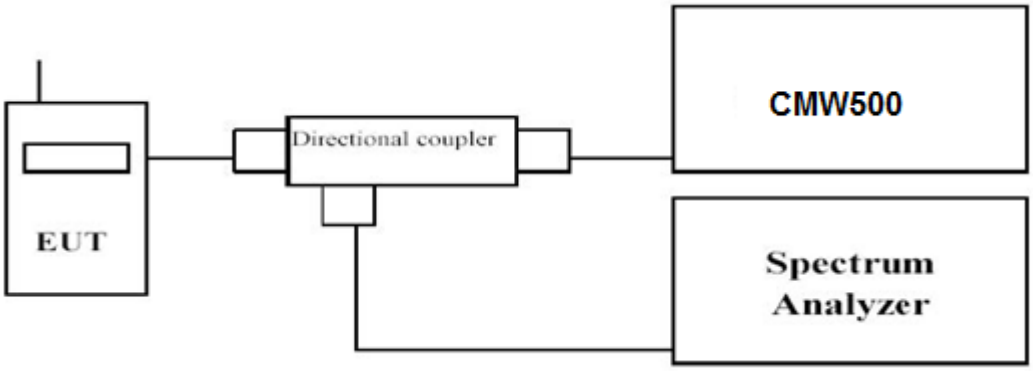
| LTE FDD Band 5– 10 MHz Channel BandwidthBand Edge Compliance | |
|---|---|
| QPSK | 16QAM |
| Low Channel | |
| | |
| 50RB#0 | 50RB#0 |
| High Channel | |
| | |
| 50RB#0 | 50RB#0 |

## 4.5 Spurious Emssionon Antenna Port

**LIMIT**

Per FCC §24.238, the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10log(P) dB.

**TEST CONFIGURATION**




**TEST PROCEDURE**

The EUT was setup according to EIA/TIA 603D

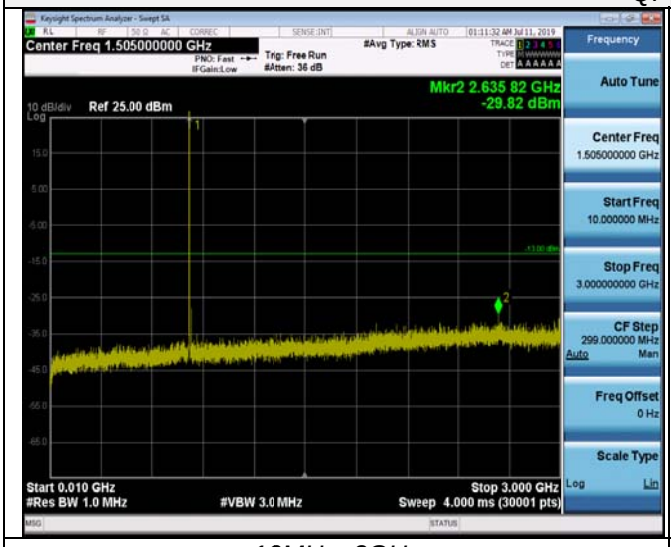
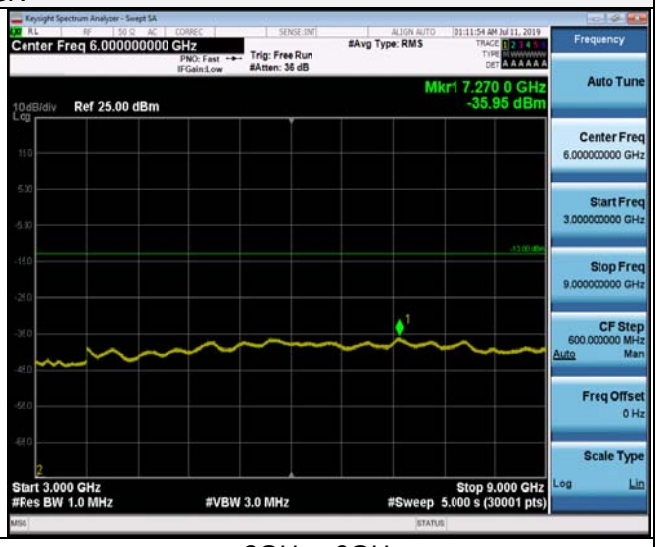
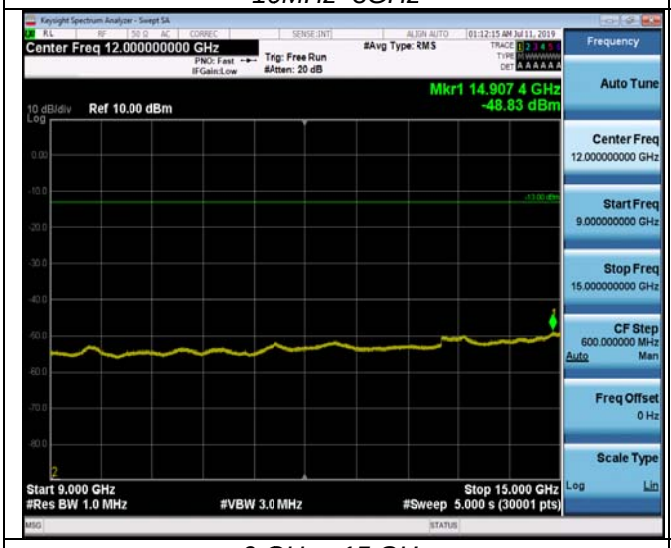
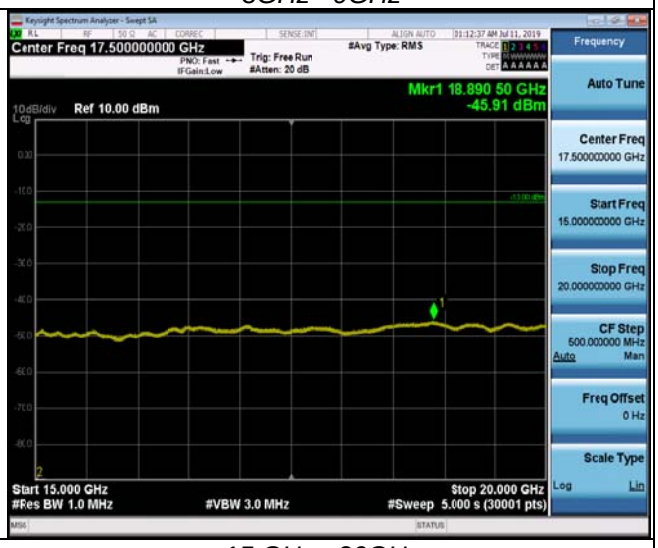
a. Place the EUT on a bench and set it in transmitting mode.
b. Connect a low loss RF cable from the antenna port to a spectrum analyzer andCMW500 by a Directional Couple.
c. EUT Communicate with CMW500, then select a channel for testing.
d. Add a correction factor to the display of spectrum, and then test.
e. The resolution bandwidth of the spectrum analyzer was setsufficient scans were taken to show the out of band Emission if any up to10$^{th}$ harmonic.
f. Please refer to following tables for test antenna conducted emissions.

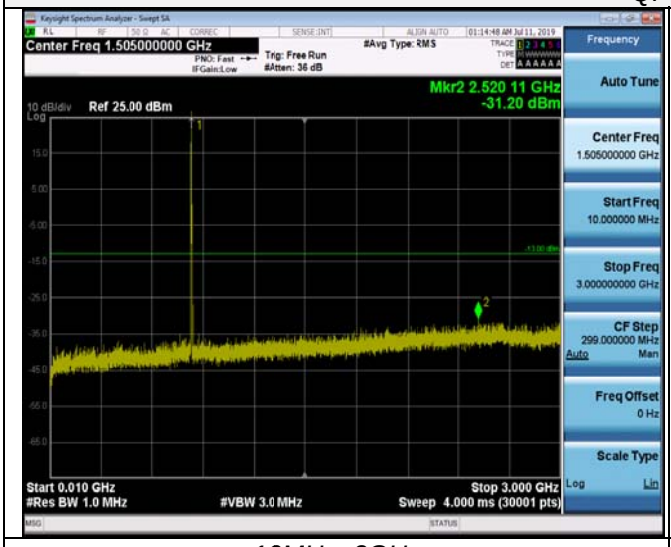
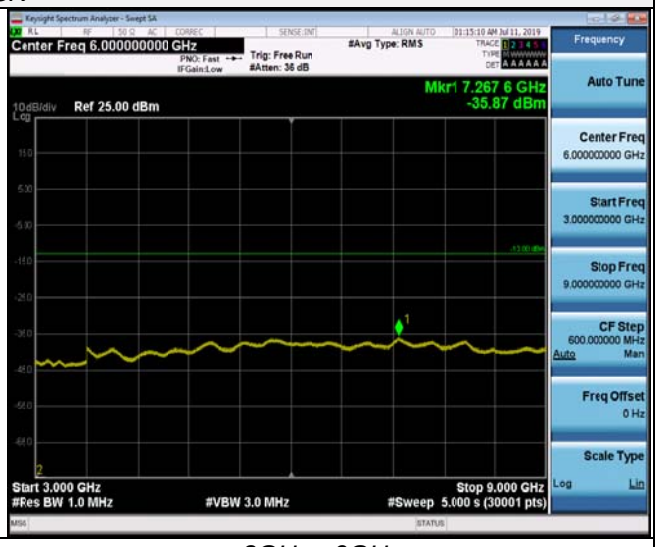
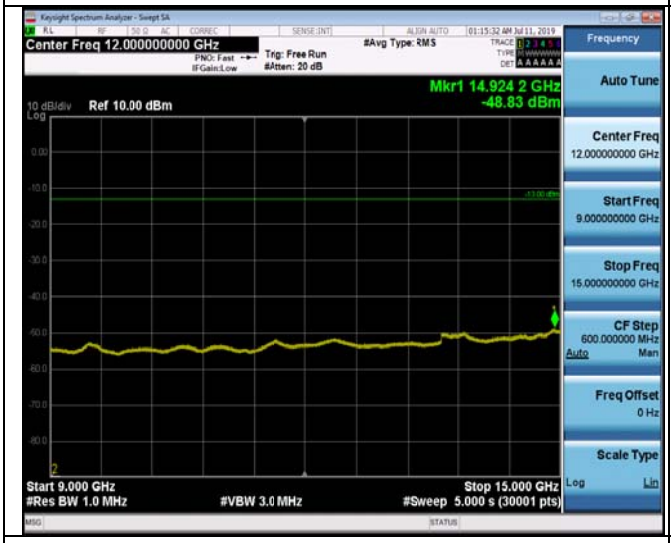
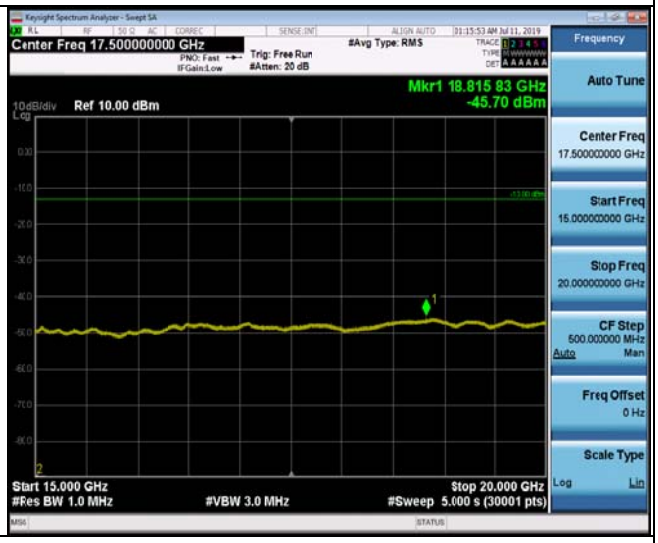
| Working Frequency | Sub range (GHz) | RBW | VBW | Sweep time (s) |
|---|---|---|---|---|
| LTE FDD Band 5 | 0.01~20 | 1 MHz | 3 MHz | Auto |

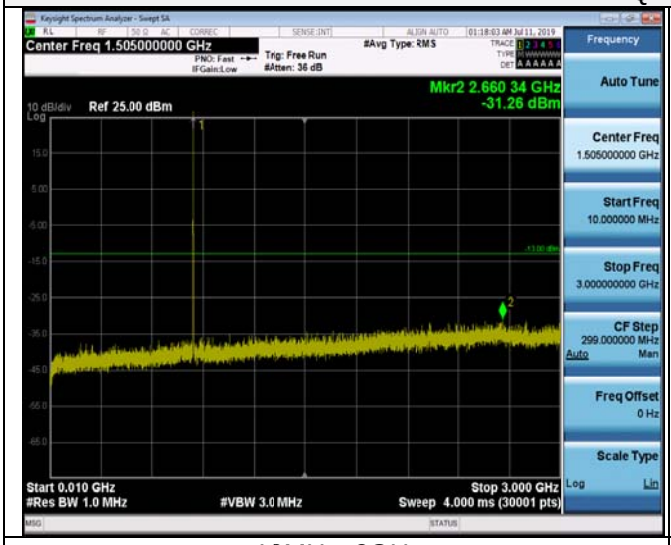
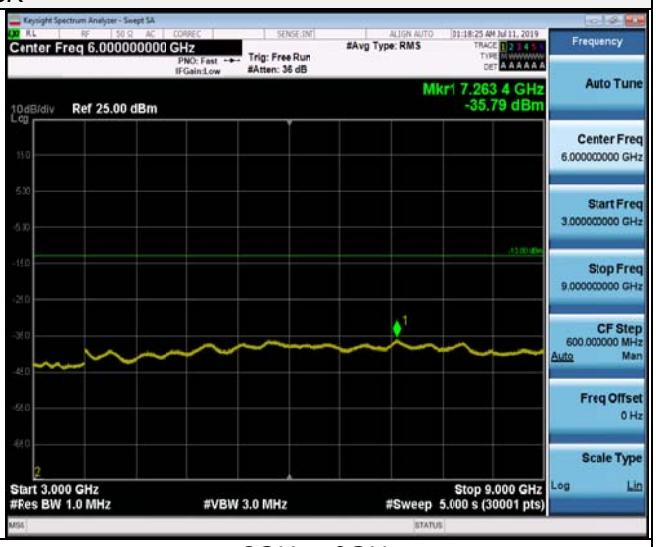
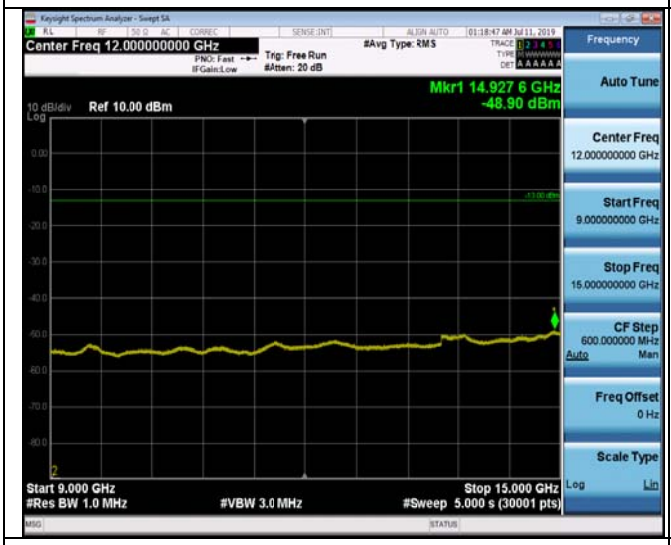
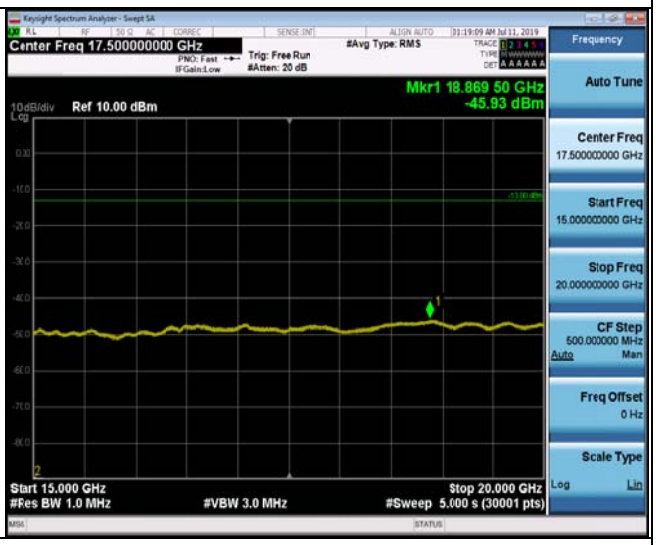
**TEST RESULTS**

*Remark:*

1. *We were tested all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 5; recorded worst case at the QPSK Mode for each Channel Bandwidth of LTE FDD Band 5*

| LTE FDD Band 5-1.4MHz Channel Bandwidth | |
|---|---|
| Low Channel | |
| QPSK | |
|  |  |
| 10MHz~3GHz | 3GHz ~9GHz |
|  |  |
| 9 GHz ~15 GHz | 15 GHz ~20GHz |

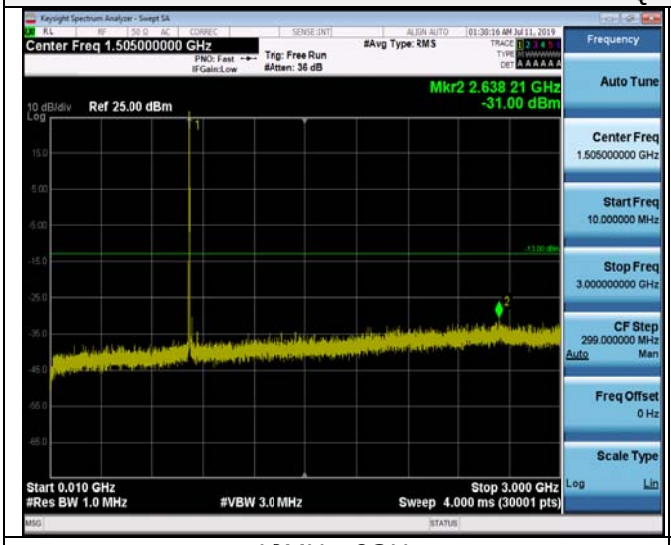
| LTE FDD Band 5-1.4MHz Channel Bandwidth | |
|---|---|
| Middle Channel | |
| QPSK | |
|  |  |
| 10MHz~3GHz | 3GHz ~9GHz |
|  |  |
| 9 GHz ~15 GHz | 15 GHz ~20GHz |

| LTE FDD Band 5-1.4MHz Channel Bandwidth | |
|---|---|
| High Channel | |
| QPSK | |
|  |  |
| 10MHz~3GHz | 3GHz ~9GHz |
|  |  |
| 9 GHz ~15 GHz | 15 GHz ~20GHz |

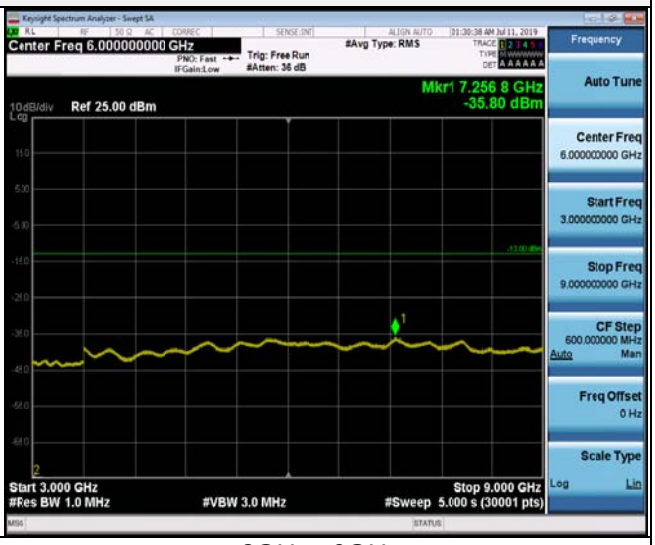
*LTE FDD Band 5-3MHz Channel Bandwidth*

*Low Channel*

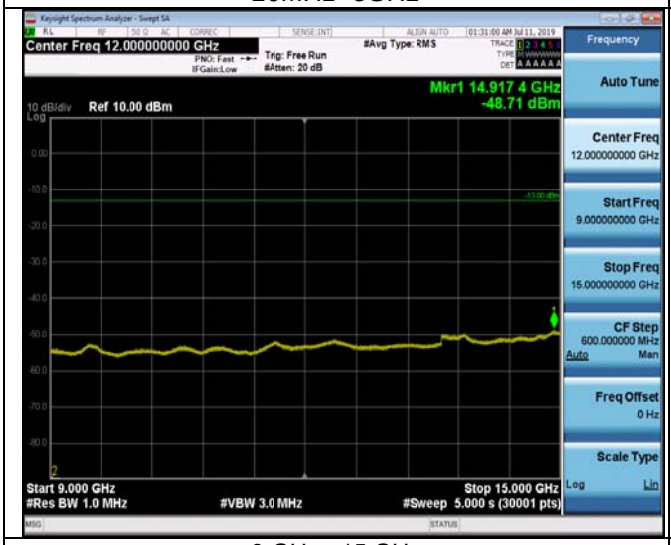
*QPSK*



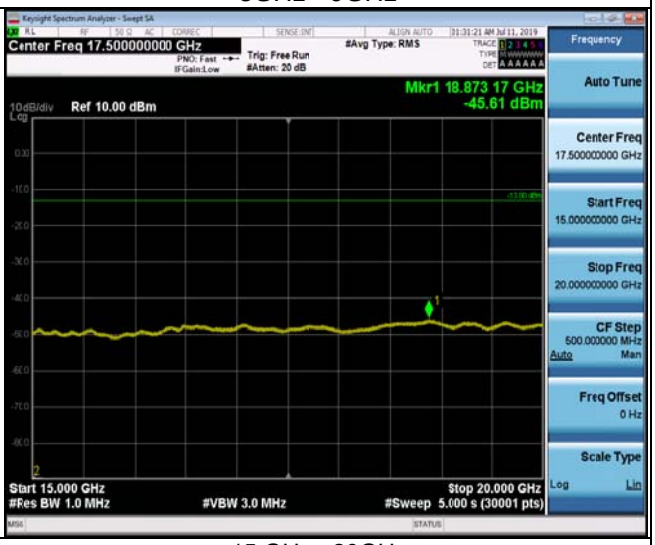

*10MHz~3GHz*



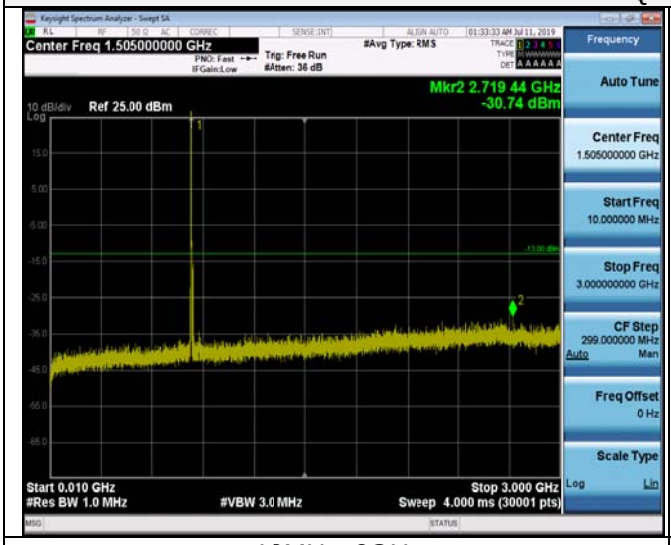
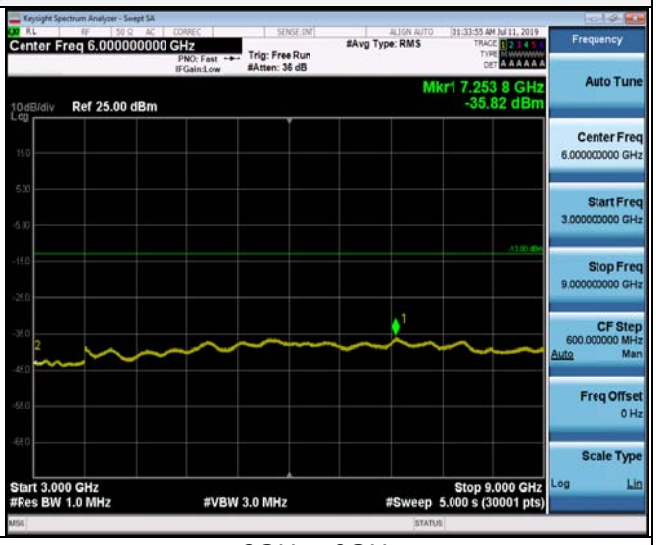
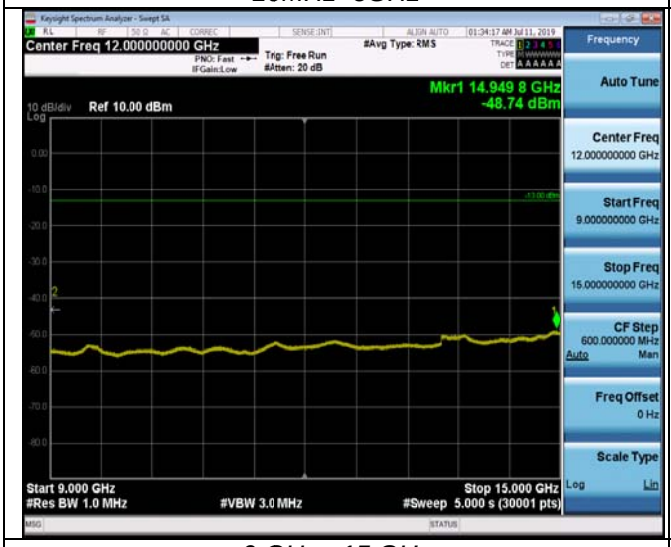
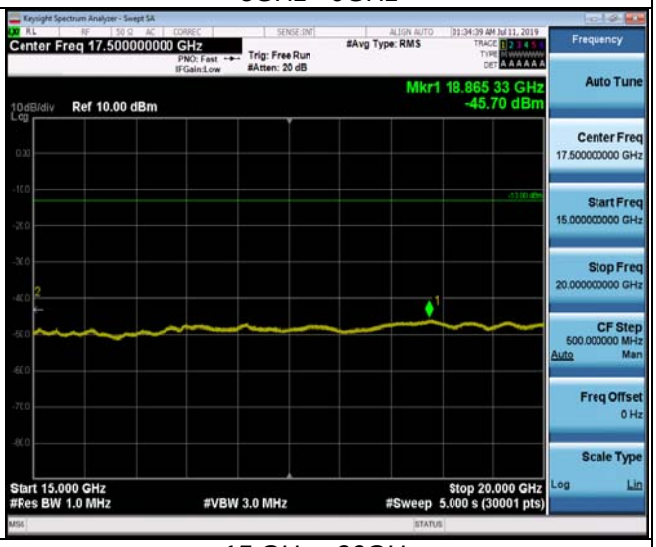

*3GHz ~9GHz*

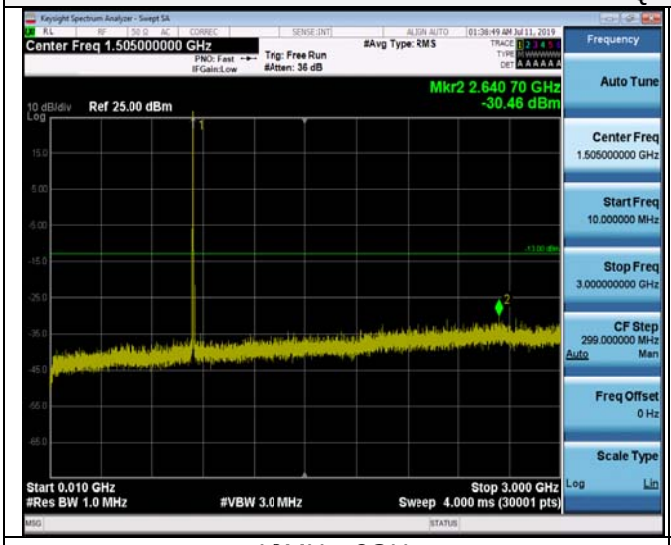
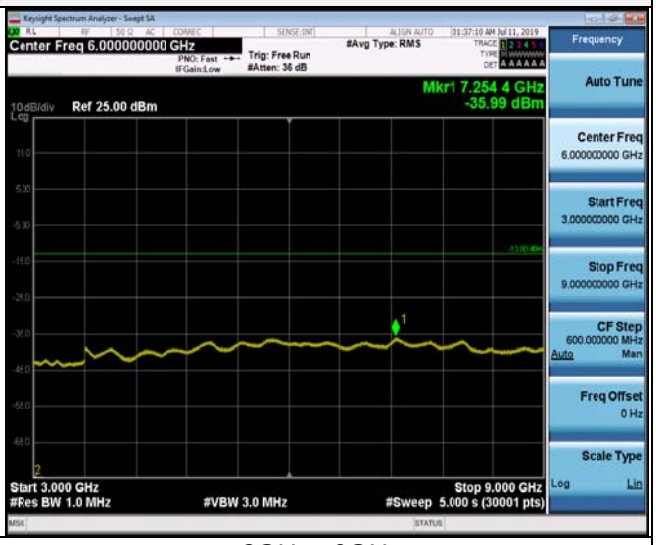
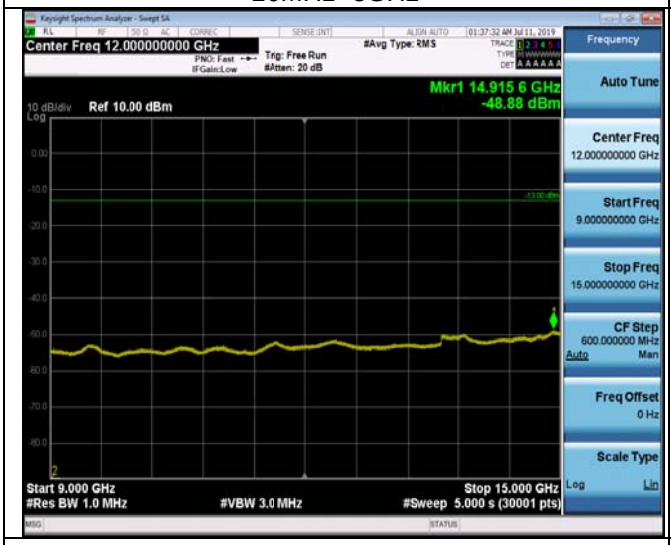
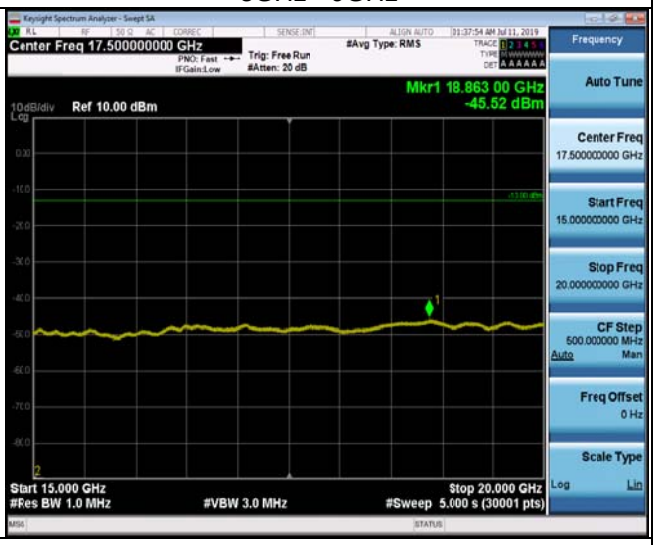



9 GHz ~15 GHz




15 GHz ~20GHz

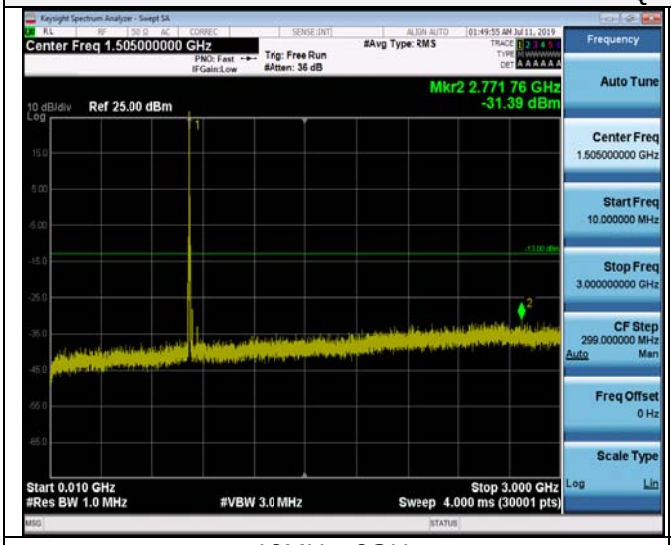
| LTE FDD Band 5-3MHz Channel Bandwidth | |
|---|---|
| Middle Channel | |
| QPSK | |
|  |  |
| 10MHz~3GHz | 3GHz ~9GHz |
|  |  |
| 9 GHz ~15 GHz | 15 GHz ~20GHz |

| LTE FDD Band 5-3MHz Channel Bandwidth | |
|---|---|
| High Channel | |
| QPSK | |
|  |  |
| 10MHz~3GHz | 3GHz ~9GHz |
|  |  |
| 9 GHz ~15 GHz | 15 GHz ~20GHz |

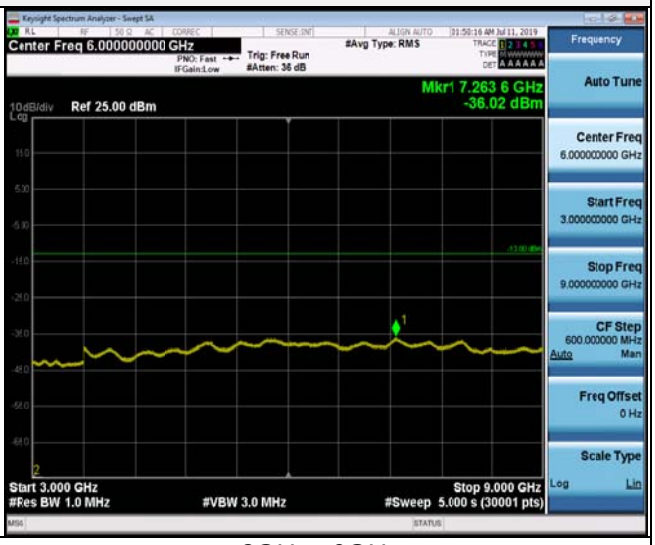
*LTE FDD Band 5-5 MHz Channel Bandwidth*

*Low Channel*

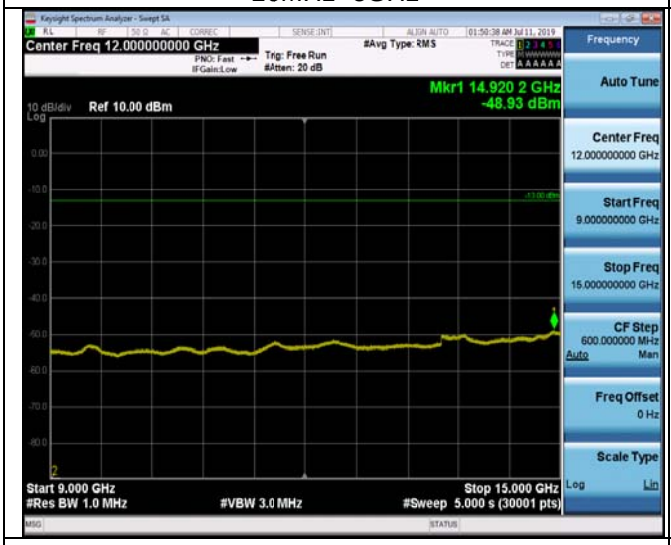
*QPSK*



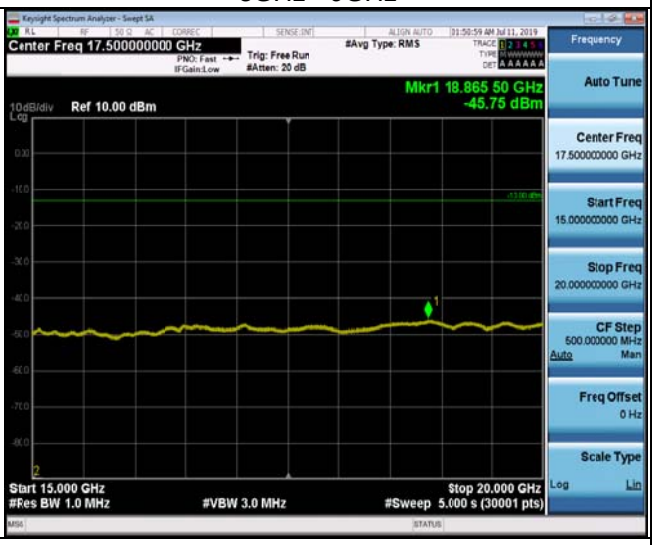

*10MHz~3GHz*



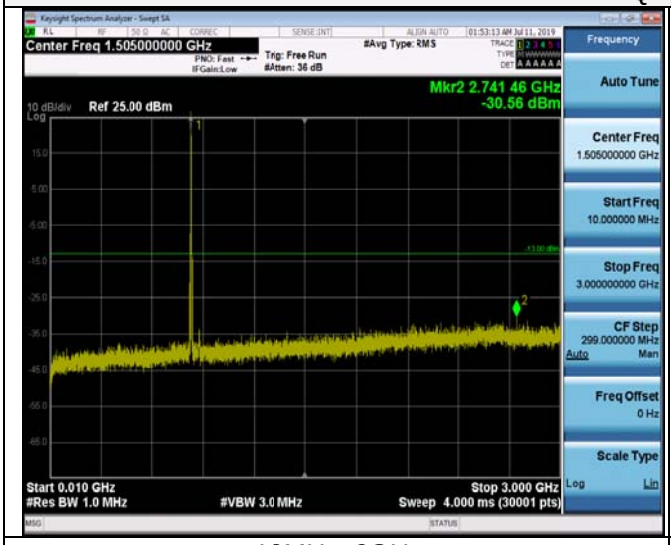
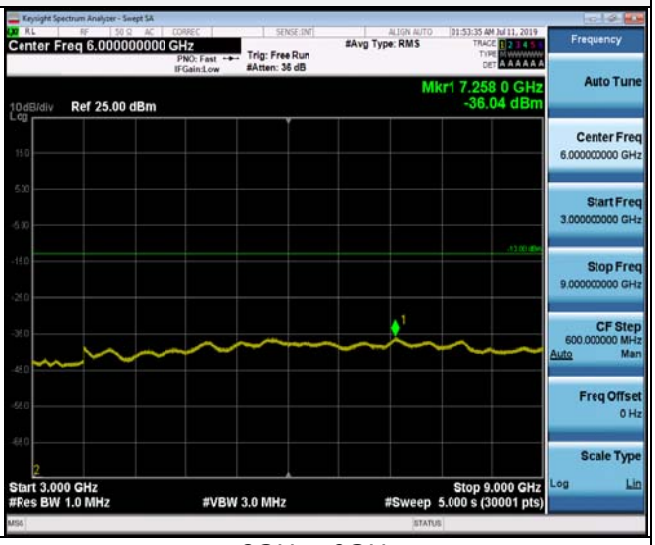
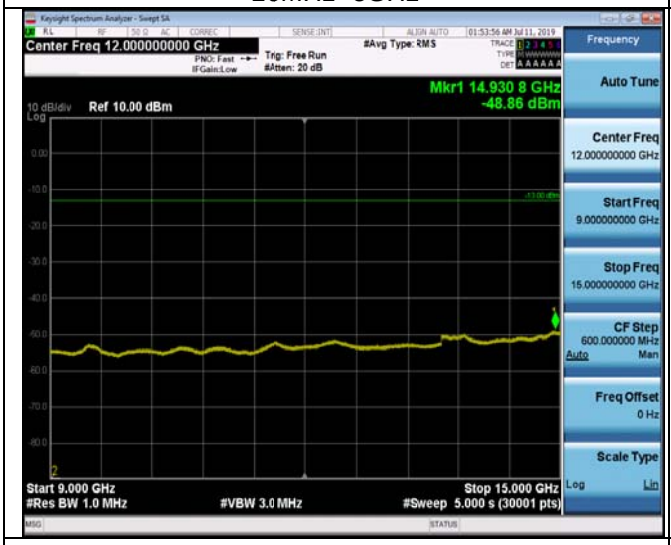
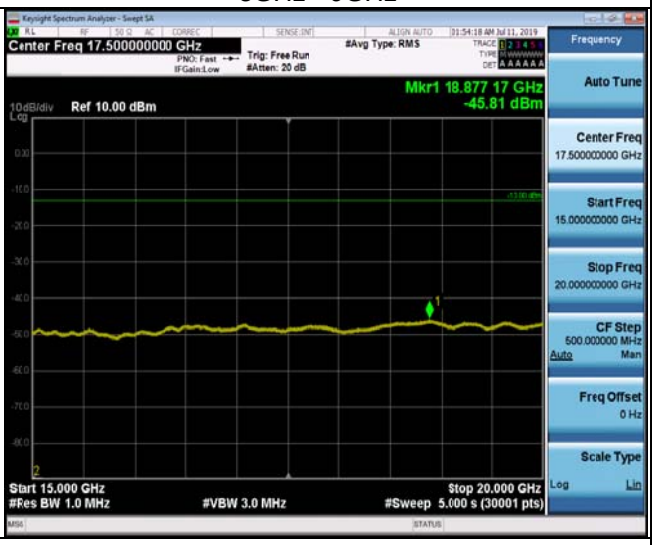

*3GHz ~9GHz*

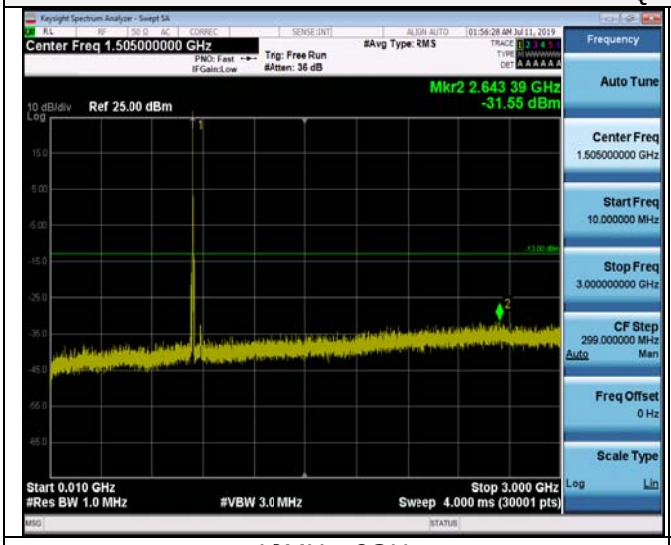
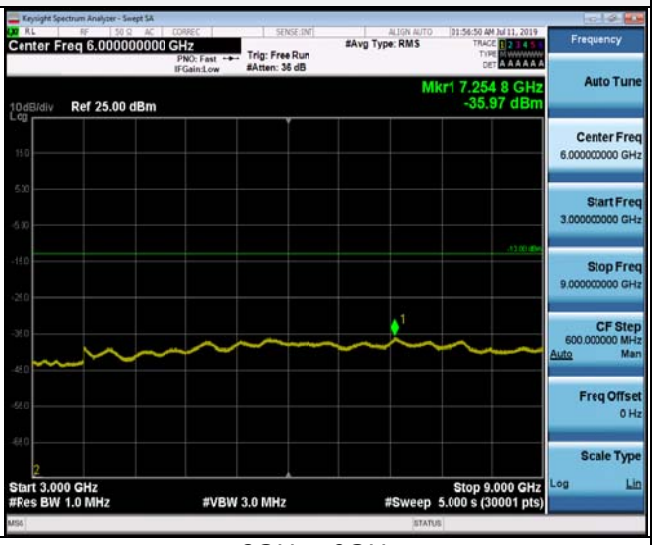
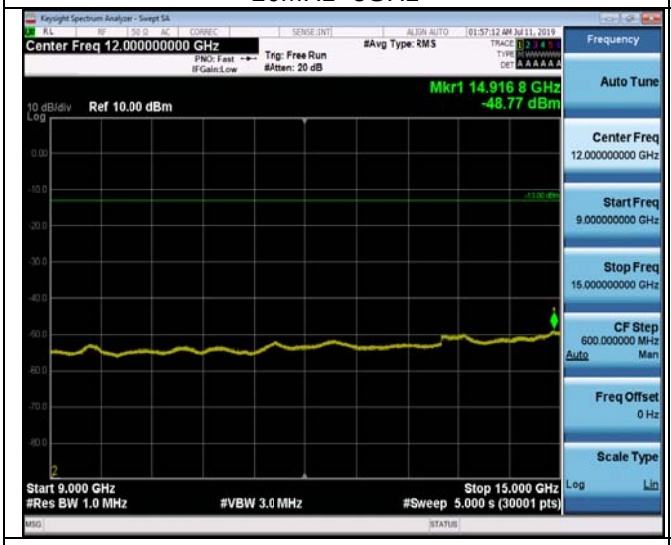
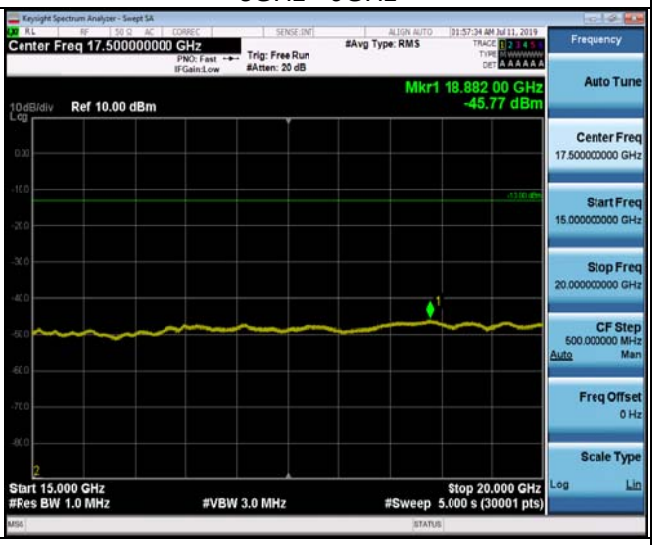


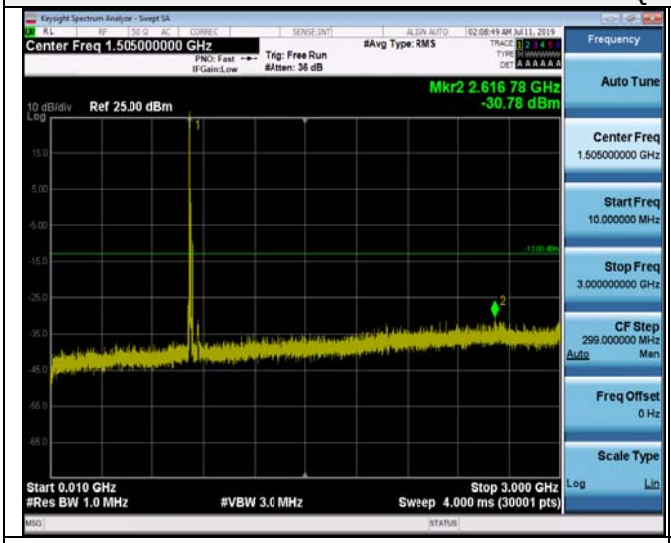
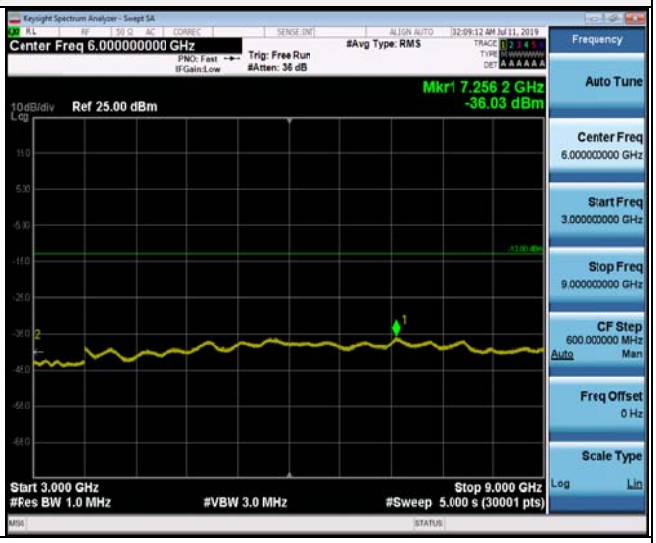
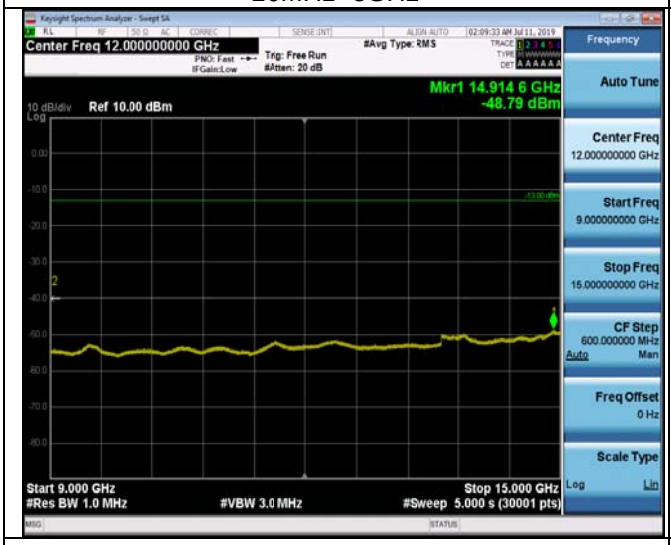
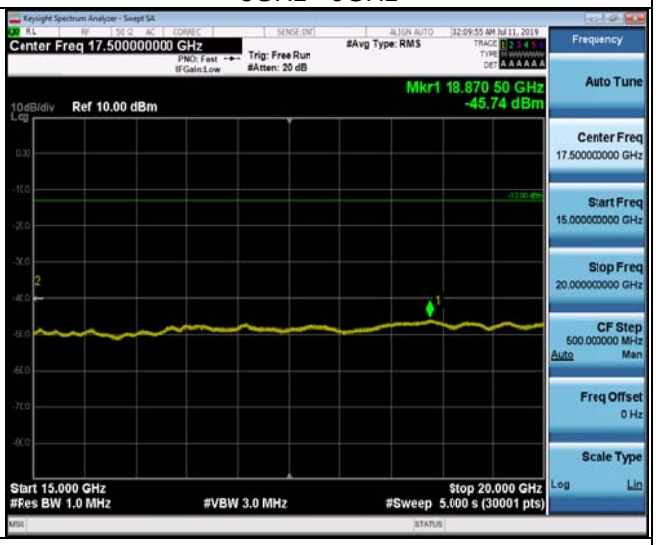

*9 GHz ~15 GHz*




*15 GHz ~20GHz*

| LTE FDD Band 5-5 MHz Channel Bandwidth | |
|---|---|
| Middle Channel | |
| QPSK | |
|  |  |
| 10MHz~3GHz | 3GHz ~9GHz |
|  |  |
| 9 GHz ~15 GHz | 15 GHz ~20GHz |

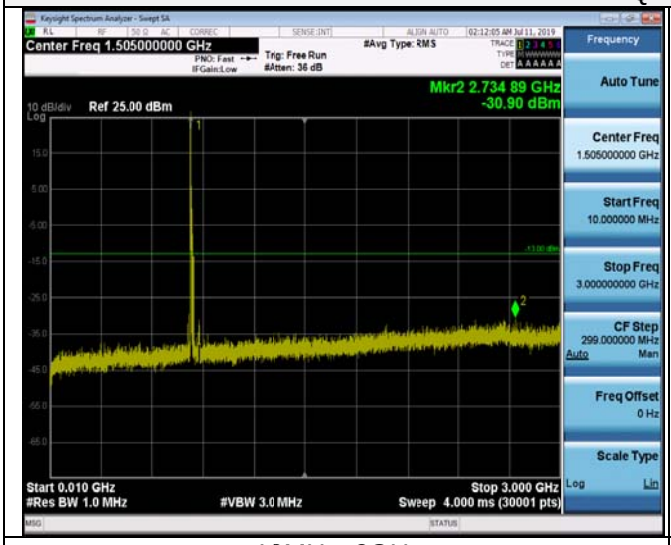
| LTE FDD Band 5-5 MHz Channel Bandwidth | |
|---|---|
| High Channel | |
| QPSK | |
|  |  |
| 10MHz~3GHz | 3GHz ~9GHz |
|  |  |
| 9 GHz ~15 GHz | 15 GHz ~20GHz |

| LTE FDD Band 5-10 MHz Channel Bandwidth | |
|---|---|
| Low Channel | |
| QPSK | |
|  |  |
| 10MHz~3GHz | 3GHz ~9GHz |
|  |  |
| 9 GHz ~15 GHz | 15 GHz ~20GHz |

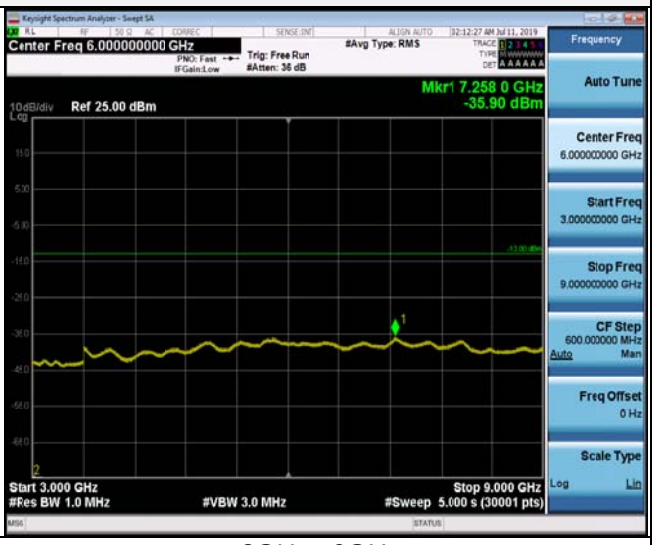
*LTE FDD Band 5-10 MHz Channel Bandwidth*

*Middle Channel*

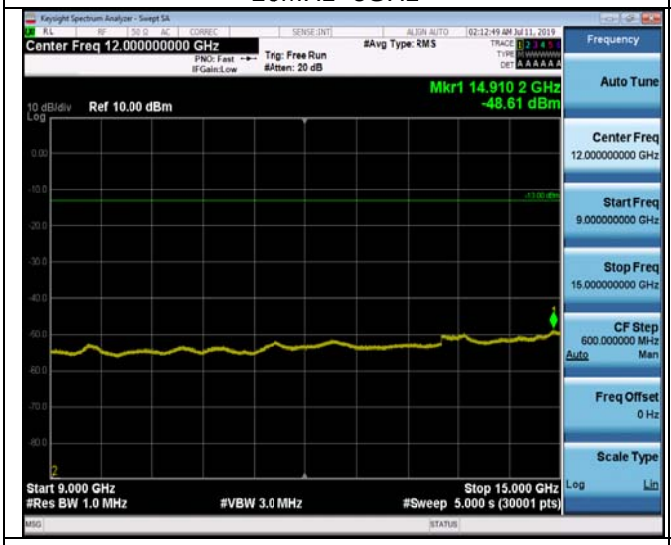
*QPSK*



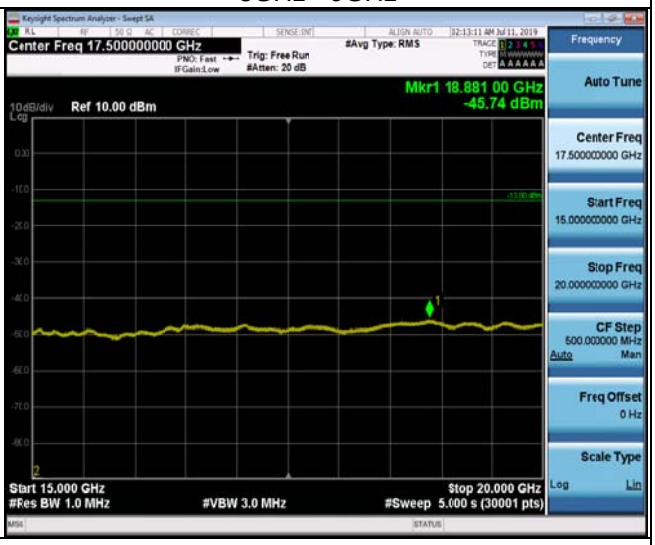

*10MHz~3GHz*



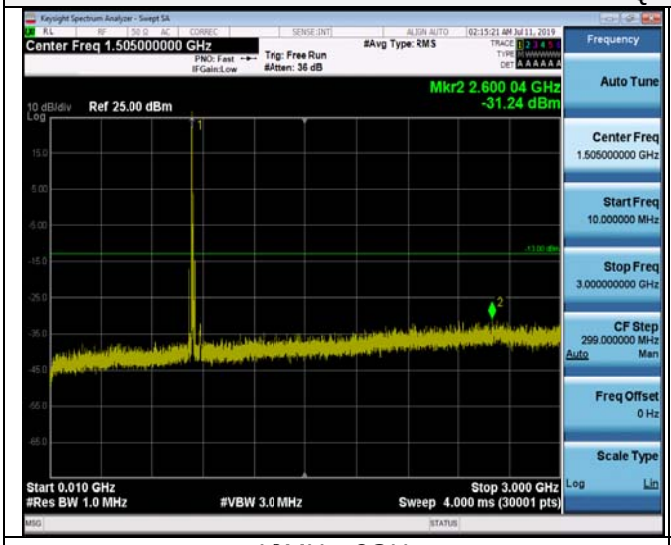
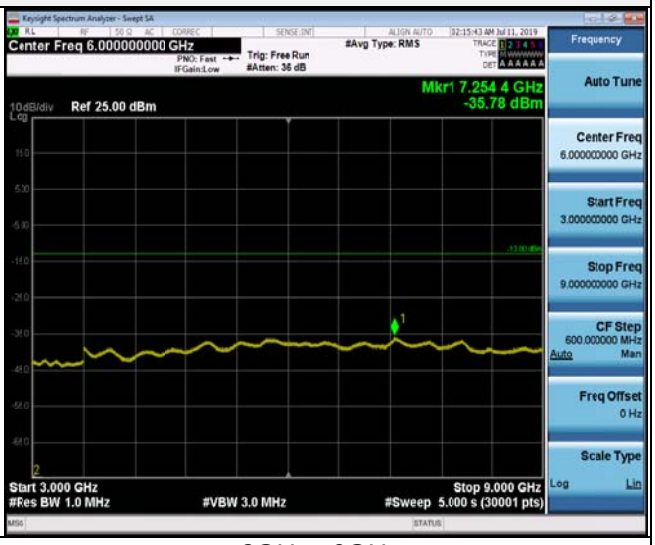
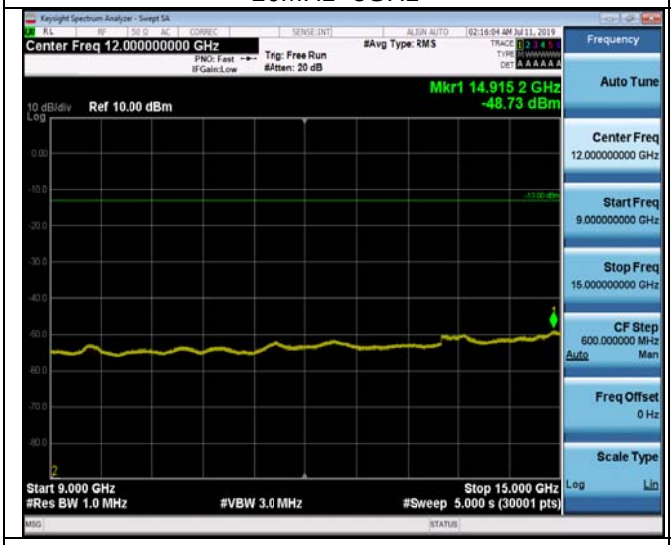
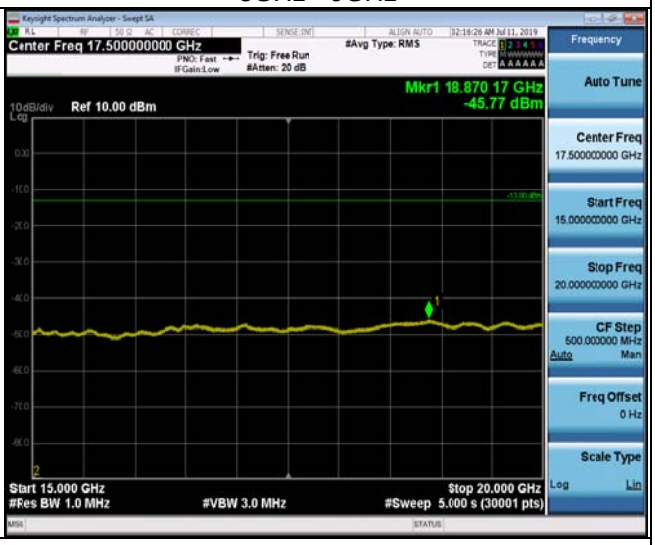

*3GHz ~9GHz*




*9 GHz ~15 GHz*




*15 GHz ~20GHz*

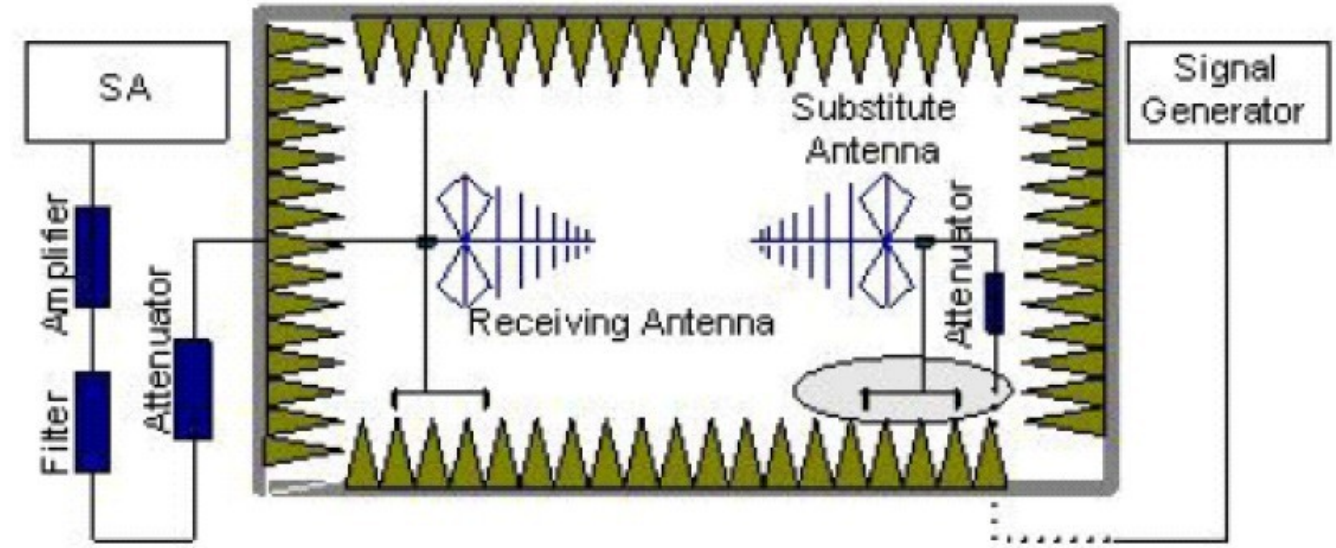
| LTE FDD Band 5-10 MHz Channel Bandwidth | |
|---|---|
| High Channel | |
| QPSK | |
|  |  |
| 10MHz~3GHz | 3GHz ~9GHz |
|  |  |
| 9 GHz ~15 GHz | 15 GHz ~20GHz |

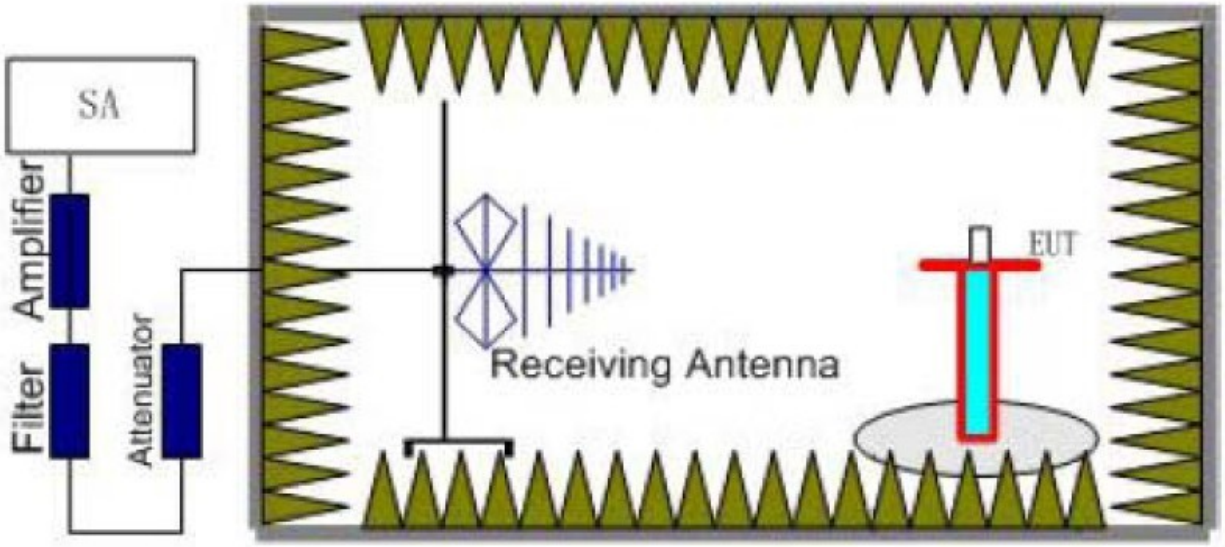
## 4.6 Radiated Spurious Emssion

**TEST APPLICABLE**

Per FCC §24.238, the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10log(P) dB.

**TEST CONFIGURATION**




**TEST PROCEDURE**

1. EUT was placed on a 1.50 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.50m. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) were measured with peak detector.
2. A log-periodic antenna or double-ridged waveguide horn antenna shall be substituted in place of the EUT. The log-periodic antenna will be driven by a signal generator and the level will be adjusted till the same power value on the spectrum analyzer or receiver. The level of the spurious emissions can be calculated through the level of the signal generator, cable loss, the gain of the substitution antenna and the reading of the spectrum analyzer or receiver.

3. The EUT is then put into continuously transmitting mode at its maximum power level during the test.Set Test Receiver or Spectrum RBW=1MHz,VBW=3MHz, And the maximum value of the receiver should be recorded as ($P_r$).
4. The EUT shall be replaced by a substitution antenna.In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest isconnected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power ($P_{Mea}$) is applied to the input of the substitution antenna, and adjust the level of the signal generator output until the value of the receiver reach the previously recorded ($P_r$). The power of signal source ($P_{Mea}$) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.
5. A amplifier should be connected to the Signal Source output port. And the cable should be connect between the Amplifier and the Substitution Antenna. The cable loss ($P_{cl}$) ,the Substitution Antenna Gain ($G_a$) and the Amplifier Gain ($P_{Ag}$) should be recorded after test.
   The measurement results are obtained as described below:
   Power(EIRP)=$P_{Mea}$- $P_{Ag}$ - $P_{cl}$+ $G_a$
6. This value is EIRP since the measurement is calibrated using an antenna of known gain (2.15 dBi) and known input power.
7. ERP can be calculated from EIRP by subtracting the gain of the dipole, ERP = EIRP -2.15dBi.
8. In order to make sure test results more clearly,we set frequency range and sweep time for difference frequency range as follows table:

| Working Frequency | Subrange (GHz) | RBW | VBW | Sweep time (s) |
|---|---|---|---|---|
| LTE BAND 5 | 0.03~1 | 100KHz | 300KHz | 10 |
| | 1~20 | 1 MHz | 3 MHz | 2 |

**TEST LIMITS**

According to 24.238 specify that the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.
The specification that emissions shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

| Frequency | Channel | Frequency Range | Verdict |
|---|---|---|---|
| LTE BAND 5 | Low | 30MHz -20GHz | PASS |
| | Middle | 30MHz -20GHz | PASS |
| | High | 30MHz -20GHz | PASS |

**Radiated Measurement:**

*Remark:*
1. *We measured all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE BAND 5; recorded worst case for each Channel Bandwidth of LTE BAND 5.*
*2. EIRP=$P_{Mea}$(dBm)-$P_{cl}$(dB) +$G_a$(dBi)*
*3. Not recorded other points as values lower than limits.*
*4. Margin = Limit – EIRP*

*Remark:*
1. *We measured all RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 5; recorded worst case for each Channel Bandwidth of LTE FDD Band 5.*
*2. EIRP=$P_{Mea}$(dBm)-$P_{cl}$(dB) +$G_a$(dBi)*
*3. Not recorded other points as values lower than limits.*
*4. Margin = Limit – EIRP*

*LTE FDDBand 5_Channel Bandwidth 1.4MHz_QPSK_ Low Channel*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | Diatance | $G_a$ Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1649.4 | -30.75 | 3.00 | 3.00 | 9.58 | -24.17 | -13.00 | 11.17 | H |
| 2474.1 | -36.55 | 3.03 | 3.00 | 10.72 | -28.86 | -13.00 | 15.86 | H |
| 1649.4 | -29.88 | 3.00 | 3.00 | 9.68 | -23.2 | -13.00 | 10.2 | V |
| 2474.1 | -39.73 | 3.03 | 3.00 | 10.72 | -32.04 | -13.00 | 19.04 | V |

*LTE FDD Band 5_Channel Bandwidth 1.4MHz_QPSK_ Middle Channel*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | Diatance | $G_a$ Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1673.0 | -27.95 | 3.00 | 3.00 | 9.58 | -21.37 | -13.00 | 8.37 | H |
| 2509.5 | -39.34 | 3.03 | 3.00 | 10.72 | -31.65 | -13.00 | 18.65 | H |
| 1673.0 | -30.47 | 3.00 | 3.00 | 9.68 | -23.79 | -13.00 | 10.79 | V |
| 2509.5 | -38.52 | 3.03 | 3.00 | 10.72 | -30.83 | -13.00 | 17.83 | V |

*LTE FDD Band 5_Channel Bandwidth 1.4MHz_QPSK_ High Channel*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | Diatance | $G_a$ Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1696.6 | -32.42 | 3.00 | 3.00 | 9.58 | -25.84 | -13.00 | 12.84 | H |
| 2544.9 | -37.58 | 3.03 | 3.00 | 10.72 | -29.89 | -13.00 | 16.89 | H |
| 1696.6 | -29.67 | 3.00 | 3.00 | 9.68 | -22.99 | -13.00 | 9.99 | V |
| 2544.9 | -35.84 | 3.03 | 3.00 | 10.72 | -28.15 | -13.00 | 15.15 | V |

*LTE FDD Band 5_Channel Bandwidth 3MHz_QPSK_ Low Channel*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | Diatance | $G_a$ Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1651.0 | -30.66 | 3.00 | 3.00 | 9.58 | -24.08 | -13.00 | 11.08 | H |
| 2476.5 | -36.74 | 3.03 | 3.00 | 10.72 | -29.05 | -13.00 | 16.05 | H |
| 1651.0 | -29.92 | 3.00 | 3.00 | 9.68 | -23.24 | -13.00 | 10.24 | V |
| 2476.5 | -39.03 | 3.03 | 3.00 | 10.72 | -31.34 | -13.00 | 18.34 | V |

*LTE FDD Band 5_Channel Bandwidth 3MHz_QPSK_ Middle Channel*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | Diatance | $G_a$ Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1673.0 | -28.69 | 3.00 | 3.00 | 9.58 | -22.11 | -13.00 | 9.11 | H |
| 2509.5 | -38.72 | 3.03 | 3.00 | 10.72 | -31.03 | -13.00 | 18.03 | H |
| 1673.0 | -31.01 | 3.00 | 3.00 | 9.68 | -24.33 | -13.00 | 11.33 | V |
| 2509.5 | -38.66 | 3.03 | 3.00 | 10.72 | -30.97 | -13.00 | 17.97 | V |

*LTE FDD Band 5_Channel Bandwidth 3MHz_QPSK_ High Channel*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | Diatance | $G_a$ Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1695.0 | -32.78 | 3.00 | 3.00 | 9.58 | -26.20 | -13.00 | 13.20 | H |
| 2542.5 | -37.65 | 3.03 | 3.00 | 10.72 | -29.96 | -13.00 | 16.96 | H |
| 1695.0 | -30.18 | 3.00 | 3.00 | 9.68 | -23.50 | -13.00 | 10.50 | V |
| 2542.5 | -35.39 | 3.03 | 3.00 | 10.72 | -27.70 | -13.00 | 14.70 | V |

*LTE FDDBand 5_Channel Bandwidth 5MHz_QPSK_ Low Channel*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | Diatance | $G_a$ Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1653.0 | -30.21 | 3.00 | 3.00 | 9.58 | -23.63 | -13.00 | 10.63 | H |
| 2479.5 | -37.06 | 3.03 | 3.00 | 10.72 | -29.37 | -13.00 | 16.37 | H |
| 1653.0 | -30.53 | 3.00 | 3.00 | 9.68 | -23.85 | -13.00 | 10.85 | V |
| 2479.5 | -39.01 | 3.03 | 3.00 | 10.72 | -31.32 | -13.00 | 18.32 | V |

*LTE FDD Band 5_Channel Bandwidth 5MHz_QPSK_ Middle Channel*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | Diatance | $G_a$ Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1673.0 | -28.79 | 3.00 | 3.00 | 9.58 | -22.21 | -13.00 | 9.21 | H |
| 2509.5 | -38.85 | 3.03 | 3.00 | 10.72 | -31.16 | -13.00 | 18.16 | H |
| 1673.0 | -30.66 | 3.00 | 3.00 | 9.68 | -23.98 | -13.00 | 10.98 | V |
| 2509.5 | -38.28 | 3.03 | 3.00 | 10.72 | -31.32 | -13.00 | 18.32 | V |

*LTE FDD Band 5_Channel Bandwidth 5MHz_QPSK_ High Channel*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | Diatance | $G_a$ Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1693.0 | -32.05 | 3.00 | 3.00 | 9.58 | -25.47 | -13.00 | 12.47 | *H* |
| 2539.5 | -37.20 | 3.03 | 3.00 | 10.72 | -29.51 | -13.00 | 16.51 | *H* |
| 1693.0 | -30.14 | 3.00 | 3.00 | 9.68 | -23.46 | -13.00 | 10.46 | *V* |
| 2539.5 | -35.92 | 3.03 | 3.00 | 10.72 | -28.23 | -13.00 | 15.23 | *V* |

*LTE FDD Band 5_Channel Bandwidth 10MHz_QPSK_ Low Channel*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | Diatance | $G_a$ Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1658.0 | -30.36 | 3.00 | 3.00 | 9.58 | -23.78 | -13.00 | 10.78 | H |
| 2487.0 | -37.08 | 3.03 | 3.00 | 10.72 | -29.39 | -13.00 | 16.39 | H |
| 1658.0 | -29.63 | 3.00 | 3.00 | 9.68 | -22.95 | -13.00 | 9.95 | V |
| 2487.0 | -39.27 | 3.03 | 3.00 | 10.72 | -31.58 | -13.00 | 18.58 | V |

*LTE FDD Band 5_Channel Bandwidth 10MHz_QPSK_ Middle Channel*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | Diatance | $G_a$ Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1673.0 | -28.64 | 3.00 | 3.00 | 9.58 | -22.06 | -13.00 | 9.06 | H |
| 2509.5 | -38.79 | 3.03 | 3.00 | 10.72 | -31.1 | -13.00 | 18.1 | H |
| 1673.0 | -30.86 | 3.00 | 3.00 | 9.68 | -24.18 | -13.00 | 11.18 | V |
| 2509.5 | -38.18 | 3.03 | 3.00 | 10.72 | -30.49 | -13.00 | 17.49 | V |

*LTE FDD Band 5_Channel Bandwidth 10MHz_QPSK_ High Channel*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | Diatance | $G_a$ Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1688.0 | -32.03 | 3.00 | 3.00 | 9.58 | -25.45 | -13.00 | 12.45 | H |
| 2532.0 | -37.89 | 3.03 | 3.00 | 10.72 | -30.2 | -13.00 | 17.2 | H |
| 1688.0 | -30.52 | 3.00 | 3.00 | 9.68 | -23.84 | -13.00 | 10.84 | V |
| 2532.0 | -35.17 | 3.03 | 3.00 | 10.72 | -27.48 | -13.00 | 14.48 | V |

*LTE FDD Band 5_Channel Bandwidth 1.4MHz_16QAM _ Low Channel*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | Diatance | $G_a$ Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1649.4 | -30.52 | 3.00 | 3.00 | 9.58 | -23.94 | -13.00 | 10.94 | H |
| 2474.1 | -37.38 | 3.03 | 3.00 | 10.72 | -29.69 | -13.00 | 16.69 | H |
| 1649.4 | -29.59 | 3.00 | 3.00 | 9.68 | -22.91 | -13.00 | 9.91 | V |
| 2474.1 | -39.26 | 3.03 | 3.00 | 10.72 | -31.57 | -13.00 | 18.57 | V |

*LTE FDD Band 5_Channel Bandwidth 1.4MHz_16QAM _ Middle Channel*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | Diatance | $G_a$ Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1673.0 | -28.45 | 3.00 | 3.00 | 9.58 | -21.87 | -13.00 | 8.87 | H |
| 2509.5 | -39.71 | 3.03 | 3.00 | 10.72 | -32.02 | -13.00 | 19.02 | H |
| 1673.0 | -30.29 | 3.00 | 3.00 | 9.68 | -23.61 | -13.00 | 10.61 | V |
| 2509.5 | -38.25 | 3.03 | 3.00 | 10.72 | -30.56 | -13.00 | 17.56 | V |

*LTE FDDBand 5_Channel Bandwidth 1.4MHz_16QAM _ High Channel*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | Diatance | $G_a$ Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1696.6 | -32.58 | 3.00 | 3.00 | 9.58 | -26.00 | -13.00 | 13.00 | H |
| 2544.9 | -37.75 | 3.03 | 3.00 | 10.72 | -30.06 | -13.00 | 17.06 | H |
| 1696.6 | -39.83 | 3.00 | 3.00 | 9.68 | -33.15 | -13.00 | 20.15 | V |
| 2544.9 | -35.89 | 3.03 | 3.00 | 10.72 | -28.20 | -13.00 | 15.20 | V |

*LTE FDD Band 5_Channel Bandwidth 3MHz_16QAM _ Low Channel*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | Diatance | $G_a$ Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1651.0 | -30.23 | 3.00 | 3.00 | 9.58 | -23.65 | -13.00 | 10.65 | H |
| 2476.5 | -36.76 | 3.03 | 3.00 | 10.72 | -29.07 | -13.00 | 16.07 | H |
| 1651.0 | -29.63 | 3.00 | 3.00 | 9.68 | -22.95 | -13.00 | 9.95 | V |
| 2476.5 | -39.37 | 3.03 | 3.00 | 10.72 | -31.68 | -13.00 | 18.68 | V |

*LTE FDD Band 5_Channel Bandwidth 3MHz_16QAM _ Middle Channel*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | Diatance | $G_a$ Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1673.0 | -28.28 | 3.00 | 3.00 | 9.58 | -21.7 | -13.00 | 8.70 | H |
| 2509.5 | -39.15 | 3.03 | 3.00 | 10.72 | -31.46 | -13.00 | 18.46 | H |
| 1673.0 | -30.36 | 3.00 | 3.00 | 9.68 | -23.68 | -13.00 | 10.68 | V |
| 2509.5 | -38.18 | 3.03 | 3.00 | 10.72 | -30.49 | -13.00 | 17.49 | V |

*LTE FDD Band 5_Channel Bandwidth 3MHz_16QAM _ High Channel*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | Diatance | $G_a$ Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1695.0 | -32.49 | 3.00 | 3.00 | 9.58 | -25.91 | -13.00 | 12.91 | H |
| 2542.5 | -38.06 | 3.03 | 3.00 | 10.72 | -30.37 | -13.00 | 17.37 | H |
| 1695.0 | -39.91 | 3.00 | 3.00 | 9.68 | -33.23 | -13.00 | 20.23 | V |
| 2542.5 | -35.15 | 3.03 | 3.00 | 10.72 | -27.46 | -13.00 | 14.46 | V |

*LTE FDD Band 5_Channel Bandwidth 5MHz_16QAM _ Low Channel*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | Diatance | $G_a$ Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1653.0 | -29.87 | 3.00 | 3.00 | 9.58 | -23.29 | -13.00 | 10.29 | H |
| 2479.5 | -36.44 | 3.03 | 3.00 | 10.72 | -28.75 | -13.00 | 15.75 | H |
| 1653.0 | -30.09 | 3.00 | 3.00 | 9.68 | -23.41 | -13.00 | 10.41 | V |
| 2479.5 | -39.03 | 3.03 | 3.00 | 10.72 | -31.34 | -13.00 | 18.34 | V |

*LTE FDD Band 5_Channel Bandwidth 5MHz_16QAM _ Middle Channel*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | Diatance | $G_a$ Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1673.0 | -28.13 | 3.00 | 3.00 | 9.58 | -21.55 | -13.00 | 8.55 | H |
| 2509.5 | -38.82 | 3.03 | 3.00 | 10.72 | -31.13 | -13.00 | 18.13 | H |
| 1673.0 | -30.71 | 3.00 | 3.00 | 9.68 | -24.03 | -13.00 | 11.03 | V |
| 2509.5 | -38.14 | 3.03 | 3.00 | 10.72 | -30.45 | -13.00 | 17.45 | V |

*LTE FDD Band 5_Channel Bandwidth 5MHz_16QAM _ High Channel*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | Diatance | $G_a$ Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1693.0 | -32.30 | 3.00 | 3.00 | 9.58 | -25.72 | -13.00 | 12.72 | H |
| 2539.5 | -37.19 | 3.03 | 3.00 | 10.72 | -29.5 | -13.00 | 16.50 | H |
| 1693.0 | -30.05 | 3.00 | 3.00 | 9.68 | -23.37 | -13.00 | 10.37 | V |
| 2539.5 | -35.68 | 3.03 | 3.00 | 10.72 | -27.99 | -13.00 | 14.99 | V |

*LTE FDD Band 5_Channel Bandwidth 10MHz_16QAM _ Low Channel*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | Diatance | $G_a$ Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1658.0 | -30.27 | 3.00 | 3.00 | 9.58 | -23.69 | -13.00 | 10.69 | H |
| 2487.0 | -37.09 | 3.03 | 3.00 | 10.72 | -29.4 | -13.00 | 16.4 | H |
| 1658.0 | -29.71 | 3.00 | 3.00 | 9.68 | -23.03 | -13.00 | 10.03 | V |
| 2487.0 | -39.01 | 3.03 | 3.00 | 10.72 | -31.32 | -13.00 | 18.32 | V |

*LTE FDD Band 5_Channel Bandwidth 10MHz_16QAM _ Middle Channel*

| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | Diatance | $G_a$ Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1673.0 | -28.22 | 3.00 | 3.00 | 9.58 | -21.64 | -13.00 | 8.64 | H |
| 2509.5 | -39.44 | 3.03 | 3.00 | 10.72 | -31.75 | -13.00 | 18.75 | H |
| 1673.0 | -30.47 | 3.00 | 3.00 | 9.68 | -23.79 | -13.00 | 10.79 | V |
| 2509.5 | -38.57 | 3.03 | 3.00 | 10.72 | -30.88 | -13.00 | 17.88 | V |

*LTE FDD Band 5_Channel Bandwidth 10MHz_16QAM _ High Channel*

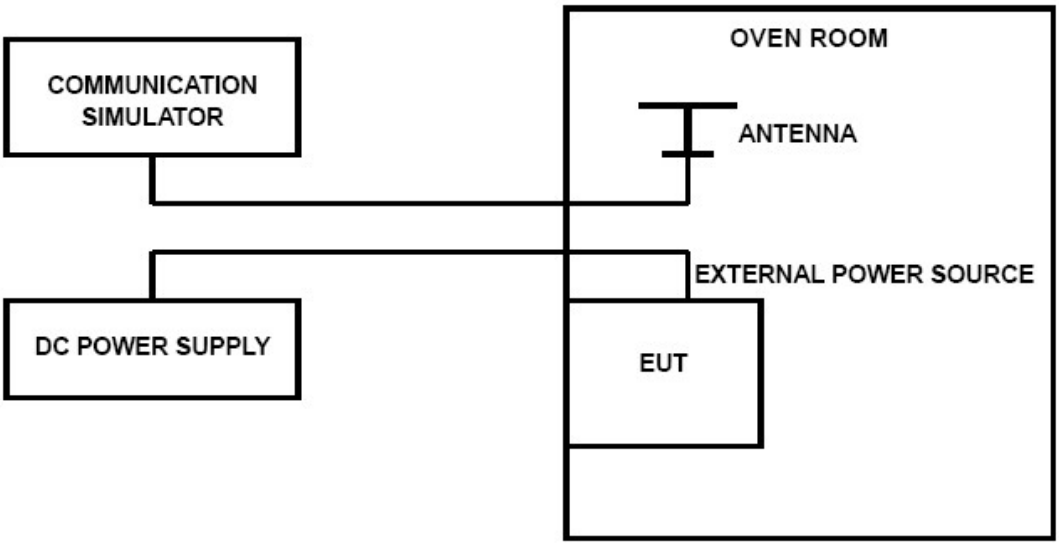
| Frequency (MHz) | $P_{Mea}$ (dBm) | $P_{cl}$ (dB) | Diatance | $G_a$ Antenna Gain(dB) | Peak EIRP (dBm) | Limit (dBm) | Margin (dB) | Polarization |
|---|---|---|---|---|---|---|---|---|
| 1688.0 | -32.25 | 3.00 | 3.00 | 9.58 | -25.67 | -13.00 | 12.67 | H |
| 2532.0 | -37.53 | 3.03 | 3.00 | 10.72 | -29.84 | -13.00 | 16.84 | H |
| 1688.0 | -29.65 | 3.00 | 3.00 | 9.68 | -22.97 | -13.00 | 9.97 | V |
| 2532.0 | -36.06 | 3.03 | 3.00 | 10.72 | -28.37 | -13.00 | 15.37 | V |

## 4.7 Frequency Stability

**LIMIT**

According to §24.235, §2.1055 requirement, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation and should not exceed 2.5ppm.

**TEST CONFIGURATION**




**TEST PROCEDURE**

The EUT was setup according to EIA/TIA 603D

**Frequency Stability Under Temperature Variations:**
In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a “call mode”. This is accomplished with the use of R&S CMW500 DIGITAL RADIO COMMUNICATION TESTER.
1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -30℃.
3. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on middle channel for LTE Band 5, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
4. Repeat the above measurements at 10℃ increments from -30℃ to +50℃. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
5. Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring carrier frequency at each voltage. Pause at nominal voltage for 1.5 hours unpowered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50℃.
7. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
8. Repeat the above measurements at 10 ℃ increments from +50℃ to -30℃. Allow at least 1.5 hours at each temperature, unpowered, before making measurements
9. At all temperature levels hold the temperature to +/- 0.5℃ during the measurement procedure.
**Frequency Stability Under Voltage Variations:**
Set chamber temperature to 20℃. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.
Reduce the input voltage to specify extreme voltage variation (±15%) and endpoint, recordthe maximum frequency change.

**TEST RESULTS**

*Remark:*

*1. We testedall RB Configuration refer 3GPP TS136 521 for each Channel Bandwidth of LTE FDD Band 5; recorded worst case.*

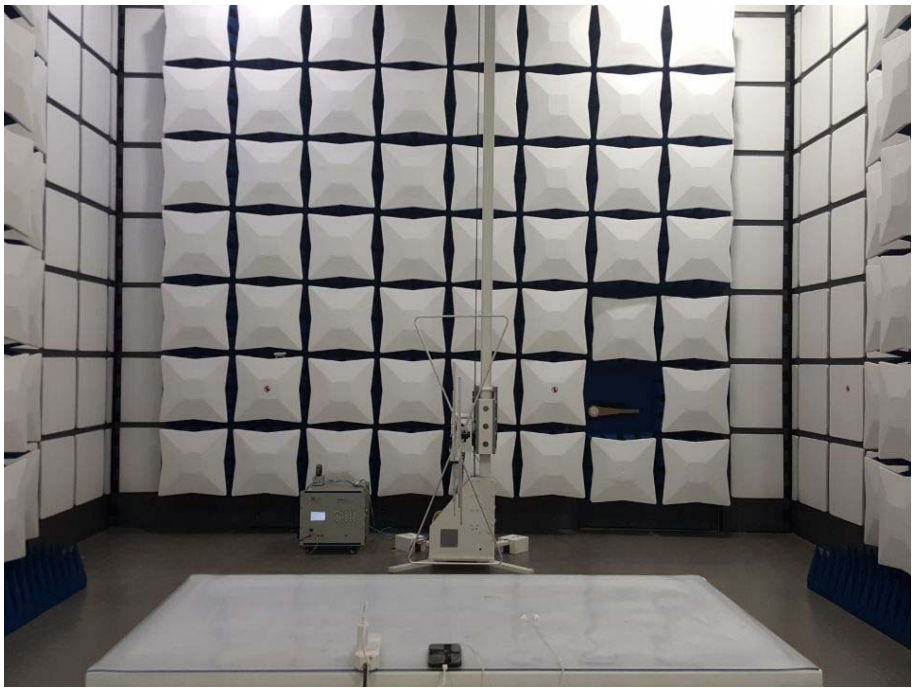
LTE Band 5, 1.4MHz bandwidth , QPSK (worst case of all bandwidths)

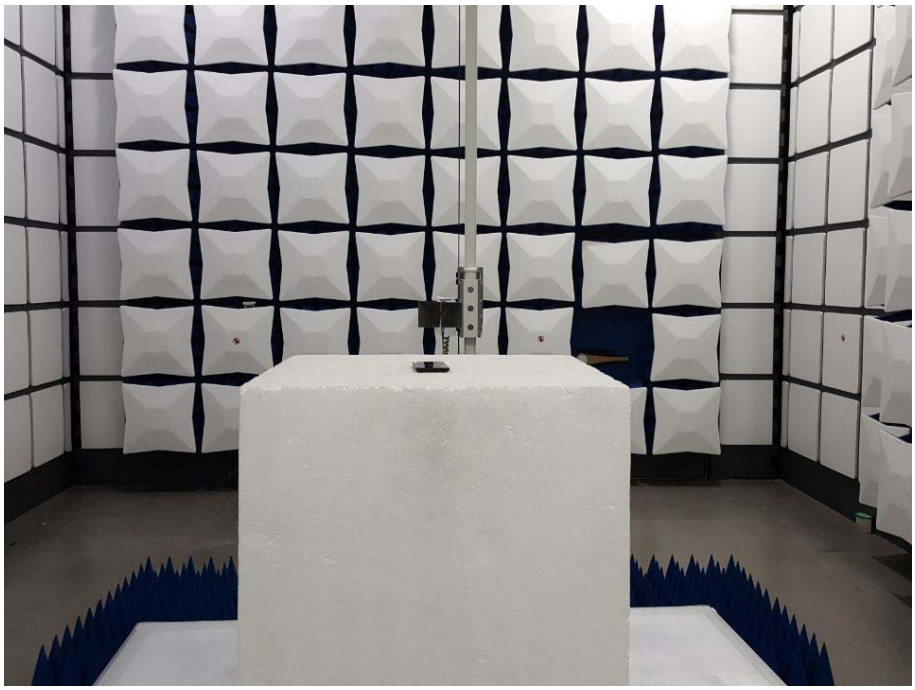
| ***LTE FDD Band 5*** | | | | | |
|---|---|---|---|---|---|
| **DC Power** | **Temperature (℃)** | **Frequency error(Hz)** | **Frequency error(ppm)** | **Limit (ppm)** | **Verdict** |
| 3.40 | 20 | 28 | 0.0156 | 2.50 | PASS |
| 3.60 | 20 | 35 | 0.0177 | 2.50 | PASS |
| 4.20 | 20 | 17 | 0.0089 | 2.50 | PASS |
| 3.60 | -30 | 26 | 0.0179 | 2.50 | PASS |
| 3.60 | -20 | 17 | 0.0095 | 2.50 | PASS |
| 3.60 | -10 | 20 | 0.0187 | 2.50 | PASS |
| 3.60 | 0 | 28 | 0.0190 | 2.50 | PASS |
| 3.60 | 10 | 21 | 0.0122 | 2.50 | PASS |
| 3.60 | 20 | 18 | 0.0078 | 2.50 | PASS |
| 3.60 | 30 | 27 | 0.0135 | 2.50 | PASS |
| 3.60 | 40 | 19 | 0.0177 | 2.50 | PASS |
| 3.60 | 50 | 25 | 0.0156 | 2.50 | PASS |

LTE Band 5, 1.4MHz bandwidth , 16QAM (worst case of all bandwidths)

| ***LTE FDD Band 5*** | | | | | |
|---|---|---|---|---|---|
| **DC Power** | **Temperature (℃)** | **Frequency error(Hz)** | **Frequency error(ppm)** | **Limit (ppm)** | **Verdict** |
| 3.40 | 20 | 38 | 0.0236 | 2.50 | PASS |
| 3.60 | 20 | 47 | 0.0235 | 2.50 | PASS |
| 4.20 | 20 | 52 | 0.0245 | 2.50 | PASS |
| 3.60 | -30 | 61 | 0.0355 | 2.50 | PASS |
| 3.60 | -20 | 37 | 0.0149 | 2.50 | PASS |
| 3.60 | -10 | 42 | 0.0224 | 2.50 | PASS |
| 3.60 | 0 | 39 | 0.0212 | 2.50 | PASS |
| 3.60 | 10 | 25 | 0.0158 | 2.50 | PASS |
| 3.60 | 20 | 29 | 0.0145 | 2.50 | PASS |
| 3.60 | 30 | 35 | 0.0175 | 2.50 | PASS |
| 3.60 | 40 | 27 | 0.0145 | 2.50 | PASS |
| 3.60 | 50 | 22 | 0.0127 | 2.50 | PASS |

# 5 Test Setup Photos of the EUT





**********End of Report**********