



RF TEST REPORT

Applicant Quectel Wireless Solutions Co., Ltd.

FCC ID XMR201707BG96

Product LTE Cat M1 & Cat NB1 & EGPRS Module

Brand Quectel

Model BG96, BG96 MINIPCIE

Marketing Quectel BG96, Quectel BG96 MINIPCIE

Report No. R1811A0536-R3

Issue Date February 26, 2019

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 2 (2018)/ FCC CFR47 Part 27C (2018)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Performed by: Peng Tao

Approved by: Kai Xu

TA Technology (Shanghai) Co., Ltd.

No.145, Jintang Rd, Tangzhen Industry Park, Pudong Shanghai, China

TEL: +86-021-50791141/2/3

FAX: +86-021-50791141/2/3-8000

Table of Contents

| | | |
|-----------------------------------------------|----------------------------------------------------|----|
| 1 | Test Laboratory | 4 |
| 1.1 | Notes of the Test Report | 4 |
| 1.2 | Test facility | 4 |
| 1.3 | Testing Location | 5 |
| 2 | General Description of Equipment under Test | 6 |
| 3 | Applied Standards | 7 |
| 4 | Test Configuration | 8 |
| 5 | Test Information | 10 |
| 5.1 | RF Power Output | 10 |
| 5.2 | Effective Isotropic Radiated Power | 13 |
| 5.3 | Occupied Bandwidth | 19 |
| 5.4 | Band Edge Compliance | 25 |
| 5.5 | Peak-to-Average Power Ratio (PAPR) | 43 |
| 5.6 | Frequency Stability | 45 |
| 5.7 | Spurious Emissions at Antenna Terminals | 52 |
| 5.8 | Radiates Spurious Emission | 68 |
| 6 | Main Test Instruments | 89 |
| ANNEX A: EUT Appearance and Test Setup | | 90 |
| A.1 | EUT Appearance | 90 |
| A.2 | Test Setup | 92 |
| ANNEX B: Product Change Description | | 93 |

Summary of Measurement Results

| Number | Test Case | Clause in FCC rules | Verdict |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------------------------------------|---------|
| 1 | RF power output | 2.1046 | PASS |
| 2 | Effective Isotropic Radiated power | 27.50(d)(4) /27.50(b)(10) /27.50(c)(10) | PASS |
| 3 | Occupied Bandwidth | 2.1049 | PASS |
| 4 | Band Edge Compliance | 27.53(h) /27.53(g) | PASS |
| 5 | Peak-to-Average Power Ratio | 27.50(d)/KDB971168 D01(5.7) | PASS |
| 6 | Frequency Stability | 2.1055 / 27.54 | PASS |
| 7 | Spurious Emissions at Antenna Terminals | 2.1051 /27.53(h) /27.53(g) /27.53(f) | PASS |
| 8 | Radiates Spurious Emission | 2.1053 /27.53(h) /27.53(g) /27.53(f) | PASS |
| Date of Testing: June 24, 2017~ July 3, 2017 | | | |
| Note: PASS: The EUT complies with the essential requirements in the standard. FAIL: The EUT does not comply with the essential requirements in the standard. | | | |

BG96, BG96 MINIPCIE (Report No: R1811A0536-R3) is a variant model of BG96 (Report No: RXA1706-0199RF03R1). The detailed product change description please refers to the ANNEX B.

1 Test Laboratory

1.1 Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (shanghai) co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein .Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above. This report must not be used by the client to claim product certification, approval, or endorsement by any government agencies.

1.2 Test facility

CNAS (accreditation number: L2264)

TA Technology (Shanghai) Co., Ltd. has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS).

FCC (recognition number is 428261)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

IC (recognition number is 8510A)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Canada to perform electromagnetic emission measurement.

VCCI (recognition number is C-4595, T-2154, R-4113, G-10766)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Japan to perform electromagnetic emission measurement.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

1.3 Testing Location

Company: TA Technology (Shanghai) Co., Ltd.
Address: No.145, Jintang Rd, Tangzhen Industry Park, Pudong Shanghai, China
City: Shanghai
Post code: 201201
Country: P. R. China
Contact: Xu Kai
Telephone: +86-021-50791141/2/3
Fax: +86-021-50791141/2/3-8000
Website: <http://www.ta-shanghai.com>
E-mail: xukai@ta-shanghai.com

2 General Description of Equipment under Test

Client Information

| | |
|-----------------------------|------------------------------------------------------------------------------------|
| Applicant | Quectel Wireless Solutions Co., Ltd. |
| Applicant address | 7th Floor, Hongye Building, No. 1801 Hongmei Road, Xuhui District, Shanghai, China |
| Manufacturer | Quectel Wireless Solutions Co., Ltd. |
| Manufacturer address | 7th Floor, Hongye Building, No. 1801 Hongmei Road, Xuhui District, Shanghai, China |

General information

| EUT Description | | | |
|----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|
| Model: | BG96, BG96 MINIPCIE | | |
| IMEI: | 866425038291656 | | |
| Hardware Version: | R1.2 | | |
| Software Version: | BG96MAR04A01M1G | | |
| Power Supply: | External power supply | | |
| Antenna Type: | The EUT don't have standard Antenna, The Antenna used for testing in this report is the after-market accessory (Dipole Antenna) | | |
| Test Mode(s): | LTE Band 4; LTE Band 12, LTE Band 13; | | |
| Test Modulation | QPSK 16QAM; | | |
| LTE Category | M1 | | |
| Maximum E.I.R.P./ E.R.P. | LTE Band 4: | 29.98dBm | |
| | LTE Band 12: | 27.79dBm | |
| | LTE Band 13: | 27.17dBm | |
| Rated Power Supply Voltage: | 3.8V | | |
| Extreme Voltage: | Minimum: 3.3V Maximum: 4.3V | | |
| Extreme Temperature: | Lowest: -40°C Highest: +85°C | | |
| Operating Frequency Range(s) | Mode | Tx (MHz) | Rx (MHz) |
| | LTE Band 4 | 1710 ~ 1755 | 2110 ~ 2155 |
| | LTE Band 12 | 699 ~ 716 | 729 ~ 746 |
| | LTE Band 13 | 777 ~ 787 | 746 ~ 756 |
| Note: 1. The information of the EUT is declared by the manufacturer. | | | |

The series model number is: BG96 MINIPCIE. The difference of these models are have different marketing requirement.

| Accessory equipment | |
|---------------------|-------------------------|
| Evaluation Board | RF Cable |
| RS232-to-USB Cable | Antenna: Dipole Antenna |
| Headset | USB Cable |

3 Applied Standards

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

Test standards

FCC CFR47 Part 2 (2018)

FCC CFR47 Part 27C (2018)

ANSI C63.26 (2015)

KDB 971168 D01 Power Meas License Digital Systems v03r01

4 Test Configuration

Radiated measurements are performed by rotating the EUT in three different orthogonal test planes. EUT lie-down stand-up position (X, Y axis), lie-down position (Z axis),. Receiver antenna polarization (horizontal and vertical), the worst emission was found in position (Z axis, vertical polarization) and the worst case was recorded.

All mode and data rates and positions and RB size and modulations were investigated.

Subsequently, only the worst case emissions are reported.

The following testing in LTE is set based on the maximum RF Output Power.

The following testing in different Bandwidth is set to detail in the following table:

Test modes are chosen to be reported as the worst case configuration below for LTE Band 4/12/13:

| Test items | Modes | Bandwidth (MHz) | | | | | | Modulation | | RB | | | Test Channel | | |
|-----------------------------------------|--------|-----------------|---|---|----|----|----|------------|-------|----|-----|------|--------------|---|---|
| | | 1.4 | 3 | 5 | 10 | 15 | 20 | QPSK | 16QAM | 1 | 50% | 100% | L | M | H |
| RF power output | LTE 4 | O | O | O | O | O | O | O | O | O | O | O | O | O | O |
| | LTE 12 | O | O | O | O | - | - | O | O | O | O | O | O | O | O |
| | LTE 13 | - | - | O | O | - | - | O | O | O | O | O | O | O | O |
| Effective Isotropic Radiated power | LTE 4 | O | O | O | O | O | O | O | O | - | - | O | O | O | O |
| | LTE 12 | O | O | O | O | - | - | O | O | - | - | O | O | O | O |
| | LTE 13 | - | - | O | O | - | - | O | O | - | - | O | O | O | O |
| Occupied Bandwidth | LTE 4 | O | O | O | O | O | O | O | O | - | - | O | - | O | - |
| | LTE 12 | O | O | O | O | - | - | O | O | - | - | O | - | O | - |
| | LTE 13 | - | - | O | O | - | - | O | O | - | - | O | - | O | - |
| Band Edge Compliance | LTE 4 | O | O | O | O | O | O | O | O | O | - | O | O | - | O |
| | LTE 12 | O | O | O | O | - | - | O | O | O | - | O | O | - | O |
| | LTE 13 | - | - | O | O | - | - | O | O | O | - | O | O | - | O |
| Peak-to-Average Power Ratio | LTE 4 | O | O | O | O | O | O | O | O | - | - | O | - | O | - |
| | LTE 12 | O | O | O | O | - | - | O | O | - | - | O | - | O | - |
| | LTE 13 | - | - | O | O | - | - | O | O | - | - | O | - | O | - |
| Frequency Stability | LTE 4 | O | O | O | O | O | O | O | O | - | - | O | - | O | - |
| | LTE 12 | O | O | O | O | - | - | O | O | - | - | O | - | O | - |
| | LTE 13 | - | - | O | O | - | - | O | O | - | - | O | - | O | - |
| Spurious Emissions at Antenna Terminals | LTE 4 | O | O | O | O | O | O | O | - | O | - | - | O | O | O |
| | LTE 12 | O | O | O | O | - | - | O | - | O | - | - | O | O | O |
| | LTE 13 | - | - | O | O | - | - | O | - | O | - | - | O | O | O |



| | | | | | | | | | | | | | | | |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Radiates Spurious Emission | LTE 4 | - | - | - | - | - | O | O | - | O | - | - | O | O | O |
| | LTE 12 | - | - | - | O | - | - | O | - | O | - | - | O | O | O |
| | LTE 13 | - | - | - | O | - | - | O | - | O | - | - | O | O | O |
| Note | <p>1. The mark "O" means that this configuration is chosen for testing.</p> <p>2. The mark "-" means that this configuration is not testing.</p> | | | | | | | | | | | | | | |

5 Test Information

5.1 RF Power Output

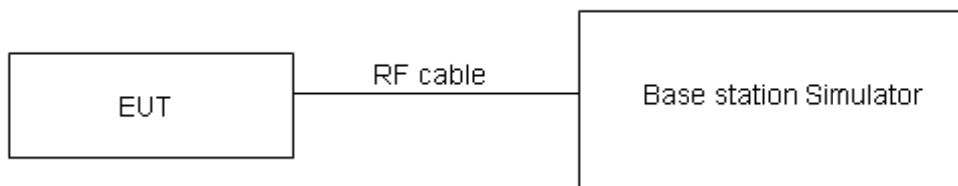
Ambient condition

| Temperature | Relative humidity | Pressure |
|-------------|-------------------|----------|
| 23°C ~25°C | 45%~50% | 101.5kPa |

Methods of Measurement

During the process of the testing, The EUT is controlled by the Base Station Simulator to ensure max power transmission and proper modulation.

Test Setup



The loss between RF output port of the EUT and the input port of the tester has been taken into consideration.

Limits

No specific RF power output requirements in part 2.1046.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U=0.4$ dB.

Test Results

| Mode | Bandwidth | Channel/ Frequency(MHz) | RB | Index | Conducted Power (dBm) | |
|--------------|-----------|----------------------------|-----|-------|-----------------------|-------|
| | | | | | QPSK | 16QAM |
| Band4 | 1.4MHz | 19957 1710.7 | 1#0 | 0 | 22.38 | 21.94 |
| | | | 6#0 | 0 | 22.13 | 22.06 |
| | | 20175/1732.5 | 1#0 | 0 | 22.31 | 22.02 |
| | | | 6#0 | 0 | 22.09 | 22.03 |
| | | 20393/1754.3 | 1#5 | 0 | 22.37 | 22.13 |
| | | | 6#0 | 0 | 22.23 | 22.21 |
| | 3MHz | 19965/1711.5 | 1#0 | 0 | 22.40 | 21.97 |
| | | | 6#0 | 0 | 22.16 | 22.09 |
| | | 20175/1732.5 | 1#0 | 0 | 22.35 | 22.04 |
| | | | 6#0 | 0 | 22.13 | 22.07 |
| | | 20385/1753.5 | 1#5 | 1 | 22.40 | 22.16 |
| | | | 6#0 | 1 | 22.26 | 22.24 |
| | 5MHz | 19975/1712.5 | 1#0 | 0 | 22.37 | 21.94 |
| | | | 6#0 | 0 | 22.14 | 22.07 |
| | | 20175/1732.5 | 1#0 | 0 | 22.33 | 22.00 |
| | | | 6#0 | 0 | 22.12 | 22.03 |
| | | 20375/1752.5 | 1#5 | 3 | 22.36 | 22.13 |
| | | | 6#0 | 3 | 22.24 | 22.19 |
| | 10MHz | 20000/1715 | 1#0 | 0 | 22.39 | 21.96 |
| | | | 4#0 | 0 | 22.22 | 22.10 |
| | | 20175/1732.5 | 1#0 | 0 | 22.34 | 22.03 |
| | | | 4#0 | 0 | 22.14 | 22.08 |
| | | 20350/1750 | 1#5 | 7 | 22.39 | 22.15 |
| | | | 4#2 | 7 | 22.28 | 22.23 |
| | 15MHz | 20025/1717.5 | 1#0 | 0 | 22.38 | 21.91 |
| | | | 6#0 | 0 | 22.20 | 22.07 |
| | | 20175/1732.5 | 1#0 | 0 | 22.30 | 22.01 |
| | | | 6#0 | 0 | 22.10 | 22.03 |
| | | 20325/1747.5 | 1#5 | 11 | 22.37 | 22.13 |
| | | | 6#0 | 11 | 22.23 | 22.19 |
| | 20MHz | 20050/1720 | 1#0 | 0 | 22.35 | 21.89 |
| | | | 6#0 | 0 | 22.17 | 22.05 |
| 20175/1732.5 | | 1#0 | 0 | 22.26 | 21.97 | |
| | | 6#0 | 0 | 22.05 | 21.99 | |
| 20300/1745 | | 1#5 | 15 | 22.34 | 22.08 | |
| | | 6#0 | 15 | 22.19 | 22.16 | |

| Mode | Bandwidth | Channel/ Frequency(MHz) | RB | Index | Conducted Power (dBm) | |
|--------|-----------|----------------------------|-----|-------|-----------------------|-------|
| | | | | | QPSK | 16QAM |
| Band12 | 1.4MHz | 23017/699.7 | 1#0 | 0 | 22.74 | 23.23 |
| | | | 6#0 | 0 | 22.48 | 22.71 |
| | | 23095/707.5 | 1#0 | 0 | 23.12 | 22.81 |
| | | | 6#0 | 0 | 22.66 | 22.90 |
| | | 23173/715.3 | 1#5 | 0 | 23.37 | 23.02 |
| | | | 6#0 | 0 | 22.64 | 22.79 |
| | 3MHz | 23025/700.5 | 1#0 | 0 | 22.76 | 23.25 |
| | | | 6#0 | 0 | 22.56 | 22.74 |
| | | 23095/707.5 | 1#0 | 0 | 23.13 | 22.84 |
| | | | 6#0 | 0 | 22.68 | 22.95 |
| | | 23165/714.5 | 1#5 | 1 | 23.40 | 23.04 |
| | | | 6#0 | 1 | 22.68 | 22.83 |
| | 5MHz | 23035/701.5 | 1#0 | 0 | 22.75 | 23.20 |
| | | | 6#0 | 0 | 22.54 | 22.71 |
| | | 23095/707.5 | 1#0 | 0 | 23.09 | 22.82 |
| | | | 6#0 | 0 | 22.64 | 22.90 |
| | | 23155/713.5 | 1#5 | 3 | 23.38 | 23.02 |
| | | | 6#0 | 3 | 22.63 | 22.79 |
| | 10MHz | 23060/704 | 1#0 | 0 | 22.72 | 23.18 |
| | | | 4#0 | 0 | 22.51 | 22.69 |
| | | 23095/707.5 | 1#0 | 0 | 23.05 | 22.78 |
| | | | 4#0 | 0 | 22.59 | 22.86 |
| | | 23130/711 | 1#5 | 7 | 23.35 | 22.97 |
| | | | 4#2 | 7 | 22.59 | 22.76 |

| Mode | Bandwidth | Channel/ Frequency(MHz) | RB | Index | Conducted Power (dBm) | |
|--------|-----------|----------------------------|-----|-------|-----------------------|-------|
| | | | | | QPSK | 16QAM |
| Band13 | 5MHz | 23205/779.5 | 1#0 | 0 | 23.10 | 23.81 |
| | | | 6#0 | 0 | 22.80 | 21.84 |
| | | 23230/782 | 1#0 | 0 | 23.32 | 23.14 |
| | | | 6#0 | 0 | 22.68 | 22.19 |
| | | 23255/784.5 | 1#5 | 3 | 23.11 | 23.72 |
| | | | 6#0 | 3 | 22.67 | 21.93 |
| | 10MHz | 23230/782 | 1#0 | 0 | 23.07 | 23.70 |
| | | | 4#0 | 0 | 22.77 | 22.95 |

5.2 Effective Isotropic Radiated Power

Ambient condition

| Temperature | Relative humidity | Pressure |
|-------------|-------------------|----------|
| 23°C ~25°C | 45%~50% | 101.5kPa |

Methods of Measurement

1. The testing follows FCC KDB 971168 D01 v03r01 Section 5.8 and ANSI C63.26 (2015).

a) Connect the equipment as illustrated. Mount the equipment with the manufacturer specified antenna in a vertical orientation on a manufacturer specified mounting surface located on a non-conducting rotating platform of a RF anechoic chamber (preferred) or a standard radiation site.

b) Key the transmitter, then rotate the EUT 360° azimuthally and record spectrum analyzer power level (LVL) measurements at angular increments that are sufficiently small to permit resolution of all peaks. If a standard radiation test site is used, raise and lower the test antenna to obtain a maximum reading at each angular increment. (Note: several batteries may be needed to offset the effect of battery voltage droop, which should not exceed 5% of the manufactured specified battery voltage during transmission).

c) Replace the transmitter under test with a vertically polarized half-wave dipole (or an antenna whose gain is known relative to an ideal half-wave dipole). The center of the antenna should be at the same location as the center of the antenna under test.

d) Connect the antenna to a signal generator with a known output power and record the path loss (in dB) as LOSS. If a standard radiation test site is used, raise and lower the test antenna to obtain a maximum reading. $LOSS = \text{Generator Output Power (dBm)} - \text{Analyzer reading (dBm)}$

e) Determine the effective radiated output power at each angular position from the readings in steps b) and d) using the following equation: $ERP \text{ (dBm)} = LVL \text{ (dBm)} + LOSS \text{ (dB)}$

f) The maximum ERP is the maximum value determined in the preceding step.

g) When calculating ERP, in addition to knowing the antenna radiation and matching characteristics, it is necessary to know the loss values of all elements (e.g. transmission line attenuation, mismatches, filters, combiners) interposed between the point where transmitter output power is measured, and the point where power is applied to the antenna. ERP can then be calculated as follows:

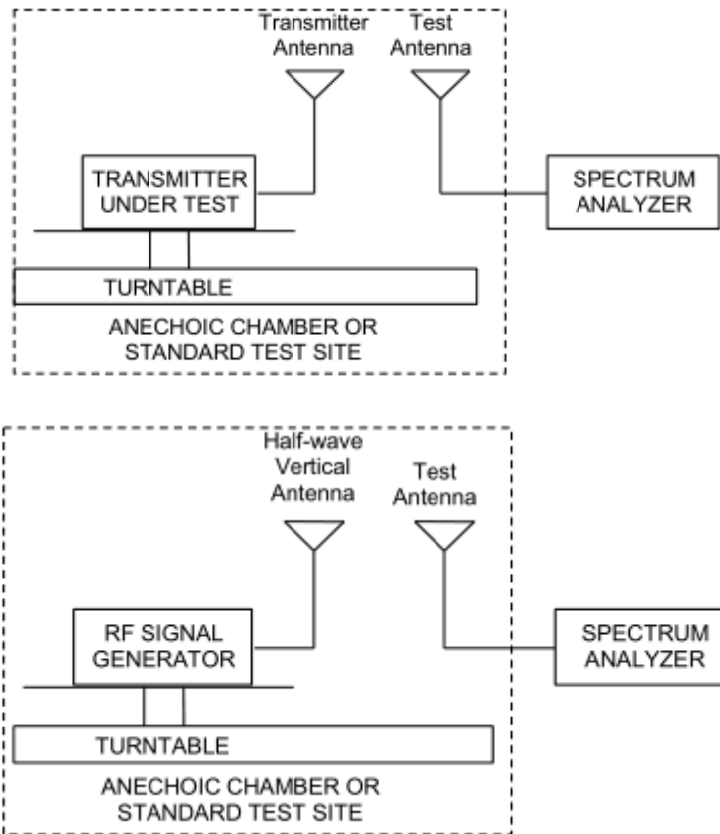
$$EIRP \text{ (dBm)} = \text{Output Power (dBm)} - \text{Losses (dB)} + \text{Antenna Gain (dBi)}$$

where: dBd refers to gain relative to an ideal dipole.

$$EIRP \text{ (dBm)} = ERP \text{ (dBm)} + 2.15 \text{ (dB.)}$$

The RB allocation refers to section 5.1, using the maximum output power configuration.

Test setup



Note: Area side:2.4mX3.6m

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Z axis) and the worst case was recorded.

**Limits**

Rule Part 27.50(b) (10) specifies that “Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP”

Rule Part 27.50(c) (10) specifies that “Portable stations (hand-held devices) in the 600 MHz uplink band and the 698-746 MHz band, and fixed and mobile stations in the 600 MHz uplink band are limited to 3 watts ERP”

Rule Part 27.50(d) (4) specifies that “Fixed, mobile and portable (hand-held) stations operating in the 1710–1755 MHz band are limited to 1 watt EIRP”

| | |
|------------------------|--------------------------------|
| Part 27.50(b)(10)Limit | $\leq 3 \text{ W}$ (34.77 dBm) |
| Part 27.50(c)(10)Limit | $\leq 3 \text{ W}$ (34.77 dBm) |
| Part 27.50(d)(4)Limit | $\leq 1 \text{ W}$ (30 dBm) |

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 1.19 \text{ dB}$

Test Results

The measurement is performed for both of horizontal and vertical antenna Polarization, and only the data of worst mode is recorded in this report.

| LTE Band 4 | | | | | | | |
|-------------------|--------------------------------|--------------|-----|-------|---------------|----------------|------------|
| Band width | Channel/ Frequency (MHz) | Polarization | RB | Index | EIRP (dBm) | Limit (dBm) | Conclusion |
| 1.4MHz (QPSK) | 19957/1710.7 | Horizontal | 1#0 | 0 | 29.04 | 30 | pass |
| | 20175/1732.5 | Horizontal | 1#2 | 0 | 29.25 | 30 | pass |
| | 20393/1754.3 | Horizontal | 1#5 | 0 | 29.52 | 30 | pass |
| 3MHz (QPSK) | 19965/1711.5 | Horizontal | 1#0 | 0 | 29.25 | 30 | pass |
| | 20175/1732.5 | Horizontal | 1#5 | 0 | 29.98 | 30 | pass |
| | 20385/1753.5 | Horizontal | 1#5 | 1 | 29.32 | 30 | pass |
| 5MHz (QPSK) | 19975/1712.5 | Horizontal | 1#0 | 0 | 29.73 | 30 | pass |
| | 20175/1732.5 | Horizontal | 1#5 | 1 | 29.18 | 30 | pass |
| | 20375/1752.5 | Horizontal | 1#5 | 3 | 29.29 | 30 | pass |
| 10MHz (QPSK) | 20000/1715 | Horizontal | 4#0 | 0 | 29.05 | 30 | pass |
| | 20175/1732.5 | Horizontal | 4#2 | 3 | 29.24 | 30 | pass |
| | 20350/1750 | Horizontal | 4#2 | 7 | 29.47 | 30 | pass |
| 15MHz (QPSK) | 20025/1717.5 | Horizontal | 1#0 | 0 | 27.28 | 30 | pass |
| | 20175/1732.5 | Horizontal | 1#5 | 5 | 27.80 | 30 | pass |
| | 20325/1747.5 | Horizontal | 1#5 | 11 | 27.93 | 30 | pass |
| 20MHz (QPSK) | 20050/1720 | Horizontal | 6#0 | 0 | 26.65 | 30 | pass |
| | 20175/1732.5 | Horizontal | 6#0 | 7 | 26.95 | 30 | pass |
| | 20300/1745 | Horizontal | 6#0 | 15 | 26.06 | 30 | pass |
| 1.4MHz (16QAM) | 19957/1710.7 | Horizontal | 1#0 | 0 | 29.72 | 30 | pass |
| | 20175/1732.5 | Horizontal | 1#2 | 0 | 29.94 | 30 | pass |
| | 20393/1754.3 | Horizontal | 1#5 | 0 | 29.21 | 30 | pass |
| 3MHz (16QAM) | 19965/1711.5 | Horizontal | 1#0 | 0 | 29.95 | 30 | pass |
| | 20175/1732.5 | Horizontal | 1#5 | 0 | 29.66 | 30 | pass |
| | 20385/1753.5 | Horizontal | 1#5 | 1 | 29.01 | 30 | pass |
| 5MHz (16QAM) | 19975/1712.5 | Horizontal | 1#0 | 0 | 29.41 | 30 | pass |
| | 20175/1732.5 | Horizontal | 1#5 | 1 | 29.55 | 30 | pass |
| | 20375/1752.5 | Horizontal | 1#5 | 3 | 29.00 | 30 | pass |
| 10MHz (16QAM) | 20000/1715 | Horizontal | 4#0 | 0 | 28.70 | 30 | pass |
| | 20175/1732.5 | Horizontal | 4#2 | 3 | 28.92 | 30 | pass |
| | 20350/1750 | Horizontal | 4#2 | 7 | 29.15 | 30 | pass |
| 15MHz (16QAM) | 20025/1717.5 | Horizontal | 1#0 | 0 | 26.97 | 30 | pass |
| | 20175/1732.5 | Horizontal | 1#5 | 5 | 27.50 | 30 | pass |
| | 20325/1747.5 | Horizontal | 1#5 | 11 | 27.62 | 30 | pass |
| 20MHz | 20050/1720 | Horizontal | 6#0 | 0 | 26.32 | 30 | pass |



| | | | | | | | |
|---------|--------------|------------|-----|----|-------|----|------|
| (16QAM) | 20175/1732.5 | Horizontal | 6#0 | 7 | 26.63 | 30 | pass |
| | 20300/1745 | Horizontal | 6#0 | 15 | 25.75 | 30 | pass |

| LTE Band 12 | | | | | | | |
|----------------|-----------------|--------------|-----|-------|------------|-------------|------------|
| Band width | Frequency (MHz) | Polarization | RB | Index | EIRP (dBm) | Limit (dBm) | Conclusion |
| 1.4MHz (QPSK) | 23017/699.7 | Horizontal | 1#0 | 0 | 25.51 | 34.7 | pass |
| | 23095/707.5 | Horizontal | 1#2 | 0 | 26.10 | 34.7 | pass |
| | 23173/715.3 | Horizontal | 1#5 | 0 | 26.92 | 34.7 | pass |
| 3MHz (QPSK) | 23025/700.5 | Horizontal | 1#0 | 0 | 25.50 | 34.7 | pass |
| | 23095/707.5 | Horizontal | 1#5 | 0 | 26.79 | 34.7 | pass |
| | 23165/714.5 | Horizontal | 1#5 | 1 | 27.79 | 34.7 | pass |
| 5MHz (QPSK) | 23035/701.5 | Horizontal | 1#0 | 0 | 25.36 | 34.7 | pass |
| | 23095/707.5 | Horizontal | 1#5 | 1 | 26.32 | 34.7 | pass |
| | 23155/713.5 | Horizontal | 1#5 | 3 | 27.30 | 34.7 | pass |
| 10MHz (QPSK) | 23060/704 | Horizontal | 4#0 | 0 | 24.70 | 34.7 | pass |
| | 23095/707.5 | Horizontal | 4#2 | 3 | 25.44 | 34.7 | pass |
| | 23130/711 | Horizontal | 4#2 | 7 | 25.97 | 34.7 | pass |
| 1.4MHz (16QAM) | 23017/699.7 | Horizontal | 1#0 | 0 | 25.18 | 34.7 | pass |
| | 23095/707.5 | Horizontal | 1#2 | 0 | 25.80 | 34.7 | pass |
| | 23173/715.3 | Horizontal | 1#5 | 0 | 27.60 | 34.7 | pass |
| 3MHz (16QAM) | 23025/700.5 | Horizontal | 1#0 | 0 | 25.17 | 34.7 | pass |
| | 23095/707.5 | Horizontal | 1#5 | 0 | 26.45 | 34.7 | pass |
| | 23165/714.5 | Horizontal | 1#5 | 1 | 27.47 | 34.7 | pass |
| 5MHz (16QAM) | 23035/701.5 | Horizontal | 1#0 | 0 | 25.07 | 34.7 | pass |
| | 23095/707.5 | Horizontal | 1#5 | 1 | 26.00 | 34.7 | pass |
| | 23155/713.5 | Horizontal | 1#5 | 3 | 26.98 | 34.7 | pass |
| 10MHz (16QAM) | 23060/704 | Horizontal | 4#0 | 0 | 24.40 | 34.7 | pass |
| | 23095/707.5 | Horizontal | 4#2 | 3 | 25.10 | 34.7 | pass |
| | 23130/711 | Horizontal | 4#2 | 7 | 25.66 | 34.7 | pass |

| LTE Band 13 | | | | | | | |
|---------------|-----------------|--------------|-----|-------|------------|-------------|------------|
| Band width | Frequency (MHz) | Polarization | RB | Index | EIRP (dBm) | Limit (dBm) | Conclusion |
| 5MHz (QPSK) | 23205/779.5 | Horizontal | 1#0 | 0 | 27.00 | 34.7 | pass |
| | 23230/782 | Horizontal | 1#5 | 1 | 26.97 | 34.7 | pass |
| | 23255/784.5 | Horizontal | 1#5 | 3 | 27.00 | 34.7 | pass |
| 10MHz (QPSK) | 23230/782 | Horizontal | 4#2 | 3 | 26.86 | 34.7 | pass |
| 5MHz (16QAM) | 23035/701.5 | Horizontal | 1#0 | 0 | 26.99 | 34.7 | pass |
| | 23095/707.5 | Horizontal | 1#5 | 1 | 26.96 | 34.7 | pass |
| | 23155/713.5 | Horizontal | 1#5 | 3 | 27.17 | 34.7 | pass |
| 10MHz (16QAM) | 23230/782 | Horizontal | 4#2 | 3 | 26.55 | 34.7 | pass |

Note: 1. EIRP= E.R.P+2.15

5.3 Occupied Bandwidth

Ambient condition

| | | |
|-------------|-------------------|----------|
| Temperature | Relative humidity | Pressure |
| 23°C ~25°C | 45%~50% | 101.5kPa |

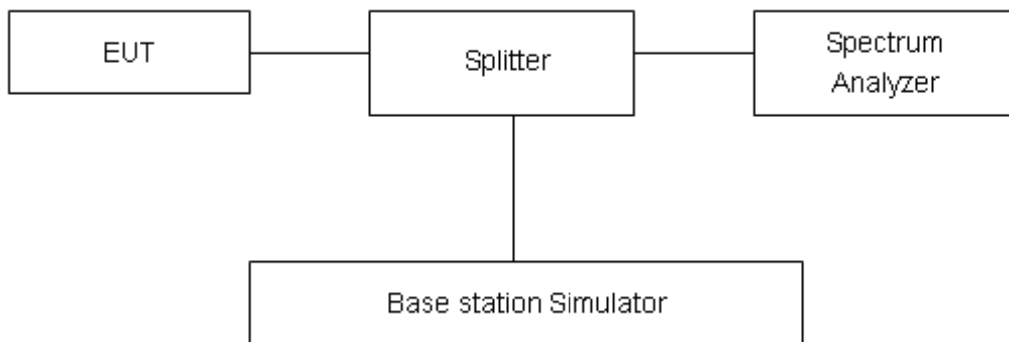
Method of Measurement

The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The occupied bandwidth is measured using spectrum analyzer.

RBW is set to 51 kHz, VBW is set to 160 kHz for LTE Band 4/12/13 .

99% power and -26dBc occupied bandwidths are recorded. Spectrum analyzer plots are included on the following pages.

Test Setup



Limits

No specific occupied bandwidth requirements in part 2.1049.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U=624\text{Hz}$.

Test Result

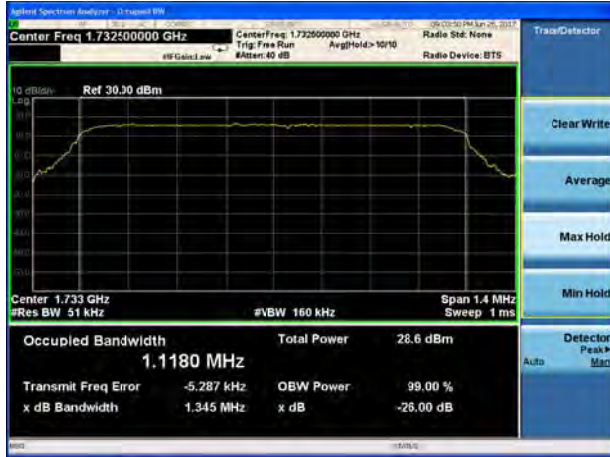
| Mode | Bandwidth | Modulation | Channel/ Frequency(MHz) | RB | Index | Bandwidth(MHz) | |
|-------|-----------|------------|----------------------------|-----|-------|----------------|--------|
| | | | | | | 99% Power | -26dBc |
| Band4 | 1.4MHz | QPSK | 20175/1732.5 | 6#0 | 0 | 1.1180 | 1.345 |
| | | 16QAM | 20175/1732.5 | 6#0 | 0 | 0.93883 | 1.215 |
| | 3MHz | QPSK | 20175/1732.5 | 6#0 | 0 | 1.15040 | 1.655 |
| | | 16QAM | 20175/1732.5 | 6#0 | 0 | 0.98073 | 1.337 |
| | 5MHz | QPSK | 20175/1732.5 | 6#0 | 0 | 1.13010 | 1.472 |
| | | 16QAM | 20175/1732.5 | 6#0 | 0 | 1.0162 | 1.496 |
| | 10MHz | QPSK | 20175/1732.5 | 6#0 | 0 | 1.1840 | 1.796 |
| | | 16QAM | 20175/1732.5 | 6#0 | 0 | 1.0660 | 1.795 |
| | 15MHz | QPSK | 20175/1732.5 | 6#0 | 0 | 1.1955 | 1.894 |
| | | 16QAM | 20175/1732.5 | 6#0 | 0 | 1.0578 | 1.889 |
| | 20MHz | QPSK | 20175/1732.5 | 6#0 | 0 | 1.2079 | 1.782 |
| | | 16QAM | 20175/1732.5 | 6#0 | 0 | 1.1125 | 1.862 |

| Mode | Bandwidth | Modulation | Channel/ Frequency(MHz) | RB | Index | Bandwidth(MHz) | |
|--------|-----------|------------|----------------------------|-----|-------|----------------|--------|
| | | | | | | 99% Power | -26dBc |
| Band12 | 1.4MHz | QPSK | 23095/707.5 | 6#0 | 0 | 1.1082 | 1.332 |
| | | 16QAM | 23095/707.5 | 6#0 | 0 | 0.93878 | 1.195 |
| | 3MHz | QPSK | 23095/707.5 | 6#0 | 0 | 1.1525 | 1.66 |
| | | 16QAM | 23095/707.5 | 6#0 | 0 | 0.98517 | 1.343 |
| | 5MHz | QPSK | 23095/707.5 | 6#0 | 0 | 1.1445 | 1.506 |
| | | 16QAM | 23095/707.5 | 6#0 | 0 | 0.97604 | 1.423 |
| | 10MHz | QPSK | 23095/707.5 | 6#0 | 0 | 1.2051 | 1.738 |
| | | 16QAM | 23095/707.5 | 6#0 | 0 | 1.0835 | 1.731 |

| Mode | Bandwidth | Modulation | Channel/ Frequency(MHz) | RB | Index | Bandwidth(MHz) | |
|--------|-----------|------------|----------------------------|-----|-------|----------------|--------|
| | | | | | | 99% Power | -26dBc |
| Band13 | 5MHz | QPSK | 23230/782 | 6#0 | 0 | 1.149 | 1.481 |
| | | 16QAM | 23230/782 | 6#0 | 0 | 0.97695 | 1.356 |
| | 10MHz | QPSK | 23230/782 | 6#0 | 0 | 1.1775 | 1.721 |
| | | 16QAM | 23230/782 | 6#0 | 0 | 1.0331 | 1.537 |



LTE Band 4 QPSK 1.4MHz CH-Middle



LTE Band 4 16QAM 1.4MHz CH-Middle



LTE Band 4 QPSK 3MHz CH-Middle



LTE Band 4 16QAM 3MHz CH-Middle

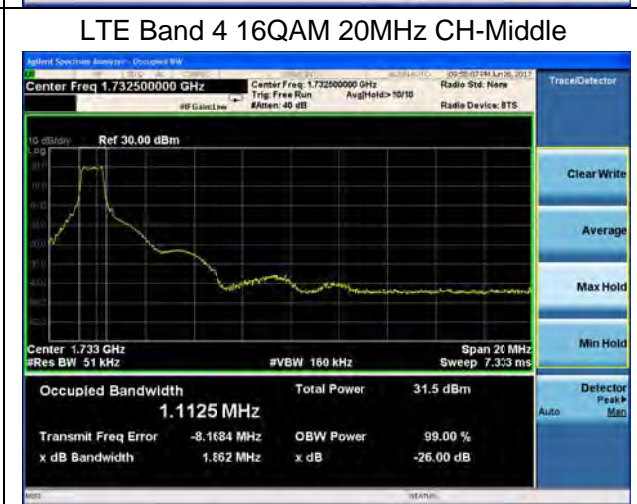
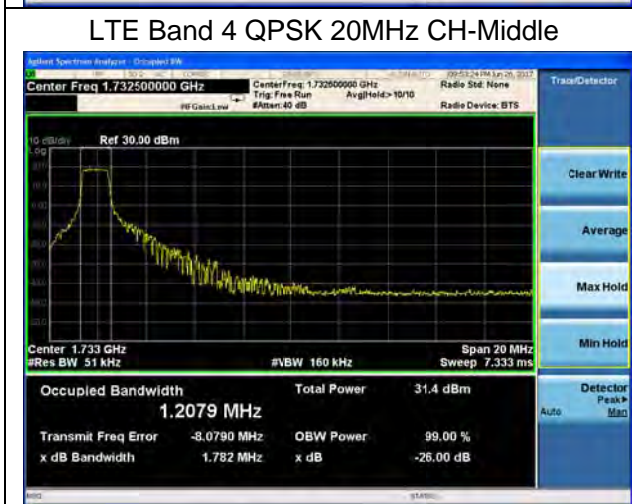
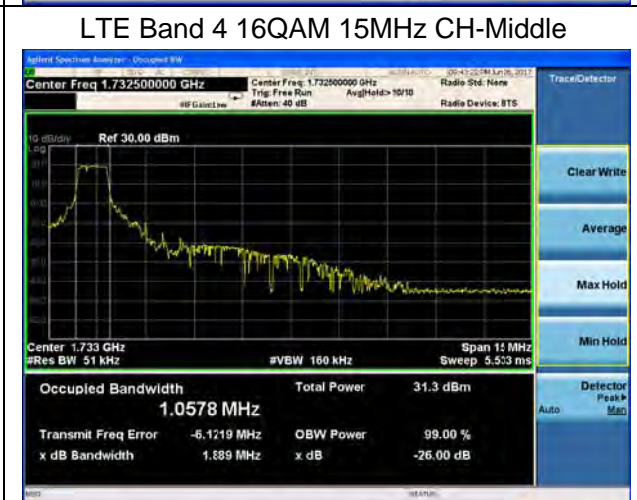
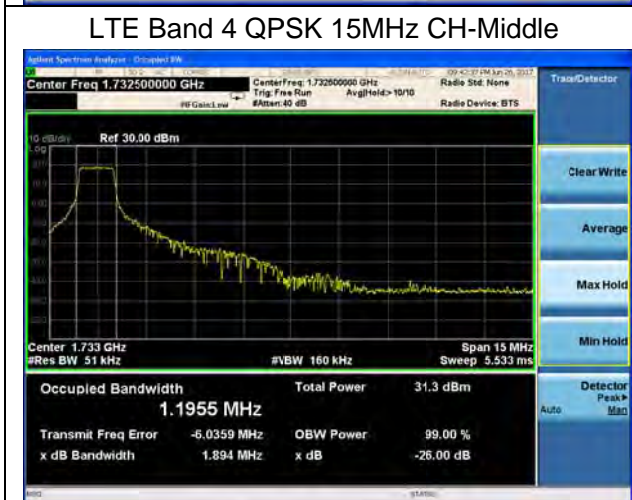
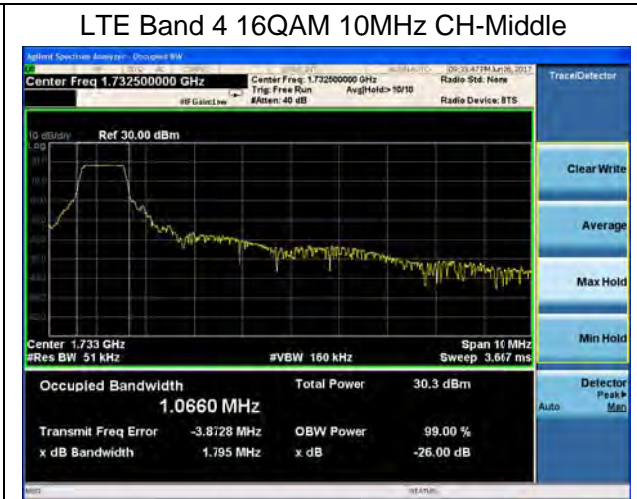
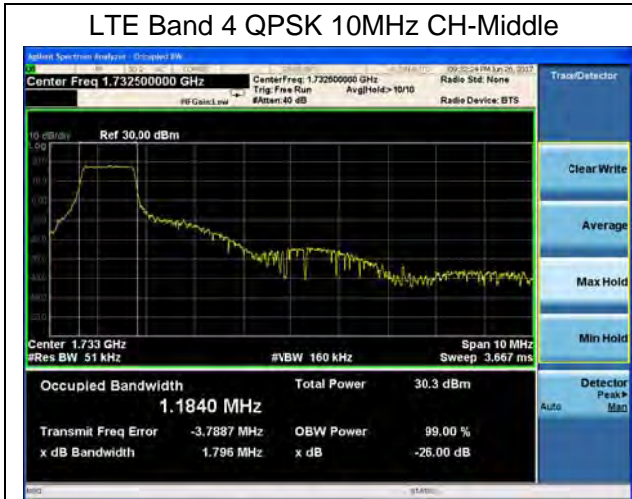


LTE Band 4 QPSK 5MHz CH-Middle



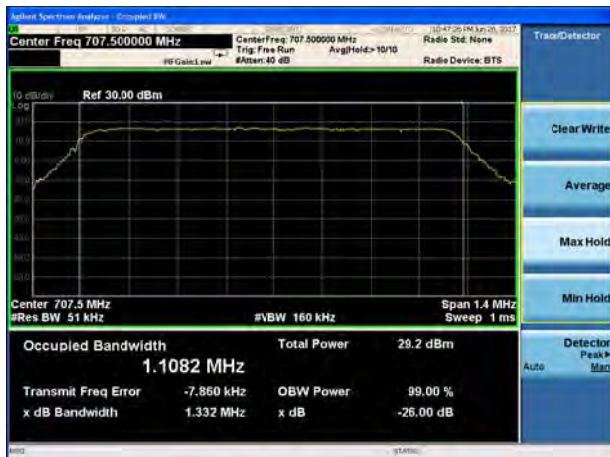
LTE Band 4 16QAM 5MHz CH-Middle







LTE Band 12 QPSK 1.4MHz CH-Middle



LTE Band 12 16QAM 1.4MHz CH-Middle



LTE Band 12 QPSK 3MHz CH-Middle



LTE Band 12 16QAM 3MHz CH-Middle



LTE Band 12 QPSK 5MHz CH-Middle



LTE Band 12 16QAM 5MHz CH-Middle

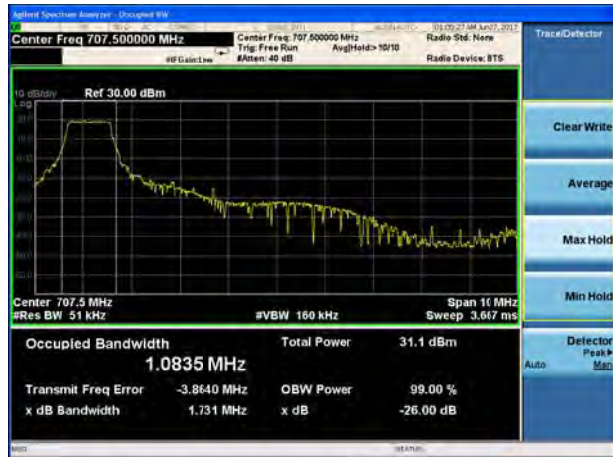




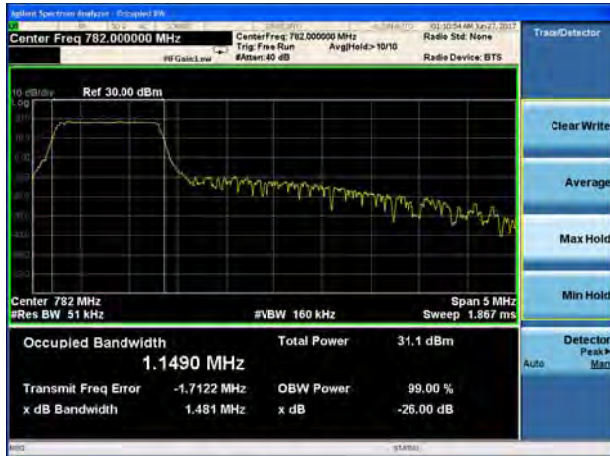
LTE Band 12 QPSK 10MHz CH-Middle



LTE Band 12 16QAM 10MHz CH-Middle



LTE Band 13 QPSK 5MHz CH-Middle



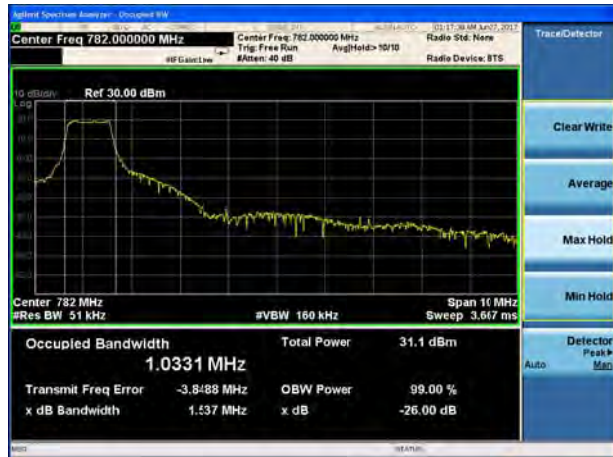
LTE Band 13 16QAM 5MHz CH-Middle



LTE Band 13 QPSK 10MHz CH-Middle



LTE Band 13 16QAM 10MHz CH-Middle



5.4 Band Edge Compliance

Ambient condition

| Temperature | Relative humidity | Pressure |
|-------------|-------------------|----------|
| 23°C ~25°C | 45%~50% | 101.5kPa |

Method of Measurement

The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The band edge of the lowest and highest channels were measured.

The testing follows KDB 971168 v02r02 Section 6.0

The EUT was connected to spectrum analyzer and system simulator via a power divider.

The band edges of low and high channels for the highest RF powers were measured.

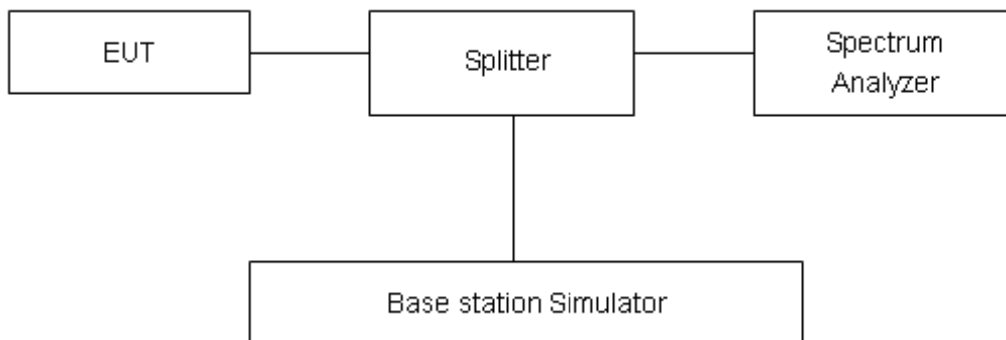
RBW is set to 51 kHz, VBW is set to 160 kHz for LTE Band 4/12/13 on spectrum analyzer.

Set spectrum analyzer with RMS detector.

The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

Checked that all the results comply with the emission limit line.

Test Setup



Limits

Rule Part 27.53(h)/ specifies that “ for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10} (P)$ dB”

Part 27.53(g) specifies that “ For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least $43 + 10 \log_{10} (P)$ dB.”

Part 27.53(m) (4)/ specifies that “for BRS and EBS stations. For mobile digital stations, the attenuation factor shall be not less than $40 + 10 \log (P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10 \log (P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10 \log (P)$ dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(4) of this section. In addition, the attenuation factor shall not be less that $43 + 10 \log (P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10 \log (P)$ dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

Example:

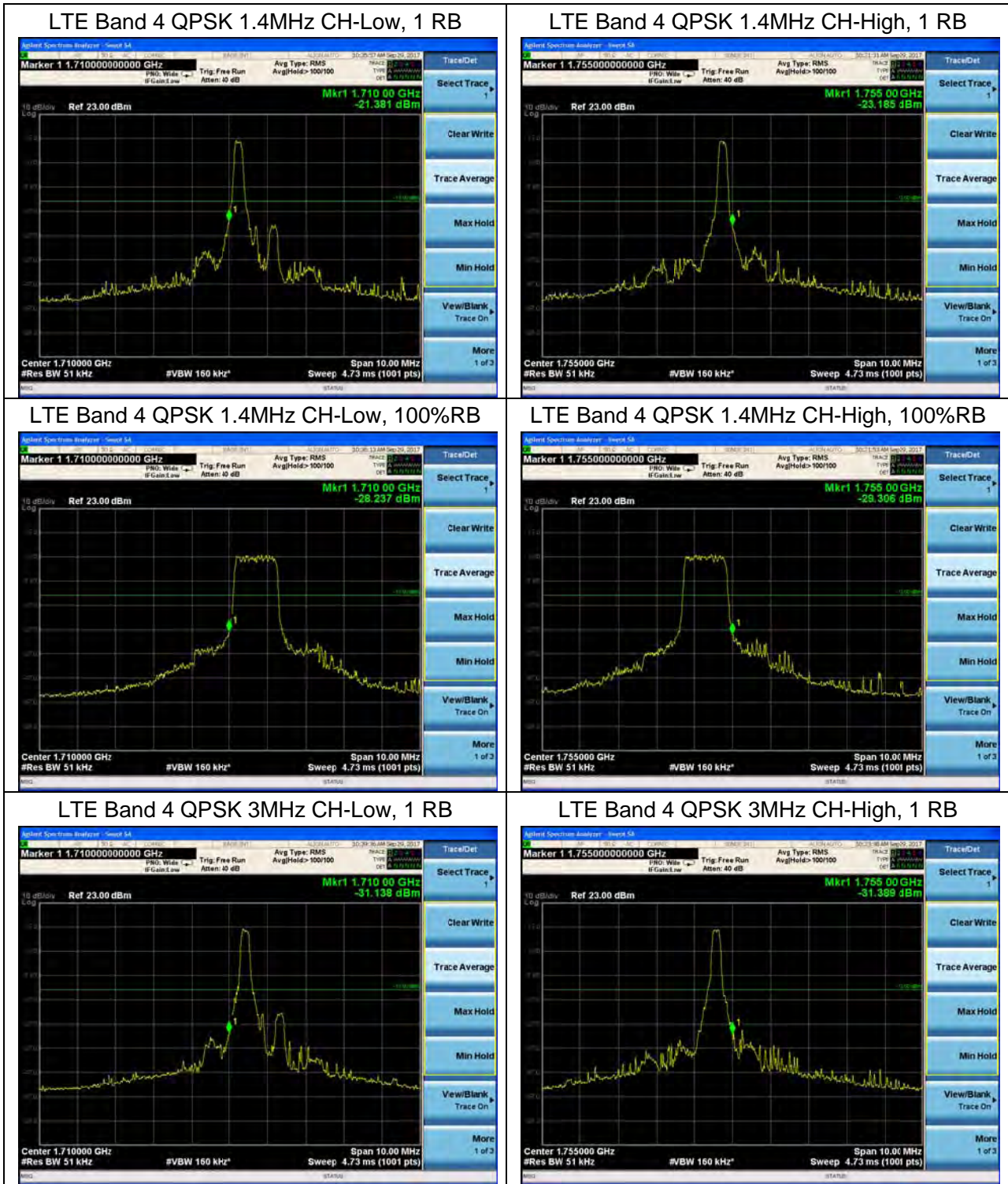
The limit line is derived from $43 + 10 \log (P)$ dB below the transmitter power P(Watts)
 $= P(W) - [43 + 10 \log(P)]$ (dB)
 $= [30 + 10 \log (P)]$ (dBm) - $[43 + 10 \log(P)]$ (dB) = -13dBm.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$, $U=0.684$ dB.

Test Result

All the test traces in the plots shows the test results clearly.





LTE Band 4 QPSK 3MHz CH-Low, 100%RB



LTE Band 4 QPSK 3MHz CH-High, 100%RB



LTE Band 4 QPSK 5MHz CH-Low, 1 RB



LTE Band 4 QPSK 5MHz CH-High, 1 RB



LTE Band 4 QPSK 5MHz CH-Low, 100%RB



LTE Band 4 QPSK 5MHz CH-High, 100%RB





LTE Band 4 QPSK 10MHz CH-Low, 1 RB



LTE Band 4 QPSK 10MHz CH-High, 1 RB



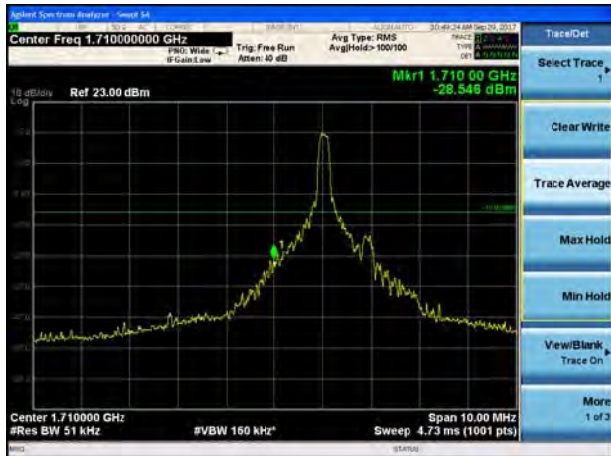
LTE Band 4 QPSK 10MHz CH-Low, 100%RB



LTE Band 4 QPSK 10MHz CH-High, 100%RB



LTE Band 4 QPSK 15MHz CH-Low, 1 RB



LTE Band 4 QPSK 15MHz CH-High, 1 RB





LTE Band 4 QPSK 15MHz CH-Low, 100%RB



LTE Band 4 QPSK 15MHz CH-High, 100%RB



LTE Band 4 QPSK 20MHz CH-Low, 1 RB



LTE Band 4 QPSK 20MHz CH-High, 1 RB



LTE Band 4 QPSK 20MHz CH-Low, 100%RB



LTE Band 4 QPSK 20MHz CH-High, 100%RB





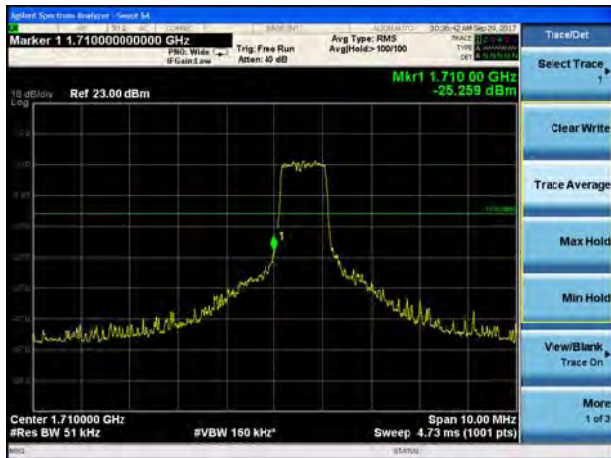
LTE Band 4 16QAM 1.4MHz CH-Low, 1 RB



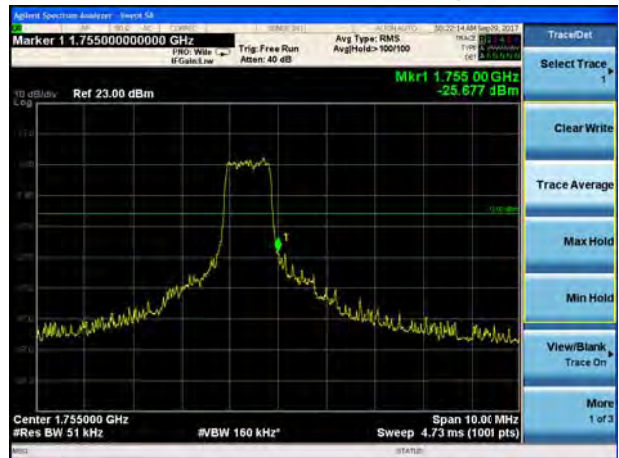
LTE Band 4 16QAM 1.4MHz CH-High, 1 RB



LTE Band 4 16QAM 1.4MHz CH-Low, 100%RB



LTE Band 4 16QAM 1.4MHz CH-High, 100%RB



LTE Band 4 16QAM 3MHz CH-Low, 1 RB

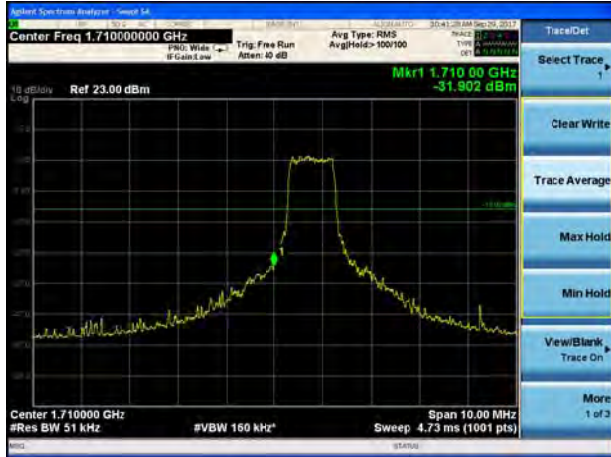


LTE Band 4 16QAM 3MHz CH-High, 1 RB





LTE Band 4 16QAM 3MHz CH-Low, 100%RB



LTE Band 4 16QAM 3MHz CH-High, 100%RB



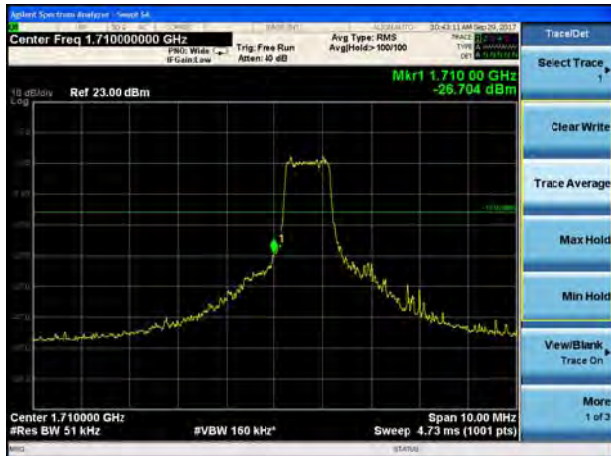
LTE Band 4 16QAM 5MHz CH-Low, 1 RB



LTE Band 4 16QAM 5MHz CH-High, 1 RB



LTE Band 4 16QAM 5MHz CH-Low, 100%RB



LTE Band 4 16QAM 5MHz CH-High, 100%RB





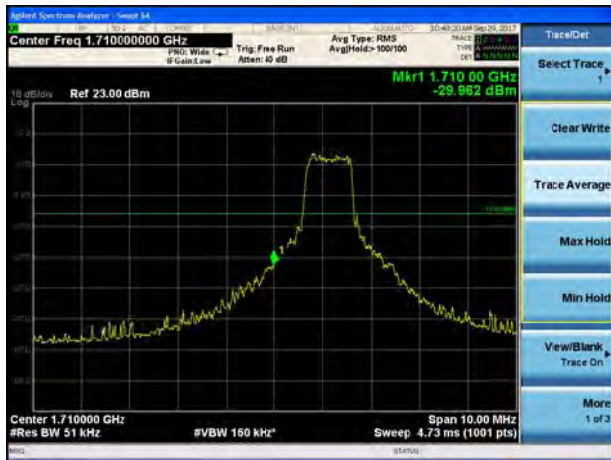
LTE Band 4 16QAM 10MHz CH-Low, 1 RB



LTE Band 4 16QAM 10MHz CH-High, 1 RB



LTE Band 4 16QAM 10MHz CH-Low, 100%RB



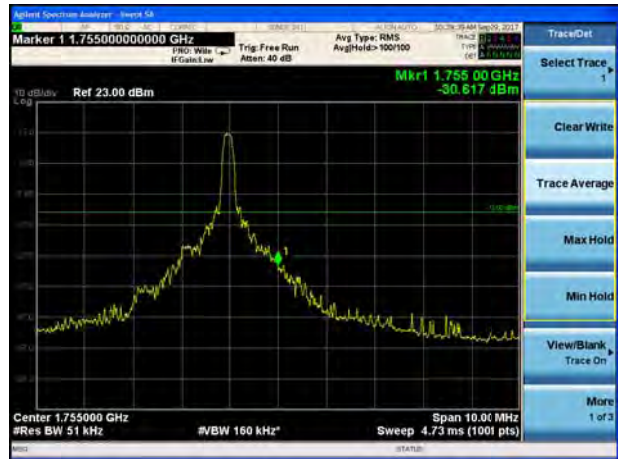
LTE Band 4 16QAM 10MHz CH-High, 100%RB



LTE Band 4 16QAM 15MHz CH-Low, 1 RB

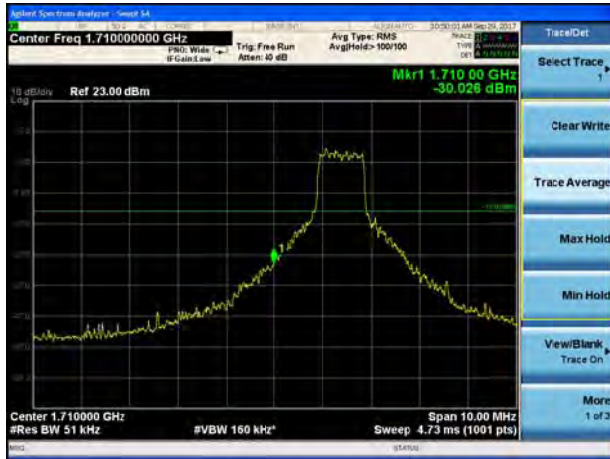


LTE Band 4 16QAM 15MHz CH-High, 1 RB





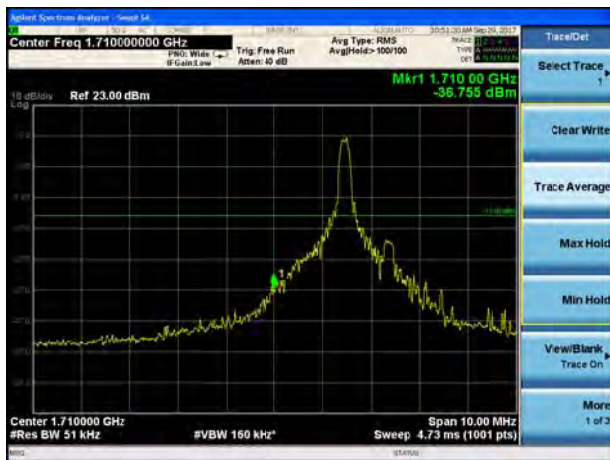
LTE Band 4 16QAM 15MHz CH-Low, 100%RB



LTE Band 4 16QAM 15MHz CH-High, 100%RB



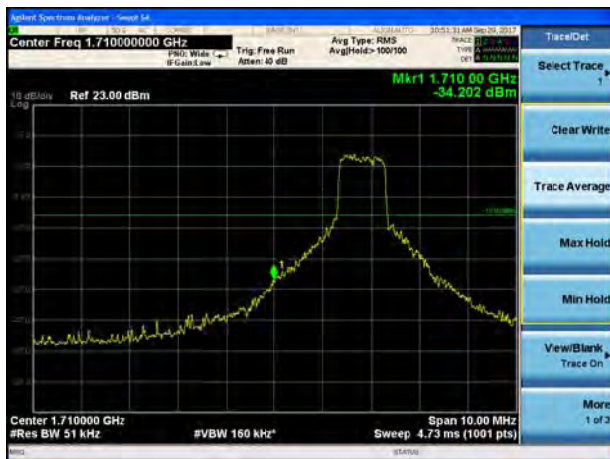
LTE Band 4 16QAM 20MHz CH-Low, 1 RB



LTE Band 4 16QAM 20MHz CH-High, 1 RB

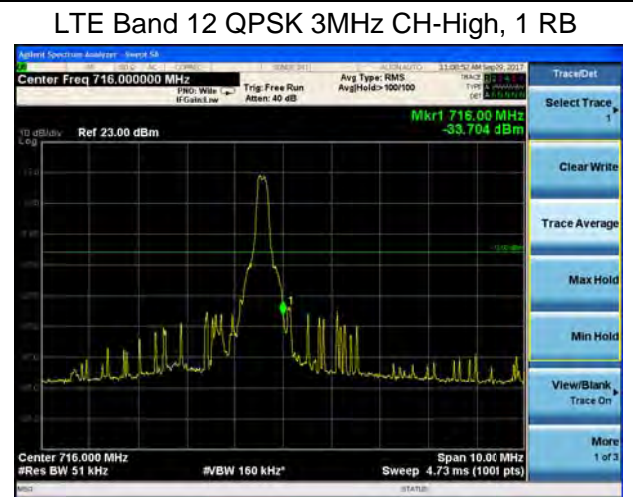
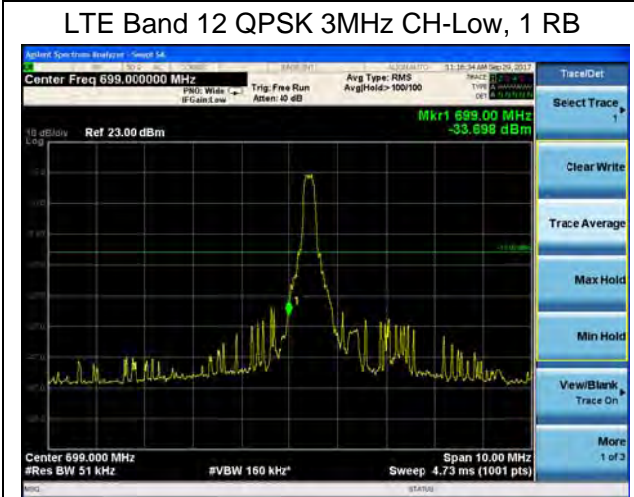
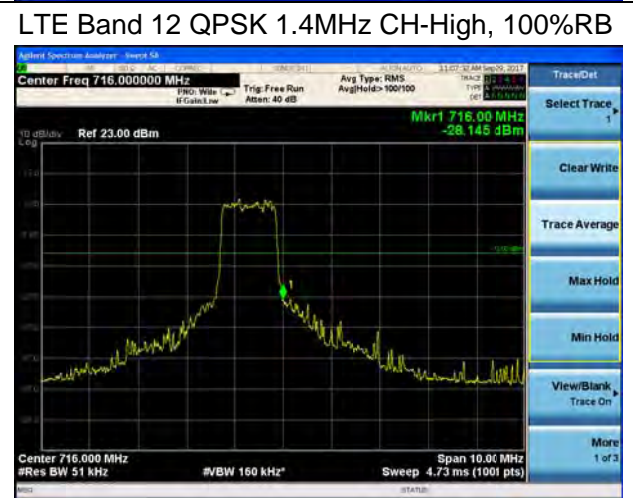
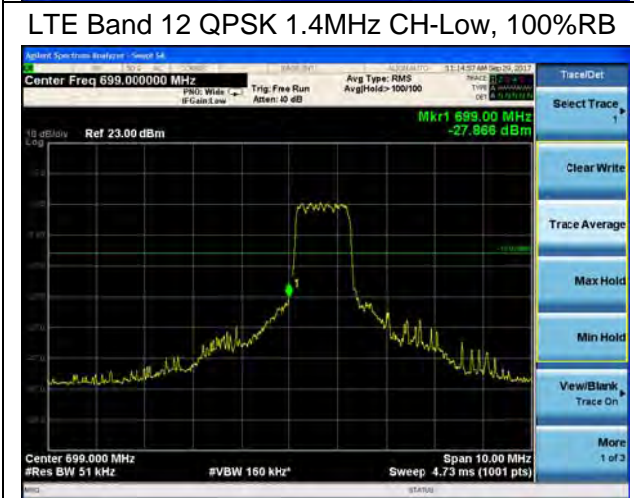
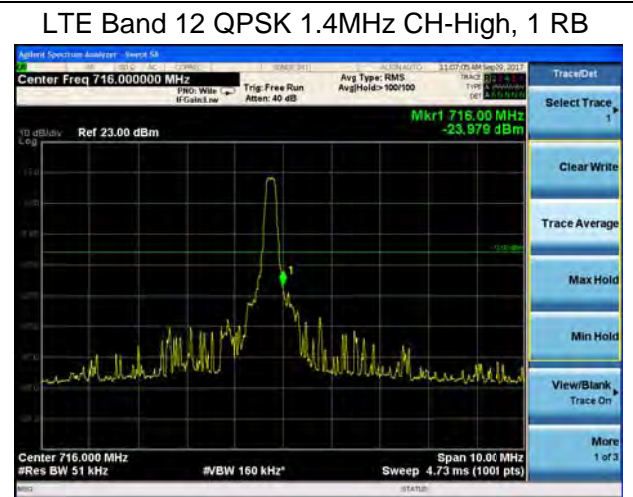
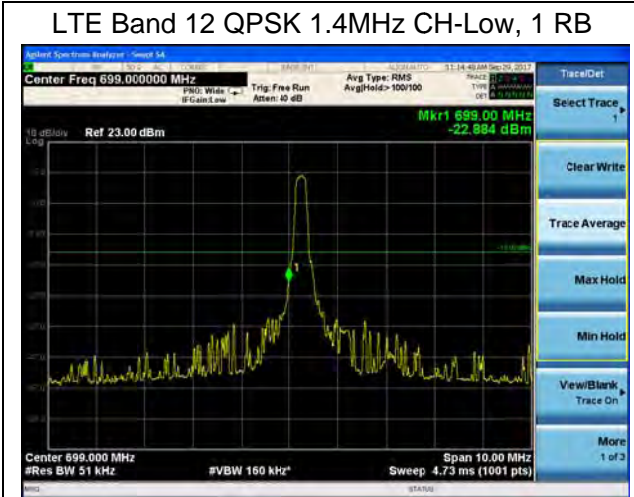


LTE Band 4 16QAM 20MHz CH-Low, 100%RB



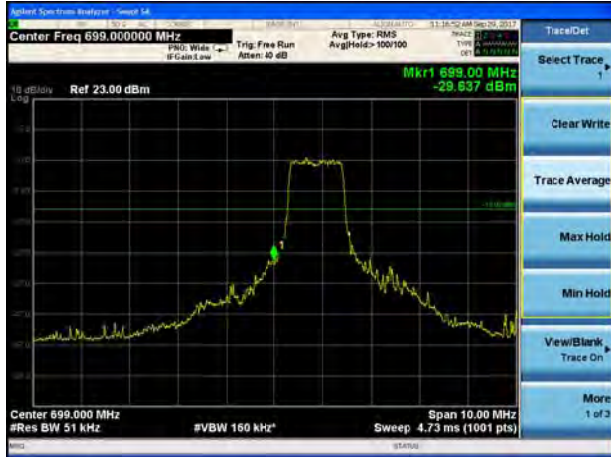
LTE Band 4 16QAM 20MHz CH-High, 100%RB







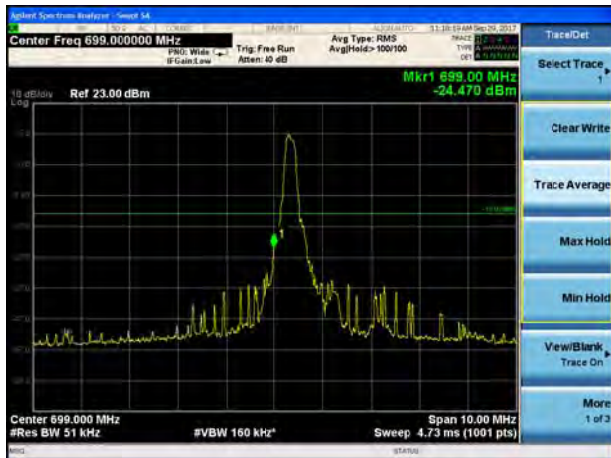
LTE Band 12 QPSK 3MHz CH-Low, 100%RB



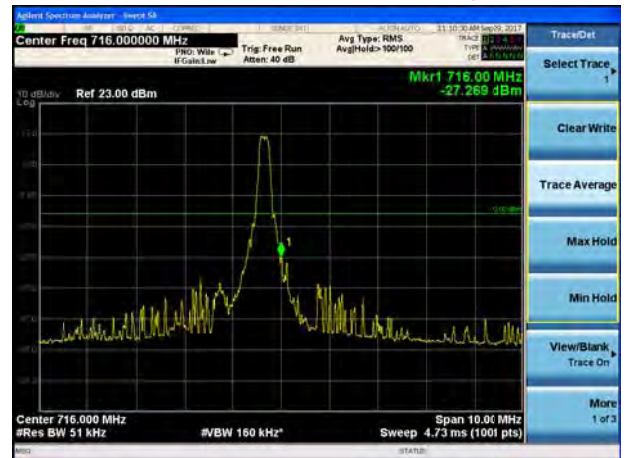
LTE Band 12 QPSK 3MHz CH-High, 100%RB



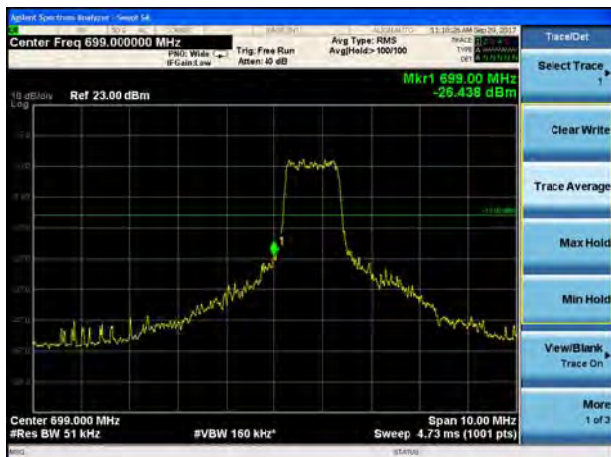
LTE Band 12 QPSK 5MHz CH-Low, 1 RB



LTE Band 12 QPSK 5MHz CH-High, 1 RB



LTE Band 12 QPSK 5MHz CH-Low, 100%RB

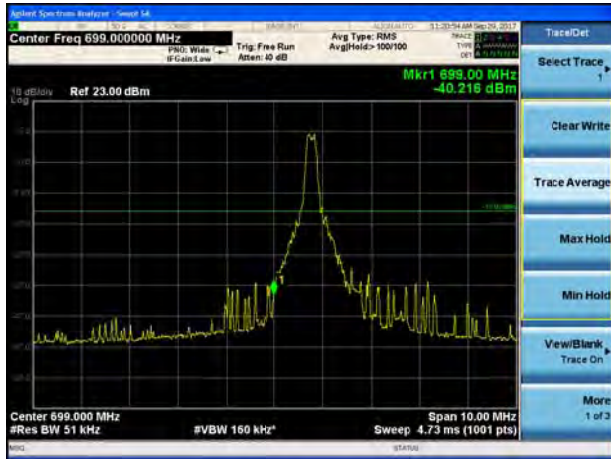


LTE Band 12 QPSK 5MHz CH-High, 100%RB

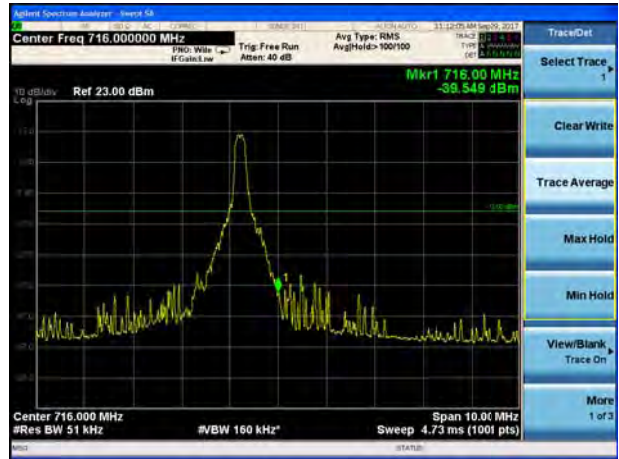




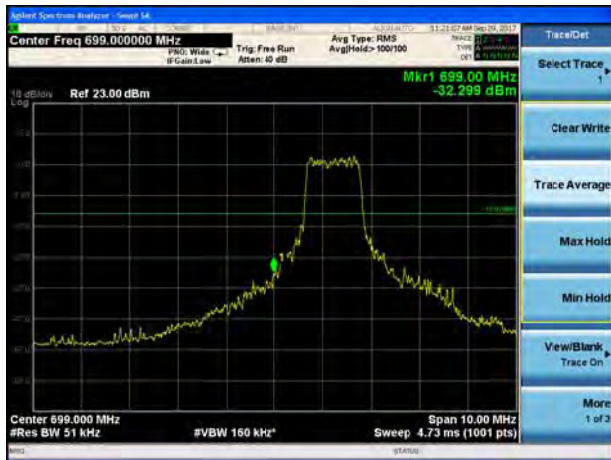
LTE Band 12 QPSK 10MHz CH-Low, 1 RB



LTE Band 12 QPSK 10MHz CH-High, 1 RB



LTE Band 12 QPSK 10MHz CH-Low, 100%RB



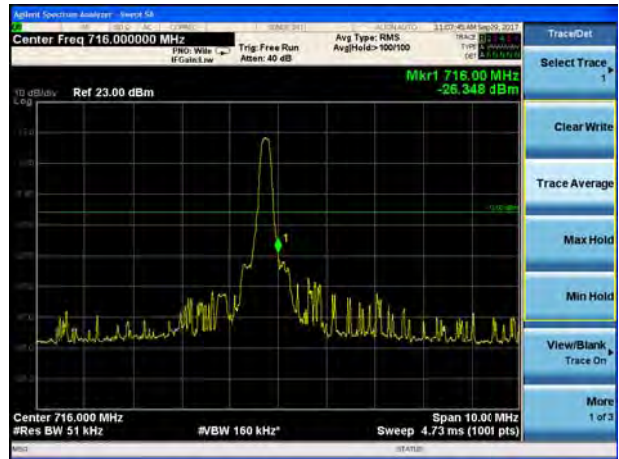
LTE Band 12 QPSK 10MHz CH-High, 100%RB



LTE Band 12 16QAM 1.4MHz CH-Low, 1 RB

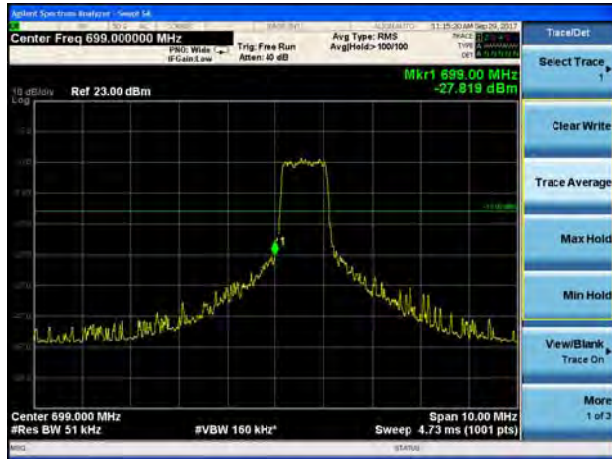


LTE Band 12 16QAM 1.4MHz CH-High, 1 RB

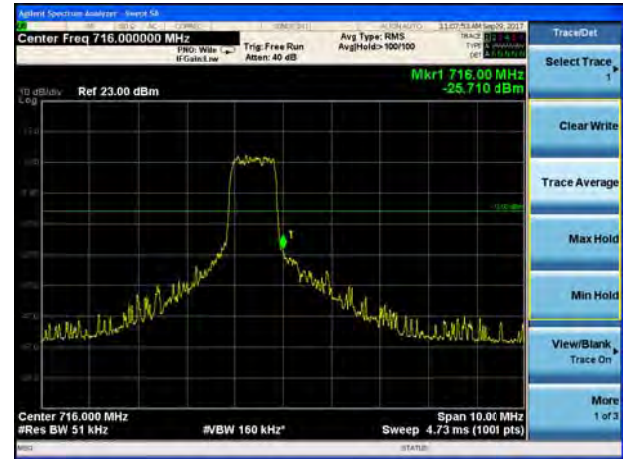




LTE Band 12 16QAM 1.4MHz CH-Low, 100%RB



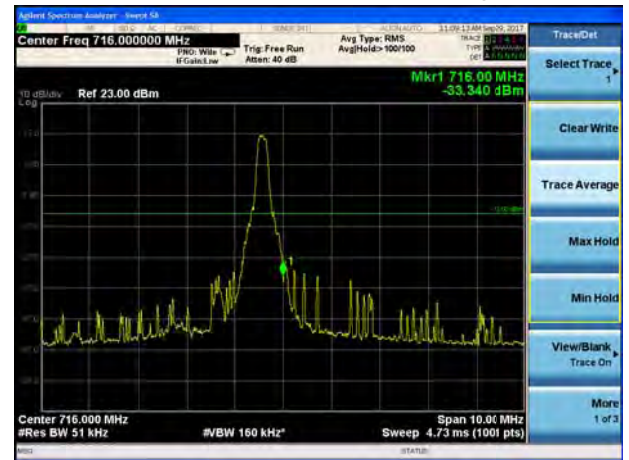
LTE Band 12 16QAM 1.4MHz CH-High, 100%RB



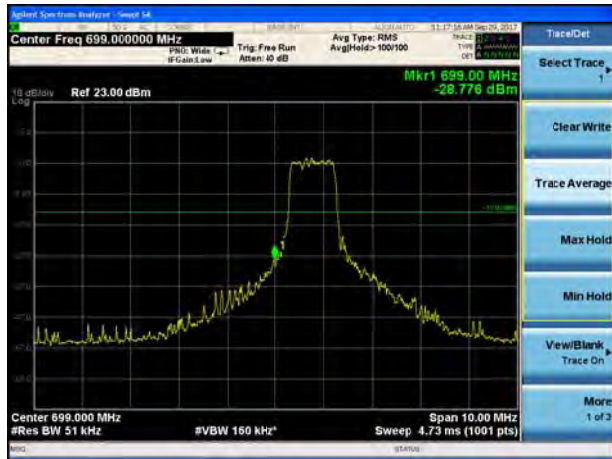
LTE Band 12 16QAM 3MHz CH-Low, 1 RB



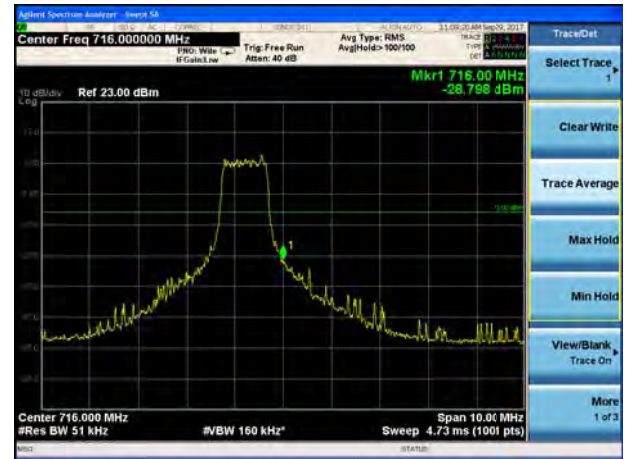
LTE Band 12 16QAM 3MHz CH-High, 1 RB



LTE Band 12 16QAM 3MHz CH-Low, 100%RB



LTE Band 12 16QAM 3MHz CH-High, 100%RB





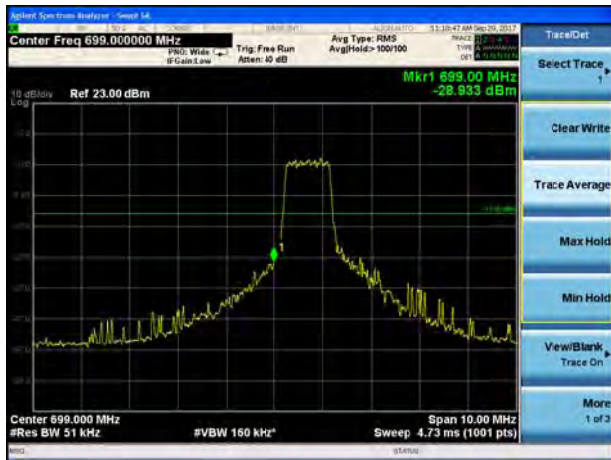
LTE Band 12 16QAM 5MHz CH-Low, 1 RB



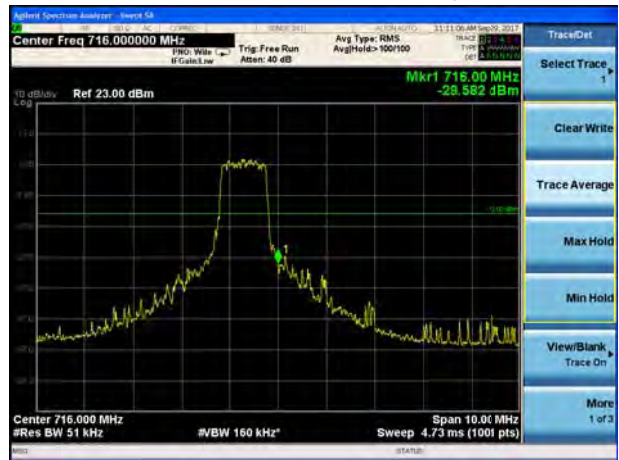
LTE Band 12 16QAM 5MHz CH-High, 1 RB



LTE Band 12 16QAM 5MHz CH-Low, 100%RB



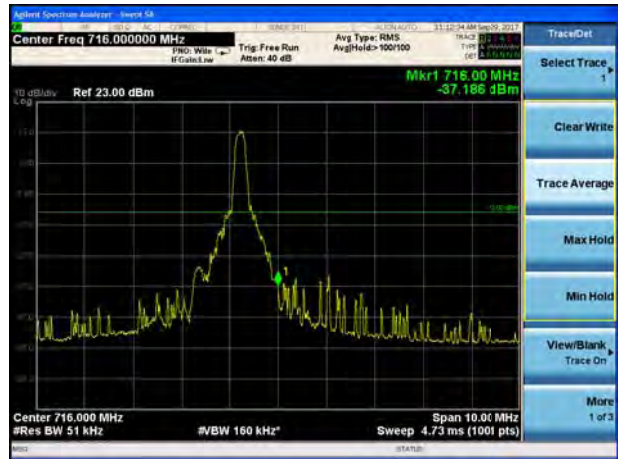
LTE Band 12 16QAM 5MHz CH-High, 100%RB



LTE Band 12 16QAM 10MHz CH-Low, 1 RB

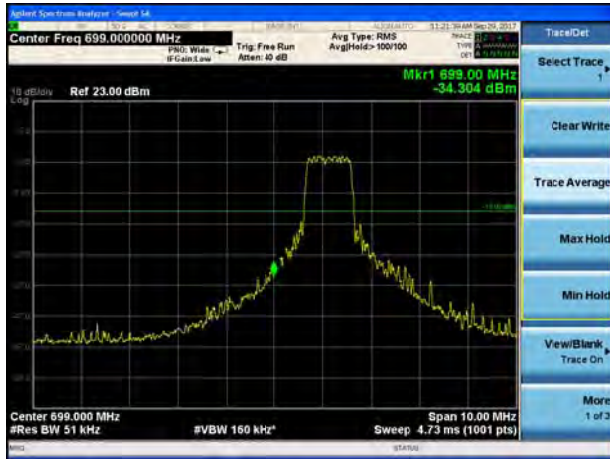


LTE Band 12 16QAM 10MHz CH-High, 1 RB

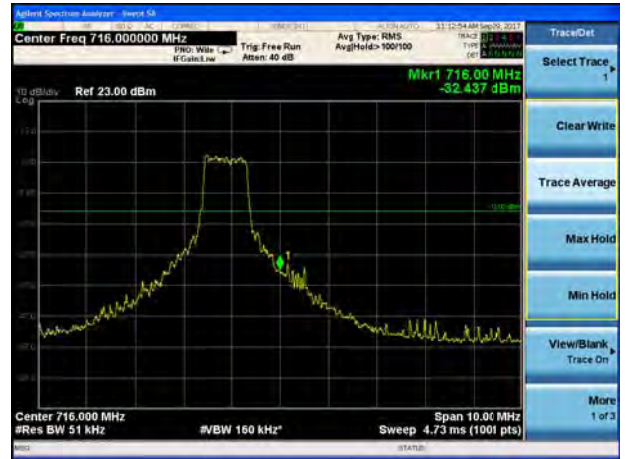




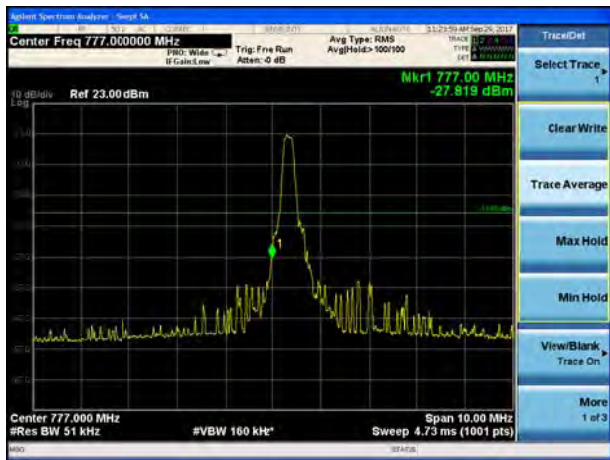
LTE Band 12 16QAM 10MHz CH-Low, 100%RB



LTE Band 12 16QAM 10MHz CH-High, 100%RB



LTE Band 13 QPSK 5MHz CH-Low, 1 RB



LTE Band 13 QPSK 5MHz CH-High, 1 RB



LTE Band 13 QPSK 5MHz CH-Low, 100%RB



LTE Band 13 QPSK 5MHz CH-High, 100%RB

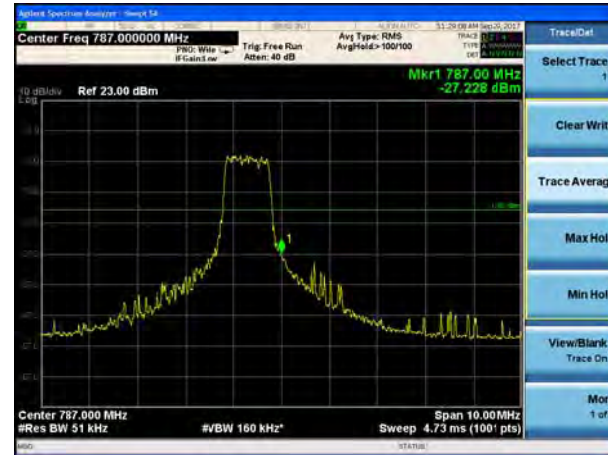




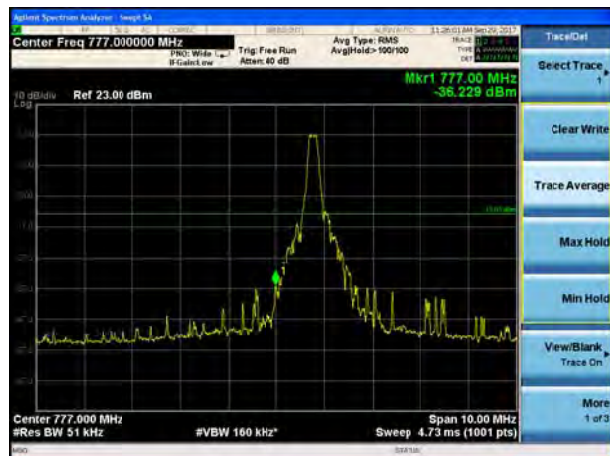
LTE Band 13 16QAM 5MHz CH-Low, 100%RB



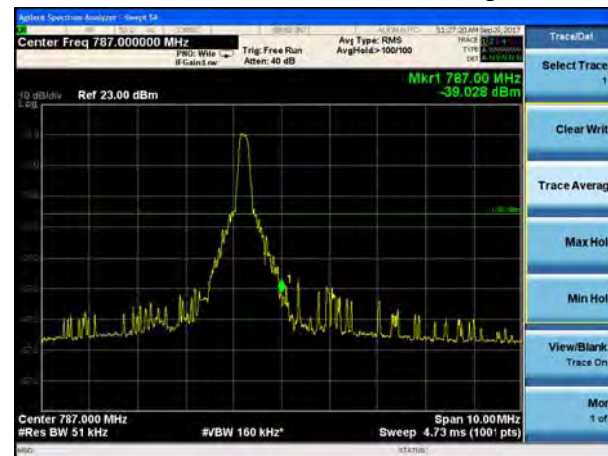
LTE Band 13 16QAM 5MHz CH-High, 100%RB



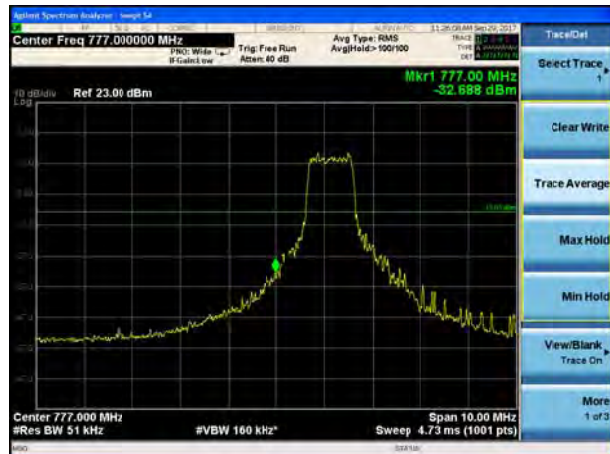
LTE Band 13 16QAM 10MHz CH-Low, 1 RB



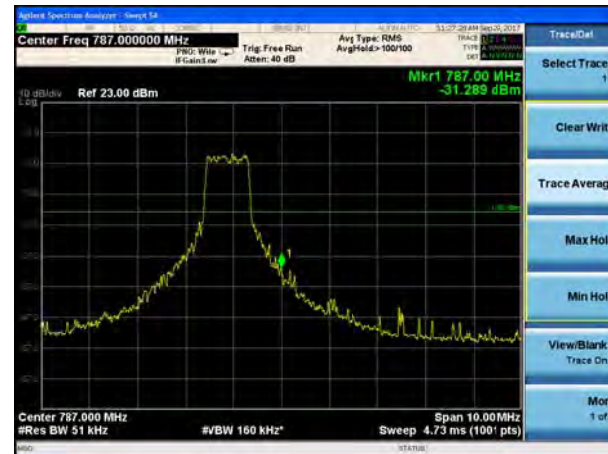
LTE Band 13 16QAM 10MHz CH-High, 1 RB



LTE Band 13 16QAM 10MHz CH-Low, 100%RB



LTE Band 13 16QAM 10MHz CH-High, 100%RB



5.5 Peak-to-Average Power Ratio (PAPR)

Ambient condition

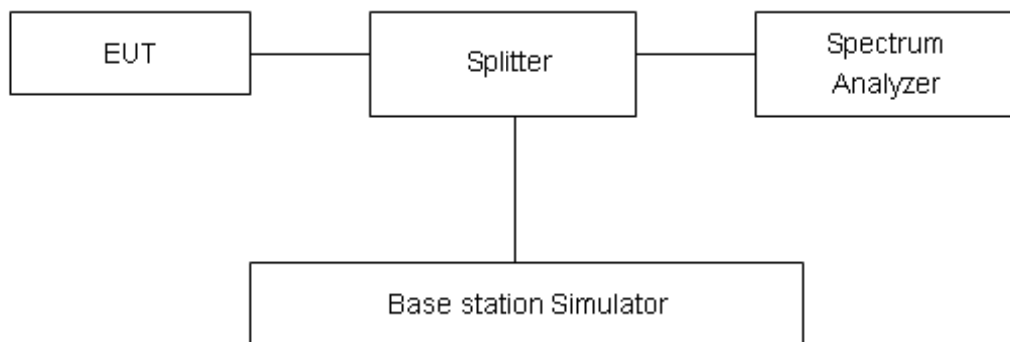
| Temperature | Relative humidity | Pressure |
|-------------|-------------------|----------|
| 23°C ~25°C | 45%~50% | 101.5kPa |

Methods of Measurement

Measure the total peak power and record as PPk. And measure the total average power and record as PAvg. Both the peak and average power levels must be expressed in the same logarithmic units (e.g., dBm). Determine the PAPR from:

$$PAPR (dB) = PPk (dBm) - PAvg (dBm).$$

Test Setup



Limits

Rule Part 27.50(d)(5) Equipment employed must be authorized in accordance with the provisions of 24.51. Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (d)(6) of this section. 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.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 0.4$ dB.

Test Results

| Mode | Bandwidth | Modulation | Channel/ Frequency(MHz) | Peak-to-Average Power Ratio (PAPR) | | |
|-------|-----------|--------------|----------------------------|---------------------------------------|----------|----------|
| | | | | Peak(dBm) | Avg(dBm) | PAPR(dB) |
| Band4 | 1.4MHz | QPSK | 20175/1732.5 | 33.37 | 22.09 | 11.28 |
| | | 16QAM | 20175/1732.5 | 34.13 | 22.03 | 12.10 |
| | 3MHz | QPSK | 20175/1732.5 | 33.56 | 22.13 | 11.43 |
| | | 16QAM | 20175/1732.5 | 33.94 | 22.07 | 11.87 |
| | 5MHz | QPSK | 20175/1732.5 | 32.06 | 22.12 | 9.94 |
| | | 16QAM | 20175/1732.5 | 32.62 | 22.03 | 10.59 |
| | 10MHz | QPSK | 20175/1732.5 | 31.69 | 22.14 | 9.55 |
| | | 16QAM | 20175/1732.5 | 32.14 | 22.08 | 10.06 |
| | 15MHz | QPSK | 20175/1732.5 | 30.77 | 22.10 | 8.67 |
| | | 16QAM | 20175/1732.5 | 30.68 | 22.03 | 8.65 |
| 20MHz | QPSK | 20175/1732.5 | 30.92 | 22.05 | 8.87 | |
| | 16QAM | 20175/1732.5 | 31.17 | 21.99 | 9.18 | |

| Mode | Bandwidth | Modulation | Channel/ Frequency(MHz) | Peak-to-Average Power Ratio (PAPR) | | |
|--------|-----------|------------|----------------------------|---------------------------------------|----------|----------|
| | | | | Peak(dBm) | Avg(dBm) | PAPR(dB) |
| Band12 | 1.4MHz | QPSK | 23095/707.5 | 32.63 | 22.66 | 9.97 |
| | | 16QAM | 23095/707.5 | 34.21 | 22.90 | 11.31 |
| | 3MHz | QPSK | 23095/707.5 | 32.56 | 22.68 | 9.88 |
| | | 16QAM | 23095/707.5 | 33.51 | 22.95 | 10.56 |
| | 5MHz | QPSK | 23095/707.5 | 32.27 | 22.64 | 9.63 |
| | | 16QAM | 23095/707.5 | 33.75 | 22.90 | 10.85 |
| | 10MHz | QPSK | 23095/707.5 | 31.88 | 22.59 | 9.29 |
| | | 16QAM | 23095/707.5 | 32.03 | 22.86 | 9.17 |

| Mode | Bandwidth | Modulation | Channel/ Frequency(MHz) | Peak-to-Average Power Ratio (PAPR) | | |
|--------|-----------|------------|----------------------------|---------------------------------------|----------|----------|
| | | | | Peak(dBm) | Avg(dBm) | PAPR(dB) |
| Band13 | 5MHz | QPSK | 23230/782 | 32.64 | 22.68 | 9.96 |
| | | 16QAM | 23230/782 | 32.23 | 22.19 | 10.04 |
| | 10MHz | QPSK | 23230/782 | 32.46 | 22.77 | 9.69 |
| | | 16QAM | 23230/782 | 32.68 | 22.95 | 9.73 |

5.6 Frequency Stability

Ambient condition

| Temperature | Relative humidity | Pressure |
|-------------|-------------------|----------|
| 23°C ~25°C | 45%~50% | 101.5kPa |

Method of Measurement

1. Frequency Stability (Temperature Variation)

The temperature inside the climate chamber is varied from -40°C to +85°C in 10°C step size.

(1) With all power removed, the temperature was decreased to -10°C and permitted to stabilize for three hours.

(2) Measure the carrier frequency with the test equipment in a “call mode”. These measurements should be made within 1 minute of powering up the mobile station, to prevent significant self warming.

(3) Repeat the above measurements at 10°C increments from -40°C to +85°C. Allow at least 1.5 hours at each temperature, un-powered, before making measurements.

2. Frequency Stability (Voltage Variation)

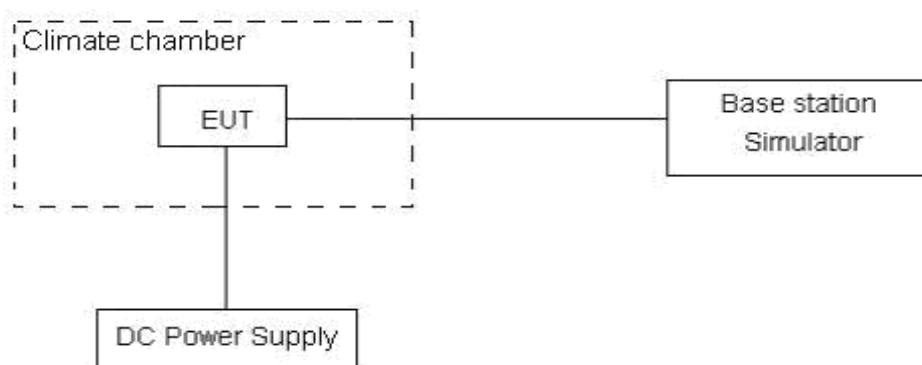
The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery-operating end point which shall be specified by the manufacturer.

This transceiver is specified to operate with an input voltage of between 3.3 V and 4.3 V, with a nominal voltage of 3.8V.

Test setup



Limits

No specific frequency stability requirements in part 27.54

Measurement Uncertainty

The assessed measurement uncertainty to ensure 99.75% confidence level for the normal distribution is with the coverage factor $k = 3$, $U=0.01$ ppm.

Test Result

| Bandwidth | Test status | LTE Band 4 Channel 20175 Test Results (ppm) | |
|-----------|----------------------|---------------------------------------------|----------|
| | | QPSK | 16QAM |
| 1.4MHz | -40°C/Normal Voltage | -0.00444 | -0.01766 |
| | -30°C/Normal Voltage | -0.00386 | -0.01513 |
| | -20°C/Normal Voltage | -0.00514 | -0.02027 |
| | -10°C/Normal Voltage | -0.00174 | -0.01773 |
| | 0°C/Normal Voltage | -0.00164 | -0.01986 |
| | 10°C/Normal Voltage | -0.00239 | -0.00601 |
| | 20°C/Normal Voltage | 0.00020 | -0.00454 |
| | 30°C/Normal Voltage | -0.00166 | -0.00570 |
| | 40°C/Normal Voltage | -0.00035 | -0.00673 |
| | 50°C/Normal Voltage | 0.00115 | -0.01853 |
| | 60°C/Normal Voltage | -0.00061 | -0.00405 |
| | 70°C/Normal Voltage | -0.00411 | -0.01242 |
| | 80°C/Normal Voltage | -0.00212 | -0.02252 |
| | 85°C/Normal Voltage | -0.00124 | -0.00496 |
| | 20°C/Min Voltage | -0.00300 | -0.00576 |
| | 20°C/Max Voltage | -0.00315 | -0.00454 |
| 3MHz | -40°C/Normal Voltage | -0.00127 | -0.00275 |
| | -30°C/Normal Voltage | -0.00184 | -0.00448 |
| | -20°C/Normal Voltage | 0.00117 | 0.01527 |
| | -10°C/Normal Voltage | 0.00008 | 0.01465 |
| | 0°C/Normal Voltage | -0.00119 | -0.00583 |
| | 10°C/Normal Voltage | -0.00255 | -0.01694 |
| | 20°C/Normal Voltage | -0.00071 | -0.00506 |
| | 30°C/Normal Voltage | -0.00063 | -0.00412 |
| | 40°C/Normal Voltage | -0.00178 | -0.00533 |
| | 50°C/Normal Voltage | -0.00078 | -0.00294 |
| | 60°C/Normal Voltage | -0.00163 | -0.01732 |
| | 70°C/Normal Voltage | -0.00091 | 0.01451 |
| | 80°C/Normal Voltage | -0.00111 | -0.00443 |
| | 85°C/Normal Voltage | 0.00137 | -0.00253 |
| | 20°C/Min Voltage | 0.00068 | -0.00301 |
| | 20°C/Max Voltage | -0.00234 | -0.00293 |
| 5MHz | -40°C/Normal Voltage | 0.00119 | -0.00739 |
| | -30°C/Normal Voltage | 0.00248 | -0.00478 |
| | -20°C/Normal Voltage | 0.00018 | -0.00477 |
| | -10°C/Normal Voltage | -0.00357 | 0.00540 |



| | | | |
|---------------------|----------------------|----------|----------|
| | 0°C/Normal Voltage | 0.00002 | -0.00554 |
| | 10°C/Normal Voltage | 0.00259 | -0.00377 |
| | 20°C/Normal Voltage | -0.00129 | -0.00622 |
| | 30°C/Normal Voltage | -0.00012 | -0.00676 |
| | 40°C/Normal Voltage | 0.00036 | 0.00380 |
| | 50°C/Normal Voltage | -0.00119 | -0.00579 |
| | 60°C/Normal Voltage | -0.00008 | -0.00890 |
| | 70°C/Normal Voltage | -0.00115 | -0.00618 |
| | 80°C/Normal Voltage | -0.00023 | -0.00478 |
| | 85°C/Normal Voltage | -0.00179 | -0.00302 |
| | 20°C/Min Voltage | -0.00188 | 0.00584 |
| | 20°C/Max Voltage | -0.00266 | 0.00141 |
| 10MHz | -40°C/Normal Voltage | 0.00069 | 0.00372 |
| | -30°C/Normal Voltage | 0.00066 | 0.00297 |
| | -20°C/Normal Voltage | -0.00119 | 0.01093 |
| | -10°C/Normal Voltage | -0.00178 | 0.00982 |
| | 0°C/Normal Voltage | 0.00127 | 0.00394 |
| | 10°C/Normal Voltage | 0.00330 | 0.00301 |
| | 20°C/Normal Voltage | 0.00152 | 0.01114 |
| | 30°C/Normal Voltage | 0.00156 | 0.00070 |
| | 40°C/Normal Voltage | 0.00224 | 0.01124 |
| | 50°C/Normal Voltage | 0.00122 | 0.00386 |
| | 60°C/Normal Voltage | -0.00124 | 0.00870 |
| | 70°C/Normal Voltage | -0.00087 | 0.01063 |
| | 80°C/Normal Voltage | -0.00141 | 0.00606 |
| | 85°C/Normal Voltage | -0.00106 | 0.00305 |
| 20°C/Min Voltage | -0.00190 | 0.00424 | |
| 20°C/Max Voltage | -0.00160 | 0.01408 | |
| 15MHz | -40°C/Normal Voltage | 0.00057 | -0.00057 |
| | -30°C/Normal Voltage | -0.00003 | 0.00023 |
| | -20°C/Normal Voltage | 0.00023 | 0.00077 |
| | -10°C/Normal Voltage | -0.00110 | -0.00147 |
| | 0°C/Normal Voltage | 0.00182 | -0.00067 |
| | 10°C/Normal Voltage | -0.00091 | 0.00086 |
| | 20°C/Normal Voltage | 0.00169 | -0.00042 |
| | 30°C/Normal Voltage | 0.00042 | -0.00301 |
| | 40°C/Normal Voltage | -0.00143 | -0.00330 |
| | 50°C/Normal Voltage | 0.00126 | -0.00059 |
| | 60°C/Normal Voltage | 0.00121 | -0.00017 |
| 70°C/Normal Voltage | -0.00056 | -0.00046 | |



| | | | |
|-------|----------------------|----------|----------|
| | 80°C/Normal Voltage | 0.00105 | 0.00106 |
| | 85°C/Normal Voltage | 0.00025 | -0.00055 |
| | 20°C/Min Voltage | -0.00002 | -0.00061 |
| | 20°C/Max Voltage | 0.00123 | -0.00216 |
| 20MHz | -40°C/Normal Voltage | -0.00081 | -0.02835 |
| | -30°C/Normal Voltage | -0.00053 | -0.02789 |
| | -20°C/Normal Voltage | -0.00130 | -0.02891 |
| | -10°C/Normal Voltage | 0.00002 | -0.02948 |
| | 0°C/Normal Voltage | -0.00100 | -0.02863 |
| | 10°C/Normal Voltage | 0.00290 | -0.02879 |
| | 20°C/Normal Voltage | -0.00079 | -0.02917 |
| | 30°C/Normal Voltage | -0.00088 | -0.03142 |
| | 40°C/Normal Voltage | -0.00241 | -0.03015 |
| | 50°C/Normal Voltage | 0.00066 | -0.02809 |
| | 60°C/Normal Voltage | 0.00032 | -0.02992 |
| | 70°C/Normal Voltage | -0.00111 | -0.02986 |
| | 80°C/Normal Voltage | 0.00077 | -0.02887 |
| | 85°C/Normal Voltage | -0.00151 | -0.03063 |
| | 20°C/Min Voltage | -0.00136 | -0.02918 |
| | 20°C/Max Voltage | 0.00297 | -0.02678 |

| Bandwidth | Test status | LTE Band 12 Channel 23095 Test Results (ppm) | |
|-----------|----------------------|----------------------------------------------|----------|
| | | QPSK | 16QAM |
| 1.4M | -40°C/Normal Voltage | -0.00582 | -0.00338 |
| | -30°C/Normal Voltage | -0.00315 | -0.01134 |
| | -20°C/Normal Voltage | -0.00743 | -0.00290 |
| | -10°C/Normal Voltage | -0.01025 | -0.00325 |
| | 0°C/Normal Voltage | -0.00144 | -0.00519 |
| | 10°C/Normal Voltage | -0.00079 | -0.00345 |
| | 20°C/Normal Voltage | -0.00287 | -0.00647 |
| | 30°C/Normal Voltage | -0.00308 | -0.00445 |
| | 40°C/Normal Voltage | -0.00445 | -0.00366 |
| | 50°C/Normal Voltage | -0.00411 | 0.00037 |
| | 60°C/Normal Voltage | -0.00223 | 0.00114 |
| | 70°C/Normal Voltage | -0.00192 | 0.00225 |
| | 80°C/Normal Voltage | -0.00257 | -0.00076 |
| | 85°C/Normal Voltage | -0.00143 | -0.00016 |
| | 20°C/Min Voltage | 0.00037 | 0.00018 |
| | 20°C/Max Voltage | -0.00075 | -0.00814 |
| 3M | -40°C/Normal Voltage | -0.00160 | -0.02580 |
| | -30°C/Normal Voltage | -0.00225 | -0.02440 |
| | -20°C/Normal Voltage | -0.00334 | -0.02595 |
| | -10°C/Normal Voltage | -0.00411 | -0.02786 |
| | 0°C/Normal Voltage | -0.00343 | -0.02806 |
| | 10°C/Normal Voltage | -0.00035 | -0.02717 |
| | 20°C/Normal Voltage | -0.00117 | -0.03013 |
| | 30°C/Normal Voltage | -0.00107 | -0.02297 |
| | 40°C/Normal Voltage | -0.00177 | -0.02185 |
| | 50°C/Normal Voltage | 0.00148 | -0.03153 |
| | 60°C/Normal Voltage | -0.00040 | -0.02669 |
| | 70°C/Normal Voltage | 0.00119 | -0.02451 |
| | 80°C/Normal Voltage | -0.00037 | -0.02336 |
| | 85°C/Normal Voltage | -0.00083 | -0.02500 |
| | 20°C/Min Voltage | -0.00392 | -0.02601 |
| | 20°C/Max Voltage | -0.00034 | -0.02301 |
| 5MHz | -40°C/Normal Voltage | -0.00300 | -0.03608 |
| | -30°C/Normal Voltage | -0.00358 | -0.03801 |
| | -20°C/Normal Voltage | -0.00165 | -0.04188 |
| | -10°C/Normal Voltage | -0.00182 | -0.03238 |
| | 0°C/Normal Voltage | -0.00225 | -0.02841 |



| | | | |
|------------------|----------------------|----------|----------|
| | 10°C/Normal Voltage | -0.00376 | -0.04006 |
| | 20°C/Normal Voltage | -0.00023 | -0.02157 |
| | 30°C/Normal Voltage | -0.00059 | -0.01495 |
| | 40°C/Normal Voltage | -0.00177 | -0.01673 |
| | 50°C/Normal Voltage | -0.00110 | -0.02314 |
| | 60°C/Normal Voltage | -0.00414 | -0.02293 |
| | 70°C/Normal Voltage | 0.00170 | -0.02475 |
| | 80°C/Normal Voltage | 0.00024 | -0.01739 |
| | 85°C/Normal Voltage | -0.00040 | -0.02205 |
| | 20°C/Min Voltage | 0.00365 | -0.03228 |
| | 20°C/Max Voltage | -0.00274 | -0.03902 |
| 10MHz | -40°C/Normal Voltage | -0.00411 | 0.00379 |
| | -30°C/Normal Voltage | -0.00327 | 0.00582 |
| | -20°C/Normal Voltage | -0.00362 | -0.00310 |
| | -10°C/Normal Voltage | -0.00174 | -0.00280 |
| | 0°C/Normal Voltage | -0.00083 | -0.00351 |
| | 10°C/Normal Voltage | -0.00202 | 0.00114 |
| | 20°C/Normal Voltage | -0.00194 | 0.00220 |
| | 30°C/Normal Voltage | -0.00016 | -0.00488 |
| | 40°C/Normal Voltage | -0.00100 | -0.00423 |
| | 50°C/Normal Voltage | -0.00232 | 0.00377 |
| | 60°C/Normal Voltage | -0.00271 | -0.00411 |
| | 70°C/Normal Voltage | -0.00400 | -0.00150 |
| | 80°C/Normal Voltage | 0.00120 | 0.00522 |
| | 85°C/Normal Voltage | -0.00137 | 0.00083 |
| | 20°C/Min Voltage | 0.00259 | -0.00408 |
| 20°C/Max Voltage | -0.00250 | 0.00533 | |



| Bandwidth | Test status | LTE Band 13 Channel 23230 Test Results (ppm) | |
|-----------|----------------------|----------------------------------------------|----------|
| | | QPSK | 16QAM |
| 5MHz | -40°C/Normal Voltage | 0.00022 | -0.02604 |
| | -30°C/Normal Voltage | -0.00203 | -0.02249 |
| | -20°C/Normal Voltage | -0.00272 | -0.00797 |
| | -10°C/Normal Voltage | -0.00165 | 0.03445 |
| | 0°C/Normal Voltage | -0.00018 | 0.03297 |
| | 10°C/Normal Voltage | -0.00093 | -0.02716 |
| | 20°C/Normal Voltage | -0.00330 | -0.03679 |
| | 30°C/Normal Voltage | -0.00271 | -0.00685 |
| | 40°C/Normal Voltage | -0.00263 | -0.00830 |
| | 50°C/Normal Voltage | -0.00049 | -0.01060 |
| | 60°C/Normal Voltage | -0.00203 | -0.01101 |
| | 70°C/Normal Voltage | 0.00084 | -0.01442 |
| | 80°C/Normal Voltage | 0.00040 | -0.02146 |
| | 85°C/Normal Voltage | -0.00301 | -0.02216 |
| | 20°C/Min Voltage | -0.00225 | -0.02006 |
| | 20°C/Max Voltage | -0.00334 | -0.02955 |
| 10MHz | -40°C/Normal Voltage | -0.00396 | -0.01558 |
| | -30°C/Normal Voltage | -0.00301 | -0.01306 |
| | -20°C/Normal Voltage | -0.00224 | -0.01606 |
| | -10°C/Normal Voltage | -0.00465 | -0.01453 |
| | 0°C/Normal Voltage | -0.00260 | -0.01353 |
| | 10°C/Normal Voltage | -0.00377 | -0.01633 |
| | 20°C/Normal Voltage | 0.00173 | -0.01482 |
| | 30°C/Normal Voltage | 0.00276 | -0.01651 |
| | 40°C/Normal Voltage | -0.00032 | -0.01604 |
| | 50°C/Normal Voltage | -0.00161 | -0.01311 |
| | 60°C/Normal Voltage | -0.00087 | -0.01611 |
| | 70°C/Normal Voltage | -0.00093 | -0.01573 |
| | 80°C/Normal Voltage | 0.00185 | -0.01488 |
| | 85°C/Normal Voltage | 0.00023 | -0.01517 |
| | 20°C/Min Voltage | -0.00132 | -0.01306 |
| | 20°C/Max Voltage | -0.00390 | -0.01573 |

5.7 Spurious Emissions at Antenna Terminals

Ambient condition

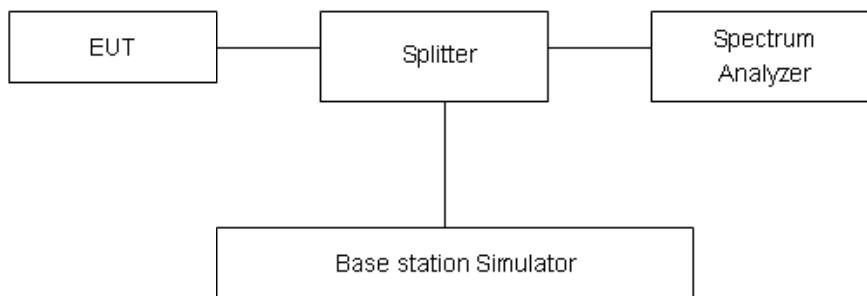
| Temperature | Relative humidity | Pressure |
|-------------|-------------------|----------|
| 23°C ~25°C | 45%~50% | 101.5kPa |

Method of Measurement

The EUT was connected to Spectrum Analyzer and Base Station Simulator via power Splitter. The measurement is carried out using a spectrum analyzer. The spectrum analyzer scans from 30MHz to the 10th harmonic of the carrier. The peak detector is used. Set RBW 1MHz and VBW3MHz, Sweep is set to ATUO.

Of those disturbances below (limit – 20 dB), the mark is not required for the EUT.

Test setup



Limits

LTE -4 Rule Part 27.53(h) specifies that “for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log₁₀ (P) dB..”

LTE -12 Rule Part 27.53 (g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

LTE -13 Rule Part 27.53(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to –70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and –80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be



tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

LTE B4/12 Limit

| | |
|-------|---------|
| Limit | -13 dBm |
|-------|---------|

LTE B13 Limit

| | |
|-------------------------------------|---------|
| Limit out of the band 1559-1610 MHz | -13 dBm |
| Limit in the band 1559-1610 MHz | -40 dBm |

Measurement Uncertainty

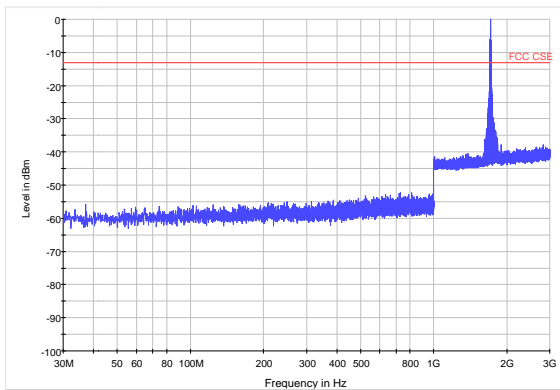
The assessed measurement uncertainty to ensure 99.75% confidence level for the normal distribution is with the coverage factor $k = 1.96$.

| Frequency | Uncertainty |
|---------------|-------------|
| 100kHz-2GHz | 0.684 dB |
| 2GHz-12.75GHz | 1.407 dB |

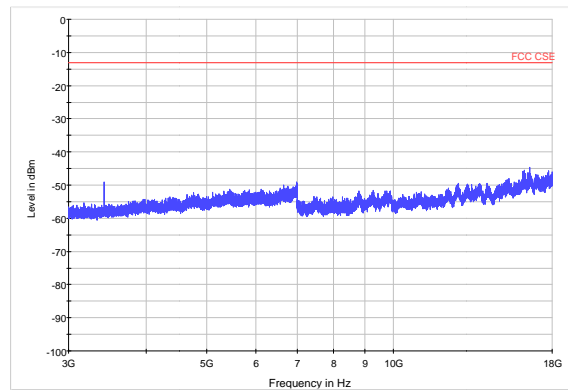


Test Result: PASS

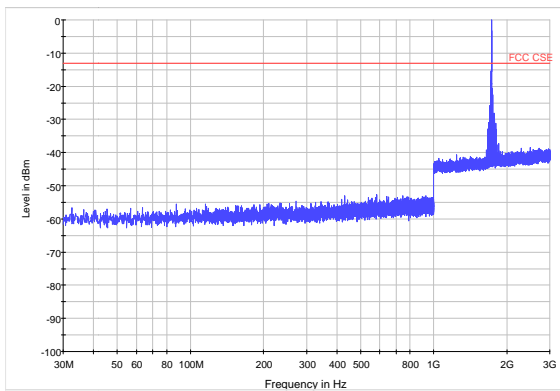
LTE Band 4 1.4MHz CH-Low 30MHz~3GHz



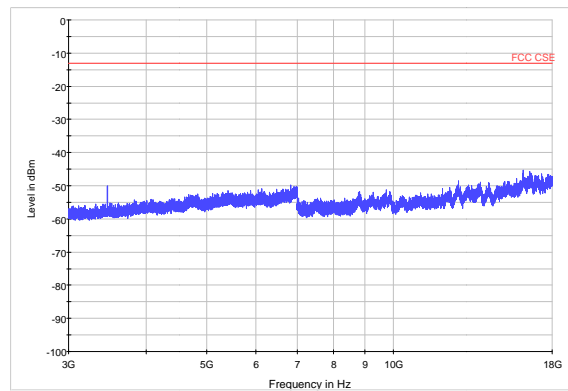
LTE Band 4 1.4MHz CH-Low 3GHz~18GHz



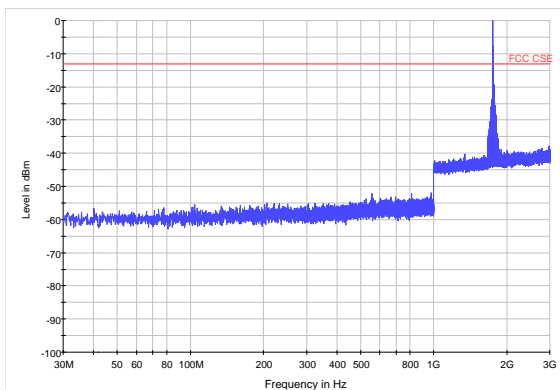
LTE Band 4 1.4MHz CH-Middle 30MHz~3GHz



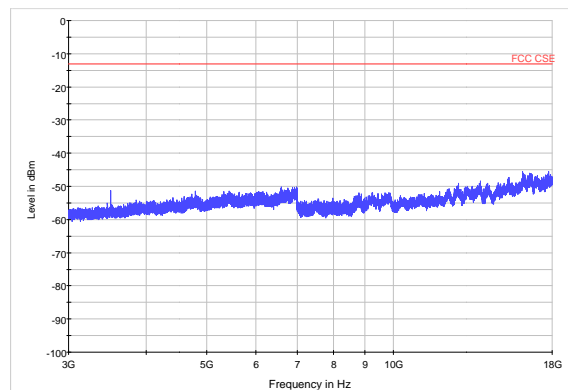
LTE Band 4 1.4MHz CH-Middle 3GHz~18GHz



LTE Band 4 1.4MHz CH-High 30MHz~3GHz

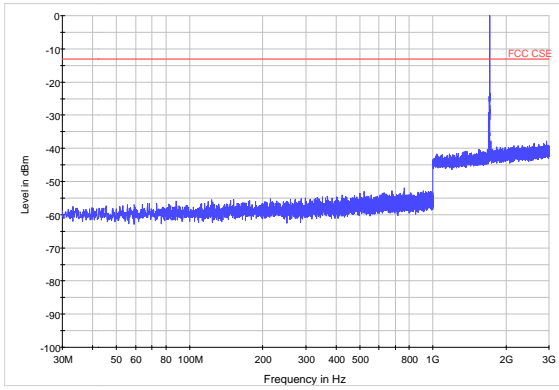


LTE Band 4 1.4MHz CH-High 3GHz~18GHz

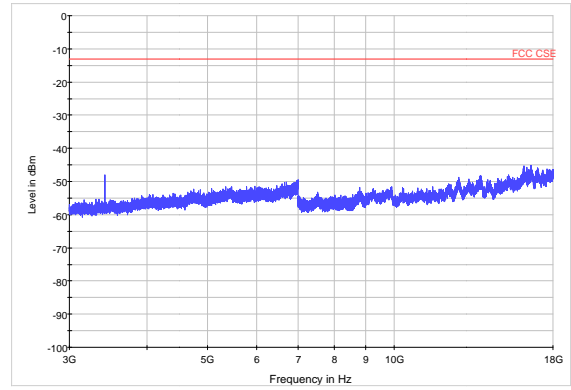




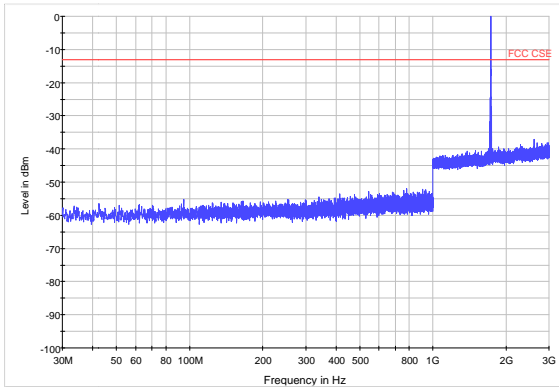
LTE Band 4 3MHz CH-Low 30MHz~3GHz



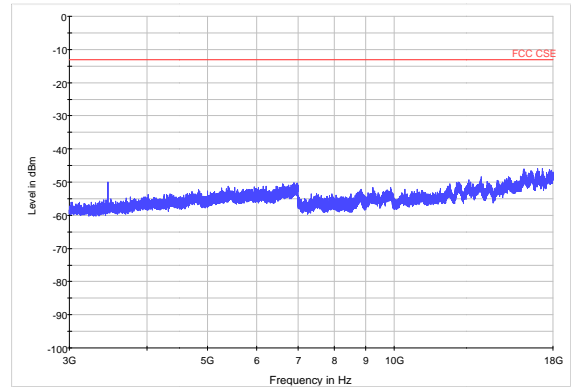
LTE Band 4 3MHz CH-Low 3GHz~18GHz



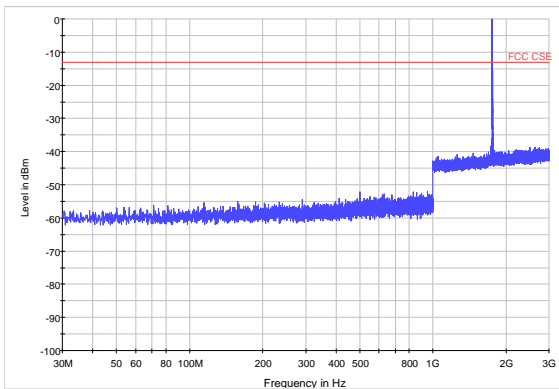
LTE Band 4 3MHz CH-Middle 30MHz~3GHz



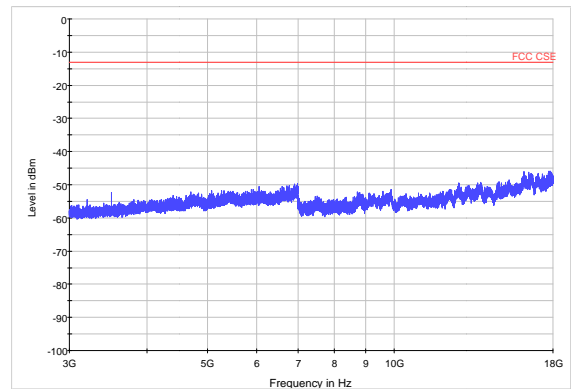
LTE Band 4 3MHz CH-Middle 3GHz~18GHz



LTE Band 4 3MHz CH-High 30MHz~3GHz

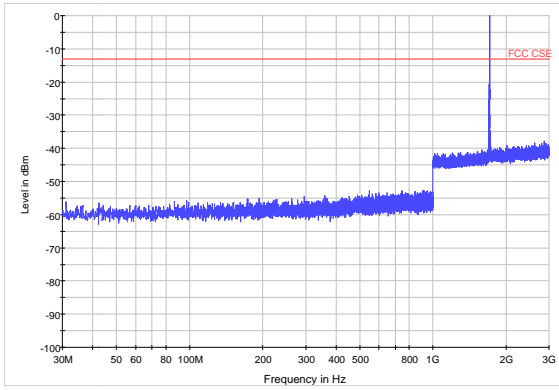


LTE Band 4 3MHz CH-High 3GHz~18GHz

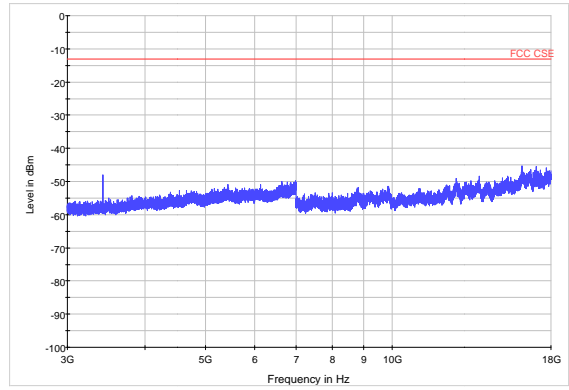




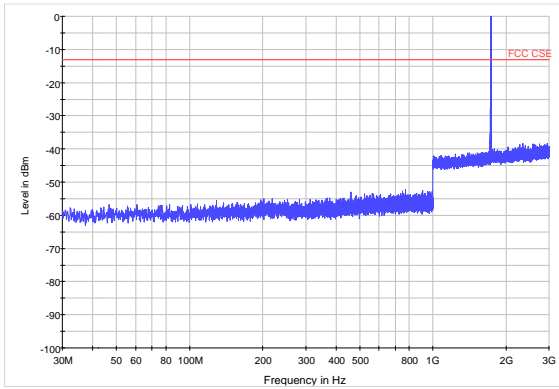
LTE Band 4 5MHz CH-Low 30MHz~3GHz



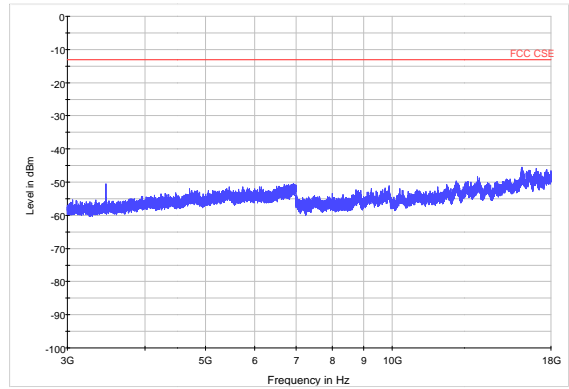
LTE Band 4 5MHz CH-Low 3GHz~18GHz



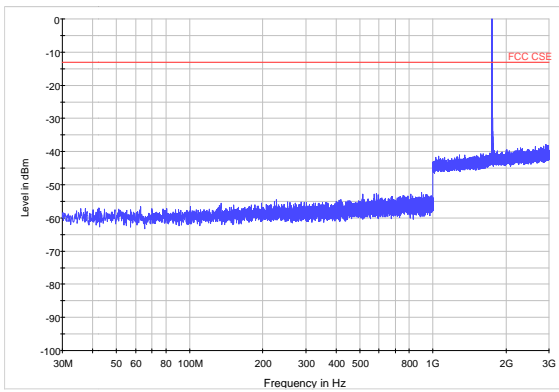
LTE Band 4 5MHz CH-Middle 30MHz~3GHz



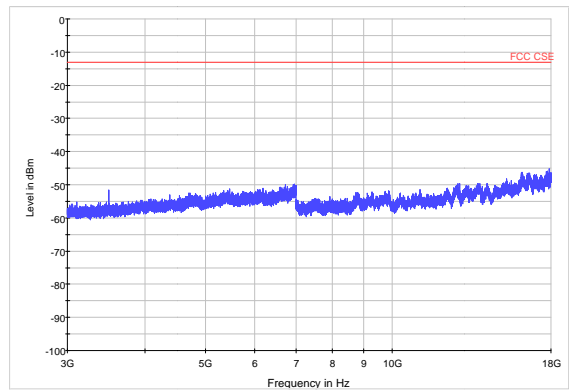
LTE Band 4 5MHz CH-Middle 3GHz~18GHz



LTE Band 4 5MHz CH-High 30MHz~3GHz

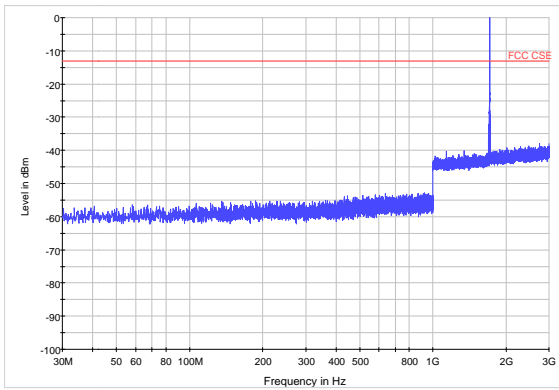


LTE Band 4 5MHz CH-High 3GHz~18GHz

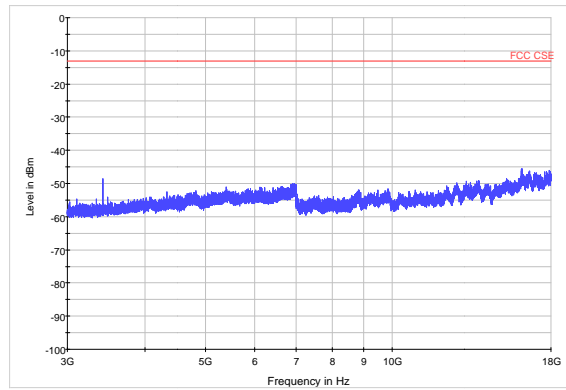




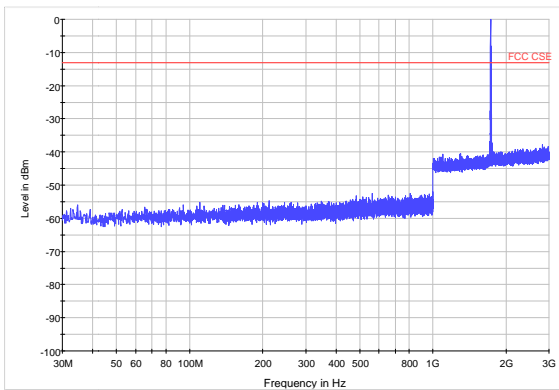
LTE Band 4 10MHz CH-Low 30MHz~3GHz



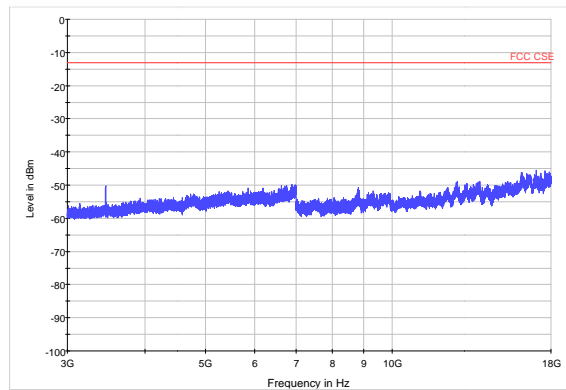
LTE Band 4 10MHz CH-Low 3GHz~18GHz



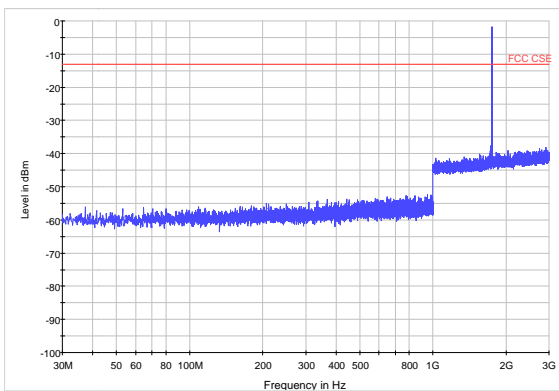
LTE Band 4 10MHz CH-Middle 30MHz~3GHz



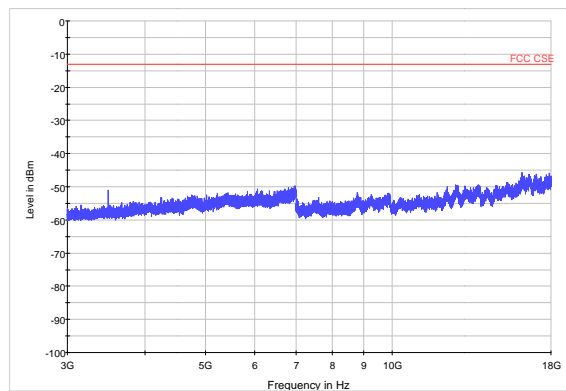
LTE Band 4 10MHz CH-Middle 3GHz~18GHz



LTE Band 4 10MHz CH-High 30MHz~3GHz

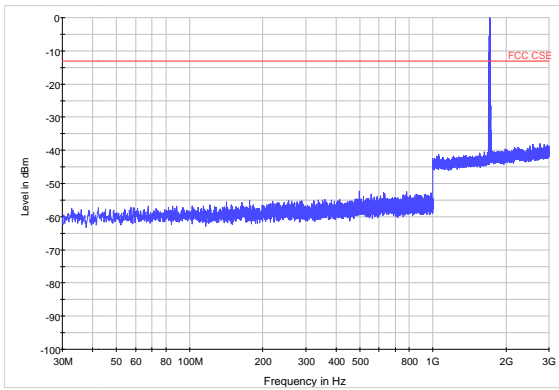


LTE Band 4 10MHz CH-High 3GHz~18GHz

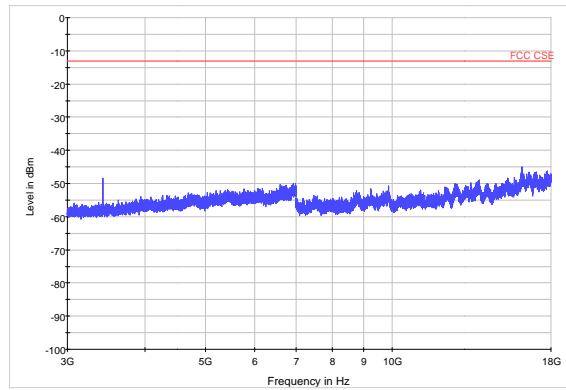




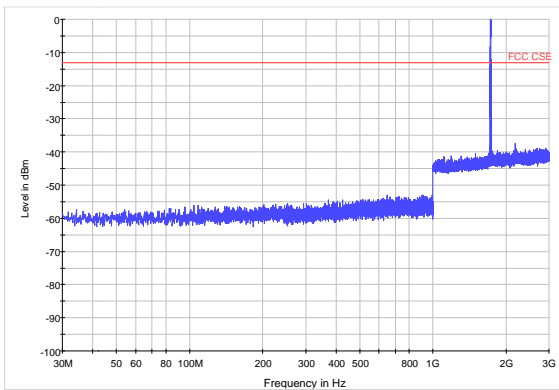
LTE Band 4 15MHz CH-Low 30MHz~3GHz



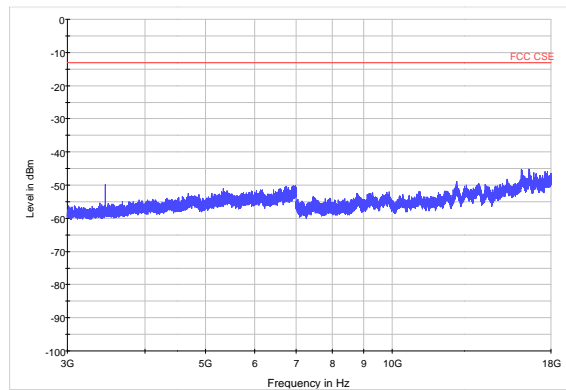
LTE Band 4 15MHz CH-Low 3GHz~18GHz



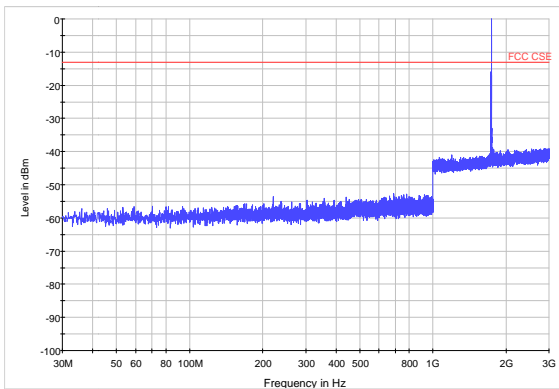
LTE Band 4 15MHz CH-Middle 30MHz~3GHz



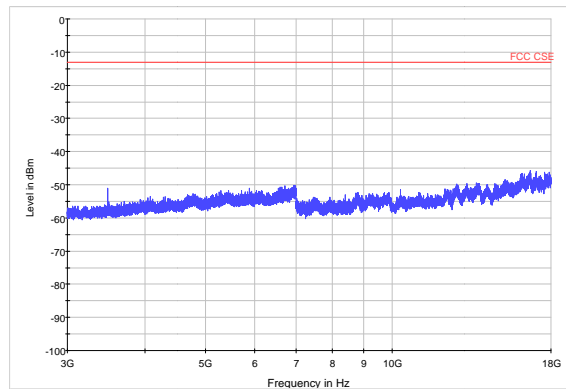
LTE Band 4 15MHz CH-Middle 3GHz~18GHz



LTE Band 4 15MHz CH-High 30MHz~3GHz

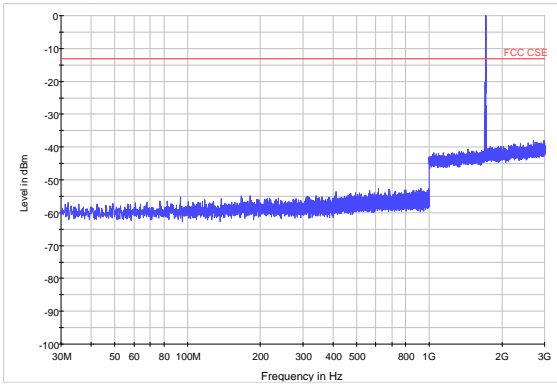


LTE Band 4 15MHz CH-High 3GHz~18GHz

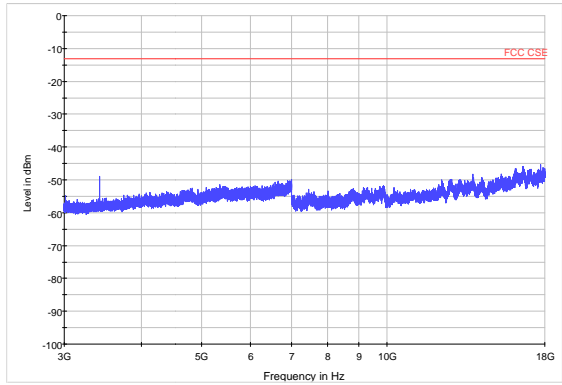




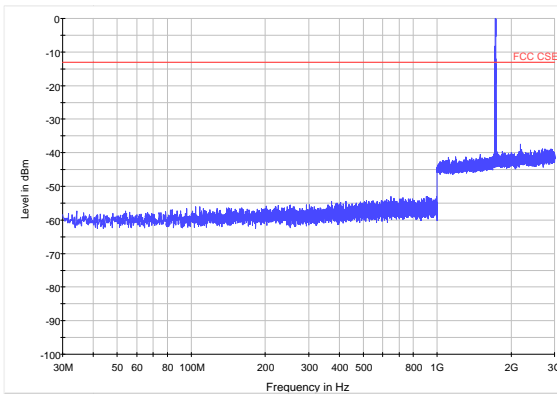
LTE Band 4 20MHz CH-Low 30MHz~3GHz



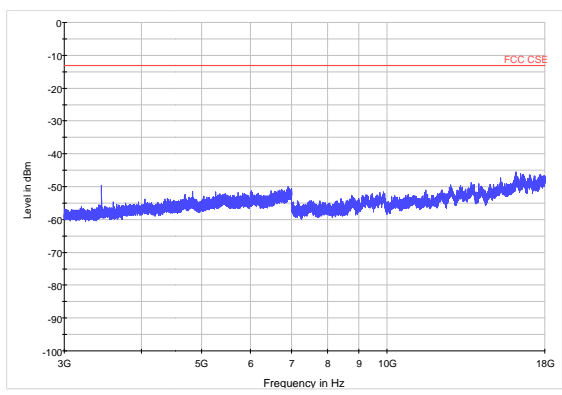
LTE Band 4 20MHz CH-Low 3GHz~18GHz



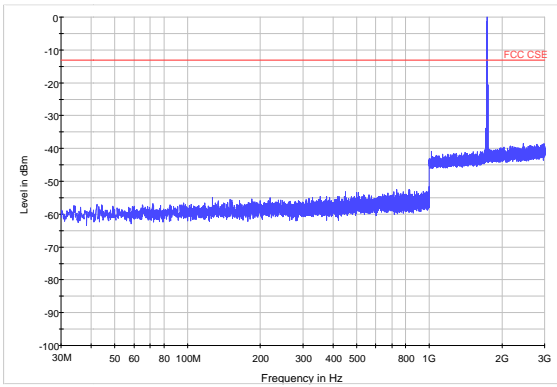
LTE Band 4 20MHz CH-Middle 30MHz~3GHz



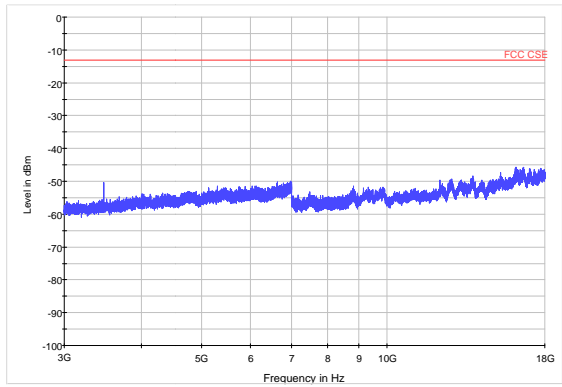
LTE Band 4 20MHz CH-Middle 3GHz~18GHz



LTE Band 4 20MHz CH-High 30MHz~3GHz

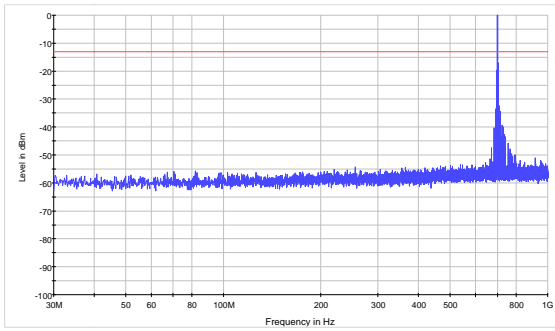


LTE Band 4 20MHz CH-High 3GHz~18GHz

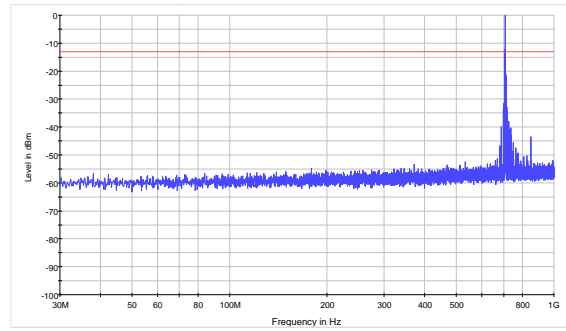




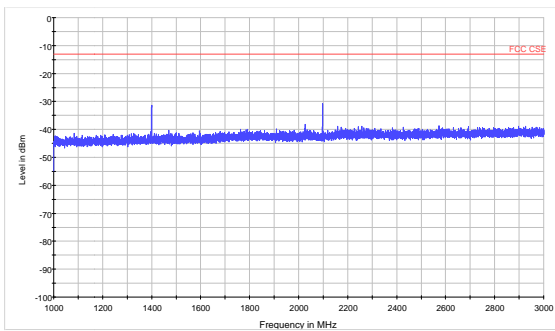
LTE Band 12 1.4MHz CH-Low 30MHz~1GHz



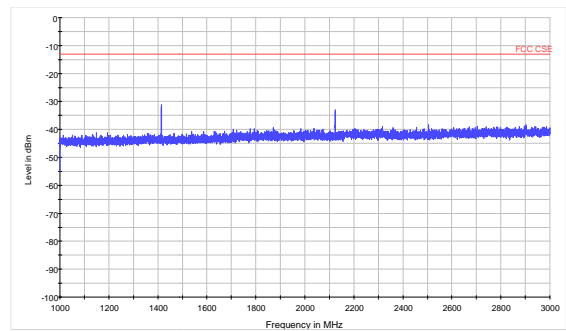
LTE Band 12 1.4MHz CH-Middle 30MHz~1GHz



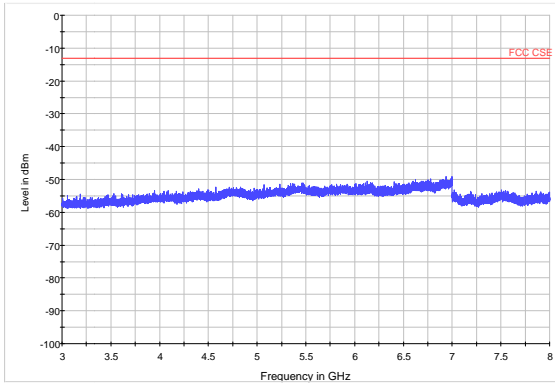
LTE Band 12 1.4MHz CH-Low 1GHz~3GHz



LTE Band 12 1.4MHz CH-Middle 1GHz~3GHz



LTE Band 12 1.4MHz CH-Low 3GHz~8GHz



LTE Band 12 1.4MHz CH-Middle 3GHz~8GHz

