# FCC RF Test Report

| | | |
|---|---|---|
| APPLICANT | : | SAFRAN Identity&Security |
| EQUIPMENT | : | MorphoTablet 2 |
| BRAND NAME | : | SAFRAN MORPHO |
| MODEL NAME | : | MPH-MB001A |
| FCC ID | : | ZBW-MPHMB001A |
| STANDARD | : | 47 CFR Part 2, 22(H), 24(E), 27(L), 27(M) |
| CLASSIFICATION | : | PCS Licensed Transmitter (PCB) |

**The product was received on Apr. 06, 2016 and completely tested on Jun. 03, 2016. We, SPORTON INTERNATIONAL (KUNSHAN) INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures given in ANSI / TIA / EIA-603-D-2010 and the testing has shown the tested sample to be in compliance with the applicable technical standards.**

**The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL (KUNSHAN) INC., the test report shall not be reproduced except in full.**

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2627

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**APPENDIX A. TEST RESULTS OF CONDUCTED TEST**

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# REVISION HISTORY

| REPORT NO. | VERSION | DESCRIPTION | ISSUED DATE |
|---|---|---|---|
| FG640601B | Rev. 01 | Initial issue of report | Jun. 28, 2016 |
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# SUMMARY OF TEST RESULT

| Report Section | FCC Rule | Description | Limit | Result | Remark |
|---|---|---|---|---|---|
| 3.4 | §2.1046 | Conducted Output Power | Reporting Only | PASS | - |
| 3.5 | §24.232(d) | Peak-to-Average Ratio | <13 dB | PASS | - |
| 3.6 | §2.1049 | Occupied Bandwidth | Reporting Only | PASS | - |
| 3.7 | §2.1051<br>§22.917(a)<br>§24.238(a)<br>§27.53(h) | Conducted Band Edge Measurement<br>(Band 2) (Band 4) (Band 5) | < 43+10log10(P[Watts]) | PASS | - |
| | §27.53(m)(4) | Conducted Band Edge Measurement<br>(Band 7) | §27.53(m)(4) | | |

| Report Section | FCC Rule | Description | Limit | Result | Remark |
|---|---|---|---|---|---|
| 3.8 | §2.1051<br>§22.917(a)<br>§24.238(a)<br>§27.53(h) | Conducted Spurious Emission<br>(Band 2) (Band 4) (Band 5) | < 43+10log10(P[Watts]) | PASS | - |
| | §2.1051<br>§27.53(m)(4) | Conducted Spurious Emission<br>(Band 7) | < 55+10log$_{10}$(P[Watts]) | | |
| 3.9 | §2.1055<br>§22.355 | Frequency Stability<br>Temperature & Voltage | < 2.5 ppm | PASS | - |
| | §2.1055<br>§24.235<br>§27.54 | | Within Authorized Band | | |
| 4.4 | §22.913(a)(2) | Effective Radiated Power<br>(Band 5) | ERP < 7 Watt | PASS | - |
| | §24.232(c)<br>§27.50(h)(2) | Equivalent Isotropic Radiated Power<br>(Band 2) (Band 7) | EIRP < 2Watt | | |
| | §27.50(d)(4) | Equivalent Isotropic Radiated Power<br>(Band 4) | EIRP < 1Watt | | |
| 4.5 | §2.1053<br>§22.917(a)<br>§24.238(a)<br>§27.53(h) | Radiated Spurious Emission<br>(Band 2) (Band 4) (Band 5) | < 43+10log$_{10}$(P[Watts]) | PASS | Under limit 15.46 dB at 7586.000 MHz |
| | §2.1053<br>§27.53(m)(4) | Radiated Spurious Emission<br>(Band 7) | < 55+10log$_{10}$(P[Watts]) | | |

# 1 General Description

## 1.1 Applicant

**SAFRAN Identity&Security**
11, boulevard Galliéni 92130 - Issy-les-Moulineaux France

## 1.2 Manufacturer

**SAFRAN Identity&Security**
11, boulevard Galliéni 92130 - Issy-les-Moulineaux France

## 1.3 Product Feature of Equipment Under Test

| Product Feature | |
|---|---|
| **Equipment** | MorphoTablet 2 |
| **Brand Name** | SAFRAN MORPHO |
| **Model Name** | MPH-MB001A |
| **FCC ID** | ZBW-MPHMB001A |
| **EUT supports Radios application** | GSM/GPRS/EGPRS(Downlink Only)/WCDMA/HSPA/<br>HSPA+(16QAM uplink is not supported)/DC-HSDPA/LTE/NFC/<br>WLAN2.4GHz 802.11b/g/n HT20/<br>Bluetooth v3.0+ EDR/Bluetooth v4.0 LE |
| **IMEI Code** | Conducted: 357079070007748<br>Radiation: 357079070000008/16<br>ERP/EIRP: 357079070006682 |
| **EUT Stage** | Identical Prototype |

## 1.4 Product Specification of Equipment Under Test

| Standards-related Product Specification | |
|---|---|
| **Tx Frequency** | LTE Band 2 : 1850.7 MHz ~ 1909.3 MHz<br>LTE Band 4 : 1710.7 MHz ~ 1754.3 MHz<br>LTE Band 5 : 824.7 MHz ~ 848.3 MHz<br>LTE Band 7 : 2502.5 MHz ~ 2567.5 MHz |
| **Rx Frequency** | LTE Band 2 : 1930.7 MHz ~ 1989.3 MHz<br>LTE Band 4 : 2110.7 MHz ~ 2154.3 MHz<br>LTE Band 5 : 869.7 MHz ~ 893.3 MHz<br>LTE Band 7 : 2622.5MHz ~ 2687.5 MHz |
| **Bandwidth** | LTE Band 2 : 1.4MHz / 3MHz / 5MHz / 10MHz / 15MHz / 20MHz<br>LTE Band 4 : 1.4MHz / 3MHz / 5MHz / 10MHz / 15MHz / 20MHz<br>LTE Band 5 : 1.4MHz / 3MHz / 5MHz / 10MHz<br>LTE Band 7 : 5MHz/ 10MHz / 15MHz / 20MHz |
| **Maximum Output Power to Antenna** | LTE Band 2 : 23.27 dBm<br>LTE Band 4 : 23.59 dBm<br>LTE Band 5 : 23.40 dBm<br>LTE Band 7 : 24.33 dBm |
| **Type of Modulation** | QPSK / 16QAM |

## 1.5 Modification of EUT

No modifications are made to the EUT during all test items.

## 1.6 Emission Designator

| LTE Band 2 | QPSK | | | 16QAM | | |
|---|---|---|---|---|---|---|
| BW(MHz) | Emission Designator (99%OBW) | Frequency Tolerance (ppm) | Maximum EIRP(W) | Emission Designator (99%OBW) | Frequency Tolerance (ppm) | Maximum EIRP(W) |
| 1.4 | 1M09G7D | - | 0.2056 | 1M10W7D | - | 0.1854 |
| 3 | 2M73G7D | - | 0.2118 | 2M72W7D | - | 0.1879 |
| 5 | 4M52G7D | - | 0.2123 | 4M53W7D | - | 0.1968 |
| 10 | 9M13G7D | 0.0022 | 0.2173 | 9M05W7D | - | 0.1746 |
| 15 | 13M4G7D | - | 0.2317 | 13M5W7D | - | 0.1766 |
| 20 | 18M4G7D | - | 0.2495 | 18M5W7D | - | 0.1905 |
| LTE Band 4 | QPSK | | | 16QAM | | |
| BW(MHz) | Emission Designator (99%OBW) | Frequency Tolerance (ppm) | Maximum EIRP(W) | Emission Designator (99%OBW) | Frequency Tolerance (ppm) | Maximum EIRP(W) |
| 1.4 | 1M09G7D | - | 0.3475 | 1M10W7D | - | 0.2404 |
| 3 | 2M73G7D | - | 0.3020 | 2M73W7D | - | 0.2472 |
| 5 | 4M51G7D | - | 0.3192 | 4M51W7D | - | 0.2286 |
| 10 | 9M09G7D | 0.0025 | 0.2944 | 9M05W7D | - | 0.2698 |
| 15 | 13M5G7D | - | 0.3236 | 13M4W7D | - | 0.2786 |
| 20 | 18M4G7D | - | 0.3221 | 18M6W7D | - | 0.2600 |

| LTE Band 5 | QPSK | | | 16QAM | | |
|---|---|---|---|---|---|---|
| BW(MHz) | Emission Designator (99%OBW) | Frequency Tolerance (ppm) | Maximum ERP(W) | Emission Designator (99%OBW) | Frequency Tolerance (ppm) | Maximum ERP(W) |
| 1.4 | 1M10G7D | - | 0.1352 | 1M09W7D | - | 0.1148 |
| 3 | 2M73G7D | - | 0.1426 | 2M73W7D | - | 0.1151 |
| 5 | 4M51G7D | - | 0.1578 | 4M51W7D | - | 0.1167 |
| 10 | 9M09G7D | 0.0075 | 0.1294 | 9M09W7D | - | 0.1300 |
| **LTE Band 7** | **QPSK** | | | **16QAM** | | |
| **BW(MHz)** | **Emission Designator (99%OBW)** | **Frequency Tolerance (ppm)** | **Maximum EIRP(W)** | **Emission Designator (99%OBW)** | **Frequency Tolerance (ppm)** | **Maximum EIRP(W)** |
| 5 | 4M54G7D | - | 0.2897 | 4M51W7D | - | 0.2280 |
| 10 | 9M07G7D | 0.0023 | 0.2877 | 9M05W7D | - | 0.2535 |
| 15 | 13M5G7D | - | 0.2979 | 13M5W7D | - | 0.2588 |
| 20 | 18M4G7D | - | 0.2729 | 18M5W7D | - | 0.2393 |

## 1.7 Testing Location

| Test Site | SPORTON INTERNATIONAL (KUNSHAN) INC. | | |
|---|---|---|---|
| Test Site Location | No. 3-2, PingXiang Road, Kunshan, Jiangsu Province, P. R. China<br>TEL: +86-0512-5790-0158<br>FAX: +86-0512-5790-0958 | | |
| Test Site No. | Sporton Site No. | | FCC Registration No. |
| | TH01-KS | 03CH02-KS | 418269 |

**Note:** The test site complies with ANSI C63.4 2014 requirement.

## 1.8 Applicable Standards

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

- 47 CFR Part 2, 22(H), 24(E), 27(L), 27(M)
- ANSI / TIA / EIA-603-D-2010
- FCC KDB 971168 D01 Power Meas. License Digital Systems v02r02

**Remark:**

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

# 2 Test Configuration of Equipment Under Test

## 2.1 Test Mode

Antenna port conducted and radiated test items listed below are performed according to KDB 971168 D01 Power Meas. License Digital Systems v02r02 with maximum output power.

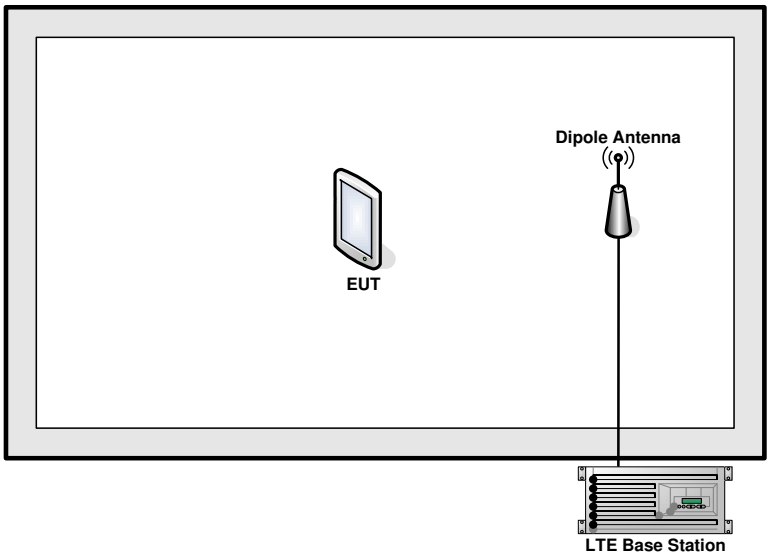
Radiated measurements are performed by rotating the EUT in three different orthogonal test planes to find the maximum emission.

| Test Items | Band | Bandwidth (MHz) | | | | | | Modulation | | RB # | | | Test Channel | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1.4 | 3 | 5 | 10 | 15 | 20 | QPSK | 16QAM | 1 | Half | Full | L | M | H |
| Max. Output Power | 2 | v | v | v | v | v | v | v | v | v | v | v | v | v | v |
| | 4 | v | v | v | v | v | v | v | v | v | v | v | v | v | v |
| | 5 | v | v | v | v | - | - | v | v | v | v | v | v | v | v |
| | 7 | - | - | v | v | v | v | v | v | v | v | v | v | v | v |
| Peak-to-Average Ratio | 2 | | | | | | v | v | v | v | | v | v | v | v |
| | 4 | | | | | | v | v | v | v | | v | v | v | v |
| | 5 | | | | v | - | - | v | v | v | | v | v | v | v |
| | 7 | - | - | | | | v | v | v | v | | v | v | v | v |
| 26dB and 99% Bandwidth | 2 | v | v | v | v | v | v | v | v | | | v | v | v | v |
| | 4 | v | v | v | v | v | v | v | v | | | v | v | v | v |
| | 5 | v | v | v | v | - | - | v | v | | | v | v | v | v |
| | 7 | - | - | v | v | v | v | v | v | | | v | v | v | v |
| Conducted Band Edge | 2 | v | v | v | v | v | v | v | v | v | | v | v | | v |
| | 4 | v | v | v | v | v | v | v | v | v | | v | v | | v |
| | 5 | v | v | v | v | - | - | v | v | v | | v | v | | v |
| | 7 | - | - | v | v | v | v | v | v | v | | v | v | | v |

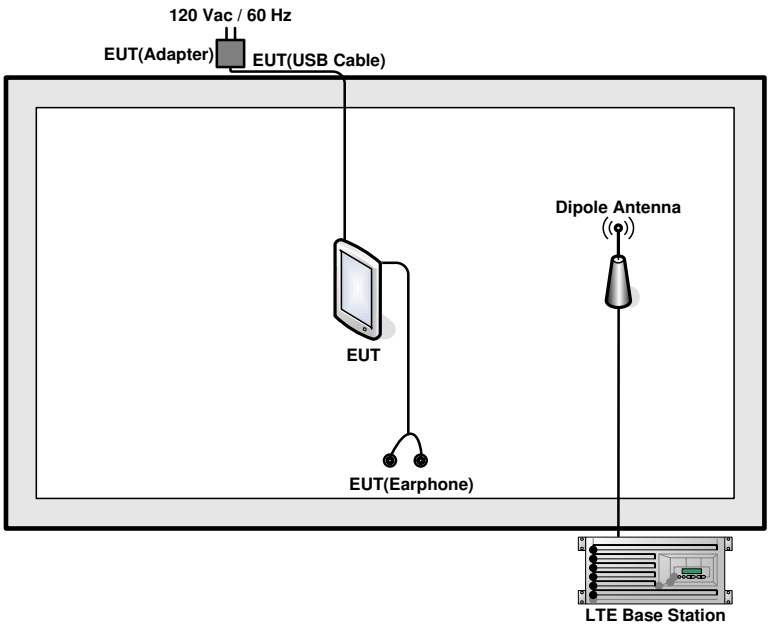
| Test Items | Band | Bandwidth (MHz) | | | | | | Modulation | | RB # | | | Test Channel | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1.4 | 3 | 5 | 10 | 15 | 20 | QPSK | 16QAM | 1 | Half | Full | L | M | H |
| Conducted Spurious Emission | 2 | v | v | v | v | v | v | v | v | v | v | | v | v | v |
| | 4 | v | v | v | v | v | v | v | v | v | v | | v | v | v |
| | 5 | v | v | v | v | - | - | v | v | v | v | | v | v | v |
| | 7 | - | - | v | v | v | v | v | v | v | | | v | v | v |
| Frequency Stability | 2 | | | | v | | | v | | | | v | | v | |
| | 4 | | | | v | | | v | | | | v | | v | |
| | 5 | | | | v | - | - | v | | | | v | | v | |
| | 7 | - | - | | v | | | v | | | | v | | v | |
| E.R.P./ E.I.R.P. | 2 | v | v | v | v | v | v | v | v | v | v | | v | v | v |
| | 4 | v | v | v | v | v | v | v | v | v | v | | v | v | v |
| | 5 | v | v | v | v | - | - | v | v | v | v | | v | v | v |
| | 7 | - | - | v | v | v | v | v | v | v | | | v | v | v |
| Radiated Spurious Emission | 2 | v | v | v | v | v | v | v | | v | | | | v | |
| | 4 | v | v | v | v | v | v | v | | v | | | | v | |
| | 5 | v | v | v | v | - | - | v | | v | | | | v | |
| | 7 | - | - | v | v | v | v | v | | v | | | | v | |
| Note | 1. The mark "v " means that this configuration is chosen for testing<br>2. The mark "-" means that this bandwidth is not supported.<br>3. The device is investigated from 30MHz to 10 times of fundamental signal for radiated spurious emission test under different RB size/offset and modulations in exploratory test. Subsequently, only the worst case emissions are reported. | | | | | | | | | | | | | | |

## 2.2 Connection Diagram of Test System

**LTE Band 2 / 5**




**LTE Band 4 / 7**



## 2.3 Support Unit used in test configuration and system

| Item | Equipment | Trade Name | Model No. | FCC ID | Data Cable | Power Cord |
|---|---|---|---|---|---|---|
| 1. | LTE Base Station | Anritsu | MT8820C | N/A | N/A | Unshielded, 1.8 m |
| 2. | DC Power Supply | GW INSTEK | GPD-2303S | N/A | N/A | Unshielded, 1.8 m |

## 2.4 Measurement Results Explanation Example

**For all conducted test items:**

The offset level is set in the spectrum analyzer to compensate the RF cable loss between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable loss.

*Offset = RF cable loss.*

Following shows an offset computation example with cable loss 5.0 dB.

Example :

*Offset(dB) = RF cable loss(dB).*

= 5.0 (dB)

## 2.5 Frequency List of Low/Middle/High Channels

| LTE Band 2 Channel and Frequency List | | | | |
|---|---|---|---|---|
| BW [MHz] | Channel/Frequency(MHz) | Lowest | Middle | Highest |
| 20 | Channel | 18700 | 18900 | 19100 |
| | Frequency | 1860 | 1880 | 1900 |
| 15 | Channel | 18675 | 18900 | 19125 |
| | Frequency | 1857.5 | 1880 | 1902.5 |
| 10 | Channel | 18650 | 18900 | 19150 |
| | Frequency | 1855 | 1880 | 1905 |
| 5 | Channel | 18625 | 18900 | 19175 |
| | Frequency | 1852.5 | 1880 | 1907.5 |
| 3 | Channel | 18615 | 18900 | 19185 |
| | Frequency | 1851.5 | 1880 | 1908.5 |
| 1.4 | Channel | 18607 | 18900 | 19193 |
| | Frequency | 1850.7 | 1880 | 1909.3 |

| LTE Band 4 Channel and Frequency List | | | | |
|---|---|---|---|---|
| BW [MHz] | Channel/Frequency(MHz) | Lowest | Middle | Highest |
| 20 | Channel | 20050 | 20175 | 20300 |
| | Frequency | 1720 | 1732.5 | 1745 |
| 15 | Channel | 20025 | 20175 | 20325 |
| | Frequency | 1717.5 | 1732.5 | 1747.5 |
| 10 | Channel | 20000 | 20175 | 20350 |
| | Frequency | 1715 | 1732.5 | 1750 |
| 5 | Channel | 19975 | 20175 | 20375 |
| | Frequency | 1712.5 | 1732.5 | 1752.5 |
| 3 | Channel | 19965 | 20175 | 20385 |
| | Frequency | 1711.5 | 1732.5 | 1753.5 |
| 1.4 | Channel | 19957 | 20175 | 20393 |
| | Frequency | 1710.7 | 1732.5 | 1754.3 |

| LTE Band 5 Channel and Frequency List | | | | |
|---|---|---|---|---|
| BW [MHz] | Channel/Frequency(MHz) | Lowest | Middle | Highest |
| 10 | Channel | 20450 | 20525 | 20600 |
| | Frequency | 829 | 836.5 | 844 |
| 5 | Channel | 20425 | 20525 | 20625 |
| | Frequency | 826.5 | 836.5 | 846.5 |
| 3 | Channel | 20415 | 20525 | 20635 |
| | Frequency | 825.5 | 836.5 | 847.5 |
| 1.4 | Channel | 20407 | 20525 | 20643 |
| | Frequency | 824.7 | 836.5 | 848.3 |

| LTE Band 7 Channel and Frequency List | | | | |
|---|---|---|---|---|
| BW [MHz] | Channel/Frequency(MHz) | Lowest | Middle | Highest |
| 20 | Channel | 20850 | 21100 | 21350 |
| | Frequency | 2510 | 2535 | 2560 |
| 15 | Channel | 20825 | 21100 | 21375 |
| | Frequency | 2507.5 | 2535 | 2562.5 |
| 10 | Channel | 20800 | 21100 | 21400 |
| | Frequency | 2505 | 2535 | 2565 |
| 5 | Channel | 20775 | 21100 | 21425 |
| | Frequency | 2502.5 | 2535 | 2567.5 |

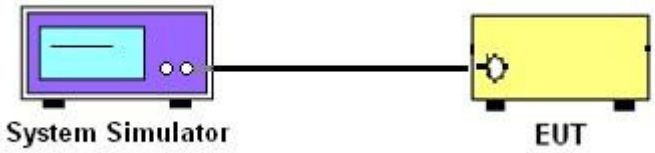
# 3 Conducted Test Items

## 3.1 Measuring Instruments

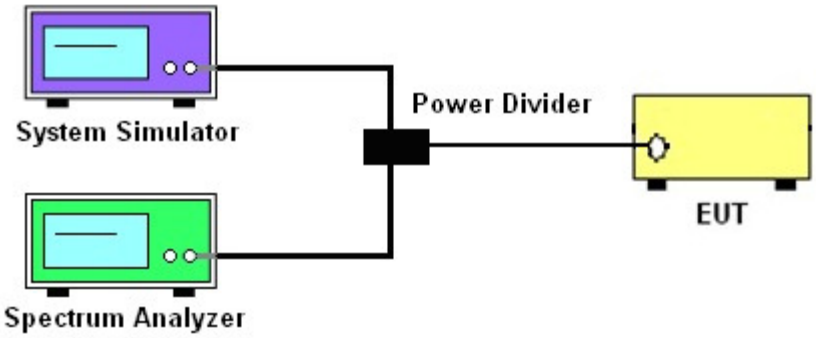
See list of measuring instruments of this test report.

## 3.2 Test Setup

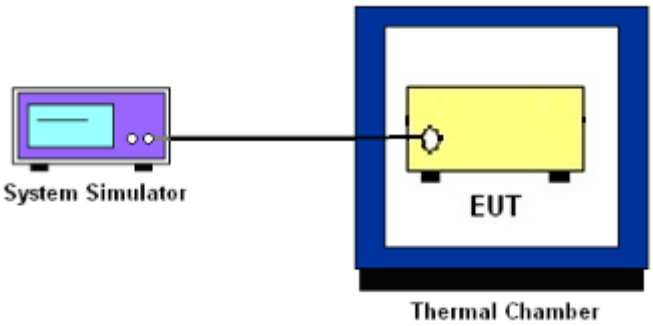
### 3.2.1 Conducted Output Power




### 3.2.2 Peak-to-Average Ratio, Occupied Bandwidth ,Conducted Band-Edge and Conducted Spurious Emission




### 3.2.3 Frequency Stability




## 3.3 Test Result of Conducted Test

Please refer to Appendix A.

## 3.4 Conducted Output Power

### 3.4.1 Description of the Conducted Output Power Measurement

A system simulator was used to establish communication with the EUT. Its parameters were set to force the EUT transmitting at maximum output power. The measured power in the radio frequency on the transmitter output terminals shall be reported.

### 3.4.2 Test Procedures

1. The transmitter output port was connected to the system simulator.
2. Set EUT at maximum power through the system simulator.
3. Select lowest, middle, and highest channels for each band and different modulation.
4. Measure and record the power level from the system simulator.

## 3.5 Peak-to-Average Ratio

### 3.5.1 Description of the PAR Measurement

Power Complementary Cumulative Distribution Function (CCDF) curves provide a means for characterizing the power peaks of a digitally modulated signal on a statistical basis. A CCDF curve depicts the probability of the peak signal amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument's resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth. 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.

### 3.5.2 Test Procedures

1. The testing follows FCC KDB 971168 v02r02 Section 5.7.1.
2. The EUT was connected to spectrum and system simulator via a power divider.
3. Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
4. The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.
5. Record the deviation as Peak to Average Ratio.

## 3.6 99% Occupied Bandwidth and 26dB Bandwidth Measurement

### 3.6.1 Description of 99% Occupied Bandwidth and 26dB Bandwidth Measurement

The occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean transmitted power.

The 26 dB emission bandwidth is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated 26 dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth equal to approximately 1.0% of the emission bandwidth.

### 3.6.2 Test Procedures

1. The testing follows FCC KDB 971168 v02r02 Section 4.2.
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be between two and five times the anticipated OBW.
4. The nominal resolution bandwidth (RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.
5. Set the detection mode to peak, and the trace mode to max hold.
6. Determine the reference value: Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace.
   (this is the reference value)
7. Determine the “-26 dB down amplitude” as equal to (Reference Value – X).
8. Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the “–X dB down amplitude” determined in step 6. If a marker is below this “-X dB down amplitude” value it shall be placed as close as possible to this value. The OBW is the positive frequency difference between the two markers.
9. Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.

# 3.7 Conducted Band Edge

## 3.7.1 Description of Conducted Band Edge Measurement

22.917(a) for Band 5

For operations in the 824 – 849 MHz band, the FCC limit is 43 + $10\log_{10}$(P[Watts]) dB below the transmitter power P(Watts) in a 100kHz bandwidth. However, in the 1MHz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

24.238 (a) for Band 2

For operations in the 1850-1910 and 1930-1990 MHz band, the FCC limit is 43 + $10\log_{10}$(P[Watts]) dB below the transmitter power P(Watts) in a 1MHz bandwidth. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

27.53 (h) for Band 4

For operations in the 1710 – 1755 MHz band, the FCC limit is 43 + $10\log_{10}$(P[Watts]) dB below the transmitter power P(Watts) in a 1 MHz bandwidth. However, in the 1MHz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed.

27.53(m)(4) for FCC Band 7:

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)(6) 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.

### 3.7.2 Test Procedures

1. The testing follows FCC KDB 971168 v02r02 Section 6.0.
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. The band edges of low and high channels for the highest RF powers were measured.
4. Set RBW >= 1% EBW in the 1MHz band immediately outside and adjacent to the band edge.
5. Beyond the 1 MHz band from the band edge, RBW=1MHz was used.
6. Set spectrum analyzer with RMS detector.
7. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
8. Checked that all the results comply with the emission limit line.

   Example:

   The limit line is derived from 43 + 10log(P)dB below the transmitter power P(Watts)

   = P(W)- [43 + 10log(P)] (dB)

   = [30 + 10log(P)] (dBm) - [43 + 10log(P)] (dB)

   = -13dBm.
9. For LTE Band 7, the other 40 dB, and 55 dB have additionally applied same calculation above.

   The limit line is derived from 40+ 10log(P)dB below the transmitter power P(Watts)

   = P(W)- [40 + 10log(P)] (dB)

   = [30 + 10log(P)] (dBm) - [40 + 10log(P)] (dB)

   = -10dBm

   The limit line is derived from 43 + 10log(P)dB below the transmitter power P(Watts)

   = P(W)- [43 + 10log(P)] (dB)

   = [30 + 10log(P)] (dBm) - [43 + 10log(P)] (dB)

   = -13dBm.

   The limit line is derived from 55+ 10log(P)dB below the transmitter power P(Watts)

   = P(W)- [55 + 10log(P)] (dB)

   = [55 + 10log(P)] (dBm) - [55 + 10log(P)] (dB)

   = -25dBm

# 3.8 Conducted Spurious Emission

## 3.8.1 Description of Conducted Spurious Emission Measurement

The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least 43 + 10 log (P) dB.

For Band 7:

The power of any emission outside of the authorized operating frequency ranges must be lower than the transmitter power (P) by a factor of at least 55 + 10 log (P) dB.

It is measured by means of a calibrated spectrum analyzer and scanned from 30 MHz up to a frequency including its $10^{th}$ harmonic.

## 3.8.2 Test Procedures

1. The testing follows FCC KDB 971168 v02r02 Section 6.0.
2. The EUT was connected to spectrum analyzer and system simulator via a power divider.
3. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
4. The middle channel for the highest RF power within the transmitting frequency was measured.
5. The conducted spurious emission for the whole frequency range was taken.
6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz.
7. Set spectrum analyzer with RMS detector.
8. Taking the record of maximum spurious emission.
9. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
10. The limit line is derived from 43 + 10log(P)dB below the transmitter power P(Watts)
    = P(W)- [43 + 10log(P)] (dB)
    = [30 + 10log(P)] (dBm) - [43 + 10log(P)] (dB)
    = -13dBm.
11. For Band 7
    The limit line is derived from 55 + 10log(P)dB below the transmitter power P(Watts)
    = P(W)- [55+ 10log(P)] (dB)
    = [30+ 10log(P)] (dBm) - [55+ 10log(P)] (dB)
    = -25dBm.

## 3.9 Frequency Stability

### 3.9.1 Description of Frequency Stability Measurement

The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within ±0.00025% (±2.5ppm) of the center frequency.

### 3.9.2 Test Procedures for Temperature Variation

1. The testing follows FCC KDB 971168 v02r02 Section 9.0.
2. The EUT was set up in the thermal chamber and connected with the system simulator.
3. With power OFF, the temperature was decreased to -30°C and the EUT was stabilized before testing. Power was applied and the maximum change in frequency was recorded within one minute.
4. With power OFF, the temperature was raised in 10°C step up to 50°C. The EUT was stabilized at each step for at least half an hour. Power was applied and the maximum frequency change was recorded within one minute.

### 3.9.3 Test Procedures for Voltage Variation

1. The testing follows FCC KDB 971168 v02r02 Section 9.0.
2. The EUT was placed in a temperature chamber at 25±5° C and connected with the system simulator.
3. The power supply voltage to the EUT was varied from 85% to 115% of the nominal value measured at the input to the EUT.
4. The variation in frequency was measured for the worst case.

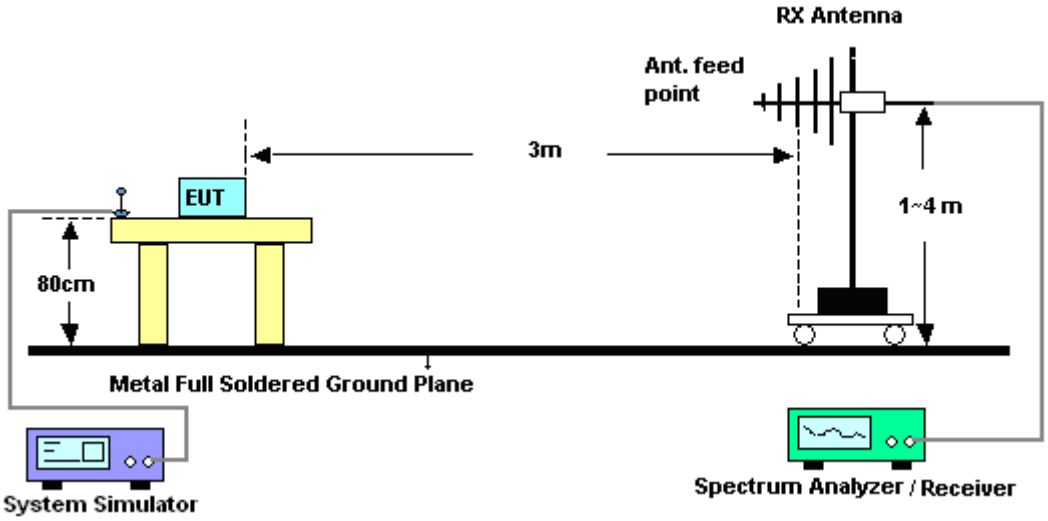
# 4 Radiated Test Items

## 4.1 Measuring Instruments

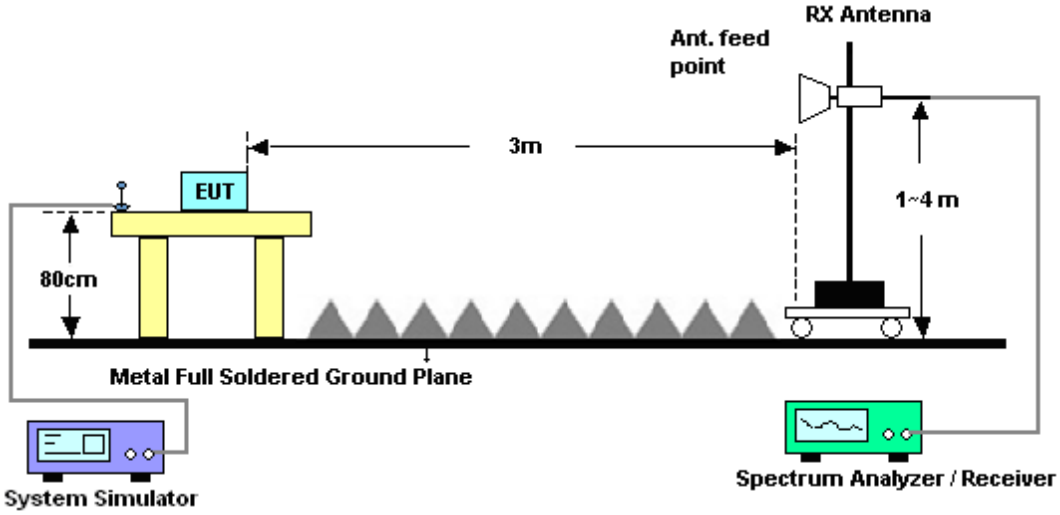
See list of measuring instruments of this test report.

## 4.2 Test Setup

### 4.2.1 For radiated test from 30MHz to 1GHz




### 4.2.2 For radiated test above 1GHz




## 4.3 Test Result of Radiated Test

Please refer to Appendix B.

## 4.4 Effective Radiated Power and Effective Isotropic Radiated Power

### 4.4.1 Description of the ERP/EIRP Measurement

Effective radiated power output measurements by substitution method according to ANSI / TIA / EIA-603-D-2010, and the spectrum analyzer configuration follows KDB 971168 D01 Power Meas. License Digital Systems v02r02. Mobile and portable (hand-held) stations operating are limited to average ERP of 7 watts with LTE band 5.

Equivalent isotropic radiated power output measurements by substitution method according to ANSI / TIA / EIA-603-D-2010, and the spectrum analyzer configuration follows KDB 971168 D01 Power Meas. License Digital Systems v02r02. Mobile and portable (hand-held) stations operating are limited to average EIRP of 2 watts with LTE band 2 / 7 and 1 watt with LTE band 4.

### 4.4.2 Test Procedures

1. The EUT was placed on a non-conductive rotating platform 0.8 meters high in a semi-anechoic chamber. The radiated emission at the fundamental frequency was measured at 3 m with a test antenna and a spectrum analyzer with RMS detector per section 5. of KDB 971168 D01.
2. During the measurement, the system simulator parameters were set to force the EUT transmitting at maximum output power. The maximum emission was recorded from analyzer power level (LVL) from the 360 degrees rotation of the turntable and the test antenna raised and lowered over a range from 1 to 4 meters in both horizontally and vertically polarized orientations.
3. Effective Isotropic Radiated Power (EIRP) was measured by substitution method according to TIA/EIA-603-D. The EUT was replaced by the substitution antenna at same location, and then a known power from S.G. was applied into the dipole antenna through a Tx cable, and then recorded the maximum Analyzer reading through raised and lowered the test antenna. The correction factor (in dB) = S.G. - Tx Cable loss + Substitution antenna gain - Analyzer reading. Then the EUT's EIRP was calculated with the correction factor, EIRP = LVL + Correction factor and ERP = EIRP - 2.15. Take the record of the output power at substitution antenna.

| | LTE Average | | | | | |
|---|---|---|---|---|---|---|
| LTE BW | 1.4M | 3M | 5M | 10M | 15M | 20M |
| Span | 3MHz | 6MHz | 10MHz | 20MHz | 30MHz | 40MHz |
| RBW | 30kHz | 100kHz | 100kHz | 300kHz | 300kHz | 300kHz |
| VBW | 100kHz | 300kHz | 300kHz | 1MHz | 1MHz | 1MHz |
| Detector | RMS | RMS | RMS | RMS | RMS | RMS |
| Trace | Average | Average | Average | Average | Average | Average |
| Average Type | Power | Power | Power | Power | Power | Power |
| Sweep Count | 100 | 100 | 100 | 100 | 100 | 100 |

# 4.5 Radiated Spurious Emission

## 4.5.1 Description of Radiated Spurious Emission

The radiated spurious emission was measured by substitution method according to ANSI / TIA / EIA-603-D-2010. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least 43 + 10 log (P) dB.

For Band 7

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least 55 + 10 log (P) dB.

The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

## 4.5.2 Test Procedures

1. The testing follows FCC KDB 971168 v02r02 Section 5.8 and ANSI / TIA-603-D-2010 Section 2.2.12.
2. The EUT was placed on a rotatable wooden table with 0.8 meter above ground.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
4. The table was rotated 360 degrees to determine the position of the highest spurious emission.
5. The height of the receiving antenna is varied between one meter and four meters to search the maximum spurious emission for both horizontal and vertical polarizations.
6. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
7. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
8. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
9. Taking the record of output power at antenna port.
10. Repeat step 7 to step 8 for another polarization.
11. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
    The limit line is derived from 43 + 10log(P)dB below the transmitter power P(Watts)
    = P(W)- [43 + 10log(P)] (dB)
    = [30 + 10log(P)] (dBm) - [43 + 10log(P)] (dB)
    = -13dBm.
    For Band 7:
    The limit line is derived from 55 + 10log(P)dB below the transmitter power P(Watts)
    = P(W)- [55 + 10log(P)] (dB)
    = [55 + 10log(P)] (dBm) - [55 + 10log(P)] (dB)
    = -25dBm
12. EIRP (dBm) = S.G. Power – Tx Cable Loss + Tx Antenna Gain
13. ERP (dBm) = EIRP - 2.15

# 5 List of Measuring Equipment

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Test Date | Due Date | Remark |
|---|---|---|---|---|---|---|---|---|
| Spectrum Analyzer | R&S | FSV40 | 101040 | 10Hz~40GHz | Sep. 10, 2015 | Apr. 19, 2016~ Apr. 21, 2016 | Sep. 09, 2016 | Conducted (TH01-KS) |
| Thermal Chamber | Ten Billion | TTC-B3S | TBN-960502 | -40~+150°C | Oct. 24, 2015 | Apr. 19, 2016~ Apr. 21, 2016 | Oct. 23, 2016 | Conducted (TH01-KS) |
| EMI Test Receiver | R&S | ESR7 | 101403 | 9kHz~7GHz;Max 30dBm | Sep. 10, 2015 | Jun. 02, 2016~ Jun. 03, 2016 | Sep. 09, 2016 | Radiation (03CH02-KS) |
| EXA Spectrum Analyzer | Keysight | N9010A | MY55150208 | 10Hz-44G,MAX 30dB | Apr. 22, 2016 | Jun. 02, 2016~ Jun. 03, 2016 | Apr. 21, 2017 | Radiation (03CH02-KS) |
| Bilog Antenna | TeseQ | CBL6112D | 37879 | 30MHz-2GHz | Sep. 12, 2015 | Jun. 02, 2016~ Jun. 03, 2016 | Sep. 11, 2016 | Radiation (03CH02-KS) |
| Double Ridge Horn Antenna | ETS-Lindgren | 3117 | 75957 | 1GHz~18GHz | Nov. 07, 2015 | Jun. 02, 2016~ Jun. 03, 2016 | Nov. 06, 2016 | Radiation (03CH02-KS) |
| SHF-EHF Horn | com-power | AH-840 | 101070 | 18GHz~40Ghz | Oct. 10, 2015 | Jun. 02, 2016~ Jun. 03, 2016 | Oct. 09, 2016 | Radiation (03CH02-KS) |
| Amplifier | com-power | PA-103A | 161069 | 1kHz~1000MHz / 32 dB | Apr. 22, 2016 | Jun. 02, 2016~ Jun. 03, 2016 | Apr. 21, 2017 | Radiation (03CH02-KS) |
| High Gain Amplifier | MITEQ | AMF-7D-00 101800-30-1 | 1865802 | 1GHz~18GHz | Jan. 20, 2016 | Jun. 02, 2016~ Jun. 03, 2016 | Jan. 19, 2017 | Radiation (03CH02-KS) |
| Amplifier | Agilent | 8449B | 3008A02384 | 1-26.5GHz Gain 30dB | Oct. 24, 2015 | Jun. 02, 2016~ Jun. 03, 2016 | Oct. 23, 2016 | Radiation (03CH02-KS) |
| Amplifier | MITEQ | TTA1840-35 -HG | 1887435 | 18~40GHz | Jan. 20, 2016 | Jun. 02, 2016~ Jun. 03, 2016 | Jan. 19, 2017 | Radiation (03CH02-KS) |
| AC Power Source | Chroma | 61601 | 616010002473 | N/A | NCR | Jun. 02, 2016~ Jun. 03, 2016 | NCR | Radiation (03CH02-KS) |
| Turn Table | MF | MF7802 | N/A | 0~360 degree | NCR | Jun. 02, 2016~ Jun. 03, 2016 | NCR | Radiation (03CH02-KS) |
| Antenna Mast | MF | MF7802 | N/A | 1 m~4 m | NCR | Jun. 02, 2016~ Jun. 03, 2016 | NCR | Radiation (03CH02-KS) |

NCR: No Calibration Required

# 6 Uncertainty of Evaluation

**Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)**

| | |
|---|---|
| **Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))** | **5.1 dB** |

# Appendix A. Test Results of Conducted Test

## Conducted Output Power(Average power)

| LTE Band 2 Maximum Average Power [dBm] | | | | | | |
|---|---|---|---|---|---|---|
| BW [MHz] | RB Size | RB Offset | Mod | Lowest | Middle | Highest |
| 20 | 1 | 0 | QPSK | 23.18 | 23.21 | 22.95 |
| 20 | 1 | 49 | | 23.24 | 23.27 | 23.16 |
| 20 | 1 | 99 | | 22.81 | 23.09 | 23.06 |
| 20 | 50 | 0 | | 21.93 | 22.03 | 21.94 |
| 20 | 50 | 24 | | 21.83 | 21.88 | 21.86 |
| 20 | 50 | 50 | | 21.75 | 22.01 | 21.89 |
| 20 | 100 | 0 | | 21.86 | 21.88 | 21.83 |
| 20 | 1 | 0 | 16-QAM | 21.80 | 21.72 | 21.55 |
| 20 | 1 | 49 | | 21.71 | 21.61 | 21.65 |
| 20 | 1 | 99 | | 21.45 | 21.64 | 21.52 |
| 20 | 50 | 0 | | 20.72 | 20.69 | 20.96 |
| 20 | 50 | 24 | | 20.63 | 20.67 | 20.90 |
| 20 | 50 | 50 | | 20.64 | 20.70 | 20.90 |
| 20 | 100 | 0 | | 20.74 | 20.64 | 20.85 |
| 15 | 1 | 0 | QPSK | 23.04 | 22.95 | 23.01 |
| 15 | 1 | 37 | | 22.81 | 22.77 | 22.86 |
| 15 | 1 | 74 | | 22.76 | 22.82 | 22.80 |
| 15 | 36 | 0 | | 21.97 | 21.89 | 21.87 |
| 15 | 36 | 20 | | 21.83 | 21.88 | 21.86 |
| 15 | 36 | 39 | | 21.80 | 21.83 | 21.89 |
| 15 | 75 | 0 | | 21.82 | 21.83 | 21.99 |
| 15 | 1 | 0 | 16-QAM | 22.30 | 22.32 | 22.37 |
| 15 | 1 | 37 | | 22.08 | 22.16 | 22.14 |
| 15 | 1 | 74 | | 22.04 | 22.08 | 22.10 |
| 15 | 36 | 0 | | 20.77 | 20.78 | 20.70 |
| 15 | 36 | 20 | | 20.74 | 20.79 | 20.61 |
| 15 | 36 | 39 | | 20.72 | 20.83 | 20.70 |
| 15 | 75 | 0 | | 20.75 | 20.74 | 20.81 |

| LTE Band 2 Maximum Average Power [dBm] | | | | | | |
|---|---|---|---|---|---|---|
| BW [MHz] | RB Size | RB Offset | Mod | Lowest | Middle | Highest |
| 10 | 1 | 0 | QPSK | 22.95 | 22.86 | 22.88 |
| 10 | 1 | 25 | | 22.74 | 22.75 | 23.17 |
| 10 | 1 | 49 | | 22.76 | 22.79 | 22.87 |
| 10 | 25 | 0 | | 21.87 | 21.78 | 21.86 |
| 10 | 25 | 12 | | 21.92 | 21.88 | 21.97 |
| 10 | 25 | 25 | | 21.78 | 21.87 | 21.87 |
| 10 | 50 | 0 | | 21.87 | 21.84 | 21.96 |
| 10 | 1 | 0 | 16-QAM | 22.31 | 22.29 | 21.85 |
| 10 | 1 | 25 | | 22.28 | 22.10 | 21.83 |
| 10 | 1 | 49 | | 22.12 | 22.24 | 21.87 |
| 10 | 25 | 0 | | 20.76 | 20.80 | 20.98 |
| 10 | 25 | 12 | | 20.85 | 21.07 | 20.82 |
| 10 | 25 | 25 | | 20.70 | 21.08 | 20.77 |
| 10 | 50 | 0 | | 20.78 | 20.85 | 20.79 |
| 5 | 1 | 0 | QPSK | 22.84 | 22.89 | 22.72 |
| 5 | 1 | 12 | | 23.20 | 22.82 | 22.88 |
| 5 | 1 | 24 | | 22.91 | 22.76 | 22.76 |
| 5 | 12 | 0 | | 21.79 | 21.67 | 21.75 |
| 5 | 12 | 7 | | 21.75 | 21.85 | 21.82 |
| 5 | 12 | 13 | | 21.73 | 21.86 | 21.81 |
| 5 | 25 | 0 | | 21.79 | 21.73 | 21.85 |
| 5 | 1 | 0 | 16-QAM | 21.94 | 22.18 | 22.13 |
| 5 | 1 | 12 | | 22.06 | 22.19 | 22.05 |
| 5 | 1 | 24 | | 21.90 | 22.14 | 22.16 |
| 5 | 12 | 0 | | 20.70 | 20.78 | 20.77 |
| 5 | 12 | 7 | | 20.68 | 20.78 | 20.71 |
| 5 | 12 | 13 | | 20.75 | 20.78 | 20.76 |
| 5 | 25 | 0 | | 20.61 | 20.74 | 20.75 |

| LTE Band 2 Maximum Average Power [dBm] | | | | | | |
|---|---|---|---|---|---|---|
| BW [MHz] | RB Size | RB Offset | Mod | Lowest | Middle | Highest |
| 3 | 1 | 0 | QPSK | 22.80 | 22.69 | 22.81 |
| 3 | 1 | 8 | | 22.87 | 22.53 | 22.94 |
| 3 | 1 | 14 | | 22.85 | 22.70 | 22.90 |
| 3 | 8 | 0 | | 21.77 | 21.79 | 21.77 |
| 3 | 8 | 4 | | 21.75 | 21.82 | 21.82 |
| 3 | 8 | 7 | | 21.81 | 21.86 | 21.82 |
| 3 | 15 | 0 | | 21.73 | 21.72 | 21.78 |
| 3 | 1 | 0 | 16-QAM | 21.51 | 21.59 | 21.51 |
| 3 | 1 | 8 | | 21.50 | 21.97 | 21.66 |
| 3 | 1 | 14 | | 21.50 | 22.06 | 21.54 |
| 3 | 8 | 0 | | 20.60 | 20.62 | 20.75 |
| 3 | 8 | 4 | | 20.55 | 20.65 | 20.67 |
| 3 | 8 | 7 | | 20.53 | 20.69 | 20.70 |
| 3 | 15 | 0 | | 20.62 | 20.42 | 20.74 |
| 1.4 | 1 | 0 | QPSK | 22.73 | 22.81 | 22.76 |
| 1.4 | 1 | 3 | | 22.86 | 22.77 | 22.68 |
| 1.4 | 1 | 5 | | 22.80 | 22.76 | 22.65 |
| 1.4 | 3 | 0 | | 22.73 | 22.82 | 22.82 |
| 1.4 | 3 | 1 | | 22.69 | 22.87 | 22.93 |
| 1.4 | 3 | 3 | | 22.76 | 22.88 | 22.82 |
| 1.4 | 6 | 0 | | 21.72 | 21.70 | 21.84 |
| 1.4 | 1 | 0 | 16-QAM | 22.10 | 22.07 | 22.02 |
| 1.4 | 1 | 3 | | 22.15 | 21.96 | 22.31 |
| 1.4 | 1 | 5 | | 21.99 | 21.83 | 21.97 |
| 1.4 | 3 | 0 | | 22.24 | 21.69 | 22.22 |
| 1.4 | 3 | 1 | | 22.18 | 21.92 | 22.20 |
| 1.4 | 3 | 3 | | 22.42 | 21.93 | 22.51 |
| 1.4 | 6 | 0 | | 20.71 | 20.40 | 20.71 |

| LTE Band 4 Maximum Average Power [dBm] | | | | | | |
|---|---|---|---|---|---|---|
| BW [MHz] | RB Size | RB Offset | Mod | Lowest | Middle | Highest |
| 20 | 1 | 0 | QPSK | 23.51 | 23.59 | 23.57 |
| 20 | 1 | 49 | | 23.29 | 23.57 | 23.56 |
| 20 | 1 | 99 | | 23.00 | 23.47 | 23.32 |
| 20 | 50 | 0 | | 22.43 | 22.99 | 22.41 |
| 20 | 50 | 24 | | 22.30 | 22.39 | 22.35 |
| 20 | 50 | 50 | | 22.14 | 22.19 | 22.15 |
| 20 | 100 | 0 | | 22.22 | 22.25 | 22.21 |
| 20 | 1 | 0 | 16-QAM | 22.82 | 22.25 | 22.34 |
| 20 | 1 | 49 | | 22.79 | 22.07 | 22.10 |
| 20 | 1 | 99 | | 22.39 | 22.01 | 21.76 |
| 20 | 50 | 0 | | 21.37 | 21.17 | 21.26 |
| 20 | 50 | 24 | | 21.24 | 21.11 | 21.21 |
| 20 | 50 | 50 | | 21.15 | 21.04 | 21.12 |
| 20 | 100 | 0 | | 21.24 | 21.19 | 21.15 |
| 15 | 1 | 0 | QPSK | 23.12 | 23.01 | 23.11 |
| 15 | 1 | 37 | | 23.32 | 23.22 | 23.27 |
| 15 | 1 | 74 | | 23.01 | 23.33 | 22.97 |
| 15 | 36 | 0 | | 22.39 | 22.34 | 22.40 |
| 15 | 36 | 20 | | 22.30 | 22.28 | 22.33 |
| 15 | 36 | 39 | | 22.33 | 22.23 | 22.15 |
| 15 | 75 | 0 | | 22.31 | 22.27 | 22.23 |
| 15 | 1 | 0 | 16-QAM | 22.85 | 22.69 | 22.87 |
| 15 | 1 | 37 | | 22.70 | 22.42 | 22.67 |
| 15 | 1 | 74 | | 22.42 | 22.54 | 22.46 |
| 15 | 36 | 0 | | 21.31 | 21.17 | 21.35 |
| 15 | 36 | 20 | | 21.24 | 21.02 | 21.36 |
| 15 | 36 | 39 | | 21.35 | 21.00 | 21.18 |
| 15 | 75 | 0 | | 21.24 | 21.21 | 21.26 |

| LTE Band 4 Maximum Average Power [dBm] | | | | | | |
|---|---|---|---|---|---|---|
| BW [MHz] | RB Size | RB Offset | Mod | Lowest | Middle | Highest |
| 10 | 1 | 0 | QPSK | 23.37 | 23.01 | 23.31 |
| 10 | 1 | 25 | | 23.31 | 23.35 | 23.11 |
| 10 | 1 | 49 | | 23.25 | 23.01 | 23.26 |
| 10 | 25 | 0 | | 22.29 | 22.30 | 22.37 |
| 10 | 25 | 12 | | 22.27 | 22.17 | 22.31 |
| 10 | 25 | 25 | | 22.27 | 22.23 | 22.09 |
| 10 | 50 | 0 | | 22.35 | 22.22 | 22.23 |
| 10 | 1 | 0 | 16-QAM | 22.11 | 22.70 | 22.75 |
| 10 | 1 | 25 | | 22.06 | 22.64 | 22.69 |
| 10 | 1 | 49 | | 22.01 | 22.64 | 22.45 |
| 10 | 25 | 0 | | 21.43 | 21.15 | 21.13 |
| 10 | 25 | 12 | | 21.23 | 21.13 | 21.16 |
| 10 | 25 | 25 | | 21.13 | 21.11 | 21.14 |
| 10 | 50 | 0 | | 21.28 | 21.18 | 21.27 |
| 5 | 1 | 0 | QPSK | 23.18 | 23.29 | 23.23 |
| 5 | 1 | 12 | | 23.13 | 23.22 | 23.32 |
| 5 | 1 | 24 | | 23.18 | 23.26 | 23.08 |
| 5 | 12 | 0 | | 22.19 | 22.23 | 22.29 |
| 5 | 12 | 7 | | 22.24 | 22.17 | 22.12 |
| 5 | 12 | 13 | | 22.30 | 22.22 | 22.14 |
| 5 | 25 | 0 | | 22.31 | 22.22 | 22.18 |
| 5 | 1 | 0 | 16-QAM | 22.62 | 22.44 | 22.51 |
| 5 | 1 | 12 | | 22.69 | 22.64 | 22.31 |
| 5 | 1 | 24 | | 22.41 | 21.94 | 22.28 |
| 5 | 12 | 0 | | 21.24 | 21.15 | 21.03 |
| 5 | 12 | 7 | | 21.19 | 21.12 | 20.95 |
| 5 | 12 | 13 | | 21.25 | 21.18 | 21.08 |
| 5 | 25 | 0 | | 21.26 | 21.18 | 21.21 |

| LTE Band 4 Maximum Average Power [dBm] | | | | | | |
|---|---|---|---|---|---|---|
| BW [MHz] | RB Size | RB Offset | Mod | Lowest | Middle | Highest |
| 3 | 1 | 0 | QPSK | 23.30 | 23.25 | 23.19 |
| 3 | 1 | 8 | | 23.13 | 23.27 | 23.10 |
| 3 | 1 | 14 | | 23.15 | 23.33 | 22.98 |
| 3 | 8 | 0 | | 22.47 | 22.19 | 22.28 |
| 3 | 8 | 4 | | 22.29 | 22.22 | 22.20 |
| 3 | 8 | 7 | | 22.31 | 22.18 | 22.28 |
| 3 | 15 | 0 | | 22.17 | 22.14 | 22.10 |
| 3 | 1 | 0 | 16-QAM | 22.72 | 21.95 | 22.38 |
| 3 | 1 | 8 | | 23.00 | 22.63 | 22.87 |
| 3 | 1 | 14 | | 22.63 | 22.43 | 22.41 |
| 3 | 8 | 0 | | 21.58 | 21.08 | 21.30 |
| 3 | 8 | 4 | | 21.25 | 21.02 | 21.29 |
| 3 | 8 | 7 | | 21.17 | 21.12 | 21.29 |
| 3 | 15 | 0 | | 21.02 | 20.91 | 21.27 |
| 1.4 | 1 | 0 | QPSK | 23.14 | 23.26 | 23.18 |
| 1.4 | 1 | 3 | | 23.03 | 23.19 | 23.21 |
| 1.4 | 1 | 5 | | 23.29 | 23.17 | 23.05 |
| 1.4 | 3 | 0 | | 23.11 | 23.24 | 23.18 |
| 1.4 | 3 | 1 | | 23.01 | 23.35 | 23.21 |
| 1.4 | 3 | 3 | | 23.02 | 23.34 | 23.21 |
| 1.4 | 6 | 0 | | 22.37 | 22.15 | 22.23 |
| 1.4 | 1 | 0 | 16-QAM | 22.02 | 21.94 | 22.36 |
| 1.4 | 1 | 3 | | 22.04 | 21.95 | 22.68 |
| 1.4 | 1 | 5 | | 21.94 | 21.87 | 22.32 |
| 1.4 | 3 | 0 | | 22.00 | 21.93 | 22.62 |
| 1.4 | 3 | 1 | | 21.95 | 21.83 | 22.55 |
| 1.4 | 3 | 3 | | 22.14 | 21.94 | 22.55 |
| 1.4 | 6 | 0 | | 21.06 | 20.95 | 21.25 |

| LTE Band 5 Maximum Average Power [dBm] | | | | | | |
|---|---|---|---|---|---|---|
| BW [MHz] | RB Size | RB Offset | Mod | Lowest | Middle | Highest |
| 10 | 1 | 0 | QPSK | 23.16 | 23.06 | 23.19 |
| 10 | 1 | 25 | | 23.19 | 23.18 | 23.40 |
| 10 | 1 | 49 | | 23.17 | 23.17 | 23.18 |
| 10 | 25 | 0 | | 22.12 | 22.11 | 22.17 |
| 10 | 25 | 12 | | 22.12 | 22.10 | 22.15 |
| 10 | 25 | 25 | | 22.05 | 22.06 | 22.10 |
| 10 | 50 | 0 | | 22.15 | 22.06 | 22.17 |
| 10 | 1 | 0 | 16-QAM | 21.71 | 21.78 | 22.61 |
| 10 | 1 | 25 | | 21.69 | 21.70 | 22.34 |
| 10 | 1 | 49 | | 21.67 | 21.70 | 22.22 |
| 10 | 25 | 0 | | 21.33 | 21.22 | 21.14 |
| 10 | 25 | 12 | | 21.13 | 21.12 | 21.14 |
| 10 | 25 | 25 | | 21.16 | 20.92 | 21.13 |
| 10 | 50 | 0 | | 21.17 | 21.04 | 20.96 |
| 5 | 1 | 0 | QPSK | 22.85 | 22.83 | 22.97 |
| 5 | 1 | 12 | | 23.08 | 22.93 | 23.19 |
| 5 | 1 | 24 | | 22.81 | 23.02 | 22.91 |
| 5 | 12 | 0 | | 22.11 | 22.02 | 22.17 |
| 5 | 12 | 7 | | 22.12 | 21.94 | 22.11 |
| 5 | 12 | 13 | | 22.13 | 21.93 | 21.93 |
| 5 | 25 | 0 | | 22.08 | 22.03 | 22.13 |
| 5 | 1 | 0 | 16-QAM | 22.60 | 22.29 | 22.43 |
| 5 | 1 | 12 | | 22.85 | 22.17 | 22.30 |
| 5 | 1 | 24 | | 22.69 | 22.33 | 22.13 |
| 5 | 12 | 0 | | 21.01 | 20.94 | 21.06 |
| 5 | 12 | 7 | | 21.06 | 20.96 | 21.04 |
| 5 | 12 | 13 | | 21.07 | 20.91 | 20.96 |
| 5 | 25 | 0 | | 21.10 | 20.91 | 21.06 |

| LTE Band 5 Maximum Average Power [dBm] | | | | | | |
|---|---|---|---|---|---|---|
| BW [MHz] | RB Size | RB Offset | Mod | Lowest | Middle | Highest |
| 3 | 1 | 0 | QPSK | 23.15 | 22.86 | 23.07 |
| 3 | 1 | 8 | | 23.07 | 23.01 | 23.03 |
| 3 | 1 | 14 | | 23.21 | 22.79 | 22.97 |
| 3 | 8 | 0 | | 22.09 | 21.98 | 22.06 |
| 3 | 8 | 4 | | 22.03 | 21.93 | 21.98 |
| 3 | 8 | 7 | | 22.13 | 21.95 | 21.99 |
| 3 | 15 | 0 | | 22.02 | 21.96 | 22.01 |
| 3 | 1 | 0 | 16-QAM | 21.71 | 22.69 | 21.80 |
| 3 | 1 | 8 | | 21.85 | 22.81 | 21.83 |
| 3 | 1 | 14 | | 21.71 | 22.65 | 21.67 |
| 3 | 8 | 0 | | 20.80 | 20.95 | 20.84 |
| 3 | 8 | 4 | | 20.84 | 20.96 | 20.77 |
| 3 | 8 | 7 | | 20.89 | 20.91 | 20.82 |
| 3 | 15 | 0 | | 20.85 | 20.74 | 20.86 |
| 1.4 | 1 | 0 | QPSK | 22.85 | 22.81 | 22.95 |
| 1.4 | 1 | 3 | | 23.09 | 22.92 | 22.93 |
| 1.4 | 1 | 5 | | 22.94 | 22.85 | 22.81 |
| 1.4 | 3 | 0 | | 22.98 | 22.91 | 23.01 |
| 1.4 | 3 | 1 | | 23.13 | 22.97 | 22.93 |
| 1.4 | 3 | 3 | | 23.05 | 22.93 | 22.79 |
| 1.4 | 6 | 0 | | 22.04 | 21.87 | 21.90 |
| 1.4 | 1 | 0 | 16-QAM | 22.13 | 22.22 | 22.62 |
| 1.4 | 1 | 3 | | 22.22 | 22.23 | 22.68 |
| 1.4 | 1 | 5 | | 22.12 | 22.15 | 22.47 |
| 1.4 | 3 | 0 | | 22.12 | 21.82 | 22.14 |
| 1.4 | 3 | 1 | | 22.08 | 22.11 | 22.05 |
| 1.4 | 3 | 3 | | 21.82 | 21.96 | 21.84 |
| 1.4 | 6 | 0 | | 20.69 | 20.72 | 20.68 |

| LTE Band 7 Maximum Average Power [dBm] | | | | | | |
|---|---|---|---|---|---|---|
| BW [MHz] | RB Size | RB Offset | Mod | Lowest | Middle | Highest |
| 20 | 1 | 0 | QPSK | 23.99 | 24.05 | 24.31 |
| 20 | 1 | 49 | | 23.97 | 23.96 | 23.99 |
| 20 | 1 | 99 | | 23.91 | 23.74 | 24.06 |
| 20 | 50 | 0 | | 23.01 | 23.08 | 23.17 |
| 20 | 50 | 24 | | 22.91 | 23.04 | 23.11 |
| 20 | 50 | 50 | | 22.99 | 23.06 | 23.09 |
| 20 | 100 | 0 | | 23.00 | 23.11 | 23.13 |
| 20 | 1 | 0 | 16-QAM | 23.26 | 23.33 | 23.03 |
| 20 | 1 | 49 | | 23.14 | 23.46 | 22.99 |
| 20 | 1 | 99 | | 23.10 | 23.10 | 22.77 |
| 20 | 50 | 0 | | 21.92 | 21.95 | 22.04 |
| 20 | 50 | 24 | | 21.88 | 21.96 | 22.03 |
| 20 | 50 | 50 | | 21.95 | 21.99 | 21.99 |
| 20 | 100 | 0 | | 22.05 | 22.01 | 22.05 |
| 15 | 1 | 0 | QPSK | 24.24 | 24.15 | 24.06 |
| 15 | 1 | 37 | | 23.92 | 24.09 | 24.04 |
| 15 | 1 | 74 | | 23.96 | 23.83 | 24.08 |
| 15 | 36 | 0 | | 23.00 | 23.10 | 23.19 |
| 15 | 36 | 20 | | 23.00 | 23.03 | 23.15 |
| 15 | 36 | 39 | | 23.08 | 23.05 | 23.09 |
| 15 | 75 | 0 | | 22.99 | 23.03 | 23.13 |
| 15 | 1 | 0 | 16-QAM | 23.06 | 23.42 | 23.47 |
| 15 | 1 | 37 | | 22.78 | 23.32 | 23.33 |
| 15 | 1 | 74 | | 22.73 | 23.22 | 23.37 |
| 15 | 36 | 0 | | 21.96 | 21.84 | 21.99 |
| 15 | 36 | 20 | | 21.98 | 21.85 | 21.90 |
| 15 | 36 | 39 | | 22.02 | 21.90 | 21.90 |
| 15 | 75 | 0 | | 21.87 | 21.99 | 22.09 |

| LTE Band 7 Maximum Average Power [dBm] | | | | | | |
|---|---|---|---|---|---|---|
| BW [MHz] | RB Size | RB Offset | Mod | Lowest | Middle | Highest |
| 10 | 1 | 0 | QPSK | 24.08 | 24.00 | 24.16 |
| 10 | 1 | 25 | | 23.87 | 24.00 | 24.17 |
| 10 | 1 | 49 | | 23.88 | 23.91 | 24.08 |
| 10 | 25 | 0 | | 22.91 | 23.06 | 23.14 |
| 10 | 25 | 12 | | 22.93 | 23.01 | 23.08 |
| 10 | 25 | 25 | | 22.90 | 23.07 | 23.08 |
| 10 | 50 | 0 | | 22.97 | 23.00 | 23.12 |
| 10 | 1 | 0 | 16-QAM | 23.41 | 23.35 | 23.27 |
| 10 | 1 | 25 | | 23.48 | 23.25 | 23.21 |
| 10 | 1 | 49 | | 23.47 | 23.28 | 22.83 |
| 10 | 25 | 0 | | 22.21 | 22.10 | 22.37 |
| 10 | 25 | 12 | | 22.25 | 22.15 | 22.30 |
| 10 | 25 | 25 | | 22.07 | 22.19 | 22.29 |
| 10 | 50 | 0 | | 21.84 | 21.85 | 22.12 |
| 5 | 1 | 0 | QPSK | 24.12 | 23.81 | 23.73 |
| 5 | 1 | 12 | | 24.25 | 24.33 | 23.90 |
| 5 | 1 | 24 | | 23.71 | 23.84 | 23.75 |
| 5 | 12 | 0 | | 23.01 | 23.05 | 22.98 |
| 5 | 12 | 7 | | 22.96 | 23.09 | 23.09 |
| 5 | 12 | 13 | | 22.82 | 23.02 | 22.98 |
| 5 | 25 | 0 | | 22.93 | 23.05 | 23.04 |
| 5 | 1 | 0 | 16-QAM | 22.99 | 23.01 | 23.02 |
| 5 | 1 | 12 | | 22.71 | 23.01 | 23.01 |
| 5 | 1 | 24 | | 22.58 | 23.03 | 23.01 |
| 5 | 12 | 0 | | 21.98 | 22.01 | 22.04 |
| 5 | 12 | 7 | | 22.21 | 21.98 | 22.04 |
| 5 | 12 | 13 | | 22.12 | 21.98 | 21.84 |
| 5 | 25 | 0 | | 21.80 | 22.18 | 21.97 |

# Peak-to-Average Ratio

| Mode | LTE Band 2 / 20MHz (dB) | | | | |
|---|---|---|---|---|---|
| Mod. | QPSK | | 16QAM | | Limit: 13 (dB) |
| RB Size | 1RB | Full RB | 1RB | Full RB | Result |
| Lowest CH | 3.77 | 4.75 | 4.64 | 5.77 | PASS |
| Middle CH | 4.49 | 4.84 | 5.62 | 5.91 | |
| Highest CH | 3.88 | 4.93 | 4.81 | 5.94 | |

| Mode | LTE Band 4 / 20MHz (dB) | | | | |
|---|---|---|---|---|---|
| Mod. | QPSK | | 16QAM | | Limit: 13 (dB) |
| RB Size | 1RB | Full RB | Result | Full RB | Result |
| Lowest CH | 4.23 | 4.78 | 4.93 | 5.77 | PASS |
| Middle CH | 4.32 | 4.78 | 5.19 | 5.83 | |
| Highest CH | 4.06 | 4.84 | 4.81 | 5.77 | |

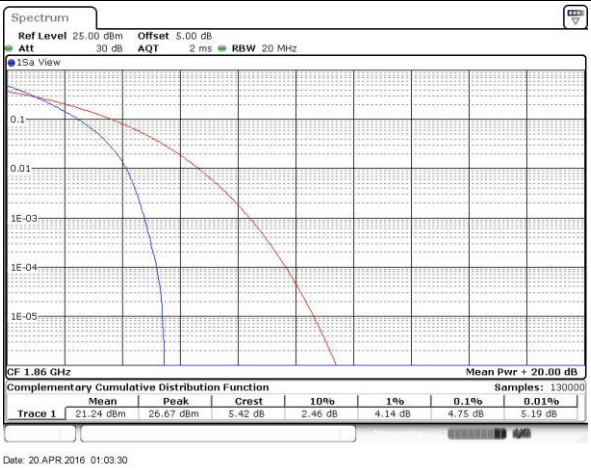
| Mode | LTE Band 5 / 10MHz (dB) | | | | |
|---|---|---|---|---|---|
| Mod. | QPSK | | 16QAM | | Limit: 13 (dB) |
| RB Size | 1RB | Full RB | Result | Full RB | Result |
| Lowest CH | 4.49 | 5.30 | 5.57 | 6.20 | PASS |
| Middle CH | 4.70 | 5.45 | 5.22 | 6.17 | |
| Highest CH | 4.78 | 5.30 | 5.59 | 6.26 | |

| Mode | LTE Band 7 / 20MHz (dB) | | | | |
|---|---|---|---|---|---|
| Mod. | QPSK | | 16QAM | | Limit: 13 (dB) |
| RB Size | 1RB | Full RB | Result | Full RB | Result |
| Lowest CH | 3.68 | 4.64 | 4.61 | 5.57 | PASS |
| Middle CH | 4.17 | 4.70 | 4.96 | 5.68 | |
| Highest CH | 3.97 | 4.72 | 4.99 | 5.68 | |

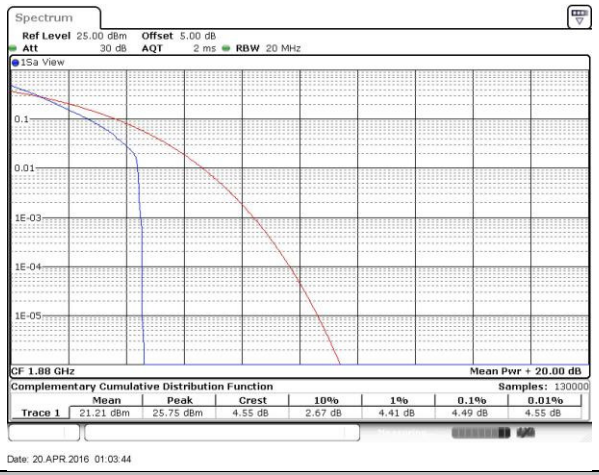
## LTE Band 2 / 20MHz / QPSK

### Lowest Channel / 1RB

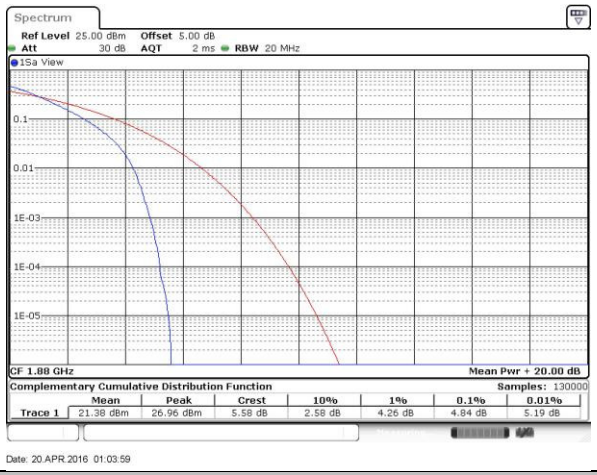
### Lowest Channel / Full RB




### Middle Channel / 1RB

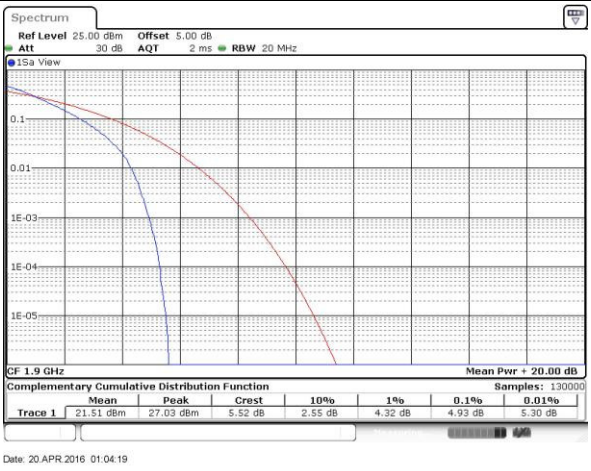



### Middle Channel / Full RB




### Highest Channel / 1RB

### Highest Channel / Full RB

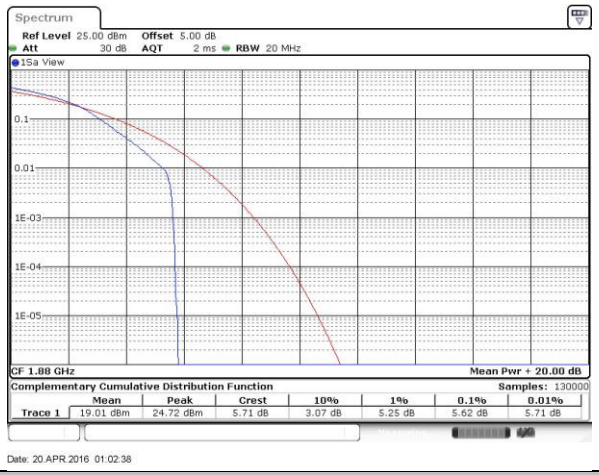


## LTE Band 2 / 20MHz / 16QAM

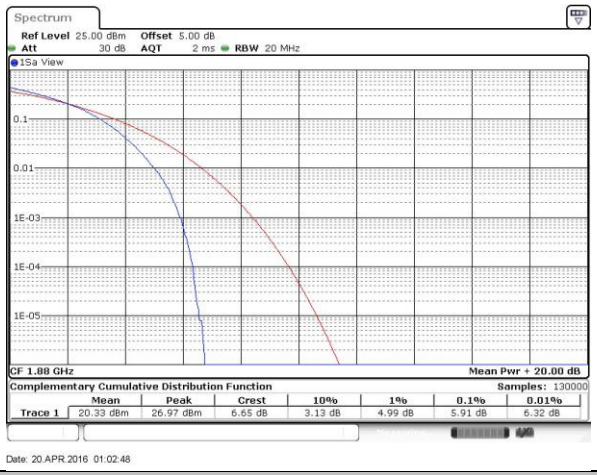
### Lowest Channel / 1RB

### Lowest Channel / Full RB

### Middle Channel / 1RB




### Middle Channel / Full RB




### Highest Channel / 1RB

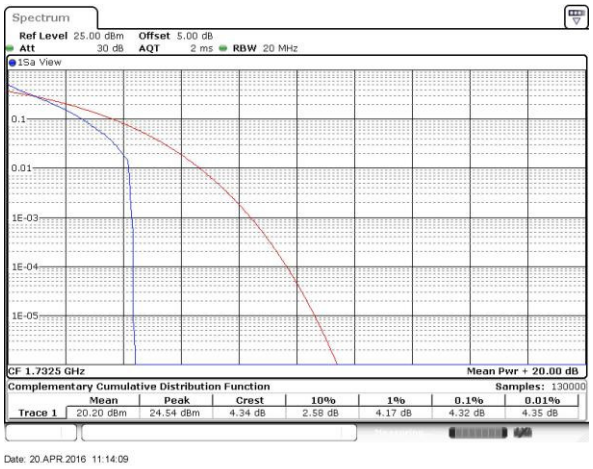
### Highest Channel / Full RB

## LTE Band 4 / 20MHz / QPSK

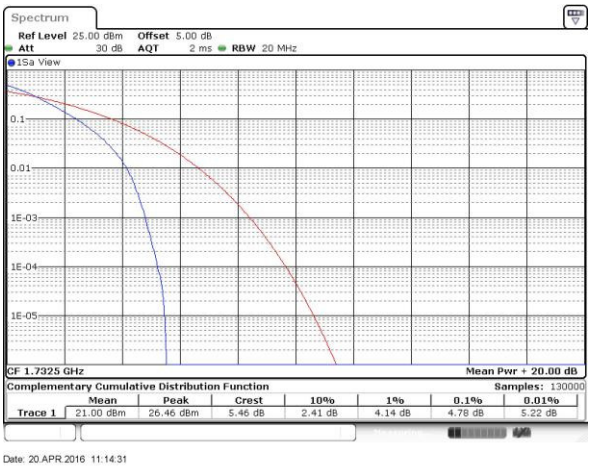
### Lowest Channel / 1RB

### Lowest Channel / Full RB

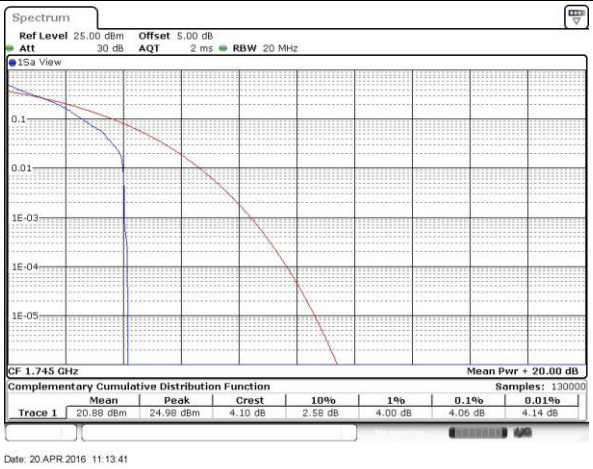
### Middle Channel / 1RB




### Middle Channel / Full RB



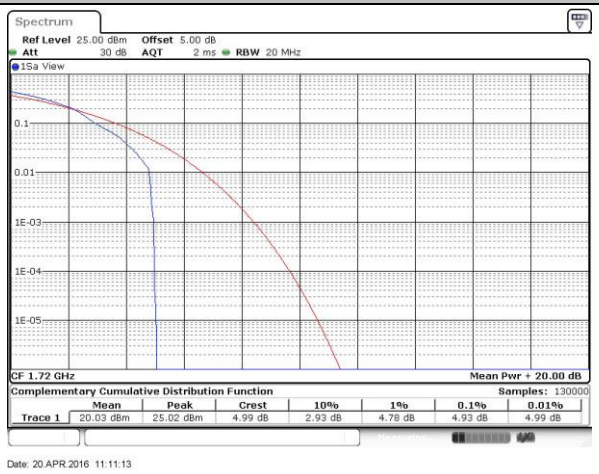

### Highest Channel / 1RB



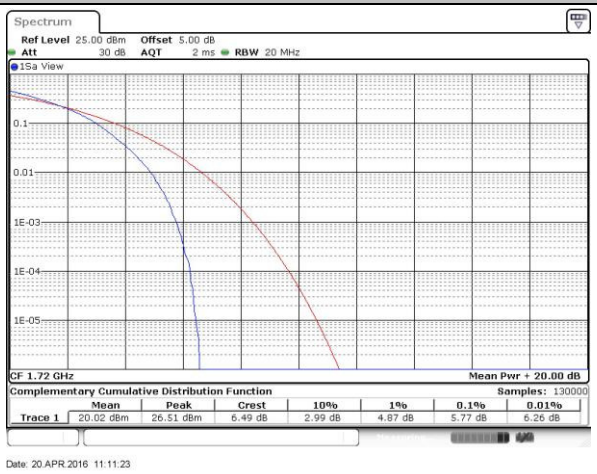

### Highest Channel / Full RB

## LTE Band 4 / 20MHz / 16QAM

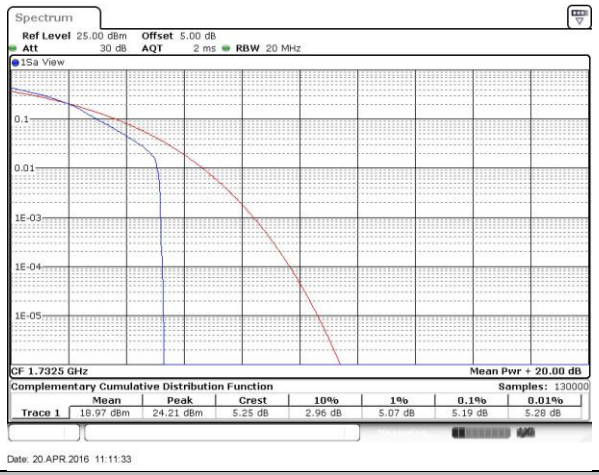
### Lowest Channel / 1RB



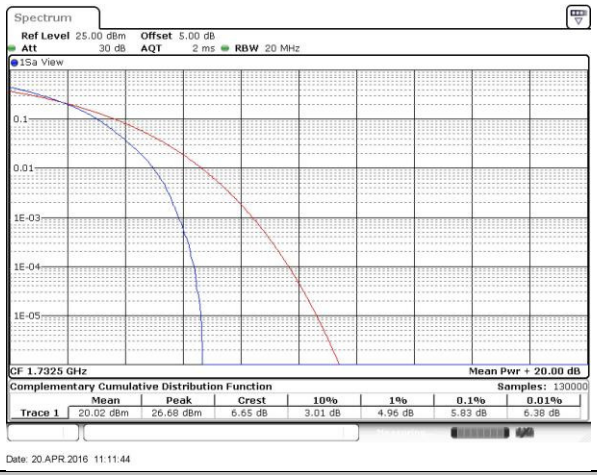

### Lowest Channel / Full RB




### Middle Channel / 1RB




### Middle Channel / Full RB



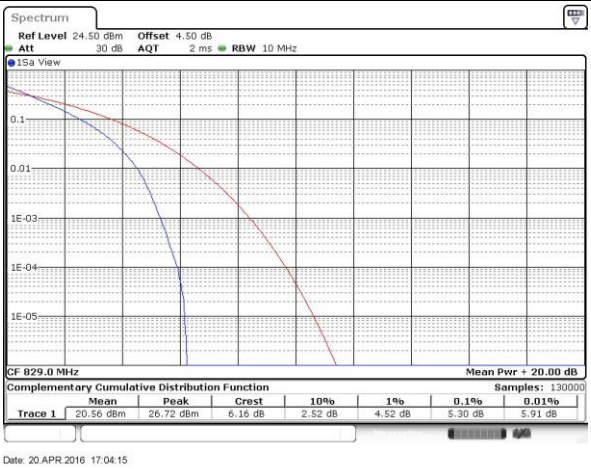

### Highest Channel / 1RB

### Highest Channel / Full RB

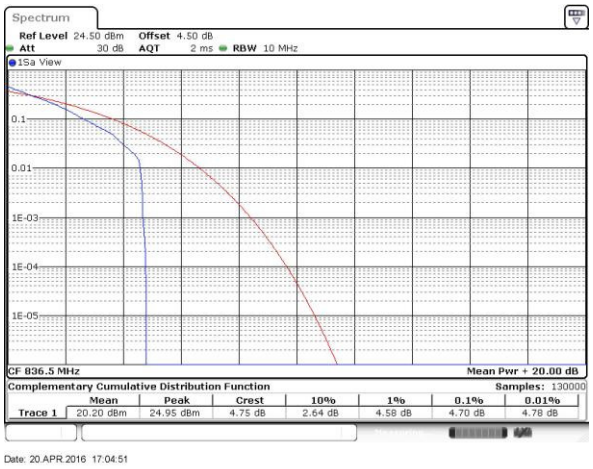
## LTE Band 5 / 10MHz / QPSK

### Lowest Channel / 1RB

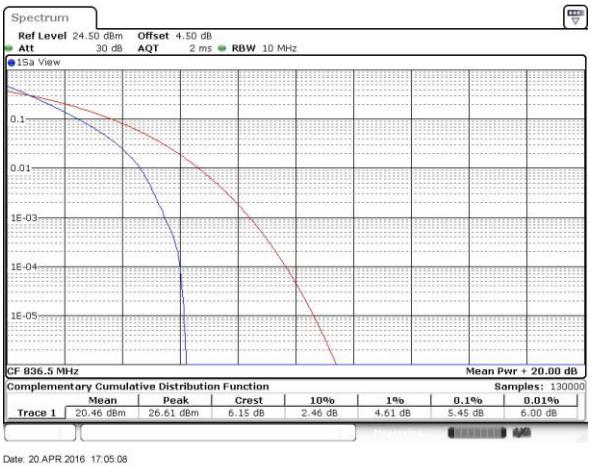
### Lowest Channel / Full RB



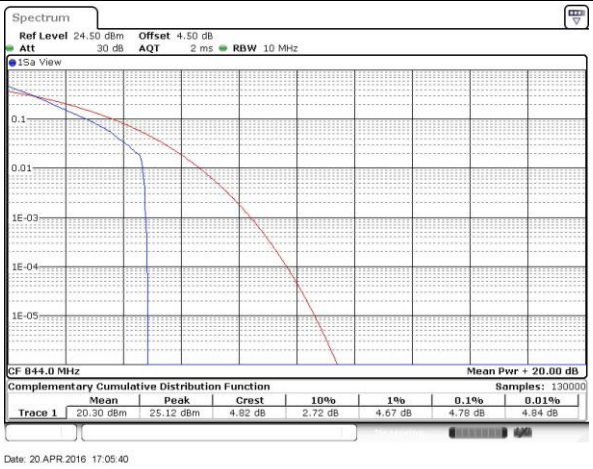

### Middle Channel / 1RB




### Middle Channel / Full RB




### Highest Channel / 1RB

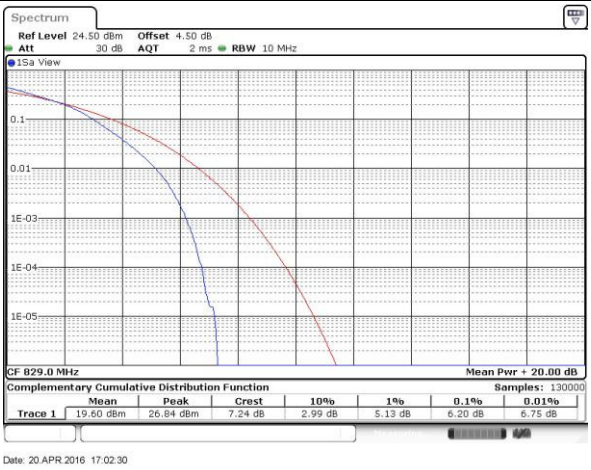



### Highest Channel / Full RB

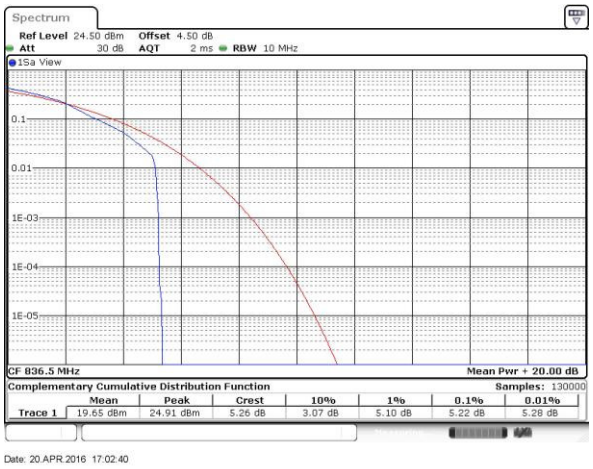
## LTE Band 5 / 10MHz / 16QAM

### Lowest Channel / 1RB

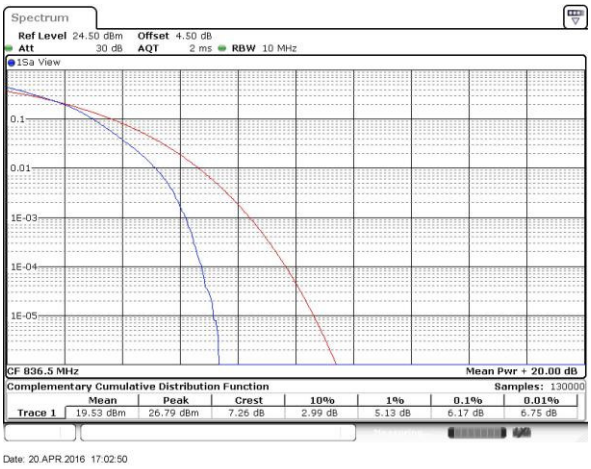
### Lowest Channel / Full RB



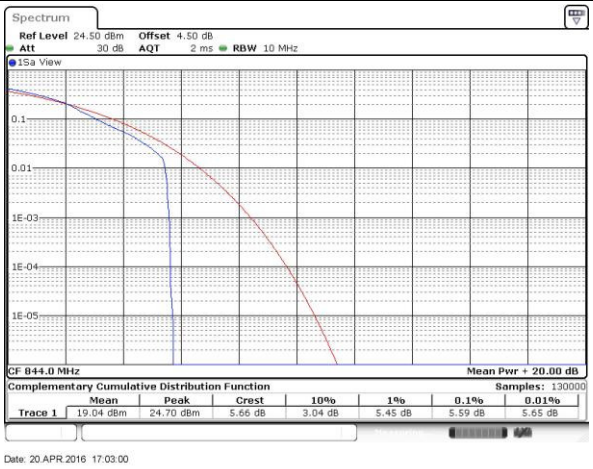

### Middle Channel / 1RB




### Middle Channel / Full RB



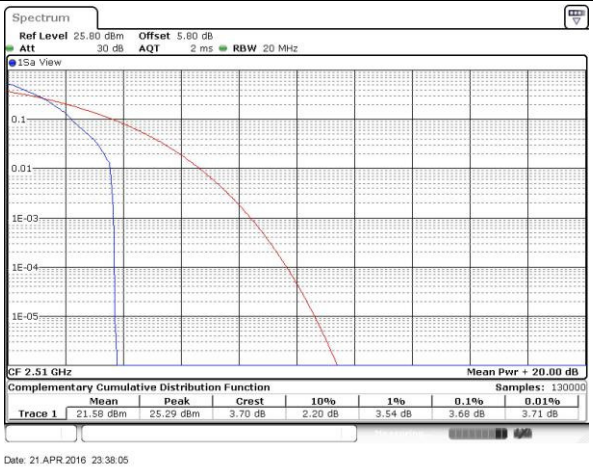

### Highest Channel / 1RB



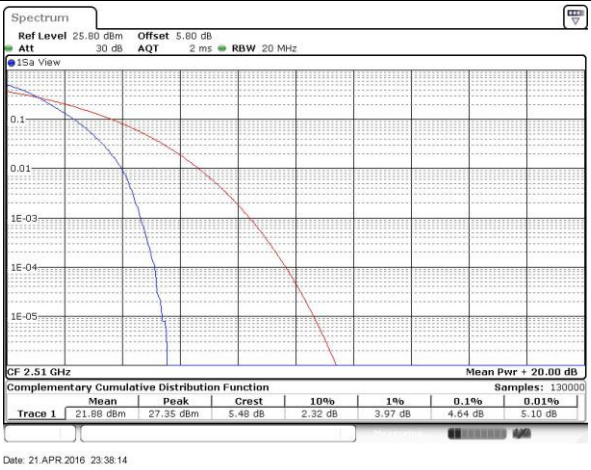

### Highest Channel / Full RB

## LTE Band 7 / 20MHz / QPSK

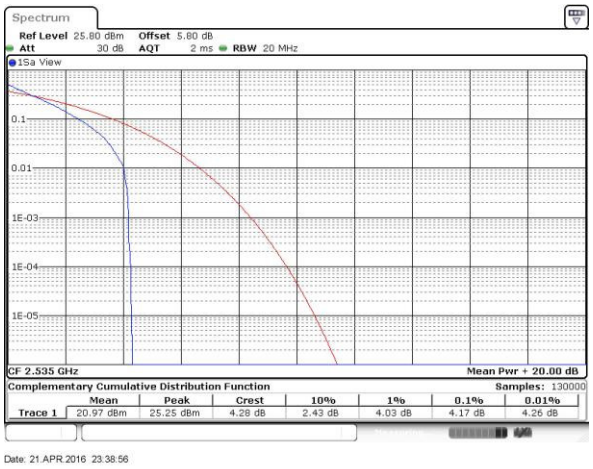
### Lowest Channel / 1RB



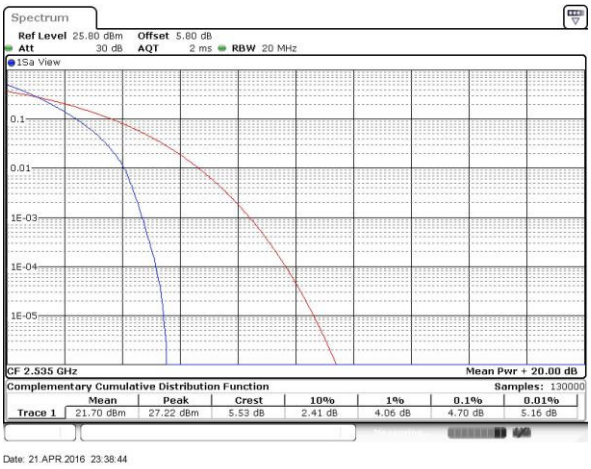

### Lowest Channel / Full RB



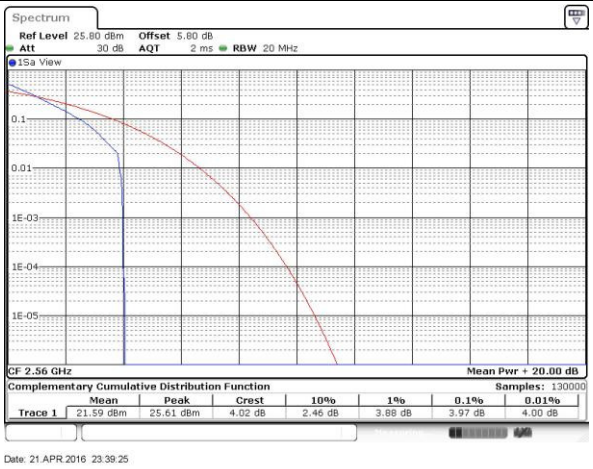

### Middle Channel / 1RB



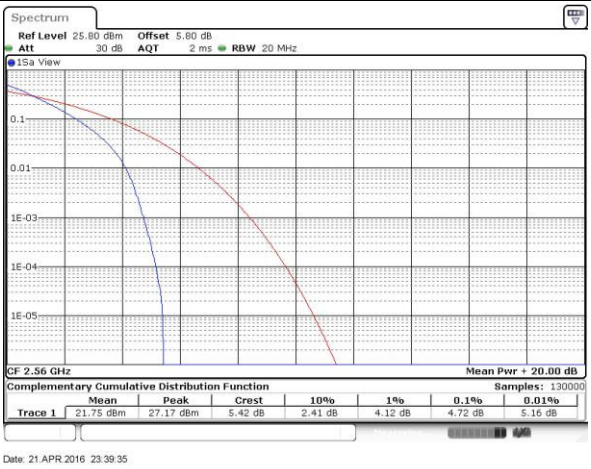

### Middle Channel / Full RB




### Highest Channel / 1RB



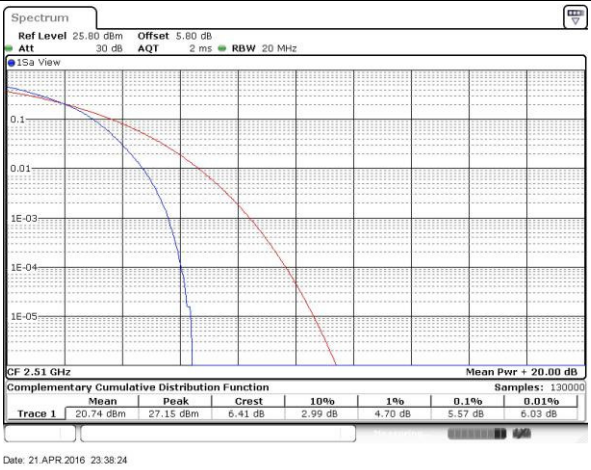

### Highest Channel / Full RB



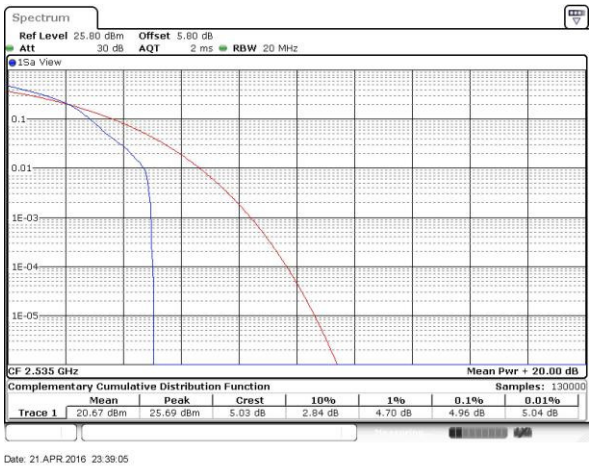
## LTE Band 7 / 20MHz / 16QAM

### Lowest Channel / 1RB

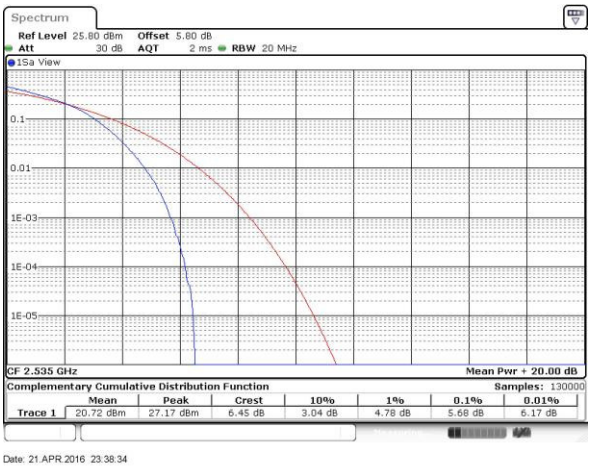
### Lowest Channel / Full RB



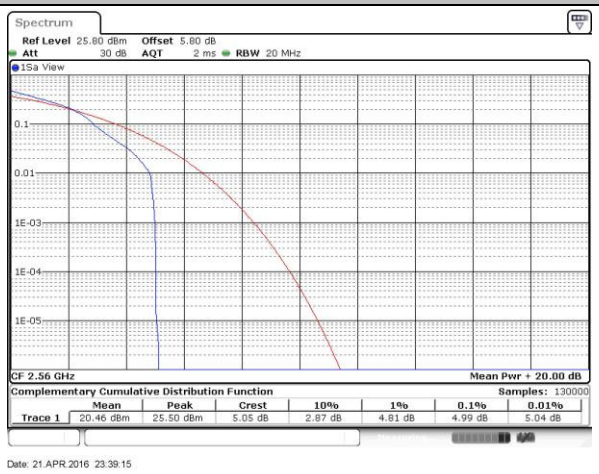

### Middle Channel / 1RB



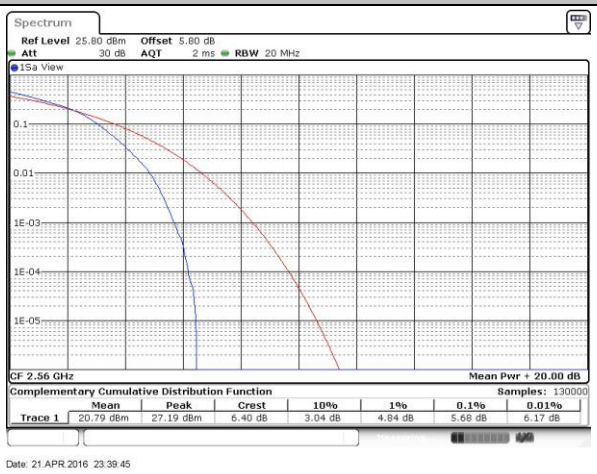

### Middle Channel / Full RB




### Highest Channel / 1RB




### Highest Channel / Full RB



# 26dB Bandwidth

| Mode | LTE Band 2 : 26dB BW (MHz) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BW | 1.4MHz | | 3MHz | | 5MHz | | 10MHz | | 15MHz | | 20MHz | |
| Mod. | QPSK | 16QAM | QPSK | 16QAM | QPSK | 16QAM | QPSK | 16QAM | QPSK | 16QAM | QPSK | 16QAM |
| Lowest CH | 1.28 | 1.30 | 3.00 | 2.98 | 4.93 | 4.85 | 9.79 | 10.05 | 14.21 | 14.48 | 20.30 | 20.26 |
| Middle CH | 1.27 | 1.27 | 2.99 | 3.02 | 5.03 | 4.77 | 9.91 | 9.87 | 14.21 | 14.45 | 20.26 | 19.90 |
| Highest CH | 1.27 | 1.27 | 3.02 | 3.02 | 4.92 | 4.91 | 9.89 | 9.69 | 14.39 | 14.45 | 20.22 | 20.42 |

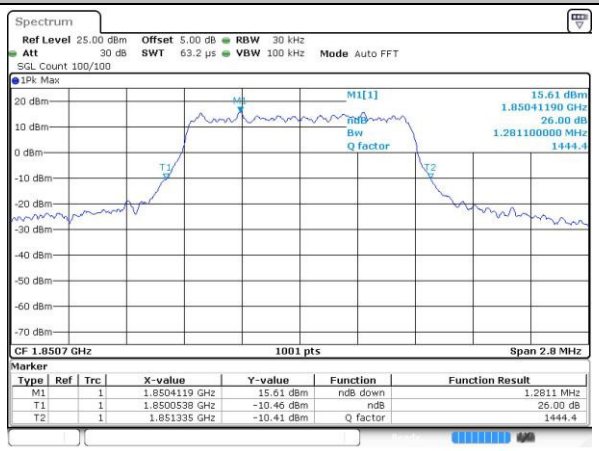
| Mode | LTE Band 4 : 26dB BW (MHz) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BW | 1.4MHz | | 3MHz | | 5MHz | | 10MHz | | 15MHz | | 20MHz | |
| Mod. | QPSK | 16QAM | QPSK | 16QAM | QPSK | 16QAM | QPSK | 16QAM | QPSK | 16QAM | QPSK | 16QAM |
| Lowest CH | 1.28 | 1.30 | 3.05 | 3.02 | 4.95 | 4.95 | 9.75 | 9.97 | 14.69 | 14.48 | 20.14 | 20.14 |
| Middle CH | 1.27 | 1.29 | 3.01 | 3.00 | 4.83 | 4.95 | 9.91 | 9.79 | 14.48 | 14.24 | 20.26 | 20.42 |
| Highest CH | 1.26 | 1.27 | 3.02 | 3.02 | 4.94 | 4.99 | 9.77 | 9.71 | 14.48 | 14.57 | 20.18 | 20.18 |

| Mode | LTE Band 5 : 26dB BW (MHz) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BW | 1.4MHz | | 3MHz | | 5MHz | | 10MHz | | 15MHz | | 20MHz | |
| Mod. | QPSK | 16QAM | QPSK | 16QAM | QPSK | 16QAM | QPSK | 16QAM | QPSK | 16QAM | QPSK | 16QAM |
| Lowest CH | 1.27 | 1.28 | 3.00 | 2.99 | 4.92 | 4.97 | 10.01 | 9.81 | - | - | - | - |
| Middle CH | 1.30 | 1.26 | 3.03 | 2.99 | 4.96 | 4.88 | 9.85 | 9.95 | - | - | - | - |
| Highest CH | 1.29 | 1.29 | 3.02 | 3.00 | 4.86 | 4.87 | 9.89 | 9.81 | - | - | - | - |

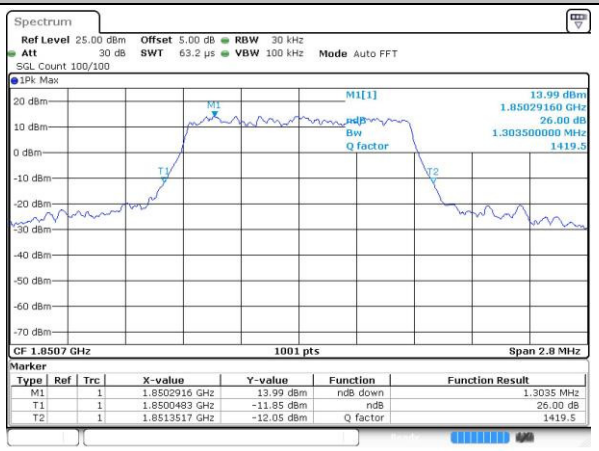
| Mode | LTE Band 7 : 26dB BW (MHz) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BW | 1.4MHz | | 3MHz | | 5MHz | | 10MHz | | 15MHz | | 20MHz | |
| Mod. | QPSK | 16QAM | QPSK | 16QAM | QPSK | 16QAM | QPSK | 16QAM | QPSK | 16QAM | QPSK | 16QAM |
| Lowest CH | - | - | - | - | 4.94 | 4.90 | 9.81 | 9.87 | 14.48 | 14.42 | 20.18 | 20.14 |
| Middle CH | - | - | - | - | 5.02 | 4.96 | 9.81 | 9.95 | 14.45 | 14.39 | 20.18 | 20.30 |
| Highest CH | - | - | - | - | 4.91 | 4.93 | 9.75 | 9.75 | 14.51 | 14.42 | 20.26 | 20.22 |

## LTE Band 2

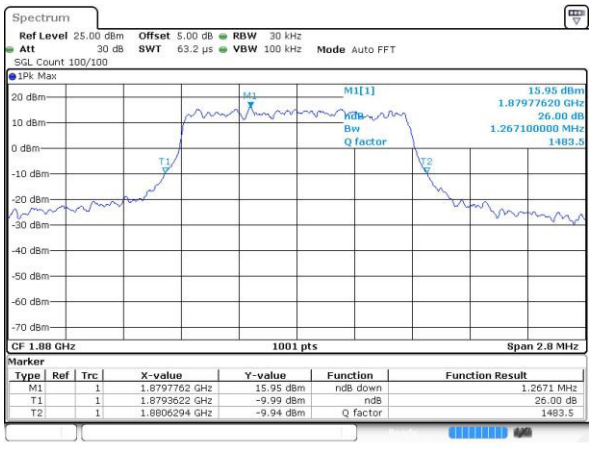
### Lowest Channel / 1.4MHz / QPSK



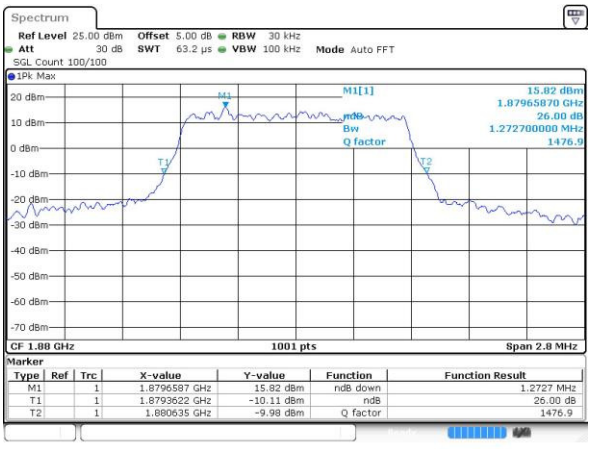

### Lowest Channel / 1.4MHz / 16QAM



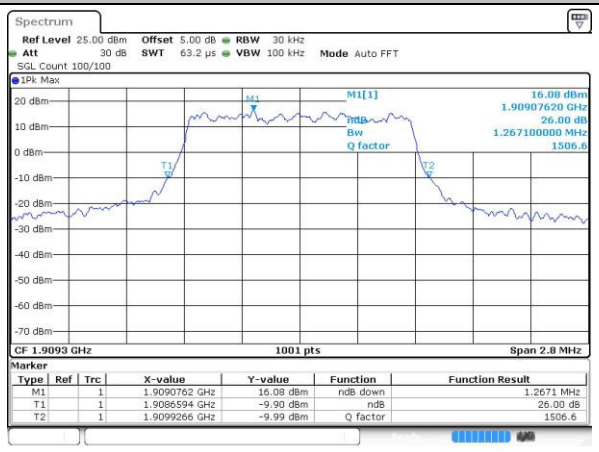

### Middle Channel / 1.4MHz / QPSK



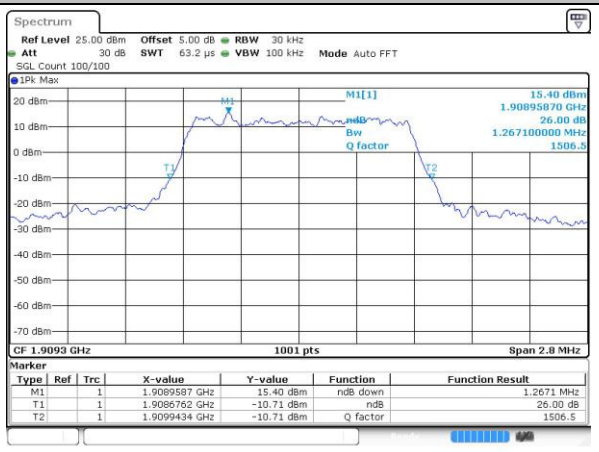

### Middle Channel / 1.4MHz / 16QAM




### Highest Channel / 1.4MHz / QPSK

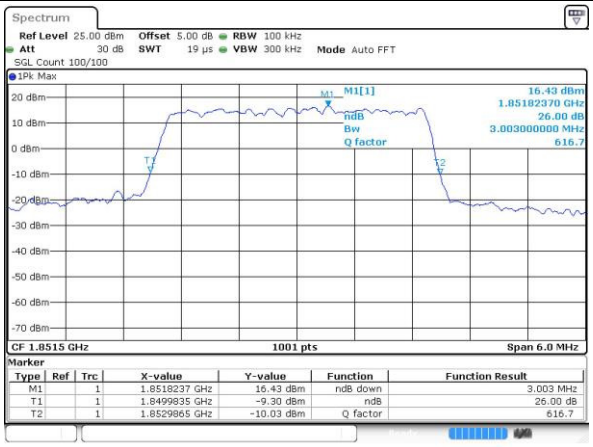



### Highest Channel / 1.4MHz / 16QAM

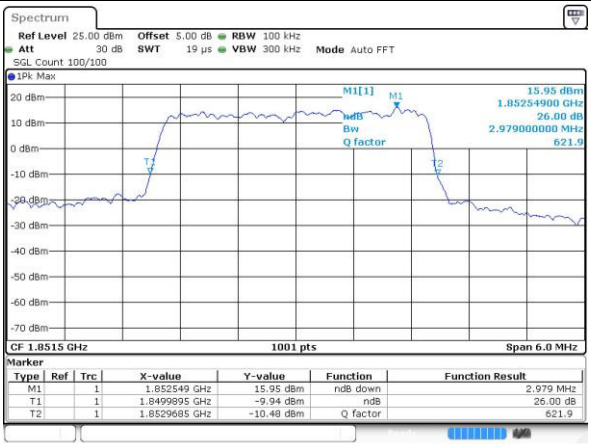


## LTE Band 2

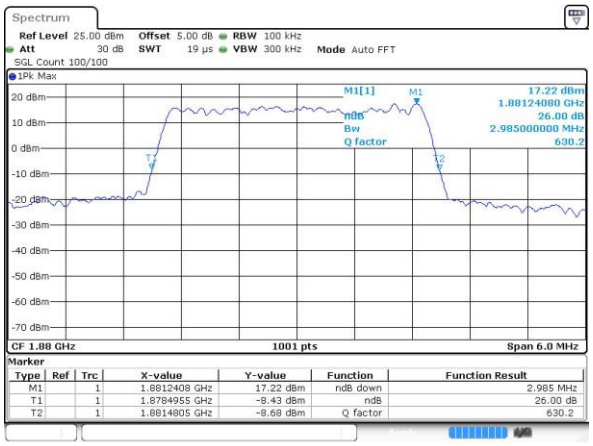
### Lowest Channel / 3MHz / QPSK



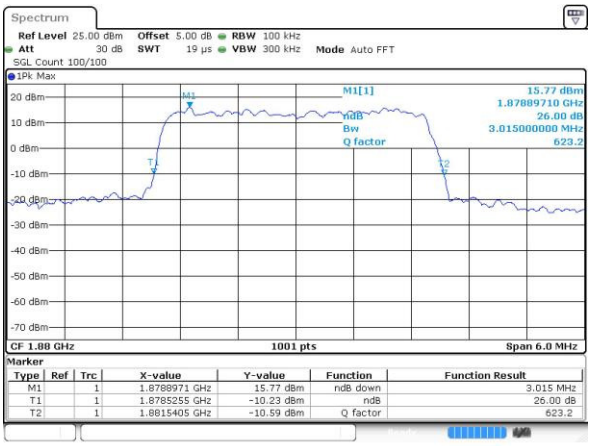

### Lowest Channel / 3MHz / 16QAM



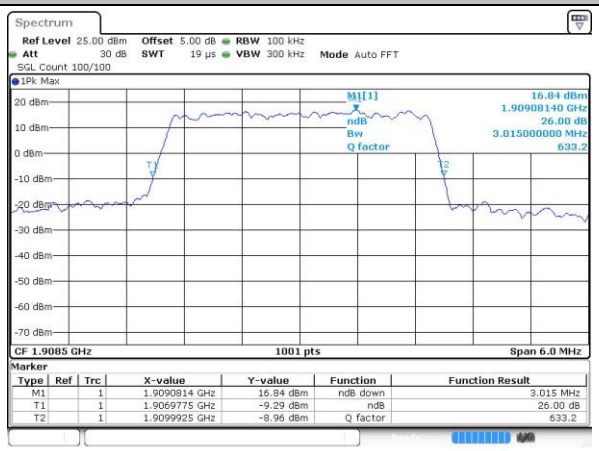

### Middle Channel / 3MHz / QPSK



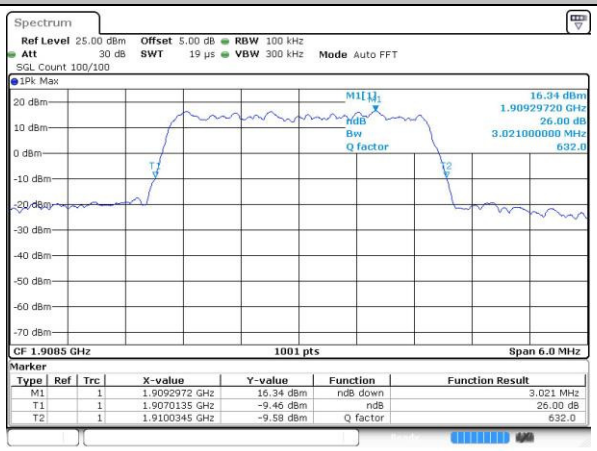

### Middle Channel /3MHz / 16QAM




### Highest Channel /3MHz / QPSK

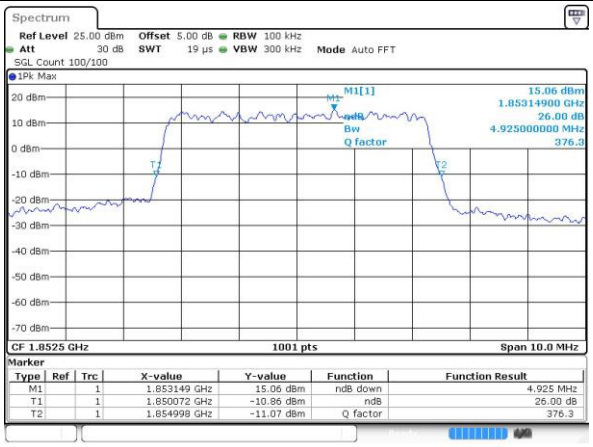



### Highest Channel /3MHz / 16QAM

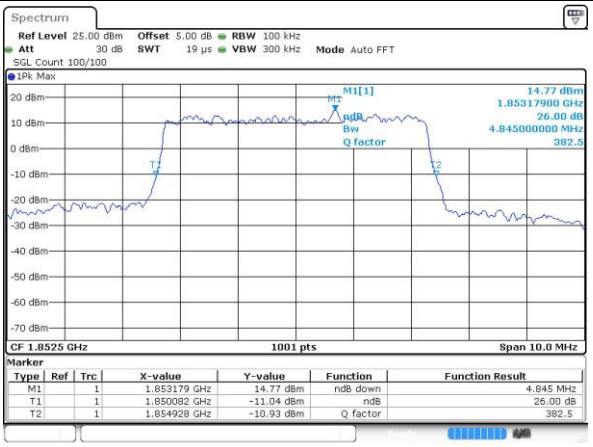


## LTE Band 2

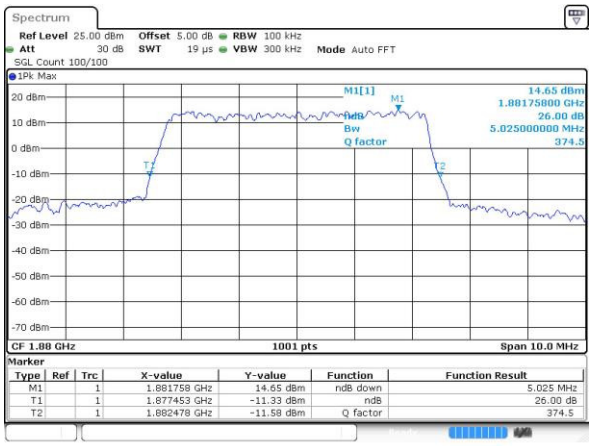
### Lowest Channel / 5MHz / QPSK



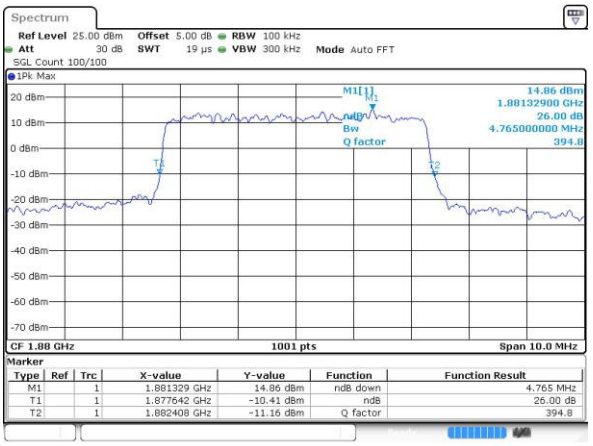

### Lowest Channel / 5MHz / 16QAM



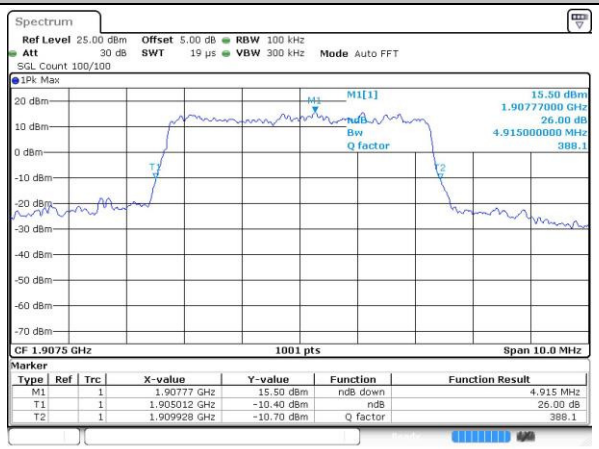

### Middle Channel / 5MHz / QPSK



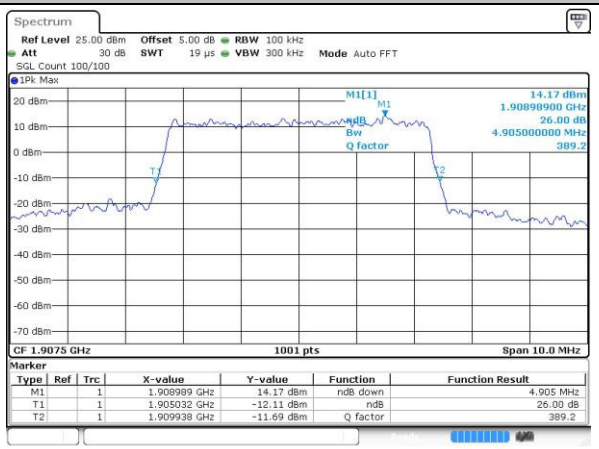

### Middle Channel / 5MHz / 16QAM




### Highest Channel / 5MHz / QPSK

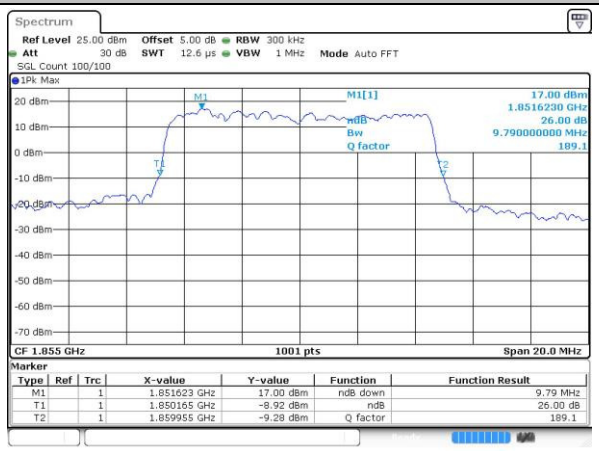



### Highest Channel / 5MHz / 16QAM

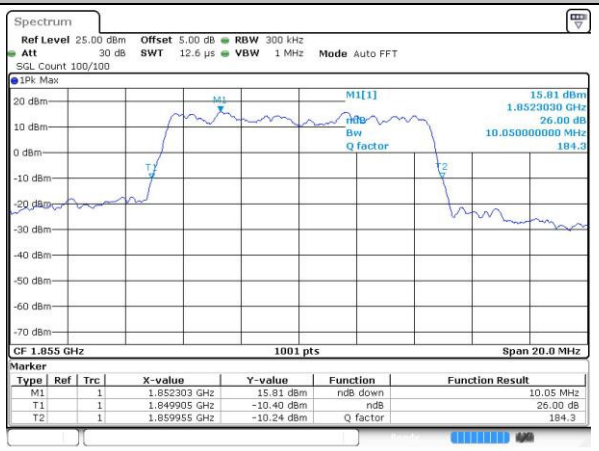


## LTE Band 2

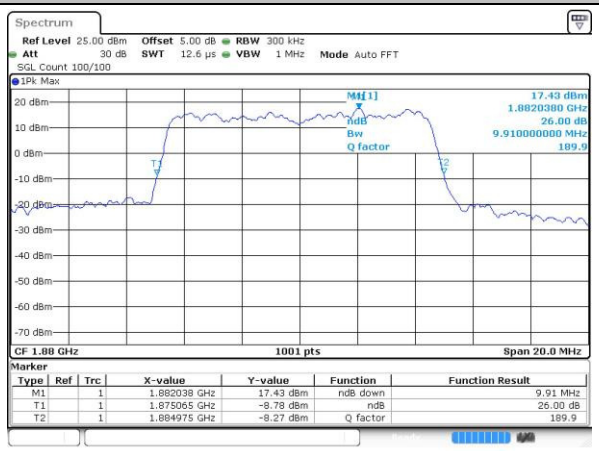
### Lowest Channel / 10MHz / QPSK



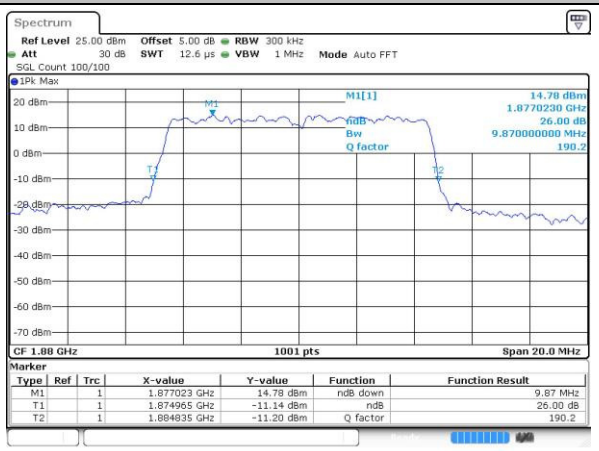

### Lowest Channel / 10MHz / 16QAM



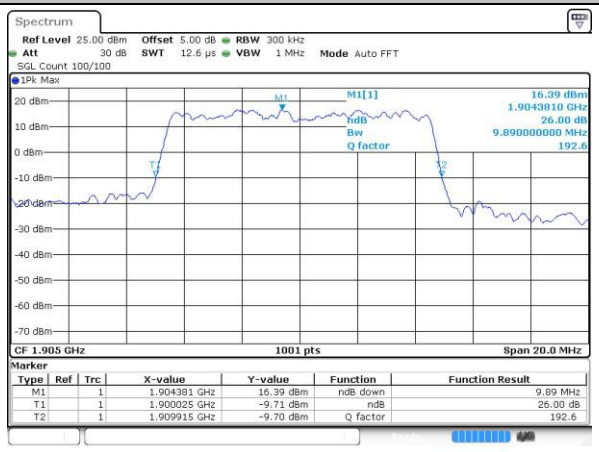

### Middle Channel / 10MHz / QPSK

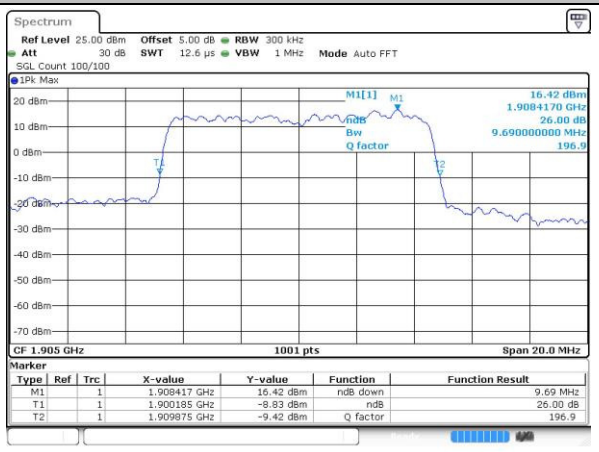



### Middle Channel / 10MHz / 16QAM




### Highest Channel / 10MHz / QPSK




### Highest Channel / 10MHz / 16QAM