

# FCC RF Test Report

**APPLICANT** : VERTU Corporation Limited  
**EQUIPMENT** : GSM 4 Band/CDMA/EVDO 2 Band/TD-SCDMA 2  
Band/UMTS 5 Band/HSUPA/HSDPA/LTE 21  
Band/WLAN/BT/NFC mobile phone  
**BRAND NAME** : VERTU  
**MODEL NAME** : CONSTELLATION X  
**TYPE NAME** : VM-08  
**FCC ID** : P7QVM-08  
**STANDARD** : FCC 47 CFR Part 2, 27  
**CLASSIFICATION** : PCS Licensed Transmitter Held to Ear (PCE)

The product was received on Jul. 20, 2016 and completely tested on Dec. 12, 2016. We, SPORTON INTERNATIONAL (KUNSHAN) INC., would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI / TIA / EIA-603-D-2010 and shown 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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## REVISION HISTORY

| REPORT NO. | VERSION | DESCRIPTION             | ISSUED DATE   |
|------------|---------|-------------------------|---------------|
| FG672003C  | Rev. 01 | Initial issue of report | Feb. 17, 2017 |
|            |         |                         |               |
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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            | -                        | Peak-to-Average Ratio                        | <13dB                                 | N/A    | Reporting only                             |
| 3.6            | §27.50 (a)(3)            | EIRP Power Density                           | EIRP < 250mW/5MHz                     | PASS   | -  |
| 3.7            | §2.1049                  | Occupied Bandwidth                           | Reporting Only                        | PASS   | -  |
| 3.8            | §2.1051<br>§27.53 (a)(4) | Conducted Band Edge Measurement              | Refer standard                        | PASS   | -  |
| 3.9            | §2.1051<br>§27.53 (a)(4) | Conducted Spurious Emission                  | $< 70 + 10\log_{10}(P[\text{Watts}])$ | PASS   | -  |
| 3.10           | §2.1055<br>§27.54        | Frequency Stability<br>Temperature & Voltage | Within the band                       | PASS   | -  |
| 4.4            | §2.1053<br>§27.53 (a)(4) | Radiated Spurious Emission                   | $< 70 + 10\log_{10}(P[\text{Watts}])$ | PASS   | Under limit<br>14.41 dB at<br>6918.000 MHz |



# 1 General Description

## 1.1 Applicant

**VERTU Corporation Limited**

Beacon Hill Road, Church Crookham, Hampshire GU52 8DY, United Kingdom.

## 1.2 Manufacturer

**VERTU Corporation Limited**

Beacon Hill Road, Church Crookham, Hampshire GU52 8DY, United Kingdom.

## 1.3 Product Feature of Equipment Under Test

| Product Feature               |  |
|-------------------------------|--|
| Equipment                     | GSM 4 Band/CDMA/EVDO 2 Band/TD-SCDMA 2 Band/UMTS 5 Band/HSUPA/HSDPA/LTE 21 Band/WLAN/BT/NFC mobile phone |
| Brand Name                    | VERTU  |
| Model Name                    | CONSTELLATION X  |
| Type Name                     | VM-08  |
| FCC ID                        | P7QVM-08   |
| GSM Operating Band(s)         | GSM 850/900/1800/1900MHz   |
| WCDMA Operating Band(s)       | FDD Band I / II / IV / V / VIII  |
| CDMA Operating Band(s)        | CDMA2000 BC0/BC1   |
| LTE Operating Band(s)         | FDD Band 1/2/3/4/5/7/8/12/13/17/19/20/25/26/28/29/30<br>TDD Band 38/39/40/41                             |
| GPRS / EGPRS Multi Slot Class | GPRS Class 33, EGPRS Class 33  |
| Wi-Fi Specification           | 2.4GHz 802.11b/g/n HT20<br>5GHz 802.11a/n HT20/HT40<br>5GHz 802.11ac VHT20/VHT40/VHT80                   |
| Bluetooth Version             | Bluetooth v3.0 + EDR / Bluetooth v4.0 LE/ Bluetooth v4.2 LE  |
| NFC Type                      | A, B, F, V   |
| IMEI Code                     | Conducted: 004402550120079/004402550120087<br>Radiation: 004402550120533/004402550120541                 |
| HW Version                    | PIO2   |
| SW Version                    | 6.0.1_1.434.0.070  |
| EUT Stage                     | Identical Prototype  |

Note: Manufacturer's declaration LTE band 40 disabled by software.

## 1.4 Product Specification of Equipment Under Test

| Product Feature                        |                                       |
|--|---------------------------------------|
| <b>Tx Frequency</b>                    | LTE Band 30 : 2307.5 MHz ~ 2312.5 MHz |
| <b>Rx Frequency</b>                    | LTE Band 30 : 2352.5 MHz ~ 2357.5 MHz |
| <b>Bandwidth</b>                       | 5MHz / 10MHz                          |
| <b>Maximum Output Power to Antenna</b> | LTE Band 30 : 23.69 dBm               |
| <b>Antenna Type</b>                    | PIFA Antenna                          |
| <b>Type of Modulation</b>              | QPSK / 16QAM                          |

## 1.5 Specification of Accessory

| Specification of Accessory      |                         |   |                          |
|---------------------------------|-------------------------|---|--------------------------|
| <b>AC Adapter</b>               | <b>Brand Name</b>       | VERTU   | <b>Model Name</b> AC-32V |
|                                 | <b>Power Rating</b>     | I/P: 100-240Vac, 450mA, O/P: 5Vdc, 2000mA       |                          |
| <b>Battery</b>                  | <b>Brand Name</b>       | VERTU   | <b>Model Name</b> VBL-04 |
|                                 | <b>Power Rating</b>     | 3.82Vdc, 3200mAh                                |                          |
| <b>USB Cable</b>                | <b>Brand Name</b>       | VERTU   | <b>Model Name</b> VC-02  |
|                                 | <b>Signal Line Type</b> | 1.20m shielded cable, without ferrite core      |                          |
| <b>Earphone 1</b>               | <b>Brand Name</b>       | VERTU   | <b>Model Name</b> WH5-V  |
|                                 | <b>Signal Line Type</b> | 1.20m Unshielded cable, without ferrite core    |                          |
| <b>Earphone 2</b>               | <b>Brand Name</b>       | VERTU   | <b>Model Name</b> HP-1V  |
|                                 | <b>Signal Line Type</b> | 1.57m Unshielded cable, without ferrite core    |                          |
| <b>Earphone 3</b>               | <b>Brand Name</b>       | VERTU   | <b>Model Name</b> HP-1V  |
|                                 | <b>Signal Line Type</b> | 1.55m Unshielded cable, without ferrite core    |                          |
| <b>Wireless Charger Pad</b>     | <b>Brand Name</b>       | VERTU   | <b>Model Name</b> AC-35V |
|                                 | <b>Power Rating</b>     | I/P: 5Vac, 1800mA                               |                          |
| <b>Car Charger</b>              | <b>Brand Name</b>       | VERTU   | <b>Model Name</b> DC-30V |
|                                 | <b>Power Rating</b>     | I/P: 12/24Vdc, 1.35A MAX, O/P: 5.15Vdc, 2.1AMAX |                          |
| <b>Bluetooth Travel Speaker</b> | <b>Brand Name</b>       | VERTU   | <b>Model Name</b> SP-1V  |
|                                 | <b>Power Rating</b>     | I/P: 5Vdc, 2Ah                                  |                          |
| <b>Portable Battery Charger</b> | <b>Brand Name</b>       | VERTU   | <b>Model Name</b> DC-10V |
|                                 | <b>Power Rating</b>     | I/P: 5Vdc, 2A, O/P: 5Vdc, 1.5/2.1A              |                          |

## 1.6 Modification of EUT

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

## 1.7 Maximum Frequency Tolerance and Emission Designator

| LTE Band 30 |                       | QPSK                         |                           |                            | 16QAM                        |                           |                            |
|-------------|-----------------------|------------------------------|---------------------------|----------------------------|------------------------------|---------------------------|----------------------------|
| BW (MHz)    | Frequency Range (MHz) | Emission Designator (99%OBW) | Frequency Tolerance (ppm) | Maximum Conducted power(W) | Emission Designator (99%OBW) | Frequency Tolerance (ppm) | Maximum Conducted power(W) |
| 5           | 2307.5 ~ 2312.5       | 4M51G7D                      | -                         | 0.2339                     | 4M49W7D                      | -                         | 0.1936                     |
| 10          | 2310.0                | 8M99G7D                      | 0.0026                    | 0.2259                     | 8M99W7D                      | -                         | 0.1963                     |

## 1.8 Testing Site

|                    |   |           |                      |
|--------------------|---|-----------|----------------------|
| 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               |

## 1.9 Applied Standards

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

- ♦ 47 CFR Part 2, Part 27(D)
- ♦ ANSI / TIA / EIA-603-D-2010
- ♦ FCC KDB 971168 Power Meas License Digital Systems D01 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

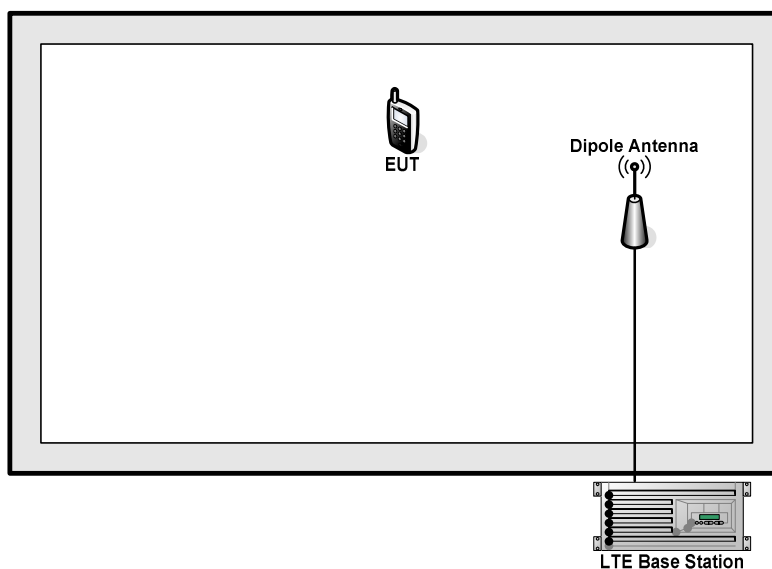
Antenna port conducted and radiated test items listed below are performed according to KDB 971168 D01 Power Meas. License Digital Systems v02r02 with maximum output power.

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

| Conducted Test Cases        | 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           | 30  | -               | - | V |    | -  | -  | V          | V     | V    | V    | V    | V            | V | V |
|                             |   | -               | - |   | V  | -  | -  | V          | V     | V    | V    | V    |              | V |   |
| Peak-to-Average Ratio       | 30  | -               | - |   | V  | -  | -  | V          | V     | V    |      | V    |              | V |   |
| E.I.R.P PSD                 | 30  | -               | - | V |    | -  | -  | V          | V     | V    |      |      | V            | V | V |
|                             |   | -               | - |   | V  | -  | -  | V          | V     | V    |      |      |              | V |   |
| 26dB and 99% Bandwidth      | 30  | -               | - | V |    | -  | -  | V          | V     |      |      | V    | V            | V | V |
|                             |   | -               | - |   | V  | -  | -  | V          | V     |      |      | V    |              | V |   |
| Conducted Band Edge         | 30  | -               | - | V |    | -  | -  | V          | V     | V    |      | V    | V            |   | V |
|                             |   | -               | - |   | V  | -  | -  | V          | V     | V    |      | V    |              | V |   |
| Conducted Spurious Emission | 30  | -               | - | V |    | -  | -  | V          | V     | V    |      |      | V            | V | V |
|                             |   | -               | - |   | V  | -  | -  | V          | V     | V    |      |      |              | V |   |
| Frequency Stability         | 30  | -               | - |   | V  | -  | -  | V          |       |      |      | V    |              | V |   |
| Radiated Spurious Emission  | 30  | -               | - | V |    | -  | -  | V          |       | V    |      |      | V            | V | V |
|                             |   |                 |   |   | V  |    |    | V          |       | V    |      |      |              | V |   |
| Note                        | <ol style="list-style-type: none"> <li>The mark "v " means that this configuration is chosen for testing</li> <li>The mark "- " means that this bandwidth is not supported.</li> <li>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.</li> </ol> |                 |   |   |    |    |    |            |       |      |      |      |              |   |   |



## 2.2 Connection Diagram of Test System



## 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  | GPS-3030D | 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 5.4 dB.

Example :

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)}. \\ &= 5.4 \text{ (dB)} \end{aligned}$$

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

| LTE Band 30 Channel and Frequency List |                        |        |        |         |
|--|------------------------|--------|--------|---------|
| BW [MHz]                               | Channel/Frequency(MHz) | Lowest | Middle | Highest |
| 10                                     | Channel                | -      | 27710  | -       |
|  | Frequency              | -      | 2310   | -       |
| 5                                      | Channel                | 27685  | 27710  | 27735   |
|  | Frequency              | 2307.5 | 2310   | 2312.5  |

### 3 Conducted Test Items

#### 3.1 Measuring Instruments

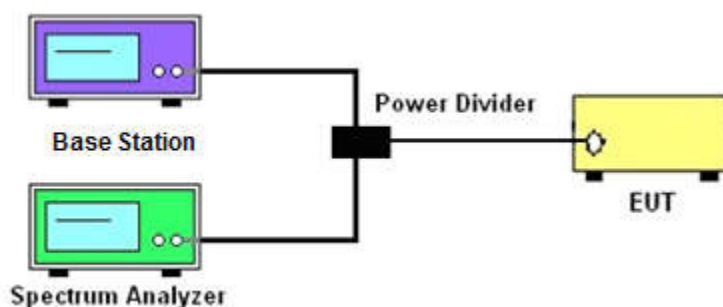
See list of measuring instruments of this test report.

#### 3.2 Test Setup

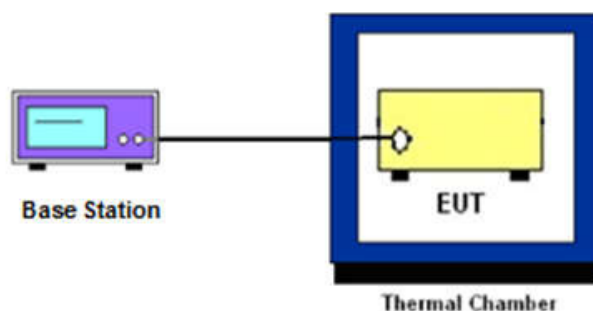
##### 3.2.1 Conducted Output Power



##### 3.2.2 Peak-to-Average Ratio, Occupied / 26dB Bandwidth ,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 Measurement**

### **3.4.1 Description of the Conducted Output Power Measurement**

A base station simulator was used to establish communication with the EUT. Its parameters were set to transmit the maximum power on the EUT. 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 base station.
2. Set EUT at maximum power through base station.
3. Select lowest, middle, and highest channels for each band and different modulation.

## **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 EIRP Power Density

### 3.6.1 Description of EIRP Power Density

For mobile and portable stations transmitting in the 2305-2315 MHz band or the 2350-2360 MHz band, the average EIRP must not exceed 50 milliwatts within any 1 megahertz of authorized bandwidth, *except that* for mobile and portable stations compliant with 3GPP LTE standards or another advanced mobile broadband protocol that avoids concentrating energy at the edge of the operating band the average EIRP must not exceed 250 milliwatts within any 5 megahertz of authorized bandwidth but may exceed 50 milliwatts within any 1 megahertz of authorized bandwidth. For mobile and portable stations using time division duplexing (TDD) technology, the duty cycle must not exceed 38 percent in the 2305-2315 MHz and 2350-2360 MHz bands. Mobile and portable stations using FDD technology are restricted to transmitting in the 2305-2315 MHz band. Power averaging shall not include intervals in which the transmitter is off.

### 3.6.2 Test Procedures

1. Set instrument center frequency to OBW center frequency.
2. Set span to at least 1.5 times the OBW.
3. Set the RBW to the specified reference bandwidth (often 1 MHz).
4. Set VBW  $\geq 3 \times$  RBW.
5. Detector = RMS (power averaging).
6. Ensure that the number of measurement points in the sweep  $\geq 2 \times$  span/RBW.
7. Sweep time = auto couple.
8. Employ trace averaging (RMS) mode over a minimum of 100 traces.
9. Use the peak marker function to determine the maximum amplitude level within the reference bandwidth (PSD).

## 3.7 Occupied Bandwidth

### 3.7.1 Description of Occupied 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 26dB 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 26 dB.

The 26 dB emission bandwidth(EBW) 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.

### 3.7.2 Test Procedures

1. The EUT was connected to Spectrum Analyzer and Base Station via power divider.
2. The 26dB and 99% occupied bandwidth (BW) of the middle channel for the highest RF powers with full RB sizes were measured.

### 3.8 Conducted Band Edge Measurement

#### 3.8.1 Description of Conducted Band Edge Measurement

27.53 (a)(4)

For mobile and portable stations operating in the 2305-2315 MHz and 2350-2360 MHz bands:

(i) By a factor of not less than:  $43 + 10 \log (P)$  dB on all frequencies between 2305 and 2320 MHz and on all frequencies between 2345 and 2360 MHz that are outside the licensed band(s) of operation, not less than  $55 + 10 \log (P)$  dB on all frequencies between 2320 and 2324 MHz and on all frequencies between 2341 and 2345 MHz, not less than  $61 + 10 \log (P)$  dB on all frequencies between 2324 and 2328 MHz and on all frequencies between 2337 and 2341 MHz, and not less than  $67 + 10 \log (P)$  dB on all frequencies between 2328 and 2337 MHz;

(ii) By a factor of not less than  $43 + 10 \log (P)$  dB on all frequencies between 2300 and 2305 MHz,  $55 + 10 \log (P)$  dB on all frequencies between 2296 and 2300 MHz,  $61 + 10 \log (P)$  dB on all frequencies between 2292 and 2296 MHz,  $67 + 10 \log (P)$  dB on all frequencies between 2288 and 2292 MHz, and  $70 + 10 \log (P)$  dB below 2288 MHz;

(iii) By a factor of not less than  $43 + 10 \log (P)$  dB on all frequencies between 2360 and 2365 MHz, and not less than  $70 + 10 \log (P)$  dB above 2365 MHz.

#### 3.8.2 Test Procedures

1. The EUT was connected to Spectrum Analyzer and Base Station via power divider.
2. The band edges of low and high channels were measured with  $RBW \geq 1\%$  EBW set in Spectrum Analyzer, while the EUT was transmitting under maximum power.
3. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
4. The limit line is derived from  $43 + 10\log(P)$  dB below the transmitter power  $P$  (Watts)  
 $= P(W) - [43 + 10\log(P)] (dB) = [30 + 10\log(P)] (dBm) - [43 + 10\log(P)] (dB) = -13dBm$ .



## 3.9 Conducted Spurious Emission Measurement

### 3.9.1 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  $70 + 10 \log (P)$  dB.

It is measured by means of a calibrated spectrum analyzer and scanned from 30MHz up to a frequency including its 10<sup>th</sup> harmonic.

### 3.9.2 Test Procedures

1. The EUT was connected to spectrum analyzer and base station via power divider.
2. 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.
3. The middle channel for the highest RF power within the transmitting frequency was measured.
4. The conducted spurious emission for the whole frequency range was taken.
5. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, taking the record of maximum spurious emission.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
7. The limit line is derived from  $70 + 10\log(P)$ dB below the transmitter power P(Watts)  
 $= P(W) - [70 + 10\log(P)] \text{ (dB)}$   
 $= [30 + 10\log(P)] \text{ (dBm)} - [70 + 10\log(P)] \text{ (dB)}$   
 $= -40\text{dBm}.$

### 3.10 Frequency Stability Measurement

#### 3.10.1 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  $\pm 0.00025\%$  ( $\pm 2.5\text{ppm}$ ) of the center frequency.

#### 3.10.2 Test Procedures for Temperature Variation

1. The EUT was set up in the thermal chamber and connected with the base station.
2. With power OFF, the temperature was decreased to  $-30^{\circ}\text{C}$  and the EUT was stabilized before testing. Power was applied and the maximum change in frequency was recorded within one minute.
3. With power OFF, the temperature was raised in  $10^{\circ}\text{C}$  step up to  $50^{\circ}\text{C}$ . 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.

#### 3.10.3 Test Procedures for Voltage Variation

1. The EUT was placed in a temperature chamber at  $25\pm 5^{\circ}\text{C}$  and connected with the base station.
2. The power supply voltage to the EUT was varied from 85% to 115% of the nominal value measured at the input to the EUT.
3. The variation in frequency was measured for the worst case.

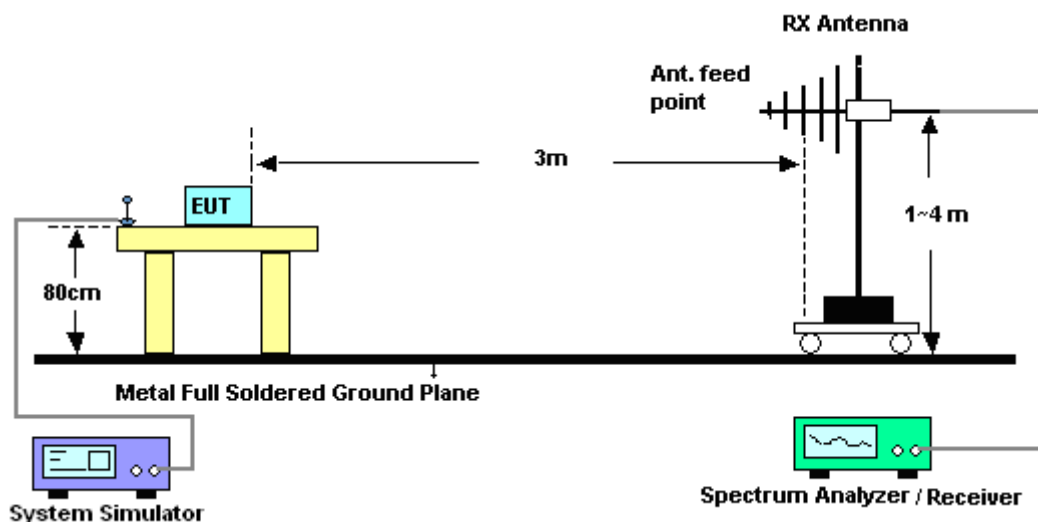
## 4 Radiated Test Items

### 4.1 Measuring Instruments

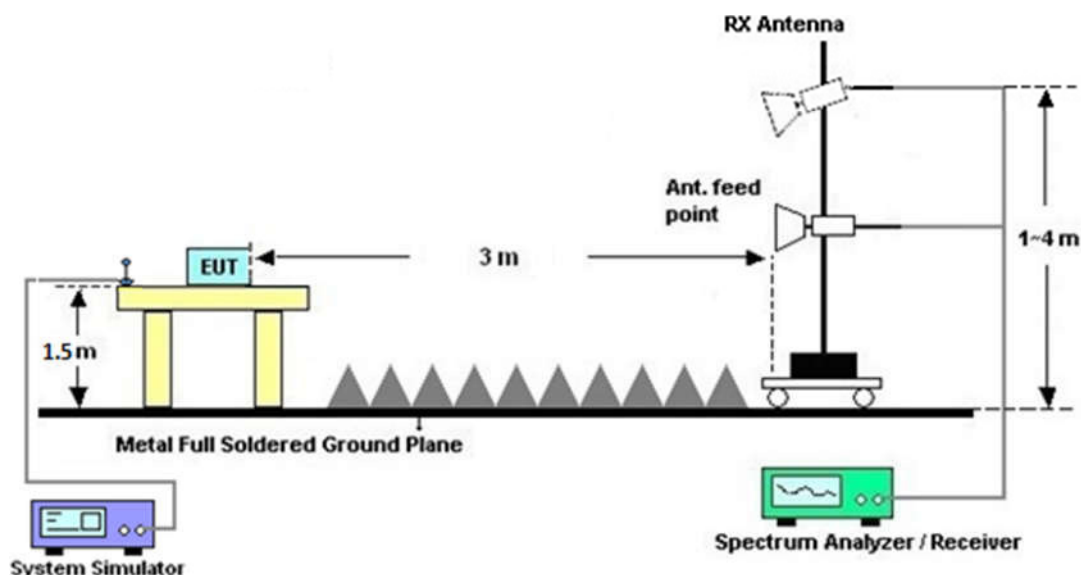
See list of measuring instruments of this test report.

### 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 Radiated Spurious Emission Measurement

### 4.4.1 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  $70 + 10 \log (P)$  dB.

### 4.4.2 Test Procedures

1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the receiving antenna, which was mounted on the antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest spurious emission.
4. 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.
5. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz, Sweep = 500ms, Taking the record of maximum spurious emission.
6. A horn antenna was substituted in place of the EUT and was driven by a signal generator.
7. Tune the output power of signal generator to the same emission level with EUT maximum spurious emission.
8. Taking the record of output power at antenna port.
9. Repeat step 7 to step 8 for another polarization.
10. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

The limit line is derived from  $70 + 10\log(P)$ dB below the transmitter power P(Watts)  
=  $P(W) - [70 + 10\log(P)]$  (dB)  
=  $[30 + 10\log(P)]$  (dBm) -  $[70 + 10\log(P)]$  (dB)  
= -40dBm.

11. EIRP (dBm) = S.G. Power – Tx Cable Loss + Tx Antenna Gain



## 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           | Aug. 09, 2016    | Dec. 08, 2016 | Aug. 08, 2017 | Conducted (TH01-KS)   |
| Thermal Chamber           | Ten Billion  | TTC-B3S       | TBN-960502   | -40~+150°C           | Oct. 13, 2016    | Dec. 08, 2016 | Oct. 12, 2017 | Conducted (TH01-KS)   |
| EXA Spectrum Analyzer     | Keysight     | N9010A        | MY55150208   | 10Hz~44GHz, MAX 30dB | Apr. 22, 2016    | Dec. 12, 2016 | Apr. 21, 2017 | Radiation (03CH02-KS) |
| Bilog Antenna             | TeseQ        | CBL6112D      | 37879        | 30MHz~2GHz           | Aug. 20, 2016    | Dec. 12, 2016 | Aug. 19, 2017 | Radiation (03CH02-KS) |
| Double Ridge Horn Antenna | ETS-Lindgren | 3117          | 75957        | 1GHz~18GHz           | Oct. 22, 2016    | Dec. 12, 2016 | Oct. 21, 2017 | Radiation (03CH02-KS) |
| SHF-EHF Horn              | Schwarzbeck  | BBHA 9170     | BBHA170249   | 15GHz~40GHz          | Mar. 03, 2016    | Dec. 12, 2016 | Mar. 02, 2017 | Radiation (03CH02-KS) |
| Amplifier                 | com-power    | PA-103A       | 161069       | 1kHz~1000MHz / 32 dB | Apr. 22, 2016    | Dec. 12, 2016 | Apr. 21, 2017 | Radiation (03CH02-KS) |
| Amplifier                 | Agilent      | 8449B         | 3008A02384   | 1~26.5GHz Gain 30dB  | Oct. 13, 2016    | Dec. 12, 2016 | Oct. 12, 2017 | Radiation (03CH02-KS) |
| Amplifier                 | MITEQ        | TTA1840-35-HG | 1887435      | 18~40GHz             | Jan. 20, 2016    | Dec. 12, 2016 | Jan. 19, 2017 | Radiation (03CH02-KS) |
| AC Power Source           | Chroma       | 61601         | 616010002473 | N/A                  | NCR              | Dec. 12, 2016 | NCR           | Radiation (03CH02-KS) |
| Turn Table                | MF           | MF7802        | N/A          | 0~360 degree         | NCR              | Dec. 12, 2016 | NCR           | Radiation (03CH02-KS) |
| Antenna Mast              | MF           | MF7802        | N/A          | 1 m~4 m              | NCR              | Dec. 12, 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% ( $U = 2U_c(y)$ ) | 5.1dB |
|--|-------|

### Uncertainty of Radiated Emission Measurement (1GHz ~ 18GHz)

|  |       |
|--|-------|
| Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2U_c(y)$ ) | 4.5dB |
|--|-------|

### Uncertainty of Radiated Emission Measurement (18GHz ~ 40GHz)

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

## Appendix A. Test Results of Conducted Test

### Conducted Output Power(Average power)

| LTE Band 30 Maximum Average Power [dBm] |         |           |        |        |        |         |
|---|---------|-----------|--------|--------|--------|---------|
| BW [MHz]                                | RB Size | RB Offset | Mod    | Lowest | Middle | Highest |
| 5                                       | 1       | 0         | QPSK   | 23.67  | 23.69  | 23.65   |
| 5                                       | 1       | 12        |        | 23.31  | 23.35  | 23.33   |
| 5                                       | 1       | 24        |        | 23.28  | 23.35  | 23.29   |
| 5                                       | 12      | 0         |        | 22.40  | 22.44  | 22.50   |
| 5                                       | 12      | 7         |        | 22.44  | 22.51  | 22.45   |
| 5                                       | 12      | 13        |        | 22.44  | 22.43  | 22.38   |
| 5                                       | 25      | 0         |        | 22.39  | 22.40  | 22.46   |
| 5                                       | 1       | 0         | 16-QAM | 22.71  | 22.87  | 22.75   |
| 5                                       | 1       | 12        |        | 22.69  | 22.73  | 22.73   |
| 5                                       | 1       | 24        |        | 22.64  | 22.75  | 22.62   |
| 5                                       | 12      | 0         |        | 21.41  | 21.44  | 21.53   |
| 5                                       | 12      | 7         |        | 21.47  | 21.48  | 21.46   |
| 5                                       | 12      | 13        |        | 21.49  | 21.45  | 21.39   |
| 5                                       | 25      | 0         |        | 21.43  | 21.46  | 21.52   |
| 10                                      | 1       | 0         | QPSK   |        | 23.54  |         |
| 10                                      | 1       | 25        |        |        | 23.35  |         |
| 10                                      | 1       | 49        |        |        | 23.28  |         |
| 10                                      | 25      | 0         |        |        | 22.48  |         |
| 10                                      | 25      | 12        |        |        | 22.52  |         |
| 10                                      | 25      | 25        |        |        | 22.36  |         |
| 10                                      | 50      | 0         |        |        | 22.46  |         |
| 10                                      | 1       | 0         | 16-QAM |        | 22.93  |         |
| 10                                      | 1       | 25        |        |        | 22.84  |         |
| 10                                      | 1       | 49        |        |        | 22.63  |         |
| 10                                      | 25      | 0         |        |        | 21.49  |         |
| 10                                      | 25      | 12        |        |        | 21.53  |         |
| 10                                      | 25      | 25        |        |        | 21.35  |         |
| 10                                      | 50      | 0         |        |        | 21.46  |         |

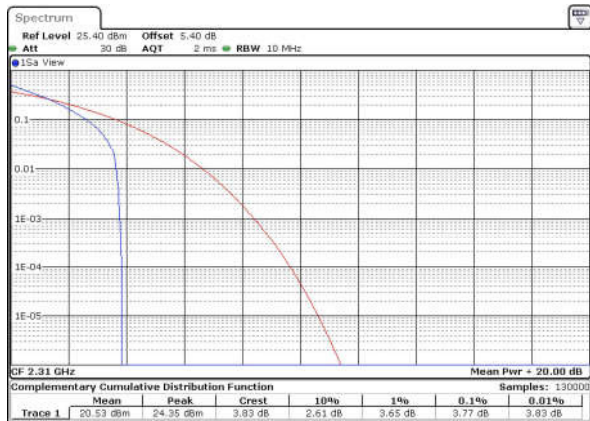
**Peak-to-Average Ratio**

| Mode      | LTE Band 30 / 10MHz |         |       |         |             |
|-----------|---------------------|---------|-------|---------|-------------|
| Mod.      | QPSK                |         | 16QAM |         | Limit: 13dB |
| RB Size   | 1RB                 | Full RB | 1RB   | Full RB | Result      |
| Middle CH | 3.77                | 4.64    | 4.61  | 5.62    | <b>PASS</b> |



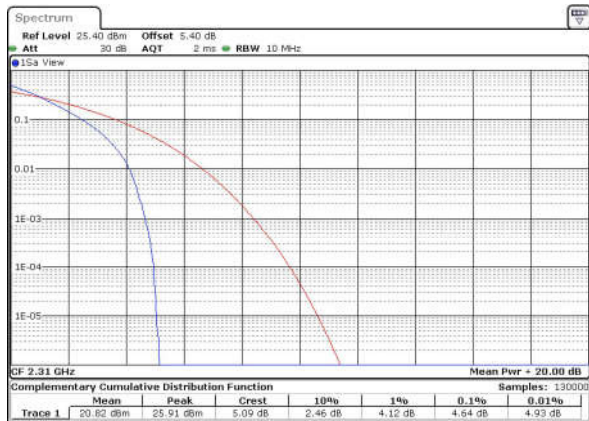
### LTE Band 30 / 10MHz / QPSK

#### Middle Channel / 1RB



Date: 8 DEC 2016 10:51:53

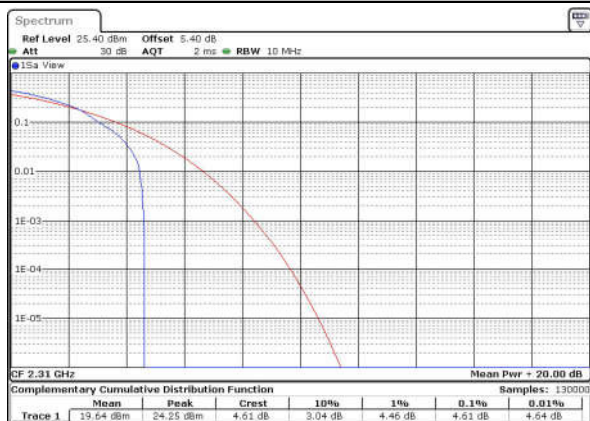
#### Middle Channel / Full RB



Date: 8 DEC 2016 10:52:04

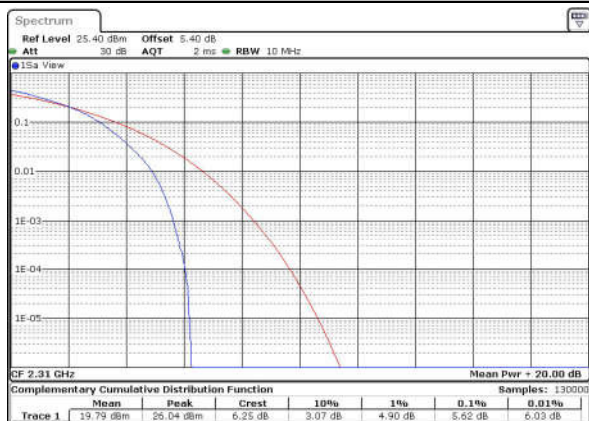
### LTE Band 30 / 10MHz / 16QAM

#### Middle Channel / 1RB



Date: 8 DEC 2016 10:52:07

#### Middle Channel / Full RB



Date: 8 DEC 2016 10:52:47

**EIRP Power Density**

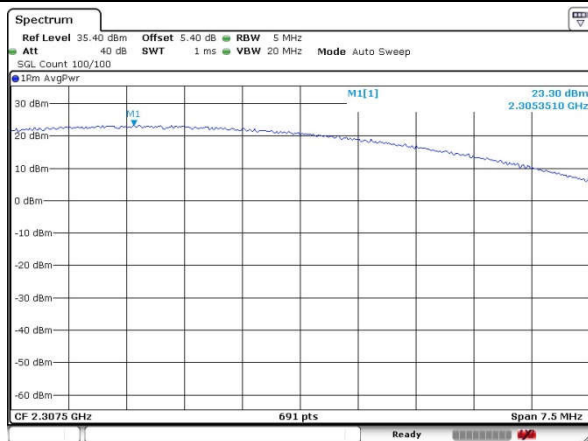
| Mode       | LTE Band 30 : Conducted Power Density (dBm/5MHz) |       |      |       |       |       |       |       |       |       |       |       |
|------------|--|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| BW         | 1.4MHz   |       | 3MHz |       | 5MHz  |       | 10MHz |       | 15MHz |       | 20MHz |       |
| Mod.       | QPSK   | 16QAM | QPSK | 16QAM | QPSK  | 16QAM | QPSK  | 16QAM | QPSK  | 16QAM | QPSK  | 16QAM |
| Lowest CH  |  |       |      |       | 23.3  | 22.35 |       |       |       |       |       |       |
| Middle CH  |  |       |      |       | 23.27 | 22.35 | 23.24 | 22.47 |       |       |       |       |
| Highest CH |  |       |      |       | 23.22 | 22.36 |       |       |       |       |       |       |

| Mode         | LTE Band 30 : EIRP Power Density (dBm/5MHz) |       |      |       |       |       |       |       |       |       |       |       |
|--------------|---|-------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| BW           | 1.4MHz                                      |       | 3MHz |       | 5MHz  |       | 10MHz |       | 15MHz |       | 20MHz |       |
| Mod.         | QPSK  | 16QAM | QPSK | 16QAM | QPSK  | 16QAM | QPSK  | 16QAM | QPSK  | 16QAM | QPSK  | 16QAM |
| Lowest CH    |   |       |      |       | 21.3  | 20.35 |       |       |       |       |       |       |
| Middle CH    |   |       |      |       | 21.27 | 20.35 | 21.24 | 20.47 |       |       |       |       |
| Highest CH   |   |       |      |       | 21.22 | 20.36 |       |       |       |       |       |       |
| Antenna Gain | -2dBi                                       |       |      |       |       |       |       |       |       |       |       |       |
| Limit        | 250mW / 5MHz = 24dBm / 5MHz                 |       |      |       |       |       |       |       |       |       |       |       |
| Result       | Pass  |       |      |       |       |       |       |       |       |       |       |       |



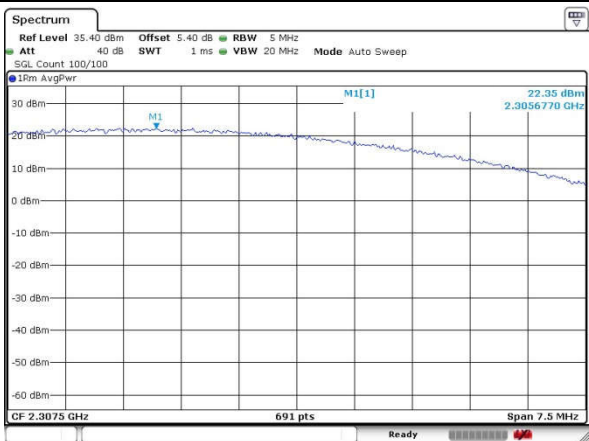
## LTE Band 30 / 5MHz

## Lowest Channel / 5MHz / 1RB0 / QPSK



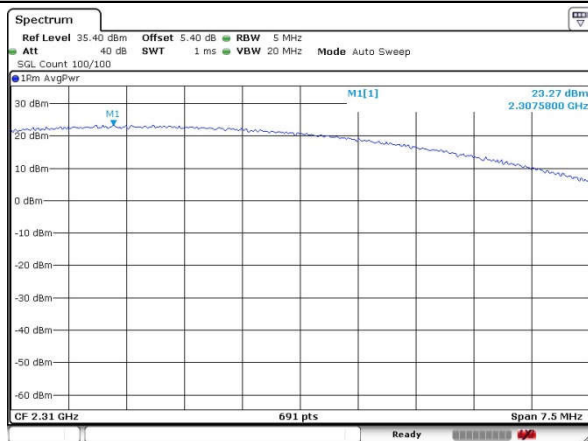
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## Lowest Channel / 5MHz / 1RB0 / 16QAM



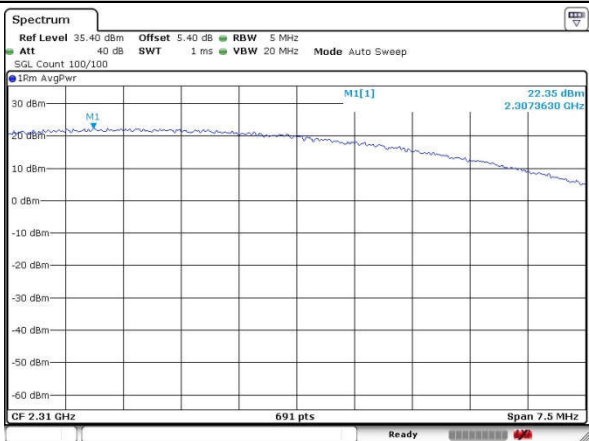
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## Middle Channel / 5MHz / 1RB0 / QPSK



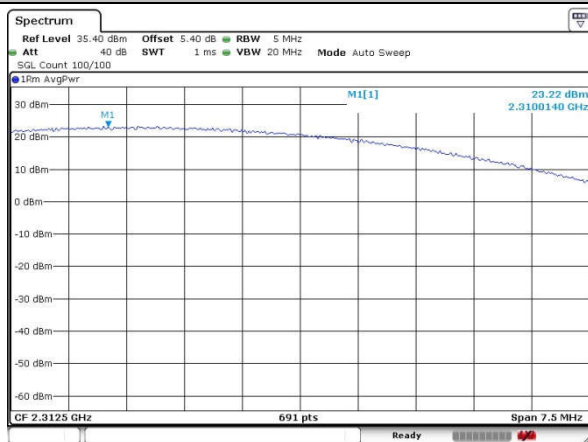
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## Middle Channel / 5MHz / 1RB0 / 16QAM



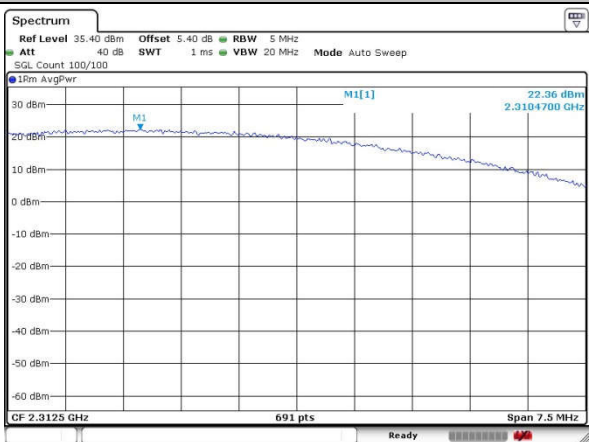
Date: 8 DEC 2016 15:07:12

## Highest Channel / 5MHz / 1RB0 / QPSK



Date: 8 DEC 2016 15:08:36

## Highest Channel / 5MHz / 1RB0 / 16QAM



Date: 8 DEC 2016 15:09:17

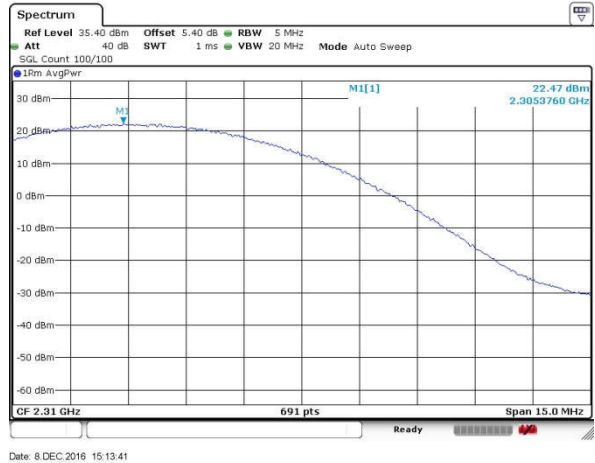


LTE Band 30 / 10MHz

Middle Channel / 10MHz / 1RB0 / QPSK



Middle Channel / 10MHz / 1RB0 / 16QAM

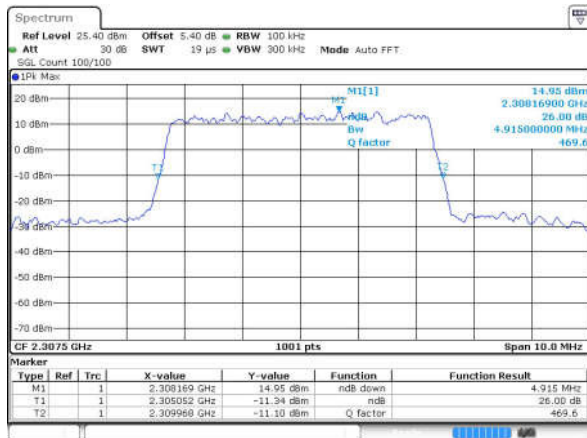


**26dB Bandwidth**

| Mode       | LTE Band 30 : 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  |                            |       |      |       | 4.92 | 4.92  |       |       |       |       |       |       |
| Middle CH  |                            |       |      |       | 4.83 | 4.89  | 9.75  | 9.85  |       |       |       |       |
| Highest CH |                            |       |      |       | 4.92 | 4.89  |       |       |       |       |       |       |

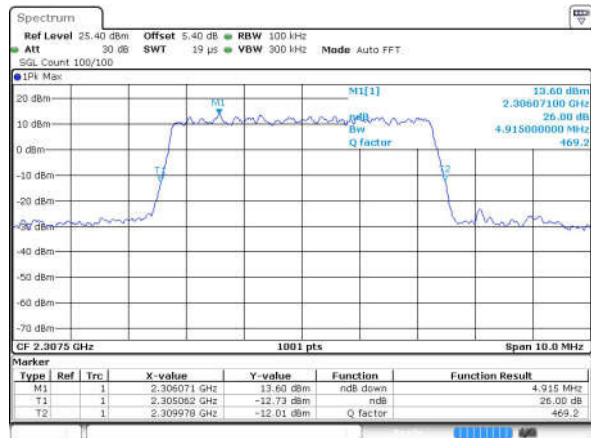
### LTE Band 30

#### Lowest Channel / 5MHz / QPSK



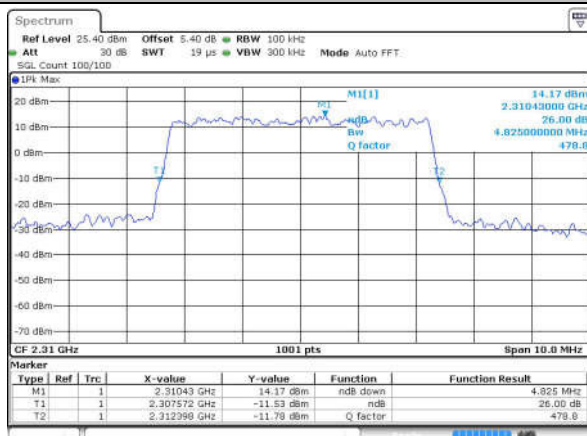
Date: 8 DEC 2016 09:54:32

#### Lowest Channel / 5MHz / 16QAM



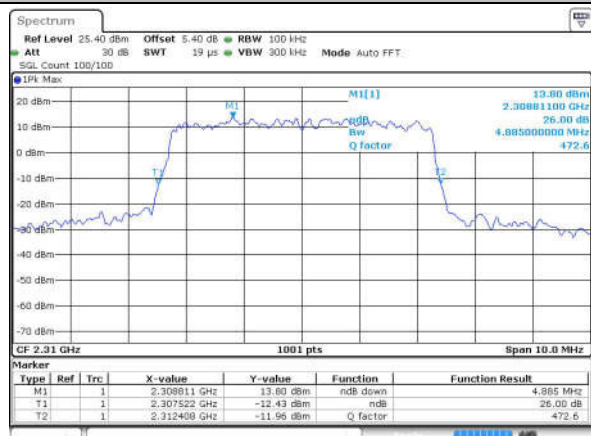
Date: 8 DEC 2016 09:58:34

#### Middle Channel / 5MHz / QPSK



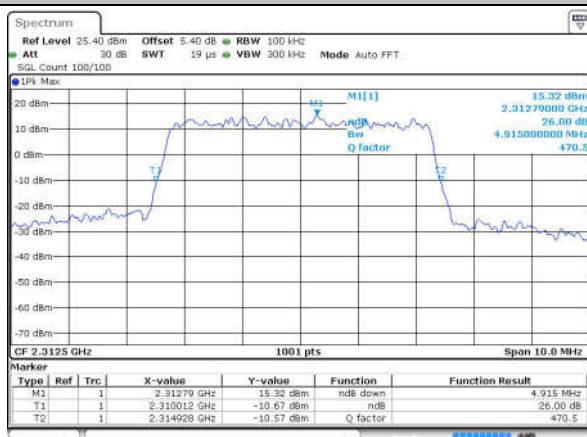
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#### Middle Channel / 5MHz / 16QAM



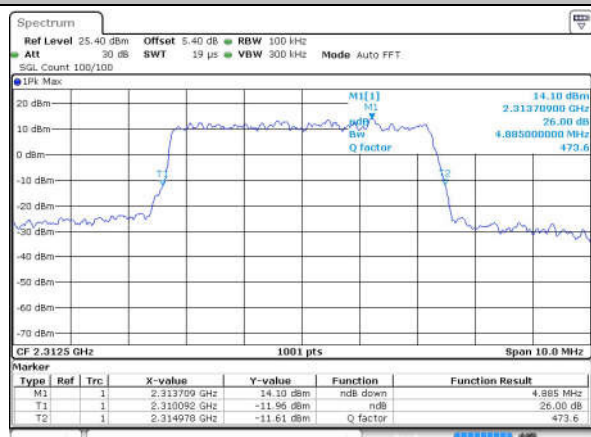
Date: 8 DEC 2016 09:58:06

#### Highest Channel / 5MHz / QPSK



Date: 8 DEC 2016 09:59:47

#### Highest Channel / 5MHz / 16QAM

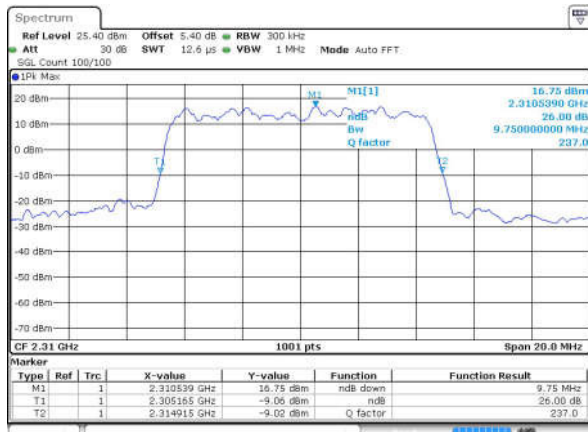


Date: 8 DEC 2016 09:55:44



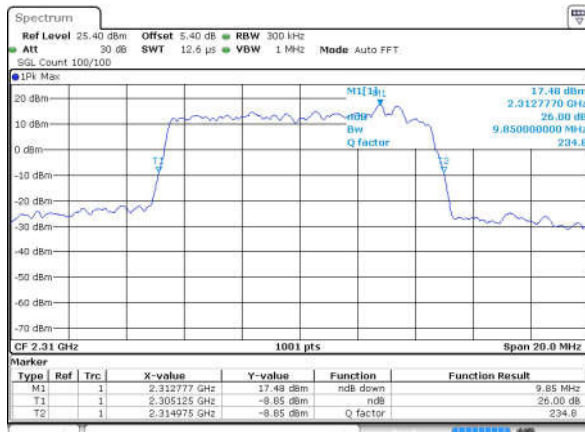
## LTE Band 30

## Middle Channel / 10MHz / QPSK



Date: 8 DEC 2016 10:02:29

## Middle Channel / 10MHz / 16QAM



Date: 8 DEC 2016 10:02:58

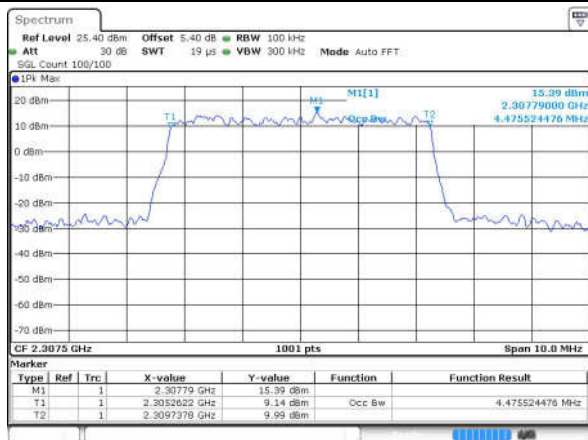
**Occupied Bandwidth**

| Mode       | LTE Band 30 : 99%OBW(MHz) |       |      |       |      |       |       |       |       |       |       |       |
|------------|---------------------------|-------|------|-------|------|-------|-------|-------|-------|-------|-------|-------|
| BW         | 1.4MHz                    |       | 3MHz |       | 5MHz |       | 10MHz |       | 15MHz |       | 20MHz |       |
| Mod.       | QPSK                      | 16QAM | QPSK | 16QAM | QPSK | 16QAM | QPSK  | 16QAM | QPSK  | 16QAM | QPSK  | 16QAM |
| Lowest CH  |                           |       |      |       | 4.48 | 4.48  |       |       |       |       |       |       |
| Middle CH  |                           |       |      |       | 4.48 | 4.49  | 8.99  | 8.99  |       |       |       |       |
| Highest CH |                           |       |      |       | 4.51 | 4.47  |       |       |       |       |       |       |



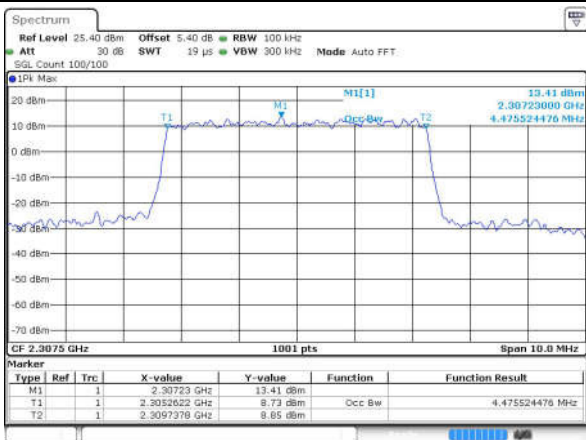
## LTE Band 30

### Lowest Channel / 5MHz / QPSK



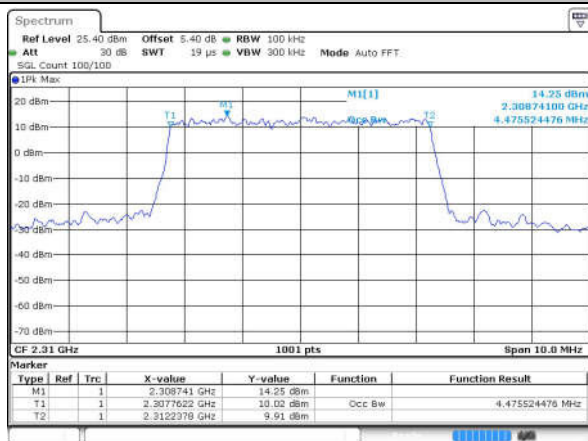
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### Lowest Channel / 5MHz / 16QAM



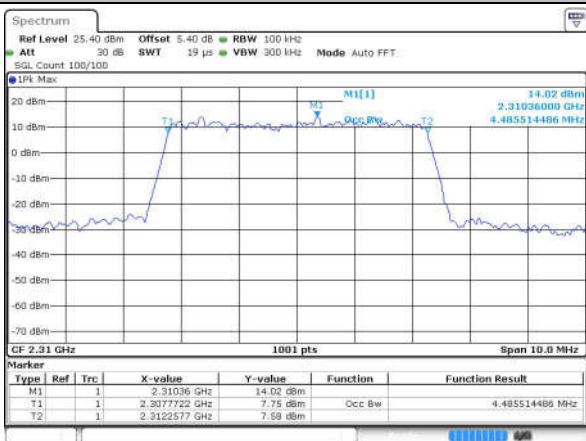
Date: 8 DEC 2016 09:56:23

### Middle Channel / 5MHz / QPSK



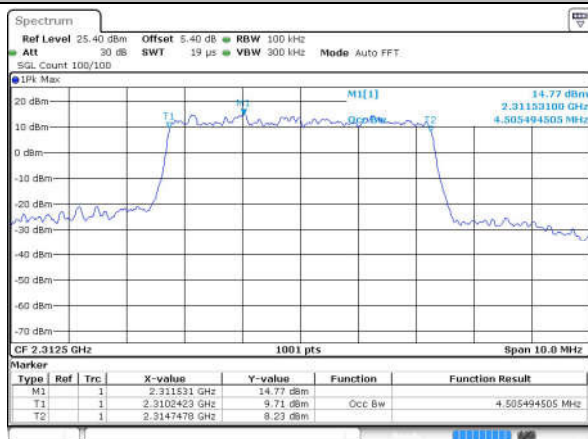
Date: 8 DEC 2016 09:54:46

### Middle Channel / 5MHz / 16QAM



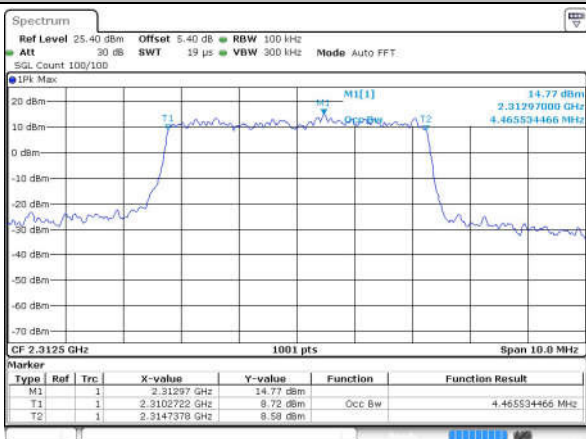
Date: 8 DEC 2016 10:00:40

### Highest Channel / 5MHz / QPSK



Date: 8 DEC 2016 10:01:28

### Highest Channel / 5MHz / 16QAM

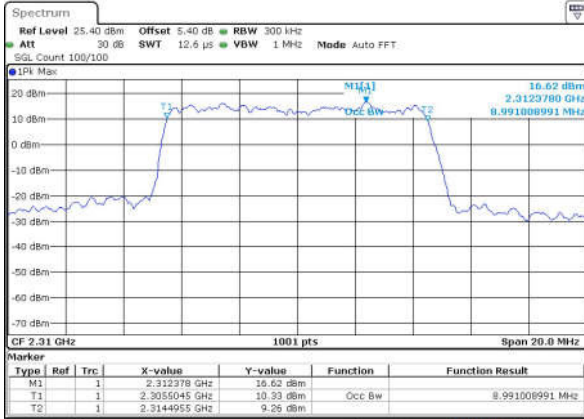


Date: 8 DEC 2016 09:55:35



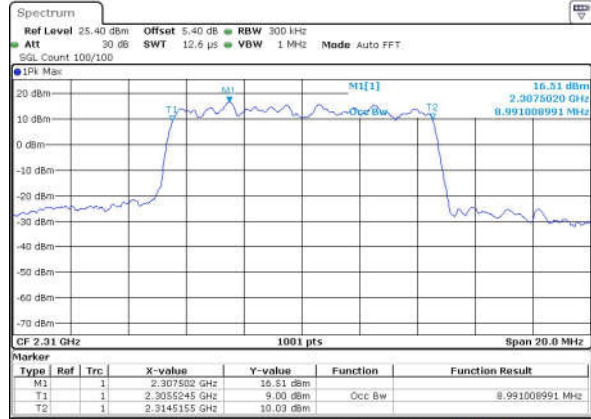
## LTE Band 30

## Middle Channel / 10MHz / QPSK



Date: 8 DEC 2016 10:04:37

## Middle Channel / 10MHz / 16QAM



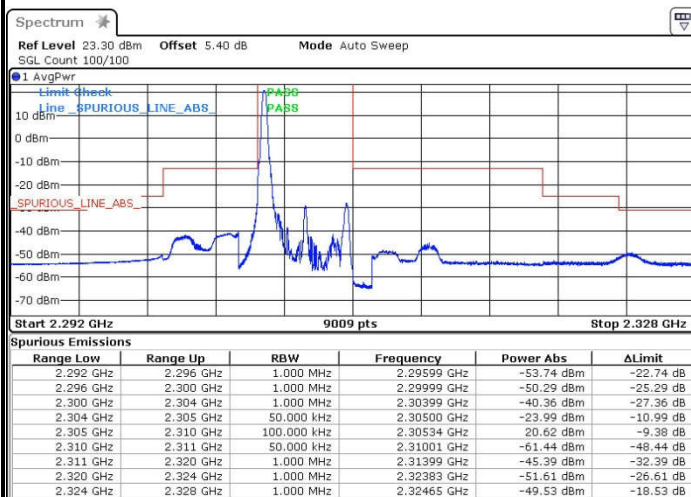
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# Conducted Band Edge

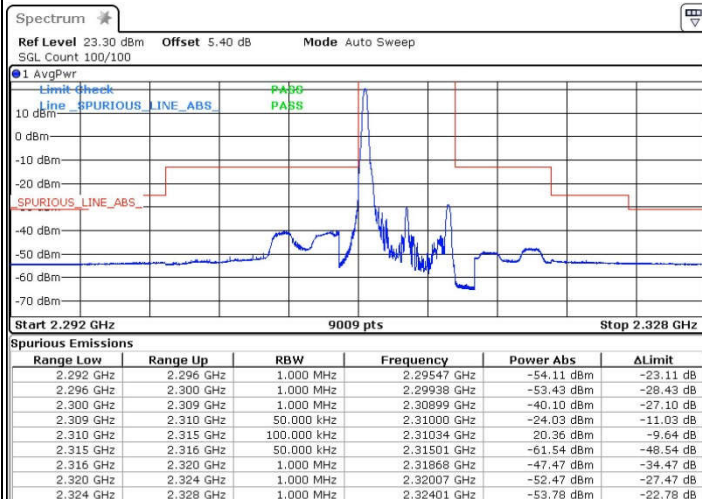
## LTE Band 30 / 5MHz / QPSK

### Lowest Band Edge / 1 RB0



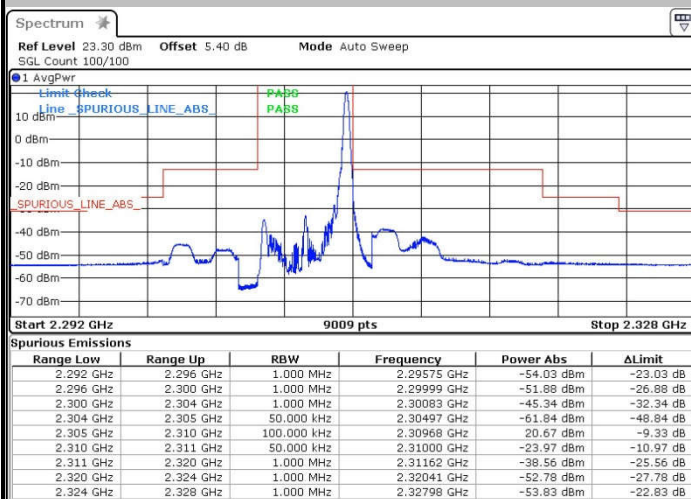
Date: 8 DEC.2016 10:41:31

### Highest Band Edge / 1 RB0



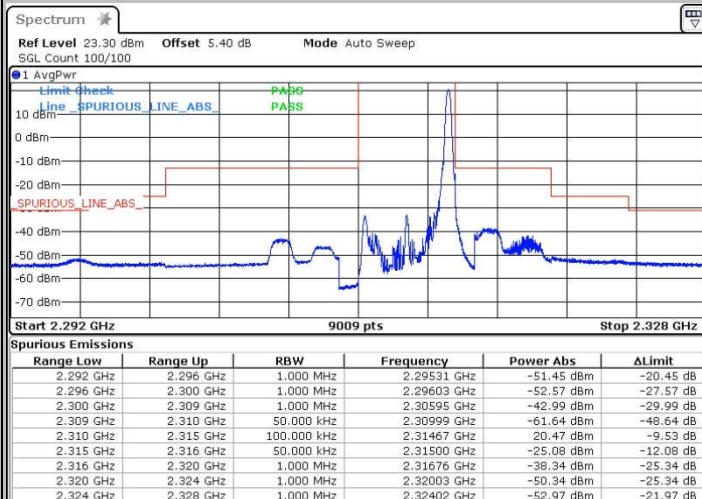
Date: 8 DEC.2016 15:36:24

### Lowest Band Edge / 1 RB max



Date: 8 DEC.2016 15:29:32

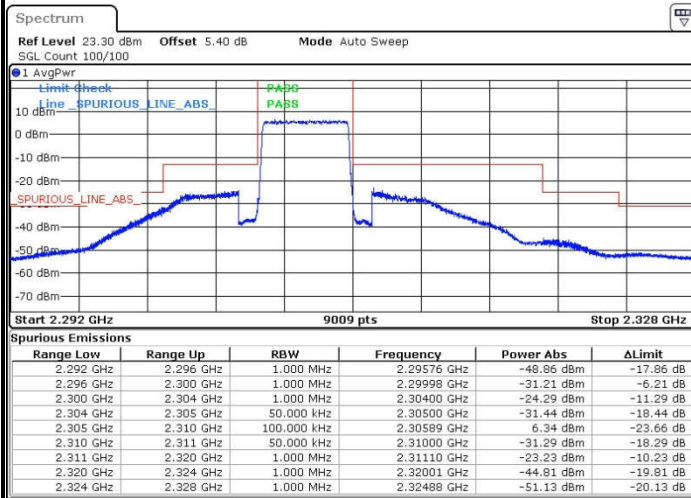
### Highest Band Edge / 1 RBmax



Date: 8 DEC.2016 10:55:06

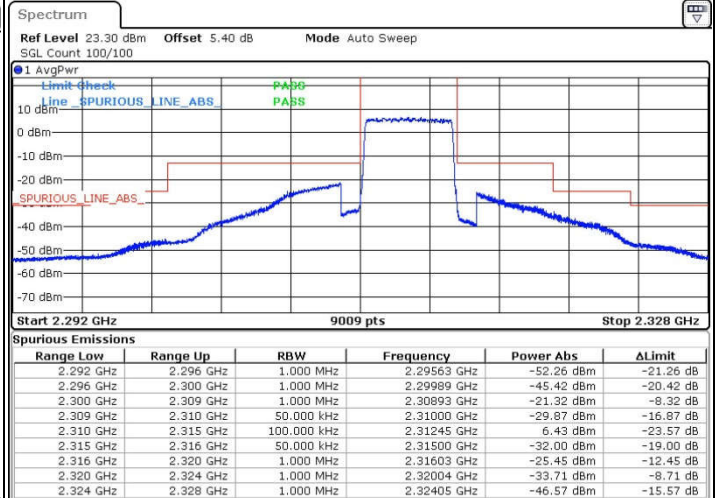


## Lowest Band Edge / Full RB



Date: 8 DEC. 2016 10:47:56

## Highest Band Edge / Full RB



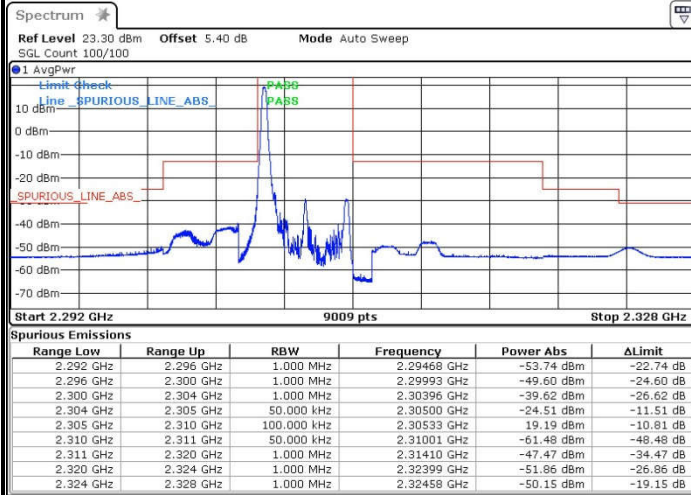
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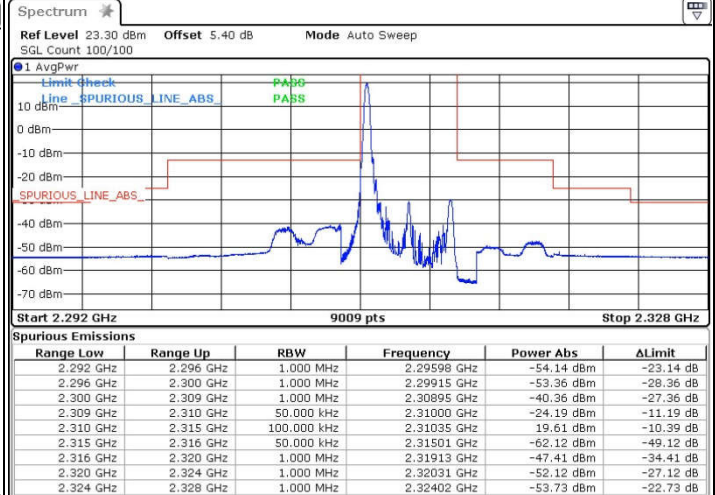
## LTE Band 30 / 5MHz / 16QAM

## Lowest Band Edge / 1 RB0



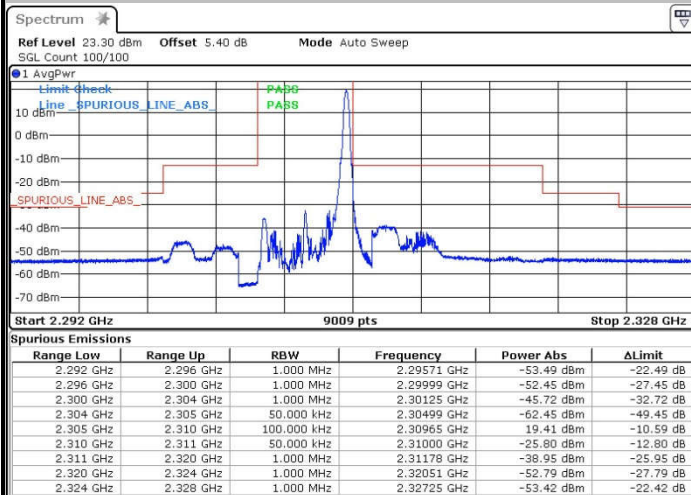
Date: 8 DEC.2016 10:46:06

## Highest Band Edge / 1 RB0



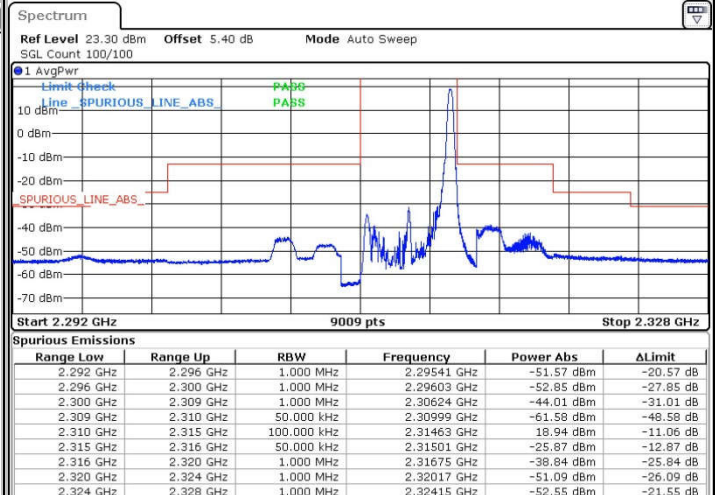
Date: 8 DEC.2016 15:47:11

## Lowest Band Edge / 1 RB max



Date: 8 DEC.2016 15:30:51

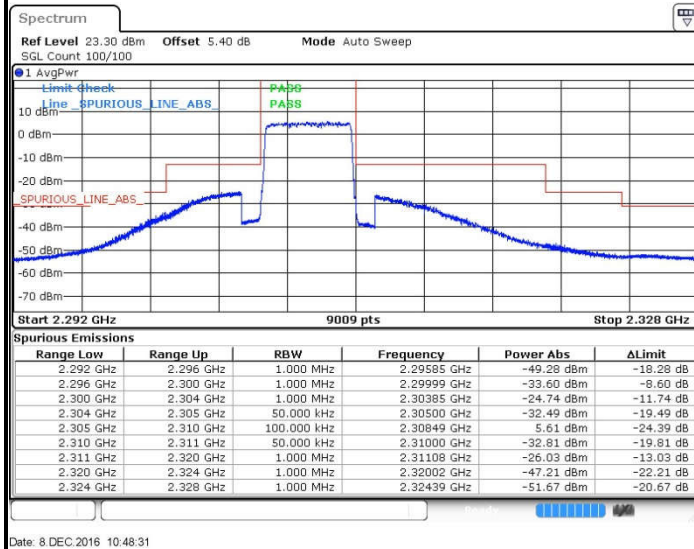
## Highest Band Edge / 1 RBmax



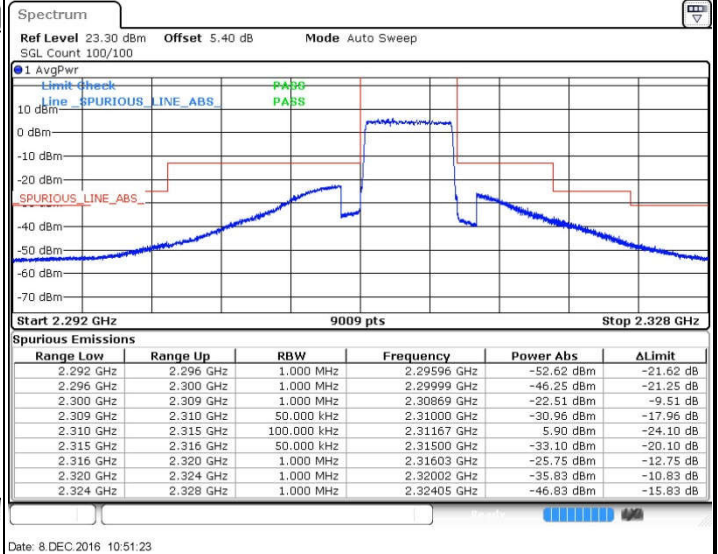
Date: 8 DEC.2016 10:50:08



## Lowest Band Edge / Full RB



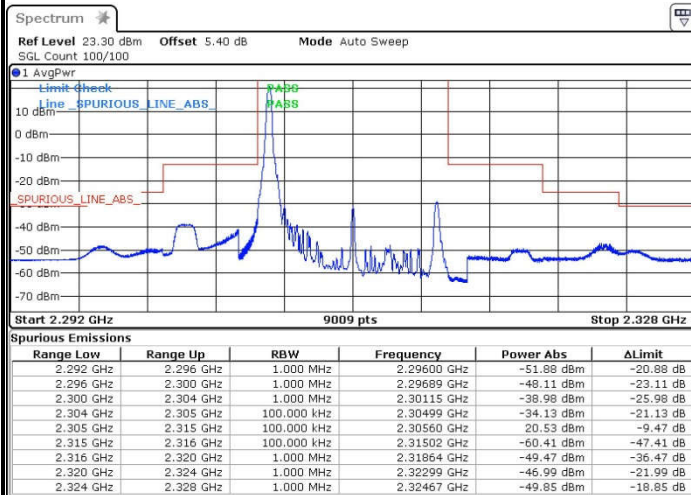
## Highest Band Edge / Full RB





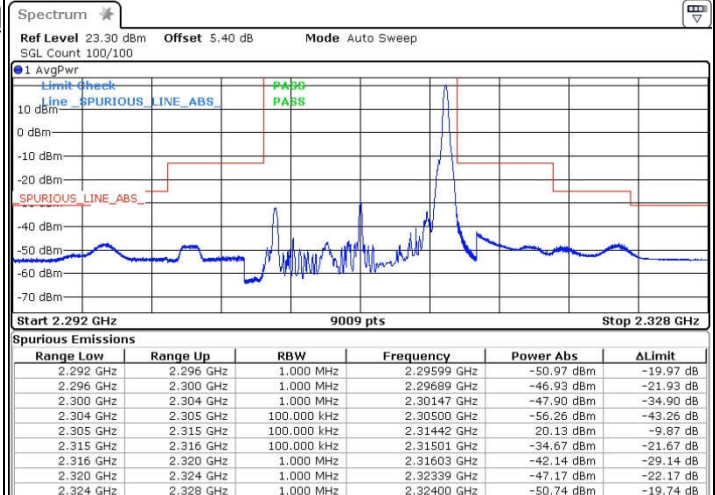
## LTE Band 30 / 10MHz / QPSK

## Lowest Band Edge / 1 RB



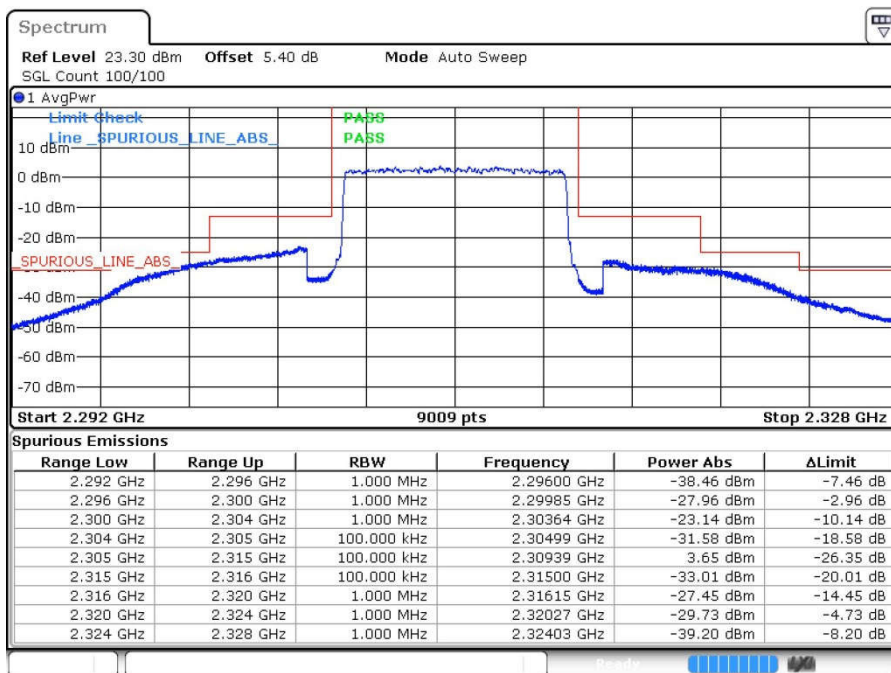
Date: 8 DEC. 2016 10:27:16

## Highest Band Edge / 1 RB



Date: 8 DEC. 2016 10:29:10

## Band Edge / Full RB

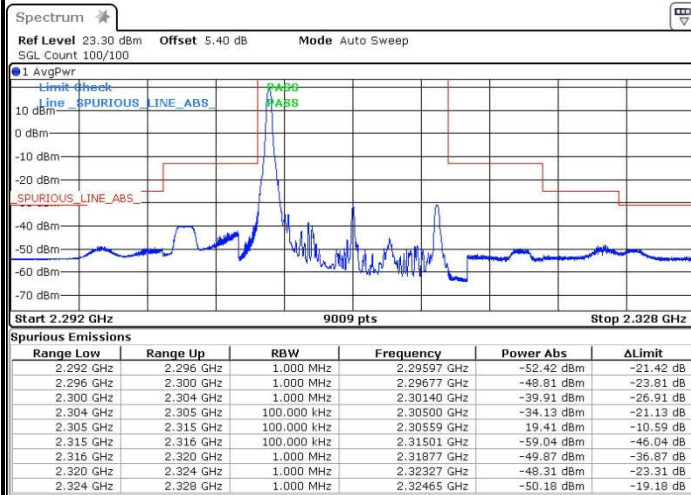


Date: 8 DEC. 2016 10:29:37



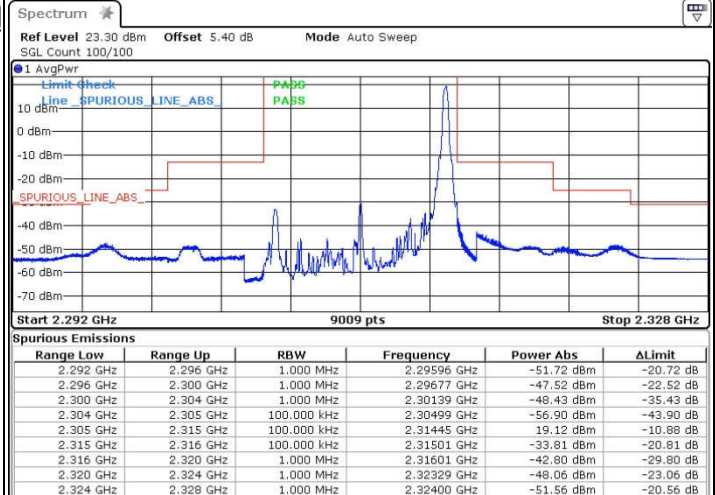
## LTE Band 30 / 10MHz / 16QAM

## Lowest Band Edge / 1 RB



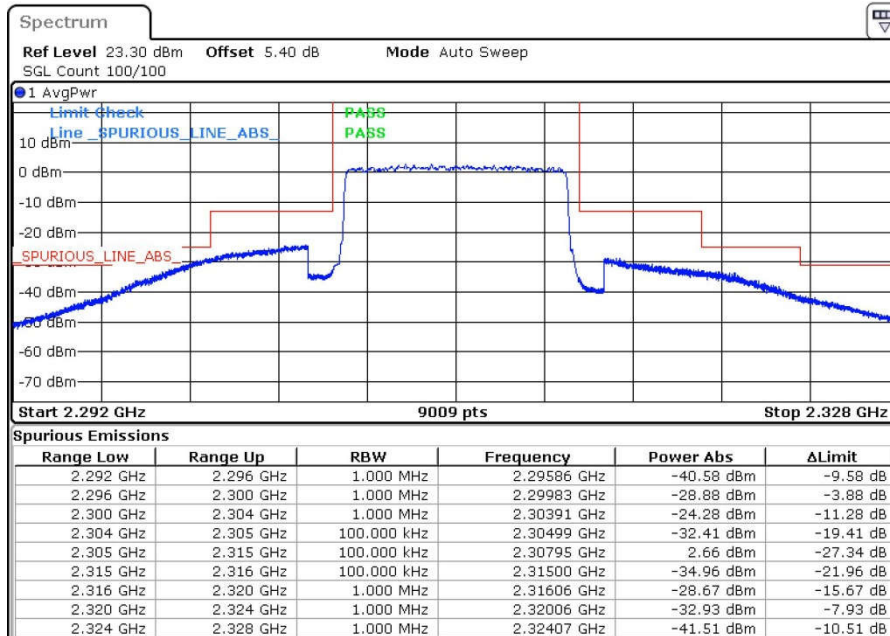
Date: 8 DEC.2016 10:38:45

## Highest Band Edge / 1 RB



Date: 8 DEC.2016 10:39:33

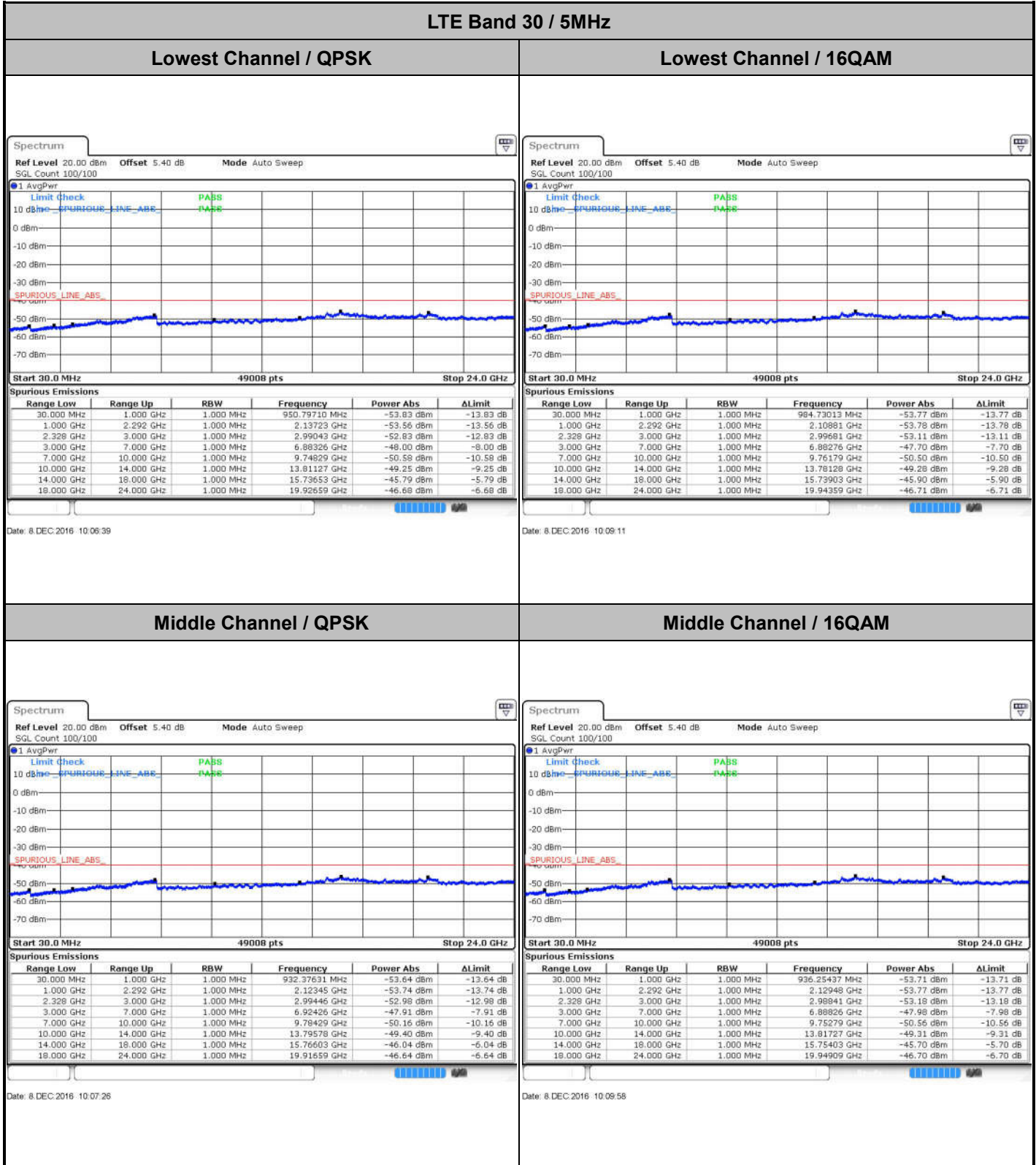
## Band Edge / Full RB



Date: 8 DEC.2016 10:39:54



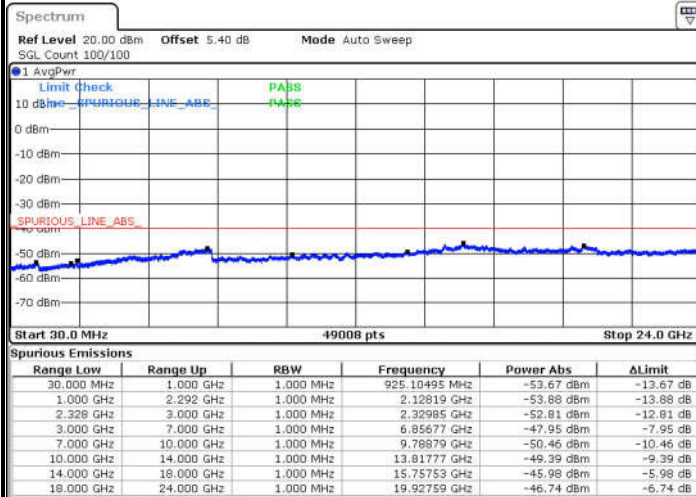
## Conducted Spurious Emission





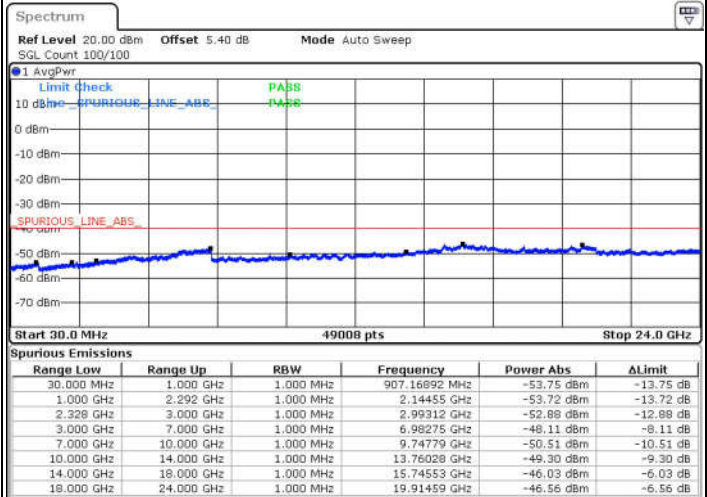
## LTE Band 30 / 5MHz

## Highest Channel / QPSK



Date: 8 DEC 2016 10:08:13

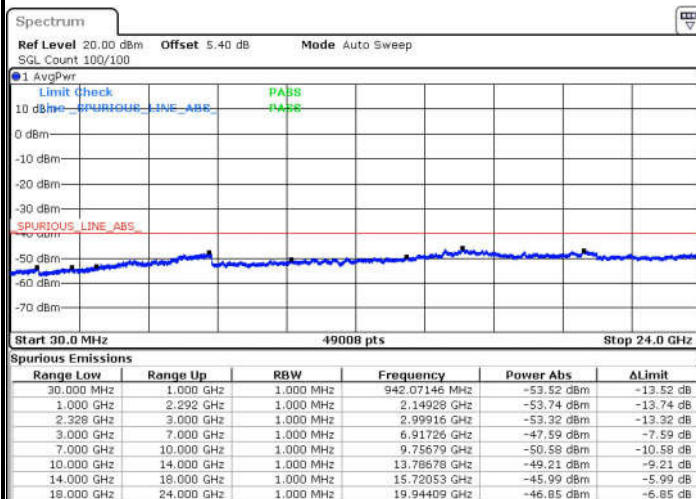
## Highest Channel / 16QAM



Date: 8 DEC 2016 10:10:47

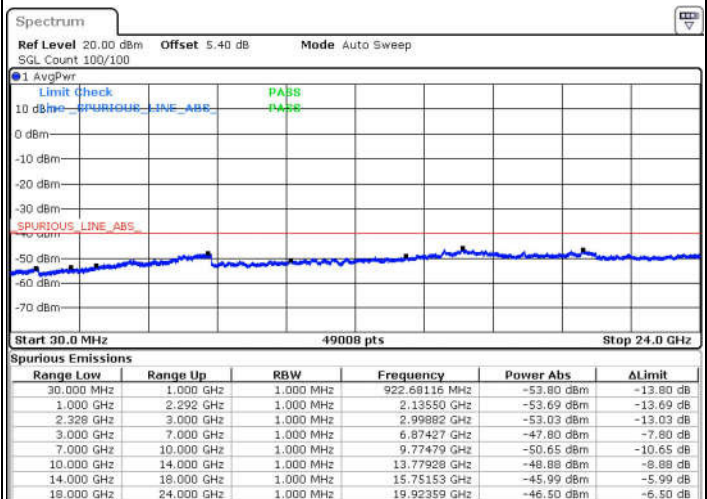
## LTE Band 30 / 10MHz

## Middle Channel / QPSK



Date: 8 DEC 2016 10:11:37

## Middle Channel / 16QAM



Date: 8 DEC 2016 10:12:24

## Frequency Stability

| Test Conditions  |                   | LTE Band 30 (QPSK) / Middle Channel | Limit   |
|------------------|-------------------|-------------------------------------|---------|
| Temperature (°C) | Voltage (Volt)    | BW 10MHz                            | Note 2. |
|                  |                   | Deviation (ppm)                     | Result  |
| 50               | Normal Voltage    | 0.0021                              | PASS    |
| 40               | Normal Voltage    | 0.0001                              |         |
| 30               | Normal Voltage    | 0.0026                              |         |
| 20(Ref.)         | Normal Voltage    | 0.0000                              |         |
| 10               | Normal Voltage    | 0.0002                              |         |
| 0                | Normal Voltage    | 0.0025                              |         |
| -10              | Normal Voltage    | 0.0017                              |         |
| -20              | Normal Voltage    | 0.0003                              |         |
| -30              | Normal Voltage    | 0.0019                              |         |
| 20               | Maximum Voltage   | 0.0004                              |         |
| 20               | Normal Voltage    | 0.0005                              |         |
| 20               | Battery End Point | 0.0018                              |         |

**Note:**

1. Normal Voltage =3.82 V. ; Battery End Point (BEP) =3.5 V. ; Maximum Voltage =4.35 V.
2. Note: The frequency fundamental emissions stay within the authorized frequency block.

## Appendix B. Test Results of Radiated Test

### Radiated Spurious Emission

| LTE Band 30 / 5MHz / QPSK / RB Size 1 Offset 0 |                      |                 |                  |                         |                         |                          |                            |                             |                       |
|--|----------------------|-----------------|------------------|-------------------------|-------------------------|--------------------------|----------------------------|-----------------------------|-----------------------|
| Channel  | Frequency<br>( MHz ) | EIRP<br>( dBm ) | Limit<br>( dBm ) | Over<br>Limit<br>( dB ) | SPA<br>Reading<br>(dBm) | S.G.<br>Power<br>( dBm ) | TX Cable<br>loss<br>( dB ) | TX Antenna<br>Gain<br>(dBi) | Polarization<br>(H/V) |
| Lowest   | 4608                 | -60.22          | -40              | -20.22                  | -47.14                  | -66.57                   | 2.24                       | 8.60                        | H                     |
|  | 6916                 | -58.71          | -40              | -18.71                  | -50.43                  | -66.23                   | 3.14                       | 10.67                       | H                     |
|  | 9225                 | -59.76          | -40              | -19.76                  | -58.09                  | -68.08                   | 3.91                       | 12.23                       | H                     |
|  | 4608                 | -60.51          | -40              | -20.51                  | -47.21                  | -66.87                   | 2.24                       | 8.60                        | V                     |
|  | 6916                 | -61.12          | -40              | -21.12                  | -51.48                  | -68.64                   | 3.14                       | 10.67                       | V                     |
|  | 9225                 | -60.06          | -40              | -20.06                  | -59                     | -68.38                   | 3.91                       | 12.23                       | V                     |
| Middle   | 4614                 | -59.50          | -40              | -19.50                  | -46.42                  | -65.85                   | 2.24                       | 8.60                        | H                     |
|  | 6923                 | -58.90          | -40              | -18.90                  | -50.62                  | -66.42                   | 3.14                       | 10.67                       | H                     |
|  | 9234                 | -60.27          | -40              | -20.27                  | -58.60                  | -68.59                   | 3.91                       | 12.23                       | H                     |
|  | 4614                 | -60.15          | -40              | -20.15                  | -46.85                  | -66.51                   | 2.24                       | 8.60                        | V                     |
|  | 6924                 | -60.74          | -40              | -20.74                  | -51.1                   | -68.26                   | 3.14                       | 10.67                       | V                     |
|  | 9234                 | -59.62          | -40              | -19.62                  | -58.56                  | -67.94                   | 3.91                       | 12.23                       | V                     |
| Highest  | 4620                 | -60.42          | -40              | -20.42                  | -47.34                  | -66.77                   | 2.24                       | 8.60                        | H                     |
|  | 6930                 | -58.38          | -40              | -18.38                  | -50.10                  | -65.90                   | 3.14                       | 10.67                       | H                     |
|  | 9243                 | -60.50          | -40              | -20.50                  | -58.83                  | -68.82                   | 3.91                       | 12.23                       | H                     |
|  | 4620                 | -61.05          | -40              | -21.05                  | -47.75                  | -67.41                   | 2.24                       | 8.60                        | V                     |
|  | 6931                 | -62.00          | -40              | -22.00                  | -52.36                  | -69.52                   | 3.14                       | 10.67                       | V                     |
|  | 9243                 | -59.79          | -40              | -19.79                  | -58.73                  | -68.11                   | 3.91                       | 12.23                       | V                     |

**Remark:** Spurious emissions within 30-1000MHz were found more than 20dB below limit line.

| LTE Band 30 / 10MHz / QPSK / RB Size 1 Offset 0 |                      |                 |                  |                         |                         |                          |                            |                             |                       |
|---|----------------------|-----------------|------------------|-------------------------|-------------------------|--------------------------|----------------------------|-----------------------------|-----------------------|
| Channel   | Frequency<br>( MHz ) | EIRP<br>( dBm ) | Limit<br>( dBm ) | Over<br>Limit<br>( dB ) | SPA<br>Reading<br>(dBm) | S.G.<br>Power<br>( dBm ) | TX Cable<br>loss<br>( dB ) | TX Antenna<br>Gain<br>(dBi) | Polarization<br>(H/V) |
| Middle  | 4614                 | -58.99          | -40              | -18.99                  | -45.91                  | -65.34                   | 2.24                       | 8.60                        | H                     |
|   | 6918                 | -56.21          | -40              | -16.21                  | -47.93                  | -63.73                   | 3.14                       | 10.67                       | H                     |
|   | 9225                 | -59.31          | -40              | -19.31                  | -57.64                  | -67.63                   | 3.91                       | 12.23                       | H                     |
|   | 4614                 | -60.94          | -40              | -20.94                  | -47.64                  | -67.30                   | 2.24                       | 8.60                        | V                     |
|   | 6918                 | -54.41          | -40              | -14.41                  | -44.77                  | -61.93                   | 3.14                       | 10.67                       | V                     |
|   | 9225                 | -58.35          | -40              | -18.35                  | -57.29                  | -66.67                   | 3.91                       | 12.23                       | V                     |

**Remark:** Spurious emissions within 30-1000MHz were found more than 20dB below limit line.