



# EMC TEST REPORT

No. I15Z40385-EMC01

for

**Sony Mobile Communications Inc.**

**GSM/WCDMA/LTE Mobile Phone**

**FCC ID: PY7-PM0817**

with

**Hardware Version: A**

**Software Version: KK-MR1-SHINANO2-DSDS-150114-0317**

**Issued Date: 2015-04-10**

**Note:**

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of TMC Beijing.

**Test Laboratory:**

**FCC 2.948 Listed: No. 525429**

**IC O.A.T.S listed: No. 12389A-1**

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## **REPORT HISTORY**

| <b>Report Number</b> | <b>Revision</b> | <b>Description</b> | <b>Issue Date</b> |
|----------------------|-----------------|--------------------|-------------------|
| I15Z40385-EMC01      | Rev.0           | 1st edition        | 2015-03-09        |
| I15Z40385-EMC01      | Rev.1           | 2nd edition        | 2015-04-10        |

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## **1. Test Laboratory**

### **1.1. Testing Location**

#### **Location 2: CTTL(Shouxiang)**

Address: No. 51 Shouxiang Science Building, Xueyuan Road,  
Haidian District, Beijing, P. R. China 100191

### **1.2. Testing Environment**

Normal Temperature: 15-35℃

Relative Humidity: 20-75%

Air pressure 980 - 1040 hPa

The climatic requirements above are general exclude the special requirements for dedicated test environments listed in section 5 and some specific test cases in other parts of this report.

### **1.3. Project data**

Receipt of Sample 2015-02-13

Testing Start Date: 2015-02-15

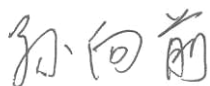
Testing End Date: 2015-04-10

### **1.4. Signature**



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**Qu Pengfei**  
**(Prepared this test report)**



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**Sun Xiangqian**  
**(Reviewed this test report)**



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**Song Chongwen**  
**(Approved this test report)**

## **2. Client Information**

### **2.1. Applicant Information**

Company Name: Sony Mobile Communications (China) Co. Ltd  
Address /Post: Sony Mobile R&D Center, No. 16, Guangshun South Street,  
Chaoyang District  
City: Beijing  
Postal Code: 100102  
Country: China  
Contact Person: Ma, Gang  
Telephone: +86-10-58656312  
Fax: +86-10-58659049

### **2.2. Manufacturer Information**

Company Name: Sony Mobile Communications Inc.  
Address /Post: 1-8-15 Konan, Minato-ku, Tokyo, 108-0075, Japan  
City: Tokyo  
Postal Code: 108-0075  
Country: Japan

### 3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

#### 3.1. About EUT

|                         |                                                                                                                                           |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Description             | GSM, GPRS, EDGE,<br>WCDMA, HSDPA, HSUPA,<br>LTE<br>Bluetooth (EDR and BLE), ANT+, WLAN ( 802.11 a/ac/b/g/n),<br>NFC, FM, GPS mobile phone |
| FCC ID                  | PY7-PM0817                                                                                                                                |
| Antenna                 | Internal                                                                                                                                  |
| Power supply            | Battery ( charged by travel adapter or vehicle charger )                                                                                  |
| Extreme vol. Limits     | 3.6VDC to 4.2VDC (nominal: 3.8VDC)                                                                                                        |
| Extreme temp. Tolerance | -10°C to +55°C                                                                                                                            |

Note: Components list, please refer to documents of the manufacturer; it is also included in the original test record of Telecommunication Metrology Center of MIIT of People's Republic of China.

#### 3.2. Internal Identification of EUT used during the test

| EUT ID* | SN         | IMEI            | HW Version | SW Version                           |
|---------|------------|-----------------|------------|--------------------------------------|
| EUT1    | CB5A21E5N5 | 004402453328522 | A          | KK-MR1-SHINANO2-D<br>SDS-150114-0317 |
| EUT13   | /          | 004402453328688 | A          | KK-MR1-SHINANO2-D<br>SDS-150114-0317 |

\*EUT ID: is used to identify the test sample in the lab internally.

#### 3.3. Internal Identification of AE used during the test

| AE ID* | Description         | SN          | Revision |
|--------|---------------------|-------------|----------|
| AE21   | Embedded Battery    | /           | /        |
| AE21   | Model name          | 1281-2461   |          |
|        | Manufacturer        | Sony Mobile |          |
|        | Minimum Capacitance | 3100 mAh    |          |
|        | Nominal Voltage     | 3.8 V       |          |

\*AE ID: is used to identify the test sample in the lab internally.

### **3.4. General Description**

The Equipment Under Test (EUT) is a model of GSM/WCDMA/LTE Mobile Phone with integrated antenna and embedded battery.

The EUT supports GSM, WCDMA and LTE. It supports GPRS service with multi-slots class 33 and EGPRS service with multi-slots class 33. The HSDPA (Cat 24) and HSUPA (Cat 6) features are also supported.

It has MP3, camera, USB memory, FM radio, GPS receiver, NFC, Bluetooth (EDR, BLE), ANT+, WLAN (802.11 a/ac/b/g/n) and Wi-Fi hotspot functions.

It consists of normal options: USB cable and travel charger.

Manual and specifications of the EUT were provided to fulfil the test.

Samples undergoing test were selected by the client.

### **3.5. EUT set-ups**

| <b>EUT Set-up No.</b> | <b>Combination of EUT and AE</b> | <b>Remarks</b>     |
|-----------------------|----------------------------------|--------------------|
| Set.1                 | EUT1 + AE21                      | ERP/EIRP/RSE tests |
| Set.10                | EUT13 + AE21                     | Conducted RF tests |

## 4. Reference Documents

### 4.1. Reference Documents for testing

The following documents listed in this section are referred for testing.

| Reference      | Title                                                                               | Version         |
|----------------|-------------------------------------------------------------------------------------|-----------------|
| FCC Part 27    | MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES                                      | 10-1-13 Edition |
| ANSI/TIA-603-C | Land Mobile FM or PM Communications Equipment Measurement and Performance Standards | 2004            |
| KDB 971168 D01 | Measurement Guidance for Certification of Licensed Digital Transmitters             | v02r01          |

## 5. LABORATORY ENVIRONMENT

**Fully-anechoic chamber FAC-3** (9 meters×6.5 meters×4 meters) did not exceed following limits along the EMC testing:

|                                                 |                                                   |
|-------------------------------------------------|---------------------------------------------------|
| Temperature                                     | Min. = 15 °C, Max. = 35 °C                        |
| Relative humidity                               | Min. = 15 %, Max. = 75 %                          |
| Shielding effectiveness                         | 0.014MHz - 1MHz, >60dB;<br>1MHz - 1000MHz, >90dB. |
| Electrical insulation                           | > 2 MΩ                                            |
| Ground system resistance                        | < 4 Ω                                             |
| Site voltage standing-wave ratio ( $S_{VSWR}$ ) | Between 0 and 6 dB, from 1GHz to 18GHz            |
| Uniformity of field strength                    | Between 0 and 6 dB, from 80 to 4000 MHz           |

## 6. SUMMARY OF TEST RESULTS

### 6.1. Summary of test results

| Abbreviations used in this clause: |         |                                                                                                       |
|------------------------------------|---------|-------------------------------------------------------------------------------------------------------|
| Verdict Column                     | P       | Pass                                                                                                  |
|                                    | F       | Fail                                                                                                  |
|                                    | NA      | Not applicable                                                                                        |
|                                    | NM      | Not measured                                                                                          |
| Location Column                    | 1/2/3/4 | The test is performed in test location 1, 2, 3 or 4 which are described in section 1.1 of this report |

#### LTE Band 7

| Items | Test Name                   | Clause in FCC rules | Section in this report | Verdict | Test Location |
|-------|-----------------------------|---------------------|------------------------|---------|---------------|
| 1     | Output Power                | 27.50(h)(2)         | A.1                    | P       | 2             |
| 2     | Emission Limit              | 27.53(m),<br>2.1051 | A.2                    | P       | 2             |
| 3     | Frequency Stability         | 27.54, 2.1055       | A.4                    | P       | 2             |
| 4     | Occupied Bandwidth          | 2.1049(h)(i)        | A.5                    | P       | 2             |
| 5     | Emission Bandwidth          | 27.53(m)            | A.6                    | P       | 2             |
| 6     | Band Edge Compliance        | 27.53(m)            | A.7                    | P       | 2             |
| 7     | Conducted Spurious Emission | 27.53(m),<br>2.1057 | A.8                    | P       | 2             |

#### LTE Band 41

| Items | Test Name                   | Clause in FCC rules | Section in this report | Verdict | Test Location |
|-------|-----------------------------|---------------------|------------------------|---------|---------------|
| 1     | Output Power                | 27.50(h)(2)         | A.1                    | P       | 2             |
| 2     | Emission Limit              | 27.53(m),<br>2.1051 | A.2                    | P       | 2             |
| 3     | Frequency Stability         | 27.54, 2.1055       | A.4                    | P       | 2             |
| 4     | Occupied Bandwidth          | 2.1049(h)(i)        | A.5                    | P       | 2             |
| 5     | Emission Bandwidth          | 27.53(m)            | A.6                    | P       | 2             |
| 6     | Band Edge Compliance        | 27.53(m)            | A.7                    | P       | 2             |
| 7     | Conducted Spurious Emission | 27.53(m),<br>2.1057 | A.8                    | P       | 2             |

### 6.2. Statements

The test cases listed in section 6.1 of this report for the EUT specified in section 3 were performed by TMC according to the standards or reference documents in section 4.1

The EUT met all applicable requirements of the standards or reference documents in section 4.1. This report only deals with the LTE functions among the features described in section 3.

## 7. Test Equipments Utilized

| NO. | NAME                                    | TYPE      | SERIES<br>NUMBER | PRODUCER     | CAL. DUE<br>DATE | CAL.<br>INTERVAL |
|-----|-----------------------------------------|-----------|------------------|--------------|------------------|------------------|
| 1.  | EMI Antenna                             | VULB 9163 | 9163-235         | Schwarzbeck  | 2017-10-29       | 3 Years          |
| 2.  | EMI Antenna                             | 3117      | 00119024         | ETS-Lindgren | 2016-01-20       | 3 Years          |
| 3.  | EMI Antenna                             | 9117      | 167              | Schwarzbeck  | 2016-04-01       |                  |
| 4.  | EMI Antenna                             | 3117      | 00058888         | ETS-Lindgren | 2017-04-20       | 3 Years          |
| 5.  | Signal Generator                        | N5183A    | MY49060052       | Agilent      | 2016-03-02       | 1 year           |
| 6.  | Power Amplifier                         | 5S1G4     | 0341863          | AR           | /                | 1 Year           |
| 7.  | Universal Radio<br>Communication Tester | CMW500    | 116588           | R&S          | 2015-10-23       | 1 Year           |
| 8.  | Spectrum Analyzer                       | E4440A    | MY49420053       | Agilent      | 2015-12-30       | 1 Year           |
| 9.  | Climatic chamber                        | SH-641    | 92014694         | ESPEC        | 2015-11-27       | 1 Year           |
| 10. | Universal Radio<br>Communication Tester | CMW500    | 101675           | 2015-07-13   | 2015-07-13       | 1 Year           |

## **ANNEX A: MEASUREMENT RESULTS**

### **A.1 OUTPUT POWER**

#### **Reference**

FCC: 27.50(h)(2)

#### **A.1.1 Summary**

During the process of testing, the EUT was controlled via Rhode & Schwarz Digital Radio Communication tester (CMW500) to ensure max power transmission and proper modulation.

This result contains peak output power, ERP/EIRP measurements and peak-to-average power ratio (PAPR) for the EUT.

In all cases, output power is within the specified limits.

#### **A.1.2 Conducted**

##### **A.1.2.1 Method of Measurements**

The EUT was set up for the max output power with pseudo random data modulation.

The power was measured with spectrum analyzer's RMS detector.

These measurements were done at 3 frequencies (bottom, middle and top of operational frequency range) for each bandwidth.

##### **A.1.2.2 Measurement result**

###### **LTE band 7**

| Bandwidth | RB size/offset | Frequency (MHz) | Power(dBm)   |       |
|-----------|----------------|-----------------|--------------|-------|
|           |                |                 | QPSK         | 16QAM |
| 5MHz      | 1 RB high      | 2502.5          | <b>23.60</b> | 22.62 |
|           |                | 2535            | 23.32        | 22.41 |
|           |                | 2567.5          | 23.56        | 22.63 |
|           | 1 RB low       | 2502.5          | 23.48        | 22.49 |
|           |                | 2535            | 23.21        | 22.25 |
|           |                | 2567.5          | 23.41        | 22.40 |
|           | 50% RB mid     | 2502.5          | 22.66        | 21.66 |
|           |                | 2535            | 22.35        | 21.41 |
|           |                | 2567.5          | 22.42        | 21.54 |
|           | 100% RB        | 2502.5          | 22.60        | 21.74 |
|           |                | 2535            | 22.31        | 21.45 |
|           |                | 2567.5          | 22.43        | 21.63 |

(Continued)

| Bandwidth | RB size/offset | Frequency (MHz) | Power(dBm) |       |
|-----------|----------------|-----------------|------------|-------|
|           |                |                 | QPSK       | 16QAM |
| 10MHz     | 1 RB high      | 2505            | 23.54      | 22.91 |
|           |                | 2535            | 23.38      | 22.79 |
|           |                | 2565            | 23.43      | 22.77 |
|           | 1 RB low       | 2505            | 23.35      | 22.76 |
|           |                | 2535            | 23.20      | 22.65 |
|           |                | 2565            | 23.35      | 22.67 |
|           | 50% RB mid     | 2505            | 22.56      | 21.58 |
|           |                | 2535            | 22.38      | 21.36 |
|           |                | 2565            | 22.46      | 21.60 |
|           | 100% RB        | 2505            | 22.58      | 21.57 |
|           |                | 2535            | 22.33      | 21.36 |
|           |                | 2565            | 22.54      | 21.57 |
| 15MHz     | 1 RB high      | 2507.5          | 23.48      | 22.84 |
|           |                | 2535            | 23.30      | 22.71 |
|           |                | 2562.5          | 23.49      | 22.81 |
|           | 1 RB low       | 2507.5          | 23.33      | 22.74 |
|           |                | 2535            | 23.13      | 22.51 |
|           |                | 2562.5          | 23.33      | 22.70 |
|           | 50% RB mid     | 2507.5          | 22.51      | 21.49 |
|           |                | 2535            | 22.34      | 21.35 |
|           |                | 2562.5          | 22.48      | 21.56 |
|           | 100% RB        | 2507.5          | 22.51      | 21.52 |
|           |                | 2535            | 22.36      | 21.39 |
|           |                | 2562.5          | 22.53      | 21.57 |



(Continued)

|       |            |      |       |       |
|-------|------------|------|-------|-------|
| 20MHz | 1 RB high  | 2510 | 23.60 | 22.69 |
|       |            | 2535 | 23.41 | 22.46 |
|       |            | 2560 | 23.48 | 22.58 |
|       | 1 RB low   | 2510 | 23.41 | 22.57 |
|       |            | 2535 | 23.26 | 22.39 |
|       |            | 2560 | 23.41 | 22.44 |
|       | 50% RB mid | 2510 | 22.41 | 21.50 |
|       |            | 2535 | 22.26 | 21.35 |
|       |            | 2560 | 22.41 | 21.53 |
|       | 100% RB    | 2510 | 22.46 | 21.48 |
|       |            | 2535 | 22.29 | 21.37 |
|       |            | 2560 | 22.39 | 21.55 |

**LTE band 41**

| Bandwidth | RB size/offset | Frequency (MHz) | Power(dBm) |       |
|-----------|----------------|-----------------|------------|-------|
|           |                |                 | QPSK       | 16QAM |
| 5MHz      | 1 RB high      | 2498.5          | 23.72      | 22.76 |
|           |                | 2593            | 23.68      | 22.87 |
|           |                | 2687.5          | 23.44      | 22.52 |
|           | 1 RB low       | 2498.5          | 23.83      | 22.79 |
|           |                | 2593            | 23.67      | 22.83 |
|           |                | 2687.5          | 23.49      | 22.54 |
|           | 50% RB mid     | 2498.5          | 22.84      | 22.10 |
|           |                | 2593            | 22.88      | 22.19 |
|           |                | 2687.5          | 22.61      | 21.85 |
|           | 100% RB        | 2498.5          | 22.90      | 21.87 |
|           |                | 2593            | 22.97      | 21.87 |
|           |                | 2687.5          | 22.62      | 21.62 |
| 10MHz     | 1 RB high      | 2501            | 23.75      | 22.89 |
|           |                | 2593            | 23.77      | 22.93 |
|           |                | 2685            | 23.57      | 22.79 |
|           | 1 RB low       | 2501            | 23.83      | 22.94 |
|           |                | 2593            | 23.77      | 22.94 |
|           |                | 2685            | 23.58      | 22.78 |
|           | 50% RB mid     | 2501            | 22.90      | 21.98 |
|           |                | 2593            | 22.92      | 21.95 |
|           |                | 2685            | 22.55      | 21.69 |
|           | 100% RB        | 2501            | 22.86      | 21.89 |
|           |                | 2593            | 22.92      | 21.90 |
|           |                | 2685            | 22.59      | 21.57 |

(Continued)

| Bandwidth | RB size/offset | Frequency (MHz) | Power(dBm) |       |
|-----------|----------------|-----------------|------------|-------|
|           |                |                 | QPSK       | 16QAM |
| 15MHz     | 1 RB high      | 2503.5          | 23.77      | 22.87 |
|           |                | 2593            | 23.78      | 22.94 |
|           |                | 2682.5          | 23.59      | 22.79 |
|           | 1 RB low       | 2503.5          | 23.95      | 22.99 |
|           |                | 2593            | 23.78      | 22.93 |
|           |                | 2682.5          | 23.53      | 22.74 |
|           | 50% RB mid     | 2503.5          | 22.97      | 21.97 |
|           |                | 2593            | 22.98      | 21.90 |
|           |                | 2682.5          | 22.63      | 21.67 |
|           | 100% RB        | 2503.5          | 23.00      | 22.05 |
|           |                | 2593            | 22.92      | 21.93 |
|           |                | 2682.5          | 22.61      | 21.69 |
| 20MHz     | 1 RB high      | 2506            | 23.86      | 23.08 |
|           |                | 2593            | 23.71      | 23.05 |
|           |                | 2680            | 23.59      | 22.86 |
|           | 1 RB low       | 2506            | 23.92      | 23.16 |
|           |                | 2593            | 23.74      | 23.21 |
|           |                | 2680            | 23.55      | 22.97 |
|           | 50% RB mid     | 2506            | 22.78      | 21.94 |
|           |                | 2593            | 22.88      | 21.92 |
|           |                | 2680            | 22.62      | 21.71 |
|           | 100% RB        | 2506            | 22.91      | 22.02 |
|           |                | 2593            | 22.94      | 21.94 |
|           |                | 2680            | 22.62      | 21.71 |

Note: Expanded measurement uncertainty is  $U = 0.83$  dB,  $k = 2$ .

### A.1.3 Radiated

#### A.1.3.1 Description

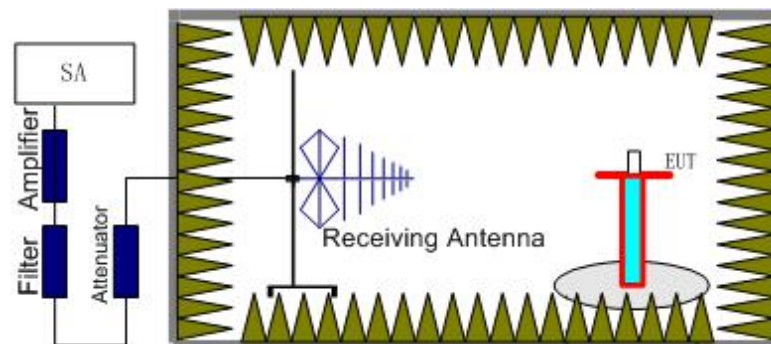
This is the test for the maximum radiated power from the EUT.

Rule Part 27.50(h)(2) specifies "Mobile stations are limited to 2.0 watts EIRP."

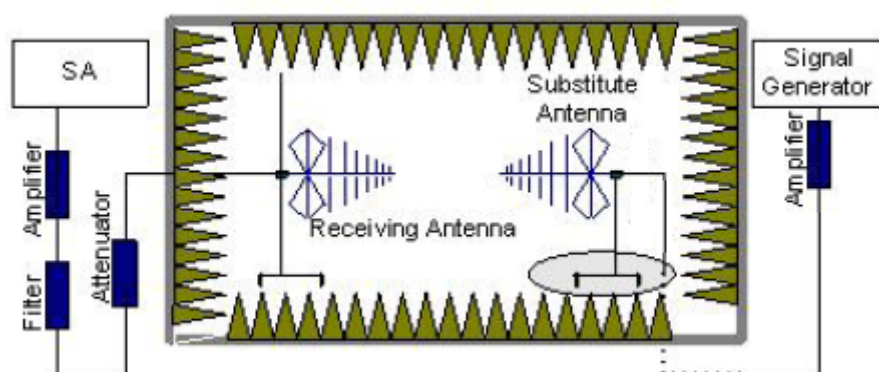
#### A.1.3.2 Method of Measurement

The measurements procedures in TIA-603C-2004 are used.

1. EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.5m. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all transmit frequencies in three channels (High, Middle, Low) were measured with peak detector.



2. The EUT is then put into continuously transmitting mode at its maximum power level during the test. And the maximum value of the receiver should be recorded as ( $P_r$ ).
3. The EUT shall be replaced by a substitution antenna. The test setup refers to figure below.



In the chamber, a substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power ( $P_{Mea}$ ) is applied to the input of the substitution antenna. Adjust the level of the signal generator output until the value of the receiver reaches the previously recorded ( $P_r$ ). The power of signal source ( $P_{Mea}$ ) is recorded.

The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

4. An amplifier should be connected to the Signal Source output port. And the cable should be connected between the amplifier and the substitution antenna.

The cable loss ( $P_{cl}$ ), the substitution antenna Gain ( $G_a$ ) and the amplifier Gain ( $P_{Ag}$ ) should be recorded after test.

The measurement results are obtained as described below:

$$\text{Power (EIRP)} = P_{\text{Mea}} - P_{\text{Ag}} - P_{\text{cl}} - G_a$$

5. This value is EIRP since the measurement is calibrated using an antenna of known gain (unit dBi) and known input power.
6. ERP can be calculated from EIRP by subtracting the gain of the dipole,  $\text{ERP} = \text{EIRP} - 2.15$ .

For test layout photo, please refer to Pic.1 in Annex B.

### A.1.3.3 Measurement result

#### LTE Band 7- ERP 27.50(h)(2)

Limits:  $\leq 33$  dBm (2W)

#### LTE Band 7\_5MHz\_QPSK

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Cable Loss (dB) | P <sub>Ag</sub> (dB) | Antenna Gain(dBi) | RMS EIRP(dBm) | Polarization |
|-----------------|------------------------|-----------------|----------------------|-------------------|---------------|--------------|
| 2502.50         | -24.70                 | 3.58            | -45.68               | -5.29             | 22.69         | Horizontal   |
| 2535.00         | -24.85                 | 3.63            | -44.82               | -5.37             | 21.71         | Horizontal   |
| 2567.50         | -24.96                 | 3.65            | -44.92               | -5.44             | 21.75         | Horizontal   |

#### LTE Band 7\_10MHz\_QPSK

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Cable Loss (dB) | P <sub>Ag</sub> (dB) | Antenna Gain(dBi) | RMS EIRP(dBm) | Polarization |
|-----------------|------------------------|-----------------|----------------------|-------------------|---------------|--------------|
| 2505.00         | -24.62                 | 3.59            | -45.64               | -5.30             | 22.73         | Horizontal   |
| 2535.00         | -24.95                 | 3.63            | -44.82               | -5.37             | 21.61         | Horizontal   |
| 2565.00         | -25.26                 | 3.65            | -44.97               | -5.43             | 21.49         | Horizontal   |

#### LTE Band 7\_15MHz\_QPSK

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Cable Loss (dB) | P <sub>Ag</sub> (dB) | Antenna Gain(dBi) | RMS EIRP(dBm) | Polarization |
|-----------------|------------------------|-----------------|----------------------|-------------------|---------------|--------------|
| 2507.50         | -24.01                 | 3.59            | -44.92               | -5.30             | 22.62         | Horizontal   |
| 2535.00         | -24.94                 | 3.63            | -44.82               | -5.37             | 21.62         | Horizontal   |
| 2562.50         | -14.97                 | 3.65            | -45.67               | 5.42              | 21.63         | Horizontal   |

#### LTE Band 7\_20MHz\_QPSK

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Cable Loss (dB) | P <sub>Ag</sub> (dB) | Antenna Gain(dBi) | RMS EIRP(dBm) | Polarization |
|-----------------|------------------------|-----------------|----------------------|-------------------|---------------|--------------|
| 2510.00         | -24.62                 | 3.58            | -45.36               | -5.31             | 22.47         | Horizontal   |
| 2535.00         | -24.87                 | 3.63            | -44.82               | -5.37             | 21.69         | Horizontal   |
| 2560.00         | -26.05                 | 3.64            | -45.98               | -5.42             | 21.71         | Horizontal   |

**LTE Band 7\_5MHz\_16QAM**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Cable Loss (dB) | P <sub>Ag</sub> (dB) | Antenna Gain(dBi) | RMS EIRP(dBm) | Polarization |
|-----------------|------------------------|-----------------|----------------------|-------------------|---------------|--------------|
| 2502.50         | -25.60                 | 3.58            | -45.68               | -5.29             | 21.79         | Horizontal   |
| 2535.00         | -25.71                 | 3.63            | -44.82               | -5.37             | 20.85         | Horizontal   |
| 2567.50         | -26.08                 | 3.65            | -44.92               | -5.44             | 20.63         | Horizontal   |

**LTE Band 7\_10MHz\_16QAM**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Cable Loss (dB) | P <sub>Ag</sub> (dB) | Antenna Gain(dBi) | RMS EIRP(dBm) | Polarization |
|-----------------|------------------------|-----------------|----------------------|-------------------|---------------|--------------|
| 2505.00         | -25.52                 | 3.59            | -45.64               | -5.30             | 21.83         | Horizontal   |
| 2535.00         | -26.01                 | 3.63            | -44.82               | -5.37             | 20.55         | Horizontal   |
| 2565.00         | -26.02                 | 3.65            | -44.97               | -5.43             | 20.73         | Horizontal   |

**LTE Band 7\_15MHz\_16QAM**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Cable Loss (dB) | P <sub>Ag</sub> (dB) | Antenna Gain(dBi) | RMS EIRP(dBm) | Polarization |
|-----------------|------------------------|-----------------|----------------------|-------------------|---------------|--------------|
| 2507.50         | -24.80                 | 3.59            | -44.92               | -5.30             | 21.83         | Horizontal   |
| 2535.00         | -25.78                 | 3.63            | -44.82               | -5.37             | 20.78         | Horizontal   |
| 2562.50         | -16.14                 | 3.65            | -45.67               | 5.42              | 20.46         | Horizontal   |

**LTE Band 7\_20MHz\_16QAM**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Cable Loss (dB) | P <sub>Ag</sub> (dB) | Antenna Gain(dBi) | RMS EIRP(dBm) | Polarization |
|-----------------|------------------------|-----------------|----------------------|-------------------|---------------|--------------|
| 2510.00         | -25.67                 | 3.58            | -45.36               | -5.31             | 21.42         | Horizontal   |
| 2535.00         | -25.81                 | 3.63            | -44.82               | -5.37             | 20.75         | Horizontal   |
| 2560.00         | -26.97                 | 3.64            | -45.98               | -5.42             | 20.79         | Horizontal   |

Sample calculation: LTE Band 7, 10 MHz bandwidth, frequency 2505.00 MHz, QPSK

$$\begin{aligned} \text{Peak EIRP(dBm)} &= P_{\text{Mea}}(-24.62\text{dBm}) - G_a(-5.30\text{dBi}) - P_{\text{Ag}}(-45.64\text{ dB}) - P_{\text{cl}}(3.59\text{dB}) \\ &= 22.73\text{ dBm} \end{aligned}$$

**LTE Band 41- ERP 27.50(h)(2)**

**Limits:** ≤33 dBm (2W)

**LTE Band 41\_5MHz\_QPSK**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Cable Loss (dB) | P <sub>Ag</sub> (dB) | Antenna Gain(dBi) | RMS EIRP(dBm) | Polarization |
|-----------------|------------------------|-----------------|----------------------|-------------------|---------------|--------------|
| 2498.50         | -23.00                 | 3.58            | -45.59               | -5.39             | 24.40         | Horizontal   |
| 2593.00         | -22.51                 | 3.68            | -44.93               | -5.64             | 24.38         | Horizontal   |
| 2687.50         | -24.78                 | 3.73            | -44.98               | -5.89             | 22.36         | Horizontal   |

**LTE Band 41\_10MHz\_QPSK**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Cable Loss (dB) | P <sub>Ag</sub> (dB) | Antenna Gain(dBi) | RMS EIRP(dBm) | Polarization |
|-----------------|------------------------|-----------------|----------------------|-------------------|---------------|--------------|
| 2501.00         | -22.98                 | 3.58            | -45.65               | -5.36             | 24.45         | Horizontal   |
| 2593.00         | -22.68                 | 3.68            | -44.93               | -5.64             | 24.21         | Horizontal   |
| 2685.00         | -24.70                 | 3.73            | -44.98               | -5.88             | 22.43         | Horizontal   |

**LTE Band 41\_15MHz\_QPSK**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Cable Loss (dB) | P <sub>Ag</sub> (dB) | Antenna Gain(dBi) | RMS EIRP(dBm) | Polarization |
|-----------------|------------------------|-----------------|----------------------|-------------------|---------------|--------------|
| 2503.50         | -23.19                 | 3.58            | -45.65               | -5.29             | 24.17         | Horizontal   |
| 2593.00         | -22.67                 | 3.68            | -44.93               | -5.64             | 24.22         | Horizontal   |
| 2682.50         | -24.43                 | 3.73            | -44.98               | -5.87             | 22.69         | Horizontal   |

**LTE Band 41\_20MHz\_QPSK**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Cable Loss (dB) | P <sub>Ag</sub> (dB) | Antenna Gain(dBi) | RMS EIRP(dBm) | Polarization |
|-----------------|------------------------|-----------------|----------------------|-------------------|---------------|--------------|
| 2506.00         | -22.51                 | 3.59            | -45.15               | -5.30             | 24.35         | Horizontal   |
| 2593.00         | -22.70                 | 3.68            | -44.93               | -5.64             | 24.19         | Horizontal   |
| 2680.00         | -24.44                 | 3.73            | -44.97               | -5.87             | 22.67         | Horizontal   |

**LTE Band 41\_5MHz\_16QAM**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Cable Loss (dB) | P <sub>Ag</sub> (dB) | Antenna Gain(dBi) | RMS EIRP(dBm) | Polarization |
|-----------------|------------------------|-----------------|----------------------|-------------------|---------------|--------------|
| 2498.50         | -23.26                 | 3.58            | -45.59               | -5.39             | 24.14         | Horizontal   |
| 2593.00         | -23.10                 | 3.68            | -44.93               | -5.64             | 23.79         | Horizontal   |
| 2687.50         | -24.96                 | 3.73            | -44.98               | -5.89             | 22.18         | Horizontal   |

**LTE Band 41\_10MHz\_16QAM**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Cable Loss (dB) | P <sub>Ag</sub> (dB) | Antenna Gain(dBi) | RMS EIRP(dBm) | Polarization |
|-----------------|------------------------|-----------------|----------------------|-------------------|---------------|--------------|
| 2501.00         | -23.35                 | 3.58            | -45.65               | -5.36             | 24.08         | Horizontal   |
| 2593.00         | -22.86                 | 3.68            | -44.93               | -5.64             | 24.03         | Horizontal   |
| 2685.00         | -24.80                 | 3.73            | -44.98               | -5.88             | 22.33         | Horizontal   |

**LTE Band 41\_15MHz\_16QAM**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Cable Loss (dB) | P <sub>Ag</sub> (dB) | Antenna Gain(dBi) | RMS EIRP(dBm) | Polarization |
|-----------------|------------------------|-----------------|----------------------|-------------------|---------------|--------------|
| 2503.50         | -23.37                 | 3.58            | -45.65               | -5.29             | 23.99         | Horizontal   |
| 2593.00         | -22.85                 | 3.68            | -44.93               | -5.64             | 24.04         | Horizontal   |
| 2682.50         | -24.57                 | 3.73            | -44.98               | -5.87             | 22.55         | Horizontal   |

**LTE Band 41\_20MHz\_16QAM**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Cable Loss (dB) | P <sub>Ag</sub> (dB) | Antenna Gain(dBi) | RMS EIRP(dBm) | Polarization |
|-----------------|------------------------|-----------------|----------------------|-------------------|---------------|--------------|
| 2506.00         | -23.14                 | 3.59            | -45.15               | -5.30             | 23.72         | Horizontal   |
| 2593.00         | -22.68                 | 3.68            | -44.93               | -5.64             | 24.21         | Horizontal   |
| 2680.00         | -24.87                 | 3.73            | -44.97               | -5.87             | 22.24         | Horizontal   |

Sample calculation: LTE Band 41, 10 MHz bandwidth, frequency 2501.00 MHz, QPSK

$$\begin{aligned} \text{Peak EIRP(dBm)} &= P_{\text{Mea}}(-22.98\text{dBm}) - G_a(-5.36 \text{ dBi}) - P_{\text{Ag}}(-45.65 \text{ dB}) - P_{\text{cl}}(3.58\text{dB}) \\ &= 24.45 \text{ dBm} \end{aligned}$$

**ANALYZER SETTINGS:**

RBW = VBW = 8MHz for occupied bandwidths equal to or less than 5MHz.

RBW = VBW = 20MHz for occupied bandwidths equal to or greater than 10MHz.

Note: Expanded measurement uncertainty is  $U = 0.96 \text{ dB}$ ,  $k = 2$ .

## A.2 EMISSION LIMIT

### Reference

FCC: CFR 2.1051, Part 27.53(h).

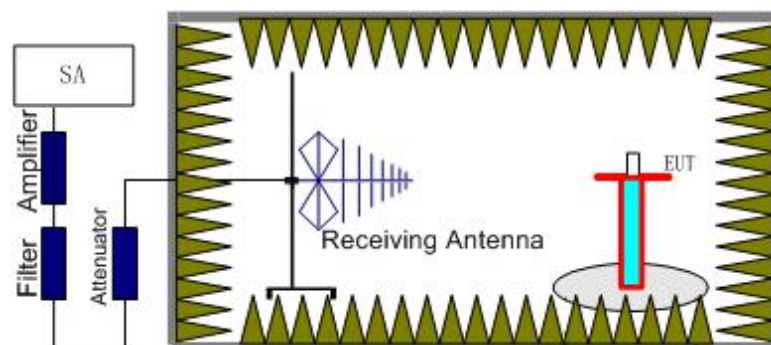
### A.2.1 Measurement Method

The measurements procedures in TIA-603C-2004 are used. This measurement is carried out in fully-anechoic chamber FAC-3.

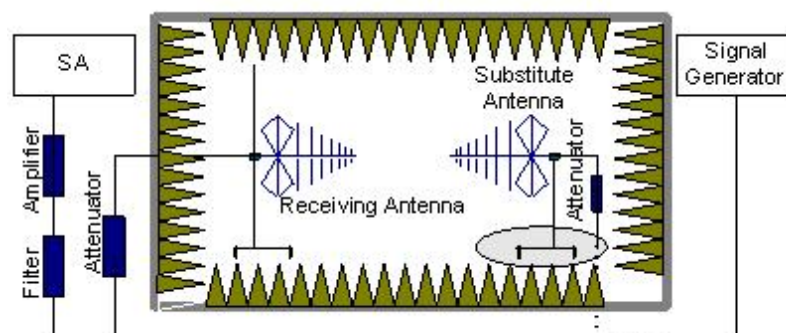
The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier. The resolution bandwidth is set 1MHz as outlined in Part 27.53(h). The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the LTE Bands 7 and 41.

### The procedure of radiated spurious emissions is as follows:

1. EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. A receiving antenna was placed on the antenna mast 3 meters from the EUT for emission measurements. The height of receiving antenna is 1.5m. The test setup refers to figure below. Detected emissions were maximized at each frequency by rotating the EUT through 360° and adjusting the receiving antenna polarization. The radiated emission measurements of all non-harmonic and harmonics of the transmit frequency through the 10th harmonic were measured with peak detector.



2. The EUT is then put into continuously transmitting mode at its maximum power level during the test. And the maximum value of the receiver should be recorded as (Pr).
3. The EUT shall be replaced by a substitution antenna. The test setup refers to figure below.



In the chamber, an substitution antenna for the frequency band of interest is placed at the

reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere with the radiation pattern of the antenna. A power ( $P_{Mea}$ ) is applied to the input of the substitution antenna. Adjust the level of the signal generator output until the value of the receiver reaches the previously recorded ( $P_r$ ). The power of signal source ( $P_{Mea}$ ) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

4. The Path loss ( $P_{pl}$ ) between the Signal Source with the Substitution Antenna and the Substitution Antenna Gain ( $G_a$ ) should be recorded after test.

An amplifier should be connected in for the test.

The Path loss ( $P_{pl}$ ) is the summation of the cable loss and the gain of the amplifier.

The measurement results are obtained as described below:

$$\text{Power (EIRP)} = P_{Mea} + P_{pl} + G_a$$

5. This value is EIRP since the measurement is calibrated using an antenna of known gain (unit: dBi) and known input power.
6. ERP can be calculated from EIRP by subtracting the gain of the dipole,  $ERP = EIRP - 2.15\text{dB}$ .

#### A.2.2 Measurement Limit

Part 27.53(h) all specify that the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power ( $P$ ) by a factor of at least  $43 + 10 \log(P)$  dB. The specification that emissions shall be attenuated below the transmitter power ( $P$ ) by at least  $43 + 10 \log(P)$  dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 dBm. At 0.001 W (0 dBm) the minimum attenuation is 13 dB, which again yields a limit of -13 dBm. In this way a translation of the specification from relative to absolute terms is carried out.

#### A.2.3 Measurement Results

Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the LTE Bands 7 and 41. It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the LTE Bands 7 and 41 into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

**LTE Band 7, 5 MHz, QPSK, Channel 20775, RB=1, RB position=middle.**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Path Loss(dB) | Antenna Gain(dBi) | Peak EIRP(dBm) | Limit (dBm) | Polarization |
|-----------------|------------------------|---------------|-------------------|----------------|-------------|--------------|
| 5008.67         | -58.29                 | 6.26          | -9.42             | -55.13         | -13.00      | Vertical     |
| 7509.30         | -57.42                 | 7.56          | -11.24            | -53.74         | -13.00      | Vertical     |
| 10010.81        | -56.33                 | 8.48          | -12.02            | -52.79         | -13.00      | Horizontal   |
| 12524.89        | -53.42                 | 9.48          | -12.39            | -50.51         | -13.00      | Vertical     |
| 15027.28        | -50.70                 | 10.43         | -13.62            | -47.51         | -13.00      | Horizontal   |
| 17518.16        | -44.68                 | 12.17         | -13.00            | -43.85         | -13.00      | Vertical     |

**LTE Band 7, 5 MHz, QPSK, Channel 21100, RB=1, RB position=middle.**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Path Loss(dB) | Antenna Gain(dBi) | Peak EIRP(dBm) | Limit (dBm) | Polarization |
|-----------------|------------------------|---------------|-------------------|----------------|-------------|--------------|
| 5075.94         | -53.56                 | 6.41          | -9.51             | -50.46         | -13.00      | Horizontal   |
| 7610.23         | -55.81                 | 7.41          | -11.33            | -51.89         | -13.00      | Vertical     |
| 10147.41        | -55.17                 | 8.43          | -11.95            | -51.65         | -13.00      | Vertical     |
| 12666.51        | -53.01                 | 9.34          | -12.48            | -49.87         | -13.00      | Horizontal   |
| 15196.50        | -50.16                 | 10.72         | -13.41            | -47.47         | -13.00      | Horizontal   |
| 17740.14        | -49.99                 | 11.42         | -13.06            | -48.35         | -13.00      | Vertical     |

**LTE Band 7, 5 MHz, QPSK, Channel 21425, RB=1, RB position=middle.**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Path Loss(dB) | Antenna Gain(dBi) | Peak EIRP(dBm) | Limit (dBm) | Polarization |
|-----------------|------------------------|---------------|-------------------|----------------|-------------|--------------|
| 5150.09         | -58.56                 | 6.35          | -9.60             | -55.31         | -13.00      | Vertical     |
| 7706.99         | -56.70                 | 7.29          | -11.42            | -52.57         | -13.00      | Vertical     |
| 10270.77        | -50.67                 | 8.97          | -11.88            | -47.76         | -13.00      | Horizontal   |
| 12851.11        | -52.08                 | 9.53          | -12.61            | -49.00         | -13.00      | Vertical     |
| 15420.49        | -51.22                 | 10.76         | -13.14            | -48.84         | -13.00      | Horizontal   |
| 17952.82        | -46.99                 | 12.51         | -13.13            | -46.37         | -13.00      | Horizontal   |

**LTE Band 7, 5 MHz, 16QAM, Channel 20775, RB=1, RB position=middle.**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Path Loss(dB) | Antenna Gain(dBi) | Peak EIRP(dBm) | Limit (dBm) | Polarization |
|-----------------|------------------------|---------------|-------------------|----------------|-------------|--------------|
| 5022.86         | -58.83                 | 6.24          | -9.44             | -55.63         | -13.00      | Vertical     |
| 7500.16         | -57.38                 | 7.59          | -11.23            | -53.74         | -13.00      | Horizontal   |
| 10052.28        | -54.70                 | 8.76          | -12.00            | -51.46         | -13.00      | Vertical     |
| 12502.70        | -52.53                 | 9.29          | -12.37            | -49.45         | -13.00      | Vertical     |
| 15026.76        | -50.47                 | 10.43         | -13.62            | -47.28         | -13.00      | Horizontal   |
| 17499.08        | -45.62                 | 12.08         | -12.99            | -44.71         | -13.00      | Vertical     |

**LTE Band 7, 5 MHz, 16QAM, Channel 21100, RB=1, RB position=middle.**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Path Loss(dB) | Antenna Gain(dBi) | Peak EIRP(dBm) | Limit (dBm) | Polarization |
|-----------------|------------------------|---------------|-------------------|----------------|-------------|--------------|
| 5076.30         | -56.53                 | 6.41          | -9.51             | -53.43         | -13.00      | Vertical     |
| 7605.68         | -54.58                 | 7.40          | -11.33            | -50.65         | -13.00      | Horizontal   |
| 10122.67        | -55.85                 | 8.31          | -11.96            | -52.20         | -13.00      | Horizontal   |
| 12685.46        | -53.62                 | 9.35          | -12.50            | -50.47         | -13.00      | Horizontal   |
| 15204.62        | -49.10                 | 10.70         | -13.40            | -46.40         | -13.00      | Vertical     |
| 17744.04        | -47.57                 | 11.45         | -13.06            | -45.96         | -13.00      | Horizontal   |

**LTE Band 7, 5 MHz, 16QAM, Channel 21425, RB=1, RB position=middle.**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Path Loss(dB) | Antenna Gain(dBi) | Peak EIRP(dBm) | Limit (dBm) | Polarization |
|-----------------|------------------------|---------------|-------------------|----------------|-------------|--------------|
| 5129.78         | -58.84                 | 6.44          | -9.57             | -55.71         | -13.00      | Vertical     |
| 7711.03         | -56.23                 | 7.29          | -11.42            | -52.10         | -13.00      | Horizontal   |
| 10270.59        | -52.67                 | 8.97          | -11.88            | -49.76         | -13.00      | Horizontal   |
| 12855.27        | -53.04                 | 9.52          | -12.61            | -49.95         | -13.00      | Horizontal   |
| 15406.14        | -48.98                 | 10.75         | -13.15            | -46.58         | -13.00      | Horizontal   |
| 17965.12        | -48.81                 | 12.56         | -13.13            | -48.24         | -13.00      | Vertical     |

**LTE Band 41, 5MHz, QPSK, Channel 39675, RB=1, RB position=middle.**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Path Loss(dB) | Antenna Gain(dBi) | Peak EIRP(dBm) | Limit (dBm) | Polarization |
|-----------------|------------------------|---------------|-------------------|----------------|-------------|--------------|
| 4997.61         | -54.99                 | 6.31          | -9.41             | -51.89         | -13.00      | Vertical     |
| 7489.88         | -51.50                 | 7.50          | -11.22            | -47.78         | -13.00      | Horizontal   |
| 9994.71         | -54.83                 | 8.50          | -12.03            | -51.30         | -13.00      | Horizontal   |
| 12474.36        | -53.68                 | 9.23          | -12.37            | -50.54         | -13.00      | Horizontal   |
| 14977.49        | -49.57                 | 10.78         | -13.60            | -46.75         | -13.00      | Horizontal   |
| 17499.54        | -46.22                 | 12.08         | -12.99            | -45.31         | -13.00      | Horizontal   |

**LTE Band 41, 5MHz, QPSK, Channel 40620, RB=1, RB position=middle.**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Path Loss(dB) | Antenna Gain(dBi) | Peak EIRP(dBm) | Limit (dBm) | Polarization |
|-----------------|------------------------|---------------|-------------------|----------------|-------------|--------------|
| 5186.47         | -30.31                 | 6.43          | -9.64             | -27.10         | -13.00      | Vertical     |
| 7779.57         | -44.95                 | 7.19          | -11.49            | -40.65         | -13.00      | Vertical     |
| 10372.03        | -50.93                 | 8.58          | -11.82            | -47.69         | -13.00      | Vertical     |
| 12973.81        | -54.32                 | 9.50          | -12.69            | -51.13         | -13.00      | Vertical     |
| 15577.04        | -51.34                 | 10.64         | -13.08            | -48.90         | -13.00      | Vertical     |
| 17907.50        | -46.40                 | 12.25         | -13.11            | -45.54         | -13.00      | Horizontal   |

**LTE Band 41, 5MHz, QPSK, Channel 41565, RB=1, RB position=middle.**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Path Loss(dB) | Antenna Gain(dBi) | Peak EIRP(dBm) | Limit (dBm) | Polarization |
|-----------------|------------------------|---------------|-------------------|----------------|-------------|--------------|
| 5375.44         | -30.13                 | 6.63          | -9.88             | -26.88         | -13.00      | Vertical     |
| 8062.90         | -45.42                 | 7.60          | -11.74            | -41.28         | -13.00      | Vertical     |
| 10750.72        | -51.61                 | 8.80          | -11.96            | -48.45         | -13.00      | Vertical     |
| 13438.29        | -50.76                 | 9.99          | -13.44            | -47.31         | -13.00      | Vertical     |
| 16126.05        | -49.52                 | 11.14         | -13.20            | -47.46         | -13.00      | Vertical     |
| 17174.98        | -45.40                 | 12.17         | -12.83            | -44.74         | -13.00      | Horizontal   |

**LTE Band 41, 5MHz, 16QAM, Channel 39675, RB=1, RB position=middle.**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Path Loss(dB) | Antenna Gain(dBi) | Peak EIRP(dBm) | Limit (dBm) | Polarization |
|-----------------|------------------------|---------------|-------------------|----------------|-------------|--------------|
| 4056.47         | -58.66                 | 5.61          | -8.31             | -55.96         | -13.00      | Horizontal   |
| 5458.70         | -59.91                 | 6.67          | -9.99             | -56.59         | -13.00      | Vertical     |
| 7349.22         | -57.74                 | 7.07          | -11.11            | -53.70         | -13.00      | Horizontal   |
| 8103.86         | -56.07                 | 7.43          | -11.78            | -51.72         | -13.00      | Horizontal   |
| 9648.00         | -55.59                 | 8.41          | -12.28            | -51.72         | -13.00      | Horizontal   |
| 13645.07        | -48.61                 | 10.47         | -13.63            | -45.45         | -13.00      | Vertical     |

**LTE Band 41, 5MHz, 16QAM, Channel 40620, RB=1, RB position=middle.**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Path Loss(dB) | Antenna Gain(dBi) | Peak EIRP(dBm) | Limit (dBm) | Polarization |
|-----------------|------------------------|---------------|-------------------|----------------|-------------|--------------|
| 5186.45         | -29.89                 | 6.43          | -9.64             | -26.68         | -13.00      | Vertical     |
| 7779.48         | -45.83                 | 7.19          | -11.49            | -41.53         | -13.00      | Vertical     |
| 10362.65        | -55.18                 | 8.42          | -11.83            | -51.77         | -13.00      | Horizontal   |
| 12965.74        | -51.77                 | 9.51          | -12.69            | -48.59         | -13.00      | Vertical     |
| 15586.27        | -48.24                 | 10.67         | -13.09            | -45.82         | -13.00      | Horizontal   |
| 17904.79        | -46.31                 | 12.26         | -13.11            | -45.46         | -13.00      | Vertical     |

**LTE Band 41, 5MHz, 16QAM, Channel 41565, RB=1, RB position=middle.**

| Frequency (MHz) | P <sub>Mea</sub> (dBm) | Path Loss(dB) | Antenna Gain(dBi) | Peak EIRP(dBm) | Limit (dBm) | Polarization |
|-----------------|------------------------|---------------|-------------------|----------------|-------------|--------------|
| 5375.32         | -32.99                 | 6.63          | -9.88             | -29.74         | -13.00      | Vertical     |
| 8063.09         | -47.48                 | 7.59          | -11.74            | -43.33         | -13.00      | Vertical     |
| 10750.57        | -53.42                 | 8.80          | -11.96            | -50.26         | -13.00      | Vertical     |
| 13438.44        | -51.81                 | 9.99          | -13.44            | -48.36         | -13.00      | Vertical     |
| 16126.10        | -47.31                 | 11.14         | -13.20            | -45.25         | -13.00      | Vertical     |
| 17169.74        | -45.37                 | 12.22         | -12.82            | -44.77         | -13.00      | Vertical     |

Note: The maximum value of expanded measurement uncertainty for this test item is  $U = 4.2$  dB,  $k = 2$ .

### **A.3 FREQUENCY STABILITY**

#### **Reference**

FCC: CFR Part 2.1055, 27.54.

#### **A.4.1 Method of Measurement**

In order to measure the carrier frequency under the condition of AFC lock, it is necessary to make measurements with the EUT in a “call mode”. This is accomplished with the use of R&S CMW500 DIGITAL RADIO COMMUNICATION TESTER.

1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -30°C.
3. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on middle channel for LTE band 7/41, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
4. Repeat the above measurements at 10°C increments from -30°C to +50°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
5. Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring carrier frequency at each voltage. Pause at nominal voltage for 1.5 hours unpowered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50°C.
7. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
8. Repeat the above measurements at 10 °C increments from +50°C to -30°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
9. At all temperature levels hold the temperature to +/- 0.5°C during the measurement procedure.

#### **A.4.2 Measurement Limit**

According to the JTC standard the frequency stability of the carrier shall be accurate to within 0.1 ppm of the received frequency from the base station. This accuracy is sufficient to meet Sec. 27.54, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d) (2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of between 3.6VDC and 4.2VDC, with a nominal voltage of 3.8VDC. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress. These voltages represent a tolerance from -5.4% to 10.8%. For the purposes of measuring frequency stability these voltage limits are to be used.

**A.4.3 Measurement results****Room Temperature: 24 °C****LTE Band 7, 20 MHz bandwidth (worst case of all bandwidths)****Frequency Error vs Voltage**

| Voltage<br>(V) | Frequency error (Hz) |       | Frequency error (ppm) |       |
|----------------|----------------------|-------|-----------------------|-------|
|                | QPSK                 | 16QAM | QPSK                  | 16QAM |
| 3.8            | -6                   | 3     | 0.002                 | 0.001 |
| 4.2            | 0                    | 5     | 0.000                 | 0.002 |
| 3.6            | -5                   | -4    | 0.002                 | 0.002 |

**Frequency Error vs Temperature**

| Temperature<br>(°C) | Frequency error (Hz) |       | Frequency error (ppm) |       |
|---------------------|----------------------|-------|-----------------------|-------|
|                     | QPSK                 | 16QAM | QPSK                  | 16QAM |
| 50°                 | -7                   | -5    | 0.003                 | 0.002 |
| 40°                 | 8                    | -11   | 0.003                 | 0.004 |
| 30°                 | -1                   | -5    | 0.000                 | 0.002 |
| 20°                 | 4                    | -8    | 0.002                 | 0.003 |
| 10°                 | 4                    | -7    | 0.002                 | 0.003 |
| 0°                  | 13                   | -14   | 0.005                 | 0.006 |
| - 10°               | -7                   | -16   | 0.003                 | 0.006 |
| - 20°               | 4                    | -10   | 0.001                 | 0.004 |
| - 30°               | 1                    | -13   | 0.000                 | 0.005 |

**LTE Band 41, 15 MHz bandwidth (worst case of all bandwidths)**

**Frequency Error vs Voltage**

| Voltage<br>(V) | Frequency error (Hz) |       | Frequency error (ppm) |       |
|----------------|----------------------|-------|-----------------------|-------|
|                | QPSK                 | 16QAM | QPSK                  | 16QAM |
| 3.8            | -5                   | -7    | 0.002                 | 0.003 |
| 4.2            | -5                   | -15   | 0.002                 | 0.006 |
| 3.6            | -3                   | -4    | 0.001                 | 0.002 |

**Frequency Error vs Temperature**

| Temperature<br>(°C) | Frequency error (Hz) |       | Frequency error (ppm) |       |
|---------------------|----------------------|-------|-----------------------|-------|
|                     | QPSK                 | 16QAM | QPSK                  | 16QAM |
| 50°                 | -6                   | -9    | 0.002                 | 0.003 |
| 40°                 | 1                    | -12   | 0.000                 | 0.005 |
| 30°                 | 5                    | -12   | 0.002                 | 0.005 |
| 20°                 | -2                   | -11   | 0.001                 | 0.004 |
| 10°                 | 1                    | -12   | 0.000                 | 0.004 |
| 0°                  | -10                  | -7    | 0.004                 | 0.003 |
| - 10°               | -2                   | -11   | 0.001                 | 0.004 |
| - 20°               | -8                   | -16   | 0.003                 | 0.006 |
| - 30°               | 6                    | -15   | 0.002                 | 0.006 |

Expanded measurement uncertainty for this test item is 10 Hz,  $k = 2$ .

## A.4 OCCUPIED BANDWIDTH

### Reference

FCC: CFR Part 2.1049(h)(i)

### A.5.1 Occupied Bandwidth Measurement Results

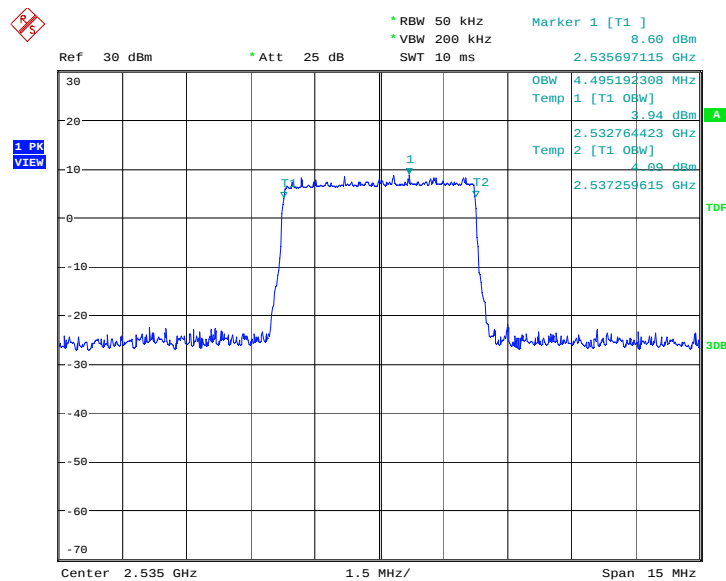
Occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the mid frequencies of the LTE bands 7 and 41. The table below lists the measured 99% BW. Spectrum analyzer plots are included on the following pages.

#### A.5.1.1 Measurement results per FCC rules

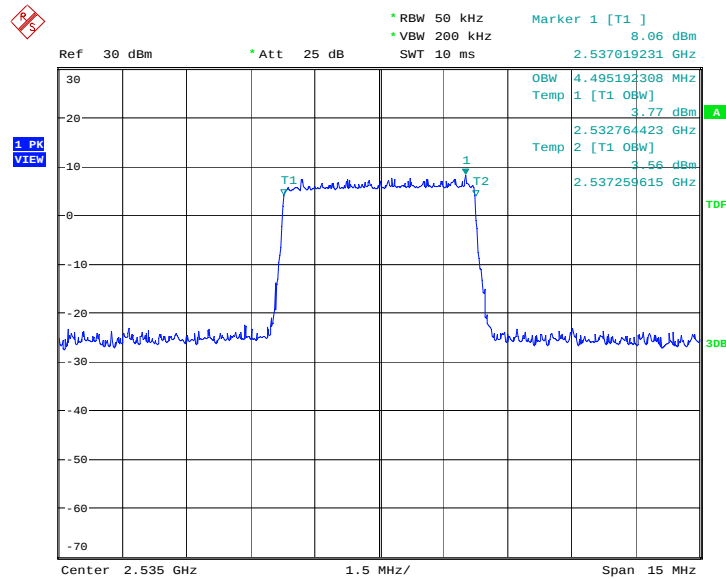
##### LTE band 7, 5MHz (99% BW)

| Frequency<br>(MHz) | Occupied Bandwidth (99% BW)( kHz) |          |
|--------------------|-----------------------------------|----------|
|                    | QPSK                              | 16QAM    |
| 2535               | 4495.192                          | 4495.192 |

##### LTE band 7, 5MHz Bandwidth, QPSK (99% BW)



### LTE band 7, 5MHz Bandwidth,16QAM (99% BW)

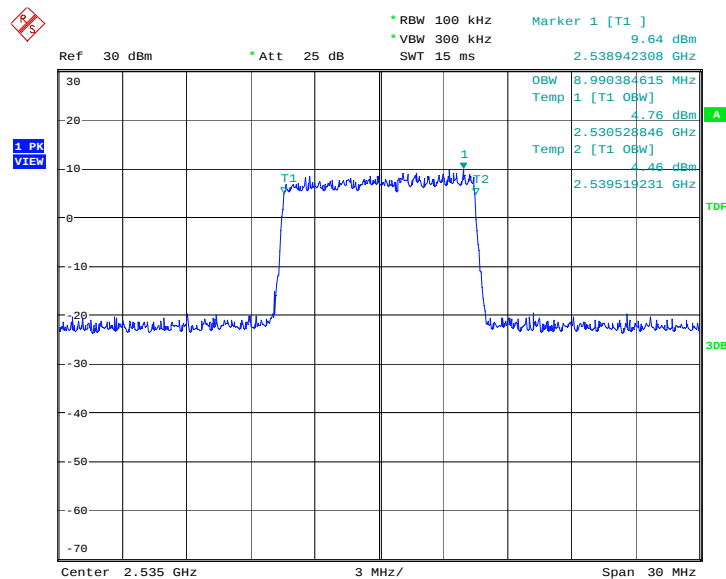


Date: 26.FEB.2015 20:42:58

### LTE band 7, 10MHz (99% BW)

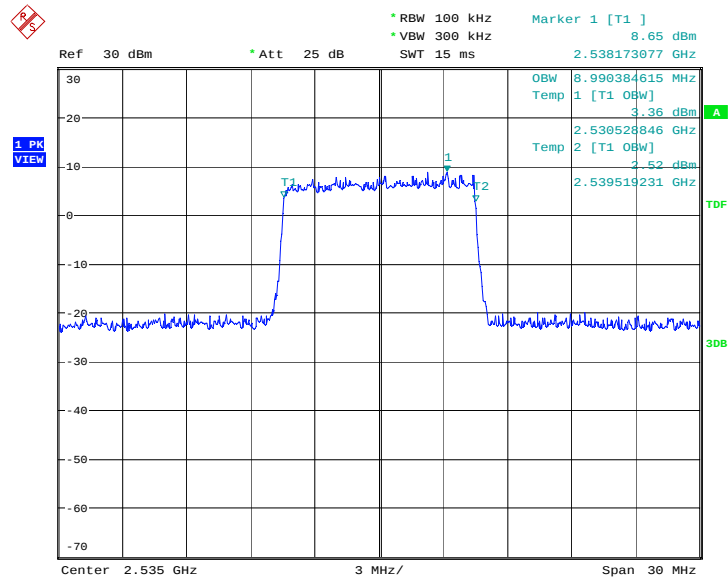
| Frequency<br>(MHz) | Occupied Bandwidth (99% BW)( kHz) |          |
|--------------------|-----------------------------------|----------|
|                    | QPSK                              | 16QAM    |
| 2535               | 8990.385                          | 8990.385 |

### LTE band 7, 10MHz Bandwidth, QPSK (99% BW)



Date: 26.FEB.2015 20:55:05

### LTE band 7, 10MHz Bandwidth, 16QAM (99% BW)

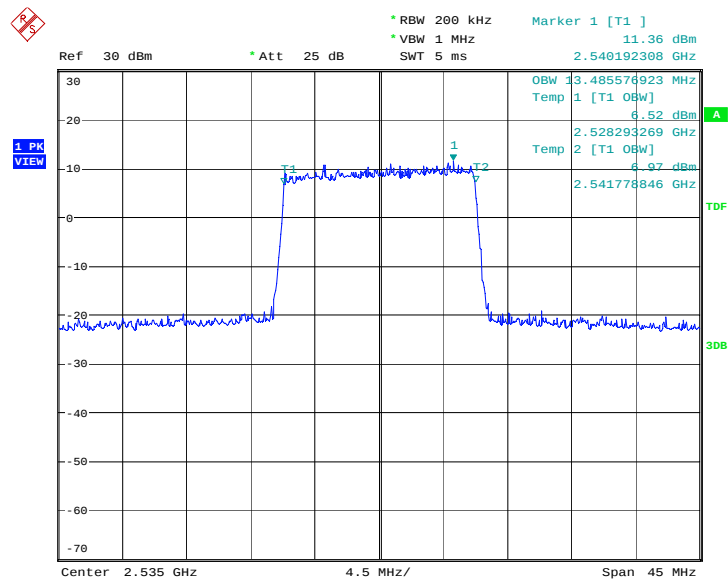


Date: 26.FEB.2015 20:55:20

### LTE band 7, 15MHz (99% BW)

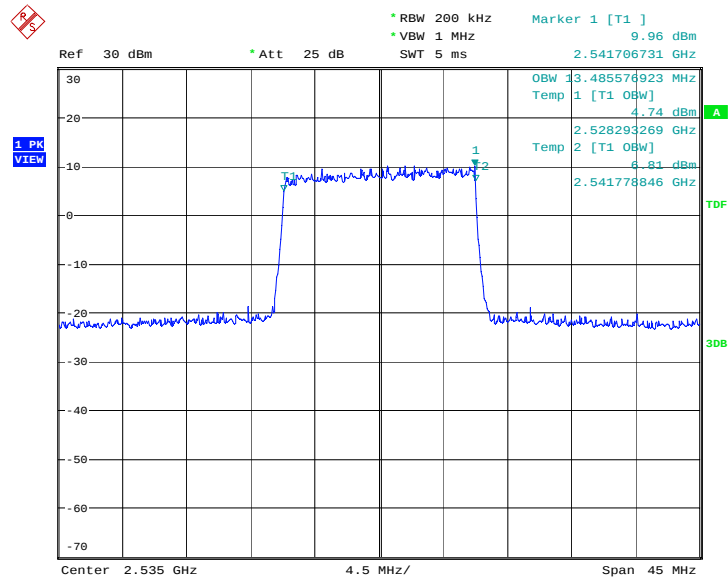
| Frequency<br>(MHz) | Occupied Bandwidth (99% BW)( kHz) |           |
|--------------------|-----------------------------------|-----------|
|                    | QPSK                              | 16QAM     |
| 2535               | 13485.577                         | 13485.577 |

### LTE band 7, 15MHz Bandwidth, QPSK (99% BW)



Date: 26.FEB.2015 21:02:23

### LTE band 7, 15MHz Bandwidth, 16QAM (99% BW)

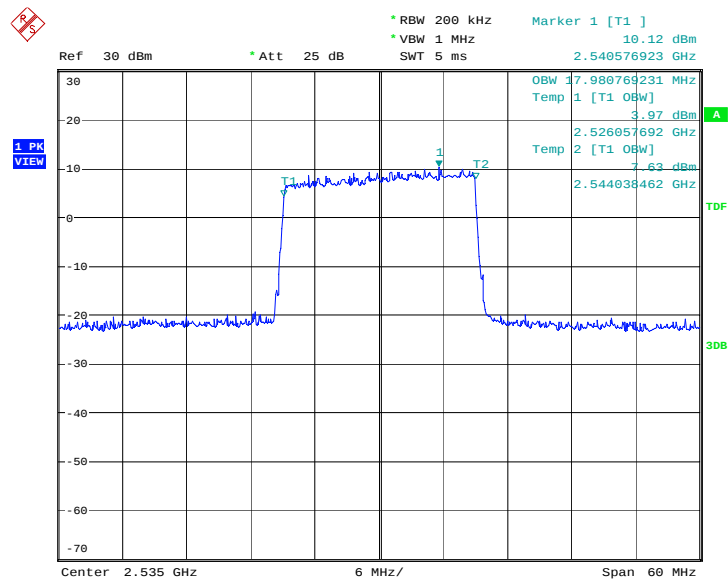


Date: 26.FEB.2015 21:02:38

### LTE band 7, 20MHz (99% BW)

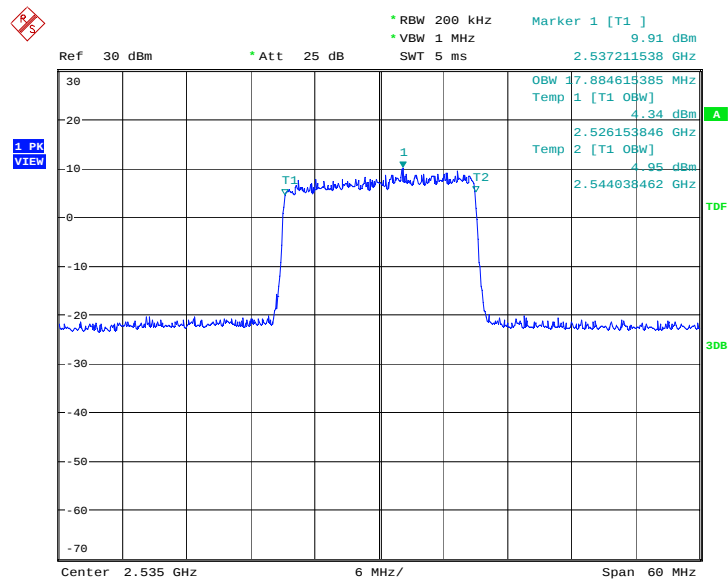
| Frequency<br>(MHz) | Occupied Bandwidth (99% BW)( kHz) |           |
|--------------------|-----------------------------------|-----------|
|                    | QPSK                              | 16QAM     |
| 2535               | 17980.769                         | 17884.615 |

### LTE band 7, 20MHz Bandwidth, QPSK (99% BW)



Date: 26.FEB.2015 21:09:45

### LTE band 7, 20MHz Bandwidth, 16QAM (99% BW)

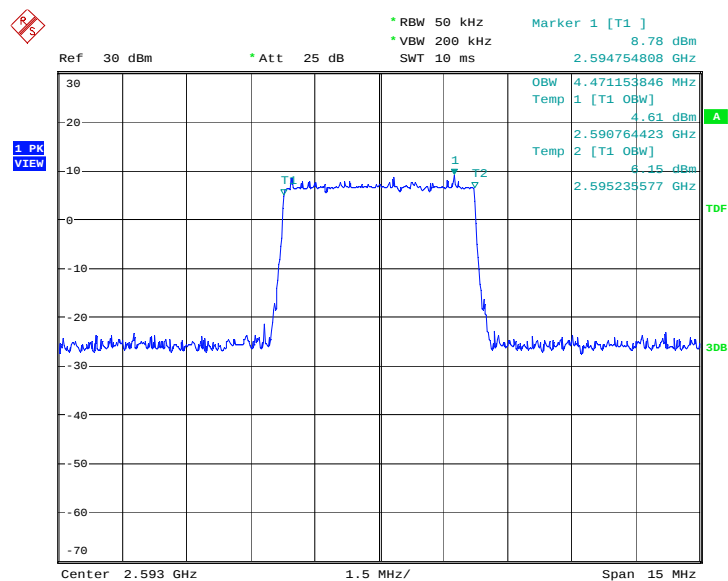


Date: 26.FEB.2015 21:10:00

### LTE band 41, 5MHz (99% BW)

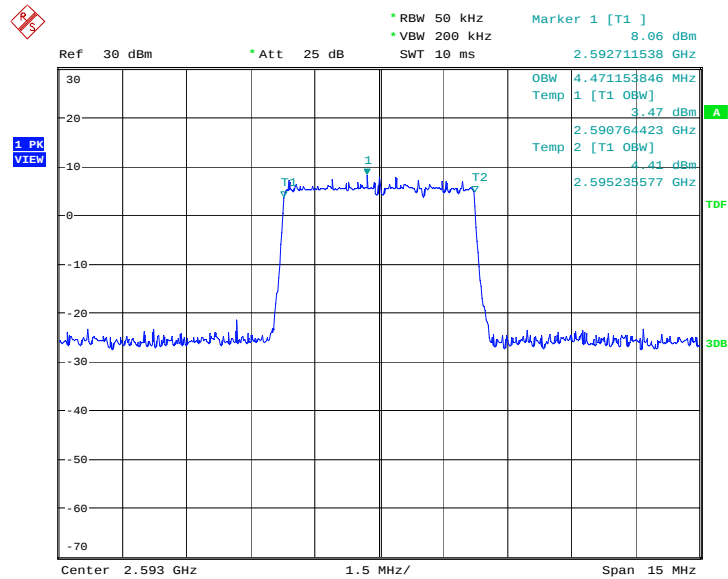
| Frequency<br>(MHz) | Occupied Bandwidth (99% BW)( kHz) |          |
|--------------------|-----------------------------------|----------|
|                    | QPSK                              | 16QAM    |
| 2535               | 4471.154                          | 4471.154 |

### LTE band 41, 5MHz Bandwidth, QPSK (99% BW)



Date: 26.FEB.2015 21:17:34

### LTE band 41, 5MHz Bandwidth,16QAM (99% BW)

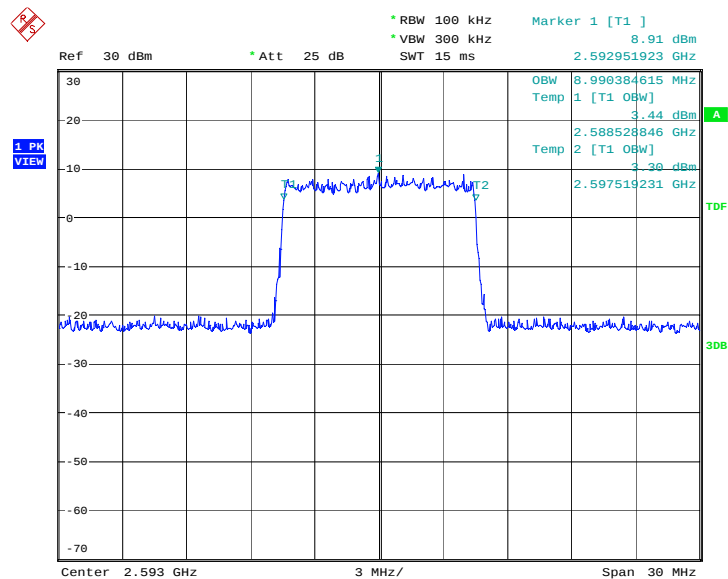


Date: 26.FEB.2015 21:17:49

### LTE band 41, 10MHz (99% BW)

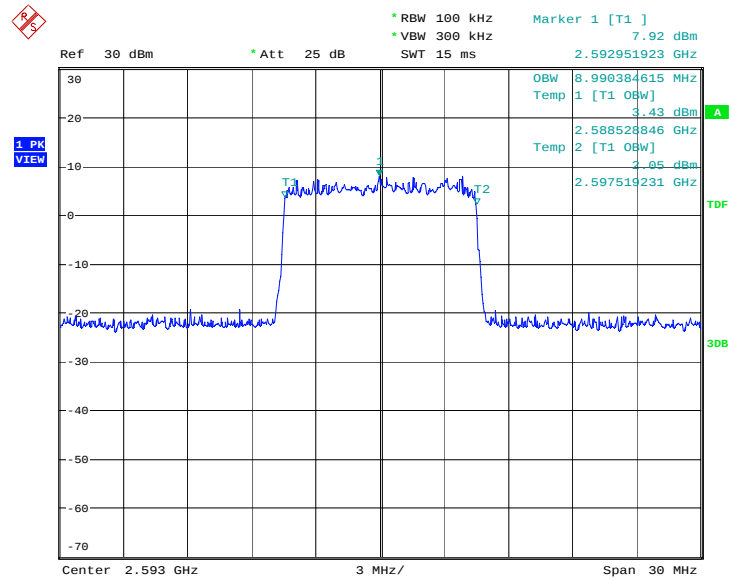
| Frequency<br>(MHz) | Occupied Bandwidth (99% BW)( kHz) |          |
|--------------------|-----------------------------------|----------|
|                    | QPSK                              | 16QAM    |
| 2535               | 8990.385                          | 8990.385 |

### LTE band 41, 10MHz Bandwidth, QPSK (99% BW)



Date: 26.FEB.2015 21:24:47

### LTE band 41, 10MHz Bandwidth, 16QAM (99% BW)

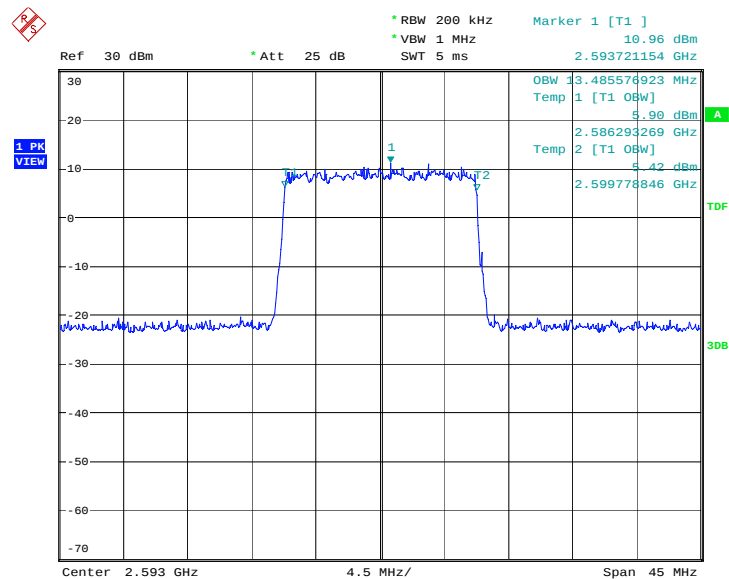


Date: 26.FEB.2015 21:25:02

### LTE band 41, 15MHz (99% BW)

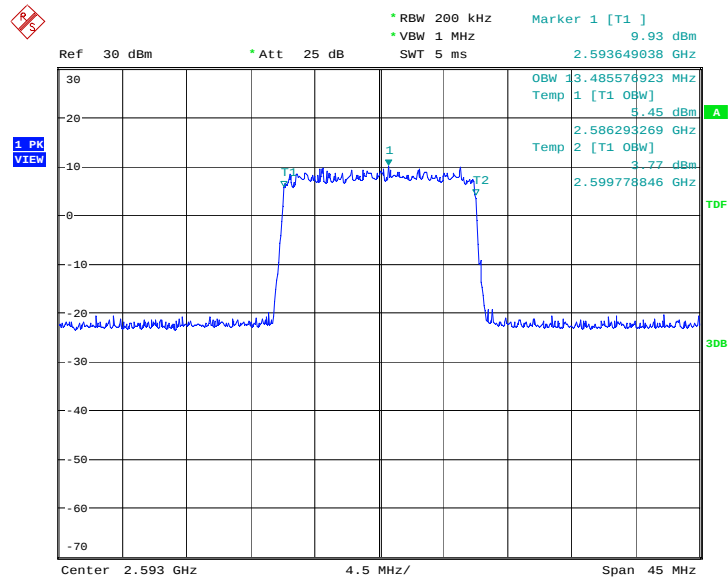
| Frequency<br>(MHz) | Occupied Bandwidth (99% BW)( kHz) |           |
|--------------------|-----------------------------------|-----------|
|                    | QPSK                              | 16QAM     |
| 2535               | 13485.577                         | 13485.577 |

### LTE band 41, 15MHz Bandwidth, QPSK (99% BW)



Date: 26.FEB.2015 21:37:13

### LTE band 41, 15MHz Bandwidth, 16QAM (99% BW)

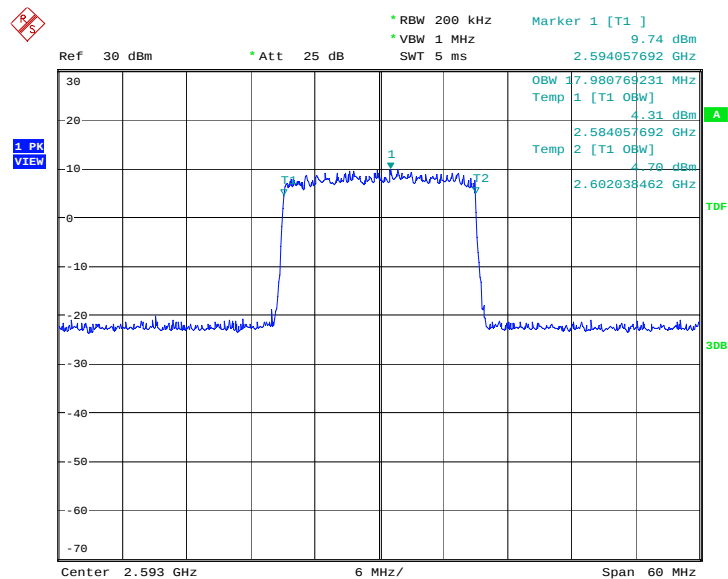


Date: 26.FEB.2015 21:37:28

### LTE band 41, 20MHz (99% BW)

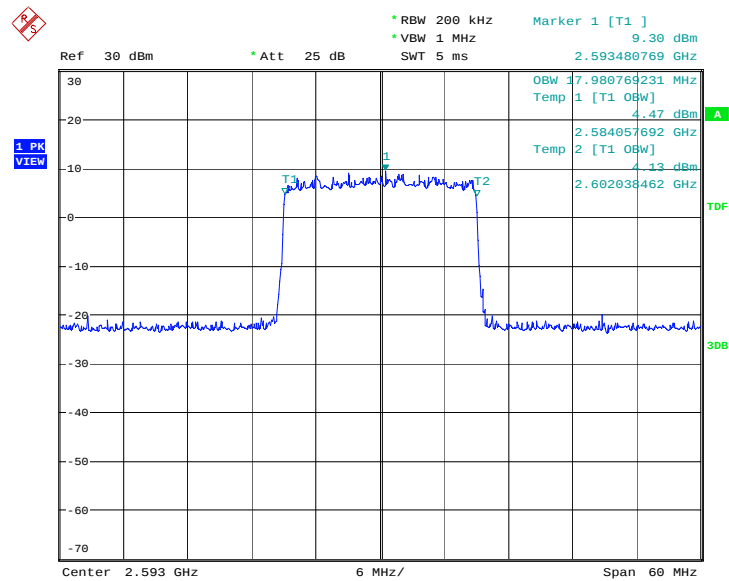
| Frequency<br>(MHz) | Occupied Bandwidth (99% BW)( kHz) |           |
|--------------------|-----------------------------------|-----------|
|                    | QPSK                              | 16QAM     |
| 2535               | 17980.769                         | 17980.769 |

### LTE band 41, 20MHz Bandwidth, QPSK (99% BW)



Date: 26.FEB.2015 21:49:42

# LTE band 41, 20MHz Bandwidth, 16QAM (99% BW)



Date: 26.FEB.2015 21:49:57

## A.6 EMISSION BANDWIDTH

### Reference

FCC: CFR Part 27.53(h).

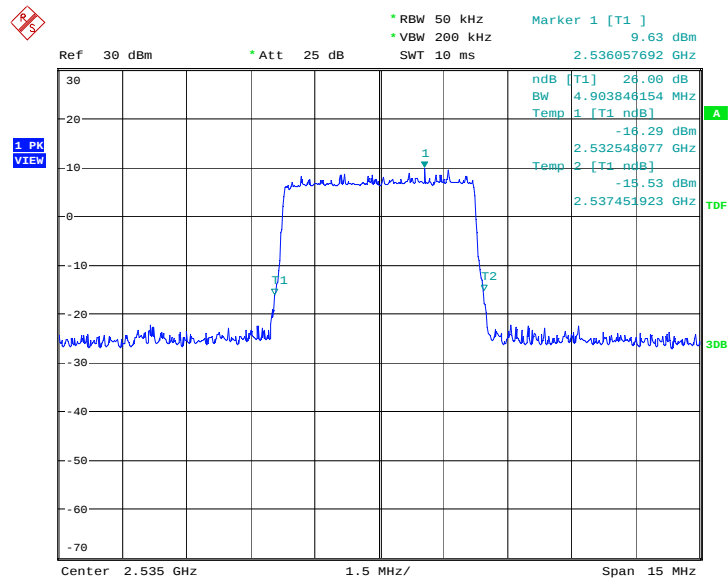
### A.6.1 Emission Bandwidth Measurement Results

Emission bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the mid frequencies of the LTE bands 7 and 41. Table below lists the measured 100% BW. Spectrum analyzer plots are included on the following pages.

#### LTE band 7, 5MHz (100% BW)

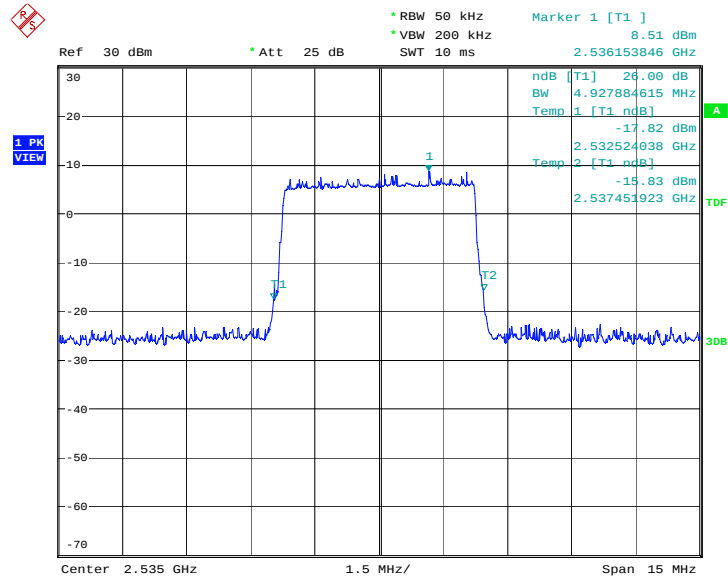
| Frequency<br>(MHz) | Occupied Bandwidth (100% BW)( kHz) |          |
|--------------------|------------------------------------|----------|
|                    | QPSK                               | 16QAM    |
| 2535               | 4903.846                           | 4927.885 |

#### LTE band 7, 5MHz Bandwidth, QPSK (100% BW)



Date: 26.FEB.2015 20:44:21

### LTE band 7, 5MHz Bandwidth,16QAM (100% BW)

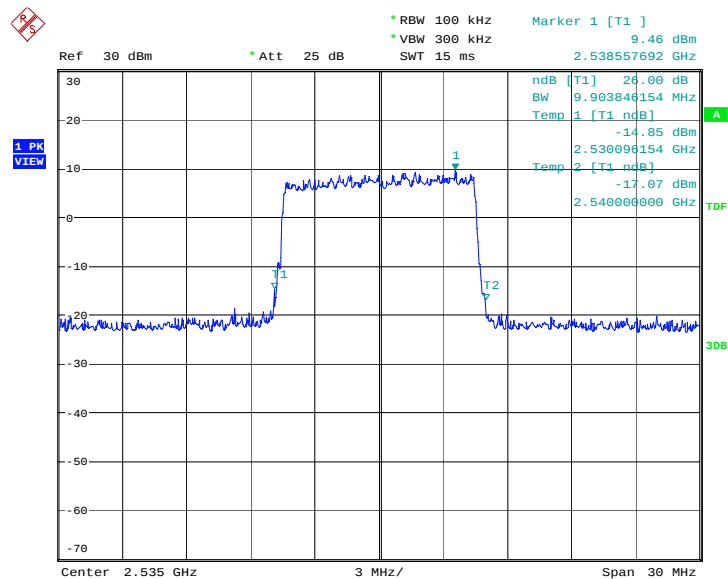


Date: 26.FEB.2015 20:44:38

### LTE band 7, 10MHz (100% BW)

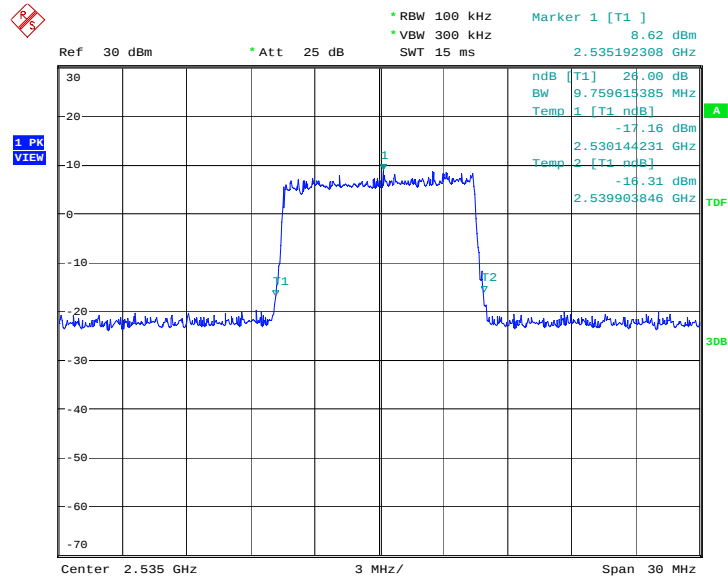
| Frequency<br>(MHz) | Occupied Bandwidth (100% BW)( kHz) |          |
|--------------------|------------------------------------|----------|
|                    | QPSK                               | 16QAM    |
| 2535               | 9903.846                           | 9759.615 |

### LTE band 7, 10MHz Bandwidth, QPSK (100% BW)



Date: 26.FEB.2015 20:56:43

### LTE band 7, 10MHz Bandwidth, 16QAM (100% BW)

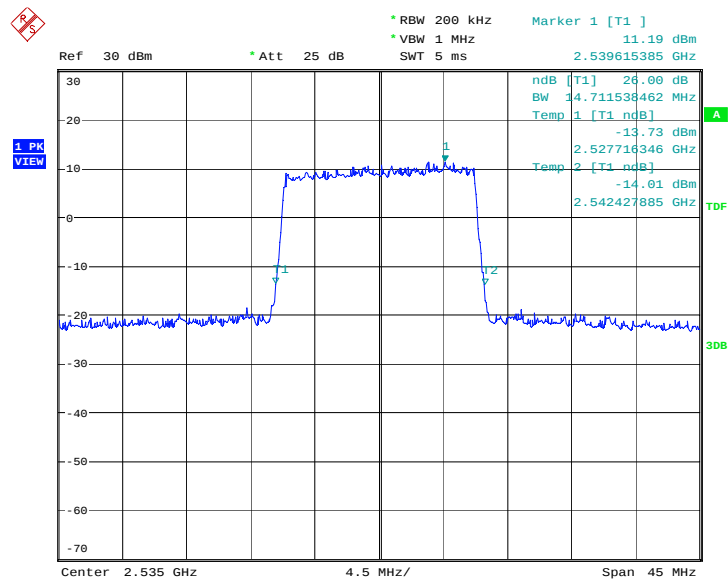


Date: 26.FEB.2015 20:57:00

### LTE band 7, 15MHz (100% BW)

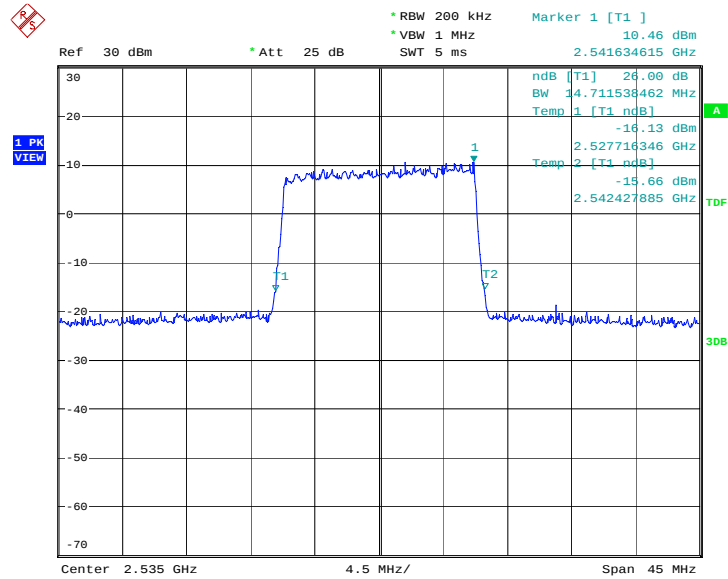
| Frequency<br>(MHz) | Occupied Bandwidth (100% BW)( kHz) |           |
|--------------------|------------------------------------|-----------|
|                    | QPSK                               | 16QAM     |
| 2535               | 14711.538                          | 14711.538 |

### LTE band 7, 15MHz Bandwidth, QPSK (100% BW)



Date: 26.FEB.2015 21:04:01

### LTE band 7, 15MHz Bandwidth, 16QAM (100% BW)

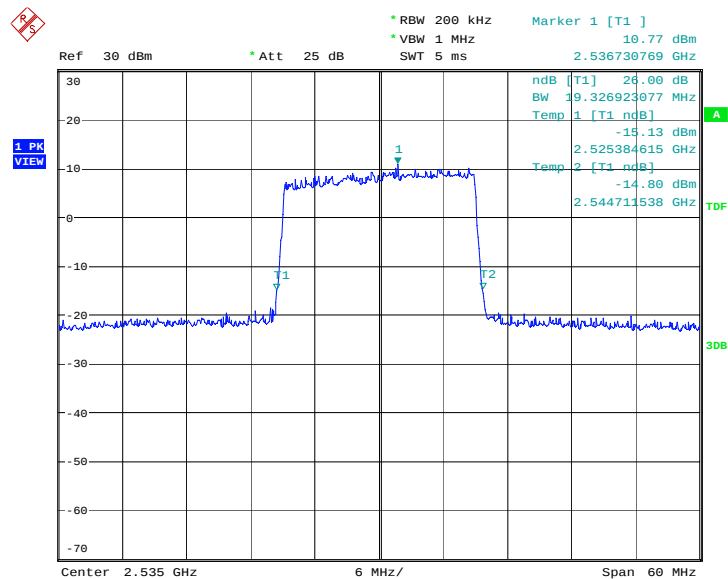


Date: 26.FEB.2015 21:04:19

### LTE band 7, 20MHz (100% BW)

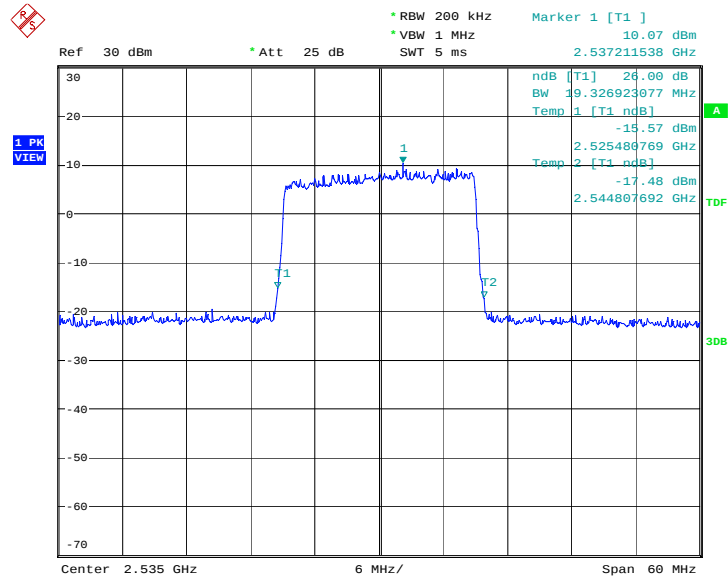
| Frequency (MHz) | Occupied Bandwidth (100% BW)( kHz) |           |
|-----------------|------------------------------------|-----------|
|                 | QPSK                               | 16QAM     |
| 2535            | 19326.923                          | 19326.923 |

### LTE band 7, 20MHz Bandwidth, QPSK (100% BW)



Date: 26.FEB.2015 21:11:24

### LTE band 7, 20MHz Bandwidth, 16QAM (100% BW)

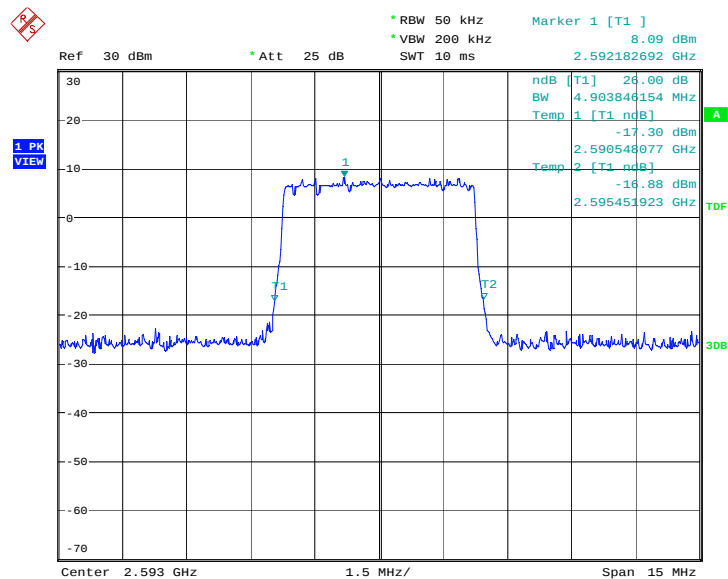


Date: 26.FEB.2015 21:11:41

### LTE band 41, 5MHz (100% BW)

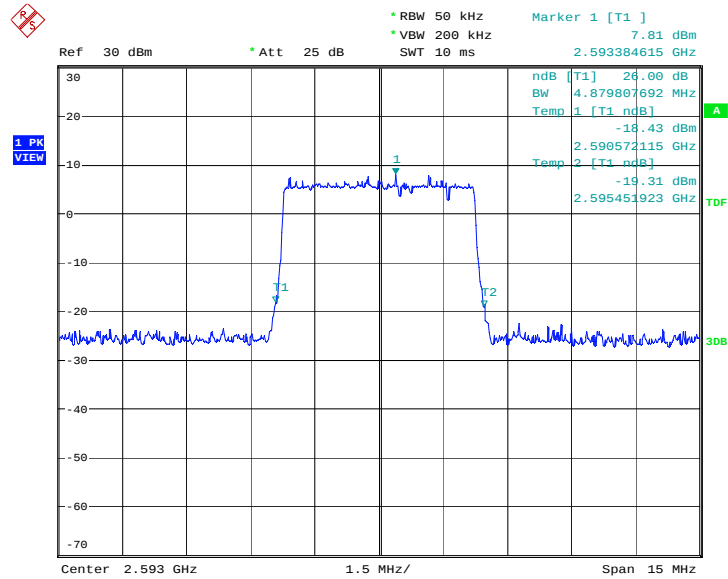
| Frequency<br>(MHz) | Occupied Bandwidth (100% BW)( kHz) |          |
|--------------------|------------------------------------|----------|
|                    | QPSK                               | 16QAM    |
| 2535               | 4903.846                           | 4879.808 |

### LTE band 41, 5MHz Bandwidth, QPSK (100% BW)



Date: 26.FEB.2015 21:19:12

### LTE band 41, 5MHz Bandwidth,16QAM (100% BW)

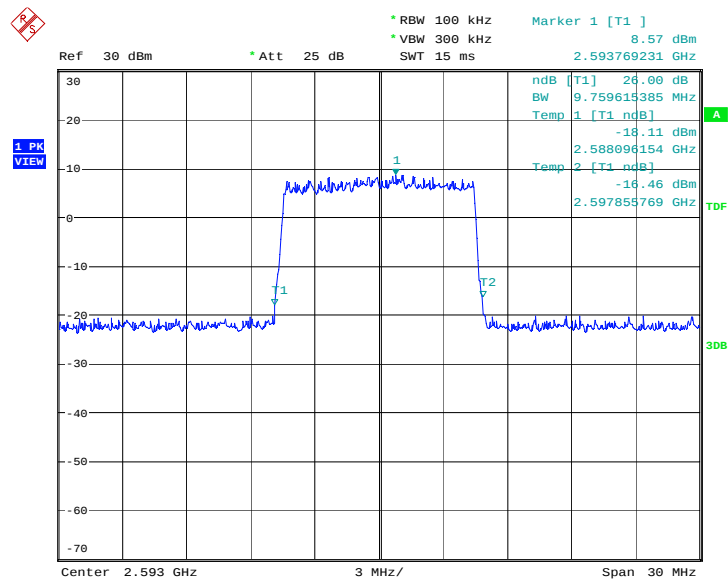


Date: 26.FEB.2015 21:19:29

### LTE band 41, 10MHz (100% BW)

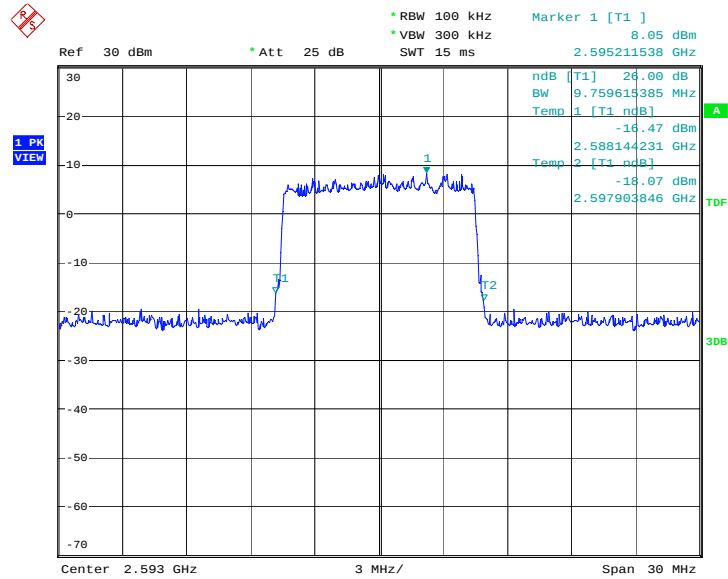
| Frequency<br>(MHz) | Occupied Bandwidth (100% BW)( kHz) |          |
|--------------------|------------------------------------|----------|
|                    | QPSK                               | 16QAM    |
| 2535               | 9759.615                           | 9759.615 |

### LTE band 41, 10MHz Bandwidth, QPSK (100% BW)



Date: 26.FEB.2015 21:26:26

### LTE band 41, 10MHz Bandwidth, 16QAM (100% BW)

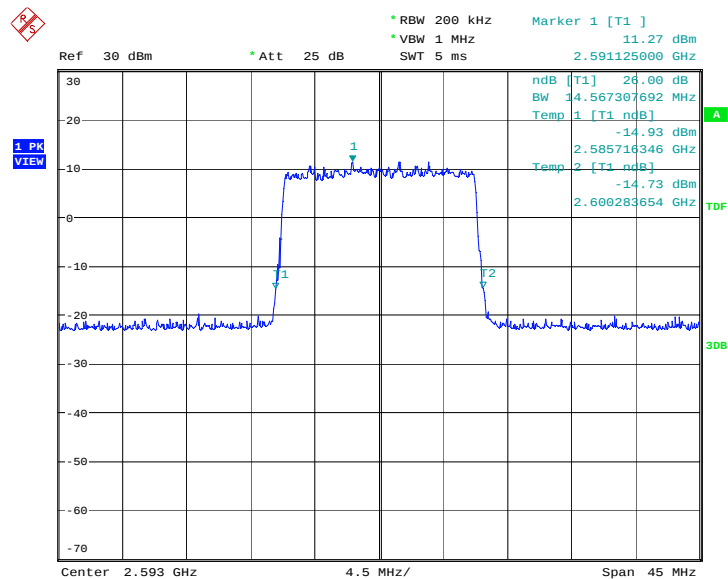


Date: 26.FEB.2015 21:26:43

### LTE band 41, 15MHz (100% BW)

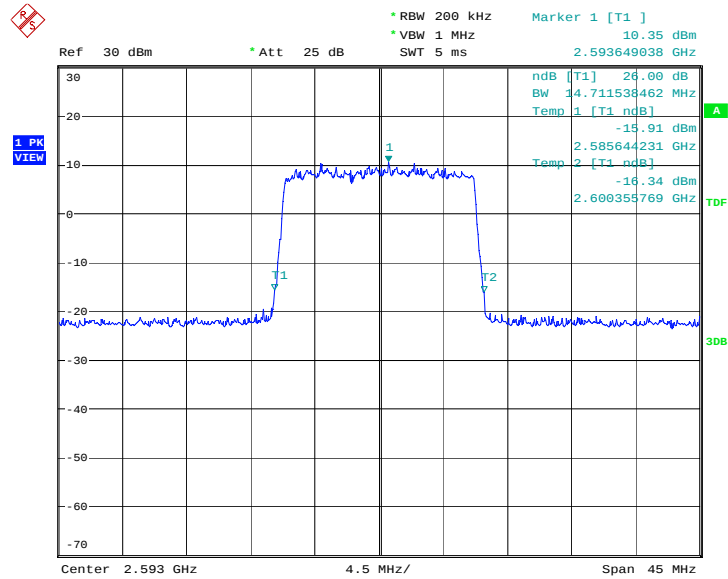
| Frequency<br>(MHz) | Occupied Bandwidth (100% BW)( kHz) |           |
|--------------------|------------------------------------|-----------|
|                    | QPSK                               | 16QAM     |
| 2535               | 14567.308                          | 14711.538 |

### LTE band 41, 15MHz Bandwidth, QPSK (100% BW)



Date: 26.FEB.2015 21:43:58

### LTE band 41, 15MHz Bandwidth, 16QAM (100% BW)

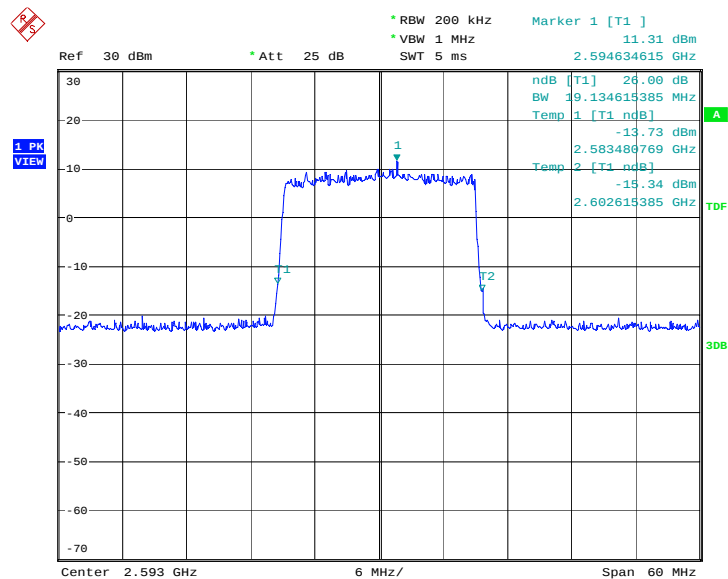


Date: 26.FEB.2015 21:44:15

### LTE band 41, 20MHz (100% BW)

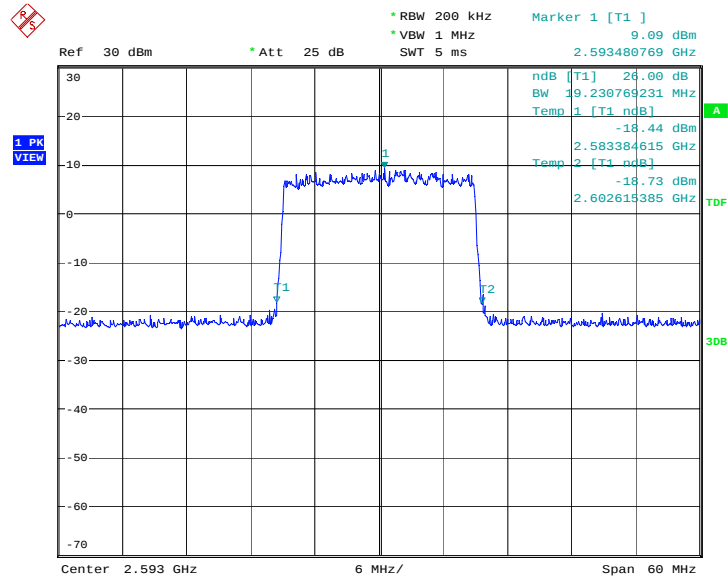
| Frequency<br>(MHz) | Occupied Bandwidth (100% BW)( kHz) |           |
|--------------------|------------------------------------|-----------|
|                    | QPSK                               | 16QAM     |
| 2535               | 19134.615                          | 19230.769 |

### LTE band 41, 20MHz Bandwidth, QPSK (100% BW)



Date: 26.FEB.2015 21:51:20

### LTE band 41, 20MHz Bandwidth, 16QAM (100% BW)



Date: 26.FEB.2015 21:51:37

## A.6 BAND EDGE COMPLIANCE

### Reference

FCC: CFR Part 27.53(h).

#### A.7.1 Measurement limit

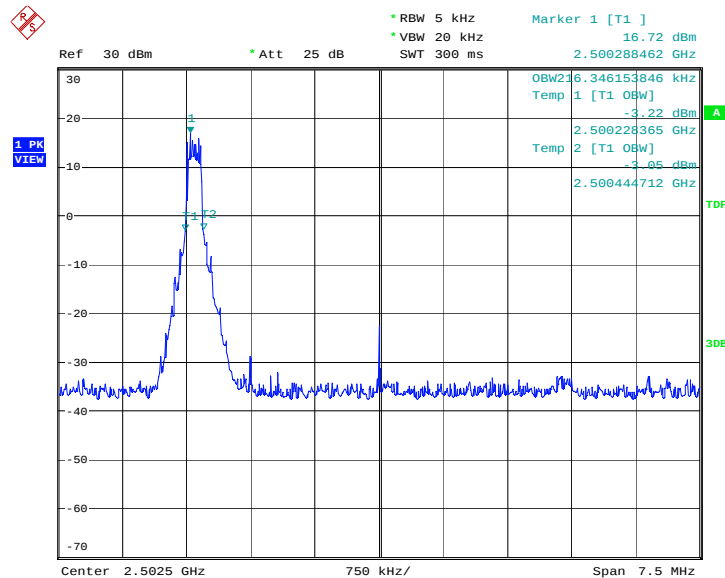
On any frequency outside frequency band of the LTE FDD bands 7 and 41 spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least  $43 + 10 \log(P)$  dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm.

#### A.7.2 Measurement result

Only worst case result is given below

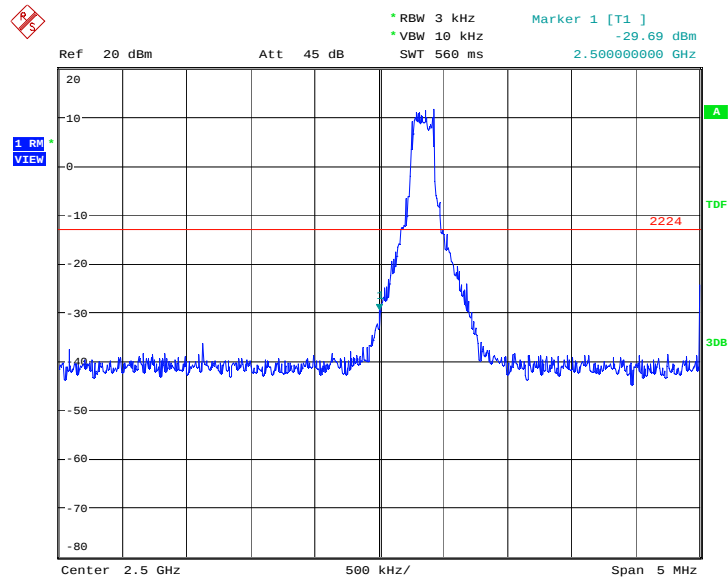
LTE band 7, 5MHz

OBW: 1RB-low\_offset



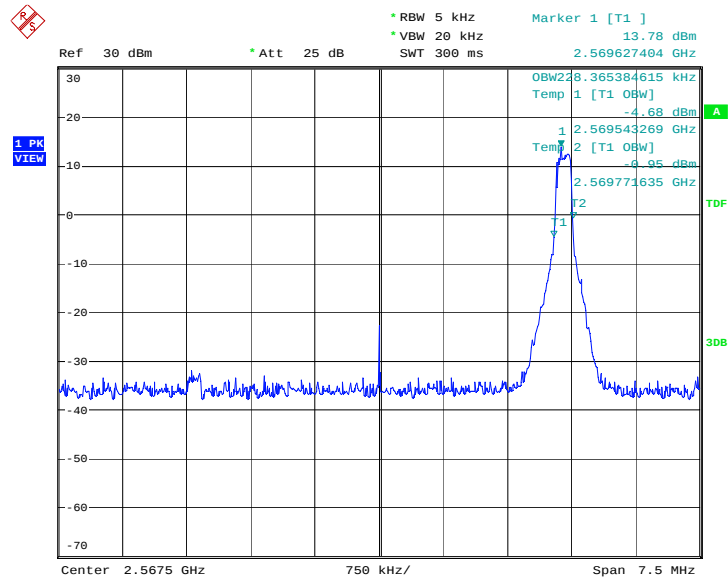
Date: 28.FEB.2015 14:06:10

### LOW BAND EDGE BLOCK-1RB-low\_offset



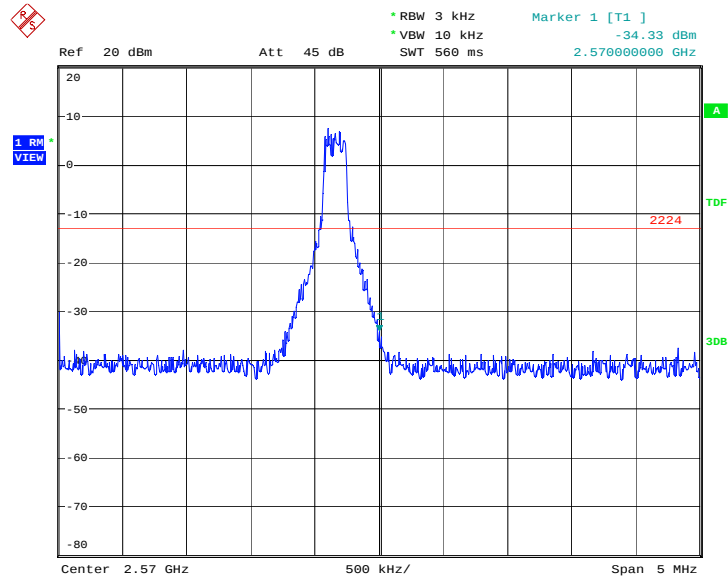
Date: 28.FEB.2015 14:06:57

### OBW: 1RB-high\_offset



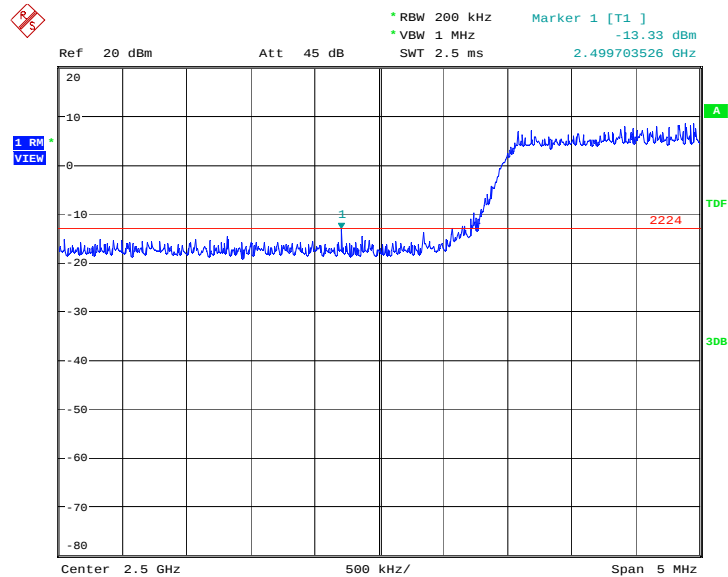
Date: 27.FEB.2015 17:22:23

## HIGH BAND EDGE BLOCK-1RB-high\_offset



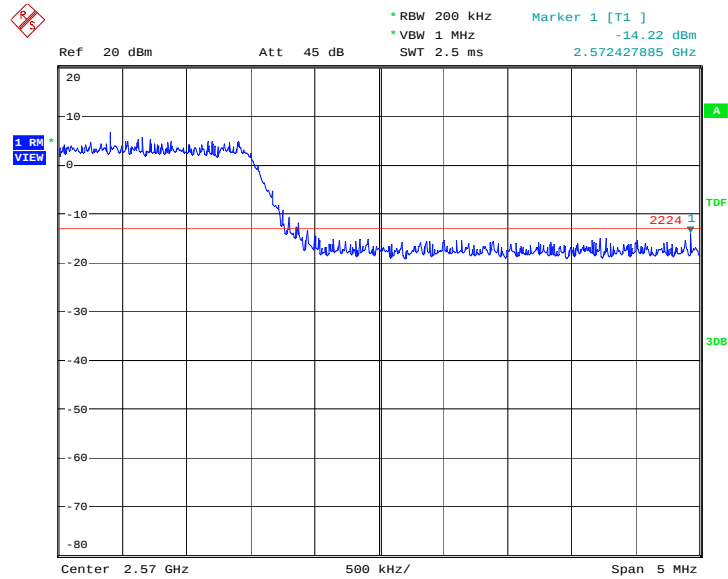
Date: 27.FEB.2015 17:23:39

## LOW BAND EDGE BLOCK-20MHz-100%RB



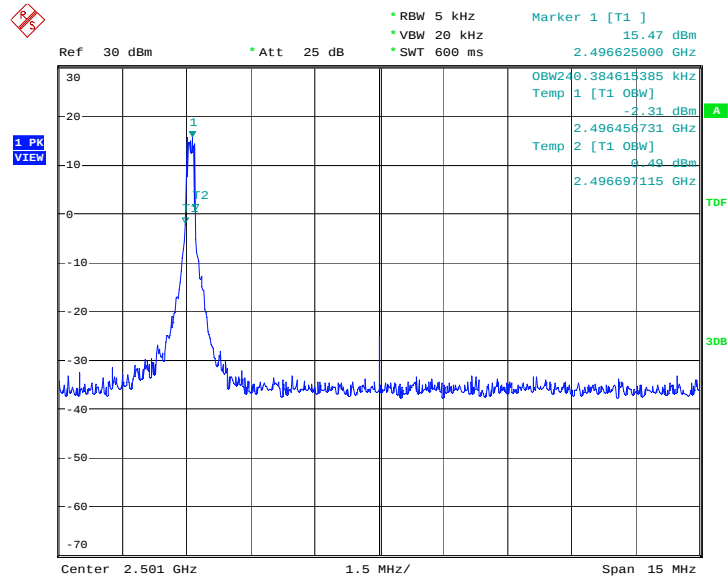
Date: 27.FEB.2015 15:40:11

# HIGH BAND EDGE BLOCK-20MHz-100%RB



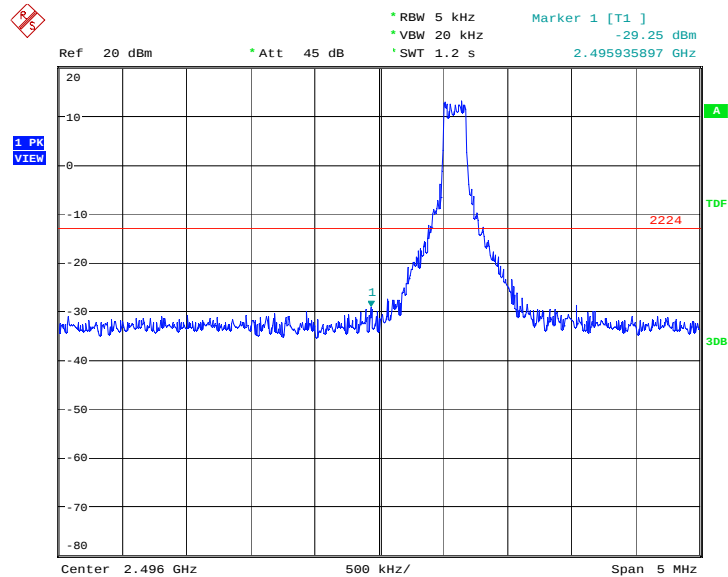
Date: 27.FEB.2015 15:41:59

LTE band 41  
OBW: 1RB-low\_offset



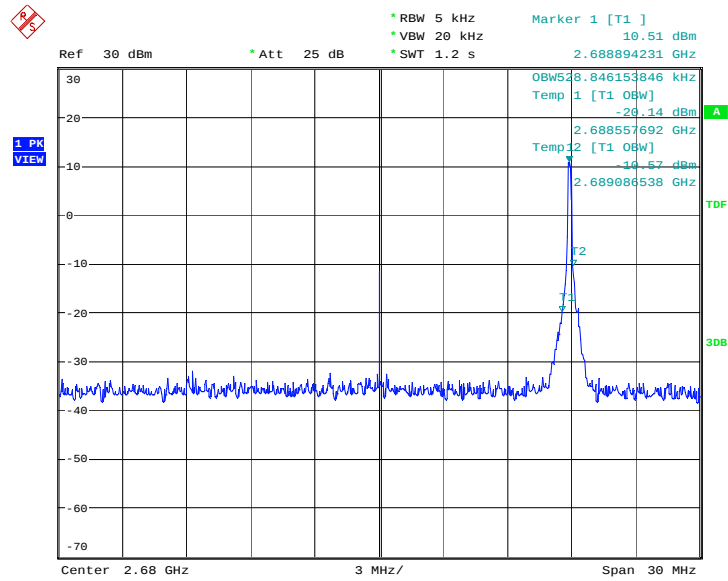
Date: 10.APR.2015 23:12:00

LOW BAND EDGE BLOCK-1RB-low\_offset



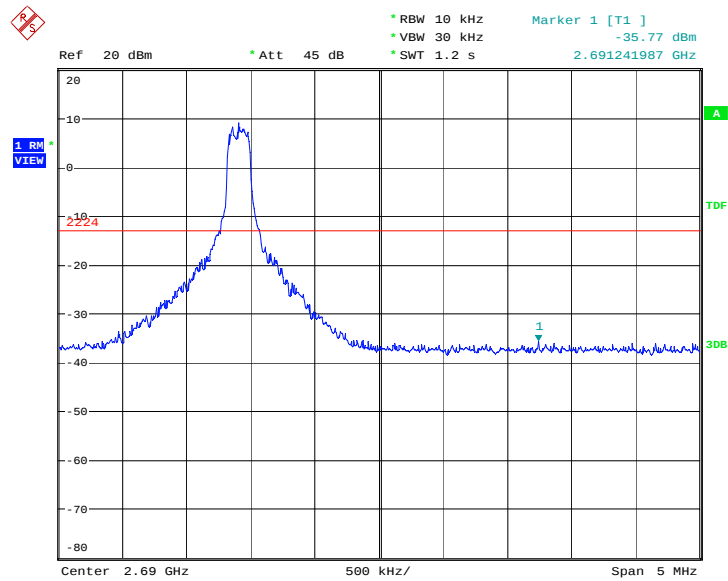
Date: 27.FEB.2015 17:19:40

### OBW: 1RB-high\_offset



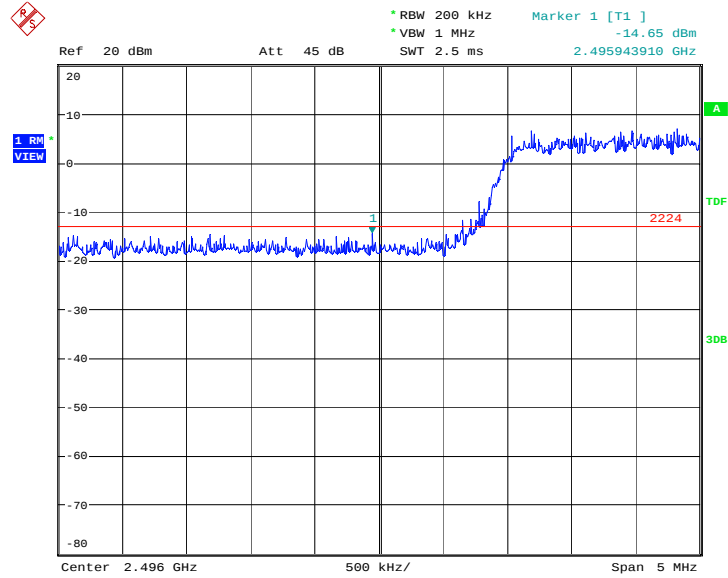
Date: 27.FEB.2015 16:35:03

### HIGH BAND EDGE BLOCK-1RB-high\_offset



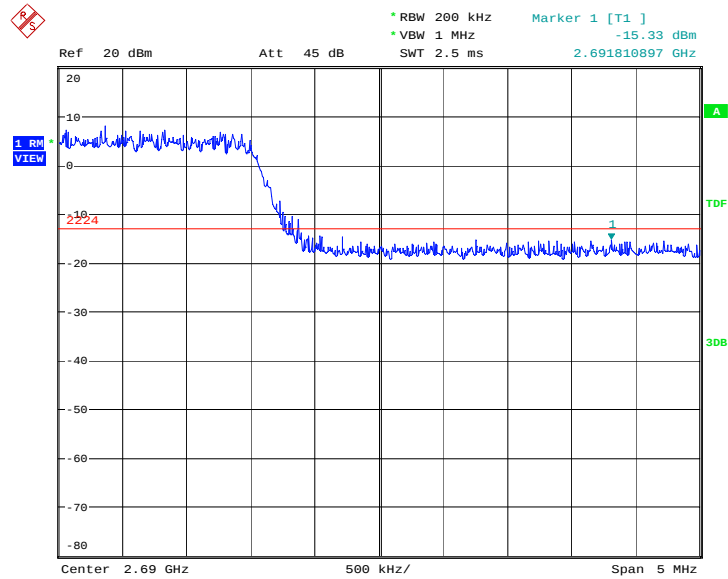
Date: 27.FEB.2015 16:47:54

### LOW BAND EDGE BLOCK-20MHz-100%RB



Date: 27.FEB.2015 15:43:49

### HIGH BAND EDGE BLOCK-20MHz-100%RB



Date: 27.FEB.2015 15:45:37

## **A.7 CONDUCTED SPURIOUS EMISSION**

### **Reference**

FCC: CFR Part 27.53(h).

### **A.8.1 Measurement Method**

The following steps outline the procedure used to measure the conducted emissions from the EUT.

1. Determine frequency range for measurements: From CFR 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency.
2. Determine EUT transmit frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.

### **A. 8.2 Measurement Limit**

Part 27.53 specify that the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

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

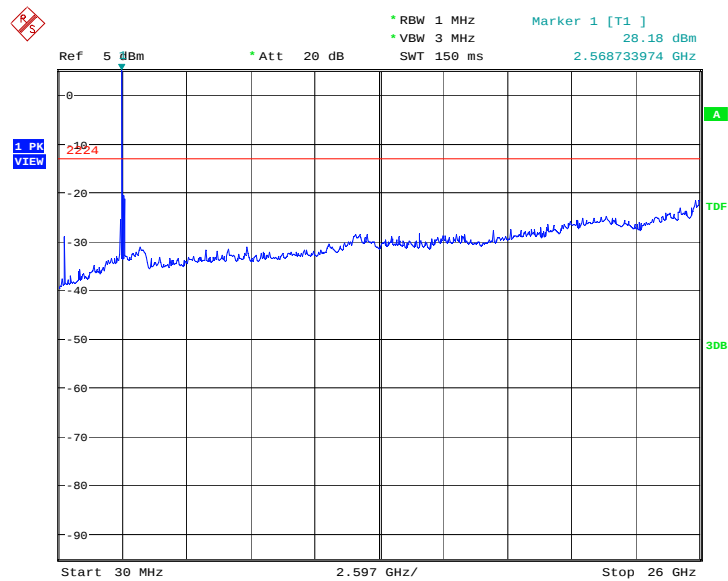
### **A. 8.3 Measurement result**

**Only worst case result is given below**

Measurement Uncertainty: 0.3dB

### LTE band 7: 30MHz – 26GHz

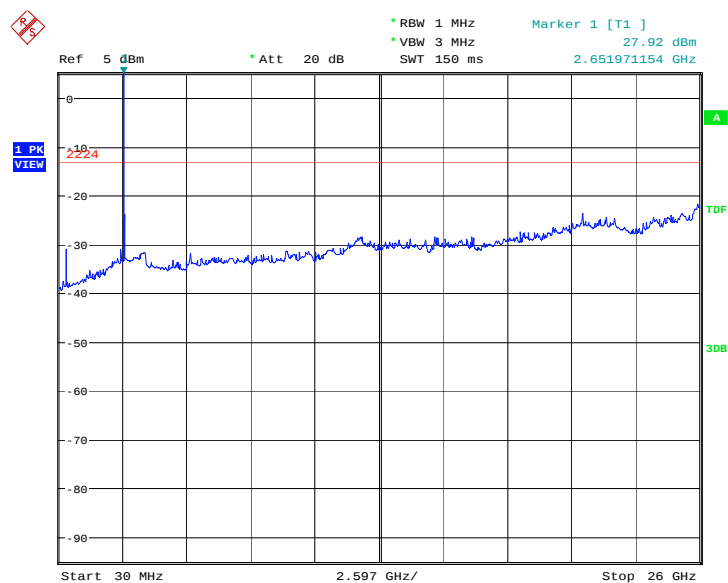
Spurious emission limit –13dBm.



Date: 27.FEB.2015 15:08:20

### LTE band 41: 30MHz – 26GHz

Spurious emission limit –13dBm.



Date: 27.FEB.2015 15:10:06

## **ANNEX B: TEST LAYOUT**



**Pic.1 Radiated spurious emission**

**\*\*\*END OF REPORT\*\*\***