



# TEST REPORT

No. I15Z43219-GTE01

for

**Huawei Technologies Co.,Ltd**

**Smart Phone**

**Model Name: HUAWEI TAG-L03**

**FCC ID: QISTAG-L03**

with

**Hardware Version: Ver.A**

**Software Version: TAG-L03C464B003\_A**

**Issued Date: 2016-01-07**

**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 CTTL.

**Test Laboratory:**

***FCC 2.948 Listed: No.525429***

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## **REPORT HISTORY**

| <b>Report Number</b> | <b>Revision</b> | <b>Description</b> | <b>Issue Date</b> |
|----------------------|-----------------|--------------------|-------------------|
| I15Z43219-GTE01      | Rev.0           | 1st edition        | 2016-01-07        |

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## **1. Test Laboratory**

### **1.1. Testing Location**

Company Name: CTTL, Telecommunication Technology Labs, Academy of  
Telecommunication Research, MIIT  
Address: No. 52, Huayuan North Road, Haidian District, Beijing, P. R. China  
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### **1.2. Testing Environment**

Normal Temperature: 15-35°C  
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**

Testing Start Date: 2015-11-03  
Testing End Date: 2015-12-29

### **1.4. Signature**



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Shen Yi

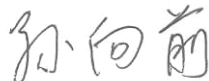
(Prepared this test report)



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Zhong Nan

(Reviewed this test report)



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Sun Xiang Qian

Deputy Director of the laboratory  
(Approved this test report)

## **2. Client Information**

### **2.1. Applicant Information**

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### **2.2. Manufacturer Information**

Company Name: Huawei Technologies Co.,Ltd  
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Telephone: 0086-0755-28970299  
Telephone: 0086-0755-89650226

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

#### **3.1. About EUT**

|                         |                                               |
|-------------------------|-----------------------------------------------|
| Description             | Smart Phone                                   |
| Model Name              | HUAWEI TAG-L03                                |
| FCC ID                  | QISTAG-L03                                    |
| Antenna                 | Integrated                                    |
| Output power            | 25.36dBm maximum EIRP measured for LTE Band 7 |
| Extreme vol. Limits     | 3.6VDC to 4.35VDC (nominal: 3.8VDC)           |
| Extreme temp. Tolerance | -30°C to +50°C                                |

Note: Components list, please refer to documents of the manufacturer; it is also included in the original test record of CTTL, Telecommunication Technology Labs, Academy of Telecommunication Research, MIIT

Note: The EUT is a variant model of HUAWEI TAG-L23. All the result is coming from the initial model.

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

| EUT ID* | IMEI            | HW Version | SW Version        |
|---------|-----------------|------------|-------------------|
| UT01a   | 868880020002024 | Ver.A      | TAG-L03C464B003_A |

\*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                         |
|--------------|-------------------------------------|
| AE1          | Battery                             |
| AE2          | Battery                             |
| AE1          |                                     |
| Model        | HB3742A0EZC+                        |
| Manufacturer | Sunwoda electronic Co., Ltd.        |
| Capacitance  | 2200mAh                             |
| AE2          |                                     |
| Model        | HB3742A0EZC+                        |
| Manufacturer | Scud (Fujian) Electronics Co., Ltd. |
| Capacitance  | 2200mAh                             |

\*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 Smart Phone with integrated antenna. Manual and specifications of the EUT were provided to fulfil the test.

## 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 22    | PUBLIC MOBILE SERVICES                                                                                                               | 10-1-14<br>Edition |
| FCC Part 24    | PERSONAL COMMUNICATIONS SERVICES                                                                                                     | 10-1-14<br>Edition |
| FCC Part 27    | MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES                                                                                       | 10-1-14<br>Edition |
| ANSI/TIA-603-D | Land Mobile FM or PM Communications Equipment Measurement and Performance Standards                                                  | 2015               |
| ANSI C63.4     | Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz | 2014               |
| KDB 971168 D01 | Measurement Guidance for Certification of Licensed Digital Transmitters                                                              | v02r02             |

## 5. LABORATORY ENVIRONMENT

**Semi-anechoic chamber SAC-1** (23 meters×17meters×10meters) 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                        | < 4Ω                                              |
| Normalised site attenuation (NSA)               | < ± 4 dB, 3m/10m distance,<br>from 30 to 1000 MHz |
| 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 3000 MHz           |

**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           |

**Shielded room** did not exceed following limits along the EMC testing:

|                          |                                                   |
|--------------------------|---------------------------------------------------|
| Temperature              | Min. = 15 °C, Max. = 35 °C                        |
| Relative humidity        | Min. = 20 %, Max. = 75 %                          |
| Shielding effectiveness  | 0.014MHz - 1MHz, >60dB;<br>1MHz - 1000MHz, >90dB. |
| Electrical insulation    | > 2 MΩ                                            |
| Ground system resistance | < 4 Ω                                             |



## 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                    | A/B/C/D | The test is performed in test location A, B, C or D which are described in section 1.1 of this report |

#### LTE Band 2

| Items | Test Name                   | Clause in FCC rules | Section in this report | Verdict |
|-------|-----------------------------|---------------------|------------------------|---------|
| 1     | Output Power                | 24.232(c)           | A.1                    | P       |
| 2     | Emission Limit              | 24.238(a), 2.1051   | A.2                    | P       |
| 3     | Frequency Stability         | 24.235, 2.1055      | A.3                    | P       |
| 4     | Occupied Bandwidth          | 2.1049(h)(i)        | A.4                    | P       |
| 5     | Emission Bandwidth          | 24.238(a)           | A.5                    | P       |
| 6     | Band Edge Compliance        | 24.238(a)           | A.6                    | P       |
| 7     | Conducted Spurious Emission | 24.238, 2.1057      | A.7                    | P       |
| 8     | Peak to Average Power Ratio | 24.232 (d)          | A.8                    | P       |

#### LTE Band 4

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

#### LTE Band 5

| Items | Test Name                   | Clause in FCC rules   | Section in this report | Verdict |
|-------|-----------------------------|-----------------------|------------------------|---------|
| 1     | Output Power                | §2.1046(a), 22.913(a) | A.1                    | P       |
| 2     | Emission Limit              | 22.917, 2.1051        | A.2                    | P       |
| 3     | Frequency Stability         | 22.235, 2.1055        | A.3                    | P       |
| 4     | Occupied Bandwidth          | 2.1049(h)(i)          | A.4                    | P       |
| 5     | Emission Bandwidth          | 22.917(b)             | A.5                    | P       |
| 6     | Band Edge Compliance        | 22.917(b)             | A.6                    | P       |
| 7     | Conducted Spurious Emission | 22.917, 2.1057        | A.7                    | P       |

#### LTE Band 7

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

### 6.2. Statements

The test cases listed in section 6.1 of this report for the EUT specified in section 3 were performed by CTTL 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. | Description                          | TYPE      | series number | MANUFACTURE  | CAL DUE DATE | Calibration interval |
|-----|--------------------------------------|-----------|---------------|--------------|--------------|----------------------|
| 1   | Test Receiver                        | ESU26     | 100235        | R&S          | 2016/3/2     | 1 year               |
| 2   | Test Receiver                        | ESU26     | 100376        | R&S          | 2016-10-29   | 1 year               |
| 3   | EMI Antenna                          | VULB 9163 | 302           | Schwarzbeck  | 2017-1-3     | 3 year               |
| 4   | EMI Antenna                          | 3117      | 00119024      | ETS-Lindgren | 2016-01-20   | 3 year               |
| 5   | LISN                                 | ENV216    | 101200        | R&S          | 2016-07-07   | 1 year               |
| 6   | Universal Radio Communication Tester | CMW500    | 101675        | R&S          | 2016-07-13   | 1 year               |
| 7   | Universal Radio Communication Tester | E5515C    | MY48361083    | Agilent      | 2016-02-27   | 1 year               |
| 8   | Spectrum Analyzer                    | E4440A    | MY48250642    | Agilent      | 2016-03-02   | 1 year               |
| 9   | EMI Antenna                          | 9117      | 167           | Schwarzbeck  | 2016-04-01   | 3 year               |
| 10  | EMI Antenna                          | VULB9163  | 9163-234      | Schwarzbeck  | 2016-09-15   | 3 year               |
| 11  | EMI Antenna                          | 3117      | 00119024      | ETS-Lindgren | 2016-01-20   | 3 year               |
| 12  | Signal Generator                     | N5183A    | MY49060052    | Agilent      | 2016-03-02   | 1 year               |
| 13  | Climate chamber                      | SH-241    | 92007454      | ESPEC        | 2017-12-14   | 2 year               |
| 14  | Loop Antenna                         | HFH2-Z2   | 829324/007    | R&S          | 2017-12-10   | 3 year               |

## **ANNEX A: MEASUREMENT RESULTS**

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

#### **Reference**

FCC: 22.913(a) ,24.232(c), 27.50(d)(4), 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. 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. 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 2**

| Bandwidth | RB size/offset | Frequency (MHz) | Power(dBm) |       |
|-----------|----------------|-----------------|------------|-------|
|           |                |                 | QPSK       | 16QAM |
| 1.4MHz    | 1 RB high      | 1850.7          | 23.27      | 22.21 |
|           |                | 1880.0          | 23.15      | 22.19 |
|           |                | 1909.3          | 23.26      | 22.30 |
|           | 1 RB low       | 1850.7          | 23.25      | 22.19 |
|           |                | 1880.0          | 23.17      | 22.18 |
|           |                | 1909.3          | 23.28      | 22.32 |
|           | 50% RB mid     | 1850.7          | 22.44      | 22.03 |
|           |                | 1880.0          | 23.13      | 22.18 |
|           |                | 1909.3          | 23.37      | 22.36 |
|           | 100% RB        | 1850.7          | 21.78      | 21.31 |
|           |                | 1880.0          | 22.15      | 21.32 |
|           |                | 1909.3          | 22.25      | 21.44 |
| 3MHz      | 1 RB high      | 1851.5          | 23.22      | 22.59 |
|           |                | 1880.0          | 23.11      | 22.62 |
|           |                | 1908.5          | 23.22      | 22.78 |
|           | 1 RB low       | 1851.5          | 23.23      | 22.72 |
|           |                | 1880.0          | 23.15      | 22.67 |
|           |                | 1908.5          | 23.25      | 22.81 |
|           | 50% RB mid     | 1851.5          | 22.33      | 21.38 |

|       |            |        |       |       |
|-------|------------|--------|-------|-------|
|       | 100% RB    | 1880.0 | 22.25 | 21.37 |
|       |            | 1908.5 | 22.36 | 21.50 |
|       |            | 1851.5 | 22.26 | 21.42 |
|       |            | 1880.0 | 22.20 | 21.26 |
|       |            | 1908.5 | 22.36 | 21.44 |
| 5MHz  | 1 RB high  | 1852.5 | 23.29 | 22.46 |
|       |            | 1880.0 | 23.18 | 22.22 |
|       |            | 1907.5 | 23.25 | 22.28 |
|       | 1 RB low   | 1852.5 | 23.07 | 22.46 |
|       |            | 1880.0 | 23.39 | 22.26 |
|       |            | 1907.5 | 23.35 | 22.36 |
|       | 50% RB mid | 1852.5 | 22.33 | 21.35 |
|       |            | 1880.0 | 22.28 | 21.32 |
|       |            | 1907.5 | 22.29 | 21.45 |
|       | 100% RB    | 1852.5 | 22.32 | 21.37 |
|       |            | 1880.0 | 22.19 | 21.31 |
|       |            | 1907.5 | 22.37 | 21.48 |
| 10MHz | 1 RB high  | 1855.0 | 23.38 | 22.78 |
|       |            | 1880.0 | 23.02 | 22.96 |
|       |            | 1905.0 | 23.45 | 22.76 |
|       | 1 RB low   | 1855.0 | 23.33 | 22.89 |
|       |            | 1880.0 | 23.31 | 23.26 |
|       |            | 1905.0 | 23.40 | 22.81 |
|       | 50% RB mid | 1855.0 | 22.37 | 21.41 |
|       |            | 1880.0 | 22.83 | 21.28 |
|       |            | 1905.0 | 22.35 | 21.74 |
|       | 100% RB    | 1855.0 | 22.40 | 21.43 |
|       |            | 1880.0 | 22.25 | 21.26 |
|       |            | 1905.0 | 22.38 | 21.51 |
| 15MHz | 1 RB high  | 1857.5 | 23.35 | 22.73 |
|       |            | 1880.0 | 23.27 | 22.85 |
|       |            | 1902.5 | 23.21 | 22.84 |
|       | 1 RB low   | 1857.5 | 23.26 | 22.88 |
|       |            | 1880.0 | 23.35 | 22.83 |
|       |            | 1902.5 | 23.37 | 22.91 |
|       | 50% RB mid | 1857.5 | 22.37 | 21.35 |
|       |            | 1880.0 | 22.25 | 21.37 |
|       |            | 1902.5 | 22.33 | 21.32 |
|       | 100% RB    | 1857.5 | 22.38 | 21.37 |

|       |            |        |       |       |
|-------|------------|--------|-------|-------|
| 20MHz |            | 1880.0 | 22.35 | 21.33 |
|       |            | 1902.5 | 22.36 | 21.39 |
|       | 1 RB high  | 1860.0 | 23.34 | 22.53 |
|       |            | 1880.0 | 23.33 | 22.61 |
|       |            | 1900.0 | 23.27 | 22.60 |
|       | 1 RB low   | 1860.0 | 23.34 | 22.66 |
|       |            | 1880.0 | 23.37 | 22.60 |
|       |            | 1900.0 | 23.41 | 22.67 |
|       | 50% RB mid | 1860.0 | 22.33 | 21.41 |
|       |            | 1880.0 | 22.26 | 21.90 |
|       |            | 1900.0 | 22.33 | 21.39 |
|       | 100% RB    | 1860.0 | 22.31 | 21.41 |
|       |            | 1880.0 | 22.29 | 21.62 |
|       |            | 1900.0 | 22.32 | 21.41 |

**LTE band 4**

| Bandwidth | RB size/offset | Frequency (MHz) | Power(dBm) |       |
|-----------|----------------|-----------------|------------|-------|
|           |                |                 | QPSK       | 16QAM |
| 1.4MHz    | 1 RB high      | 1754.3          | 23.25      | 22.20 |
|           |                | 1732.5          | 23.36      | 22.35 |
|           |                | 1710.7          | 23.45      | 22.45 |
|           | 1 RB low       | 1754.3          | 23.24      | 22.19 |
|           |                | 1732.5          | 23.35      | 22.33 |
|           |                | 1710.7          | 23.45      | 22.44 |
|           | 50% RB mid     | 1754.3          | 23.22      | 22.21 |
|           |                | 1732.5          | 23.31      | 22.34 |
|           |                | 1710.7          | 23.48      | 22.46 |
|           | 100% RB        | 1754.3          | 22.25      | 21.36 |
|           |                | 1732.5          | 22.32      | 21.45 |
|           |                | 1710.7          | 22.43      | 21.60 |
| 3MHz      | 1 RB high      | 1753.5          | 23.20      | 22.64 |
|           |                | 1732.5          | 23.26      | 22.80 |
|           |                | 1711.5          | 23.39      | 22.91 |
|           | 1 RB low       | 1753.5          | 23.21      | 22.67 |
|           |                | 1732.5          | 23.32      | 22.85 |
|           |                | 1711.5          | 23.39      | 22.94 |
|           | 50% RB mid     | 1753.5          | 22.29      | 21.38 |
|           |                | 1732.5          | 22.42      | 21.54 |
|           |                | 1711.5          | 22.50      | 21.65 |
|           | 100% RB        | 1753.5          | 22.26      | 21.28 |
|           |                | 1732.5          | 22.37      | 21.41 |
|           |                | 1711.5          | 22.47      | 21.50 |
| 5MHz      | 1 RB high      | 1752.5          | 23.28      | 22.22 |
|           |                | 1732.5          | 23.35      | 22.36 |
|           |                | 1712.5          | 23.50      | 22.49 |
|           | 1 RB low       | 1752.5          | 23.32      | 22.29 |
|           |                | 1732.5          | 23.43      | 22.43 |
|           |                | 1712.5          | 23.50      | 22.48 |
|           | 50% RB mid     | 1752.5          | 22.29      | 21.31 |
|           |                | 1732.5          | 22.42      | 21.46 |
|           |                | 1712.5          | 22.50      | 21.55 |
|           | 100% RB        | 1752.5          | 22.25      | 21.33 |
|           |                | 1732.5          | 22.36      | 21.48 |
|           |                | 1712.5          | 22.47      | 21.58 |

|       |            |        |       |       |
|-------|------------|--------|-------|-------|
| 10MHz | 1 RB high  | 1750   | 23.24 | 22.69 |
|       |            | 1732.5 | 23.36 | 22.90 |
|       |            | 1715   | 23.48 | 22.97 |
|       | 1 RB low   | 1750   | 23.34 | 22.84 |
|       |            | 1732.5 | 23.50 | 22.99 |
|       |            | 1715   | 23.47 | 22.99 |
|       | 50% RB mid | 1750   | 22.27 | 21.29 |
|       |            | 1732.5 | 22.38 | 21.41 |
|       |            | 1715   | 22.49 | 21.54 |
|       | 100% RB    | 1750   | 22.27 | 21.29 |
|       |            | 1732.5 | 22.39 | 21.40 |
|       |            | 1715   | 22.51 | 21.51 |
| 15MHz | 1 RB high  | 1747.5 | 23.30 | 22.74 |
|       |            | 1732.5 | 23.42 | 22.93 |
|       |            | 1717.5 | 23.52 | 22.97 |
|       | 1 RB low   | 1747.5 | 23.39 | 22.92 |
|       |            | 1732.5 | 23.51 | 23.00 |
|       |            | 1717.5 | 23.50 | 23.01 |
|       | 50% RB mid | 1747.5 | 22.38 | 21.37 |
|       |            | 1732.5 | 22.47 | 21.43 |
|       |            | 1717.5 | 22.56 | 21.52 |
|       | 100% RB    | 1747.5 | 22.38 | 21.34 |
|       |            | 1732.5 | 22.48 | 21.46 |
|       |            | 1717.5 | 22.56 | 21.53 |
| 20MHz | 1 RB high  | 1745   | 23.31 | 22.52 |
|       |            | 1732.5 | 23.43 | 22.67 |
|       |            | 1720   | 23.51 | 22.73 |
|       | 1 RB low   | 1745   | 23.47 | 22.70 |
|       |            | 1732.5 | 23.60 | 22.80 |
|       |            | 1720   | 23.56 | 22.80 |
|       | 50% RB mid | 1745   | 22.34 | 21.40 |
|       |            | 1732.5 | 22.42 | 21.46 |
|       |            | 1720   | 22.50 | 21.56 |
|       | 100% RB    | 1745   | 22.34 | 21.38 |
|       |            | 1732.5 | 22.42 | 21.47 |
|       |            | 1720   | 22.49 | 21.53 |



**LTE band 5**

| Bandwidth | RB size/offset | Frequency (MHz) | Power(dBm) |       |
|-----------|----------------|-----------------|------------|-------|
|           |                |                 | QPSK       | 16QAM |
| 1.4MHz    | 1 RB high      | 848.3           | 23.20      | 22.22 |
|           |                | 836.5           | 23.18      | 22.24 |
|           |                | 824.7           | 23.06      | 22.13 |
|           | 1 RB low       | 848.3           | 23.21      | 22.23 |
|           |                | 836.5           | 23.38      | 22.20 |
|           |                | 824.7           | 23.04      | 22.09 |
|           | 50% RB mid     | 848.3           | 23.18      | 22.21 |
|           |                | 836.5           | 23.22      | 22.27 |
|           |                | 824.7           | 23.13      | 22.15 |
|           | 100% RB        | 848.3           | 22.17      | 21.34 |
|           |                | 836.5           | 22.15      | 21.36 |
|           |                | 824.7           | 22.09      | 21.25 |
| 3MHz      | 1 RB high      | 847.5           | 23.14      | 22.63 |
|           |                | 836.5           | 23.15      | 22.73 |
|           |                | 825.5           | 23.02      | 22.64 |
|           | 1 RB low       | 847.5           | 23.21      | 22.79 |
|           |                | 836.5           | 23.13      | 22.76 |
|           |                | 825.5           | 23.02      | 22.60 |
|           | 50% RB mid     | 847.5           | 22.27      | 21.41 |
|           |                | 836.5           | 22.25      | 21.40 |
|           |                | 825.5           | 22.17      | 21.30 |
|           | 100% RB        | 847.5           | 22.25      | 21.31 |
|           |                | 836.5           | 22.24      | 21.31 |
|           |                | 825.5           | 22.14      | 21.19 |
| 5MHz      | 1 RB high      | 846.5           | 23.22      | 22.23 |
|           |                | 836.5           | 23.30      | 22.32 |
|           |                | 826.5           | 23.16      | 22.24 |
|           | 1 RB low       | 846.5           | 23.39      | 22.38 |
|           |                | 836.5           | 23.26      | 22.31 |
|           |                | 826.5           | 23.14      | 22.18 |
|           | 50% RB mid     | 846.5           | 22.36      | 21.39 |
|           |                | 836.5           | 22.29      | 21.34 |
|           |                | 826.5           | 22.22      | 21.25 |
|           | 100% RB        | 846.5           | 22.29      | 21.39 |
|           |                | 836.5           | 22.25      | 21.38 |
|           |                | 826.5           | 22.17      | 21.27 |

|       |            |       |       |       |
|-------|------------|-------|-------|-------|
| 10MHz | 1 RB high  | 844.0 | 23.22 | 22.78 |
|       |            | 836.5 | 23.31 | 22.89 |
|       |            | 829.0 | 23.19 | 22.87 |
|       | 1 RB low   | 844.0 | 23.33 | 22.86 |
|       |            | 836.5 | 23.24 | 22.89 |
|       |            | 829.0 | 23.09 | 22.66 |
|       | 50% RB mid | 844.0 | 22.37 | 21.41 |
|       |            | 836.5 | 22.26 | 21.33 |
|       |            | 829.0 | 22.25 | 21.29 |
|       | 100% RB    | 844.0 | 22.32 | 21.34 |
|       |            | 836.5 | 22.32 | 21.34 |
|       |            | 829.0 | 22.23 | 21.24 |

**LTE band 7**

| Bandwidth | RB size/offset | Frequency (MHz) | Power(dBm) |       |
|-----------|----------------|-----------------|------------|-------|
|           |                |                 | QPSK       | 16QAM |
| 5MHz      | 1 RB high      | 2502.5          | 22.98      | 21.71 |
|           |                | 2535            | 23.00      | 22.12 |
|           |                | 2567.5          | 22.92      | 21.85 |
|           | 1 RB low       | 2502.5          | 23.06      | 21.98 |
|           |                | 2535            | 23.00      | 21.66 |
|           |                | 2567.5          | 22.93      | 21.82 |
|           | 50% RB mid     | 2502.5          | 22.00      | 21.01 |
|           |                | 2535            | 21.91      | 20.90 |
|           |                | 2567.5          | 21.81      | 20.79 |
|           | 100% RB        | 2502.5          | 21.96      | 21.02 |
|           |                | 2535            | 21.87      | 20.92 |
|           |                | 2567.5          | 21.76      | 20.84 |
| 10MHz     | 1 RB high      | 2505            | 23.01      | 22.44 |
|           |                | 2535            | 23.03      | 22.46 |
|           |                | 2565            | 22.85      | 22.27 |
|           | 1 RB low       | 2505            | 23.09      | 22.41 |
|           |                | 2535            | 23.05      | 22.39 |
|           |                | 2565            | 22.86      | 22.24 |
|           | 50% RB mid     | 2505            | 21.97      | 20.96 |
|           |                | 2535            | 21.85      | 20.88 |
|           |                | 2565            | 21.80      | 20.82 |
|           | 100% RB        | 2505            | 21.93      | 20.90 |
|           |                | 2535            | 21.90      | 20.87 |
|           |                | 2565            | 21.80      | 20.77 |
| 15MHz     | 1 RB high      | 2507.5          | 22.98      | 22.37 |
|           |                | 2535            | 23.15      | 22.55 |
|           |                | 2562.5          | 22.91      | 22.30 |
|           | 1 RB low       | 2507.5          | 23.08      | 22.38 |
|           |                | 2535            | 23.12      | 22.45 |
|           |                | 2562.5          | 22.92      | 22.28 |
|           | 50% RB mid     | 2507.5          | 22.03      | 20.97 |
|           |                | 2535            | 22.01      | 20.95 |
|           |                | 2562.5          | 21.95      | 20.88 |
|           | 100% RB        | 2507.5          | 22.03      | 20.98 |
|           |                | 2535            | 22.01      | 20.97 |
|           |                | 2562.5          | 21.93      | 20.87 |

|       |            |      |       |       |
|-------|------------|------|-------|-------|
| 20MHz | 1 RB high  | 2510 | 23.02 | 22.18 |
|       |            | 2535 | 23.15 | 22.28 |
|       |            | 2560 | 23.02 | 22.14 |
|       | 1 RB low   | 2510 | 23.24 | 22.34 |
|       |            | 2535 | 23.15 | 22.29 |
|       |            | 2560 | 22.96 | 22.12 |
|       | 50% RB mid | 2510 | 21.91 | 20.91 |
|       |            | 2535 | 21.94 | 20.94 |
|       |            | 2560 | 21.83 | 20.86 |
|       | 100% RB    | 2510 | 21.93 | 20.95 |
|       |            | 2535 | 21.97 | 20.99 |
|       |            | 2560 | 21.82 | 20.83 |

### A.1.3 Radiated

#### A.1.3.1 Description

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

Rule Part 24.232(b) specifies, "Mobile/portable stations are limited to 2 watts e.i.r.p. Peak power" and 24.232(c) specifies that "Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage."

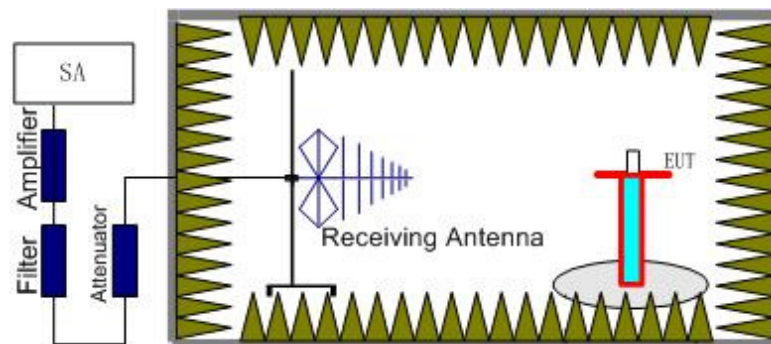
Rule Part 27.50(d) specifies "Fixed, mobile, and portable (handheld) stations operating in the 1710–1755 MHz band are limited to 1 watt EIRP".

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

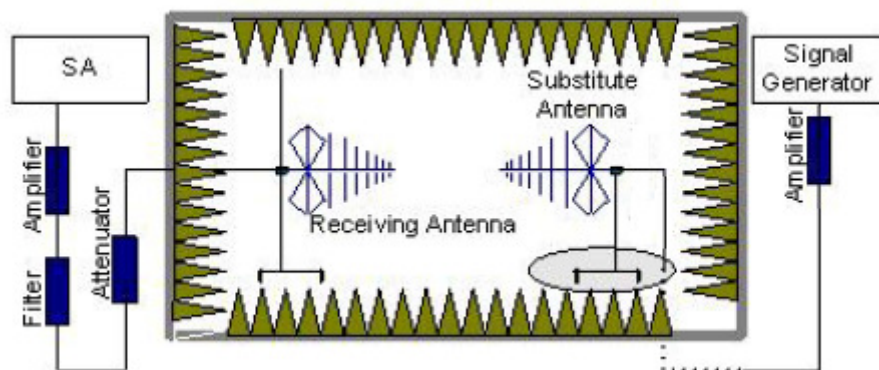
#### A.1.3.2 Method of Measurement

The measurements procedures in TIA-603D-2015 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 (Pr).
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:

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

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,  $ERP = EIRP - 2.15$ .

### A.1.3.3 Measurement result

#### LTE Band 2- EIRP 24. 232(b)

Limits:  $\leq 33\text{dBm}$  (2W)

#### LTE Band 2\_1.4MHz\_QPSK

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 1850.70        | -24.10                 | 2.92                 | -43.75               | -4.87                           | <b>21.60</b> | 33.00      | 11.40      | H            |
| 1880.00        | -26.09                 | 2.85                 | -43.75               | -4.82                           | 19.63        | 33.00      | 13.37      | H            |
| 1909.30        | -25.46                 | 2.87                 | -43.77               | -4.76                           | 20.20        | 33.00      | 12.80      | H            |

#### LTE Band 2\_3MHz\_QPSK

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 1851.50        | -24.48                 | 2.87                 | -43.75               | -4.87                           | <b>21.27</b> | 33.00      | 11.73      | H            |
| 1880.00        | -26.18                 | 2.85                 | -43.75               | -4.82                           | 19.54        | 33.00      | 13.46      | H            |
| 1908.50        | -25.53                 | 2.89                 | -43.78               | -4.76                           | 20.12        | 33.00      | 12.88      | H            |

#### LTE Band 2\_5MHz\_QPSK

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 1852.50        | -24.38                 | 2.87                 | -43.75               | -4.87                           | <b>21.37</b> | 33.00      | 11.63      | H            |
| 1880.00        | -26.15                 | 2.85                 | -43.75               | -4.82                           | 19.57        | 33.00      | 13.43      | H            |
| 1907.50        | -25.43                 | 2.84                 | -43.77               | -4.77                           | 20.27        | 33.00      | 12.73      | H            |

#### LTE Band 2\_10MHz\_QPSK

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 1855.00        | -24.71                 | 2.88                 | -43.74               | -4.86                           | <b>21.01</b> | 33.00      | 11.99      | H            |
| 1880.00        | -26.20                 | 2.85                 | -43.75               | -4.82                           | 19.52        | 33.00      | 13.48      | H            |
| 1905.00        | -25.48                 | 2.87                 | -43.77               | -4.77                           | 20.19        | 33.00      | 12.81      | H            |

#### LTE Band 2\_15MHz\_QPSK

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 1857.50        | -25.02                 | 2.87                 | -43.75               | -4.86                           | <b>20.72</b> | 33.00      | 12.28      | H            |
| 1880.00        | -26.23                 | 2.85                 | -43.75               | -4.82                           | 19.49        | 33.00      | 13.51      | H            |
| 1902.50        | -25.41                 | 2.86                 | -43.77               | -4.78                           | 20.28        | 33.00      | 12.72      | H            |

#### LTE Band 2\_20 MHz\_QPSK

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 1860.00        | -25.00                 | 2.86                 | -43.75               | -4.85                           | <b>20.74</b> | 33.00      | 12.26      | H            |
| 1880.00        | -26.00                 | 2.85                 | -43.75               | -4.82                           | 19.72        | 33.00      | 13.28      | H            |
| 1900.00        | -25.60                 | 2.87                 | -43.77               | -4.78                           | 20.08        | 33.00      | 12.92      | H            |

### LTE Band 2\_1.4MHz\_16QAM

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 1850.70        | -25.21                 | 2.92                 | -43.75               | -4.87                           | <b>20.49</b> | 33.00      | 12.51      | H            |
| 1880.00        | -27.05                 | 2.85                 | -43.75               | -4.82                           | 18.67        | 33.00      | 14.33      | H            |
| 1909.30        | -26.30                 | 2.87                 | -43.77               | -4.76                           | 19.36        | 33.00      | 13.64      | H            |

### LTE Band 2\_3MHz\_16QAM

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 1851.50        | -25.43                 | 2.87                 | -43.75               | -4.87                           | <b>20.32</b> | 33.00      | 12.68      | H            |
| 1880.00        | -27.00                 | 2.85                 | -43.75               | -4.82                           | 18.72        | 33.00      | 14.28      | H            |
| 1908.50        | -26.40                 | 2.89                 | -43.78               | -4.76                           | 19.25        | 33.00      | 13.75      | H            |

### LTE Band 2\_5MHz\_16QAM

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 1852.50        | -25.12                 | 2.87                 | -43.75               | -4.87                           | <b>20.63</b> | 33.00      | 12.37      | H            |
| 1880.00        | -27.08                 | 2.85                 | -43.75               | -4.82                           | 18.64        | 33.00      | 14.36      | H            |
| 1907.50        | -26.18                 | 2.84                 | -43.77               | -4.77                           | 19.52        | 33.00      | 13.48      | H            |

### LTE Band 2\_10MHz\_16QAM

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 1855.00        | -25.63                 | 2.88                 | -43.74               | -4.86                           | <b>20.09</b> | 33.00      | 12.91      | H            |
| 1880.00        | -27.06                 | 2.85                 | -43.75               | -4.82                           | 18.66        | 33.00      | 14.34      | H            |
| 1905.00        | -26.20                 | 2.87                 | -43.77               | -4.77                           | 19.47        | 33.00      | 13.53      | H            |

### LTE Band 2\_15MHz\_16QAM

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 1857.50        | -25.83                 | 2.87                 | -43.75               | -4.86                           | <b>19.91</b> | 33.00      | 13.09      | H            |
| 1880.00        | -27.04                 | 2.85                 | -43.75               | -4.82                           | 18.68        | 33.00      | 14.32      | H            |
| 1902.50        | -26.45                 | 2.86                 | -43.77               | -4.78                           | 19.24        | 33.00      | 13.76      | H            |

### LTE Band 2\_20 MHz\_16QAM

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 1860.00        | -25.95                 | 2.86                 | -43.75               | -4.85                           | <b>19.79</b> | 33.00      | 13.21      | H            |
| 1880.00        | -27.11                 | 2.85                 | -43.75               | -4.82                           | 18.61        | 33.00      | 14.39      | H            |
| 1900.00        | -26.32                 | 2.87                 | -43.77               | -4.78                           | 19.36        | 33.00      | 13.64      | H            |

Peak EIRP(dBm) = P<sub>Mea</sub>(-24.10dBm) - G<sub>a</sub> (-4.87dB) - P<sub>Ag</sub> (-43.75dB) - P<sub>cl</sub> (2.92dB) = 21.60dBm



### LTE Band 4- EIRP 27.50(d)

Limits: ≤30dBm (1W)

#### LTE Band 4\_1.4MHz\_QPSK

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 1710.70        | -25.05                 | 3.17                 | -44.10               | -5.12                           | 21.00        | 30.00      | 9.00       | H            |
| 1732.50        | -24.05                 | 3.33                 | -44.14               | -5.08                           | <b>21.84</b> | 30.00      | 8.16       | H            |
| 1754.30        | -24.39                 | 3.76                 | -44.14               | -5.04                           | 21.03        | 30.00      | 8.97       | H            |

#### LTE Band 4\_3MHz\_QPSK

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 1711.50        | -24.70                 | 3.40                 | -44.10               | -5.12                           | 21.12        | 30.00      | 8.88       | H            |
| 1732.50        | -24.12                 | 3.33                 | -44.14               | -5.08                           | <b>21.77</b> | 30.00      | 8.23       | H            |
| 1753.50        | -24.35                 | 3.80                 | -44.13               | -5.04                           | 21.02        | 30.00      | 8.98       | H            |

#### LTE Band 4\_5MHz\_QPSK

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 1712.50        | -24.34                 | 3.66                 | -44.10               | -5.12                           | 21.22        | 30.00      | 8.78       | H            |
| 1732.50        | -24.06                 | 3.33                 | -44.14               | -5.08                           | <b>21.83</b> | 30.00      | 8.17       | H            |
| 1752.50        | -24.27                 | 3.82                 | -44.14               | -5.05                           | 21.10        | 30.00      | 8.90       | H            |

#### LTE Band 4\_10MHz\_QPSK

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 1715.00        | -24.29                 | 3.56                 | -44.10               | -5.11                           | 21.36        | 30.00      | 8.64       | H            |
| 1732.50        | -24.11                 | 3.33                 | -44.14               | -5.08                           | <b>21.78</b> | 30.00      | 8.22       | H            |
| 1750.00        | -25.12                 | 3.00                 | -44.15               | -5.05                           | 21.08        | 30.00      | 8.92       | H            |

#### LTE Band 4\_15MHz\_QPSK

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 1717.50        | -24.22                 | 3.47                 | -44.11               | -5.11                           | 21.53        | 30.00      | 8.47       | H            |
| 1732.50        | -24.10                 | 3.33                 | -44.14               | -5.08                           | <b>21.79</b> | 30.00      | 8.21       | H            |
| 1747.50        | -24.88                 | 3.34                 | -44.15               | -5.05                           | 20.98        | 30.00      | 9.02       | H            |

#### LTE Band 4\_20MHz\_QPSK

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 1720.00        | -24.13                 | 3.37                 | -44.11               | -5.10                           | 21.71        | 30.00      | 8.29       | H            |
| 1732.50        | -24.08                 | 3.33                 | -44.14               | -5.08                           | <b>21.81</b> | 30.00      | 8.19       | H            |
| 1745.00        | -24.47                 | 3.68                 | -44.16               | -5.06                           | 21.07        | 30.00      | 8.93       | H            |

#### LTE Band 4\_1.4MHz\_16QAM

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 1710.70        | -26.03                 | 3.17                 | -44.10               | -5.12                           | 20.02        | 30.00      | 9.98       | H            |
| 1732.50        | -25.06                 | 3.33                 | -44.14               | -5.08                           | <b>20.83</b> | 30.00      | 9.17       | H            |
| 1754.30        | -25.37                 | 3.76                 | -44.14               | -5.04                           | 20.05        | 30.00      | 9.95       | H            |

#### LTE Band 4\_3MHz\_16QAM

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 1711.50        | -25.69                 | 3.40                 | -44.10               | -5.12                           | 20.13        | 30.00      | 9.87       | H            |
| 1732.50        | -24.97                 | 3.33                 | -44.14               | -5.08                           | <b>20.92</b> | 30.00      | 9.08       | H            |
| 1753.50        | -25.33                 | 3.80                 | -44.13               | -5.04                           | 20.04        | 30.00      | 9.96       | H            |

#### LTE Band 4\_5MHz\_16QAM

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 1712.50        | -25.15                 | 3.66                 | -44.10               | -5.12                           | 20.41        | 30.00      | 9.59       | H            |
| 1732.50        | -25.04                 | 3.33                 | -44.14               | -5.08                           | <b>20.85</b> | 30.00      | 9.15       | H            |
| 1752.50        | -25.15                 | 3.82                 | -44.14               | -5.05                           | 20.22        | 30.00      | 9.78       | H            |

#### LTE Band 4\_10MHz\_16QAM

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 1715.00        | -25.30                 | 3.56                 | -44.10               | -5.11                           | 20.35        | 30.00      | 9.65       | H            |
| 1732.50        | -25.06                 | 3.33                 | -44.14               | -5.08                           | <b>20.83</b> | 30.00      | 9.17       | H            |
| 1750.00        | -26.05                 | 3.00                 | -44.15               | -5.05                           | 20.15        | 30.00      | 9.85       | H            |

#### LTE Band 4\_15MHz\_16QAM

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 1717.50        | -25.10                 | 3.47                 | -44.11               | -5.11                           | 20.65        | 30.00      | 9.35       | H            |
| 1732.50        | -24.96                 | 3.33                 | -44.14               | -5.08                           | <b>20.93</b> | 30.00      | 9.07       | H            |
| 1747.50        | -25.86                 | 3.34                 | -44.15               | -5.05                           | 20.00        | 30.00      | 10.00      | H            |

#### LTE Band 4\_20MHz\_16QAM

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 1720.00        | -25.14                 | 3.37                 | -44.11               | -5.10                           | 20.70        | 30.00      | 9.30       | H            |
| 1732.50        | -24.94                 | 3.33                 | -44.14               | -5.08                           | <b>20.95</b> | 30.00      | 9.05       | H            |
| 1745.00        | -25.43                 | 3.68                 | -44.16               | -5.06                           | 20.11        | 30.00      | 9.89       | H            |

Peak EIRP(dBm) = P<sub>Mea</sub>(-24.05dBm) - G<sub>a</sub> (-5.08dB) - P<sub>Ag</sub> (-44.14dB) - P<sub>cl</sub> (3.33dB) = 21.84dBm

**LTE Band 5- ERP 22.913(a)**

**Limits:** ≤38.45dBm (7W)

**LTE Band 5\_1.4MHz\_QPSK**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna<br>Gain(dB) | Correction<br>(dB) | ERP(dBm)     | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|------------------------------------|--------------------|--------------|------------|------------|--------------|
| 824.70         | -23.01                 | 2.26                 | -45.79               | -0.95                              | 2.15               | 19.32        | 38.45      | 19.13      | H            |
| 836.50         | -21.67                 | 2.26                 | -45.66               | -0.82                              | 2.15               | 20.40        | 38.45      | 18.05      | H            |
| 848.30         | -21.01                 | 2.27                 | -45.55               | -0.80                              | 2.15               | <b>20.92</b> | 38.45      | 17.53      | V            |

**LTE Band 5\_3MHz\_QPSK**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna<br>Gain(dB) | Correction<br>(dB) | ERP(dBm)     | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|------------------------------------|--------------------|--------------|------------|------------|--------------|
| 825.50         | -22.95                 | 2.26                 | -45.79               | -0.94                              | 2.15               | 19.37        | 38.45      | 19.08      | H            |
| 836.50         | -21.75                 | 2.26                 | -45.66               | -0.82                              | 2.15               | 20.32        | 38.45      | 18.13      | H            |
| 847.50         | -21.03                 | 2.27                 | -45.56               | -0.81                              | 2.15               | <b>20.92</b> | 38.45      | 17.53      | V            |

**LTE Band 5\_5MHz\_QPSK**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna<br>Gain(dB) | Correction<br>(dB) | ERP(dBm)     | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|------------------------------------|--------------------|--------------|------------|------------|--------------|
| 826.50         | -23.13                 | 2.25                 | -45.77               | -0.93                              | 2.15               | 19.17        | 38.45      | 19.28      | H            |
| 836.50         | -21.82                 | 2.26                 | -45.66               | -0.82                              | 2.15               | 20.25        | 38.45      | 18.20      | H            |
| 846.50         | -21.13                 | 2.26                 | -45.56               | -0.82                              | 2.15               | <b>20.84</b> | 38.45      | 17.61      | V            |

**LTE Band 5\_10MHz\_QPSK**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna<br>Gain(dB) | Correction<br>(dB) | ERP(dBm)     | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|------------------------------------|--------------------|--------------|------------|------------|--------------|
| 829.00         | -22.91                 | 2.13                 | -45.74               | -0.90                              | 2.15               | 19.45        | 38.45      | 19.00      | H            |
| 836.50         | -21.82                 | 2.26                 | -45.66               | -0.82                              | 2.15               | 20.25        | 38.45      | 18.20      | H            |
| 844.00         | -21.39                 | 2.26                 | -45.59               | -0.82                              | 2.15               | <b>20.61</b> | 38.45      | 17.84      | V            |

#### LTE Band 5\_1.4MHz\_16QAM

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | Correction (dB) | ERP(dBm)     | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|-----------------|--------------|------------|------------|--------------|
| 824.70         | -24.03                 | 2.26                 | -45.79               | -0.95                           | 2.15            | 18.30        | 38.45      | 20.15      | H            |
| 836.50         | -22.66                 | 2.26                 | -45.66               | -0.82                           | 2.15            | 19.41        | 38.45      | 19.04      | H            |
| 848.30         | -21.99                 | 2.27                 | -45.55               | -0.80                           | 2.15            | <b>19.94</b> | 38.45      | 18.51      | V            |

#### LTE Band 5\_3MHz\_16QAM

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | Correction (dB) | ERP(dBm)     | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|-----------------|--------------|------------|------------|--------------|
| 825.50         | -23.91                 | 2.26                 | -45.79               | -0.94                           | 2.15            | 18.41        | 38.45      | 20.04      | H            |
| 836.50         | -22.61                 | 2.26                 | -45.66               | -0.82                           | 2.15            | 19.46        | 38.45      | 18.99      | H            |
| 847.50         | -22.00                 | 2.27                 | -45.56               | -0.81                           | 2.15            | <b>19.95</b> | 38.45      | 18.50      | V            |

#### LTE Band 5\_5MHz\_16QAM

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | Correction (dB) | ERP(dBm)     | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|-----------------|--------------|------------|------------|--------------|
| 826.50         | -24.07                 | 2.25                 | -45.77               | -0.93                           | 2.15            | 18.23        | 38.45      | 20.22      | H            |
| 836.50         | -22.66                 | 2.26                 | -45.66               | -0.82                           | 2.15            | 19.41        | 38.45      | 19.04      | H            |
| 846.50         | -21.93                 | 2.26                 | -45.56               | -0.82                           | 2.15            | <b>20.04</b> | 38.45      | 18.41      | V            |

#### LTE Band 5\_10MHz\_16QAM

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | Correction (dB) | ERP(dBm)     | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|-----------------|--------------|------------|------------|--------------|
| 829.00         | -23.79                 | 2.13                 | -45.74               | -0.90                           | 2.15            | 18.57        | 38.45      | 19.88      | H            |
| 836.50         | -22.67                 | 2.26                 | -45.66               | -0.82                           | 2.15            | 19.40        | 38.45      | 19.05      | H            |
| 844.00         | -22.22                 | 2.26                 | -45.59               | -0.82                           | 2.15            | <b>19.78</b> | 38.45      | 18.67      | V            |

$$\text{Peak ERP(dBm)} = P_{\text{Mea}}(-21.01\text{dBm}) - G_a(-0.80\text{dBi}) - P_{\text{Ag}}(-45.55\text{dB}) - P_{\text{cl}}(2.27\text{dB}) - 2.15\text{dB} = 20.92\text{dBm}$$

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

Limits: ≤33 dBm (2W)

#### LTE Band 7\_5MHz\_QPSK

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 2502.50        | -27.40                 | 3.58                 | -45.68               | -6.10                           | 20.80        | 33.00      | 12.20      | H            |
| 2535.00        | -24.04                 | 3.63                 | -44.82               | -6.16                           | 23.31        | 33.00      | 9.69       | H            |
| 2567.50        | -22.34                 | 3.65                 | -44.92               | -6.22                           | <b>25.15</b> | 33.00      | 7.85       | H            |

#### LTE Band 7\_10MHz\_QPSK

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 2505.00        | -27.16                 | 3.59                 | -45.64               | -6.11                           | 21.00        | 33.00      | 12.00      | H            |
| 2535.00        | -24.10                 | 3.63                 | -44.82               | -6.16                           | 23.25        | 33.00      | 9.75       | H            |
| 2565.00        | -22.34                 | 3.65                 | -44.97               | -6.22                           | <b>25.20</b> | 33.00      | 7.80       | H            |

#### LTE Band 7\_15MHz\_QPSK

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 2507.50        | -26.23                 | 3.59                 | -44.92               | -6.11                           | 21.21        | 33.00      | 11.79      | H            |
| 2535.00        | -24.21                 | 3.63                 | -44.82               | -6.16                           | 23.14        | 33.00      | 9.86       | H            |
| 2562.50        | -22.87                 | 3.65                 | -45.67               | -6.21                           | <b>25.36</b> | 33.00      | 7.64       | H            |

#### LTE Band 7\_20MHz\_QPSK

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 2510.00        | -26.47                 | 3.58                 | -45.36               | -6.12                           | 21.43        | 33.00      | 11.57      | H            |
| 2535.00        | -24.32                 | 3.63                 | -44.82               | -6.16                           | 23.03        | 33.00      | 9.97       | H            |
| 2560.00        | -23.36                 | 3.64                 | -45.98               | -6.21                           | <b>25.19</b> | 33.00      | 7.81       | H            |

### LTE Band 7\_5MHz\_16QAM

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 2502.50        | -28.25                 | 3.58                 | -45.68               | -6.10                           | 19.95        | 33.00      | 13.05      | H            |
| 2535.00        | -24.86                 | 3.63                 | -44.82               | -6.16                           | 22.49        | 33.00      | 10.51      | H            |
| 2567.50        | -23.35                 | 3.65                 | -44.92               | -6.22                           | <b>24.14</b> | 33.00      | 8.86       | H            |

### LTE Band 7\_10MHz\_16QAM

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 2505.00        | -28.07                 | 3.59                 | -45.64               | -6.11                           | 20.09        | 33.00      | 12.91      | H            |
| 2535.00        | -25.01                 | 3.63                 | -44.82               | -6.16                           | 22.34        | 33.00      | 10.66      | H            |
| 2565.00        | -23.37                 | 3.65                 | -44.97               | -6.22                           | <b>24.17</b> | 33.00      | 8.83       | H            |

### LTE Band 7\_15MHz\_16QAM

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 2507.50        | -27.30                 | 3.59                 | -44.92               | -6.11                           | 20.14        | 33.00      | 12.86      | H            |
| 2535.00        | -24.90                 | 3.63                 | -44.82               | -6.16                           | 22.45        | 33.00      | 10.55      | H            |
| 2562.50        | -23.86                 | 3.65                 | -45.67               | -6.21                           | <b>24.37</b> | 33.00      | 8.63       | H            |

### LTE Band 7\_20MHz\_16QAM

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | P <sub>cl</sub> (dB) | P <sub>Ag</sub> (dB) | G <sub>a</sub> Antenna Gain(dB) | EIRP(dBm)    | Limit(dBm) | Margin(dB) | Polarization |
|----------------|------------------------|----------------------|----------------------|---------------------------------|--------------|------------|------------|--------------|
| 2510.00        | -27.39                 | 3.58                 | -45.36               | -6.12                           | 20.51        | 33.00      | 12.49      | H            |
| 2535.00        | -25.19                 | 3.63                 | -44.82               | -6.16                           | 22.16        | 33.00      | 10.84      | H            |
| 2560.00        | -24.45                 | 3.64                 | -45.98               | -6.21                           | <b>24.10</b> | 33.00      | 8.90       | H            |

Peak EIRP(dBm) = P<sub>Mea</sub>(-22.87 dBm) - G<sub>a</sub> (-6.21dBi) - P<sub>Ag</sub> (-45.67dB) - P<sub>cl</sub> (3.65 dB) = 25.36dBm

### 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  $U = 0.96$  dB,  $k = 2$ .

## A.2 EMISSION LIMIT

### Reference

FCC: CFR 2.1051, 22.917, 24.238(a), 27.53(h), 27.53(m).

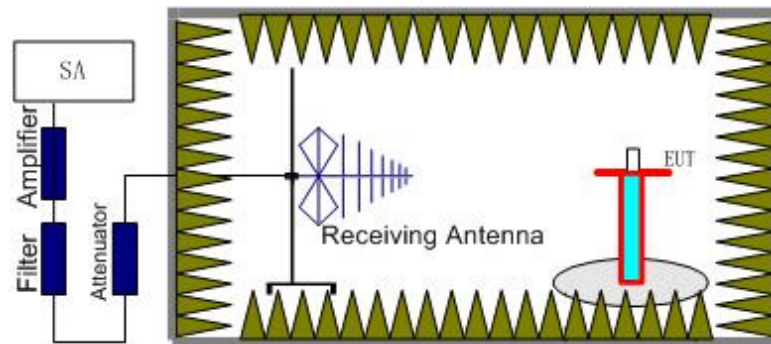
### A.2.1 Measurement Method

The measurements procedures in TIA-603D-2015 are used. This measurement is carried out in fully-anechoic chamber FAC-3.

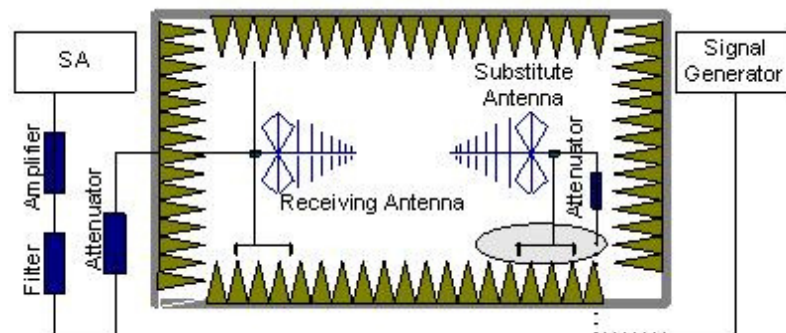
The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier. The resolution bandwidth is set 1MHz as outlined in Part 22.917, Part 24.238(a), Part 27.53(h), Part 27.53(m). The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the LTE Bands 2,4,5,7.

### 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 22.917, Part 24.238(a), Part 27.53(h), Part 27.53(m) 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 2, 4, 5, 7. 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 2, 4, 5, 7 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 2, 1.4MHz, QPSK, Channel 18607**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak EIRP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|----------------|-------------|------------|--------------|
| 3701.67        | -57.60                 | 5.35      | -8.48        | -54.47         | -13.00      | 41.47      | V            |
| 5552.46        | -40.75                 | 6.60      | -10.59       | -36.76         | -13.00      | 23.76      | V            |
| 7365.03        | -61.13                 | 6.98      | -12.04       | -56.07         | -13.00      | 43.07      | H            |
| 9435.55        | -64.94                 | 8.00      | -13.36       | -59.58         | -13.00      | 46.58      | H            |
| 11665.30       | -59.45                 | 8.87      | -13.07       | -55.25         | -13.00      | 42.25      | H            |
| 13727.67       | -55.99                 | 9.76      | -14.34       | -51.41         | -13.00      | 38.41      | H            |

**LTE Band 2, 1.4MHz, QPSK, Channel 18900**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak EIRP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|----------------|-------------|------------|--------------|
| 3789.58        | -66.15                 | 5.09      | -8.61        | -62.63         | -13.00      | 49.63      | V            |
| 5640.28        | -46.03                 | 6.85      | -10.57       | -42.31         | -13.00      | 29.31      | H            |
| 7431.71        | -61.94                 | 7.18      | -12.12       | -57.00         | -13.00      | 44.00      | H            |
| 9886.27        | -62.66                 | 8.23      | -13.01       | -57.88         | -13.00      | 44.88      | V            |
| 11900.61       | -58.37                 | 9.49      | -13.02       | -54.84         | -13.00      | 41.84      | H            |
| 13882.18       | -56.16                 | 10.10     | -14.43       | -51.83         | -13.00      | 38.83      | H            |

**LTE Band 2, 1.4MHz, QPSK, Channel 19193**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak EIRP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|----------------|-------------|------------|--------------|
| 3818.25        | -61.03                 | 5.46      | -8.65        | -57.84         | -13.00      | 44.84      | V            |
| 5119.52        | -62.15                 | 6.51      | -10.07       | -58.59         | -13.00      | 45.59      | H            |
| 7497.60        | -62.22                 | 7.57      | -12.20       | -57.59         | -13.00      | 44.59      | V            |
| 9524.06        | -63.93                 | 8.36      | -13.38       | -58.91         | -13.00      | 45.91      | V            |
| 11631.89       | -57.88                 | 8.93      | -13.07       | -53.74         | -13.00      | 40.74      | H            |
| 13389.13       | -55.59                 | 9.84      | -14.04       | -51.39         | -13.00      | 38.39      | V            |

**LTE Band 2, 1.4MHz, 16QAM, Channel 18607**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak EIRP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|----------------|-------------|------------|--------------|
| 3701.88        | -56.60                 | 5.35      | -8.48        | -53.47         | -13.00      | 40.47      | V            |
| 5552.42        | -42.63                 | 6.60      | -10.59       | -38.64         | -13.00      | 25.64      | H            |
| 7406.49        | -63.87                 | 7.22      | -12.09       | -59.00         | -13.00      | 46.00      | H            |
| 9565.68        | -60.88                 | 8.18      | -13.33       | -55.73         | -13.00      | 42.73      | V            |
| 11649.47       | -61.42                 | 8.90      | -13.07       | -57.25         | -13.00      | 44.25      | H            |
| 14464.75       | -50.81                 | 10.13     | -14.41       | -46.53         | -13.00      | 33.53      | V            |

**LTE Band 2, 1.4MHz, 16QAM, Channel 18900**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak EIRP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|----------------|-------------|------------|--------------|
| 3808.24        | -63.53                 | 5.32      | -8.63        | -60.22         | -13.00      | 47.22      | V            |
| 5640.29        | -45.93                 | 6.85      | -10.57       | -42.21         | -13.00      | 29.21      | H            |
| 7399.37        | -63.65                 | 7.19      | -12.08       | -58.76         | -13.00      | 45.76      | V            |
| 9552.88        | -64.84                 | 8.19      | -13.35       | -59.68         | -13.00      | 46.68      | H            |
| 11310.07       | -60.57                 | 9.07      | -13.14       | -56.50         | -13.00      | 43.50      | H            |
| 13536.43       | -53.52                 | 9.91      | -14.22       | -49.21         | -13.00      | 36.21      | V            |

**LTE Band 2, 1.4MHz, 16QAM, Channel 19193**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak EIRP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|----------------|-------------|------------|--------------|
| 3573.87        | -61.18                 | 5.49      | -8.30        | -58.37         | -13.00      | 45.37      | V            |
| 5728.19        | -50.84                 | 6.76      | -10.55       | -47.05         | -13.00      | 34.05      | H            |
| 7826.08        | -60.87                 | 7.46      | -12.46       | -55.87         | -13.00      | 42.87      | H            |
| 9707.30        | -62.98                 | 8.09      | -13.19       | -57.88         | -13.00      | 44.88      | V            |
| 11511.29       | -61.86                 | 9.01      | -13.10       | -57.77         | -13.00      | 44.77      | H            |
| 13336.30       | -54.69                 | 9.72      | -13.97       | -50.44         | -13.00      | 37.44      | V            |

**LTE Band 4, 1.4MHz QPSK, Channel 19957**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak EIRP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|----------------|-------------|------------|--------------|
| 3479.13        | -62.80                 | 5.40      | -8.15        | -60.05         | -13.00      | 47.05      | V            |
| 5132.40        | -35.53                 | 6.42      | -10.09       | -31.86         | -13.00      | 18.86      | V            |
| 6855.72        | -61.77                 | 6.75      | -11.43       | -57.09         | -13.00      | 44.09      | V            |
| 8514.73        | -61.67                 | 7.76      | -13.00       | -56.43         | -13.00      | 43.43      | H            |
| 10322.64       | -60.06                 | 8.54      | -13.03       | -55.57         | -13.00      | 42.57      | H            |
| 12642.62       | -55.70                 | 9.46      | -13.29       | -51.87         | -13.00      | 38.87      | H            |

**LTE Band 4, 1.4MHz, QPSK, Channel 20175**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak EIRP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|----------------|-------------|------------|--------------|
| 3751.20        | -60.70                 | 5.16      | -8.55        | -57.31         | -13.00      | 44.31      | H            |
| 5197.60        | -37.73                 | 6.55      | -10.18       | -34.10         | -13.00      | 21.10      | V            |
| 6758.79        | -63.25                 | 7.12      | -11.31       | -59.06         | -13.00      | 46.06      | V            |
| 8352.08        | -65.98                 | 7.90      | -12.88       | -61.00         | -13.00      | 48.00      | H            |
| 10205.11       | -58.31                 | 8.39      | -12.98       | -53.72         | -13.00      | 40.72      | V            |
| 11507.34       | -57.98                 | 9.00      | -13.10       | -53.88         | -13.00      | 40.88      | V            |

**LTE Band 4, 1.4MHz, QPSK, Channel 20393**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak EIRP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|----------------|-------------|------------|--------------|
| 3678.36        | -63.85                 | 5.36      | -8.45        | -60.76         | -13.00      | 47.76      | V            |
| 5262.99        | -41.32                 | 6.45      | -10.27       | -37.50         | -13.00      | 24.50      | V            |
| 6865.24        | -64.42                 | 6.68      | -11.44       | -59.66         | -13.00      | 46.66      | H            |
| 8393.69        | -64.77                 | 7.91      | -12.91       | -59.77         | -13.00      | 46.77      | V            |
| 10219.18       | -61.78                 | 8.38      | -12.99       | -57.17         | -13.00      | 44.17      | H            |
| 11901.58       | -59.68                 | 9.48      | -13.02       | -56.14         | -13.00      | 43.14      | H            |

**LTE Band 4, 1.4MHz, 16QAM, Channel 19957**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak EIRP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|----------------|-------------|------------|--------------|
| 3421.71        | -57.84                 | 5.47      | -8.01        | -55.30         | -13.00      | 42.30      | V            |
| 5132.57        | -36.40                 | 6.42      | -10.09       | -32.73         | -13.00      | 19.73      | V            |
| 6616.16        | -61.64                 | 7.19      | -11.14       | -57.69         | -13.00      | 44.69      | V            |
| 8381.69        | -62.70                 | 7.82      | -12.91       | -57.61         | -13.00      | 44.61      | V            |
| 10113.97       | -59.08                 | 8.32      | -12.95       | -54.45         | -13.00      | 41.45      | H            |
| 11861.07       | -57.30                 | 9.10      | -13.03       | -53.37         | -13.00      | 40.37      | H            |

**LTE Band 4, 1.4MHz, 16QAM, Channel 20175**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak EIRP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|----------------|-------------|------------|--------------|
| 3464.85        | -59.69                 | 5.41      | -8.12        | -56.98         | -13.00      | 43.98      | V            |
| 5197.76        | -37.61                 | 6.55      | -10.18       | -33.98         | -13.00      | 20.98      | V            |
| 6641.53        | -63.16                 | 7.38      | -11.17       | -59.37         | -13.00      | 46.37      | H            |
| 8532.97        | -64.26                 | 7.78      | -13.01       | -59.03         | -13.00      | 46.03      | H            |
| 10127.97       | -60.85                 | 8.32      | -12.95       | -56.22         | -13.00      | 43.22      | H            |
| 11991.12       | -56.90                 | 9.02      | -13.00       | -52.92         | -13.00      | 39.92      | V            |

**LTE Band 4, 1.4MHz, 16QAM, Channel 20393**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak EIRP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|----------------|-------------|------------|--------------|
| 3764.19        | -62.05                 | 5.11      | -8.57        | -58.59         | -13.00      | 45.59      | H            |
| 5263.32        | -42.65                 | 6.45      | -10.27       | -38.83         | -13.00      | 25.83      | V            |
| 7513.05        | -63.63                 | 7.54      | -12.21       | -58.96         | -13.00      | 45.96      | H            |
| 8670.11        | -62.47                 | 7.71      | -13.03       | -57.15         | -13.00      | 44.15      | H            |
| 10104.50       | -64.64                 | 8.34      | -12.94       | -60.04         | -13.00      | 47.04      | V            |
| 12608.27       | -57.08                 | 9.50      | -13.26       | -53.32         | -13.00      | 40.32      | V            |

**LTE Band 5, 1.4MHz, QPSK, Channel 20407**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Correction (dB) | Peak ERP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|-----------------|---------------|-------------|------------|--------------|
| 1649.20        | -64.87                 | 3.41      | -5.23        | 2.15            | -65.20        | -13.00      | 52.20      | V            |
| 2474.55        | -53.65                 | 4.43      | -6.02        | 2.15            | -54.21        | -13.00      | 41.21      | V            |
| 3424.17        | -62.93                 | 5.47      | -8.02        | 2.15            | -62.53        | -13.00      | 49.53      | V            |
| 4140.63        | -64.12                 | 5.77      | -9.04        | 2.15            | -63.00        | -13.00      | 50.00      | V            |
| 4948.71        | -51.18                 | 6.32      | -9.85        | 2.15            | -49.80        | -13.00      | 36.80      | V            |
| 5837.83        | -63.00                 | 6.57      | -10.53       | 2.15            | -61.19        | -13.00      | 48.19      | H            |

**LTE Band 5, 1.4MHz, QPSK, Channel 20525**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Correction (dB) | Peak ERP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|-----------------|---------------|-------------|------------|--------------|
| 1673.38        | -60.38                 | 3.54      | -5.19        | 2.15            | -60.88        | -13.00      | 47.88      | V            |
| 2510.11        | -45.31                 | 4.48      | -6.12        | 2.15            | -45.82        | -13.00      | 32.82      | V            |
| 3209.37        | -62.11                 | 5.25      | -7.50        | 2.15            | -62.01        | -13.00      | 49.01      | H            |
| 4090.46        | -63.37                 | 5.68      | -8.99        | 2.15            | -62.21        | -13.00      | 49.21      | H            |
| 5019.44        | -64.97                 | 6.21      | -9.93        | 2.15            | -63.40        | -13.00      | 50.40      | H            |
| 5815.15        | -62.93                 | 6.64      | -10.54       | 2.15            | -61.18        | -13.00      | 48.18      | V            |

**LTE Band 5, 1.4MHz, QPSK, Channel 20643**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Correction (dB) | Peak ERP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|-----------------|---------------|-------------|------------|--------------|
| 1696.80        | -60.75                 | 3.45      | -5.15        | 2.15            | -61.20        | -13.00      | 48.20      | V            |
| 2545.13        | -42.86                 | 4.47      | -6.18        | 2.15            | -43.30        | -13.00      | 30.30      | V            |
| 3303.37        | -64.46                 | 5.35      | -7.73        | 2.15            | -64.23        | -13.00      | 51.23      | H            |
| 4285.56        | -64.35                 | 5.98      | -9.19        | 2.15            | -63.29        | -13.00      | 50.29      | H            |
| 5090.53        | -59.13                 | 6.46      | -10.03       | 2.15            | -57.71        | -13.00      | 44.71      | H            |
| 6252.08        | -61.37                 | 6.79      | -10.75       | 2.15            | -59.56        | -13.00      | 46.56      | V            |

**LTE Band 5, 1.4MHz, 16QAM, Channel 20407**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Correction (dB) | Peak ERP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|-----------------|---------------|-------------|------------|--------------|
| 1638.69        | -69.51                 | 3.35      | -5.25        | 2.15            | -69.76        | -13.00      | 56.76      | V            |
| 2474.67        | -54.50                 | 4.43      | -6.02        | 2.15            | -55.06        | -13.00      | 42.06      | V            |
| 3207.83        | -65.69                 | 5.25      | -7.50        | 2.15            | -65.59        | -13.00      | 52.59      | H            |
| 4143.03        | -63.56                 | 5.77      | -9.04        | 2.15            | -62.44        | -13.00      | 49.44      | H            |
| 5315.96        | -62.18                 | 6.53      | -10.34       | 2.15            | -60.52        | -13.00      | 47.52      | V            |
| 6234.81        | -62.80                 | 6.82      | -10.73       | 2.15            | -61.04        | -13.00      | 48.04      | H            |

**LTE Band 5, 1.4MHz, 16QAM, Channel 20525**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Correction (dB) | Peak ERP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|-----------------|---------------|-------------|------------|--------------|
| 1673.45        | -59.55                 | 3.54      | -5.19        | 2.15            | -60.05        | -13.00      | 47.05      | V            |
| 2509.71        | -48.20                 | 4.48      | -6.12        | 2.15            | -48.71        | -13.00      | 35.71      | V            |
| 3492.52        | -60.41                 | 5.42      | -8.18        | 2.15            | -59.80        | -13.00      | 46.80      | H            |
| 4288.44        | -64.52                 | 5.97      | -9.19        | 2.15            | -63.45        | -13.00      | 50.45      | V            |
| 5019.65        | -58.14                 | 6.21      | -9.93        | 2.15            | -56.57        | -13.00      | 43.57      | V            |
| 5945.44        | -62.76                 | 6.95      | -10.51       | 2.15            | -61.35        | -13.00      | 48.35      | H            |

**LTE Band 5, 1.4MHz, 16QAM, Channel 20643**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Correction (dB) | Peak ERP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|-----------------|---------------|-------------|------------|--------------|
| 1696.68        | -60.82                 | 3.45      | -5.15        | 2.15            | -61.27        | -13.00      | 48.27      | V            |
| 2544.99        | -43.49                 | 4.47      | -6.18        | 2.15            | -43.93        | -13.00      | 30.93      | V            |
| 3459.28        | -64.45                 | 5.42      | -8.10        | 2.15            | -63.92        | -13.00      | 50.92      | H            |
| 4154.45        | -64.00                 | 5.81      | -9.05        | 2.15            | -62.91        | -13.00      | 49.91      | H            |
| 5090.47        | -59.26                 | 6.46      | -10.03       | 2.15            | -57.84        | -13.00      | 44.84      | V            |
| 6090.24        | -65.08                 | 6.79      | -10.59       | 2.15            | -63.43        | -13.00      | 50.43      | V            |

**LTE Band 7, 5 MHz, QPSK, Channel 20775**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak EIRP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|----------------|-------------|------------|--------------|
| 5005.22        | -48.76                 | 6.27      | -9.91        | -45.12         | -13.00      | 32.12      | V            |
| 7507.92        | -45.20                 | 7.56      | -12.21       | -40.55         | -13.00      | 27.55      | V            |
| 10010.82       | -59.15                 | 8.48      | -12.90       | -54.73         | -13.00      | 41.73      | V            |
| 12501.27       | -58.42                 | 9.28      | -13.20       | -54.50         | -13.00      | 41.50      | H            |
| 15042.07       | -55.58                 | 10.42     | -13.97       | -52.03         | -13.00      | 39.03      | V            |
| 17515.21       | -49.76                 | 12.16     | -14.92       | -47.00         | -13.00      | 34.00      | V            |

**LTE Band 7, 5 MHz, QPSK, Channel 21100**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak EIRP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|----------------|-------------|------------|--------------|
| 5070.27        | -48.94                 | 6.42      | -10.00       | -45.36         | -13.00      | 32.36      | V            |
| 7605.33        | -49.02                 | 7.40      | -12.28       | -44.14         | -13.00      | 31.14      | V            |
| 10140.62       | -58.10                 | 8.35      | -12.96       | -53.49         | -13.00      | 40.49      | V            |
| 12675.40       | -56.85                 | 9.32      | -13.31       | -52.86         | -13.00      | 39.86      | V            |
| 15204.12       | -53.13                 | 10.70     | -13.88       | -49.95         | -13.00      | 36.95      | H            |
| 17743.06       | -52.82                 | 11.45     | -15.24       | -49.03         | -13.00      | 36.03      | V            |

**LTE Band 7, 5 MHz, QPSK, Channel 21425**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak EIRP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|----------------|-------------|------------|--------------|
| 5135.26        | -50.06                 | 6.40      | -10.09       | -46.37         | -13.00      | 33.37      | H            |
| 7658.78        | -63.38                 | 7.59      | -12.33       | -58.64         | -13.00      | 45.64      | V            |
| 10224.56       | -62.29                 | 8.43      | -12.99       | -57.73         | -13.00      | 44.73      | H            |
| 12767.40       | -55.95                 | 9.67      | -13.36       | -52.26         | -13.00      | 39.26      | V            |
| 15267.15       | -51.51                 | 10.57     | -13.84       | -48.24         | -13.00      | 35.24      | H            |
| 17909.51       | -50.73                 | 12.24     | -15.47       | -47.50         | -13.00      | 34.50      | H            |

**LTE Band 7, 5 MHz, 16QAM, Channel 20775**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak EIRP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|----------------|-------------|------------|--------------|
| 5005.46        | -49.75                 | 6.27      | -9.91        | -46.11         | -13.00      | 33.11      | V            |
| 7508.06        | -46.46                 | 7.56      | -12.21       | -41.81         | -13.00      | 28.81      | V            |
| 10062.56       | -64.78                 | 8.82      | -12.93       | -60.67         | -13.00      | 47.67      | H            |
| 12501.08       | -60.04                 | 9.28      | -13.20       | -56.12         | -13.00      | 43.12      | V            |
| 14993.07       | -53.92                 | 10.64     | -14.01       | -50.55         | -13.00      | 37.55      | V            |
| 17508.66       | -51.94                 | 12.12     | -14.91       | -49.15         | -13.00      | 36.15      | V            |

**LTE Band 7, 5 MHz, 16QAM, Channel 21100**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak EIRP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|----------------|-------------|------------|--------------|
| 5070.34        | -48.11                 | 6.42      | -10.00       | -44.53         | -13.00      | 31.53      | V            |
| 7605.27        | -48.62                 | 7.40      | -12.28       | -43.74         | -13.00      | 30.74      | V            |
| 10140.14       | -59.36                 | 8.35      | -12.96       | -54.75         | -13.00      | 41.75      | V            |
| 12673.20       | -55.23                 | 9.33      | -13.30       | -51.26         | -13.00      | 38.26      | H            |
| 15207.19       | -56.94                 | 10.71     | -13.88       | -53.77         | -13.00      | 40.77      | H            |
| 17672.71       | -53.63                 | 11.82     | -15.14       | -50.31         | -13.00      | 37.31      | V            |

**LTE Band 7, 5 MHz, 16QAM, Channel 21425**

| Frequency(MHz) | P <sub>Mea</sub> (dBm) | Path Loss | Antenna Gain | Peak EIRP(dBm) | Limit (dBm) | Margin(dB) | Polarization |
|----------------|------------------------|-----------|--------------|----------------|-------------|------------|--------------|
| 5135.20        | -46.81                 | 6.40      | -10.09       | -43.12         | -13.00      | 30.12      | V            |
| 7703.03        | -46.87                 | 7.29      | -12.36       | -41.80         | -13.00      | 28.80      | V            |
| 10022.98       | -59.87                 | 8.49      | -12.91       | -55.45         | -13.00      | 42.45      | H            |
| 12646.21       | -57.15                 | 9.43      | -13.29       | -53.29         | -13.00      | 40.29      | V            |
| 15115.25       | -54.36                 | 10.88     | -13.93       | -51.31         | -13.00      | 38.31      | H            |
| 16653.90       | -50.17                 | 11.13     | -13.66       | -47.64         | -13.00      | 34.64      | V            |

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, 22.235, 24.235, 27.54.

#### **A.3.1 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 2/4/5/7, 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 0.1 Volt 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.3.2 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. 24.235, 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 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 4.35VDC, 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.3.3 Measurement results

#### LTE Band 2, 1.4MHz bandwidth (worst case of all bandwidths)

##### Frequency Error vs Voltage

| Voltage<br>(V) | Frequency error (Hz) |       | Frequency error (ppm) |       |
|----------------|----------------------|-------|-----------------------|-------|
|                | QPSK                 | 16QAM | QPSK                  | 16QAM |
| 3.6            | -2                   | 19    | 0.001                 | 0.010 |
| 3.8            | -20                  | 14    | 0.011                 | 0.007 |
| 4.35           | 0                    | 15    | 0.000                 | 0.008 |

##### Frequency Error vs Temperature

| Temperature<br>(°C) | Frequency error (Hz) |       | Frequency error (ppm) |       |
|---------------------|----------------------|-------|-----------------------|-------|
|                     | QPSK                 | 16QAM | QPSK                  | 16QAM |
| 50°                 | 7                    | 21    | 0.004                 | 0.011 |
| 40°                 | 1                    | 14    | 0.000                 | 0.007 |
| 30°                 | 1                    | 13    | 0.001                 | 0.007 |
| 20°                 | 1                    | 16    | 0.001                 | 0.009 |
| 10°                 | -2                   | 16    | 0.001                 | 0.008 |
| 0°                  | 1                    | 16    | 0.000                 | 0.009 |
| - 10°               | -4                   | 19    | 0.002                 | 0.010 |
| - 20°               | -5                   | 21    | 0.003                 | 0.011 |
| - 30°               | -1                   | 16    | 0.000                 | 0.008 |

#### LTE Band 4, 1.4MHz bandwidth (worst case of all bandwidths)

##### Frequency Error vs Voltage

| Voltage<br>(V) | Frequency error (Hz) |       | Frequency error (ppm) |       |
|----------------|----------------------|-------|-----------------------|-------|
|                | QPSK                 | 16QAM | QPSK                  | 16QAM |
| 3.6            | -2                   | 20    | 0.001                 | 0.011 |
| 3.8            | -17                  | 18    | 0.010                 | 0.010 |
| 4.35           | 5                    | 15    | 0.003                 | 0.009 |

##### Frequency Error vs Temperature

| Temperature<br>(°C) | Frequency error (Hz) |       | Frequency error (ppm) |       |
|---------------------|----------------------|-------|-----------------------|-------|
|                     | QPSK                 | 16QAM | QPSK                  | 16QAM |
| 50°                 | 12                   | 20    | 0.007                 | 0.011 |
| 40°                 | 3                    | 20    | 0.002                 | 0.012 |
| 30°                 | 3                    | 18    | 0.002                 | 0.010 |
| 20°                 | -1                   | 23    | 0.001                 | 0.013 |
| 10°                 | -1                   | 20    | 0.001                 | 0.011 |
| 0°                  | 2                    | 25    | 0.001                 | 0.014 |
| - 10°               | -2                   | 16    | 0.001                 | 0.009 |
| - 20°               | 3                    | 17    | 0.002                 | 0.010 |
| - 30°               | 2                    | 18    | 0.001                 | 0.010 |

**LTE Band 5, 1.4MHz bandwidth (worst case of all bandwidths)**
**Frequency Error vs Voltage**

| Voltage<br>(V) | Frequency error (Hz) |       | Frequency error (ppm) |       |
|----------------|----------------------|-------|-----------------------|-------|
|                | QPSK                 | 16QAM | QPSK                  | 16QAM |
| 3.6            | 3                    | 21    | 0.003                 | 0.025 |
| 3.8            | -9                   | 21    | 0.010                 | 0.025 |
| 4.35           | 6                    | 20    | 0.007                 | 0.024 |

**Frequency Error vs Temperature**

| Temperature<br>(°C) | Frequency error (Hz) |       | Frequency error (ppm) |       |
|---------------------|----------------------|-------|-----------------------|-------|
|                     | QPSK                 | 16QAM | QPSK                  | 16QAM |
| 50°                 | 6                    | 20    | 0.008                 | 0.024 |
| 40°                 | 3                    | 21    | 0.004                 | 0.025 |
| 30°                 | 2                    | 21    | 0.003                 | 0.025 |
| 20°                 | 3                    | 18    | 0.004                 | 0.021 |
| 10°                 | 3                    | 21    | 0.004                 | 0.025 |
| 0°                  | 1                    | 22    | 0.001                 | 0.027 |
| - 10°               | 1                    | 17    | 0.001                 | 0.020 |
| - 20°               | 2                    | 22    | 0.003                 | 0.027 |
| - 30°               | -1                   | 17    | 0.001                 | 0.020 |

**LTE Band 7, 5MHz bandwidth (worst case of all bandwidths)**
**Frequency Error vs Voltage**

| Voltage<br>(V) | Frequency error (Hz) |       | Frequency error (ppm) |       |
|----------------|----------------------|-------|-----------------------|-------|
|                | QPSK                 | 16QAM | QPSK                  | 16QAM |
| 3.6            | 5                    | 2     | 0.002                 | 0.001 |
| 3.8            | 9                    | -4    | 0.004                 | 0.002 |
| 4.35           | 3                    | -1    | 0.001                 | 0.000 |

**Frequency Error vs Temperature**

| Temperature<br>(°C) | Frequency error (Hz) |       | Frequency error (ppm) |       |
|---------------------|----------------------|-------|-----------------------|-------|
|                     | QPSK                 | 16QAM | QPSK                  | 16QAM |
| 50°                 | 9                    | 3     | 0.003                 | 0.001 |
| 40°                 | 6                    | -1    | 0.002                 | 0.000 |
| 30°                 | 1                    | -5    | 0.000                 | 0.002 |
| 20°                 | 3                    | 1     | 0.001                 | 0.000 |
| 10°                 | 1                    | 4     | 0.000                 | 0.002 |
| 0°                  | 1                    | -1    | 0.000                 | 0.000 |
| - 10°               | 7                    | 4     | 0.003                 | 0.002 |
| - 20°               | 2                    | 5     | 0.001                 | 0.002 |
| - 30°               | 7                    | 2     | 0.003                 | 0.001 |

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.4.1 Occupied Bandwidth Results**

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

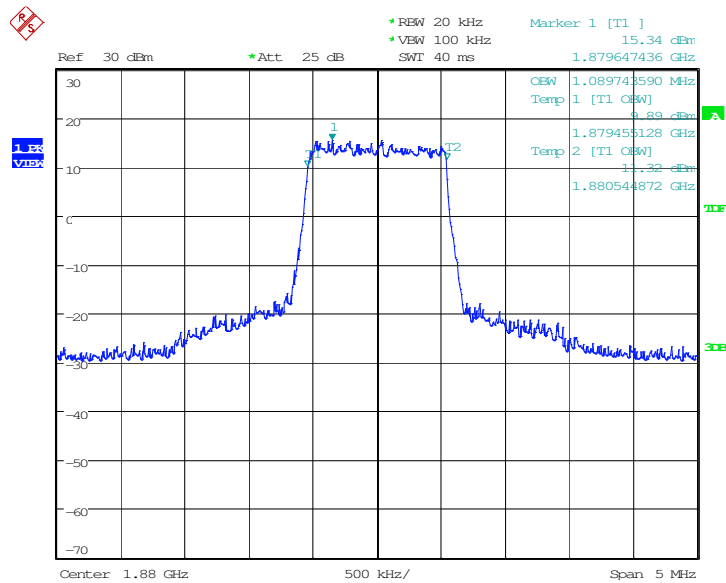
The measurement method is from KDB 971168 4.2:

- a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation products including the emission skirts (i.e., two to five times the OBW).
- b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.
- c) Set the reference level of the instrument as required to keep the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope must be at least  $10\log(\text{OBW} / \text{RBW})$  below the reference level.
- d) Set the detection mode to peak, and the trace mode to max hold.
- e) Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.

### LTE band 2, 1.4MHz (99%)

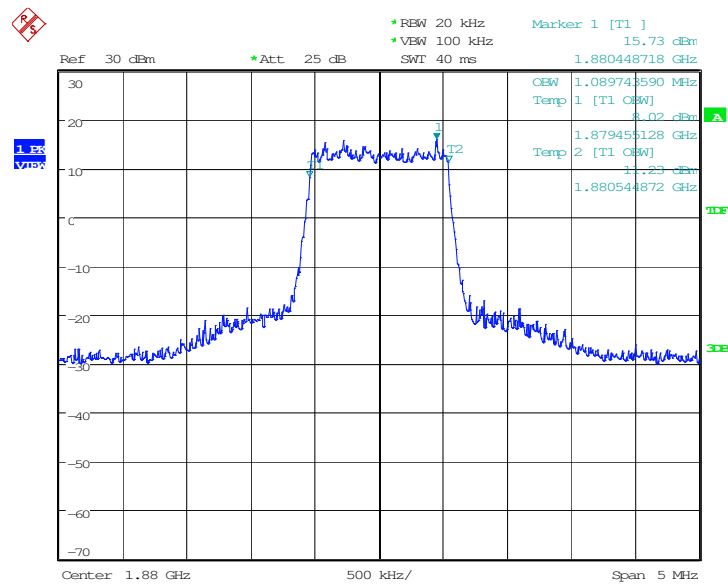
| Frequency(MHz) | Occupied Bandwidth (99%)( kHz) |         |
|----------------|--------------------------------|---------|
| 1880.0         | QPSK                           | 16QAM   |
|                | 1089.74                        | 1089.74 |

### LTE band 2, 1.4MHz Bandwidth, QPSK (99% BW)



Date: 3.NOV.2015 20:06:36

**LTE band 2, 1.4MHz Bandwidth, 16QAM (99% BW)**



Date: 3.NOV.2015 20:06:50

| Frequency(MHz) | Occupied Bandwidth (99%)( kHz) |         |
|----------------|--------------------------------|---------|
| 1880.0         | QPSK                           | 16QAM   |
|                | 2692.31                        | 2692.31 |

REF 30 dBm      \* Att 25 dB      SWI 30 ms  
 Center 1.8 GHz      1 MHz/      Span 10 MHz

| Marker | Freq            | Temp            | Mag       |
|--------|-----------------|-----------------|-----------|
| 1 [T1] | 1.878651846 GHz | 2.692307692 MHz | 13.71 dBm |
| 2 [T2] | 1.881346154 GHz | 1.878830128 GHz | 13.71 dBm |

REF 30 dBm  
 \*Att 25 dB  
 REW 30 kHz  
 VEW 100 kHz  
 SWI 30 ms  
 Marker 1 [T1]  
 12.42 dBm  
 1.879759615 GHz

NEF 1 [T1] 12.42 dBm  
 P1dB 2 [T1] 1.878653846 GHz  
 NEF 2 [T1] 1.881346154 GHz

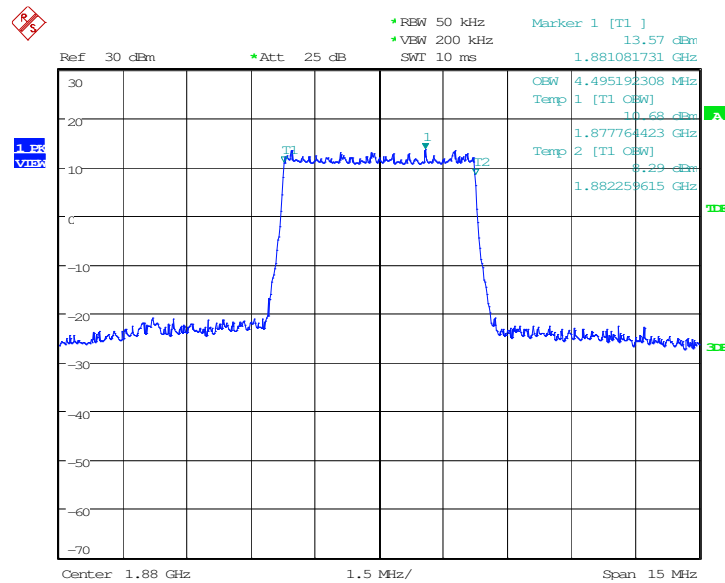
Center 1.88 GHz  
 1 MHz/  
 Span 10 MHz

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### LTE band 2, 5MHz (99%)

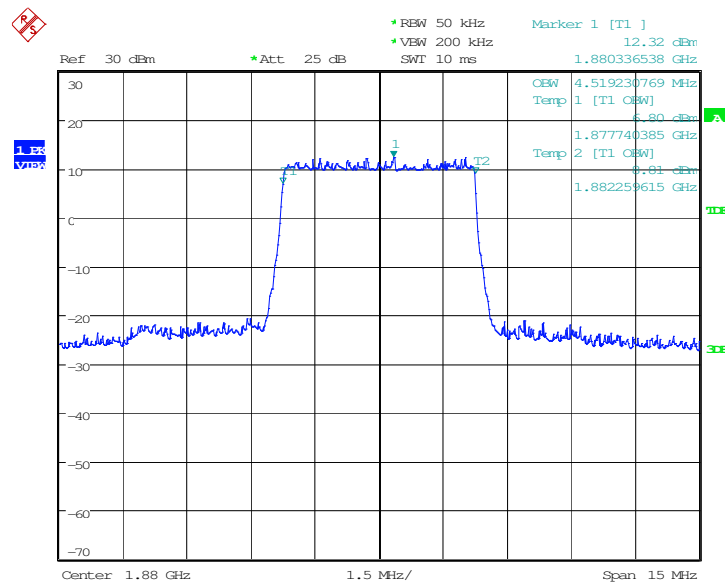
| Frequency(MHz) | Occupied Bandwidth (99%)( kHz) |         |
|----------------|--------------------------------|---------|
| 1880.0         | QPSK                           | 16QAM   |
|                | 4495.19                        | 4519.23 |

### LTE band 2, 5MHz Bandwidth, QPSK (99% BW)



Date: 3.NOV.2015 20:17:52

### LTE band 2, 5MHz Bandwidth, 16QAM (99% BW)



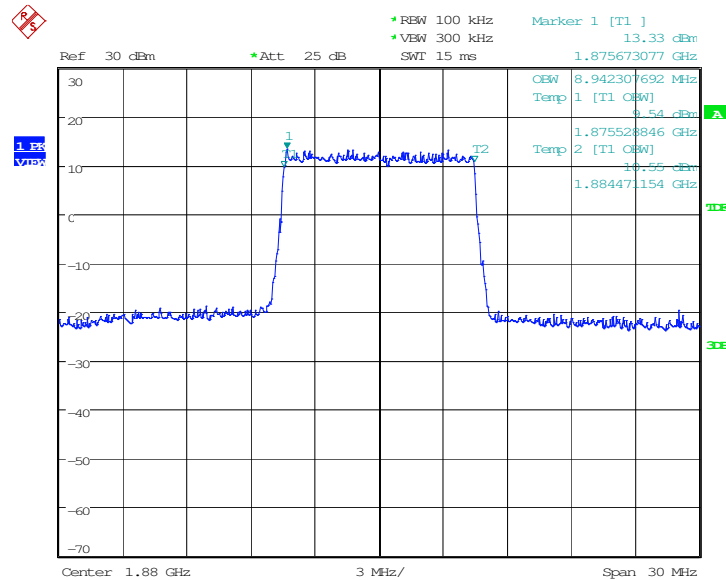
Date: 3.NOV.2015 20:18:05



### LTE band 2, 10MHz (99%)

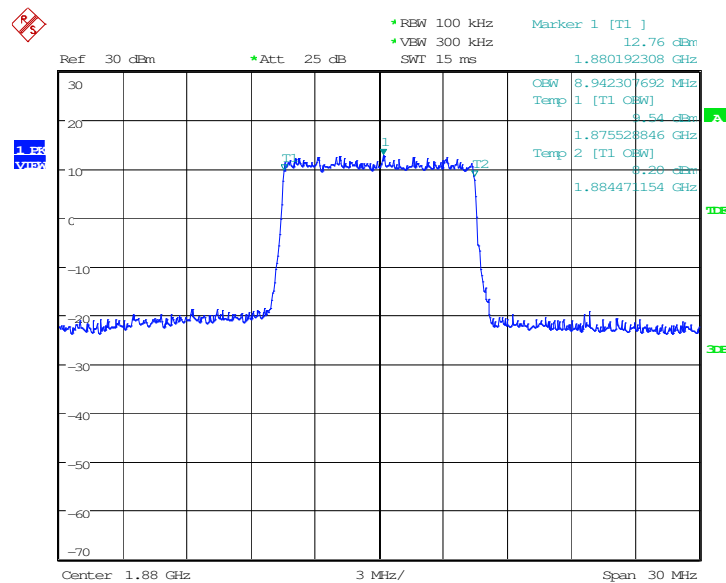
| Frequency(MHz) | Occupied Bandwidth (99%)( kHz) |         |
|----------------|--------------------------------|---------|
| 1880.0         | QPSK                           | 16QAM   |
|                | 8942.31                        | 8942.31 |

### LTE band 2, 10MHz Bandwidth, QPSK (99% BW)



Date: 3.NOV.2015 20:23:30

### LTE band 2, 10MHz Bandwidth, 16QAM (99% BW)

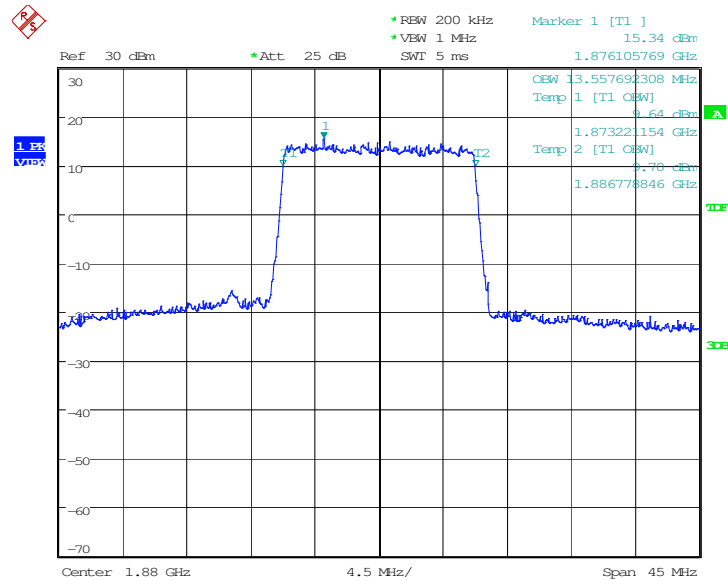


Date: 3.NOV.2015 20:23:43

### LTE band 2, 15MHz (99%)

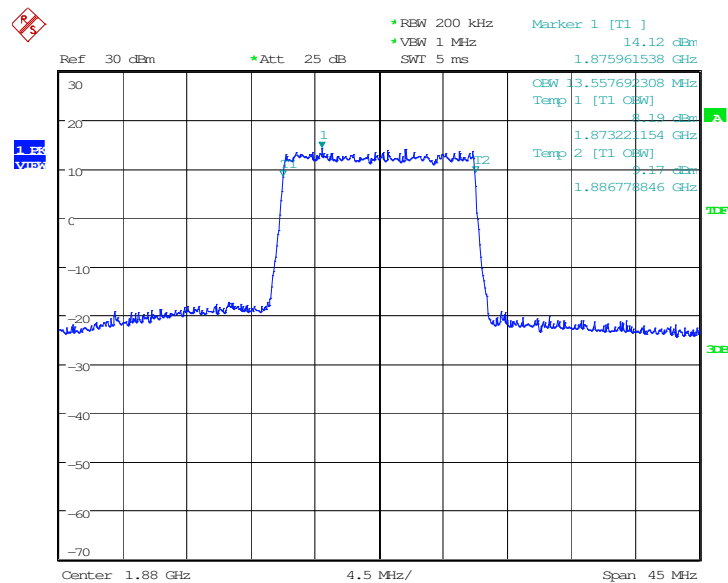
| Frequency(MHz) | Occupied Bandwidth (99%)( kHz) |          |
|----------------|--------------------------------|----------|
| 1880.0         | QPSK                           | 16QAM    |
|                | 13557.69                       | 13557.69 |

### LTE band 2, 15MHz Bandwidth, QPSK (99% BW)



Date: 3.NOV.2015 20:29:13

### LTE band 2, 15MHz Bandwidth, 16QAM (99% BW)

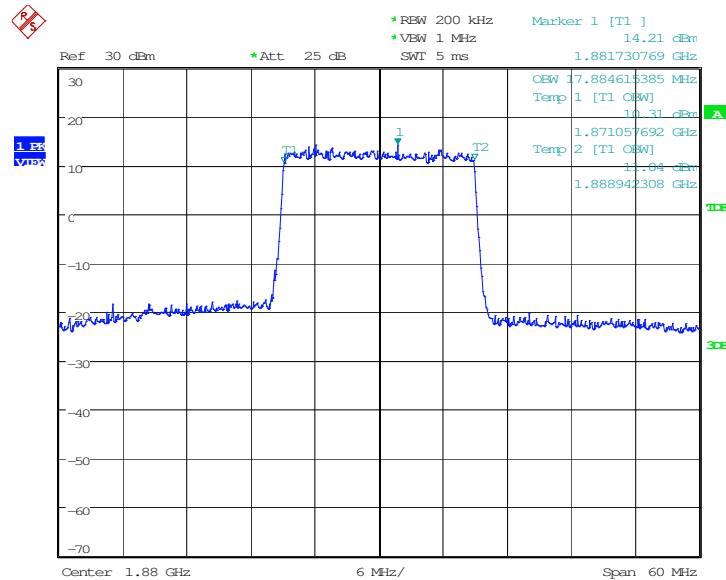


Date: 3.NOV.2015 20:29:26

### LTE band 2, 20MHz (99%)

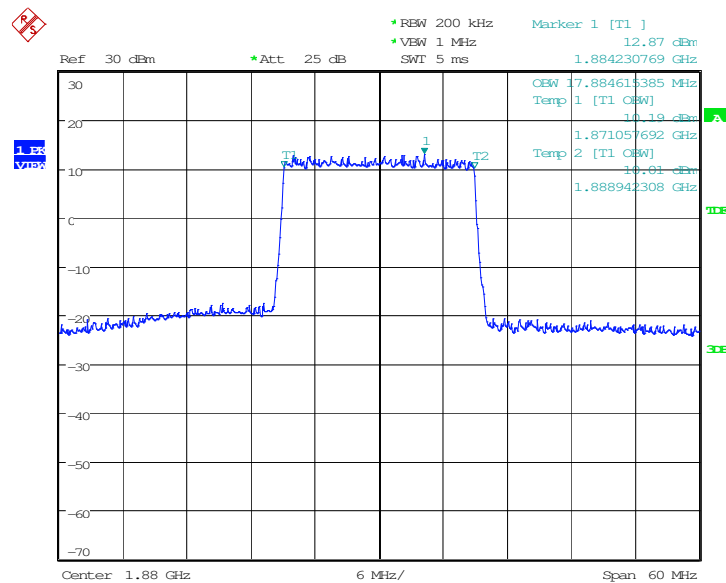
| Frequency(MHz) | Occupied Bandwidth (99%)( kHz) |          |
|----------------|--------------------------------|----------|
| 1880.0         | QPSK                           | 16QAM    |
|                | 17884.62                       | 17884.62 |

### LTE band 2, 20MHz Bandwidth, QPSK (99% BW)



Date: 3.NOV.2015 20:34:59

### LTE band 2, 20MHz Bandwidth, 16QAM (99% BW)

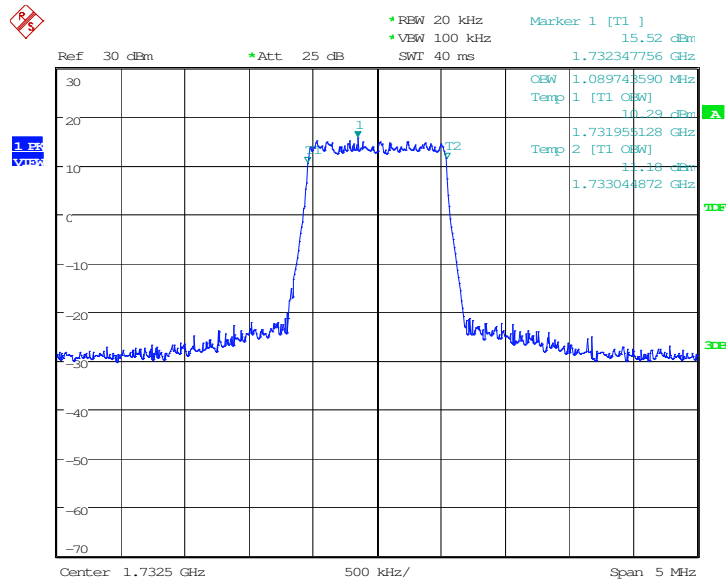


Date: 3.NOV.2015 20:35:13

### LTE band 4, 1.4MHz (99%)

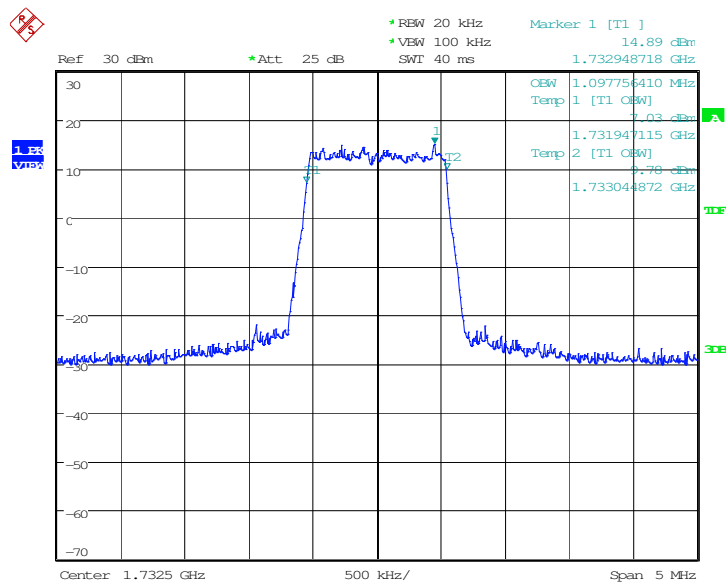
| Frequency(MHz) | Occupied Bandwidth (99%)( kHz) |         |
|----------------|--------------------------------|---------|
| 1732.5         | QPSK                           | 16QAM   |
|                | 1089.74                        | 1097.76 |

### LTE band 4, 1.4MHz Bandwidth, QPSK (99% BW)



Date: 3.NOV.2015 20:40:41

### LTE band 4, 1.4MHz Bandwidth, 16QAM (99% BW)

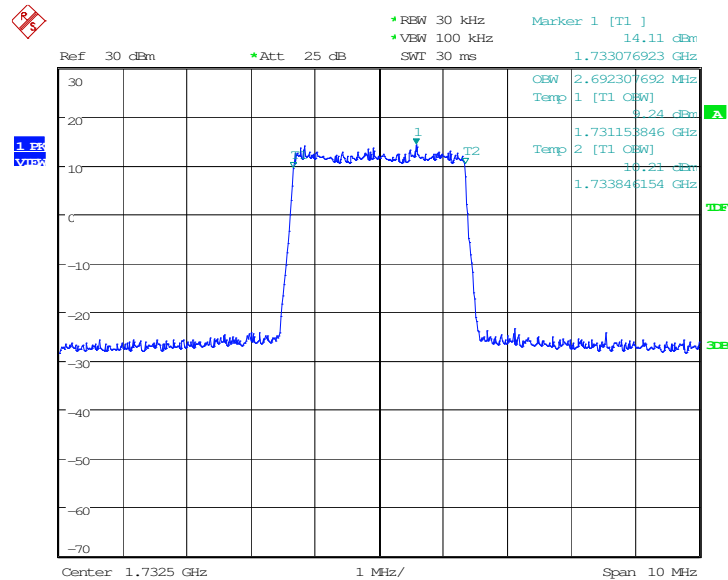


Date: 3.NOV.2015 20:40:54

### LTE band 4, 3MHz (99%)

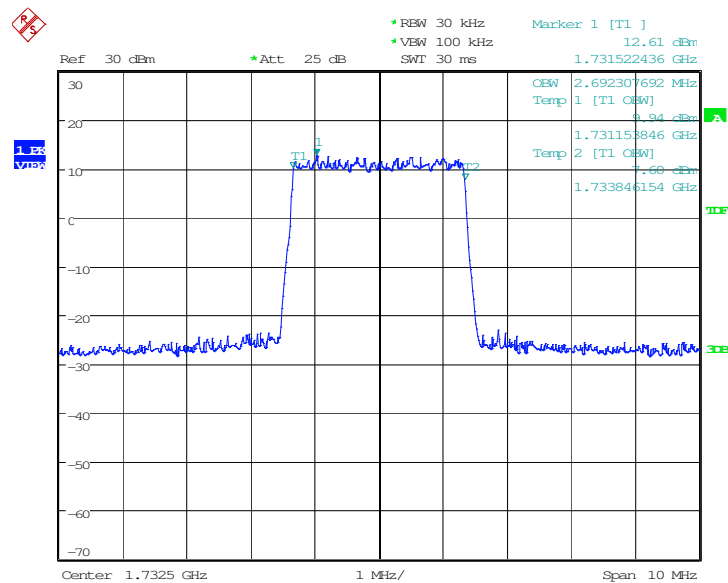
| Frequency(MHz) | Occupied Bandwidth (99%)( kHz) |         |
|----------------|--------------------------------|---------|
| 1732.5         | QPSK                           | 16QAM   |
|                | 2692.31                        | 2692.31 |

### LTE band 4, 3MHz Bandwidth, QPSK (99% BW)



Date: 3.NOV.2015 20:46:18

### LTE band 4, 3MHz Bandwidth, 16QAM (99% BW)

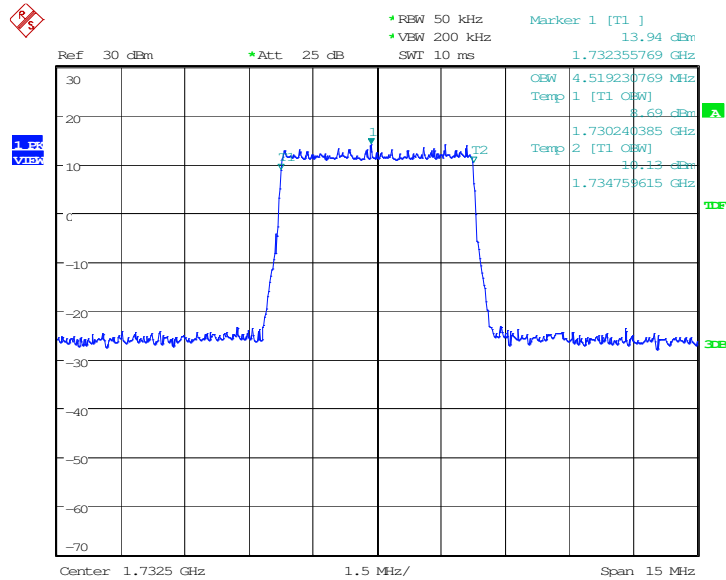


Date: 3.NOV.2015 20:46:32

### LTE band 4, 5MHz (99%)

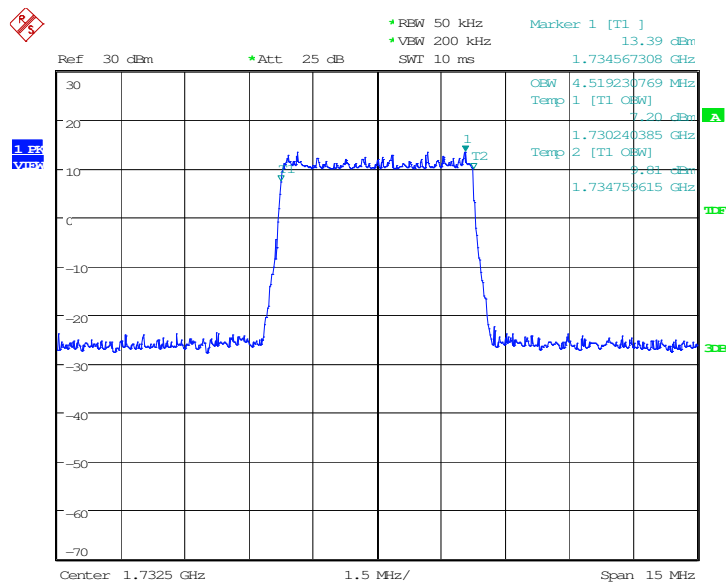
| Frequency(MHz) | Occupied Bandwidth (99%)( kHz) |         |
|----------------|--------------------------------|---------|
| 1732.5         | QPSK                           | 16QAM   |
|                | 4519.23                        | 4519.23 |

### LTE band 4, 5MHz Bandwidth, QPSK (99% BW)



Date: 3.NOV.2015 20:51:56

### LTE band 4, 5MHz Bandwidth, 16QAM (99% BW)

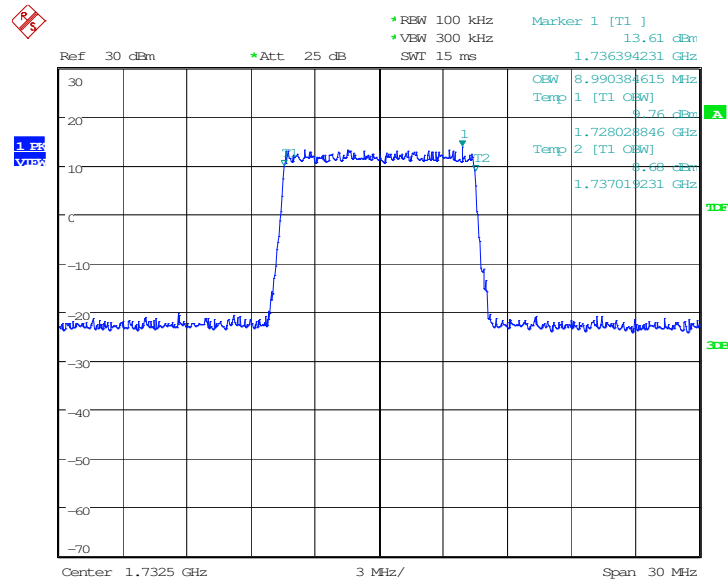


Date: 3.NOV.2015 20:52:10

### LTE band 4, 10MHz (99%)

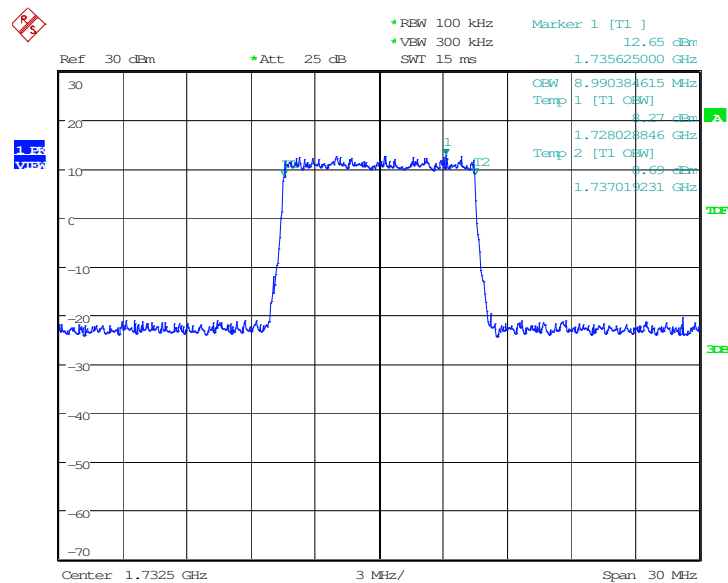
| Frequency(MHz) | Occupied Bandwidth (99%)( kHz) |         |
|----------------|--------------------------------|---------|
| 1732.5         | QPSK                           | 16QAM   |
|                | 8990.38                        | 8990.38 |

### LTE band 4, 10MHz Bandwidth, QPSK (99% BW)



Date: 3.NOV.2015 20:57:34

### LTE band 4, 10MHz Bandwidth, 16QAM (99% BW)

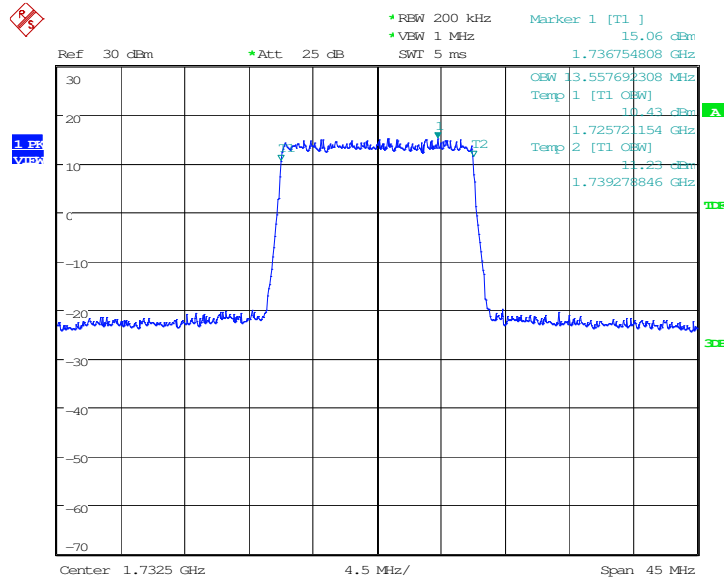


Date: 3.NOV.2015 20:57:48

### LTE band 4, 15MHz (99%)

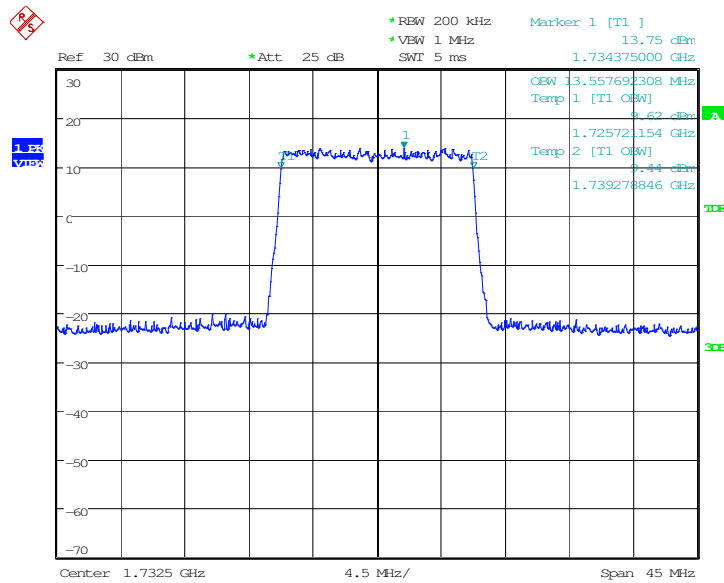
| Frequency(MHz) | Occupied Bandwidth (99%)( kHz) |          |
|----------------|--------------------------------|----------|
| 1732.5         | QPSK                           | 16QAM    |
|                | 13557.69                       | 13557.69 |

### LTE band 4, 15MHz Bandwidth, QPSK (99% BW)



Date: 3.NOV.2015 21:03:17

### LTE band 4, 15MHz Bandwidth, 16QAM (99% BW)



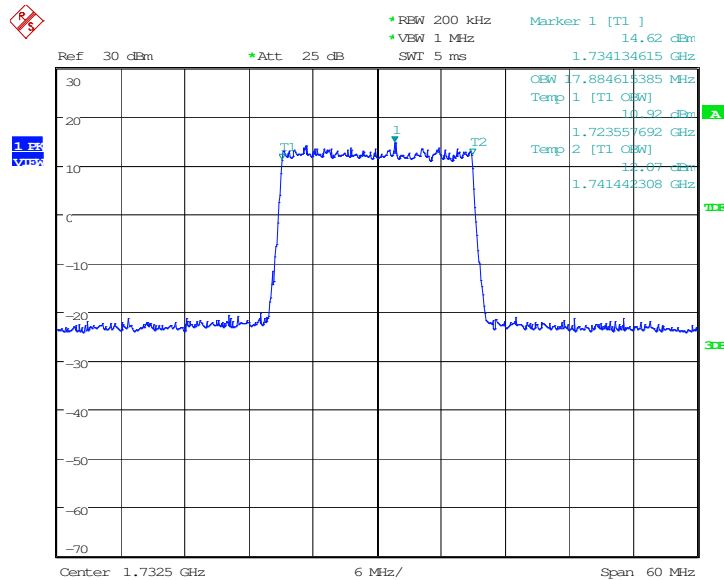
Date: 3.NOV.2015 21:03:31



### LTE band 4, 20MHz (99%)

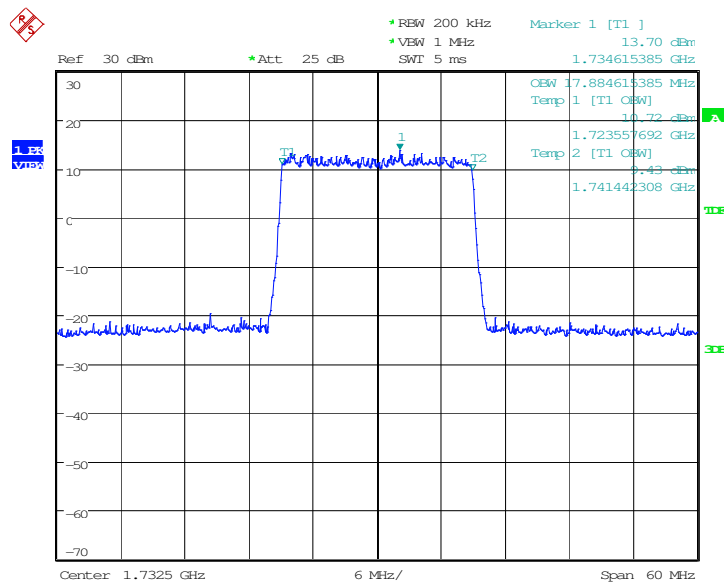
| Frequency(MHz) | Occupied Bandwidth (99%)( kHz) |          |
|----------------|--------------------------------|----------|
| 1732.5         | QPSK                           | 16QAM    |
|                | 17884.62                       | 17884.62 |

### LTE band 4, 20MHz Bandwidth, QPSK (99% BW)



Date: 3.NOV.2015 21:09:03

### LTE band 4, 20MHz Bandwidth, 16QAM (99% BW)

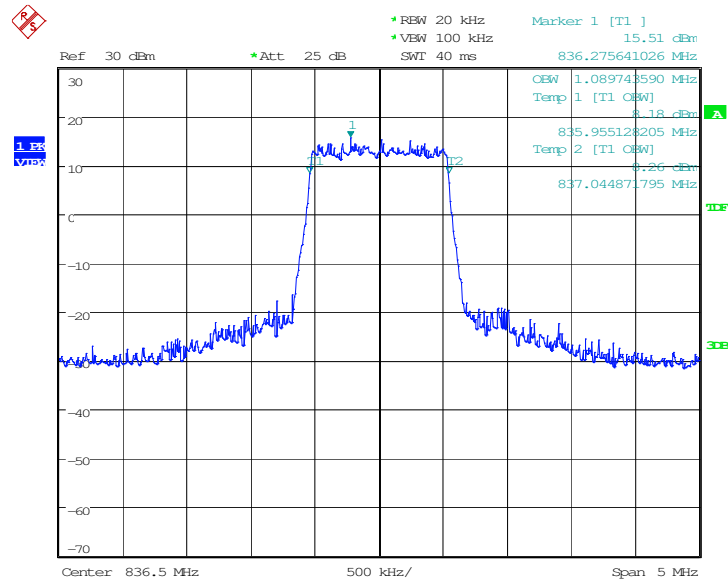


Date: 3.NOV.2015 21:09:17

### LTE band 5, 1.4MHz (99%)

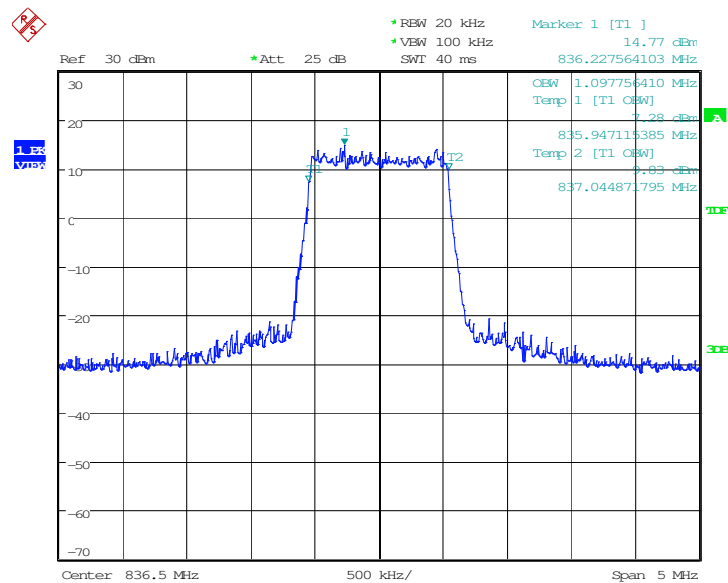
| Frequency(MHz) | Occupied Bandwidth (99%)( kHz) |         |
|----------------|--------------------------------|---------|
| 836.5          | QPSK                           | 16QAM   |
|                | 1089.74                        | 1097.76 |

### LTE band 5, 1.4MHz Bandwidth, QPSK (99% BW)



Date: 3.NOV.2015 19:44:01

### LTE band 5, 1.4MHz Bandwidth, 16QAM (99% BW)

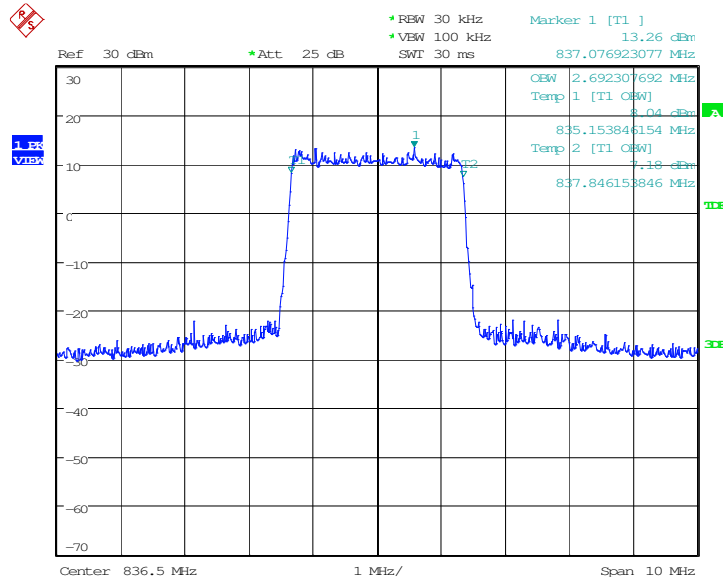


Date: 3.NOV.2015 19:44:15

### LTE band 5, 3MHz (99%)

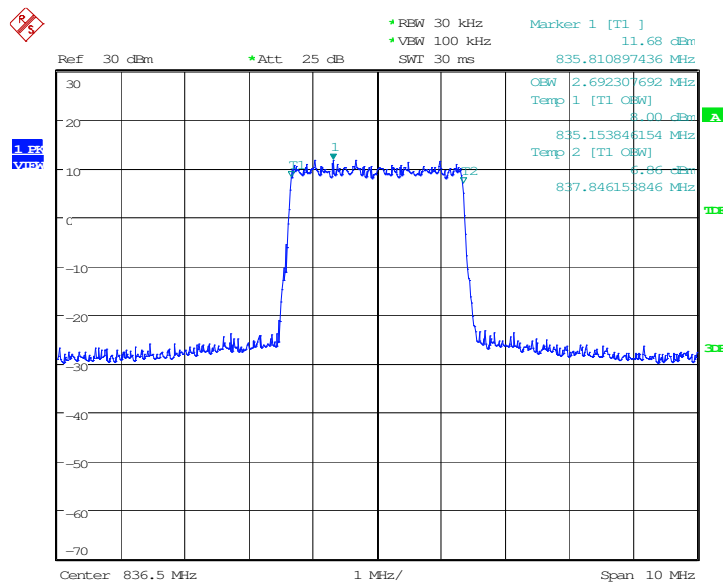
| Frequency(MHz) | Occupied Bandwidth (99%)( kHz) |         |
|----------------|--------------------------------|---------|
| 836.5          | QPSK                           | 16QAM   |
|                | 2692.31                        | 2692.31 |

### LTE band 5, 3MHz Bandwidth, QPSK (99% BW)



Date: 3.NOV.2015 19:49:39

### LTE band 5, 3MHz Bandwidth, 16QAM (99% BW)

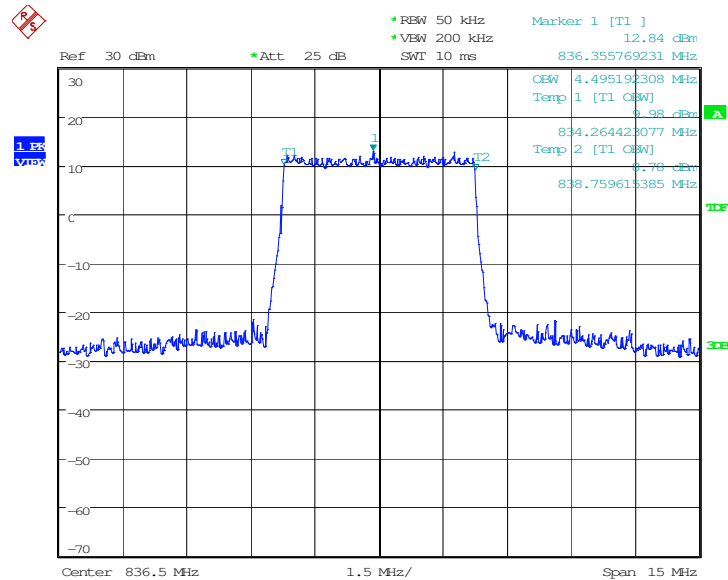


Date: 3.NOV.2015 19:49:52

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

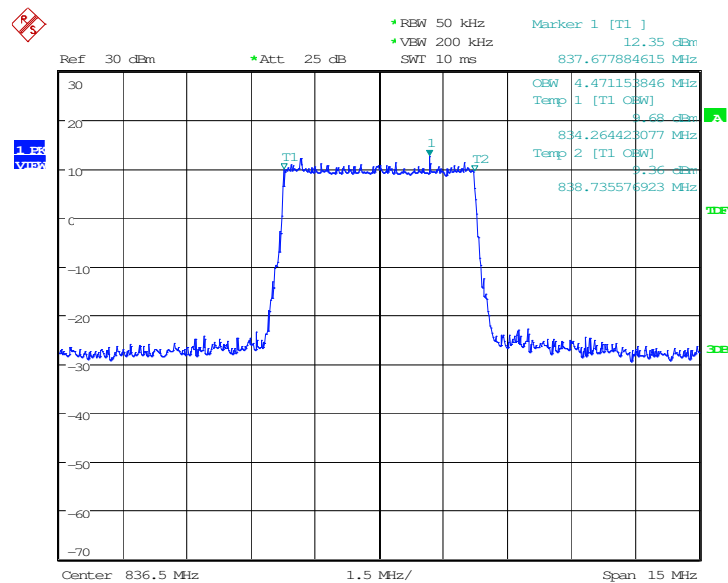
| Frequency(MHz) | Occupied Bandwidth (99%)( kHz) |         |
|----------------|--------------------------------|---------|
| 836.5          | QPSK                           | 16QAM   |
|                | 4495.19                        | 4471.15 |

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



Date: 3.NOV.2015 19:55:16

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



Date: 3.NOV.2015 19:55:30

|                |                                |         |
|----------------|--------------------------------|---------|
| Frequency(MHz) | Occupied Bandwidth (99%)( kHz) |         |
| 836.5          | QPSK                           | 16QAM   |
|                | 8990.38                        | 8990.38 |

\*RBW 100 kHz  
 \*VEW 300 kHz  
 SWT 15 ms

Ref 30 dBm  
 \*Att 25 dB

Marker 1 [T1]  
 13.12 dBm  
 835.153846154 MHz

OEW 8.990384615 Mhz  
 Temp 1 [T1 OEW]  
 0.95 dBm  
 832.028846154 Mhz  
 Temp 2 [T1 OEW]  
 0.69 dBm  
 841.019230769 Mhz

Center 836.5 MHz  
 3 MHz/  
 Span 30 MHz

Date: 3.NOV.2015 20:00:54

The image shows a Keysight E67 Series Spectrum Analyzer interface. The main display area shows a spectrum plot with a blue trace. The y-axis represents power in dBm, ranging from -70 to 30. The x-axis represents frequency in MHz, with a center frequency of 836.5 MHz and a span of 30 MHz. The plot shows a noise floor at approximately -25 dBm and a signal with two markers, T1 and T2, at approximately 832.0 MHz and 841.0 MHz respectively. The signal level is around 10 dBm. The right side of the screen displays a table of data for the two markers.

| Marker | Freq              | Power     | Temp              |
|--------|-------------------|-----------|-------------------|
| 1 [T1] | 832.028846154 MHz | -7.79 dBm | 8.990384615 MHz   |
| 2 [T2] | 841.019230769 MHz | -7.87 dBm | 841.019230769 MHz |

Settings displayed on the left side of the screen include:

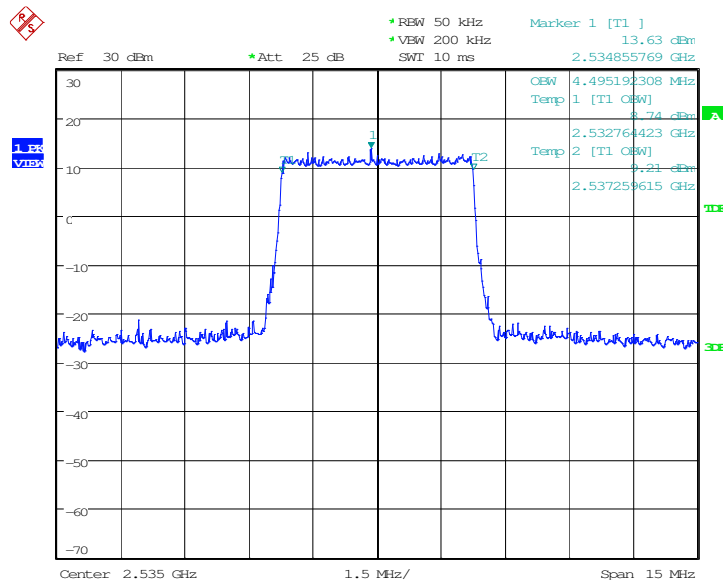
- Ref: 30 dBm
- Att: 25 dB
- REW: 100 kHz
- VEW: 300 kHz
- SWT: 15 ms
- Marker 1: [T1]
- Center: 836.5 MHz
- Span: 30 MHz

Date: 3.NOV.2015 20:01:08

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

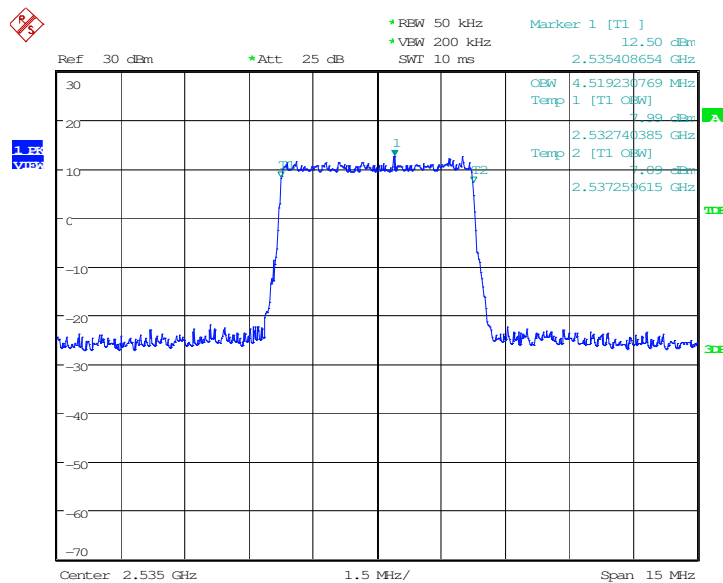
| Frequency(MHz) | Occupied Bandwidth (99%)( kHz) |         |
|----------------|--------------------------------|---------|
| 2535.0         | QPSK                           | 16QAM   |
|                | 4495.19                        | 4519.23 |

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



Date: 3.NOV.2015 19:21:04

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

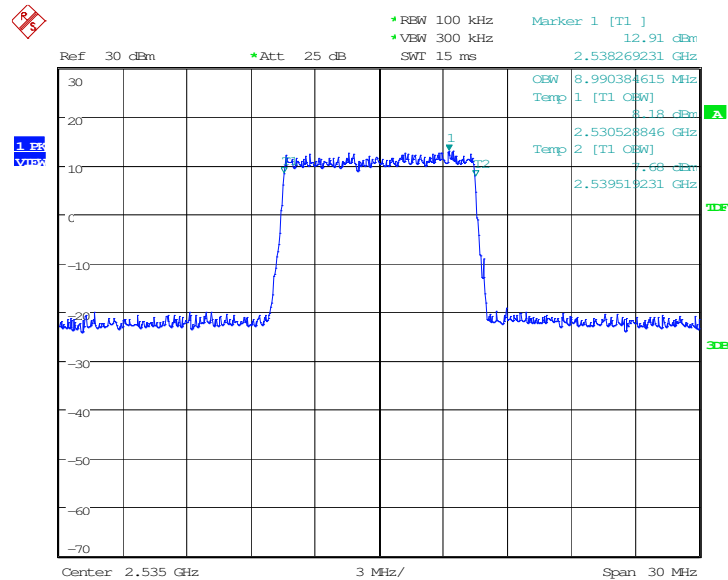


Date: 3.NOV.2015 19:21:19

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

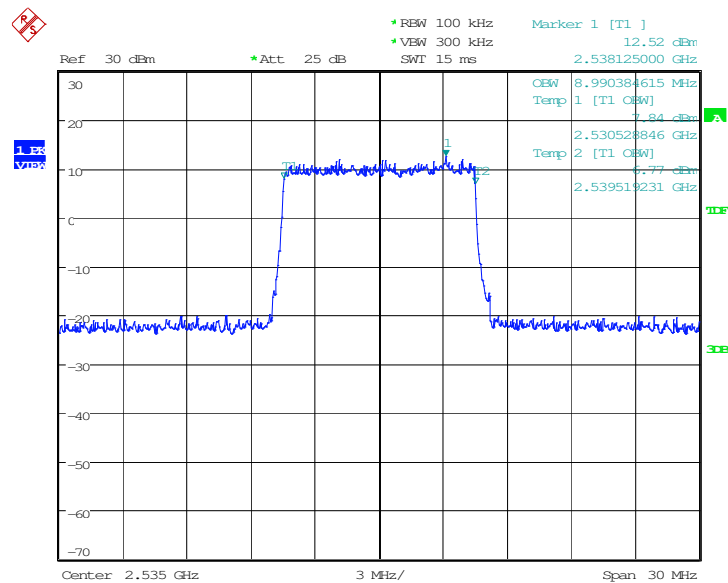
| Frequency(MHz) | Occupied Bandwidth (99%)( kHz) |         |
|----------------|--------------------------------|---------|
| 2535.0         | QPSK                           | 16QAM   |
|                | 8990.38                        | 8990.38 |

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



Date: 3.NOV.2015 19:26:47

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

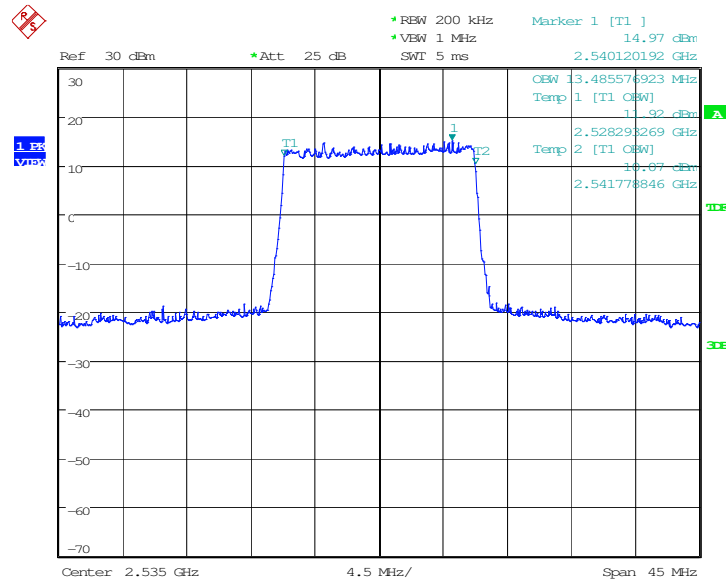


Date: 3.NOV.2015 19:27:02

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

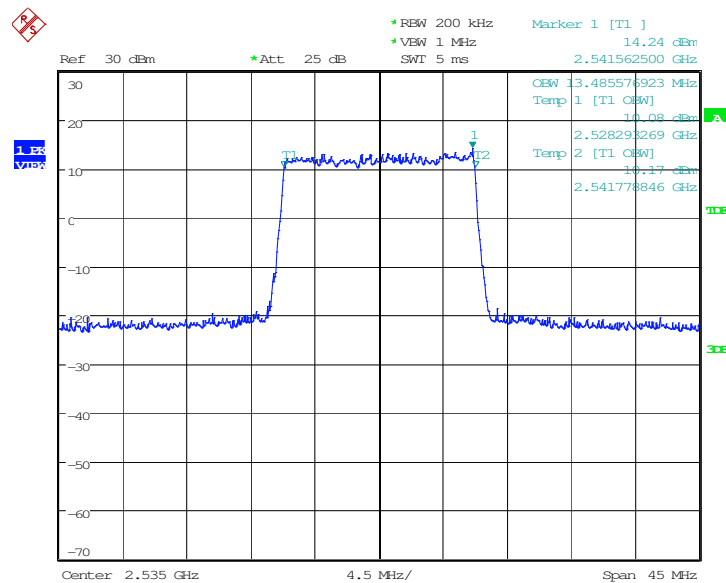
| Frequency(MHz) | Occupied Bandwidth (99%)( kHz) |          |
|----------------|--------------------------------|----------|
| 2535.0         | QPSK                           | 16QAM    |
|                | 13485.58                       | 13485.58 |

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



Date: 3.NOV.2015 19:32:33

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



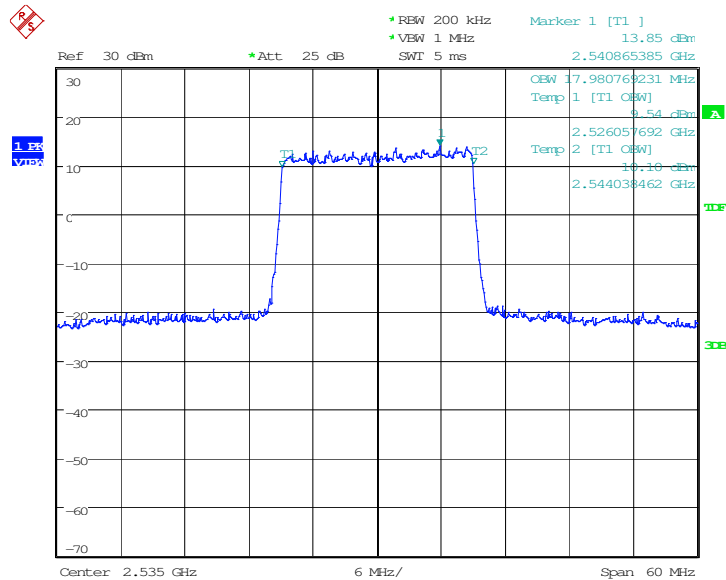
Date: 3.NOV.2015 19:32:47



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

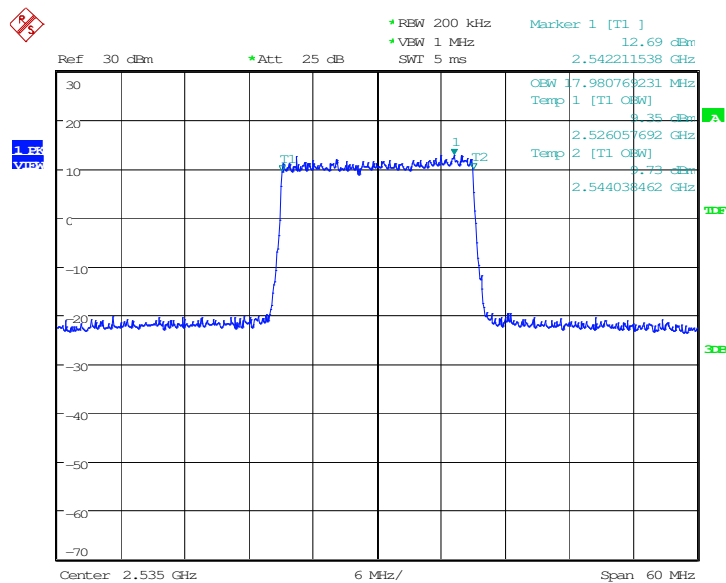
| Frequency(MHz) | Occupied Bandwidth (99%)( kHz) |          |
|----------------|--------------------------------|----------|
| 2535.0         | QPSK                           | 16QAM    |
|                | 17980.77                       | 17980.77 |

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



Date: 3.NOV.2015 19:38:19

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



Date: 3.NOV.2015 19:38:33

## A.5 EMISSION BANDWIDTH

### Reference

FCC: CFR Part 22.917(b), 24.238(a), 27.53(h), 27.53(m)

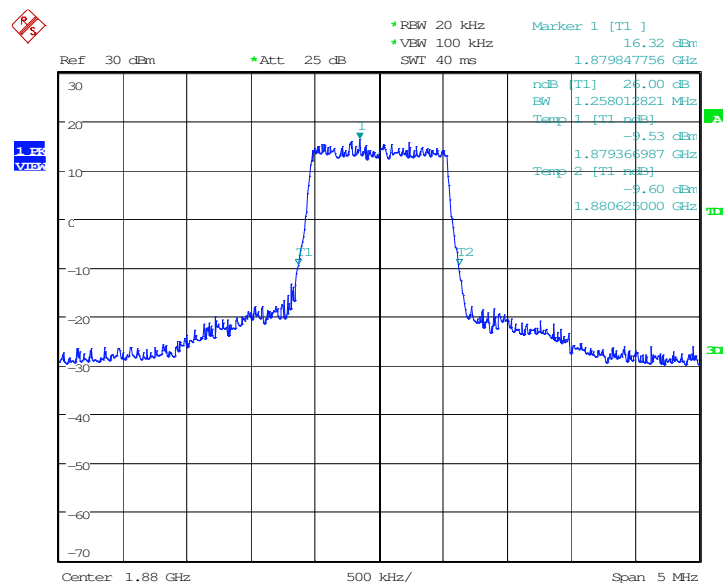
### A.5.1 Emission Bandwidth Results

The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power. Table below lists the measured -26dBc BW. Spectrum analyzer plots are included on the following pages.

#### LTE band 2, 1.4MHz (-26dBc)

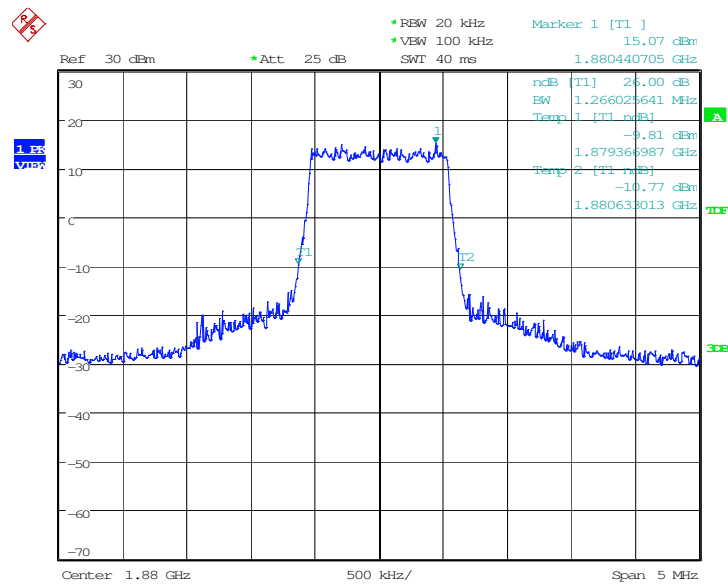
| Frequency(MHz) | Occupied Bandwidth (-26dBc)( kHz) |         |
|----------------|-----------------------------------|---------|
| 1880.0         | QPSK                              | 16QAM   |
|                | 1258.01                           | 1266.03 |

#### LTE band 2, 1.4MHz Bandwidth, QPSK (-26dBc BW)



Date: 3.NOV.2015 20:07:42

# LTE band 2, 1.4MHz Bandwidth, 16QAM (-26dBc BW)

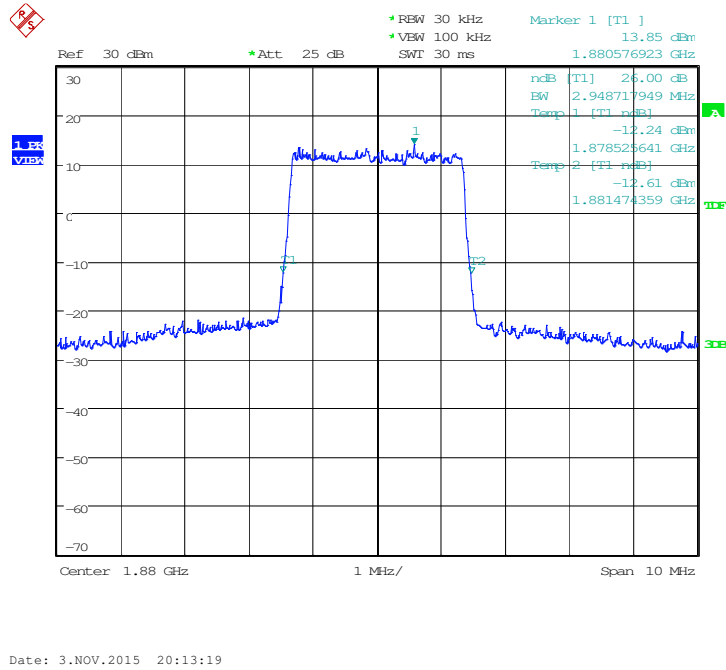


Date: 3.NOV.2015 20:07:57

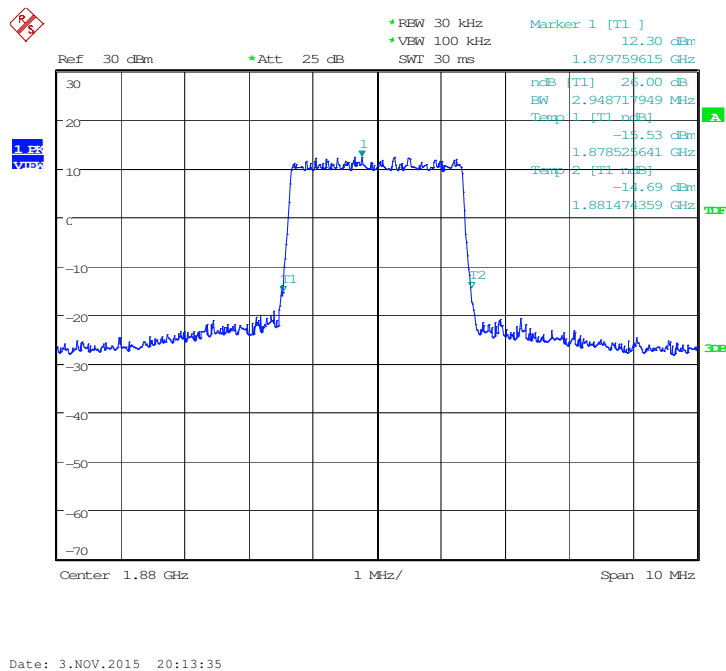
### LTE band 2, 3MHz (-26dBc)

| Frequency(MHz) | Occupied Bandwidth (-26dBc)( kHz) |         |
|----------------|-----------------------------------|---------|
| 1880.0         | QPSK                              | 16QAM   |
|                | 2948.72                           | 2948.72 |

### LTE band 2, 3MHz Bandwidth, QPSK (-26dBc BW)



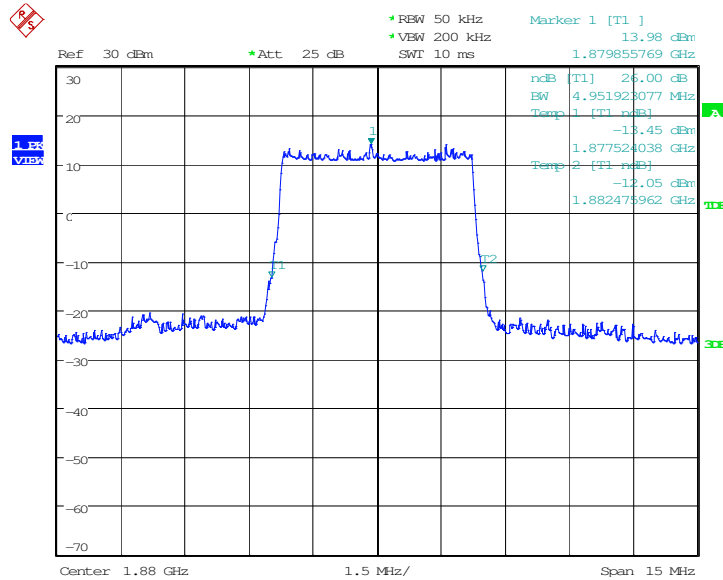
### LTE band 2, 3MHz Bandwidth, 16QAM (-26dBc BW)



### LTE band 2, 5MHz (-26dBc)

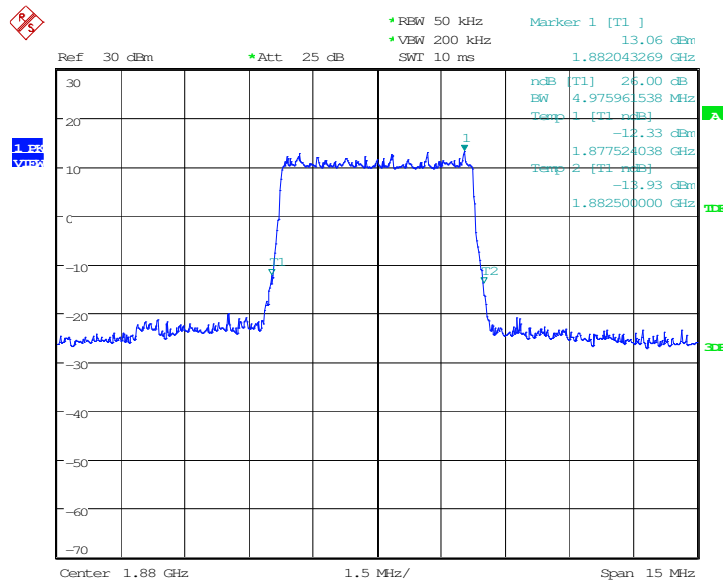
| Frequency(MHz) | Occupied Bandwidth (-26dBc)( kHz) |         |
|----------------|-----------------------------------|---------|
| 1880.0         | QPSK                              | 16QAM   |
|                | 4951.92                           | 4975.96 |

### LTE band 2, 5MHz Bandwidth, QPSK (-26dBc BW)



Date: 3.NOV.2015 20:18:57

### LTE band 2, 5MHz Bandwidth, 16QAM (-26dBc BW)

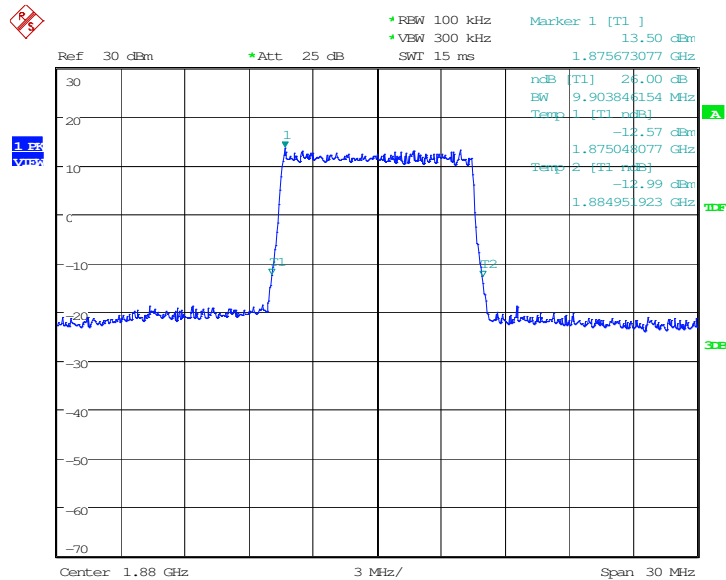


Date: 3.NOV.2015 20:19:13

### LTE band 2, 10MHz (-26dBc)

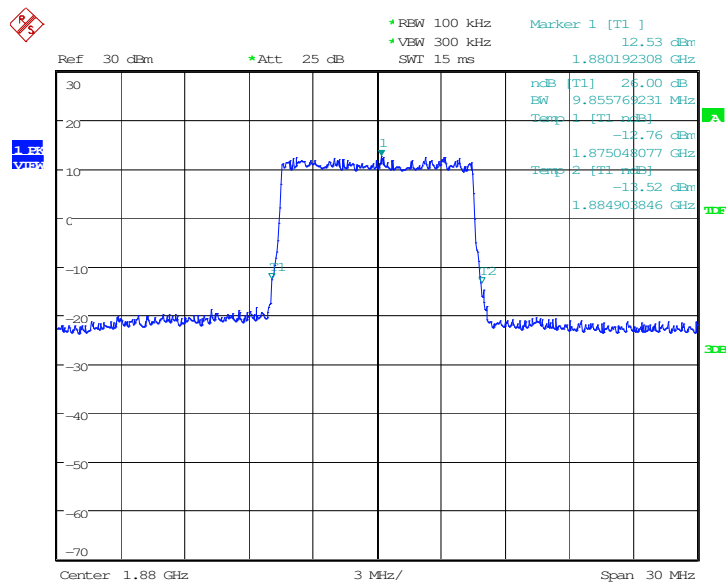
| Frequency(MHz) | Occupied Bandwidth (-26dBc)( kHz) |         |
|----------------|-----------------------------------|---------|
| 1880.0         | QPSK                              | 16QAM   |
|                | 9903.85                           | 9855.77 |

### LTE band 2, 10MHz Bandwidth, QPSK (-26dBc BW)



Date: 3.NOV.2015 20:24:35

### LTE band 2, 10MHz Bandwidth, 16QAM (-26dBc BW)

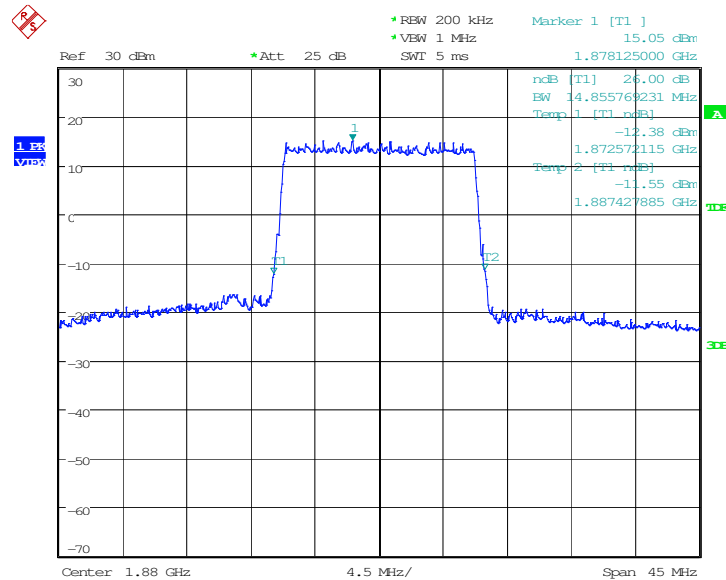


Date: 3.NOV.2015 20:24:51

### LTE band 2, 15MHz (-26dBc)

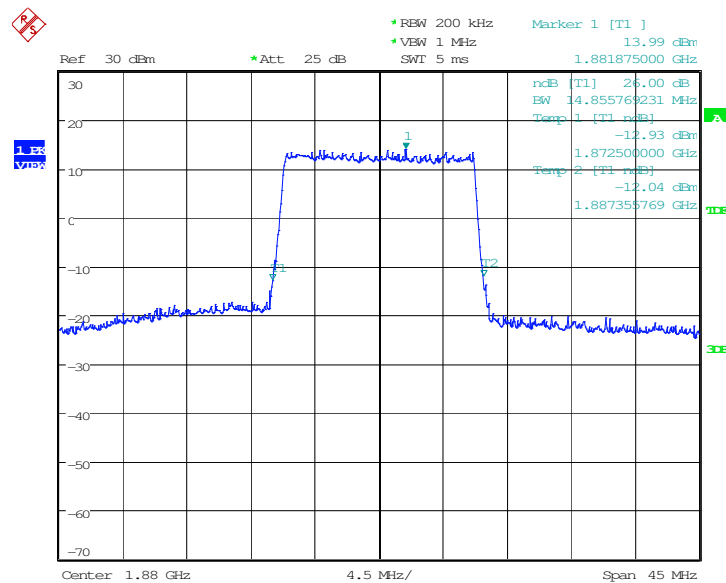
| Frequency(MHz) | Occupied Bandwidth (-26dBc)( kHz) |          |
|----------------|-----------------------------------|----------|
| 1880.0         | QPSK                              | 16QAM    |
|                | 14855.77                          | 14855.77 |

### LTE band 2, 15MHz Bandwidth, QPSK (-26dBc BW)



Date: 3.NOV.2015 20:30:18

### LTE band 2, 15MHz Bandwidth, 16QAM (-26dBc BW)

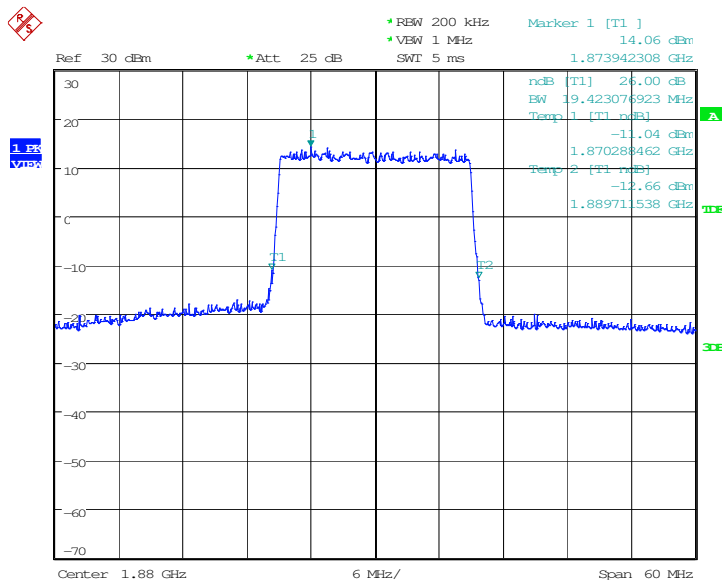


Date: 3.NOV.2015 20:30:34

### LTE band 2, 20MHz (-26dBc)

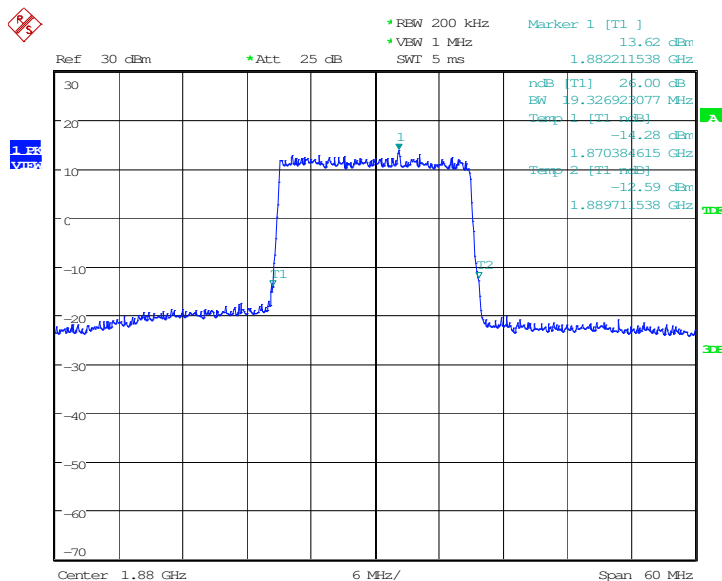
| Frequency(MHz) | Occupied Bandwidth (-26dBc)( kHz) |          |
|----------------|-----------------------------------|----------|
| 1880.0         | QPSK                              | 16QAM    |
|                | 19423.08                          | 19326.92 |

### LTE band 2, 20MHz Bandwidth, QPSK (-26dBc BW)



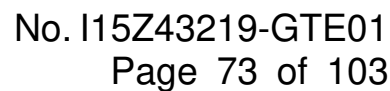
Date: 3.NOV.2015 20:36:05

### LTE band 2, 20MHz Bandwidth, 16QAM (-26dBc BW)



Date: 3.NOV.2015 20:36:20





| Frequency(MHz) | Occupied Bandwidth (-26dBc)( kHz) |         |
|----------------|-----------------------------------|---------|
| 1732.5         | QPSK                              | 16QAM   |
|                | 1274.04                           | 1274.04 |

\*RBW 20 kHz  
 \*VIEW 100 kHz  
 \*Att 25 dB  
 SWT 40 ms  
 Marker 1 [T1]  
 14.87 dBm  
 1.732516026 GHz

Ref 30 dBm  
 \*Att 25 dB  
 SWT 40 ms  
 Marker 1 [T1]  
 14.87 dBm  
 1.732516026 GHz

ncB [T1] 26.00 dB  
 BW 1.274038462 MHz  
 Temp 1 [T1 ncB]  
 -10.89 dBm  
 1.731858974 GHz  
 Temp 2 [T1 ncB]  
 -11.49 dBm  
 1.733138013 GHz

Center 1.7325 GHz  
 500 kHz/  
 Span 5 MHz

Date: 3.NOV.2015 20:41:46

\*REW 20 kHz  
 \*VEW 100 kHz  
 \*Att. 25 dB  
 \*SWT 40 ms

Marker 1 [T1]  
 14.64 dBm  
 1.732387821 GHz

Ref 30 dBm  
 30 dBm

n dB [T1] 26.00 dB  
 BW 1.274038462 MHz  
 Temp 1 [T1 n dB] -12.10 dBm  
 1.731858974 GHz  
 Temp 2 [T1 n dB] -10.80 dBm  
 1.733138013 GHz

Center 1.7325 GHz  
 500 kHz/  
 Span 5 MHz

Date: 3.NOV.2015 20:42:02

|                |                                   |         |
|----------------|-----------------------------------|---------|
| Frequency(MHz) | Occupied Bandwidth (-26dBc)( kHz) |         |
| 1732.5         | QPSK                              | 16QAM   |
|                | 2948.72                           | 2948.72 |

Ref 30 dBm      \*Att 25 dB      RBW 30 kHz      VBW 100 kHz      SWT 30 ms

Marker 1 [T1]      14.19 dBm      1.733076923 GHz

ncdB [T1] 26.00 dB  
BW 2.94871949 MHz  
Temp 1 [T1 ncdB] -12.79 dBm  
1.731025641 GHz  
Temp 2 [T2 ncdB] -12.21 dBm  
1.733974359 GHz

Center 1.7325 GHz      1 MHz/      Span 10 MHz

Date: 3.NOV.2015 20:47:24

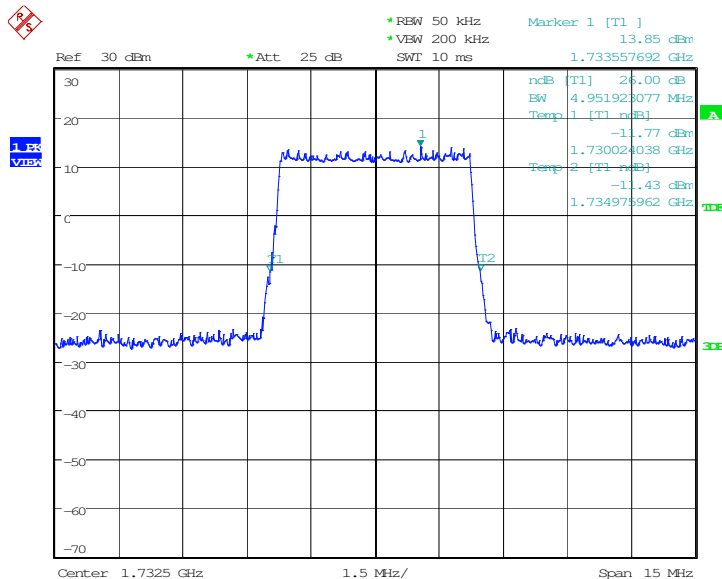
[illegible]

Date: 3.NOV.2015 20:47:40

### LTE band 4, 5MHz (-26dBc)

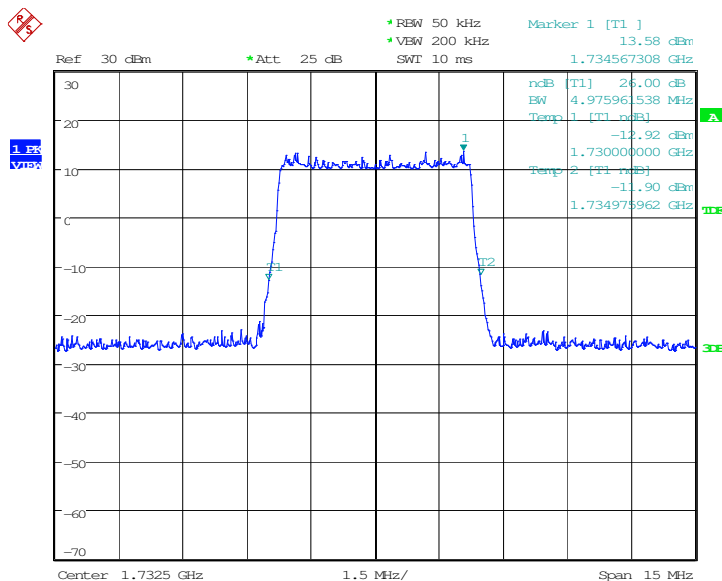
| Frequency(MHz) | Occupied Bandwidth (-26dBc)( kHz) |         |
|----------------|-----------------------------------|---------|
| 1732.5         | QPSK                              | 16QAM   |
|                | 4951.92                           | 4975.96 |

### LTE band 4, 5MHz Bandwidth, QPSK (-26dBc BW)



Date: 3.NOV.2015 20:53:02

### LTE band 4, 5MHz Bandwidth, 16QAM (-26dBc BW)

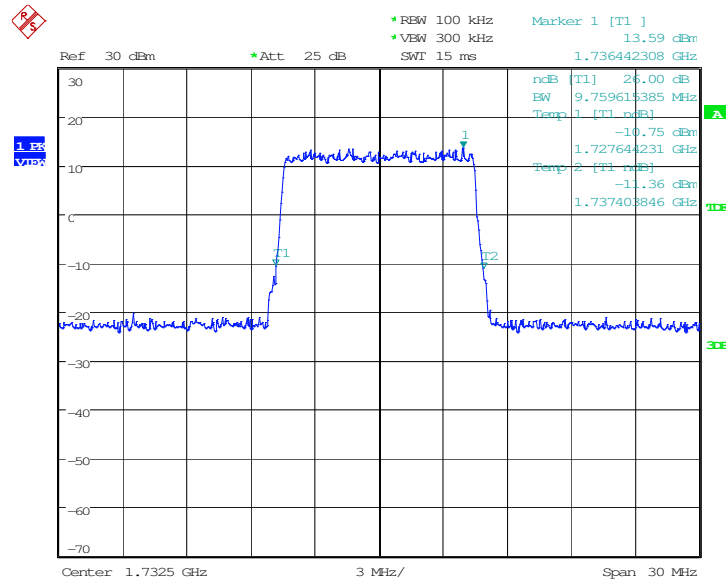


Date: 3.NOV.2015 20:53:18

### LTE band 4, 10MHz (-26dBc)

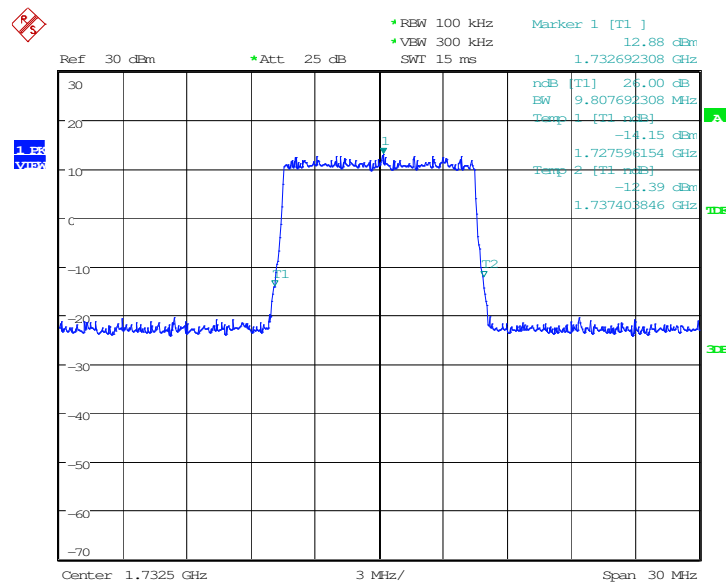
| Frequency(MHz) | Occupied Bandwidth (-26dBc)( kHz) |         |
|----------------|-----------------------------------|---------|
| 1732.5         | QPSK                              | 16QAM   |
|                | 9759.62                           | 9807.69 |

### LTE band 4, 10MHz Bandwidth, QPSK (-26dBc BW)



Date: 3.NOV.2015 20:58:40

### LTE band 4, 10MHz Bandwidth, 16QAM (-26dBc BW)

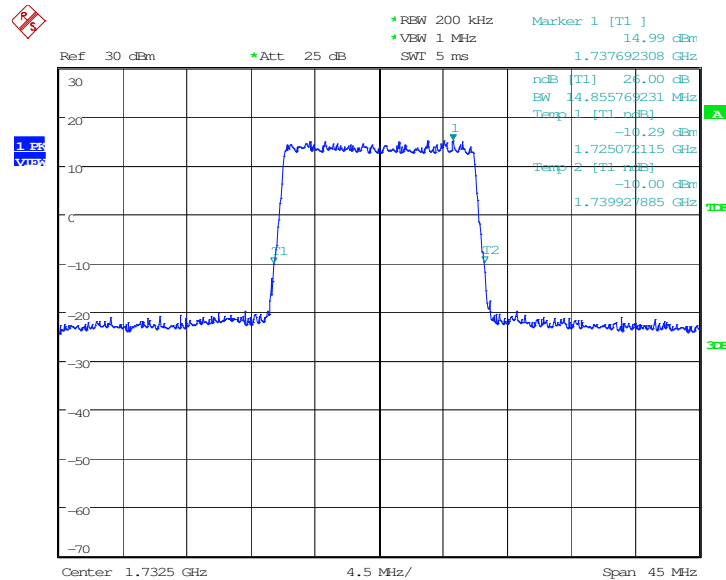


Date: 3.NOV.2015 20:58:55

### LTE band 4, 15MHz (-26dBc)

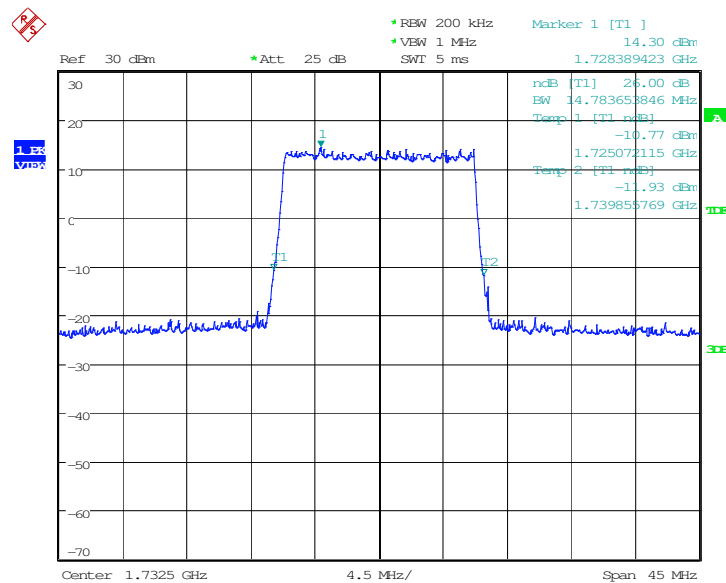
| Frequency(MHz) | Occupied Bandwidth (-26dBc)( kHz) |          |
|----------------|-----------------------------------|----------|
| 1732.5         | QPSK                              | 16QAM    |
|                | 14855.77                          | 14783.65 |

### LTE band 4, 15MHz Bandwidth, QPSK (-26dBc BW)



Date: 3.NOV.2015 21:04:23

### LTE band 4, 15MHz Bandwidth, 16QAM (-26dBc BW)

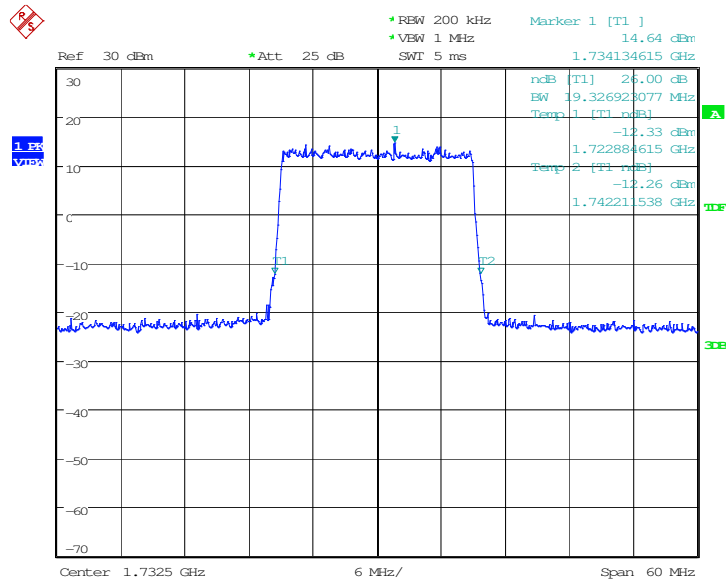


Date: 3.NOV.2015 21:04:38

### LTE band 4, 20MHz (-26dBc)

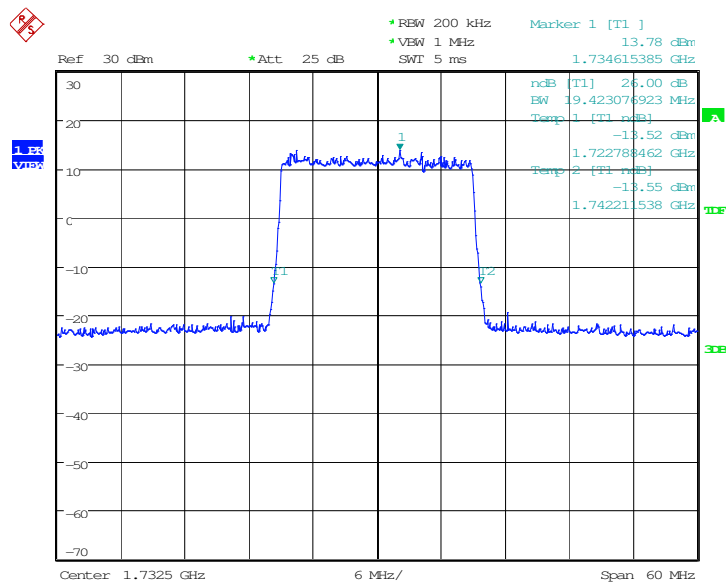
| Frequency(MHz) | Occupied Bandwidth (-26dBc)( kHz) |          |
|----------------|-----------------------------------|----------|
| 1732.5         | QPSK                              | 16QAM    |
|                | 19326.92                          | 19423.08 |

### LTE band 4, 20MHz Bandwidth, QPSK (-26dBc BW)



Date: 3.NOV.2015 21:10:09

### LTE band 4, 20MHz Bandwidth, 16QAM (-26dBc BW)

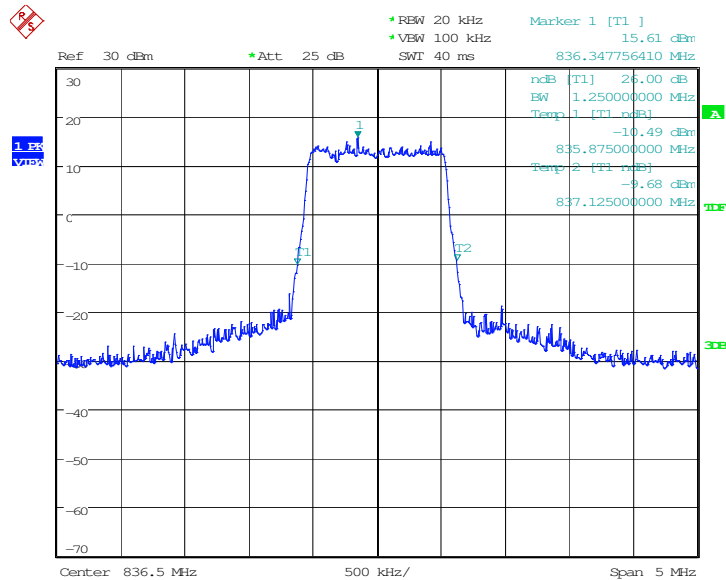


Date: 3.NOV.2015 21:10:25

### LTE band 5, 1.4MHz (-26dBc)

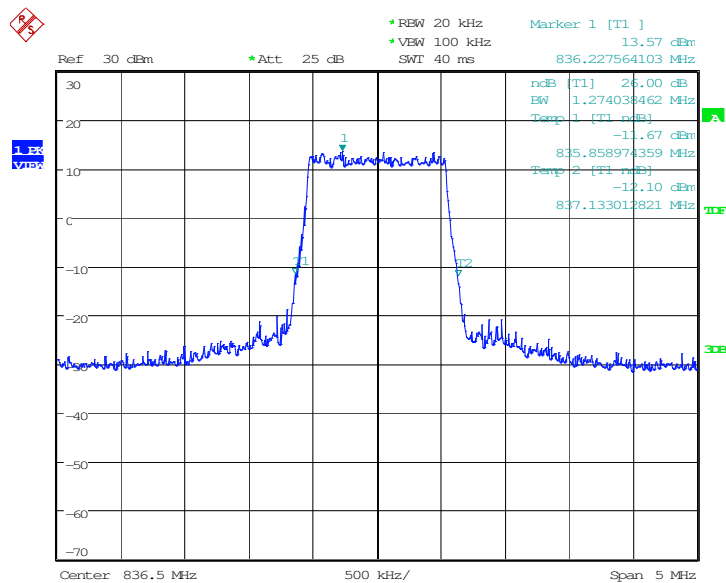
| Frequency(MHz) | Occupied Bandwidth (-26dBc)( kHz) |         |
|----------------|-----------------------------------|---------|
| 836.5          | QPSK                              | 16QAM   |
|                | 1250.00                           | 1274.04 |

### LTE band 5, 1.4MHz Bandwidth, QPSK (-26dBc BW)



Date: 3.NOV.2015 19:45:06

### LTE band 5, 1.4MHz Bandwidth, 16QAM (-26dBc BW)

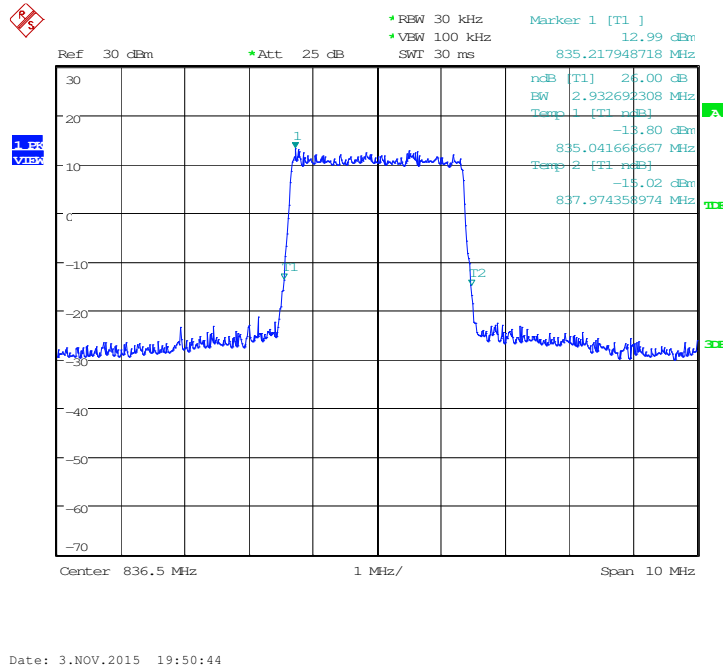


Date: 3.NOV.2015 19:45:22

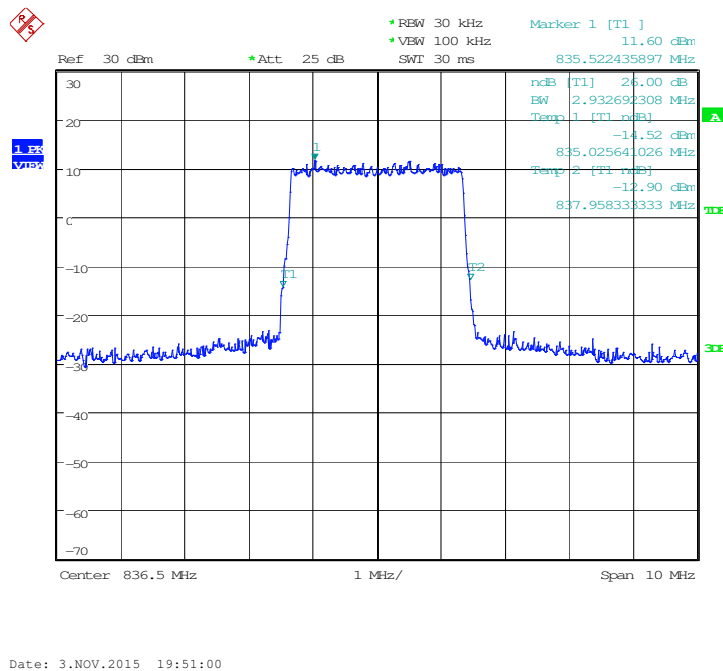
### LTE band 5, 3MHz (-26dBc)

| Frequency(MHz) | Occupied Bandwidth (-26dBc)( kHz) |         |
|----------------|-----------------------------------|---------|
| 836.5          | QPSK                              | 16QAM   |
|                | 2932.69                           | 2932.69 |

### LTE band 5, 3MHz Bandwidth, QPSK (-26dBc BW)



### LTE band 5, 3MHz Bandwidth, 16QAM (-26dBc BW)

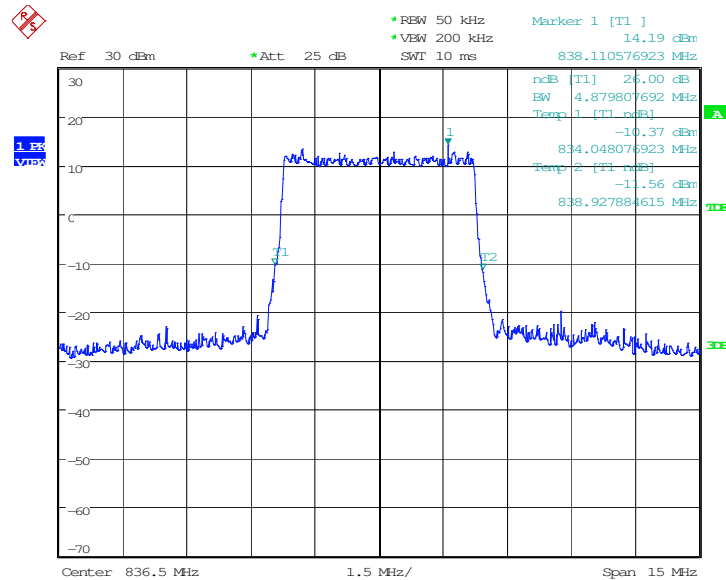




### LTE band 5, 5MHz (-26dBc)

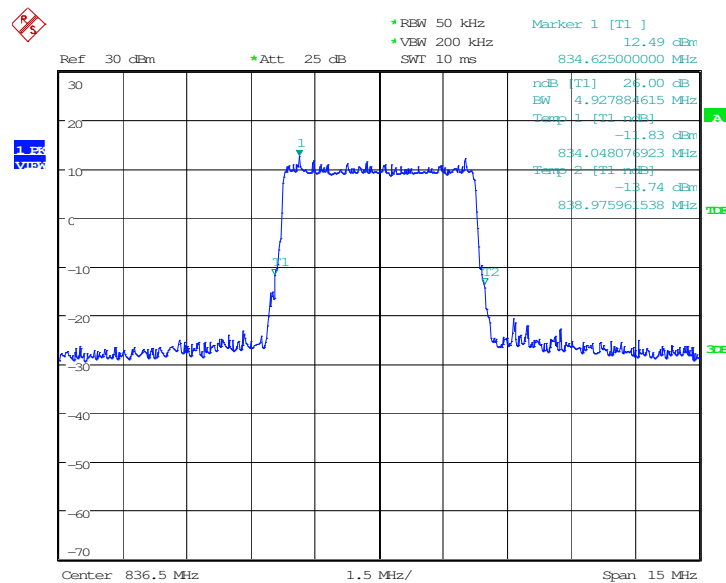
| Frequency(MHz) | Occupied Bandwidth (-26dBc)( kHz) |         |
|----------------|-----------------------------------|---------|
| 836.5          | QPSK                              | 16QAM   |
|                | 4879.81                           | 4927.88 |

### LTE band 5, 5MHz Bandwidth, QPSK (-26dBc BW)



Date: 3.NOV.2015 19:56:22

### LTE band 5, 5MHz Bandwidth, 16QAM (-26dBc BW)

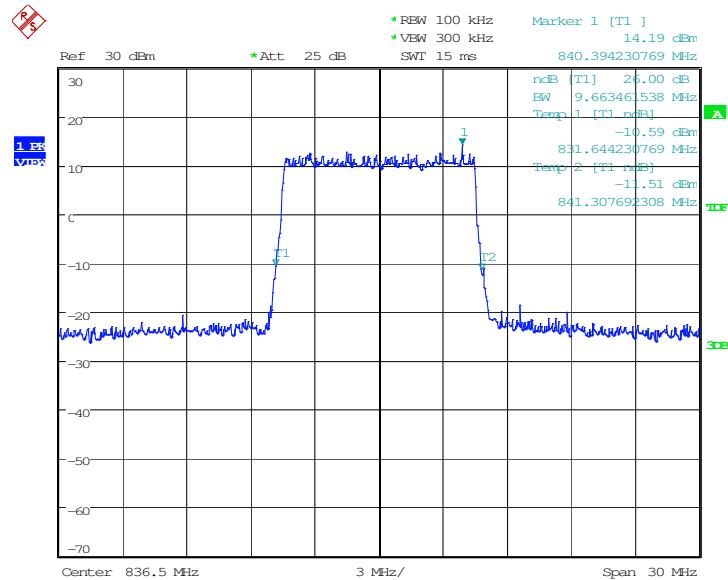


Date: 3.NOV.2015 19:56:38

### LTE band 5, 10MHz (-26dBc)

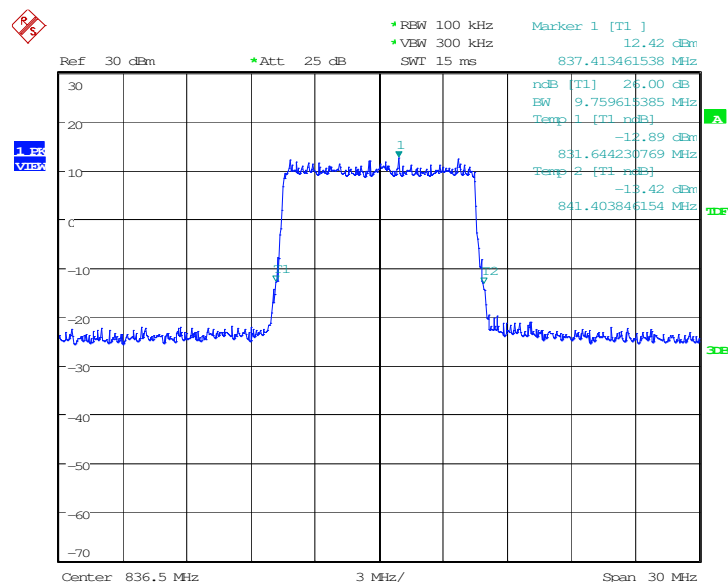
| Frequency(MHz) | Occupied Bandwidth (-26dBc)( kHz) |         |
|----------------|-----------------------------------|---------|
| 836.5          | QPSK                              | 16QAM   |
|                | 9663.46                           | 9759.62 |

### LTE band 5, 10MHz Bandwidth, QPSK (-26dBc BW)



Date: 3.NOV.2015 20:02:00

### LTE band 5, 10MHz Bandwidth, 16QAM (-26dBc BW)

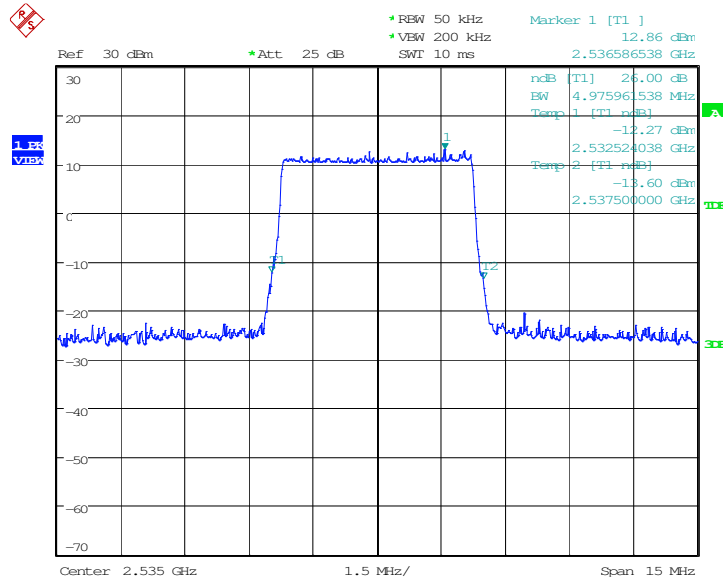


Date: 3.NOV.2015 20:02:16

### LTE band 7, 5MHz (-26dBc)

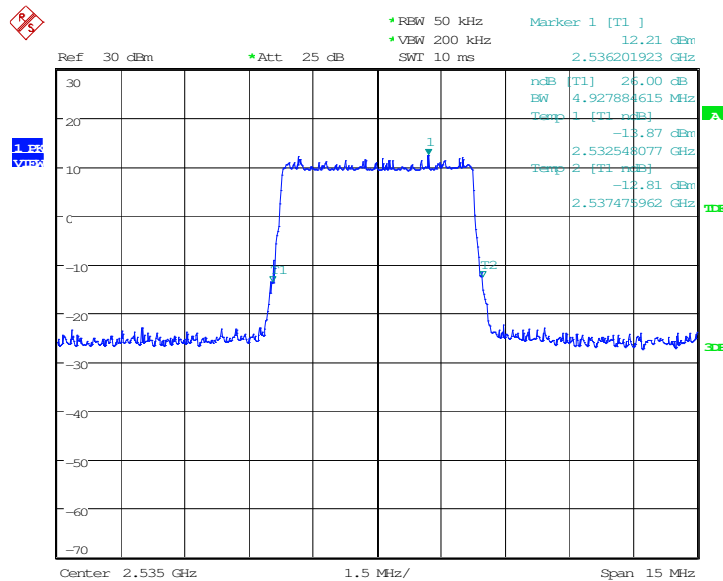
| Frequency(MHz) | Occupied Bandwidth (-26dBc)( kHz) |         |
|----------------|-----------------------------------|---------|
| 2535.0         | QPSK                              | 16QAM   |
|                | 4975.96                           | 4927.88 |

### LTE band 7, 5MHz Bandwidth, QPSK (-26dBc BW)



Date: 3.NOV.2015 19:22:13

### LTE band 7, 5MHz Bandwidth, 16QAM (-26dBc BW)

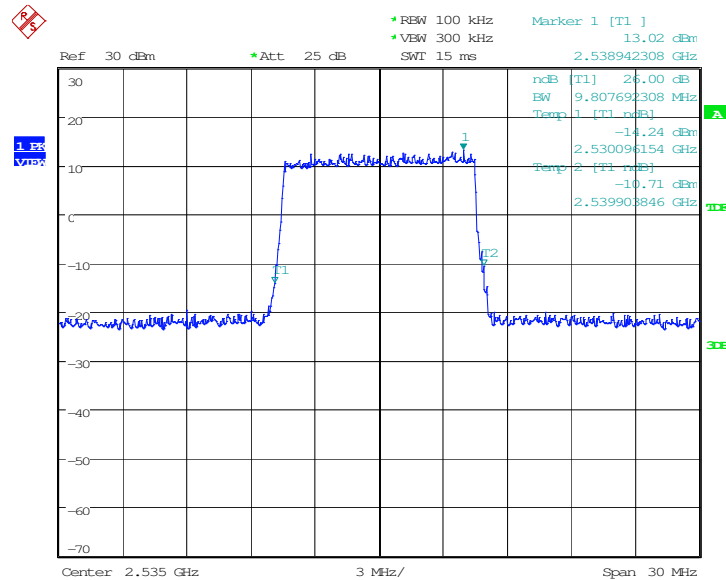


Date: 3.NOV.2015 19:22:30

### LTE band 7, 10MHz (-26dBc)

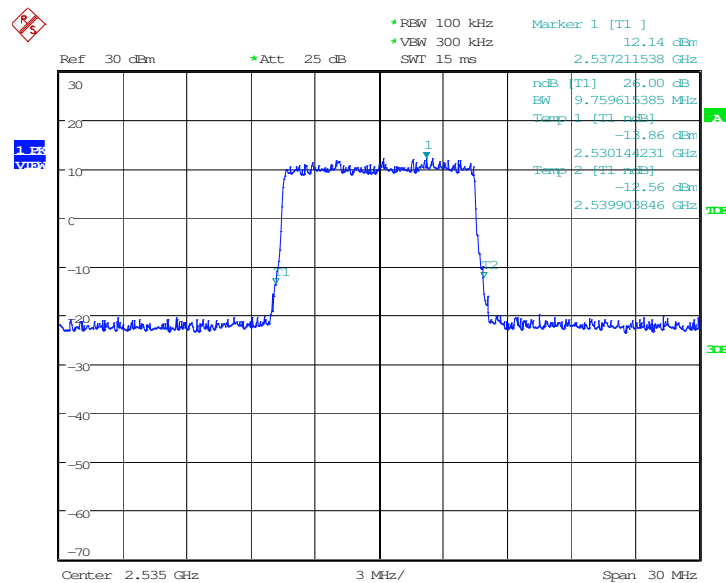
| Frequency(MHz) | Occupied Bandwidth (-26dBc)( kHz) |         |
|----------------|-----------------------------------|---------|
| 2535.0         | QPSK                              | 16QAM   |
|                | 9807.69                           | 9759.62 |

### LTE band 7, 10MHz Bandwidth, QPSK (-26dBc BW)



Date: 3.NOV.2015 19:27:56

### LTE band 7, 10MHz Bandwidth, 16QAM (-26dBc BW)

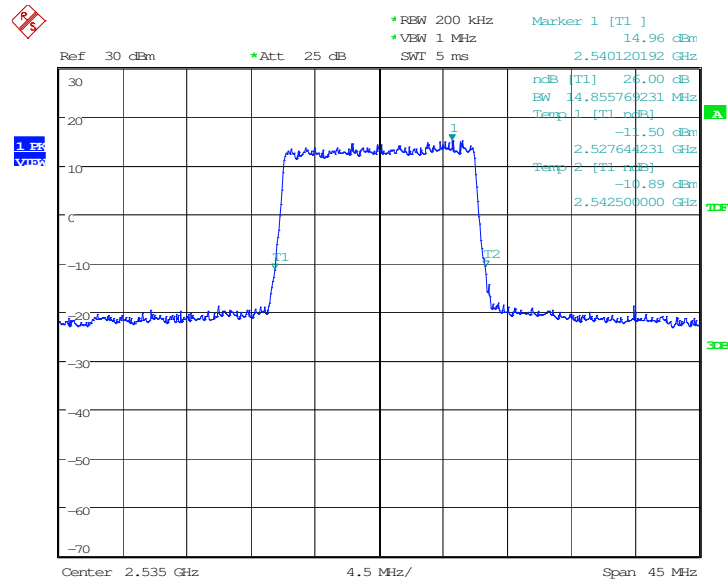


Date: 3.NOV.2015 19:28:11

### LTE band 7, 15MHz (-26dBc)

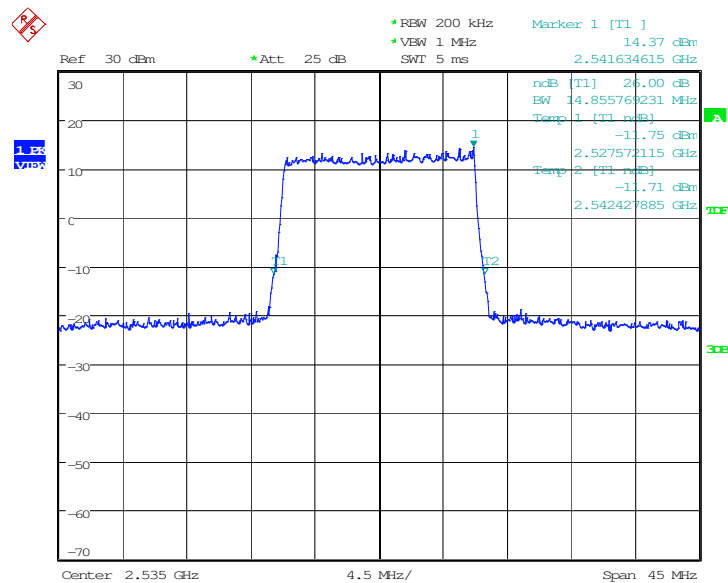
| Frequency(MHz) | Occupied Bandwidth (-26dBc)( kHz) |          |
|----------------|-----------------------------------|----------|
| 2535.0         | QPSK                              | 16QAM    |
|                | 14855.77                          | 14855.77 |

### LTE band 7, 15MHz Bandwidth, QPSK (-26dBc BW)



Date: 3.NOV.2015 19:33:39

### LTE band 7, 15MHz Bandwidth, 16QAM (-26dBc BW)

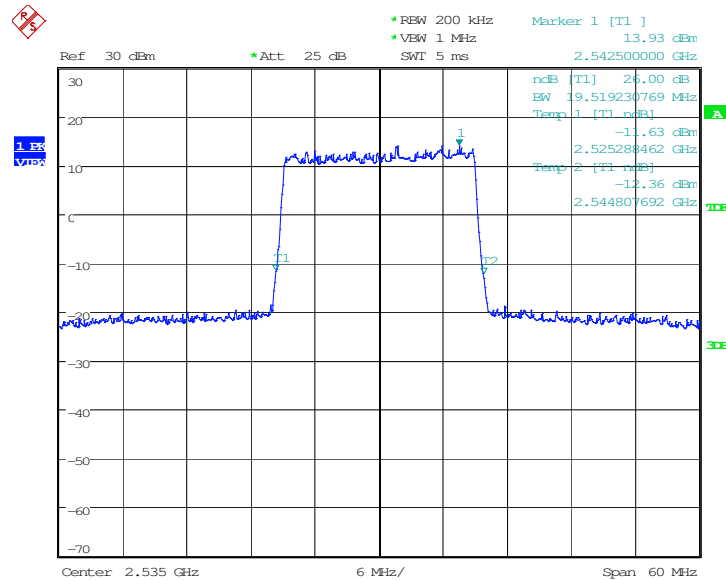


Date: 3.NOV.2015 19:33:54

### LTE band 7, 20MHz (-26dBc)

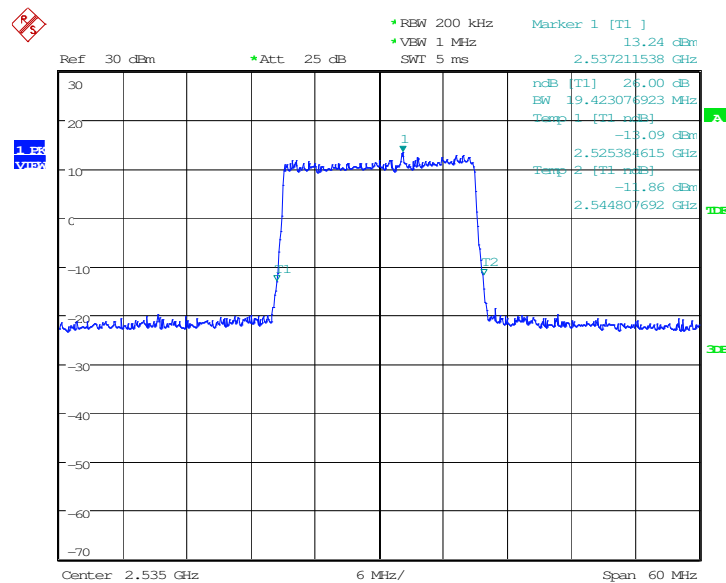
| Frequency(MHz) | Occupied Bandwidth (-26dBc)( kHz) |          |
|----------------|-----------------------------------|----------|
| 2535.0         | QPSK                              | 16QAM    |
|                | 19519.23                          | 19423.08 |

### LTE band 7, 20MHz Bandwidth, QPSK (-26dBc BW)



Date: 3.NOV.2015 19:39:25

### LTE band 7, 20MHz Bandwidth, 16QAM (-26dBc BW)



Date: 3.NOV.2015 19:39:41

## **A.6 BAND EDGE COMPLIANCE**

### **Reference**

FCC: CFR Part 22.917(b), 24.238(a), 27.53(h), 27.53(m).

#### **A.6.1 Measurement limit**

Part 22.917(b), 24.238(a), 27.53(h) state that on any frequency outside frequency band of the US Cellular/PCS 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.

According to KDB 971168 6.0, a relaxation of the reference bandwidth is often provided for measurements within a specified frequency range at the edge of the authorized frequency block/band. This is often implemented by permitting the use of a narrower RBW (typically limited to a minimum RBW of 1% of the OBW) for measuring the out-of-band emissions without a requirement to integrate the result over the full reference bandwidth.

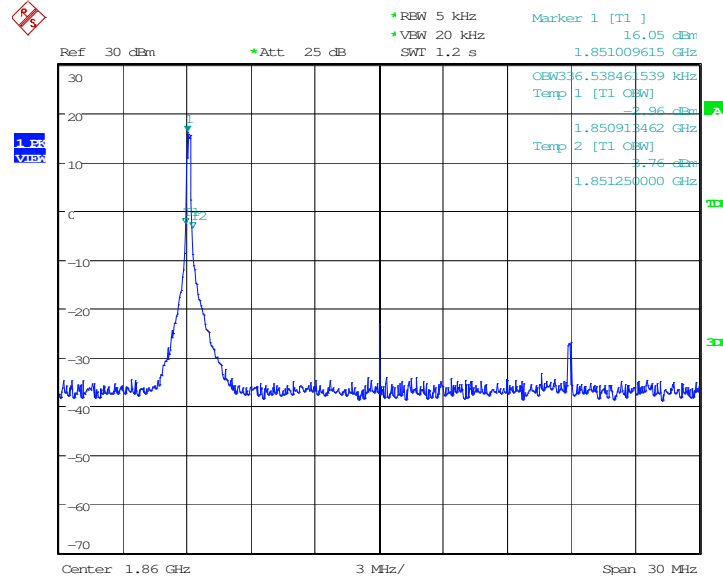
Part 27.53(m) states that for mobile digital stations, the attenuation factor shall be not less than  $40 + 10 \log(P)$  dB on all frequencies between the channel edge and 5 megahertz from the channel edge,  $43 + 10 \log(P)$  dB on all frequencies between 5 megahertz and X megahertz from the channel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

## A.6.2 Measurement result

Only worst case result is given below

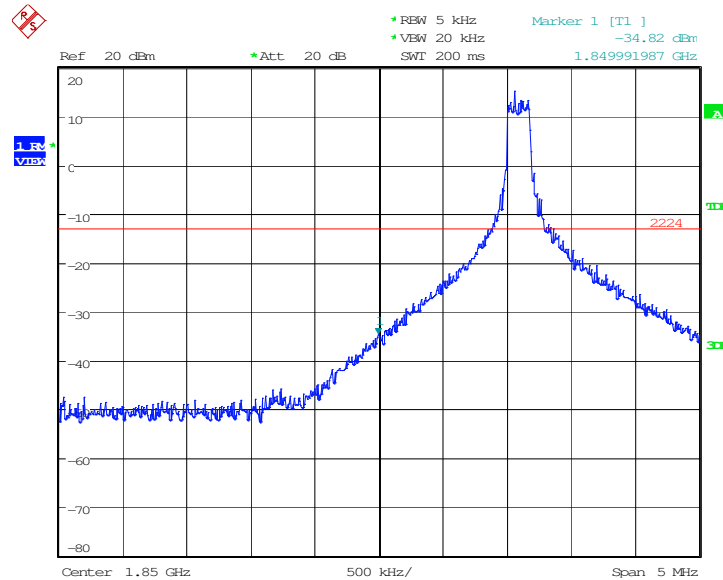
LTE band 2

OBW: 1RB-low\_offset



Date: 4.NOV.2015 19:24:47

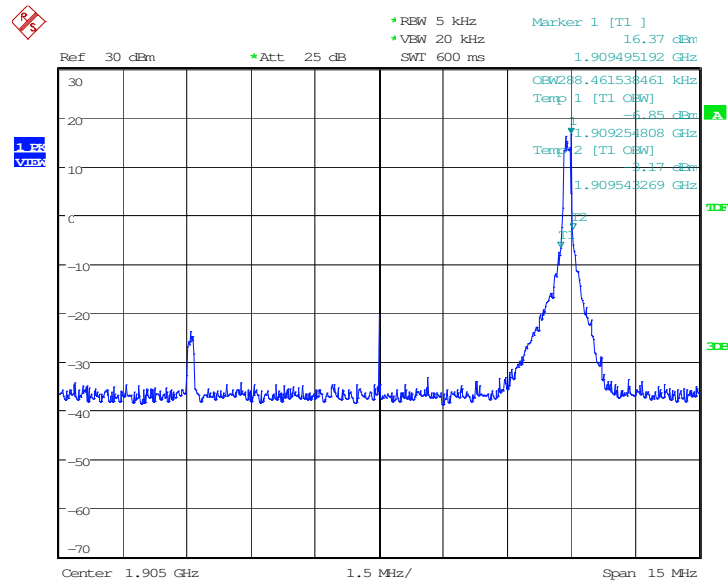
## LOW BAND EDGE BLOCK-1RB-low\_offset



Date: 4.NOV.2015 19:25:33

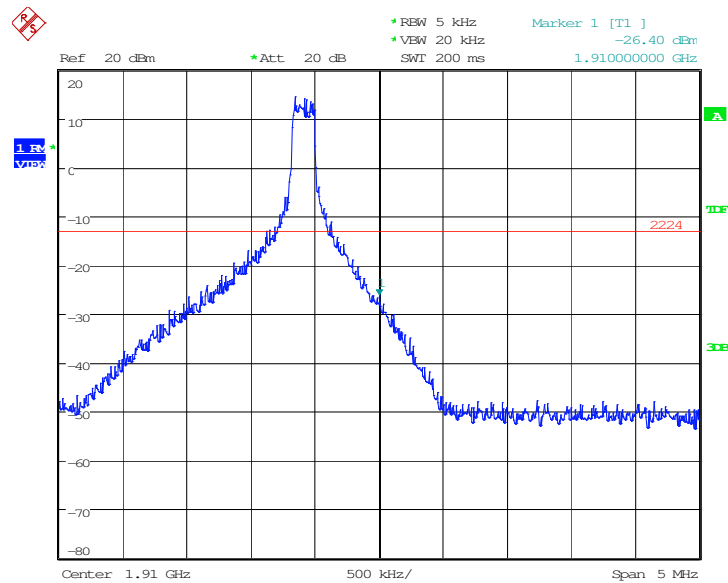


### OBW: 1RB-high\_offset



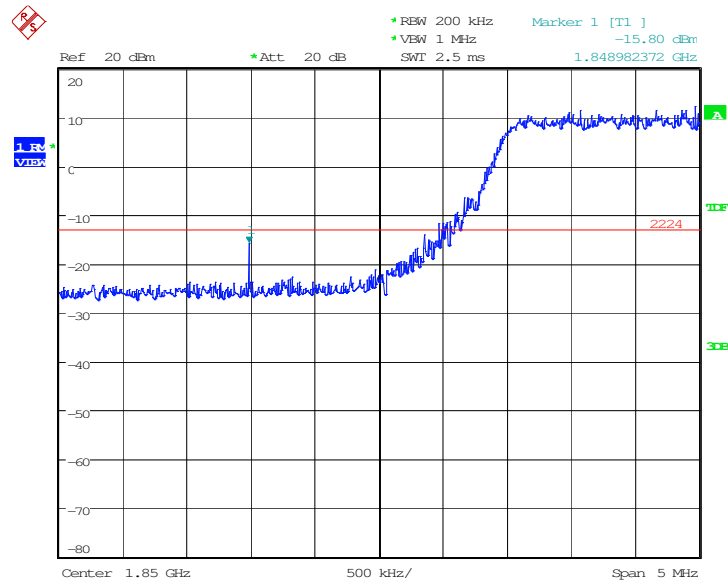
Date: 4.NOV.2015 19:08:58

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



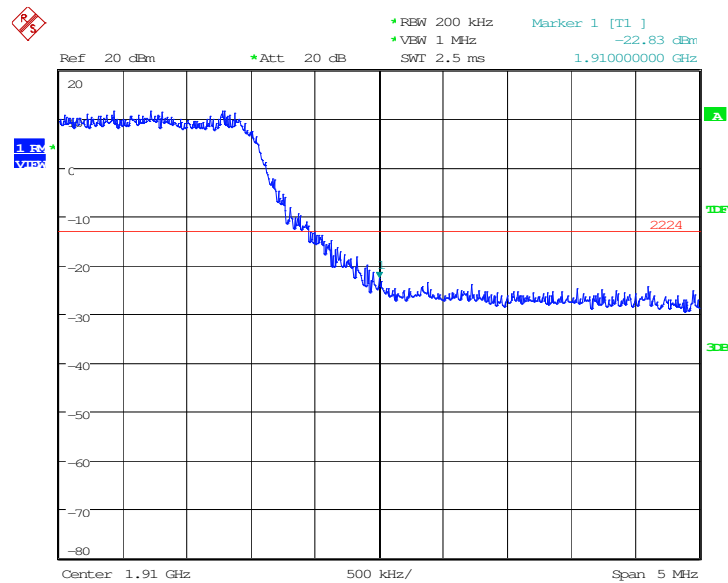
Date: 4.NOV.2015 19:09:45

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



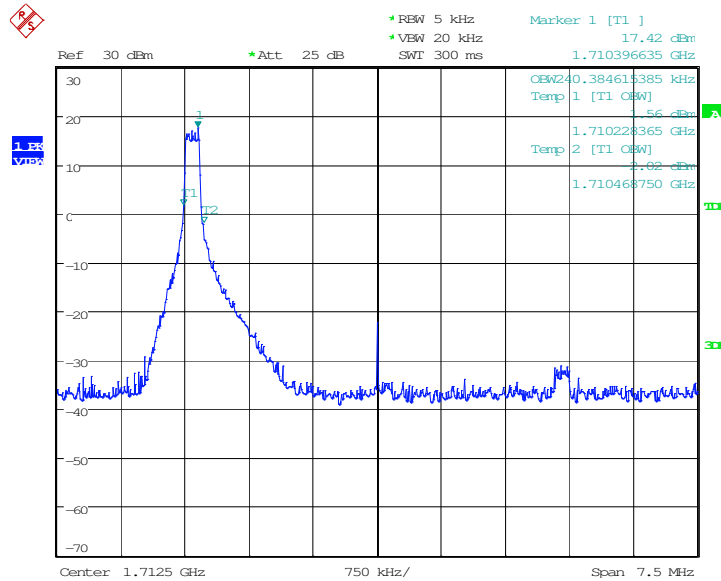
Date: 4.NOV.2015 18:25:48

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



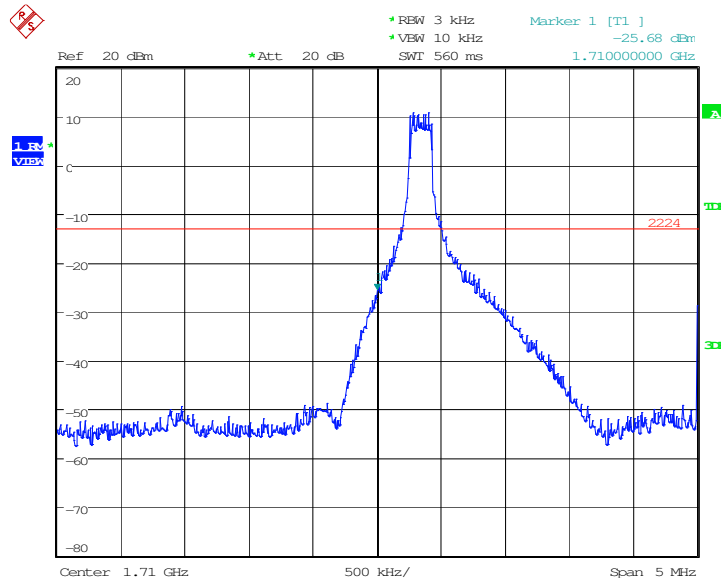
Date: 4.NOV.2015 18:26:37

## LTE band 4 OBW: 1RB-low\_offset



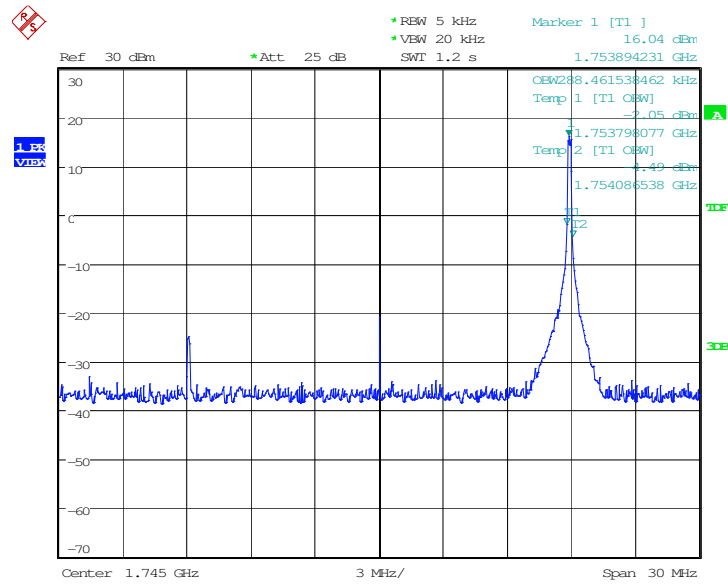
Date: 4.NOV.2015 19:20:56

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



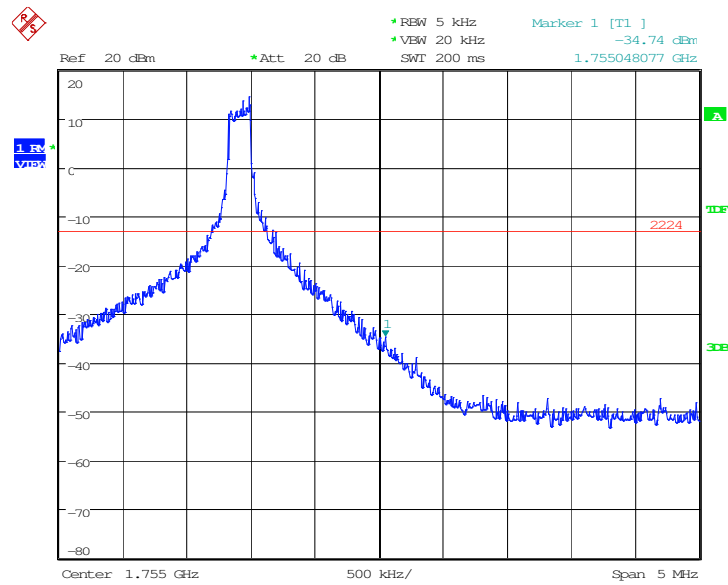
Date: 4.NOV.2015 19:21:43

### OBW: 1RB-high\_offset



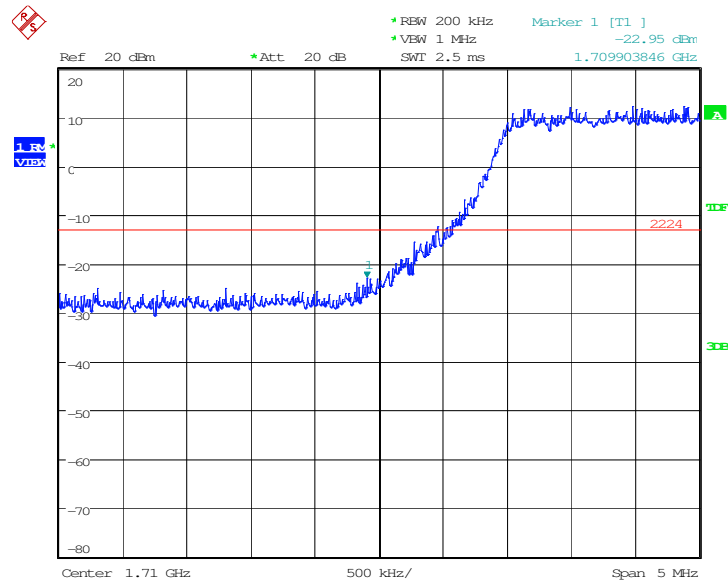
Date: 4.NOV.2015 19:04:55

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



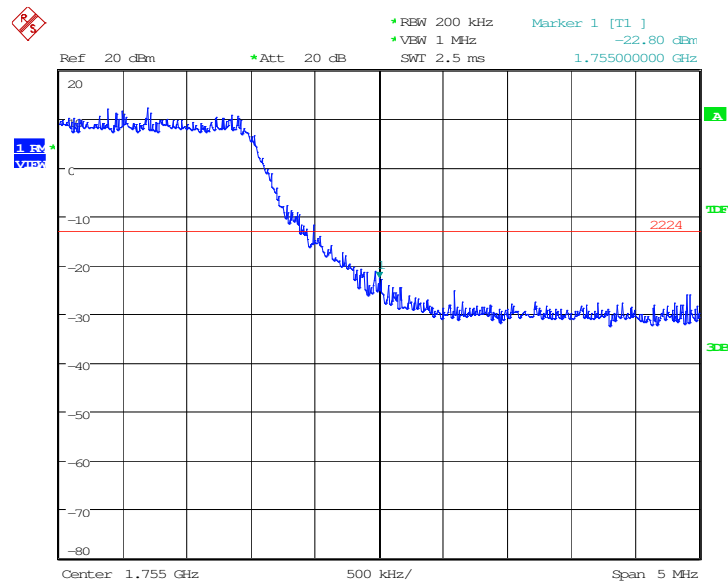
Date: 4.NOV.2015 19:05:42

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



Date: 4.NOV.2015 18:27:31

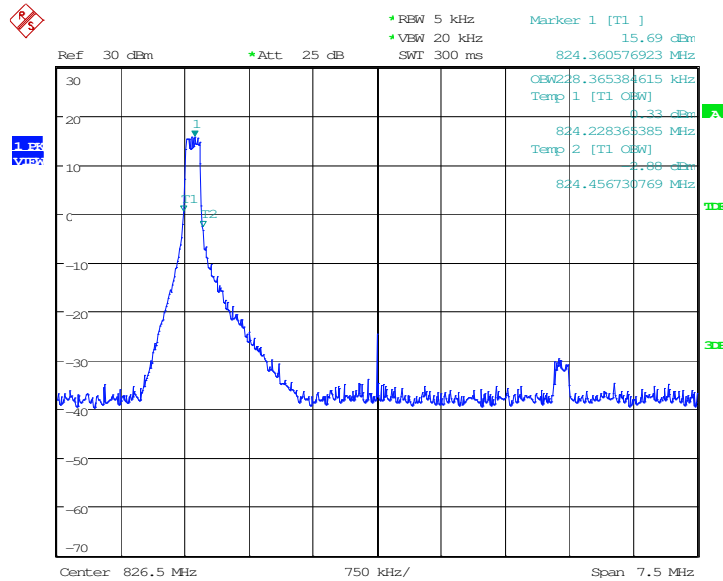
### HIGH BAND EDGE BLOCK-20MHz-100%RB



Date: 4.NOV.2015 18:28:19

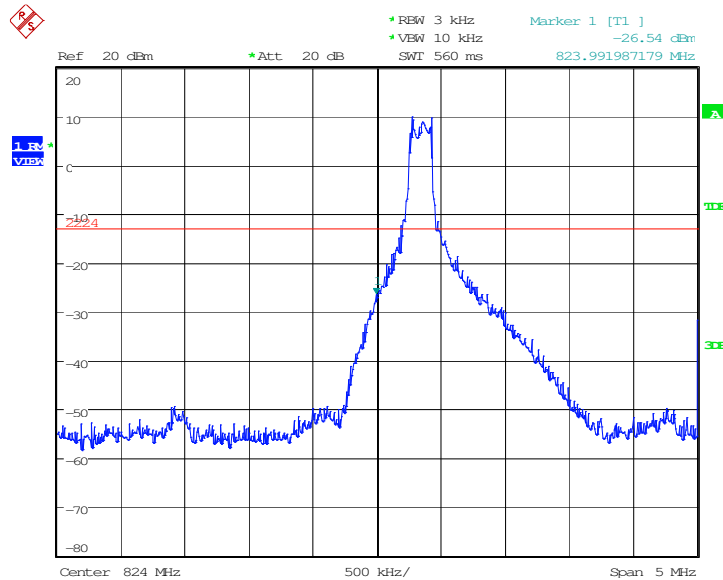
## LTE band 5

### OBW: 1RB-low\_offset



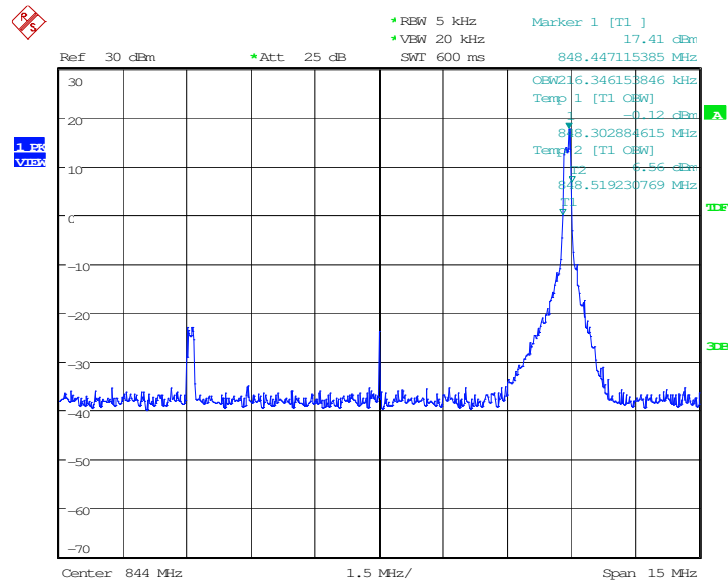
Date: 4.NOV.2015 19:19:13

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



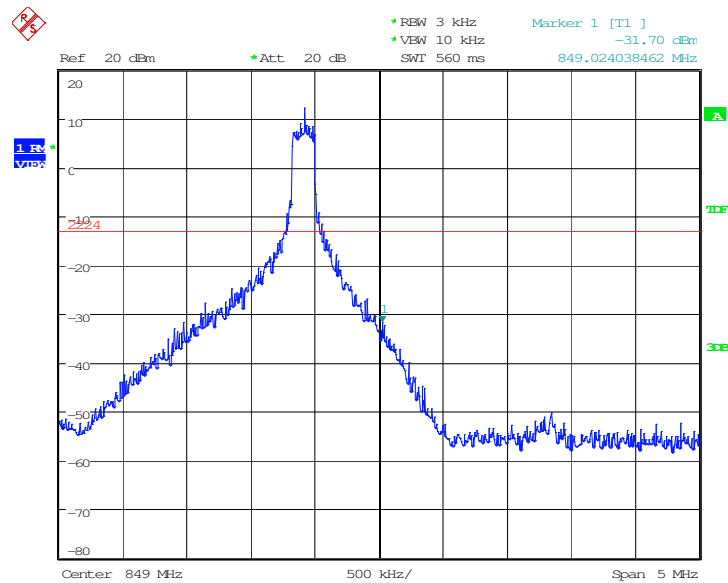
Date: 4.NOV.2015 19:19:59

### OBW: 1RB-high\_offset



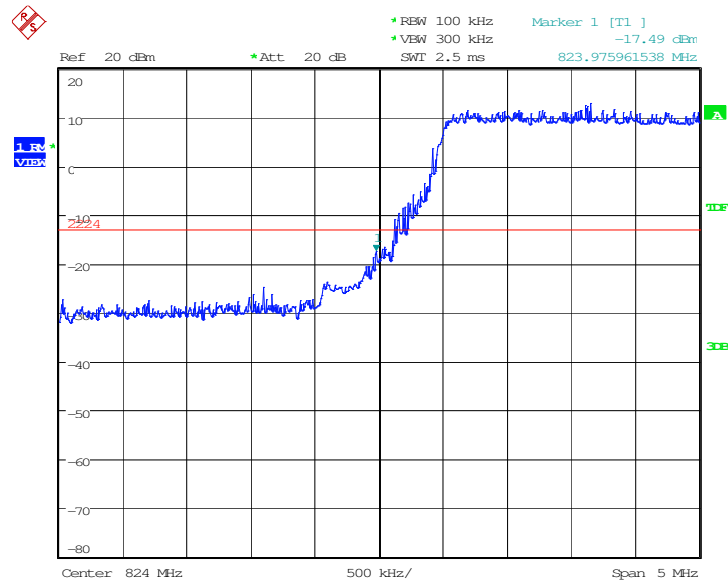
Date: 4.NOV.2015 19:07:13

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



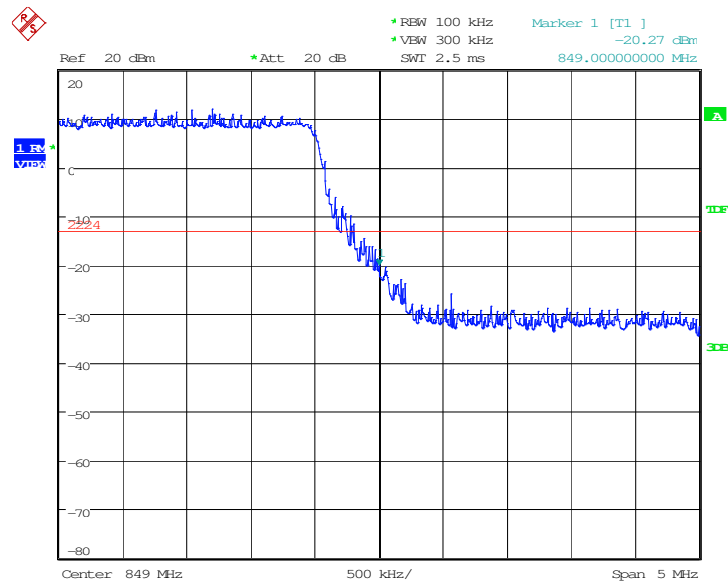
Date: 4.NOV.2015 19:08:02

### LOW BAND EDGE BLOCK-10MHz-100%RB



Date: 4.NOV.2015 18:13:34

### HIGH BAND EDGE BLOCK-10MHz-100%RB

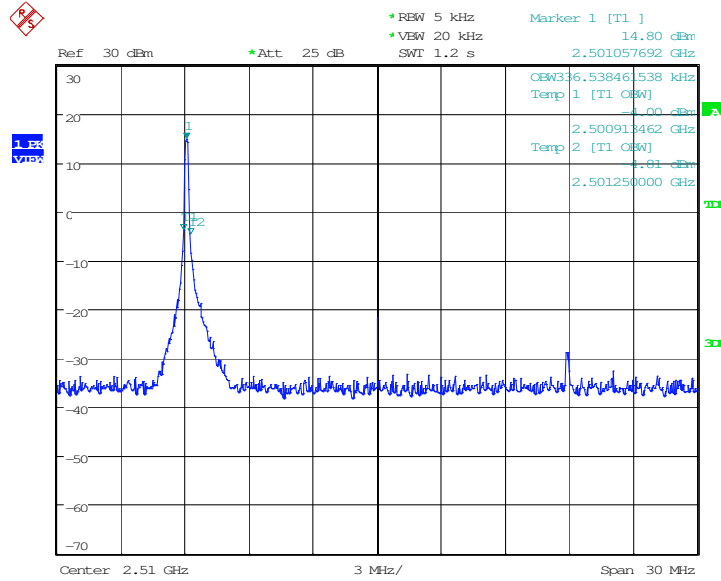


Date: 4.NOV.2015 18:14:23



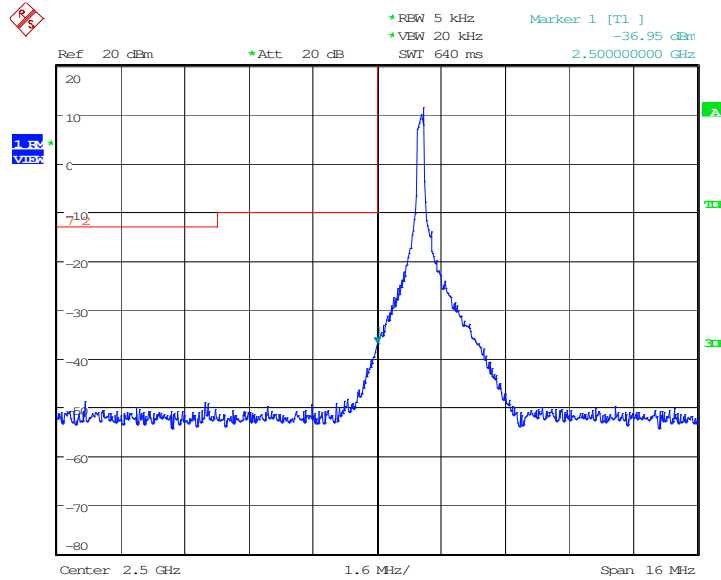
## LTE band 7

### OBW: 1RB-low\_offset



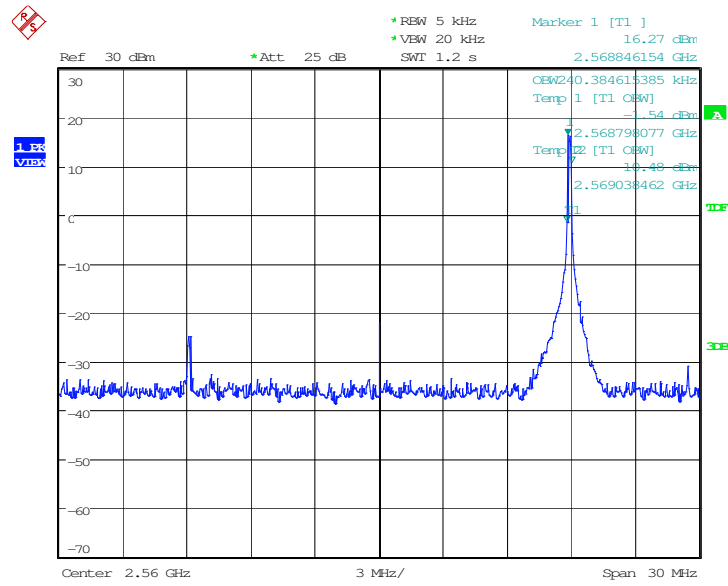
Date: 4.NOV.2015 19:23:03

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



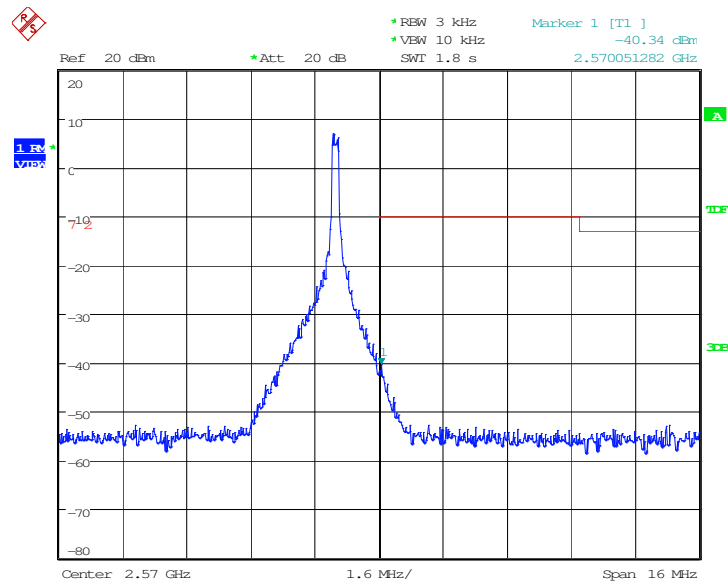
Date: 4.NOV.2015 19:23:50

### OBW: 1RB-high\_offset



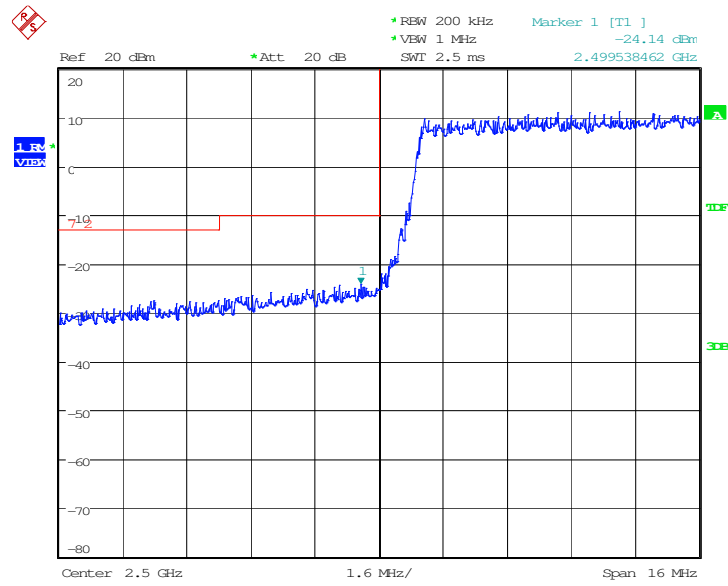
Date: 4.NOV.2015 19:03:12

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



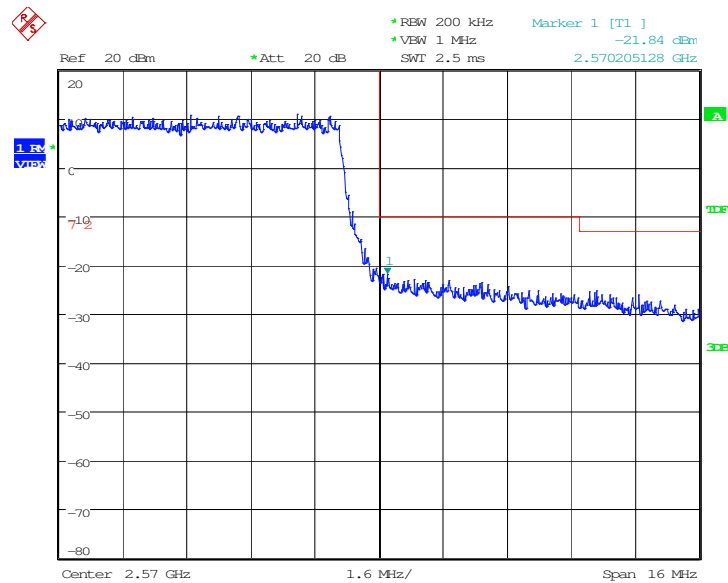
Date: 4.NOV.2015 19:03:58

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



Date: 4.NOV.2015 18:15:27

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



Date: 4.NOV.2015 18:16:15

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

### **Reference**

FCC: CFR Part 2.1057, 22.917, 24.238, 27.53(h), 27.53(m).

#### **A.7.1 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. For the mobile station equipment tested, this equates to a frequency range of 13 MHz to 9 GHz, data taken from 10 MHz to 25 GHz.
2. Determine EUT transmit frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.
3. The number of sweep points of spectrum analyzer is set to 30001 which is greater than span/RBW.

#### **A. 7.2 Measurement Limit**

Part 22.917, Part 24.238 and Part 27.53(h) 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.

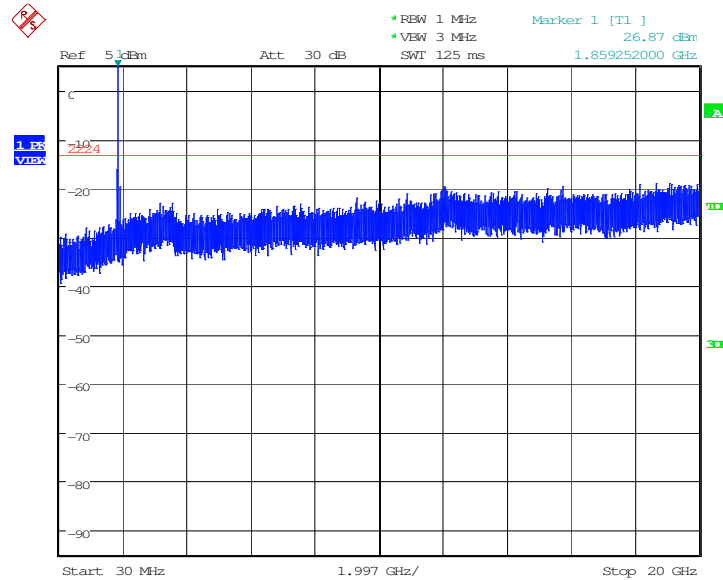
Part 27.53(m)(4) specifies for mobile digital stations, the attenuation factor shall be not less than  $40 + 10 \log(P)$  dB on all frequencies between the channel edge and 5 megahertz from the channel edge,  $43 + 10 \log(P)$  dB on all frequencies between 5 megahertz and X megahertz from the channel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

### A. 7.3 Measurement result

Only worst case result is given below

#### LTE band 2: 30MHz – 20GHz

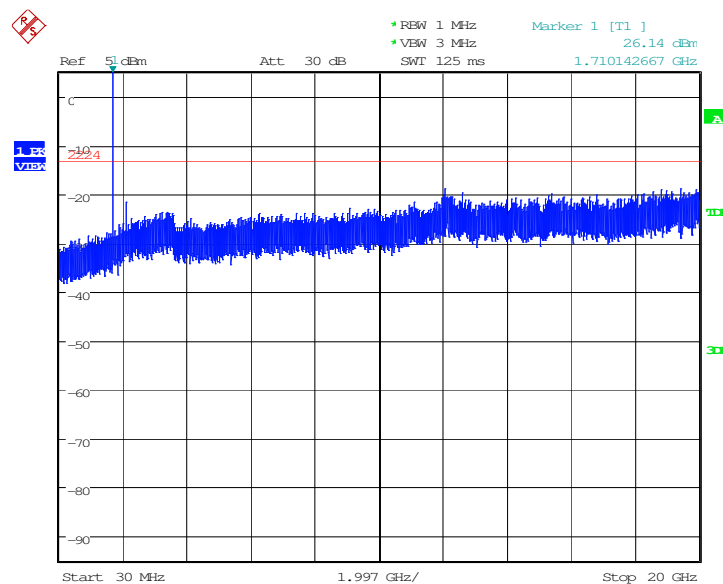
Spurious emission limit –13dBm.



Date: 4.NOV.2015 18:58:26

#### LTE band 4: 30MHz – 20GHz

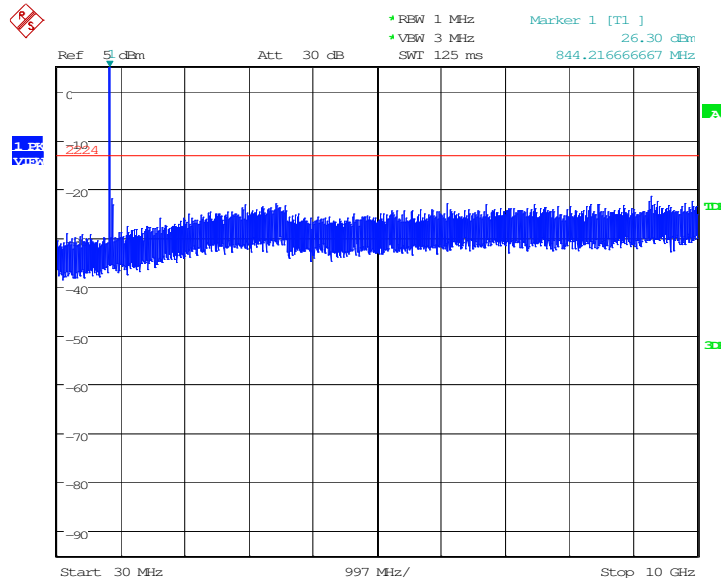
Spurious emission limit –13dBm.



Date: 4.NOV.2015 18:59:55

### LTE band 5: 30MHz – 10GHz

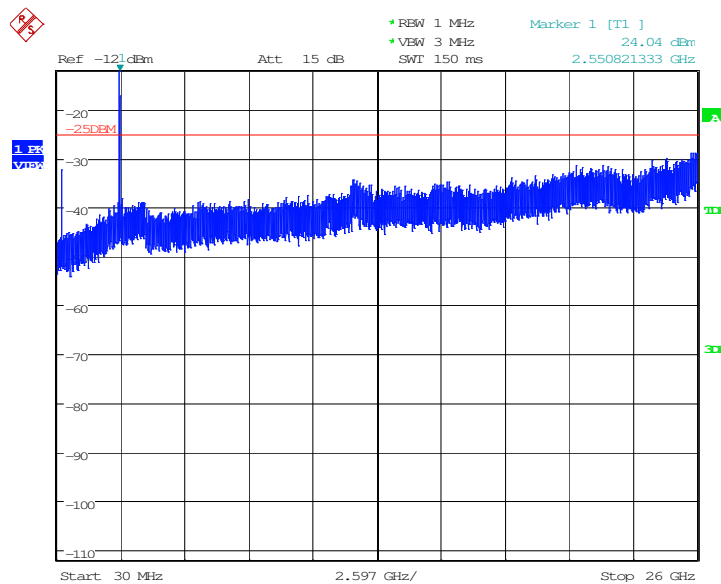
Spurious emission limit –13dBm.



Date: 4.NOV.2015 19:01:29

### LTE band 7: 30MHz – 26GHz

Spurious emission limit –13dBm.



Date: 4.NOV.2015 21:45:36

## **A.8 PEAK-TO-AVERAGE POWER RATIO**

### **Reference**

FCC: CFR Part 24.232 (d), 27.50(a)

The peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB. The PAPR measurements should be made using either an instrument with complementary cumulative distribution function (CCDF) capabilities to determine that PAPR will not exceed 13 dB for more than 0.1 percent of the time or other Commission approved procedure. The measurement must be performed using a signal corresponding to the highest PAPR expected during periods of continuous transmission.

According to KDB 971168 5.7.1:

- a) Refer to instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function;
- b) Set resolution/measurement bandwidth  $\geq$  signal's occupied bandwidth;
- c) Set the number of counts to a value that stabilizes the measured CCDF curve;
- d) Set the measurement interval to 1 ms
- e) Record the maximum PAPR level associated with a probability of 0.1%

### **A.8.1 Measurement limit**

not exceed 13 dB

### **A.8.2 Measurement results**

#### **LTE band 2**

| Frequency(MHz) | PAPR(dB) |       |
|----------------|----------|-------|
| 1880.0         | QPSK     | 16QAM |
|                | 6.63     | 7.44  |

#### **LTE band 4**

| Frequency(MHz) | PAPR(dB) |       |
|----------------|----------|-------|
| 1732.5         | QPSK     | 16QAM |
|                | 6.60     | 7.34  |

#### **LTE band 7**

| Frequency(MHz) | PAPR(dB) |       |
|----------------|----------|-------|
| 2535.0         | QPSK     | 16QAM |
|                | 6.86     | 7.37  |

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