



# TEST REPORT

No. I16Z41276-GTE01

for

**Shanghai Simcom Ltd.**

**LTE-FDD/HSPA MODULE**

**Model Name: SIM7500A**

**FCC ID: UDV-201606**

with

**Hardware Version: V1.02**

**Software Version: SIM7500A\_V1.0**

**Issued Date: 2016-07-27**

**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>
I16Z41276-GTE01	Rev.0	1st edition	2016-07-13
I16Z41276-GTE01	Rev.1	2nd edition	2016-07-27
I16Z41276-GTE01	Rev.2	3th edition	2016-08-05

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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  
100191  
Postal Code: 100191  
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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: 2016-06-14  
Testing End Date: 2016-07-27

### **1.4. Signature**



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Shen Yi

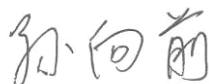
(Prepared this test report)



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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**

Company Name: Shanghai Simcom Ltd.  
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### **2.2. Manufacturer Information**

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

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

Description	LTE-FDD/HSPA MODULE
Model Name	SIM7500A
FCC ID	UDV-201606
Antenna	Integrated
Extreme vol. Limits	3.4VDC to 4.2VDC (nominal: 4.0VDC)
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

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

EUT ID*	IMEI	HW Version	SW Version
UT01a	861475030000543	V1.02	SIM7500A_V1.0

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

#### **3.3. General Description**

The Equipment Under Test (EUT) is a model of LTE-FDD/HSPA MODULE 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.

<b>Reference</b>	<b>Title</b>	<b>Version</b>
FCC Part 24	PERSONAL COMMUNICATIONS SERVICES	10-1-15 Edition
FCC Part 27	MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES	10-1-15 Edition
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; 1MHz - 1000MHz, >90dB.
Electrical insulation	> 2 MΩ
Ground system resistance	< 4Ω
Normalised site attenuation (NSA)	< ± 4 dB, 3m/10m distance, 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; 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; 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	Frequency Stability	24.235, 2.1055	A.2	P
3	Occupied Bandwidth	2.1049(h)(i)	A.3	P
4	Emission Bandwidth	24.238(a)	A.4	P
5	Band Edge Compliance	24.238(a)	A.5	P
6	Conducted Spurious Emission	24.238, 2.1057	A.6	P
7	Peak to Average Power Ratio	24.232 (d)	A.7	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	Frequency Stability	27.54, 2.1055	A.2	P
3	Occupied Bandwidth	2.1049(h)(i)	A.3	P
4	Emission Bandwidth	27.53(h)	A.4	P
5	Band Edge Compliance	27.53(h)	A.5	P
6	Conducted Spurious Emission	27.53(h), 2.1057	A.6	P
7	Peak to Average Power Ratio	27.50(a)	A.7	P



**LTE Band 17**

Items	Test Name	Clause in FCC rules	Section in this report	Verdict
1	Output Power	27.50(c)(10)	A.1	P
2	Frequency Stability	27.54, 2.1055	A.2	P
3	Occupied Bandwidth	2.1049(h)(i)	A.3	P
4	Emission Bandwidth	27.53(g)	A.4	P
5	Band Edge Compliance	27.53(g)	A.5	P
6	Conducted Spurious Emission	27.53(g), 2.1057	A.6	P
7	Peak to Average Power Ratio	27.50(a)	A.7	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	Universal Radio Communication Tester	CMW500	101675	R&S	2017-07-13	1 year
2	Spectrum Analyzer	FSU	200030	R&S	2017-06-11	1 year

## **ANNEX A: MEASUREMENT RESULTS**

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

#### **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	1909.3	22.83	22.17
		1880.0	22.73	21.50
		1850.7	22.98	21.87
	1 RB low	1909.3	22.78	22.20
		1880.0	22.59	21.39
		1850.7	22.86	21.52
	50% RB mid	1909.3	22.75	21.65
		1880.0	22.67	21.41
		1850.7	22.63	21.64
	100% RB	1909.3	21.60	20.75
		1880.0	21.59	20.36
		1850.7	21.68	20.41
3MHz	1 RB high	1908.5	22.61	21.98
		1880.0	22.66	22.07
		1851.5	22.59	21.37
	1 RB low	1908.5	22.51	21.96
		1880.0	22.63	22.36
		1851.5	22.43	21.32
	50% RB mid	1908.5	21.81	20.79
		1880.0	21.69	20.79
		1851.5	21.67	20.89
	100% RB	1908.5	21.76	20.78

		1880.0	21.55	20.71
		1851.5	21.62	20.68
5MHz	1 RB high	1907.5	22.64	21.09
		1880.0	22.48	21.92
		1852.5	22.66	21.61
	1 RB low	1907.5	22.60	21.08
		1880.0	22.60	21.97
		1852.5	22.58	21.28
	50% RB mid	1907.5	21.84	20.65
		1880.0	21.57	20.72
		1852.5	21.65	20.62
	100% RB	1907.5	21.79	20.81
		1880.0	21.63	20.70
		1852.5	21.62	20.70
10MHz	1 RB high	1905.0	22.69	22.59
		1880.0	22.66	22.37
		1855.0	22.63	21.98
	1 RB low	1905.0	22.75	22.25
		1880.0	22.67	22.34
		1855.0	22.86	21.91
	50% RB mid	1905.0	21.70	/
		1880.0	21.67	/
		1855.0	21.85	/
	100% RB	1905.0	21.73	/
		1880.0	21.65	/
		1855.0	21.77	/
15MHz	1 RB high	1902.5	22.50	22.71
		1880.0	22.53	22.48
		1857.5	22.51	22.57
	1 RB low	1902.5	22.55	22.46
		1880.0	22.54	22.29
		1857.5	22.81	22.51
	50% RB mid	1902.5	21.76	/
		1880.0	21.79	/
		1857.5	21.86	/
	100% RB	1902.5	21.79	/
		1880.0	21.75	/
		1857.5	21.88	/
20MHz	1 RB high	1900.0	22.74	22.94

		1880.0	22.48	22.18
		1860.0	22.46	22.81
	1 RB low	1900.0	22.81	22.39
		1880.0	22.53	22.30
		1860.0	22.43	22.28
	50% RB mid	1900.0	21.75	/
		1880.0	21.74	/
		1860.0	21.71	/
	100% RB	1900.0	21.68	/
		1880.0	21.65	/
		1860.0	21.74	/

**LTE band 4**

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
1.4MHz	1 RB high	1754.3	23.24	22.25
		1732.5	22.82	21.96
		1710.7	22.84	21.92
	1 RB low	1754.3	23.20	22.23
		1732.5	22.81	21.94
		1710.7	22.92	21.97
	50% RB mid	1754.3	23.11	22.27
		1732.5	22.98	22.18
		1710.7	22.92	22.25
	100% RB	1754.3	22.09	21.13
		1732.5	21.97	21.17
		1710.7	21.97	21.10
3MHz	1 RB high	1753.5	23.11	22.36
		1732.5	23.07	22.29
		1711.5	22.95	22.13
	1 RB low	1753.5	22.95	22.32
		1732.5	22.87	22.26
		1711.5	22.79	22.17
	50% RB mid	1753.5	22.11	21.22
		1732.5	22.02	21.18
		1711.5	22.09	21.16
	100% RB	1753.5	22.13	21.15
		1732.5	22.08	21.12
		1711.5	22.16	21.03
5MHz	1 RB high	1752.5	23.00	21.68
		1732.5	22.86	21.84
		1712.5	22.99	21.66
	1 RB low	1752.5	22.98	21.42
		1732.5	22.97	21.67
		1712.5	22.80	21.53
	50% RB mid	1752.5	22.18	21.32
		1732.5	21.94	20.97
		1712.5	22.11	20.98
	100% RB	1752.5	22.17	21.28
		1732.5	21.98	20.94
		1712.5	21.96	21.14
10MHz	1 RB high	1750	22.97	22.49
		1732.5	22.89	22.15



	1 RB low	1715	23.13	22.14
		1750	23.32	22.26
		1732.5	22.94	22.32
		1715	22.91	21.71
	50% RB mid	1750	22.12	/
		1732.5	22.14	/
		1715	22.18	/
	100% RB	1750	22.12	/
		1732.5	22.11	/
		1715	22.01	/
15MHz	1 RB high	1747.5	22.81	23.29
		1732.5	22.86	22.31
		1717.5	22.88	22.01
	1 RB low	1747.5	22.87	22.58
		1732.5	22.76	22.42
		1717.5	22.77	22.21
	50% RB mid	1747.5	21.98	/
		1732.5	21.85	/
		1717.5	21.77	/
	100% RB	1747.5	21.95	/
		1732.5	21.89	/
		1717.5	21.85	/
20MHz	1 RB high	1745	22.89	22.69
		1732.5	22.80	22.45
		1720	23.03	22.64
	1 RB low	1745	23.10	22.11
		1732.5	22.88	22.60
		1720	22.81	22.29
	50% RB mid	1745	22.06	/
		1732.5	22.01	/
		1720	21.99	/
	100% RB	1745	22.03	/
		1732.5	21.97	/
		1720	21.95	/

**LTE band 17**

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
5MHz	1 RB high	713.5	22.52	21.78
		710.0	22.46	21.65
		706.5	22.25	21.52
	1 RB low	713.5	22.33	21.56
		710.0	22.65	21.72
		706.5	22.47	21.43
	50% RB mid	713.5	21.53	20.98
		710.0	21.57	21.02
		706.5	21.39	20.86
	100% RB	713.5	21.53	20.95
		710.0	21.61	21.01
		706.5	21.46	20.94
10MHz	1 RB high	711	22.63	22.33
		710	22.63	22.49
		709	22.69	22.89
	1 RB low	711	22.45	21.83
		710	22.67	21.90
		709	22.36	22.89
	50% RB mid	711	21.47	/
		710	21.54	/
		709	21.57	/
	100% RB	711	21.44	/
		710	21.42	/
		709	21.40	/

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

## **A.2 FREQUENCY STABILITY**

### **A.2.1 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 2/4/17, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
4. Repeat the above measurements at 10°C increments from -30°C to +50°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
5. Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring carrier frequency at each voltage. Pause at nominal voltage for 1.5 hours unpowered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50°C.
7. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
8. Repeat the above measurements at 10 °C increments from +50°C to -30°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
9. At all temperature levels hold the temperature to +/- 0.5°C during the measurement procedure.

### **A.2.2 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(d) (2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of between 3.4VDC and 4.2VDC, with a nominal voltage of 4.0VDC. 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.2.3 Measurement results

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

##### Frequency Error vs Voltage

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.4	-2.05	12.97	0.001	0.007
4.0	0.50	11.87	0.000	0.006
4.2	-4.68	16.25	0.002	0.009

##### Frequency Error vs Temperature

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	-1.23	16.32	0.001	0.009
40°	-2.17	16.12	0.001	0.009
30°	-6.05	14.39	0.003	0.008
20°	-4.95	12.25	0.003	0.007
10°	1.03	16.78	0.001	0.009
0°	-4.89	12.07	0.003	0.006
- 10°	-7.75	13.45	0.004	0.007
- 20°	-3.78	14.26	0.002	0.008
- 30°	-2.13	10.77	0.001	0.006

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

##### Frequency Error vs Voltage

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.4	2.00	19.74	0.001	0.011
4.0	0.11	18.98	0.000	0.011
4.2	5.88	20.43	0.003	0.012

##### Frequency Error vs Temperature

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	-2.86	19.45	0.002	0.011
40°	0.16	19.44	0.000	0.011
30°	1.14	20.00	0.001	0.012
20°	3.28	21.16	0.002	0.012
10°	2.95	17.57	0.002	0.010
0°	-2.43	19.54	0.001	0.011
- 10°	1.49	23.32	0.001	0.013
- 20°	3.08	16.55	0.002	0.010
- 30°	3.45	21.97	0.002	0.013

**LTE Band 17, 5MHz bandwidth (worst case of all bandwidths)**

**Frequency Error vs Voltage**

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.4	1.42	9.08	0.002	0.013
4.0	-0.56	8.07	0.001	0.011
4.2	-0.46	8.38	0.001	0.012

**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	-0.67	5.69	0.001	0.008
40°	-0.97	9.76	0.001	0.014
30°	0.39	7.38	0.001	0.010
20°	-0.94	9.36	0.001	0.013
10°	-1.23	9.70	0.002	0.014
0°	-1.87	8.55	0.003	0.012
- 10°	-1.57	11.10	0.002	0.016
- 20°	-0.92	7.55	0.001	0.011
- 30°	-1.13	6.49	0.002	0.009

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

### A.3 OCCUPIED BANDWIDTH

#### A.3.1 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.

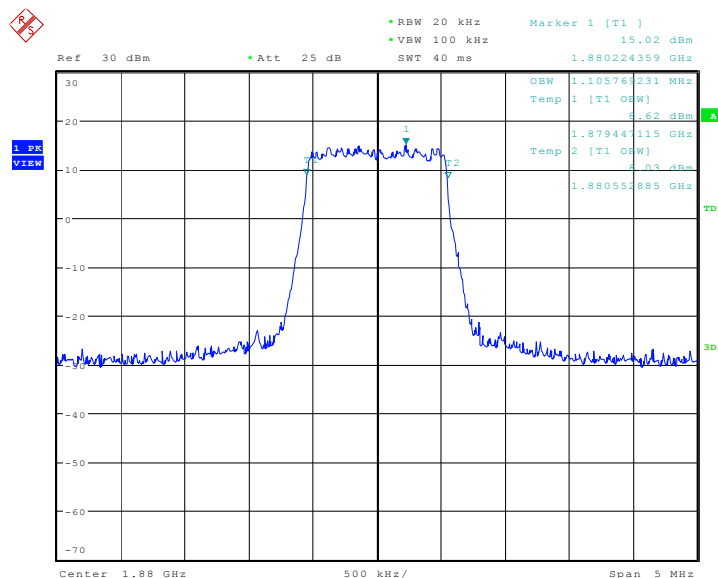
The measurement method is from KDB 971168 4.2:

- 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).
- 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.
- 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.
- Set the detection mode to peak, and the trace mode to max hold.
- 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
	1105.77	1089.74

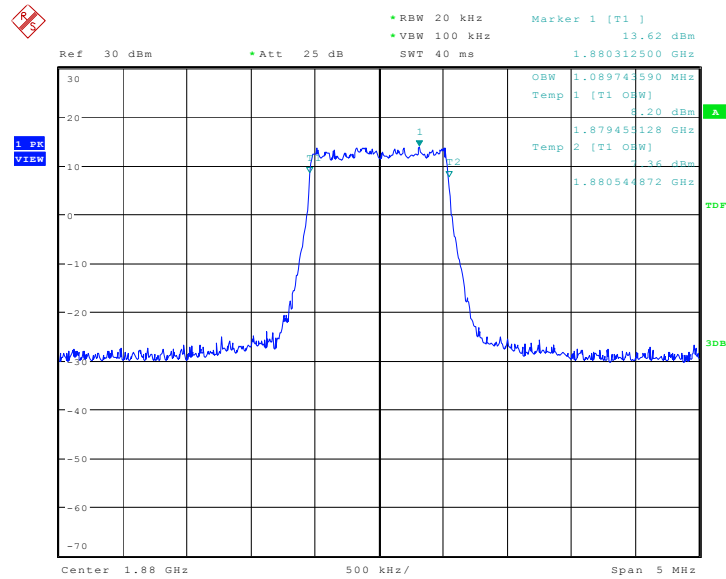
#### LTE band 2, 1.4MHz Bandwidth, QPSK (99% BW)



Date: 14.JUN.2016 00:29:44



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

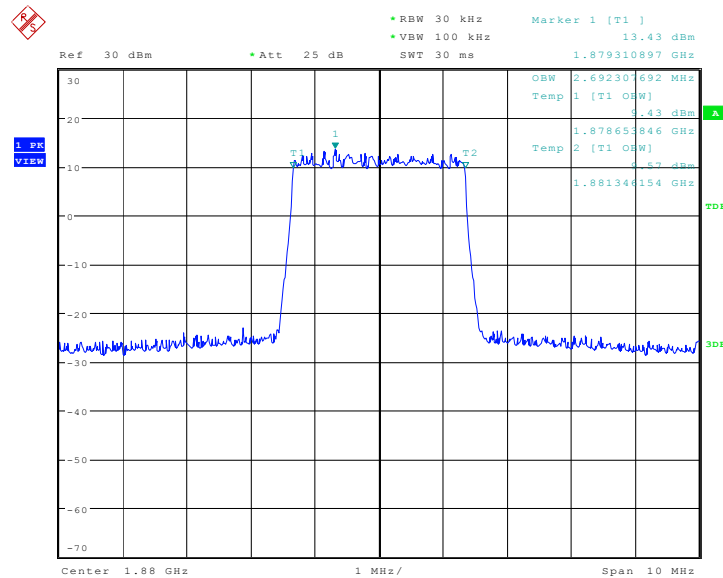


Date: 14.JUN.2016 00:29:59

### LTE band 2, 3MHz (99%)

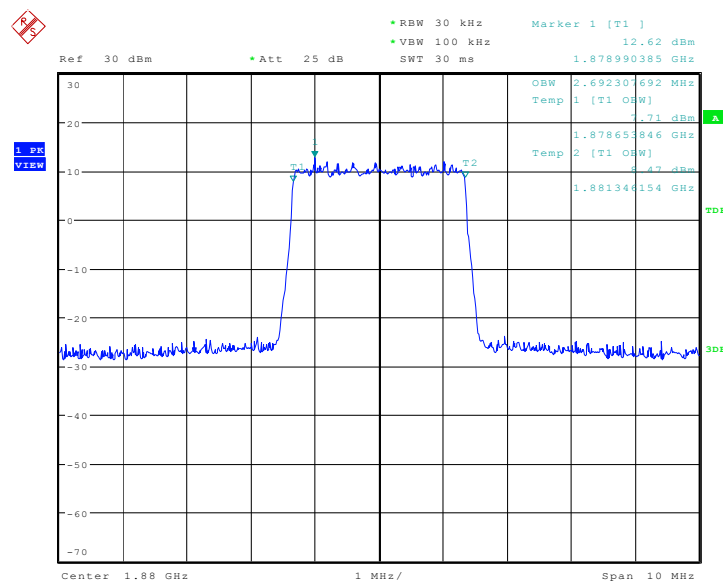
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
1880.0	QPSK	16QAM
	2692.31	2692.31

### LTE band 2, 3MHz Bandwidth, QPSK (99% BW)



Date: 14..JUN.2016 00:35:26

### LTE band 2, 3MHz Bandwidth, 16QAM (99% BW)



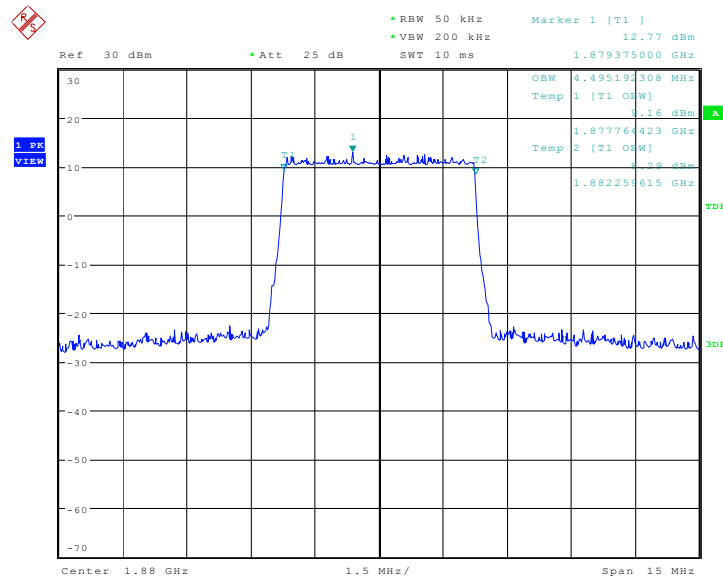
Date: 14..JUN.2016 00:35:41



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

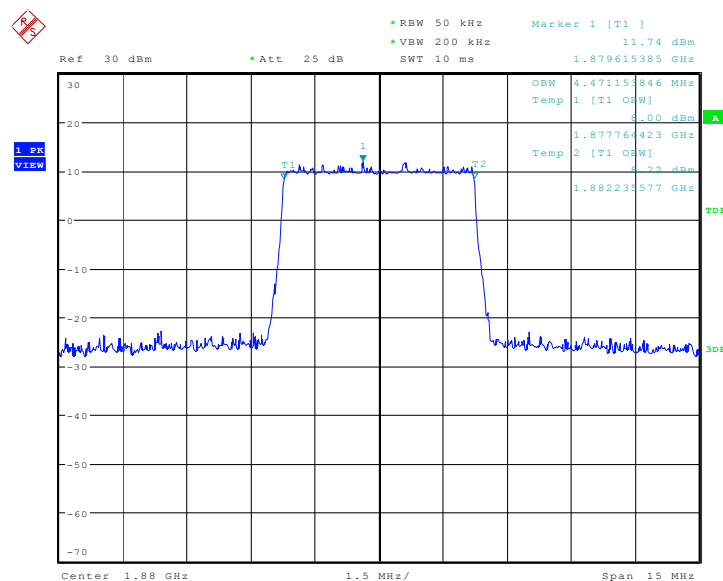
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
1880.0	QPSK	16QAM
	4495.19	4471.15

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



Date: 14..JUN.2016 00:41:09

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

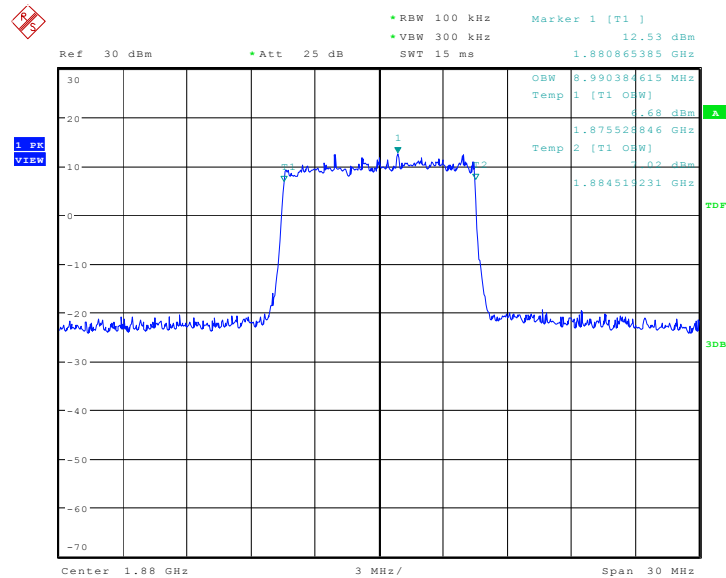


Date: 14..JUN.2016 00:41:24

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

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
1880.0	QPSK	16QAM
	8990.38	/

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

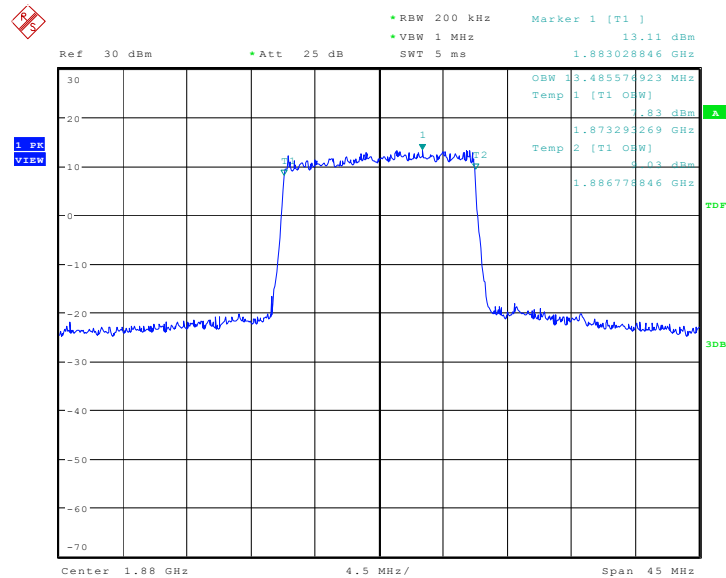


Date: 11..III..2016 22:13:35

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

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
1880.0	QPSK	16QAM
	13485.58	/

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

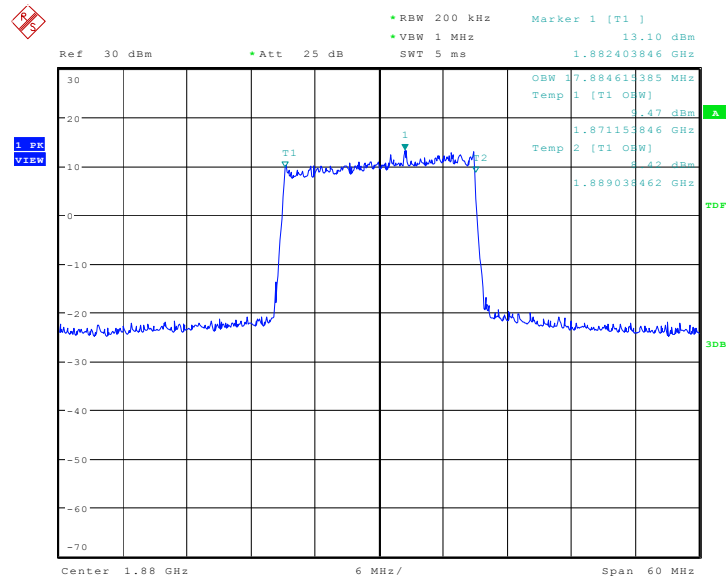


Date: 11..III..2016 22:15:22

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

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

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

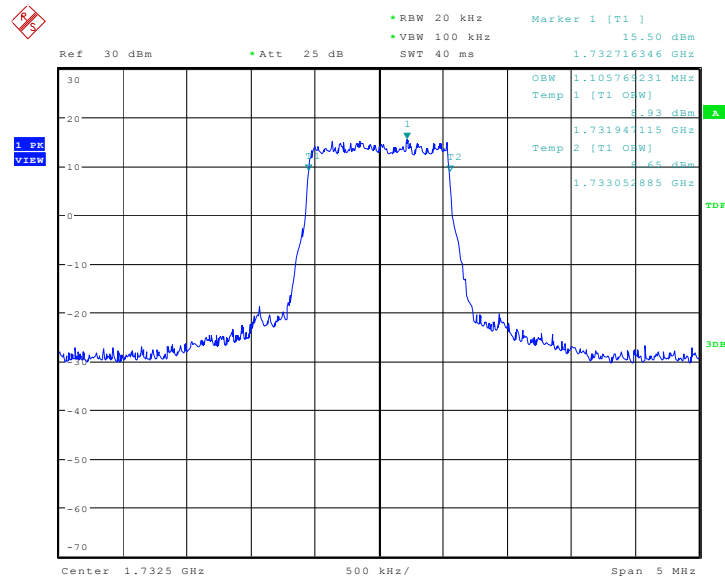


Date: 11..III..2016 22:17:09

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

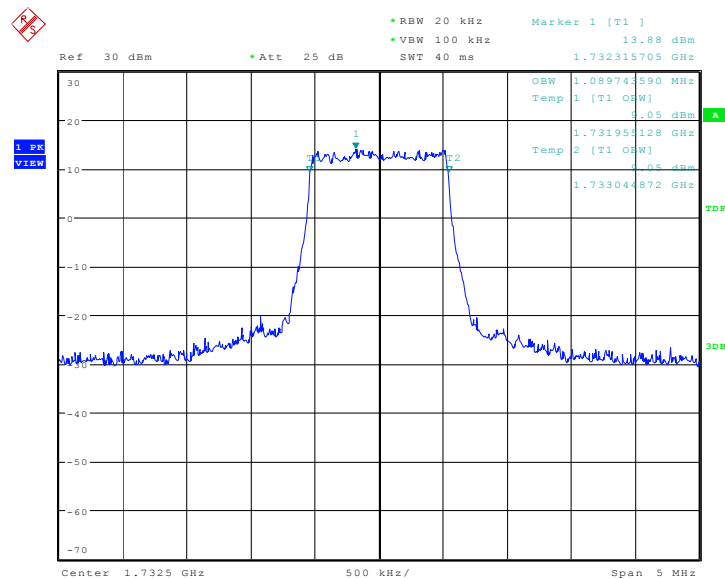
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
1732.5	QPSK	16QAM
	1105.77	1089.74

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



Date: 14..JUN.2016 01:04:13

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

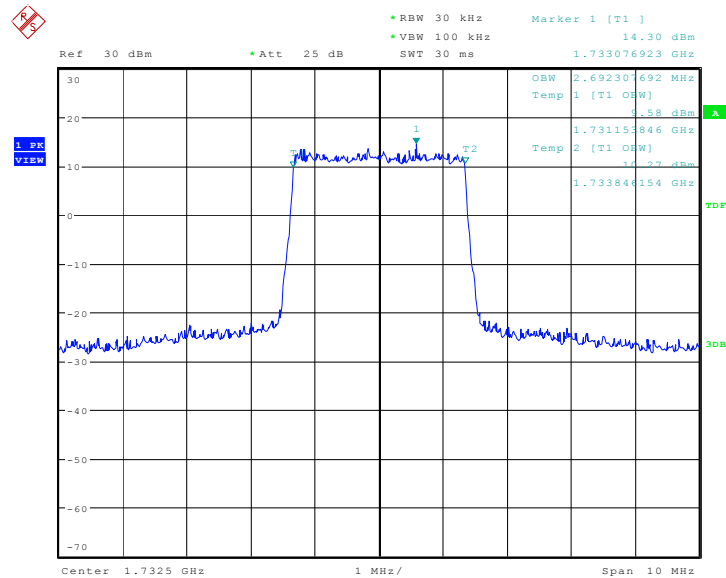


Date: 14..JUN.2016 01:04:28

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

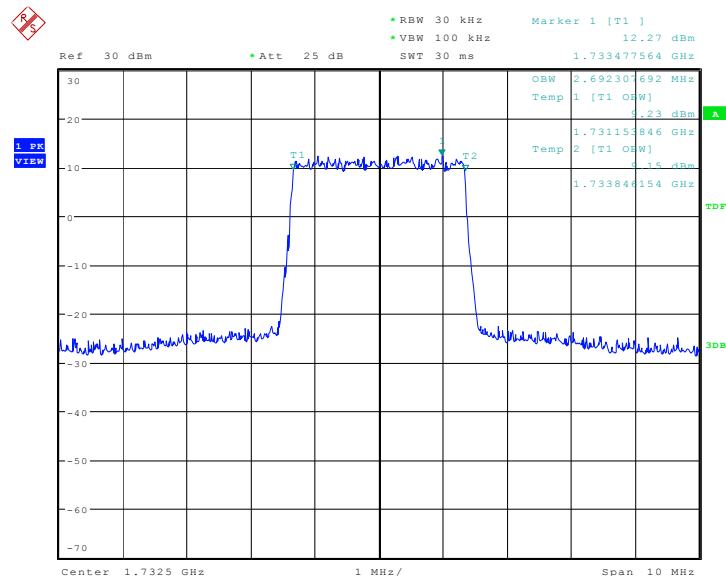
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
1732.5	QPSK	16QAM
	2692.31	2692.31

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



Date: 14.JUN.2016 01:09:55

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

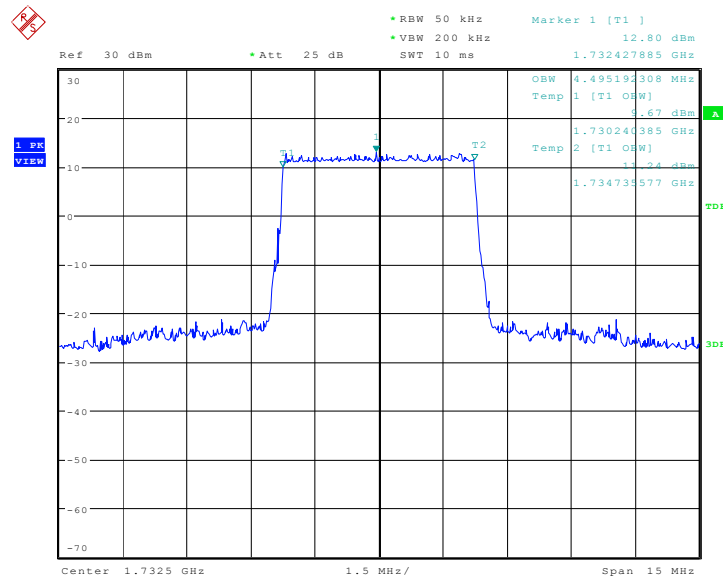


Date: 14.JUN.2016 01:10:10

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

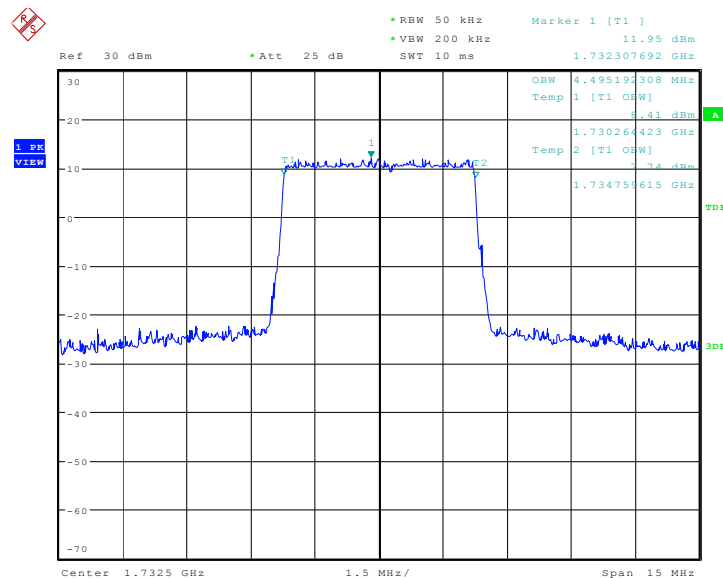
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
1732.5	QPSK	16QAM
	4495.19	4495.19

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



Date: 14.JUN.2016 01:15:38

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

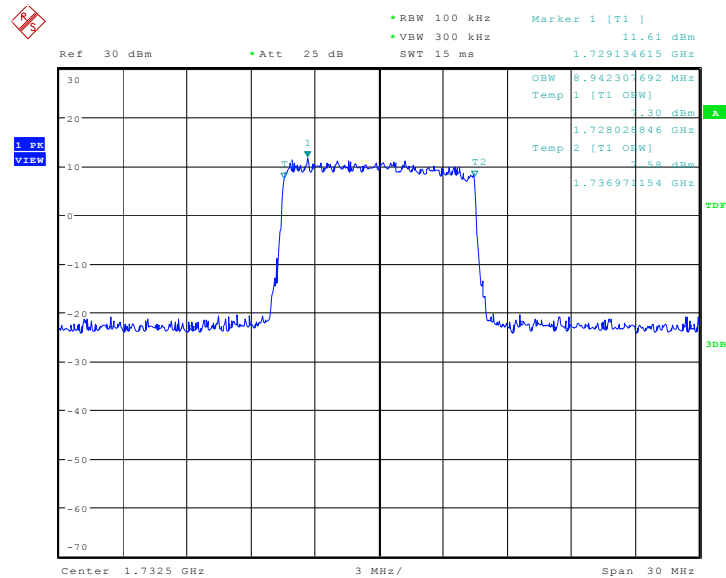


Date: 14.JUN.2016 01:15:53

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

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
1732.5	QPSK	16QAM
	8942.31	/

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



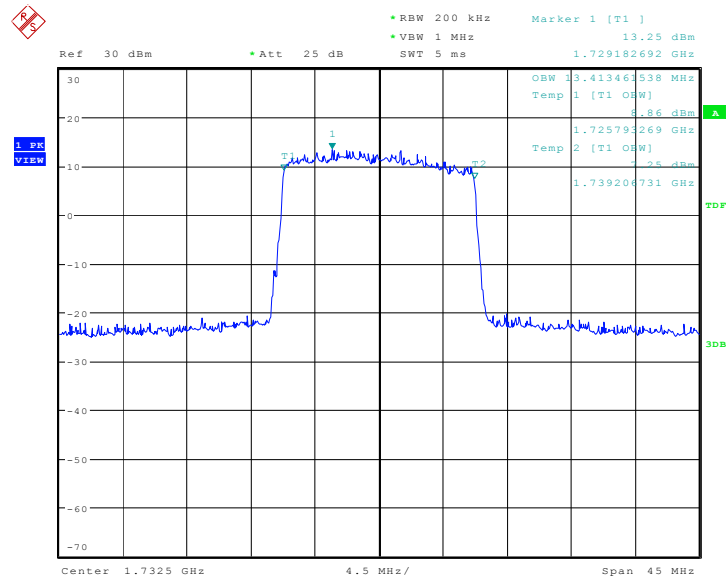
Date: 11..III..2016 22:18:56



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

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
1732.5	QPSK	16QAM
	13413.46	/

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

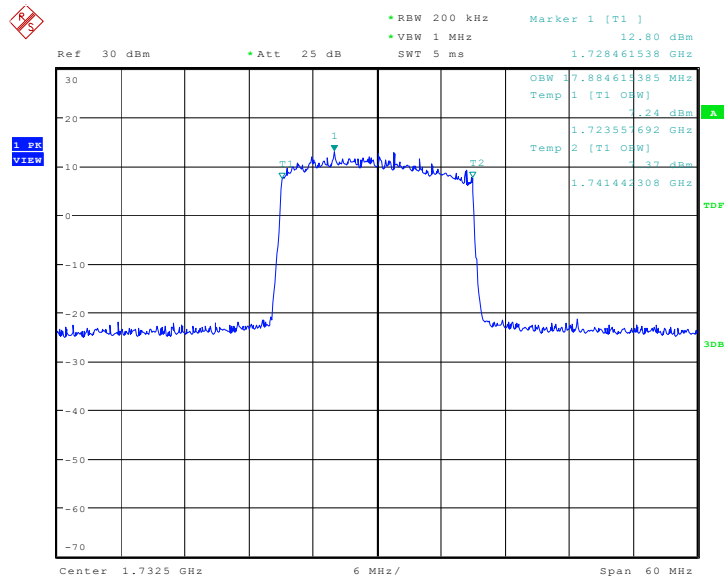


Date: 11..III..2016 22:20:42

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

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

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

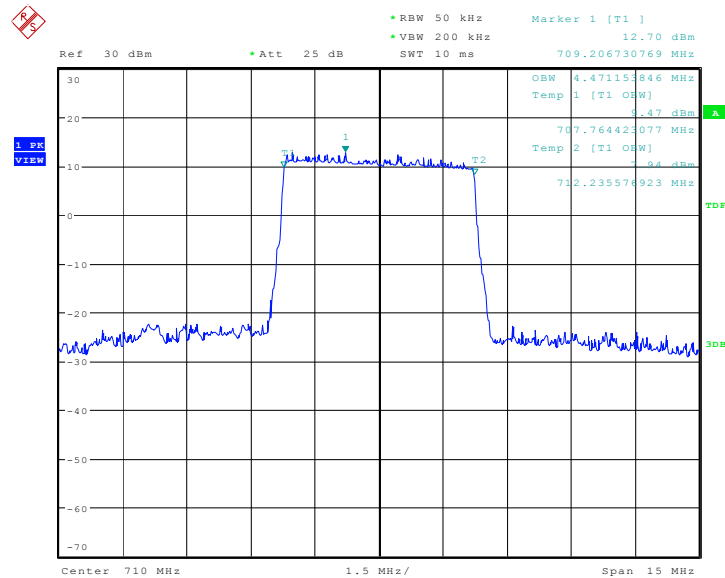


Date: 11..III..2016 22:22:29

### LTE band 17, 5MHz (99%)

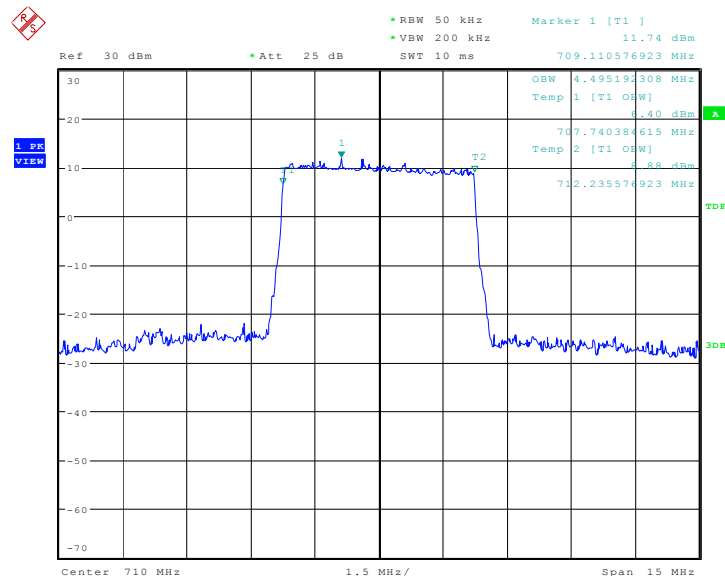
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
710.0	QPSK	16QAM
	4471.15	4495.19

### LTE band 17, 5MHz Bandwidth, QPSK (99% BW)



Date: 14.JUN.2016 01:38:38

### LTE band 17, 5MHz Bandwidth, 16QAM (99% BW)

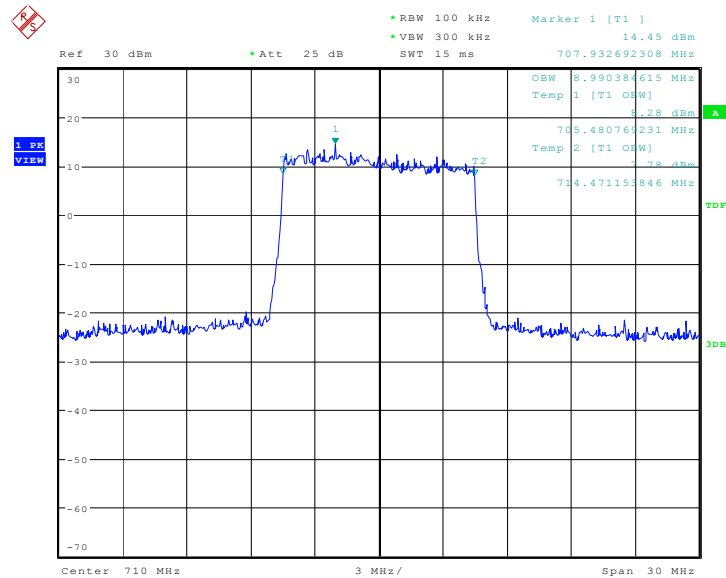


Date: 14.JUN.2016 01:38:51

**LTE band 17, 10MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
710.0	QPSK	16QAM
	8990.38	/

**LTE band 17, 10MHz Bandwidth, QPSK (99% BW)**



Date: 11..III..2016 22:24:17

## A.4 EMISSION BANDWIDTH

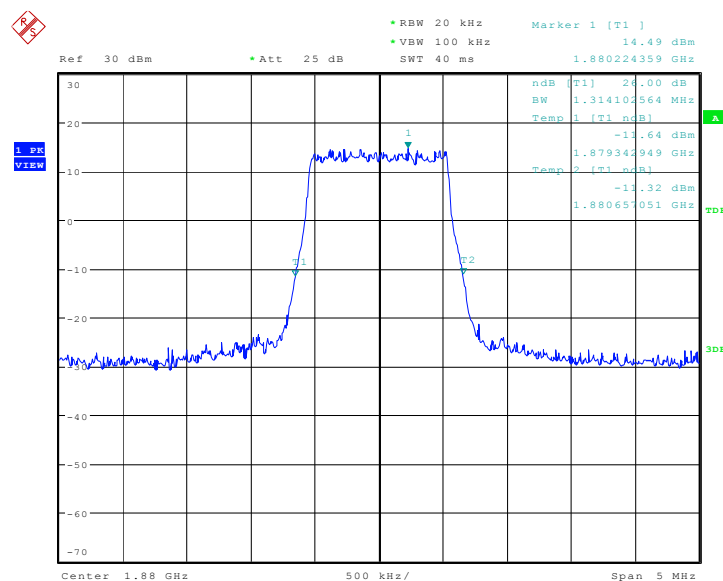
### Emission Bandwidth Results

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
	1314.10	1290.06

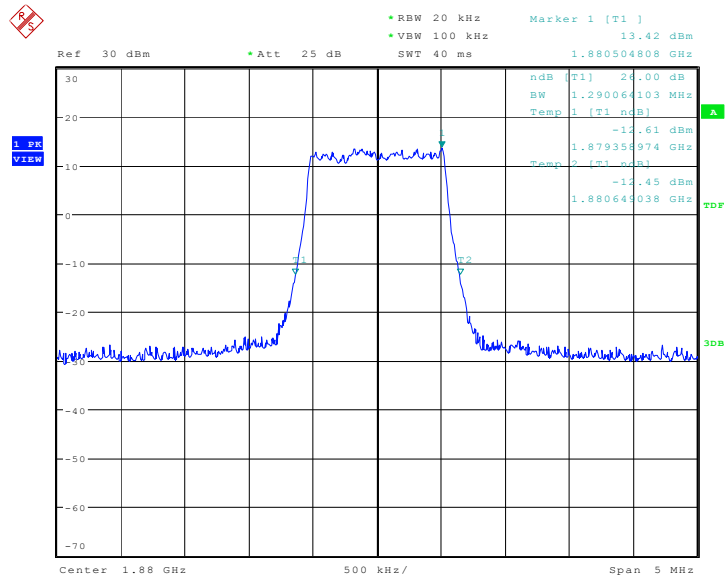
#### LTE band 2, 1.4MHz Bandwidth, QPSK (-26dBc BW)



Date: 14.JUN.2016 00:30:52



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

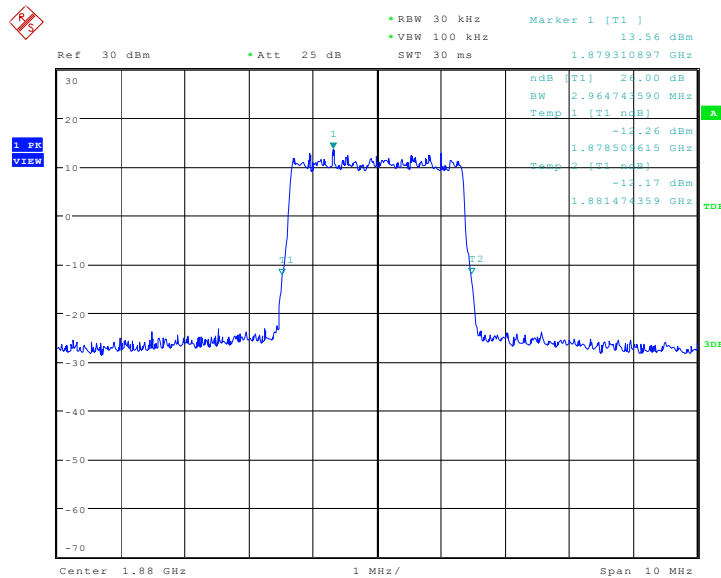


Date: 14.JUN.2016 00:31:09

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

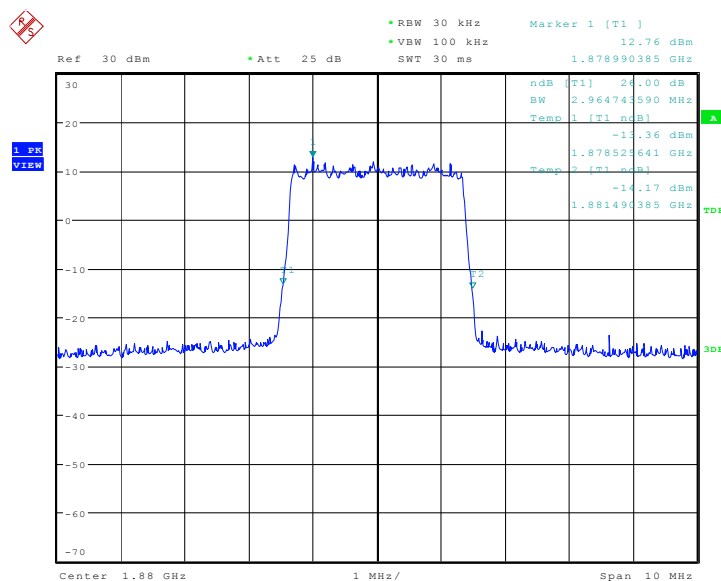
Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
1880.0	QPSK	16QAM
	2964.74	2964.74

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



Date: 14..JUN.2016 00:36:34

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

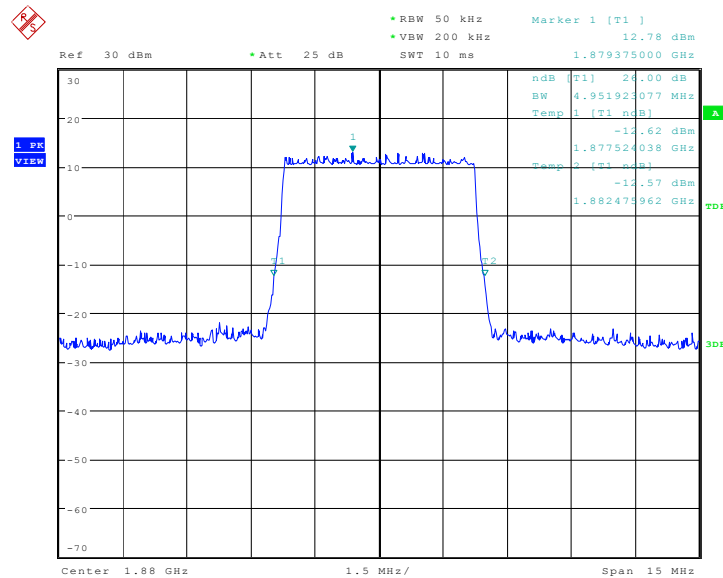


Date: 14..JUN.2016 00:36:51

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

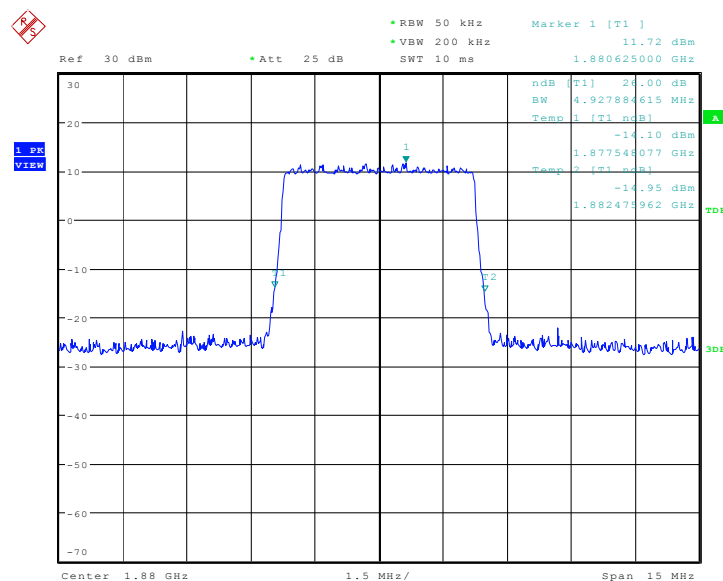
Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
1880.0	QPSK	16QAM
	4951.92	4927.88

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



Date: 14..JUN.2016 00:42:17

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



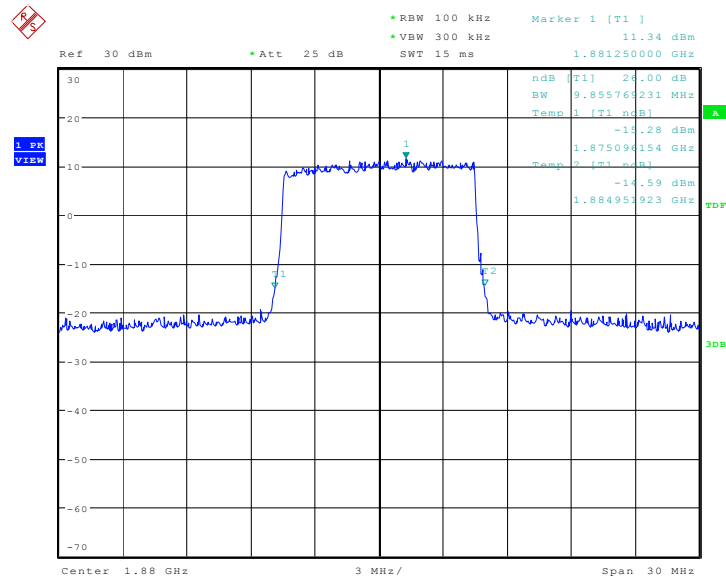
Date: 14..JUN.2016 00:42:34



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

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

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

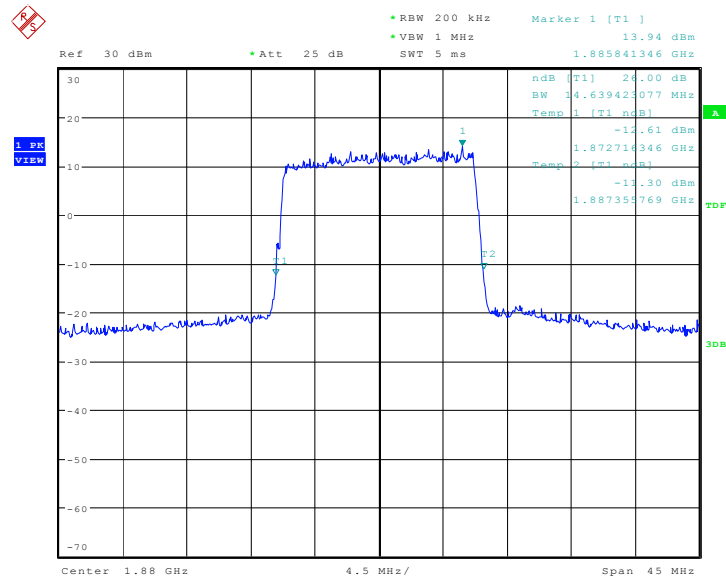


Date: 11..III..2016 22:14:28

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

Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
1880.0	QPSK	16QAM
	14639.42	/

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

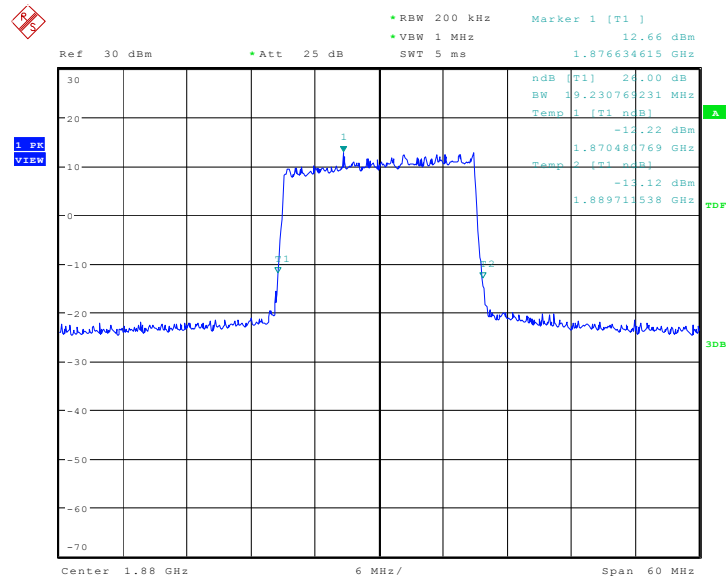


Date: 11..III..2016 22:16:15

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

Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
1880.0	QPSK	16QAM
	19230.77	/

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

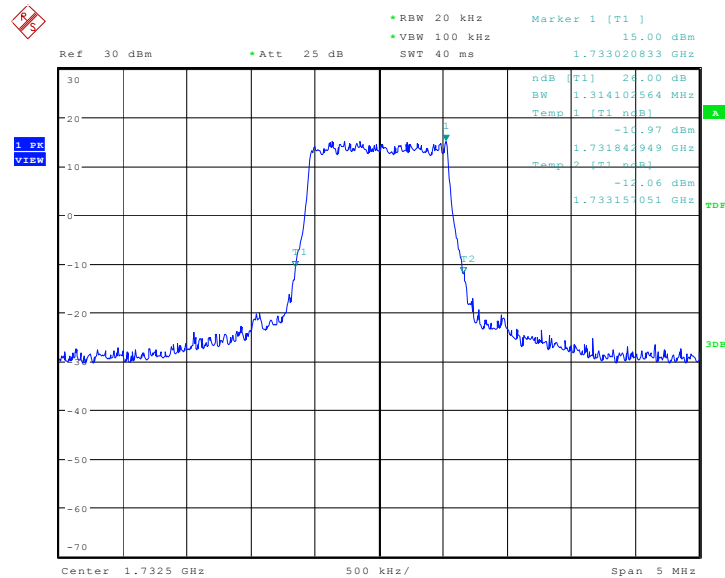


Date: 11..III..2016 22:18:02

### LTE band 4, 1.4MHz (-26dBc)

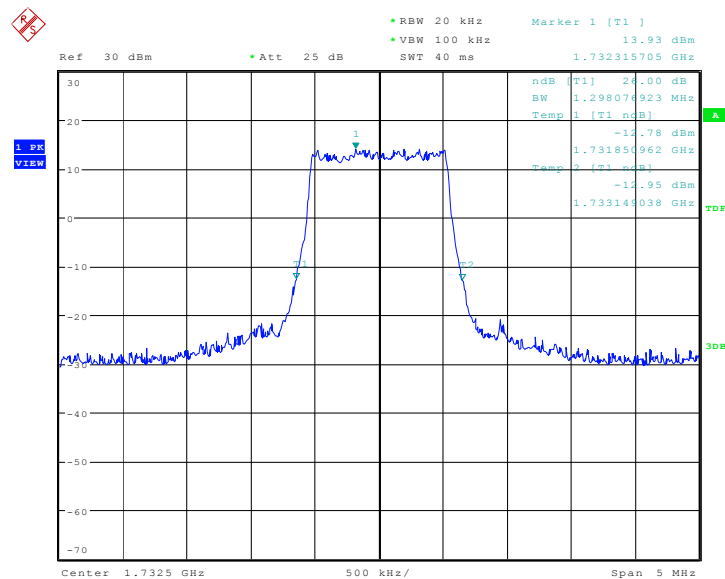
Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
1732.5	QPSK	16QAM
	1314.10	1298.08

### LTE band 4, 1.4MHz Bandwidth, QPSK (-26dBc BW)



Date: 14..JUN.2016 01:05:21

### LTE band 4, 1.4MHz Bandwidth, 16QAM (-26dBc BW)

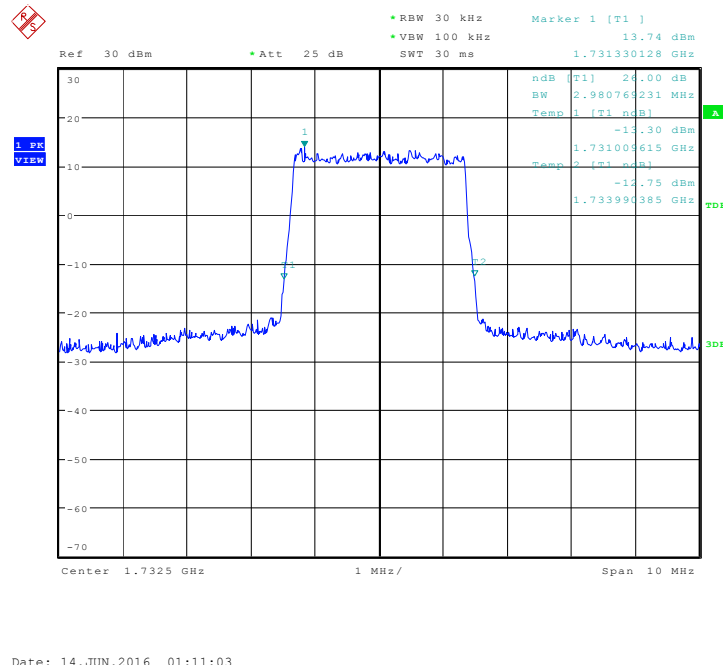


Date: 14..JUN.2016 01:05:38

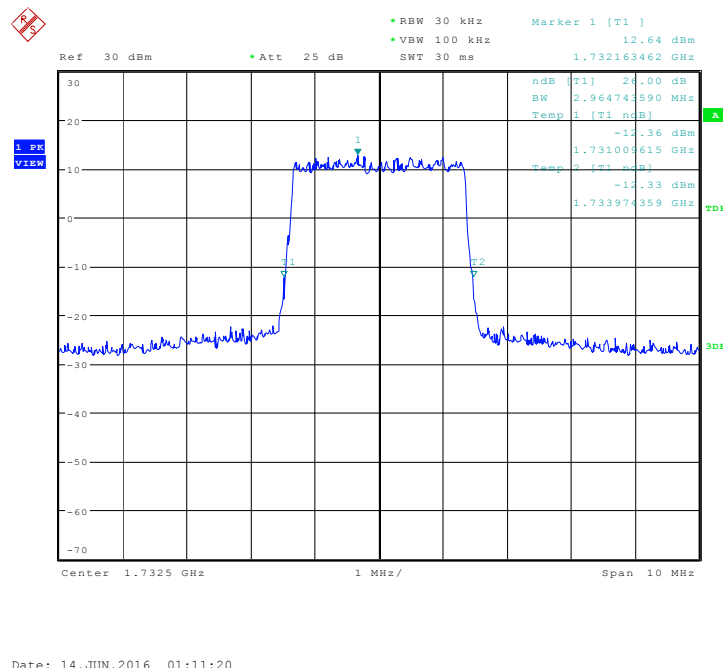
### LTE band 4, 3MHz (-26dBc)

Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
1732.5	QPSK	16QAM
	2980.77	2964.74

### LTE band 4, 3MHz Bandwidth, QPSK (-26dBc BW)



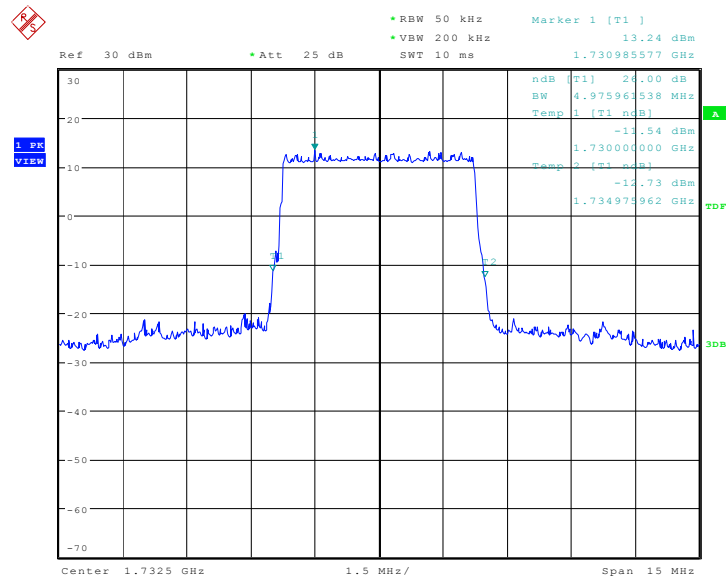
### LTE band 4, 3MHz Bandwidth, 16QAM (-26dBc BW)



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

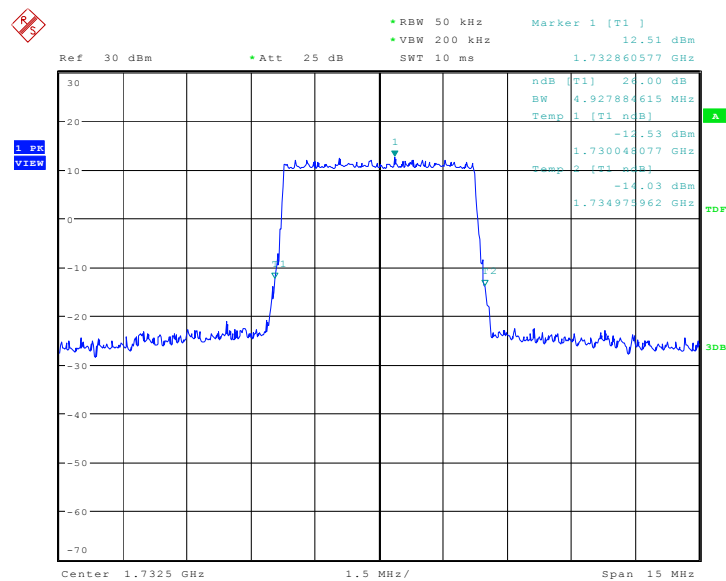
Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
1732.5	QPSK	16QAM
	4975.96	4927.88

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



Date: 14.JUN.2016 01:16:46

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

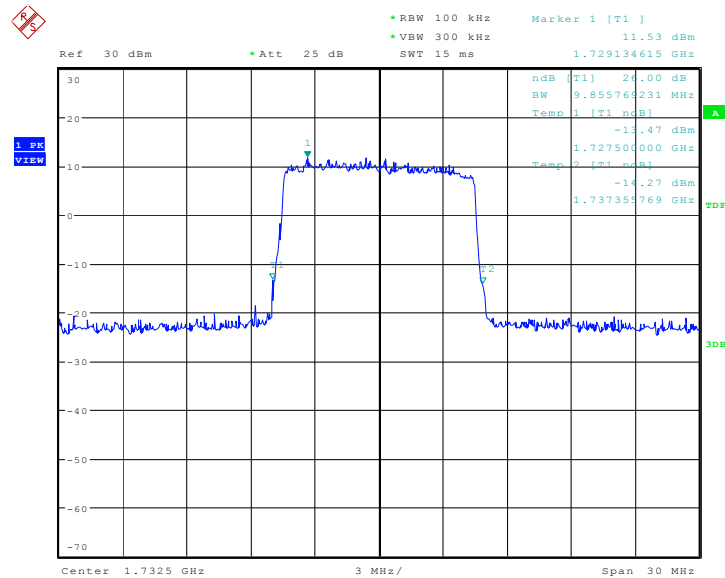


Date: 14.JUN.2016 01:17:03

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

Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
1732.5	QPSK	16QAM
	9855.77	/

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

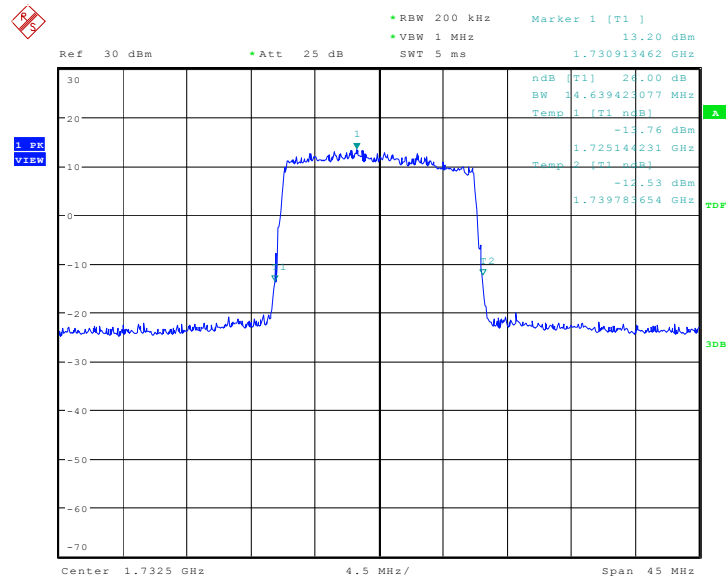


Date: 11..III..2016 22:19:49

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

Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
1732.5	QPSK	16QAM
	14639.42	/

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



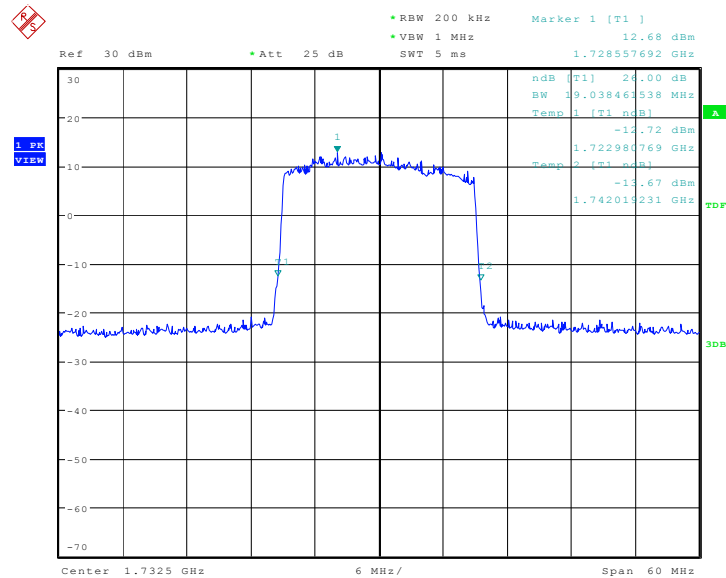
Date: 11..III..2016 22:21:36



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

Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
1732.5	QPSK	16QAM
	19038.46	/

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

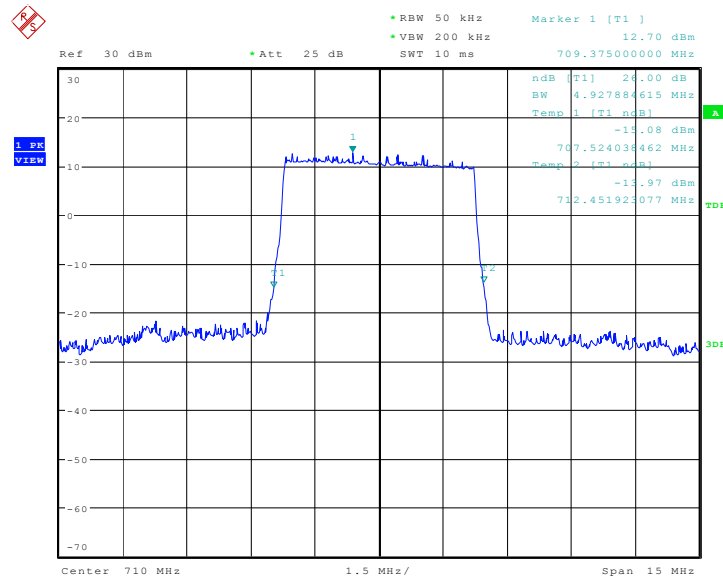


Date: 11..III..2016 22:23:22

### LTE band 17, 5MHz (-26dBc)

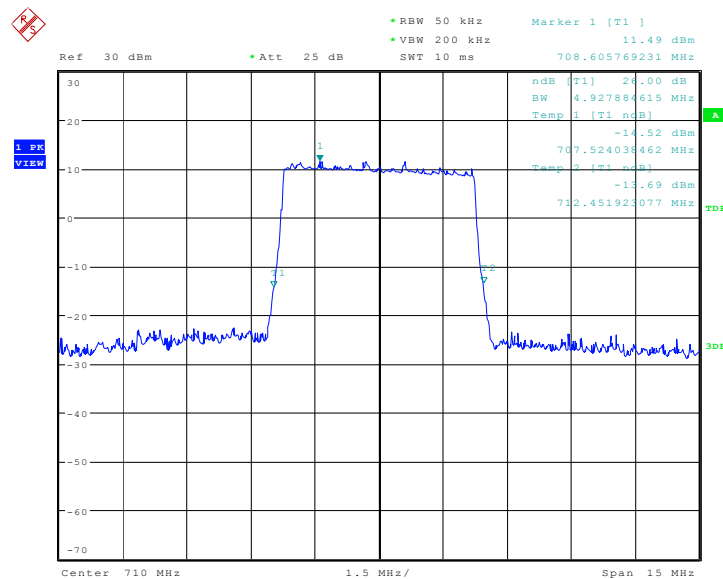
Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
710.0	QPSK	16QAM
	4927.88	4927.88

### LTE band 17, 5MHz Bandwidth, QPSK (-26dBc BW)



Date: 14..JUN.2016 01:39:43

### LTE band 17, 5MHz Bandwidth, 16QAM (-26dBc BW)

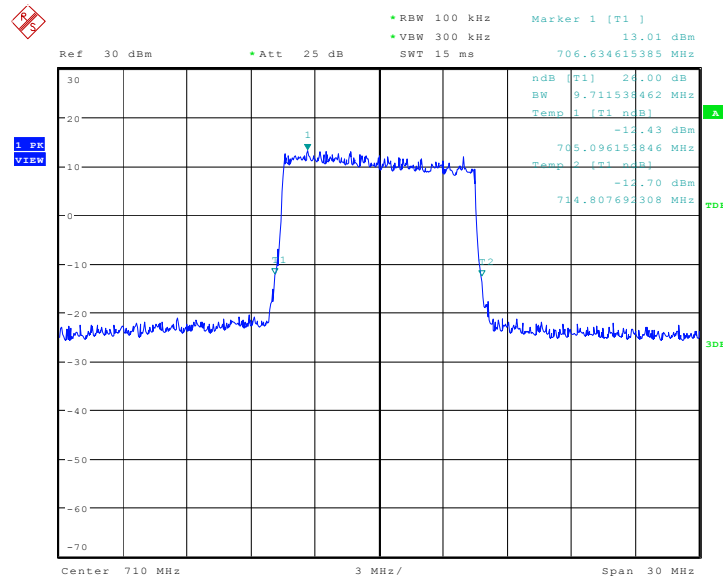


Date: 14..JUN.2016 01:39:59

### LTE band 17, 10MHz (-26dBc)

Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
710.0	QPSK	16QAM
	9711.54	/

### LTE band 17, 10MHz Bandwidth, QPSK (-26dBc BW)



Date: 11..III..2016 22:25:10

## **A.5 BAND EDGE COMPLIANCE**

### **A.5.1 Measurement limit**

Part 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.

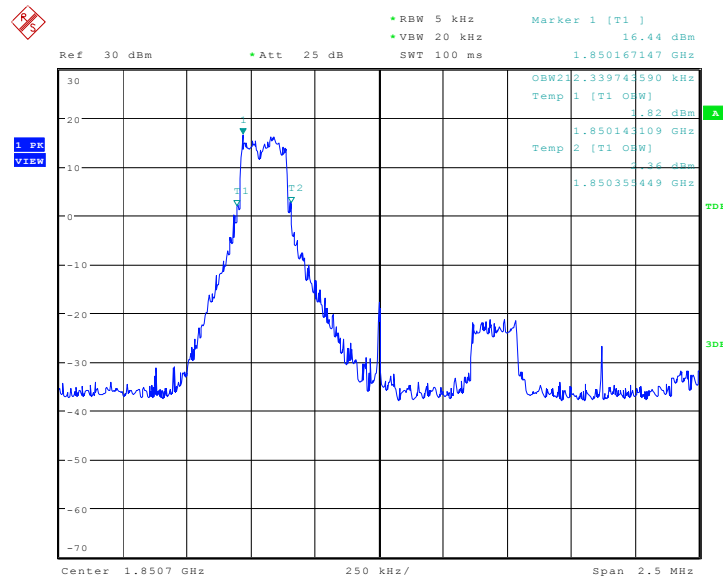
Part 27.53(a) states for mobile and portable stations operating in the 2305–2315 MHz and 2350–2360 MHz bands: By a factor of not less than:  $43 + 10 \log(P)$  dB on all frequencies between 2305 and 2320 MHz and on all frequencies between 2345 and 2360 MHz that are outside the licensed band(s) of operation, not less than  $55 + 10 \log(P)$  dB on all frequencies between 2320 and 2324 MHz and on all frequencies between 2341 and 2345 MHz, not less than  $61 + 10 \log(P)$  dB on all frequencies between 2324 and 2328 MHz and on all frequencies between 2337 and 2341 MHz, and not less than  $67 + 10 \log(P)$  dB on all frequencies between 2328 and 2337 MHz; By a factor of not less than  $43 + 10 \log(P)$  dB on all frequencies between 2300 and 2305 MHz,  $55 + 10 \log(P)$  dB on all frequencies between 2296 and 2300 MHz,  $61 + 10 \log(P)$  dB on all frequencies between 2292 and 2296 MHz,  $67 + 10 \log(P)$  dB on all frequencies between 2288 and 2292 MHz, and  $70 + 10 \log(P)$  dB below 2288 MHz; By a factor of not less than  $43 + 10 \log(P)$  dB on all frequencies between 2360 and 2365 MHz, and not less than  $70 + 10 \log(P)$  dB above 2365 MHz.

### A.5.2 Measurement result

Only worst case result is given below

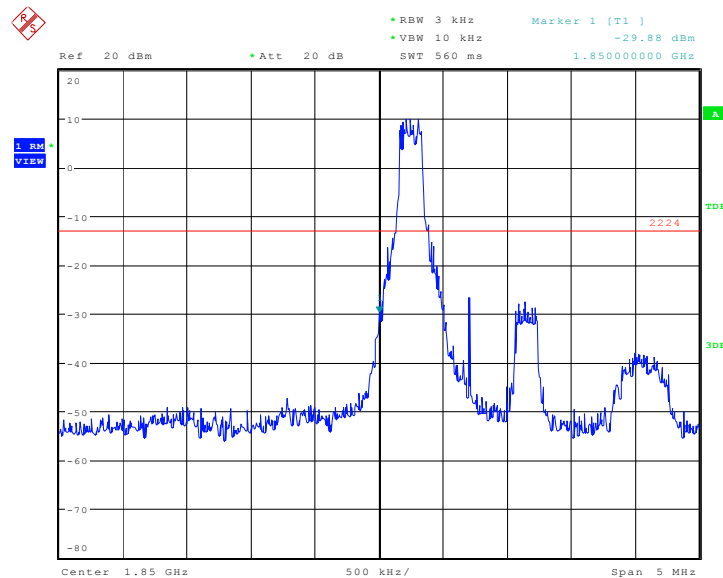
LTE band 2

OBW: 1RB-low\_offset



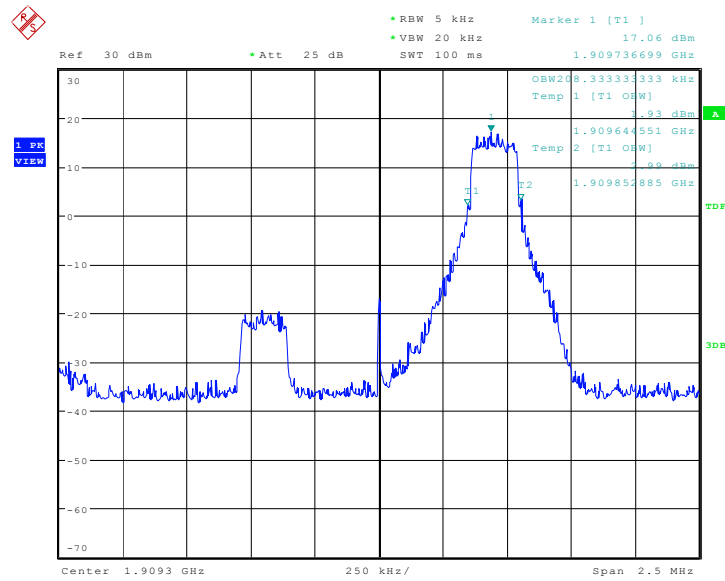
Date: 13.JUN.2016 22:44:00

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



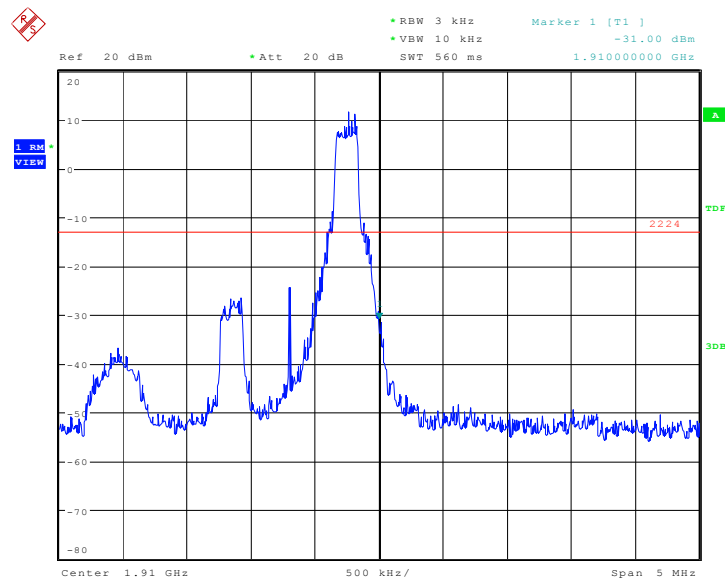
Date: 13.JUN.2016 22:44:46

## OBW: 1RB-high\_offset



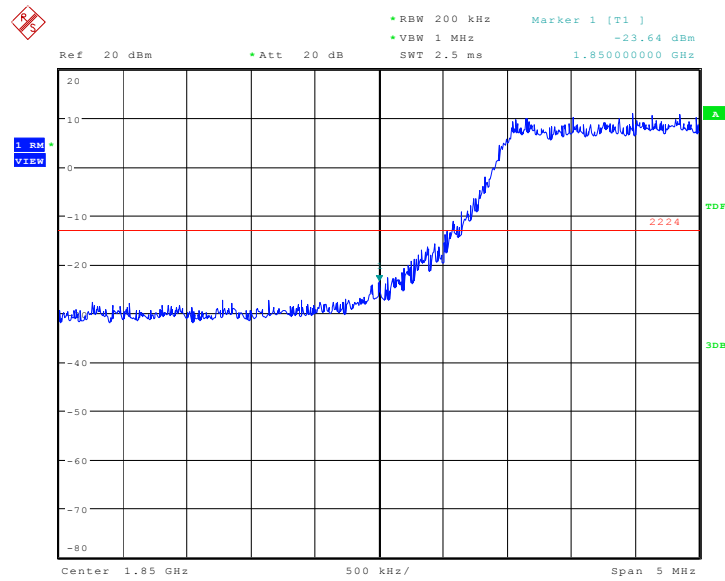
Date: 13..JUN.2016 22:56:33

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



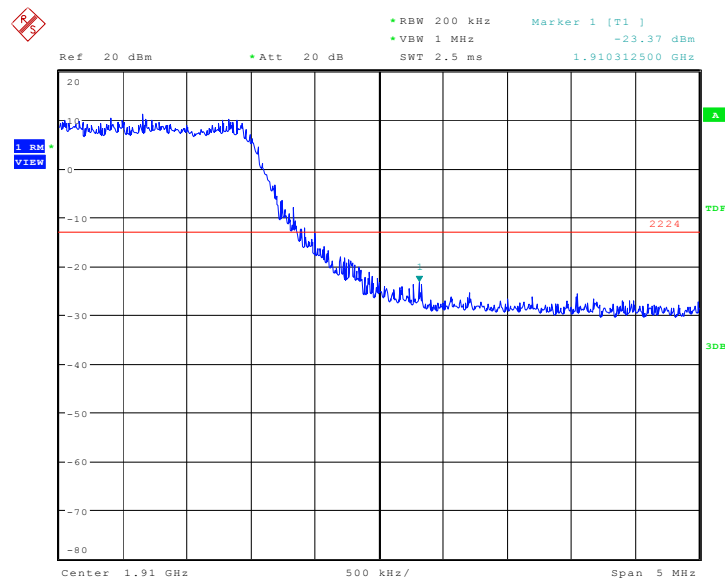
Date: 13..JUN.2016 22:58:19

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



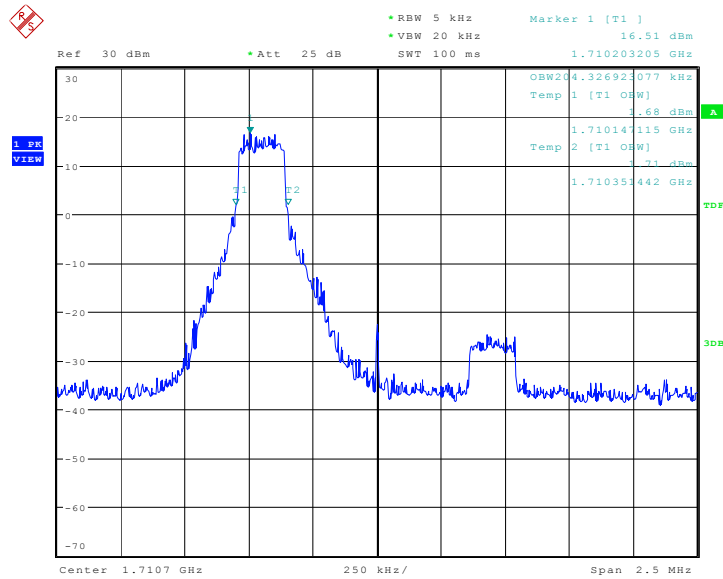
Date: 13..JUN.2016 22:24:48

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



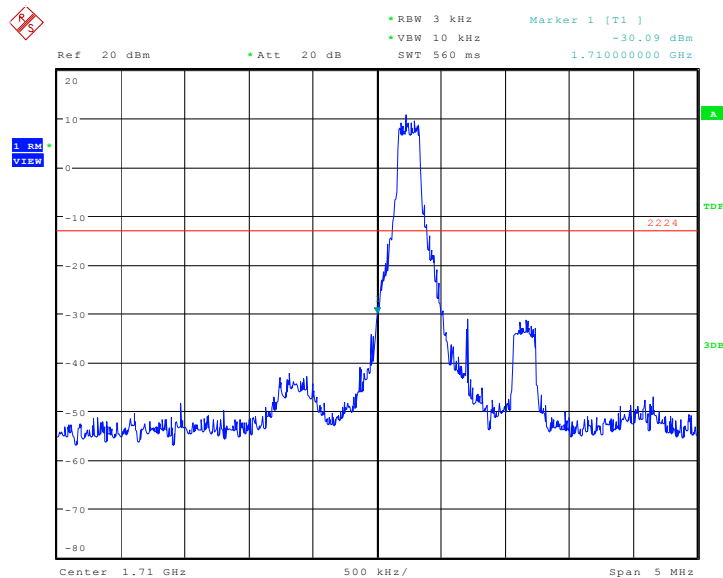
Date: 13..JUN.2016 22:28:10

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



Date: 13.JUN.2016 22:45:41

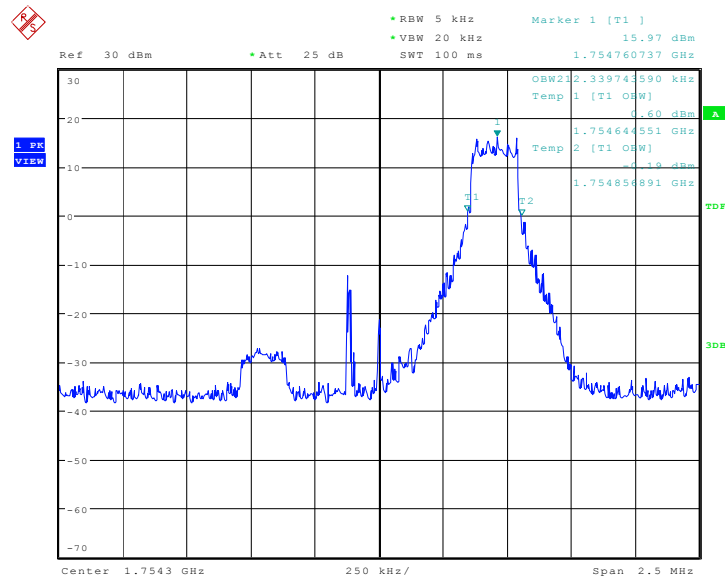
## LOW BAND EDGE BLOCK-1RB-low\_offset



Date: 13.JUN.2016 22:46:27

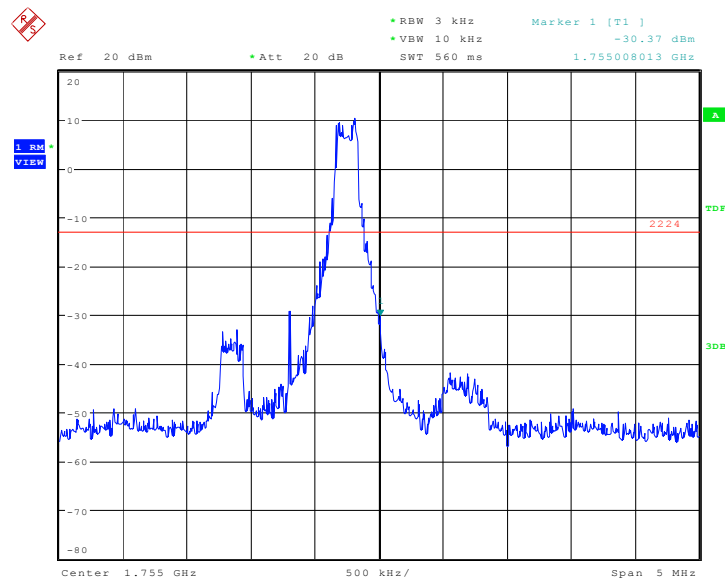


## OBW: 1RB-high\_offset



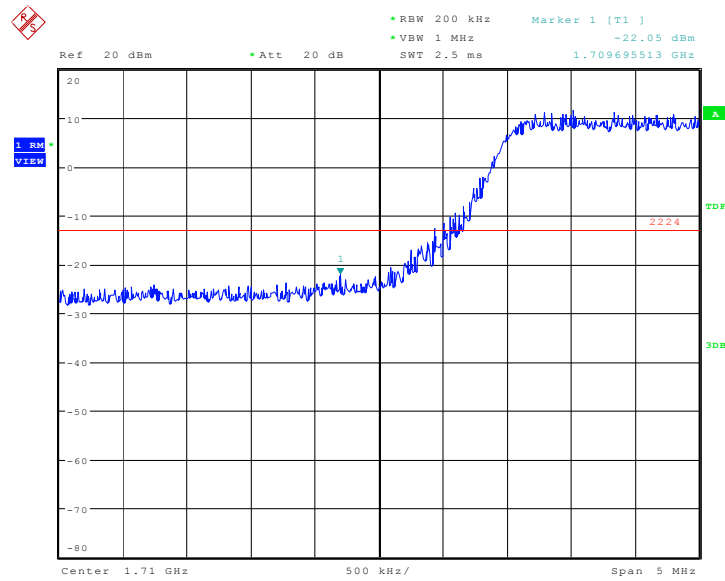
Date: 13..JUN.2016 23:00:15

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



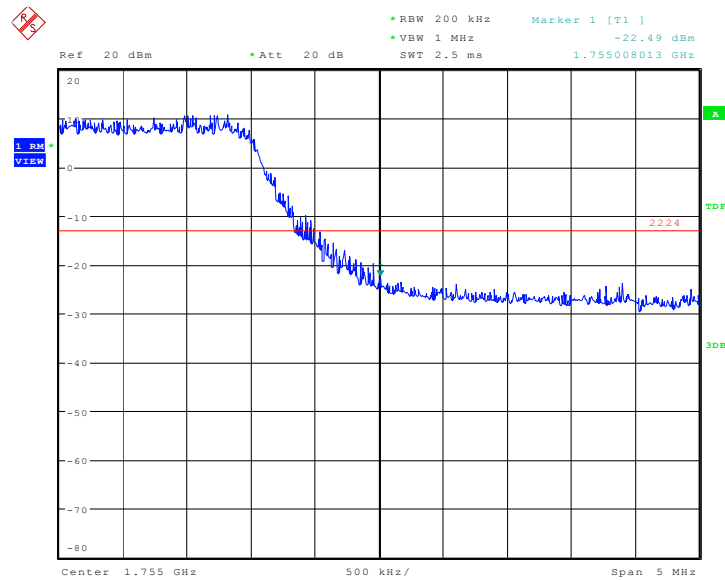
Date: 13..JUN.2016 23:01:31

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



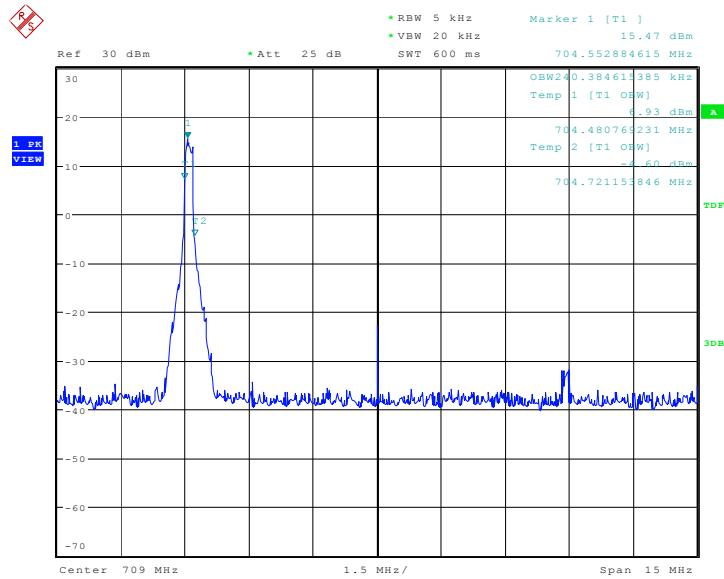
Date: 13.JUN.2016 22:25:37

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



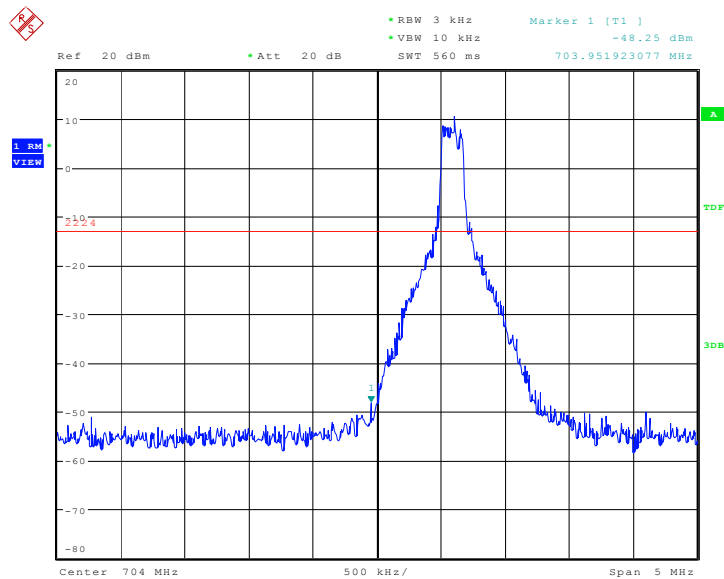
Date: 13.JUN.2016 22:29:00

**LTE band 17**  
**OBW: 1RB-low\_offset**



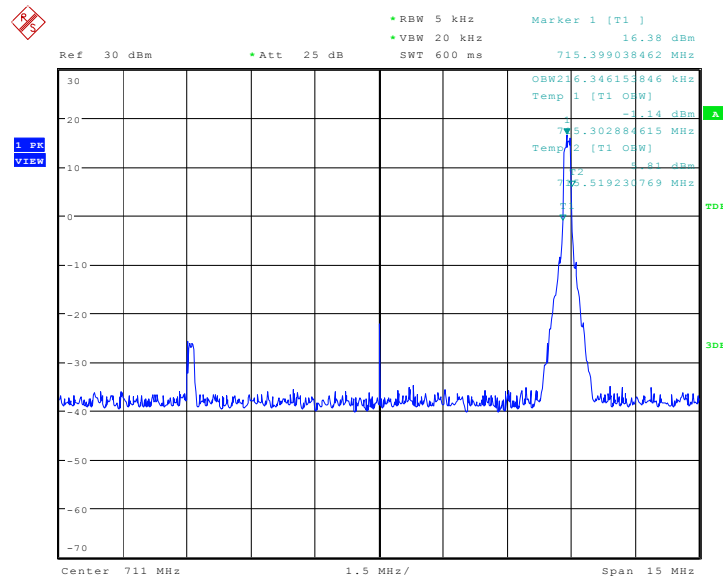
Date: 14.JUN.2016 00:22:25

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



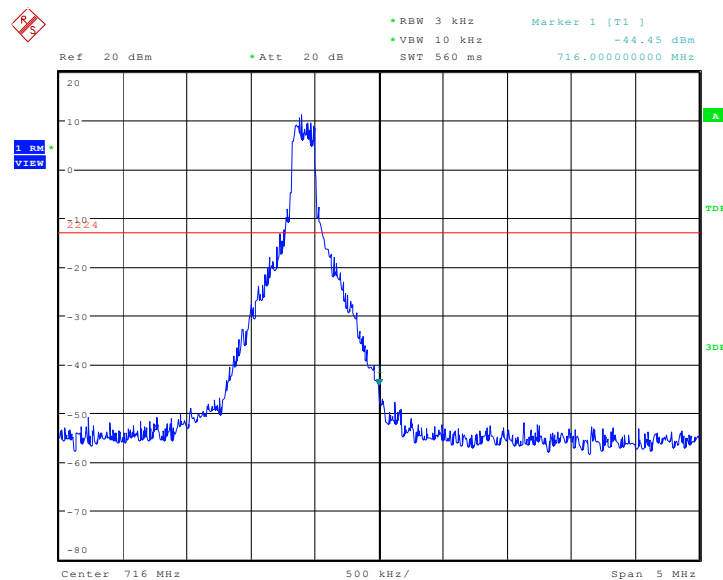
Date: 14.JUN.2016 00:23:11

## OBW: 1RB-high\_offset



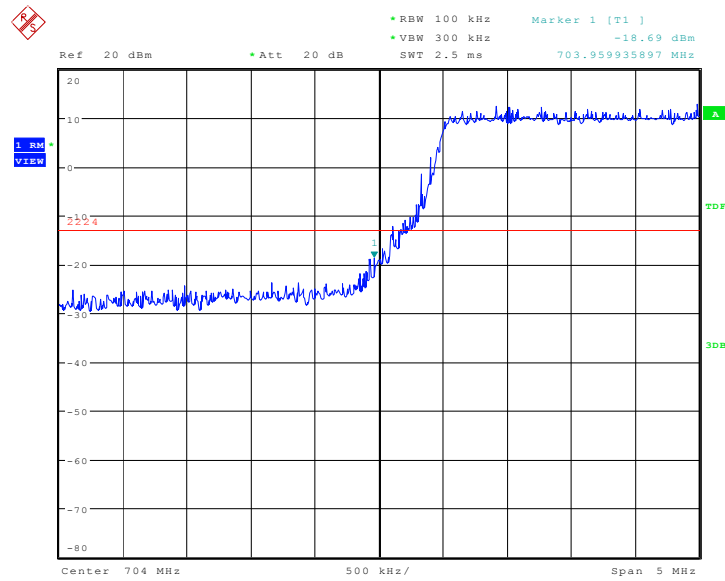
Date: 13.JUN.2016 23:24:41

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



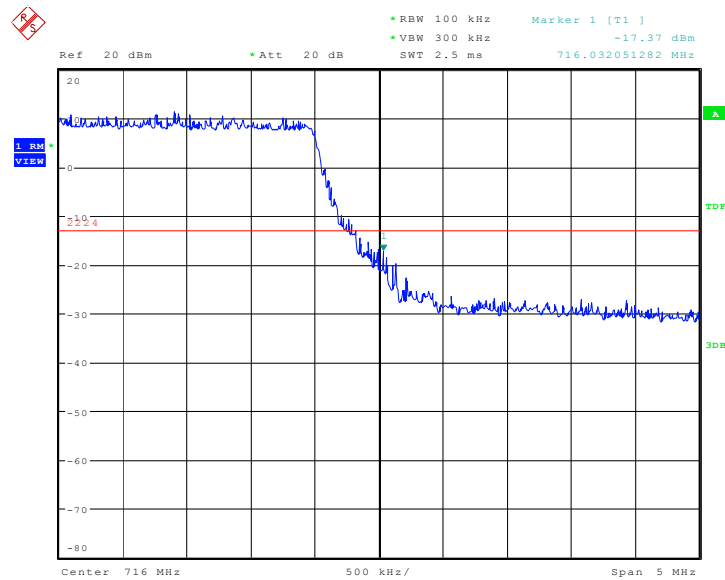
Date: 13.JUN.2016 23:29:28

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



Date: 13.JUN.2016 22:13:08

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



Date: 13.JUN.2016 22:22:34

## **A.6 CONDUCTED SPURIOUS EMISSION**

### **A.6.1 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. 6.2 Measurement Limit**

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.

Part 27.53(a) states for mobile and portable stations operating in the 2305–2315 MHz and 2350–2360 MHz bands: By a factor of not less than:  $43 + 10 \log(P)$  dB on all frequencies between 2305 and 2320 MHz and on all frequencies between 2345 and 2360 MHz that are outside the licensed band(s) of operation, not less than  $55 + 10 \log(P)$  dB on all frequencies between 2320 and 2324 MHz and on all frequencies between 2341 and 2345 MHz, not less than  $61 + 10 \log(P)$  dB on all frequencies between 2324 and 2328 MHz and on all frequencies between 2337 and 2341 MHz, and not less than  $67 + 10 \log(P)$  dB on all frequencies between 2328 and 2337 MHz; By a factor of not less than  $43 + 10 \log(P)$  dB on all frequencies between 2300 and 2305 MHz, 55



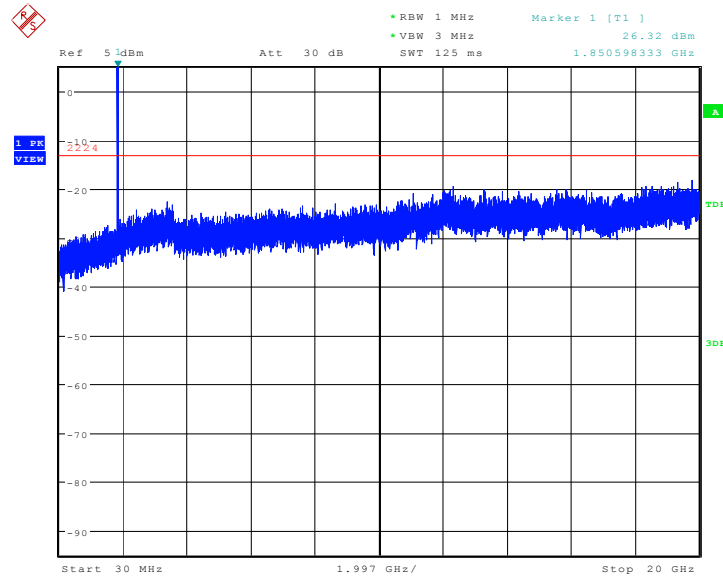
+ 10 log (P) dB on all frequencies between 2296 and 2300MHz, 61 + 10 log (P) dB on all frequencies between 2292 and 2296 MHz, 67 + 10 log (P) dB on all frequencies between 2288 and 2292 MHz, and 70 + 10 log (P) dB below 2288 MHz; By a factor of not less than 43 + 10 log (P) dB on all frequencies between 2360 and 2365 MHz, and not less than 70 + 10 log (P) dB above 2365 MHz.

### A.6.3 Measurement result

Only worst case result is given below

**LTE band 2: 30MHz – 20GHz**

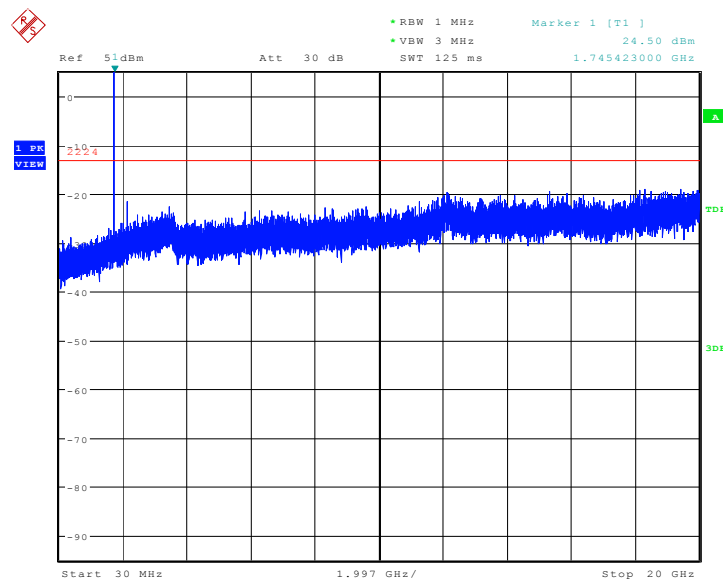
Spurious emission limit –13dBm.



Date: 13..JUN.2016 21:57:10

**LTE band 4: 30MHz – 20GHz**

Spurious emission limit –13dBm.

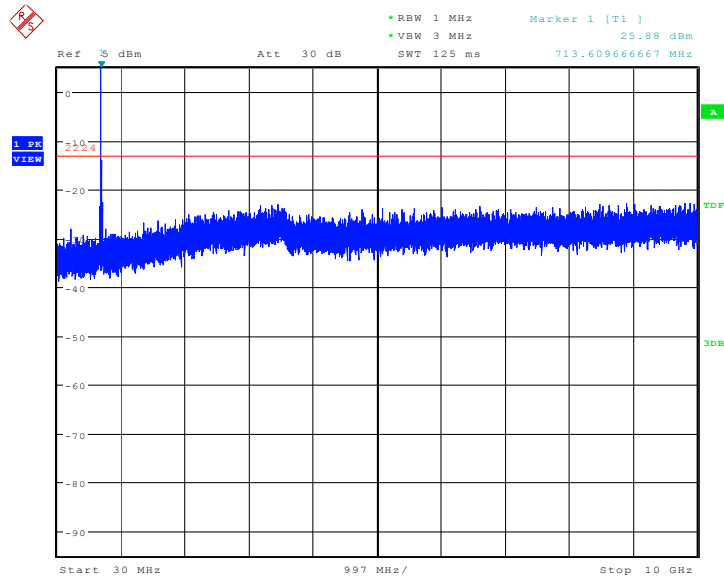


Date: 13..JUN.2016 22:07:46





**LTE band 17: 30MHz – 10GHz**  
Spurious emission limit –13dBm.



Date: 13.JUN.2016 22:10:30

## **A.7 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 v02r02 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%

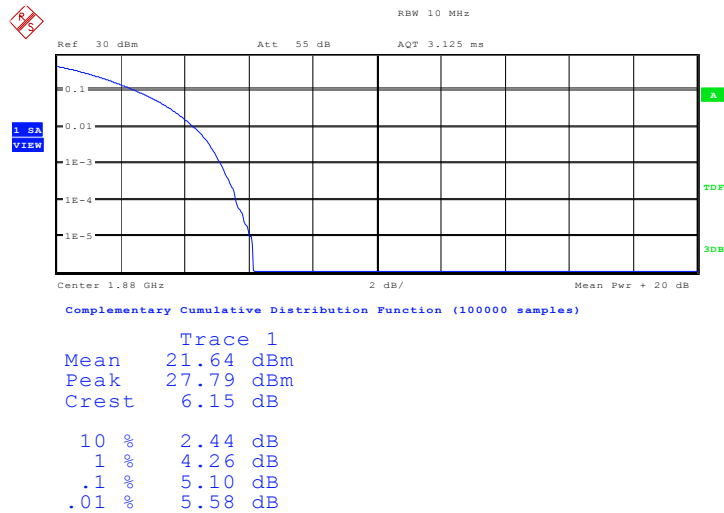
### **A.7.1 Measurement limit**

not exceed 13 dB

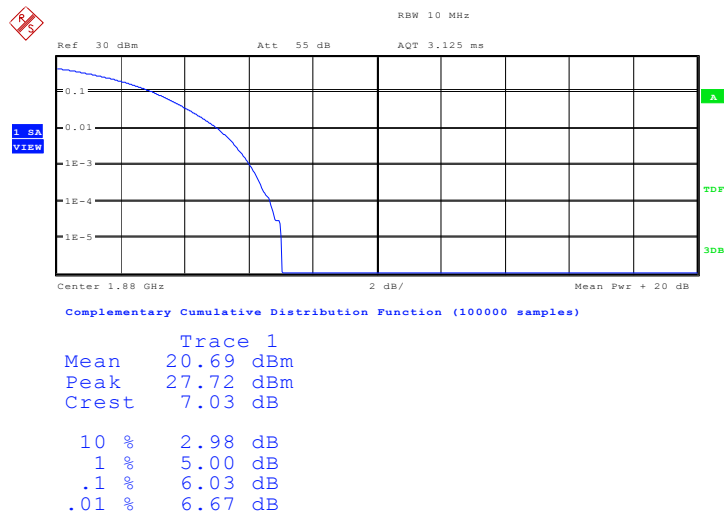
### **A.7.2 Measurement results**

### LTE band 2, 20MHz

Frequency(MHz)	PAPR(dB)	
	QPSK	16QAM
1860.0	5.10	6.03



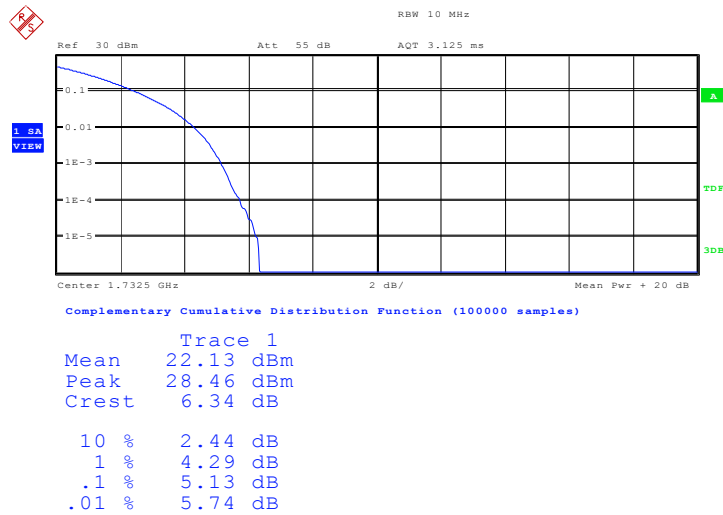
Date: 13.JUN.2016 23:42:27



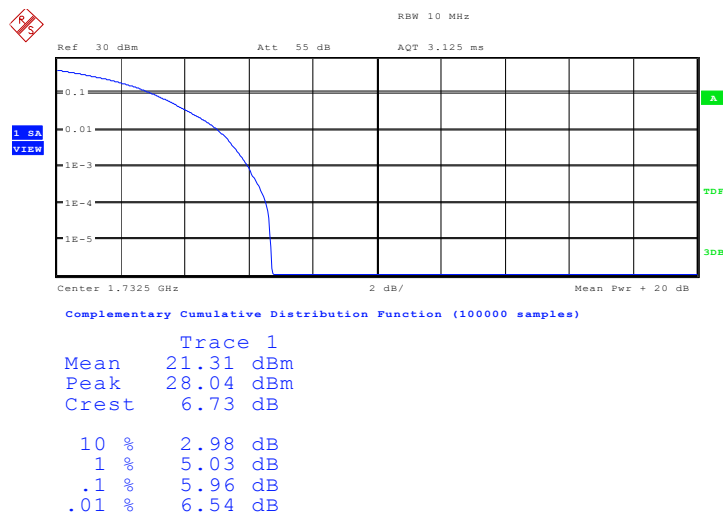
Date: 13.JUN.2016 23:42:52

### LTE band 4, 20MHz

Frequency(MHz)	PAPR(dB)	
1745.0	QPSK	16QAM
	5.13	5.96



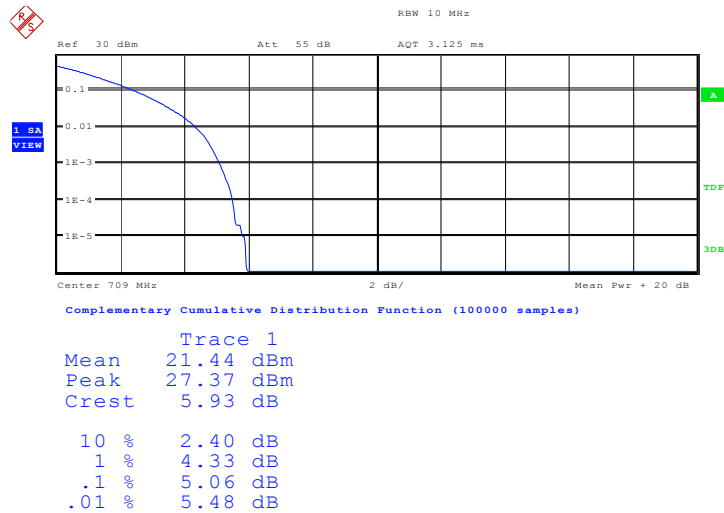
Date: 13.JUN.2016 23:59:51



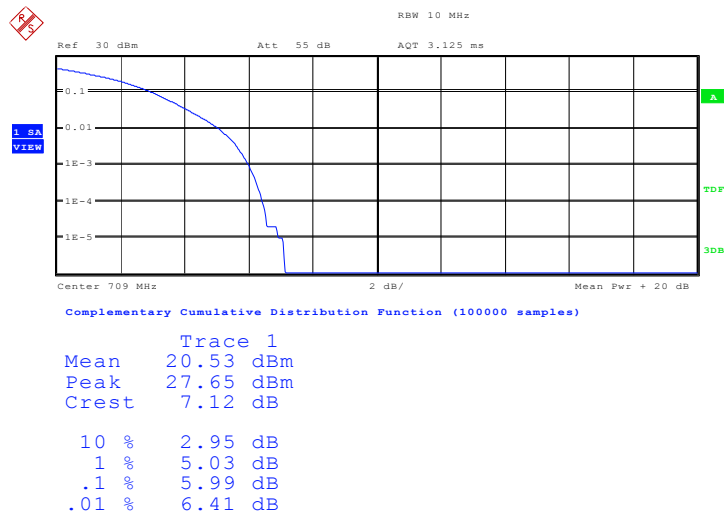
Date: 14.JUN.2016 00:00:16

### LTE band 17,10MHz

Frequency(MHz)	PAPR(dB)	
	QPSK	16QAM
710.0	5.06	5.99



Date: 14.JUN.2016 00:10:05



Date: 14.JUN.2016 00:10:30

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