



# TEST REPORT

No. I17Z60076-GTE03

for

**HMD Global Oy**

**Smart Phone**

**Model Name: TA-1021**

**FCC ID: 2AJOTTA-1021**

with

**Hardware Version: 3**

**Software Version: 000C\_3\_050**

**Issued Date: 2017-04-28**

**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>
I17Z60076-GTE03	Rev.0	1 <sup>st</sup> edition	2017-04-14
I17Z60076-GTE03	Rev.1	2nd edition fix typo on page 32	2017-04-28



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## **1. Test Laboratory**

### **1.1. Testing Location**

Company Name: CCTL, Telecommunication Technology Labs, Academy of Telecommunication Research, MIT  
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### **1.1. Testing Environment**

Normal Temperature: 15-35°C  
Relative Humidity: 20-75%

### **1.2. Project data**

Testing Start Date: 2017-04-07  
Testing End Date: 2017-04-13

### **1.3. 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**

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

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

Description	Smart Phone
Model Name	TA-1021
FCC ID	2AJOTTA-1021
Antenna	Integrated
Output power	22.74dBm maximum EIRP measured for Band 7
Extreme vol. Limits	3.6VDC to 4.4VDC (nominal: 3.84VDC)
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, MIT

Note: The EUT is a variant model of TA-1025. Only LTE Band 5 had been tested. The other result is coming from the initial model.

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

<b>EUT ID*</b>	<b>IMEI</b>	<b>HW Version</b>	<b>SW Version</b>
UT81a	356020080014531	3	000C_3_050
UT97a	356020080022575	3	000C_3_050

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

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

<b>AE ID*</b>	<b>Description</b>	<b>SN</b>	<b>Note</b>
AE1	Battery	/	INBUILT
AE2	Battery	/	INBUILT
AE3	Travel charger	/	/
AE4	Travel charger	/	/
AE5	USB cable	/	/
AE6	Headset	/	/
AE7	Travel charger	/	/
AE8	Travel charger	/	/
AE9	Travel charger	/	/
AE10	Travel charger	/	/

#### **AE1**

Model	HE316
Manufacturer	SCUD(FUJIAN) ELECTRONICS CO LTD
Capacitance	3000mAh
Nominal voltage	3.82V

#### **AE2**

Model	HE317
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Manufacturer	SCUD(FUJIAN) ELECTRONICS CO LTD
Capacitance	3000mAh
Nominal voltage	3.84V

AE3/AE4

Model	FC0100
Manufacturer	Salcomp
Length of cable	/

AE5

Model	CUBB01M-FA010-DH
Manufacturer	FOXCONN
Length of cable	99cm

AE6

Model	5CAB5422B-N01-DG
Manufacturer	FOXCONN
Length of cable	/

AE7

Type	FC0101
Manufacturer	Salcomp
Length of cable	/

AE8

Type	FC0102
Manufacturer	Salcomp
Length of cable	/

AE9

Type	FC0103
Manufacturer	Salcomp
Length of cable	/

AE10

Type	FC0111
Manufacturer	Salcomp
Length of cable	/

\*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.

<b>Reference</b>	<b>Title</b>	<b>Version</b>
FCC Part 22	PUBLIC MOBILE SERVICES	10-1-15 Edition
FCC Part 27	MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES	10-1-15 Edition
ANSI/TIA-603-D	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	2010
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; 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 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

**LTE Band 38**

<b>Items</b>	<b>Test Name</b>	<b>Clause in FCC rules</b>	<b>Section in this report</b>	<b>Verdict</b>
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	2018-03-01	1 year
2	Test Receiver	ESU26	100376	R&S	2017-10-26	1 year
3	EMI Antenna	3117	00058889	ETS-Lindgren	2017-12-15	3 year
4	Universal Radio Communication Tester	CMU200	108646	R&S	2017-10-27	1 year
5	Universal Radio Communication Tester	CMW500	149646	R&S	2017-11-02	1 year
6	Spectrum Analyzer	E4440A	MY49420053	Agilent	2018-03-01	1 year
7	EMI Antenna	9117	177	Schwarzbeck	2017-06-25	3 year
8	EMI Antenna	VULB9163	9163-235	Schwarzbeck	2017-10-29	3 year
9	Signal Generator	SMF100A	101295	R&S	2017-11-07	1 year
10	Climate chamber	SH-241	92007454	ESPEC	2017-12-14	2 year
11	Loop Antenna	HFH2-Z2	829324/007	R&S	2017-12-10	3 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 5**

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
1.4MHz	1 RB high	848.3	22.03	21.36
		836.5	21.96	21.31
		824.7	22.08	21.20
	1 RB low	848.3	21.87	21.42
		836.5	21.82	21.30
		824.7	22.09	21.39
	50% RB mid	848.3	21.85	20.90
		836.5	21.91	21.04
		824.7	22.24	21.09
	100% RB	848.3	20.70	19.70
		836.5	20.87	19.86
		824.7	21.02	20.01
3MHz	1 RB high	847.5	21.94	21.27
		836.5	21.97	21.41
		825.5	22.06	21.22
	1 RB low	847.5	21.84	21.31
		836.5	21.85	21.23
		825.5	22.11	21.21
	50% RB mid	847.5	20.82	19.88
		836.5	20.95	20.18
		825.5	21.08	20.23
	100% RB	847.5	20.93	19.94

		836.5	20.96	19.98
		825.5	21.04	20.20
5MHz	1 RB high	846.5	21.60	21.19
		836.5	21.82	21.13
		826.5	21.84	21.26
	1 RB low	846.5	21.57	20.97
		836.5	21.82	21.13
		826.5	21.96	21.38
	50% RB mid	846.5	20.76	19.76
		836.5	21.02	19.89
		826.5	21.02	20.04
	100% RB	846.5	20.72	19.84
		836.5	20.93	19.96
		826.5	20.85	19.97
10MHz	1 RB high	844.0	21.89	21.30
		836.5	22.11	21.54
		829.0	22.04	21.38
	1 RB low	844.0	21.82	21.24
		836.5	21.97	21.50
		829.0	21.92	21.49
	50% RB mid	844.0	20.86	19.69
		836.5	20.90	19.88
		829.0	21.04	20.03
	100% RB	844.0	20.85	19.91
		836.5	20.98	19.90
		829.0	20.99	19.98

**LTE band 7**

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
5MHz	1 RB high	2567.5	22.51	21.95
		2535	22.58	21.93
		2502.5	22.53	21.65
	1 RB low	2567.5	22.40	21.92
		2535	22.62	21.98
		2502.5	22.51	21.36
	50% RB mid	2567.5	21.71	20.79
		2535	21.76	20.77
		2502.5	21.64	20.84
	100% RB	2567.5	21.64	20.66
		2535	21.71	20.87
		2502.5	21.60	20.75
10MHz	1 RB high	2565	22.71	22.20
		2535	23.01	21.89
		2505	22.61	21.91
	1 RB low	2565	22.80	22.28
		2535	22.84	22.03
		2505	22.67	21.99
	50% RB mid	2565	21.75	20.83
		2535	21.68	20.82
		2505	21.66	20.79
	100% RB	2565	21.69	20.79
		2535	21.74	20.87
		2505	21.76	20.68
15MHz	1 RB high	2562.5	22.49	22.45
		2535	22.87	22.17
		2507.5	22.54	22.36
	1 RB low	2562.5	22.73	22.21
		2535	22.68	22.26
		2507.5	22.67	22.37
	50% RB mid	2562.5	21.73	20.63
		2535	21.69	20.70
		2507.5	21.73	20.85
	100% RB	2562.5	21.73	20.73
		2535	21.80	20.76
		2507.5	21.73	20.86
20MHz	1 RB high	2560	22.85	21.90





		2535	22.54	22.18
		2510	22.91	21.72
	1 RB low	2560	22.75	22.02
		2535	22.52	22.13
		2510	22.80	21.74
	50% RB mid	2560	21.84	20.95
		2535	21.75	20.82
		2510	21.73	20.72
	100% RB	2560	21.84	20.78
		2535	21.80	20.89
		2510	21.65	20.72



**LTE band 38**

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
5MHz	1 RB high	2617.5	23.28	22.90
		2595.0	23.26	22.52
		2572.5	23.41	22.57
	1 RB low	2617.5	23.34	22.87
		2595.0	23.43	22.79
		2572.5	23.37	22.73
	50% RB mid	2617.5	22.52	21.63
		2595.0	22.49	21.54
		2572.5	22.50	21.71
	100% RB	2617.5	22.45	21.62
		2595.0	22.51	21.63
		2572.5	22.49	21.59
10MHz	1 RB high	2615.0	23.49	22.74
		2595.0	23.45	22.61
		2575.0	23.40	22.75
	1 RB low	2615.0	23.36	22.67
		2595.0	23.37	22.76
		2575.0	23.38	22.75
	50% RB mid	2615.0	21.60	21.60
		2595.0	21.61	21.61
		2575.0	21.61	21.61
	100% RB	2615.0	21.59	21.70
		2595.0	21.59	21.59
		2575.0	21.68	21.70
15MHz	1 RB high	2612.5	23.44	22.71
		2595.0	23.24	22.72
		2577.5	23.35	22.74
	1 RB low	2612.5	23.43	22.60
		2595.0	23.52	22.60
		2577.5	23.36	22.62
	50% RB mid	2612.5	22.60	21.66
		2595.0	21.59	21.58
		2577.5	21.59	21.58
	100% RB	2612.5	22.59	21.67
		2595.0	21.76	21.76
		2577.5	21.57	21.57
20MHz	1 RB high	2610.0	23.57	22.64



		2595.0	23.50	22.74
		2580.0	23.52	22.74
	1 RB low	2610.0	23.62	22.90
		2595.0	23.45	22.32
		2580.0	23.38	22.33
	50% RB mid	2610.0	22.44	21.36
		2595.0	22.47	21.39
		2580.0	22.46	21.49
	100% RB	2610.0	22.41	21.46
		2595.0	22.44	21.48
		2580.0	22.43	21.22

### A.1.3 Radiated

#### A.1.3.1 Description

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

Rule Part 27.50(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.”.

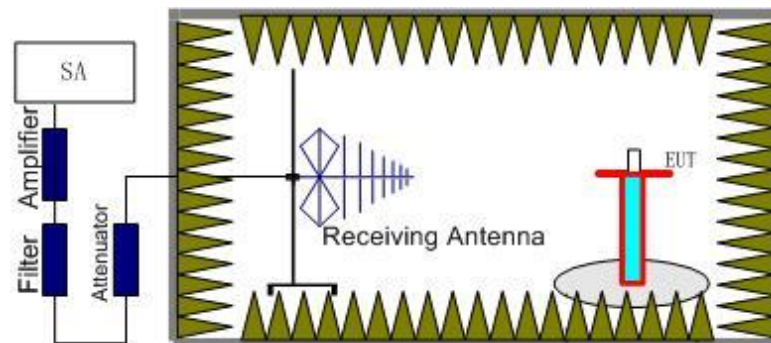
Rule Part 27.50(c) specifies “Portable stations (hand-held de-vices) are limited to 3 watts ERP.”.

Rule Part 27.50(a)(3) specifies “For mobile and portable stations transmitting in the 2305–2315 MHz band or the 2350–2360 MHz band, the average EIRP must not exceed 50 milliwatts within any 1 megahertz of authorized bandwidth, except that for mobile and portable stations compliant with 3GPP LTE standards or another advanced mobile broadband protocol that avoids concentrating energy at the edge of the operating band the average EIRP must not exceed 250 milliwatts within any 5 megahertz of authorized bandwidth but may exceed 50 milliwatts within any 1 megahertz of authorized bandwidth.”

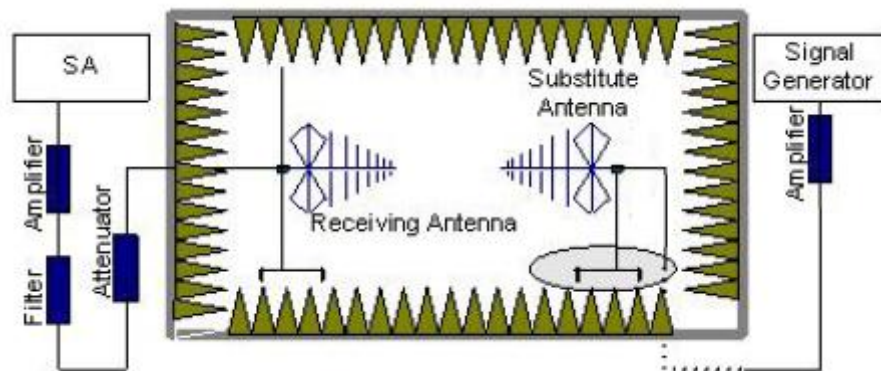
#### A.1.3.2 Method of Measurement

The measurements procedures in TIA-603D-2010 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 ( $P_d$ ), 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:

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

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 5- ERP 22.913(a)**

**Limits:** ≤38.45dBm (7W)

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>ci</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	-24.34	2.26	-45.79	-0.95	2.15	17.99	38.45	20.46	H
836.50	-24.06	2.26	-45.66	-0.82	2.15	18.01	38.45	20.44	V
848.30	-23.67	2.27	-45.55	-0.80	2.15	18.26	38.45	20.19	V

**LTE Band 5\_3MHz\_QPSK**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>ci</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	-24.76	2.26	-45.79	-0.94	2.15	17.56	38.45	20.89	H
836.50	-24.02	2.26	-45.66	-0.82	2.15	18.05	38.45	20.40	V
847.50	-23.61	2.27	-45.56	-0.81	2.15	18.34	38.45	20.11	V

**LTE Band 5\_5MHz\_QPSK**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>ci</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	-24.93	2.25	-45.77	-0.93	2.15	17.37	38.45	21.08	H
836.50	-24.12	2.26	-45.66	-0.82	2.15	17.95	38.45	20.50	V
846.50	-23.59	2.26	-45.56	-0.82	2.15	18.38	38.45	20.07	V

**LTE Band 5\_10MHz\_QPSK**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>ci</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	-24.90	2.13	-45.74	-0.90	2.15	17.46	38.45	20.99	H
836.50	-23.87	2.26	-45.66	-0.82	2.15	18.20	38.45	20.25	V
844.00	-23.71	2.26	-45.59	-0.82	2.15	18.29	38.45	20.16	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	-25.05	2.26	-45.79	-0.95	2.15	17.28	38.45	21.17	H
836.50	-24.81	2.26	-45.66	-0.82	2.15	17.26	38.45	21.19	V
848.30	-24.37	2.27	-45.55	-0.80	2.15	17.56	38.45	20.89	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	-25.27	2.26	-45.79	-0.94	2.15	17.05	38.45	21.40	H
836.50	-24.92	2.26	-45.66	-0.82	2.15	17.15	38.45	21.30	V
847.50	-24.59	2.27	-45.56	-0.81	2.15	17.36	38.45	21.09	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	-26.21	2.25	-45.77	-0.93	2.15	16.09	38.45	22.36	V
836.50	-25.05	2.26	-45.66	-0.82	2.15	17.02	38.45	21.43	H
846.50	-24.45	2.26	-45.56	-0.82	2.15	17.52	38.45	20.93	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	-25.42	2.13	-45.74	-0.90	2.15	16.94	38.45	21.51	H
836.50	-24.80	2.26	-45.66	-0.82	2.15	17.27	38.45	21.18	V
844.00	-24.69	2.26	-45.59	-0.82	2.15	17.31	38.45	21.14	V



**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	-28.29	3.58	-45.68	-6.10	19.91	33.00	13.09	H
2535.00	-25.75	3.63	-44.82	-6.16	21.60	33.00	11.40	H
2567.50	-25.82	3.65	-44.92	-6.22	21.67	33.00	11.33	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	-27.99	3.59	-45.64	-6.11	20.17	33.00	12.83	H
2535.00	-25.44	3.63	-44.82	-6.16	21.91	33.00	11.09	H
2565.00	-25.48	3.65	-44.97	-6.22	22.06	33.00	10.94	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	-27.27	3.59	-44.92	-6.11	20.17	33.00	12.83	H
2535.00	-25.76	3.63	-44.82	-6.16	21.59	33.00	11.41	H
2562.50	-26.40	3.65	-45.67	-6.21	21.83	33.00	11.17	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	-27.43	3.58	-45.36	-6.12	20.47	33.00	12.53	H
2535.00	-25.76	3.63	-44.82	-6.16	21.59	33.00	11.41	H
2560.00	-25.81	3.64	-45.98	-6.21	22.74	33.00	10.26	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	-29.35	3.58	-45.68	-6.10	18.85	33.00	14.15	H
2535.00	-27.11	3.63	-44.82	-6.16	20.24	33.00	12.76	H
2567.50	-26.58	3.65	-44.92	-6.22	20.91	33.00	12.09	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	-29.05	3.59	-45.64	-6.11	19.11	33.00	13.89	H
2535.00	-26.54	3.63	-44.82	-6.16	20.81	33.00	12.19	H
2565.00	-26.16	3.65	-44.97	-6.22	21.38	33.00	11.62	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	-28.42	3.59	-44.92	-6.11	19.02	33.00	13.98	H
2535.00	-26.75	3.63	-44.82	-6.16	20.60	33.00	12.40	H
2562.50	-27.19	3.65	-45.67	-6.21	21.04	33.00	11.96	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	-28.88	3.58	-45.36	-6.12	19.02	33.00	13.98	H
2535.00	-26.25	3.63	-44.82	-6.16	21.10	33.00	11.90	H
2560.00	-26.96	3.64	-45.98	-6.21	21.59	33.00	11.41	H



**LTE Band 38- EIRP Part 27.50(h)(2)**

**Limits:** ≤33dBm (2W)

**LTE Band 38\_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
2572.50	-29.55	3.66	-44.92	-6.23	17.94	33.00	15.06	H
2595.00	-29.49	3.68	-44.91	-6.27	18.01	33.00	14.99	H
2617.50	-29.83	3.68	-44.94	-6.31	17.74	33.00	15.26	H

**LTE Band 38\_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
2575.00	-29.44	3.66	-44.92	-6.23	18.05	33.00	14.95	H
2595.00	-29.35	3.68	-44.91	-6.27	18.15	33.00	14.85	H
2615.00	-29.48	3.68	-44.94	-6.31	18.09	33.00	14.91	H

**LTE Band 38\_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
2577.50	-29.54	3.66	-44.92	-6.23	17.95	33.00	15.05	H
2595.00	-29.13	3.68	-44.91	-6.27	18.37	33.00	14.63	H
2612.50	-29.72	3.68	-44.94	-6.30	17.84	33.00	15.16	H

**LTE Band 38\_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
2580.00	-29.35	3.67	-44.92	-6.24	18.14	33.00	14.86	H
2595.00	-28.88	3.68	-44.91	-6.27	18.62	33.00	14.38	H
2610.00	-29.68	3.68	-44.94	-6.30	17.88	33.00	15.12	H

**LTE Band 38\_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
2572.50	-30.32	3.66	-44.92	-6.23	17.17	33.00	15.83	H
2595.00	-30.58	3.68	-44.91	-6.27	16.92	33.00	16.08	H
2617.50	-30.84	3.68	-44.94	-6.31	16.73	33.00	16.27	H

**LTE Band 38\_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
2575.00	-30.25	3.66	-44.92	-6.23	17.24	33.00	15.76	H
2595.00	-29.88	3.68	-44.91	-6.27	17.62	33.00	15.38	H
2615.00	-30.36	3.68	-44.94	-6.31	17.21	33.00	15.79	H

**LTE Band 38\_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
2577.50	-30.57	3.66	-44.92	-6.23	16.92	33.00	16.08	H
2595.00	-30.23	3.68	-44.91	-6.27	17.27	33.00	15.73	H
2612.50	-30.98	3.68	-44.94	-6.30	16.58	33.00	16.42	H

**LTE Band 38\_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
2580.00	-29.77	3.67	-44.92	-6.24	17.72	33.00	15.28	H
2595.00	-30.43	3.68	-44.91	-6.27	17.07	33.00	15.93	H
2610.00	-30.28	3.68	-44.94	-6.30	17.28	33.00	15.72	H

**ANALYZER SETTINGS:**

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

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

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

## A.2 EMISSION LIMIT

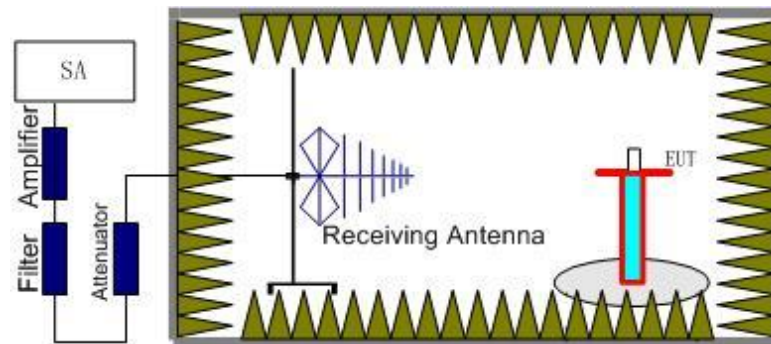
### A.2.1 Measurement Method

The measurements procedures in TIA-603D-2010 are used. This measurement is carried out in fully-anechoic chamber FAC-3.

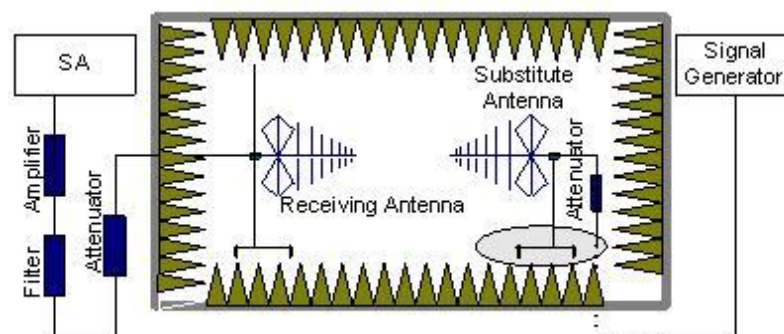
The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier. The resolution bandwidth is set 1MHz. The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the LTE Bands 5,7,38.

#### 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:  
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,  $ERP = EIRP - 2.15dB$ .

### A.2.2 Measurement Limit

Part 22.917, Part 24.238(a), Part 27.53(g), 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(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.2.3 Measurement Results

Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the LTE Bands 5,7,38. 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 5,7,38 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. The evaluated frequency range is from 30MHz to 26GHz.



**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
1660.32	-65.66	3.91	-5.21	2.15	-66.51	-13.00	53.51	V
2478.09	-59.08	4.78	-6.03	2.15	-59.98	-13.00	46.98	H
3372.20	-65.32	5.59	-7.89	2.15	-65.17	-13.00	52.17	V
4175.38	-64.98	6.17	-9.08	2.15	-64.22	-13.00	51.22	V
4953.95	-64.07	6.73	-9.85	2.15	-63.10	-13.00	50.10	H
5829.96	-62.65	7.33	-10.53	2.15	-61.60	-13.00	48.60	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
1676.24	-65.01	3.88	-5.18	2.15	-65.86	-13.00	52.86	H
2498.77	-59.47	4.74	-6.10	2.15	-60.26	-13.00	47.26	H
3340.02	-65.18	5.55	-7.82	2.15	-65.06	-13.00	52.06	V
4162.64	-59.77	6.17	-9.06	2.15	-59.03	-13.00	46.03	H
5009.15	-62.87	6.77	-9.91	2.15	-61.88	-13.00	48.88	V
5847.28	-66.14	7.33	-10.53	2.15	-65.09	-13.00	52.09	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
1685.47	-65.59	3.95	-5.17	2.15	-66.52	-13.00	53.52	V
2546.15	-59.13	4.80	-6.18	2.15	-59.90	-13.00	46.90	V
3381.54	-66.38	5.62	-7.92	2.15	-66.23	-13.00	53.23	H
4259.91	-63.80	6.26	-9.16	2.15	-63.05	-13.00	50.05	V
5087.92	-63.94	6.81	-10.02	2.15	-62.88	-13.00	49.88	H
5953.41	-60.91	7.41	-10.51	2.15	-59.96	-13.00	46.96	H

**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
1632.31	-64.85	3.83	-5.26	2.15	-65.57	-13.00	52.57	H
2470.44	-59.65	4.76	-6.01	2.15	-60.55	-13.00	47.55	H
3277.58	-63.16	5.47	-7.67	2.15	-63.11	-13.00	50.11	V
4105.64	-65.32	6.17	-9.01	2.15	-64.63	-13.00	51.63	H
4991.27	-63.92	6.77	-9.89	2.15	-62.95	-13.00	49.95	V
5750.48	-62.24	7.25	-10.55	2.15	-61.09	-13.00	48.09	V

**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
1620.27	-65.54	3.85	-5.28	2.15	-66.26	-13.00	53.26	H
2490.35	-56.15	4.77	-6.07	2.15	-57.00	-13.00	44.00	V
3360.07	-62.21	5.56	-7.86	2.15	-62.06	-13.00	49.06	V
4164.54	-66.61	6.17	-9.06	2.15	-65.87	-13.00	52.87	H
5024.18	-62.86	6.77	-9.93	2.15	-61.85	-13.00	48.85	V
5863.76	-64.21	7.35	-10.53	2.15	-63.18	-13.00	50.18	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
1681.70	-66.37	3.91	-5.17	2.15	-67.26	-13.00	54.26	V
2548.70	-55.37	4.81	-6.19	2.15	-56.14	-13.00	43.14	H
3369.27	-65.34	5.58	-7.89	2.15	-65.18	-13.00	52.18	H
4260.10	-63.42	6.26	-9.16	2.15	-62.67	-13.00	49.67	V
5069.33	-64.71	6.75	-10.00	2.15	-63.61	-13.00	50.61	V
5991.31	-62.09	7.43	-10.50	2.15	-61.17	-13.00	48.17	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
4960.64	-62.82	6.73	-9.86	-59.69	-13.00	46.69	H
7508.13	-50.62	8.36	-12.21	-46.77	-13.00	33.77	H
10010.84	-50.44	9.53	-12.90	-47.07	-13.00	34.07	H
12534.24	-56.62	10.71	-13.22	-54.11	-13.00	41.11	V
15030.35	-53.64	11.86	-13.98	-51.52	-13.00	38.52	H
17317.60	-48.66	12.73	-14.50	-46.89	-13.00	33.89	H

**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
5079.41	-62.22	6.74	-10.01	-58.95	-13.00	45.95	H
7605.53	-48.45	8.32	-12.28	-44.49	-13.00	31.49	H
10140.76	-52.15	9.57	-12.96	-48.76	-13.00	35.76	V
12431.21	-57.30	10.69	-13.17	-54.82	-13.00	41.82	H
15051.25	-53.20	11.80	-13.97	-51.03	-13.00	38.03	H
17635.43	-51.02	12.95	-15.09	-48.88	-13.00	35.88	H

**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
5003.33	-62.86	6.79	-9.90	-59.75	-13.00	46.75	V
7703.08	-42.92	8.37	-12.36	-38.93	-13.00	25.93	H
10270.86	-51.80	9.55	-13.01	-48.34	-13.00	35.34	V
12652.57	-56.04	10.79	-13.29	-53.54	-13.00	40.54	H
15304.07	-51.50	11.93	-13.82	-49.61	-13.00	36.61	H
17843.62	-51.50	13.11	-15.38	-49.23	-13.00	36.23	V



**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
5003.33	-62.86	6.79	-9.90	-59.75	-13.00	46.75	V
7703.08	-42.92	8.37	-12.36	-38.93	-13.00	25.93	H
10270.86	-51.80	9.55	-13.01	-48.34	-13.00	35.34	V
12652.57	-56.04	10.79	-13.29	-53.54	-13.00	40.54	H
15304.07	-51.50	11.93	-13.82	-49.61	-13.00	36.61	H
17843.62	-51.50	13.11	-15.38	-49.23	-13.00	36.23	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
4966.72	-61.33	6.73	-9.87	-58.19	-13.00	45.19	V
7581.12	-61.80	8.38	-12.26	-57.92	-13.00	44.92	H
10140.79	-52.49	9.57	-12.96	-49.10	-13.00	36.10	V
12434.83	-58.36	10.70	-13.17	-55.89	-13.00	42.89	V
15004.07	-51.35	11.85	-14.00	-49.20	-13.00	36.20	V
17472.18	-52.25	12.83	-14.84	-50.24	-13.00	37.24	H

**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
5283.29	-61.77	6.94	-10.30	-58.41	-13.00	45.41	H
7702.88	-43.34	8.37	-12.36	-39.35	-13.00	26.35	H
10270.92	-50.94	9.55	-13.01	-47.48	-13.00	34.48	V
12619.67	-59.23	10.76	-13.27	-56.72	-13.00	43.72	H
15511.37	-53.77	12.06	-13.70	-52.13	-13.00	39.13	V
17869.25	-51.07	13.02	-15.42	-48.67	-13.00	35.67	V

**LTE Band 38, 5MHz, QPSK, Channel 37775**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit (dBm)	Margin(dB)	Polarization
5145.50	-53.07	6.87	-10.10	-49.84	-13.00	36.84	H
7365.23	-64.89	8.15	-12.04	-61.00	-13.00	48.00	H
10290.51	-53.58	9.54	-13.02	-50.10	-13.00	37.10	V
12650.42	-59.81	10.79	-13.29	-57.31	-13.00	44.31	V
15005.98	-54.77	11.86	-14.00	-52.63	-13.00	39.63	H
17770.70	-50.88	13.16	-15.28	-48.76	-13.00	35.76	V

**LTE Band 38, 5MHz, QPSK, Channel 38000**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit (dBm)	Margin(dB)	Polarization
5190.42	-53.57	6.90	-10.17	-50.30	-13.00	37.30	H
7462.82	-65.30	8.29	-12.16	-61.43	-13.00	48.43	V
10380.26	-55.74	9.73	-13.05	-52.42	-13.00	39.42	V
12673.27	-59.76	10.82	-13.30	-57.28	-13.00	44.28	V
15665.65	-54.49	12.14	-13.70	-52.93	-13.00	39.93	V
17839.07	-49.80	13.12	-15.37	-47.55	-13.00	34.55	H

**LTE Band 38, 5MHz, QPSK, Channel 38225**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit (dBm)	Margin(dB)	Polarization
5235.28	-53.88	6.95	-10.23	-50.60	-13.00	37.60	H
7689.71	-64.50	8.37	-12.35	-60.52	-13.00	47.52	V
10261.66	-60.32	9.63	-13.00	-56.95	-13.00	43.95	H
12328.03	-59.87	10.62	-13.13	-57.36	-13.00	44.36	V
15059.77	-52.14	11.80	-13.96	-49.98	-13.00	36.98	H
17755.04	-50.05	13.05	-15.26	-47.84	-13.00	34.84	H

**LTE Band 38, 5MHz, 16QAM, Channel 37775**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit (dBm)	Margin(dB)	Polarization
5145.36	-56.33	6.87	-10.10	-53.10	-13.00	40.10	H
7683.72	-63.53	8.37	-12.35	-59.55	-13.00	46.55	H
10174.34	-61.57	9.62	-12.97	-58.22	-13.00	45.22	V
12751.48	-58.22	10.85	-13.35	-55.72	-13.00	42.72	H
15322.46	-51.31	11.99	-13.81	-49.49	-13.00	36.49	H
17625.60	-50.24	13.02	-15.08	-48.18	-13.00	35.18	H

**LTE Band 38, 5MHz, 16QAM, Channel 38000**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit (dBm)	Margin(dB)	Polarization
5453.08	-63.77	7.06	-10.53	-60.30	-13.00	47.30	H
7625.33	-63.20	8.36	-12.30	-59.26	-13.00	46.26	V
10617.14	-61.08	9.82	-13.12	-57.78	-13.00	44.78	V
12888.89	-57.99	10.91	-13.43	-55.47	-13.00	42.47	V
15297.14	-52.04	11.91	-13.82	-50.13	-13.00	37.13	H
17938.02	-50.34	12.97	-15.51	-47.80	-13.00	34.80	H

**LTE Band 38, 5MHz, 16QAM, Channel 38225**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit (dBm)	Margin(dB)	Polarization
5235.32	-55.95	6.95	-10.23	-52.67	-13.00	39.67	H
7606.72	-63.27	8.33	-12.29	-59.31	-13.00	46.31	H
10233.59	-60.56	9.66	-12.99	-57.23	-13.00	44.23	H
12642.68	-56.81	10.80	-13.29	-54.32	-13.00	41.32	H
15135.01	-50.45	11.86	-13.92	-48.39	-13.00	35.39	H
17764.56	-49.18	13.10	-15.27	-47.01	-13.00	34.01	H

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

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

#### **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 5/7/38, 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 0.1V 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. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d) (2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of between 3.6VDC and 4.4VDC, with a nominal voltage of 3.84VDC. 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 5, 1.4MHz bandwidth (worst case of all bandwidths)**

**Frequency Error vs Voltage**

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.6	-0.29	18.71	0.000	0.022
3.84	-1.47	20.04	0.002	0.024
4.4	-1.23	18.31	0.001	0.022

**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	-0.50	20.34	0.001	0.024
40°	-0.06	20.16	0.000	0.024
30°	-2.00	17.09	0.002	0.020
20°	0.96	19.05	0.001	0.023
10°	-1.39	18.30	0.002	0.022
0°	-2.52	18.35	0.003	0.022
- 10°	-1.40	18.75	0.002	0.022
- 20°	-1.33	18.11	0.002	0.022
- 30°	-0.90	17.28	0.001	0.021

**LTE Band 7, 10MHz bandwidth (worst case of all bandwidths)**

**Frequency Error vs Voltage**

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.6	4.82	-3.35	0.002	0.001
3.84	-5.42	-0.77	0.002	0.000
4.4	-6.32	-5.79	0.002	0.002

**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	4.82	-3.35	0.002	0.001
40°	-5.42	-0.77	0.002	0.000
30°	-6.32	-5.79	0.002	0.002
20°	4.82	-3.35	0.002	0.001
10°	-5.42	-0.77	0.002	0.000
0°	-6.32	-5.79	0.002	0.002
- 10°	4.82	-3.35	0.002	0.001
- 20°	-5.42	-0.77	0.002	0.000
- 30°	-6.32	-5.79	0.002	0.002

**LTE Band 38, 5MHz bandwidth (worst case of all bandwidths)**

**Frequency Error vs Voltage**

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.6	-0.49	-6.84	0.000	0.003
3.84	-1.10	-14.09	0.000	0.005
4.4	-0.03	-7.31	0.000	0.003

**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	-5.89	-8.15	0.002	0.003
40°	2.60	-13.79	0.001	0.005
30°	0.17	-8.97	0.000	0.003
20°	1.70	-5.15	0.001	0.002
10°	1.46	-5.95	0.001	0.002
0°	-5.29	-4.62	0.002	0.002
- 10°	-3.13	-12.30	0.001	0.005
- 20°	-9.18	-15.38	0.004	0.006
- 30°	2.37	-12.19	0.001	0.005

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

## A.4 OCCUPIED BANDWIDTH

### 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.

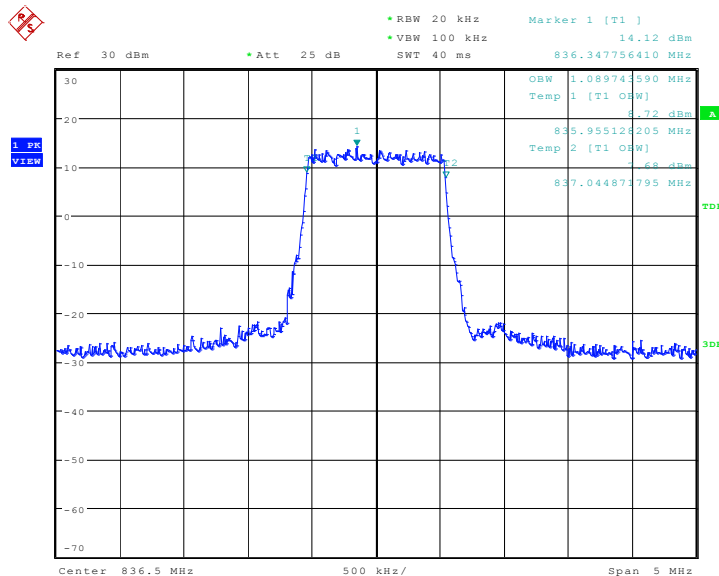
The measurement method is from KDB 971168 4.2:

- 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 5, 1.4MHz (99%)

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

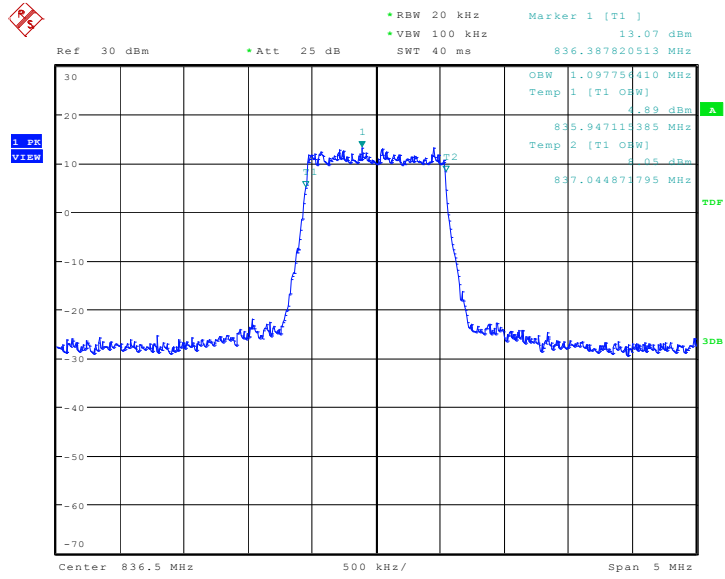
### LTE band 5, 1.4MHz Bandwidth, QPSK (99% BW)



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

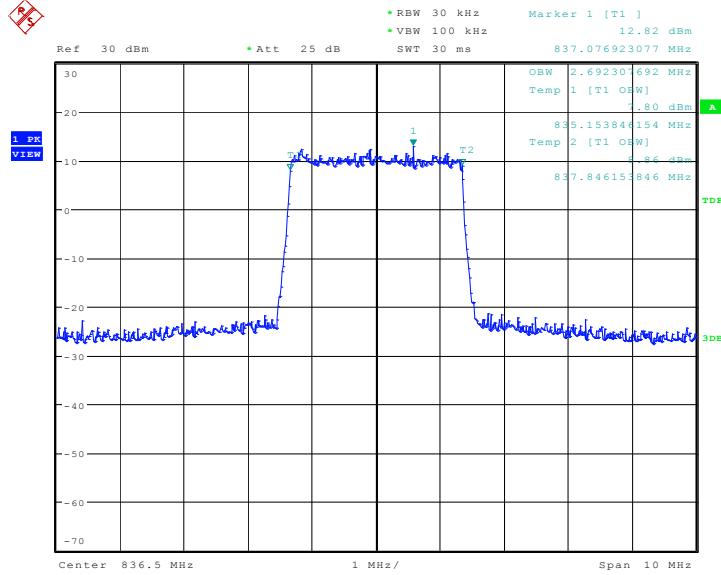


Date: 11.APR.2017 16:07:31

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

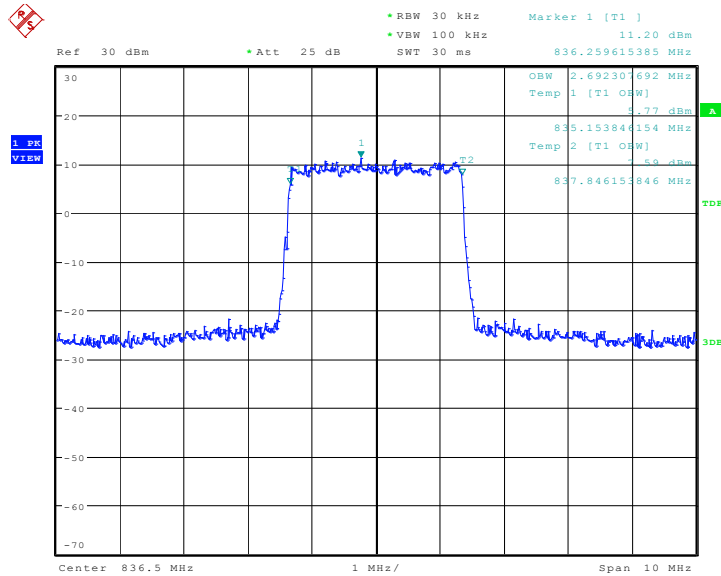
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
836.5	QPSK	16QAM
	2692.31	2692.31

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



Date: 11.APR.2017 16:12:58

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

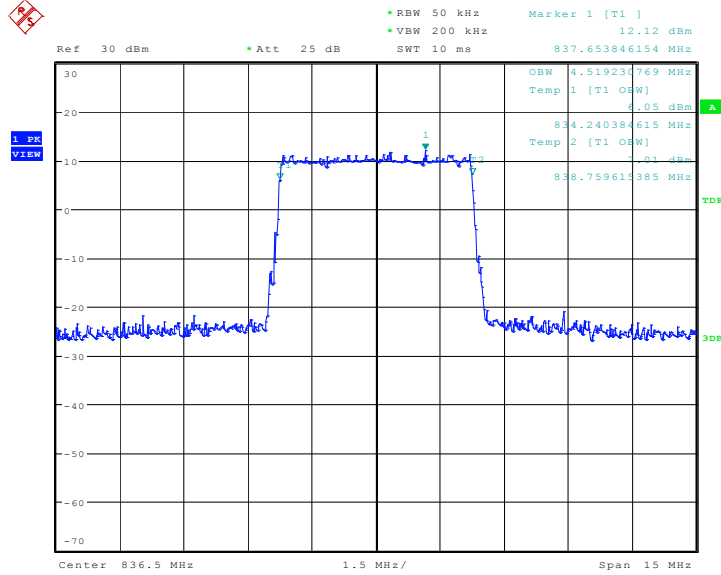


Date: 11.APR.2017 16:13:13

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

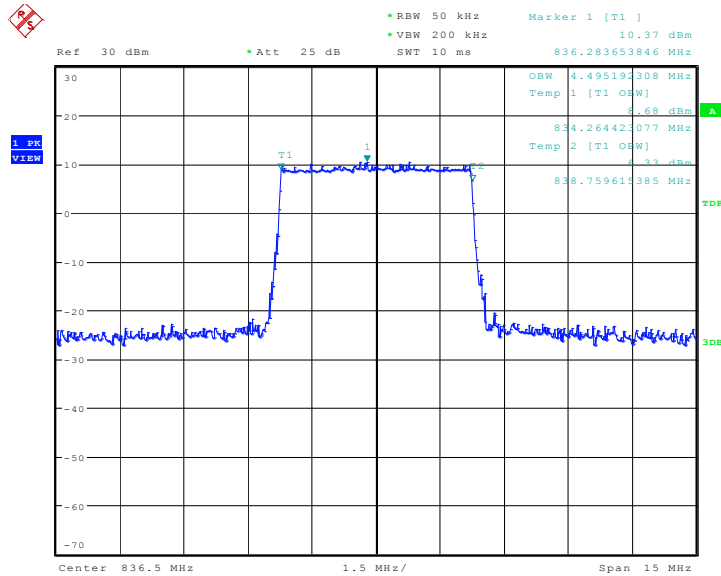
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
836.5	QPSK	16QAM
	4519.23	4495.19

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



Date: 11.APR.2017 16:18:41

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

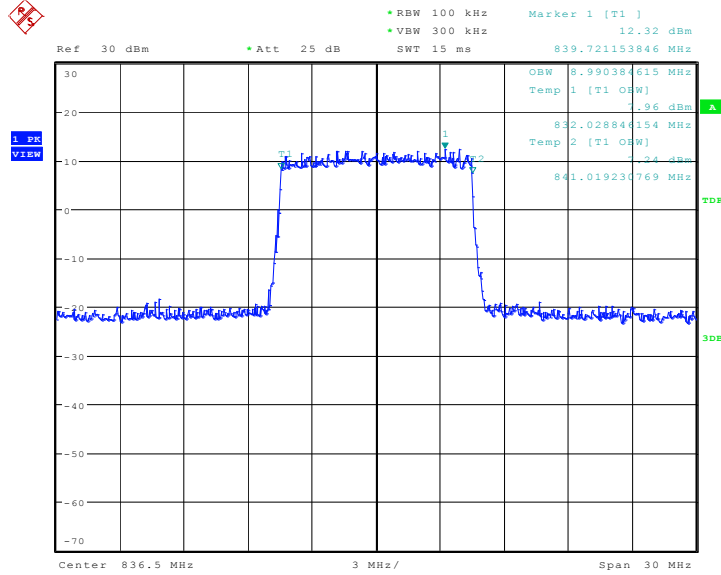


Date: 11.APR.2017 16:18:56

**LTE band 5, 10MHz (99%)**

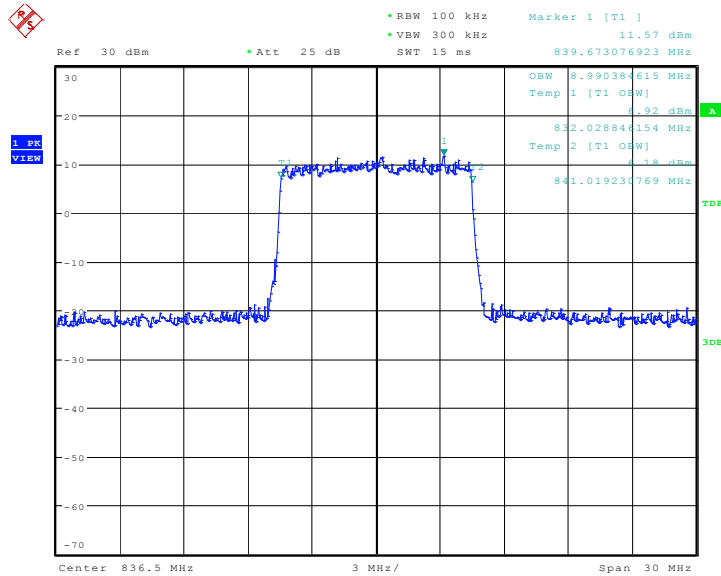
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
836.5	QPSK	16QAM
	8990.38	8990.38

**LTE band 5, 10MHz Bandwidth, QPSK (99% BW)**



Date: 11.APR.2017 16:24:23

**LTE band 5, 10MHz Bandwidth, 16QAM (99% BW)**

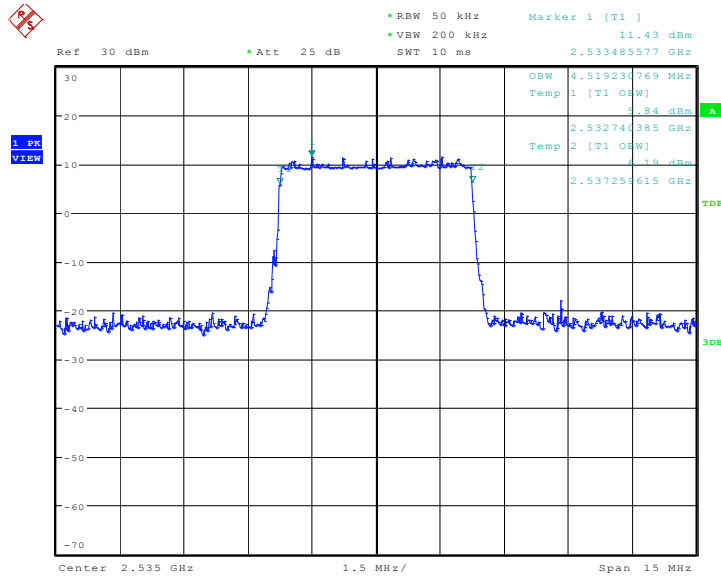


Date: 11.APR.2017 16:24:38

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

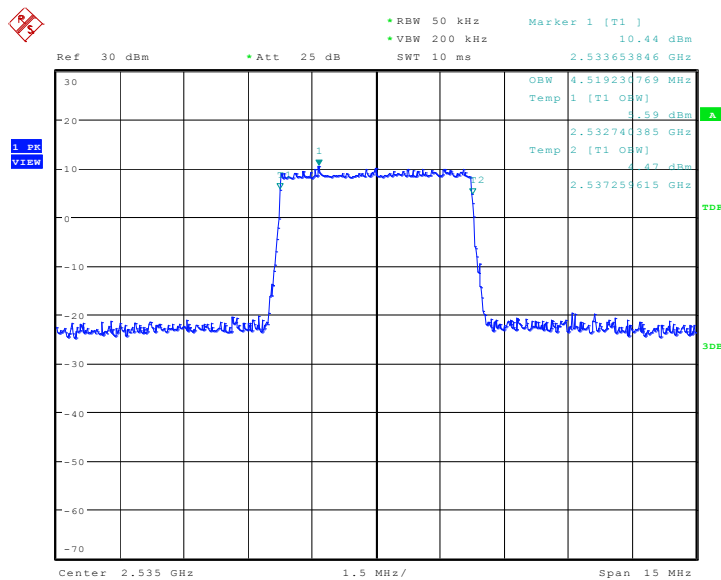
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
2535.0	QPSK	16QAM
	4519.23	4519.23

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



Date: 7.APR.2017 18:09:04

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

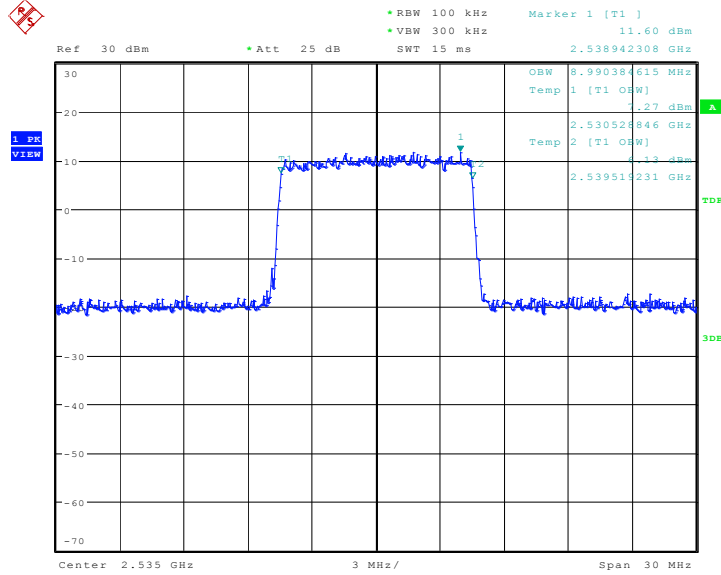


Date: 7.APR.2017 18:09:19

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

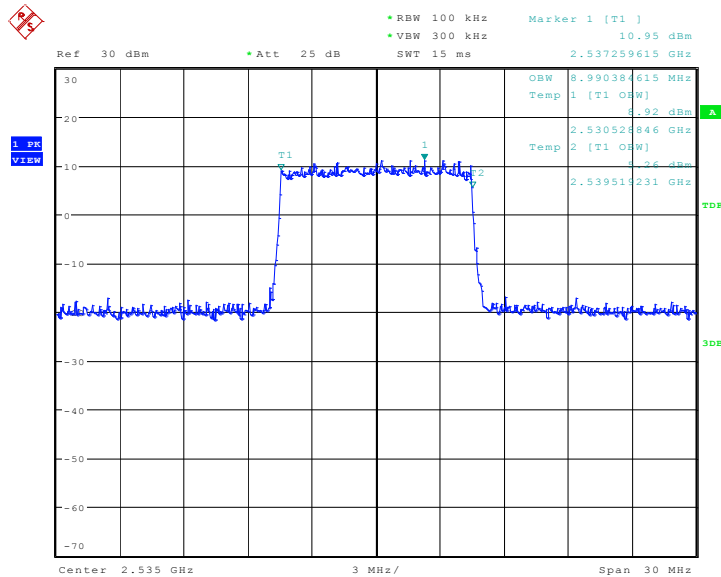
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
2535.0	QPSK	16QAM
	8990.38	8990.38

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



Date: 7.APR.2017 18:14:47

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

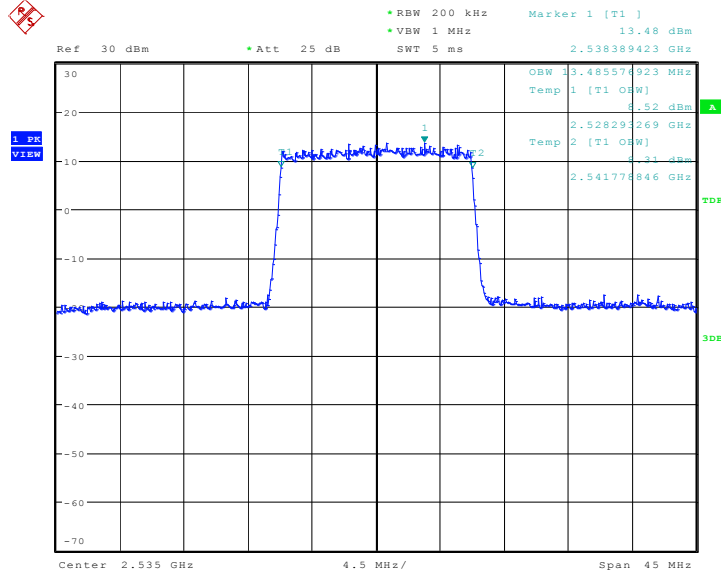


Date: 7.APR.2017 18:15:02

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

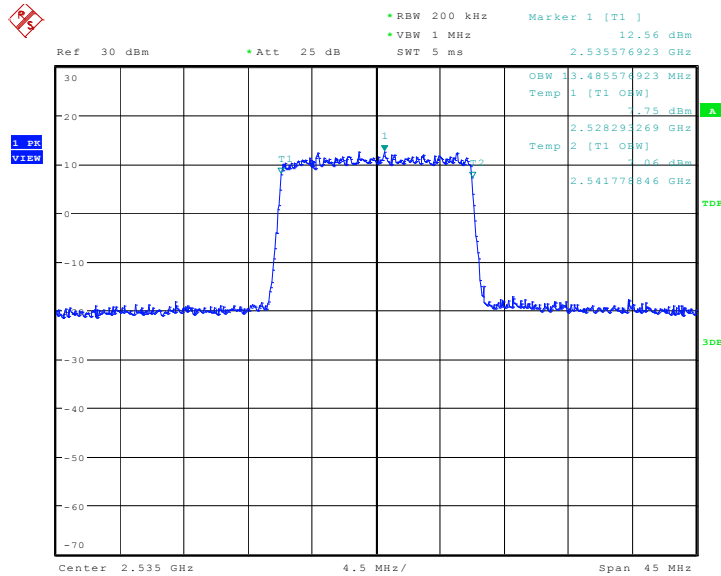
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
	2535.0	QPSK
13485.58		13485.58

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



Date: 7.APR.2017 18:20:35

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

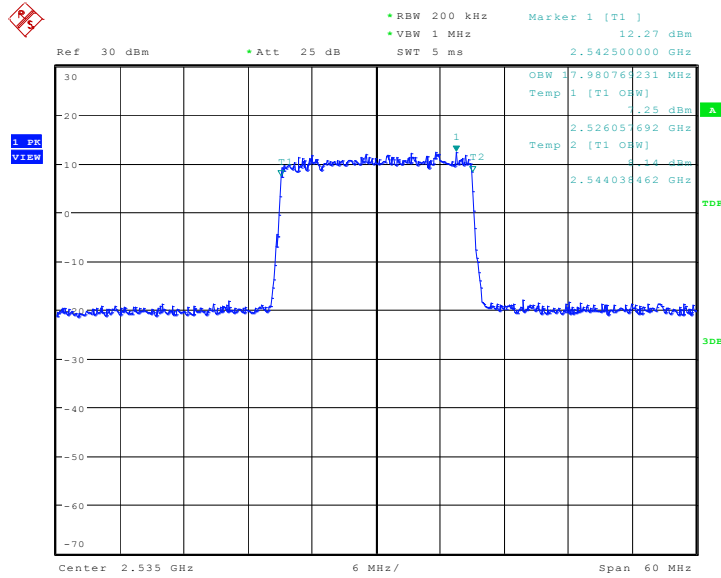


Date: 7.APR.2017 18:20:50

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

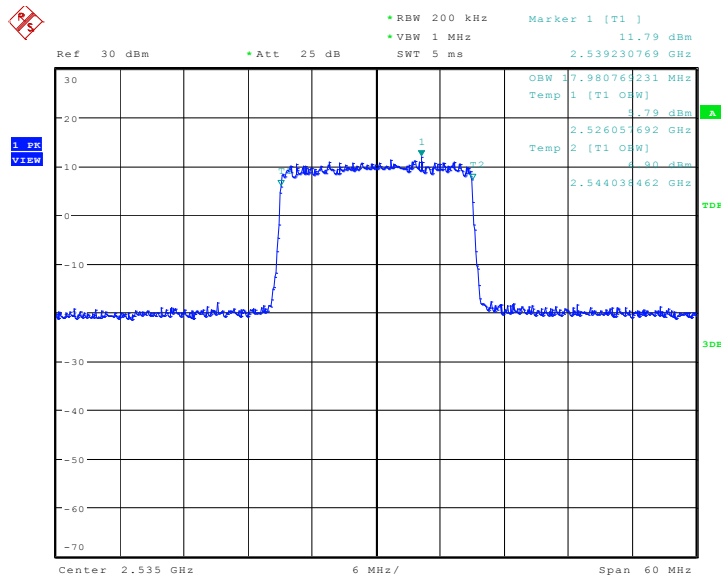
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
2535.0	QPSK	16QAM
	17980.77	17980.77

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



Date: 7.APR.2017 18:26:28

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



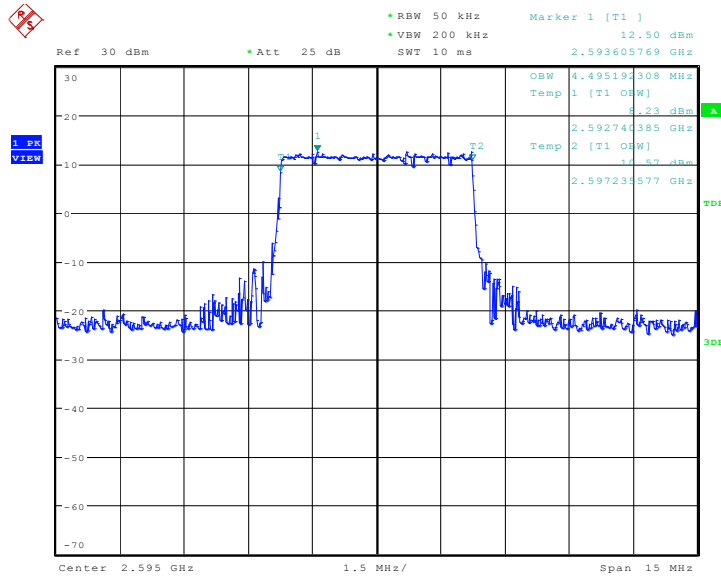
Date: 7.APR.2017 18:26:43



**LTE band 38, 5MHz (99%)**

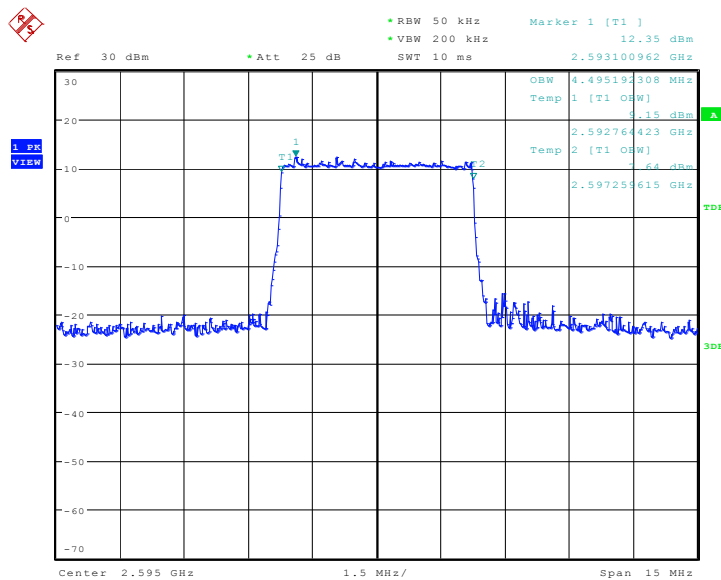
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
2595.0	QPSK	16QAM
	4495.19	4495.19

**LTE band 38, 5MHz Bandwidth, QPSK (99% BW)**



Date: 11.APR.2017 13:47:35

**LTE band 38, 5MHz Bandwidth, 16QAM (99% BW)**

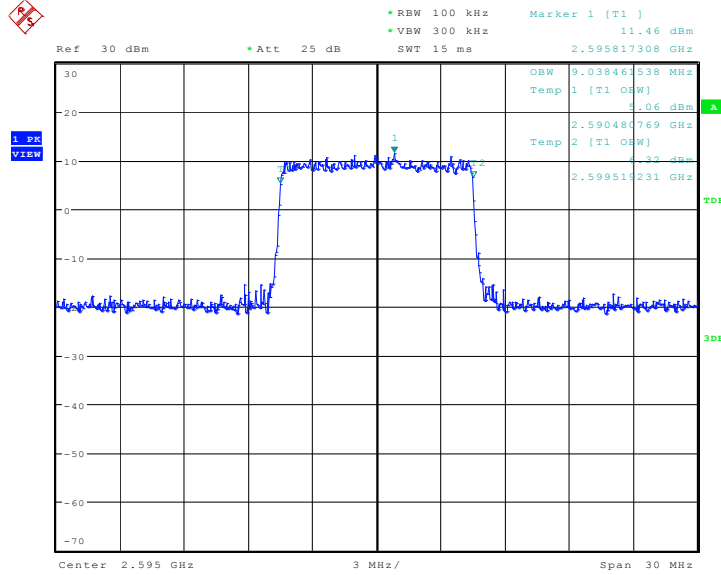


Date: 11.APR.2017 13:47:48

**LTE band 38, 10MHz (99%)**

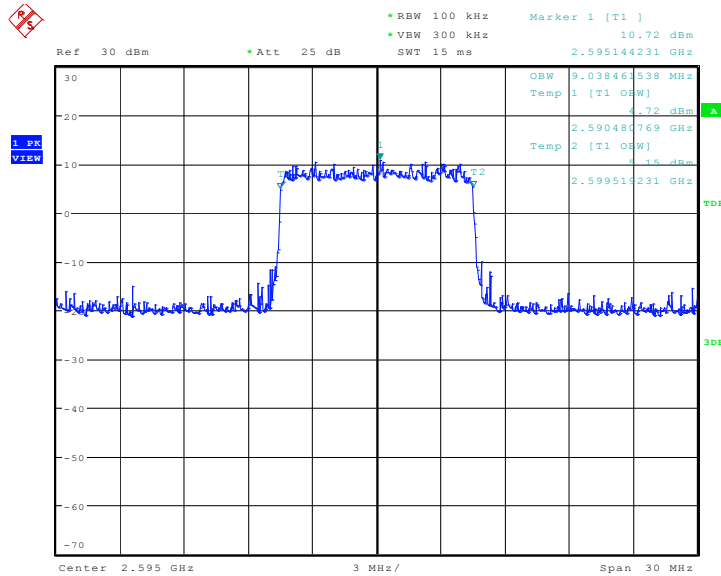
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
2595.0	QPSK	16QAM
	9038.46	9038.46

**LTE band 38, 10MHz Bandwidth, QPSK (99% BW)**



Date: 11.APR.2017 14:05:08

**LTE band 38, 10MHz Bandwidth, 16QAM (99% BW)**

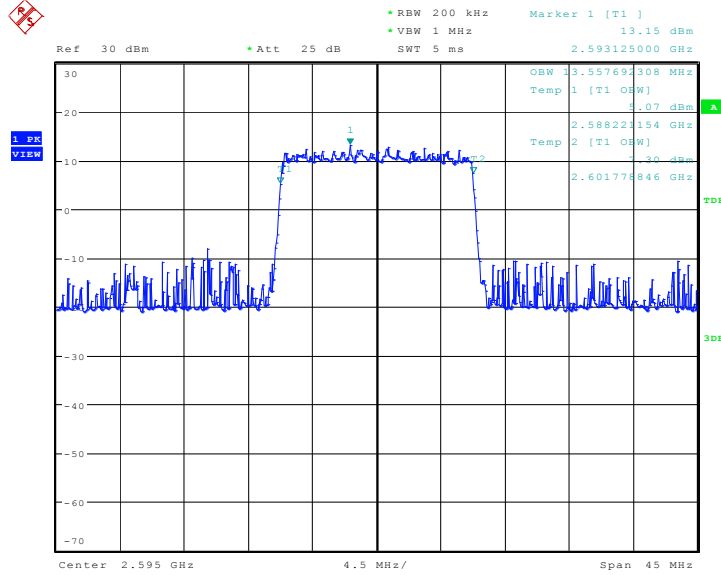


Date: 11.APR.2017 14:05:23

**LTE band 38, 15MHz (99%)**

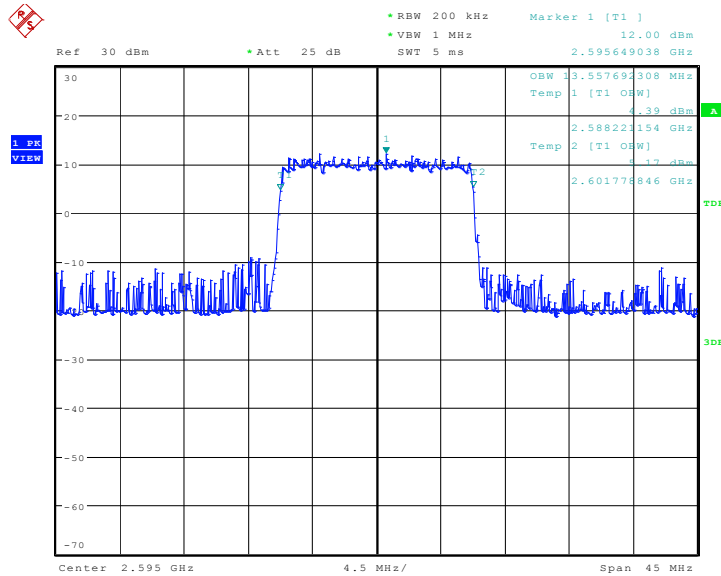
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
2595.0	QPSK	16QAM
	13557.69	13557.69

**LTE band 38, 15MHz Bandwidth, QPSK (99% BW)**



Date: 11.APR.2017 14:10:56

**LTE band 38, 15MHz Bandwidth, 16QAM (99% BW)**

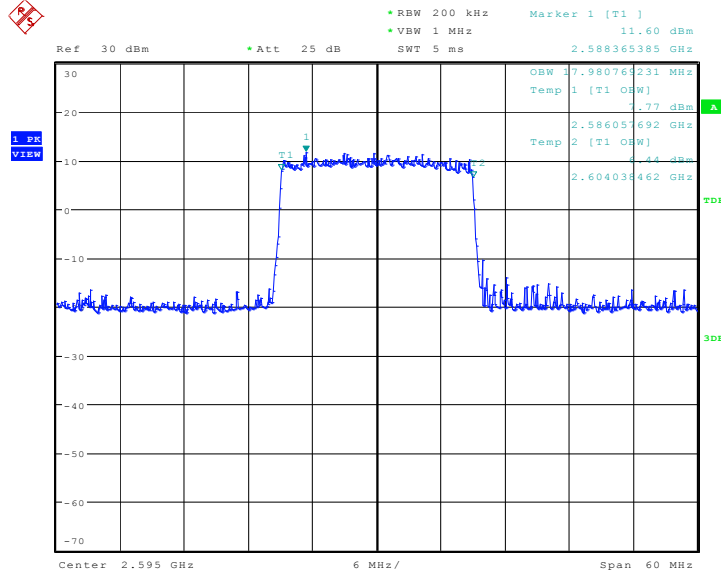


Date: 11.APR.2017 14:11:11

**LTE band 38, 20MHz (99%)**

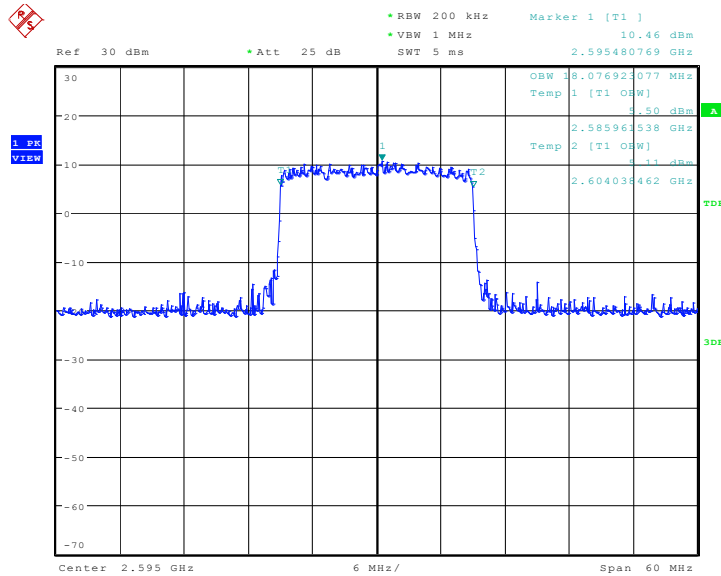
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
2595.0	QPSK	16QAM
	17980.77	18076.92

**LTE band 38, 20MHz Bandwidth, QPSK (99% BW)**



Date: 11.APR.2017 14:19:19

**LTE band38, 20MHz Bandwidth, 16QAM (99% BW)**



Date: 11.APR.2017 14:19:34

## A.5 EMISSION BANDWIDTH

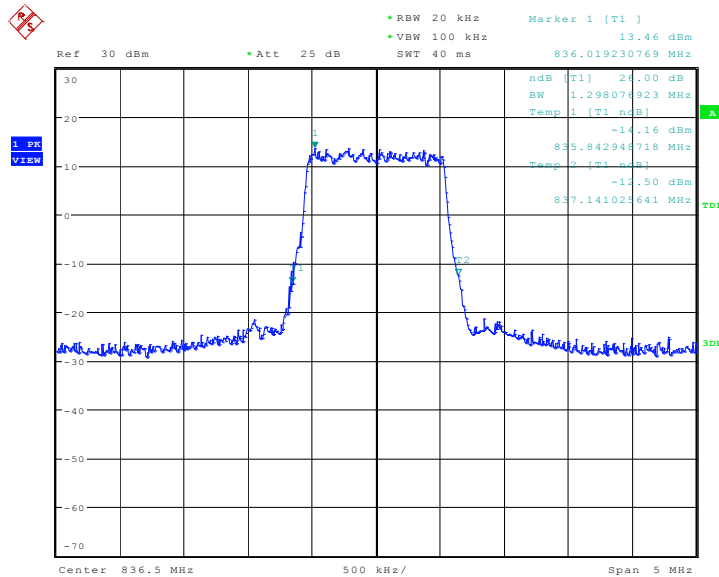
### A.5.1 Emission Bandwidth Results

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 5, 1.4MHz (-26dBc)

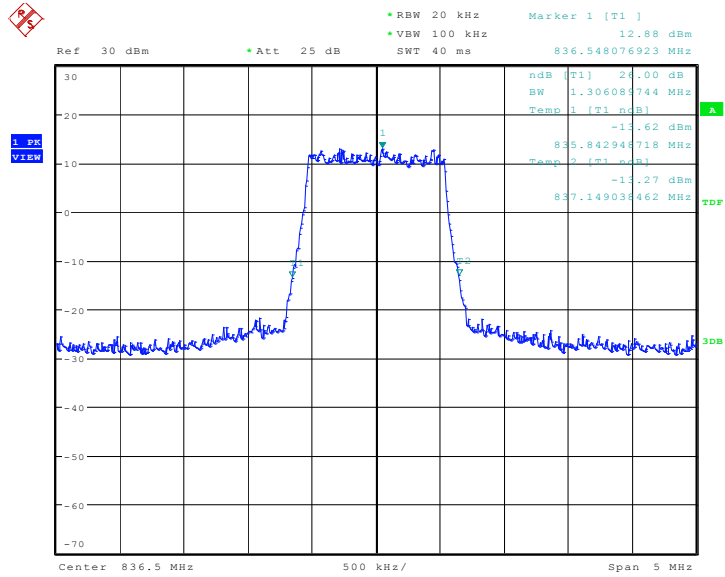
Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
836.5	QPSK	16QAM
	1298.08	1306.09

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





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

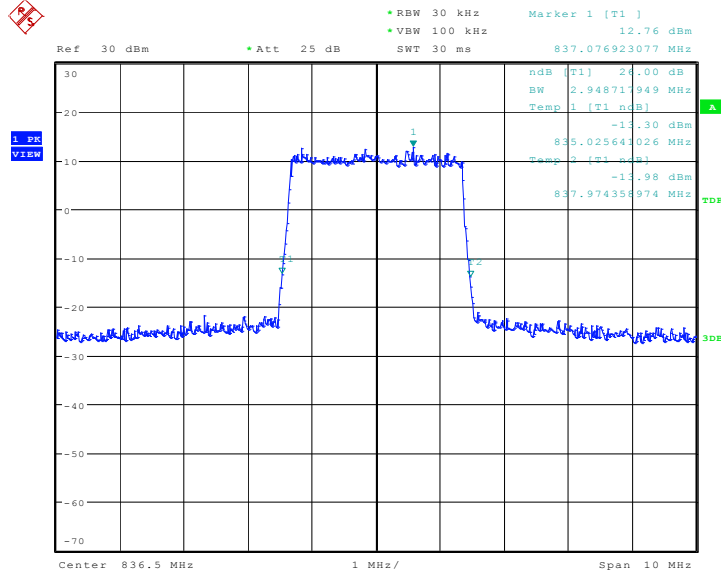


Date: 11.APR.2017 16:08:41

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

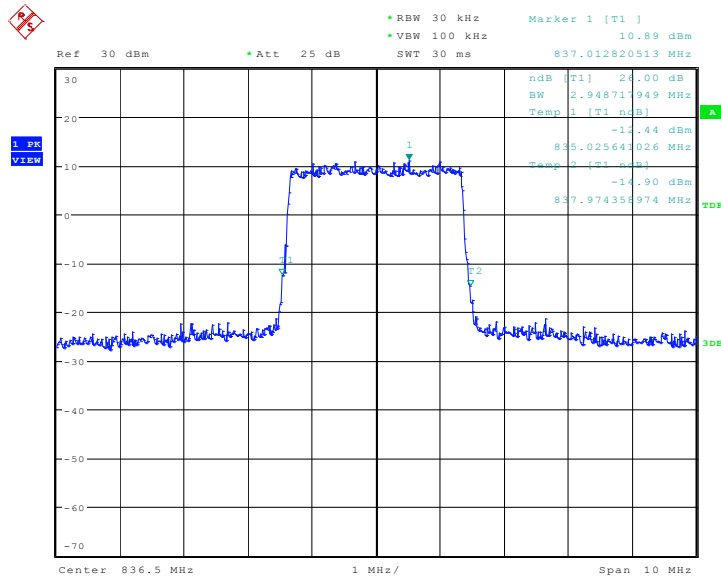
Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
	836.5	QPSK
2948.72		2948.72

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



Date: 11.APR.2017 16:14:06

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

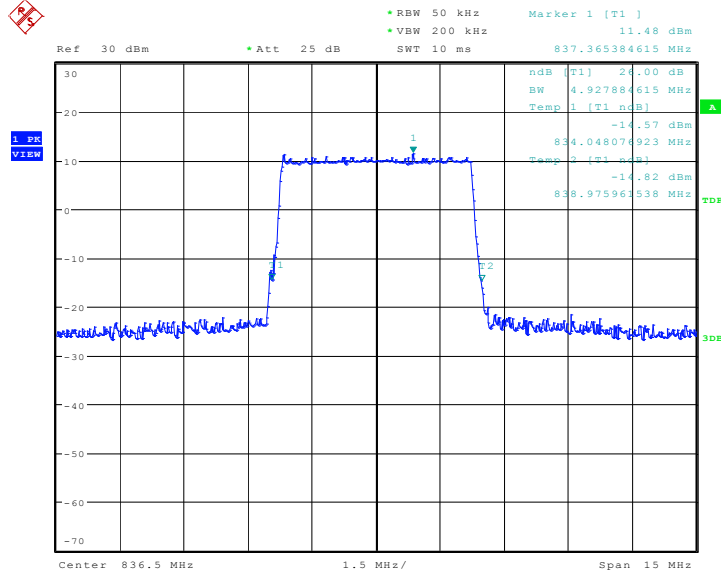


Date: 11.APR.2017 16:14:23

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

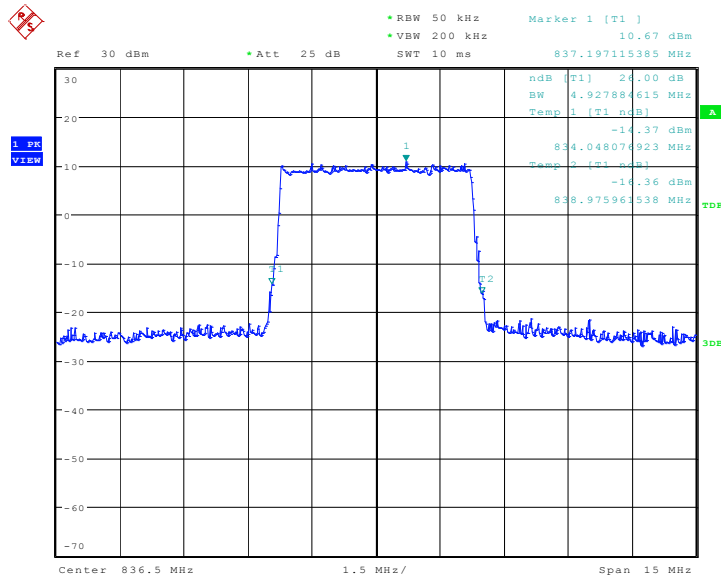
Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
	836.5	QPSK
4927.88		4927.88

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



Date: 11.APR.2017 16:19:49

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



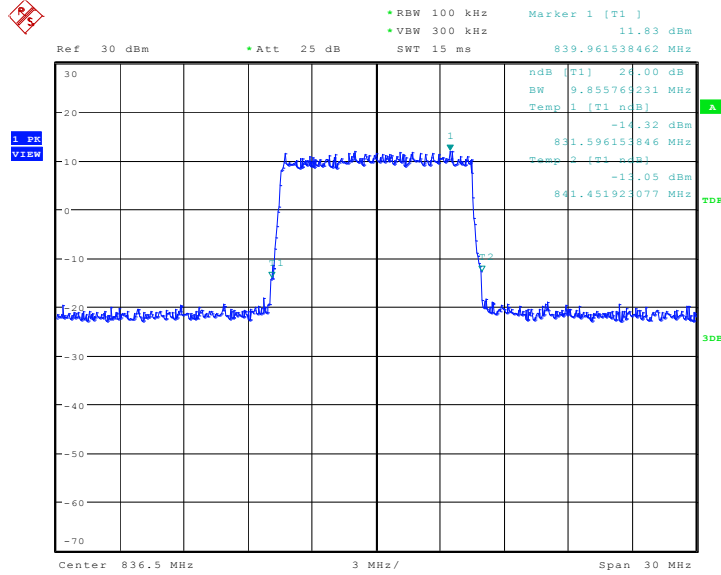
Date: 11.APR.2017 16:20:06



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

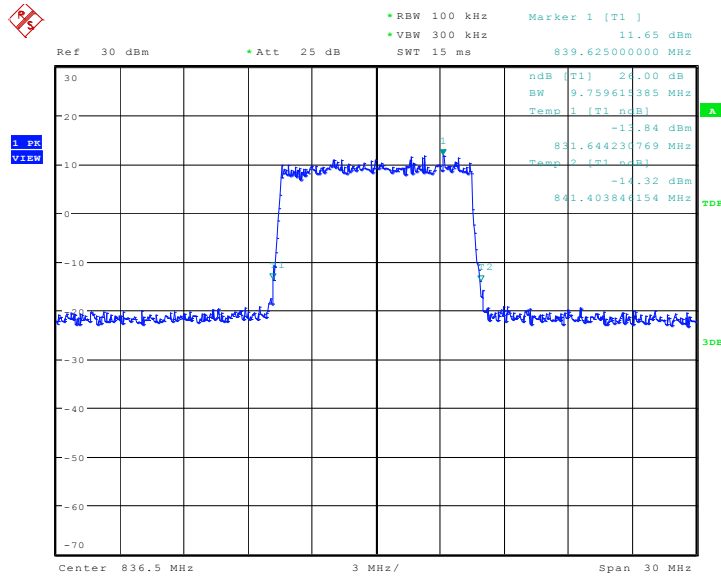
Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
	836.5	QPSK
9855.77		9759.62

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



Date: 11.APR.2017 16:25:32

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

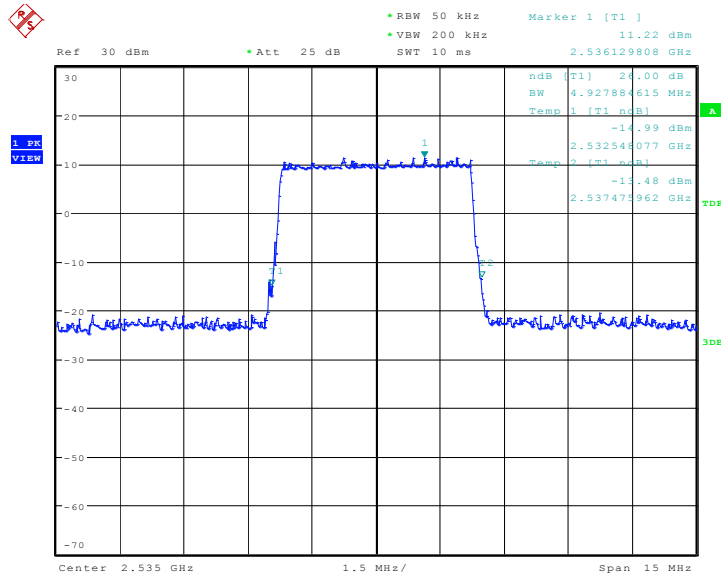


Date: 11.APR.2017 16:25:49

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

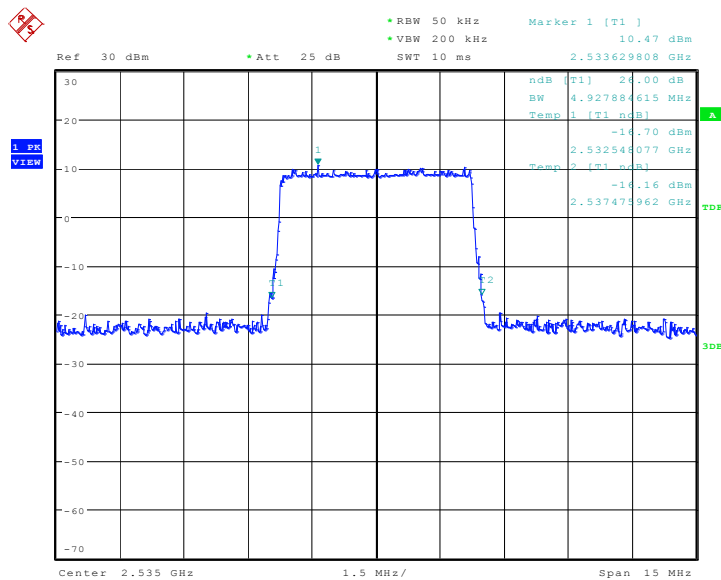
Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
2535.0	QPSK	16QAM
	4927.88	4927.88

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



Date: 7.APR.2017 18:10:12

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

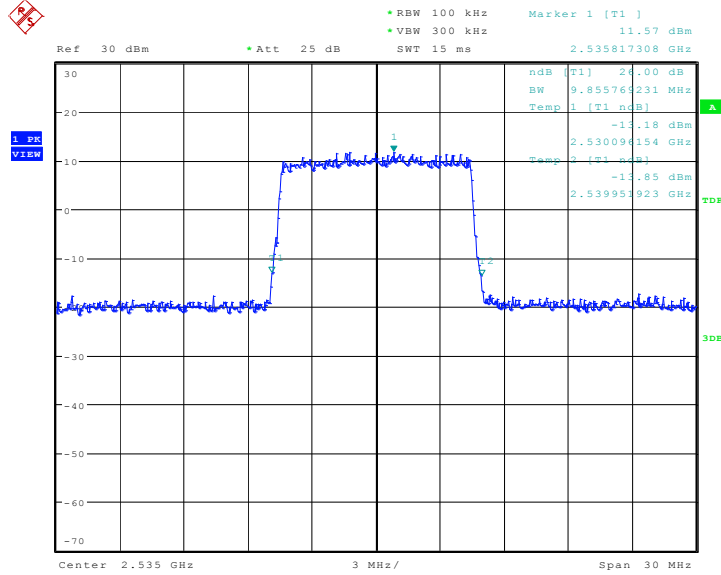


Date: 7.APR.2017 18:10:29

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

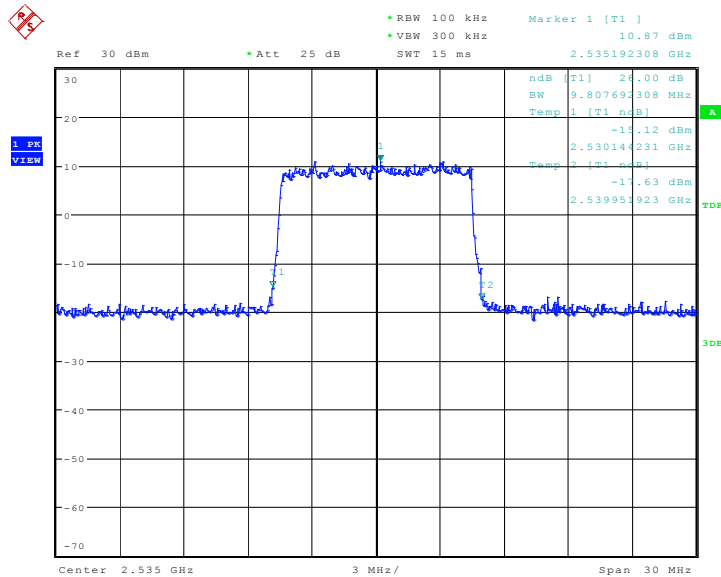
Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
	2535.0	QPSK
9855.77		9807.69

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



Date: 7.APR.2017 18:15:55

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

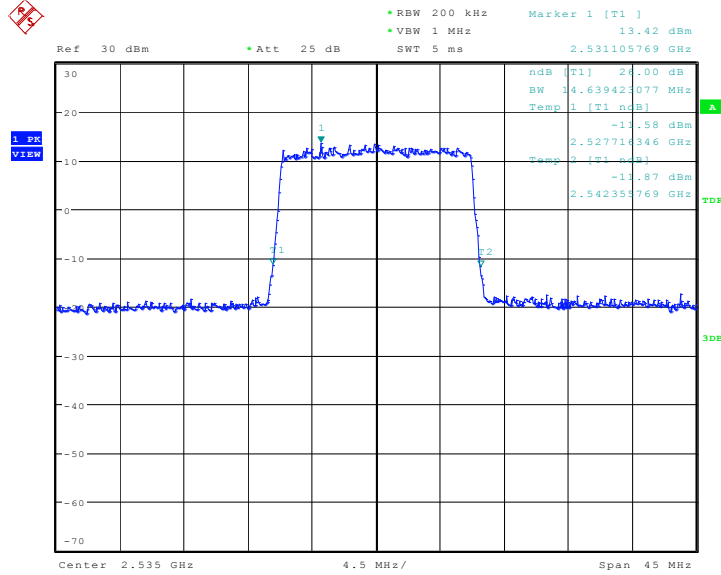


Date: 7.APR.2017 18:16:12

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

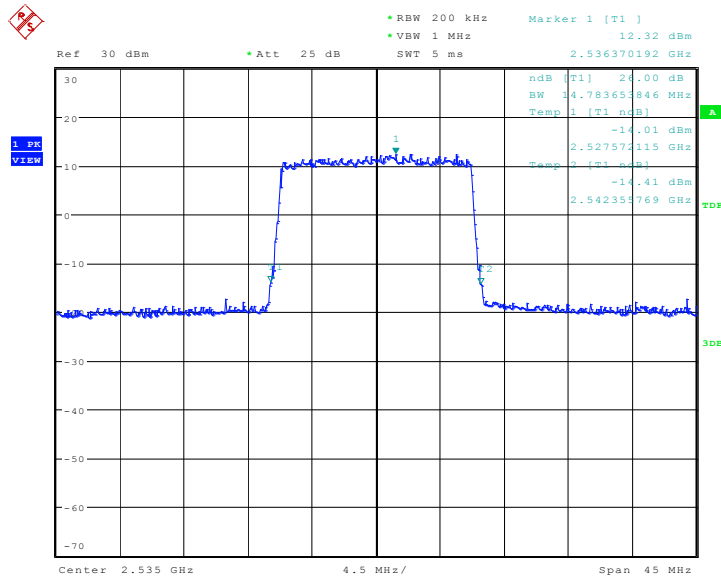
Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
	QPSK	16QAM
2535.0	14639.42	14783.65

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



Date: 7.APR.2017 18:21:43

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

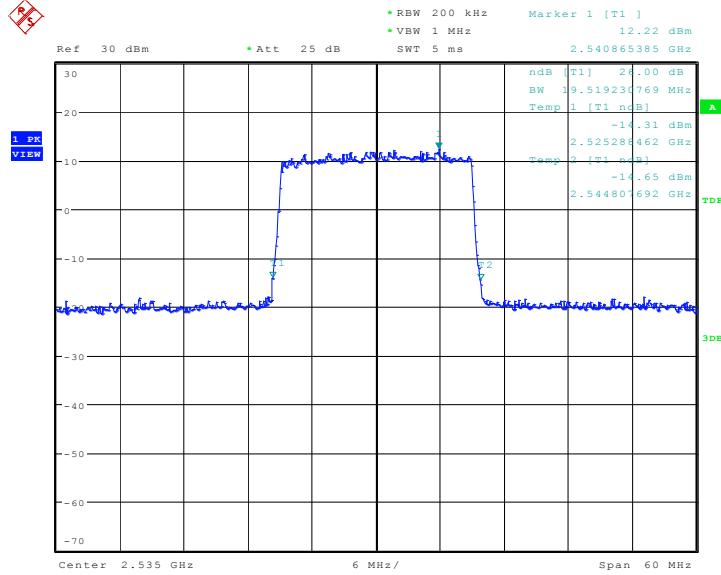


Date: 7.APR.2017 18:22:00

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

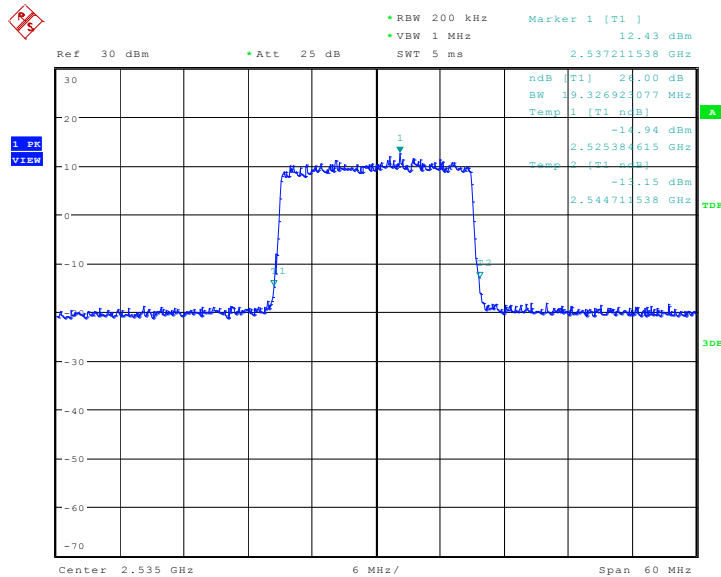
Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
	2535.0	QPSK
19519.23		19326.92

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



Date: 7.APR.2017 18:27:36

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

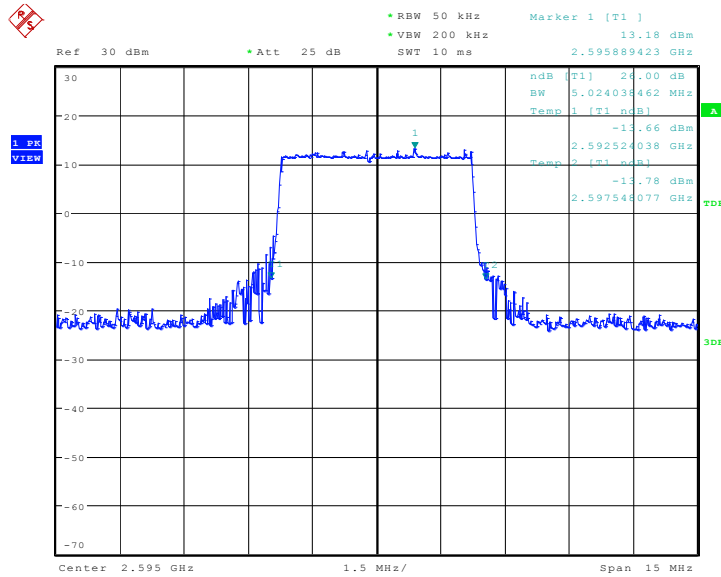


Date: 7.APR.2017 18:27:53

**LTE band 38, 5MHz (-26dBc)**

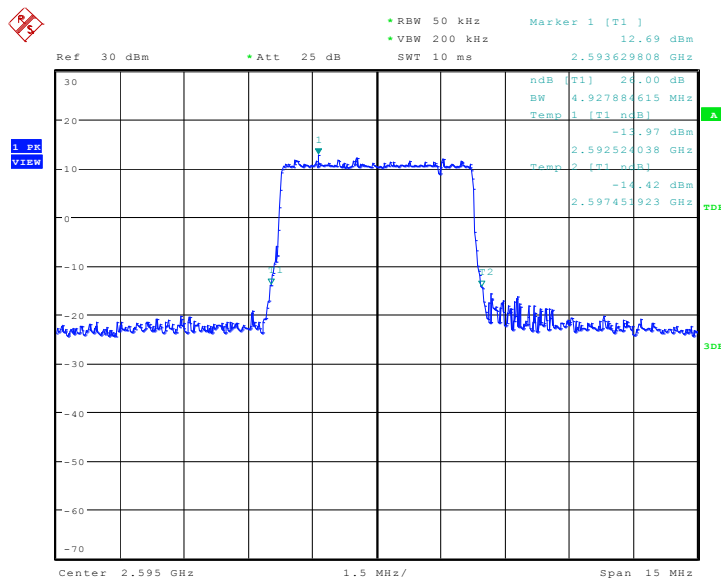
Frequency(MHz)	Occupied Bandwidth (-26dBc) ( kHz)	
2595.0	QPSK	16QAM
	5024.04	4927.88

**LTE band 38, 5MHz Bandwidth, QPSK (-26dBc BW)**



Date: 11.APR.2017 13:48:40

**LTE band 38, 5MHz Bandwidth,16QAM (-26dBc BW)**

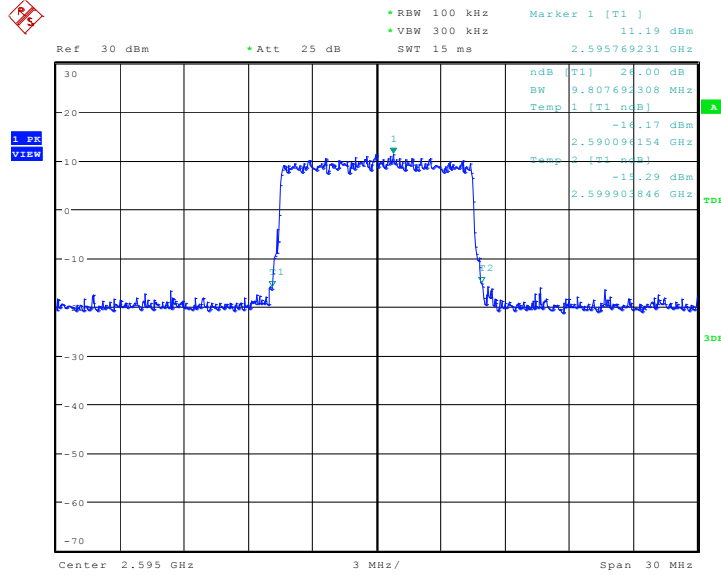


Date: 11.APR.2017 13:48:56

**LTE band 38, 10MHz (-26dBc)**

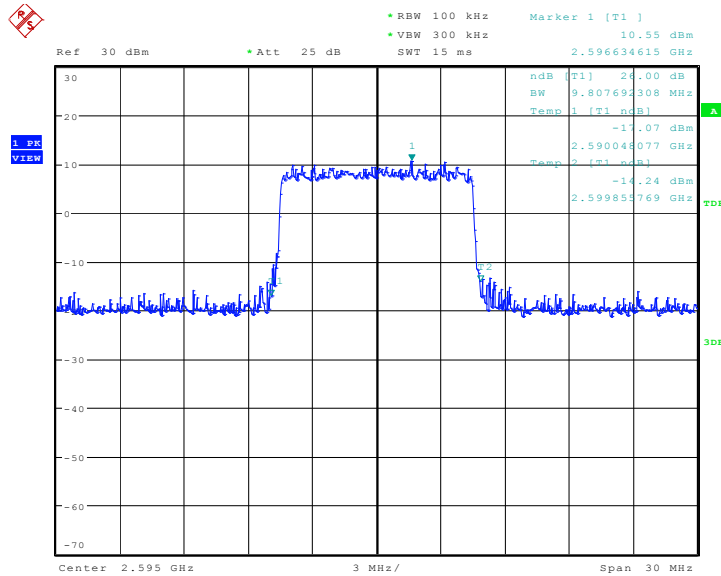
Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
	2595.0	QPSK
9807.69		9807.69

**LTE band 38, 10MHz Bandwidth, QPSK (-26dBc BW)**



Date: 11.APR.2017 14:06:16

**LTE band 38, 10MHz Bandwidth, 16QAM (-26dBc BW)**

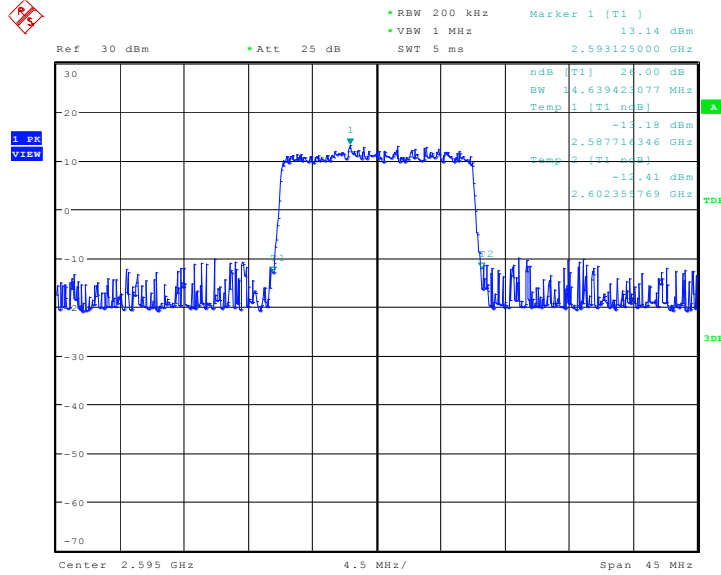


Date: 11.APR.2017 14:06:33

**LTE band 38, 15MHz (-26dBc)**

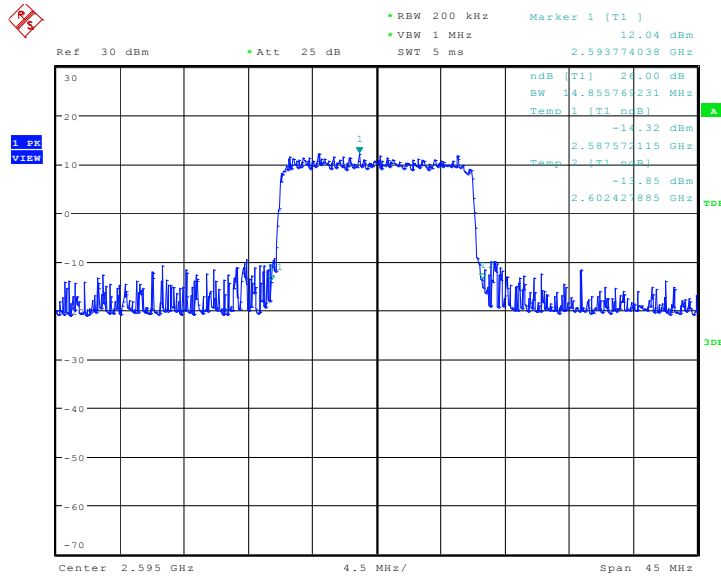
Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
	2595.0	QPSK
14639.42		14855.77

**LTE band 38, 15MHz Bandwidth, QPSK (-26dBc BW)**



Date: 11.APR.2017 14:12:04

**LTE band 38, 15MHz Bandwidth, 16QAM (-26dBc BW)**



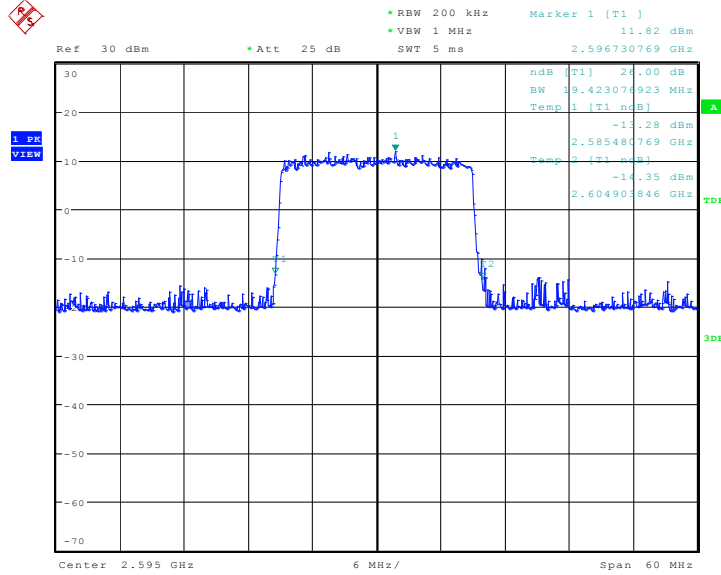
Date: 11.APR.2017 14:12:21



**LTE band 38, 20MHz (-26dBc)**

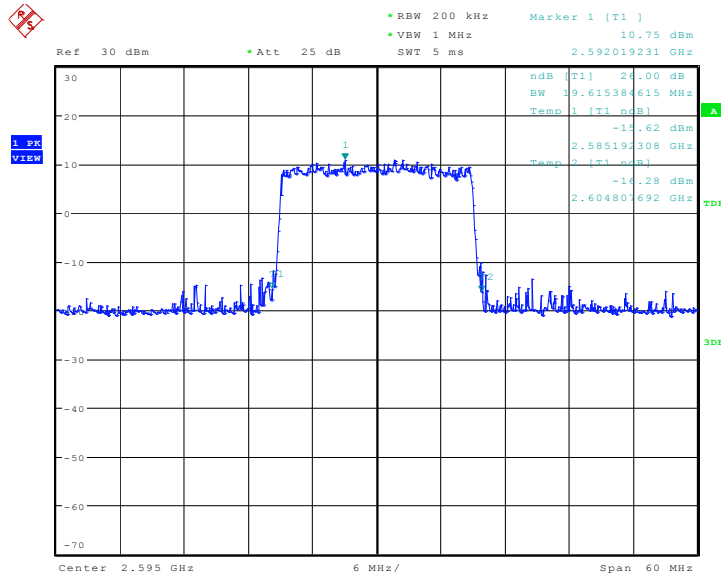
Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
	2595.0	QPSK
19423.08		19615.38

**LTE band 38, 20MHz Bandwidth, QPSK (-26dBc BW)**



Date: 11.APR.2017 14:20:27

**LTE band38, 20MHz Bandwidth, 16QAM (-26dBc BW)**



Date: 11.APR.2017 14:20:44



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

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

Part 27.53(h) states 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.

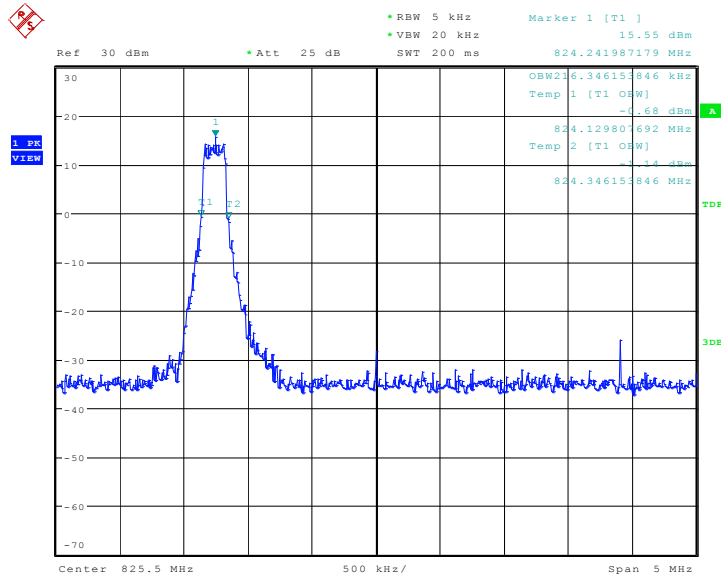
Part 27.53(c) states for operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following: (1) On any frequency outside the 746-758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log(P)$  dB; (2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least  $43 + 10 \log(P)$  dB.



dB;(4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than  $65 + 10 \log (P)$  dB in a 6.25 kHz band segment, for mobile and portable stations

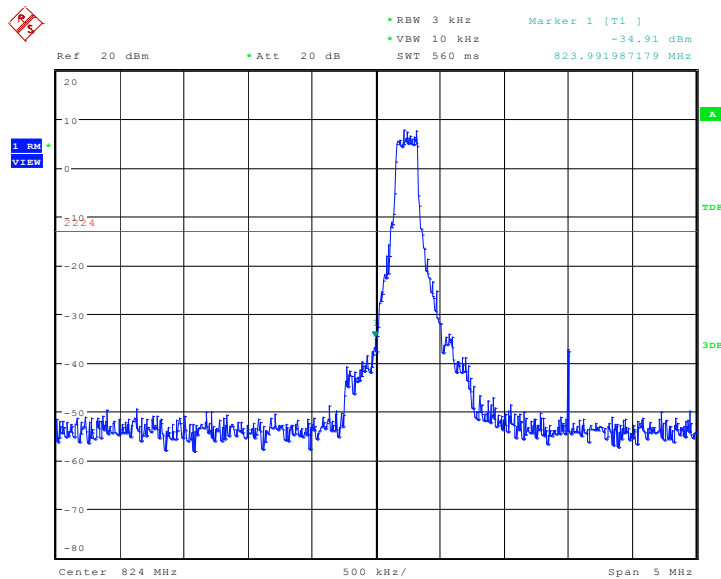
**A.6.2 Measurement result**  
Only worst case result is given below

**LTE band 5**  
**OBW: 1RB-low\_offset**



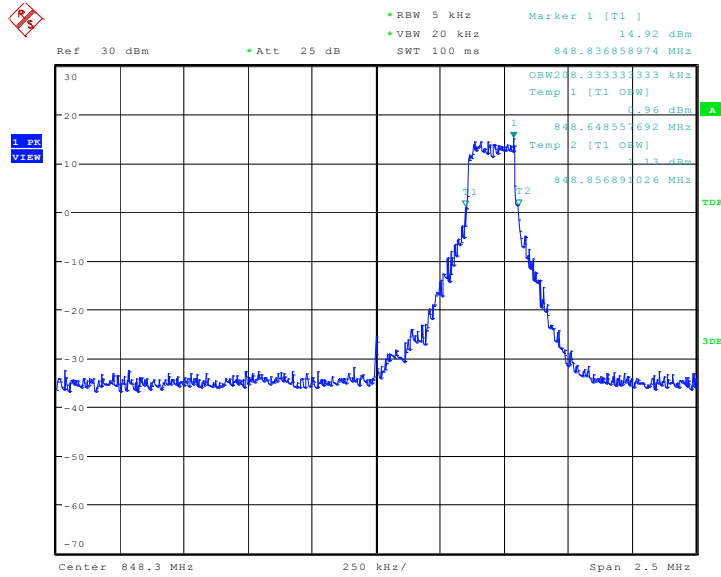
Date: 11.APR.2017 17:02:10

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



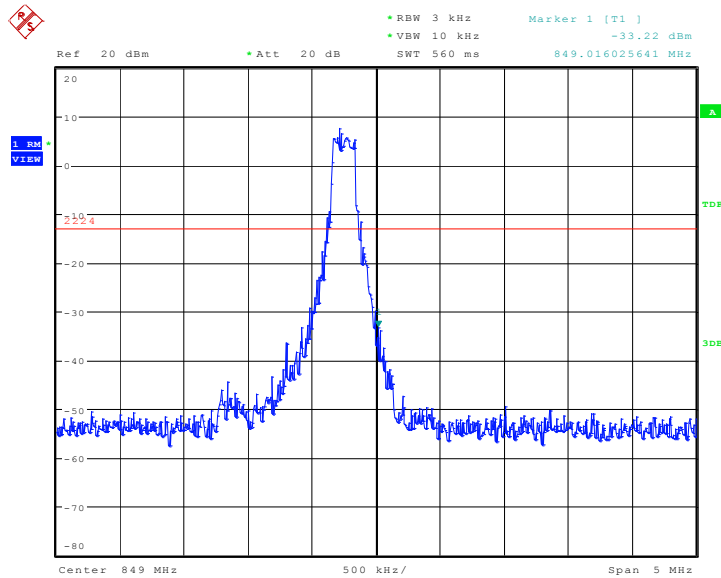
Date: 11.APR.2017 17:02:54

**OBW: 1RB-high\_offset**



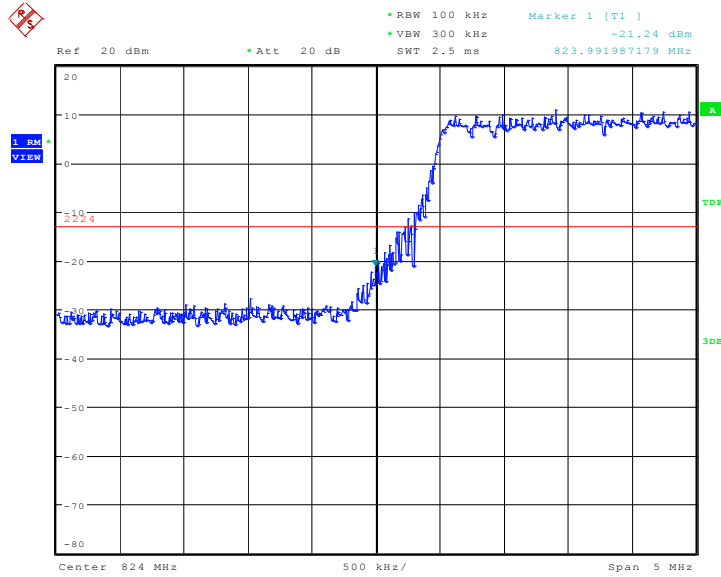
Date: 11.APR.2017 16:59:53

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



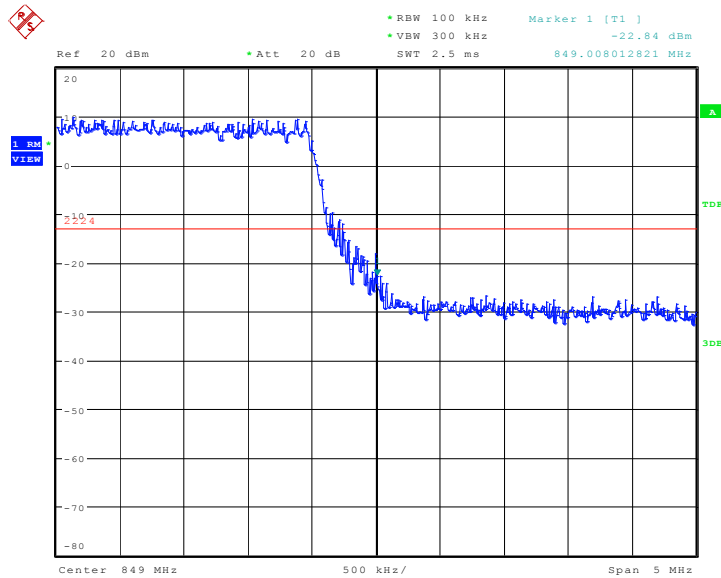
Date: 11.APR.2017 17:00:36

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



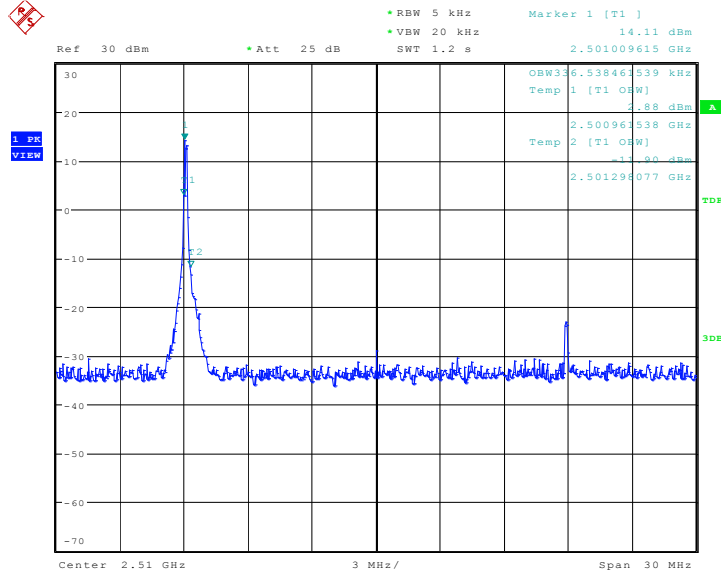
Date: 11.APR.2017 17:10:18

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



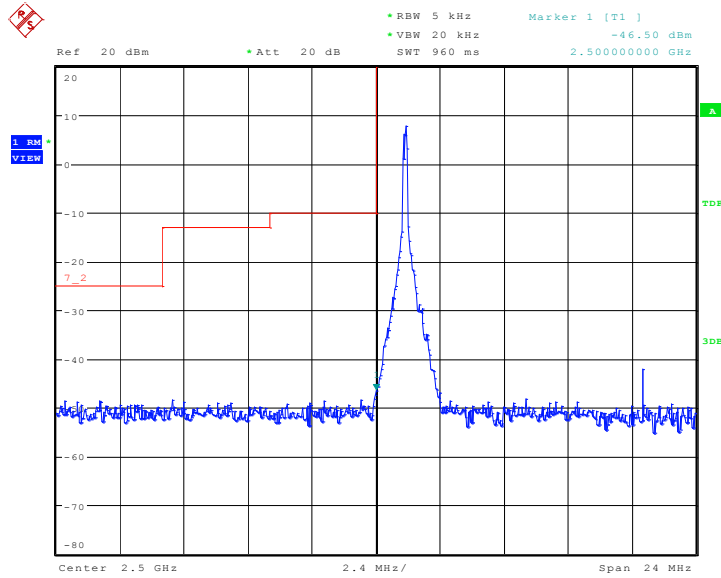
Date: 11.APR.2017 17:11:03

**LTE band 7**  
**OBW: 1RB-low\_offset**



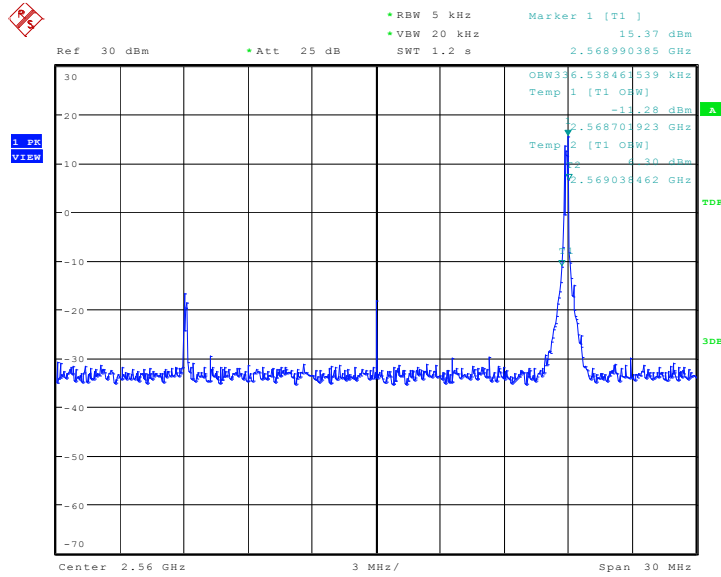
Date: 12.APR.2017 10:27:39

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



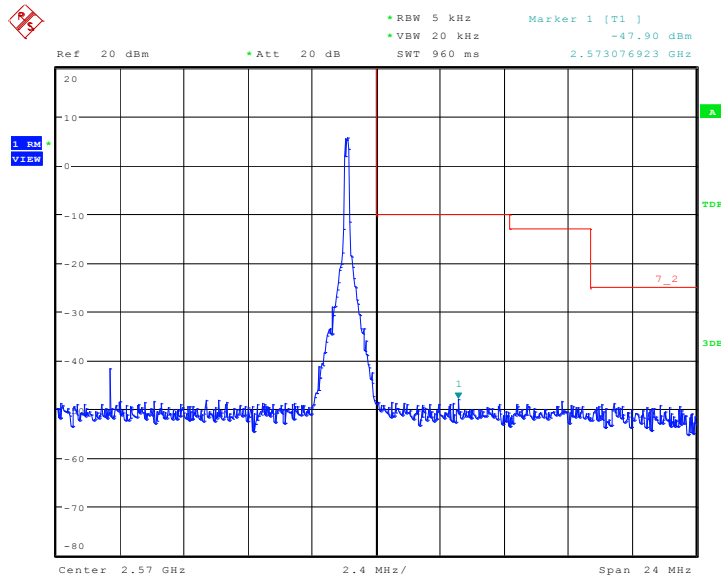
Date: 12.APR.2017 10:28:23

**OBW: 1RB-high\_offset**



Date: 12.APR.2017 09:56:07

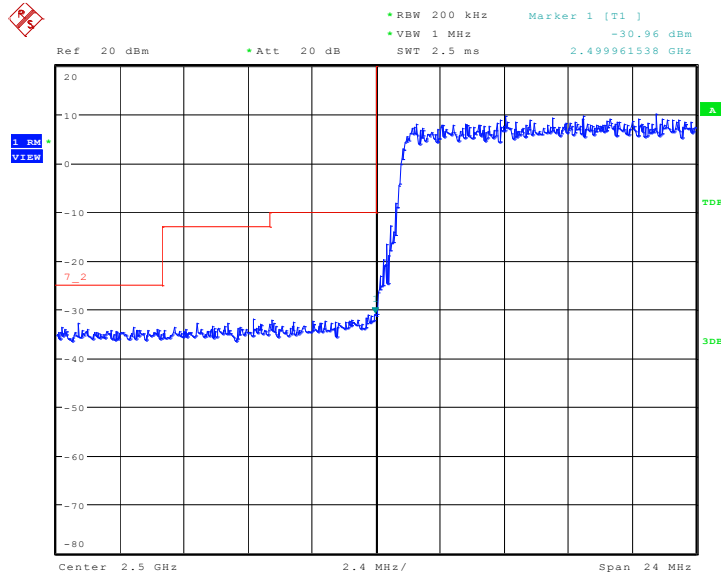
**HIGH BAND EDGE BLOCK-1RB-high\_offset**



Date: 12.APR.2017 09:56:51

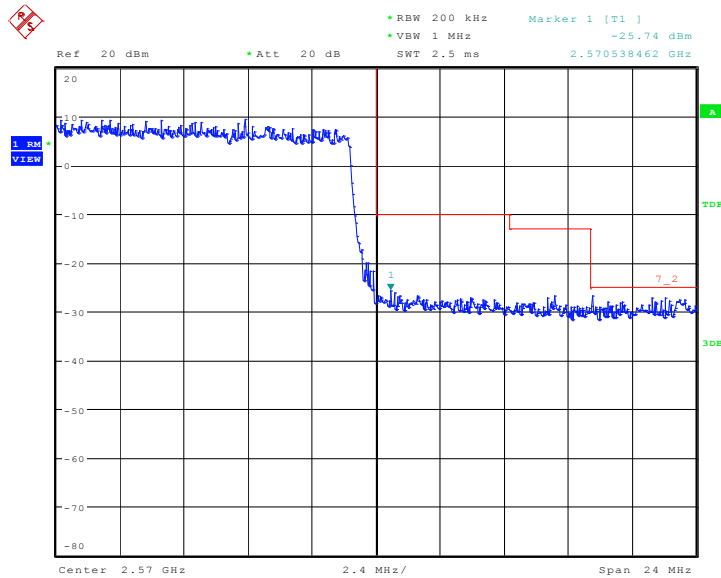


### LOW BAND EDGE BLOCK-20MHz-100%RB



Date: 12.APR.2017 09:37:11

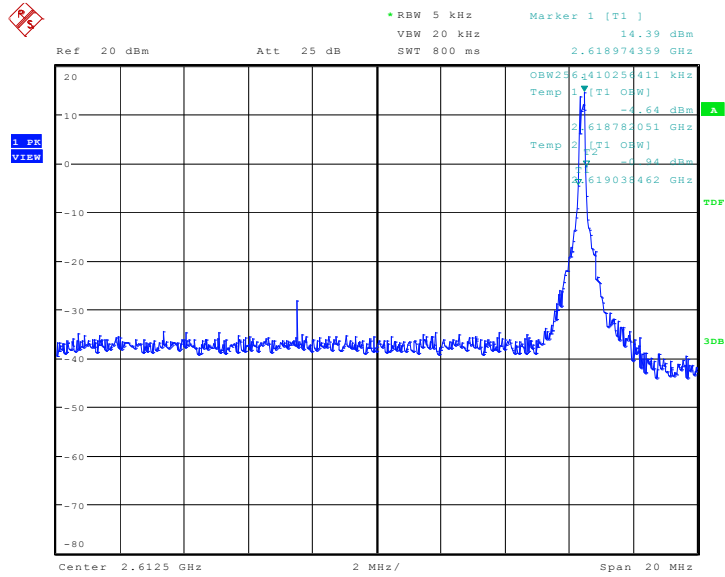
### HIGH BAND EDGE BLOCK-20MHz-100%RB



Date: 12.APR.2017 09:37:57

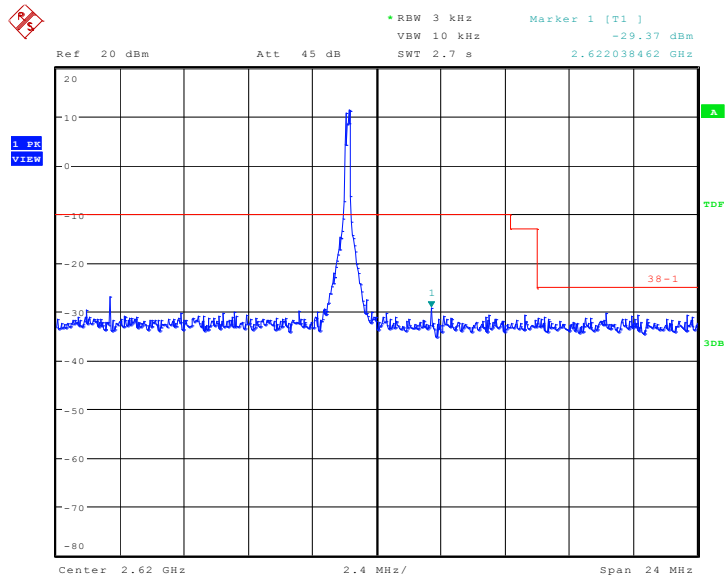


**OBW: 1RB-high\_offset**



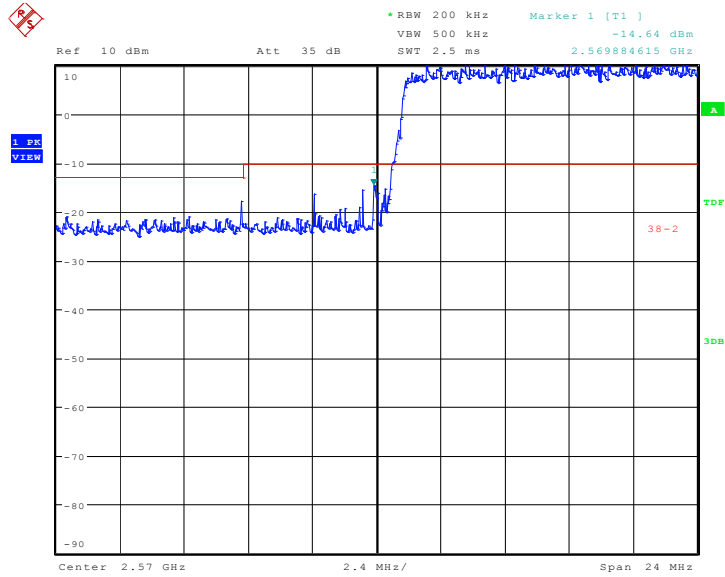
Date: 13.APR.2017 10:41:06

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



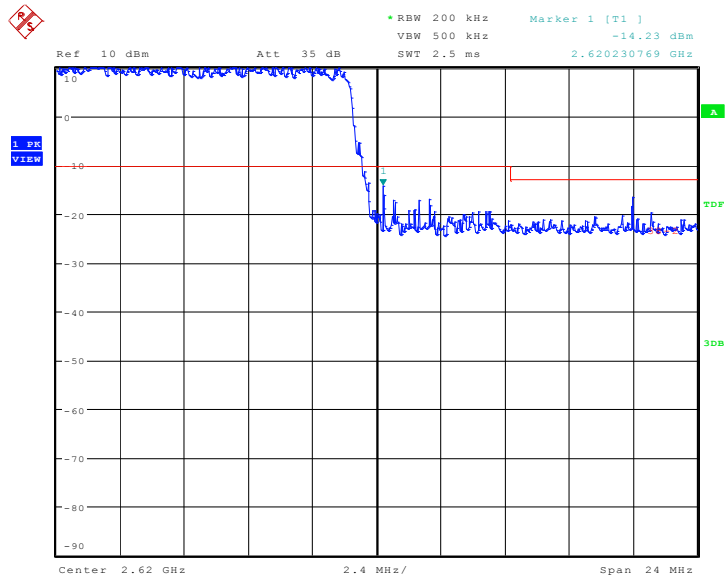
Date: 13.APR.2017 10:43:44

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



Date: 13.APR.2017 10:47:25

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



Date: 13.APR.2017 10:45:38

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

### **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 27.53(h) specifies 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 2300 MHz,  $61 + 10 \log(P)$  dB on all



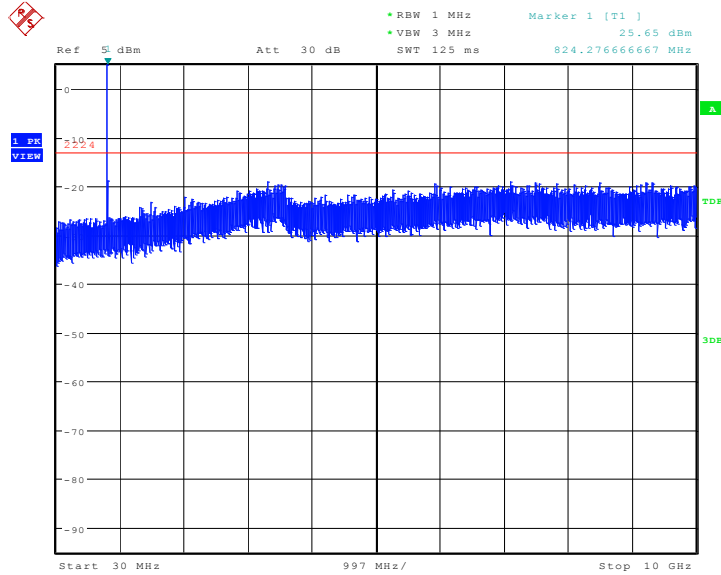
frequencies between 2292 and 2296 MHz,  $67 + 10 \log (P)$  dB on all frequencies between 2288 and 2292 MHz, and  $70 + 10 \log (P)$  dB below 2288 MHz; By a factor of not less than  $43 + 10 \log (P)$  dB on all frequencies between 2360 and 2365 MHz, and not less than  $70 + 10 \log (P)$  dB above 2365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

### A. 7.3 Measurement result

Only worst case result is given below

#### LTE band 5: 30MHz – 10GHz

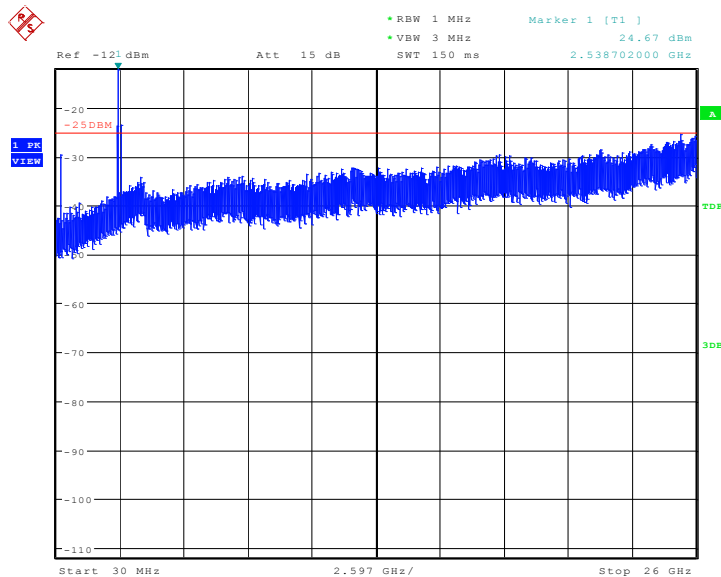
Spurious emission limit –13dBm.



Date: 11.APR.2017 17:04:38

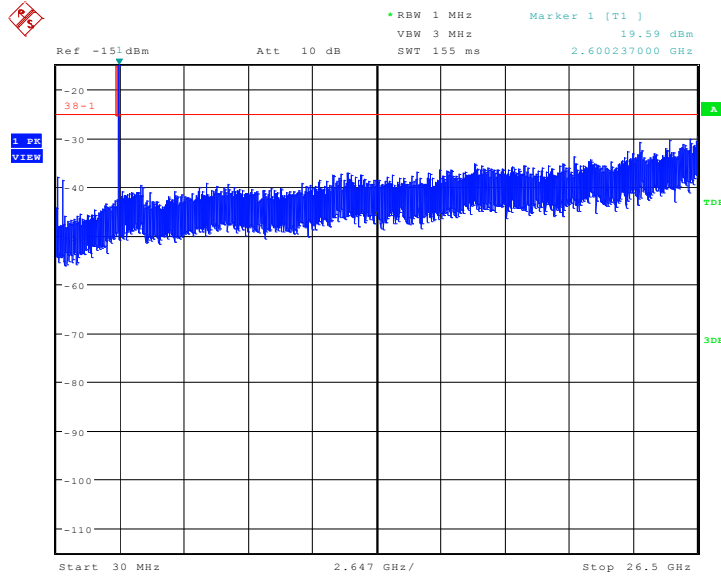
#### LTE band 7: 30MHz – 26GHz

Spurious emission limit –25dBm.



Date: 12.APR.2017 10:35:43

**LTE band 38: 30MHz – 26GHz**  
Spurious emission limit -25dBm.



Date: 13.APR.2017 10:58:31





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

### **Reference**

FCC: CFR Part 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 7, 20MHz**

Frequency(MHz)	PAPR(dB)	
	QPSK	16QAM
2510.0	7.12	7.37

#### **LTE band 38, 5MHz**

Frequency(MHz)	PAPR(dB)	
	QPSK	16QAM
2595.0	7.53	8.46



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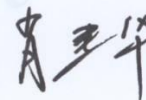
*The scope of accreditation is detailed in the attached schedule bearing the  
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Date of Issue: 2015-11-13

Date of Expiry: 2017-06-19

Date of Initial Accreditation: 1998-07-03

Signed on behalf of China National Accreditation Service for Conformity Assessment



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