



# TEST REPORT

No. I15Z40275-GTE03

for

**Asiatelco Technologies Co.**

**LTE Mobile hotspot**

**Model Name: ALM-N245**

**FCC ID: XYOALM-N245**

with

**Hardware Version: KF1030**

**Software Version: N245V1.0.0B03**

**Issued Date: 2015-06-12**

**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>
I15Z40275-GTE03	Rev.0	1st edition	2015-06-12

## **CONTENTS**

<b>1. TEST LABORATORY.....</b>	<b>4</b>
1.1. TESTING LOCATION .....	4
1.2. TESTING ENVIRONMENT .....	4
1.3. PROJECT DATA.....	4
1.4. SIGNATURE .....	4
<b>2. CLIENT INFORMATION.....</b>	<b>5</b>
2.1. APPLICANT INFORMATION.....	5
2.2. MANUFACTURER INFORMATION.....	5
<b>3. EQUIPMENT UNDER TEST (EUT) AND ANCILLARY EQUIPMENT (AE) .....</b>	<b>6</b>
3.1. ABOUT EUT .....	6
3.2. INTERNAL IDENTIFICATION OF EUT USED DURING THE TEST .....	6
3.3. INTERNAL IDENTIFICATION OF AE USED DURING THE TEST.....	6
3.4. GENERAL DESCRIPTION .....	7
<b>4. REFERENCE DOCUMENTS .....</b>	<b>8</b>
4.1. REFERENCE DOCUMENTS FOR TESTING.....	8
<b>5. LABORATORY ENVIRONMENT .....</b>	<b>9</b>
<b>6. SUMMARY OF TEST RESULTS.....</b>	<b>10</b>
6.1. SUMMARY OF TEST RESULTS .....	10
<b>STATEMENTS.....</b>	<b>11</b>
<b>7. TEST EQUIPMENTS UTILIZED.....</b>	<b>12</b>
<b>ANNEX A: MEASUREMENT RESULTS.....</b>	<b>13</b>
A.1 OUTPUT POWER.....	13
A.2 EMISSION LIMIT .....	20
A.3 FREQUENCY STABILITY .....	24
A.4 OCCUPIED BANDWIDTH .....	26
A.5 EMISSION BANDWIDTH.....	32
A.6 BAND EDGE COMPLIANCE .....	38
A.7 CONDUCTED SPURIOUS EMISSION .....	42

## 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

### 1.2. Testing Environment

Normal Temperature: 15-35°C  
Relative Humidity: 20-75%  
Air pressure 980 - 1040 hPa

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

### 1.3. Project data

Testing Start Date: 2015-03-30  
Testing End Date: 2015-06-04

### 1.4. Signature



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Shen Yi

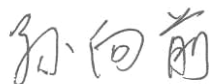
(Prepared this test report)



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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: Asiatelco Technologies Co.  
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### **2.2. Manufacturer Information**

Company Name: HUIZHOU QIAOXING TELECOMMUNICATION INDUSTRY  
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Guangdong Province, P.R.C  
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### **3. Equipment Under Test (EUT) and Ancillary Equipment (AE)**

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

Description	LTE Mobile hotspot
Model Name	ALM-N245
FCC ID	XYOALM-N245
Antenna	Integrated
Output power	22.16dBm maximum ERP measured for LTE Band 26
Extreme vol. Limits	3.4VDC to 4.2VDC (nominal: 3.7VDC)
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
UT03a	863867020576672	KF1030	N245V1.0.0B03
UT07a	863867020575039	KF1030	N245V1.0.0B03

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

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

AE ID*	Description
AE1	Battery
AE2	Travel charger

##### **AE1**

Model	N-1800
Manufacturer	Heyuan New Lingjia Electroacoustic Co.,Ltd
Capacitance	1800mAh
Nominal voltage	3.7V

##### **AE2**

Model	ASUC30a-050100
Manufacturer	AQUIL STAR PRECISION INDUSTRIAL(Shenzhen) CO.,Ltd

\*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 LTE Mobile hotspot with integrated antenna. Manual and specifications of the EUT were provided to fulfil the test.

## 4. Reference Documents

### 4.1. Reference Documents for testing

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

Reference	Title	Version
FCC Part 22	PUBLIC MOBILE SERVICES	10-1-14 Edition
ANSI/TIA-603-C	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	2004
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	2009
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 26

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

## **6.2. Statements**

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

The EUT met all applicable requirements of the standards or reference documents in section 4.1.

This report only deals with the LTE functions among the features described in section 3.

## 7. Test Equipments Utilized

NO.	Description	TYPE	series number	MANUFACTURE	CAL DUE DATE	Calibration interval
1	Test Receiver	ESU26	100235	R&S	2016/3/2	1 year
2	Test Receiver	ESU26	100376	R&S	2015-10-29	1 year
3	EMI Antenna	VULB 9163	302	Schwarzbeck	2017-1-3	3 year
4	EMI Antenna	3117	00119024	ETS-Lindgren	2016-01-20	3 year
5	LISN	NV216	101200	R&S	2015-07-07	1 year
6	Universal Radio Communication Tester	CMW500	101675	R&S	2015-07-13	1 year
7	Universal Radio Communication Tester	E5515C	MY48361083	Agilent	2016-02-27	1 year
8	Spectrum Analyzer	E4440A	MY48250642	Agilent	2016-03-02	1 year
9	EMI Antenna	9117	167	Schwarzbeck	2016-04-01	3 year
10	EMI Antenna	VULB 9163	9163 175	Schwarzbeck	2015-07-15	3 year
11	EMI Antenna	3117	00119024	ETS-Lindgren	2016-01-20	3 year
12	Signal Generator	N5183A	MY49060052	Agilent	2016-03-02	1 year
13	Climate chamber	SH-241	92007454	ESPEC	2015-12-14	2 year
14	Loop Antenna	HFH2-Z2	829324/007	R&S	2017-12-10	3 year

## **ANNEX A: MEASUREMENT RESULTS**

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

#### **Reference**

FCC: 22.913(a)

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

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

This result contains peak output power and ERP/EIRP measurements for the EUT.

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

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

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

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

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 26**

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
1.4MHz	1 RB high	848.3	22.07	20.99
		836.5	22.87	21.66
		824.7	22.98	21.73
	1 RB low	848.3	22.21	21.12
		836.5	22.87	21.64
		824.7	22.92	21.72
	50% RB mid	848.3	22.07	21.28
		836.5	22.82	21.82
		824.7	22.92	21.85
	100% RB	848.3	21.13	20.31
		836.5	21.88	20.95
		824.7	21.91	20.96
3MHz	1 RB high	847.5	21.98	21.65
		836.5	22.88	22.52
		825.5	22.61	22.33
	1 RB low	847.5	22.35	22.01

		836.5	22.76	22.49
		825.5	22.79	22.42
	50% RB mid	847.5	21.26	20.37
		836.5	21.80	20.94
		825.5	21.82	20.98
	100% RB	847.5	21.24	20.24
		836.5	21.79	20.82
		825.5	21.80	20.85
5MHz	1 RB high	846.5	22.11	20.87
		836.5	23.01	21.63
		826.5	22.61	21.34
	1 RB low	846.5	22.43	21.16
		836.5	22.73	21.41
		826.5	22.95	21.55
	50% RB mid	846.5	21.45	20.34
		836.5	21.79	20.80
		826.5	21.83	20.77
	100% RB	846.5	21.34	20.29
		836.5	21.62	20.72
		826.5	21.72	20.71
10MHz	1 RB high	844.0	22.08	21.71
		836.5	22.95	21.63
		829.0	22.64	22.30
	1 RB low	844.0	22.88	22.46
		836.5	22.56	21.32
		829.0	22.82	22.45
	50% RB mid	844.0	21.49	20.55
		836.5	21.60	20.65
		829.0	21.49	20.52
	100% RB	844.0	21.38	20.42
		836.5	21.53	20.55
		829.0	21.37	20.38
15MHz	1 RB high	841.5	22.08	21.62
		836.5	22.66	22.33
		831.5	22.95	22.52
	1 RB low	841.5	22.61	22.34
		836.5	22.62	22.26
		831.5	22.89	22.43
	50% RB mid	841.5	21.43	20.54
		836.5	21.51	20.58



		831.5	21.47	20.42
	100% RB	841.5	21.54	20.47
		836.5	21.44	20.44
		831.5	21.40	20.38

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

### A.1.3 Radiated

#### A.1.3.1 Description

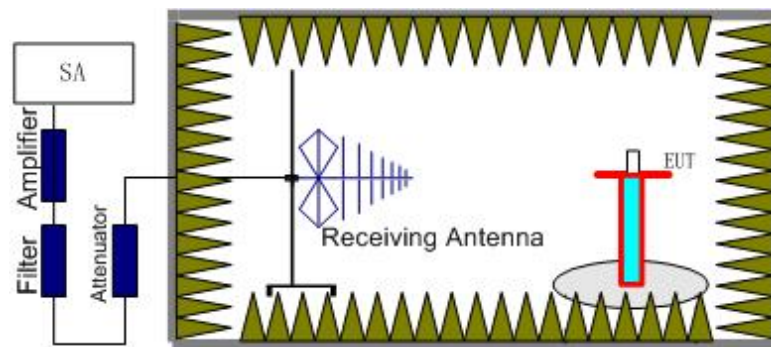
This is the test for the maximum radiated power from the EUT.

Rule Part 22.913(a) specifies "Mobile stations are limited to 2.0 watts EIRP."

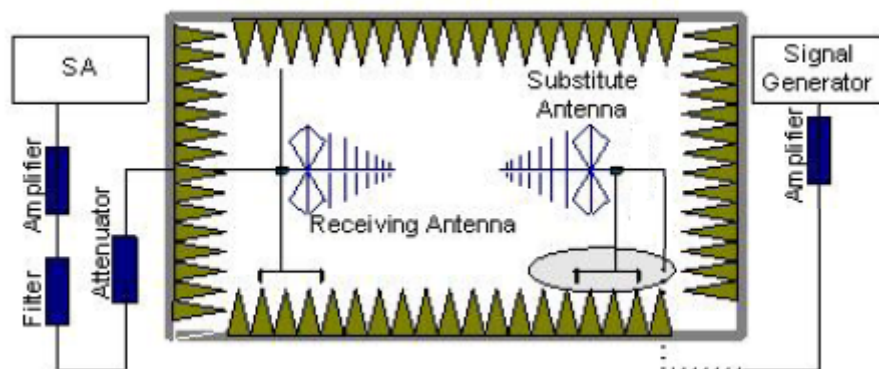
#### A.1.3.2 Method of Measurement

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

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



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



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



polarization.

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

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

The measurement results are obtained as described below:

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

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

### A.1.3.3 Measurement result

#### LTE Band 26- ERP 22.913(a)

Limits:  $\leq 38.45\text{dBm}$  (7W)

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	Correction (dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
824.70	-22.63	2.26	-45.79	-0.95	2.15	19.70	38.45	18.75	H
836.50	-19.99	2.26	-45.66	-0.82	2.15	22.08	38.45	16.37	H
848.30	-20.38	2.27	-45.55	-0.80	2.15	21.55	38.45	16.90	V

#### LTE Band 26\_3MHz\_QPSK

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	Correction (dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
825.50	-22.74	2.26	-45.79	-0.94	2.15	19.58	38.45	18.87	H
836.50	-20.04	2.26	-45.66	-0.82	2.15	22.03	38.45	16.42	H
847.50	-20.21	2.27	-45.56	-0.81	2.15	21.74	38.45	16.71	V

#### LTE Band 26\_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)	Correction (dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
826.50	-22.08	2.25	-45.77	-0.93	2.15	20.22	38.45	18.23	H
836.50	-20.03	2.26	-45.66	-0.82	2.15	22.04	38.45	16.41	H
846.50	-20.27	2.27	-45.55	-0.80	2.15	21.66	38.45	16.79	V

#### LTE Band 26\_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)	Correction (dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
829.00	-21.13	2.13	-45.74	-0.90	2.15	21.23	38.45	17.22	H
836.50	-20.02	2.26	-45.66	-0.82	2.15	22.05	38.45	16.40	H
844.00	-20.33	2.27	-45.55	-0.80	2.15	21.60	38.45	16.85	V

#### LTE Band 26\_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)	Correction (dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
831.50	-20.15	2.12	-45.71	-0.87	2.15	22.16	38.45	16.29	H
836.50	-20.12	2.26	-45.66	-0.82	2.15	21.95	38.45	16.50	H
841.50	-20.37	2.27	-45.55	-0.80	2.15	21.56	38.45	16.89	V

**LTE Band 26\_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	-23.84	2.26	-45.79	-0.95	2.15	18.49	38.45	19.96	H
836.50	-21.21	2.26	-45.66	-0.82	2.15	20.86	38.45	17.59	H
848.30	-21.44	2.27	-45.55	-0.80	2.15	20.49	38.45	17.96	V

**LTE Band 26\_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	-24.05	2.26	-45.79	-0.94	2.15	18.27	38.45	20.18	H
836.50	-20.83	2.26	-45.66	-0.82	2.15	21.24	38.45	17.21	H
847.50	-21.41	2.27	-45.56	-0.81	2.15	20.54	38.45	17.91	V

**LTE Band 26\_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	-23.13	2.25	-45.77	-0.93	2.15	19.17	38.45	19.28	H
836.50	-20.98	2.26	-45.66	-0.82	2.15	21.09	38.45	17.36	H
846.50	-21.47	2.27	-45.55	-0.80	2.15	20.46	38.45	17.99	V

**LTE Band 26\_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	-22.44	2.13	-45.74	-0.90	2.15	19.92	38.45	18.53	H
836.50	-20.79	2.26	-45.66	-0.82	2.15	21.28	38.45	17.17	H
844.00	-21.48	2.27	-45.55	-0.80	2.15	20.45	38.45	18.00	V

**LTE Band 26\_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)	Correction (dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
831.50	-21.01	2.12	-45.71	-0.87	2.15	21.30	38.45	17.15	H
836.50	-21.35	2.26	-45.66	-0.82	2.15	20.72	38.45	17.73	H
841.50	-21.58	2.27	-45.55	-0.80	2.15	20.35	38.45	18.10	V

$$\text{Peak ERP(dBm)} = P_{\text{Mea}}(-20.15\text{dBm}) - G_a(-0.87\text{dBi}) - P_{\text{Ag}}(-45.71\text{dB}) - P_{\text{cl}}(2.26\text{dB}) - 2.15\text{dB} = 22.16\text{dBm}$$

**ANALYZER SETTINGS:**

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

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

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

## A.2 EMISSION LIMIT

### Reference

FCC: CFR 2.1051, 22.917.

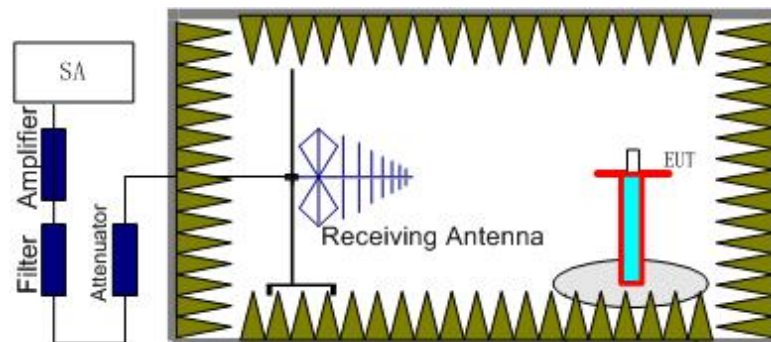
#### A.2.1 Measurement Method

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

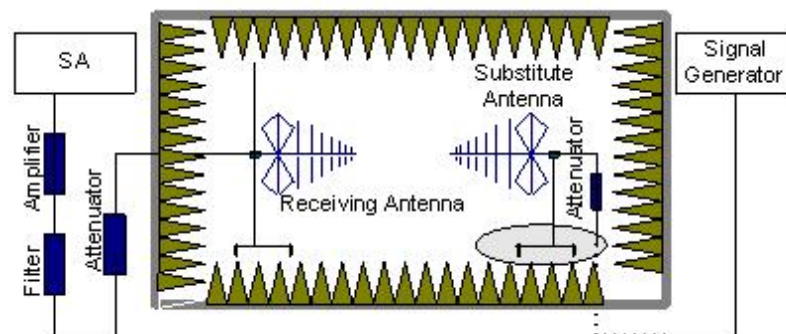
The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier. The resolution bandwidth is set 1MHz as outlined in Part 22.917. The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the LTE Band26.

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

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



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



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

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

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

An amplifier should be connected in for the test.

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

The measurement results are obtained as described below:

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

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

#### A.2.2 Measurement Limit

Part 22.917 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.

#### A.2.3 Measurement Results

Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the LTE Bands 26. 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 26 into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

**LTE Band 26, 1.4MHz, QPSK, Channel 26797**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Correction (dB)	Peak ERP(dBm)	Limit (dBm)	Margin(dB)	Polarization
1649.52	-26.66	3.41	-5.23	2.15	-26.99	-13.00	13.99	V
2474.21	-45.97	4.43	-6.02	2.15	-46.53	-13.00	33.53	V
3574.13	-59.12	5.49	-8.30	2.15	-58.46	-13.00	45.46	V
5055.99	-57.89	6.42	-9.98	2.15	-56.48	-13.00	43.48	H
6639.38	-58.71	7.37	-11.17	2.15	-57.06	-13.00	44.06	H
7425.46	-57.36	7.22	-12.11	2.15	-54.62	-13.00	41.62	H

**LTE Band 26, 1.4MHz, QPSK, Channel 26915**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Correction (dB)	Peak ERP(dBm)	Limit (dBm)	Margin(dB)	Polarization
1673.20	-25.61	3.54	-5.19	2.15	-26.11	-13.00	13.11	V
2509.61	-48.63	4.48	-6.12	2.15	-49.14	-13.00	36.14	V
3462.60	-61.95	5.41	-8.11	2.15	-61.40	-13.00	48.40	V
4476.34	-58.94	5.95	-9.38	2.15	-57.66	-13.00	44.66	H
5665.61	-60.23	6.76	-10.57	2.15	-58.57	-13.00	45.57	V
6355.94	-57.59	6.88	-10.86	2.15	-55.76	-13.00	42.76	V

**LTE Band 26, 1.4MHz, QPSK, Channel 27033**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Correction (dB)	Peak ERP(dBm)	Limit (dBm)	Margin(dB)	Polarization
1696.71	-24.84	3.45	-5.15	2.15	-25.29	-13.00	12.29	V
3361.46	-57.40	5.30	-7.87	2.15	-56.98	-13.00	43.98	V
4015.17	-59.47	5.69	-8.92	2.15	-58.39	-13.00	45.39	V
5270.26	-58.96	6.43	-10.28	2.15	-57.26	-13.00	44.26	H
7455.84	-57.95	7.23	-12.15	2.15	-55.18	-13.00	42.18	H
9582.76	-54.66	8.24	-13.32	2.15	-51.73	-13.00	38.73	H

**LTE Band 26, 1.4MHz, 16QAM, Channel 26797**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Correction (dB)	Peak ERP(dBm)	Limit (dBm)	Margin(dB)	Polarization
1649.62	-27.16	3.41	-5.23	2.15	-27.49	-13.00	14.49	V
2474.44	-50.27	4.43	-6.02	2.15	-50.83	-13.00	37.83	V
3557.00	-58.68	5.47	-8.28	2.15	-58.02	-13.00	45.02	H
4849.75	-58.83	6.31	-9.75	2.15	-57.54	-13.00	44.54	V
5494.87	-59.86	6.68	-10.59	2.15	-58.10	-13.00	45.10	H
6816.57	-55.94	7.15	-11.38	2.15	-53.86	-13.00	40.86	V

**LTE Band 26, 1.4MHz, 16QAM, Channel 26915**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Correction (dB)	Peak ERP(dBm)	Limit (dBm)	Margin(dB)	Polarization
1673.10	-25.95	3.54	-5.19	2.15	-26.45	-13.00	13.45	V
2510.06	-46.34	4.48	-6.12	2.15	-46.85	-13.00	33.85	V
3326.80	-56.86	5.17	-7.78	2.15	-56.40	-13.00	43.40	H
4278.23	-57.34	5.98	-9.18	2.15	-56.29	-13.00	43.29	H
5658.61	-59.30	6.78	-10.57	2.15	-57.66	-13.00	44.66	V
6323.44	-59.08	6.93	-10.82	2.15	-57.34	-13.00	44.34	H

**LTE Band 26, 1.4MHz, 16QAM, Channel 27033**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Correction (dB)	Peak ERP(dBm)	Limit (dBm)	Margin(dB)	Polarization
1696.61	-40.35	3.45	-5.15	2.15	-40.80	-13.00	27.80	H
3405.99	-56.88	5.52	-7.97	2.15	-56.58	-13.00	43.58	H
4522.91	-56.71	5.99	-9.42	2.15	-55.43	-13.00	42.43	V
5742.76	-58.76	6.78	-10.55	2.15	-57.14	-13.00	44.14	H
6945.04	-57.22	7.12	-11.53	2.15	-54.96	-13.00	41.96	V
8807.45	-56.33	7.99	-13.06	2.15	-53.41	-13.00	40.41	V

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

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

#### **Reference**

FCC: CFR Part 2.1055,22.235.

#### **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 26, 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.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 3.4VDC and 4.2VDC, with a nominal voltage of 3.7VDC. 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 26, 1.4MHz bandwidth (worst case of all bandwidths)****Frequency Error vs Voltage**

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.55	2	19	0.002	0.022
3.8	0	18	0.001	0.022
4.35	-3	17	0.004	0.020

**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	-2	21	0.003	0.026
40°	-2	21	0.002	0.025
30°	-2	22	0.002	0.026
20°	-1	20	0.001	0.024
10°	2	23	0.003	0.027
0°	1	20	0.001	0.024
- 10°	1	20	0.001	0.024
- 20°	0	17	0.001	0.020
- 30°	3	23	0.003	0.028

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

#### **A.4 OCCUPIED BANDWIDTH**

##### **Reference**

FCC: CFR Part 2.1049(h)(i)

##### **A.4.1 Occupied Bandwidth Results**

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

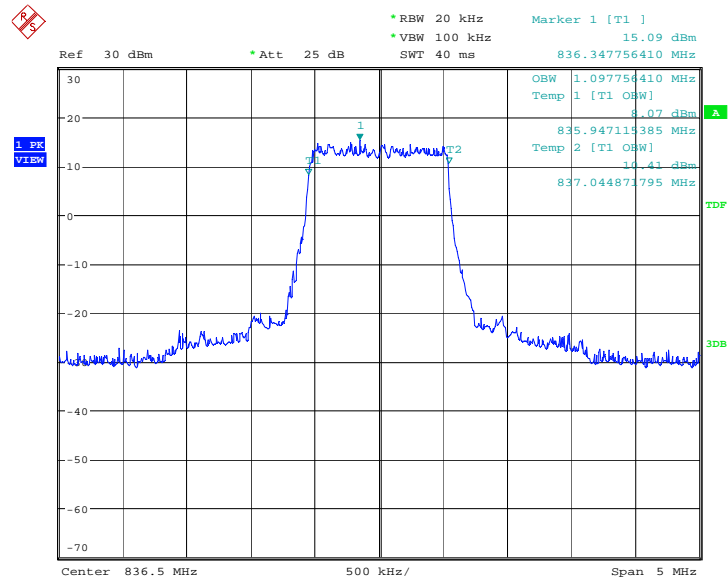
The measurement method is from KDB 971168 4.2:

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

##### **LTE band 26, 1.4MHz (99%)**

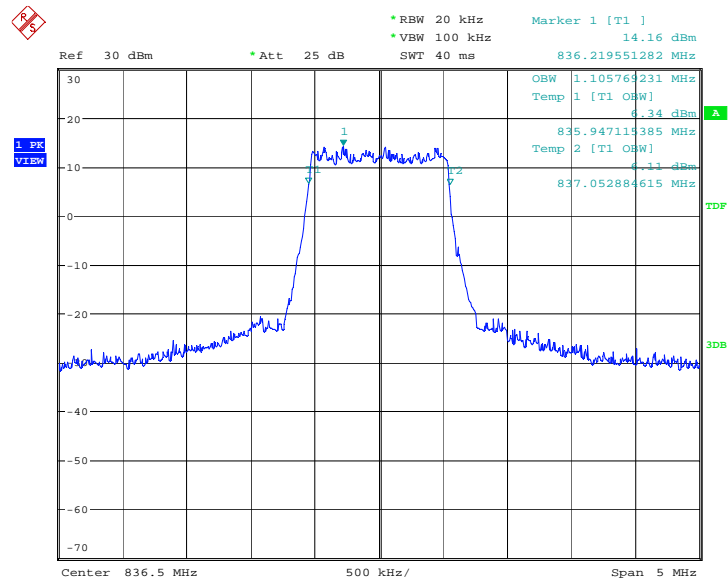
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
836.5	QPSK	16QAM
	1097.76	1105.77

### LTE band 26, 1.4MHz Bandwidth, QPSK (99% BW)



Date: 22.MAY.2015 03:09:09

### LTE band 26, 1.4MHz Bandwidth, 16QAM (99% BW)

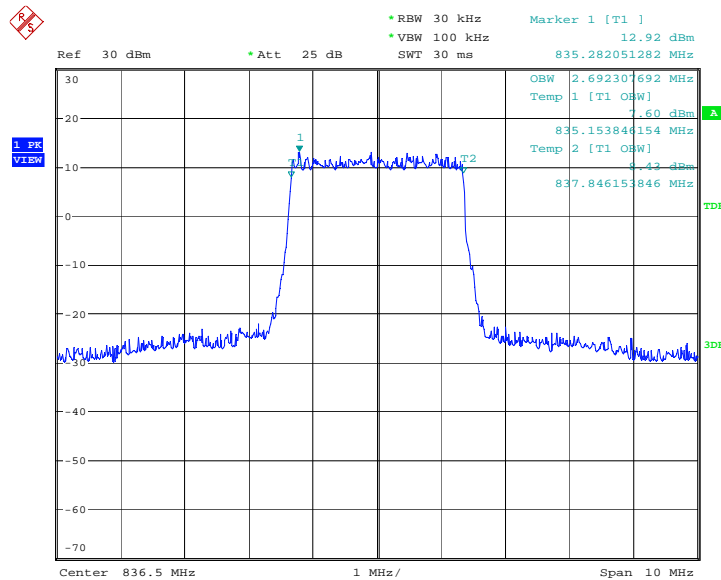


Date: 22.MAY.2015 03:09:24

### LTE band 26, 3MHz (99%)

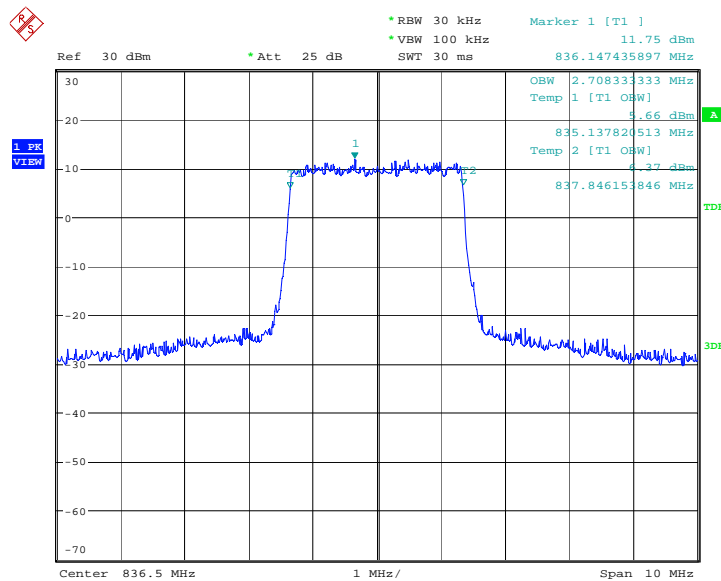
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
836.5	QPSK	16QAM
	2692.31	2708.33

### LTE band 26, 3MHz Bandwidth, QPSK (99% BW)



Date: 22.MAY.2015 03:14:52

### LTE band 26, 3MHz Bandwidth, 16QAM (99% BW)

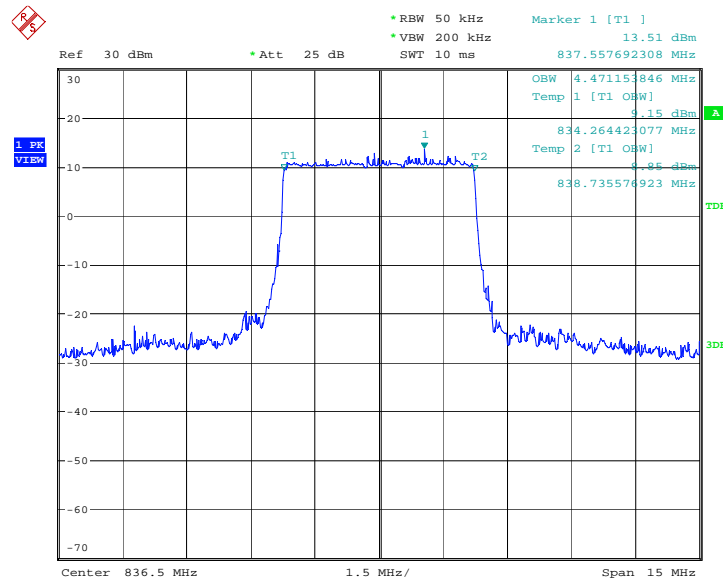


Date: 22.MAY.2015 03:15:07

### LTE band 26, 5MHz (99%)

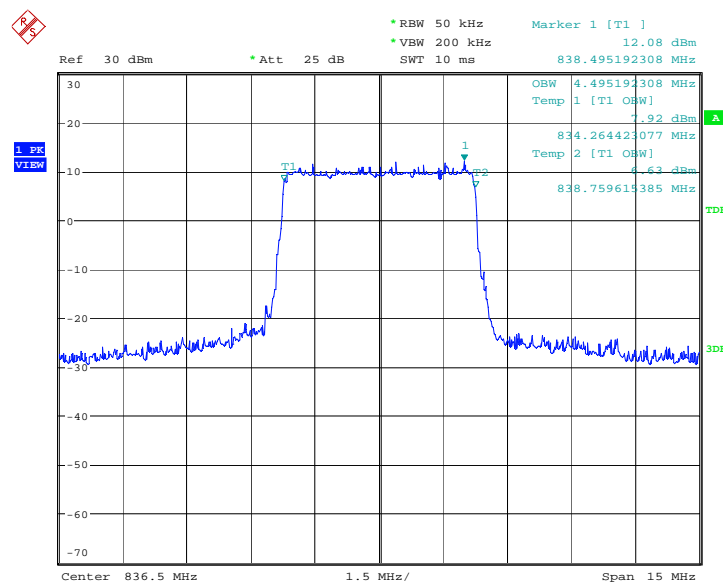
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
836.5	QPSK	16QAM
	4471.15	4495.19

### LTE band 26, 5MHz Bandwidth, QPSK (99% BW)



Date: 22.MAY.2015 03:20:36

### LTE band 26, 5MHz Bandwidth, 16QAM (99% BW)

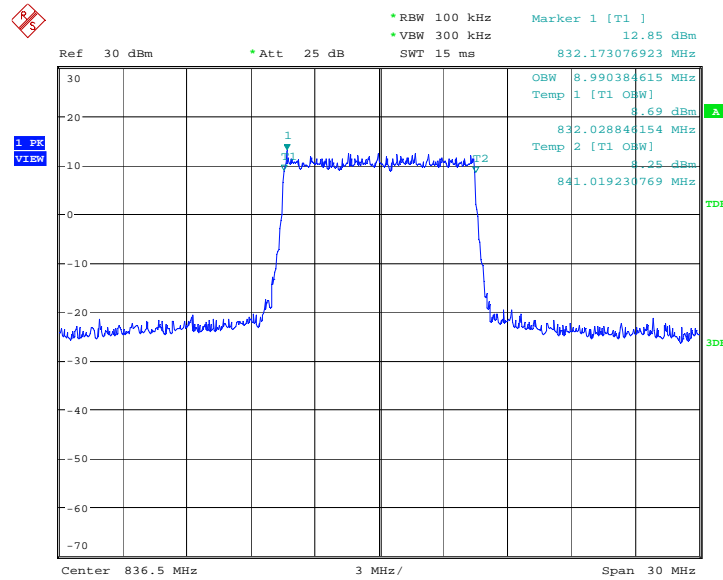


Date: 22.MAY.2015 03:20:51

### LTE band 26, 10MHz (99%)

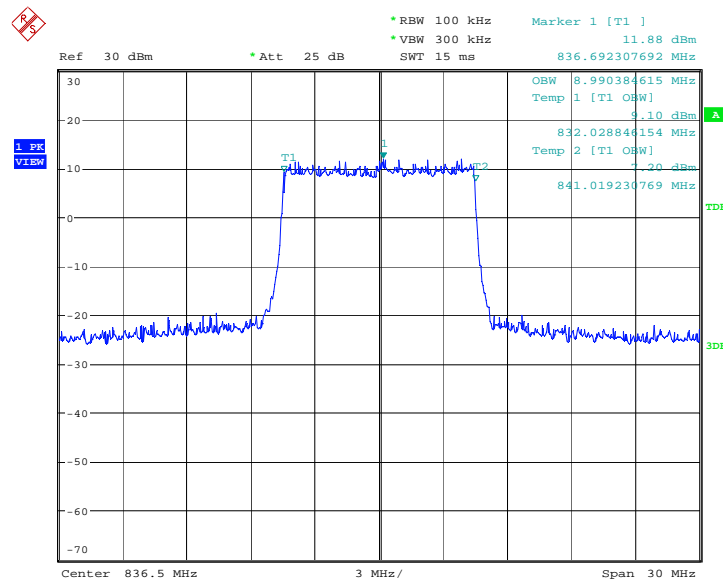
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
836.5	QPSK	16QAM
	8990.38	8990.38

### LTE band 26, 10MHz Bandwidth, QPSK (99% BW)



Date: 22.MAY.2015 03:26:19

### LTE band 26, 10MHz Bandwidth, 16QAM (99% BW)

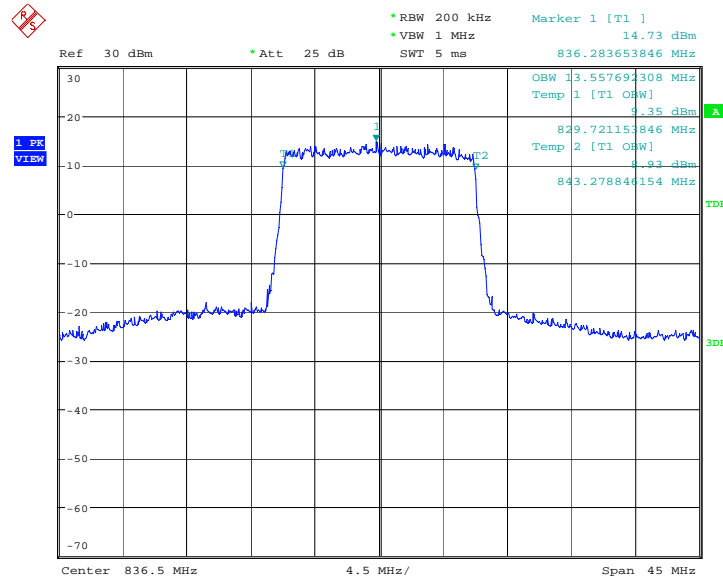


Date: 22.MAY.2015 03:26:34

### LTE band 26, 15MHz (99%)

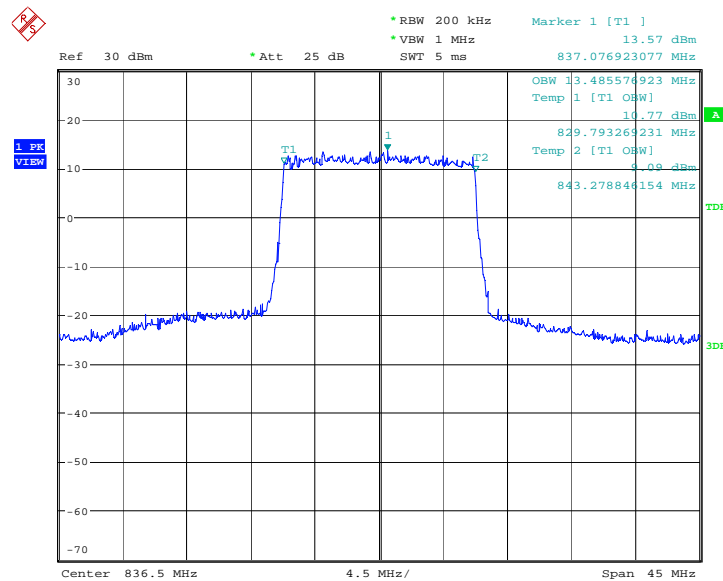
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
836.5	QPSK	16QAM
	13557.69	13485.58

### LTE band 26, 15MHz Bandwidth, QPSK (99% BW)



Date: 22.MAY.2015 03:32:07

### LTE band 26, 15MHz Bandwidth, 16QAM (99% BW)



Date: 22.MAY.2015 03:32:23

## A.5 EMISSION BANDWIDTH

### Reference

FCC: CFR Part 22.917(b).

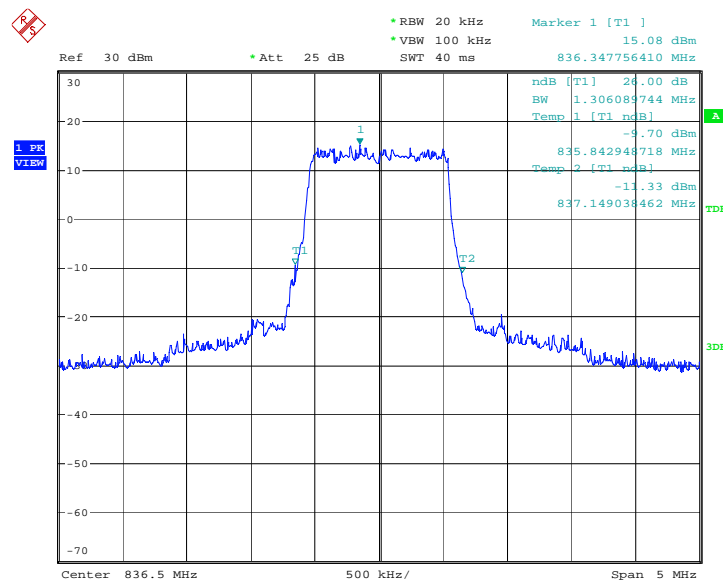
### A.5.1 Emission Bandwidth Results

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 26, 1.4MHz (-26dBc)

Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
836.5	QPSK	16QAM
	1306.09	1314.10

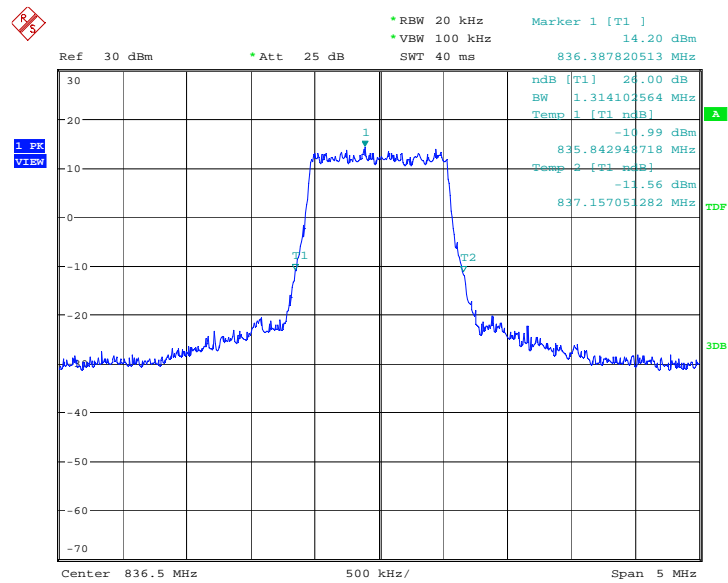
#### LTE band 26, 1.4MHz Bandwidth, QPSK (-26dBc BW)



Date: 22.MAY.2015 03:10:17



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

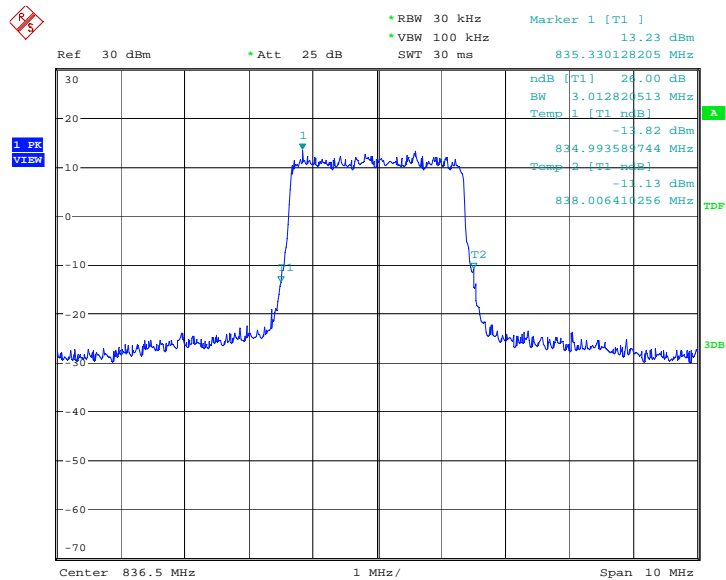


Date: 22.MAY.2015 03:10:34

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

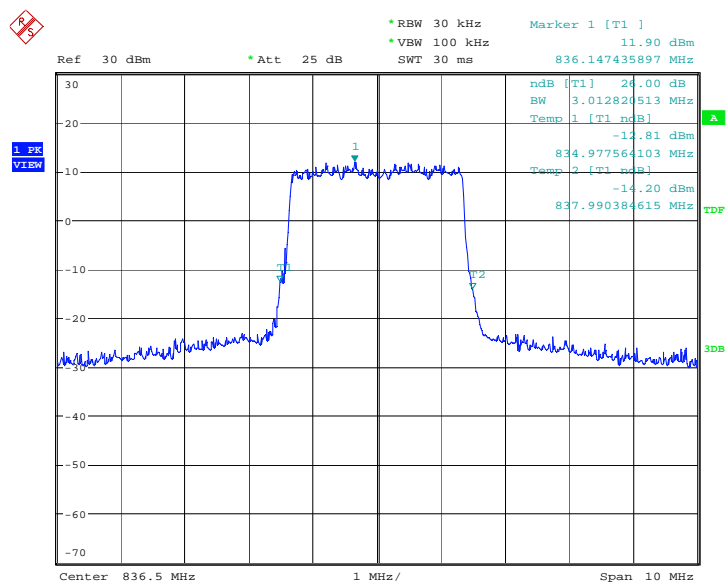
Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
836.5	QPSK	16QAM
	3012.82	3012.82

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



Date: 22.MAY.2015 03:16:01

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

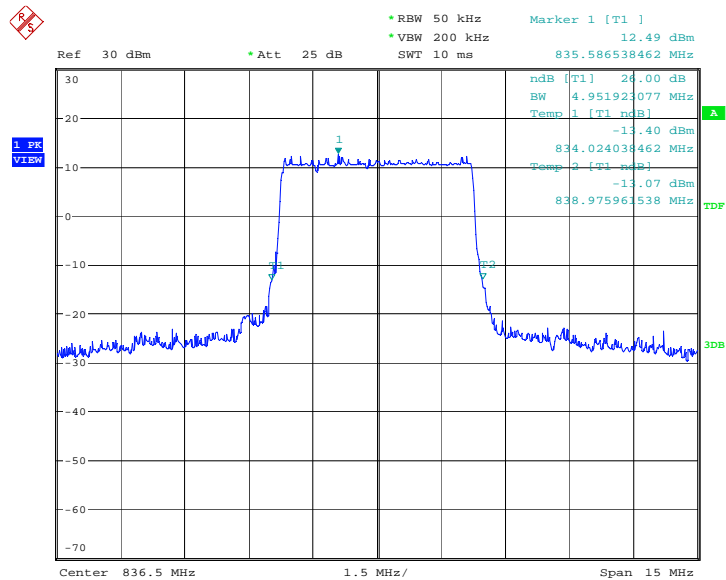


Date: 22.MAY.2015 03:16:18

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

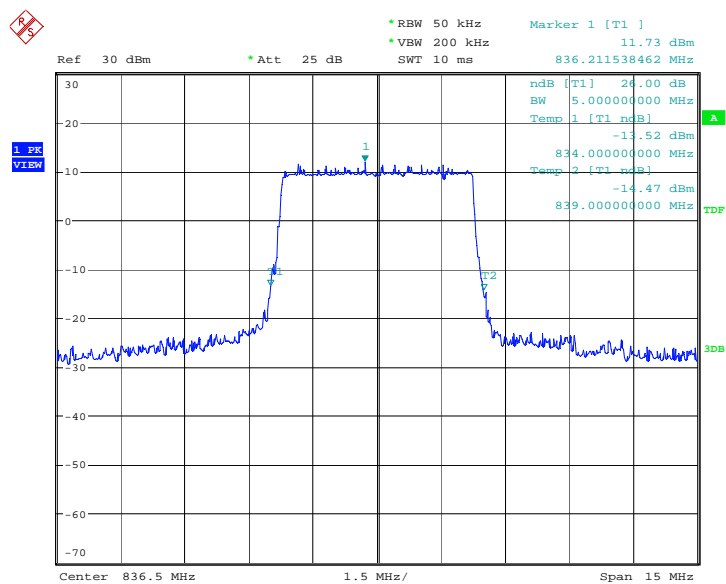
Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
836.5	QPSK	16QAM
	4951.92	5000.00

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



Date: 22.MAY.2015 03:21:44

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

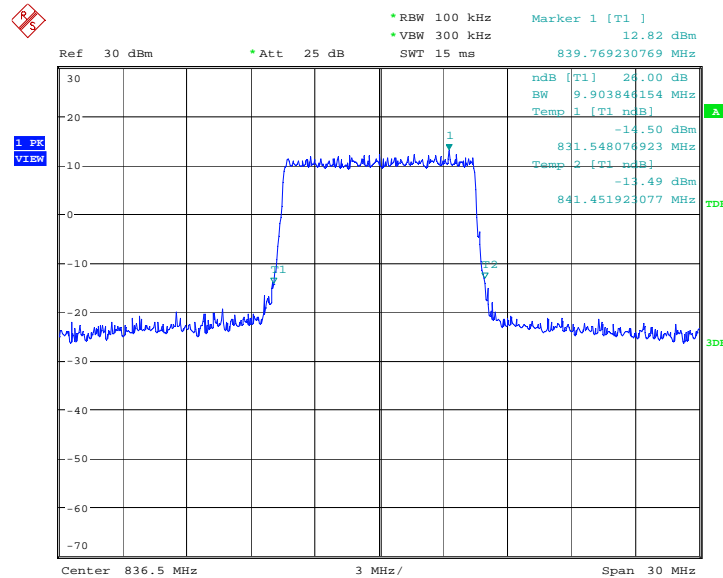


Date: 22.MAY.2015 03:22:01

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

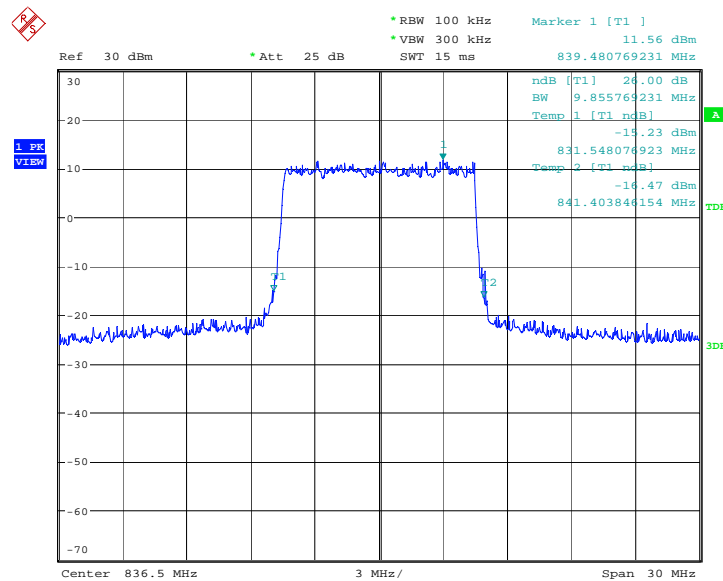
Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
836.5	QPSK	16QAM
	9903.85	9855.77

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



Date: 22.MAY.2015 03:27:27

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

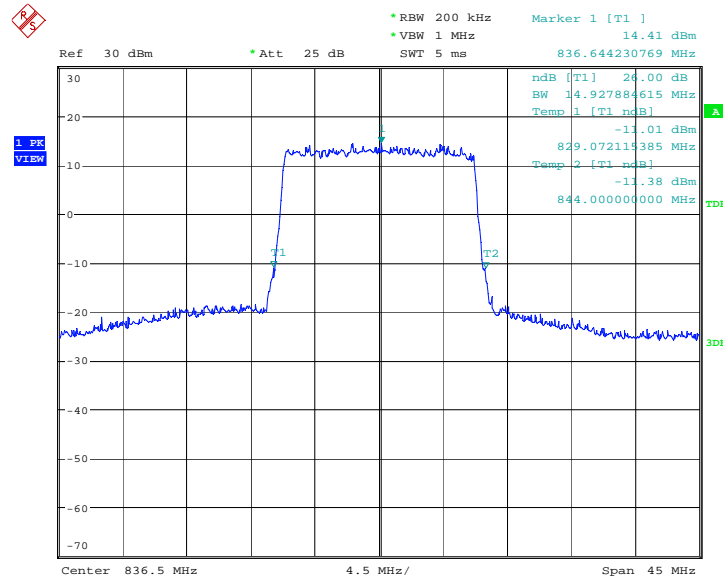


Date: 22.MAY.2015 03:27:44

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

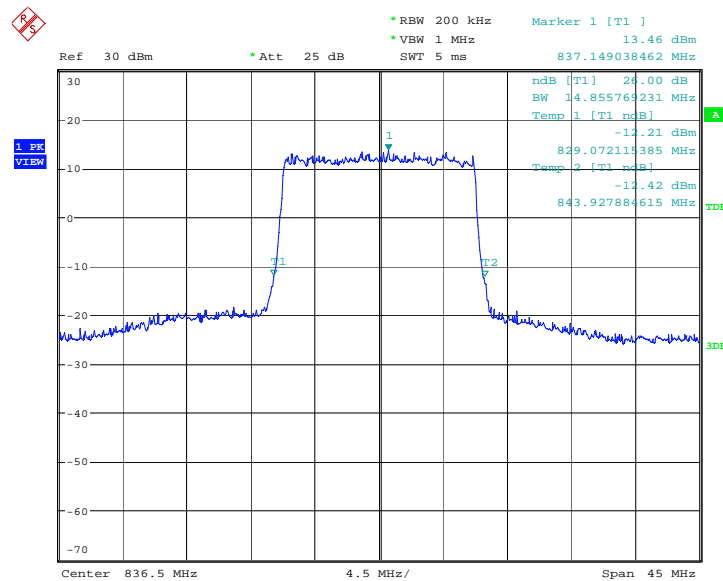
Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
836.5	QPSK	16QAM
	14927.88	14855.77

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



Date: 22.MAY.2015 03:33:16

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



Date: 22.MAY.2015 03:33:33

## A.6 BAND EDGE COMPLIANCE

### Reference

FCC: CFR Part 22.917(b).

#### A.6.1 Measurement limit

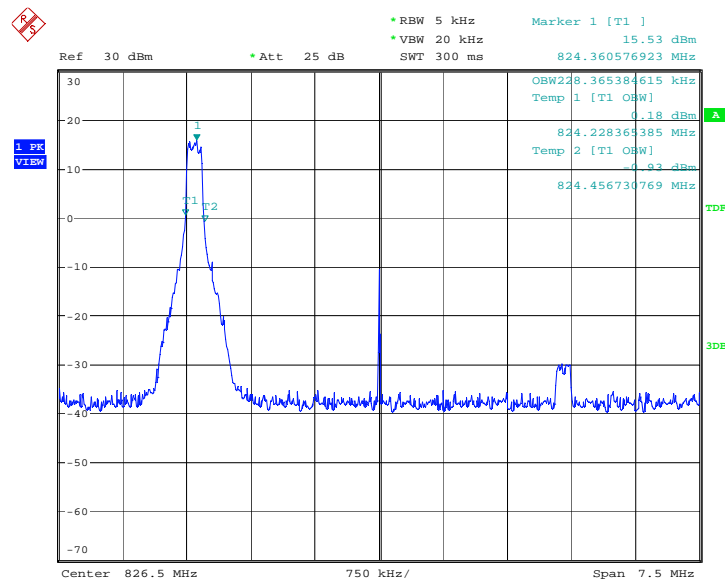
On any frequency outside frequency band of the US Cellular/PCS spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least  $43 + 10\log(P)$  dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm. According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

#### A.6.2 Measurement result

Only worst case result is given below

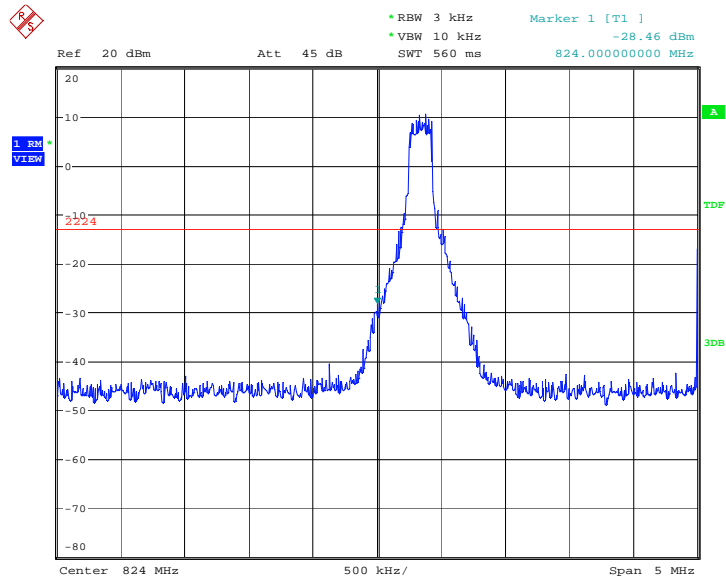
LTE band 26

OBW: 1RB-low\_offset



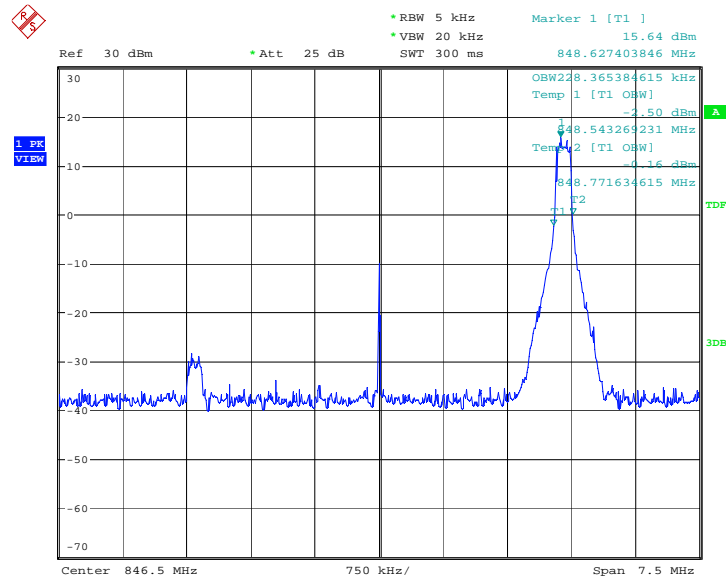
Date: 3.JUN.2015 23:06:24

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



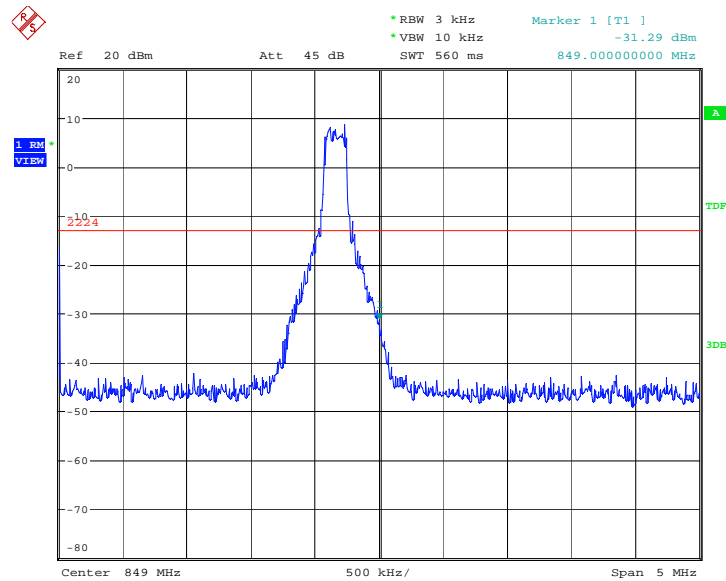
Date: 3.JUN.2015 23:07:10

### OBW: 1RB-high\_offset



Date: 3.JUN.2015 22:57:00

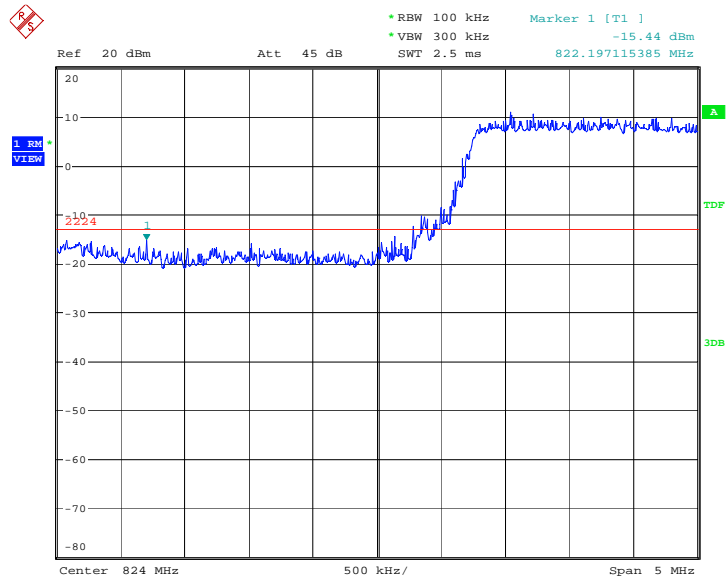
### HIGH BAND EDGE BLOCK-1RB-high\_offset



Date: 3.JUN.2015 22:57:46

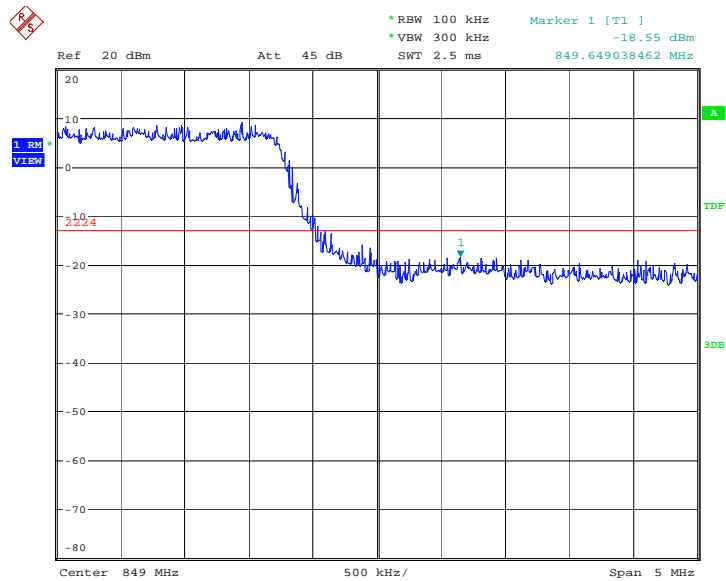


### LOW BAND EDGE BLOCK-15MHz-100%RB



Date: 29.MAY.2015 20:12:00

### HIGH BAND EDGE BLOCK-15MHz-100%RB



Date: 29.MAY.2015 20:05:10

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

### **Reference**

FCC: CFR Part 2.1057, 22.917.

#### **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.

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

Part 22.917 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.

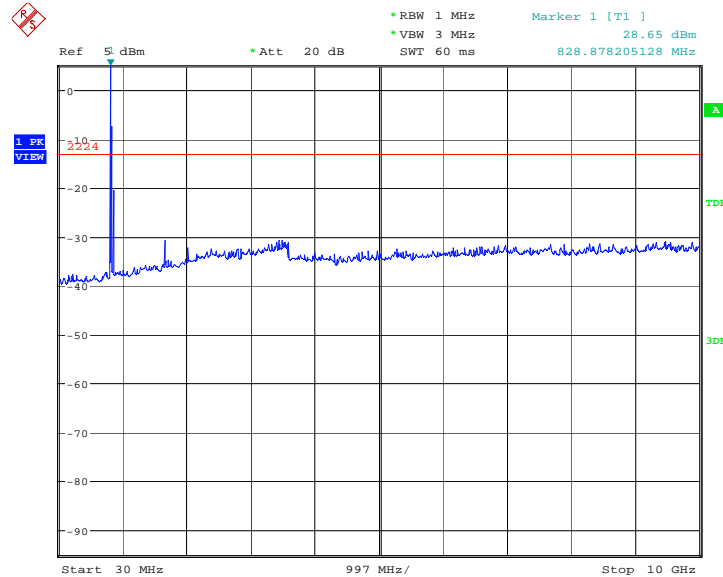
The specification that emissions shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log(P)$  dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13 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.

### A. 7.3 Measurement result

Only worst case result is given below

**LTE band 26: 30MHz – 10GHz**

Spurious emission limit –13dBm.



Date: 29.MAY.2015 20:29:13

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