



## TEST REPORT

**No. I18N00243-LTE**

for

**Doro AB**

**Doro 4GLTE Clamshell phone**

**Model Name: DFC-0190**

**FCC ID: WS5DFC0190**

with

**Hardware Version: 3011**

**Software Version: CALM01A-S01A\_DFC0190\_120\_180321094522**

**Issued Date: 2018-04-03**

**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 SAICT.

**Test Laboratory:**

Designation Number: CN1210

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## **REPORT HISTORY**

<b>Report Number</b>	<b>Revision</b>	<b>Description</b>	<b>Issue Date</b>
I18N00243-LTE	Rev.0	1 <sup>st</sup> edition	2018-04-03

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## 1. Test Laboratory

### 1.1. Testing Location

Company Name: Shenzhen Academy of Information and Communications  
Technology  
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Postal Code: 518026  
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### 1.2. Testing Environment

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

### 1.3. Project data

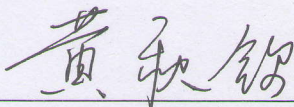
Testing Start Date: 2018-02-28  
Testing End Date: 2018-03-22

### 1.4. Signature



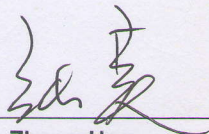
Lai Minghua

(Prepared this test report)



Huang Qiuqin

(Reviewed this test report)



Zhang Hao

Deputy Director of the laboratory

(Approved this test report)

## **2. Client Information**

### **2.1. Applicant Information**

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### **2.2. Manufacturer Information**

Company Name: CK TELECOM LTD.  
Address /Post: Technology Road.High-Tech Development Zone. Heyuan,  
Guangdong,P.R.China  
Contact Person: Xin Li  
Contact Email xin.li@ck-telecom.com  
Telephone: 0755-26739100 ext.8515  
Fax: 0755-26739600



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

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

Description	Doro 4GLTE Clamshell phone
Model Name	DFC-0190
FCC ID	WS5DFC0190
Frequency Bands	LTE Band 7
Antenna	Integrated
Extreme vol. Limits	3.6VDC to 4.35VDC (nominal: 3.8VDC)
Extreme temp. Tolerance	-30°C to +50°C

#### **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>	<b>Sample Arrival Date</b>
UT03aa	352499090009323	3011	CALM01A-S01A_DF C0190_120_1803210 94522	2018-02-28

\*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>
AE1	Battery
AE2	Charger1
AE3	Charger2

AE1

Model	DBS-1350A
Manufacturer	Veken
Capacitance	1350 mAh

AE2

Model	A2-3762-501000
Manufacturer	Dongguan Aohai Power Techonolgy Co.,LTD

AE3

Model	A806A-050100U-UK1
Manufacturer	Dongguan Aohai Power Techonolgy 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 TD-LTE mobile phone with integrated antenna. It consists of normal options: lithium battery, charger. Manual and specifications of the EUT were provided to fulfil the test.

#### 4. Reference Documents

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

<b>Reference</b>	<b>Title</b>	<b>Version</b>
FCC Part 2	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS	10-1-16 Edition
FCC Part 27	MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES	10-1-16 Edition
ANSI/TIA-603-E	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	2016
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	v03

## 5. LABORATORY ENVIRONMENT

**Control room / conducted chamber** did not exceed following limits along the EMC testing:

Temperature	Min. = 15 °C, Max. = 35 °C
Relative humidity	Min. = 20 %, Max. = 80 %
Shielding effectiveness	> 110 dB
Electrical insulation	> 2 MΩ
Ground system resistance	< 0.5 Ω

**Fully-anechoic chamber 2** (8.6 meters X 6.1 meters X 3.85 meters) did not exceed following limits along the EMC testing:

Temperature	Min. = 15 °C, Max. = 30 °C
Relative humidity	Min. = 35 %, Max. = 60 %
Shielding effectiveness	> 110 dB
Electrical insulation	> 2 MΩ
Ground system resistance	< 1 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

**Semi-anechoic chamber 2 / Fully-anechoic chamber 3** (10 meters X 6.7 meters X 6.15 meters) did not exceed following limits along the EMC testing:

Temperature	Min. = 15 °C, Max. = 30 °C
Relative humidity	Min. = 35 %, Max. = 60 %
Shielding effectiveness	> 100 dB
Electrical insulation	> 2 MΩ
Ground system resistance	< 0.5 Ω
Normalised site attenuation (NSA)	< ±3.5 dB, 3 m distance
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



## 6. 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 7

Items	Test Name	Clause in FCC rules	Section in this report	Verdict
1	Output Power	2.1046/27.50(h)	A.1	P
2	Field Strength of Spurious Radiation	2.1053/27.53(m)	A.2	P
3	Frequency Stability	2.1055/27.54	A.3	P
4	Occupied Bandwidth	2.1049/27.53(m)	A.4	P
5	Emission Bandwidth	2.1049/27.53(m)	A.5	P
6	Band Edge Compliance	2.1051/27.53(m)(4)	A.6	P
7	Conducted Spurious Emission	2.1051/27.53(m)	A.7	P
8	Peak to Average Ratio	27.50(a)/KDB971168 D01(5.7.1)	A.8	P

## 7. Test Equipments Utilized

NO.	Description	TYPE	Manufacture	series number	CAL DUE DATE
1	Test Receiver	ESR7	R&S	101676	2018.11.29
2	BiLog Antenna	VULB9163	Schwarzbeck	9163 329	2020.02.27
3	Horn Antenna	3117	ETS-lindgren	00066577	2019.04.05
4	Horn Antenna	QSH-SL-18-26-S-20	Q-par	17013	2020.01.15
5	Antenna	SBA 9113	Schwarzbeck	814	/
6	Antenna	SBA 9112	Schwarzbeck	302	/
7	Antenna	QWH-SL-18-40-K-SG	Q-par	15979	2020.01.16
8	preamplifier	83017A	Agilent	MY39501110	/
9	Signal Generator	SMB100A	R&S	179725	2018.11.29
10	Fully Anechoic Chamber	FACT3-2.0	ETS-Lindgren	1285	2019.11.27
11	Spectrum Analyzer	FSV40	R&S	101192	2018.05.22
12	Universal Radio Communication Tester	CMW500	R&S	152499	2018-07-19
13	Universal Radio Communication Tester	CMW500	R&S	115794	2018-03-01
14	Spectrum Analyzer	FSU	R&S	200679	2018-12-13
15	Temperature Chamber	SH-241	ESPECs	92007516	2018-11-14
16	DC Power Supply	U3606A	Agilent Technologies	MY50450012	2018-11-14

### Test software

Item	Name	Vesion
Radiated	EMC32	Version 10.01.00

## **ANNEX A: MEASUREMENT RESULTS**

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

#### **Reference**

FCC: CFR Part 2.1046, 27.50(h)

#### **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 7**

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
5MHz	1 RB high	2567.5	21.54	20.90
		2535.0	22.00	21.18
		2502.5	21.91	20.21
	1 RB low	2567.5	21.31	20.64
		2535.0	21.98	21.31
		2502.5	21.99	20.25
	50% RB mid	2567.5	20.92	20.06
		2535.0	20.94	19.99
		2502.5	20.91	19.99
	100% RB	2567.5	20.77	19.91
		2535.0	20.88	20.03
		2502.5	20.87	20.02
10MHz	1 RB high	2565.0	20.67	19.88
		2535.0	21.49	20.74
		2505.0	21.05	20.29
	1 RB low	2565.0	20.21	19.44
		2535.0	21.54	20.77
		2505.0	21.07	20.30
	50% RB mid	2565.0	21.22	20.05
		2535.0	20.94	20.08
		2505.0	20.96	20.10
	100% RB	2565.0	20.87	19.98

		2535.0	20.82	19.98
		2505.0	20.77	19.88
15MHz	1 RB high	2562.5	20.67	19.93
		2535.0	21.24	20.49
		2507.5	21.15	20.40
	1 RB low	2562.5	20.43	19.67
		2535.0	21.53	20.74
		2507.5	21.05	20.29
	50% RB mid	2562.5	21.02	20.16
		2535.0	21.04	20.17
		2507.5	20.88	19.94
	100% RB	2562.5	20.84	19.97
		2535.0	20.87	19.99
		2507.5	20.78	19.91
20MHz	1 RB high	2560.0	20.38	19.63
		2535.0	20.79	20.07
		2510.0	21.01	20.29
	1 RB low	2560.0	20.33	19.62
		2535.0	21.15	20.43
		2510.0	20.70	19.97
	50% RB mid	2560.0	20.86	19.98
		2535.0	20.97	20.01
		2510.0	20.88	20.00
	100% RB	2560.0	20.70	19.81
		2535.0	20.90	20.09
		2510.0	20.86	20.06

Note: Expanded measurement uncertainty is  $U = 0.488$  dB,  $k = 1.96$

### A.1.3 Radiated

#### A.1.3.1 Description

##### A.1.3.1 Description

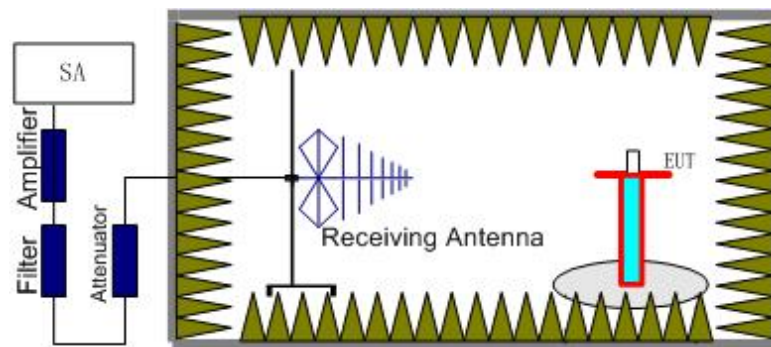
This is the test for the maximum radiated power from the EUT.

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

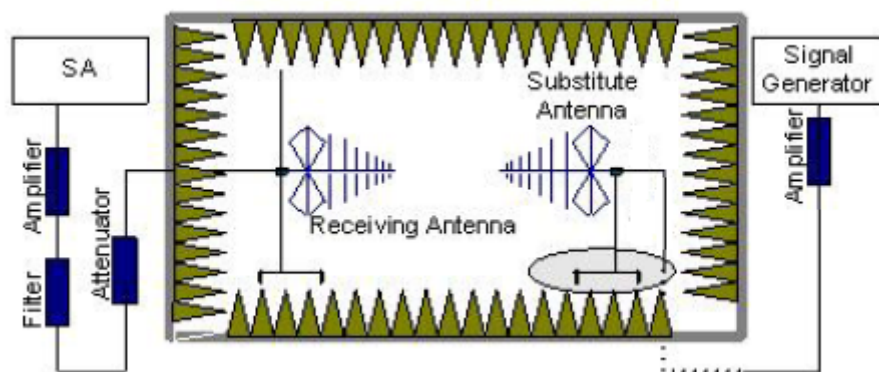
##### A.1.3.2 Method of Measurement

The measurements procedures in TIA-603-E-2016 are used.

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



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



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

receiver reaches the previously recorded ( $P_r$ ). The power of signal source ( $P_{Mea}$ ) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

4. An amplifier should be connected to the Signal Source output port. And the cable should be connected between the amplifier and the substitution antenna. The cable loss ( $P_{cl}$ ), the substitution antenna Gain ( $G_a$ ) and the amplifier Gain ( $P_{Ag}$ ) should be recorded after test.

The measurement results are obtained as described below:

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

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



### A.1.3.3 Measurement result

The test cases are selected as the worst cases for every conditions

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

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

#### LTE Band 7\_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)	EIRP(dBm)	Limit(dBm)	Polarization
2502.50	-8.18	-28.70	0.59	21.11	33.00	H
2535.00	-7.93	-28.60	0.45	21.13	33.00	H
<b>2567.50</b>	<b>-7.59</b>	<b>-28.60</b>	<b>0.38</b>	<b>21.40</b>	<b>33.00</b>	<b>H</b>

#### LTE Band 7\_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)	EIRP(dBm)	Limit(dBm)	Polarization
2505.00	-9.06	-28.70	0.59	20.24	33.00	H
2535.00	-8.58	-28.60	0.45	20.47	33.00	H
2565.00	-8.75	-28.60	0.38	20.23	33.00	H

#### LTE Band 7\_15MHz\_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)	EIRP(dBm)	Limit(dBm)	Polarization
2507.50	-10.27	-28.70	0.59	19.03	33.00	H
2535.00	120.24	-28.60	0.45	19.29	33.00	H
2562.50	-10.16	-28.60	0.38	18.82	33.00	H

#### LTE Band 7\_20MHz\_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)	EIRP(dBm)	Limit(dBm)	Polarization
2510.00	-10.40	-28.70	0.59	18.89	33.00	H
2535.00	-10.25	-28.60	0.45	18.80	33.00	H
2560.00	-10.60	-28.60	0.38	18.38	33.00	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)	Polarization
2502.50	-8.16	-28.70	0.59	21.13	33.00	H
2535.00	-7.95	-28.60	0.45	21.10	33.00	H
2567.50	-7.65	-28.60	0.38	21.33	33.00	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)	Polarization
2505.00	-8.75	-28.70	0.59	20.54	33.00	H
2535.00	-8.24	-28.60	0.45	20.81	33.00	H
2565.00	-8.37	-28.60	0.38	20.61	33.00	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)	Polarization
2507.50	-9.95	-28.70	0.59	19.34	33.00	H
2535.00	-9.35	-28.60	0.45	19.70	33.00	H
2562.50	-9.53	-28.60	0.38	19.45	33.00	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)	Polarization
2510.00	-10.19	-28.70	0.59	19.10	33.00	H
2535.00	-9.77	-28.60	0.45	19.28	33.00	H
2560.00	-10.17	-28.60	0.38	18.81	33.00	H

Peak EIRP (dBm)=P<sub>Mea</sub>(-7.59dBm)-(P<sub>cl</sub>+P<sub>Ag</sub>)(-28.60dB)+G<sub>a</sub>(0.38dB)=21.40dBm

**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: The maximum value of expanded measurement uncertainty for this test item is  $U =$

4.92dB(30MHz-3GHz)/4.88dB(3GHz-18GHz)/5.66dB(18GHz-40GHz),  $k = 2$

## A.2 FIELD STRENGTH OF SPURIOUS RADIATION

### Reference

FCC: CFR 2.1053, 27.53(m).

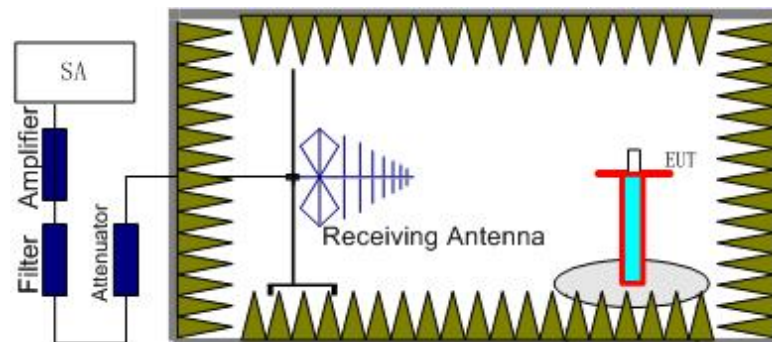
### A.2.1 Measurement Method

The measurements procedures in TIA-603-E-2016 are used. This measurement is carried out in fully-anechoic chamber FAC-3.

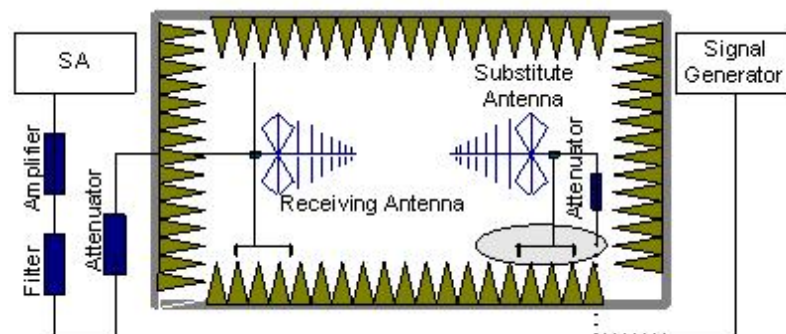
The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier. The resolution bandwidth is set 1MHz as outlined in Part 27.53(h). The spectrum was scanned with the mobile station transmitting at carrier frequencies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

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

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



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



In the chamber, an substitution antenna for the frequency band of interest is placed at the reference point of the chamber. An RF Signal source for the frequency band of interest is connected to the substitution antenna with a cable that has been constructed to not interfere

with the radiation pattern of the antenna. A power ( $P_{Mea}$ ) is applied to the input of the substitution antenna. Adjust the level of the signal generator output until the value of the receiver reaches the previously recorded ( $P_r$ ). The power of signal source ( $P_{Mea}$ ) is recorded. The test should be performed by rotating the test item and adjusting the receiving antenna polarization.

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

An amplifier should be connected in for the test.

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

The measurement results are obtained as described below:

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

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

### **A.2.2 Measurement Limit**

Part 27.53(m) (4) all specify that the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power ( $P$ ) by a factor of at least  $55 + 10 \log(P)$  dB. The specification that emissions shall be attenuated below the transmitter power ( $P$ ) by at least  $55 + 10 \log(P)$  dB, translates in the relevant power range (1 to 0.001 W) to -25 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -25 dBm. At 0.001 W (0 dBm) the minimum attenuation is 25 dB, which again yields a limit of -25 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 Band 7. It was decided that measurements at these three carrier frequencies would be sufficient to demonstrate compliance with emissions limits because it was seen that all the significant spurs occur well outside the band and no radiation was seen from a carrier in one block of the LTE Band 7 into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this.

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit (dBm)	Polarization
16851.5625	-35.18	2.90	-0.26	-38.34	-25.00	V
17199.375	-34.84	2.90	-0.79	-38.53	-25.00	H
17421.1875	-33.90	3.20	-1.08	-38.18	-25.00	H
17623.3125	-33.82	3.20	-1.01	-38.03	-25.00	H
17780.15625	-33.14	3.20	-0.75	-37.09	-25.00	H
17921.90625	-33.00	3.20	-0.64	-36.84	-25.00	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)	Polarization
17209.21875	-32.18	2.90	-1.01	-36.09	-25.00	H
17369.34375	-32.49	2.90	-0.98	-36.37	-25.00	H
17450.71875	-30.84	3.20	-1.08	-35.12	-25.00	H
17597.71875	-32.18	3.20	-0.81	-36.19	-25.00	H
17803.78125	-31.70	3.20	-0.84	-35.74	-25.00	V
17924.53125	-31.21	3.20	-0.64	-35.05	-25.00	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)	Polarization
16801.03125	-34.85	2.90	-0.26	-38.01	-25.00	H
17198.0625	-34.91	2.90	-0.79	-38.60	-25.00	H
17444.8125	-33.84	3.20	-1.08	-38.12	-25.00	H
17593.125	-34.89	3.20	-0.81	-38.90	-25.00	H
17765.71875	-34.21	3.20	-0.75	-38.16	-25.00	H
17927.8125	-32.82	3.20	-0.64	-36.66	-25.00	H

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit (dBm)	Polarization
16798.40625	-35.70	2.90	-0.26	-38.86	-25.00	V
17192.15625	-35.41	2.90	-0.79	-39.10	-25.00	H
17341.78125	-34.83	2.90	-0.98	-38.71	-25.00	H
17436.9375	-34.04	3.20	-1.08	-38.32	-25.00	H
17767.6875	-34.30	3.20	-0.75	-38.25	-25.00	H
17922.5625	-32.53	3.20	-0.64	-36.37	-25.00	H

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit (dBm)	Polarization
16806.9375	-35.43	2.90	-0.26	-38.59	-25.00	H
17200.6875	-35.29	2.90	-1.01	-39.20	-25.00	H
17274.84375	-34.88	2.90	-1.01	-38.79	-25.00	H
17398.21875	-34.77	2.90	-0.98	-38.65	-25.00	V
17795.90625	-33.02	3.20	-0.75	-36.97	-25.00	V
17928.46875	-33.57	3.20	-0.64	-37.41	-25.00	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)	Polarization
16808.25	-35.29	2.90	-0.26	-38.45	-25.00	H
17186.25	-34.79	2.90	-0.79	-38.48	-25.00	H
17410.6875	-33.69	3.20	-1.08	-37.97	-25.00	H
17620.6875	-34.88	3.20	-1.01	-39.09	-25.00	H
17764.40625	-33.73	3.20	-0.75	-37.68	-25.00	H
17919.28125	-34.09	3.20	-0.64	-37.93	-25.00	H

Note: The maximum value of expanded measurement uncertainty for this test item is  $U = 4.92\text{dB}(30\text{MHz}-3\text{GHz})/4.88\text{dB}(3\text{GHz}-18\text{GHz})/5.66\text{dB}(18\text{GHz}-40\text{GHz})$ ,  $k = 2$



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

#### **Reference**

FCC: CFR Part 2.1055, 27.54.

#### **A.3.1 Method of Measurement**

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

1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -30°C.
3. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on middle channel, 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 3.6VDC and 4.35VDC, with a nominal voltage of 3.8VDC. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress. These voltages represent a tolerance from -5.4% to 10.8%. For the purposes of measuring frequency stability these voltage limits are to be used.

#### A.4.3 Measurement results

##### 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	25	-11	0.010	0.004
3.8	16	-8	0.006	0.003
4.35	11	-21	0.004	0.008

##### Frequency Error vs Temperature

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
-30°	8	-5	0.003	0.002
-20°	15	-9	0.006	0.004
-10°	24	-22	0.009	0.009
0°	33	-7	0.013	0.003
10°	11	-4	0.004	0.002
20°	16	-3	0.006	0.001
30°	8	-26	0.003	0.010
40°	15	-18	0.006	0.007
50°	24	-7	0.009	0.003

Expanded measurement uncertainty is 10Hz, k = 2

## **A.4 OCCUPIED BANDWIDTH**

### **Reference**

FCC: CFR Part 2.1049, 27.53(m).

### **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.

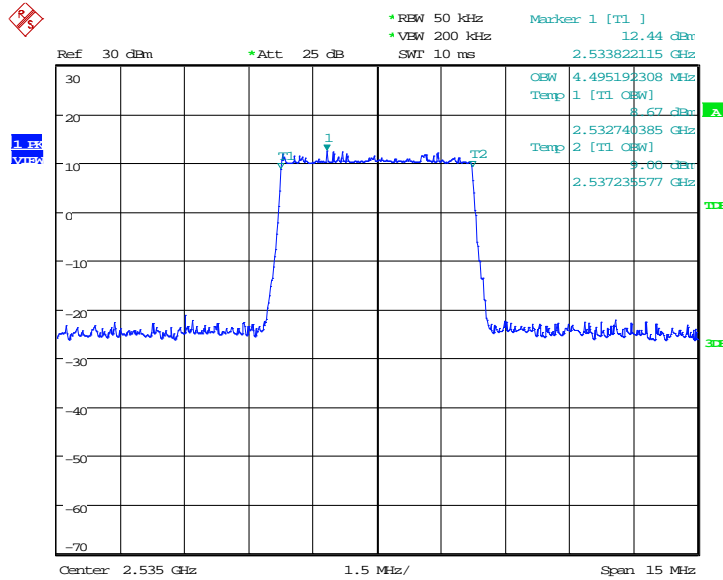
The measurement method is from KDB 971168 4.2:

- 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 7, 5MHz (99%)**

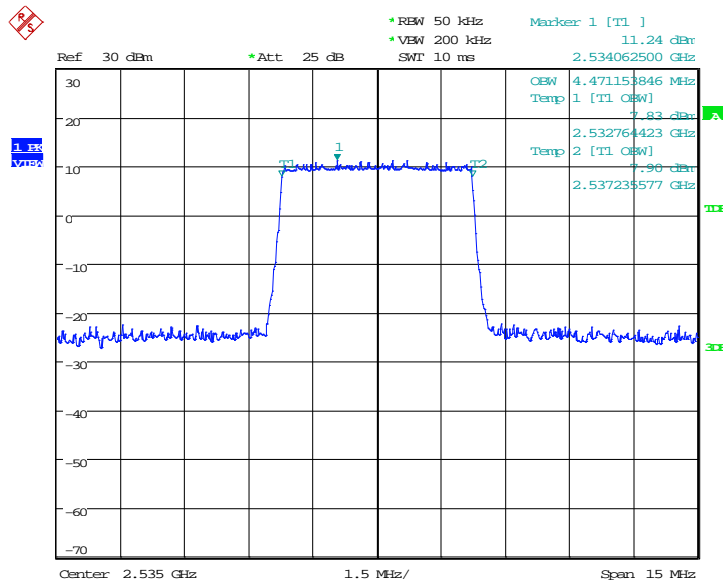
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
2535.0	QPSK	16QAM
	4495.19	4471.15

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



Date: 6.MAR.2018 06:30:36

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

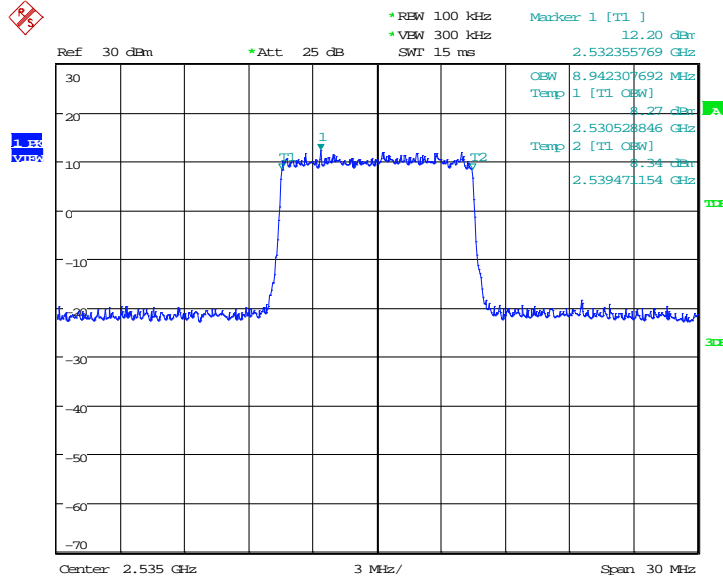


Date: 6.MAR.2018 06:30:50

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

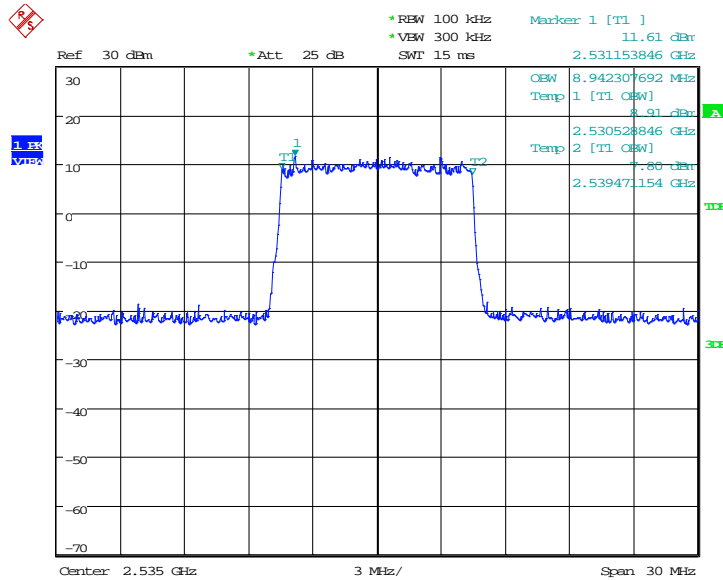
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
2535.0	QPSK	16QAM
	8942.31	8942.31

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



Date: 6.MAR.2018 06:34:45

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

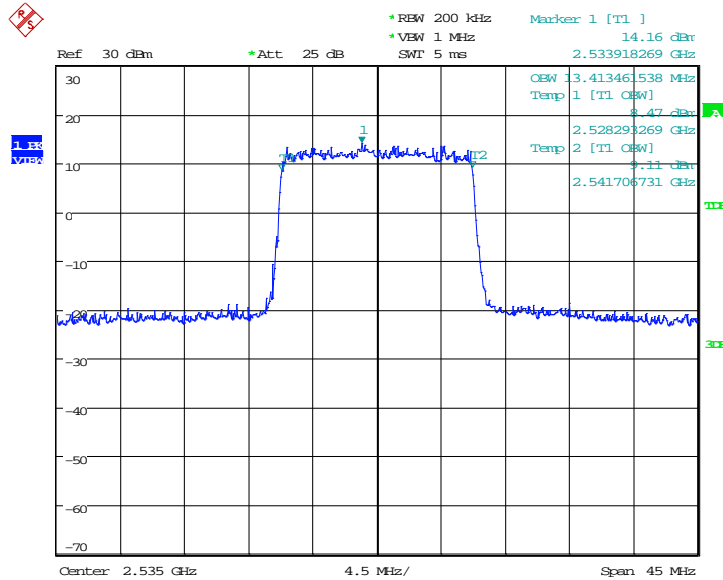


Date: 6.MAR.2018 06:34:59

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

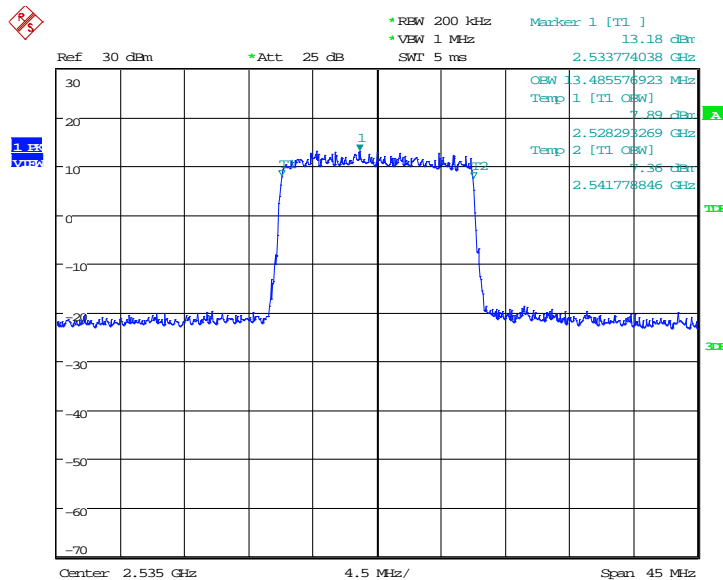
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
2535.0	QPSK	16QAM
	13413.46	13485.58

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



Date: 6.MAR.2018 06:38:55

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



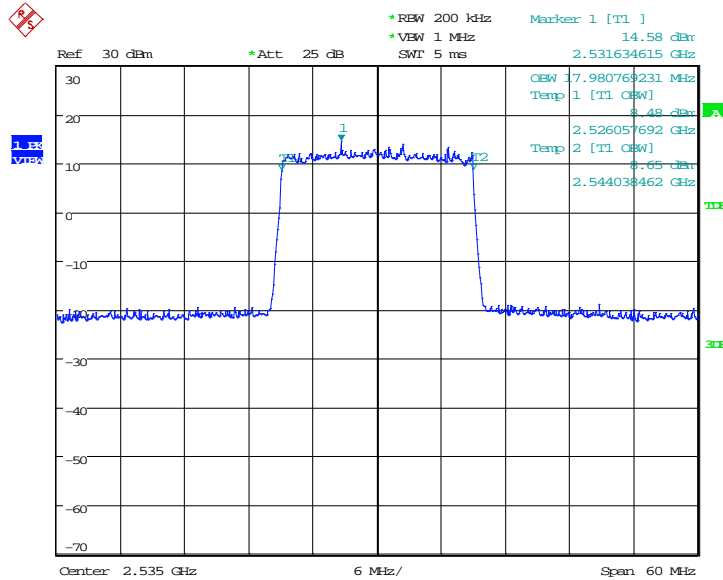
Date: 6.MAR.2018 06:39:09



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

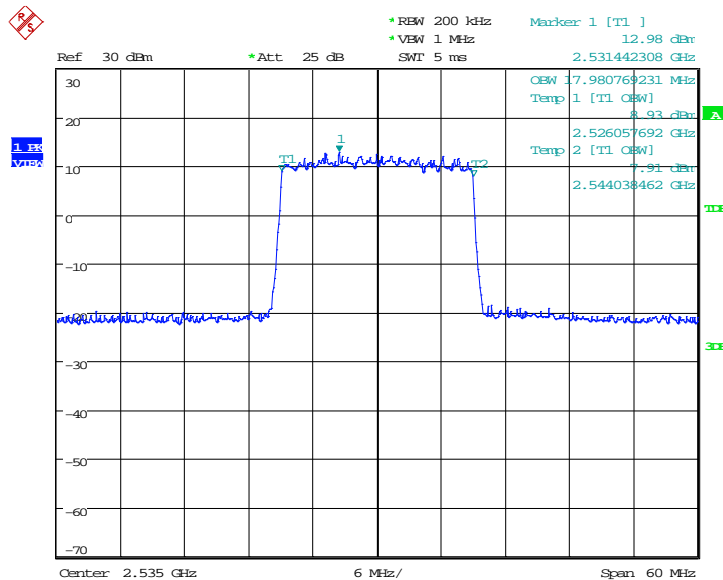
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
2535.0	QPSK	16QAM
	17980.77	17980.77

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



Date: 6.MAR.2018 06:43:04

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



Date: 6.MAR.2018 06:43:18

Note: Expanded measurement uncertainty is  $U = 3428\text{Hz}$ ,  $k = 2$

## **A.5 EMISSION BANDWIDTH**

### **Reference**

FCC: CFR Part 2.1049, 27.53(m)

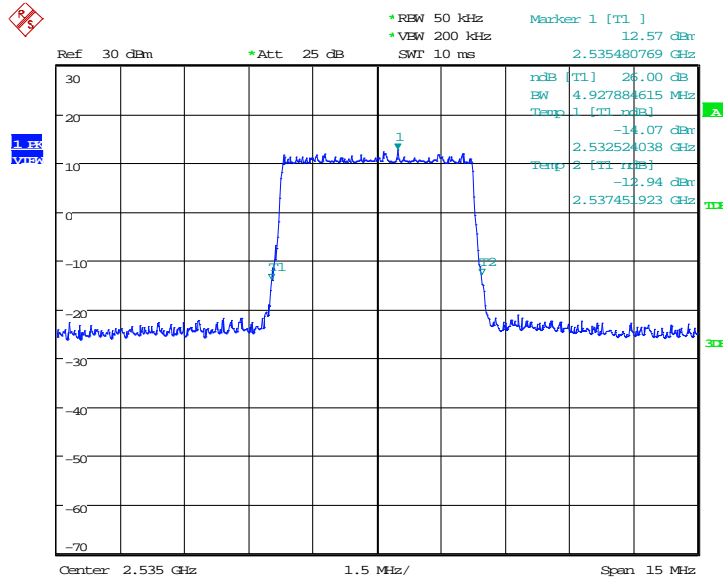
### **A.5.1 Emission Bandwidth Results**

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

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

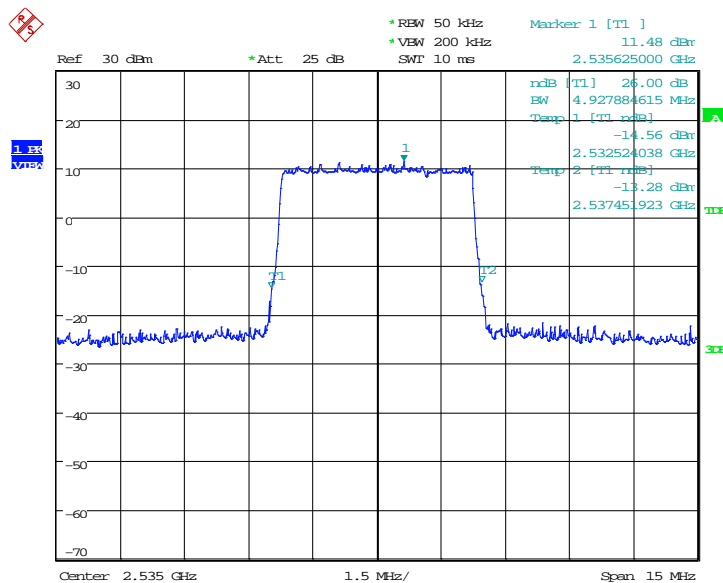
Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
2535.0	QPSK	16QAM
	4927.88	4927.88

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



Date: 6.MAR.2018 06:31:42

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

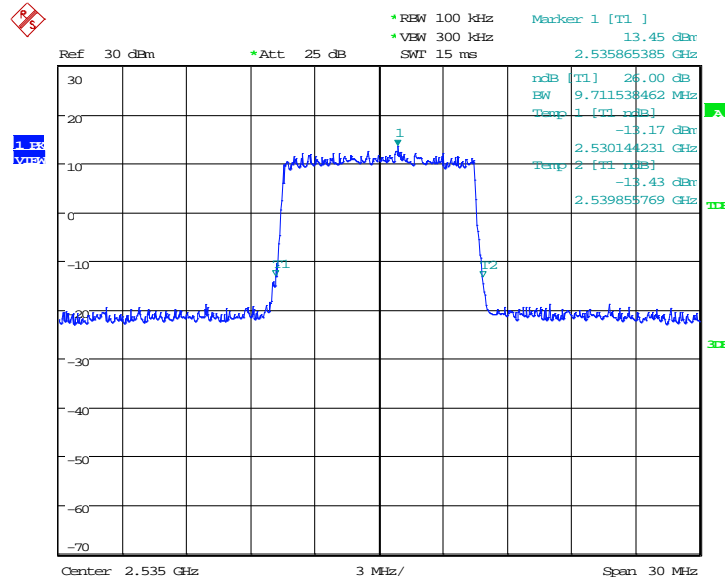


Date: 6.MAR.2018 06:31:57

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

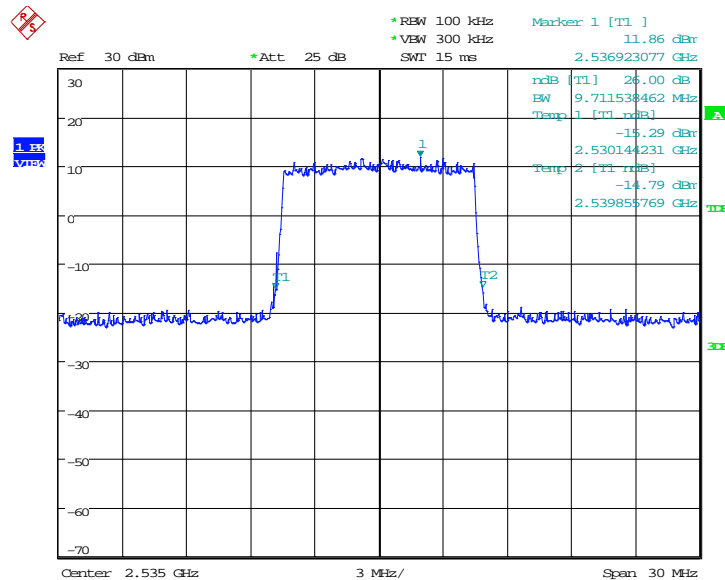
Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
2535.0	QPSK	16QAM
	9711.54	9711.54

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



Date: 6.MAR.2018 06:35:51

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

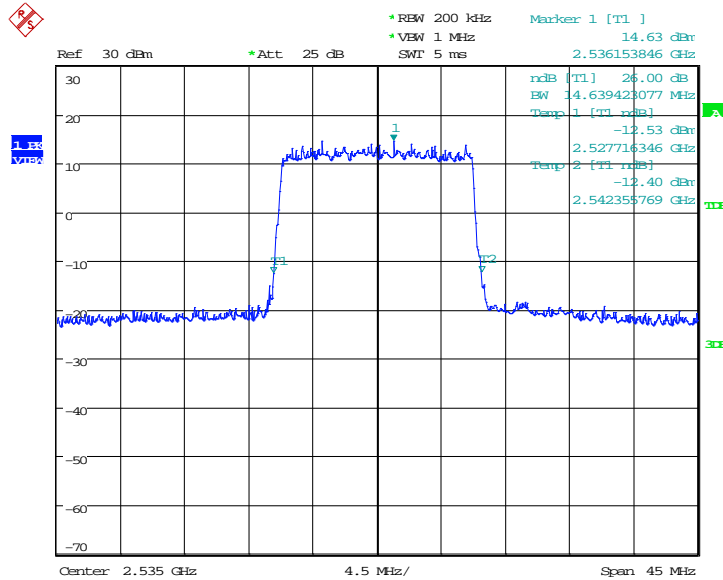


Date: 6.MAR.2018 06:36:07

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

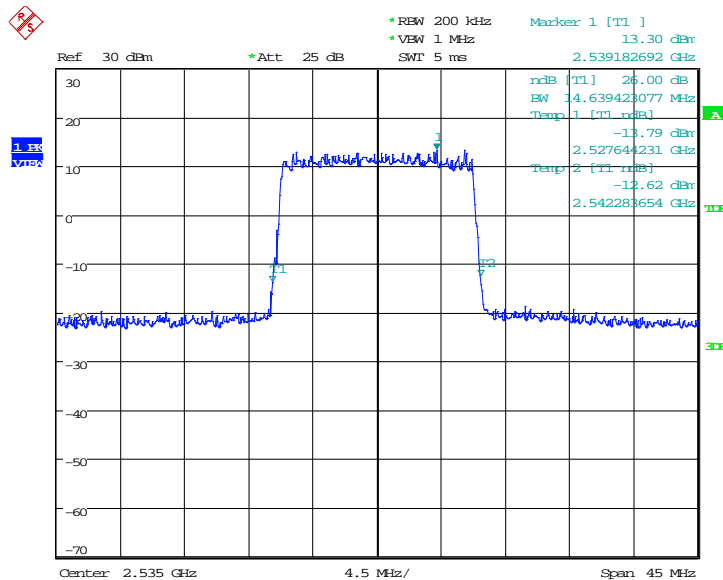
Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
	2535.0	QPSK
	14639.42	14639.42

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



Date: 6.MAR.2018 06:40:01

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

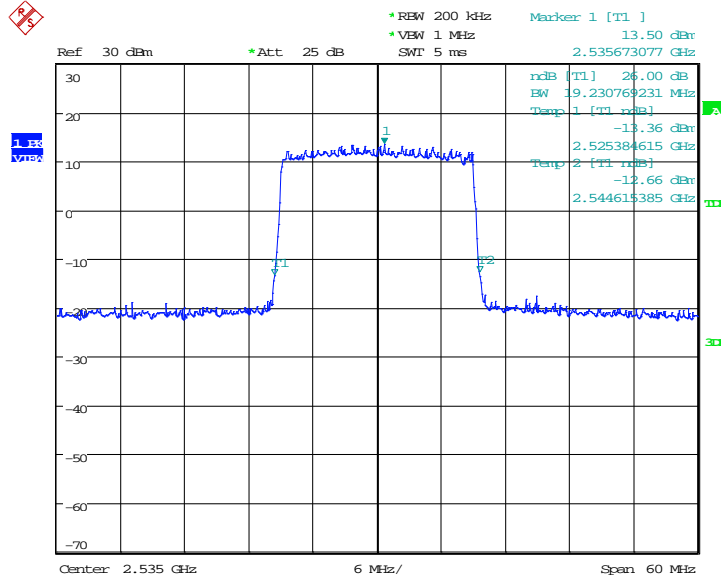


Date: 6.MAR.2018 06:40:16

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

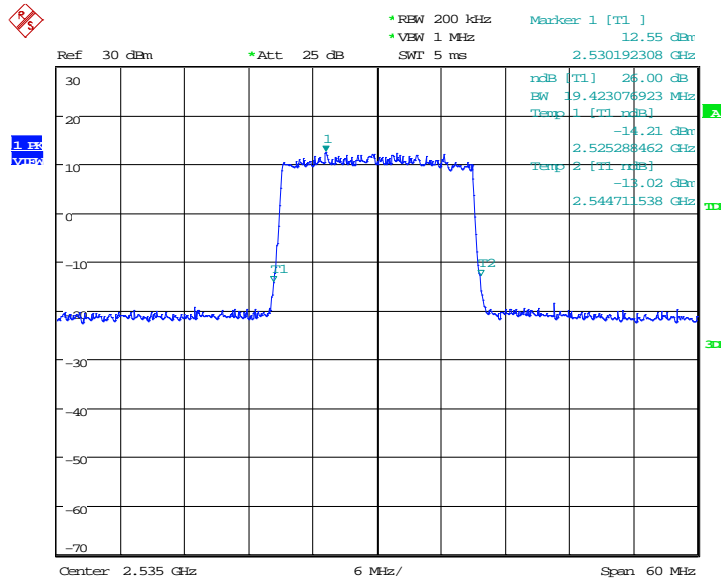
Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
2535.0	QPSK	16QAM
	19230.77	19423.08

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



Date: 6.MAR.2018 06:44:10

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



Date: 6.MAR.2018 06:44:26

Note: Expanded measurement uncertainty is  $U = 3428\text{Hz}$ ,  $k = 2$

## A.6 BAND EDGE COMPLIANCE

### Reference

FCC: CFR Part 2.1051, 27.53(m)(4).

#### A.6.1 Measurement limit

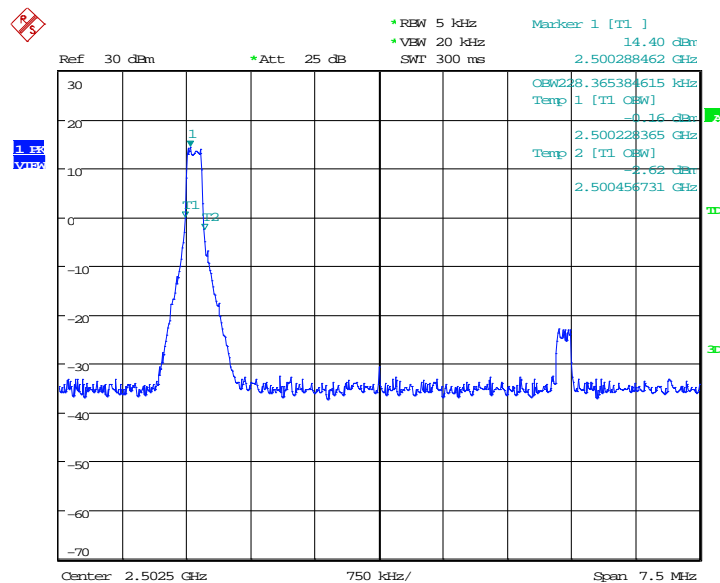
On any frequency outside frequency band of the US Cellular/PCS spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least  $43+10\log(P)$  dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm. According to KDB 971168 D01 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

The test cases are selected as the worst cases for every conditions

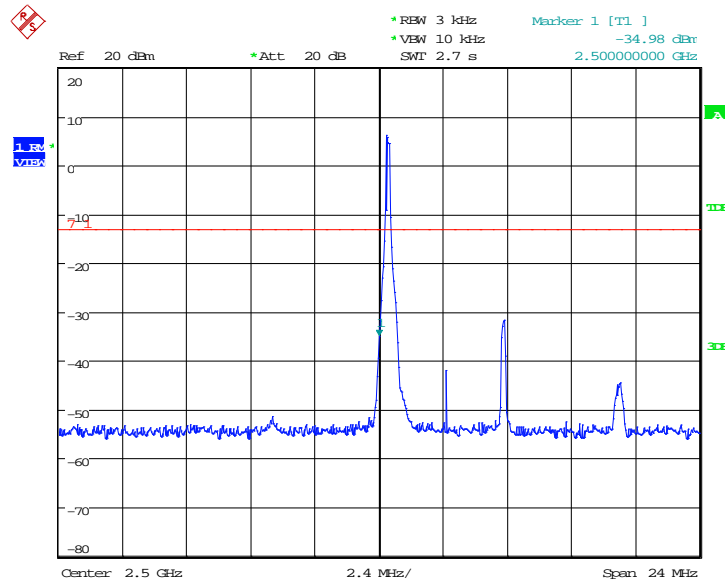
LTE band 7

OBW: 1RB-low\_offset



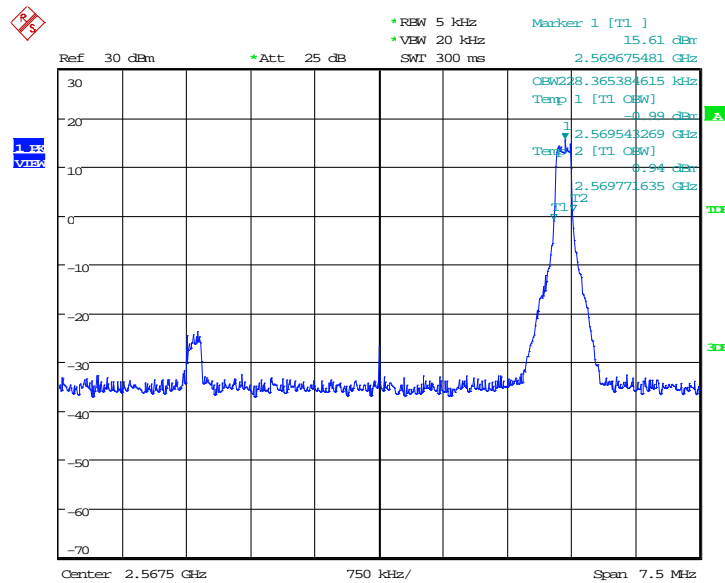
Date: 6.MAR.2018 07:41:47

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



Date: 6.MAR.2018 09:28:12

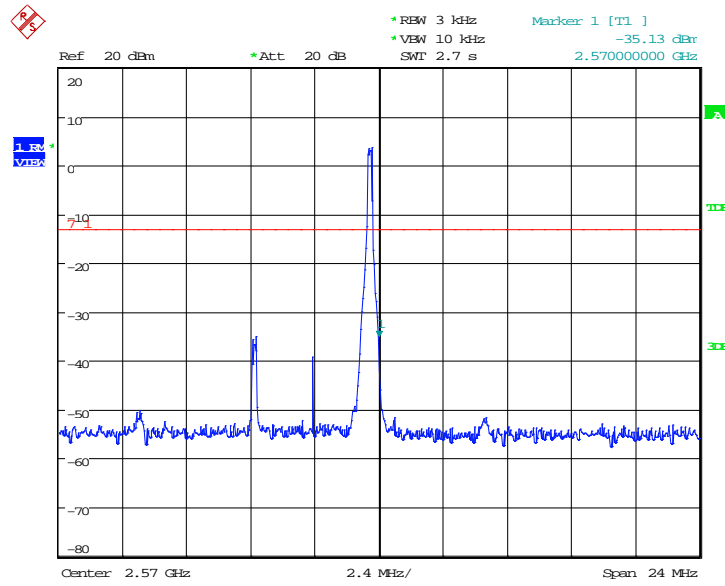
### OBW: 1RB-high\_offset



Date: 6.MAR.2018 07:36:13

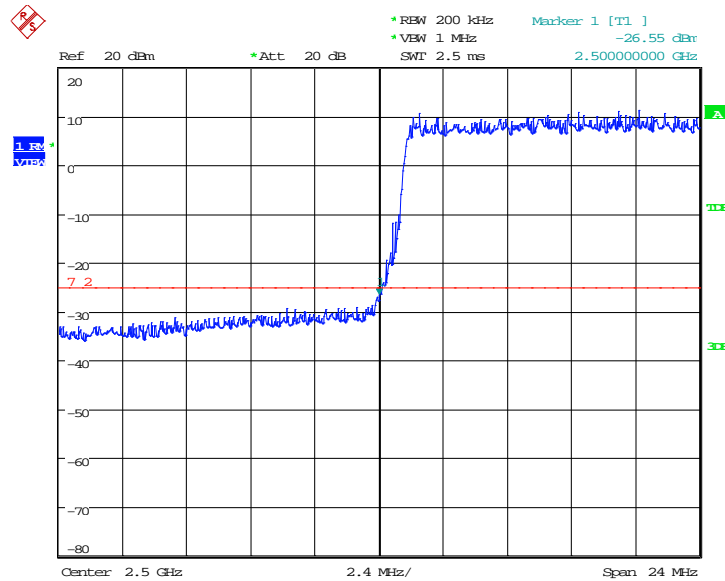


### HIGH BAND EDGE BLOCK-1RB-high\_offset



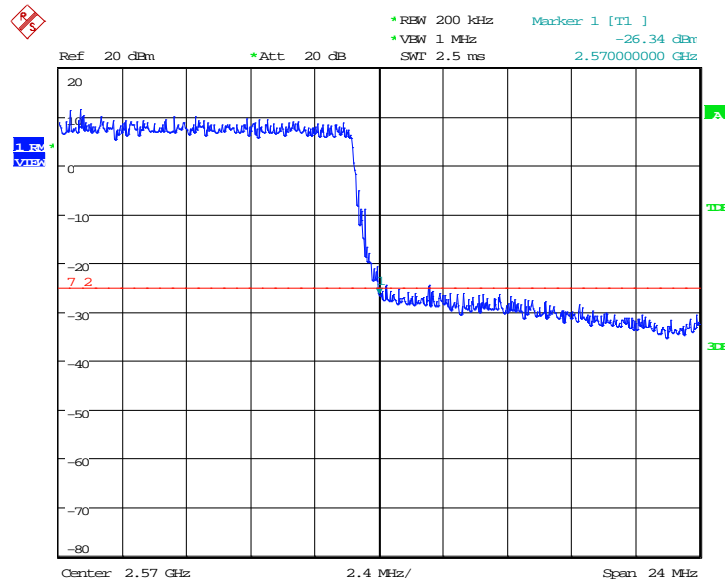
Date: 6.MAR.2018 09:27:02

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



Date: 6.MAR.2018 09:19:49

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



Date: 6.MAR.2018 09:20:45

Note: Expanded measurement uncertainty is  $U = 0.488\text{dB}(100\text{KHz}-2\text{GHz})/1.211\text{dB}(2\text{GHz}-26.5\text{GHz})$ ,  $k = 1.96$

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

### **Reference**

FCC: CFR Part 2.1051, 27.53(m).

#### **A.7.1 Measurement Method**

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

1. Determine frequency range for measurements: From CFR Part 2.1051 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) specify that the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

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

Part 27.53(m)(4) specifies for mobile digital stations, the attenuation factor shall be not less than  $40 + 10 \log(P)$  dB on all frequencies between the channel edge and 5 megahertz from the channel edge,  $43 + 10 \log(P)$  dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and  $55 + 10 \log(P)$  dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less that  $43 + 10 \log(P)$  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 2337MHz;

By a factor of not less than  $43 + 10 \log (P)$  dB on all frequencies between 2300 and 2305 MHz,  $55 + 10 \log (P)$  dB on all frequencies between 2296 and 2300MHz,  $61 + 10 \log (P)$  dB on all frequencies between 2292 and 2296 MHz,  $67 + 10 \log (P)$  dB on all frequencies between 2288 and 2292 MHz, and  $70 + 10 \log (P)$  dB below 2288 MHz; By a factor of not less than  $43 + 10 \log (P)$  dB on all frequencies between 2360 and 2365 MHz, and not less than  $70 + 10 \log (P)$  dB above 2365 MHz.

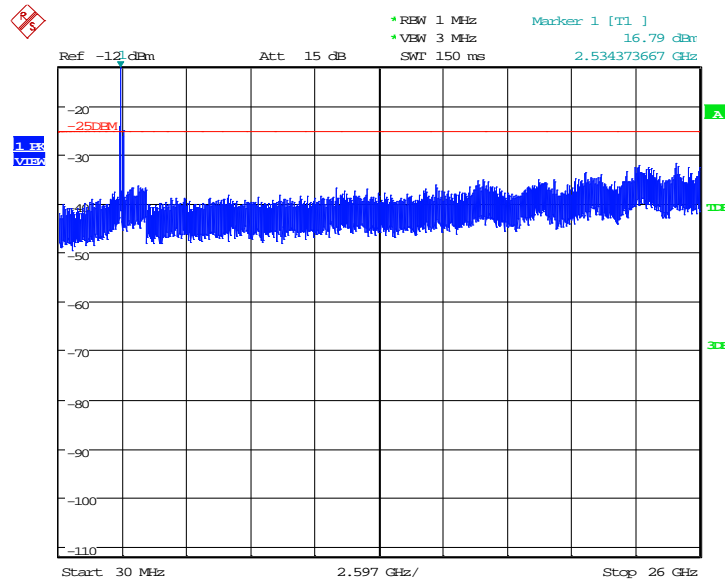
**A. 7.3 Measurement result**

The test cases are selected as the worst cases for every conditions

LTE band 7 20MHz QPSK: 30MHz – 26GHz

Spurious emission limit –25dBm.

**NOTE: peak above the limit line is the carrier frequency.**



Date: 6.MAR.2018 06:45:19

Note: Expanded measurement uncertainty is  $U = 0.488\text{dB}(100\text{KHz}-2\text{GHz})/1.211\text{dB}(2\text{GHz}-26.5\text{GHz}), k = 1.96$

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

### **Reference**

FCC: CFR Part 27.50(a), KDB971168 D01(5.7.1)

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 D01 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)	Bandwidth(MHz)	PAPR(dB)	
		QPSK	16QAM
2510.0	20	7.28	7.63
	15	6.86	7.37
	10	5.99	6.76
	5	5.99	6.63

Note: Expanded measurement uncertainty is  $U = 0.483$ ,  $k = 2$

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