



# TEST REPORT

**No. I19N02247-RF-LTE**

**for**

**Doro AB**

**LTE phone**

**Model Name: DSB-0230**

**FCC ID: WS5DSB0230**

**with**

**Hardware Version: 1031**

**Software Version:**

**MAGIC01A-S10A\_DSB0230\_123\_USERDEBUG\_190925**

**Issued Date: 2019-11-05**

**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>
I19N02247-RF-LTE	Rev.0	1st edition	2019-11-05

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## 1. Summary of Test Report

### 1.1. Test Items

Description	LTE phone
Model Name	DSB-0230
Applicant's name	Doro AB
Manufacturer's Name	CK TELECOM LTD.

### 1.2. Test Standards

Please refer to "4. Reference Documents"

### 1.3. Test Result

Pass / Fail / Please refer to "6 Test Results"

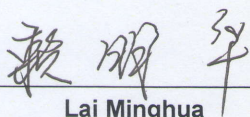
### 1.4. Testing Location

Address: Building G, Shenzhen International Innovation Center, No.1006 Shennan Road,  
Futian District, Shenzhen, Guangdong, P. R. China

### 1.5. Project Data

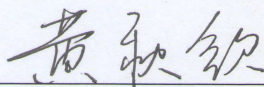
Testing Start Date:	2019-10-09
Testing End Date:	2019-11-04

### 1.6. Signature



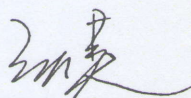
Lai Minghua

(Prepared this test report)



Huang Qiuqin

(Reviewed this test report)



Zhang Hao

(Approved this test report)

## **2. Client Information**

### **2.1. Applicant Information**

Company Name: Doro AB  
Address /Post: Jörgen Kocksgatan 1B SE-211 20 Malmö Sweden  
Contact Person: Per Carlenhag  
Contact Email per.carlenhag@doro.com  
Telephone: +46 46 280 5000  
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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: mourong xie  
Contact Email mourong.xie@ck-telecom.com  
Telephone: 0755-26739100 ext.8514  
Fax: 0755-26739600 /

### **3. EQUIPMENT UNDER TEST (EUT) AND ANCILLARY EQUIPMENT**

#### **(AE)**

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

Description	LTE phone
Model Name	DSB-0230
FCC ID	WS5DSB0230
Frequency Bands	LTE Band 7
Antenna	Integrated
Extreme vol. Limits	3.4VDC to 4.4VDC (nominal: 3.85VDC)
Condition of EUT as received	No abnormality in appearance

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

EUT ID*	IMEI	HW Version	SW Version	Sample Arrival Date
UT05aa	358707100008273	1031	MAGIC01A-S10A_DSB0230_ 123_USERDEBUG_190925	2019-10-09
UT01aa	358707100006038	1031	MAGIC01A-S10A_DSB0230_ 123_USERDEBUG_190925	2019-10-09

\*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	SN
AE1	Battery	/
AE2	Charger1	/
AE3	Charger2	/

##### **AE1**

Model	DBV 3000A
Manufacturer	Dongguang HongDe Battery Co.,Ltd
Capacity	3000mAh

##### **AE2**

Model	UT-133E-5100BY
Manufacturer	ShenZhenBaiJunDaElectronic 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 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	10-1-18 Edition
FCC Part 27	MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES	10-1-18 Edition
ANSI C63.26	American National Standard of Procedures for Compliance Testing of Licensed Transmitters Used in Licensed Radio Service	2015

## 5. LABORATORY ENVIRONMENT

**Control room / conducted chamber** did not exceed following limits along the RF 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	< 4 Ω

**Fully-anechoic chamber** 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> 60 dB; 1MHz-18000MHz>90 dB
Electrical insulation	> 2MΩ
Ground system resistance	< 4 Ω
Voltage Standing Wave Ratio (VSWR)	≤ 6 dB, from 1 to 18 GHz, 3 m distance
Uniformity of field strength	Between 0 and 6 dB, from 80 to 6000 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 1.4 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)	A.6	P
7	Conducted Spurious Emission	2.1051/27.53(m)	A.7	P
8	Peak-to-Average Power Ratio	27.50(a)	A.8	P

## **7. STATEMENT**

Since the information of samples in this report is provided by the client, the laboratory is not responsible for the authenticity of sample information.

This report takes measured values as criterion of test conclusion. The test conclusion meets the limit requirements.

## 8. Test Equipments Utilized

NO.	Description	Type	Manufacture	Series Number	Cal Due Date
1	Test Receiver	ESR7	R&S	101676	2019-11-28
2	BiLog Antenna	3142E	ETS	00224831	2021-05-17
3	Horn Antenna	3117	ETS-lindgren	00066577	2022-04-02
4	Horn Antenna	QSH-SL-18-26-S-20	Q-par	17013	2020-01-15
5	Antenna	BBHA 9120D	Schwarzbeck	1593	2019-12-11
6	Antenna	VUBA 9117	Schwarzbeck	207	2020-07-16
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	2019-11-28
10	Fully Anechoic Chamber	FACT3-2.0	ETS-Lindgren	1285	2020-07-20
11	Spectrum Analyzer	FSV40	R&S	101192	2020-05-20
12	Universal Radio Communication Tester	CMW500	R&S	152499	2020-07-17
13	Universal Radio Communication Tester	CMW500	R&S	129146	2020-04-24
14	Spectrum Analyzer	FSU	R&S	101506	2019-12-13
15	Temperature Chamber	SH-241	ESPECs	92007516	2019-11-13
16	DC Power Supply	U3606A	Agilent Technologies	MY50450012	2019-11-13

### 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

#### **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	22.26	21.29
		2535.0	22.50	21.33
		2502.5	22.45	21.21
	1 RB low	2567.5	22.39	21.20
		2535.0	22.42	20.99
		2502.5	22.47	21.10
	50% RB mid	2567.5	21.54	20.60
		2535.0	21.60	20.54
		2502.5	21.61	20.51
	100% RB	2567.5	21.50	20.60
		2535.0	21.59	20.56
		2502.5	21.55	20.61
10MHz	1 RB high	2565.0	22.64	21.29
		2535.0	22.66	21.40
		2505.0	22.58	21.21
	1 RB low	2565.0	22.68	21.65
		2535.0	22.46	21.40
		2505.0	22.56	21.02
	50% RB mid	2565.0	21.61	20.72
		2535.0	21.58	20.74
		2505.0	21.67	20.71

	100% RB	2565.0	21.49	20.63
		2535.0	21.63	20.65
		2505.0	21.66	20.63
15MHz	1 RB high	2562.5	22.40	20.89
		2535.0	22.79	21.28
		2507.5	22.68	21.17
	1 RB low	2562.5	22.56	21.62
		2535.0	22.53	20.79
		2507.5	22.62	21.30
	50% RB mid	2562.5	21.66	20.68
		2535.0	21.64	20.63
		2507.5	21.63	20.65
	100% RB	2562.5	21.48	20.63
		2535.0	21.65	20.73
		2507.5	21.71	20.76
20MHz	1 RB high	2560.0	22.56	21.26
		2535.0	22.48	21.35
		2510.0	22.32	21.08
	1 RB low	2560.0	22.40	21.63
		2535.0	22.29	20.66
		2510.0	22.36	20.81
	50% RB mid	2560.0	21.71	20.66
		2535.0	21.49	20.48
		2510.0	21.57	20.81
	100% RB	2560.0	21.58	20.53
		2535.0	21.67	20.64
		2510.0	21.64	20.67

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

### 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”.

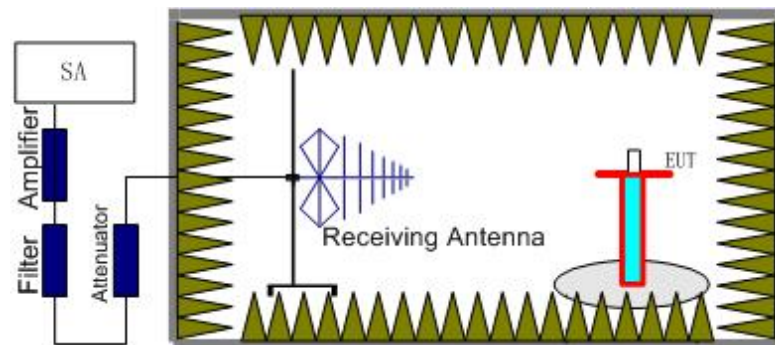
Rule Part 27.50(h)(2) specifies “Mobile stations are limited to 2.0 watts EIRP.”.

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

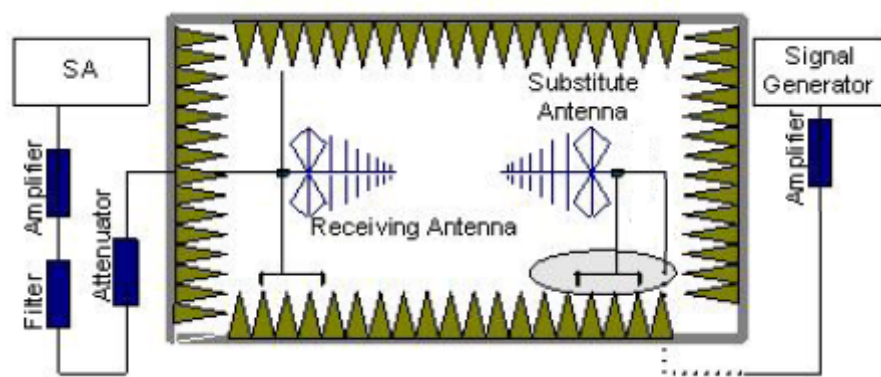
Rule Part 27.50(a)(3) specifies “For mobile and portable stations transmitting in the 2305–2315 MHz band or the 2350–2360 MHz band, the average EIRP must not exceed 50 milliwatts within any 1 megahertz of authorized bandwidth, except that for mobile and portable stations compliant with 3GPP LTE standards 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

1. For radiated emissions measurements performed at frequencies less than or equal to 1 GHz, EUT was placed on a 80 cm high non-conductive stand at a 3 meter test distance from the receive antenna. For radiated measurements performed at frequencies above 1 GHz, EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. Receiving antenna was placed on the antenna mast 3 meters from the EUT. For emission measurements. The receiving antenna shall be varied from 1 m to 4 m in height above the reference ground in a search for the relative positioning that produces the maximum radiated signal level. 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, and adjusts 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(dBi) ( $G_a$ ) 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

#### 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>cl</sub> (dB)+ P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dBi)	EIRP(dBm)	Limit(dBm)	Polarization
2502.50	-15.72	-28.70	10.80	23.78	33.00	H
2535.00	-13.61	-28.60	10.80	25.79	33.00	H
2567.50	-13.42	-28.60	10.80	25.98	33.00	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(dBi)	EIRP(dBm)	Limit(dBm)	Polarization
2505.00	-15.66	-28.70	10.80	23.84	33.00	H
2535.00	-13.55	-28.60	10.80	25.85	33.00	H
2565.00	-13.36	-28.60	10.80	26.04	33.00	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)	Polarization
2507.50	-15.91	-28.70	10.80	23.59	33.00	H
2535.00	-13.71	-28.60	10.80	25.69	33.00	H
2562.50	-13.60	-28.60	10.80	25.80	33.00	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(dBi)	EIRP(dBm)	Limit(dBm)	Polarization
2510.00	-15.96	-28.70	10.80	23.54	33.00	H
2535.00	-14.83	-28.60	10.80	24.57	33.00	H
2560.00	-13.95	-28.60	10.80	25.45	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(dBi)	EIRP(dBm)	Limit(dBm)	Polarization
2502.50	-14.58	-28.70	10.80	24.93	33.00	H
2535.00	-13.55	-28.60	10.80	25.85	33.00	H
<b>2567.50</b>	<b>-12.74</b>	<b>-28.60</b>	<b>10.80</b>	<b>26.66</b>	<b>33.00</b>	<b>H</b>

### 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(dBi)	EIRP(dBm)	Limit(dBm)	Polarization
2505.00	-14.81	-28.70	10.80	24.69	33.00	H
2535.00	-13.52	-28.60	10.80	25.88	33.00	H
2565.00	-13.06	-28.60	10.80	26.34	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(dBi)	EIRP(dBm)	Limit(dBm)	Polarization
2507.50	-15.14	-28.70	10.80	24.36	33.00	H
2535.00	-13.71	-28.60	10.80	25.69	33.00	H
2562.50	-13.47	-28.60	10.80	25.93	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(dBi)	EIRP(dBm)	Limit(dBm)	Polarization
2510.00	-15.38	-28.70	10.80	24.12	33.00	H
2535.00	-14.71	-28.60	10.80	24.69	33.00	H
2560.00	-13.76	-28.60	10.80	25.64	33.00	H

Peak EIRP (dBm)=P<sub>Mea</sub>(-12.74dBm)-(P<sub>cl</sub>+P<sub>Ag</sub>)(-28.60dB)+G<sub>a</sub>(10.80dB) =26.66dBm

### 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 = 3.34dB(30MHz-3GHz)/4.06dB(3GHz-18GHz)/4.56dB(18GHz-40GHz), k = 2

**Note: Both of Vertical and Horizontal polarizations are evaluated, but only the worst case is recorded in this report.**

## **A.2 FIELD STRENGTH OF SPURIOUS RADIATION**

### **Reference**

FCC: CFR 2.1053, 27.53

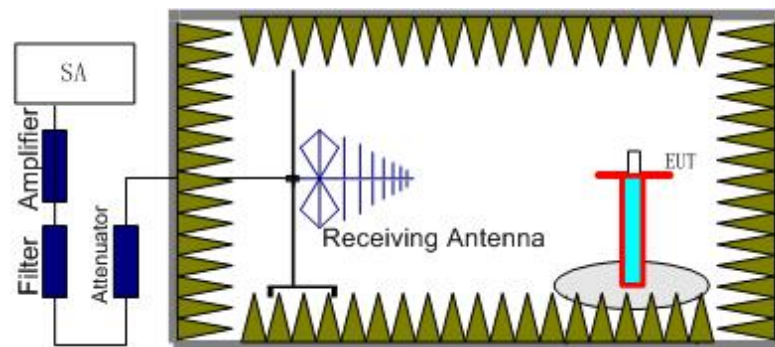
### **A.2.1 Measurement Method**

This measurement is carried out in fully-anechoic chamber FAC-3.

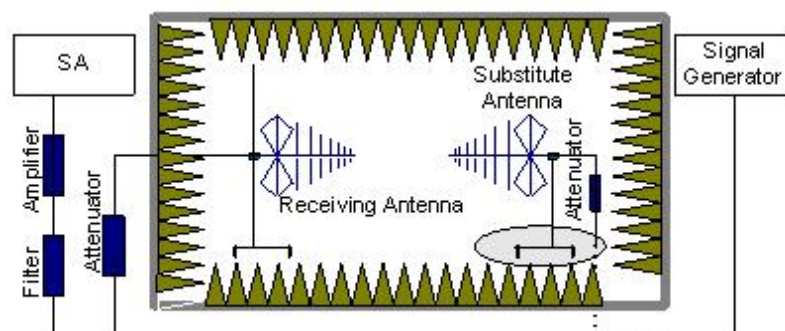
The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier. The resolution bandwidth is set 1MHz as outlined in Part 27.53(h). The spectrum was scanned with the mobile station transmitting at carrier frequencies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

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

1. For radiated emissions measurements performed at frequencies less than or equal to 1 GHz, EUT was placed on a 80 cm high non-conductive stand at a 3 meter test distance from the receive antenna. For radiated measurements performed at frequencies above 1 GHz, EUT was placed on a 1.5 meter high non-conductive stand at a 3 meter test distance from the receive antenna. Receiving antenna was placed on the antenna mast 3 meters from the EUT. For emission measurements. The receiving antenna shall be varied from 1 m to 4 m in height above the reference ground in a search for the relative positioning that produces the maximum radiated signal level. 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, 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, and adjusts 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(dBi) ( $G_a$ ) 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 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. Only worst case result is given below.

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain(dBi)	Peak EIRP(dBm)	Limit(dBm)	Polarization
6806.50	-47.31	1.80	1.80	-47.31	-25.00	V
9954.72	-44.73	2.20	2.20	-44.73	-25.00	V
12841.00	-41.89	2.70	2.70	-41.89	-25.00	V
15584.89	-38.56	2.70	2.70	-38.56	-25.00	V
16629.89	-39.06	2.90	2.60	-39.36	-25.00	V
17910.17	-35.65	3.20	3.20	-35.65	-25.00	V

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain(dBi)	Peak EIRP(dBm)	Limit(dBm)	Polarization
3193.00	-49.39	1.10	1.10	-49.39	-25.00	V
5463.50	-48.43	1.30	1.40	-48.33	-25.00	V
7466.89	-46.53	1.90	1.90	-46.53	-25.00	V
9377.83	-46.12	2.10	2.10	-46.12	-25.00	V
12900.89	-42.64	2.50	2.50	-42.64	-25.00	V
17906.50	-37.41	3.20	3.20	-37.41	-25.00	V

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain(dBi)	Peak EIRP(dBm)	Limit(dBm)	Polarization
7559.78	-46.00	1.80	1.80	-46.00	-25.00	V
9893.61	-44.56	2.20	2.20	-44.56	-25.00	V
13411.17	-40.98	2.50	2.50	-40.98	-25.00	V
15611.78	-38.81	2.70	2.70	-38.81	-25.00	V
16689.78	-38.38	2.90	2.60	-38.68	-25.00	V
17909.56	-36.73	3.20	3.20	-36.73	-25.00	V

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain(dBi)	Peak EIRP(dBm)	Limit(dBm)	Polarization
3190.50	-58.79	1.10	11.40	-48.49	-25.00	V
5436.50	-61.40	1.30	13.20	-49.50	-25.00	V
7510.89	-55.36	1.80	11.50	-45.66	-25.00	V
9940.67	-54.21	2.20	11.60	-44.81	-25.00	V
12533.00	-54.20	2.40	14.10	-42.50	-25.00	V
17910.17	-36.70	3.20	3.60	-36.30	-25.00	V

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain(dBi)	Peak EIRP(dBm)	Limit(dBm)	Polarization
9992.00	-53.98	2.20	11.60	-44.58	-25.00	V
13398.94	-51.82	2.50	13.70	-40.62	-25.00	V
14761.72	-50.61	2.50	11.90	-41.21	-25.00	V
15617.28	-51.54	2.70	15.50	-38.74	-25.00	V
16665.33	-51.36	2.90	15.20	-39.06	-25.00	V
17908.33	-36.67	3.20	3.60	-36.27	-25.00	V

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain(dBi)	Peak EIRP(dBm)	Limit(dBm)	Polarization
3193.50	-60.01	1.10	11.40	-49.71	-25.00	V
5481.00	-60.70	1.30	13.20	-48.80	-25.00	H
5841.00	-57.99	1.40	13.20	-46.19	-25.00	H
8760.00	-55.79	1.90	12.40	-45.29	-25.00	H
12343.56	-52.72	2.60	13.10	-42.22	-25.00	V
16630.50	-38.95	2.90	3.60	-38.25	-25.00	V

Note: The maximum value of expanded measurement uncertainty for this test item is U = 3.34dB(30MHz-3GHz)/4.06dB(3GHz-18GHz)/4.56dB(18GHz-40GHz), 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 -10°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 -10°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 -10°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 4.4VDC, with a nominal voltage of 3.85VDC. 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, 5MHz bandwidth (worst case of all bandwidths)

##### Frequency Error vs Voltage

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.4	21	16	0.008	0.006
3.85	13	9	0.005	0.004
4.4	8	25	0.003	0.010

##### Frequency Error vs Temperature

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
-10	29	9	0.011	0.004
0	18	14	0.007	0.006
10	5	12	0.002	0.005
20	7	22	0.003	0.009
30	13	15	0.005	0.006
40	22	13	0.009	0.005
50	16	18	0.006	0.007

Expanded measurement uncertainty is 10Hz, k = 2

## **A.4 OCCUPIED BANDWIDTH**

### **Reference**

FCC: CFR Part 2.1049, 27.53.

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

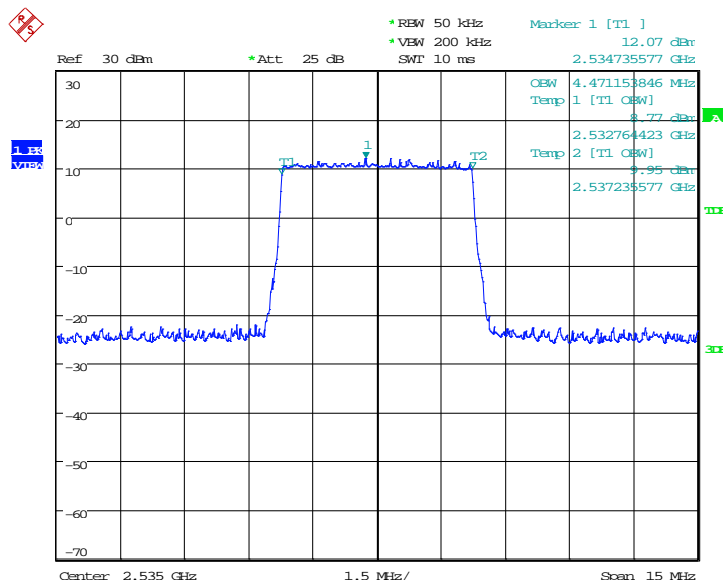
Occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of the US Cellular/PCS frequency bands. The table below lists the measured 99% BW. Spectrum analyzer plots are included on the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

- 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% BW)

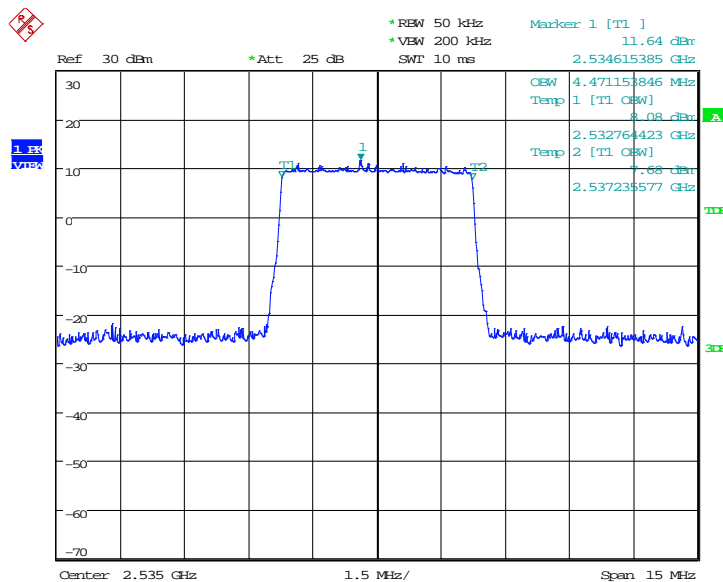
Frequency(MHz)	Occupied Bandwidth (99% BW)( kHz)	
2535.0	QPSK	16QAM
	4471.15	4471.15

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



Date: 9.OCT.2019 19:20:11

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

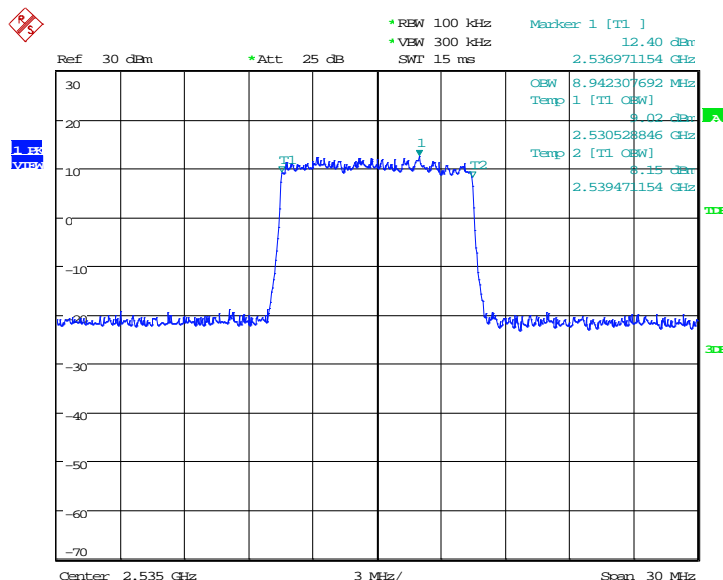


Date: 9.OCT.2019 19:20:25

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

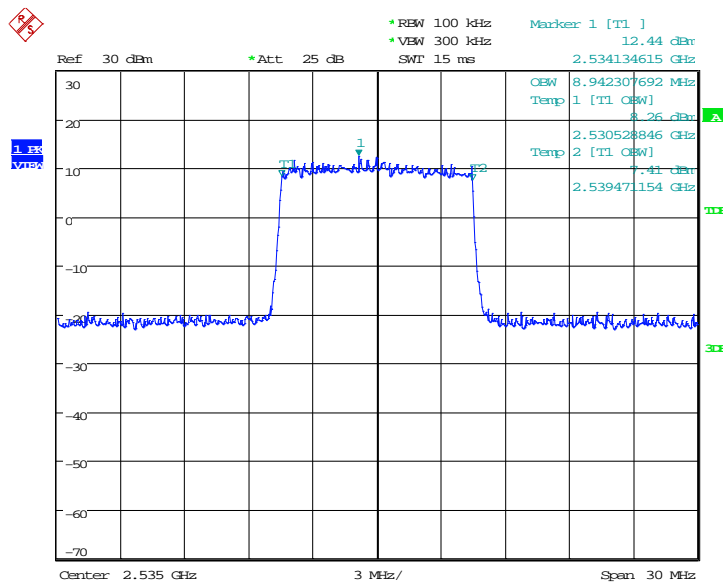
Frequency(MHz)	Occupied Bandwidth (99% BW)( kHz)	
2535.0	QPSK	16QAM
	8942.31	8942.31

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



Date: 9.OCT.2019 19:24:29

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

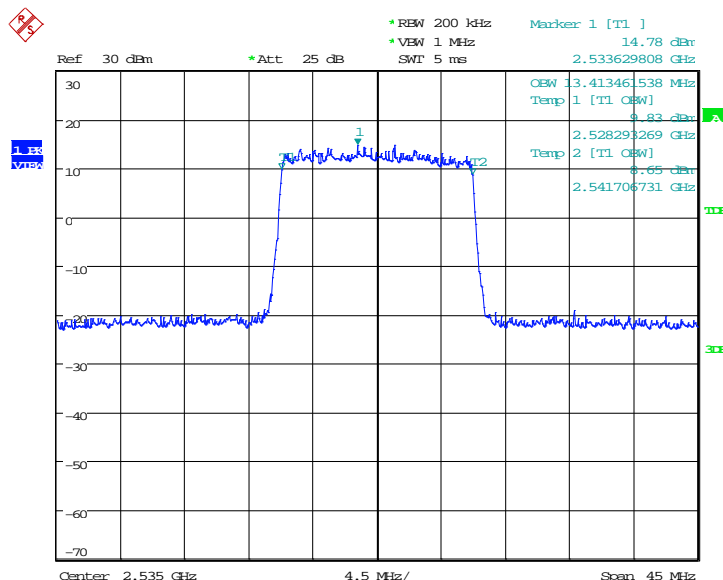


Date: 9.OCT.2019 19:24:42

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

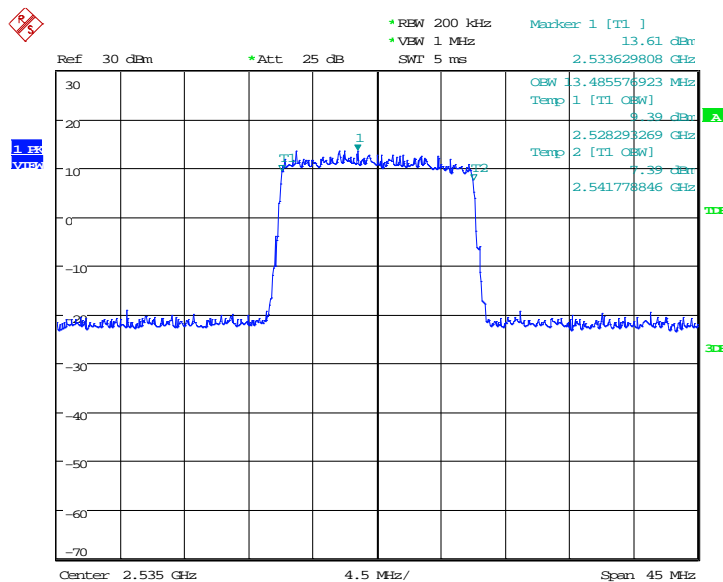
Frequency(MHz)	Occupied Bandwidth (99% BW)( kHz)	
2535.0	QPSK	16QAM
	13413.46	13485.58

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



Date: 9.OCT.2019 19:28:49

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

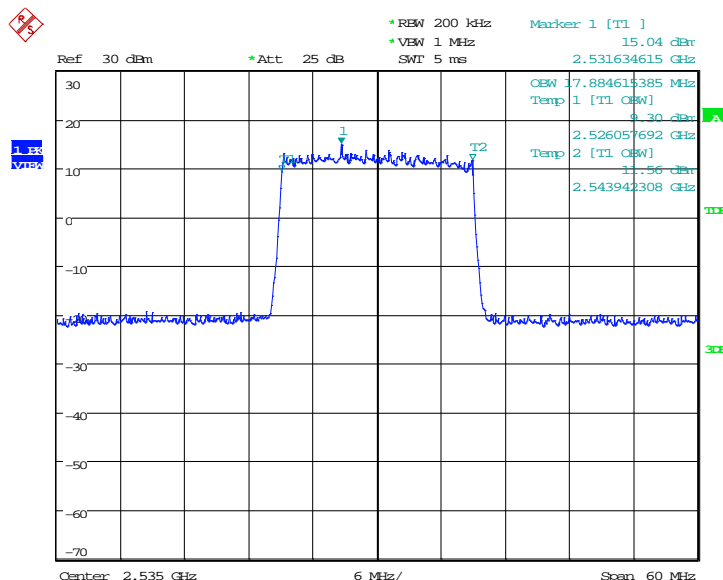


Date: 9.OCT.2019 19:29:03

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

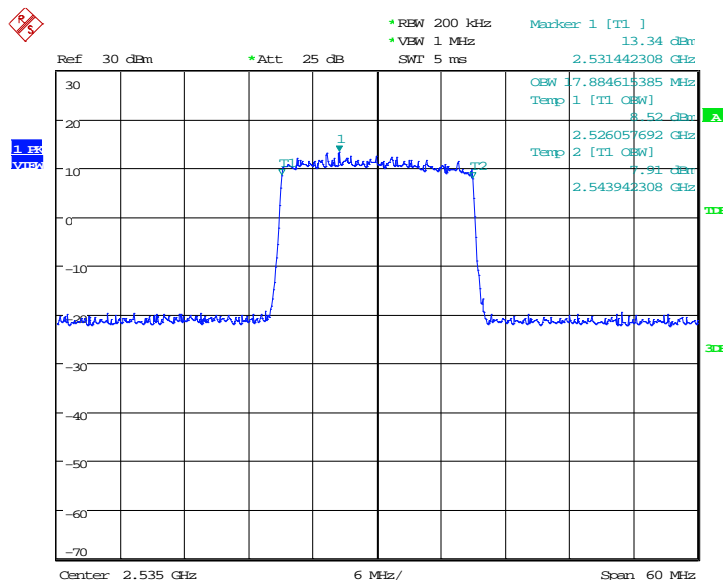
Frequency(MHz)	Occupied Bandwidth (99% BW)( kHz)	
2535.0	QPSK	16QAM
	17884.62	17884.62

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



Date: 9.OCT.2019 19:33:07

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



Date: 9.OCT.2019 19:33:21

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

## A.5 EMISSION BANDWIDTH

### Reference

FCC: CFR Part 2.1049, 27.53

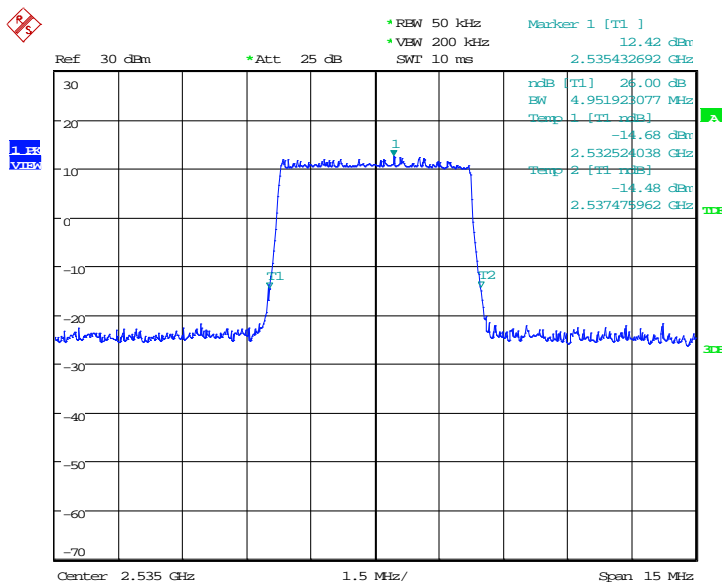
### A.5.1 Emission Bandwidth Results

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 BW)

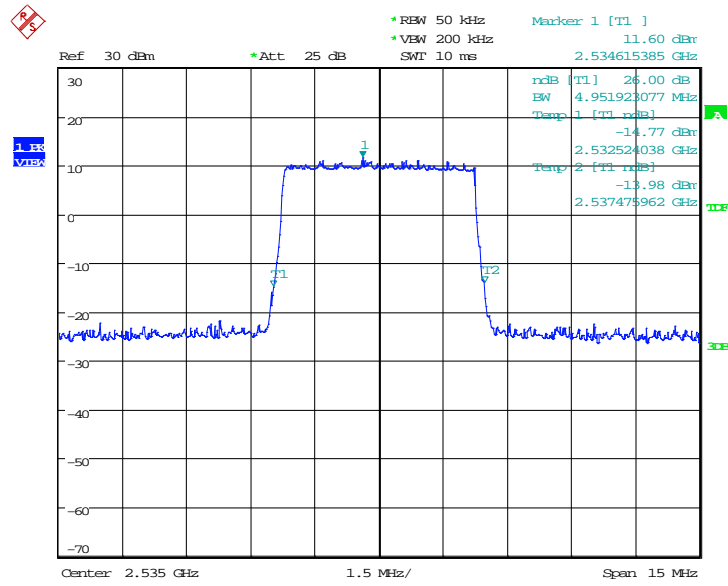
Frequency(MHz)	Emission Bandwidth (-26dBc BW)(kHz)	
2535.0	QPSK	16QAM
	4951.92	4951.92

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



Date: 9.OCT.2019 19:21:19

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

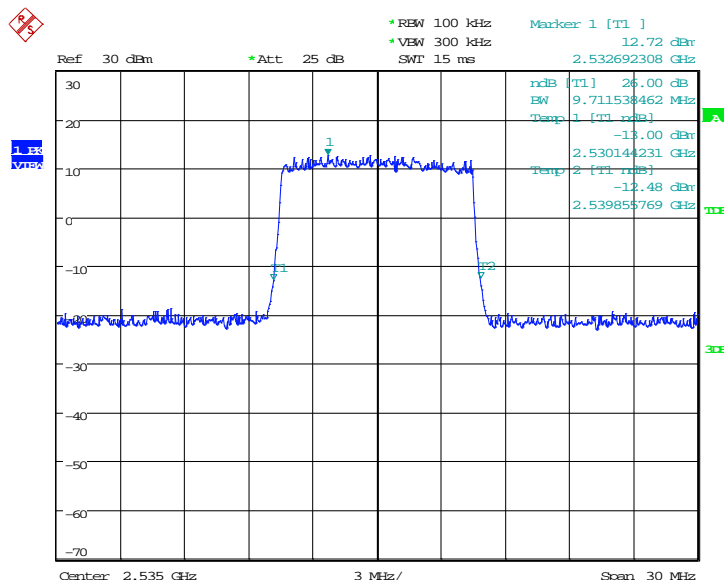


Date: 9.OCT.2019 19:21:34

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

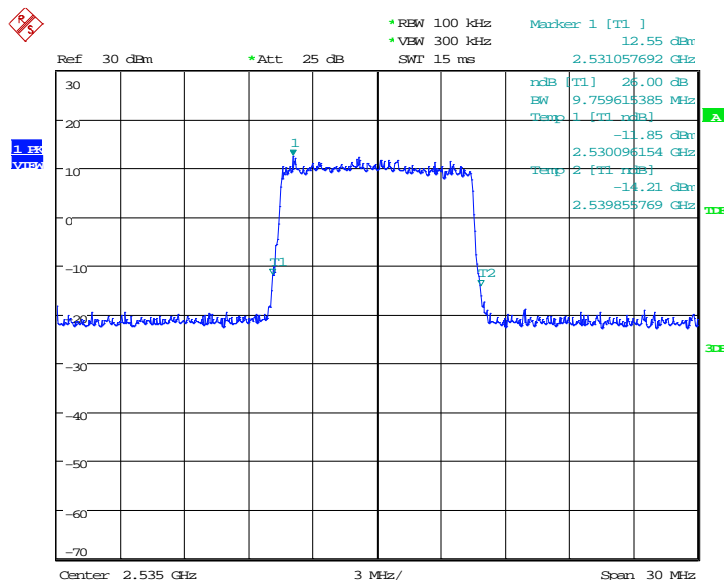
Frequency(MHz)	Emission Bandwidth (-26dBc BW)(kHz)	
2535.0	QPSK	16QAM
	9711.54	9759.62

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



Date: 9.OCT.2019 19:25:36

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

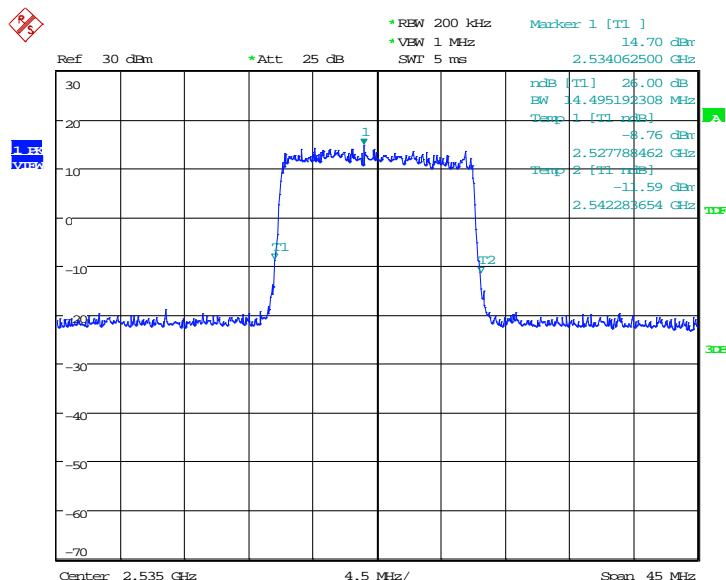


Date: 9.OCT.2019 19:25:52

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

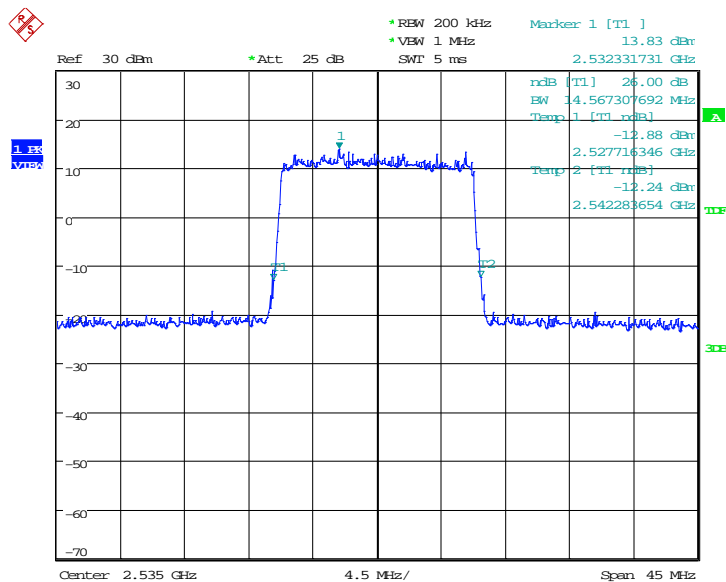
Frequency(MHz)	Emission Bandwidth (-26dBc BW)(kHz)	
2535.0	QPSK	16QAM
	14495.19	14567.31

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



Date: 9.OCT.2019 19:29:57

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

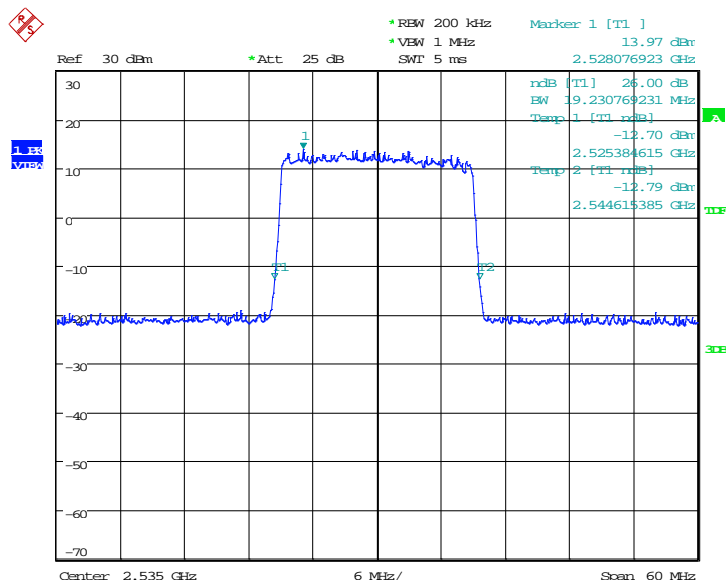


Date: 9.OCT.2019 19:30:13

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

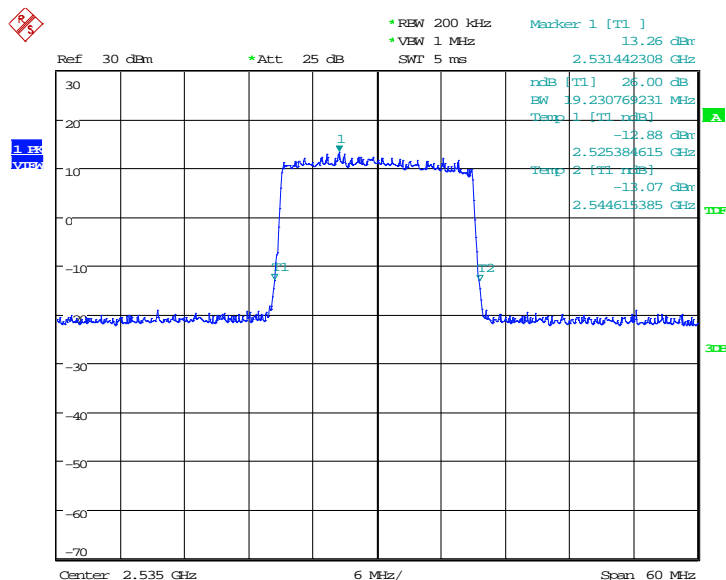
Frequency(MHz)	Emission Bandwidth (-26dBc BW)(kHz)	
2535.0	QPSK	16QAM
	19230.77	19230.77

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



Date: 9.OCT.2019 19:34:15

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



Date: 9.OCT.2019 19:34:31

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

## A.6 BAND EDGE COMPLIANCE

### Reference

FCC: CFR Part 2.1051, 27.53.

#### A.6.1 Measurement limit

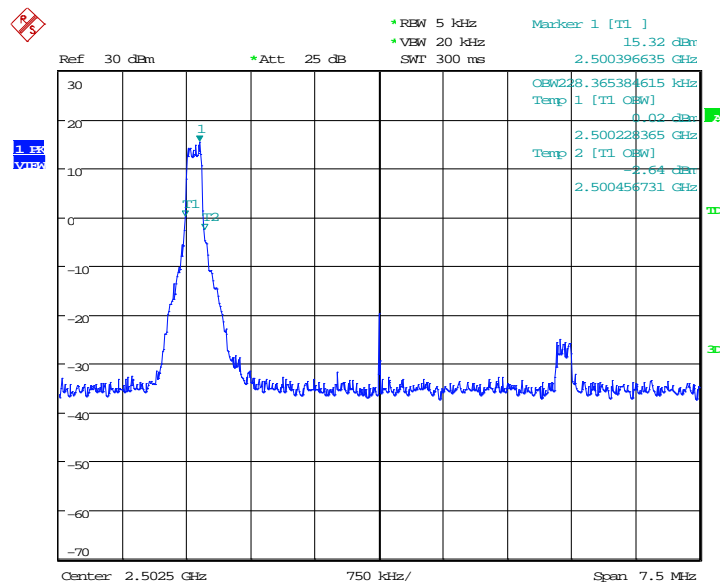
On any frequency outside frequency band of the US Cellular/PCS spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least  $43+10\log(P)$  dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm. A relaxation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

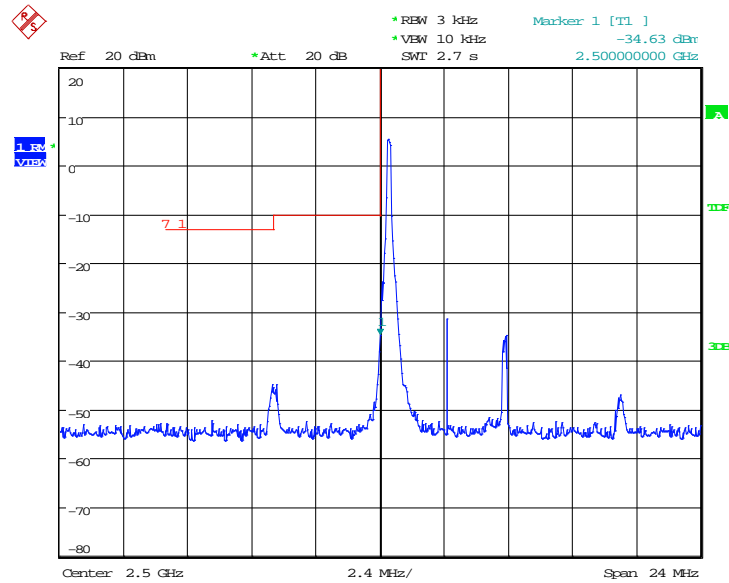
LTE band 7

OBW: 1RB-low\_offset



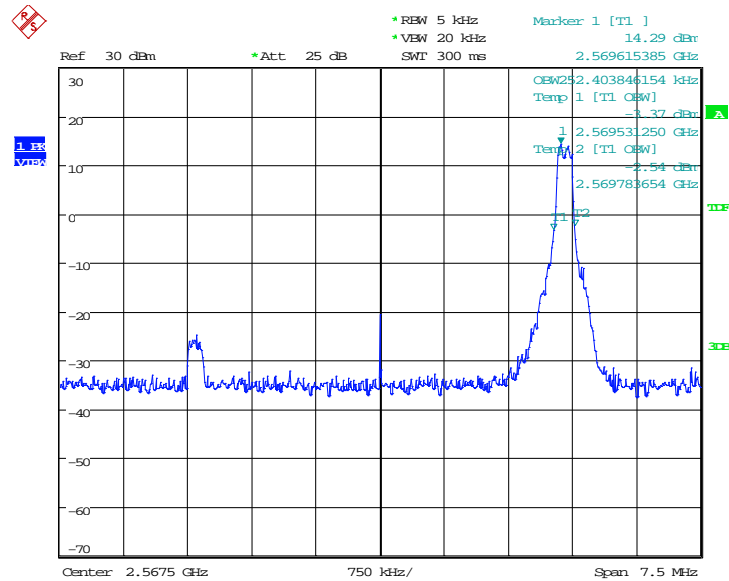
Date: 9.OCT.2019 19:54:52

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



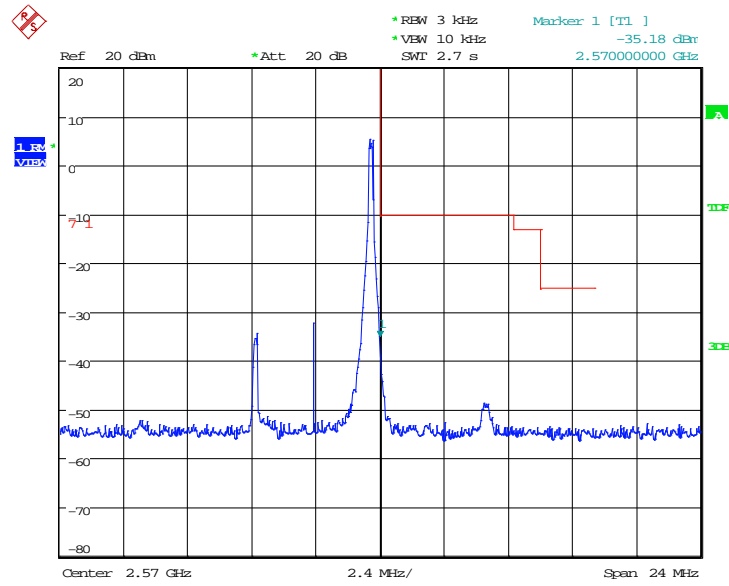
Date: 9.OCT.2019 20:00:44

## OBW: 1RB-high\_offset



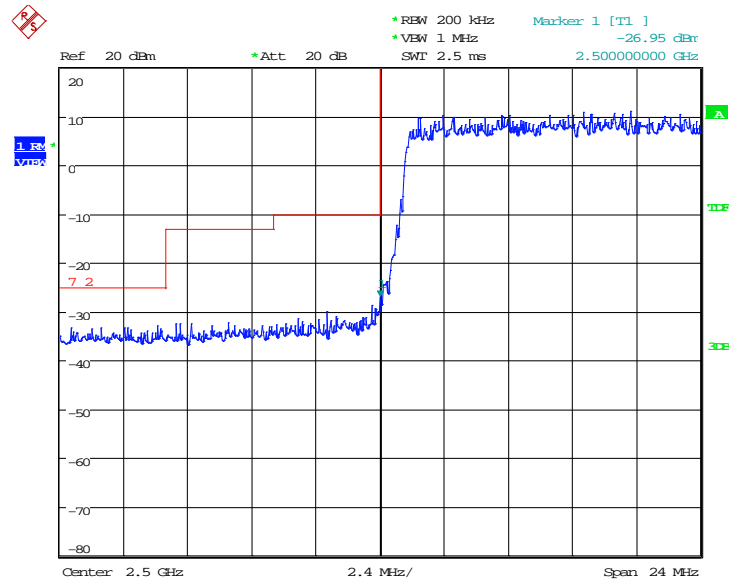
Date: 9.OCT.2019 19:51:02

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



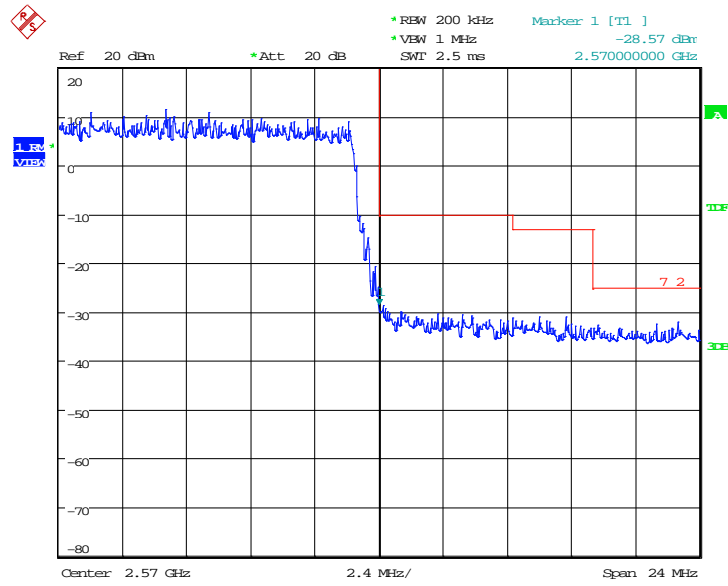
Date: 9.OCT.2019 20:03:09

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



Date: 9.OCT.2019 19:46:44

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



Date: 9.OCT.2019 19:47:31

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.

### **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 2.1051 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.

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

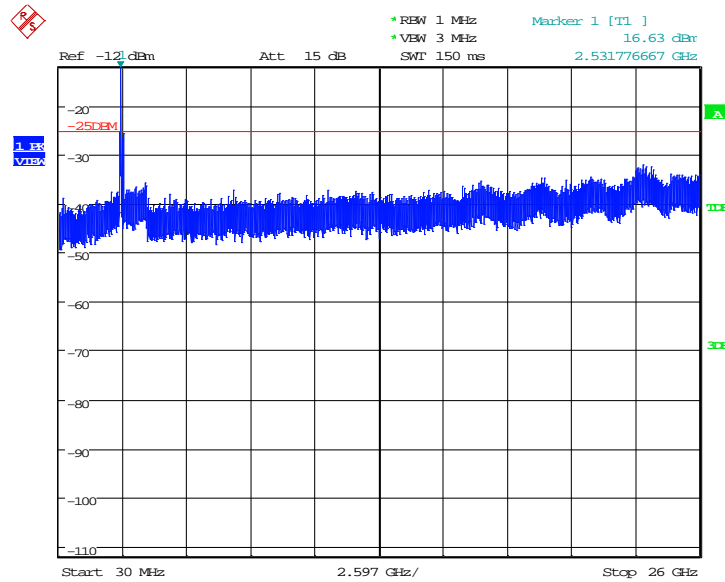
### A. 7.3 Measurement result

Only worst case result is given below

LTE band 7 20MHz QPSK: 30MHz – 26GHz

Spurious emission limit –25dBm.

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



Date: 9.OCT.2019 19:35:25

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(d)

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.

- 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

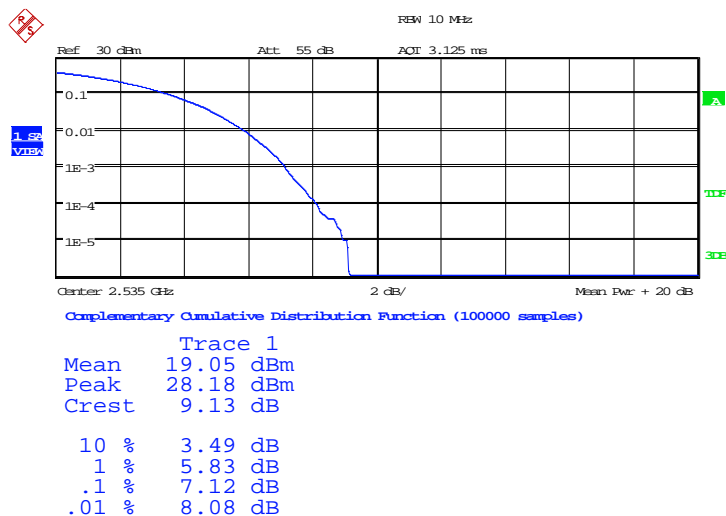
### **A.8.2 Measurement results**

#### **LTE band 7**

Frequency(MHz)	Bandwidth(MHz)	PAPR(dB)	
		QPSK	16QAM
2510.0	20	7.12	7.69
	15	6.83	7.34
	10	6.12	6.63
	5	5.99	6.67

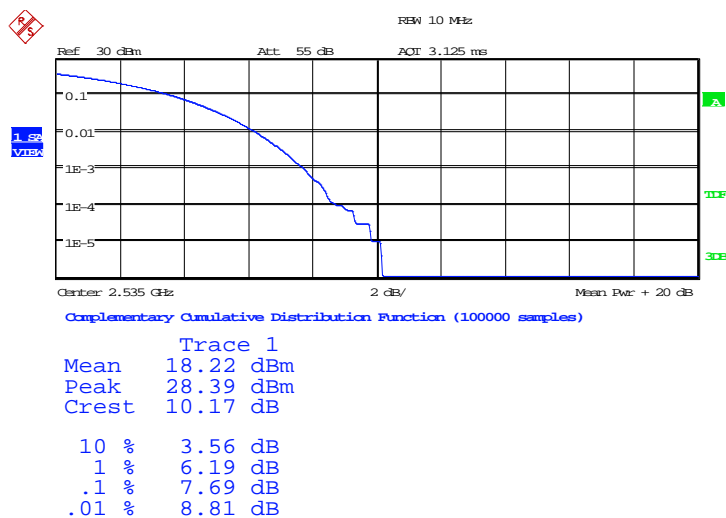
Note: Expanded measurement uncertainty is  $U = 0.483$ ,  $k = 2$

Only worst case result is given below  
LTE band 7 20MHz QPSK (PAPR)



Date: 9.OCT.2019 19:37:31

LTE band 7 20MHz 16QAM (PAPR)



Date: 9.OCT.2019 19:37:37

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