



*Full*

# TEST REPORT

No. I18D00208-SRD01

*For*

**Client : Shanghai SIMCom Wireless Solution Ltd.**

**Production : SIMCom 4G Smart module**

**Model Name : SIM8905A**

**FCC ID: 2AJYU-8PSA301**

**Hardware Version: V1.01**

**Software Version: B01**

**Issued date: 2018-11-15**

**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 ECIT Shanghai.

**Test Laboratory:**

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**Revision Version**

<b>Report Number</b>	<b>Revision</b>	<b>Date</b>	<b>Memo</b>
I18D00208-SRD01	00	2018-11-11	Initial creation of test report
I18D00208-SRD01	01	2018-11-14	Second creation of test report
I18D00208-SRD01	02	2018-11-15	Third creation of test report

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## 1. Test Laboratory

### 1.1. Testing Location

Company Name:	ECIT Shanghai, East China Institute of Telecommunications
Address:	7-8F, G Area, No. 668, Beijing East Road, Huangpu District, Shanghai, P. R. China
Postal Code:	200001
Telephone:	(+86)-021-63843300
Fax:	(+86)-021-63843301
FCC registration No	958356

### 1.2. Testing Environment

Normal Temperature:	15-35°C
Extreme Temperature:	-30/+50°C
Relative Humidity:	25-75%

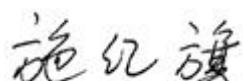
### 1.3. Project data

Project Leader:	Yu anlu
Testing Start Date:	2018-10-23
Testing End Date:	2018-11-15

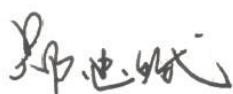
### 1.4. Signature



Yang Dejun  
(Prepared this test report)



Shi Hongqi  
(Reviewed this test report)



Zheng Zhongbin  
(Approved this test report)

## 2. Client Information

### 2.1. Applicant Information

Company Name: Shanghai SIMCom Wireless Solution Ltd.  
Address: Bldg. B, SIM Technology Bldg.,No.633, Jinzhong Rd,  
Changning Dist., Shanghai, P.R.China  
Telephone: 021-31575186  
Postcode: 200335

### 2.2. Manufacturer Information

Company Name: Shanghai SIMCom Wireless Solution Ltd.  
Address: Bldg. B, SIM Technology Bldg.,No.633, Jinzhong Rd,  
Changning Dist., Shanghai, P.R.China  
Telephone: 021-31575186  
Postcode: 200335

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

#### 3.1. About EUT

EUT Description	SIMCom 4G Smart module
Model name	SIM8905A
FCC ID	2AJYU-8PSA301
GSM Frequency Band	NA
UMTS Frequency Band	NA
CDMA Frequency Band	NA
LTE Frequency Band	Band 2/4/5/12
Additional Communication Function	LTE
Extreme Temperature	-30/+50°C
Nominal Voltage	3.9 V
Extreme High Voltage	4.4 V
Extreme Low Voltage	3.4 V

Note: Photographs of EUT are shown in ANNEX A of this test report.

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

EUT ID*	Model Name	SN or IMEI	HW Version	SW Version	Date of receipt
N11	SIM8905A	NA	V1.01	B01	2018-10-22
N12	SIM8905A	NA	V1.01	B01	2018-10-22
N13	SIM8905A	NA	V1.01	B01	2018-10-22

\*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	RF cable	---

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

#### 3.4. Statements

The SIM8905A, supporting LTE, manufactured by Shanghai SIMCom Wireless Solution Ltd., which is a new product for testing.

ECIT has verified that the compliance of the tested device specified in section 5 of this test report is successfully evaluated according to the procedure and test methods as defined in type certification requirement listed in section 5 of this test report.

## 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	2017/10/01
FCC Part 24	PERSONAL COMMUNICATIONS SERVICES	2017/10/01
FCC Part 27	MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES	2017/10/01
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. SUMMARY OF TEST RESULTS

### LTE Band 2

Items	Test Name	Clause in FCC rules	Clause in IC rules RSS-Gen and RSS-133	Section in this report	Verdict
1	Output Power	24.232(c)	/	A.1	P
2	Emission Limit	24.238(a), 2.1051	/	A.2	P
3	Frequency Stability	24.235, 2.1055	/	A.3	P
4	Occupied Bandwidth	2.1049(h)(i)	/	A.4	P
5	Emission Bandwidth	24.238(a)	/	A.5	P
6	Band Edge Compliance	24.238(a)	/	A.6	P
7	Conducted Spurious Emission	24.238, 2.1057	/	A.7	P
8	Peak to Average Power Ratio	24.232 (d)	/	A.8	P

### LTE Band 4

Items	Test Name	Clause in FCC rules	Clause in IC rules RSS-Gen and RSS-139	Section in this report	Verdict
1	Output Power	27.50(d)(4)	/	A.1	P
2	Emission Limit	27.53(h), 2.1051	/	A.2	P
3	Frequency Stability	27.54, 2.1055	/	A.3	P
4	Occupied Bandwidth	2.1049(h)(i)	/	A.4	P
5	Emission Bandwidth	27.53(h)	/	A.5	P
6	Band Edge Compliance	27.53(h)	/	A.6	P
7	Conducted Spurious Emission	27.53(h), 2.1057	/	A.7	P
8	Peak to Average Power Ratio	27.50(a)	/	A.8	P

### LTE Band 5

Items	Test Name	Clause in FCC rules	Clause in IC rules RSS-Gen and RSS-132	Section in this report	Verdict
1	Output Power	§2.1046(a), 22.913(a)	/	A.1	P
2	Emission Limit	22.917, 2.1051	/	A.2	P
3	Frequency Stability	22.235, 2.1055	/	A.3	P

4	Occupied Bandwidth	2.1049(h)(i)	/	A.4	P
5	Emission Bandwidth	22.917(b)	/	A.5	P
6	Band Edge Compliance	22.917(b)	/	A.6	P
7	Conducted Spurious Emission	22.917, 2.1057	/	A.7	P

**LTE Band 12**

Items	Test Name	Clause in FCC rules	Clause in IC rules RSS-Gen and RSS-130	Section in this report	Verdict
1	Output Power	27.50(c)(10)	/	A.1	P
2	Emission Limit	27.53(g), 2.1051	/	A.2	P
3	Frequency Stability	27.54, 2.1055	/	A.3	P
4	Occupied Bandwidth	2.1049(h)(i)	/	A.4	P
5	Emission Bandwidth	27.53(g)	/	A.5	P
6	Band Edge Compliance	27.53(g)	/	A.6	P
7	Conducted Spurious Emission	27.53(g), 2.1057	/	A.7	P
8	Peak to Average Power Ratio	27.50(a)	/	A.8	P

## 6. Test Equipment Utilized

### Climate chamber

No.	Equipment	Model	Serial Number	Manufacturer	Calibration date	Cal.interval
1	Climate chamber	SH-641	92012011	ESPEC	2017-12-25	2 Year

### Radiated emission test system

The test equipment and ancillaries used are as follows.

No.	Equipment	Model	Serial Number	Manufacturer	Calibration date	Cal.interval
1	Universal Radio Communication Tester	CMW500	104178	R&S	2018-05-11	1 Year
2	Test Receiver	ESU40	100307	R&S	2018-05-11	1 Year
3	TRILOG Broadband Antenna	VULB9163-163	VULB9163-515	Schwarzbeck	2017-02-25	3 Year
4	Double Ridged Guide Antenna	ETS-3117	135890	ETS	2017-01-11	3 Year
5	2-Line V-Network	ENV216	101380	R&S	2018-05-11	1 Year
6	Substitution Antenna	ETS-3117	00135890	ETS	2017-01-11	3 Year
7	RF Signal Generator	SMF100A	102314	R&S	2018-05-11	1 Year
8	Substitution Antenna	VUBA9117	9117-266	Schwarzbeck	2017-11-18	3 Year
9	Amplifier	SCU08	10146	R&S	2018-05-11	1 Year

## Conducted test system

No.	Name	Type	SN	Manufacture	Calibration date	Cal.interval
1	Vector Signal Analyser	FSQ40	200063	Rohde&Schwarz	2017-12-17	1 Year
2	Wireless communication comprehensive tester	CMW500	148904	Rohde&Schwarz	2018-08-21	1 Year
3	DC Power Supply	ZUP60-14	LOC-220Z 006 -0007	TDL-Lambda	2018-05-11	1 Year

## Software

Name	Version
Eagle FCC LTE auto test system	V3.0
EMC32	V9.15

## 7. Test Environment

**Shielding Room1** (6.0 meters×3.0 meters×2.7 meters) did not exceed following limits along the conducted RF performance testing:

Temperature	Min. = 15 °C, Max. = 35 °C
Relative humidity	Min. = 20%, Max. = 75 %
Shielding effectiveness	> 100 dB
Ground system resistance	< 0.5

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

Temperature	Min. = 15 °C, Max. = 35 °C
Relative humidity	Min. = 25 %, Max. = 75 %
Shielding effectiveness	> 100 dB
Electrical insulation	> 10 k
Ground system resistance	< 0.5

**Fully-anechoic chamber1** (6.9 meters×10.9 meters×5.4 meters) did not exceed following limits along the EMC testing:

Temperature	Min. = 15 °C, Max. = 35 °C
Relative humidity	Min. = 25 %, Max. = 75 %
Shielding effectiveness	> 100 dB
Electrical insulation	> 10 k
Ground system resistance	< 0.5
VSWR	Between 0 and 6 dB, from 1GHz to 18GHz
Site Attenuation Deviation	Between -4 and 4 dB, 30MHz to 1GHz
Uniformity of field strength	Between 0 and 6 dB, from 80MHz to 3000 MHz

## ANNEX A. MEASUREMENT RESULTS

### ANNEX A.1. OUTPUT POWER

#### A.1.1. Summary

During the process of testing, the EUT was controlled via Rhode & Schwarz Digital Radio Communication tester (CMW500) to ensure max power transmission and proper modulation. In all cases, output power is within the specified limits.

#### A.1.2. Conducted

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

The EUT was set up for the max output power with pseudo random data modulation. These measurements were done at 3 frequencies (bottom, middle and top of operational frequency range) for each bandwidth.

##### A.1.2.2 Measurement result

###### LTE band 2

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
1.4MHz	1 RB high	1850.7	22.39	21.44
		1880.0	22.92	22.18
		1909.3	22.72	21.87
	1 RB low	1850.7	22.31	20.83
		1880.0	22.83	21.89
		1909.3	22.83	22.11
	50% RB mid	1850.7	22.57	21.6
		1880.0	22.74	22.43
		1909.3	22.65	22.05
	100% RB	1850.7	21.62	20.54
		1880.0	21.85	20.91
		1909.3	21.78	20.99
3MHz	1 RB high	1851.5	22.69	21.74
		1880.0	22.94	22.52
		1908.5	22.76	21.9
	1 RB low	1851.5	22.49	21.45
		1880.0	22.74	22.15
		1908.5	22.95	22.14
	50% RB mid	1851.5	22.56	21.93
		1880.0	22.5	21.8
		1908.5	22.66	21.98

		1851.5	21.73	20.59
		1880.0	21.74	20.93
		1908.5	21.92	21.07
5MHz	100% RB	1852.5	22.73	21.85
		1880.0	22.6	21.67
		1907.5	22.78	22.07
	1 RB low	1852.5	22.52	21.8
		1880.0	22.53	20.82
		1907.5	23.16	21.74
	50% RB mid	1852.5	22.97	21.92
		1880.0	22.91	21.21
		1907.5	22.59	21.93
	100% RB	1852.5	21.67	20.73
		1880.0	21.9	21.09
		1907.5	21.79	20.73
10MHz	1 RB high	1855.0	22.75	21.91
		1880.0	22.78	21.96
		1905.0	22.79	21.96
	1 RB low	1855.0	22.65	21.73
		1880.0	22.58	21.78
		1905.0	22.9	22.14
	50% RB mid	1855.0	22.81	21.92
		1880.0	22.86	22.19
		1905.0	23.11	22.31
	100% RB	1855.0	21.75	20.77
		1880.0	21.97	20.87
		1905.0	21.94	21.07
15MHz	1 RB high	1857.5	22.82	22.07
		1880.0	22.85	22.19
		1902.5	22.8	22.07
	1 RB low	1857.5	22.62	21.93
		1880.0	22.69	22.09
		1902.5	23.04	22.19
	50% RB mid	1857.5	22.66	21.72
		1880.0	22.8	21.86
		1902.5	23.02	22.07
	100% RB	1857.5	21.84	20.88
		1880.0	21.81	20.86
		1902.5	21.96	21.13

20MHz	1 RB high	1860.0	22.86	22.08
		1880.0	23.11	22.43
		1900.0	23.03	21.82
	1 RB low	1860.0	22.58	22.1
		1880.0	22.79	21.6
		1900.0	22.94	22.17
	50% RB mid	1860.0	22.97	22.04
		1880.0	23.24	22.18
		1900.0	22.92	22.24
	100% RB	1860.0	21.76	20.74
		1880.0	21.95	20.87
		1900.0	21.98	20.95

**LTE band 4**

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
1.4MHz	1 RB high	1710.7	22.98	21.43
		1732.5	22.92	22.2
		1754.3	22.73	21.66
	1 RB low	1710.7	22.87	21.53
		1732.5	22.81	21.76
		1754.3	22.57	21.42
	50% RB mid	1710.7	22.81	21.93
		1732.5	23.01	21.64
		1754.3	22.66	21.92
	100% RB	1710.7	22.1	20.99
		1732.5	21.89	21.18
		1754.3	21.87	21
3MHz	1 RB high	1711.5	22.77	22.19
		1732.5	22.87	22.04
		1753.5	22.77	22.07
	1 RB low	1711.5	23.22	22.85
		1732.5	22.77	22.28
		1753.5	22.7	21.77
	50% RB mid	1711.5	22.97	22.25
		1732.5	22.91	22.26
		1753.5	22.63	21.81
	100% RB	1711.5	22.05	21.13
		1732.5	21.93	21.04
		1753.5	21.74	20.69
5MHz	1 RB high	1712.5	22.88	22.1
		1732.5	22.53	20.93
		1752.5	22.68	21.77
	1 RB low	1712.5	23.17	22.34
		1732.5	22.83	21.2
		1752.5	22.67	22.02
	50% RB mid	1712.5	22.75	22.07
		1732.5	22.65	21.07
		1752.5	22.4	21.75
	100% RB	1712.5	21.96	20.98
		1732.5	21.93	21.12
		1752.5	21.78	20.85
10MHz	1 RB high	1715	22.84	22

15MHz	1 RB low	1732.5	22.96	22.22
		1750	22.64	21.53
		1715	23.29	22.39
		1732.5	22.85	22.34
		1750	22.78	22
	50% RB mid	1715	23.26	22.15
		1732.5	23.1	22.37
		1750	22.66	21.86
	100% RB	1715	22.08	21.04
		1732.5	21.86	20.9
		1750	21.75	20.82
20MHz	1 RB high	1717.5	22.84	22.21
		1732.5	23.05	22.76
		1747.5	22.85	21.9
	1 RB low	1717.5	23.18	22.46
		1732.5	22.87	22
		1747.5	23.01	22.1
	50% RB mid	1717.5	22.79	22.11
		1732.5	22.83	22.22
		1747.5	22.64	21.85
	100% RB	1717.5	22.04	20.98
		1732.5	21.97	20.97
		1747.5	21.92	20.86
	1 RB high	1720	22.86	22.23
		1732.5	23.29	22.22
		1745	22.79	21.49
	1 RB low	1720	23.34	22.26
		1732.5	22.68	21.65
		1745	23.08	22.11
	50% RB mid	1720	23.24	22.56
		1732.5	22.82	22.03
		1745	23.09	22.05
	100% RB	1720	21.97	21.03
		1732.5	21.92	20.97
		1745	21.86	20.92

**LTE band 5**

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
1.4MHz	1 RB high	824.7	23.54	22.68
		836.5	23.24	22.6
		848.3	22.87	22.12
	1 RB low	824.7	23.56	22.75
		836.5	23.35	22.76
		848.3	23.33	22.39
	50% RB mid	824.7	23.54	22.68
		836.5	23.36	22.43
		848.3	23.16	22.18
	100% RB	824.7	22.45	21.43
		836.5	22.22	21.47
		848.3	22.13	21.14
3MHz	1 RB high	825.5	23.39	22.98
		836.5	23.28	22.76
		847.5	22.96	22.09
	1 RB low	825.5	23.49	22.54
		836.5	23.62	22.67
		847.5	23.31	22.39
	50% RB mid	825.5	23.19	22.56
		836.5	23.22	22.57
		847.5	23.13	22.66
	100% RB	825.5	22.48	21.3
		836.5	22.29	21.41
		847.5	22.25	21.27
5MHz	1 RB high	826.5	23.43	22.59
		836.5	23.05	22.01
		846.5	22.98	22.13
	1 RB low	826.5	23.63	22.57
		836.5	23.35	21.31
		846.5	23.24	22.02
	50% RB mid	826.5	23.54	22.79
		836.5	23.11	21.94
		846.5	22.88	22.27
	100% RB	826.5	22.44	21.28
		836.5	22.33	21.53
		846.5	22.18	21.12

10MHz	1 RB high	829.0	23.19	22.07
		836.5	22.88	22.37
		844.0	22.95	22.24
	1 RB low	829.0	23.48	22.65
		836.5	23.41	23.14
		844.0	23.29	22.49
	50% RB mid	829.0	23.54	22.59
		836.5	23.31	22.62
		844.0	23.29	22.36
	100% RB	829.0	22.39	21.32
		836.5	22.38	21.24
		844.0	22.25	21.22

**LTE band 12**

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
1.4MHz	1 RB high	699.7	23.32	22.57
		707.5	23.52	22.59
		715.3	23.31	22.71
	1 RB low	699.7	23.21	22.54
		707.5	23.38	22.74
		715.3	23.38	22.6
	50% RB mid	699.7	23.5	22.63
		707.5	23.67	22.89
		715.3	23.38	22.69
	100% RB	699.7	22.32	21.17
		707.5	22.44	21.64
		715.3	22.37	21.49
3MHz	1 RB high	700.5	23.25	22.4
		707.5	23.22	22.42
		714.5	23.2	22.54
	1 RB low	700.5	23.24	22.08
		707.5	23.1	22.78
		714.5	23.47	22.58
	50% RB mid	700.5	23.38	22.66
		707.5	23.23	22.4
		714.5	23.42	22.8
	100% RB	700.5	22.38	21.37
		707.5	22.42	21.42
		714.5	22.57	21.61
5MHz	1 RB high	701.5	23.38	22.55
		707.5	22.98	22.17
		713.5	23.25	22.66
	1 RB low	701.5	23.29	22.56
		707.5	23.24	21.66
		713.5	23.64	22.23
	50% RB mid	701.5	23.34	21.99
		707.5	23.03	21.55
		713.5	23.42	22.19
	100% RB	701.5	22.35	21.36
		707.5	22.42	21.42
		713.5	22.4	21.25

10MHz	1 RB high	704.0	23.29	22.48
		707.5	23.23	22.62
		711.0	23.29	22.32
	1 RB low	704.0	23.27	22.32
		707.5	23.32	22.73
		711.0	23.36	22.39
	50% RB mid	704.0	23.21	22.71
		707.5	23.48	23.18
		711.0	23.48	22.37
	100% RB	704.0	22.36	21.41
		707.5	22.44	21.5
		711.0	22.44	21.5

### A.1.3 Radiated

#### 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."

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".

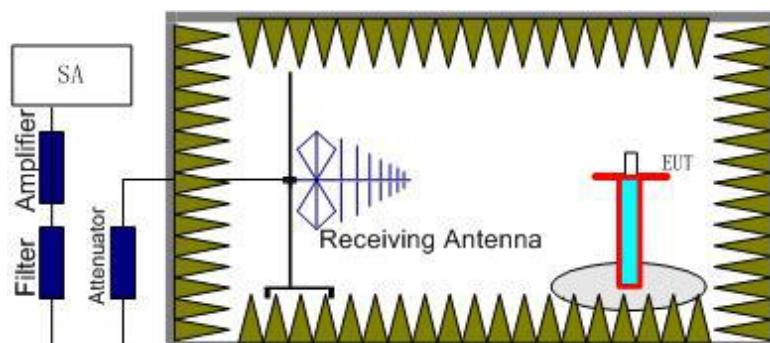
Rule Part 27.50(h)(2) specifies "Mobile stations are limited to 2.0 watts EIRP".

Rule Part 27.50(c) specifies "Portable stations (hand-held devices) are limited to 3 watts ERP".

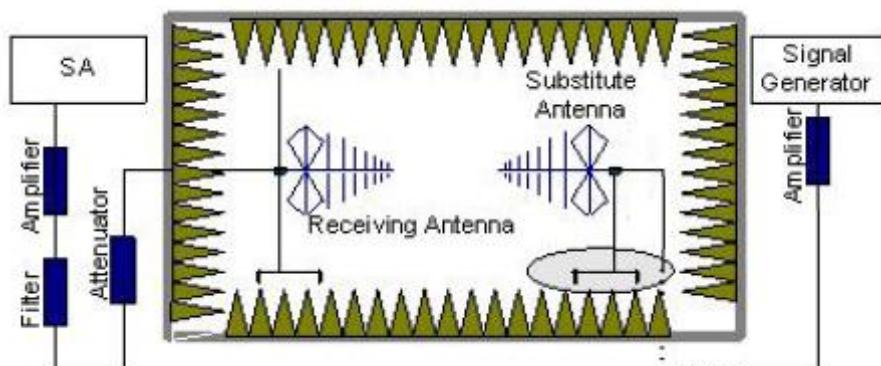
#### A.1.3.2 Method of Measurement

The measurements procedures in TIA-603E-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.



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,  $\text{ERP} = \text{EIRP} - 2.15$ .

#### A.1.3.3 Measurement result

##### LTE Band 2- EIRP 24. 232(b)

**Limits:** ≤33dBm (2W)

##### LTE Band 2\_1.4MHz\_QPSK

Frequency(MHz)	$P_{Mea}$ (dBm)	$P_{cl}$ (dB)	$P_{Ag}$ (dB)	$G_a$ Antenna Gain(dBi)	EIRP(dB m)	Limit(dBm)	Margin(dB)	Polarization
1850.70	-8.82	4.6	36.0	2.8	25.38	33.00	7.62	H
1880.00	-8.1	4.6	35.6	2.8	25.7	33.00	7.3	H
1909.30	-8.07	4.7	35.9	2.8	25.93	33.00	7.07	H

##### LTE Band 2\_3MHz\_QPSK

Frequency(MHz)	$P_{Mea}$ (dBm)	$P_{cl}$ (dB)	$P_{Ag}$ (dB)	$G_a$ Antenna Gain(dBi)	EIRP(dB m)	Limit(dBm)	Margin(dB)	Polarization
1851.50	-8.71	4.6	36.0	2.8	25.49	33.00	7.51	H
1880.00	-8.05	4.6	35.6	2.8	25.75	33.00	7.25	H
1908.50	-8.05	4.7	35.9	2.8	25.95	33.00	7.05	H

##### LTE Band 2\_5MHz\_QPSK

Frequency(MHz)	$P_{Mea}$ (dBm)	$P_{cl}$ (dB)	$P_{Ag}$ (dB)	$G_a$ Antenna Gain(dBi)	EIRP(dB m)	Limit(dBm)	Margin(dB)	Polarization
1852.50	-8.94	4.6	36.0	2.8	25.26	33.00	7.74	H
1880.00	-7.95	4.6	35.6	2.8	25.85	33.00	7.15	H
1907.50	-8.16	4.7	35.9	2.8	25.84	33.00	7.16	H

##### LTE Band 2\_10MHz\_QPSK

Frequency(MHz)	$P_{Mea}$ (dBm)	$P_{cl}$ (dB)	$P_{Ag}$ (dB)	$G_a$ Antenna Gain(dBi)	EIRP(dB m)	Limit(dBm)	Margin(dB)	Polarization
1855.00	-8.74	4.6	36.0	2.8	25.46	33.00	7.54	H
1880.00	-7.8	4.6	35.6	2.8	26	33.00	7	H

1905.00	-7.91	4.7	35.9	2.8	26.09	33.00	6.91	H
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**LTE Band 2\_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(dBi)	EIRP(dB m)	Limit(dBm)	Margin(dB)	Polarization
1857.50	-8.53	4.6	36.0	2.8	25.67	33.00	7.33	H
1880.00	-7.89	4.6	35.6	2.8	25.91	33.00	7.09	H
1902.50	-7.8	4.7	36.0	2.8	26.3	33.00	6.7	H

**LTE Band 2\_20 MHz\_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(dB m)	Limit(dBm)	Margin(dB)	Polarization
1860.00	-8.46	4.6	36.0	2.8	25.74	33.00	7.26	H
1880.00	-8.04	4.6	35.6	2.8	25.76	33.00	7.24	H
1900.00	-8.16	4.7	36.4	2.8	26.34	33.00	6.66	H

**LTE Band 2\_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(dBi)	EIRP(dB m)	Limit(dBm)	Margin(dB)	Polarization
1850.70	-8.6	4.6	36.0	2.8	25.6	33.00	7.4	H
1880.00	-8.05	4.6	35.6	2.8	25.75	33.00	7.25	H
1909.30	-8.11	4.7	35.9	2.8	25.89	33.00	7.11	H

**LTE Band 2\_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(dBi)	EIRP(dB m)	Limit(dBm)	Margin(dB)	Polarization
1851.50	-8.58	4.6	36.0	2.8	25.62	33.00	7.38	H
1880.00	-7.92	4.6	35.6	2.8	25.88	33.00	7.12	H
1908.50	-7.78	4.7	35.9	2.8	26.22	33.00	6.78	H

**LTE Band 2\_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(dB m)	Limit(dBm)	Margin(dB)	Polarization
1852.50	-8.75	4.6	36.0	2.8	25.45	33.00	7.55	H
1880.00	-7.74	4.6	35.6	2.8	26.06	33.00	6.94	H
1907.50	-8.18	4.7	35.9	2.8	25.82	33.00	7.18	H

**LTE Band 2\_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(dB m)	Limit(dBm)	Margin(dB)	Polarization
1855.00	-8.34	4.6	36.0	2.8	25.86	33.00	7.14	H
1880.00	-7.76	4.6	35.6	2.8	26.04	33.00	6.96	H
1905.00	-7.65	4.7	35.9	2.8	26.35	33.00	6.65	H

**LTE Band 2\_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(dB m)	Limit(dBm)	Margin(dB)	Polarization
1857.50	-8.36	4.6	36.0	2.8	25.84	33.00	7.16	H
1880.00	-7.82	4.6	35.6	2.8	25.98	33.00	7.02	H
1902.50	-7.88	4.7	36.0	2.8	26.22	33.00	6.78	H

**LTE Band 2\_20 MHz\_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(dB m)	Limit(dBm)	Margin(dB)	Polarization
1860.00	-8.5	4.6	36.0	2.8	25.7	33.00	7.3	H
1880.00	-7.81	4.6	35.6	2.8	25.99	33.00	7.01	H
1900.00	-8.23	4.7	36.4	2.8	26.27	33.00	6.73	H

Peak EIRP(dBm) = P<sub>Mea</sub>(-8.23dBm) + G<sub>a</sub> (2.8dBi) + P<sub>Ag</sub> (36.4dB) - P<sub>cl</sub> (4.7dB) = 26.27dBm

**LTE Band 4- EIRP 27.50(d)**

Limits: ≤30dBm (1W)

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>c</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dBi)	EIRP(dB m)	Limit(dBm)	Margin(dB)	Polarization
1710.70	-13.62	4.4	36.2	3	21.18	30.00	8.82	H
1732.50	-12.78	4.4	36.1	3	21.92	30.00	8.08	H
1754.30	-11.89	4.5	36.4	2.9	22.91	30.00	7.09	H

**LTE Band 4\_3MHz\_QPSK**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>c</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dBi)	EIRP(dB m)	Limit(dBm)	Margin(dB)	Polarization
1711.50	-13.62	4.4	36.2	3	21.18	30.00	8.82	H
1732.50	-12.8	4.4	36.1	3	21.9	30.00	8.1	H
1753.50	-11.95	4.5	36.4	2.9	22.85	30.00	7.15	H

**LTE Band 4\_5MHz\_QPSK**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>c</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dBi)	EIRP(dB m)	Limit(dBm)	Margin(dB)	Polarization
1712.50	-13.89	4.4	36.2	3	20.91	30.00	9.09	H
1732.50	-12.68	4.4	36.1	3	22.02	30.00	7.98	H
1752.50	-12.23	4.5	36.5	2.9	22.67	30.00	7.33	H

**LTE Band 4\_10MHz\_QPSK**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>c</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dBi)	EIRP(dB m)	Limit(dBm)	Margin(dB)	Polarization
1715.00	-13.59	4.4	36.2	3	21.21	30.00	8.79	H
1732.50	-12.76	4.4	36.1	3	21.94	30.00	8.06	H
1750.50	-11.74	4.5	36.1	2.9	22.76	30.00	7.24	H

**LTE Band 4\_15MHz\_QPSK**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>c</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dBi)	EIRP(dB m)	Limit(dBm)	Margin(dB)	Polarization
1717.50	-13.46	4.4	36.2	3	21.34	30.00	8.66	H
1732.50	-12.95	4.4	36.1	3	21.75	30.00	8.25	H
1747.50	-11.98	4.5	36.5	2.9	22.92	30.00	7.08	H

**LTE Band 4\_20MHz\_QPSK**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>c</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dBi)	EIRP(dB m)	Limit(dBm)	Margin(dB)	Polarization
1720.00	-13.3	4.4	36.2	3	21.5	30.00	8.5	H
1732.50	-12.92	4.4	36.1	3	21.78	30.00	8.22	H
1745.00	-11.07	4.5	35.8	2.9	23.13	30.00	6.87	H

**LTE Band 4\_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(dBi)	EIRP(dB m)	Limit(dBm)	Margin(dB)	Polarization
1710.70	-13.4	4.4	36.2	3	21.4	30.00	8.6	H
1732.50	-12.89	4.4	36.1	3	21.81	30.00	8.19	H
1754.30	-11.89	4.5	36.4	2.9	22.91	30.00	7.09	H

**LTE Band 4\_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(dBi)	EIRP(dB m)	Limit(dBm)	Margin(dB)	Polarization
1711.50	-13.35	4.4	36.2	3	21.45	30.00	8.55	H
1732.50	-12.99	4.4	36.1	3	21.71	30.00	8.29	H
1753.50	-11.95	4.5	36.4	2.9	22.85	30.00	7.15	H

**LTE Band 4\_5MHz\_16QAM**

Frequency( MHz)	P <sub>Mea</sub> (dB m)	P <sub>cl</sub> (d B)	P <sub>Ag</sub> (d B)	G <sub>a</sub> Antenna Gain(dBi)	EIRP(d Bm)	Limit(d Bm)	Margin( dB)	Polarizat ion
1712.50	-13.79	4.4	36.2	3	21.01	30.00	8.99	H
1732.50	-12.9	4.4	36.1	3	21.8	30.00	8.2	H
1752.50	-12.22	4.5	36.5	2.9	22.68	30.00	7.32	H

**LTE Band 4\_10MHz\_16QAM**

Frequency( MHz)	P <sub>Mea</sub> (dB m)	P <sub>cl</sub> (d B)	P <sub>Ag</sub> (d B)	G <sub>a</sub> Antenna Gain(dBi)	EIRP(d Bm)	Limit(d Bm)	Margin( dB)	Polarizat ion
1715.00	-13.65	4.4	36.2	3	21.15	30.00	8.85	H
1732.50	-12.99	4.4	36.1	3	21.71	30.00	8.29	H
1750.50	-11.56	4.5	36.1	2.9	22.94	30.00	7.06	H

**LTE Band 4\_15MHz\_16QAM**

Frequency( MHz)	P <sub>Mea</sub> (dB m)	P <sub>cl</sub> (d B)	P <sub>Ag</sub> (d B)	G <sub>a</sub> Antenna Gain(dBi)	EIRP(d Bm)	Limit(d Bm)	Margin( dB)	Polarizat ion
1717.50	-13.42	4.4	36.2	3	21.38	30.00	8.62	H
1732.50	-12.91	4.4	36.1	3	21.79	30.00	8.21	H
1747.50	-12.17	4.5	36.5	2.9	22.73	30.00	7.27	H

**LTE Band 4\_20MHz\_16QAM**

Frequency( MHz)	P <sub>Mea</sub> (dB m)	P <sub>cl</sub> (d B)	P <sub>Ag</sub> (d B)	G <sub>a</sub> Antenna Gain(dBi)	EIRP(d Bm)	Limit(d Bm)	Margin( dB)	Polarizat ion
1720.00	-13.52	4.4	36.2	3	21.28	30.00	8.72	H
1732.50	-13.12	4.4	36.1	3	21.58	30.00	8.42	H
1745.00	-11.1	4.5	35.8	2.9	23.1	30.00	6.9	H

Peak EIRP(dBm) = P<sub>Mea</sub>(-11.1dBm) + G<sub>a</sub> (2.9dB) + P<sub>Ag</sub> (35.8dB) - P<sub>cl</sub> (4.5dB) = 23.1dBm

**LTE Band 5- ERP 22.913(a)**

Limits: ≤38.45dBm (7W)

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dBd)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
824.70	-4.98	3.1	36.8	-2.87	25.85	38.45	12.6	H
836.50	-5.43	3.1	37.1	-3.11	25.46	38.45	12.99	H
848.30	-5.78	3.1	36.9	-3.11	24.91	38.45	13.54	H

**LTE Band 5\_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(dBd)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
825.50	-5.74	3.1	36.9	-2.87	25.19	38.45	13.26	H
836.50	-5.81	3.1	37.1	-3.11	25.08	38.45	13.37	H
847.50	-6.11	3.1	37.0	-3.11	24.68	38.45	13.77	H

**LTE Band 5\_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(dBd)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
826.50	-6.14	3.1	37.0	-2.87	24.89	38.45	13.56	H
836.50	-6.06	3.1	37.1	-3.11	24.83	38.45	13.62	H
846.50	-6.39	3.1	37.0	-3.11	24.4	38.45	14.05	H

**LTE Band 5\_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(dBd)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
829.00	-5.91	3.1	37.0	-2.87	25.12	38.45	13.33	H
836.50	-5.91	3.1	37.1	-3.11	24.98	38.45	13.47	H
844.00	-6.2	3.1	36.9	-3.11	24.49	38.45	13.96	H

**LTE Band 5\_1.4MHz\_16QAM**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dBd)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
824.70	-5.44	3.1	36.8	-2.87	25.39	38.45	13.06	H
836.50	-6.06	3.1	37.1	-3.11	24.83	38.45	13.62	H
848.30	-6.1	3.1	36.9	-3.11	24.59	38.45	13.86	H

**LTE Band 5\_3MHz\_16QAM**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dBd)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
825.50	-5.51	3.1	36.9	-2.87	25.42	38.45	13.03	H
836.50	-6.01	3.1	37.1	-3.11	24.88	38.45	13.57	H
847.50	-6.16	3.1	37.0	-3.11	24.63	38.45	13.82	H

**LTE Band 5\_5MHz\_16QAM**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dBd)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
826.50	-5.81	3.1	37.0	-2.87	25.22	38.45	13.23	H
836.50	-6.01	3.1	37.1	-3.11	24.88	38.45	13.57	H
846.50	-6.24	3.1	37.0	-3.11	24.55	38.45	13.9	H

**LTE Band 5\_10MHz\_16QAM**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dBd)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
829.00	-5.72	3.1	37.0	-2.87	25.31	38.45	13.14	H
836.50	-5.96	3.1	37.1	-3.11	24.93	38.45	13.52	H
844.00	-6.12	3.1	36.9	-3.11	24.57	38.45	13.88	H

Peak ERP(dBm)=P<sub>Mea</sub>(-6.12dBm)+G<sub>a</sub>(-3.11dB)<sub>i</sub>+P<sub>Ag</sub>(36.9dB)-P<sub>cl</sub>(3.1dB) = 24.57dBm

**LTE Band 12 - ERP 27.50(c)(10)**

Limits: ≤34.77dBm (3W)

**LTE Band 12\_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(dBd)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
699.70	-14.39	2.8	37.1	4.7	24.61	34.77	10.16	H
707.50	-14.15	2.8	37.1	4.7	24.85	34.77	9.92	H
715.30	-14.21	2.8	37.3	4.5	24.79	34.77	9.98	H

**LTE Band 12\_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(dBd)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
700.50	-14.35	2.8	37.1	4.7	24.65	34.77	10.12	H
707.50	-14.23	2.8	37.1	4.7	24.77	34.77	10	H
714.50	-14.13	2.8	37.1	4.5	24.67	34.77	10.1	H

**LTE Band 12\_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(dBd)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
701.50	-14.68	2.8	37.1	4.7	24.32	34.77	10.45	H
707.50	-14.43	2.8	37.1	4.7	24.57	34.77	10.2	H
713.50	-14.17	2.8	37.1	4.5	24.63	34.77	10.14	H

**LTE Band 12\_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(dBd)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
704.00	-14.68	2.8	37.1	4.7	24.32	34.77	10.45	H
707.50	-14.32	2.8	37.1	4.7	24.68	34.77	10.09	H
711.00	-14.37	2.8	37.1	4.5	24.43	34.77	10.34	H

**LTE Band 12\_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(dBd)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
699.70	-13.98	2.8	37.1	4.7	25.02	34.77	9.75	H
707.50	-14.29	2.8	37.1	4.7	24.71	34.77	10.06	H
715.30	-14.06	2.8	37.3	4.5	24.94	34.77	9.83	H

**LTE Band 12\_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(dBd)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
700.50	-14.22	2.8	37.1	4.7	24.78	34.77	9.99	H
707.50	-14.33	2.8	37.1	4.7	24.67	34.77	10.1	H
714.50	-13.87	2.8	37.1	4.5	24.93	34.77	9.84	H

**LTE Band 12\_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(dBd)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
701.50	-14.44	2.8	37.1	4.7	24.56	34.77	10.21	H
707.50	-14.37	2.8	37.1	4.7	24.63	34.77	10.14	H
713.50	-14.3	2.8	37.1	4.5	24.5	34.77	10.27	H

**LTE Band 12\_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(dBd)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
704.00	-14.63	2.8	37.1	4.7	24.37	34.77	10.4	H
707.50	-14.47	2.8	37.1	4.7	24.53	34.77	10.24	H
711.00	-14.16	2.8	37.1	4.5	24.64	34.77	10.13	H

Peak ERP(dBm)=P<sub>Mea</sub>(-14.16dBm)+G<sub>a</sub>(4.5dB)<sub>i</sub>+P<sub>Ag</sub>(37.1dB)-P<sub>cl</sub>(2.8dB) = 24.64dBm

**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.

## ANNEX A.2. EMISSION LIMIT

### Reference

FCC: CFR 2.1051, 22.917,24.238(a), 27.53(g), 27.53(h) , 27.53(m).

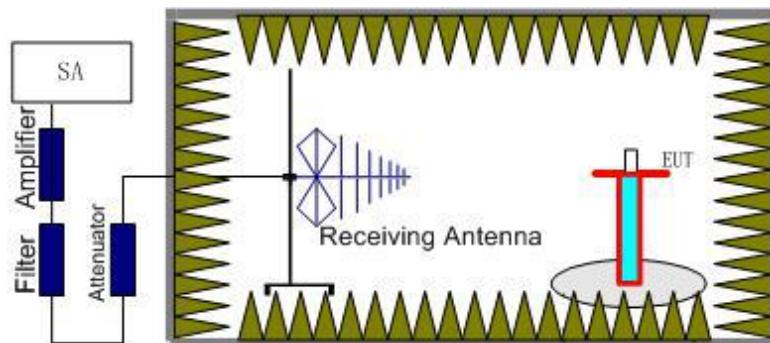
### A.2.1 Measurement Method

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

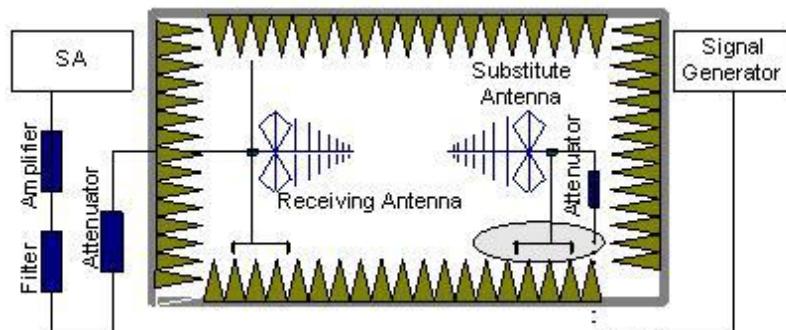
The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier. The resolution bandwidth is set 1MHz as outlined in Part 22.917,Part 24.238(a), Part 27.53(g), Part 27.53(h), Part 27.53(m). The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the LTE Bands 2,4,5,12.

**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,  $ERP = EIRP - 2.15dB$ .

### A.2.2 Measurement Limit

Part 22.917, Part 24.238(a), Part 27.53(g), Part 27.53(h), Part 27.53(m) 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  $43 + 10 \log(P)$  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

7. Radiated emissions measurements were made only at the upper, middle, and lower carrier frequencies of the LTE Bands 2,4,5,12. 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 2,4,5,12. into any of the other blocks. The equipment must still, however, meet emissions requirements with the carrier at all frequencies over which it is capable of operating and it is the manufacturer's responsibility to verify this. The evaluated frequency range is from 30MHz to 26GHz.

#### LTE Band 2, 1.4MHz, QPSK, Channel 18607

Frequenc y (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarizati on
3700.4	-35.9	6.6	7.7	-34.8	-13	V

5550.0	-39.41	8.2	9.5	-38.11	-13	H
7400.8	-40.28	9.7	14.6	-35.38	-13	H
11100.8	-45.18	12.1	18.1	-39.18	-13	H
14299.8	-48.25	13.6	23.5	-38.35	-13	V
16289.2	-41.35	14.7	20.9	-35.15	-13	H

**LTE Band 2, 1.4MHz, QPSK, Channel 18900**

Frequenc y (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarizati on
3758.8	-40.7	6.6	7.7	-39.6	-13	H
5638.8	-43.63	8.3	10.5	-41.43	-13	H
7518.4	-44.9	9.7	14.6	-40	-13	H
9248.0	-54.05	10.6	18.5	-46.15	-13	H
13035.6	-47.68	13.2	20.2	-40.68	-13	V
16594.4	-40.24	14.9	20.1	-35.04	-13	H

**LTE Band 2, 1.4MHz, QPSK, Channel 19193**

Frequenc y (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarizati on
3817.6	-44.97	6.7	7.7	-43.97	-13	H
5726.4	-31.9	8.5	10.5	-29.9	-13	H
7635.2	-46.53	9.7	15.3	-40.93	-13	H
10796.4	-48.99	11.7	17.3	-43.39	-13	H
14315.2	-47.52	13.6	23.5	-37.62	-13	H
16863.2	-38.56	16.3	20.0	-34.86	-13	H

**LTE Band 4, 1.4MHz QPSK, Channel 19957**

Frequenc y (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarizati on
3428.8	-40.37	6.4	4.7	-42.07	-13	V
5143.6	-41.35	7.9	8.7	-40.55	-13	H
6858.4	-44.3	9.2	12.3	-41.2	-13	H
8572.4	-54.12	10.3	18.1	-46.32	-13	H
10810.0	-48.27	11.7	17.3	-42.67	-13	H
13618.0	-48.8	13.8	23.4	-39.2	-13	V

**LTE Band 4, 1.4MHz, QPSK, Channel 20175**

Frequenc y (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarizati on
3464.0	-33.95	6.4	4.7	-35.65	-13	H
5196.0	-35.47	8.0	8.7	-34.77	-13	H
6928.0	-35.7	9.3	12.9	-32.1	-13	H
8660.0	-48.5	10.3	18.5	-40.3	-13	H
10392.4	-48.87	11.6	17.1	-43.37	-13	H
12947.4	-47.36	13.0	20.2	-40.16	-13	H

**LTE Band 4, 1.4MHz, QPSK, Channel 20393**

Frequenc y (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarizati on
3498.8	-35.19	6.4	4.7	-36.89	-13	H
5248.4	-38.64	8.0	8.7	-37.94	-13	H
6998.4	-40.22	9.3	12.9	-36.62	-13	H
8747.6	-53.9	10.4	18.5	-45.8	-13	H
11260.4	-49.56	12.1	18.5	-43.16	-13	V
14299.8	-47.78	13.6	23.5	-37.88	-13	H

## LTE Band 5, 1.4MHz, QPSK, Channel 20407

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
1657.0	-43.96	4.3	2.9	-45.36	-13	H
2587.3	-38.04	5.5	3.7	-39.84	-13	V
3572.8	-50.39	6.4	4.7	-52.09	-13	V
5800.0	-49.36	8.4	10.5	-47.26	-13	H
7456.3	-52.29	9.7	14.6	-47.39	-13	H
9132.1	-53.89	10.5	18.5	-45.89	-13	V

## LTE Band 5, 1.4MHz, QPSK, Channel 20525

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
1828.3	-39.48	4.6	2.9	-41.18	-13	H
2588.5	-38.94	5.5	3.7	-40.74	-13	H
3574.8	-48.68	6.4	4.7	-50.38	-13	H
4516.8	-50.6	7.3	7.3	-50.6	-13	H
5567.2	-53	8.2	9.5	-51.7	-13	V
7076.2	-52.46	9.4	12.9	-48.96	-13	V

## LTE Band 5, 1.4MHz, QPSK, Channel 20643

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
1687.1	-44.1	4.4	2.9	-45.6	-13	H
2530.8	-36.49	5.4	3.7	-38.19	-13	H
3574.8	-49.47	6.4	4.7	-51.17	-13	H
4560.0	-50.8	7.4	7.3	-50.9	-13	H
5904.8	-48.59	8.5	10.4	-46.69	-13	H
8170.3	-55.04	10.0	17.3	-47.74	-13	H

**LTE Band 12, 1.4MHz, QPSK, Channel 23017**

Frequenc y (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarizati on
1407.0	-40.92	4.0	3.4	-41.52	-13	H
1835.6	-40.55	4.6	2.9	-42.25	-13	H
2814.2	-31.56	5.7	4.1	-33.16	-13	H
3517.6	-27.2	6.4	4.7	-28.9	-13	V
4221.2	-42.91	7.0	7.7	-42.21	-13	V
5269.2	-52.22	8.0	8.7	-51.52	-13	V

**LTE Band 12, 1.4MHz, QPSK, Channel 23095**

Frequenc y (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarizati on
1414.0	-38.23	4.0	3.4	-38.83	-13	H
1844.6	-39.81	4.6	2.9	-41.51	-13	V
2828.1	-30.32	5.8	4.1	-32.02	-13	H
3535.2	-20.46	6.4	4.7	-22.16	-13	V
4242.4	-41.46	7.1	7.7	-40.86	-13	V
5818.0	-52.64	8.4	10.5	-50.54	-13	H

**LTE Band 12, 1.4MHz, QPSK, Channel 23173**

Frequenc y (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarizati on
1420.9	-43.4	4.0	3.4	-44	-13	H
1833.2	-39.35	4.6	2.9	-41.05	-13	H
2842.3	-32.49	5.8	4.1	-34.19	-13	H
3552.4	-25.49	6.4	4.7	-27.19	-13	V
4263.2	-43.62	7.1	7.7	-43.02	-13	V
5482.4	-52.03	8.2	9.5	-50.73	-13	V

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

## ANNEX A.3. FREQUENCY STABILITY

### Reference

FCC: CFR Part 2.1055, 22.235, 24.235, 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 for LTE band 2/4/5/12, 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 0.1 Volt 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 decrements 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. This accuracy is sufficient to meet Sec. 24.235, Frequency Stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. As this transceiver is considered "Hand carried, battery powered equipment" Section 2.1055(d) (2) applies. This requires that the lower voltage for frequency stability testing be specified by the manufacturer. This transceiver is specified to operate with an input voltage of between 3.4VDC and 4.4VDC, with a nominal voltage of 3.9VDC. 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. For the purposes of measuring frequency stability these voltage limits are to be used.

**A.3.3 Measurement results****LTE Band 2, 1.4MHz bandwidth (worst case of all bandwidths)****Frequency Error vs Voltage**

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.4	-6.11	-6.69	0	0
3.9	-6.58	6.32	0	0
4.4	-6.41	9.31	0	0.01

**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	-5.75	6.82	0	0
40°	-6.07	-8.14	0	0
30°	-5.61	6.85	0	0
20°	-4.59	-6.21	0	0
10°	-8.13	-6.91	0	0
0°	-6.27	-6.78	0	0
-10°	-4.65	-9.54	0	0.01
-20°	8.64	8.64	0	0.01
-30°	-6.91	-6.27	0	0

**LTE Band 4, 1.4MHz bandwidth (worst case of all bandwidths)****Frequency Error vs Voltage**

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.4	3.62	-12.23	0	0.01
3.9	3.1	-13.12	0	0.01
4.4	-2.25	-13.28	0	0.01

**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	3.91	-14.22	0	0.01
40°	3.58	-13.16	0	0.01
30°	4.81	-13.78	0	0.01
20°	4.23	-12.36	0	0.01
10°	-5.94	-13.15	0	0.01
0°	3.08	-11.43	0	0.01
-10°	3.75	-13.7	0	0.01
-20°	-3.92	-13.46	0	0.01
-30°	5.68	-12.76	0	0.01

**LTE Band 5, 1.4MHz bandwidth (worst case of all bandwidths)**
**Frequency Error vs Voltage**

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.4	-1.69	-15.72	0	0.02
3.9	2.69	-14.58	0	0.02
4.4	-2.35	-13.5	0	0.02

**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	2.65	-12.73	0	0.02
40°	2.69	-13.65	0	0.02
30°	-3.71	-14.62	0	0.02
20°	-2.12	-12.93	0	0.02
10°	-1.86	-12.8	0	0.02
0°	1.9	-13.26	0	0.02
-10°	-1.92	-12.9	0	0.02
-20°	-2.6	-14.03	0	0.02
-30°	-2.6	-12.73	0	0.02

**LTE Band 12, 1.4MHz bandwidth (worst case of all bandwidths)**
**Frequency Error vs Voltage**

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.4	-3.28	10.39	0.01	0.02
3.9	-2.5	9.4	0	0.01
4.4	-2.2	8.44	0	0.01

**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	-2.3	9.53	0	0.01
40°	-2.07	9.18	0	0.01
30°	-2.45	9.76	0	0.01
20°	-2.22	8.97	0	0.01
10°	-1.67	9.61	0	0.01
0°	2.35	9.66	0	0.01
-10°	-3.36	8.85	0.01	0.01
-20°	-2.6	9.17	0	0.01
-30°	-2.76	10.81	0	0.02

## ANNEX A.4. OCCUPIED BANDWIDTH

### Reference

FCC: CFR Part 2.1049(h)(i)

#### A.4.1 Occupied Bandwidth Results

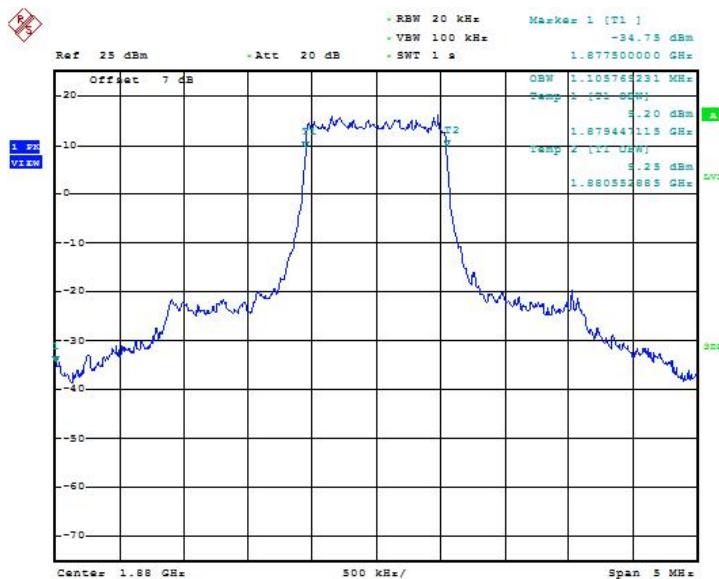
Occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of the US Cellular/PCS frequency bands. The table below lists the measured 99% BW. Spectrum analyzer plots are included on the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

The measurement method is from KDB 971168 4:

- 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.

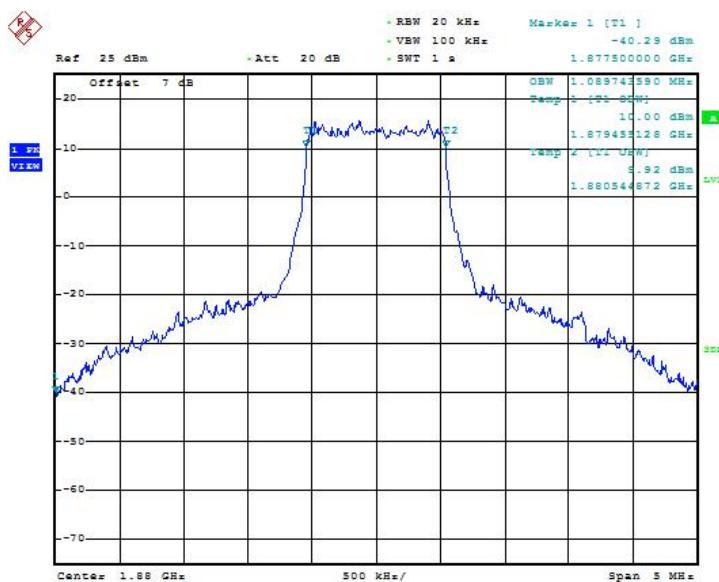
#### LTE band 2, 1.4MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	QPSK	16QAM
1880.0	1.106	1.109



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Fig.1 LTE band 2, 1.4MHz Bandwidth, QPSK (99% BW)

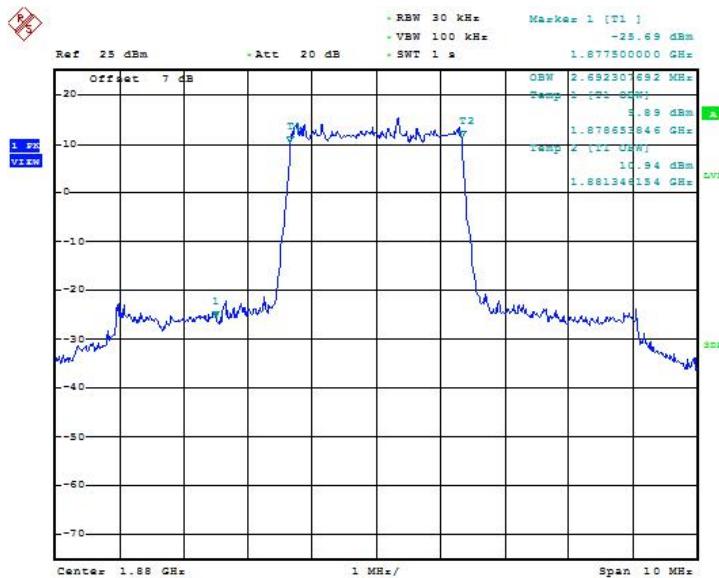


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Fig.2 LTE band 2, 1.4MHz Bandwidth, 16QAM (99% BW)

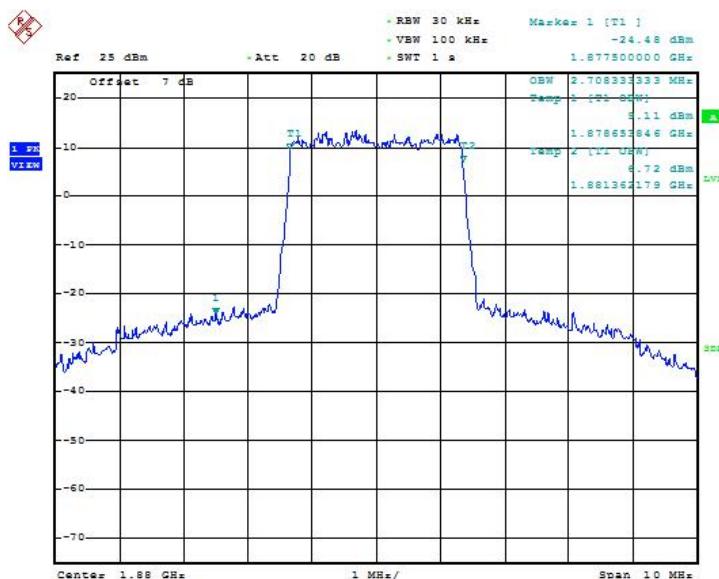
**LTE band 2, 3MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	QPSK	16QAM
1880.0	2.692	2.708



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

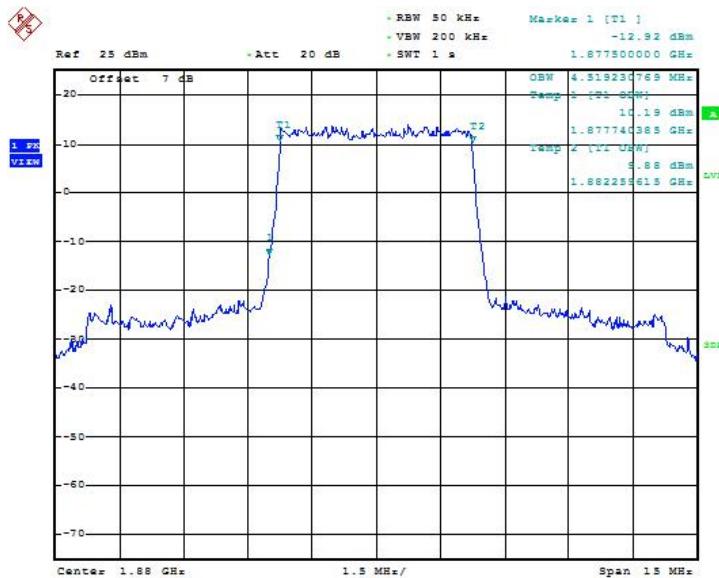


Date: 24.OCT.2018 13:31:06

Fig.4 LTE band 2, 3MHz Bandwidth, 16QAM (99% BW)

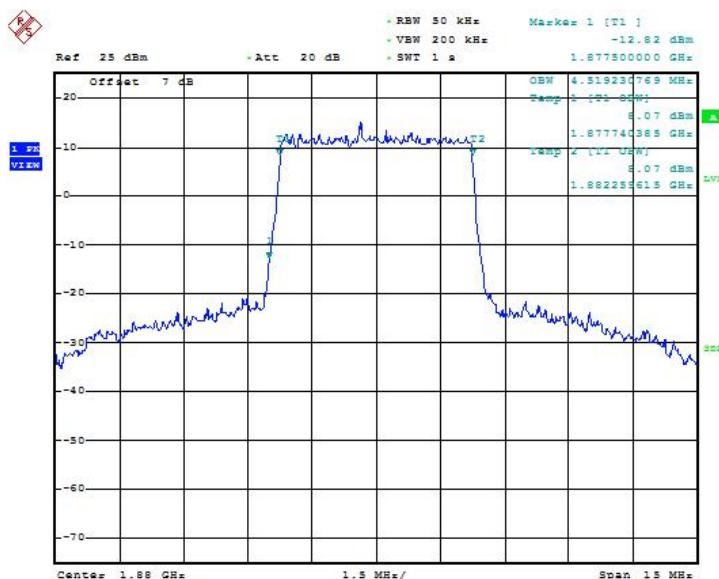
**LTE band 2, 5MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	QPSK	16QAM
1880.0	4.519	4.519



Date: 24.OCT.2018 13:32:09

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

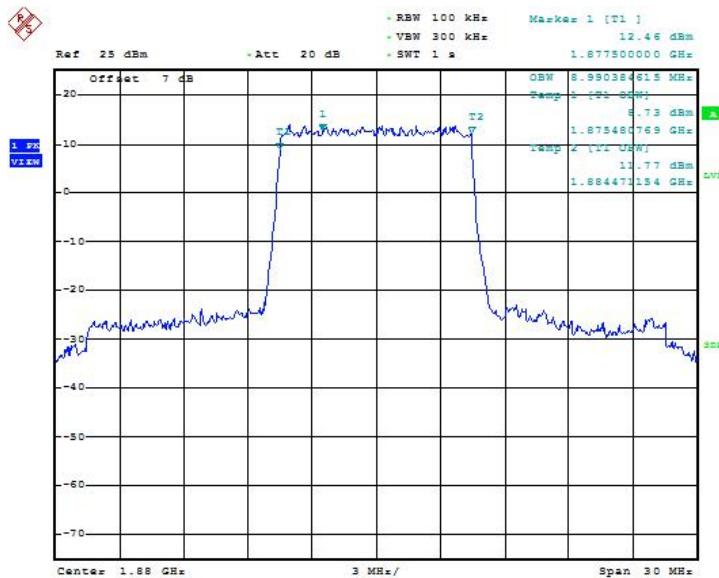


Date: 24.OCT.2018 13:33:04

Fig.6 LTE band 2, 5MHz Bandwidth,16QAM (99% BW)

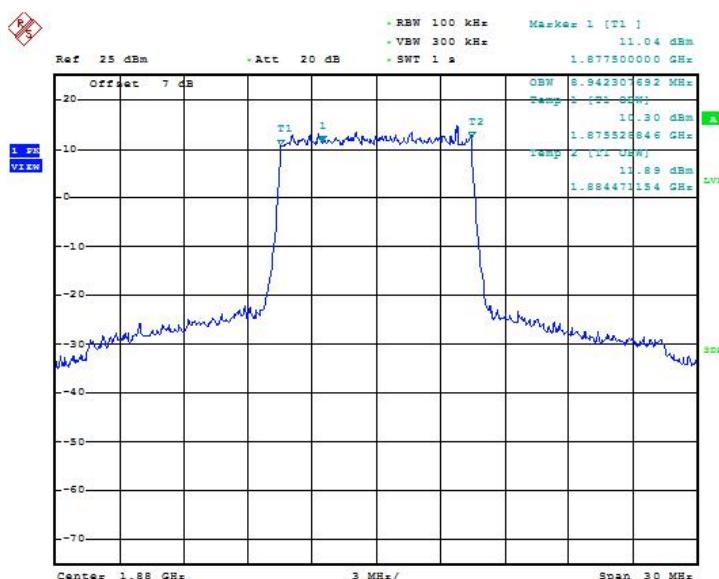
**LTE band 2, 10MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	QPSK	16QAM
1880.0	8.99	8.942



Date: 24.OCT.2018 13:34:08

Fig.7 LTE band 2, 10MHz Bandwidth, QPSK (99% BW)

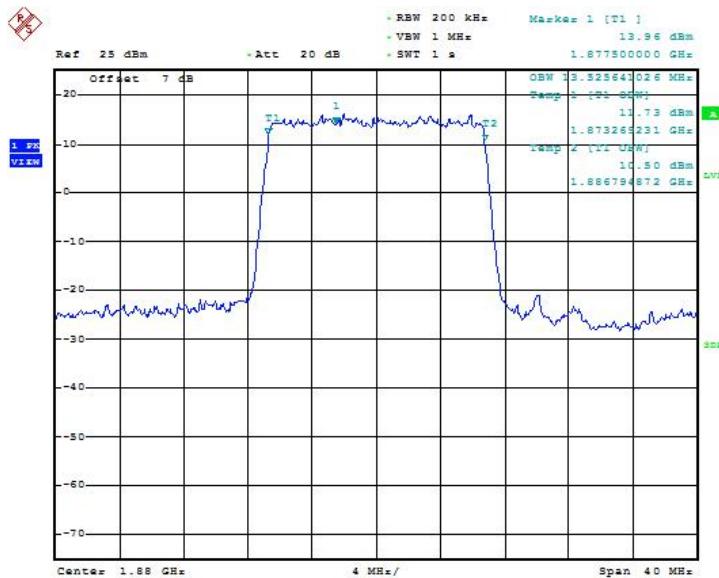


Date: 24.OCT.2018 13:35:03

Fig.8 LTE band 2, 10MHz Bandwidth, 16QAM (99% BW)

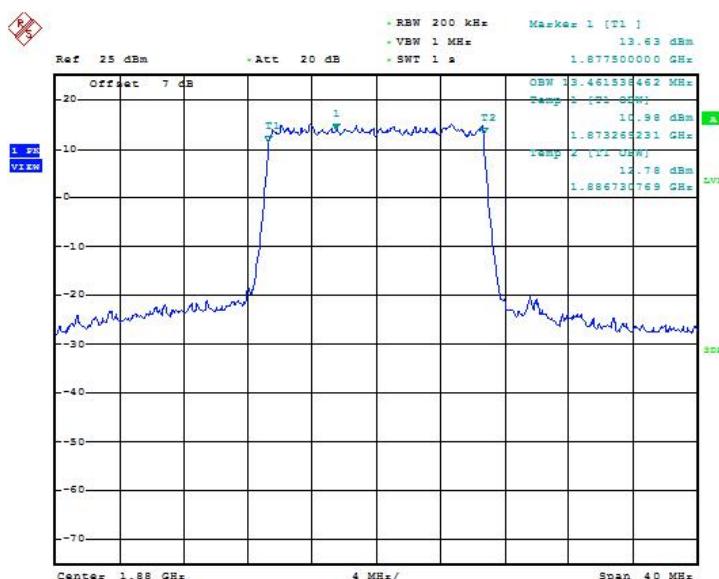
**LTE band 2, 15MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
1880.0	QPSK	16QAM
	13.526	13.462



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Fig.9 LTE band 2, 15MHz Bandwidth, QPSK (99% BW)

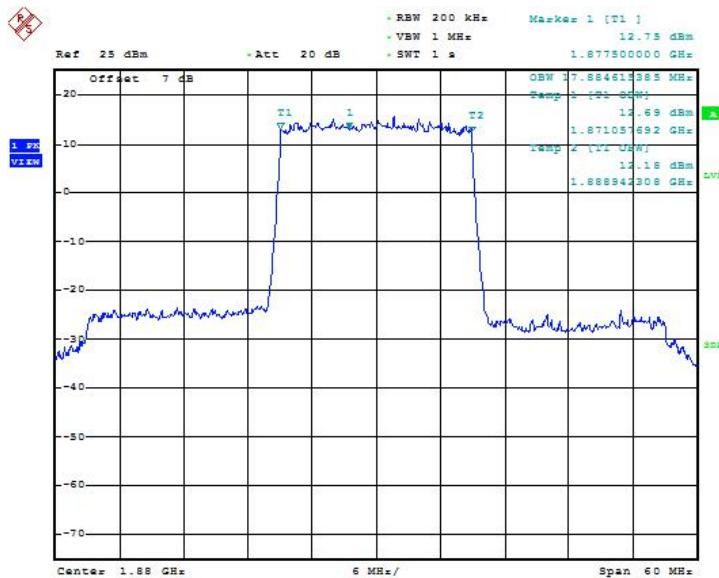
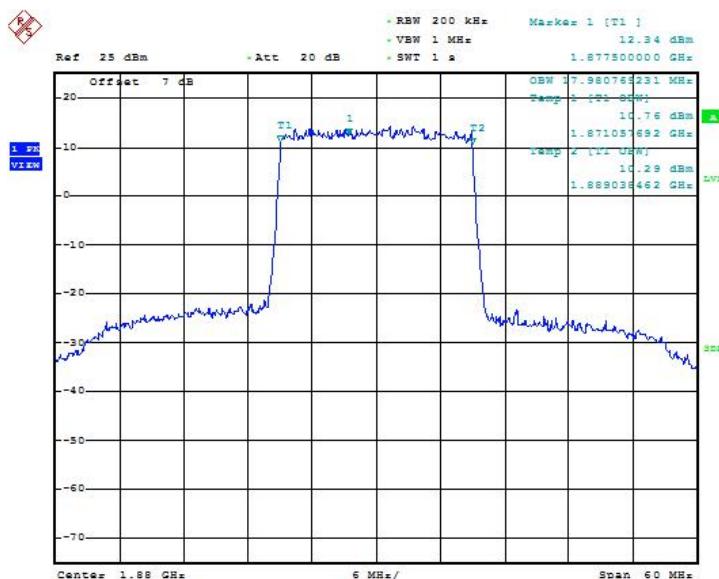


Date: 24.OCT.2018 13:37:02

Fig.10 LTE band 2, 15MHz Bandwidth, 16QAM (99% BW)

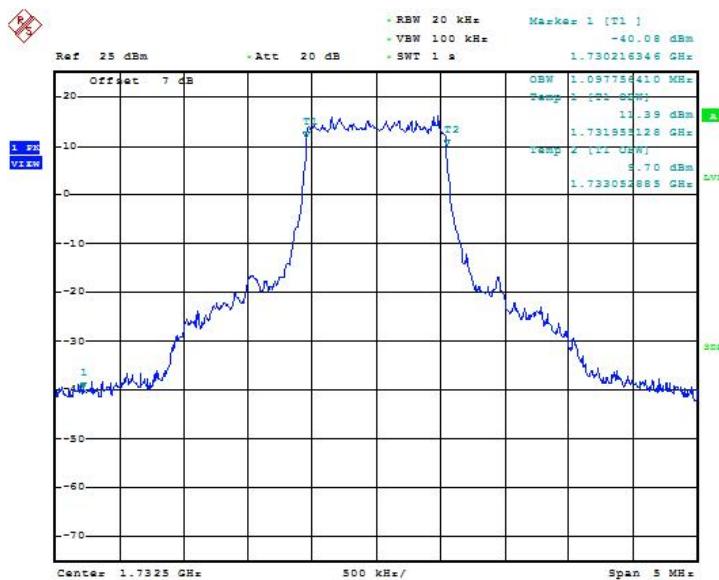
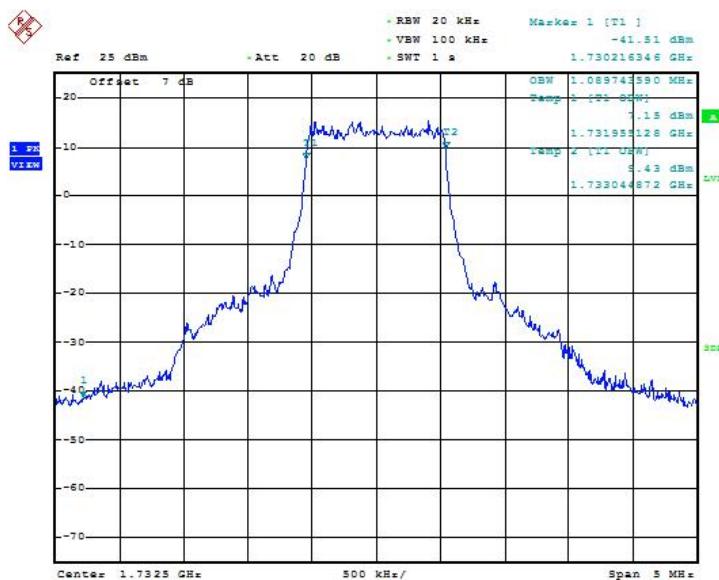
**LTE band 2, 20MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
1880.0	QPSK	16QAM
	17.885	17.981


**Fig.11 LTE band 2, 20MHz Bandwidth, QPSK (99% BW)**

**Fig.12 LTE band 2, 20MHz Bandwidth, 16QAM (99% BW)**

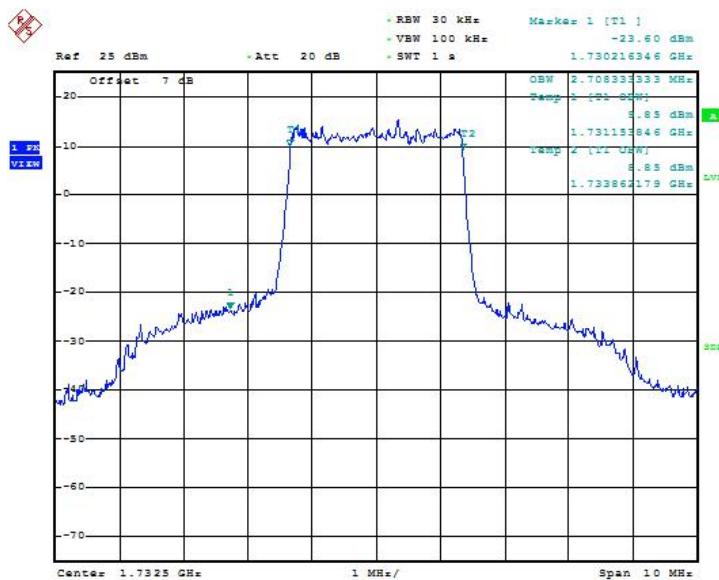
**LTE band 4, 1.4MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	QPSK	16QAM
	1.098	1.09


**Fig.13 LTE band 4, 1.4MHz Bandwidth, QPSK (99% BW)**

**Fig.14 LTE band 4, 1.4MHz Bandwidth, 16QAM (99% BW)**

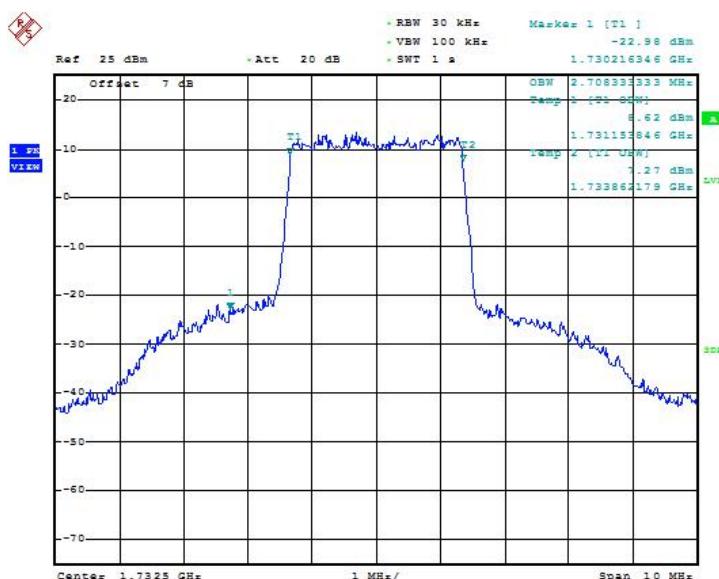
**LTE band 4, 3MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	QPSK	16QAM
1732.5	2.708	2.708



Date: 24.OCT.2018 13:16:44

Fig.15 LTE band 4, 3MHz Bandwidth, QPSK (99% BW)

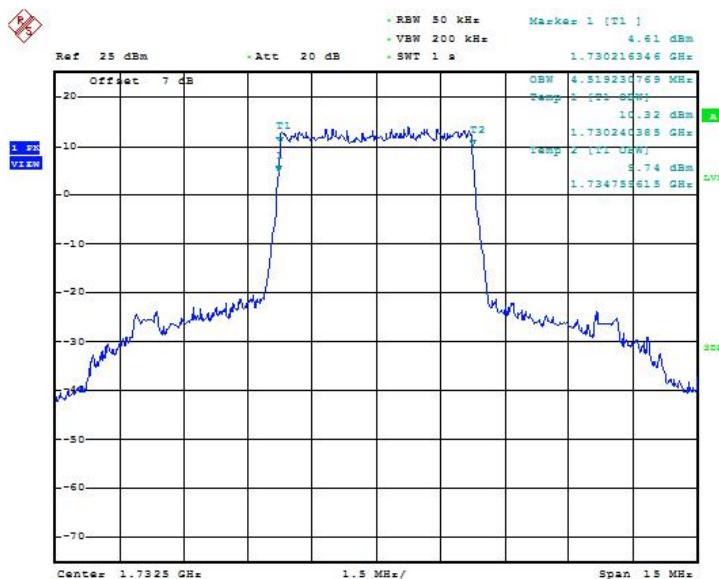


Date: 24.OCT.2018 13:17:39

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

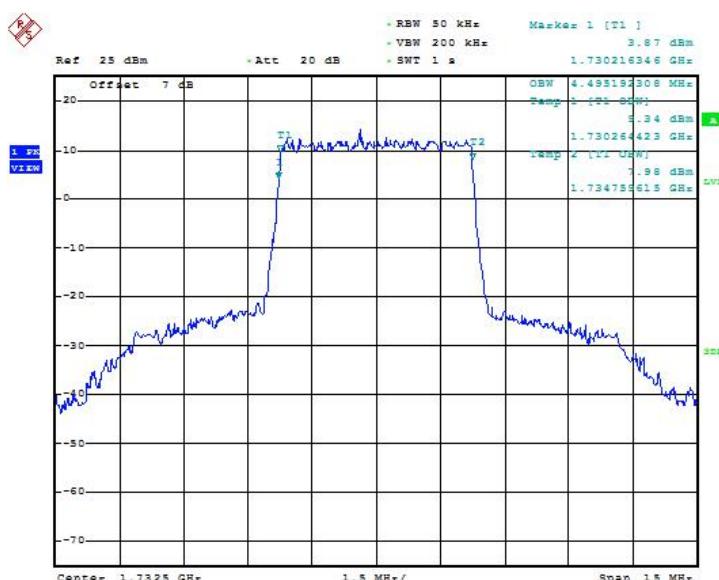
**LTE band 4, 5MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
1732.5	QPSK	16QAM
	4.519	4.495



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Fig.17 LTE band 4, 5MHz Bandwidth, QPSK (99% BW)

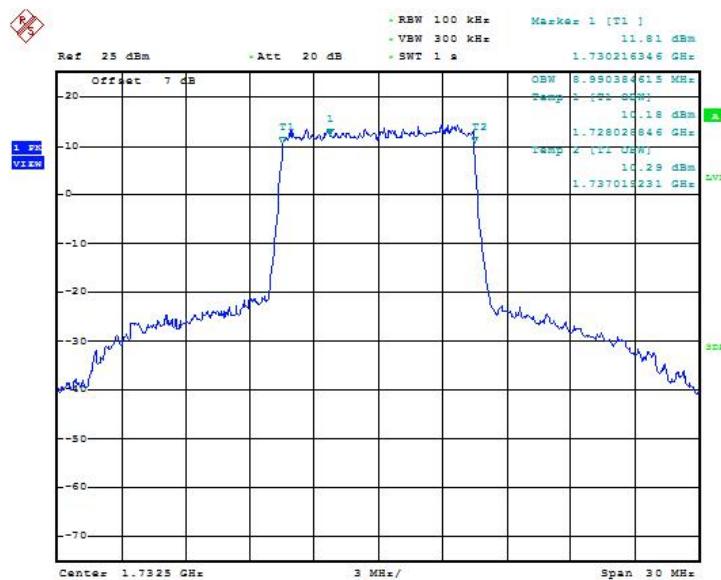


Date: 24.OCT.2018 13:19:38

Fig.18 LTE band 4, 5MHz Bandwidth,16QAM (99% BW)

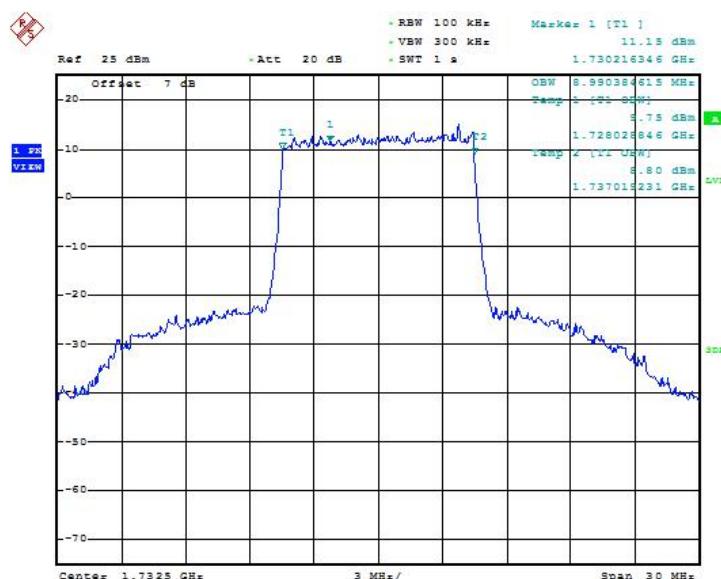
## LTE band 4, 10MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
1732.5	QPSK	16QAM
	8.99	8.99



Date: 24.OCT.2018 13:20:42

Fig.19 LTE band 4, 10MHz Bandwidth, QPSK (99% BW)

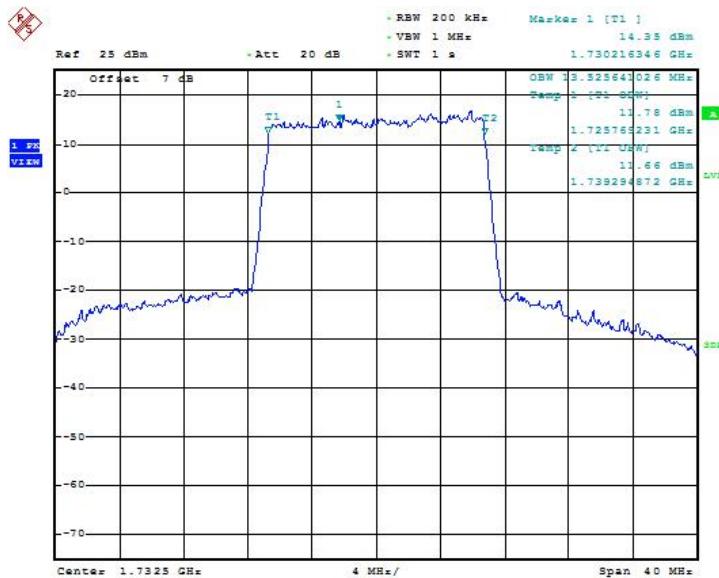


Date: 24.OCT.2018 13:21:37

Fig.20 LTE band 4, 10MHz Bandwidth, 16QAM (99% BW)

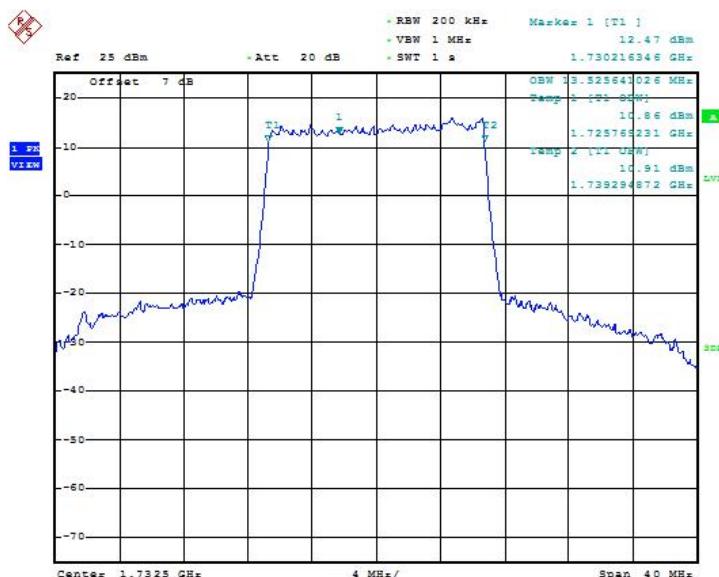
**LTE band 4, 15MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
1732.5	QPSK	16QAM
	13.526	13.526



Date: 24.OCT.2018 13:22:42

Fig.21 LTE band 4, 15MHz Bandwidth, QPSK (99% BW)

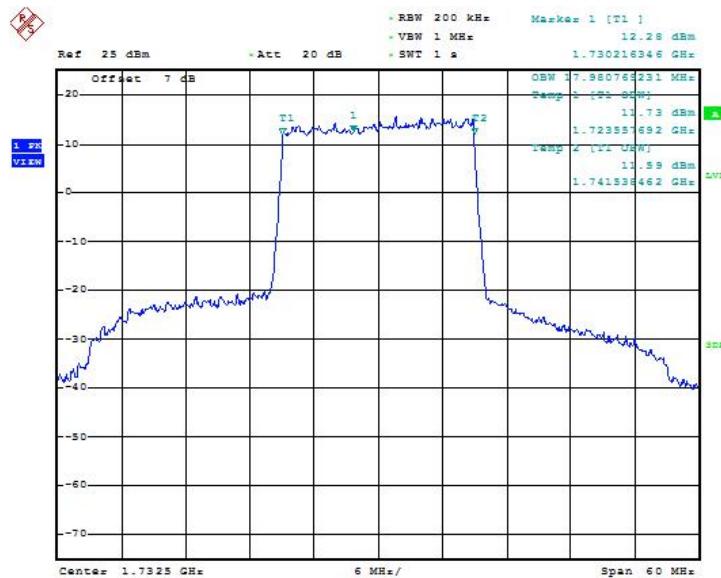
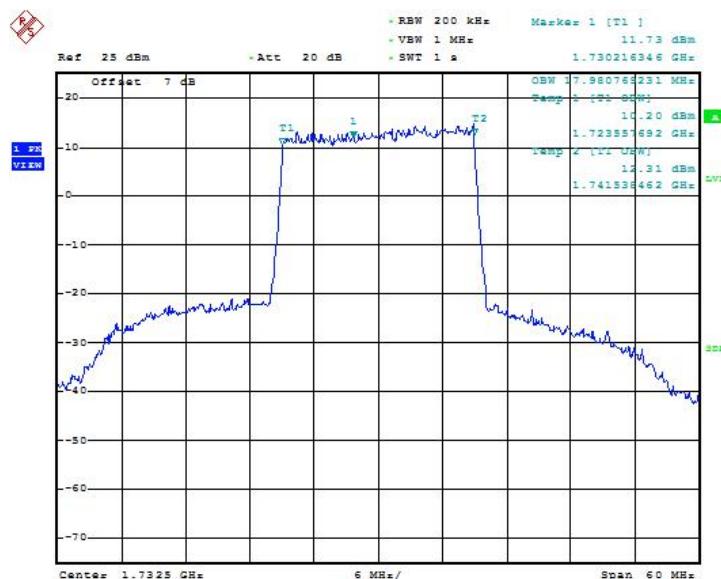


Date: 24.OCT.2018 13:29:37

Fig.22 LTE band 4, 15MHz Bandwidth, 16QAM (99% BW)

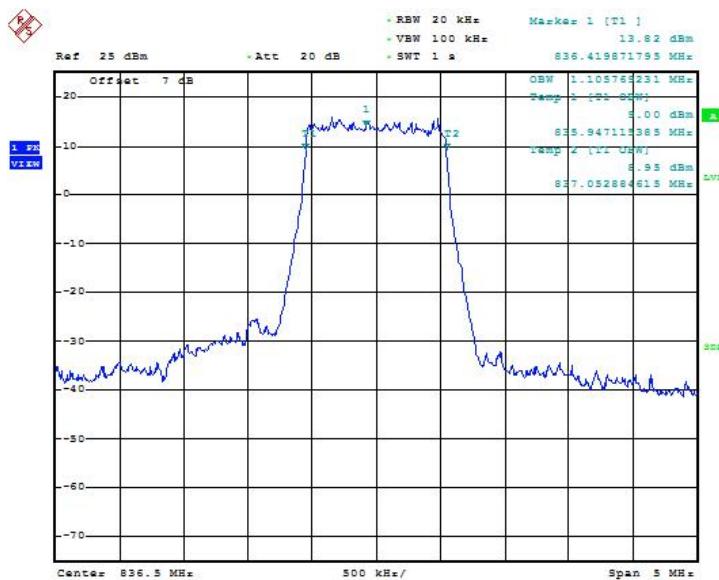
**LTE band 4, 20MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
1732.5	QPSK	16QAM
	17.981	17.981


**Fig.23** LTE band 4, 20MHz Bandwidth, QPSK (99% BW)

**Fig.24** LTE band 4, 20MHz Bandwidth, 16QAM (99% BW)

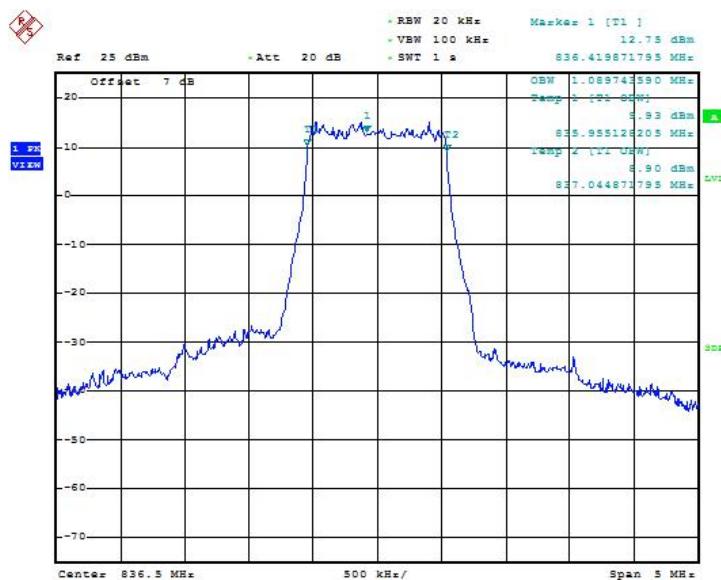
**LTE band 5, 1.4MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	QPSK	16QAM
836.5	1.106	1.09



Date: 24.OCT.2018 13:05:42

Fig.25 LTE band 5, 1.4MHz Bandwidth, QPSK (99% BW)

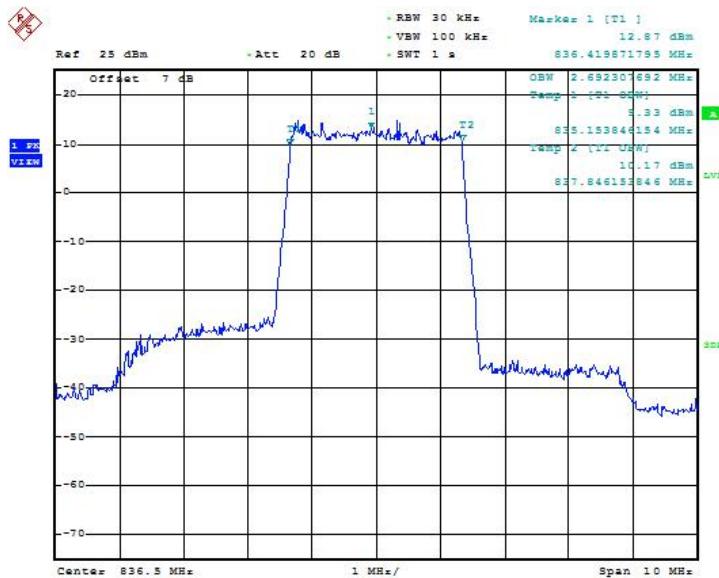
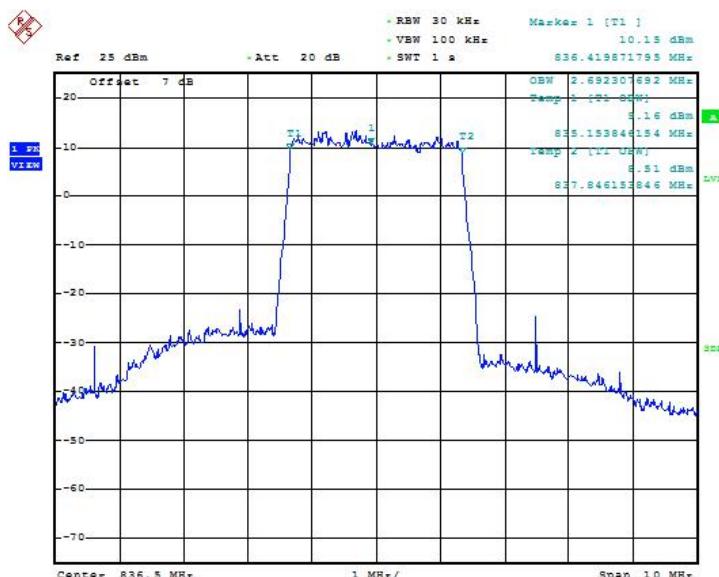


Date: 24.OCT.2018 13:06:37

Fig.26 LTE band 5, 1.4MHz Bandwidth, 16QAM (99% BW)

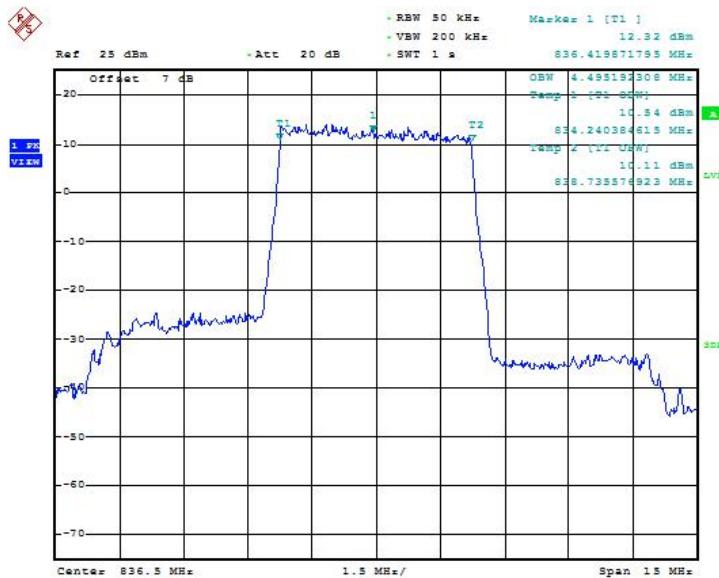
**LTE band 5, 3MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
836.5	QPSK	16QAM
	2.692	2.692


**Fig.27 LTE band 5, 3MHz Bandwidth, QPSK (99% BW)**

**Fig.28 LTE band 5, 3 MHz Bandwidth, 16QAM (99% BW)**

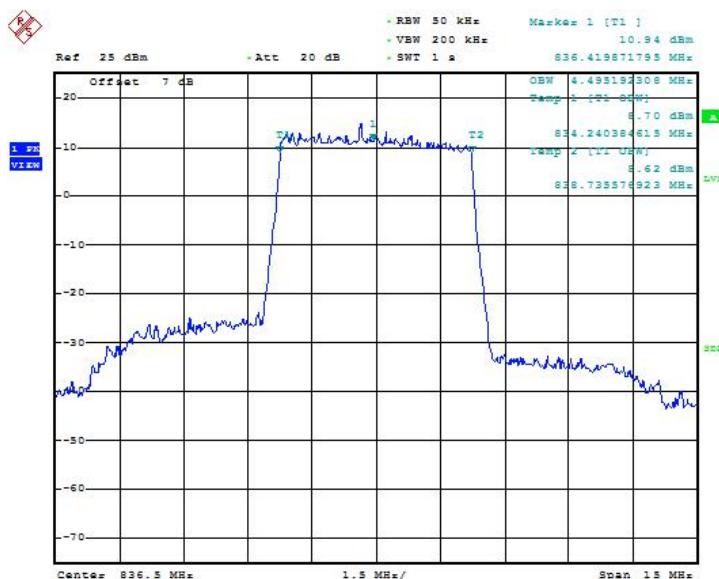
**LTE band 5, 5MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
836.5	QPSK	16QAM
	4.495	4.495



Date: 24.OCT.2018 13:09:40

Fig.29 LTE band 5, 5MHz Bandwidth, QPSK (99% BW)

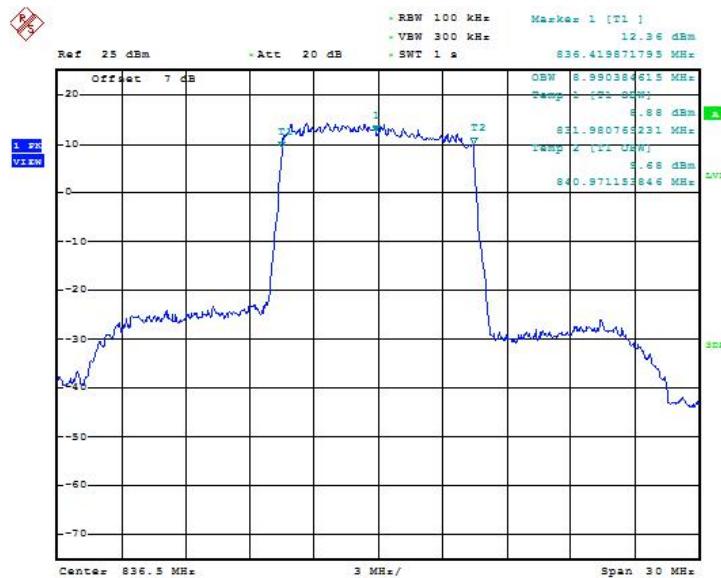


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Fig.30 LTE band 5, 5MHz Bandwidth, 16QAM (99% BW)

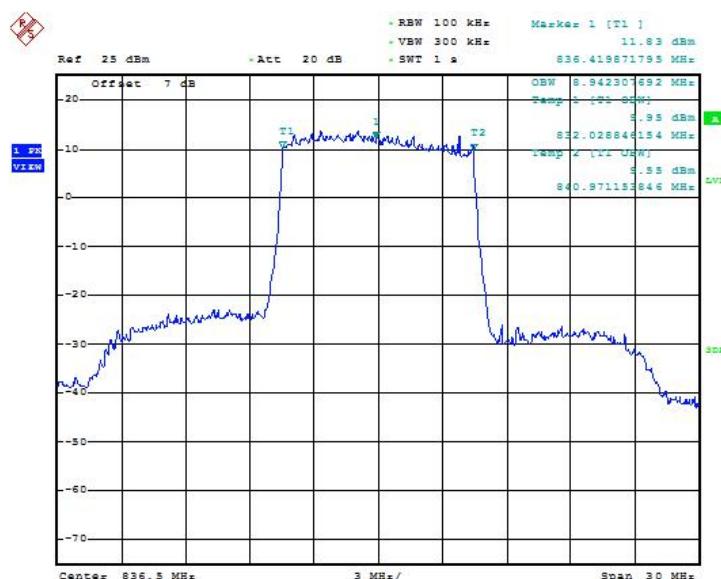
**LTE band 5, 10MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
836.5	QPSK	16QAM
	8.99	8.942



Date: 24.OCT.2018 13:11:40

Fig.31 LTE band 5, 10MHz Bandwidth, QPSK (99% BW)

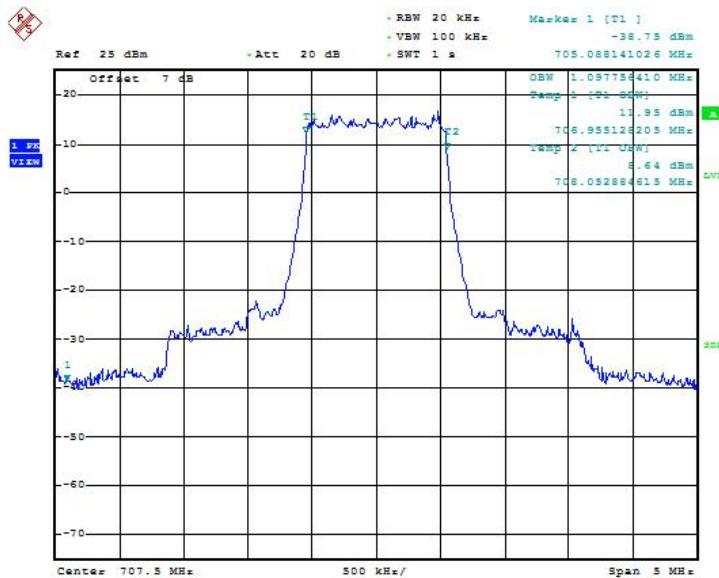


Date: 24.OCT.2018 13:12:35

Fig.32 LTE band 5, 10MHz Bandwidth, 16QAM (99% BW)

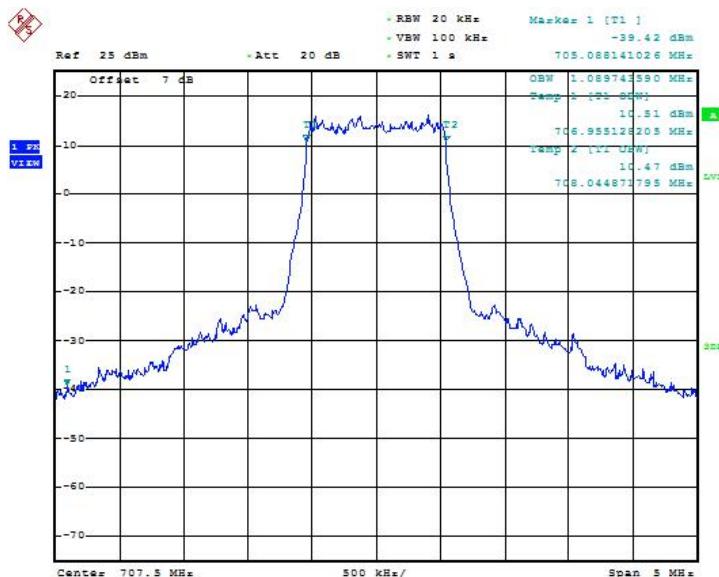
**LTE band 12, 1.4MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	QPSK	16QAM
707.5	1.098	1.09



Date: 24.OCT.2018 11:24:02

Fig.33 LTE band 12, 1.4MHz Bandwidth, QPSK (99% BW)

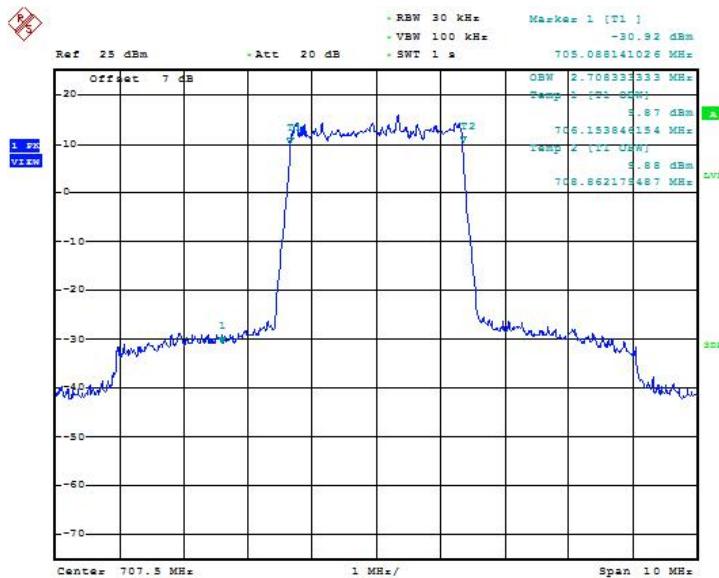
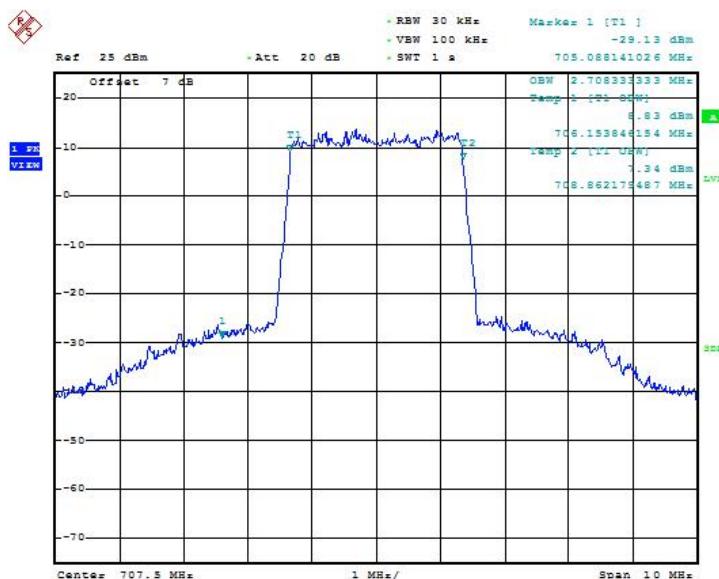


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Fig.34 LTE band 12, 1.4MHz Bandwidth, 16QAM (99% BW)

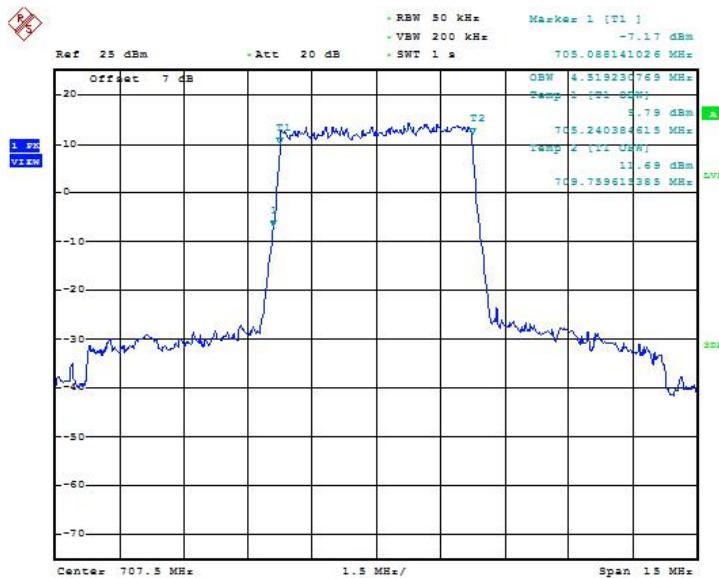
**LTE band 12, 3MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
707.5	QPSK	16QAM
	2.708	2.708


**Fig.35 LTE band 12, 3MHz Bandwidth, QPSK (99% BW)**

**Fig.36 LTE band 12, 3MHz Bandwidth, 16QAM (99% BW)**

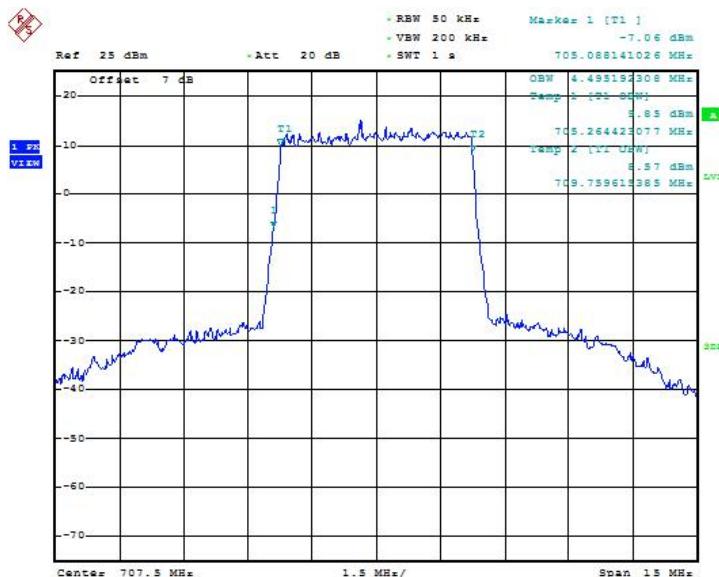
**LTE band 12, 5MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
707.5	QPSK	16QAM
	4.519	4.495



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Fig.37 LTE band 12, 3MHz Bandwidth, QPSK (99% BW)

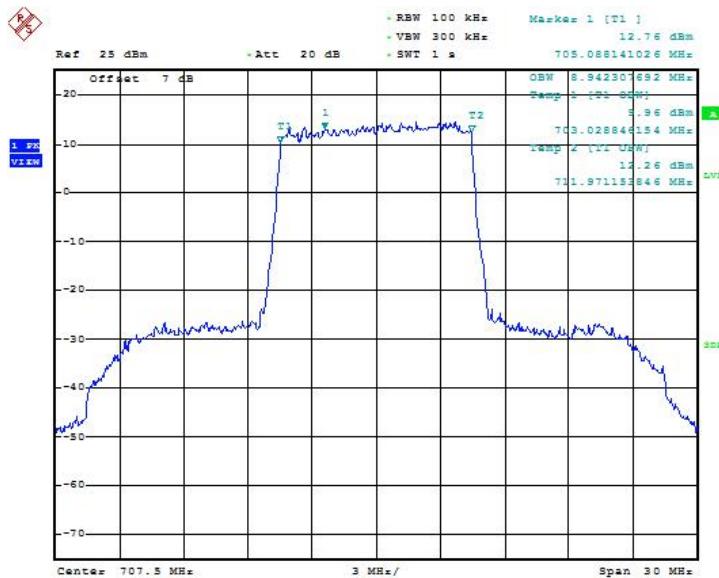


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Fig.38 LTE band 12, 3MHz Bandwidth, 16QAM (99% BW)

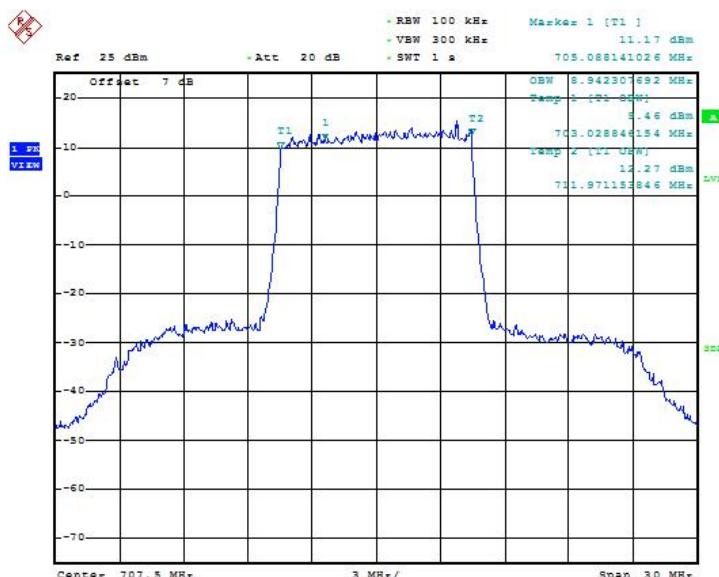
**LTE band 12, 10MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	QPSK	16QAM
707.5	8.942	8.942



Date: 24.OCT.2018 11:30:01

Fig.39 LTE band 12, 10MHz Bandwidth, QPSK (99% BW)



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Fig.40 LTE band 12, 10MHz Bandwidth, 16QAM (99% BW)

## ANNEX A.5. EMISSION BANDWIDTH

### Reference

FCC: CFR Part 22.917(b),24.238(a), 27.53(g),27.53(h), 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 2, 1.4MHz (-26dBc)

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	QPSK	16QAM
1880.0	1.338	1.354

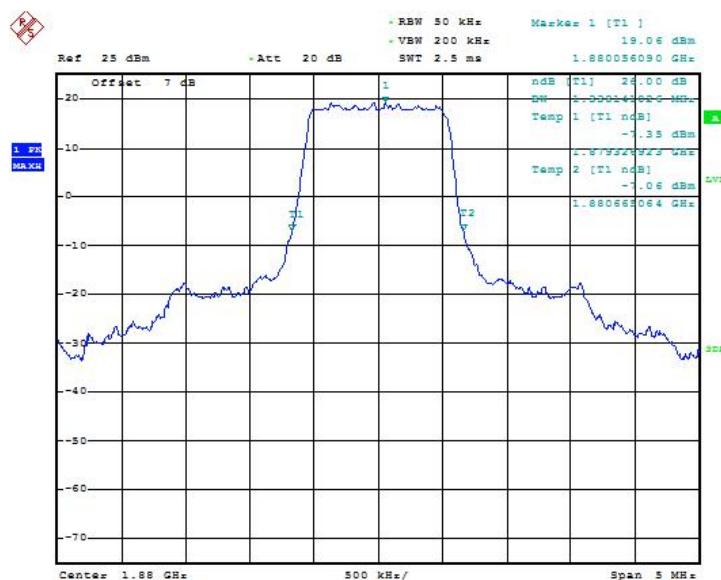
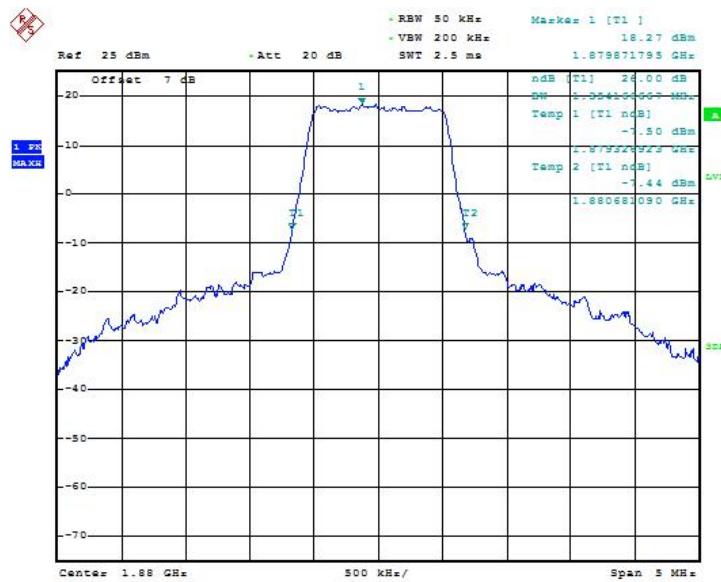


Fig.41 LTE band 2, 1.4MHz Bandwidth, QPSK (-26dBc BW)

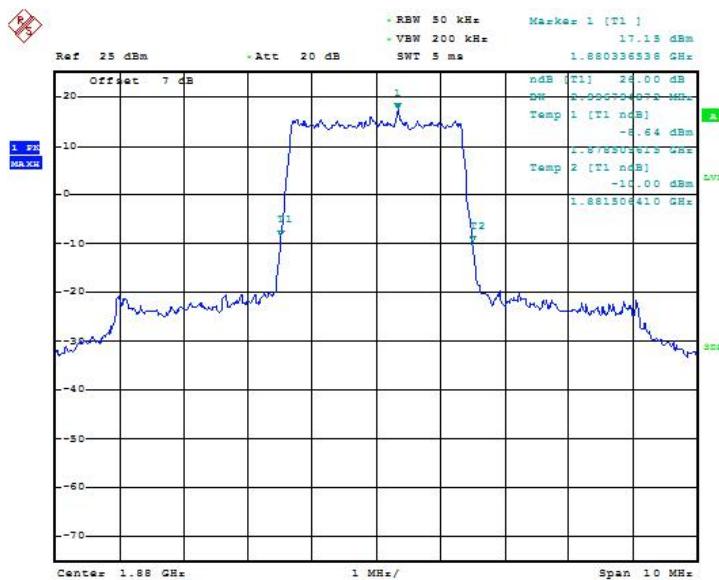
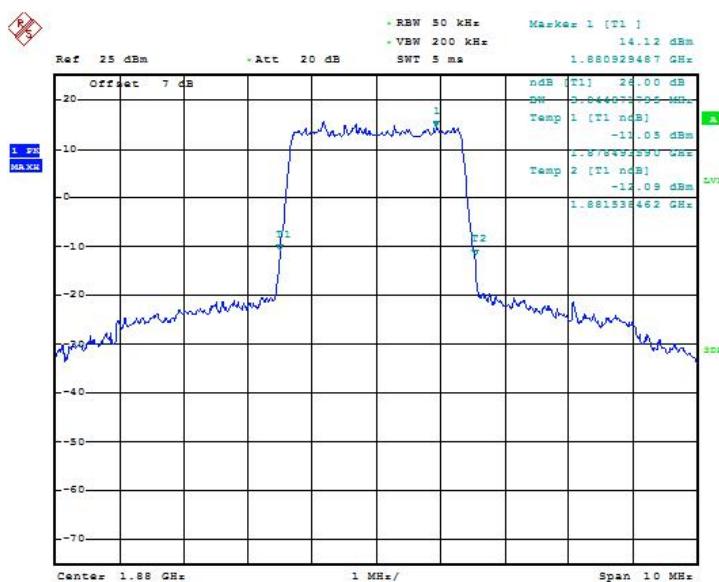


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Fig.42 LTE band 2, 1.4MHz Bandwidth, 16QAM (-26dBc BW)

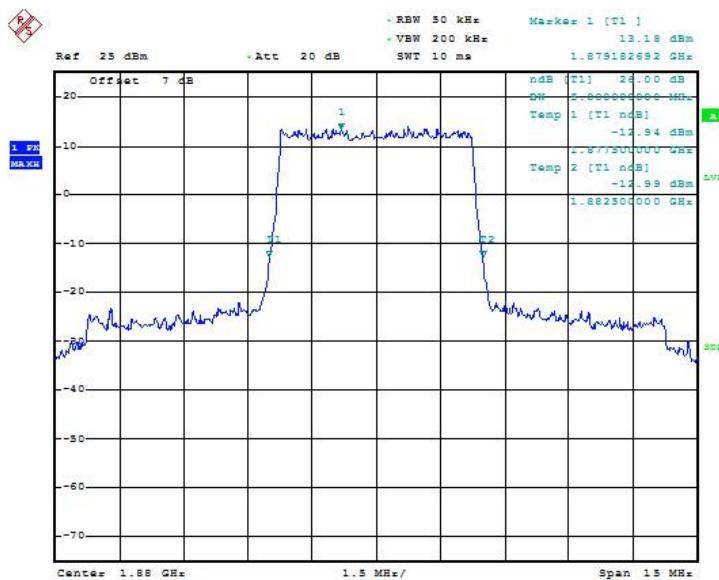
**LTE band 2, 3MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	QPSK	16QAM
1880.0	2.997	3.045


**Fig.43** LTE band 2, 3MHz Bandwidth, QPSK (-26dBc BW)

**Fig.44** LTE band 2, 3MHz Bandwidth, 16QAM (-26dBc BW)

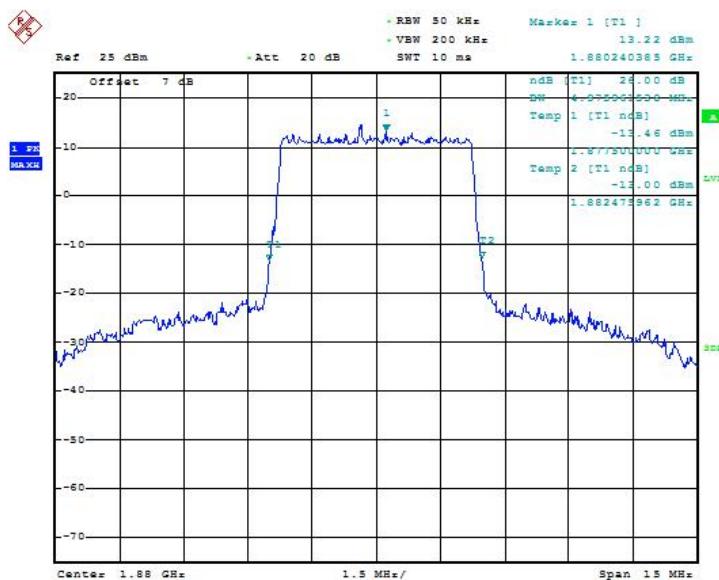
**LTE band 2, 5MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	QPSK	16QAM
	5	4.976



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Fig.45 LTE band 2, 5MHz Bandwidth, QPSK (-26dBc BW)

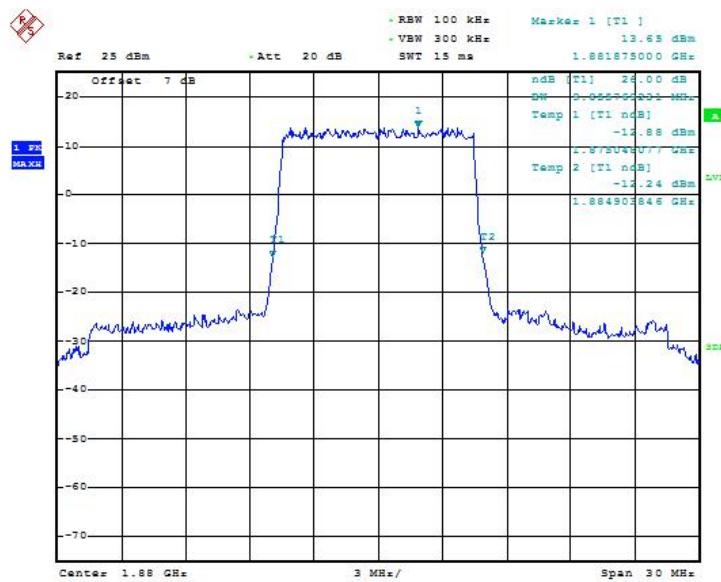


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Fig.46 LTE band 2, 5MHz Bandwidth, 16QAM (-26dBc BW)

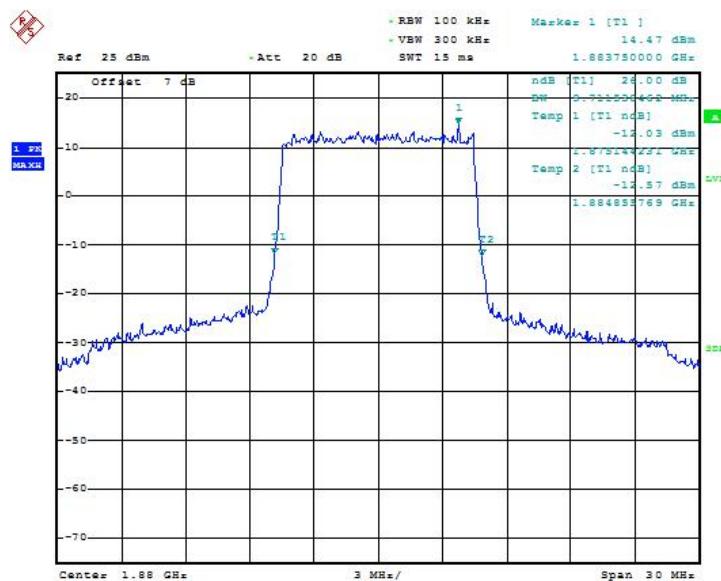
## LTE band 2, 10MHz (-26dBc)

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
1880.0	QPSK	16QAM
	9.856	9.712



Date: 24.OCT.2018 10:40:07

Fig.47 LTE band 2, 10MHz Bandwidth, QPSK (-26dBc BW)

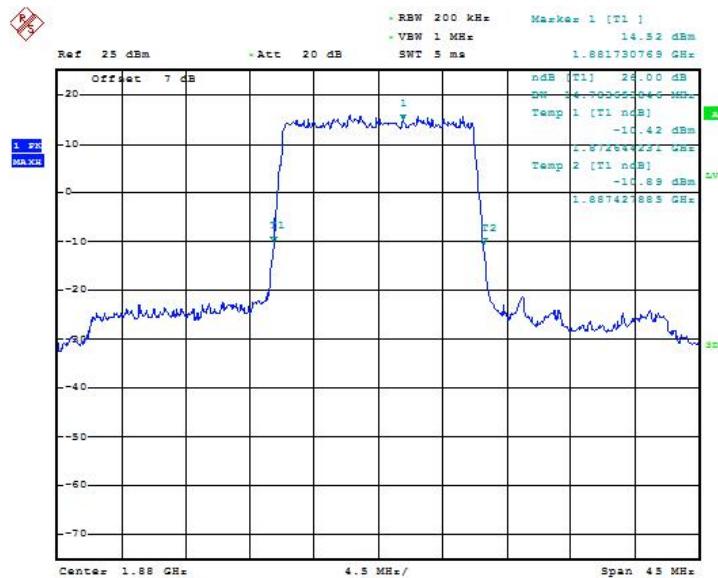
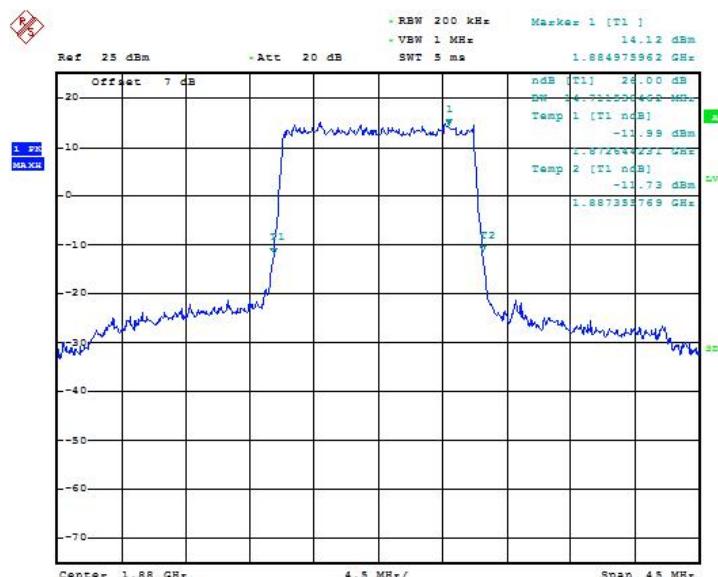


Date: 24.OCT.2018 10:41:12

Fig.48 LTE band 2, 10MHz Bandwidth, 16QAM (-26dBc BW)

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

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	QPSK	16QAM
	14.784	14.712


**Fig.49 LTE band 2, 15MHz Bandwidth, QPSK (-26dBc BW)**

**Fig.50 LTE band 2, 15MHz Bandwidth, 16QAM (-26dBc BW)**

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

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
1880.0	QPSK	16QAM
	19.231	19.423

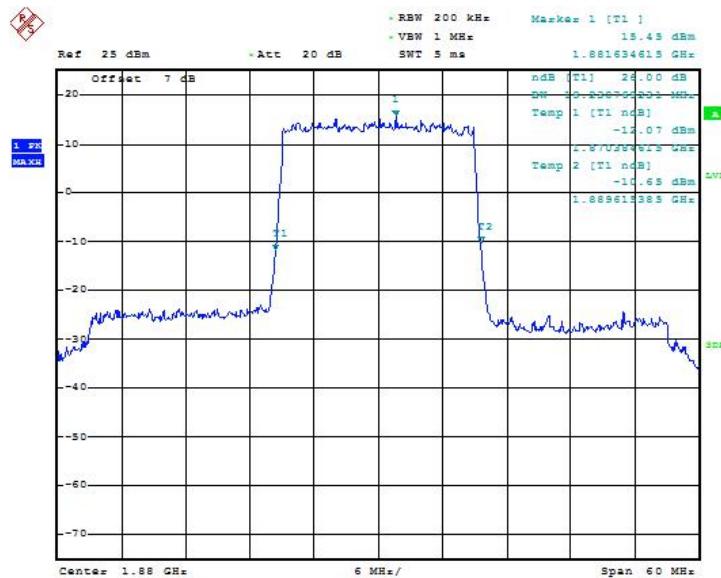


Fig.51 LTE band 2, 20MHz Bandwidth, QPSK (-26dBc BW)

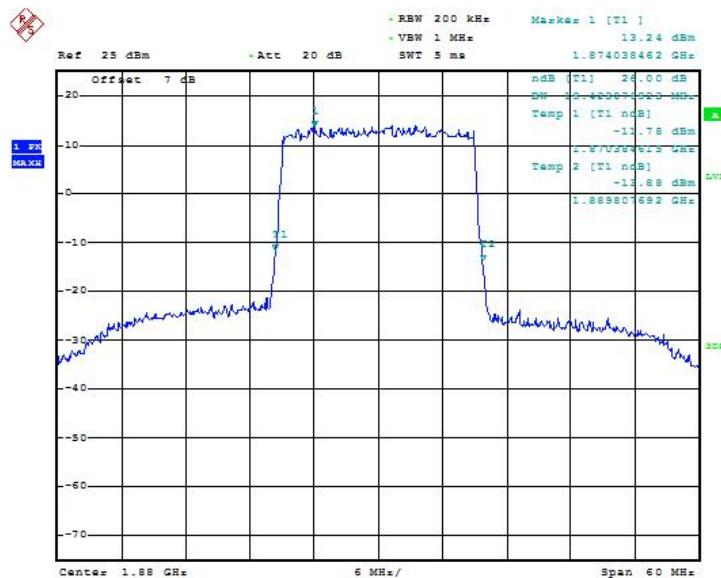
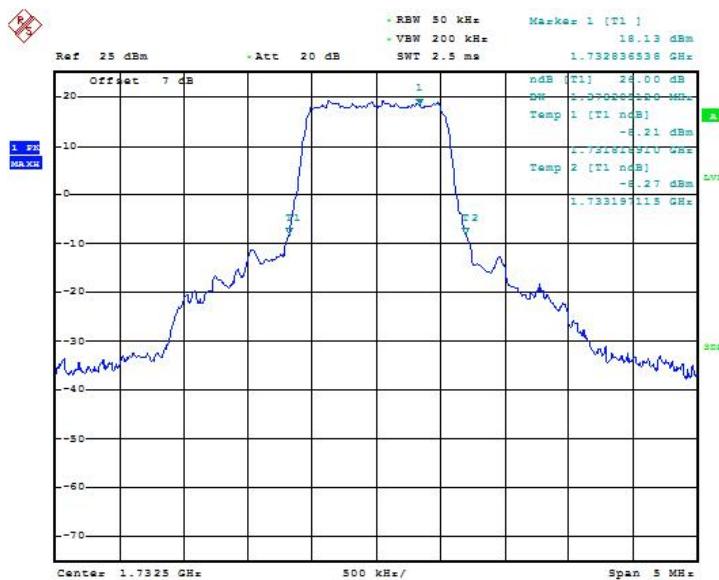


Fig.52 LTE band 2, 20MHz Bandwidth, 16QAM (-26dBc BW)

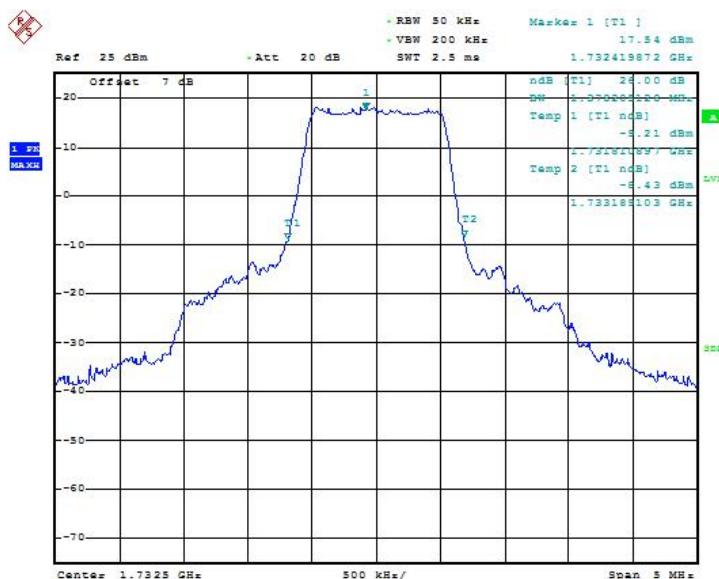
**LTE band 4, 1.4MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	QPSK	16QAM
	1.378	1.378



Date: 24.OCT.2018 10:48:27

Fig.53 LTE band 4, 1.4MHz Bandwidth, QPSK (-26dBc BW)

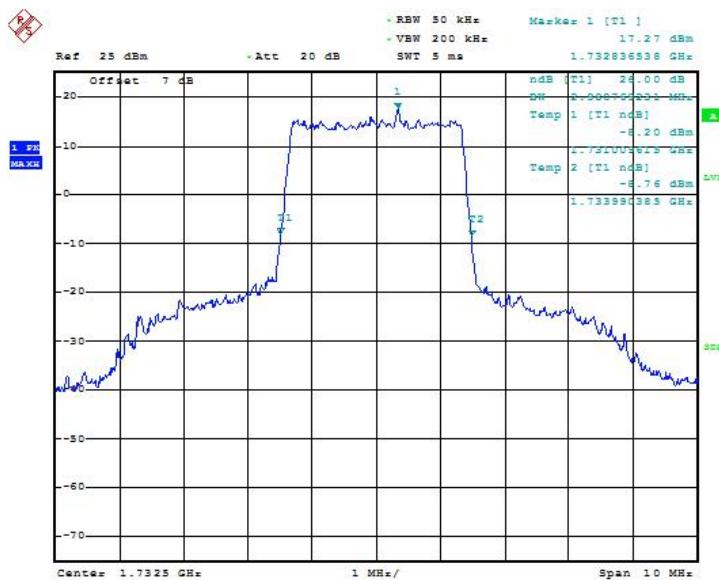


Date: 24.OCT.2018 10:49:32

Fig.54 LTE band 4, 1.4MHz Bandwidth, 16QAM (-26dBc BW)

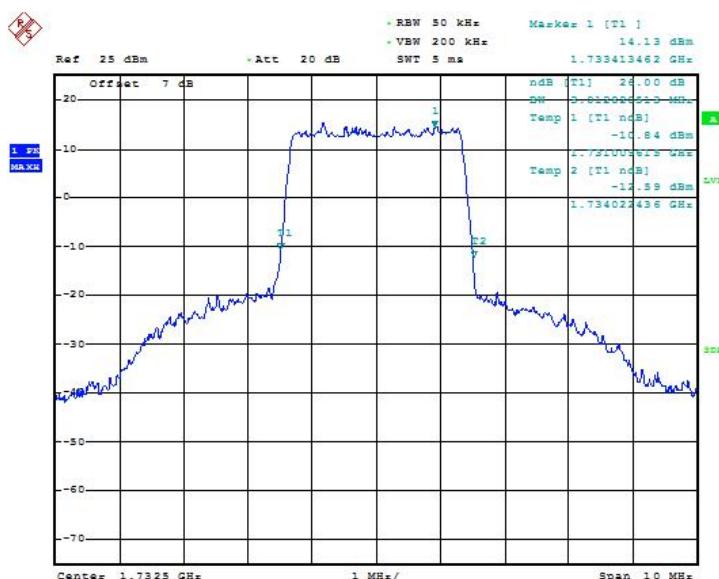
**LTE band 4, 3MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	QPSK	16QAM
	2.981	3.013



Date: 24.OCT.2018 10:50:45

Fig.55 LTE band 4, 3MHz Bandwidth, QPSK (-26dBc BW)

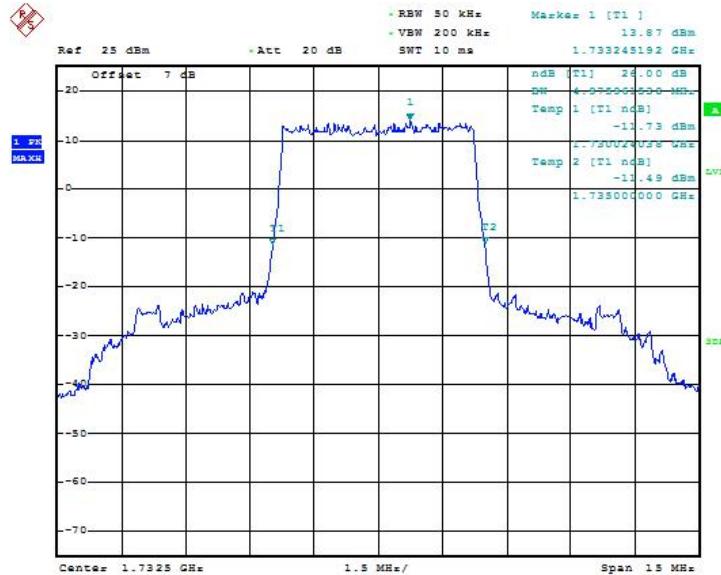


Date: 24.OCT.2018 10:51:50

Fig.56 LTE band 4, 3MHz Bandwidth, 16QAM (-26dBc BW)

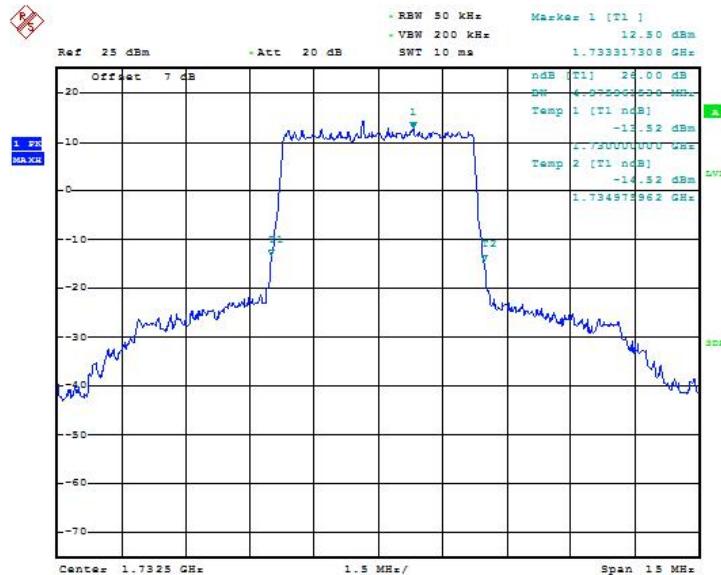
## LTE band 4, 5MHz (-26dBc)

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
1732.5	QPSK	16QAM
	4.976	4.976



Date: 24.OCT.2018 10:53:04

Fig.57 LTE band 4, 5MHz Bandwidth, QPSK (-26dBc BW)

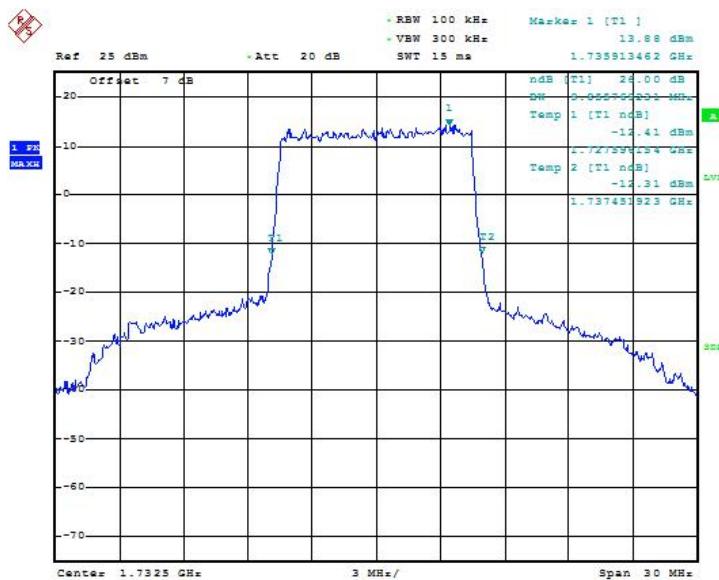


Date: 24.OCT.2018 10:54:09

Fig.58 LTE band 4, 5MHz Bandwidth, 16QAM (-26dBc BW)

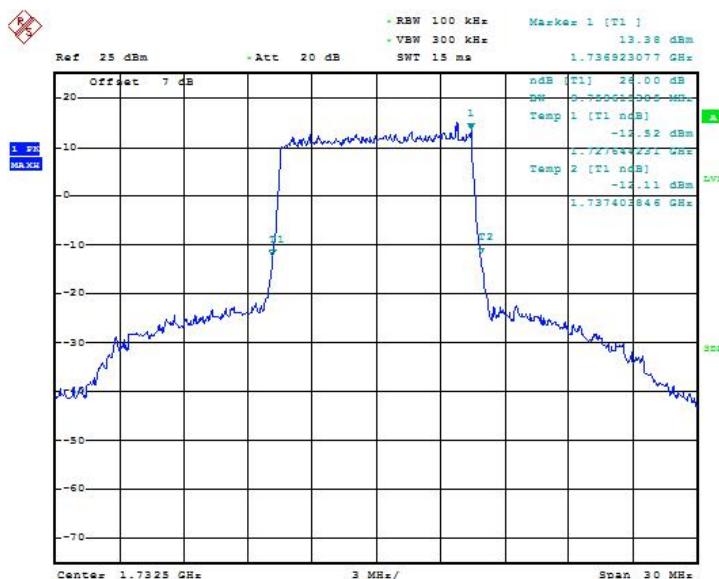
**LTE band 4, 10MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	QPSK	16QAM
	9.856	9.76



Date: 24.OCT.2018 10:55:23

Fig.59 LTE band 4, 10MHz Bandwidth, QPSK (-26dBc BW)

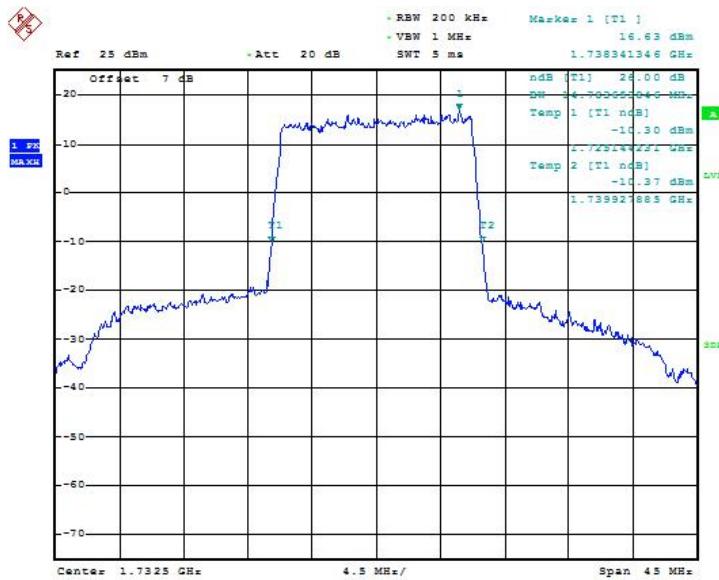


Date: 24.OCT.2018 10:56:28

Fig.60 LTE band 4, 10MHz Bandwidth, 16QAM (-26dBc BW)

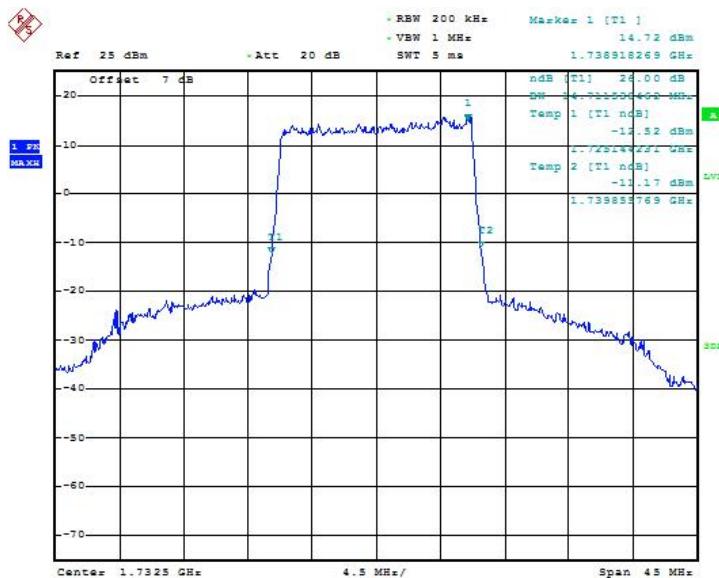
**LTE band 4, 15MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	QPSK	16QAM
	14.784	14.712



Date: 24.OCT.2018 10:57:42

Fig.61 LTE band 4, 15MHz Bandwidth, QPSK (-26dBc BW)

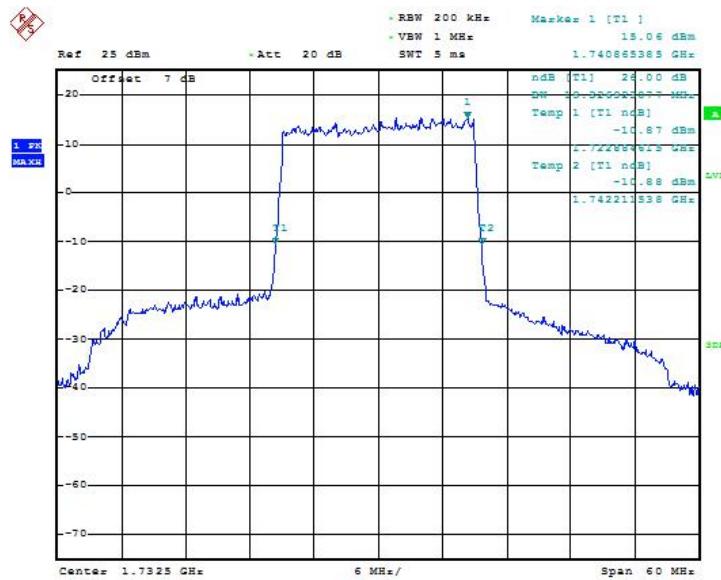


Date: 24.OCT.2018 10:58:47

Fig.62 LTE band 4, 15MHz Bandwidth, 16QAM (-26dBc BW)

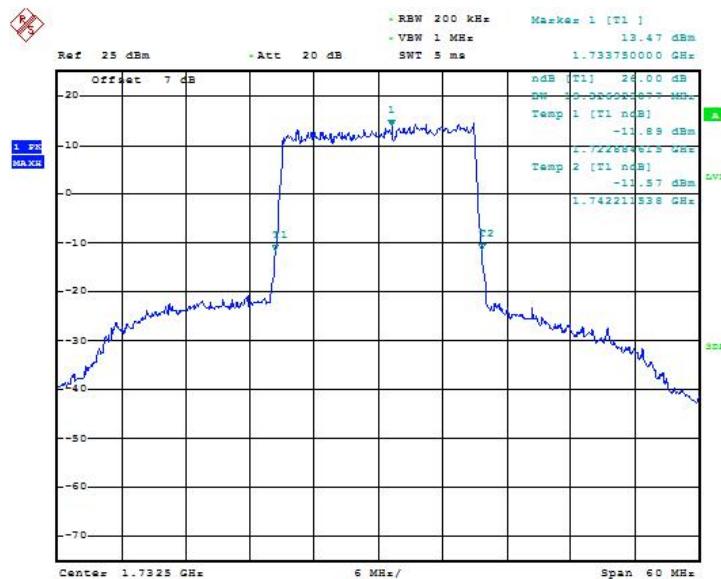
**LTE band 4, 20MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	QPSK	16QAM
	19.327	19.327



Date: 24.OCT.2018 11:00:01

Fig.63 LTE band 4, 20MHz Bandwidth, QPSK (-26dBc BW)

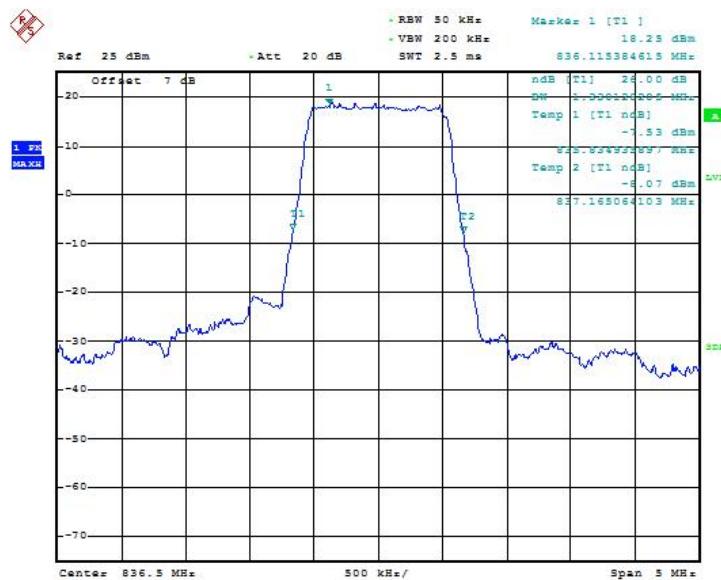


Date: 24.OCT.2018 11:01:07

Fig.64 LTE band 4, 20MHz Bandwidth, 16QAM (-26dBc BW)

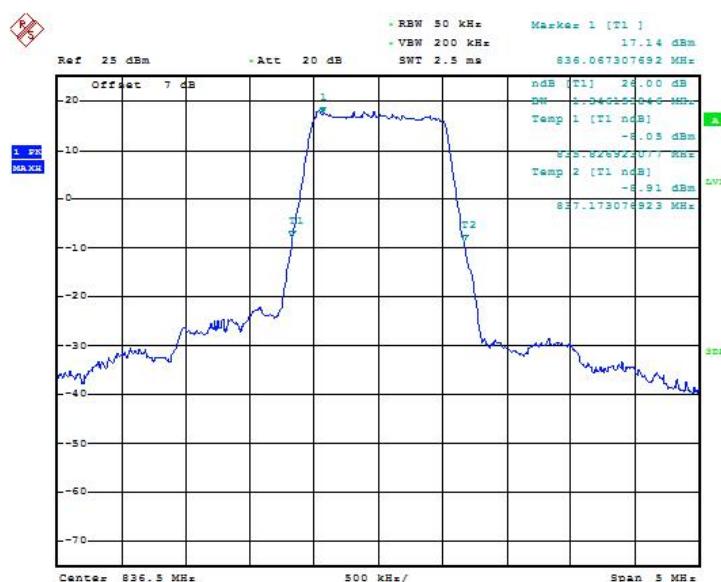
**LTE band 5, 1.4MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	QPSK	16QAM
	1.33	1.346



Date: 24.OCT.2018 11:03:45

Fig.65 LTE band 5, 1.4MHz Bandwidth, QPSK (-26dBc BW)

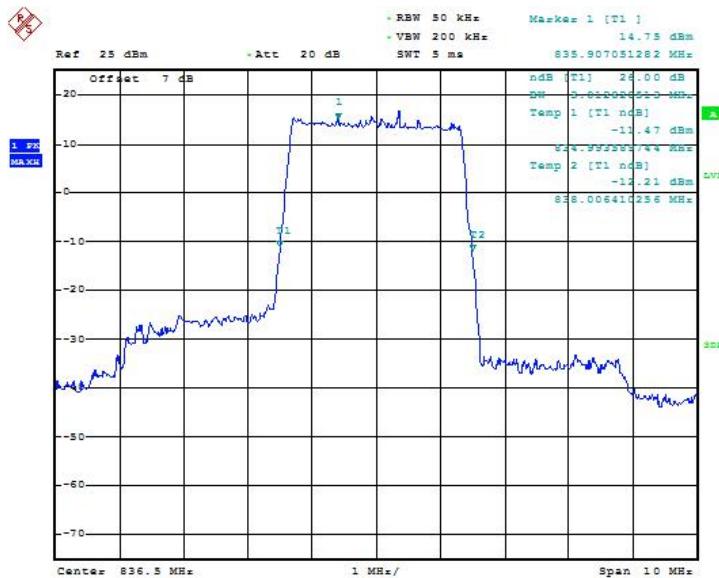


Date: 24.OCT.2018 11:04:51

Fig.66 LTE band 5, 1.4MHz Bandwidth, 16QAM (-26dBc BW)

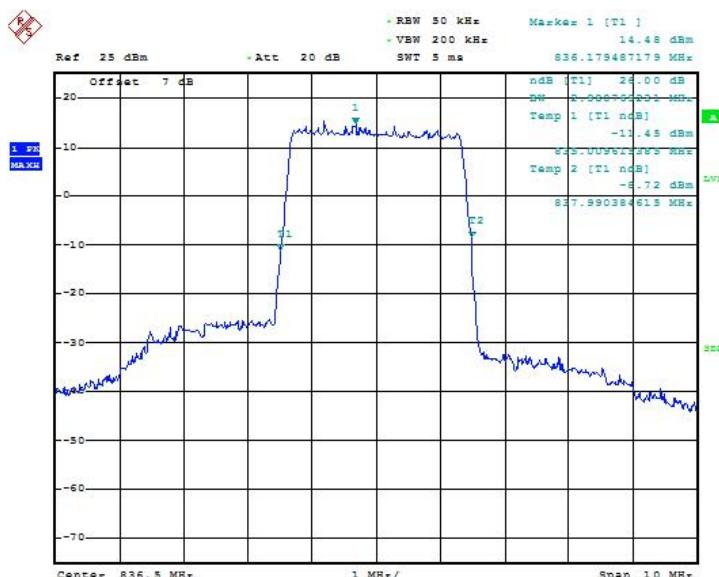
**LTE band 5, 3MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	QPSK	16QAM
836.5	3.013	2.981



Date: 24.OCT.2018 11:06:05

Fig.67 LTE band 5, 3MHz Bandwidth, QPSK (-26dBc BW)

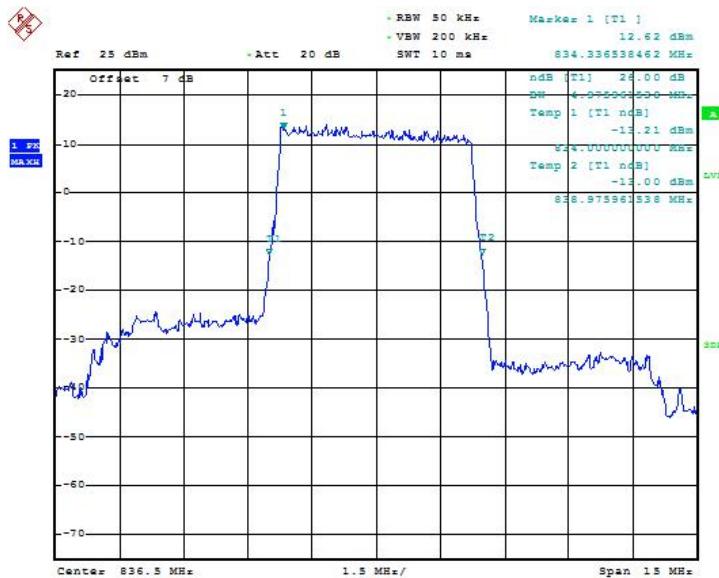


Date: 24.OCT.2018 11:07:11

Fig.68 LTE band 5, 3MHz Bandwidth, 16QAM (-26dBc BW)

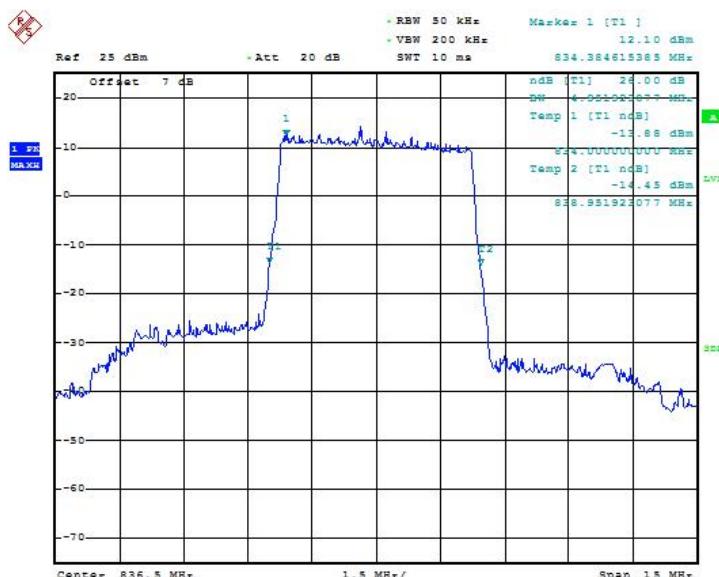
**LTE band 5, 5MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
836.5	QPSK	16QAM
	4.976	4.952



Date: 24.OCT.2018 11:08:25

Fig.69 LTE band 5, 5MHz Bandwidth, QPSK (-26dBc BW)



Date: 24.OCT.2018 11:09:31

Fig.70 LTE band 5, 5MHz Bandwidth, 16QAM (-26dBc BW)

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

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	QPSK	16QAM
	9.76	9.663



Fig.71 LTE band 5, 10MHz Bandwidth, QPSK (-26dBc BW)

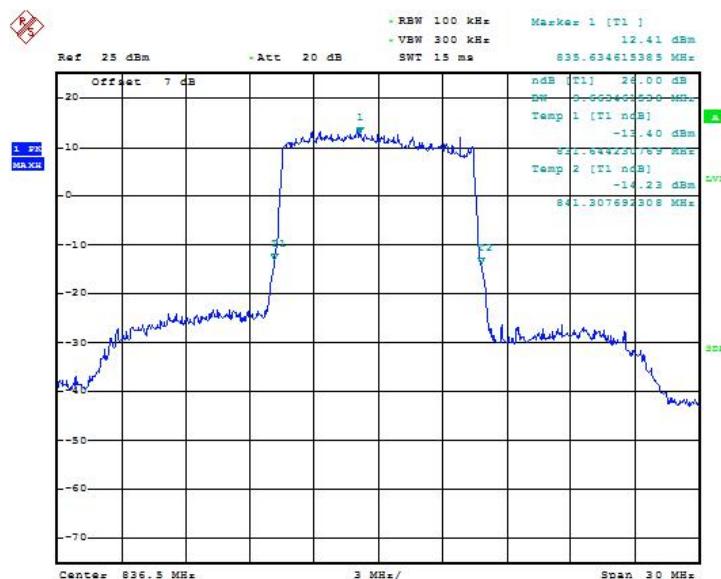
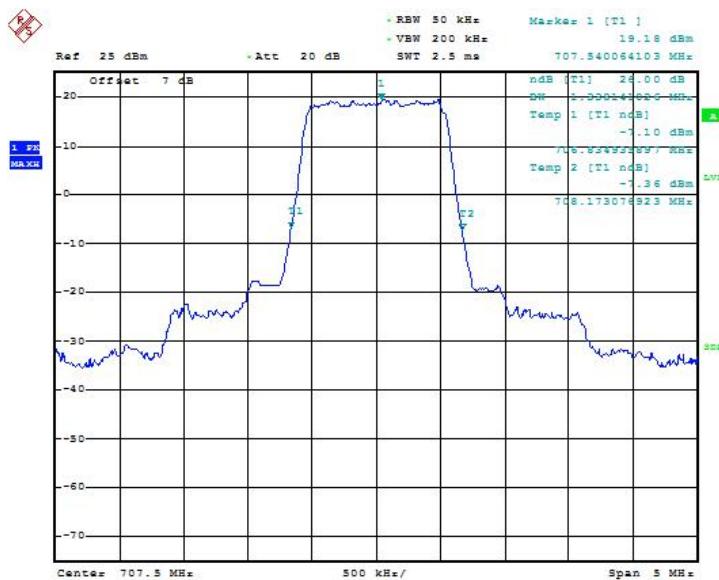


Fig.72 LTE band 5, 10MHz Bandwidth, 16QAM (-26dBc BW)

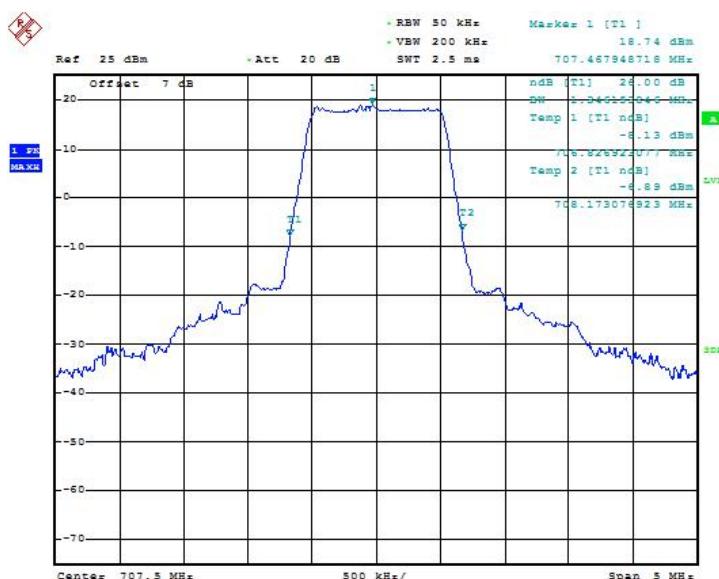
**LTE band 12, 1.4MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	QPSK	16QAM
	1.338	1.346



Date: 24.OCT.2018 11:14:03

Fig.73 LTE band 12, 1.4MHz Bandwidth, QPSK (-26dBc BW)

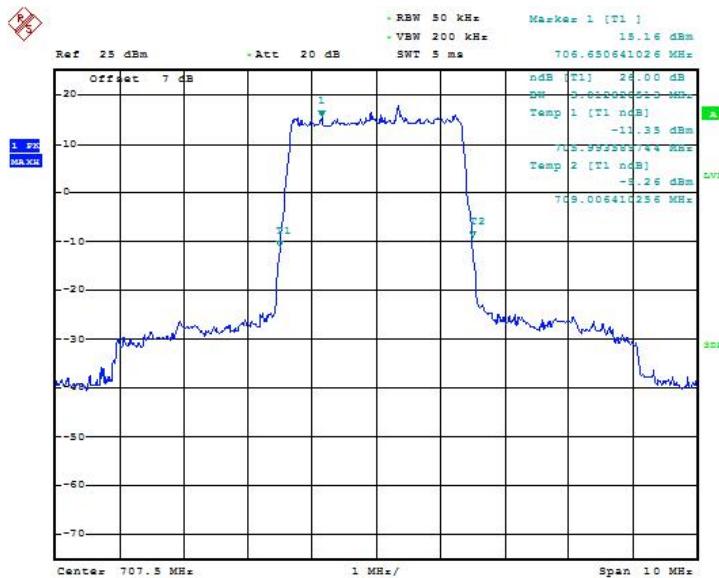


Date: 24.OCT.2018 11:15:08

Fig.74 LTE band 12, 1.4MHz Bandwidth, 16QAM (-26dBc BW)

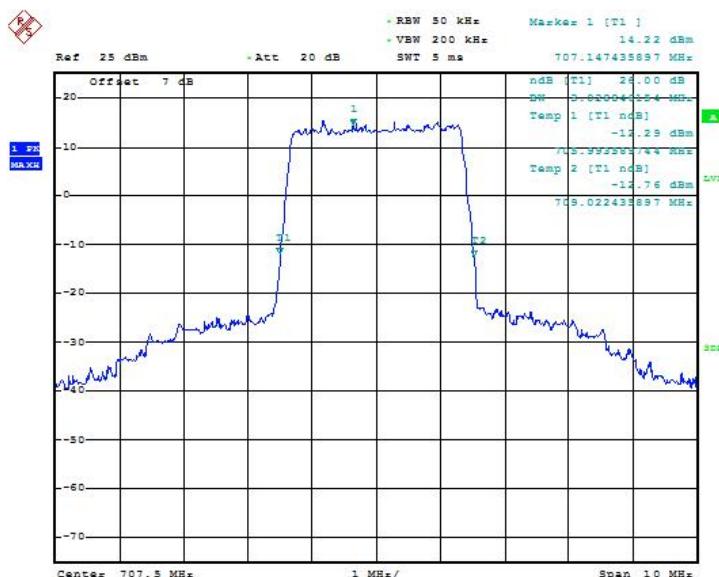
**LTE band 12, 3MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
707.5	QPSK	16QAM
	3.013	3.029



Date: 24.OCT.2018 11:16:23

Fig.75 LTE band 12, 3MHz Bandwidth, QPSK (-26dBc BW)

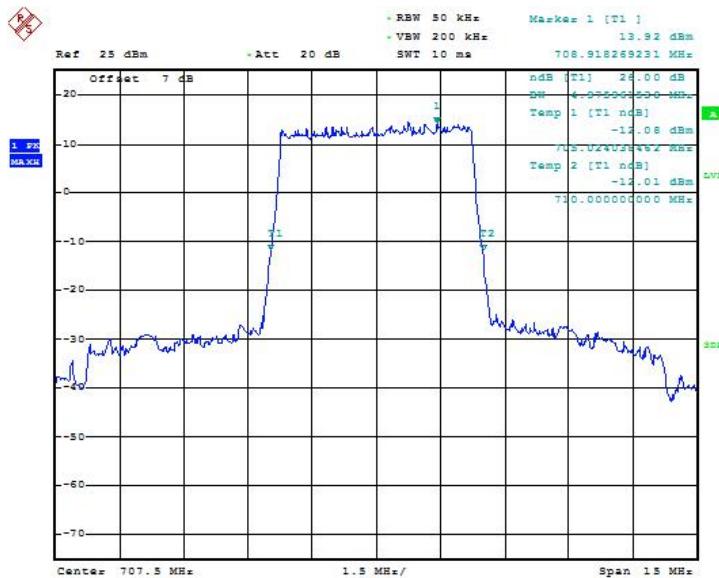
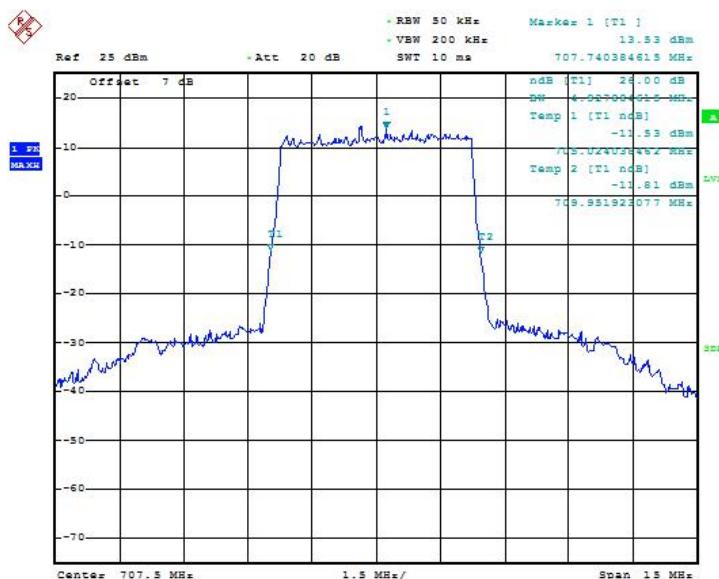


Date: 24.OCT.2018 11:17:28

Fig.76 LTE band 12, 3MHz Bandwidth, 16QAM (-26dBc BW)

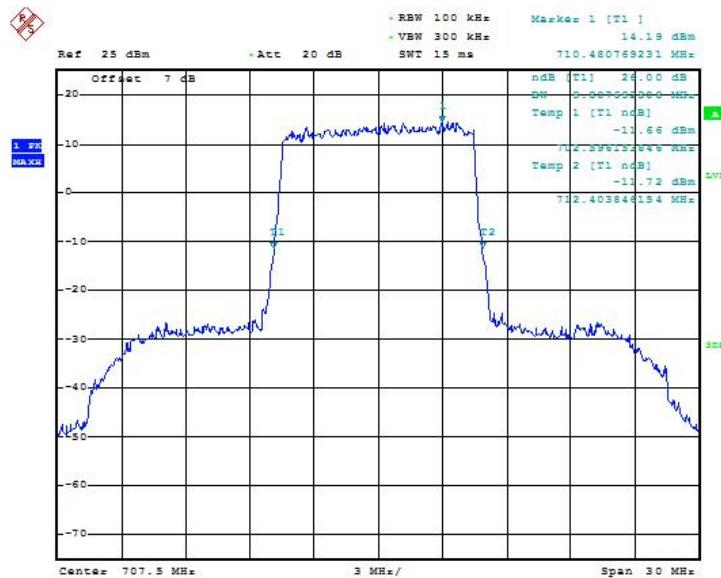
**LTE band 12, 5MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
707.5	QPSK	16QAM
	4.976	4.928


**Fig.77** LTE band 12, 5MHz Bandwidth, QPSK (-26dBc BW)

**Fig.78** LTE band 12, 5MHz Bandwidth, 16QAM (-26dBc BW)

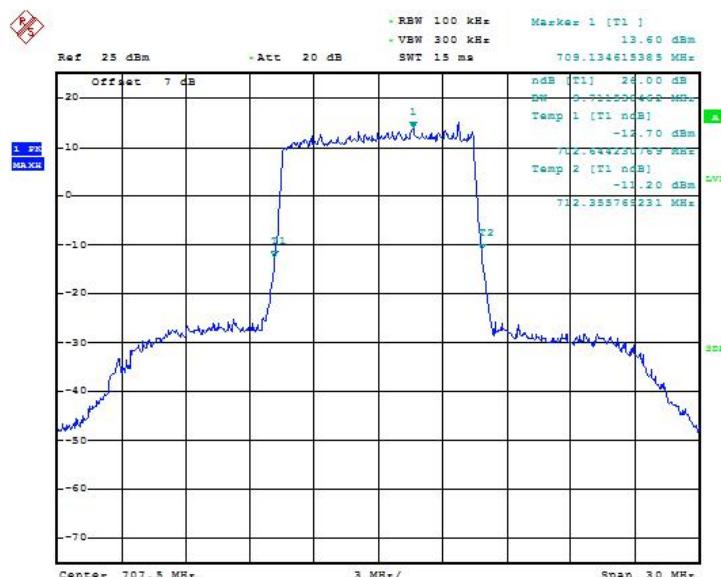
**LTE band 12, 10MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	QPSK	16QAM
707.5	9.808	9.712



Date: 24.OCT.2018 11:21:02

Fig.79 LTE band 12, 10MHz Bandwidth, QPSK (-26dBc BW)



Date: 24.OCT.2018 11:22:08

Fig.80 LTE band 12, 10MHz Bandwidth, 16QAM (-26dBc BW)

## ANNEX A.6. BAND EDGE COMPLIANCE

### Reference

FCC: CFR Part 22.917(b),24.238(a), 27.53(g),27.53(h), 27.53(m)

#### A.6.1 Measurement limit

Part 22.917(b),24.238(a), 27.53(g),27.53(h), 27.53(m) state that on any frequency outside frequency band of the US Cellular/PCS spectrum, the power of any emission shall be attenuated below the transmitter power ( $P$ , in Watts) by at least  $43+10\log(P)$  dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm.

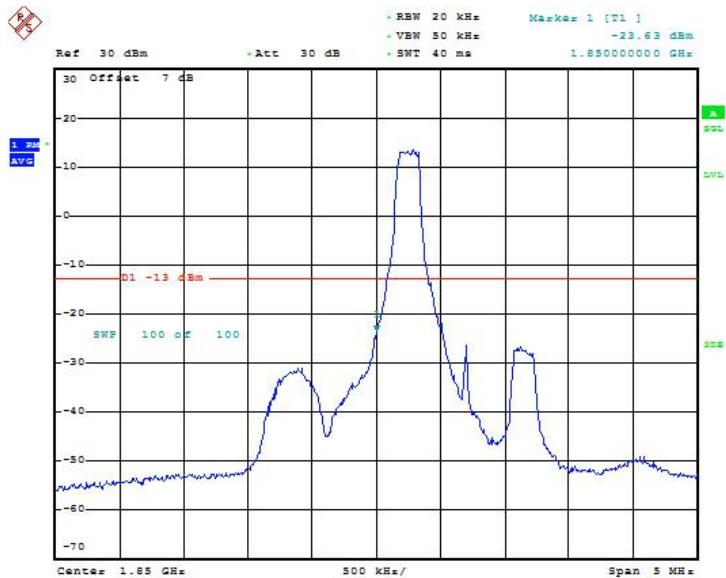
According to KDB 971168 6, a relaxation of the reference bandwidth is often provided for measurements within a specified frequency range at the edge of the authorized frequency block/band. This is often implemented by permitting the use of a narrower RBW (typically limited to a minimum RBW of 1% of the OBW) for measuring the out-of-band emissions without a requirement to integrate the result over the full reference bandwidth.

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

### A.6.2 Measurement result

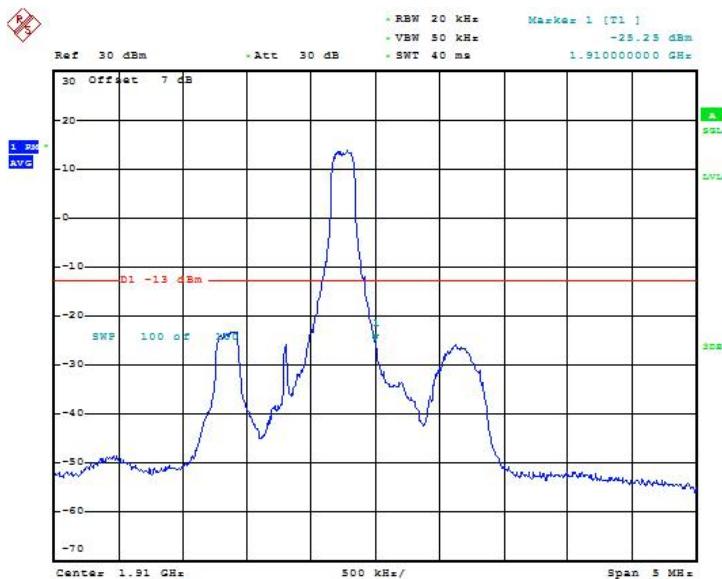
Only worst case result is given below

LTE band 2



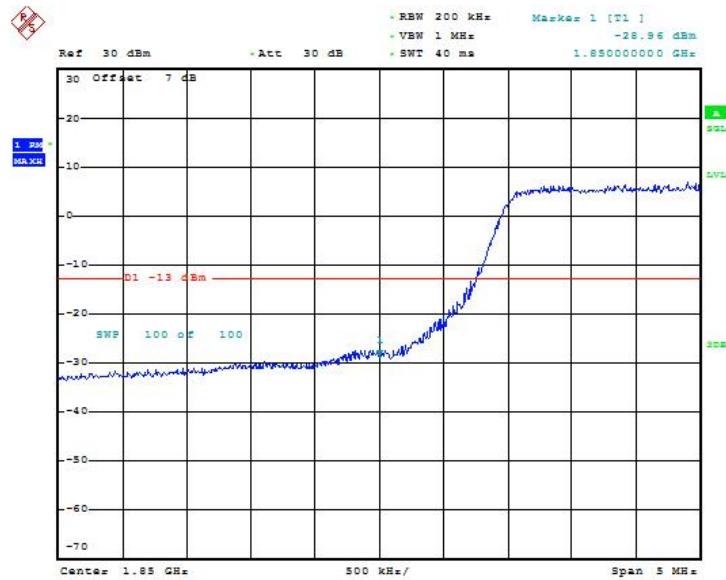
Date: 14.NOV.2018 14:20:39

Fig.81 LOW BAND EDGE BLOCK-1RB-low\_offset

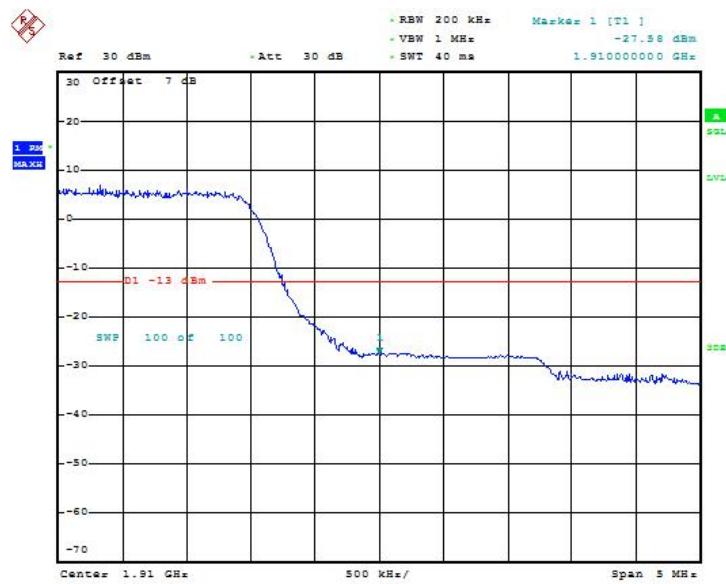


Date: 14.NOV.2018 14:21:12

Fig.82 HIGH BAND EDGE BLOCK-1RB-high\_offset

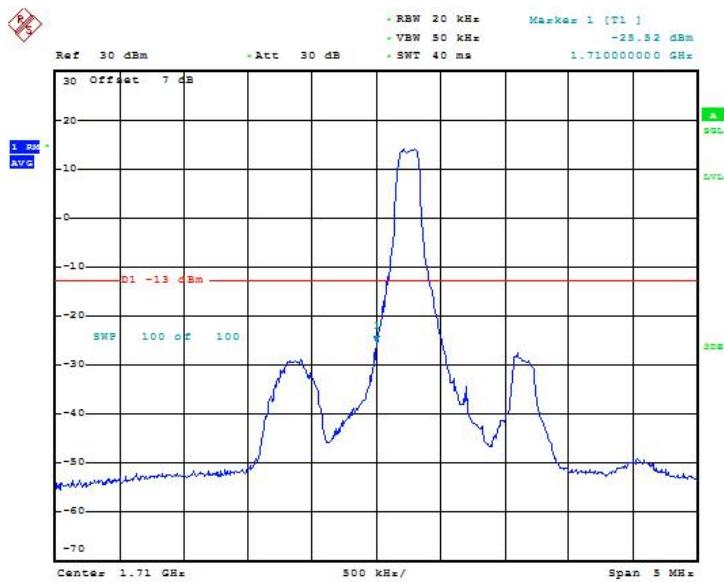


Date: 24.OCT.2018 15:05:22

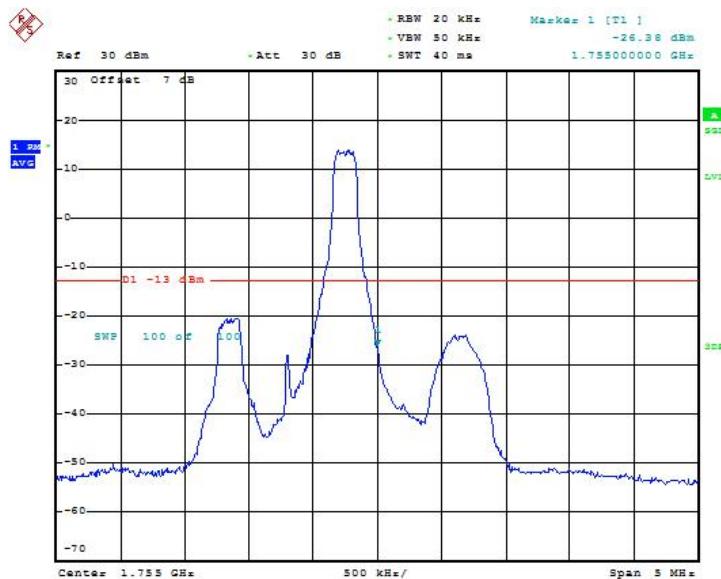
**Fig.83 LOW BAND EDGE BLOCK-20MHz-100%RB**


Date: 24.OCT.2018 15:05:57

**Fig.84 HIGH BAND EDGE BLOCK-20MHz-100%RB**

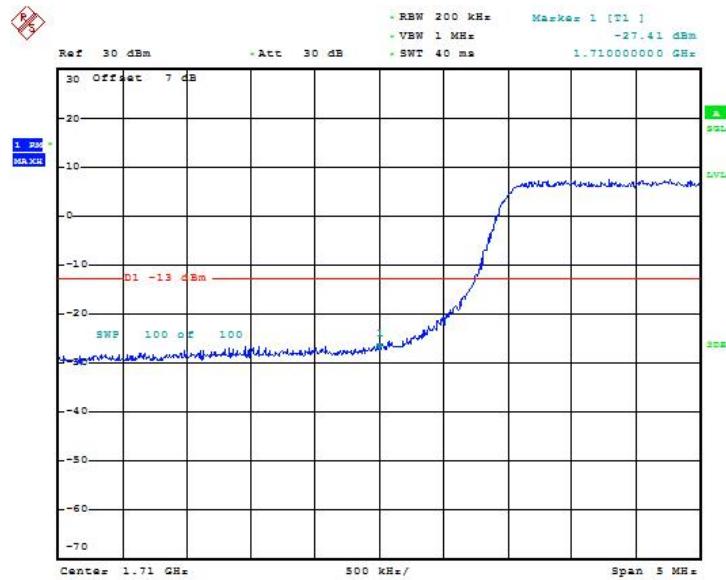
**LTE band 4**


Date: 14.NOV.2018 14:25:48

**Fig.85 LOW BAND EDGE BLOCK-1RB-low\_offset**


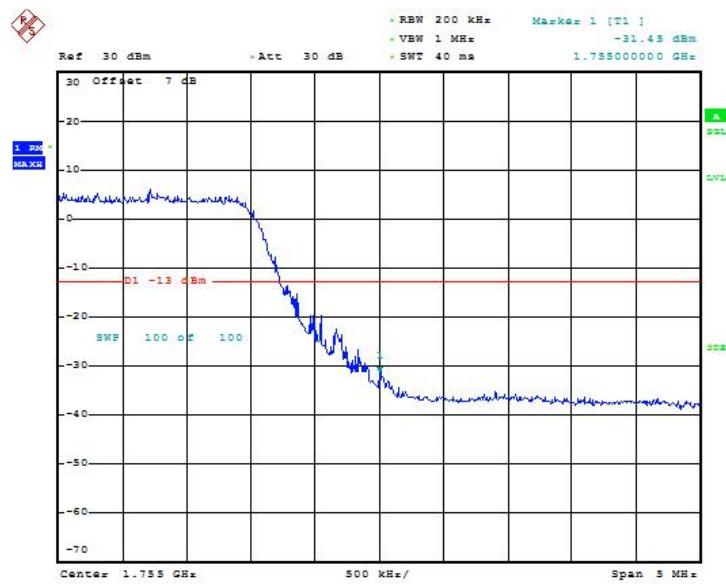
Date: 14.NOV.2018 14:26:21

**Fig.86 HIGH BAND EDGE BLOCK-1RB-high\_offset**



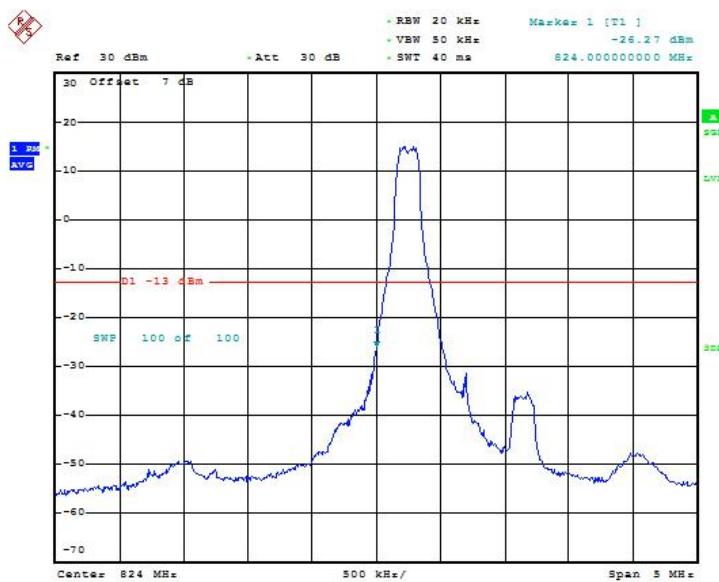
Date: 24.OCT.2018 15:08:00

**Fig.87 LOW BAND EDGE BLOCK-20MHz-100%RB**

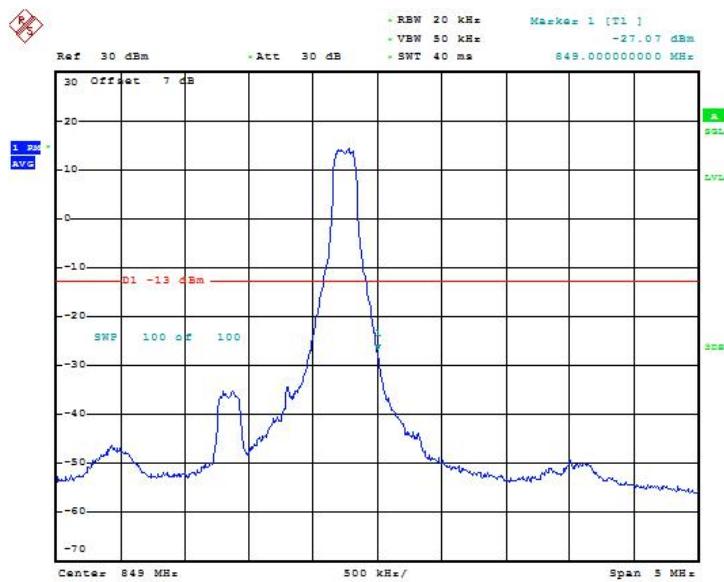


Date: 24.OCT.2018 15:08:35

**Fig.88 HIGH BAND EDGE BLOCK-20MHz-100%RB**

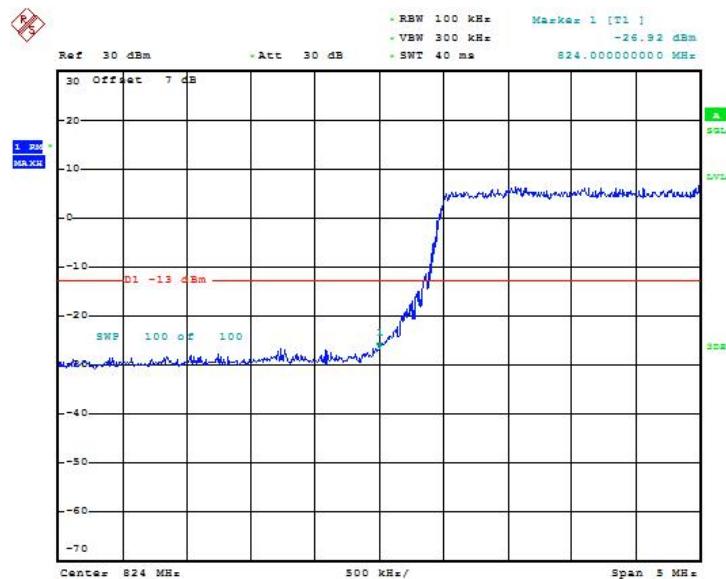
**LTE band 5**


Date: 14.NOV.2018 14:28:04

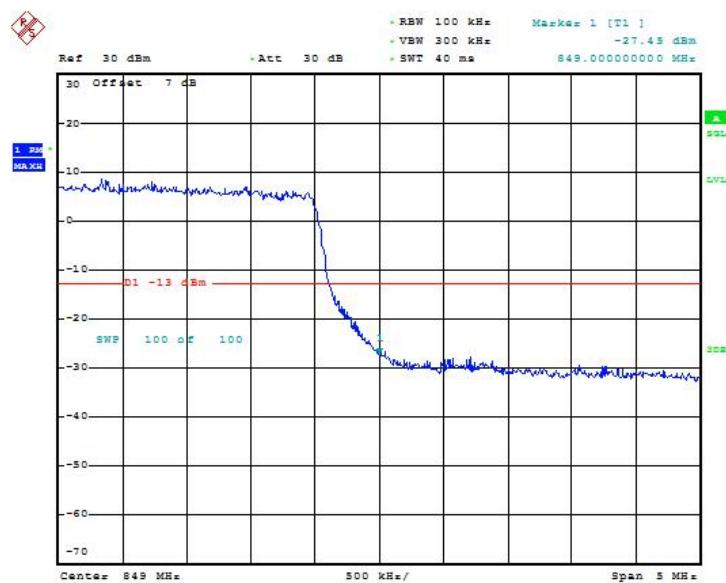
**Fig.89 LOW BAND EDGE BLOCK-1RB-low\_offset**


Date: 14.NOV.2018 14:28:38

**Fig.90 HIGH BAND EDGE BLOCK-1RB-high\_offset**

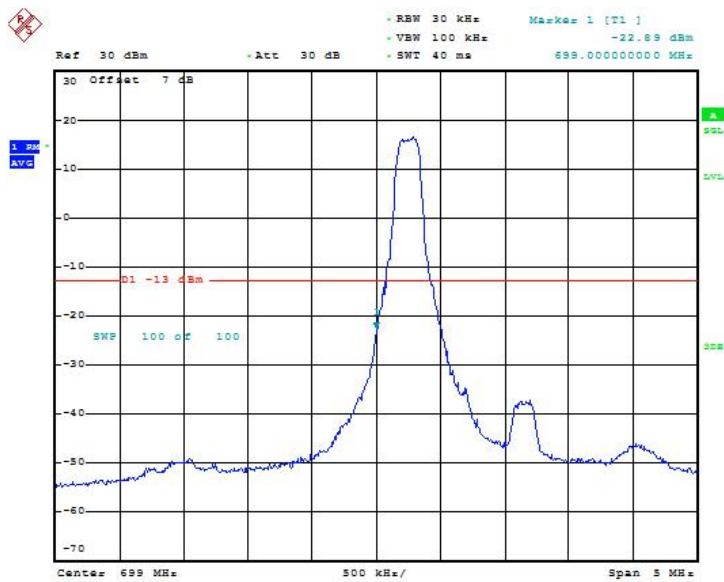


Date: 24.OCT.2018 15:11:26

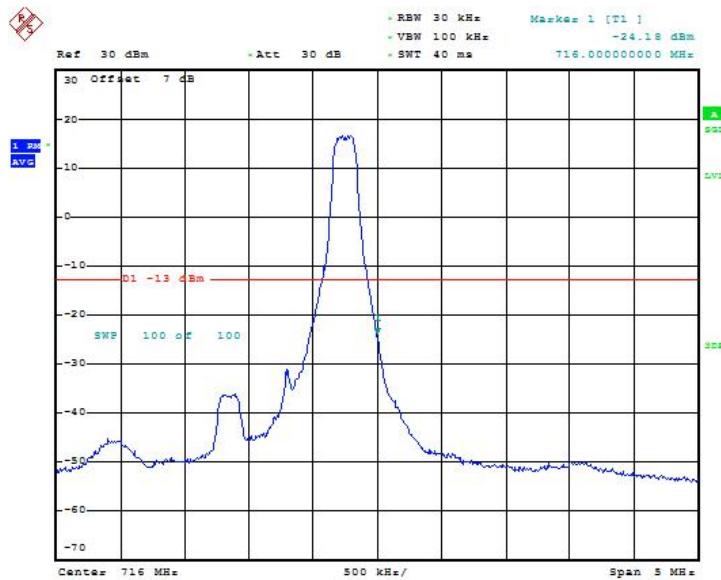
**Fig.91 LOW BAND EDGE BLOCK-10MHz-100%RB**


Date: 24.OCT.2018 15:12:01

**Fig.92 HIGH BAND EDGE BLOCK-10MHz-100%RB**

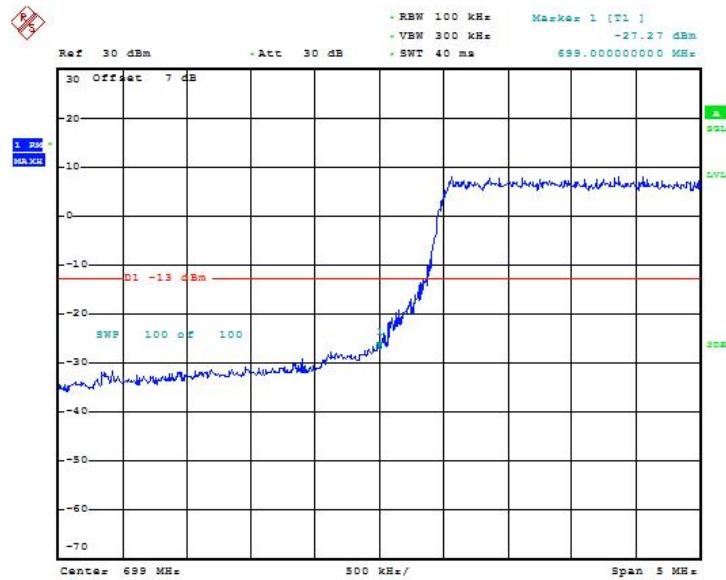
**LTE band 12**


Date: 15.NOV.2018 08:25:10

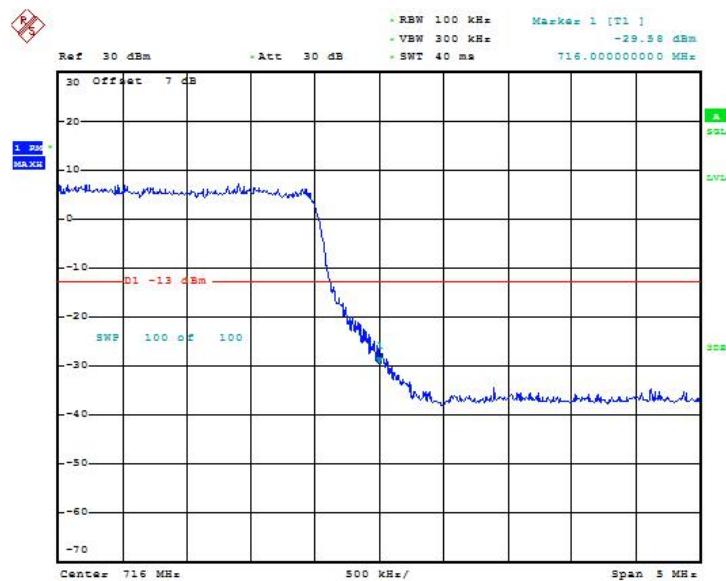
**Fig.93 LOW BAND EDGE BLOCK-1RB-low\_offset**


Date: 15.NOV.2018 08:25:43

**Fig.94 HIGH BAND EDGE BLOCK-1RB-high\_offset**



Date: 24.OCT.2018 15:14:09

**Fig.95 LOW BAND EDGE BLOCK-10MHz-100%RB**


Date: 24.OCT.2018 15:14:45

**Fig.96 HIGH BAND EDGE BLOCK-10MHz-100%RB**

## ANNEX A.7. CONDUCTED SPURIOUS EMISSION

### Reference

FCC: CFR Part 22.917(b),24.238(a), 27.53(g),27.53(h), 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 2.1057 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the mobile station equipment tested, this equates to a frequency range of 13 MHz to 9 GHz, data taken from 10 MHz to 25 GHz.
2. Determine EUT transmit frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.
3. The number of sweep points of spectrum analyzer is set to 30001 which is greater than span/RBW.

#### A. 7.2 Measurement Limit

Part 22.917(b),24.238(a), 27.53(g),27.53(h), 27.53(m) specify that the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least  $43 + 10 \log(P)$  dB.

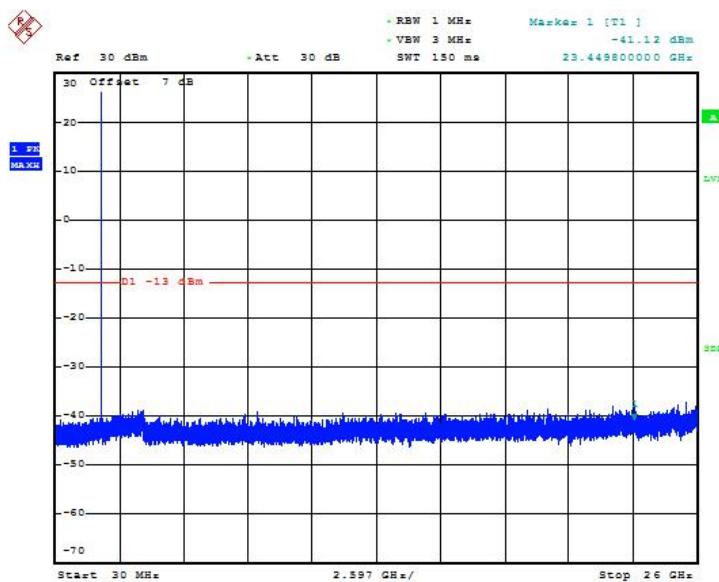
The specification that emissions shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log(P)$  dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13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

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

### A. 7.3 Measurement result

Only worst case result is given below

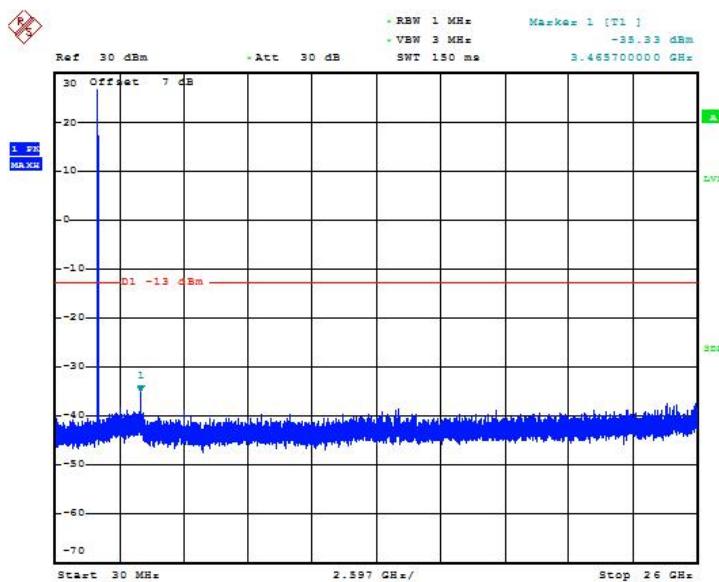
LTE band 2: Spurious emission limit –13dBm.



Date: 24.OCT.2018 14:50:37

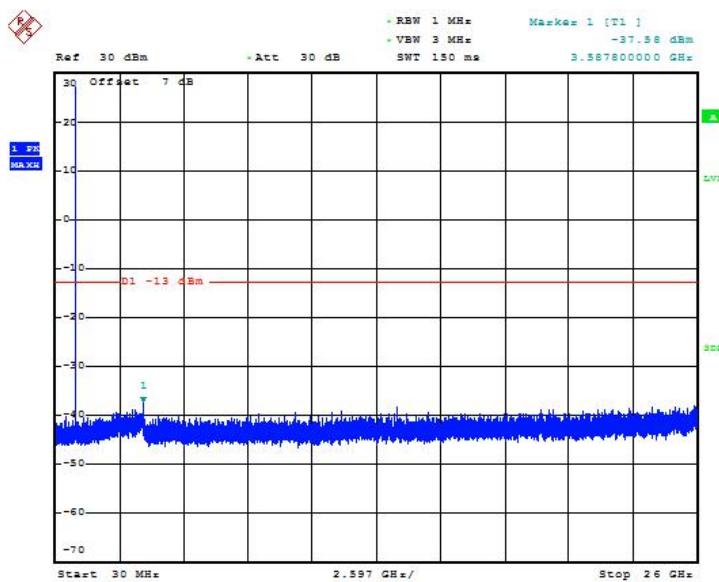
Fig.97 LTE band 2: 30MHz – 26GHz

LTE band 4: Spurious emission limit –13dBm.



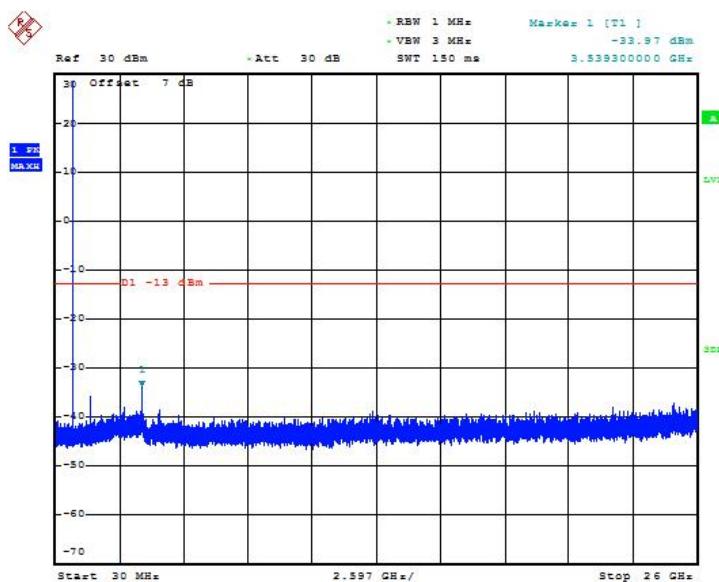
Date: 24.OCT.2018 14:49:08

Fig.98 LTE band 4: 30MHz – 26GHz

**LTE band 5: Spurious emission limit –13dBm.**


Date: 24.OCT.2018 14:51:48

Fig.99 LTE band 5: 30MHz – 26GHz

**LTE band 12: Spurious emission limit –13dBm.**


Date: 24.OCT.2018 14:46:36

Fig.100 LTE band 12: 30MHz – 26GHz

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

### Reference

FCC: CFR Part 24.232 (d), 27.50(a)

The peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB. The PAPR measurements should be made using either an instrument with complementary cumulative distribution function (CCDF) capabilities to determine that PAPR will not exceed 13 dB for more than 0.1 percent of the time or other Commission approved procedure. The measurement must be performed using a signal corresponding to the highest PAPR expected during periods of continuous transmission.

According to KDB 971168 5.7:

- 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 2, 20MHz

Frequency(MHz)	PAPR(dB)	
	QPSK	16QAM
1880.0	4.97	6.28

#### LTE band 4, 20MHz

Frequency(MHz)	PAPR(dB)	
	QPSK	16QAM
1732.5	4.97	6.35

#### LTE band 5, 10MHz

Frequency(MHz)	PAPR(dB)	
	QPSK	16QAM
836.5	5.29	6.19

#### LTE band 12,10MHz

Frequency(MHz)	PAPR(dB)	
	QPSK	16QAM
707.5	5.26	6.12

**ANNEX B. Deviations from Prescribed Test Methods**

No deviation from Prescribed Test Methods.

## ANNEX C. Accreditation Certificate

**Accredited Laboratory**

A2LA has accredited

**EAST CHINA INSTITUTE OF TELECOMMUNICATIONS**

Shanghai, People's Republic of China

for technical competence in the field of

**Electrical Testing**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005  
General requirements for the competence of testing and calibration laboratories. This accreditation demonstrates  
technical competence for a defined scope and the operation of a laboratory quality management system  
(refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).

Presented this 15<sup>th</sup> day of March 2017.

President and CEO  
For the Accreditation Council  
Certificate Number 3682.01  
Valid to February 28, 2019



For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

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