



*Full*

## **TEST REPORT**

**No. I19D00117-SRD06**

*For*

**Client: Micronet**

**Production: A9 PCBA module**

**Model Name: A9**

**Brand Name: TREQ**

**FCC ID: U80-A9**

**IC ID: 12186A-A9**

**Hardware Version: C801\_V1.00\_PCB**

**Software Version: SC\_10.2.0.0**

**Issued date: 2019-09-16**

## NOTE

1. The test results in this test report relate only to the devices specified in this report.
2. This report shall not be reproduced except in full without the written approval of East China Institute of Telecommunications.
3. ANSI/TIA-603-E and KDB 971168 D01 has not been accredited by A2LA.
4. For the test results, the uncertainty of measurement is not taken into account when judging the compliance with specification, and the results of measurement or the average value of measurement results are taken as the criterion of the compliance with specification directly.

**Test Laboratory:**

East China Institute of Telecommunications

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**Revision Version**

<b>Report Number</b>	<b>Revision</b>	<b>Date</b>	<b>Memo</b>
I19D00117-SRD06	00	2019-09-16	Initial 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	7-8/F., Area G, No.668, Beijing East Road, Shanghai, China
Postal Code	200001
Telephone	(+86)-021-63843300
Fax	(+86)-021-63843301
FCC registration No	CN1177

### 1.2. Testing Environment

Normal Temperature	15°C-35°C
Relative Humidity	25%-75%

### 1.3. Project data

Project Leader	Zhou Yan
Testing Start Date	2019-08-15
Testing End Date	2019-08-20

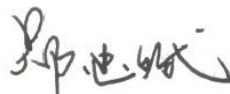
### 1.4. Signature



\_\_\_\_\_  
**Wang Liang**  
(Prepared this test report)



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**Fan Songyan**  
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\_\_\_\_\_  
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## 2. Client Information

### 2.1. Applicant Information

Company Name	Micronet
Address	1865 West 2100 South, Suite 2Salt Lake City, Utah 84119 United States
Telephone	+1-801-990-8700
Postcode	84119

### 2.2. Manufacturer Information

Company Name	Micronet
Address	1865 West 2100 South, Suite 2Salt Lake City, Utah 84119 United States
Telephone	+1-801-990-8700
Postcode	84119

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

#### 3.1. About EUT

Production	A9 PCBA module
Model name	A9
GSM Frequency Band	GSM850/GSM900/GSM1800/GSM1900
UMTS Frequency Band	Band I/II/IV/V/VIII
CDMA Frequency Band	NA
LTE Frequency Band	Band 1/2/3/4/5/7/8/12/13/17/20/28
Additional Communication Function	BT/BLE/2.4G WLAN 802.11 b/g/n20/n40/5G WLAN 802.11 a20/n20/n40/ac20/ac40
Extreme Temperature	-20/+70°C
Nominal Voltage	3.8V
Extreme High Voltage	4.2V
Extreme Low Voltage	3.7V

Note:

- a. Photographs of EUT are shown in ANNEX A of this test report.
- b. The value of the antenna gain is provided by the customer. For specific antenna information, please check the antenna specifications of the customer.

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

EUT ID*	SN or IMEI	HW Version	SW Version	Date of receipt
N19	/	C801_V1.00_PCB	SC_10.2.0.0	2019-08-14
N20	/	C801_V1.00_PCB	SC_10.2.0.0	2019-08-14

\*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.



## 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 2	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS	2018-10-01
FCC Part 22	PUBLIC MOBILE SERVICES	2018-10-01
FCC Part 24	PERSONAL COMMUNICATIONS SERVICES	2018-10-01
FCC Part 27	MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES	2018-10-01
ANSI/TIA-603-E	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	2016
ANSI C63.26	American National Standard of Procedures for Compliance Testing of Licensed Transmitters Used in Licensed Radio	2015
KDB 971168 D01	Measurement Guidance for Certification of Licensed Digital Transmitters	v03r01
RSS 133	2 GHz Personal Communications Services	2018-01
RSS 139	Advanced Wireless Services Equipment Operating in the Bands 1710-1780 MHz and 2110-2180 MHz	2015-07
RSS 132	Cellular Telephone Systems Operating in the Bands 824-849 MHz and 869-894 MHz	2013-10
RSS 130	Mobile Broadband Services (MBS) Equipment Operating in the Frequency Bands 698-756 MHz and 777-787 MHz	2019-02

## 5. Test Results

### 5.1. 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)	6.4	A.1	P
2	Emission Limit	24.238(a), 2.1051	6.5	A.2	P
3	Frequency Stability	24.235, 2.1055	6.3	A.3	P
4	Occupied Bandwidth	2.1049(h)(i)	6.6	A.4	P
5	Emission Bandwidth	24.238(a)	6.6	A.5	P
6	Band Edge Compliance	24.238(a)	6.5	A.6	P
7	Conducted Spurious Emission	24.238, 2.1057	6.13/6.5	A.7	P
8	Peak to Average Power Ratio	24.232 (d)	6.4	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)	6.5	A.1	P
2	Emission Limit	27.53(h), 2.1051	6.6	A.2	P
3	Frequency Stability	27.54, 2.1055	6.4	A.3	P
4	Occupied Bandwidth	2.1049(h)(i)	6.6	A.4	P
5	Emission Bandwidth	27.53(h)	6.6	A.5	P
6	Band Edge Compliance	27.53(h)	6.6	A.6	P
7	Conducted Spurious Emission	27.53(h), 2.1057	6.6	A.7	P
8	Peak to Average Power Ratio	27.50(a)	6.5	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),	5.4	A.1	P

		22.913(a)			
2	Emission Limit	22.917, 2.1051	6.6	A.2	P
3	Frequency Stability	22.235, 2.1055	5.3	A.3	P
4	Occupied Bandwidth	2.1049(h)(i)	6.6	A.4	P
5	Emission Bandwidth	22.917(b)	6.6	A.5	P
6	Band Edge Compliance	22.917(b)	5.5	A.6	P
7	Conducted Spurious Emission	22.917, 2.1057	5.5	A.7	P

**LTE Band 7**

Items	Test Name	Clause in FCC rules	Clause in IC rules RSS-Gen and RSS-199	Section in this report	Verdict
1	Output Power	27.50(h)(2)	6.5	A.1	P
2	Emission Limit	27.53(m), 2.1051	6.6	A.2	P
3	Frequency Stability	27.54, 2.1055	6.4	A.3	P
4	Occupied Bandwidth	2.1049(h)(i)	6.6	A.4	P
5	Emission Bandwidth	27.53(m)	6.6	A.5	P
6	Band Edge Compliance	27.53(m)	6.6	A.6	P
7	Conducted Spurious Emission	27.53(m), 2.1057	6.6	A.7	P
8	Peak to Average Power Ratio	27.50(a)	6.5	A.8	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)	4.4	A.1	P
2	Emission Limit	27.53(g), 2.1051	4.6	A.2	P
3	Frequency Stability	27.54, 2.1055	4.3	A.3	P
4	Occupied Bandwidth	2.1049(h)(i)	6.6	A.4	P
5	Emission Bandwidth	27.53(g)	6.6	A.5	P
6	Band Edge Compliance	27.53(g)	4.6	A.6	P
7	Conducted Spurious Emission	27.53(g), 2.1057	4.6	A.7	P
8	Peak to Average Power Ratio	27.50(a)	4.4	A.8	P

**LTE Band 13**

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(b)(10)	4.4	A.1	P
2	Emission Limit	27.53(c), 2.1051	4.6	A.2	P
3	Frequency Stability	27.54, 2.1055	4.3	A.3	P
4	Occupied Bandwidth	2.1049(h)(i)	6.6	A.4	P
5	Emission Bandwidth	27.53(c)	6.6	A.5	P
6	Band Edge Compliance	27.53(c)	4.6	A.6	P
7	Conducted Spurious Emission	27.53(c), 2.1057	4.6	A.7	P
8	Peak to Average Power Ratio	27.50(a)	4.4	A.8	P

**LTE Band 17**

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)	4.4	A.1	P
2	Emission Limit	27.53(g), 2.1051	4.6	A.2	P
3	Frequency Stability	27.54, 2.1055	4.3	A.3	P
4	Occupied Bandwidth	2.1049(h)(i)	6.6	A.4	P
5	Emission Bandwidth	27.53(g)	6.6	A.5	P
6	Band Edge Compliance	27.53(g)	4.6	A.6	P
7	Conducted Spurious Emission	27.53(g), 2.1057	4.6	A.7	P
8	Peak to Average Power Ratio	27.50(a)	4.4	A.8	P

Note: please refer to Annex C in this test report for the detailed test results.

The following terms are used in the above table.

P	Pass, the EUT complies with the essential requirements in the standard.
NM	Not measure, the test was not measured by ECIT.
NA	Not applicable, the test was not applicable.
F	Fail, the EUT does not comply with the essential requirements in the standard.

**5.2. Statements**

The A9 is a new product for testing.

ECIT only performed test cases which identified with P/NM/NA/F results in Annex C.

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.

## 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 years

### 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	2019-05-10	1 year
2	Test Receiver	ESU40	100307	R&S	2019-05-10	1 year
3	TRILOG Broadband Antenna	VULB9163	VULB9163-515	Schwarzbeck	2017-02-25	3 years
4	Double Ridged Guide Antenna	ETS-3117	135890	ETS	2017-01-11	3 years
5	2-Line V-Network	ENV216	101380	R&S	2019-05-10	1 year
6	Substitution Antenna	ETS-3117	00135890	ETS	2017-01-11	3 year
7	RF Signal Generator	SMF100A	102314	R&S	2019-05-10	1 year
8	Substitution Antenna	VUBA9117	9117-266	Schwarzbeck	2017-11-18	3 years
9	Amplifier	SCU08	10146	R&S	2019-05-10	1 year

**Conducted test system**

No.	Name	Type	SN	Manufacture	Calibration date	Cal.interval
1	Vector Signal Analyser	FSQ40	200063	R&S	2019-05-10	1 year
2	Wireless communication comprehensive tester	CMW500	148904	R&S	2019-05-10	1 year
3	DC Power Supply	ZUP60-14	LOC-220Z 006 -0007	TDL-Lambda	2019-05-10	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 Ω

**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 kΩ
Ground system resistance	< 0.5 Ω

**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 kΩ
Ground system resistance	< 0.5 Ω
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



## 8. Measurement Uncertainty

Measurement uncertainty for all the testing in this report are within the limit specified in ECIT documents. The detailed measurement uncertainty to see the column, k=2

Measurement Items	Range	Confidence Level	Calculated Uncertainty
Maximum Peak Output Power	30MHz-3600MHz	95%	$\pm 0.544\text{dB}$
EBW and VBW	30MHz-3600MHz	95%	$\pm 62.04\text{Hz}$
Transmitter Spurious Emission-Conducted	30MHz-2GHz	95%	$\pm 0.90\text{dB}$
Transmitter Spurious Emission-Conducted	2GHz-3.6GHz	95%	$\pm 0.88\text{dB}$
Transmitter Spurious Emission-Conducted	3.6GHz-8GHz	95%	$\pm 0.96\text{dB}$
Transmitter Spurious Emission-Conducted	8GHz-20GHz	95%	$\pm 0.94\text{dB}$
Transmitter Spurious Emission-Radiated	9KHz-30MHz	95%	$\pm 5.66\text{dB}$
Transmitter Spurious Emission-Radiated	30MHz-1000MHz	95%	$\pm 4.98\text{dB}$
Transmitter Spurious Emission-Radiated	1000MHz -18000MHz	95%	$\pm 5.06\text{dB}$
Transmitter Spurious Emission-Radiated	18000MHz -40000MHz	95%	$\pm 5.20\text{dB}$
Frequency stability	1MHz-16GHz	95%	$\pm 62.04\text{Hz}$

## 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.

CMW500 setting:

1: CMW500 is connected to the DUT

2; Set RX Expected PEP to 30 dbm

#### 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

LTE						
Modulation	RB	RB Offset	1.4MHz			
			19193	18900	18607	
QPSK	1	Low	22.80	22.71	22.69	
		Middle	23.13	23.05	23.00	
		High	22.86	22.68	22.55	
	50%	Low	23.20	23.02	22.85	
		Middle	23.13	23.08	22.93	
		High	23.10	23.04	22.94	
	100%	/	22.16	22.11	21.95	
	16QAM	1	Low	22.19	22.05	21.99
			Middle	22.50	22.34	22.27
High			22.09	22.03	21.78	
5		Low	22.14	21.93	21.82	
		Middle	22.12	22.00	21.88	
		High	22.05	22.02	21.83	
100%		/	21.14	21.06	20.90	
Modulation		RB	RB Offset	3MHz		
				19185	18900	18615
QPSK	1	Low	22.82	22.75	22.72	
		Middle	23.16	23.10	23.04	

	50%	High	22.89	22.73	22.59	
		Low	22.30	22.14	21.98	
		Middle	22.25	22.18	22.05	
		High	22.20	22.15	22.04	
	100%	/	22.19	22.15	21.98	
16QAM	1	Low	22.22	22.07	22.02	
		Middle	22.53	22.39	22.31	
		High	22.11	22.07	21.81	
	50%	Low	21.25	21.06	20.94	
		Middle	21.23	21.13	21.00	
		High	21.15	21.14	20.96	
	100%	/	21.17	21.10	20.93	
	Modulation	RB	RB Offset	5MHz		
				19175	18900	18625
QPSK	1	Low	22.79	22.73	22.68	
		Middle	23.14	23.06	23.01	
		High	22.86	22.68	22.55	
	50%	Low	22.27	22.09	21.94	
		Middle	22.23	22.14	22.00	
		High	22.18	22.13	22.00	
	100%	/	22.17	22.14	21.96	
	16QAM	1	Low	22.19	22.03	21.99
			Middle	22.50	22.37	22.28
High			22.08	22.05	21.77	
50%		Low	21.23	21.02	20.91	
		Middle	21.20	21.08	20.96	
		High	21.12	21.09	20.92	
100%		/	21.15	21.06	20.88	
Modulation		RB	RB Offset	10MHz		
				19150	18900	18650
QPSK	1	Low	22.81	22.74	22.71	
		Middle	23.17	23.11	23.05	
		High	22.88	22.72	22.58	
	50%	Low	22.30	22.14	21.98	
		Middle	22.26	22.19	22.04	
		High	22.20	22.17	22.05	
	100%	/	22.25	22.16	22.00	
	16QAM	1	Low	22.21	22.06	22.01
			Middle	22.53	22.41	22.31
High			22.11	22.07	21.80	
50%		Low	21.26	21.07	20.95	
		Middle	21.22	21.12	20.99	

		High	21.15	21.14	20.96
	100%	/	21.18	21.11	20.92
Modulation	RB	RB Offset	15MHz		
			19125	18900	18675
QPSK	1	Low	22.80	22.70	22.69
		Middle	23.15	23.10	23.02
		High	22.85	22.67	22.54
	50%	Low	22.28	22.10	21.95
		Middle	22.23	22.14	22.00
		High	22.17	22.14	22.01
	100%	/	22.23	22.12	21.95
16QAM	1	Low	22.16	22.04	21.99
		Middle	22.51	22.38	22.29
		High	22.08	22.03	21.77
	50%	Low	21.23	21.05	20.92
		Middle	21.19	21.07	20.95
		High	21.13	21.10	20.93
	100%	/	21.15	21.06	20.88
Modulation	RB	RB Offset	20MHz		
			19100	18900	18700
QPSK	1	Low	22.77	22.66	22.66
		Middle	23.14	23.06	23.00
		High	22.83	22.66	22.51
	50%	Low	22.25	22.05	21.91
		Middle	22.21	22.10	21.97
		High	22.14	22.09	21.97
	100%	/	22.20	22.07	21.91
16QAM	1	Low	22.14	22.00	21.94
		Middle	22.47	22.36	22.25
		High	22.06	22.00	21.75
	50%	Low	21.20	21.01	20.89
		Middle	21.16	21.05	20.92
		High	21.10	21.05	20.89
	100%	/	21.13	21.02	20.85

**LTE band 4**

LTE						
Modulation	RB	RB Offset	1.4MHz			
			20393	20175	19957	
QPSK	1	Low	22.19	22.20	22.25	
		Middle	22.49	22.44	22.45	
		High	22.05	22.11	22.09	
	50%	Low	22.48	22.46	22.37	
		Middle	22.38	22.44	22.45	
		High	22.32	22.27	22.40	
	100%	/	21.43	21.43	21.41	
	16QAM	1	Low	21.46	21.50	21.49
			Middle	21.79	21.66	21.82
High			21.32	21.31	21.39	
50%		Low	21.46	21.39	21.32	
		Middle	21.40	21.33	21.40	
		High	21.29	21.24	21.34	
100%		/	20.44	20.41	20.41	
Modulation		RB	RB Offset	3MHz		
				20385	20175	19965
QPSK	1	Low	22.21	22.24	22.28	
		Middle	22.52	22.49	22.49	
		High	22.08	22.16	22.13	
	50%	Low	21.58	21.58	21.50	
		Middle	21.50	21.54	21.57	
		High	21.42	21.38	21.50	
	100%	/	21.46	21.47	21.44	
	16QAM	1	Low	21.49	21.52	21.52
			Middle	21.82	21.71	21.86
High			21.34	21.35	21.42	
50%		Low	20.57	20.52	20.44	
		Middle	20.51	20.46	20.52	
		High	20.39	20.36	20.47	
100%		/	20.47	20.45	20.44	
Modulation		RB	RB Offset	5MHz		
				20375	20175	19975
QPSK	1	Low	22.18	22.22	22.24	
		Middle	22.50	22.45	22.46	
		High	22.05	22.11	22.09	
	50%	Low	21.55	21.53	21.46	
		Middle	21.48	21.50	21.52	
		High	21.40	21.36	21.46	

	100%	/	21.44	21.46	21.42
16QAM	1	Low	21.46	21.48	21.49
		Middle	21.79	21.69	21.83
		High	21.31	21.33	21.38
	50%	Low	20.55	20.48	20.41
		Middle	20.48	20.41	20.48
		High	20.36	20.31	20.43
	100%	/	20.45	20.41	20.39
Modulation	RB	RB Offset	10MHz		
			20350	20175	20000
QPSK	1	Low	22.20	22.23	22.27
		Middle	22.53	22.50	22.50
		High	22.07	22.15	22.12
	50%	Low	21.58	21.58	21.50
		Middle	21.51	21.55	21.56
		High	21.42	21.40	21.51
	100%	/	21.52	21.48	21.46
16QAM	1	Low	21.48	21.51	21.51
		Middle	21.82	21.73	21.86
		High	21.34	21.35	21.41
	50%	Low	20.58	20.53	20.45
		Middle	20.50	20.45	20.51
		High	20.39	20.36	20.47
	100%	/	20.48	20.46	20.43
Modulation	RB	RB Offset	15MHz		
			20325	20175	20025
QPSK	1	Low	22.19	22.19	22.25
		Middle	22.51	22.49	22.47
		High	22.04	22.10	22.08
	50%	Low	21.56	21.54	21.47
		Middle	21.48	21.50	21.52
		High	21.39	21.37	21.47
	100%	/	21.50	21.44	21.41
16QAM	1	Low	21.43	21.49	21.49
		Middle	21.80	21.70	21.84
		High	21.31	21.31	21.38
	50%	Low	20.55	20.51	20.42
		Middle	20.47	20.40	20.47
		High	20.37	20.32	20.44
	100%	/	20.45	20.41	20.39
Modulation	RB	RB Offset	20MHz		
			20300	20175	20050

QPSK	1	Low	22.16	22.15	22.22	
		Middle	22.50	22.45	22.45	
		High	22.02	22.09	22.05	
	50%	Low	21.53	21.49	21.43	
		Middle	21.46	21.46	21.49	
		High	21.36	21.32	21.43	
	100%	/	21.47	21.39	21.37	
	16QAM	1	Low	21.41	21.45	21.44
			Middle	21.76	21.68	21.80
High			21.29	21.28	21.36	
50%		Low	20.52	20.47	20.39	
		Middle	20.44	20.38	20.44	
		High	20.34	20.27	20.40	
100%		/	20.43	20.37	20.36	

**LTE band 5**

LTE						
Modulation	RB	RB Offset	1.4MHz			
			20643	20525	20407	
QPSK	1	Low	23.46	23.51	23.49	
		Middle	24.34	23.79	23.89	
		High	24.11	23.55	23.64	
	50%	Low	22.77	22.79	22.89	
		Middle	22.95	22.88	22.94	
		High	23.00	22.81	23.04	
	100%	/	22.82	22.84	22.98	
	16QAM	1	Low	22.73	22.69	22.67
			Middle	23.21	23.04	23.15
High			22.86	22.86	22.92	
50%		Low	21.78	21.73	21.85	
		Middle	21.94	21.82	21.91	
		High	22.00	21.78	21.99	
100%		/	21.84	21.75	21.86	
Modulation		RB	RB Offset	3MHz		
				20635	20525	20415
QPSK	1	Low	23.48	23.52	23.52	
		Middle	24.37	23.84	23.93	
		High	24.13	23.59	23.67	
	50%	Low	22.80	22.84	22.93	
		Middle	22.98	22.93	22.98	
		High	23.02	22.85	23.09	
	100%	/	22.90	22.86	23.02	

16QAM	1	Low	22.75	22.72	22.69
		Middle	23.24	23.08	23.18
		High	22.89	22.88	22.95
	50%	Low	21.81	21.78	21.89
		Middle	21.96	21.86	21.94
		High	22.03	21.83	22.03
	100%	/	21.87	21.80	21.90
Modulation	RB	RB Offset	5MHz		
			20625	20525	20425
QPSK	1	Low	23.47	23.48	23.50
		Middle	24.35	23.83	23.90
		High	24.10	23.54	23.63
	50%	Low	22.78	22.80	22.90
		Middle	22.95	22.88	22.94
		High	22.99	22.82	23.05
	100%	/	22.88	22.82	22.97
16QAM	1	Low	22.70	22.70	22.67
		Middle	23.22	23.05	23.16
		High	22.86	22.84	22.92
	50%	Low	21.78	21.76	21.86
		Middle	21.93	21.81	21.90
		High	22.01	21.79	22.00
	100%	/	21.84	21.75	21.86
Modulation	RB	RB Offset	10MHz		
			20600	20525	20450
QPSK	1	Low	23.44	23.44	23.47
		Middle	24.34	23.79	23.88
		High	24.08	23.53	23.60
	50%	Low	22.75	22.75	22.86
		Middle	22.93	22.84	22.91
		High	22.96	22.77	23.01
	100%	/	22.85	22.77	22.93
16QAM	1	Low	22.68	22.66	22.62
		Middle	23.18	23.03	23.12
		High	22.84	22.81	22.90
	50%	Low	21.75	21.72	21.83
		Middle	21.90	21.79	21.87
		High	21.98	21.74	21.96
	100%	/	21.82	21.71	21.83



**LTE band 7**

LTE					
Modulation	RB	RB Offset	5MHz		
			21425	21100	20775
QPSK	1	Low	22.20	22.39	22.41
		Middle	22.39	22.50	22.59
		High	22.27	22.41	22.50
	50%	Low	21.25	21.38	21.46
		Middle	21.21	21.39	21.45
		High	21.36	21.47	21.52
100%	/	21.18	21.39	21.44	
16QAM	1	Low	21.14	21.23	21.36
		Middle	21.60	21.74	21.83
		High	21.31	21.45	21.51
	50%	Low	20.39	20.44	20.52
		Middle	20.31	20.38	20.45
		High	20.22	20.30	20.36
100%	/	20.24	20.42	20.44	
Modulation	RB	RB Offset	10MHz		
			21400	21100	20800
QPSK	1	Low	22.22	22.40	22.44
		Middle	22.42	22.55	22.63
		High	22.29	22.45	22.53
	50%	Low	21.28	21.43	21.50
		Middle	21.24	21.44	21.49
		High	21.38	21.51	21.57
100%	/	21.26	21.41	21.48	
16QAM	1	Low	21.16	21.26	21.38
		Middle	21.63	21.78	21.86
		High	21.34	21.47	21.54
	50%	Low	20.42	20.49	20.56
		Middle	20.33	20.42	20.48
		High	20.25	20.35	20.40
100%	/	20.27	20.47	20.48	
Modulation	RB	RB Offset	15MHz		
			21375	21100	20825
QPSK	1	Low	22.21	22.36	22.42
		Middle	22.40	22.54	22.60
		High	22.26	22.40	22.49
	50%	Low	21.26	21.39	21.47
		Middle	21.21	21.39	21.45
		High	21.35	21.48	21.53

	100%	/	21.24	21.37	21.43
16QAM	1	Low	21.11	21.24	21.36
		Middle	21.61	21.75	21.84
		High	21.31	21.43	21.51
	50%	Low	20.39	20.47	20.53
		Middle	20.30	20.37	20.44
		High	20.23	20.31	20.37
100%	/	20.24	20.42	20.44	
Modulation	RB	RB Offset	20MHz		
			21350	21100	20850
QPSK	1	Low	22.18	22.32	22.39
		Middle	22.39	22.50	22.58
		High	22.24	22.39	22.46
	50%	Low	21.23	21.34	21.43
		Middle	21.19	21.35	21.42
		High	21.32	21.43	21.49
100%	/	21.21	21.32	21.39	
16QAM	1	Low	21.09	21.20	21.31
		Middle	21.57	21.73	21.80
		High	21.29	21.40	21.49
	50%	Low	20.36	20.43	20.50
		Middle	20.27	20.35	20.41
		High	20.20	20.26	20.33
100%	/	20.22	20.38	20.41	

**LTE band 12**

LTE					
Modulation	RB	RB Offset	1.4MHz		
			23173	23095	23017
QPSK	1	Low	22.66	22.61	22.46
		Middle	22.84	22.68	22.79
		High	22.76	22.55	22.53
	50%	Low	22.00	21.97	21.92
		Middle	22.11	22.02	21.98
		High	22.06	22.01	21.88
100%	/	22.05	21.92	21.94	
16QAM	1	Low	22.17	22.01	21.97
		Middle	22.28	22.25	22.16
		High	21.96	21.93	21.65
	50%	Low	21.12	21.00	20.89
		Middle	21.18	20.96	20.87
		High	20.93	20.96	21.00

	100%	/	21.84	21.75	21.86	
Modulation	RB	RB Offset	3MHz			
			23165	23095	23025	
QPSK	1	Low	22.68	22.62	22.49	
		Middle	22.87	22.73	22.83	
		High	22.78	22.59	22.56	
	50%	Low	22.03	22.02	21.96	
		Middle	22.14	22.07	22.02	
		High	22.08	22.05	21.93	
	100%	/	22.13	21.94	21.98	
	16QAM	1	Low	22.19	22.04	21.99
			Middle	22.31	22.29	22.19
High			21.99	21.95	21.68	
50%		Low	21.15	21.05	20.93	
		Middle	21.20	21.00	20.90	
		High	20.96	21.01	21.04	
100%		/	21.09	21.03	20.90	
Modulation		RB	RB Offset	5MHz		
				23155	23095	23035
QPSK	1	Low	22.67	22.58	22.47	
		Middle	22.85	22.72	22.80	
		High	22.75	22.54	22.52	
	50%	Low	22.01	21.98	21.93	
		Middle	22.11	22.02	21.98	
		High	22.05	22.02	21.89	
	100%	/	22.11	21.90	21.93	
	16QAM	1	Low	22.14	22.02	21.97
			Middle	22.29	22.26	22.17
High			21.96	21.91	21.65	
50%		Low	21.12	21.03	20.90	
		Middle	21.17	20.95	20.86	
		High	20.94	20.97	21.01	
100%		/	21.06	20.98	20.86	
Modulation		RB	RB Offset	10MHz		
				23130	23095	23060
QPSK	1	Low	22.64	22.54	22.44	
		Middle	22.84	22.68	22.78	
		High	22.73	22.53	22.49	
	50%	Low	21.98	21.93	21.89	
		Middle	22.09	21.98	21.95	
		High	22.02	21.97	21.85	
	100%	/	22.08	21.85	21.89	

16QAM	1	Low	22.12	21.98	21.92
		Middle	22.25	22.24	22.13
		High	21.94	21.88	21.63
	50%	Low	21.09	20.99	20.87
		Middle	21.14	20.93	20.83
		High	20.91	20.92	20.97
	100%	/	21.04	20.94	20.83

**LTE band 13**

LTE					
Modulation	RB	RB Offset	5MHz		
			23255	23230	23205
QPSK	1	Low	23.24	23.42	23.37
		Middle	23.74	23.67	23.63
		High	23.68	23.39	23.42
	50%	Low	22.65	22.85	22.76
		Middle	22.77	22.52	22.81
		High	22.72	22.57	22.71
	100%	/	22.63	22.77	22.63
16QAM	1	Low	22.43	22.50	22.32
		Middle	22.87	22.76	22.86
		High	22.54	22.67	22.68
	50%	Low	21.51	21.62	21.62
		Middle	21.53	21.63	21.64
		High	21.74	21.64	21.66
	100%	/	21.62	21.59	21.63
Modulation	RB	RB Offset	10MHz		
			/	23230	/
QPSK	1	Low	/	23.38	/
		Middle	/	23.63	/
		High	/	23.38	/
	50%	Low	/	22.80	/
		Middle	/	22.48	/
		High	/	22.52	/
	100%	/	/	22.72	/
16QAM	1	Low	/	22.46	/
		Middle	/	22.74	/
		High	/	22.64	/
	50%	Low	/	21.58	/
		Middle	/	21.61	/
		High	/	21.59	/

**LTE band 17**

LTE						
Modulation	RB	RB Offset	5MHz			
			23825	23790	23755	
QPSK	1	Low	23.30	23.31	23.35	
		Middle	23.48	23.49	23.51	
		High	23.37	23.33	23.40	
	50%	Low	22.45	22.43	22.37	
		Middle	22.46	22.46	22.45	
		High	22.46	22.42	22.42	
	100%	/	22.47	22.46	22.40	
	16QAM	1	Low	22.53	22.51	22.59
			Middle	22.77	22.68	22.79
High			22.52	22.57	22.64	
50%		Low	21.38	21.32	21.26	
		Middle	21.41	21.40	21.40	
		High	21.39	21.35	21.33	
100%		/	21.38	21.36	21.33	
Modulation		RB	RB Offset	10MHz		
				23800	23790	23780
QPSK	1	Low	23.27	23.27	23.32	
		Middle	23.47	23.45	23.49	
		High	23.35	23.32	23.37	
	50%	Low	22.42	22.38	22.33	
		Middle	22.44	22.42	22.42	
		High	22.43	22.37	22.38	
	100%	/	22.44	22.41	22.36	
	16QAM	1	Low	22.51	22.47	22.54
			Middle	22.73	22.66	22.75
High			22.50	22.54	22.62	
50%		Low	21.35	21.28	21.23	
		Middle	21.38	21.38	21.37	
		High	21.36	21.30	21.29	
100%		/	21.36	21.32	21.30	

### 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".

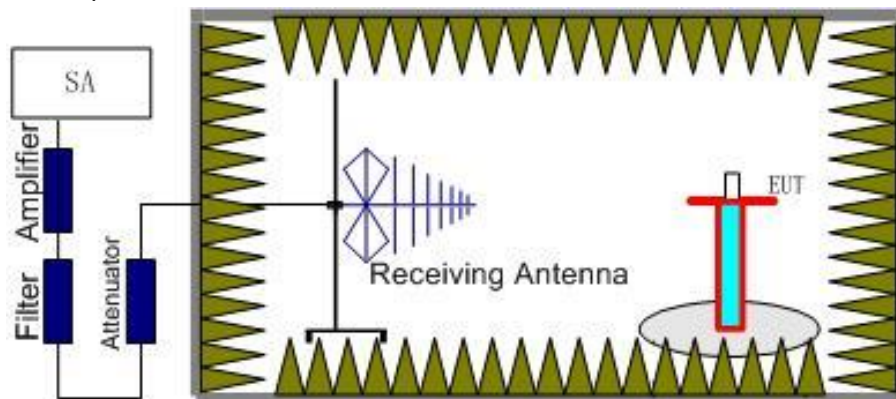
Rule Part 27.50(h)(2) specifies "Mobile stations are limited to 2.0 watts EIRP".

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

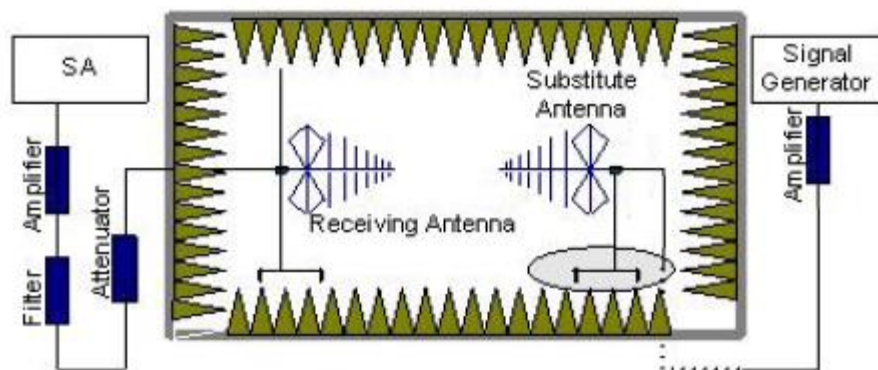
#### A.1.3.2 Method of Measurement

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 ( $P_r$ ).
3. The EUT shall be replaced by a substitution antenna. The test setup refers to figure below.



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

4. An amplifier should be connected to the Signal Source output port. And the cable should be connected between the amplifier and the substitution antenna.  
The cable loss ( $P_{cl}$ ), the substitution antenna Gain ( $G_a$ ) and the amplifier Gain ( $P_{Ag}$ ) should be recorded after test.  
The measurement results are obtained as described below:  
Power (EIRP) =  $P_{Mea} + P_{Ag} - P_{cl} + G_a$
5. This value is EIRP since the measurement is calibrated using an antenna of known gain (unit dBi) and known input power.
6. ERP can be calculated from EIRP by subtracting the gain of the dipole,  $ERP = EIRP - 2.15$ .

### A.1.3.3 Measurement result

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

Limits:  $\leq 33\text{dBm}$  (2W)

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

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
1850.7	19.55	33.00	H
1880	20.62	33.00	H
1909.3	20.91	33.00	H

#### LTE Band 2\_3MHz\_QPSK

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
1851.5	19.66	33.00	H
1880	21.03	33.00	H
1908.5	20.76	33.00	H

#### LTE Band 2\_5MHz\_QPSK

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
1852.5	19.45	33.00	H
1880	20.8	33.00	H
1907.5	20.98	33.00	H

#### LTE Band 2\_10MHz\_QPSK

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
1855	19.69	33.00	H
1880	21.02	33.00	H
1905	21.06	33.00	H

**LTE Band 2\_15MHz\_QPSK**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
1857.5	19.75	33.00	H
1880	20.81	33.00	H
1902.5	21.19	33.00	H

**LTE Band 2\_20 MHz\_QPSK**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
1860	19.41	33.00	H
1880	20.81	33.00	H
1900	21.24	33.00	H

**LTE Band 2\_1.4MHz\_16QAM**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
1850.7	19.77	33.00	H
1880	21.08	33.00	H
1909.3	20.56	33.00	H

**LTE Band 2\_3MHz\_16QAM**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
1851.5	19.75	33.00	H
1880	21.04	33.00	H
1908.5	20.75	33.00	H

**LTE Band 2\_5MHz\_16QAM**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
1852.5	19.74	33.00	H
1880	20.67	33.00	H
1907.5	20.72	33.00	H

**LTE Band 2\_10MHz\_16QAM**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
1855	20.06	33.00	H
1880	21.25	33.00	H
1905	20.95	33.00	H

**LTE Band 2\_15MHz\_16QAM**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
1857.5	19.67	33.00	H
1880	21.13	33.00	H
1902.5	21.14	33.00	H

**LTE Band 2\_20 MHz\_16QAM**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
1860	19.3	33.00	H
1880	21.08	33.00	H
1900	20.82	33.00	H

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



**Limits:** ≤30dBm (1W)

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

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
1710.7	19.44	30.00	H
1732.5	17.82	30.00	H
1754.3	18.23	30.00	H

**LTE Band 4\_3MHz\_QPSK**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
1711.5	19.45	30.00	H
1732.5	17.98	30.00	H
1753.5	18.26	30.00	H

**LTE Band 4\_5MHz\_QPSK**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
1712.5	19.03	30.00	H
1732.5	17.82	30.00	H
1752.5	18.39	30.00	H

**LTE Band 4\_10MHz\_QPSK**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
1715	19.16	30.00	H
1732.5	17.71	30.00	H
1750	18.95	30.00	H

**LTE Band 4\_15MHz\_QPSK**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
1717.5	19.47	30.00	H
1732.5	17.7	30.00	H
1747.5	18.46	30.00	H

**LTE Band 4\_20MHz\_QPSK**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
1720	18.95	30.00	H
1732.5	17.58	30.00	H
1745	18.57	30.00	H

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

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
1710.7	19.56	30.00	H
1732.5	17.74	30.00	H
1754.3	18.32	30.00	H

**LTE Band 4\_3MHz\_16QAM**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
1711.5	19.48	30.00	H
1732.5	18.02	30.00	H
1753.5	18.33	30.00	H

**LTE Band 4\_5MHz\_16QAM**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
1712.5	19.26	30.00	H
1732.5	17.58	30.00	H
1752.5	18.56	30.00	H

**LTE Band 4\_10MHz\_16QAM**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
1715	19.42	30.00	H
1732.5	18	30.00	H
1750.5	18.88	30.00	H

**LTE Band 4\_15MHz\_16QAM**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
1717.5	19.72	30.00	H
1732.5	17.88	30.00	H
1747.5	18.28	30.00	H

**LTE Band 4\_20MHz\_16QAM**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
1720	19.16	30.00	H
1732.5	17.97	30.00	H
1745	18.31	30.00	H

**LTE Band 5- ERP 22.913(a)**
**Limits:**  $\leq 38.45\text{dBm}$  (7W)

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

Frequency(MHz)	ERP(dBm)	Limit(dBm)	Polarization
824.70	19.82	38.45	H
836.50	19.37	38.45	H
848.30	19.41	38.45	H

**LTE Band 5\_3MHz\_QPSK**

Frequency(MHz)	ERP(dBm)	Limit(dBm)	Polarization
825.50	20.54	38.45	H
836.50	19.10	38.45	H
847.50	19.07	38.45	H

**LTE Band 5\_5MHz\_QPSK**

Frequency(MHz)	ERP(dBm)	Limit(dBm)	Polarization
826.50	20.42	38.45	H
836.50	18.56	38.45	H
846.50	19.03	38.45	H

**LTE Band 5\_10MHz\_QPSK**

Frequency(MHz)	ERP(dBm)	Limit(dBm)	Polarization
829.00	20.29	38.45	H
836.50	18.82	38.45	H
844.00	18.90	38.45	H

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

Frequency(MHz)	ERP(dBm)	Limit(dBm)	Polarization
824.70	20.96	38.45	H
836.50	19.33	38.45	H
848.30	19.83	38.45	H

**LTE Band 5\_3MHz\_16QAM**

Frequency(MHz)	ERP(dBm)	Limit(dBm)	Polarization
825.50	21.32	38.45	H
836.50	19.39	38.45	H
847.50	19.56	38.45	H

**LTE Band 5\_5MHz\_16QAM**

Frequency(MHz)	ERP(dBm)	Limit(dBm)	Polarization
826.50	21.12	38.45	H
836.50	19.07	38.45	H
846.50	19.38	38.45	H

**LTE Band 5\_10MHz\_16QAM**

Frequency(MHz)	ERP(dBm)	Limit(dBm)	Polarization
829.00	20.98	38.45	H
836.50	19.44	38.45	H
844.00	19.47	38.45	H

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

Limits: ≤33 dBm (2W)

**LTE Band 7\_5MHz\_QPSK**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
2502.5	16.71	33.00	H
2535	16.67	33.00	H
2567.5	17.45	33.00	H

**LTE Band 7\_10MHz\_QPSK**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
2505	17.24	33.00	H
2535	16.43	33.00	H
2565	17.56	33.00	H

**LTE Band 7\_15MHz\_QPSK**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
2507.5	17.23	33.00	H
2535	16.71	33.00	H

2562.5	17.17	33.00	H
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**LTE Band 7\_20MHz\_QPSK**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
2510	17.24	33.00	H
2535	16.86	33.00	H
2560	17.36	33.00	H

**LTE Band 7\_5MHz\_16QAM**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
2502.5	16.8	33.00	H
2535	16.4	33.00	H
2567.5	17.49	33.00	H

**LTE Band 7\_10MHz\_16QAM**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
2505	16.58	33.00	H
2535	17.24	33.00	H
2565	16.88	33.00	H

**LTE Band 7\_15MHz\_16QAM**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
2507.5	17.11	33.00	H
2535	16.64	33.00	H
2562.5	17.58	33.00	H

**LTE Band 7\_20MHz\_16QAM**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
2510	16.67	33.00	H
2535	16.89	33.00	H
2560	17.28	33.00	H

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

Limits:  $\leq 34.77$ dBm (3W)

**LTE Band 12\_1.4MHz\_QPSK**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
699.7	23.91	33.00	H
707.5	21.36	33.00	H
715.3	19.94	33.00	H

**LTE Band 12\_3MHz\_QPSK**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
700.5	23.99	33.00	H
707.5	21.71	33.00	H
714.5	19.73	33.00	H

**LTE Band 12\_5MHz\_QPSK**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
701.5	23.76	33.00	H
707.5	21.45	33.00	H
713.5	19.65	33.00	H

**LTE Band 12\_10MHz\_QPSK**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
704	23.19	33.00	H
707.5	21.53	33.00	H
711	19.58	33.00	H

**LTE Band 12\_1.4MHz\_16QAM**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
699.7	24.68	33.00	H
707.5	22.03	33.00	H
715.3	20.7	33.00	H

**LTE Band 12\_3MHz\_16QAM**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
700.5	24.53	33.00	H
707.5	22.17	33.00	H
714.5	20.48	33.00	H

**LTE Band 12\_5MHz\_16QAM**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
701.5	24	33.00	H
707.5	21.84	33.00	H
713.5	20.54	33.00	H

**LTE Band 12\_10MHz\_16QAM**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
704	23.64	33.00	H
707.5	21.83	33.00	H
711	20.76	33.00	H

**LTE Band 13- EIRP 27.50(c)(10)**

**Limits:** ≤34.77dBm (3W)

**LTE Band 13\_5MHz\_QPSK**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
779.5	22.09	33.00	H
782	22.08	33.00	H
784.5	22.14	33.00	H

**LTE Band 13\_10MHz\_QPSK**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
782	21.98	33.00	H

**LTE Band 13\_5MHz\_16QAM**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
779.5	22.05	33.00	H
782	22.33	33.00	H
784.5	22.59	33.00	H

**LTE Band 13\_10MHz\_16QAM**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
782	21.97	33.00	H

**LTE Band 17- EIRP 27.50(c)(10)**

 Limits:  $\leq 34.77$ dBm (3W)

**LTE Band 17\_5MHz\_QPSK**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
706.5	21.89	34.77	H
710	20.36	34.77	H
713.5	19.42	34.77	H

**LTE Band 17\_10MHz\_QPSK**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
709	21.91	34.77	H
710	20.44	34.77	H
711	19.66	34.77	H

**LTE Band 17\_5MHz\_16QAM**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
706.5	21.78	34.77	H
710	20.92	34.77	H
713.5	19.89	34.77	H

**LTE Band 17\_10MHz\_16QAM**

Frequency(MHz)	EIRP(dBm)	Limit(dBm)	Polarization
709	21.69	34.77	H
710	20.87	34.77	H
711	19.95	34.77	H

## ANNEX A.2. EMISSION LIMIT

### Reference

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

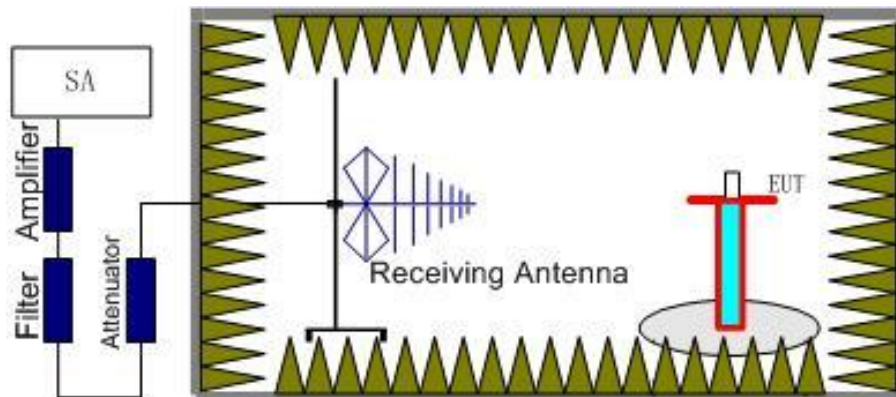
### A.2.1 Measurement Method

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

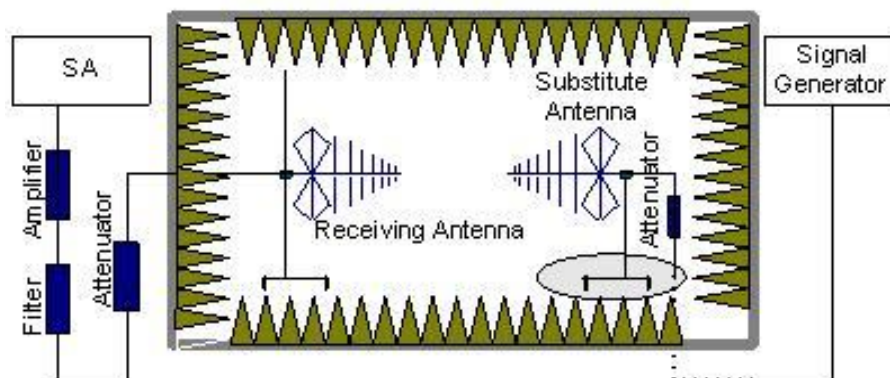
The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier. The resolution bandwidth is set 1MHz as outlined in Part 22.917,Part 24.238(a), Part 27.53(g), Part 27.53(h), Part 27.53(m). The spectrum was scanned with the mobile station transmitting at carrier frequencies that pertain to low, mid and high channels of the LTE Bands 2,4,5,7,12,13,17.

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

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

An amplifier should be connected in for the test.

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

The measurement results are obtained as described below:

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

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

### A.2.2 Measurement Limit

Part 22.917, 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 2,4,5,7,12,13,17. 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 2,4,5,7,12,13,17. 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**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
3588.0	-49.44	6.5	4.7	-51.24	-13	V
4476.0	-52.02	7.3	7.3	-52.02	-13	H
5554.0	-50.87	8.2	9.5	-49.57	-13	H
7140.4	-53.45	9.4	13.7	-49.15	-13	V
9262.0	-51	10.6	18.5	-43.1	-13	H
11820.4	-47.56	12.5	17.6	-42.46	-13	V

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

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
3760.4	-53.1	6.6	7.7	-52	-13	H
4628.4	-51.86	7.5	7.9	-51.46	-13	V
5636.4	-48.02	8.3	10.5	-45.82	-13	H
7520.0	-52.13	9.7	14.6	-47.23	-13	H
9404.0	-47.35	10.7	18.6	-39.45	-13	H
10805.6	-48.51	11.7	17.3	-42.91	-13	H

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

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
3817.2	-53.37	6.7	7.7	-52.37	-13	H
4537.2	-51.33	7.4	7.3	-51.43	-13	V
5722.4	-52.49	8.5	10.5	-50.49	-13	H
7630.0	-53.84	9.7	15.3	-48.24	-13	H
9544.0	-45.11	10.7	18.6	-37.21	-13	H
11256.2	-49.93	12.1	18.5	-43.53	-13	V

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

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
3589.6	-50.85	6.5	4.7	-52.65	-13	V
4550.4	-50.93	7.4	7.3	-51.03	-13	V
5506.4	-52.58	8.2	9.5	-51.28	-13	H
6404.0	-52.21	8.9	11.5	-49.61	-13	V
7934.8	-55.18	9.8	16.6	-48.38	-13	V
9486.4	-53.68	10.7	18.6	-45.78	-13	V

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

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
3949.2	-52.69	6.8	7.7	-51.79	-13	H
4662.8	-52.01	7.5	7.9	-51.61	-13	V
5907.2	-52.66	8.5	10.4	-50.76	-13	V
7226.8	-53.26	9.6	13.7	-49.16	-13	H
8668.4	-54.97	10.3	18.5	-46.77	-13	H
10789.6	-49	11.7	17.3	-43.4	-13	H

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

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
3554.4	-50.38	6.4	4.7	-52.08	-13	V
4530.4	-50.6	7.4	7.3	-50.7	-13	V
5564.8	-51.97	8.2	9.5	-50.67	-13	H
7057.2	-52.76	9.4	12.9	-49.26	-13	H
8759.2	-52.78	10.4	18.5	-44.68	-13	H
10803.6	-48.47	11.7	17.3	-42.87	-13	H

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

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
1527.2	-48.96	4.2	3.4	-49.76	-13	V
2461.2	-38.68	5.3	3.7	-40.28	-13	H
3310.4	-45.32	6.2	4.7	-46.82	-13	H
4138.4	-37.34	7.0	7.7	-36.64	-13	H
5202.8	-53.27	8.0	8.7	-52.57	-13	H
6147.2	-52.84	8.7	10.8	-50.74	-13	H

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

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
1508.1	-47.85	4.1	3.4	-48.55	-13	V
2455.4	-39	5.3	3.7	-40.6	-13	V
3350.4	-42.92	6.2	4.7	-44.42	-13	H
4188.0	-39.54	7.0	7.7	-38.84	-13	V
5235.6	-52.67	8.0	8.7	-51.97	-13	H
6285.6	-52.83	8.8	10.8	-50.83	-13	V

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

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
1516.1	-49.05	4.1	3.4	-49.75	-13	V
2455.8	-39.59	5.3	3.7	-41.19	-13	H
3390.4	-40.64	6.3	4.7	-42.24	-13	H
4226.8	-37.48	7.1	7.7	-36.88	-13	H
5238.4	-53.27	8.0	8.7	-52.57	-13	H
6390.0	-51.81	8.9	11.5	-49.21	-13	H

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

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
3752.8	-50.23	6.6	7.7	-49.13	-13	H
4772.4	-47.73	7.5	7.9	-47.33	-13	V
5722.0	-50.12	8.5	10.5	-48.12	-13	H
6592.4	-47.04	9.1	11.5	-44.64	-13	H
7892.4	-49.83	9.9	16.6	-43.13	-13	V
9510.4	-49.05	10.7	18.6	-41.15	-13	V

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

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
3628.4	-50.4	6.6	7.7	-49.3	-13	V
4574.0	-47.29	7.4	7.3	-47.39	-13	H
5528.4	-47.29	8.2	9.5	-45.99	-13	V
7048.0	-48.44	9.4	12.9	-44.94	-13	V
8544.4	-50.32	10.3	18.1	-42.52	-13	V
10677.6	-44.22	11.7	17.3	-38.62	-13	V

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

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
4242.4	-47.77	7.1	7.7	-47.17	-13	V
5126.8	-48.76	7.9	8.7	-47.96	-13	H
5977.6	-48.39	8.6	10.4	-46.59	-13	H
7336.0	-47.63	9.6	13.7	-43.53	-13	V
8907.6	-49.81	10.4	18.3	-41.91	-13	V
10780.8	-43.33	11.7	17.3	-37.73	-13	H

**LTE Band 12, 10 MHz, QPSK, Channel 23017**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
1634.5	-46.39	4.3	2.9	-47.79	-13	H
2625.8	-37.8	5.5	4.1	-39.2	-13	H
3513.2	-44.69	6.4	4.7	-46.39	-13	H
4204.0	-52.76	7.0	7.7	-52.06	-13	H
5442.0	-52.92	8.1	9.5	-51.52	-13	V
6396.4	-52.41	8.9	11.5	-49.81	-13	H

**LTE Band 12, 10 MHz, QPSK, Channel 23095**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
1735.9	-44.76	4.4	2.9	-46.26	-13	V
2538.8	-39.57	5.4	3.7	-41.27	-13	V
3537.6	-41.4	6.4	4.7	-43.1	-13	H
4542.0	-50.9	7.4	7.3	-51	-13	V
5406.8	-52.59	8.1	9.5	-51.19	-13	V
6494.0	-52.48	9.0	11.5	-49.98	-13	H

**LTE Band 12, 5 MHz, QPSK, Channel 23173**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
1470.7	-49.06	4.1	3.4	-49.76	-13	V
2659.2	-37.28	5.5	4.1	-38.68	-13	H
3567.6	-42.49	6.4	4.7	-44.19	-13	H
4287.6	-52.39	7.1	7.7	-51.79	-13	H
4965.2	-54.45	7.7	9.0	-53.15	-13	H
5630.4	-54.31	8.3	10.5	-52.11	-13	V

**LTE Band 13, 1.4MHz QPSK, Channel 23205**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
1309.4	-48.38	3.9	2.0	-50.28	-13	V
1534.8	-48.74	4.2	3.4	-49.54	-13	V
1935.3	-42.91	4.7	2.8	-44.81	-13	V
2457.3	-39.5	5.3	3.7	-41.1	-13	H
3583.6	-50.07	6.5	4.7	-51.87	-13	H
4520.4	-50.64	7.3	7.3	-50.64	-13	V

**LTE Band 13, 1.4MHz, QPSK, Channel 20175**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
1364.1	-49.05	3.9	2.0	-50.95	-13	V
1735.9	-45.61	4.4	2.9	-47.11	-13	V
2158.5	-41.55	5.0	3.3	-43.25	-13	V
2724.6	-36.6	5.6	4.1	-38.1	-13	V
3575.6	-49.07	6.5	4.7	-50.87	-13	H
4570.4	-50.79	7.4	7.3	-50.89	-13	H

**LTE Band 13, 1.4MHz, QPSK, Channel 20393**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBd)	Peak ERP (dBm)	Limit (dBm)	Polarization
1358.9	-49.57	3.9	2.0	-51.47	-13	V
1650.0	-47.18	4.3	2.9	-48.58	-13	H
2108.5	-40.23	4.9	2.8	-42.33	-13	V
2715.4	-37.43	5.6	4.1	-38.93	-13	V
3580.8	-50.02	6.5	4.7	-51.82	-13	V
4574.8	-51.37	7.4	7.3	-51.47	-13	V

**LTE Band 17, 5MHz, QPSK, Channel 23755**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
1385.2	-50.12	4.0	3.4	-50.72	-13	V
1769.8	-43.32	4.5	2.9	-44.92	-13	V
2194.2	-40.82	5.0	3.3	-42.52	-13	V
2810.8	-36.71	5.7	4.1	-38.31	-13	H
3538.0	-40.64	6.4	4.7	-42.34	-13	H
4236.4	-51.6	7.1	7.7	-51	-13	H

**LTE Band 17, 5MHz, QPSK, Channel 23790**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
1297.7	-48.3	3.9	2.0	-50.2	-13	H
1626.5	-47.71	4.3	2.9	-49.11	-13	H
2030.0	-42.88	4.8	2.8	-44.88	-13	H
2591.5	-38.12	5.5	3.7	-39.92	-13	V
3543.6	-45.71	6.4	4.7	-47.41	-13	H
4532.4	-50.85	7.4	7.3	-50.95	-13	H

**LTE Band 17, 5MHz, QPSK, Channel 23825**

Frequency (MHz)	PMea (dBm)	Pcl (dBm)	Ga (dBi)	Peak EIRP (dBm)	Limit (dBm)	Polarization
1268.2	-47.53	3.8	2.0	-49.33	-13	H
1534.1	-48.76	4.2	3.4	-49.56	-13	V
2040.4	-42.87	4.8	2.8	-44.87	-13	H
2569.2	-39.54	5.4	3.7	-41.24	-13	V
3567.6	-43.25	6.4	4.7	-44.95	-13	H
4544.0	-50.72	7.4	7.3	-50.82	-13	H

## **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 band2,4,5,7,12,13,17, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
4. Repeat the above measurements at 10°C increments from -30°C to +50°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
5. Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring carrier frequency at each voltage. Pause at nominal voltage for 1.5 hours unpowered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50°C.
7. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
8. Repeat the above measurements at 10 °C 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 3.7VDC and 4.2VDC, with a nominal voltage of 3.8 VDC. 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
3.7	-7.739	-19.183	0.004	0.010
3.8	-6.523	-18.168	0.003	0.010
4.2	-6.824	-19.212	0.004	0.010

##### Frequency Error vs Temperature

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	-6.008	-18.668	0.003	0.010
40°	-7.524	-19.398	0.004	0.010
30°	-6.952	-18.640	0.004	0.010
20°	-5.822	-17.982	0.003	0.010
10°	-6.566	-17.753	0.003	0.009
0°	-7.339	-19.712	0.004	0.010
- 10°	-6.309	-18.783	0.003	0.010
- 20°	-8.011	-18.740	0.004	0.010
- 30°	-5.765	-19.841	0.003	0.011

#### 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
3.7	3.705	11.659	0.002	0.007
3.8	2.961	10.343	0.002	0.006
4.2	2.990	10.858	0.002	0.006

##### Frequency Error vs Temperature

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	3.462	11.330	0.002	0.007
40°	3.662	11.415	0.002	0.007
30°	4.363	9.985	0.003	0.006
20°	-3.920	10.757	0.002	0.006
10°	-4.091	11.115	0.002	0.006
0°	3.791	10.686	0.002	0.006
- 10°	4.292	10.300	0.002	0.006
- 20°	3.533	12.202	0.002	0.007
- 30°	-3.190	9.885	0.002	0.006

**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
3.7	-2.804	8.383	0.003	0.010
3.8	-2.131	9.441	0.003	0.011
4.2	-2.947	9.027	0.004	0.011

**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	-2.503	8.268	0.003	0.010
40°	-1.788	8.755	0.002	0.010
30°	-3.548	9.112	0.004	0.011
20°	-3.147	8.583	0.004	0.010
10°	-2.146	10.986	0.003	0.013
0°	-2.403	8.154	0.003	0.010
- 10°	-1.774	8.454	0.002	0.010
- 20°	-1.945	8.798	0.002	0.011
- 30°	-1.373	9.813	0.002	0.012

**LTE Band 7, 5MHz bandwidth (worst case of all bandwidths)**
**Frequency Error vs Voltage**

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.7	-10.471	-11.916	0.004	0.005
3.8	-7.482	-10.829	0.003	0.004
4.2	-8.354	-9.570	0.003	0.004

**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	-8.326	12.159	0.003	0.005
40°	-6.022	10.428	0.002	0.004
30°	-7.181	-11.158	0.003	0.004
20°	-7.825	-11.773	0.003	0.005
10°	-7.267	-9.770	0.003	0.004
0°	-6.537	-10.343	0.003	0.004
- 10°	-6.166	10.114	0.002	0.004
- 20°	-73.428	10.271	0.029	0.004
- 30°	-3.576	-12.259	0.001	0.005

**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
3.7	-2.632	-13.633	0.004	0.019
3.8	2.003	-13.089	0.003	0.019
4.2	-2.360	-12.631	0.003	0.018

**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	-2.217	-14.133	0.003	0.020
40°	2.260	-13.261	0.003	0.019
30°	-1.760	-13.847	0.002	0.020
20°	-1.674	-14.691	0.002	0.021
10°	-2.131	-12.388	0.003	0.018
0°	-2.232	-13.247	0.003	0.019
- 10°	-1.988	-13.704	0.003	0.019
- 20°	-2.818	-13.547	0.0004	0.019
- 30°	1.888	-13.661	0.003	0.019

**LTE Band 13, 5MHz bandwidth (worst case of all bandwidths)**
**Frequency Error vs Voltage**

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.7	-2.275	10.157	0.003	0.013
3.8	1.459	12.116	0.002	0.015
4.2	2.947	12.059	0.004	0.015

**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	2.604	11.301	0.003	0.014
40°	-1.945	12.031	0.002	0.015
30°	3.004	11.401	0.004	0.015
20°	3.419	10.629	0.004	0.014
10°	2.260	11.573	0.003	0.015
0°	3.018	11.830	0.004	0.015
- 10°	2.189	11.187	0.003	0.014
- 20°	3.004	10.886	0.0004	0.014
- 30°	3.405	13.804	0.0004	0.018

**LTE Band 17, 5MHz bandwidth (worst case of all bandwidths)****Frequency Error vs Voltage**

Voltage (V)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
3.7	1.631	10.271	0.002	0.014
3.8	1.831	9.542	0.003	0.013
4.2	-2.160	8.254	0.003	0.012

**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
50°	-2.518	8.912	0.004	0.013
40°	-1.502	9.127	0.002	0.013
30°	-2.289	8.383	0.003	0.012
20°	-2.389	8.297	0.003	0.012
10°	-1.574	7.524	0.002	0.011
0°	1.903	9.270	0.003	0.013
- 10°	2.031	10.343	0.003	0.015
- 20°	2.346	9.770	0.003	0.014
- 30°	-1.659	10.400	0.002	0.015

## ANNEX A.4. OCCUPIED BANDWIDTH

### Reference

FCC: CFR Part 2.1049(h)(i)

#### A.4.1 Occupied Bandwidth Results

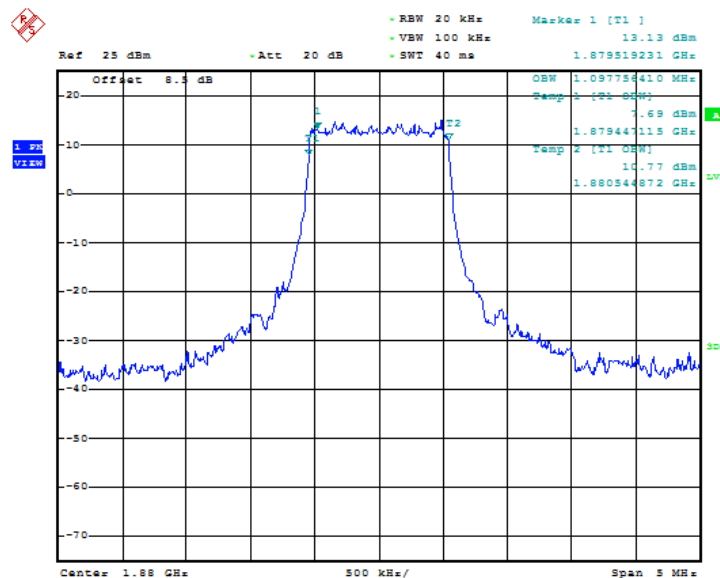
Occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of the US Cellular/PCS frequency bands. The table below lists the measured 99% BW. Spectrum analyzer plots are included on the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

The measurement method is from KDB 971168 4:

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

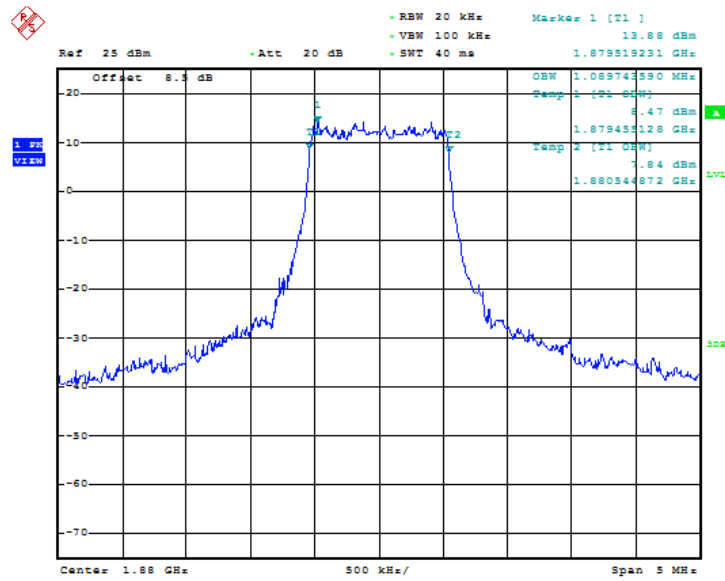
#### LTE band 2, 1.4MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	QPSK	16QAM
1880.0	1.098	1.09



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

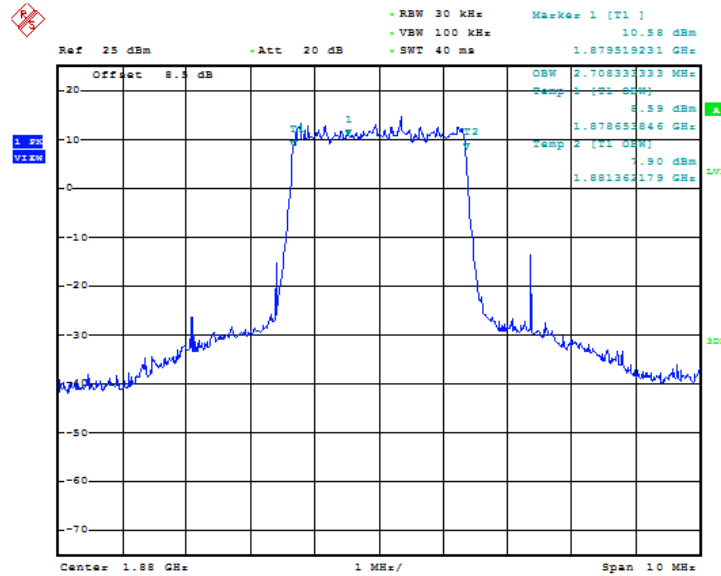


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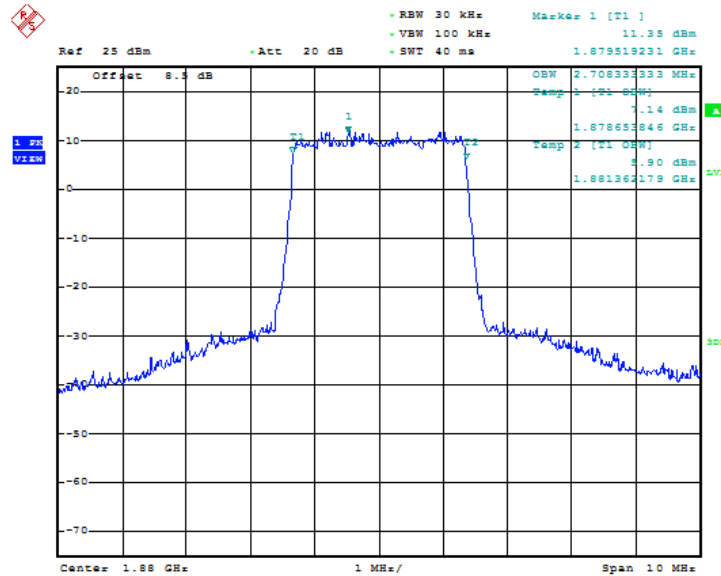
Fig.2 LTE band 2, 1.4MHz Bandwidth, 16QAM (99% BW)

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

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	1880.0	QPSK
	2.708	2.708



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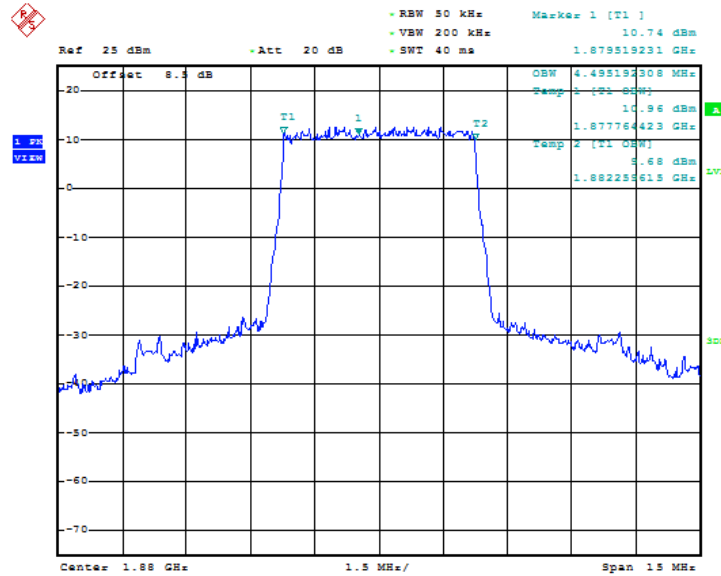
**Fig.3 LTE band 2, 3MHz Bandwidth, QPSK (99% BW)**


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

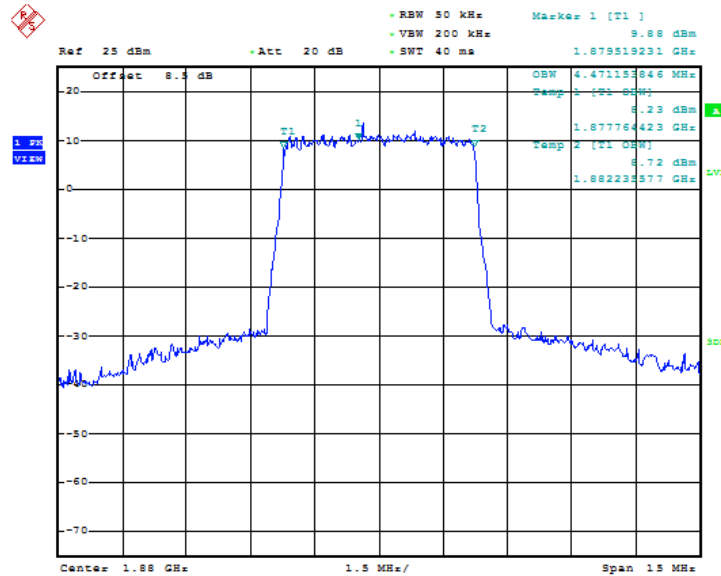
**LTE band 2, 5MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	1880.0	QPSK
4.495		4.471



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



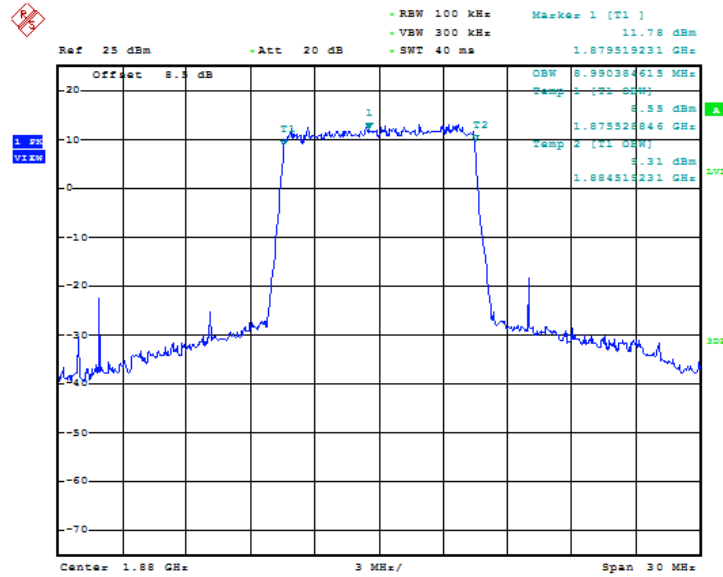
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Fig.6 LTE band 2, 5MHz Bandwidth, 16QAM (99% BW)



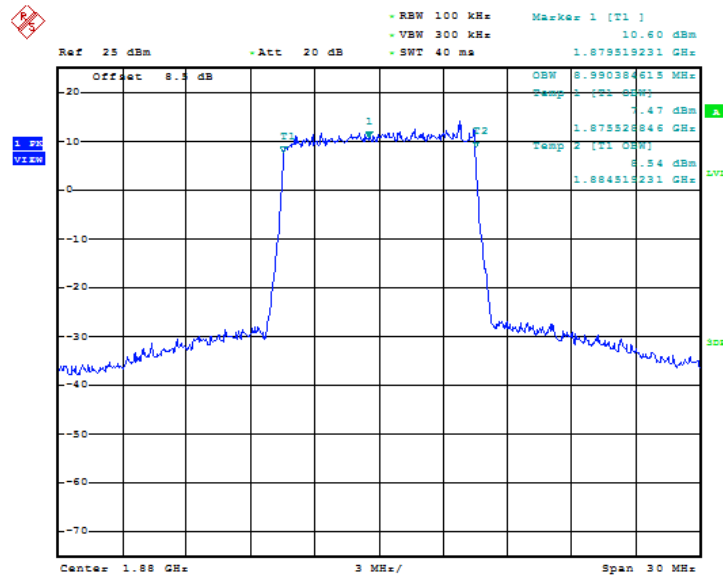
**LTE band 2, 10MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	1880.0	QPSK
	8.99	8.99



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

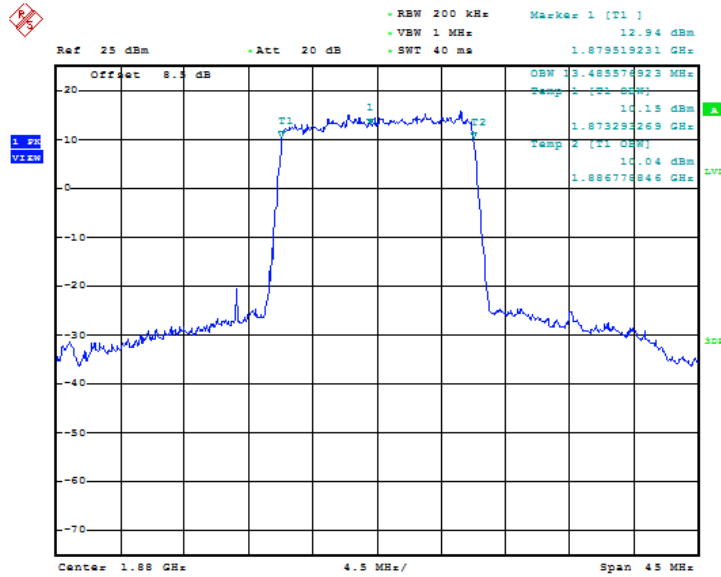


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Fig.8 LTE band 2, 10MHz Bandwidth, 16QAM (99% BW)

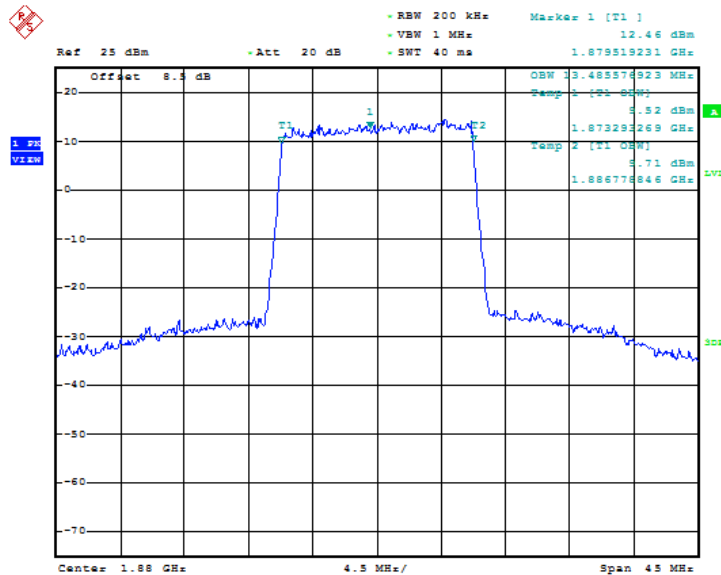
**LTE band 2, 15MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	1880.0	QPSK
13.486		13.486



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

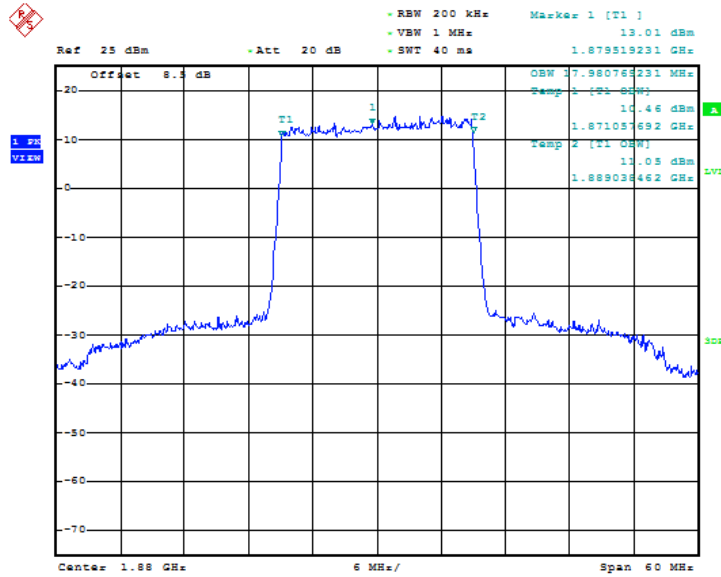


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Fig.10 LTE band 2, 15MHz Bandwidth, 16QAM (99% BW)

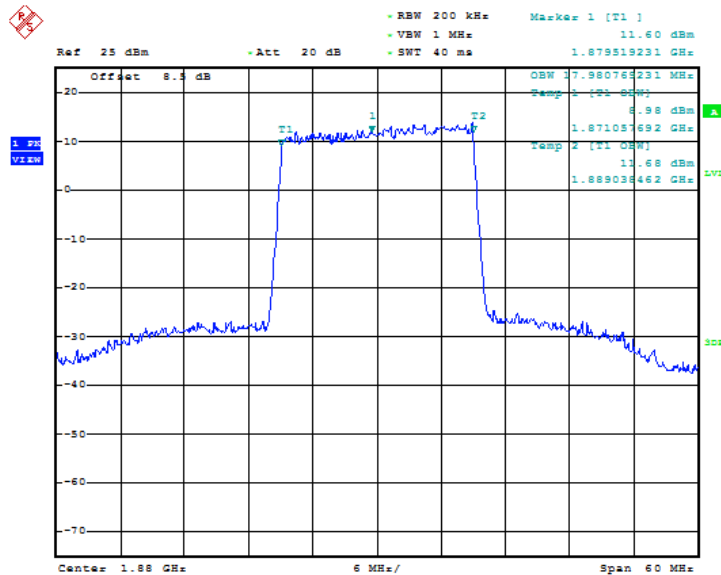
**LTE band 2, 20MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	1880.0	QPSK
17.981		17.981



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

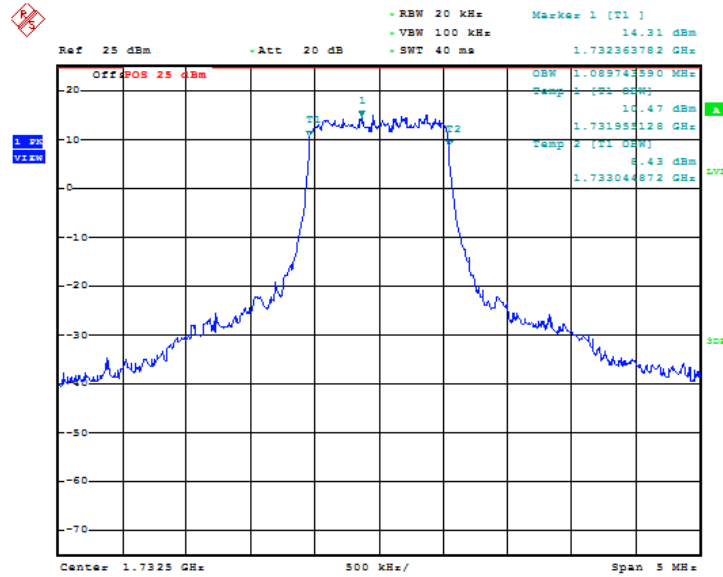


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Fig.12 LTE band 2, 20MHz Bandwidth, 16QAM (99% BW)

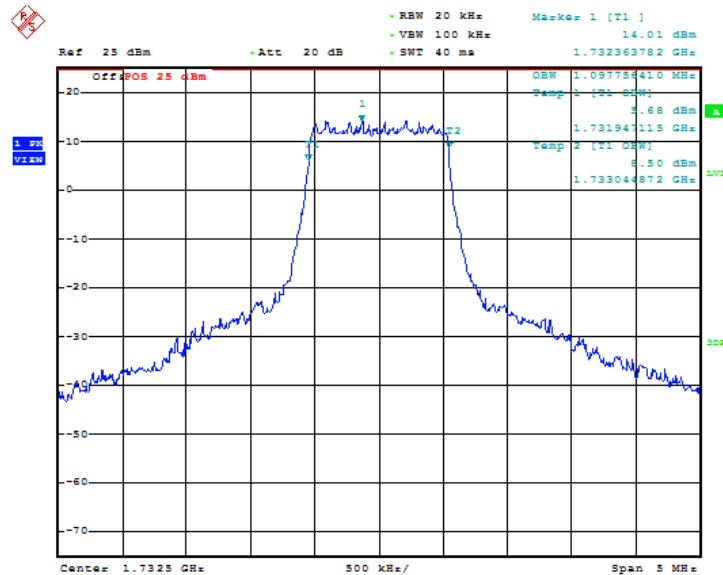
**LTE band 4, 1.4MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	1732.5	QPSK
	1.09	1.098



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

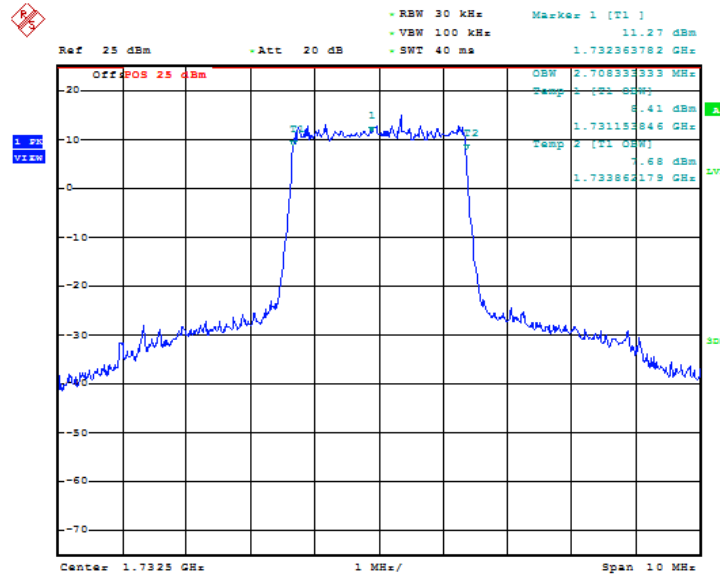


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Fig.14 LTE band 4, 1.4MHz Bandwidth, 16QAM (99% BW)

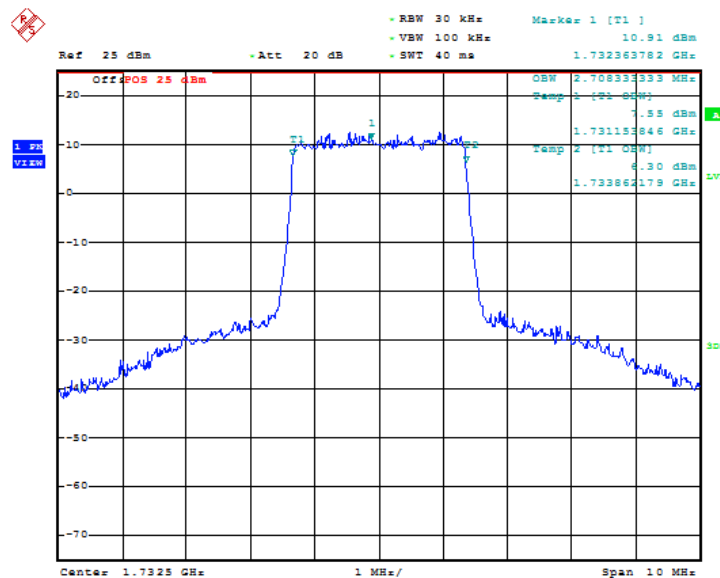
**LTE band 4, 3MHz (99%)**

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



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

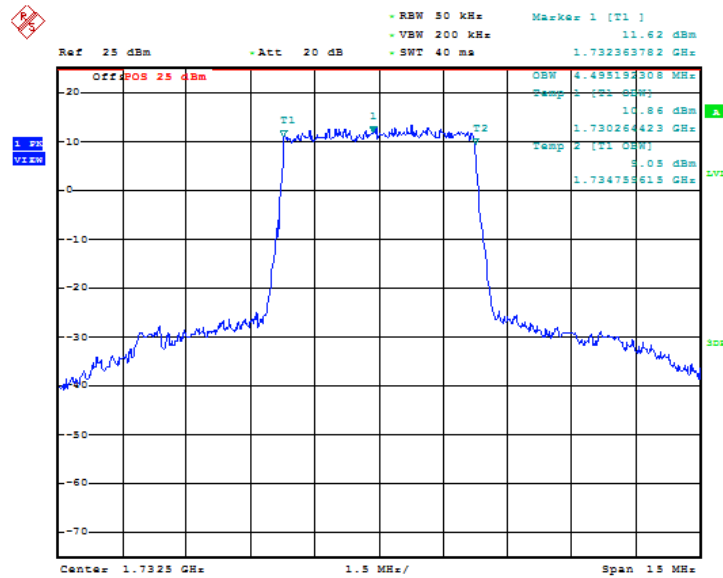


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Fig.16 LTE band 4, 3MHz Bandwidth, 16QAM (99% BW)

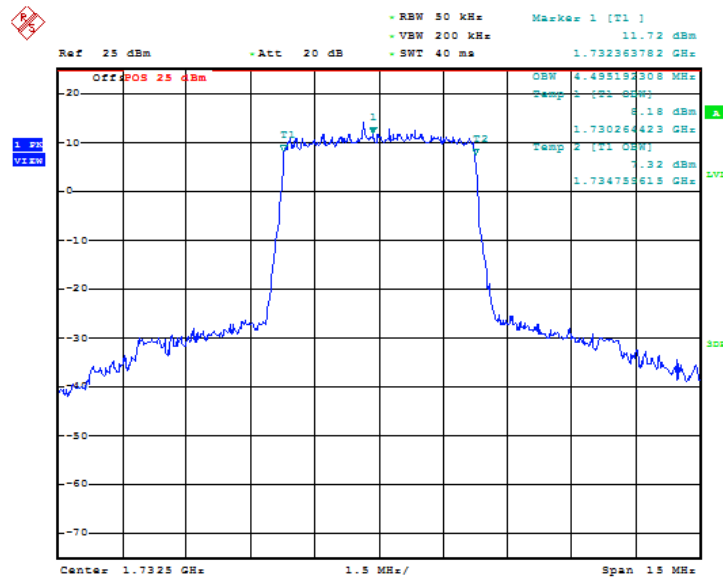
**LTE band 4, 5MHz (99%)**

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



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

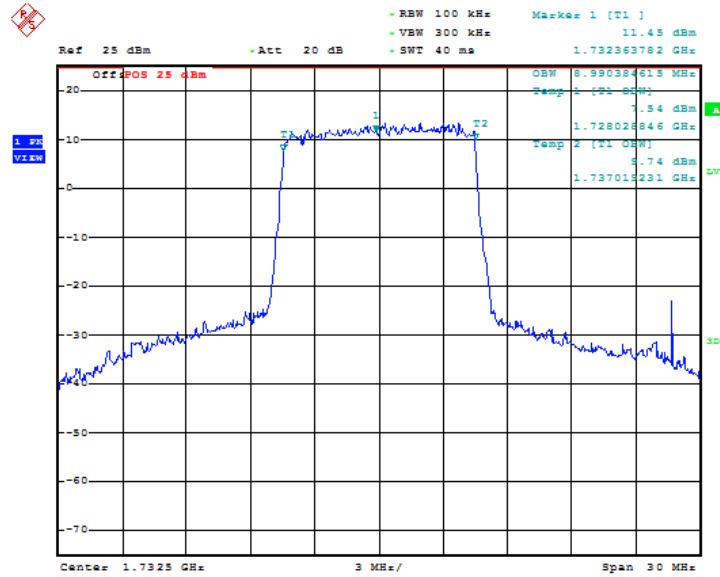


Date: 16.AUG.2019 08:04:24

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

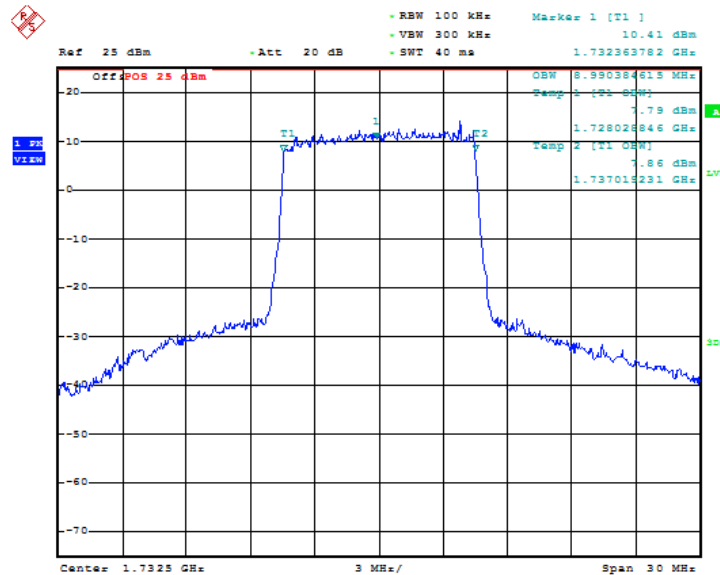
**LTE band 4, 10MHz (99%)**

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



Date: 16.AUG.2019 08:05:10

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

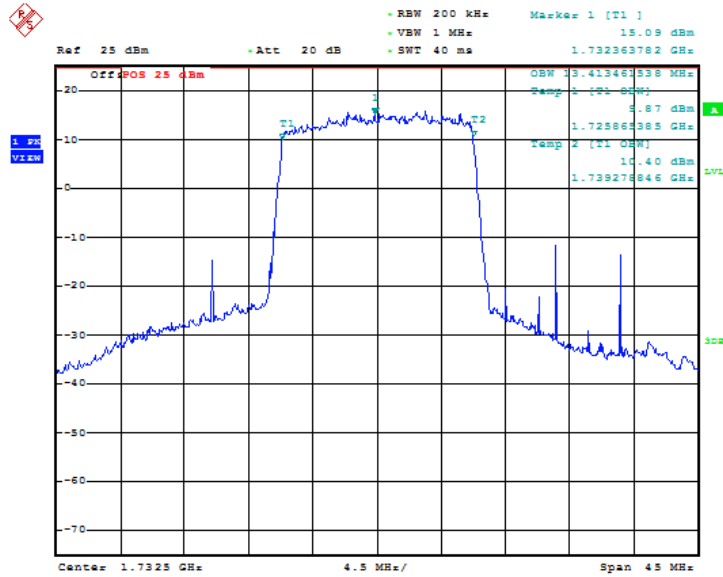


Date: 16.AUG.2019 08:05:48

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

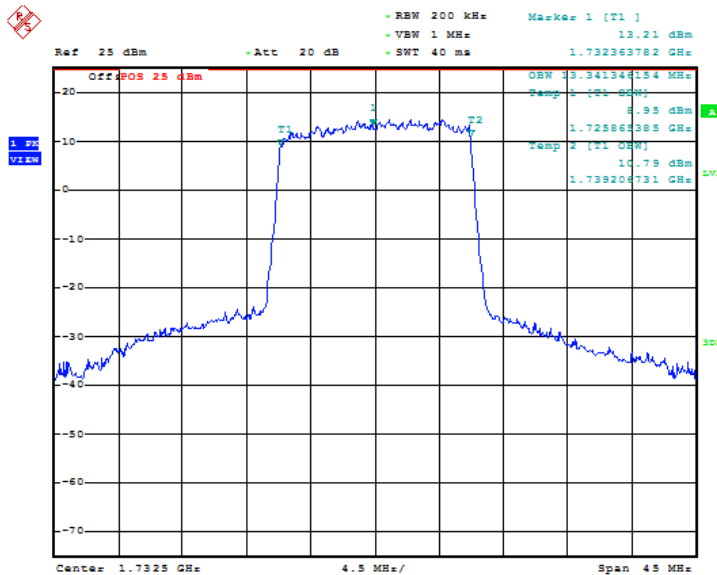
**LTE band 4, 15MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	1732.5	QPSK
	13.413	13.341



9 Date: 16.AUG.2019 08:06:35

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



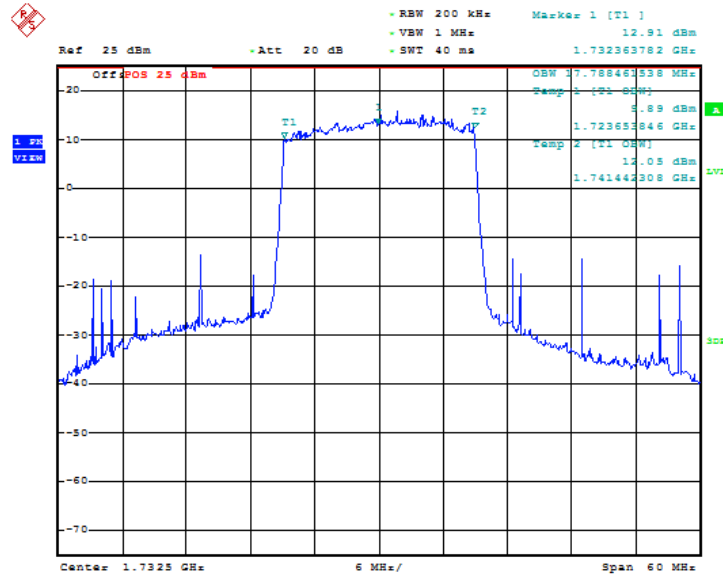
Date: 16.AUG.2019 08:07:13

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



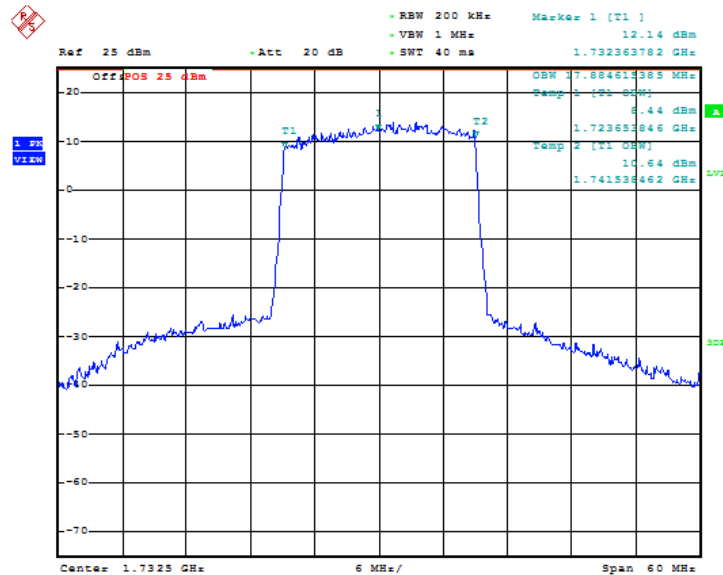
**LTE band 4, 20MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	1732.5	QPSK
	17.788	17.885



Date: 16.AUG.2019 08:08:00

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

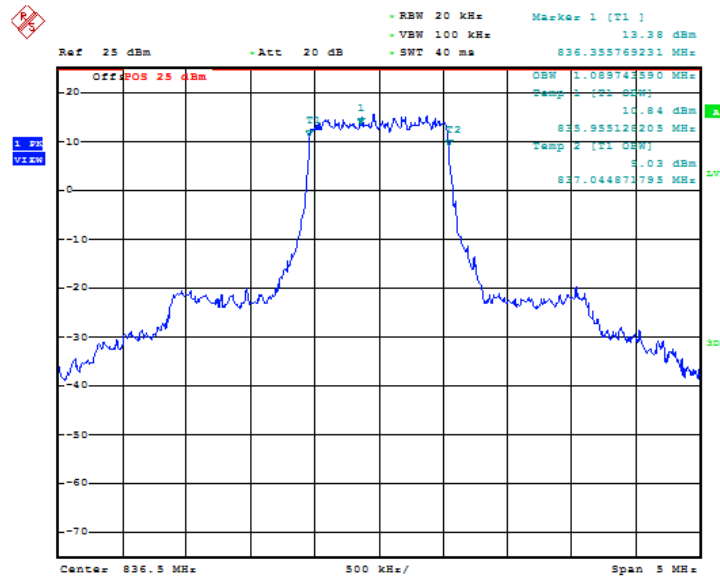


Date: 16.AUG.2019 08:08:38

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

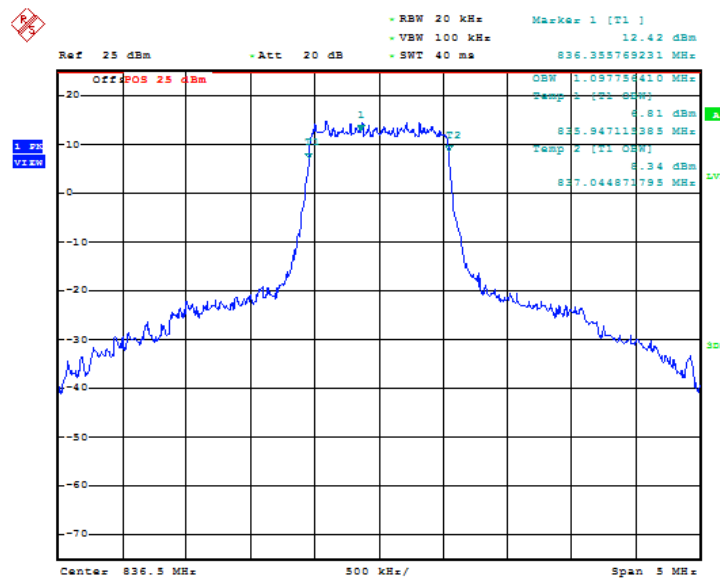
**LTE band 5,1.4MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	836.5	QPSK
	1.09	1.098



Date: 16.AUG.2019 08:29:17

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

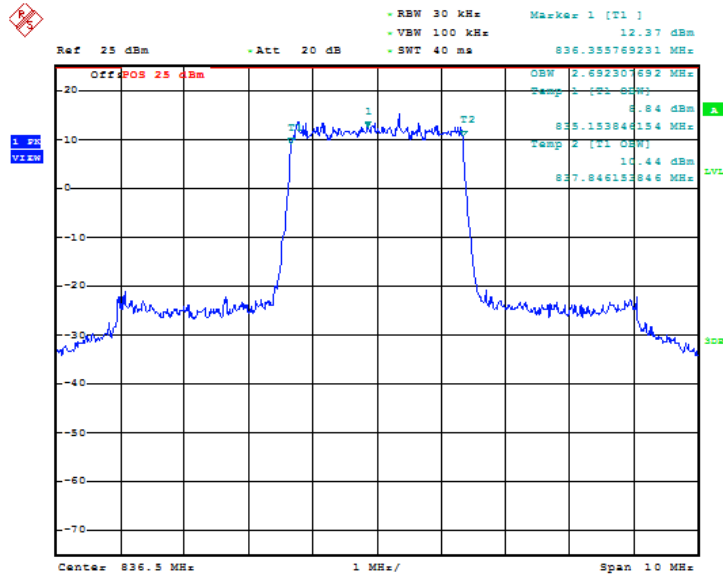


Date: 16.AUG.2019 08:29:55

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

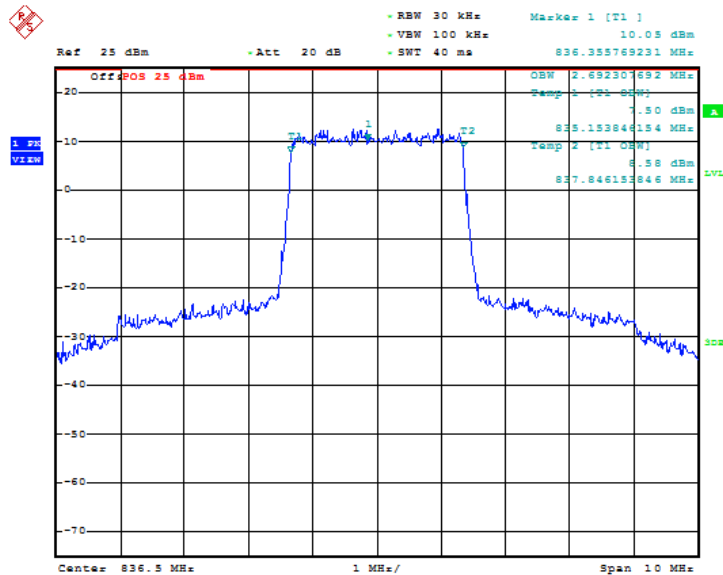
**LTE band 5, 3MHz (99%)**

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



Date: 16.AUG.2019 08:24:41

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

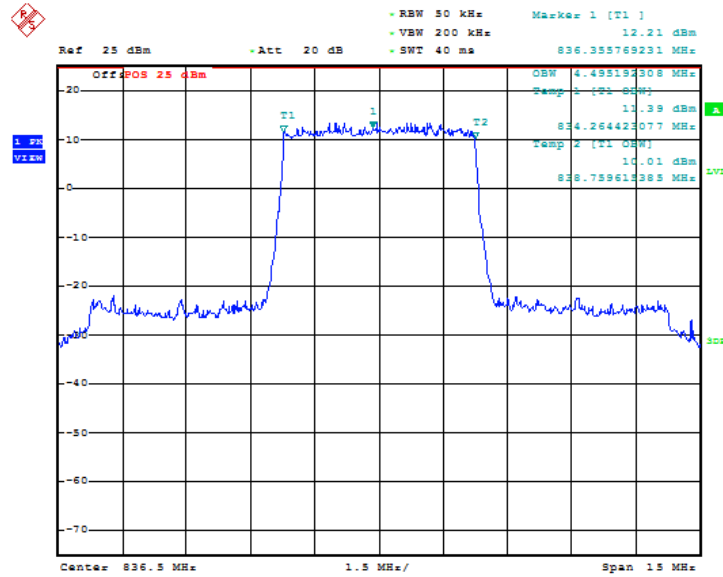


Date: 16.AUG.2019 08:25:19

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

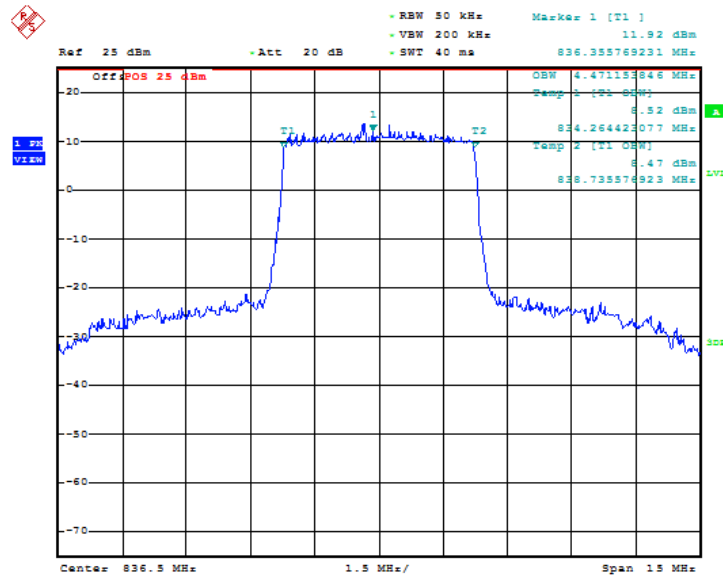
**LTE band 5, 5MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	836.5	QPSK
4.495		4.471



Date: 16.AUG.2019 08:26:06

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

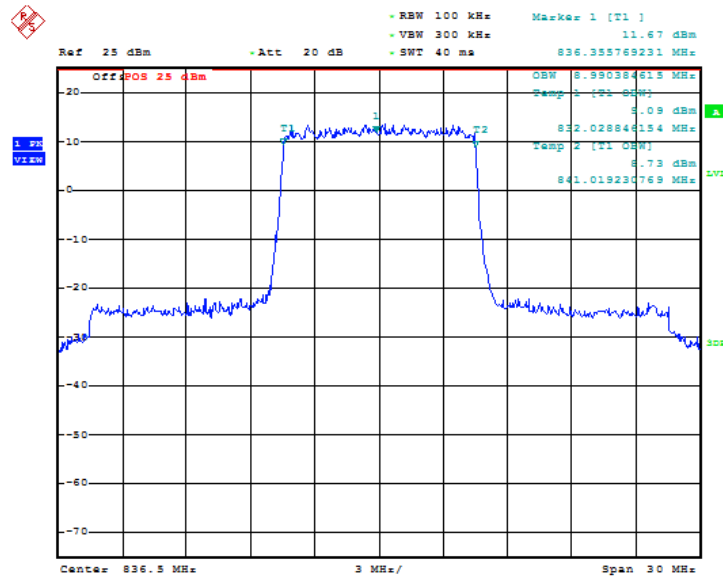


Date: 16.AUG.2019 08:26:44

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

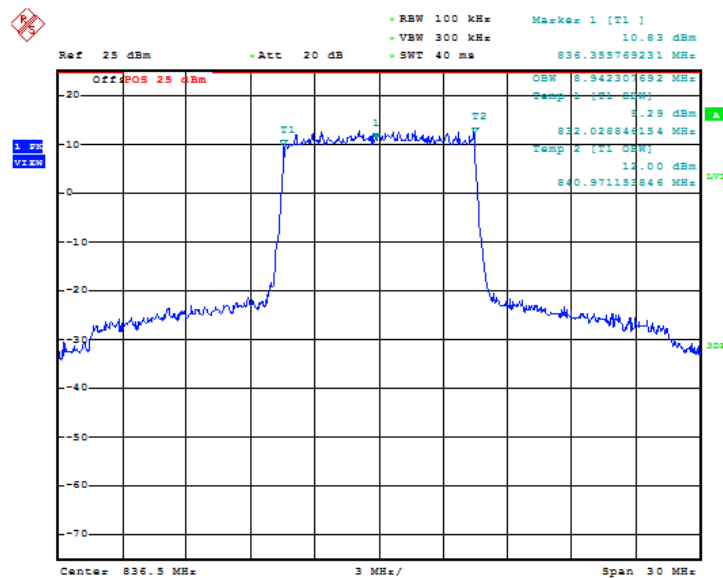
**LTE band 5, 10MHz (99%)**

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



Date: 16.AUG.2019 08:27:30

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

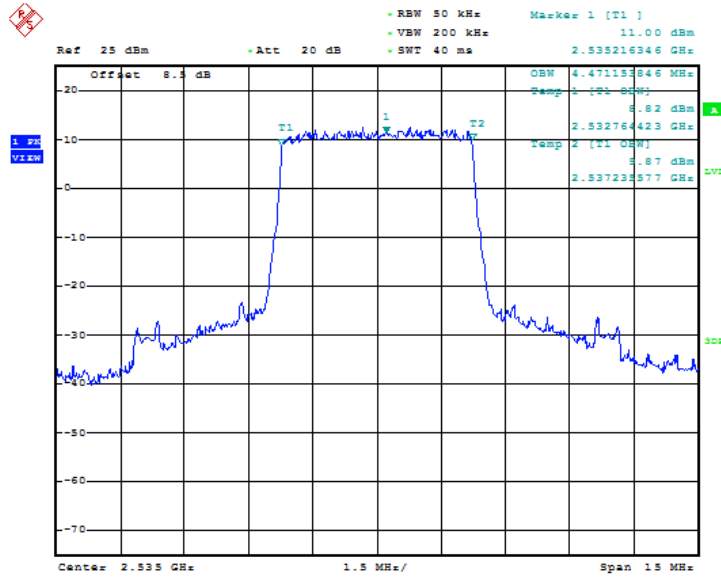


Date: 16.AUG.2019 08:28:08

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

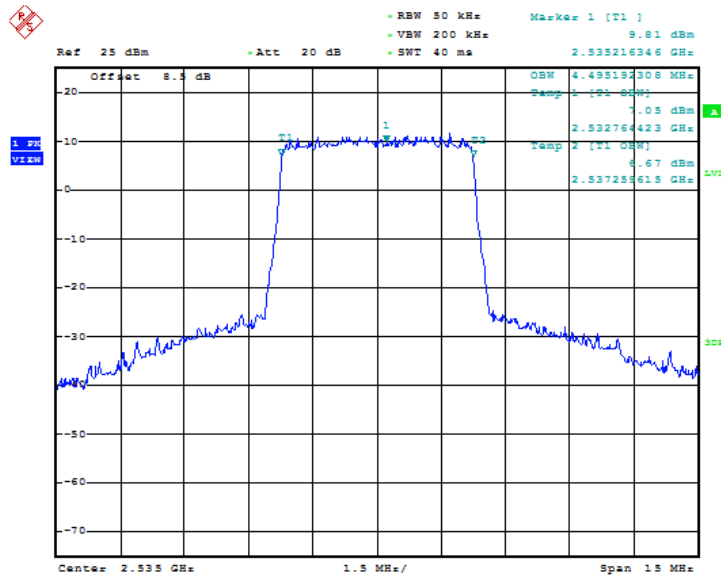
**LTE band 7, 5MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	2535.0	QPSK
4.471		4.495



Date: 16.AUG.2019 08:30:03

Fig.33 LTE band 7, 5MHz Bandwidth, QPSK (99% BW)

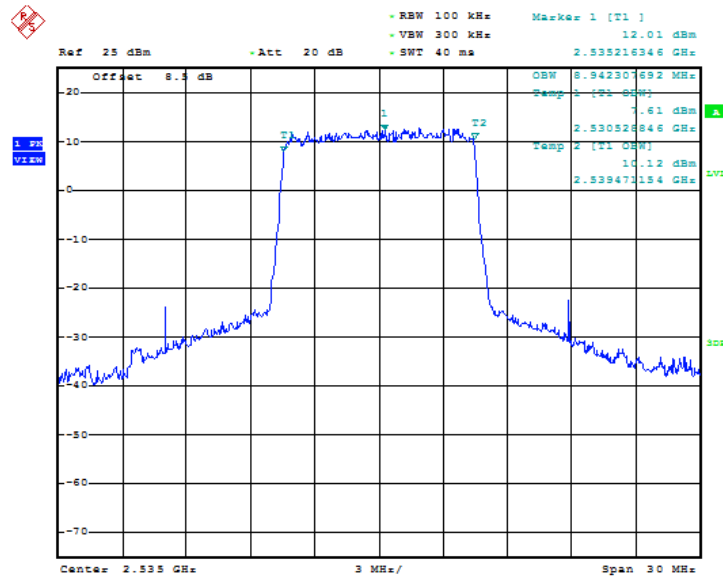


Date: 16.AUG.2019 08:30:41

Fig.34 LTE band 7, 5MHz Bandwidth, 16QAM (99% BW)

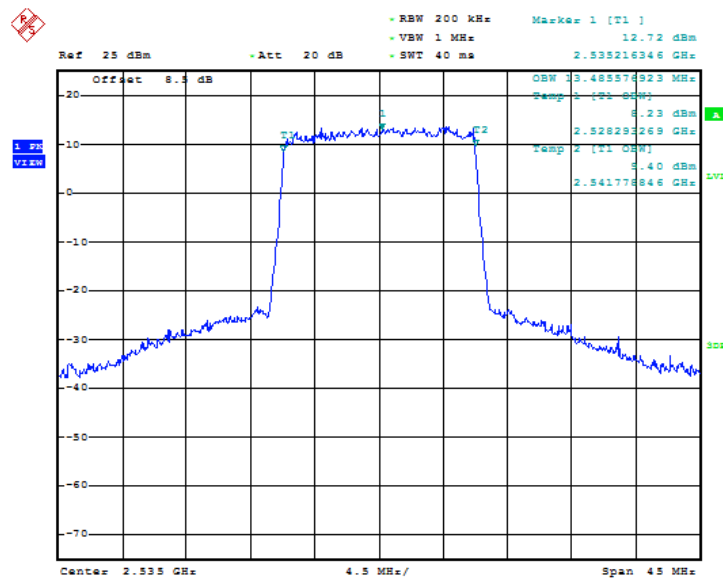
**LTE band 7, 10MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	2535.0	QPSK
8.942		8.942



Date: 16.AUG.2019 08:31:27

Fig.35 LTE band 7, 10MHz Bandwidth, QPSK (99% BW)

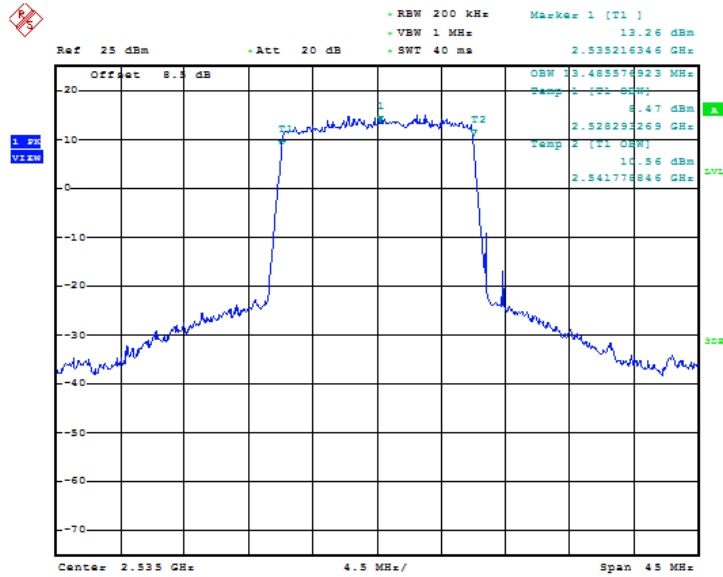


Date: 16.AUG.2019 08:33:30

Fig.36 LTE band 7, 10MHz Bandwidth, 16QAM (99% BW)

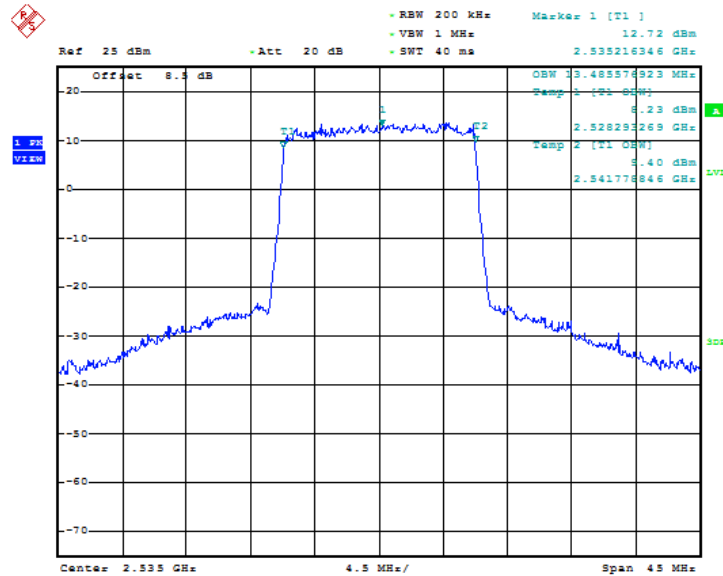
**LTE band 7, 15MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	2535.0	QPSK
	13.486	13.486



9 Date: 16.AUG.2019 08:32:52

Fig.37 LTE band 7, 15MHz Bandwidth, QPSK (99% BW)



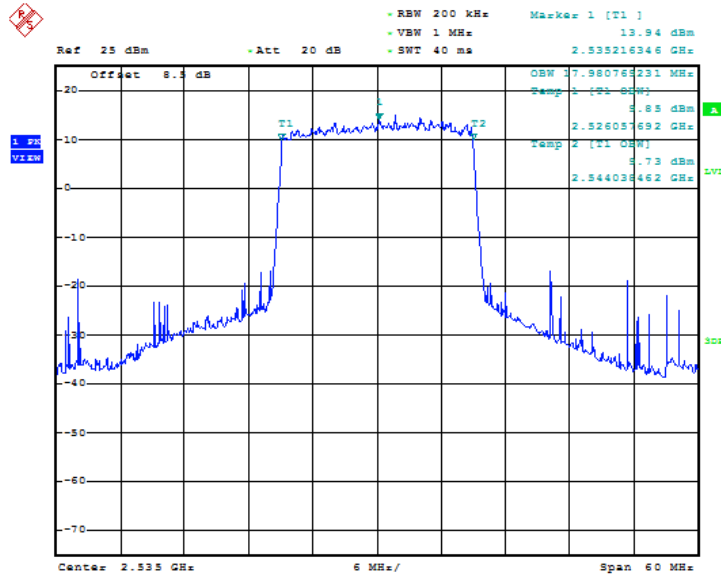
Date: 16.AUG.2019 08:33:30

Fig.38 LTE band 7, 15MHz Bandwidth, 16QAM (99% BW)



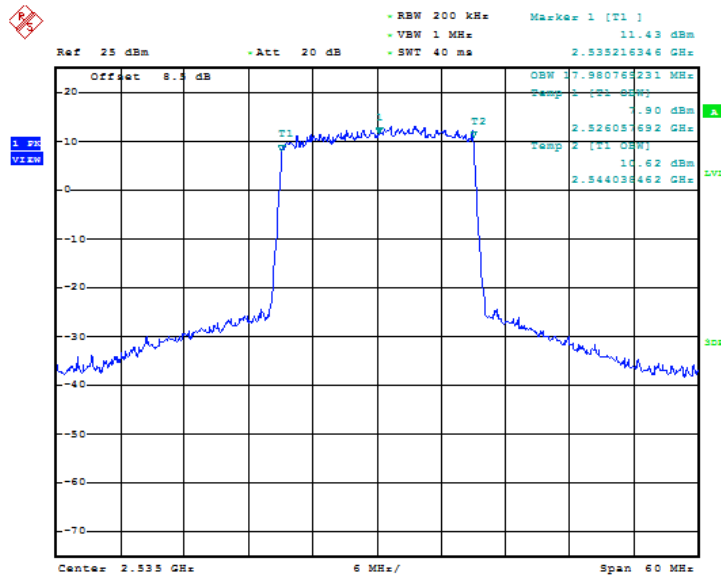
**LTE band 7, 20MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	2535.0	QPSK
	17.981	17.981



Date: 16.AUG.2019 08:34:16

Fig.39 LTE band 7, 20MHz Bandwidth, QPSK (99% BW)

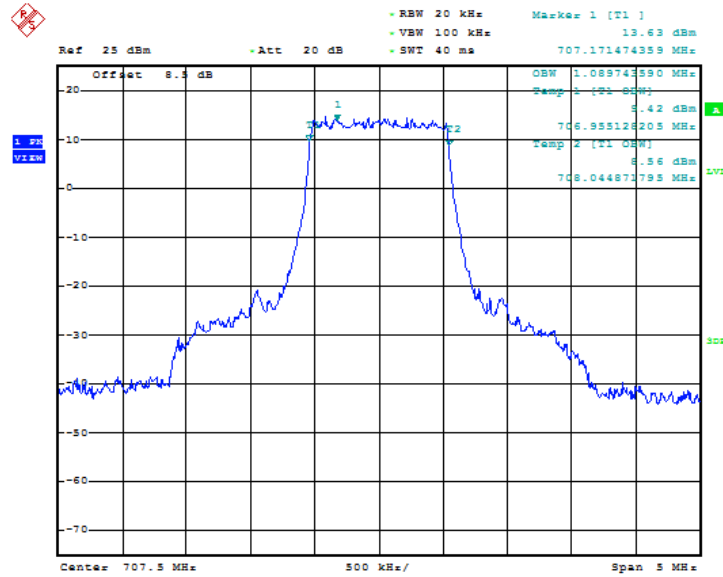


Date: 16.AUG.2019 08:34:54

Fig.40 LTE band 7, 20MHz Bandwidth, 16QAM (99% BW)

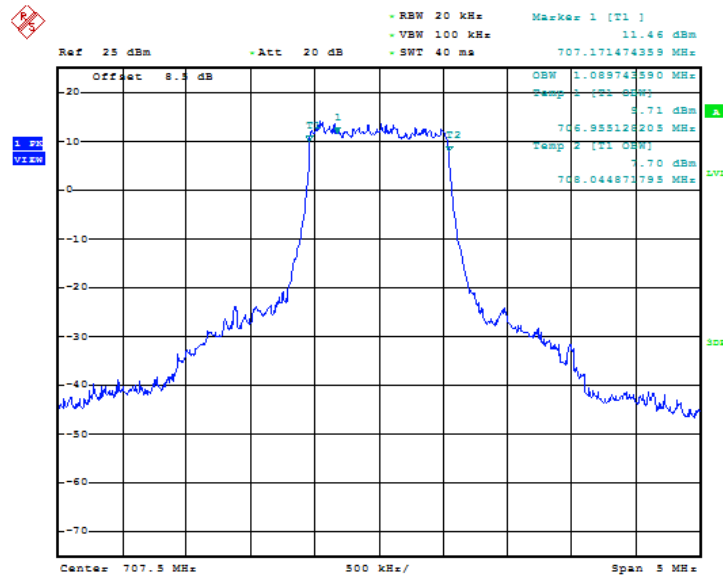
**LTE band 12,1.4MHz (99%)**

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



Date: 16.AUG.2019 08:40:12

Fig.41 LTE band 12, 1.4MHz Bandwidth, QPSK (99% BW)

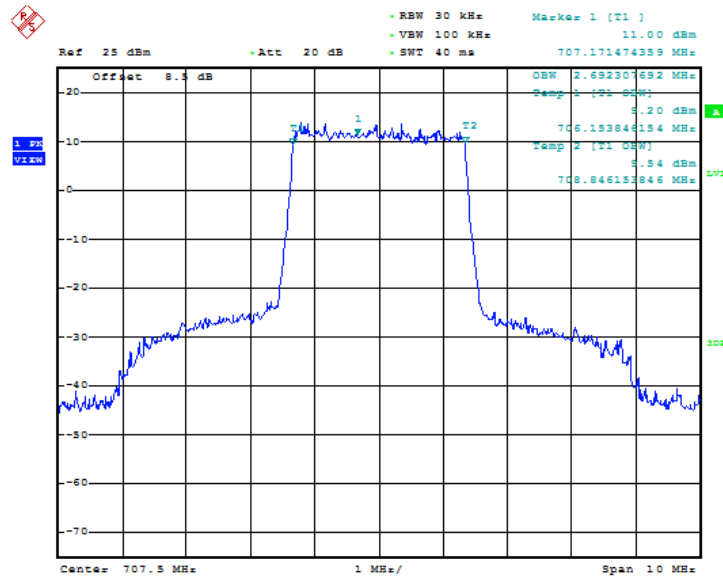


Date: 16.AUG.2019 08:40:51

Fig.42 LTE band 12, 1.4MHz Bandwidth, 16QAM (99% BW)

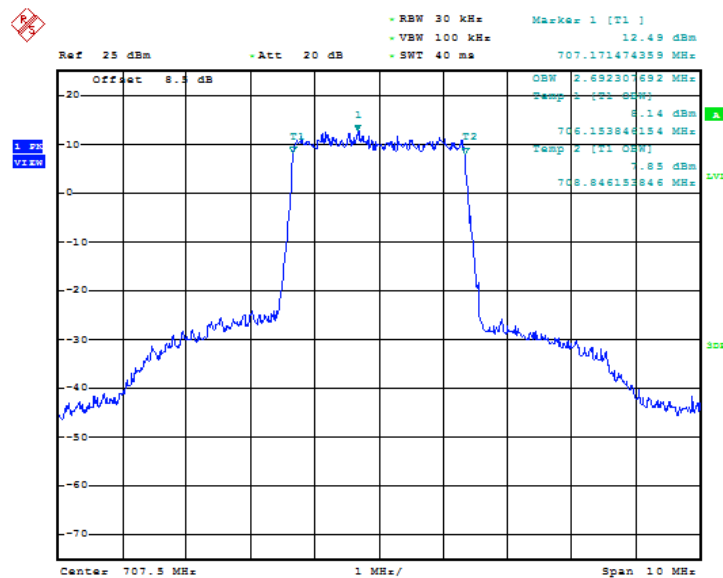
**LTE band 12, 3MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	707.5	QPSK
	2.692	2.692



Date: 16.AUG.2019 08:41:37

Fig.43 LTE band 12, 3MHz Bandwidth, QPSK (99% BW)

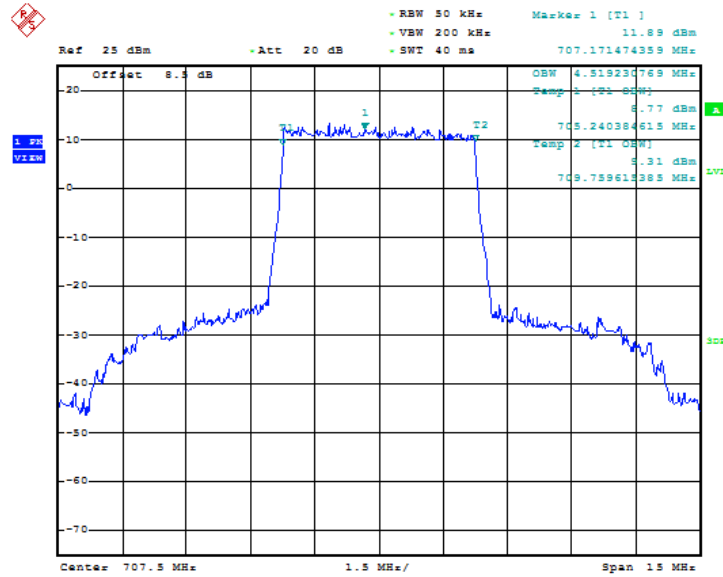


Date: 16.AUG.2019 08:42:15

Fig.44 LTE band 12, 3MHz Bandwidth, 16QAM (99% BW)

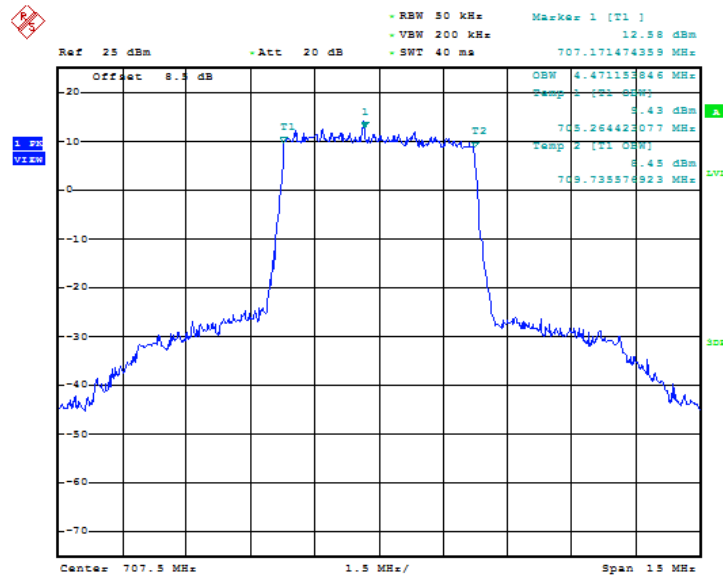
**LTE band 12, 5MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	707.5	QPSK
4.519		4.471



Date: 16.AUG.2019 08:49:01

Fig.45 LTE band 12, 5MHz Bandwidth, QPSK (99% BW)

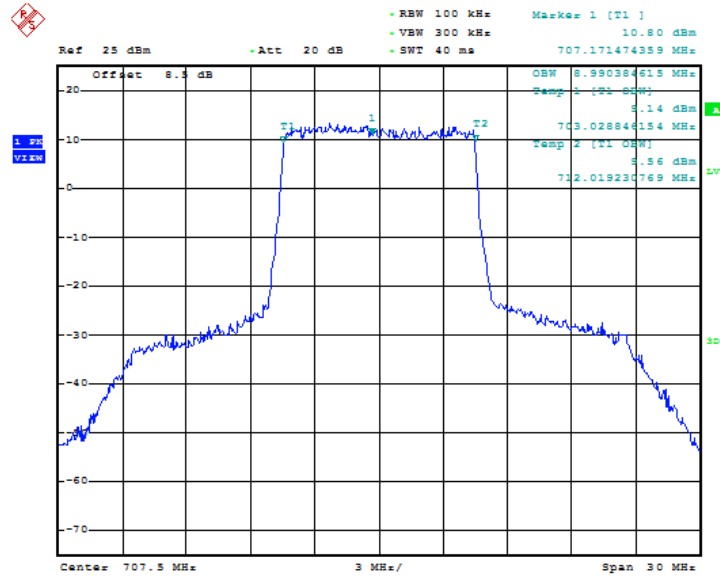


Date: 16.AUG.2019 08:49:39

Fig.46 LTE band 12, 5MHz Bandwidth, 16QAM (99% BW)

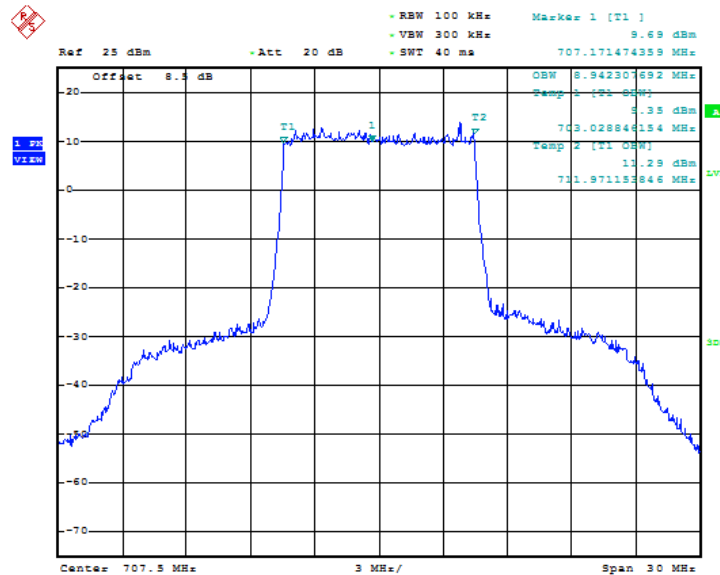
**LTE band 12, 10MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	707.5	QPSK
8.99		8.942



Date: 16.AUG.2019 08:44:26

Fig.47 LTE band 12, 10MHz Bandwidth, QPSK (99% BW)

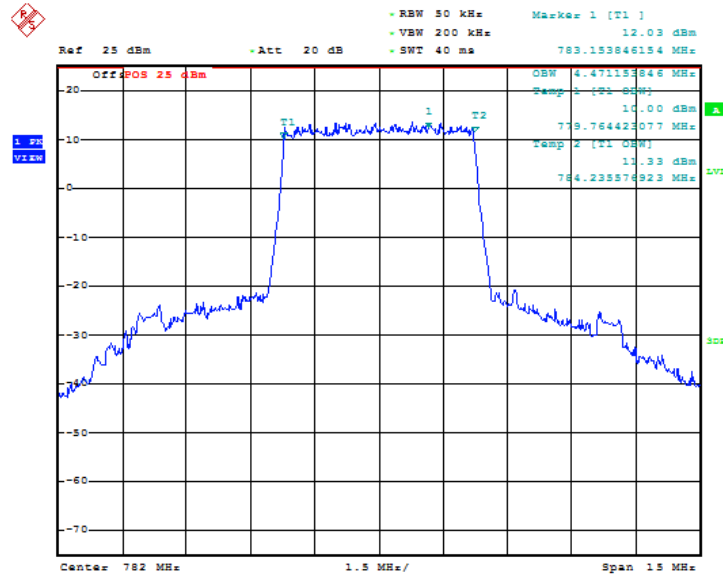


Date: 16.AUG.2019 08:45:04

Fig.48 LTE band 12, 10MHz Bandwidth, 16QAM (99% BW)

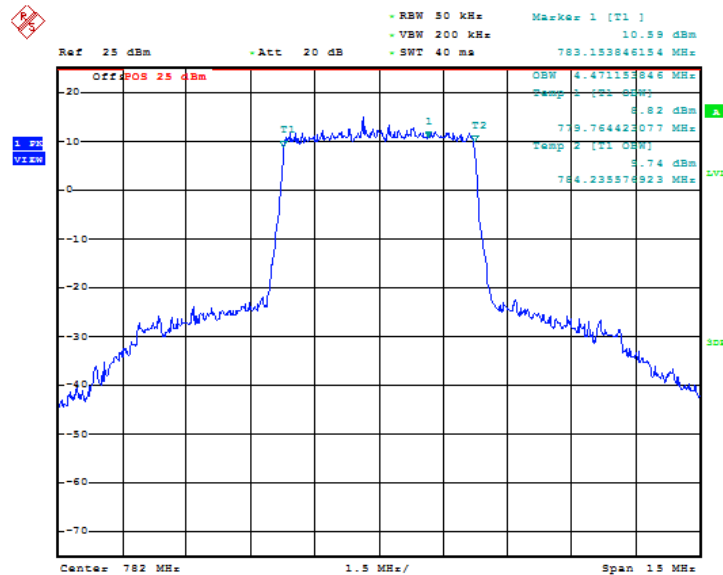
**LTE band 13, 5MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	782.0	QPSK
4.471		4.471



Date: 16.AUG.2019 08:50:24

Fig.49 LTE band 13, 5MHz Bandwidth, QPSK (99% BW)

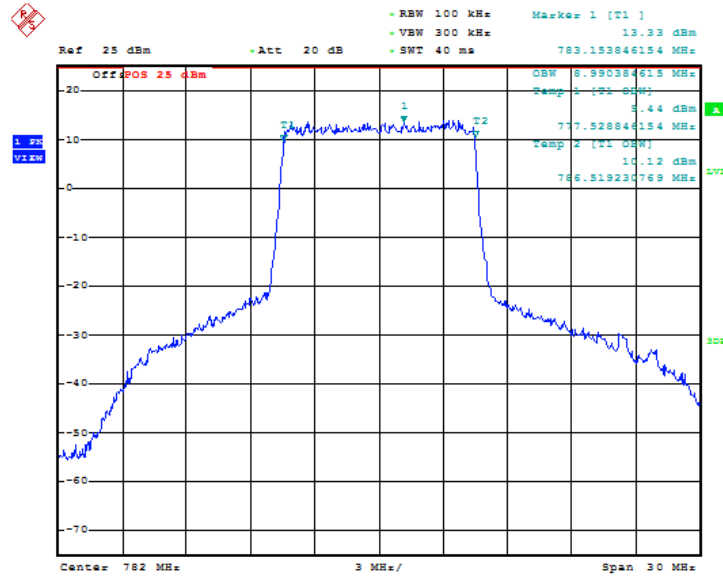


Date: 16.AUG.2019 08:51:02

Fig.50 LTE band 13, 5MHz Bandwidth, 16QAM (99% BW)

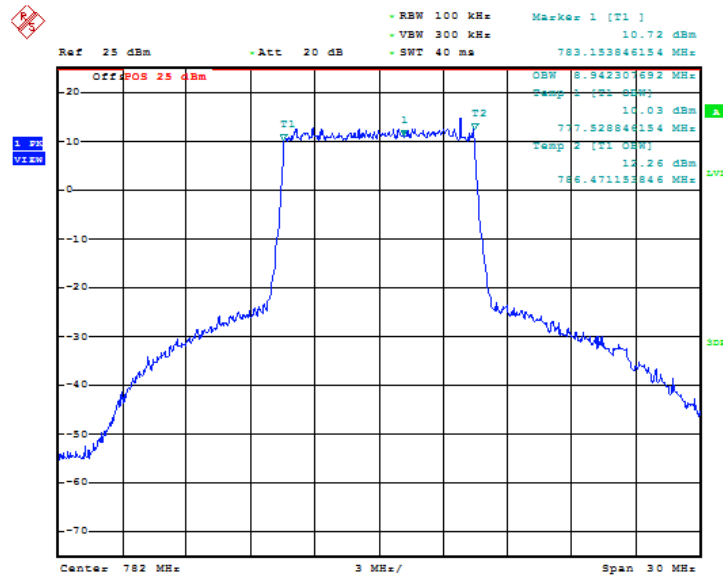
**LTE band 13, 10MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	782.0	QPSK
	8.99	8.942



Date: 16.AUG.2019 08:51:48

Fig.51 LTE band 13, 10MHz Bandwidth, QPSK (99% BW)

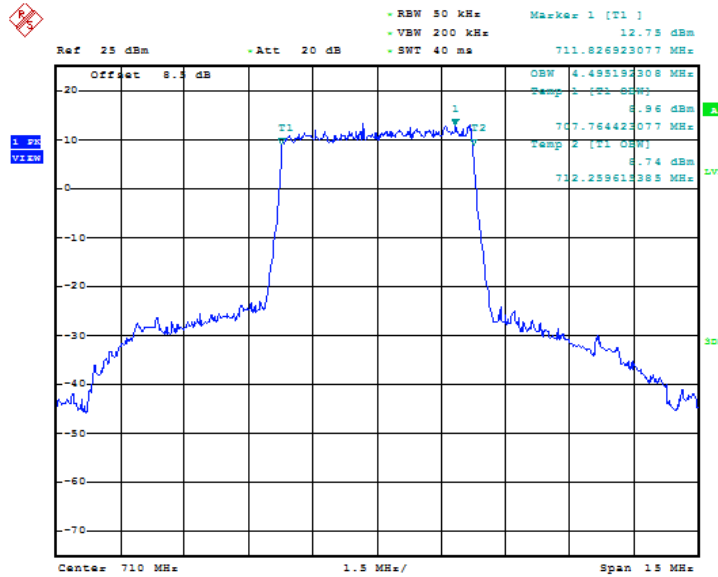


Date: 16.AUG.2019 08:52:27

Fig.52 LTE band 13, 10MHz Bandwidth, 16QAM (99% BW)

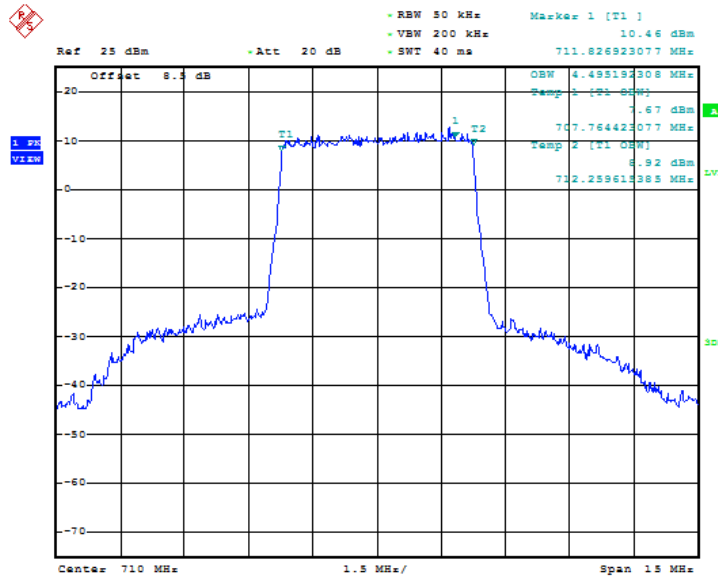
**LTE band 17, 5MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	710.0	QPSK
4.495		4.495



Date: 16.AUG.2019 08:53:57

Fig.53 LTE band 17, 5MHz Bandwidth, QPSK (99% BW)



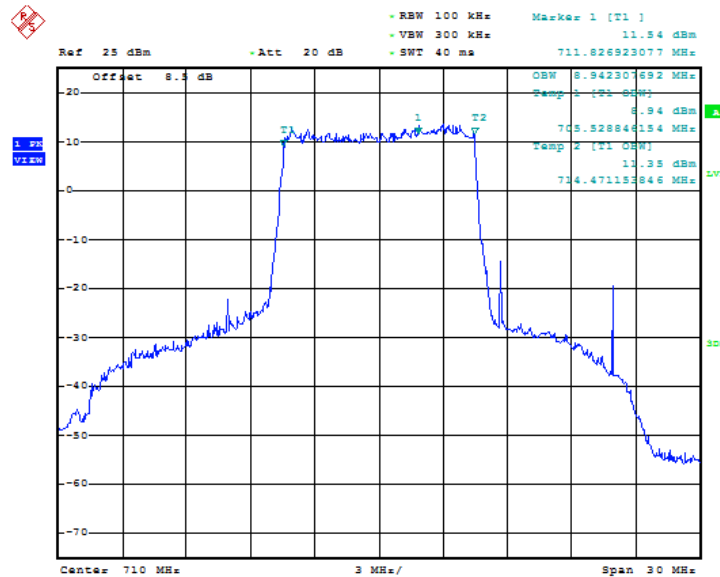
Date: 16.AUG.2019 08:54:35

Fig.54 LTE band 17, 5MHz Bandwidth, 16QAM (99% BW)



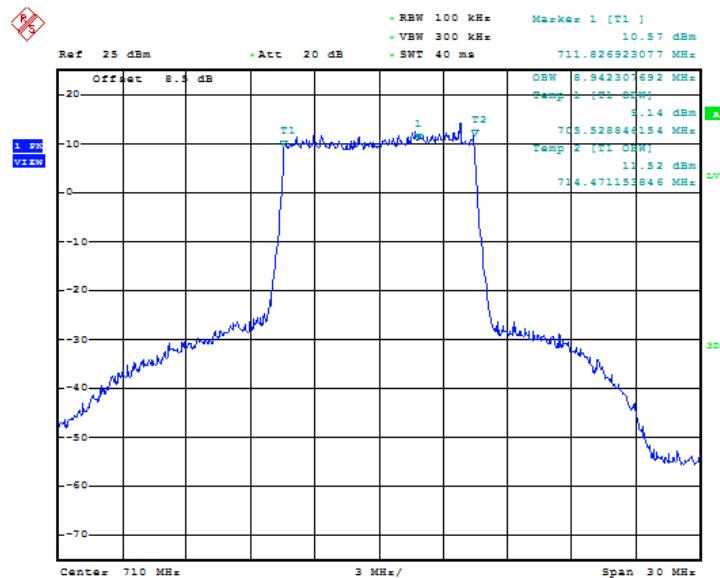
**LTE band 17, 10MHz (99%)**

Frequency(MHz)	Occupied Bandwidth (99%)( MHz)	
	710.0	QPSK
	8.942	8.942



Date: 16.AUG.2019 08:55:22

Fig.55 LTE band 17, 10MHz Bandwidth, QPSK (99% BW)



Date: 16.AUG.2019 08:56:00

Fig.56 LTE band 17, 10MHz Bandwidth, 16QAM (99% BW)

## ANNEX A.5. EMISSION BANDWIDTH

### Reference

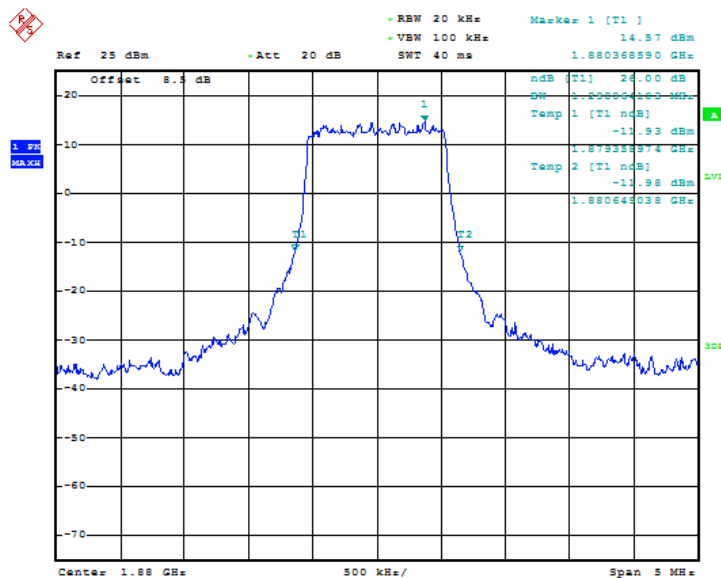
FCC: CFR Part 22.917(b),24.238(a), 27.53(g),27.53(h), 27.53(m)

### 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.

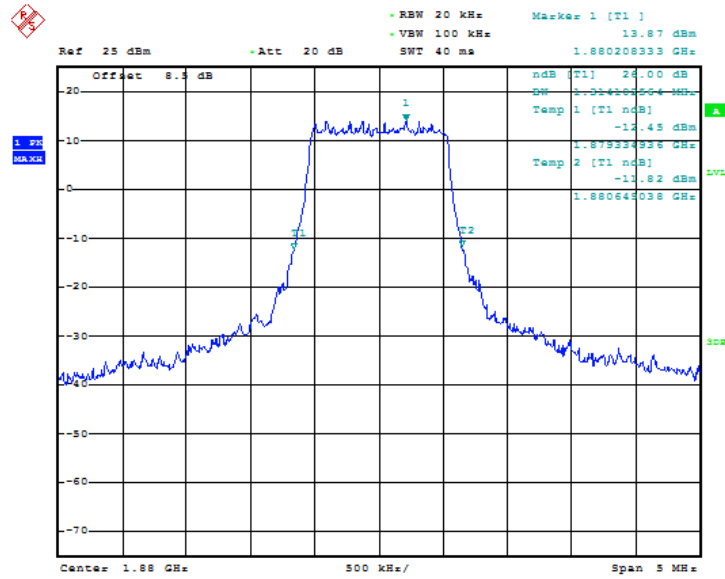
#### LTE band 2, 1.4MHz (-26dBc)

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	QPSK	16QAM
1880.0	1.29	1.31



9 Date: 15.AUG.2019 10:08:14

Fig.57 LTE band 2, 1.4MHz Bandwidth, QPSK (-26dBc BW)

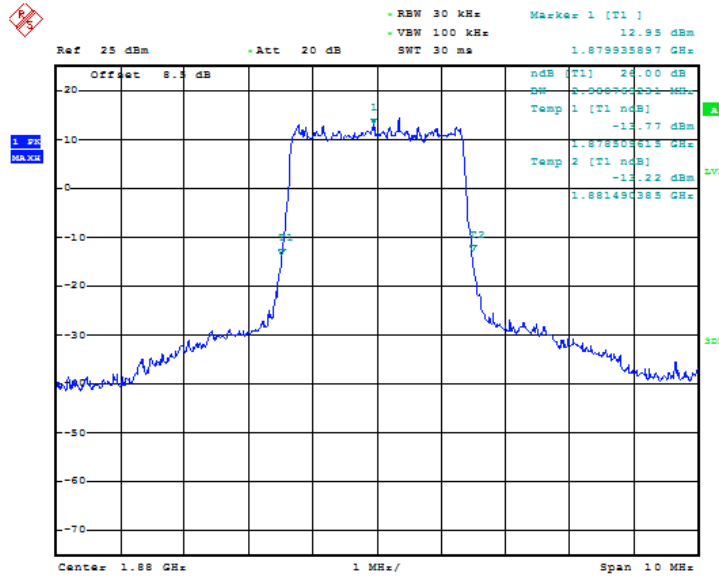


Date: 15.AUG.2019 10:09:19

Fig.58 LTE band 2, 1.4MHz Bandwidth, 16QAM (-26dBc BW)

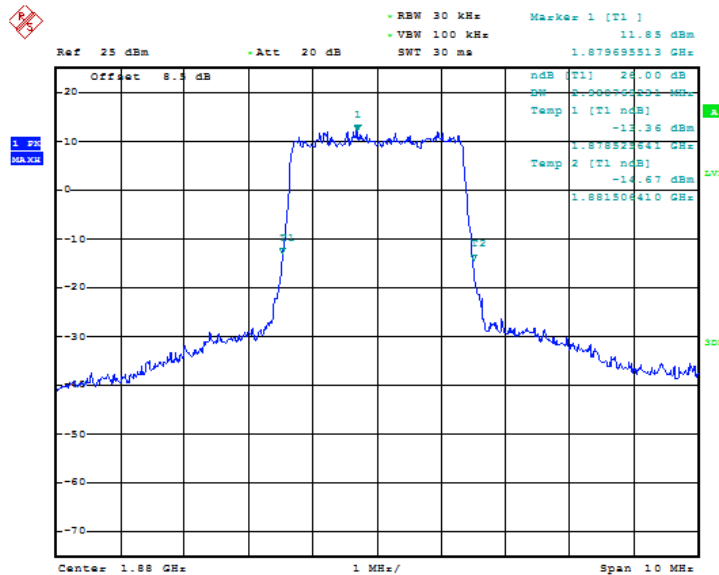
LTE band 2, 3MHz (-26dBc)

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	1880.0	QPSK
	2.98	2.98



Date: 15.AUG.2019 10:10:33

Fig.59 LTE band 2, 3MHz Bandwidth, QPSK (-26dBc BW)

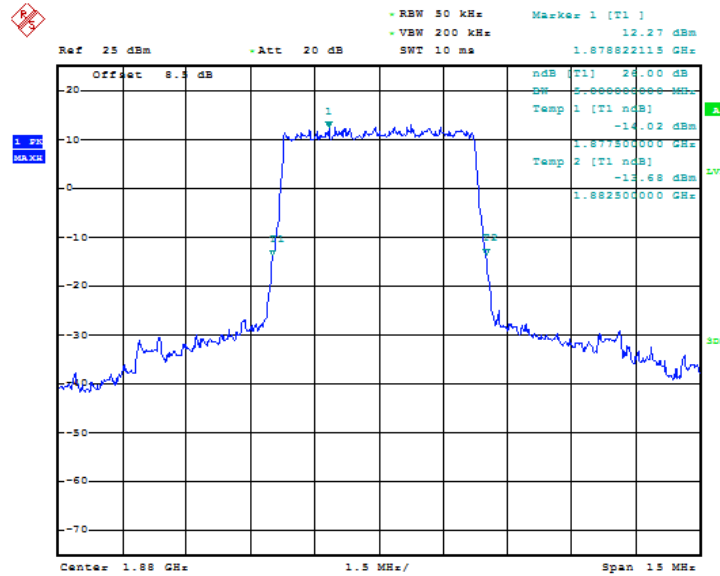


Date: 15.AUG.2019 10:11:37

Fig.60 LTE band 2, 3MHz Bandwidth, 16QAM (-26dBc BW)

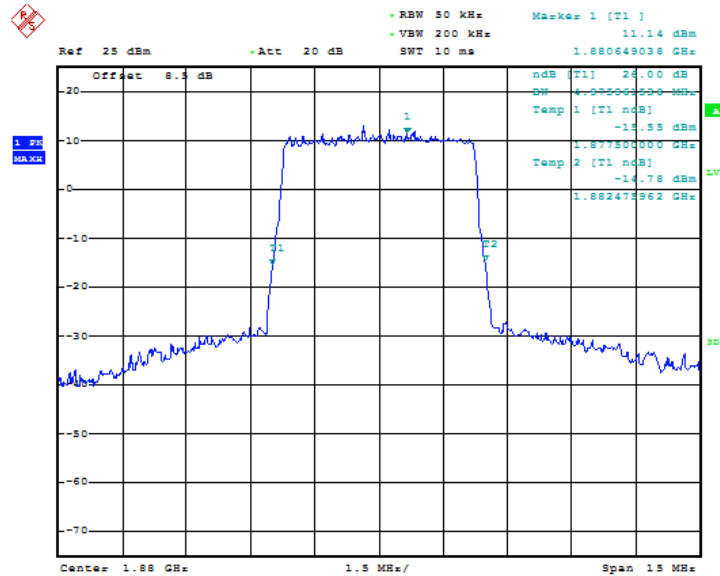
**LTE band 2, 5MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	1880.0	QPSK
5.00		4.97



Date: 15.AUG.2019 10:12:51

Fig.61 LTE band 2, 5MHz Bandwidth, QPSK (-26dBc BW)

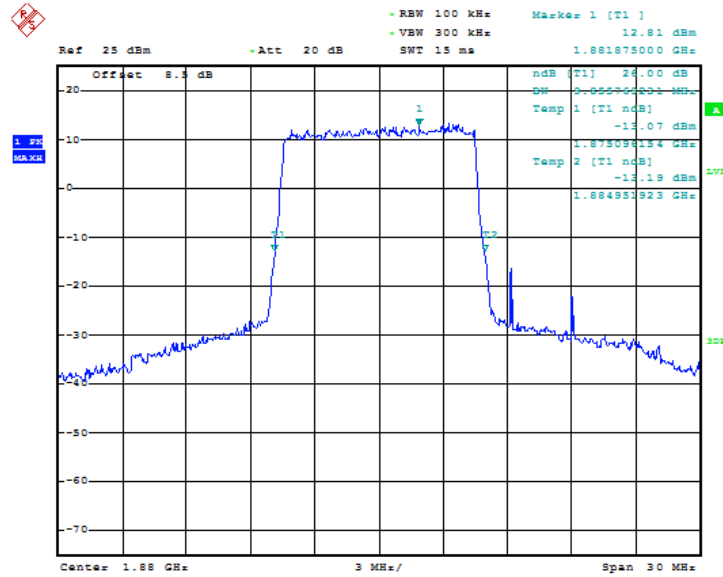


Date: 15.AUG.2019 10:13:56

Fig.62 LTE band 2, 5MHz Bandwidth, 16QAM (-26dBc BW)

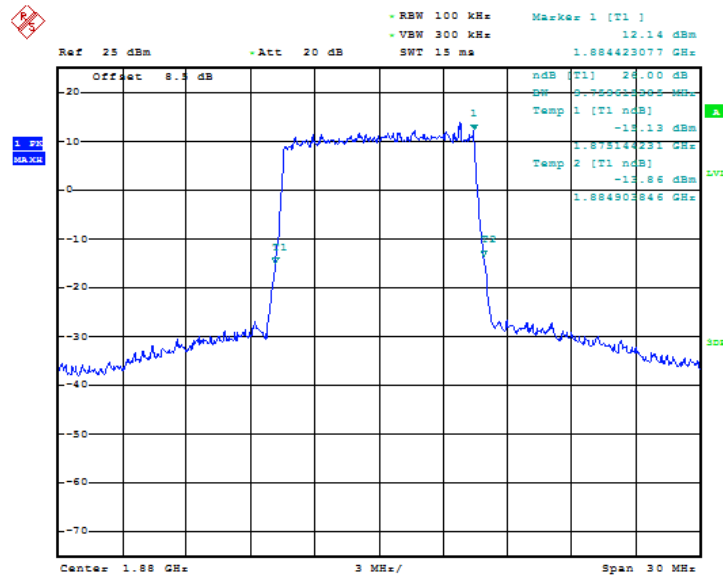
**LTE band 2, 10MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	1880.0	QPSK
9.85		9.76



Date: 15.AUG.2019 10:15:11

Fig.63 LTE band 2, 10MHz Bandwidth, QPSK (-26dBc BW)

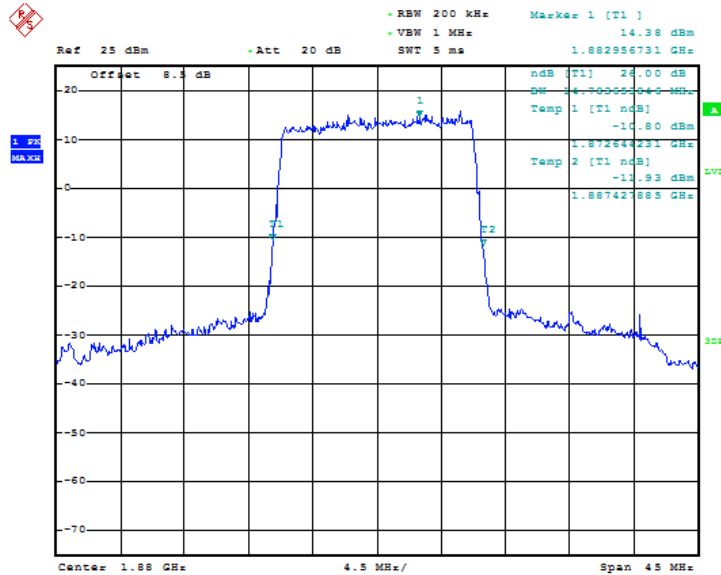


Date: 15.AUG.2019 10:16:15

Fig.64 LTE band 2, 10MHz Bandwidth, 16QAM (-26dBc BW)

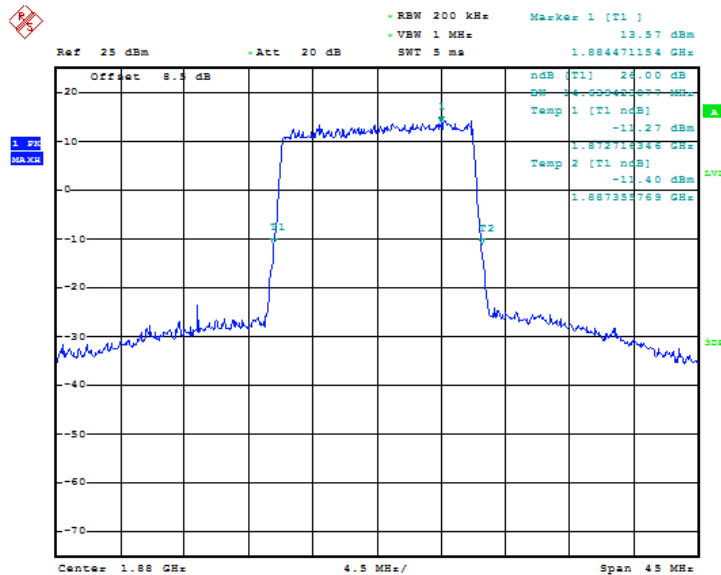
**LTE band 2, 15MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	1880.0	QPSK
	14.78	14.64



Date: 15.AUG.2019 10:17:29

Fig.65 LTE band 2, 15MHz Bandwidth, QPSK (-26dBc BW)



Date: 15.AUG.2019 10:18:34

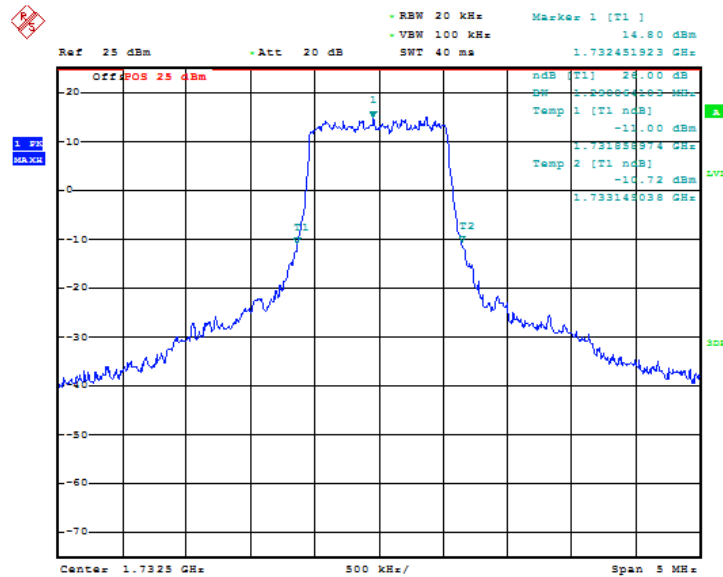
Fig.66 LTE band 2, 15MHz Bandwidth, 16QAM (-26dBc BW)





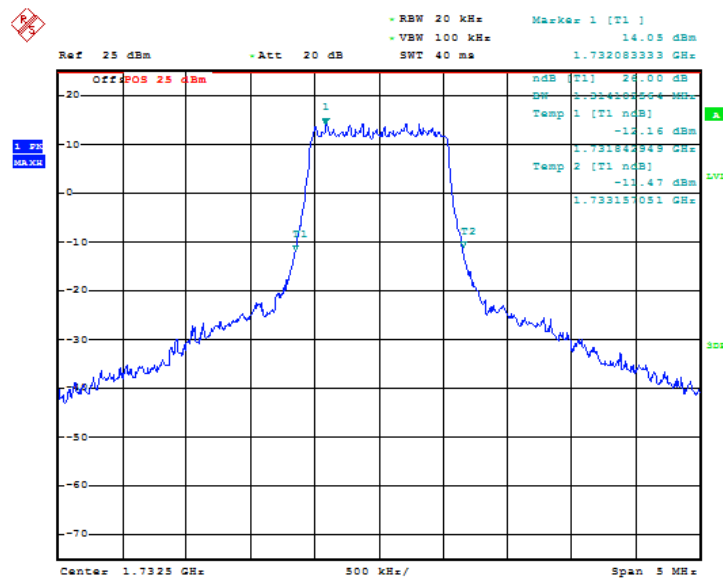
**LTE band 4, 1.4MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	1732.5	QPSK
1.29		1.31



Date: 15.AUG.2019 10:24:41

Fig.69 LTE band 4, 1.4MHz Bandwidth, QPSK (-26dBc BW)

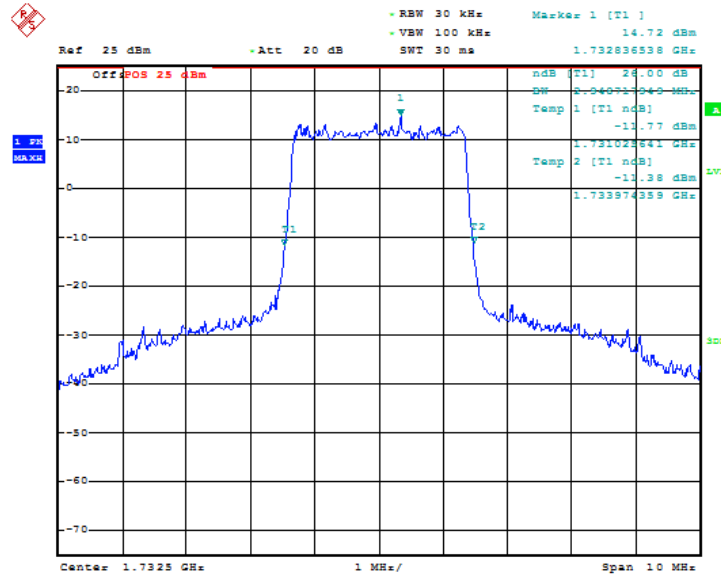


Date: 15.AUG.2019 10:25:46

Fig.70 LTE band 4, 1.4MHz Bandwidth, 16QAM (-26dBc BW)

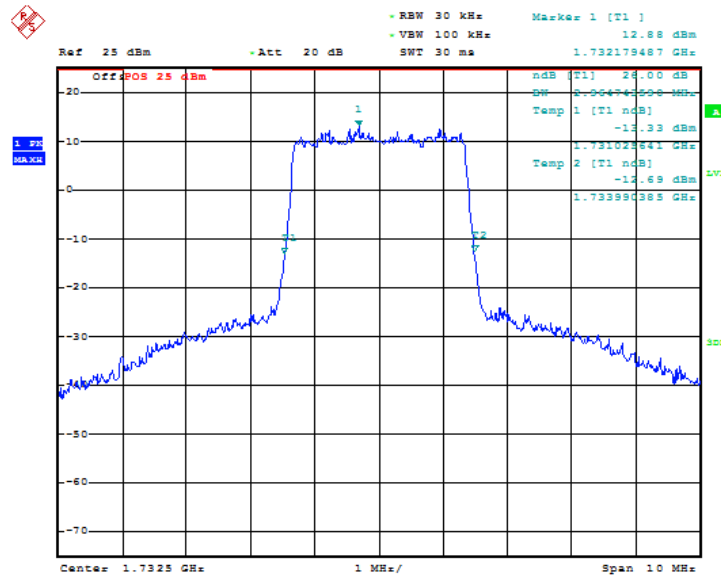
**LTE band 4, 3MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	1732.5	QPSK
2.95		2.96



Date: 15.AUG.2019 10:27:00

Fig.71 LTE band 4, 3MHz Bandwidth, QPSK (-26dBc BW)

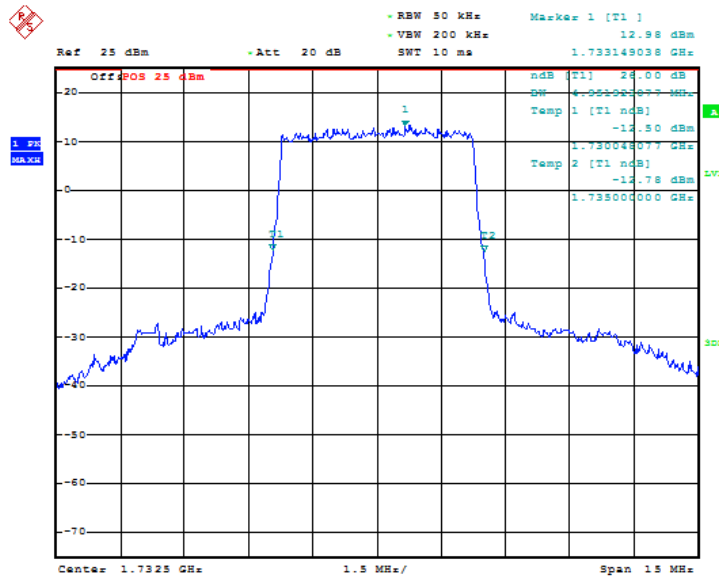


Date: 15.AUG.2019 10:28:06

Fig.72 LTE band 4, 3MHz Bandwidth, 16QAM (-26dBc BW)

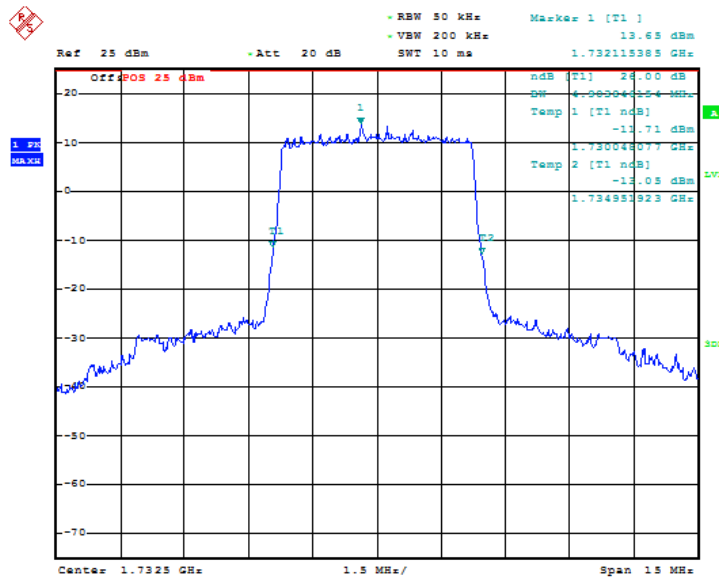
**LTE band 4, 5MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
1732.5	QPSK	16QAM
	4.95	4.90



Date: 15.AUG.2019 10:29:19

Fig.73 LTE band 4, 5MHz Bandwidth, QPSK (-26dBc BW)

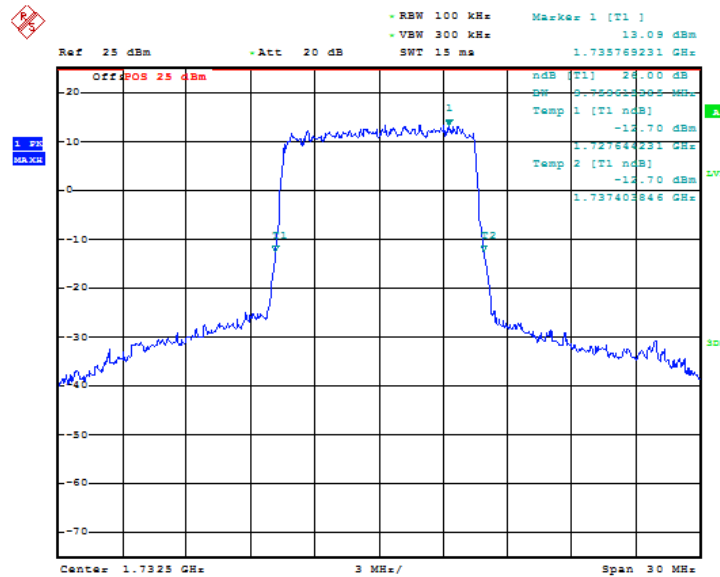


Date: 15.AUG.2019 10:30:24

Fig.74 LTE band 4, 5MHz Bandwidth, 16QAM (-26dBc BW)

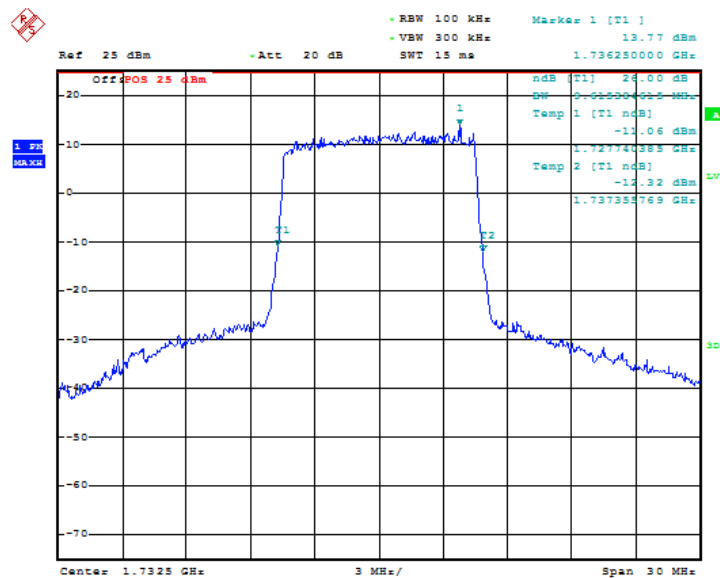
**LTE band 4, 10MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	1732.5	QPSK
9.76		9.62



Date: 15.AUG.2019 10:31:38

Fig.75 LTE band 4, 10MHz Bandwidth, QPSK (-26dBc BW)

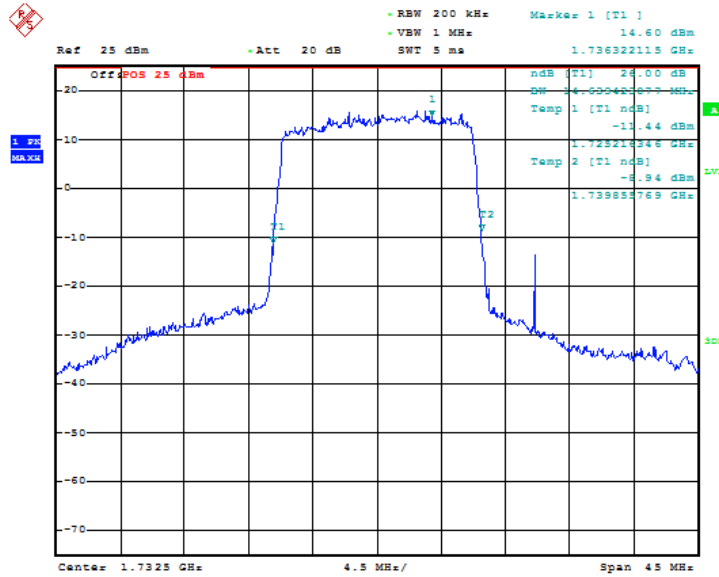


Date: 15.AUG.2019 10:32:42

Fig.76 LTE band 4, 10MHz Bandwidth, 16QAM (-26dBc BW)

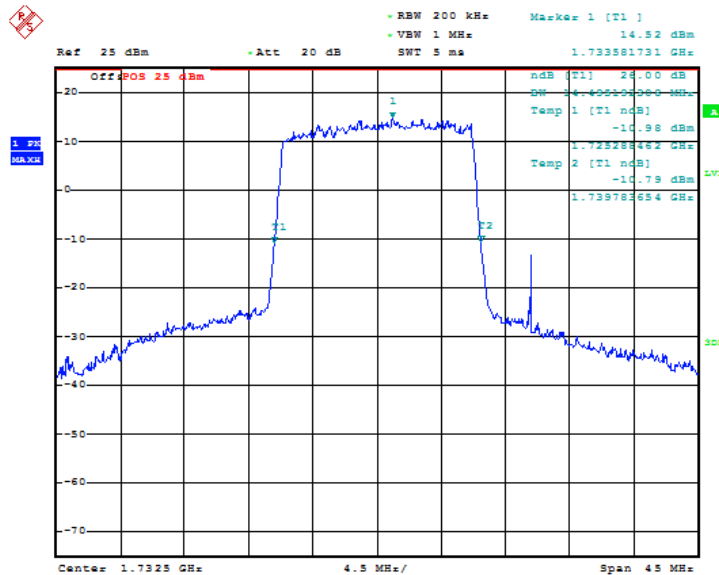
**LTE band 4, 15MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	1732.5	QPSK
	14.64	14.50



Date: 15.AUG.2019 10:39:56

Fig.77 LTE band 4, 15MHz Bandwidth, QPSK (-26dBc BW)

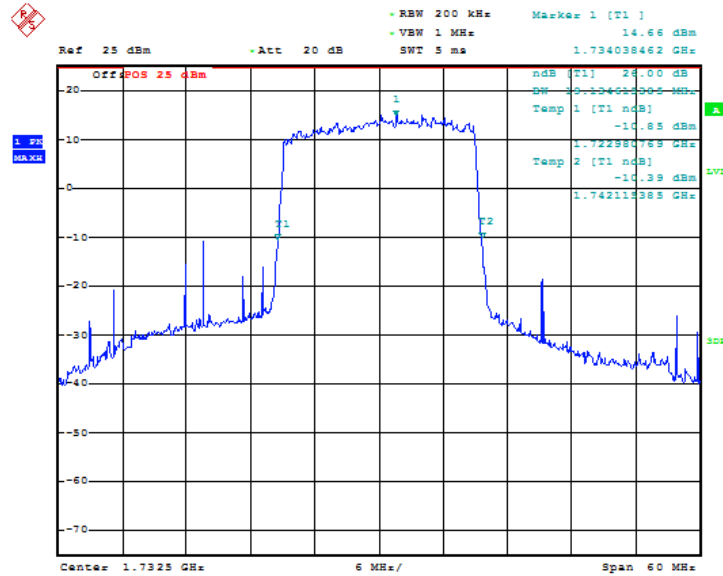


Date: 15.AUG.2019 10:35:01

Fig.78 LTE band 4, 15MHz Bandwidth, 16QAM (-26dBc BW)

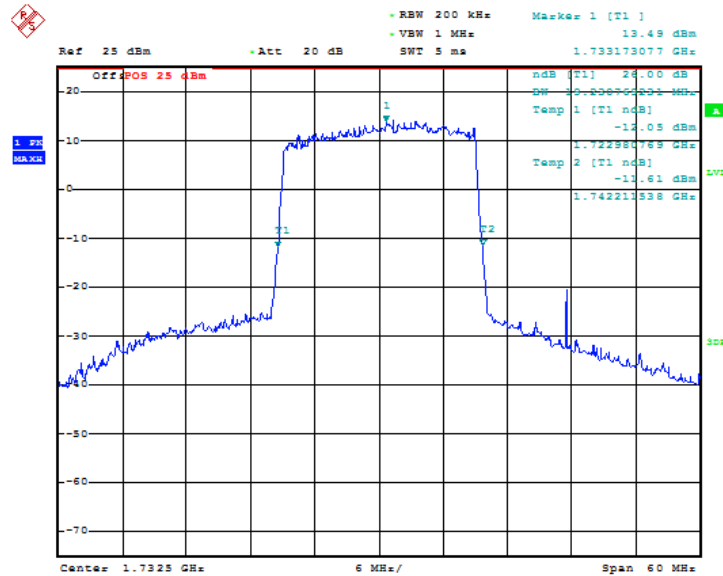
**LTE band 4, 20MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	1732.5	QPSK
	19.13	19.23



Date: 15.AUG.2019 10:36:15

Fig.79 LTE band 4, 20MHz Bandwidth, QPSK (-26dBc BW)

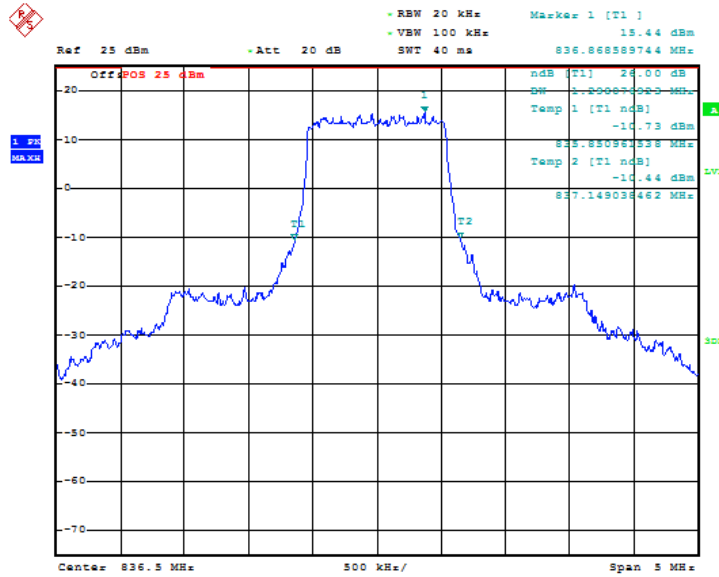


Date: 15.AUG.2019 10:37:20

Fig.80 LTE band 4, 20MHz Bandwidth, 16QAM (-26dBc BW)

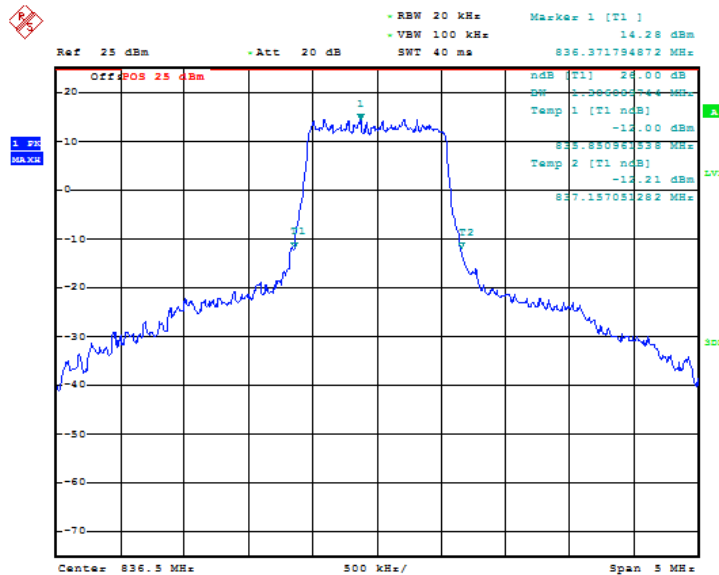
**LTE band 5, 1.4MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	836.5	QPSK
	1.30	1.31



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Fig.81 LTE band 5, 1.4MHz Bandwidth, QPSK (-26dBc BW)

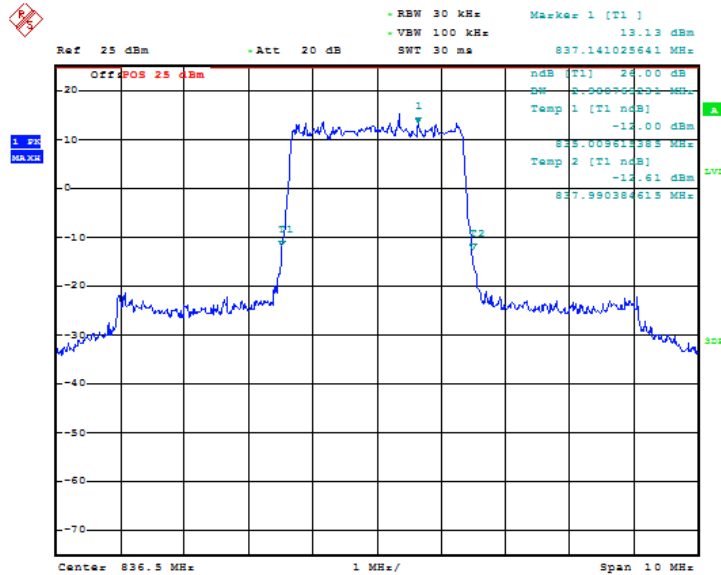


Date: 15.AUG.2019 10:41:42

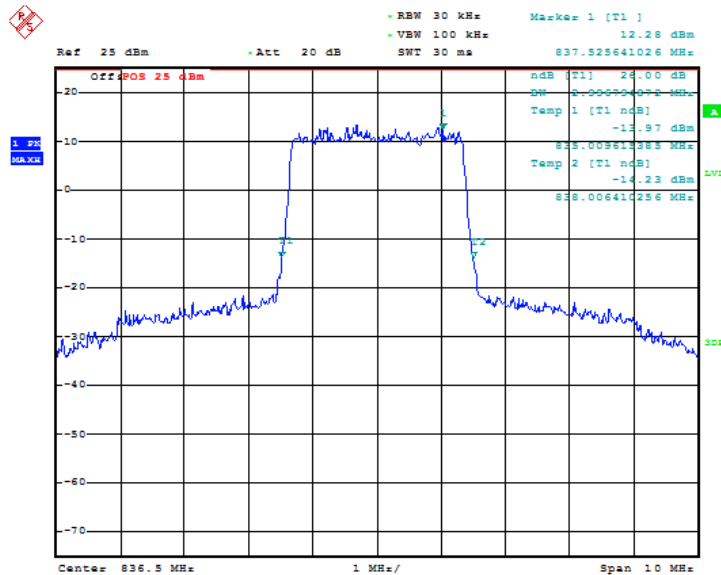
Fig.82 LTE band 5, 1.4MHz Bandwidth, 16QAM (-26dBc BW)

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

Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
	836.5	QPSK
2.98		2.99



Date: 15.AUG.2019 10:42:56

**Fig.83 LTE band 5, 3MHz Bandwidth, QPSK (-26dBc BW)**


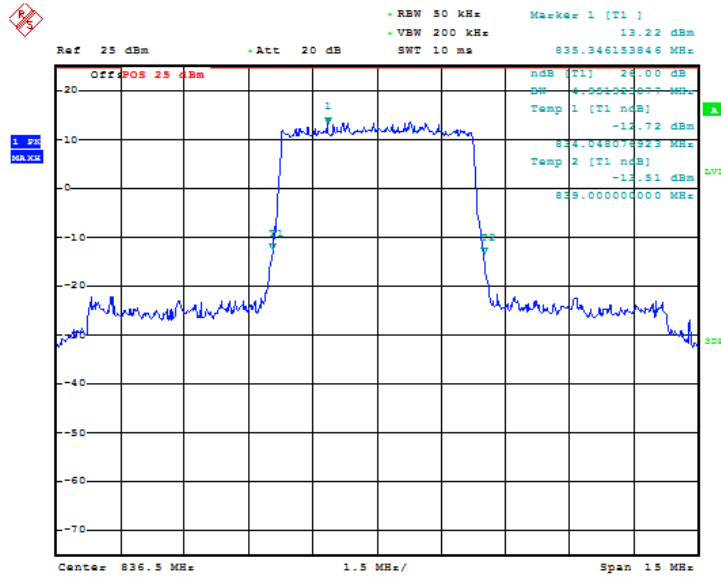
Date: 15.AUG.2019 10:44:01

**Fig.84 LTE band 5, 3MHz Bandwidth, 16QAM (-26dBc BW)**



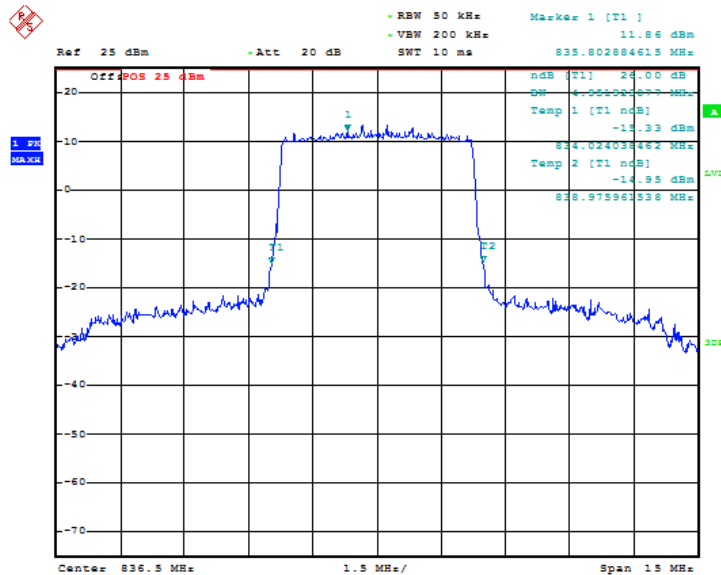
**LTE band 5, 5MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	836.5	QPSK
4.95		4.95



Date: 15.AUG.2019 10:45:15

Fig.85 LTE band 5, 5MHz Bandwidth, QPSK (-26dBc BW)

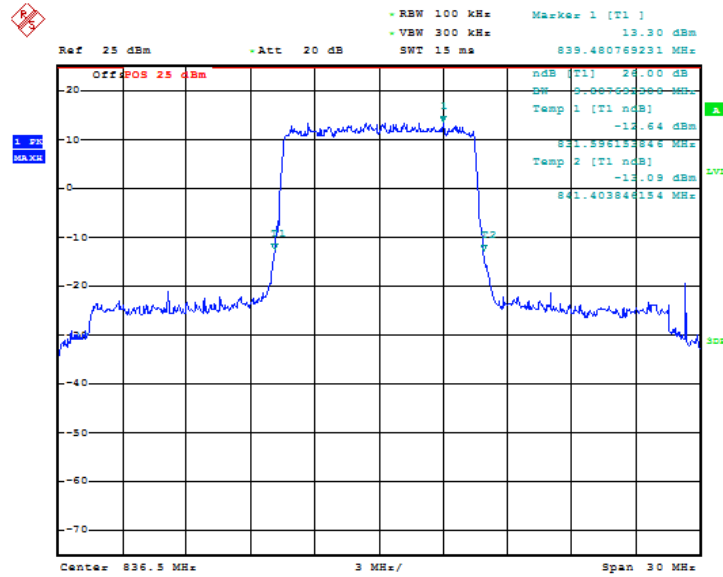


Date: 15.AUG.2019 10:46:20

Fig.86 LTE band 5, 5MHz Bandwidth, 16QAM (-26dBc BW)

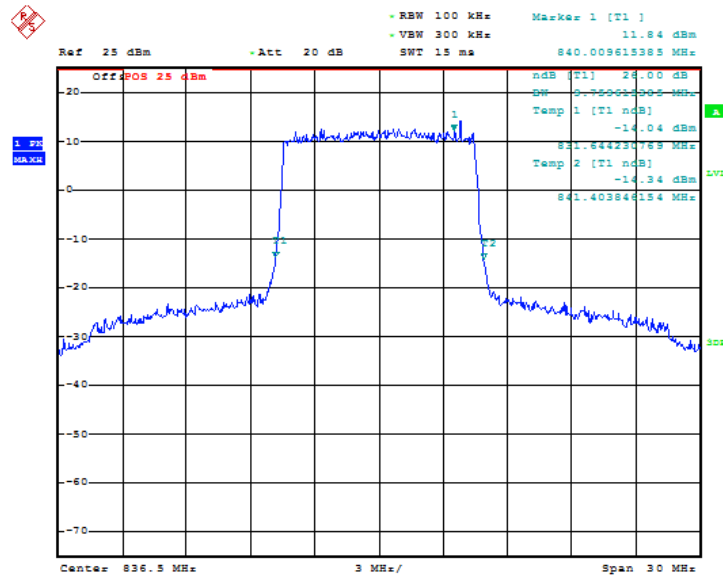
**LTE band 5, 10MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	836.5	QPSK
	9.81	9.76



Date: 15.AUG.2019 10:47:34

Fig.87 LTE band 5, 10MHz Bandwidth, QPSK (-26dBc BW)

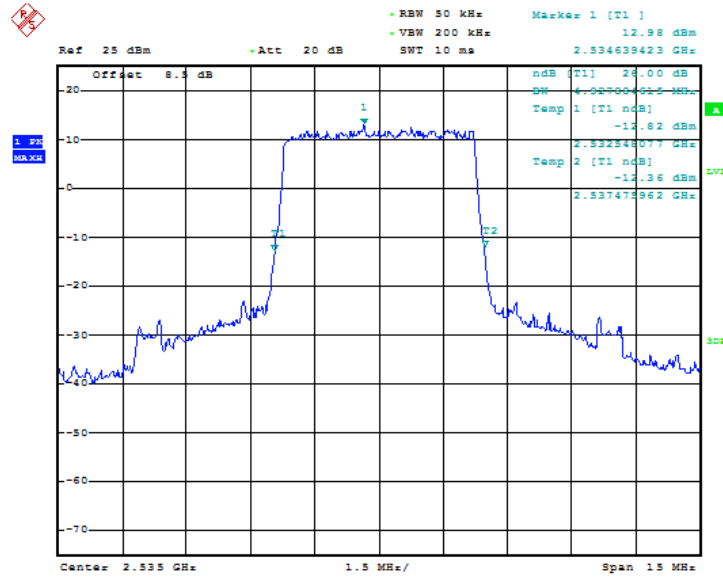


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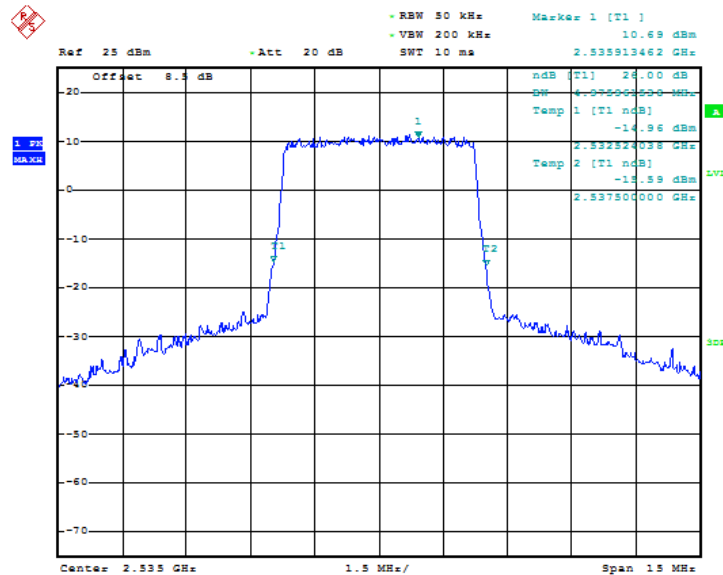
Fig.88 LTE band 5, 10MHz Bandwidth, 16QAM (-26dBc BW)

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

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	2535.0	QPSK
	4.93	4.98



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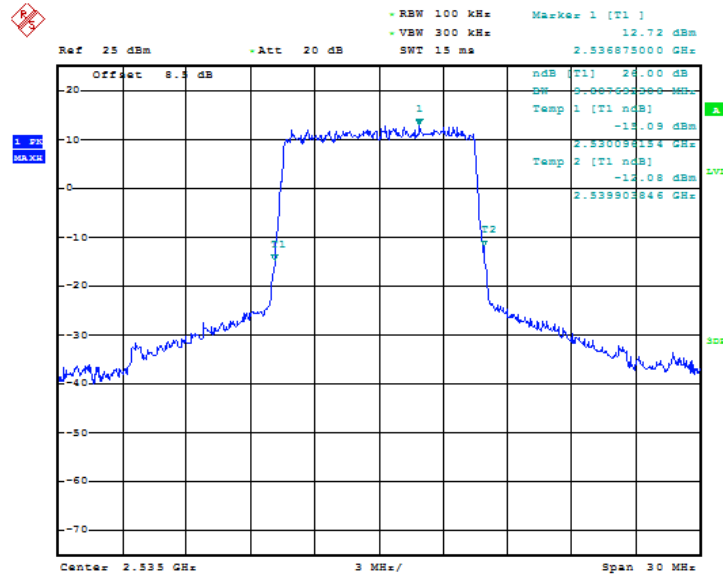
**Fig.89 LTE band 7, 5MHz Bandwidth, QPSK (-26dBc BW)**


Date: 15.AUG.2019 11:10:11

**Fig.90 LTE band 7, 5MHz Bandwidth, 16QAM (-26dBc BW)**

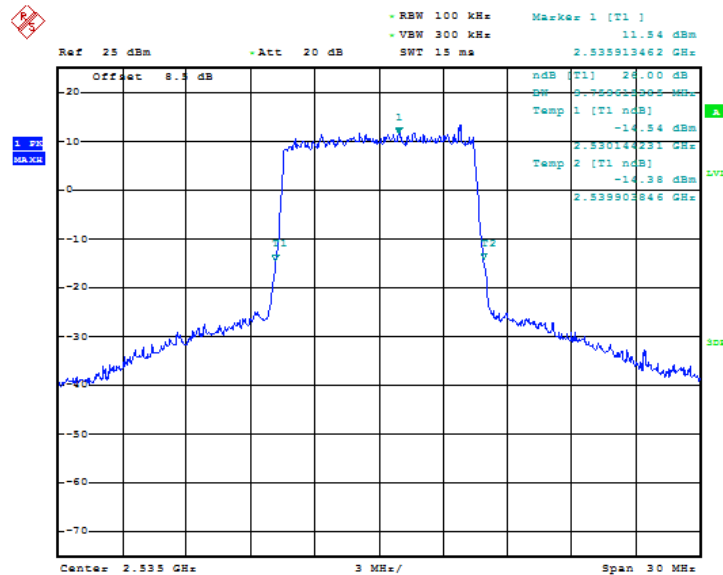
**LTE band 7, 10MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
	2535.0	QPSK
	9.80	9.76



Date: 15.AUG.2019 11:11:25

Fig.91 LTE band 7, 10MHz Bandwidth, QPSK (-26dBc BW)

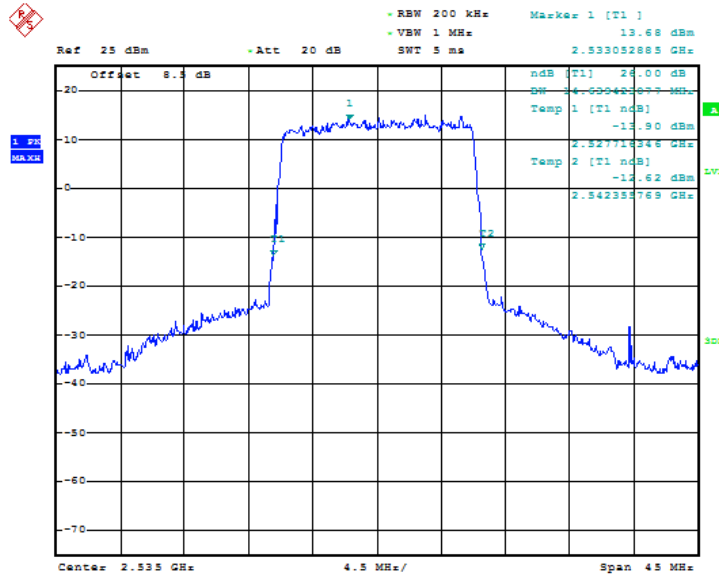


Date: 15.AUG.2019 11:12:30

Fig.92 LTE band 7, 10MHz Bandwidth, 16QAM (-26dBc BW)

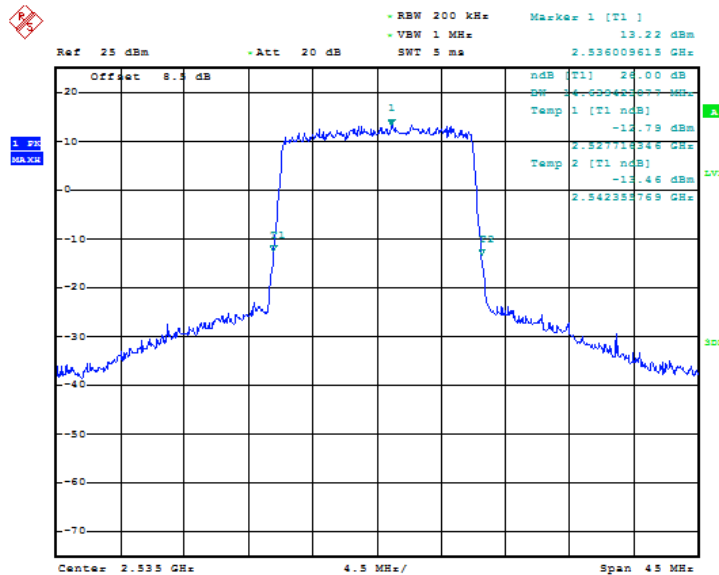
**LTE band 7, 15MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	2535.0	QPSK
	14.64	14.64



Date: 15.AUG.2019 11:13:44

Fig.93 LTE band 7, 15MHz Bandwidth, QPSK (-26dBc BW)

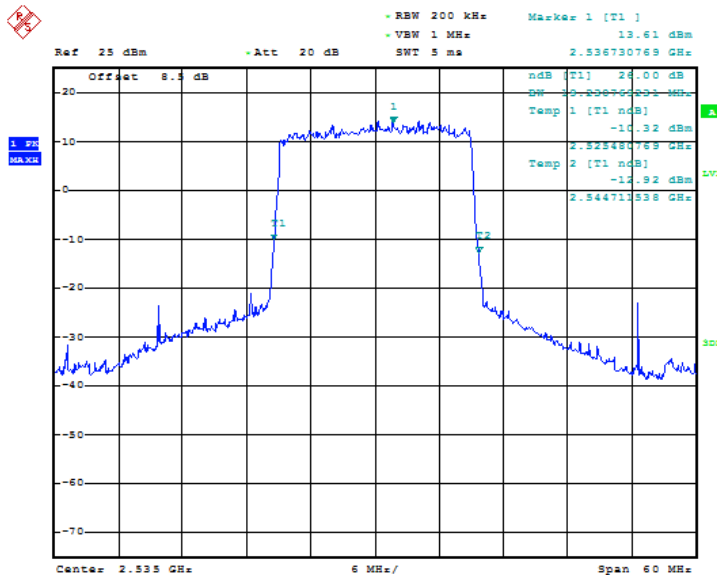


Date: 15.AUG.2019 11:14:49

Fig.94 LTE band 7, 15MHz Bandwidth, 16QAM (-26dBc BW)

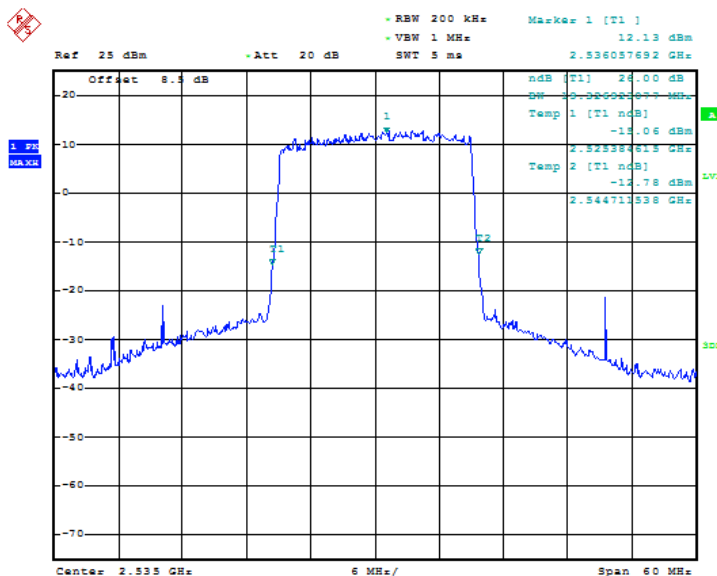
**LTE band 7, 20MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	2535.0	QPSK
19.23		19.32



Date: 15.AUG.2019 11:16:03

Fig.95 LTE band 7, 20MHz Bandwidth, QPSK (-26dBc BW)

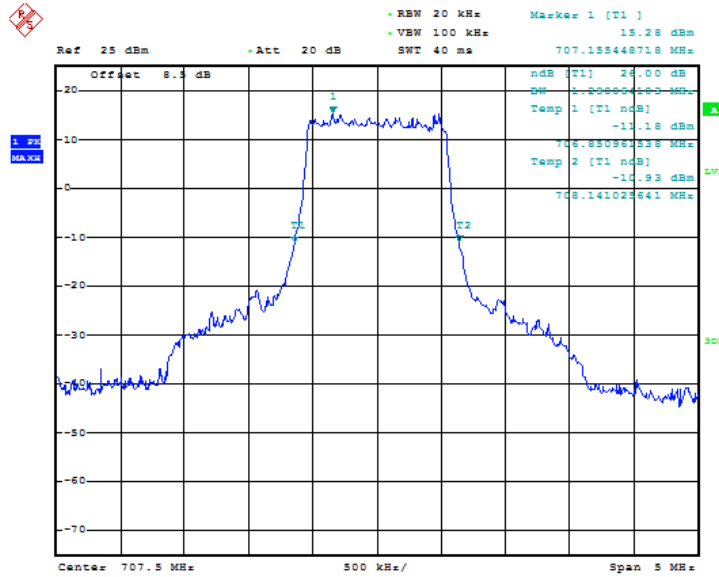


Date: 15.AUG.2019 11:17:08

Fig.96 LTE band 7, 20MHz Bandwidth, 16QAM (-26dBc BW)

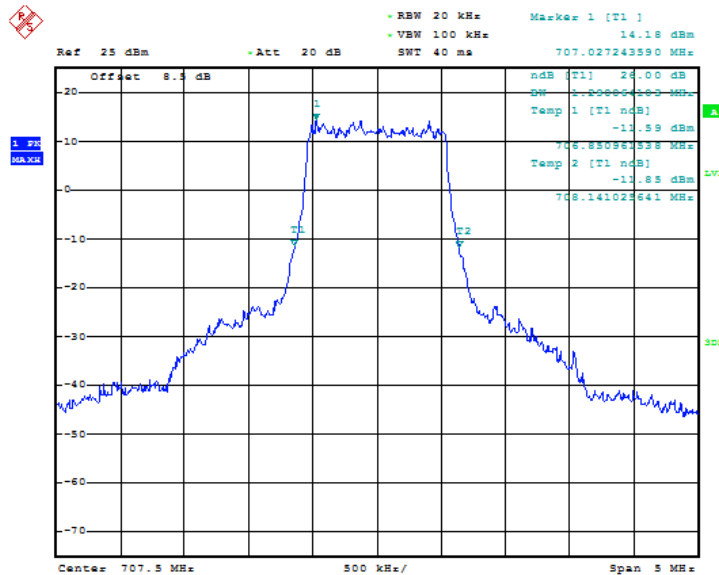
**LTE band 12, 1.4MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	707.5	QPSK
	1.29	1.29



Date: 15.AUG.2019 11:20:07

Fig.97 LTE band 12, 1.4MHz Bandwidth, QPSK (-26dBc BW)

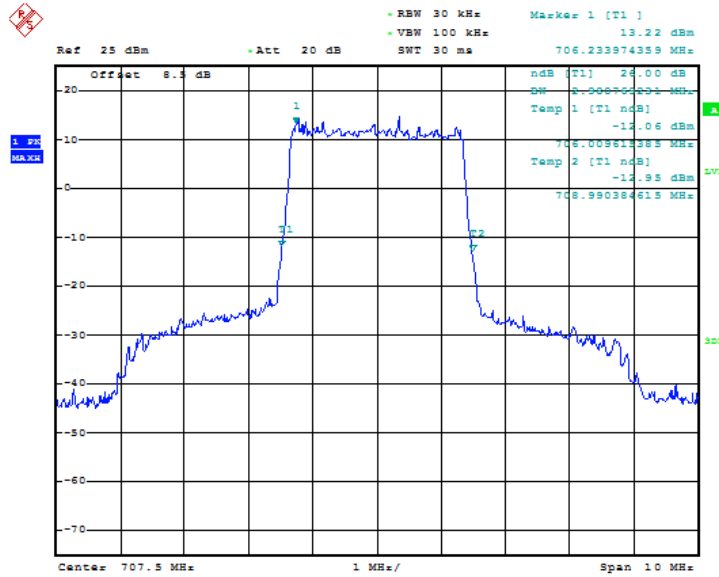


Date: 15.AUG.2019 11:21:12

Fig.98 LTE band 12, 1.4MHz Bandwidth, 16QAM (-26dBc BW)

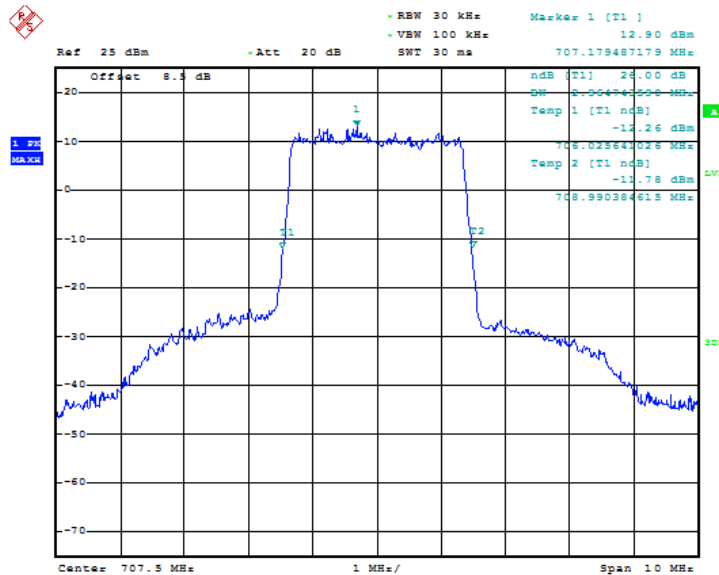
**LTE band12, 3MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( kHz)	
	707.5	QPSK
2.99		2.96



Date: 15.AUG.2019 11:22:26

Fig.99 LTE band 12, 3MHz Bandwidth, QPSK (-26dBc BW)



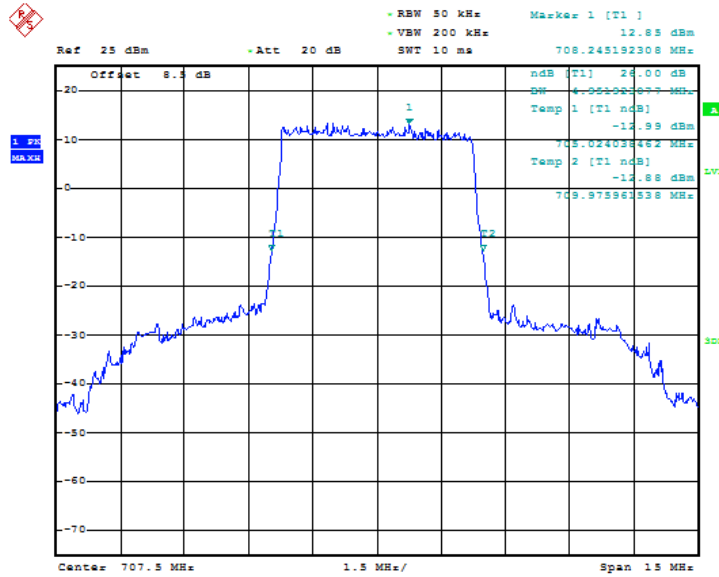
Date: 15.AUG.2019 11:29:31

Fig.100 LTE band 12, 3MHz Bandwidth, 16QAM (-26dBc BW)



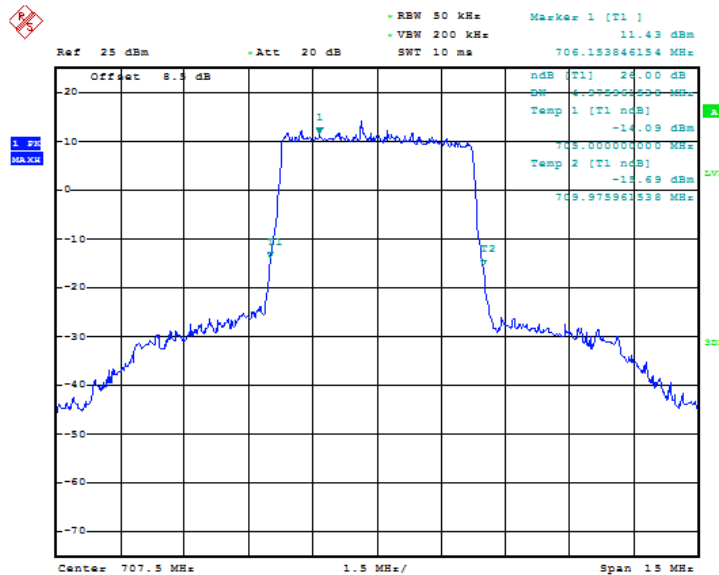
**LTE band 12, 5MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
707.5	QPSK	16QAM
	4.95	4.98



Date: 15.AUG.2019 11:24:45

Fig.101 LTE band12, 5MHz Bandwidth, QPSK (-26dBc BW)

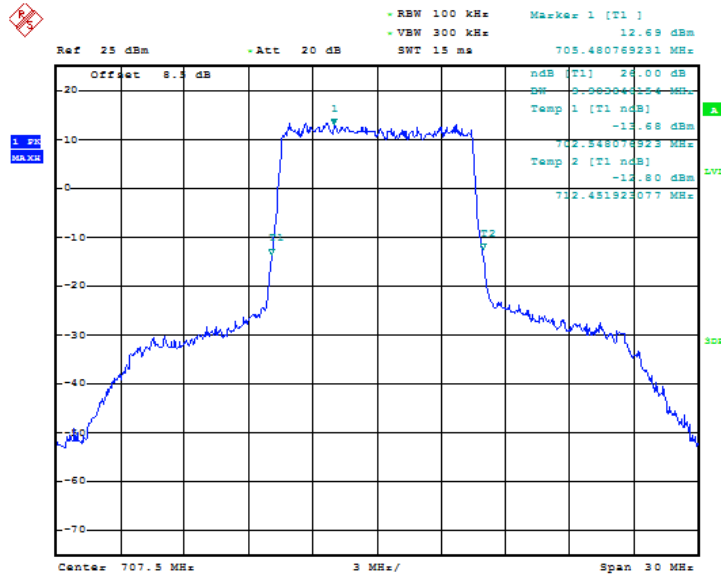


Date: 15.AUG.2019 11:25:50

Fig.102 LTE band 12, 5MHz Bandwidth, 16QAM (-26dBc BW)

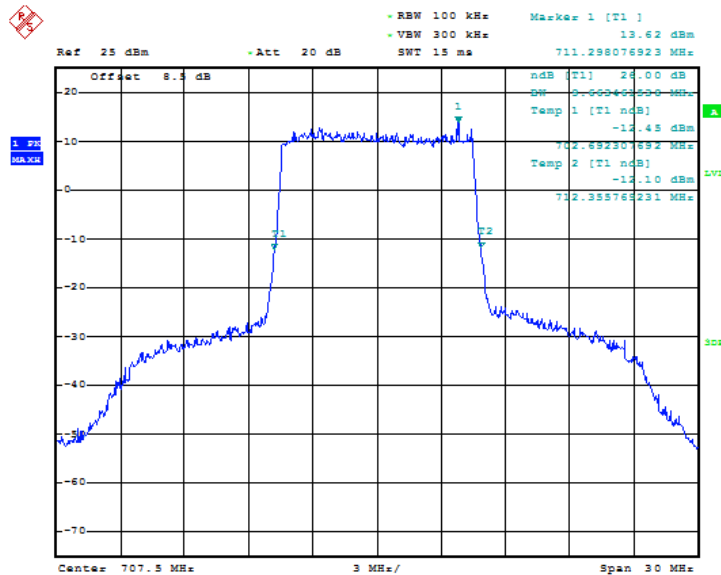
**LTE band 12, 10MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	707.5	QPSK
9.90		9.66



Date: 15.AUG.2019 11:27:04

Fig.103 LTE band 12, 10MHz Bandwidth, QPSK (-26dBc BW)

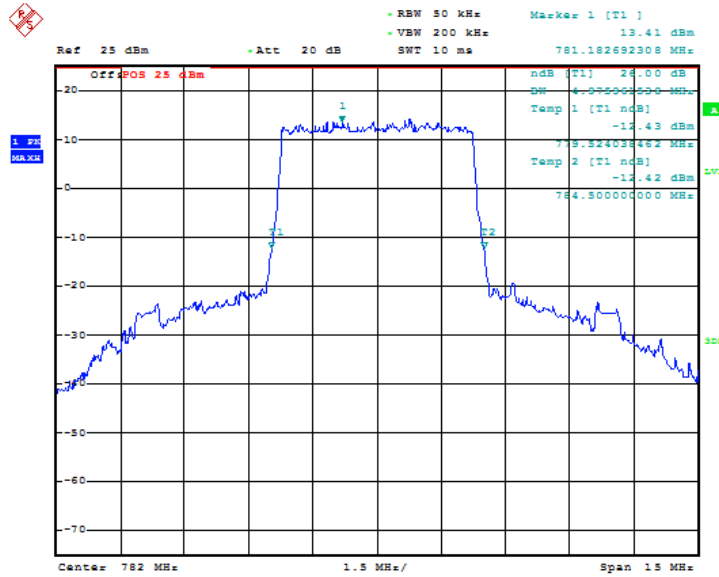


Date: 15.AUG.2019 11:28:09

Fig.104 LTE band12, 10MHz Bandwidth, 16QAM (-26dBc BW)

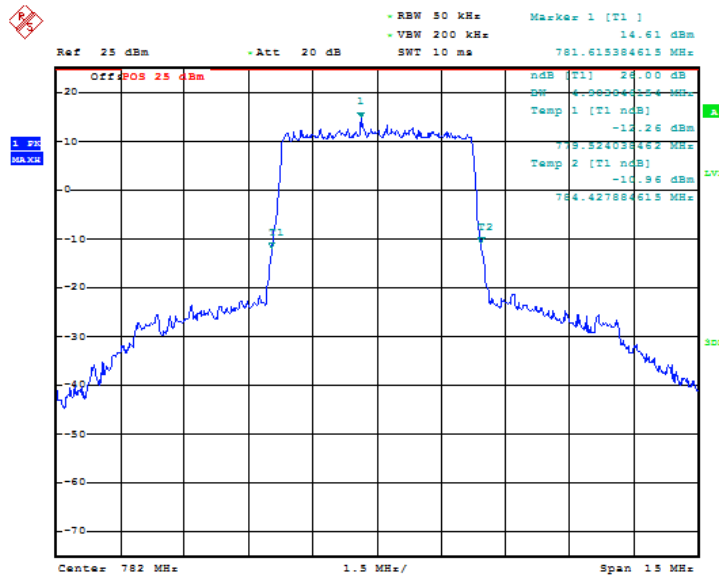
**LTE band 13, 5MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	782.0	QPSK
	4.98	4.90



Date: 16.AUG.2019 06:18:41

Fig.105 LTE band13, 5MHz Bandwidth, QPSK (-26dBc BW)

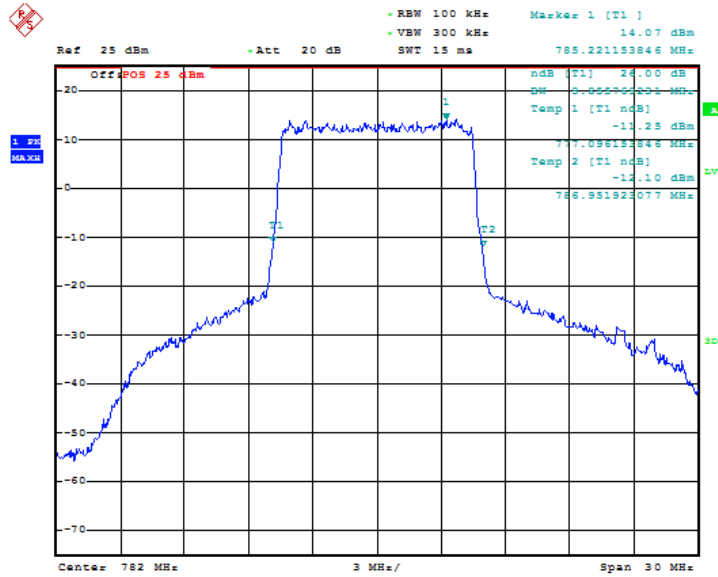


Date: 16.AUG.2019 06:19:45

Fig.106 LTE band 13, 5MHz Bandwidth, 16QAM (-26dBc BW)

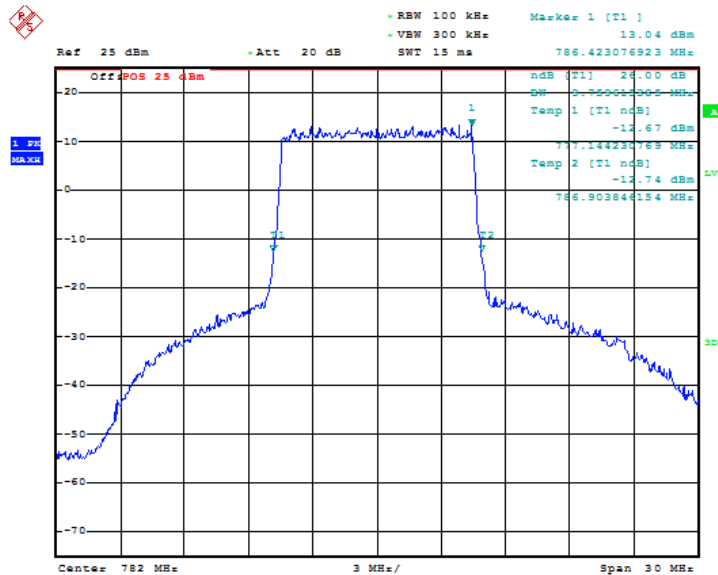
**LTE band 13, 10MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
	782.0	QPSK
9.86		9.76



Date: 16.AUG.2019 06:20:59

Fig.107 LTE band 13, 10MHz Bandwidth, QPSK (-26dBc BW)

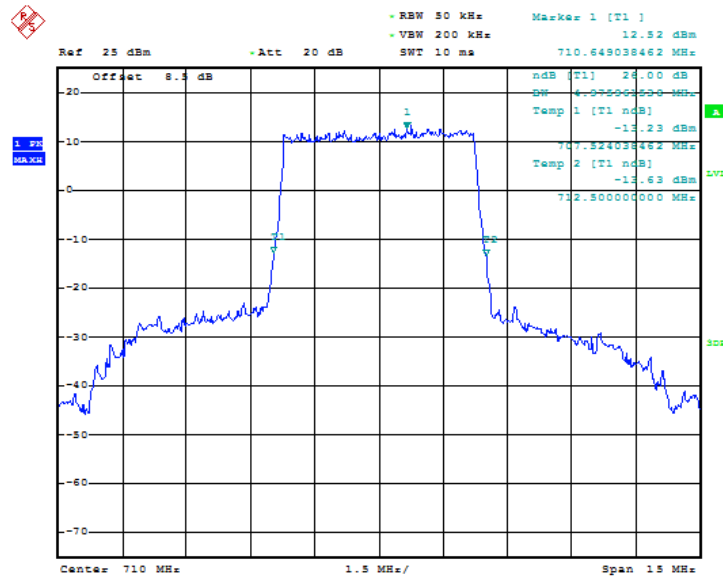


Date: 16.AUG.2019 06:22:04

Fig.108 LTE band13, 10MHz Bandwidth, 16QAM (-26dBc BW)

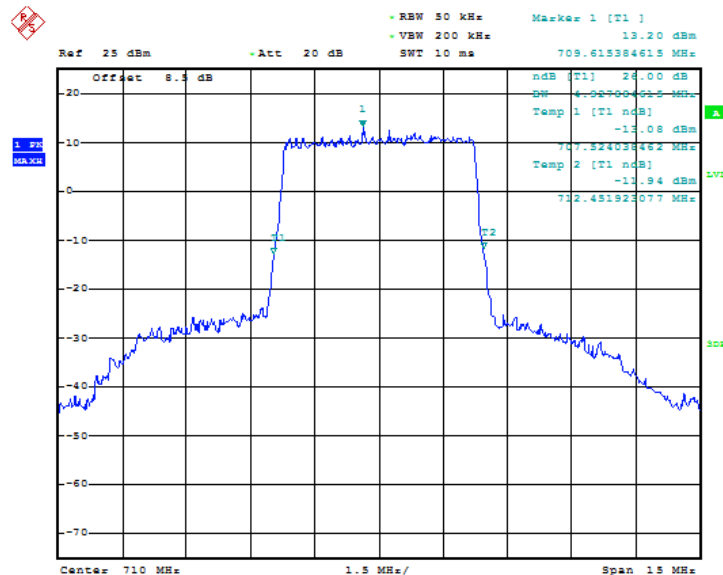
**LTE band 17, 5MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
710.0	QPSK	16QAM
	4.96	4.93



Date: 16.AUG.2019 06:24:55

Fig.109 LTE band 17, 5MHz Bandwidth, QPSK (-26dBc BW)

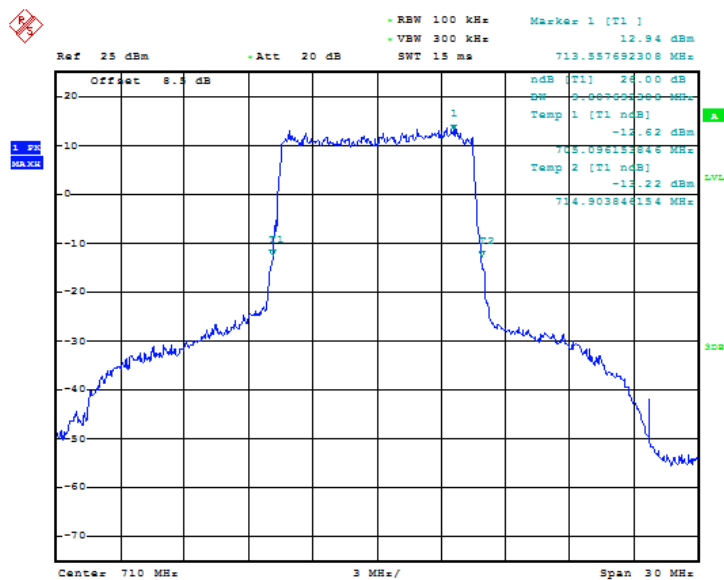


Date: 16.AUG.2019 06:26:00

Fig.110 LTE band 17, 5MHz Bandwidth, 16QAM (-26dBc BW)

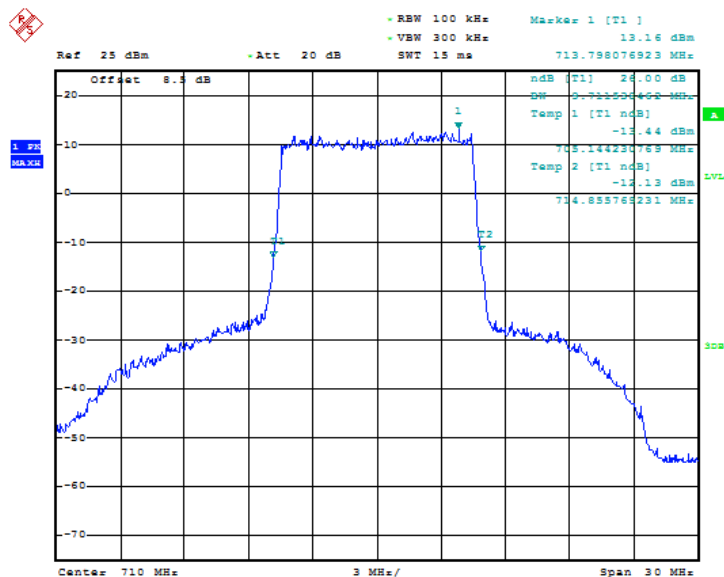
**LTE band 17, 10MHz (-26dBc)**

Frequency(MHz)	Occupied Bandwidth (-26dBc)( MHz)	
710.0	QPSK	16QAM
	9.80	9.71



Date: 16.AUG.2019 06:27:13

Fig.111 LTE band 17, 10MHz Bandwidth, QPSK (-26dBc BW)



Date: 16.AUG.2019 06:28:18

Fig.112 LTE band 17, 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)

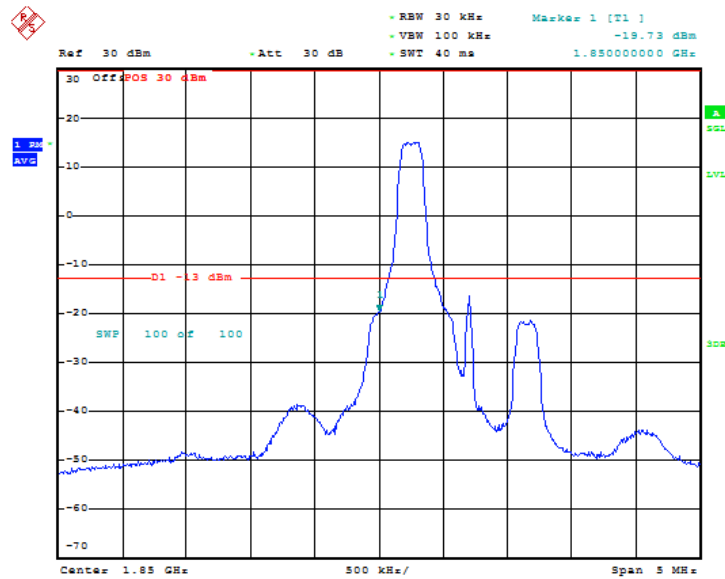
### **A.6.1 Measurement limit**

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.

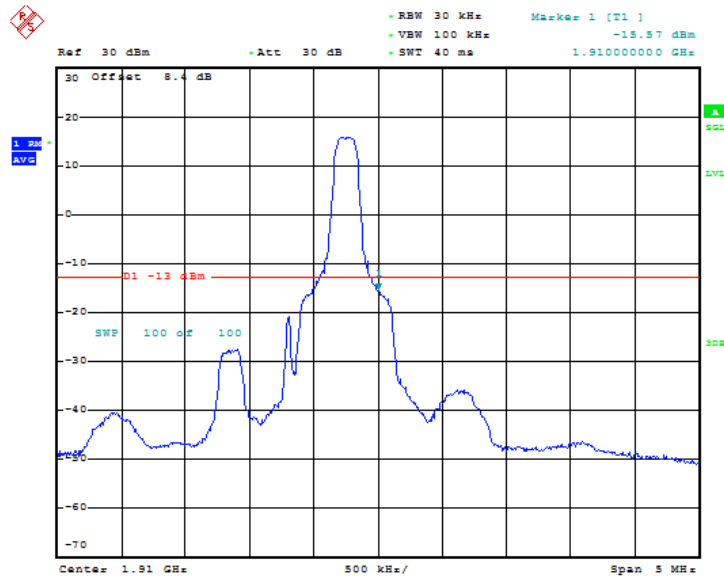
Part 27.53(m) states that for mobile digital stations, the attenuation factor shall be not less than  $40 + 10 \log(P)$  dB on all frequencies between the channel edge and 5 megahertz from the channel edge,  $43 + 10 \log(P)$  dB on all frequencies between 5 megahertz and X megahertz from the channel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

**A.6.2 Measurement result**  
**Only worst case result is given below**  
**LTE band 2**



Date: 16.AUG.2019 06:33:23

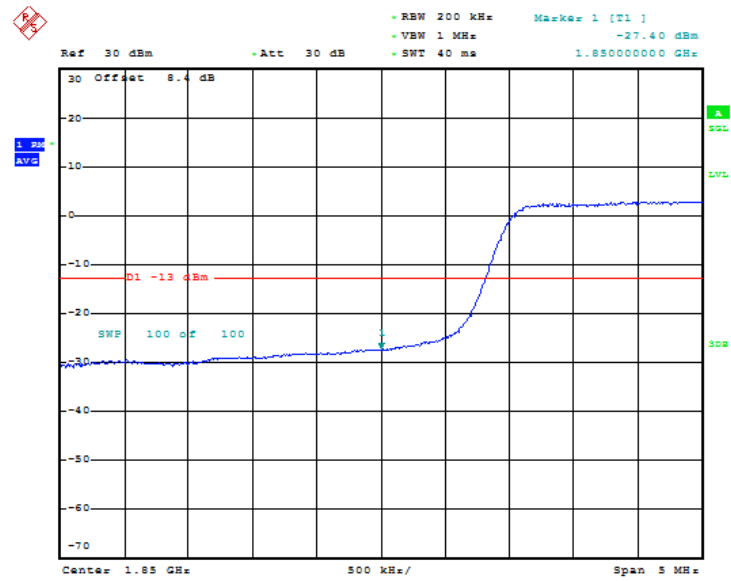
Fig.113 LOW BAND EDGE BLOCK-1RB-low\_offset



Date: 16.AUG.2019 06:34:37

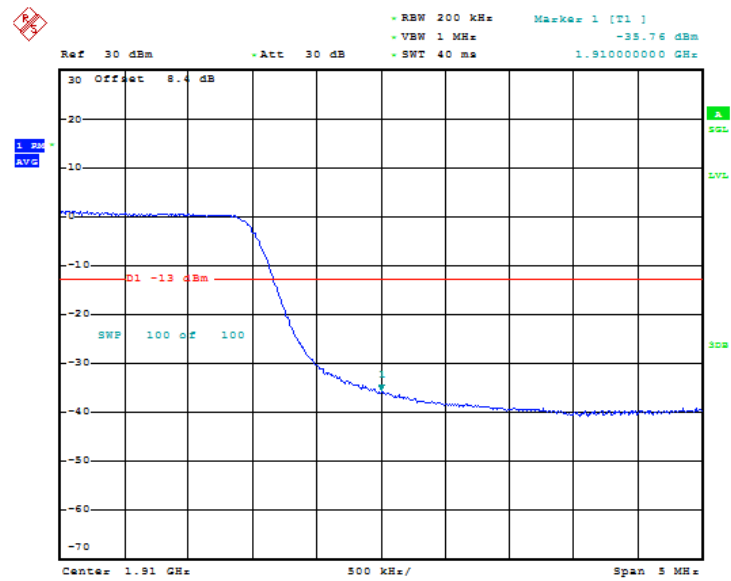
Fig.114 HIGH BAND EDGE BLOCK-1RB-high\_offset





Date: 16.AUG.2019 06:36:35

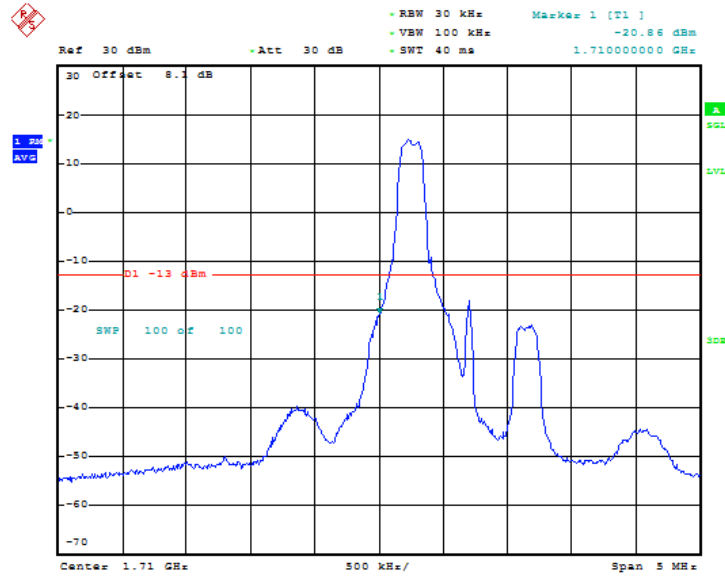
Fig.115 LOW BAND EDGE BLOCK-20MHz-100%RB



Date: 16.AUG.2019 06:39:53

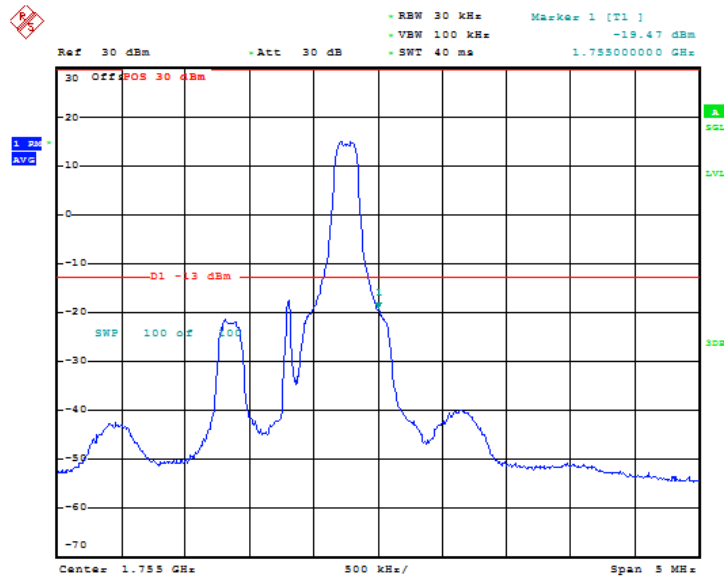
Fig.116 HIGH BAND EDGE BLOCK-20MHz-100%RB

**LTE band 4**



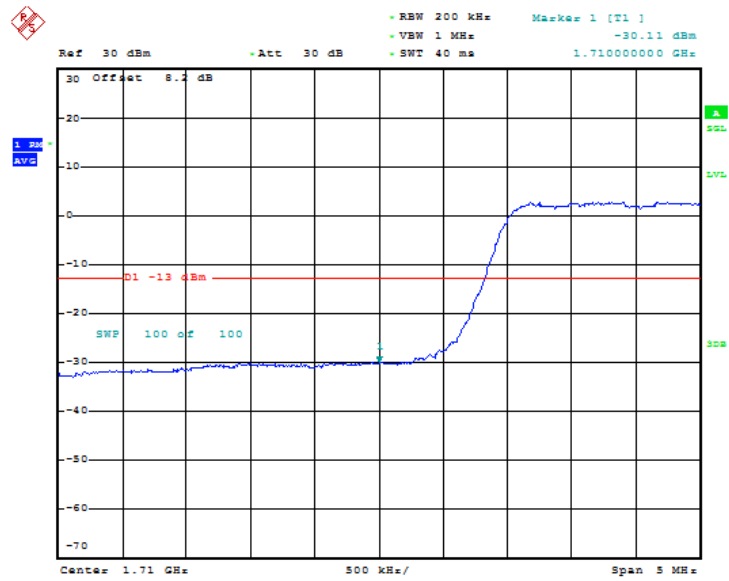
Date: 16.AUG.2019 06:45:58

Fig.117 LOW BAND EDGE BLOCK-1RB-low\_offset



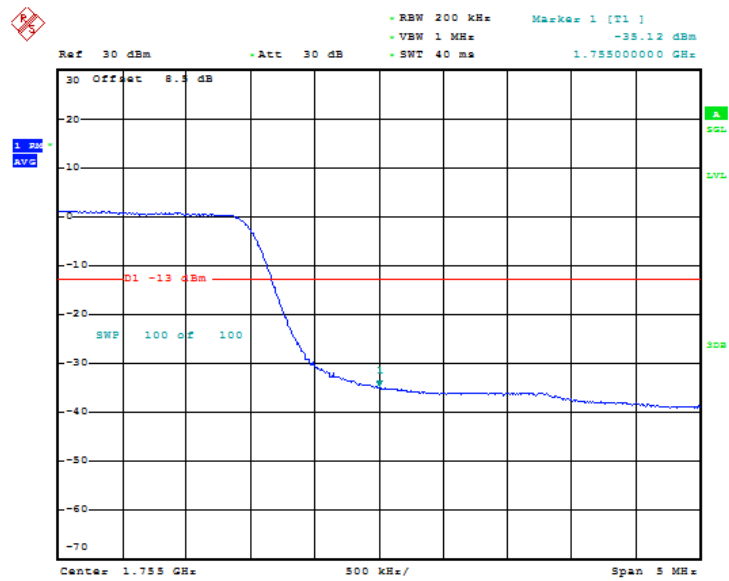
Date: 16.AUG.2019 06:47:08

Fig.118 HIGH BAND EDGE BLOCK-1RB-high\_offset



Date: 16.AUG.2019 06:43:29

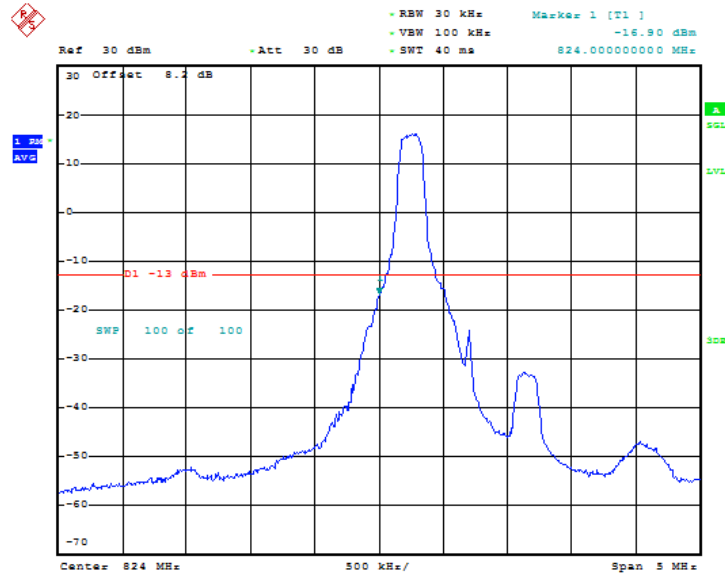
Fig.119 LOW BAND EDGE BLOCK-20MHz-100%RB



Date: 16.AUG.2019 06:44:05

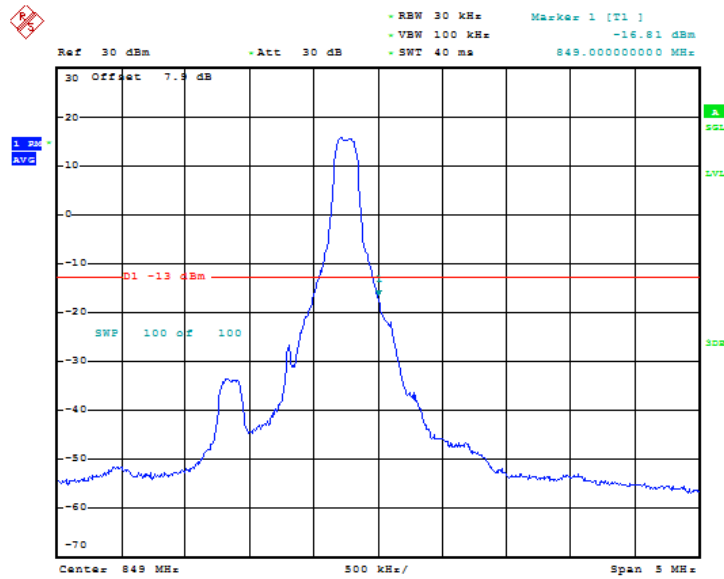
Fig.120 HIGH BAND EDGE BLOCK-20MHz-100%RB

LTE band 5



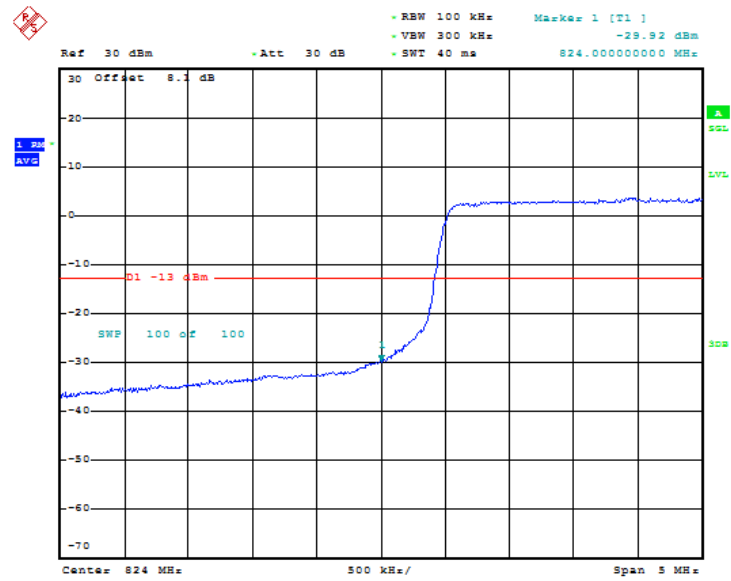
Date: 16.AUG.2019 06:49:54

Fig.121 LOW BAND EDGE BLOCK-1RB-low\_offset



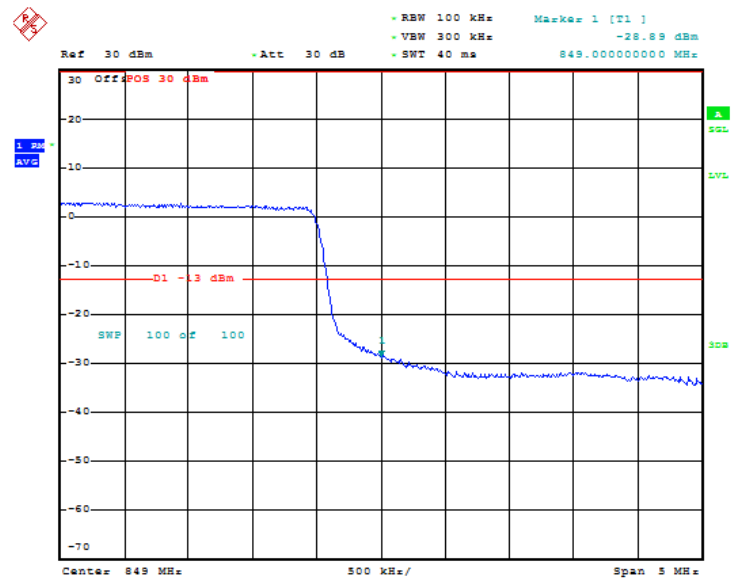
Date: 16.AUG.2019 06:50:34

Fig.122 HIGH BAND EDGE BLOCK-1RB-high\_offset



Date: 16.AUG.2019 06:52:45

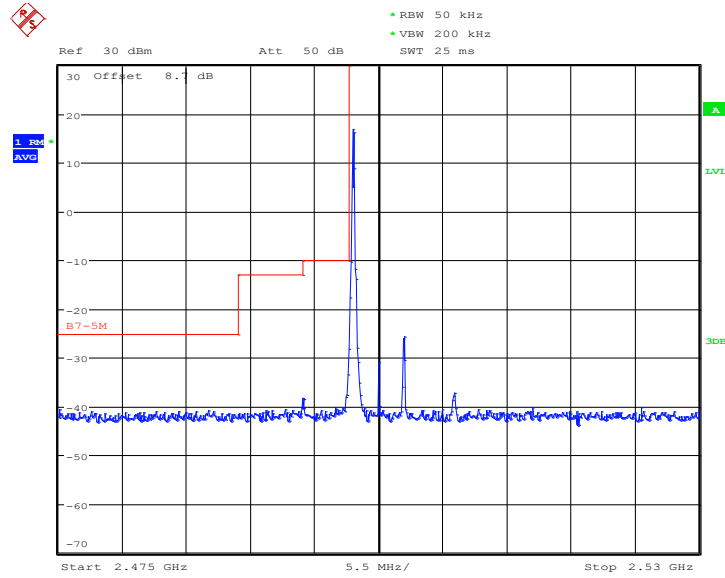
Fig.123 LOW BAND EDGE BLOCK-10MHz-100%RB



Date: 16.AUG.2019 06:53:20

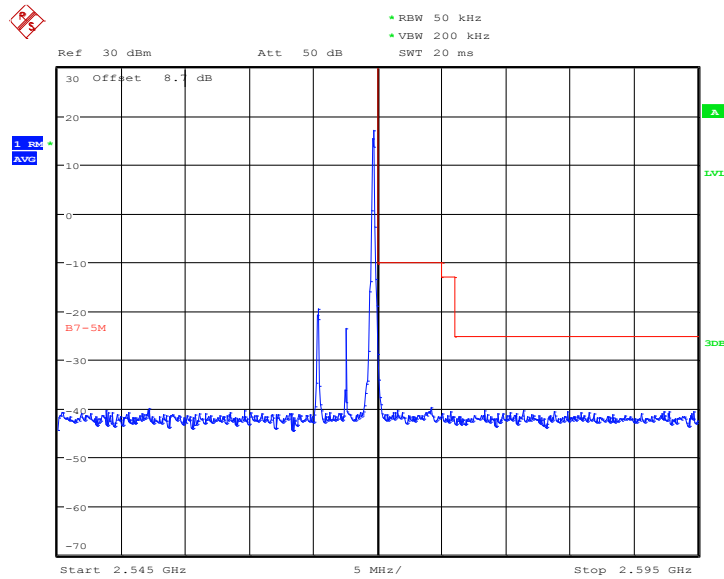
Fig.124 HIGH BAND EDGE BLOCK-10MHz-100%RB

**LTE band 7**



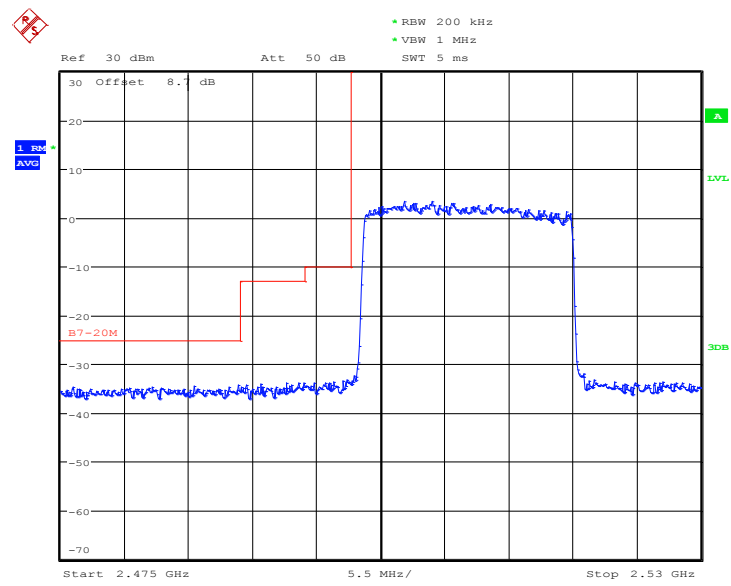
Date: 24.AUG.2019 08:18:10

**Fig.125 LOW BAND EDGE BLOCK-1RB-low\_offset**



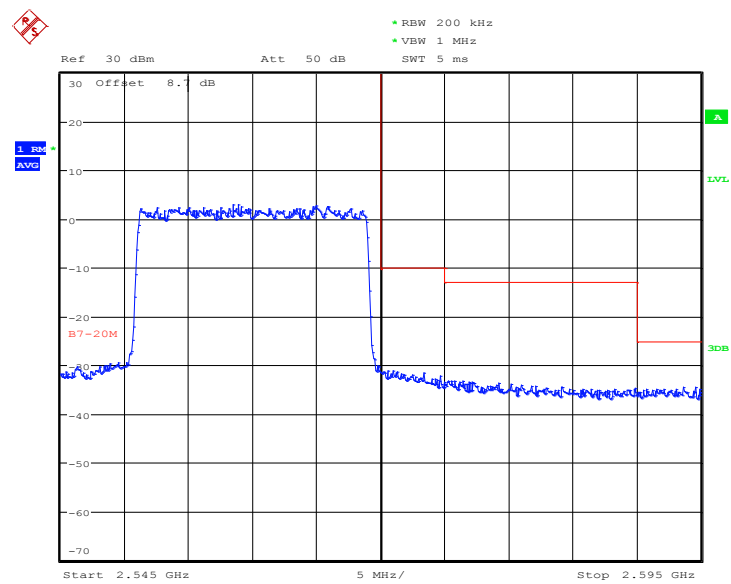
Date: 24.AUG.2019 08:19:16

**Fig.126 HIGH BAND EDGE BLOCK-1RB-high\_offset**



Date: 24.AUG.2019 08:20:55

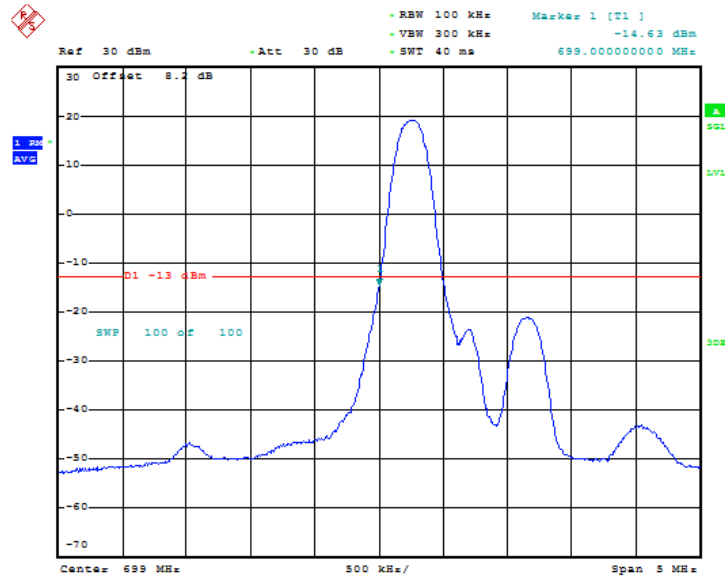
Fig.127 LOW BAND EDGE BLOCK-20MHz-100%RB



Date: 24.AUG.2019 08:21:31

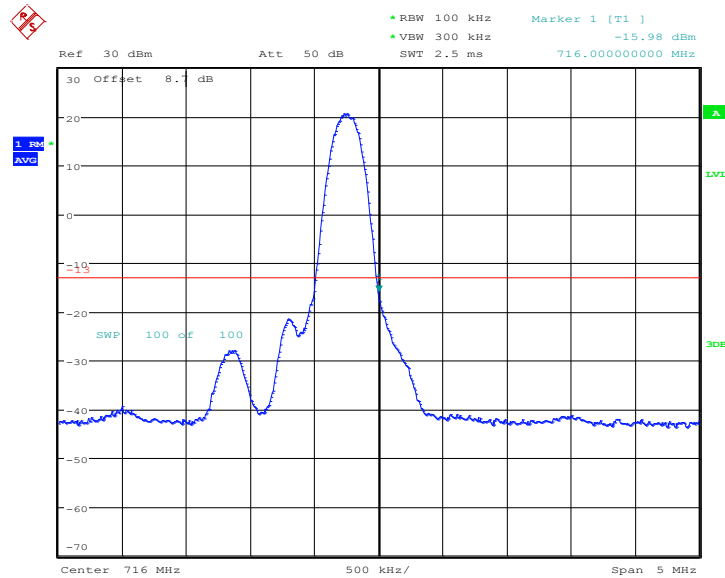
Fig.128 HIGH BAND EDGE BLOCK-20MHz-100%RB

LTE band 12



Date: 24.AUG.2019 08:26:51

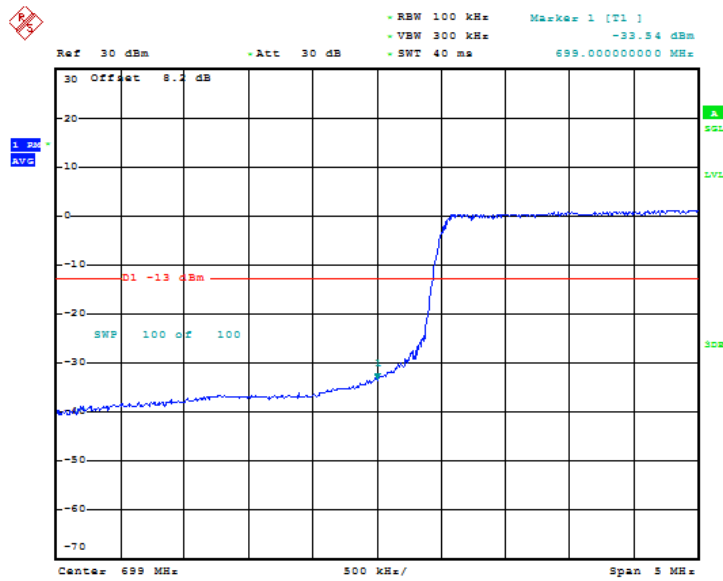
Fig.129 LOW BAND EDGE BLOCK-1RB-low\_offset



Date: 6.SEP.2019 11:23:00

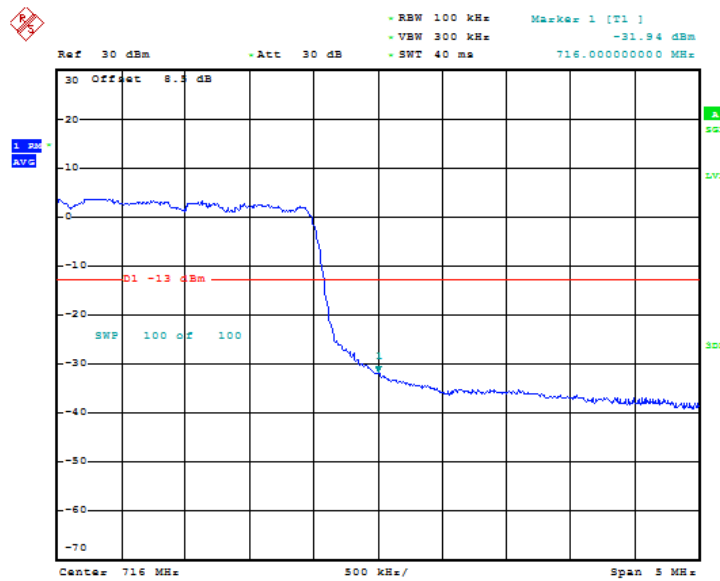
Fig.130 HIGH BAND EDGE BLOCK-1RB-high\_offset





Date: 16.AUG.2019 06:54:46

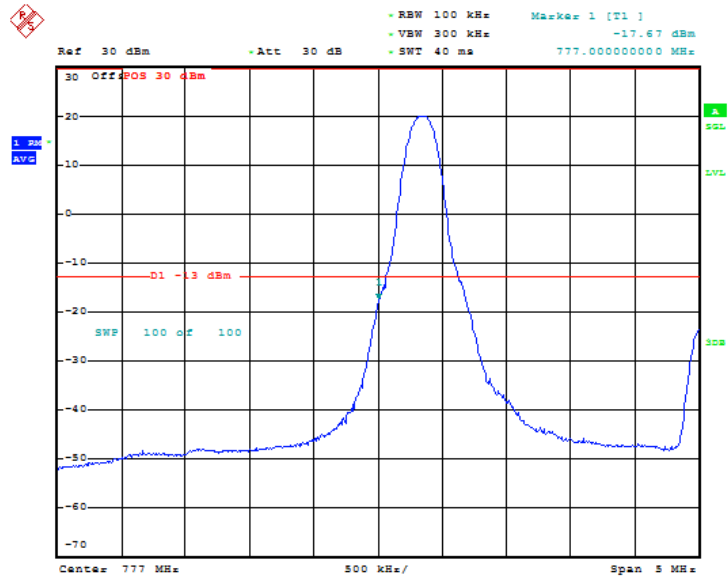
Fig.131 LOW BAND EDGE BLOCK-10MHz-100%RB



Date: 16.AUG.2019 06:55:21

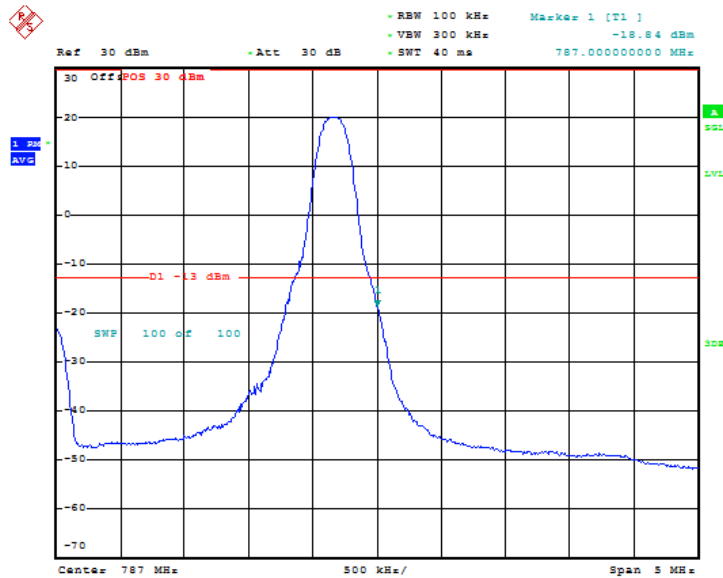
Fig.132 HIGH BAND EDGE BLOCK-10MHz-100%RB

LTE band 13



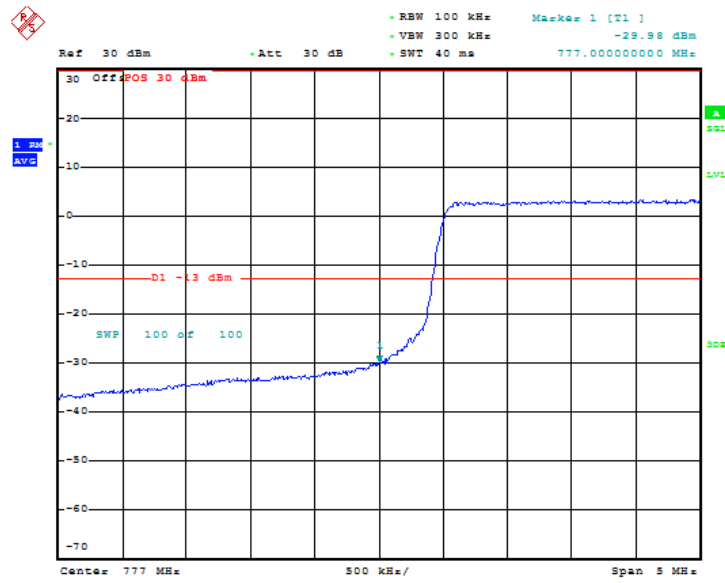
Date: 24.AUG.2019 09:08:54

Fig.133 LOW BAND EDGE BLOCK-1RB-low\_offset



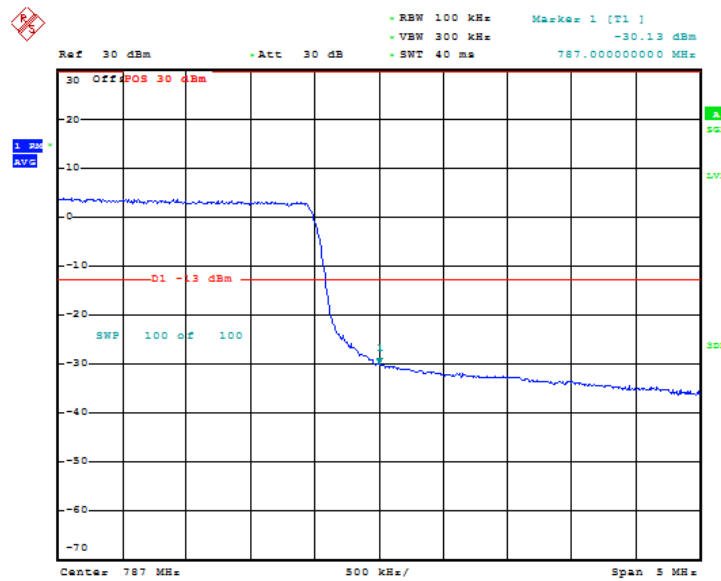
Date: 24.AUG.2019 09:09:50

Fig.134 HIGH BAND EDGE BLOCK-1RB-high\_offset



Date: 16.AUG.2019 07:08:00

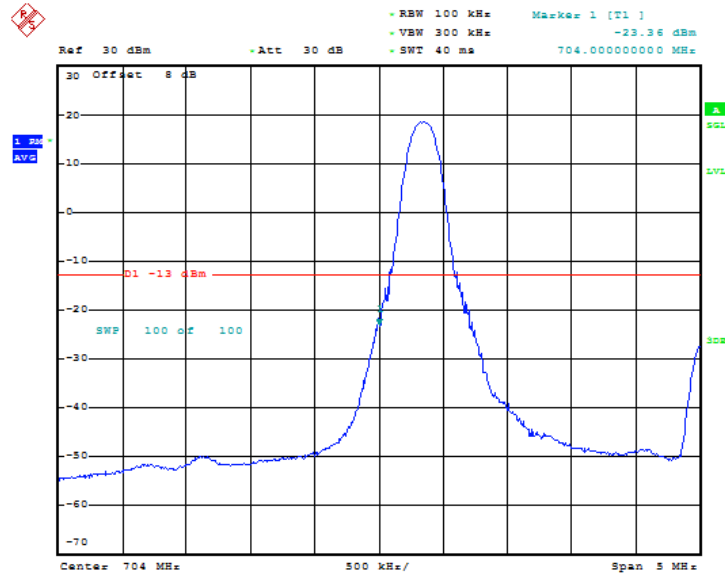
Fig.135 LOW BAND EDGE BLOCK-10MHz-100%RB



Date: 16.AUG.2019 07:08:35

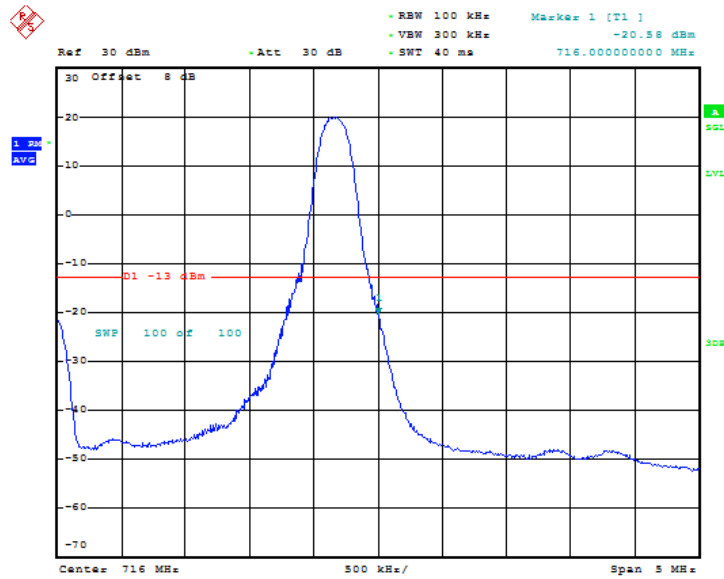
Fig.136 HIGH BAND EDGE BLOCK-10MHz-100%RB

LTE band 17



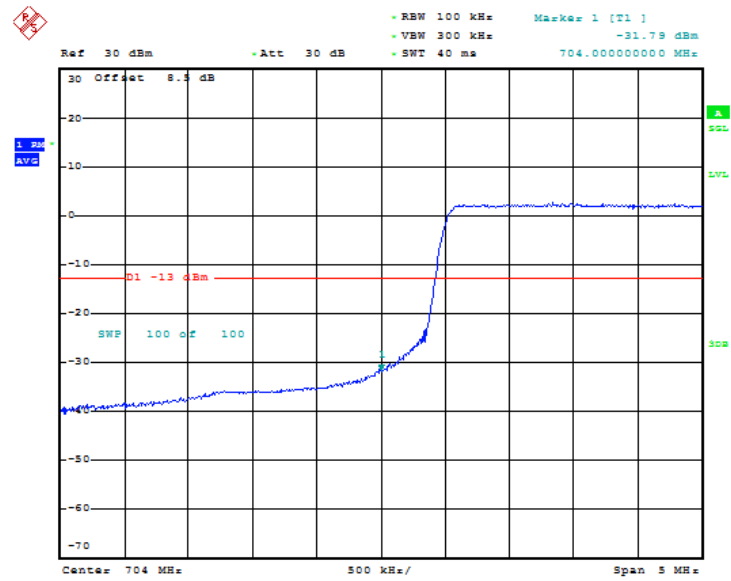
Date: 24.AUG.2019 11:49:10

Fig.137 LOW BAND EDGE BLOCK-1RB-low\_offset



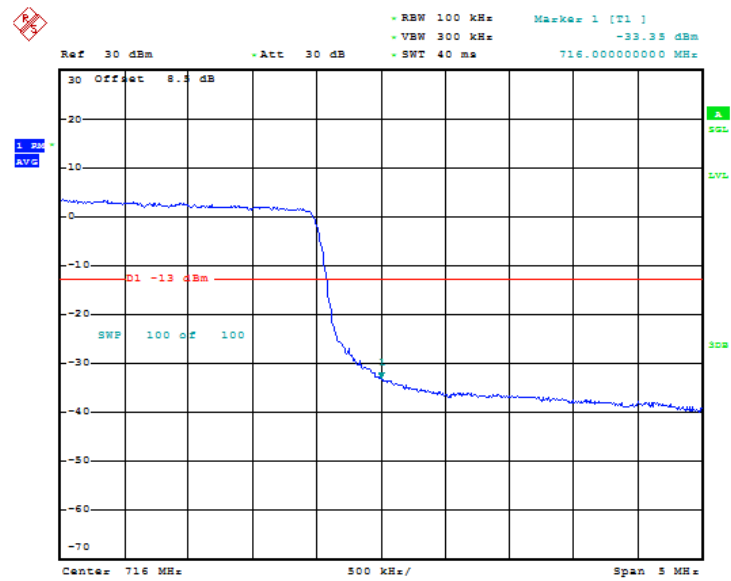
Date: 24.AUG.2019 11:49:44

Fig.138 HIGH BAND EDGE BLOCK-1RB-high\_offset



Date: 16.AUG.2019 07:11:12

Fig.139 LOW BAND EDGE BLOCK-10MHz-100%RB



Date: 16.AUG.2019 07:11:47

Fig.140 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.

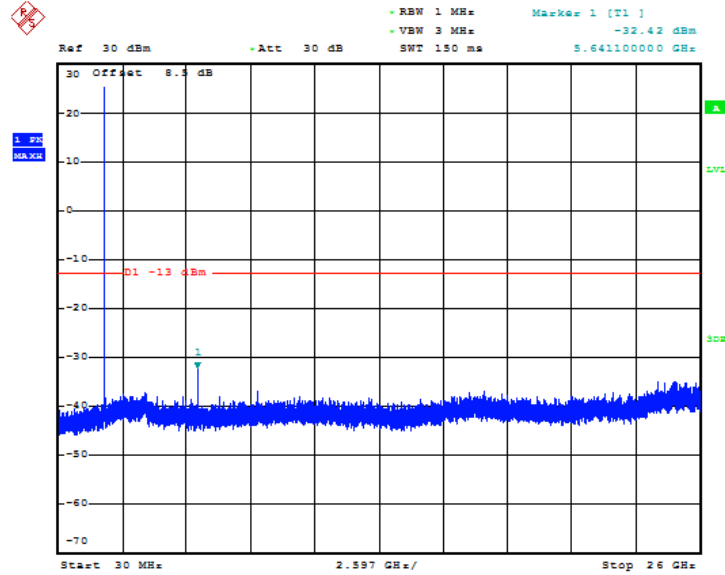
The specification that emissions shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -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 that  $43 + 10 \log (P)$  dB on all frequencies between 2490.5 MHz and 2496 MHz and  $55 + 10 \log (P)$  dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

**A. 7.3 Measurement result**

Only worst case result is given below

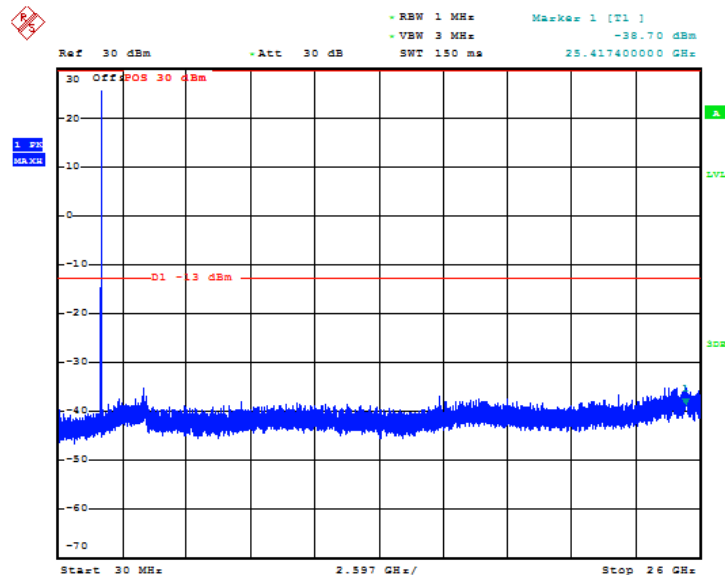
**LTE band 2: Spurious emission limit -13dBm.**



Date: 16.AUG.2019 07:16:39

Fig.141 LTE band 2: 30MHz – 26GHz

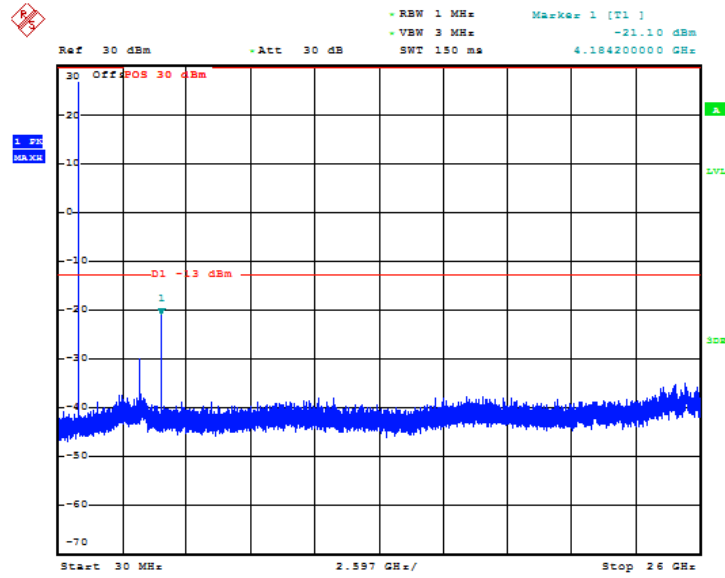
**LTE band 4: Spurious emission limit -13dBm.**



Date: 16.AUG.2019 07:17:52

Fig.142 LTE band 4: 30MHz – 26GHz

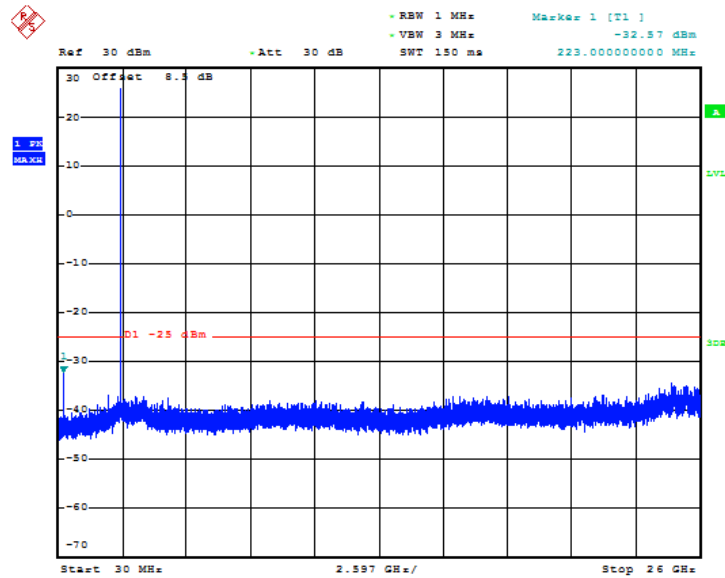
**LTE band 5: Spurious emission limit -13dBm.**



Date: 16.AUG.2019 07:28:11

Fig.143 LTE band 5: 30MHz – 26GHz

**LTE band 7: Spurious emission limit -25dBm.**

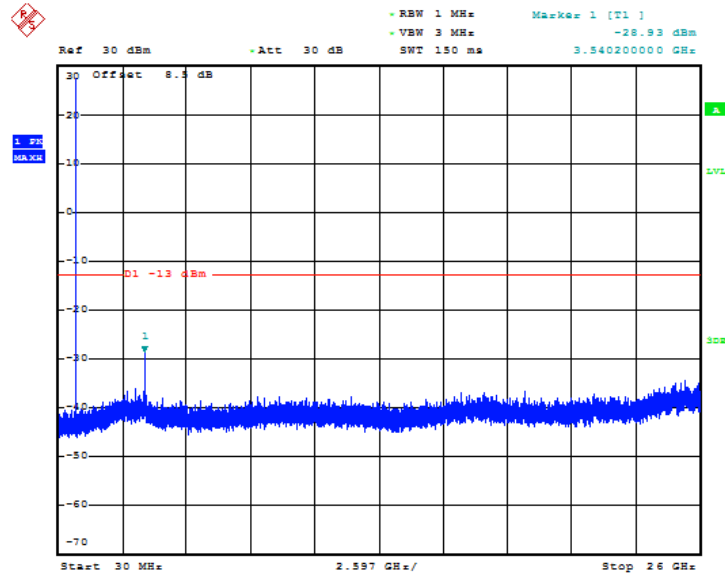


Date: 16.AUG.2019 07:24:53

Fig.144 LTE band 7: 30MHz – 26GHz



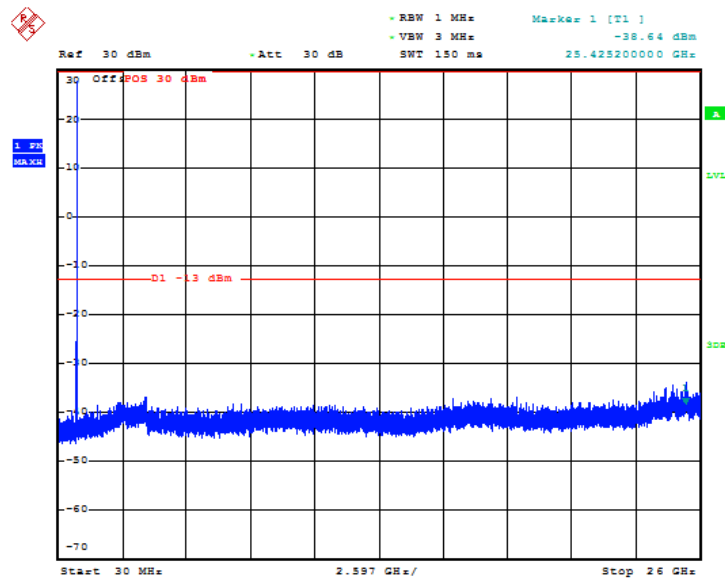
**LTE band 12: Spurious emission limit -13dBm.**



Date: 16.AUG.2019 07:26:14

Fig.145 LTE band 12: 30MHz – 26GHz

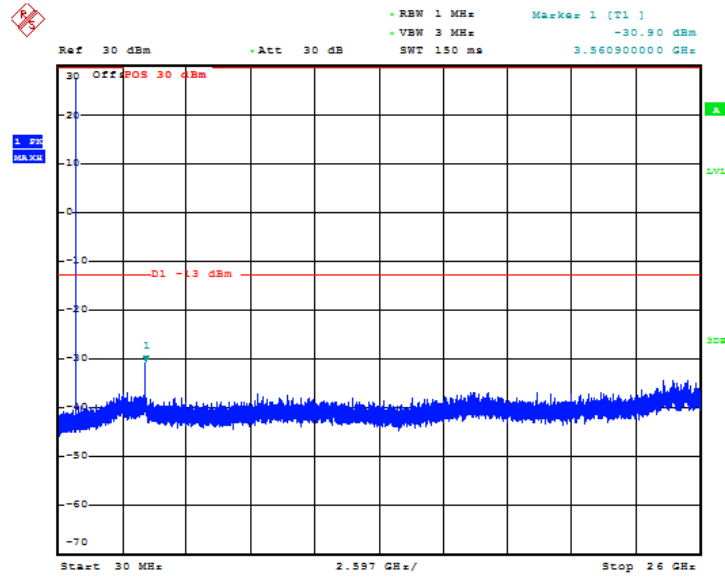
**LTE band 13: Spurious emission limit -13dBm.**



Date: 16.AUG.2019 07:27:35

Fig.146 LTE band 13: 30MHz – 26GHz

LTE band 17: Spurious emission limit -13dBm.



Date: 16.AUG.2019 07:28:14

Fig.147 LTE band 17: 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)	
	1880.0	QPSK
5.00		6.38

#### LTE band 4, 20MHz

Frequency(MHz)	PAPR(dB)	
	1732.5	QPSK
4.94		6.35

#### LTE band 5, 20MHz

Frequency(MHz)	PAPR(dB)	
	836.5	QPSK
4.68		5.54

#### LTE band 7, 20MHz

Frequency(MHz)	PAPR(dB)	
	2535.0	QPSK
5.00		6.47

**LTE band 12, 20MHz**

Frequency(MHz)	PAPR(dB)	
836.5	QPSK	16QAM
	5.35	6.09

**LTE band 13, 20MHz**

Frequency(MHz)	PAPR(dB)	
836.5	QPSK	16QAM
	5.26	6.06

**LTE band 17,10MHz**

Frequency(MHz)	PAPR(dB)	
710.0	QPSK	16QAM
	5.45	6.25

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

No deviation from Prescribed Test Methods.

## ANNEX C. Detailed Test Results

### ANNEX C.1. Main Terms

Verdict	Verdict of each test cases.
Test cases	Test cases identification number and description in ETSI EN 300 328 test specification and ETSI specification.

### ANNEX C.2. Terms used in Condition column

Tnom	Normal temperature
Tmin	Low temperature
Tmax	High temperature
Vnom	Normal voltage

### ANNEX C.3. Terms used in Verdict column

P	Pass,the EUT complies with the essential requirements in the standard.
NM	Not measure, the test was not measured by ECIT.
NA	Not applicable, the test was not applicable.
F	Fail, the EUT does not comply with the essential requirements in the standard.

### ANNEX C.4. Terms used in Note column

EUT ID	EUT ID (e.g N01, N02.....) is used to identify the EUT tested used for each test cases as specified in section 3 of this test report.
Lab Code	Lab code is used to identify the subcontracted lab if this test cases is performed in the subcontracted lab.

Subcontracted test lab code: N/A

**ANNEX D. 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 17025:2017  
*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 April 2017).  

 Presented this 6<sup>th</sup> day of May 2019.  
  
 Vice President, Accreditation Services  
 For the Accreditation Council  
 Certificate Number 3682.01  
 Valid to February 28, 2021  
 For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

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