



*Full*

# TEST REPORT

**No. I17D00058-LTE**

*For*

**Client : Lenovo (Shanghai) Electronics**

**Production : Portable Tablet Computer**

**Model Name : TB-X704V**

**FCC ID: O57TBX704V**

**IC ID 10407A-TBX704V**

**Brand Lenovo**

**Hardware Version: Lenovo Tablet TB-X704V**

**Software Version: TB-X704V\_RF01\_20170301**

**Issued date: 2017-06-22**

**Note:**

The test results in this test report relate only to the devices specified in this report. This report shall not be reproduced except in full without the written approval of ECIT Shanghai.

**Test Laboratory:**

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**Revision Version**

<b>Report Number</b>	<b>Revision</b>	<b>Date</b>	<b>Memo</b>
I17D00058-LTE	00	2017-06-15	Initial creation of test report
I17D00058-LTE	01	2017-06-22	Second creation of test report

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## 1. Test Laboratory

### 1.1. Testing Location

Company Name:	ECIT Shanghai, East China Institute of Telecommunications
Address:	7-8F, G Area, No. 668, Beijing East Road, Huangpu District, Shanghai, P. R. China
Postal Code:	200001
Telephone:	(+86)-021-63843300
Fax:	(+86)-021-63843301
FCC Registration NO.:	489729
IC OAT S Test Site Registration Number	10766A-1

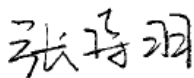
### 1.2. Testing Environment

Normal Temperature:	15-35°C
Extreme Temperature:	0/+45°C
Relative Humidity:	25-75%

### 1.3. Project data

Project Leader:	Chen Minfei
Testing Start Date:	2017-03-17
Testing End Date:	2017-06-07

### 1.4. Signature



\_\_\_\_\_  
**Zhang Shiyu**  
 (Prepared this test report)



\_\_\_\_\_  
**Ding Li**  
 (Reviewed this test report)



\_\_\_\_\_  
**Zheng Zhongbin**  
 Director of the laboratory  
 (Approved this test report)

## 2. Client Information

### 2.1. Applicant Information

Company Name: Lenovo (Shanghai) Electronics Technology Co., Ltd  
Address: NO.68 BUILDING, 199 FENJU RD, Pilot Free Trade Zone, Shanghai,  
200131, China  
Email: zhoucb1@lenovo.com  
Tel: 13776306969

### 2.2. Manufacturer Information

Company Name: Lenovo PC HK Limited  
Address: 23/F, Lincoln House, Taikoo Place 979 King's Road, Quarry Bay,  
Hong Kong  
Email: zhoucb1@lenovo.com  
Tel: 13776306969

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

#### 3.1. About EUT

EUT Description	Portable Tablet Computer
Model name	TB-X704V
FCC ID	O57TBX704V
IC ID	10407A-TBX704V
Frequency	LTE FDD2/4/5/7/12/13
Extreme Temperature	0/+45°C
Nominal Voltage	4V
Extreme High Voltage	4.35V
Extreme Low Voltage	3.6V

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

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

EUT ID*	SN or IMEI	HW Version	SW Version	Date of receipt
N08	863923030005374	Lenovo Tablet TB-X704V	TB-X704V_RF01_2017 0301	2017-03-15

\*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	---
AE2	Dummy Battery	---

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

#### 3.4. Statements

The product name TB-X704V, supporting LTE, manufactured by Lenovo PC HK Limited. is a new product for testing.

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

## 4. Reference Documents

### 4.1. Reference Documents for testing

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

Reference	Title	Version
FCC Part 22	PUBLIC MOBILE SERVICES	2014
FCC Part 24	PERSONAL COMMUNICATIONS SERVICES	2014
FCC Part 27	MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES	2014
ANSI/TIA-603-D	Land Mobile FM or PM Communications Equipment Measurement and Performance Standards	2010
ANSI C63.4	Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz	2014
KDB 971168 D01	Measurement Guidance for Certification of Licensed Digital Transmitters	v02r02
RSS-Gen	RSS-Gen —General Requirements for Compliance of Radio Apparatus	Issue 4
RSS-130	Mobile Broadband Services (MBS) Equipment Operating in the Frequency Bands 698-756 MHz and 777-787 MHz	Issue 1
RSS-132	Cellular Telephones Employing New Technologies Operating in the Bands 824-849 MHz and 869-894 MHz	Issue 3
RSS-133	2 GHz Personal Communications Services	Issue 6
RSS-139	Advanced Wireless Services Equipment Operating in the Bands 1710-1755 MHz and 2110-2155 MHz	Issue 3
RSS-199	Broadband Radio Service (BRS) Equipment Operating in the Band 2500-2690 MHz	Issue 2



## 5. SUMMARY OF TEST RESULTS

### LTE Band 2

Items	Test Name	Clause in FCC rules	Clause in IC rules RSS-Gen and RSS-133	Section in this report	Verdict
1	Output Power	24.232(c)	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), 22.913(a)	5.4	A.1	P
2	Emission Limit	22.917, 2.1051	5.5	A.2	P
3	Frequency Stability	22.235,	5.3	A.3	P

		2.1055			
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	6.13/5.5	A.7	P
			5.4		

### 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)	4.4	A.1	P
2	Emission Limit	27.53(m), 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)	4.2	A.4	P
5	Emission Bandwidth	27.53(m)	4.2	A.5	P
6	Band Edge Compliance	27.53(m)	4.6	A.6	P
7	Conducted Spurious Emission	27.53(m), 2.1057	4.6	A.7	P
8	Peak to Average Power Ratio	27.50(a)	4.4	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	Section in this report	Verdict
1	Output Power	27.50(b)(10)	A.1	P
2	Emission Limit	27.53(c),	A.2	P

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

**Receiver Radiated Emission**

Items	Test Name	Clause in IC rules		Section in this report	Verdict
		RSS-132	RSS-133		
9	Receiver Radiated Emissions	5.6	6.6	A.9	P

## 6. Test Equipment Utilized

### Climate chamber

No.	Equipment	Model	Serial Number	Manufacturer	Calibration date	Cal.interval
1	Climate chamber	SH-641	92012011	ESPEC	2016-01-07	2 Year

### Radiated emission test system

The test equipment and ancillaries used are as follows.

No.	Equipment	Model	Serial Number	Manufacturer	Calibration date	Cal.interval
1	Universal Radio Communication Tester	CMW500	104178	R&S	2017-05-11	1 Year
2	Test Receiver	ESU40	100307	R&S	2017-05-11	1 Year
3	Trilog Antenna	VULB9163	VULB9163-515	Schwarzbeck	2014-11-05	3 Year
4	Double Ridged Guide Antenna	ETS-3117	135890	ETS	2017-01-11	3 Year
5	2-Line V-Network	ENV216	101380	R&S	2017-05-11	1 Year
6	Substitution Antenna	ETS-3117	00135890	ETS	2017-01-11	3 Year
7	RF Signal Generator	SMF100A	102314	R&S	2017-05-11	1 Year
8	Substitution Antenna	VUBA9117	9117-266	Schwarzbeck	2014-08-19	3 Year
9	Amplifier	SCU03	10009	R&S	2017-01-05	1 Year

10	Amplifier	NTWPA -008610 F	12023024	Rflight	2017-01-05	1 Year
11	Attenuators	BW-N3 W5+	/	MCL	2017-01-05	1 Year

**Conducted test system**

No.	Name	Type	SN	Manufacture	Calibration date	Cal.interval
1	Vector Signal Analyser	FSQ26	101096	Rohde&Schwarz	2017-05-11	1 Year
2	Wireless communication comprehensive tester	CMW500	115828	Rohde&Schwarz	2016-11-17	1 Year
3	DC Power Supply	ZUP60-1 4	LOC-220Z 006 -0007	TDL-Lambda	2017-05-11	1 Year

**Software**

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

## 7. Test Environment

**Shielding Room** (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. = 25 %, Max. = 75 %
Shielding effectiveness	> 110 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	> 110 dB
Electrical insulation	> 10 kΩ
Ground system resistance	< 0.5 Ω

**Fully-anechoic chamber** (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

## ANNEX A. MEASUREMENT RESULTS

### ANNEX A.1. OUTPUT POWER

#### A.1.1. Summary

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

#### A.1.2. Conducted

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

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

##### A.1.2.2 Measurement result

###### LTE band 2

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
1.4MHz	1 RB high	1850.7	23.87	23.17
		1880.0	23.83	22.73
		1909.3	23.55	22.78
	1 RB low	1850.7	23.74	23.19
		1880.0	23.81	22.86
		1909.3	23.59	23.3
	50% RB mid	1850.7	23.73	23.79
		1880.0	23.56	23.45
		1909.3	23.87	23.82
	100% RB	1850.7	22.69	21.74
		1880.0	22.67	21.71
		1909.3	22.76	21.78
3MHz	1 RB high	1851.5	23.82	23.34
		1880.0	23.94	22.96
		1908.5	23.67	22.97
	1 RB low	1851.5	23.68	23.4
		1880.0	23.51	22.79
		1908.5	23.56	23.41
	50% RB mid	1851.5	22.77	22.03
		1880.0	22.56	21.72
		1908.5	22.74	21.94

	100% RB	1851.5	22.75	21.63
		1880.0	22.69	21.82
		1908.5	22.74	22.03
5MHz	1 RB high	1852.5	23.44	23.18
		1880.0	23.69	22.77
		1907.5	23.64	23.13
	1 RB low	1852.5	23.61	22.98
		1880.0	23.5	22.05
		1907.5	23.72	23.01
	50% RB mid	1852.5	22.98	22.7
		1880.0	22.69	21.57
		1907.5	22.77	22.77
	100% RB	1852.5	22.75	21.6
		1880.0	22.58	21.57
		1907.5	22.77	21.74
10MHz	1 RB high	1855.0	23.86	23.12
		1880.0	23.47	22.96
		1905.0	23.76	23.49
	1 RB low	1855.0	23.74	23.39
		1880.0	23.62	23.05
		1905.0	23.72	23.1
	50% RB mid	1855.0	22.8	22.8
		1880.0	22.73	22.64
		1905.0	22.79	22.79
	100% RB	1855.0	22.78	21.69
		1880.0	22.71	21.54
		1905.0	22.78	21.86
15MHz	1 RB high	1857.5	23.76	23.13
		1880.0	23.5	22.72
		1902.5	23.66	23.17
	1 RB low	1857.5	23.57	23.21
		1880.0	23.61	22.98
		1902.5	23.9	23.4
	50% RB mid	1857.5	22.77	22.78
		1880.0	22.67	22.65
		1902.5	22.77	22.68
	100% RB	1857.5	22.76	21.8
		1880.0	22.62	21.66
		1902.5	22.88	21.84



20MHz	1 RB high	1860.0	23.61	22.72
		1880.0	23.58	22.97
		1900.0	23.9	22.83
	1 RB low	1860.0	24.02	22.76
		1880.0	23.45	23.17
		1900.0	23.82	22.79
	50% RB mid	1860.0	22.72	22.73
		1880.0	22.7	22.7
		1900.0	22.79	22.79
	100% RB	1860.0	22.8	21.73
		1880.0	22.72	21.74
		1900.0	22.76	21.82

**LTE band 4**

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
1.4MHz	1 RB high	1754.3	24.22	23.88
		1732.5	24.66	23.66
		1710.7	23.71	23.64
	1 RB low	1754.3	24.17	23.79
		1732.5	24.58	23.74
		1710.7	23.73	23.62
	50% RB mid	1754.3	24.43	24.46
		1732.5	24.27	24.37
		1710.7	24.07	24.05
	100% RB	1754.3	23.51	22.52
		1732.5	23.54	22.37
		1710.7	23.03	21.69
3MHz	1 RB high	1753.5	24.41	24.2
		1732.5	24.24	23.75
		1711.5	23.9	23.55
	1 RB low	1753.5	24.25	24.05
		1732.5	24.33	23.72
		1711.5	23.92	23.51
	50% RB mid	1753.5	23.49	22.79
		1732.5	23.53	22.55
		1711.5	23.05	21.82
	100% RB	1753.5	23.4	22.4
		1732.5	23.56	22.57

		1711.5	23.02	21.91
5MHz	1 RB high	1752.5	24.4	23.95
		1732.5	24.42	22.77
		1712.5	23.62	23.16
	1 RB low	1752.5	24.55	23.85
		1732.5	24.33	22.78
		1712.5	23.76	23.3
	50% RB mid	1752.5	23.71	23.63
		1732.5	23.56	23.5
		1712.5	22.96	22.95
	100% RB	1752.5	23.55	22.6
		1732.5	23.49	22.8
		1712.5	22.96	21.9
10MHz	1 RB high	1750	24.46	24.36
		1732.5	24.18	23.7
		1715	23.83	23.45
	1 RB low	1750	24.36	24.15
		1732.5	24.47	23.74
		1715	23.95	23.31
	50% RB mid	1750	23.53	23.53
		1732.5	23.5	23.55
		1715	22.99	22.98
	100% RB	1750	23.59	22.62
		1732.5	23.56	22.72
		1715	22.97	21.88
15MHz	1 RB high	1747.5	24.32	24.05
		1732.5	24.34	23.82
		1717.5	24.07	23.7
	1 RB low	1747.5	24.5	24.21
		1732.5	24.13	23.57
		1717.5	23.87	23.5
	50% RB mid	1747.5	23.61	23.6
		1732.5	23.51	23.52
		1717.5	23.02	23.06
	100% RB	1747.5	23.65	22.78
		1732.5	23.47	22.64
		1717.5	23.08	21.93
20MHz	1 RB high	1745	24.58	23.72
		1732.5	24.5	24.14

	1 RB low	1720	24.43	23.49	
		1745	24.64	23.63	
		1732.5	24.08	23.53	
	50% RB mid	1720	23.86	23.17	
		1745	23.51	23.6	
		1732.5	23.52	23.52	
	100% RB	1720	23.31	23.38	
		1745	23.62	22.62	
		1732.5	23.53	22.71	
			1720	23.16	22.18

**LTE band 5**

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
1.4MHz	1 RB high	848.3	23.21	22.39
		836.5	24.09	23
		824.7	23.39	22.2
	1 RB low	848.3	23.3	22.38
		836.5	24.23	23.2
		824.7	23.47	21.98
	50% RB mid	848.3	23.17	23.36
		836.5	23.76	23.87
		824.7	23.37	23.36
	100% RB	848.3	22.27	21.36
		836.5	23	22.08
		824.7	22.54	21.54
3MHz	1 RB high	847.5	23.23	23.04
		836.5	23.89	23.3
		825.5	23.66	23.27
	1 RB low	847.5	23.32	22.85
		836.5	24.11	23.29
		825.5	23.48	22.99
	50% RB mid	847.5	22.25	21.16
		836.5	23.16	21.94
		825.5	22.61	21.91
	100% RB	847.5	22.31	21.28
		836.5	23.07	21.98
		825.5	22.5	21.4

5MHz	1 RB high	846.5	23	22.54
		836.5	23.83	22.38
		826.5	23.58	23
	1 RB low	846.5	23.56	22.8
		836.5	23.92	22.68
		826.5	23.35	22.56
	50% RB mid	846.5	22.3	22.29
		836.5	22.93	22.97
		826.5	22.77	22.76
	100% RB	846.5	22.33	21.39
		836.5	22.99	22.12
		826.5	22.56	21.5
10MHz	1 RB high	844.0	23.37	22.87
		836.5	23.68	23.1
		829.0	24.22	23.51
	1 RB low	844.0	23.84	23.27
		836.5	24.25	23.46
		829.0	23.39	23.03
	50% RB mid	844.0	22.35	22.35
		836.5	22.98	22.99
		829.0	23.09	23.08
	100% RB	844.0	22.59	21.55
		836.5	23.1	22.17
		829.0	22.86	21.82

**LTE band 7**

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
5MHz	1 RB high	2502.5	24.52	24.02
		2535	24.53	23.16
		2567.5	24.86	24.36
	1 RB low	2502.5	24.54	24.15
		2535	24.65	23.36
		2567.5	24.97	24.97
	50% RB mid	2502.5	23.76	23.66
		2535	23.77	23.76
		2567.5	24.04	24.04
	100% RB	2502.5	23.65	22.7
		2535	23.74	23.09
		2567.5	24	23.06

10MHz	1 RB high	2505	24.81	23.91
		2535	24.68	23.95
		2565	24.88	24.59
	1 RB low	2505	24.83	23.58
		2535	25.02	24.1
		2565	24.92	24.54
	50% RB mid	2505	23.91	23.94
		2535	23.81	23.81
		2565	24.11	24.12
	100% RB	2505	23.89	22.8
		2535	23.87	22.88
		2565	24.1	23.09
15MHz	1 RB high	2507.5	24.9	24.46
		2535	24.6	24.04
		2562.5	24.92	24.4
	1 RB low	2507.5	24.53	24.01
		2535	24.78	24.13
		2562.5	24.84	24.23
	50% RB mid	2507.5	23.97	23.96
		2535	23.77	23.77
		2562.5	23.94	23.93
	100% RB	2507.5	23.84	22.84
		2535	23.75	22.76
		2562.5	23.89	22.97
20MHz	1 RB high	2510	25.15	23.99
		2535	24.39	23.76
		2560	25.04	24.17
	1 RB low	2510	24.11	23.59
		2535	25.03	24.33
		2560	24.27	23.71
	50% RB mid	2510	23.9	23.89
		2535	23.84	23.83
		2560	24.04	24.01
	100% RB	2510	23.93	22.97
		2535	23.81	22.86
		2560	23.89	22.91

**LTE band 12**

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
1.4MHz	1 RB high	699.7	24.35	23.23
		707.5	24.6	23.71
		715.3	24.17	23.02
	1 RB low	699.7	24.39	23.21
		707.5	24.45	23.61
		715.3	24.11	22.88
	50% RB mid	699.7	24.03	24.02
		707.5	24.61	24.6
		715.3	24.24	24.04
	100% RB	699.7	23.09	22.16
		707.5	23.51	22.48
		715.3	23.08	22.02
3MHz	1 RB high	700.5	24.07	23.68
		707.5	24.25	23.43
		714.5	24.07	23.58
	1 RB low	700.5	24.03	23.24
		707.5	24.34	23.62
		714.5	24.21	23.86
	50% RB mid	700.5	23.15	22.44
		707.5	23.43	22.48
		714.5	23.19	22.39
	100% RB	700.5	23.19	22.06
		707.5	23.67	22.41
		714.5	23.18	22.35
5MHz	1 RB high	701.5	24.14	23.55
		707.5	24.35	22.74
		713.5	24.09	23.47
	1 RB low	701.5	23.9	23.42
		707.5	24.36	22.97
		713.5	24.11	23.62
	50% RB mid	701.5	23.24	23.23
		707.5	23.48	23.48
		713.5	23.09	23.05
	100% RB	701.5	23.14	22.13
		707.5	23.47	22.63
		713.5	23.23	22.26
10MHz	1 RB high	704.0	24.65	24.13
		707.5	23.97	23.42

		711.0	23.98	23.16
	1 RB low	704.0	24.07	23.22
		707.5	24.4	23.44
		711.0	24.48	23.96
	50% RB mid	704.0	23.41	23.41
		707.5	23.43	23.37
		711.0	23.32	23.31
	100% RB	704.0	23.31	22.3
		707.5	23.53	22.39
		711.0	23.56	22.55

## LTE band 13

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
5MHz	1 RB high	779.5	23.51	22.84
		782	23.47	21.72
		784.5	23.2	22.74
	1 RB low	779.5	23.45	23.08
		782	23.42	21.61
		784.5	23,71	22.69
	50% RB mid	779.5	22.48	22.42
		782	22.47	22.47
		784.5	22.39	22.39
	100% RB	779.5	22.43	21.38
		782	22.5	21.42
		784.5	22.43	21.36
10MHz	1 RB high	782	23.38	22.77
	1 RB low	782	23.47	22.58
	50% RB mid	782	22.54	22.47
	100% RB	782	22.51	21.44

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



**A.1.3 Radiated**

**A.1.3.1 Description**

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

Rule Part 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".

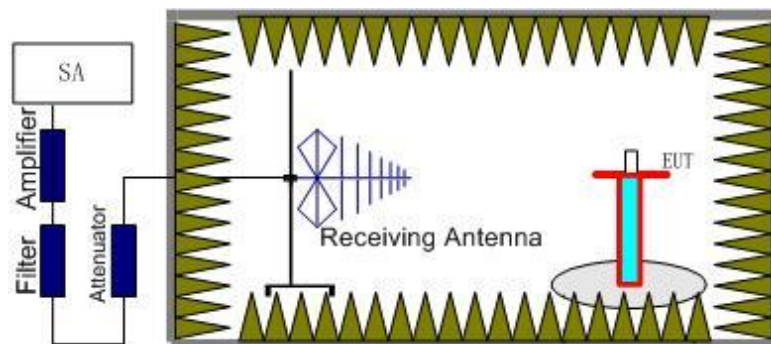
Rule Part 27.50(h)(2) specifies "Mobile stations are limited to 2.0 watts EIRP".

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

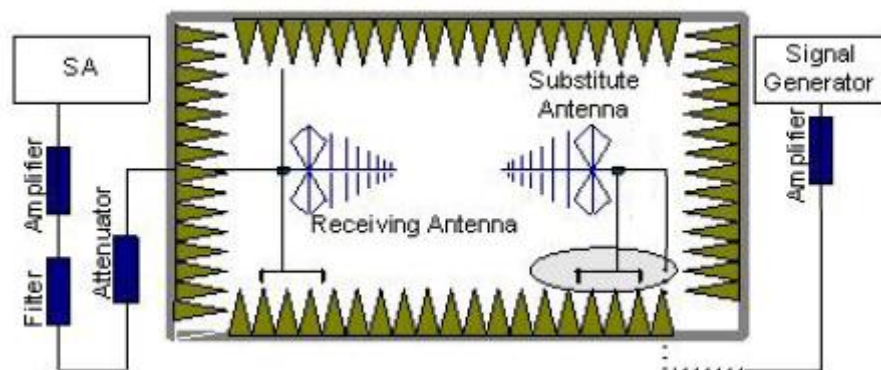
**A.1.3.2 Method of Measurement**

The measurements procedures in TIA-603D-2010 are used.

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



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



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

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

The measurement results are obtained as described below:

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

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

### 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)	$P_{Mea}$ (dBm)	$P_{cl}$ (dB)	$P_{Ag}$ (dB)	$G_a$ Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
1850.70	-7.51	4.6	36	4.7	28.59	33	4.41	H
1880.00	-7.72	4.6	35.6	4.7	27.98	33	5.02	H
1909.30	-8.65	4.7	35.9	4.5	27.05	33	5.95	H

#### LTE Band 2\_3MHz\_QPSK

Frequency(MHz)	$P_{Mea}$ (dBm)	$P_{cl}$ (dB)	$P_{Ag}$ (dB)	$G_a$ Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
1851.50	-11.15	4.6	36	4.7	24.95	33	8.05	H
1880.00	-11.2	4.6	35.6	4.7	24.5	33	8.5	H
1908.50	-11.36	4.7	35.9	4.5	24.34	33	8.66	H

#### LTE Band 2\_5MHz\_QPSK

Frequency(MHz)	$P_{Mea}$ (dBm)	$P_{cl}$ (dB)	$P_{Ag}$ (dB)	$G_a$ Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
1852.50	-8.32	4.6	36	4.7	27.78	33	5.22	H
1880.00	-8.99	4.6	35.6	4.7	26.71	33	6.29	H
1907.50	-8.76	4.7	35.9	4.5	26.94	33	6.06	H

#### LTE Band 2\_10MHz\_QPSK

Frequency(MHz)	$P_{Mea}$ (dBm)	$P_{cl}$ (dB)	$P_{Ag}$ (dB)	$G_a$ Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
1855.00	-7.59	4.6	36	4.7	28.51	33	4.49	H
1880.00	-7.86	4.6	35.6	4.7	27.84	33	5.16	H
1905.00	-7.42	4.7	35.9	4.5	28.28	33	4.72	H

#### LTE Band 2\_15MHz\_QPSK

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
1857.50	-9.14	4.6	36	4.7	26.96	33	6.04	H
1880.00	-8.86	4.6	35.6	4.7	26.84	33	6.16	H
1902.50	-8.3	4.7	35.9	4.5	27.4	33	5.6	H

### LTE Band 2\_20 MHz\_QPSK

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
1860.00	-7.67	4.6	36	4.7	28.43	33	4.57	H
1880.00	-7.28	4.6	35.6	4.7	28.42	33	4.58	H
1900.00	-8.23	4.7	35.9	4.5	27.47	33	5.53	H

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
1850.70	-7.14	4.6	36	4.7	28.96	33	4.04	H
1880.00	-7.52	4.6	35.6	4.7	28.18	33	4.82	H
1909.30	-8.21	4.7	35.9	4.5	27.49	33	5.51	H

### LTE Band 2\_3MHz\_16QAM

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
1851.50	-7.74	4.6	36	4.7	28.36	33	4.64	H
1880.00	-8.3	4.6	35.6	4.7	27.4	33	5.6	H
1908.50	-7.51	4.7	35.9	4.5	28.19	33	4.81	H

### LTE Band 2\_5MHz\_16QAM

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
1852.50	-7.09	4.6	36	4.7	29.01	33	3.99	H
1880.00	-7.96	4.6	35.6	4.7	27.74	33	5.26	H
1907.50	-8.25	4.7	35.9	4.5	27.45	33	5.55	H

### LTE Band 2\_10MHz\_16QAM

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
1855.00	-6.68	4.6	36	4.7	29.42	33	3.58	H
1880.00	-7.54	4.6	35.6	4.7	28.16	33	4.84	H
1905.00	-7.25	4.7	35.9	4.5	28.45	33	4.55	H

### LTE Band 2\_15MHz\_16QAM

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
1857.50	-8.31	4.6	36	4.7	27.79	33	5.21	H
1880.00	-9.01	4.6	35.6	4.7	26.69	33	6.31	H
1902.50	-8.51	4.7	35.9	4.5	27.19	33	5.81	H

### LTE Band 2\_20 MHz\_16QAM

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
1860.00	-7.6	4.6	36	4.7	28.5	33	4.5	H
1880.00	-6.97	4.6	35.6	4.7	28.73	33	4.27	H
1900.00	-8.33	4.7	35.9	4.5	27.37	33	5.63	H

Peak EIRP(dBm) = P<sub>Mea</sub>(-7.6dBm) + G<sub>a</sub> (4.7dBi) + P<sub>Ag</sub> (36dB) - P<sub>cl</sub> (4.6dB) = 28.5dBm

## LTE Band 4- EIRP 27.50(d)

Limits: ≤30dBm (1W)

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
1710.70	-11.76	4.4	36.2	4.7	24.74	30	5.26	H
1732.50	-11.23	4.4	36.1	4.7	25.17	30	4.83	H
1754.30	-10.86	4.5	36.4	4.7	25.74	30	4.26	H

### LTE Band 4\_3MHz\_QPSK

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
1711.50	-10.99	4.4	36.2	4.7	25.51	30	4.49	H
1732.50	-11.34	4.4	36.1	4.7	25.06	30	4.94	H
1753.50	-12.61	4.5	36.4	4.7	23.99	30	6.01	H

### LTE Band 4\_5MHz\_QPSK

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
1712.50	-10.45	4.4	36.2	4.7	26.05	30	3.95	H
1732.50	-11.34	4.4	36.1	4.7	25.06	30	4.94	H
1752.50	-12.42	4.5	36.4	4.7	24.18	30	5.82	H

### LTE Band 4\_10MHz\_QPSK

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
1715.00	-10.84	4.4	36.2	4.7	25.66	30	4.34	H
1732.50	-11.07	4.4	36.1	4.7	25.33	30	4.67	H
1750.50	-12.93	4.5	36.4	4.7	23.67	30	6.33	H

### LTE Band 4\_15MHz\_QPSK

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
1717.50	-12.19	4.4	36.2	4.7	24.31	30	5.69	H
1732.50	-11.9	4.4	36.1	4.7	24.5	30	5.5	H
1747.50	-13.41	4.5	36.4	4.7	23.19	30	6.81	H

### LTE Band 4\_20MHz\_QPSK

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
1720.00	-12.75	4.4	36.2	4.7	23.75	30	6.25	H
1732.50	-13.13	4.4	36.1	4.7	23.27	30	6.73	H
1745.00	-13.01	4.5	36.4	4.7	23.59	30	6.41	H

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
1710.70	-11.6	4.4	36.2	4.7	24.9	30	5.1	H
1732.50	-11.28	4.4	36.1	4.7	25.12	30	4.88	H
1754.30	-10.78	4.5	36.4	4.7	25.82	30	4.18	H

### LTE Band 4\_3MHz\_16QAM

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
1711.50	-10.5	4.4	36.2	4.7	26	30	4	H
1732.50	-12.03	4.4	36.1	4.7	24.37	30	5.63	H
1753.50	-12.68	4.5	36.4	4.7	23.92	30	6.08	H

### LTE Band 4\_5MHz\_16QAM

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
1712.50	-10.74	4.4	36.2	4.7	25.76	30	4.24	H
1732.50	-11.51	4.4	36.1	4.7	24.89	30	5.11	H
1752.50	-12.85	4.5	36.4	4.7	23.75	30	6.25	H

### LTE Band 4\_10MHz\_16QAM

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
1715.00	-10.56	4.4	36.2	4.7	25.94	30	4.06	H
1732.50	-11.27	4.4	36.1	4.7	25.13	30	4.87	H
1750.50	-12.53	4.5	36.4	4.7	24.07	30	5.93	H

### LTE Band 4\_15MHz\_16QAM

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
1717.50	-11.59	4.4	36.2	4.7	24.91	30	5.09	H
1732.50	-12.28	4.4	36.1	4.7	24.12	30	5.88	H
1747.50	-13.41	4.5	36.4	4.7	23.19	30	6.81	H

### LTE Band 4\_20MHz\_16QAM

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
1720.00	-12.84	4.4	36.2	4.7	23.66	30	6.34	H
1732.50	-13.23	4.4	36.1	4.7	23.17	30	6.83	H
1745.00	-13.02	4.5	36.4	4.7	23.58	30	6.42	H

$$\text{Peak EIRP(dBm)} = P_{\text{Mea}}(-12.84\text{dBm}) + G_a(4.7\text{dBi}) + P_{\text{Ag}}(36.2\text{dB}) - P_{\text{cl}}(4.4\text{dB}) = 23.66\text{dBm}$$

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

**Limits:** ≤38.45dBm (7W)

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>ci</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
824.70	-9.76	3.1	37	-2.87	21.27	38.45	17.18	H
836.50	-7.97	3.1	37	-3.11	22.82	38.45	15.63	H
848.30	-9.18	3.1	37	-3.11	21.61	38.45	16.84	H

#### LTE Band 5\_3MHz\_QPSK

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>ci</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
825.50	-9.76	3.1	37	-2.87	21.27	38.45	17.18	H
836.50	-8.29	3.1	37	-3.11	22.50	38.45	15.95	H
847.50	-9.43	3.1	37	-3.11	21.36	38.45	17.09	H

#### LTE Band 5\_5MHz\_QPSK

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>ci</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
826.50	-9.83	3.1	37	-2.87	21.20	38.45	17.25	H
836.50	-8.56	3.1	37	-3.11	22.23	38.45	16.22	H
846.50	-8.9	3.1	37	-3.11	21.89	38.45	16.56	H

#### LTE Band 5\_10MHz\_QPSK

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>ci</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
829.00	-7.51	3.1	37	-2.87	<b>23.52</b>	38.45	14.93	H
836.50	-5.82	3.1	37	-3.11	<b>24.97</b>	38.45	13.48	H
844.00	-5.06	3.1	37	-3.11	<b>25.73</b>	38.45	12.72	H

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
824.70	-9.92	3.1	37	-2.87	21.11	38.45	17.34	H
836.50	-8.06	3.1	37	-3.11	22.73	38.45	15.72	H
848.30	-9.52	3.1	37	-3.11	21.27	38.45	17.18	H

### LTE Band 5\_3MHz\_16QAM

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
825.50	-9.28	3.1	37	-2.87	21.75	38.45	16.7	H
836.50	-8.76	3.1	37	-3.11	22.03	38.45	16.42	H
847.50	-9.63	3.1	37	-3.11	21.16	38.45	17.29	H

### LTE Band 5\_5MHz\_16QAM

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
826.50	-9.94	3.1	37	-2.87	21.09	38.45	17.36	H
836.50	-9.05	3.1	37	-3.11	21.74	38.45	16.71	H
846.50	-9.64	3.1	37	-3.11	21.15	38.45	17.3	H

### LTE Band 5\_10MHz\_16QAM

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
829.00	-8.36	3.1	37	-2.87	22.67	38.45	15.78	H
836.50	-5.79	3.1	37	-3.11	25.00	38.45	13.45	H
844.00	-4.49	3.1	37	-3.11	26.30	38.45	12.15	H

Peak ERP(dBm)=P<sub>Mea</sub>(-8.36dBm)+G<sub>a</sub>(-2.87dBi)+P<sub>Ag</sub>(37dB)-P<sub>cl</sub>(3.1)dB =22.67 dBm

**LTE Band 7- EIRP 27.50(h)(2)**
**Limits:** ≤33 dBm (2W)

**LTE Band 7\_5MHz\_QPSK**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
2502.50	-8.2	5.4	34.7	5.6	26.7	33.00	6.3	H
2535.00	-8.15	5.4	35.1	5.8	27.35	33.00	5.65	H
2567.50	-7.87	5.4	34.8	6.1	27.63	33.00	5.37	H

**LTE Band 7\_10MHz\_QPSK**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
2505.00	-7.81	5.4	34.7	5.6	27.09	33.00	5.91	H
2535.00	-8.16	5.4	35.1	5.8	27.34	33.00	5.66	H
2565.00	-7.96	5.4	34.8	6.1	27.54	33.00	5.46	H

**LTE Band 7\_15MHz\_QPSK**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
2507.50	-8.16	5.4	34.7	5.6	26.74	33.00	6.26	H
2535.00	-8.1	5.4	35.1	5.8	27.4	33.00	5.6	H
2562.50	-7.78	5.4	34.8	6.1	27.72	33.00	5.28	H

**LTE Band 7\_20MHz\_QPSK**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
2510.00	-8.23	5.4	34.7	5.6	26.67	33.00	6.33	H
2535.00	-8.1	5.4	35.1	5.8	27.4	33.00	5.6	H
2560.00	-7.5	5.4	34.8	6.1	28	33.00	5	H



### LTE Band 7\_5MHz\_16QAM

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
2502.50	-8.9	5.4	34.7	5.6	26	33.00	7	H
2535.00	-9.17	5.4	35.1	5.8	26.33	33.00	6.67	H
2567.50	-8.86	5.4	34.8	6.1	26.64	33.00	6.36	H

### LTE Band 7\_10MHz\_16QAM

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
2505.00	-8.63	5.4	34.7	5.6	26.27	33.00	6.73	H
2535.00	-9.1	5.4	35.1	5.8	26.4	33.00	6.6	H
2565.00	-8.8	5.4	34.8	6.1	26.7	33.00	6.3	H

### LTE Band 7\_15MHz\_16QAM

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
2507.50	-8.74	5.4	34.7	5.6	26.16	33.00	6.84	H
2535.00	-8.96	5.4	35.1	5.8	26.54	33.00	6.46	H
2562.50	-8.7	5.4	34.8	6.1	26.8	33.00	6.2	H

### LTE Band 7\_20MHz\_16QAM

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	EIRP(dBm)	Limit(dBm)	Margin(dB)	Polarization
2510.00	-8.81	5.4	34.7	5.6	26.09	33.00	6.91	H
2535.00	-9.1	5.4	35.1	5.8	26.4	33.00	6.6	H
2560.00	-8.45	5.4	34.8	6.1	27.05	33.00	5.95	H

Peak EIRP(dBm) = P<sub>Mea</sub>(-8.81dBm) + G<sub>a</sub> (5.6dBi) + P<sub>Ag</sub> (34.7dB) - P<sub>cl</sub> (5.4dB) = 26.09dBm

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

Limits: ≤34.77dBm (3W)

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
699.70	-11.19	2.8	37	-3.26	19.75	34.77	15.02	H
707.50	-9.91	2.8	37	-3.26	21.03	34.77	13.74	H
715.30	-10.5	2.8	37.3	-3.26	20.74	34.77	14.03	H

#### LTE Band 12\_3MHz\_QPSK

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
700.50	-11.38	2.8	37	-3.26	19.56	34.77	15.21	H
707.50	-10.15	2.8	37	-3.26	20.79	34.77	13.98	H
714.50	-10.6	2.8	37.3	-3.26	20.64	34.77	14.13	H

#### LTE Band 12\_5MHz\_QPSK

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
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701.50	-11.25	2.8	37	-3.26	19.69	34.77	15.08	H
707.50	-10.58	2.8	37	-3.26	20.36	34.77	14.41	H
713.50	-11.08	2.8	37.3	-3.26	20.16	34.77	14.61	H

**LTE Band 12\_10MHz\_QPSK**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>ci</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
704.00	-9.33	2.8	37	-3.26	21.61	34.77	13.16	H
707.50	-8.44	2.8	37	-3.26	22.50	34.77	12.27	H
711.00	-8.35	2.8	37.3	-3.26	22.89	34.77	11.88	H

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
699.70	-11.33	2.8	37	-3.26	19.61	34.77	15.16	V
707.50	-10.67	2.8	37	-3.26	20.27	34.77	14.5	V
715.30	-10.01	2.8	37.3	-3.26	21.23	34.77	13.54	V

### LTE Band 12\_3MHz\_16QAM

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
700.50	-11.51	2.8	37	-3.26	19.43	34.77	15.34	V
707.50	-9.97	2.8	37	-3.26	20.97	34.77	13.8	V
714.50	-10.98	2.8	37.3	-3.26	20.26	34.77	14.51	V

### LTE Band 12\_5MHz\_16QAM

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
701.50	-11.85	2.8	37	-3.26	19.09	34.77	15.68	V
707.50	-10.94	2.8	37	-3.26	20.00	34.77	14.77	V
713.50	-10.8	2.8	37.3	-3.26	20.44	34.77	14.33	V

### LTE Band 12\_10MHz\_16QAM

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
704.00	-9.17	2.8	37	-3.26	21.77	34.77	13	V
707.50	-8.73	2.8	37	-3.26	22.21	34.77	12.56	V
711.00	-8.75	2.8	37.3	-3.26	22.49	34.77	12.28	V

Peak ERP(dBm)=P<sub>Mea</sub>(-9.17dBm)+G<sub>a</sub>(-3.26dBi)+P<sub>Ag</sub>(37dB)-P<sub>cl</sub>(2.8dB) = 13dBm

### LTE Band 13 - ERP 27.50(c)(10)

Limits: ≤34.77dBm (3W)

### LTE Band 13\_5MHz\_QPSK

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
779.50	-9.25	3.0	37.1	-2.87	21.98	34.77	12.79	V
782.00	-8.36	3.0	36.9	-2.87	22.67	34.77	12.1	V
784.50	-9.66	3.0	36.9	-2.87	21.37	34.77	13.4	V

### LTE Band 13\_10MHz\_QPSK

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
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782.00	-8.36	3.0	36.9	-2.87	22.67	34.77	12.1	V
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### LTE Band 13\_5MHz\_16QAM

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
779.50	-9.25	3.0	37.1	-2.87	21.98	34.77	12.79	V
782.00	-8.36	3.0	36.9	-2.87	22.67	34.77	12.1	V
784.50	-9.66	3.0	36.9	-2.87	21.37	34.77	13.4	V

### LTE Band 13\_10MHz\_16QAM

Frequency(MHz)	P <sub>Mea</sub> (dBm)	P <sub>cl</sub> (dB)	P <sub>Ag</sub> (dB)	G <sub>a</sub> Antenna Gain(dB)	ERP(dBm)	Limit(dBm)	Margin(dB)	Polarization
782.00	-8.36	3.0	36.9	-2.87	22.67	34.77	12.1	V

$$\text{Peak ERP(dBm)} = P_{\text{Mea}}(-8.36\text{dBm}) + G_a(-2.87\text{dBi}) + P_{\text{Ag}}(36.9\text{dB}) - P_{\text{cl}}(3.0\text{dB}) = 22.67\text{dBm}$$

### ANALYZER SETTINGS:

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

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

## ANNEX A.2. EMISSION LIMIT

### Reference

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

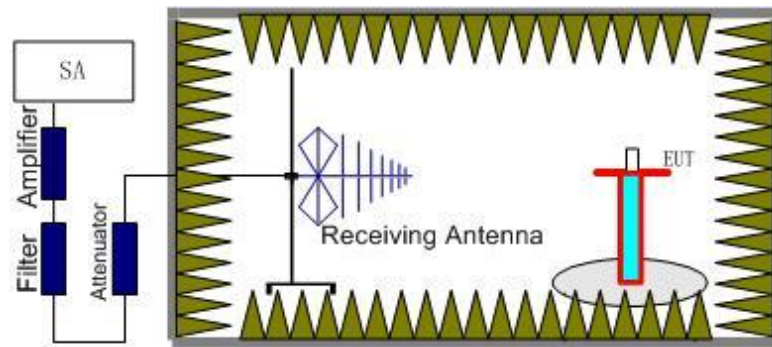
### A.2.1 Measurement Method

The measurements procedures in TIA-603D-2010 are used. This measurement is carried out in fully-anechoic chamber FAC-3.

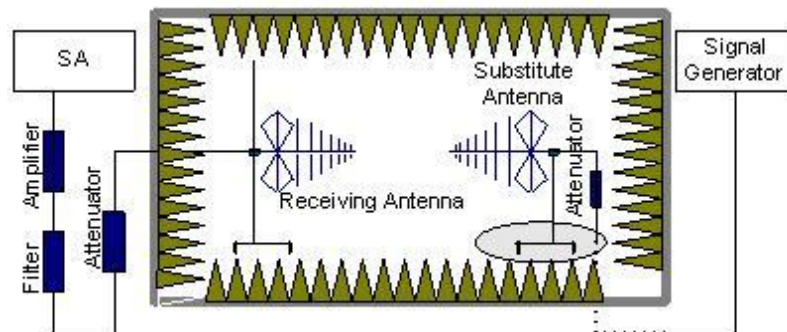
The spectrum was scanned from 30 MHz to the 10th harmonic of the highest frequency generated within the equipment, which is the transmitted carrier. The resolution bandwidth is set 1MHz as outlined in Part 22.917, Part 24.238(a), Part 27.53(g), Part 27.53(h), Part 27.53(m). The spectrum was scanned with 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.

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



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

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

An amplifier should be connected in for the test.

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

The measurement results are obtained as described below:

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

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

### A.2.2 Measurement Limit

Part 22.917, 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. 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 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 )	P <sub>Mea</sub> (dB m)	Path Loss	Antenna Gain	Peak EIRP(dBm )	Limit (dBm)	Margin(dB )	Polarization
3706.800000	-46.07	6.6	7.9	-44.77	-13.00	31.77	V
5559.600000	-58.63	8.3	9.8	-57.13	-13.00	44.13	H
10791.600000	-51.1	11.7	12.4	-50.40	-13.00	37.40	H
14813.250000	-45.57	14.3	13.7	-46.17	-13.00	33.17	V
15858.000000	-42.36	15	13.1	-44.26	-13.00	31.26	V
16864.950000	-40.56	15.8	13	-43.36	-13.00	30.36	H

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

Frequency(MHz )	P <sub>Mea</sub> (dB m)	Path Loss	Antenna Gain	Peak EIRP(dBm )	Limit (dBm)	Margin(dB )	Polarization
3762.400000	-52.81	6.6	7.9	-51.51	-13.00	38.51	V
9810.000000	-54.28	11	12.6	-52.68	-13.00	39.68	V
11639.450000	-49.65	12.2	12.4	-49.45	-13.00	36.45	V
12720.600000	-48.19	12.7	12.8	-48.09	-13.00	35.09	H
14425.800000	-46.16	13.9	13.6	-46.46	-13.00	33.46	H
16269.600000	-42.83	14.7	13.2	-44.33	-13.00	31.33	H

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

Frequency(MHz )	P <sub>Mea</sub> (dB m)	Path Loss	Antenna Gain	Peak EIRP(dBm )	Limit (dBm)	Margin(dB )	Polarization
3817.200000	-53.4	6.7	7.9	-52.20	-13.00	39.20	V
5720.800000	-58.22	8.5	10.2	-56.52	-13.00	43.52	H
7635.200000	-54.76	9.7	11.8	-52.66	-13.00	39.66	V

12480.150000	-46.26	12.7	12.7	-46.26	-13.00	33.26	V
14719.800000	-44.97	14	13.6	-45.37	-13.00	32.37	V
17179.950000	-40.14	16	12.9	-43.24	-13.00	30.24	H

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit (dBm)	Margin(dB)	Polarization
3700.400000	-34.12	6.6	7.9	-32.82	-13.00	19.82	H
5551.200000	-46.88	8.2	9.8	-45.28	-13.00	32.28	H
11606.200000	-42.83	12.2	12.6	-42.43	-13.00	29.43	V
13261.000000	-40.35	12.5	13.4	-39.45	-13.00	26.45	V
14827.600000	-36.93	14.3	13.7	-37.53	-13.00	24.53	H
16499.200000	-33.34	14.6	13	-34.94	-13.00	21.94	H

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit (dBm)	Margin(dB)	Polarization
3755.600000	-35.04	6.6	7.9	-33.74	-13.00	20.74	H
5633.200000	-48.31	8.3	9.8	-46.81	-13.00	33.81	H
7511.200000	-46.86	9.7	11.6	-44.96	-13.00	31.96	H
9388.800000	-46.66	10.7	12.7	-44.66	-13.00	31.66	V
13144.800000	-37.93	13	13.1	-37.83	-13.00	24.83	V
15022.200000	-35.2	14.4	13.9	-35.70	-13.00	22.70	H

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit (dBm)	Margin(dB)	Polarization
3810.400000	-41.76	6.7	7.9	-40.56	-13.00	27.56	H
5716.000000	-48.8	8.5	10.2	-47.10	-13.00	34.10	H
7620.800000	-46.44	9.7	11.6	-44.54	-13.00	31.54	V
11954.800000	-41.6	12.5	12.3	-41.80	-13.00	28.80	H
13336.600000	-37.38	13.6	13.4	-37.58	-13.00	24.58	V
15243.400000	-36	14.5	14	-36.50	-13.00	23.50	H

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Peak ERP(dBm)	Limit (dBm)	Margin(dB)	Polarization
4515.200000	-60.25	7.3	8.7	-58.85	-13.00	45.85	H
5635.200000	-59.15	8.3	9.6	-57.85	-13.00	44.85	V
6542.000000	-57.77	9	9.8	-56.97	-13.00	43.97	H
7663.600000	-58.77	9.7	11.7	-56.77	-13.00	43.77	V
8861.800000	-57.67	10.4	12.7	-55.37	-13.00	42.37	V
9787.000000	-54.85	11	12.6	-53.25	-13.00	40.25	H

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Peak ERP(dBm)	Limit (dBm)	Margin(dB)	Polarization
2371.153846	-55.05	5.2	5.1	-55.15	-13.00	42.15	V
3634.800000	-62.3	6.6	7.8	-61.10	-13.00	48.10	V
5023.200000	-60.44	7.8	9.6	-58.64	-13.00	45.64	H
6526.800000	-58.8	8.9	10.6	-57.10	-13.00	44.10	V
8420.800000	-58.78	10.2	12.6	-56.38	-13.00	43.38	V
9371.800000	-56.54	10.7	12.7	-54.54	-13.00	41.54	V

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Peak ERP(dBm)	Limit (dBm)	Margin(dB)	Polarization
2404.615385	-55.82	5.3	5.6	-55.52	-13.00	42.52	H
3180.800000	-63.67	6.1	6.9	-62.87	-13.00	49.87	H
4117.200000	-62.17	7	8.6	-60.57	-13.00	47.57	H
5794.400000	-59.31	8.4	10.2	-57.51	-13.00	44.51	V
7548.400000	-59.07	9.7	11.6	-57.17	-13.00	44.17	V
9355.600000	-56.97	10.7	12.7	-54.97	-13.00	41.97	H



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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit (dBm)	Margin(dB)	Polarization
5000.3	-58.82	7.5	12.7	-53.62	-13.00	40.62	H
7501.4	-60.35	1.1	11.3	-50.15	-13.00	37.15	H
10000.3	-58.89	0.4	12.1	-47.19	-13.00	34.19	H
12500.1	-58.27	0.5	13.2	-45.57	-13.00	32.57	H
15000.6	-60.20	0.4	13.6	-47.00	-13.00	34	H
17250.4	-59.11	0.3	15.1	-44.31	-13.00	31.31	V

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit (dBm)	Margin(dB)	Polarization
5070.1	-60.47	7.5	12.7	-55.27	-13.00	42.27	H
7605.3	-58.50	1.1	11.3	-48.30	-13.00	35.3	H
10141.3	-58.76	0.4	12.1	-47.06	-13.00	34.06	H
12675.2	-59.26	0.5	13.2	-46.56	-13.00	33.56	H
15209.4	-59.75	0.4	13.6	-46.55	-13.00	33.55	H
17745.2	-58.67	0.3	15.1	-43.87	-13.00	30.87	V

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Peak EIRP(dBm)	Limit (dBm)	Margin(dB)	Polarization
5140.3	-58.55	7.5	12.7	-53.35	-13.00	40.35	H
7710.3	-59.05	1.1	11.3	-48.85	-13.00	35.85	H
10280.4	-58.98	0.4	12.1	-47.28	-13.00	34.28	H
12850.3	-60.05	0.5	13.2	-47.35	-13.00	34.35	H
15420.5	-59.59	0.4	13.6	-46.39	-13.00	33.39	H
17990.7	-58.49	0.3	15.1	-43.69	-13.00	30.69	V

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Peak ERP(dBm)	Limit (dBm)	Margin(dB)	Polarization
1414.653846	-47.33	4.0	5.3	-46.03	-13.00	33.03	H
2600.000000	-41.17	5.5	5.6	-41.07	-13.00	28.07	H
3580.400000	-52.29	6.5	7.8	-50.99	-13.00	37.99	H
5788.000000	-53.28	8.4	10.2	-51.48	-13.00	38.48	V
7244.200000	-50.95	9.6	11.4	-49.15	-13.00	36.15	H
9111.400000	-49	10.5	12.6	-46.90	-13.00	33.90	V

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Peak ERP(dBm)	Limit (dBm)	Margin(dB)	Polarization
1415.346154	-46.86	4.0	5.3	-45.56	-13.00	32.56	V
2566.923077	-41.93	5.5	5.6	-41.83	-13.00	28.83	V
3578.000000	-53.31	6.5	7.8	-52.01	-13.00	39.01	H
5388.400000	-52.09	8.1	9.4	-50.79	-13.00	37.79	H
6571.600000	-52.46	9.0	10.6	-50.86	-13.00	37.86	H
9243.700000	-48.42	10.5	12.7	-46.22	-13.00	33.22	H

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

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Peak ERP(dBm)	Limit (dBm)	Margin(dB)	Polarization
1414.307692	-44.98	4.0	5.3	-43.68	-13.00	30.68	H
2041.538462	-45.75	5.5	4.5	-46.75	-13.00	33.75	H
3604.800000	-54.5	6.5	7.8	-53.20	-13.00	40.20	V
5040.800000	-53.11	7.8	9.6	-51.31	-13.00	38.31	V
7258.900000	-50.84	9.6	11.4	-49.04	-13.00	36.04	V
9228.100000	-49.36	10.5	12.7	-47.16	-13.00	34.16	H

**LTE Band 13, 5MHz, QPSK, Channel 23205**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Peak ERP(dBm)	Limit (dBm)	Margin(dB)	Polarization
1554.2	-47.13	4.7	9.4	-42.43	-13.00	29.43	H
2331.5	-40.34	5.9	10.6	-35.64	-13.00	22.64	H
3108.4	-59.40	6.8	12.6	-53.60	-13.00	40.6	H
3885.2	-59.92	7.8	12.6	-55.12	-13.00	42.12	V
4662.7	-58.01	7.5	12.7	-52.81	-13.00	39.81	H
5439.5	-58.25	1.8	13.1	-46.95	-13.00	33.95	V

**LTE Band 13, 5MHz, QPSK, Channel 23230**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Peak ERP(dBm)	Limit (dBm)	Margin(dB)	Polarization
1562.3	-46.76	4.7	9.4	-42.06	-13.00	29.06	H
2346.4	-42.80	5.9	10.6	-38.10	-13.00	25.1	H
3128.4	-60.46	6.8	12.6	-54.66	-13.00	41.66	H
3910.2	-59.90	7.8	12.6	-55.10	-13.00	42.1	H
4692.8	-58.16	7.5	12.7	-52.96	-13.00	39.96	H
5474.2	-60.41	1.8	13.1	-49.11	-13.00	36.11	V

**LTE Band 13, 5MHz, QPSK, Channel 23255**

Frequency(MHz)	P <sub>Mea</sub> (dBm)	Path Loss	Antenna Gain	Peak ERP(dBm)	Limit (dBm)	Margin(dB)	Polarization
1574.3	-47.54	4.7	9.4	-42.84	-13.00	29.84	H
2361.2	-41.33	5.9	10.6	-36.63	-13.00	23.63	H
3148.3	-59.99	6.8	12.6	-54.19	-13.00	41.19	H
3935.4	-58.70	7.8	12.6	-53.90	-13.00	40.9	H
4722.6	-59.05	7.5	12.7	-53.85	-13.00	40.85	V
5509.5	-59.18	1.8	13.1	-47.88	-13.00	34.88	H

measurement uncertainty for this test item is  $U = 4.2$  dB,  $k = 2$ .

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

### **Reference**

FCC: CFR Part 2.1055, 22.235,24.235, 27.54.

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

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

1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -30°C.
3. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on middle channel for LTE band 2/4/5/7/12/13, 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 0°C to +45°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 +45°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 +45°C to 0°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 3.6VDC and 4.35VDC, with a nominal voltage of 4VDC. 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
3.6	-7.8	-9.2	0.004	0.005
4	-6.49	-9.38	0.003	0.005
4.35	-6.51	-10.29	0.003	0.005

**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
45°	-8.41	-9.61	0.004	0.005
40°	-6.25	-9.6	0.003	0.005
30°	-6.41	-11.47	0.003	0.006
20°	-7.35	-8.91	0.004	0.005
10°	-7.02	-8.51	0.004	0.005
0°	-6.67	-9.07	0.004	0.005

**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
3.6	4.26	11.74	0.002	0.007
4	-5.79	8.68	0.003	0.005
4.35	3.4	8.73	0.002	0.005

**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
45°	3.36	8.38	0.002	0.005
40°	5.26	8.4	0.003	0.005
30°	-8.6	9.9	0.005	0.006
20°	3.58	9.57	0.002	0.006
10°	-2.63	10.73	0.002	0.006
0°	-3.33	9.66	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
3.6	-3.82	9.77	0.005	0.012
4	-3.19	11.36	0.004	0.014
4.35	-1.97	11.22	0.002	0.013

**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
45°	-1.46	10.17	0.002	0.012
40°	-3.92	10.27	0.005	0.012
30°	-2.62	10.2	0.003	0.012
20°	-2.26	10.66	0.003	0.013
10°	3.65	9.73	0.004	0.012
0°	-4.63	11.16	0.006	0.013

**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
3.6	-9.41	7.37	0.004	0.003
4	-8.93	6.17	0.004	0.002
4.35	-6.12	6.27	0.002	0.002

**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
45°	-6.19	7.68	0.002	0.003
40°	-7.88	6.62	0.003	0.003
30°	-7.54	7.72	0.003	0.003
20°	-7.74	-6.81	0.003	0.003
10°	-8.38	8.27	0.003	0.003
0°	-9.16	9.37	0.004	0.004

**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
3.6	-2.9	14.05	0.004	0.02
4	-1.97	13.63	0.003	0.019
4.35	-2.49	13.63	0.004	0.019

**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
45°	-2.26	12.77	0.003	0.018
40°	-3.13	12.47	0.004	0.018
30°	-3.38	13.07	0.005	0.018
20°	-2.53	13.55	0.004	0.019
10°	-1.99	14.41	0.003	0.02
0°	-2.19	12.65	0.003	0.018

**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
3.6	-4.66	6.91	0.006	0.009
4	-4.13	9.06	0.005	0.012
4.35	-3.45	8.88	0.004	0.011

**Frequency Error vs Temperature**

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
45°	-3.53	8.53	0.005	0.011
40°	-3.08	7.02	0.004	0.009
30°	-2.76	8.38	0.004	0.011
20°	-4.03	7.42	0.005	0.009
10°	-4.51	25.06	0.006	0.032
0°	-6.19	7.62	0.008	0.001

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

**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.

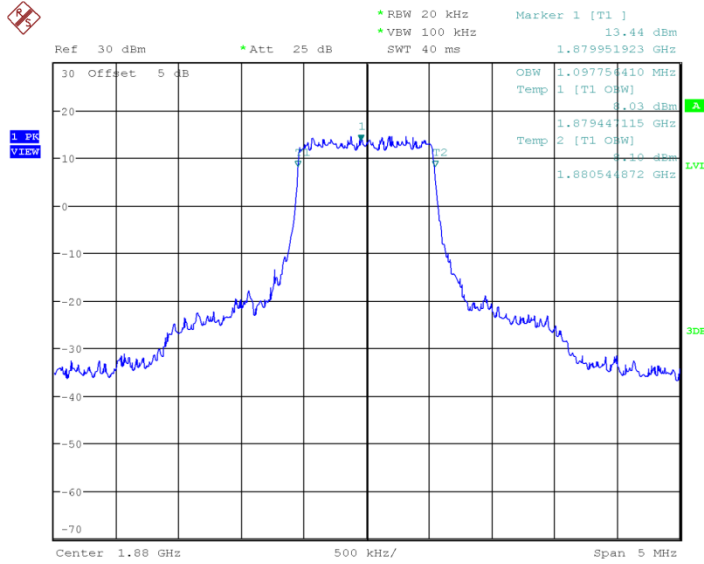
The measurement method is from KDB 971168 4.2:

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



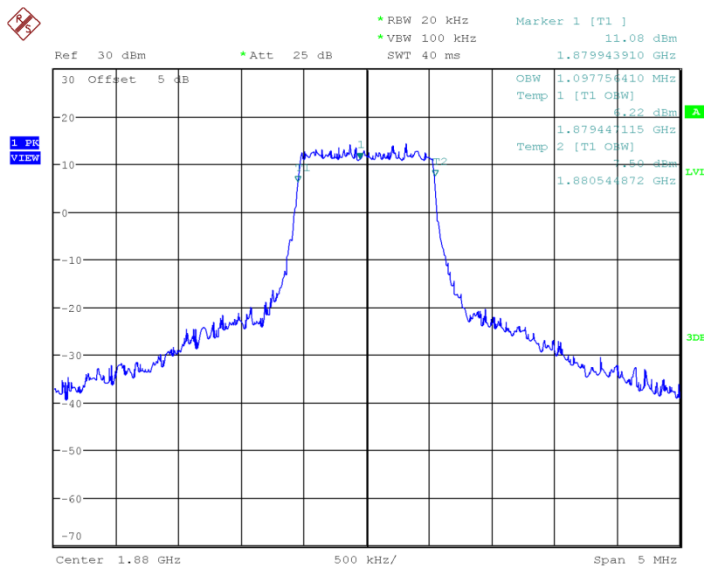
## LTE band 2, 1.4MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
	1880.0	QPSK
	1097.756	1097.756



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## LTE band 2, 1.4MHz Bandwidth, QPSK (99% BW)

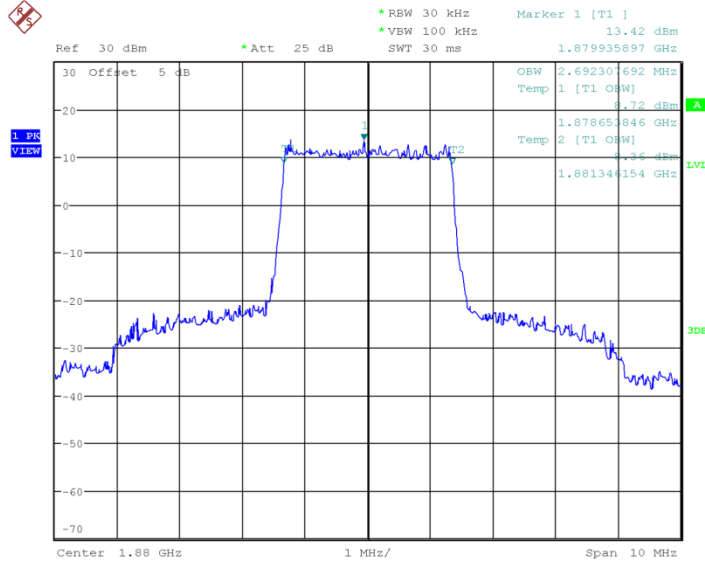


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## LTE band 2, 1.4MHz Bandwidth, 16QAM (99% BW)

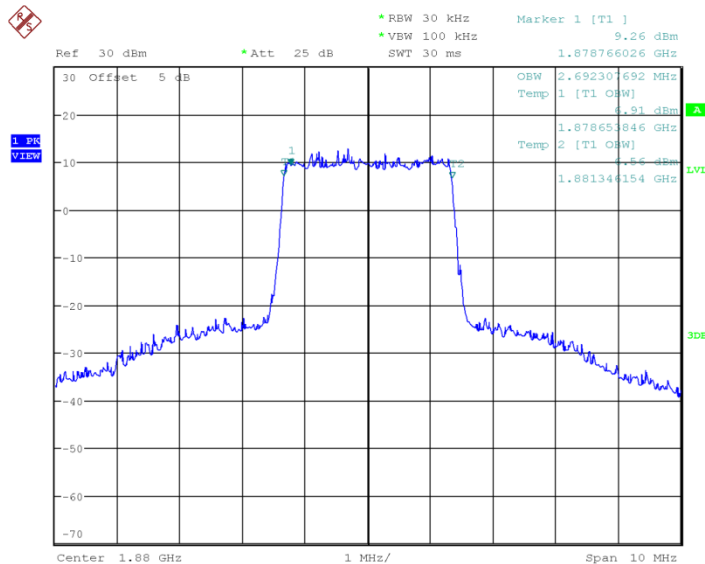
## LTE band 2, 3MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
	1880.0	QPSK
	2692.308	2692.308



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

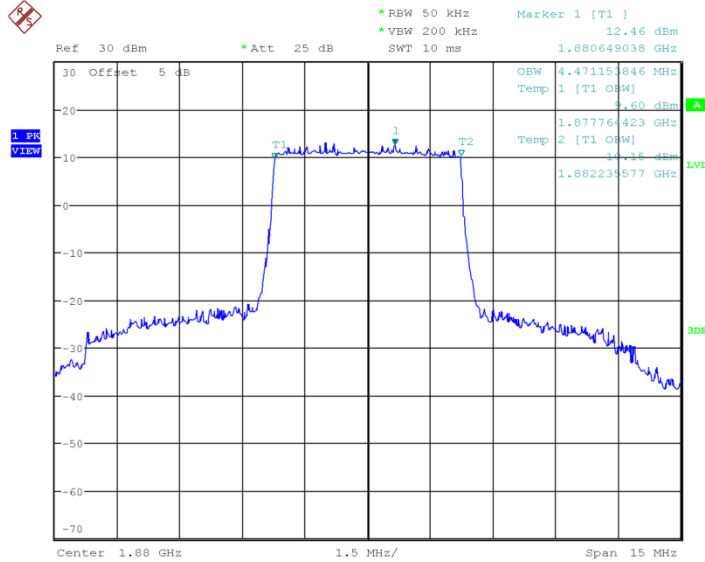


Date: 22.JAN.2003 14:55:17

## LTE band 2, 3MHz Bandwidth, 16QAM (99% BW)

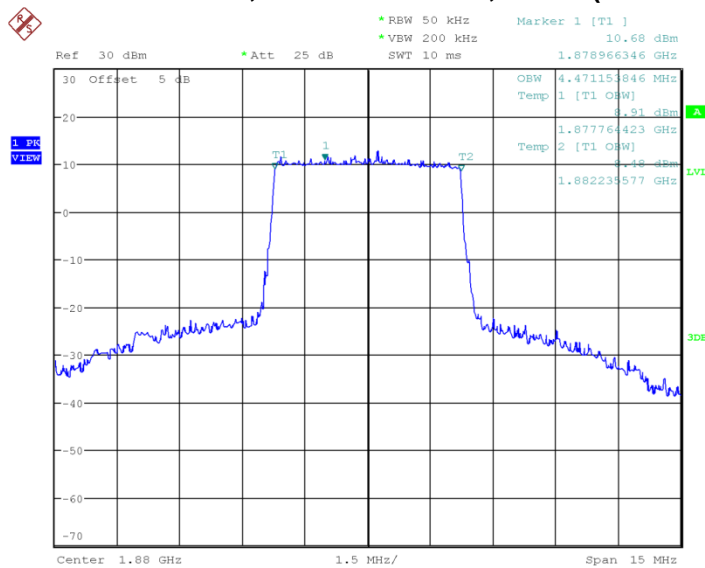
## LTE band 2, 5MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
	1880.0	QPSK
	4471.154	4471.154



Date: 22.JAN.2003 14:55:46

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

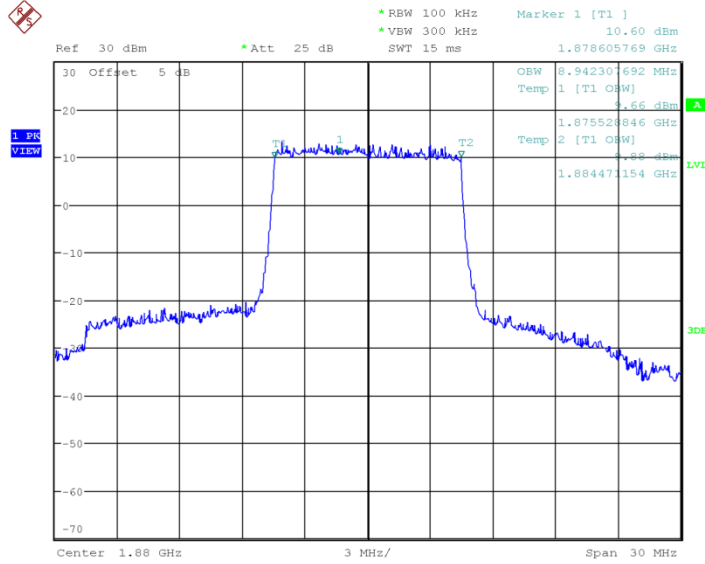


Date: 22.JAN.2003 14:56:00

## LTE band 2, 5MHz Bandwidth,16QAM (99% BW)

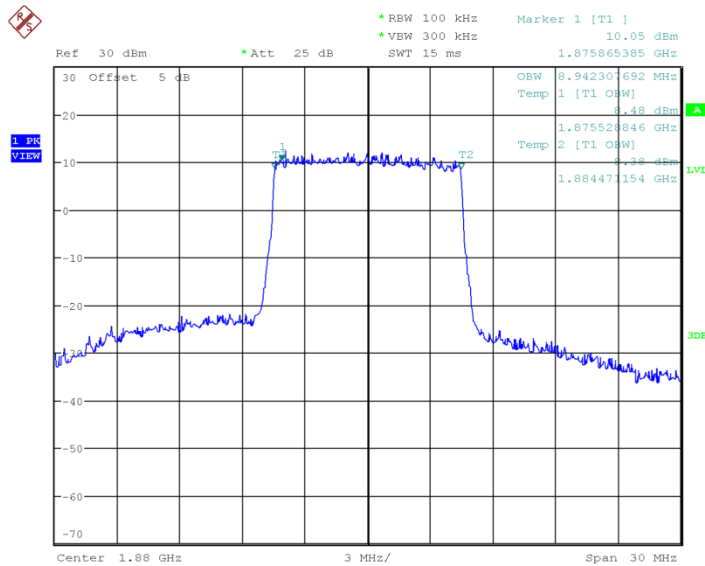
## LTE band 2, 10MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
	1880.0	QPSK
	8942.308	8942.308



Date: 22.JAN.2003 14:56:29

## LTE band 2, 10MHz Bandwidth, QPSK (99% BW)

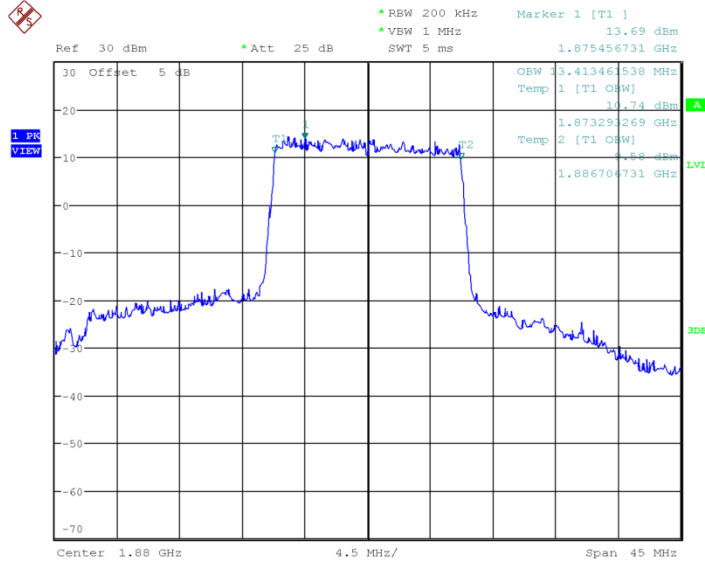


Date: 22.JAN.2003 14:56:42

## LTE band 2, 10MHz Bandwidth, 16QAM (99% BW)

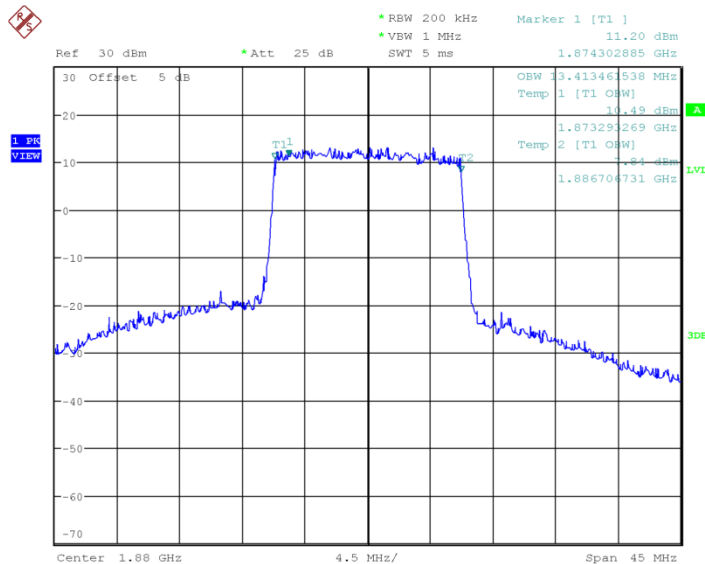
## LTE band 2, 15MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
	QPSK	16QAM
1880.0	13413.462	13413.462



Date: 22.JAN.2003 14:57:11

## LTE band 2, 15MHz Bandwidth, QPSK (99% BW)

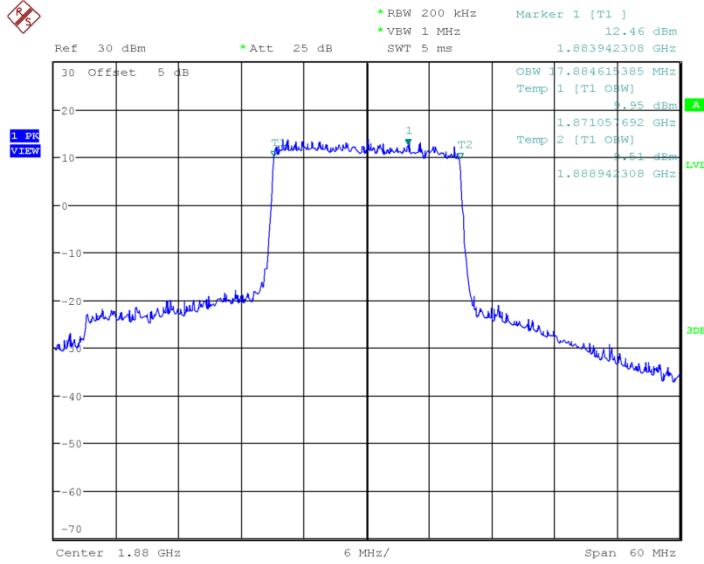


Date: 22.JAN.2003 14:57:24

## LTE band 2, 15MHz Bandwidth, 16QAM (99% BW)

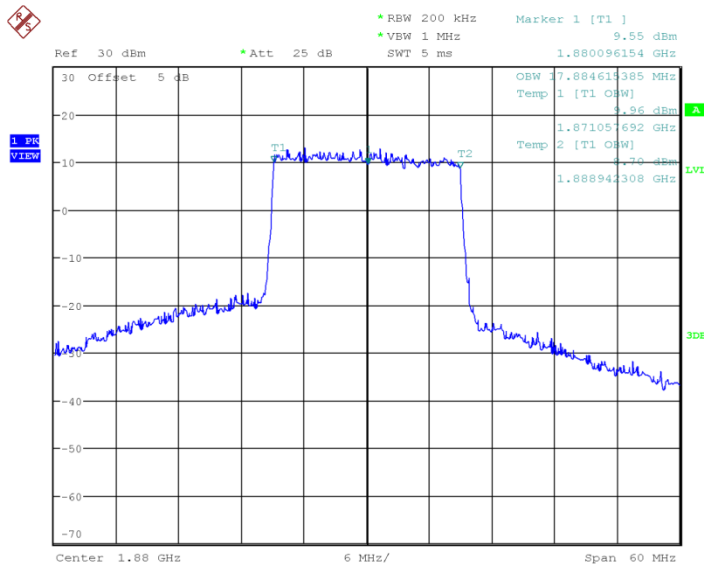
## LTE band 2, 20MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
	QPSK	16QAM
1880.0	17884.615	17884.615



Date: 22.JAN.2003 14:57:53

## LTE band 2, 20MHz Bandwidth, QPSK (99% BW)

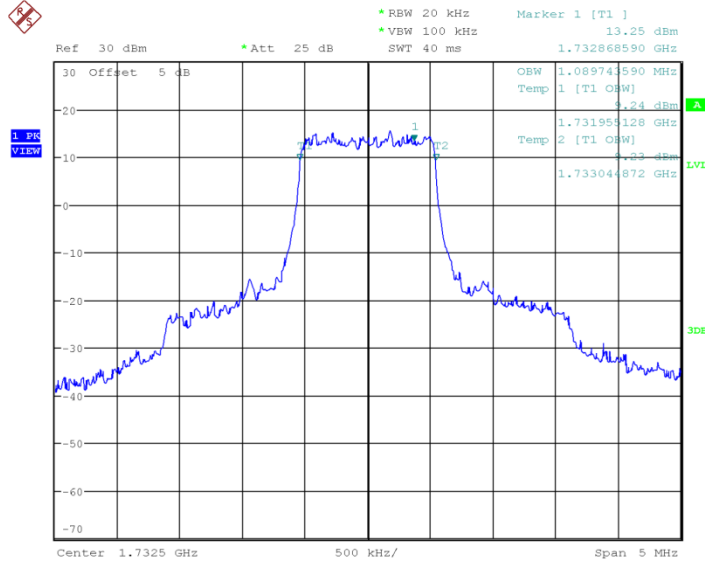


Date: 22.JAN.2003 14:58:07

## LTE band 2, 20MHz Bandwidth, 16QAM (99% BW)

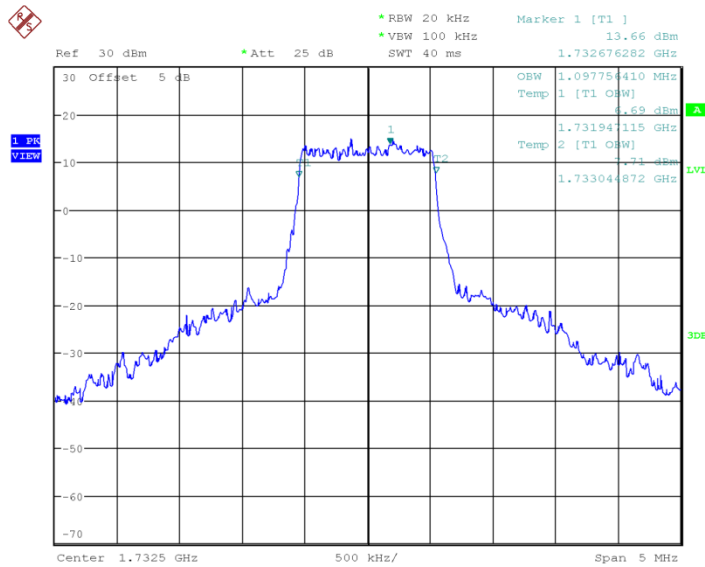
## LTE band 4, 1.4MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
	1732.5	QPSK
	1089.744	1097.756



Date: 22.JAN.2003 14:58:39

## LTE band 4, 1.4MHz Bandwidth, QPSK (99% BW)

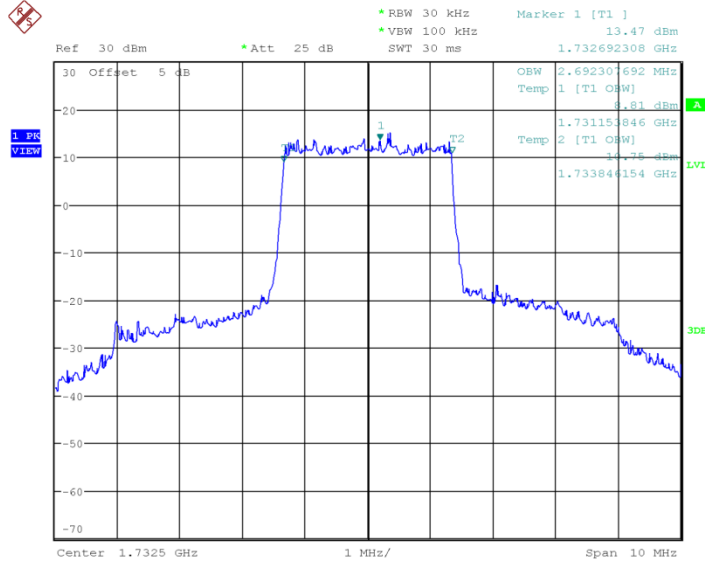


Date: 22.JAN.2003 14:58:52

## LTE band 4, 1.4MHz Bandwidth, 16QAM (99% BW)

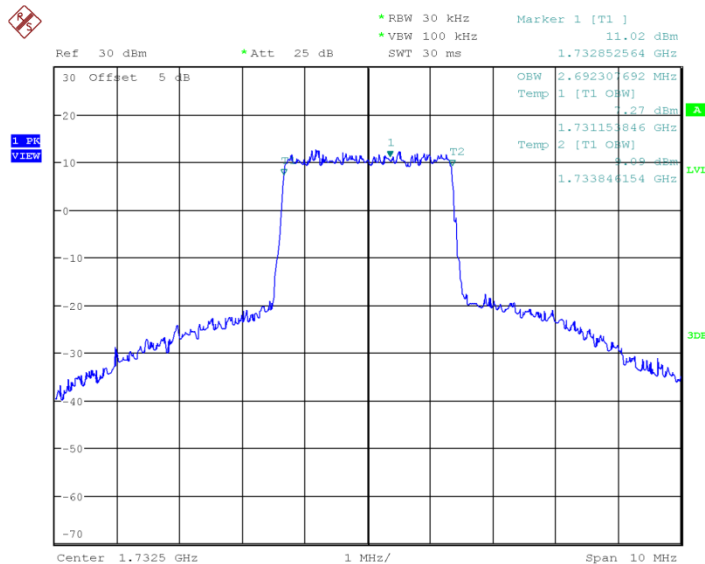
## LTE band 4, 3MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
1732.5	QPSK	16QAM
	2692.308	2692.308



Date: 22.JAN.2003 14:59:21

## LTE band 4, 3MHz Bandwidth, QPSK (99% BW)



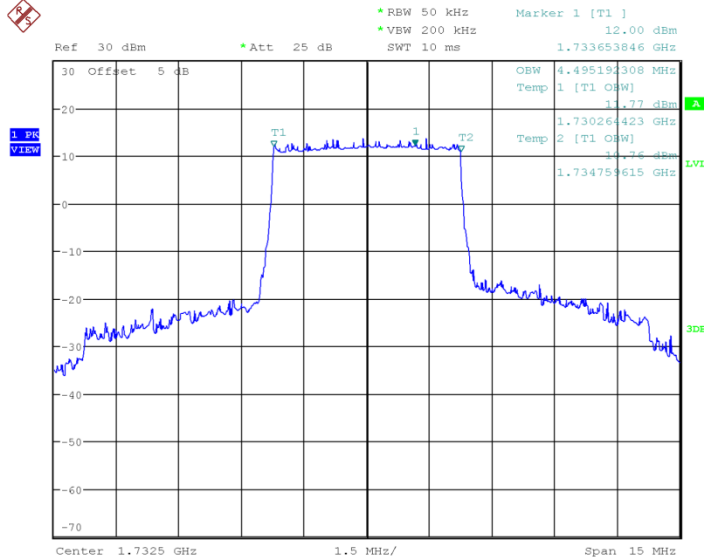
Date: 22.JAN.2003 14:59:35

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



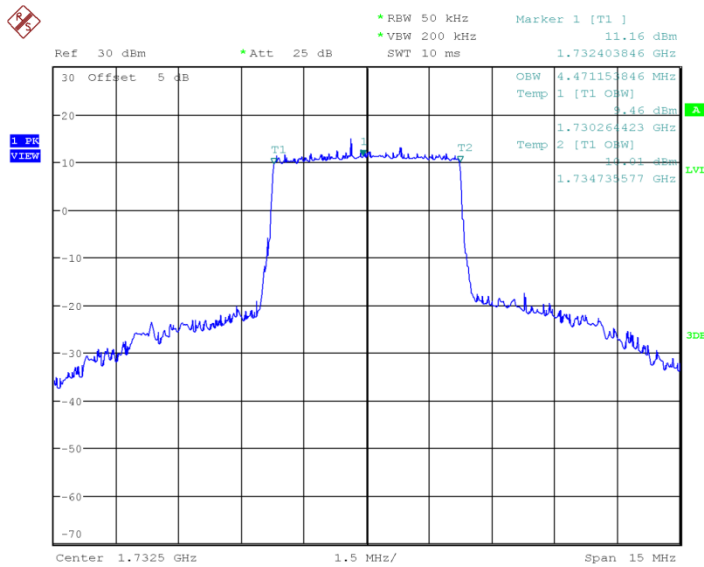
## LTE band 4, 5MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
1732.5	QPSK	16QAM
	4495.192	4471.154



Date: 22.JAN.2003 15:00:04

## LTE band 4, 5MHz Bandwidth, QPSK (99% BW)

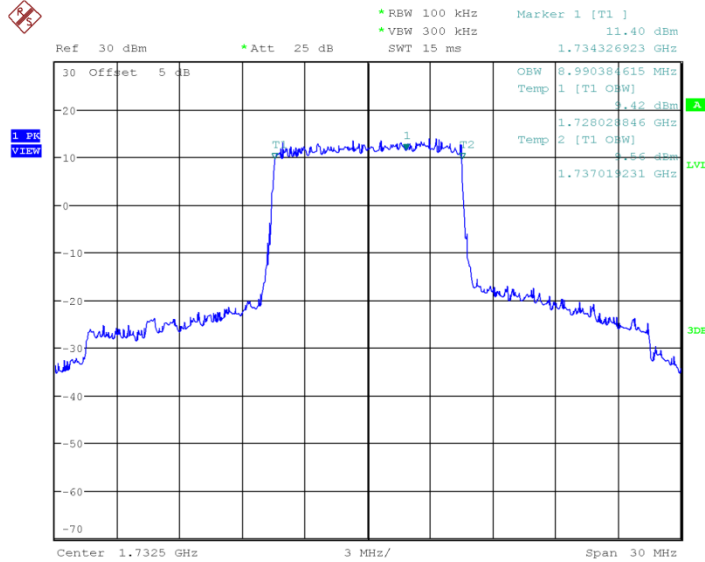


Date: 22.JAN.2003 15:00:17

## LTE band 4, 5MHz Bandwidth,16QAM (99% BW)

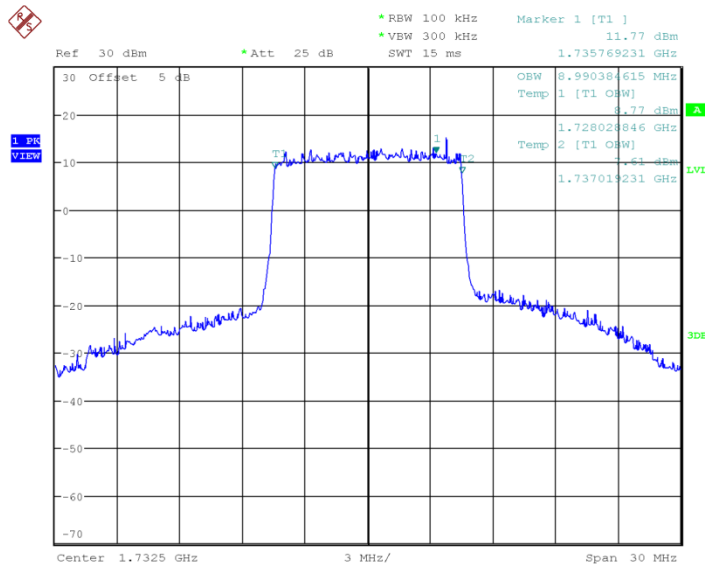
## LTE band 4, 10MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
1732.5	QPSK	16QAM
	8990.385	8990.385



Date: 22.JAN.2003 15:00:46

## LTE band 4, 10MHz Bandwidth, QPSK (99% BW)

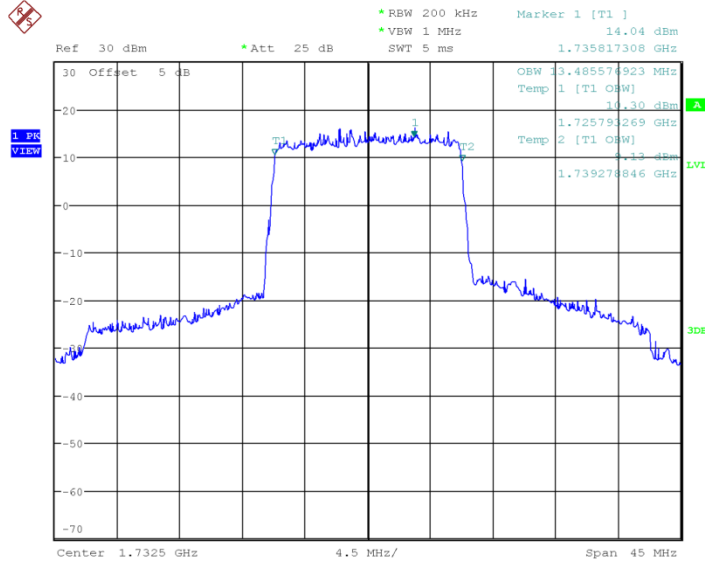


Date: 22.JAN.2003 15:01:00

## LTE band 4, 10MHz Bandwidth, 16QAM (99% BW)

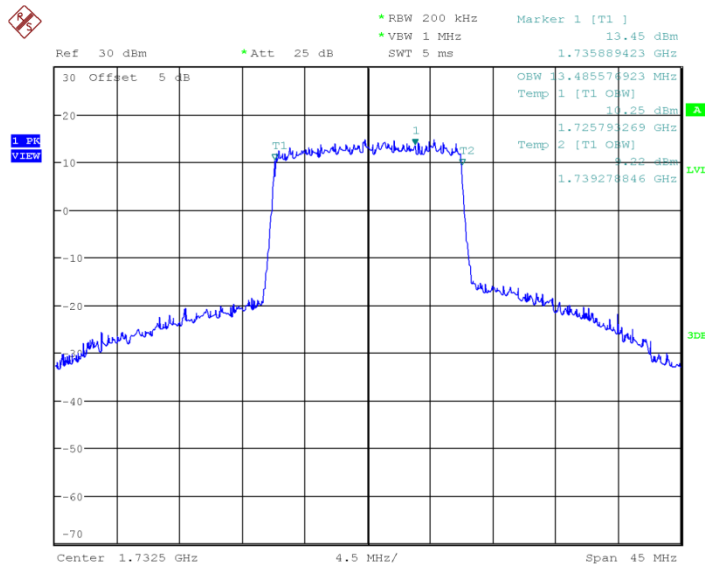
## LTE band 4, 15MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
	1732.5	QPSK
	13485.577	13485.577



Date: 22.JAN.2003 15:01:29

## LTE band 4, 15MHz Bandwidth, QPSK (99% BW)

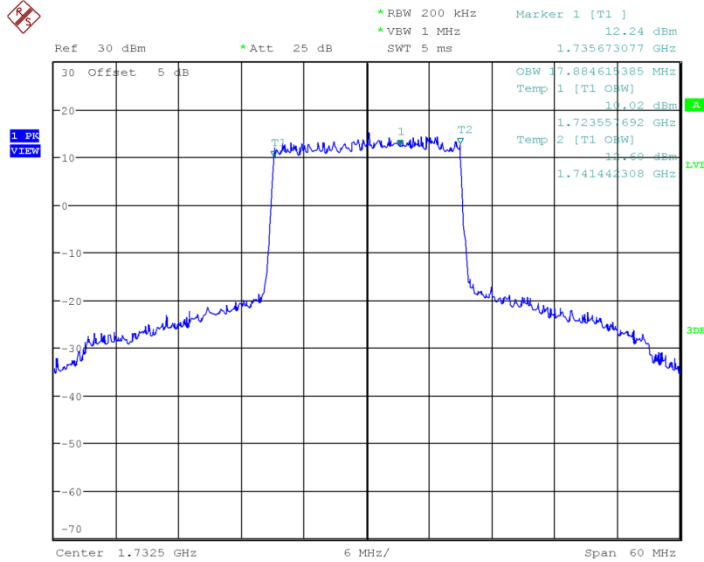


Date: 22.JAN.2003 15:01:42

## LTE band 4, 15MHz Bandwidth, 16QAM (99% BW)

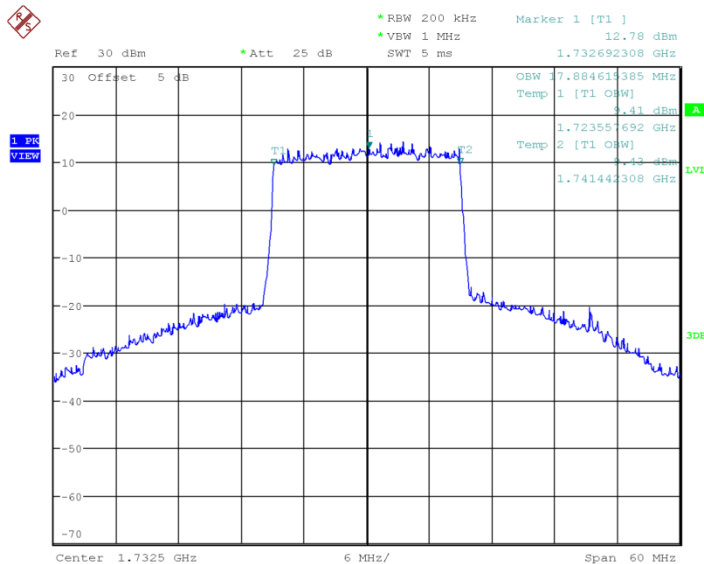
## LTE band 4, 20MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
	QPSK	16QAM
1732.5	17884.615	17884.615



Date: 22.JAN.2003 15:02:11

## LTE band 4, 20MHz Bandwidth, QPSK (99% BW)

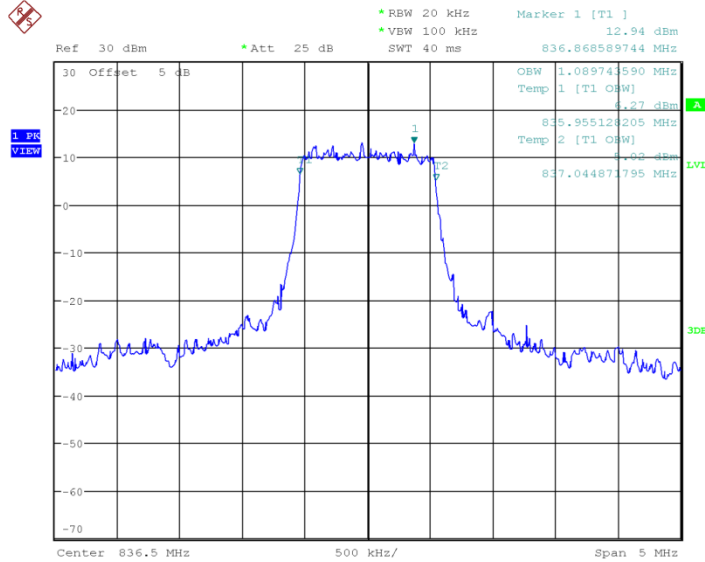


Date: 22.JAN.2003 15:02:24

## LTE band 4, 20MHz Bandwidth, 16QAM (99% BW)

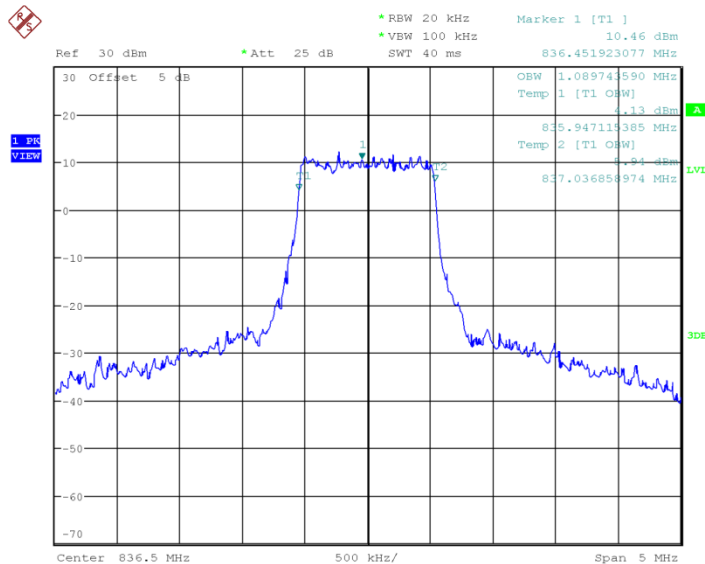
## LTE band 5, 1.4MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
	836.5	QPSK
	1089.744	1089.744



Date: 22.JAN.2003 16:18:05

## LTE band 5, 1.4MHz Bandwidth, QPSK (99% BW)

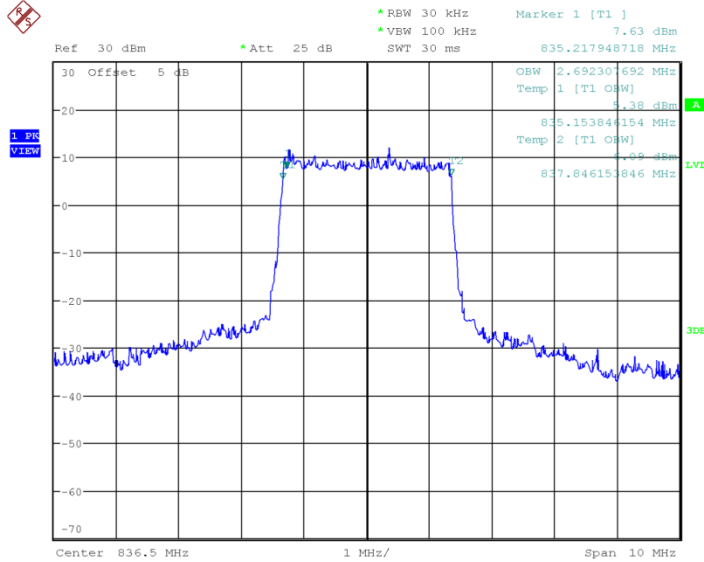


Date: 22.JAN.2003 16:18:18

## LTE band 5, 1.4MHz Bandwidth, 16QAM (99% BW)

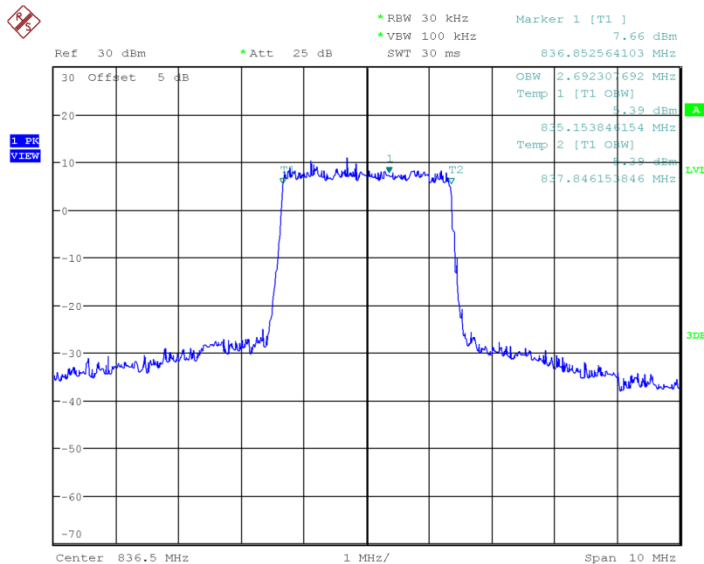
## LTE band 5, 3MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
	836.5	QPSK
	2692.308	2692.308



Date: 22.JAN.2003 16:18:47

## LTE band 5, 3MHz Bandwidth, QPSK (99% BW)

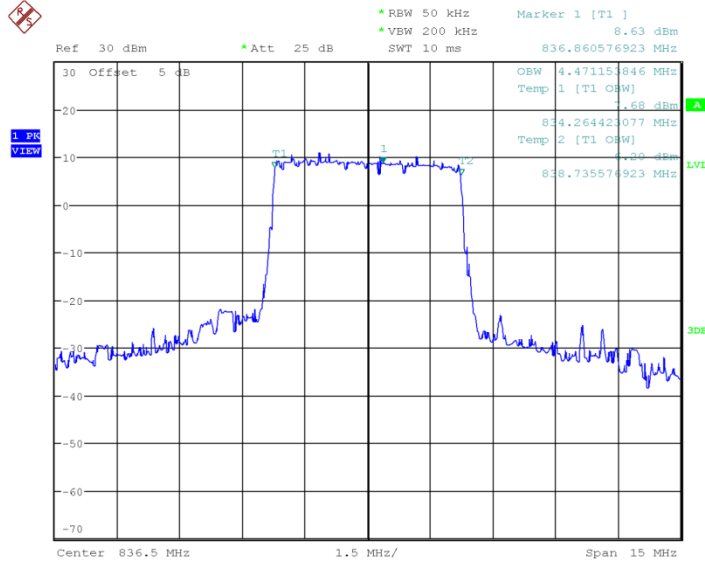


Date: 22.JAN.2003 16:19:00

## LTE band 5, 3MHz Bandwidth, 16QAM (99% BW)

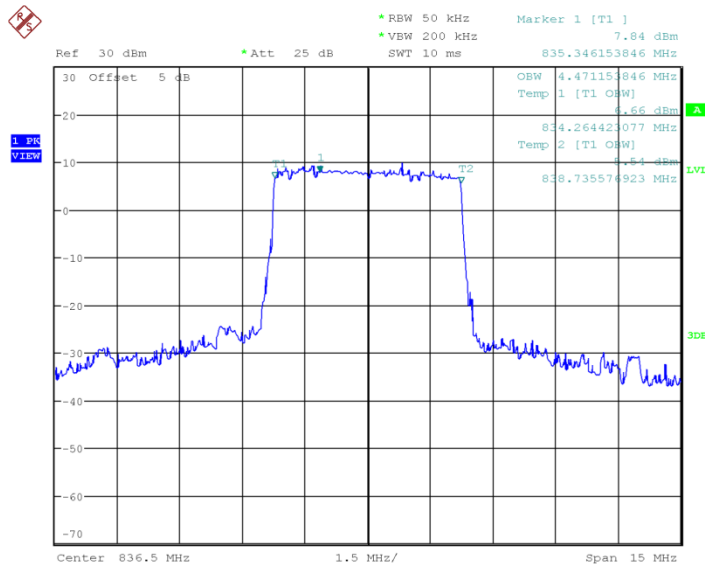
## LTE band 5, 5MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
	QPSK	16QAM
836.5	4471.154	4471.154



Date: 22.JAN.2003 16:19:29

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

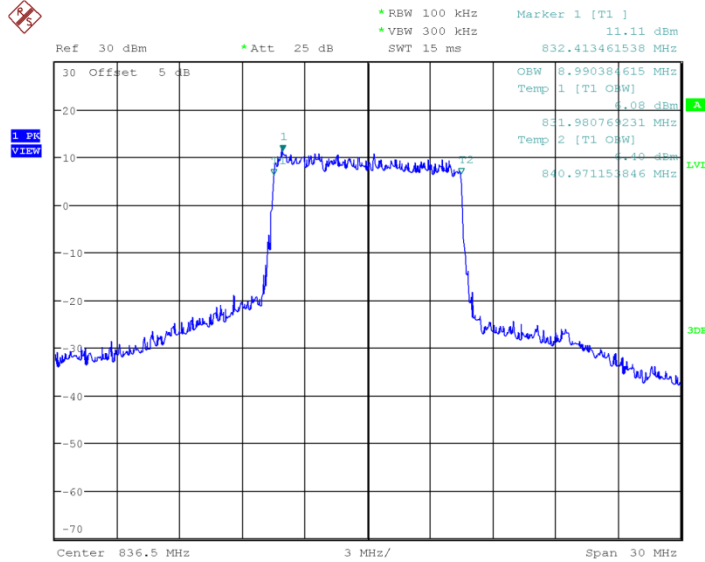


Date: 22.JAN.2003 16:19:42

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

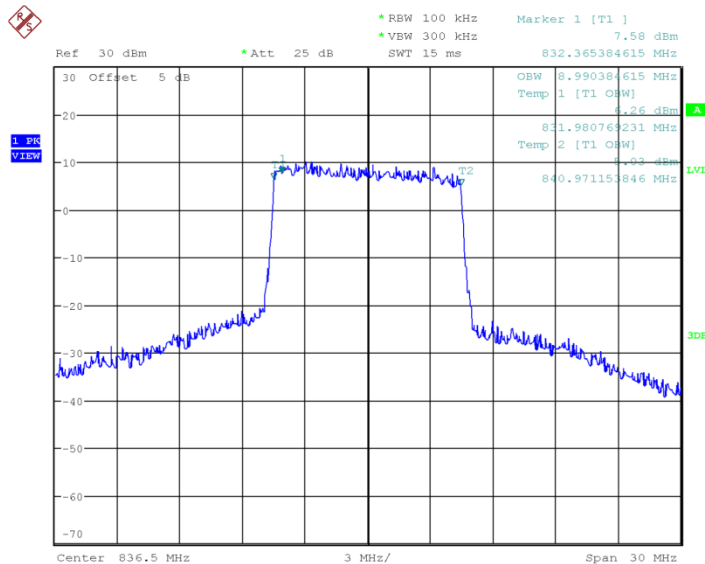
## LTE band 5, 10MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
	QPSK	16QAM
836.5	8990.385	8990.385



Date: 22.JAN.2003 16:20:11

## LTE band 5, 10MHz Bandwidth, QPSK (99% BW)



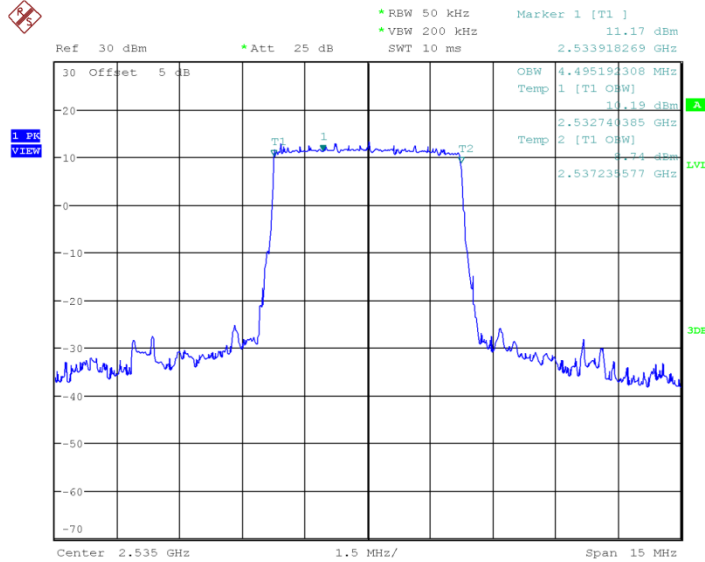
Date: 22.JAN.2003 16:20:24

## LTE band 5, 10MHz Bandwidth, 16QAM (99% BW)



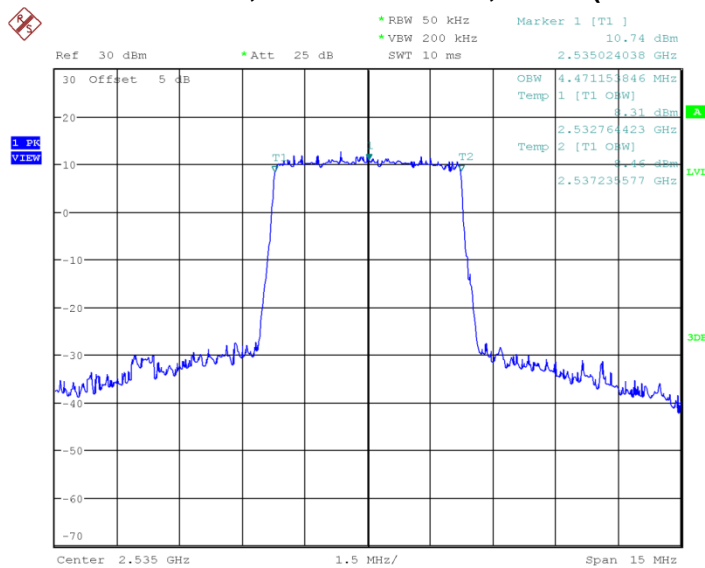
## LTE band 7, 5MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
	2535.0	QPSK
	4495.192	4471.154



Date: 3.FEB.2003 19:12:21

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

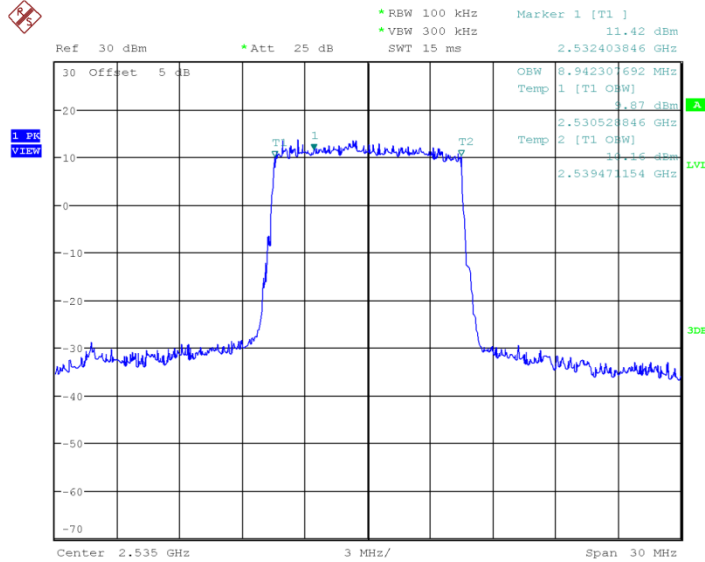


Date: 3.FEB.2003 19:12:34

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

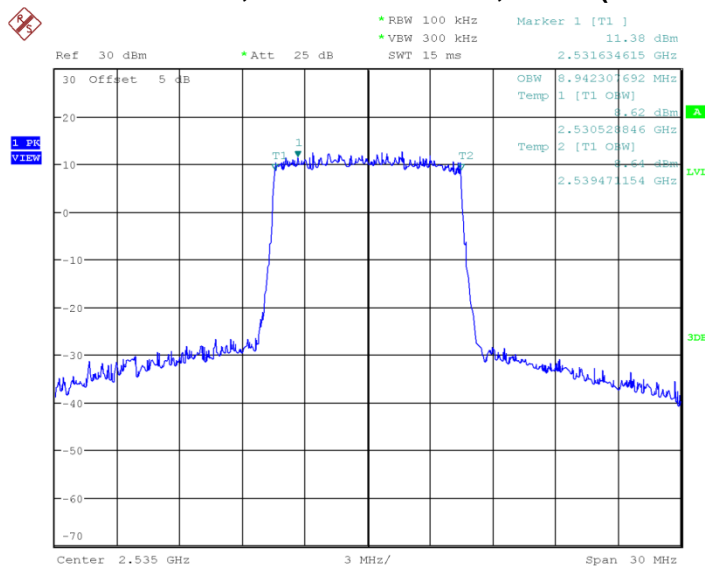
## LTE band 7, 10MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
2535.0	QPSK	16QAM
	8942.308	8942.308



Date: 3.FEB.2003 19:12:56

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

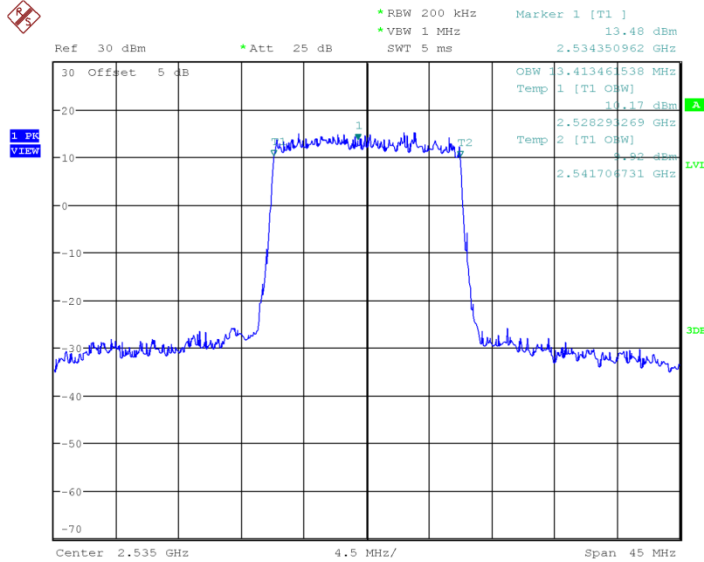


Date: 3.FEB.2003 19:13:10

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

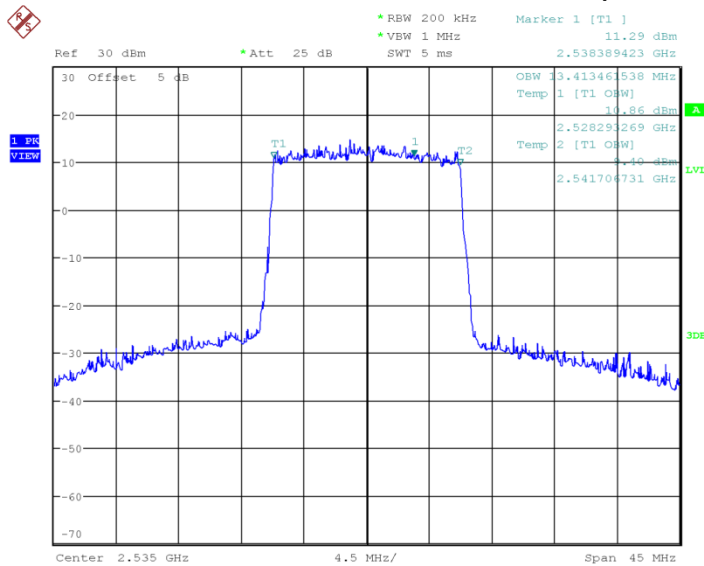
## LTE band 7, 15MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
	2535.0	QPSK
	13413.462	13413.462



Date: 3.FEB.2003 19:13:32

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

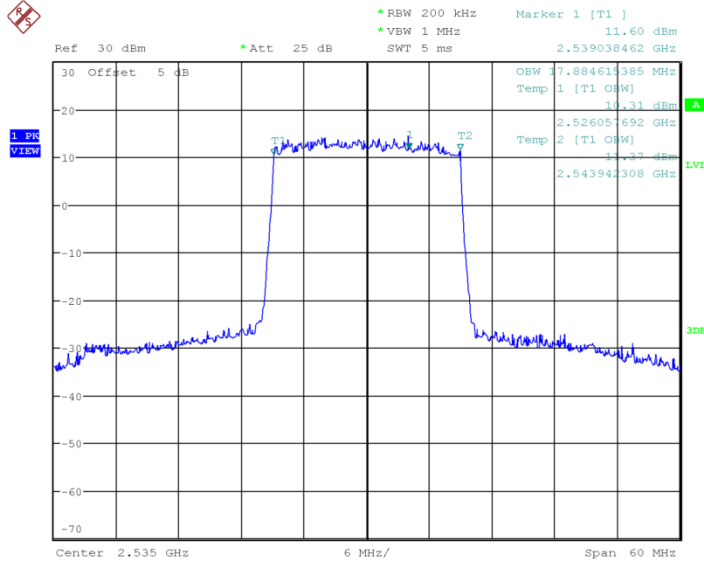


Date: 3.FEB.2003 19:13:45

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

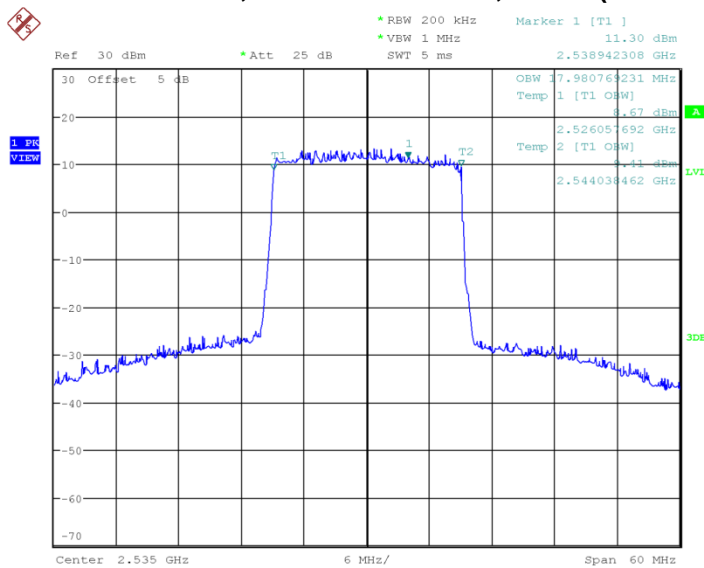
## LTE band 7, 20MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
2535.0	QPSK	16QAM
	17884.615	17980.769



Date: 3.FEB.2003 19:14:08

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



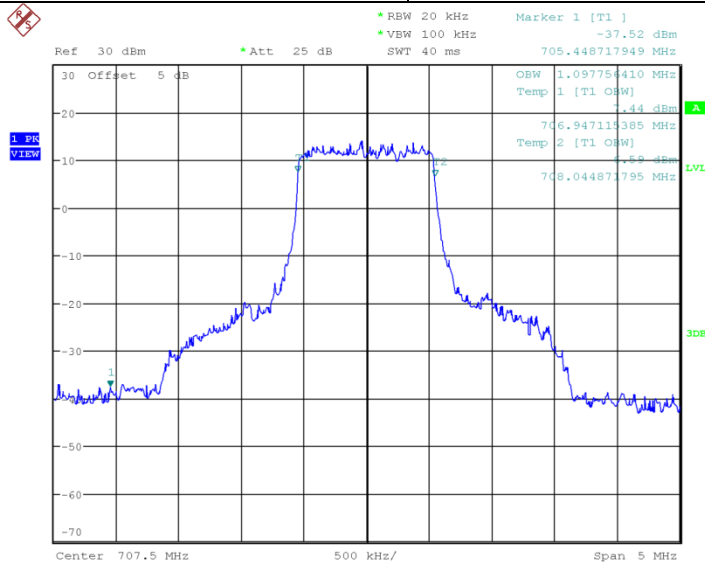
Date: 3.FEB.2003 19:14:21

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

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

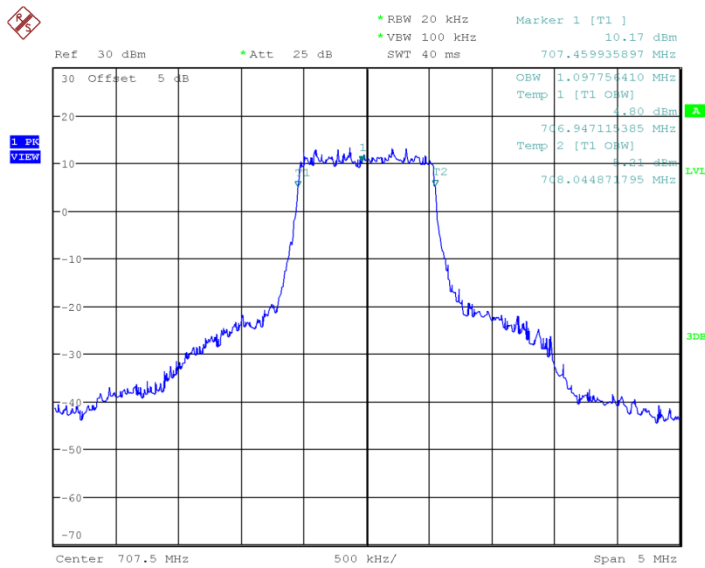
Frequency(MHz)	Occupied Bandwidth (99%)( kHz)
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707.5	QPSK	16QAM
	1097.756	1097.756



Date: 3.FEB.2003 18:41:09

### LTE band 12, 1.4MHz Bandwidth, QPSK (99% BW)

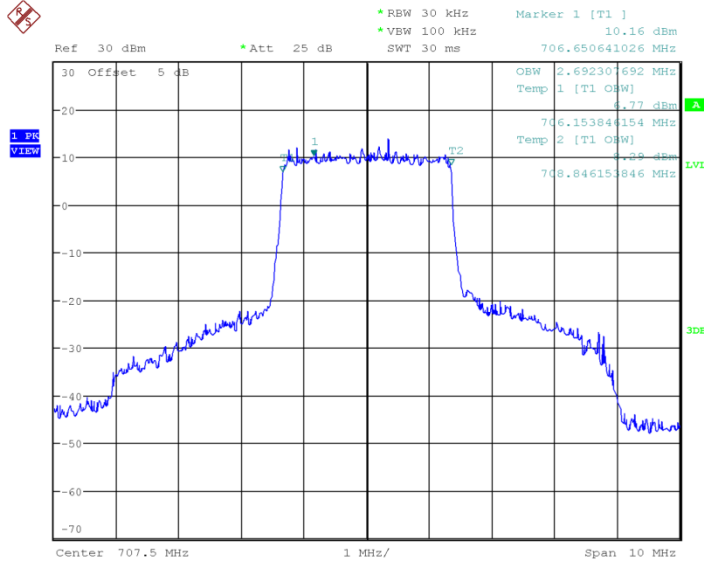


Date: 3.FEB.2003 18:41:22

### LTE band 12, 1.4MHz Bandwidth, 16QAM (99% BW)

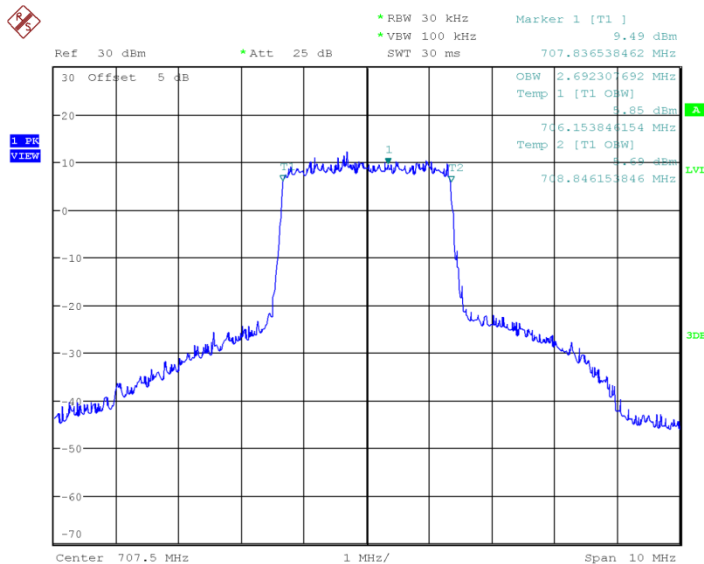
## LTE band 12, 3MHz (99%)

Frequency(MHz)	Occupied Bandwidth (99%)( kHz)	
	707.5	QPSK
	2692.308	2692.308



Date: 3.FEB.2003 18:41:45

## LTE band 12, 3MHz Bandwidth, QPSK (99% BW)



Date: 3.FEB.2003 18:41:58

## LTE band 12, 3MHz Bandwidth, 16QAM (99% BW)