



TEST REPORT

No. I18N00930-LTE

for

Yulong Computer Telecommunication Scientific (Shenzhen) Co., Ltd

Mobile Hotspot

Model Name: cp331A

FCC ID: R38YLCP331A

with

Hardware Version: P1

Software Version: 2.0.158.P0.180824.cp331A

Issued Date: 2018-09-07

Note:

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

Test Laboratory:

Designation Number: CN1210

SAICT, Shenzhen Academy of Information and Communications Technology

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REPORT HISTORY

Report Number	Revision	Description	Issue Date
I18N00930-LTE	Rev.0	1 st edition	2018-09-07

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1. Test Laboratory**1.1. Testing Location**

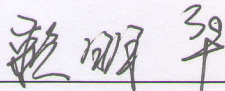
Company Name: Shenzhen Academy of Information and Communications
Technology
Address: Building G, Shenzhen International Innovation Center, No.1006
Shennan Road, Futian District, Shenzhen, Guangdong, P. R. China
Postal Code: 518026
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1.2. Testing Environment

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

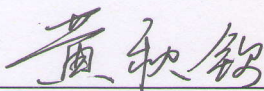
1.3. Project data

Testing Start Date: 2018-08-03
Testing End Date: 2018-08-14

1.4. Signature

Lai Minghua

(Prepared this test report)



Huang Qiugin

(Reviewed this test report)



Zhang Hao

(Approved this test report)

2. Client Information

2.1. Applicant Information

Company Name: Yulong Computer Telecommunication Scientific (Shenzhen) Co., Ltd
Address /Post: Coolpad Information Harbor, High-tech Industrial Park (North),
Nanshan District, Shenzhen, P.R.C.
Contact Person: chen yanting
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2.2. Manufacturer Information

Company Name: Yulong Computer Telecommunication Scientific (Shenzhen) Co., Ltd
Address /Post: Coolpad Information Harbor, High-tech Industrial Park (North),
Nanshan District, Shenzhen, P.R.C.
Contact Person: chen yanting
Contact Email: chenyanting@yulong.com
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3. Equipment Under Test (EUT) and Ancillary Equipment (AE)

3.1. About EUT

Description	Mobile Hotspot
Model Name	cp331A
FCC ID	R38YLCP331A
Frequency Bands	LTE Band 2,4,12,66,71
Antenna	Integrated
Extreme vol. Limits	3.6VDC to 4.4VDC (nominal: 3.85VDC)
Extreme temp. Tolerance	-30°C to +50°C
Condition of EUT as received	No abnormality in appearance

3.2. Internal Identification of EUT used during the test

EUT ID*	IMEI	HW Version	SW Version	Sample Arrival Date
UT02ab	860006040001402	P1	2.0.158.P0.180824.c p331A	2018-07-30

*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

AE1	Battery
AE2	Charger

AE1

Model	/
Manufacturer	/
Capacitance	/

AE2

Model	/
Manufacturer	/

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

3.4. General Description

The Equipment Under Test (EUT) is a model TD-LTE mobile phone with integrated antenna. It consists of normal options: lithium battery, charger. Manual and specifications of the EUT were provided to fulfil the test.

4. Reference Documents

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

Reference	Title	Version
FCC Part 24	PERSONAL COMMUNICATIONS SERVICES	10-1-17 Edition
FCC Part 2	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS	10-1-17 Edition
FCC Part 27	MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES	10-1-17 Edition
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 Service	2015

5. LABORATORY ENVIRONMENT

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

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

Fully-anechoic chamber did not exceed following limits along the EMC testing

Temperature	Min. = 15 °C, Max. = 35 °C
Relative humidity	Min. = 15 %, Max. = 75 %
Shielding effectiveness	0.014MHz-1MHz> 60 dB; 1MHz-18000MHz>90 dB
Electrical insulation	> 2MΩ
Ground system resistance	< 4 Ω
Voltage Standing Wave Ratio (VSWR)	≤ 6 dB, from 1 to 18 GHz, 3 m distance
Uniformity of field strength	Between 0 and 6 dB, from 80 to 6000 MHz

6. SUMMARY OF TEST RESULTS

Abbreviations used in this clause:		
Verdict Column	P	Pass
	F	Fail
	NA	Not applicable
	NM	Not measured
Location Column	A/B/C/D	The test is performed in test location A, B, C or D which are described in section 1.1 of this report

LTE Band 2

Items	Test Name	Clause in FCC rules	Section in this report	Verdict
1	Output Power	2.1046/24.232	A.1	P
2	Frequency Stability	2.1055/24.235	A.2	P
3	Occupied Bandwidth	2.1049/24.238	A.3	P
4	Emission Bandwidth	2.1049/24.238	A.4	P
5	Band Edge Compliance	2.1051/24.238	A.5	P
6	Conducted Spurious Emission	2.1051/24.238	A.6	P
7	Peak to Average Power Ratio	24.232	A.7	P
*8	Radiated Results	2.1053/24.232/24.238	ANNEX B	P

* mean radiated data refer to report No.BL-SZ1880381-501

LTE Band 4

Items	Test Name	Clause in FCC rules	Section in this report	Verdict
1	Output Power	2.1046/27.50(d)	A.1	P
2	Frequency Stability	2.1055/27.54	A.2	P
3	Occupied Bandwidth	2.1049/27.53(g)	A.3	P
4	Emission Bandwidth	2.1049/27.53(g)	A.4	P
5	Band Edge Compliance	2.1051/27.53(h)	A.5	P
6	Conducted Spurious Emission	2.1051/27.53(h)	A.6	P
7	Peak to Average Power Ratio	27.50(d)	A.7	P
*8	Radiated Results	2.1053/27.50(d)/27.53(h)	ANNEX B	P

* mean radiated data refer to report No.BL-SZ1880381-501

LTE Band 12

Items	Test Name	Clause in FCC rules	Section in this report	Verdict
1	Output Power	2.1046/27.50(c)	A.1	P
2	Frequency Stability	2.1055/27.54	A.2	P
3	Occupied Bandwidth	2.1049/27.53(g)	A.3	P
4	Emission Bandwidth	2.1049/27.53(g)	A.4	P
5	Band Edge Compliance	2.1051/27.53(g)	A.5	P
6	Conducted Spurious Emission	2.1051/27.53(g)	A.6	P
7	Peak to Average Power Ratio	27.50(a)	A.7	P
*8	Radiated Results	2.1053/27.50(c)/27.53(g)	ANNEX B	P

* mean radiated data refer to report No.BL-SZ1880381-501

LTE Band 66

Items	Test Name	Clause in FCC rules	Section in this report	Verdict
1	Output Power	2.1046/27.50(d)	A.1	P
2	Frequency Stability	2.1055/27.54	A.2	P
3	Occupied Bandwidth	2.1049/27.53(h)	A.3	P
4	Emission Bandwidth	2.1049/27.53(h)	A.4	P
5	Band Edge Compliance	2.1051/27.53(h)	A.5	P
6	Conducted Spurious Emission	2.1051/27.53(h)	A.6	P
7	Peak to Average Power Ratio	27.50(a)	A.7	P
*8	Radiated Results	2.1053/27.50(d)/27.53(h)	ANNEX B	P

* mean radiated data refer to report No.BL-SZ1880381-501

LTE Band 71

Items	Test Name	Clause in FCC rules	Section in this report	Verdict
1	Output Power	2.1046/27.50(c)	A.1	P
2	Frequency Stability	2.1055/27.54	A.2	P
3	Occupied Bandwidth	2.1049/27.53(g)	A.3	P
4	Emission Bandwidth	2.1049/27.53(g)	A.4	P
5	Band Edge Compliance	2.1051/27.53(g)	A.5	P
6	Conducted Spurious Emission	2.1051/27.53(g)	A.6	P
7	Peak to Average Power Ratio	27.50(a)	A.7	P
*8	Radiated Results	2.1053/27.50(c)/27.53(g)	ANNEX B	P

* mean radiated data refer to report No.BL-SZ1880381-501

7. Test Equipments Utilized

NO.	Description	TYPE	Manufacture	series number	CAL DUE DATE
1	Universal Radio Communication Tester	CMW500	R&S	129146	2019-04-24
2	Spectrum Analyzer	FSU	R&S	200679	2018-12-13
3	Temperature Chamber	SH-241	ESPECs	92007516	2018-11-14
4	DC Power Supply	U3606A	Agilent Technologies	MY50450012	2018-11-14

ANNEX A: MEASUREMENT RESULTS

A.1 OUTPUT POWER

Reference

FCC: CFR Part 2.1046, 24.232, 27.50

A.1.1 Summary

During the process of testing, the EUT was controlled via Rhode & Schwarz Digital Radio Communication tester (CMW500) to ensure max power transmission and proper modulation.

This result contains peak output power and ERP/EIRP measurements for the EUT. In all cases, output power is within the specified limits.

The radiated results are tested by Shenzhen BALUN Technology Co., Ltd. Address Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen Guangdong Province, P.R.C. The results of radiated please see Annex B, that the partial report issued by Shenzhen BALUN Technology Co., Ltd and report No.BL-SZ1880381-501

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	1909.3	23.20	22.25
		1880.0	23.56	22.78
		1850.7	23.39	22.47
	1 RB low	1909.3	23.28	22.39
		1880.0	23.44	22.62
		1850.7	23.37	22.32
	50% RB mid	1909.3	23.15	22.21
		1880.0	23.44	22.43
		1850.7	23.48	22.51
	100% RB	1909.3	22.17	21.34
		1880.0	22.38	21.37
		1850.7	22.29	21.29
3MHz	1 RB high	1908.5	23.22	21.99
		1880.0	23.15	22.34
		1851.5	23.33	22.49
	1 RB low	1908.5	23.27	22.02

		1880.0	23.30	22.50
		1851.5	23.39	22.39
		1908.5	22.19	21.26
	50% RB mid	1880.0	22.19	21.33
		1851.5	22.35	21.49
		1908.5	22.17	21.31
	100% RB	1880.0	22.16	21.26
		1851.5	22.30	21.41
		1908.5	22.17	21.31
5MHz	1 RB high	1907.5	23.15	22.01
		1880.0	23.33	22.57
		1852.5	23.50	22.24
	1 RB low	1907.5	23.19	21.79
		1880.0	23.37	22.69
		1852.5	23.42	22.02
	50% RB mid	1907.5	22.17	21.27
		1880.0	22.30	21.19
		1852.5	22.37	21.38
	100% RB	1907.5	22.20	21.33
		1880.0	22.32	21.34
		1852.5	22.25	21.39
10MHz	1 RB high	1905.0	23.23	22.15
		1880.0	23.46	22.68
		1855.0	23.15	22.22
	1 RB low	1905.0	23.05	22.12
		1880.0	23.11	22.42
		1855.0	23.06	22.11
	50% RB mid	1905.0	22.18	21.27
		1880.0	22.44	21.51
		1855.0	22.37	21.42
	100% RB	1905.0	22.11	21.17
		1880.0	22.21	21.27
		1855.0	22.28	21.33
15MHz	1 RB high	1902.5	22.88	22.16
		1880.0	23.42	22.64
		1857.5	22.86	22.18
	1 RB low	1902.5	23.47	22.34
		1880.0	23.11	22.55
		1857.5	23.00	22.35
	50% RB mid	1902.5	22.13	21.35
		1880.0	22.44	21.54

	100% RB	1857.5	22.52	21.60
		1902.5	22.21	21.22
		1880.0	22.25	21.27
		1857.5	22.32	21.37
20MHz	1 RB high	1900.0	23.01	22.82
		1880.0	23.64	22.32
		1860.0	23.16	22.77
	1 RB low	1900.0	23.59	23.18
		1880.0	23.39	22.39
		1860.0	23.57	23.17
	50% RB mid	1900.0	22.29	21.33
		1880.0	22.38	21.39
		1860.0	22.43	21.43
	100% RB	1900.0	22.18	21.23
		1880.0	22.23	21.26
		1860.0	22.19	21.25

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

LTE band 4

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
1.4MHz	1 RB high	1754.3	23.33	21.86
		1732.5	23.56	22.63
		1710.7	23.41	22.51
	1 RB low	1754.3	23.28	22.37
		1732.5	23.45	22.22
		1710.7	23.36	22.27
	50% RB mid	1754.3	23.20	21.88
		1732.5	23.17	22.20
		1710.7	23.28	22.28
	100% RB	1754.3	21.99	20.99
		1732.5	22.08	21.08
		1710.7	22.16	21.15
3MHz	1 RB high	1753.5	23.36	21.73
		1732.5	22.90	22.59
		1711.5	23.17	22.07
	1 RB low	1753.5	22.94	22.29
		1732.5	23.35	23.23
		1711.5	23.09	21.89
	50% RB mid	1753.5	21.82	21.10
		1732.5	22.11	21.17
		1711.5	22.14	21.06
	100% RB	1753.5	21.92	20.91
		1732.5	22.09	21.21
		1711.5	22.02	20.94
5MHz	1 RB high	1752.5	23.06	22.04
		1732.5	23.10	22.75
		1712.5	23.16	21.97
	1 RB low	1752.5	22.83	21.89
		1732.5	23.51	22.75
		1712.5	23.01	21.94
	50% RB mid	1752.5	21.94	21.01
		1732.5	22.20	21.28
		1712.5	22.19	21.20
	100% RB	1752.5	22.12	21.13
		1732.5	22.15	21.36
		1712.5	22.15	21.27
10MHz	1 RB high	1750.0	23.01	22.25
		1732.5	23.05	22.57

	1 RB low	1715.0	23.25	21.55
		1750.0	23.21	21.89
		1732.5	23.16	22.69
		1715.0	22.90	21.96
	50% RB mid	1750.0	22.01	21.21
		1732.5	22.15	21.25
		1715.0	22.16	21.16
	100% RB	1750.0	21.96	21.14
		1732.5	22.22	21.37
		1715.0	22.13	21.19
15MHz	1 RB high	1747.5	22.89	22.28
		1732.5	22.94	22.19
		1717.5	23.04	22.09
	1 RB low	1747.5	23.09	22.36
		1732.5	22.87	22.32
		1717.5	22.93	22.19
	50% RB mid	1747.5	22.10	21.12
		1732.5	22.27	21.39
		1717.5	22.24	21.36
	100% RB	1747.5	21.94	21.08
		1732.5	22.08	21.16
		1717.5	22.05	21.19
20MHz	1 RB high	1745.0	22.81	22.76
		1732.5	23.29	22.21
		1720.0	22.88	22.38
	1 RB low	1745.0	23.40	23.10
		1732.5	23.15	21.96
		1720.0	22.67	22.15
	50% RB mid	1745.0	22.16	21.13
		1732.5	22.11	21.15
		1720.0	22.03	21.05
	100% RB	1745.0	21.97	21.11
		1732.5	22.06	21.16
		1720.0	22.03	21.14

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

LTE band 12

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
1.4MHz	1 RB high	715.3	23.31	22.17
		707.5	23.24	22.08
		699.7	23.62	22.39
	1 RB low	715.3	23.17	21.94
		707.5	23.18	21.63
		699.7	23.45	22.46
	50% RB mid	715.3	23.26	21.93
		707.5	23.26	22.26
		699.7	23.18	22.29
	100% RB	715.3	22.30	20.93
		707.5	22.27	21.07
		699.7	22.23	20.96
3MHz	1 RB high	714.5	23.59	22.33
		707.5	23.10	22.27
		700.5	23.05	22.19
	1 RB low	714.5	23.27	22.07
		707.5	23.19	22.38
		700.5	23.12	22.08
	50% RB mid	714.5	22.06	21.12
		707.5	22.19	21.30
		700.5	22.30	21.51
	100% RB	714.5	22.13	21.13
		707.5	22.14	21.19
		700.5	22.24	21.39
5MHz	1 RB high	713.5	23.24	21.90
		707.5	22.98	22.31
		701.5	23.35	22.41
	1 RB low	713.5	23.07	22.23
		707.5	23.04	22.78
		701.5	23.28	21.90
	50% RB mid	713.5	22.05	21.14
		707.5	22.12	21.19
		701.5	22.12	21.28
	100% RB	713.5	22.07	21.25
		707.5	22.00	21.16
		701.5	22.13	21.31
10MHz	1 RB high	711.0	23.24	22.03

		707.5	23.08	22.32
		704.0	23.21	22.34
	1 RB low	711.0	23.15	21.92
		707.5	23.08	22.71
		704.0	23.02	21.96
	50% RB mid	711.0	22.17	21.14
		707.5	22.15	21.11
		704.0	22.17	21.14
	100% RB	711.0	22.07	21.19
		707.5	22.01	21.15
		704.0	22.06	20.96

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

LTE band 66

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
1.4MHz	1 RB high	1779.3	23.40	22.28
		1745.0	23.51	22.34
		1710.7	23.16	22.09
	1 RB low	1779.3	23.28	22.60
		1745.0	23.44	22.69
		1710.7	23.34	22.64
	50% RB mid	1779.3	23.47	22.27
		1745.0	23.73	22.81
		1710.7	23.23	22.06
	100% RB	1779.3	22.39	21.31
		1745.0	22.55	21.49
		1710.7	22.21	21.23
3MHz	1 RB high	1778.5	23.77	22.63
		1745.0	23.60	22.73
		1711.5	23.15	22.09
	1 RB low	1778.5	23.63	21.99
		1745.0	23.65	23.07
		1711.5	23.12	22.17
	50% RB mid	1778.5	22.51	21.42
		1745.0	22.57	21.68
		1711.5	22.27	21.37
	100% RB	1778.5	22.48	21.54
		1745.0	22.53	21.60
		1711.5	22.20	21.27
5MHz	1 RB high	1777.5	23.43	22.26
		1745.0	23.44	22.74
		1712.5	23.14	22.23
	1 RB low	1777.5	23.43	22.26
		1745.0	23.43	22.73
		1712.5	23.19	22.26
	50% RB mid	1777.5	22.56	21.58
		1745.0	22.56	21.65
		1712.5	22.28	21.46
	100% RB	1777.5	22.51	21.69
		1745.0	22.54	21.63
		1712.5	22.33	21.43
10MHz	1 RB high	1775.0	23.42	22.45
		1745.0	23.55	23.05

	1 RB low	1715.0	23.33	22.21
		1775.0	23.22	22.14
		1745.0	23.66	23.25
		1715.0	23.11	22.17
	50% RB mid	1775.0	22.52	21.59
		1745.0	22.65	21.72
		1715.0	22.41	21.48
	100% RB	1775.0	22.38	21.41
		1745.0	22.52	21.56
		1715.0	22.35	21.38
15MHz	1 RB high	1772.5	23.28	22.65
		1745.0	23.54	23.42
		1717.5	23.23	22.54
	1 RB low	1772.5	23.27	22.39
		1745.0	23.58	23.26
		1717.5	23.17	22.34
	50% RB mid	1772.5	22.59	21.78
		1745.0	22.73	21.80
		1717.5	22.43	21.50
	100% RB	1772.5	22.32	21.36
		1745.0	22.38	21.46
		1717.5	22.32	21.36
20MHz	1 RB high	1770.0	23.75	23.47
		1745.0	23.70	22.70
		1720.0	23.28	22.62
	1 RB low	1770.0	23.27	23.14
		1745.0	23.58	22.64
		1720.0	23.28	22.95
	50% RB mid	1770.0	22.49	21.55
		1745.0	22.63	21.64
		1720.0	22.32	21.30
	100% RB	1770.0	22.38	21.39
		1745.0	22.39	21.45
		1720.0	22.32	21.33

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

LTE band 71

Bandwidth	RB size/offset	Frequency (MHz)	Power(dBm)	
			QPSK	16QAM
5MHz	1 RB high	695.5	23.11	22.16
		680.5	23.21	21.96
		665.5	23.07	21.93
	1 RB low	695.5	23.16	22.06
		680.5	23.32	21.68
		665.5	23.17	22.12
	50% RB mid	695.5	22.68	21.72
		680.5	22.46	21.37
		665.5	22.54	21.56
	100% RB	695.5	22.36	21.42
		680.5	22.51	21.53
		665.5	22.44	21.49
10MHz	1 RB high	693	23.45	22.81
		680.5	23.34	22.74
		668	23.27	22.65
	1 RB low	693	23.48	22.64
		680.5	23.35	22.76
		668	23.38	22.72
	50% RB mid	693	22.64	21.66
		680.5	22.46	21.52
		668	22.58	21.56
	100% RB	693	22.46	21.51
		680.5	22.51	21.55
		668	22.58	21.52
15MHz	1 RB high	690.5	23.56	22.81
		680.5	23.28	22.78
		670.5	23.41	22.66
	1 RB low	690.5	23.28	22.75
		680.5	23.48	22.92
		670.5	23.39	22.77
	50% RB mid	690.5	22.65	21.58
		680.5	22.43	21.36
		670.5	22.51	21.33
	100% RB	690.5	22.39	21.48
		680.5	22.42	21.53
		670.5	22.26	21.46
20MHz	1 RB high	688	23.46	22.79

		680.5	23.59	22.94
		673	23.38	22.75
	1 RB low	688	23.36	22.63
		680.5	23.12	22.73
		673	23.44	22.55
	50% RB mid	688	22.58	21.66
		680.5	22.46	21.56
		673	22.64	21.71
	100% RB	688	22.51	21.68
		680.5	22.41	21.61
		673	22.35	21.51

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

A.2 FREQUENCY STABILITY

Reference

FCC: CFR Part 2.1055, 24.235, 27.54.

A.2.1 Method of Measurement

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

1. Measure the carrier frequency at room temperature.
2. Subject the EUT to overnight soak at -30°C.
3. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on middle channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
4. Repeat the above measurements at 10°C increments from -30°C to +50°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
5. Re-measure carrier frequency at room temperature with nominal voltage. Vary supply voltage from minimum voltage to maximum voltage, in 0.1Volt increments re-measuring carrier frequency at each voltage. Pause at nominal voltage for 1.5 hours unpowered, to allow any self-heating to stabilize, before continuing.
6. Subject the EUT to overnight soak at +50°C.
7. With the EUT, powered via nominal voltage, connected to the CMW500 and in a simulated call on the centre channel, measure the carrier frequency. These measurements should be made within 2 minutes of Powering up the EUT, to prevent significant self-warming.
8. Repeat the above measurements at 10 °C increments from +50°C to -30°C. Allow at least 1.5 hours at each temperature, unpowered, before making measurements.
9. At all temperature levels hold the temperature to +/- 0.5°C during the measurement procedure.

A.2.2 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 4.4VDC, with a nominal voltage of 3.85VDC. Operation above or below these voltage limits is prohibited by transceiver software in order to prevent improper operation as well as to protect components from overstress. These voltages represent a tolerance from -5.4% to 10.8%. For the purposes of measuring frequency stability these voltage limits are to be used.

A.2.3 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	21	33	0.011	0.018
3.85	6	27	0.003	0.014
4.4	11	36	0.006	0.019

Frequency Error vs Temperature

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
-30	13	44	0.007	0.023
-20	2	15	0.001	0.008
-10	5	28	0.003	0.015
0	14	44	0.007	0.023
10	18	23	0.010	0.012
20	25	35	0.013	0.019
30	6	19	0.003	0.010
40	11	25	0.006	0.013
50	7	7	0.004	0.004

Expanded measurement uncertainty is 10 Hz, $k = 2$

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	8	19	0.005	0.011
3.85	15	5	0.009	0.003
4.4	22	4	0.013	0.002

Frequency Error vs Temperature

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
-30	4	15	0.002	0.009
-20	17	28	0.010	0.016
-10	28	56	0.016	0.032
0	55	43	0.032	0.025
10	46	21	0.027	0.012
20	35	15	0.020	0.009
30	4	3	0.002	0.002
40	2	9	0.001	0.005
50	18	18	0.010	0.010

Expanded measurement uncertainty is 10Hz, $k = 2$

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	22	11	0.031	0.016
3.85	5	25	0.007	0.035
4.4	14	18	0.020	0.025

Frequency Error vs Temperature

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
-30	27	6	0.038	0.008
-20	45	4	0.064	0.006
-10	12	28	0.017	0.040
0	18	54	0.025	0.076
10	47	15	0.066	0.021
20	66	3	0.093	0.004
30	35	14	0.049	0.020
40	2	12	0.003	0.017
50	19	7	0.027	0.010

Expanded measurement uncertainty is 10Hz, k = 2

LTE Band 66, 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	27	22	0.015	0.013
3.85	18	3	0.010	0.002
4.4	54	16	0.031	0.009

Frequency Error vs Temperature

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
-30	41	36	0.023	0.021
-20	38	25	0.022	0.014
-10	49	14	0.028	0.008
0	56	17	0.032	0.010
10	17	48	0.010	0.028
20	18	26	0.010	0.015
30	59	35	0.034	0.020
40	25	32	0.014	0.018
50	38	14	0.022	0.008

Expanded measurement uncertainty is 10Hz, k = 2

LTE Band 71, 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	11	22	0.016	0.032
3.85	14	26	0.021	0.038
4.4	12	37	0.018	0.054

Frequency Error vs Temperature

Temperature (°C)	Frequency error (Hz)		Frequency error (ppm)	
	QPSK	16QAM	QPSK	16QAM
-30	33	36	0.048	0.053
-20	26	29	0.038	0.043
-10	15	56	0.022	0.082
0	24	64	0.035	0.094
10	8	61	0.012	0.090
20	6	35	0.009	0.051
30	4	28	0.006	0.041
40	17	55	0.025	0.081
50	22	47	0.032	0.069

Expanded measurement uncertainty is 10Hz, k = 2

A.3 OCCUPIED BANDWIDTH

Reference

FCC: CFR Part 2.1049, 24.238, 27.53.

A.3.1 Occupied Bandwidth Results

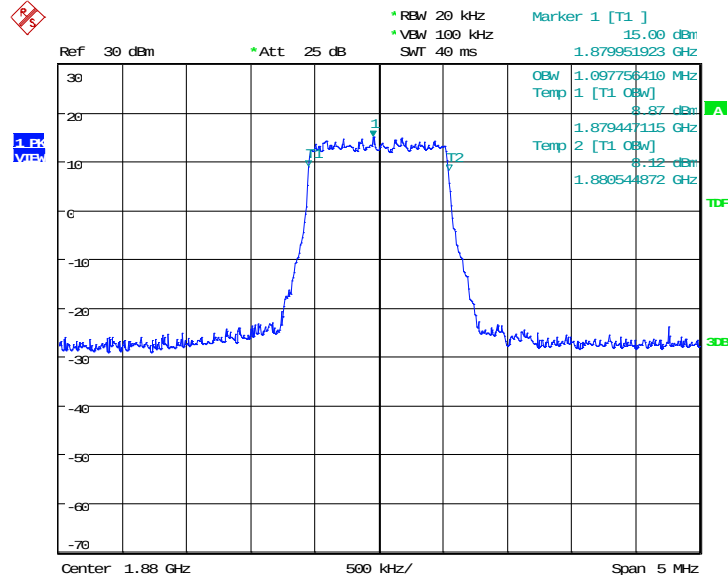
Occupied bandwidth measurements are only provided for selected frequencies in order to reduce the amount of submitted data. Data were taken at the extreme and mid frequencies of the US Cellular/PCS frequency bands. The table below lists the measured 99% BW. Spectrum analyzer plots are included on the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

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

LTE band 2, 1.4MHz (99%)

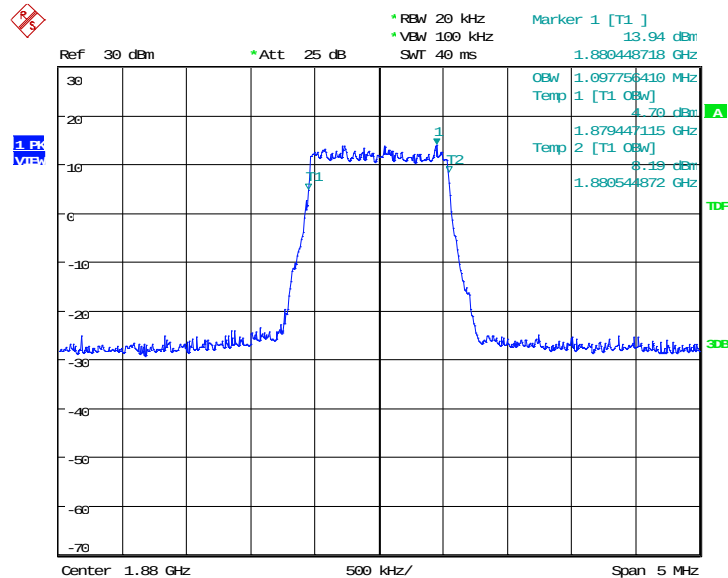
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
1880.0	QPSK	16QAM
	1097.76	1097.76

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



Date: 31.JUL.2018 10:47:54

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

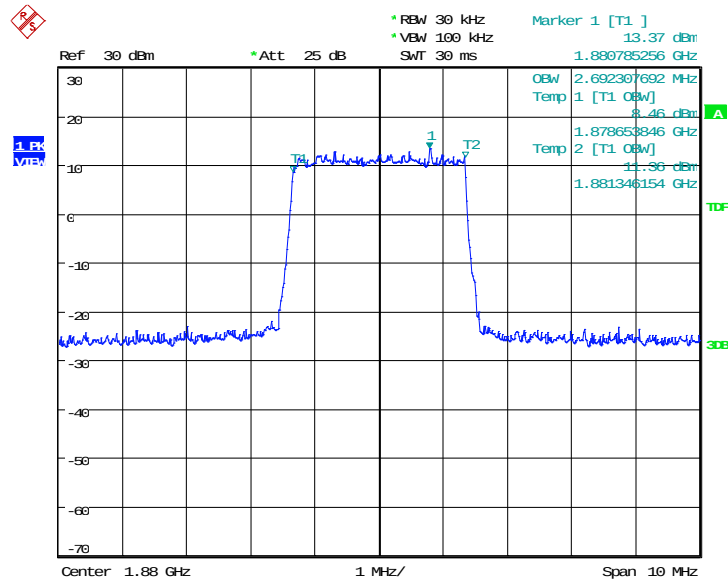


Date: 31.JUL.2018 10:48:08

LTE band 2, 3MHz (99%)

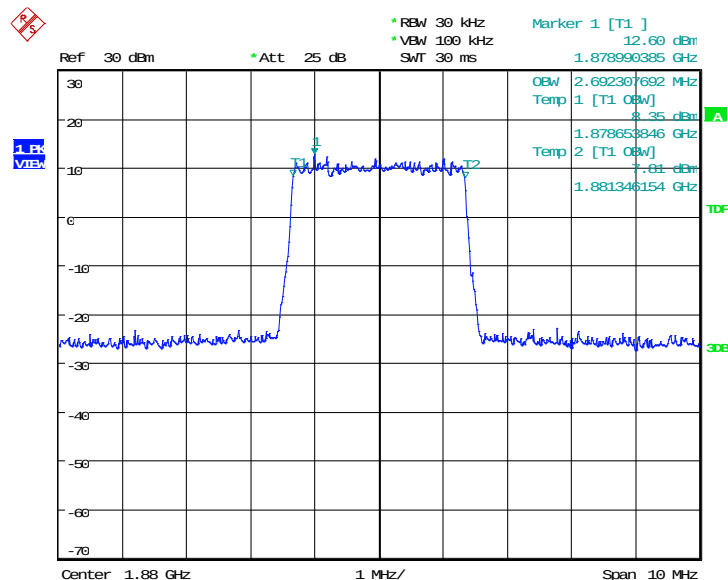
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
1880.0	QPSK	16QAM
	2692.31	2692.31

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



Date: 31.JUL.2018 10:52:14

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

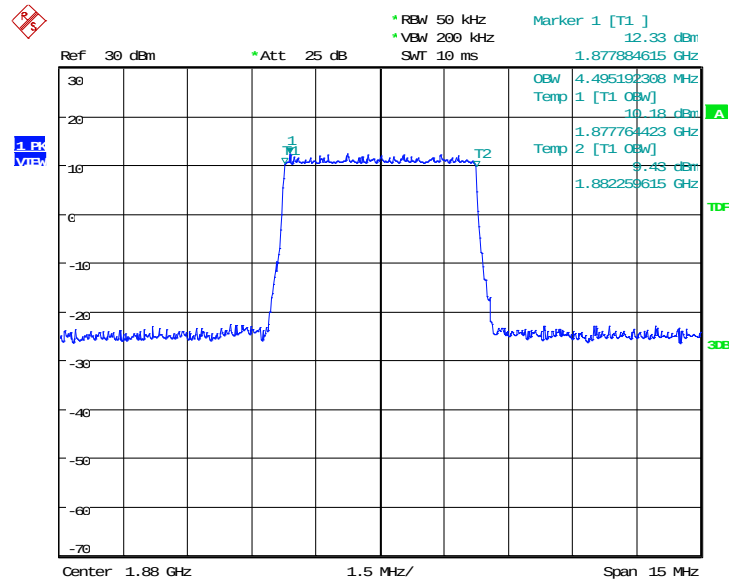


Date: 31.JUL.2018 10:52:28

LTE band 2, 5MHz (99%)

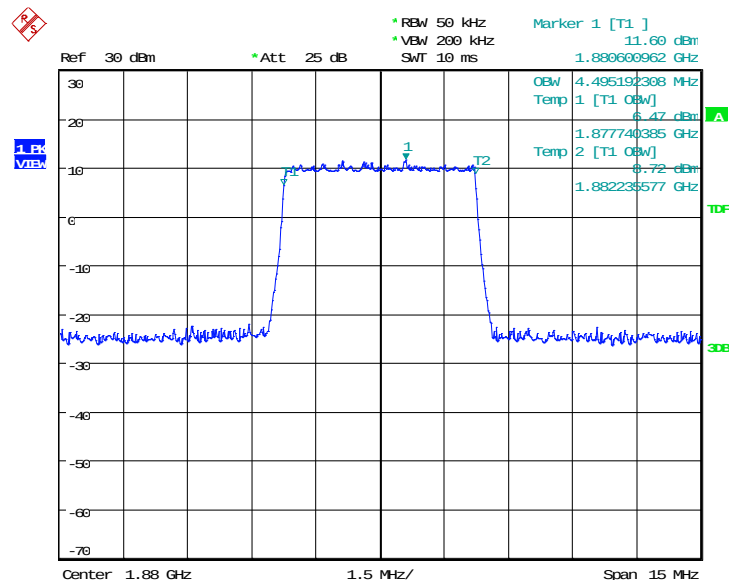
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
1880.0	QPSK	16QAM
	4495.19	4495.19

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



Date: 31.JUL.2018 10:56:34

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

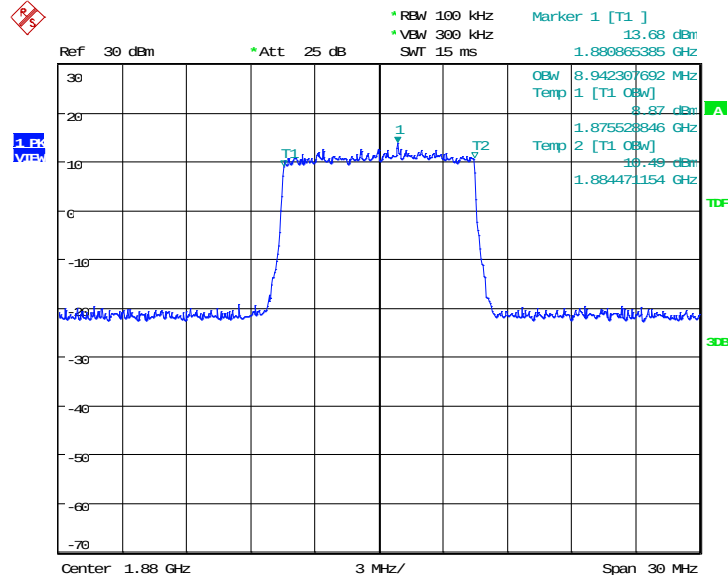


Date: 31.JUL.2018 10:56:48

LTE band 2, 10MHz (99%)

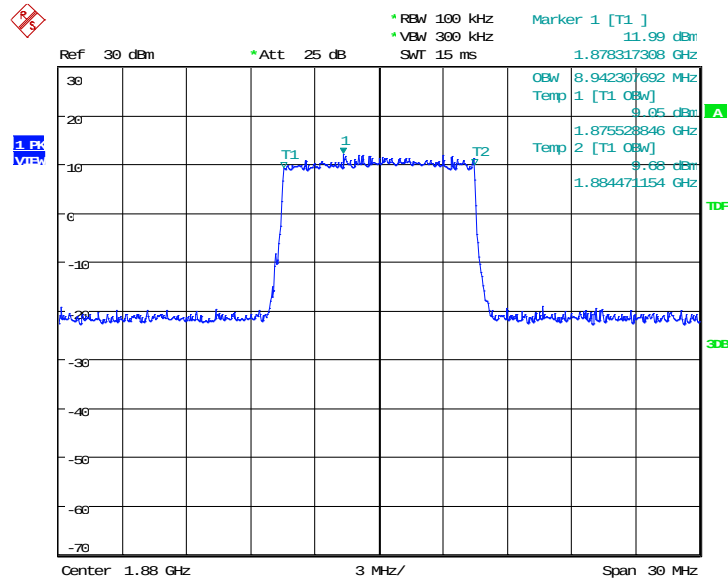
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
1880.0	QPSK	16QAM
	8942.31	8942.31

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



Date: 31.JUL.2018 11:00:52

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

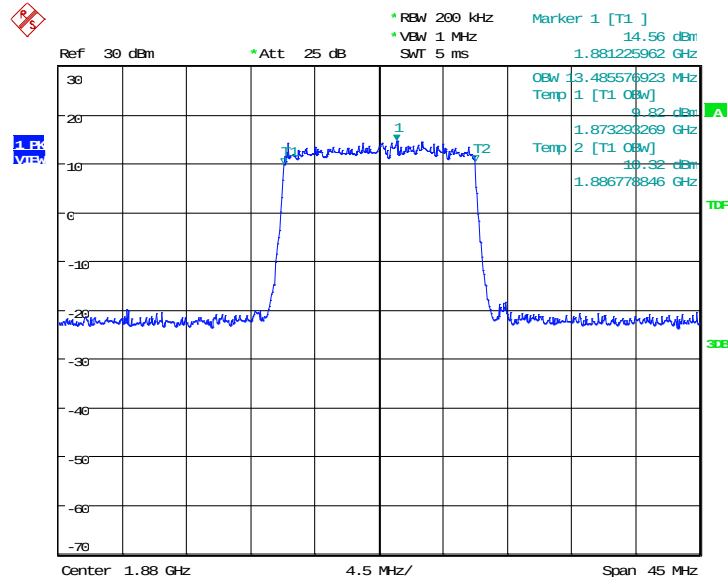


Date: 31.JUL.2018 11:01:05

LTE band 2, 15MHz (99%)

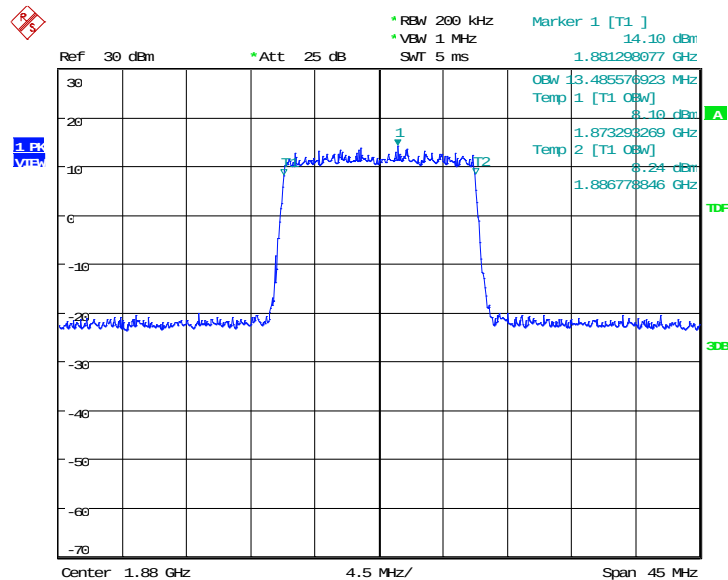
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
1880.0	QPSK	16QAM
	13485.58	13485.58

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



Date: 31.JUL.2018 11:05:10

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

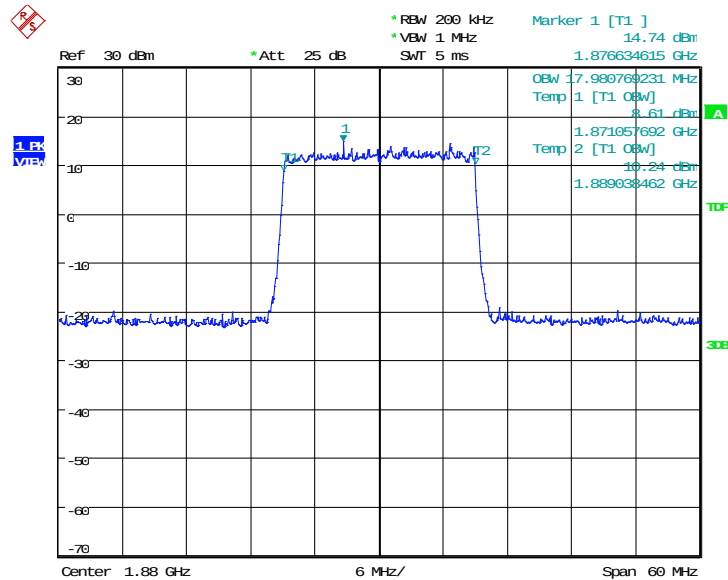


Date: 31.JUL.2018 11:05:24

LTE band 2, 20MHz (99%)

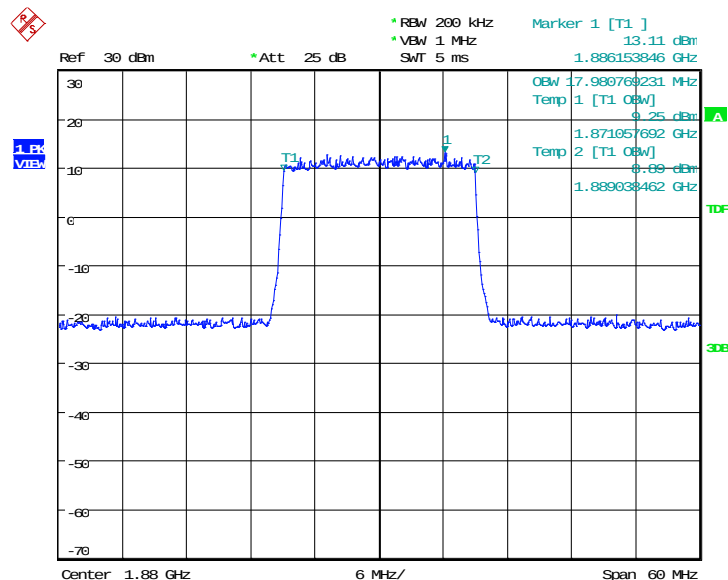
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
1880.0	QPSK	16QAM
	17980.77	17980.77

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



Date: 31.JUL.2018 11:09:30

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

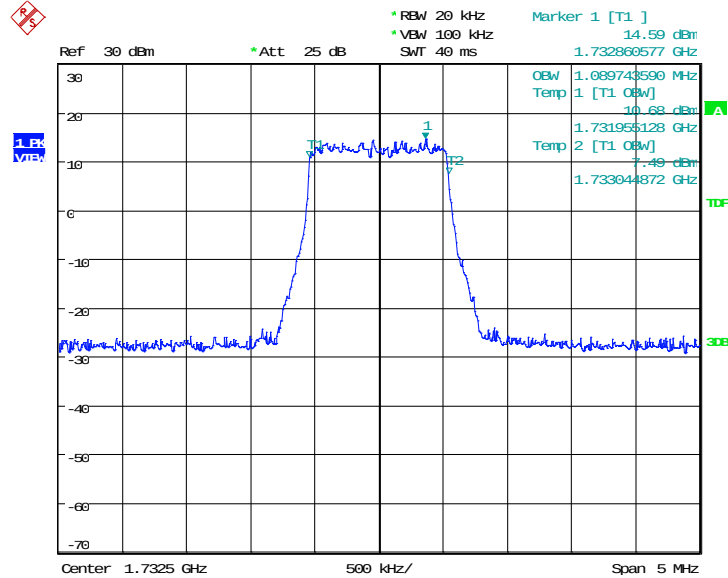


Date: 31.JUL.2018 11:09:44

LTE band 4, 1.4MHz (99%)

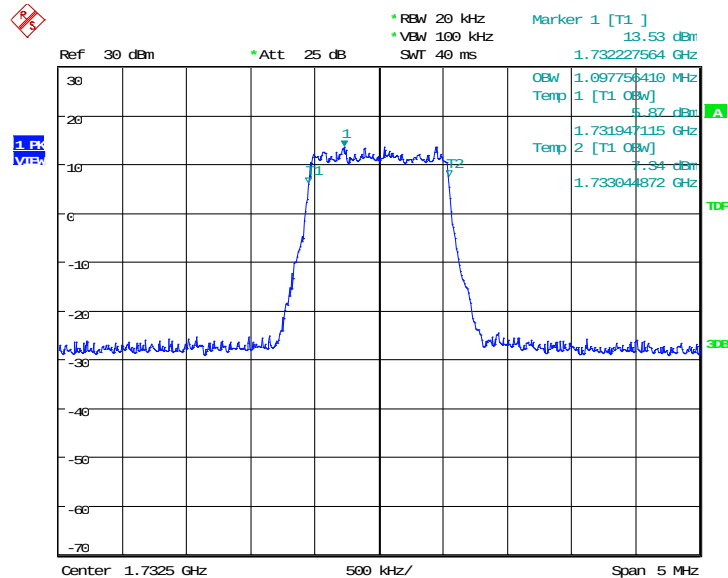
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
1732.5	QPSK	16QAM
	1089.74	1097.76

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



Date: 31.JUL.2018 11:13:52

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

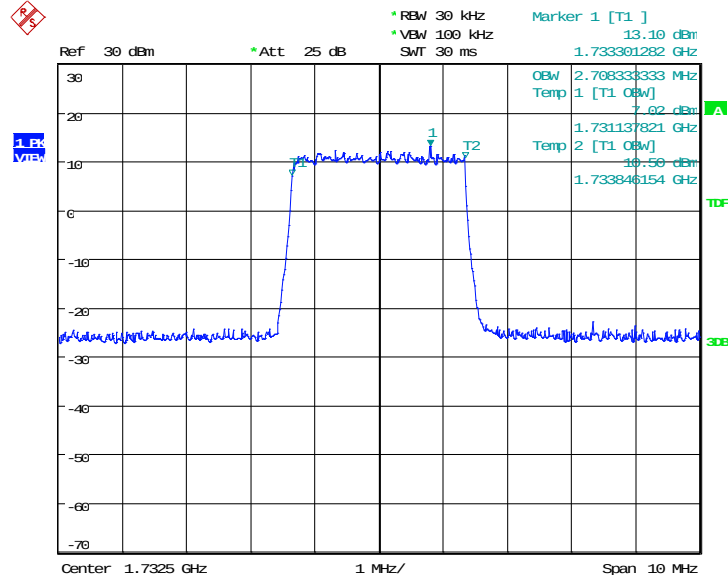


Date: 31.JUL.2018 11:14:06

LTE band 4, 3MHz (99%)

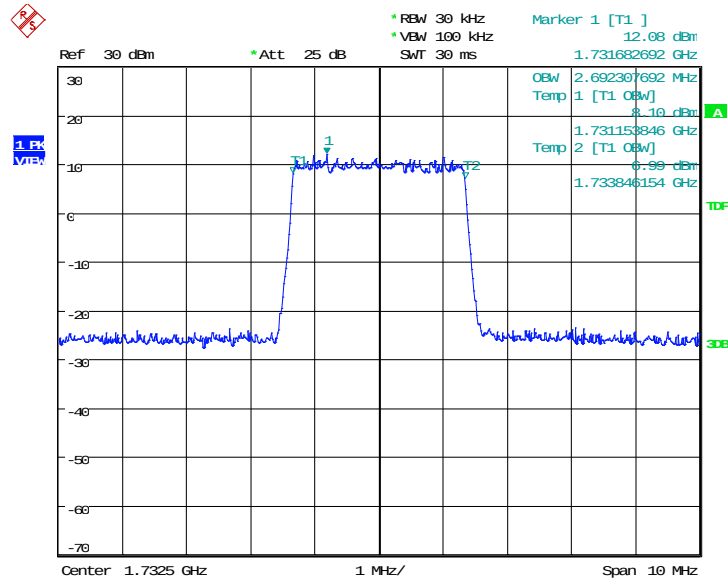
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
1732.5	QPSK	16QAM
	2708.33	2692.31

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



Date: 31.JUL.2018 11:18:10

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

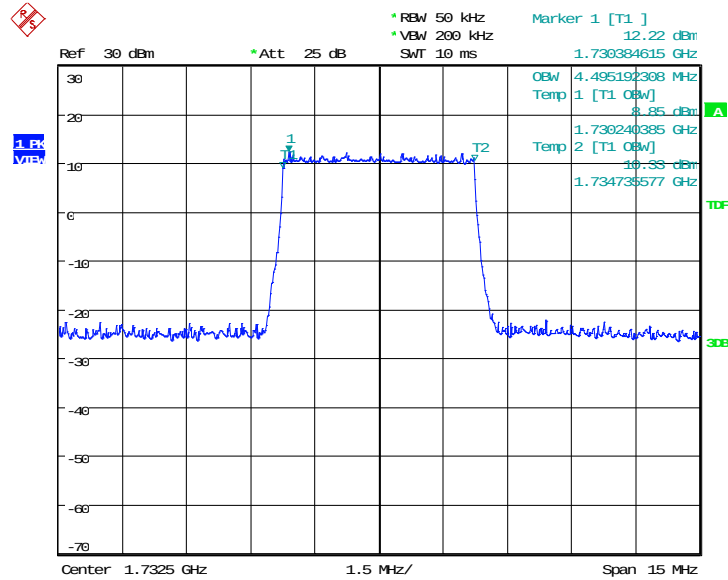


Date: 31.JUL.2018 11:18:24

LTE band 4, 5MHz (99%)

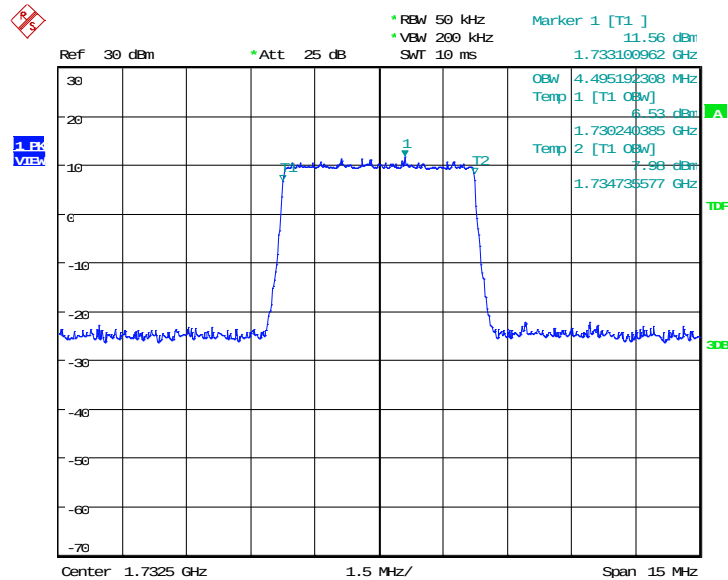
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
1732.5	QPSK	16QAM
	4495.19	4495.19

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



Date: 31.JUL.2018 11:22:28

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

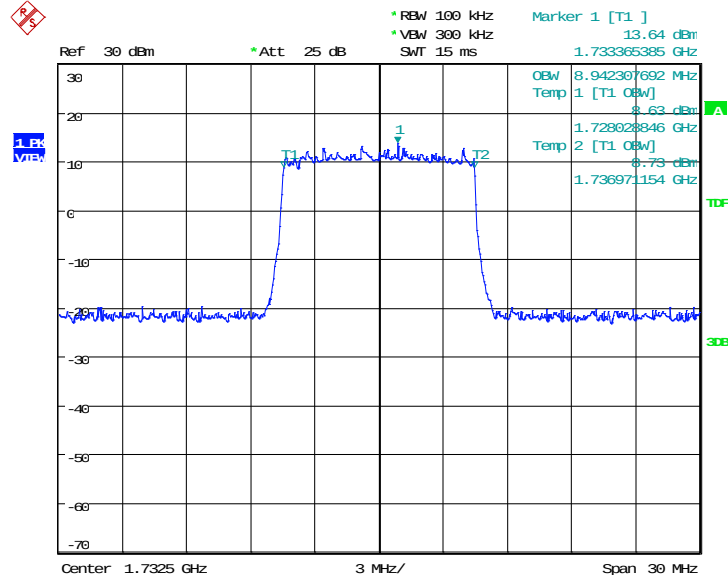


Date: 31.JUL.2018 11:22:42

LTE band 4, 10MHz (99%)

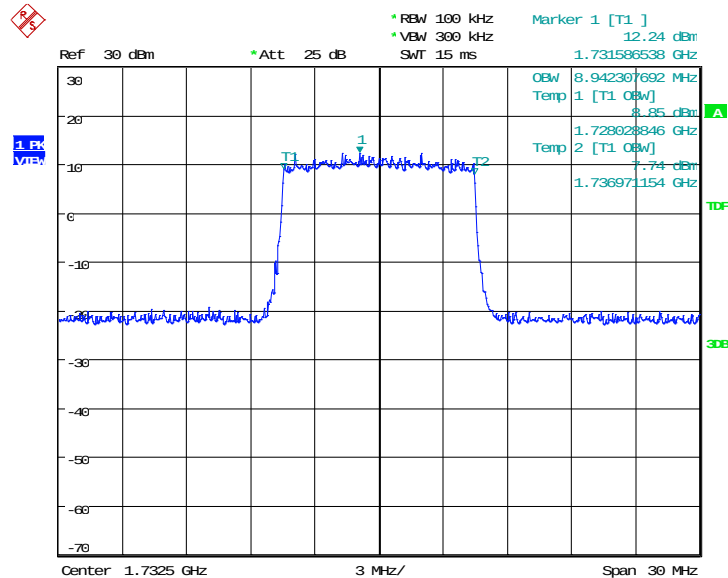
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
1732.5	QPSK	16QAM
	8942.31	8942.31

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



Date: 31.JUL.2018 11:26:49

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

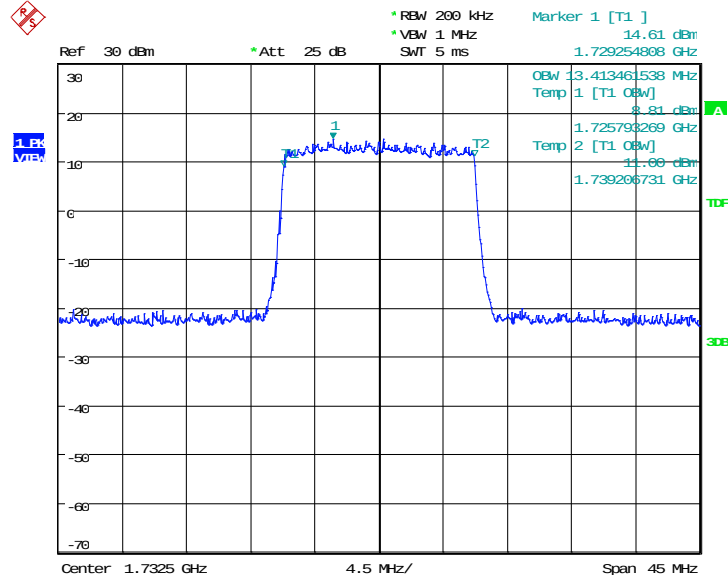


Date: 31.JUL.2018 11:27:02

LTE band 4, 15MHz (99%)

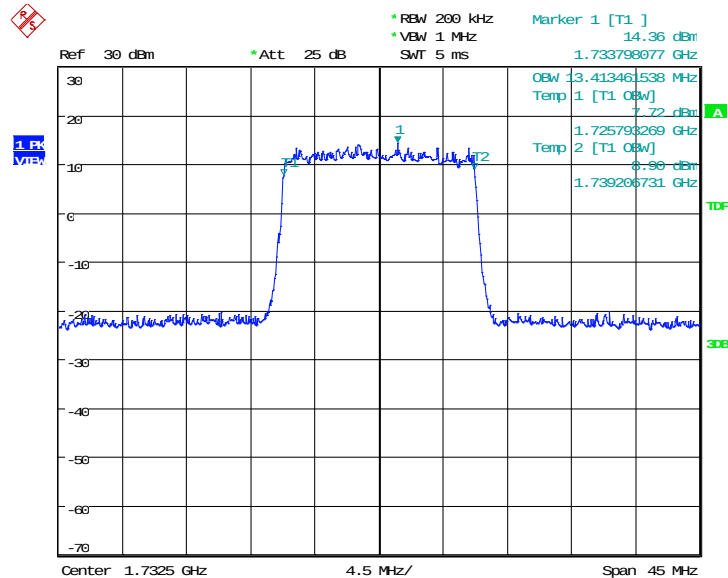
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
1732.5	QPSK	16QAM
	13413.46	13413.46

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



Date: 31.JUL.2018 11:31:07

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

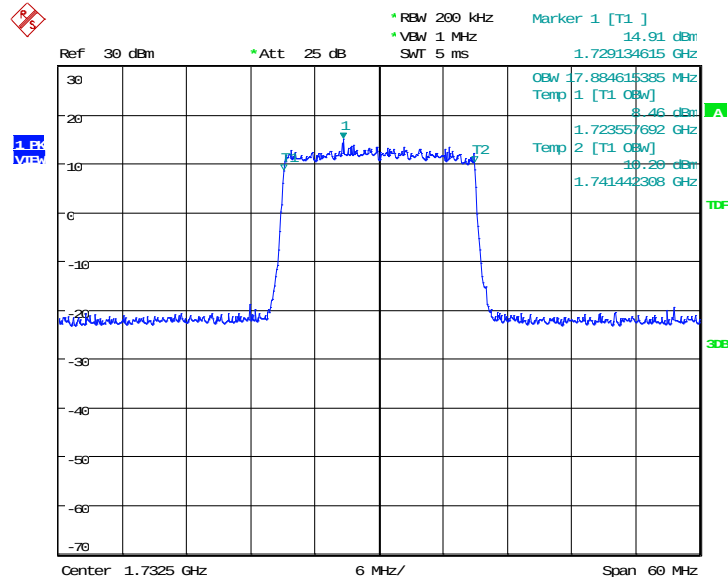


Date: 31.JUL.2018 11:31:21

LTE band 4, 20MHz (99%)

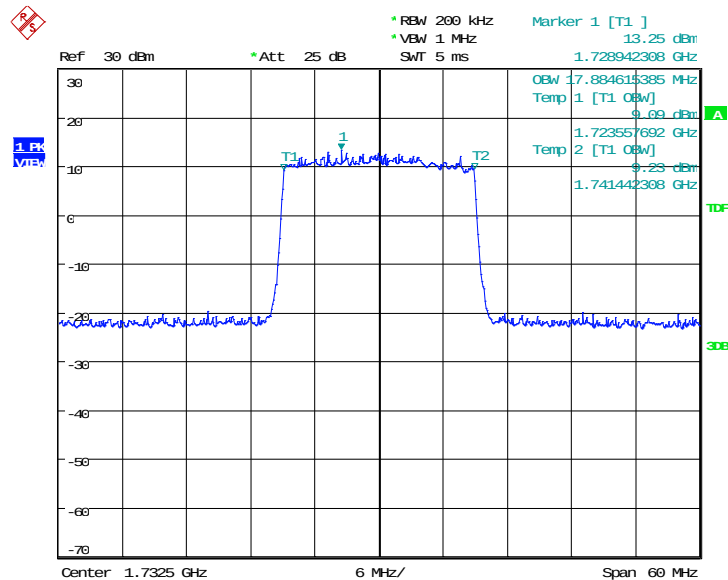
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
1732.5	QPSK	16QAM
	17884.62	17884.62

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



Date: 31.JUL.2018 11:35:28

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

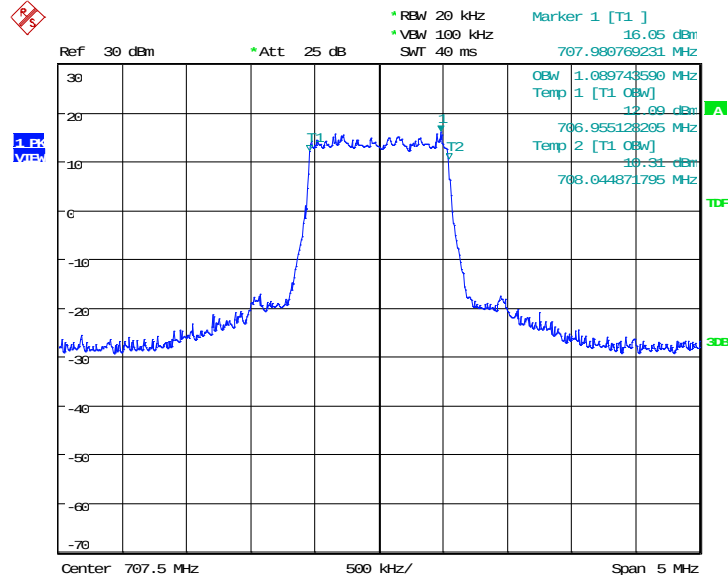


Date: 31.JUL.2018 11:35:42

LTE band 12, 1.4MHz (99%)

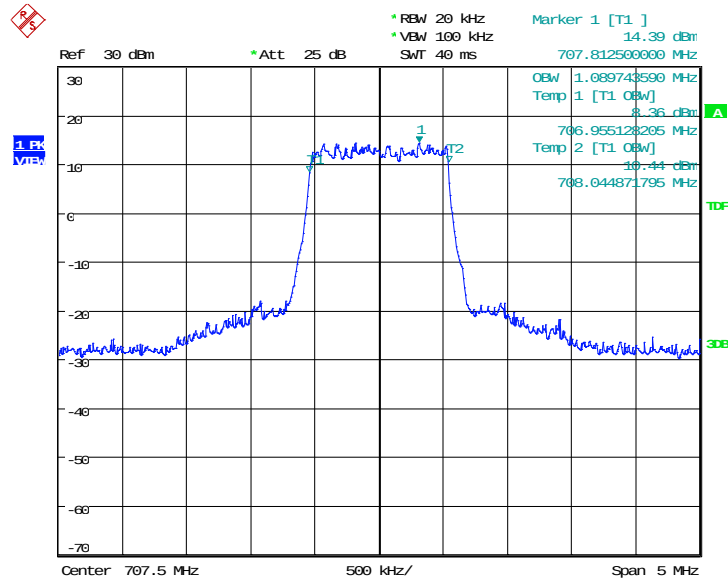
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
707.5	QPSK	16QAM
	1089.74	1089.74

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



Date: 31.JUL.2018 11:51:05

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

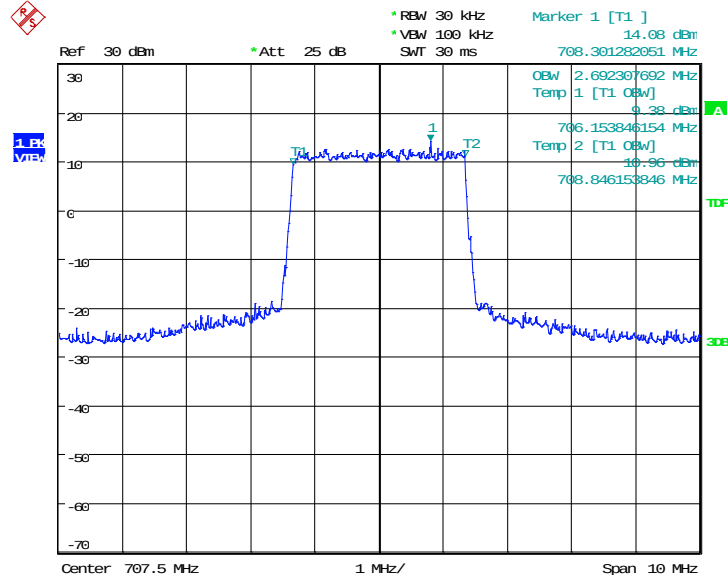


Date: 31.JUL.2018 11:51:19

LTE band 12, 3MHz (99%)

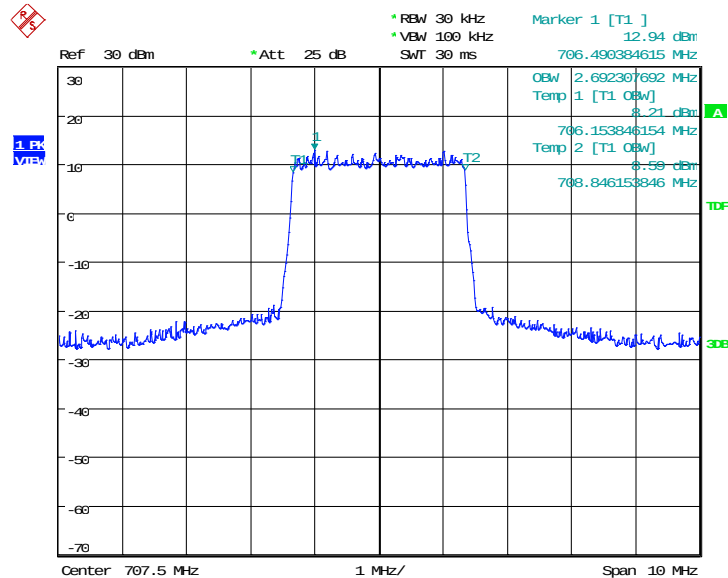
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
707.5	QPSK	16QAM
	2692.31	2692.31

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



Date: 31.JUL.2018 11:55:23

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

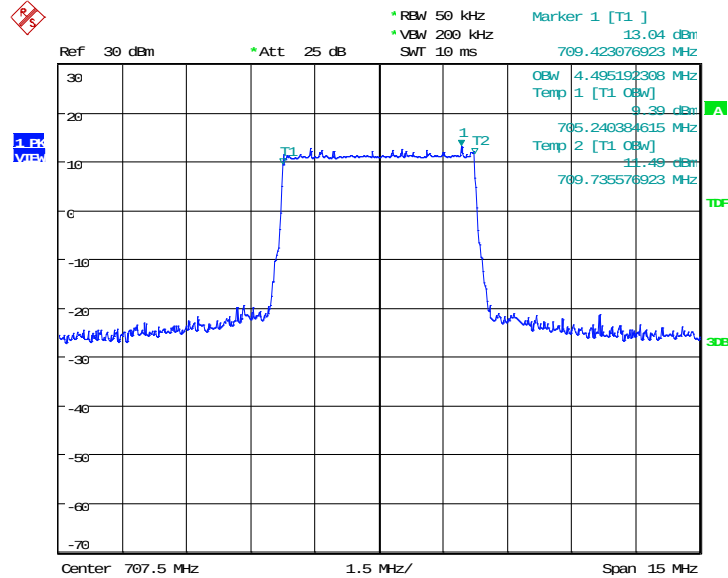


Date: 31.JUL.2018 11:55:37

LTE band 12, 5MHz (99%)

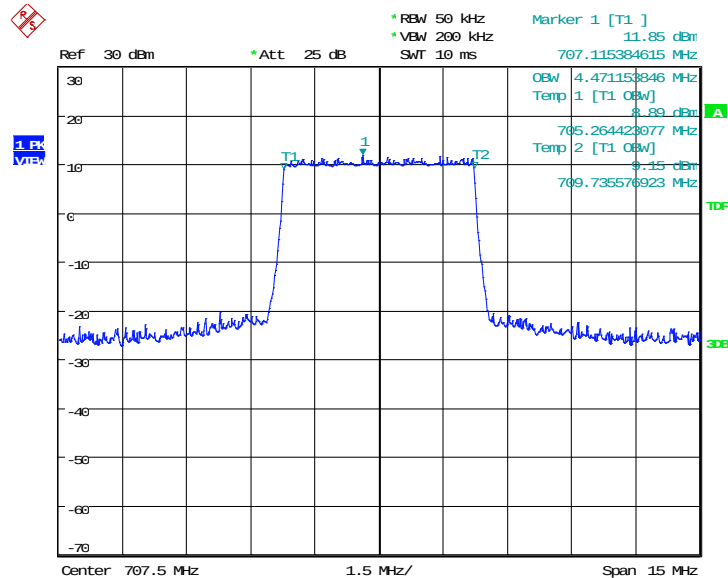
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
707.5	QPSK	16QAM
	4495.19	4471.15

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



Date: 31.JUL.2018 11:59:43

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

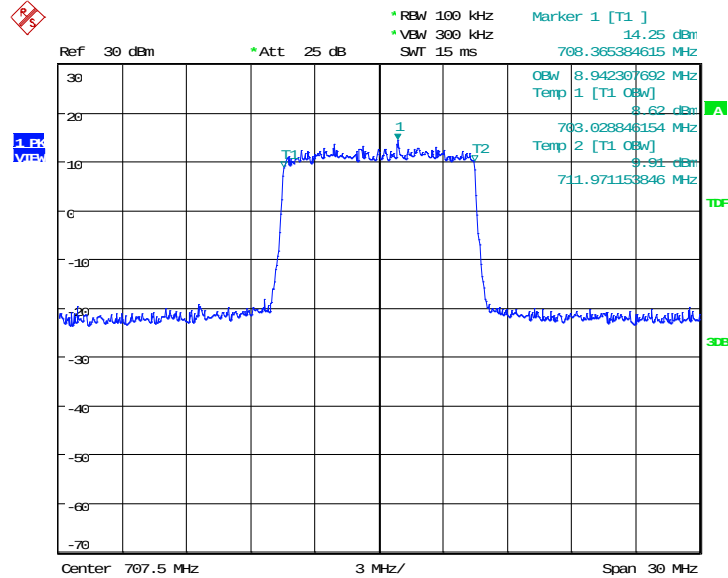


Date: 31.JUL.2018 11:59:57

LTE band 12, 10MHz (99%)

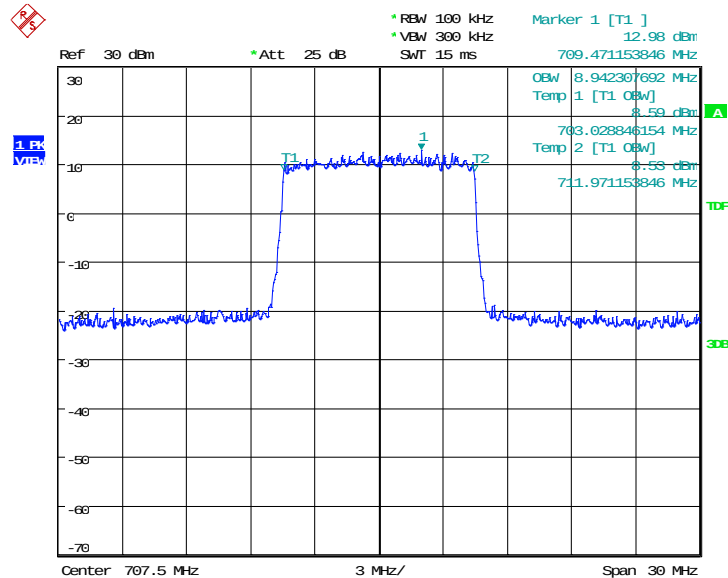
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
707.5	QPSK	16QAM
	8942.31	8942.31

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



Date: 31.JUL.2018 12:04:04

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

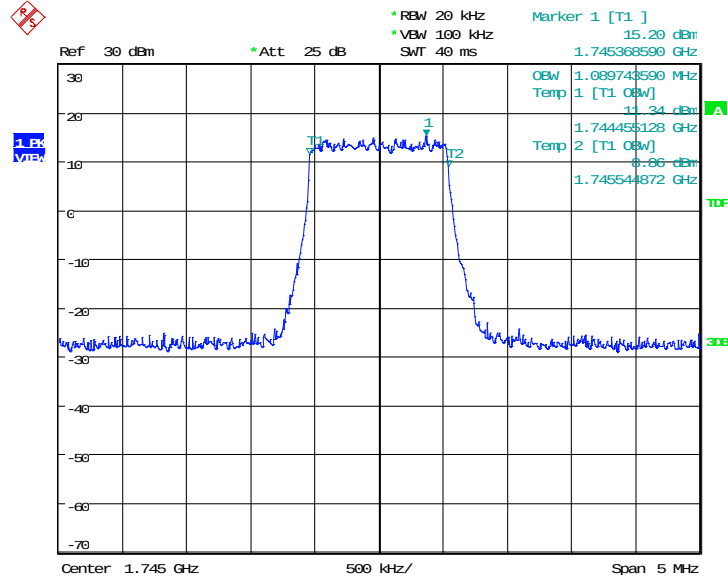


Date: 31.JUL.2018 12:04:18

LTE band 66, 1.4MHz (99%)

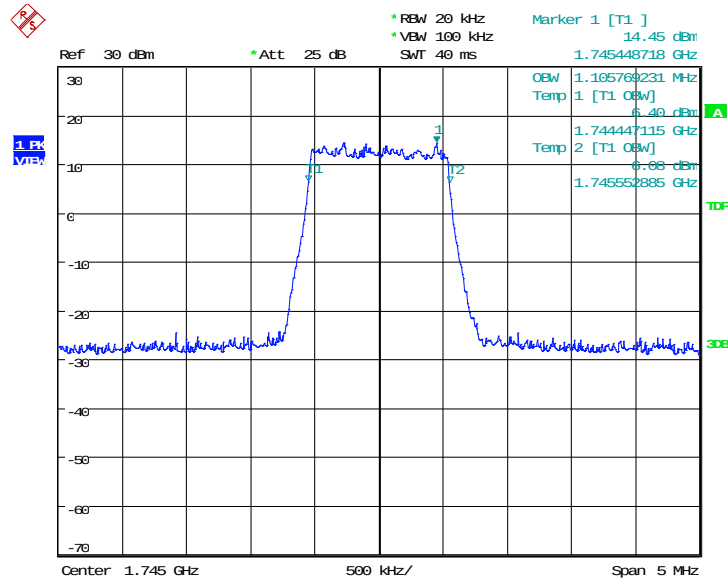
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
1745.0	QPSK	16QAM
	1089.74	1105.77

LTE band 66, 1.4MHz Bandwidth, QPSK (99% BW)



Date: 31.JUL.2018 12:14:36

LTE band 66, 1.4MHz Bandwidth, 16QAM (99% BW)

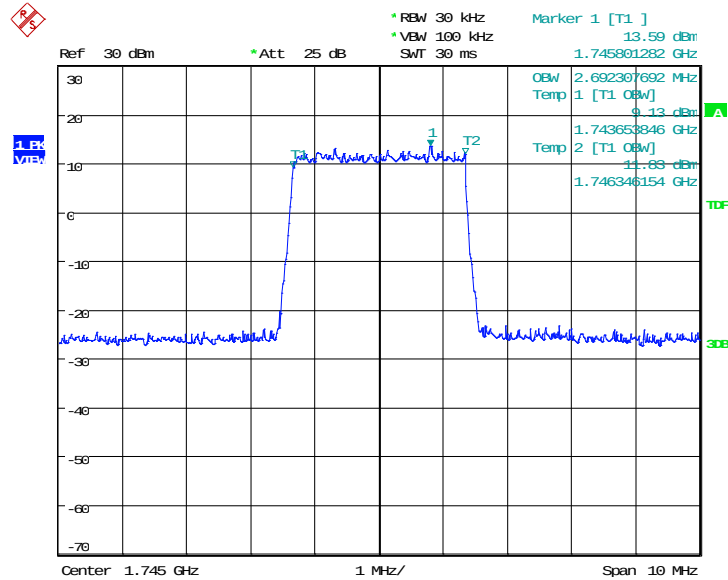


Date: 31.JUL.2018 12:14:49

LTE band 66, 3MHz (99%)

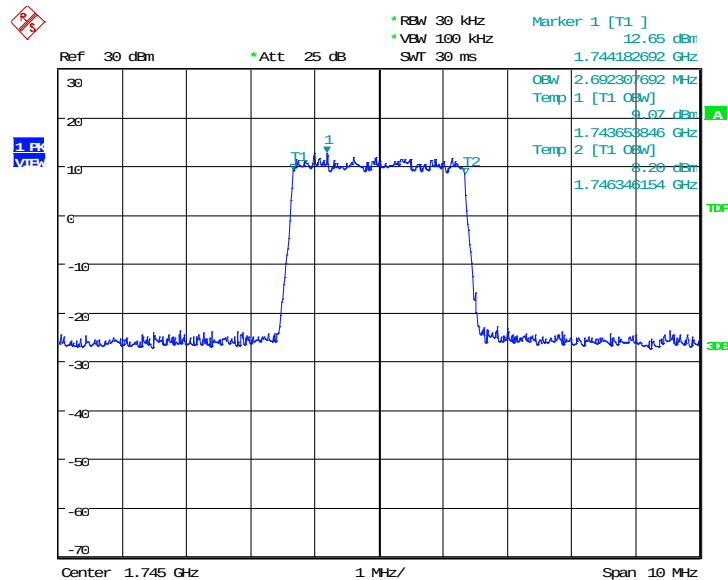
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
1745.0	QPSK	16QAM
	2692.31	2692.31

LTE band 66, 3MHz Bandwidth, QPSK (99% BW)



Date: 31.JUL.2018 12:18:56

LTE band 66, 3MHz Bandwidth, 16QAM (99% BW)

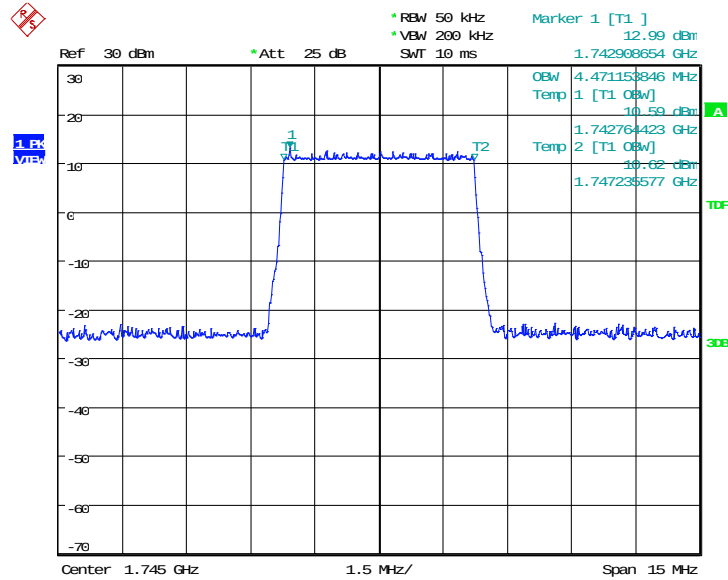


Date: 31.JUL.2018 12:19:10

LTE band 66, 5MHz (99%)

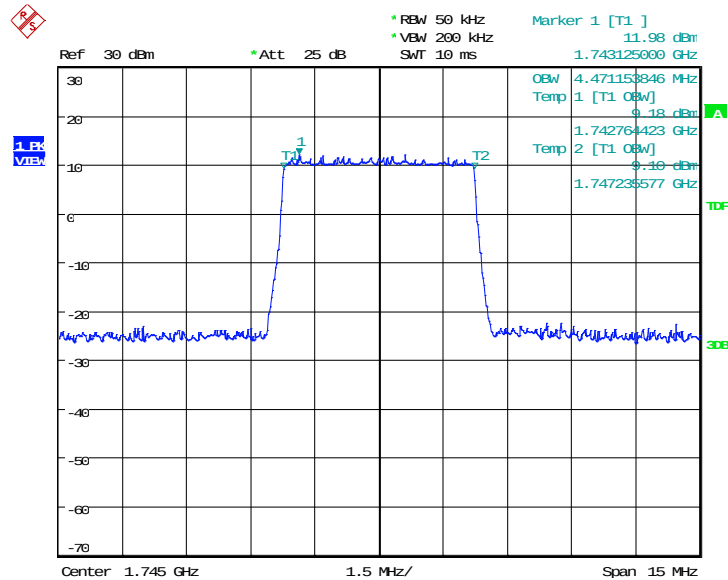
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
1745.0	QPSK	16QAM
	4471.15	4471.15

LTE band 66, 5MHz Bandwidth, QPSK (99% BW)



Date: 31.JUL.2018 12:23:14

LTE band 66, 5MHz Bandwidth,16QAM (99% BW)

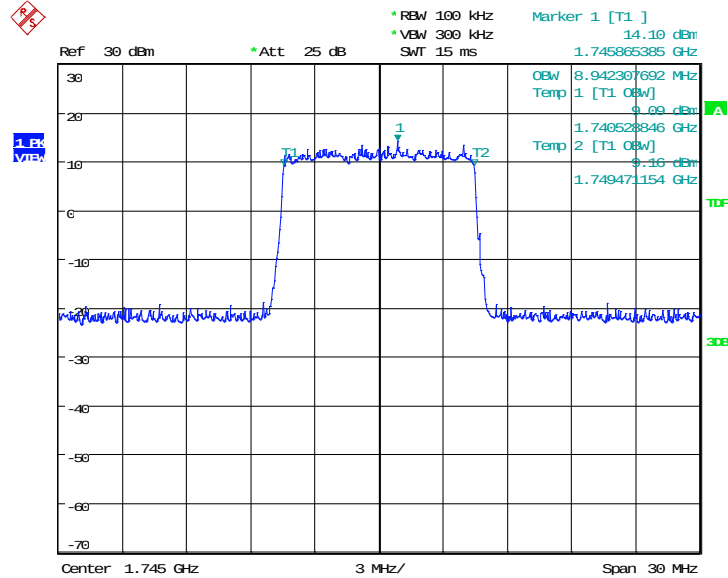


Date: 31.JUL.2018 12:23:28

LTE band 66, 10MHz (99%)

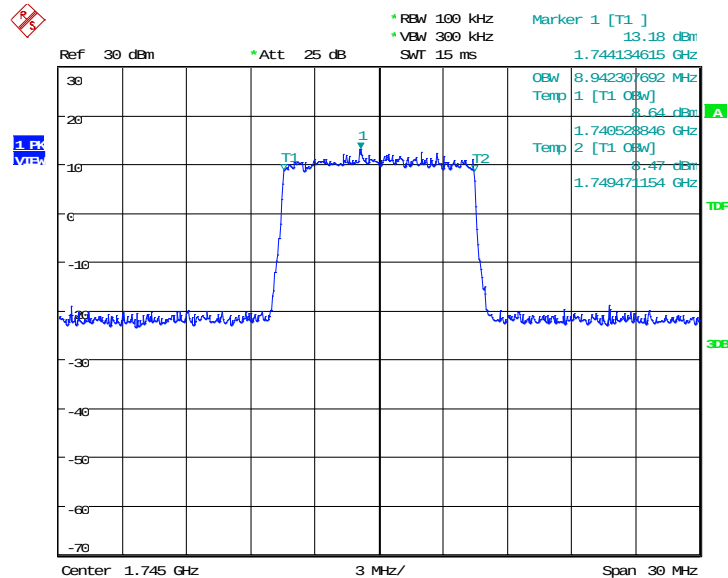
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
1745.0	QPSK	16QAM
	8942.31	8942.31

LTE band 66, 10MHz Bandwidth, QPSK (99% BW)



Date: 31.JUL.2018 12:27:32

LTE band 66, 10MHz Bandwidth, 16QAM (99% BW)

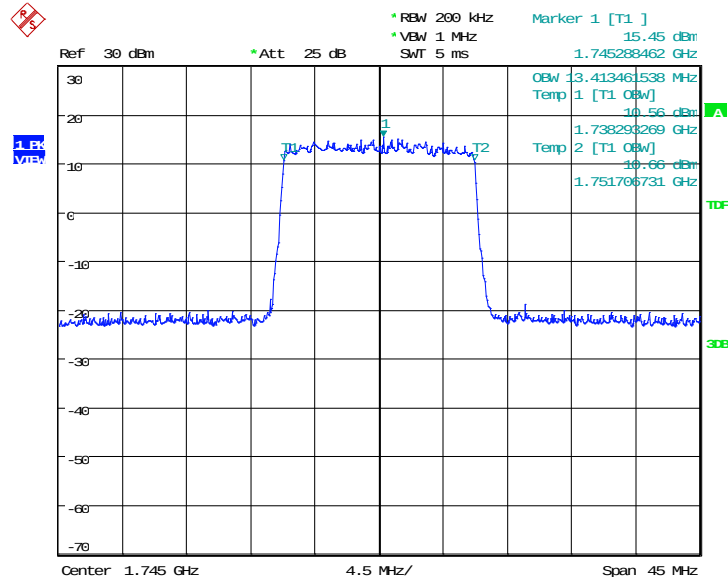


Date: 31.JUL.2018 12:27:46

LTE band 66, 15MHz (99%)

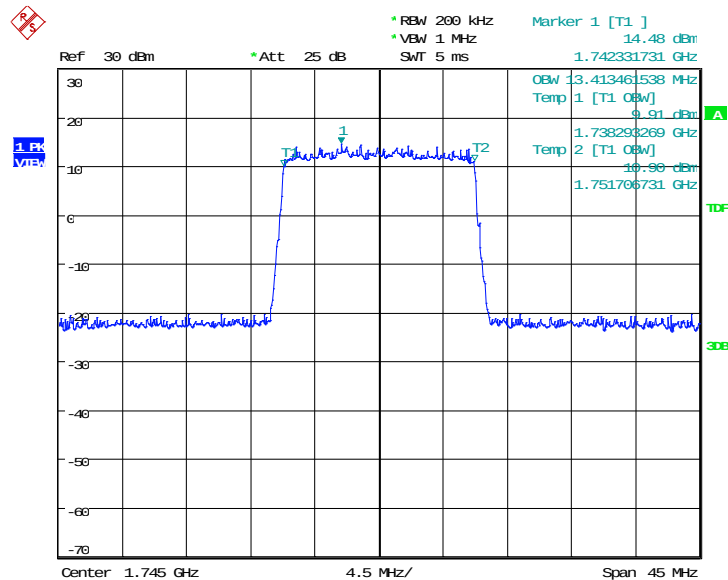
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
1745.0	QPSK	16QAM
	13413.46	13413.46

LTE band 66, 15MHz Bandwidth, QPSK (99% BW)



Date: 31.JUL.2018 12:31:50

LTE band 66, 15MHz Bandwidth, 16QAM (99% BW)

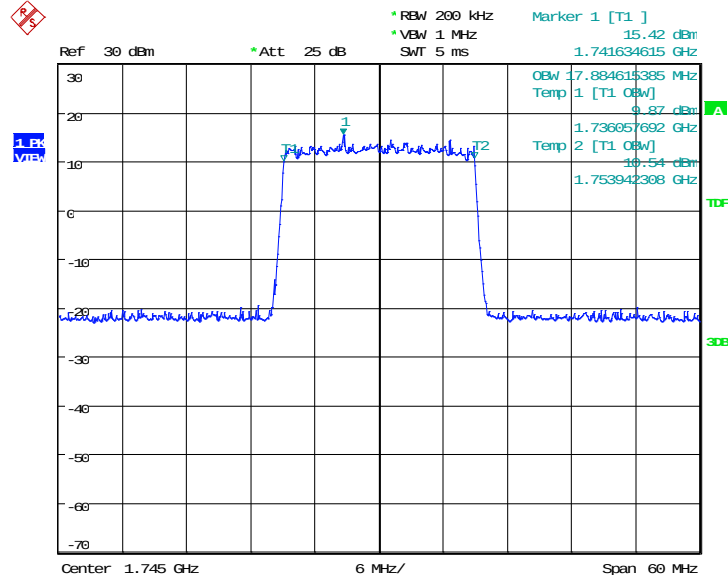


Date: 31.JUL.2018 12:32:04

LTE band 66, 20MHz (99%)

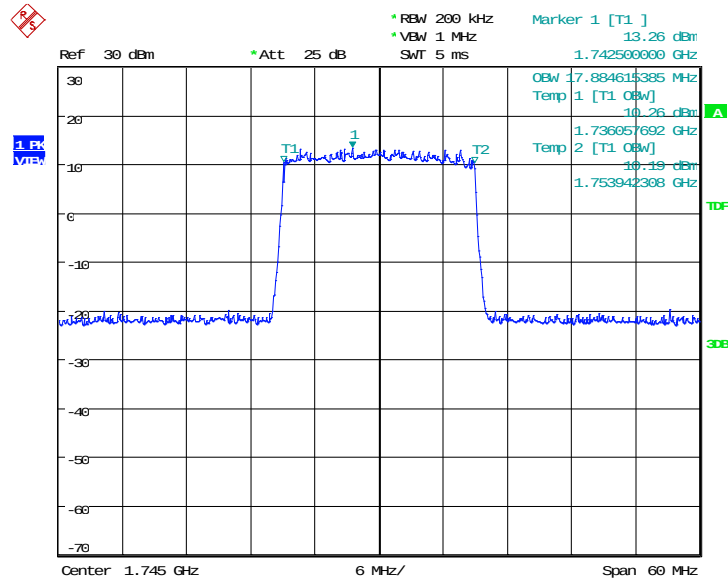
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
1745.0	QPSK	16QAM
	17884.62	17884.62

LTE band 66, 20MHz Bandwidth, QPSK (99% BW)



Date: 31.JUL.2018 12:36:11

LTE band 66, 20MHz Bandwidth, 16QAM (99% BW)



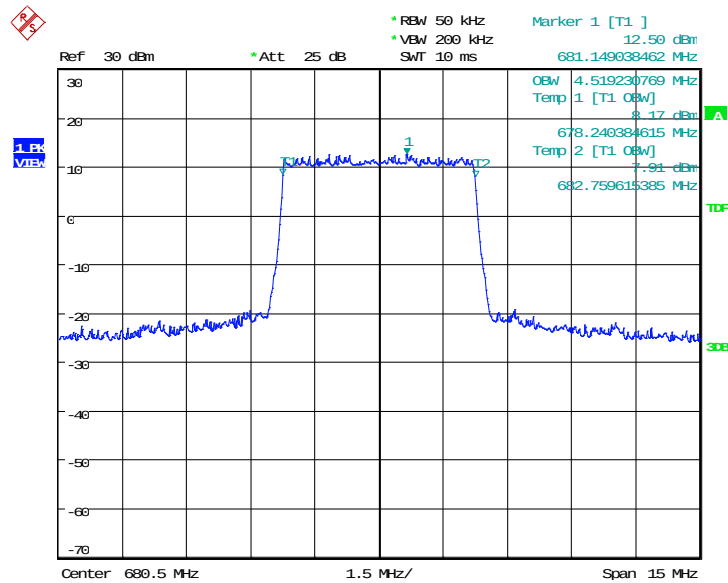
Date: 31.JUL.2018 12:36:25

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

LTE band 71, 5MHz (99%)

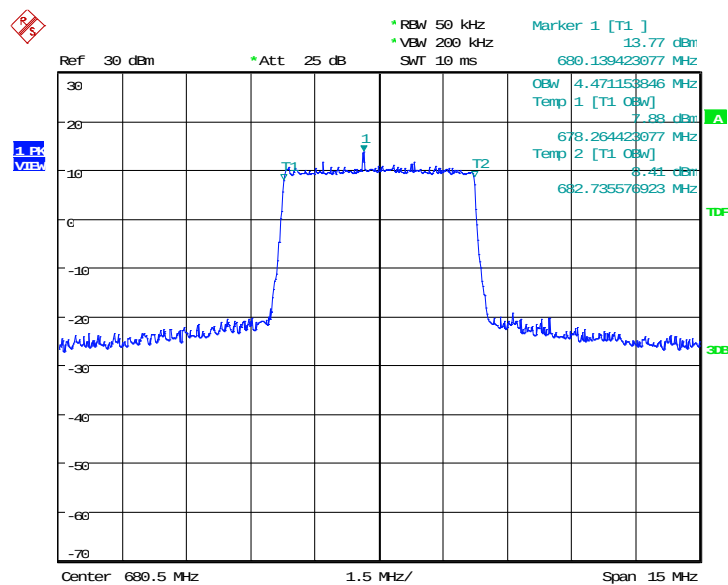
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
680.5	QPSK	16QAM
	4495.19	4495.19

LTE band 71, 5MHz Bandwidth, QPSK (99% BW)



Date: 16.AUG.2018 06:29:04

LTE band 71, 5MHz Bandwidth,16QAM (99% BW)

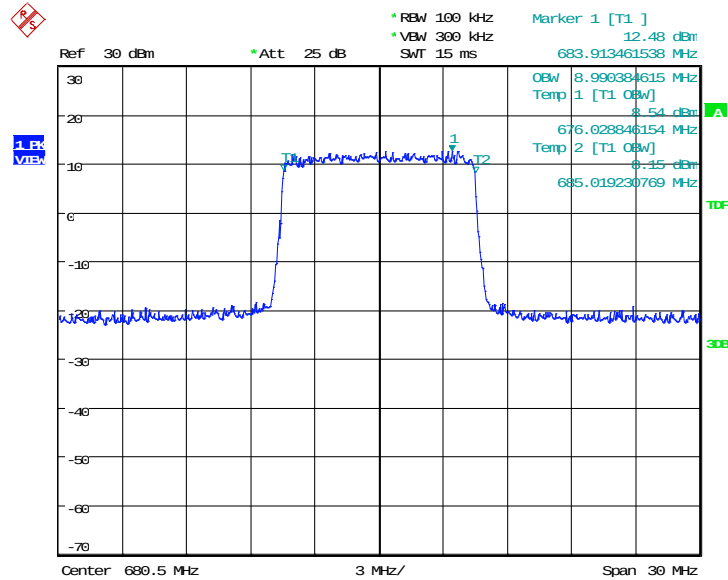


Date: 16.AUG.2018 06:29:40

LTE band 71, 10MHz (99%)

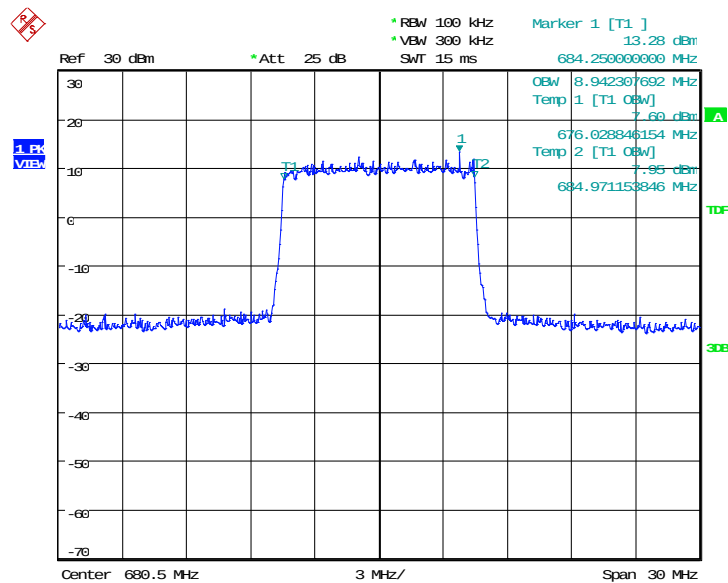
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
680.5	QPSK	16QAM
	8942.31	8942.31

LTE band 71, 10MHz Bandwidth, QPSK (99% BW)



Date: 16.AUG.2018 06:35:40

LTE band 71, 10MHz Bandwidth, 16QAM (99% BW)

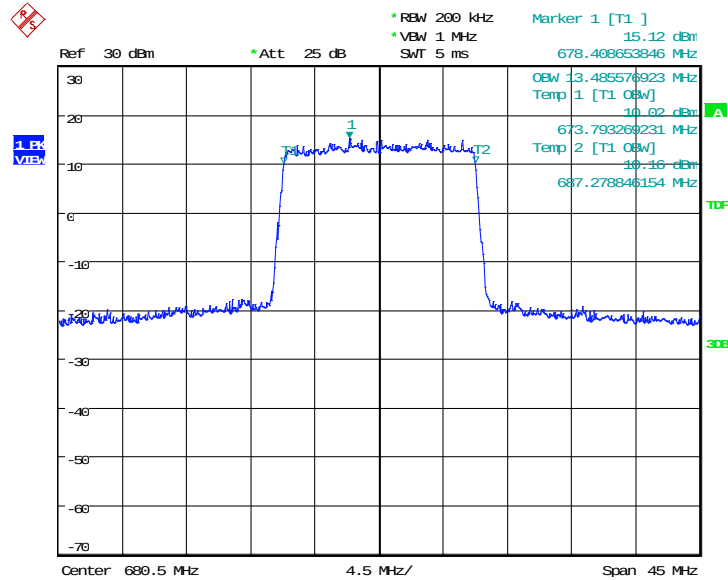


Date: 16.AUG.2018 06:34:57

LTE band 71, 15MHz (99%)

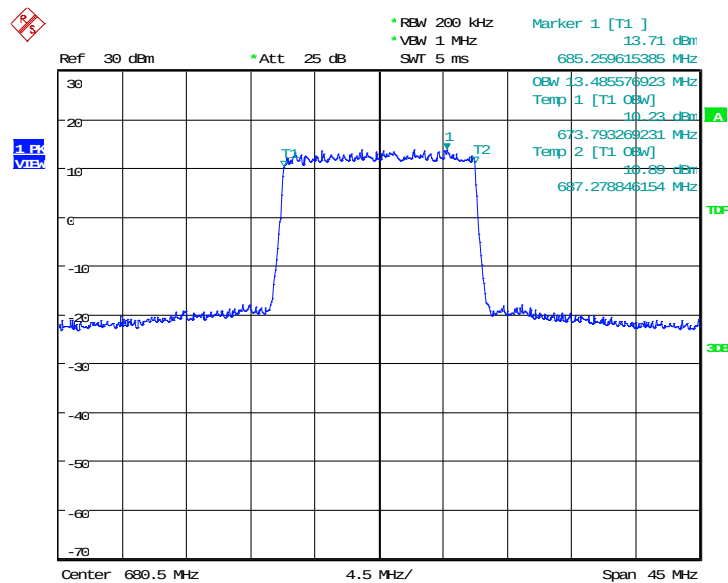
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
680.5	QPSK	16QAM
	13485.58	13485.58

LTE band 71, 15MHz Bandwidth, QPSK (99% BW)



Date: 16.AUG.2018 06:44:05

LTE band 71, 15MHz Bandwidth, 16QAM (99% BW)

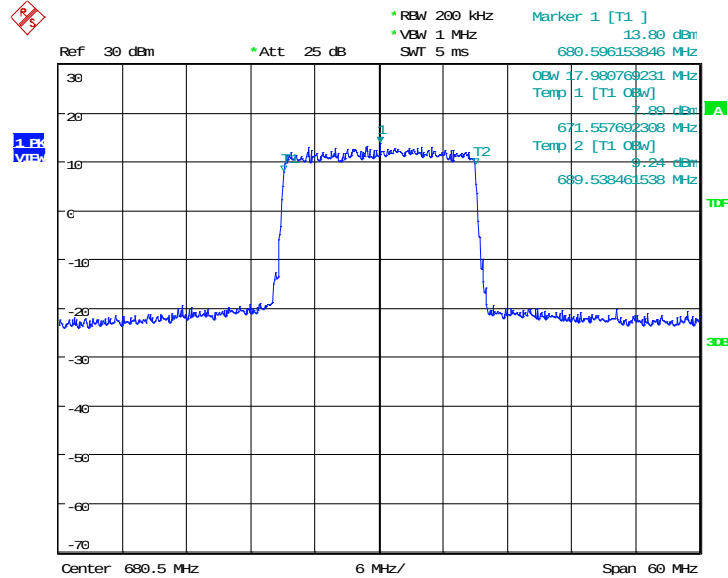


Date: 16.AUG.2018 06:45:03

LTE band 71, 20MHz (99%)

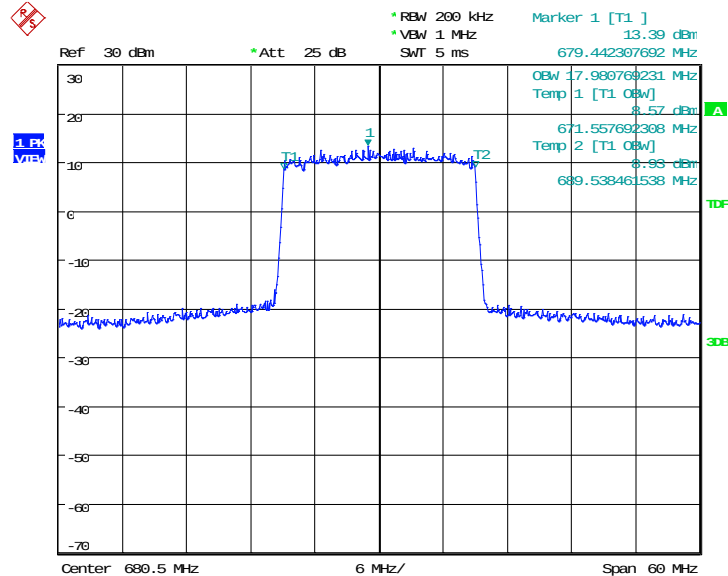
Frequency(MHz)	Occupied Bandwidth (99%)(kHz)	
680.5	QPSK	16QAM
	17980.77	17980.77

LTE band 71, 20MHz Bandwidth, QPSK (99% BW)



Date: 16.AUG.2018 06:52:57

LTE band 71, 20MHz Bandwidth, 16QAM (99% BW)



Date: 16.AUG.2018 06:52:33

A.4 EMISSION BANDWIDTH

Reference

FCC: CFR Part 2.1049, 24.238, 27.53

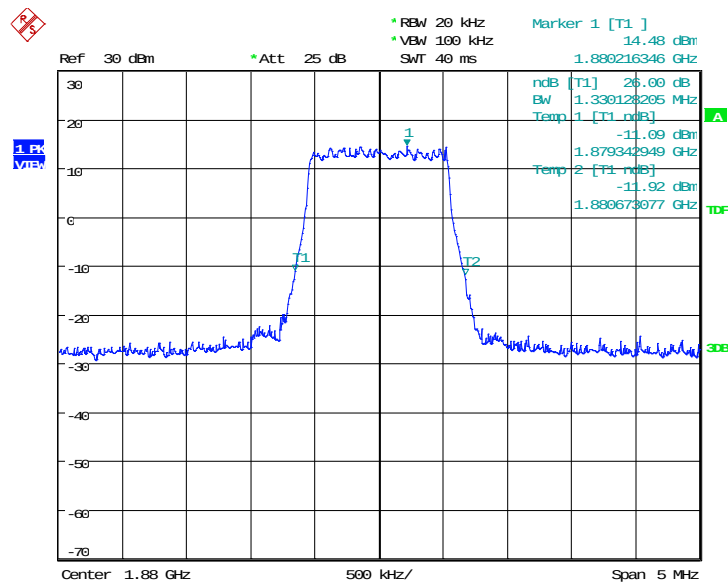
A.4.1 Emission Bandwidth Results

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)

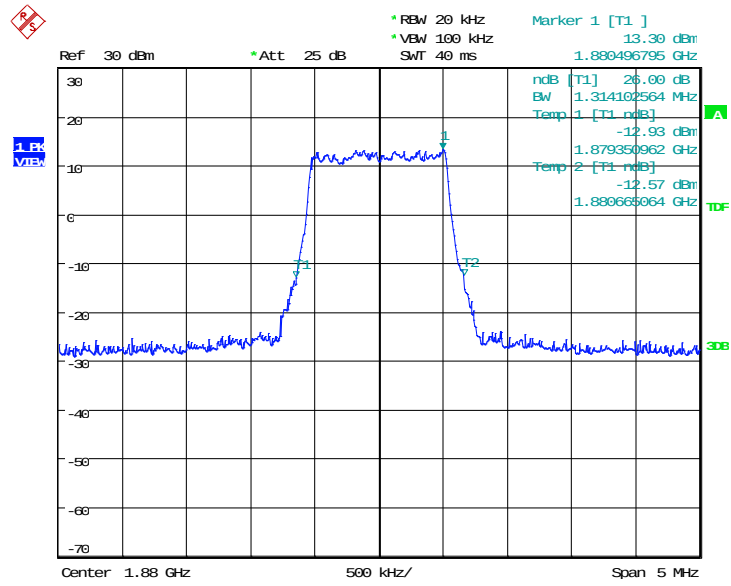
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
1880.0	QPSK	16QAM
	1330.13	1314.10

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



Date: 31.JUL.2018 10:49:02

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

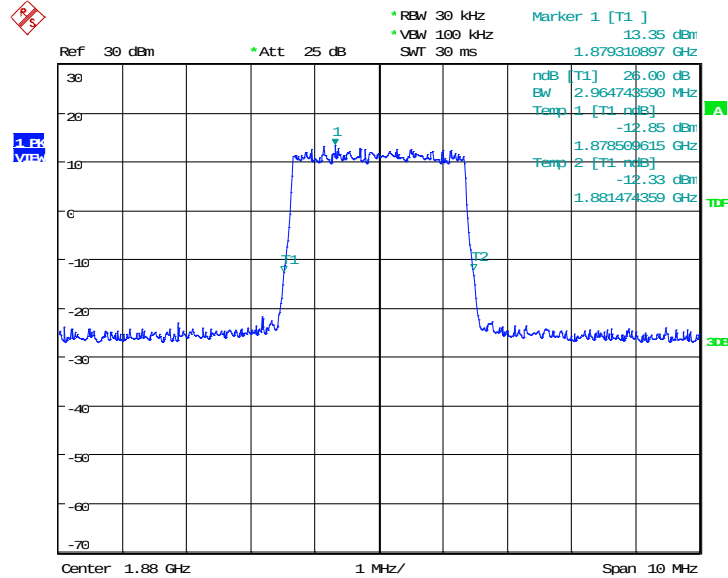


Date: 31.JUL.2018 10:49:18

LTE band 2, 3MHz (-26dBc)

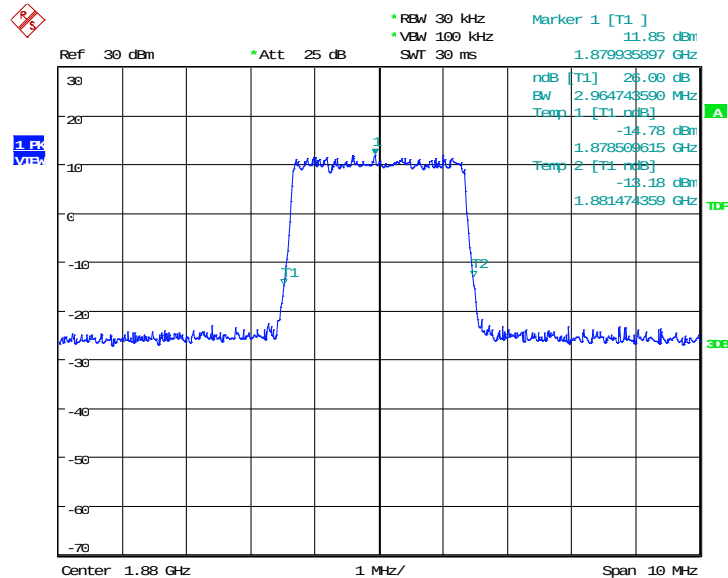
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
1880.0	QPSK	16QAM
	2964.74	2964.74

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



Date: 31.JUL.2018 10:53:22

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

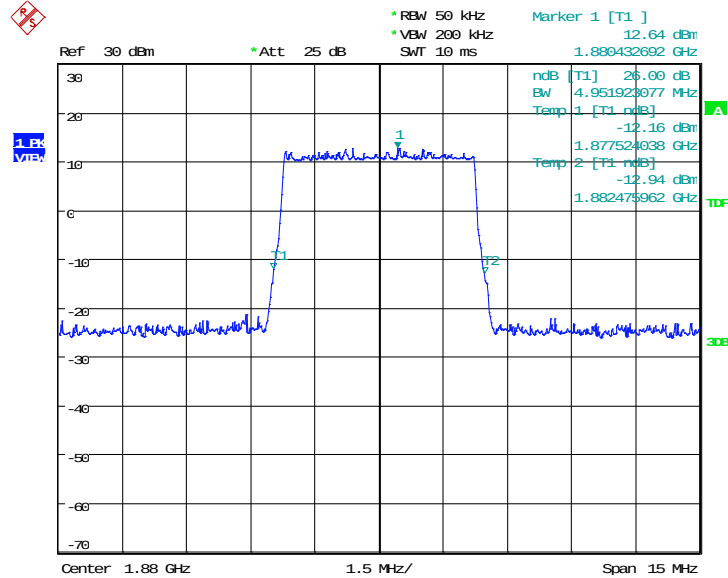


Date: 31.JUL.2018 10:53:38

LTE band 2, 5MHz (-26dBc)

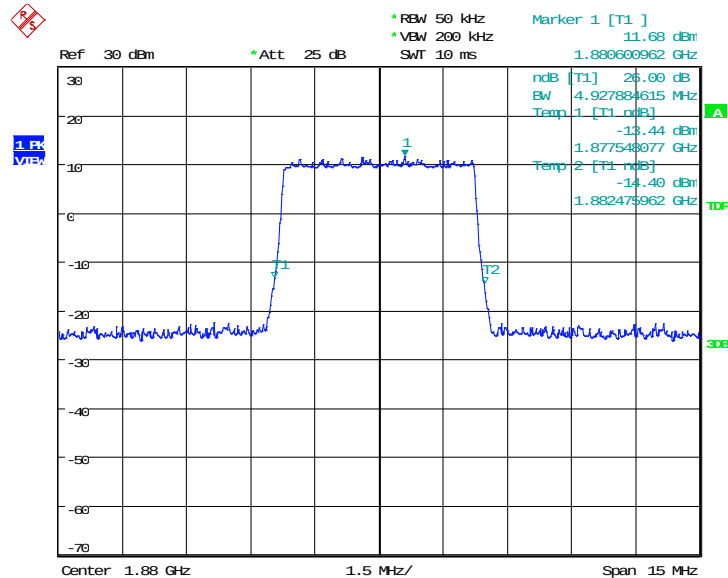
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
1880.0	QPSK	16QAM
	4951.92	4927.88

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



Date: 31.JUL.2018 10:57:42

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

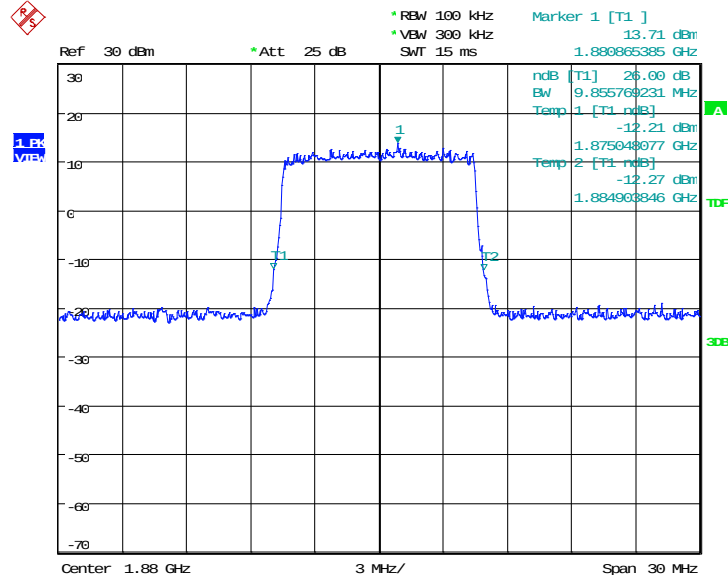


Date: 31.JUL.2018 10:57:58

LTE band 2, 10MHz (-26dBc)

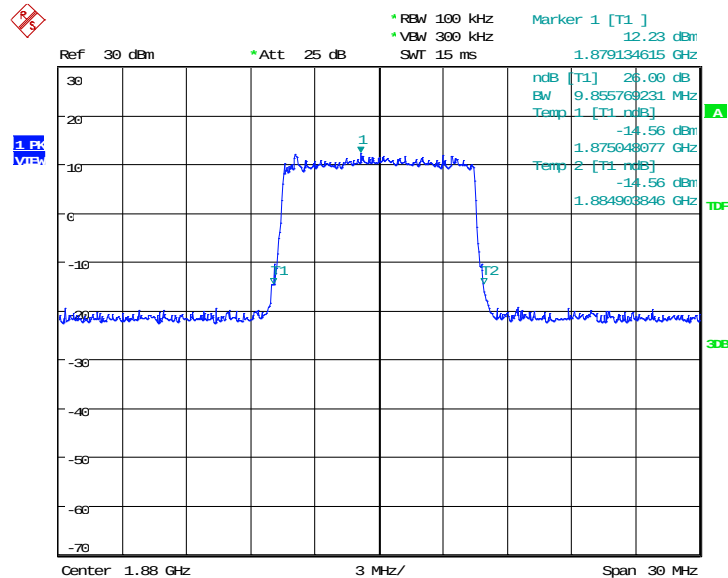
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
1880.0	QPSK	16QAM
	9855.77	9855.77

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



Date: 31.JUL.2018 11:02:00

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

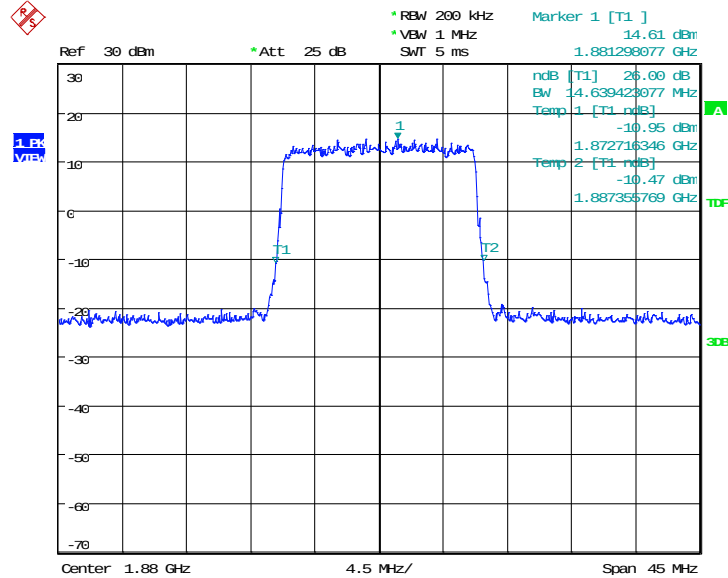


Date: 31.JUL.2018 11:02:15

LTE band 2, 15MHz (-26dBc)

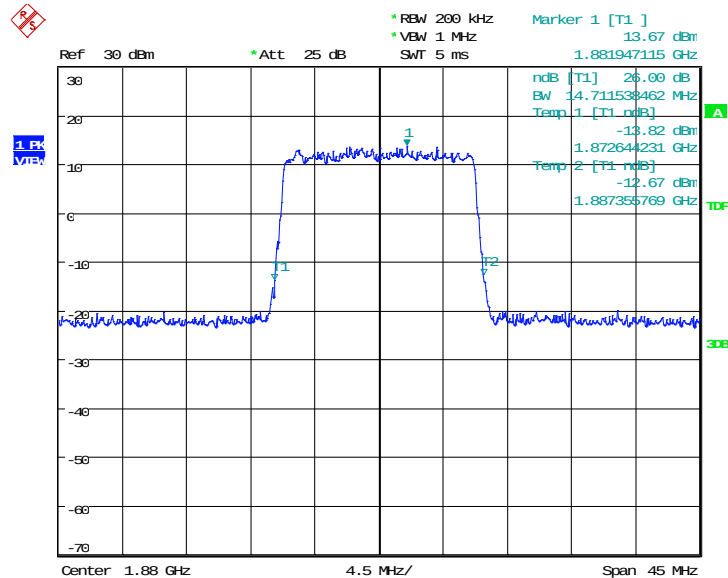
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
1880.0	QPSK	16QAM
	14639.42	14711.54

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



Date: 31.JUL.2018 11:06:18

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

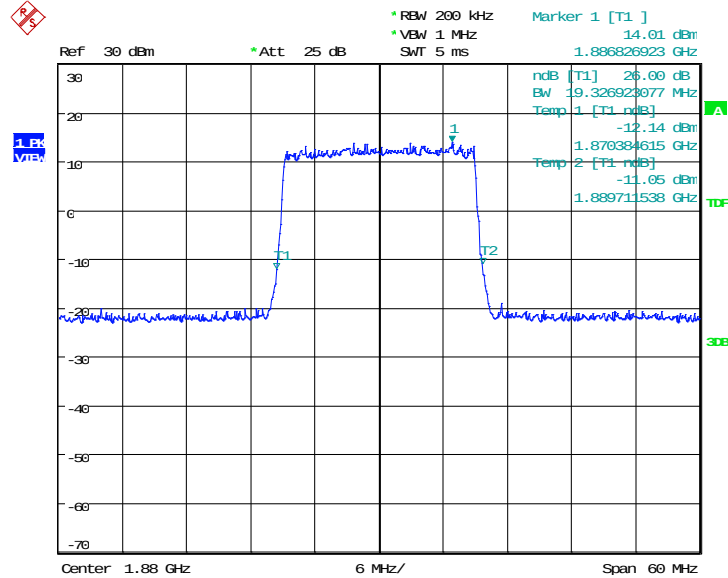


Date: 31.JUL.2018 11:06:33

LTE band 2, 20MHz (-26dBc)

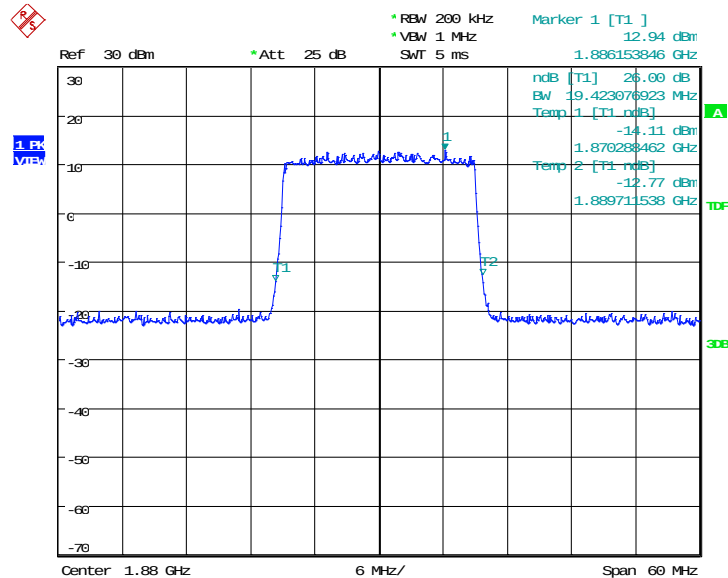
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
1880.0	QPSK	16QAM
	19326.92	19423.08

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



Date: 31.JUL.2018 11:10:38

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

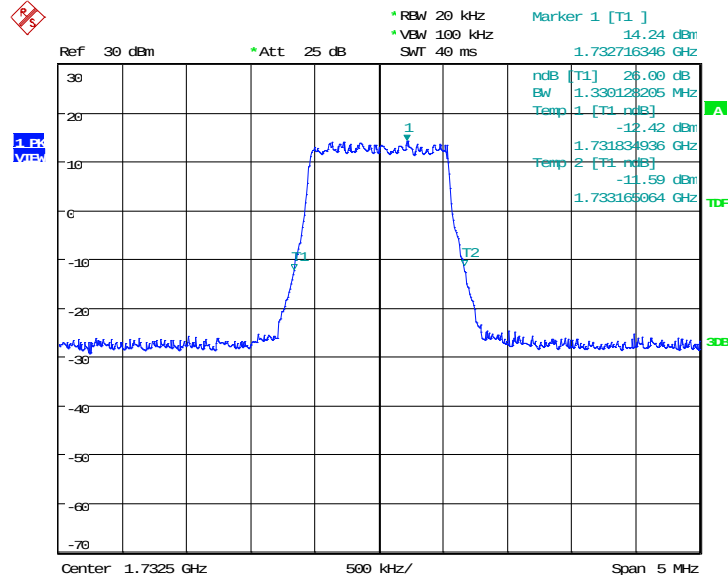


Date: 31.JUL.2018 11:10:54

LTE band 4, 1.4MHz (-26dBc)

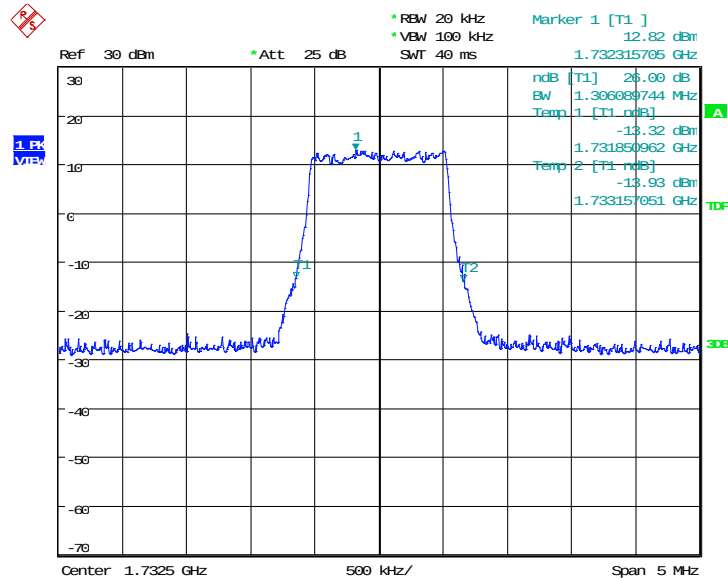
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
1732.5	QPSK	16QAM
	1330.13	1306.09

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



Date: 31.JUL.2018 11:15:00

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

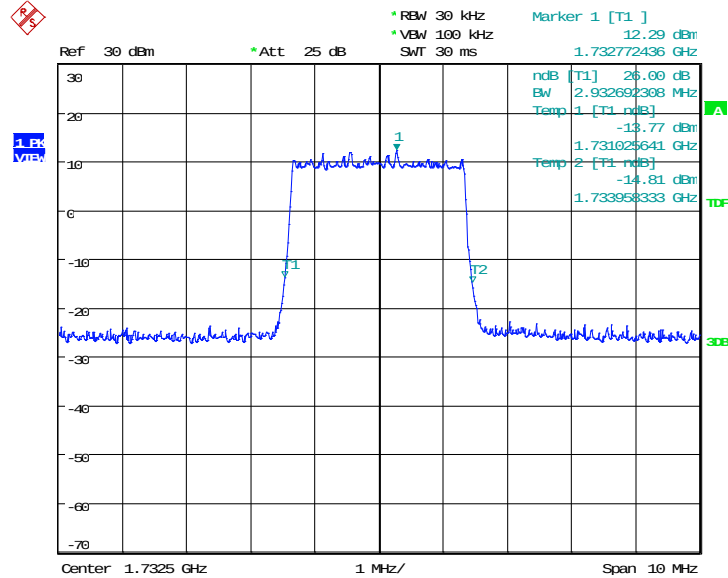


Date: 31.JUL.2018 11:15:16

LTE band 4, 3MHz (-26dBc)

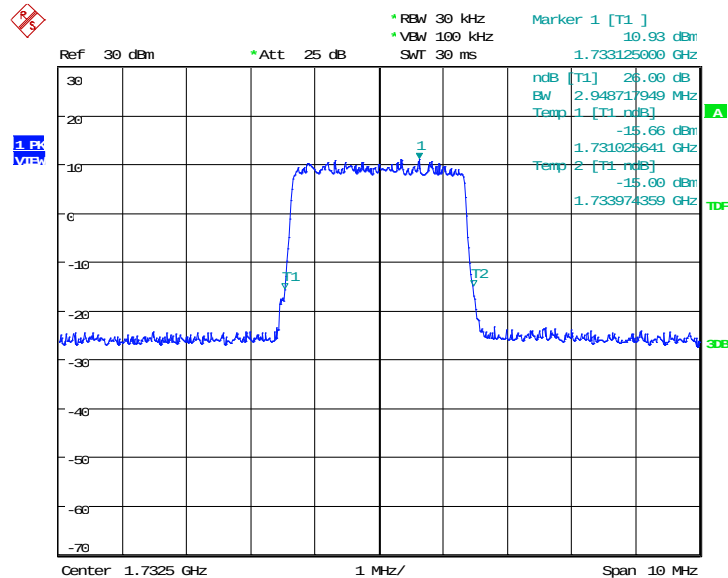
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
1732.5	QPSK	16QAM
	2932.69	2948.72

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



Date: 31.JUL.2018 11:19:18

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

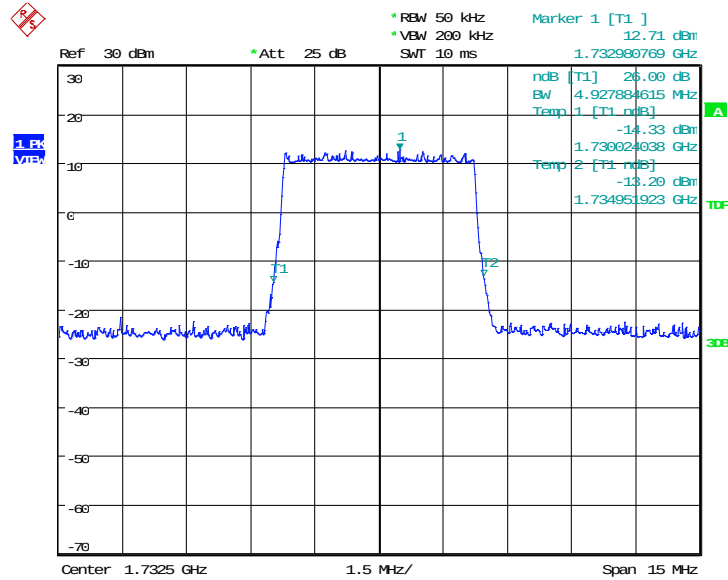


Date: 31.JUL.2018 11:19:34

LTE band 4, 5MHz (-26dBc)

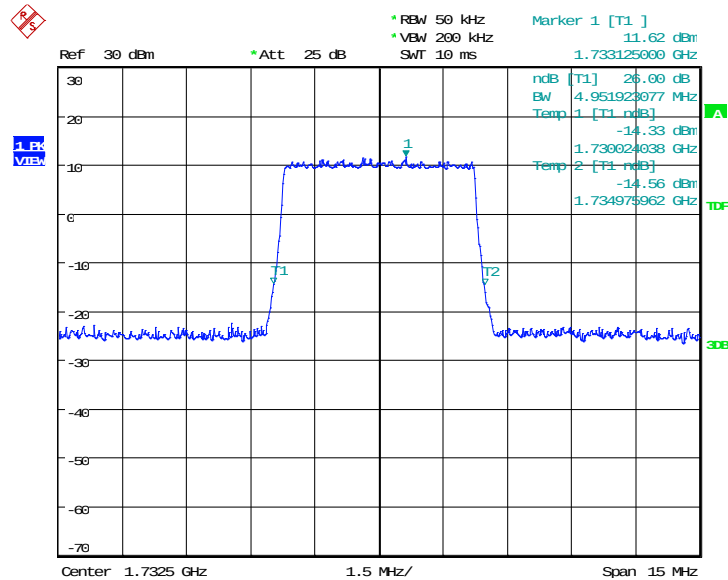
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
1732.5	QPSK	16QAM
	4927.88	4951.92

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



Date: 31.JUL.2018 11:23:36

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

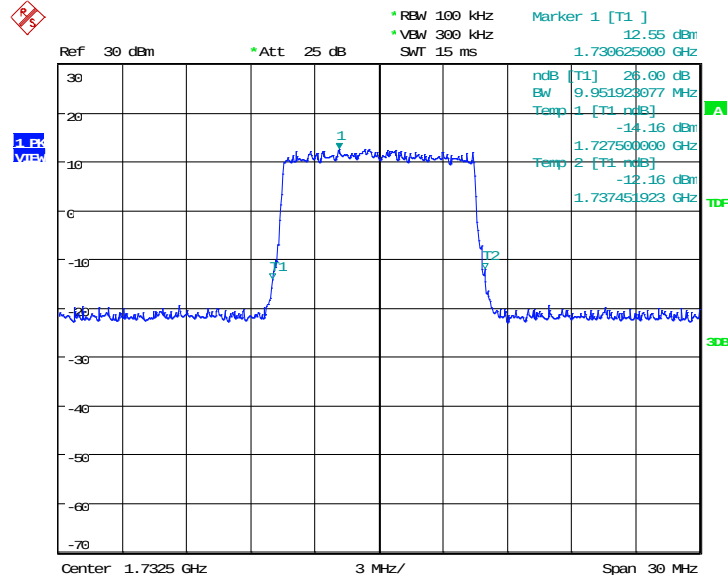


Date: 31.JUL.2018 11:23:52

LTE band 4, 10MHz (-26dBc)

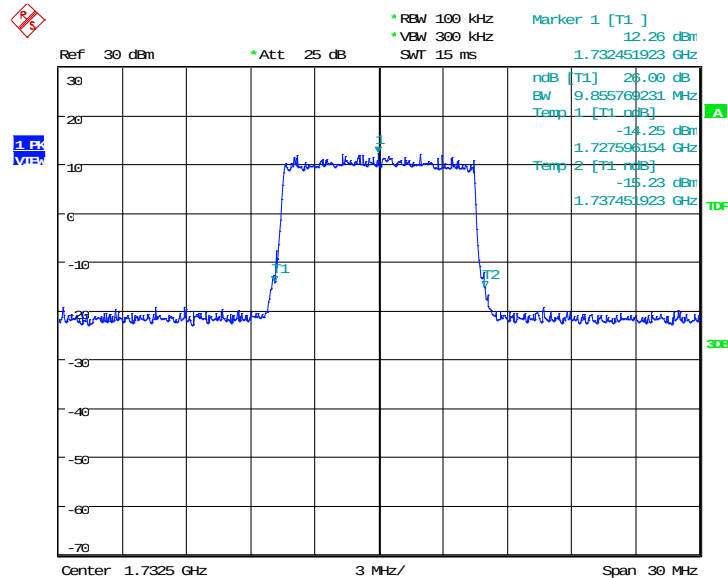
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
1732.5	QPSK	16QAM
	9951.92	9855.77

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



Date: 31.JUL.2018 11:27:57

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

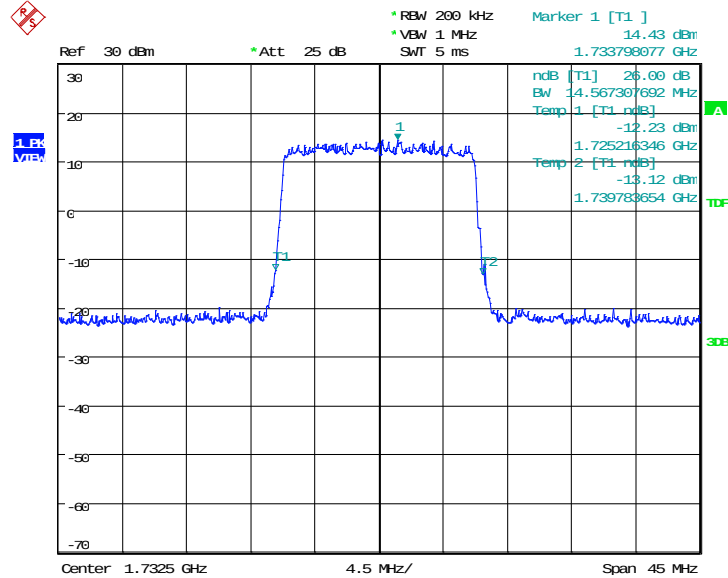


Date: 31.JUL.2018 11:28:12

LTE band 4, 15MHz (-26dBc)

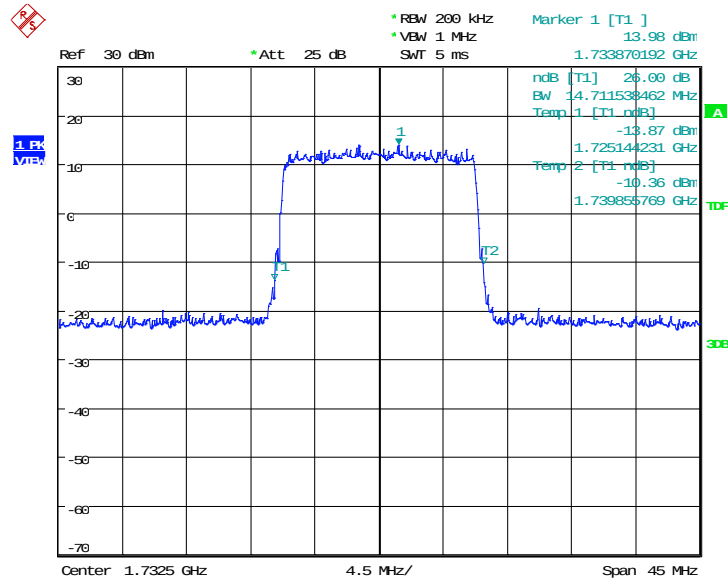
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
1732.5	QPSK	16QAM
	14567.31	14711.54

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



Date: 31.JUL.2018 11:32:15

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

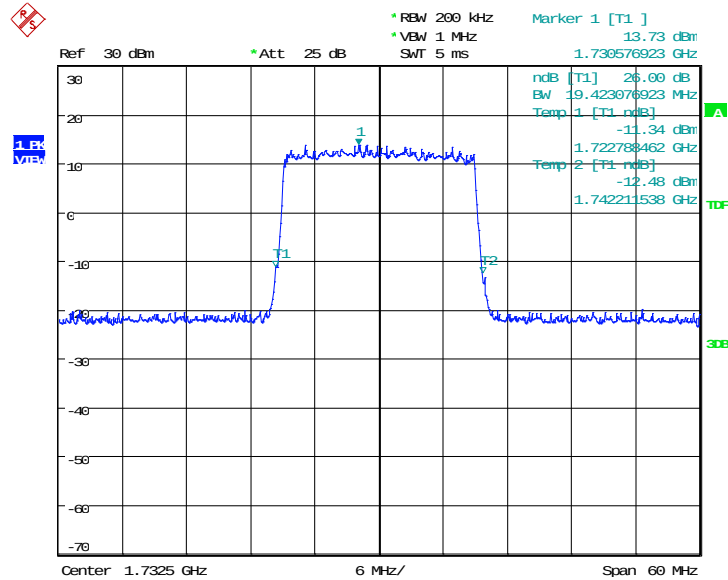


Date: 31.JUL.2018 11:32:31

LTE band 4, 20MHz (-26dBc)

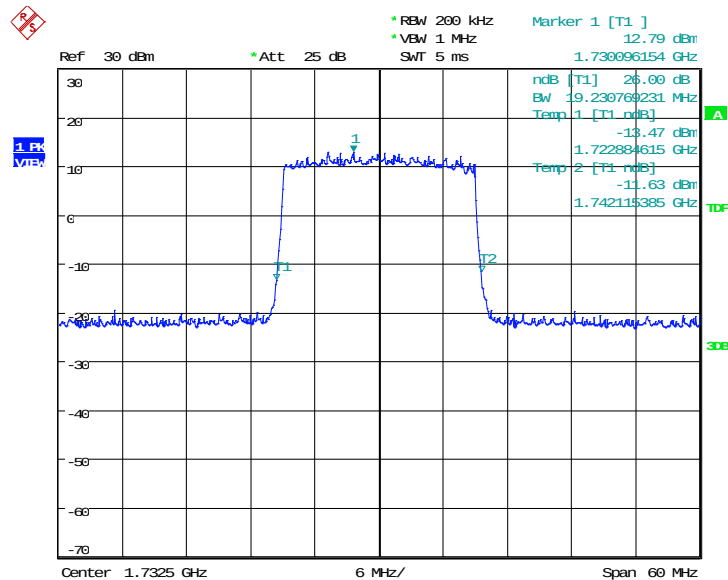
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
1732.5	QPSK	16QAM
	19423.08	19230.77

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



Date: 31.JUL.2018 11:36:36

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

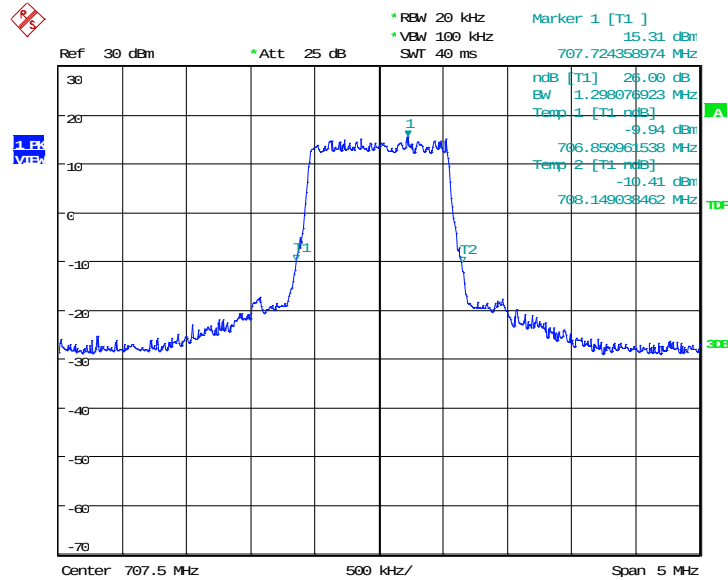


Date: 31.JUL.2018 11:36:52

LTE band 12, 1.4MHz (-26dBc)

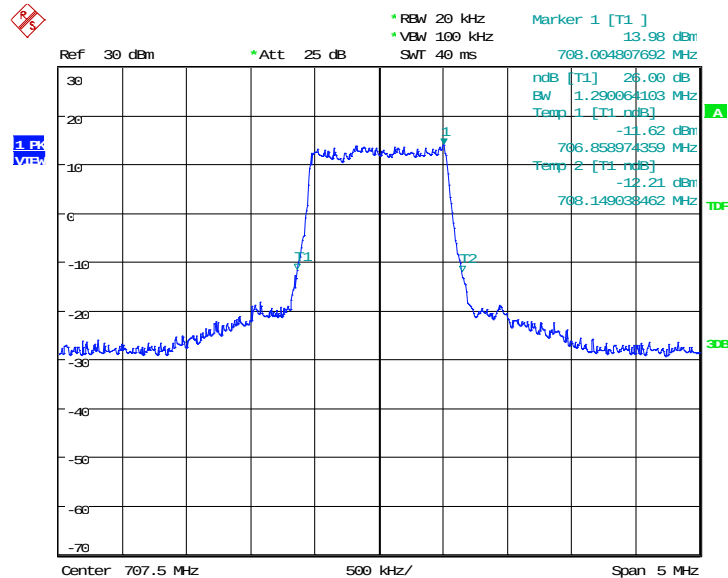
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
707.5	QPSK	16QAM
	1298.08	1290.06

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



Date: 31.JUL.2018 11:52:13

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

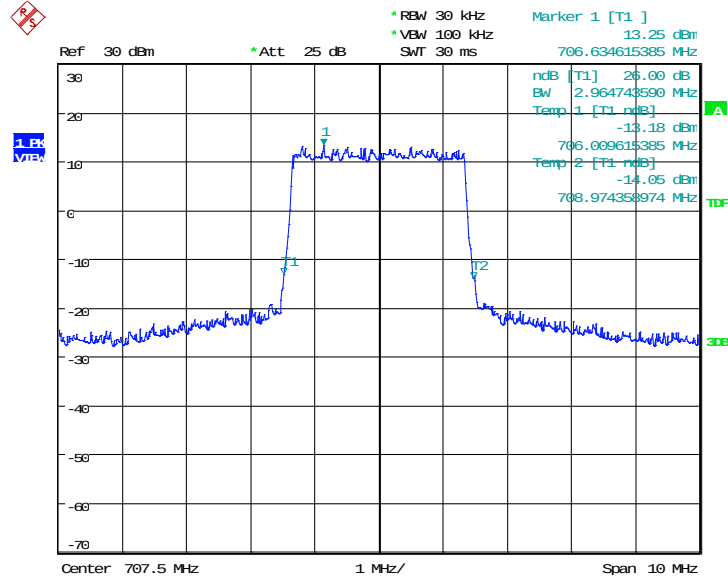


Date: 31.JUL.2018 11:52:29

LTE band 12, 3MHz (-26dBc)

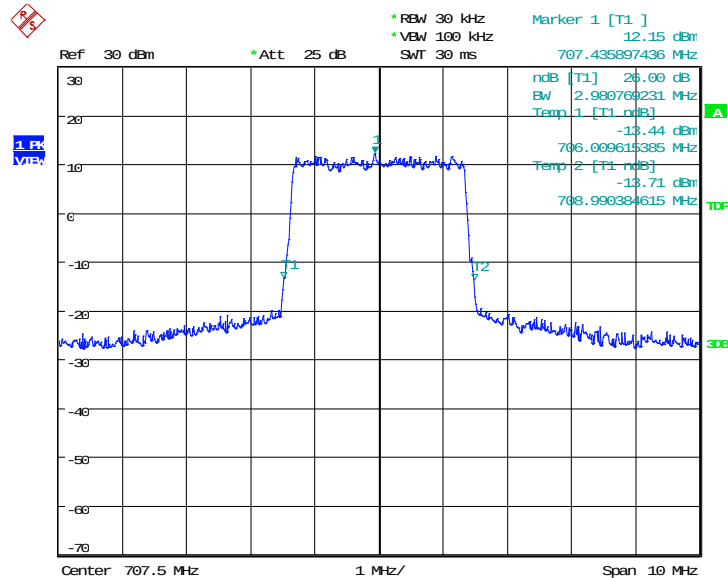
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
707.5	QPSK	16QAM
	2964.74	2980.77

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



Date: 31.JUL.2018 11:56:31

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

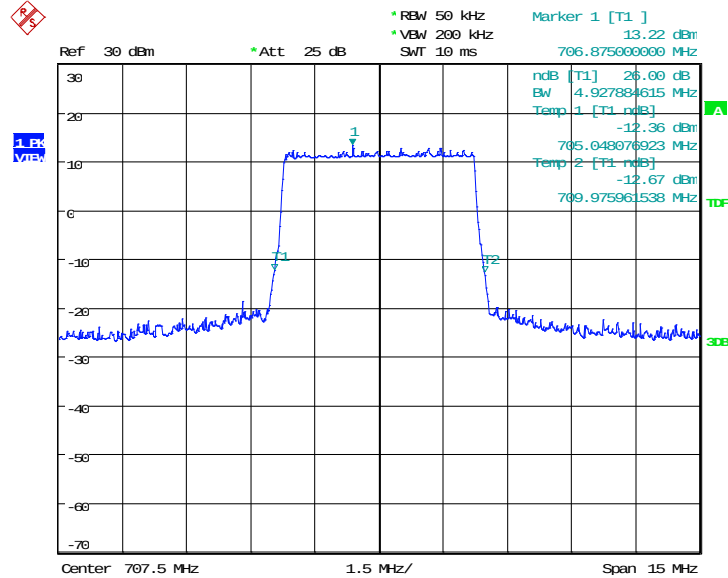


Date: 31.JUL.2018 11:56:47

LTE band 12, 5MHz (-26dBc)

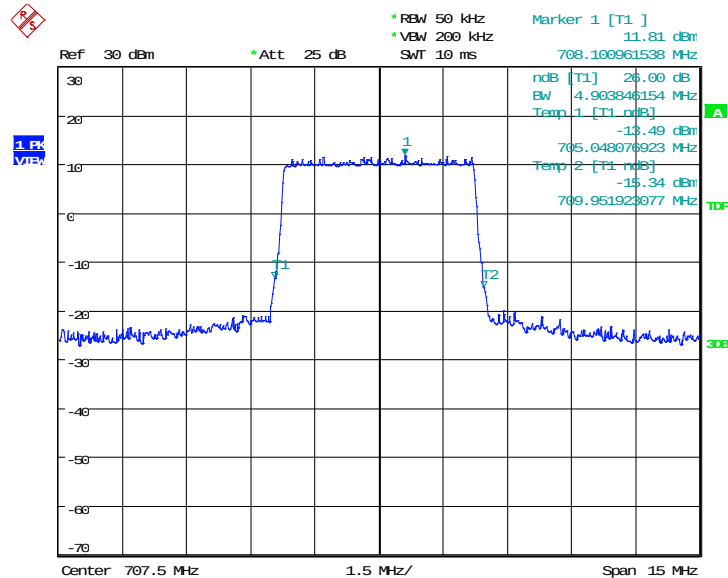
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
707.5	QPSK	16QAM
	4927.88	4903.85

LTE band 12, 5MHz Bandwidth, QPSK (-26dBc BW)



Date: 31.JUL.2018 12:00:51

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

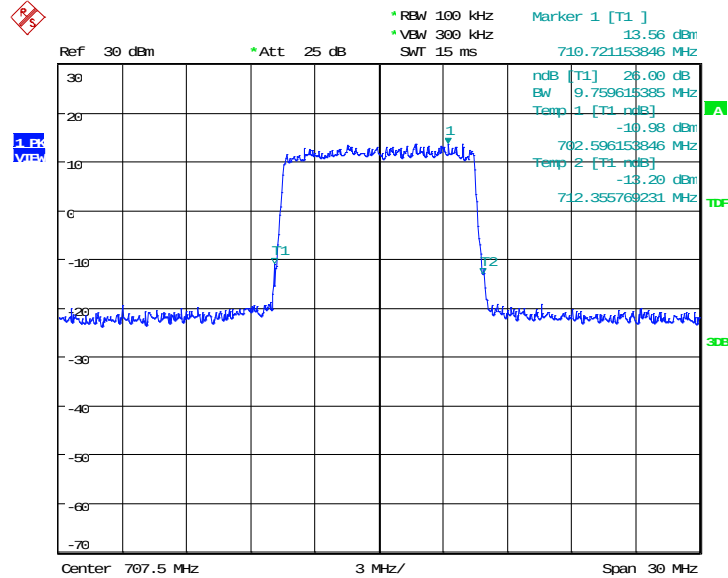


Date: 31.JUL.2018 12:01:07

LTE band 12, 10MHz (-26dBc)

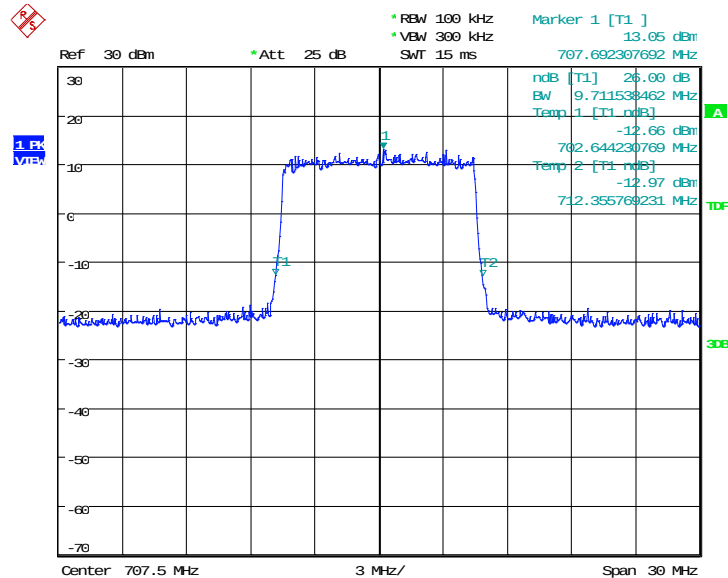
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
707.5	QPSK	16QAM
	9759.62	9711.54

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



Date: 31.JUL.2018 12:11:19

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

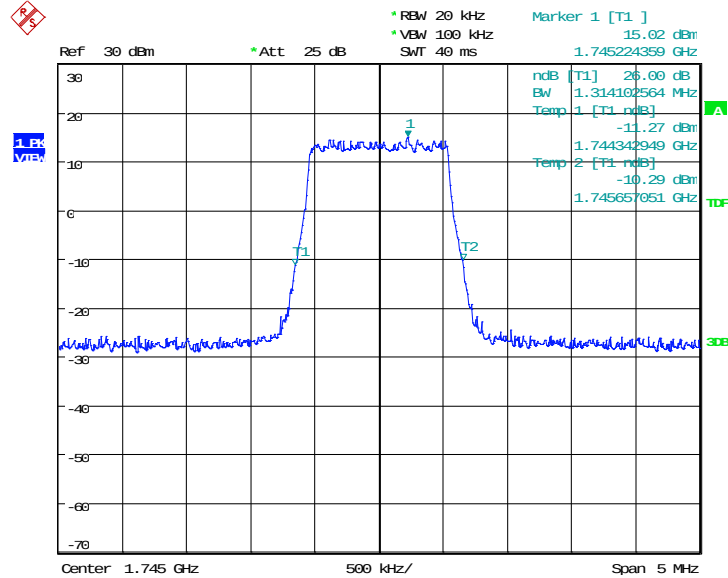


Date: 31.JUL.2018 12:11:35

LTE band 66, 1.4MHz (-26dBc)

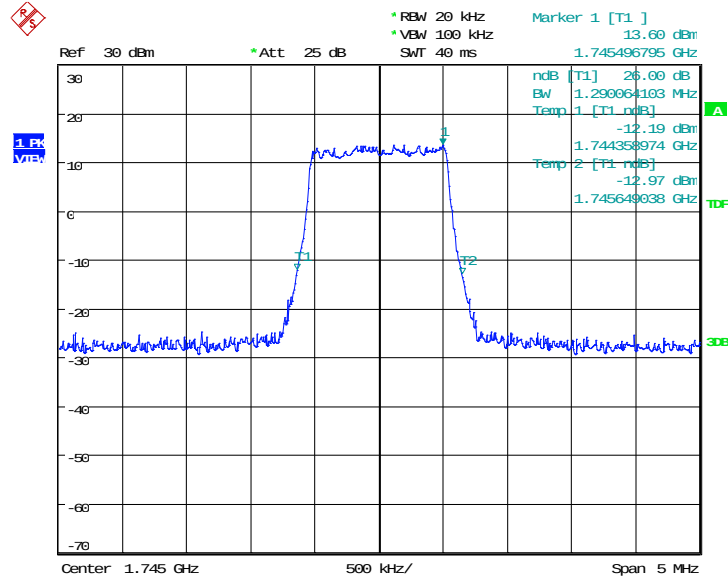
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
1745.0	QPSK	16QAM
	1314.10	1290.06

LTE band 66, 1.4MHz Bandwidth, QPSK (-26dBc BW)



Date: 31.JUL.2018 12:15:44

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

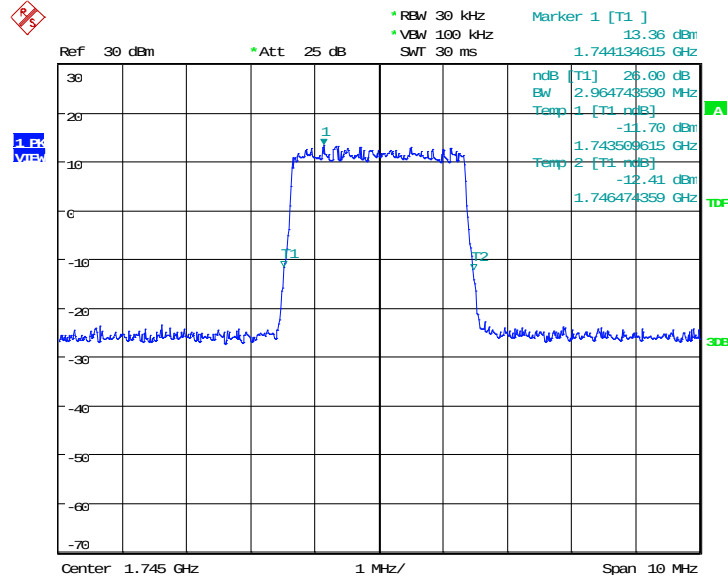


Date: 31.JUL.2018 12:15:59

LTE band 66, 3MHz (-26dBc)

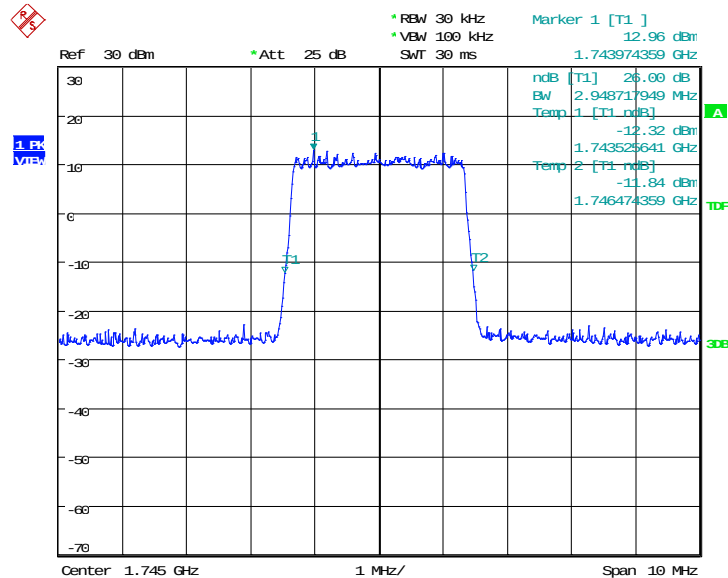
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
1745.0	QPSK	16QAM
	2964.74	2948.72

LTE band 66, 3MHz Bandwidth, QPSK (-26dBc BW)



Date: 31.JUL.2018 12:20:04

LTE band 66, 3MHz Bandwidth, 16QAM (-26dBc BW)

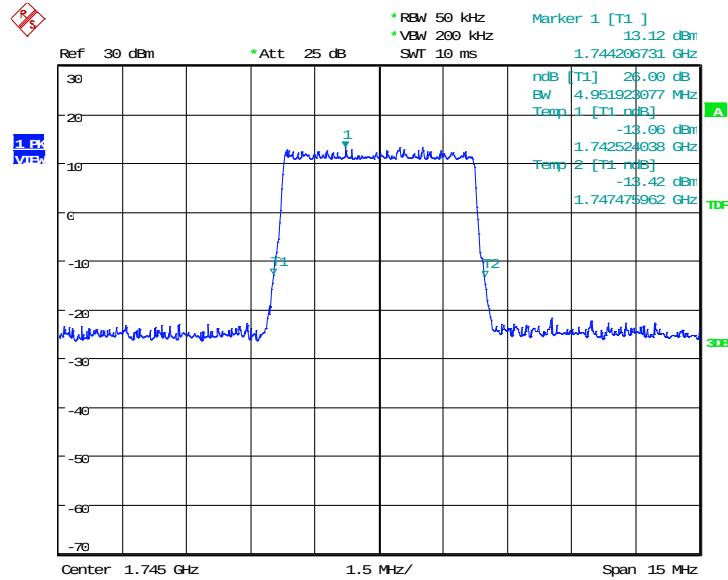


Date: 31.JUL.2018 12:20:19

LTE band 66, 5MHz (-26dBc)

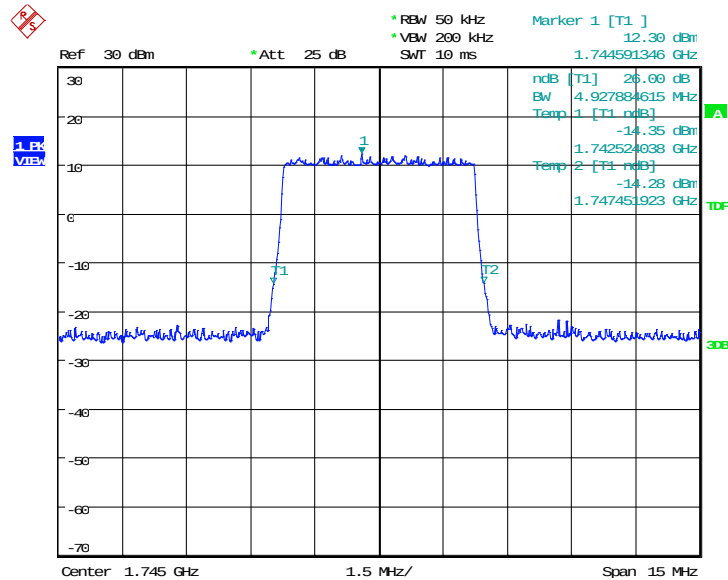
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
1745.0	QPSK	16QAM
	4951.92	4927.88

LTE band 66, 5MHz Bandwidth, QPSK (-26dBc BW)



Date: 31.JUL.2018 12:24:22

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

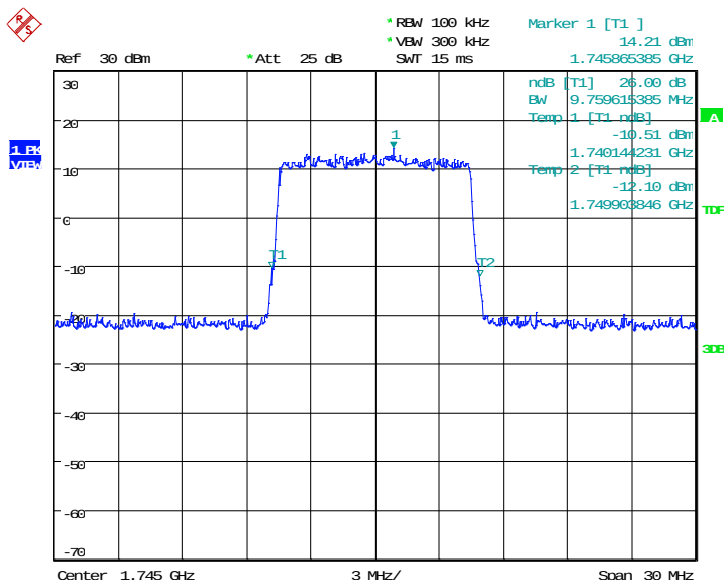


Date: 31.JUL.2018 12:24:38

LTE band 66, 10MHz (-26dBc)

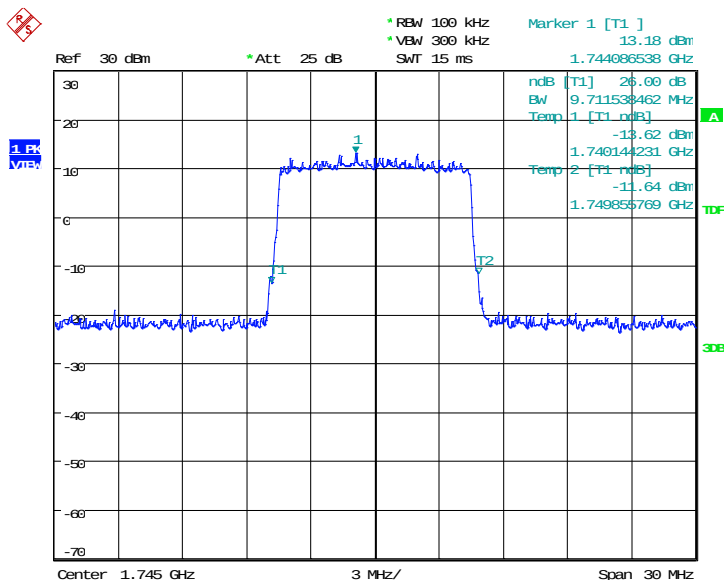
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
1745.0	QPSK	16QAM
	9759.62	9711.54

LTE band 66, 10MHz Bandwidth, QPSK (-26dBc BW)



Date: 31.JUL.2018 12:28:40

LTE band 66, 10MHz Bandwidth, 16QAM (-26dBc BW)

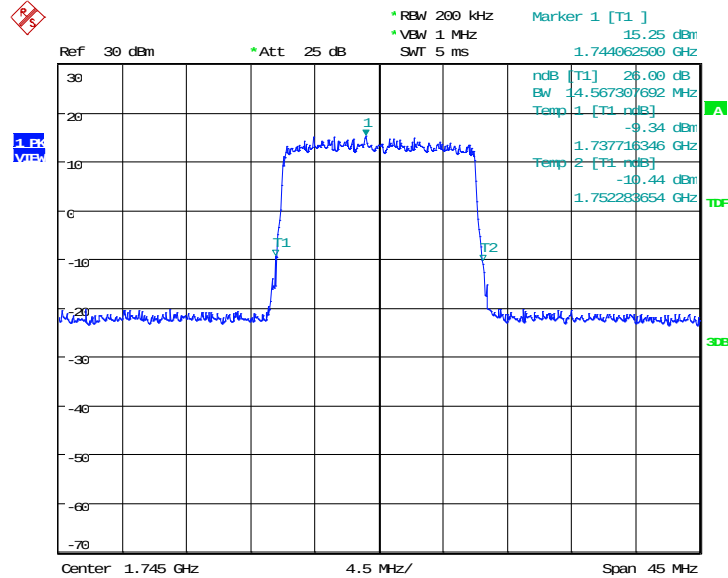


Date: 31.JUL.2018 12:28:56

LTE band 66, 15MHz (-26dBc)

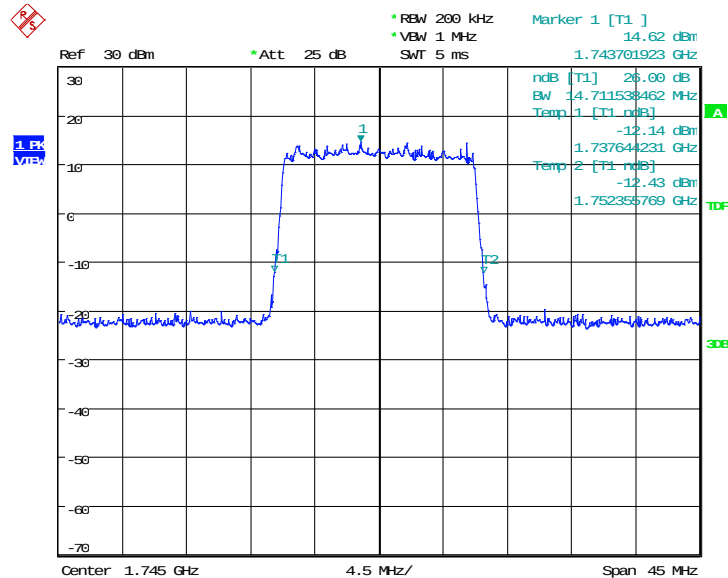
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
1745.0	QPSK	16QAM
	14567.31	14711.54

LTE band 66, 15MHz Bandwidth, QPSK (-26dBc BW)



Date: 31.JUL.2018 12:32:58

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

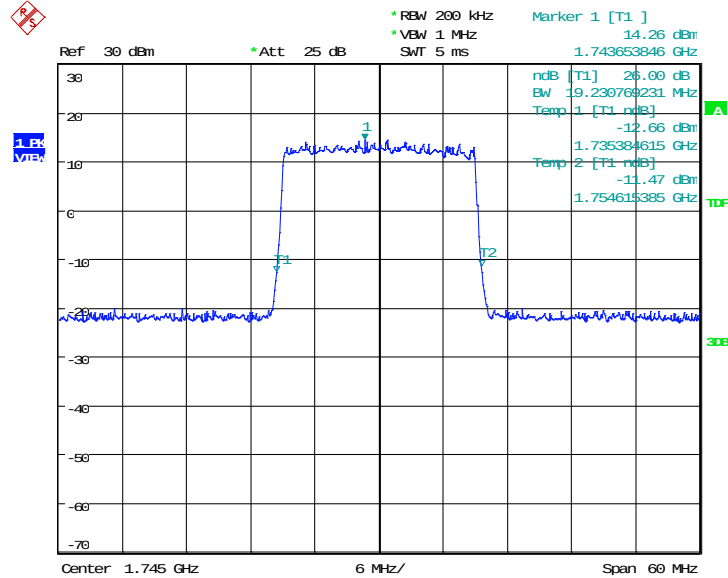


Date: 31.JUL.2018 12:33:14

LTE band 66, 20MHz (-26dBc)

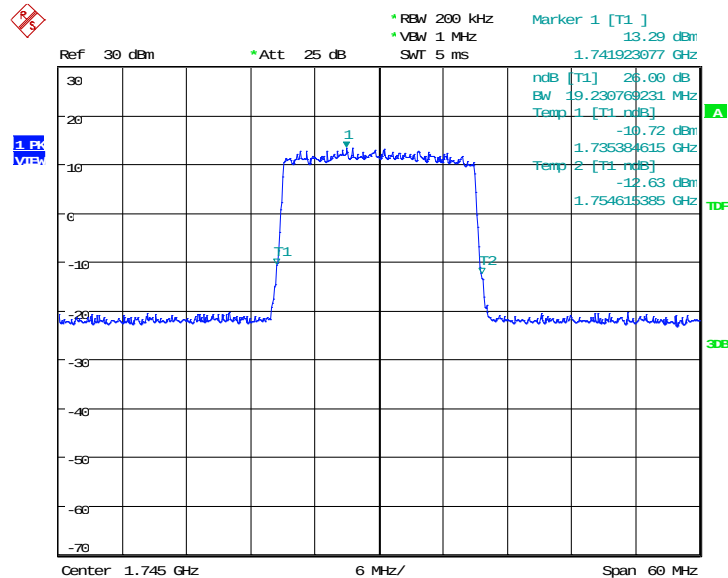
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
1745.0	QPSK	16QAM
	19230.77	19230.77

LTE band 66, 20MHz Bandwidth, QPSK (-26dBc BW)



Date: 31.JUL.2018 12:37:19

LTE band 66, 20MHz Bandwidth, 16QAM (-26dBc BW)



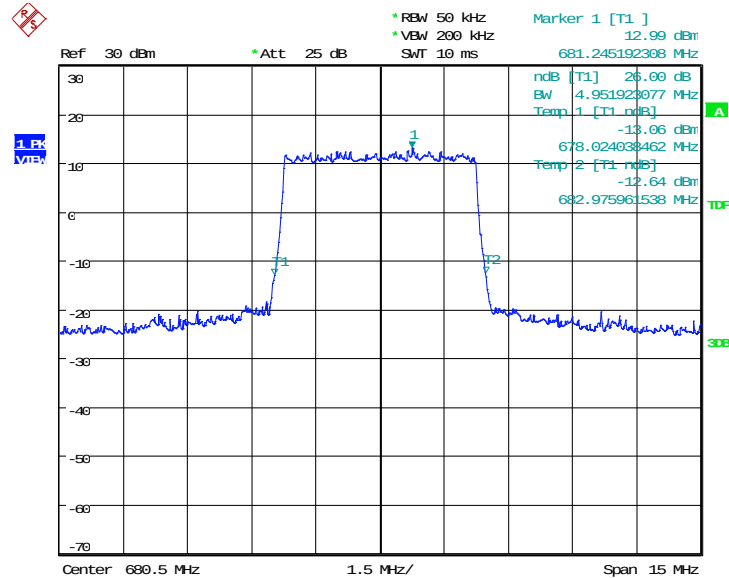
Date: 31.JUL.2018 12:37:35

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

LTE band 71, 5MHz (-26dBc)

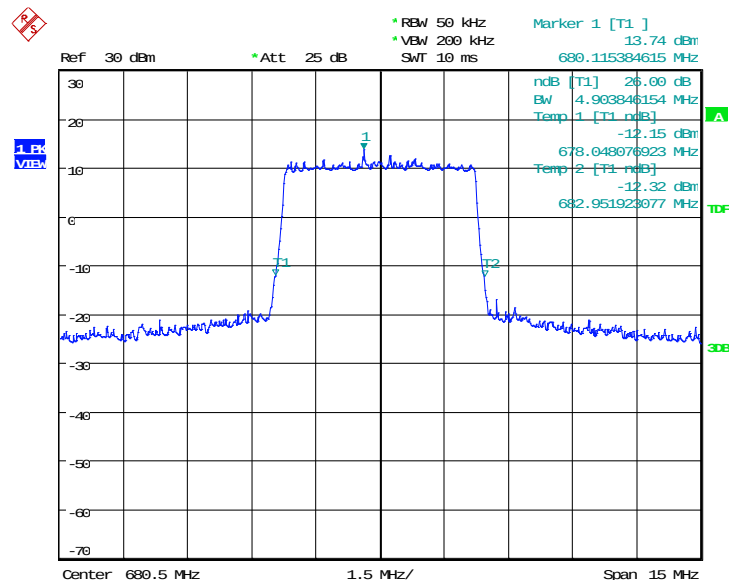
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
680.5	QPSK	16QAM
	4879.81	4855.77

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



Date: 16.AUG.2018 06:32:06

LTE band 71, 5MHz Bandwidth,16QAM (-26dBc BW)

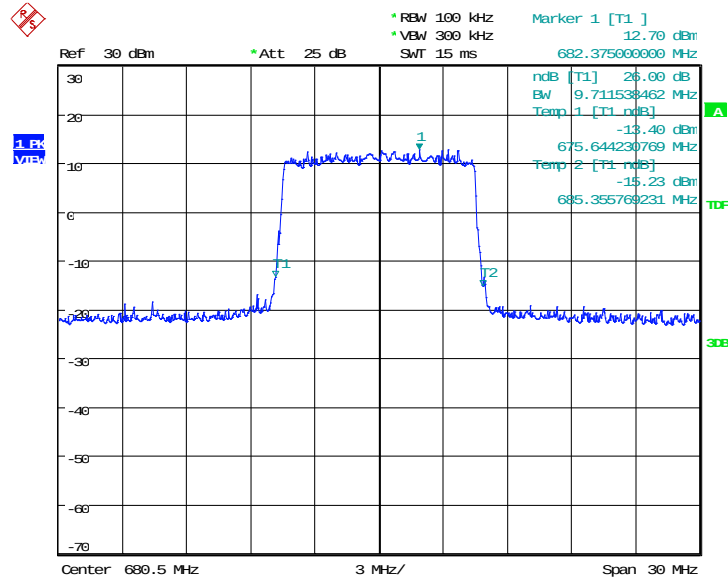


Date: 16.AUG.2018 06:30:42

LTE band 71, 10MHz (-26dBc)

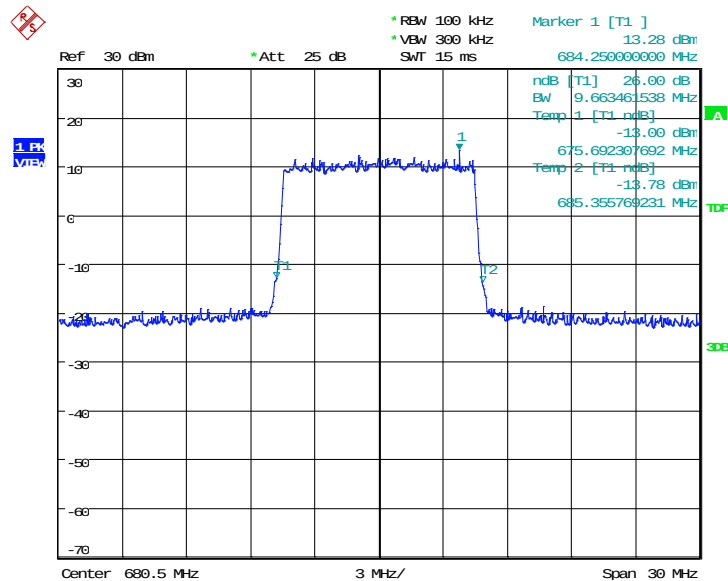
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
680.5	QPSK	16QAM
	9615.38	9519.23

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



Date: 16.AUG.2018 06:33:58

LTE band 71, 10MHz Bandwidth, 16QAM (-26dBc BW)

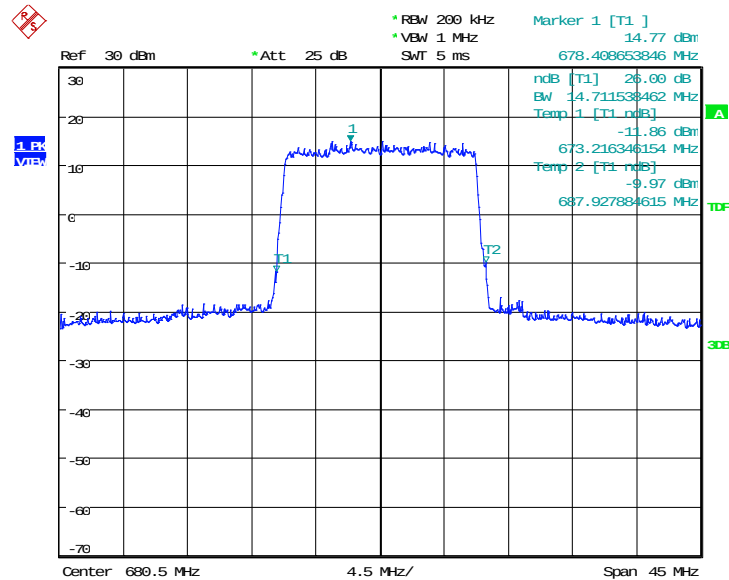


Date: 16.AUG.2018 06:34:30

LTE band 71, 15MHz (-26dBc)

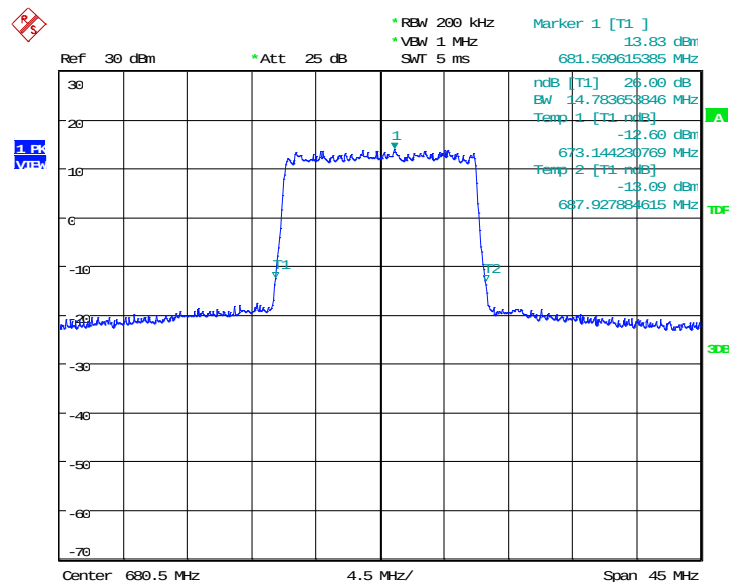
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
680.5	QPSK	16QAM
	14495.19	14495.19

LTE band 71, 15MHz Bandwidth, QPSK (-26dBc BW)



Date: 16.AUG.2018 06:47:21

LTE band 71, 15MHz Bandwidth, 16QAM (-26dBc BW)

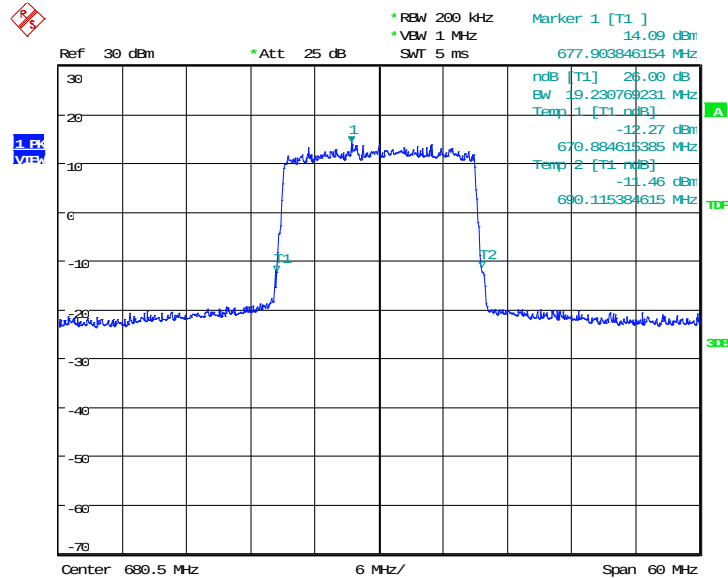


Date: 16.AUG.2018 06:46:30

LTE band 71, 20MHz (-26dBc)

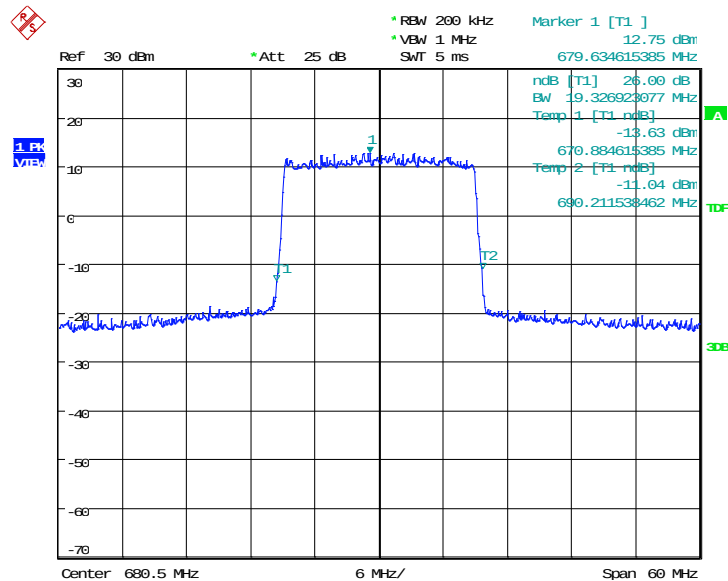
Frequency(MHz)	Occupied Bandwidth (-26dBc)(kHz)	
680.5	QPSK	16QAM
	18942.31	19038.46

LTE band 71, 20MHz Bandwidth, QPSK (-26dBc BW)



Date: 16.AUG.2018 06:51:45

LTE band 71, 20MHz Bandwidth, 16QAM (-26dBc BW)



Date: 16.AUG.2018 06:52:09

A.5 BAND EDGE COMPLIANCE

Reference

FCC: CFR Part 2.1051, 24.238, 27.53.

A.5.1 Measurement limit

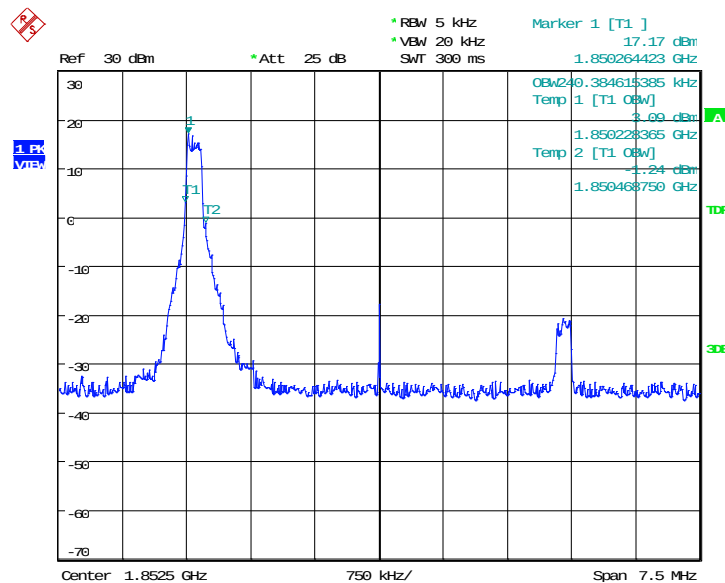
On any frequency outside frequency band of the US Cellular/PCS spectrum, the power of any emission shall be attenuated below the transmitter power (P, in Watts) by at least $43+10\log(P)$ dB. For all power levels +30 dBm to 0 dBm, this becomes a constant specification limit of -13 dBm. A relaxation of the reference bandwidth is often provided for measurements within a specified frequency range at the edge of the authorized frequency block/band. This is often implemented by permitting the use of a narrower RBW (typically limited to a minimum RBW of 1% of the OBW) for measuring the out-of-band emissions without a requirement to integrate the result over the full reference bandwidth.

A.5.2 Measurement result

Only worst case result is given below

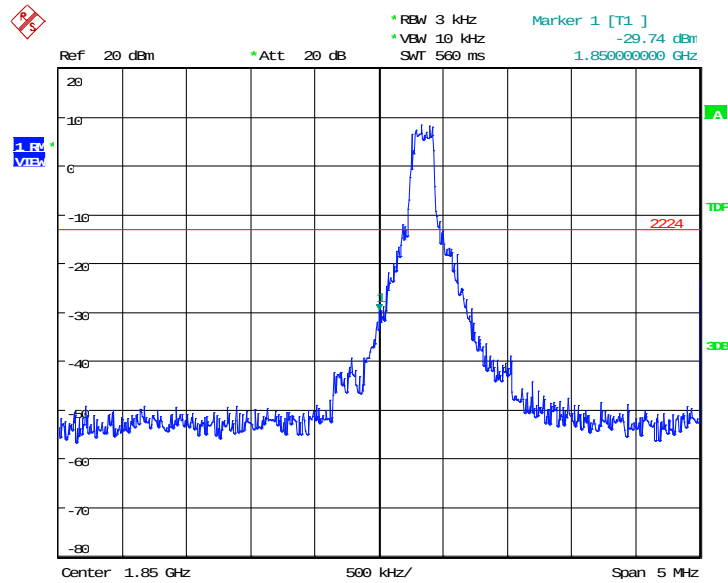
LTE band 2

OBW: 1RB-low_offset



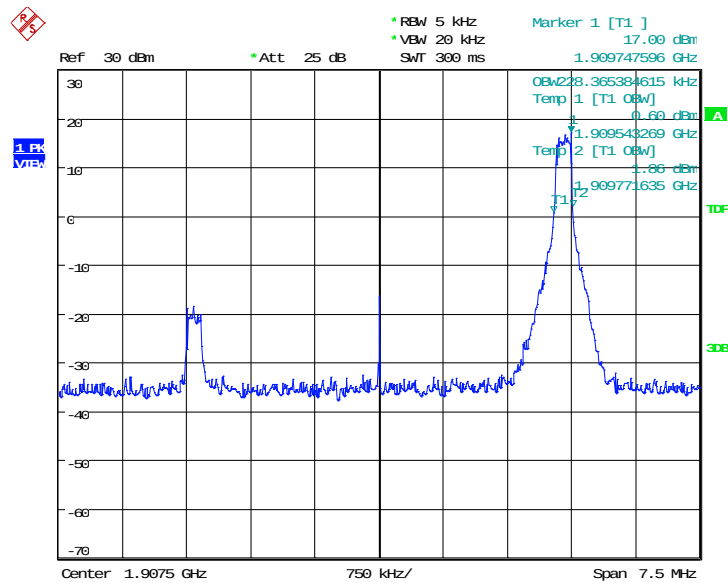
Date: 9.AUG.2018 07:59:58

LOW BAND EDGE BLOCK-1RB-low_offset



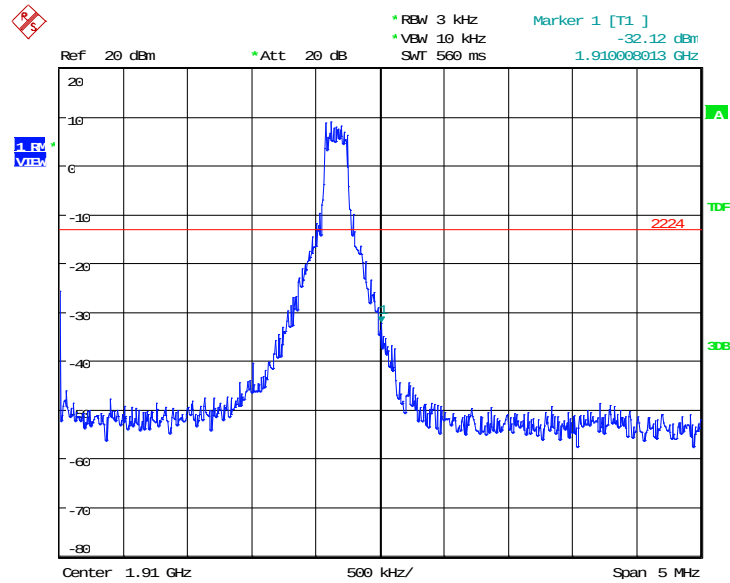
Date: 9.AUG.2018 08:01:50

OBW: 1RB-high_offset



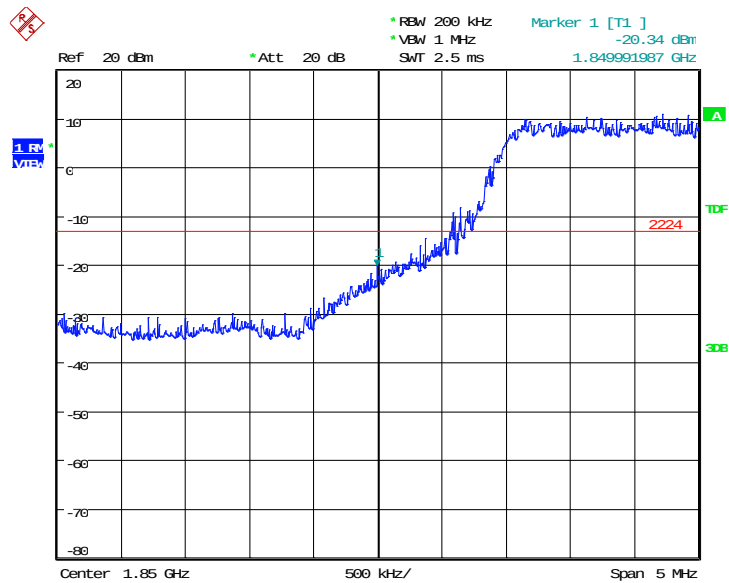
Date: 9.AUG.2018 08:00:48

HIGH BAND EDGE BLOCK-1RB-high_offset



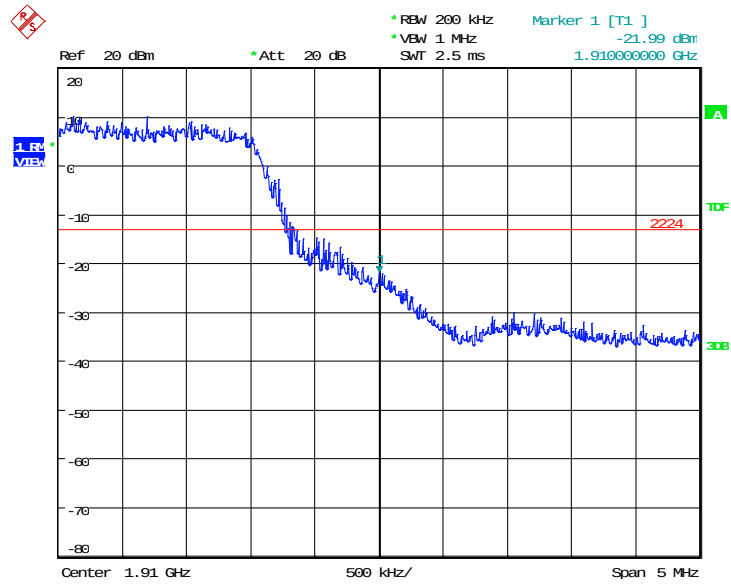
Date: 9.AUG.2018 08:02:33

LOW BAND EDGE BLOCK-20MHz-100%RB



Date: 31.JUL.2018 13:23:23

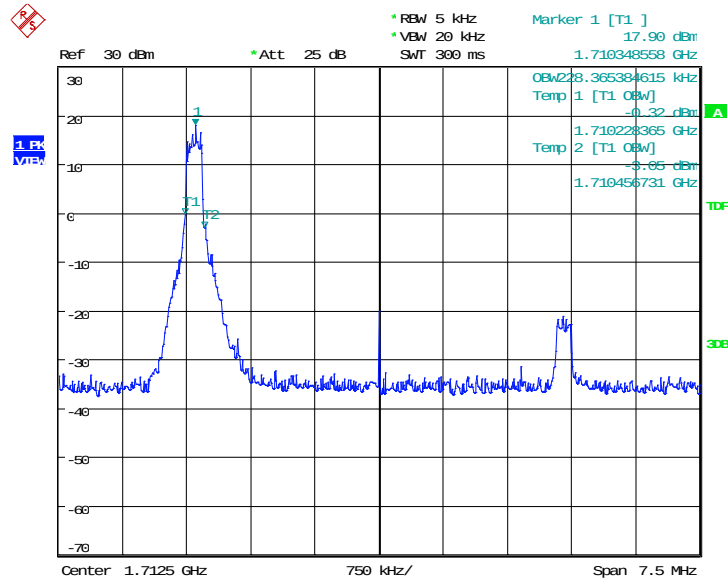
HIGH BAND EDGE BLOCK-20MHz-100%RB



Date: 31.JUL.2018 13:24:09

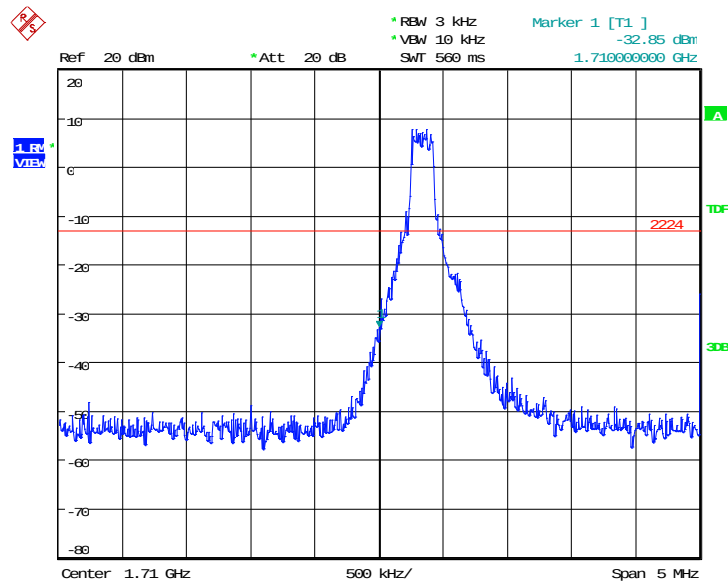
LTE band 4

OBW: 1RB-low_offset



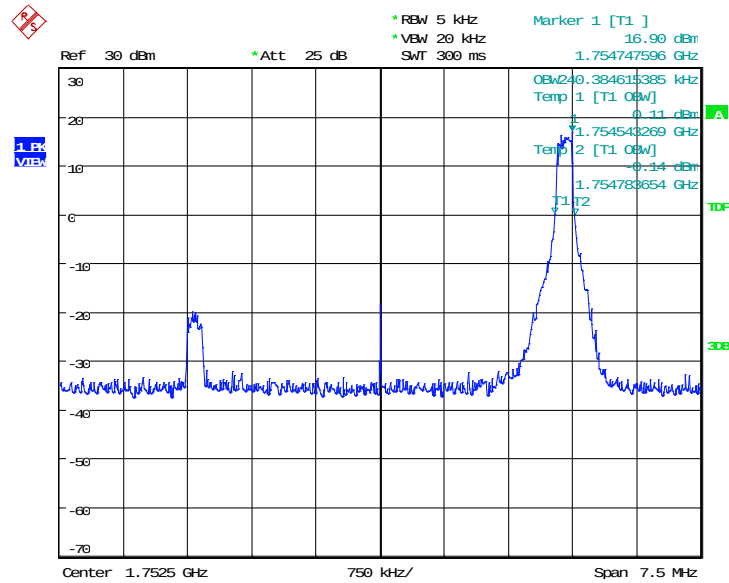
Date: 9.AUG.2018 08:03:48

LOW BAND EDGE BLOCK-1RB-low_offset



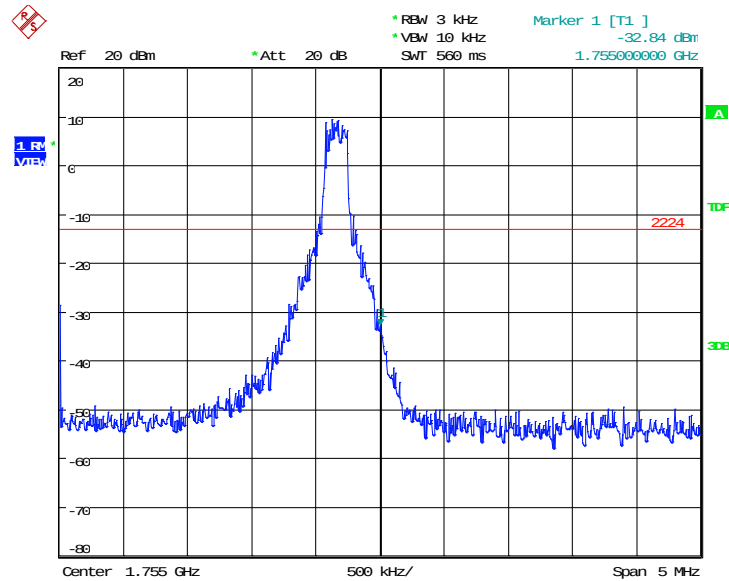
Date: 9.AUG.2018 08:05:40

OBW: 1RB-high_offset



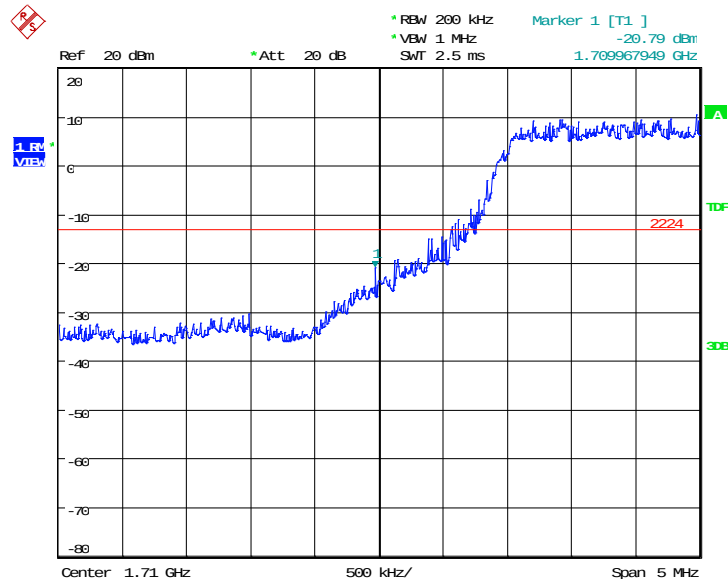
Date: 9.AUG.2018 08:04:38

HIGH BAND EDGE BLOCK-1RB-high_offset



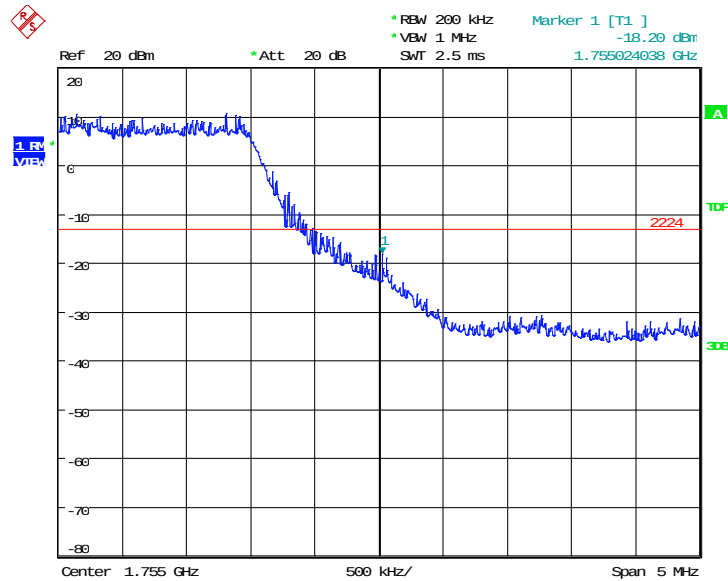
Date: 9.AUG.2018 08:06:23

LOW BAND EDGE BLOCK-20MHz-100%RB



Date: 31.JUL.2018 13:37:52

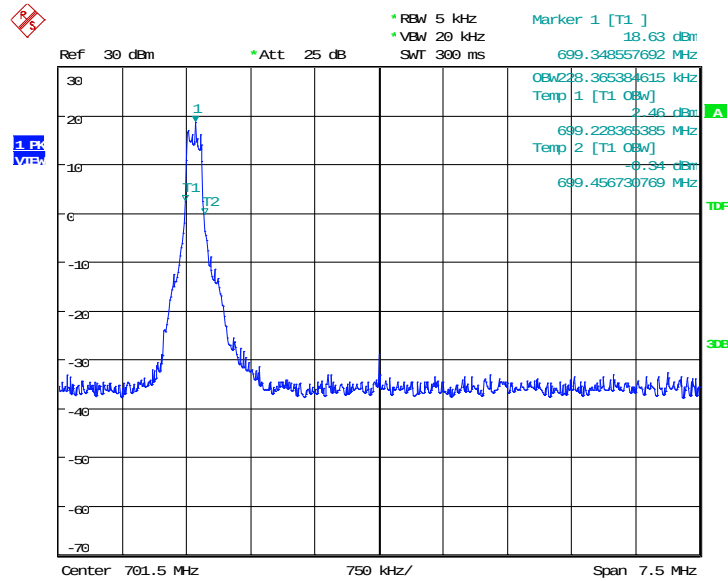
HIGH BAND EDGE BLOCK-20MHz-100%RB



Date: 31.JUL.2018 13:38:39

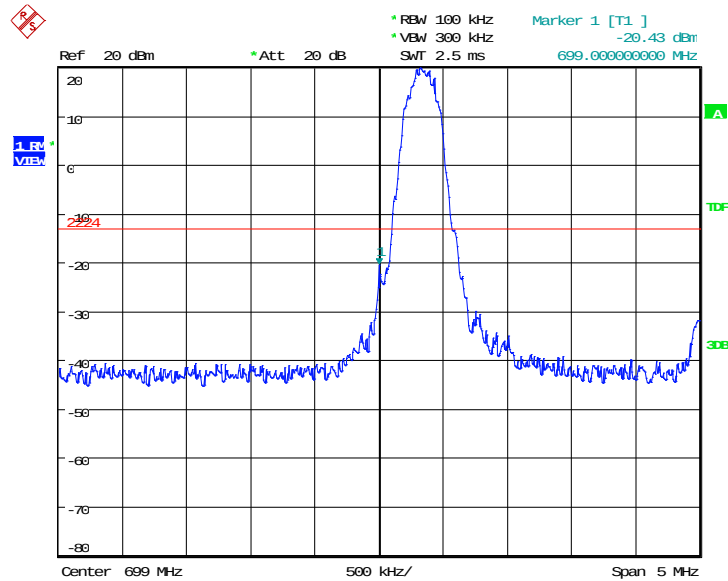
LTE band 12

OBW: 1RB-low_offset



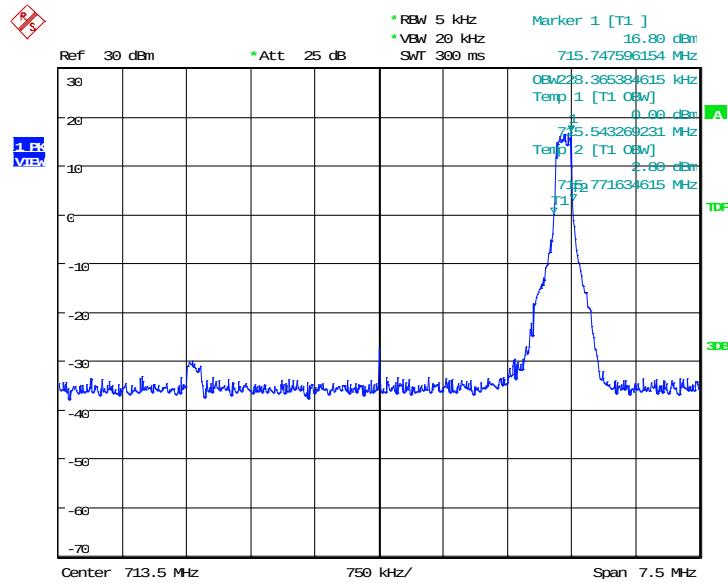
Date: 9.AUG.2018 08:07:38

LOW BAND EDGE BLOCK-1RB-low_offset



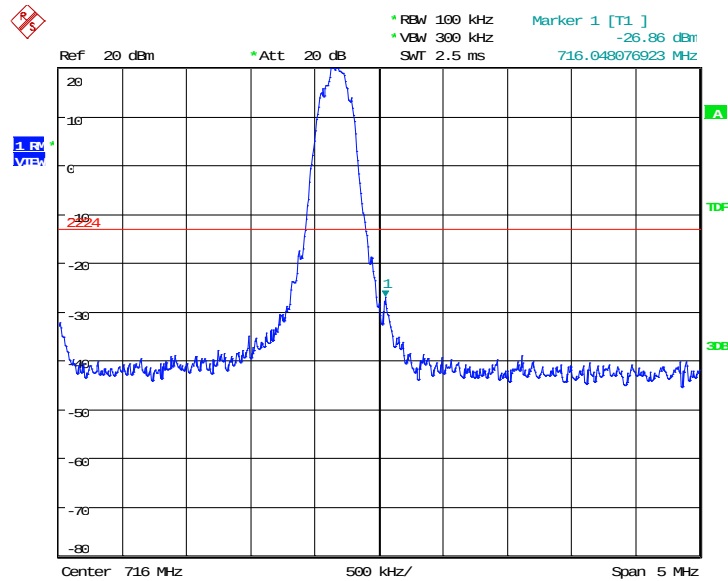
Date: 9.AUG.2018 08:09:29

OBW: 1RB-high_offset



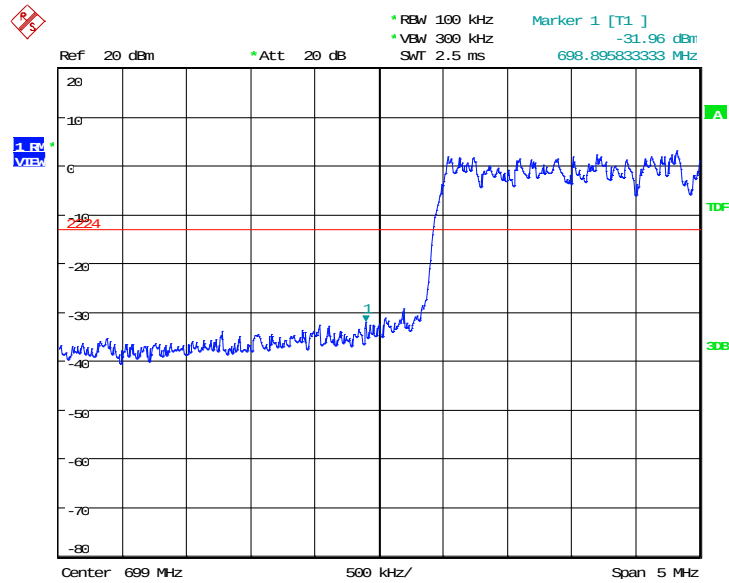
Date: 9.AUG.2018 08:08:28

HIGH BAND EDGE BLOCK-1RB-high_offset



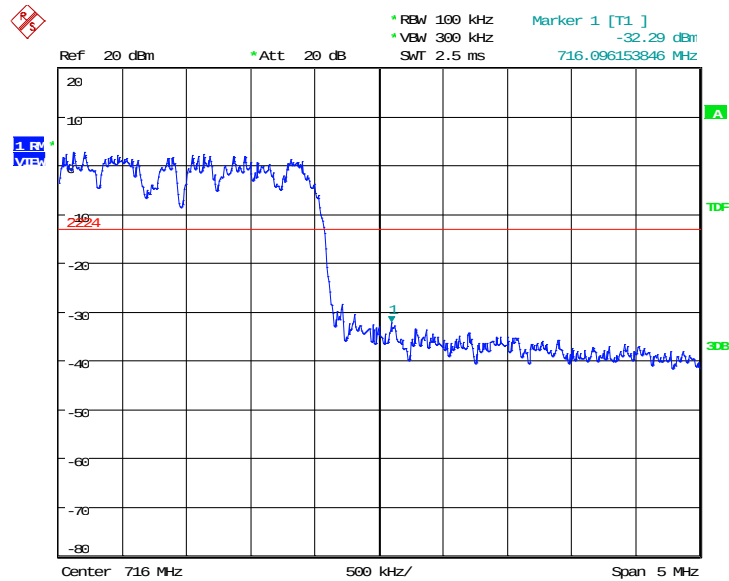
Date: 9.AUG.2018 08:10:13

LOW BAND EDGE BLOCK-10MHz-100%RB



Date: 13.AUG.2018 11:26:08

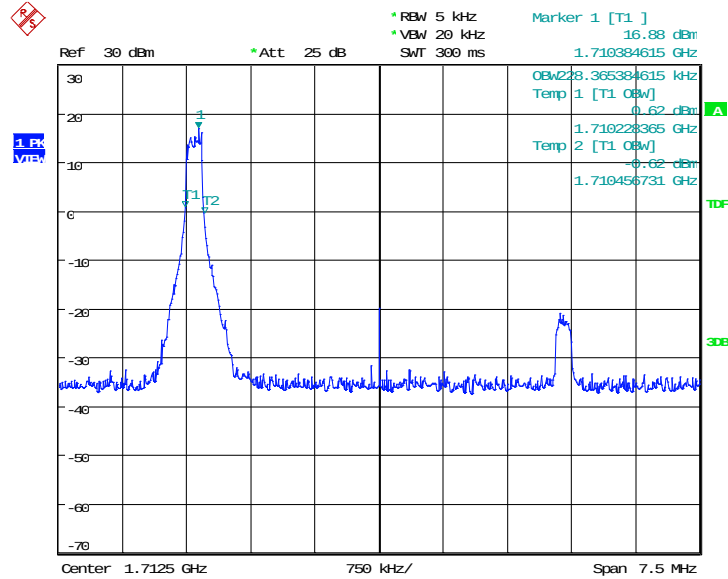
HIGH BAND EDGE BLOCK-10MHz-100%RB



Date: 13.AUG.2018 11:26:52

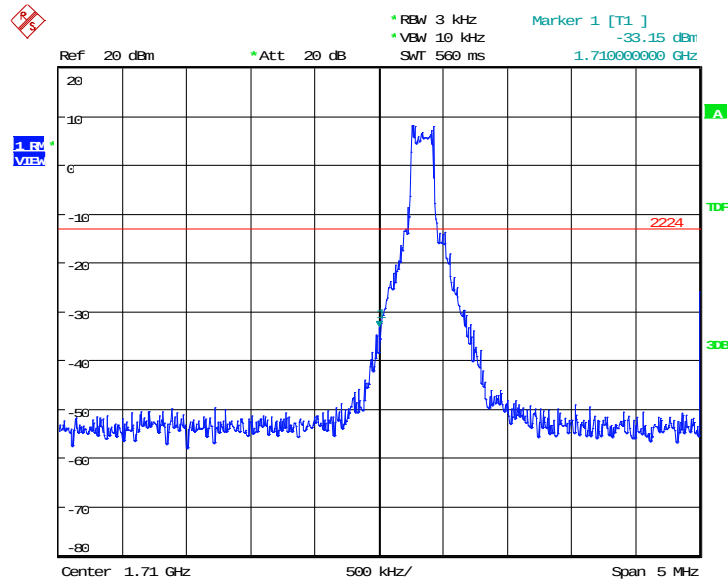
LTE band 66

OBW: 1RB-low_offset



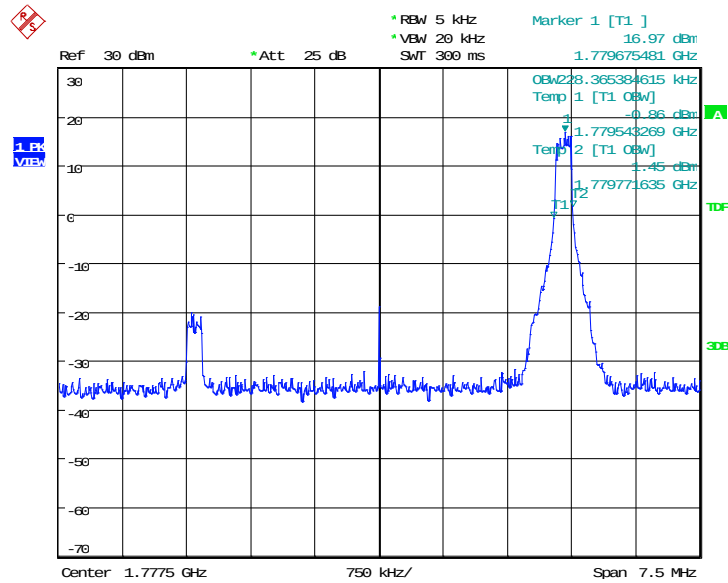
Date: 9.AUG.2018 08:11:29

LOW BAND EDGE BLOCK-1RB-low_offset



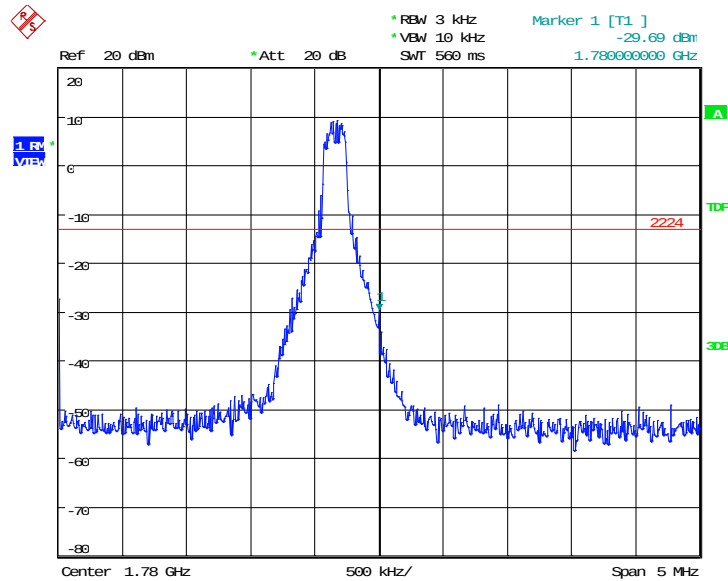
Date: 9.AUG.2018 08:13:20

OBW: 1RB-high_offset



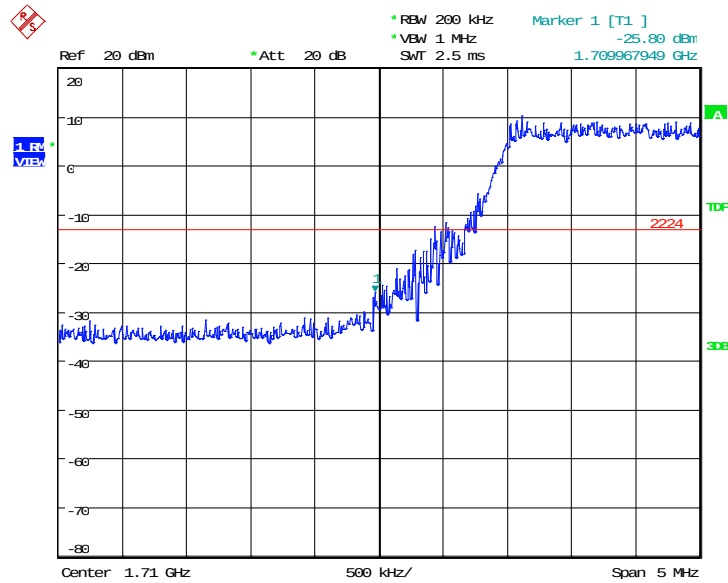
Date: 9.AUG.2018 08:12:19

HIGH BAND EDGE BLOCK-1RB-high_offset



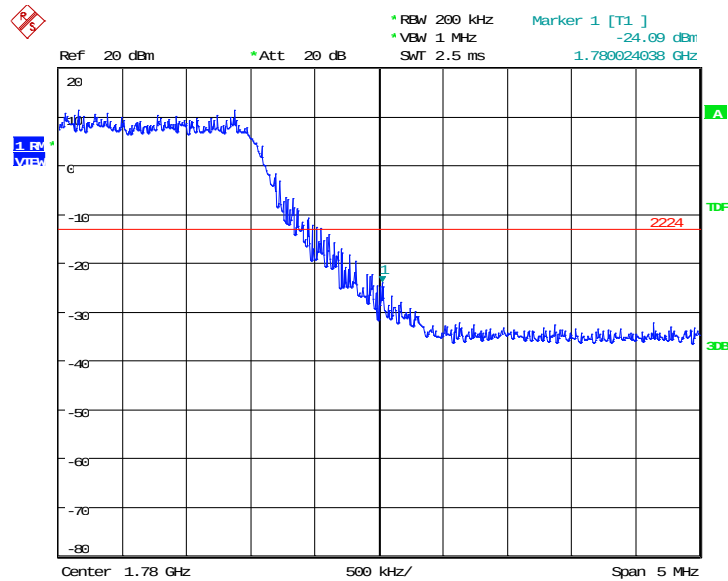
Date: 9.AUG.2018 08:14:04

LOW BAND EDGE BLOCK-20MHz-100%RB



Date: 31.JUL.2018 13:39:26

HIGH BAND EDGE BLOCK-20MHz-100%RB

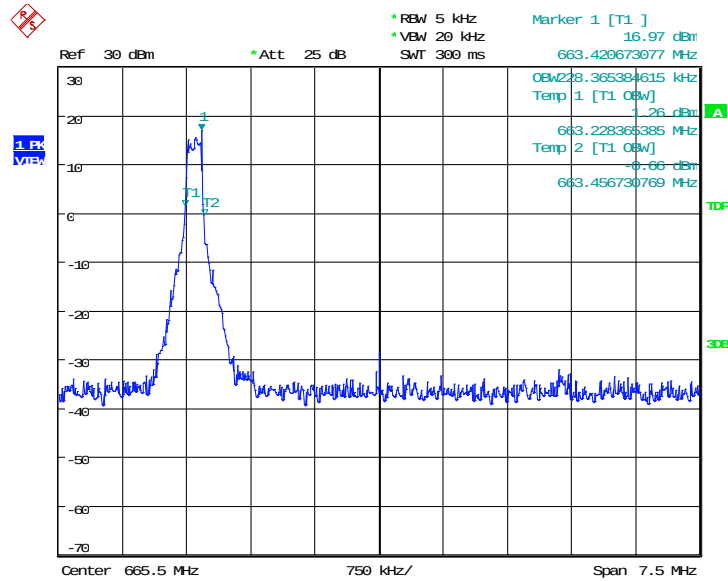


Date: 31.JUL.2018 13:40:13

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

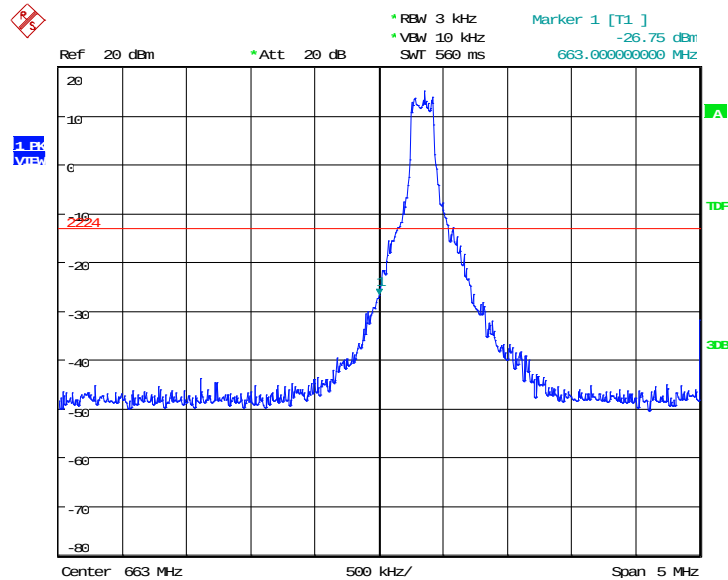
LTE band 71

OBW: 1RB-low_offset



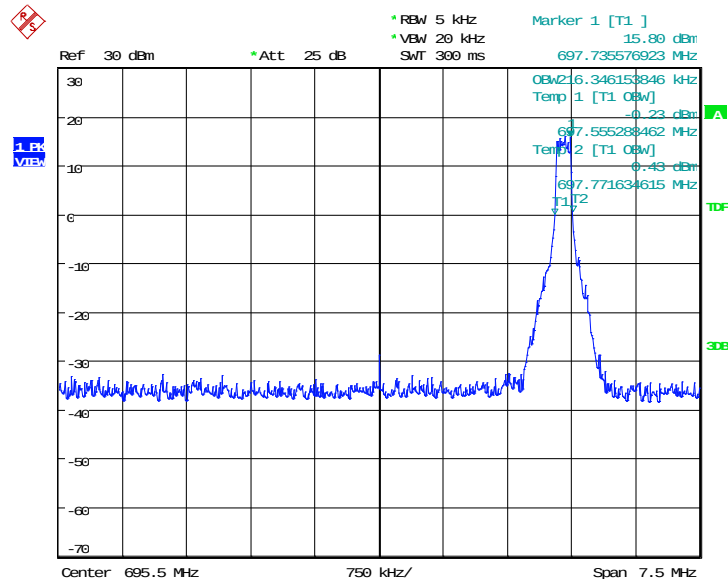
Date: 16.AUG.2018 07:01:35

LOW BAND EDGE BLOCK-1RB-low_offset



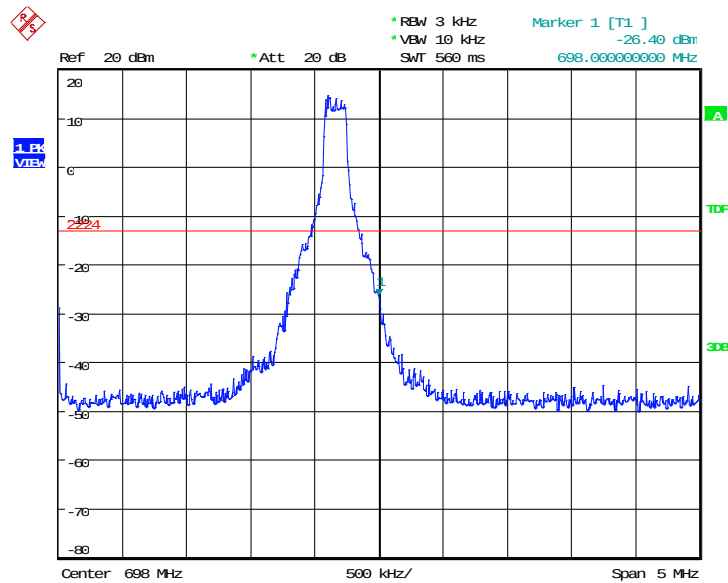
Date: 16.AUG.2018 07:08:21

OBW: 1RB-high_offset



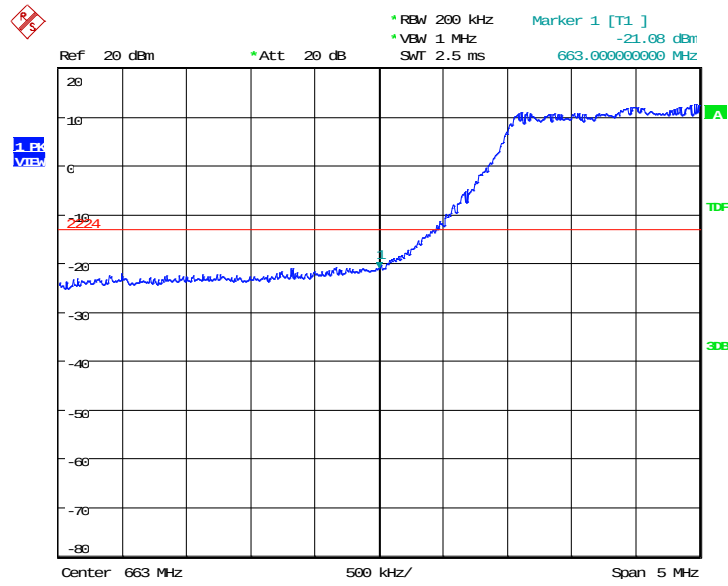
Date: 16.AUG.2018 07:04:43

HIGH BAND EDGE BLOCK-1RB-high_offset



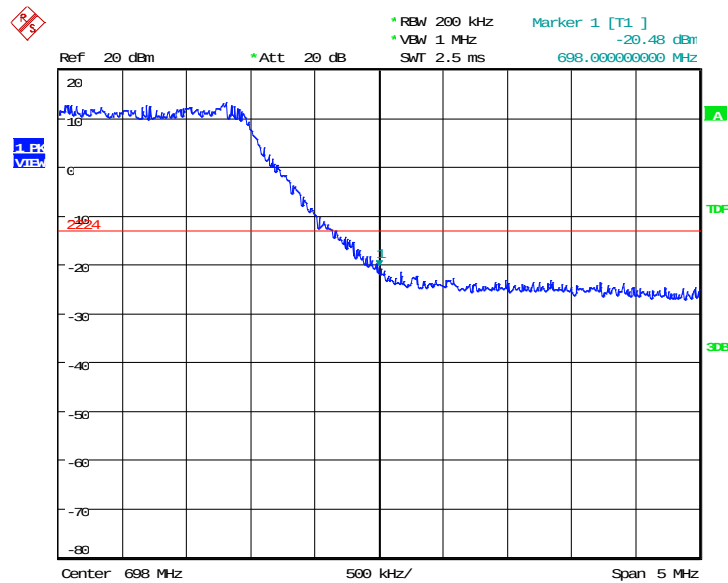
Date: 16.AUG.2018 07:06:49

LOW BAND EDGE BLOCK-20MHz-100%RB



Date: 16.AUG.2018 06:58:45

HIGH BAND EDGE BLOCK-20MHz-100%RB



Date: 16.AUG.2018 06:59:26

A.6 CONDUCTED SPURIOUS EMISSION

Reference

FCC: CFR Part 2.1051, 24.238, 27.53.

A.6.1 Measurement Method

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

1. Determine frequency range for measurements: From CFR 2.1051 the spectrum should be investigated from the lowest radio frequency generated in the equipment up to at least the 10th harmonic of the carrier frequency. For the mobile station equipment tested, this equates to a frequency range of 13 MHz to 9 GHz, data taken from 10 MHz to 25 GHz.
2. Determine EUT transmit frequencies: below outlines the band edge frequencies pertinent to conducted emissions testing.
3. The number of sweep points of spectrum analyzer is set to 30001 which is greater than span/RBW.

A. 6.2 Measurement Limit

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

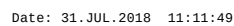
The specification that emissions shall be attenuated below the transmitter power (P) by at least $43 + 10 \log(P)$ dB, translates in the relevant power range (1 to 0.001 W) to -13 dBm. At 1 W the specified minimum attenuation becomes 43 dB and relative to a 30 dBm (1 W) carrier becomes a limit of -13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

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

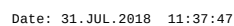
Part 27.53(a) states for mobile and portable stations operating in the 2305–2315 MHz and 2350–2360 MHz bands: By a factor of not less than: $43 + 10 \log(P)$ dB on all frequencies between 2305 and 2320 MHz and on all frequencies between 2345 and 2360 MHz that are outside the licensed band(s) of operation, not less than $55 + 10 \log(P)$ dB on all frequencies between 2320 and 2324 MHz and on all frequencies between 2341 and 2345 MHz, not less than $61 + 10 \log(P)$ dB on all frequencies between 2324 and 2328 MHz and on all frequencies between 2337 and 2341 MHz, and not less than $67 + 10 \log(P)$ dB on all frequencies between 2328 and 2337 MHz;

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

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

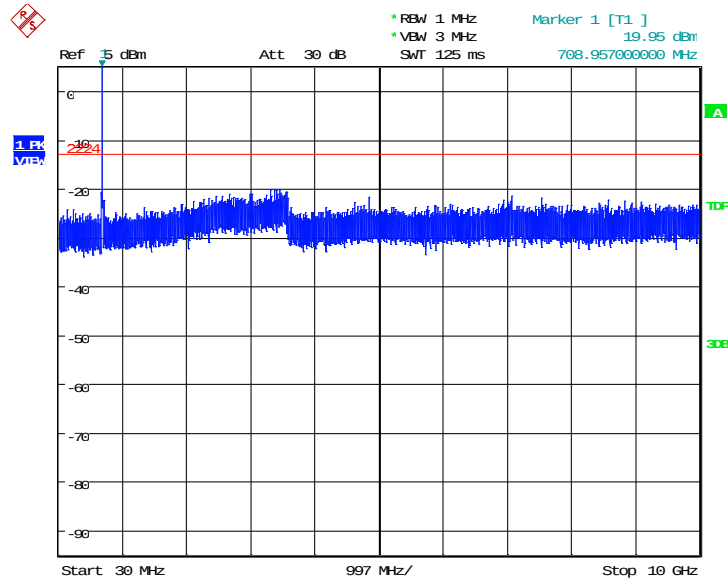


NOTE: peak above the limit line is the carrier frequency.



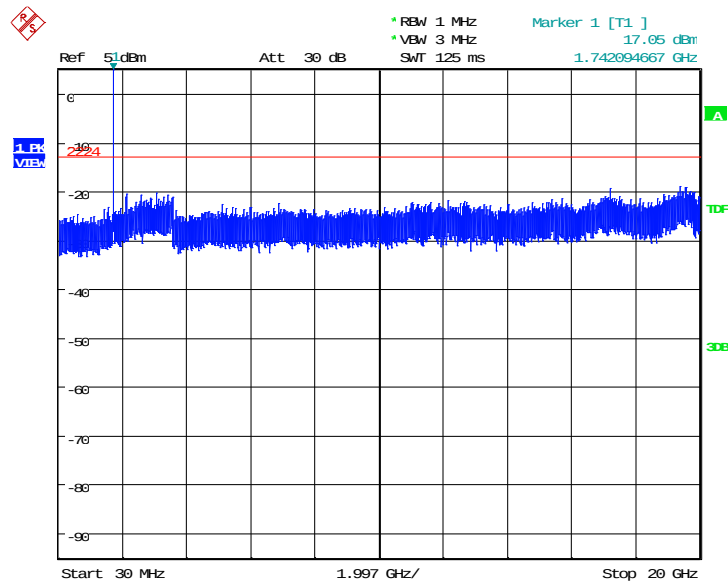
LTE band 12: 30MHz – 10GHz

Spurious emission limit –13dBm.



Date: 31.JUL.2018 12:12:29

LTE band 66: 30MHz – 20GHz



Date: 31.JUL.2018 12:38:30

The spectrum plot shows a signal with a peak at 997 MHz. The peak is labeled with a value of -16.65 dBm. The plot includes a grid with frequency on the horizontal axis and power on the vertical axis. The horizontal axis ranges from 30 MHz to 10 GHz, with major ticks every 100 MHz. The vertical axis ranges from -90 dBm to 0 dBm, with major ticks every 10 dBm. The signal is represented by a blue trace, and the peak is highlighted with a red line. The plot also shows a noise floor around -120 dBm.

Ref: 5 dBm
Att: 30 dB
RBW: 1 MHz
VBW: 3 MHz
SWT: 125 ms
Marker 1 [T1]
16.65 dBm
681.373333333 MHz

Start: 30 MHz
997 MHz/
Stop: 10 GHz

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

A.7 PEAK-TO-AVERAGE POWER RATIO

Reference

FCC: CFR Part 24.232, 27.50(d)

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

- a) Refer to instrument's analyzer instruction manual for details on how to use the power statistics/CCDF function;
- b) Set resolution/measurement bandwidth $\geq$ signal's occupied bandwidth;
- c) Set the number of counts to a value that stabilizes the measured CCDF curve;
- d) Set the measurement interval to 1 ms
- e) Record the maximum PAPR level associated with a probability of 0.1%

A.7.1 Measurement limit

not exceed 13 dB

A.7.2 Measurement results

LTE band 2

Frequency(MHz)	Bandwidth(MHz)	PAPR(dB)	
		QPSK	16QAM
1860.0	20	6.92	7.40
	15	6.57	7.15
	10	5.51	6.28
	5	5.38	5.96
	3	5.54	6.15
	1.4	5.35	6.06

LTE band 4

Frequency(MHz)	Bandwidth(MHz)	PAPR(dB)	
		QPSK	16QAM
1732.5	20	6.96	7.37
	15	6.57	7.08
	10	5.45	6.22
	5	5.19	6.03
	3	5.38	5.99
	1.4	5.35	5.90

LTE band 12

Frequency(MHz)	Bandwidth(MHz)	PAPR(dB)	
		QPSK	16QAM
707.5	10	5.80	6.70
	5	5.96	6.67
	3	6.15	6.92
	1.4	6.06	6.73

LTE band 66

Frequency(MHz)	Bandwidth(MHz)	PAPR(dB)	
		QPSK	16QAM
1745.0	20	6.89	7.50
	15	6.44	7.12
	10	5.77	6.51
	5	5.71	6.47
	3	5.74	6.44
	1.4	5.74	6.47

LTE band 71

Frequency(MHz)	Bandwidth(MHz)	PAPR(dB)	
		QPSK	16QAM
680.5	20	6.47	7.31
	15	5.77	6.86
	10	5.35	6.31
	5	5.54	6.38

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

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