FCC/ISED RF TEST REPORT

Test Report Number……	**PTK-18103001-LC-RF-LTE**
Applicant……	**Pacific Track, LLC**
Applicant Address……	**1300 Bristol Street North, Suite 100, Newport Beach, CA 92660**
Product Name……	Telematics Device
Model Number……	PT40
Family Product/Model……	None
FCC ID……	2ALBDPT40
IC ID……	23259-PT40
Date of EUT received……	01/21/2019
Date of Test……	01/23/2019 – 02/12/2019
Report Issue Date……	02/12/2019
Test Standards……	**47CFR Part 22: 2018** **47CFR Part 24: 2018** **47CFR Part 27: 2018** **RSS-130 Issue 2: Feb 2019** **RSS-132 Issue 3: Jan 2013** **RSS-133 Issue 6: Jan 2018** **RSS-139 Issue 3: Jul 2015** **SRSP-510 Issue 5: Feb 2009** **RSS-Gen Issue 5: Apr 2018**
Test Result……	Pass

Issued By:

Vista Laboratories

1261 Puerta Del Sol, San Clemente, CA 92673 USA

www.vista-compliance.com

Tested by:	**Approved By:**
Sherwin Lee/Test Engineer	**David Zhang/Technical Manager**

Laboratory Introduction

Vista Labs is an A2LA accredited 17025 compliant regulatory compliance testing laboratories (Cert. number: 4848-01) strategically located in Orange County, providing services in the electrical and telecommunication industries. Vista labs is also recognized testing facility for Australia (ACMA), Chinese Taipei (BSMI), Chinese Taipei (NCC), Hong Kong (OFCA), Israel (MOC), Korea (RRA), Singapore (IMDA), Vietnam (MIC), etc.

Our comprehensive testing services include safety testing, EMC emission and susceptibility testing, RF and wireless testing (including DFS).

As your partner, Vista investigates appropriate test standards, develops test plans, performs troubleshooting & failure analysis, reviews documentation, and provides test reports for a complete compliance testing and certification package.

ilac-MRA A2LA

Accredited Laboratory

A2LA has accredited

VISTA LABORATORIES, INC.

San Clemente, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 21st day of June 2018.

President and CEO
For the Accreditation Council
Certificate Number 4848.01
Valid to July 31, 2020

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

17025 Product Testing Accreditation Certificate

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REVISION HISTORY

Revision	Issue Date	Description	Note
Original	02/12/2019	Original release	N/A

1 General Information

1.1 Applicant

Applicant:	Pacific Track, LLC
Applicant address:	1300 Bristol Street North, Suite 100, Newport Beach, CA 92660
Manufacturer:	Pacific Track, LLC
Manufacturer Address:	1300 Bristol Street North, Suite 100, Newport Beach, CA 92660

1.2 Product information

Product Name	Telematics Device
Model Number	PT40
Family Product/Model Number	None
Serial Number	4C1000000011
Frequency Band	BLE: 2402-2480MHz LTE Cat-M1 Band 2: 1850.7-1909.3MHz LTE Cat-M1 Band 4: 1710.7-1754.3MHz LTE Cat-M1 Band 5: 824.7-836.5MHz LTE Cat-M1 Band 12: 699.7-715.3MHz LTE Cat-M1 Band 13: 777.7-786.3MHz
Type of modulation	GFSK (BLE), QPSK/16QAM (LTE Cat-M1)
Equipment Class/ Category	DTS (BLE), PCB (LTE Cat-M1)
Maximum output power	3.99 dBm (BLE), 24.50 dBm (LTE Cat-M1)
Antenna Information	BLE - On board PCB trace antenna, gain: 5.3 dBi LTE Cat-M1 – On board PIFA antenna, gain: 0 dBi
Clock Frequencies	N/A
Port/Connectors	USB-C port, Molex Micro-Fit 3.0™ 20 pin connector
Input Power	Battery: 12VDC on vehicle
Power Adapter Manu/Model	N/A
Power Adapter SN	N/A
Hardware version	N/A
Software version	N/A
Simultaneous Transmission	BLE and LTE can transmit simultaneously.
Additional Info	N/A

1.3 Test standard and method

Test standard	47CFR Part 22: 2018 47CFR Part 24: 2018 47CFR Part 27: 2018 RSS-130 Issue 2: Feb 2019 RSS-132 Issue 3: Jan 2013 RSS-133 Issue 6: Jan 2018 RSS-139 Issue 3: Jul 2015 SRSP-510 Issue 5: Feb 2009 RSS-Gen Issue 5: Apr 2018
Test method	ANSI C63.26: 2015 KDB 971168 D01 Power Meas License Digital Systems v03r01 KDB 412172 D01 Determining ERP and EIRP v01r01

1.4 Test Purpose and statement

The purpose of this test report is intended to demonstrate the compliance of product listed in section 1.2, received from company listed in section 1.1, to the requirements of standard and method listed in section 1.3. Based on our test results, we conclude that the product tested complies with the requirements of the standards indicated.

2 Test site information

Lab performing tests	**Vista Laboratories**
Lab Address	1261 Puerta Del Sol, San Clemente, CA 92673 USA
Phone Number	+1 (949) 393-1123
Website	www. Vista-compliance.com

Test condition	Test Engineer	Test Environment	Test Date
RF conducted	Sherwin Lee	23.5°C / 58.2%/996 mbar	01/23/2019 – 02/12/2019
Radiated	Sherwin Lee	23.5°C / 58.2%/996 mbar	01/23/2019 – 02/12/2019

3 Modification of EUT

For RF conducted measurement purpose, the original antenna of test sample was removed and replace with external SMA connector; a short serial wire cable was soldered onto the PCB for sending command from Laptop to EUT to enable RF test mode; the special test firmware is used for testing purpose.

4 Test configuration and operation

4.1 EUT test configuration

EUT is powered by external battery. It is connected to a test laptop through USB-C to USB cable to receive test command for RF measurement. Serial port utility software is used to send command to EUT to enable the RF test mode.

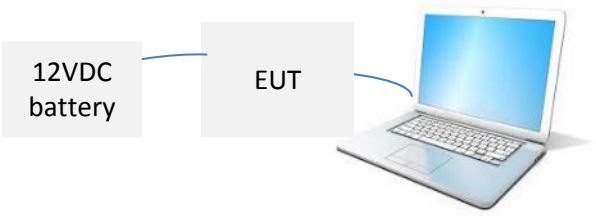
4.2 EUT test mode

Radio	Band	Bandwidth (MHz)	Modulation	Channel	Frequency (MHz)
LTE Cat-M1	2	1.4	QPSK/16QAM	18607	1850.7
LTE Cat-M1	2	1.4	QPSK/16QAM	18900	1880
LTE Cat-M1	2	1.4	QPSK/16QAM	19193	1909.3
LTE Cat-M1	4	1.4	QPSK/16QAM	19957	1710.7
LTE Cat-M1	4	1.4	QPSK/16QAM	20175	1732.5
LTE Cat-M1	4	1.4	QPSK/16QAM	20393	1754.3
LTE Cat-M1	5	1.4	QPSK/16QAM	20407	824.7
LTE Cat-M1	5	1.4	QPSK/16QAM	20525	836.5
LTE Cat-M1	5	1.4	QPSK/16QAM	20643	848.3
LTE Cat-M1	12	1.4	QPSK/16QAM	23017	699.7
LTE Cat-M1	12	1.4	QPSK/16QAM	23095	707.5
LTE Cat-M1	12	1.4	QPSK/16QAM	23173	715.3
LTE Cat-M1	13	1.4	QPSK/16QAM	23187	777.7
LTE Cat-M1	13	1.4	QPSK/16QAM	23230	782
LTE Cat-M1	13	1.4	QPSK/16QAM	23273	786.3

4.3 Supporting Equipment

Index	Description	Model	S/N	Brand	Remark
1	Laptop	P29G003	G1H5102	Dell	N/A

4.4 EUT setup diagram



4.5 EUT operation

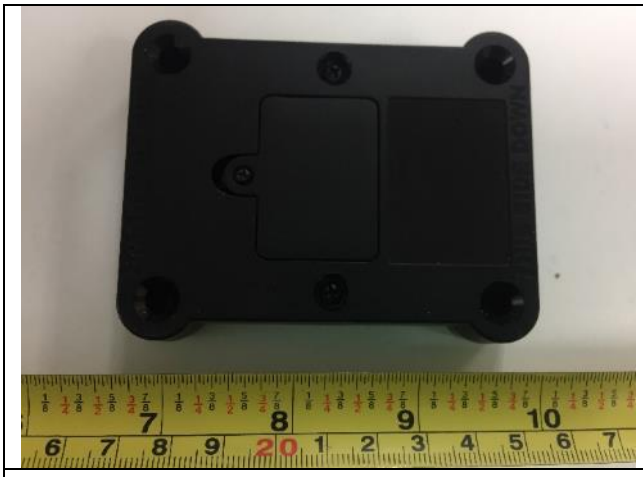
Serial port utility software and U-Blox m-Center software are used to send command to EUT to enable the RF test mode.

4.6 Test software

Index	Description	Remark
1	Serial Port Utility 3.8.2.0302	Serial utility software to send command to device for running RF test mode.
2	U-Blox m-Center 01.12.00	Software to send command to device for running RF test mode.
3	EMISoft Vasona 6.0049	EMC/Spurious emission test software used during testing

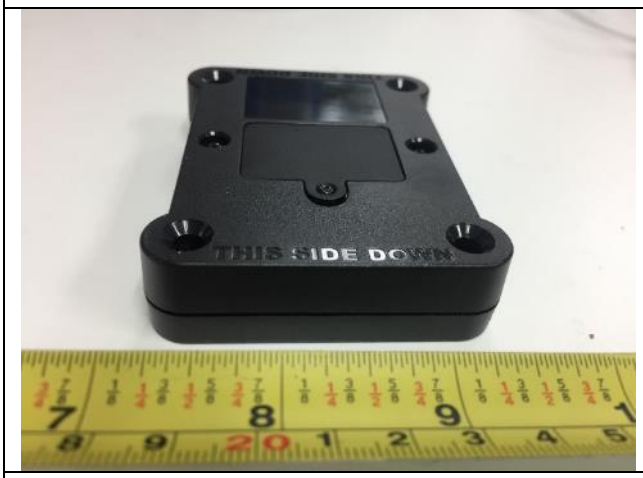
5 EUT and test setup pictures

5.1 EUT pictures



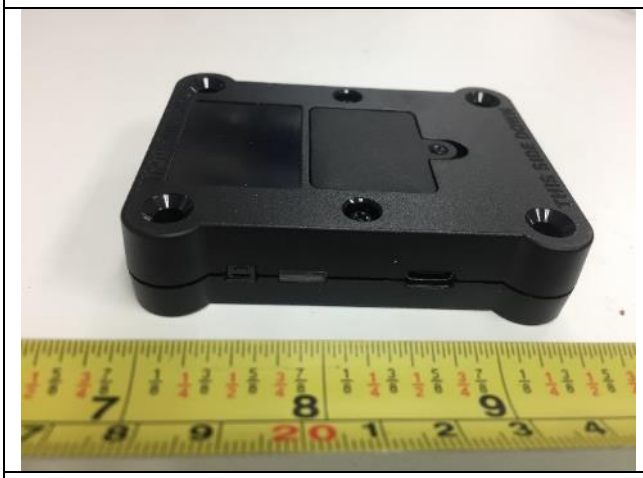
EUT Top View

EUT Bottom View

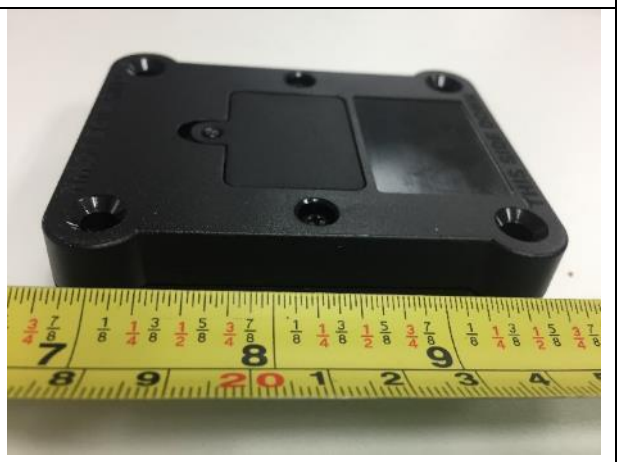


EUT Front View

EUT Rear View



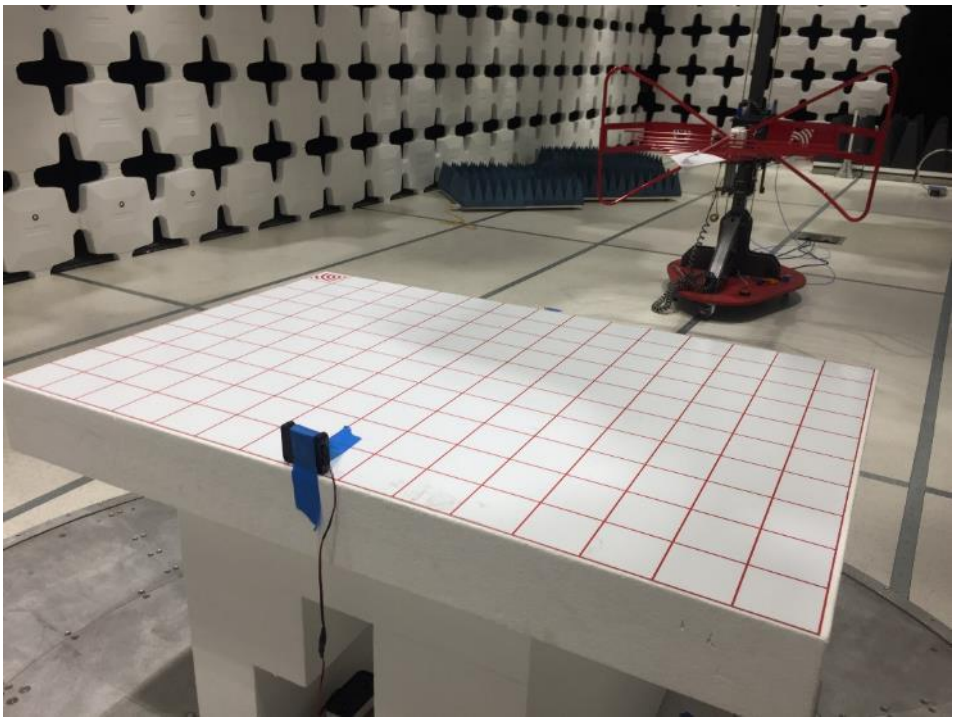
EUT Left View



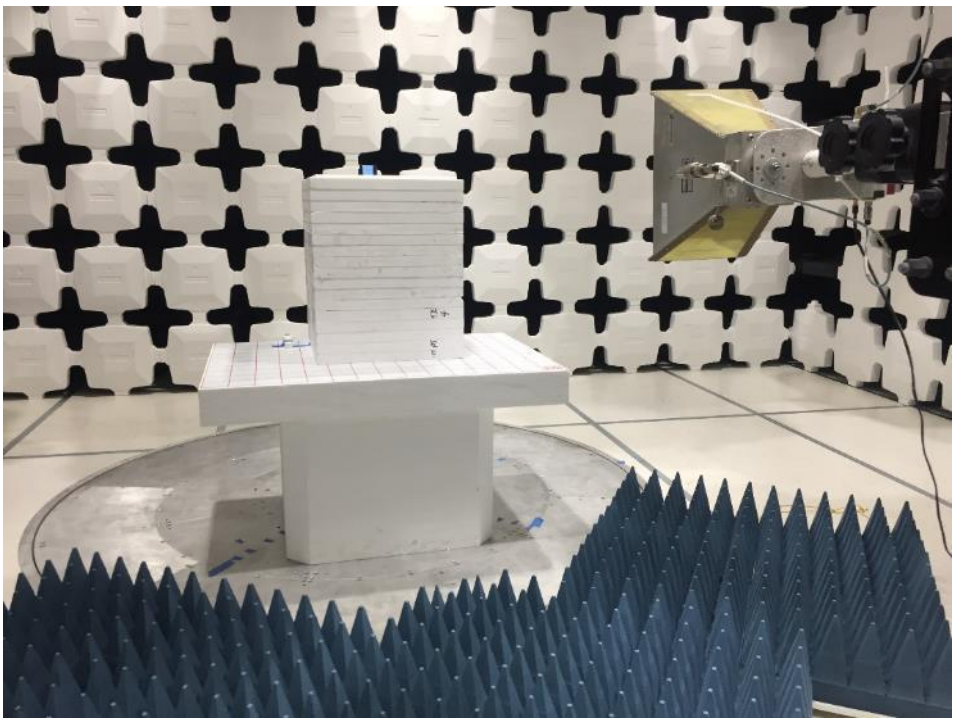
EUT Right View

5.2 EUT test setup pictures

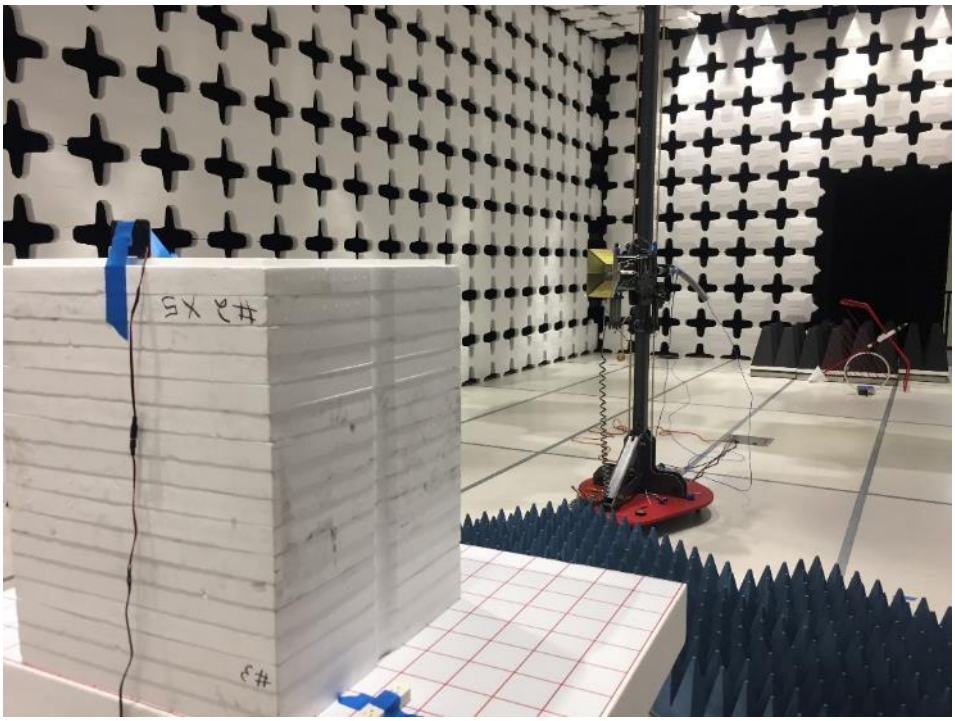
Radiated Emissions Below 1GHz setup – Front



Radiated Emissions Below 1GHz setup – Rear



Radiated Emissions Above 1GHz setup – Front



Radiated Emissions Above 1GHz setup – Rear

6 Test Summary

FCC Rules	ISED Rules	Test Item	Section	Verdict
2.1046, 22.913(a)(5), 24.232(c) 27.50 (b)(9) and (10)	RSS-130(4.6), RSS-132(5.4), RSS-133(6.4), RSS-139(6.5)	Transmitter Conducted Output Power	8.1	Pass
22.913(a)(5), 2.1046 27.50 (b)(9) and (10)	RSS-130(4.6),	Effective Radiated Power	8.2	Pass
24.232(c),2.1046	RSS-132(5.4), RSS-133(6.4), RSS-139(6.5), SRSP-510(5.1.2)	Equivalent Isotropic Radiated Power	8.3	Pass
2.1049,22.917(b), 24.238(b), 27.53	RSS-Gen 6.7	Occupied Bandwidth	8.4	N/A
24.232(d), 27.50 (d)(5)	RSS-130(4.6.1), RSS-132(5.4), RSS-133(6.4), RSS-139(6.5)	Peak-Average Ratio	8.5	Pass
2.1051,22.917(a), 24.238(a) 27.53 (c)(2) and (5)	RSS-130(4.7.1), RSS-132(5.5), RSS-133(6.5), RSS-139(6.6)	Band Edge	8.6	Pass
2.1051,22.917(a), 24.238(a) 27.53 (c)(1),(2),(4),(5),(6) and (f)	RSS-130(4.7.1), RSS-132(5.5), RSS-133(6.5), RSS-139(6.6)	Conducted Spurious Emissions	8.7	Pass
Clause 7of KDB971168 D01 v02r02		Field Strength Of Spurious Radiation	8.8	Pass
2.1055,22.355,24.235, 27.54	RSS-130(4.5), RSS-132(5.3), RSS-133(6.3), RSS-139(6.4)	Frequency Stability	8.9	Pass
-	RSS-132(5.6), RSS-133(6.6) RSS-Gen (7.0)	Receiver Spurious Emissions	N/A	N/A 1)
-	RSS-Gen (8.8)	Power Line Conducted Emission	N/A	N/A 2)

Note:

1) Testing covered the receive mode, and receiver spurious emissions are considered to be the same as transmitter.
2) EUT is powered by battery only. This item is not applicable.

7 Uncertainly of Measurement

Test item	Measurement Uncertainty (dB)
RF Output Power (Conducted)	±1.2 dB
Power Spectral Density	±0.9 dB
Unwanted Emission (conducted)	±2.6 dB
Occupied Channel Bandwidth	±5 %
Radiated Emission (9KHz-30MHz)	±3.5 dB
Radiated Emission (30MHz-1GHz)	±4.6 dB
Radiated Emission (1-18GHz)	±4.9 dB
Radiated Emission (18-40GHz)	±3.5 dB

8 Test summary and result

8.1 Transmitter Output Power (ERP/EIRP)

8.1.1 Requirement

2.1046, 22.913(a)(5), 24.232(c), 27.50 (b)(9) and (10)

RSS-130(4.6), RSS-132(5.4), RSS-133(6.4), RSS-139(6.5)

FCC 47 CFR Part 2, Clause 2.1046:

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in §2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

(c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

FCC 47 CFR Part 22, Clause 22.913 (a)(5):

The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts

FCC 47 CFR Part 22, Clause 24.232 (c):

Mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

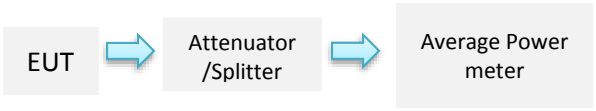
FCC 47 CFR Part 27, Clause 27.50 (b)(9):

Control stations and mobile stations transmitting in the 746–757 MHz, 776–788 MHz, and 805–806 MHz bands and fixed stations transmitting in the 787–788 MHz and 805–806 MHz bands are limited to 30 watts ERP.

FCC 47 CFR Part 27, Clause 27.50 (b)(10):

Portable stations (hand-held devices) transmitting in the 746-757 MHz, 776-788 MHz, and 805-806 MHz bands are limited to 3 watts ERP.

8.1.2 Test setup



8.1.3 Test Procedure

ANSI C63.26: 2015 section 5.2

KDB 971168 D01 Power Meas License Digital Systems v03r01 section 5.6
KDB 412172 D01 Determining ERP and EIRP v01r01

A Wideband average power meter is used to make the RF Conducted measurement. ERP and EIRP calculation is according to KDB 412172.

ERP/EIRP = PMeas + GT – LC

Where: ERP/EIRP = effective or equivalent radiated power;

PMeas = transmitter output power, expressed in dBW, dBm, or PSD;

GT = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);

LC = signal attenuation in the connecting cable between the transmitter and antenna, in dB.

8.1.4 Test Result

LTE Band 2

Band	Bandwidth (MHz)	Modulation	Frequency (MHz)	Conducted AV Power (dBm)	EIRP (dBm)	ERP (dBm)	EIRP (W)	ERP (W)
2	1.4	QPSK	1850.7	23.28	23.28	21.13	0.213	0.130
2	1.4	QPSK	1880.0	22.99	22.99	20.84	0.199	0.121
2	1.4	QPSK	1909.3	22.95	22.95	20.80	0.197	0.120
2	1.4	16QAM	1850.7	23.50	23.50	21.35	0.224	0.136
2	1.4	16QAM	1880.0	23.02	23.02	20.87	0.200	0.122
2	1.4	16QAM	1909.3	22.96	22.96	20.81	0.198	0.121

Note: Antenna Gain = 0dBi

LTE Band 4

Band	Bandwidth (MHz)	Modulation	Frequency (MHz)	Conducted AV Power (dBm)	EIRP (dBm)	ERP (dBm)	EIRP (W)	ERP (W)
4	1.4	QPSK	1710.7	23.12	23.12	20.97	0.205	0.125
4	1.4	QPSK	1732.5	23.30	23.30	21.15	0.214	0.130
4	1.4	QPSK	1754.3	23.29	23.29	21.14	0.213	0.130
4	1.4	16QAM	1710.7	23.22	23.22	21.07	0.210	0.128
4	1.4	16QAM	1732.5	23.29	23.29	21.14	0.213	0.130
4	1.4	16QAM	1754.3	23.26	23.26	21.11	0.212	0.129

LTE Band 5

Band	Bandwidth (MHz)	Modulation	Frequency (MHz)	Conducted AV Power (dBm)	EIRP (dBm)	ERP (dBm)	EIRP (W)	ERP (W)
5	1.4	QPSK	824.7	23.79	23.79	21.64	0.239	0.146
5	1.4	QPSK	836.5	23.88	23.88	21.73	0.244	0.149
5	1.4	QPSK	848.3	24.09	24.09	21.94	0.256	0.156
5	1.4	16QAM	824.7	23.68	23.68	21.53	0.233	0.142
5	1.4	16QAM	836.5	23.92	23.92	21.77	0.247	0.150
5	1.4	16QAM	848.3	23.97	23.97	21.82	0.249	0.152

LTE Band 12

Band	Bandwidth (MHz)	Modulation	Frequency (MHz)	Conducted AV Power (dBm)	EIRP (dBm)	ERP (dBm)	EIRP (W)	ERP (W)
12	1.4	QPSK	699.7	24.50	24.50	22.35	0.282	0.172
12	1.4	QPSK	707.5	24.41	24.41	22.26	0.276	0.168
12	1.4	QPSK	715.3	24.37	24.37	22.22	0.274	0.167
12	1.4	16QAM	699.7	24.36	24.36	22.21	0.273	0.166
12	1.4	16QAM	707.5	24.27	24.27	22.12	0.267	0.163
12	1.4	16QAM	715.3	24.29	24.29	22.14	0.269	0.164

LTE Band 13

Band	Bandwidth (MHz)	Modulation	Frequency (MHz)	Conducted AV Power (dBm)	EIRP (dBm)	ERP (dBm)	EIRP (W)	ERP (W)
13	1.4	QPSK	777.7	24.25	24.25	22.10	0.266	0.162
13	1.4	QPSK	782.0	24.36	24.36	22.21	0.273	0.166
13	1.4	QPSK	786.3	24.07	24.07	21.92	0.255	0.156
13	1.4	16QAM	777.7	24.43	24.43	22.28	0.277	0.169
13	1.4	16QAM	782.0	24.17	24.17	22.02	0.261	0.159
13	1.4	16QAM	786.3	24.04	24.04	21.89	0.254	0.155

8.2 Occupied Bandwidth

8.2.1 Requirement

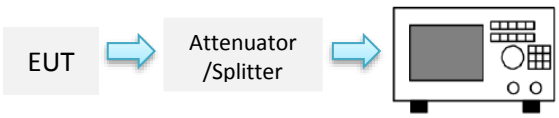
§ 2.1049,22.917(b), 24.238(b), 27.53

RSS-Gen 6.7

The transmitted signal bandwidth shall be reported as the 99% emission bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are equal to 0.5 percent of the total mean power radiated by a give emission.

26dB 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 by at least 26 dB below the transmitter power.

8.2.2 Test setup



8.2.3 Test Procedure

ANSI C63.26: 2015 section 5.4

KDB 971168 D01 Power Meas License Digital Systems v03r01 section 5.6

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW ≥ 3 × RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

1. Set RBW = 1% to 5% of the actual occupied BW.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Span = large enough to capture all products of the modulation process
7. Allow the trace to stabilize.
8. Use automatic bandwidth measurement capability on instrument to obtain BW result.

8.2.4 Test Result

LTE Band 2

Band	Bandwidth (MHz)	Modulation	Frequency (MHz)	99% BW (KHz)	26 dB BW (KHz)	Emission Designator
2	1.4	QPSK	1850.7	1085.83	1285.40	1M09G7D
2	1.4	QPSK	1880.0	1093.81	1277.40	1M09G7D
2	1.4	QPSK	1909.3	1093.81	1277.40	1M09G7D
2	1.4	16QAM	1850.7	1093.83	1277.40	1M09W7D
2	1.4	16QAM	1880.0	1093.81	1277.40	1M09W7D
2	1.4	16QAM	1909.3	1093.81	1277.40	1M09W7D

LTE Band 4

Band	Bandwidth (MHz)	Modulation	Frequency (MHz)	99% BW (KHz)	26 dB BW (KHz)	Emission Designator
4	1.4	QPSK	1710.7	1093.81	1268.50	1M09G7D
4	1.4	QPSK	1732.5	1093.81	1269.50	1M09G7D
4	1.4	QPSK	1754.3	1093.81	1269.50	1M09G7D
4	1.4	16QAM	1710.7	1093.81	1277.40	1M09W7D
4	1.4	16QAM	1732.5	1093.81	1277.40	1M09W7D
4	1.4	16QAM	1754.3	1093.81	1269.50	1M09W7D

LTE Band 5

Band	Bandwidth (MHz)	Modulation	Frequency (MHz)	99% BW (KHz)	26 dB BW (KHz)	Emission Designator
5	1.4	QPSK	824.7	1085.83	1261.50	1M09G7D
5	1.4	QPSK	836.5	1085.83	1269.50	1M09G7D
5	1.4	QPSK	848.3	1085.83	1269.50	1M09G7D
5	1.4	16QAM	824.7	1085.83	1261.50	1M09W7D
5	1.4	16QAM	836.5	1085.83	1261.50	1M09W7D
5	1.4	16QAM	848.3	1101.80	1269.50	1M10W7D

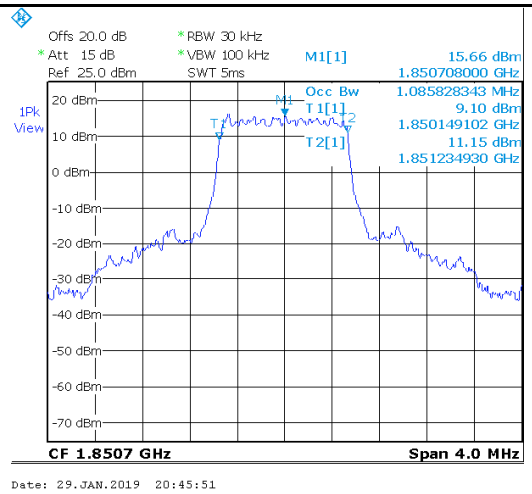
LTE Band 12

Band	Bandwidth (MHz)	Modulation	Frequency (MHz)	99% BW (KHz)	26 dB BW (KHz)	Emission Designator
12	1.4	QPSK	699.7	1093.81	1261.50	1M09G7D
12	1.4	QPSK	707.5	1093.81	1269.50	1M09G7D
12	1.4	QPSK	715.3	1101.80	1269.50	1M10G7D
12	1.4	16QAM	699.7	1093.81	1269.50	1M09W7D
12	1.4	16QAM	707.5	1093.81	1269.50	1M09W7D
12	1.4	16QAM	715.3	1101.80	1269.50	1M10W7D

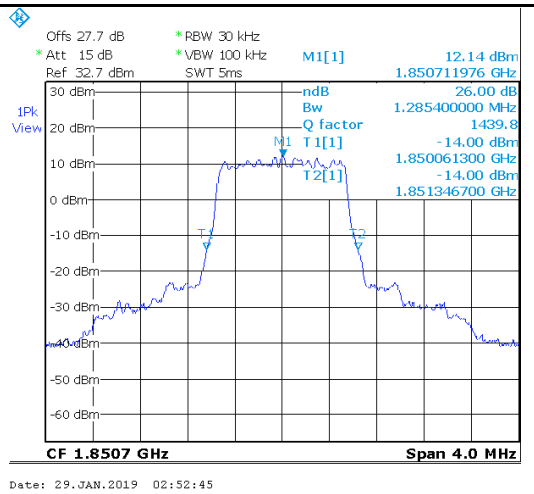
LTE Band 13

Band	Bandwidth (MHz)	Modulation	Frequency (MHz)	99% BW (KHz)	26 dB BW (KHz)	Emission Designator
13	1.4	QPSK	777.7	1093.81	1277.40	1M09G7D
13	1.4	QPSK	782.0	1101.80	1269.50	1M10G7D
13	1.4	QPSK	786.3	1093.81	1277.40	1M09G7D
13	1.4	16QAM	777.7	1093.81	1269.50	1M09W7D
13	1.4	16QAM	782.0	1101.80	1277.40	1M10W7D
13	1.4	16QAM	786.3	1093.81	1269.50	1M09W7D

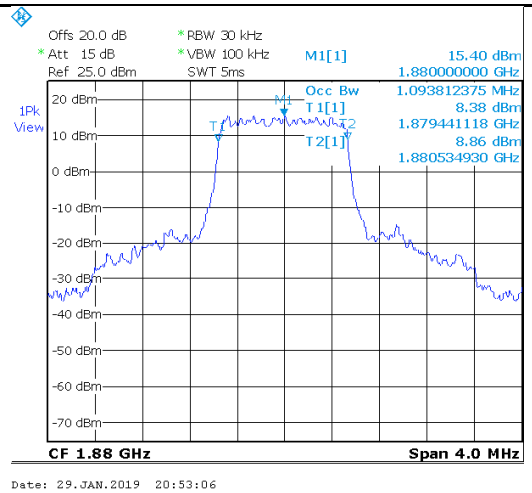
8.2.5 Test Plots



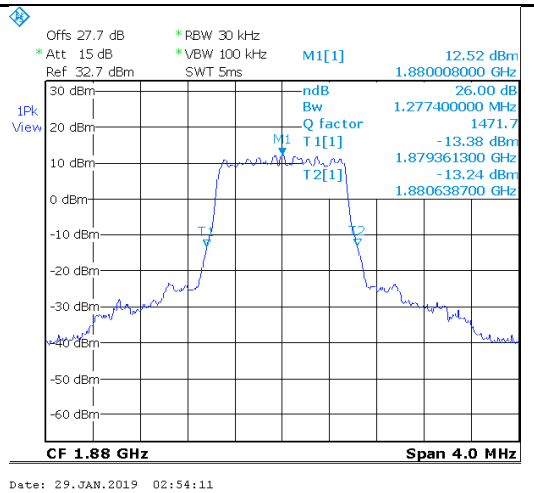
LTE-B2-QPSK-99% BW-Low



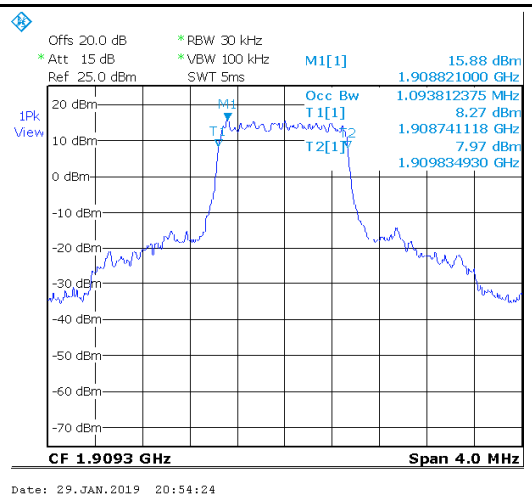
LTE-B2-QPSK-26 dB BW-Low



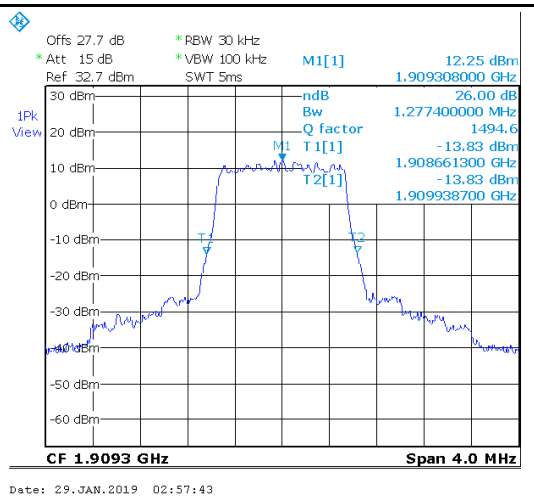
LTE-B2-QPSK-99% BW-Mid



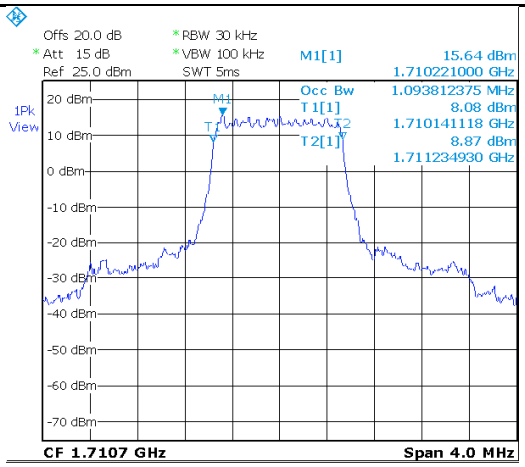
LTE-B2-QPSK-26 dB BW-Mid



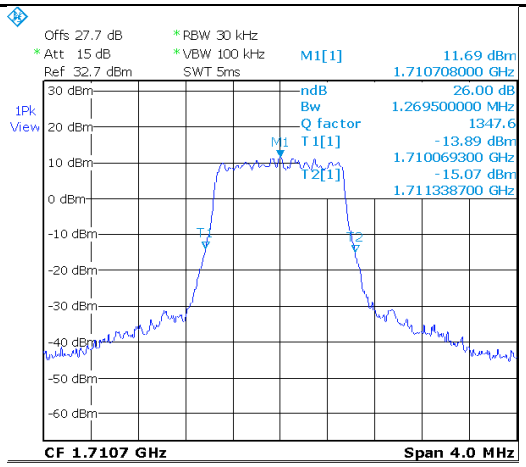
LTE-B2-QPSK-99% BW-High



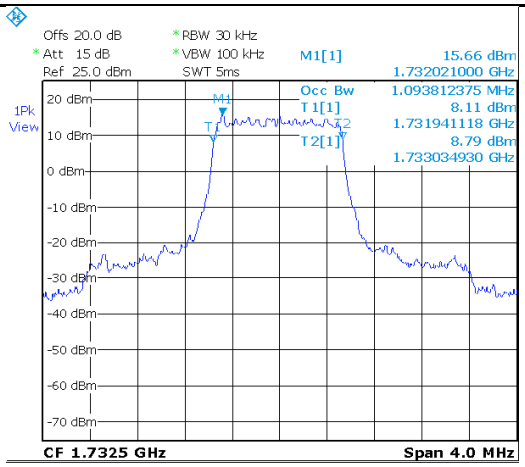
LTE-B2-QPSK-26 dB BW-High



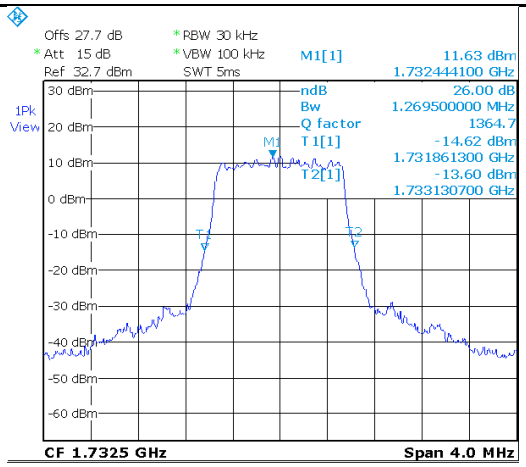
LTE-B4-QPSK-99% BW-Low



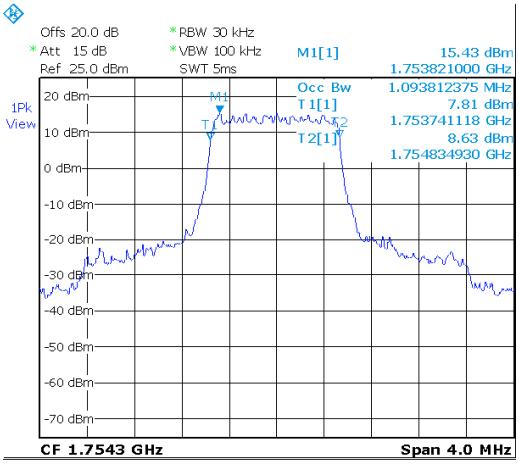
LTE-B4-QPSK-26 dB BW-Low



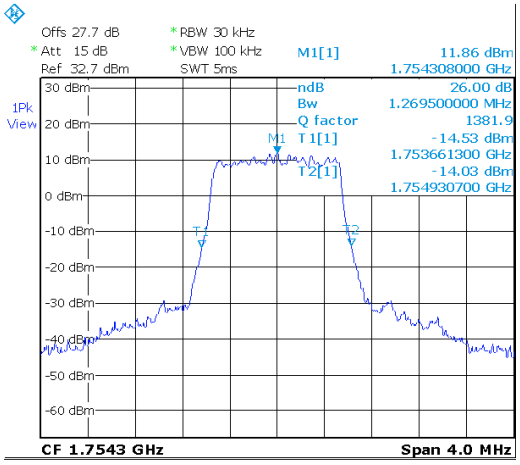
LTE-B4-QPSK-99% BW-Mid



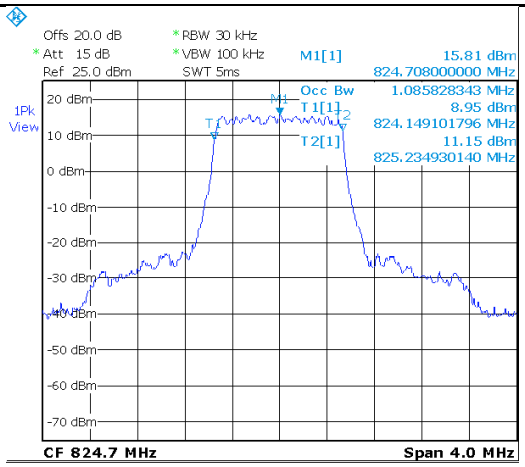
LTE-B4-QPSK-26 dB BW-Mid



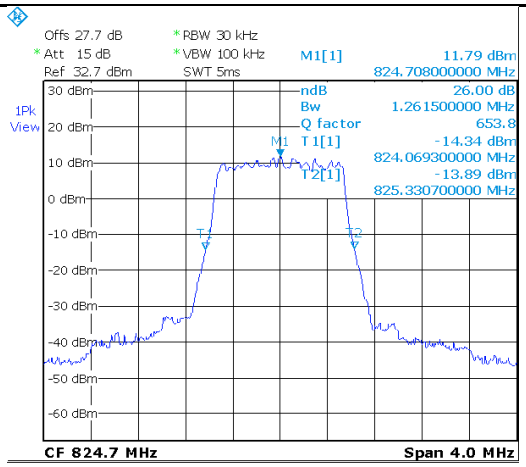
LTE-B4-QPSK-99% BW-High



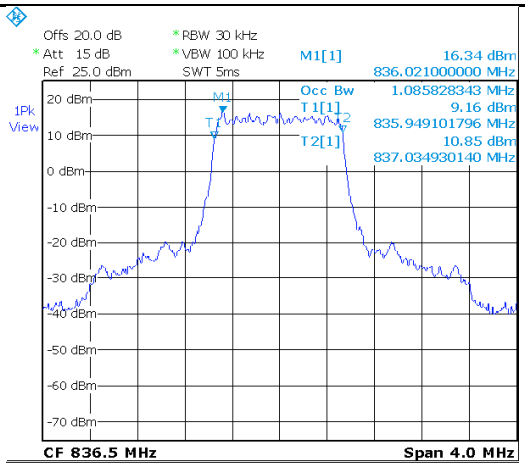
LTE-B4-QPSK-26 dB BW-High



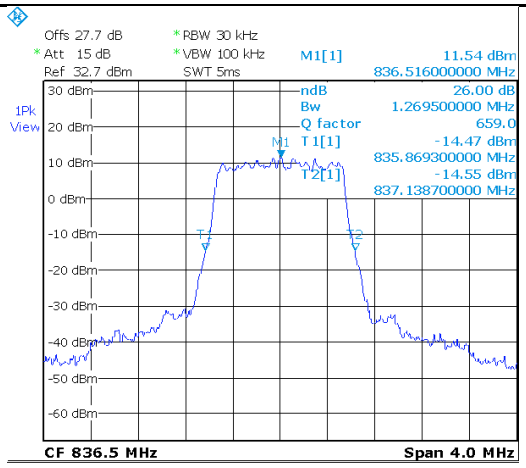
LTE-B5-QPSK-99% BW-Low



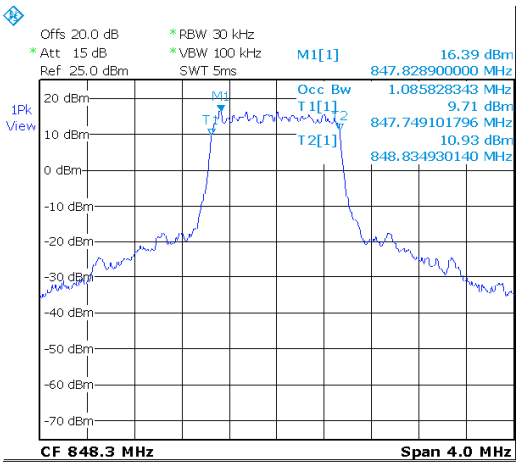
LTE-B5-QPSK-26 dB BW-Low



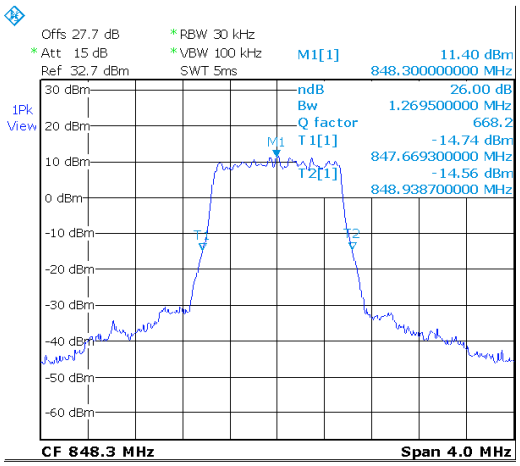
LTE-B5-QPSK-99% BW-Mid



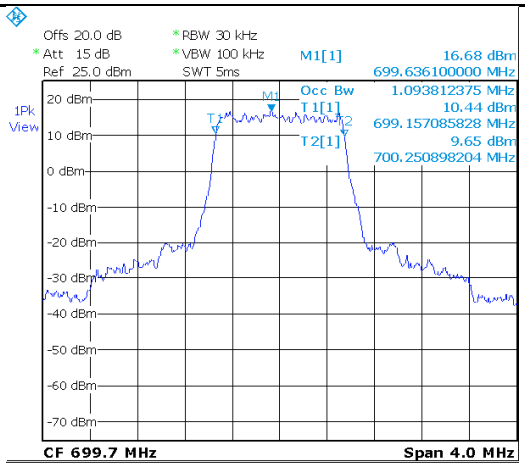
LTE-B5-QPSK-26 dB BW-Mid



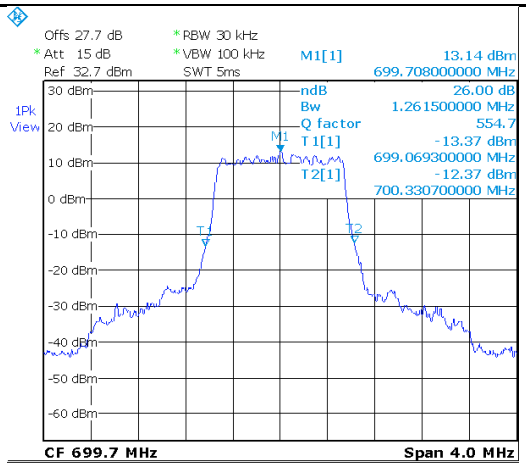
LTE-B5-QPSK-99% BW-High



LTE-B5-QPSK-26 dB BW-High



LTE-B12-QPSK-99% BW-Low



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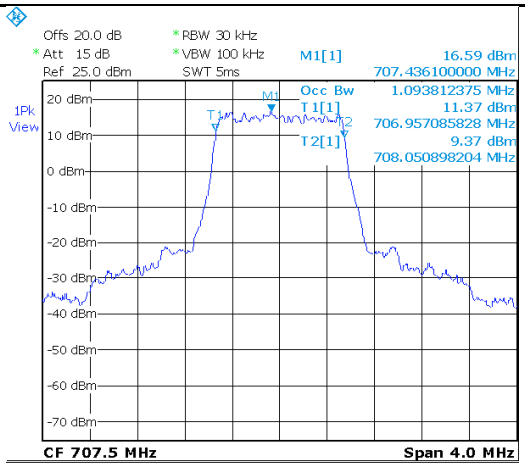
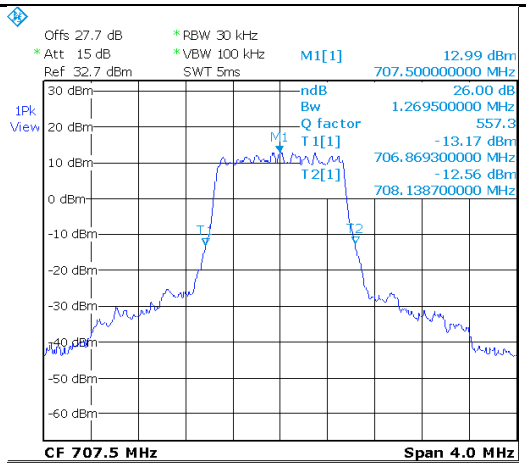
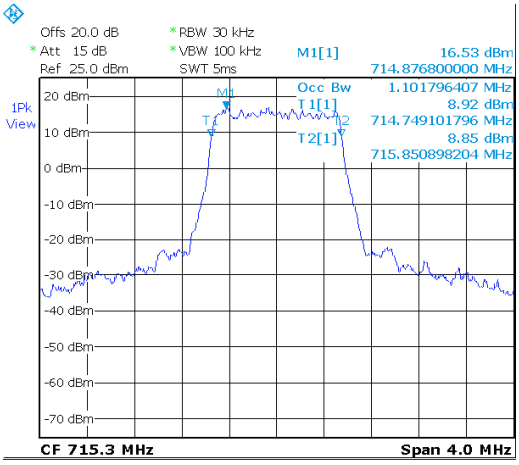


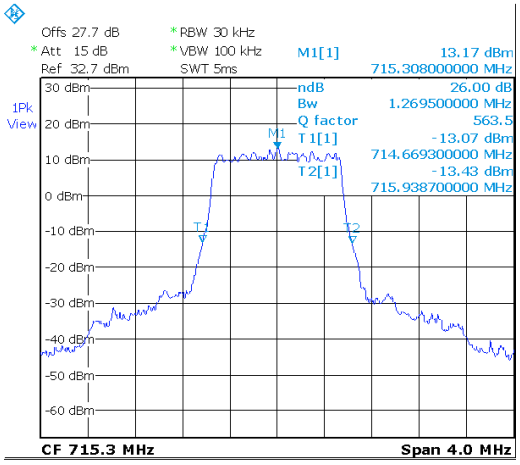
LTE-B12-QPSK-99% BW-Mid



LTE-B12-QPSK-26 dB BW-Mid



LTE-B12-QPSK-99% BW-High



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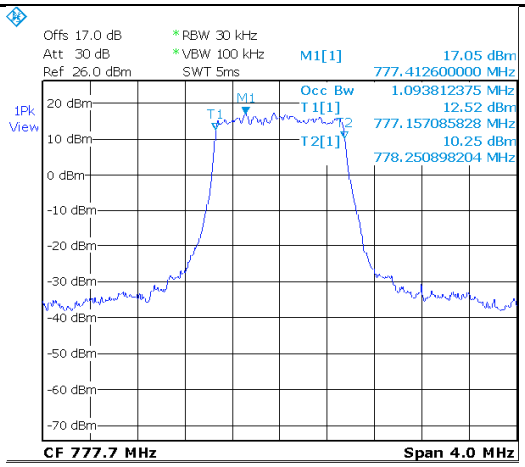
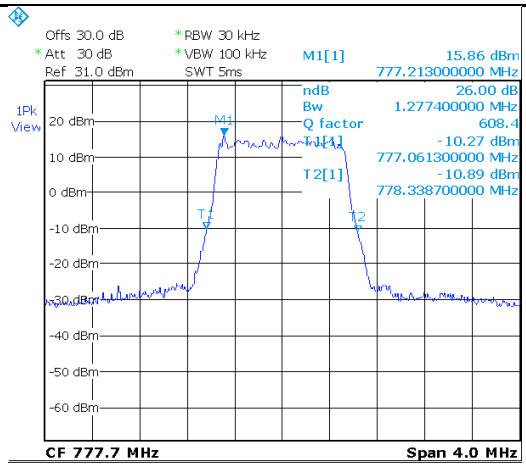


LTE-B13-QPSK-99% BW-Low



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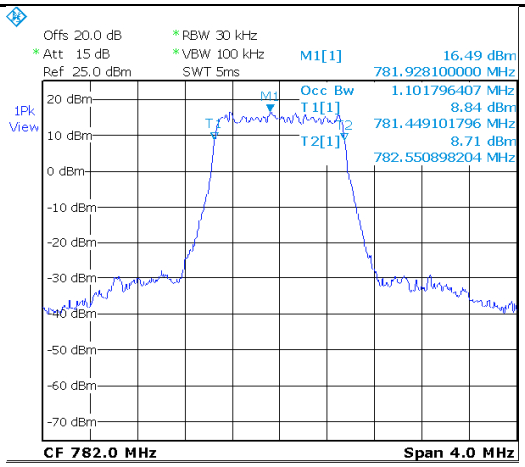
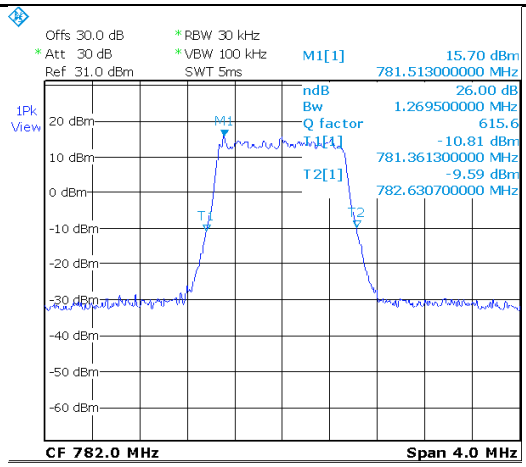


LTE-B13-QPSK-99% BW-Mid



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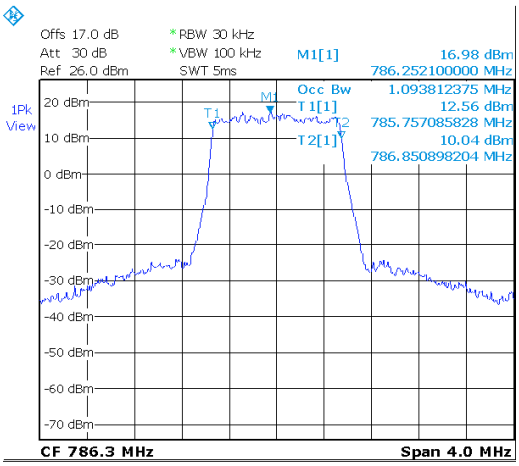
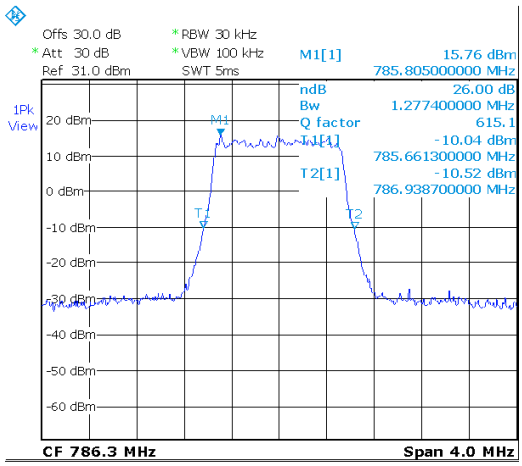
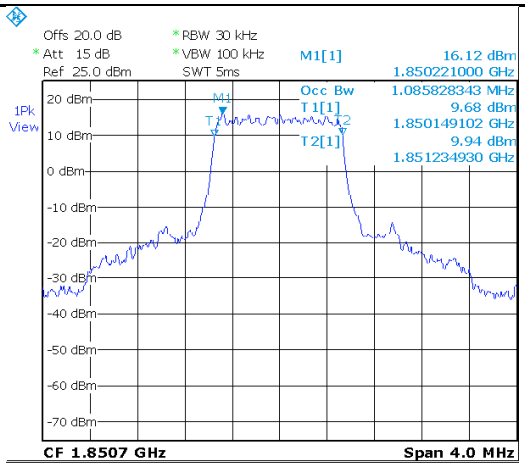


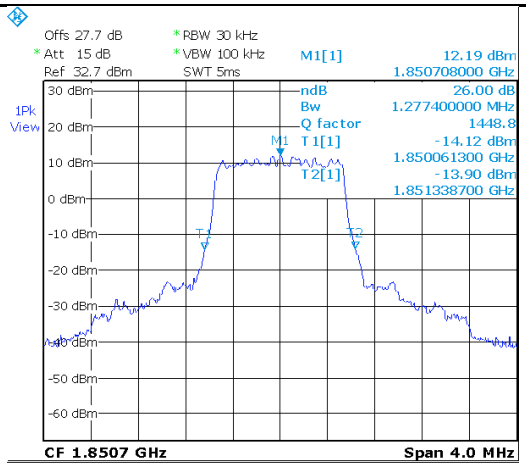
LTE-B13-QPSK-99% BW-High



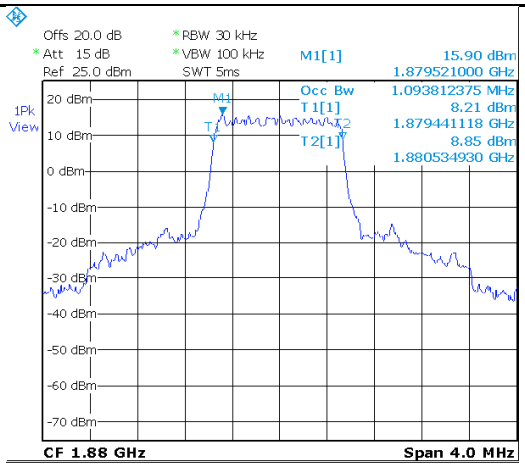
LTE-B13-QPSK-26 dB BW-High



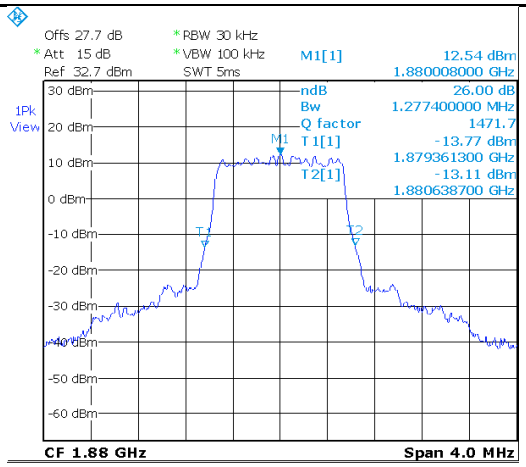
LTE-B2-16QAM-99% BW-Low



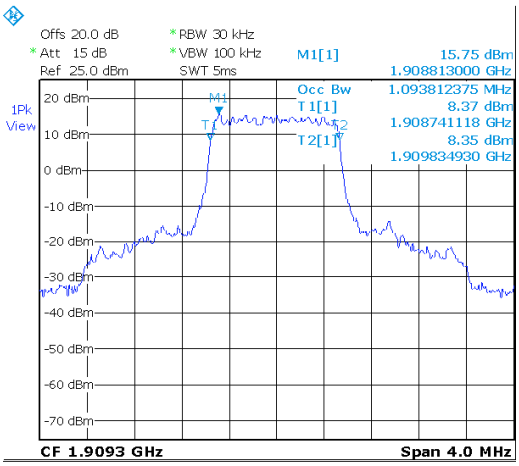
LTE-B2-16QAM-26 dB BW-Low



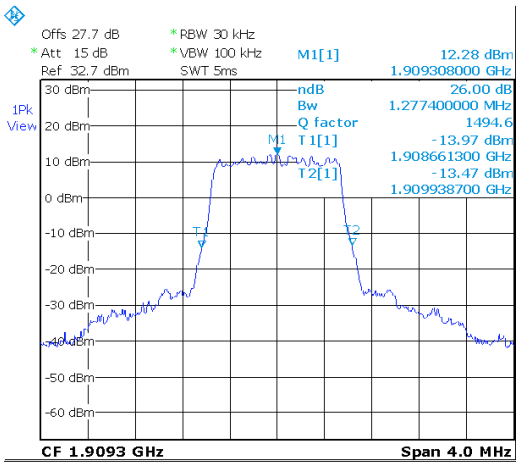
LTE-B2-16QAM-99% BW-Mid



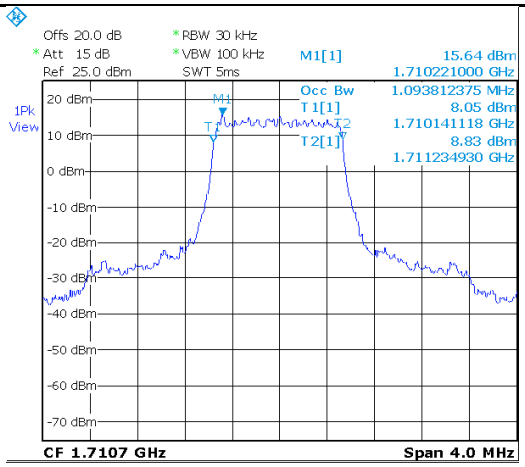
LTE-B2-16QAM-26 dB BW-Mid



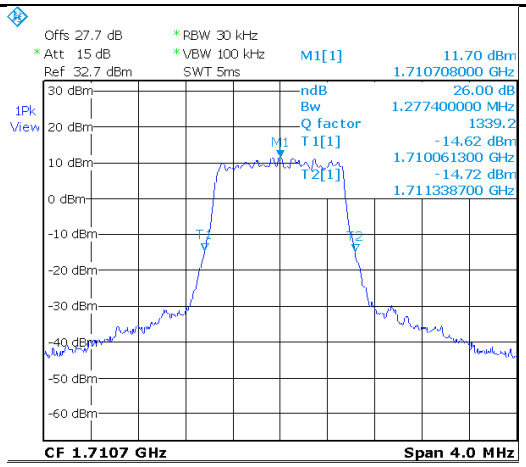
LTE-B2-16QAM-99% BW-High



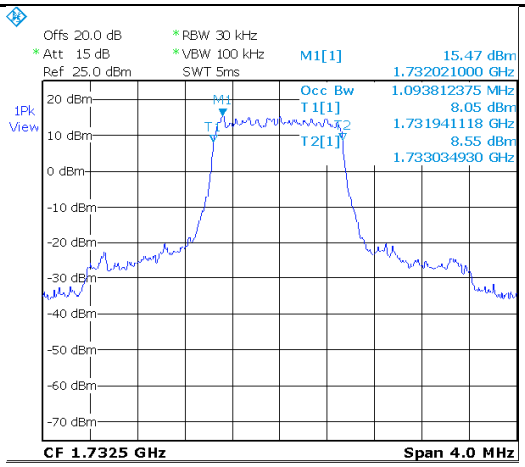
LTE-B2-16QAM-26 dB BW-High



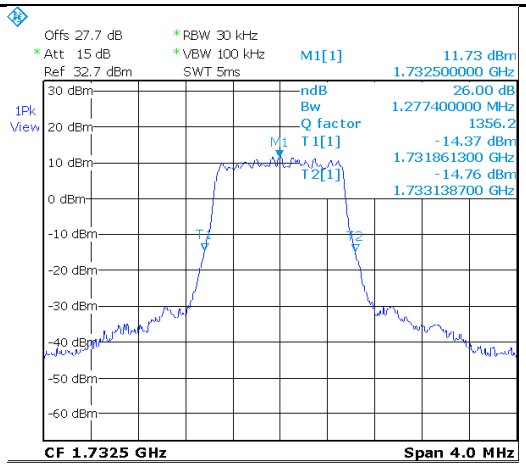
LTE-B4-16QAM-99% BW-Low



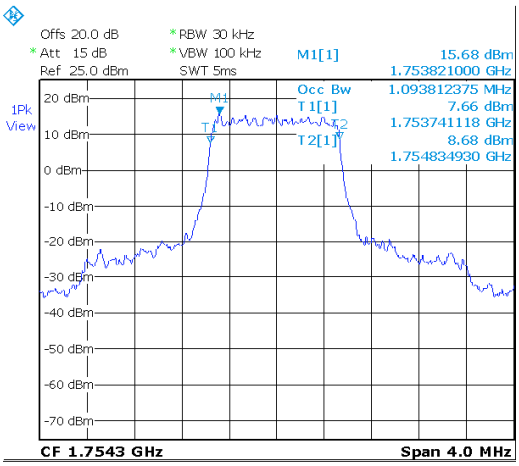
LTE-B4-16QAM-26 dB BW-Low



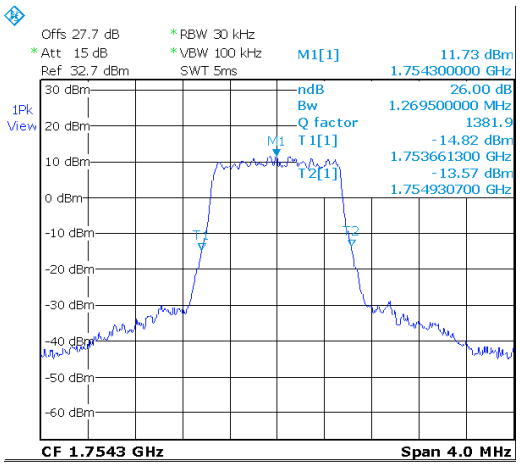
LTE-B4-16QAM-99% BW-Mid



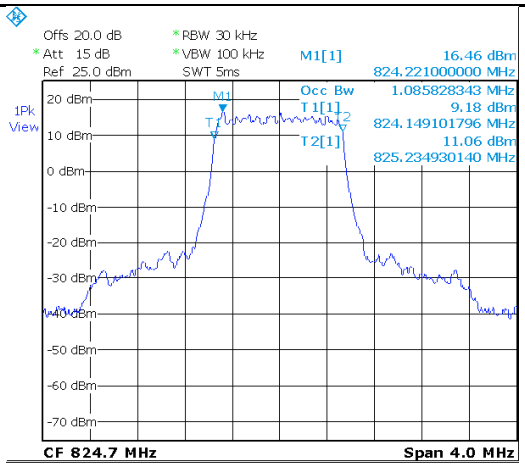
LTE-B4-16QAM-26 dB BW-Mid



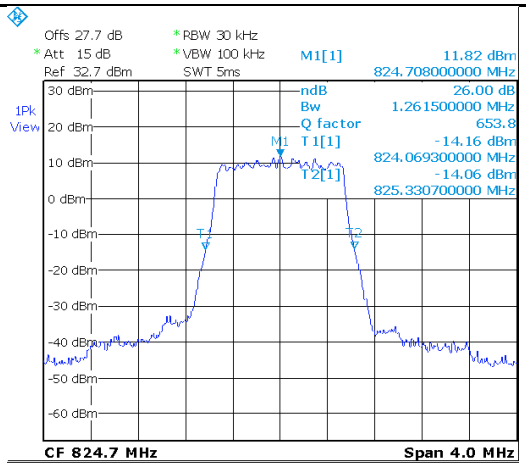
LTE-B4-16QAM-99% BW-High



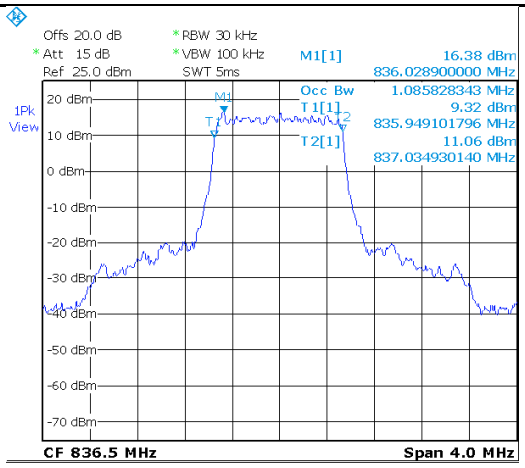
LTE-B4-16QAM-26 dB BW-High



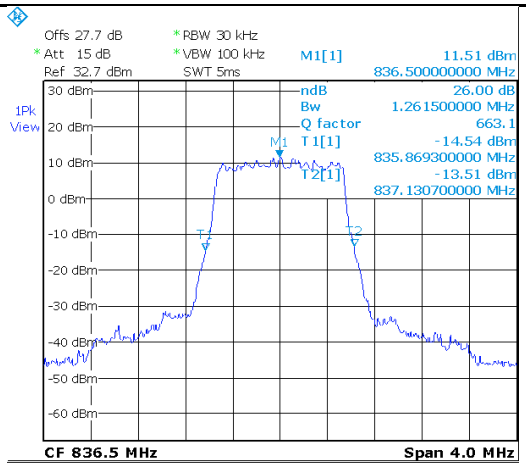
LTE-B5-16QAM-99% BW-Low



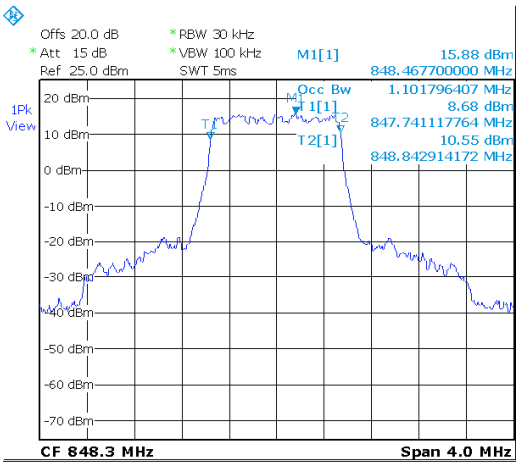
LTE-B5-16QAM-26 dB BW-Low



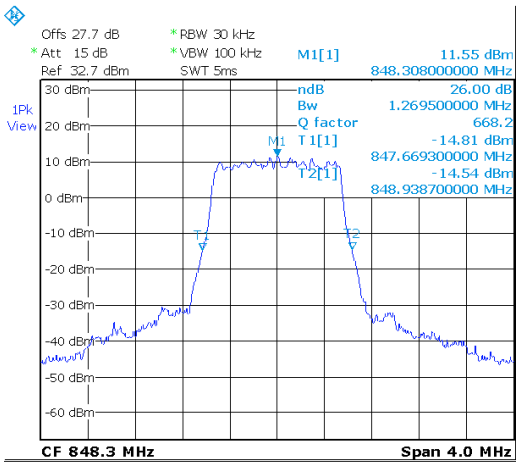
LTE-B5-16QAM-99% BW-Mid



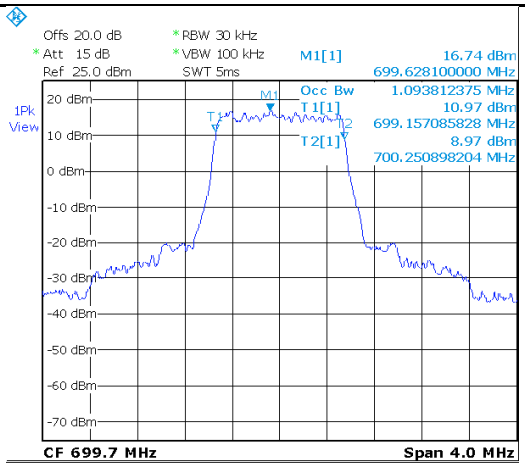
LTE-B5-16QAM-26 dB BW-Mid



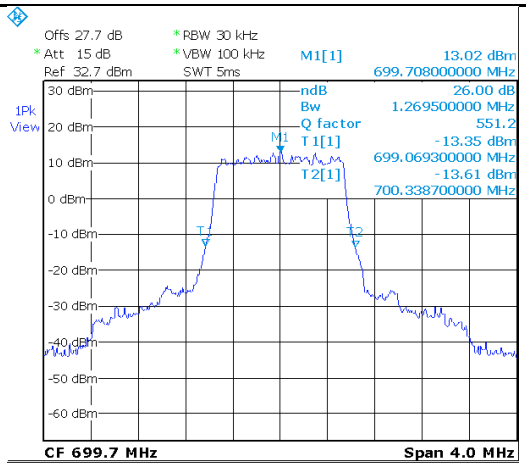
LTE-B5-16QAM-99% BW-High



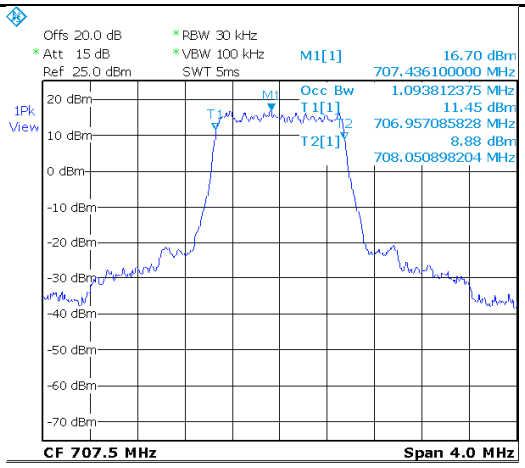
LTE-B5-16QAM-26 dB BW-High



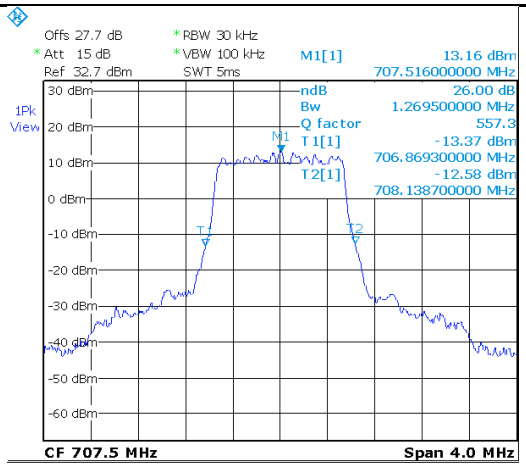
LTE-B12-16QAM-99% BW-Low



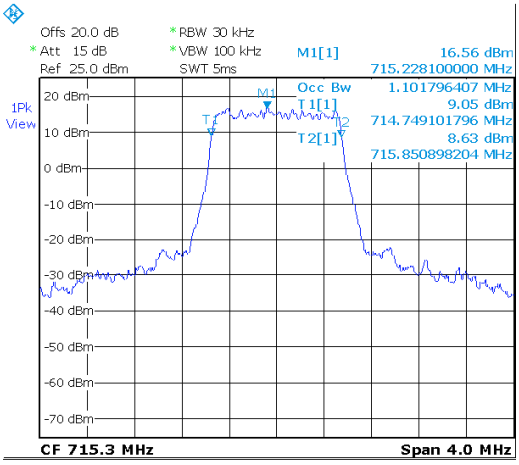
LTE-B12-16QAM-26 dB BW-Low



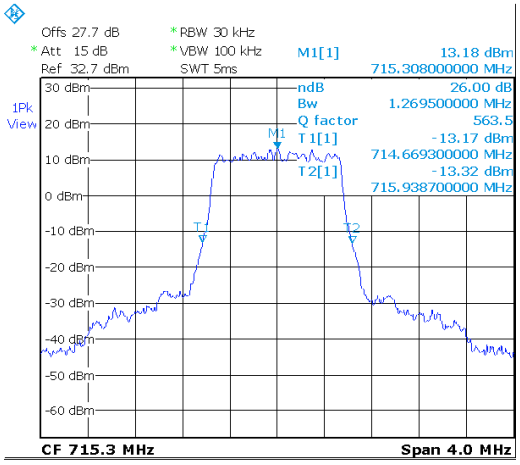
LTE-B12-16QAM-99% BW-Mid



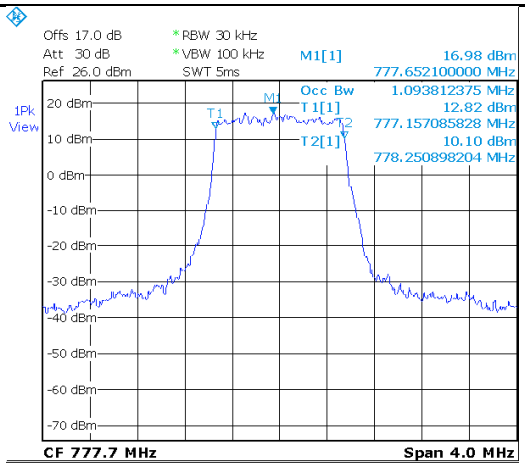
LTE-B12-16QAM-26 dB BW-Mid



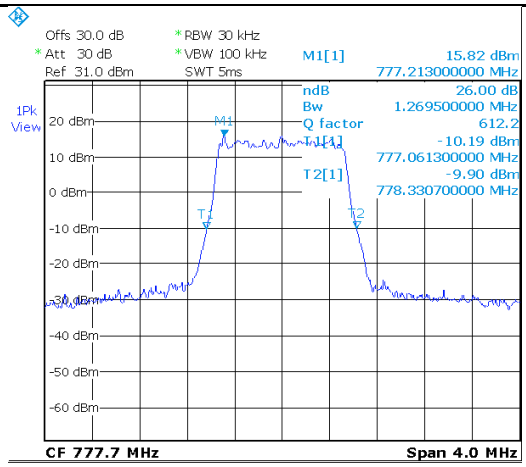
LTE-B12-16QAM-99% BW-High



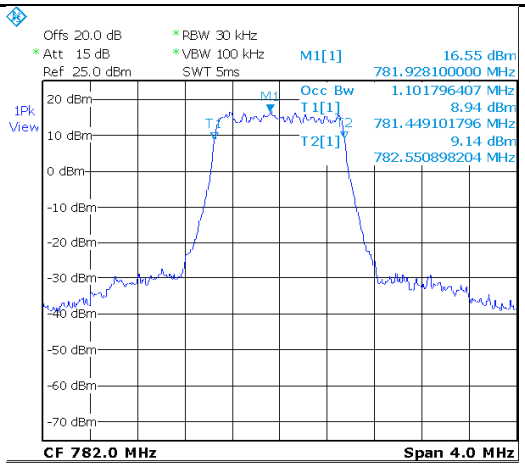
LTE-B12-16QAM-26 dB BW-High



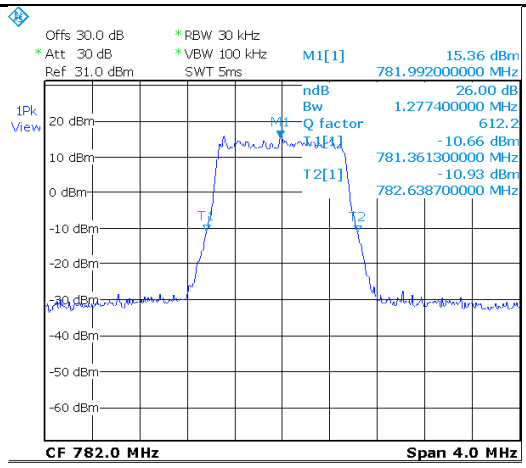
LTE-B13-16QAM-99% BW-Low



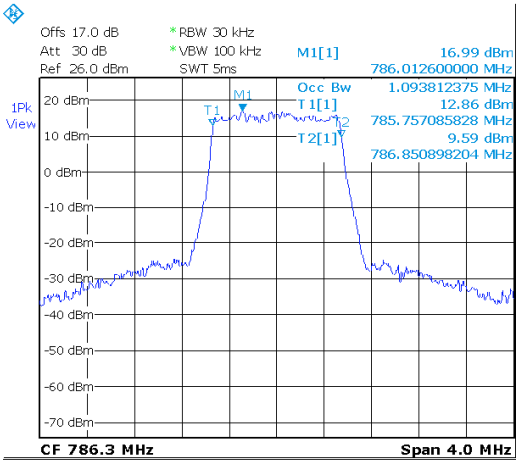
LTE-B13-16QAM-26 dB BW-Low



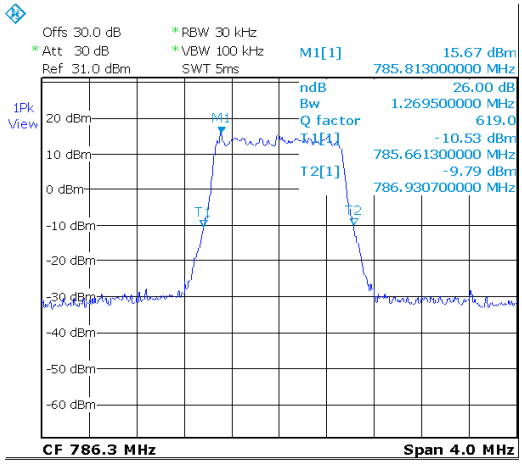
LTE-B13-16QAM-99% BW-Mid



LTE-B13-16QAM-26 dB BW-Mid



LTE-B13-16QAM-99% BW-High



LTE-B13-16QAM-26 dB BW-High

8.3 Peak-Average Ratio

8.3.1 Requirement

§ 22.232 (d), 27.50 (d) (5)
RSS-130(4.6.1), RSS-132(5.4), RSS-133(6.4), RSS-139(6.5)

FCC 47 CFR Part 27, Clause 27.50 (d)(5)

Equipment employed must be authorized in accordance with the provisions of §24.51. Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (d)(6) of this section. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

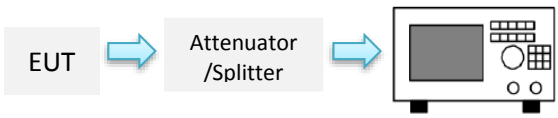
RSS-133(5.4) and RSS-133(6.4)

In addition, the transmitter's peak-to-average power ratio (PAPR) shall not exceed 13 dB for more than 0.1% of the time using a signal corresponding to the highest PAPR during periods of continuous transmission.

RSS-130, Clause 4.6.1 and RSS-139, Clause 6.5

In addition, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time and shall use a signal corresponding to the highest PAPR during periods of continuous transmission.

8.3.2 Test setup



8.3.3 Test Procedure

ANSI C63.26: 2015 section 5.4

KDB 971168 D01 Power Meas License Digital Systems v03r01 section 5.7.1

Measurement was done using the Spectrum Analyzer's Complementary Cumulative Distribution Function (CCDF) measurement profile. The built-in function is used to determine the largest deviation between the average and the peak power of the EUT in a given bandwidth (crest factor or peak-to-average ratio) The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signals spends at or above the level defines the probability for that particular power level. The maximum PAPR level associated with a probability of 0.1% was recorded.

8.3.4 Test Result

LTE Band 2

Band	Bandwidth (MHz)	Modulation	Frequency (MHz)	PAR (dB)	Limit (dB)	Result
2	1.4	QPSK	1850.7	6.04	13	Pass
2	1.4	QPSK	1880.0	6.08	13	Pass
2	1.4	QPSK	1909.3	6.60	13	Pass
2	1.4	16QAM	1850.7	6.00	13	Pass
2	1.4	16QAM	1880.0	6.04	13	Pass
2	1.4	16QAM	1909.3	6.60	13	Pass

LTE Band 4

Band	Bandwidth (MHz)	Modulation	Frequency (MHz)	PAR (dB)	Limit (dB)	Result
4	1.4	QPSK	1710.7	5.68	13	Pass
4	1.4	QPSK	1732.5	5.80	13	Pass
4	1.4	QPSK	1754.3	6.64	13	Pass
4	1.4	16QAM	1710.7	5.68	13	Pass
4	1.4	16QAM	1732.5	5.80	13	Pass
4	1.4	16QAM	1754.3	6.64	13	Pass

LTE Band 5

Band	Bandwidth (MHz)	Modulation	Frequency (MHz)	PAR (dB)	Limit (dB)	Result
5	1.4	QPSK	824.7	5.40	13	Pass
5	1.4	QPSK	836.5	5.52	13	Pass
5	1.4	QPSK	848.3	6.16	13	Pass
5	1.4	16QAM	824.7	5.40	13	Pass
5	1.4	16QAM	836.5	5.52	13	Pass
5	1.4	16QAM	848.3	5.76	13	Pass

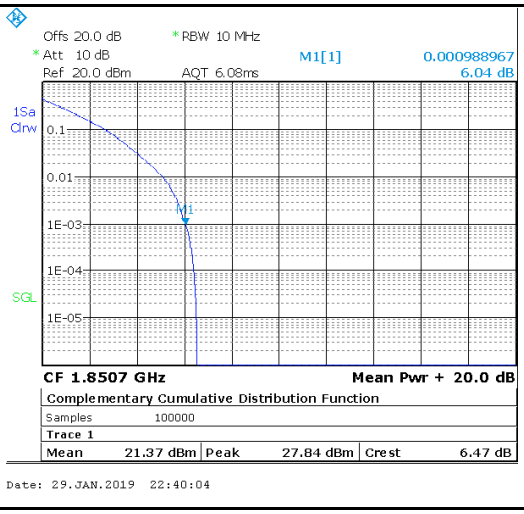
LTE Band 12

Band	Bandwidth (MHz)	Modulation	Frequency (MHz)	PAR (dB)	Limit (dB)	Result
12	1.4	QPSK	699.7	5.48	13	Pass
12	1.4	QPSK	707.5	5.40	13	Pass
12	1.4	QPSK	715.3	5.68	13	Pass
12	1.4	16QAM	699.7	5.48	13	Pass
12	1.4	16QAM	707.5	5.40	13	Pass
12	1.4	16QAM	715.3	5.68	13	Pass

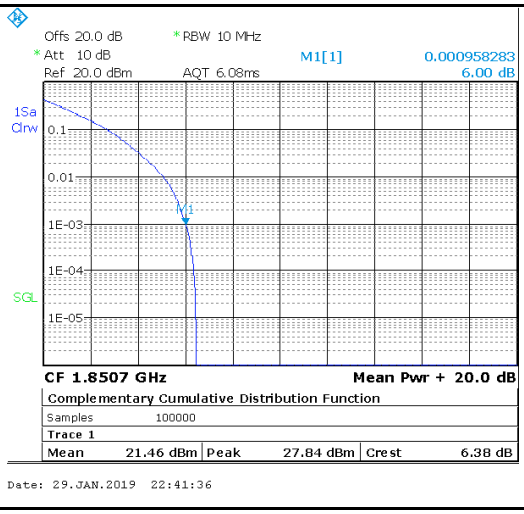
LTE Band 13

Band	Bandwidth (MHz)	Modulation	Frequency (MHz)	PAR (dB)	Limit (dB)	Result
13	1.4	QPSK	777.7	4.92	13	Pass
13	1.4	QPSK	782.0	4.92	13	Pass
13	1.4	QPSK	786.3	5.24	13	Pass
13	1.4	16QAM	777.7	4.92	13	Pass
13	1.4	16QAM	782.0	4.92	13	Pass
13	1.4	16QAM	786.3	5.24	13	Pass

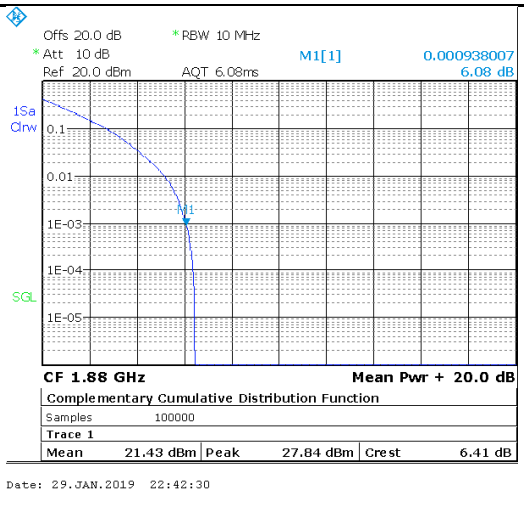
8.3.5 Test Plot



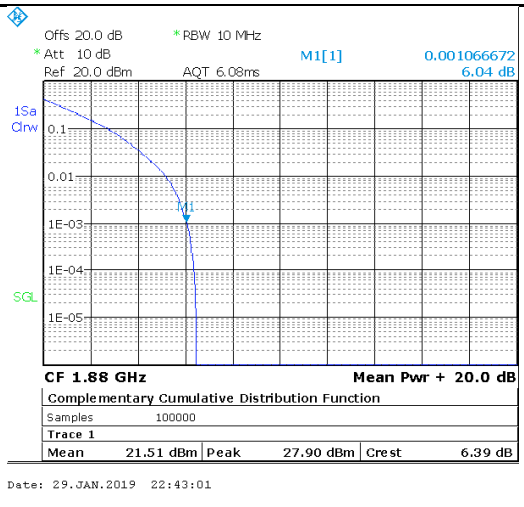
LTE-B2-QPSK-PAR-Low



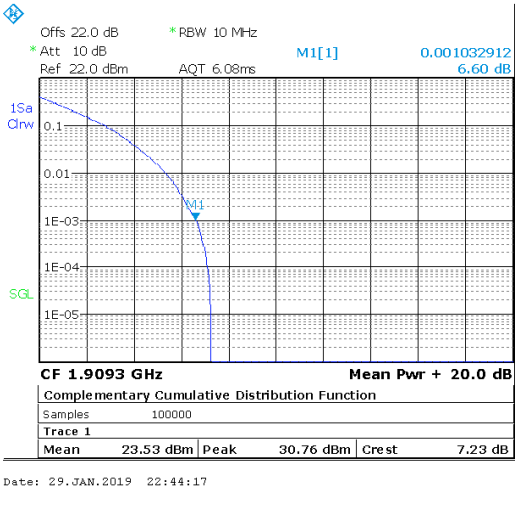
LTE-B2-16QAM-PAR-Low



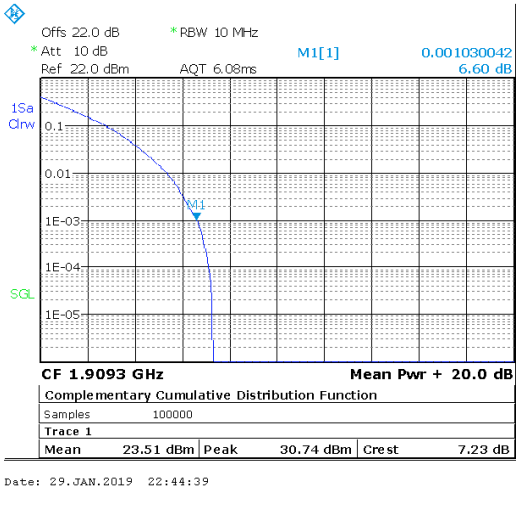
LTE-B2-QPSK-PAR-Mid



LTE-B2-16QAM-PAR-Mid



LTE-B2-QPSK-PAR-High



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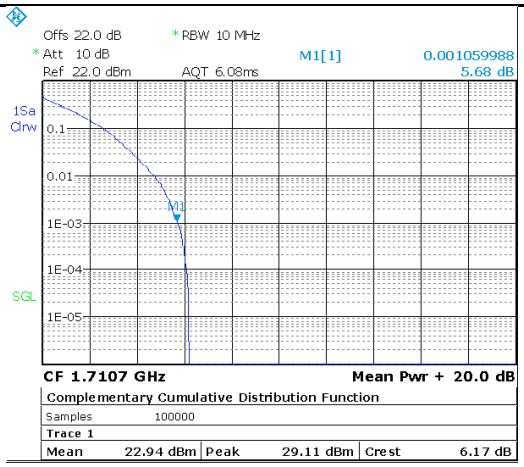

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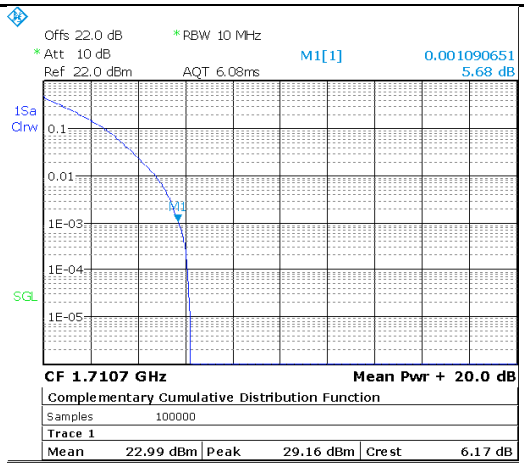

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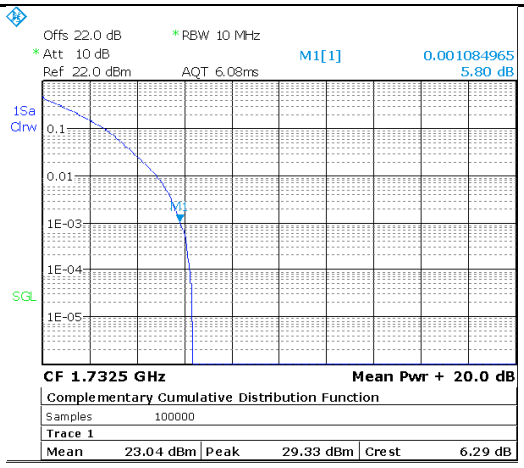

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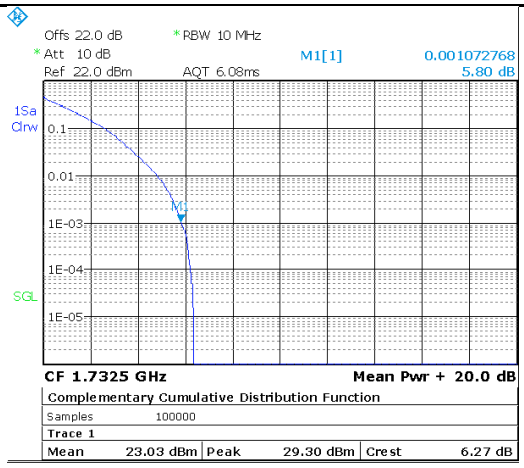

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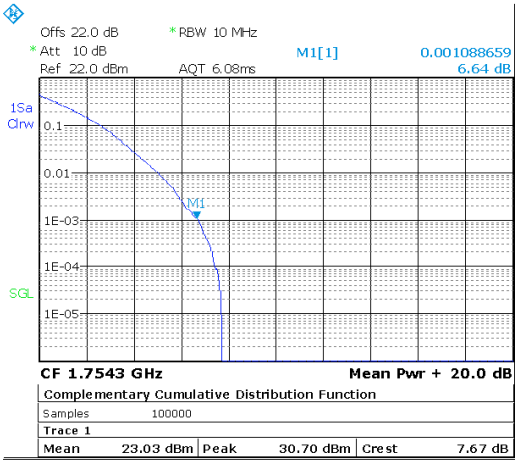

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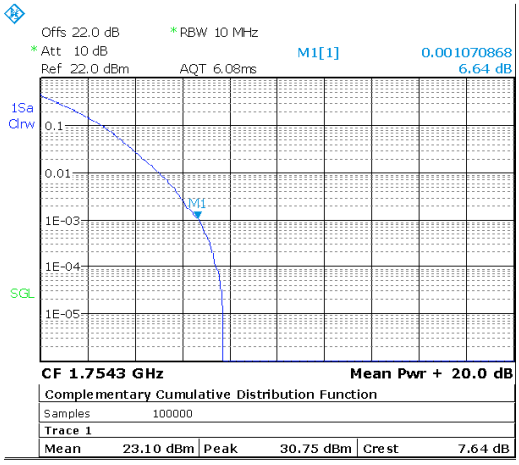

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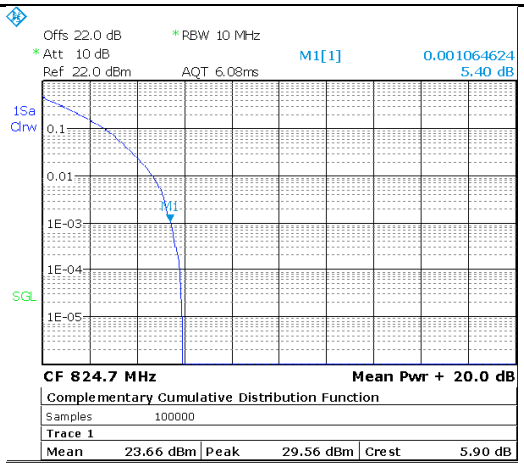

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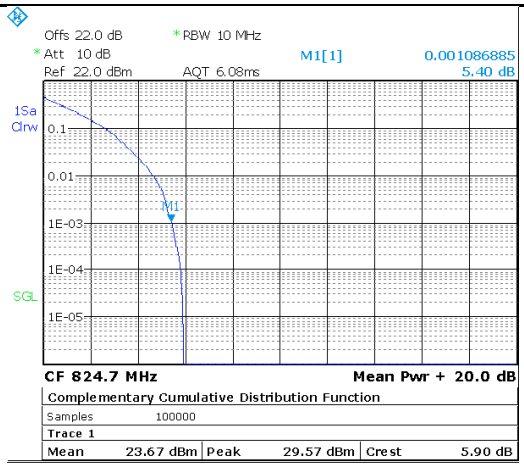

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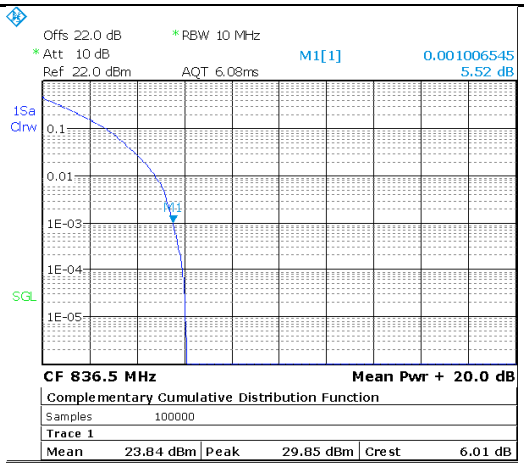
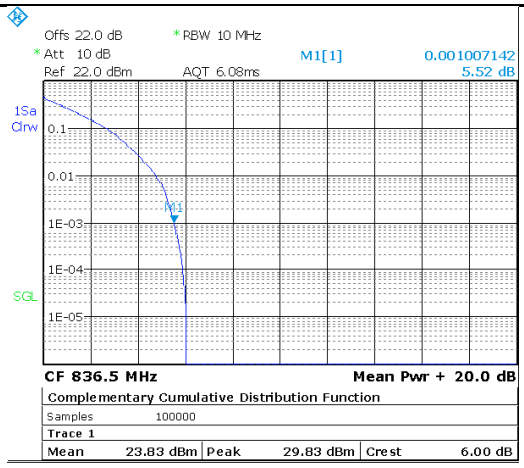


LTE-B5-QPSK-PAR-Mid



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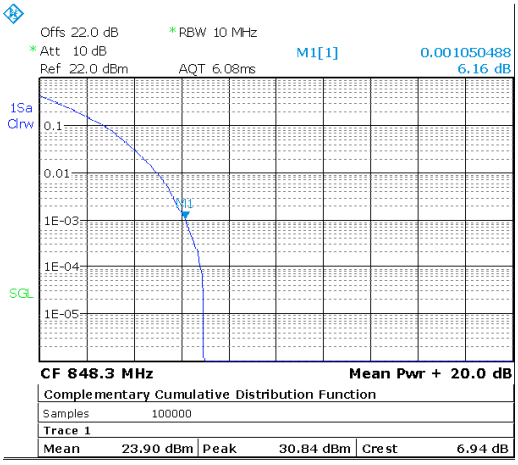

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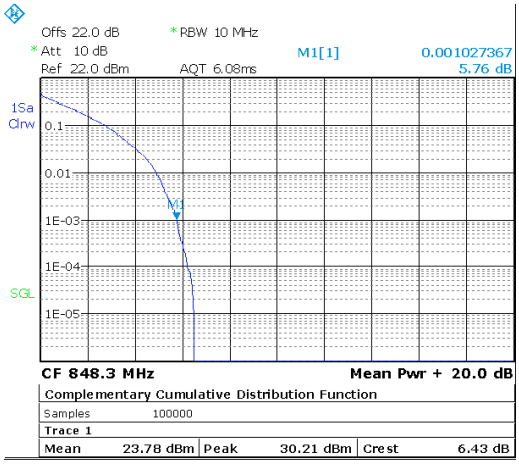

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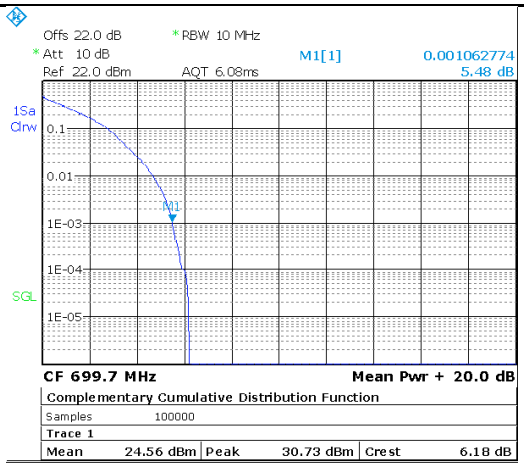

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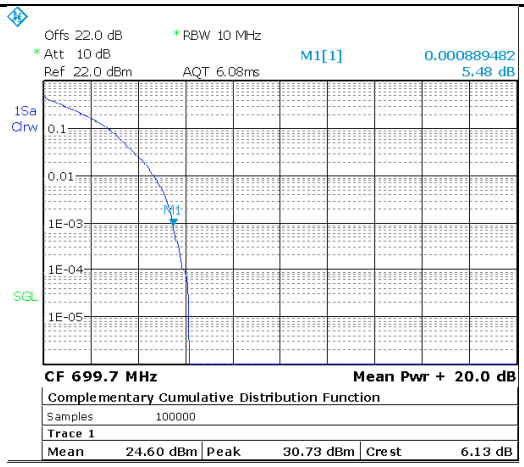

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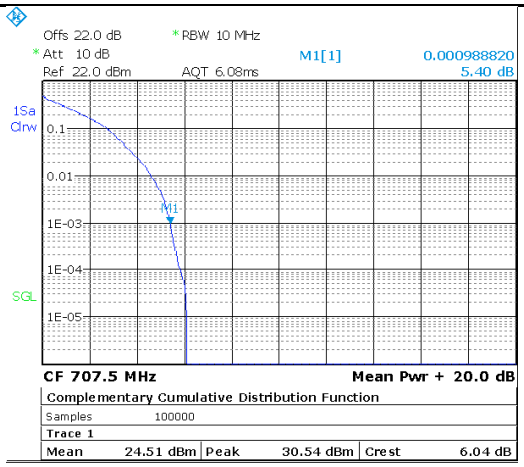
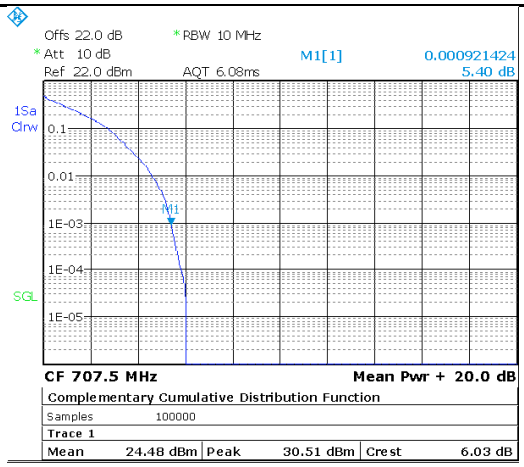


LTE-B12-QPSK-PAR-Mid



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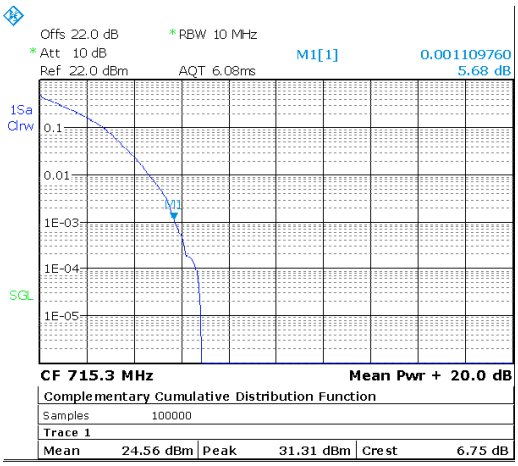

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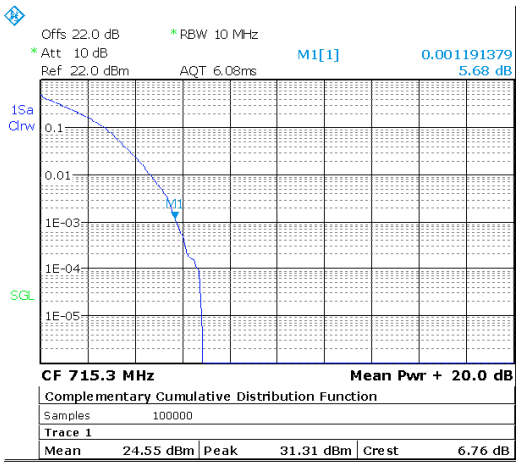

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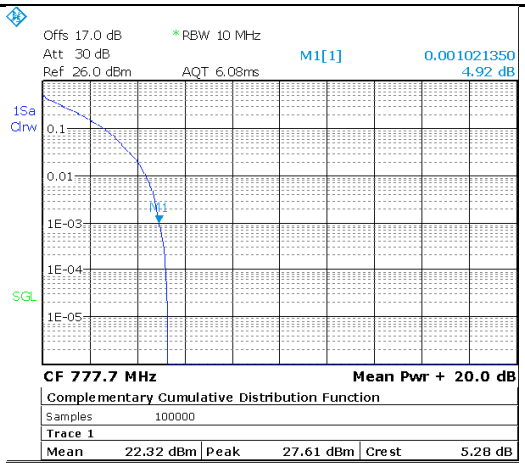
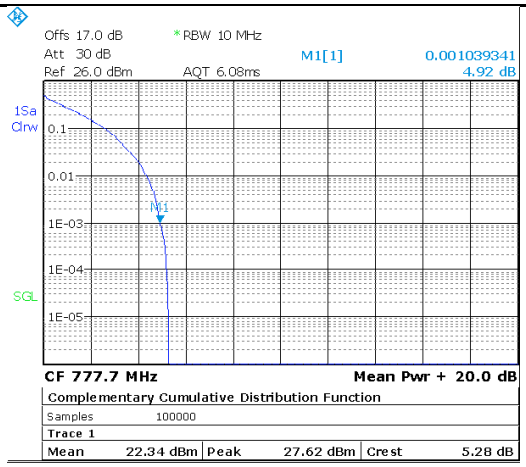


LTE-B13-QPSK-PAR-Low



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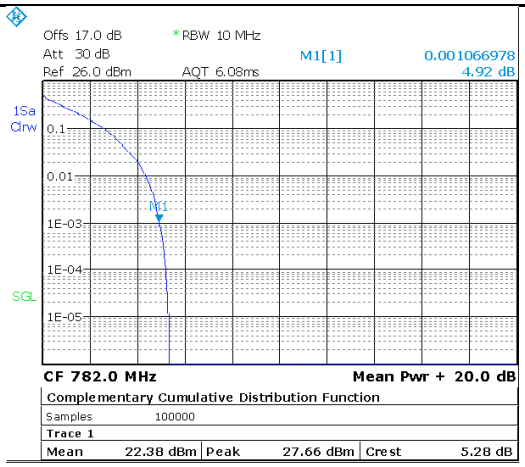

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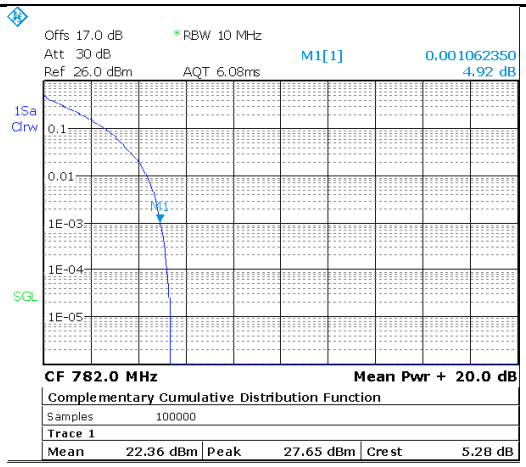

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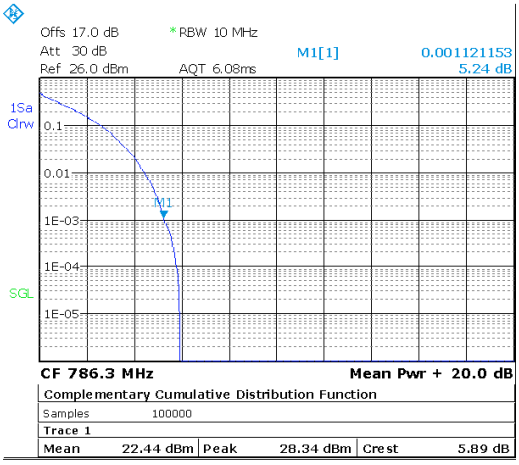
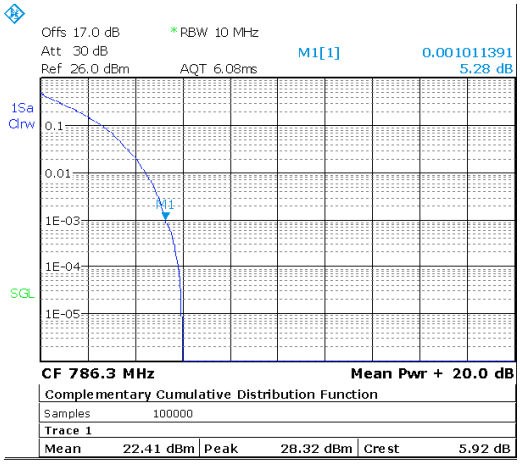


LTE-B13-QPSK-PAR-High



LTE-B13-16QAM-PAR-High

8.4 Band Edge

8.4.1 Requirement

§ 2.1051,22.917(a), 24.238(a), 27.53 (f), (g), (h) and (c)(2) and (5)

RSS-130(4.7.1) and (4.7.2), RSS-132(5.5), RSS-133(6.5), RSS-139(6.6)

FCC 47 CFR Part 22, Clause 22.917 (a) and FCC 47 CFR Part 24, Clause 24.238 (a)

(a)Out of band emissions. 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.

FCC 47 CFR Part 27, Clause 27.53 (c)(2) and (5)

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

FCC 47 CFR Part 27, Clause 27.53 (f)

(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

FCC 47 CFR Part 27, Clause 27.53 (g)

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

FCC 47 CFR Part 27, Clause 27.53 (h)

(h) AWS emission limits — (1) General protection levels. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB.

(3) Measurement procedure. (i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. 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.

RSS-130, Clause 4.7.1 and 4.7.2

The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least 43 + 10 log10 p (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

In addition to the limit outlined in section 4.7.1 above, equipment operating in the frequency bands 746- 756 MHz and 777-787 MHz shall also comply with the following restrictions:

a) The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least:

(i) 76 + 10 log10 p (watts), dB, for base and fixed equipment, and

(ii) 65 + 10 log10 p (watts), dB, for mobile and portable equipment.

b) The e.i.r.p. in the band 1559-1610 MHz shall not exceed -70 dBW/MHz for wideband signal and 80 dBW for discrete emission with bandwidth less than 700 Hz.

RSS-132, Clause 5.5

Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

(i) In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p (watts).

(ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

RSS-133, Clause 6.5.1

Equipment shall comply with the limits in (i) and (ii) below.

(i) In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p(watts).

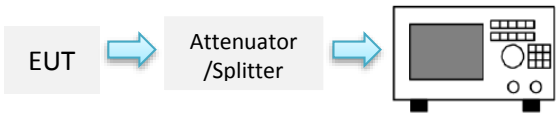
(ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p(watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

RSS-139, Clause 6.6

(i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 p (watts) dB.

(ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 p (watts) dB.

8.4.2 Test setup



8.4.3 Test Procedure

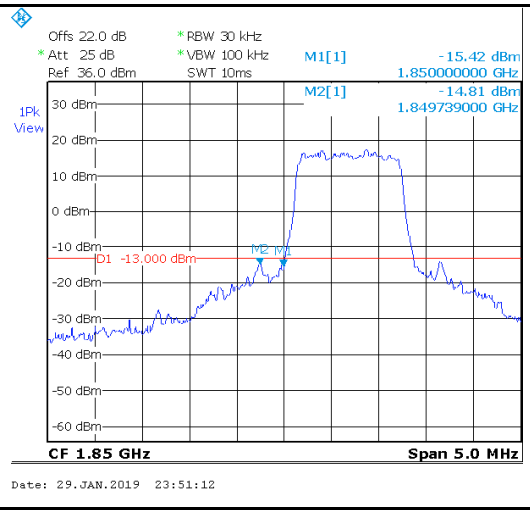
KDB 971168 D01 Power Meas License Digital Systems v03r01 section 6.0

1. Set analyser centre frequency to the edge frequency
2. Set the span to wide enough covering the signal spectrum.
3. Set the RBW to minimum 1% of the EBW or OBW
4. Set the VBW ≥ 3 x RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.

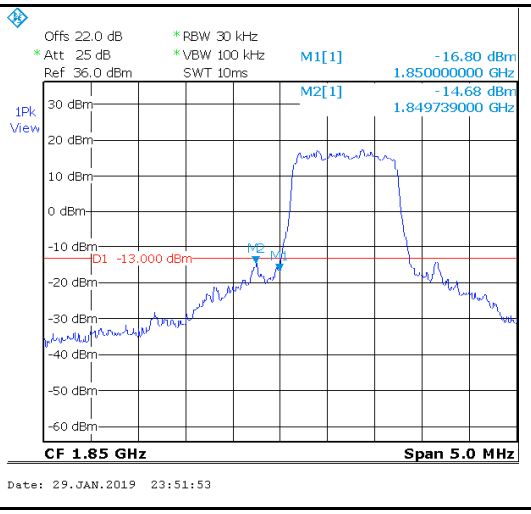
8.4.4 Test Result

See test plots

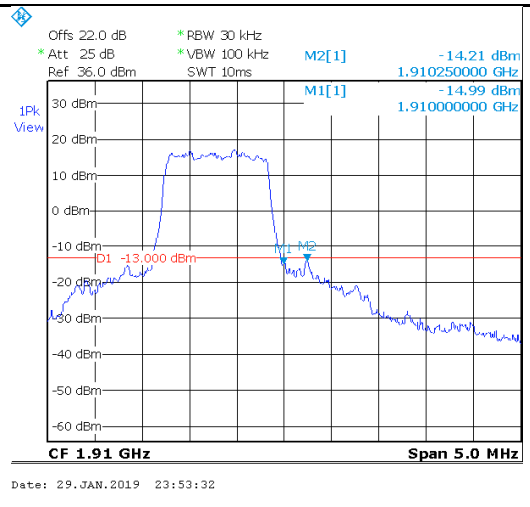
8.4.5 Test Plots



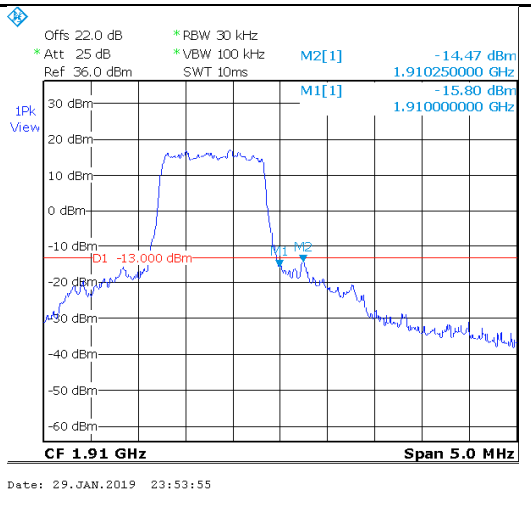
LTE-B2-QPSK-EDGE-Low



LTE-B2-16QAM-EDGE-Low



LTE-B2-QPSK-EDGE-High



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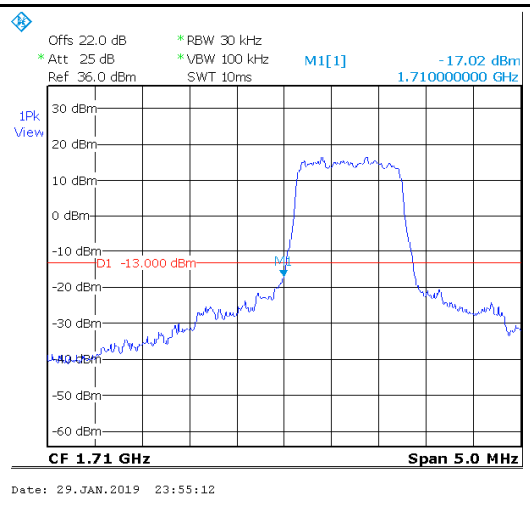

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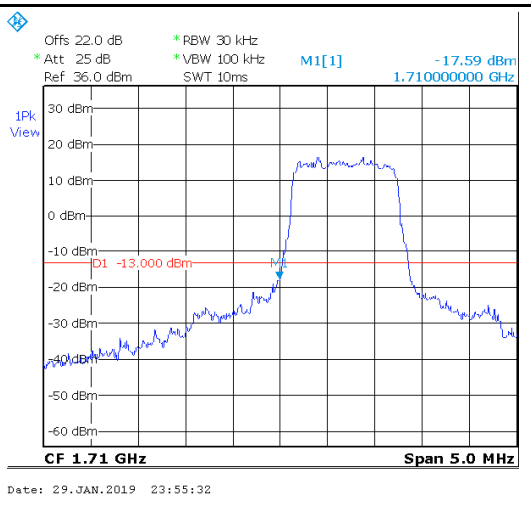

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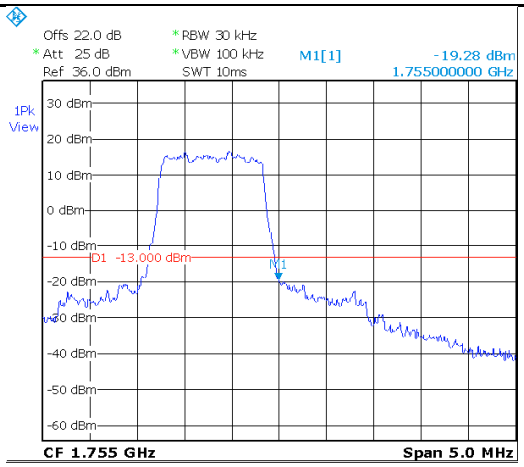

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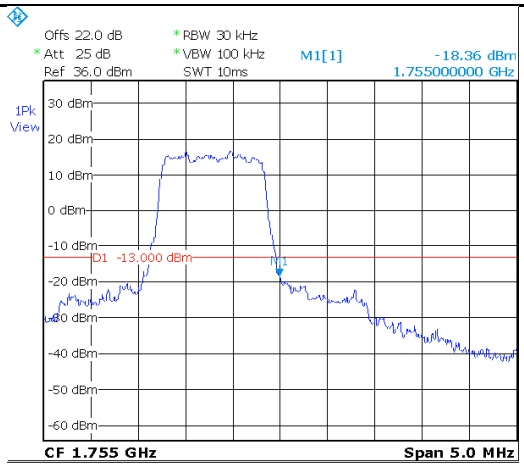

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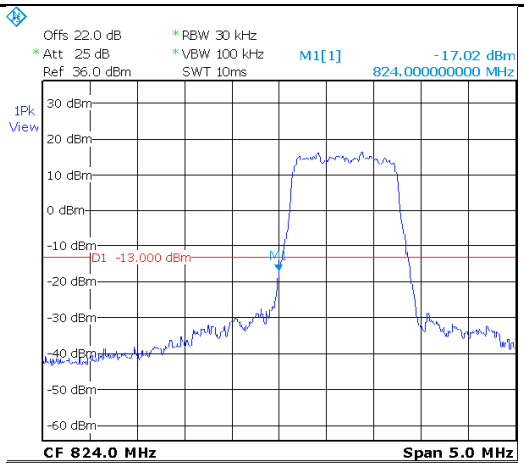

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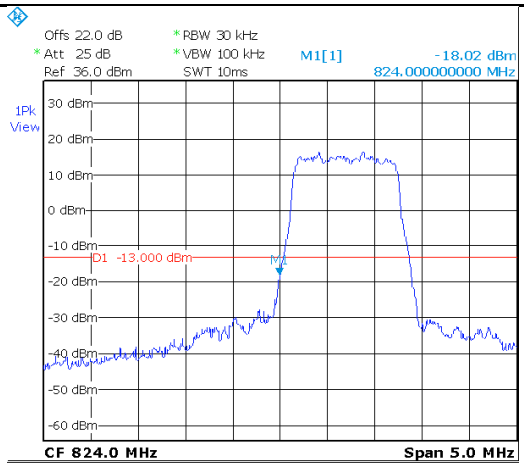

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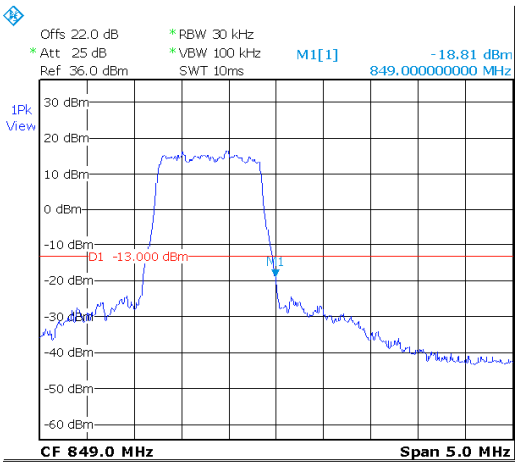

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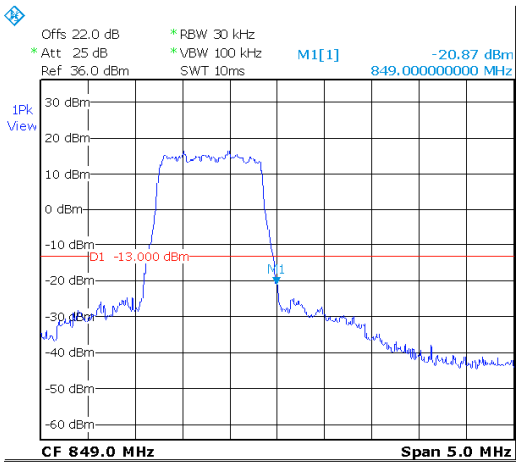
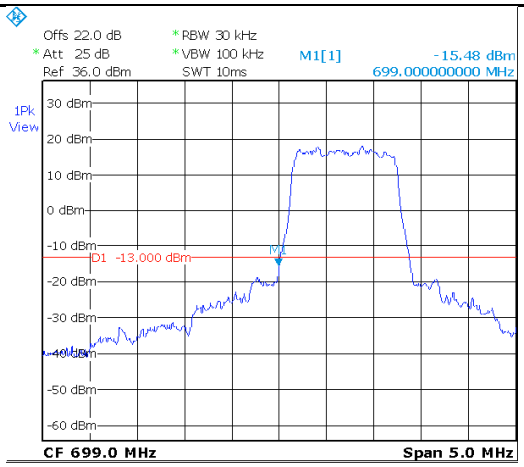
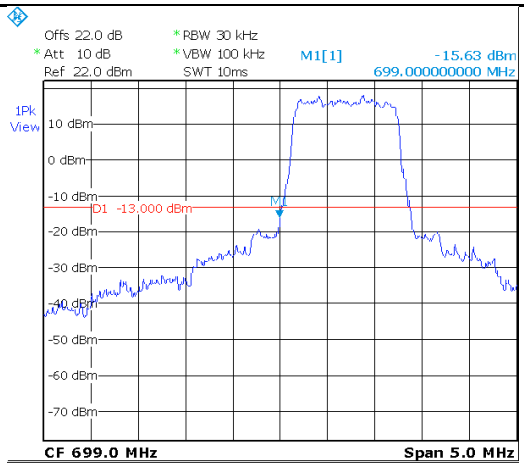


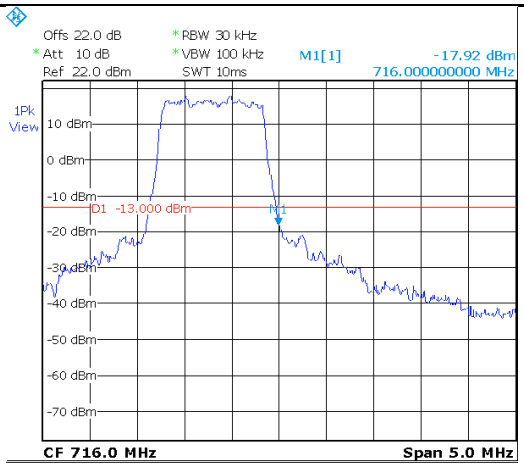
LTE-B5-16QAM-EDGE-High



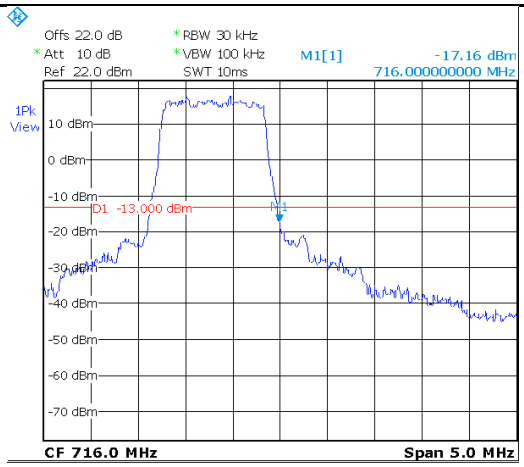
LTE-B12-QPSK-EDGE-Low



LTE-B12-16QAM-EDGE-Low



LTE-B12-QPSK-EDGE-High



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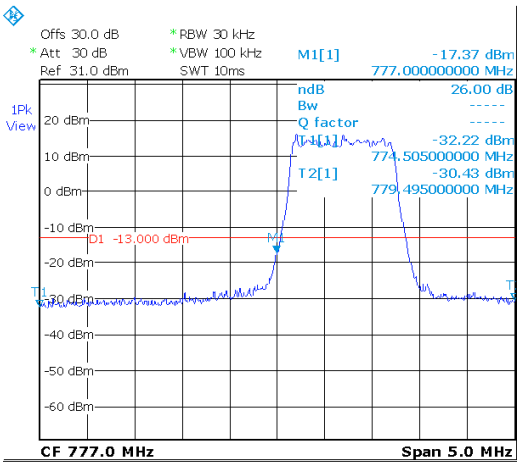

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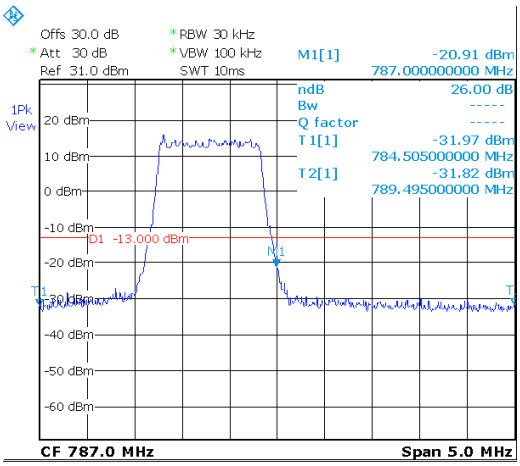

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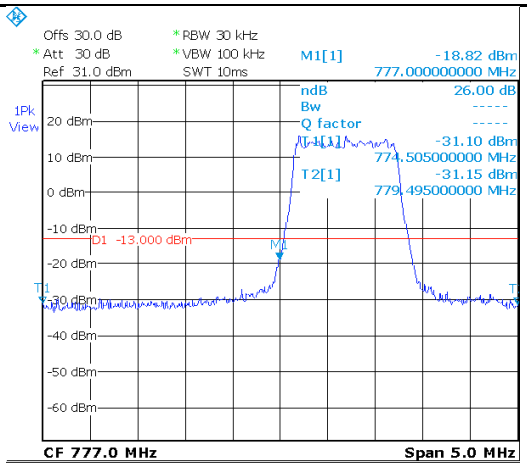

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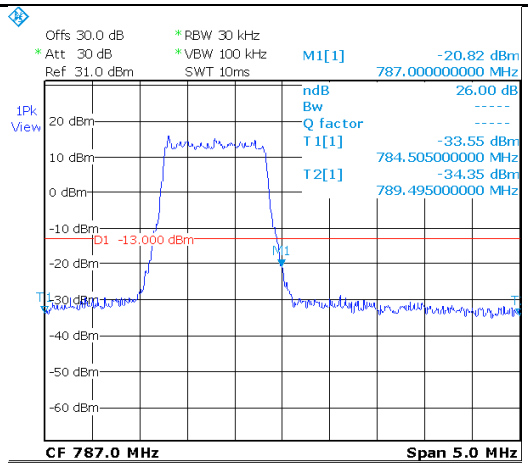
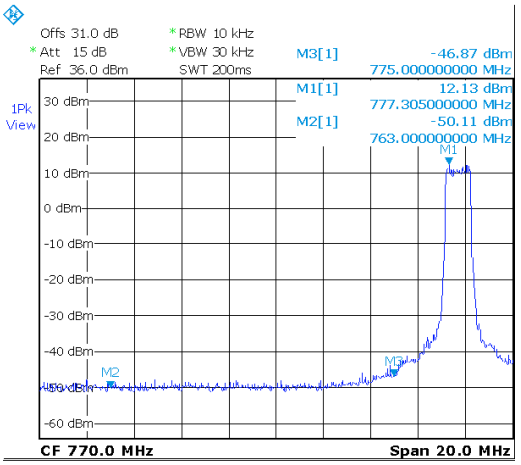
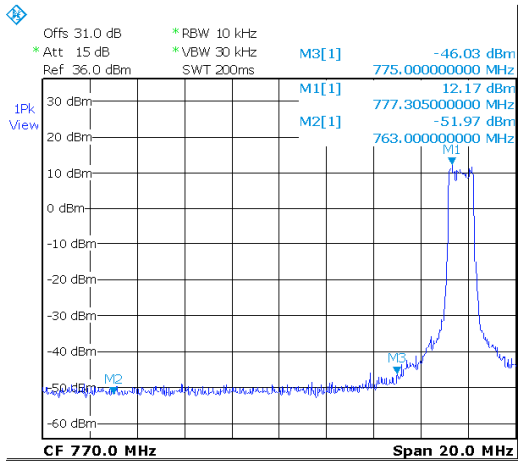


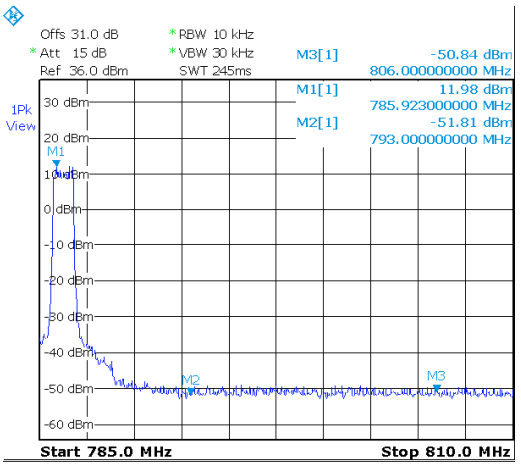
LTE-B13-16QAM-EDGE-High



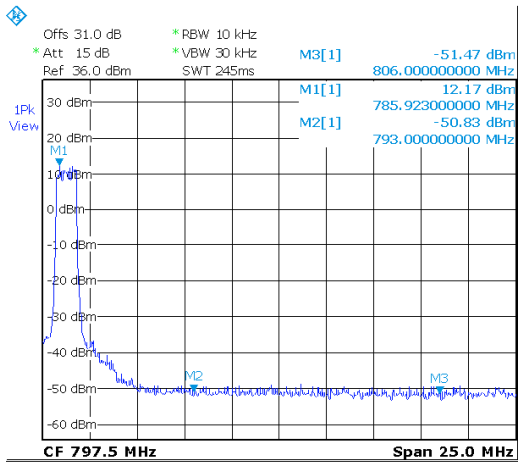
LTE-B13-QPSK-763-775 MHz-Low



LTE-B13-QPSK-763-775 MHz-High



LTE-B13-QPSK-793-806 MHz-Low



LTE-B13-QPSK-793-806 MHz-High

8.5 Conducted Spurious Emissions Measurement

8.5.1 Requirement

§ 2.1051,22.917(a), 24.238(a), 27.53 (f), (g), (h) and (c)(2) and (5)

RSS-130(4.7.1) and (4.7.2), RSS-132(5.5), RSS-133(6.5), RSS-139(6.6)

FCC 47 CFR Part 22, Clause 22.917 (a) and FCC 47 CFR Part 24, Clause 24.238 (a)

(a)Out of band emissions. 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.

FCC 47 CFR Part 27, Clause 27.53 (c)(2) and (5)

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

FCC 47 CFR Part 27, Clause 27.53 (f)

(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

FCC 47 CFR Part 27, Clause 27.53 (g)

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

FCC 47 CFR Part 27, Clause 27.53 (h)

(h) AWS emission limits — (1) General protection levels. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB.

(3) Measurement procedure. (i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. 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.

RSS-130, Clause 4.7.1 and 4.7.2

The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least 43 + 10 log10 p (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

In addition to the limit outlined in section 4.7.1 above, equipment operating in the frequency bands 746- 756 MHz and 777-787 MHz shall also comply with the following restrictions:

a) The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least:

(i) 76 + 10 log10 p (watts), dB, for base and fixed equipment, and

(ii) 65 + 10 log10 p (watts), dB, for mobile and portable equipment.

b) The e.i.r.p. in the band 1559-1610 MHz shall not exceed -70 dBW/MHz for wideband signal and 80 dBW for discrete emission with bandwidth less than 700 Hz.

RSS-132, Clause 5.5

Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

(i) In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p (watts).

(ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

RSS-133, Clause 6.5.1

Equipment shall comply with the limits in (i) and (ii) below.

(i) In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p(watts).

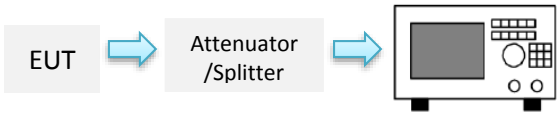
(ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p(watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

RSS-139, Clause 6.6

(i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 p (watts) dB.

(ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 p (watts) dB.

8.5.2 Test setup



8.5.3 Test Procedure

ANSI C63.26: 2015 section 5.7

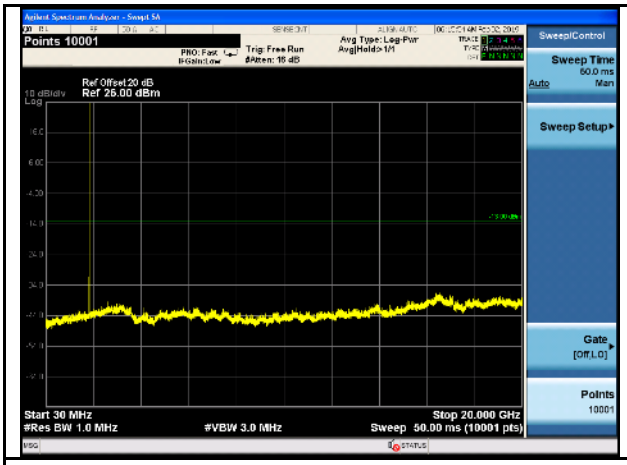
KDB 971168 D01 Power Meas License Digital Systems v03r01 section 6

1. Set the start and stop frequency covering 10th harmonic of the operating frequency
2. Set the RBW = 1MHz. (worst case)
3. Set the VBW ≥ 3 X RBW.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum amplitude level.

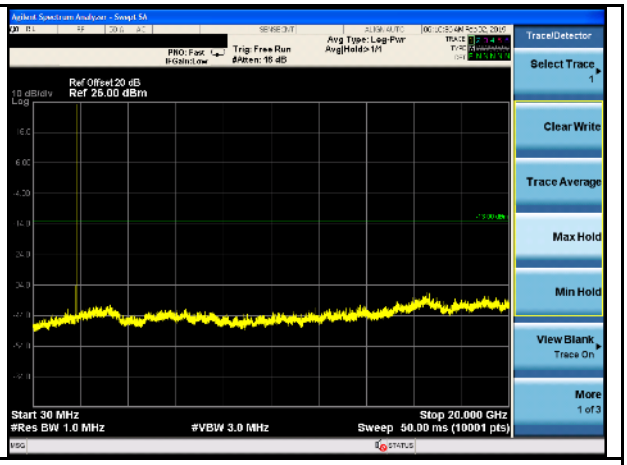
8.5.4 Test Result

See test plots

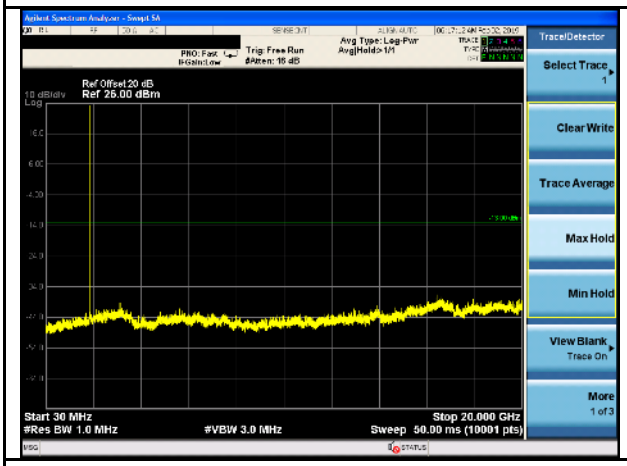
8.5.5 Test Plots



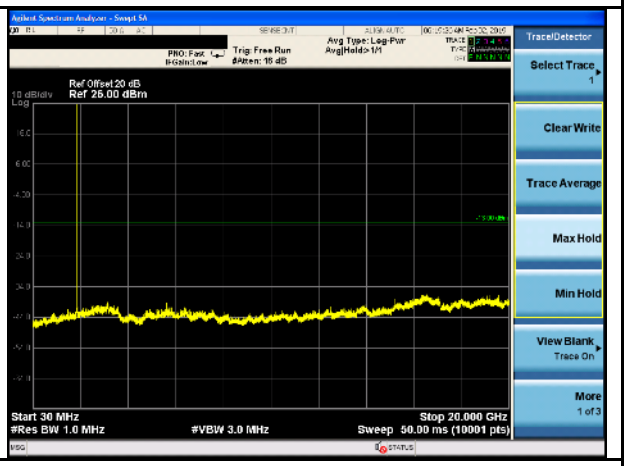
LTE-B2-QPSK-CSE-Low



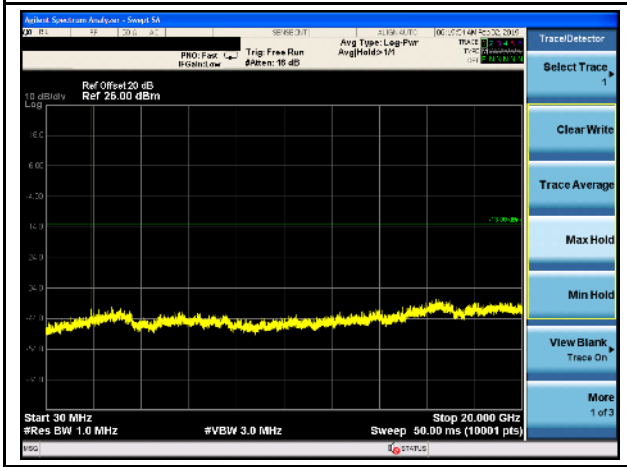
LTE-B2-16QAM-CSE-Low



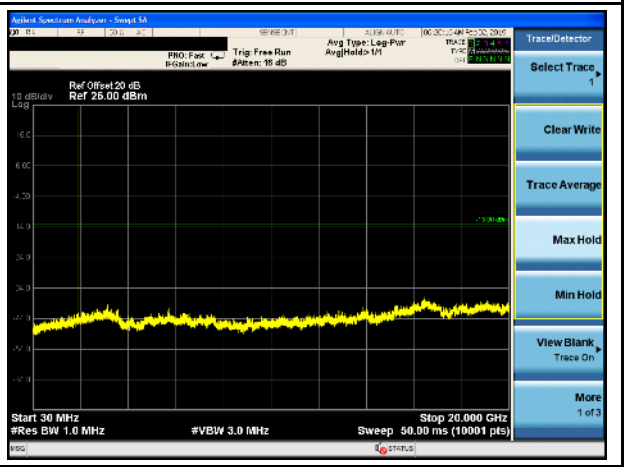
LTE-B2-QPSK-CSE-Mid



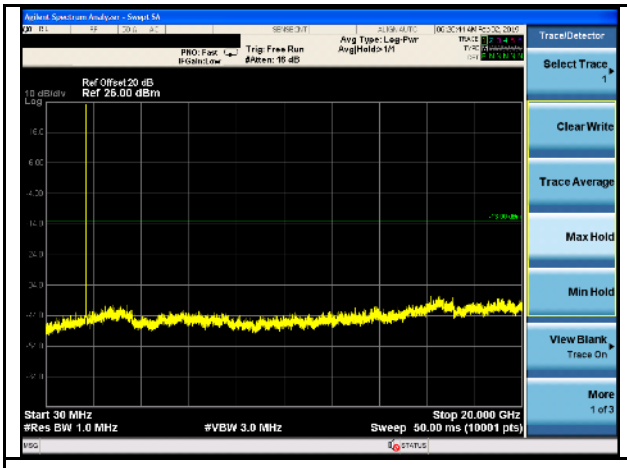
LTE-B2-16QAM-CSE-Mid



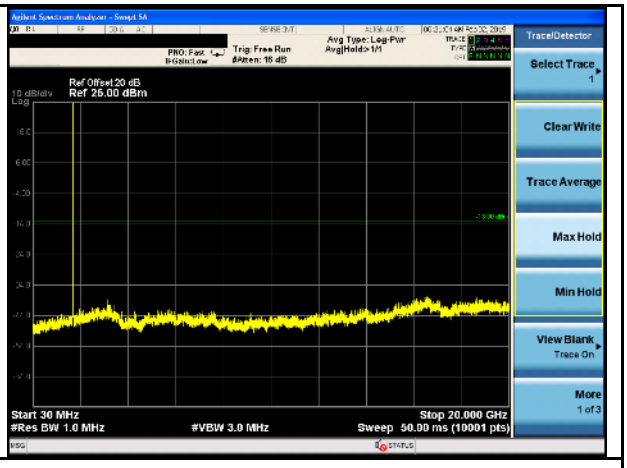
LTE-B2-QPSK-CSE-High



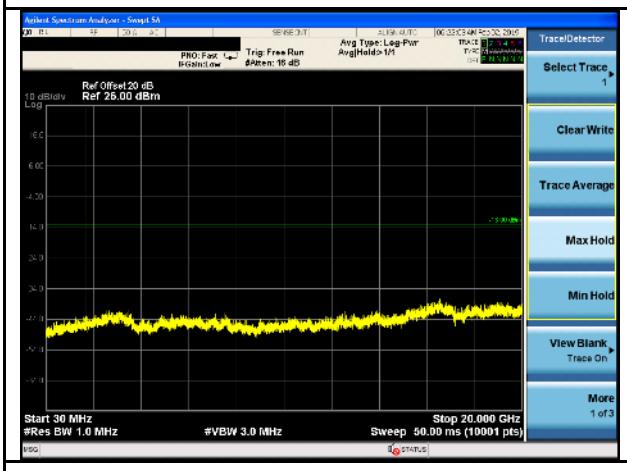
LTE-B2-16QAM-CSE-High



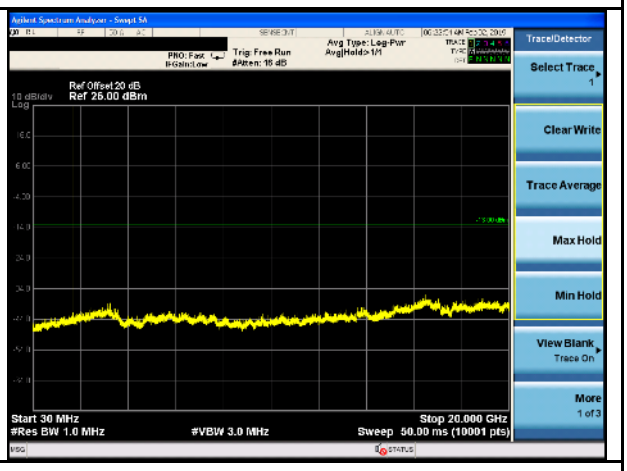
LTE-B4-QPSK-CSE-Low



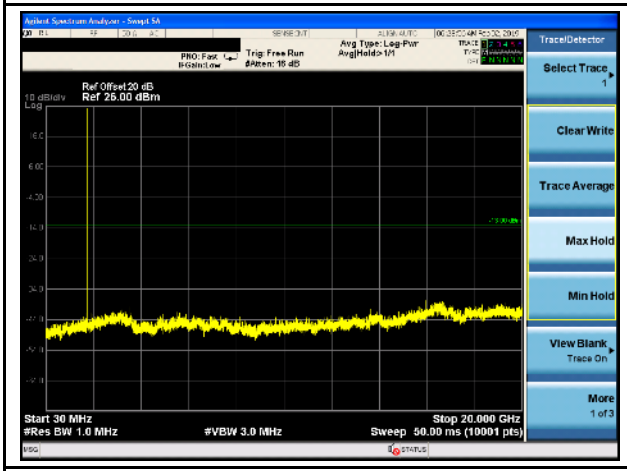
LTE-B4-16QAM-CSE-Low



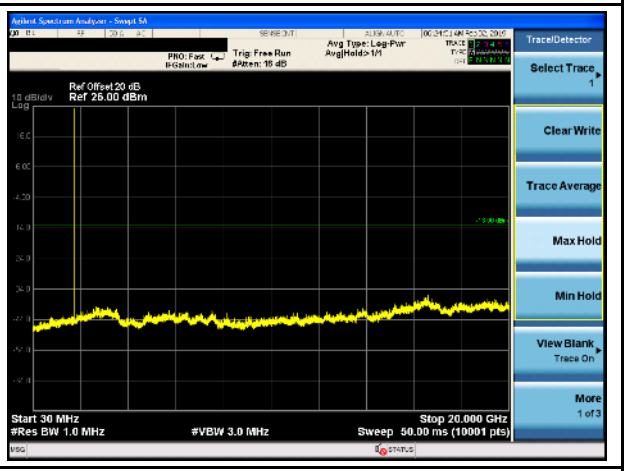
LTE-B4-QPSK-CSE-Mid



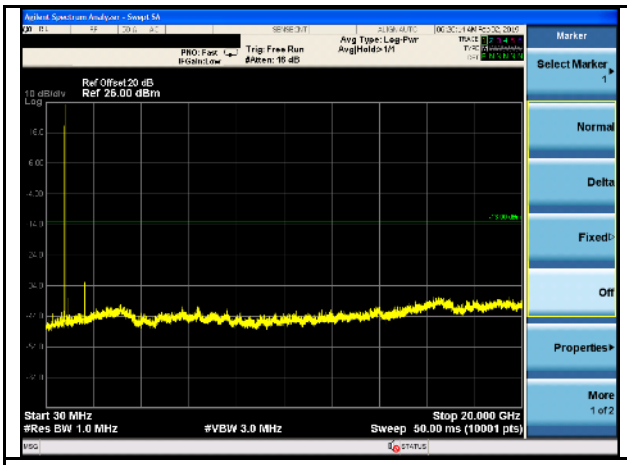
LTE-B4-16QAM-CSE-Mid



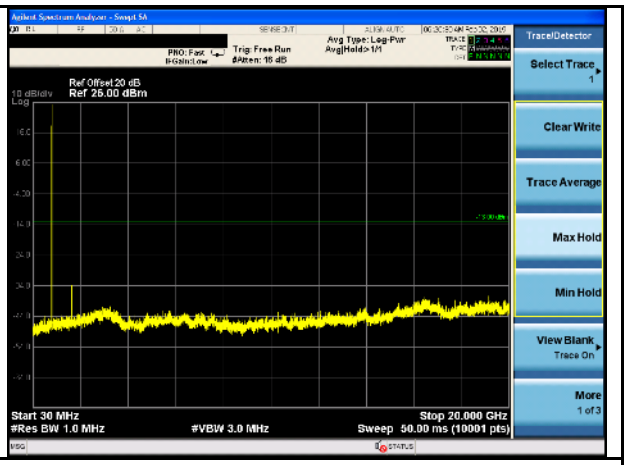
LTE-B4-QPSK-CSE-High



LTE-B4-16QAM-CSE-High



LTE-B5-QPSK-CSE-Low



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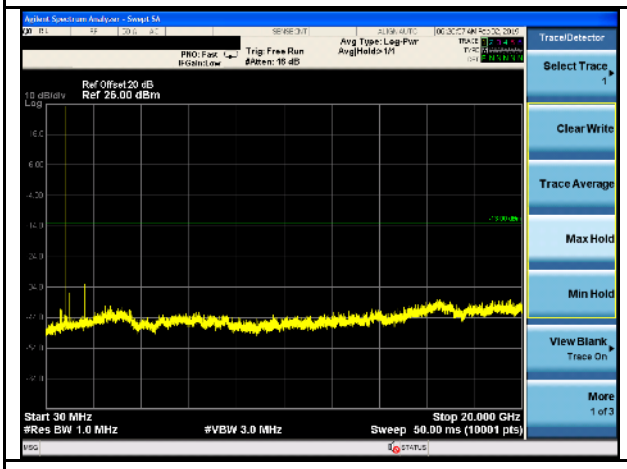

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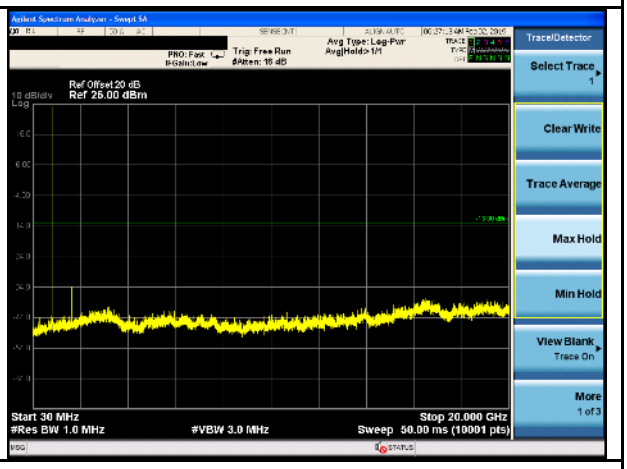

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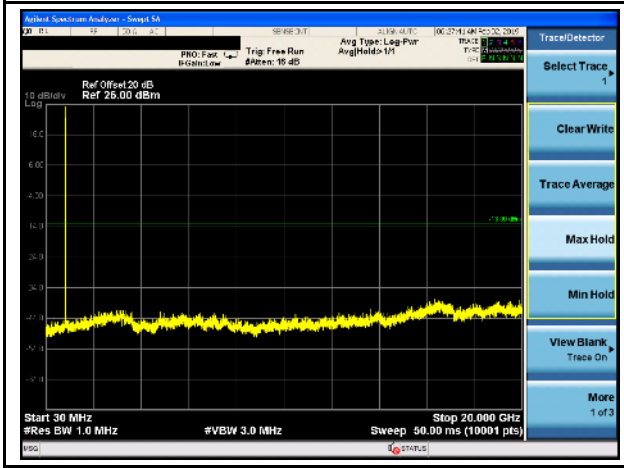

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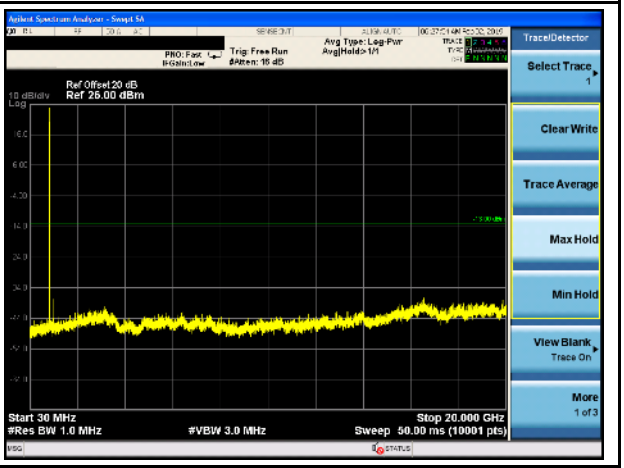

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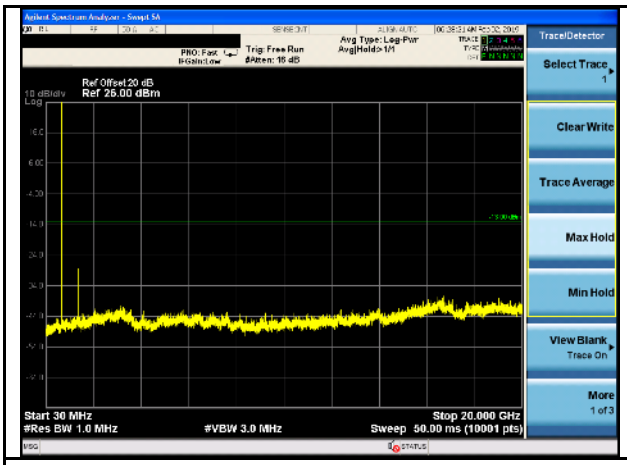
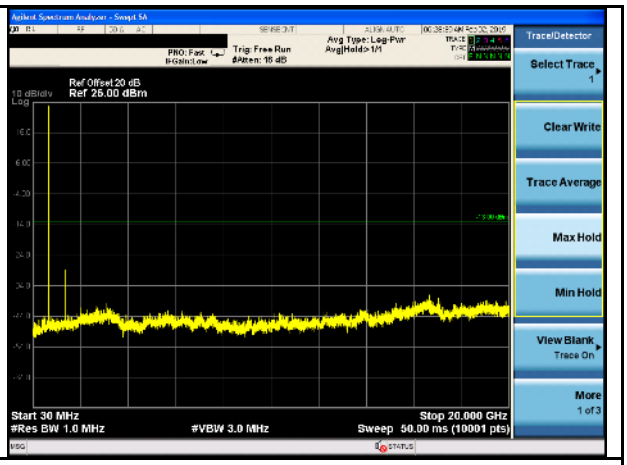


LTE-B12-QPSK-CSE-Low



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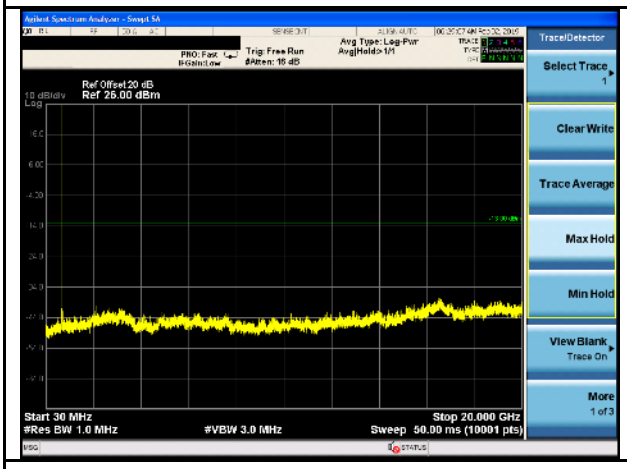

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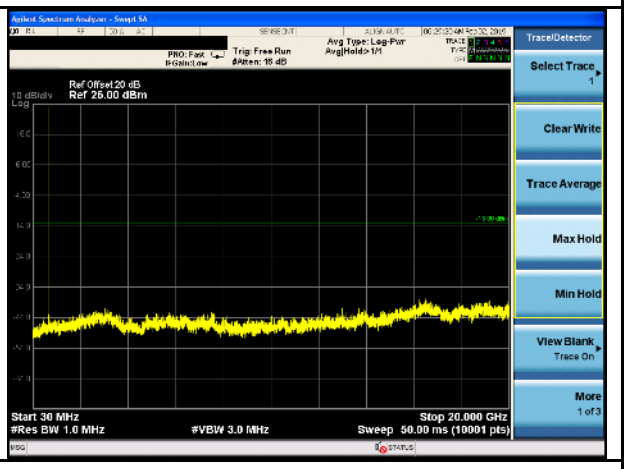

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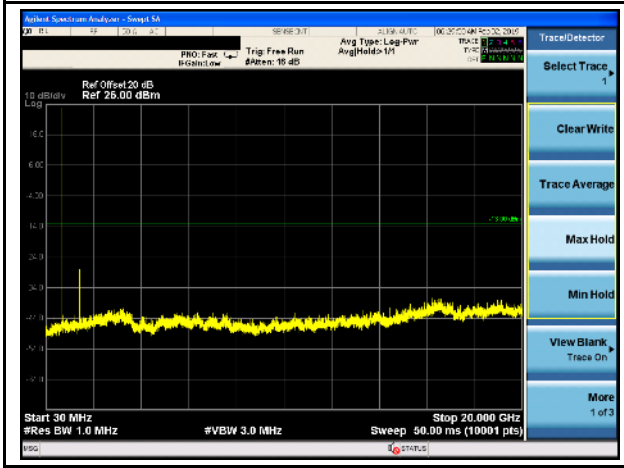

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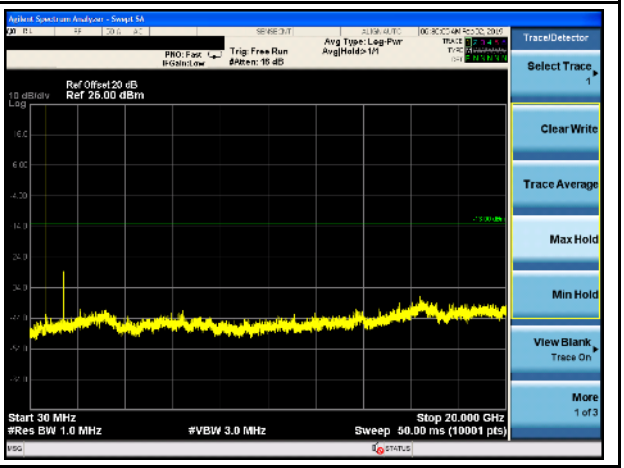

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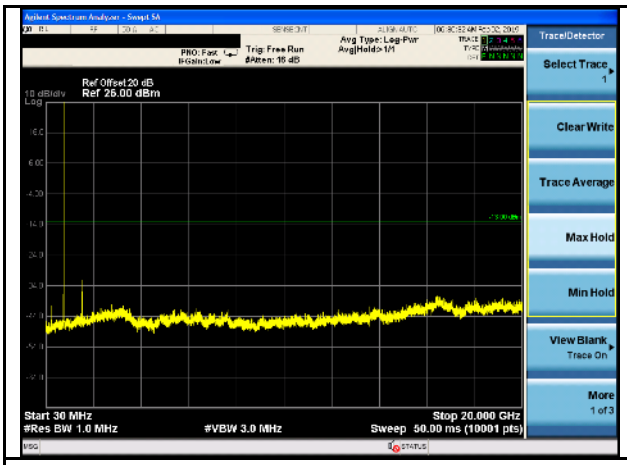
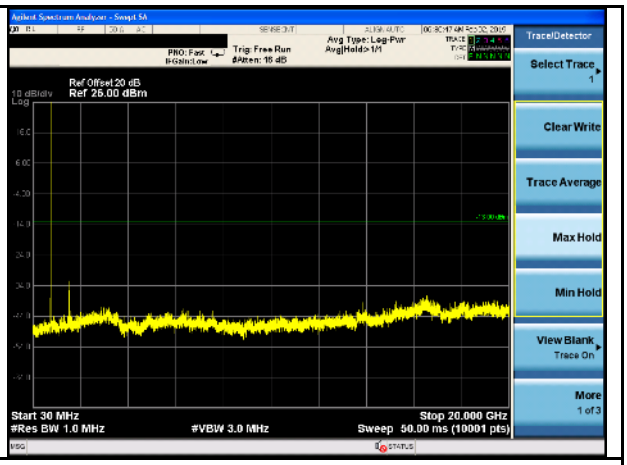


LTE-B13-QPSK-CSE-Low



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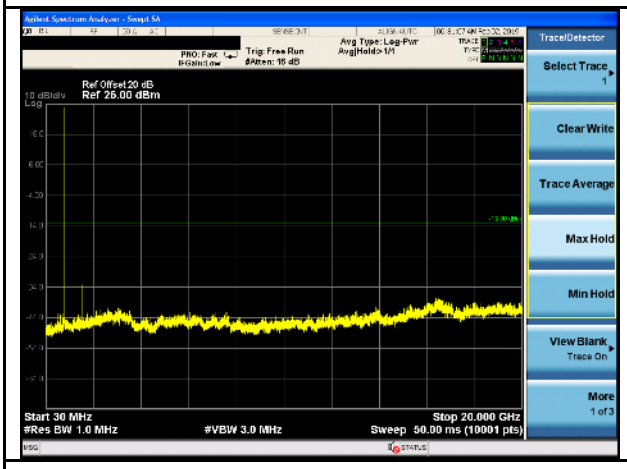

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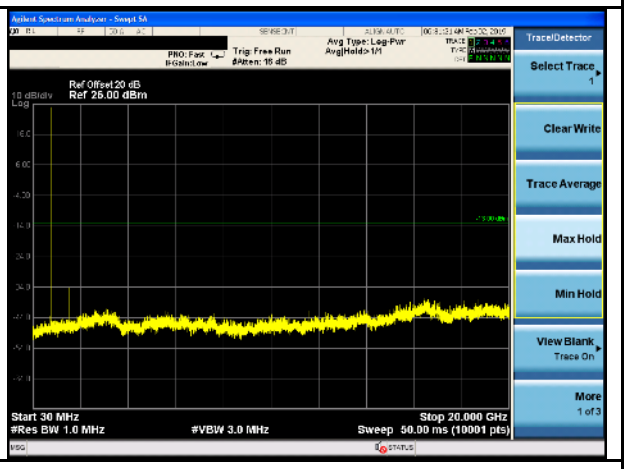

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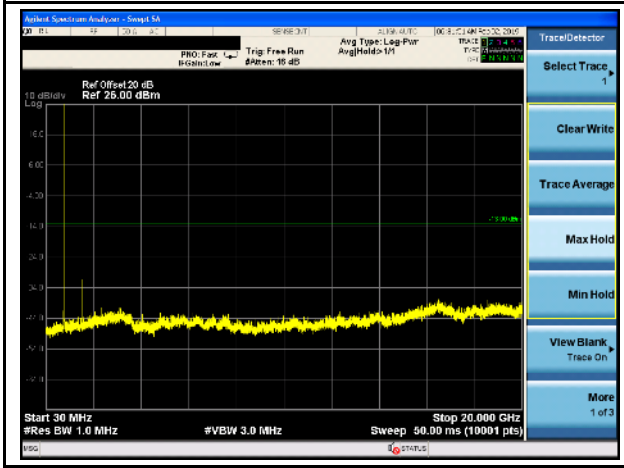
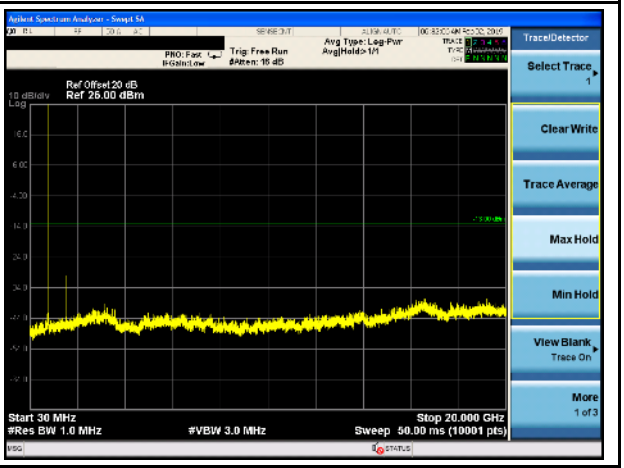


LTE-B13-QPSK-CSE-High



LTE-B13-16QAM-CSE-High

8.6 Field Strength of Spurious Radiation

8.6.1 Requirement

§ 2.1051,22.917(a), 24.238(a), 27.53 (f), (g), (h) and (c)(2) and (5)

RSS-130(4.7.1) and (4.7.2), RSS-132(5.5), RSS-133(6.5), RSS-139(6.6)

FCC 47 CFR Part 22, Clause 22.917 (a) and FCC 47 CFR Part 24, Clause 24.238 (a)

(a)Out of band emissions. 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.

FCC 47 CFR Part 27, Clause 27.53 (c)(2) and (5)

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

FCC 47 CFR Part 27, Clause 27.53 (f)

(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

FCC 47 CFR Part 27, Clause 27.53 (g)

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

FCC 47 CFR Part 27, Clause 27.53 (h)

(h) AWS emission limits — (1) General protection levels. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB.

(3) Measurement procedure. (i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. 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.

RSS-130, Clause 4.7.1 and 4.7.2

The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least 43 + 10 log10 p (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

In addition to the limit outlined in section 4.7.1 above, equipment operating in the frequency bands 746- 756 MHz and 777-787 MHz shall also comply with the following restrictions:

a) The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least:

(i) 76 + 10 log10 p (watts), dB, for base and fixed equipment, and

(ii) 65 + 10 log10 p (watts), dB, for mobile and portable equipment.

b) The e.i.r.p. in the band 1559-1610 MHz shall not exceed -70 dBW/MHz for wideband signal and 80 dBW for discrete emission with bandwidth less than 700 Hz.

RSS-132, Clause 5.5

Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

(i) In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p (watts).

(ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

RSS-133, Clause 6.5.1

Equipment shall comply with the limits in (i) and (ii) below.

(i) In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p(watts).

(ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p(watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

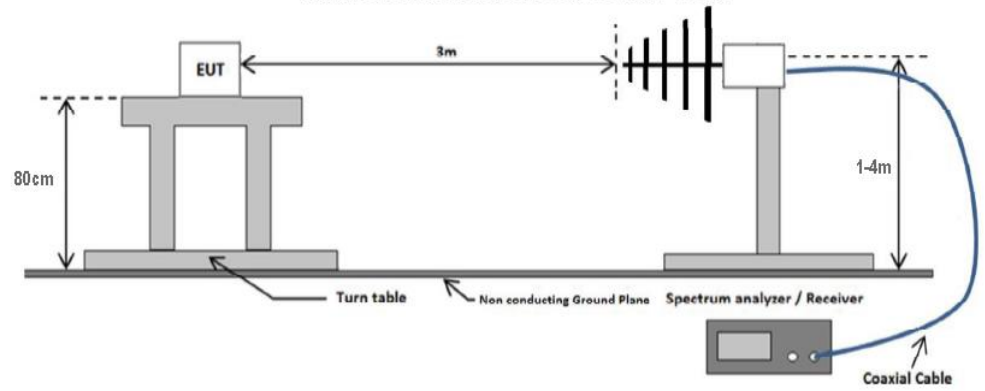
RSS-139, Clause 6.6

(i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 p (watts) dB.

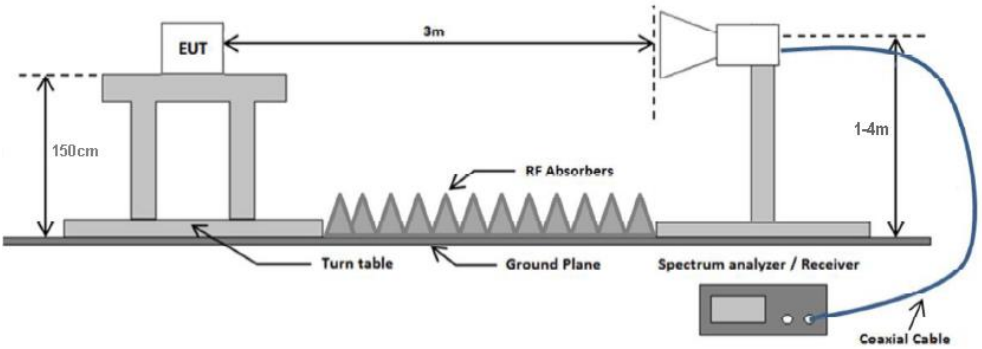
(ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 p (watts) dB.

8.6.2 Test setup

Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



8.6.3 Test Procedure

ANSI C63.26: 2015 section 5.5

KDB 971168 D01 Power Meas License Digital Systems v03r01 section 7

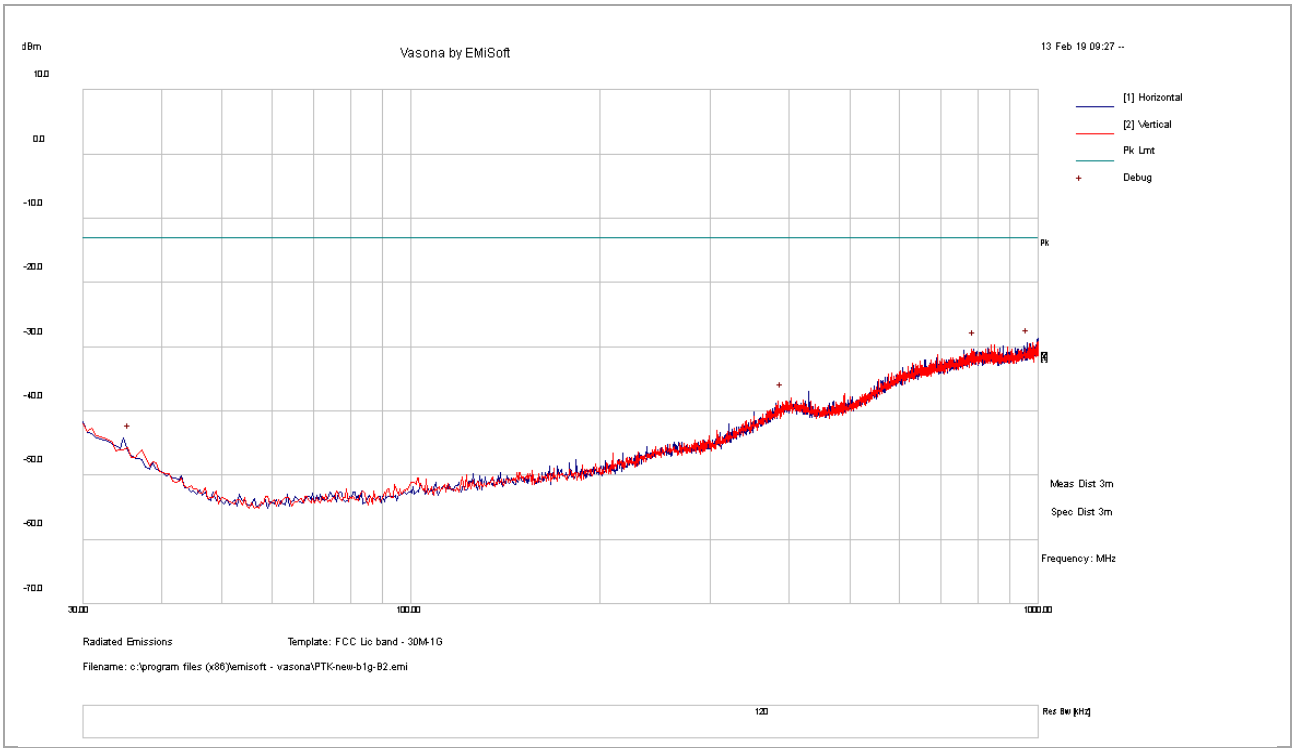
Boresight antenna mast was used during the scanning to point to EUT to maximize the emission. The process will be repeated in 3 EUT orientations.

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
   a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
   b. The EUT was then rotated to the direction that gave the maximum emission.
   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 300 Hz for frequency below 150KHz.

4. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 10 kHz for frequency between 150KHz – 30MHz.
5. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-Peak detection at frequency between 30MHz - 1GHz.
6. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak and average measurement at frequency above 1GHz.
7. Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter.
8. Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a non-radiating cable. With the antennas at both ends horizontally polarized, and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained.
9. Steps 2 - 8 were repeated for the next frequency point, until all selected frequency points were measured

8.6.4 Test Result

Test Standard:	**Part 24E & RSS 133**	**Mode:**	**LTE Band 2**
Frequency Range:	**30-1000MHz**	**Test Date:**	**02/01/2019**
Antenna Type/Polarity:	**Bi-Log/Hor & Ver**	**Test Personnel:**	**Sherwin Lee**
Remark:	**N/A**	**Test Result:**	**Pass**

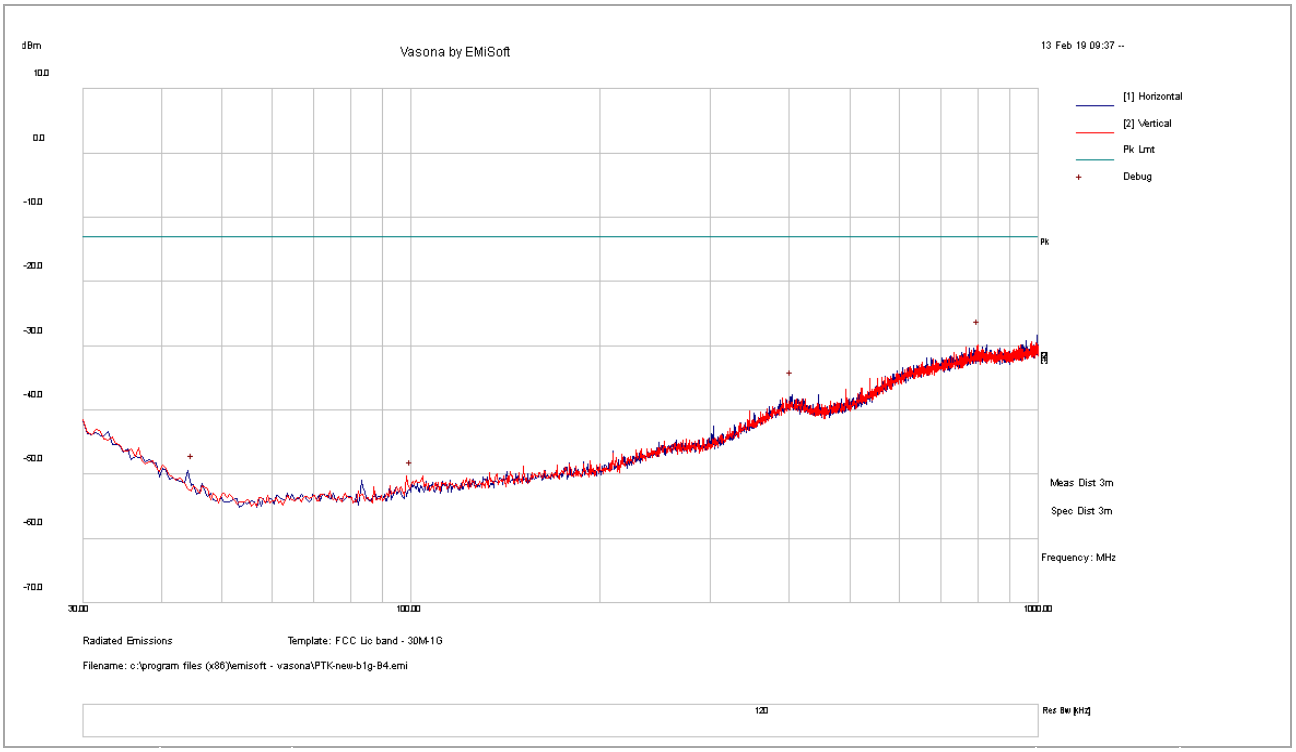


Frequency MHz	Raw dB	Cable dB	AF dB	Level dBm	Det	Pol deg	Height cm	Table deg	Limit dBm	Margin dB
35.62	-73.68	14.18	12.82	-46.68	RMS	V	102	309	-13.00	-33.68
389.36	-75.97	18.07	17.55	-40.34	RMS	H	112	183	-13.00	-27.34
787.85	-76.92	19.02	23.66	-34.24	RMS	V	128	281	-13.00	-21.24
958.79	-77.49	19.61	23.90	-33.98	RMS	V	171	31	-13.00	-20.98

Note:

1) For below 1GHz, all different channel and modes were verified but only the worst case result is shown here.
2) All different modes have been verified and the worst case result is presented here.
3) EUT was tested in 3 orientations.
4) Final substitution measurement is not necessary as margin is over 20 dB.

Test Standard:	**Part 27 & RSS 139**	**Mode:**	**LTE Band 4**
Frequency Range:	**30-1000MHz**	**Test Date:**	**02/01/2019**
Antenna Type/Polarity:	**Bi-Log/Hor & Ver**	**Test Personnel:**	**Sherwin Lee**
Remark:	**N/A**	**Test Result:**	**Pass**

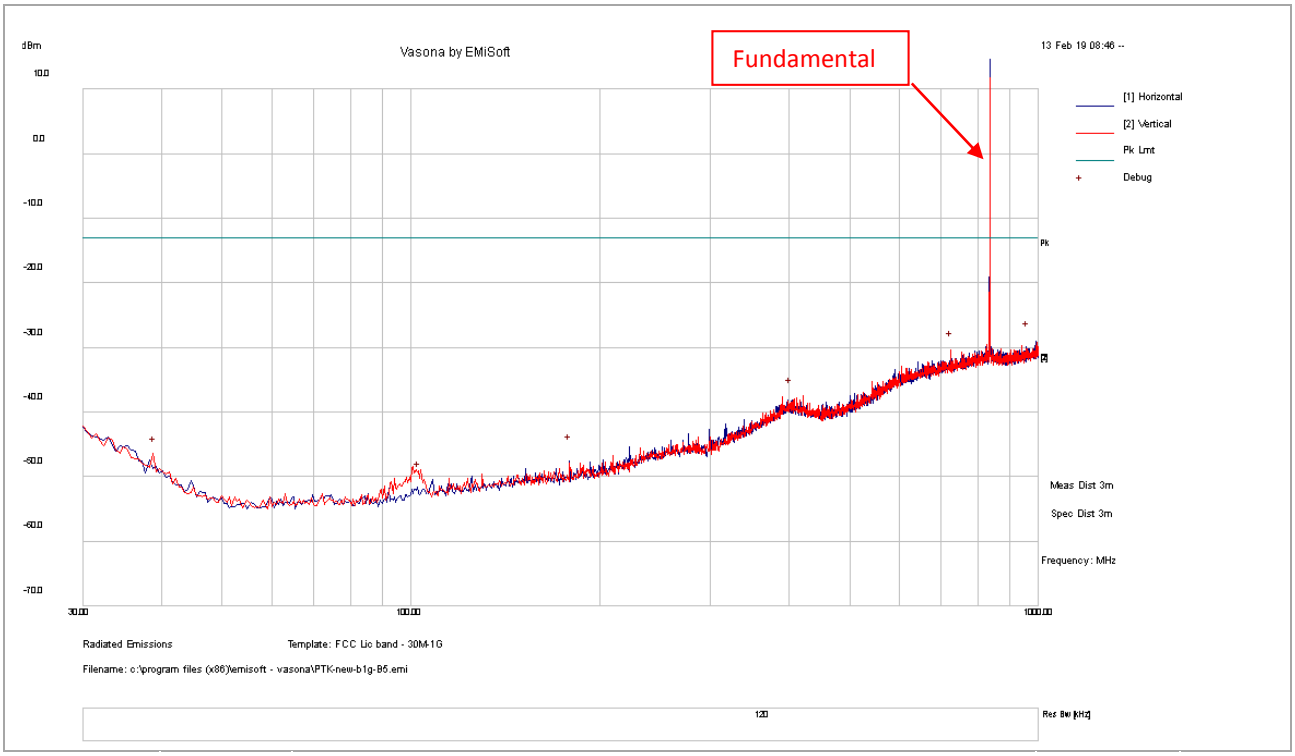


Frequency MHz	Raw dB	Cable dB	AF dB	Level dBm	Det	Pol deg	Height cm	Table deg	Limit dBm	Margin dB
35.62	-73.68	14.18	12.82	-46.68	RMS	V	192	36	-13.00	-38.73
389.36	-75.97	18.07	17.55	-40.34	RMS	H	102	310	-13.00	-39.63
787.85	-76.92	19.02	23.66	-34.24	RMS	V	156	130	-13.00	-25.66
958.79	-77.49	19.61	23.90	-33.98	RMS	V	113	98	-13.00	-23.76

Note:

1) For below 1GHz, all different channel and modes were verified but only the worst case result is shown here.
2) All different modes have been verified and the worst case result is presented here.
3) EUT was tested in 3 orientations.
4) Final substitution measurement is not necessary as margin is over 20 dB.

Test Standard:	**Part 22 & RSS 132**	**Mode:**	**LTE Band 5**
Frequency Range:	**30-1000MHz**	**Test Date:**	**02/01/2019**
Antenna Type/Polarity:	**Bi-Log/Hor & Ver**	**Test Personnel:**	**Sherwin Lee**
Remark:	**N/A**	**Test Result:**	**Pass**

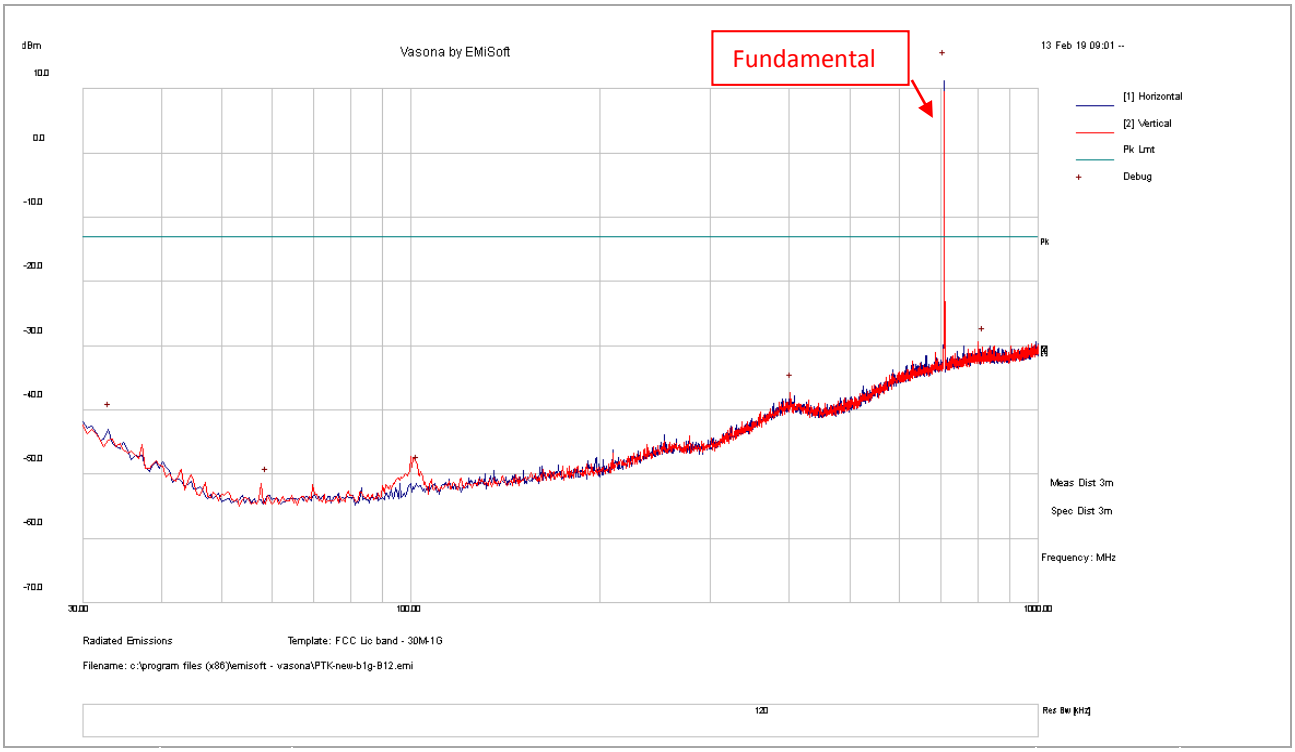


Frequency MHz	Raw dB	Cable dB	AF dB	Level dBm	Det	Pol deg	Height cm	Table deg	Limit dBm	Margin dB
102.72	-75.83	15.38	7.99	-52.46	RMS	V	112	36	-13.00	-39.46
401.84	-75.63	18.13	18.07	-39.43	RMS	H	120	160	-13.00	-26.43
724.15	-76.18	19.07	22.90	-34.21	RMS	V	172	31	-13.00	-21.21
38.96	-73.82	14.28	10.94	-48.59	RMS	V	109	92	-13.00	-35.59
962.16	-78.27	19.62	23.93	-34.72	RMS	H	122	182	-13.00	-21.72
178.76	-74.36	16.31	9.69	-48.36	RMS	V	209	98	-13.00	-35.36
102.72	-75.83	15.38	7.99	-52.46	RMS	V	173	260	-13.00	-39.46

Note:

1) For below 1GHz, all different channel and modes were verified but only the worst case result is shown here.
2) All different modes have been verified and the worst case result is presented here.
3) EUT was tested in 3 orientations.
4) Final substitution measurement is not necessary as margin is over 20 dB.

Test Standard:	**Part 27 & RSS 130**	**Mode:**	**LTE Band 12**
Frequency Range:	**30-1000MHz**	**Test Date:**	**02/01/2019**
Antenna Type/Polarity:	**Bi-Log/Hor & Ver**	**Test Personnel:**	**Sherwin Lee**
Remark:	**N/A**	**Test Result:**	**Pass**

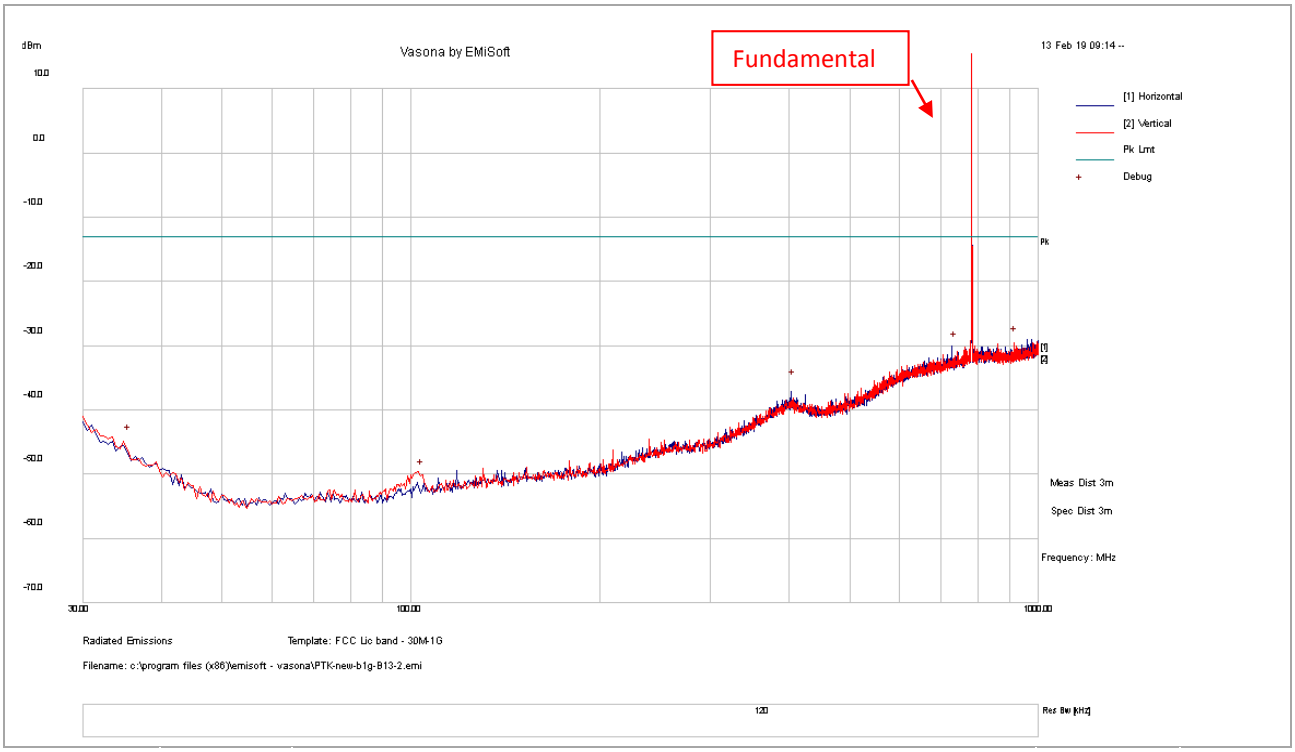


Frequency MHz	Raw dB	Cable dB	AF dB	Level dBm	Det	Pol deg	Height cm	Table deg	Limit dBm	Margin dB
707.06	-30.48	19.08	22.69	11.29	RMS	H	162	0	-13.00	24.29
58.82	-74.83	14.74	6.47	-53.61	RMS	V	124	20	-13.00	-40.61
102.36	-75.12	15.37	7.97	-51.77	RMS	V	182	321	-13.00	-38.77
404.67	-75.12	18.12	18.02	-38.98	RMS	V	109	309	-13.00	-25.98
817.40	-77.60	19.08	23.71	-34.81	RMS	V	113	317	-13.00	-21.81
33.04	-72.02	14.10	14.29	-43.62	RMS	V	182	182	-13.00	-30.62

Note:

1) For below 1GHz, all different channel and modes were verified but only the worst case result is shown here.
2) All different modes have been verified and the worst case result is presented here.
3) EUT was tested in 3 orientations.
4) Final substitution measurement is not necessary as margin is over 20 dB.

Test Standard:	**Part 27 & RSS 130**	**Mode:**	**LTE Band 13**
Frequency Range:	**30-1000MHz**	**Test Date:**	**02/01/2019**
Antenna Type/Polarity:	**Bi-Log/Hor & Ver**	**Test Personnel:**	**Sherwin Lee**
Remark:	**N/A**	**Test Result:**	**Pass**

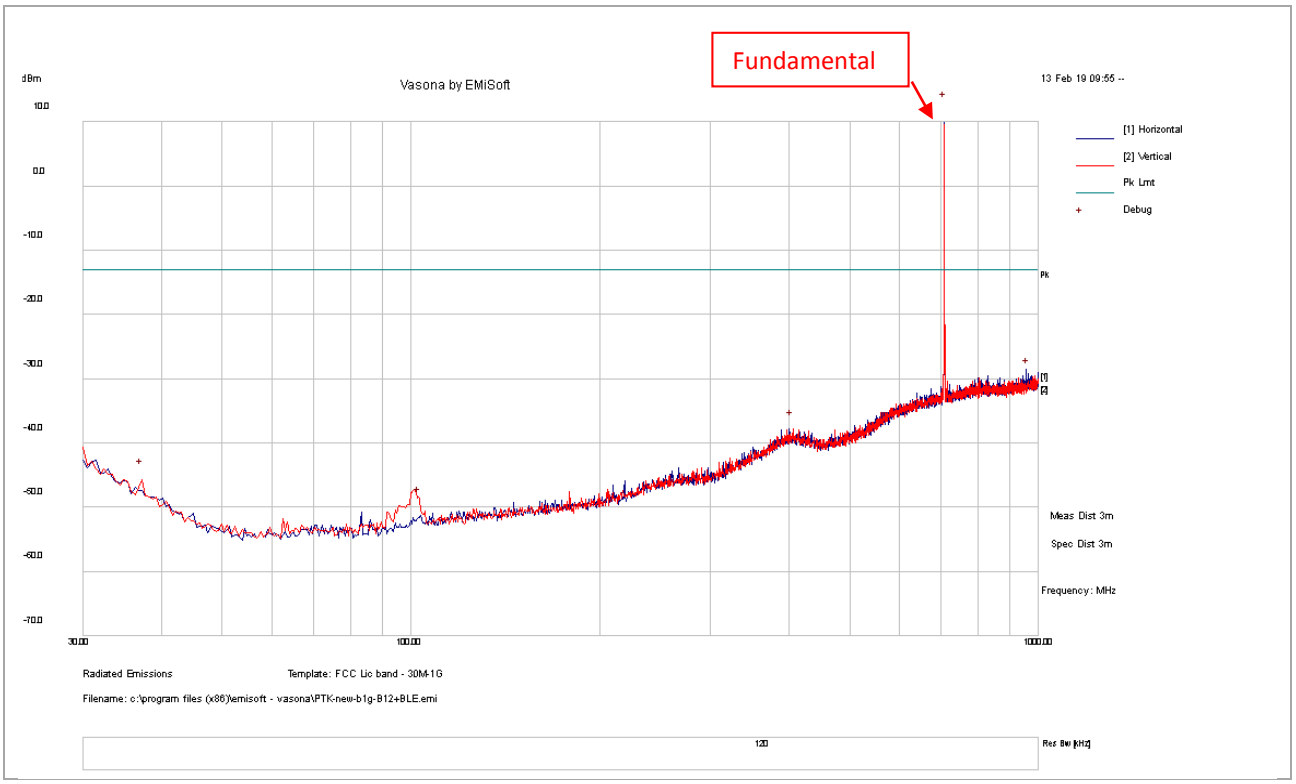


Frequency MHz	Raw dB	Cable dB	AF dB	Level dBm	Det	Pol deg	Height cm	Table deg	Limit dBm	Margin dB
782.24	-27.07	19.03	23.60	15.55	RMS	V	109	0	-13.00	28.55
103.99	-75.86	15.40	8.03	-52.43	RMS	V	122	88	-13.00	-39.43
35.50	-74.19	14.18	12.89	-47.11	RMS	H	291	310	-13.00	-34.11
406.80	-74.54	18.12	17.99	-38.44	RMS	H	182	290	-13.00	-25.44
735.78	-78.79	19.06	23.05	-36.68	RMS	V	101	102	-13.00	-23.68
917.68	-78.72	19.45	23.48	-35.79	RMS	V	134	36	-13.00	-22.79

Note:

1) For below 1GHz, all different channel and modes were verified but only the worst case result is shown here.
2) All different modes have been verified and the worst case result is presented here.
3) EUT was tested in 3 orientations.
4) Final substitution measurement is not necessary as margin is over 20 dB.

Test Standard:	**Part 27 & RSS 130**	**Mode:**	**BLE 2402MHz + LTE B12**
Frequency Range:	**30-1000MHz**	**Test Date:**	**02/01/2019**
Antenna Type/Polarity:	**Bi-Log/Hor & Ver**	**Test Personnel:**	**Sherwin Lee**
Remark:	**BLE and LTE transmit simultaneously**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBm	Det	Pol deg	Height cm	Table deg	Limit dBm	Margin dB
102.72	-74.94	15.38	7.99	-51.57	RMS	V	109	33	-13.00	-38.57
37.09	-73.52	14.23	11.95	-47.34	RMS	H	281	98	-13.00	-34.34
404.67	-75.85	18.12	18.02	-39.71	RMS	V	173	192	-13.00	-26.71
962.16	-78.14	19.62	23.93	-34.59	RMS	V	118	113	-13.00	-21.59

Note:

1) For below 1GHz, all different channel and modes were verified but only the worst case result is shown here.
2) All different modes have been verified and the worst case result is presented here.
3) EUT was tested in 3 orientations.
4) Final substitution measurement is not necessary as margin is over 20 dB.

1GHz – 20GHz Test Result

Test Mode: LTE Band 2 – QPSK -Low

Freq. MHz	Raw dBuV	Cable Loss	AF dB	Level dBm	Meas. Type	Pol	Hgt cm	Deg	Limit dBm	Margin dB	Pass /Fail
3700.16	-62.28	17.88	-6.85	-51.25	RMS	V	314	27	-13.00	-38.25	Pass
14304.69	-77.44	26.18	8.26	-43.00	RMS	V	157	221	-13.00	-30.00	Pass
7441.69	-72.01	21.44	-1.14	-51.71	RMS	H	113	98	-13.00	-38.71	Pass
17741.74	-76.37	29.23	9.52	-37.62	RMS	V	271	72	-13.00	-24.62	Pass

Test Mode: LTE Band 2 – QPSK -Mid

Freq. MHz	Raw dBuV	Cable Loss	AF dB	Level dBm	Meas. Type	Pol	Hgt cm	Deg	Limit dBm	Margin dB	Pass /Fail
2425.16	-64.48	16.62	-9.79	-57.65	RMS	V	328	306	-13.00	-44.65	Pass
3761.92	-62.54	17.94	-6.58	-51.17	RMS	H	169	129	-13.00	-38.17	Pass
8295.82	-69.91	21.60	-0.17	-48.48	RMS	V	291	29	-13.00	-35.48	Pass
17563.16	-78.39	29.02	11.51	-37.86	RMS	V	118	113	-13.00	-24.86	Pass

Test Mode: LTE Band 2 – QPSK -High

Freq. MHz	Raw dBuV	Cable Loss	AF dB	Level dBm	Meas. Type	Pol	Hgt cm	Deg	Limit dBm	Margin dB	Pass /Fail
2418.16	-64.53	16.62	-9.81	-57.73	RMS	V	141	304	-13.00	-44.73	Pass
3817.14	-62.97	18.00	-6.24	-51.21	RMS	V	336	235	-13.00	-38.21	Pass
8319.84	-70.93	21.60	-0.16	-49.48	RMS	V	192	92	-13.00	-36.48	Pass
14554.93	-77.29	26.79	7.14	-43.36	RMS	V	221	76	-13.00	-30.36	Pass

1) EUT was tested in 3 orientations.
2) Final substitution measurement is not necessary as margin is over 20 dB.
3) No difference it found between QPSK & 16QAM. Only the worst case result is presented here.

Test Mode: LTE Band 4 – QPSK -Low

Freq. MHz	Raw dBuV	Cable Loss	AF dB	Level dBm	Meas. Type	Pol	Hgt cm	Deg	Limit dBm	Margin dB	Pass /Fail
3700.16	-62.28	17.88	-6.85	-51.25	RMS	V	314	27	-13.00	-38.25	Pass
14304.69	-77.44	26.18	8.26	-43.00	RMS	V	157	221	-13.00	-30.00	Pass
7441.69	-72.01	21.44	-1.14	-51.71	RMS	H	113	98	-13.00	-38.71	Pass
17741.74	-76.37	29.23	9.52	-37.62	RMS	V	271	72	-13.00	-24.62	Pass

Test Mode: LTE Band 4 – QPSK -Mid

Freq. MHz	Raw dBuV	Cable Loss	AF dB	Level dBm	Meas. Type	Pol	Hgt cm	Deg	Limit dBm	Margin dB	Pass /Fail
2425.16	-64.48	16.62	-9.79	-57.65	RMS	V	328	306	-13.00	-44.65	Pass
3761.92	-62.54	17.94	-6.58	-51.17	RMS	H	169	129	-13.00	-38.17	Pass
8295.82	-69.91	21.60	-0.17	-48.48	RMS	V	291	29	-13.00	-35.48	Pass
17563.16	-78.39	29.02	11.51	-37.86	RMS	V	118	113	-13.00	-24.86	Pass

Test Mode: LTE Band 4 – QPSK -High

Freq. MHz	Raw dBuV	Cable Loss	AF dB	Level dBm	Meas. Type	Pol	Hgt cm	Deg	Limit dBm	Margin dB	Pass /Fail
2418.16	-64.53	16.62	-9.81	-57.73	RMS	V	141	304	-13.00	-44.73	Pass
3817.14	-62.97	18.00	-6.24	-51.21	RMS	V	336	235	-13.00	-38.21	Pass
8319.84	-70.93	21.60	-0.16	-49.48	RMS	V	192	92	-13.00	-36.48	Pass
14554.93	-77.29	26.79	7.14	-43.36	RMS	V	221	76	-13.00	-30.36	Pass

1) EUT was tested in 3 orientations.
2) Final substitution measurement is not necessary as margin is over 20 dB.
3) No difference it found between QPSK & 16QAM. Only the worst case result is presented here.

Test Mode: LTE Band 5 – QPSK -Low

Freq. MHz	Raw dBuV	Cable Loss	AF dB	Level dBm	Meas. Type	Pol	Hgt cm	Deg	Limit dBm	Margin dB	Pass /Fail
2442.75	-65.81	16.64	-9.75	-58.92	RMS	V	294	149	-13.00	-45.92	Pass
7204.37	-71.12	20.95	-1.40	-51.57	RMS	V	235	97	-13.00	-38.57	Pass
14597.06	-78.92	26.89	6.80	-45.23	RMS	H	133	14	-13.00	-32.23	Pass
17690.53	-76.97	29.17	9.92	-37.88	RMS	V	124	192	-13.00	-24.88	Pass

Test Mode: LTE Band 5 – QPSK -Mid

Freq. MHz	Raw dBuV	Cable Loss	AF dB	Level dBm	Meas. Type	Pol	Hgt cm	Deg	Limit dBm	Margin dB	Pass /Fail
2418.16	-65.54	16.62	-9.81	-58.74	RMS	V	297	14	-13.00	-45.74	Pass
7205.86	-70.37	20.95	-1.40	-50.82	RMS	V	170	280	-13.00	-37.82	Pass
14491.96	-77.20	26.63	7.63	-42.94	RMS	H	192	81	-13.00	-29.94	Pass
17741.74	-77.02	29.23	9.52	-38.27	RMS	V	227	109	-13.00	-25.27	Pass

Test Mode: LTE Band 5 – QPSK -High

Freq. MHz	Raw dBuV	Cable Loss	AF dB	Level dBm	Meas. Type	Pol	Hgt cm	Deg	Limit dBm	Margin dB	Pass /Fail
7439.73	-68.56	21.44	-1.14	-48.26	RMS	V	199	196	-13.00	-35.26	Pass
7938.23	-68.92	21.55	-0.91	-48.28	RMS	V	131	44	-13.00	-35.28	Pass
14366.84	-78.72	26.33	8.33	-44.06	RMS	V	291	213	-13.00	-31.06	Pass
17793.09	-76.81	29.30	8.80	-38.71	RMS	V	112	98	-13.00	-25.71	Pass

1) EUT was tested in 3 orientations.
2) Final substitution measurement is not necessary as margin is over 20 dB.
3) No difference it found between QPSK & 16QAM. Only the worst case result is presented here

Test Mode: LTE Band 12 – QPSK -Low

Freq. MHz	Raw dBuV	Cable Loss	AF dB	Level dBm	Meas. Type	Pol	Hgt cm	Deg	Limit dBm	Margin dB	Pass /Fail
2422.01	-65.43	16.62	-9.80	-58.61	RMS	V	274	181	-13.00	-45.61	Pass
2480.20	-65.74	16.67	-9.50	-58.57	RMS	V	233	233	-13.00	-45.57	Pass
8295.82	-70.76	21.60	-0.17	-49.33	RMS	H	192	13	-13.00	-36.33	Pass
5292.01	-63.79	18.65	-5.80	-50.93	RMS	V	113	82	-13.00	-37.93	Pass

Test Mode: LTE Band 12 – QPSK -Mid

Freq. MHz	Raw dBuV	Cable Loss	AF dB	Level dBm	Meas. Type	Pol	Hgt cm	Deg	Limit dBm	Margin dB	Pass /Fail
4254.92	-66.54	18.39	-6.69	-54.84	RMS	V	193	71	-13.00	-41.84	Pass
8319.84	-71.30	21.60	-0.16	-49.85	RMS	V	254	278	-13.00	-36.85	Pass
14366.84	-77.63	26.33	8.33	-42.97	RMS	V	109	13	-13.00	-29.97	Pass
17614.00	-77.41	29.08	11.68	-36.65	RMS	H	112	51	-13.00	-23.65	Pass

Test Mode: LTE Band 12 – QPSK -High

Freq. MHz	Raw dBuV	Cable Loss	AF dB	Level dBm	Meas. Type	Pol	Hgt cm	Deg	Limit dBm	Margin dB	Pass /Fail
3816.12	-64.41	18.00	-6.25	-52.66	RMS	V	179	115	-13.00	-39.66	Pass
8271.88	-70.00	21.60	-0.22	-48.63	RMS	V	183	351	-13.00	-35.63	Pass
14450.13	-76.81	26.53	7.92	-42.36	RMS	H	118	98	-13.00	-29.36	Pass
17614.00	-78.39	29.08	11.68	-37.63	RMS	V	172	281	-13.00	-24.63	Pass

1) EUT was tested in 3 orientations.
2) Final substitution measurement is not necessary as margin is over 20 dB.
3) No difference it found between QPSK & 16QAM. Only the worst case result is presented here

Test Mode: LTE Band 13 – QPSK -Low

Freq. MHz	Raw dBuV	Cable Loss	AF dB	Level dBm	Meas. Type	Pol	Hgt cm	Deg	Limit dBm	Margin dB	Pass /Fail
2442.75	-66.10	16.64	-9.75	-59.21	RMS	V	279	321	-13.00	-46.21	Pass
8236.09	-70.28	21.59	-0.32	-49.01	RMS	H	160	93	-13.00	-36.01	Pass
14263.40	-78.07	26.08	8.12	-43.87	RMS	V	171	12	-13.00	-30.87	Pass
17635.10	-77.93	29.11	11.24	-37.58	RMS	V	113	118	-13.00	-24.58	Pass

Test Mode: LTE Band 13 – QPSK -Mid

Freq. MHz	Raw dBuV	Cable Loss	AF dB	Level dBm	Meas. Type	Pol	Hgt cm	Deg	Limit dBm	Margin dB	Pass /Fail
2507.13	-65.43	16.69	-9.32	-58.06	RMS	V	247	315	-13.00	-45.06	Pass
2449.82	-66.03	16.64	-9.73	-59.11	RMS	V	223	256	-13.00	-46.11	Pass
9434.51	-70.69	22.32	0.31	-48.07	RMS	V	192	22	-13.00	-35.07	Pass
14304.69	-78.71	26.18	8.26	-44.27	RMS	H	177	142	-13.00	-31.27	Pass

Test Mode: LTE Band 13 – QPSK -High

Freq. MHz	Raw dBuV	Cable Loss	AF dB	Level dBm	Meas. Type	Pol	Hgt cm	Deg	Limit dBm	Margin dB	Pass /Fail
2371.15	-62.52	16.57	-9.97	-55.92	RMS	H	110	28	-13.00	-42.92	Pass
2478.52	-65.59	16.67	-9.51	-58.43	RMS	V	108	349	-13.00	-45.43	Pass
14304.69	-76.91	26.18	8.26	-42.47	RMS	V	113	134	-13.00	-29.47	Pass
17690.53	-76.55	29.17	9.92	-37.46	RMS	V	198	52	-13.00	-24.46	Pass

1) EUT was tested in 3 orientations.
2) Final substitution measurement is not necessary as margin is over 20 dB.
3) No difference it found between QPSK & 16QAM. Only the worst case result is presented here
4) For band 13, The emissions in the band 1559-1610 MHz was found to be under -40 dBm/MHz.

Test Mode: LTE Band 12 simultaneously transmit with BLE 2402MHz

Freq. MHz	Raw dBuV	Cable Loss	AF dB	Level dBm	Meas. Type	Pol	Hgt cm	Deg	Limit dBm	Margin dB	Pass /Fail
2478.24	-64.58	16.67	-9.51	-57.43	RMS	V	158	118	-13.00	-44.43	Pass
3702.30	-63.62	17.88	-6.85	-52.58	RMS	H	133	22	-13.00	-39.58	Pass
14450.13	-76.56	26.53	7.92	-42.11	RMS	V	281	109	-13.00	-29.11	Pass
17741.74	-76.69	29.23	9.52	-37.94	RMS	V	173	87	-13.00	-24.94	Pass

1) EUT was tested in 3 orientations.
2) Final substitution measurement is not necessary as margin is over 20 dB.

8.7 Frequency Stability

8.7.1 Requirement

Per § 2.1055, 22.355, 24.235, 27.54,

§ 2.1055 (a), the frequency stability shall be measured with variation of ambient temperature as follows: (1) From −30° to + 50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

Part 22 Clause 22.355: Except as otherwise provided in this part, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table C–1 of this section.

Part 24, Clause 24.235: The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

FCC 47 CFR Part 27, Clause 27.54

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

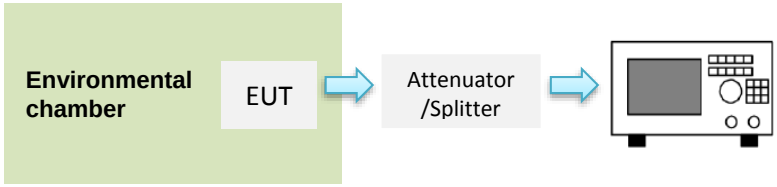
RSS-130, Clause 4.3, the applicant shall ensure frequency stability by showing that fL minus the frequency offset and fH plus the frequency offset shall be within the frequency range in which the equipment is designed to operate.

RSS-132 Clause 5.3: The carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations.

RSS-133 Clasue 6.3: The carrier frequency shall not depart from the reference frequency, in excess of ±2.5 ppm for mobile stations.

RSS-139, Clause 6.4: The frequency stability shall be sufficient to ensure that the occupied bandwidth stays within the operating frequency block when tested to the temperature and supply voltage variations specified in RSS-Gen.

8.7.2 Test setup



8.7.3 Test Procedure

ANSI C63.26: 2015 section 5.6
KDB 971168 D01 Power Meas License Digital Systems v03r01 section 9
RSS-130 Clause 4.3

1. Connect the equipment as illustrated.
2. Set the equipment to transmit with modulation continuously.
3. Set the environmental chamber to required environmental condition.
4. Operate the equipment in standby conditions for 15 minutes before proceeding.
5. On spectrum analyser, set the RBW=1KHz, VBW=3KHz, Span = 50KHz.
6. Using a resolution bandwidth of 1% of the occupied bandwidth, a reference point at the unwanted emission level which complies with the attenuation of 43 + 10 log10 p (watts) on the emission mask of the lowest and highest channel shall be selected, and the frequency at these points shall be recorded as fL and fH respectively.
7. Obtained center frequency is (fL + fH)/2
8. Calculate the ppm frequency error.
9. Repeat step 3 to step 8 for other required environmental condition.

8.7.4 Test Result

LTE Band 2

Test Freq. (MHz)	Test Voltage (VDC)	Temperature (°C)	Measured Freq. (MHz)	Freq. Drift (Hz)	Freq. Deviation (ppm)	Result
1880.0	12	50	1879.9922	1500	0.80	Pass
1880.0	12	40	1879.9917	1000	0.53	Pass
1880.0	12	30	1879.9911	400	0.21	Pass
1880.0	10.2	20	1879.9907	0	0.00	Pass
1880.0	12	20	1879.9907	0	0.00	Pass
1880.0	13.8	20	1879.9907	0	0.00	Pass
1880.0	12	10	1879.9907	0	0.00	Pass
1880.0	12	0	1879.9911	400	0.21	Pass
1880.0	12	-10	1879.9910	300	0.16	Pass
1880.0	12	-20	1879.9912	500	0.27	Pass
1880.0	12	-30	1879.9907	0	0.00	Pass

LTE Band 4

Test Freq. (MHz)	Test Voltage (VDC)	Temperature (°C)	Measured Freq. (MHz)	Freq. Drift (Hz)	Freq. Deviation (ppm)	Result
1732.5	12	50	1732.4872	500	-0.29	Pass
1732.5	12	40	1732.4943	2400	-1.39	Pass
1732.5	12	30	1732.4948	1900	-1.10	Pass
1732.5	10.2	20	1732.4987	0	0.00	Pass
1732.5	12	20	1732.4987	0	0.00	Pass
1732.5	13.8	20	1732.4987	0	0.00	Pass
1732.5	12	10	1732.4977	0	0.00	Pass
1732.5	12	0	1732.5016	2900	1.67	Pass
1732.5	12	-10	1732.4971	600	-0.35	Pass
1732.5	12	-20	1732.4970	700	-0.40	Pass
1732.5	12	-30	1732.4963	1400	-0.81	Pass

LTE Band 5

Test Freq. (MHz)	Test Voltage (VDC)	Temperature (°C)	Measured Freq. (MHz)	Freq. Drift (Hz)	Freq. Deviation (ppm)	Result
836.5	12	50	836.4957	0	0.00	Pass
836.5	12	40	836.4956	100	-0.12	Pass
836.5	12	30	836.4961	400	0.48	Pass
836.5	10.2	20	836.4957	0	0.00	Pass
836.5	12	20	836.4957	0	0.00	Pass
836.5	13.8	20	836.4957	0	0.00	Pass
836.5	12	10	836.4960	300	0.36	Pass
836.5	12	0	836.4961	400	0.48	Pass
836.5	12	-10	836.4964	700	0.84	Pass
836.5	12	-20	836.4967	1000	1.20	Pass
836.5	12	-30	836.4963	600	0.72	Pass

LTE Band 12

Test Freq. (MHz)	Test Voltage (VDC)	Temperature (°C)	Measured Freq. (MHz)	Freq. Drift (Hz)	Freq. Deviation (ppm)	Result
707.5	12	50	707.4982	1400	1.98	Pass
707.5	12	40	707.4976	800	1.13	Pass
707.5	12	30	707.4971	300	0.42	Pass
707.5	10.2	20	707.4968	0	0.00	Pass
707.5	12	20	707.4968	0	0.00	Pass
707.5	13.8	20	707.4968	0	0.00	Pass
707.5	12	10	707.4976	800	1.13	Pass
707.5	12	0	707.4977	900	1.27	Pass
707.5	12	-10	707.4967	100	-0.14	Pass
707.5	12	-20	707.4969	100	0.14	Pass
707.5	12	-30	707.4962	600	-0.85	Pass

LTE Band 13

Test Freq. (MHz)	Test Voltage (VDC)	Temperature (°C)	Measured Freq. (MHz)	Freq. Drift (Hz)	Freq. Deviation (ppm)	Result
782.0	12	50	781.9814	900	-1.15	Pass
782.0	12	40	781.9916	700	-0.90	Pass
782.0	12	30	781.9939	400	-0.51	Pass
782.0	10.2	20	781.9958	500	0.64	Pass
782.0	12	20	782.0043	0	0.00	Pass
782.0	13.8	20	782.0043	0	0.00	Pass
782.0	12	10	782.0026	1700	-2.17	Pass
782.0	12	0	782.0063	1000	1.28	Pass
782.0	12	-10	782.0042	100	-0.13	Pass
782.0	12	-20	782.0041	200	-0.26	Pass
782.0	12	-30	782.0018	500	-0.64	Pass

9 Test instrument list

Equipment	Manufacturer	Model	Serial Number	Cal. Date	Cal. Due
Semi-Anechoic Chamber	ETS-Lindgren	10M	VL001	5/11/2018	5/11/2019
Shielding Control Room	ETS-Lindgren	Series 81	VL006	N/A	N/A
Spectrum Analyzer	Keysight	N9020A	MY50110074	5/4/2018	5/4/2019
EMC Test Receiver	R&S	ESL6	100230	5/7/2018	5/7/2019
LISN (9KHz – 30MHz)	EMCO	3816/2	9705-1066	5/4/2018	5/4/2019
Bi-Log Antenna	ETS-Lindgren	3142E	217921	11/15/2018	11/15/2019
Horn Antenna (1-18GHz)	Electro-Metrics	EM-6961	6292	5/2/2018	5/2/2019
Horn Antenna (18-40GHz)	Com-Power	AH-840	101109	5/2/2018	5/2/2019
Preamplifier	RF Bay, Inc.	LPA-10-20	11180621	5/10/2018	5/10/2019
True RMS Multi-meter	UNI-T	UT181A	C173014829	5/10/2018	5/10/2019
Temp / Humidity / Pressure Meter	PCE Instruments	PCE-THB 40	R062028	5/9/2018	5/9/2019
RF Attenuator	Pasternack	PE7005-3	VL061	5/10/2018	5/10/2019
Preamplifier 100KHz - 40GHz	Aeroflex	33711-392-77150-11	064	5/10/2018	5/10/2019
EM Center Control	ETS-Lindgren	7006-001	160136	N/A	N/A
Turn Table	ETS-Lindgren	2181-3.03	VL002	N/A	N/A
Boresight Antenna Tower	ETS-Lindgren	2171B	VL003	N/A	N/A
Loop Antenna (9k-30MHz)	Com-Power	AL-130	121012	5/9/2018	5/9/2019
RE test cable(below 6GHz)	Vista	RE-6GHz-01	RE-6GHz-01	5/10/2018	5/10/2019
RE test cable (1-18GHz)	PhaseTrack	II-240	RE-18GHz-01	5/10/2018	5/10/2019
RE test cable (>18GHz)	Sucoflex	104	344903/4	5/10/2018	5/10/2019
Pulse limiter	Com-Power	LIT-930A	531727	5/15/2018	5/15/2019
CE test cable #1	FIRST RF	FRF-C-1002-001	CE-6GHz-01	5/10/2018	5/10/2019
CE test cable#2	FIRST RF	FRF-C-1002-001	CE-6GHz-02	5/9/2018	5/9/2019