FCC CFR47 PART 22H, 24E, 27 CERTIFICATION TEST REPORT

FCC ID: 2AVE6NJ44A

Product: Tractive GPS DOG LTE

Trade Mark: N/A

Model Number: TRNJA4

Family Model: N/A

Report No.: S19040802703004

Prepared for

Tractive GmbH

Randlstrasse 18a, 4061 Pasching Austria

Prepared by

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TEST RESULT CERTIFICATION

Applicant's name ..... :	Tractive GmbH
Address..... :	Randlstrasse 18a, 4061 Pasching Austria
Manufacturer's Name..... :	Tractive GmbH
Address..... :	Randlstrasse 18a, 4061 Pasching Austria
Product name..... :	Tractive GPS DOG LTE
Model and/or type reference .. :	TRNJA4
Family Model:	N/A
Standards..... :	FCC CFR 47 Part 22H, Part 24E, Part 27
Test procedure ..... :	ANSI C63.26:2015
	ANSI/TIA-603-E-2016

This device described above has been tested by NTEK, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Date of Test .....

Date (s) of performance of tests..... 18 Dec. 2019 ~ 09 Jan. 2020

Date of Issue..... 09 Jan. 2020

Test Result..... **Pass**

Testing Engineer : Mary. Hu

(Mary Hu)

Technical Manager : Jason chen

(Jason Chen)

Authorized Signatory : Sam. Chen

(Sam Chen)

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1. GENERAL INFORMATION

1.1 PRODUCT DESCRIPTION

A major technical description of EUT is described as following:

Product Designation:	Tractive GPS DOG LTE
Trade Mark	Bmobile
Model Name	TRNJA4
FCC ID:	2AVE6NJ44A
Frequency Bands:	U.S. Bands: ☒LTE FDD Band 2,4,5,12,13
Frequency Range:	LTE FDD Band 2 Uplink: 1850MHz-1910MHz, Downlink: 1930MHz-1990MHz; LTE FDD Band 4 Uplink: 1710MHz-1755MHz, Downlink: 2110MHz-2155MHz; LTE FDD Band 5 Uplink: 824MHz-849MHz, Downlink: 869MHz-894MHz; LTE FDD Band 12 Uplink: 699MHz-716MHz, Downlink: 729MHz-746MHz; LTE FDD Band 13 Uplink: 777MHz-787MHz, Downlink: 746MHz-756MHz;
Type of Modulation:	QPSK/16QAM
Category	Cat M1
Antenna:	FPCB Antenna
Antenna gain:	B2/B4: -1.05dBi; B5: -4.78dBi; B12/B13: -2.16dBi
Power Supply:	DC 3.8V from Battery or DC 5V from USB port
Battery parameter:	DC 3.8V/810mAh
Adapter:	N/A
Extreme Vol. Limits:	DC 3.6V to DC 4.4V (Nominal DC 3.8V)Note
HW Version	NJ4-4
SW Version	NJ4-119r
** Note: 1. The High Voltage DC 4.4V and Low Voltage 3.6V was declared by manufacturer, The EUT couldn't be operate normally with higher or lower voltage. 2. That the EUT just support 1.4MHz bandwidth	

1.2 RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for **FCC ID: 2AVE6NJ44A** filing to comply with the FCC Part 22H&24E &27.

1.3 TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI/TIA-603-E-2016, FCC CFR 47 Part 2, Part 22, Part 24, Part 27, ANSI C63.26:2015.

1.4 TEST FACILITY

Site Description

CNAS-Lab.	:	The Laboratory has been assessed and proved to be in compliance with CNAS-CL01:2006 (identical to ISO/IEC 17025:2005) The Certificate Registration Number is L5516.
IC-Registration		The Certificate Registration Number is 9270A. CAB identifier:CN0074
FCC- Accredited		Test Firm Registration Number: 463705. Designation Number: CN1184
A2LA-Lab.		The Certificate Registration Number is 4298.01 This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 General requirements for the competence of testing and calibration laboratories. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).
Name of Firm	:	Shenzhen NTEK Testing Technology Co., Ltd.
Site Location	:	1/F, Building E, Fenda Science Park, Sanwei Community, Xixiang Street, Bao'an District, Shenzhen 518126 P.R. China.

MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95 %.

No.	Item	Uncertainty
1	Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	2.5dB

1.5 SPECIAL ACCESSORIES

The battery and the charger, earphone supplied by the applicant were used as accessories and being tested with EUT intended for FCC grant together.

1.6 WORST-CASE CONFIGURATION AND MODE

The worst-case scenario for all measurements is based on the investigation results.
The RF output power and occupied bandwidth for LTE Cat M1 was tested with the TX configured to QPSK and 16QAM modulation.
For the fundamental investigation of radiated emissions, the EUT is investigated for vertical and horizontal antenna orientations and X Y and Z orientations of the EUT alone. After the investigations the worst case was determined to be at X orientation for all LTE bands.

2. SYSTEM TEST CONFIGURATION

2.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commission's requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT EXERCISE

The Transmitter was operated in the maximum output power mode through Communication Tester. The TX frequency was fixed which was for the purpose of the measurements.

2.3 CONFIGURATION OF EUT SYSTEM

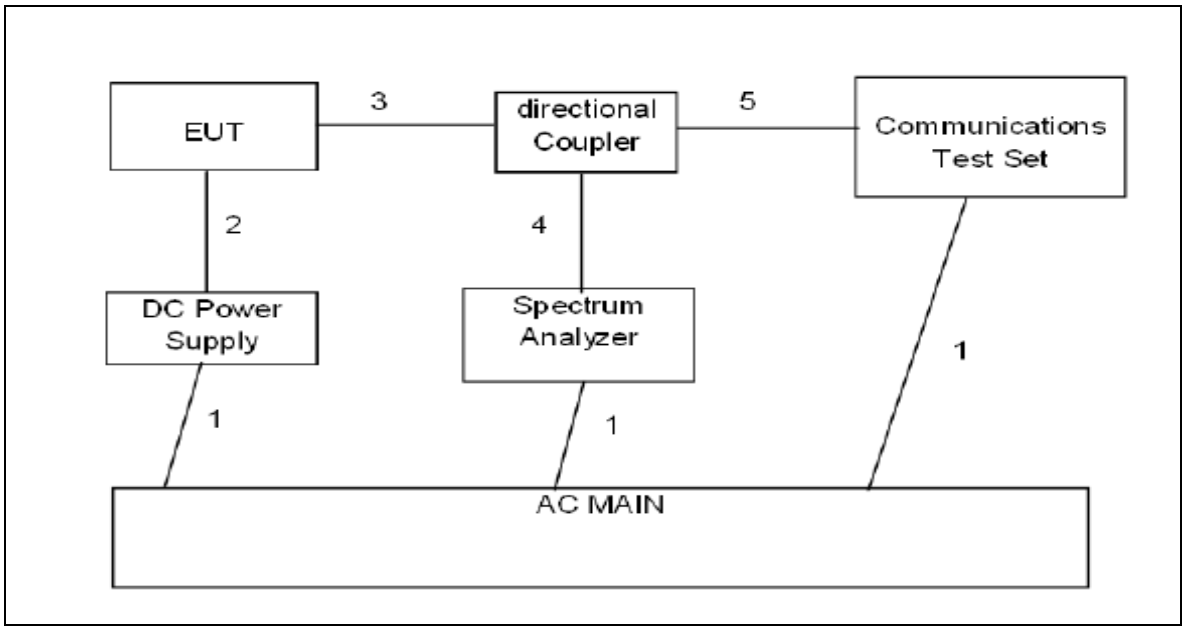
Table 2-1 Equipment Used in EUT System

Item	Equipment	Model No.	ID or Specification	Note
1	Tractive GPS DOG LTE	TRNJA4	FCC ID: 2AVE6NJ44A	EUT

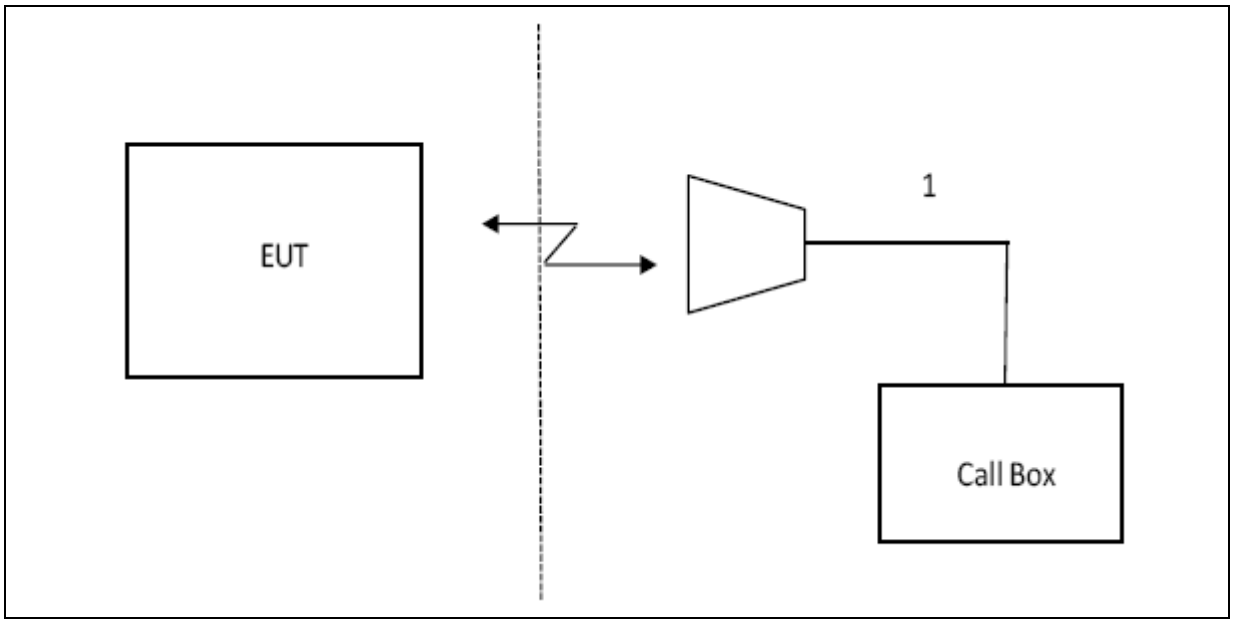
Note: All the accessories have been used during the test.
the following "EUT" in setup diagram means EUT system.

2.4 TEST SETUP

CONDUCTED SETUP DIAGRAM FOR TESTS



RADIATED SETUP DIAGRAM FOR TESTS



3.TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

NAME OF EQUIPMENT	MANUFACTURER	MODEL	SERIAL NUMBER	NEXT CAL. DATE
SPECTRUM ANALYZER	AGILENT	N9020A	MY49100060	2020.05.12
TEST RECEIVER	R&S	ESCI	A0304218	2020.05.12
COMMUNICATION TESTER	R&S	CMU200	117858	2020.05.12
COMMUNICATION TESTER	R&S	CMW500	148500	2020.05.12
TEST RECEIVER	R&S	ESPI	101318	2020.05.12
LISN	SCHWARZBECK	NSLK8127	A0304233	2020.05.12
CLIMATE CHAMBER	ALBATROSS	--	--	2020.05.12
Loop Antenna	ARA	PLA-1030/B	1029	2020.05.12
Bilogical Antenna	TESEQ	CBL6111D	31216	2020.05.12
Horn Antenna	EM	EM-AH-10180	2011071402	2020.05.12
DC Power Source	N/A	PS-6005D	20170402923	2020.05.12

4. OUTPUT POWER

4.1 OUTPUT POWER MEASUREMENT

Cat M1 Measurement Procedure:

All Cat M1 bands conducted power peak and average are obtained from the CMW500 telecommunication test set. The following tests were conducted according to the test requirements outlined in section 6.2.2F of the 3GPP TS36.101 specification.

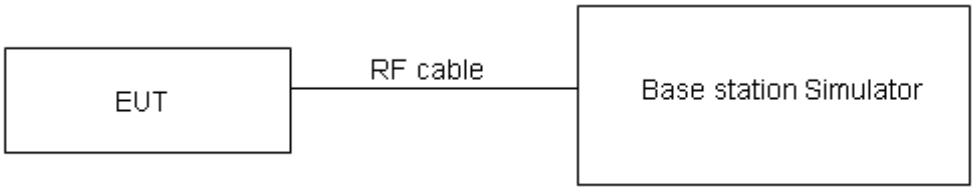
Table 6.2.2E-1: UE Power Class

EUTRA band	Class 3 (dBm)	Tolerance (dB)	Class 5 (dBm)	Tolerance (dB)	Class 6 (dBm)	Tolerance (dB)
1	23	±2	20	±2	14	±2.5
2	23	±2[2]	20	±2[2]	14	±2.5
3	23	±2[2]	20	±2[2]	14	±2.5
4	23	±2	20	±2	14	±2.5
5	23	±2	20	±2	14	±2.5
7	23	±2[2]	20	±2[2]	14	±2.5
8	23	±2[2]	20	±2[2]	14	±2.5
11	23	±2	20	±2	14	±2.5
12	23	±2[2]	20	±2[2]	14	±2.5
13	23	±2	20	±2	14	±2.5
14	23	±2	20	±2	14	±2.5
18	23	±2[5]	20	±2[5]	14	±2.5
19	23	±2	20	±2	14	±2.5
20	23	±2[2]	20	±2[2]	14	±2.5
21	23	±2	20	±2	14	±2.5
25	23	±2[2]	20	±2	14	±2.5
26	23	±2[2]	20	±2[2]	14	±2.5
27	23	±2	20	±2	14	±2.5
28	23	+2/-2.5	20	+2/-2.5	14	±2.5
31	23	±2	20	±2	14	±2.5
…						
39	23	±2	20	±2	14	±2.5
40	23	±2[2]	20	±2	14	±2.5
41	23	±2[2]	20	±2[2]	14	±2.5
…						
71	23	±2	20	±2	14	±2.5
72	23	±2	20	±2	14	±2.5
73	23	±2	20	±2	14	±2.5
74	23	±2	20	±2	14	±2.5
85	23	±2[2]	20	±2[2]	14	±2.5

Methods of Measurement

During the process of the testing, The EUT is controlled by the Base Station Simulator to ensure max power transmission and proper modulation.

Test Setup



4.2 Test Results

Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		18607/1850.7	18900/1880	19193/1909.3
LTE Band II	1.4MHz	QPSK	1	0	21.00	20.38	20.43	20.52
			1	2	21.00	20.35	20.45	20.53
			1	5	21.00	20.36	20.44	20.60
			3	0	21.00	20.56	20.65	20.65
			3	1	21.00	20.55	20.66	20.66
			3	2	21.00	20.62	20.51	20.68
			6	0	20.00	19.62	19.50	19.91
		16QAM	1	0	21.00	20.56	20.98	20.95
			1	2	21.00	20.56	20.88	20.96
			1	5	21.00	20.62	20.98	20.94
			3	0	20.00	19.75	19.57	19.59
			3	1	20.00	19.72	19.55	19.68
			3	2	20.00	19.68	19.76	19.82
			6	0	20.00	19.86	19.83	19.95

Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		19957/1710.7	20175/1732.5	20393/1754.3
LTE Band IV	1.4MHz	QPSK	1	0	22.00	21.02	21.23	21.31
			1	2	22.00	21.05	21.25	21.35
			1	5	22.00	21.05	21.31	21.32
			3	0	21.00	20.84	20.64	20.78
			3	1	21.00	20.83	20.68	20.75
			3	2	21.00	20.74	20.71	20.76
			6	0	20.00	19.83	19.65	19.82
		16QAM	1	0	22.00	21.35	21.32	21.43
			1	2	22.00	21.46	21.43	21.45
			1	5	22.00	21.47	21.56	21.42
			3	0	20.00	19.91	19.73	19.92
			3	1	20.00	19.89	19.75	19.98
			3	2	20.00	19.95	19.68	19.91
			6	0	21.00	20.07	19.94	20.21

Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		20407/824.7	20525/836.5	20643/848.3
LTE Band V	1.4MHz	QPSK	1	0	21.00	20.71	20.97	20.89
			1	2	21.00	20.73	20.96	20.88
			1	5	21.00	20.75	20.97	20.79
			3	0	21.00	20.96	20.97	20.89
			3	1	21.00	20.95	20.95	20.95
			3	2	21.00	20.97	20.98	20.93
			6	0	20.00	19.86	19.97	19.89
		16QAM	1	0	21.00	20.02	20.80	20.88
			1	2	21.00	20.13	20.80	20.85
			1	5	21.00	20.11	20.78	20.76
			3	0	21.00	20.22	20.20	20.25
			3	1	21.00	20.21	20.31	20.22
			3	2	21.00	20.15	20.25	20.19
			6	0	21.00	20.13	20.15	20.22

Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		23017/699.7	23095/707.5	23173/715.3
LTE Band XII	1.4MHz	QPSK	1	0	22.00	20.71	21.11	20.94
			1	2	22.00	20.74	21.09	20.93
			1	5	22.00	20.76	21.08	20.91
			3	0	21.00	19.80	20.02	20.06
			3	1	21.00	19.82	20.03	20.05
			3	2	21.00	19.82	20.05	20.05
			6	0	21.00	20.51	20.54	20.53
		16QAM	1	0	22.00	20.11	21.23	21.21
			1	2	22.00	20.09	21.22	21.33
			1	5	22.00	20.08	21.25	21.28
			3	0	21.00	20.69	20.74	20.76
			3	1	21.00	20.86	20.75	20.78
			3	2	21.00	20.92	20.71	20.80
			6	0	21.00	20.79	20.78	20.87

Band	Band Width	Modulation	RB Configuration		Tune-up	Channel/Frequency(MHz)		
			RB Size	RB Offset		23205/779.5	23230/782	23255/784.5
LTE Band XIII	1.4MHz	QPSK	1	0	22.00	21.03	20.96	21.03
			1	2	22.00	21.13	20.95	21.05
			1	5	22.00	21.04	20.98	21.02
			3	0	21.00	20.02	19.99	20.03
			3	1	21.00	20.05	19.98	20.03
			3	2	21.00	20.03	19.96	20.01
			6	0	21.00	20.01	19.98	20.19
		16QAM	1	0	21.00	20.96	20.95	20.93
			1	2	21.00	20.95	20.96	20.95
			1	5	21.00	20.94	20.95	20.92
			3	0	21.00	20.43	20.36	20.43
			3	1	21.00	20.42	20.35	20.45
			3	2	21.00	20.45	20.43	20.44
			6	0	21.00	20.90	20.81	20.83

5. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049

LIMITS

For reporting purposes only

TEST PROCEDURE

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the low, middle and high channel in each band. The -26dB bandwidth was also measured and recorded.

MODES TESTED

CAT M1 Band 2
CAT M1 Band 4
CAT M1 Band 5
CAT M1 Band 12
CAT M1 Band 13

RESULTS

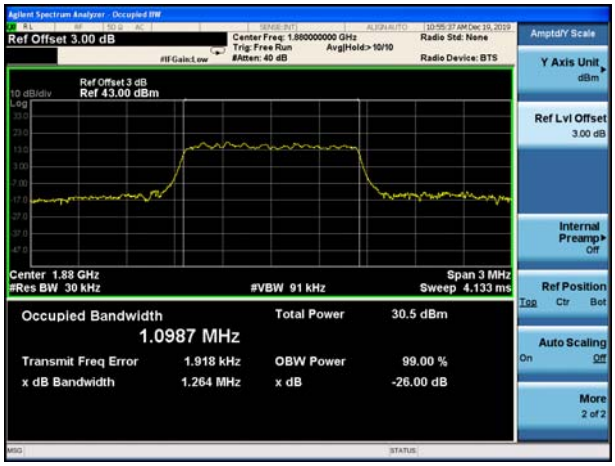
PASS

Test results:

Band	Mode	RB Size/RB Offset	Frequency (MHz)	99% Occupied Bandwidth (MHz)	-26dBc Occupied Bandwidth (MHz)
CAT M1 Band 2	1.4MHz BAND QPSK	6/0	1880.0	1.0987	1.264
	1.4MHz BAND 16QAM	6/0	1880.0	1.1101	1.332
CAT M1 Band 4	1.4MHz BAND QPSK	15/0	1733.0	1.1026	1.319
	1.4MHz BAND 16QAM	15/0	1733.0	1.0994	1.293
CAT M1 Band 5	1.4MHz BAND QPSK	25/0	836.5	1.1043	1.340
	1.4MHz BAND 16QAM	25/0	836.5	1.1059	1.320
CAT M1 Band 12	1.4MHz BAND QPSK	50/0	707.5	1.1042	1.324
	1.4MHz BAND 16QAM	50/0	707.5	1.1015	1.362
CAT M1 Band 13	1.4MHz BAND QPSK	75/0	780.3	1.1322	1.929
	1.4MHz BAND 16QAM	75/0	780.3	1.1293	2.033

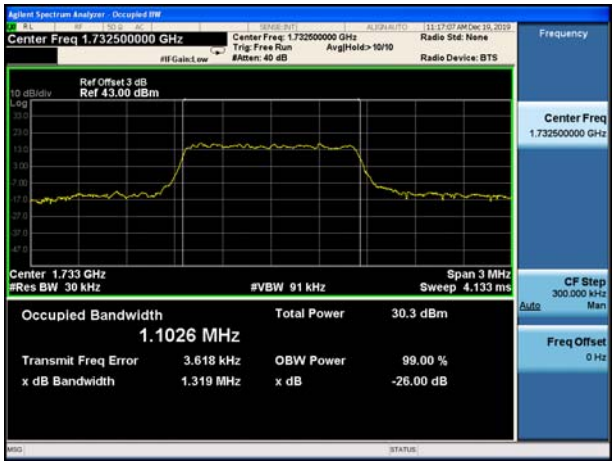
Test plot

CAT M1 B2 QPSK Mid Channel

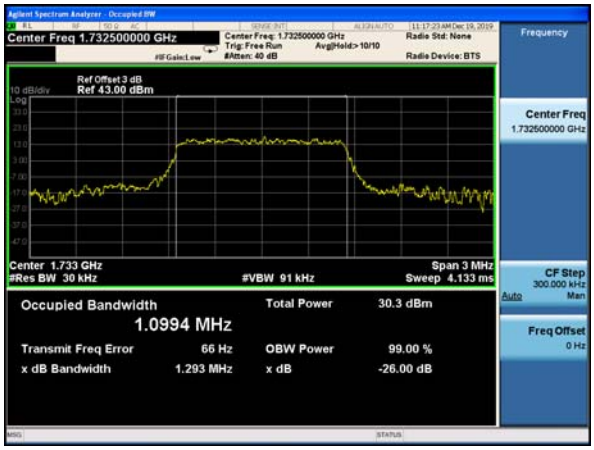


CAT M1 B2 16QAM Mid Channel

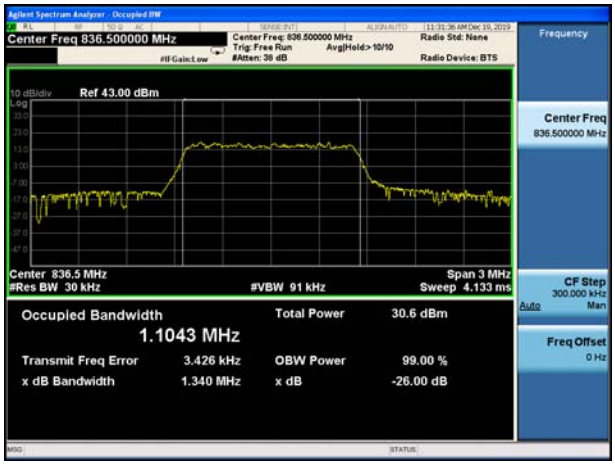
CAT M1 B4 QPSK Mid Channel



CAT M1 B4 16QAM Mid Channel



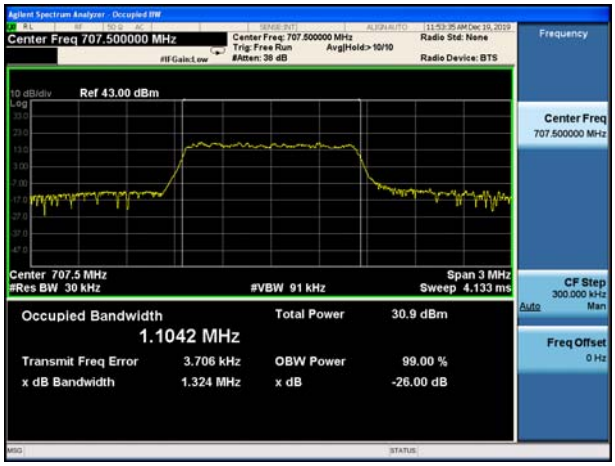
CAT M1 B5 QPSK Mid Channel



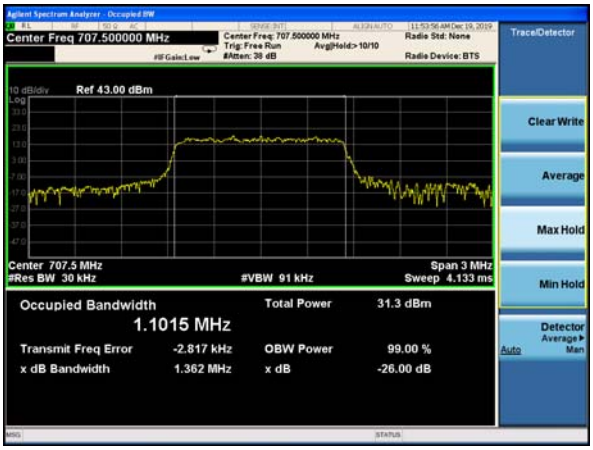
CAT M1 B5 16QAM Mid Channel

Test plot

CAT M1 B12 QPSK Mid Channel



CAT M1 B12 16QAM Mid Channel



CAT M1 B13 QPSK Mid Channel

CAT M1 B13 16QAM Mid Channel

6. BANDEDGE AND EMISSION MASK

RULE PART(S)

FCC: §2.1051,
FCC: §22.359
FCC: §27.53,

LIMITS

FCC: §22.359,
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: §27.53,
(c)(4) On all frequencies between 763-775 MHz and 793-805 MHz, by a factor not less than 65 + 10 log (P) dB in a 6.25 kHz band segment, for mobile and portable stations;

TEST PROCEDURE

The transmitter output was connected to a CMW500Test Set and configured to operate at maximum power. The band edge emissions were measured at the required operating frequencies in each band on the Spectrum Analyzer.
For each band edge measurement:
Set the spectrum analyzer span to include the block edge frequency.
Set a marker to point the corresponding band edge frequency in each test case.
Set display line at -13 dBm
Set resolution bandwidth to at least 1% of emission bandwidth.

MODES TESTED

CAT M1 Band 2
CAT M1 Band 4
CAT M1 Band 5
CAT M1 Band 12
CAT M1 Band 13

RESULTS

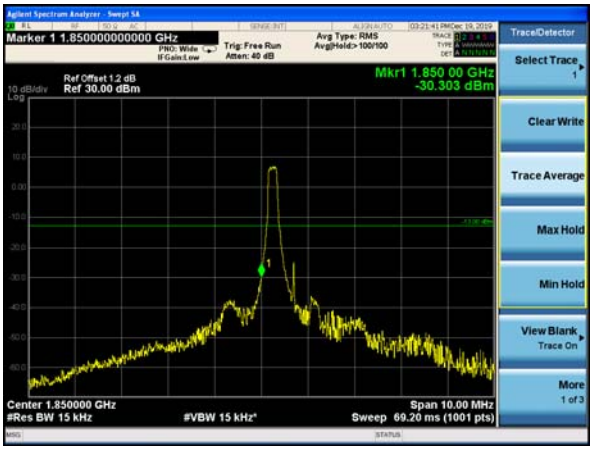
Pass

6.1 CAT M1 Band 2

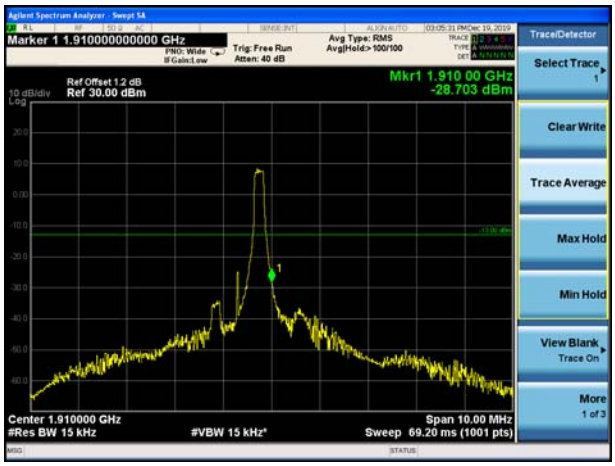
Test plot

CAT M1 B2 QPSK BW 1.4, NO. RB 1,CH-Low

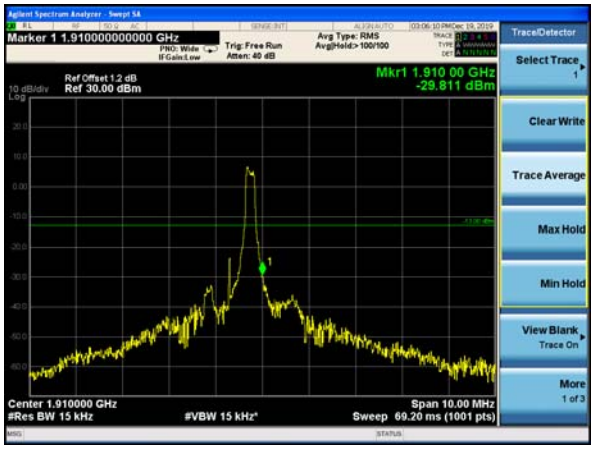
CAT M1 B2 16QAM BW 1.4, NO. RB 1,CH-Low



CAT M1 B2 QPSK BW 1.4, NO. RB 1,CH-High

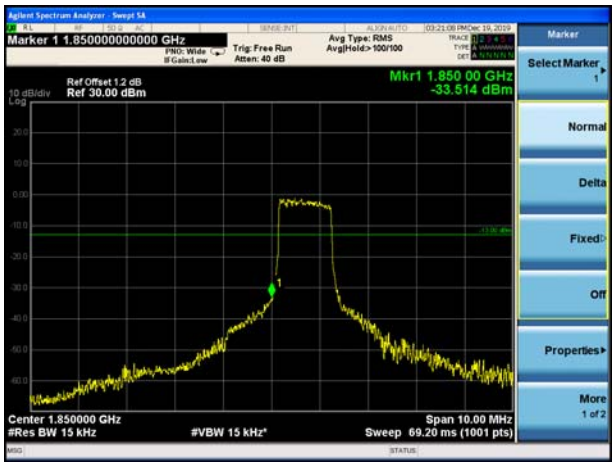


CAT M1 B2 16QAM BW 1.4, NO. RB 1,CH- High

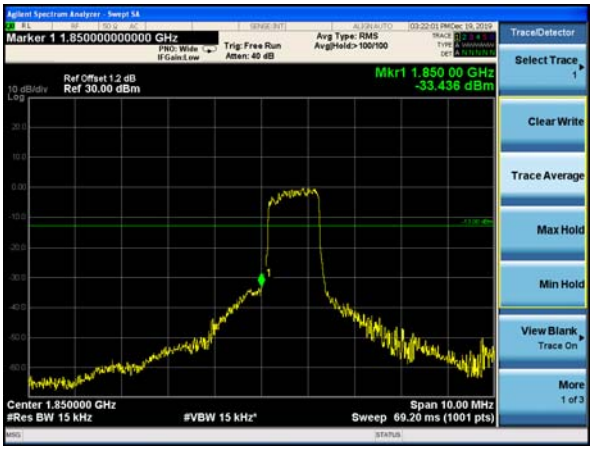


Test plot

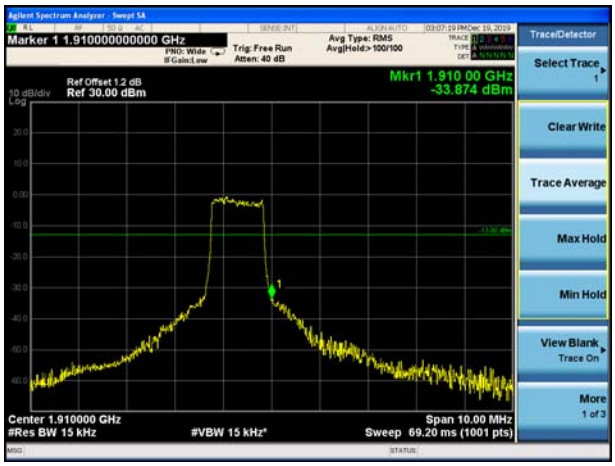
CAT M1 B2 QPSK BW 1.4, NO. RB 6,CH-Low



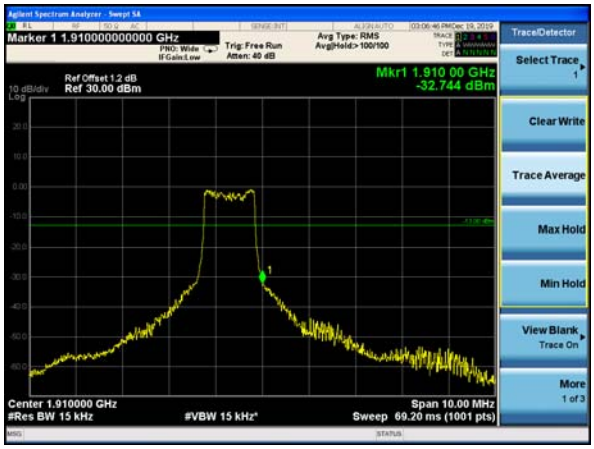
CAT M1 B2 16QAM BW 1.4, NO. RB 6,CH-Low



CAT M1 B2 QPSK BW 1.4, NO. RB 6,CH-High



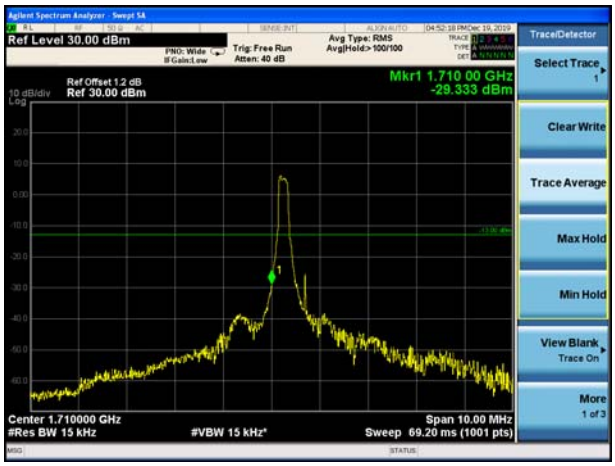
CAT M1 B2 16QAM BW 1.4, NO. RB 6,CH- High



CAT M1 Band 4

Test plot

CAT M1 B4 QPSK BW 1.4, NO. RB 1,CH-Low



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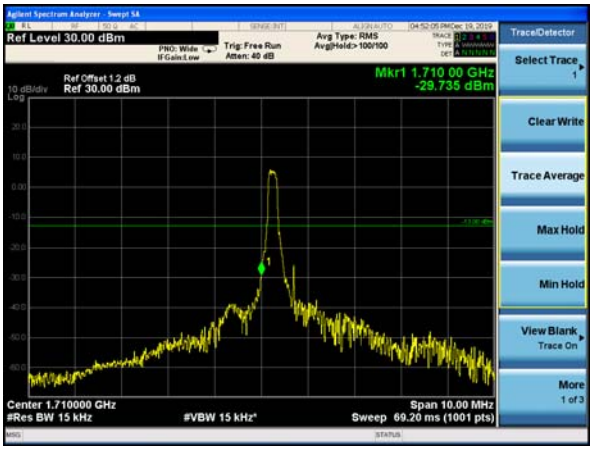

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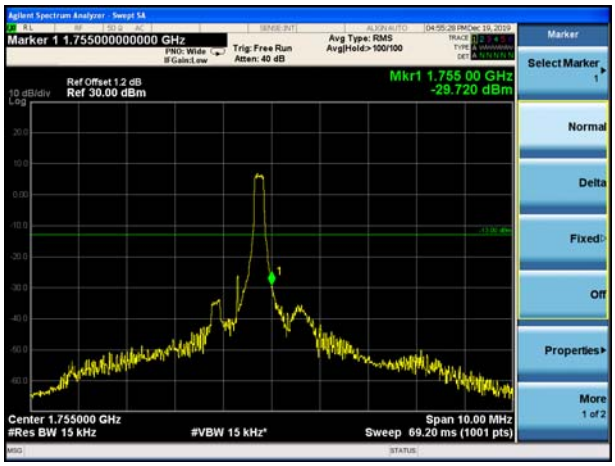

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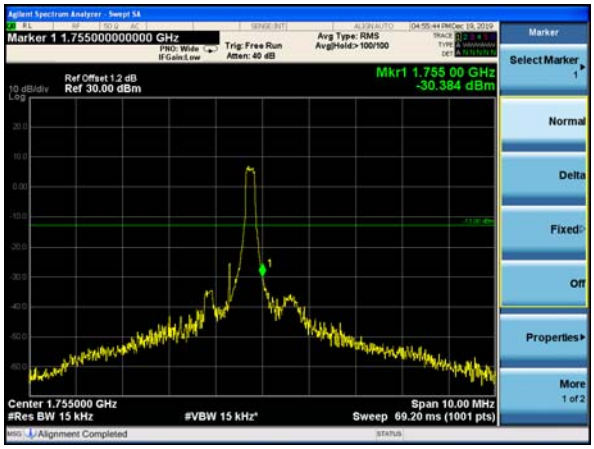
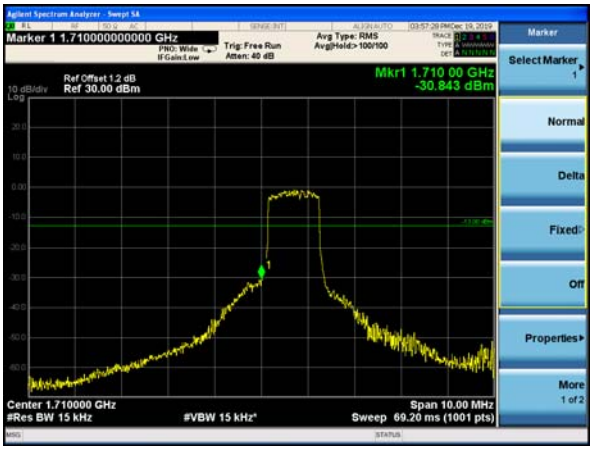


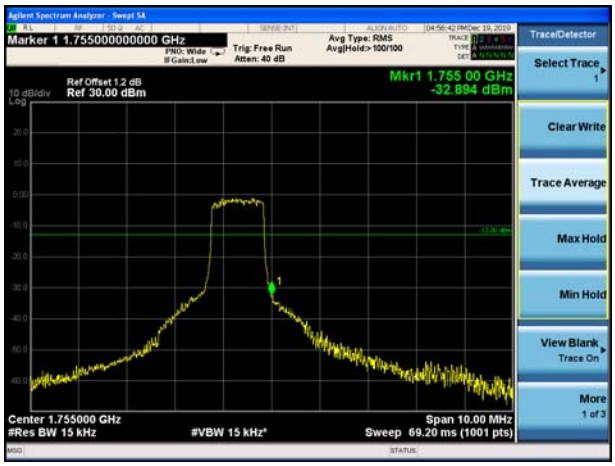
Test plot

CAT M1 B4 QPSK BW 1.4, NO. RB 6,CH-Low

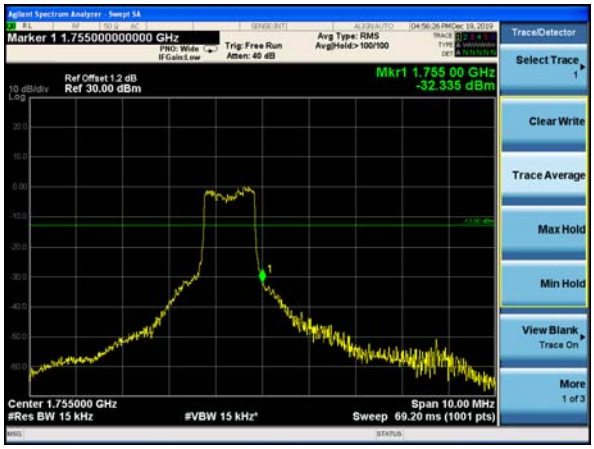
CAT M1 B4 16QAM BW 1.4, NO. RB 6,CH-Low



CAT M1 B4 QPSK BW 1.4, NO. RB 6,CH-High



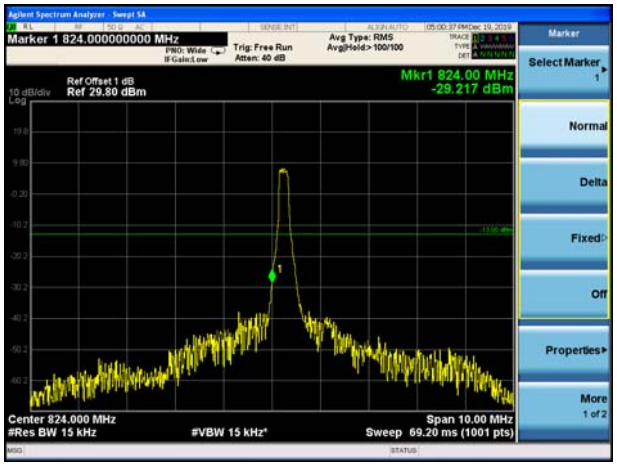
CAT M1 B4 16QAM BW 1.4, NO. RB 6,CH- High



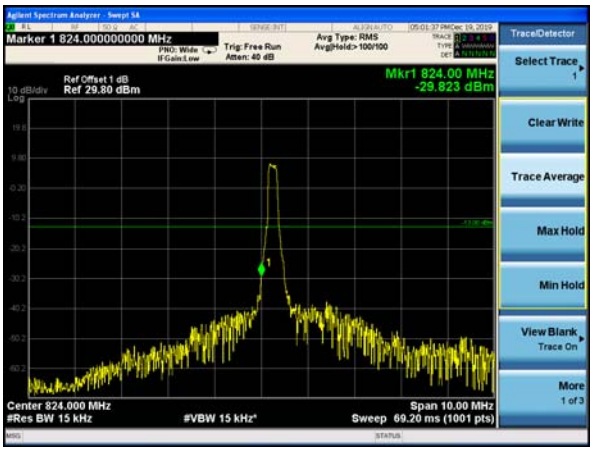
CAT M1 Band 5

Test plot

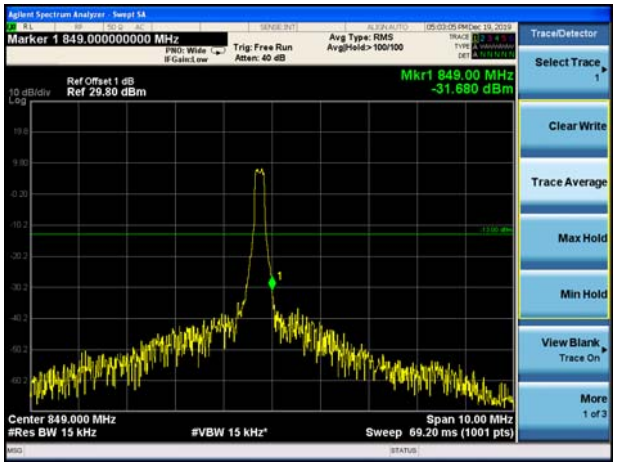
CAT M1 B5 QPSK BW 1.4, NO. RB 1,CH-Low



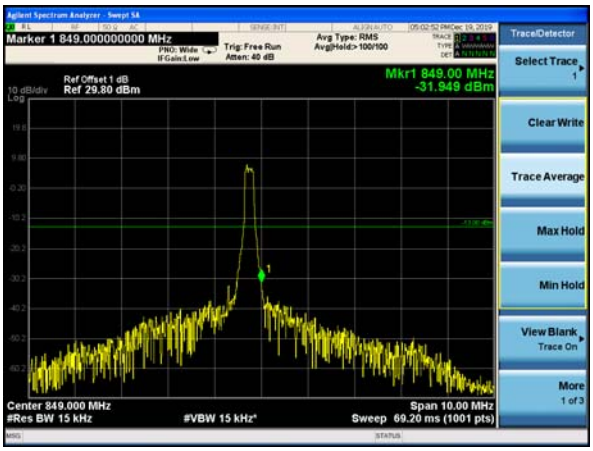
CAT M1 B5 16QAM BW 1.4, NO. RB 1,CH-Low



CAT M1 B5 QPSK BW 1.4, NO. RB 1,CH-High

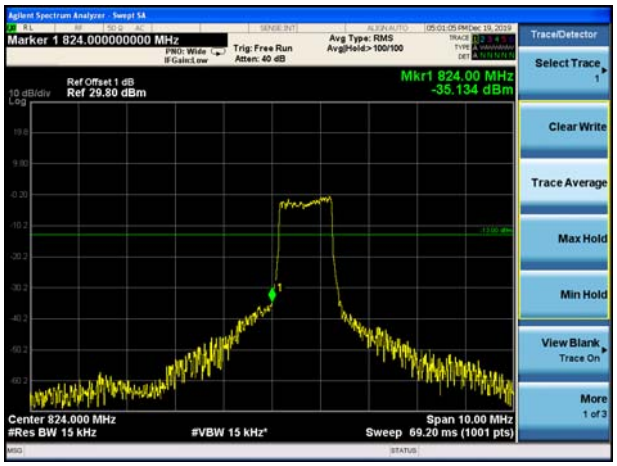


CAT M1 B5 16QAM BW 1.4, NO. RB 1,CH- High

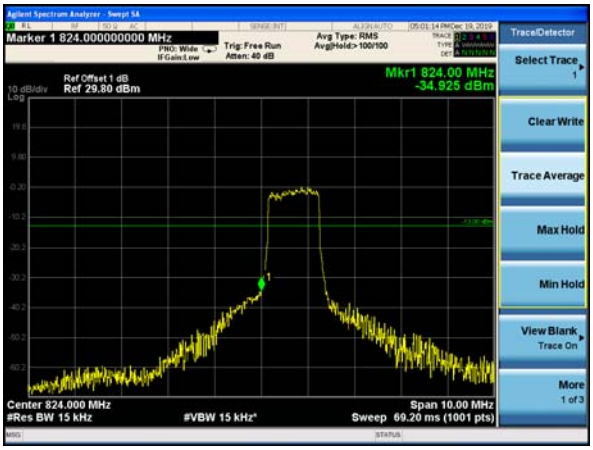


Test plot

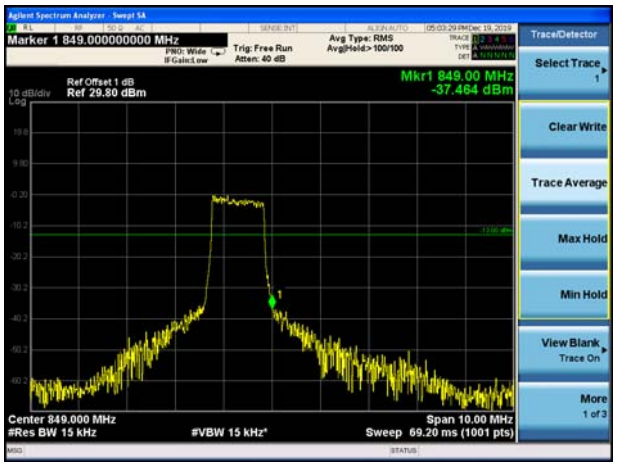
CAT M1 B5 QPSK BW 1.4, NO. RB 6,CH-Low



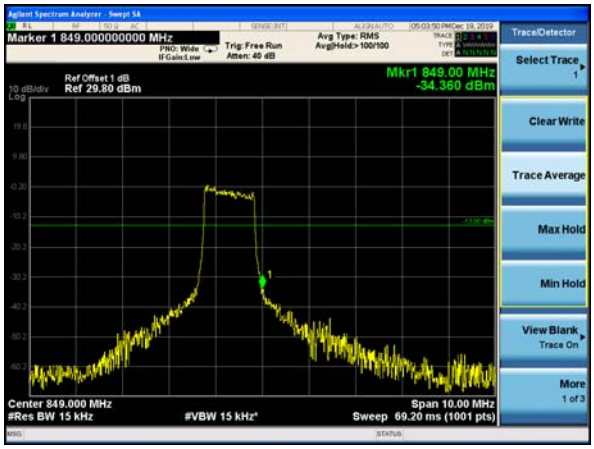
CAT M1 B5 16QAM BW 1.4, NO. RB 6,CH-Low



CAT M1 B5 QPSK BW 1.4, NO. RB 6,CH-High



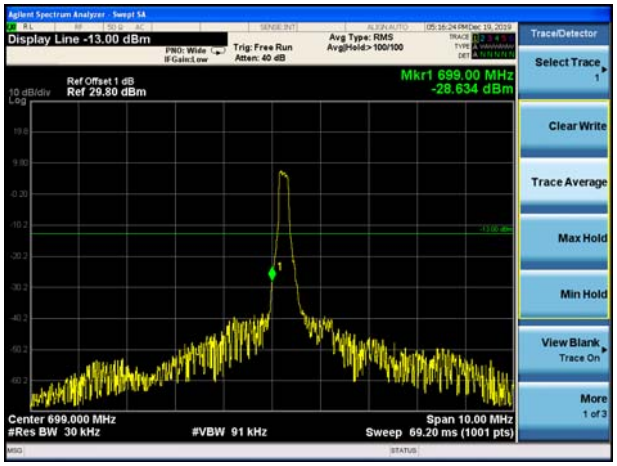
CAT M1 B5 16QAM BW 1.4, NO. RB 6,CH- High



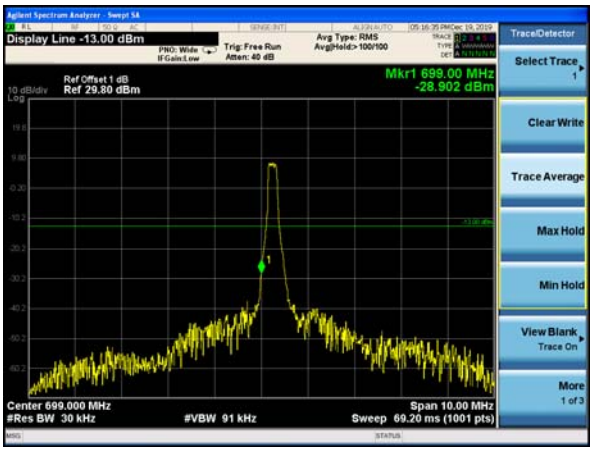
CAT M1 Band 12

Test plot

CAT M1 B12 QPSK BW 1.4, NO. RB 1,CH-Low



CAT M1 B12 16QAM BW 1.4, NO. RB 1,CH-Low



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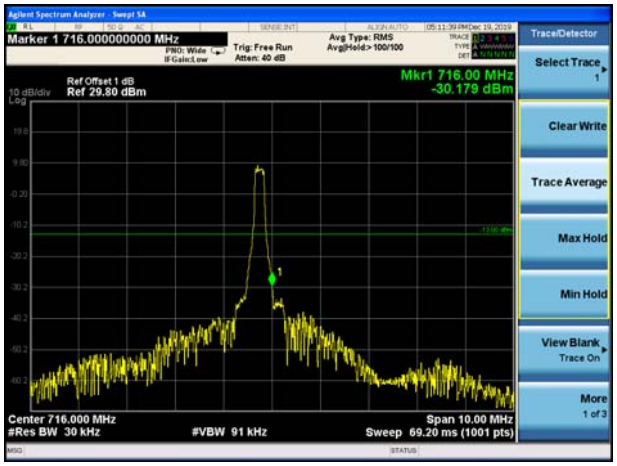
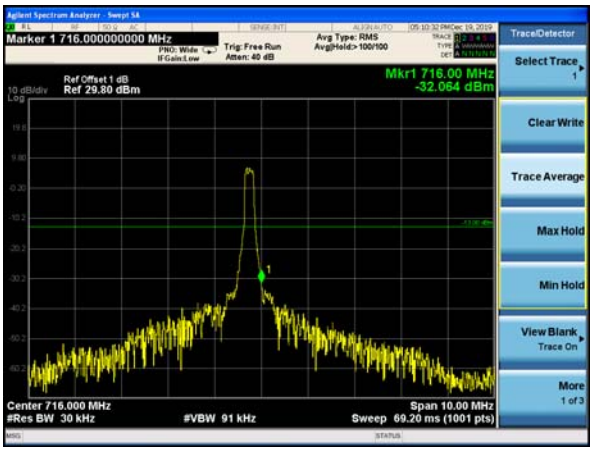
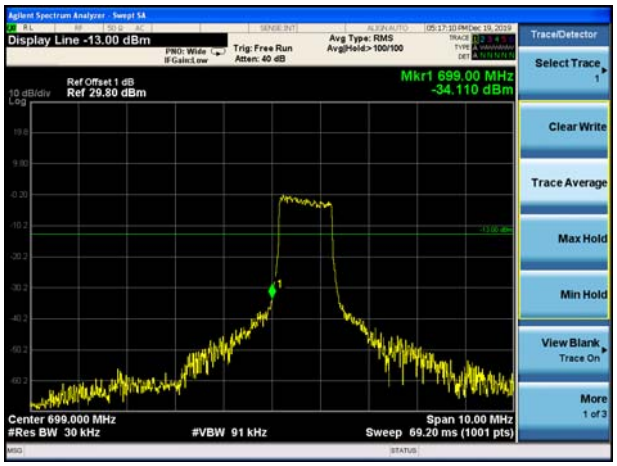


CAT M1 B12 16QAM BW 1.4, NO. RB 1,CH- High



Test plot

CAT M1 B12 QPSK BW 1.4, NO. RB 6,CH-Low



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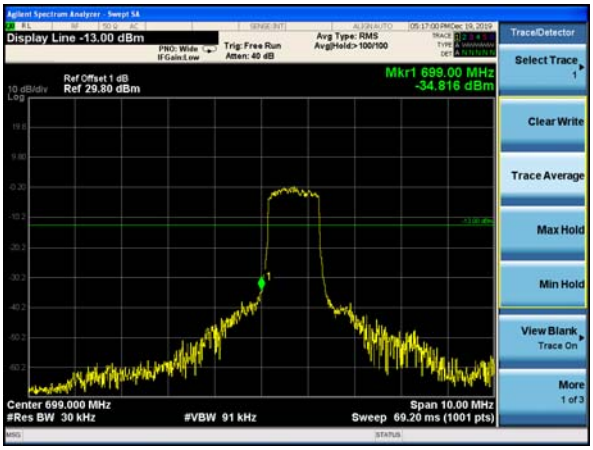
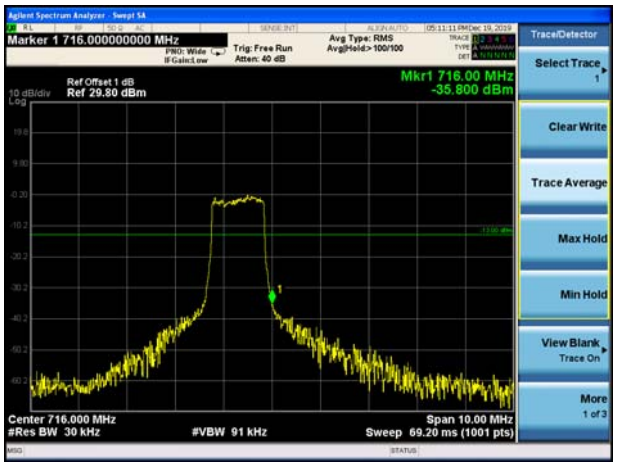


CAT M1 B12 QPSK BW 1.4, NO. RB 6,CH-High



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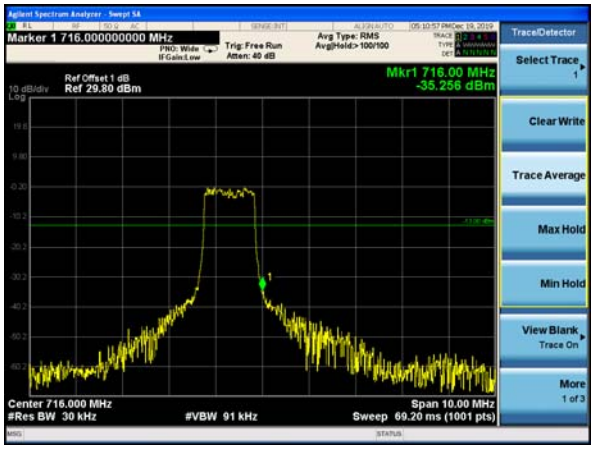
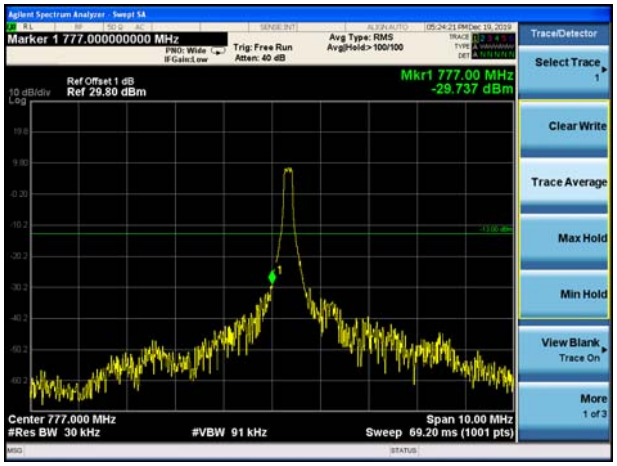


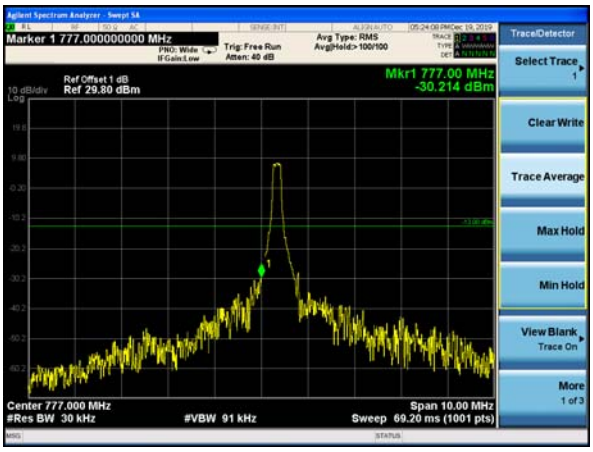
CAT M1 Band 13

Test plot

CAT M1 B13 QPSK BW 1.4, NO. RB 1,CH-Low



CAT M1 B13 16QAM BW 1.4, NO. RB 1,CH-Low



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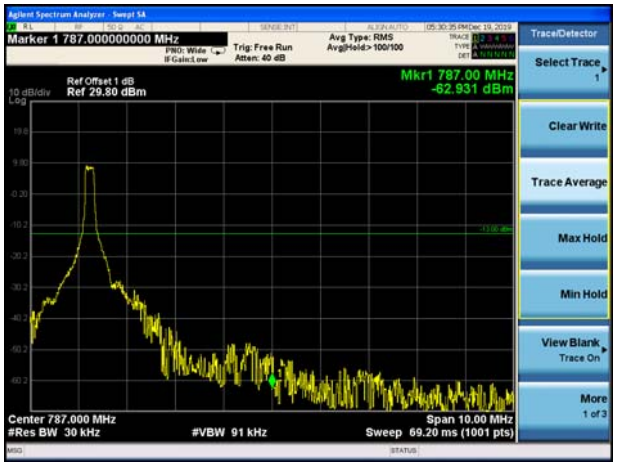
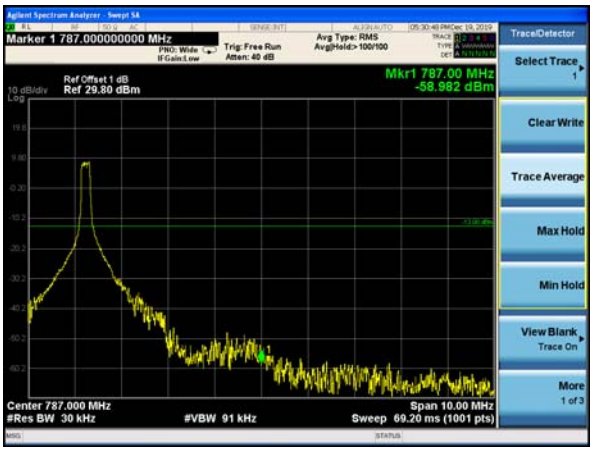
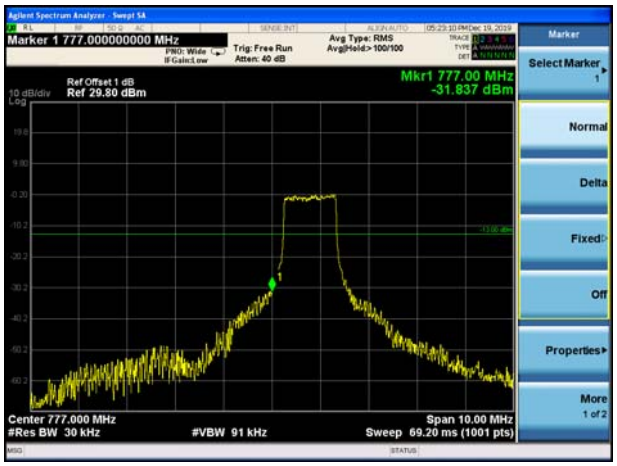


CAT M1 B13 16QAM BW 1.4, NO. RB 1,CH- High

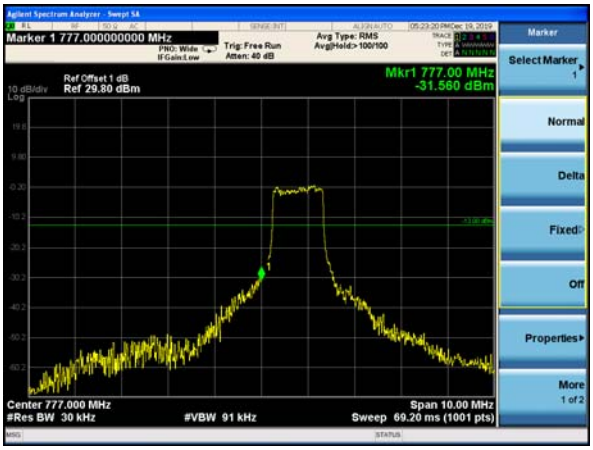


Test plot

CAT M1 B13 QPSK BW 1.4, NO. RB 6,CH-Low



CAT M1 B13 16QAM BW 1.4, NO. RB 6,CH-Low

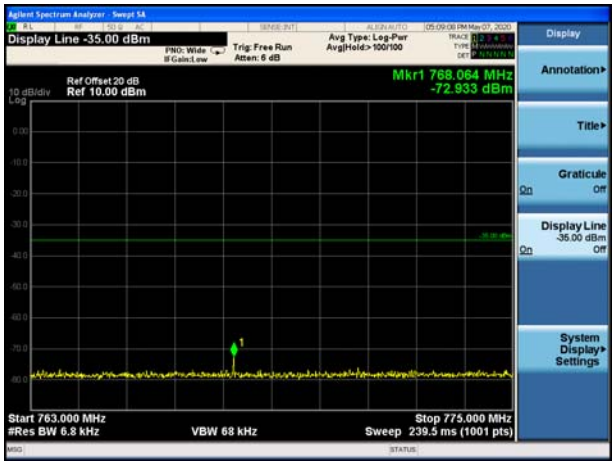


CAT M1 B13 QPSK BW 1.4, NO. RB 6,CH-High

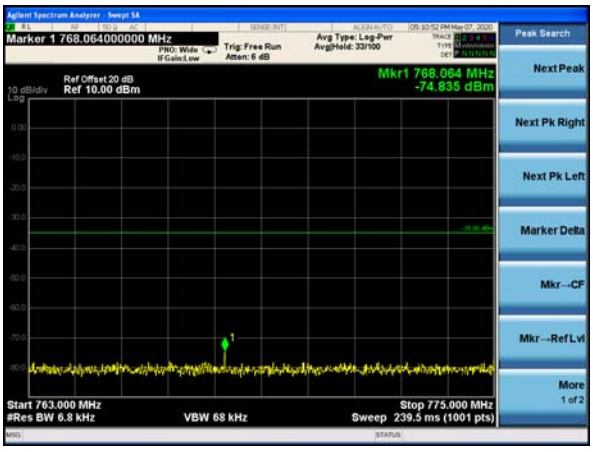
CAT M1 B13 16QAM BW 1.4, NO. RB 6,CH- High

Test plot

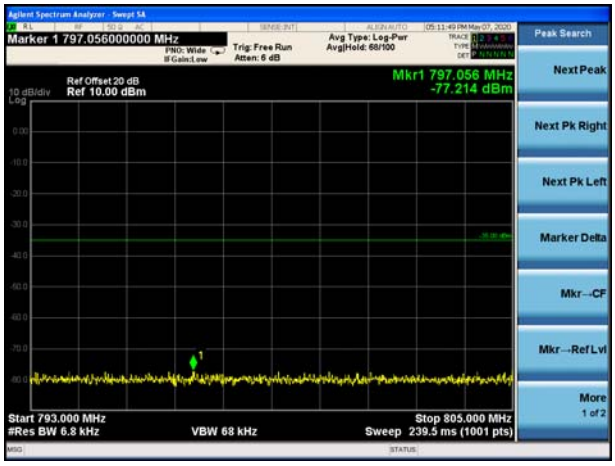
CAT M1 B13 QPSK BW 1.4, NO. RB 1,CH-Low
763-775 MHz



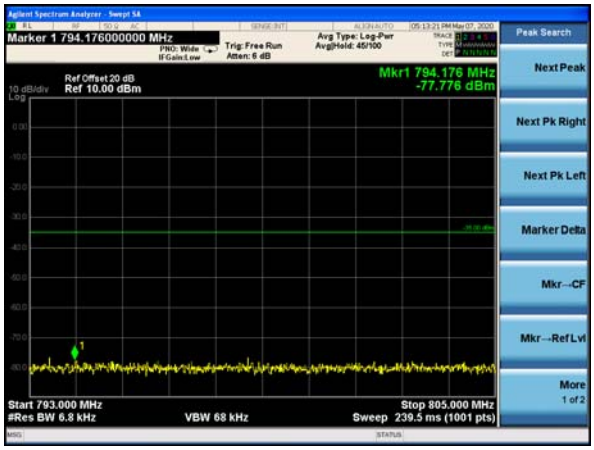
CAT M1 B13 16QAM BW 1.4, NO. RB 1,CH-Low
763-775 MHz



CAT M1 B13 QPSK BW 1.4, NO. RB 1,CH-High
793-805 MHz

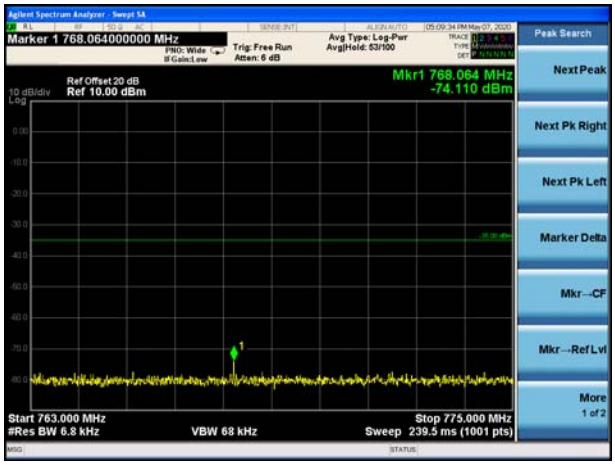


CAT M1 B13 16QAM BW 1.4, NO. RB 1,CH- High
793-805 MHz

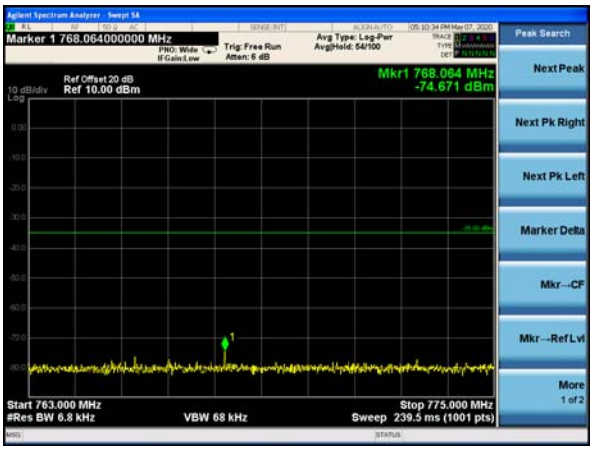


Test plot

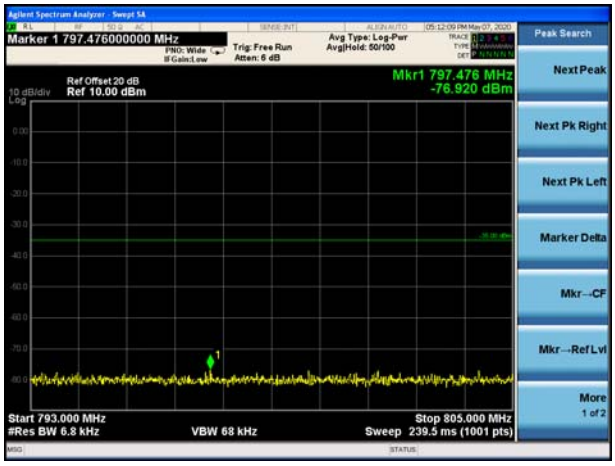
CAT M1 B13 QPSK BW 1.4, NO. RB 6,CH-Low 763-775 MHz



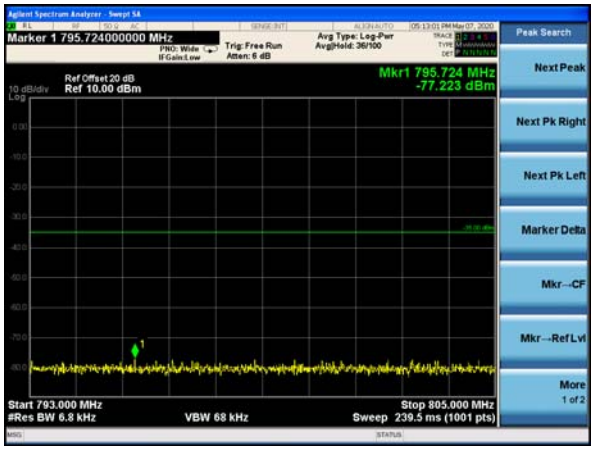
CAT M1 B13 16QAM BW 1.4, NO. RB 6,CH-Low 763-775 MHz



CAT M1 B13 QPSK BW 1.4, NO. RB 6,CH-High 793-805 MHz



CAT M1 B13 16QAM BW 1.4, NO. RB 6,CH- High 793-805 MHz



7. OUT OF BAND EMISSIONS

RULE PART(S)

FCC: §2.1051, §22.917,

LIMITS

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.

TEST PROCEDURE

The RF output of the transmitter was connected to a spectrum analyzer through a calibrated coaxial cable. Sufficient scans were taken to show the out-of-band Emissions, if any, up to 10th harmonic. Multiple sweeps were recorded in maximum hold mode using a peak detector to ensure that the worst-case emissions were caught.

For each out of band emissions measurement:

Set display line at -13 dBm

Set RBW & VBW to 100 kHz for the measurement below 1 GHz, and 1 MHz for the measurement above 1 GHz.

MODES TESTED

CAT M1 Band 2
CAT M1 Band 4
CAT M1 Band 5
CAT M1 Band 12
CAT M1 Band 13

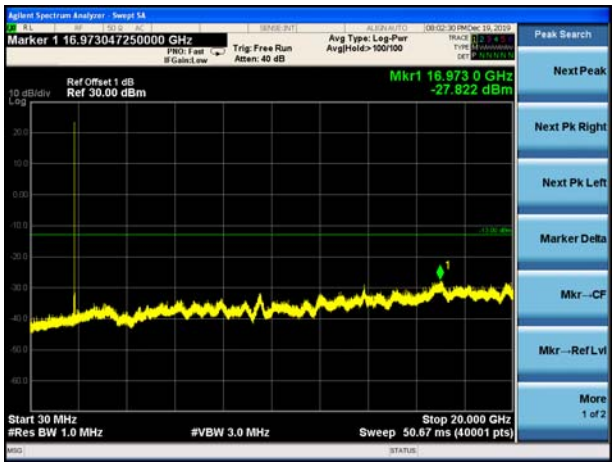
7.1 MEASUREMENT METHOD

The test set up and general procedure is similar to conducted peak output power test. Only different for setting the measurement configuration of the measuring instrument of Spectrum Analyzer.

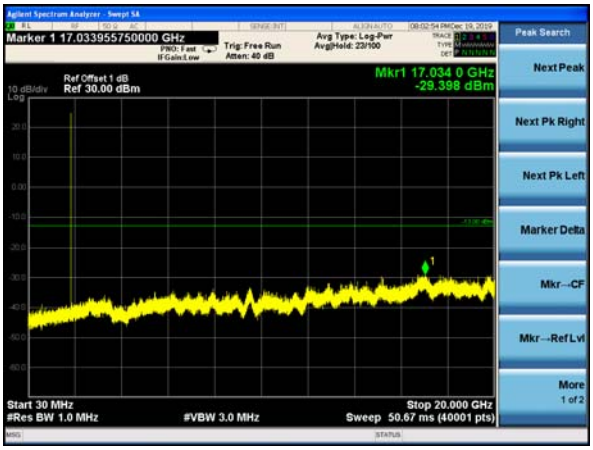
7.1 CAT M1 BAND 2

Test plot

CAT M1 B2 QPSK BW 1.4, NO. RB 6,CH-Low

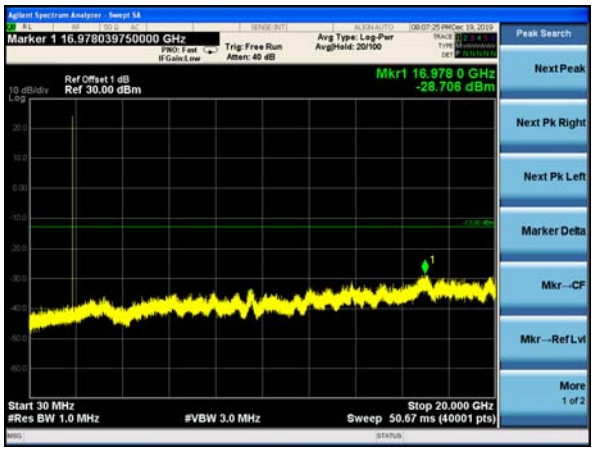


CAT M1 B2 16QAM BW 1.4, NO. RB 6,CH-Low



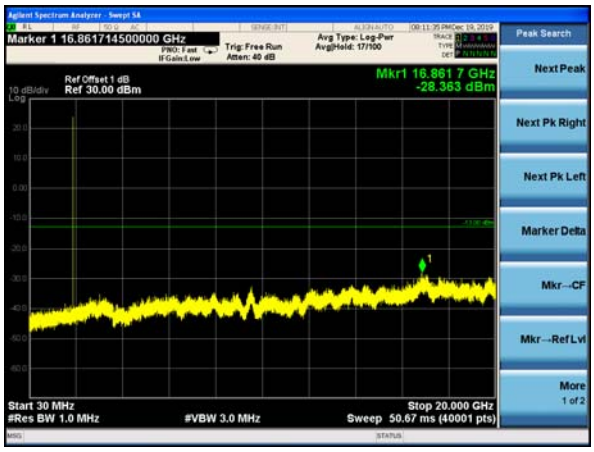
CAT M1 B2 QPSK BW 1.4, NO. RB 6,CH-Middle

CAT M1 B2 16QAM BW 1.4, NO. RB 6,CH-Middle



CAT M1 B2 QPSK BW 1.4, NO. RB 6,CH-High

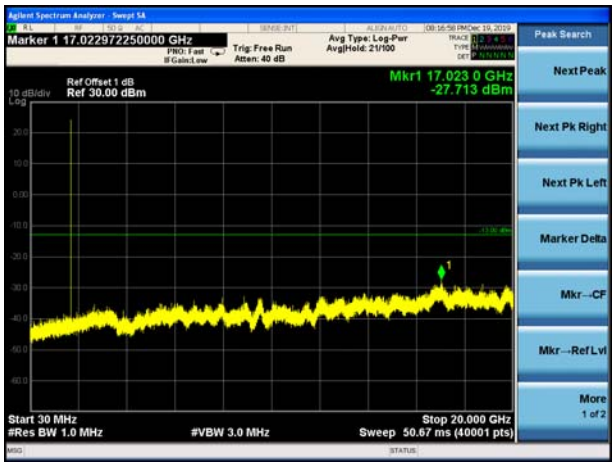
CAT M1 B2 QPSK BW 1.4, NO. RB 6,CH-High



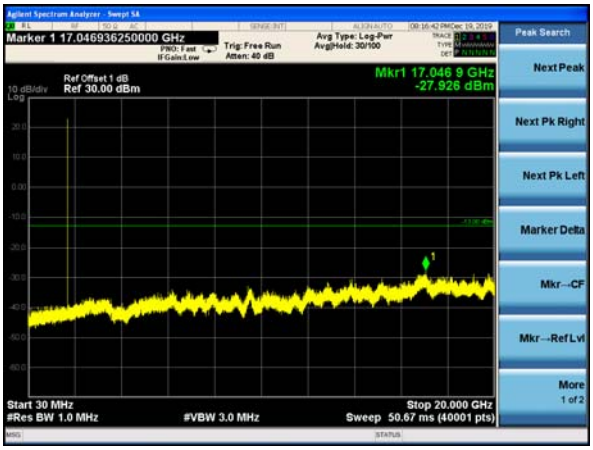
CAT M1 BAND 4

Test plot

CAT M1 B4 QPSK BW 1.4, NO. RB 6,CH-Low

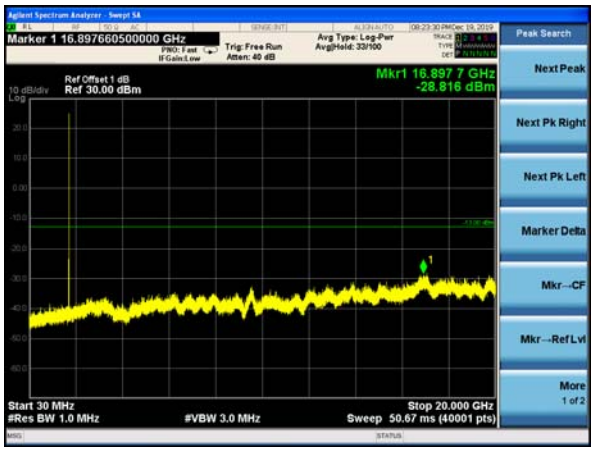


CAT M1 B4 16QAM BW 1.4, NO. RB 6,CH-Low

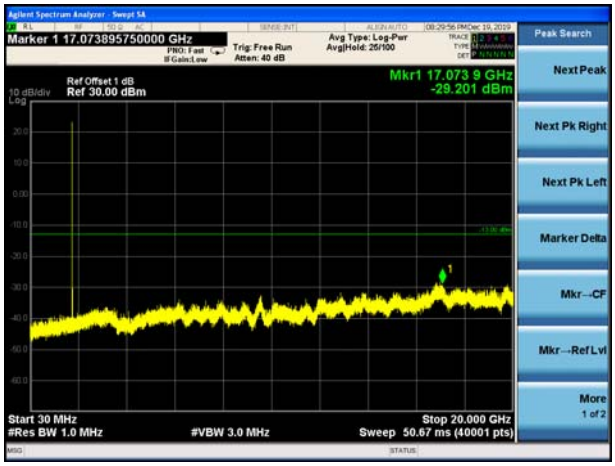


CAT M1 B4 QPSK BW 1.4, NO. RB 6,CH-Middle

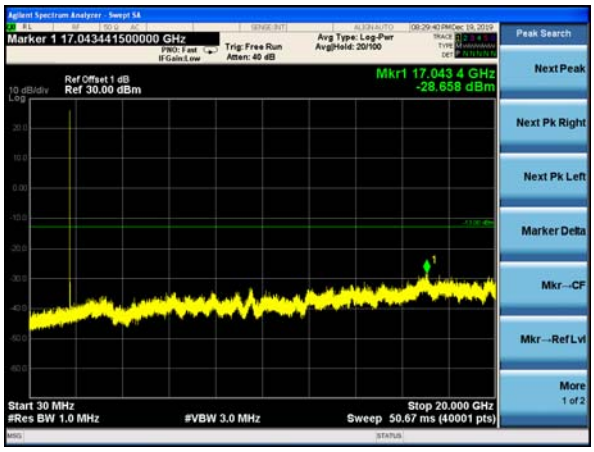
CAT M1 B4 16QAM BW 1.4, NO. RB 6,CH-Middle



CAT M1 B4 QPSK BW 1.4, NO. RB 6,CH-High



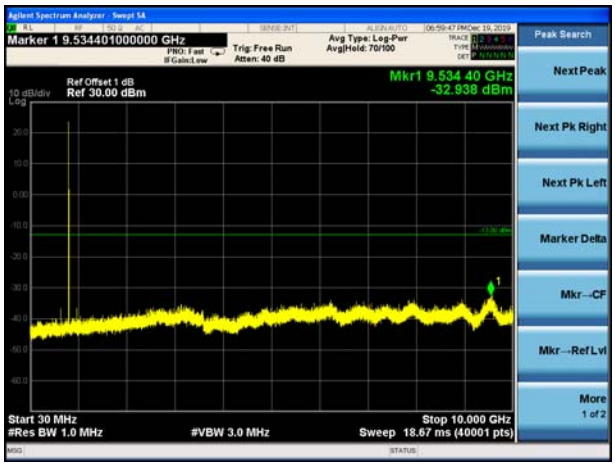
CAT M1 B4 QPSK BW 1.4, NO. RB 6,CH-High



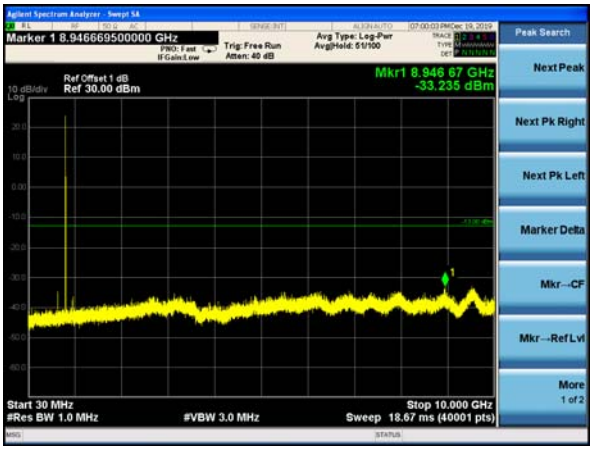
CAT M1 BAND 5

Test plot

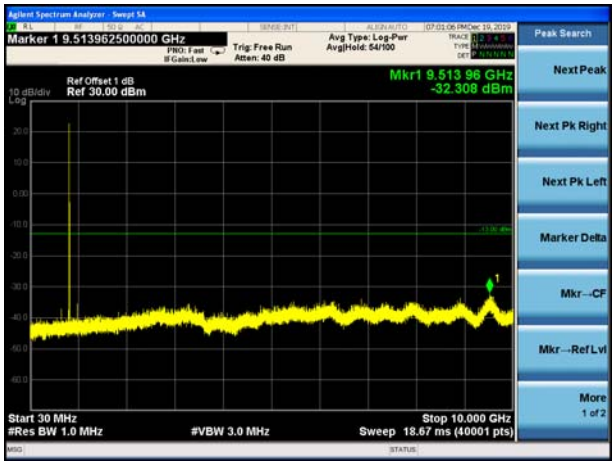
CAT M1 B5 QPSK BW 1.4, NO. RB 6,CH-Low



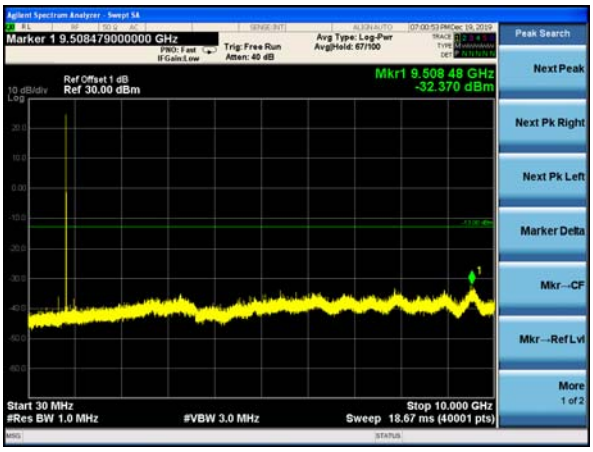
CAT M1 B5 16QAM BW 1.4, NO. RB 6,CH-Low



CAT M1 B5 QPSK BW 1.4, NO. RB 6,CH-Middle



CAT M1 B5 16QAM BW 1.4, NO. RB 6,CH-Middle



CAT M1 B5 QPSK BW 1.4, NO. RB 6,CH-High

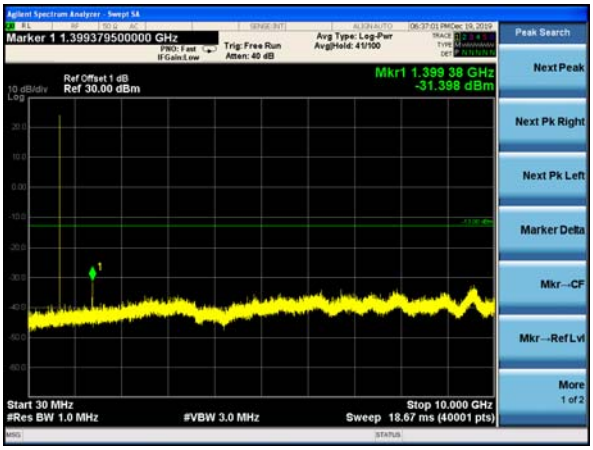
CAT M1 B5 QPSK BW 1.4, NO. RB 6,CH-High

CAT M1 BAND 12

Test plot

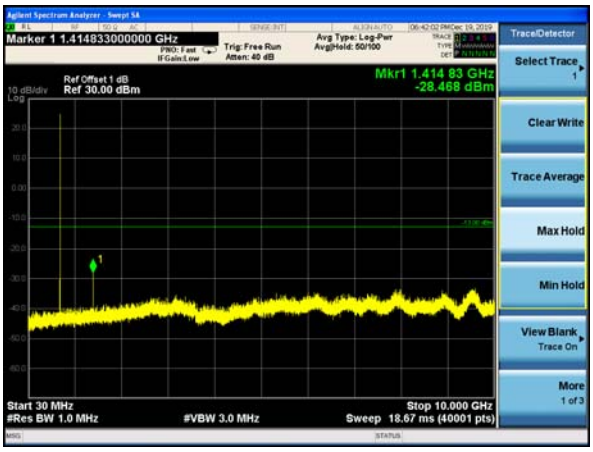
CAT M1 B12 QPSK BW 1.4, NO. RB 6,CH-Low

CAT M1 B12 16QAM BW 1.4, NO. RB 6,CH-Low

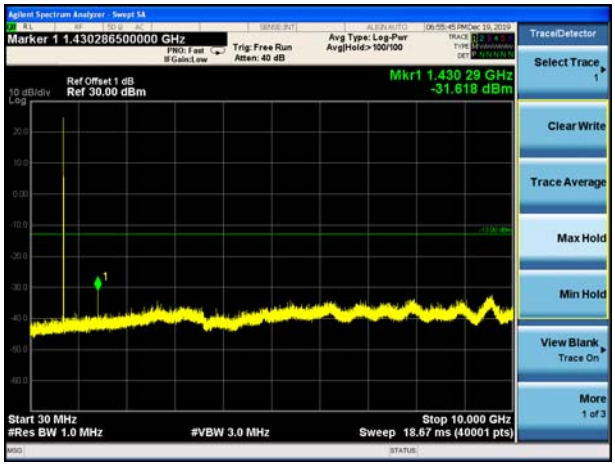


CAT M1 B12 QPSK BW 1.4, NO. RB 6,CH-Middle

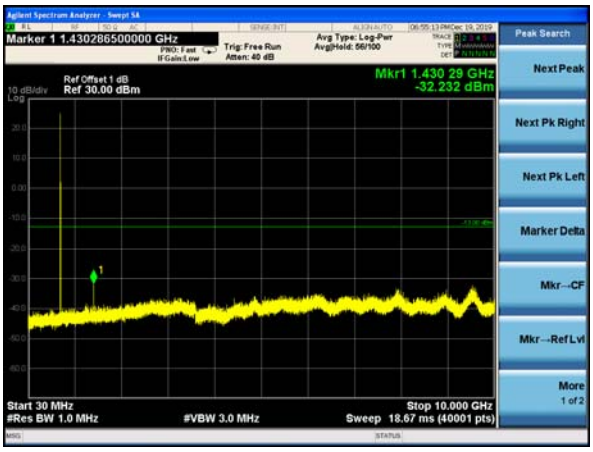
CAT M1 B12 16QAM BW 1.4, NO. RB 6,CH-Middle



CAT M1 B12 QPSK BW 1.4, NO. RB 6,CH-High



CAT M1 B12 QPSK BW 1.4, NO. RB 6,CH-High



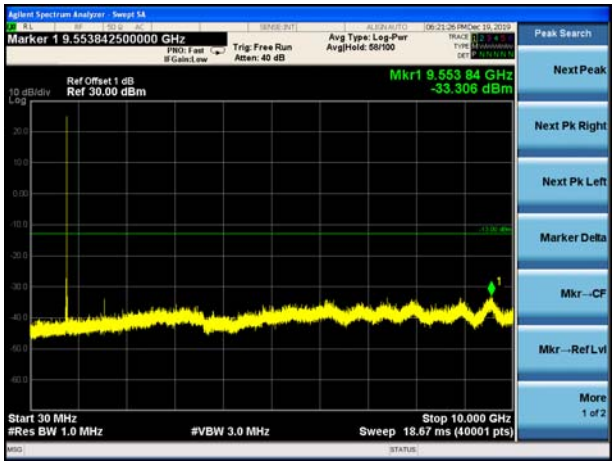
CAT M1 BAND 13

Test plot

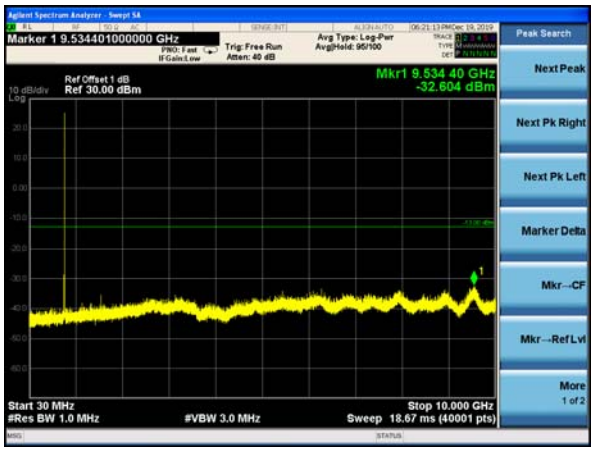
CAT M1 B13 QPSK BW 1.4, NO. RB 6,CH-Low

CAT M1 B13 16QAM BW 1.4, NO. RB 6,CH-Low

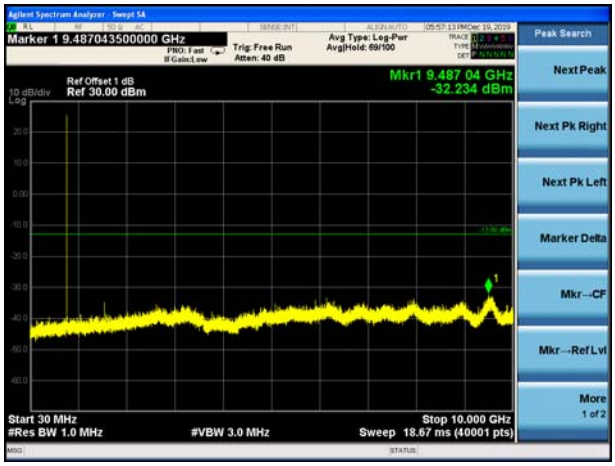
CAT M1 B13 QPSK BW 1.4, NO. RB 6,CH-Middle



CAT M1 B13 16QAM BW 1.4, NO. RB 6,CH-Middle



CAT M1 B13 QPSK BW 1.4, NO. RB 6,CH-High



CAT M1 B13 QPSK BW 1.4, NO. RB 6,CH-High

8. RADIATED MEASUREMENT

8.1. RADIATED POWER (ERP & EIRP)

RULE PART(S)

FCC: §2.1046, §22.913,

LIMITS:

22.913(a) - The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

TEST PROCEDURE

ANSI/TIA-603-E Clause 2.2.17

KDB 971168 v02r01 RF power output using broadband peak and average power meter method.

KDB 971168 D01 Power Meas License Digital Systems v02r01, “Measurement Guidance for Certification of Licensed Digital Transmitters”

MODES TESTED

CAT M1 Band 2
CAT M1 Band 4
CAT M1 Band 5
CAT M1 Band 12
CAT M1 Band 13

RESULTS

Pass

8.2 CAT M1 Band 2

Radiated Power (EIRP) for Band 2									
Mode	RB/RB SIZE	Frequency	Result						Conclusion
			SG Level (dBm)	Cable Loss (dBm)	Antenna Gain (dB)	Max. EIRP Average (dBm)	Max. EIRP Average (mW)	Polarization Of Max. EIRP	
1.4MHz Band QPSK	3/0	1850.7	-4.22	3.76	28.24	20.26	106.170	Horizontal	Pass
		1880	-4	3.91	28.22	20.31	107.399	Horizontal	Pass
		1909.3	-3.99	3.93	28.2	20.28	106.660	Horizontal	Pass
1.4MHz Band QPSK	3/0	1850.7	-4.65	3.76	28.24	19.83	96.161	Vertical	Pass
		1880	-4.52	3.91	28.22	19.79	95.280	Vertical	Pass
		1909.3	-4.45	3.93	28.2	19.82	95.940	Vertical	Pass
1.4MHz Band 16 QAM	3/0	1850.7	-4.16	3.76	28.24	20.32	107.647	Horizontal	Pass
		1880	-3.86	3.91	28.22	20.45	110.917	Horizontal	Pass
		1909.3	-3.89	3.93	28.2	20.38	109.144	Horizontal	Pass
1.4MHz Band 16 QAM	3/0	1850.7	-4.8	3.76	28.24	19.68	92.897	Vertical	Pass
		1880	-4.58	3.91	28.22	19.73	93.972	Vertical	Pass
		1909.3	-4.42	3.93	28.2	19.85	96.605	Vertical	Pass

Note:
SG Level= Signal generator output
Max. EIRP Average (dBm)= Antenna Gain(dB)+ SG Level (dBm)- Cable Loss(dBm)

CAT M1 Band 4

Radiated Power (EIRP) for Band 4									
Mode	RB/RB SIZE	Frequency	Result						Conclusion
			SG Level (dBm)	Cable Loss (dBm)	Antenna Gain (dB)	Max. EIRP Average (dBm)	Max. EIRP Average (mW)	Polarization Of Max. EIRP	
1.4MHz Band QPSK	1/0	1710.7	-4.4	3.12	27.58	20.06	101.391	Horizontal	Pass
		1732.5	-4.0	3.27	27.61	20.34	108.143	Horizontal	Pass
		1754.3	-4.27	3.29	27.63	20.07	101.625	Horizontal	Pass
1.4MHz Band QPSK	1/0	1710.7	-4.43	3.12	27.58	20.03	100.693	Vertical	Pass
		1732.5	-4.09	3.27	27.61	20.25	105.925	Vertical	Pass
		1754.3	-4.27	3.29	27.63	20.07	101.625	Vertical	Pass
1.4MHz Band 16 QAM	1/0	1710.7	-4.1	3.12	27.58	20.36	108.643	Horizontal	Pass
		1732.5	-4.07	3.27	27.61	20.27	106.414	Horizontal	Pass
		1754.3	-4.17	3.29	27.63	20.17	103.992	Horizontal	Pass
1.4MHz Band 16 QAM	1/0	1710.7	-4.35	3.12	27.58	20.11	102.565	Vertical	Pass
		1732.5	-4.3	3.27	27.61	20.04	100.925	Vertical	Pass
		1754.3	-4.33	3.29	27.63	20.01	100.231	Vertical	Pass

Note:
SG Level= Signal generator output
Max. ERP Average (dBm)= Antenna Gain(dB)+ SG Level (dBm)- Cable Loss(dBm)

CAT M1 Band 5

Radiated Power (ERP) for Band 5										
Mode	RB/RB SIZE	Frequency	Result							Conclusion
			SG Level (dBm)	Cable Loss (dBm)	Antenna Gain (dB)	Correction (dB)	Max. ERP Average (dBm)	Max. ERP Average (mW)	Polarization Of Max. ERP	
1.4MHz Band QPSK	1/0	824.7	1.63	2.01	19.68	2.15	17.15	51.880	Horizontal	Pass
		836.5	1.63	2.01	19.77	2.15	17.24	52.966	Horizontal	Pass
		848.3	1.52	2.02	19.82	2.15	17.17	52.119	Horizontal	Pass
1.4MHz Band QPSK	1/0	824.7	1.48	2.01	19.68	2.15	17.00	50.119	Vertical	Pass
		836.5	1.5	2.01	19.77	2.15	17.11	51.404	Vertical	Pass
		848.3	1.42	2.02	19.82	2.15	17.07	50.933	Vertical	Pass
1.4MHz Band 16 QAM	3/0	824.7	1.37	2.01	19.68	2.15	16.89	48.865	Horizontal	Pass
		836.5	1.51	2.01	19.77	2.15	17.12	51.523	Horizontal	Pass
		848.3	1.45	2.02	19.82	2.15	17.1	51.286	Horizontal	Pass
1.4MHz Band 16 QAM	3/0	824.7	1.26	2.01	19.68	2.15	16.78	47.643	Vertical	Pass
		836.5	1.24	2.01	19.77	2.15	16.85	48.417	Vertical	Pass
		848.3	0.7	2.02	19.82	2.15	16.35	43.152	Vertical	Pass

Note:
SG Level= Signal generator output
Max. ERP Average (dBm)= Antenna Gain(dB)+ SG Level (dBm)- Cable Loss(dBm)- Correction

CAT M1 Band 12

Radiated Power (ERP) for Band 12										
Mode	RB/RB SIZE	Frequency	Result							Conclusion
			SG Level (dBm)	Cable Loss (dBm)	Antenna Gain (dB)	Correction (dB)	Max. ERP Average (dBm)	Max. ERP Average (mW)	Polarization Of Max. ERP	
1.4MHz Band QPSK	1/0	699.7	4.47	1.91	19.21	2.15	19.62	91.622	Vertical	Pass
		707.5	4.58	1.91	19.26	2.15	19.78	95.060	Vertical	Pass
		715.3	4.53	1.93	19.34	2.15	19.79	95.280	Vertical	Pass
1.4MHz Band QPSK	1/0	699.7	4.93	1.91	19.21	2.15	20.08	101.859	Horizontal	Pass
		707.5	5.01	1.91	19.26	2.15	20.21	104.954	Horizontal	Pass
		715.3	4.97	1.93	19.34	2.15	20.23	105.439	Horizontal	Pass
1.4MHz Band 16 QAM	1/0	699.7	4.58	1.91	19.21	2.15	19.73	93.972	Vertical	Pass
		707.5	4.89	1.91	19.26	2.15	20.09	102.094	Vertical	Pass
		715.3	4.86	1.93	19.34	2.15	20.12	102.802	Vertical	Pass
1.4MHz Band 16 QAM	1/0	699.7	4.73	1.91	19.21	2.15	19.88	97.275	Horizontal	Pass
		707.5	5.06	1.91	19.26	2.15	20.26	106.170	Horizontal	Pass
		715.3	4.97	1.93	19.34	2.15	20.23	105.439	Horizontal	Pass

Note:
SG Level= Signal generator output
Max. ERP Average (dBm)= Antenna Gain(dB)+ SG Level (dBm)- Cable Loss(dBm)- Correction

CAT M1 Band 13

Radiated Power (ERP) for Band 13										
Mode	RB/RB SIZE	Frequency	Result							Conclusion
			SG Level (dBm)	Cable Loss (dBm)	Antenna Gain (dB)	Correction (dB)	Max. ERP Average (dBm)	Max. ERP Average (mW)	Polarization Of Max. ERP	
1.4MHz Band QPSK	1/0	779.5	4.79	1.91	19.23	2.15	19.96	99.083	Vertical	Pass
		782	4.66	1.91	19.26	2.15	19.86	96.828	Vertical	Pass
		784.5	4.63	1.92	19.33	2.15	19.89	97.499	Vertical	Pass
1.4MHz Band QPSK	1/0	779.5	4.9	1.91	19.23	2.15	20.07	101.625	Horizontal	Pass
		782	4.69	1.91	19.26	2.15	19.89	97.499	Horizontal	Pass
		784.5	4.61	1.92	19.33	2.15	19.87	97.051	Horizontal	Pass
1.4MHz Band 16 QAM	1/0	779.5	4.71	1.91	19.23	2.15	19.88	97.275	Vertical	Pass
		782	4.66	1.91	19.26	2.15	19.86	96.828	Vertical	Pass
		784.5	4.52	1.92	19.33	2.15	19.78	95.060	Vertical	Pass
1.4MHz Band 16 QAM	1/0	779.5	4.86	1.91	19.23	2.15	20.03	100.693	Horizontal	Pass
		782	4.77	1.91	19.26	2.15	19.97	99.312	Horizontal	Pass
		784.5	4.7	1.92	19.33	2.15	19.96	99.083	Horizontal	Pass

Note:
SG Level= Signal generator output
Max. ERP Average (dBm)= Antenna Gain(dB)+ SG Level (dBm)- Cable Loss(dBm)- Correction

9. SPURIOUS RADIATION EMISSION

RULE PART(S)

FCC: §2.1053, §22.917,

LIMIT

§22.917 (e): 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.

TEST PROCEDURE

For Cellular equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 100 kHz or 1 percent of emission bandwidth, as specified). 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.

For PCS equipment - Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). 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.

The unwanted emission power shall be measured with a resolution bandwidth of at least 1% of the occupied bandwidth in the 1 MHz band immediately outside and adjacent to the channel edge of the equipment. Beyond the 1 MHz band immediately outside the channel edge of the equipment, a resolution bandwidth of 1 MHz shall be employed. A narrower resolution bandwidth is allowed to be used provided that the measured power is integrated over the full required measurement bandwidth of 1 MHz or 1% of the occupied bandwidth as applicable.

The power of any unwanted emissions measured from the channel edge of the equipment shall be attenuated below the transmitter power, P (dBW), as follows:
a. for base station and subscriber equipment, other than mobile subscriber equipment, the attenuation shall not be less than 43 + 10 Log10 (p), dB; and
b. for mobile subscriber equipment, the attenuation shall not be less than 43 + 10 Log10 (p), dB at the channel edges and 55 + 10 Log10 (p) at 5.5 MHz away and beyond the channel edges where p in (a) and (b) is the transmitter power measured in watts.

MODES TESTED

CAT M1 Band 2
CAT M1 Band 4
CAT M1 Band 5
CAT M1 Band 12
CAT M1 Band 13

RESULTS
PASS

9.3 Test Results

CAT M1 Band 2 (QPSK 1.4MHZ BANDWIDTH)

Test Results for Low Channel 1850.7MHz							
Frequency(MHz)	SG Level(dBm)	Cable Loss(dB)	Antenna Gain(dB)	Absolute Level(dBm)	Limit（dBm）	Margin(dBm)	Polarity
3701.4	-80.13	4.04	27.83	-56.34	-13	-43.34	Horizontal
3701.4	-78.98	4.04	27.83	-55.19	-13	-42.19	Vertical
5552.1	-79.48	4.02	29.86	-53.64	-13	-40.64	Vertical
5552.1	-82.29	4.02	29.86	-56.45	-13	-43.45	Horizontal
Test Results for Mid Channel 1880MHz							
3760	-81.40	4.04	27.83	-57.61	-13	-44.61	Horizontal
3760	-80.21	4.04	27.83	-56.42	-13	-43.42	Vertical
5640	-82.76	4.02	29.86	-56.92	-13	-43.92	Vertical
5640	-82.69	4.02	29.86	-56.85	-13	-43.85	Horizontal
Test Results for High Channel 1909.3MHz							
3818.6	-82.42	4.04	27.83	-58.63	-13	-45.63	Horizontal
3818.6	-81.74	4.04	27.83	-57.95	-13	-44.95	Vertical
5727.9	-84.90	4.02	29.86	-59.06	-13	-46.06	Vertical
5727.9	-83.97	4.02	29.86	-58.13	-13	-45.13	Horizontal

CAT M1 Band 4 (QPSK 1.4MHZ BANDWIDTH)

Test Results for Low Channel 1710.7MHz							
Frequency(MHz)	SG Level(dBm)	Cable Loss(dB)	Antenna Gain(dB)	Absolute Level(dBm)	Limit（dBm）	Margin(dBm)	Polarity
3421.4	-75.78	4.04	27.83	-51.99	-13	-38.99	Horizontal
3421.4	-76.45	4.04	27.83	-52.66	-13	-39.66	Vertical
5132.1	-81.60	4.02	29.86	-55.76	-13	-42.76	Vertical
5132.1	-82.92	4.02	29.86	-57.08	-13	-44.08	Horizontal
Test Results for Mid Channel 1732.5MHz							
3465	-73.43	4.04	27.83	-49.64	-13	-36.64	Horizontal
3465	-72.03	4.04	27.83	-48.24	-13	-35.24	Vertical
5197.5	-75.91	4.02	29.86	-50.07	-13	-37.07	Vertical
5197.5	-76.12	4.02	29.86	-50.28	-13	-37.28	Horizontal
Test Results for High Channel 1754.3MHz							
3508.6	-74.38	4.04	27.83	-50.59	-13	-37.59	Horizontal
3508.6	-76.14	4.04	27.83	-52.35	-13	-39.35	Vertical
5262.9	-75.95	4.02	29.86	-50.11	-13	-37.11	Vertical
5262.9	-76.87	4.02	29.86	-51.03	-13	-38.03	Horizontal

CAT M1 Band 5 (QPSK 1.4MHZ BANDWIDTH)

Test Results for Low Channel 824.7MHz							
Frequency(MHz)	SG Level(dBm)	Cable Loss(dB)	Antenna Gain(dB)	Absolute Level(dBm)	Limit（dBm）	Margin(dBm)	Polarity
1649.4	-80.34	2.78	27.48	-55.64	-13	-42.64	Horizontal
1649.4	-74.88	2.78	27.48	-50.18	-13	-37.18	Vertical
2474.1	-78.06	2.90	27.80	-53.16	-13	-40.16	Vertical
2474.1	-79.22	2.90	27.80	-54.32	-13	-41.32	Horizontal
Test Results For Mid Channel 836.5MHz							
1673	-80.52	2.80	27.48	-55.84	-13	-42.84	Horizontal
1673	-78.62	2.80	27.48	-53.94	-13	-40.94	Vertical
2509.5	-81.49	2.91	27.80	-56.60	-13	-43.60	Vertical
2509.5	-77.97	2.91	27.80	-53.08	-13	-40.08	Horizontal
Test Results for High Channel 848.3MHz							
1696.6	-79.08	2.82	27.43	-54.47	-13	-41.47	Horizontal
1696.6	-78.49	2.82	27.43	-53.88	-13	-40.88	Vertical
2544.9	-74.89	2.92	27.74	-50.07	-13	-37.07	Vertical
2544.9	-80.98	2.92	27.74	-56.16	-13	-43.16	Horizontal

CAT M1 Band 12 (QPSK 1.4MHZ BANDWIDTH)

Test Results for Low Channel 699.7MHz							
Frequency(MHz)	SG Level(dBm)	Cable	Antenna	Absolute	Limit（dBm）	Margin(dBm)	Polarity
1399.4	-73.60	2.60	27.20	-49.00	-13	-36.00	Horizontal
1399.4	-74.97	2.60	27.20	-50.37	-13	-37.37	Vertical
2099.1	-74.40	2.85	27.54	-49.71	-13	-36.71	Vertical
2099.1	-74.44	2.85	27.54	-49.75	-13	-36.75	Horizontal
Test Results For Mid Channel 707.5MHz							
1415	-76.56	2.61	27.28	-51.89	-13	-38.89	Horizontal
1415	-74.16	2.61	27.28	-49.49	-13	-36.49	Vertical
2122.5	-75.40	2.87	27.59	-50.68	-13	-37.68	Vertical
2122.5	-76.83	2.87	27.59	-52.11	-13	-39.11	Horizontal
Test Results for High Channel 715.3MHz							
1430.6	-76.83	2.63	27.28	-52.18	-13	-39.18	Horizontal
1430.6	-78.15	2.63	27.28	-53.50	-13	-40.50	Vertical
2145.9	-78.11	2.88	27.60	-53.39	-13	-40.39	Vertical
2145.9	-75.51	2.88	27.60	-50.79	-13	-37.79	Horizontal

CAT M1 Band 13(QPSK 1.4MHZ BANDWIDTH)

Test Results for Low Channel 779.5MHz							
Frequency(MHz)	SG Level(dBm)	Cable Loss(dB)	Antenna Gain(dB)	Absolute Level(dBm)	Limit（dBm）	Margin(dBm)	Polarity
1559	-77.88	2.6	27.2	-53.28	-13	-40.28	Horizontal
1559	-75.74	2.6	27.2	-51.14	-13	-38.14	Vertical
2338.5	-77.00	2.85	27.54	-52.31	-13	-39.31	Vertical
2338.5	-80.09	2.85	27.54	-55.40	-13	-42.40	Horizontal
Test Results For Mid Channel 782MHz							
1564	-77.51	2.61	27.28	-52.84	-13	-39.84	Horizontal
1564	-75.02	2.61	27.28	-50.35	-13	-37.35	Vertical
2346	-79.43	2.87	27.59	-54.71	-13	-41.71	Vertical
2346	-75.01	2.87	27.59	-50.29	-13	-37.29	Horizontal
Test Results for High Channel 784.5MHz							
1569	-75.98	2.63	27.28	-51.33	-13	-38.33	Horizontal
1569	-76.59	2.63	27.28	-51.94	-13	-38.94	Vertical
2353.5	-75.61	2.88	27.6	-50.89	-13	-37.89	Vertical
2353.5	-78.56	2.88	27.6	-53.84	-13	-40.84	Horizontal

Note:

1. SG Level= Signal generator output

Max. EIRP Average (dBm)= Antenna Gain(dB)+ SG Level (dBm)- Cable Loss(dBm)

2. That QPSK & 16QAM mode both have been tested, but just reported the worst case QPSK mode.

10. FREQUENCY STABILITY

RULE PART(S)

FCC: §2.1055, §22.355,

LIMITS

§22.355 - The carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations.

TEST PROCEDURE

Use CMW 500 with Frequency Error measurement capability.

Temp. = −30° to +50°C

Voltage =low voltage, DC 3.8V, Normal, DC 3.2V and High voltage, DC 4.2V.

Frequency Stability vs Temperature:

The EUT is place inside a temperature chamber. The temperature is set to -30ºC and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, and then the measurement is repeated. This is repeated until +50ºC is reached.

Frequency Stability vs Voltage:

The peak frequency error is recorded (worst-case).

MODES TESTED

CAT M1 Band 2

CAT M1 Band 4

CAT M1 Band 5

CAT M1 Band 12

CAT M1 Band 13

RESULTS

See the following pages.

10.3 Test Results

CAT M1 Band 2 (QPSK 1.4MHZ BANDWIDTH)

Frequency error vs. Voltage

Voltage	Frequency	Frequency*	Frequency	Limit
[Vdc]	[MHz]	Error[Hz]	Error[ppm]	[ppm]
3.2	1880	-14.99	-0.007973	2.5
3.8	1880	-15.09	-0.008027	2.5
4.2	1880	-14.59	-0.007761	2.5

Frequency error vs. Temperature

Temperature	Frequency	Frequency*	Frequency	Limit
[°C]	[MHz]	Error[Hz]	Error[ppm]	[ppm]
Normal (25°C)	1880	-11.21	-0.005963	2.5
Extreme (50°C)	1880	-9.11	-0.004846	2.5
Extreme (40°C)	1880	-9.21	-0.004899	2.5
Extreme (30°C)	1880	-11.31	-0.006016	2.5
Extreme (10°C)	1880	-11.81	-0.006282	2.5
Extreme (0°C)	1880	-11.71	-0.006229	2.5
Extreme (-10°C)	1880	-13.41	-0.007133	2.5
Extreme (-20°C)	1880	-12.61	-0.006707	2.5
Extreme (-30°C)	1880	-13.31	-0.007080	2.5

***Note:** Frequency error measurements were made by using the build-in capability of the Wireless Communication Test Set.

CAT M1 Band 2 (16QAM 1.4MHZ BANDWIDTH)

Frequency error vs. Voltage

Voltage	Frequency	Frequency*	Frequency	Limit
[Vdc]	[MHz]	Error[Hz]	Error[ppm]	[ppm]
3.2	1880	-17.1	-0.009101	2.5
3.8	1880	-13.5	-0.007186	2.5
4.2	1880	-16.7	-0.008888	2.5

Frequency error vs. Temperature

Temperature	Frequency	Frequency*	Frequency	Limit
[°C]	[MHz]	Error[Hz]	Error[ppm]	[ppm]
Normal (25°C)	1880	-17.41	-0.009261	2.5
Extreme (50°C)	1880	-18.61	-0.009899	2.5
Extreme (40°C)	1880	-18.21	-0.009686	2.5
Extreme (30°C)	1880	-16.71	-0.008888	2.5
Extreme (10°C)	1880	-17.31	-0.009207	2.5
Extreme (0°C)	1880	-16.21	-0.008622	2.5
Extreme (-10°C)	1880	-15.61	-0.008303	2.5
Extreme (-20°C)	1880	-15.41	-0.008197	2.5
Extreme (-30°C)	1880	-14.71	-0.007824	2.5

***Note:** Frequency error measurements were made by using the build-in capability of the Wireless Communication Test Set.

CAT M1 Band 4 (QPSK 1.4MHZ BANDWIDTH)

Frequency error vs. Voltage

Voltage	Frequency	Frequency*	Frequency	Limit
[Vdc]	[MHz]	Error[Hz]	Error[ppm]	[ppm]
3.2	1732.5	-13.01	-0.007509	2.5
3.8	1732.5	-13.01	-0.007509	2.5
4.2	1732.5	-13.11	-0.007567	2.5

Frequency error vs. Temperature

Temperature	Frequency	Frequency*	Frequency	Limit
[°C]	[MHz]	Error[Hz]	Error[ppm]	[ppm]
Normal (25°C)	1732.5	-9.91	-0.005720	2.5
Extreme (50°C)	1732.5	-11.61	-0.006701	2.5
Extreme (40°C)	1732.5	-11.31	-0.006528	2.5
Extreme (30°C)	1732.5	-11.31	-0.006528	2.5
Extreme (10°C)	1732.5	-9.61	-0.005547	2.5
Extreme (0°C)	1732.5	-8.81	-0.005085	2.5
Extreme (-10°C)	1732.5	-9.11	-0.005258	2.5
Extreme (-20°C)	1732.5	-13.31	-0.007683	2.5
Extreme (-30°C)	1732.5	-11.71	-0.006759	2.5

***Note:** Frequency error measurements were made by using the build-in capability of the Wireless Communication Test Set.

CAT M1 Band 4 (16QAM 1.4MHZ BANDWIDTH)

Frequency error vs. Voltage

Voltage	Frequency	Frequency*	Frequency	Limit
[Vdc]	[MHz]	Error[Hz]	Error[ppm]	[ppm]
3.2	1732.5	-10.71	-0.006182	2.5
3.8	1732.5	-11.41	-0.006586	2.5
4.2	1732.5	-11.21	-0.006470	2.5

Frequency error vs. Temperature

Temperature	Frequency	Frequency*	Frequency	Limit
[°C]	[MHz]	Error[Hz]	Error[ppm]	[ppm]
Normal (25°C)	1732.5	-11.31	-0.006528	2.5
Extreme (50°C)	1732.5	-8.31	-0.004797	2.5
Extreme (40°C)	1732.5	-8.81	-0.005085	2.5
Extreme (30°C)	1732.5	-10.11	-0.005835	2.5
Extreme (10°C)	1732.5	-10.71	-0.006182	2.5
Extreme (0°C)	1732.5	-10.41	-0.006009	2.5
Extreme (-10°C)	1732.5	-8.61	-0.004970	2.5
Extreme (-20°C)	1732.5	-10.21	-0.005893	2.5
Extreme (-30°C)	1732.5	-10.11	-0.005835	2.5

***Note:** Frequency error measurements were made by using the build-in capability of the Wireless Communication Test Set.

CAT M1 Band 5 (QPSK 1.4MHZ BANDWIDTH)

Frequency error vs. Voltage

Voltage	Frequency	Frequency*	Frequency	Limit
[Vdc]	[MHz]	Error[Hz]	Error[ppm]	[ppm]
3.4	836.5	-12.51	-0.014955	2.5
3.8	836.5	-12.11	-0.014477	2.5
4.3	836.5	-12.71	-0.015194	2.5

Frequency error vs. Temperature

Temperature	Frequency	Frequency*	Frequency	Limit
[°C]	[MHz]	Error[Hz]	Error[ppm]	[ppm]
Normal (25°C)	836.5	-12.21	-0.014597	2.5
Extreme (50°C)	836.5	-13.21	-0.015792	2.5
Extreme (40°C)	836.5	-12.71	-0.015194	2.5
Extreme (30°C)	836.5	-12.51	-0.014955	2.5
Extreme (10°C)	836.5	-12.41	-0.014836	2.5
Extreme (0°C)	836.5	-11.31	-0.013521	2.5
Extreme (-10°C)	836.5	-12.91	-0.015433	2.5
Extreme (-20°C)	836.5	-15.71	-0.018781	2.5
Extreme (-30°C)	836.5	-16.91	-0.020215	2.5

***Note:** Frequency error measurements were made by using the build-in capability of the Wireless Communication Test Set.

CAT M1 Band 5 (16QAM 1.4MHZ BANDWIDTH)

Frequency error vs. Voltage

Voltage	Frequency	Frequency*	Frequency	Limit
[Vdc]	[MHz]	Error[Hz]	Error[ppm]	[ppm]
3.4	836.5	-12.91	-0.015433	2.5
3.8	836.5	-13.11	-0.015672	2.5
4.3	836.5	-13.51	-0.016151	2.5

Frequency error vs. Temperature

Temperature	Frequency	Frequency*	Frequency	Limit
[°C]	[MHz]	Error[Hz]	Error[ppm]	[ppm]
Normal (25°C)	836.5	-13.41	-0.016031	2.5
Extreme (50°C)	836.5	-14.51	-0.017346	2.5
Extreme (40°C)	836.5	-14.51	-0.017346	2.5
Extreme (30°C)	836.5	-13.71	-0.016390	2.5
Extreme (10°C)	836.5	-12.91	-0.015433	2.5
Extreme (0°C)	836.5	-11.91	-0.014238	2.5
Extreme (-10°C)	836.5	-13.71	-0.016390	2.5
Extreme (-20°C)	836.5	-13.51	-0.016151	2.5
Extreme (-30°C)	836.5	-12.41	-0.014836	2.5

***Note:** Frequency error measurements were made by using the build-in capability of the Wireless Communication Test Set.

CAT M1 Band 12 (QPSK 1.4MHZ BANDWIDTH)

Frequency error vs. Voltage

Voltage	Frequency	Frequency*	Frequency	Limit
[Vdc]	[MHz]	Error[Hz]	Error[ppm]	[ppm]
3.4	707.5	-2.51	-0.003548	2.5
3.8	707.5	-3.11	-0.004396	2.5
4.2	707.5	-2.71	-0.003830	2.5

Frequency error vs. Temperature

Temperature	Frequency	Frequency*	Frequency	Limit
[°C]	[MHz]	Error[Hz]	Error[ppm]	[ppm]
Normal (25°C)	707.5	-2.91	-0.004113	2.5
Extreme (50°C)	707.5	-3.71	-0.005244	2.5
Extreme (40°C)	707.5	-3.21	-0.004537	2.5
Extreme (30°C)	707.5	-4.01	-0.005668	2.5
Extreme (10°C)	707.5	-3.41	-0.004820	2.5
Extreme (0°C)	707.5	-0.81	-0.001145	2.5
Extreme (-10°C)	707.5	-3.21	-0.004537	2.5
Extreme (-20°C)	707.5	-2.81	-0.003972	2.5
Extreme (-30°C)	707.5	-3.51	-0.004961	2.5

***Note:** Frequency error measurements were made by using the build-in capability of the Wireless Communication Test Set.

CAT M1 Band 12 (16QAM 1.4MHZ BANDWIDTH)

Frequency error vs. Voltage

Voltage	Frequency	Frequency*	Frequency	Limit
[Vdc]	[MHz]	Error[Hz]	Error[ppm]	[ppm]
3.4	707.5	-8.91	-0.012594	2.5
3.8	707.5	-8.31	-0.011746	2.5
4.2	707.5	-8.51	-0.012028	2.5

Frequency error vs. Temperature

Temperature	Frequency	Frequency*	Frequency	Limit
[°C]	[MHz]	Error[Hz]	Error[ppm]	[ppm]
Normal (25°C)	707.5	-8.21	-0.011604	2.5
Extreme (50°C)	707.5	-9.01	-0.012735	2.5
Extreme (40°C)	707.5	-8.41	-0.011887	2.5
Extreme (30°C)	707.5	-8.51	-0.012028	2.5
Extreme (10°C)	707.5	-8.61	-0.012170	2.5
Extreme (0°C)	707.5	-8.11	-0.011463	2.5
Extreme (-10°C)	707.5	-9.11	-0.012876	2.5
Extreme (-20°C)	707.5	-8.71	-0.012311	2.5
Extreme (-30°C)	707.5	-8.21	-0.011604	2.5

***Note:** Frequency error measurements were made by using the build-in capability of the Wireless Communication Test Set.

CAT M1 Band 13 (QPSK 1.4MHZ BANDWIDTH)

Frequency error vs. Voltage

Voltage	Frequency	Frequency*	Frequency	Limit
[Vdc]	[MHz]	Error[Hz]	Error[ppm]	[ppm]
3.4	782.5	-5.61	-0.007901	2.5
3.8	782.5	-5.01	-0.007056	2.5
4.2	782.5	-4.81	-0.006775	2.5

Frequency error vs. Temperature

Temperature	Frequency	Frequency*	Frequency	Limit
[°C]	[MHz]	Error[Hz]	Error[ppm]	[ppm]
Normal (25°C)	782.5	-5.11	-0.007197	2.5
Extreme (50°C)	782.5	-5.61	-0.007901	2.5
Extreme (40°C)	782.5	-5.11	-0.007197	2.5
Extreme (30°C)	782.5	-5.91	-0.008324	2.5
Extreme (10°C)	782.5	-5.81	-0.008183	2.5
Extreme (0°C)	782.5	-5.91	-0.008324	2.5
Extreme (-10°C)	782.5	-5.01	-0.007056	2.5
Extreme (-20°C)	782.5	-5.51	-0.007761	2.5
Extreme (-30°C)	782.5	-5.41	-0.007620	2.5

***Note:** Frequency error measurements were made by using the build-in capability of the Wireless Communication Test Set.

CAT M1 Band 13 (16QAM 1.4MHZ BANDWIDTH)

Frequency error vs. Voltage

Voltage	Frequency	Frequency*	Frequency	Limit
[Vdc]	[MHz]	Error[Hz]	Error[ppm]	[ppm]
3.4	782.5	-6.91	-0.009732	2.5
3.8	782.5	-7.21	-0.010155	2.5
4.2	782.5	-6.71	-0.009451	2.5

Frequency error vs. Temperature

Temperature	Frequency	Frequency*	Frequency	Limit
[°C]	[MHz]	Error[Hz]	Error[ppm]	[ppm]
Normal (25°C)	782.5	-6.71	-0.009451	2.5
Extreme (50°C)	782.5	-7.81	-0.011000	2.5
Extreme (40°C)	782.5	-7.31	-0.010296	2.5
Extreme (30°C)	782.5	-6.81	-0.009592	2.5
Extreme (10°C)	782.5	-6.91	-0.009732	2.5
Extreme (0°C)	782.5	-7.31	-0.010296	2.5
Extreme (-10°C)	782.5	-7.61	-0.010718	2.5
Extreme (-20°C)	782.5	-7.11	-0.010014	2.5
Extreme (-30°C)	782.5	-7.51	-0.010577	2.5

***Note:** Frequency error measurements were made by using the build-in capability of the Wireless Communication Test Set.

11. Peak-to-Average Ratio

11.1 Description of the PAR Measurement

The peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

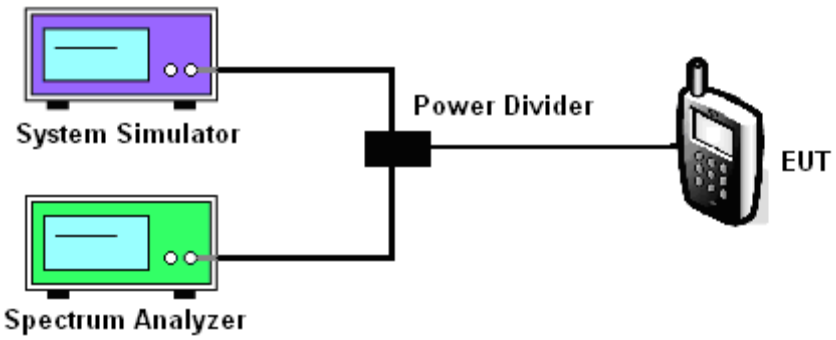
11.2 Measuring Instruments

See list of measuring instruments of this test report.

11.3 Test Procedures

1. The EUT was connected to Spectrum Analyzer and Base Station via power divider.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. For GSM/EGPRS operating modes:
   a. Set the RBW = 1MHz, VBW = 1MHz, Peak detector in spectrum analyzer.
   b. Set EUT in maximum power output, and triggered the burst signal.
   c. Measured respectively the Peak level and Mean level, and the deviation was recorded as Peak to Average Ratio.
4. For UMTS operating modes:
   a. Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
   b. The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.

11.4 Test Setup



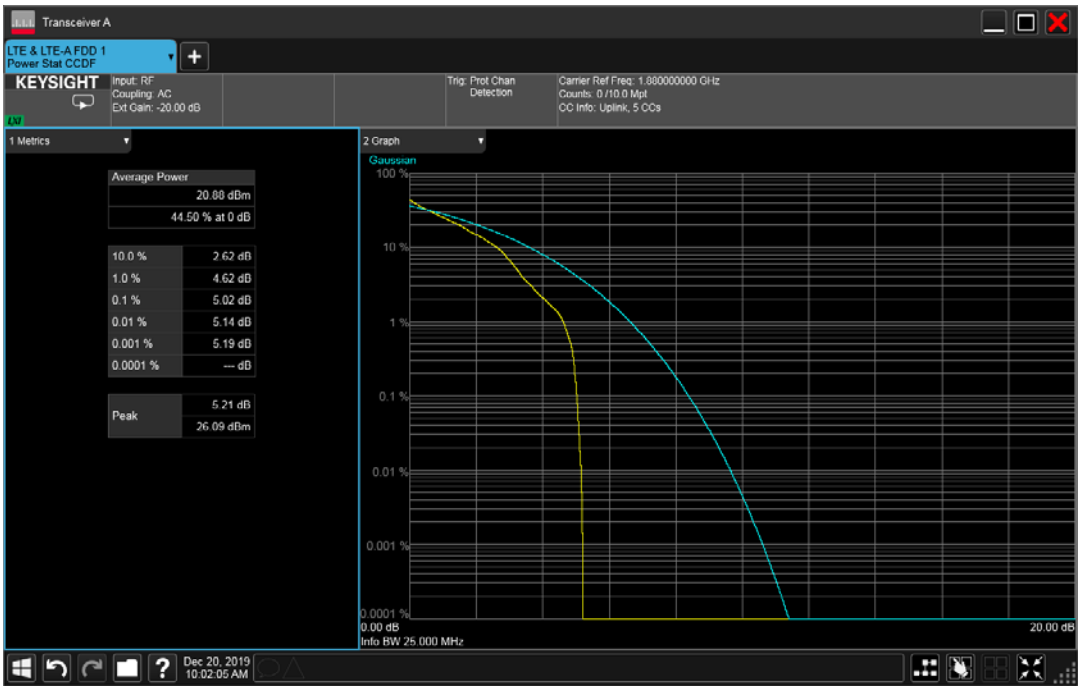
MODES TESTED

CAT M1 Band 2
CAT M1 Band 4
CAT M1 Band 5
CAT M1 Band 12
CAT M1 Band 13

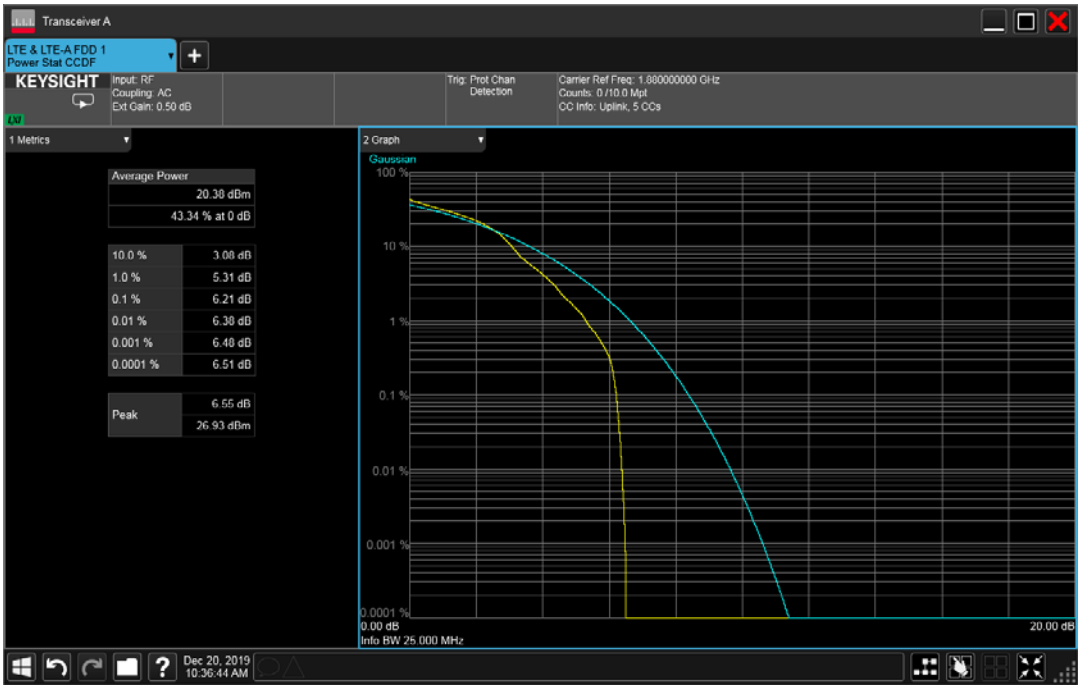
11.5 Test Results

BAND	CHANNEL	Frequency [MHz]	BANDWIDTH	NO. RB	RB POS.	MODULATION	PAR [dB]
2	18900	1880.0	1.4	1	Low	QPSK	5.02
2	18900	1880.0	1.4	1	Low	16-QAM	6.21
2	18900	1880.0	1.4	6	Low	QPSK	5.82
2	18900	1880.0	1.4	6	Low	16-QAM	6.72
4	20175	1732.5	1.4	1	Low	QPSK	5.29
4	20175	1732.5	1.4	1	Low	16-QAM	6.31
4	20175	1732.5	1.4	6	Low	QPSK	5.92
4	20175	1732.5	1.4	6	Low	16-QAM	6.88
5	20525	836.5	1.4	1	Low	QPSK	6.11
5	20525	836.5	1.4	1	Low	16-QAM	6.11
5	20525	836.5	1.4	6	Low	QPSK	6.12
5	20525	836.5	1.4	6	Low	16-QAM	6.10
12	23095	707.5	1.4	1	Low	QPSK	5.68
12	23095	707.5	1.4	1	Low	16-QAM	5.68
12	23095	707.5	1.4	6	Low	QPSK	5.68
12	23095	707.5	1.4	6	Low	16-QAM	5.66
13	23230	782.5	1.4	1	Low	QPSK	5.25
13	23230	782.5	1.4	1	Low	16-QAM	5.42
13	23230	782.5	1.4	6	Low	QPSK	4.74
13	23230	782.5	1.4	6	Low	16-QAM	5.66

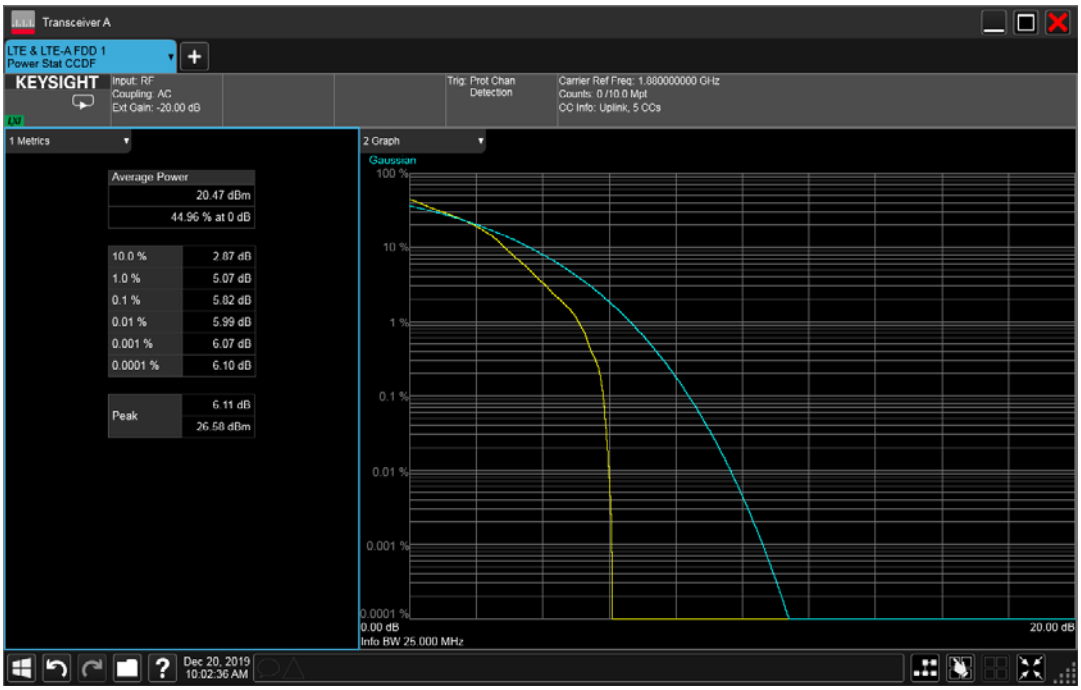
Band 2,UL Channel 18900,UL Frequency 1880.0,BW 1.4,NO. RB 1,RB POS. Low,QPSK



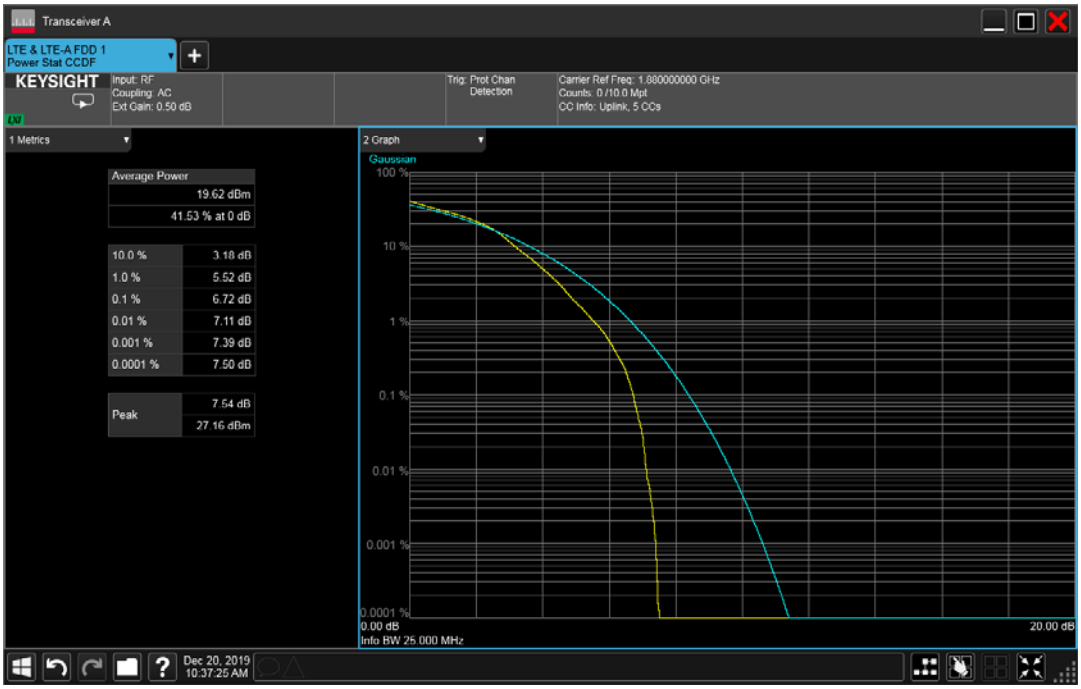
Band 2,UL Channel 18900,UL Frequency 1880.0,BW 1.4,NO. RB 1,RB POS. Low,16QAM



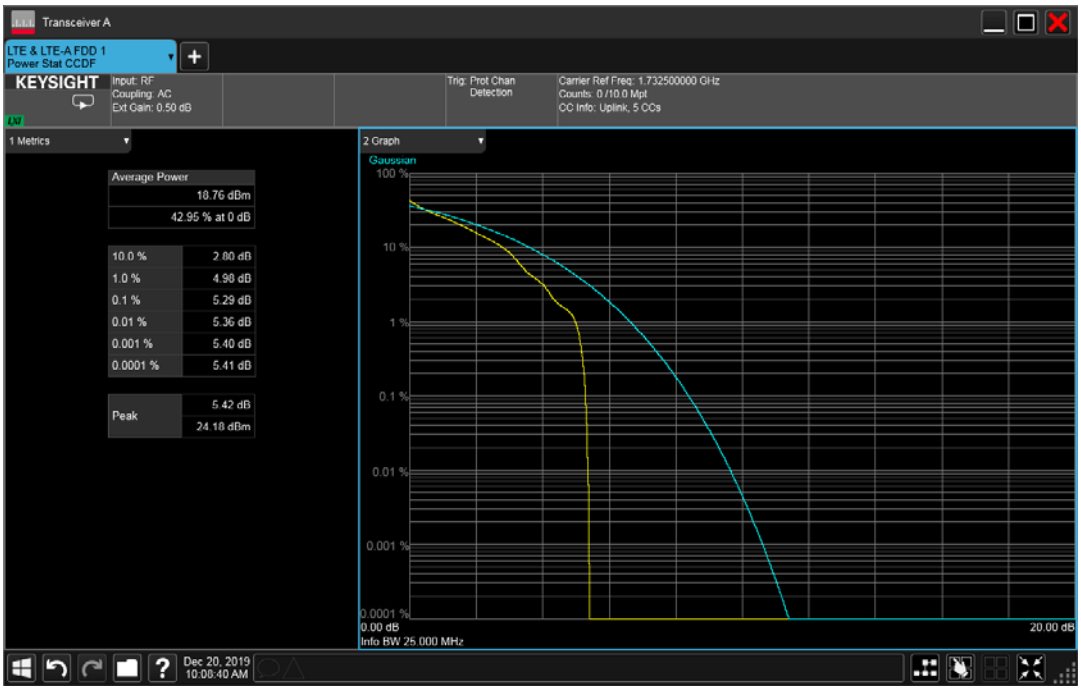
Band 2,UL Channel 18900,UL Frequency 1880.0,BW 1.4,NO. RB 6,RB POS. Low,QPSK



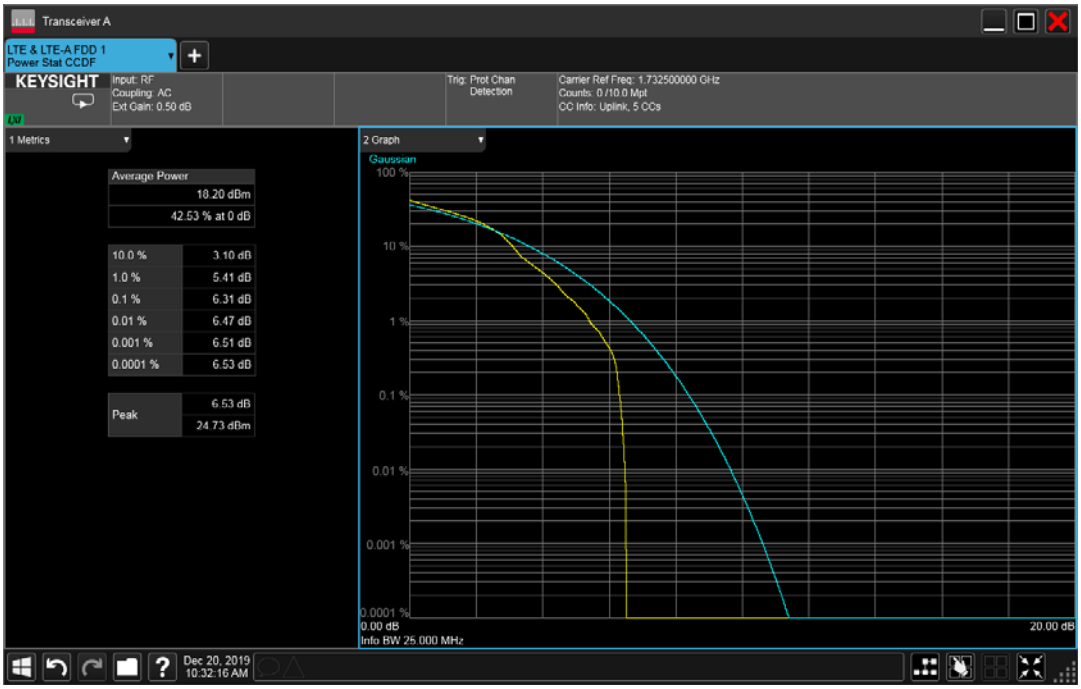
Band 2,UL Channel 18900,UL Frequency 1880.0,BW 1.4,NO. RB 6,RB POS. Low,16QAM



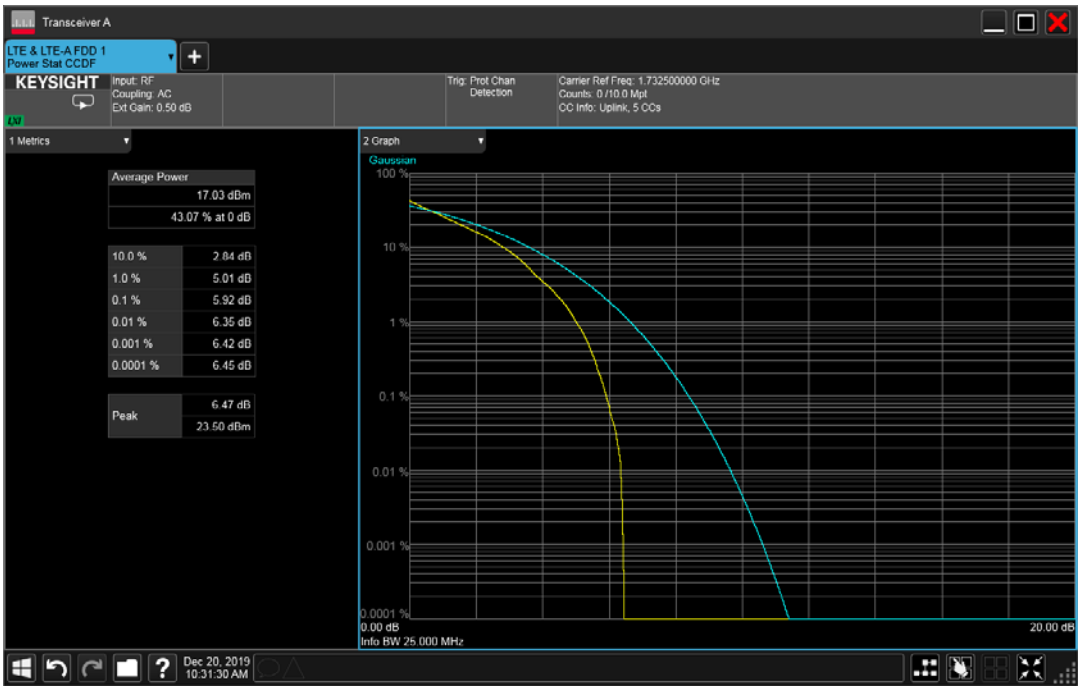
Band 4,UL Channel 20175,UL Frequency 1732.5,BW 1.4,NO. RB 1,RB POS. Low,QPSK



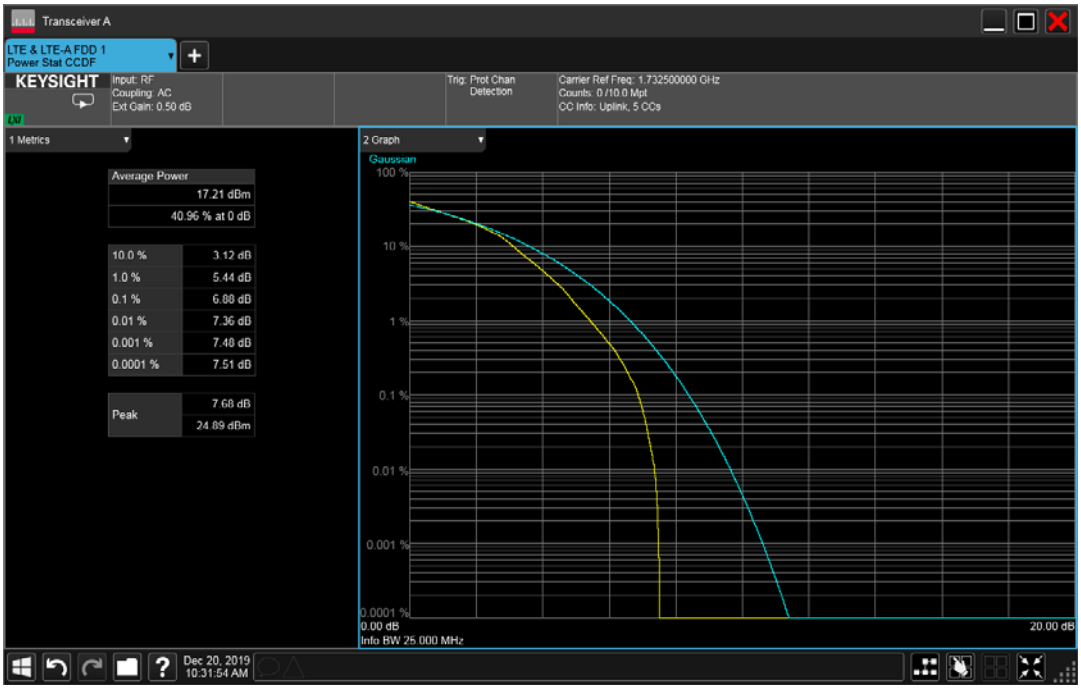
Band 4,UL Channel 20175,UL Frequency 1732.5,BW 1.4,NO. RB 1,RB POS. Low,16QAM



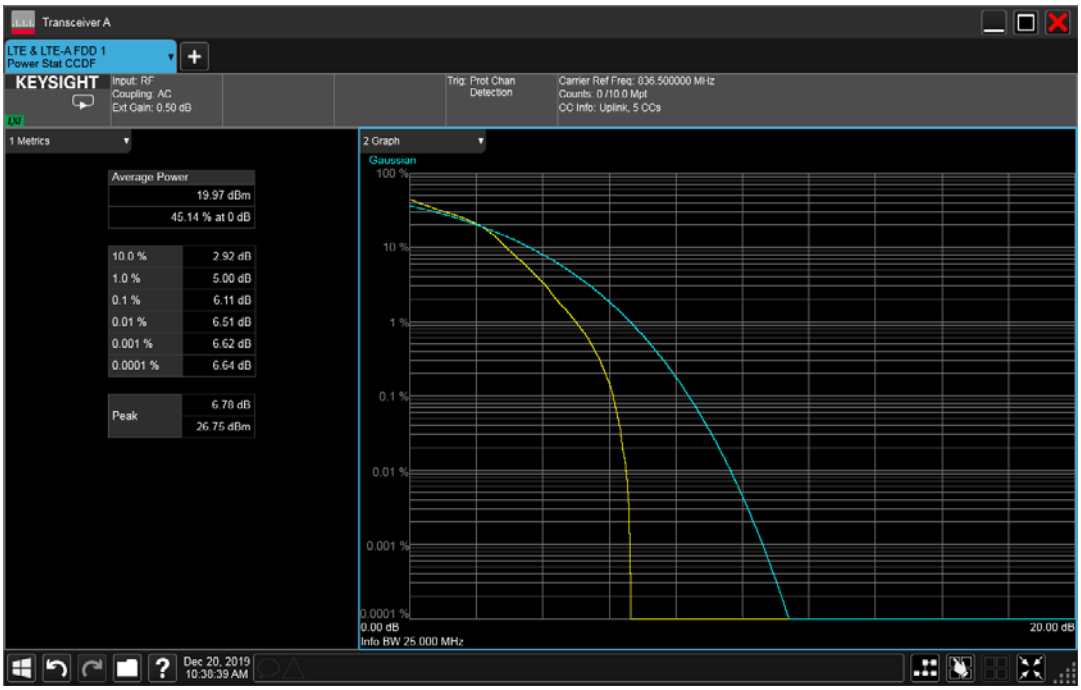
Band 4,UL Channel 20175,UL Frequency 1732.5,BW 1.4,NO. RB 6,RB POS. Low,QPSK



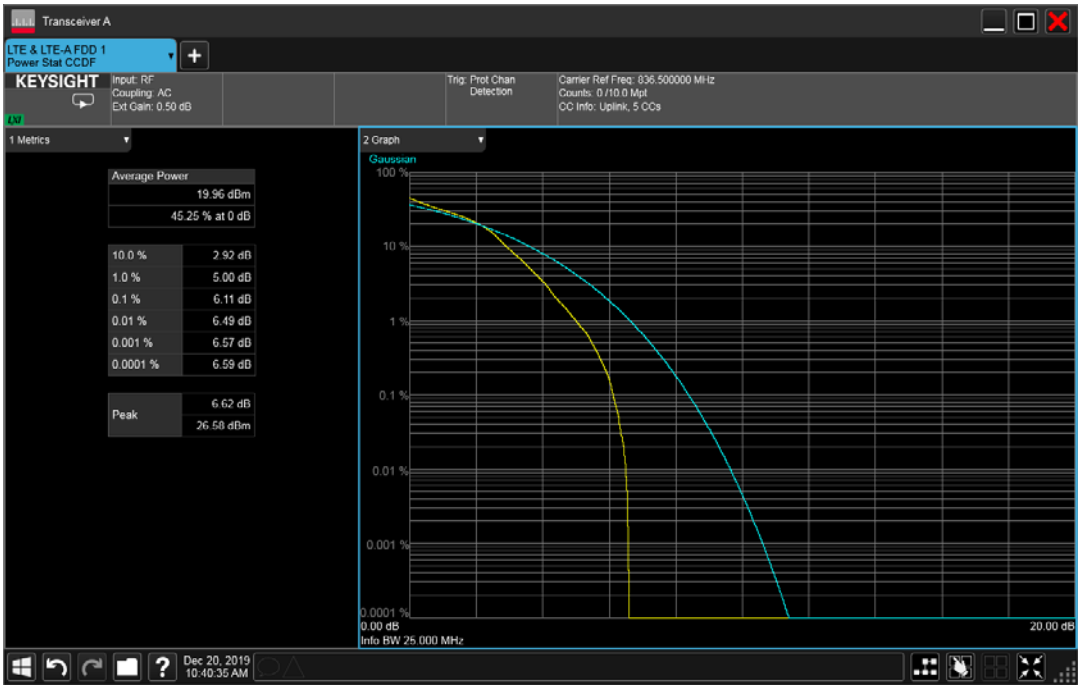
Band 4,UL Channel 20175,UL Frequency 1732.5,BW 1.4,NO. RB 6,RB POS. Low,16QAM



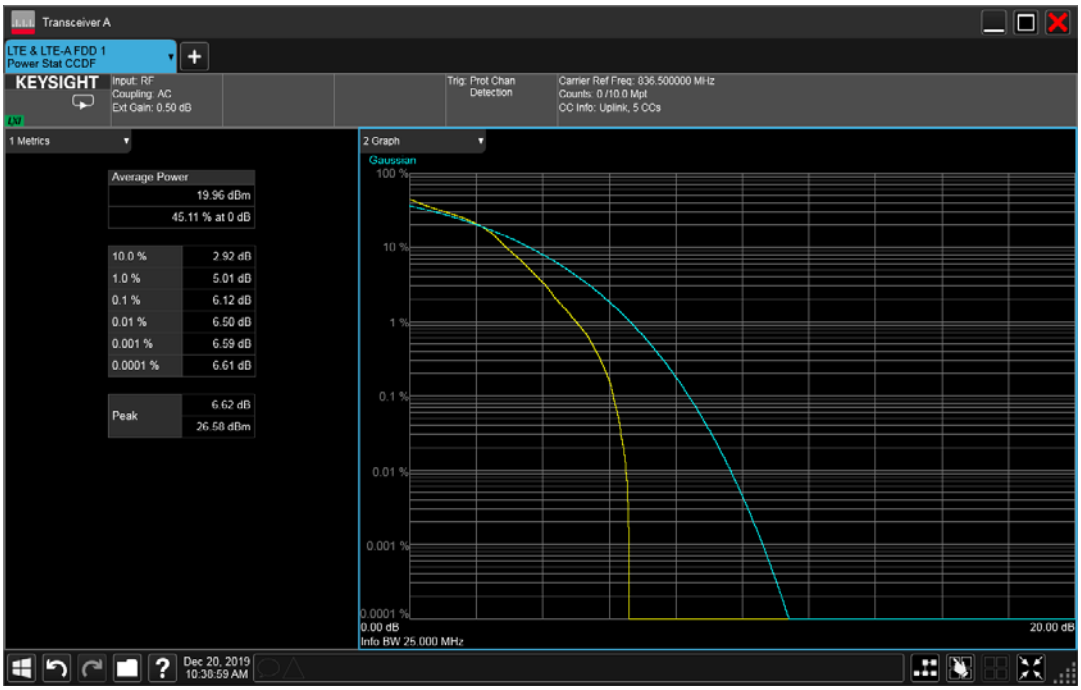
Band 5,UL Channel 20525,UL Frequency 836.5,BW 1.4,NO. RB 1,RB POS. Low,QPSK



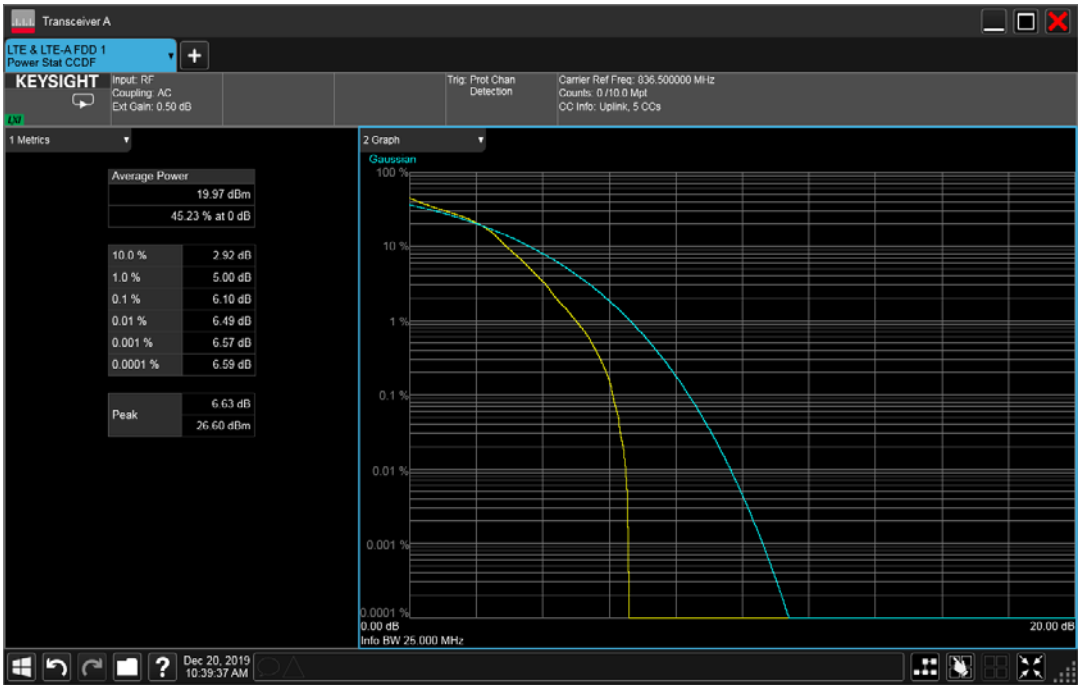
Band 5,UL Channel 20525,UL Frequency 836.5,BW 1.4,NO. RB 1,RB POS. Low,16QAM



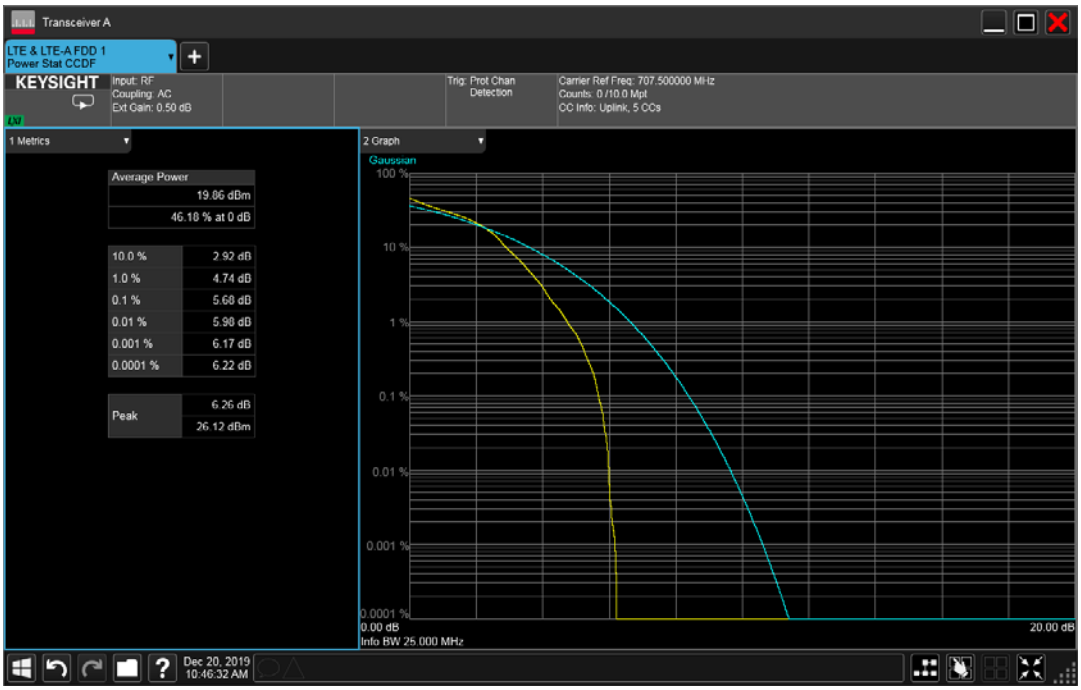
Band 5,UL Channel 20525,UL Frequency 836.5,BW 1.4,NO. RB 6,RB POS. Low,QPSK



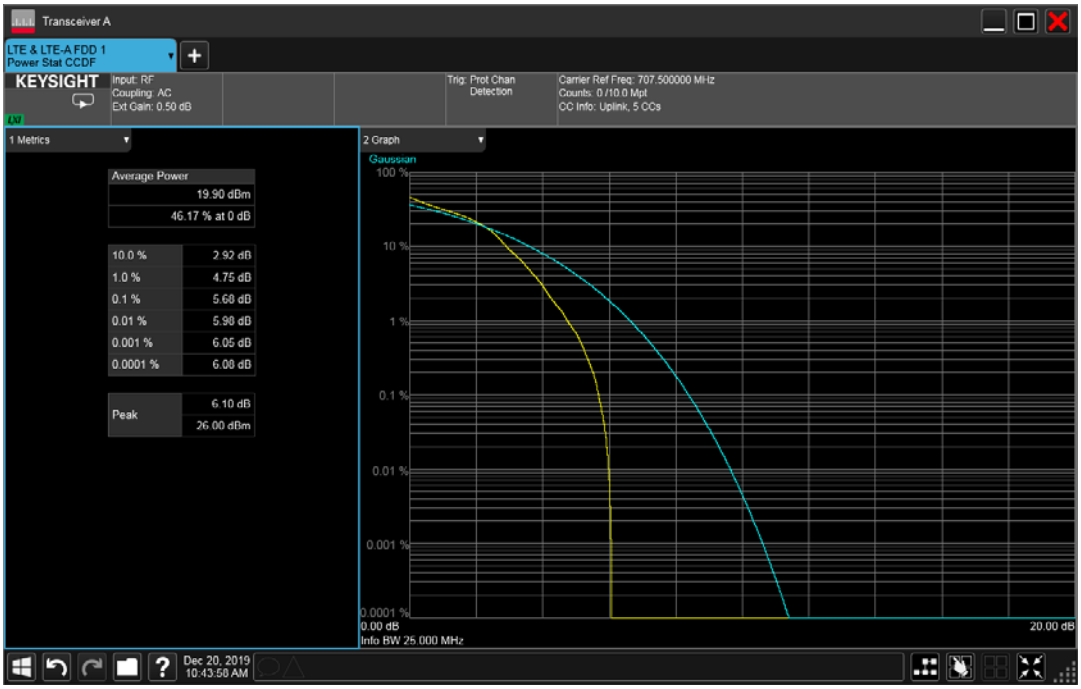
Band 5,UL Channel 20525,UL Frequency 836.5,BW 1.4,NO. RB 6,RB POS. Low,16QAM



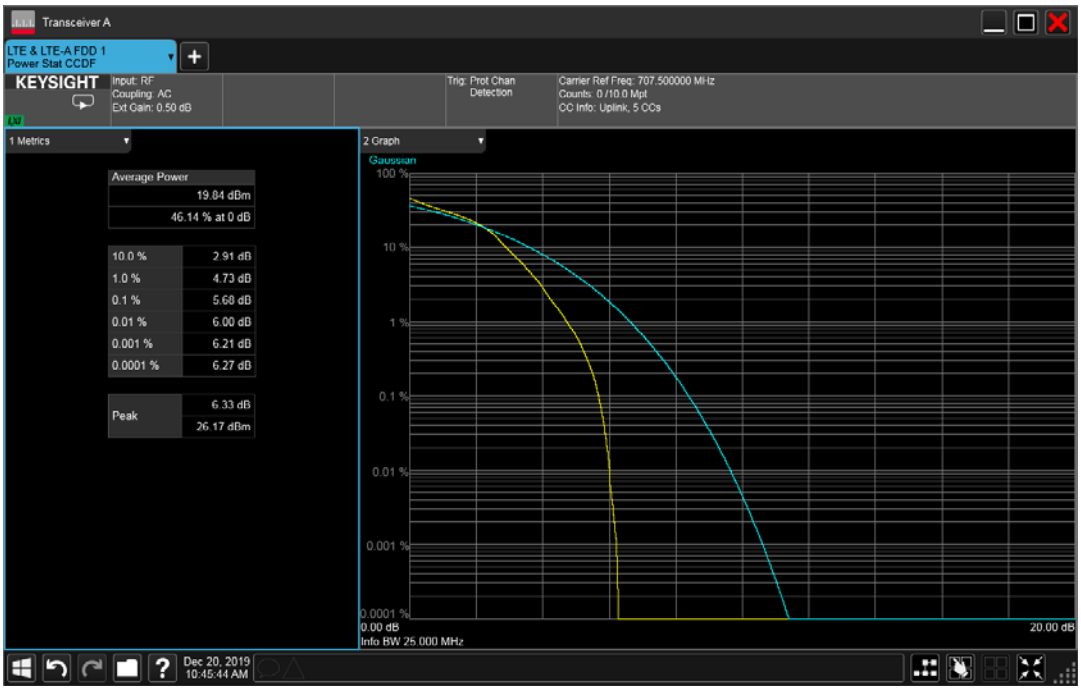
Band 12,UL Channel 23095,UL Frequency 707.5,BW 1.4,NO. RB 1,RB POS. Low,QPSK



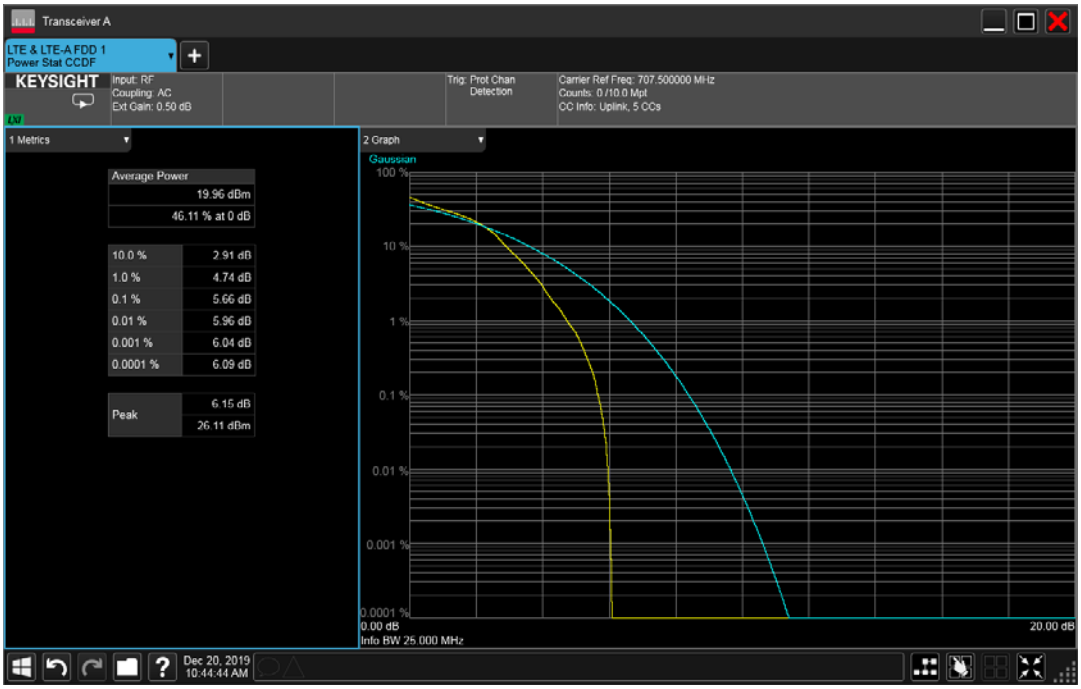
Band 12,UL Channel 23095,UL Frequency 707.5,BW 1.4,NO. RB 1,RB POS. Low,16QAM



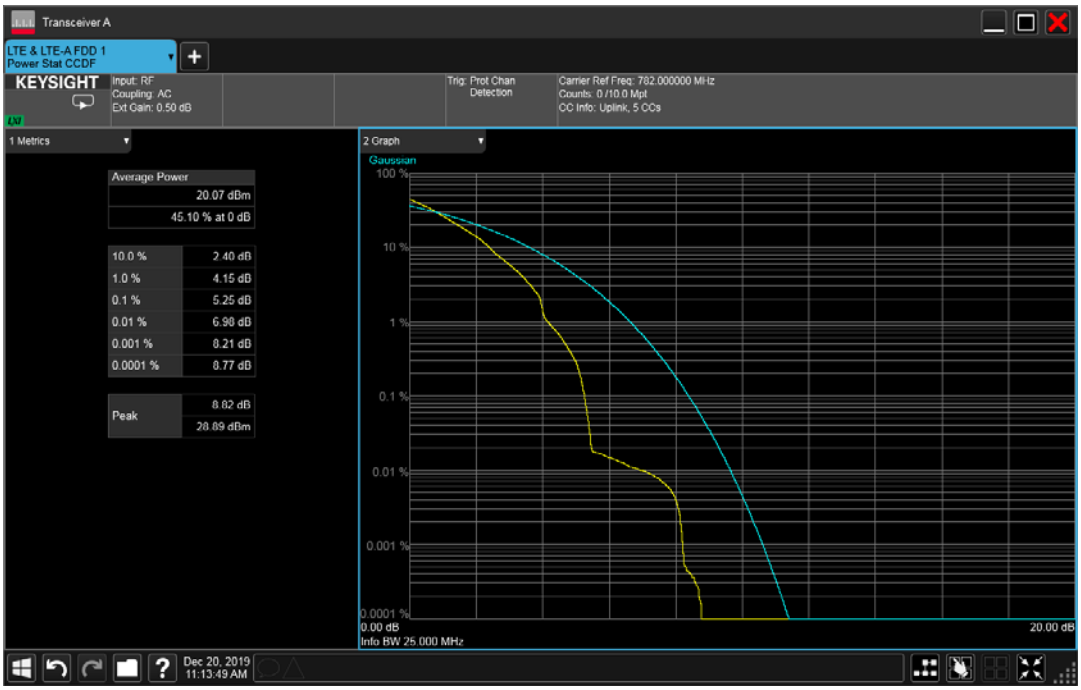
Band 12,UL Channel 23095,UL Frequency 707.5,BW 1.4,NO. RB 6,RB POS. Low,QPSK



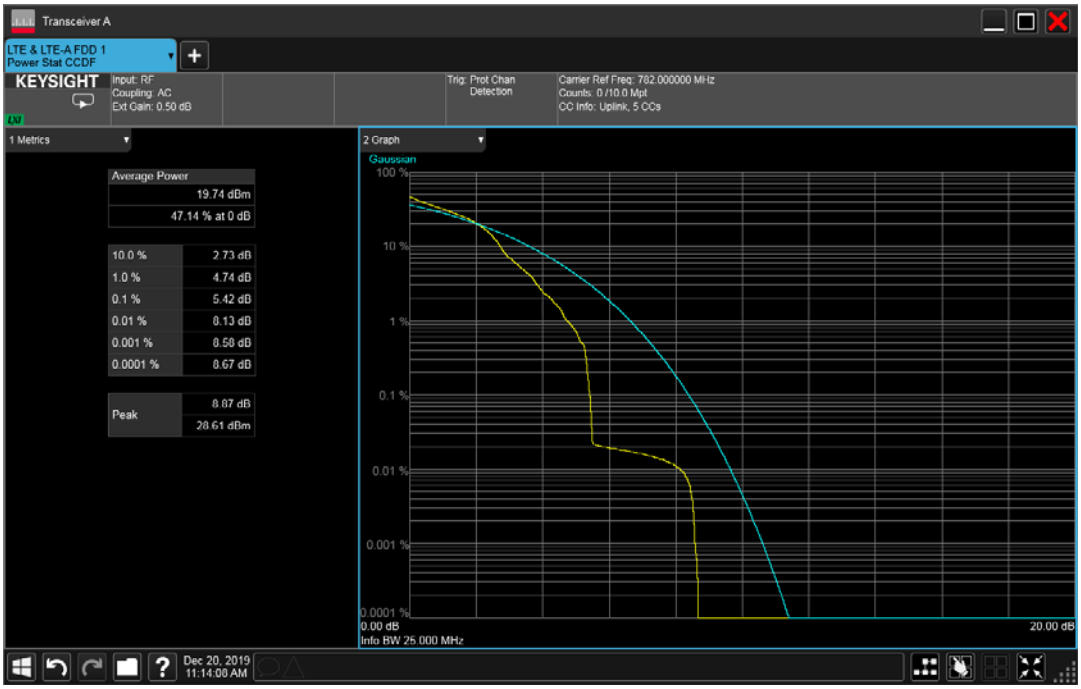
Band 12,UL Channel 23095,UL Frequency 707.5,BW 1.4,NO. RB 6,RB POS. Low,16QAM



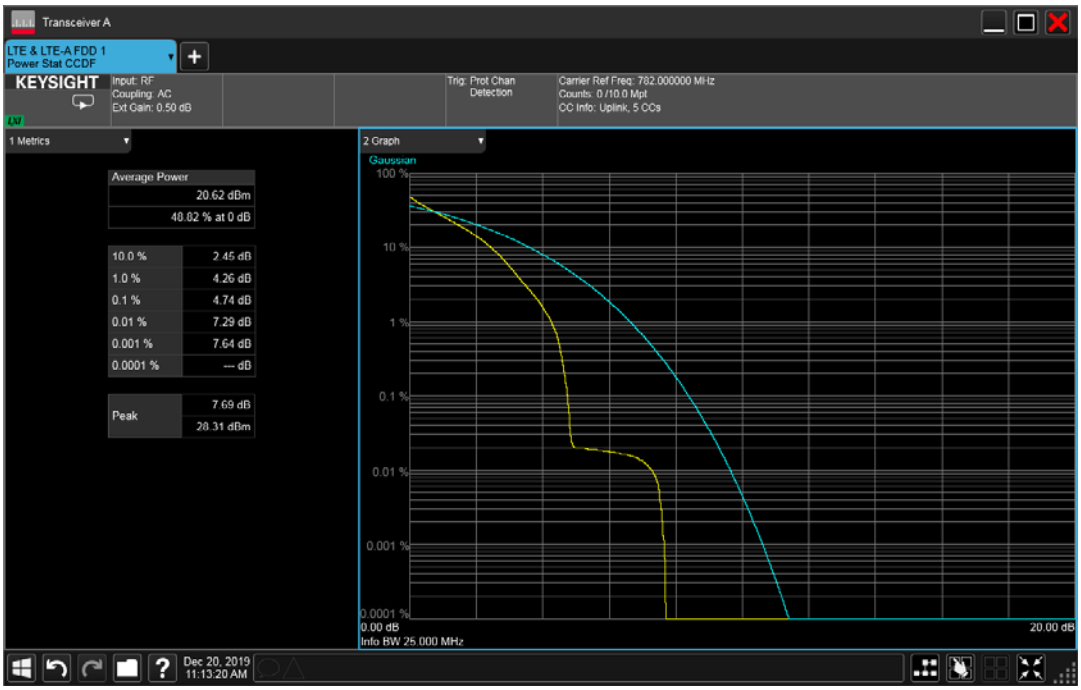
Band 13,UL Channel 23230,UL Frequency 782.5,BW 1.4,NO. RB 1,RB POS. Low,QPSK



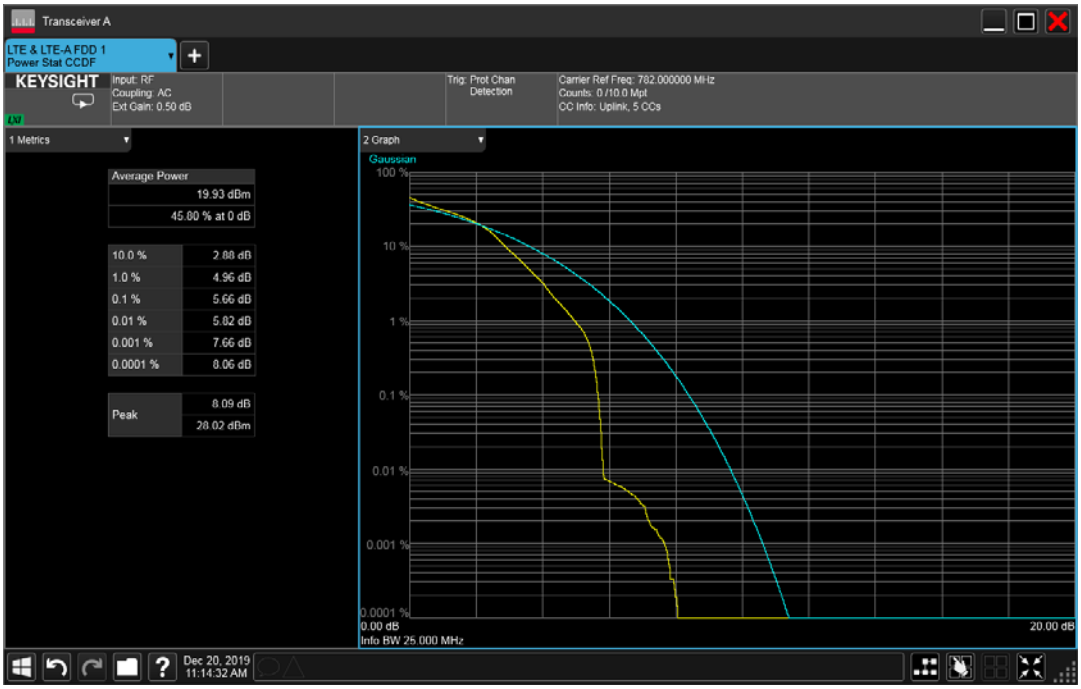
Band 13,UL Channel 23230,UL Frequency 782.5,BW 1.4,NO. RB 1,RB POS. Low,16QAM



Band 13,UL Channel 23230,UL Frequency 782.5,BW 1.4,NO. RB 6,RB POS. Low,QPSK



Band 13,UL Channel 23230,UL Frequency 782.5,BW 1.4,NO. RB 6,RB POS. Low,16QAM



----END OF REPORT----