

TEST REPORT

of

FCC Part 2 Subpart J, Part 22 Subpart C/H,
and Part 27 Subpart C

FCC ID: BEJTA4HEBW2

Equipment Under Test : Car Telematics Device
Model Name : TA4HEB-W
Variant Model Name(s) : TA4HEB-W2, TA4LEN-W, TA4LEN-W2
Applicant : LG Electronics USA
Manufacturer : LG Electronics Inc.
Date of Receipt : 2020.11.16
Date of Test(s) : 2020.01.13 ~ 2021.02.09
Date of Issue : 2021.02.26

In the configuration tested, the EUT complied with the standards specified above. This test report does not assure KOLAS accreditation.

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Tested by:



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SGS Korea Co., Ltd. Gunpo Laboratory

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1. General Information

1.1. Testing Laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)

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- 4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
- Designation number: KR0150

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1.2. Details of Applicant

Applicant : LG Electronics USA

Address : 111 Sylvan Avenue, North Building, Englewood Cliffs, New Jersey, United States, 07632

Contact Person : Kim, Dae-woong

Phone No. : +1 201 266 2215

1.3. Details of Manufacturer

Company : LG Electronics Inc.

Address : 10, Magokjungang 10-ro, Gangseo-gu, Seoul, Korea, 07796

1.4. Description of EUT

Kind of Product	Car Telematics Device
Model Name	TA4HEB-W
Variant Model Name	TA4HEB-W2, TA4LEN-W, TA4LEN-W2
Power Supply	DC 12 V
Rated Power	LTE Band 5, 7, 26: 23 dBm
Frequency Range	LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2 500 MHz ~ 2 570 MHz LTE Band 26: 824 MHz ~ 849 MHz
Emission Designator	LTE Band 7 (5 MHz): 4M50G7D (QPSK) / 4M50D7D (16QAM) LTE Band 7 (10 MHz): 8M94G7D (QPSK) / 8M94D7D (16QAM) LTE Band 7 (15 MHz): 13M5G7D (QPSK) / 13M5D7D (16QAM) LTE Band 7 (20 MHz): 17M9G7D (QPSK) / 17M9D7D (16QAM) LTE Band 26/5 (1.4 MHz): 1M09G7D (QPSK) / 1M09D7D (16QAM) LTE Band 26/5 (3 MHz): 2M67G7D (QPSK) / 2M68D7D (16QAM) LTE Band 26/5 (5 MHz): 4M49G7D (QPSK) / 4M50D7D (16QAM) LTE Band 26/5 (10 MHz): 8M94G7D (QPSK) / 8M94D7D (16QAM) LTE Band 26 (15 MHz): 13M5G7D (QPSK) / 13M5D7D (16QAM)
Modulation Technique	QPSK, 16QAM, 64QAM
Antenna Type	External antenna
Antenna gain	824 MHz ~ 849 MHz: -0.69 dB i 2 500 MHz ~ 2 570 MHz: 0.99 dB i
H/W Version	Rev.D
S/W Version	V9.1.02

1.5. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due
Signal Generator	R&S	SMR40	100272	Jun. 18, 2020	Annual	Jun. 18, 2021
Signal Generator	R&S	SMBV100A	255834	Jun. 03, 2020	Annual	Jun. 03, 2021
Spectrum Analyzer	R&S	FSV30	103101	Jun. 01, 2020	Annual	Jun. 01, 2021
Spectrum Analyzer	Agilent	N9020A	MY53421758	Sep. 04, 2020	Annual	Sep. 04, 2021
Spectrum Analyzer	Agilent	N9030A	US51350132	Nov. 12, 2020	Annual	Nov. 12, 2021
Mobile Test Unit	R&S	CMW500	144034	Feb. 28, 2020	Annual	Feb. 28, 2021
Mobile Test Unit	Anritsu	MT8821C	6262192291	Oct. 08, 2020	Annual	Oct. 08, 2021
Power Meter	Anritsu	ML2495A	1223004	Jun. 01, 2020	Annual	Jun. 01, 2021
Power Sensor	Anritsu	MA2411B	1207272	Jun. 01, 2020	Annual	Jun. 01, 2021
Temperature Chamber	ESPEC CORP.	PL-1J	15000796	Nov. 06, 2020	Annual	Nov. 06, 2021
High Pass Filter	Wainwright Instrument GmbH	WHKX10-900-1000-18000-40SS	7	Mar. 04, 2020	Annual	Mar. 04, 2021
High Pass Filter	Wainwright Instrument GmbH	WHK3.0/18G-10SS	344	May 18, 2020	Annual	May 18, 2021
High Pass Filter	Wainwright Instrument GmbH	WHK7.5/26.5G-6SS	15	Jun. 05, 2020	Annual	Jun. 05, 2021
Directional Coupler	KRYTAR	152613	122660	Jun. 11, 2020	Annual	Jun. 11, 2021
DC Power Supply	Agilent	U8002A	MY53150029	Jun. 04, 2020	Annual	Jun. 04, 2021
Preamplifier	H.P.	8447F	2944A03909	Aug. 06, 2020	Annual	Aug. 06, 2021
Preamplifier	R&S	SCU 18	10117	Jun. 10, 2020	Annual	Jun. 10, 2021
Preamplifier	MITEQ Inc.	JS44-18004000-35-8P	1546891	May 08, 2020	Annual	May 08, 2021
Test Receiver	R&S	ESU26	100109	Feb. 18, 2020	Annual	Feb. 18, 2021
Loop Antenna	Schwarzbeck Mess-Elektronik	FMZB 1519	1519-039	Aug. 22, 2019	Biennial	Aug. 22, 2021
Bilog Antenna	Schwarzbeck Mess-Elektronik	VULB9163	396	Mar. 21, 2019	Biennial	Mar. 21, 2021
Horn Antenna	R&S	HF906	100326	Feb. 14, 2020	Annual	Feb. 14, 2021
Horn Antenna	R&S	HF907	102270	Feb. 14, 2020	Annual	Feb. 14, 2021
Horn Antenna	Schwarzbeck Mess-Elektronik	BBHA9170	9170-540	Jul. 24, 2019	Biennial	Jul. 24, 2021
Antenna Master	Innco systems GmbH	MM4000	N/A	N.C.R.	N/A	N.C.R.
Turn Table	Innco systems GmbH	DS 1200S	N/A	N.C.R.	N/A	N.C.R.
Controller	Innco systems GmbH	CONTROLLER CO3000-4P	CO3000/963/383 30516/L	N.C.R.	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.4 m)	N/A	N.C.R.	N/A	N.C.R.
Coaxial Cable	RFONE	MWX221-NMSNMS (4 m)	J1023142	Dec. 01, 2020	Semi-annual	Jun. 01, 2021
Coaxial Cable	RFONE	SFX086-NMNM-10M (10 m)	20200324001	Dec. 01, 2020	Semi-annual	Jun. 01, 2021
Coaxial Cable	Rosenberger	LA1-C006-1500	131014 07/20	Aug. 21, 2020	Semi-annual	Feb. 21, 2021
Coaxial Cable	Rosenberger	LA1-C006-1500	131014 10/20	Aug. 21, 2020	Semi-annual	Feb. 21, 2021
Coaxial Cable	Rosenberger	LA1-C006-1500	131014 11/20	Aug. 21, 2020	Semi-annual	Feb. 21, 2021

► Support Equipment

Description	Manufacturer	Model	Serial Number
N/A	-	-	-

1.6. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 2, 22 and 27		
Section	Test Item	Result
§22.913(a)(5) §27.50(h)(2)	E.R.P. / E.I.R.P.	Complied
§22.917(a) §27.53(m)(4)	Spurious Radiated Emission	Complied
§2.1046	Conducted Output Power	Complied
§2.1049	Occupied Bandwidth	Complied
§22.913(d) §27.50(d)(5)	Peak-Average Ratio	Complied
§22.917(a) §27.53(m)(4)	Spurious Emission at Antenna Terminal	Complied
§22.917(a) §27.53(m)(4)	Band Edge	Complied
§2.1055 §22.355 §27.54	Frequency Stability	Complied

1.7. Sample Calculation for Offset

Where relevant, the following sample calculation is provided:

1.7.1. Conducted Test

Offset value (dB) = Directional Coupler (dB) + Cable loss (dB)

1.7.2. Radiation Test

- E.I.R.P. (dB m) = Measured level (dB μ V) + Antenna factor (dB) + Cable loss (dB) + 20 Log D - 104.5; where D is the measurement distance in meters.
- E.R.P (dB m) = E.I.R.P. (dB m) - 2.15 (dB)

1.8. Device Capabilities

This device contains the following capabilities;

LTE Band 26 (814 MHz ~ 849 MHz) overlaps the entire frequency range of LTE Band 5 (824 MHz ~ 849 MHz). Therefore, test data provided in this report covers LTE Band 5 as well as Band 26.

1.9. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty	
Radiated Emission, 9 kHz to 30 MHz	H	± 3.66 dB
	V	± 3.66 dB
Radiated Emission, below 1 GHz	H	± 4.90 dB
	V	± 4.82 dB
Radiated Emission, above 1 GHz	H	± 3.62 dB
	V	± 3.64 dB

Uncertainty figures are valid to a confidence level of 95 %.

1.10. Test Report Revision

Revision	Report Number	Date of Issue	Description
0	F690501-RF-RTL001653	2021.02.09	Initial
1	F690501-RF-RTL001653-1	2021.02.26	Revise variant model name

1.11. Variant model

Model Names	Information
TA4HEB-W	- Basic model
TA4LEN-W	- Same RF module and circuit to basic model, except below. - De-populated to Audio amp, DSP part - De-populated to BUB(Backup battery) part
TA4HEB-W2	- Same to basic model - Model name for Costa Rica, Thailand
TA4LEN-W2	- Same RF module and circuit to basic model, except below. - De-populated to Audio amp, DSP part - De-populated to BUB(Backup battery) part - Model name for Costa Rica, Thailand



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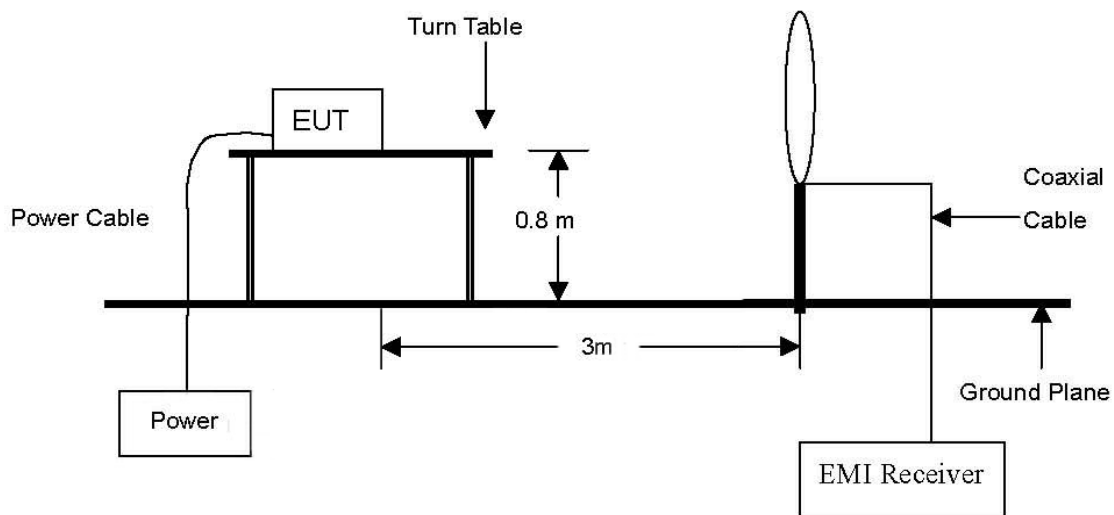
Report Number: F690501-RF-RTL001653-1

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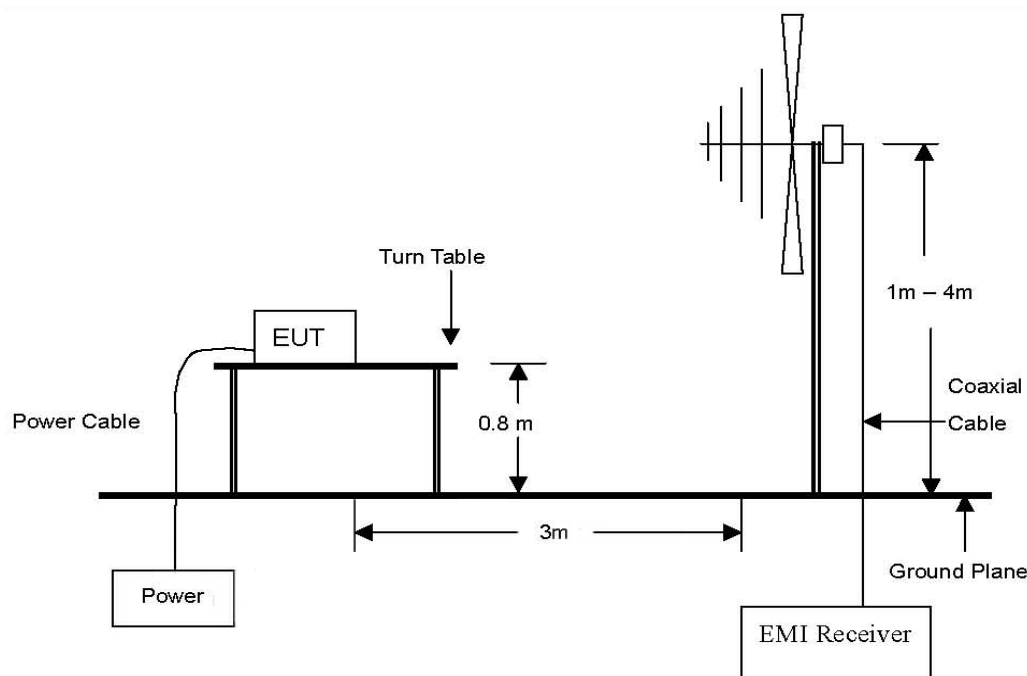
2. Spurious Radiated Emission

2.1. Test Setup

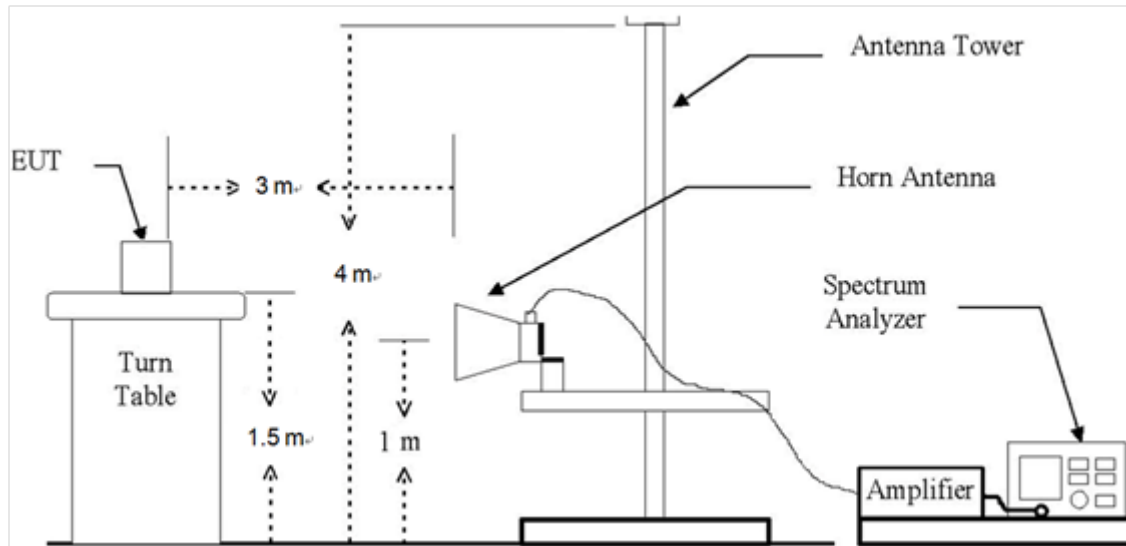
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz.



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to 26 GHz.



2.2. Limit

2.2.1. Limit of E.R.P. / E.I.R.P.

- §22.913(a)(5), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.
- §27.50(h)(2), mobile and other user stations. Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.

2.2.2. Limit of Spurious Radiated Emission

- §22.917(a), 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. 5/26 22h
- §27.53(m)(4), for mobile digital stations, the attenuation factor shall be not less than $40 + 10\log_{10}(P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10\log_{10}(P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10\log_{10}(P)$ dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less than $43 + 10\log_{10}(P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10\log_{10}(P)$ dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees. 7 27c

2.3. Test Procedure: Based on ANSI/TIA 603E: 2016 and ANSI C63.26-2015

1. On a test site, the EUT shall be placed at 0.8 m or 1.5 m height on a turn table, and in the position close to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to correspond to the fundamental frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the peak detector is used for the measurement.
4. The maximized power level is recorded using the spectrum analyzer "Channel Power" function with the integration band set to the emissions occupied bandwidth, RBW = 1-5 % of the OBW (not to exceed 1 MHz), VBW $\geq 3 \times$ RBW, Detector = power averaging (rms), sweep time = auto, trace average at least 100 traces in power averaging (rms) mode, per the guidelines of KDB 971168 D01 Power Meas License Digital Systems v03r01.
5. Radiated spurious emissions measurement method was set as follows:
RBW = 100 kHz for emissions below 1 GHz and 1 MHz for emissions above 1 GHz, VBW $\geq 3 \times$ RBW, Detector = RMS, trace mode = max hold, per the guidelines of ANSI C63.26-2015 and KDB 971168 D01 Power Meas License Digital Systems v03r01.
6. The transmitter shall be switched on, the measuring receiver shall be tuned to the frequency of the transmitter under test.
7. The test antenna shall be raised and lowered through the specified range of height until the maximum signal level is detected by the measuring receiver.
8. The transmitter shall be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
9. The test antenna shall be raised and lowered again through the specified range of height until the maximum signal level is detected by the measuring receiver.
10. The maximum signal level detected by the measuring receiver shall be noted.
11. In necessary, the input attenuator setting on the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
12. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
13. The measurement shall be repeated with the test antenna orientated for horizontal polarization.

2.4. Test Result for E.R.P./E.I.R.P.

Ambient temperature : (23 ± 1) °C
 Relative humidity : 47 % R.H.

Band	Frequency (MHz)	Maximum Conducted Power (dB m)	Maximum Conducted Power (W)	Antenna Gain (dB i)	Maximum E.I.R.P. (dB m)	Maximum E.I.R.P. (W)	Maximum E.R.P. (dB m)	Maximum E.R.P. (W)	Output Power Limit
7	2 500 ~ 2 570	25.50	0.355	0.99	26.49	0.446			2 W E.I.R.P.
26/5	824 ~ 849	25.50	0.355	-0.69	24.81	0.303	22.66	0.185	7 W E.R.P.

Remark;

1. E.I.R.P. (dB m) = Maximum Conducted Power (dB m) + Antenna Gain (dB i)
2. E.R.P. (dB m) = E.I.R.P. (dB m) - 2.15 (dB); where E.R.P. and E.I.R.P. are expressed in consistent units.

2.5. Spurious Radiated Emission

LTE band 7 (5 MHz - QPSK)

Frequency (MHz)	Measured Level (dBμV)	Ant. Pol.	AF (dB/m)	AMP+CL (dB)	E (dBμV/m)	CF (dB)	E.I.R.P. (dB m)	Limit (dB m)	Margin (dB)
Low Channel (2 502.5 MHz)									
5 000.54	46.92	H	33.20	-35.46	44.66	-95.26	-50.60	-25	25.60
5 000.90	48.10	V	33.20	-35.46	45.84	-95.26	-49.42	-25	24.42
7 501.50	47.56	H	36.00	-34.30	49.26	-95.26	-46.00	-25	21.00
7 501.00	42.43	V	36.00	-34.30	44.13	-95.26	-51.13	-25	26.13
Middle Channel (2 535.0 MHz)									
5 065.61	46.90	H	33.26	-35.80	44.36	-95.26	-50.90	-25	25.90
5 065.84	50.69	V	33.26	-35.80	48.15	-95.26	-47.11	-25	22.11
7 598.57	46.21	H	36.00	-33.53	48.68	-95.26	-46.58	-25	21.58
7 598.70	47.94	V	36.00	-33.53	50.41	-95.26	-44.85	-25	19.85
High Channel (2 567.5 MHz)									
5 130.64	46.60	H	33.46	-35.59	44.47	-95.26	-50.79	-25	25.79
5 130.82	50.60	V	33.46	-35.59	48.47	-95.26	-46.79	-25	21.79
7 696.04	44.09	H	35.91	-33.93	46.07	-95.26	-49.19	-25	24.19
7 696.01	47.22	V	35.91	-33.93	49.20	-95.26	-46.06	-25	21.06

* 5 BW 1 RB size / 0 Offset for B7

LTE band 7 (10 MHz - QPSK)

Frequency (MHz)	Measured Level (dBμV)	Ant. Pol.	AF (dB/m)	AMP+CL (dB)	E (dBμV/m)	CF (dB)	E.I.R.P. (dB m)	Limit (dB m)	Margin (dB)
Low Channel (2 505.0 MHz)									
5 001.22	47.54	H	33.20	-35.47	45.27	-95.26	-49.99	-25	24.99
5 001.23	47.88	V	33.20	-35.47	45.61	-95.26	-49.65	-25	24.65
7 501.73	46.86	H	36.00	-34.30	48.56	-95.26	-46.70	-25	21.70
7 501.96	41.38	V	36.00	-34.30	43.08	-95.26	-52.18	-25	27.18
Middle Channel (2 535.0 MHz)									
5 061.06	47.47	H	33.24	-35.78	44.93	-95.26	-50.33	-25	25.33
5 061.11	49.65	V	33.24	-35.78	47.11	-95.26	-48.15	-25	23.15
7 591.85	44.66	H	36.00	-33.59	47.07	-95.26	-48.19	-25	23.19
7 591.61	46.68	V	36.00	-33.60	49.08	-95.26	-46.18	-25	21.18
High Channel (2 565.0 MHz)									
5 121.08	46.62	H	33.44	-35.63	44.43	-95.26	-50.83	-25	25.83
5 121.34	49.63	V	33.44	-35.63	47.44	-95.26	-47.82	-25	22.82
7 681.93	42.64	H	35.94	-33.94	44.64	-95.26	-50.62	-25	25.62
7 681.74	46.33	V	35.94	-33.94	48.33	-95.26	-46.93	-25	21.93

* 10 BW 1 RB size / 0 Offset for B7

LTE band 7 (15 MHz - QPSK)

Frequency (MHz)	Measured Level (dBμV)	Ant. Pol.	AF (dB/m)	AMP+CL (dB)	E (dBμV/m)	CF (dB)	E.I.R.P. (dB m)	Limit (dB m)	Margin (dB)
Low Channel (2 507.5 MHz)									
5 001.68	48.97	H	33.20	-35.48	46.69	-95.26	-48.57	-25	23.57
5 001.76	49.46	V	33.20	-35.48	47.18	-95.26	-48.08	-25	23.08
7 502.47	47.83	H	36.00	-34.30	49.53	-95.26	-45.73	-25	20.73
7 502.29	41.84	V	36.00	-34.30	43.54	-95.26	-51.72	-25	26.72
Middle Channel (2 535.0 MHz)									
5 056.78	47.24	H	33.23	-35.77	44.70	-95.26	-50.56	-25	25.56
5 056.72	50.21	V	33.23	-35.77	47.67	-95.26	-47.59	-25	22.59
7 585.03	46.34	H	36.00	-33.66	48.68	-95.26	-46.58	-25	21.58
7 585.04	48.22	V	36.00	-33.66	50.56	-95.26	-44.70	-25	19.70
High Channel (2 562.5 MHz)									
5 111.60	46.86	H	33.42	-35.68	44.60	-95.26	-50.66	-25	25.66
5 111.66	50.75	V	33.42	-35.68	48.49	-95.26	-46.77	-25	21.77
7 667.32	45.41	H	35.97	-33.96	47.42	-95.26	-47.84	-25	22.84
7 667.39	48.66	V	35.97	-33.96	50.67	-95.26	-44.59	-25	19.59

* 15 BW 1 RB size / 0 Offset for B7

LTE band 7 (20 MHz - QPSK)

Frequency (MHz)	Measured Level (dBμV)	Ant. Pol.	AF (dB/m)	AMP+CL (dB)	E (dBμV/m)	CF (dB)	E.I.R.P. (dB m)	Limit (dB m)	Margin (dB)
Low Channel (2 510.0 MHz)									
5 002.06	48.45	H	33.20	-35.48	46.17	-95.26	-49.09	-25	24.09
5 002.20	50.64	V	33.20	-35.49	48.35	-95.26	-46.91	-25	21.91
7 503.41	47.86	H	36.00	-34.29	49.57	-95.26	-45.69	-25	20.69
7 503.31	42.54	V	36.00	-34.29	44.25	-95.26	-51.01	-25	26.01
Middle Channel (2 535.0 MHz)									
5 052.10	47.72	H	33.21	-35.75	45.18	-95.26	-50.08	-25	25.08
5 052.25	49.00	V	33.21	-35.76	46.45	-95.26	-48.81	-25	23.81
7 578.27	46.38	H	36.00	-33.72	48.66	-95.26	-46.60	-25	21.60
7 578.28	48.92	V	36.00	-33.72	51.20	-95.26	-44.06	-25	19.06
High Channel (2 560.0 MHz)									
5 102.19	46.06	H	33.40	-35.74	43.72	-95.26	-51.54	-25	26.54
5 102.06	50.19	V	33.40	-35.74	47.85	-95.26	-47.41	-25	22.41
7 653.39	47.22	H	35.99	-33.97	49.24	-95.26	-46.02	-25	21.02
7 653.19	48.29	V	35.99	-33.97	50.31	-95.26	-44.95	-25	19.95

* 20 BW 1 RB size / 0 Offset for B7

LTE band 26/5 (1.4 MHz – QPSK)

Frequency (MHz)	Measured Level (dBμV)	Ant. Pol.	AF (dB/m)	AMP+CL (dB)	E (dBμV/m)	CF (dB)	E.R.P. (dB m)	Limit (dB m)	Margin (dB)
Low Channel (824.7 MHz)									
Above 0.009	Not detected	-	-	-	-	-	-	-	-
Middle Channel (836.5 MHz)									
2 508.18	68.10	H	28.30	-39.00	57.40	-97.41	-40.01	-13	27.01
2 508.06	68.89	V	28.30	-39.00	58.19	-97.41	-39.22	-13	26.22
High Channel (848.3 MHz)									
2 543.49	71.61	H	28.30	-38.93	60.98	-97.41	-36.43	-13	23.43
2 543.61	72.84	V	28.30	-38.93	62.21	-97.41	-35.20	-13	22.20

* 1.4 BW 1RB size / 0 Offset for B26/5

LTE band 26/5 (3 MHz – QPSK)

Frequency (MHz)	Measured Level (dBμV)	Ant. Pol.	AF (dB/m)	AMP+CL (dB)	E (dBμV/m)	CF (dB)	E.R.P. (dB m)	Limit (dB m)	Margin (dB)
Low Channel (825.5 MHz)									
Above 0.009	Not detected	-	-	-	-	-	-	-	-
Middle Channel (836.5 MHz)									
2 505.78	67.24	H	28.30	-39.02	56.52	-97.41	-40.89	-13	27.89
2 505.62	67.87	V	28.30	-39.02	57.15	-97.41	-40.26	-13	27.26
High Channel (847.5 MHz)									
2 538.71	70.96	H	28.30	-38.92	60.34	-97.41	-37.07	-13	24.07
2 538.77	72.15	V	28.30	-38.92	61.53	-97.41	-35.88	-13	22.88

* 3 BW 1RB size / 0 Offset for B26/5

LTE band 26/5 (5 MHz – QPSK)

Frequency (MHz)	Measured Level (dBμV)	Ant. Pol.	AF (dB/m)	AMP+CL (dB)	E (dBμV/m)	CF (dB)	E.R.P. (dB m)	Limit (dB m)	Margin (dB)
Low Channel (826.5 MHz)									
Above 0.009	Not detected	-	-	-	-	-	-	-	-
Middle Channel (836.5 MHz)									
2 503.03	66.49	H	28.30	-39.04	55.75	-97.41	-41.66	-13	28.66
2 502.98	67.28	V	28.30	-39.04	56.54	-97.41	-40.87	-13	27.87
High Channel (846.5 MHz)									
2 533.09	70.69	H	28.30	-38.92	60.07	-97.41	-37.34	-13	24.34
2 532.98	72.10	V	28.30	-38.92	61.48	-97.41	-35.93	-13	22.93

* 5 BW 1RB size / 0 Offset for B26/5

LTE band 26/5 (10 MHz – QPSK)

Frequency (MHz)	Measured Level (dBμV)	Ant. Pol.	AF (dB/m)	AMP+CL (dB)	E (dBμV/m)	CF (dB)	E.R.P. (dB m)	Limit (dB m)	Margin (dB)
Low Channel (829.0 MHz)									
Above 0.009	Not detected	-	-	-	-	-	-	-	-
Middle Channel (836.5 MHz)									
2 496.42	65.35	H	28.31	-39.07	54.59	-97.41	-42.82	-13	29.82
2 496.38	64.31	V	28.31	-39.07	53.55	-97.41	-43.86	-13	30.86
High Channel (844.0 MHz)									
2 518.87	68.05	H	28.30	-38.94	57.41	-97.41	-40.00	-13	27.00
2 518.76	68.76	V	28.30	-38.94	58.12	-97.41	-39.29	-13	26.29

* 10 BW 1RB size / 0 Offset for B26/5

LTE band 26 (15 MHz – QPSK)

Frequency (MHz)	Measured Level (dBμV)	Ant. Pol.	AF (dB/m)	AMP+CL (dB)	E (dBμV/m)	CF (dB)	E.R.P. (dB m)	Limit (dB m)	Margin (dB)
Low Channel (831.5 MHz)									
Above 0.009	Not detected	-	-	-	-	-	-	-	-
High Channel (841.5 MHz)									
2 504.95	65.85	H	28.30	-39.02	55.13	-97.41	-42.28	-13	29.28
2 504.52	68.22	V	28.30	-39.03	57.49	-97.41	-39.92	-13	26.92

* 15 BW 1RB size / 0 Offset for B26

Remark;

1. $E \text{ (dB}\mu\text{V/m)} = \text{Measured Level (dB}\mu\text{V)} + \text{Antenna Factor (dB/m)} + \text{Cable Loss (dB)}$.
2. $E.I.R.P. \text{ (dB m)} = E \text{ (dB}\mu\text{V/m)} + 20 \log D - 104.8$; where D is the measurement distance in meters.
3. $E.R.P. \text{ (dB m)} = E.I.R.P. \text{ (dB m)} - 2.15 \text{ (dB)}$; where E.R.P. and E.I.R.P. are expressed in consistent units.
4. $CF \text{ (dB)} (E.I.R.P.) = 20 \log D - 104.8 - \text{Distance Correction Factor}$
5. $CF \text{ (dB)} (E.R.P.) = 20 \log D - 104.8 - 2.15$.
6. Distance Correction Factor = $20 \log (\text{specific distance} / \text{test distance})$
7. AF = Antenna Factor, CL = Cable Loss, CF = Conversion Factor.

3. Conducted Output Power

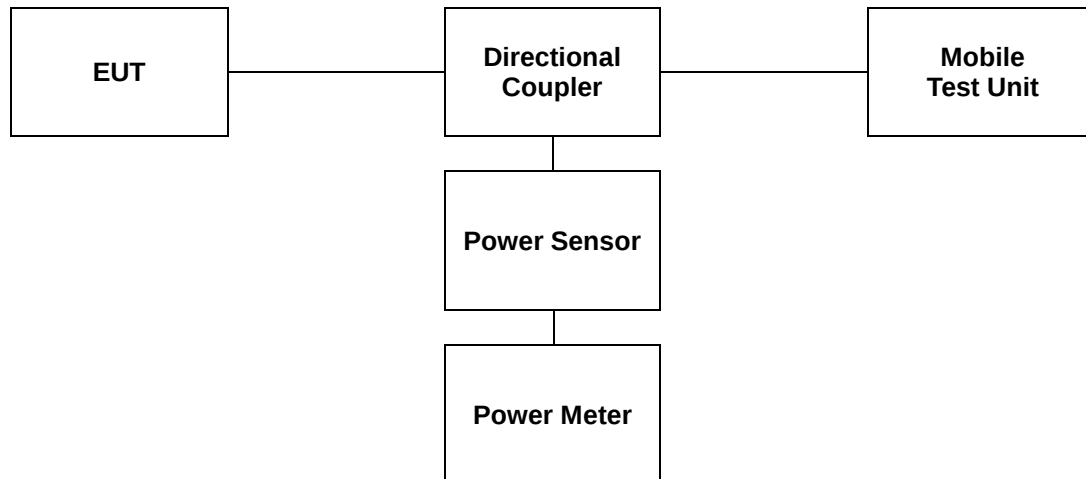
3.1. Limit

CFR 47, Section FCC §2.1046.

3.2. Test Procedure

Output power shall be measured at the RF output terminals for all configurations.

1. The RF output of the transmitter was connected to the input of the mobile test unit in order to establish communication with the EUT.
2. The EUT was set up for the max. output power with pseudo random data modulation by using mobile test unit parameters.
3. The measurement performed using a wideband RF power meter.
4. This EUT was tested under all configurations and the highest power was investigated and reported.



3.3. Test Result

Ambient temperature : (23 ± 1) °C
 Relative humidity : 47 % R.H.

Band	Bandwidth (MHz)	RB Size	RB Offset	Conducted Output Power (dB m)								
				QPSK			16QAM			64QAM		
				20775	21100	21425	20775	21100	21425	20775	21100	21425
				2502.5 (MHz)	2535.0 (MHz)	2567.5 (MHz)	2502.5 (MHz)	2535.0 (MHz)	2567.5 (MHz)	2502.5 (MHz)	2535.0 (MHz)	2567.5 (MHz)
7	5	1	0	23.12	23.17	23.14	22.13	22.33	22.29	22.11	22.24	22.21
		1	12	23.05	23.07	23.10	22.26	22.23	22.19	22.14	22.13	22.11
		1	24	22.92	23.04	23.01	22.02	22.15	22.04	21.91	22.09	22.06
		12	0	21.94	22.04	21.98	20.99	21.04	21.01	20.95	21.01	20.97
		12	7	21.93	22.03	21.99	20.97	21.07	21.00	20.96	21.03	20.96
		12	13	21.90	21.99	21.90	20.91	20.99	20.93	20.88	21.01	20.87
		25	0	21.86	21.99	21.88	20.95	21.01	20.94	20.92	21.06	20.93
	Bandwidth (MHz)	RB Size	RB Offset	20800	21100	21400	20800	21100	21400	20800	21100	21400
				2505.0 (MHz)	2535.0 (MHz)	2565.0 (MHz)	2505.0 (MHz)	2535.0 (MHz)	2565.0 (MHz)	2505.0 (MHz)	2535.0 (MHz)	2565.0 (MHz)
	10	1	0	23.16	23.14	23.12	22.22	22.30	22.25	22.13	22.22	22.18
		1	25	22.95	23.02	23.07	22.18	22.22	22.16	22.02	22.16	22.06
		1	49	22.83	22.85	22.81	22.09	22.05	22.04	21.93	22.01	21.93
		25	0	22.01	22.11	21.97	20.99	21.13	20.98	21.02	21.08	21.00
		25	12	21.98	22.04	22.04	20.95	21.06	21.04	20.95	21.04	21.04
		25	25	21.88	21.96	21.87	20.87	21.01	20.86	20.84	20.96	20.89
		50	0	21.92	22.00	21.98	20.93	21.04	20.93	20.92	21.02	20.91
	Bandwidth (MHz)	RB Size	RB Offset	20825	21100	21375	20825	21100	21375	20825	21100	21375
				2507.5 (MHz)	2535.0 (MHz)	2562.5 (MHz)	2507.5 (MHz)	2535.0 (MHz)	2562.5 (MHz)	2507.5 (MHz)	2535.0 (MHz)	2562.5 (MHz)
	15	1	0	23.74	23.81	23.74	22.90	23.04	22.95	22.80	22.95	22.95
		1	37	23.01	23.08	23.03	22.10	22.25	22.31	21.98	22.20	22.13
		1	74	23.37	23.35	23.40	22.52	22.48	22.60	22.46	22.48	22.42
		36	0	22.29	22.41	22.34	21.25	21.39	21.31	21.21	21.37	21.28
		36	20	22.02	22.13	22.06	21.02	21.16	21.04	21.02	21.11	21.23
		36	39	22.02	22.14	22.18	21.00	21.07	21.10	21.02	21.12	21.14
		75	0	22.19	22.24	22.17	21.14	21.26	21.21	21.16	21.20	21.17
	Bandwidth (MHz)	RB Size	RB Offset	20850	21100	21350	20850	21100	21350	20850	21100	21350
				2510.0 (MHz)	2535.0 (MHz)	2560.0 (MHz)	2510.0 (MHz)	2535.0 (MHz)	2560.0 (MHz)	2510.0 (MHz)	2535.0 (MHz)	2560.0 (MHz)
	20	1	0	24.02	24.18	24.04	23.33	23.37	23.35	23.30	23.22	23.17
		1	50	23.05	23.05	23.04	22.21	22.25	22.31	22.12	22.21	22.19
		1	99	23.63	23.71	23.61	22.84	22.92	22.91	22.74	22.84	22.78
		50	0	22.42	22.49	22.54	21.44	21.50	21.52	21.42	21.50	21.51
		50	25	22.15	22.21	22.19	21.17	21.23	21.20	21.14	21.21	21.15
		50	50	22.24	22.21	22.21	21.23	21.25	21.20	21.25	21.20	21.16
		100	0	22.27	22.35	22.48	21.28	21.38	21.42	21.30	21.34	21.40

Band	Bandwidth (MHz)	RB Size	RB Offset	Conducted Output Power (dB m)								
				QPSK			16QAM			64QAM		
				20407	20525	20643	20407	20525	20643	20407	20525	20643
				824.7 (MHz)	836.5 (MHz)	848.3 (MHz)	824.7 (MHz)	836.5 (MHz)	848.3 (MHz)	824.7 (MHz)	836.5 (MHz)	848.3 (MHz)
26/5	1.4	1	0	22.40	22.46	22.45	21.63	21.66	21.61	21.57	21.63	21.59
		1	3	22.40	22.46	22.44	21.62	21.70	21.68	21.63	21.64	21.63
		1	5	22.41	22.38	22.35	21.69	21.66	21.60	21.53	21.55	21.52
		3	0	22.40	22.45	22.39	21.50	21.48	21.47	21.49	21.52	21.53
		3	2	22.47	22.48	22.44	21.48	21.53	21.53	21.50	21.54	21.57
		3	3	22.41	22.44	22.45	21.43	21.48	21.39	21.51	21.53	21.54
		6	0	21.49	21.49	21.49	20.56	20.53	20.60	20.47	20.46	20.49
	Bandwidth (MHz)	RB Size	RB Offset	20415	20525	20635	20415	20525	20635	20415	20525	20635
				825.5 (MHz)	836.5 (MHz)	847.5 (MHz)	825.5 (MHz)	836.5 (MHz)	847.5 (MHz)	825.5 (MHz)	836.5 (MHz)	847.5 (MHz)
	3	1	0	22.48	22.52	22.56	21.74	21.70	21.68	21.60	21.65	21.59
		1	8	22.58	22.58	22.56	21.77	21.80	21.81	21.65	21.61	21.73
		1	14	22.42	22.53	22.49	21.54	21.62	21.71	21.62	21.61	21.58
		8	0	21.52	21.58	21.55	20.65	20.66	20.66	20.61	20.62	20.60
		8	4	21.47	21.67	21.62	20.59	20.74	20.69	20.55	20.69	20.64
		8	7	21.42	21.59	21.51	20.57	20.65	20.58	20.49	20.62	20.61
		15	0	21.55	21.59	21.55	20.56	20.70	20.62	20.56	20.66	20.55
	Bandwidth (MHz)	RB Size	RB Offset	20425	20525	20625	20425	20525	20625	20425	20525	20625
				826.5 (MHz)	836.5 (MHz)	846.5 (MHz)	826.5 (MHz)	836.5 (MHz)	846.5 (MHz)	826.5 (MHz)	836.5 (MHz)	846.5 (MHz)
	5	1	0	22.58	22.53	22.59	21.73	21.68	21.77	21.57	21.64	21.70
		1	12	22.42	22.48	22.53	21.62	21.70	21.78	21.63	21.59	21.63
		1	24	22.49	22.48	22.54	21.59	21.62	21.63	21.66	21.61	21.57
		12	0	21.59	21.60	21.61	20.63	20.59	20.66	20.61	20.53	20.59
		12	7	21.55	21.73	21.58	20.53	20.74	20.60	20.58	20.67	20.57
		12	13	21.48	21.57	21.57	20.49	20.61	20.53	20.47	20.54	20.50
		25	0	21.53	21.54	21.57	20.57	20.60	20.60	20.52	20.59	20.59
	Bandwidth (MHz)	RB Size	RB Offset	20450	20525	20600	20450	20525	20600	20450	20525	20600
				829.0 (MHz)	836.5 (MHz)	844.0 (MHz)	829.0 (MHz)	836.5 (MHz)	844.0 (MHz)	829.0 (MHz)	836.5 (MHz)	844.0 (MHz)
	10	1	0	22.50	22.43	22.48	21.69	21.62	21.56	21.60	21.50	21.55
		1	25	22.55	22.62	22.61	21.79	21.87	21.63	21.67	21.76	21.68
		1	49	22.30	22.46	22.36	21.50	21.66	21.53	21.34	21.48	21.48
		25	0	21.56	21.78	21.66	20.56	20.58	20.60	20.56	20.58	20.63
		25	12	21.55	21.80	21.71	20.61	20.66	20.62	20.57	20.64	20.62
		25	25	21.51	21.78	21.56	20.52	20.54	20.56	20.56	20.54	20.58
		50	0	21.55	21.80	21.71	20.52	20.57	20.65	20.52	20.60	20.63
26	Bandwidth (MHz)	RB Size	RB Offset	26865	-	26965	26865	-	26965	26865	-	26965
				831.5 (MHz)	-	841.5 (MHz)	831.5 (MHz)	-	841.5 (MHz)	831.5 (MHz)	-	841.5 (MHz)
	15	1	0	22.85	-	22.80	21.84	-	21.97	21.79	-	21.97
		1	37	22.66	-	22.55	21.71	-	21.75	21.71	-	21.78
		1	74	22.69	-	22.63	21.82	-	21.92	21.83	-	21.88
		36	0	21.81	-	21.80	20.75	-	20.78	20.79	-	20.79
		36	20	21.72	-	21.74	20.64	-	20.76	20.65	-	20.69
		36	39	21.69	-	21.71	20.67	-	20.66	20.70	-	20.65
		75	0	21.67	-	21.72	20.72	-	20.65	20.72	-	20.69

4. Occupied Bandwidth

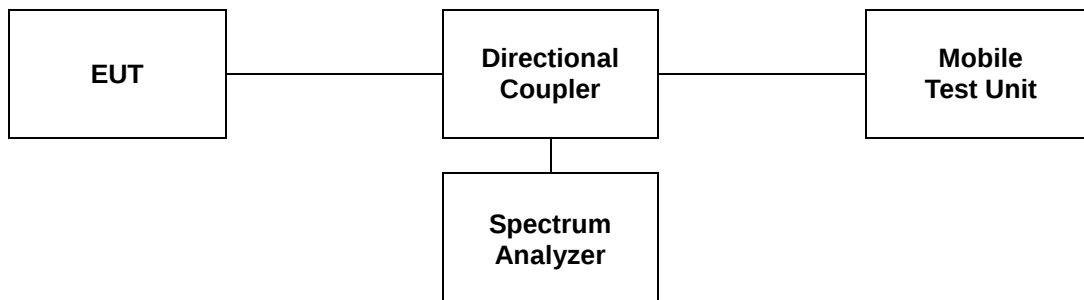
4.1. Limit

CFR 47, Section FCC §2.1049.

4.2. Test Procedure

The test follows section 5.4.4 of ANSI C63.26-2015.

- The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation. products including the emission skirts (typically a span of $1.5 \times \text{OBW}$ is sufficient).
- The nominal IF filter 3 dB bandwidth (RBW) shall be in the range of 1 % to 5 % of the anticipated OBW, and the VBW shall be set $\geq 3 \times \text{RBW}$.
- Set the reference level of the instrument as required to prevent the signal amplitude from exceeding the maximum spectrum analyzer input mixer level for linear operation. See guidance provided in 4.2.3.
- Set the detection mode to peak, and the trace mode to max-hold.
- If the instrument does not have a 99 % OBW function, recover the trace data points and sum directly in linear power terms. Place the recovered amplitude data points, beginning at the lowest frequency, in a running sum until 0.5 % of the total is reached. Record that frequency as the lower OBW frequency. Repeat the process until 99.5 % of the total is reached and record that frequency as the upper OBW frequency. The 99 % power OBW can be determined by computing the difference these two frequencies.
- The OBW shall be reported and plot(s) of the measuring instrument display shall be provided with the test report. The frequency and amplitude axis and scale shall be clearly labeled. Tabular data can be reported in addition to the plot(s).



4.3 Test Results

Ambient temperature : (23 ± 1) °C
 Relative humidity : 47 % R.H.

Band	Bandwidth (MHz)	Frequency (MHz)	Occupied Bandwidth (MHz)	
			QPSK	16QAM
7	5	2 535.0	4.501	4.501
	10		8.944	8.944
	15		13.502	13.459
	20		17.887	17.945

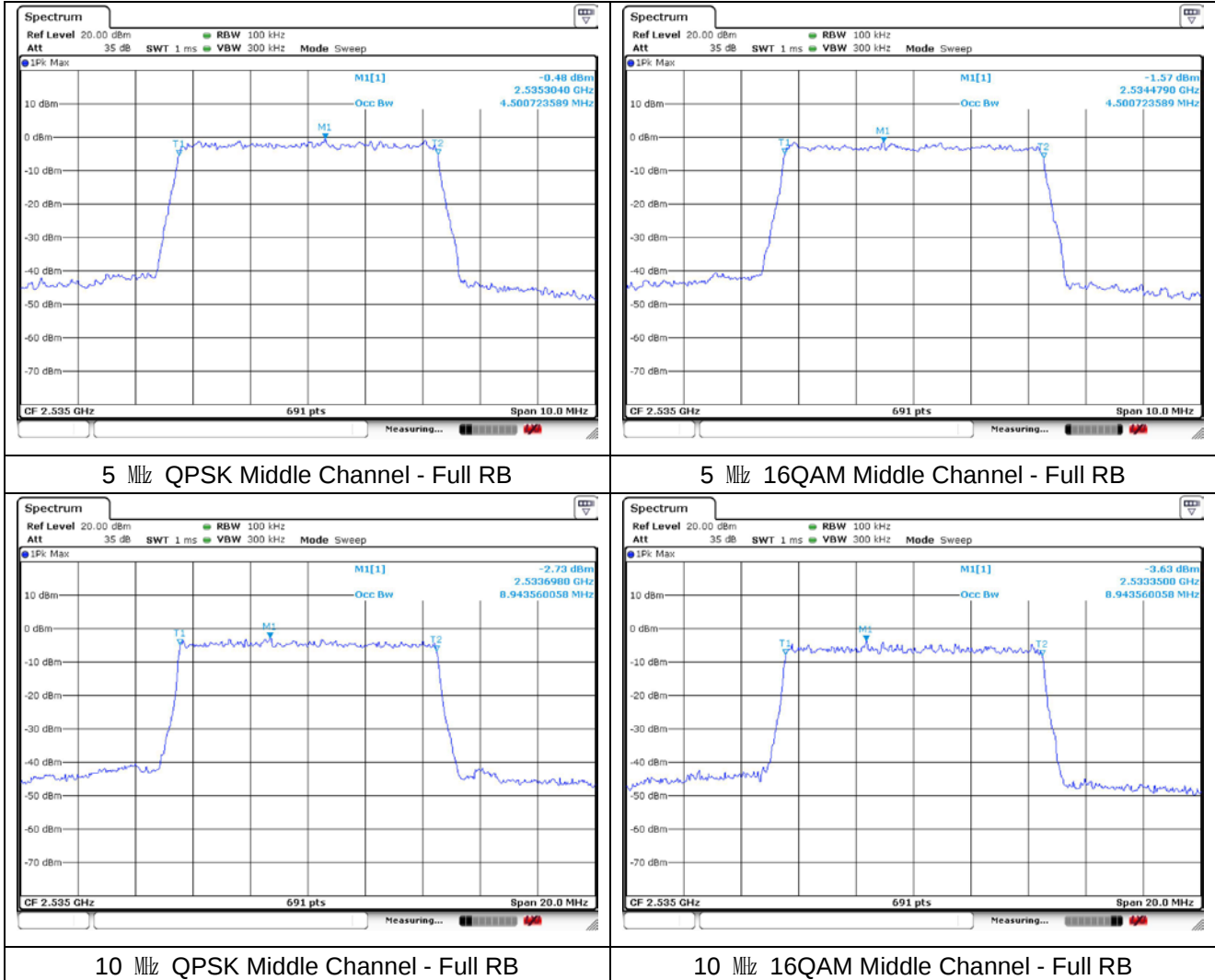
Band	Bandwidth (MHz)	Frequency (MHz)	Occupied Bandwidth (MHz)	
			QPSK	16QAM
26/5	1.4	836.5	1.090	1.085
	3		2.674	2.683
	5		4.486	4.501
	10		8.944	8.944
26	15	831.5	13.502	13.459

Note;

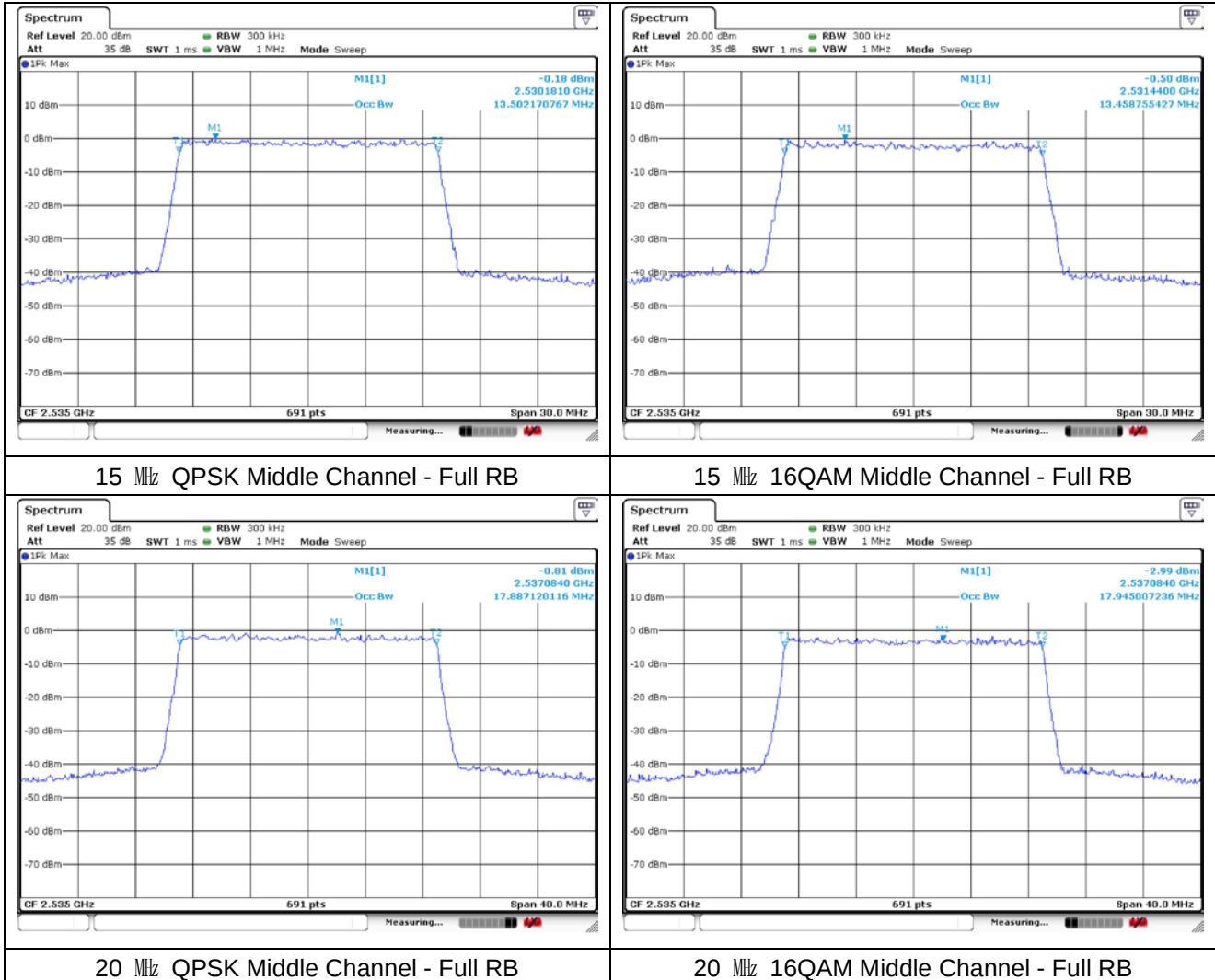
There is no limit required and power is the same for low, middle and high channel; therefore, all channels were tested but only middle channel was reported.

- Test plots

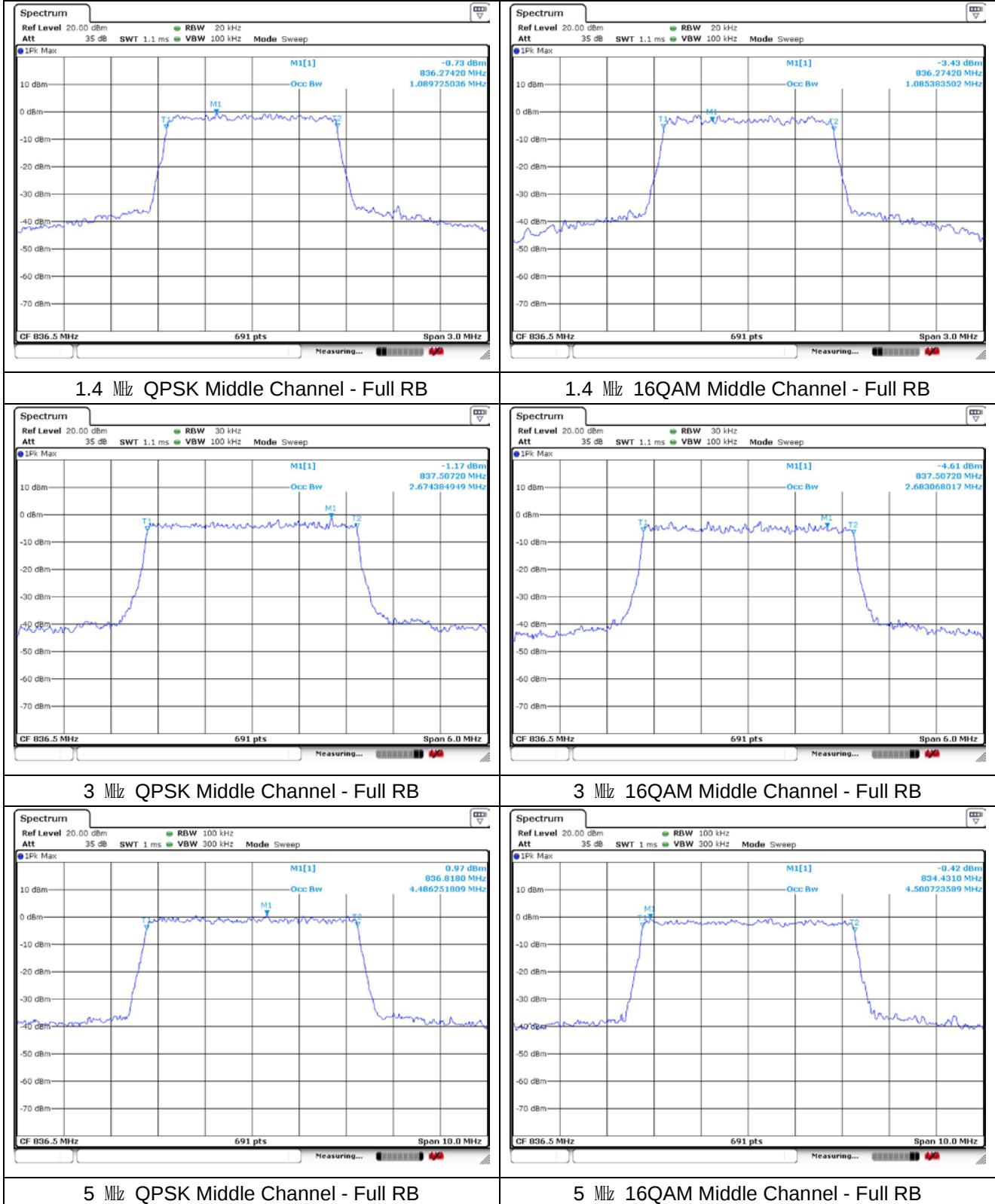
LTE band 7



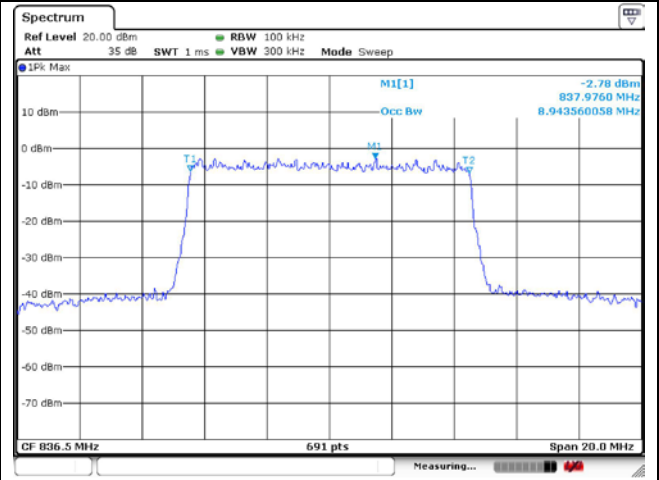
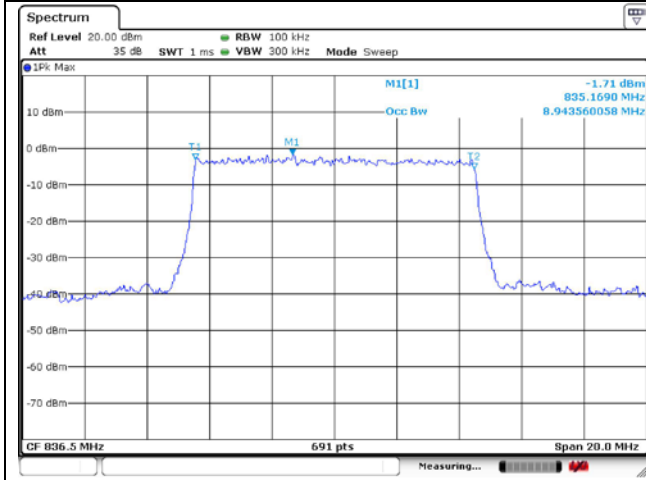
LTE band 7



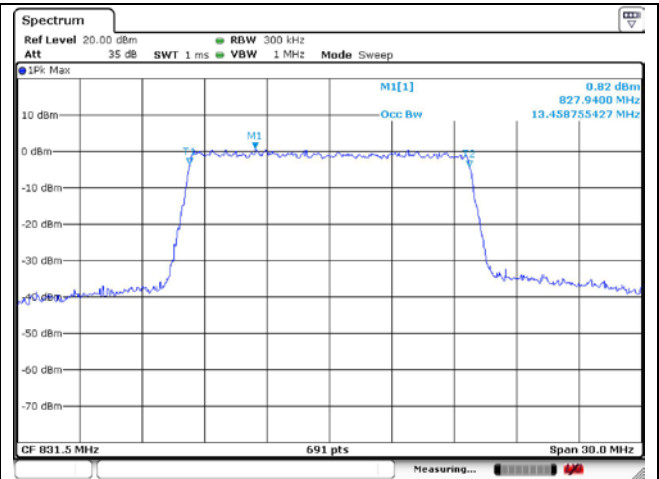
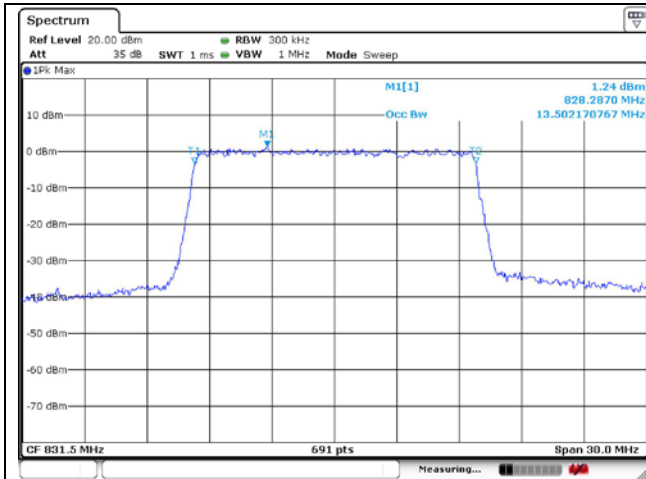
LTE band 26/5



LTE band 26/5



LTE band 26



5. Peak-Average Ratio

5.1. Limit

- §22.913(d) Measurement of the ERP of Cellular base transmitters and repeaters must be made using an average power measurement technique. The peak-to-average ratio (PAR) of the transmission must not exceed 13 dB.

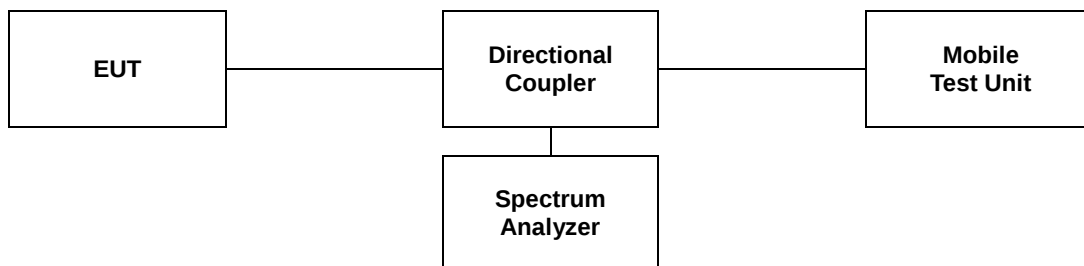
- §27.50(d)(5), power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (d)(6) of this section. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

5.2. Test Procedure

The test follows section 5.2.3.4 of ANSI C63.26-2015.

See instrumentation-specific application literature for further guidance regarding use of the CCDF capability. The following guidelines are offered for performing a CCDF measurement.

- a. Set resolution/measurement bandwidth $\geq$ OBW or specified reference bandwidth.
- b. Set the number of counts to a value that stabilizes the measured CCDF curve.
- c. Set the measurement interval as follows:
 - 1) For continuous transmissions, set to greater of $[10 \times (\text{number of points in sweep}) \times (\text{transmission symbol period})]$ or 1 ms.
 - 2) For burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize. Set the measurement interval to a time that is less than or equal to the burst duration.
 - 3) If there are several carriers in a single antenna port, the peak power shall be determined for each individual carrier (by disabling the other carriers while measuring the required carrier) and the total peak power calculated from the sum of the individual carrier peak powers.
- d. Record the maximum PAPR level associated with a probability of 0.1 %.
- e. The peak power level is calculated from the sum of the PAPR value from step d) to the measured average power.



5.3 Test Results

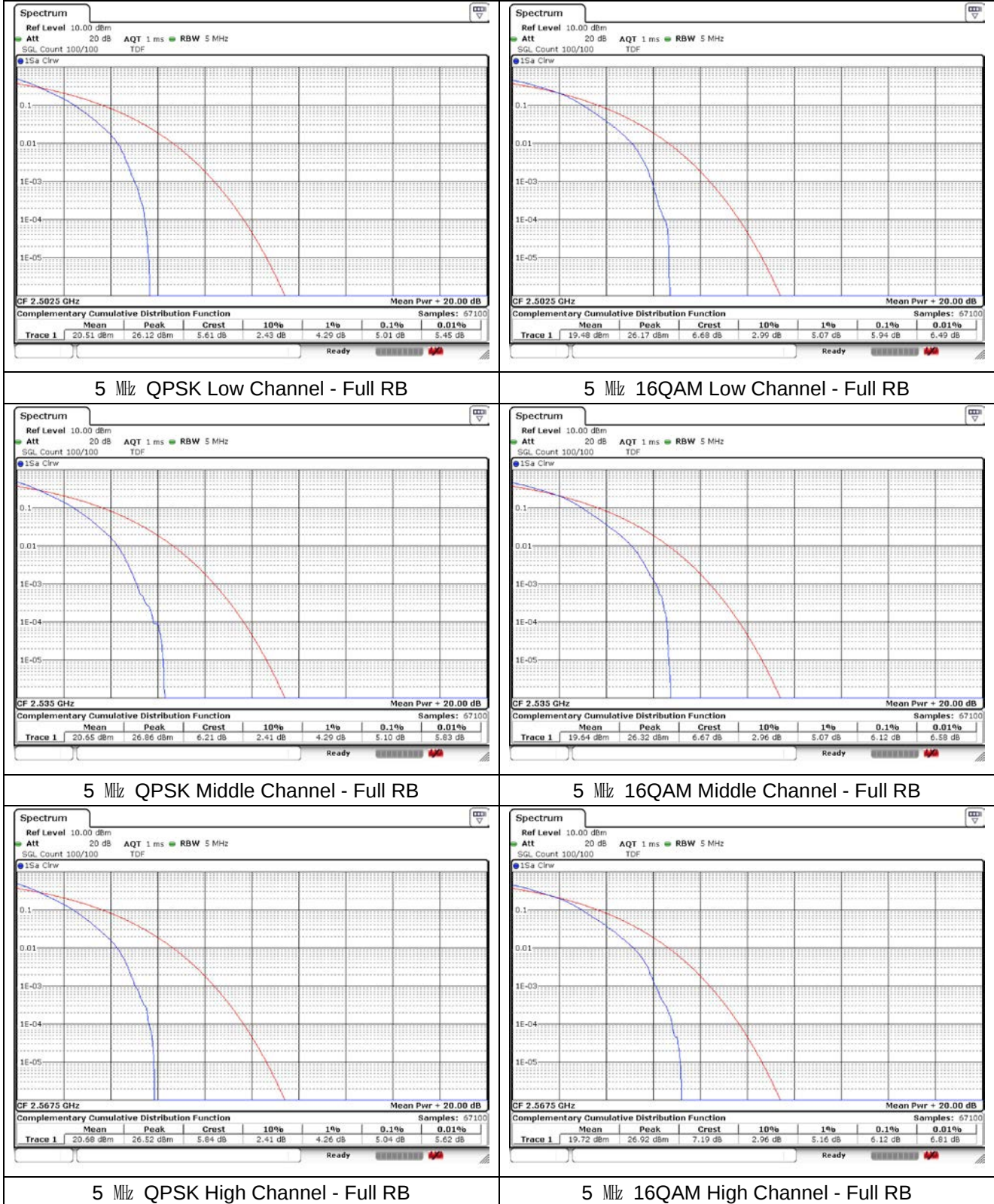
Ambient temperature : (23 ± 1) °C
 Relative humidity : 47 % R.H.

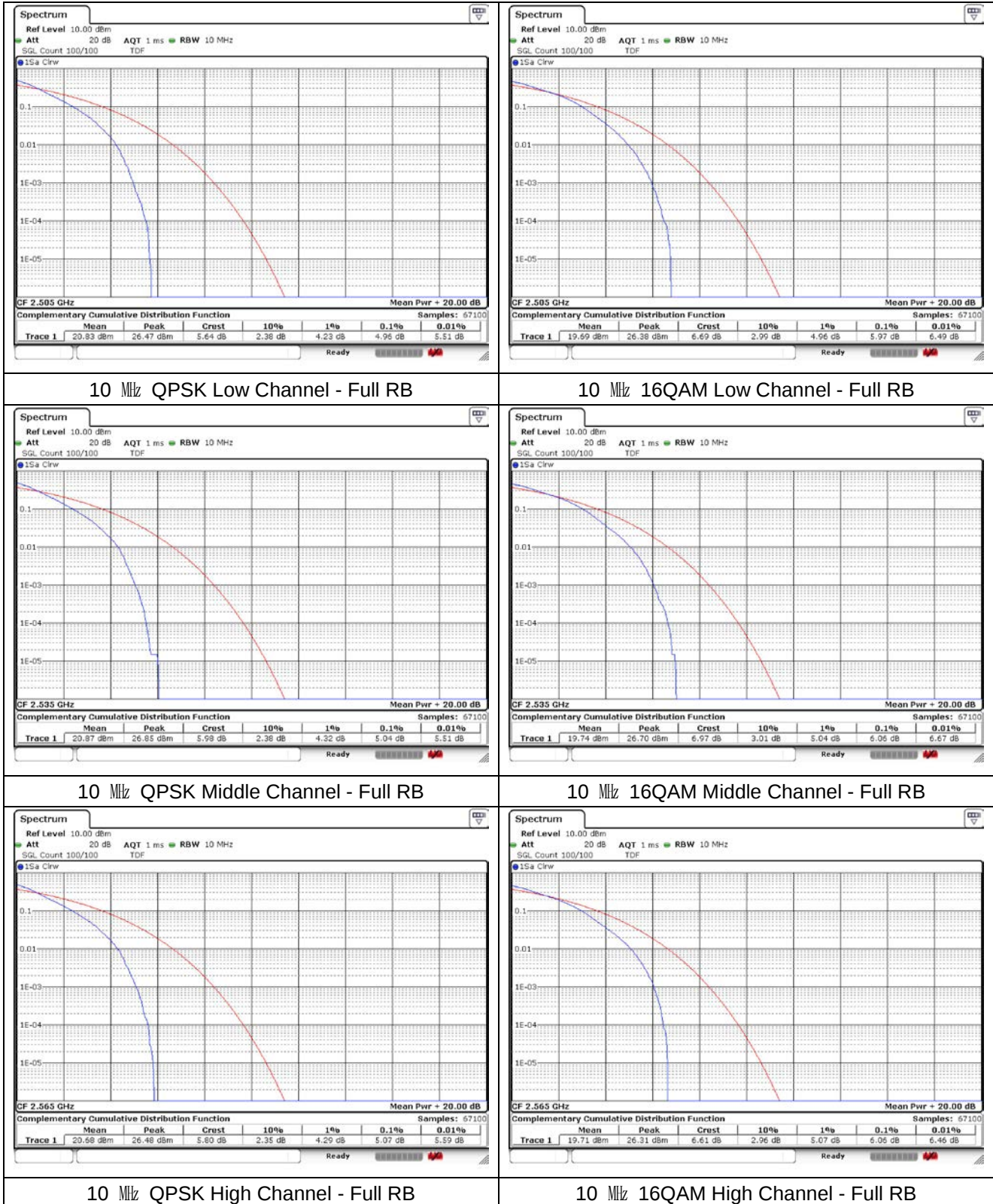
Band	Bandwidth (MHz)	Frequency (MHz)	PAR (dB)	
			QPSK	16QAM
7	5	2 502.5	5.01	5.94
		2 535.0	5.10	6.12
		2 567.5	5.04	6.12
	10	2 505.0	4.96	5.97
		2 535.0	5.04	6.06
		2 565.0	5.07	6.06
	15	2 507.5	5.16	6.06
		2 535.0	5.30	6.09
		2 562.5	5.39	6.03
	20	2 510.0	4.96	5.91
		2 535.0	4.99	5.97
		2 560.0	4.99	5.97

Band	Bandwidth (MHz)	Frequency (MHz)	PAR (dB)	
			QPSK	16QAM
26/5	1.4	824.7	5.04	5.54
		836.5	4.93	5.62
		848.3	4.78	5.74
	3	825.5	4.67	5.65
		836.5	4.61	5.57
		847.5	4.72	5.68
	5	826.5	4.70	5.57
		836.5	4.70	5.54
		846.5	4.70	5.71
	10	829.0	4.99	5.86
		836.5	4.52	5.54
		844.0	4.72	5.77
26	15	831.5	4.67	5.54
		841.5	5.01	5.74

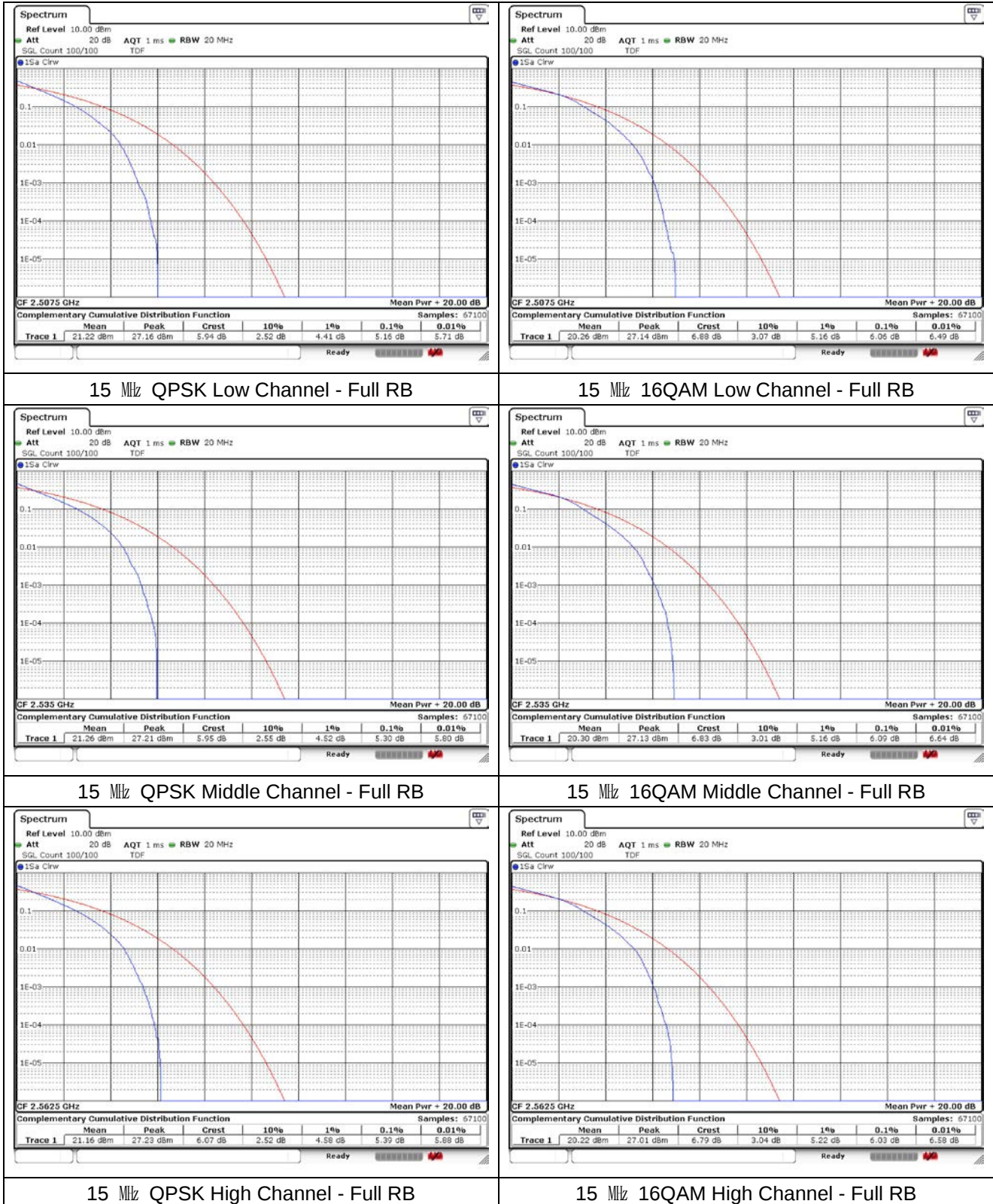
- Test plots

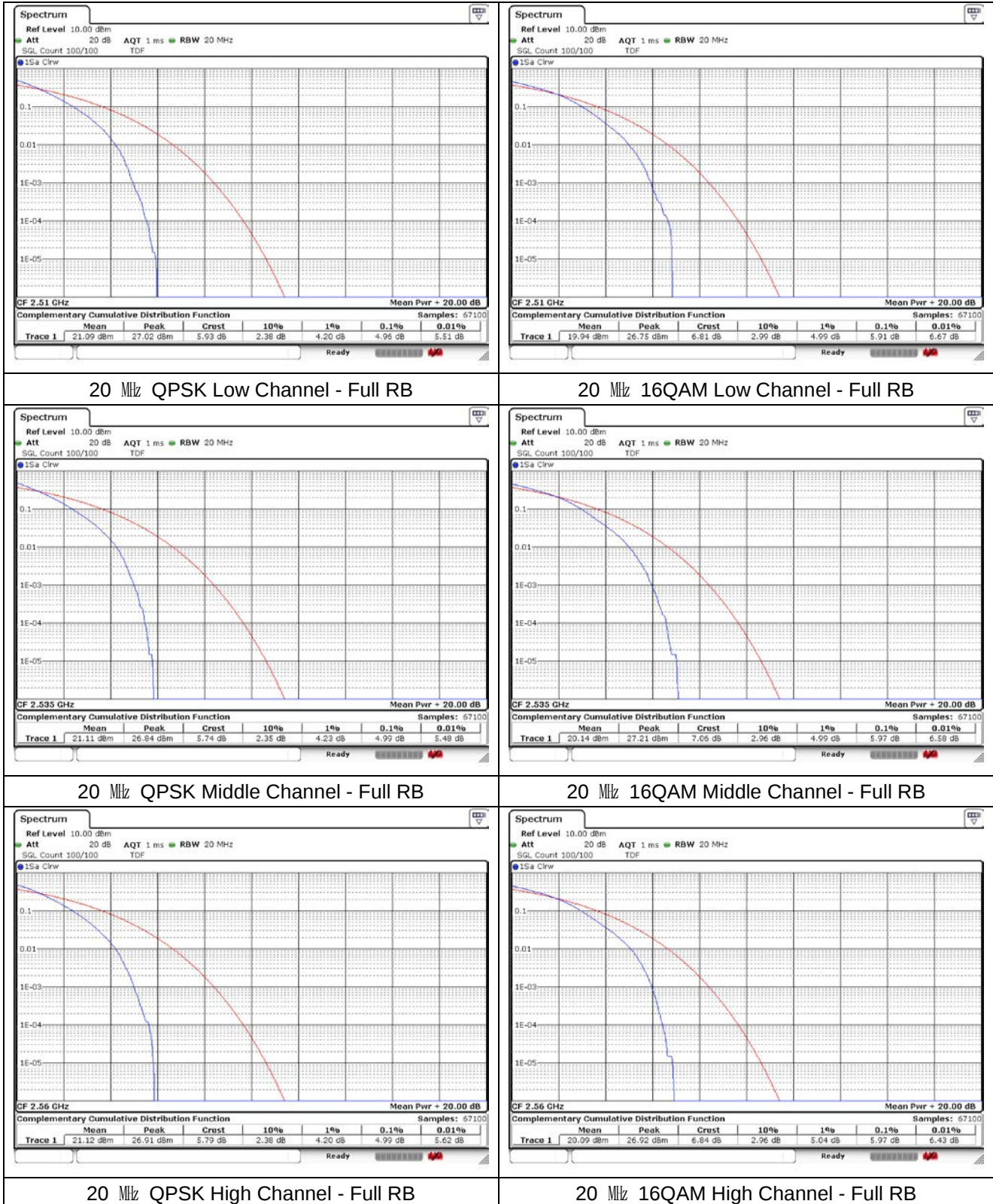
LTE band 7



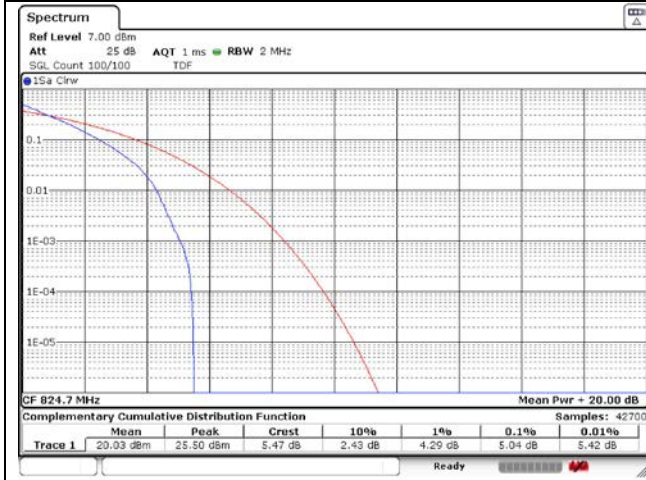
LTE band 7


LTE band 7

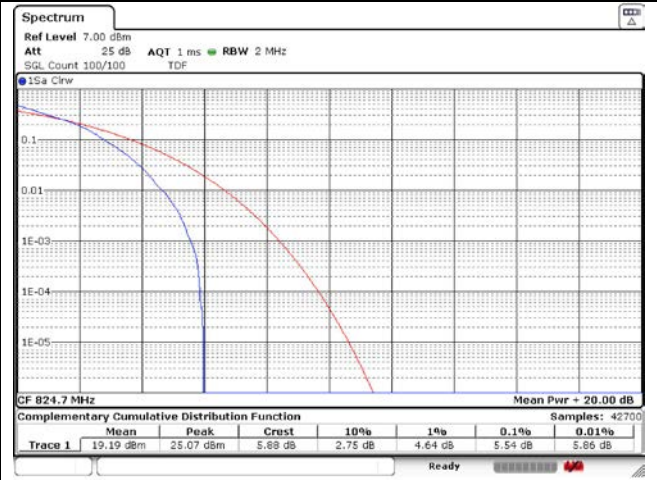


LTE band 7


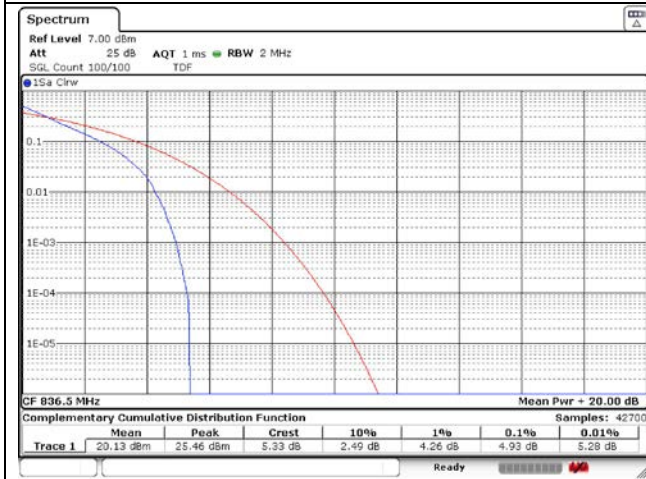
LTE band 26/5



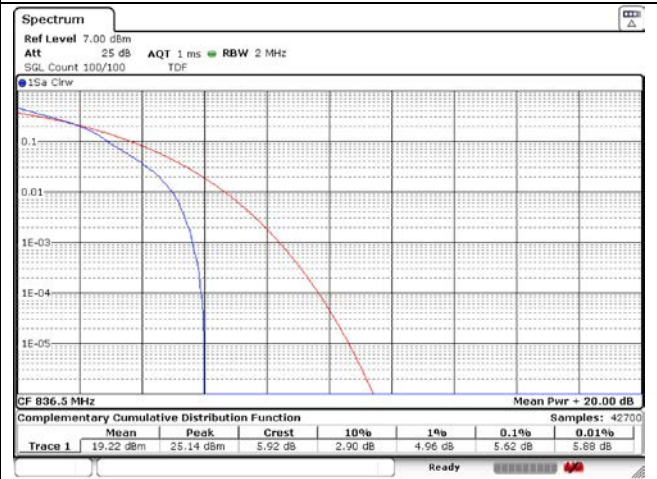
1.4 MHz QPSK Low Channel - Full RB



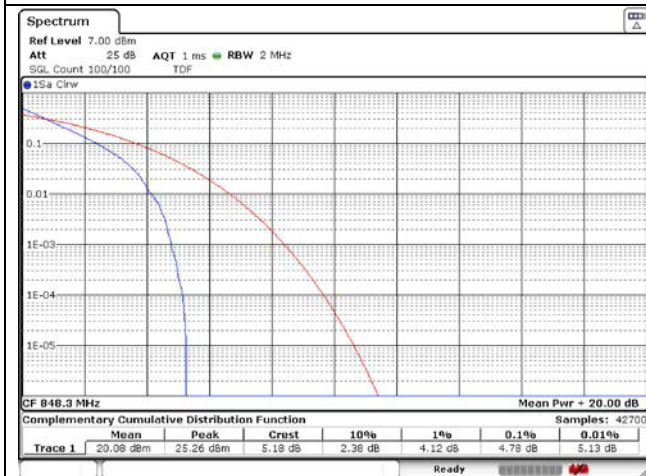
1.4 MHz 16QAM Low Channel - Full RB



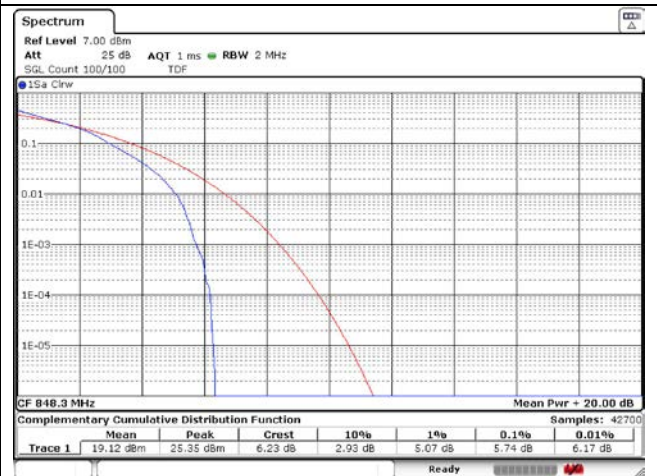
1.4 MHz QPSK Middle Channel - Full RB



1.4 MHz 16QAM Middle Channel - Full RB

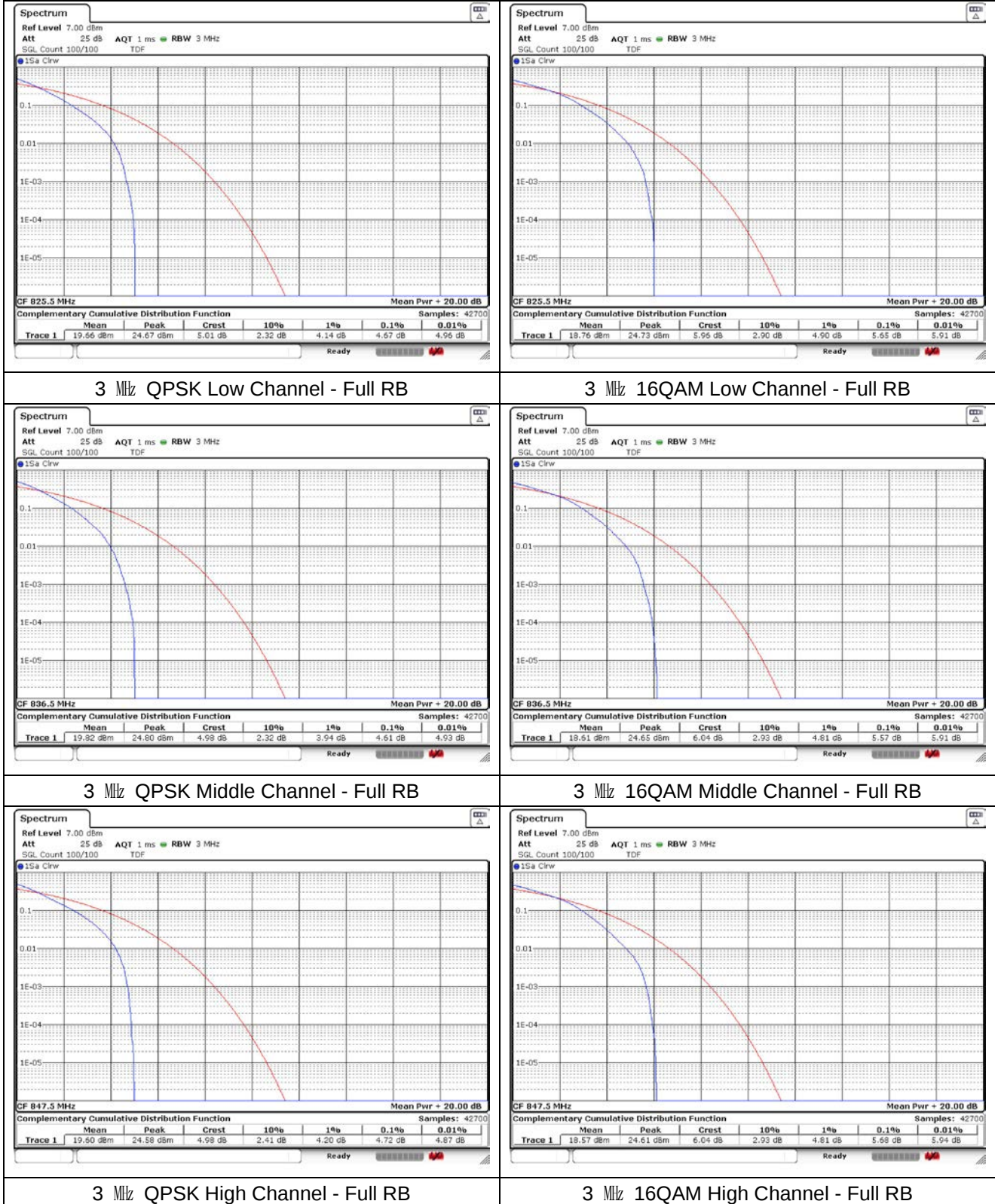


1.4 MHz QPSK High Channel - Full RB

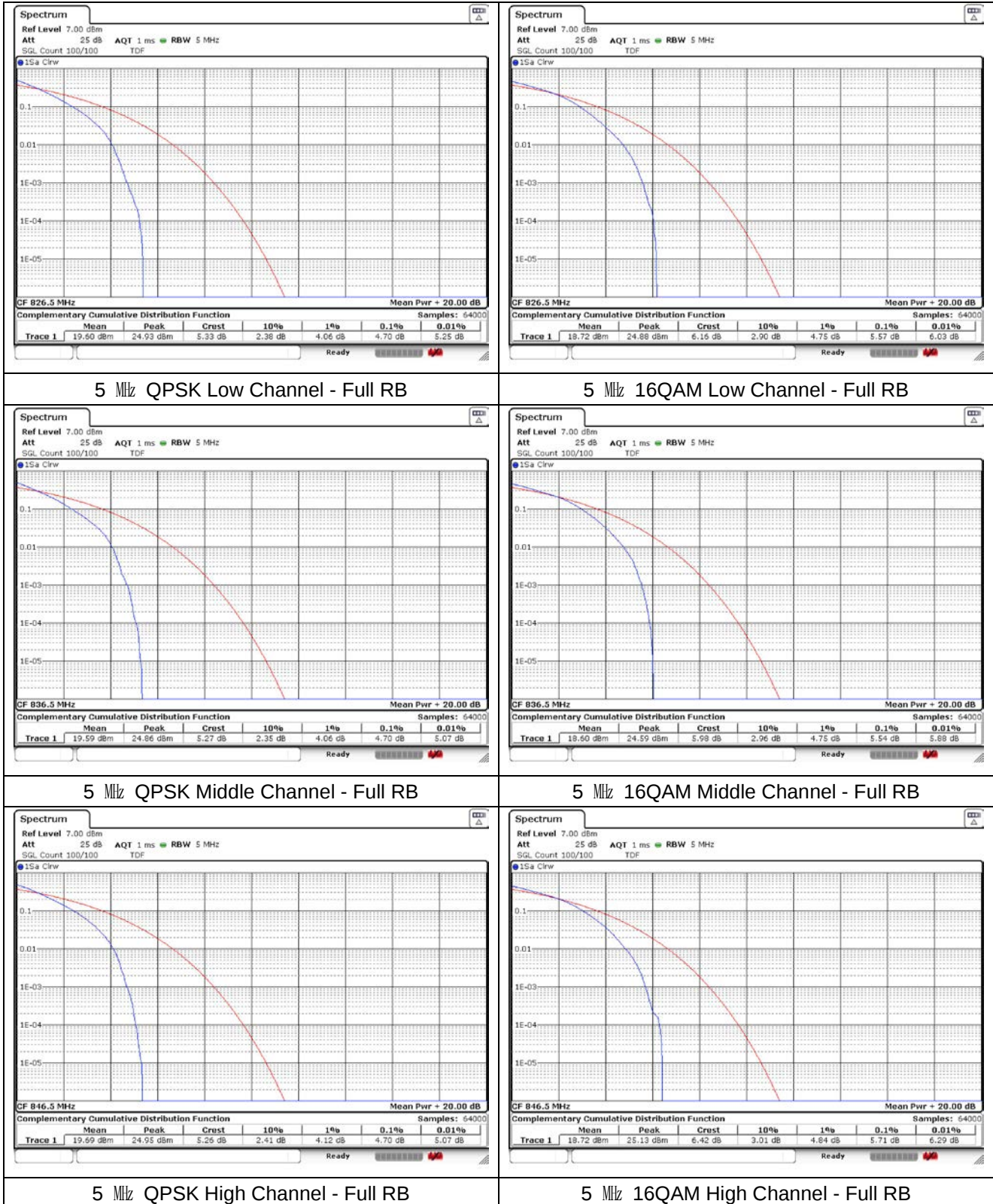


1.4 MHz 16QAM High Channel - Full RB

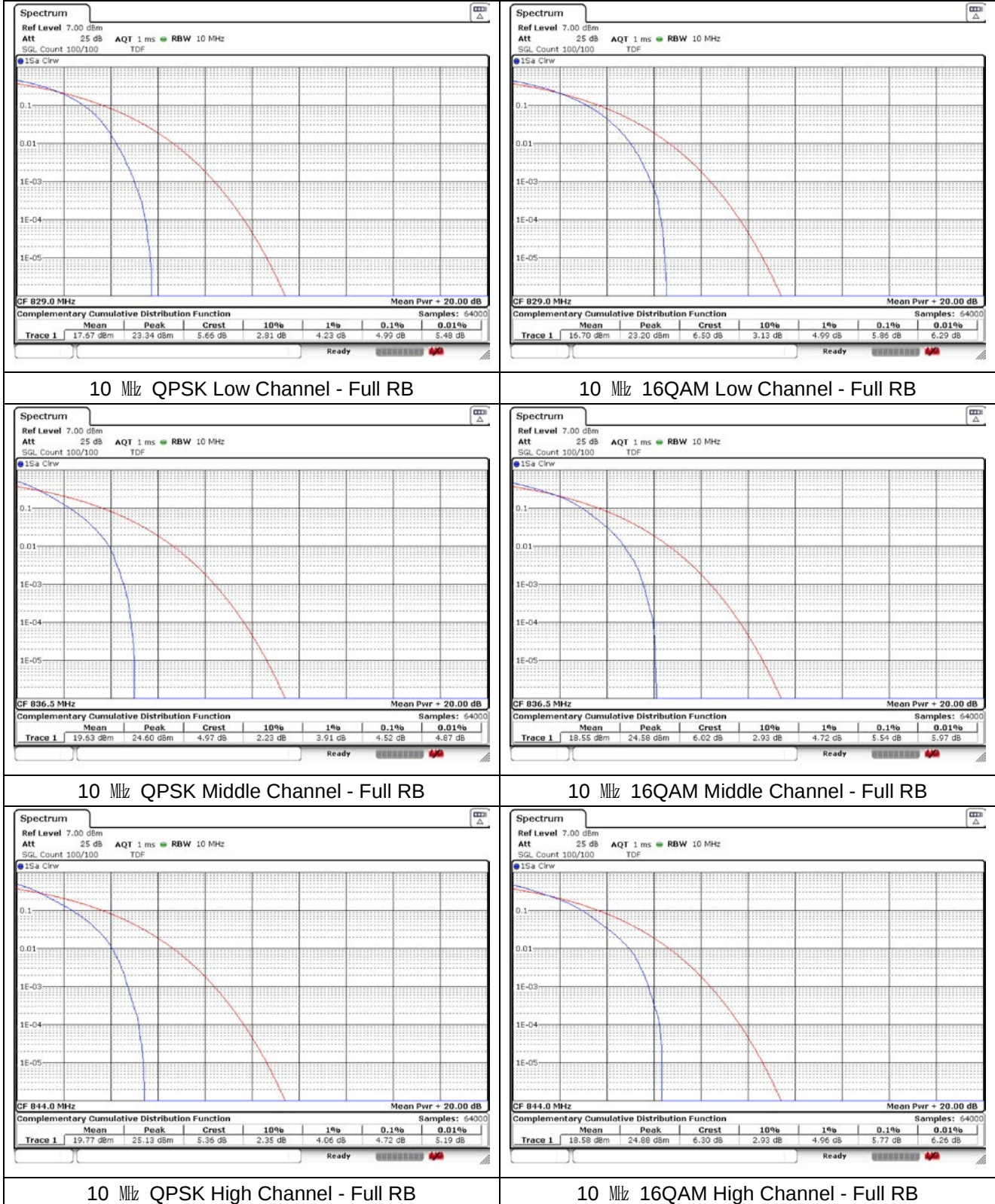
LTE band 26/5



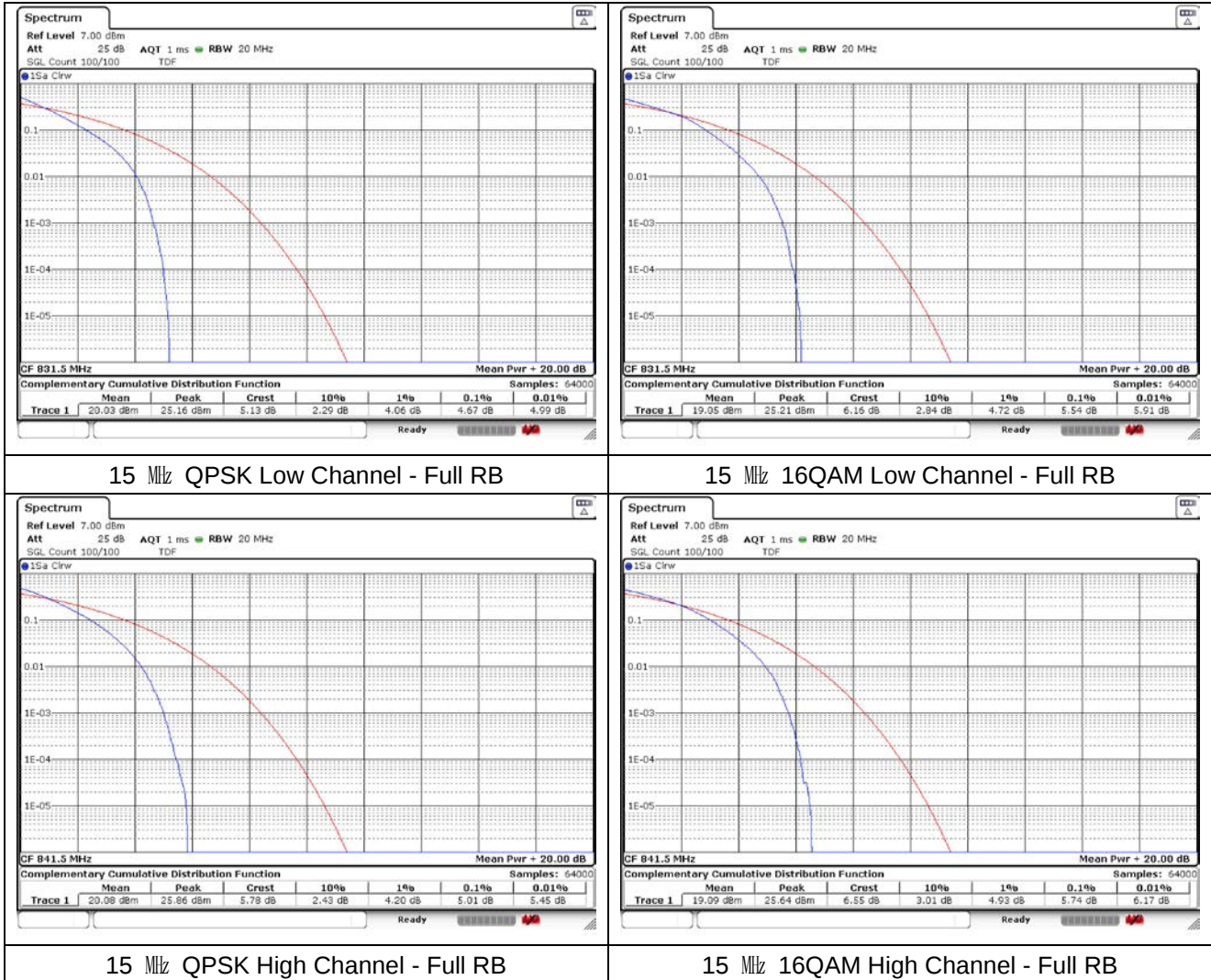
LTE band 26/5



LTE band 26/5



LTE band 26



6. Spurious Emissions at Antenna Terminal

6.1. Limit

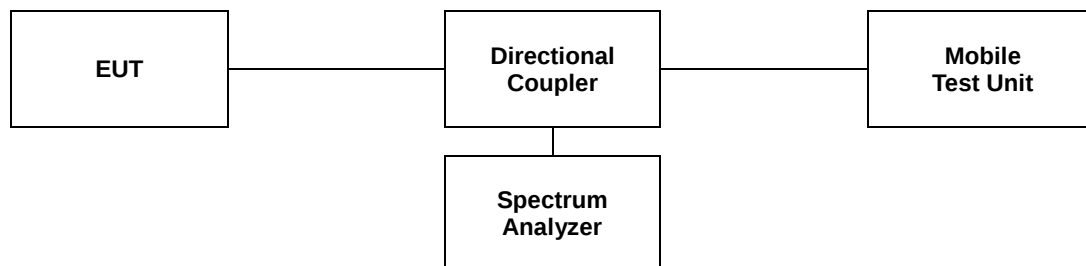
- §22.917(a), the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10\log(P)$ dB.

- §27.53(m)(4), For mobile digital stations, the attenuation factor shall be not less than $40 + 10 \log_{10} (P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10 \log_{10} (P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10 \log_{10} (P)$ dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less than $43 + 10 \log_{10} (P)$ dB on all frequencies between 2 490.5 MHz and 2 496 MHz and $55 + 10 \log_{10} (P)$ dB at or below 2 490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2 495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees

6.2. Test Procedure

The test follows section 5.7 of ANSI C63.26-2015.

1. Start frequency was set to 9 kHz and stop frequency was set to at least 10* the fundamental frequency.
2. Detector = Peak.
3. Trace mode = Max hold.
4. Sweep time = Auto couple.
5. The trace was allowed to stabilize.
6. Please see notes below for RBW and VBW settings.
7. For plots showing conducted spurious emissions from 9 kHz to 26 GHz, all path loss of wide frequency range was investigated and compensated to spectrum analyzer as correction factor.



Note;

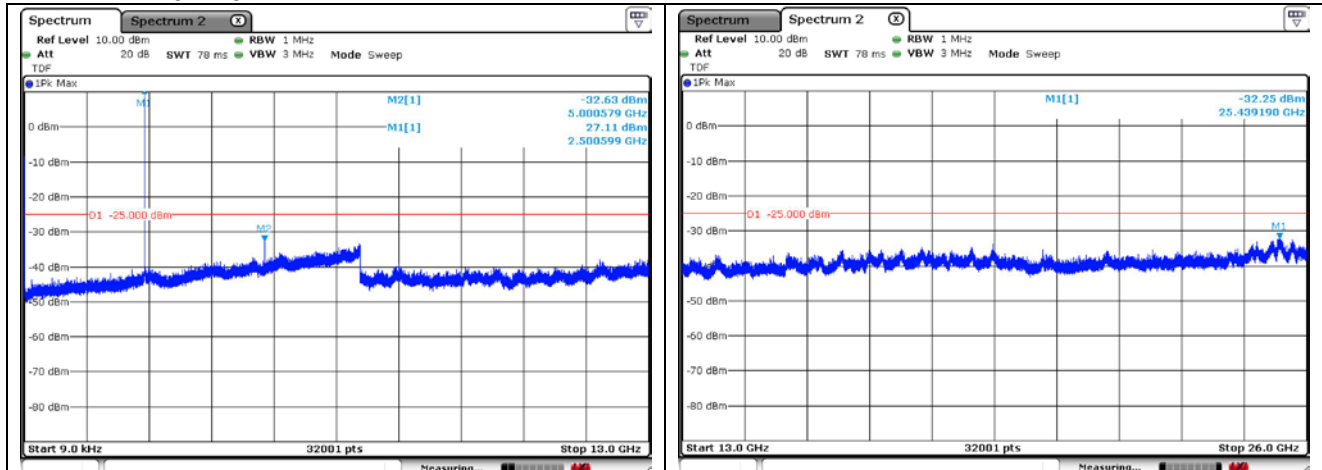
Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for frequencies less than 1 GHz and frequencies greater than 1 GHz. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two point, one below the carrier center frequency and one above the carrier center frequency, outside of which all emission are attenuated at least 26 dB below the transmitter power.

6.3. Test Results

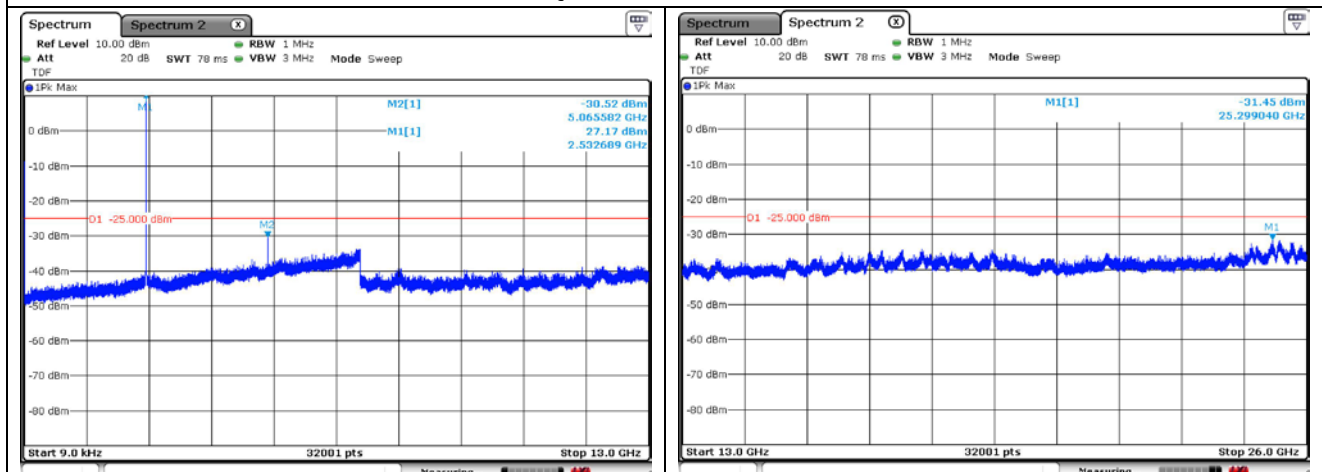
Ambient temperature : $(23 \pm 1) ^\circ\text{C}$
 Relative humidity : 47 % R.H.

- Test plots

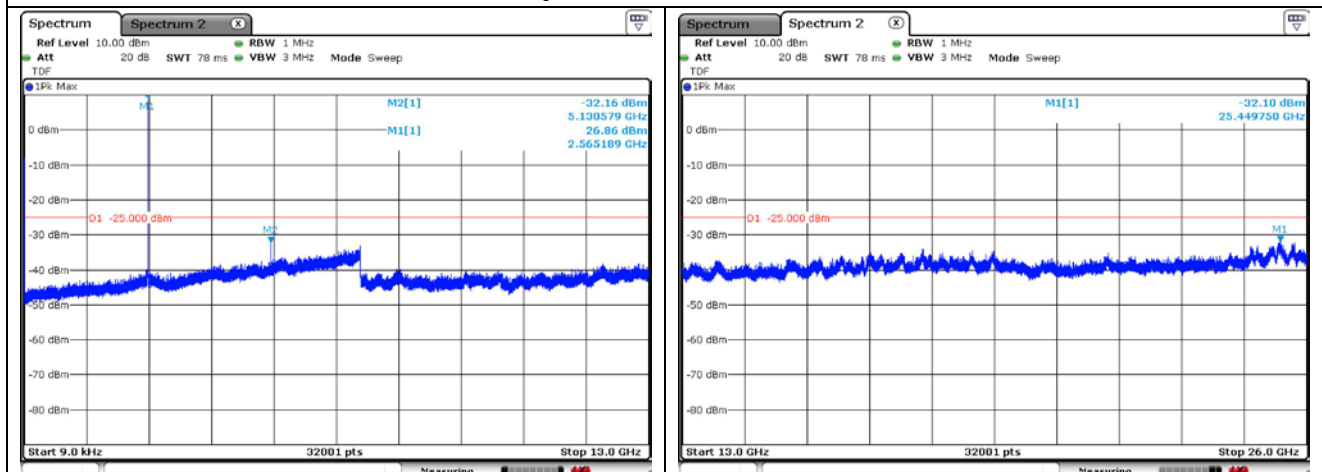
LTE band 7 (5 MHz)



QPSK Low Channel

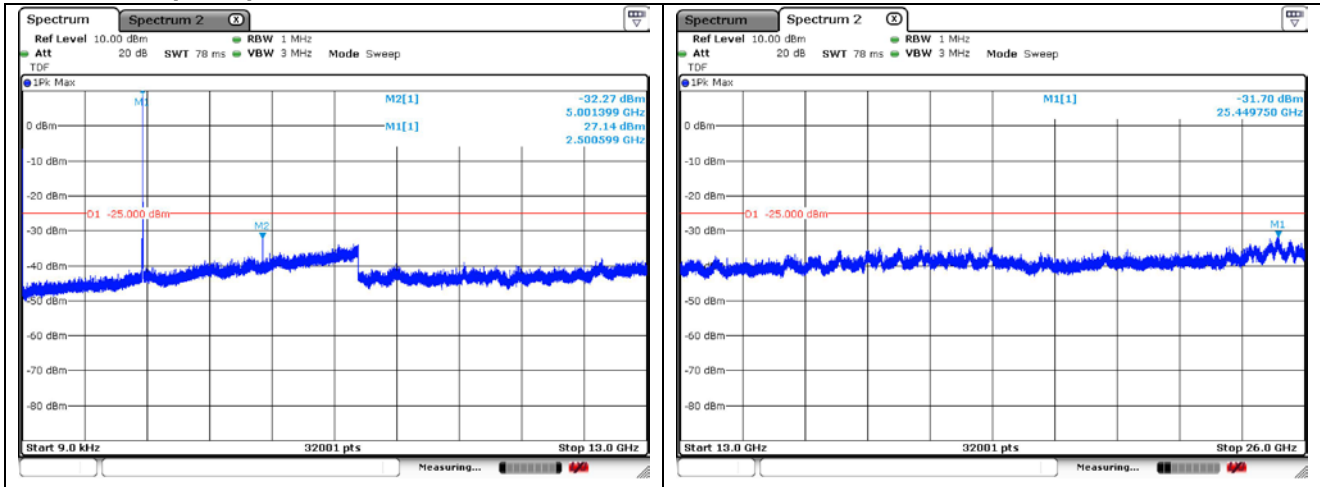


QPSK Middle Channel

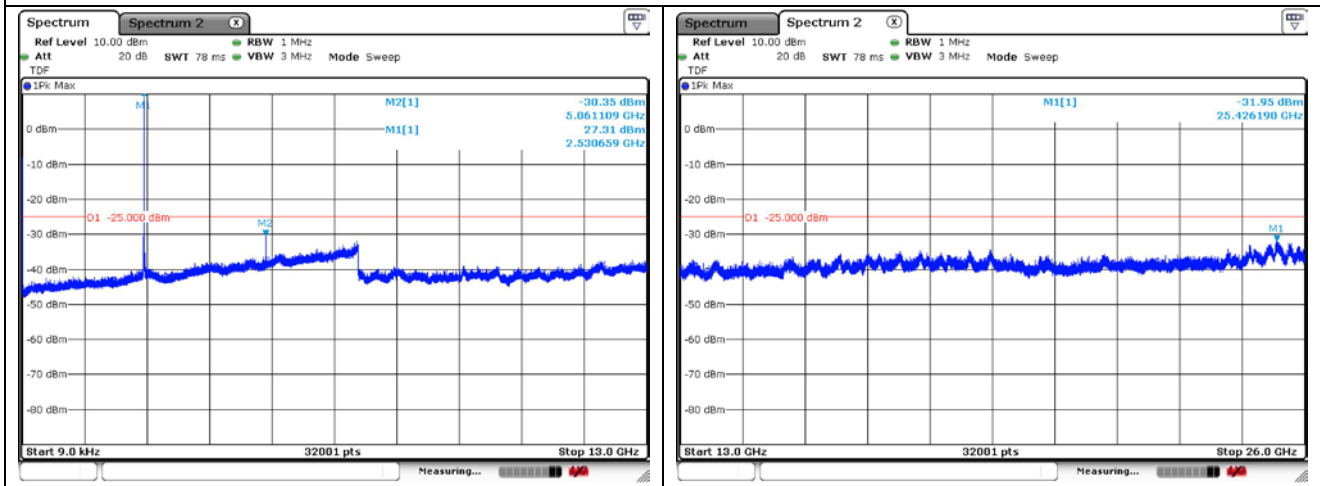


QPSK High Channel

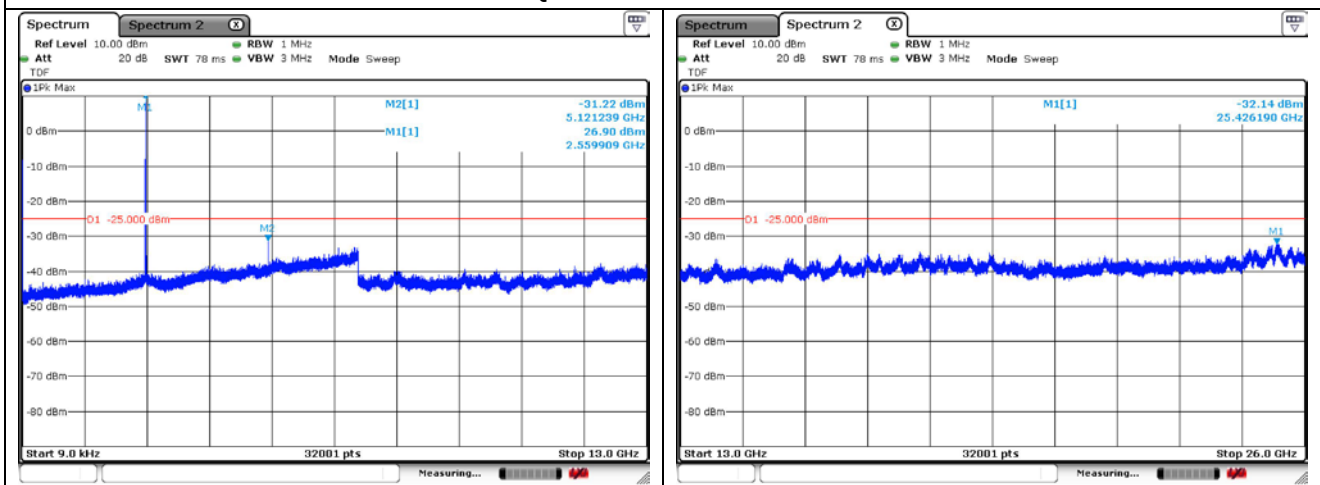
LTE band 7 (10 MHz)



QPSK Low Channel

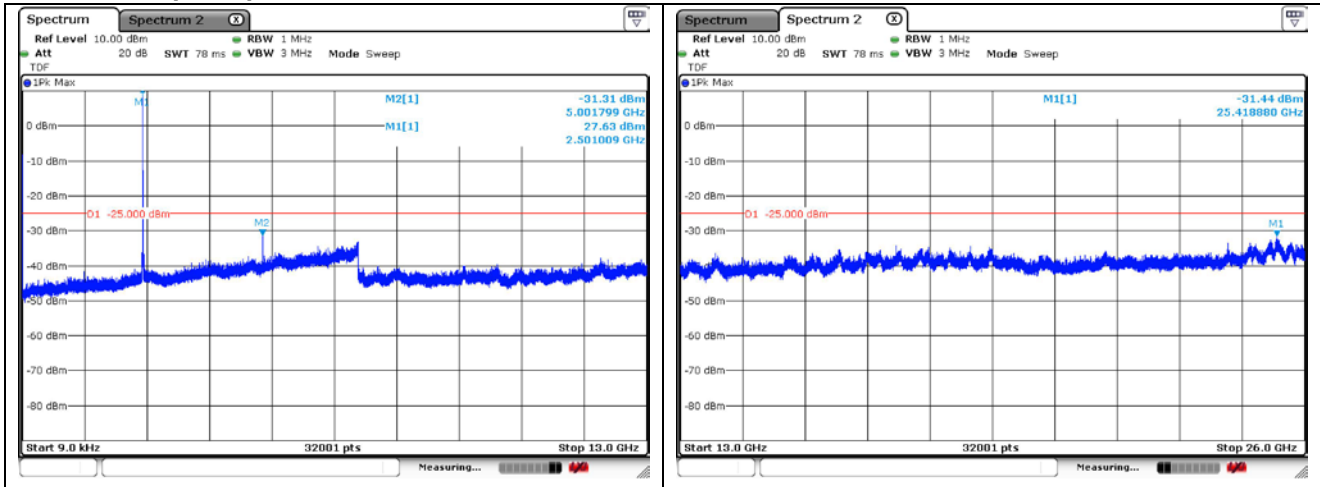


QPSK Middle Channel

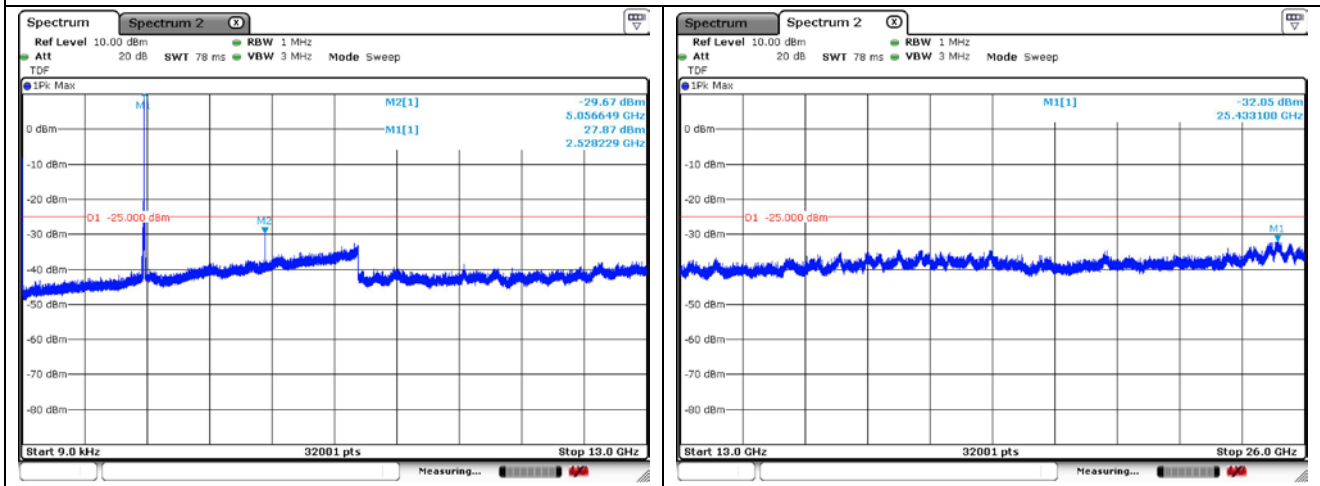


QPSK High Channel

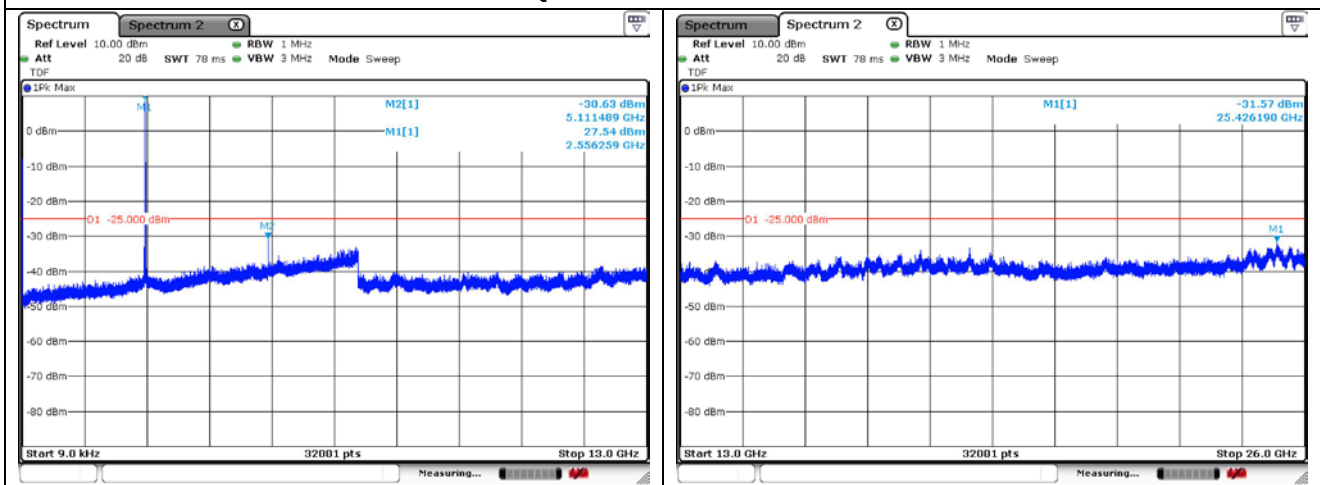
LTE band 7 (15 MHz)



QPSK Low Channel



QPSK Middle Channel



QPSK High Channel