TEST REPORT

of

FCC Part 27 Subpart C

FCC ID: BEJIAH1483SKDE

Equipment Under Test	:	Car Navigation System
Model Name	:	IAH1483SKDE
Applicant	:	LG Electronics USA.
Manufacturer	:	LG Electronics Inc.
Date of Receipt	:	2018.06.27
Date of Test(s)	:	2018.07.02 ~ 2018.07.11
Date of Issue	:	2018.07.12

In the configuration tested, the EUT complied with the standards specified above.

Tested By: **Nancy Park** **Date:** **2018.07.12**

Technical Manager: **Jungmin Yang** **Date:** **2018.07.12**

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1. General information

1.1. Testing laboratory

SGS Korea Co., Ltd. (Gunpo Laboratory)
- Wireless Div. 2FL, 10-2, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, Korea, 15807
- Designation number: KR0150

All SGS services are rendered in accordance with the applicable SGS conditions of service available on request and accessible at http://www.sgs.com/en/Terms-and-Conditions.aspx.

Telephone : +82 31 688 0901
FAX : +82 31 688 0921

1.2. Details of applicant

Applicant : LG Electronics USA.
Address : 1000 Sylvan Avenue, Englewood Cliffs, New Jersey, United States, 07632
Contact Person : Han, Kyung-su
Phone No. : +1 201 472 2623

1.3. Details of manufacturer

Company : LG Electronics Inc.
Address : 222 LG-ro, Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do, 17709, Korea

1.4. Description of EUT

Kind of Product	Car Navigation System
Model Name	IAH1483SKDE
Power Supply	DC 14.4 V
Rated Power	LTE Band 7: 23 ㎧ m
Frequency Range	LTE Band 7: 2 500 ㎒ ~ 2 570 ㎒
Emission Designator	LTE Band 7 (5 ㎒): 4M53G7D (QPSK) / 4M53W7D (16QAM) LTE Band 7 (10 ㎒): 8M94G7D (QPSK) / 8M94W7D (16QAM) LTE Band 7 (15 ㎒): 13M5G7D (QPSK) / 13M4W7D (16QAM) LTE Band 7 (20 ㎒): 17M9G7D (QPSK) / 17M9W7D (16QAM)
H/W Version	Rev2.0
S/W Version	SK3_EV.EUR.0000.013.006.180517

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1.5. Test equipment list

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due.
Signal Generator	Agilent	E8257D	MY51501169	Jul. 03, 2018	Annual	Jul. 03, 2019
Spectrum Analyzer	R&S	FSV30	103100	Jun. 21, 2018	Annual	Jun. 21, 2019
Spectrum Analyzer	Agilent	N9020A	MY53421758	Sep. 25, 2017	Annual	Sep. 25, 2018
Mobile Test Unit	R&S	CMW500	144034	Mar. 08, 2018	Annual	Mar. 08, 2019
Power Meter	Anritsu	ML2495A	1223004	Jun. 12, 2018	Annual	Jun. 12, 2019
Power Sensor	Anritsu	MA2411B	1207272	Jun. 12, 2018	Annual	Jun. 12, 2019
Directional Coupler	KRYTAR	152613	122660	Jun. 14, 2018	Annual	Jun. 14, 2019
Temperature Chamber	ESPEC CORP.	PL-1J	15000796	Sep. 22, 2017	Annual	Sep. 22, 2018
High Pass Filter	Wainwright Instrument GmbH	WHK3.0/18G-10SS	344	May 27, 2018	Annual	May 27, 2019
DC Power Supply	Agilent	U8002A	MY49030063	Nov. 27, 2017	Annual	Nov. 27, 2018
Preamplifier	H.P.	8447F	2944A03909	Aug. 11, 2017	Annual	Aug. 11, 2018
Preamplifier	R&S	SCU 18	102244	Sep. 22, 2017	Annual	Sep. 22, 2018
Preamplifier	MITEQ Inc.	JS44-18004000-35-8P	1546891	May 13, 2018	Annual	May 13, 2019
Test Receiver	R&S	ESU26	100109	Feb. 07, 2018	Annual	Feb. 07, 2019
Bilog Antenna	SCHWARZBECK MESSELEKTRONIK	VULB 9163	01126	Mar. 26, 2018	Biennial	Mar. 26, 2020
Horn Antenna	R&S	HF906	100326	Feb. 14, 2018	Biennial	Feb. 14, 2020
Dipole Antenna	SCHWARZBECK MESSELEKTRONIK	UHA 9105	9105-2514	May 15, 2017	Biennial	May 15, 2019
Dipole Antenna	SCHWARZBECK MESSELEKTRONIK	VHA 9103	9103-2817	May 15, 2017	Biennial	May 15, 2019
Horn Antenna	SCHWARZBECK MESSELEKTRONIK	BBHA 9170	BBHA9170431	Aug. 25, 2016	Biennial	Aug. 25, 2018
Horn Antenna	SCHWARZBECK MESSELEKTRONIK	BBHA 9170	BBHA9170223	Aug. 25, 2016	Biennial	Aug. 25, 2018
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	CO3000/963/38 330516/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	SUCOFLEX	104 (3 m)	MY3258414	Jul. 04, 2018	Semi-annual	Jan. 04, 2019
Coaxial Cable	SUCOFLEX	104 (10 m)	MY3145814	Jul. 04, 2018	Semi-annual	Jan. 04, 2019
Coaxial Cable	Rosenberger	LA1-C006-1500	131014 05/20	Mar. 05, 2018	Semi-annual	Sep. 05, 2018
Coaxial Cable	Rosenberger	LA1-C006-1500	131014 06/20	Mar. 05, 2018	Semi-annual	Sep. 05, 2018
Coaxial Cable	Rosenberger	LA1-C006-1500	131014 07/20	Mar. 05, 2018	Semi-annual	Sep. 05, 2018

▶ Support equipment

Description	Manufacturer	Model	Serial Number
N/A	-	-	-

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1.6. Summary of test results

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC Part 2 and 27		
Section	**Test Item**	**Result**
§27.50(h)(2)	RF Radiated Output Power	Complied
§2.1053 §27.53(m)(4)	Spurious Radiated Emission	Complied
§2.1046	Conducted Output Power	Complied
§2.1049	Occupied Bandwidth	Complied
§27.50(d)(5)	Peak-Average Ratio	Complied
§2.1051 §27.53(m)(4)	Spurious Emission at Antenna Terminal	Complied
§27.53(m)(4)	Band Edge	Complied
§2.1055 §27.54	Frequency Stability	Complied

1.7. Test report revision

Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL012875	2018.07.12	Initial

1.8. Sample calculation for offset

Where relevant, the following sample calculation is provided:

1.8.1. Conducted test

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

1.8.2. Radiation test

E.R.P. & E.I.R.P. = [S.G level + Amp.] (dB m) - Cable loss (dB) + Ant. gain (dB d/dB i)

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1.9. Measurement Uncertainty

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

Parameter	Uncertainty (dB)
Radiated Disturbance, below 1 ㎓	±5.88
Radiated Disturbance, above 1 ㎓	±5.94

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

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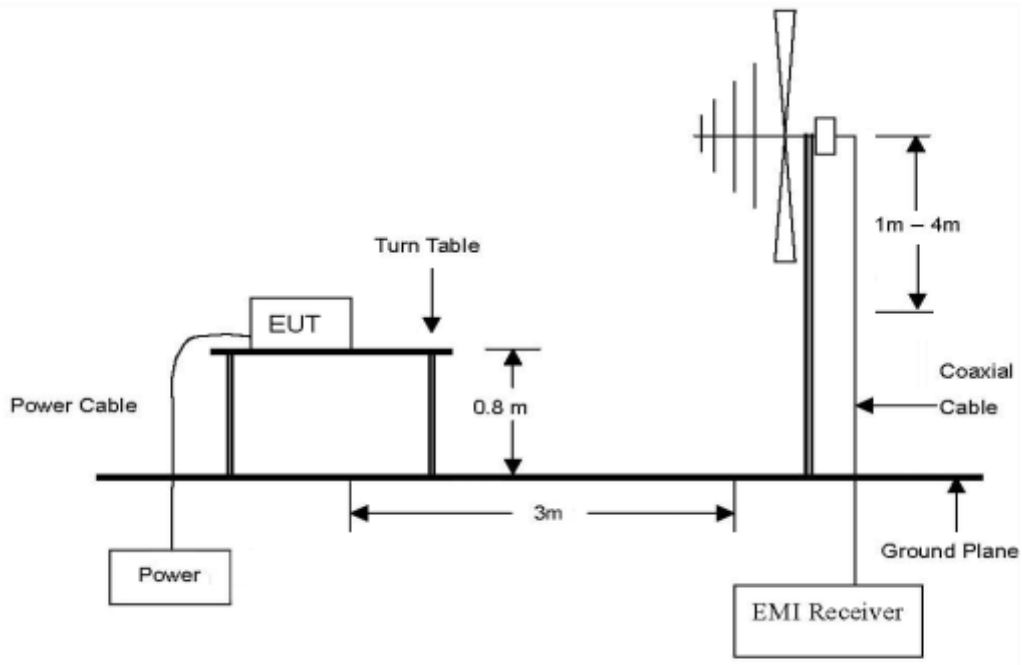
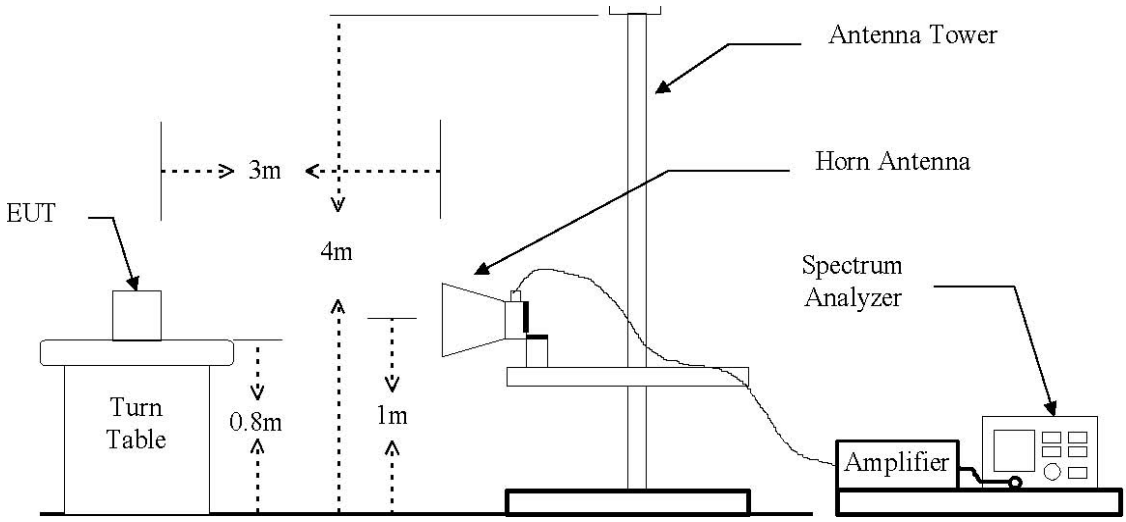
2. RF radiated output power & spurious radiated emission

2.1. Test setup

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



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



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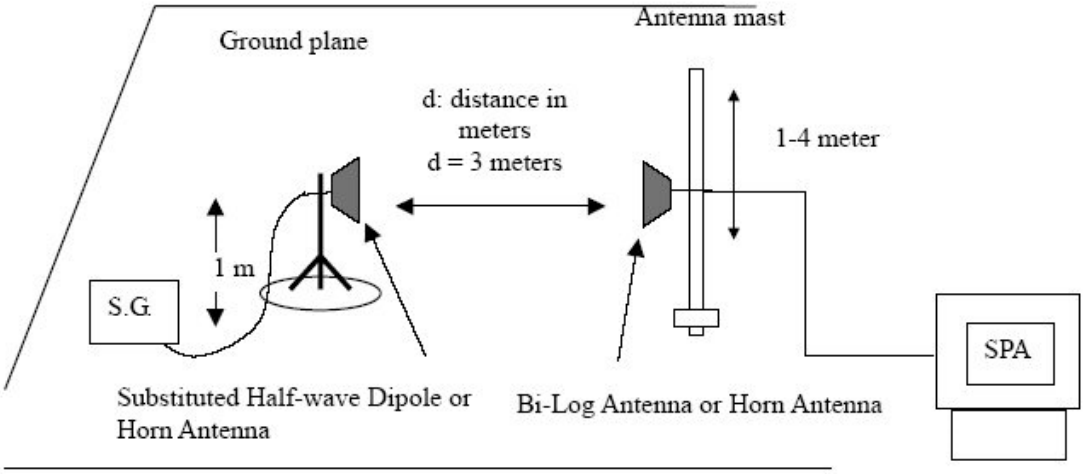
The diagram below shows the test setup for substituted method.



2.2. Limit

2.2.1. Limit of radiated output power

- §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

- §27.53(m)(4), For mobile digital stations, the attenuation factor shall be not less than 40 + 10 $\log_{10}$ (P) ㎧ on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 $\log_{10}$ (P) ㎧ on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 $\log_{10}$ (P) ㎧ 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 that 43 + 10 $\log_{10}$ (P) ㎧ on all frequencies between 2490.5 ㎒ and 2496 ㎒ and 55 + 10 $\log_{10}$ (P) ㎧ at or below 2490.5 ㎒. Mobile Satellite Service licensees operating on frequencies below 2495 ㎒ 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.

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2.3. Test procedure: Based on ANSI/TIA 603E: 2016

1. On a test site, the EUT shall be placed at 80 cm 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 ㎒), VBW ≥ 3 x 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 v03r01.
5. Radiated spurious emissions measurement method was set as follows:
   RBW = 100 ㎑ for emissions below 1 ㎓ and 1 ㎒ for emissions above 1 ㎓, VBW ≥ 3 x RBW,
   Detector = Peak, trace mode = max hold, per the guidelines of KDB 971168 D01 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. The EUT was replaced by half-wave dipole (1 ㎓ below) or horn antenna (1 ㎓ above) connected to a signal generator.
12. In necessary, the input attenuator setting on the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
13. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
14. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring received, which is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
15. The input level to the substitution antenna shall be recorded as power level in ㏈m, corrected for any change of input attenuator setting of the measuring receiver.
16. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.

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2.4. Test result for RF radiated output power

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

LTE band 7 (5 ㎒ - QPSK)

Frequency (㎒)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB i)	E.I.R.P.	
					(dB m)	(㎽)
2 502.5	H	20.11	4.81	9.13	24.43	277.33
2 502.5	V	20.27	4.81	9.13	24.59	287.74
2 535.0	H	20.98	4.86	9.06	25.18	329.61
2 535.0	V	22.54	4.86	9.06	26.74	472.06
2 567.5	H	21.14	4.90	8.98	25.22	332.66
2 567.5	V	20.10	4.90	8.98	24.18	261.82

* 5 BW 1RB size / 0 Offset

LTE band 7 (5 ㎒ - 16QAM)

Frequency (㎒)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB i)	E.I.R.P.	
					(dB m)	(㎽)
2 502.5	H	18.79	4.81	9.13	23.11	204.64
2 502.5	V	19.91	4.81	9.13	24.23	264.85
2 535.0	H	19.82	4.86	9.06	24.02	252.35
2 535.0	V	21.20	4.86	9.06	25.40	346.74
2 567.5	H	20.59	4.90	8.98	24.67	293.09
2 567.5	V	19.33	4.90	8.98	23.41	219.28

* 5 BW 1RB size / 0 Offset

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LTE band 7 (10 ㎒ - QPSK)

Frequency (㎒)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB i)	E.I.R.P.	
					(dB m)	(㎽)
2 505.0	H	20.22	4.82	9.13	24.53	283.79
2 505.0	V	20.14	4.82	9.13	24.45	278.61
2 535.0	H	20.73	4.86	9.06	24.93	311.17
2 535.0	V	21.84	4.86	9.06	26.04	401.79
2 565.0	H	20.16	4.90	8.99	24.25	266.07
2 565.0	V	20.35	4.90	8.99	24.44	277.97

* 10 BW 1RB size / 0 Offset

LTE band 7 (10 ㎒ - 16QAM)

Frequency (㎒)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB i)	E.I.R.P.	
					(dB m)	(㎽)
2 505.0	H	19.48	4.82	9.13	23.79	239.33
2 505.0	V	18.49	4.82	9.13	22.80	190.55
2 535.0	H	19.44	4.86	9.06	23.64	231.21
2 535.0	V	21.08	4.86	9.06	25.28	337.29
2 565.0	H	19.02	4.90	8.99	23.11	204.64
2 565.0	V	19.63	4.90	8.99	23.72	235.50

* 10 BW 1RB size / 0 Offset

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LTE band 7 (15 ㎒ - QPSK)

Frequency (㎒)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB i)	E.I.R.P.	
					(dB m)	(㎽)
2 507.5	H	20.62	4.82	9.12	24.92	310.46
2 507.5	V	20.09	4.82	9.12	24.39	274.79
2 535.0	H	20.71	4.86	9.06	24.91	309.74
2 535.0	V	21.88	4.86	9.06	26.08	405.51
2 562.5	H	19.98	4.90	9.00	24.08	255.86
2 562.5	V	21.08	4.90	9.00	25.18	329.61

* 15 BW 1RB size / 0 Offset

LTE band 7 (15 ㎒ - 16QAM)

Frequency (㎒)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB i)	E.I.R.P.	
					(dB m)	(㎽)
2 507.5	H	19.97	4.82	9.12	24.27	267.30
2 507.5	V	20.03	4.82	9.12	24.33	271.02
2 535.0	H	19.48	4.86	9.06	23.68	233.35
2 535.0	V	21.26	4.86	9.06	25.46	351.56
2 562.5	H	18.94	4.90	9.00	23.04	201.37
2 562.5	V	19.76	4.90	9.00	23.86	243.22

* 15 BW 1RB size / 0 Offset

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LTE band 7 (20 ㎒ - QPSK)

Frequency (㎒)	Ant. Pol. (H/V)	S.G level + Amp. (㏈m)	Cable loss (㏈)	Ant. gain (㏈i)	E.I.R.P.	
					(㏈m)	(㎽)
2 510.0	H	20.51	4.82	9.12	24.81	302.69
2 510.0	V	20.29	4.82	9.12	24.59	287.74
2 535.0	H	20.77	4.86	9.06	24.97	314.05
2 535.0	V	21.78	4.86	9.06	25.98	396.28
2 560.0	H	20.01	4.89	9.00	24.12	258.23
2 560.0	V	20.81	4.89	9.00	24.92	310.46

* 20 BW 1RB size / 0 Offset

LTE band 7 (20 ㎒ - 16QAM)

Frequency (㎒)	Ant. Pol. (H/V)	S.G level + Amp. (㏈m)	Cable loss (㏈)	Ant. gain (㏈i)	E.I.R.P.	
					(㏈m)	(㎽)
2 510.0	H	19.76	4.82	9.12	24.06	254.68
2 510.0	V	19.15	4.82	9.12	23.45	221.31
2 535.0	H	19.51	4.86	9.06	23.71	234.96
2 535.0	V	21.31	4.86	9.06	25.51	355.63
2 560.0	H	19.25	4.89	9.00	23.36	216.77
2 560.0	V	20.55	4.89	9.00	24.66	292.42

* 20 BW 1RB size / 0 Offset

Remark:

- E.I.R.P. = [S.G level + Amp.] (㏈m) - Cable loss (㏈) + Ant. gain (㏈i)

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2.5. Spurious radiated emission

- Measured output Power: 26.74 ㏈m = 0.472 1 W
- Modulation Signal: LTE band 7 (5 ㎒ - QPSK)
- Distance: 3 meters
- Limit: 55 + 10log$_{10}$(W) = 51.74 ㏈c

Frequency (㎒)	Ant. Pol. (H/V)	S.G level + Amp. (㏈m)	Cable loss (㏈)	Ant. gain (㏈i)	E.I.R.P. (㏈m)	Limit (㏈m)	Margin (㏈)
Low Channel (2 502.5 ㎒)							
5 000.74	H	-50.76	7.44	9.86	-48.34	-25	-23.34
5 000.72	V	-49.87	7.44	9.86	-47.45	-25	-22.45
7 500.80	H	-50.02	9.04	11.84	-47.22	-25	-22.22
7 501.00	V	-46.87	9.04	11.84	-44.07	-25	-19.07
Middle Channel (2 535.0 ㎒)							
5 065.82	H	-52.37	7.51	10.20	-49.68	-25	-24.68
5 065.56	V	-55.43	7.51	10.20	-52.74	-25	-27.74
7 598.70	H	-46.66	9.12	11.80	-43.98	-25	-18.98
7 598.51	V	-48.47	9.12	11.80	-45.79	-25	-20.79
High Channel (2 567.5 ㎒)							
5 130.69	H	-52.22	7.61	10.44	-49.39	-25	-24.39
5 130.67	V	-53.26	7.61	10.44	-50.43	-25	-25.43
7 696.00	H	-41.11	8.85	11.64	-38.32	-25	-13.32
7 696.12	V	-45.54	8.85	11.64	-42.75	-25	-17.75

* 5 BW 1RB size / 0 Offset

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- Measured output Power: 26.04 ㏈m = 0.401 8 W
- Modulation Signal: LTE band 7 (10 ㎒ - QPSK)
- Distance: 3 meters
- Limit: 55 + 10log$_{10}$(W) = 51.04 ㏈c

Frequency (㎒)	Ant. Pol. (H/V)	S.G level + Amp. (㏈m)	Cable loss (㏈)	Ant. gain (㏈i)	E.I.R.P. (㏈m)	Limit (㏈m)	Margin (㏈)
Low Channel (2 505.0 ㎒)							
5 001.16	H	-50.58	7.44	9.87	-48.15	-25	-23.15
5 001.12	V	-48.85	7.44	9.87	-46.42	-25	-21.42
7 501.96	H	-50.08	9.04	11.84	-47.28	-25	-22.28
7 501.72	V	-46.61	9.04	11.84	-43.81	-25	-18.81
Middle Channel (2 535.0 ㎒)							
5 061.12	H	-52.22	7.50	10.17	-49.55	-25	-24.55
5 061.18	V	-55.31	7.50	10.17	-52.64	-25	-27.64
7 591.78	H	-47.28	9.11	11.80	-44.59	-25	-19.59
7 591.87	V	-48.81	9.11	11.80	-46.12	-25	-21.12
High Channel (2 565.0 ㎒)							
5 121.38	H	-52.43	7.59	10.42	-49.60	-25	-24.60
5 121.44	V	-55.30	7.59	10.42	-52.47	-25	-27.47
7 681.86	H	-40.94	8.89	11.66	-38.17	-25	-13.17
7 681.84	V	-45.86	8.89	11.66	-43.09	-25	-18.09

* 10 BW 1RB size / 0 Offset

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- Measured output Power: 26.08 ㏈m = 0.405 5 W
- Modulation Signal: LTE band 7 (15 ㎒ - QPSK)
- Distance: 3 meters
- Limit: 55 + 10log$_{10}$(W) = 51.08 ㏈c

Frequency (㎒)	Ant. Pol. (H/V)	S.G level + Amp. (㏈m)	Cable loss (㏈)	Ant. gain (㏈i)	E.I.R.P. (㏈m)	Limit (㏈m)	Margin (㏈)
Low Channel (2 507.5 ㎒)							
5 001.76	H	-50.94	7.44	9.87	-48.51	-25	-23.51
5 001.78	V	-49.29	7.44	9.87	-46.86	-25	-21.86
7 502.52	H	-50.35	9.04	11.84	-47.55	-25	-22.55
7 502.62	V	-46.88	9.04	11.84	-44.08	-25	-19.08
Middle Channel (2 535.0 ㎒)							
5 056.84	H	-52.17	7.50	10.15	-49.52	-25	-24.52
5 056.70	V	-55.03	7.50	10.15	-52.38	-25	-27.38
7 585.07	H	-48.56	9.11	11.80	-45.87	-25	-20.87
7 584.98	V	-48.85	9.11	11.80	-46.16	-25	-21.16
High Channel (2 562.5 ㎒)							
5 111.74	H	-52.73	7.57	10.40	-49.90	-25	-24.90
5 111.45	V	-55.02	7.57	10.40	-52.19	-25	-27.19
7 667.60	H	-41.73	8.93	11.68	-38.98	-25	-13.98
7 667.61	V	-46.23	8.93	11.68	-43.48	-25	-18.48

* 15 BW 1RB size / 0 Offset

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- Measured output Power: 25.98 ㏈m = 0.396 3 W
- Modulation Signal: LTE band 7 (20 ㎒ - QPSK)
- Distance: 3 meters
- Limit: 55 + 10log$_{10}$(W) = 50.98 ㏈c

Frequency (㎒)	Ant. Pol. (H/V)	S.G level + Amp. (㏈m)	Cable loss (㏈)	Ant. gain (㏈i)	E.I.R.P. (㏈m)	Limit (㏈m)	Margin (㏈)
Low Channel (2 510.0 ㎒)							
5 002.22	H	-50.88	7.44	9.87	-48.45	-25	-23.45
5 002.30	V	-50.03	7.44	9.87	-47.60	-25	-22.60
7 503.48	H	-50.33	9.04	11.84	-47.53	-25	-22.53
7 503.08	V	-46.86	9.04	11.84	-44.06	-25	-19.06
Middle Channel (2 535.0 ㎒)							
5 052.39	H	-50.96	7.49	10.13	-48.32	-25	-23.32
5 052.33	V	-55.38	7.49	10.13	-52.74	-25	-27.74
7 578.40	H	-48.46	9.10	11.81	-45.75	-25	-20.75
7 578.43	V	-49.19	9.10	11.81	-46.48	-25	-21.48
High Channel (2 560.0 ㎒)							
5 102.34	H	-52.52	7.55	10.38	-49.69	-25	-24.69
5 102.12	V	-56.41	7.54	10.38	-53.57	-25	-28.57
7 653.42	H	-42.17	8.97	11.71	-39.43	-25	-14.43
7 653.33	V	-45.93	8.97	11.71	-43.19	-25	-18.19

* 20 BW 1RB size / 0 Offset

Remark:

- E.I.R.P. = S.G level (㏈m) - Cable loss (㏈) + Ant. gain (㏈i)

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3. Conducted Output Power

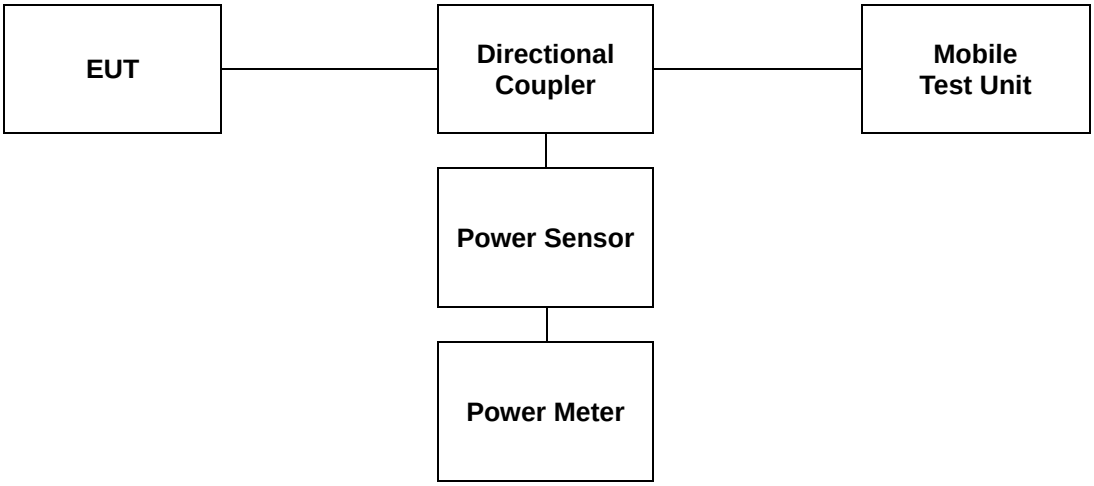
3.1. Limit

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.



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3.3. Test Result

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

LTE Band	Bandwidth (㎒)	RB Size	RB Offset	QPSK			16QAM		
				20775	21100	21425	20775	21100	21425
				2 502.5	2 535.0	2 567.5	2 502.5	2 535.0	2 567.5
7	5	1	0	23.48	23.37	23.29	22.16	22.06	22.04
		1	12	23.34	23.49	23.25	22.29	22.23	21.82
		1	24	23.16	23.33	23.07	22.06	22.16	21.87
		12	0	22.44	22.57	22.42	21.29	21.49	21.29
		12	7	22.31	22.46	22.39	21.27	21.36	21.27
		12	13	22.27	22.43	22.32	21.27	21.29	21.22
		25	0	22.28	22.50	22.38	21.36	21.54	21.39
	Bandwidth (㎒)	**RB Size**	**RB Offset**	**20800**	**21100**	**21400**	**20800**	**21100**	**21400**
				2 505.0	**2 535.0**	**2 565.0**	**2 505.0**	**2 535.0**	**2 565.0**
	10	1	0	23.40	23.41	23.58	22.65	22.02	22.64
		1	25	23.35	23.70	23.55	22.75	22.42	22.73
		1	49	23.18	23.28	23.24	22.61	22.21	22.65
		25	0	22.34	22.44	22.51	21.35	21.52	21.58
		25	12	22.37	22.46	22.48	21.33	21.65	21.47
		25	25	22.40	22.48	22.46	21.31	21.68	21.36
		50	0	22.40	22.33	22.46	21.39	21.38	21.40
	Bandwidth (㎒)	**RB Size**	**RB Offset**	**20825**	**21100**	**21375**	**20825**	**21100**	**21375**
				2 507.5	**2 535.0**	**2 562.0**	**2 507.5**	**2 535.0**	**2 562.0**
	15	1	0	23.39	23.45	23.60	22.62	22.47	22.69
		1	37	23.46	23.50	23.30	22.60	22.38	22.65
		1	74	23.59	23.30	23.28	22.59	22.11	22.60
		36	0	22.29	22.51	22.54	21.33	21.37	21.51
		36	20	22.37	22.51	22.52	21.45	21.46	21.43
		36	39	22.50	22.52	22.50	21.48	21.56	21.32
		75	0	22.42	22.38	22.45	21.49	21.41	21.52
	Bandwidth (㎒)	**RB Size**	**RB Offset**	**20850**	**21100**	**21350**	**20850**	**21100**	**21350**
				2 510.0	**2 535.0**	**2 560.0**	**2 510.0**	**2 535.0**	**2 560.0**
	20	1	0	23.13	23.25	23.44	22.55	22.46	22.57
		1	50	23.36	23.38	23.52	22.69	22.61	22.56
		1	99	23.21	23.40	23.28	22.56	22.38	22.30
		50	0	22.24	22.40	22.57	21.44	21.44	21.60
		50	25	22.37	22.41	22.55	21.46	21.49	21.54
		50	50	22.40	22.42	22.54	21.49	21.57	21.48
		100	0	22.46	22.40	22.47	21.27	21.58	21.52

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4. Occupied Bandwidth 99 %

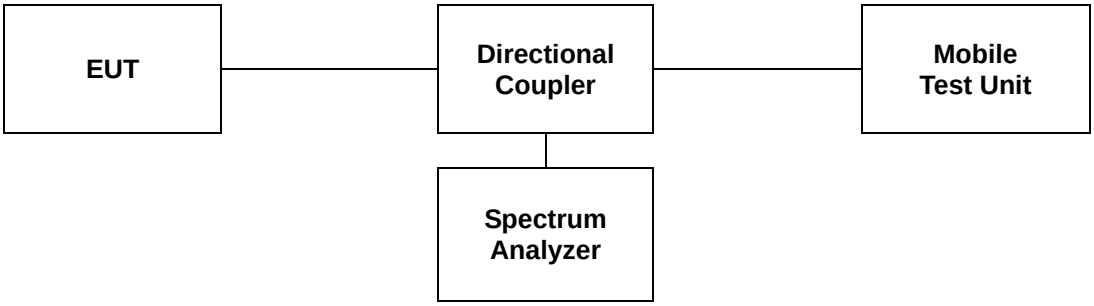
4.1. Limit

CFR 47, Section FCC §2.1049.

4.2. Test Procedure

The test follows section 4.3 of FCC KDB Publication 971168 D01 v03r01.

a. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be set wide enough to capture all modulation. products including the emission skirts (typically a span of 1.5 × OBW is sufficient).
b. 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 ≥ 3 × RBW.
c. 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.
d. Set the detection mode to peak, and the trace mode to max-hold.
e. 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.
f. 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).



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4.3 Test Results

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

LTE Band	Mode	Frequency (㎒)	Occupied Bandwidth (㎒)
7 (5 ㎒)	QPSK	2 502.5	4.52
		2 535.0	4.53
		2 567.5	4.50
7 (5 ㎒)	16QAM	2 502.5	4.50
		2 535.0	4.53
		2 567.5	4.53
7 (10 ㎒)	QPSK	2 505.0	8.94
		2 535.0	8.94
		2 565.0	8.91
7 (10 ㎒)	16QAM	2 505.0	8.94
		2 535.0	8.94
		2 565.0	8.91
7 (15 ㎒)	QPSK	2 507.5	13.42
		2 535.0	13.46
		2 562.5	13.37
7 (15 ㎒)	16QAM	2 507.5	13.42
		2 535.0	13.42
		2 562.5	13.37
7 (20 ㎒)	QPSK	2 510.0	17.89
		2 535.0	17.83
		2 560.0	17.83
7 (20 ㎒)	16QAM	2 510.0	17.83
		2 535.0	17.89
		2 560.0	17.89

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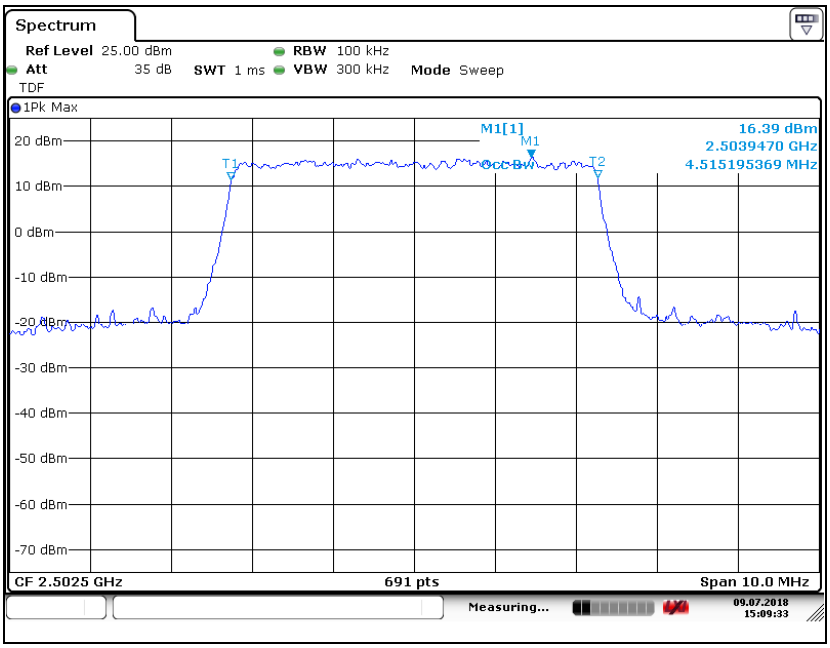
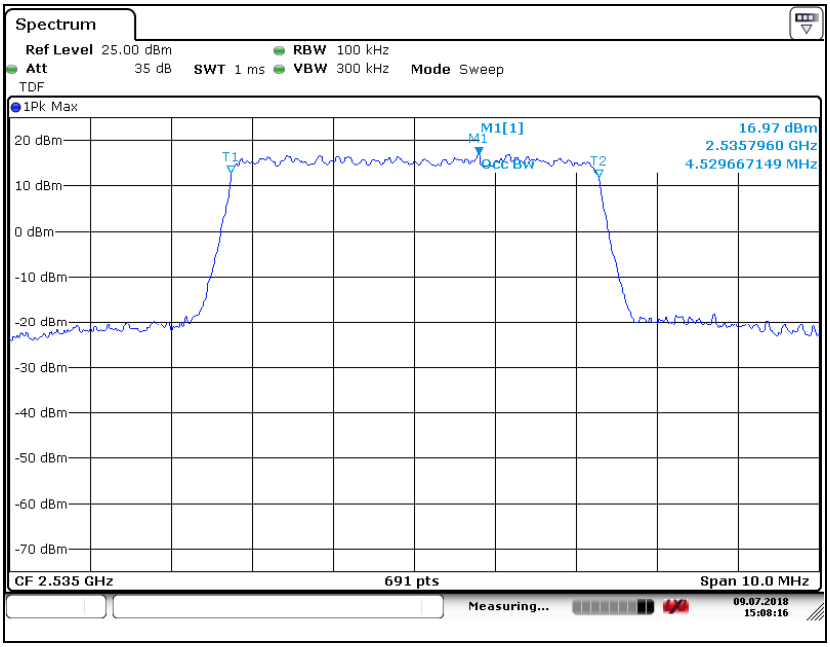
LTE band 7 (5 ㎒ - QPSK)

Low Channel



Middle Channel



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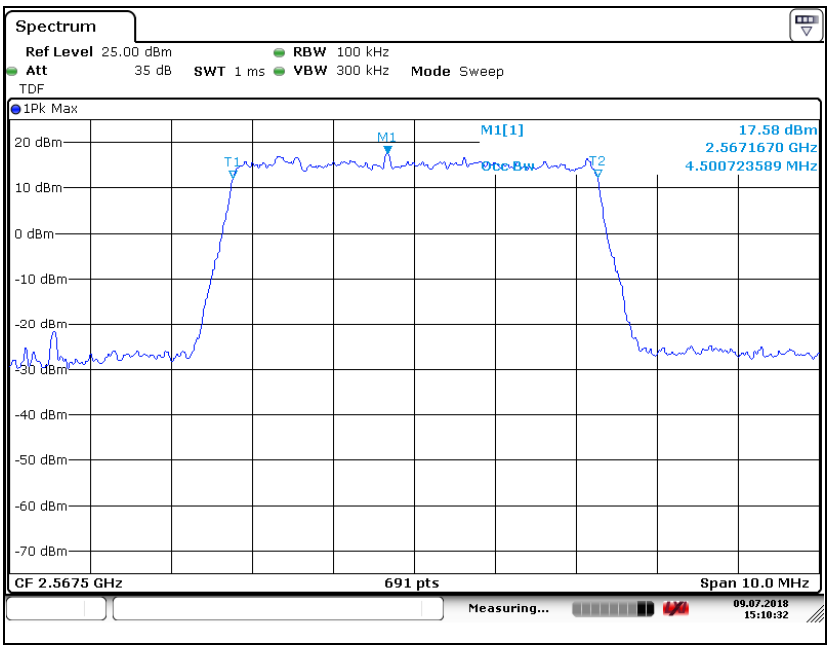
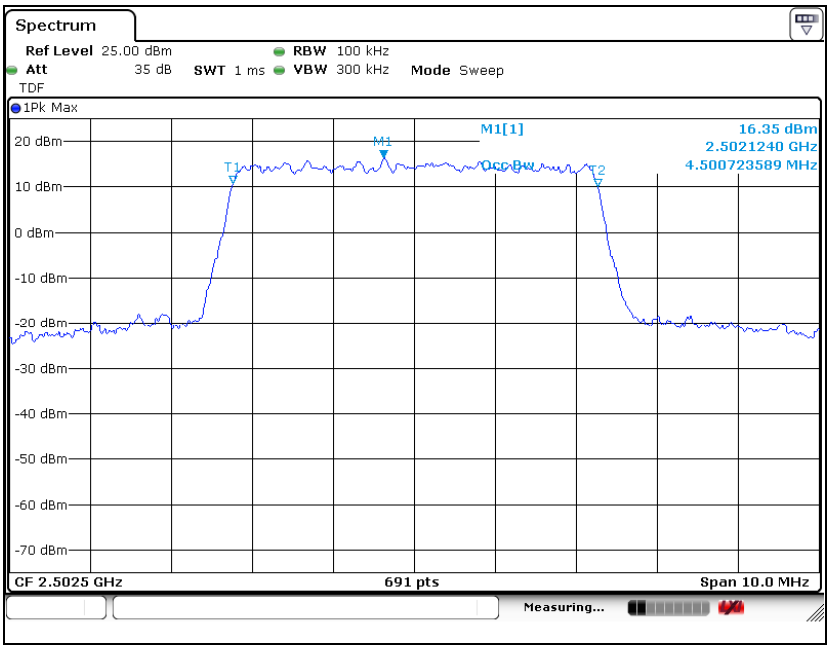
High Channel



LTE band 7 (5 ㎒ - 16QAM)

Low Channel



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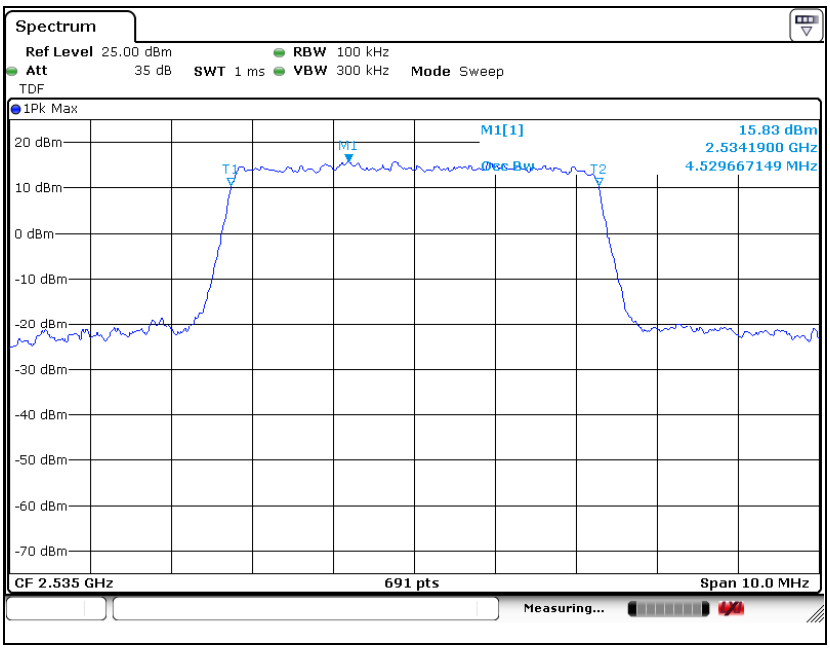
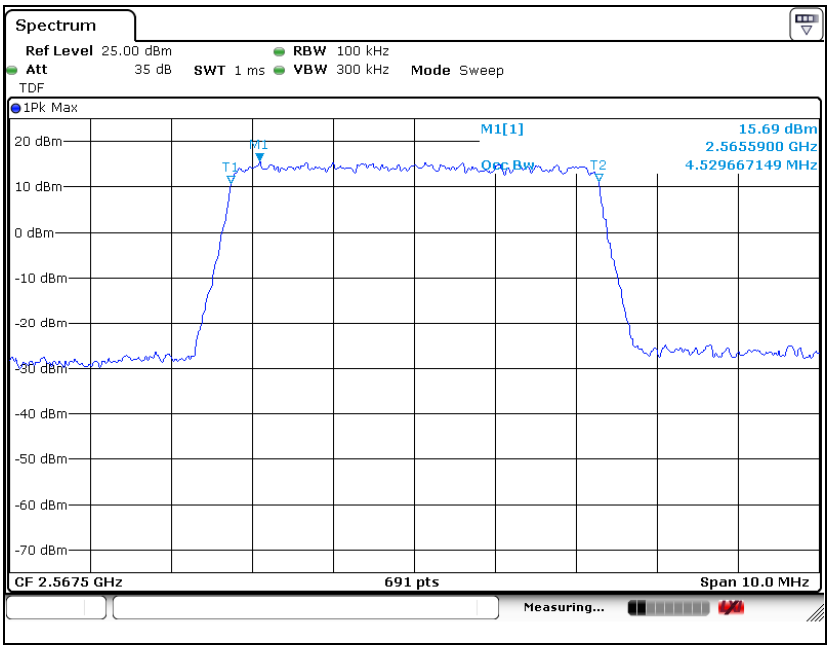
Middle Channel



High Channel



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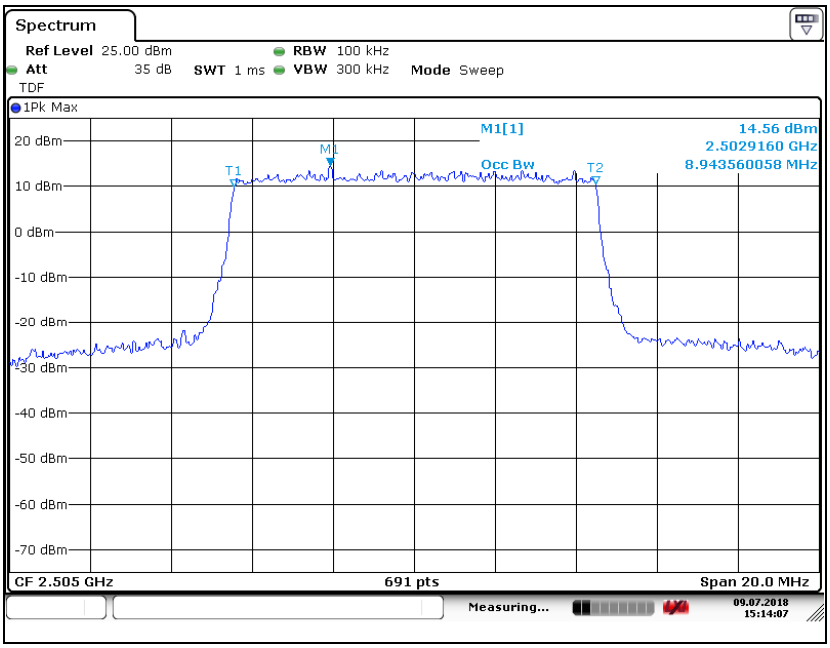
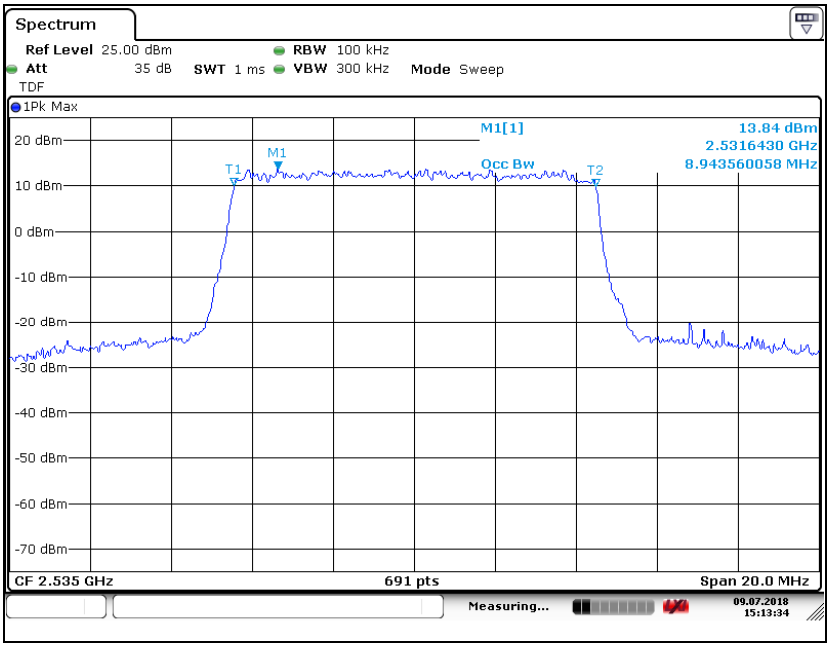
LTE band 7 (10 ㎒ - QPSK)

Low Channel



Middle Channel



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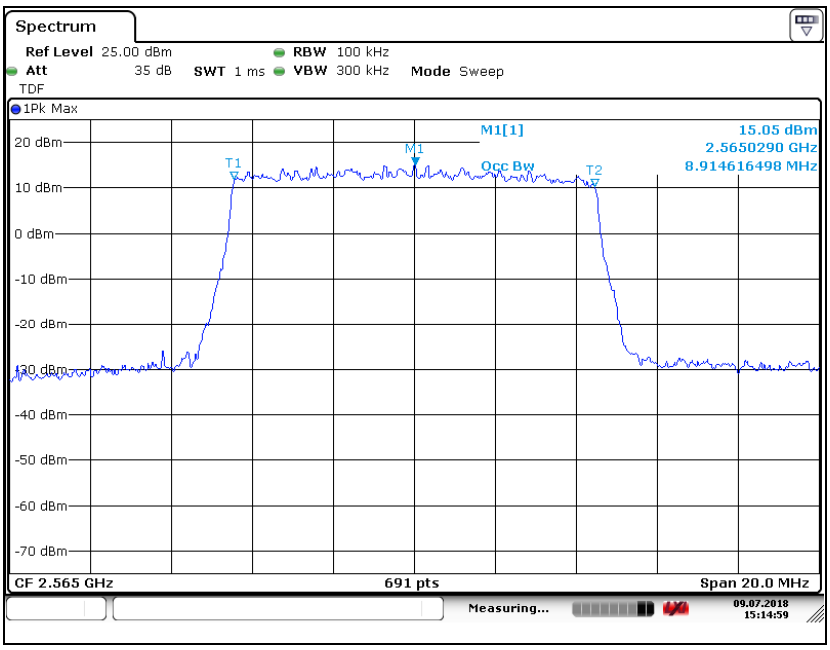
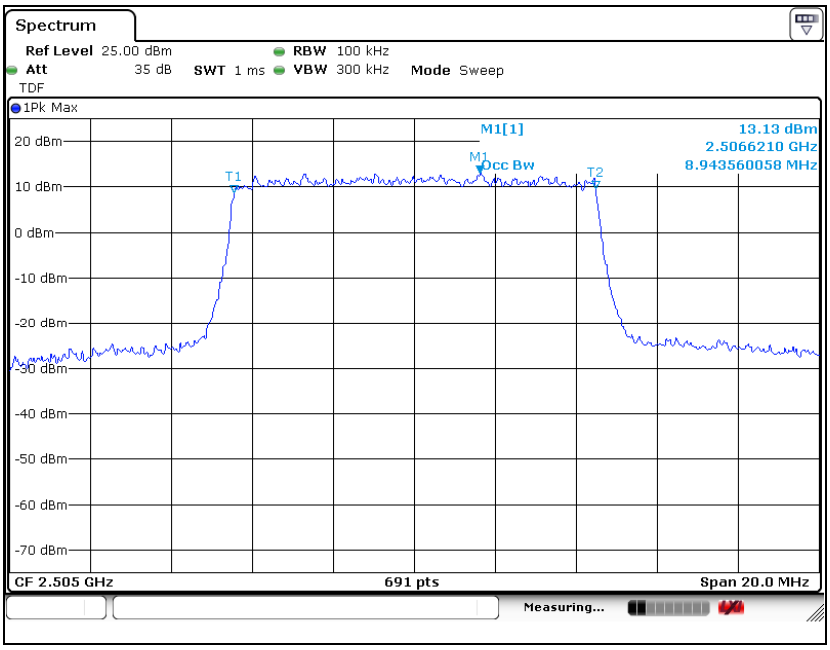
High Channel



LTE band 7 (10 ㎒ - 16QAM)

Low Channel



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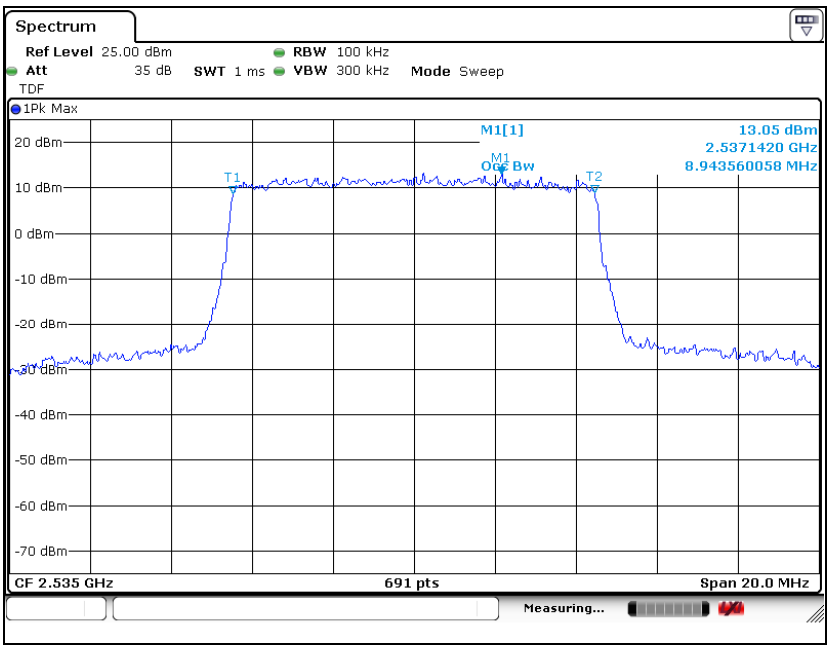
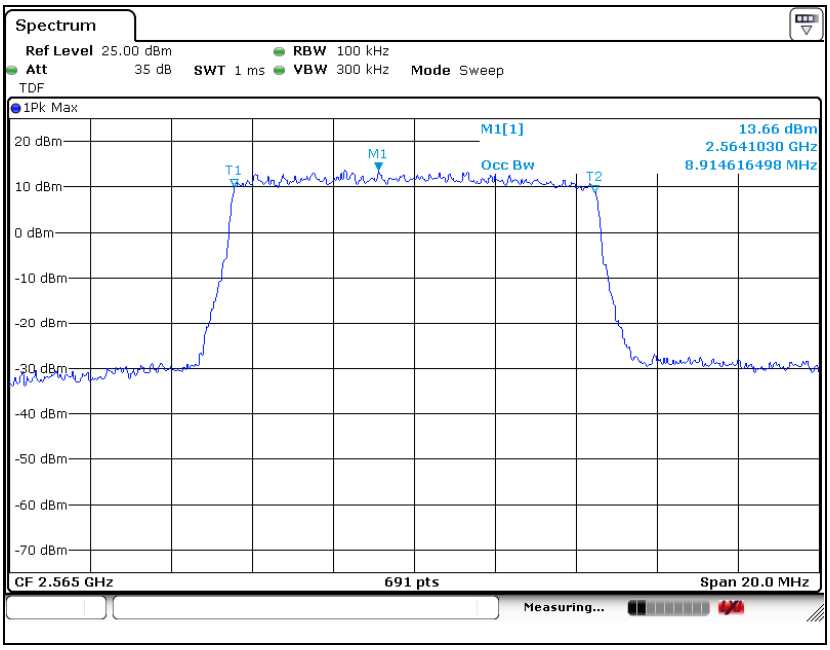
Middle Channel



High Channel



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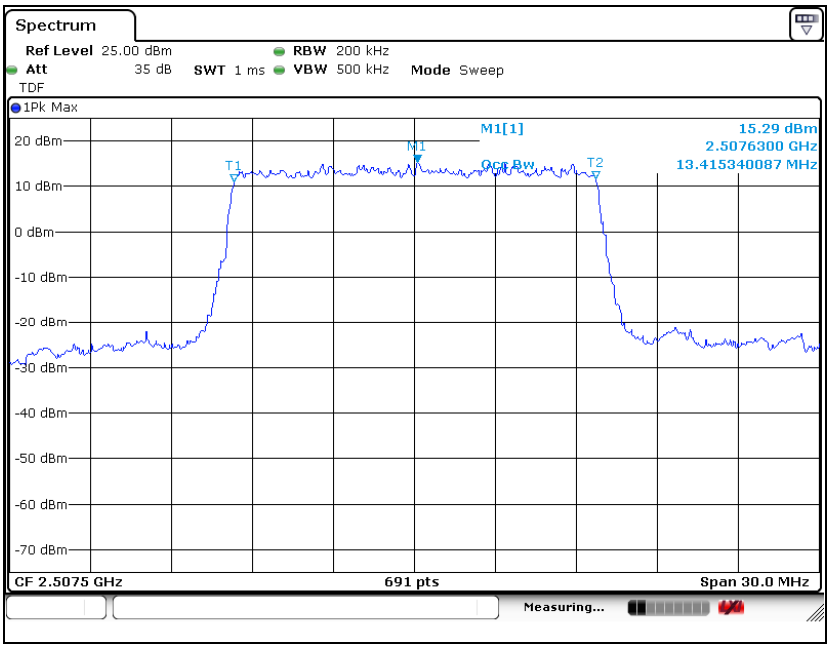
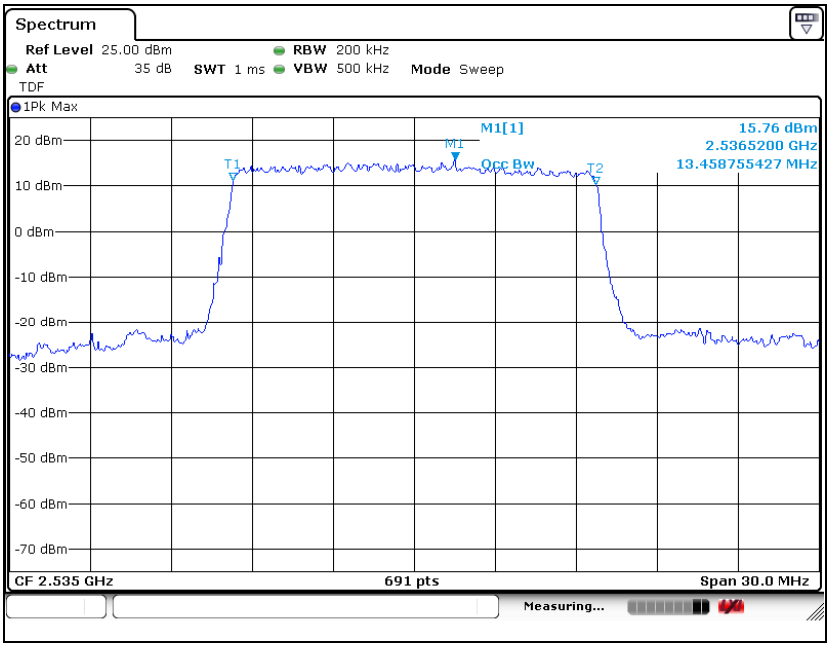
LTE band 7 (15 ㎒ - QPSK)

Low Channel



Middle Channel



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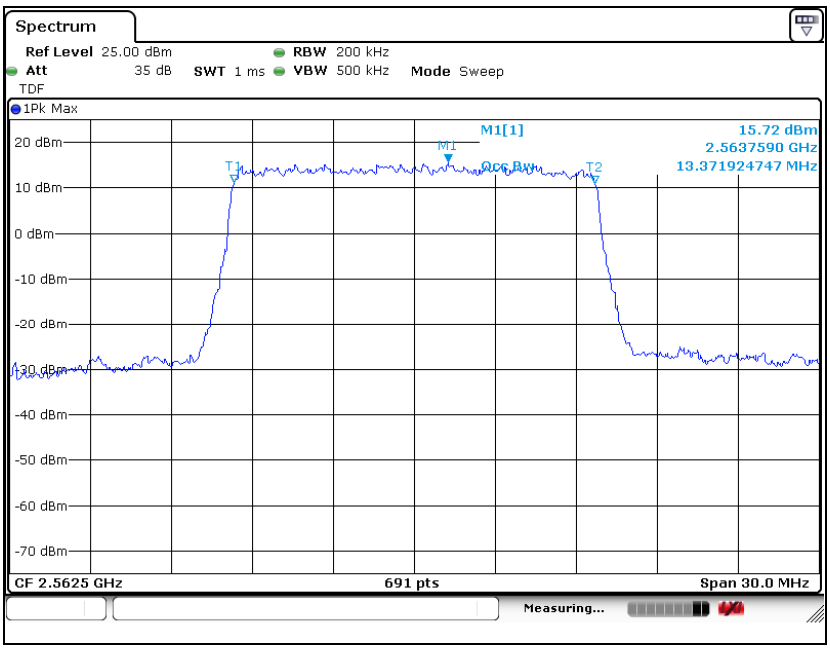
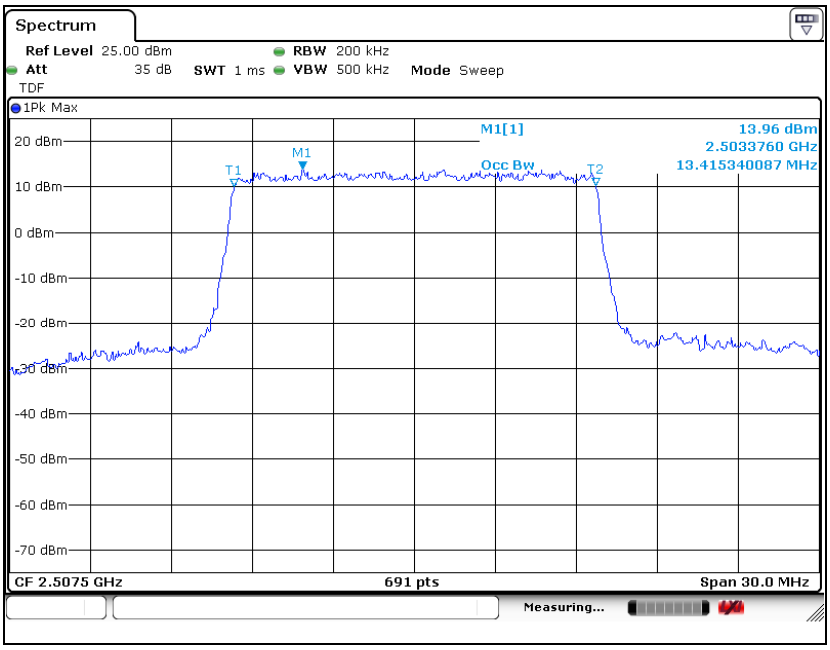
High Channel



LTE band 7 (15 ㎒ - 16QAM)

Low Channel



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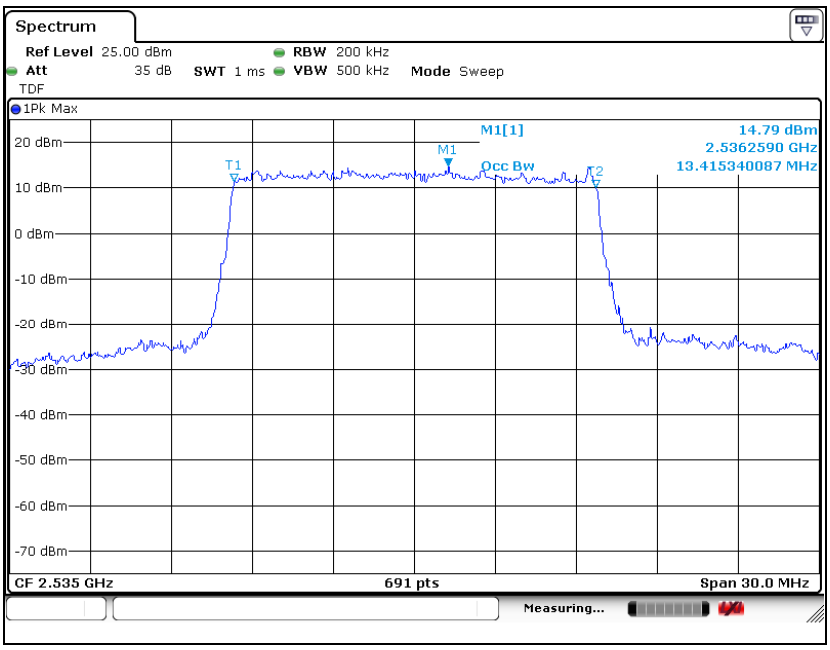
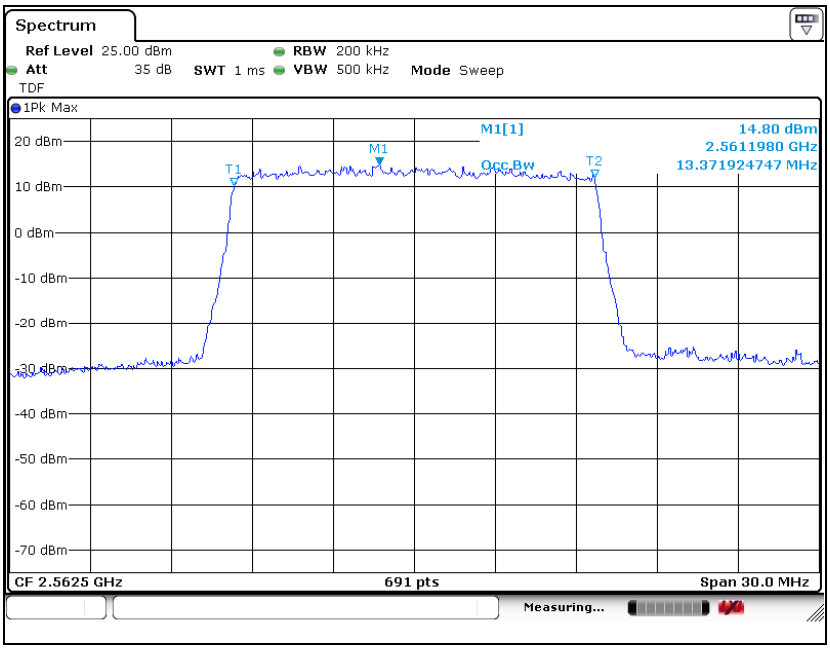
Middle Channel



High Channel



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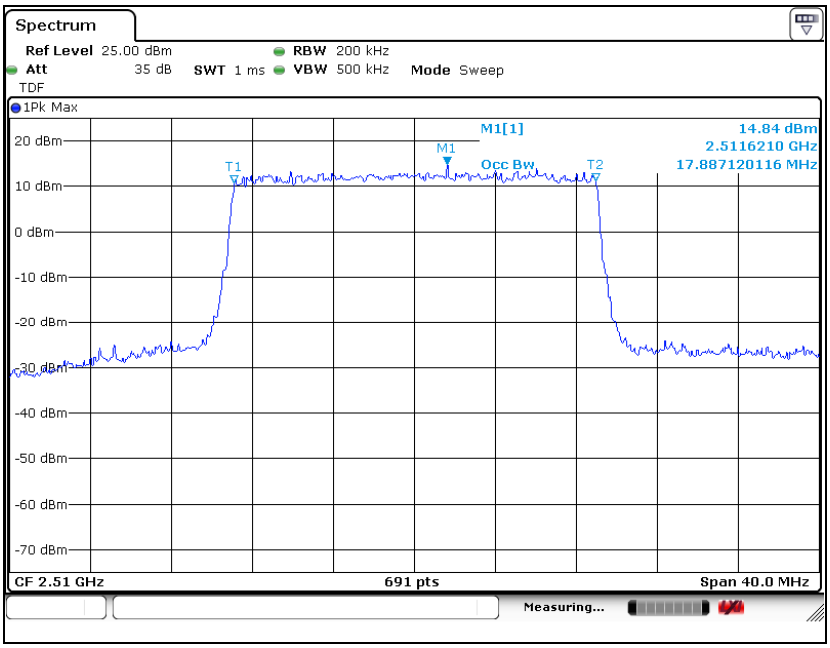
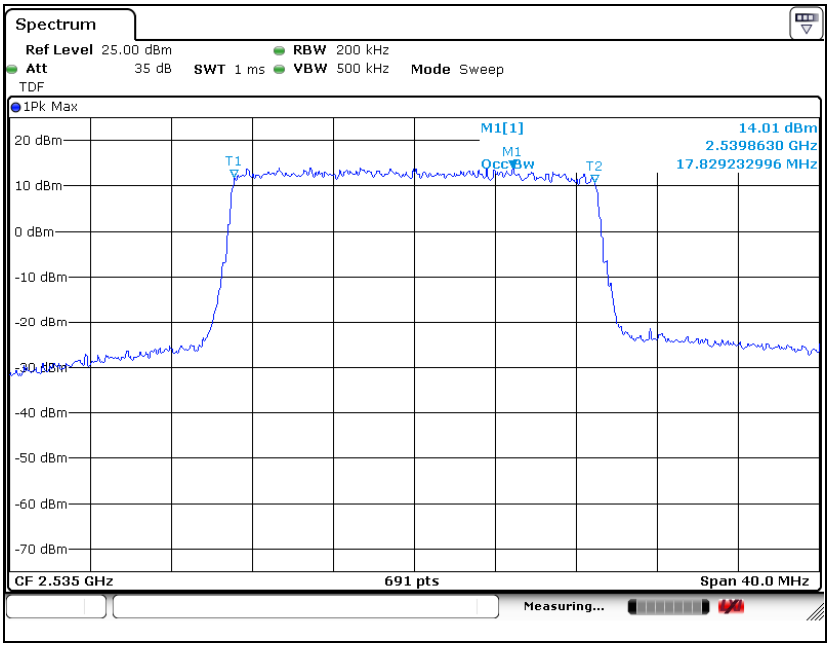
LTE band 7 (20 ㎒ - QPSK)

Low Channel



Middle Channel



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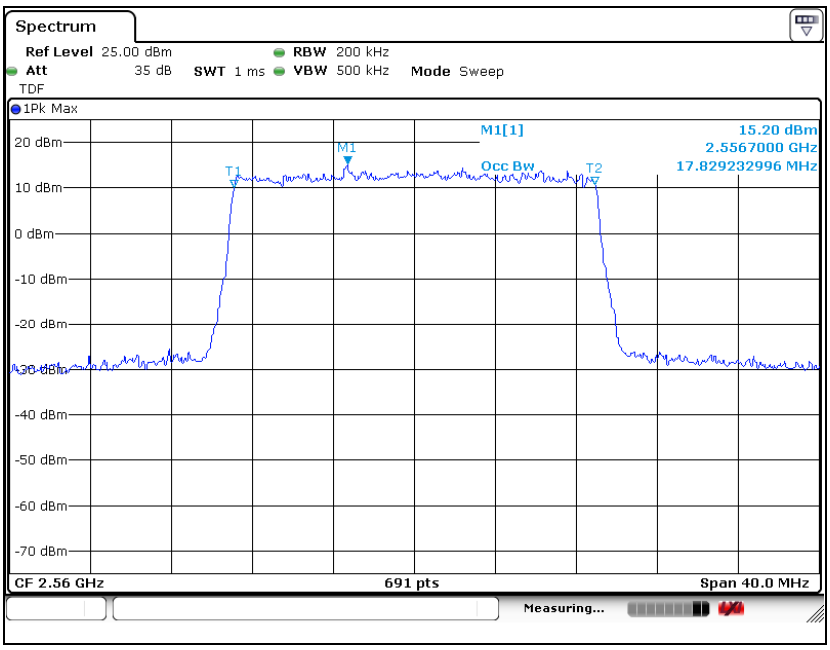
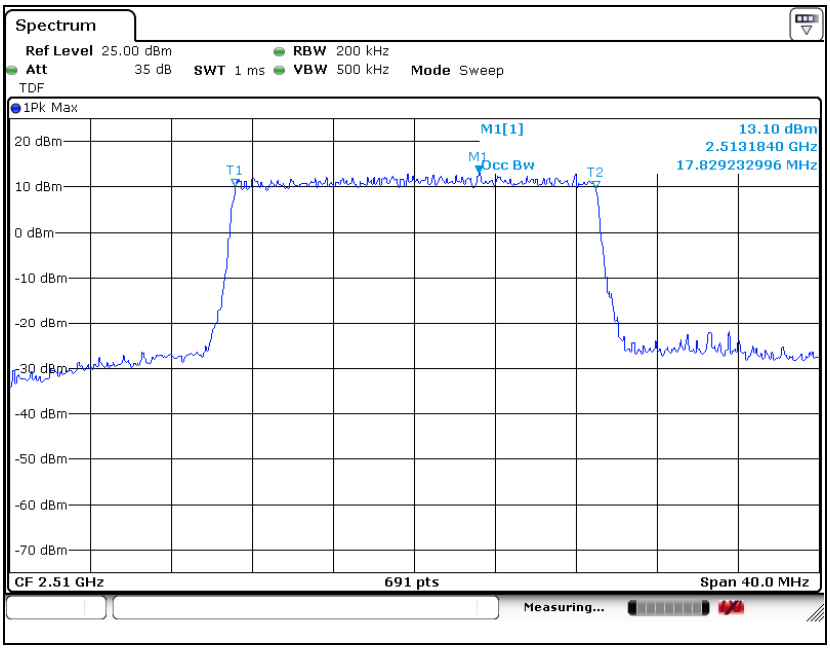
High Channel



LTE band 7 (20 ㎒ - 16QAM)

Low Channel



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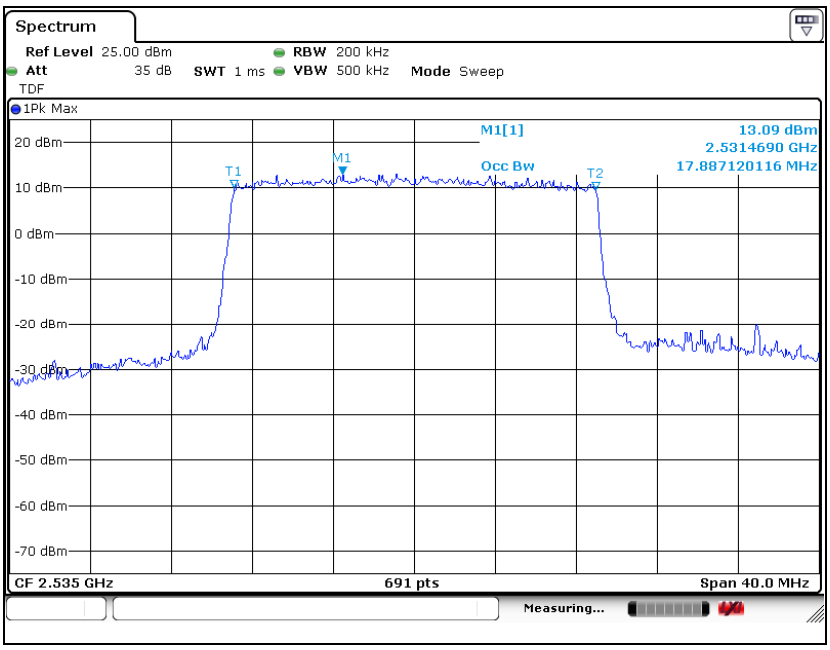
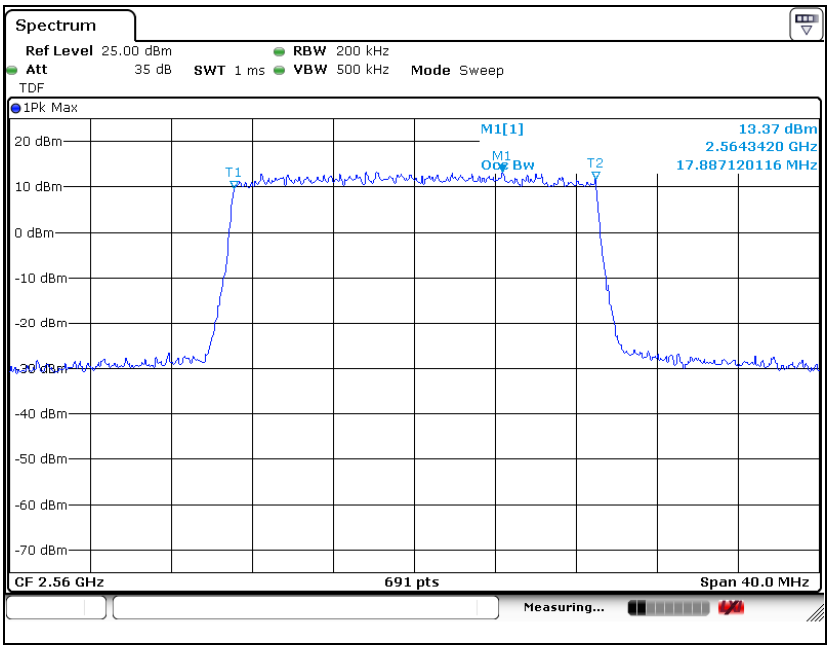
Middle Channel



High Channel



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5. Peak-Average Ratio

5.1. Limit

- §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 5.7.2 of FCC KDB Publication 971168 D01 v03r01.

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 ≥ 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:

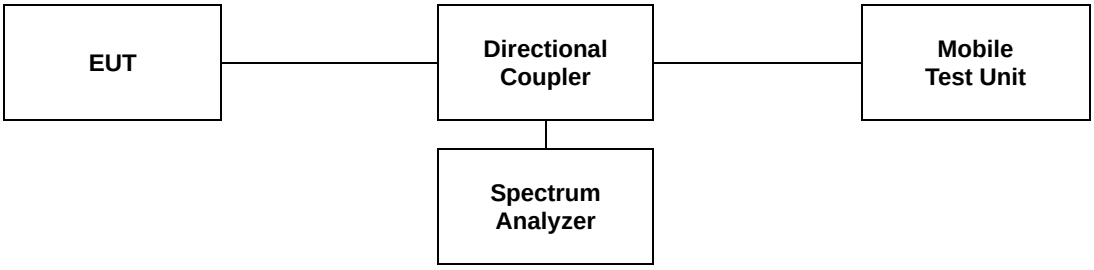
1) For continuous transmissions, set to greater of [10 x (number of points in sweep) x (transmission symbol period)] or 1 ms.

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 form the sum of the PAPR value from step d) to the measured average power.



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5.3 Test Results

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

LTE Band	Mode	Frequency (㎒)	PAR (㏈)
7 (5 ㎒)	QPSK	2 502.5	4.35
		2 535.0	4.55
		2 567.5	4.78
7 (10 ㎒)	QPSK	2 505.0	4.46
		2 535.0	4.52
		2 565.0	4.72
7 (15 ㎒)	QPSK	2 507.5	4.87
		2 535.0	4.81
		2 562.5	5.01
7 (20 ㎒)	QPSK	2 510.0	4.70
		2 535.0	4.49
		2 560.0	4.78

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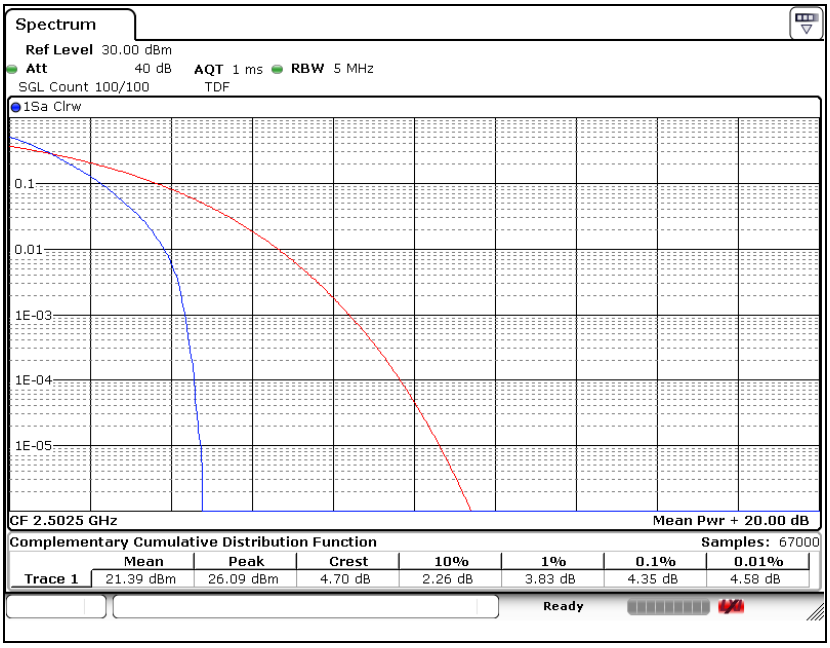
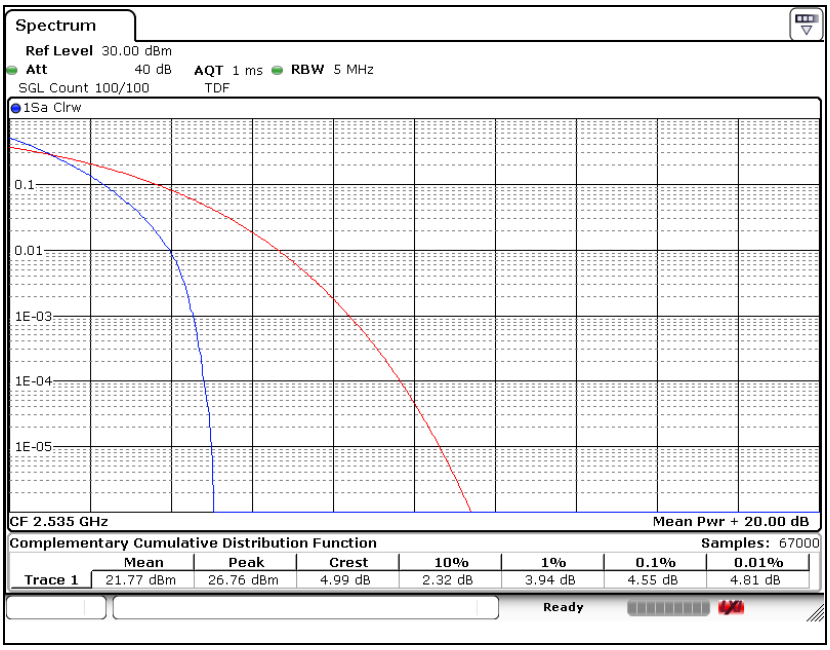
LTE band 7 (5 ㎒ - QPSK)

Low Channel



Middle Channel



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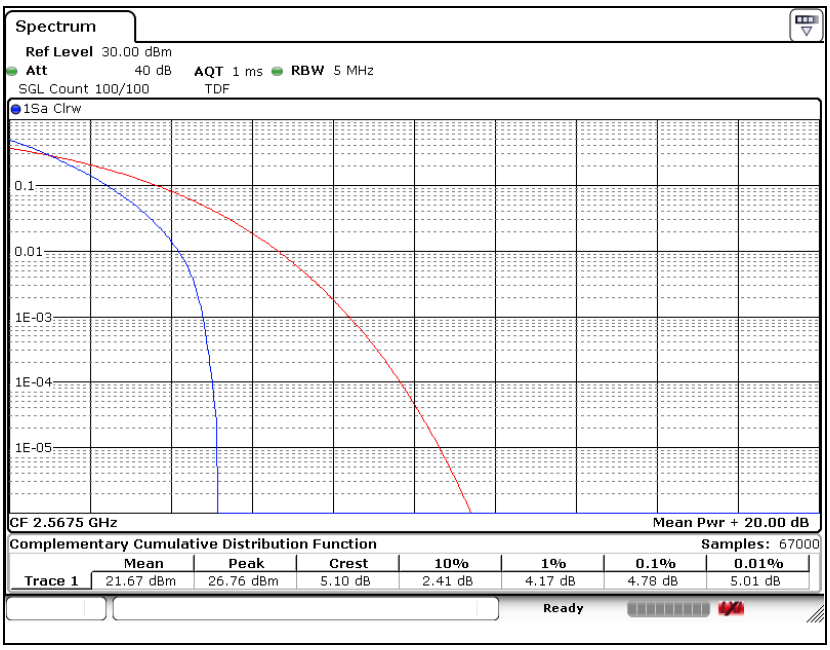
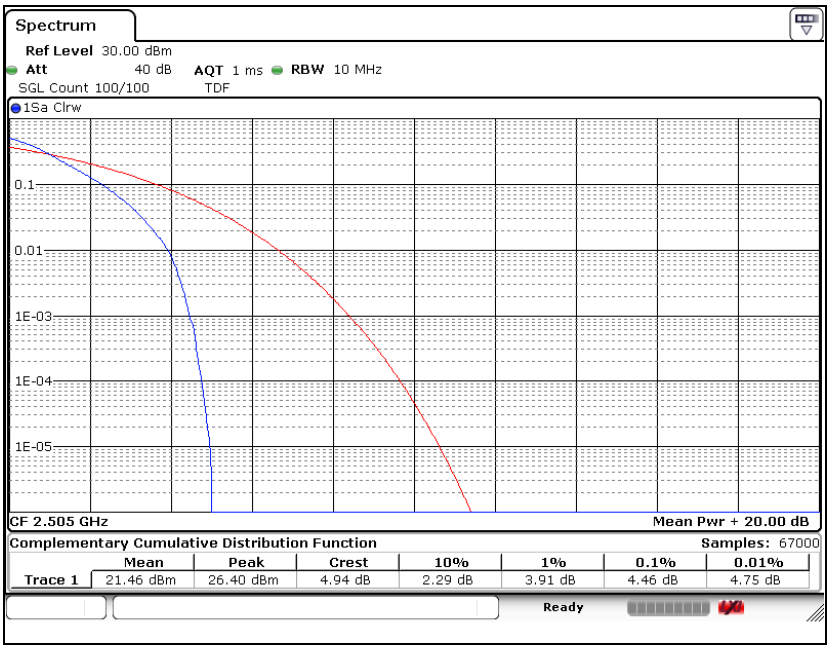
High Channel



LTE band 7 (10 ㎒ - QPSK)

Low Channel



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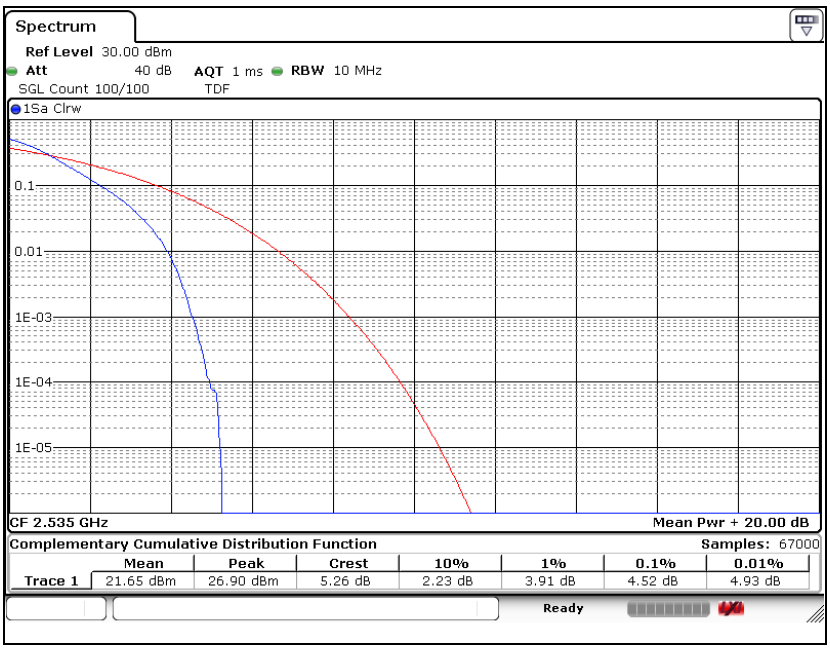
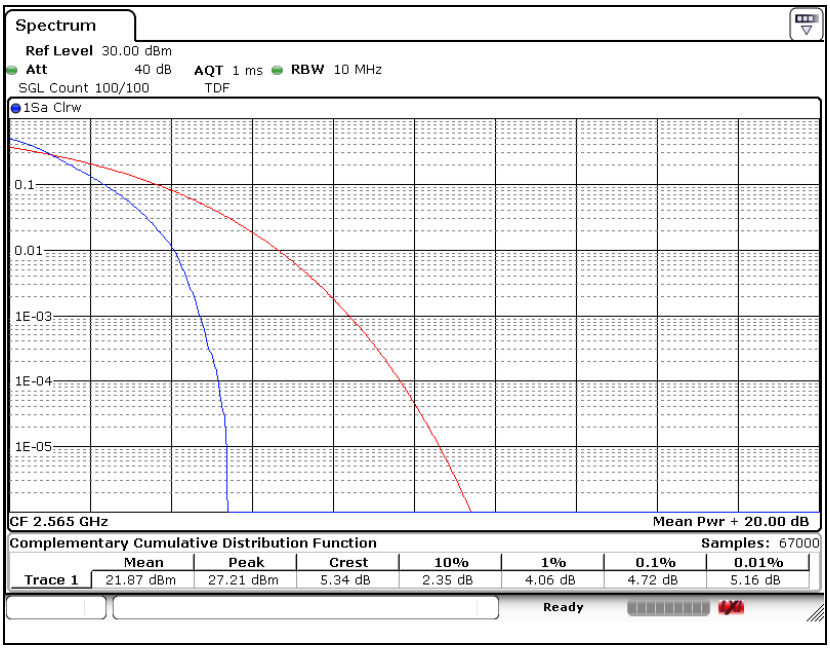
Middle Channel



High Channel



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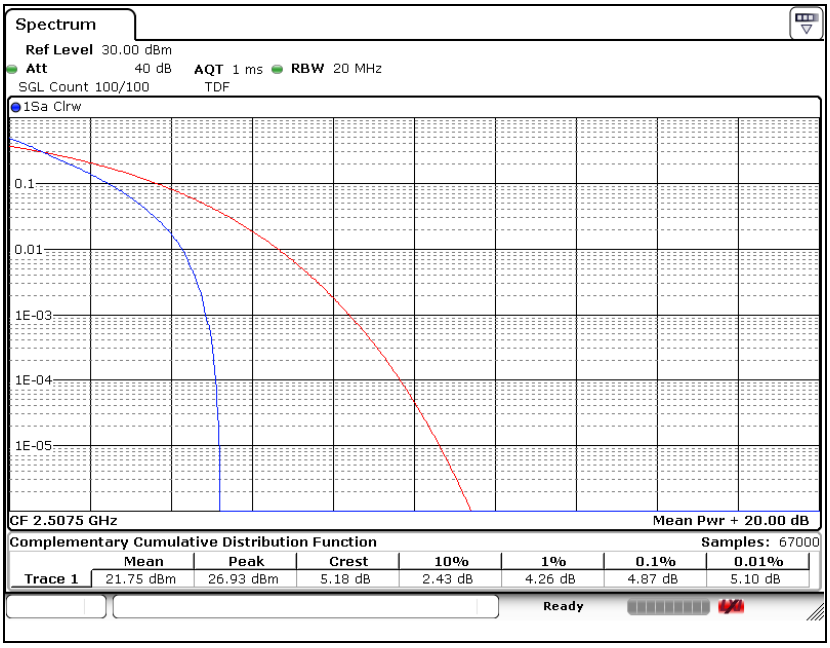
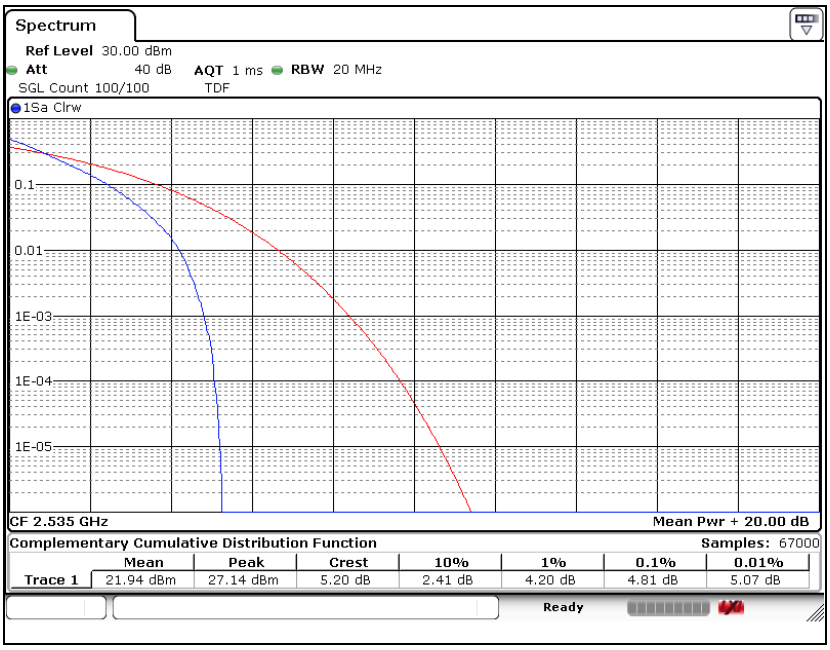
LTE band 7 (15 ㎒ - QPSK)

Low Channel



Middle Channel



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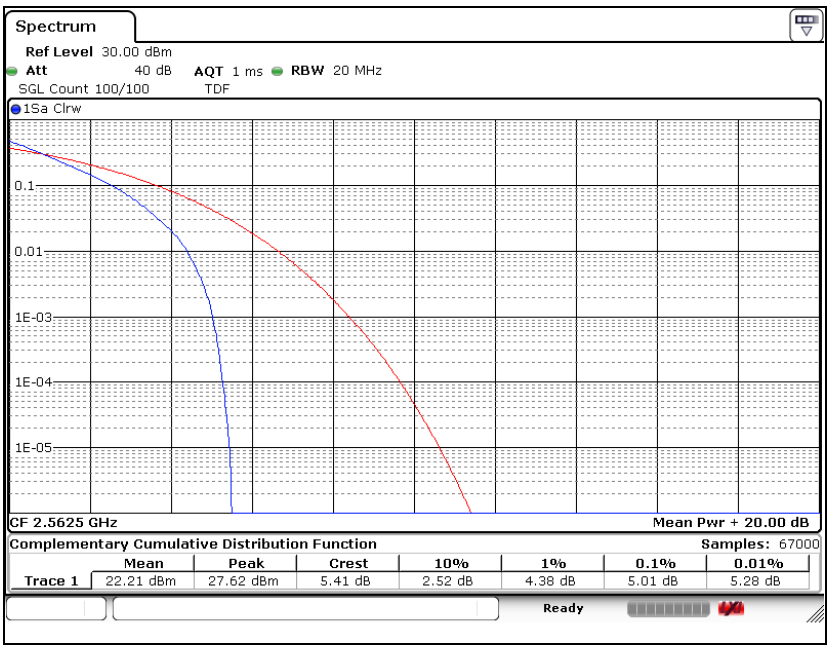
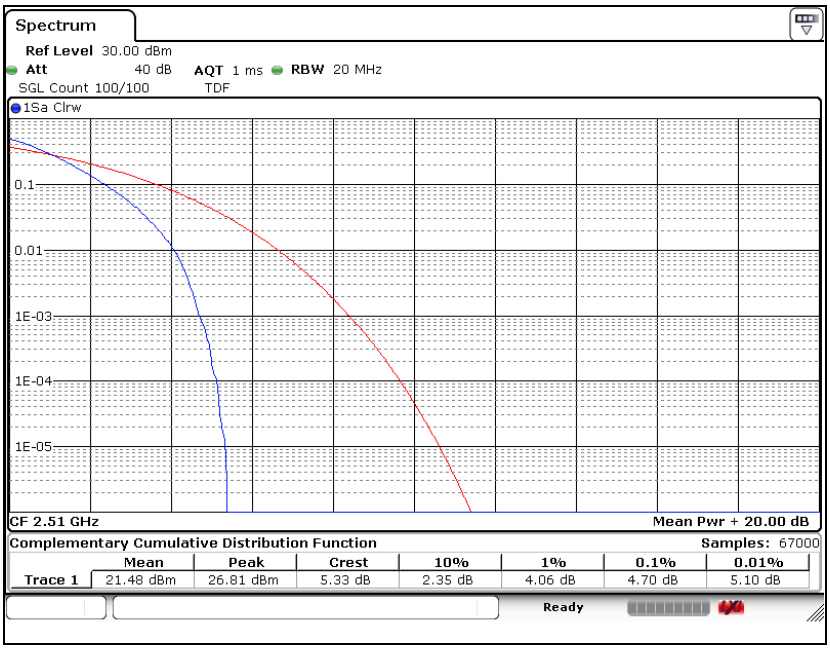
High Channel



LTE band 7 (20 ㎒ - QPSK)

Low Channel



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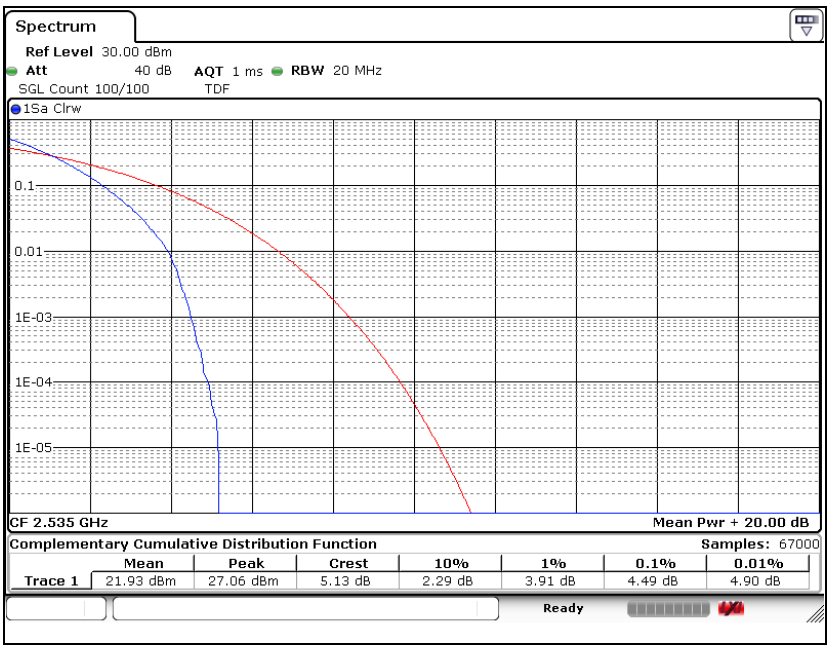
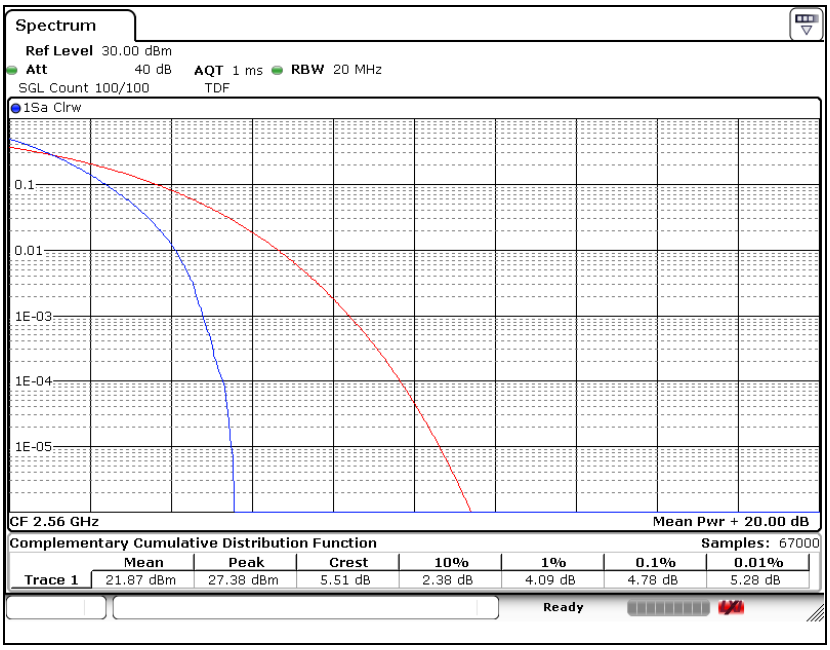
Middle Channel



High Channel



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6. Spurious Emissions at Antenna Terminal

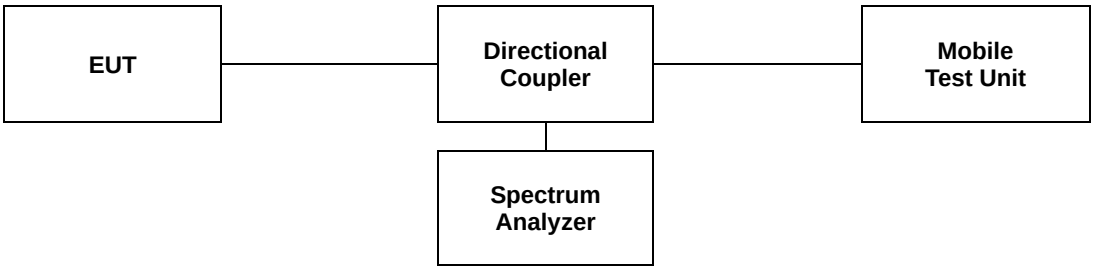
6.1. Limit

- §27.53(m)(4), For mobile digital stations, the attenuation factor shall be not less than 40 + 10 $\log_{10}$ (P) ㎲ on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 $\log_{10}$ (P) ㎲ on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 $\log_{10}$ (P) ㎲ 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 that 43 + 10 $\log_{10}$ (P) ㎲ on all frequencies between 2490.5 ㎒ and 2496 ㎒ and 55 + 10 $\log_{10}$ (P) ㎲ at or below 2490.5 ㎒. Mobile Satellite Service licensees operating on frequencies below 2495 ㎒ 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 6.1 of FCC KDB Publication 971168 D01 v03r01.

a. Start frequency was set to 30 ㎒ and stop frequency was set to at least 10* the fundamental frequency.
b. Detector = Peak.
c. Trace mode = Max hold.
d. Sweep time = Auto couple.
e. The trace was allowed to stabilize.
f. Please see notes below for RBW and VBW settings.
g. For plots showing conducted spurious emissions from 30 ㎒ to 26 ㎓, all path loss of wide frequency range was investigated and compensated to spectrum analyzer as TDF function.



Note:

Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 ㎑ or greater for frequencies less than 1 ㎓ and frequencies greater than 1 ㎓. However, in the 1 ㎒ 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 ㎲ below the transmitter power.

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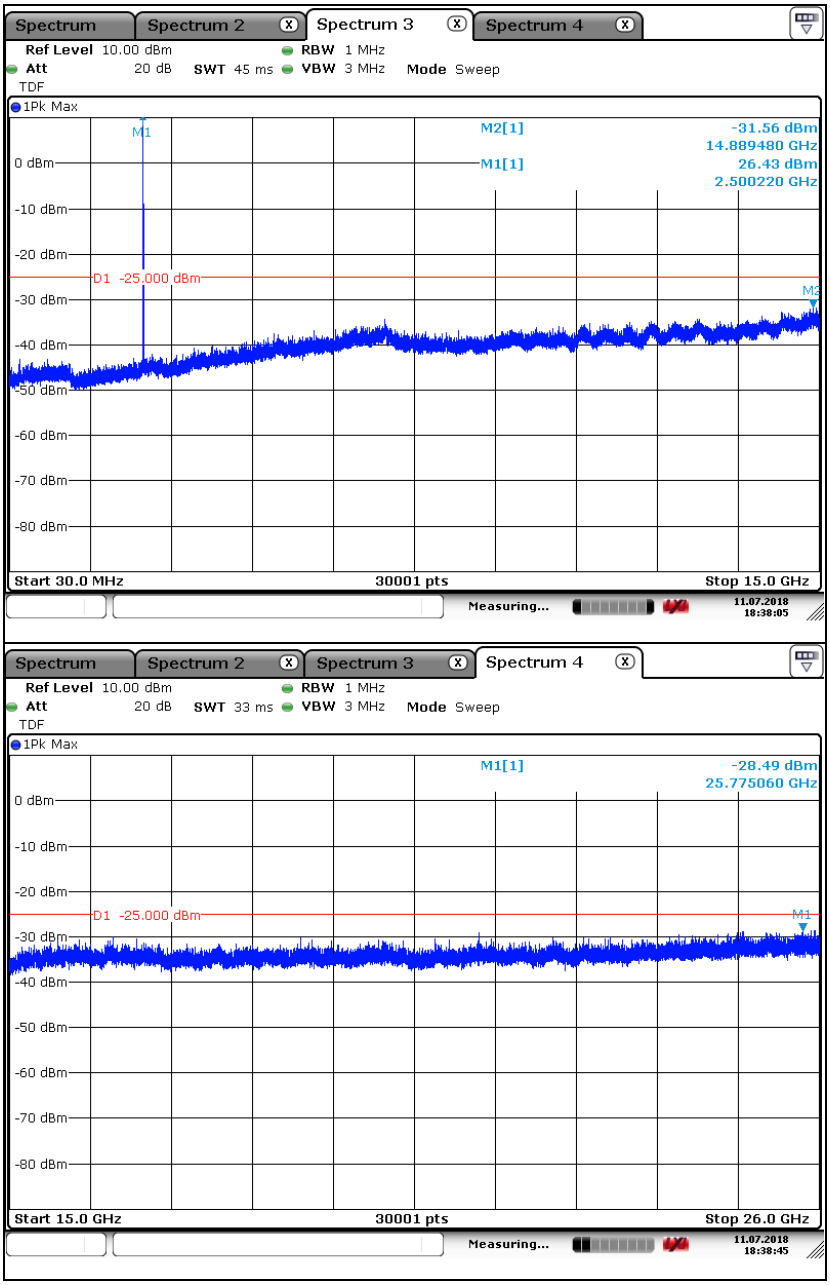
6.3. Test Results

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

Please refer to the following plots.

LTE band 7 (5 ㎒ - QPSK)
Low Channel



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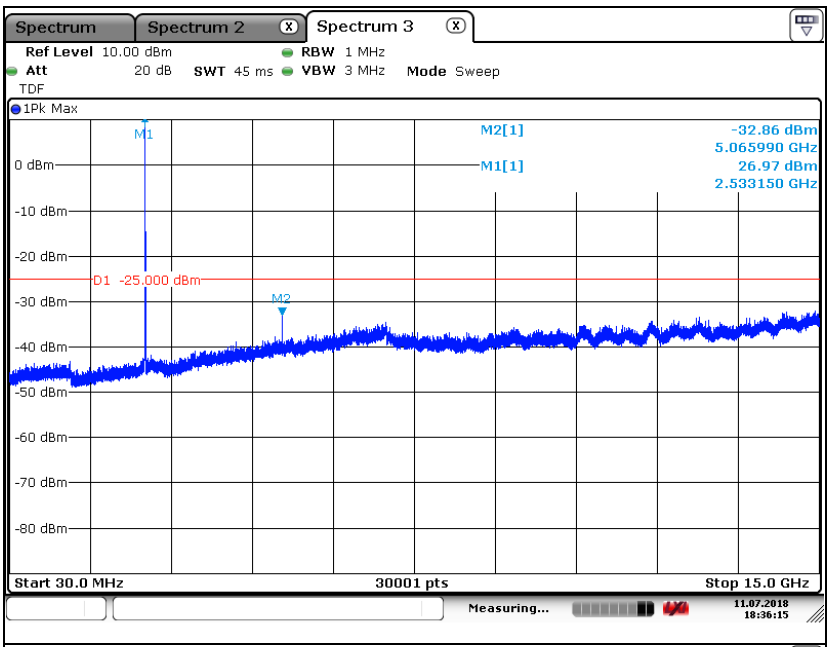
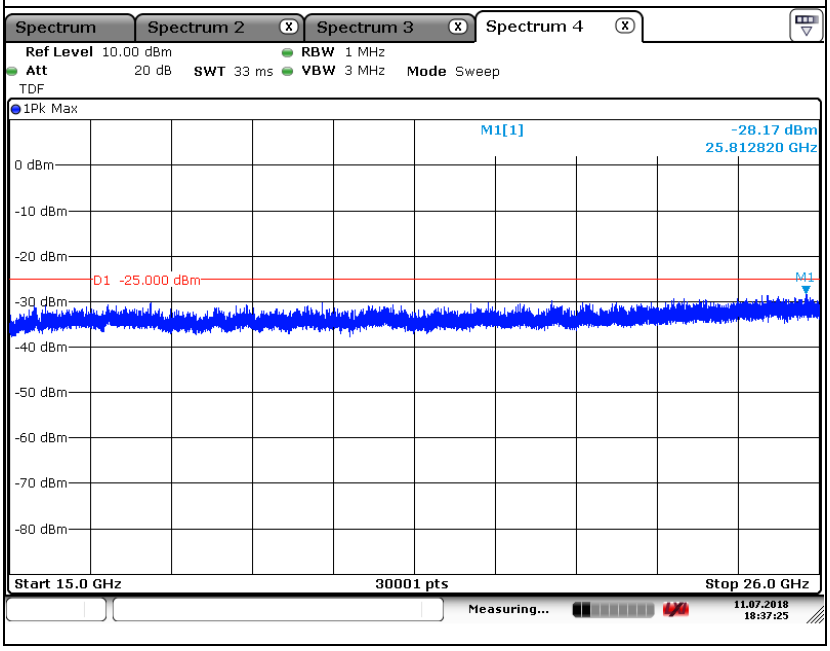
Middle Channel





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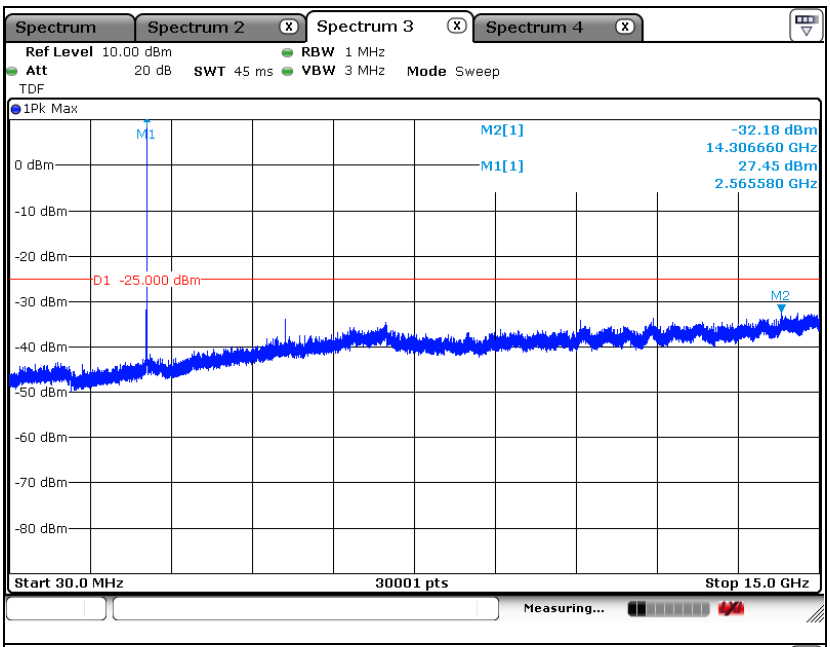
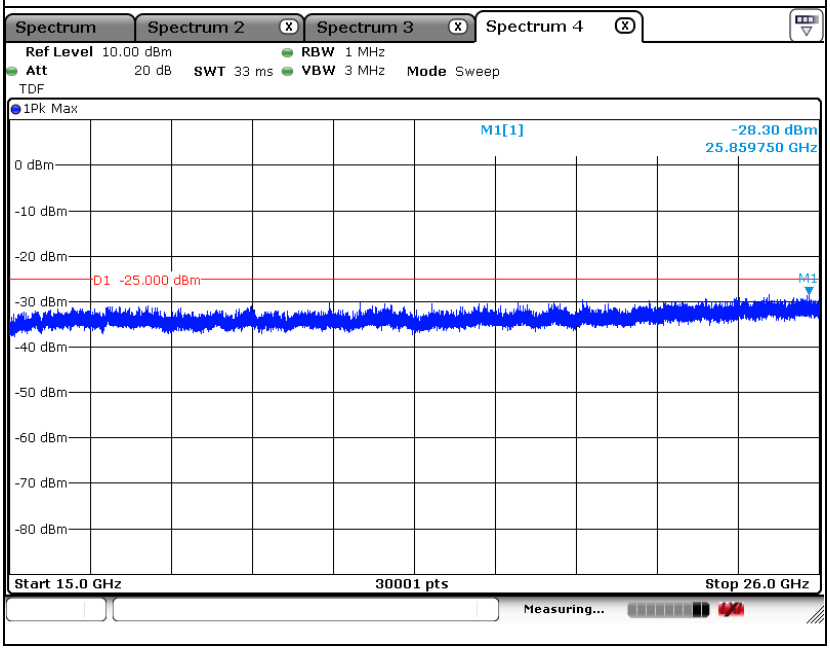
High Channel





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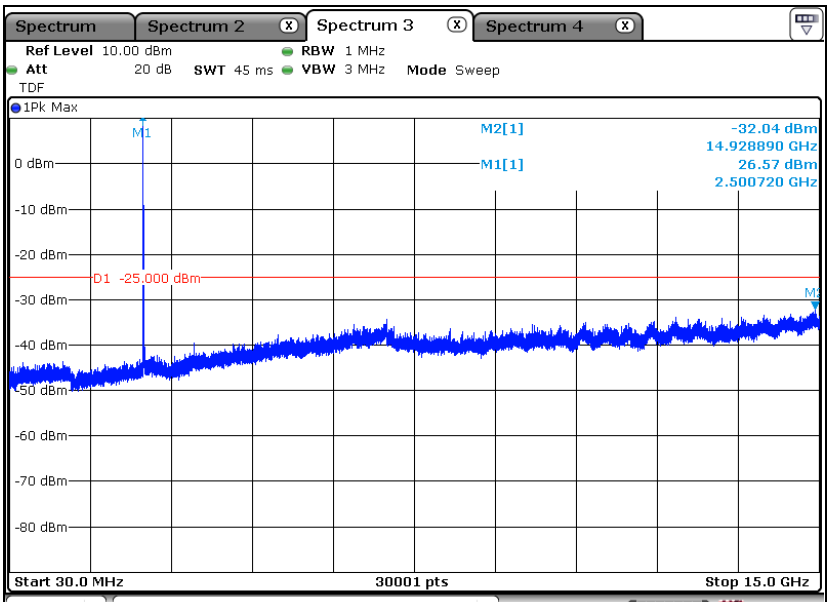
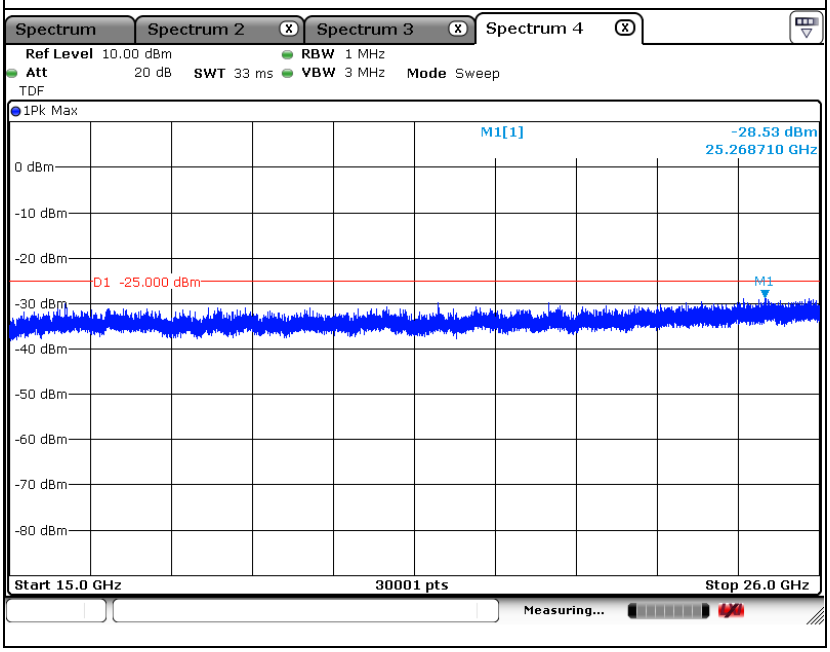
LTE band 7 (10 ㎒ - QPSK)

Low Channel





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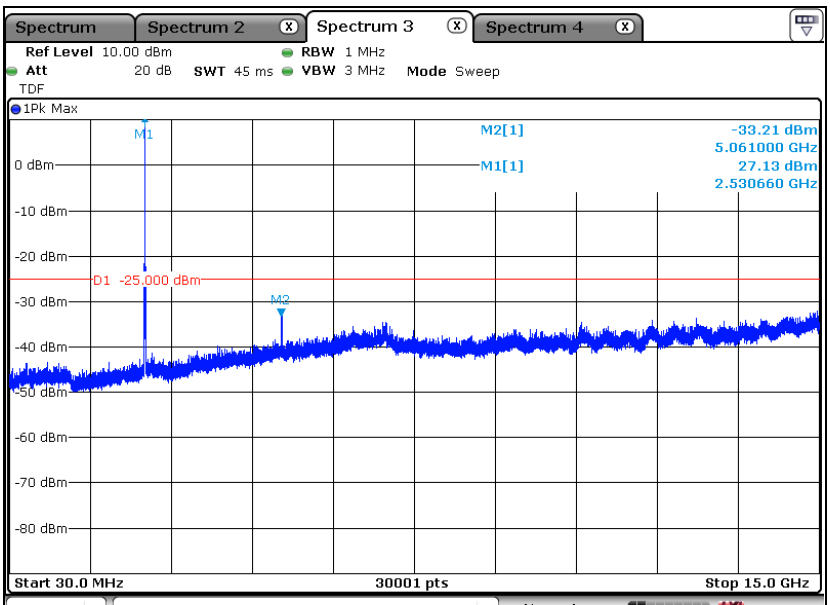
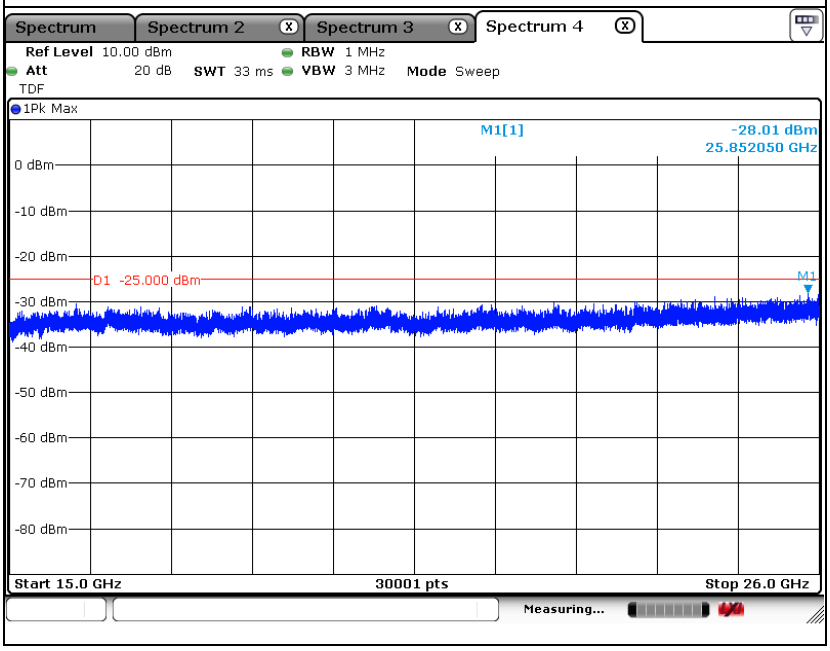
Middle Channel





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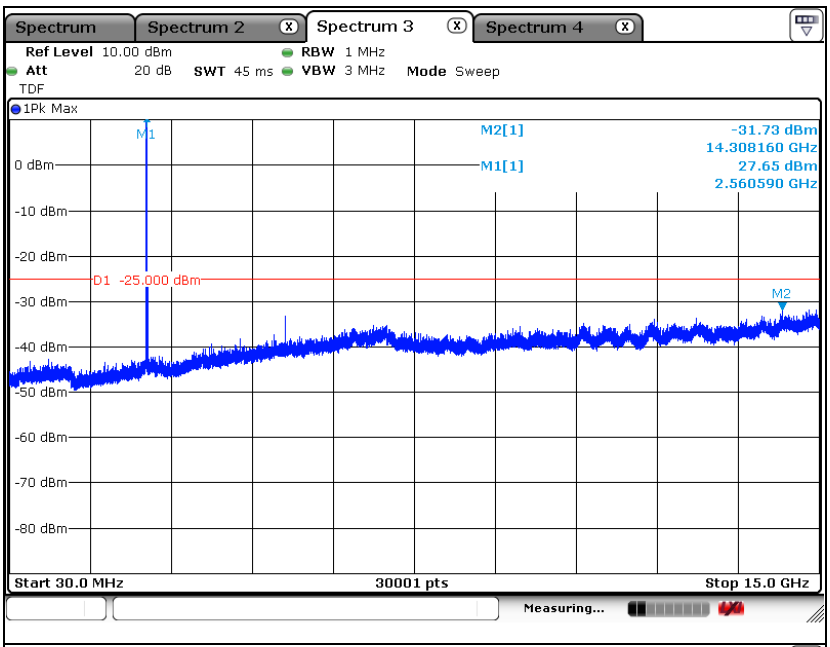
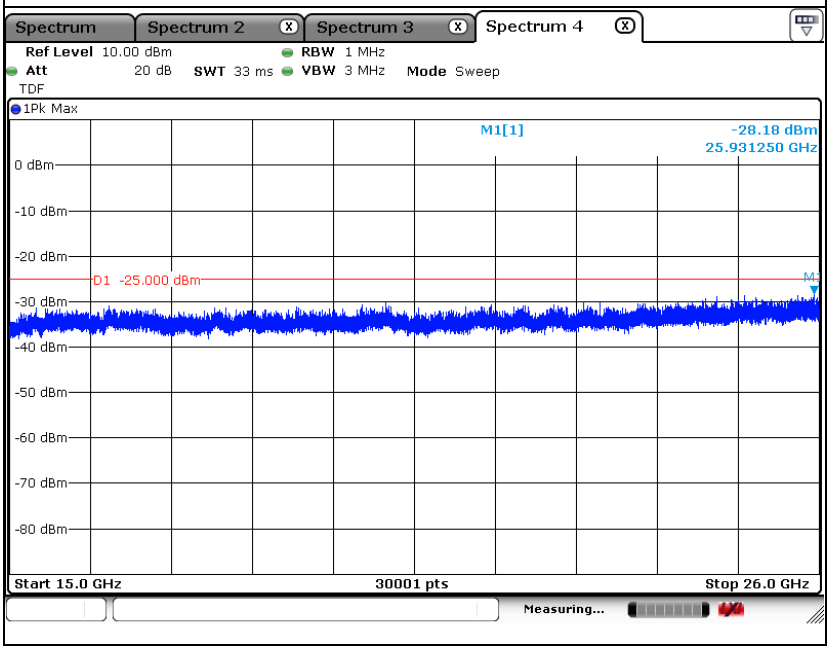
High Channel





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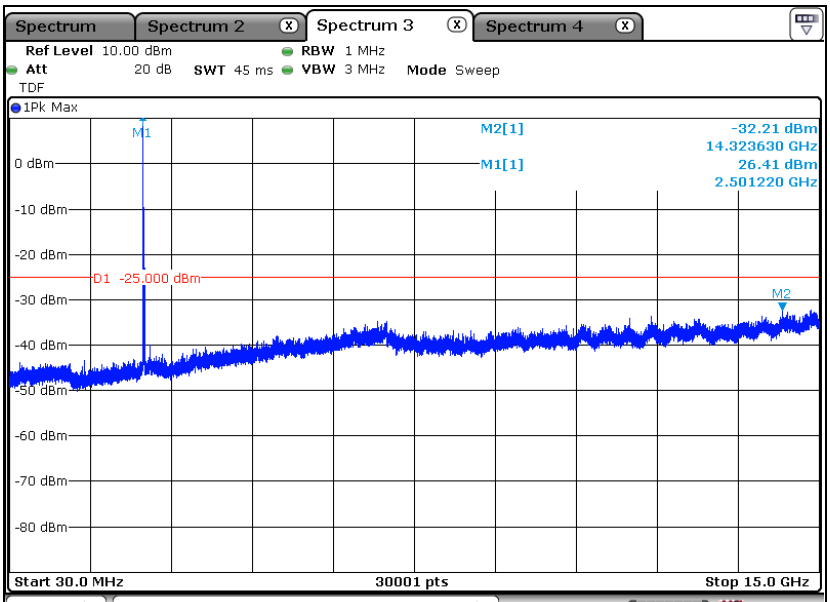
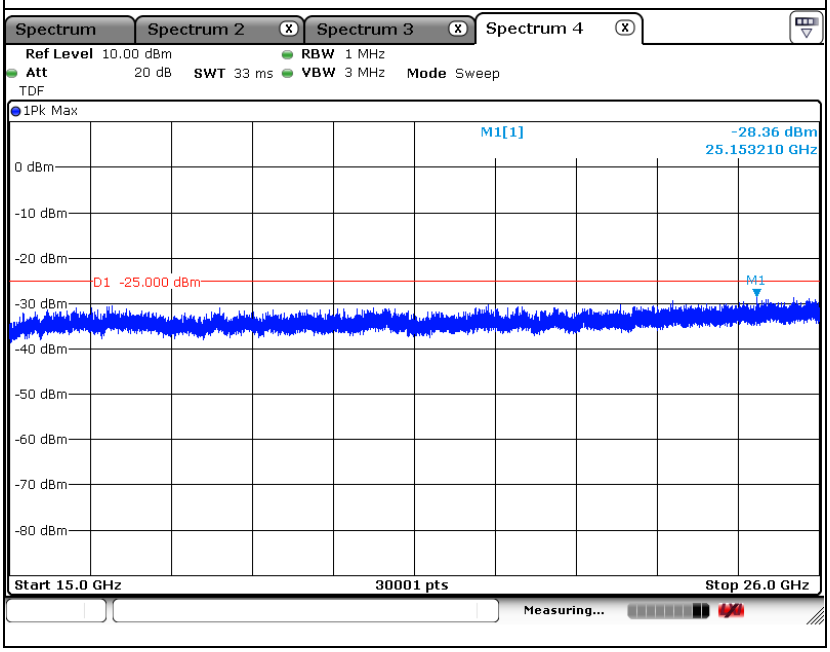
LTE band 7 (15 ㎒ - QPSK)

Low Channel





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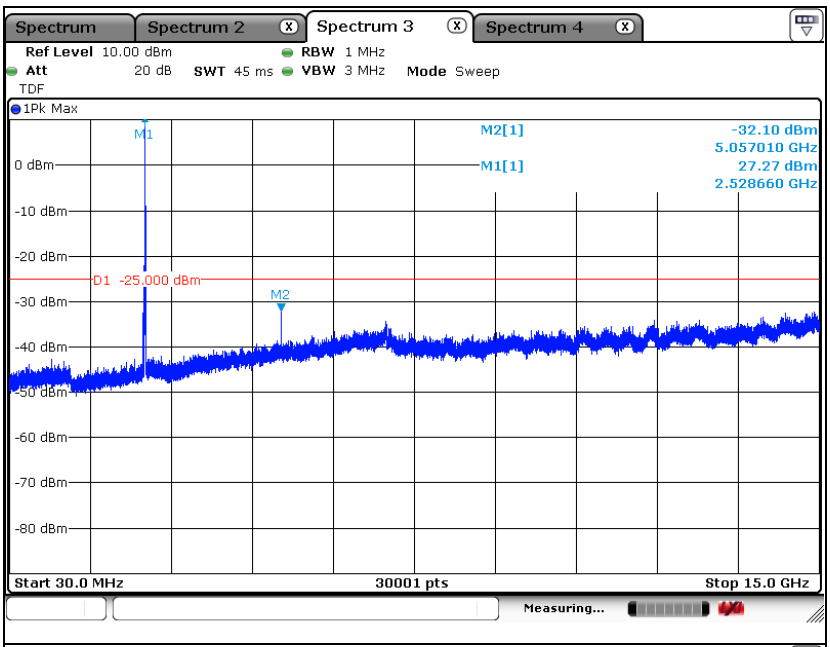
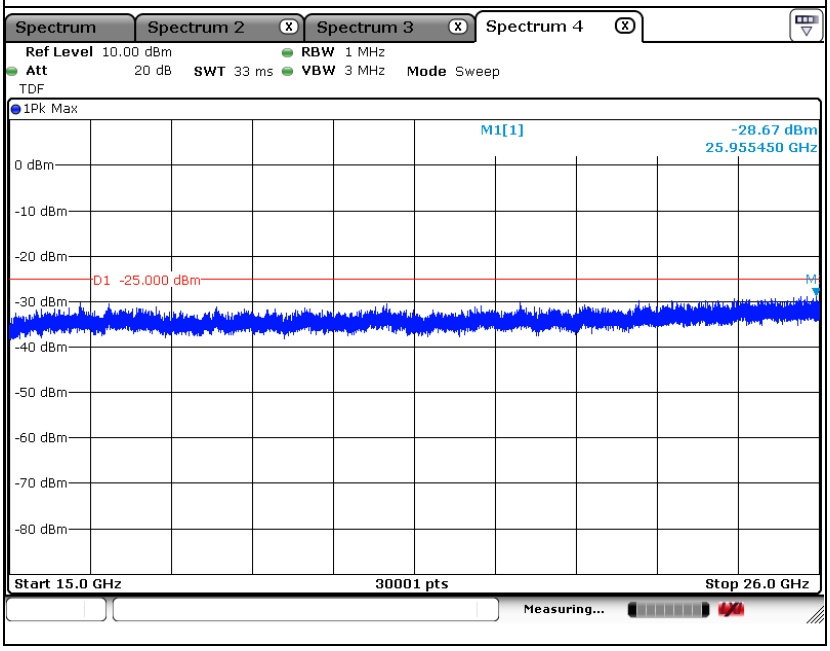
Middle Channel





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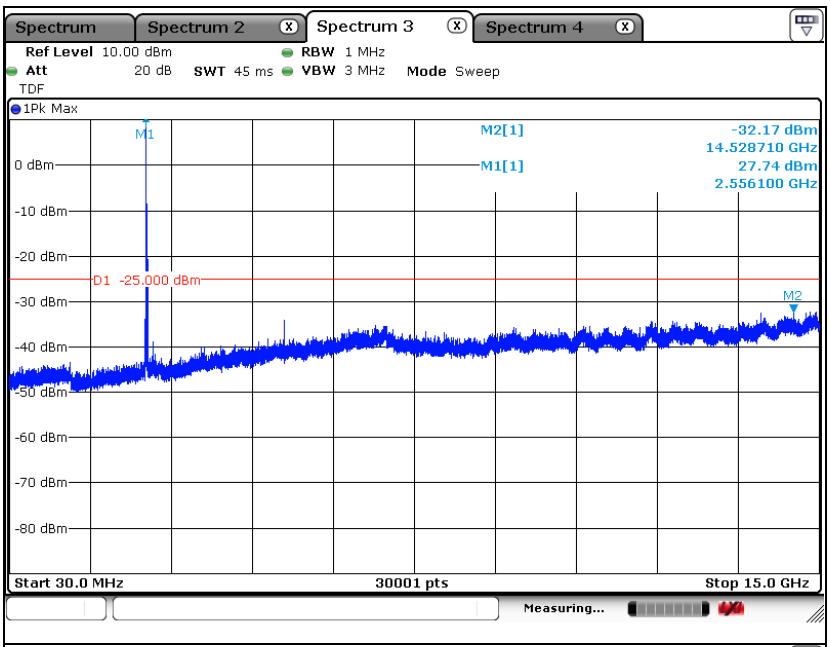
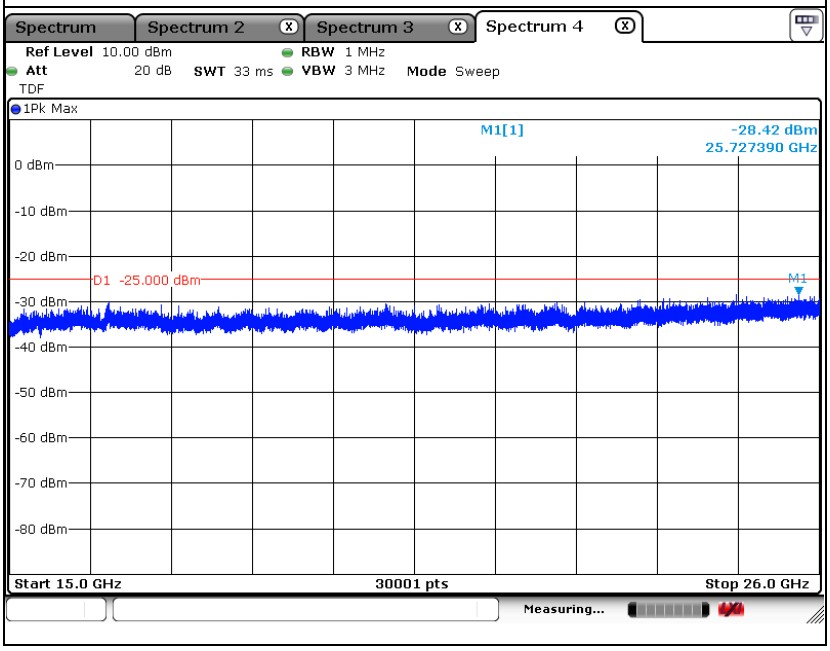
High Channel





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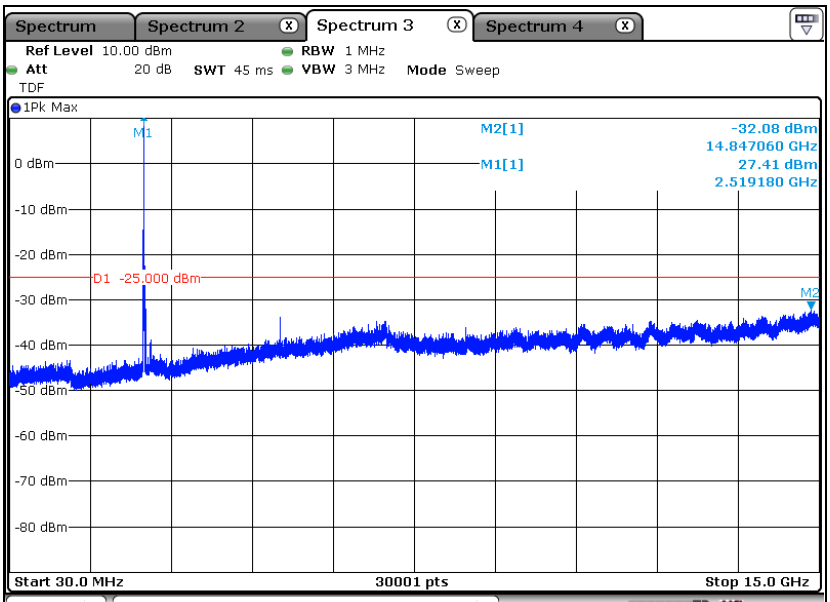
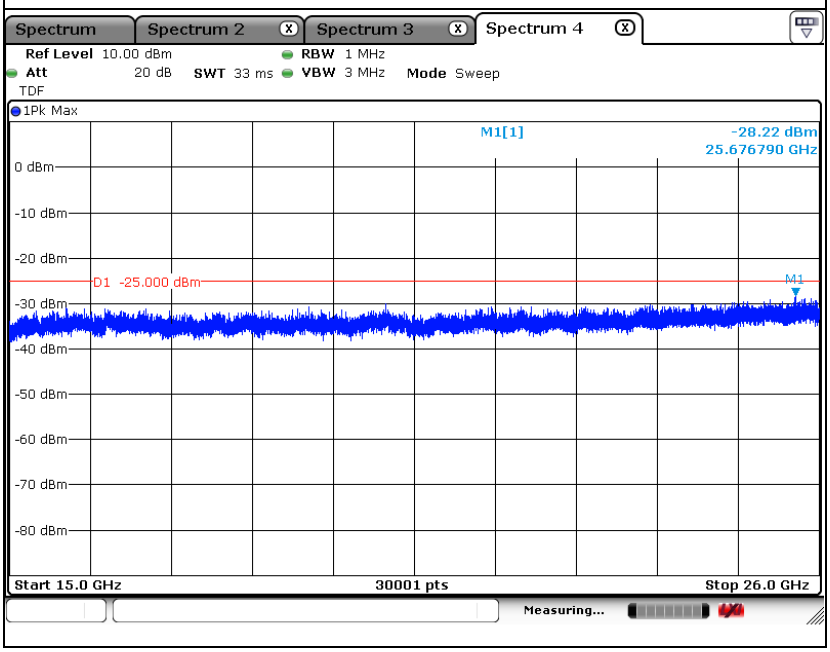
LTE band 7 (20 ㎒ - QPSK)

Low Channel





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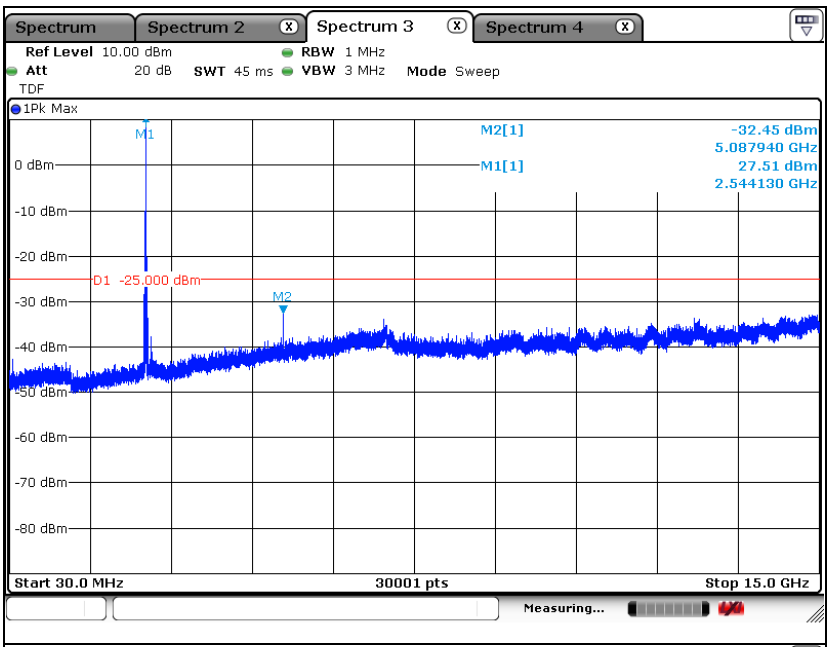
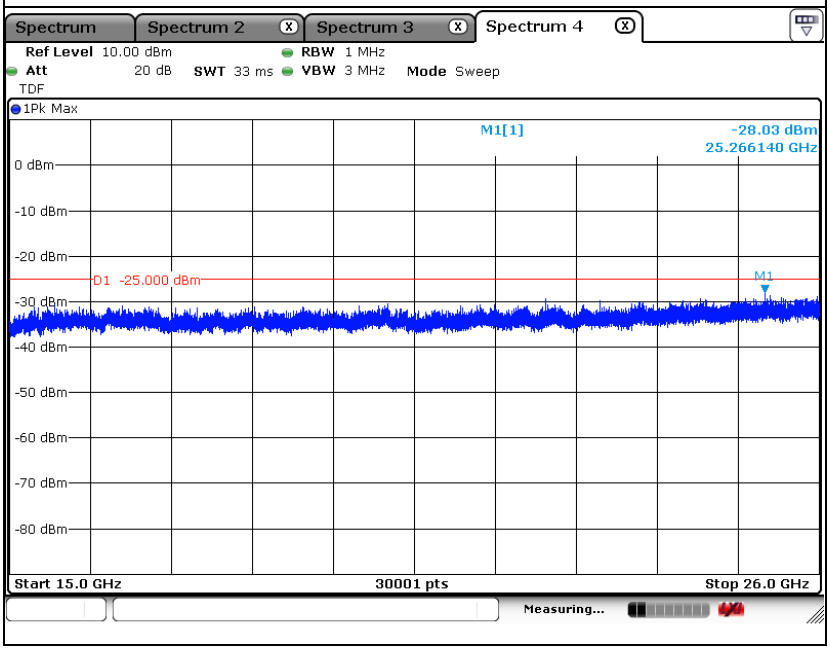
Middle Channel





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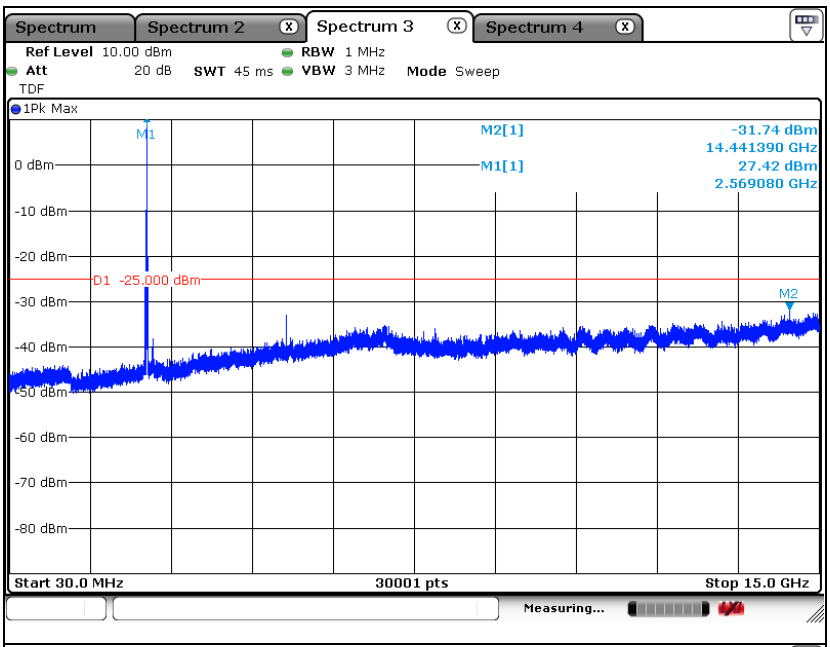
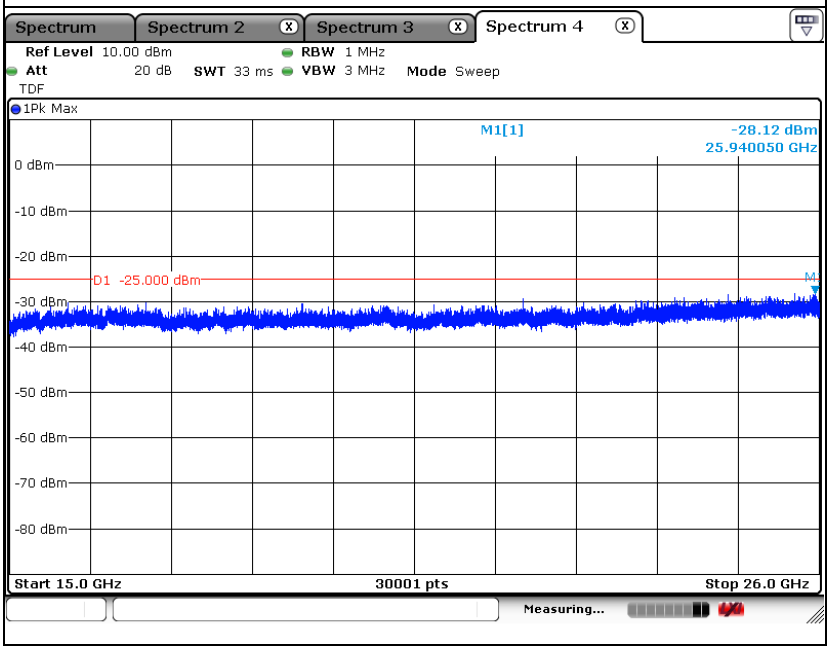
High Channel





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7. Band Edge

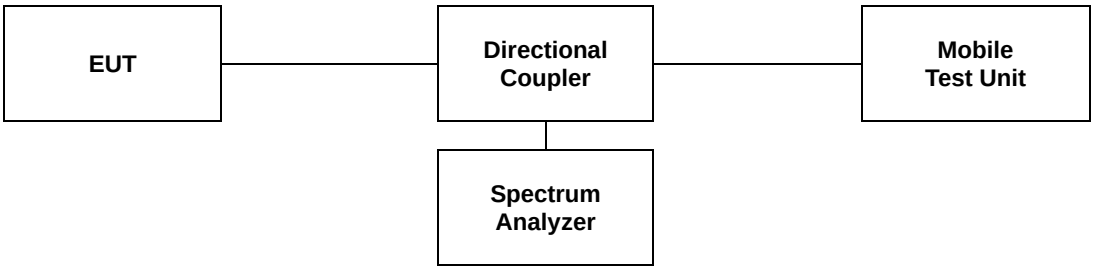
7.1. Limit

- §27.53(m)(4), For mobile digital stations, the attenuation factor shall be not less than 40 + 10 $\log_{10}$ (P) ㎤ on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 $\log_{10}$ (P) ㎤ on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 $\log_{10}$ (P) ㎤ 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 that 43 + 10 $\log_{10}$ (P) ㎤ on all frequencies between 2490.5 ㎒ and 2496 ㎒ and 55 + 10 $\log_{10}$ (P) ㎤ at or below 2490.5 ㎒. Mobile Satellite Service licensees operating on frequencies below 2495 ㎒ 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.

7.2. Test Procedure

The test follows section 6.0 of FCC KDB Publication 971168 D01 v03r01.

a. Span was set large enough so as to capture all out of band emissions near the band edge.
b. RBW ≥ 1 % of OBW
c. VBW ≥ 3 x RBW.
d. Detector = RMS.
e. Trace mode = Average.
f. Sweep time = Auto.
g. The trace was allowed to stabilize.
h. All path loss of frequency range was investigated and compensated to spectrum analyzer as TDF function.



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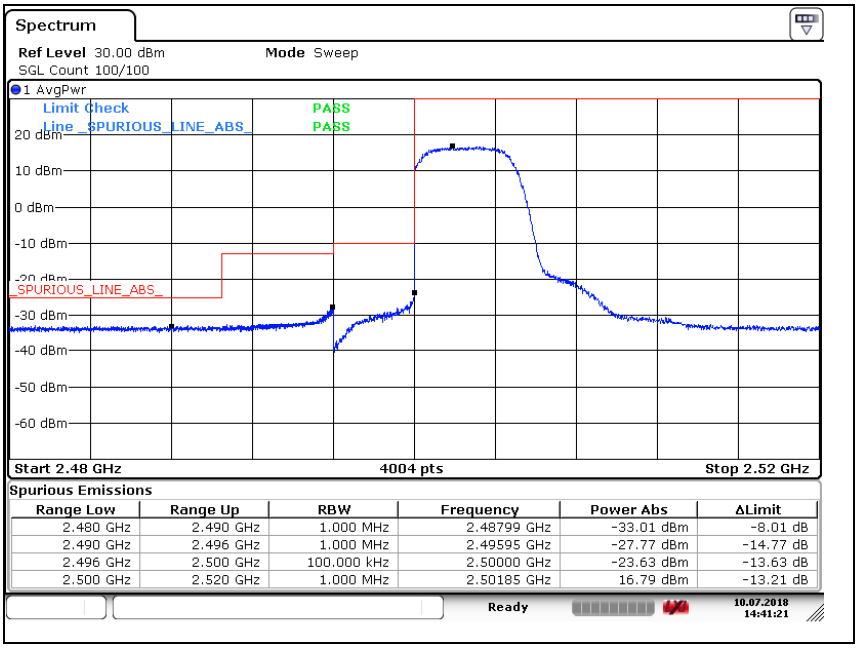
7.3. Test Results

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

Please refer to the following plots.

LTE band 7 (5 ㎒ - QPSK_RB 25)
Low Channel



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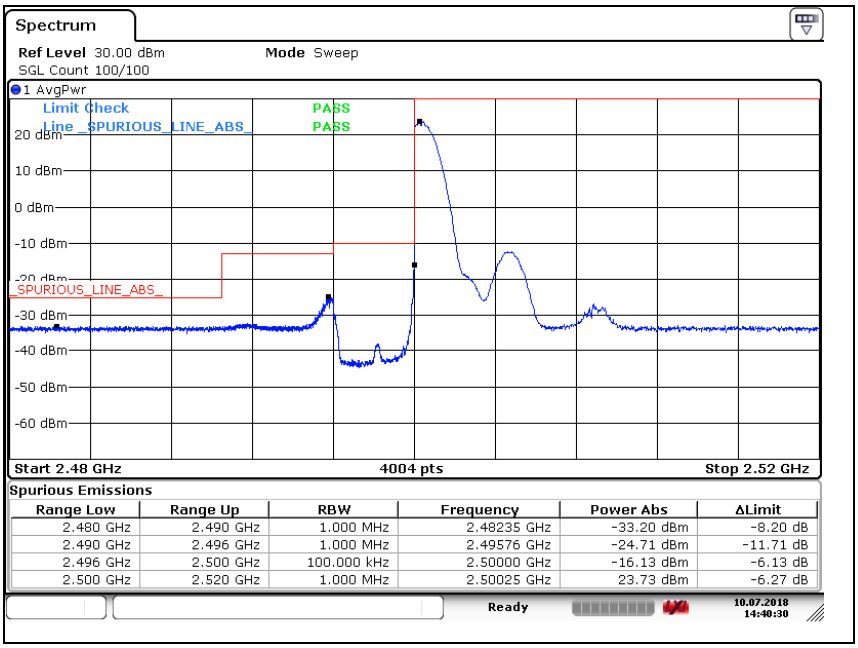
LTE band 7 (5 ㎒ - QPSK_RB 1)

Low Channel



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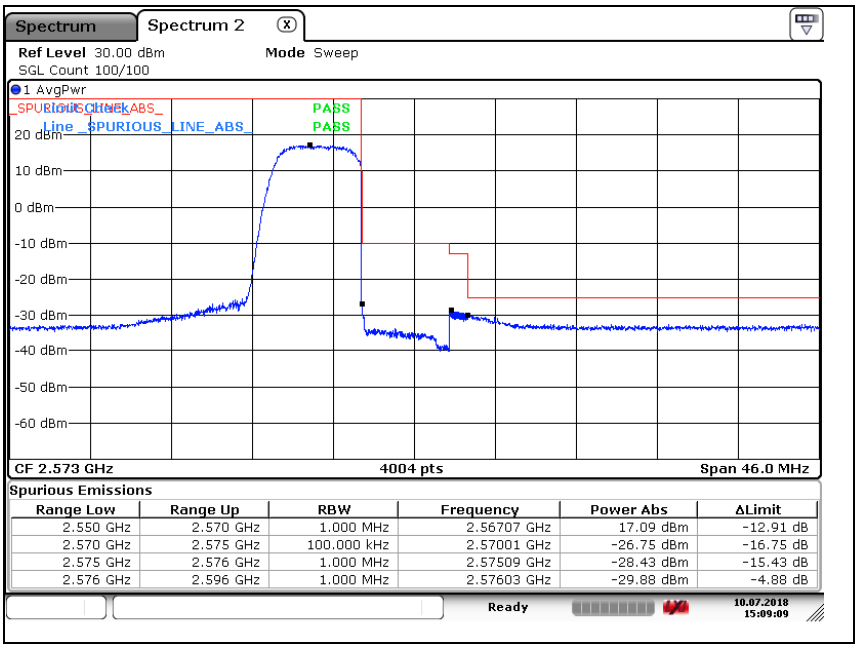
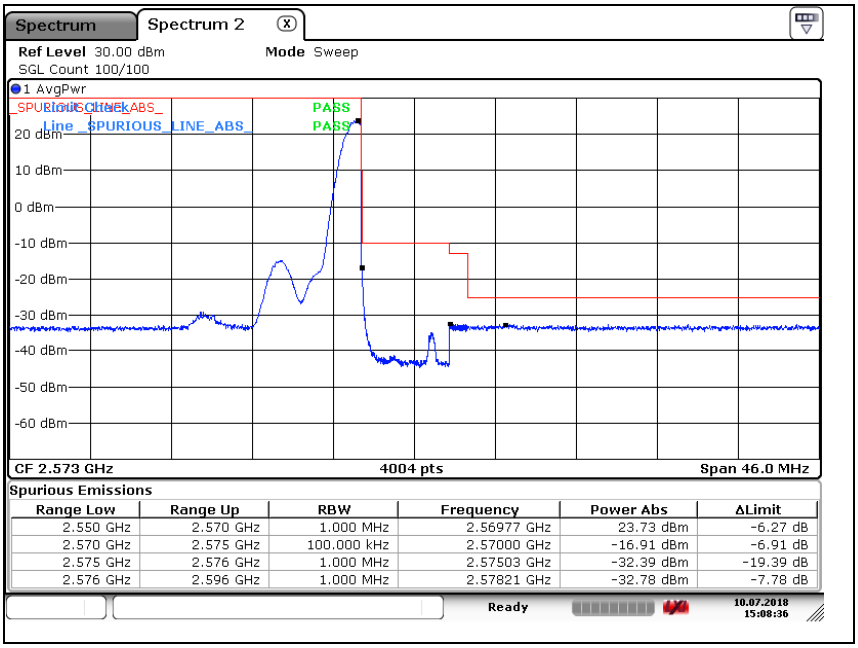
LTE band 7 (5 ㎒ - QPSK_RB 25)
High Channel



LTE band 7 (5 ㎒ - QPSK_RB 1)
High Channel



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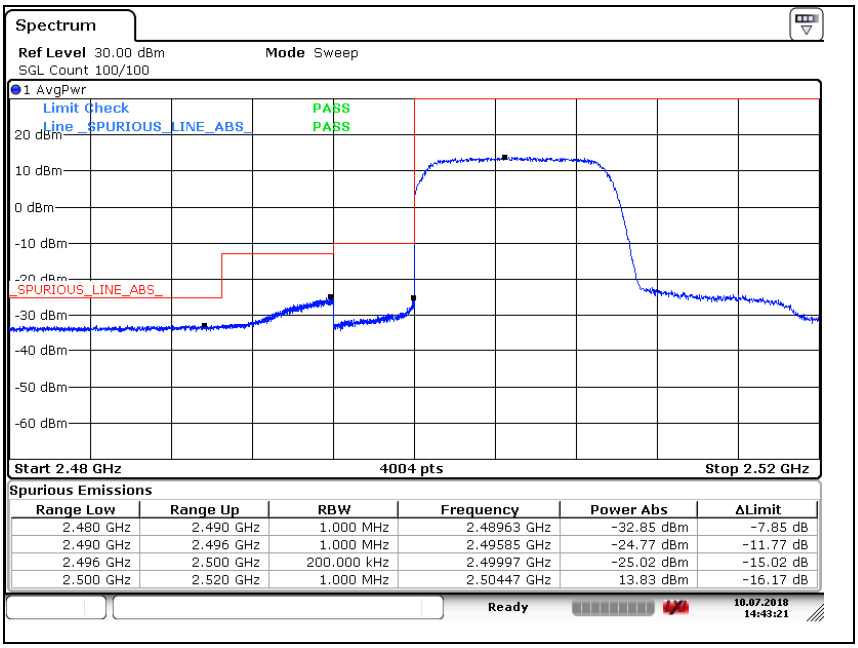
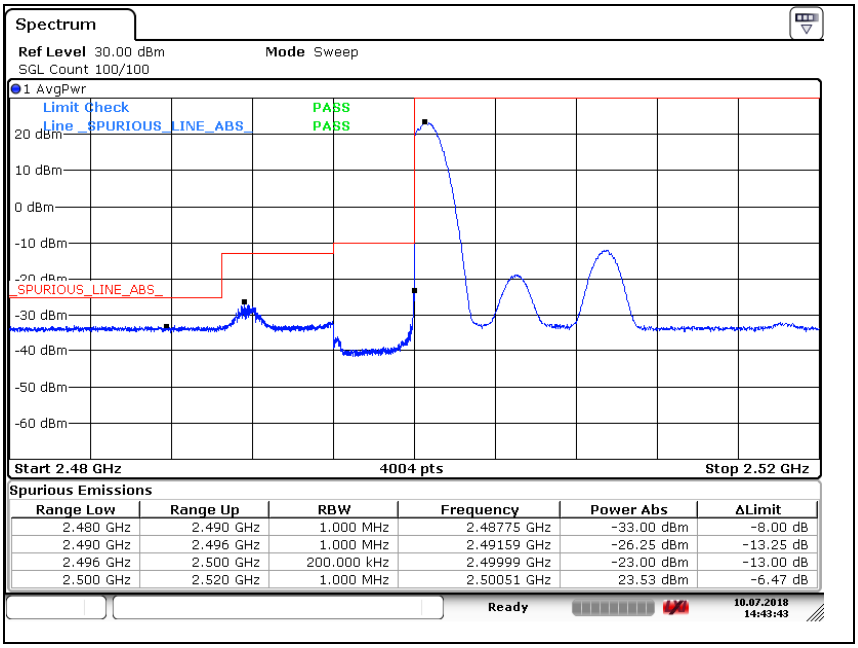
LTE band 7 (10 ㎒ - QPSK_RB 50)

Low Channel



LTE band 7 (10 ㎒ - QPSK_RB 1)

Low Channel



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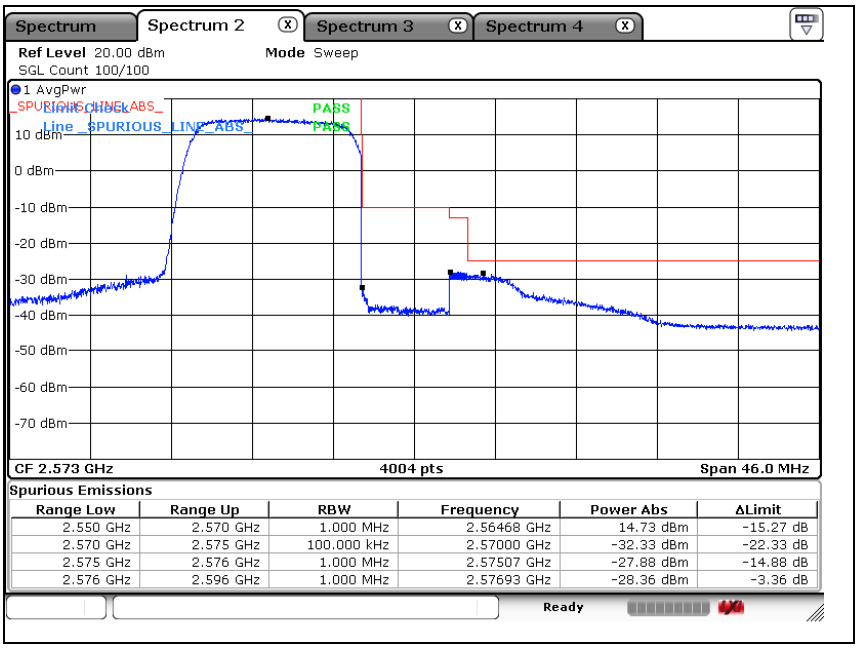
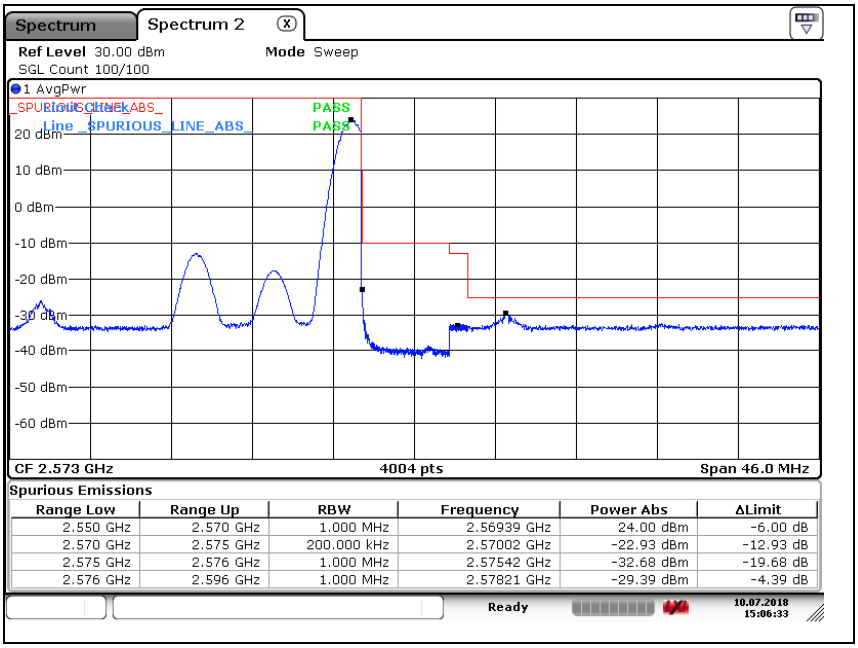
LTE band 7 (10 ㎒ - QPSK_RB 50)
High Channel



LTE band 7 (10 ㎒ - QPSK_RB 1)
High Channel



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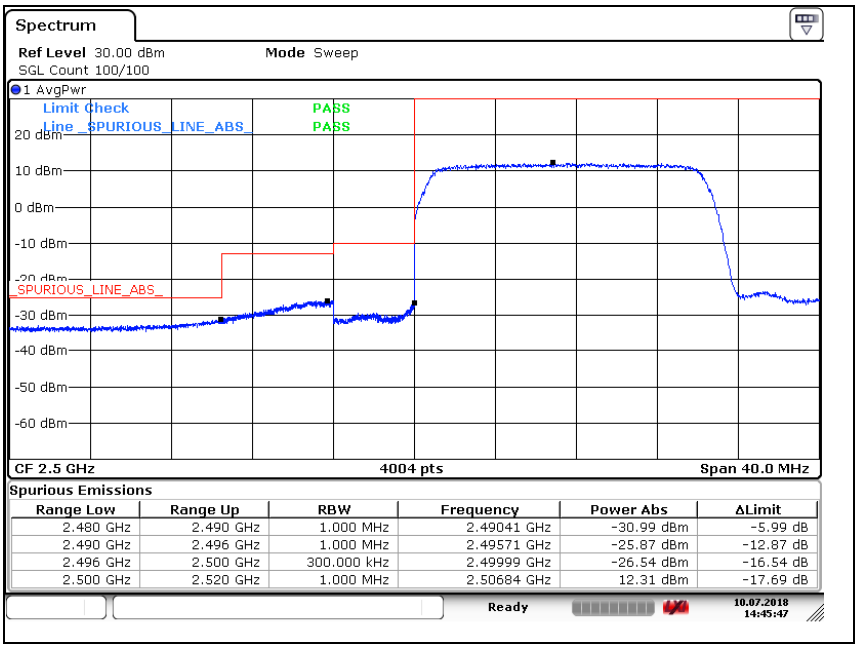
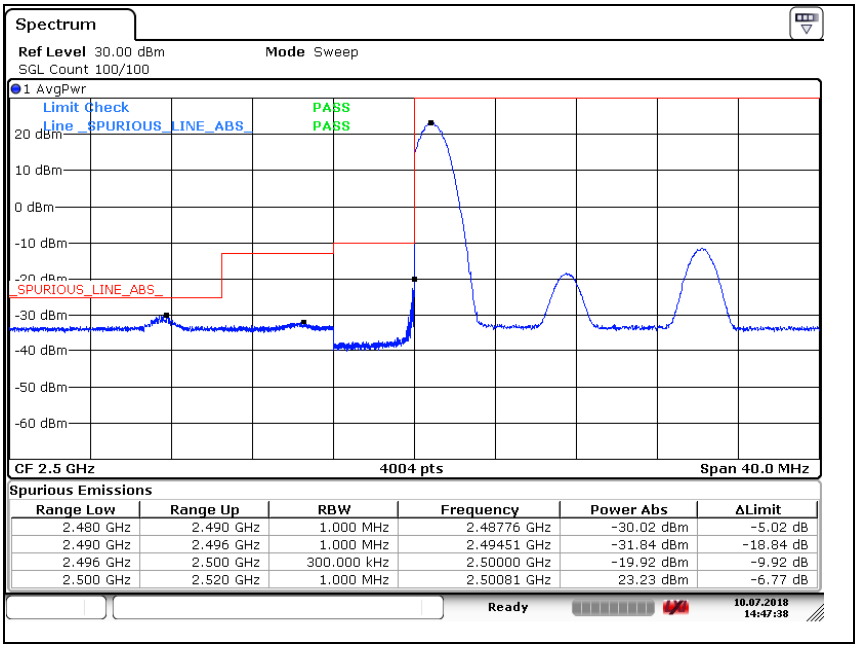
LTE band 7 (15 ㎒ - QPSK_RB 75)

Low Channel



LTE band 7 (15 ㎒ - QPSK_RB 1)

Low Channel



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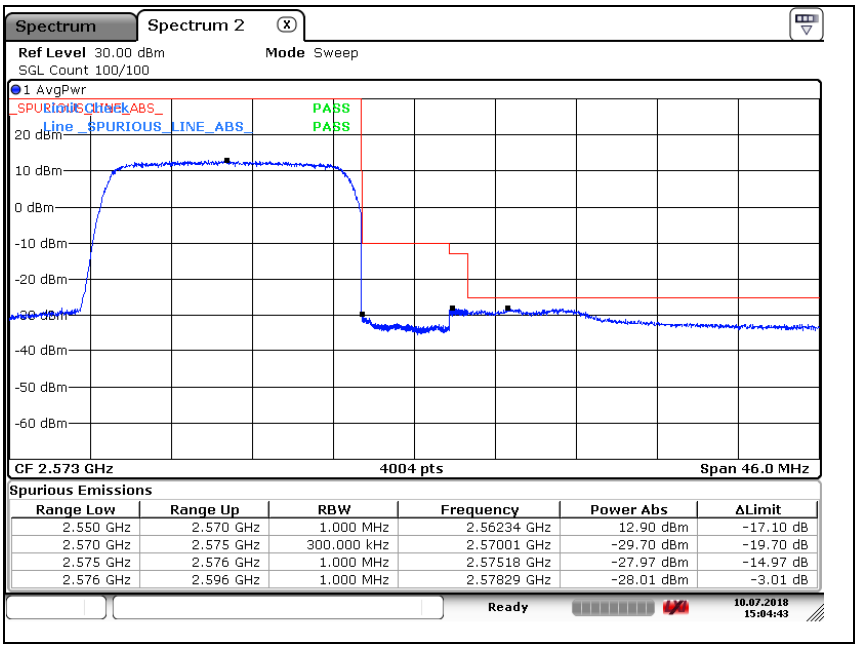
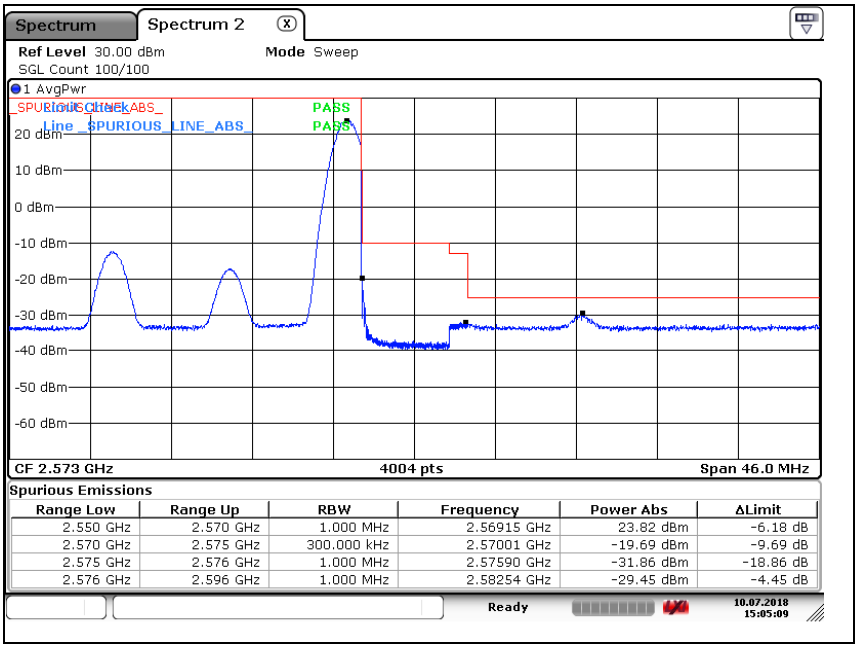
LTE band 7 (15 ㎒ - QPSK_RB 75)
High Channel



LTE band 7 (15 ㎒ - QPSK_RB 1)
High Channel



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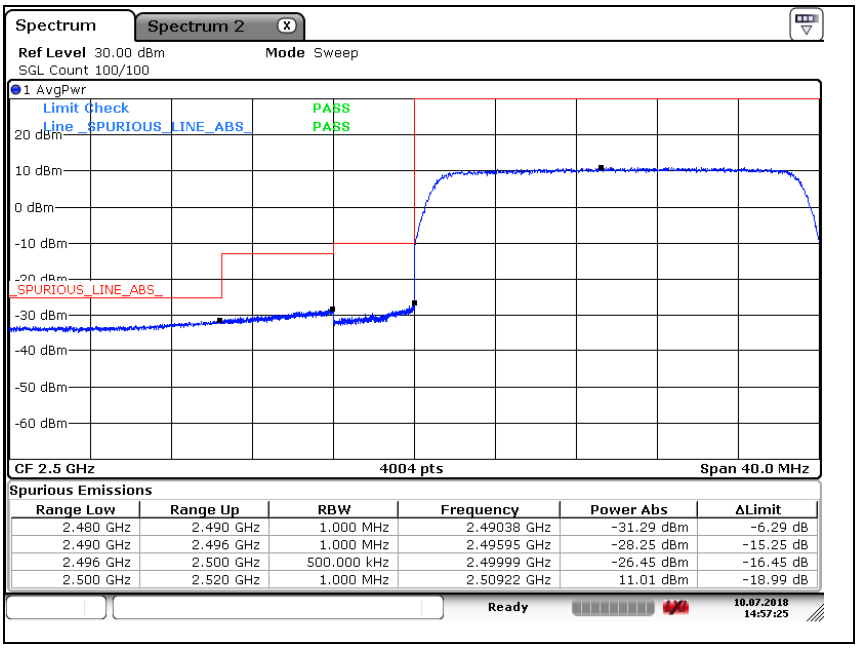
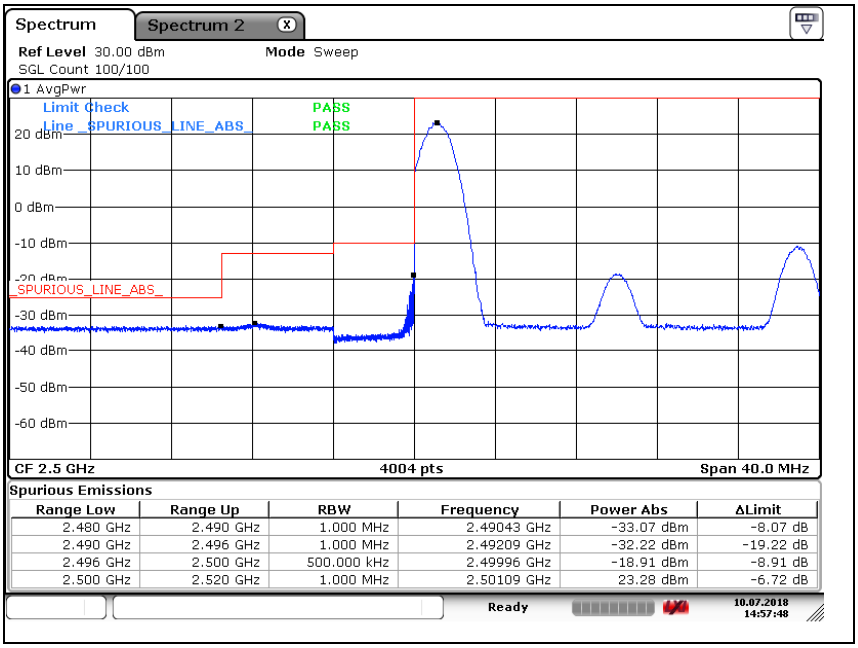
LTE band 7 (20 ㎒ - QPSK_RB 100)

Low Channel



LTE band 7 (20 ㎒ - QPSK_RB 1)

Low Channel



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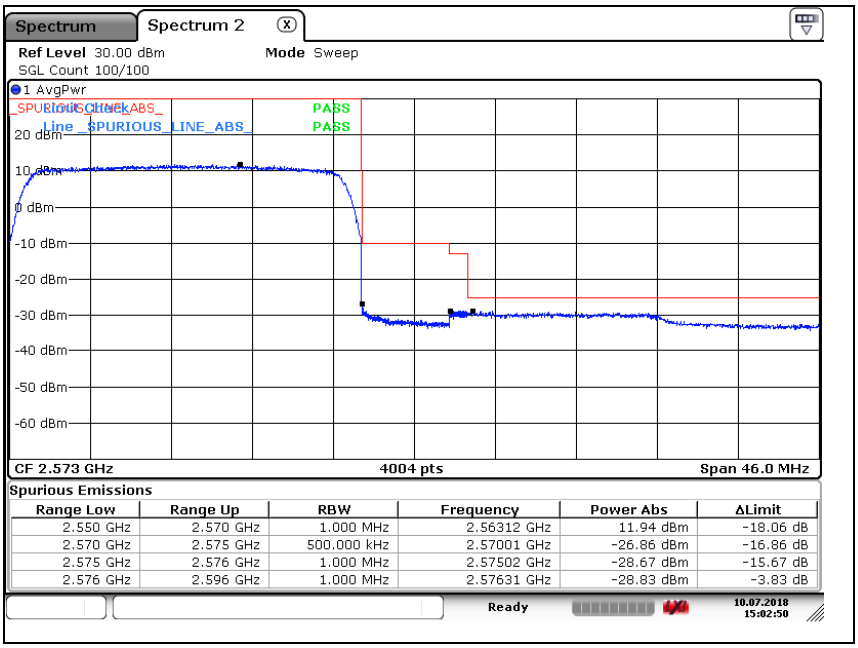
LTE band 7 (20 ㎒ - QPSK_RB 100)

High Channel

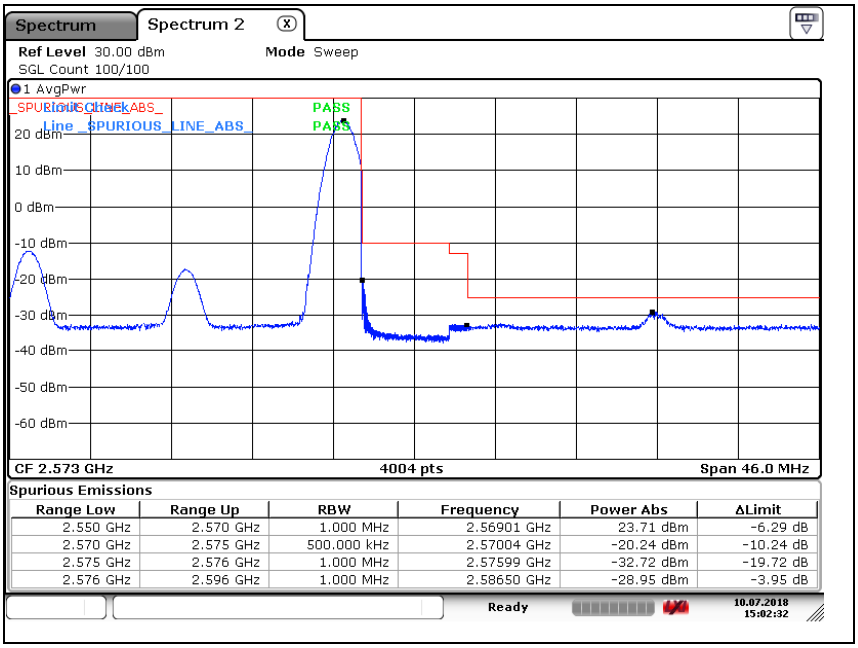


Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
2.550 GHz	2.570 GHz	1.000 MHz	2.56312 GHz	11.94 dBm	-18.06 dB
2.570 GHz	2.575 GHz	500.000 kHz	2.57001 GHz	-26.86 dBm	-16.86 dB
2.575 GHz	2.576 GHz	1.000 MHz	2.57502 GHz	-28.67 dBm	-15.67 dB
2.576 GHz	2.596 GHz	1.000 MHz	2.57631 GHz	-28.83 dBm	-3.83 dB

LTE band 7 (20 ㎒ - QPSK_RB 1)

High Channel



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
2.550 GHz	2.570 GHz	1.000 MHz	2.56901 GHz	23.71 dBm	-6.29 dB
2.570 GHz	2.575 GHz	500.000 kHz	2.57004 GHz	-20.24 dBm	-10.24 dB
2.575 GHz	2.576 GHz	1.000 MHz	2.57599 GHz	-32.72 dBm	-19.72 dB
2.576 GHz	2.596 GHz	1.000 MHz	2.58650 GHz	-28.95 dBm	-3.95 dB

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8. Frequency Stability

8.1. Limit

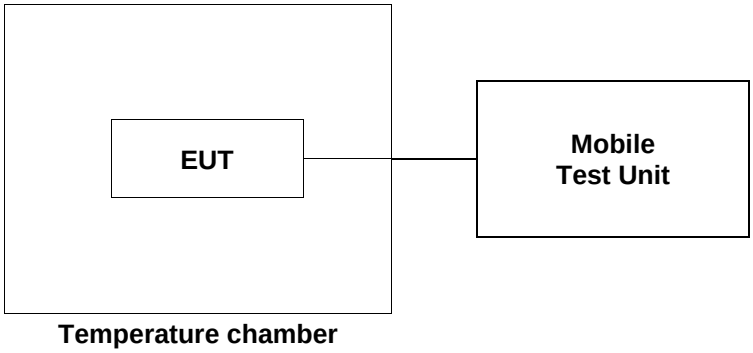
- §2.1055 (a), The frequency stability shall be measured with variation of ambient temperature as follows:
(1) From −30° to + 50° centigrade for all equipment except that specified in paragraphs (a)(2) and (3) of this section.
(2) From −20° to + 50° centigrade for equipment to be licensed for use in the Maritime Services under part 80 of this chapter, except for Class A, B, and S Emergency Position Indicating Radiobeacons (EPIRBS), and equipment to be licensed for use above 952 ㎒ at operational fixed stations in all services, stations in the Local Television Transmission Service and Point-to-Point Microwave Radio Service under part 21 of this chapter, equipment licensed for use aboard aircraft in the Aviation Services under part 87 of this chapter, and equipment authorized for use in the Family Radio Service under part 95 of this chapter.
(3) From 0° to + 50° centigrade for equipment to be licensed for use in the Radio Broadcast Services under part 73 of this chapter.

- §2.1055 (d), The frequency stability shall be measured with variation of primary supply voltage as follows:
(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.
(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.
(3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

- §27.54, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

8.2. Test Procedure

1. Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to a Mobile Test Unit via feed-through attenuators.
2. The EUT was placed inside the temperature chamber.
3. After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from Mobile Test Unit.



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8.3. Test Results

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

LTE band 7 at middle channel

Reference Frequency: 2 535.0 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	14.4	1	0.000 4
40		-4	-0.001 6
30		-2	-0.000 8
23		-5	-0.002 0
10		-3	-0.001 2
0		-3	-0.001 2
-10		-5	-0.002 0
-20		-9	-0.003 6
-30		-8	-0.003 2
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
23	12.24	-2	-0.000 8
	16.56	-6	-0.002 4

- End of the Test Report -

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