TEST REPORT

of

FCC Part 27 Subpart H / M

FCC ID: BEJTM01LA-E

Equipment Under Test	:	Telematics Module
Model Name	:	TM01LA-E
Applicant	:	LG Electronics Inc.
Manufacturer	:	LG Electronics Inc.
Date of Receipt	:	2017.04.28
Date of Test(s)	:	2017.04.29 ~ 2017.05.02
Date of Issue	:	2017.05.04

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

Tested By:	**Jungmin Yang**	**Date:**	**2017.05.04**
Technical Manager:	**Hyunchae You**	**Date:**	**2017.05.04**

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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

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 Inc.
Address : 222 LG-ro Jinwi-myeon, Pyeongtaek-si, Gyeonggi-do, 17709, Korea
Contact Person : Park, Eui-Soon
Phone No. : +82 2 2033 1110

1.3. Description of EUT

Kind of Product	Telematics Module
Model Name	TM01LA-E
Power Supply	DC 12 V
Rated Power	GSM 850: 33 ㎧ m WCDMA Band 5: 22.5 ㎧ m LTE Band 7: 23.5 ㎧ m
Frequency Range	GSM 850: 824 ㎒ ~ 849 ㎒ WCDMA Band 5: 824 ㎒ ~ 849 ㎒ LTE Band 7: 2 500 ㎒ ~ 2 570 ㎒
Emission Designator	GSM 850: 242KGXW (Voice) / 246KG7W (EDGE) WCDMA Band 5: 4M17F9W LTE Band 7 (5 ㎒): 4M52G7D (QPSK) / 4M52W7D (16QAM) LTE Band 7 (10 ㎒): 9M01G7D (QPSK) / 9M02W7D (16QAM) LTE Band 7 (15 ㎒): 13M5G7D (QPSK) / 13M5W7D (16QAM) LTE Band 7 (20 ㎒): 18M1G7D (QPSK) / 18M1W7D (16QAM)

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1.4. Test equipment list

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due
Signal Generator	Agilent	E8257D	MY51501169	Jul. 07, 2016	Annual	Jul. 07, 2017
Spectrum Analyzer	R&S	FSV30	103100	Jun. 24, 2016	Annual	Jun. 24, 2017
Spectrum Analyzer	Agilent	N9030A	US51350132	Sep. 23, 2016	Annual	Sep. 23, 2017
Mobile Test Unit	R&S	CMW500	144034	Feb. 28, 2017	Annual	Feb. 28, 2018
Temperature Chamber	ESPEC CORP.	PL-1J	15000793	Jun. 20, 2016	Annual	Jun. 20, 2017
Power Meter	Anritsu	ML2495A	1223004	Jun. 10, 2016	Annual	Jun. 10, 2017
Power Sensor	Anritsu	MA2411B	1207272	Jun. 10, 2016	Annual	Jun. 10, 2017
Directional Coupler	KRYTAR	152613	140972	Jun. 07, 2016	Annual	Jun. 07, 2017
High Pass Filter	Wainwright Instrument GmbH	WHK3.0/18G-10SS	344	Jun. 03, 2016	Annual	Jun. 03, 2017
High Pass Filter	Wainwright Instrument GmbH	WHNX7.5/26.5G-6SS	11	Jun. 03, 2016	Annual	Jun. 03, 2017
DC Power Supply	Agilent	U8002A	MY50060028	Mar. 16, 2017	Annual	Mar. 16, 2018
Preamplifier	H.P.	8447F	2944A03909	Aug. 11, 2016	Annual	Aug. 11, 2017
Preamplifier	R&S	SCU 18	10117	Apr. 08, 2017	Annual	Apr. 08, 2018
Preamplifier	MITEQ Inc.	JS44-18004000-35-8P	1546891	May 12, 2016	Annual	May 12, 2017
Test Receiver	R&S	ESU26	100109	Feb. 17, 2017	Annual	Feb. 17, 2018
Bilog Antenna	SCHWARZBECK MESSELEKTRONIK	VULB9163	396	Jun. 18, 2015	Biennial	Jun. 18, 2017
Horn Antenna	R&S	HF906	100208	Oct. 21, 2016	Biennial	Oct. 21, 2018
Horn Antenna	SCHWARZBECK MESSELEKTRONIK	BBHA9170	BBHA9170223	Aug. 25, 2016	Biennial	Aug. 25, 2018
Antenna Mast	Innco systems GmbH	MA4640-XP-ET	MA4640/536/383 30516/L	N.C.R.	N/A	N.C.R.
Turn Table	Innco systems GmbH	DS 1200 S	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.

▶ Support equipment

Description	Manufacturer	Model	Serial Number
N/A	-	-	-

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1.5. Summary of test results

The EUT has been tested according to the following specifications:

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

1.6. Test report revision

Revision	Report number	Date of Issue	Description
0	F690501/RF-RTL011189	2017.05.02	Initial
1	F690501/RF-RTL011189-1	2017.05.04	Modify test equipment list

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.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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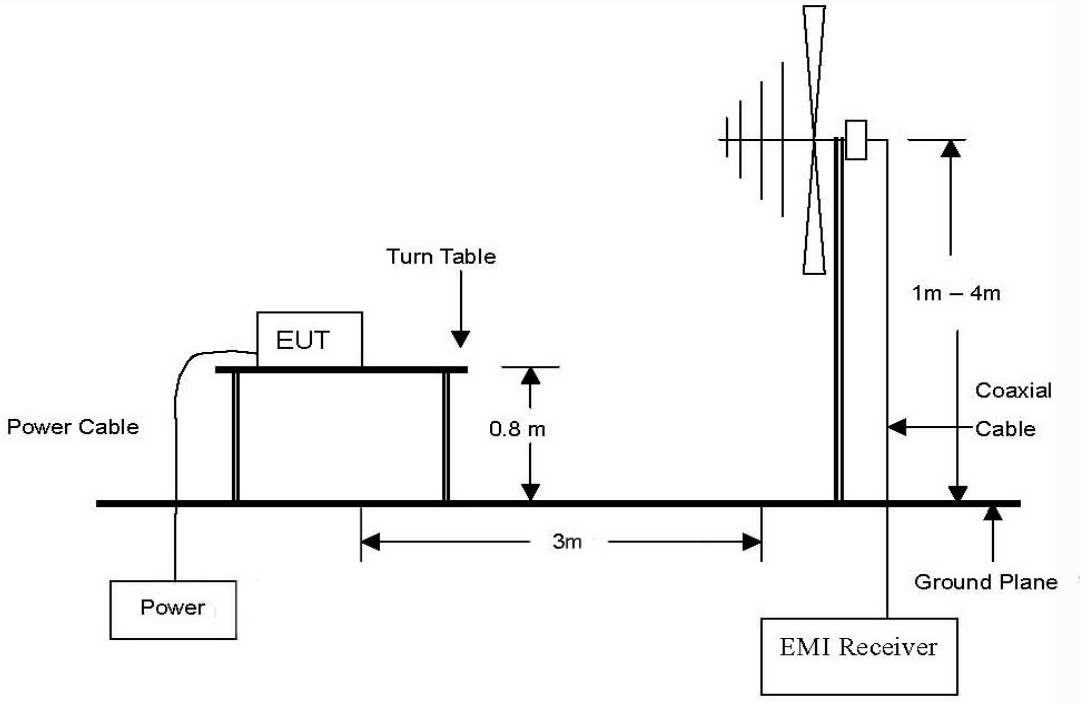
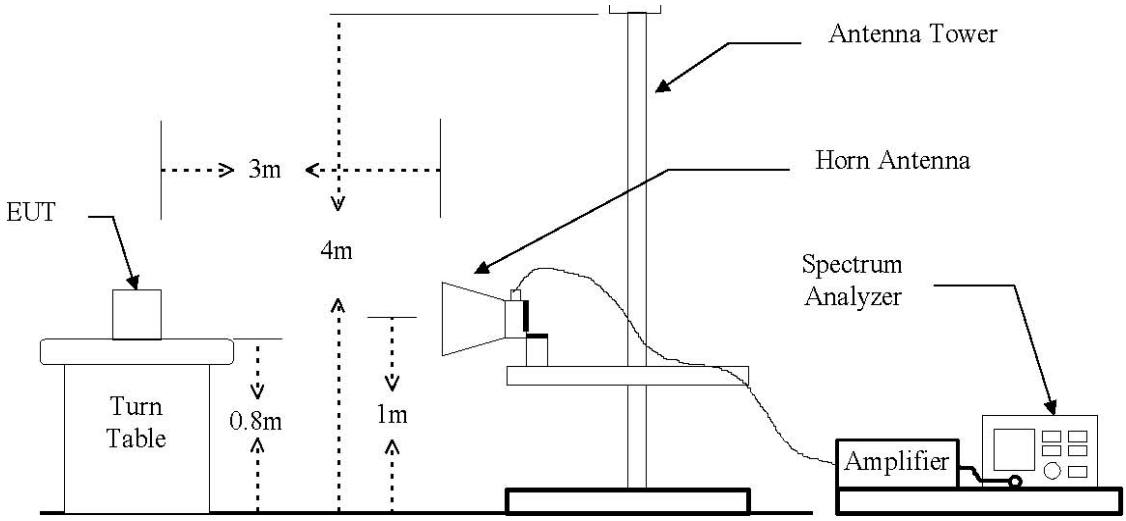
2. RF Radiated Output Power & Spurious Radiated Emission

2.1. Test setup

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



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



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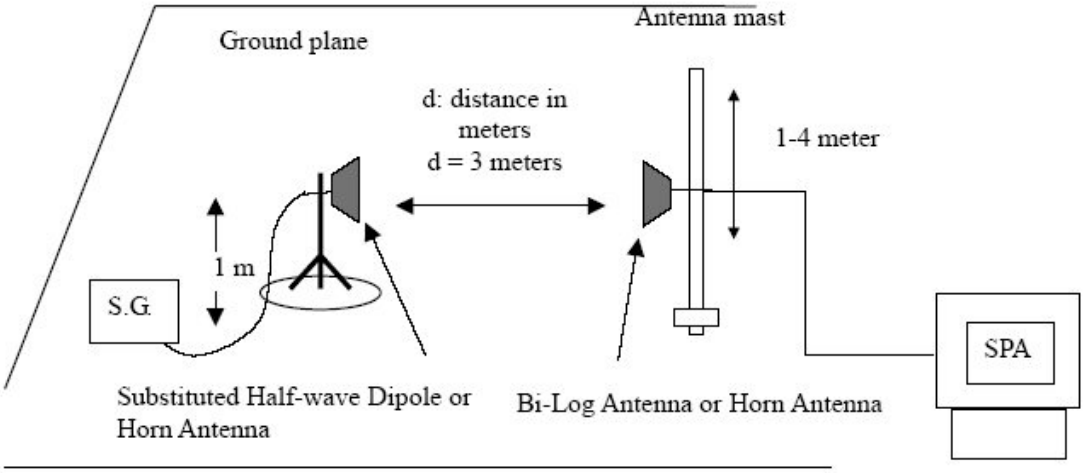
The diagram below shows the test setup for substituted method.



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), For BRS and EBS stations, the power of any emissions outside the licensee's frequency bands of operation shall be attenuated below the transmitter power (P) measured in watts in accordance with the standards below. If a licensee has multiple contiguous channels, out-of-band emissions shall be measured from the upper and lower edges of the contiguous channels.

(4) For mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) ㏈ on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) ㏈ on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (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 (P) ㏈ on all frequencies between 2490.5 ㎒ and 2496 ㎒ and 55 + 10 log (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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(6) *Measurement procedure.* Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. 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; for mobile digital stations, in the 1 megahertz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least two percent may be employed, except when the 1 megahertz band is 2495-2496 ㎒, in which case a resolution bandwidth of at least one percent may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 megahertz or 1 percent of emission bandwidth, as specified; or 1 megahertz or 2 percent for mobile digital stations, except in the band 2495-2496 ㎒). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 ㏈ below the transmitter power. With respect to television operations, measurements must be made of the separate visual and aural operating powers at sufficiently frequent intervals to ensure compliance with the rules.

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2.3. Test procedure: Based on ANSI/TIA 603C: 2004

1. On a test site, the EUT shall be placed at 80 ㎝ 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 v03.
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 v03.
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. (㏈ m)	Cable loss (㏈)	Ant. gain (㏈

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LTE Band 7 (10 ㎒ – 16QAM)

Frequency (㎒)	Ant. Pol. (H/V)	S.G level + Amp. (dB m)	Cable loss (dB)	Ant. gain (dB

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LTE Band 7 (20 ㎒ – QPSK)

Frequency (㎒)	Ant. Pol. (H/V)	S.G level + Amp. (㏈ m)	Cable loss (㏈)	Ant. gain (㏈

2.5. Spurious radiated emission

- Measured output Power : 23.28 ㏈m = 0.212 8 W
- Modulation Signal : LTE Band 7 (5 ㎒ – QPSK)
- Distance : 3 meters
- Limit : 55 + 10log$_{10}$(W) = 48.28 ㏈c

Frequency (㎒)	Ant. Pol. (H/V)	S.G level + Amp. (㏈m)	Cable loss (㏈)	Ant. gain (㏈i)	E.I.R.P. (㏈m)	㏈c	Margin (㏈)
Low Channel (2 502.5 ㎒)							
5 000.58	V	-41.93	7.44	9.86	-39.51	62.79	14.51
5 000.58	H	-40.80	7.44	9.86	-38.38	61.66	13.38
7 501.07	V	-49.64	9.04	11.84	-46.84	70.12	21.84
7 500.71	H	-51.61	9.04	11.84	-48.81	72.09	23.81
Middle Channel (2 535.0 ㎒)							
5 065.46	V	-43.90	7.51	10.19	-41.22	64.50	16.22
5 065.58	H	-42.62	7.51	10.20	-39.93	63.21	14.93
7 598.19	V	-51.08	9.12	11.80	-48.40	71.68	23.40
7 598.81	H	-49.88	9.12	11.80	-47.20	70.48	22.20
High Channel (2 567.5 ㎒)							
5 130.64	V	-44.45	7.61	10.44	-41.62	64.90	16.62
5 130.81	H	-41.79	7.61	10.44	-38.96	62.24	13.96
7 696.17	V	-50.75	8.85	11.64	-47.96	71.24	22.96

* 5 BW 1RB size / 0 Offset for B7

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- Measured output Power : 22.91 dBm = 0.195 4 W
- Modulation Signal : LTE Band 7 (10 MHz – QPSK)
- Distance : 3 meters
- Limit : 55 + 10log$_{10}$(W) = 47.91 dBc

Frequency (MHz)	Ant. Pol. (H/V)	S.G level + Amp. (dBm)	Cable loss (dB)	Ant. gain (dBi)	E.I.R.P. (dBm)	dBc	Margin (dB)
Low Channel (2 505.0 MHz)							
5 010.00	V	-40.97	7.45	9.91	-38.51	61.42	13.51
5 001.16	H	-41.28	7.44	9.87	-38.85	61.76	13.85
7 501.71	V	-50.44	9.04	11.84	-47.64	70.55	22.64
7 502.11	H	-51.69	9.04	11.84	-48.89	71.80	23.89
Middle Channel (2 535.0 MHz)							
5 061.14	V	-45.32	7.50	10.17	-42.65	65.56	17.65
5 061.10	H	-41.80	7.50	10.17	-39.13	62.04	14.13
7 591.49	V	-50.00	9.11	11.80	-47.31	70.22	22.31
7 591.74	H	-49.72	9.11	11.80	-47.03	69.94	22.03
High Channel (2 565.0 MHz)							
5 121.03	V	-46.53	7.59	10.42	-43.70	66.61	18.70
5 121.07	H	-43.73	7.59	10.42	-40.90	63.81	15.90
7 681.67	V	-50.39	8.89	11.66	-47.62	70.53	22.62

* 10 BW 1RB size / 0 Offset for B7

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- Measured output Power : 23.98 ㏈m = 0.250 0 W
- Modulation Signal : LTE Band 7 (15 ㎒ – QPSK)
- Distance : 3 meters
- Limit : 55 + 10log$_{10}$(W) = 48.98 ㏈c

Frequency (㎒)	Ant. Pol. (H/V)	S.G level + Amp. (㏈m)	Cable loss (㏈)	Ant. gain (㏈i)	E.I.R.P. (㏈m)	㏈c	Margin (㏈)
Low Channel (2 507.5 ㎒)							
5 001.82	V	-41.19	7.44	9.87	-38.76	62.74	13.76
5 001.67	H	-40.73	7.44	9.87	-38.30	62.28	13.30
7 502.81	V	-49.47	9.04	11.84	-46.67	70.65	21.67
7 502.20	H	-41.19	7.44	9.87	-38.76	62.74	13.76
Middle Channel (2 535.0 ㎒)							
5 056.61	V	-44.91	7.50	10.15	-42.26	66.24	17.26
5 056.78	H	-43.52	7.50	10.15	-40.87	64.85	15.87
7 585.08	V	-51.68	9.11	11.80	-48.99	72.97	23.99
High Channel (2 562.5 ㎒)							
5 111.71	V	-46.50	7.57	10.40	-43.67	67.65	18.67
5 111.69	H	-43.54	7.57	10.40	-40.71	64.69	15.71
7 667.58	V	-52.47	8.93	11.68	-49.72	73.70	24.72

* 15 BW 1RB size / 0 Offset for B7

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- Measured output Power : 24.25 ㏈m = 0.266 0 W
- Modulation Signal : LTE Band 7 (20 ㎒ – QPSK)
- Distance : 3 meters
- Limit : 55 + 10log$_{10}$(W) = 49.25 ㏈c

Frequency (㎒)	Ant. Pol. (H/V)	S.G level + Amp. (㏈m)	Cable loss (㏈)	Ant. gain (㏈i)	E.I.R.P. (㏈m)	㏈c	Margin (㏈)
Low Channel (2 510.0 ㎒)							
5 002.29	V	-41.26	7.44	9.87	-38.83	63.08	13.83
5 002.29	H	-40.91	7.44	9.87	-38.48	62.73	13.48
7 503.30	V	-49.48	9.04	11.84	-46.68	70.93	21.68
Middle Channel (2 535.0 ㎒)							
5 052.52	V	-45.49	7.49	10.13	-42.85	67.10	17.85
5 052.20	H	-41.99	7.49	10.13	-39.35	63.60	14.35
7 578.62	V	-51.80	9.10	11.81	-49.09	73.34	24.09
High Channel (2 560.0 ㎒)							
5 102.12	V	-44.14	7.54	10.38	-41.30	65.55	16.30
5 102.14	H	-41.57	7.54	10.38	-38.73	62.98	13.73

* 20 BW 1RB size / 0 Offset for B7

Remark:

1. E.I.R.P. = S.G level (㏈m) - Cable loss (㏈) + Ant. gain (㏈i)
2. This device was tested under all bandwidths, and RB configurations, and modulations.
3. The data reported in the table above was measured in worst case.

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3. Conducted Output Power

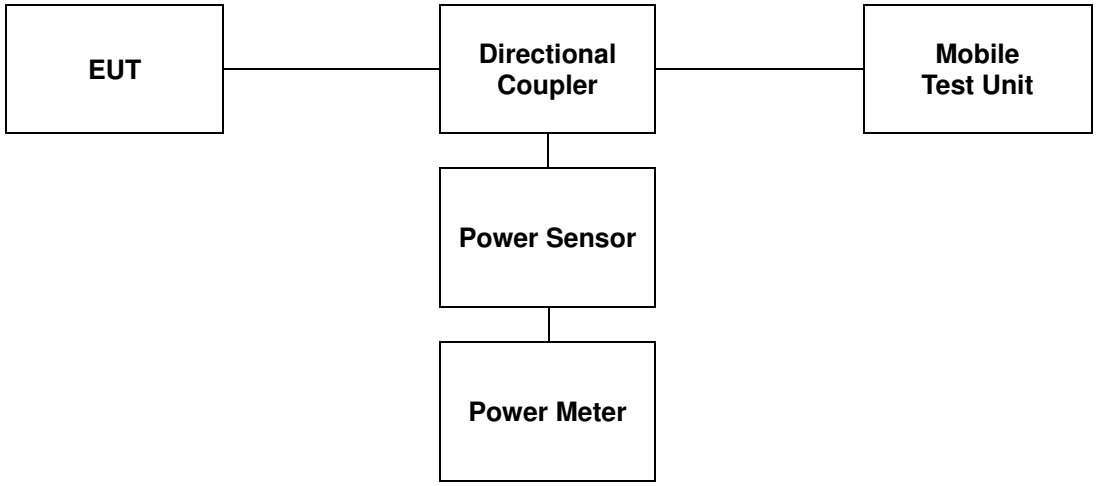
3.1. Limit

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	**22.22**	22.20	22.15	21.20	21.10	21.00
		1	12	22.04	22.10	21.95	21.06	21.08	20.93
		1	24	22.02	22.05	21.77	21.00	21.10	20.82
		12	0	21.05	21.06	21.09	20.13	20.08	20.02
		12	6	21.02	21.05	20.85	20.10	20.11	20.00
		12	13	21.00	21.05	20.80	20.03	20.16	19.86
		25	0	20.90	21.00	20.85	20.05	20.04	19.98
	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	22.25	**22.27**	22.19	21.20	21.26	21.10
		1	25	22.18	22.16	22.15	21.20	21.23	21.08
		1	49	22.21	22.13	21.83	21.16	21.13	20.84
		25	0	20.96	21.19	20.88	20.11	20.15	20.02
		25	12	20.96	21.10	20.86	20.08	20.10	19.99
		25	25	20.98	21.07	20.82	20.09	20.10	19.97
		50	0	20.97	21.10	20.86	20.06	20.10	19.89
	Bandwidth (㎒)	**RB Size**	**RB Offset**	**20825**	**21100**	**21375**	**20825**	**21100**	**21375**
				2 507.5	**2 535.0**	**2 562.5**	**2 507.5**	**2 535.0**	**2 562.5**
	15	1	0	22.28	**22.32**	22.20	21.15	21.33	21.17
		1	36	22.17	22.12	22.00	21.07	21.21	21.03
		1	74	22.25	22.14	21.80	21.30	21.15	20.78
		36	0	20.94	21.10	20.98	20.05	20.08	19.90
		36	18	21.00	20.97	20.84	20.00	20.03	19.92
		36	37	21.02	21.00	20.65	20.10	20.00	19.91
		75	0	20.97	21.05	20.80	20.00	19.97	19.87
	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	22.20	**22.23**	22.15	21.11	21.20	21.18
		1	50	22.10	22.13	22.13	21.17	21.21	21.13
		1	99	22.12	22.08	21.81	21.20	21.25	20.84
		50	0	20.94	21.11	21.03	20.05	20.10	20.04
		50	25	20.97	21.01	21.00	20.06	20.03	20.00
		50	50	21.01	20.90	20.81	20.10	19.95	19.89
		100	0	21.16	21.06	20.94	20.11	20.02	20.02

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4. Occupied Bandwidth

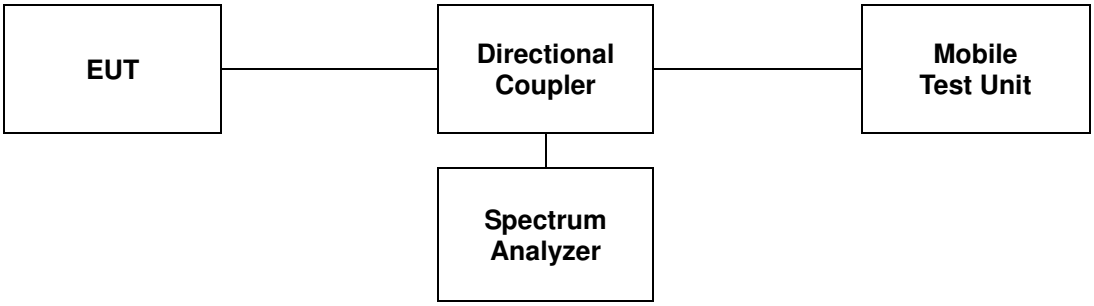
4.1. Limit

CFR 47, Section FCC §2.1049.

4.2. Test Procedure

The test follows section 4.3 of FCC KDB 971168 D01 v03.

1. Set span = 2 – 5 x OBW.
2. Set resolution bandwidth (RBW) = 1 – 5 % of OBW.
3. Set video bandwidth (VBW) ≥ 3 x RBW.
4. Detector = Peak.
5. Trace mode = Max hold.
6. Use the 99 % power bandwidth function of the spectrum analyzer (if available) and report the measured bandwidth.



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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	4.156
		2 535.0	4.524
		2 567.5	4.515
7 (5 ㎒)	16QAM	2 502.5	4.519
		2 535.0	4.519
		2 567.5	4.515
7 (10 ㎒)	QPSK	2 505.0	8.994
		2 535.0	9.011
		2 565.0	9.009
7 (10 ㎒)	16QAM	2 505.0	9.019
		2 535.0	9.001
		2 565.0	9.017
7 (15 ㎒)	QPSK	2 507.5	13.512
		2 535.0	13.483
		2 562.5	13.522
7 (15 ㎒)	16QAM	2 507.5	13.528
		2 535.0	13.493
		2 562.5	13.517
7 (20 ㎒)	QPSK	2 510.0	18.016
		2 535.0	18.059
		2 560.0	18.047
7 (20 ㎒)	16QAM	2 510.0	18.066
		2 535.0	18.052
		2 560.0	18.031

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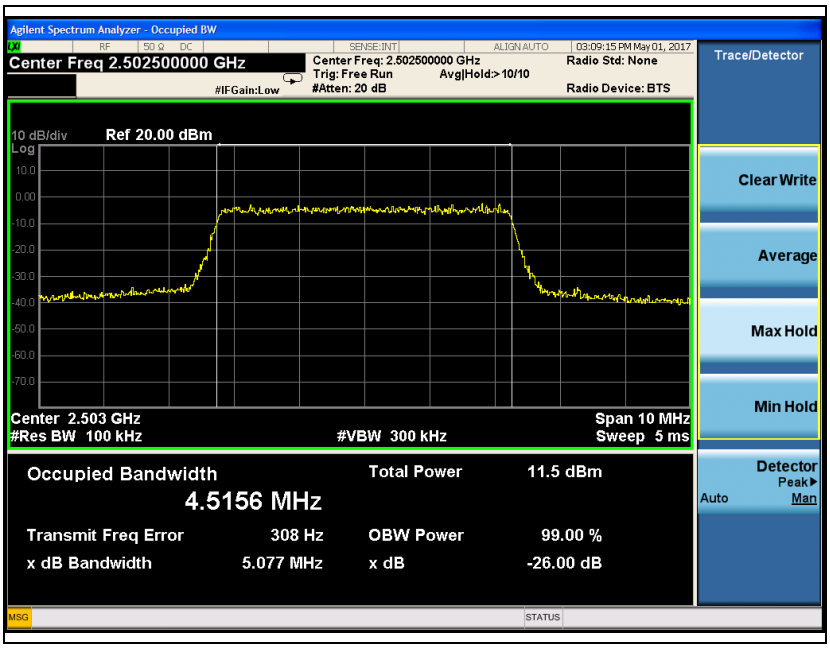
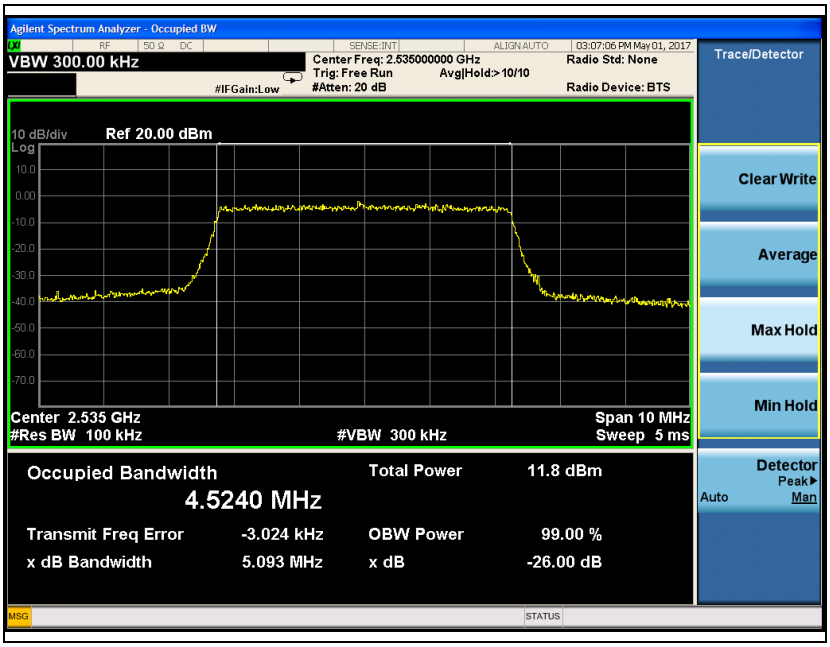
LTE Band 7 (5 ㎒ – QPSK)

Low Channel



Middle Channel



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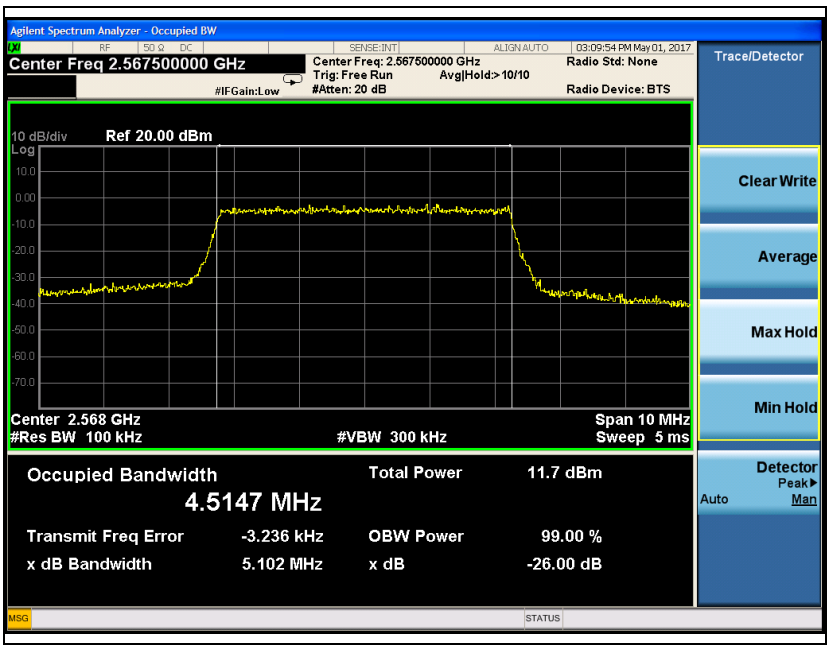
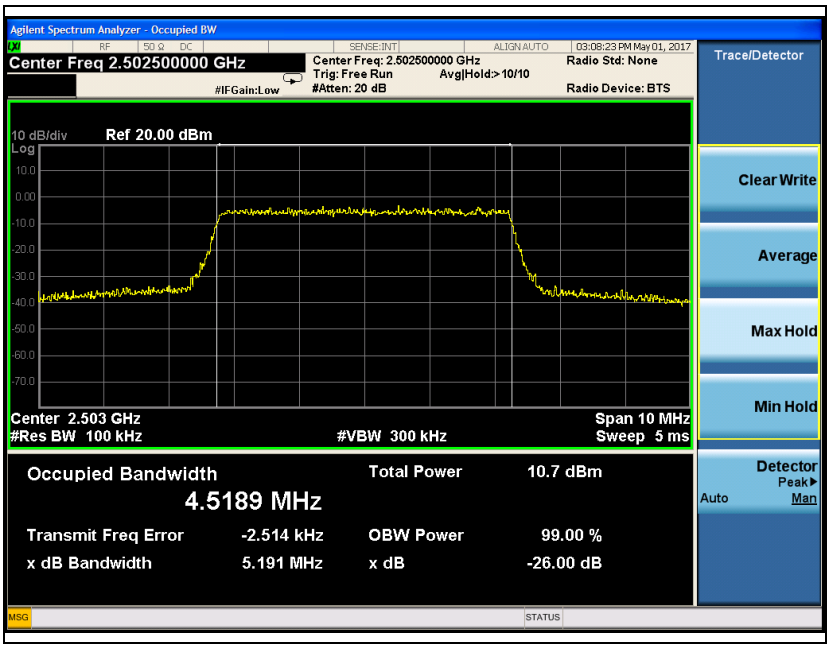
High Channel

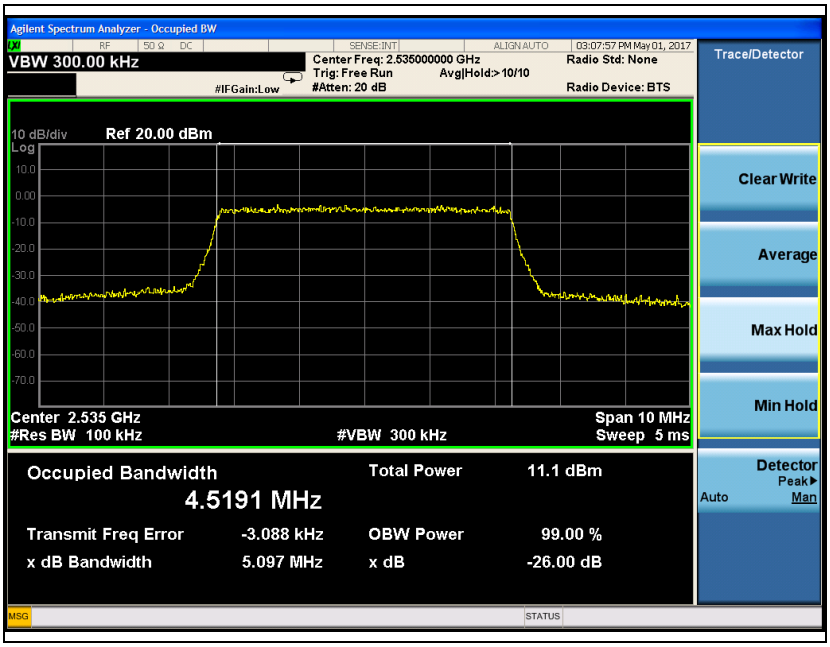


LTE Band 7 (5 ㎒ – 16QAM)

Low Channel



Middle Channel



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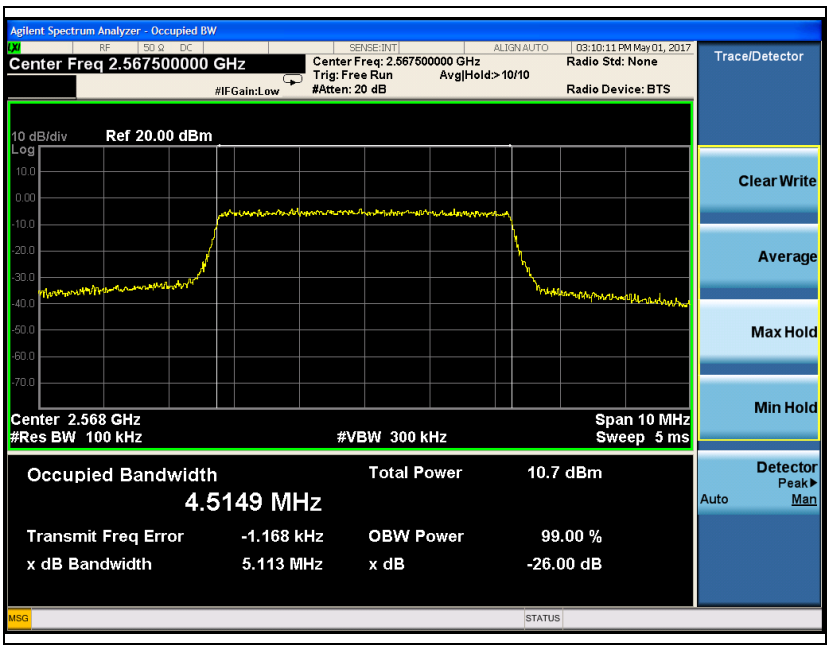
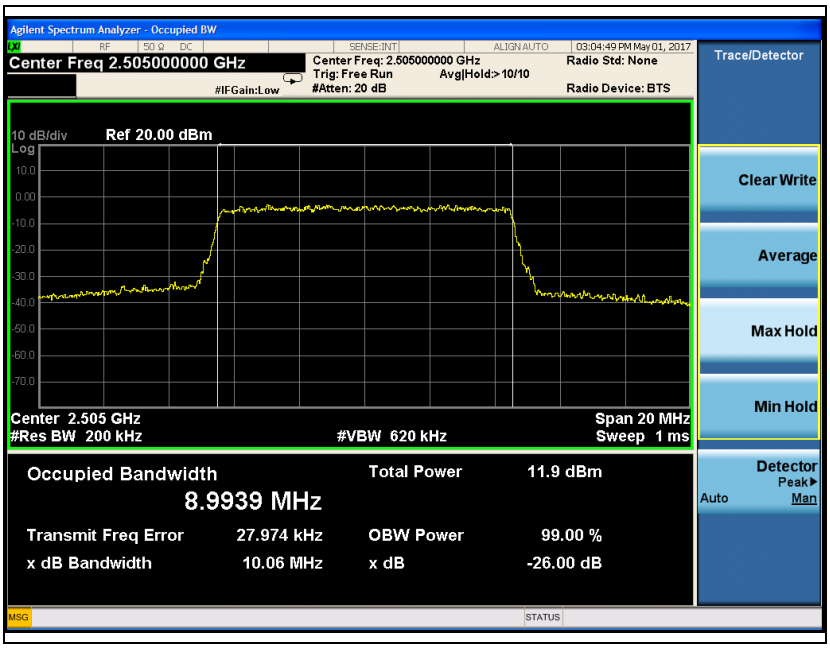
High Channel

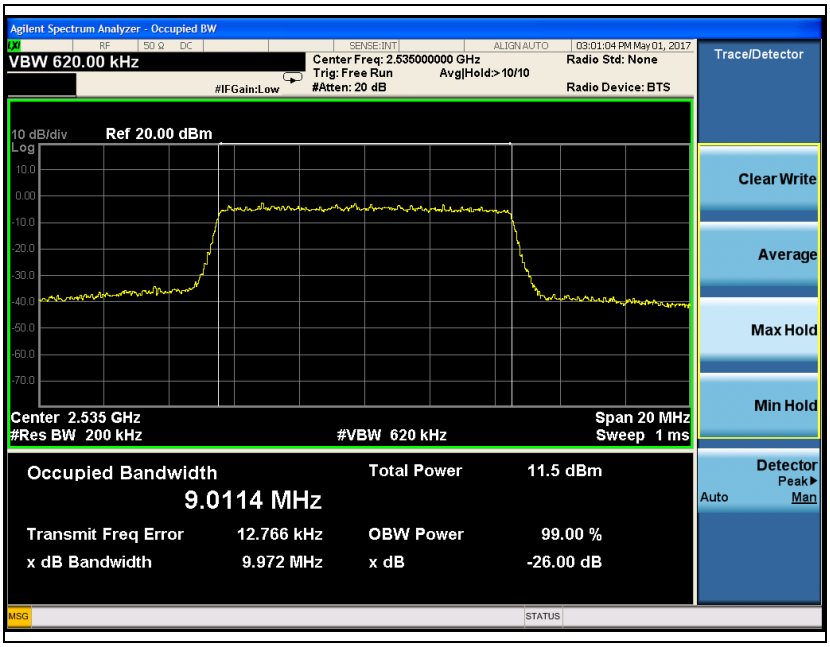


LTE Band 7 (10 ㎒ – QPSK)

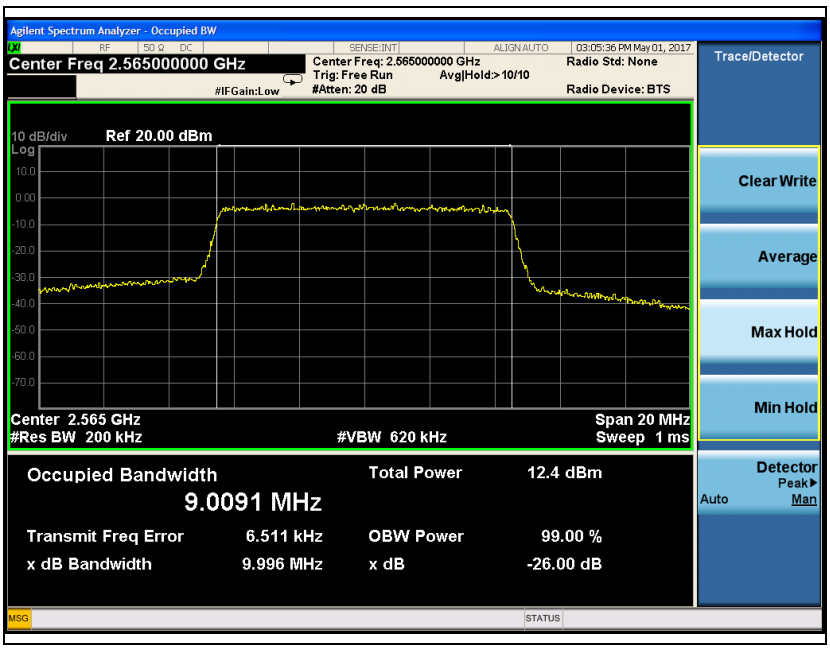
Low Channel



Middle Channel

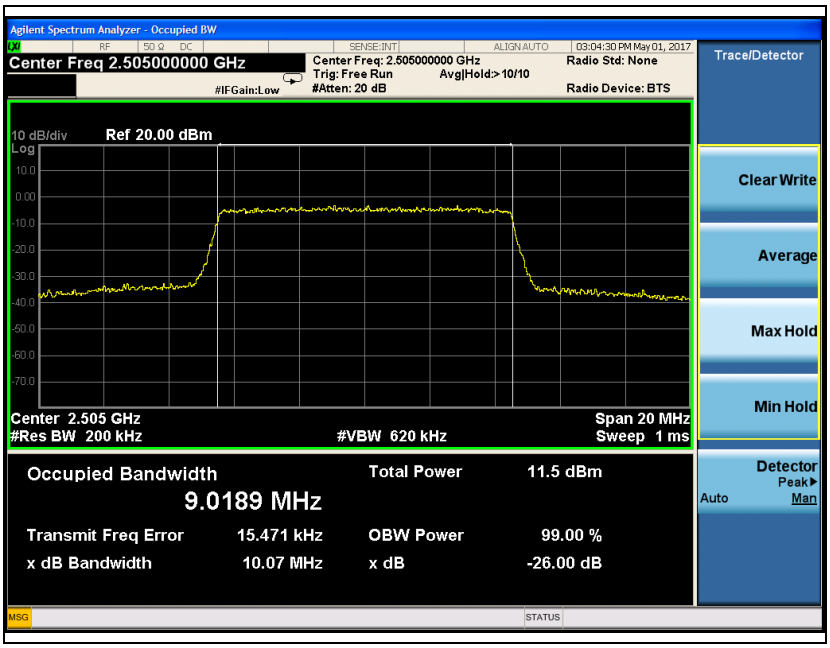


High Channel

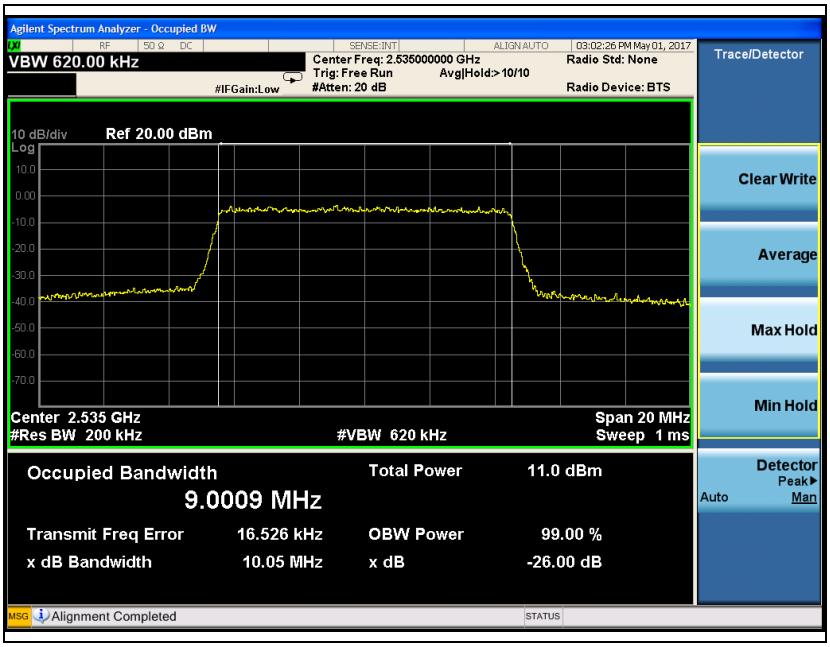


LTE Band 7 (10 ㎒ – 16QAM)

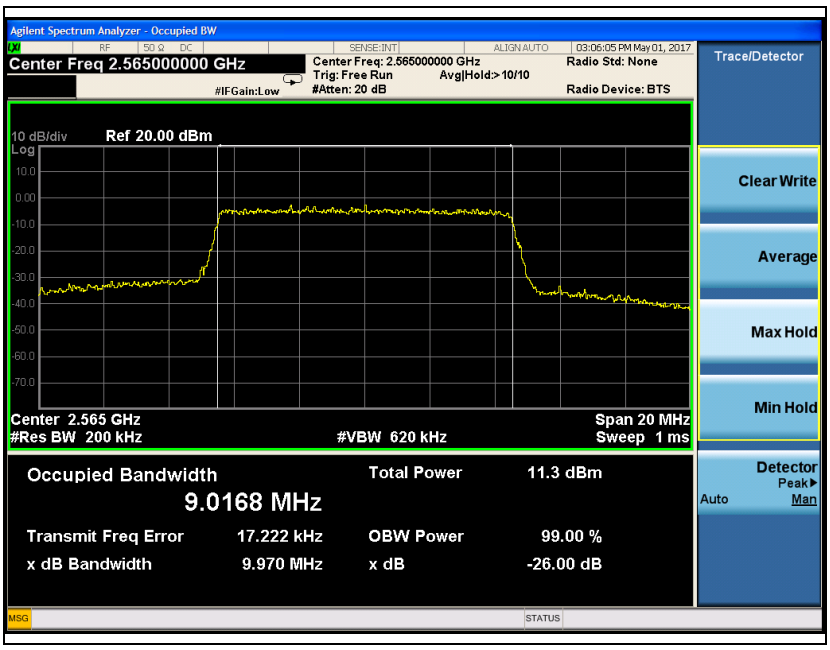
Low Channel



Middle Channel

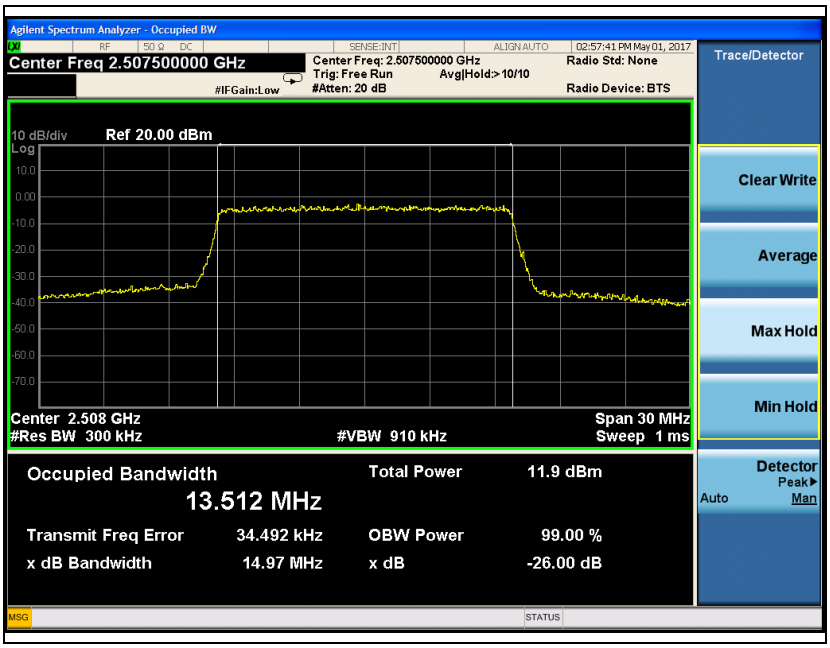


High Channel

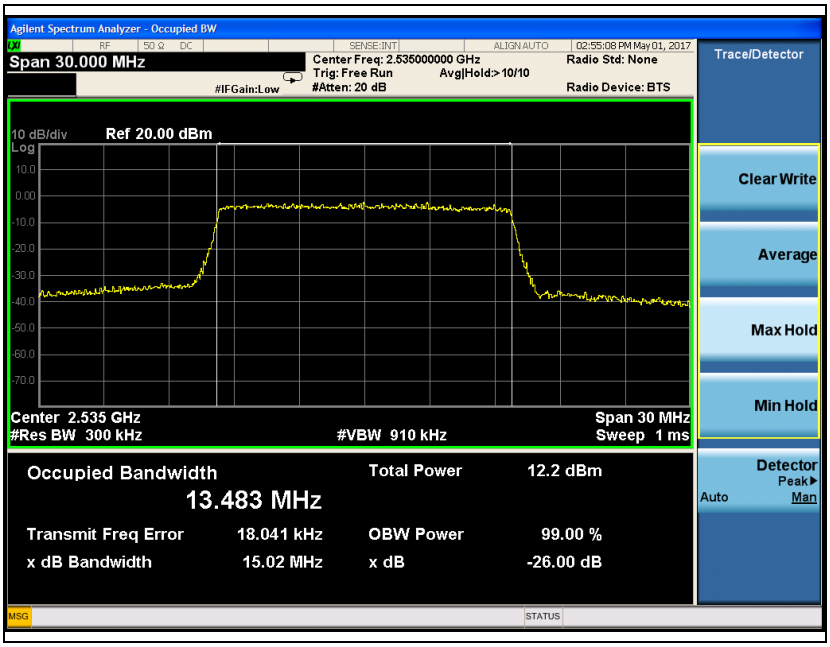


LTE Band 7 (15 ㎒ – QPSK)

Low Channel



Middle Channel



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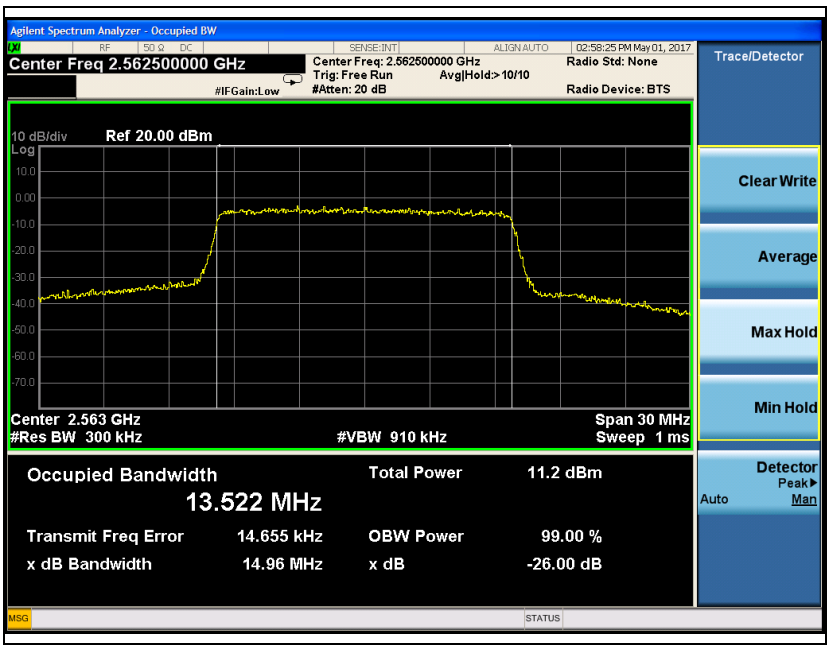
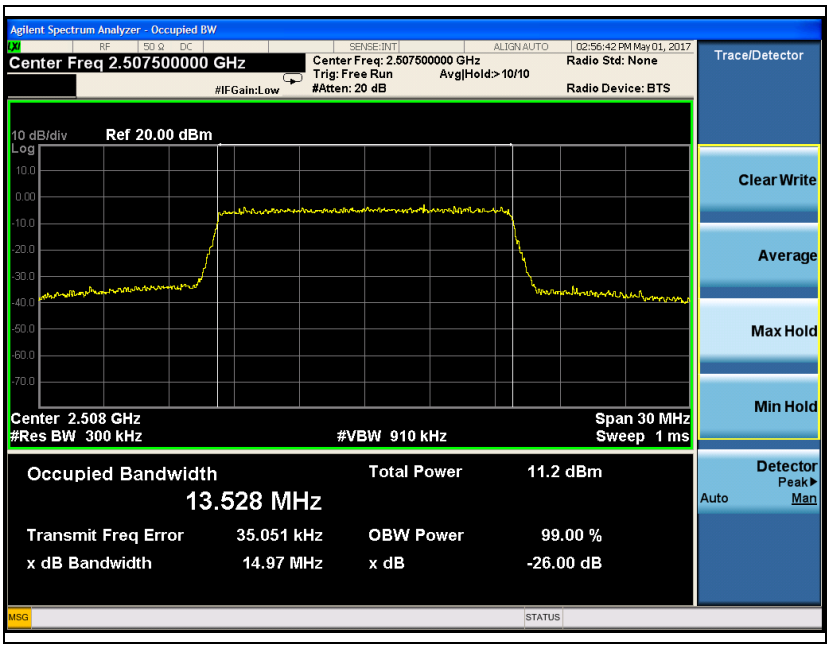
High Channel

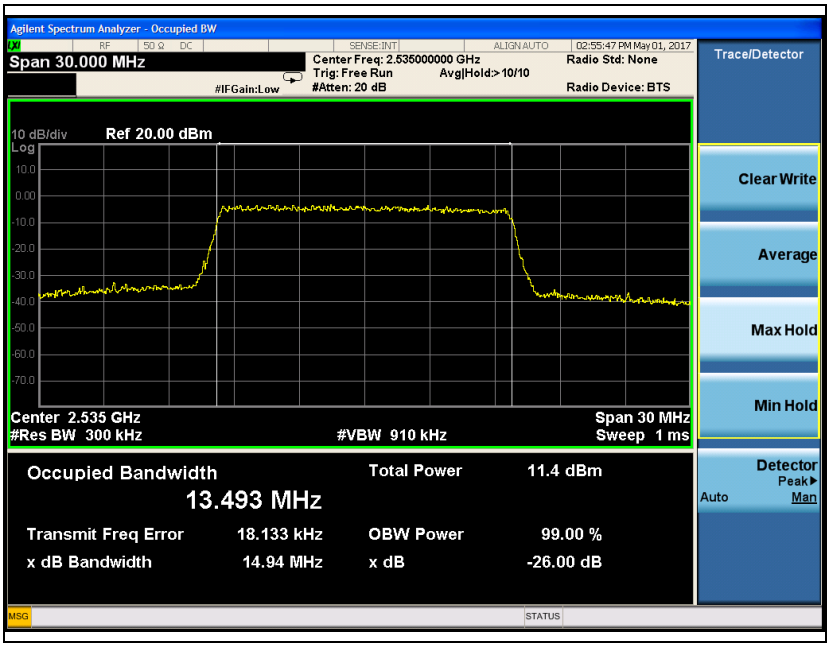


LTE Band 7 (15 ㎒ – 16QAM)

Low Channel



Middle Channel



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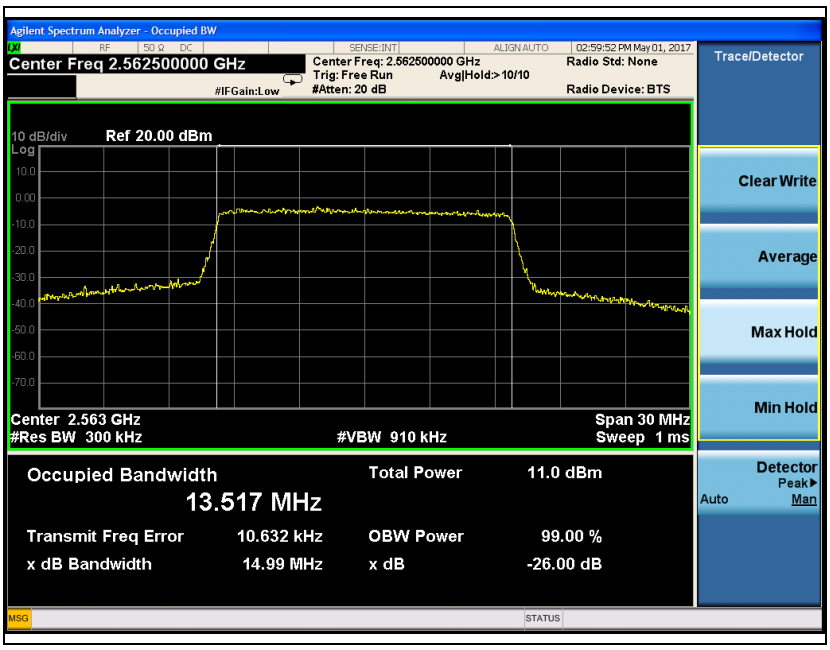
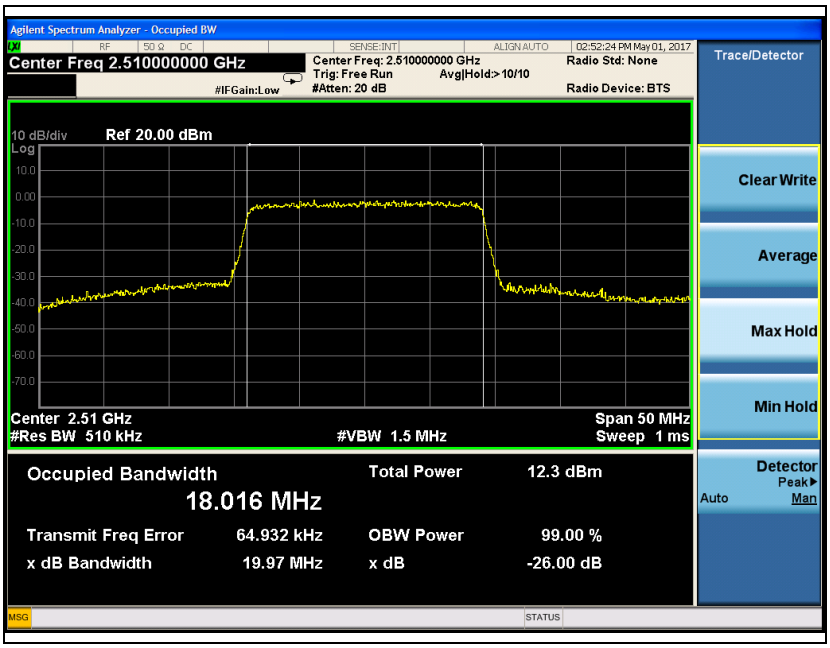
High Channel

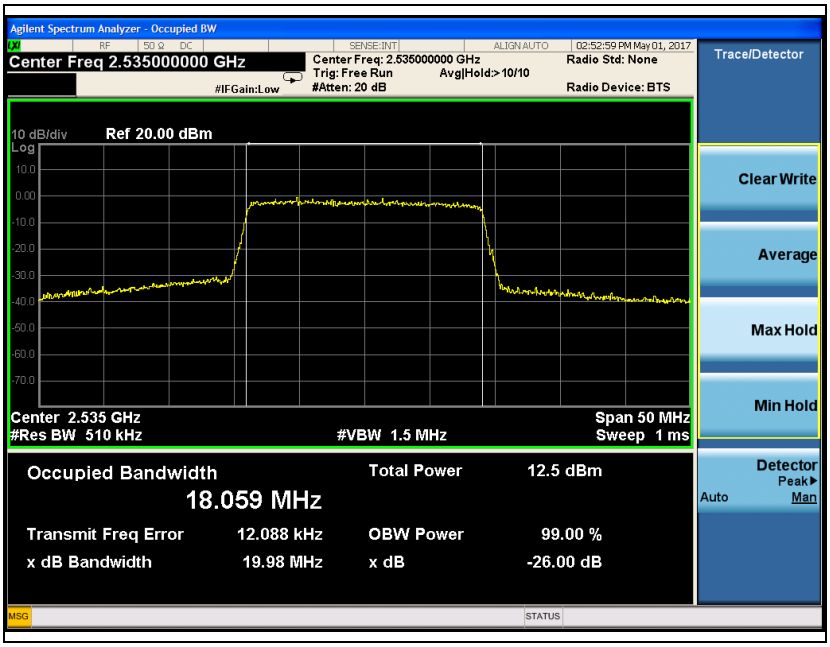


LTE Band 7 (20 ㎒ – QPSK)

Low Channel



Middle Channel



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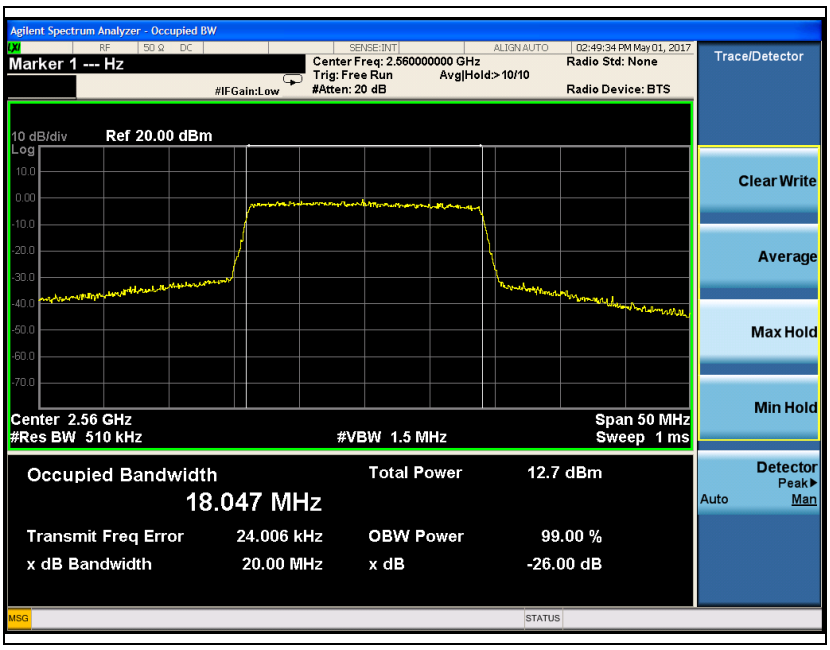
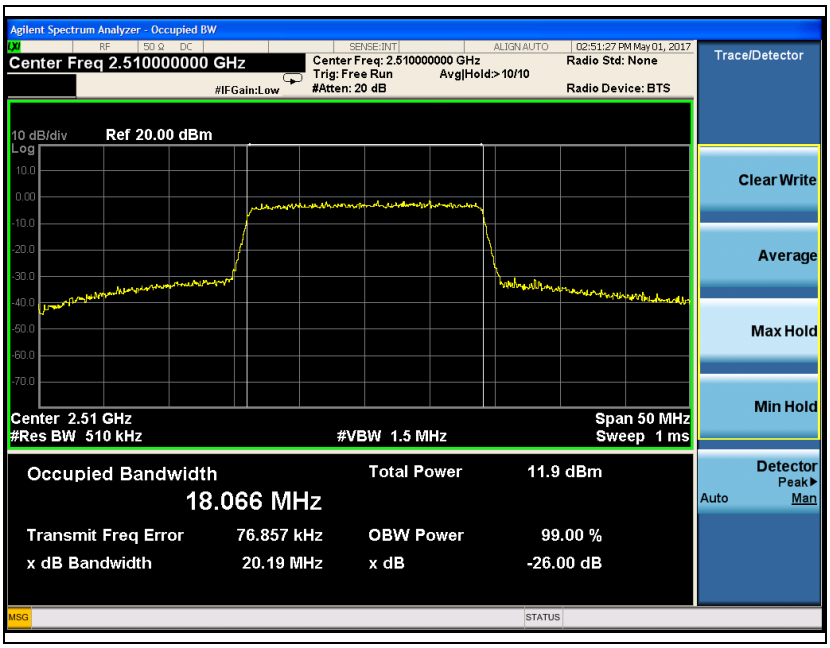
High Channel

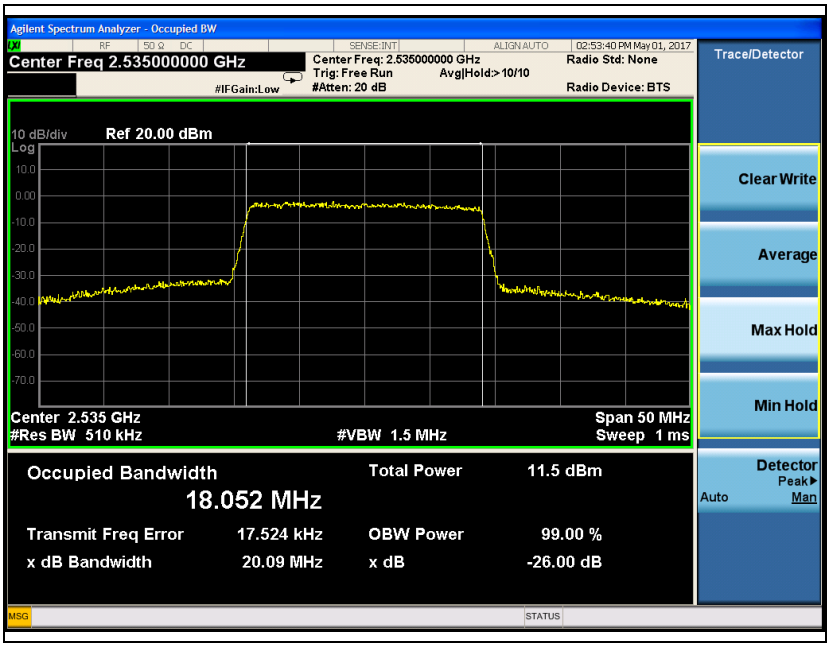


LTE Band 7 (20 ㎒ – 16QAM)

Low Channel



Middle Channel



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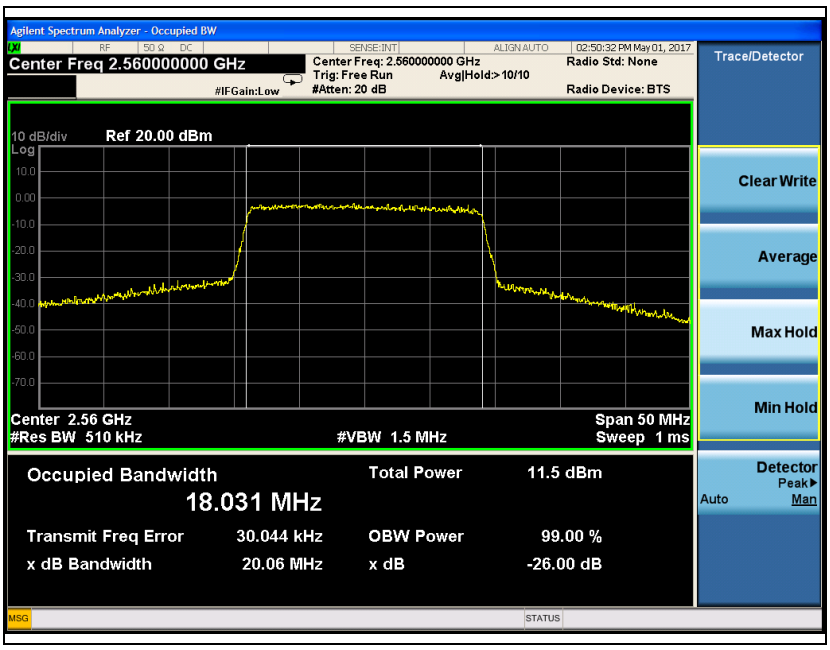
High Channel



5. Spurious Emissions at Antenna Terminal

5.1. Limit

- §27.53(m), For BRS and EBS stations, the power of any emissions outside the licensee's frequency bands of operation shall be attenuated below the transmitter power (P) measured in watts in accordance with the standards below. If a licensee has multiple contiguous channels, out-of-band emissions shall be measured from the upper and lower edges of the contiguous channels.

(4) For mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) ㎤ on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) ㎤ on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (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 (P) ㎤ on all frequencies between 2490.5 ㎒ and 2496 ㎒ and 55 + 10 log (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) *Measurement procedure.* Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. 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; for mobile digital stations, in the 1 megahertz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least two percent may be employed, except when the 1 megahertz band is 2495-2496 ㎒, in which case a resolution bandwidth of at least one percent may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 megahertz or 1 percent of emission bandwidth, as specified; or 1 megahertz or 2 percent for mobile digital stations, except in the band 2495-2496 ㎒). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 ㎤ below the transmitter power. With respect to television operations, measurements must be made of the separate visual and aural operating powers at sufficiently frequent intervals to ensure compliance with the rules.

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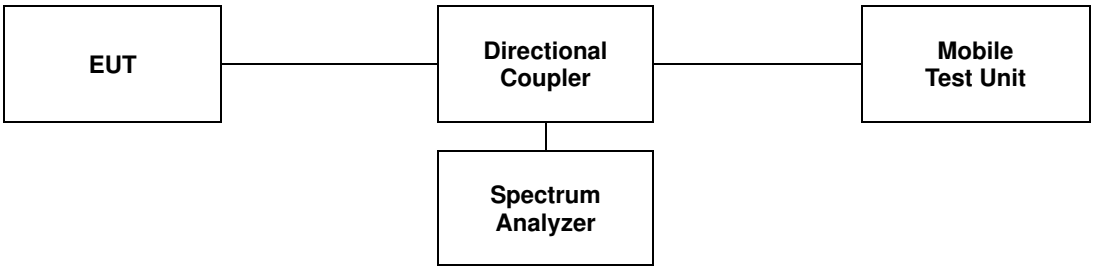
5.2. Test Procedure

The test follows section 6.0 of FCC KDB 971168 D01 v03.

1. Start frequency was set to 30 ㎒ 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 30 ㎒ to 26 ㎓, all path loss of wide frequency range was investigated and compensated to spectrum analyzer as correction factor.



Notes;

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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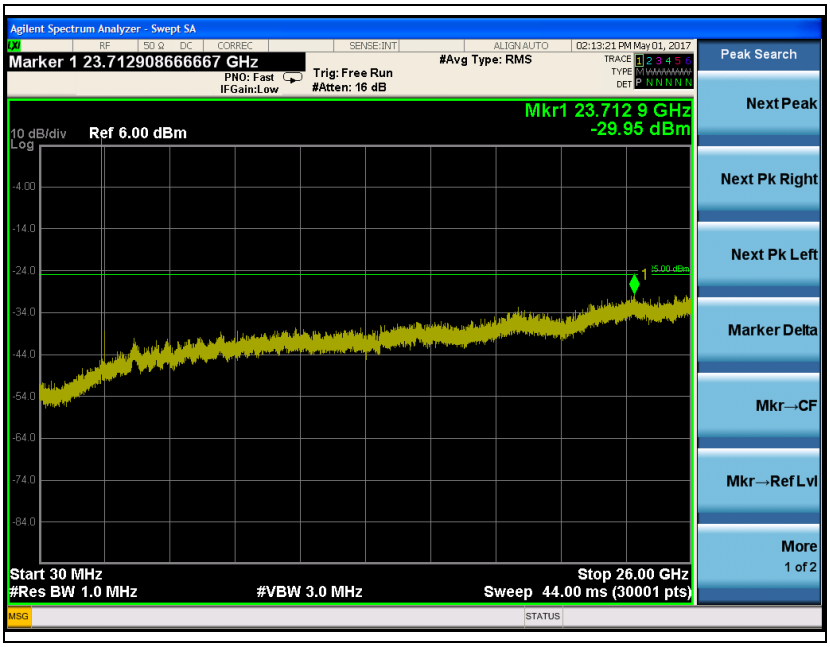
5.3. Test Results

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

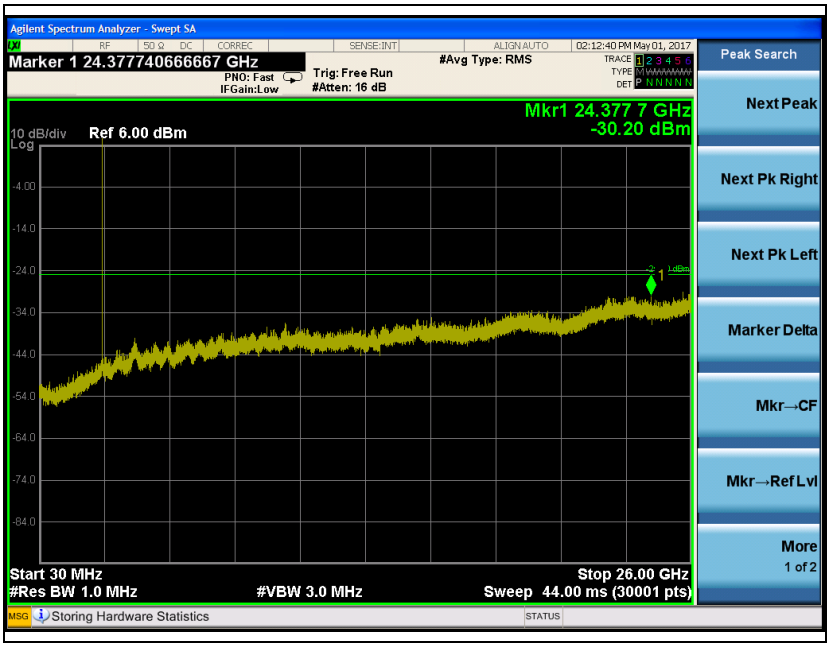
Please refer to the following plots.

LTE Band 7 (5 ㎒ – QPSK)

Low Channel



Middle Channel



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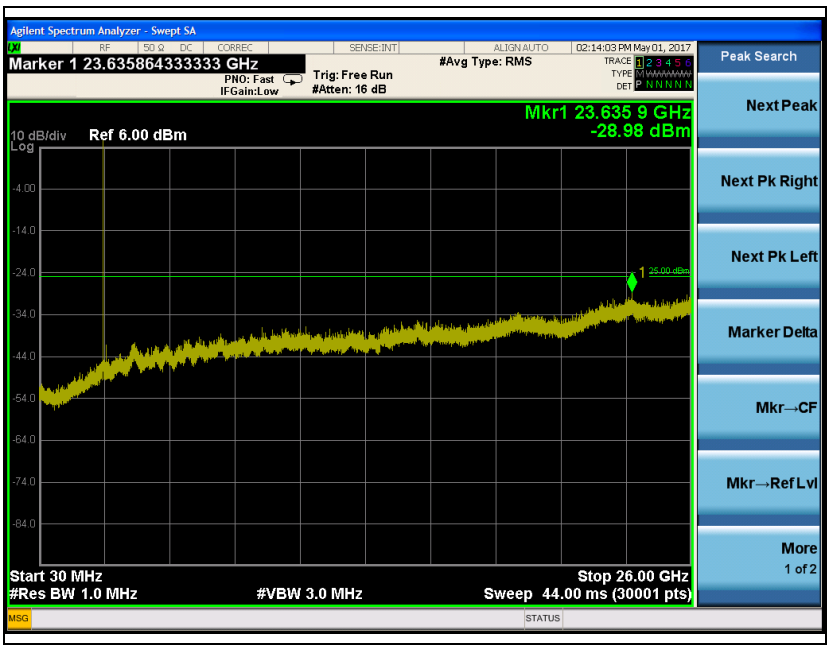
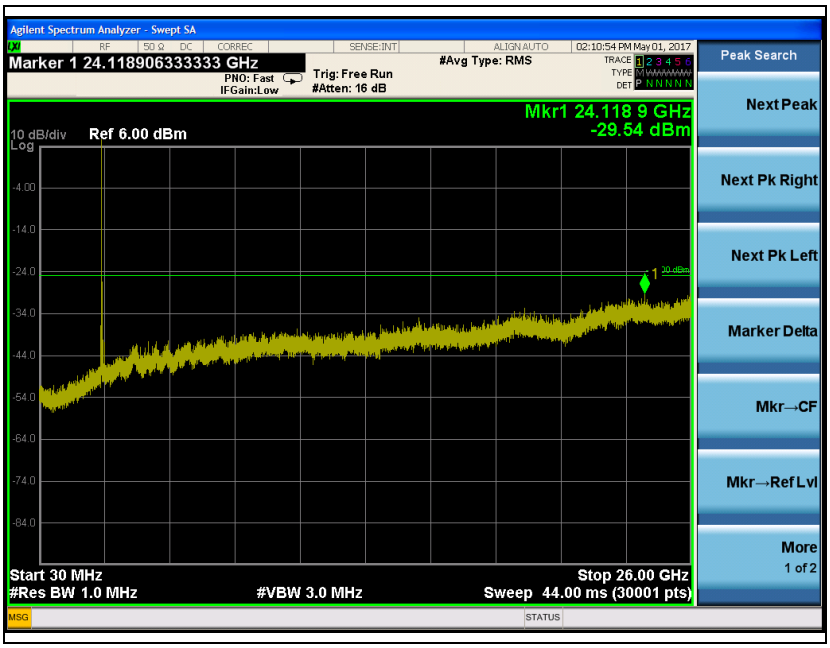
High Channel

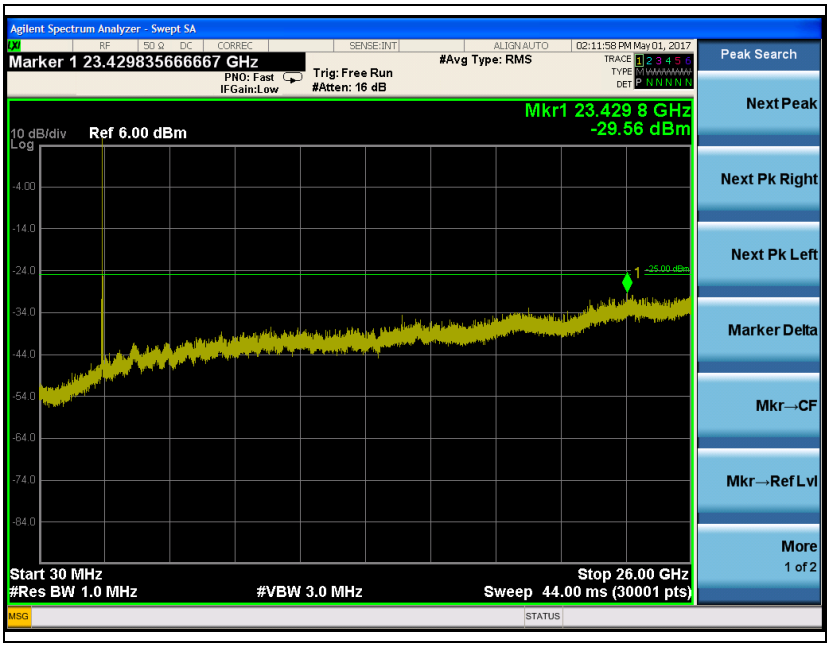


LTE Band 7 (10 ㎒ – QPSK)

Low Channel



Middle Channel



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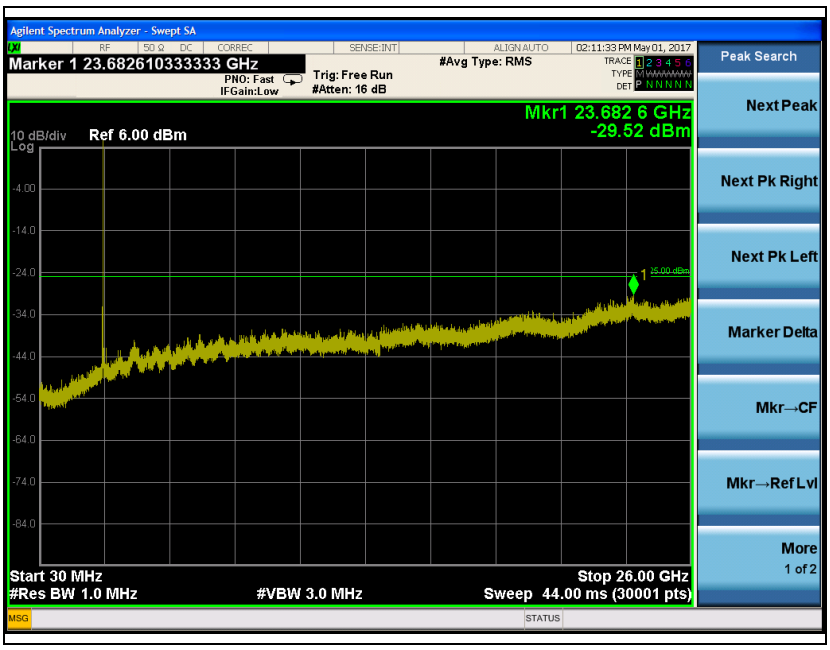
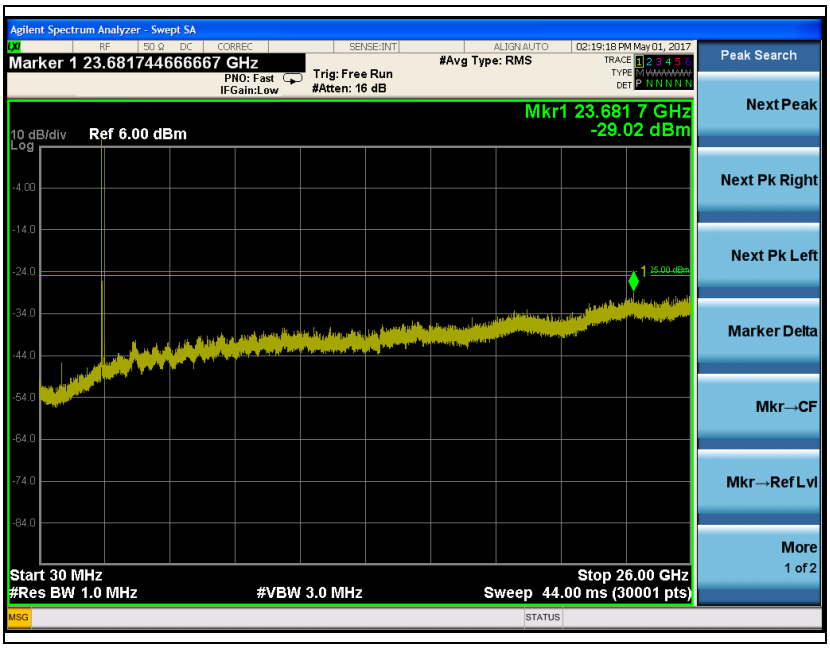
High Channel

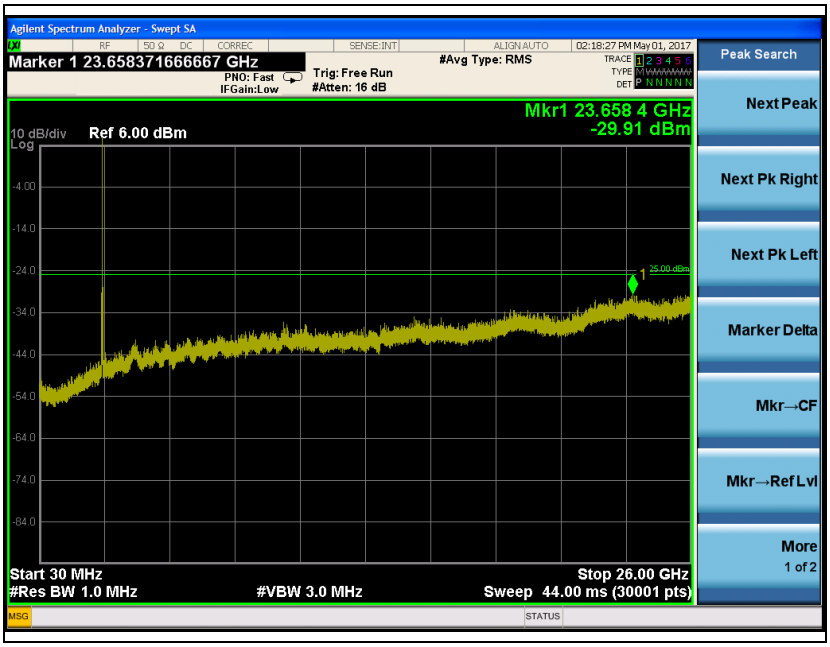


LTE Band 7 (15 ㎒ – QPSK)

Low Channel



Middle Channel



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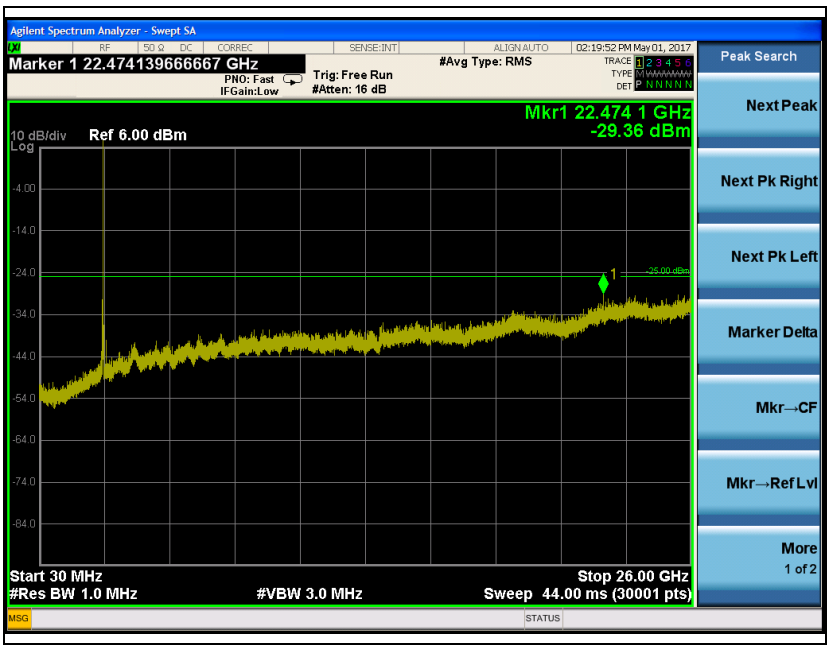
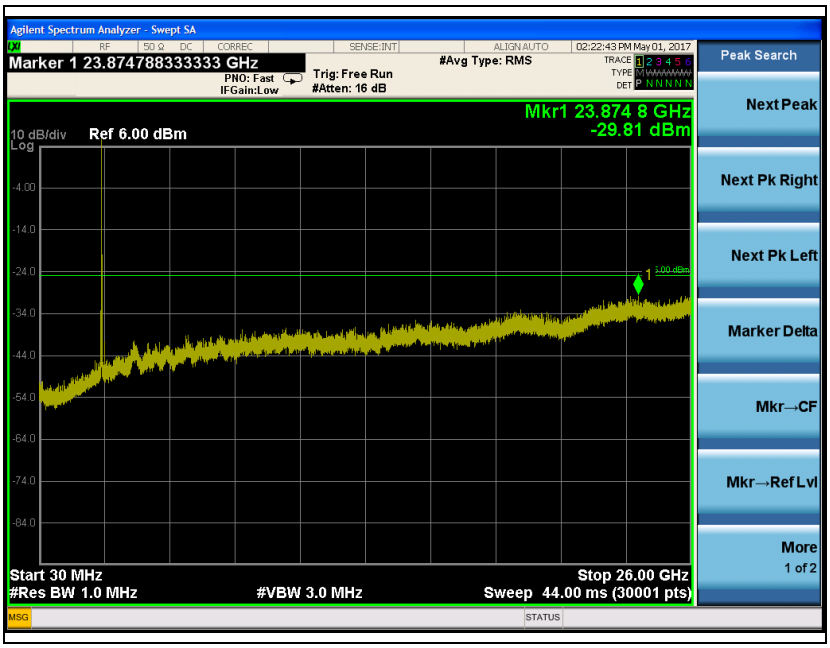
High Channel

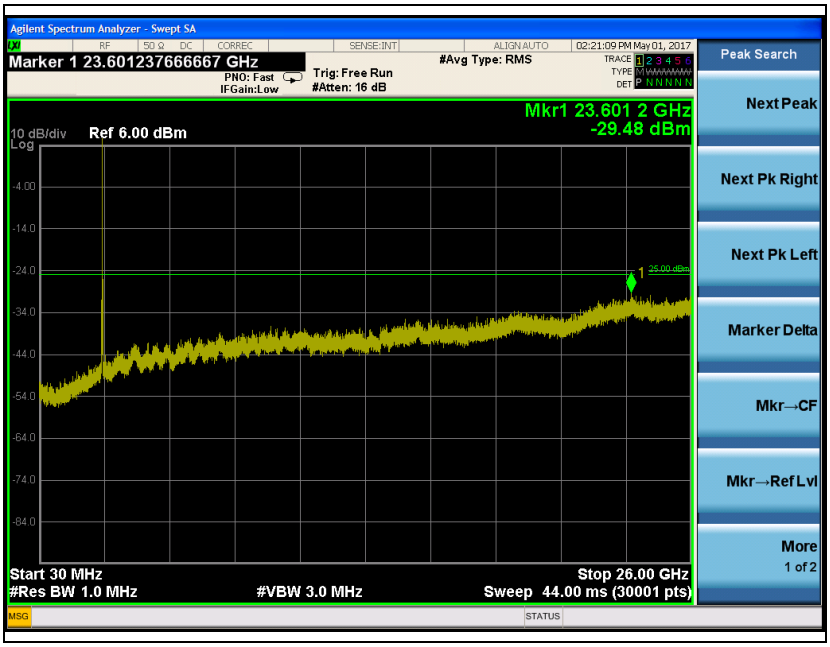


LTE Band 7 (20 ㎒ – QPSK)

Low Channel



Middle Channel



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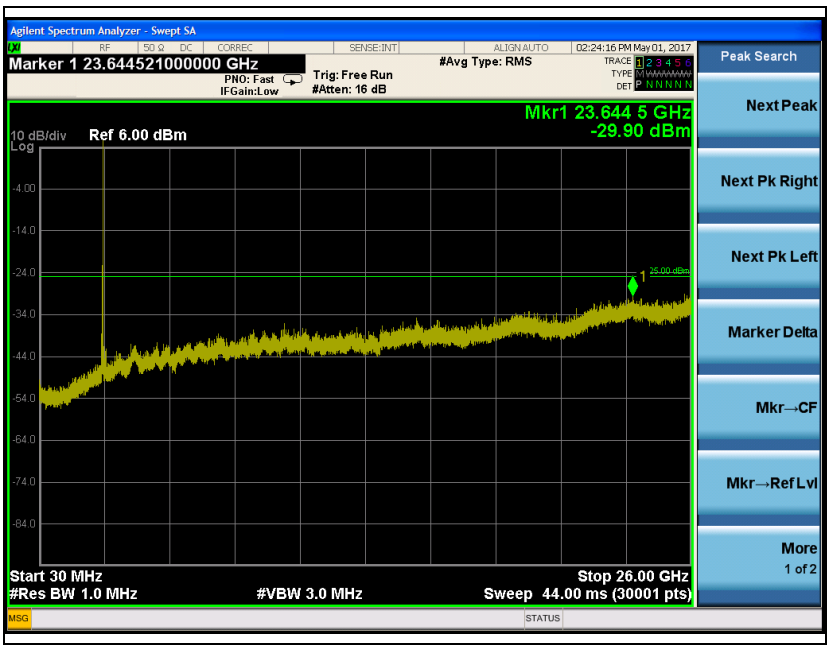
High Channel



6. Band Edge

6.1. Limit

- §27.53(m), For BRS and EBS stations, the power of any emissions outside the licensee's frequency bands of operation shall be attenuated below the transmitter power (P) measured in watts in accordance with the standards below. If a licensee has multiple contiguous channels, out-of-band emissions shall be measured from the upper and lower edges of the contiguous channels.

(4) For mobile digital stations, the attenuation factor shall be not less than 40 + 10 log (P) ㎧ on all frequencies between the channel edge and 5 megahertz from the channel edge, 43 + 10 log (P) ㎧ on all frequencies between 5 megahertz and X megahertz from the channel edge, and 55 + 10 log (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 (P) ㎧ on all frequencies between 2490.5 ㎒ and 2496 ㎒ and 55 + 10 log (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) *Measurement procedure.* Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. 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; for mobile digital stations, in the 1 megahertz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least two percent may be employed, except when the 1 megahertz band is 2495-2496 ㎒, in which case a resolution bandwidth of at least one percent may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 megahertz or 1 percent of emission bandwidth, as specified; or 1 megahertz or 2 percent for mobile digital stations, except in the band 2495-2496 ㎒). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 ㎧ below the transmitter power. With respect to television operations, measurements must be made of the separate visual and aural operating powers at sufficiently frequent intervals to ensure compliance with the rules.

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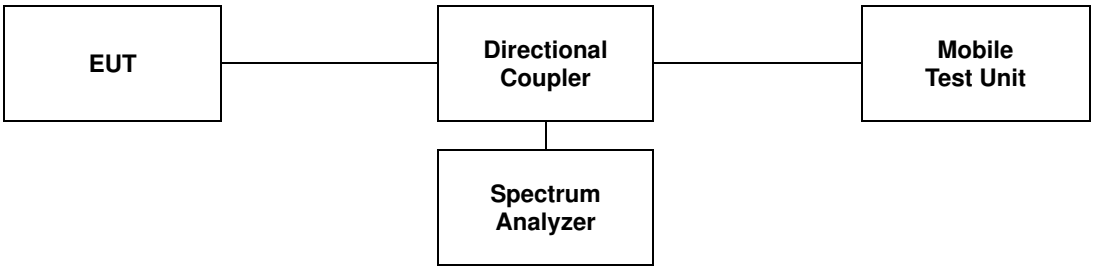
6.2. Test Procedure

The test follows section 6.0 of FCC KDB 971168 D01 v03.

1. Span was set large enough so as to capture all out of band emissions near the band edge.
2. RBW ≥ 1 % of OBW
3. VBW ≥ 3 x RBW.
4. Detector = RMS.
5. Trace mode = Trace average.
6. Sweep time = Auto.
7. The trace was allowed to stabilize.
8. All path loss of frequency range was investigated and compensated to spectrum analyzer as correction factor.



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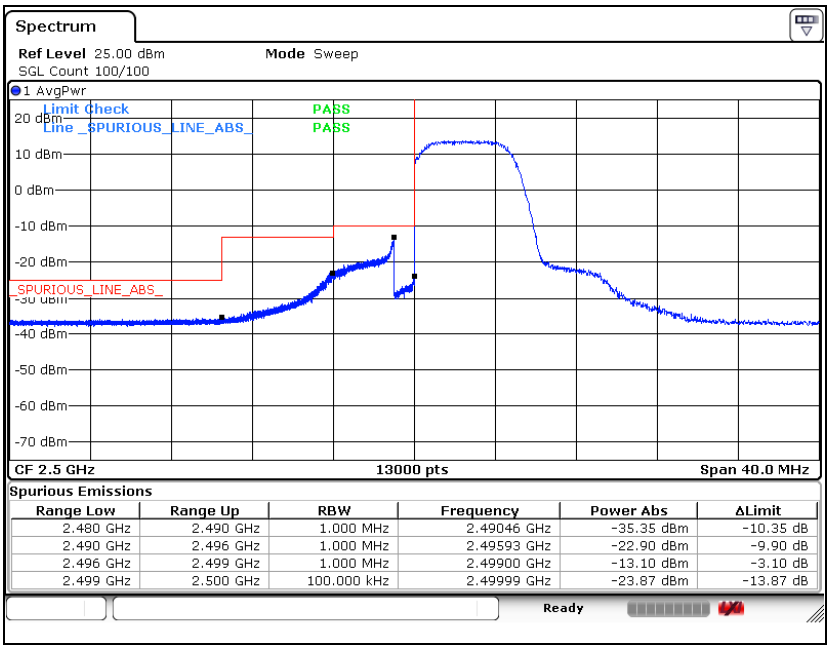
7.3. Test Results

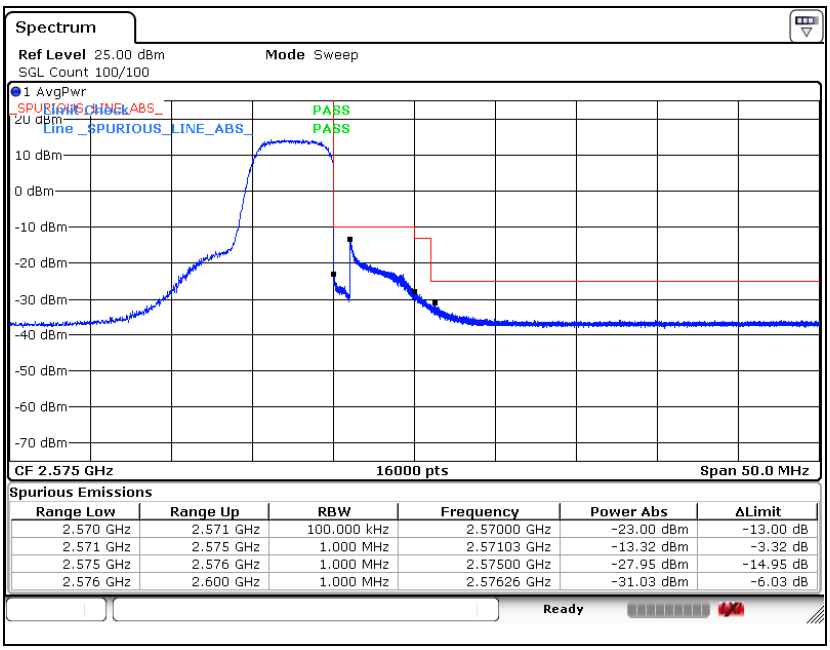
Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 % R.H.

Please refer to the following plots.

LTE Band 7 (5 ㎒ – QPSK_RB 25)
Low Channel



LTE Band 7 (5 ㎒ – QPSK_RB 25)
High Channel



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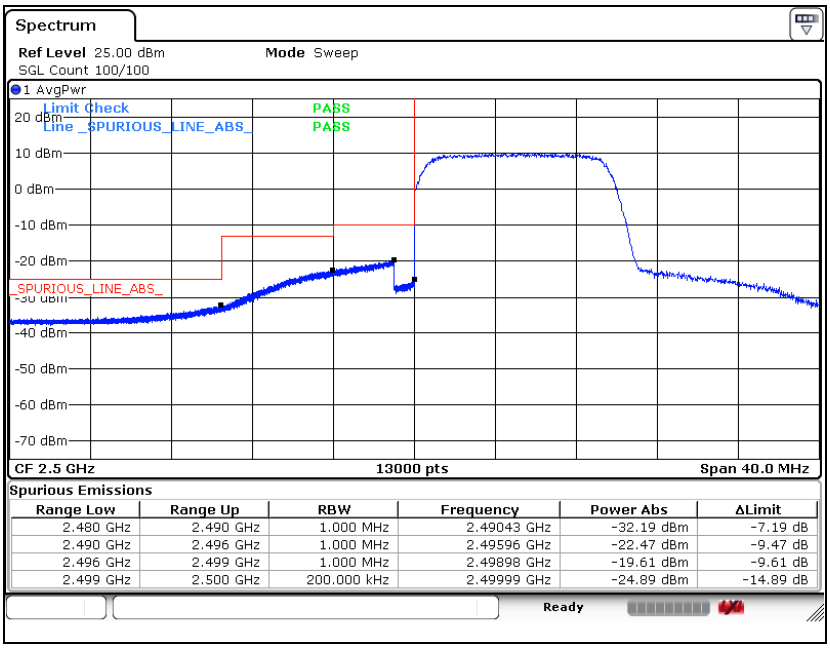
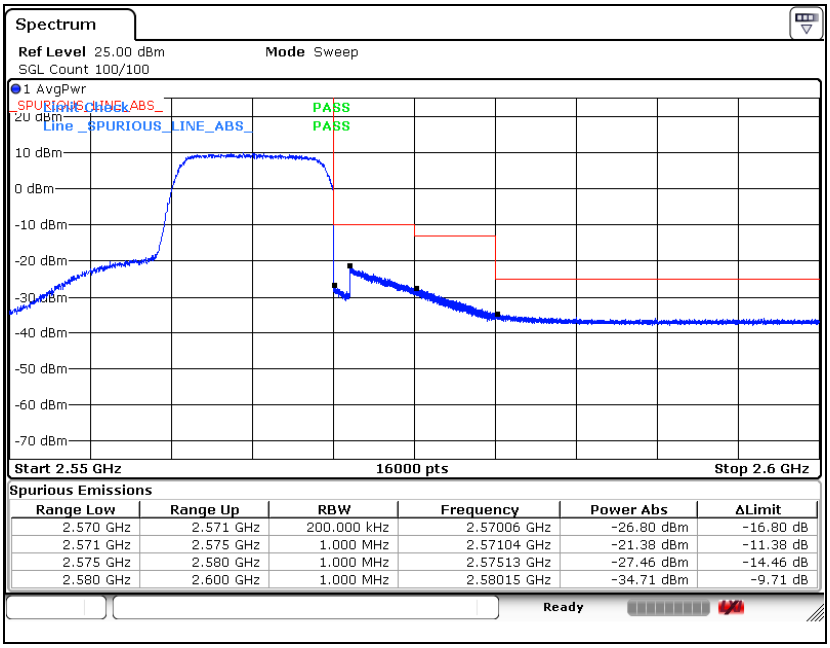
LTE Band 7 (10 ㎒ – QPSK_RB 50)
Low Channel



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
2.480 GHz	2.490 GHz	1.000 MHz	2.49043 GHz	-32.19 dBm	-7.19 dB
2.490 GHz	2.496 GHz	1.000 MHz	2.49596 GHz	-22.47 dBm	-9.47 dB
2.496 GHz	2.499 GHz	1.000 MHz	2.49898 GHz	-19.61 dBm	-9.61 dB
2.499 GHz	2.500 GHz	200.000 kHz	2.49999 GHz	-24.89 dBm	-14.89 dB

LTE Band 7 (10 ㎒ – QPSK_RB 50)
High Channel



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
2.570 GHz	2.571 GHz	200.000 kHz	2.57006 GHz	-26.80 dBm	-16.80 dB
2.571 GHz	2.575 GHz	1.000 MHz	2.57104 GHz	-21.38 dBm	-11.38 dB
2.575 GHz	2.580 GHz	1.000 MHz	2.57513 GHz	-27.46 dBm	-14.46 dB
2.580 GHz	2.600 GHz	1.000 MHz	2.58015 GHz	-34.71 dBm	-9.71 dB

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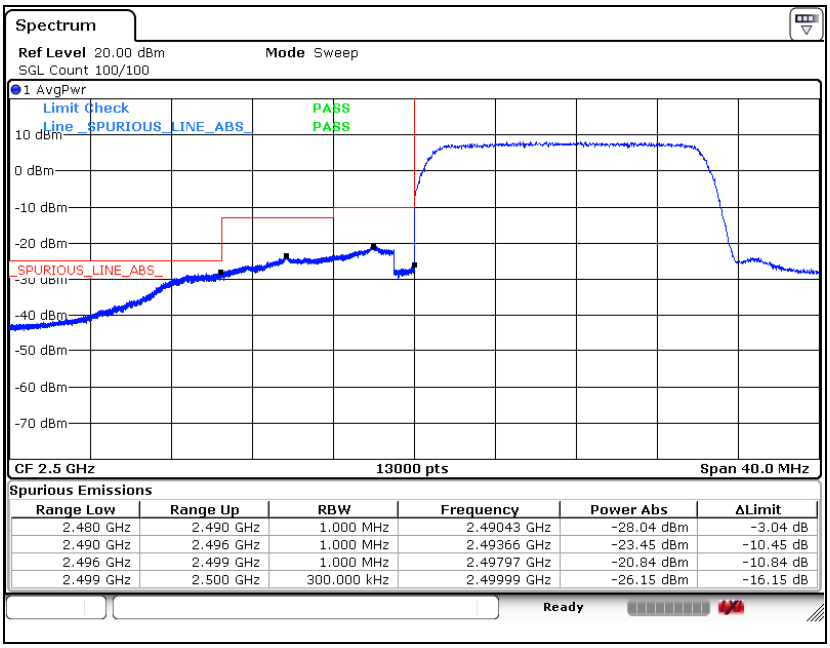
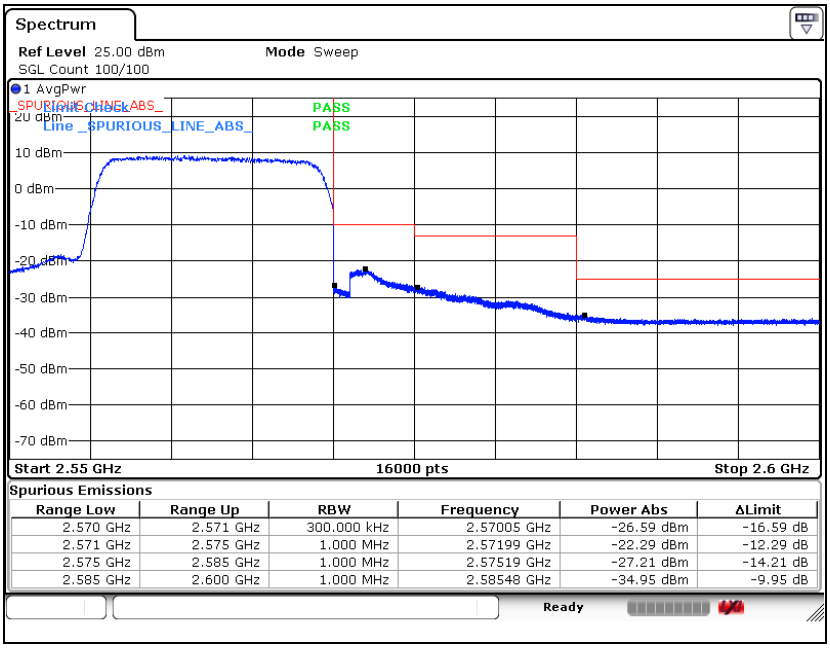
LTE Band 7 (15 ㎒ – QPSK_RB 75)
Low Channel



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
2.480 GHz	2.490 GHz	1.000 MHz	2.49043 GHz	-28.04 dBm	-3.04 dB
2.490 GHz	2.496 GHz	1.000 MHz	2.49366 GHz	-23.45 dBm	-10.45 dB
2.496 GHz	2.499 GHz	1.000 MHz	2.49797 GHz	-20.84 dBm	-10.84 dB
2.499 GHz	2.500 GHz	300.000 kHz	2.49999 GHz	-26.15 dBm	-16.15 dB

LTE Band 7 (15 ㎒ – QPSK_RB 75)
High Channel



Spurious Emissions

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
2.570 GHz	2.571 GHz	300.000 kHz	2.57005 GHz	-26.59 dBm	-16.59 dB
2.571 GHz	2.575 GHz	1.000 MHz	2.57199 GHz	-22.29 dBm	-12.29 dB
2.575 GHz	2.585 GHz	1.000 MHz	2.57519 GHz	-27.21 dBm	-14.21 dB
2.585 GHz	2.600 GHz	1.000 MHz	2.58548 GHz	-34.95 dBm	-9.95 dB

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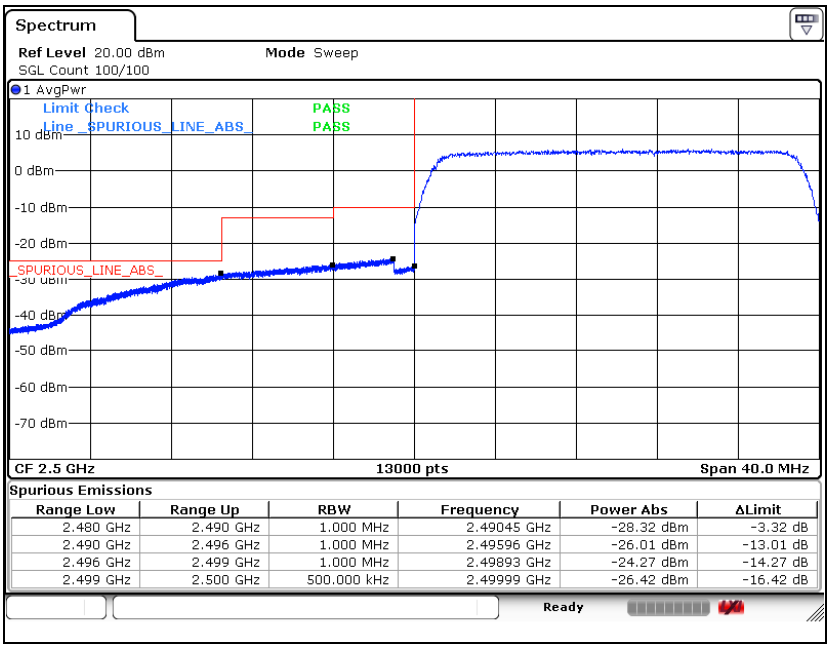
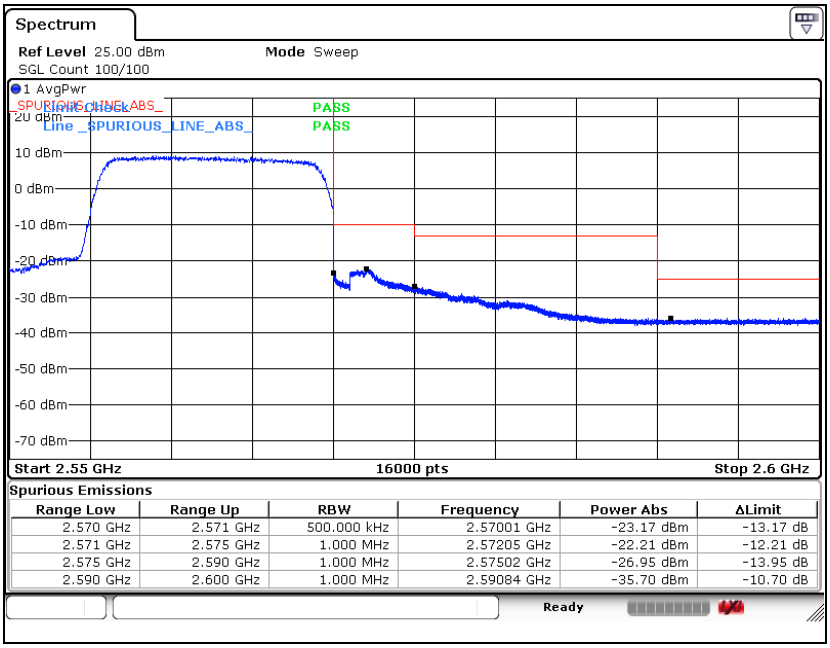
LTE Band 7 (20 ㎒ – QPSK_RB 100)
Low Channel



LTE Band 7 (20 ㎒ – QPSK_RB 100)
High Channel



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7. Frequency Stability

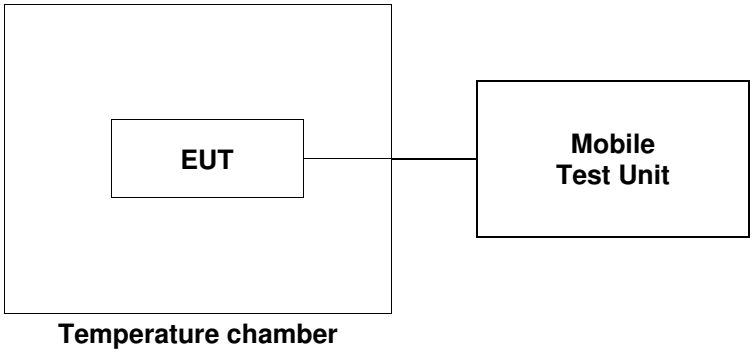
7.1. Limit

- § 2.1055 (a), § 2.1055 (d) & following:

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

7.2. 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	12	3	0.001 2
40		-3	-0.001 2
30		2	0.000 8
23		5	0.002 0
10		-4	-0.001 6
0		3	0.001 2
-10		4	0.001 6
-20		1	0.000 4
-30		-1	-0.000 4
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V_{dc})**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
23	13.8	8	0.003 2
	10.2	-6	0.002 4

- End of the Test Report -

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