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TEST REPORT

of

FCC Part 2 Subpart J, Part 27 Subpart C

FCC ID: YZP-OA1000

Equipment Under Test	:	Telematics Module
Model Name	:	LTD-OA1000
Applicant	:	LG Innotek Co., Ltd.
Manufacturer	:	LG Innotek Co., Ltd.
Date of Receipt	:	2024.05.09
Date of Test(s)	:	2024.05.13 ~ 2024.07.05
Date of Issue	:	2024.07.11

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

1) The results of this test report are effective only to the items tested.
2) The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received.
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4) The data marked ※ in this report was provided by the customer and may affect the validity of the test results.
We are responsible for all the information of this test report except for the data(※) provided by the customer.

Tested by: Youngbin Kim

Technical Manager: Jinhyoung Cho

SGS Korea Co., Ltd. Gunpo Laboratory

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1. General Information

1.1. Testing Laboratory

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

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1.2. Details of Applicant

Applicant : LG Innotek Co., Ltd.
Address : 30, Magokjungang 10-ro, Gangseo-gu, Seoul, Korea, 07796
Contact Person : Jeong, In-chang
Phone No. : +82 62 950 0332

1.3. Details of Manufacturer

Company : LG Innotek Co., Ltd.
Address : 30, Magokjungang 10-ro, Gangseo-gu, Seoul, Korea, 07796
Factory 1 : LG Innotek Co., Ltd.
Factory 1 Address : 26, Hanamsandan 5beon-ro, Gwangsan-gu, Gwangju, Republic of Korea, 62229
Factory 2 : PT. LG INNOTEK INDONESIA
Factory 2 Address : Bekasi International Industrial Estate, Blok C8 No.12 & 12A, Desa Cibatu, Cikarang Selatan, Bekasi 17750, Jawa Barat - Indonesia

1.4. Description of EUT

Kind of Product	Telematics Module
Model Name	LTD-OA1000
Serial Number	Conducted: C-01 Radiated: R-01
Power Supply	DC 4.0 V
Rated Power	LTE Band 41: 23 ㏈m
Frequency Range	LTE Band 41: 2 496 ㎒ ~ 2 690 ㎒
Modulation Technique	QPSK, 16QAM
Antenna Type	Dipole Antenna
Antenna Gain※	2 496 ㎒ ~ 2 690 ㎒ : 3.97 dBi
H/W Version	0
S/W Version	01C_D20SKUS
FVIN	N/A

1.5. Test Equipment List

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval	Cal. Due
Spectrum Analyzer	R&S	FSV30	100955	Mar. 08, 2024	Annual	Mar. 08, 2025
Signal Generator	R&S	SMBV100A	255834	Dec. 01, 2023	Annual	Dec. 01, 2024
DC Power Supply	R&S	HMP2020	102133	Apr. 23, 2024	Annual	Apr. 23, 2025
Communication Analyzer	Anritsu	MT8821C	6262094325	Mar. 05, 2024	Annual	Mar. 05, 2025
Temperature Chamber	ESPEC CORP.	PL-2J	15004184	Jun. 03, 2024	Annual	Jun. 03, 2025
Directional Coupler	KRYTAR	152613	140972	Jul. 04, 2023	Annual	Jul. 04, 2024
BRIDGE Coupler	MARK MICROWAVE INC	CBR16-0012	1542	May 13, 2024	Annual	May 13, 2025
Power Sensor	Anritsu	MA2411B	1207272	May 29, 2024	Annual	May 29, 2025
Power Meter	Anritsu	ML2495A	1223004	May 29, 2024	Annual	May 29, 2025
Power Splitter	Weinschel	1534	499	Nov. 03, 2023	Annual	Nov. 03, 2024
Spectrum Analyzer	R&S	FSW43	100637	Apr. 08, 2024	Annual	Apr. 08, 2025
Low Pass Filter	Mini-Circuits	NLP-1200+	V 8979400903-1	May 17, 2024	Annual	May 17, 2025
High Pass Filter	Wainwright Instrument GmbH	WHKX10-900-1000-18000-40SS	7	Feb. 27, 2024	Annual	Feb. 27, 2025
High Pass Filter	Wainwright Instrument GmbH	WHKX3.0/18G-6SS	51	Jun. 14, 2023	Annual	Jun. 14, 2024
High Pass Filter	Wainwright Instrument GmbH	WHNX7.5/26.5G-6SS	11	Oct. 17, 2023	Annual	Oct. 17, 2024
Preamplifier	H.P.	8447F	2944A03909	Aug. 04, 2023	Annual	Aug. 04, 2024
Preamplifier	R&S	SCU 18F	101058	Dec. 07, 2023	Annual	Dec. 07, 2024
Preamplifier	MITEQ Inc.	JS44-18004000-35-8P	1546891	Oct. 06, 2023	Annual	Oct. 06, 2024
Test Receiver	R&S	ESU26	100109	Jan. 16, 2024	Annual	Jan. 16, 2025
Loop Antenna	Schwarzbeck Mess-Elektronik	FMZB 1519	1519-039	Aug. 21, 2023	Biennial	Aug. 21, 2025
Bilog Antenna	Schwarzbeck Mess-Elektronik	VULB9163	9163-437	May 29, 2024	Biennial	May 29, 2026
Horn Antenna	R&S	HF906	100326	Feb. 19, 2024	Annual	Feb. 19, 2025
Horn Antenna	Schwarzbeck Mess-Elektronik	BBHA 9170	9170-540	Dec. 05, 2023	Annual	Dec. 05, 2024
Antenna Master	Innco systems GmbH	MA4640-XP-ET	MA4640/536/38330516/L	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	CO3000/963/38330516/L	N.C.R.	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.6 m)	N/A	N.C.R.	N/A	N.C.R.
Coaxial Cable	RADIALL	TESTPRO 3	182287	Apr. 12, 2024	Semi-Annual	Oct. 12, 2024
Coaxial Cable	RADIALL	TESTPRO 3	182288	Apr. 12, 2024	Semi-Annual	Oct. 12, 2024
Coaxial Cable	RADIALL	TESTPRO 3	182291	Apr. 12, 2024	Semi-Annual	Oct. 12, 2024
Coaxial Cable	RF ONE	NMST-13A26-NMST-5m	TPC2402190004	Apr. 03, 2024	Semi-Annual	Oct. 03, 2024
Coaxial Cable	RF ONE	NMST-13A26-NMST-10m	TPC2402190001	Apr. 03, 2024	Semi-Annual	Oct. 03, 2024

Note;

For equipment listed above that has a calibration date or calibration due date that falls within the test date range, care was taken to ensure that this equipment was used after the calibration date and before the calibration due date.

1.6. Summary of Test Results

The EUT has been tested according to the following specifications:

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

1.7. Sample Calculation for Offset

Where relevant, the following sample calculation is provided:

1.7.1. Conducted Test

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

1.7.2. Radiation test

- E.I.R.P. (㏈ m) = Measured level (㏈㎶) + Antenna factor (㏈/m) + Cable loss (㏈) + 20 Log D - 104.8; where D is the measurement distance in meters.
- E.R.P. (㏈ m) = E.I.R.P. (㏈ m) - 2.15 (㏈)

1.8. Worst Case Configuration and Mode

The worst-case is based on the conducted output power measurement investigation results.
Output power measurements were measured on QPSK and 16QAM modulations.
All testing was performed using QPSK and 16QAM modulations. However, the spurious radiated emission and spurious at antenna terminal were only performed on bandwidth and RB offset (with RB size 1) with the highest conducted power in QPSK.
The Peak-Average Ratio test was measured on 16QAM modulations.

The radiation test of the EUT was investigated in three orthogonal orientations X, Y, and Z, and the worst case data is reported.

1.9. Measurement Configuration

Test Items	Band	Test Channel			Bandwidth				Modulation		RB #		
		Low	Mid	High	5	10	15	20	QPSK	16QAM	1	Half	Full
Conducted Output Power	41	V	V	V	V	V	V	V	V	V	V	V	V
Frequency Stability	41	-	V	-	V	-	-	-	V	-	-	-	V
Occupied Bandwidth	41	V	V	V	V	V	V	V	V	V	-	-	V
Peak-to-Average Ratio	41	V	V	V	V	V	V	V	V	-	-	-	V
Band edge	41	V	V	V	V	V	V	V	V	V	V	-	V
Spurious at antenna terminal & Radiated Spurious Emissions	41	V	V	V	Worst Case								

1.10 . Measurement Uncertainty

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

Parameter	Uncertainty	
Conducted Output Power	0.33 dB	
Occupied Bandwidth	0.05 ㎒	
Conducted Spurious Emissions	0.99 dB	
Peak to Average Ratio	0.66 dB	
Frequency Stability	116 ㎐	
Radiated Emission, 9 ㎑ to 30 ㎒	H	3.60 dB
	V	3.60 dB
Radiated Emission, below 1 ㎓	H	4.60 dB
	V	4.90 dB
Radiated Emission, above 1 ㎓	H	3.90 dB
	V	3.80 dB

All measurement uncertainty values are shown with a coverage factor of *k*=2 to indicate a 95 % level of confidence.

1.11. Test Report Revision

Revision	Report Number	Date of Issue	Description
0	F690501-RF-RTL005248	2024.07.11	Initial

1.12. Emission Designator and Max Power

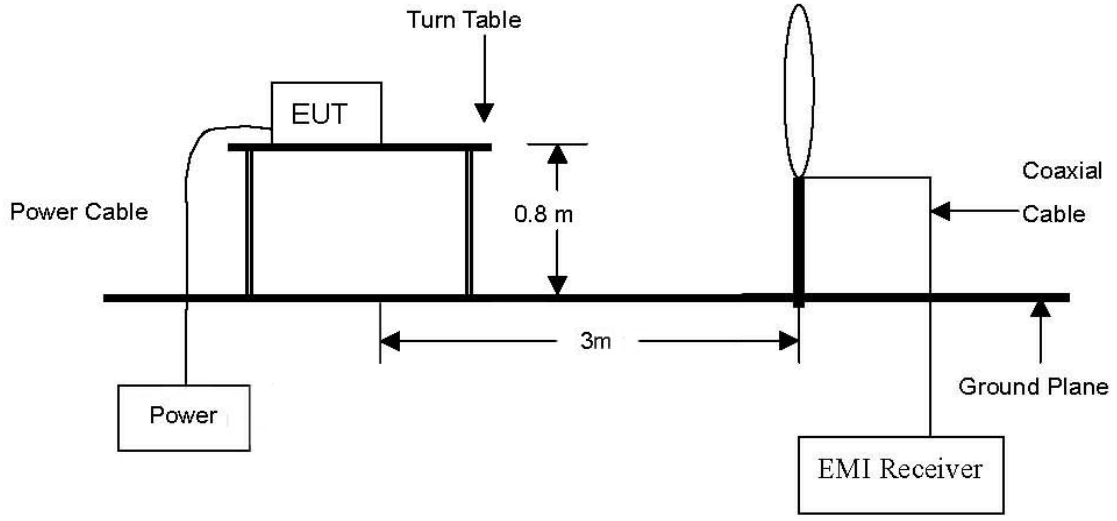
LTE

Band	Band width (㎒)	Modulation	Low Freq. (㎒)	Upper Freq. (㎒)	Conducted Average (㏈m)	Ant. Gain (㏈i)	E.R.P. / E.I.R.P. Average (㏈m)	E.R.P. / E.I.R.P. Average (W)	Emission Designator
41	5	QPSK	2 498.5	2 687.5	23.37	3.97	27.34	0.542	4M50G7D
		16QAM			22.46		26.43	0.440	4M51D7D
	10	QPSK	2 501.0	2 685.0	23.60		27.57	0.571	8M93G7D
		16QAM			22.48		26.45	0.442	8M93D7D
	15	QPSK	2 503.5	2 682.5	23.58		27.55	0.569	13M5G7D
		16QAM			22.69		26.66	0.463	13M5D7D
	20	QPSK	2 506.0	2 680.0	23.59		27.56	0.570	17M9G7D
		16QAM			22.69		26.66	0.463	17M9D7D

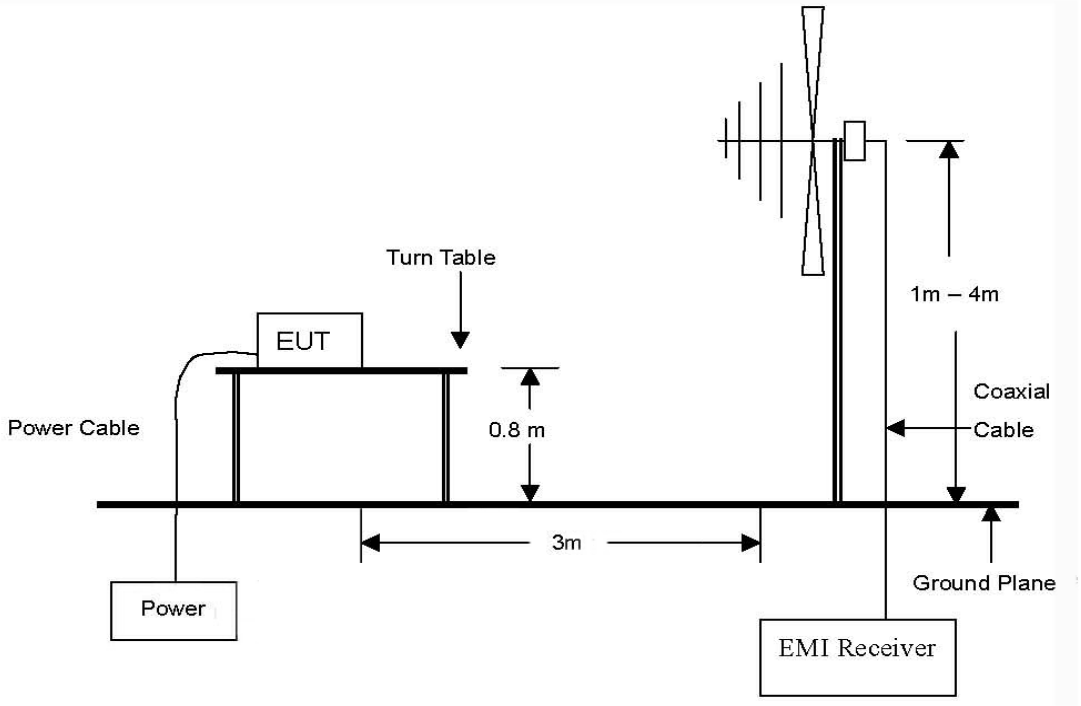
2. E.R.P. / E.I.R.P. & Radiated Spurious Emissions

2.1. Test setup

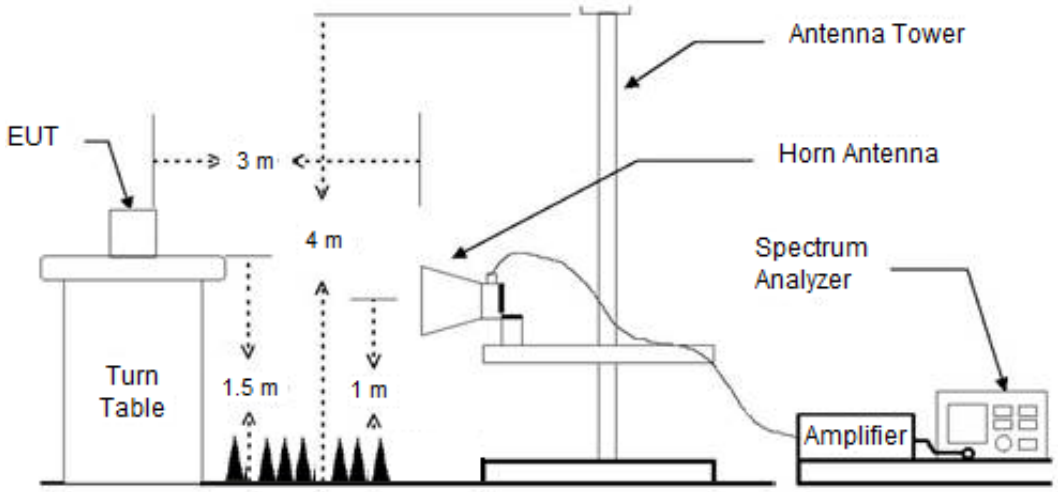
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 ㎑ to 30 ㎒.



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 27 ㎓ Emissions.



2.2. Limit

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

- §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 Radiated Spurious Emissions

- §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 2 490.5 ㎒ and 2 496 ㎒ and 55 + 10 $\log_{10}$ (P) ㏈ at or below 2 490.5 ㎒. Mobile Satellite Service licensees operating on frequencies below 2 495 ㎒ 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.

2.3. Test Procedure

2.3.1. E.R.P. or E.I.R.P. from conducted RF output power

According to subclause 5.2.5.5 of ANSI C63.26-2015 E.R.P. and E.I.R.P. are defined as the product of the power supplied to the antenna and its gain.

The relevant equation for determining the E.R.P. or E.I.R.P. from the conducted RF output power measured using the guidance provided above is:

E.R.P. or E.I.R.P. = $P_{Meas} + G_T$

where:
E.R.P. or E.I.R.P. = effective radiated power or equivalent isotropically radiated power, respectively (expressed in the same units as P_{Meas}, typically dBW or dBm);
P_{Meas} = measured transmitter output power or PSD, in dBm or dBW;
G_T = gain of the transmitting antenna, in dBd (ERP) or dBi (EIRP);

2.3.2. Radiated Spurious Emissions

The test based on ANSI/TIA 603E: 2016 and ANSI C63.26-2015 and KDB 971168 D01 Power Meas License Digital Systems v03r01.

1. On a test site, the EUT shall be placed at 0.8 m or 1.5 m height on a turn table, and in the position close to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to correspond to the fundamental frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the peak detector is used for the measurement.
4. Radiated spurious emissions measurement method was set as follows:
   RBW = 100 kHz for emissions below 1 GHz and 1 MHz for emissions above 1 GHz, VBW ≥ 3 x RBW,
   Detector = RMS, trace mode = max hold, per the guidelines of KDB 971168 D01 Power Meas License Digital Systems v03r01.
5. The transmitter shall be switched on, the measuring receiver shall be tuned to the frequency of the transmitter under test.
6. 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.
7. The transmitter shall be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
8. 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.
9. The maximum signal level detected by the measuring receiver shall be noted.
10. In necessary, the input attenuator setting on the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
11. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
12. The measurement shall be repeated with the test antenna orientated for horizontal polarization.

2.4. Test results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 ± 2 %

2.4.1. E.R.P. / E.I.R.P.

LTE

Band	Frequency (㎒)	Maximum Conducted Power (dB m)	Maximum Conducted Power (W)	Antenna Gain (dB i)	Maximum E.I.R.P. (dB m)	Maximum E.I.R.P. (W)	Maximum E.R.P. (dB m)	Maximum E.R.P. (W)	Limit
41	2 496 ~ 2 690	23.60	0.229	3.97	27.57	0.571			2 W E.I.R.P.

Remark;

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

2.4.2. Radiated spurious emissions

LTE band 41 (10 ㎒ - QPSK)

Frequency (㎒)	Measured Level (dB㎶)	Ant. Pol.	AF (dB/m)	AMP+CL (dB)	E (dB㎶/m)	CF (dB)	E.I.R.P. (dB m)	Limit (dB m)	Margin (dB)
Low Channel (2 501.0 ㎒)									
5 002.04	38.07	H	33.40	-29.17	42.30	-95.26	-52.96	-25	27.96
5 002.00	37.71	V	33.40	-29.17	41.94	-95.26	-53.32	-25	28.32
Above 5 100.00	Not detected	–	–	–	–	–	–	–	–
Middle Channel (2 593.0 ㎒)									
5 185.96	41.35	H	33.67	-29.52	45.50	-95.26	**-49.76**	-25	24.76
5 189.32	36.89	V	33.68	-29.63	40.94	-95.26	-54.32	-25	29.32
Above 5 200.00	Not detected	–	–	–	–	–	–	–	–
High Channel (2 685.0 ㎒)									
5 369.36	34.56	H	34.04	-27.62	40.98	-95.26	-54.28	-25	29.28
5 370.00	34.31	V	34.04	-27.59	40.76	-95.26	-54.50	-25	29.50
Above 5 400.00	Not detected	–	–	–	–	–	–	–	–

Remark;

1. AF = Antenna Factor, CL = Cable Loss, CF = Conversion Factor.
2. E (dB㎶/m) = Measured Level (dB㎶) + Antenna Factor (dB/m) + AMP (dB) + Cable Loss (dB).
3. E.I.R.P. (dB m) = E (dB㎶/m) + CF (dB).
4. E.R.P. (dB m) = E (dB㎶/m) + CF (dB) - 2.15 (dB); where E.R.P. and E.I.R.P. are expressed in consistent units.
5. CF (dB) = 20 log D - 104.8; where D is the measurement distance in meters, According to KDB 971168 D01 v03r01 5.8.4.
6. The frequency spectrum is examined from 9 ㎑ to the 10th harmonic of the fundamental frequency of the transmitter. No other spurious and harmonic emissions were reported greater than listed emissions above table.

3. Conducted Output Power

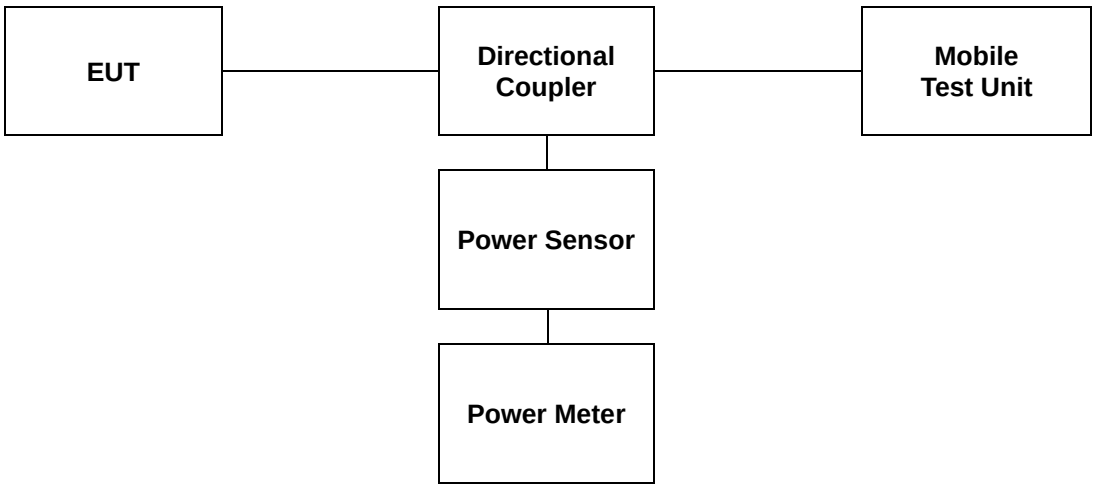
3.1. Limit

CFR 47, Section FCC §2.1046

3.2. Test Procedure

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

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



3.3. Test Result

Ambient temperature : (23 ± 1) ℃

Relative humidity : 47 ± 2 %

LTE Band 41									
Bandwidth (㎒)	Modulation	RB Size	RB Offset	Conducted Output Power					
				39675 (2 498.5 ㎒)		40620 (2 593.0 ㎒)		41565 (2 687.5 ㎒)	
				(dB m)	(W)	(dB m)	(W)	(dB m)	(W)
5	QPSK	1	0	23.30	0.214	23.28	0.213	23.26	0.212
		1	12	23.35	0.216	23.34	0.216	23.25	0.211
		1	24	**23.37**	**0.217**	23.35	0.216	23.27	0.212
		12	0	22.41	0.174	22.44	0.175	22.41	0.174
		12	6	22.39	0.173	22.47	0.177	22.43	0.175
		12	13	22.39	0.173	22.49	0.177	22.39	0.173
		25	0	22.37	0.173	22.44	0.175	22.35	0.172
	16QAM	1	0	22.42	0.175	22.46	0.176	22.39	0.173
		1	12	22.40	0.174	22.45	0.176	22.40	0.174
		1	24	22.42	0.175	**22.46**	**0.176**	22.40	0.174
		12	0	21.34	0.136	21.44	0.139	21.53	0.142
		12	6	21.39	0.138	21.47	0.140	21.49	0.141
		12	13	21.40	0.138	21.50	0.141	21.45	0.140
		25	0	21.42	0.139	21.49	0.141	21.50	0.141

LTE Band 41									
Bandwidth (㎒)	Modulation	RB Size	RB Offset	Conducted Output Power					
				39700 (2 501.0 ㎒)		40620 (2 593.0 ㎒)		41540 (2 685.0 ㎒)	
				(dB m)	(W)	(dB m)	(W)	(dB m)	(W)
10	QPSK	1	0	23.21	0.209	**23.60**	**0.229**	23.25	0.211
		1	25	23.22	0.210	23.29	0.214	23.18	0.208
		1	49	23.22	0.210	23.27	0.212	23.17	0.207
		25	0	22.35	0.172	22.35	0.172	22.42	0.175
		25	12	22.42	0.175	22.56	0.180	22.41	0.174
		25	25	22.41	0.174	22.47	0.177	22.42	0.175
		50	0	22.38	0.173	22.49	0.177	22.41	0.174
	16QAM	1	0	22.37	0.173	**22.48**	**0.177**	22.42	0.175
		1	25	22.37	0.173	22.48	0.177	22.31	0.170
		1	49	22.36	0.172	22.41	0.174	22.32	0.171
		25	0	21.42	0.139	21.45	0.140	21.43	0.139
		25	12	21.33	0.136	21.47	0.140	21.44	0.139
		25	25	21.45	0.140	21.45	0.140	21.44	0.139
		50	0	21.44	0.139	21.54	0.143	21.43	0.139

LTE Band 41									
Bandwidth (㎒)	Modulation	RB Size	RB Offset	Conducted Output Power					
				39725 (2 503.5 ㎒)		40620 (2 593.0 ㎒)		41515 (2 682.5 ㎒)	
				(dB m)	(W)	(dB m)	(W)	(dB m)	(W)
15	QPSK	1	0	23.40	0.219	23.44	0.221	23.34	0.216
		1	36	23.32	0.215	23.34	0.216	23.31	0.214
		1	74	23.49	0.223	**23.55**	**0.226**	23.45	0.221
		36	0	22.51	0.178	22.55	0.180	22.53	0.179
		36	18	22.41	0.174	22.47	0.177	22.60	0.182
		36	37	22.45	0.176	22.48	0.177	22.55	0.180
		75	0	22.55	0.180	22.62	0.183	22.57	0.181
	16QAM	1	0	22.54	0.179	22.63	0.183	22.48	0.177
		1	36	22.46	0.176	22.55	0.180	22.48	0.177
		1	74	22.63	0.183	**22.69**	**0.186**	22.54	0.179
		36	0	21.45	0.140	21.59	0.144	21.59	0.144
		36	18	21.61	0.145	21.67	0.147	21.64	0.146
		36	37	21.56	0.143	21.65	0.146	21.46	0.140
		75	0	21.44	0.139	21.56	0.143	21.38	0.137

LTE Band 41									
Bandwidth (㎒)	Modulation	RB Size	RB Offset	Conducted Output Power					
				39750 (2 506.0 ㎒)		40620 (2 593.0 ㎒)		41490 (2 680.0 ㎒)	
				(dB m)	(W)	(dB m)	(W)	(dB m)	(W)
20	QPSK	1	0	23.38	0.218	23.48	0.223	23.34	0.216
		1	50	23.42	0.220	**23.49**	**0.223**	23.35	0.216
		1	99	23.35	0.216	23.46	0.222	23.36	0.217
		50	0	22.45	0.176	22.69	0.186	22.55	0.180
		50	25	22.51	0.178	22.51	0.178	22.60	0.182
		50	13	22.55	0.180	22.47	0.177	22.60	0.182
		100	0	22.49	0.177	22.62	0.183	22.55	0.180
	16QAM	1	0	22.58	0.181	22.62	0.183	22.52	0.179
		1	50	22.57	0.181	**22.69**	**0.186**	22.52	0.179
		1	99	22.50	0.178	22.60	0.182	22.52	0.179
		50	0	21.56	0.143	21.55	0.143	21.57	0.144
		50	25	21.62	0.145	21.68	0.147	21.56	0.143
		50	50	21.45	0.140	21.49	0.141	21.59	0.144
		100	0	21.52	0.142	21.67	0.147	21.60	0.145

4. Occupied Bandwidth

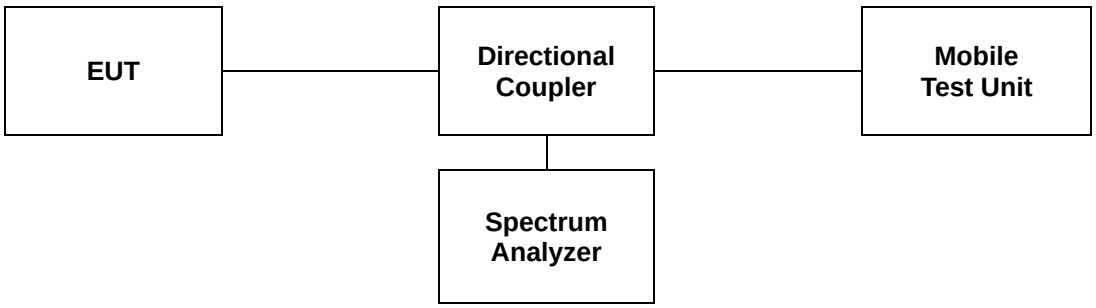
4.1. Limit

CFR 47, Section FCC §2.1049

4.2. Test Procedure

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

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).



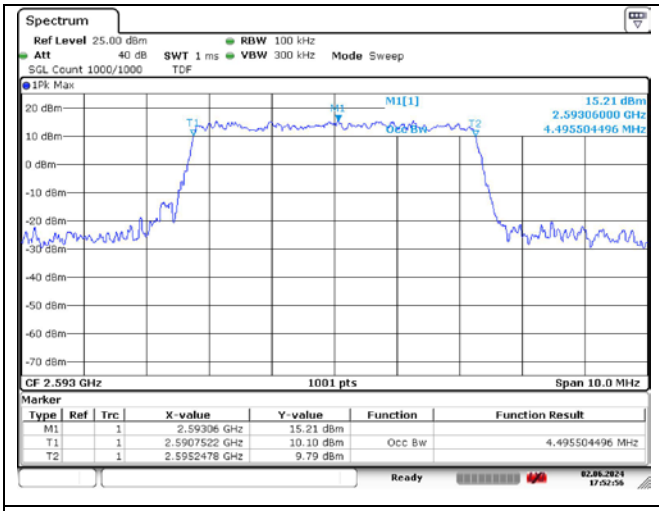
4.3 Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 ± 2 %

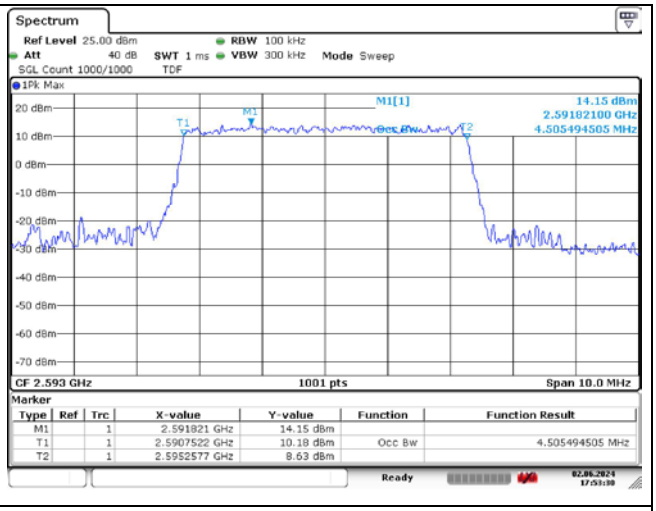
Band	Bandwidth (㎒)	Frequency (㎒)	Occupied Bandwidth (㎒)	
			QPSK	16QAM
41	5	2 593.0	4.496	4.505
	10		8.931	8.931
	15		13.487	13.457
	20		17.902	17.902

- Test plots

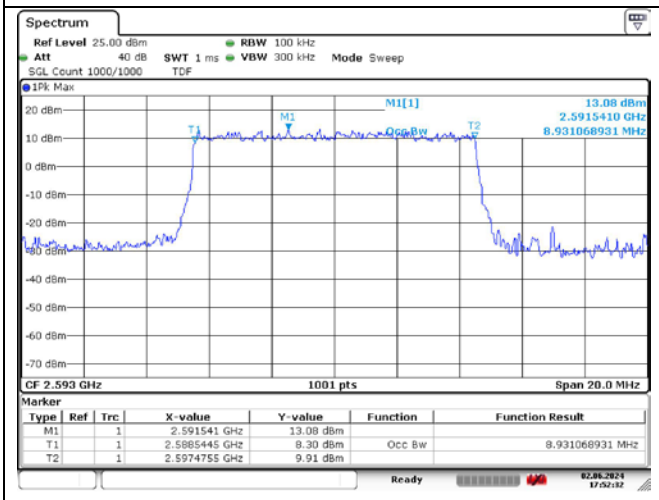
LTE band 41



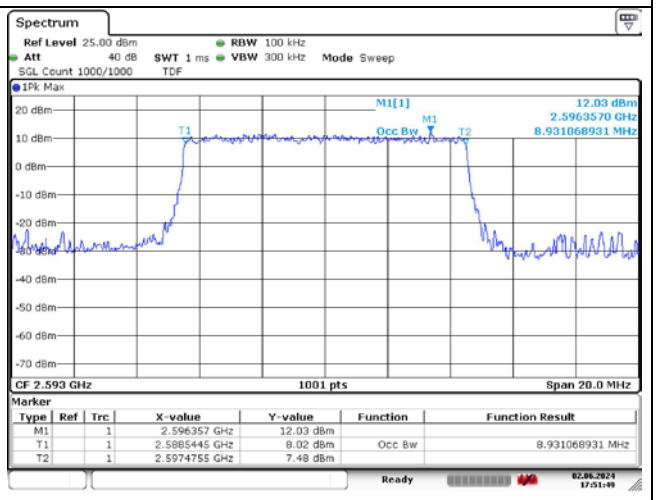
5 ㎒ QPSK Middle Channel - Full RB



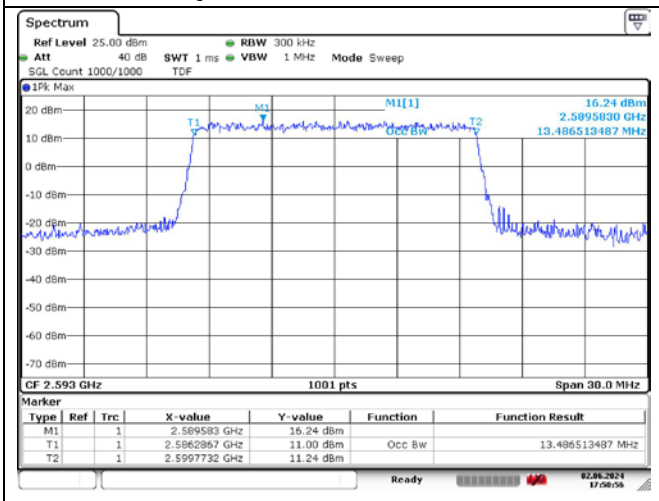
5 ㎒ 16QAM Middle Channel - Full RB



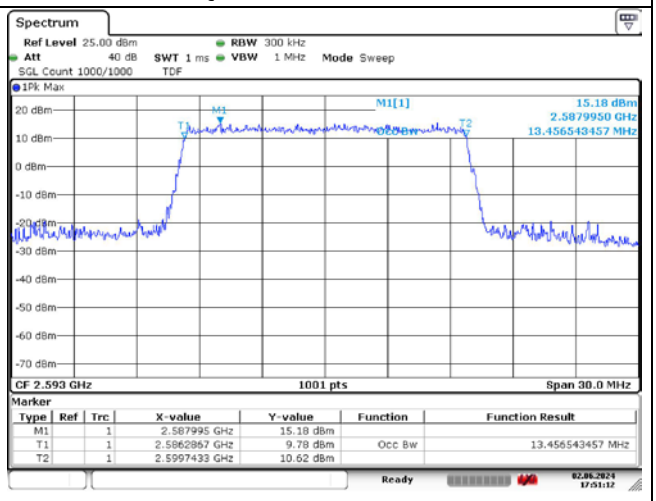
10 ㎒ QPSK Middle Channel - Full RB



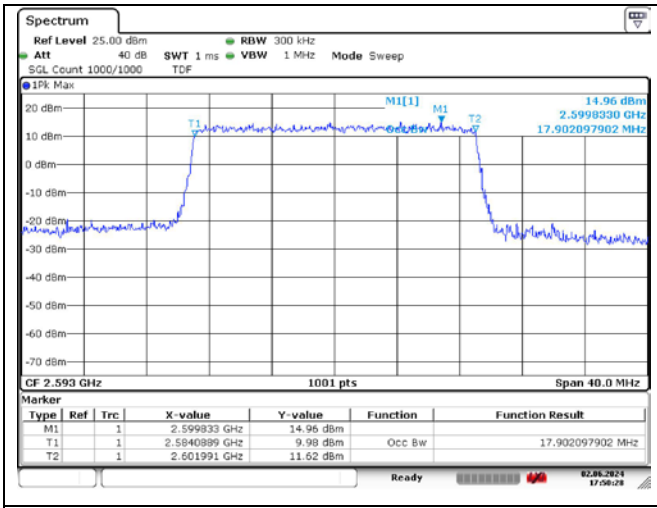
10 ㎒ 16QAM Middle Channel - Full RB



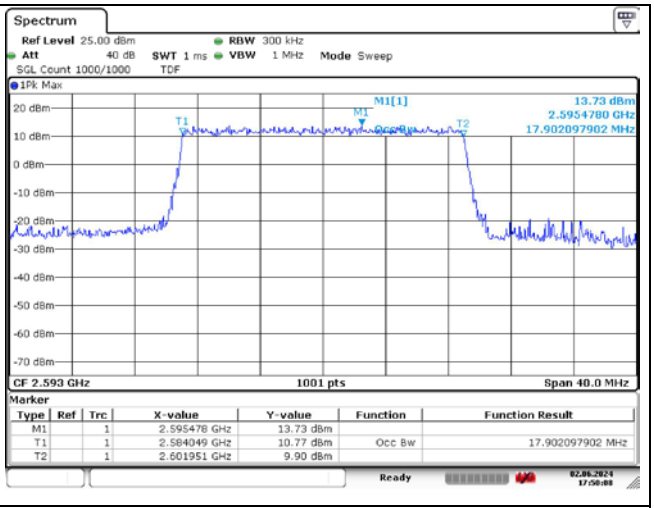
15 ㎒ QPSK Middle Channel - Full RB



15 ㎒ 16QAM Middle Channel - Full RB



20 ㎒ QPSK Middle Channel - Full RB



20 ㎒ 16QAM Middle Channel - Full RB

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 5.2.3.4 of ANSI C63.26-2015.

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

a. Set resolution/measurement bandwidth ≥ 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:

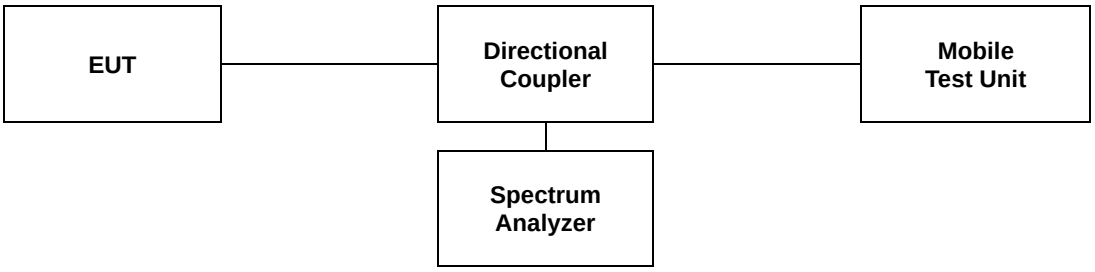
1) For continuous transmissions, set to greater of [10 x (number of points in sweep) x (transmission symbol period)] or 1 ms.

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.



5.3 Test Results

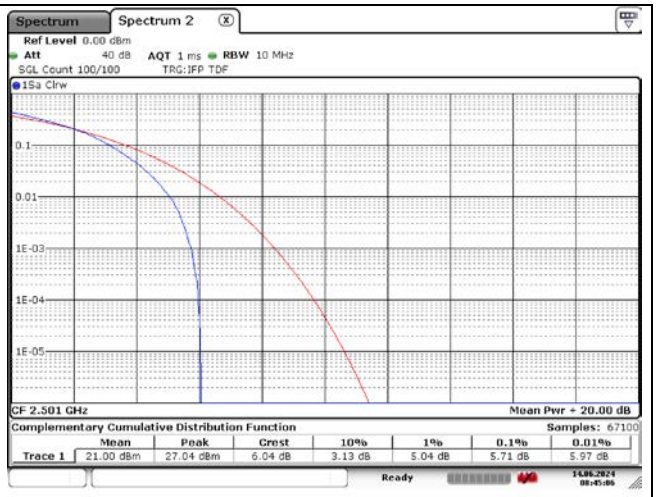
Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 ± 2 %

Band	Bandwidth (㎒)	Mode	Frequency (㎒)	PAR (dB)
41	5	16QAM	2 498.5	5.62
			2 593.0	5.74
			2 687.5	5.68
	10		2 501.0	5.71
			2 593.0	5.77
			2 685.0	5.65
	15		2 503.5	5.74
			2 593.0	5.77
			2 682.5	5.68
	20		2 506.0	5.74
			2 593.0	5.74
			2 680.0	5.74

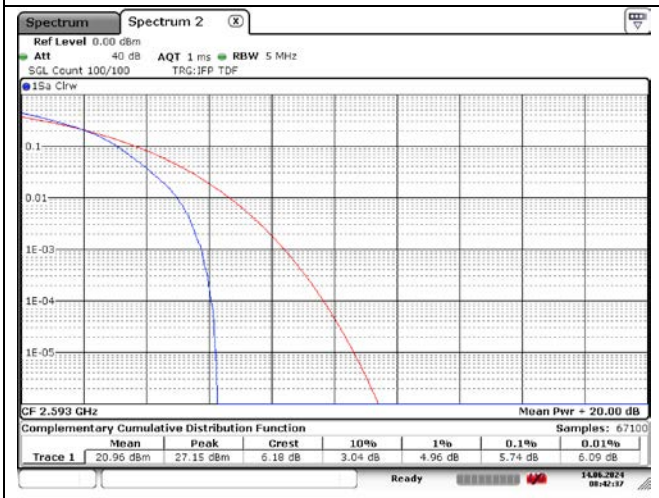
- Test plots

LTE band 41

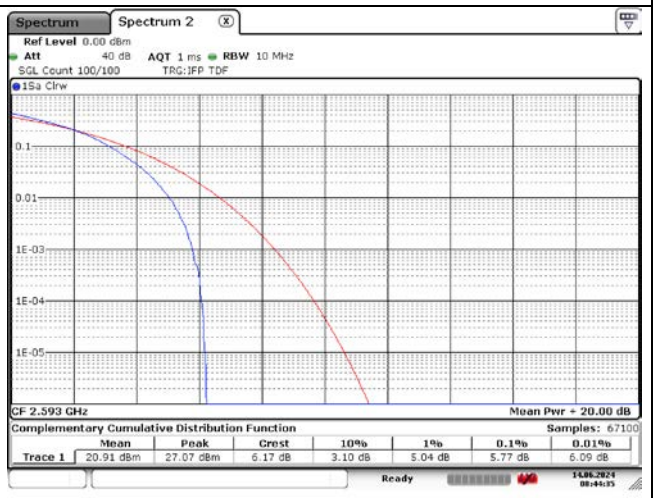
5 ㎒ Low Channel - Full RB



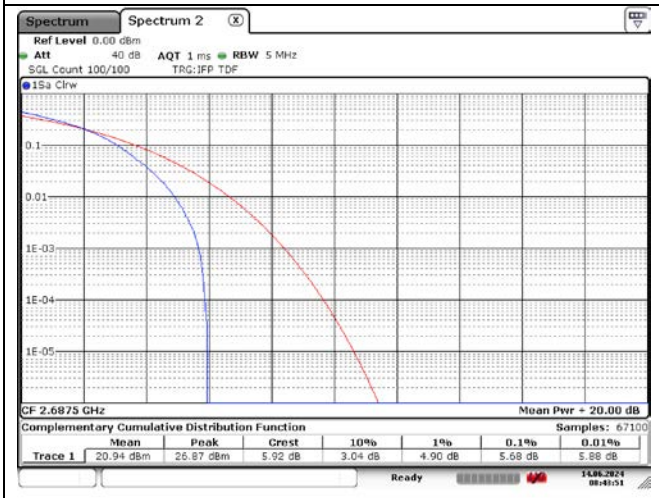
10 ㎒ Low Channel - Full RB



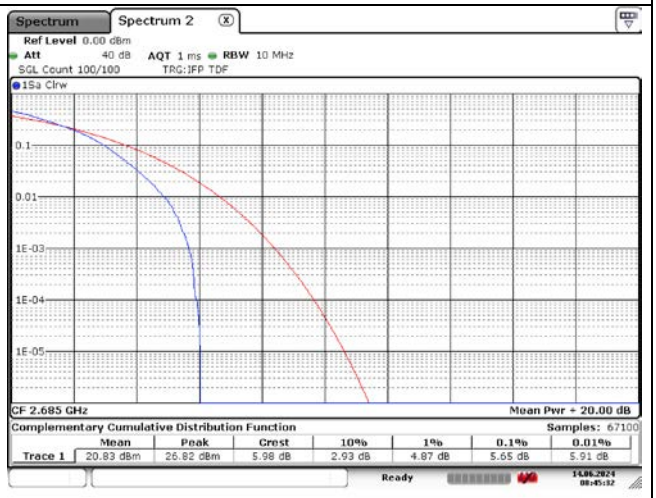
5 ㎒ Middle Channel - Full RB



10 ㎒ Middle Channel - Full RB

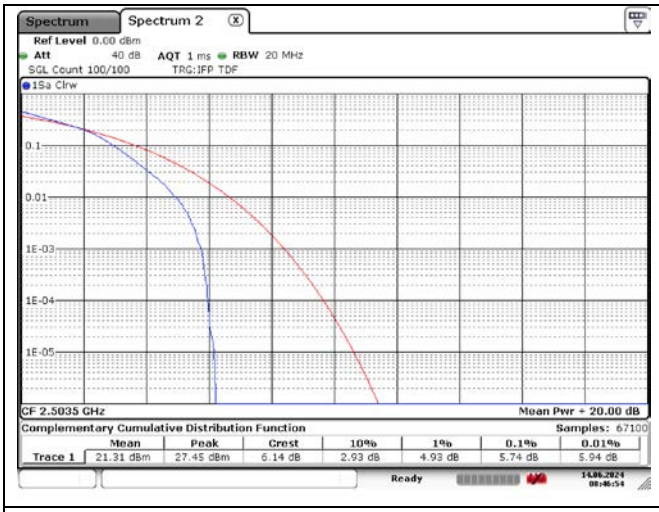


5 ㎒ High Channel - Full RB

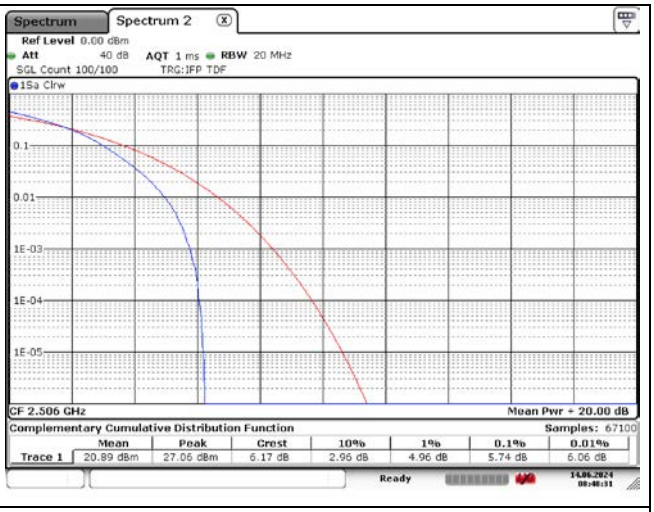


10 ㎒ High Channel - Full RB

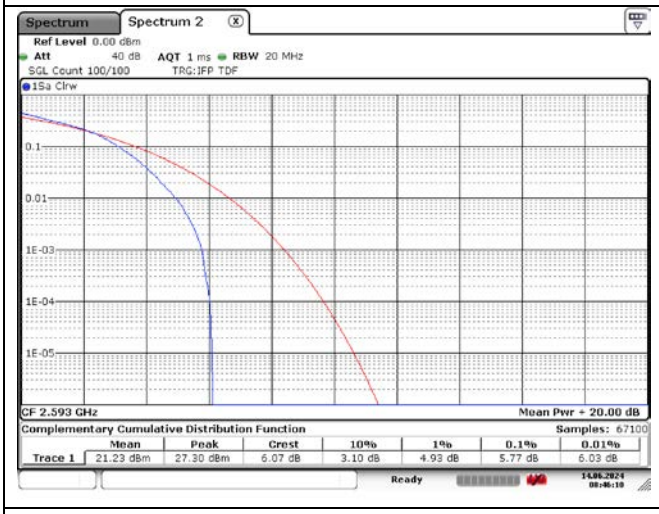
LTE band 41



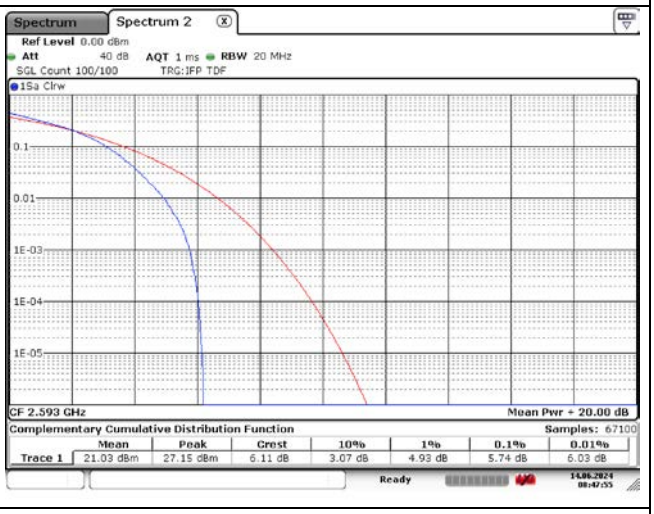
15 ㎒ Low Channel - Full RB



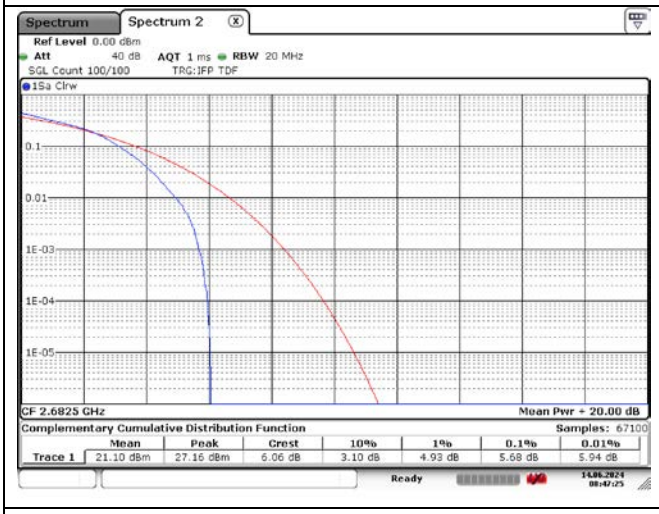
20 ㎒ Low Channel - Full RB



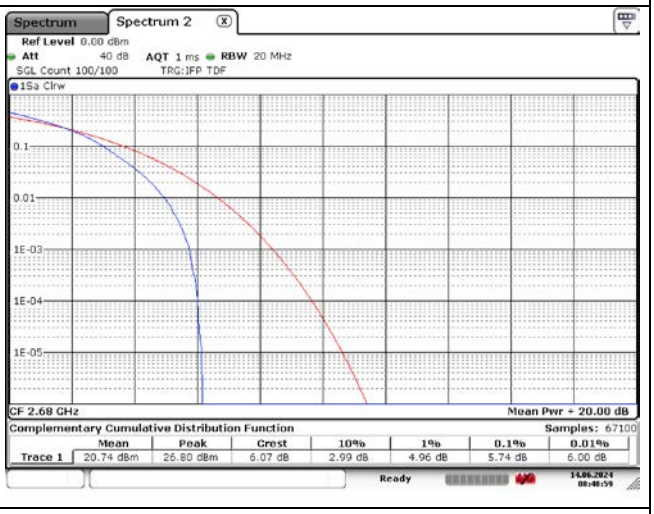
15 ㎒ Middle Channel - Full RB



20 ㎒ Middle Channel - Full RB



15 ㎒ High Channel - Full RB



20 ㎒ High Channel - Full RB

6. Spurious Emissions at Antenna Terminal

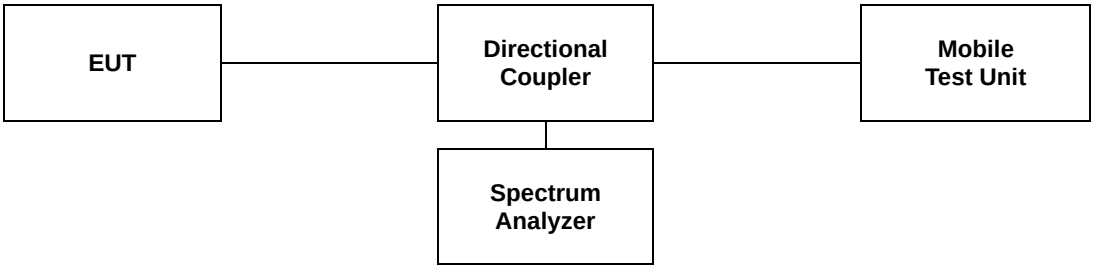
6.1. Limit

- §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 2 490.5 ㎒ and 2 496 ㎒ and 55 + 10 $\log_{10}$ (P) ㏈ at or below 2 490.5 ㎒. Mobile Satellite Service licensees operating on frequencies below 2 495 ㎒ may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

6.2. Test Procedure

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

1. Start frequency was set to 9 ㎑ and stop frequency was set to at least 10* the fundamental frequency.
2. Detector = RMS.
3. Trace mode = Max hold.
4. Sweep time = Auto couple.
5. The trace was allowed to stabilize.
6. Please see notes below for RBW and VBW settings.
7. For plots showing conducted spurious emissions from 9 ㎑ to 27 ㎓, all path loss of wide frequency range was investigated and compensated to spectrum analyzer as TDF function.



Note;

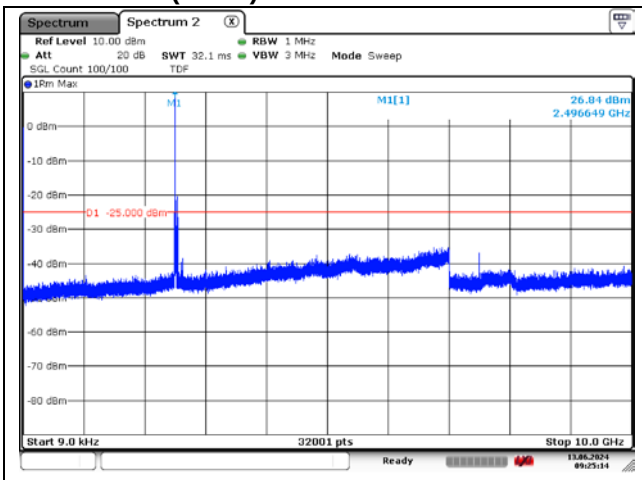
Compliance with the applicable limits is based on the use of measurement instrumentation employing a resolution bandwidth of 100 ㎑ or greater for frequencies less than 1 ㎓ and frequencies greater than 1 ㎓. However, in the 1 ㎒ bands immediately outside and adjacent to the frequency block a resolution 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.

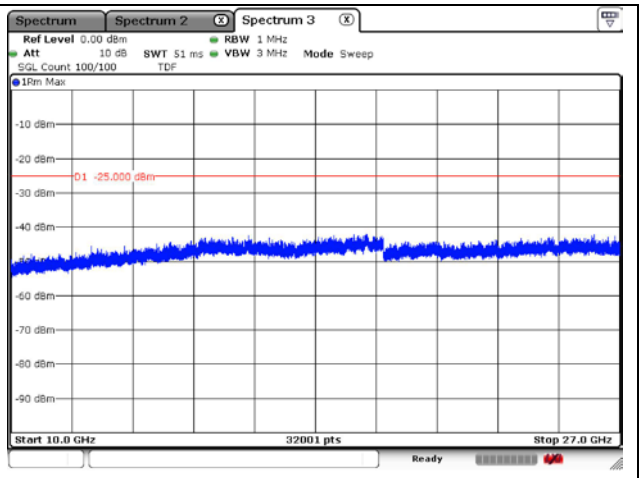
6.3. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 ± 2 %

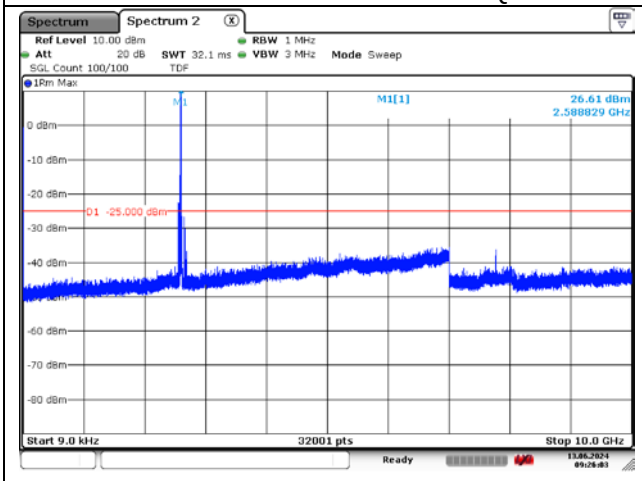
- Test plots

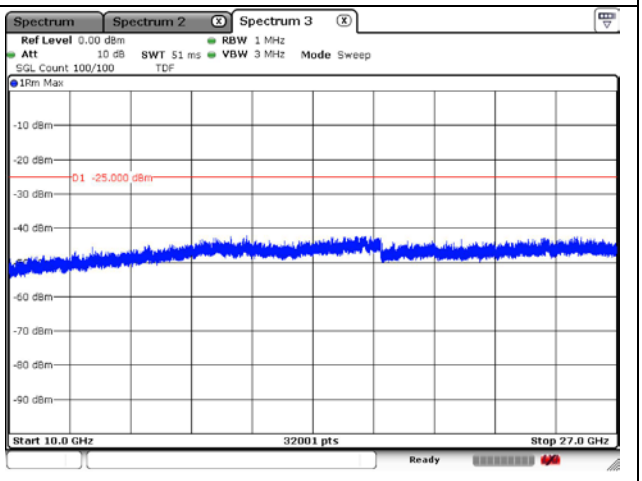
LTE band 41 (10 ㎒)



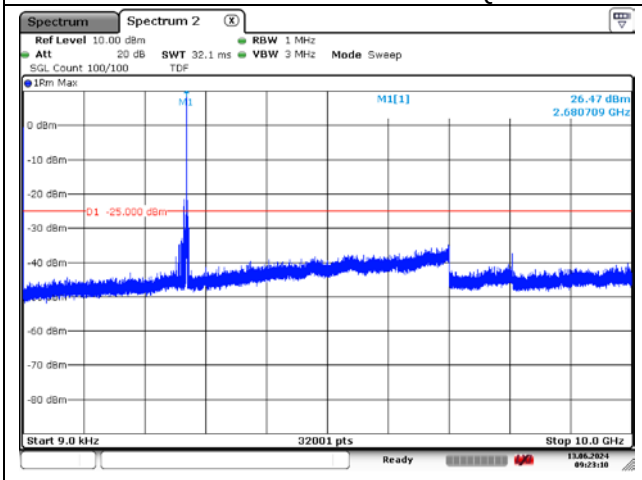


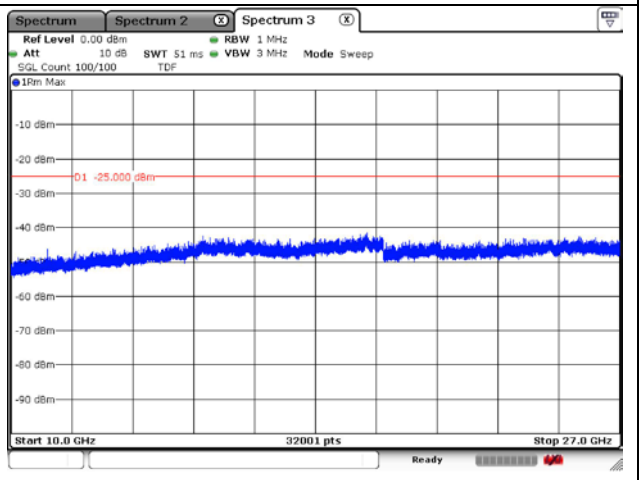
QPSK Low Channel - 1 RB





QPSK Middle Channel - 1 RB





QPSK High Channel - 1 RB

7. Band Edge and Emission Mask

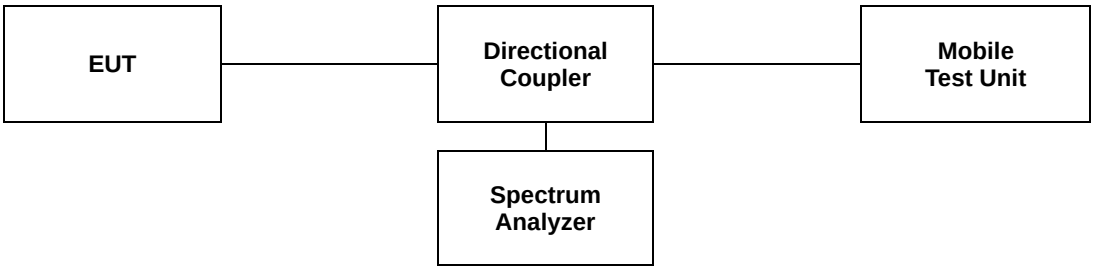
7.1. Limit

- §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 2 490.5 ㎒ and 2 496 ㎒ and 55 + 10 $\log_{10}$ (P) ㏈ at or below 2 490.5 ㎒. Mobile Satellite Service licensees operating on frequencies below 2 495 ㎒ 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 5.7 of ANSI C63.26-2015.

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.

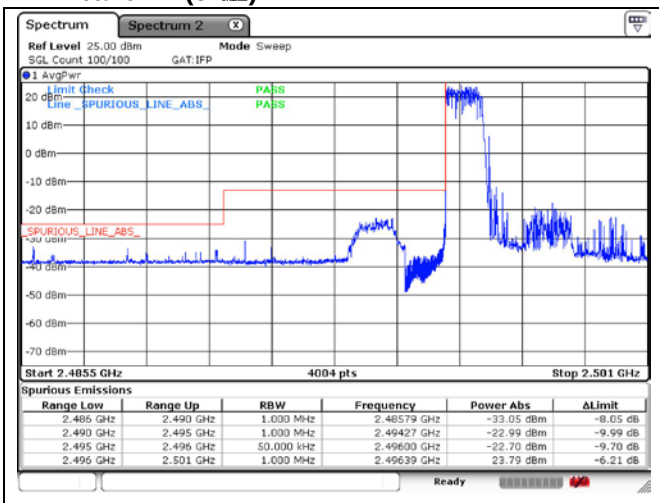


7.3. Test Results

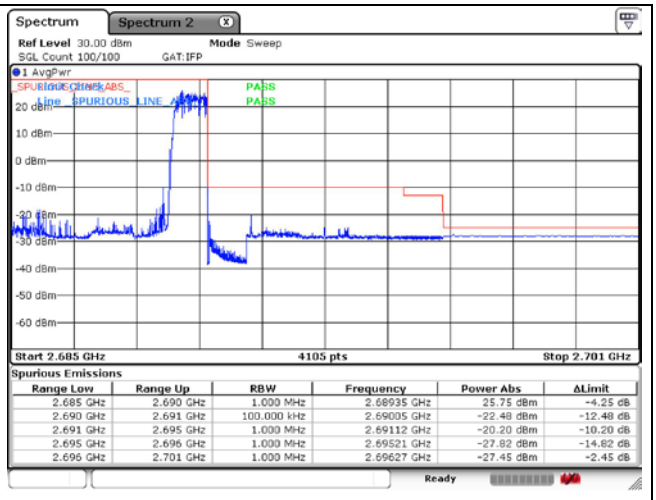
Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 ± 2 %

- Test plots

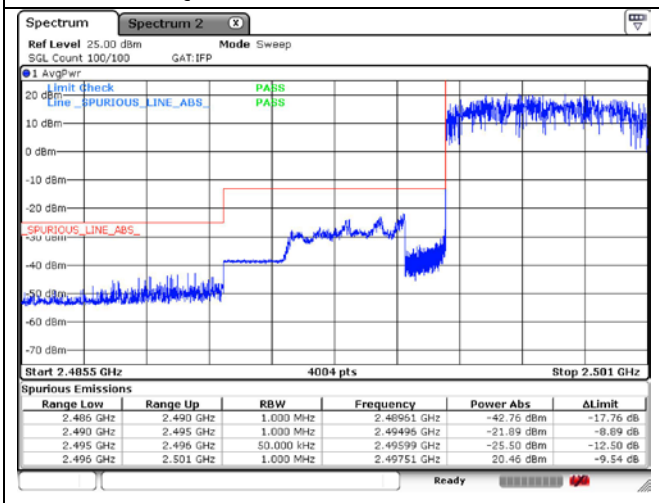
LTE band 41 (5 ㎒)



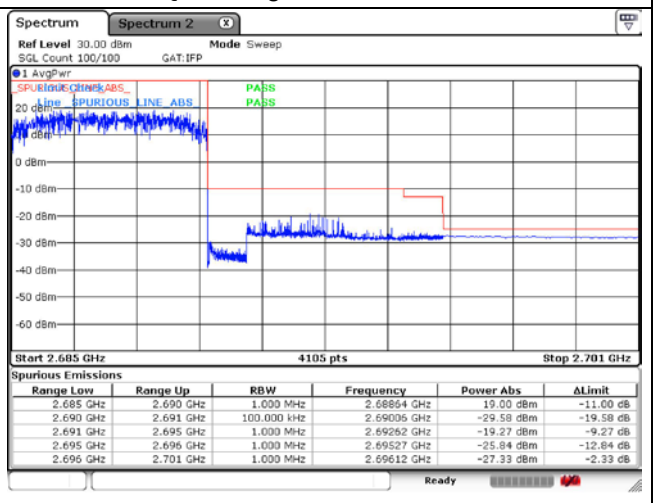
QPSK Low Channel - 1 RB



QPSK High Channel - 1 RB

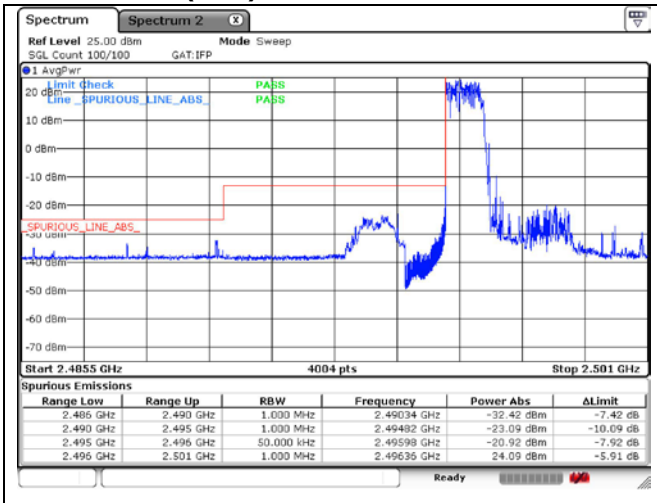


QPSK Low Channel - Full RB

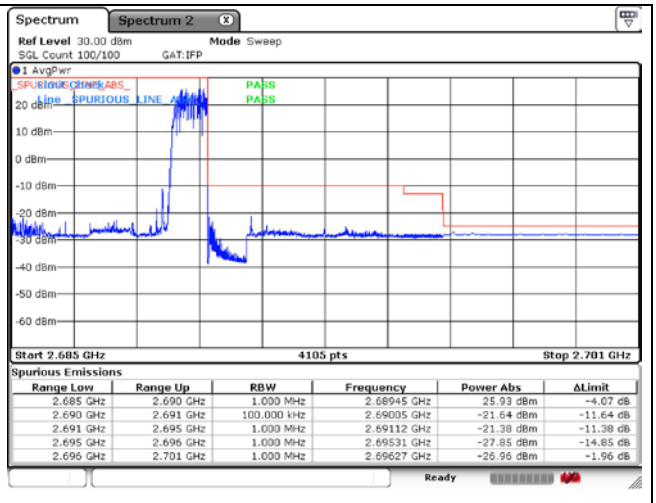


QPSK High Channel - Full RB

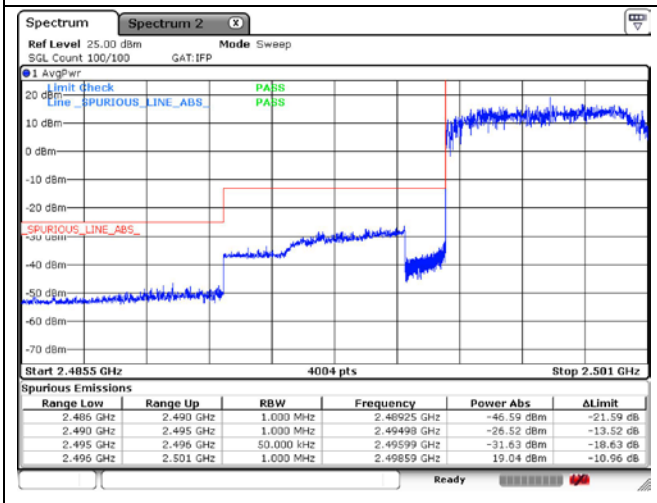
LTE band 41 (5 ㎒)



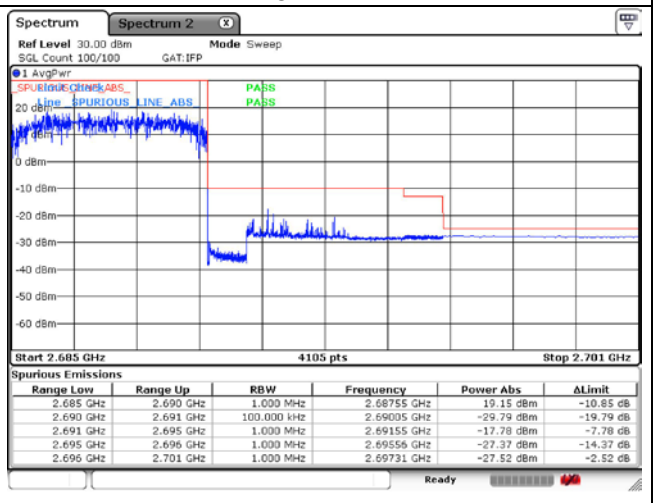
16QAM Low Channel - 1 RB



16QAM High Channel - 1 RB

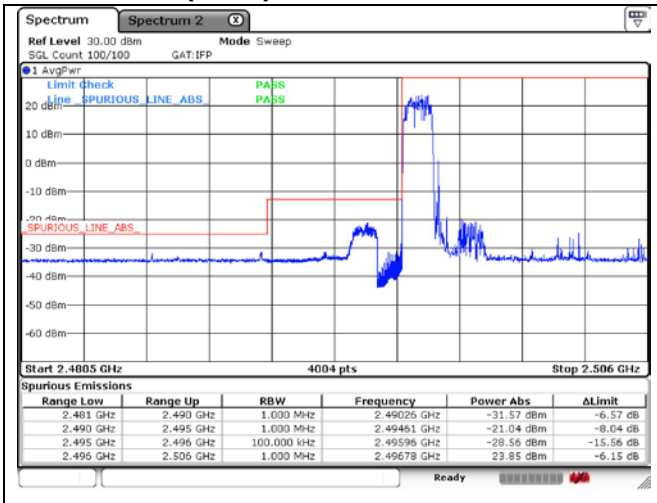


16QAM Low Channel - Full RB

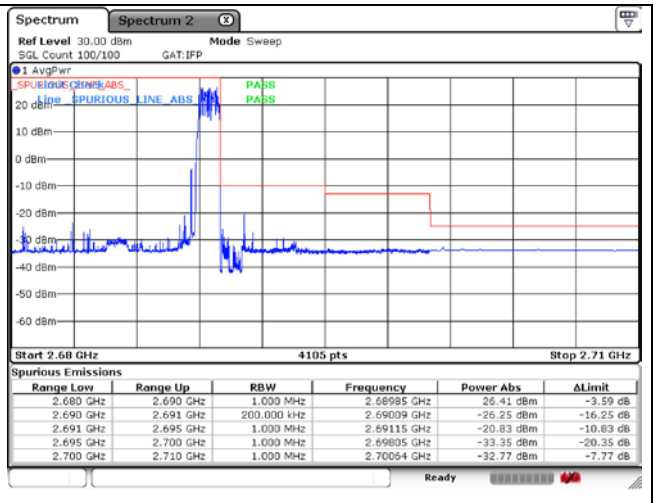


16QAM High Channel - Full RB

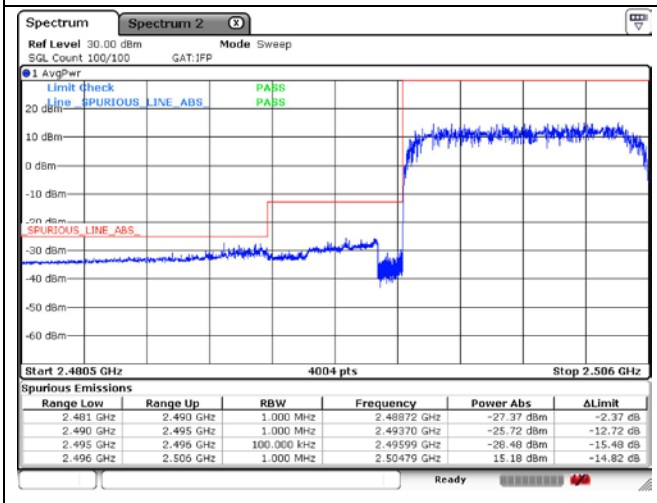
LTE band 41 (10 ㎒)



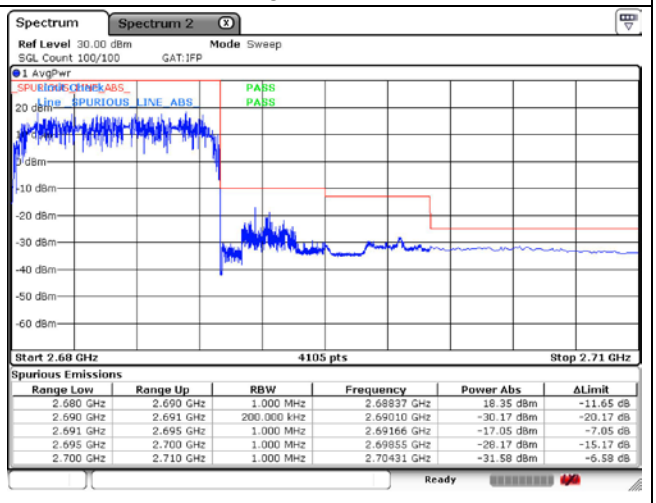
QPSK Low Channel - 1 RB



QPSK High Channel - 1 RB

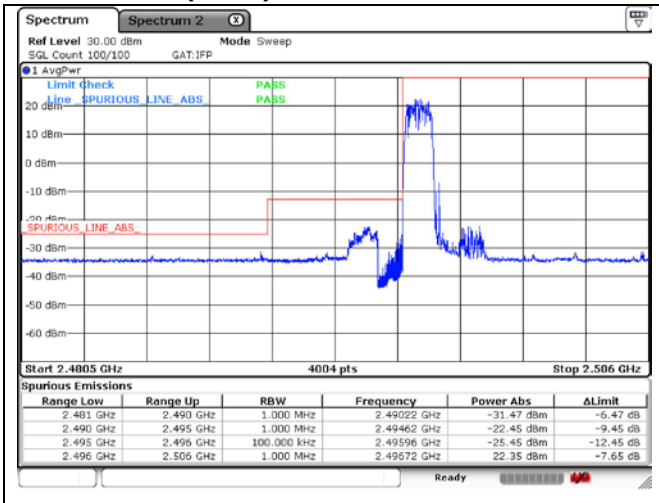


QPSK Low Channel - Full RB

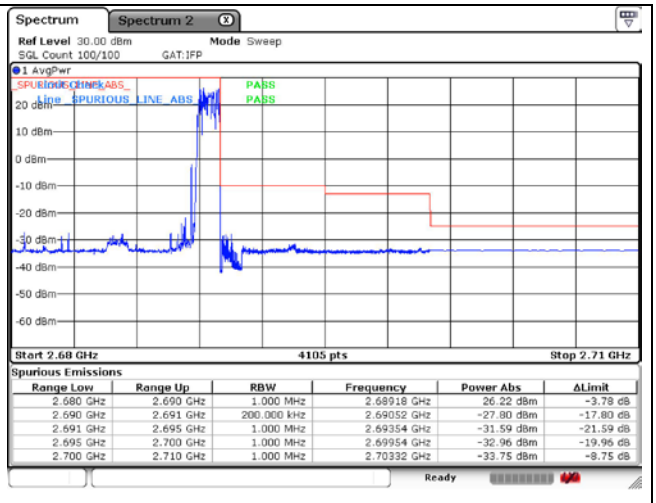


QPSK High Channel - Full RB

LTE band 41 (10 ㎒)



16QAM Low Channel - 1 RB



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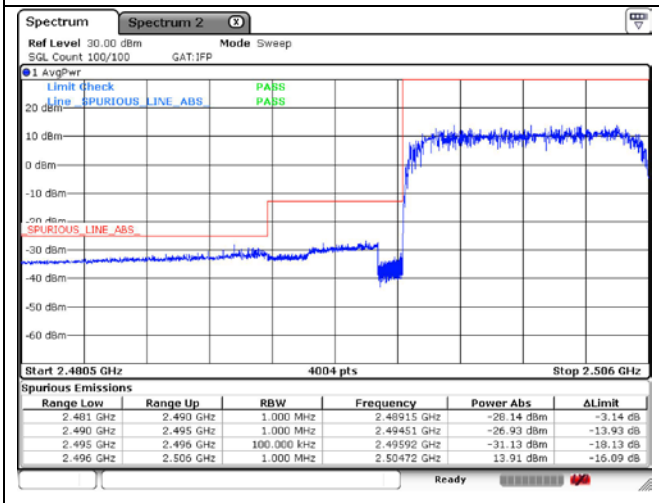
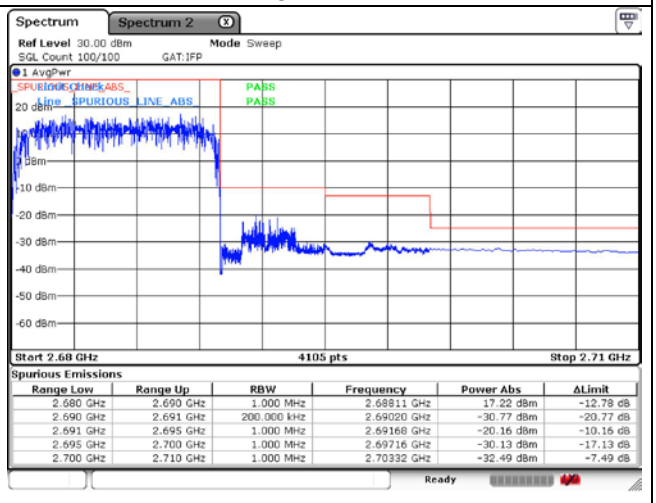
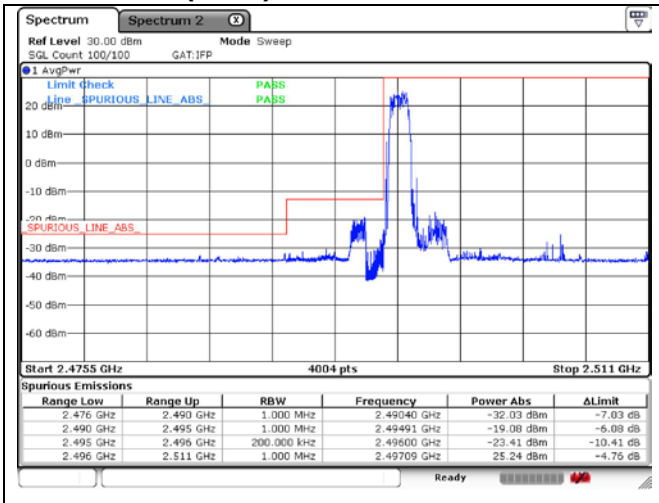


16QAM Low Channel - Full RB

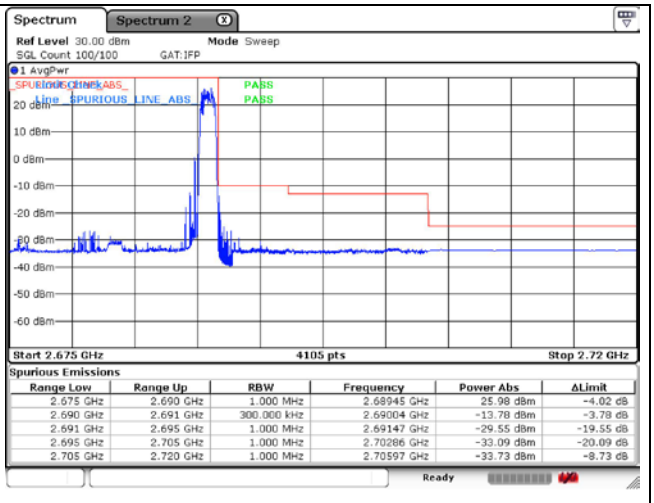


16QAM High Channel - Full RB

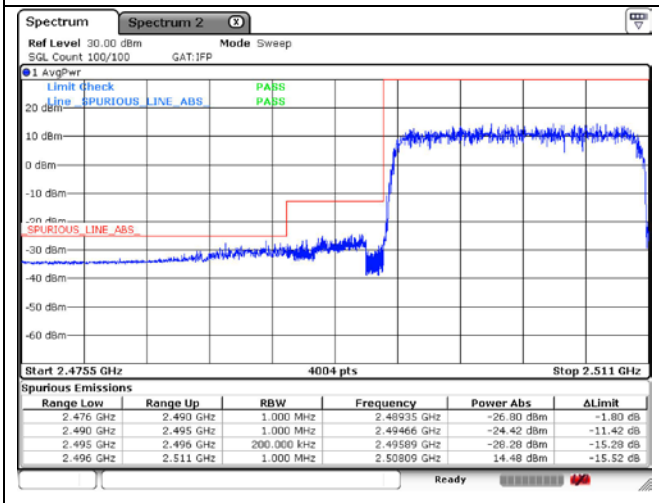
LTE band 41 (15 ㎒)



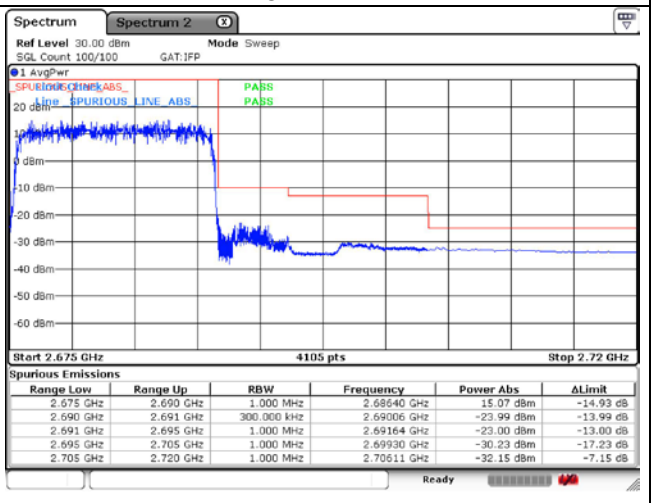
QPSK Low Channel - 1 RB



QPSK High Channel - 1 RB

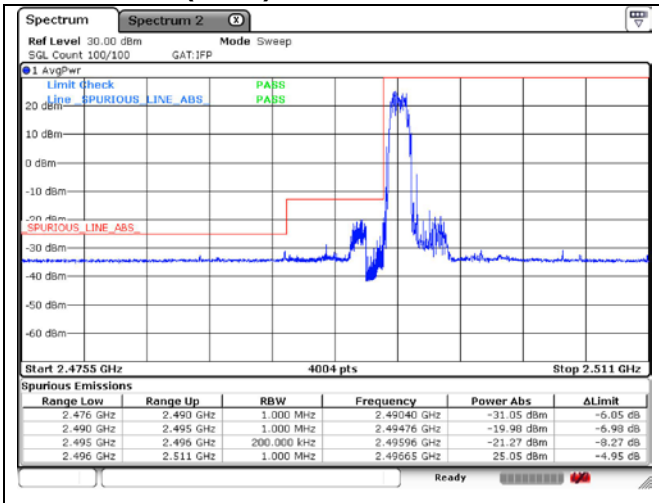


QPSK Low Channel - Full RB

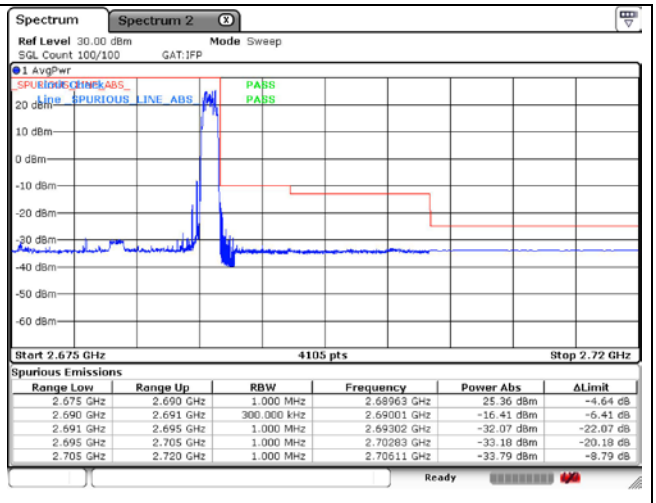


QPSK High Channel - Full RB

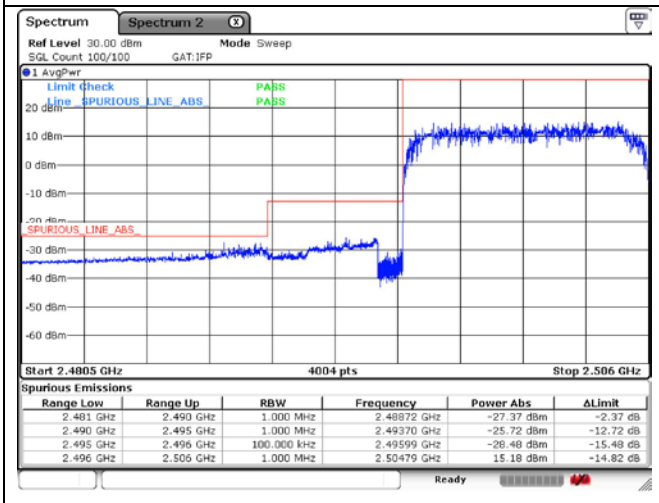
LTE band 41 (15 ㎒)



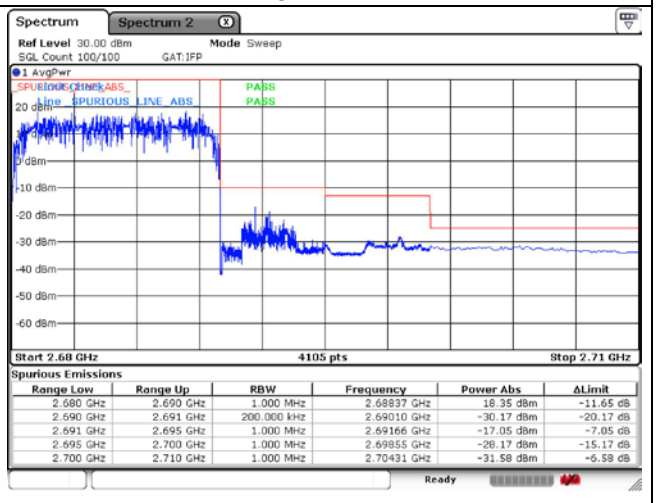
16QAM Low Channel - 1 RB



16QAM High Channel - 1 RB

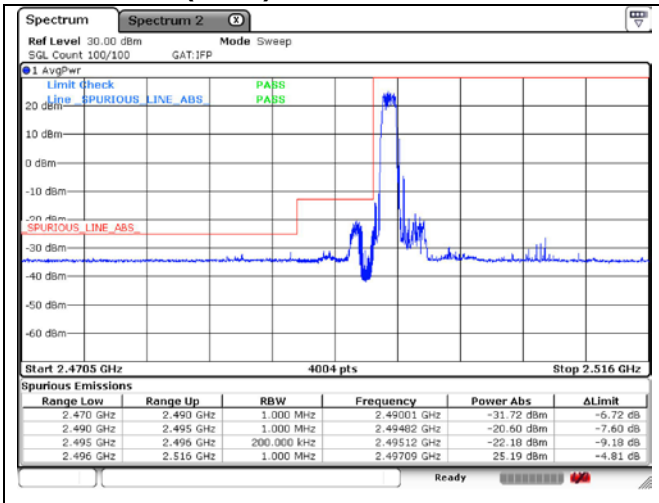


16QAM Low Channel - Full RB

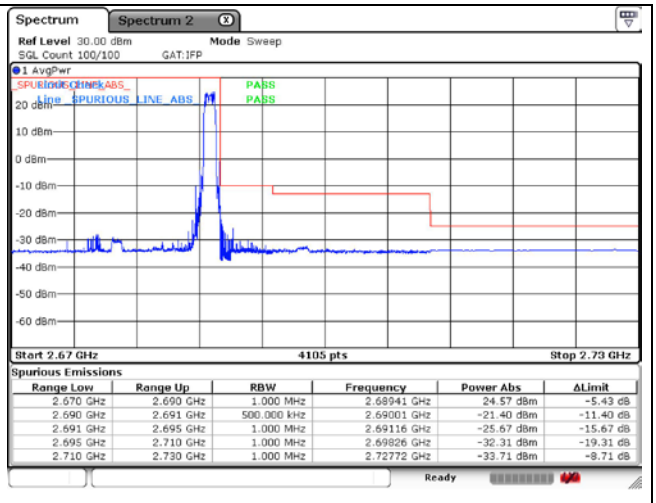


16QAM High Channel - Full RB

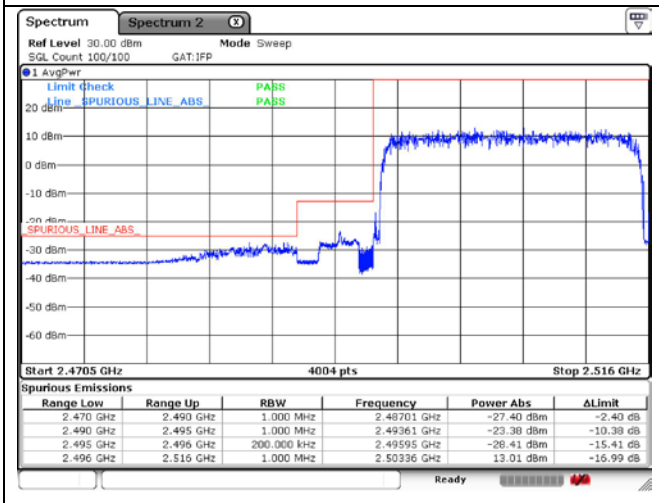
LTE band 41 (20 ㎒)



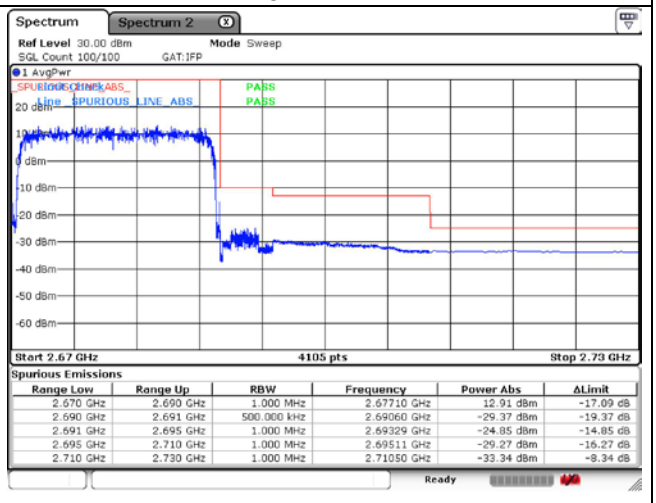
QPSK Low Channel - 1 RB



QPSK High Channel - 1 RB

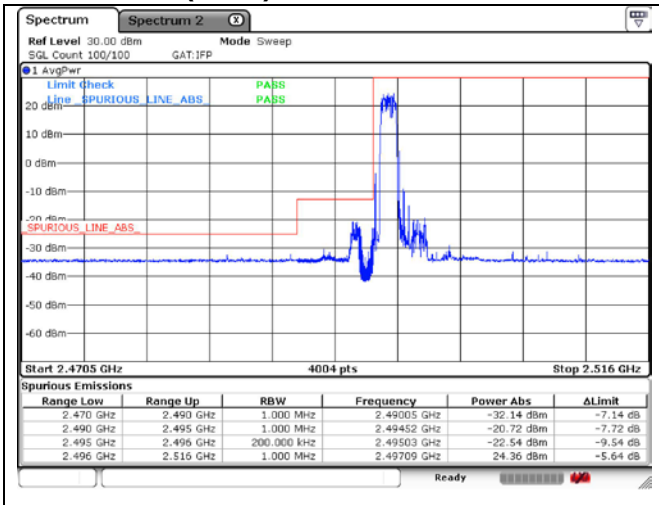


QPSK Low Channel - Full RB

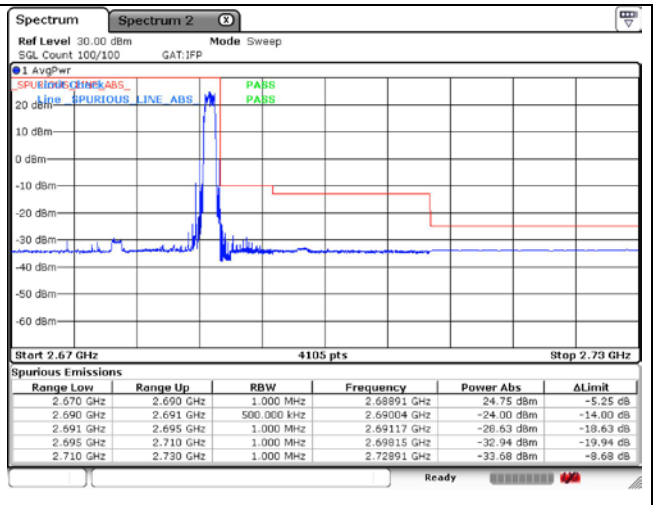


QPSK High Channel - Full RB

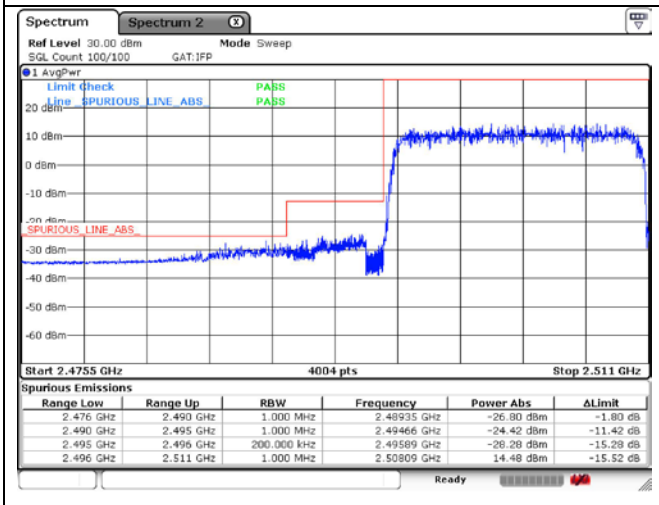
LTE band 41 (20 ㎒)



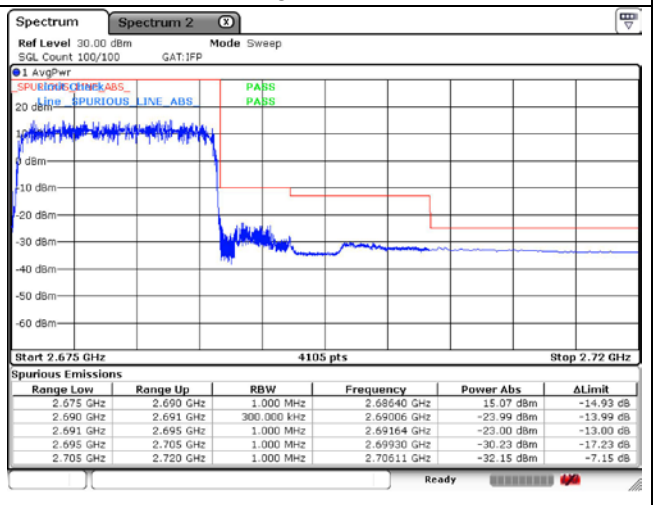
16QAM Low Channel - 1 RB



16QAM High Channel - 1 RB



16QAM Low Channel - Full RB



16QAM High Channel - Full RB

8. Frequency Stability

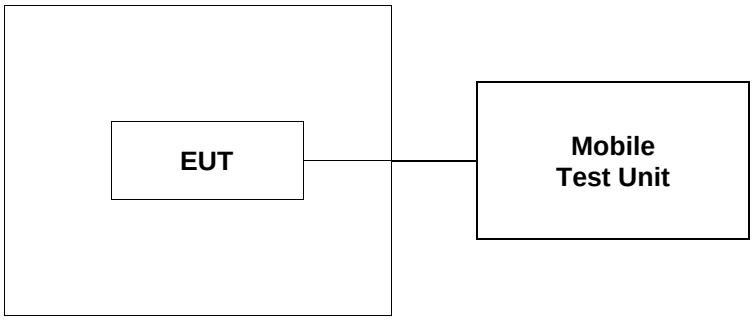
8.1. Limit

- § 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.

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.



8.3. Test Results

Ambient temperature : (23 ± 1) ℃
Relative humidity : 47 ± 2 %

LTE band 41 at middle channel

Reference Frequency: 2 593.0 ㎒			
Frequency Stability versus Temperature			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
50	4.00	11.05	0.002 13
40		11.31	0.002 23
30		12.25	0.002 59
20(Ref.)		5.53	-
10		3.17	-0.000 91
0		9.88	0.001 68
-10		12.28	0.002 60
-20		9.57	0.001 56
-30		11.24	0.002 20
Frequency Stability versus Power Supply			
Environment Temperature (℃)	**Power Supplied (V)**	**Frequency Measure with Time Elapse**	
		Frequency Error (㎐)	**ppm**
20	3.40 (85%)	11.73	0.002 39
	4.60 (115%)	12.55	0.002 71

- End of the Test Report -