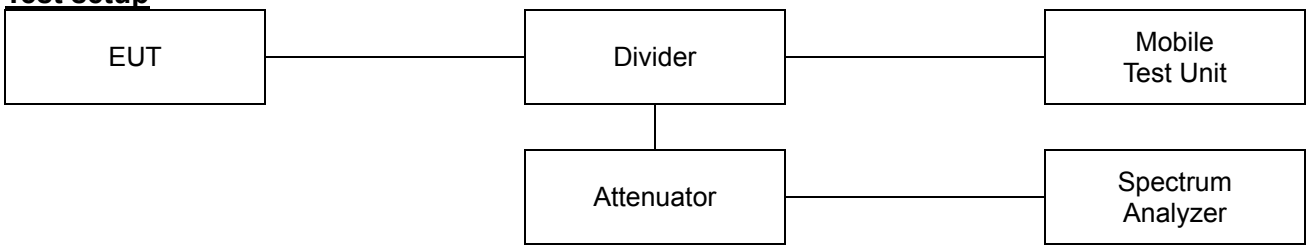
7.5. Peak to Average Power Ratio (PAPR)

Test setup



Limit

According to §27.50(d)(5), the peak-to-average ratio(PAR) of the transmission must not exceed 13 dB.

Test procedure

971168 D01 v03r01 - Section 5.7.2
ANSI 63.26-2015 – Section 5.2.3.4

Test settings

5.2.3.4 Measurement of peak power in a broadband noise-like signal using CCDF

1) Set resolution/measurement bandwidth ≥ OBW or specified reference bandwidth
2) Set the number of counts to a value that stabilizes the measured CCDF curve.
3) Set the measurement interval as follows:
   a) For continuous transmissions, set to the greater of [10 x (number of points in sweep) x (transmission symbol period)] or 1 ms.
   b) 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 internal to a time that is less than or equal to the burst duration.
   c) 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.
4) Record the maximum PAPR level associated with a probability of 0.1%

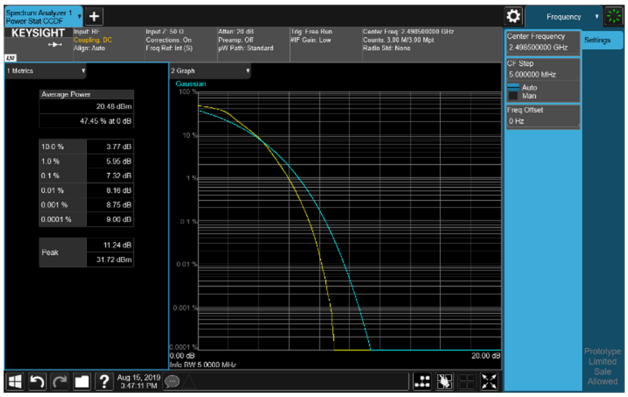
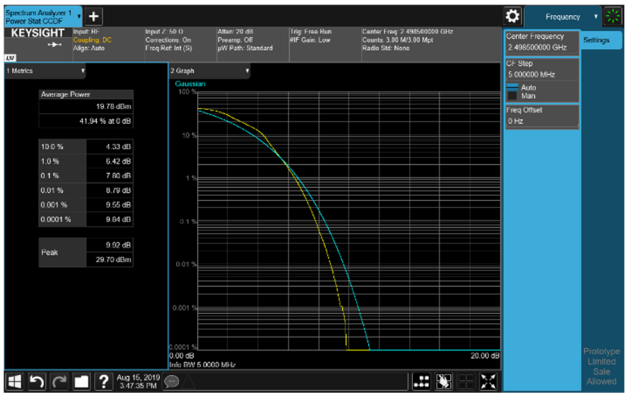
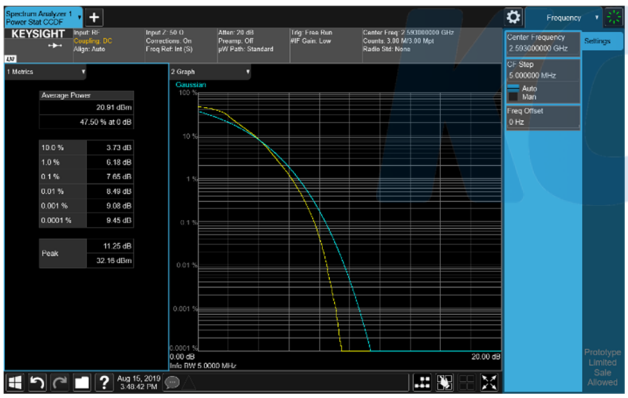
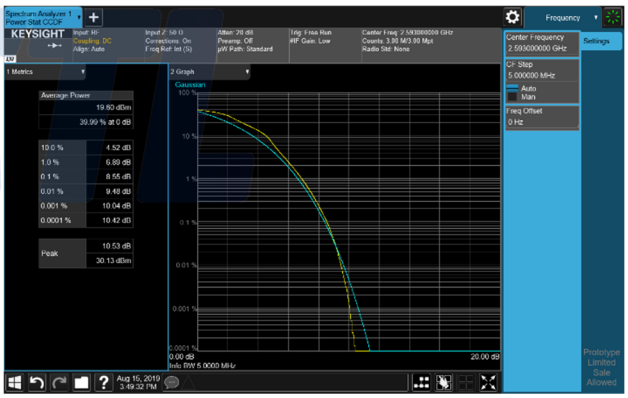
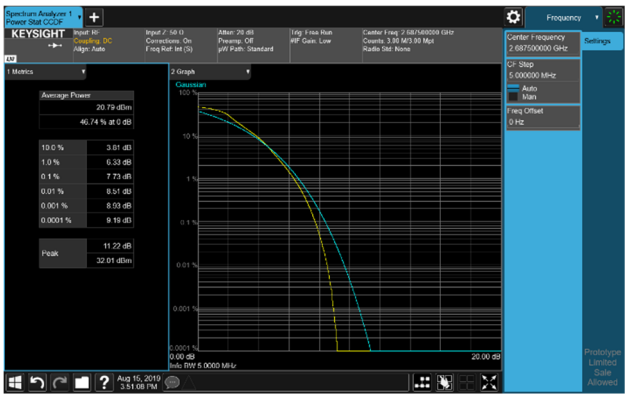
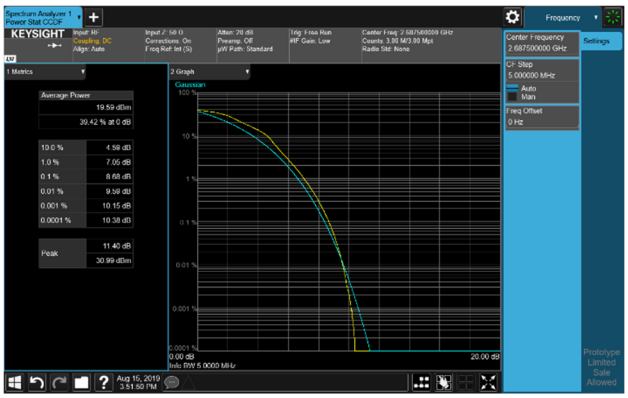
5.2.6 Peak-to-average power ratio

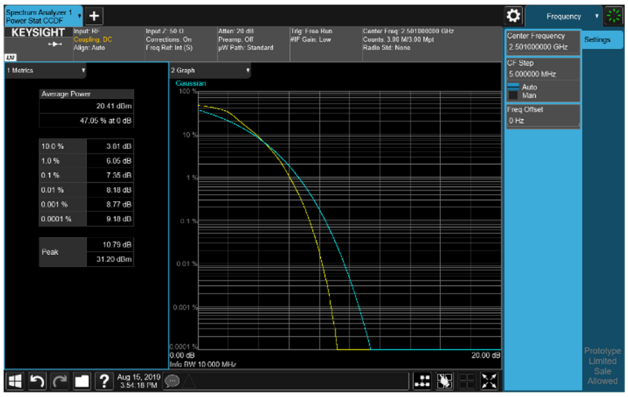
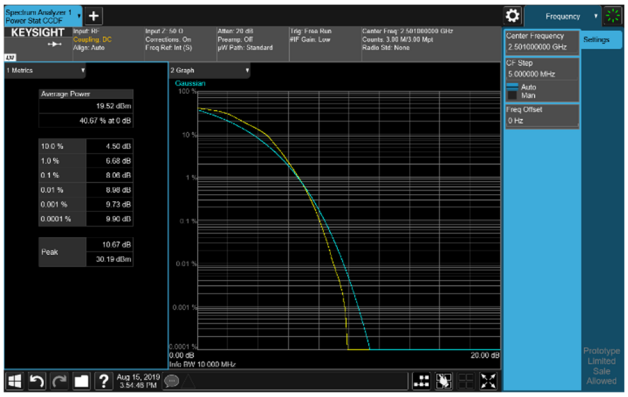
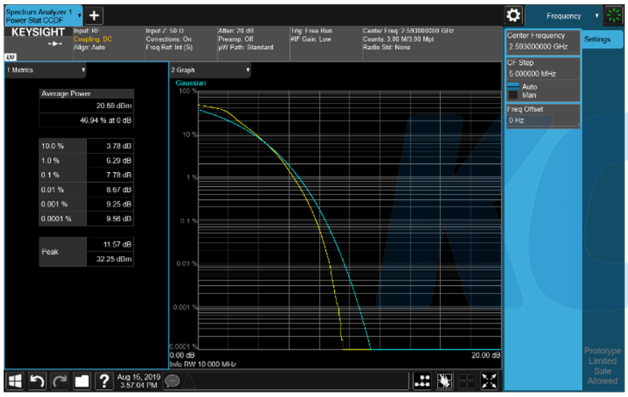
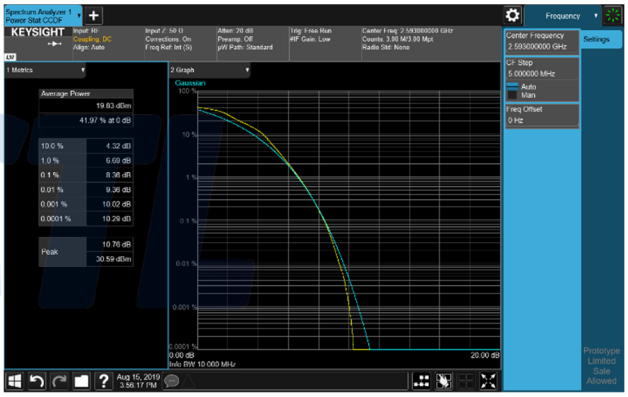
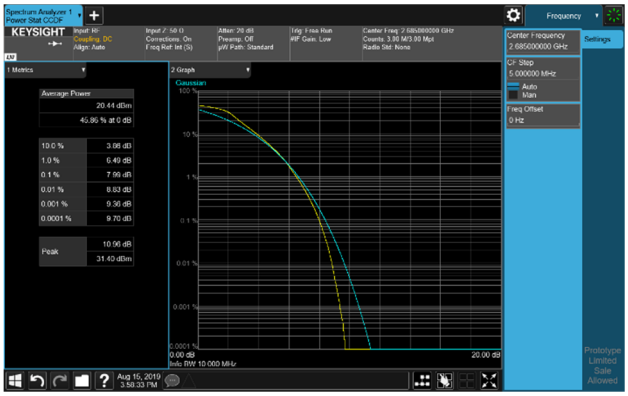
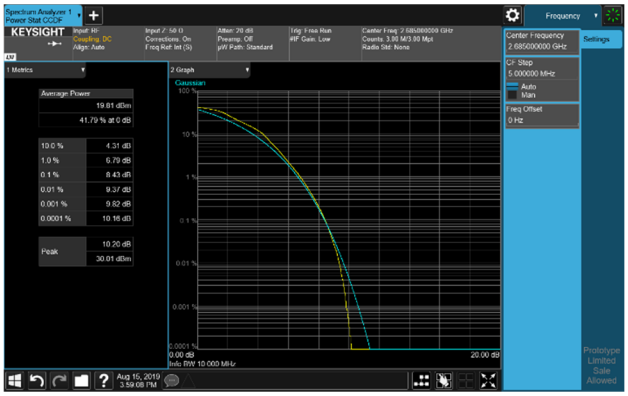
Use one of the procedures presented in 5.2(ANSI C63.26-2015) to measure the total peak power and record as P_{PK}.
Use one of the applicable procedure presented 5.2(ANSI C63.26-2015) to measure the total average power and record as P_{AG}. Determine the P.A.P.R from:

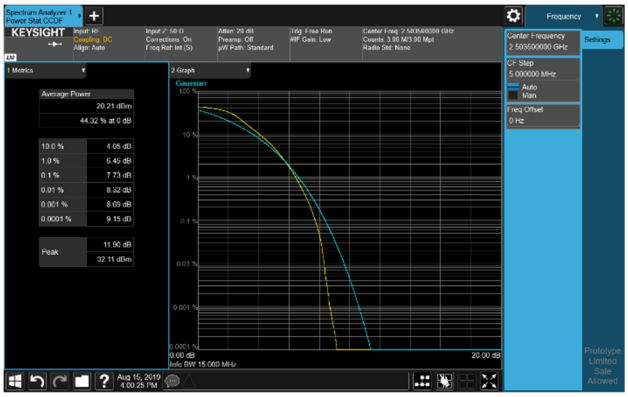
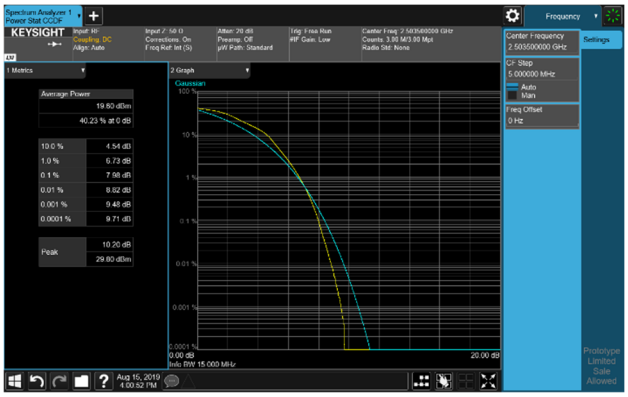
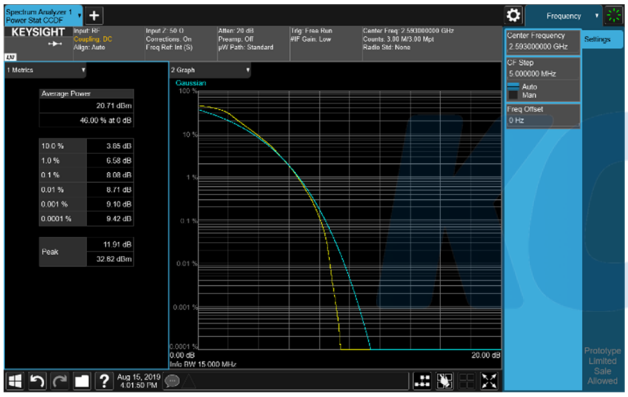
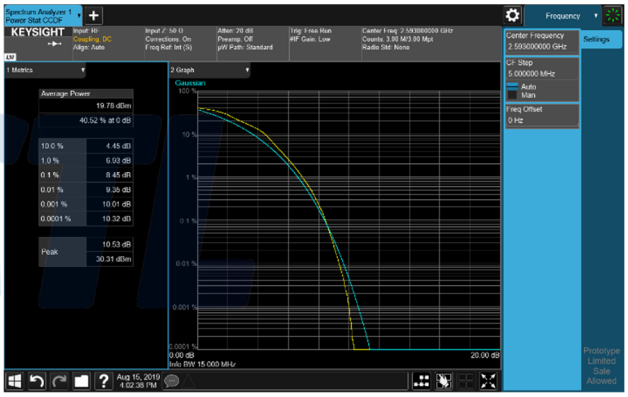
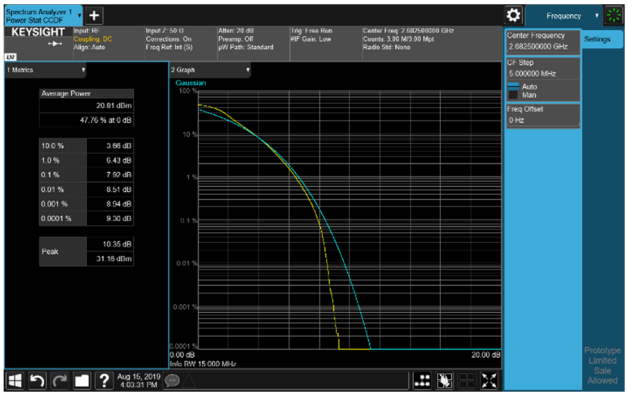
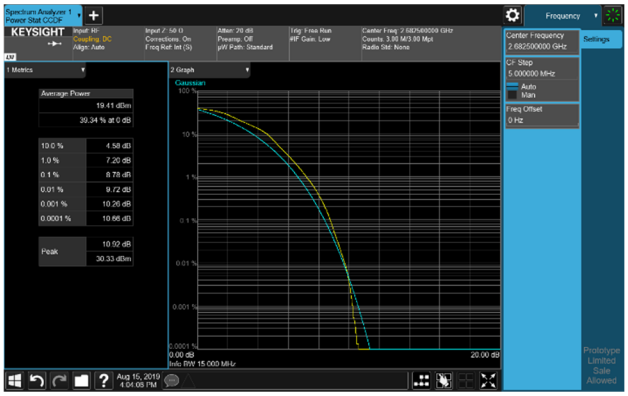
PAPR(dB) = P_{PK} (dBm or dBW) - P_{AG}(dBm or dBW)

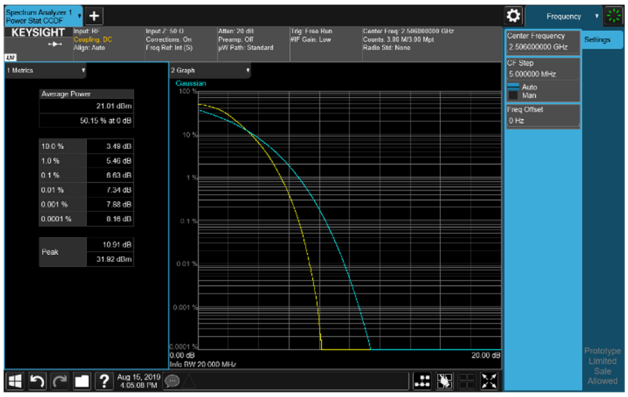
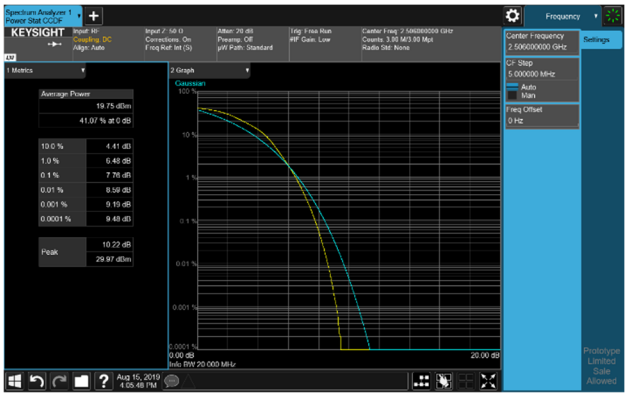
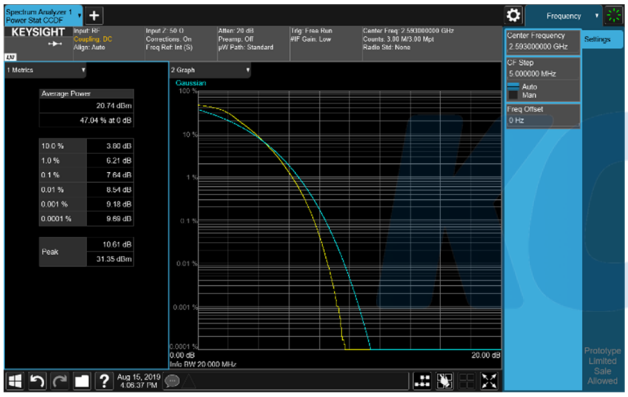
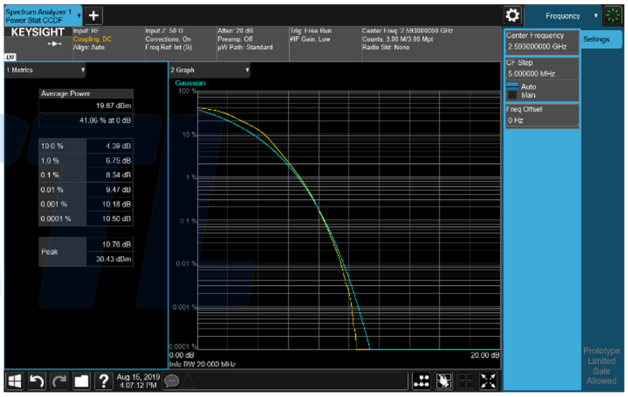
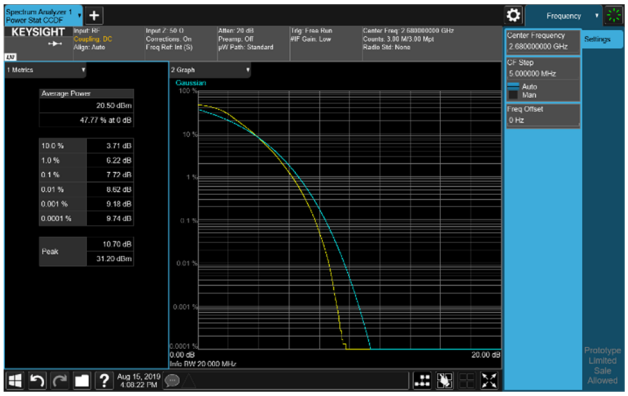
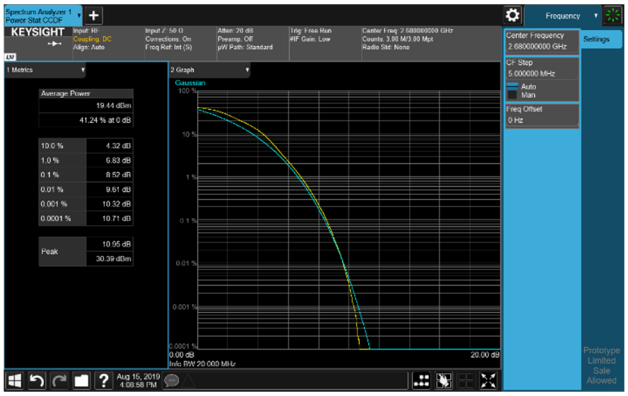
Test results

Test mode: LTE Band 41

5M BW / QPSK / Low ch.	5M BW / 16QAM / Low ch.
	
5M BW / QPSK / Mid ch.	**5M BW / 16QAM / Mid ch.**
	
5M BW / QPSK / High ch.	**5M BW / 16QAM / High ch.**
	

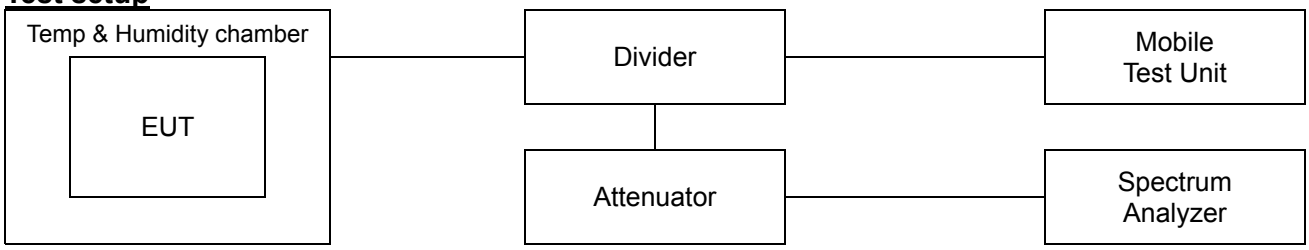
10M BW / QPSK / Low ch.	10M BW / 16QAM / Low ch.
	
10M BW / QPSK / Mid ch.	**10M BW / 16QAM / Mid ch.**
	
10M BW / QPSK / High ch.	**10M BW / 16QAM / High ch.**
	

15M BW / QPSK / Low ch.	15M BW / 16QAM / Low ch.
	
15M BW / QPSK / Mid ch.	**15M BW / 16QAM / Mid ch.**
	
15M BW / QPSK / High ch.	**15M BW / 16QAM / High ch.**
	

20M BW / QPSK / Low ch.	20M BW / 16QAM / Low ch.
	
20M BW / QPSK / Mid ch.	**20M BW / 16QAM / Mid ch.**
	
20M BW / QPSK / High ch.	**20M BW / 16QAM / High ch.**
	

7.6. Frequency stability

Test setup



Limit

According to §2.1055(a),

The frequency stability shall be measured with variation of ambient temperature as follows:

1) From -30° to + 50° centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.
2) From -20° to + 50° centigrade for equipment to be licensed for use in the maritime services under part 80 of this chapter, except for class A, B, and S emergency position indicating radiobeacons (EPIRBS), and equipment to be licensed for use above 952 ㎒ at operational fixed stations in all services, stations in the local television transmission service and point-to-point microwave radio service under part 21 of this chapter, equipment licensed for use aboard aircraft in the aviation services under part 87 of this chapter, and equipment authorized for use in the family radio service under part 95 of this chapter.
3) From 0° to + 50° centigrade for equipment to be licensed for use in the radio broadcast Services under part 73 of this chapter.

According to §2.1055(d),

The frequency stability shall be measured with variation of primary supply Voltage as follows:

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

According to §22.355.

The carrier frequency of each transmitter in the public mobile services must be maintained within the tolerances given in Table of this section.

For mobile devices operating in the 824 to 849 ㎒ band at a power level than or equal to 3 Watts, the limit specified in Table C-1 is ±2.5 ppm.

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According to §27.54.

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the Authorized bands of operation.

Test procedure

ANSI 63.26-2015 – Section 5.6

Test settings

1) The carrier frequency of the transmitter is measured at room temperature. (20°C to provide a reference)
2) The equipment is turned on in a “standby” condition for one minute before applying power to the transmitter. Measurement of the carrier frequency of the transmitter is made within one minute after applying power to the transmitter.
3) Frequency measurements are made at 10°C intervals ranging from -30°C to +50°C. A period of at least one half-hour is provided to allow stabilization of the equipment at each Temperature level.

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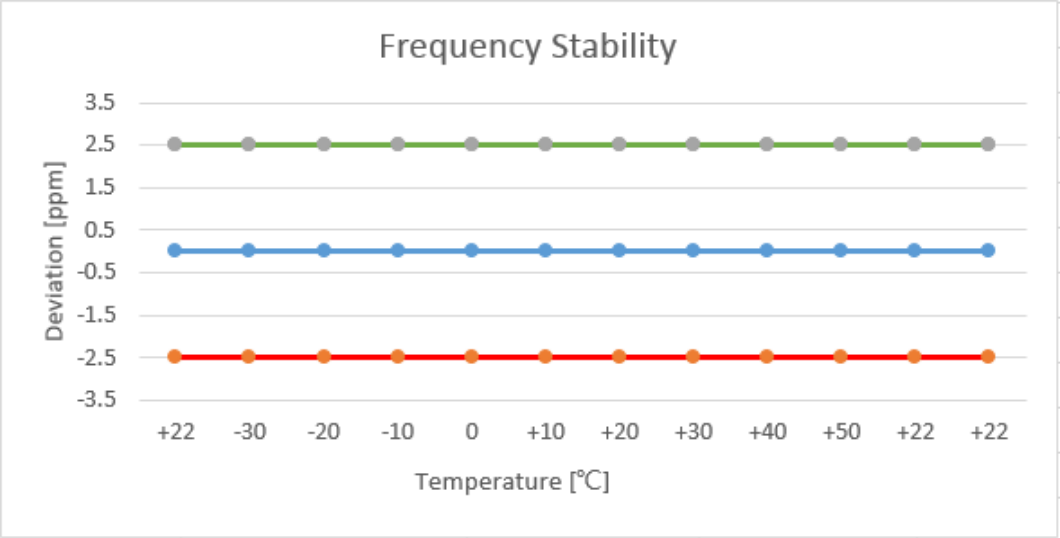
Test results

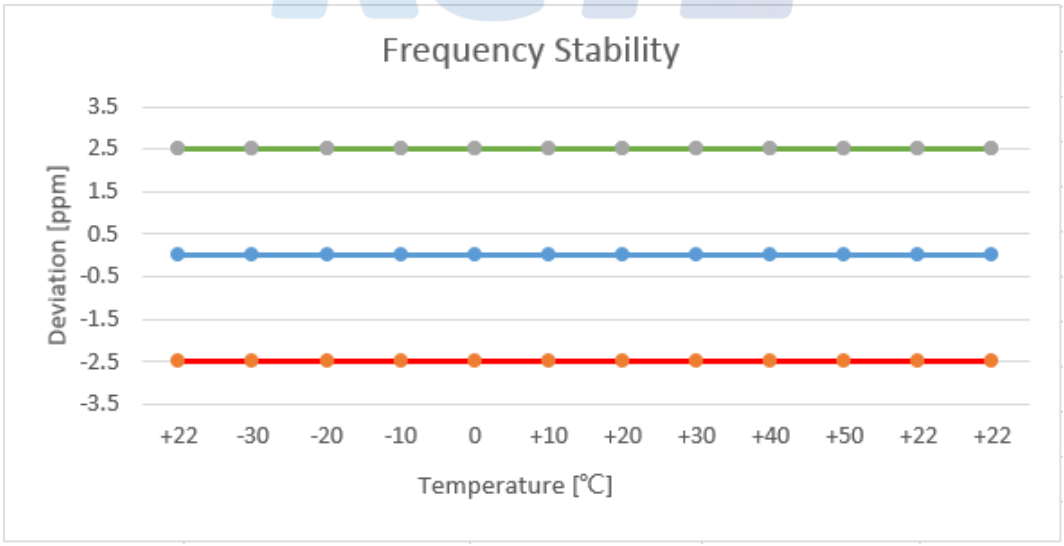
Test mode : LTE Band 5
Frequency (㎐) : 836 500 000
Channel : 20525
Deviation limit : ±0.00025% or 2.5ppm

Voltage (%)	Power (V)	Temp. (°C)	Frequency (㎐)	Frequency error (㎐)	Deviation	
					(ppm)	(%)
100%	3.85	+22(Ref)	836,499,997	-2.33	0.0	0.000000
		-30	836,499,994	-5.17	0.0	-0.000001
		-20	836,499,998	-1.43	0.0	0.000000
		-10	836,500,000	0.62	0.0	0.000000
		0	836,500,000	0.42	0.0	0.000000
		+10	836,499,998	-1.31	0.0	0.000000
		+20	836,499,998	-1.65	0.0	0.000000
		+30	836,499,997	-2.16	0.0	0.000000
		+40	836,499,999	-0.56	0.0	0.000000
		+50	836,499,998	-1.61	0.0	0.000000
115%	4.43	+22	836,499,997	-2.13	0.0	0.000000
End point	2.55	+22	836,499,994	-5.30	0.0	-0.000001



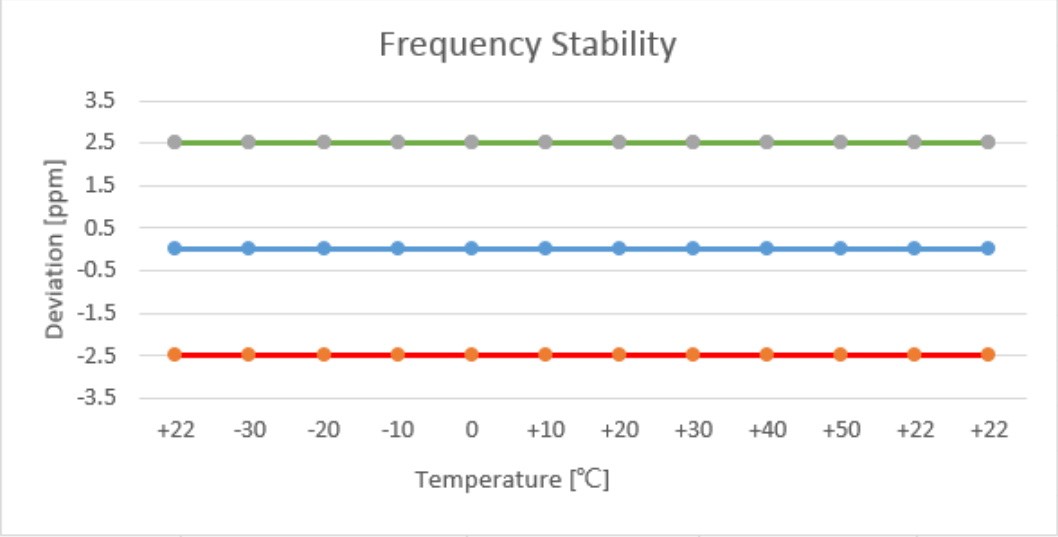
Test mode : LTE Band 26
Frequency (㎐) : 836 500 000
Channel : 26915
Deviation limit : ±0.00025% or 2.5ppm

Voltage (%)	Power (V)	Temp. (°C)	Frequency (㎐)	Frequency error (㎐)	Deviation	
					(ppm)	(%)
100%	3.85	+22(Ref)	836,499,998	-1.39	0.0	0.000000
		-30	836,499,997	-2.63	0.0	0.000000
		-20	836,499,999	-0.69	0.0	0.000000
		-10	836,499,999	-0.41	0.0	0.000000
		0	836,499,999	-0.31	0.0	0.000000
		+10	836,500,000	0.44	0.0	0.000000
		+20	836,499,999	-0.39	0.0	0.000000
		+30	836,500,002	2.06	0.0	0.000000
		+40	836,499,999	-0.14	0.0	0.000000
		+50	836,499,997	-2.72	0.0	0.000000
115%	4.43	+22	836,499,998	-1.53	0.0	0.000000
End point	2.55	+22	836,499,997	-2.94	0.0	0.000000



Test mode : LTE **Band** 41
Frequency (㎐) : 2 593 000 000
Channel : 40620
Deviation limit : The frequency stability shall be sufficient to ensure that the fundamental emission stays wthin the authorized frequency block.

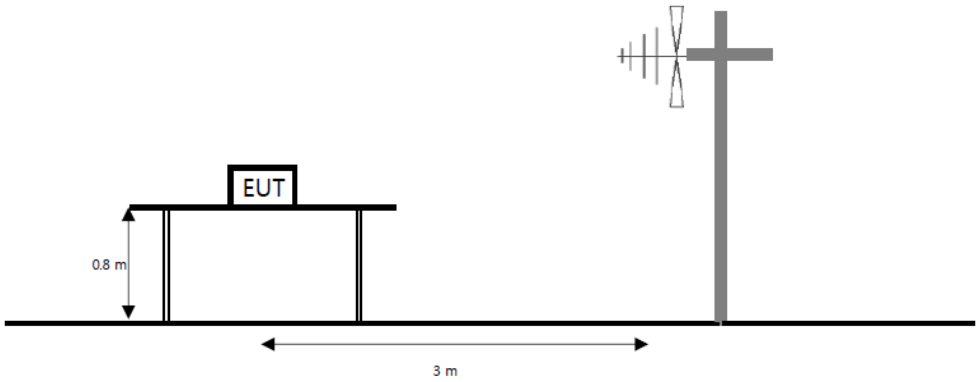
Voltage (%)	Power (V)	Temp. (°C)	Frequency (㎐)	Frequency error (㎐)	Deviation	
					(ppm)	(%)
100%	3.85	+22(Ref)	2,592,999,997	-2.66	0.0	0.000000
		-30	2,592,999,998	-2.13	0.0	0.000000
		-20	2,592,999,995	-5.18	0.0	0.000000
		-10	2,592,999,998	-1.85	0.0	0.000000
		0	2,593,000,001	0.53	0.0	0.000000
		+10	2,592,999,999	-1.14	0.0	0.000000
		+20	2,592,999,999	-1.29	0.0	0.000000
		+30	2,593,000,001	0.72	0.0	0.000000
		+40	2,592,999,999	-0.64	0.0	0.000000
		+50	2,592,999,997	-3.30	0.0	0.000000
115%	4.43	+22	2,592,999,996	-3.51	0.0	0.000000
End point	2.55	+22	2,592,999,998	-2.29	0.0	0.000000



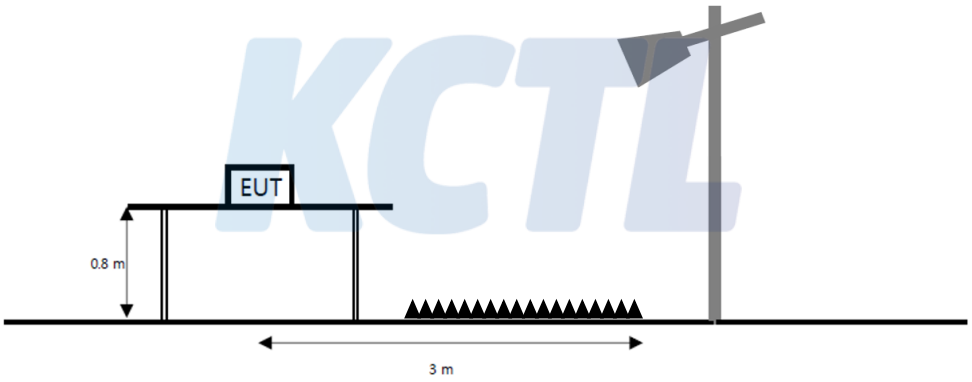
7.7. Radiated Power (ERP/EIRP)

Test setup

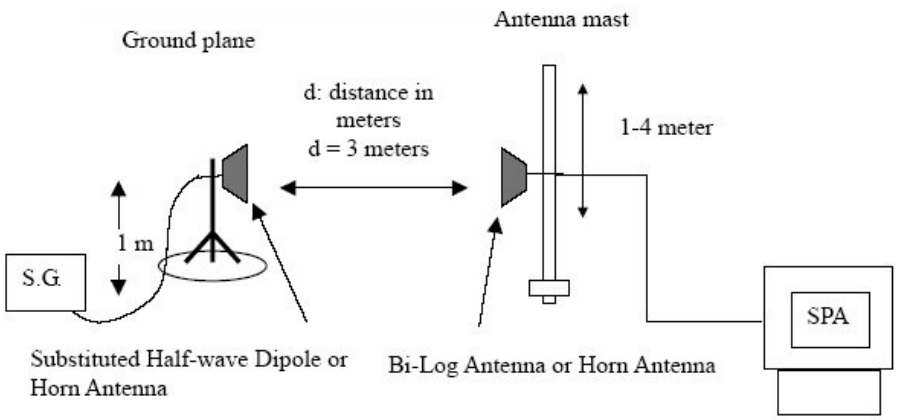
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 ㎓ to the tenth harmonic of the highest fundamental frequency or to 40 ㎓ emissions, whichever is lower.



The diagram below shows the test setup for substituted method.



Limit

According to §22.913(a)(5), the ERP of transmitters in the cellular radiotelephone service must not exceed the limits in this section. The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

According to §27.50(h)(2), Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.

Test procedure

971168 D01 v03r01 - Section 5.2 and 5.8, 412172 D01 v01r01
ANSI 63.26-2015 – Section 5.2
ANSI/TIA-603-E-2016 - Section 2.2.17

Test settings

1) RBW = 1 % to 5 % of the OBW.
2) VBW ≥ 3 × RBW.
3) SPAN = 2 × to 3 × the OBW.
4) Number of measurement points in sweep ≥ 2 × span / RBW.
5) Sweep time :
   1) Auto couple, or
   2) ≥ [10 × (number of points in sweep) × (transmission period)] for single sweep (automation-compatible) measurement. Transmission period is the on and off time of the transmitter.
6) Detector = RMS
7) If the EUT can be configured to transmit continuously, then set the trigger to free run.
8) If the EUT cannot be configured to transmit continuously, then use a sweep trigger with the level set to enable triggering only on full power bursts and configure the EUT to transmit at full power for the entire duration of each sweep. Verify that the sweep time is less than or equal to the transmission burst duration. Time gating can also be used under similar constraints (i.e., configured such that measurement data is collected only during active full -power transmissions).
9) Trace mode = trace averaging (RMS) over 100 sweeps.
10) Compute the power by integrating the spectrum across the OBW of the signal using the instrument's band or channel power measurement function, with the band/channel limits set equal to the OBW band edges. If the instrument does not have a band or channel power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.
11) Allow trace to fully stabilize.

Notes:

1. On a test site, the EUT shall be placed at 80 cm height on a turn table, and in the position close To normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to Correspond to the fundamental frequency of the transmitter.
3. The turntable is rotated through 360°, and the receiving antenna scans in order to determine the Level of the maximized emission.
4. 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.

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5. The maximum signal level detected by the measuring receiver shall be noted.
6. The EUT was replaced by half-wave dipole (1 ㎓ below) or horn antenna (1 ㎓ above) connected to a signal generator.
   The power is calculated by the following formula;
   Pd(dBm) = Pg(dBm) – Cable loss (dB) + Antenna gain (dB)
   Note. Pd is the dipole equivalent power and Pg is the generator output power into the substitution antenna.
7. The test antenna shall be raised and lowered through the specified range of height to ensure that The maximum signal is received.
8. The input signal to the substitution antenna shall be adjusted to the level that produces a level Detected by the measuring corrected for the change of input attenuator setting of the measuring Receiver.
9. The input level to the substitution antenna shall be recorded as power level in dBm, corrected for Any change of input attenuator setting of the measuring receiver.
10. The measurement shall be repeated with the test antenna and the substitution antenna Orientated for horizontal polarization.

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Test results

Test mode: LTE Band 5

Bandwidth	Modulation	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	ERP	
		[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[W]
1.4 M	QPSK	824.7	V	-0.60	3.69	26.38	22.09	0.162
		836.5	H	-0.50	3.72	25.24	21.02	0.126
		848.3	H	-0.50	3.74	25.23	20.99	0.126
	16QAM	824.7	V	-0.60	3.69	24.78	20.49	0.112
		836.5	V	-0.50	3.72	24.40	20.18	0.104
		848.3	H	-0.50	3.74	24.78	20.54	0.113
3 M	QPSK	825.5	V	-0.60	3.70	25.99	21.69	0.148
		836.5	H	-0.50	3.72	25.37	21.15	0.130
		847.5	H	-0.50	3.74	25.52	21.28	0.134
	16QAM	825.5	H	-0.60	3.70	24.97	20.67	0.117
		836.5	H	-0.50	3.72	24.63	20.41	0.110
		847.5	V	-0.50	3.74	24.50	20.26	0.106
5 M	QPSK	826.5	H	-0.60	3.71	25.91	21.60	0.145
		836.5	H	-0.50	3.72	25.38	21.16	0.131
		846.5	H	-0.50	3.73	25.41	21.18	0.131
	16QAM	826.5	V	-0.60	3.71	25.13	20.82	0.121
		836.5	H	-0.50	3.72	24.08	19.86	0.097
		846.5	H	-0.50	3.73	24.49	20.26	0.106
10 M	QPSK	829.0	V	-0.60	3.71	26.17	21.86	0.153
		836.5	H	-0.50	3.72	25.33	21.11	0.129
		844.0	V	-0.50	3.73	25.43	21.20	0.132
	16QAM	829.0	V	-0.60	3.71	25.18	20.87	0.122
		836.5	H	-0.50	3.72	24.69	20.47	0.111
		844.0	H	-0.50	3.73	25.00	20.77	0.119

Note.
1. E.R.P & E.I.R.P(dBm) = Substitute Level(dB) + Antenna gain(dBi) - C.L(Cable loss) (dB)

Test mode: LTE Band 26

Bandwidth	Modulation	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	ERP	
		[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[W]
1.4 M	QPSK	824.7	V	-0.60	3.69	25.41	21.12	0.129
		836.5	V	-0.50	3.72	24.80	20.58	0.114
		848.3	V	-0.50	3.74	25.28	21.04	0.127
	16QAM	824.7	H	-0.60	3.69	24.22	19.93	0.098
		836.5	V	-0.50	3.72	23.84	19.62	0.092
		848.3	V	-0.50	3.74	24.18	19.94	0.099
3 M	QPSK	825.5	H	-0.60	3.70	25.08	20.78	0.120
		836.5	H	-0.50	3.72	24.72	20.50	0.112
		847.5	H	-0.50	3.74	24.99	20.75	0.119
	16QAM	825.5	H	-0.60	3.70	24.15	19.85	0.097
		836.5	H	-0.50	3.72	24.01	19.79	0.095
		847.5	H	-0.50	3.74	23.89	19.65	0.092
5 M	QPSK	826.5	H	-0.60	3.71	25.11	20.80	0.120
		836.5	H	-0.50	3.72	24.75	20.53	0.113
		846.5	H	-0.50	3.73	25.07	20.84	0.121
	16QAM	826.5	H	-0.60	3.71	24.46	20.15	0.104
		836.5	H	-0.50	3.72	23.70	19.48	0.089
		846.5	H	-0.50	3.73	24.36	20.13	0.103
10 M	QPSK	829.0	H	-0.60	3.71	25.34	21.03	0.127
		836.5	H	-0.50	3.72	24.82	20.60	0.115
		844.0	H	-0.50	3.73	25.18	20.95	0.124
	16QAM	829.0	H	-0.60	3.71	24.07	19.76	0.095
		836.5	H	-0.50	3.72	24.21	19.99	0.100
		844.0	H	-0.50	3.73	24.10	19.87	0.097
15 M	QPSK	831.5	H	-0.50	3.71	25.09	20.88	0.122
		841.5	H	-0.50	3.73	24.87	20.64	0.116
	16QAM	831.5	H	-0.50	3.71	24.04	19.83	0.096
		841.5	V	-0.50	3.73	24.30	20.07	0.102

Note.
1. E.R.P & E.I.R.P(dBm) = Substitute Level(dB) + Antenna gain(dBi) - C.L(Cable loss) (dB)

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Test mode: LTE Band 41

Bandwidth	Modulation	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	EIRP	
		[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[W]
5 M	QPSK	2 498.5	H	6.30	6.62	23.37	23.05	0.202
		2 593.0	H	6.40	6.78	26.81	26.43	0.440
		2 687.5	H	6.60	6.92	23.39	23.07	0.203
	16QAM	2 498.5	H	6.30	6.62	22.41	22.09	0.162
		2 593.0	H	6.40	6.78	25.36	24.98	0.315
		2 687.5	H	6.60	6.92	22.01	21.69	0.148
10 M	QPSK	2 501.0	H	6.30	6.62	23.02	22.70	0.186
		2 593.0	H	6.40	6.78	24.99	24.61	0.289
		2 685.0	H	6.60	6.92	22.57	22.25	0.168
	16QAM	2 501.0	H	6.30	6.62	22.04	21.72	0.149
		2 593.0	H	6.40	6.78	23.91	23.53	0.225
		2 685.0	H	6.60	6.92	21.44	21.12	0.129
15 M	QPSK	2 503.5	H	6.30	6.63	23.09	22.76	0.189
		2 593.0	H	6.40	6.78	25.91	25.53	0.357
		2 682.5	H	6.60	6.94	22.23	21.89	0.155
	16QAM	2 503.5	H	6.30	6.63	22.50	22.17	0.165
		2 593.0	H	6.40	6.78	24.92	24.54	0.284
		2 682.5	H	6.60	6.94	21.13	20.79	0.120
20 M	QPSK	2 506.0	H	6.30	6.63	23.14	22.81	0.191
		2 593.0	H	6.40	6.78	23.67	23.29	0.213
		2 680.0	H	6.60	6.94	22.02	21.68	0.147
	16QAM	2 506.0	H	6.30	6.63	21.63	21.30	0.135
		2 593.0	H	6.40	6.78	23.04	22.66	0.185
		2 680.0	H	6.60	6.94	21.60	21.26	0.134

Note.
1. E.R.P & E.I.R.P(㏈m) = Substitute Level(㏈) + Antenna gain(㏈i) - C.L(Cable loss) (㏈)

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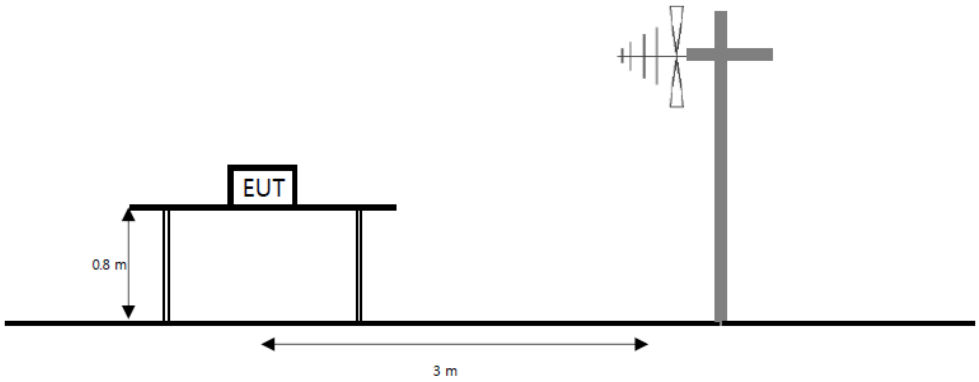
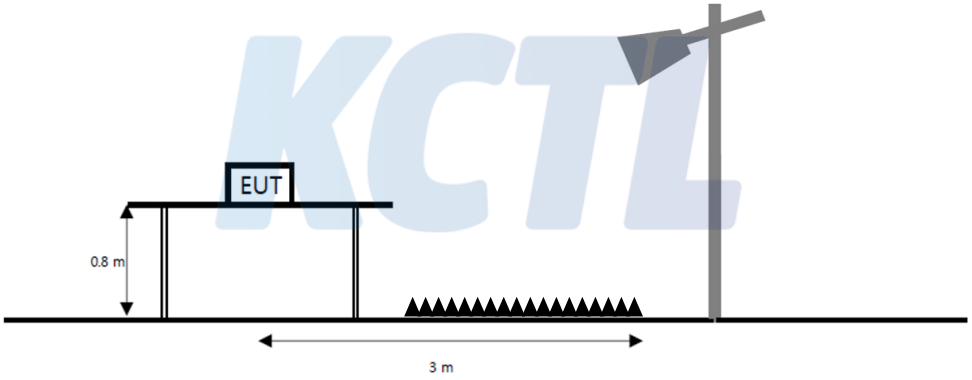
7.8. Radiated Spurious Emissions

Test setup

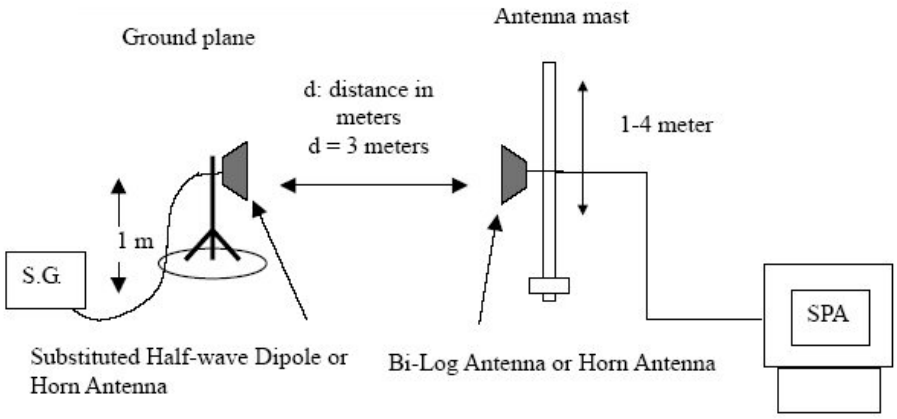
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 ㎓ to the tenth harmonic of the highest fundamental frequency or to 40 ㎓ emissions, whichever is lower.



The diagram below shows the test setup for substituted method.



Limit

According to §22.917(a), the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10log($P_{[Watts]}$) dB.

According to §27.53(m)(4), the minimum permissible attenuation level of any spurious emission is 53 + 10log($P_{[Watts]}$) dB.

Test procedure

971168 D01 v03r01 - Section 6.2
ANSI 63.26-2015 – Section 5.5
ANSI/TIA-603-E-2016 - Section 2.2.12

Test settings

1) RBW = 1 kHz for below 1 GHz and 1 MHz for above 1 GHz.
2) VBW ≥ 3 × RBW.
3) Detector = RMS
4) Trace mode = Max hold
5) Sweep time = Auto couple
6) Number of sweep points ≥ 2 × span / RBW
7) Allow trace to fully stabilize.

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Notes:

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 turntable is rotated through 360°, and the receiving antenna scans in order to determine the level of the maximized emission.
4. 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.
5. The maximum signal level detected by the measuring receiver shall be noted.
6. The EUT was replaced by half-wave dipole (1 ㎓ below) or horn antenna (1 ㎓ above) connected to a signal generator.
7. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
8. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring corrected for the change of input attenuator setting of the measuring receiver.
9. 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.
10. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.

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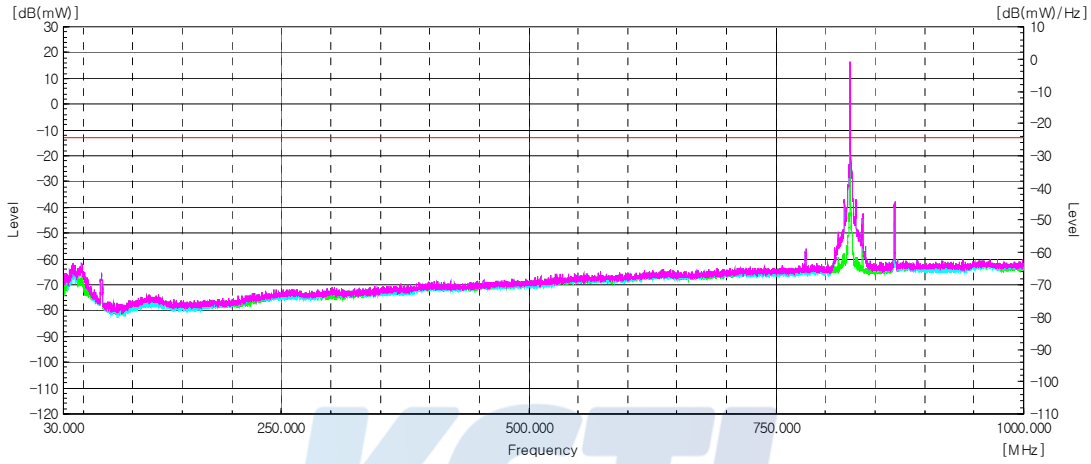
Test results (Below 1 000 ㎒) – Worst case

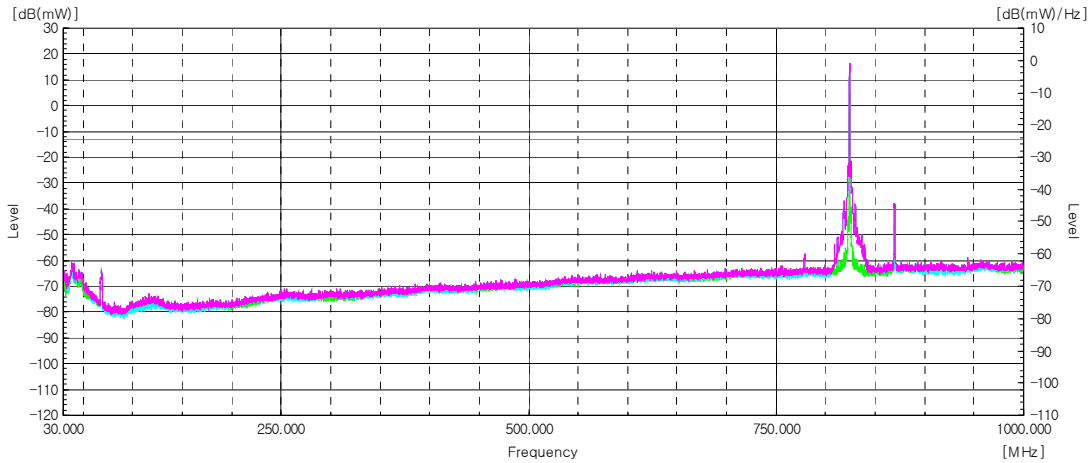
Test mode : LTE Band 5
Frequency (㎒) : 824.7
Channel : 20407
Bandwidth (㎒) : 1.4

Horizontal/Vertical



Test mode : LTE Band 26
Frequency (㎒) : 824.7
Channel : 26697
Bandwidth (㎒) : 1.4

Horizontal/Vertical



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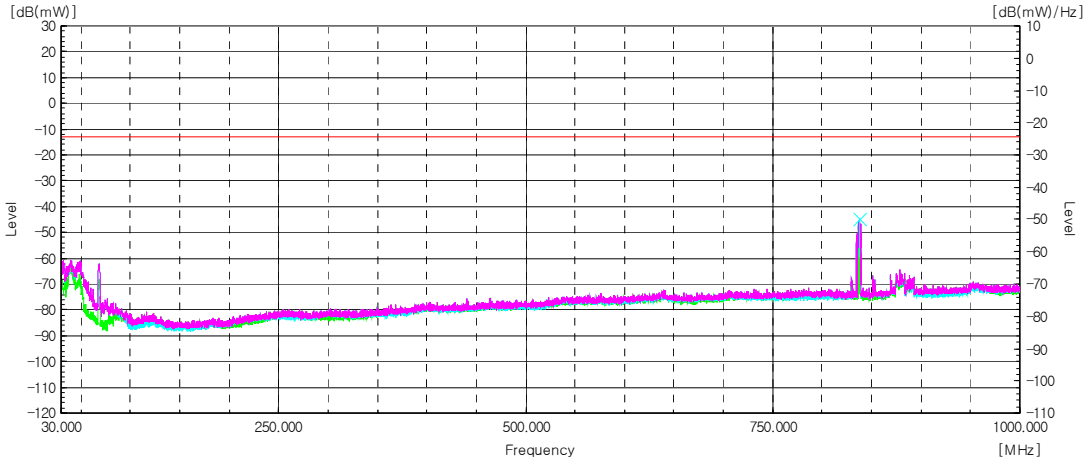
Test mode	:	LTE Band 41
Frequency (㎒)	:	2 498.5
Channel	:	39675
Bandwidth (㎒)	:	5

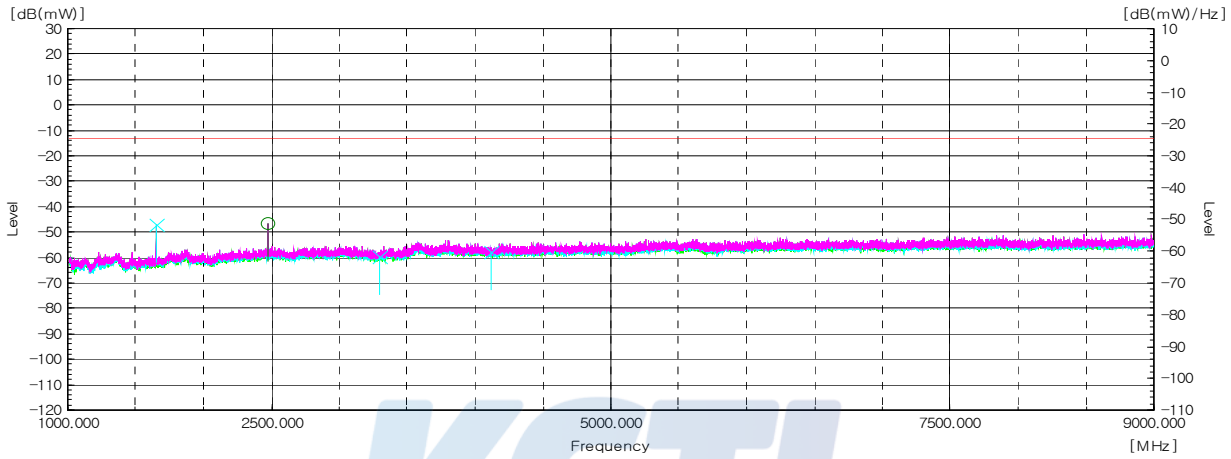
Horizontal/Vertical



Test results (Above 1 000 ㎒)

Test mode : LTE Band 5
Frequency(㎒) : 824.7
Channel : 20407
Bandwidth(㎒) : 1.4

Horizontal/Vertical



Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 649.541	V	5.90	5.33	-47.47	-46.90	-13.00	33.90
	2 474.092	H	6.20	6.56	-46.44	-46.80	-13.00	33.80
	3 298.143	V	7.60	7.56	-59.84	-59.80	-13.00	46.80
	4 123.695	V	8.70	8.57	-58.13	-58.00	-13.00	45.00

Note.
1. Limit Calculation(dBm)= 43 + 10log($P_{[Watts]}$)
2. ERP & E.I.R.P(dB m)= Substitute Level(dB) + Antenna gain(dBi) – Cable Loss(dB)

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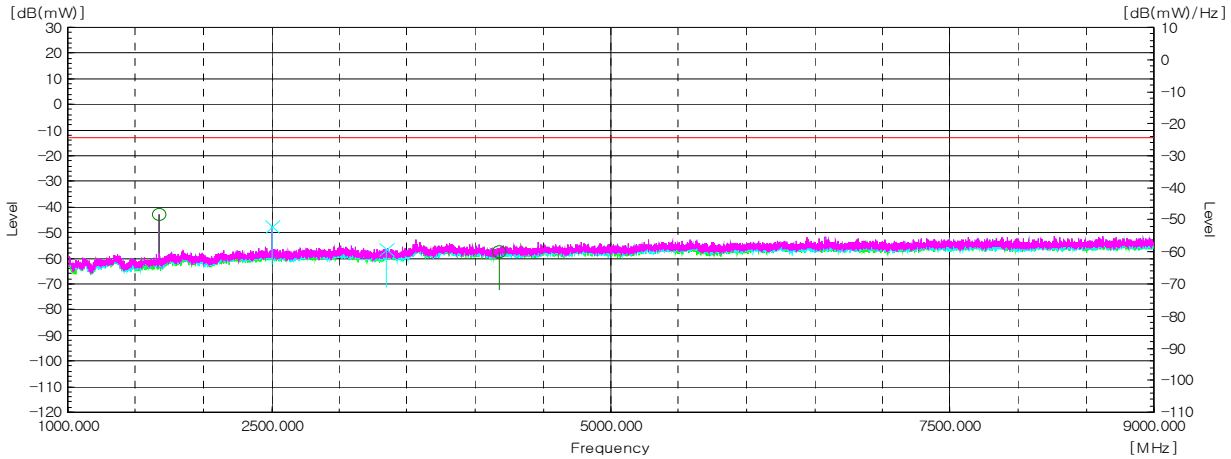
Test mode : LTE Band 5
Frequency(㎒) : 836.5
Channel : 20525
Bandwidth(㎒) : 1.4

Horizontal/Vertical



Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 672.042	H	5.10	5.38	-42.52	-42.80	-13.00	29.80
	2 508.094	V	6.30	6.62	-47.08	-47.40	-13.00	34.40
	3 346.146	V	7.70	7.63	-56.47	-56.40	-13.00	43.40
	4 182.199	H	9.00	8.62	-57.58	-57.20	-13.00	44.20

Note.
1. Limit Calculation(㏈m)= 43 + 10log($P_{[Watts]}$)
2. ERP & E.I.R.P(㏈ m)= Substitute Level(㏈) + Antenna gain(㏈i) – Cable Loss(㏈)

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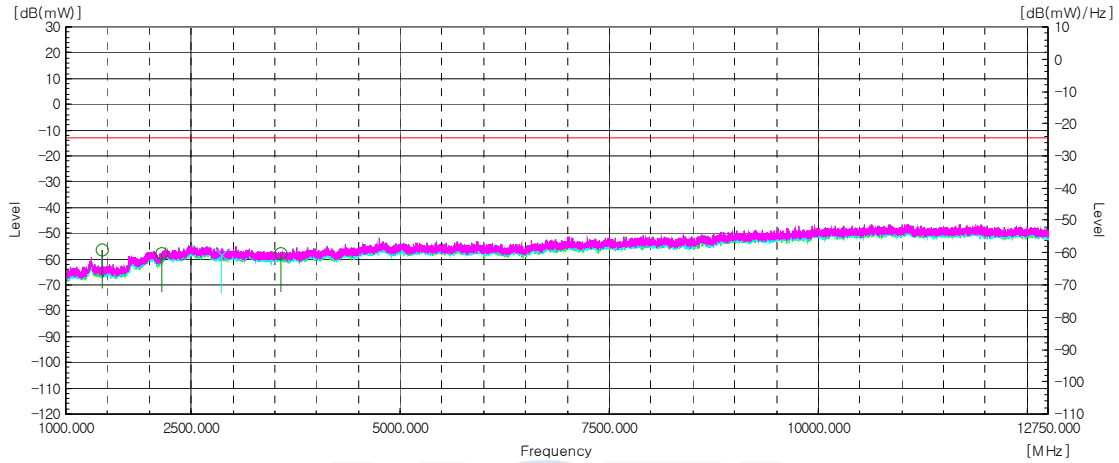
Test mode : LTE Band 5
Frequency(㎒) : 848.3
Channel : 20643
Bandwidth(㎒) : 1.4

Horizontal/Vertical



Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 697.044	V	4.60	5.44	-43.86	-44.70	-13.00	31.70
	2 545.097	H	6.40	6.72	-47.68	-48.00	-13.00	35.00
	3 393.649	H	7.90	7.69	-57.31	-57.10	-13.00	44.10
	4 241.202	H	9.20	8.66	-56.54	-56.00	-13.00	43.00

Note.
1. Limit Calculation(㏈m)= 43 + 10log($P_{[Watts]}$)
2. ERP & E.I.R.P(㏈ m)= Substitute Level(㏈) + Antenna gain(㏈i) – Cable Loss(㏈)

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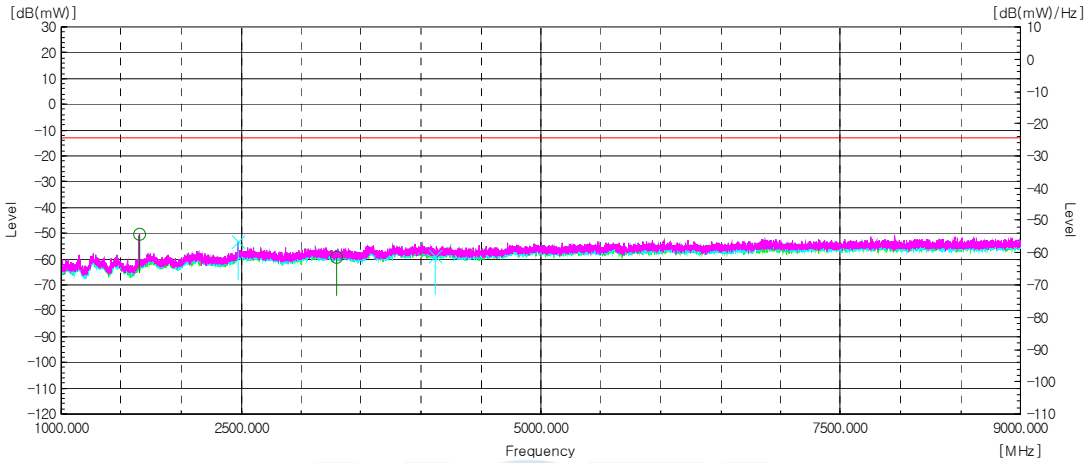
Test mode : LTE Band 26
Frequency(㎒) : 824.7
Channel : 27033
Bandwidth(㎒) : 1.4

Horizontal/Vertical



Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 648.541	H	5.90	5.33	-51.07	-50.50	-13.00	37.50
	2 472.592	V	6.20	6.56	-52.94	-53.30	-13.00	40.30
	3 298.143	H	7.60	7.56	-59.24	-59.20	-13.00	46.20
	4 123.695	V	8.70	8.57	-59.13	-59.00	-13.00	46.00

Note.
1. Limit Calculation(dBm)= 43 + 10log($P_{[Watts]}$)
2. ERP & E.I.R.P(dB m)= Substitute Level(dB) + Antenna gain(dBi) – Cable Loss(dB)

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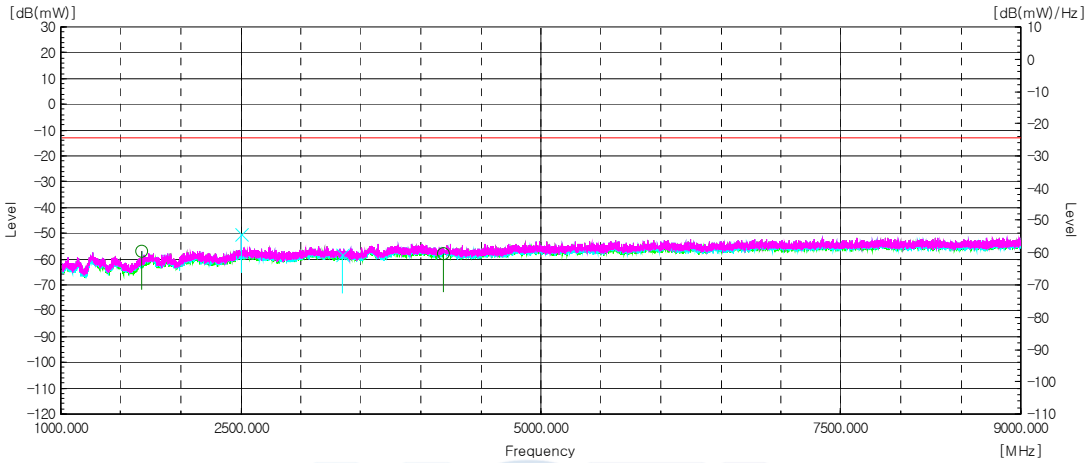
Test mode : LTE Band 26
Frequency(㎒) : 836.5
Channel : 26915
Bandwidth(㎒) : 1.4

Horizontal/Vertical



Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 672.542	H	5.10	5.38	-56.52	-56.80	-13.00	43.80
	2 508.094	V	6.30	6.62	-49.98	-50.30	-13.00	37.30
	3 346.146	V	7.70	7.63	-58.47	-58.40	-13.00	45.40
	4 183.199	H	9.00	8.62	-58.08	-57.70	-13.00	44.70

Note.
1. Limit Calculation(dBm)= 43 + 10log($P_{[Watts]}$)
2. ERP & E.I.R.P(dB m)= Substitute Level(dB) + Antenna gain(dBi) – Cable Loss(dB)

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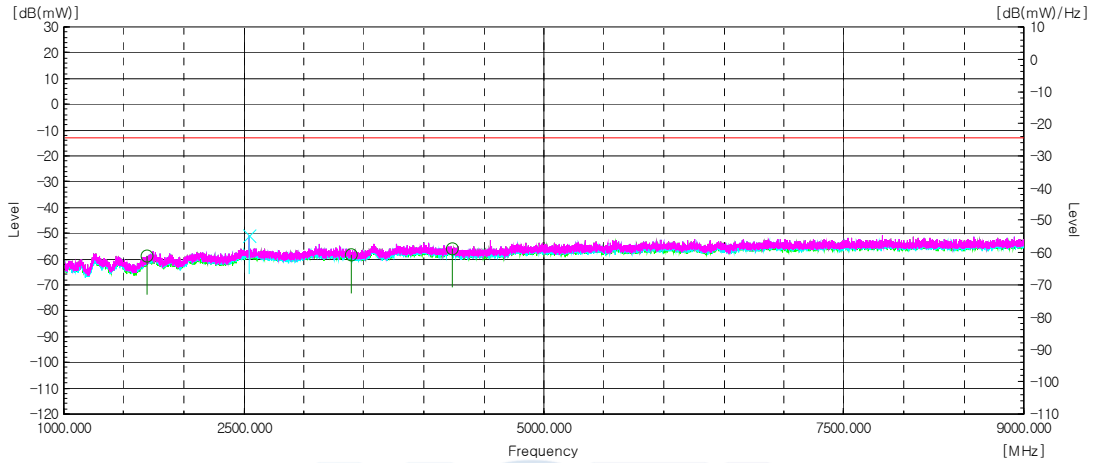
Test mode : LTE Band 26
Frequency(㎒) : 848.3
Channel : 27033
Bandwidth(㎒) : 1.4

Horizontal/Vertical



Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 696.043	H	4.60	5.44	-57.86	-58.70	-13.00	45.70
	2 543.096	V	6.40	6.72	-50.38	-50.70	-13.00	37.70
	3 393.649	H	7.90	7.69	-58.81	-58.60	-13.00	45.60
	4 241.202	H	9.20	8.66	-56.34	-55.80	-13.00	42.80

Note.
1. Limit Calculation(㏈m)= 43 + 10log($P_{[Watts]}$)
2. ERP & E.I.R.P(㏈ m)= Substitute Level(㏈) + Antenna gain(㏈i) – Cable Loss(㏈)

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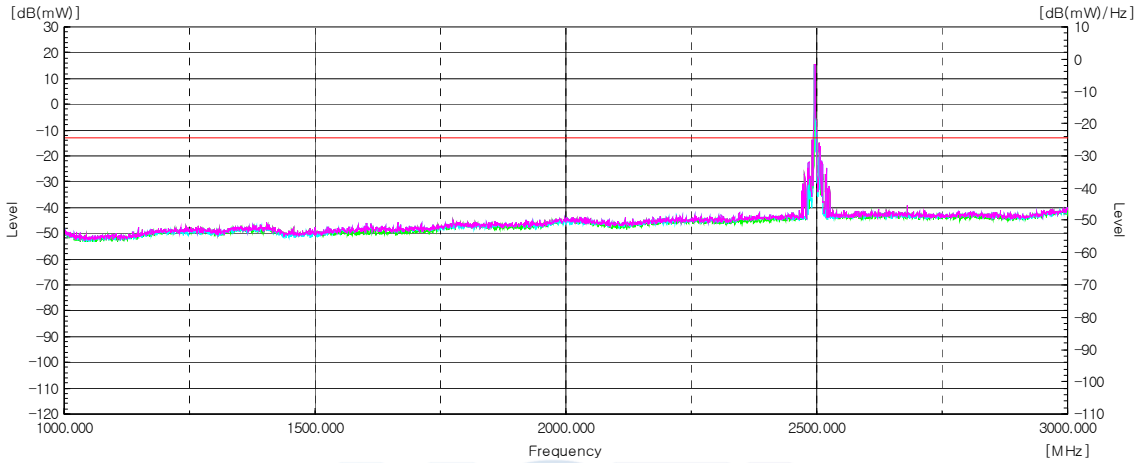
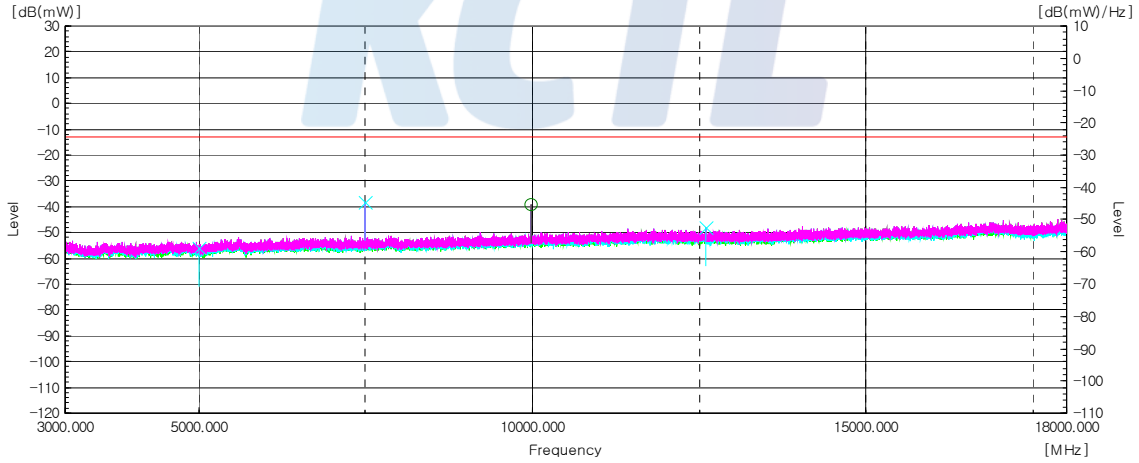
Test mode : LTE Band 41
Frequency(㎒) : 2 498.5
Channel : 39675
Bandwidth(㎒) : 5

Horizontal/Vertical for 1 ㎓ ~ 3 ㎓



Horizontal/Vertical for 3 ㎓ ~ 18 ㎓



Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	4 997.567	V	9.60	9.47	-56.13	-56.00	-13.00	43.00
	7 489.150	V	11.90	11.72	-38.48	-38.30	-13.00	25.30
	9 985.732	H	12.50	13.67	-37.83	-39.00	-13.00	26.00
	12 590.319	V	13.20	15.34	-45.76	-47.90	-13.00	34.90

Note.
1. Limit Calculation(dBm)= 43 + 10log($P_{[Watts]}$)
2. ERP & E.I.R.P(dB m)= Substitute Level(dB) + Antenna gain(dBi) – Cable Loss(dB)

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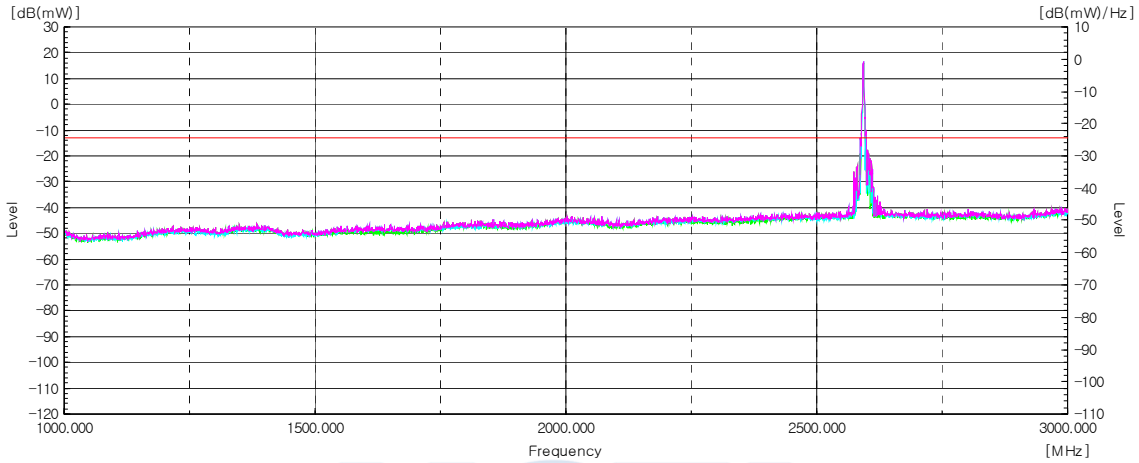
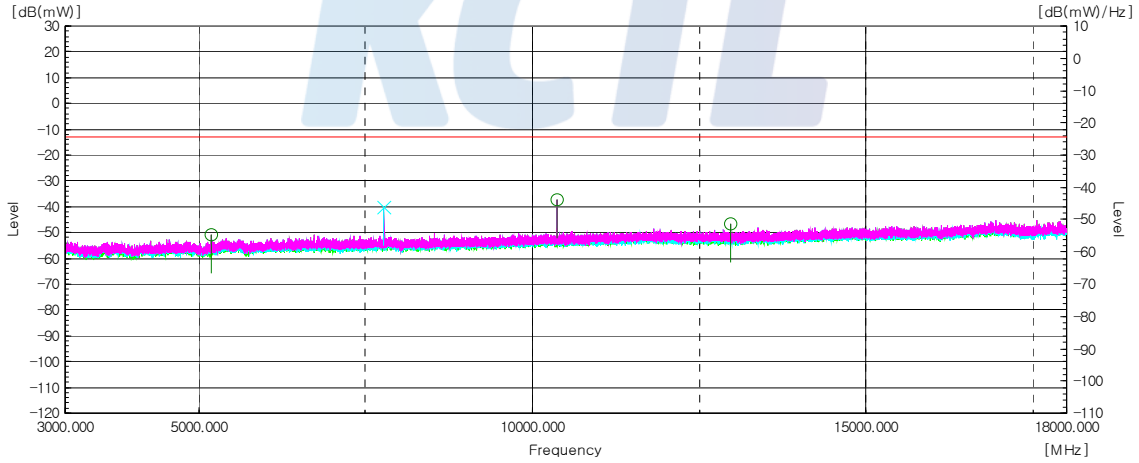
Test mode : LTE Band 41
Frequency(㎒) : 2 593.0
Channel : 40620
Bandwidth(㎒) : 5

Horizontal/Vertical for 1 ㎓ ~ 3 ㎓



Horizontal/Vertical for 3 ㎓ ~ 18 ㎓



Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	5 186.073	H	9.30	9.63	-50.47	-50.80	-13.00	37.80
	7 779.659	V	12.30	11.99	-40.31	-40.00	-13.00	27.00
	10 372.745	H	12.70	13.89	-36.21	-37.40	-13.00	24.40
	12 965.831	H	13.40	15.61	-44.49	-46.70	-13.00	33.70

Note.
1. Limit Calculation(㏈m)= 43 + 10log($P_{[Watts]}$)
2. ERP & E.I.R.P(㏈ m)= Substitute Level(㏈) + Antenna gain(㏈i) – Cable Loss(㏈)

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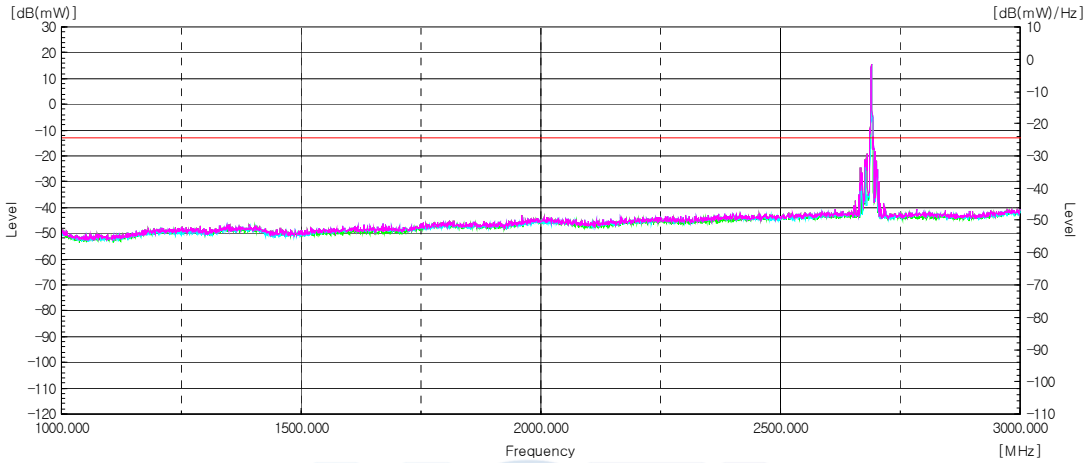
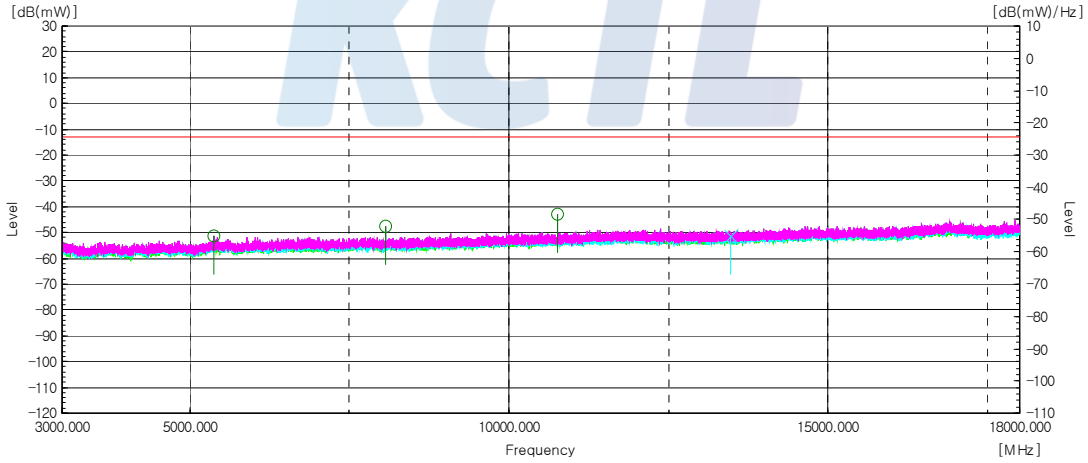
Test mode : LTE Band 41
Frequency(㎒) : 2 687.5
Channel : 41565
Bandwidth(㎒) : 5

Horizontal/Vertical for 1 ㎓ ~ 3 ㎓



Horizontal/Vertical for 3 ㎓ ~ 18 ㎓



Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	5 379.579	H	10.10	9.83	-51.67	-51.40	-13.00	38.40
	8 068.669	H	12.50	12.33	-47.77	-47.60	-13.00	34.60
	10 758.758	H	12.80	14.20	-41.30	-42.70	-13.00	29.70
	13 476.348	V	13.50	15.92	-49.08	-51.50	-13.00	38.50

Note.
1. Limit Calculation(㏈m)= 43 + 10log($P_{[Watts]}$)
2. ERP & E.I.R.P(㏈ m)= Substitute Level(㏈) + Antenna gain(㏈i) – Cable Loss(㏈)

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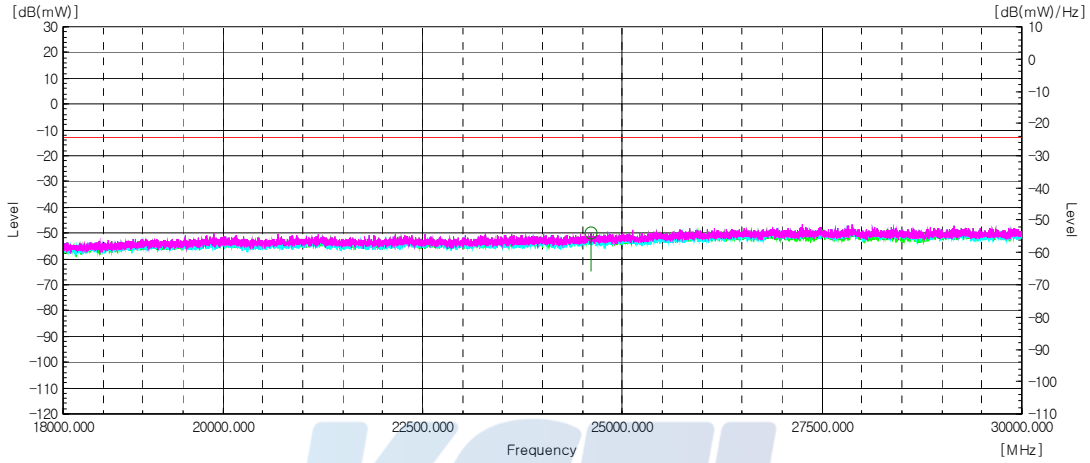
Test results (Above 18 ㎓ to 30 ㎓) – Worst case

Test mode	:	LTE Band 41
Frequency (㎒)	:	2 498.5
Channel	:	39675
Bandwidth(㎒)	:	5

Horizontal/Vertical



Note.
1. No spurious emissions were detected above 18㎓.

8. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
Spectrum Analyzer	R & S	FSV30	100808	20.07.30
Spectrum Analyzer	AGILENT	N9040B	US56050101	20.07.31
Spectrum Analyzer	AGILENT	N9040B	MY57010132	19.10.12
Signal Generator	R&S	SMR40	100007	20.05.13
Power Divider	AGILENT	11636B	54456	20.01.08
Attenuator	API Inmet	40AH2W-10	14	20.05.15
Attenuator	Weinschel ENGINEERING	10	AJ1239	20.05.14
DC Power Supply	Agilent	E3632A	KR94907664	20.05.13
Temp & Humid Chamber	ESPEC CORP.	SH-661	92004048	20.01.04
Wideband Radio Communication Tester	R & S	CMW500	132120	20.07.17
High pass Filter	Wainwright Instruments GmbH	WHKX3.0/18G-12SS	44	20.01.25
High pass Filter	Wainwright Instruments GmbH	WHKX1.0/1.5S-10SS	14	20.01.25
Biconical VHF-UHF Broadband Antenna	SCHWARZBECK	VUBA9117	275	20.04.13
Bilog Antenna	Teseq GmbH	CBL 6143A	35039	21.05.21
Horn Antenna	ETS.lindgren	3117	161225	20.05.22
Horn Antenna	ETS.lindgren	3115	62589	20.08.01
Horn Antenna	ETS.lindgren	3116	00086632	20.02.15
Horn Antenna	ETS.lindgren	3116	00086635	20.05.09
Amplifier	SONOMA INSTRUMENT	317	321041	20.01.04
Amplifier	L-3 Narda-MITE	AMF-7D-01001800-22-10P	2031196	20.02.21
Amplifier	L-3 Narda-MITEQ	JS44-18004000-33-8P	2000997	20.08.01
Antenna Mast	MATURO	EAS 1.5	042/8941211	N/A
Antenna Mast	MATURO	EAS 1.5	043/8941211	N/A
Turn Table	MATURO	TT 0.8 PF	041/8941211	N/A
Cable Assembly	Radiall	R286303620	1649.241	N/A
Cable Assembly	Radiall	TESTPRO 3	N/A	N/A
Cable Assembly	JUNFLON	J12J102248-00-5	JUL-06-14-108	N/A
Cable Assembly	JUNFLON	MWX221-DMWDMS	J0965546	N/A

End of test report

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