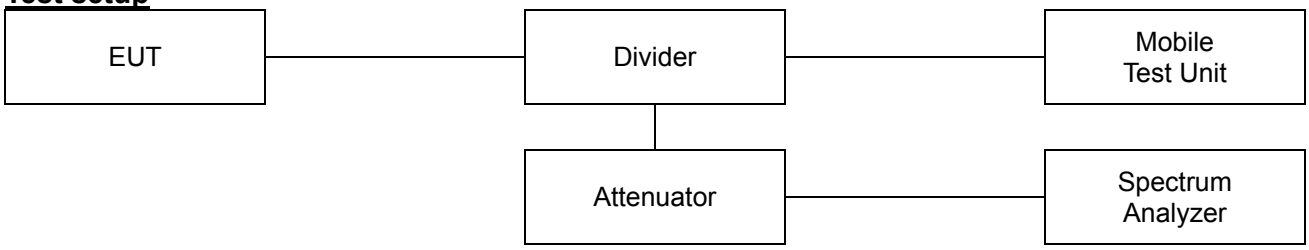
7.5. Peak to Average Power Ratio (PAPR)

Test setup



Limit

According to §24.232(d) and §27.50(d)(5), the peak-to-average ratio(PAR) of the transmission must not exceed 13 ㏈.

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 ㎳.
   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%

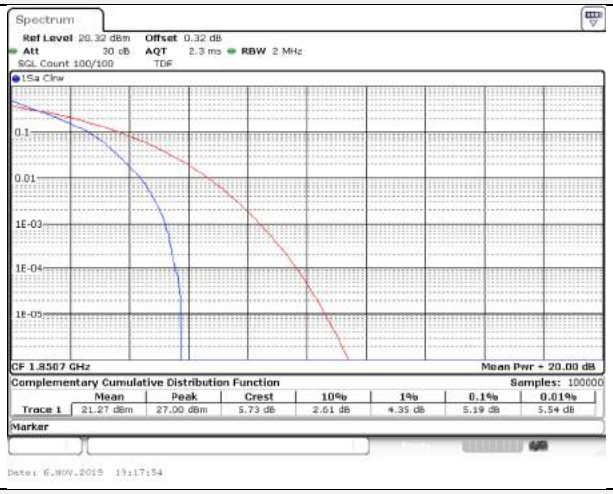
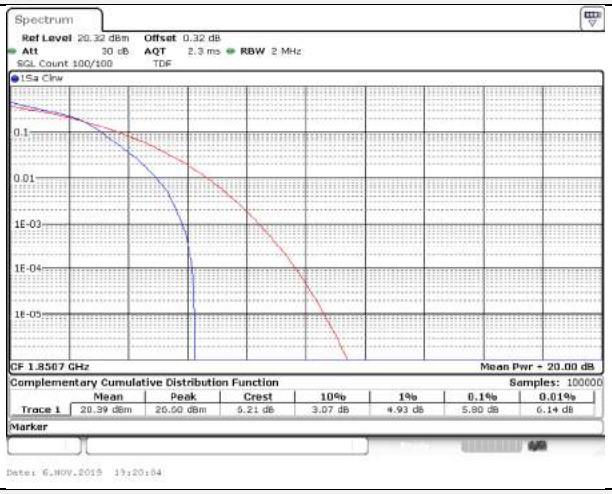
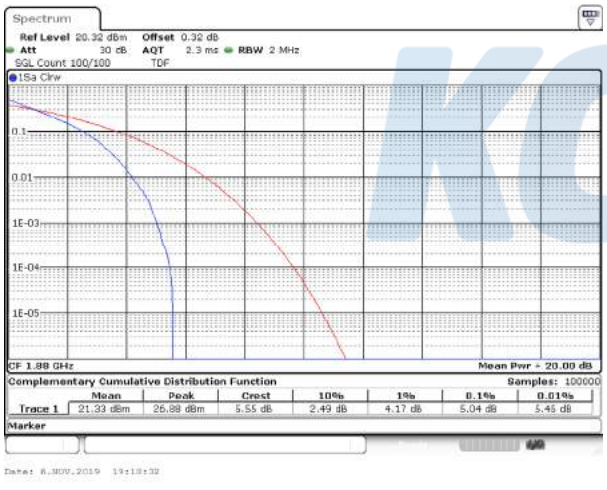
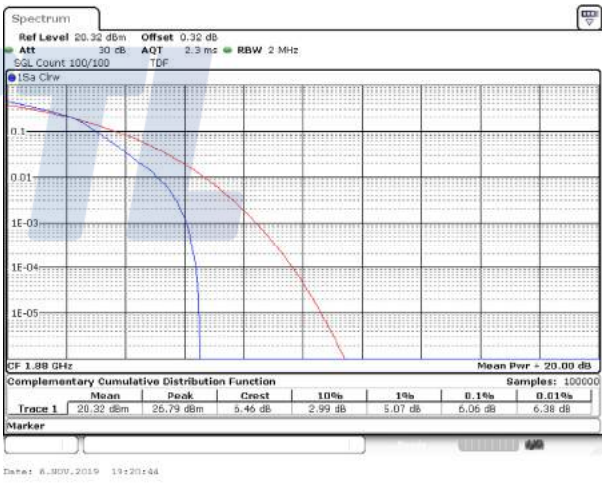
5.2.6 Peak-to-average power ratio

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:

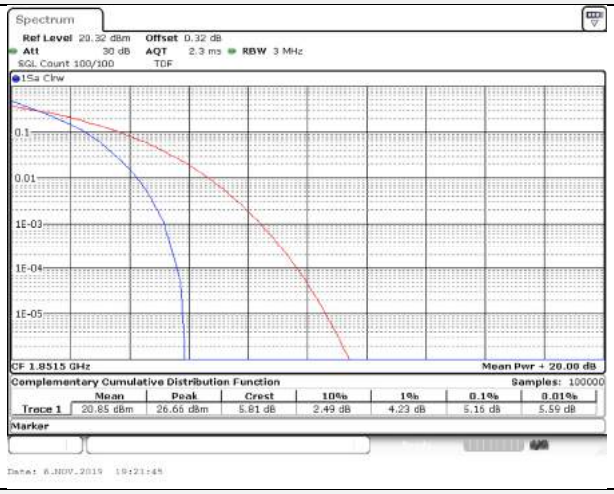
PAPR(㏈) = P_{PK} (dBm or dBW) - P_{AG}(dBm or dBW)

Test results

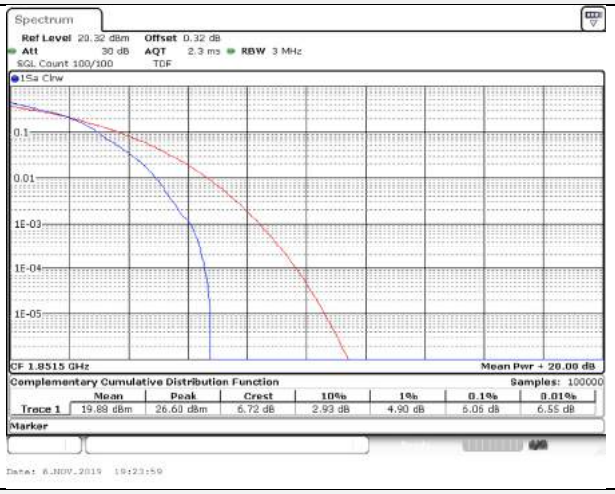
Test mode: LTE Band 2

1.4M BW / QPSK / Low ch.	1.4M BW / 16QAM / Low ch.
	
1.4M BW / QPSK / Mid ch.	**1.4M BW / 16QAM / Mid ch.**
	
1.4M BW / QPSK / High ch.	**1.4M BW / 16QAM / High ch.**
	

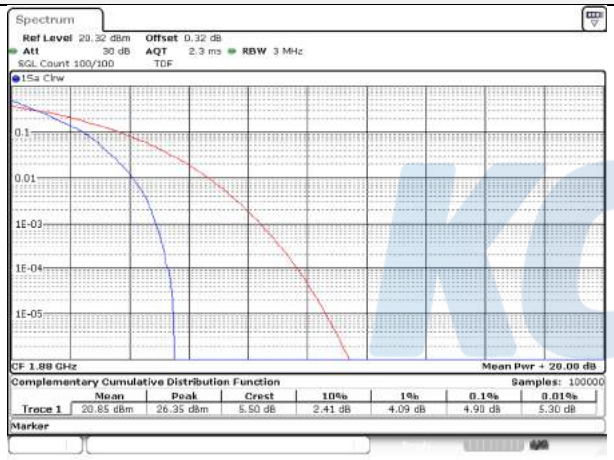
3M BW / QPSK / Low ch.



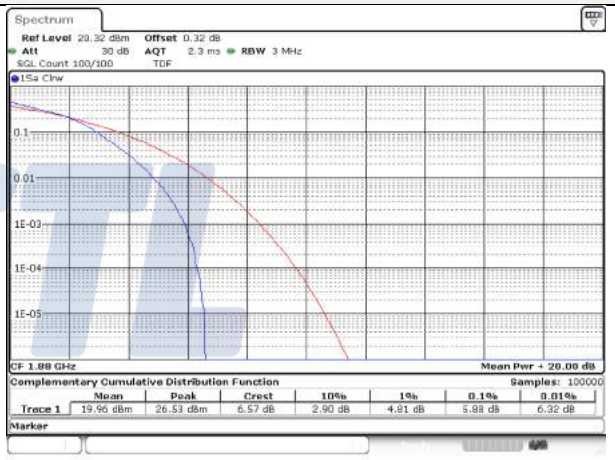
3M BW / 16QAM / Low ch.



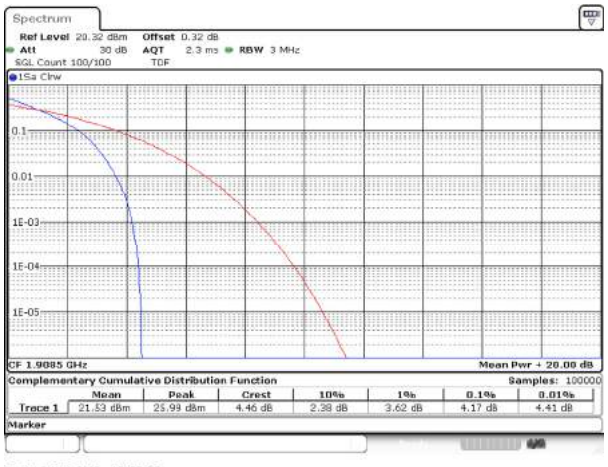
3M BW / QPSK / Mid ch.



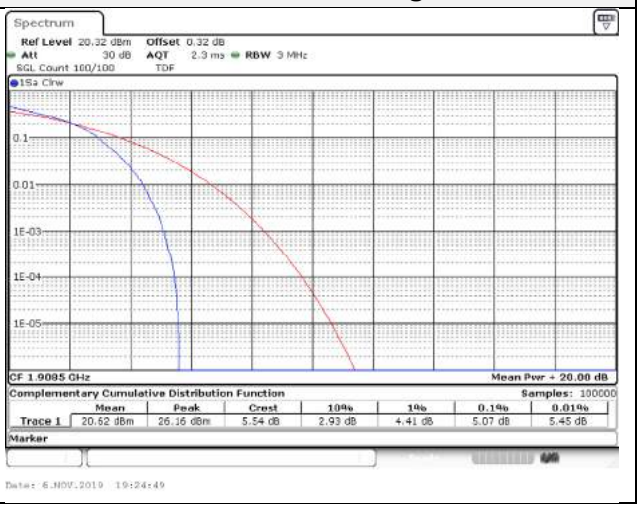
3M BW / 16QAM / Mid ch.

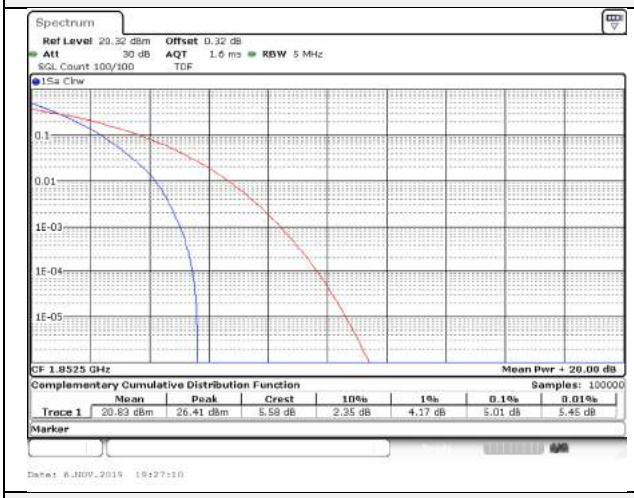
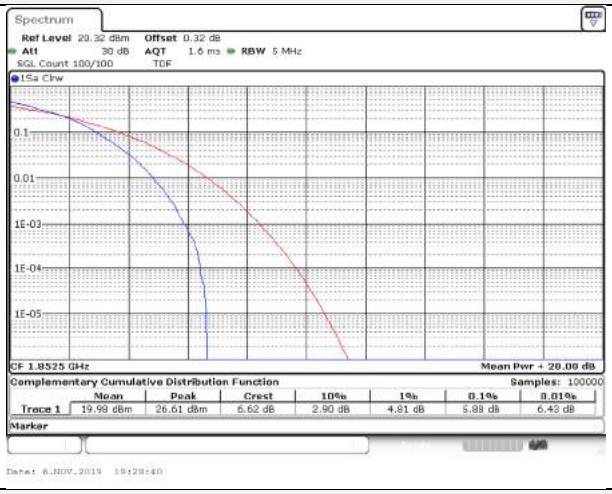
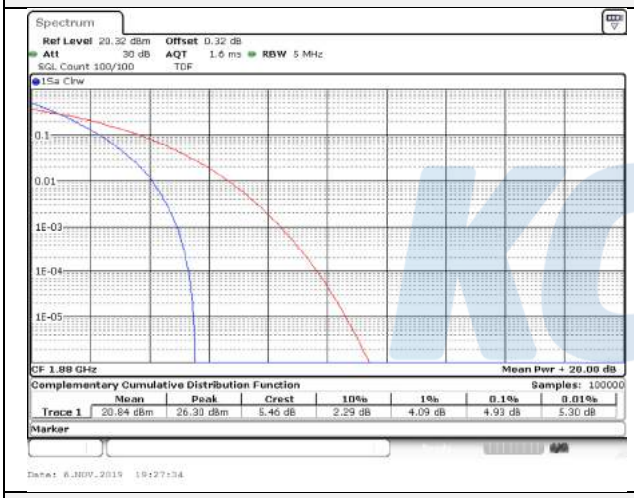
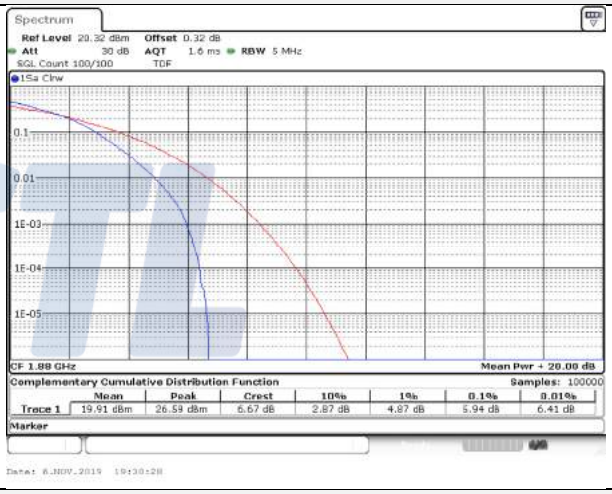
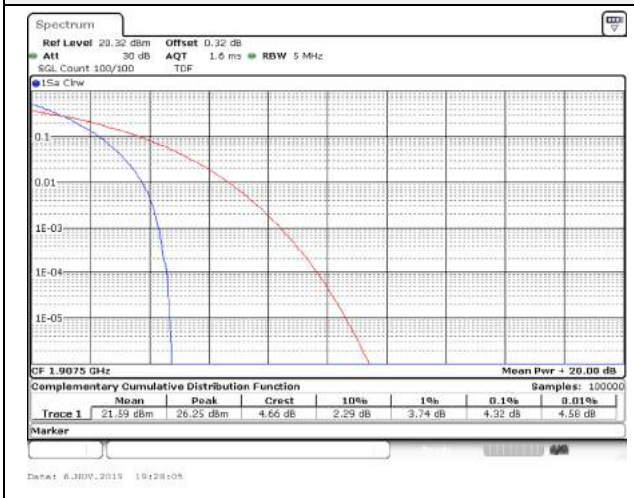
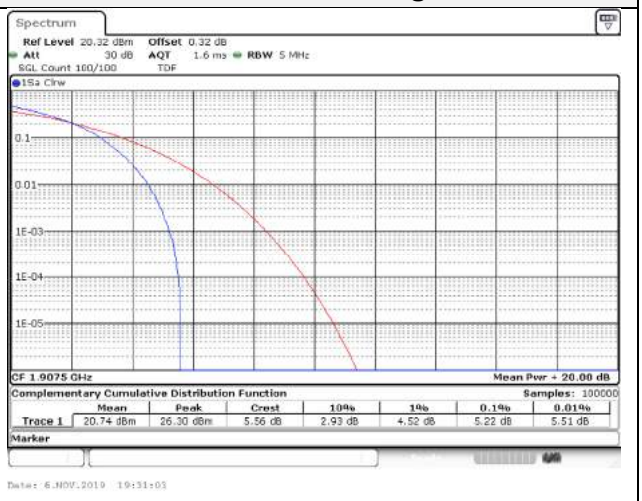


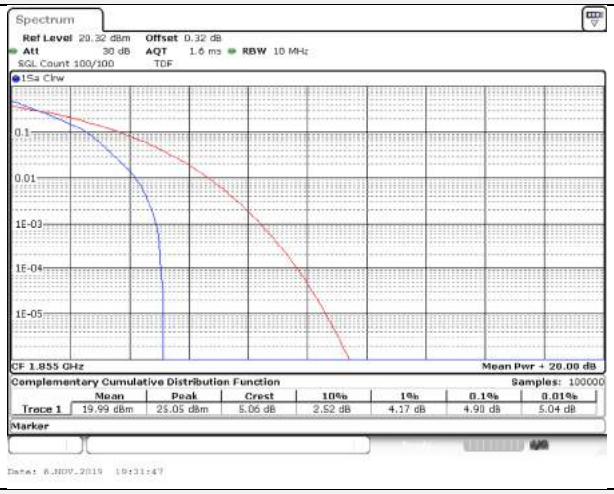
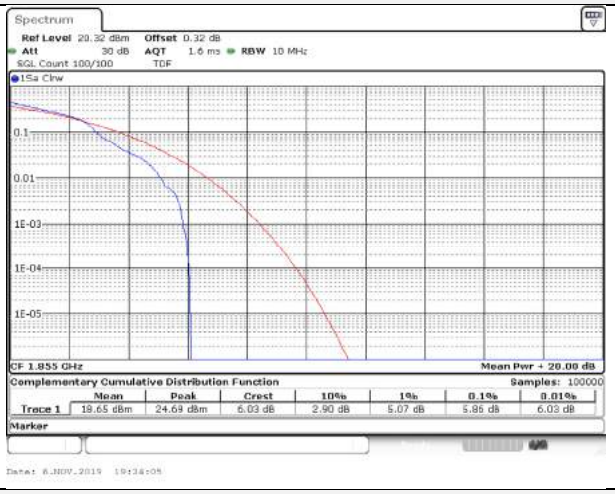
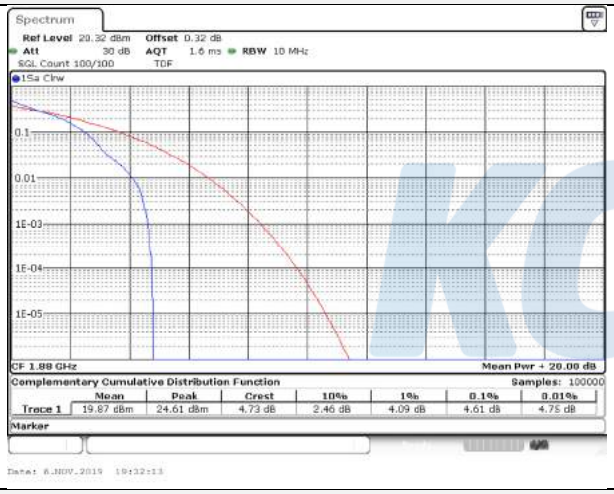
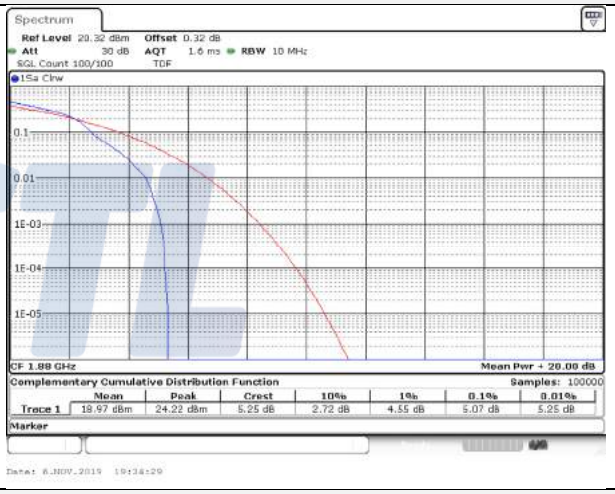
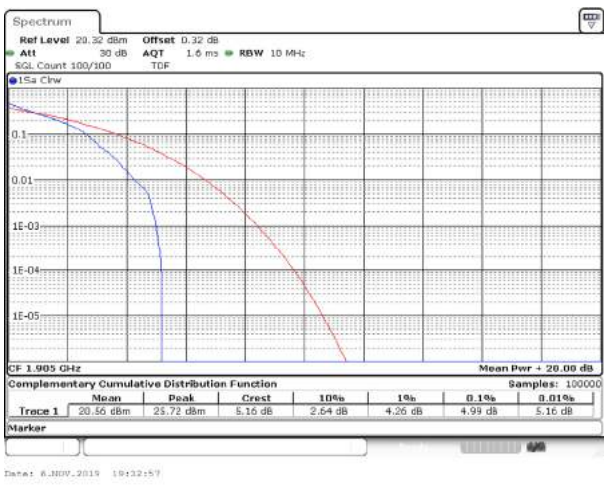
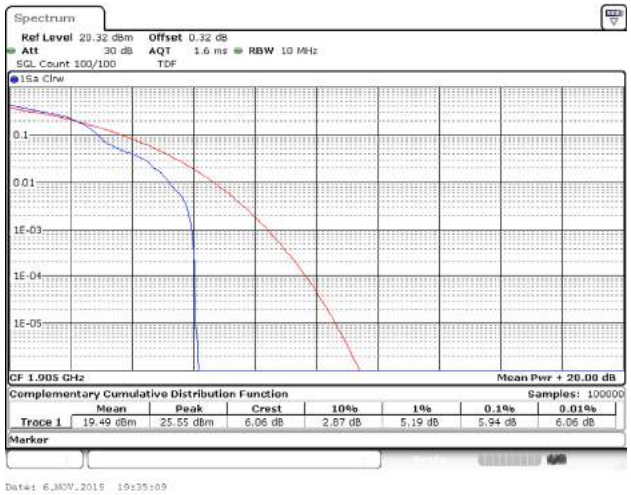
3M BW / QPSK / High ch.

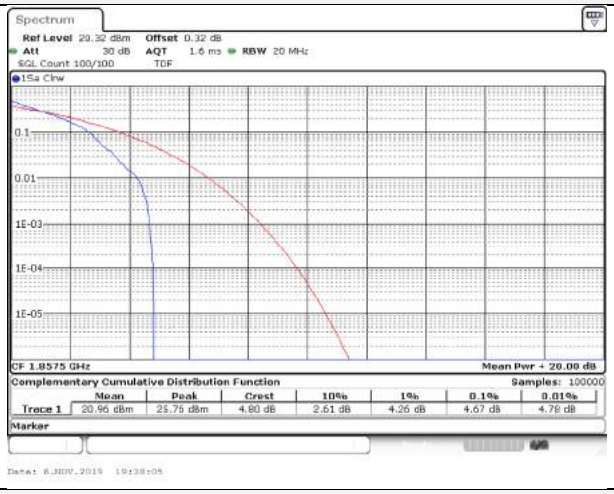
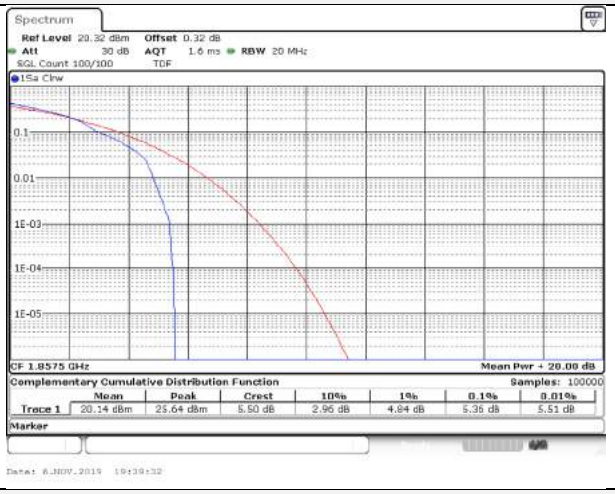
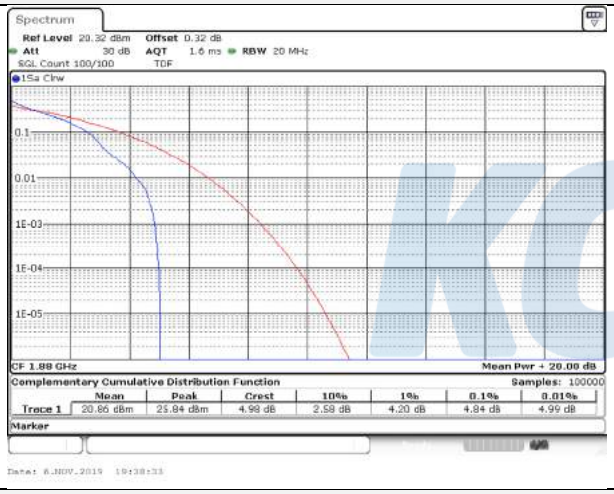
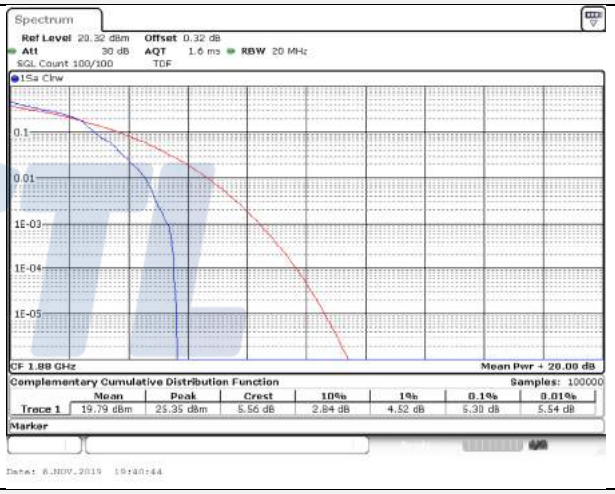
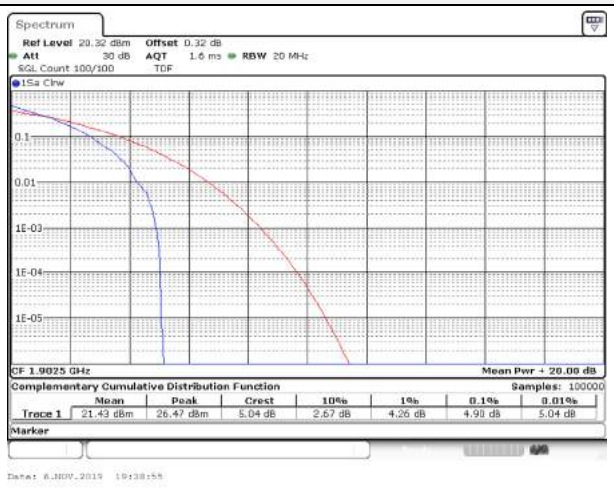
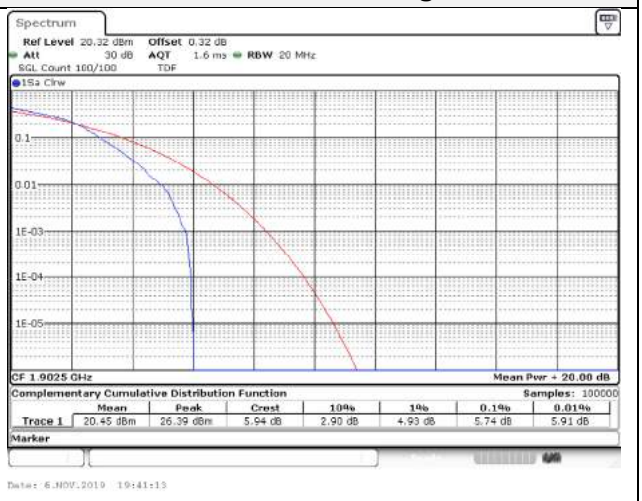


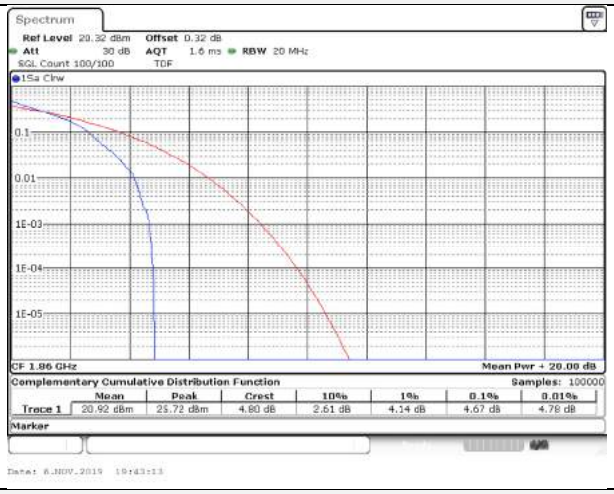
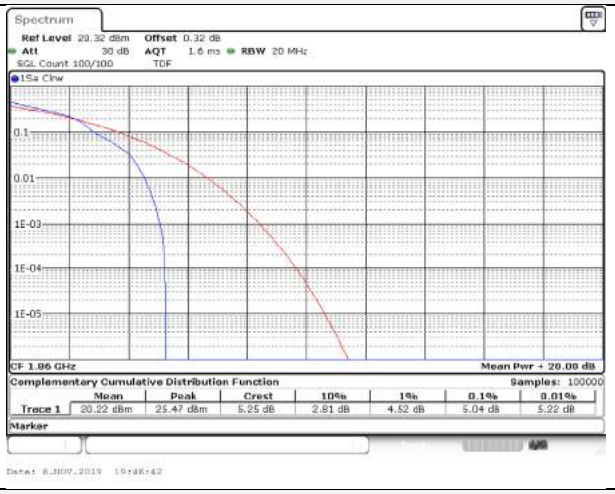
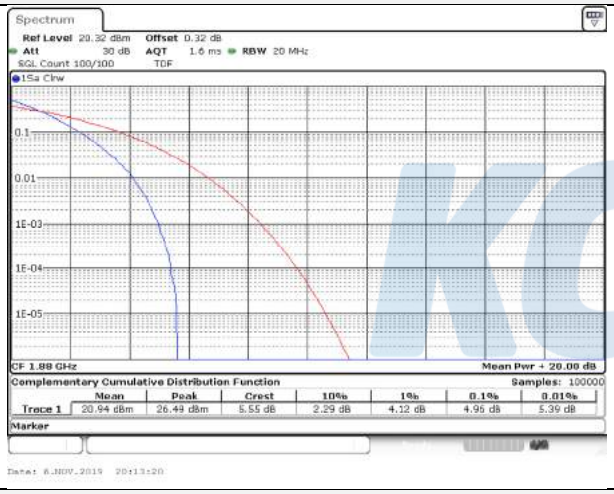
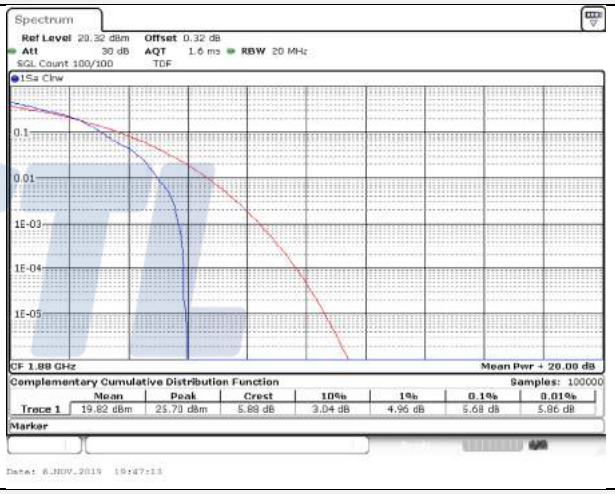
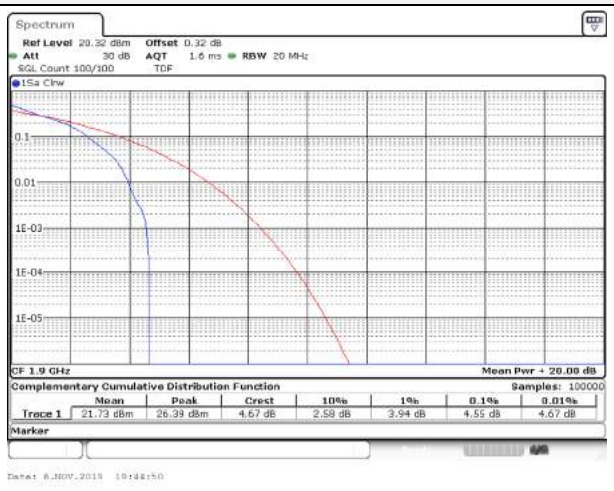
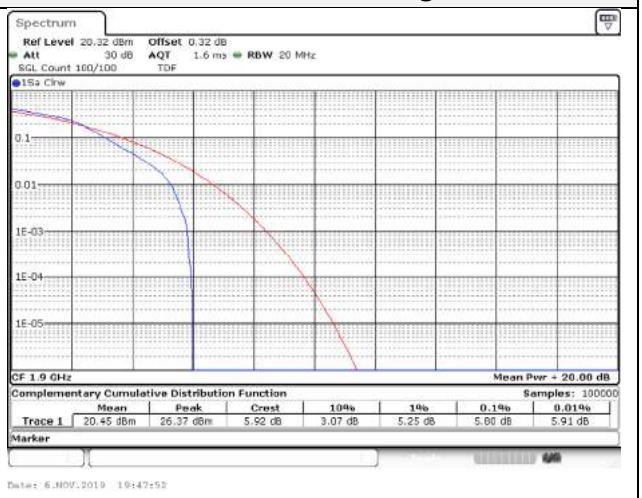
3M BW / 16QAM / High ch.



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.**
	

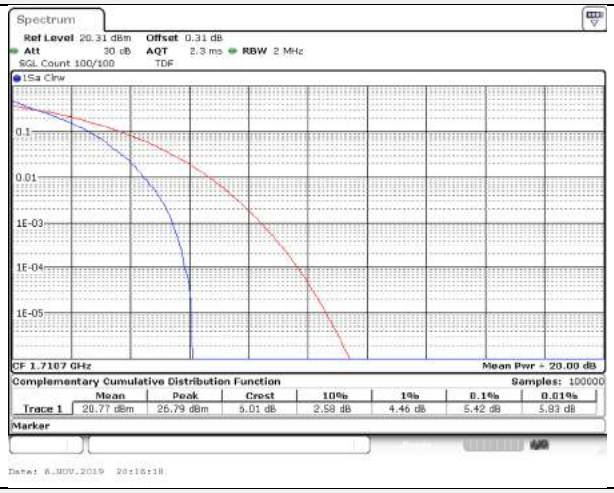
10M BW / QPSK / Low ch.	10M BW / 16QAM / Low ch.
	
10M BW / QPSK / Mid ch.	**10M BW / 16QAM / Mid ch.**
	
10M BW / QPSK / High ch.	**10M BW / 16QAM / High ch.**
	

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.**
	

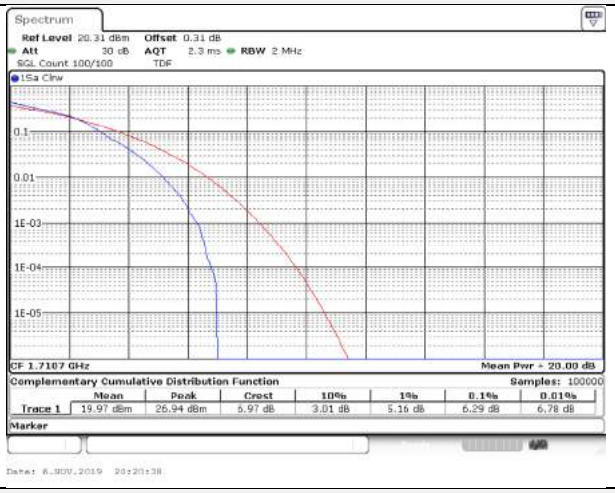
20M BW / QPSK / Low ch.	20M BW / 16QAM / Low ch.
	
20M BW / QPSK / Mid ch.	**20M BW / 16QAM / Mid ch.**
	
20M BW / QPSK / High ch.	**20M BW / 16QAM / High ch.**
	

Test mode: LTE Band 4/66

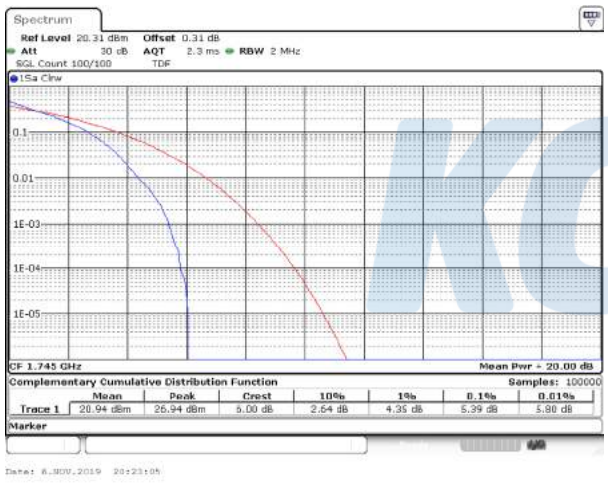
1.4M BW / QPSK / Low ch.



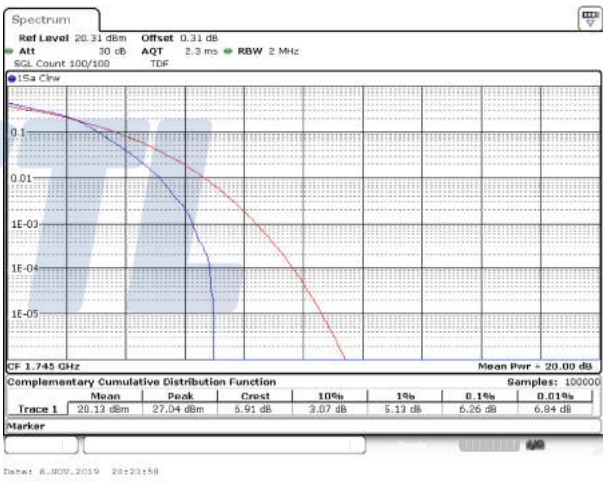
1.4M BW / 16QAM / Low ch.



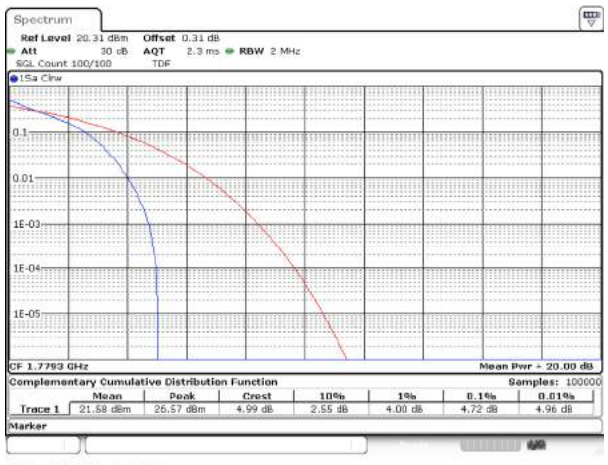
1.4M BW / QPSK / Mid ch.



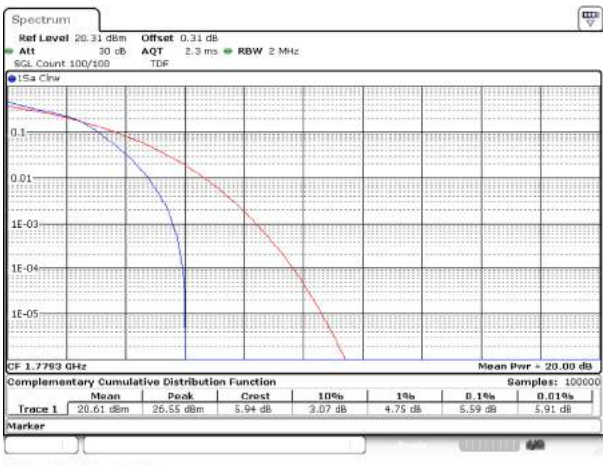
1.4M BW / 16QAM / Mid ch.



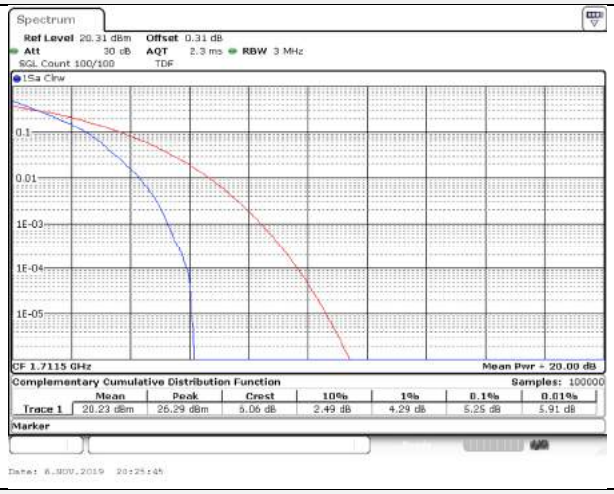
1.4M BW / QPSK / High ch.



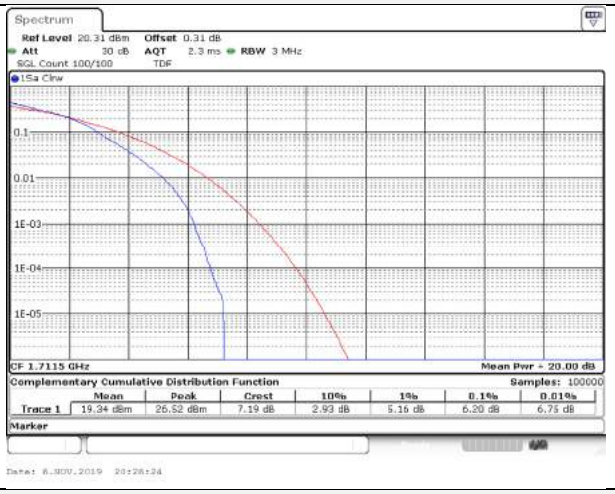
1.4M BW / 16QAM / High ch.



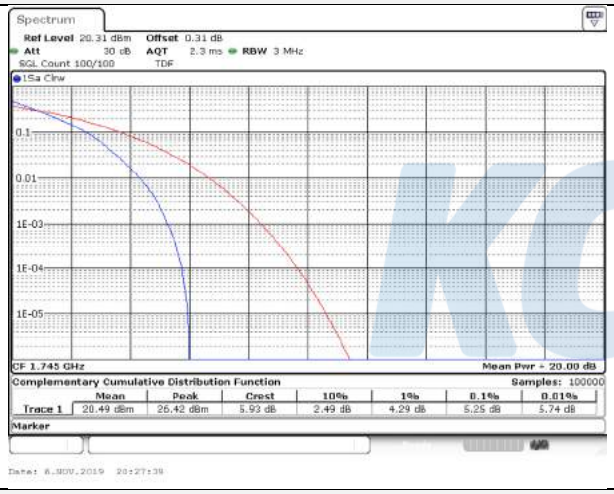
3M BW / QPSK / Low ch.



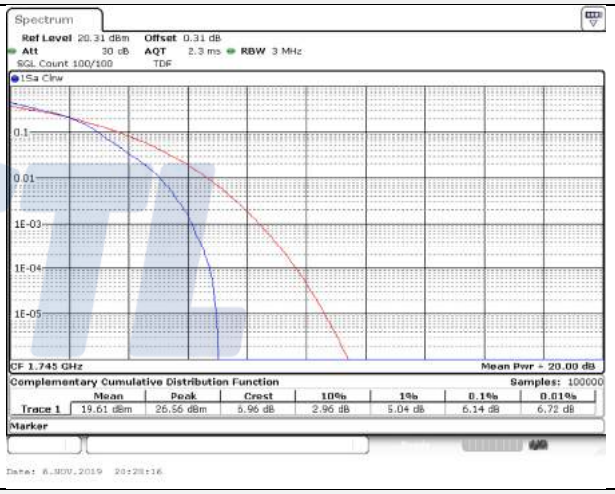
3M BW / 16QAM / Low ch.



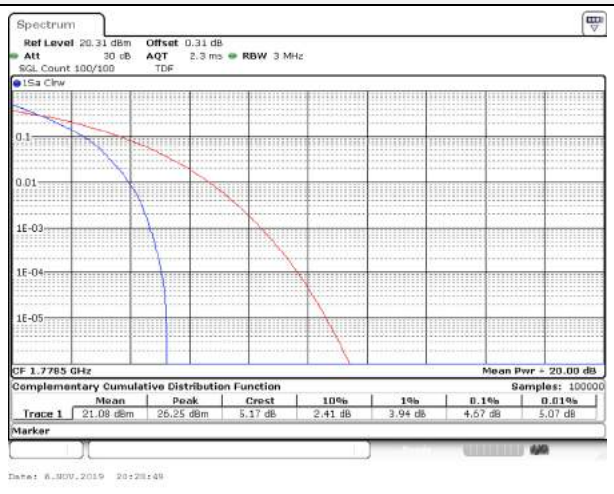
3M BW / QPSK / Mid ch.



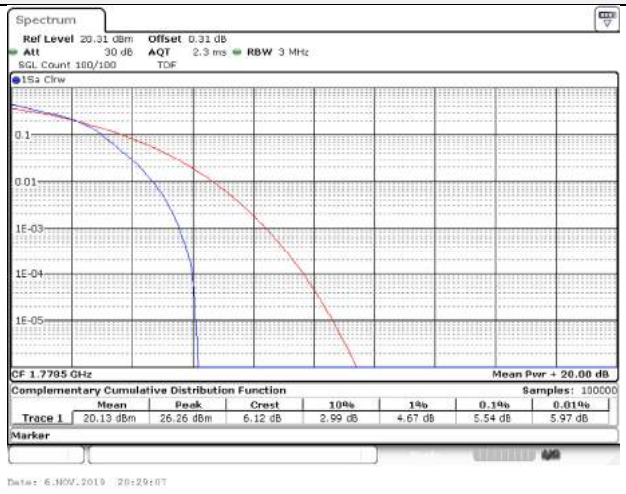
3M BW / 16QAM / Mid ch.



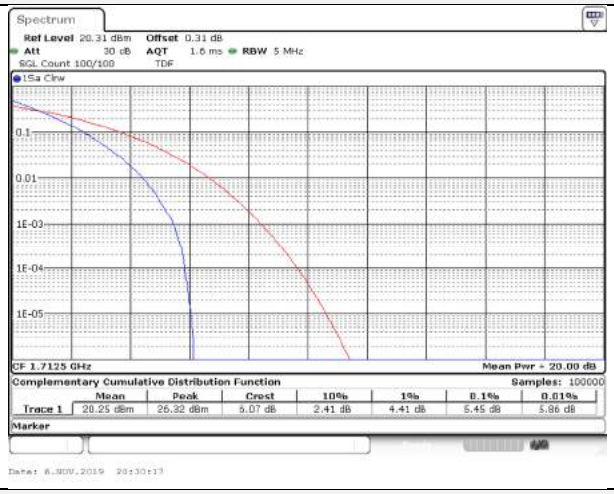
3M BW / QPSK / High ch.



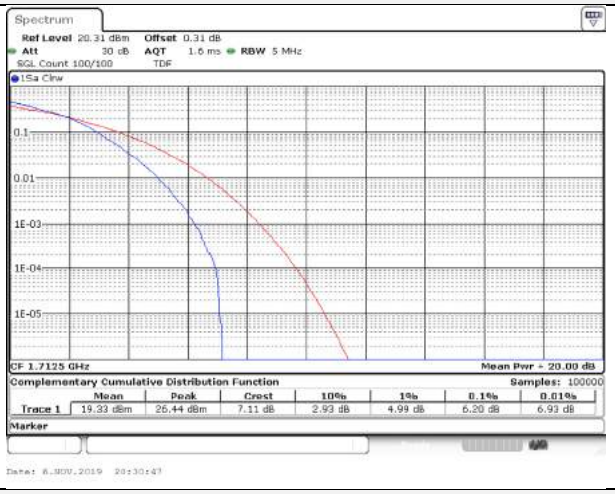
3M BW / 16QAM / High ch.



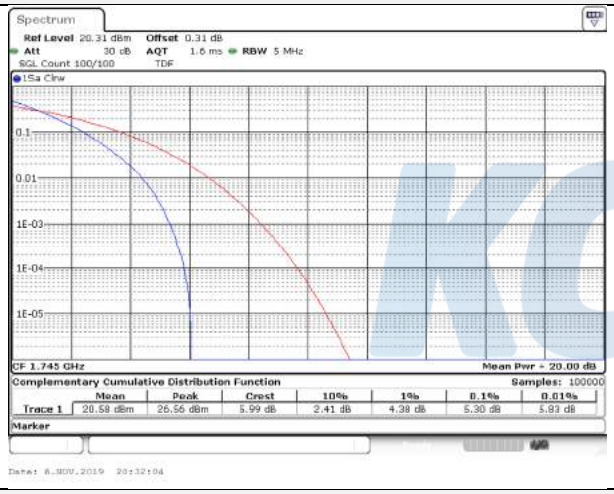
5M BW / QPSK / Low ch.



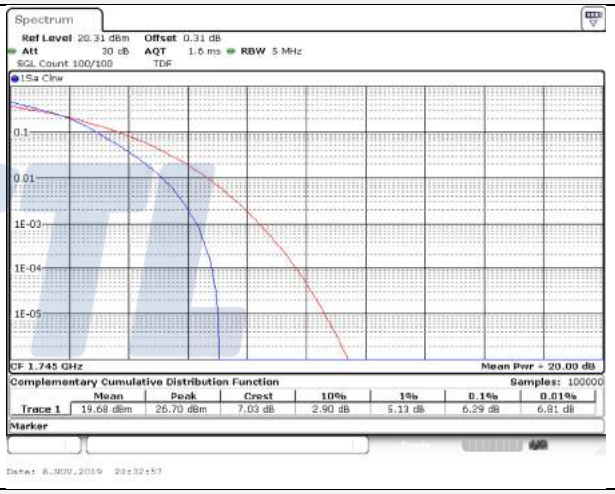
5M BW / 16QAM / Low ch.



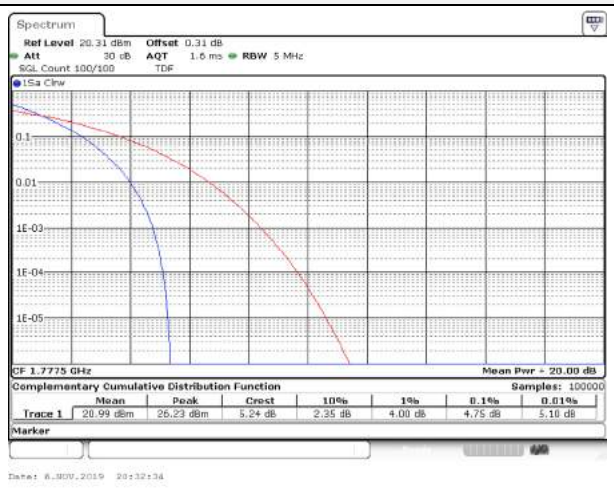
5M BW / QPSK / Mid ch.



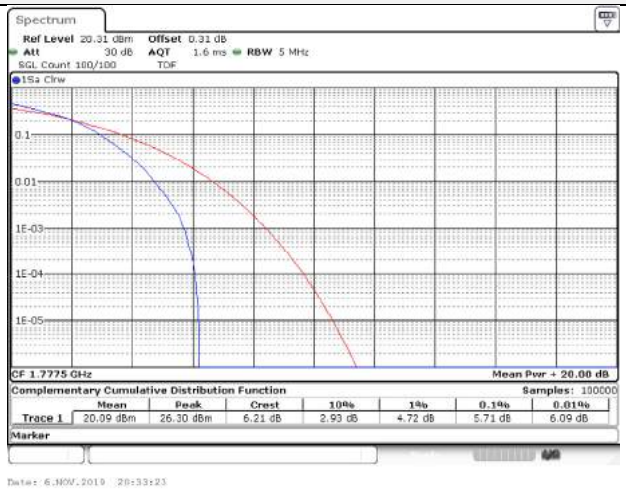
5M BW / 16QAM / Mid ch.

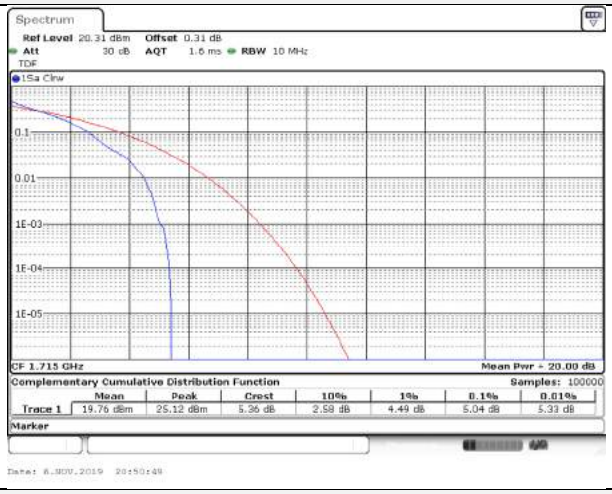
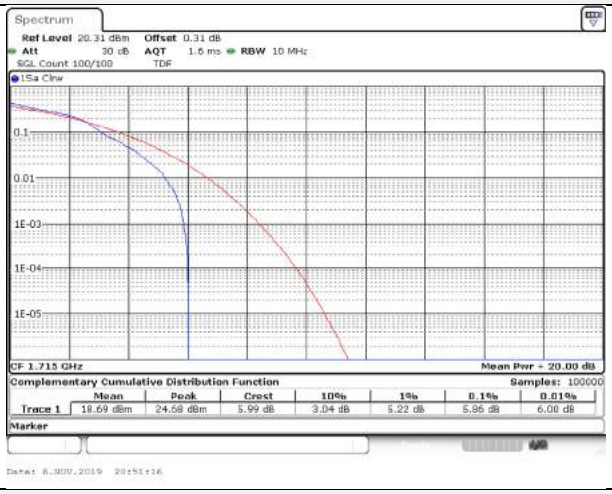
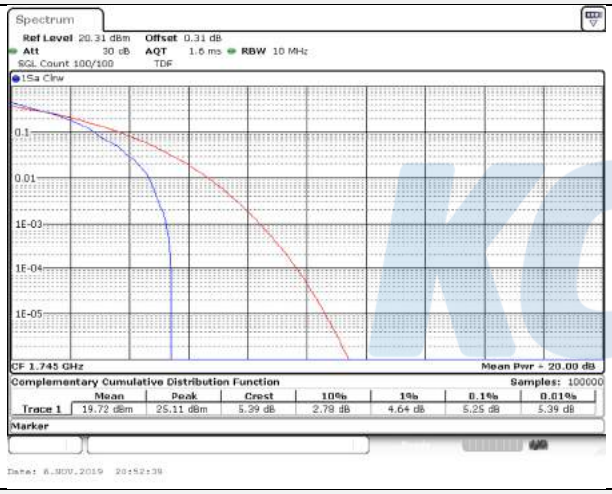
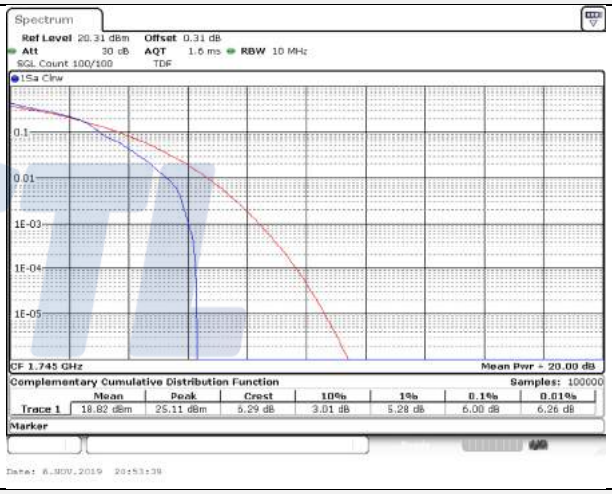
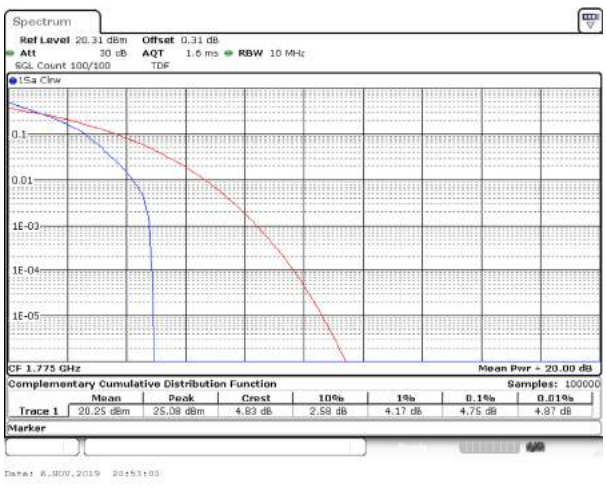
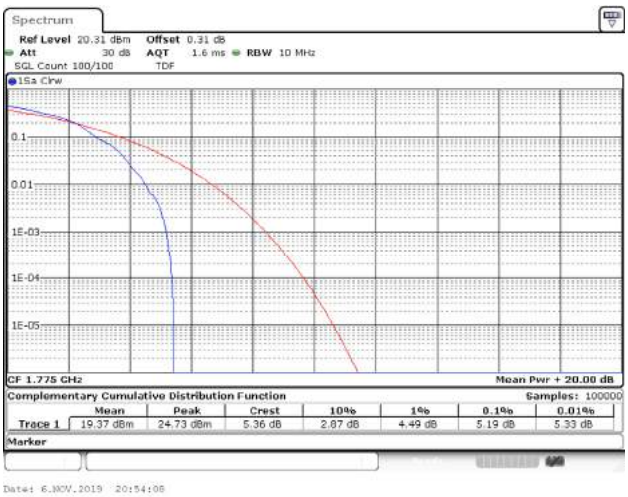


5M BW / QPSK / High ch.

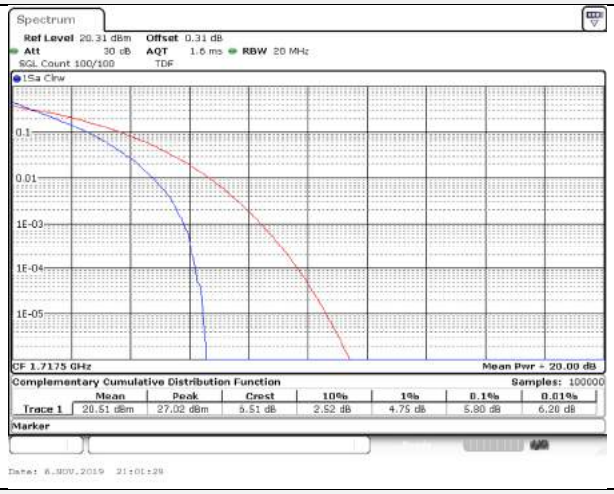


5M BW / 16QAM / High ch.



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.



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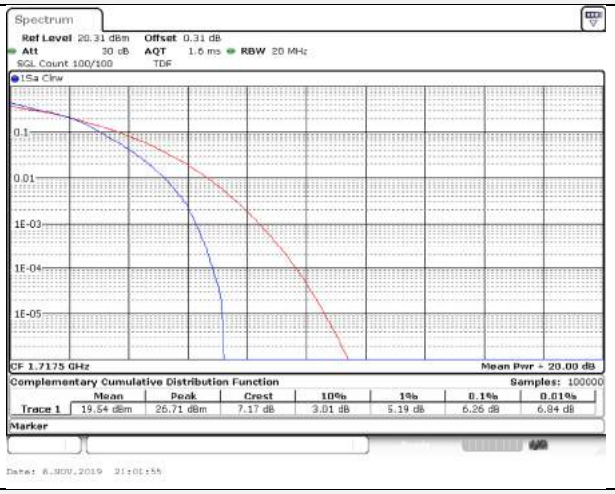
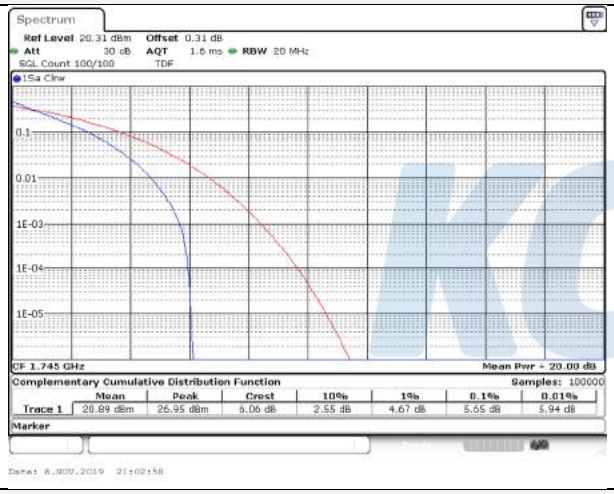
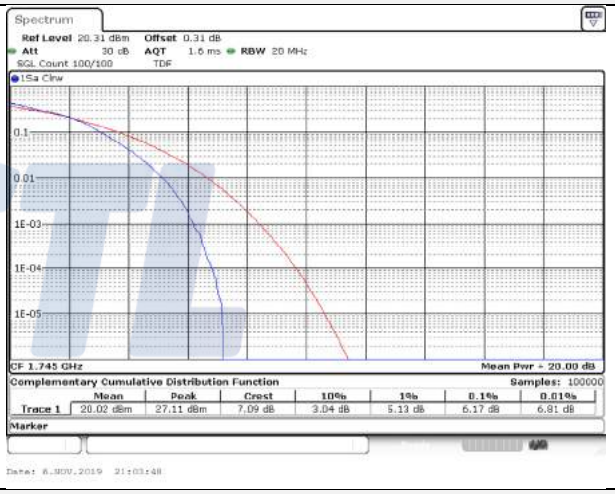


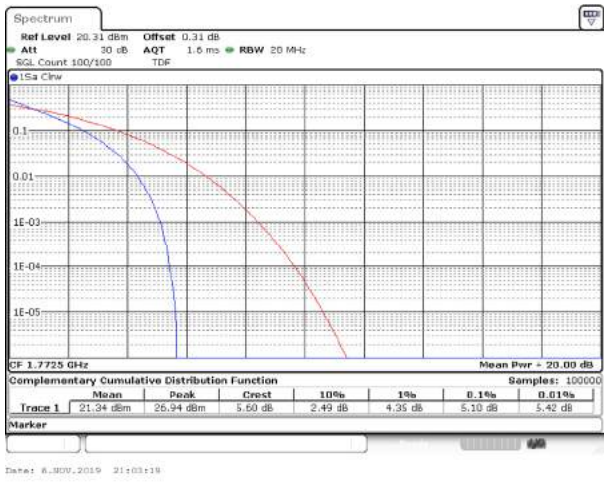
15M BW / QPSK / Mid ch.



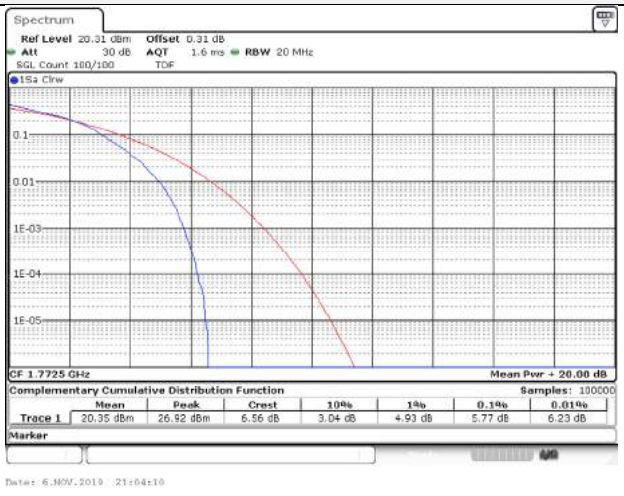
15M BW / 16QAM / Mid ch.

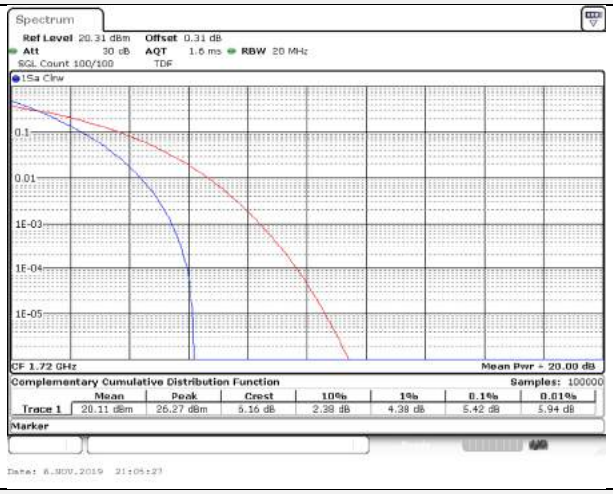
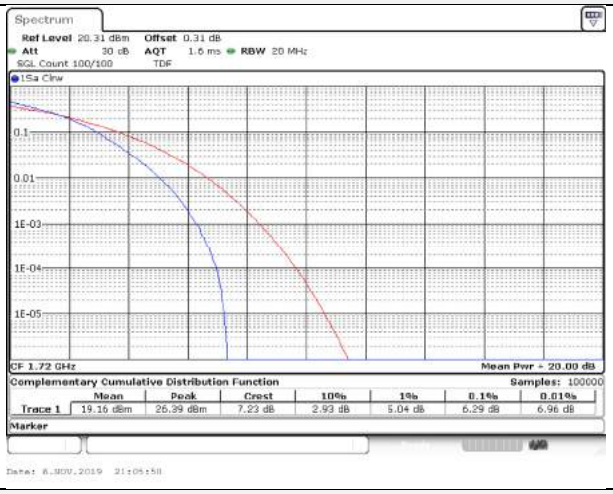
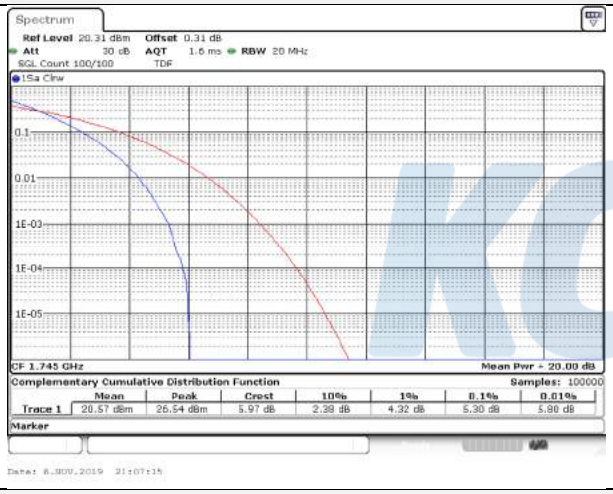
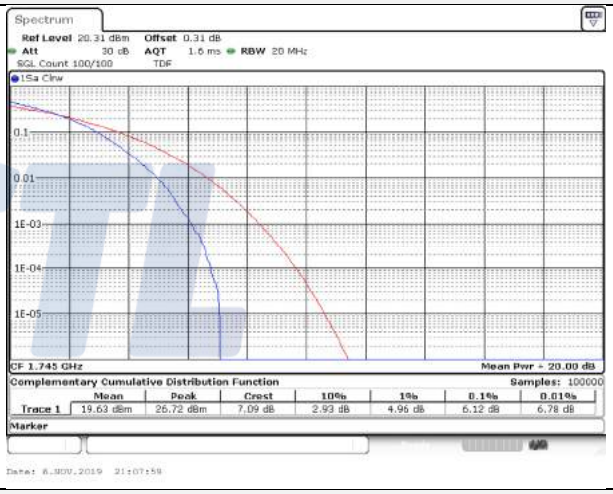
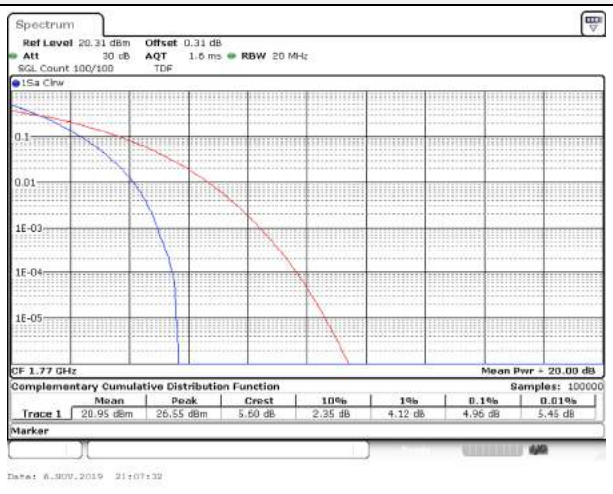
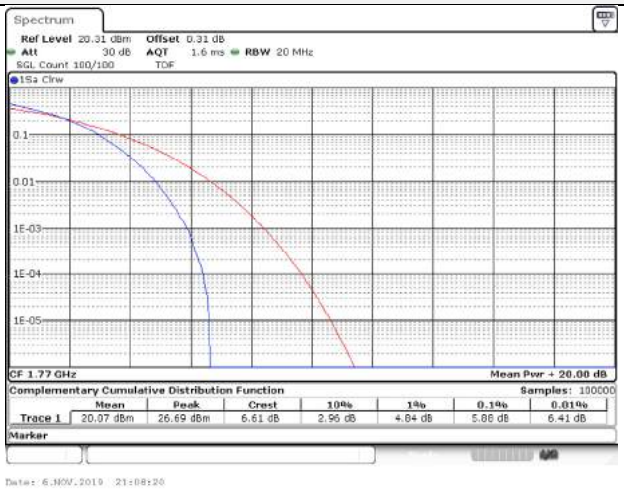


15M BW / QPSK / High ch.



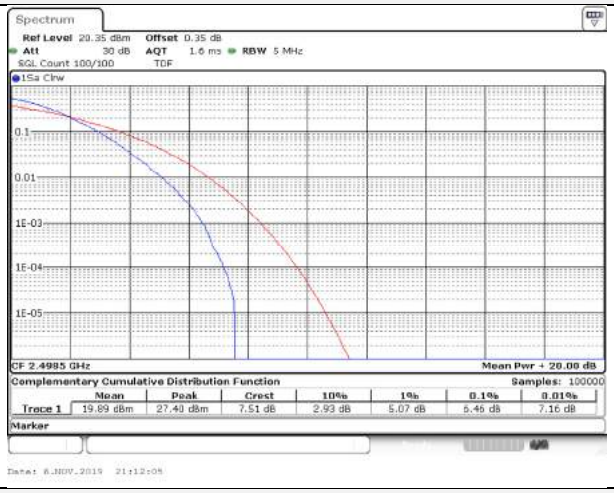
15M BW / 16QAM / High ch.



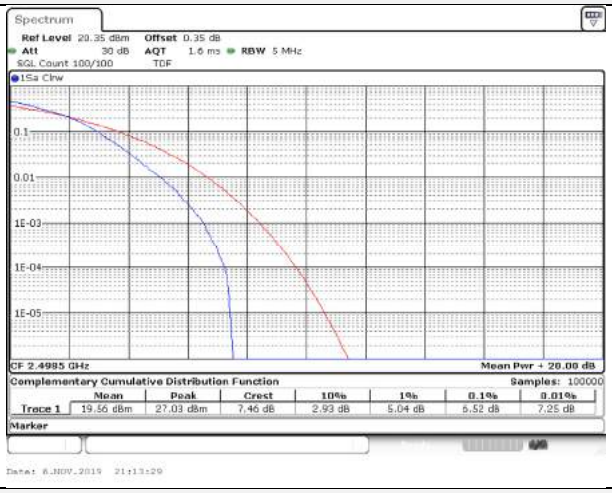
20M BW / QPSK / Low ch.	20M BW / 16QAM / Low ch.
	
20M BW / QPSK / Mid ch.	**20M BW / 16QAM / Mid ch.**
	
20M BW / QPSK / High ch.	**20M BW / 16QAM / High ch.**
	

Test mode: LTE Band 41

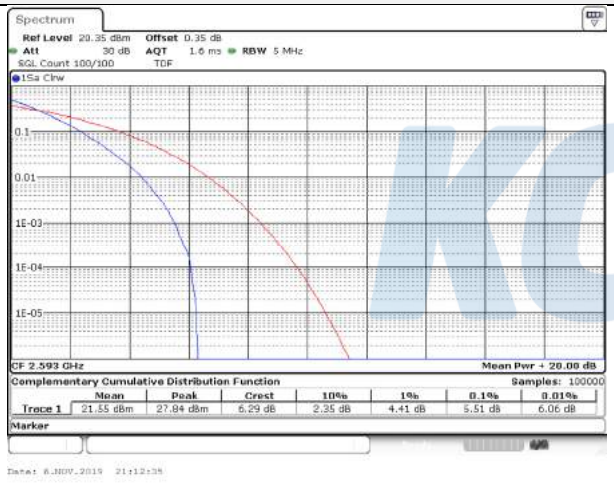
5M BW / QPSK / Low ch.



5M BW / 16QAM / Low ch.



5M BW / QPSK / Mid ch.



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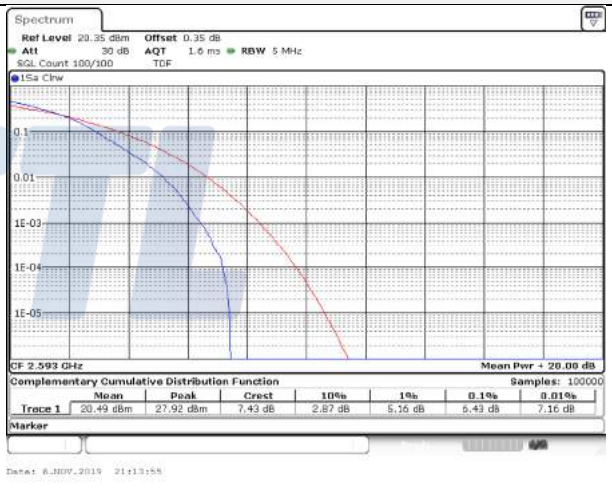
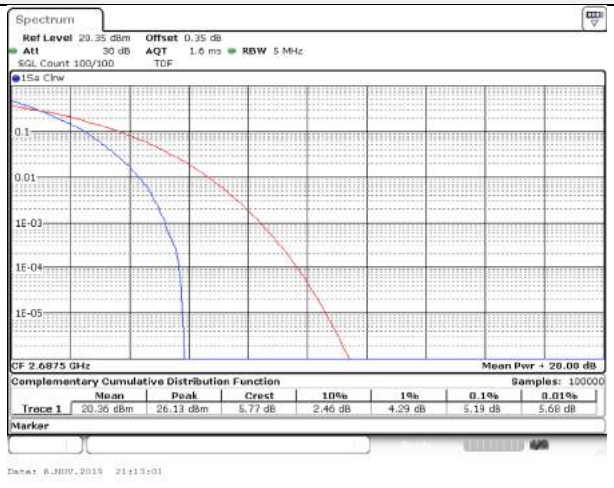
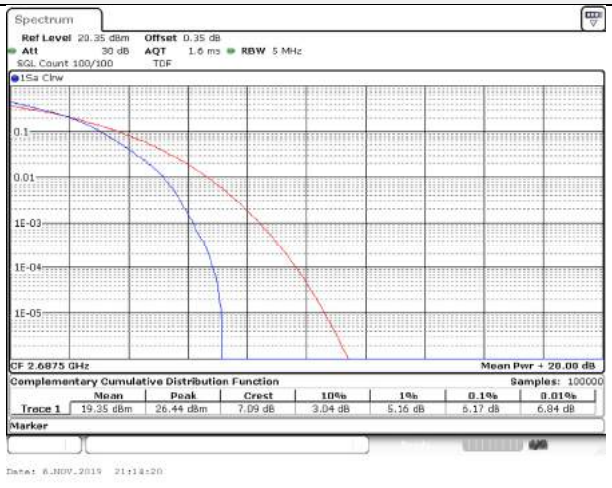


5M BW / QPSK / High ch.



5M BW / 16QAM / High ch.



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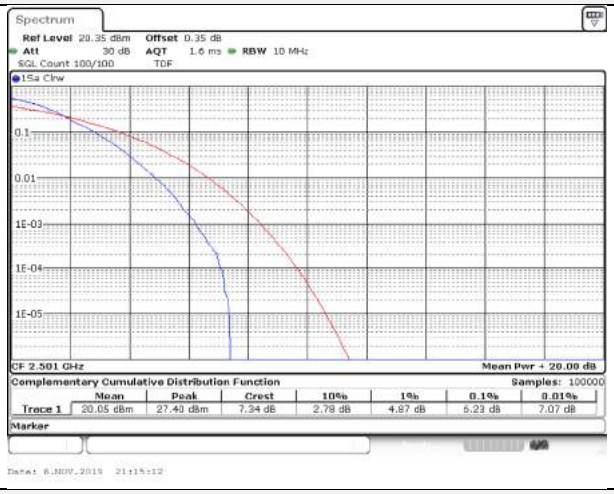
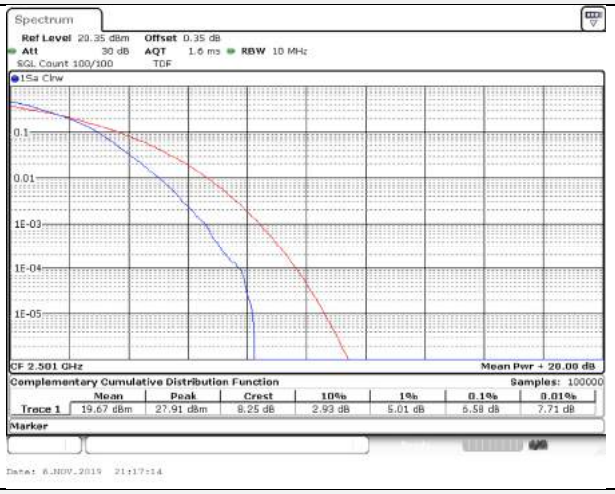
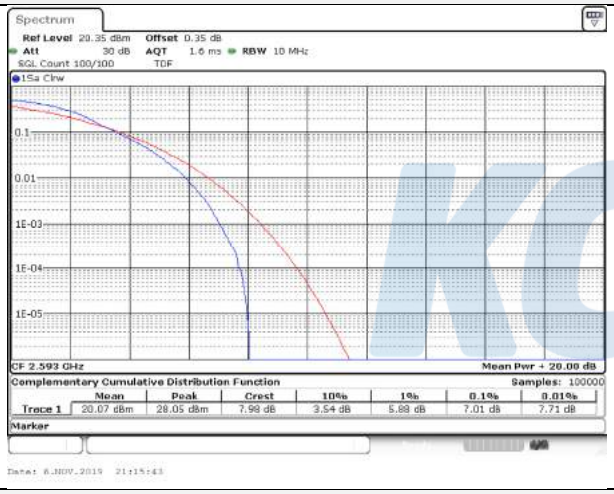


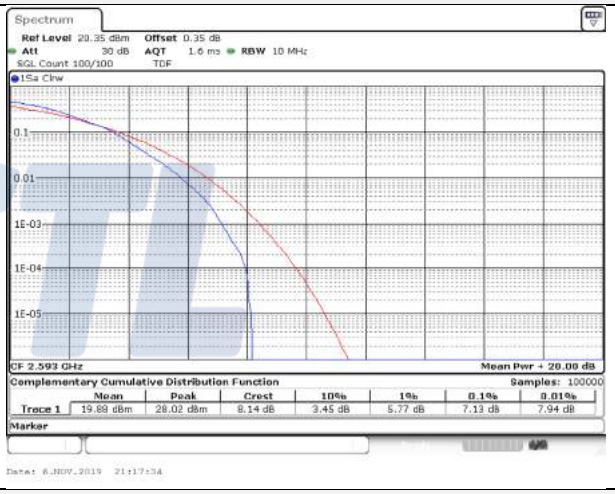
10M BW / 16QAM / Low ch.



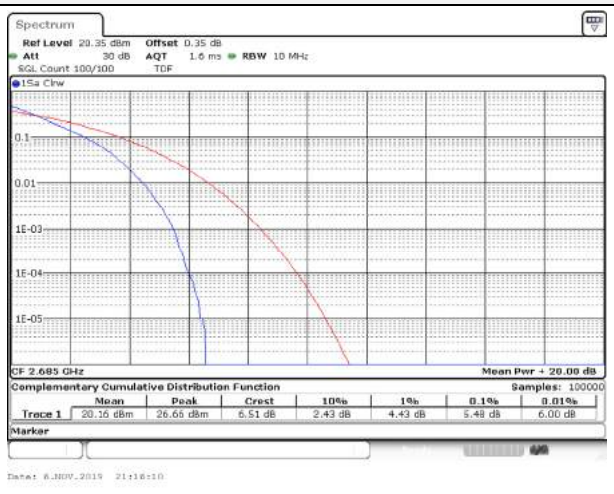
10M BW / QPSK / Mid ch.



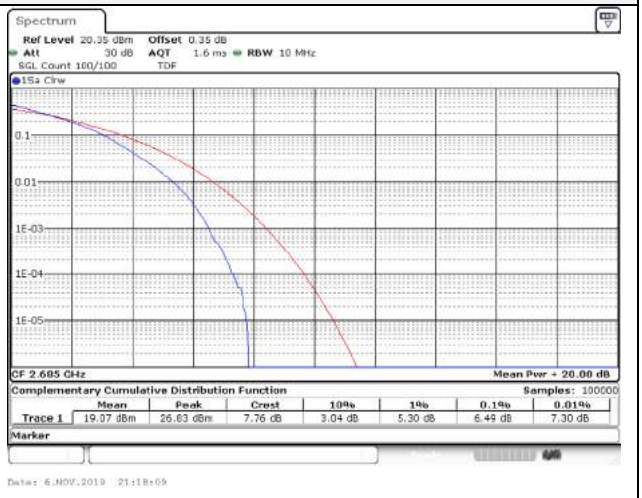
10M BW / 16QAM / Mid ch.



10M BW / QPSK / High ch.



10M BW / 16QAM / High ch.



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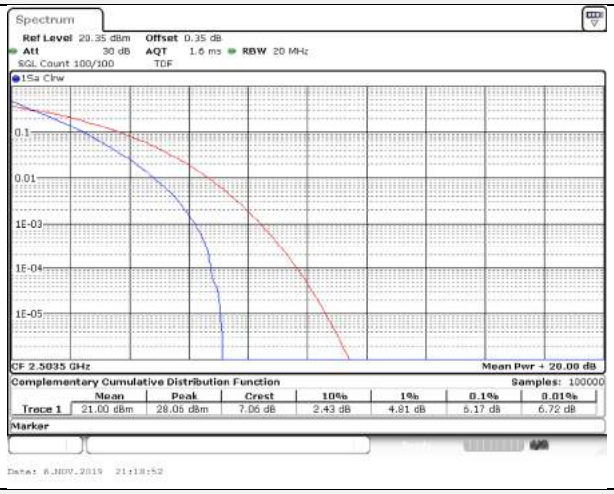
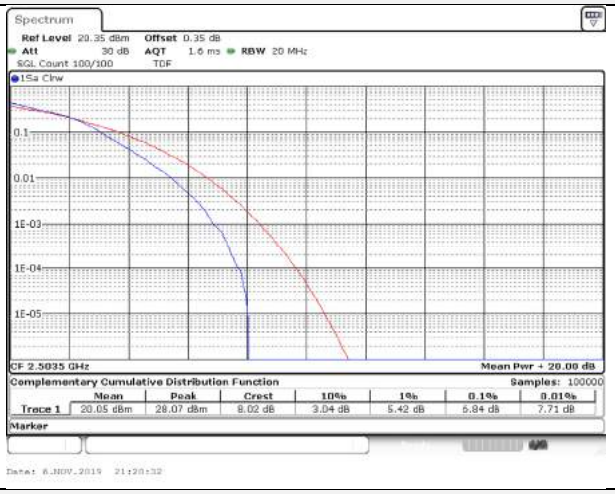
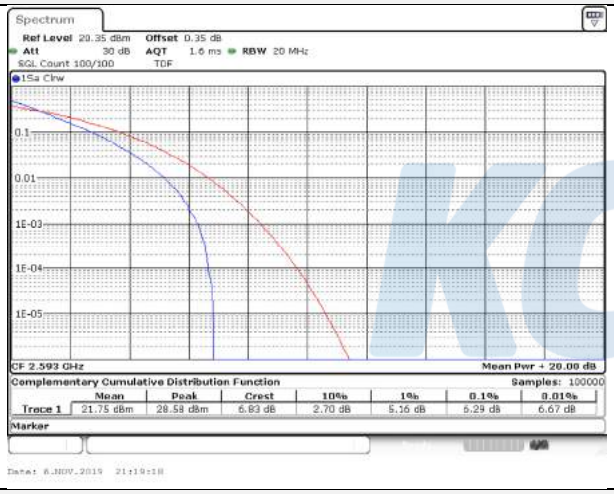


15M BW / 16QAM / Low ch.



15M BW / QPSK / Mid ch.



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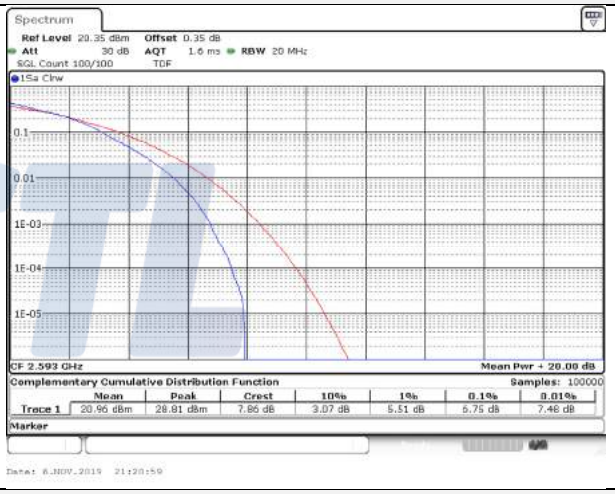

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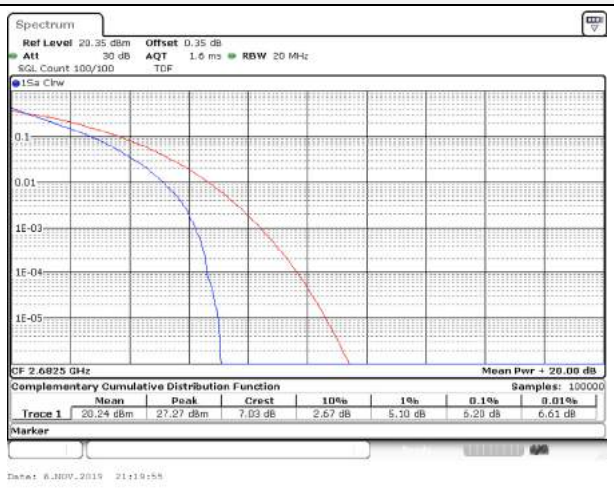

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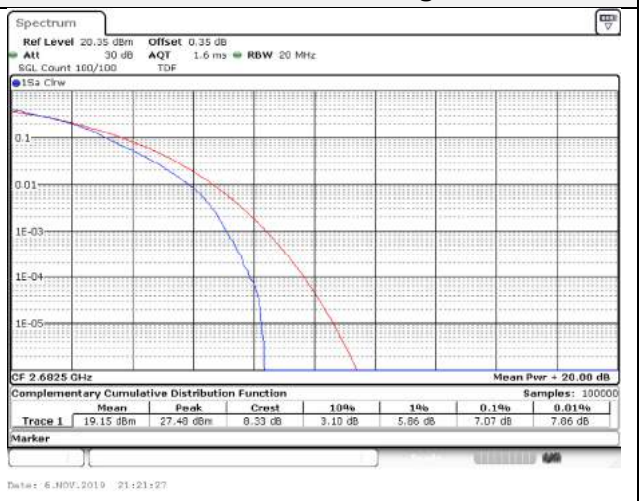

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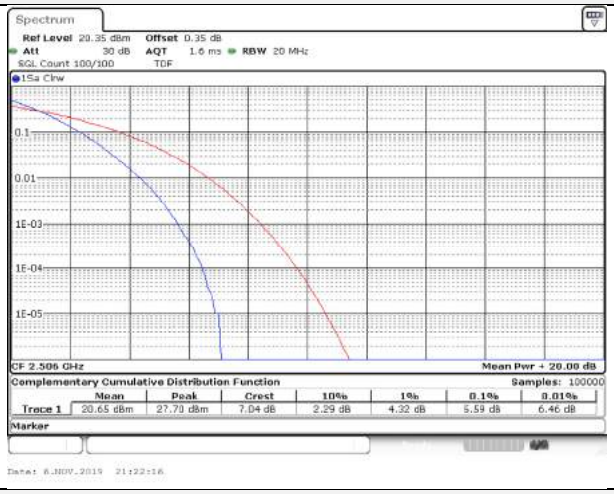
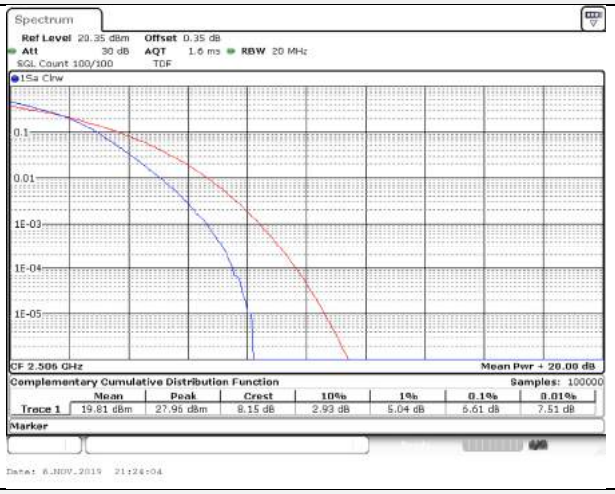
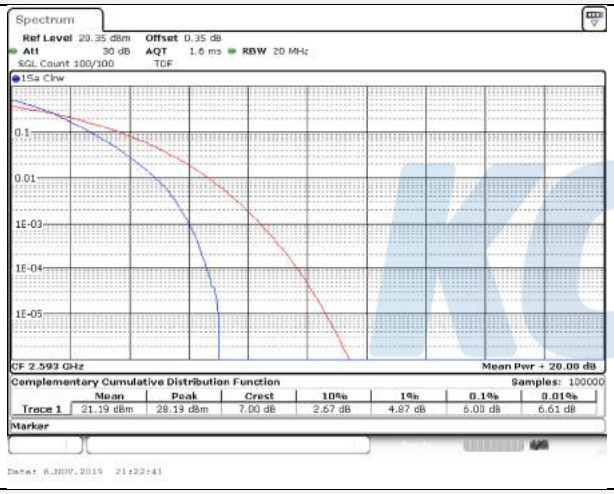


20M BW / 16QAM / Low ch.



20M BW / QPSK / Mid ch.



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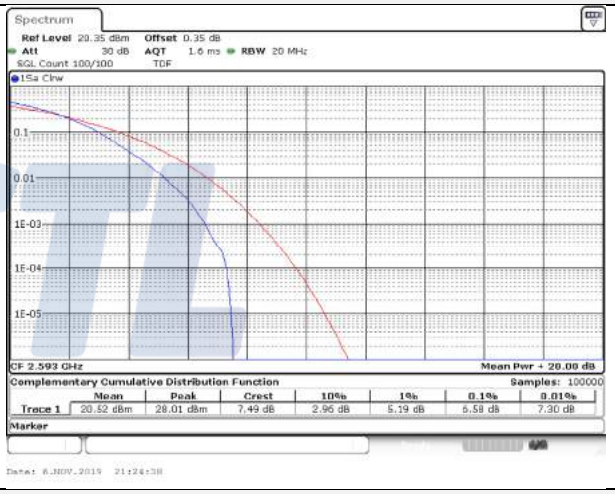
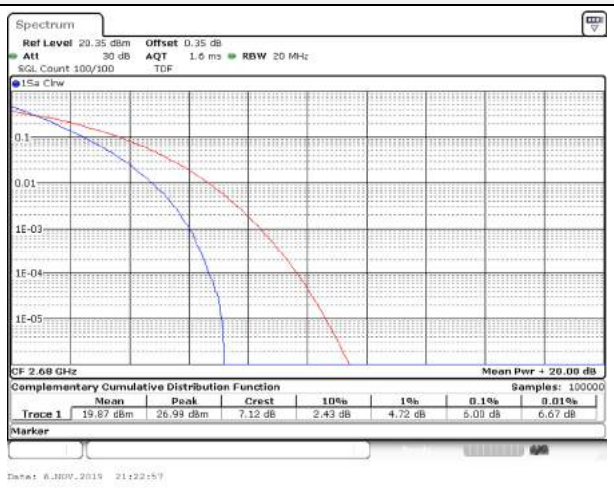
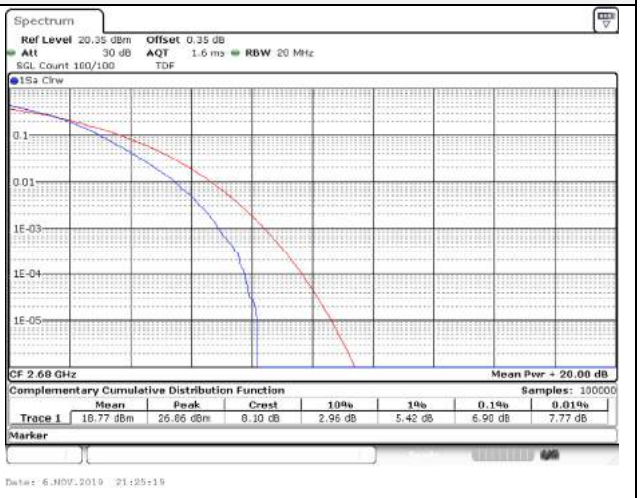


20M BW / QPSK / High ch.

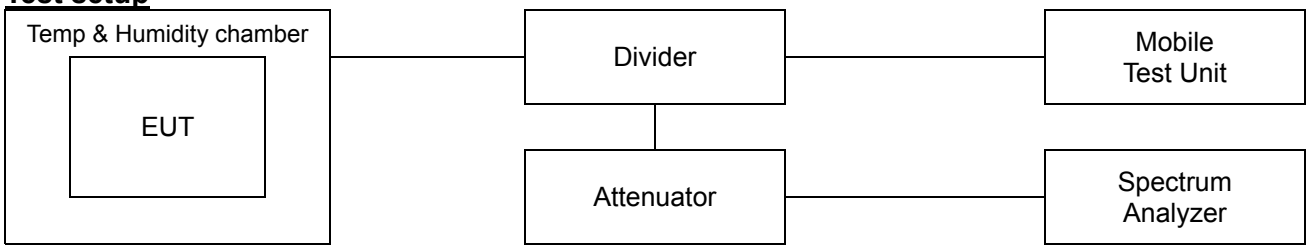


20M BW / 16QAM / High ch.



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 §24.235,

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

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

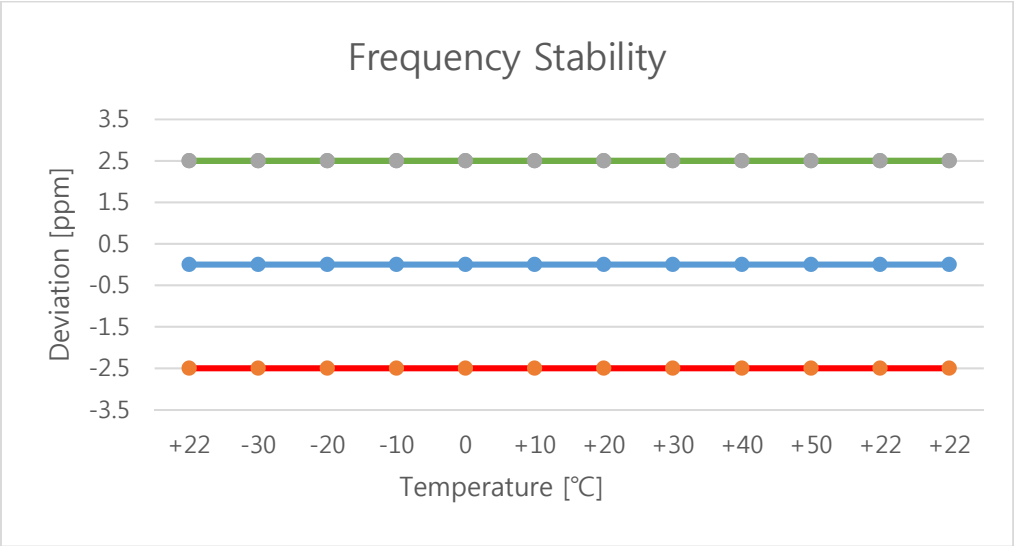
Test settings

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.

Test results

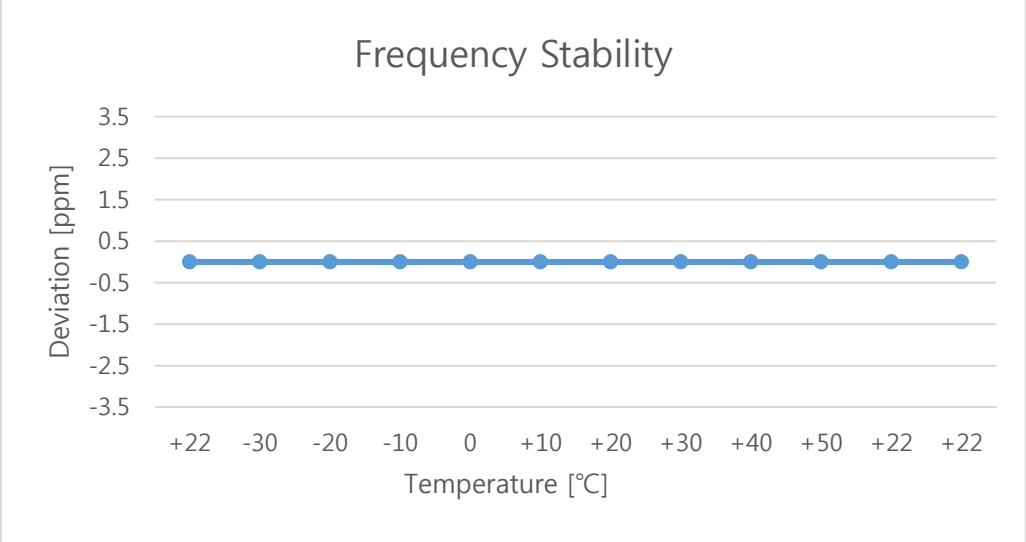
Test mode : LTE Band 2
Frequency (㎐) : 1 880 000 000
Channel : 18900
Deviation limit : ±0.00025% or 2.5ppm

Voltage (%)	Power (V)	Temp. (°C)	Frequency (㎐)	Frequency error (㎐)	Deviation	
					(ppm)	(%)
100%	3.85	+22(Ref)	1,879,999,999	-1.44	0.0	0.000000
		-30	1,879,999,997	-3.00	0.0	0.000000
		-20	1,879,999,998	-2.33	0.0	0.000000
		-10	1,879,999,999	-1.11	0.0	0.000000
		0	1,880,000,001	0.74	0.0	0.000000
		+10	1,880,000,000	-0.39	0.0	0.000000
		+20	1,880,000,000	-0.20	0.0	0.000000
		+30	1,879,999,998	-1.70	0.0	0.000000
		+40	1,879,999,997	-3.34	0.0	0.000000
		+50	1,879,999,995	-5.04	0.0	0.000000
115%	4.43	+22	1,879,999,998	-1.95	0.0	0.000000
End point	2.55	+22	1,879,999,999	-1.30	0.0	0.000000



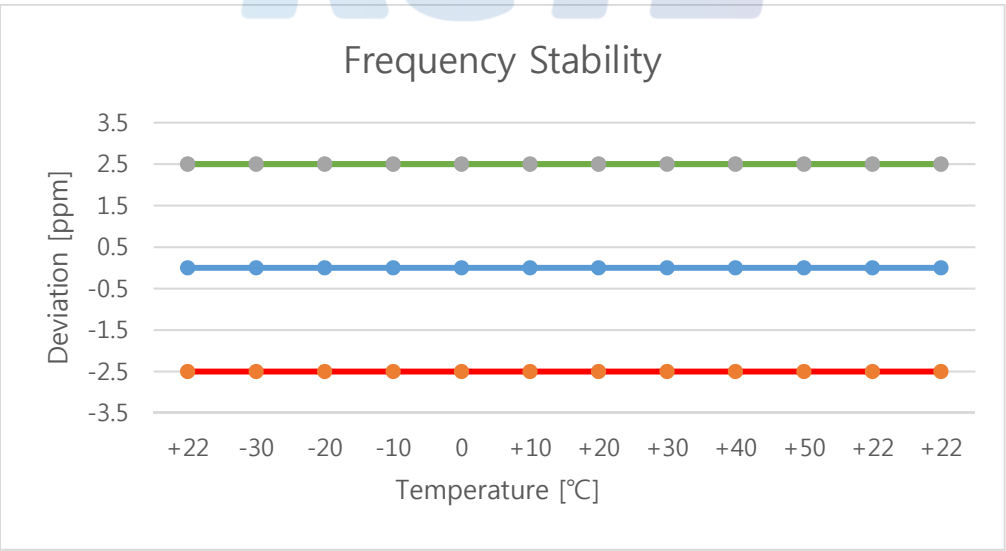
Test mode : LTE Band 4/66
Frequency (㎐) : 1 745 000 000
Channel : 132322
Deviation limit : The frequency stability shall be sufficient to ensure that the fundamental emission stays wthin the authorized frequency block.

Voltage (%)	Power (V)	Temp. (°C)	Frequency (㎐)	Frequency error (㎐)	Deviation	
					(ppm)	(%)
100%	3.85	+22(Ref)	1,745,000,002	1.54	0.0	0.000000
		-30	1,744,999,997	-2.95	0.0	0.000000
		-20	1,744,999,997	-2.66	0.0	0.000000
		-10	1,744,999,998	-1.58	0.0	0.000000
		0	1,744,999,998	-1.58	0.0	0.000000
		+10	1,744,999,999	-0.58	0.0	0.000000
		+20	1,745,000,001	0.97	0.0	0.000000
		+30	1,745,000,000	0.36	0.0	0.000000
		+40	1,744,999,999	-1.18	0.0	0.000000
		+50	1,744,999,998	-1.93	0.0	0.000000
115%	4.43	+22	1,745,000,001	1.47	0.0	0.000000
End point	2.55	+22	1,745,000,001	1.26	0.0	0.000000



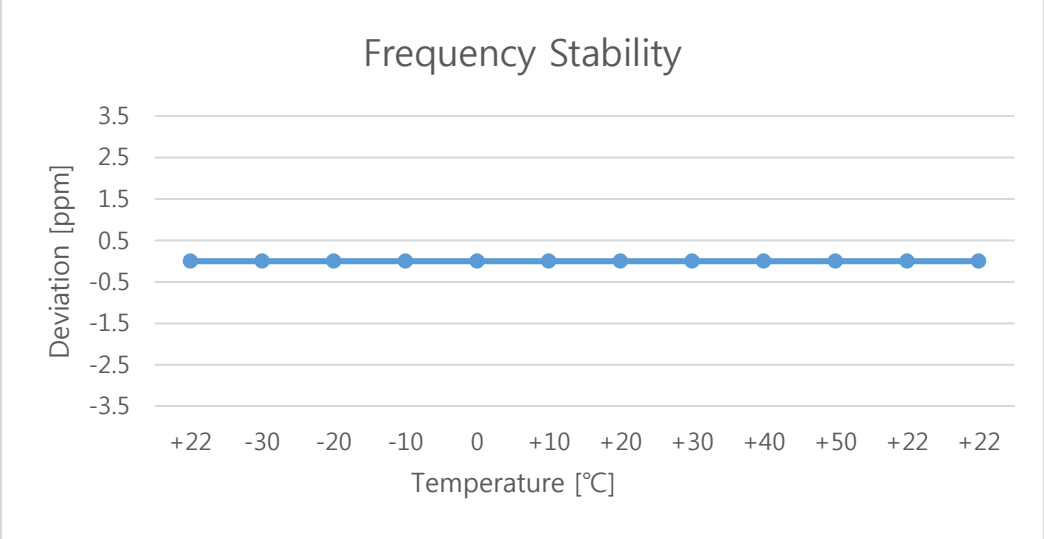
Test mode : LTE Band 5
Frequency (㎐) : 836 500 000
Channel : 20525
Deviation limit : ±0.00025% or 2.5ppm

Voltage (%)	Power (V)	Temp. (°C)	Frequency (㎐)	Frequency error (㎐)	Deviation	
					(ppm)	(%)
100%	3.85	+22(Ref)	836,500,001.24	1.24	0.0	0.000000
		-30	836,499,998.43	-1.57	0.0	0.000000
		-20	836,499,997.99	-2.01	0.0	0.000000
		-10	836,499,998.56	-1.44	0.0	0.000000
		0	836,500,000.59	0.59	0.0	0.000000
		+10	836,500,001.17	1.17	0.0	0.000000
		+20	836,500,002.16	2.16	0.0	0.000000
		+30	836,499,998.06	-1.94	0.0	0.000000
		+40	836,499,996.57	-3.43	0.0	0.000000
		+50	836,499,997.97	-2.03	0.0	0.000000
115%	4.43	+22	836,500,001.83	1.83	0.0	0.000000
End point	2.55	+22	836,500,001.30	1.30	0.0	0.000000



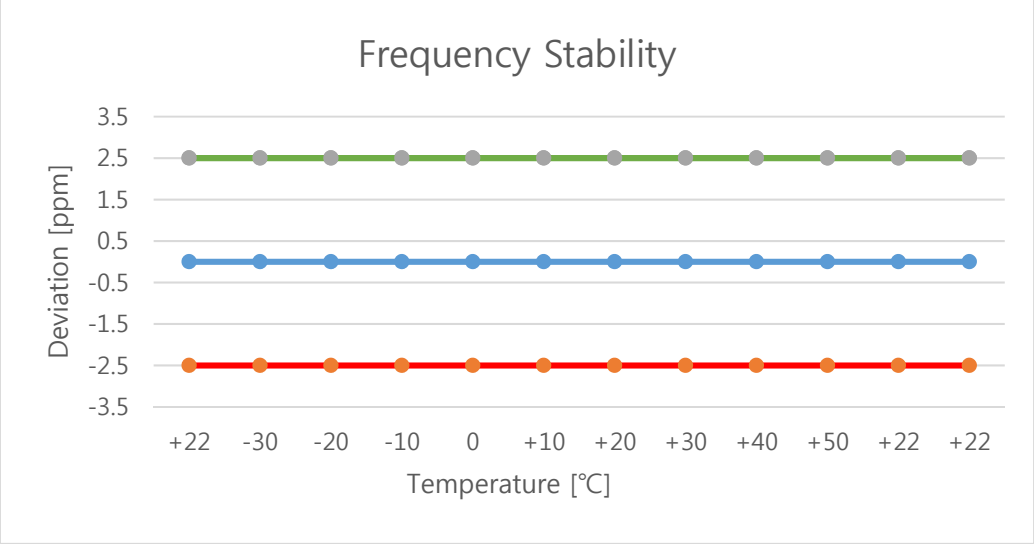
Test mode : LTE Band 12/17
Frequency (㎐) : 707 500 000
Channel : 23095
Deviation limit : The frequency stability shall be sufficient to ensure that the fundamental emission stays wthin the authorized frequency block.

Voltage (%)	Power (V)	Temp. (°C)	Frequency (㎐)	Frequency error (㎐)	Deviation	
					(ppm)	(%)
100%	3.85	+22(Ref)	707,500,001	1.00	0.0	0.000000
		-30	707,499,999	-1.06	0.0	0.000000
		-20	707,499,999	-1.34	0.0	0.000000
		-10	707,499,998	-2.01	0.0	0.000000
		0	707,499,998	-1.90	0.0	0.000000
		+10	707,500,001	0.55	0.0	0.000000
		+20	707,500,001	1.31	0.0	0.000000
		+30	707,500,000	0.29	0.0	0.000000
		+40	707,499,998	-1.66	0.0	0.000000
		+50	707,499,998	-1.86	0.0	0.000000
115%	4.43	+22	707,500,002	1.67	0.0	0.000000
End point	2.55	+22	707,500,002	1.66	0.0	0.000000



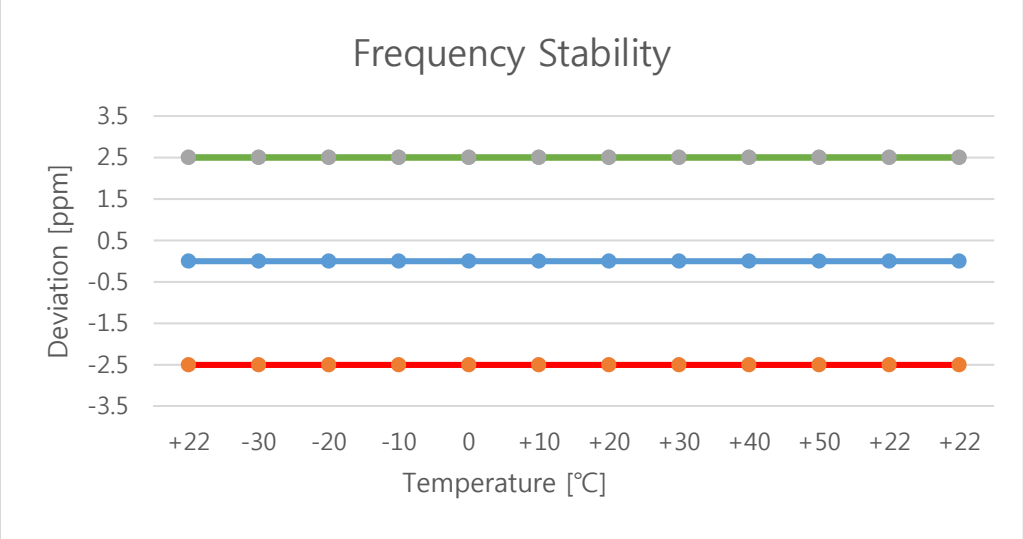
Test mode : LTE Band 13
Frequency (㎐) : 782 000 000
Channel : 23230
Deviation limit : ±0.00025% or 2.5ppm

Voltage (%)	Power (V)	Temp. (°C)	Frequency (㎐)	Frequency error (㎐)	Deviation	
					(ppm)	(%)
100%	3.85	+22(Ref)	782,000,002	2.22	0.0	0.000000
		-30	782,000,002	1.60	0.0	0.000000
		-20	782,000,002	1.93	0.0	0.000000
		-10	781,999,997	-2.55	0.0	0.000000
		0	781,999,999	-0.91	0.0	0.000000
		+10	782,000,000	0.26	0.0	0.000000
		+20	782,000,001	0.88	0.0	0.000000
		+30	781,999,999	-1.34	0.0	0.000000
		+40	781,999,997	-2.64	0.0	0.000000
		+50	781,999,996	-3.55	0.0	0.000000
115%	4.43	+22	782,000,002	2.06	0.0	0.000000
End point	2.55	+22	782,000,002	1.59	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.

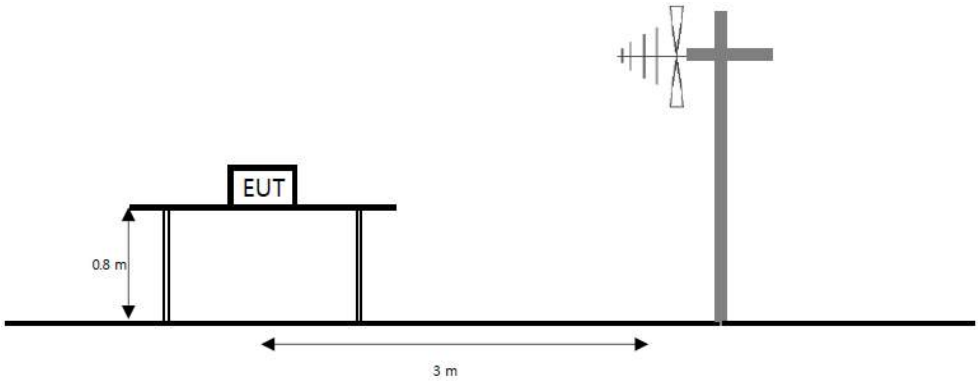
Voltage (%)	Power (V)	Temp. (°C)	Frequency (㎐)	Frequency error (㎐)	Deviation	
					(ppm)	(%)
100%	3.85	+22(Ref)	2,592,999,993	-6.81	0.0	0.000000
		-30	2,592,999,994	-6.34	0.0	0.000000
		-20	2,592,999,993	-7.11	0.0	0.000000
		-10	2,592,999,992	-7.64	0.0	0.000000
		0	2,592,999,995	-4.84	0.0	0.000000
		+10	2,592,999,997	-3.33	0.0	0.000000
		+20	2,592,999,994	-5.99	0.0	0.000000
		+30	2,593,000,001	0.67	0.0	0.000000
		+40	2,593,000,001	1.19	0.0	0.000000
		+50	2,593,000,002	2.07	0.0	0.000000
115%	4.43	+22	2,592,999,993	-7.40	0.0	0.000000
End point	2.55	+22	2,592,999,991	-8.83	0.0	0.000000



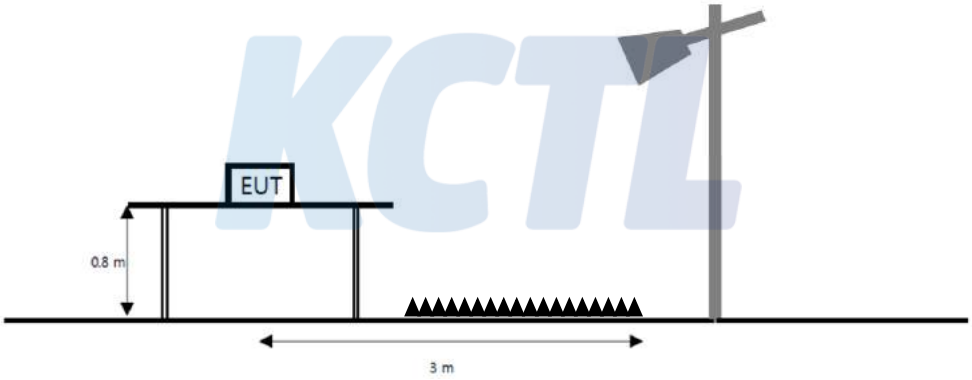
7.7. Radiated Power (ERP/EIRP)

Test setup

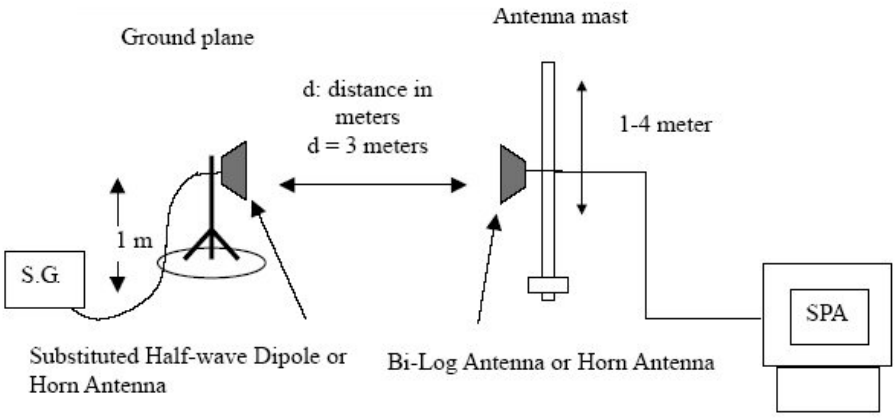
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.



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 §24.232(c), mobile and portable stations are limited to 2 watts EIRP and the equipment must employ a means for limiting power to the minimum necessary for successful communications.

According to §27.50(b)(10), 27.50(c)(10), Portable stations (hand-held devices) in the 698 -746㎒, 746-757㎒, 776-788㎒, and 805-806 ㎒ bands are limited 3 watts ERP.

According to §27.50(d)(4), fixed, mobile, and portable (hand-held) stations operating in the 1710~1755 ㎒ band and mobile and portable stations operating in the 1695~1710 ㎒ and 1755~1780 ㎒ bands are 1 watt EIRP.

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.
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(㏈m) = Pg(㏈m) – Cable loss (㏈) + Antenna gain (㏈)
   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 ㏈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.

Test results

Test mode: LTE Band 2

Bandwidth	Modulation	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	EIRP	
		[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[W]
1.4 M	QPSK	1 850.7	H	6.18	5.74	18.66	19.10	0.081
		1 880.0	H	6.14	5.78	18.80	19.16	0.082
		1 909.3	H	6.11	5.81	20.22	20.52	0.113
	16QAM	1 850.7	H	6.18	5.74	17.43	17.87	0.061
		1 880.0	H	6.14	5.78	17.66	18.02	0.063
		1 909.3	H	6.11	5.81	19.23	19.53	0.090
3 M	QPSK	1 851.5	H	6.18	5.74	18.28	18.72	0.074
		1 880.0	H	6.14	5.78	18.96	19.32	0.086
		1 908.5	H	6.11	5.81	19.79	20.09	0.102
	16QAM	1 851.5	H	6.18	5.74	17.20	17.64	0.058
		1 880.0	H	6.14	5.78	17.92	18.28	0.067
		1 908.5	H	6.11	5.81	18.77	19.07	0.081
5 M	QPSK	1 852.5	H	6.18	5.74	18.45	18.89	0.077
		1 880.0	H	6.14	5.78	18.85	19.21	0.083
		1 907.5	H	6.11	5.80	20.13	20.44	0.111
	16QAM	1 852.5	H	6.18	5.74	17.64	18.08	0.064
		1 880.0	H	6.14	5.78	17.95	18.31	0.068
		1 907.5	H	6.11	5.80	18.71	19.02	0.080
10 M	QPSK	1 855.0	H	6.17	5.75	18.79	19.21	0.083
		1 880.0	H	6.14	5.78	19.04	19.40	0.087
		1 905.0	H	6.11	5.79	19.96	20.28	0.107
	16QAM	1 855.0	H	6.17	5.75	17.62	18.04	0.064
		1 880.0	H	6.14	5.78	18.03	18.39	0.069
		1 905.0	H	6.11	5.79	18.68	19.00	0.079
15 M	QPSK	1 857.5	H	6.17	5.75	18.82	19.24	0.084
		1 880.0	H	6.14	5.78	19.00	19.36	0.086
		1 902.5	H	6.12	5.79	19.99	20.32	0.108
	16QAM	1 857.5	H	6.17	5.75	17.50	17.92	0.062
		1 880.0	H	6.14	5.78	18.15	18.51	0.071
		1 902.5	H	6.12	5.79	18.88	19.21	0.083
20 M	QPSK	1 860.0	H	6.17	5.75	18.61	19.03	0.080
		1 880.0	H	6.14	5.78	18.98	19.34	0.086
		1 900.0	H	6.12	5.79	19.71	20.04	0.101
	16QAM	1 860.0	H	6.17	5.75	17.66	18.08	0.064
		1 880.0	H	6.14	5.78	18.06	18.42	0.070
		1 900.0	H	6.12	5.79	19.09	19.42	0.087

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

Test mode: LTE Band 4

Bandwidth	Modulation	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	EIRP	
		[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[W]
1.4 M	QPSK	1 710.7	H	6.35	5.48	19.32	20.19	0.104
		1 732.5	H	6.32	5.52	18.75	19.55	0.090
		1 754.3	H	6.29	5.56	20.17	20.90	0.123
	16QAM	1 710.7	H	6.35	5.48	18.27	19.14	0.082
		1 732.5	H	6.32	5.52	17.32	18.12	0.065
		1 754.3	H	6.29	5.56	19.12	19.85	0.097
3 M	QPSK	1 711.5	H	6.35	5.48	19.12	19.99	0.100
		1 732.5	H	6.32	5.52	18.55	19.35	0.086
		1 753.5	H	6.30	5.56	19.99	20.73	0.118
	16QAM	1 711.5	H	6.35	5.48	17.98	18.85	0.077
		1 732.5	H	6.32	5.52	17.27	18.07	0.064
		1 753.5	H	6.30	5.56	18.86	19.60	0.091
5 M	QPSK	1 712.5	H	6.35	5.49	19.23	20.08	0.102
		1 732.5	H	6.32	5.52	18.56	19.36	0.086
		1 752.5	H	6.30	5.55	19.83	20.58	0.114
	16QAM	1 712.5	H	6.35	5.49	18.34	19.19	0.083
		1 732.5	H	6.32	5.52	17.43	18.23	0.067
		1 752.5	H	6.30	5.55	18.76	19.51	0.089
10 M	QPSK	1 715.0	H	6.34	5.50	20.04	20.88	0.122
		1 732.5	H	6.32	5.52	18.98	19.78	0.095
		1 750.0	H	6.30	5.54	18.63	19.39	0.087
	16QAM	1 715.0	H	6.34	5.50	18.79	19.63	0.092
		1 732.5	H	6.32	5.52	18.24	19.04	0.080
		1 750.0	H	6.30	5.54	17.52	18.28	0.067
15 M	QPSK	1 717.5	H	6.34	5.49	20.12	20.97	0.125
		1 732.5	H	6.32	5.52	19.14	19.94	0.099
		1 747.5	H	6.30	5.54	18.50	19.26	0.084
	16QAM	1 717.5	H	6.34	5.49	19.09	19.94	0.099
		1 732.5	H	6.32	5.52	17.94	18.74	0.075
		1 747.5	H	6.30	5.54	17.49	18.25	0.067
20 M	QPSK	1 720.0	H	6.34	5.50	20.38	21.22	0.132
		1 732.5	H	6.32	5.52	19.12	19.92	0.098
		1 745.0	H	6.31	5.56	18.18	18.93	0.078
	16QAM	1 720.0	H	6.34	5.50	19.38	20.22	0.105
		1 732.5	H	6.32	5.52	18.35	19.15	0.082
		1 745.0	H	6.31	5.56	17.02	17.77	0.060

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 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	H	-0.60	3.69	23.25	18.96	0.079
		836.5	H	-0.50	3.72	22.56	18.34	0.068
		848.3	H	-0.50	3.74	22.87	18.63	0.073
	16QAM	824.7	H	-0.60	3.69	21.96	17.67	0.058
		836.5	H	-0.50	3.72	21.54	17.32	0.054
		848.3	H	-0.50	3.74	21.80	17.56	0.057
3 M	QPSK	825.5	H	-0.60	3.70	23.44	19.14	0.082
		836.5	H	-0.50	3.72	23.02	18.80	0.076
		847.5	H	-0.50	3.74	22.99	18.75	0.075
	16QAM	825.5	H	-0.60	3.70	21.59	17.29	0.054
		836.5	H	-0.50	3.72	21.80	17.58	0.057
		847.5	H	-0.50	3.74	21.93	17.69	0.059
5 M	QPSK	826.5	H	-0.60	3.71	23.41	19.10	0.081
		836.5	H	-0.50	3.72	22.84	18.62	0.073
		846.5	H	-0.50	3.73	23.11	18.88	0.077
	16QAM	826.5	H	-0.60	3.71	22.39	18.08	0.064
		836.5	H	-0.50	3.72	21.93	17.71	0.059
		846.5	H	-0.50	3.73	21.83	17.60	0.058
10 M	QPSK	829.0	H	-0.60	3.71	23.68	19.37	0.086
		836.5	H	-0.50	3.72	22.79	18.57	0.072
		844.0	H	-0.50	3.73	22.98	18.75	0.075
	16QAM	829.0	H	-0.60	3.71	22.56	18.25	0.067
		836.5	H	-0.50	3.72	22.13	17.91	0.062
		844.0	H	-0.50	3.73	21.87	17.64	0.058

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 12

Bandwidth	Modulation	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	ERP	
		[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[W]
1.4 M	QPSK	699.7	H	-0.60	3.40	21.54	17.54	0.057
		707.5	H	-0.70	3.42	22.22	18.10	0.065
		715.3	H	-0.80	3.44	23.30	19.06	0.081
	16QAM	699.7	H	-0.60	3.40	20.41	16.41	0.044
		707.5	H	-0.70	3.42	21.33	17.21	0.053
		715.3	H	-0.80	3.44	22.49	18.25	0.067
3 M	QPSK	700.5	H	-0.70	3.40	21.76	17.66	0.058
		707.5	H	-0.70	3.42	22.28	18.16	0.065
		714.5	H	-0.80	3.44	23.30	19.06	0.081
	16QAM	700.5	H	-0.70	3.40	21.31	17.21	0.053
		707.5	H	-0.70	3.42	21.09	16.97	0.050
		714.5	H	-0.80	3.44	21.89	17.65	0.058
5 M	QPSK	701.5	H	-0.70	3.40	21.88	17.78	0.060
		707.5	H	-0.70	3.44	22.26	18.12	0.065
		713.5	H	-0.80	3.44	23.13	18.89	0.077
	16QAM	701.5	H	-0.70	3.40	21.04	16.94	0.049
		707.5	H	-0.70	3.44	21.17	17.03	0.050
		713.5	H	-0.80	3.44	21.50	17.26	0.053
10 M	QPSK	704.0	H	-0.70	3.40	22.19	18.09	0.064
		707.5	H	-0.70	3.44	22.31	18.17	0.066
		711.0	H	-0.80	3.42	23.07	18.85	0.077
	16QAM	704.0	H	-0.70	3.40	21.14	17.04	0.051
		707.5	H	-0.70	3.44	21.45	17.31	0.054
		711.0	H	-0.80	3.42	21.80	17.58	0.057

Test mode: LTE Band 13

Bandwidth	Modulation	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	ERP	
		[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[W]
5 M	QPSK	779.5	H	0.00	3.59	22.42	18.83	0.076
		782.0	H	0.10	3.62	22.05	18.53	0.071
		784.5	H	0.10	3.62	22.08	18.56	0.072
	16QAM	779.5	H	0.00	3.59	21.03	17.44	0.055
		782.0	H	0.10	3.62	21.06	17.54	0.057
		784.5	H	0.10	6.62	23.75	17.23	0.053
10 M	QPSK	782.0	H	0.10	3.62	22.08	18.56	0.072
	16QAM	782.0	H	0.10	3.62	20.87	17.35	0.054

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 17

Bandwidth	Modulation	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	ERP	
		[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[W]
5 M	QPSK	706.5	H	-0.70	3.40	22.29	18.19	0.066
		710.0	H	-0.80	3.42	22.82	18.60	0.072
		713.5	H	-0.80	3.44	23.20	18.96	0.079
	16QAM	706.5	H	-0.70	3.40	21.22	17.12	0.052
		710.0	H	-0.80	3.42	21.68	17.46	0.056
		713.5	H	-0.80	3.44	21.95	17.71	0.059
10 M	QPSK	709.0	H	-0.70	3.42	22.60	18.48	0.070
		710.0	H	-0.80	3.42	22.92	18.70	0.074
		711.0	H	-0.80	3.42	22.98	18.76	0.075
	16QAM	709.0	H	-0.70	3.42	21.70	17.58	0.057
		710.0	H	-0.80	3.42	21.81	17.59	0.057
		711.0	H	-0.80	3.42	22.26	18.04	0.064

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 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	6.00	6.62	21.70	21.08	0.128
		2 593.0	H	6.13	6.78	20.38	19.73	0.094
		2 687.5	H	6.26	6.92	18.48	17.82	0.061
	16QAM	2 498.5	H	6.00	6.62	20.55	19.93	0.098
		2 593.0	H	6.13	6.78	19.16	18.51	0.071
		2 687.5	H	6.26	6.92	18.26	17.60	0.058
10 M	QPSK	2 501.0	H	6.00	6.62	23.72	23.10	0.204
		2 593.0	H	6.13	6.78	24.39	23.74	0.237
		2 685.0	H	6.26	6.92	21.95	21.29	0.135
	16QAM	2 501.0	H	6.00	6.62	22.20	21.58	0.144
		2 593.0	H	6.13	6.78	21.81	21.16	0.131
		2 685.0	H	6.26	6.92	19.22	18.56	0.072
15 M	QPSK	2 503.5	H	6.00	6.63	23.24	22.61	0.182
		2 593.0	H	6.13	6.78	24.17	23.52	0.225
		2 682.5	H	6.26	6.94	21.37	20.69	0.117
	16QAM	2 503.5	H	6.00	6.63	23.20	22.57	0.181
		2 593.0	H	6.13	6.78	21.69	21.04	0.127
		2 682.5	H	6.26	6.94	19.19	18.51	0.071
20 M	QPSK	2 506.0	H	6.01	6.63	23.15	22.53	0.179
		2 593.0	H	6.13	6.78	24.52	23.87	0.244
		2 680.0	H	6.25	6.94	21.03	20.34	0.108
	16QAM	2 506.0	H	6.01	6.63	21.84	21.22	0.132
		2 593.0	H	6.13	6.78	21.23	20.58	0.114
		2 680.0	H	6.25	6.94	20.41	19.72	0.094

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 66

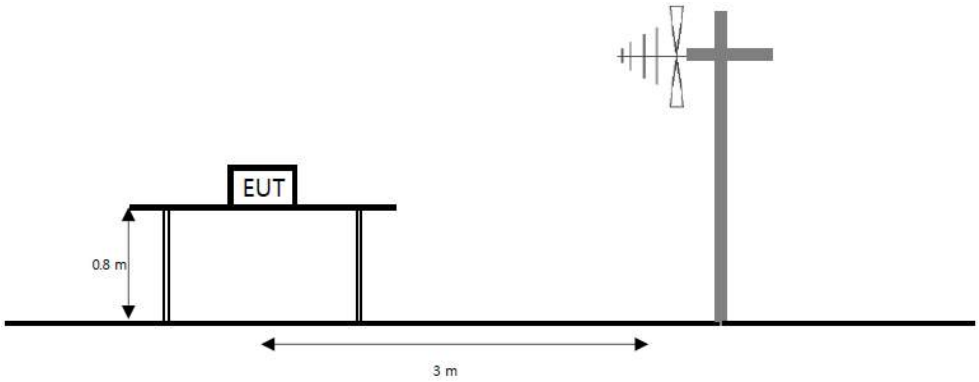
Bandwidth	Modulation	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	EIRP	
		[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[W]
1.4 M	QPSK	1 710.7	H	6.35	5.48	20.63	21.50	0.141
		1 745.0	H	6.31	5.56	19.46	20.21	0.105
		1 779.3	H	6.26	5.58	21.62	22.30	0.170
	16QAM	1 710.7	H	6.35	5.48	19.50	20.37	0.109
		1 745.0	H	6.31	5.56	18.42	19.17	0.083
		1 779.3	H	6.26	5.58	20.60	21.28	0.134
3 M	QPSK	1 711.5	H	6.35	5.48	19.99	20.86	0.122
		1 745.0	H	6.31	5.56	19.78	20.53	0.113
		1 778.5	H	6.27	5.58	21.97	22.66	0.185
	16QAM	1 711.5	H	6.35	5.48	18.82	19.69	0.093
		1 745.0	H	6.31	5.56	19.01	19.76	0.095
		1 778.5	H	6.27	5.58	20.86	21.55	0.143
5 M	QPSK	1 712.5	H	6.35	5.49	20.14	20.99	0.126
		1 745.0	H	6.31	5.56	19.89	20.64	0.116
		1 777.5	H	6.27	5.58	21.51	22.20	0.166
	16QAM	1 712.5	H	6.35	5.49	19.09	19.94	0.099
		1 745.0	H	6.31	5.56	18.71	19.46	0.088
		1 777.5	H	6.27	5.58	20.23	20.92	0.124
10 M	QPSK	1 715.0	H	6.34	5.50	20.79	21.63	0.146
		1 745.0	H	6.31	5.56	19.17	19.92	0.098
		1 775.0	H	6.27	5.57	21.55	22.25	0.168
	16QAM	1 715.0	H	6.34	5.50	19.57	20.41	0.110
		1 745.0	H	6.31	5.56	18.12	18.87	0.077
		1 775.0	H	6.27	5.57	20.31	21.01	0.126
15 M	QPSK	1 717.5	H	6.34	5.49	20.99	21.84	0.153
		1 745.0	H	6.31	5.56	17.55	18.30	0.068
		1 772.5	H	6.27	5.57	19.69	20.39	0.109
	16QAM	1 717.5	H	6.34	5.49	19.97	20.82	0.121
		1 745.0	H	6.31	5.56	17.00	17.75	0.060
		1 772.5	H	6.27	5.57	19.56	20.26	0.106
20 M	QPSK	1 720.0	H	6.34	5.50	19.13	19.97	0.099
		1 745.0	H	6.31	5.56	17.13	17.88	0.061
		1 770.0	H	6.28	5.57	19.26	19.97	0.099
	16QAM	1 720.0	H	6.34	5.50	18.76	19.60	0.091
		1 745.0	H	6.31	5.56	16.97	17.72	0.059
		1 770.0	H	6.28	5.57	18.95	19.66	0.092

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

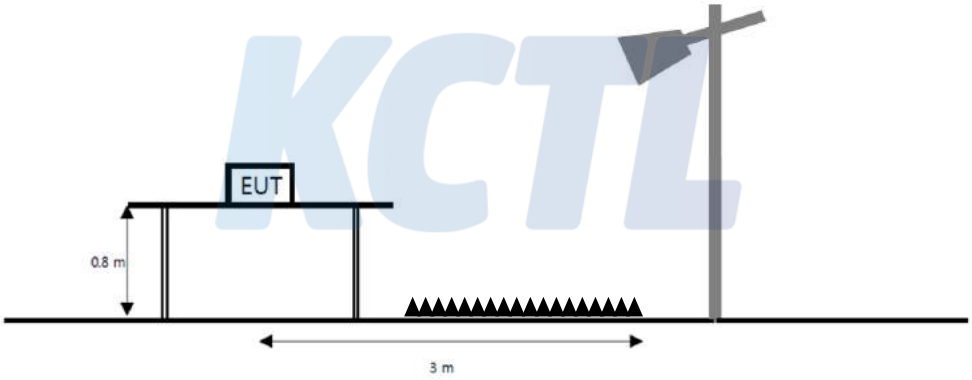
7.8. Radiated Spurious Emissions

Test setup

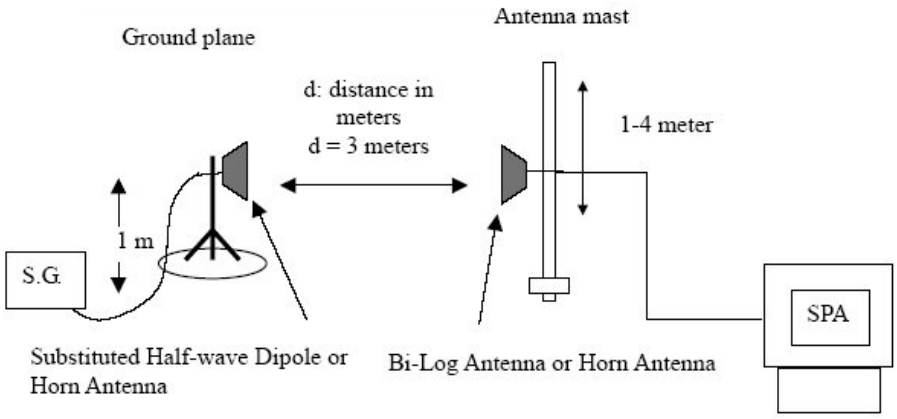
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.



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) and §24.238(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($P_{[Watts]}$) ㏈.

According to §27.53(c)(2), on any frequency outside the 776-788 ㎒ band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10log($P_{[Watts]}$) ㏈ and 27.53(f), for operations in the 746-758 ㎒, 775-788 ㎒, and 805-806 ㎒ bands, emissions in the band 1559-1610 ㎒ shall be limited to -70 ㏈W/㎒ equivalent isotropically radiated power (EIRP) for wideband signals, and -80 ㏈W EIRP for discrete emissions of less than 700 ㎐ bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

According to §27.53(g), for operations in the 600 ㎒ band and the 698-746 ㎒ band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10log($P_{[Watts]}$) ㏈.

According to §27.53(h), the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10log($P_{[Watts]}$) ㏈.

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

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 ㎑ for below 1 ㎓ and 1 ㎒ for above 1 ㎓.
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.

For the narrowband spurious settings:

1) RBW = 1 ㎑
2) VBW = 3 ㎑
3) Detector = RMS
4) Trace mode = Max hold
5) Sweep speed slow enough to maintain measurement calibration.

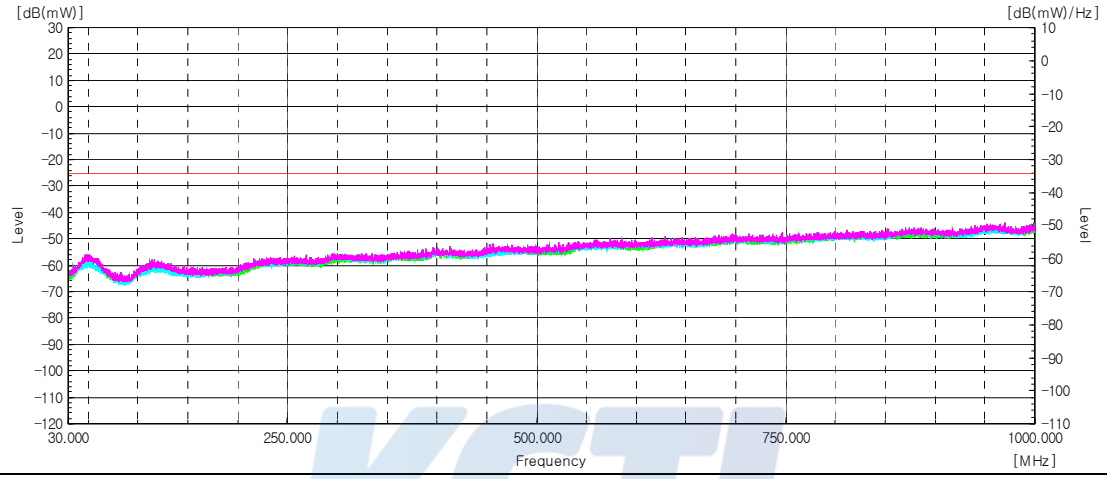
Notes:

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.
11. This EUT was tested under all configurations and the highest power is reported in QPSK modulation.

Test results (Below 1 000 ㎒) – Worst case

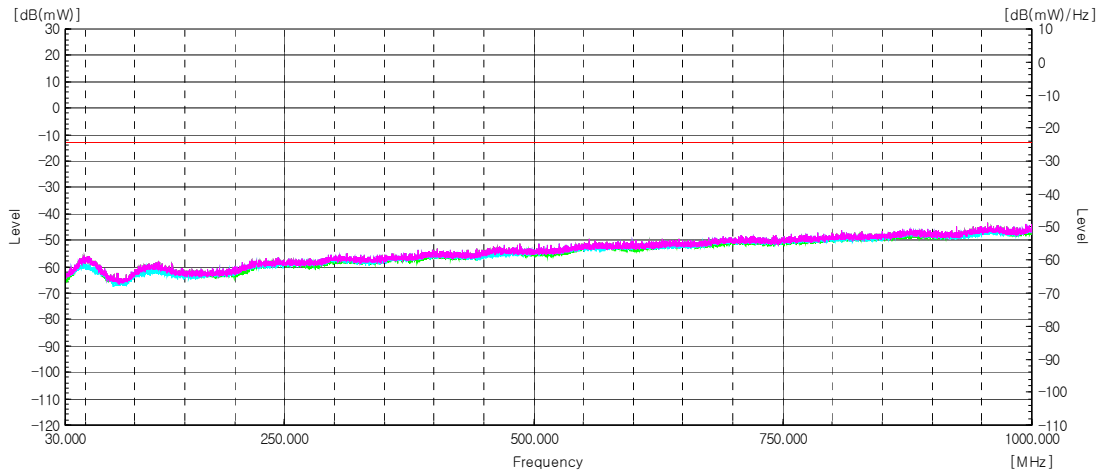
Test mode : LTE Band 2
Frequency (㎒) : 1 909.3
Channel : 19193
Bandwidth (㎒) : 1.4

Horizontal/Vertical



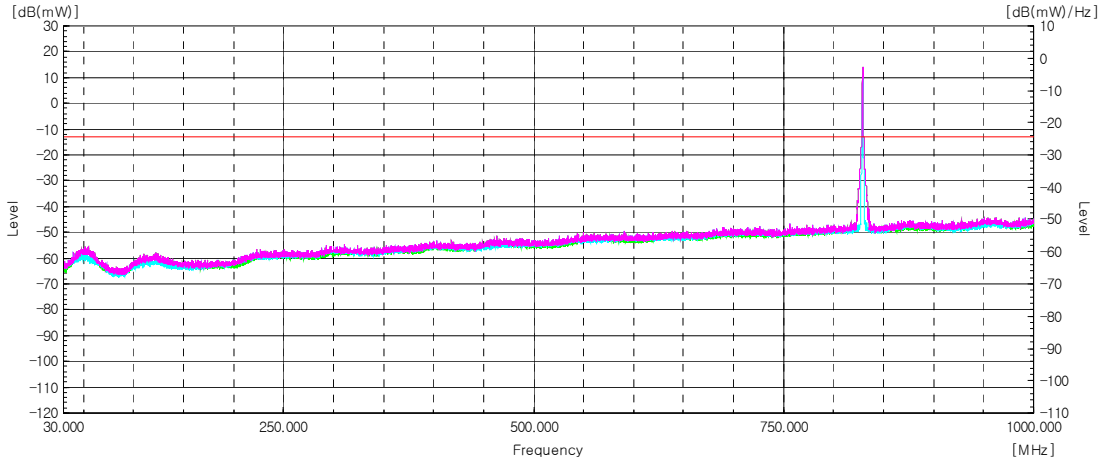
Test mode : LTE Band 4/66
Frequency (㎒) : 1 778.5
Channel : 132657
Bandwidth (㎒) : 3

Horizontal/Vertical



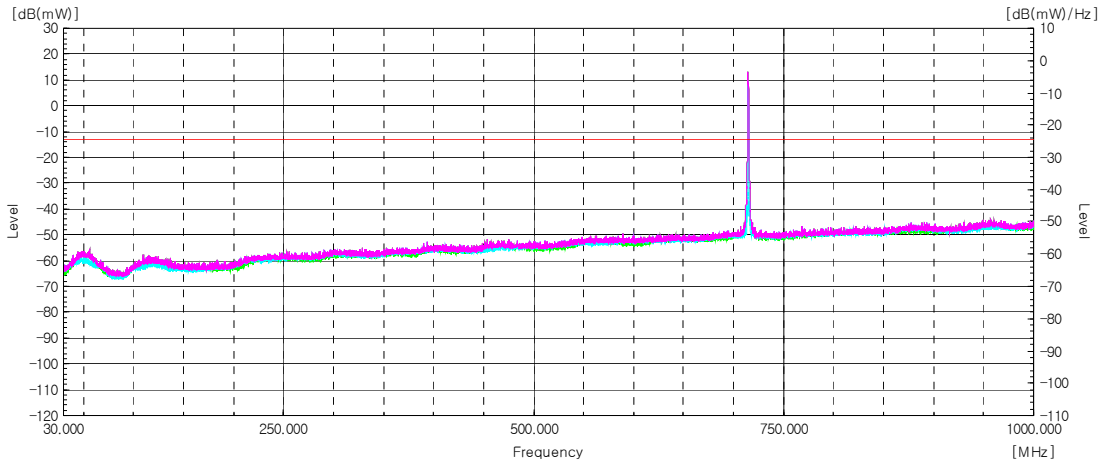
Test mode	:	LTE Band 5
Frequency (㎒)	:	829.0
Channel	:	20450
Bandwidth (㎒)	:	10

Horizontal/Vertical



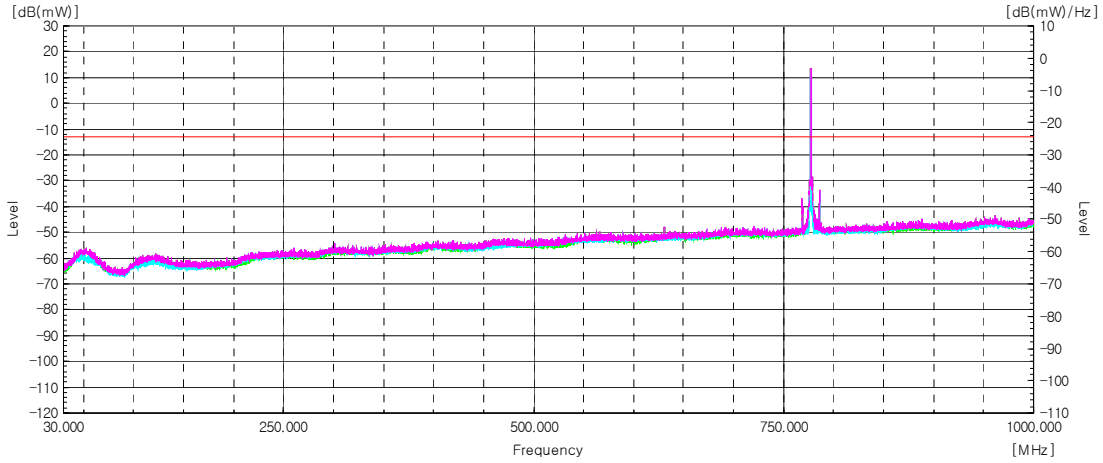
Test mode	:	LTE Band 12/17
Frequency (㎒)	:	714.5
Channel	:	23165
Bandwidth (㎒)	:	3

Horizontal/Vertical



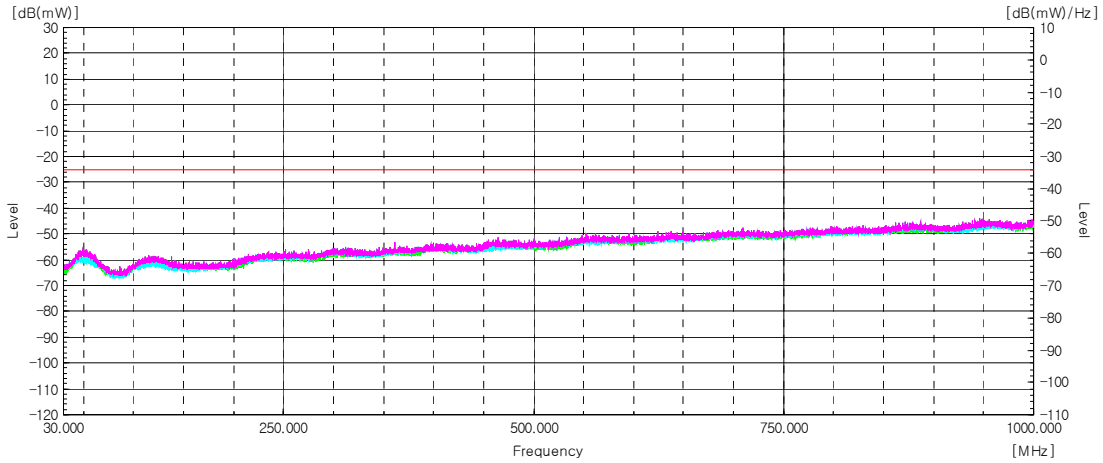
Test mode	:	LTE Band 13
Frequency (㎒)	:	779.5
Channel	:	23205
Bandwidth (㎒)	:	5

Horizontal/Vertical



Test mode	:	LTE Band 41
Frequency (㎒)	:	2 593.0
Channel	:	40620
Bandwidth (㎒)	:	20

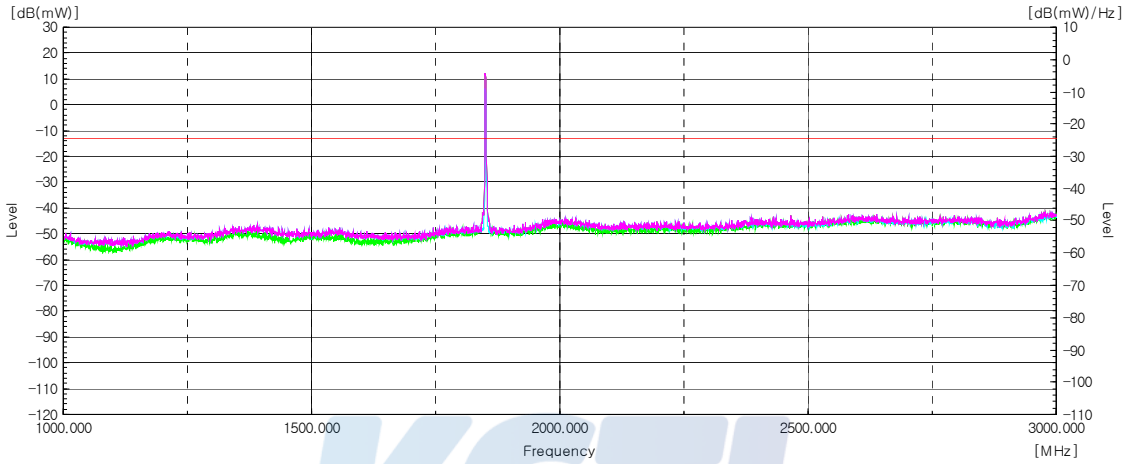
Horizontal/Vertical



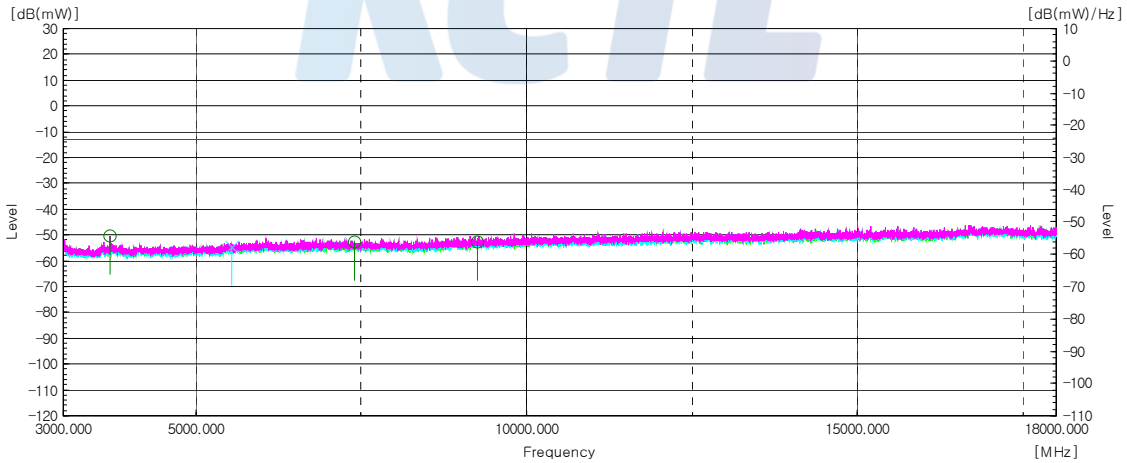
Test results (Above 1 000 ㎒)

Test mode : LTE Band 2
Frequency(㎒) : 1 850.7
Channel : 18607
Bandwidth(㎒) : 1.4

Horizontal/Vertical for 1 ㎓ ~ 3 ㎓



Horizontal/Vertical for 3 ㎓ ~ 18 ㎓

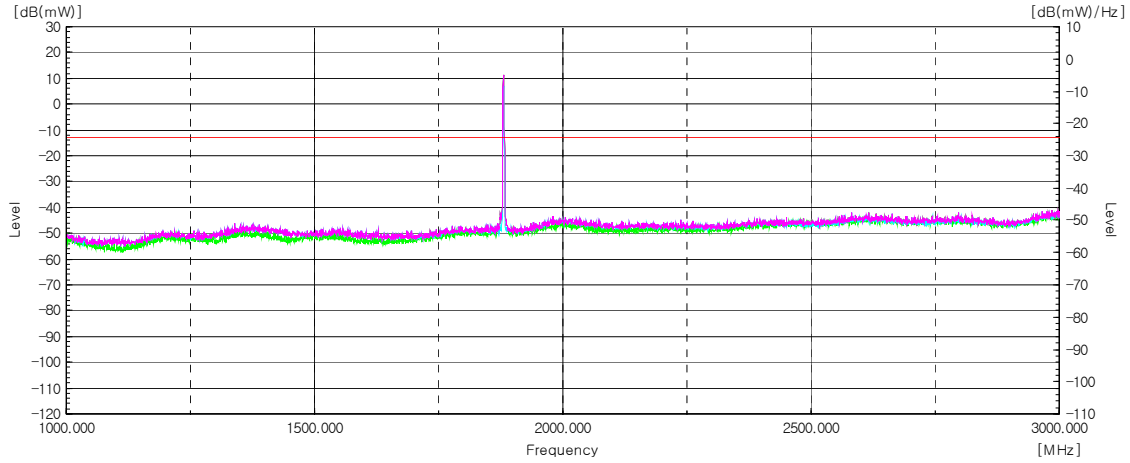


Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 701.05	H	8.12	8.15	-50.37	-50.40	-13.00	37.40
	5 551.17	V	10.60	10.05	-54.95	-54.40	-13.00	41.40
	7 405.29	H	11.83	11.62	-52.81	-52.60	-13.00	39.60
	9 251.42	H	12.95	13.13	-52.72	-52.90	-13.00	39.90

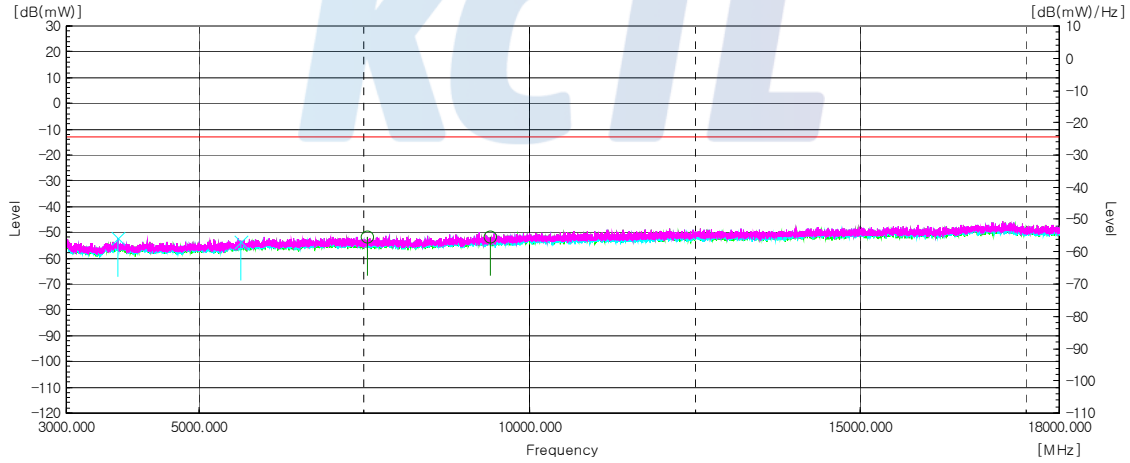
Note.
1. Limit Calculation(dBm)= 43 + 10log($P_{[Watts]}$)
2. ERP & E.I.R.P(dB m)= Substitute Level(dB) + Antenna gain(dBi) – Cable Loss(dB)

Test mode : LTE Band 2
Frequency(㎒) : 1 880.0
Channel : 18900
Bandwidth(㎒) : 1.4

Horizontal/Vertical for 1 ㎓ ~ 3 ㎓



Horizontal/Vertical for 3 ㎓ ~ 18 ㎓

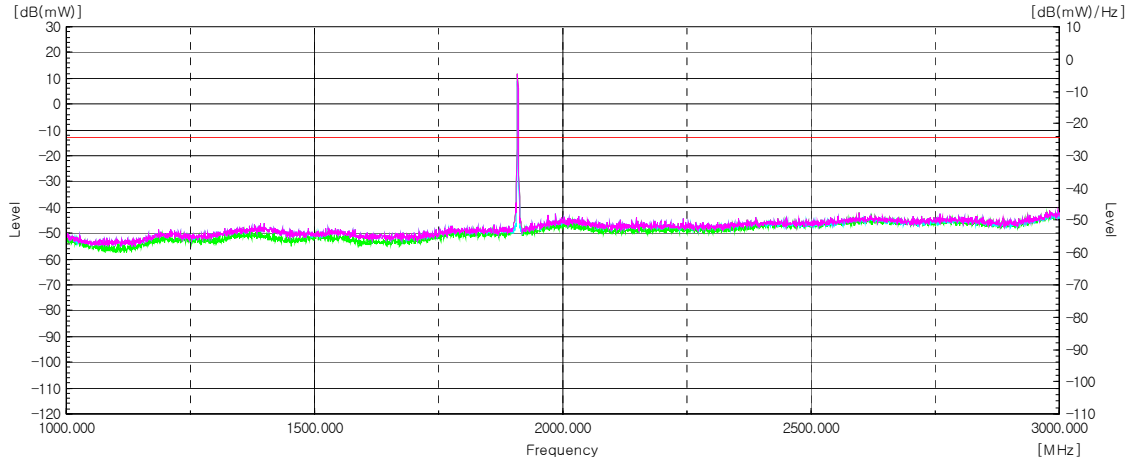


Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 777.05	V	8.24	8.26	-52.08	-52.10	-13.00	39.10
	5 639.18	V	10.60	10.18	-54.12	-53.70	-13.00	40.70
	7 553.30	H	12.05	11.85	-52.20	-52.00	-13.00	39.00
	9 404.43	H	13.04	13.31	-51.43	-51.70	-13.00	38.70

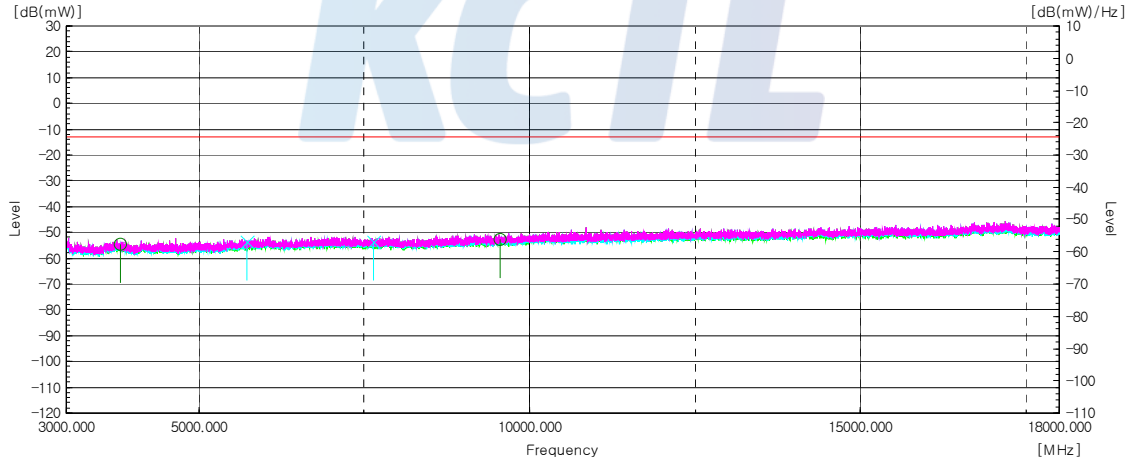
Note.
1. Limit Calculation(dBm)= 43 + 10log($P_{[Watts]}$)
2. ERP & E.I.R.P(dB m)= Substitute Level(dB) + Antenna gain(dBi) – Cable Loss(dB)

Test mode : LTE Band 2
Frequency(㎒) : 1 9090.3
Channel : 19193
Bandwidth(㎒) : 1.4

Horizontal/Vertical for 1 ㎓ ~ 3 ㎓



Horizontal/Vertical for 3 ㎓ ~ 18 ㎓

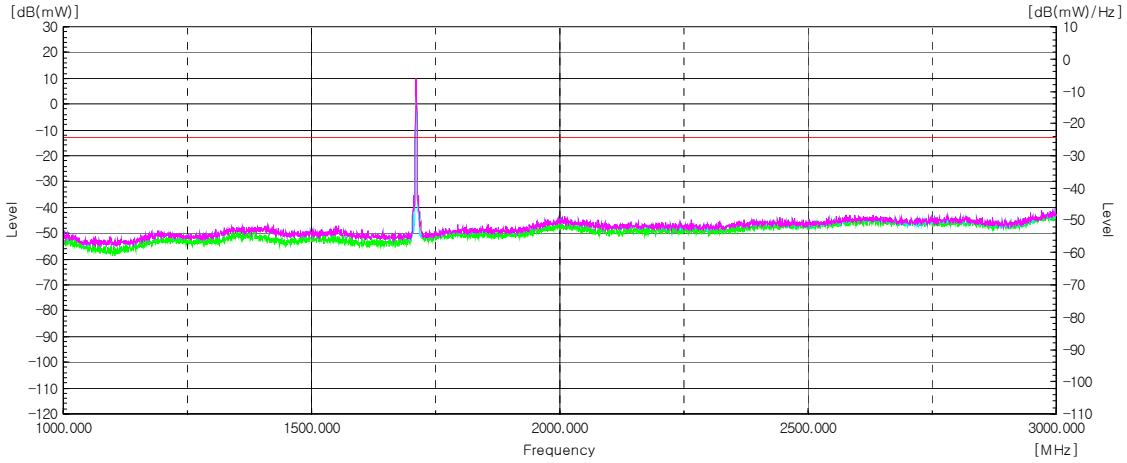


Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 818.06	H	8.31	8.21	-54.70	-54.60	-13.00	41.60
	5 729.18	V	10.60	10.45	-53.95	-53.80	-13.00	40.80
	7 638.31	V	12.14	11.92	-53.92	-53.70	-13.00	40.70
	9 546.44	H	13.06	13.32	-52.54	-52.80	-13.00	39.80

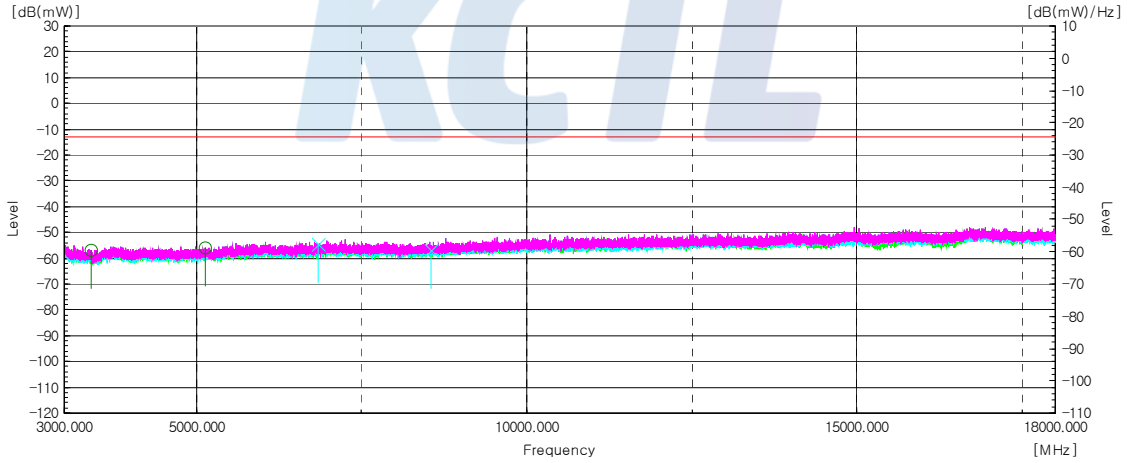
Note.
1. Limit Calculation(dBm)= 43 + 10log($P_{[Watts]}$)
2. ERP & E.I.R.P(dB m)= Substitute Level(dB) + Antenna gain(dBi) – Cable Loss(dB)

Test mode : LTE Band 4/66
Frequency(㎒) : 1 711.5
Channel : 131987
Bandwidth(㎒) : 3

Horizontal/Vertical for 1 ㎓ ~ 3 ㎓



Horizontal/Vertical for 3 ㎓ ~ 18 ㎓

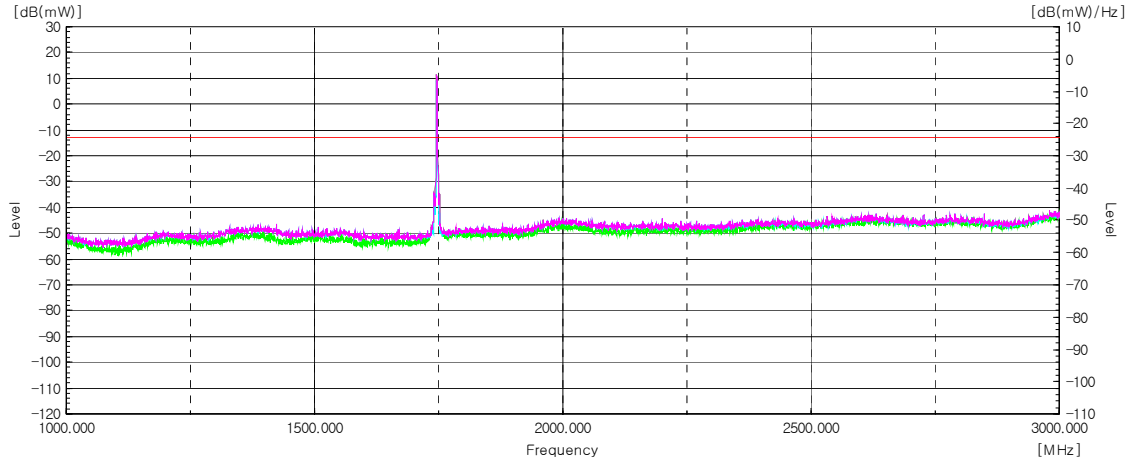


Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 416.50	H	7.62	7.81	-56.51	-56.70	-13.00	43.70
	5 133.50	H	10.09	9.67	-56.42	-56.00	-13.00	43.00
	6 846.50	V	11.04	11.28	-54.56	-54.80	-13.00	41.80
	8 550.00	V	12.98	12.61	-57.07	-56.70	-13.00	43.70

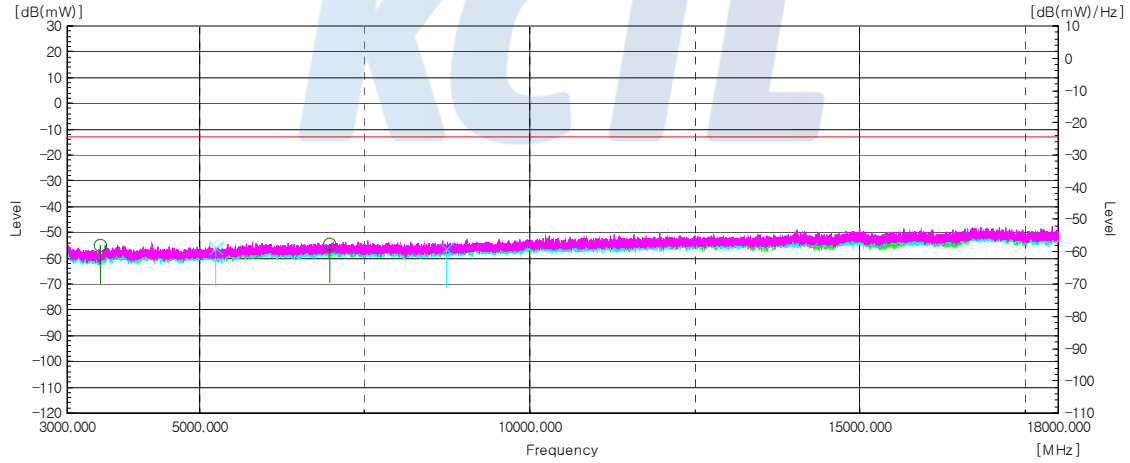
Note.
1. Limit Calculation(dBm)= 43 + 10log($P_{[Watts]}$)
2. ERP & E.I.R.P(dB m)= Substitute Level(dB) + Antenna gain(dBi) – Cable Loss(dB)

Test mode : LTE Band 4/66
Frequency(㎒) : 1 745.0
Channel : 132322
Bandwidth(㎒) : 3

Horizontal/Vertical for 1 ㎓ ~ 3 ㎓



Horizontal/Vertical for 3 ㎓ ~ 18 ㎓

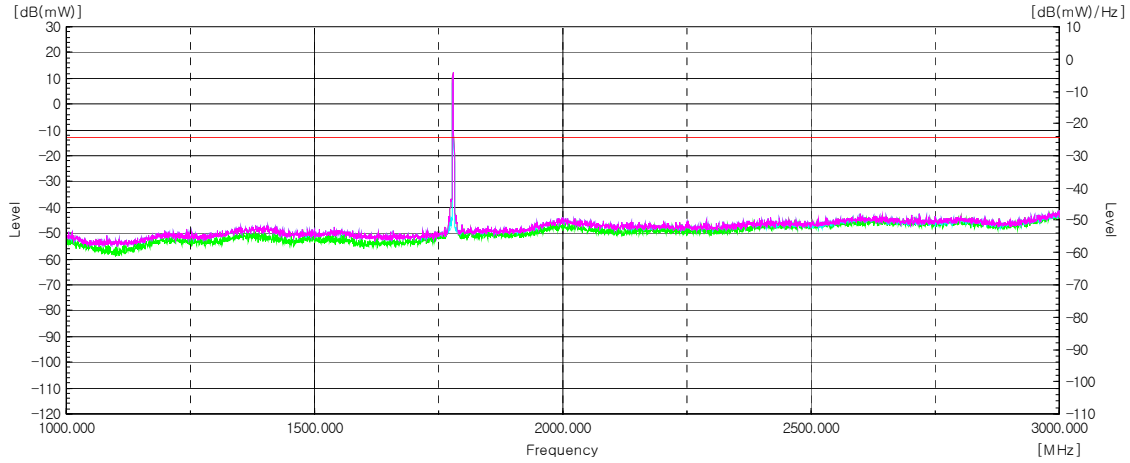


Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 492.50	H	7.78	7.90	-54.78	-54.90	-13.00	41.90
	5 238.00	V	10.23	9.66	-56.67	-56.10	-13.00	43.10
	6 980.50	H	11.09	11.43	-54.06	-54.40	-13.00	41.40
	8 735.50	V	12.91	12.88	-56.33	-56.30	-13.00	43.30

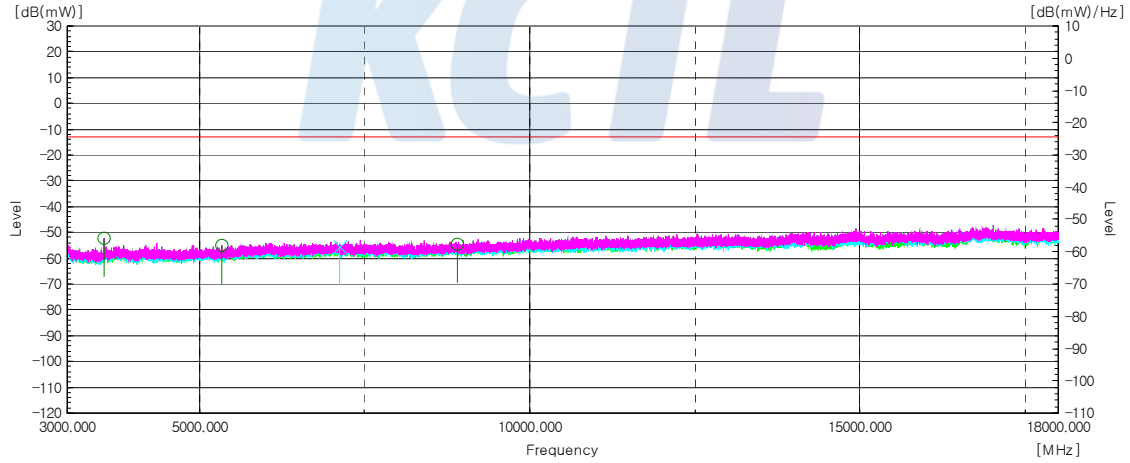
Note.
1. Limit Calculation(㏈m)= 43 + 10log($P_{[Watts]}$)
2. ERP & E.I.R.P(㏈ m)= Substitute Level(㏈) + Antenna gain(㏈i) – Cable Loss(㏈)

Test mode : LTE Band 4/66
Frequency(㎒) : 1 778.5
Channel : 132657
Bandwidth(㎒) : 3

Horizontal/Vertical for 1 ㎓ ~ 3 ㎓



Horizontal/Vertical for 3 ㎓ ~ 18 ㎓

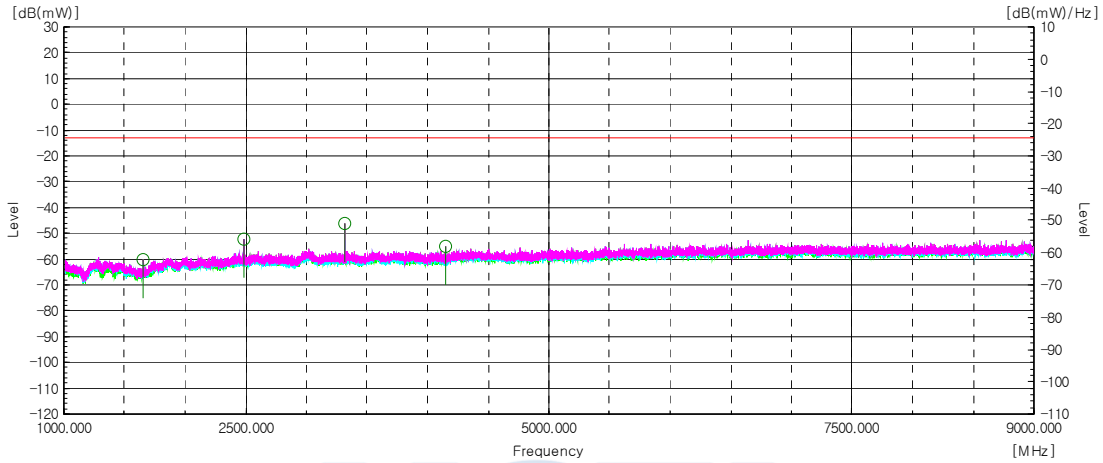


Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 557.00	H	7.89	7.95	-52.24	-52.30	-13.00	39.30
	5 336.00	H	10.37	9.86	-55.61	-55.10	-13.00	42.10
	7 114.00	V	11.31	11.43	-55.28	-55.40	-13.00	42.40
	8 896.50	H	12.84	12.84	-54.60	-54.60	-13.00	41.60

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

Test mode : LTE Band 5
Frequency(㎒) : 829.0
Channel : 20450
Bandwidth(㎒) : 10

Horizontal/Vertical

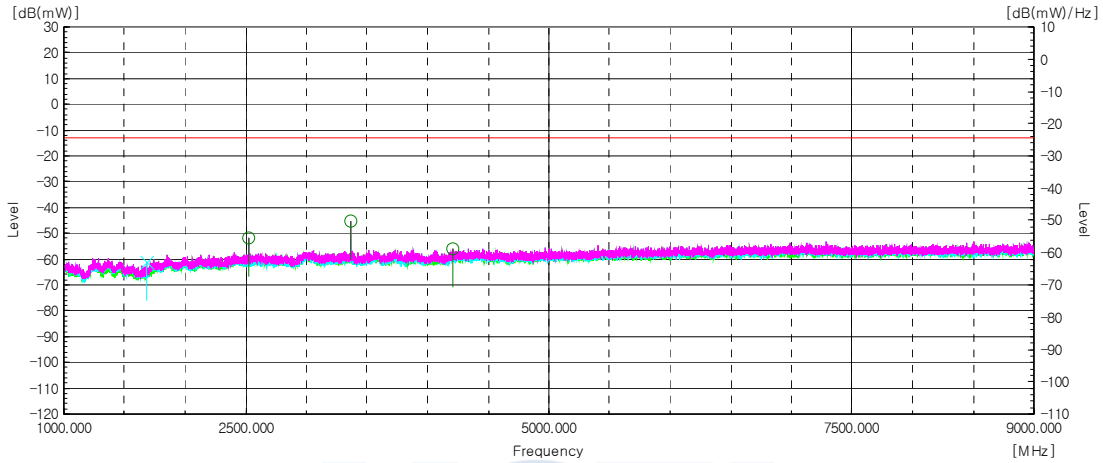


Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 658.04	H	6.41	5.37	-61.04	-60.00	-13.00	47.00
	2 487.09	H	6.00	6.65	-51.55	-52.20	-13.00	39.20
	3 316.15	H	7.40	7.68	-45.82	-46.10	-13.00	33.10
	4 145.20	H	8.75	8.61	-55.24	-55.10	-13.00	42.10

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)

Test mode : LTE Band 5
Frequency(㎒) : 836.5
Channel : 20525
Bandwidth(㎒) : 10

Horizontal/Vertical

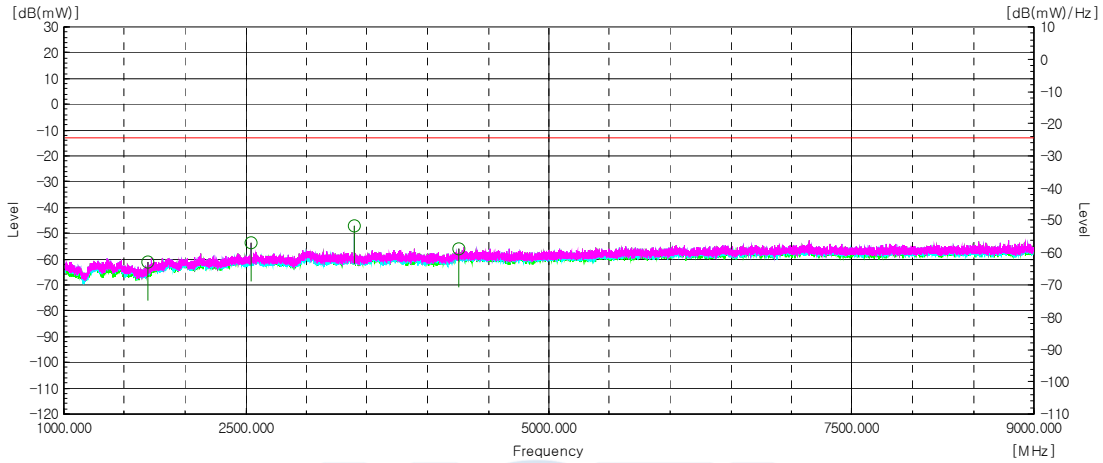


Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 682.04	V	6.38	5.42	-62.16	-61.20	-13.00	48.20
	2 522.60	H	6.03	6.69	-51.04	-51.70	-13.00	38.70
	3 363.65	H	7.50	7.74	-44.86	-45.10	-13.00	32.10
	4 204.20	H	8.80	8.66	-56.14	-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(㏈)

Test mode : LTE Band 5
Frequency(㎒) : 844.0
Channel : 20600
Bandwidth(㎒) : 10

Horizontal/Vertical

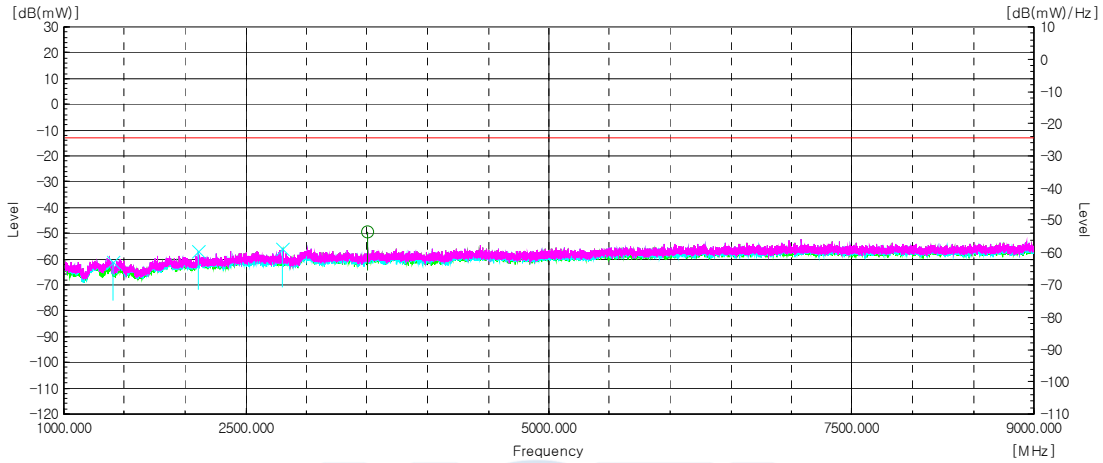


Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 696.54	H	6.36	5.45	-61.91	-61.00	-13.00	48.00
	2 545.10	H	6.06	6.73	-53.03	-53.70	-13.00	40.70
	3 393.65	H	7.57	7.78	-46.99	-47.20	-13.00	34.20
	4 256.20	H	8.86	8.74	-56.02	-55.90	-13.00	42.90

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

Test mode : LTE Band 12/17
Frequency(㎒) : 700.5
Channel : 23025
Bandwidth(㎒) : 3

Horizontal/Vertical

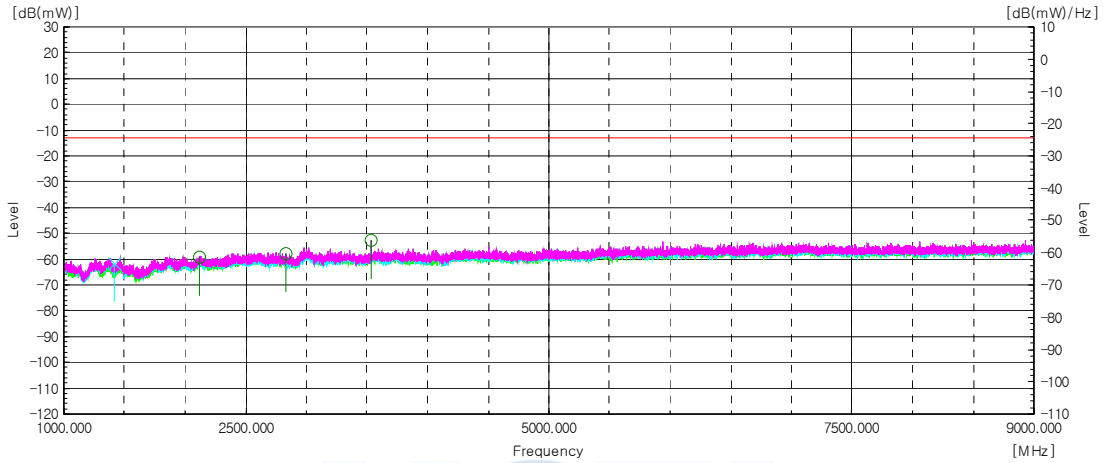


Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 403.53	V	5.67	4.94	-61.83	-61.10	-13.00	48.10
	2 105.07	V	6.00	6.09	-56.71	-56.80	-13.00	43.80
	2 806.61	V	6.43	7.06	-55.47	-56.10	-13.00	43.10
	3 508.66	H	7.81	7.92	-49.29	-49.40	-13.00	36.40

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

Test mode : LTE Band 12/17
Frequency(㎒) : 707.5
Channel : 23095
Bandwidth(㎒) : 3

Horizontal/Vertical

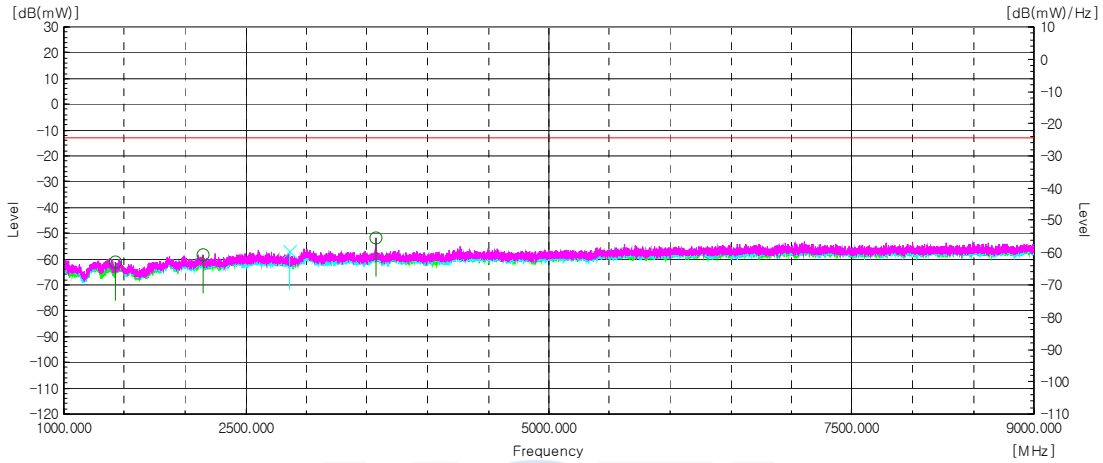


Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 415.53	V	5.79	4.96	-62.33	-61.50	-13.00	48.50
	2 121.07	H	6.00	6.11	-59.09	-59.20	-13.00	46.20
	2 830.61	H	6.46	7.09	-57.07	-57.70	-13.00	44.70
	3 538.16	H	7.86	7.95	-52.61	-52.70	-13.00	39.70

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

Test mode : LTE Band 12/17
Frequency(㎒) : 714.5
Channel : 23165
Bandwidth(㎒) : 3

Horizontal/Vertical

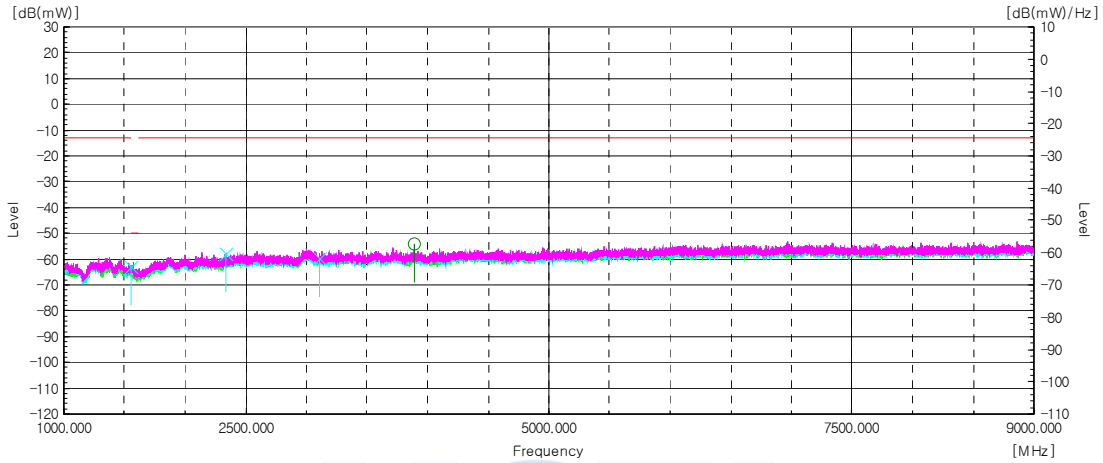


Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 429.03	H	5.92	4.98	-61.84	-60.90	-13.00	47.90
	2 143.57	H	6.00	6.14	-58.16	-58.30	-13.00	45.30
	2 858.62	V	6.50	7.13	-56.27	-56.90	-13.00	43.90
	3 573.16	H	7.92	7.96	-51.86	-51.90	-13.00	38.90

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)

Test mode : LTE Band 13
Frequency(㎒) : 779.5
Channel : 23025
Bandwidth(㎒) : 5

Horizontal/Vertical

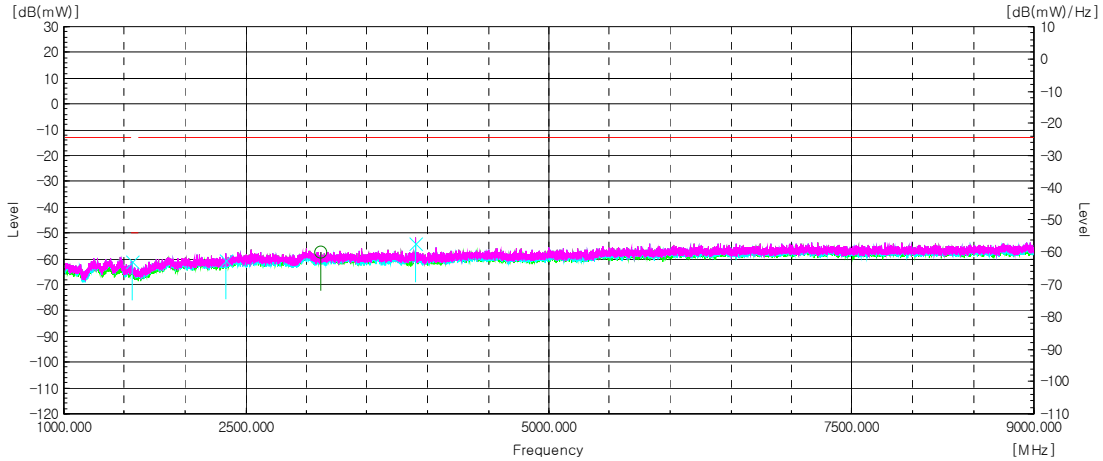


Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 554.04	V	6.54	5.20	-64.54	-63.20	-13.00	50.20
	2 332.08	V	6.00	6.44	-57.36	-57.80	-13.00	44.80
	3 108.13	V	6.94	7.43	-59.21	-59.70	-13.00	46.70
	3 886.68	H	8.42	8.35	-54.17	-54.10	-13.00	41.10

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)

Test mode : LTE Band 13
Frequency(㎒) : 782.0
Channel : 23230
Bandwidth(㎒) : 5

Horizontal/Vertical

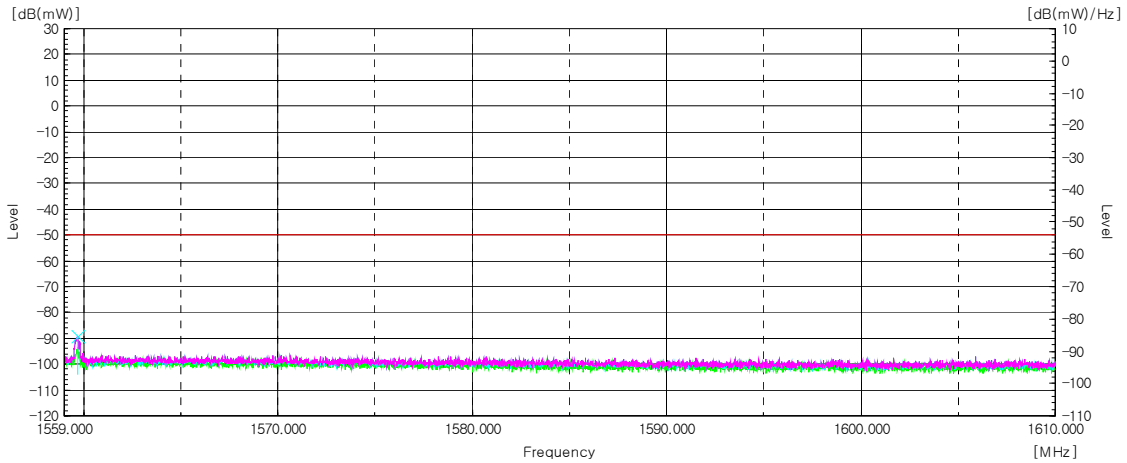


Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 559.54	V	6.53	5.21	-62.62	-61.30	-50.00	11.30
	2 338.58	V	6.00	6.45	-60.25	-60.70	-13.00	47.70
	3 119.63	H	6.96	7.44	-57.02	-57.50	-13.00	44.50
	3 899.18	V	8.44	8.36	-54.08	-54.00	-13.00	41.00

Note.
1. Limit Calculation(dBm)= 43 + 10log($P_{[Watts]}$)
   Limit Calculation of narrow-band (dBm) = -80dBW (-50dBm)
2. ERP & E.I.R.P(dB m)= Substitute Level(dB) + Antenna gain(dBi) – Cable Loss(dB)

Test mode : LTE Band 13
Frequency(㎒) : 782.0 (1 559 – 1 610 ㎒)
Channel : 23230
Bandwidth(㎒) : 5

Horizontal/Vertical

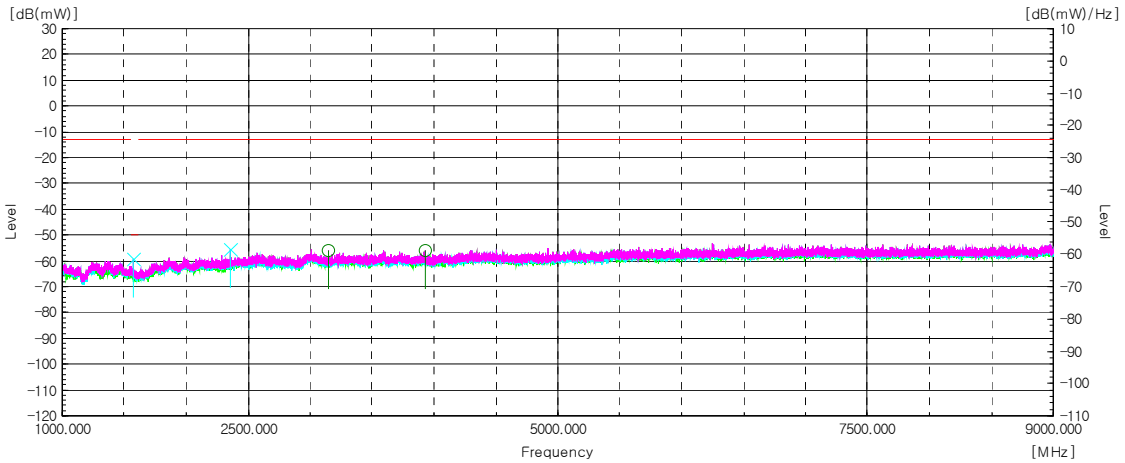


Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 559.69	V	6.53	5.21	-90.62	-89.30	-50.00	39.30

Note.
1. Limit Calculation of wide-band (dBm/㎒) = -70dBW/㎒ (-40 dBm/㎒)
2. Limit Calculation of narrow-band (dBm) = -80dBW (-50dBm)

Test mode : LTE Band 13
Frequency(㎒) : 784.5
Channel : 23255
Bandwidth(㎒) : 5

Horizontal/Vertical

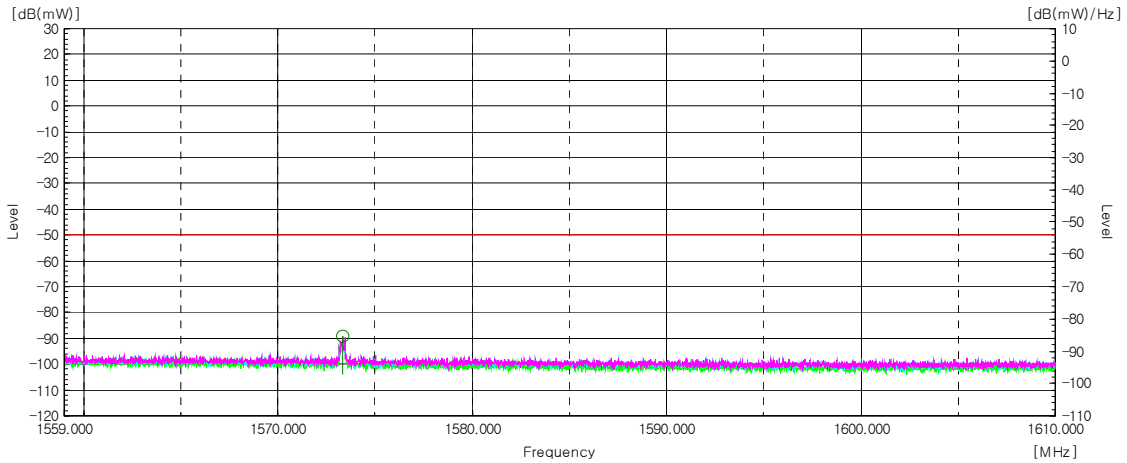


Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 573.04	V	6.51	5.23	-60.68	-59.40	-50.00	9.40
	2 360.09	V	6.00	6.48	-54.92	-55.40	-13.00	42.40
	3 146.63	H	7.02	7.48	-55.34	-55.80	-13.00	42.80
	3 933.18	H	8.49	8.39	-56.20	-56.10	-13.00	43.10

Note.
1. Limit Calculation(㏈m)= 43 + 10log($P_{[Watts]}$)
   Limit Calculation of narrow-band (㏈m) = -80㏈W (-50㏈m)
2. ERP & E.I.R.P(㏈ m)= Substitute Level(㏈) + Antenna gain(㏈i) – Cable Loss(㏈)

Test mode : LTE Band 13
Frequency(㎒) : 784.5 (1 559 – 1 610 ㎒)
Channel : 23255
Bandwidth(㎒) : 5

Horizontal/Vertical

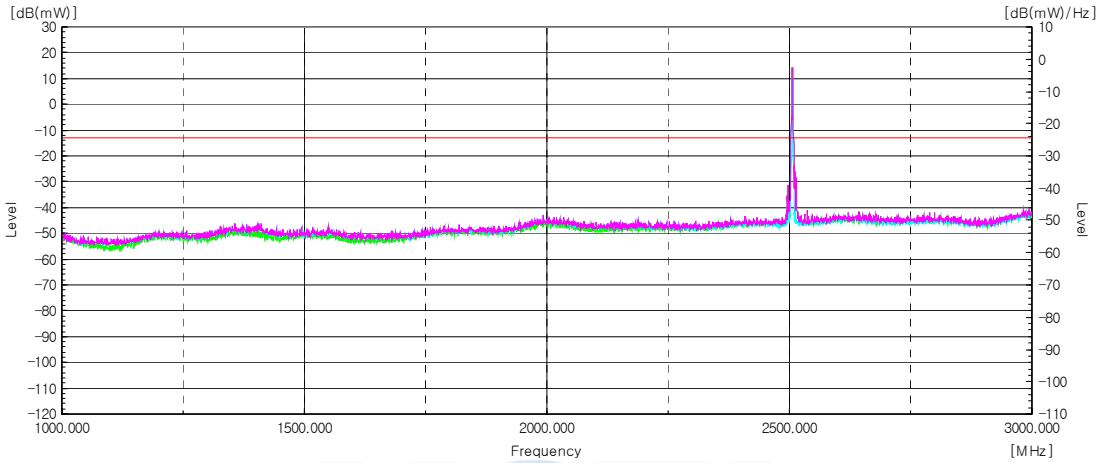


Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 573.32	H	6.51	5.23	-90.48	-89.20	-50.00	39.20

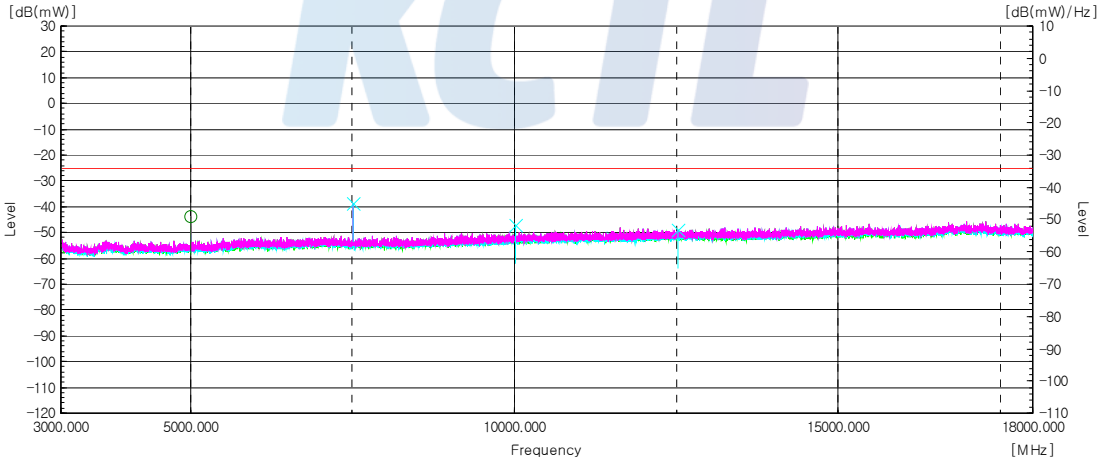
Note.
1. Limit Calculation of wide-band (dBm/㎒) = -70dBW/㎒ (-40 dBm/㎒)
2. Limit Calculation of narrow-band (dBm) = -80dBW (-50dBm)

Test mode : LTE Band 41
Frequency(㎒) : 2 506
Channel : 39750
Bandwidth(㎒) : 20

Horizontal/Vertical for 1 ㎓ ~ 3 ㎓



Horizontal/Vertical for 3 ㎓ ~ 18 ㎓

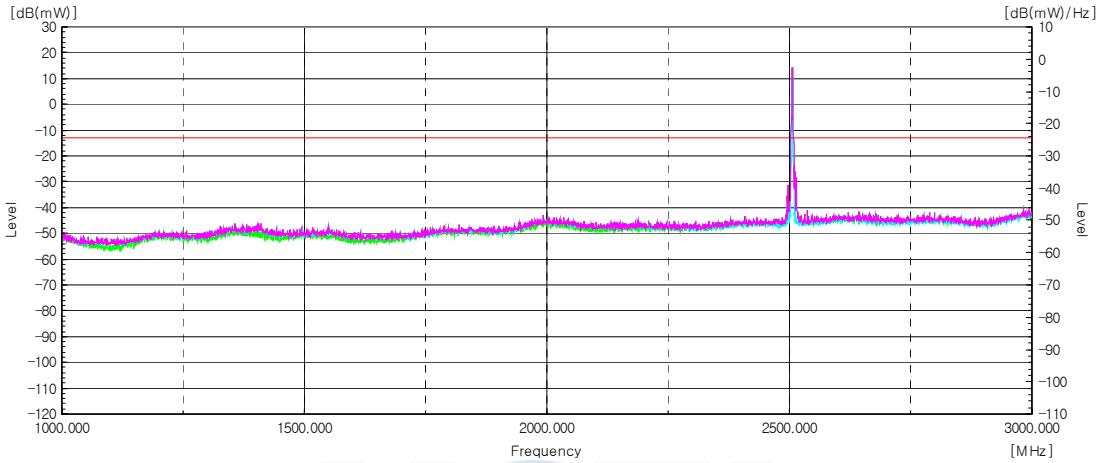


Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	5 012.13	H	9.92	9.61	-44.31	-44.00	-25.00	19.00
	7 518.30	V	12.02	11.82	-39.00	-38.80	-25.00	13.80
	10 024.47	V	12.71	13.71	-46.00	-47.00	-25.00	22.00
	12 530.63	V	13.32	15.38	-46.74	-48.80	-25.00	23.80

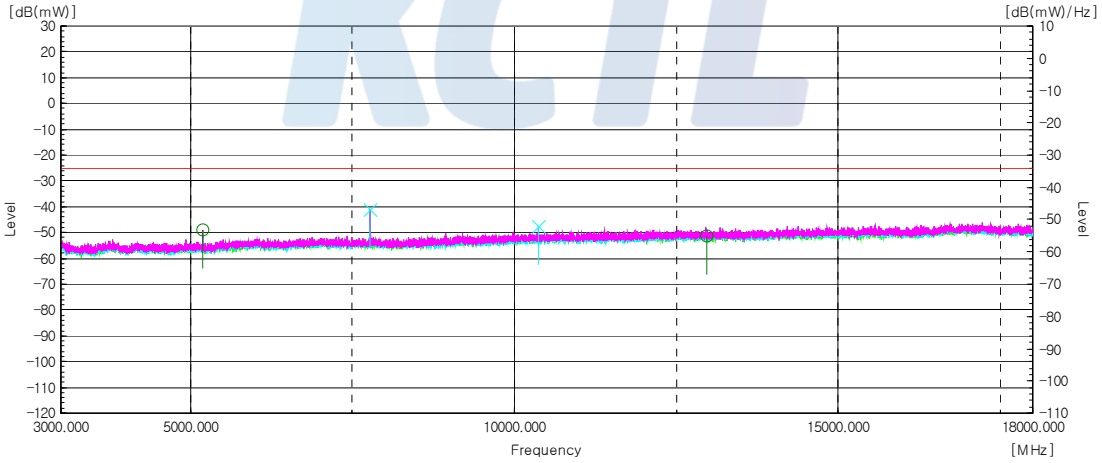
Note.
1. Limit Calculation(㏈m)= 55 + 10log($P_{[Watts]}$)
2. ERP & E.I.R.P(㏈ m)= Substitute Level(㏈) + Antenna gain(㏈i) – Cable Loss(㏈)

Test mode : LTE Band 41
Frequency(㎒) : 2 593.0
Channel : 40620
Bandwidth(㎒) : 20

Horizontal/Vertical for 1 ㎓ ~ 3 ㎓



Horizontal/Vertical for 3 ㎓ ~ 18 ㎓

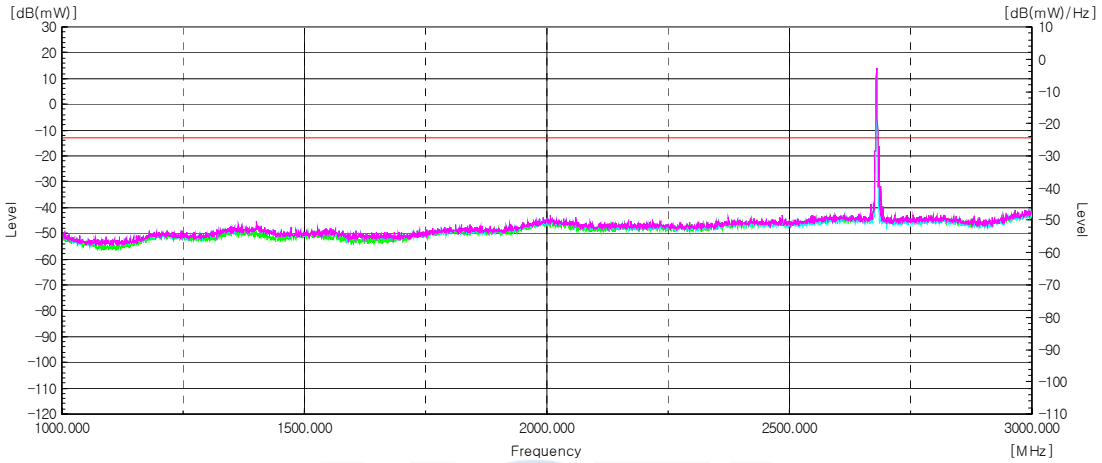


Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	5 186.15	H	10.16	9.72	-49.24	-48.80	-25.00	23.80
	7 779.32	V	12.28	11.98	-41.40	-41.10	-25.00	16.10
	10 372.49	V	12.85	13.92	-46.63	-47.70	-25.00	22.70
	12 965.66	H	13.67	15.65	-49.42	-51.40	-25.00	26.40

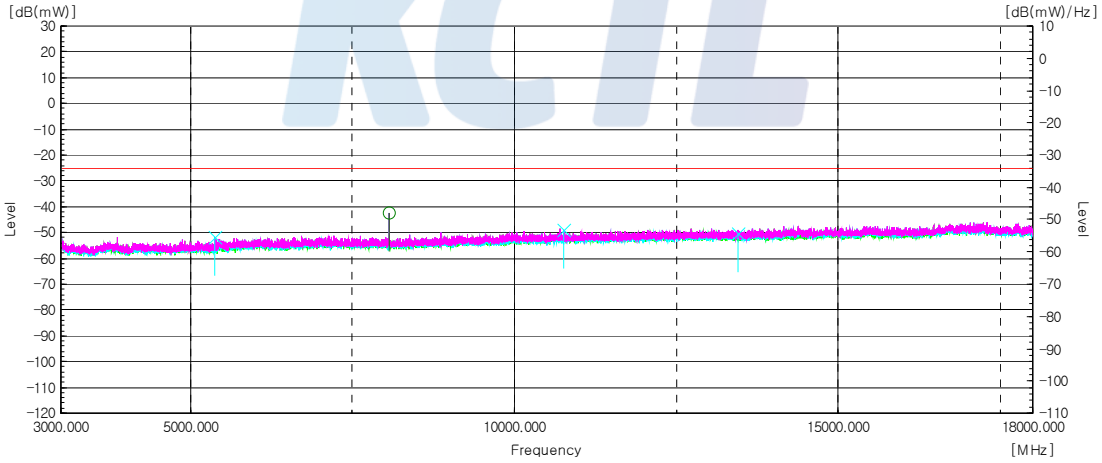
Note.
1. Limit Calculation(dBm)= 55 + 10log($P_{[Watts]}$)
2. ERP & E.I.R.P(dB m)= Substitute Level(dB) + Antenna gain(dBi) – Cable Loss(dB)

Test mode : LTE Band 41
Frequency(㎒) : 2 680.0
Channel : 41490
Bandwidth(㎒) : 20

Horizontal/Vertical for 1 ㎓ ~ 3 ㎓



Horizontal/Vertical for 3 ㎓ ~ 18 ㎓



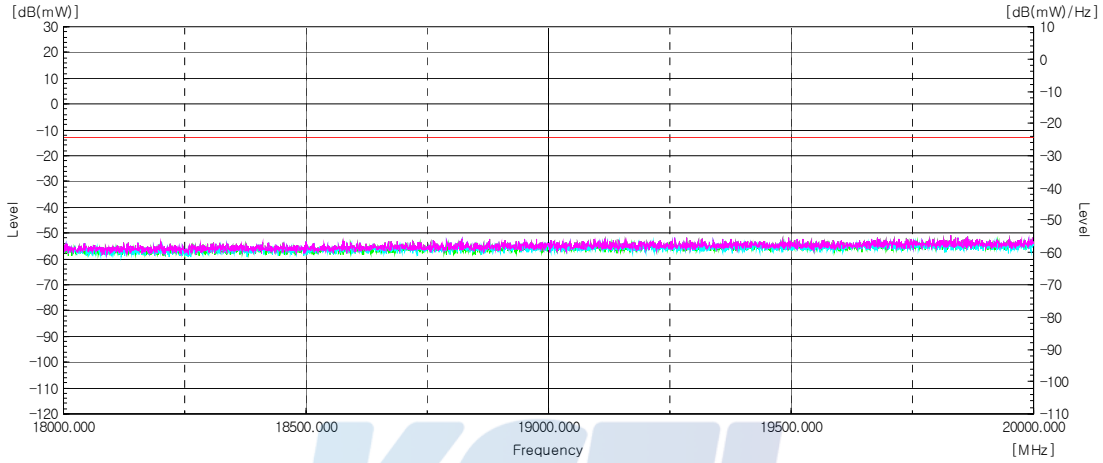
Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	5 377.16	V	10.43	9.90	-52.43	-51.90	-25.00	26.90
	8 066.34	H	12.57	12.36	-42.51	-42.30	-25.00	17.30
	10 755.52	V	12.90	14.23	-47.57	-48.90	-25.00	23.90
	13 442.70	V	13.79	15.94	-48.35	-50.50	-25.00	25.50

Note.
1. Limit Calculation(㏈m)= 55 + 10log($P_{[Watts]}$)
2. ERP & E.I.R.P(㏈ m)= Substitute Level(㏈) + Antenna gain(㏈i) – Cable Loss(㏈)

Test results (Above 18 ㎓) – Worst case

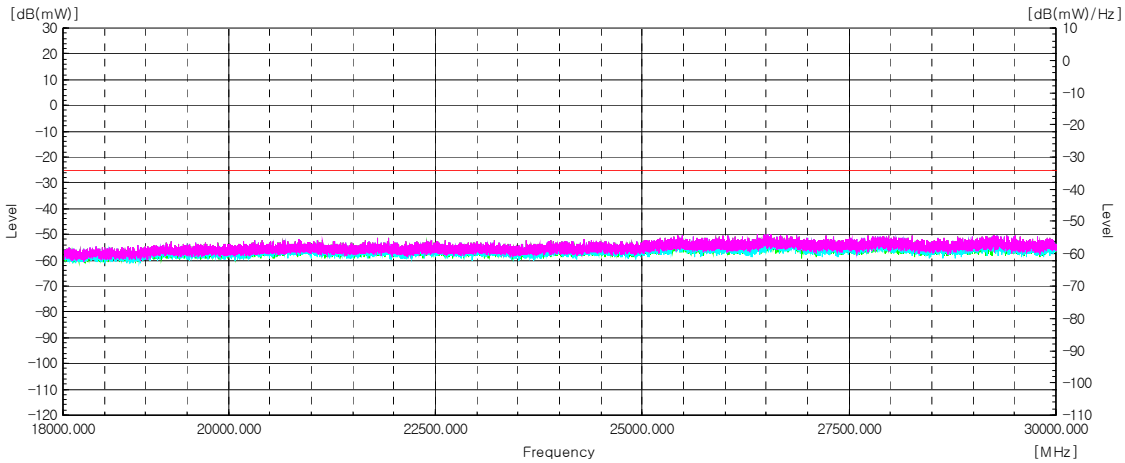
Test mode	:	LTE Band 2
Frequency (㎒)	:	1 909.3
Channel	:	19193
Bandwidth(㎒)	:	1.4

Horizontal/Vertical



Test mode	:	LTE Band 41
Frequency (㎒)	:	2 593.0
Channel	:	40620
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	100914	20.10.14
Spectrum Analyzer	AGILENT	N9040B	MY57010132	20.07.31
Signal Generator	R&S	SMB100A	176206	20.01.25
Power Divider	Aeroflex /Weinschel, Inc.	1580-1	SC571	20.08.01
Attenuator	API Inmet	40AH2W-10	16	20.05.15
Attenuator	API Inmet	40AH2W-10	12	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-641	92004785	20.05.13
Wideband Radio Communication Tester	R & S	CMW500	132120	20.07.17
Wideband Radio Communication Tester	R & S	CMW500	141780	20.04.18
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	00161083	20.09.18
Horn Antenna	ETS.lindgren	3117	161225	20.05.22
Horn Antenna	ETS.lindgren	3116	00086632	20.02.15
Horn Antenna	ETS.lindgren	3116	00086635	20.05.09
Amplifier	SONOMA INSTRUMENT	310N	186402	20.01.04
Amplifier	L-3 Narda-MITEQ	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

End of test report