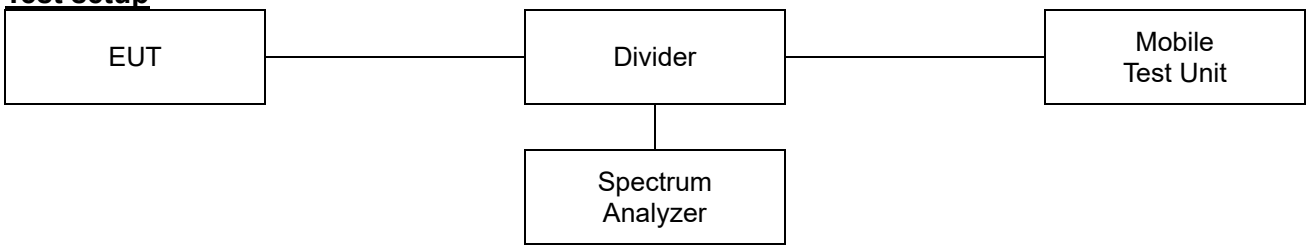
7.5. Peak to Average Power Ratio (PAPR)

Test setup



Limit

According to §24.232(d), §27.50(d)(5) and RSS-130(4.6), RSS-132(5.4), RSS-133(6.4), RSS-139(6.5), 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

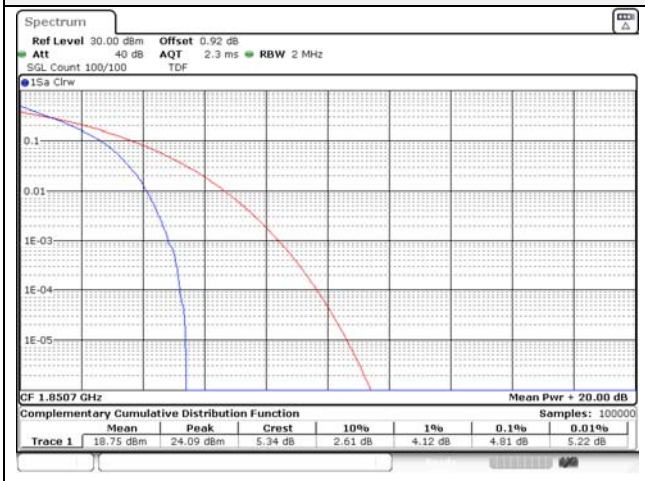
Use one of the procedures presented in 5.2(ANSI C63.26-2015) to measure the total peak power and record as P_{PK}.
Use one of the applicable procedure presented 5.2(ANSI C63.26-2015) to measure the total average power and record as P_{AG}. Determine the P.A.P.R from:

PAPR(㏈) = P_{PK} (㏈m or ㏈W) - P_{AG}(㏈m or ㏈W)

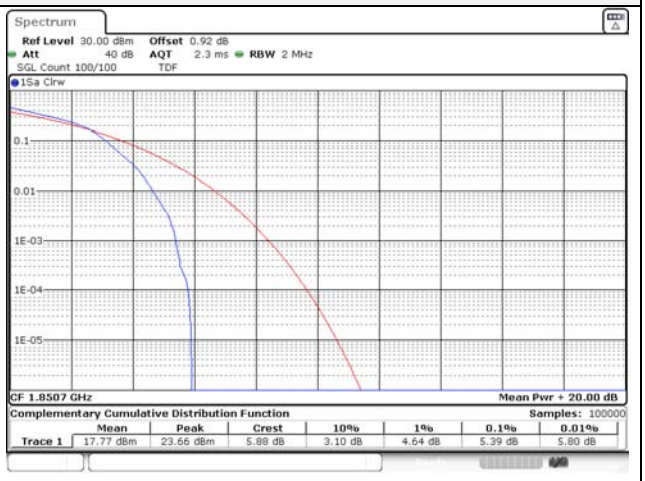
Test results

Test mode: LTE Band 2

1.4M BW QPSK Low ch.



1.4M BW 16QAM Low ch.



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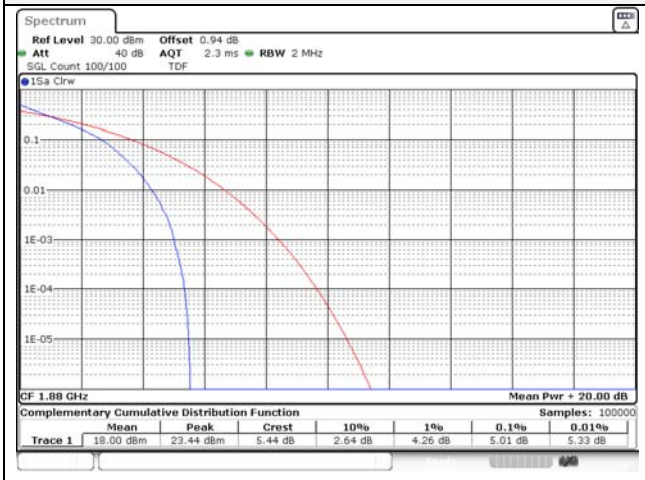

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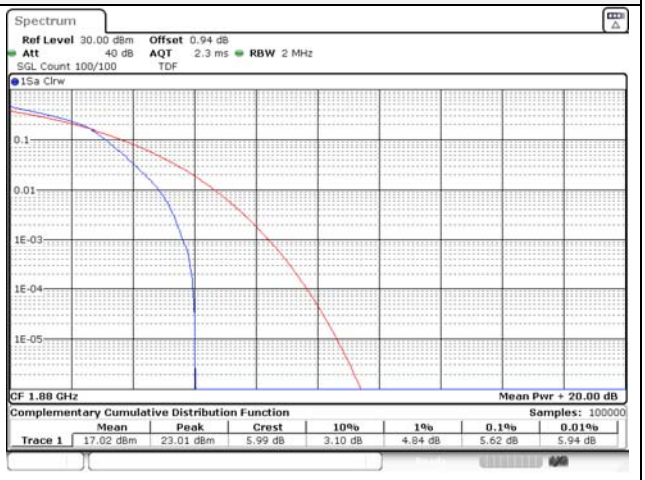
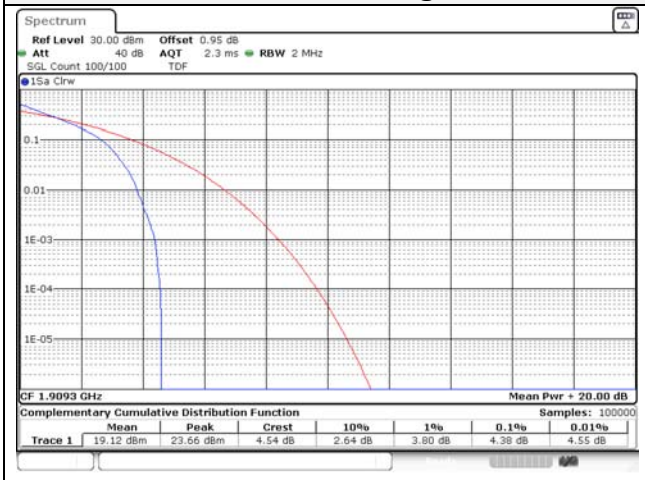


1.4M BW QPSK High ch.



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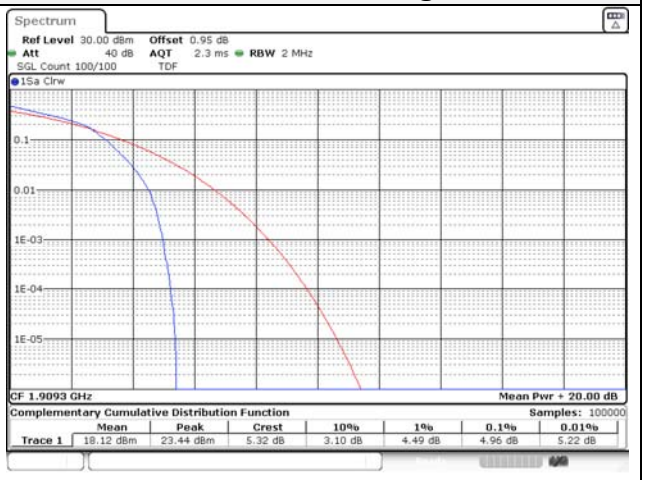
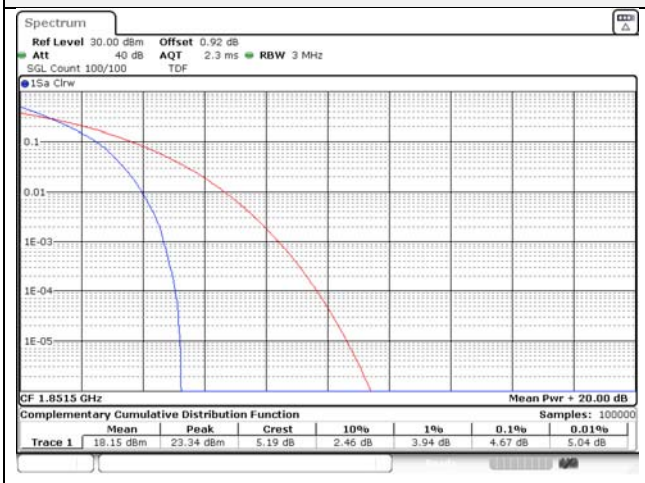
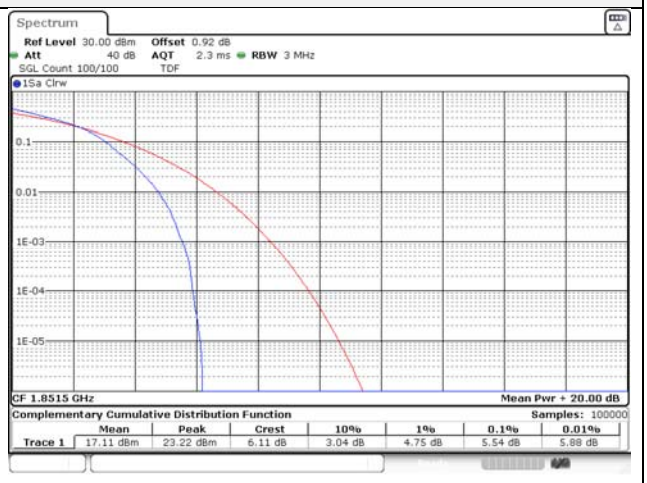


3M BW QPSK Low ch.



3M BW 16QAM Low ch.



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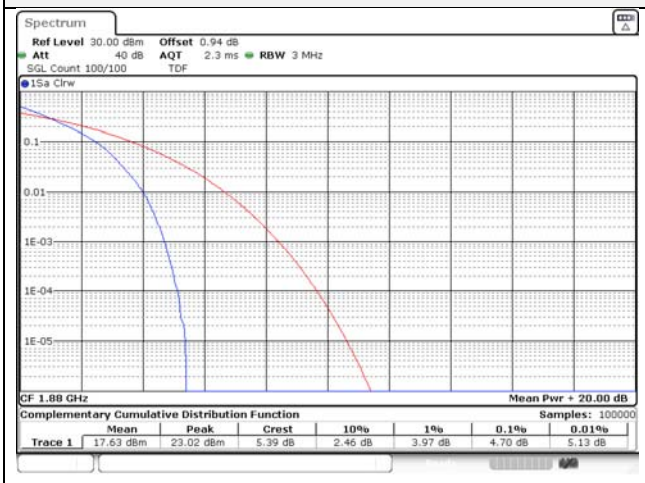

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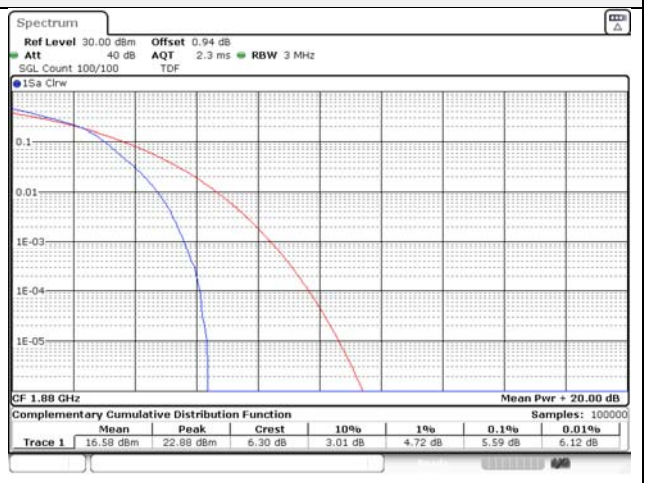

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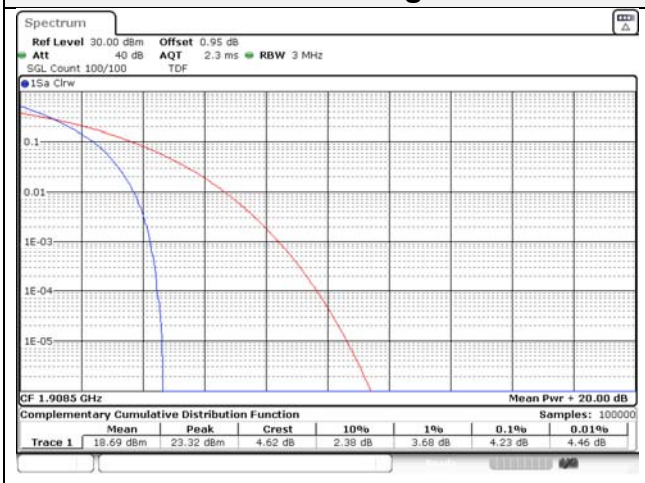
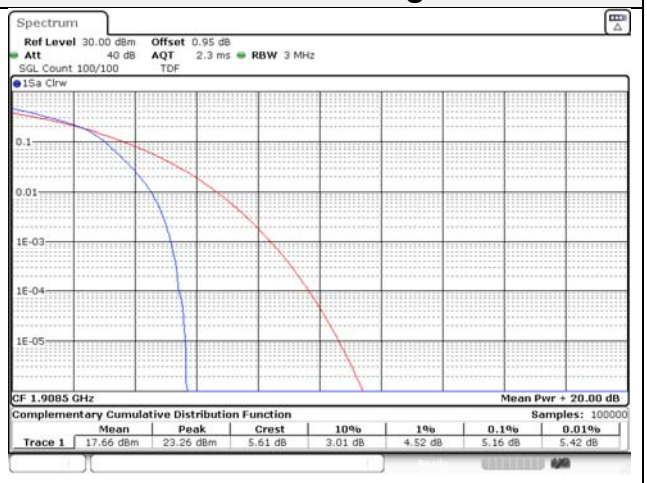


3M BW 16QAM High ch.



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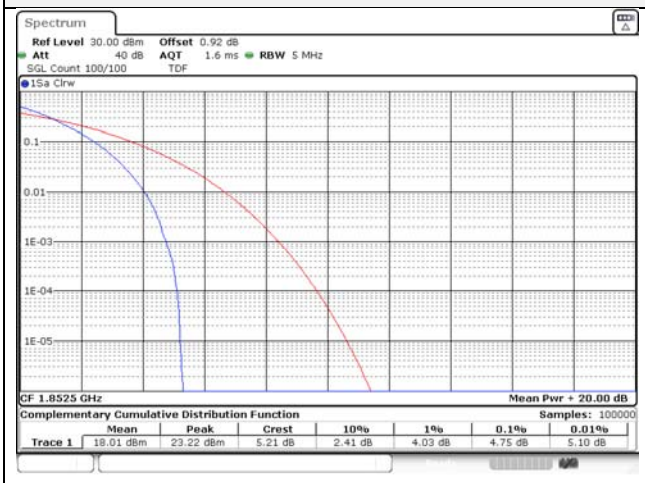

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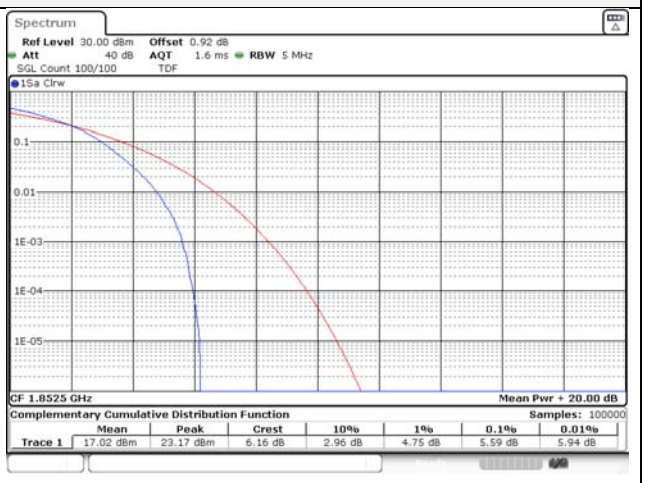

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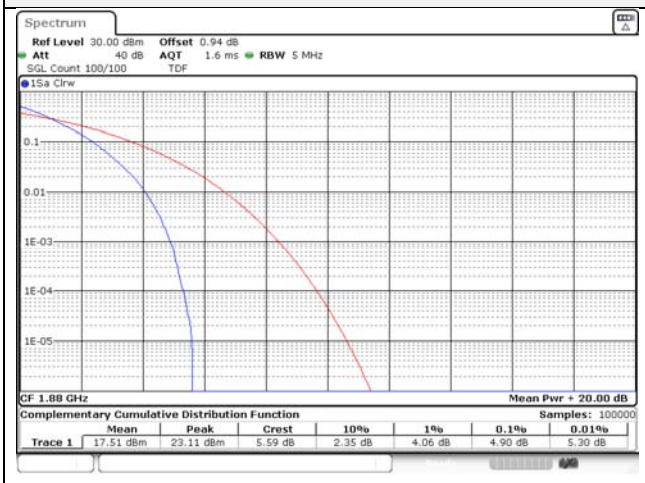

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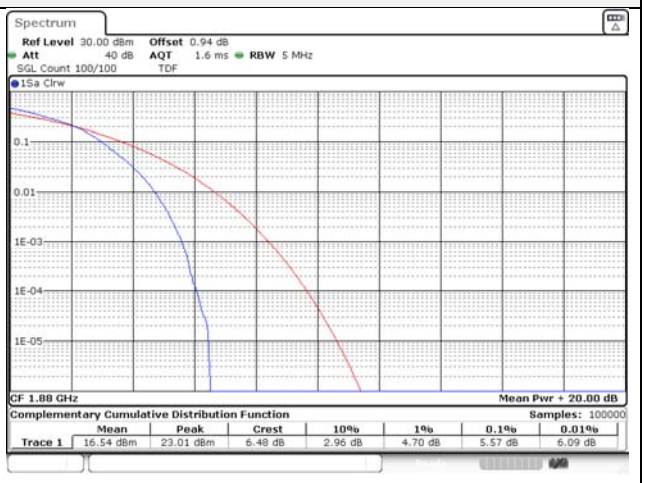

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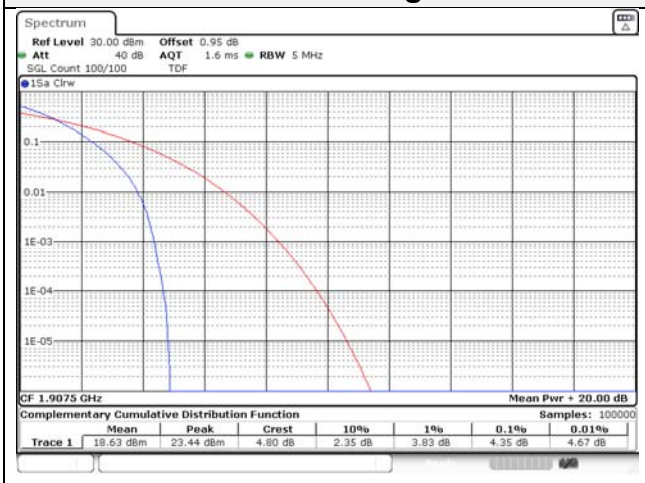

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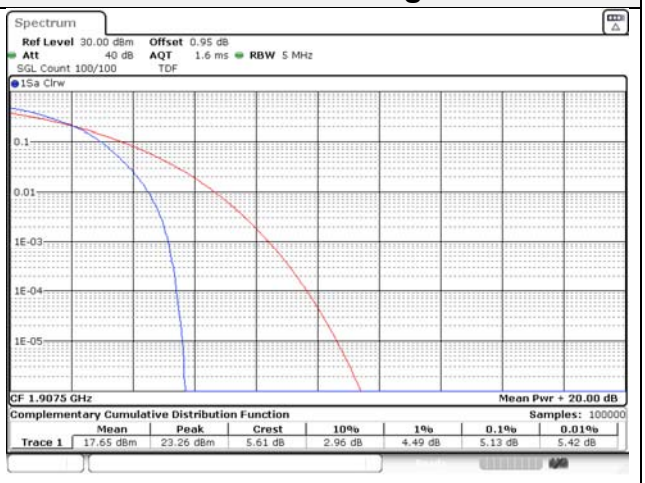

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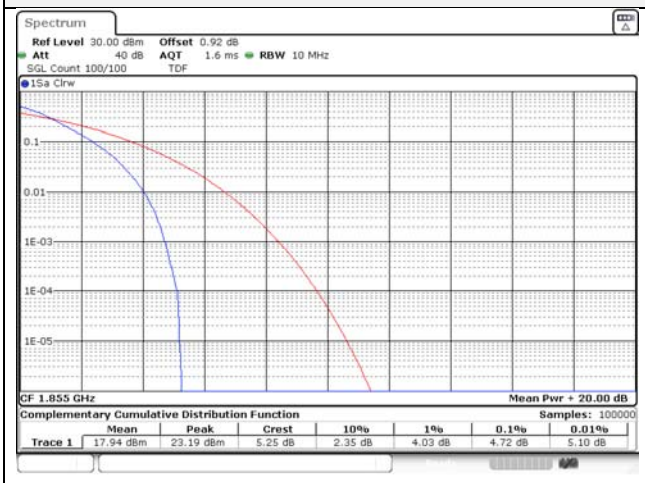

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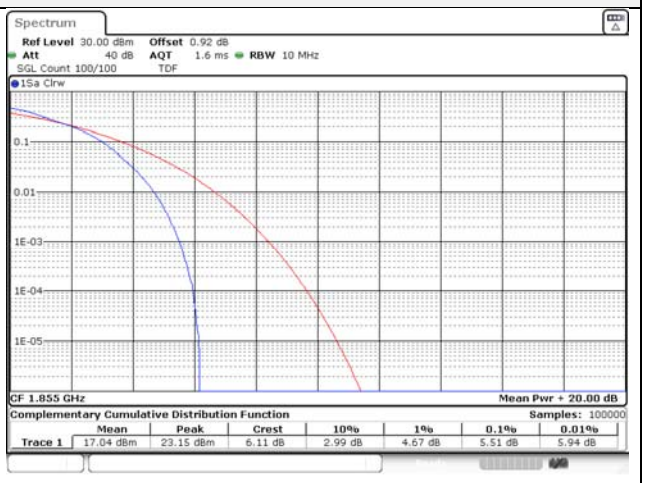

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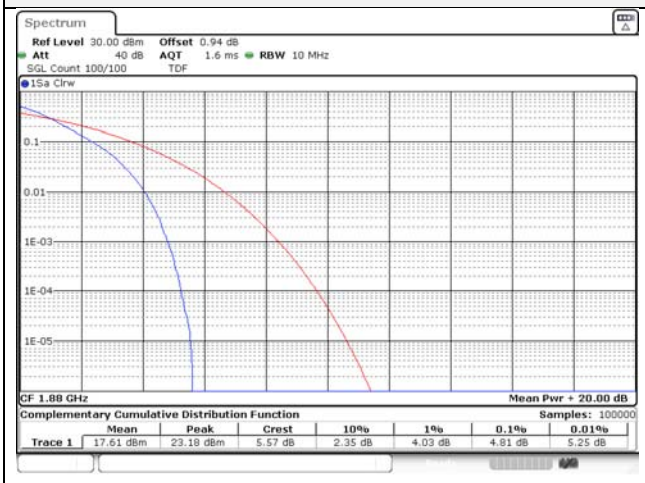

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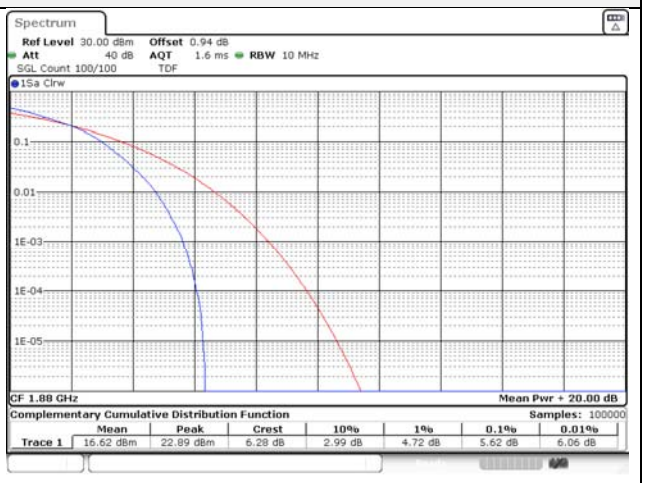

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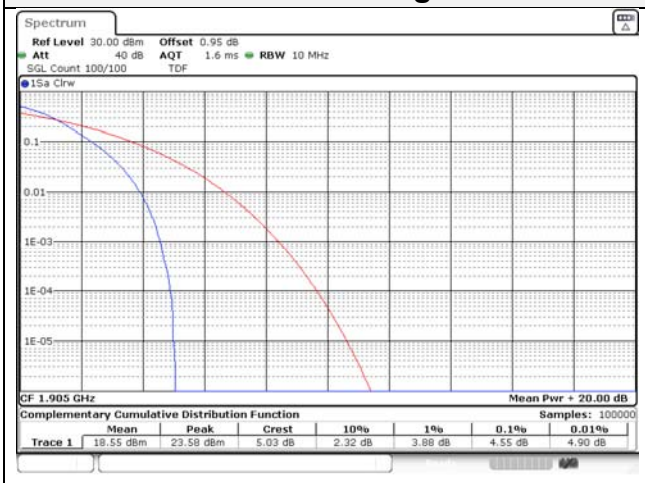

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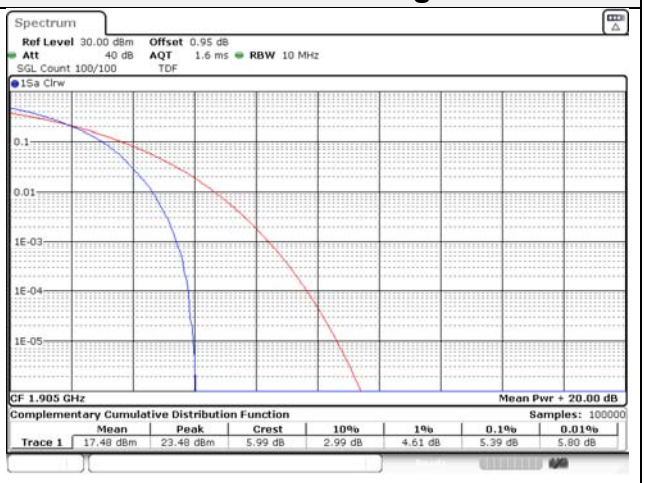

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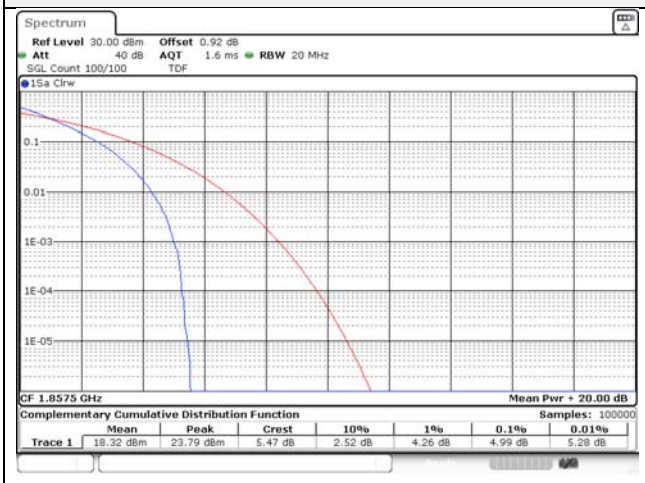

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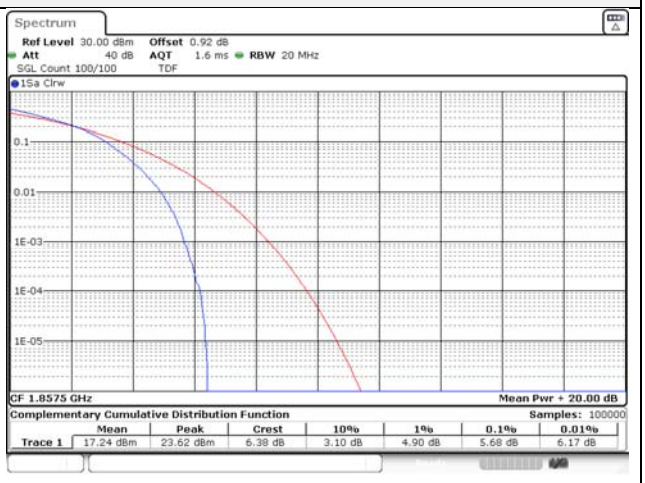

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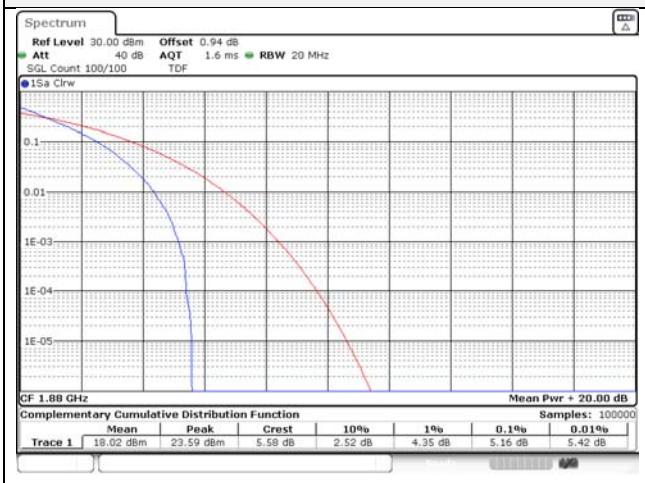

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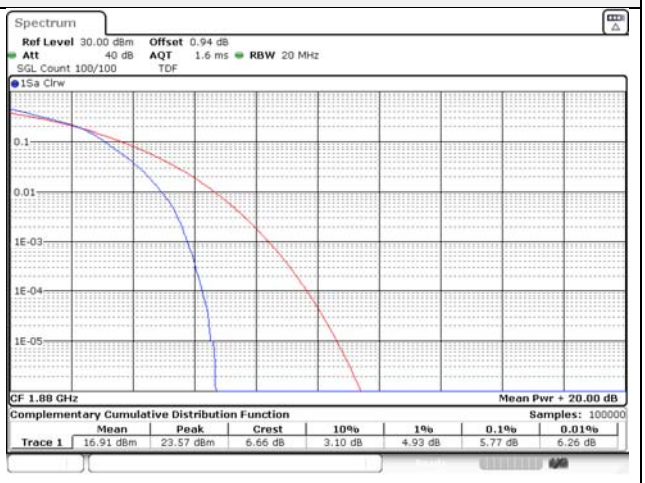

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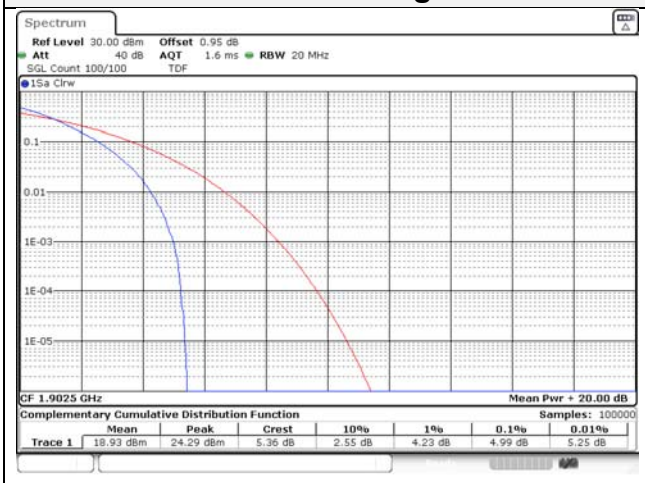

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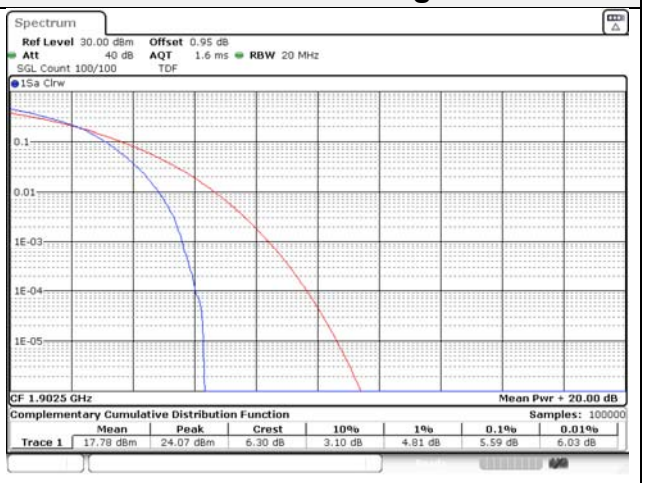

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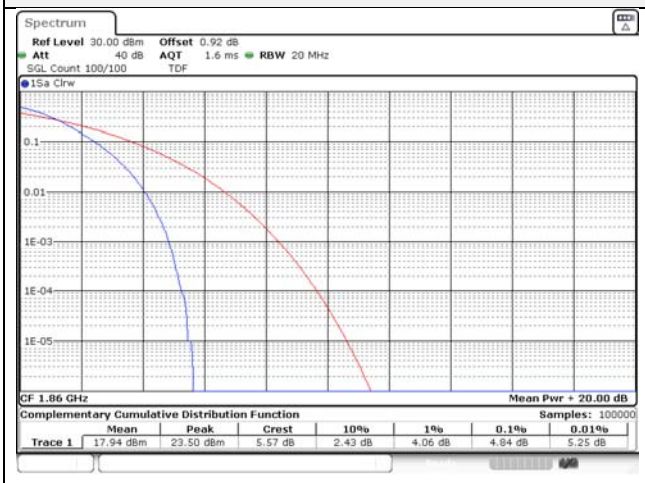

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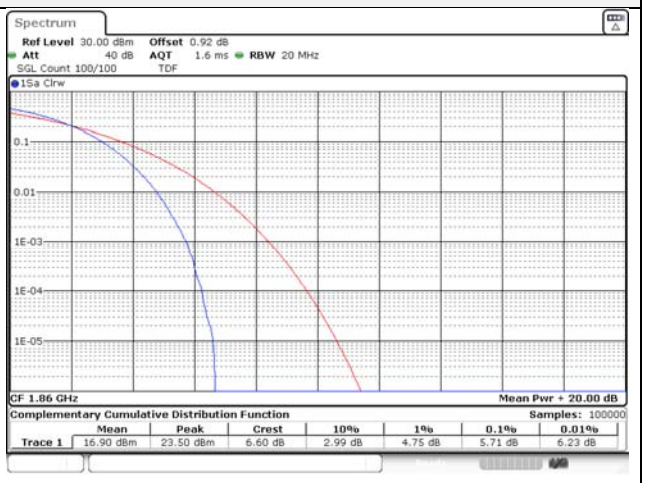
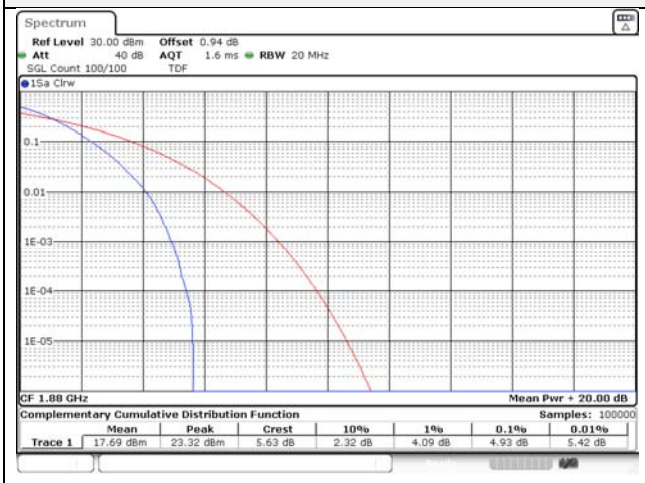
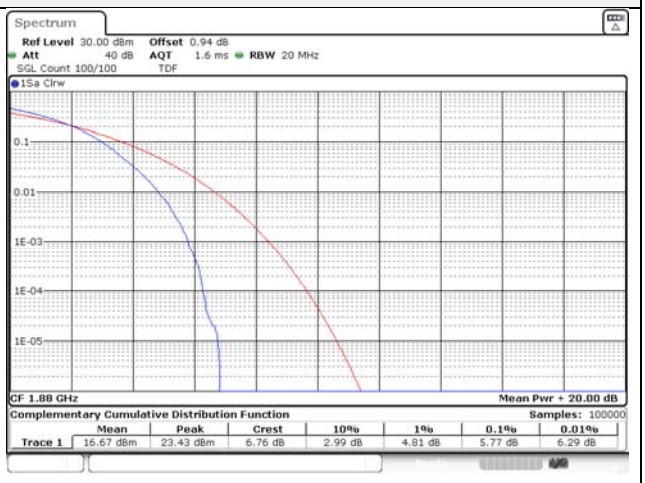


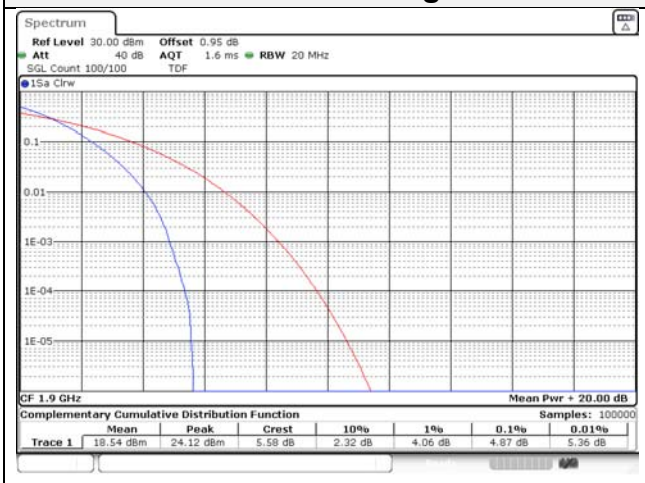
20M BW QPSK / Mid ch.



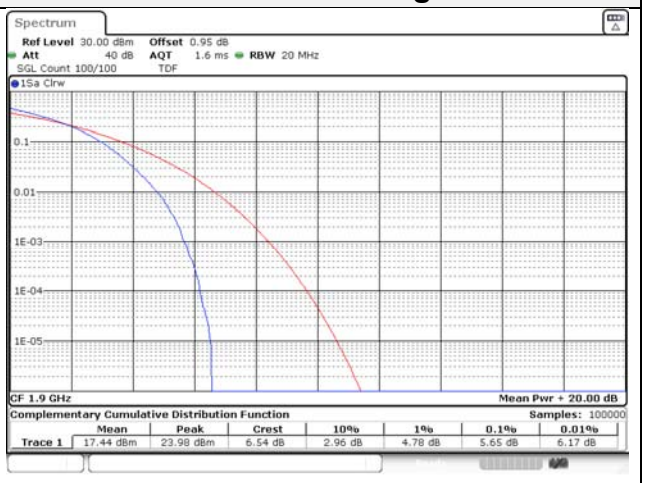
20M BW 16QAM Mid ch.



20M BW QPSK / High ch.



20M BW 16QAM High ch.



Test mode: LTE Band 25

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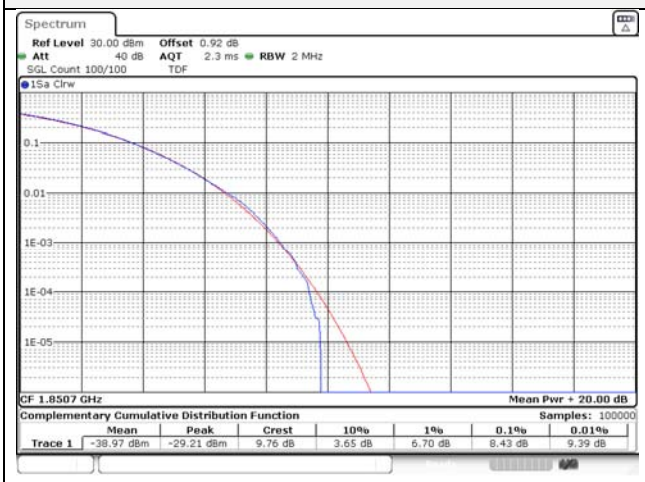

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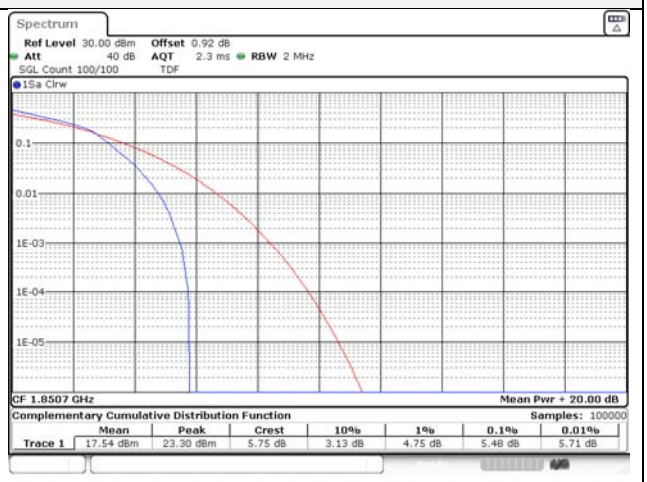
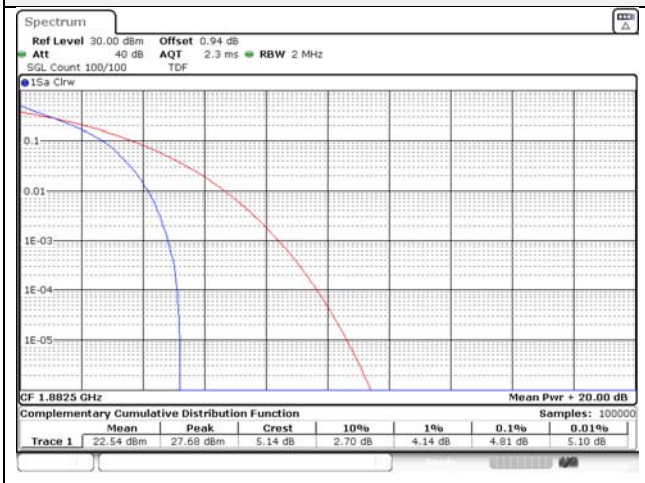
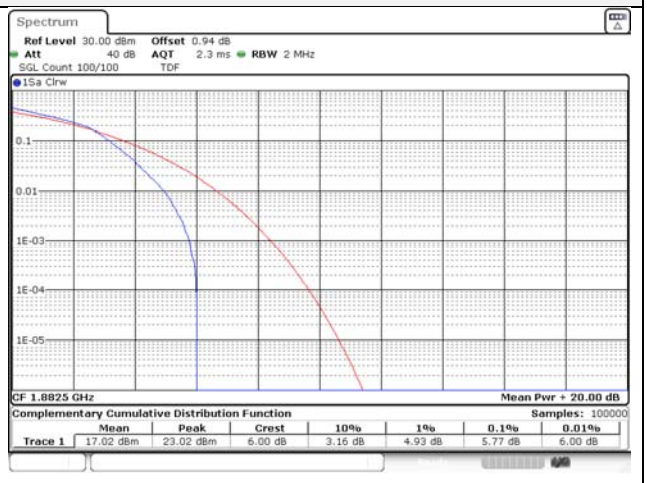


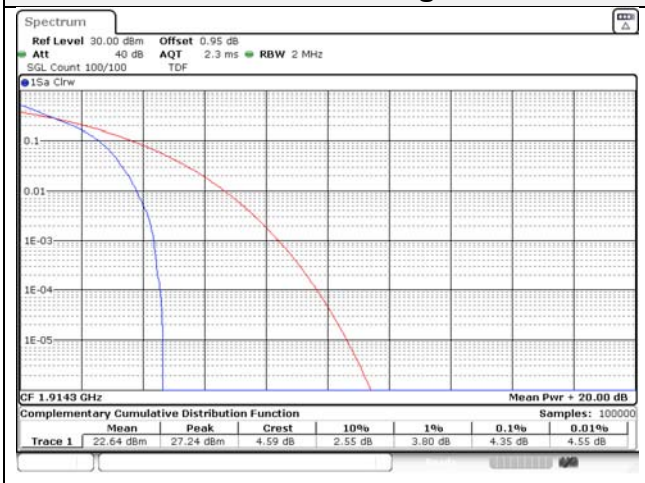
1.4M BW QPSK Mid ch.



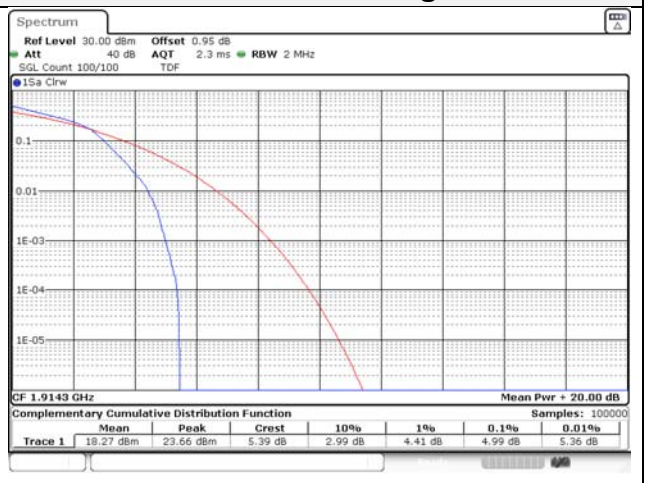
1.4M BW 16QAM Mid ch.



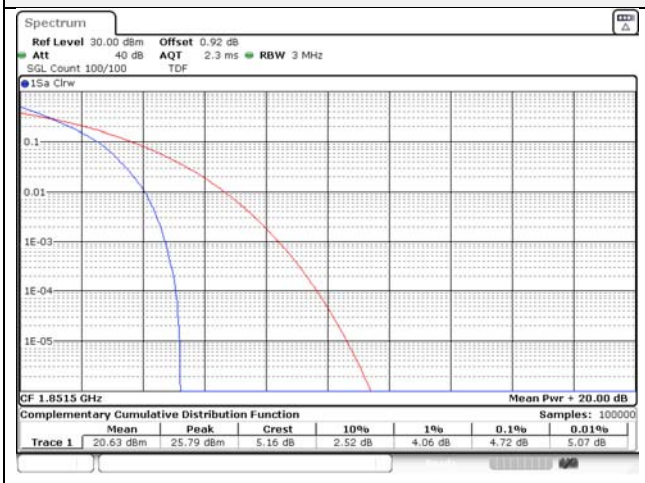
1.4M BW QPSK High ch.



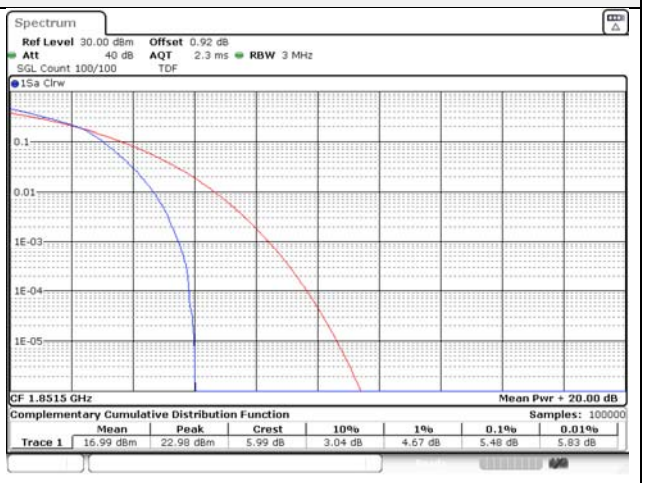
1.4M BW 16QAM High ch.



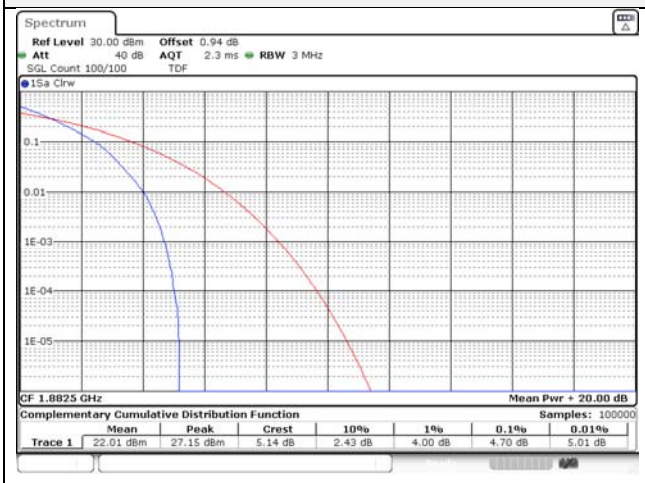
3M BW QPSK Low ch.



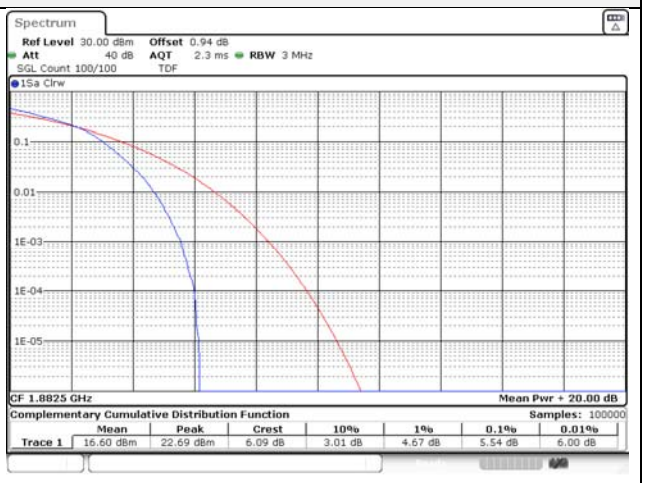
3M BW 16QAM Low ch.



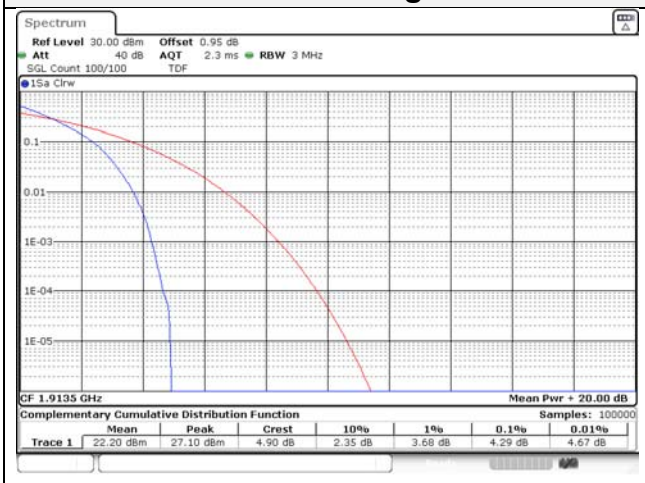
3M BW QPSK Mid ch.



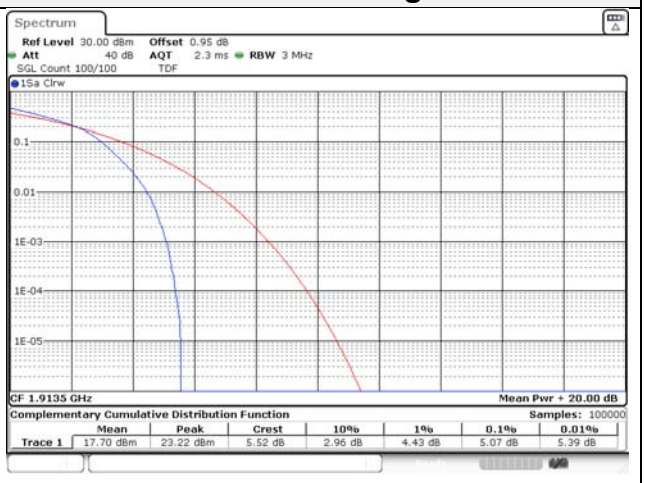
3M BW 16QAM Mid ch.



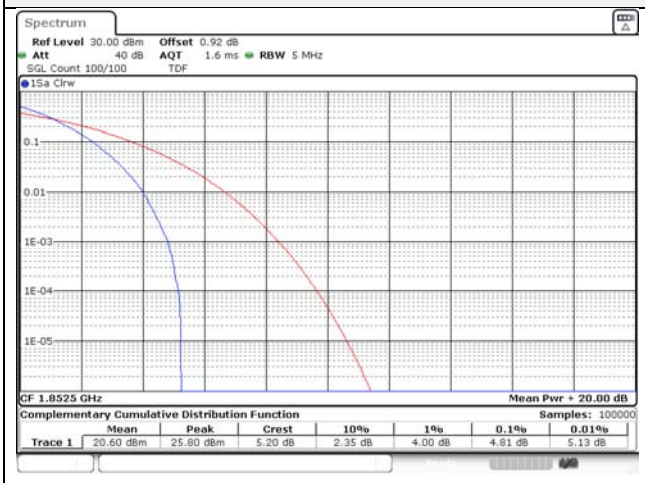
3M BW QPSK High ch.



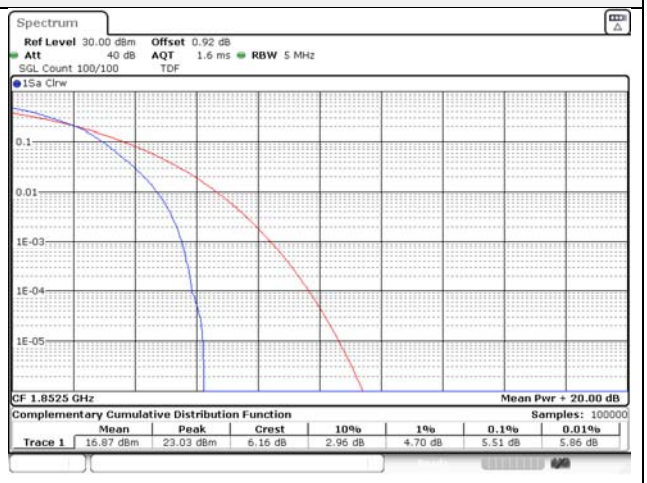
3M BW 16QAM High ch.



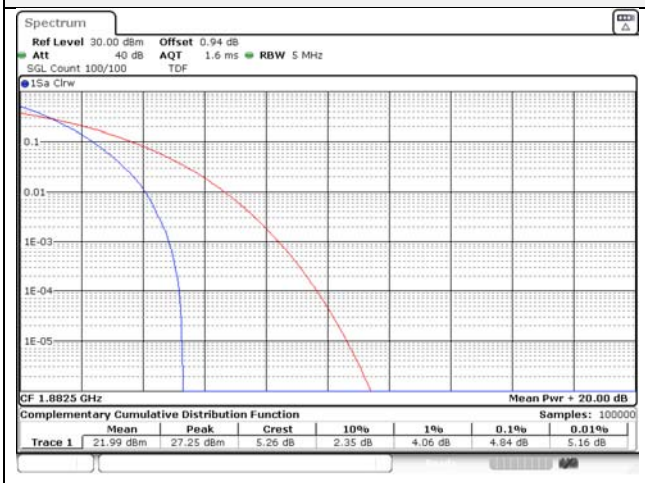
5M BW QPSK Low ch.



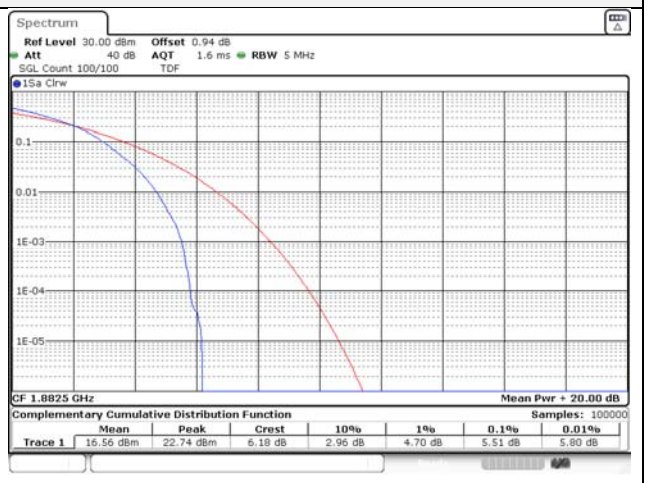
5M BW 16QAM Low ch.



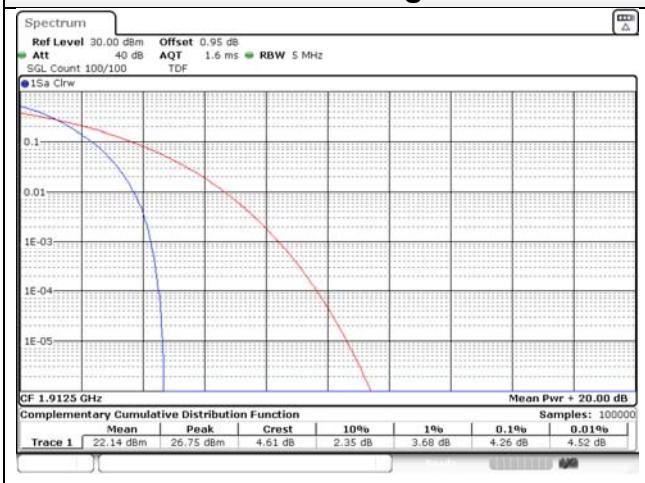
5M BW QPSK Mid ch.



5M BW 16QAM Mid ch.



5M BW QPSK High ch.



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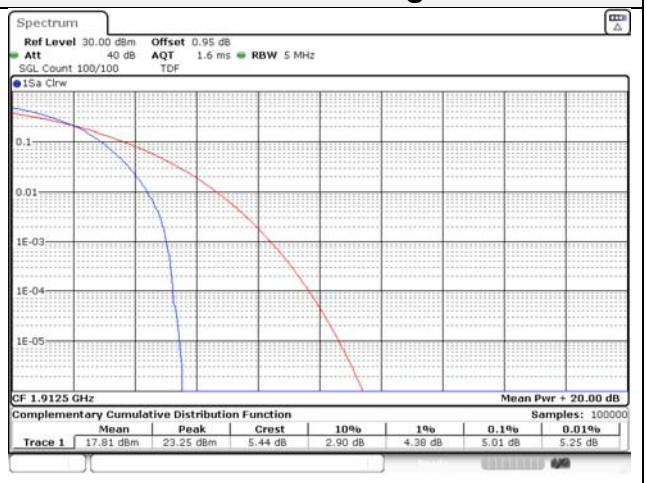

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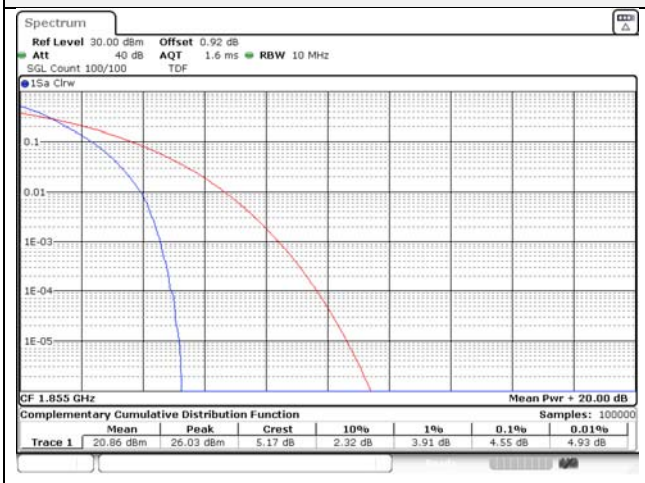
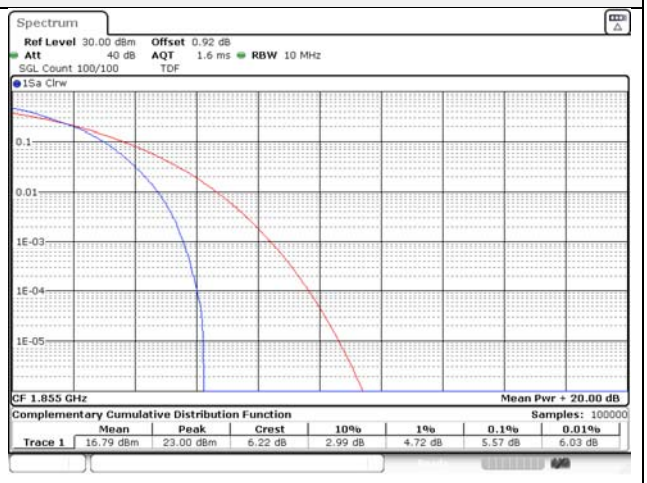
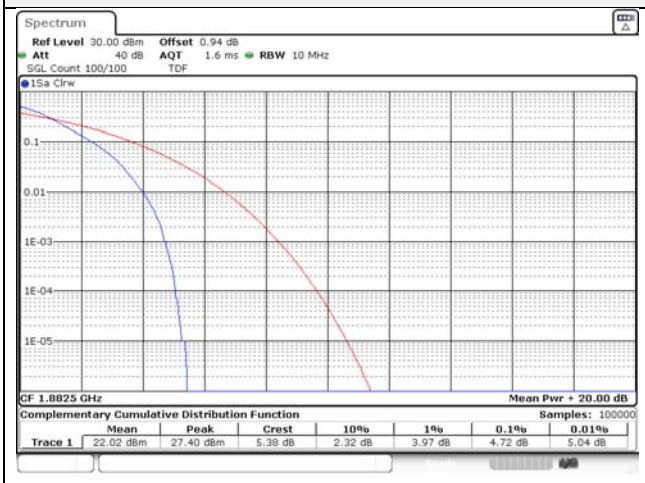


10M BW 16QAM Low ch.



10M BW QPSK Mid ch.



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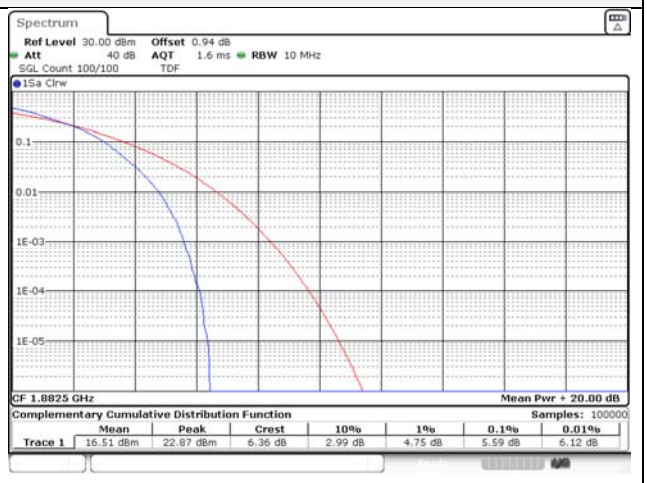

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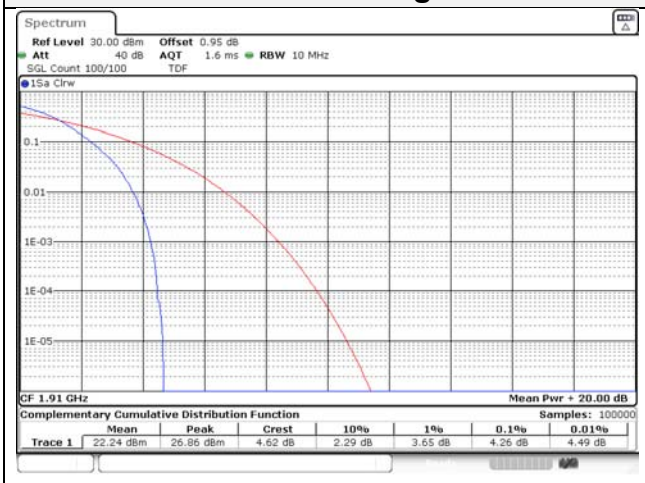

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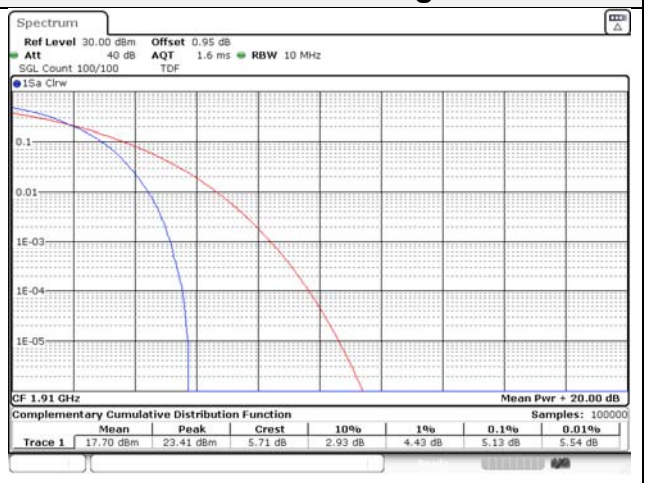

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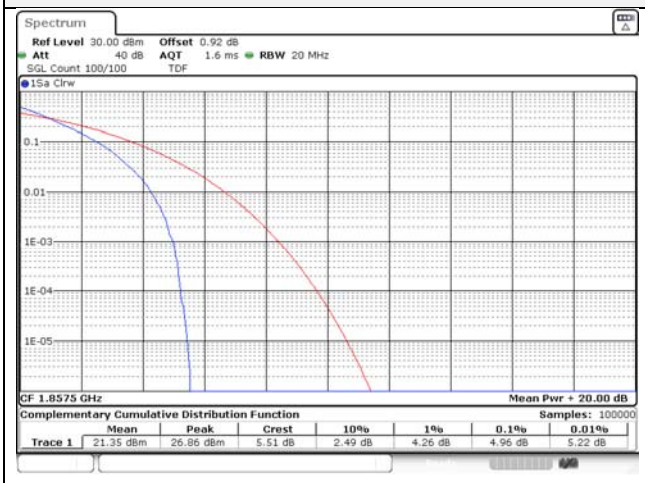

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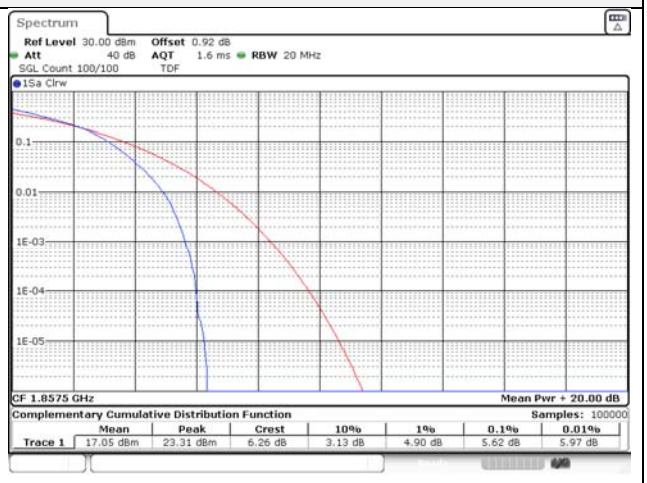

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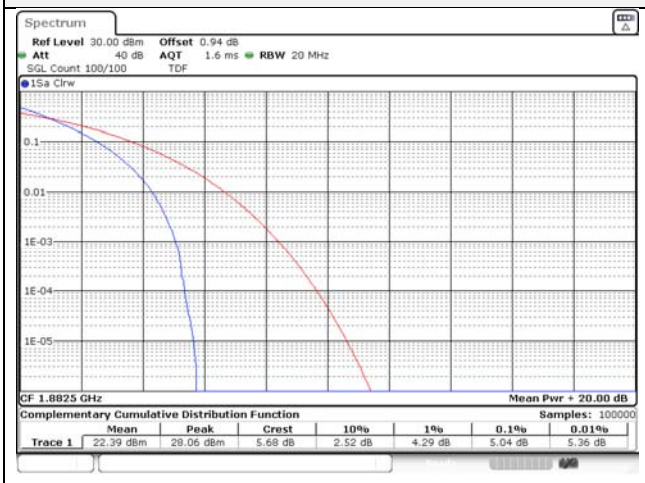

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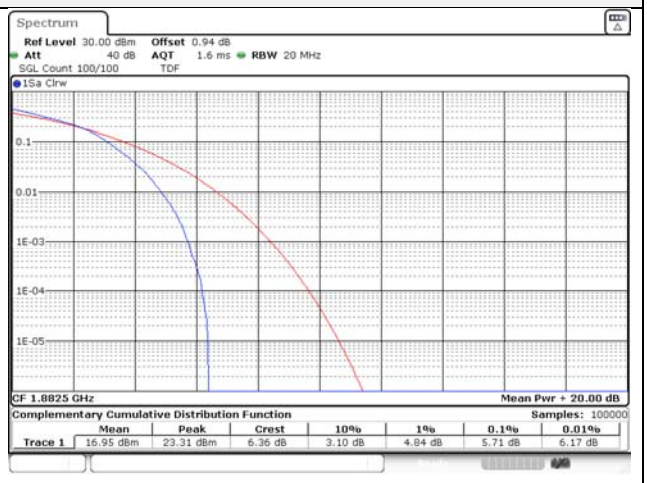

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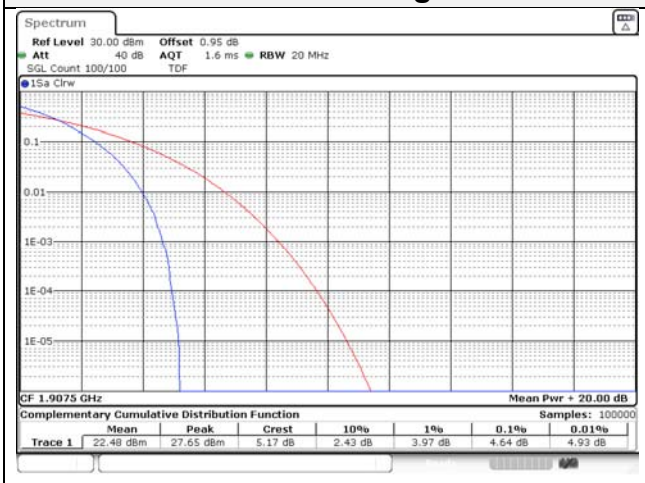

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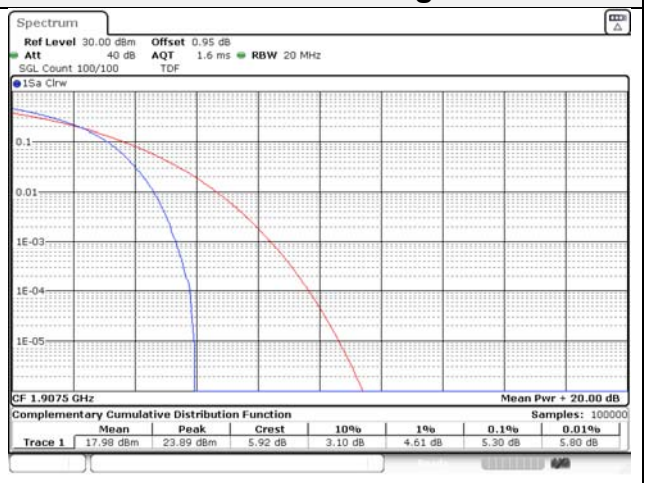

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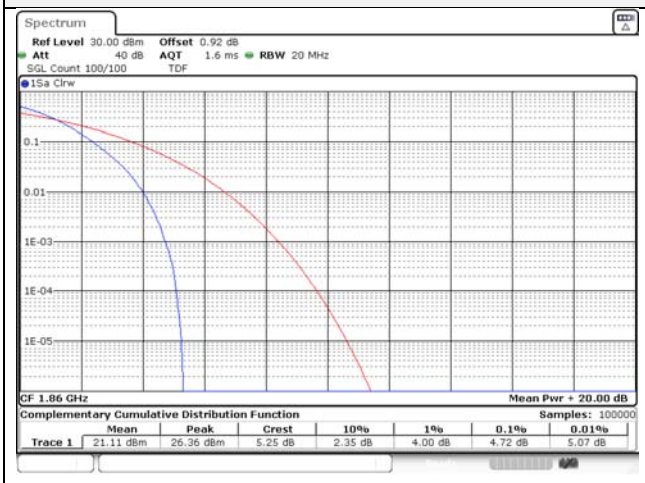

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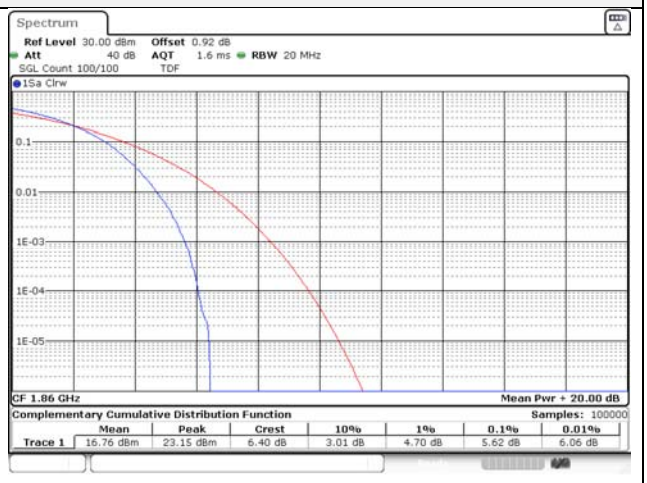

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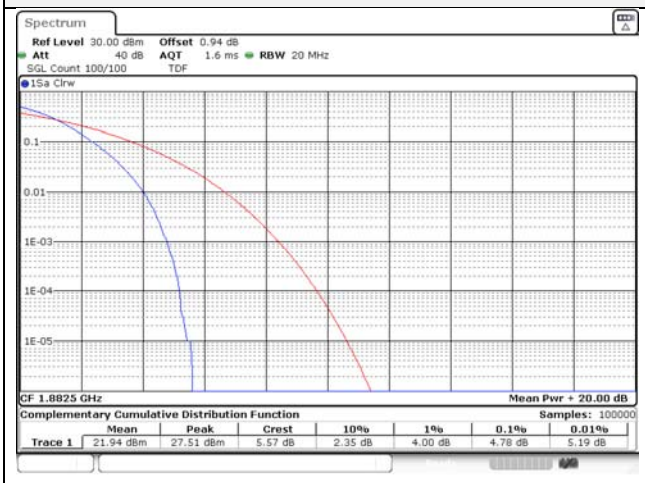

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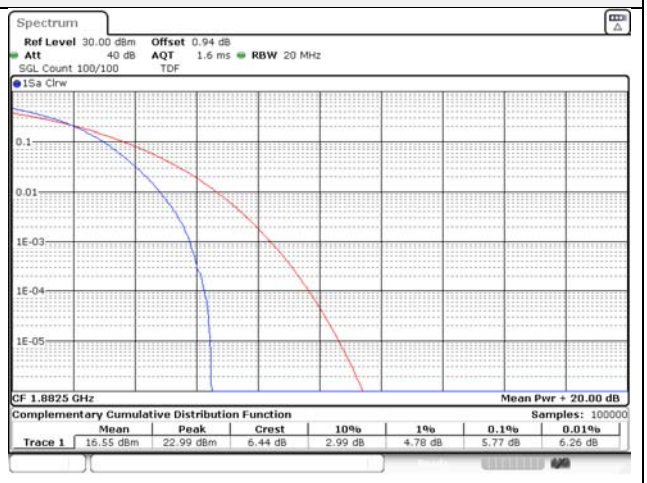

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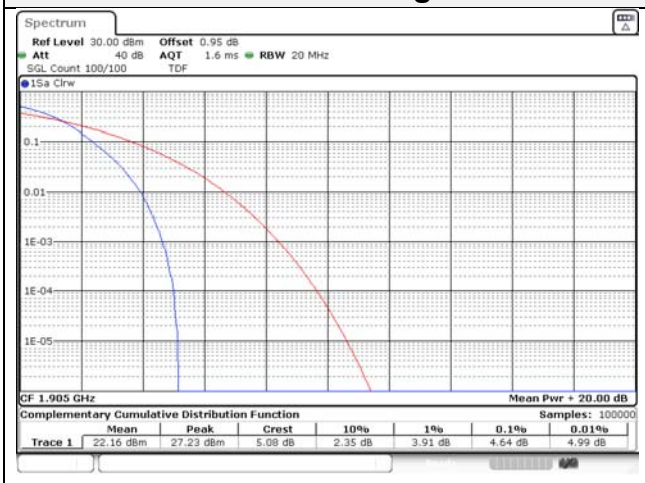

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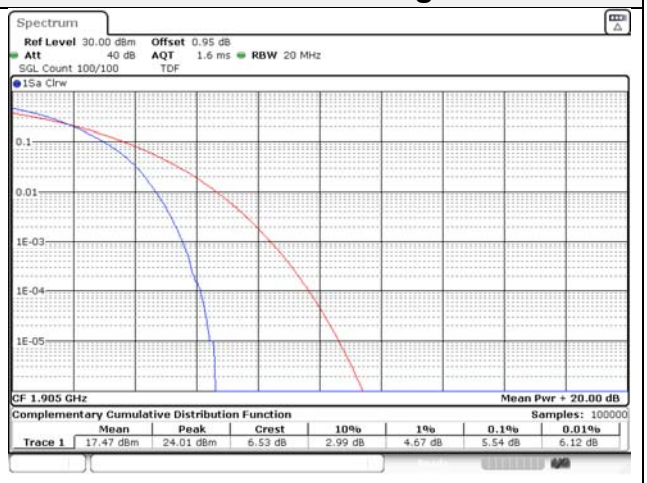
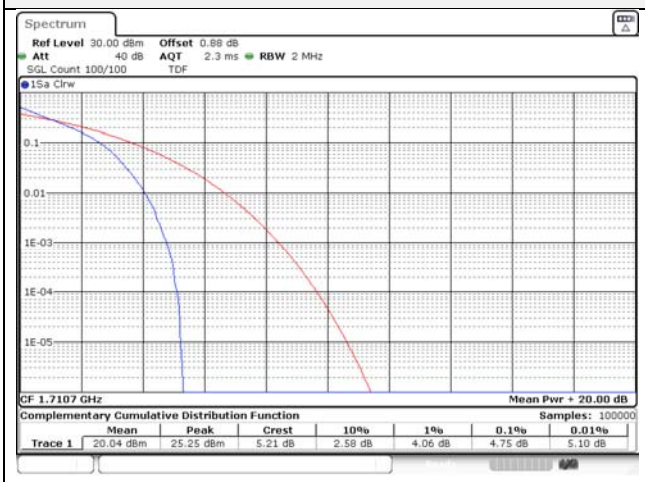
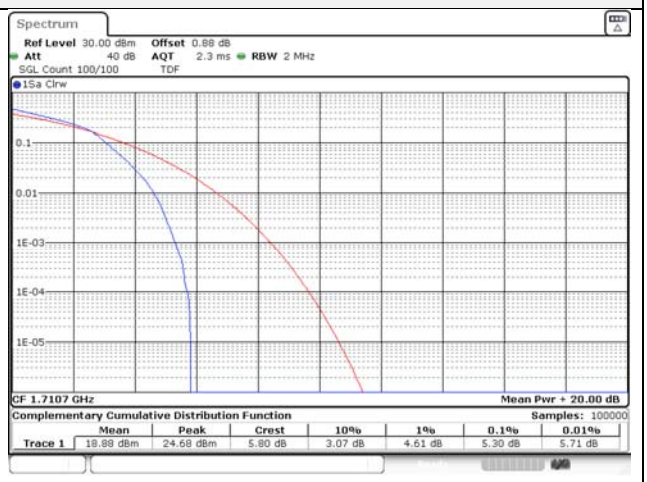


Test mode: LTE Band 66/4

1.4M BW QPSK Low ch.



1.4M BW 16QAM Low ch.



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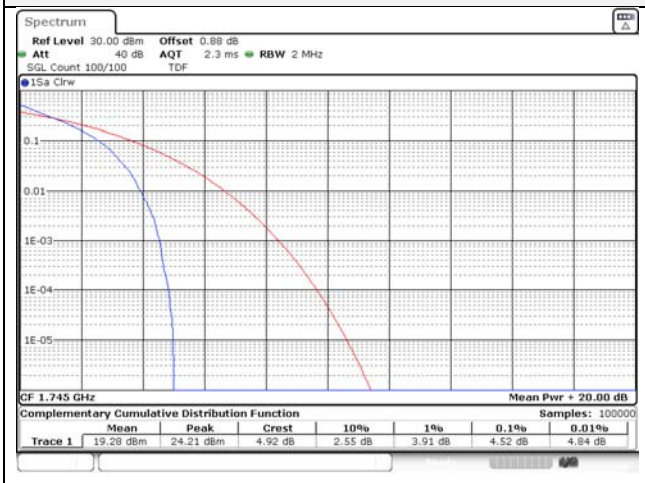
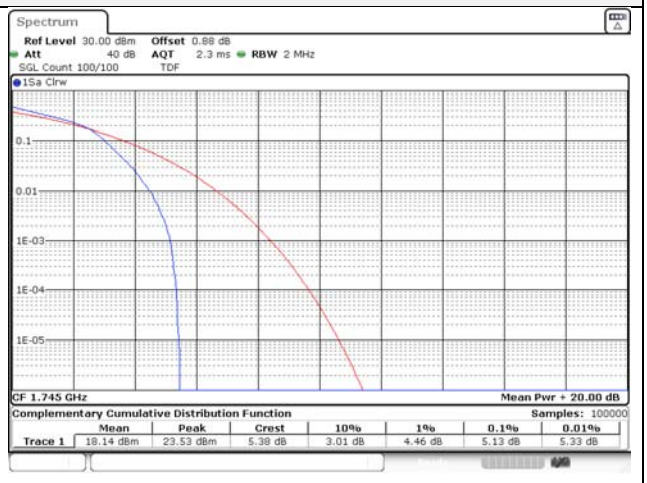


1.4M BW 16QAM Mid ch.



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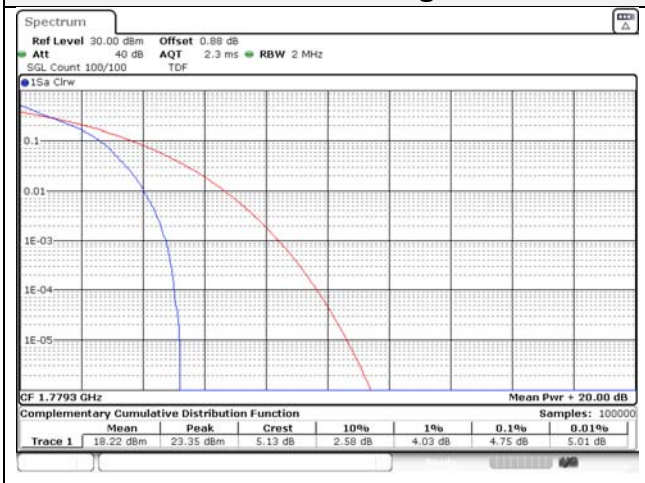
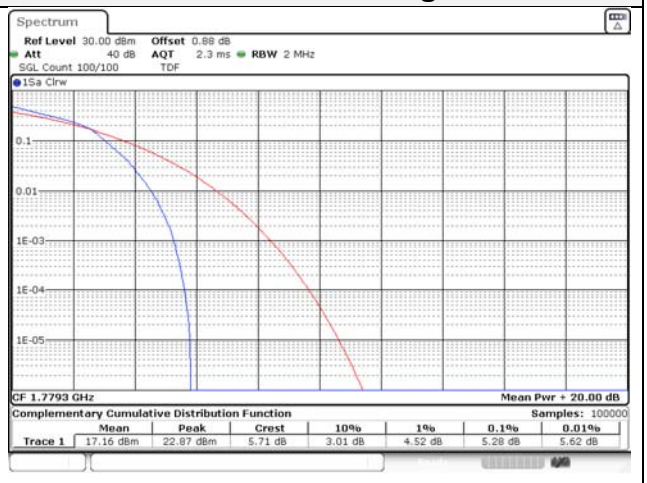
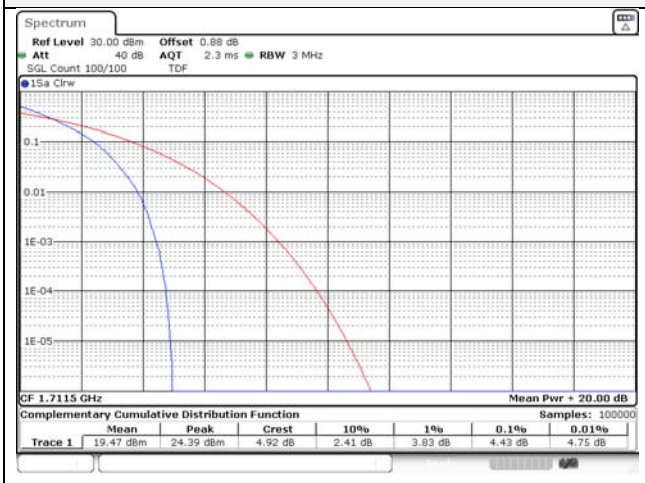


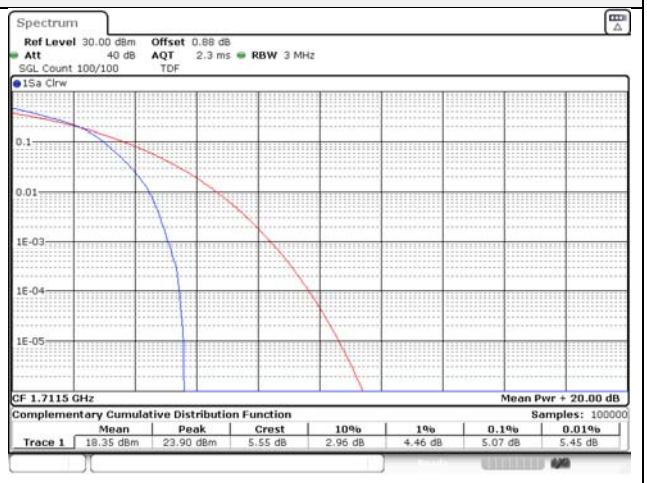
1.4M BW 16QAM High ch.



3M BW QPSK Low ch.



3M BW 16QAM Low ch.



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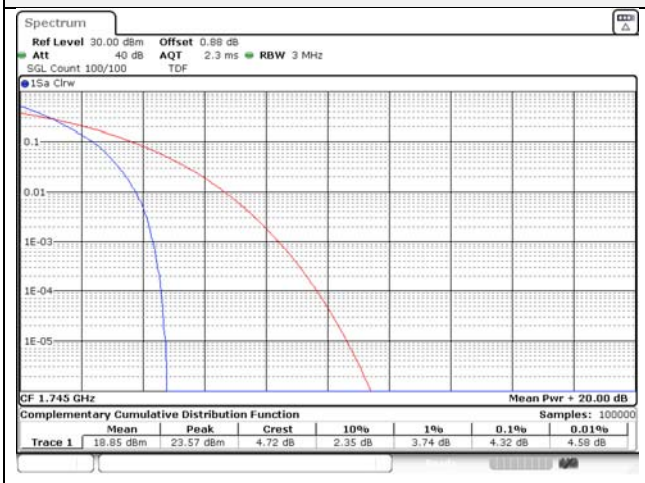

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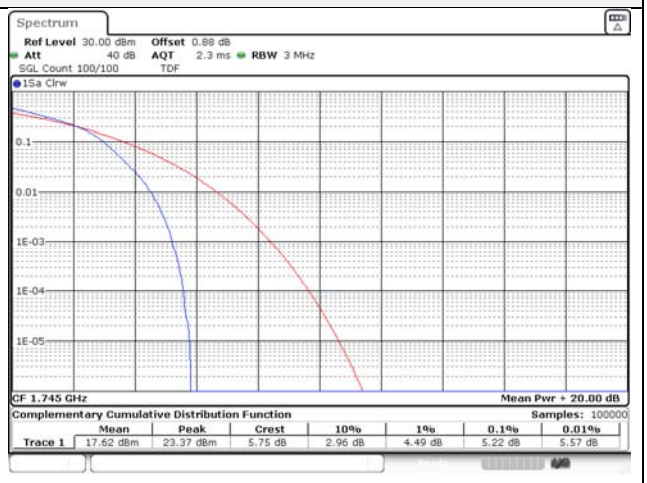

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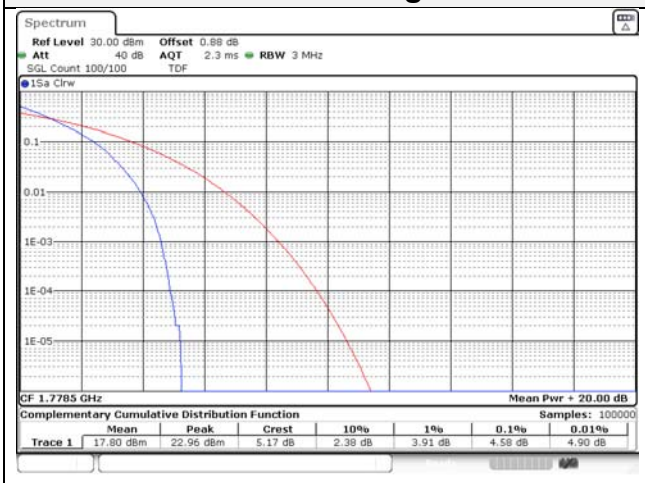

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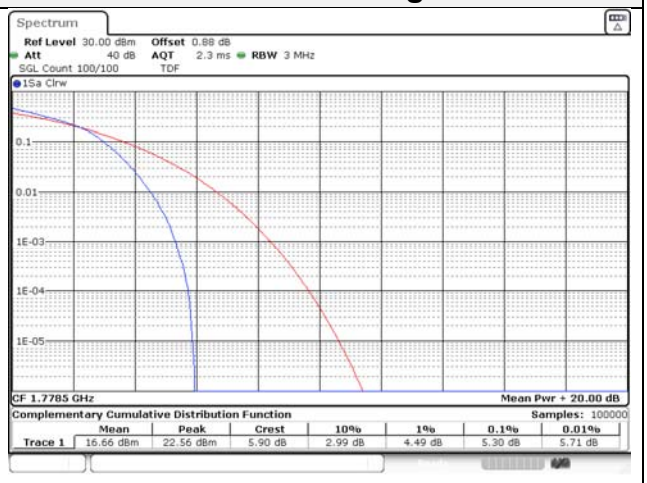

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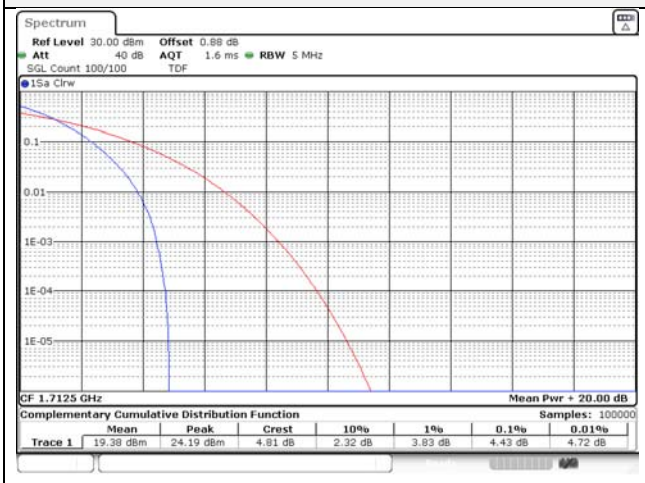
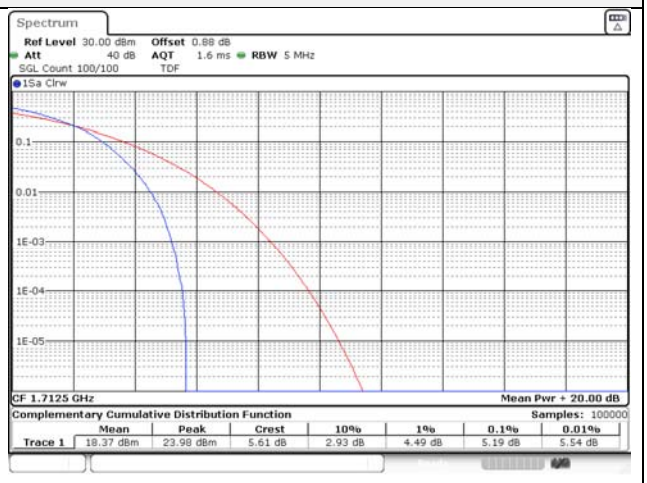


5M BW 16QAM Low ch.



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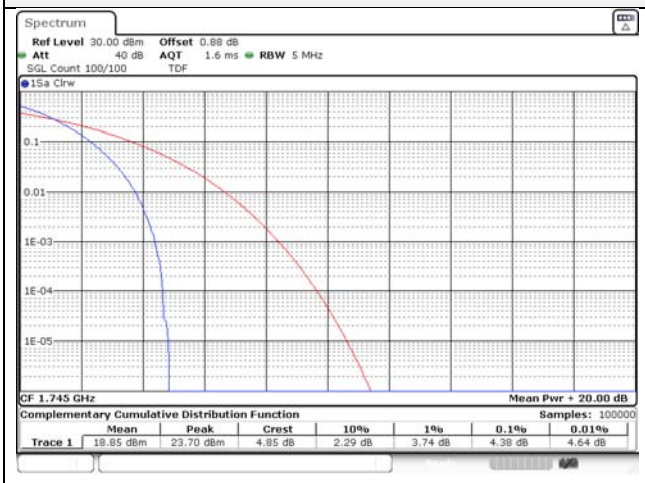

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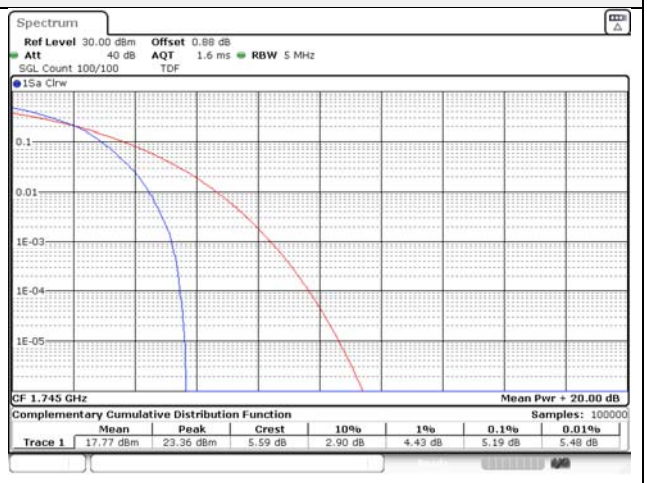

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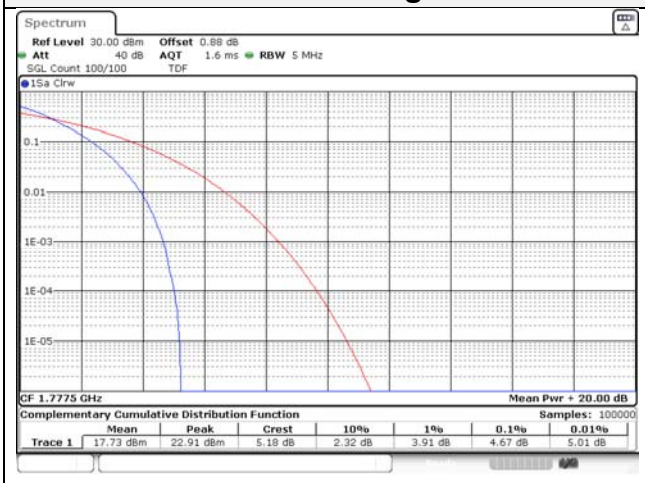

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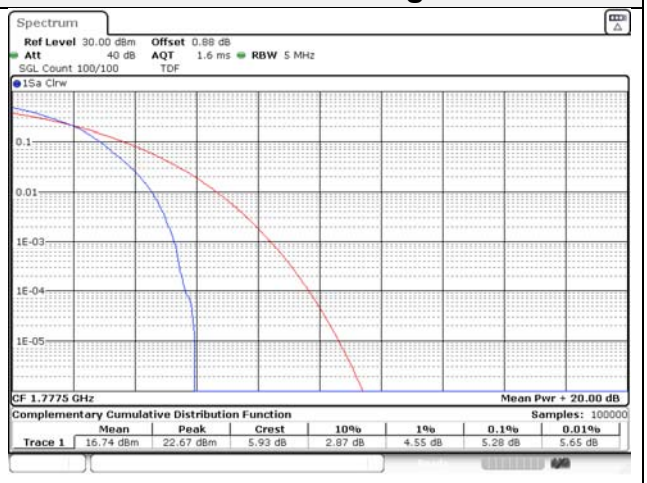

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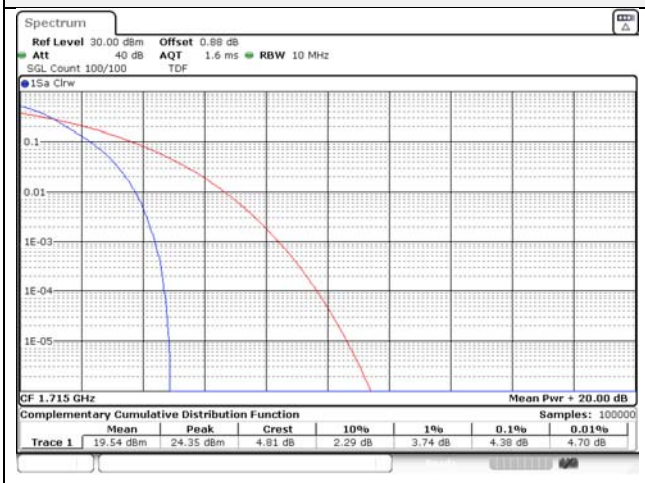

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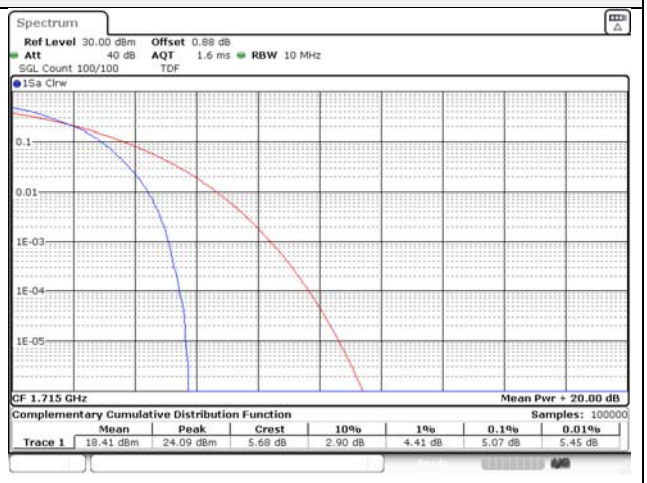
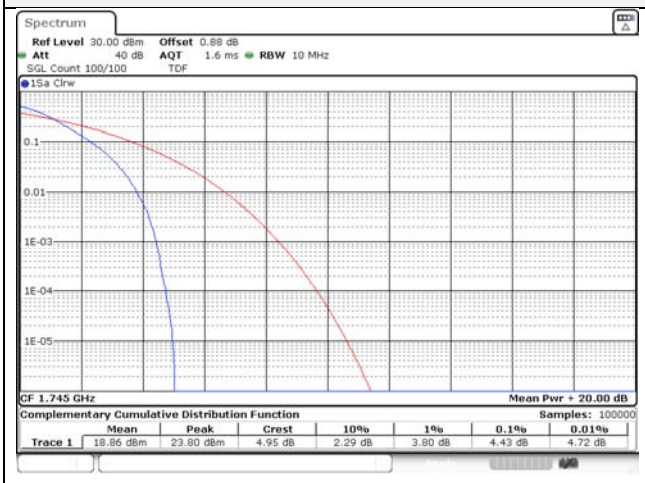


10M BW QPSK Mid ch.



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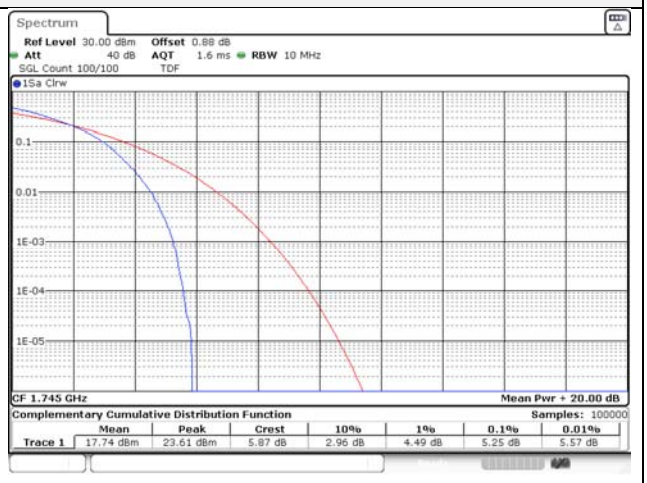
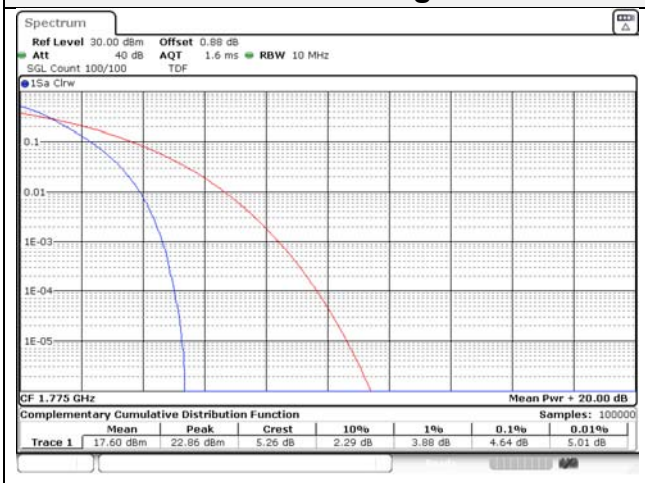


10M BW QPSK High ch.



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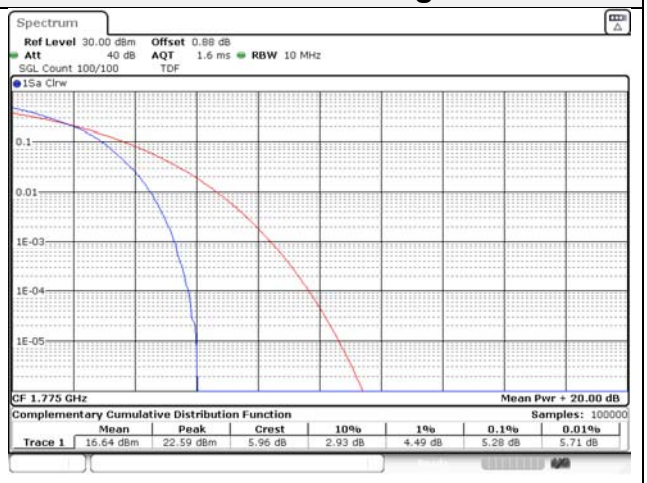

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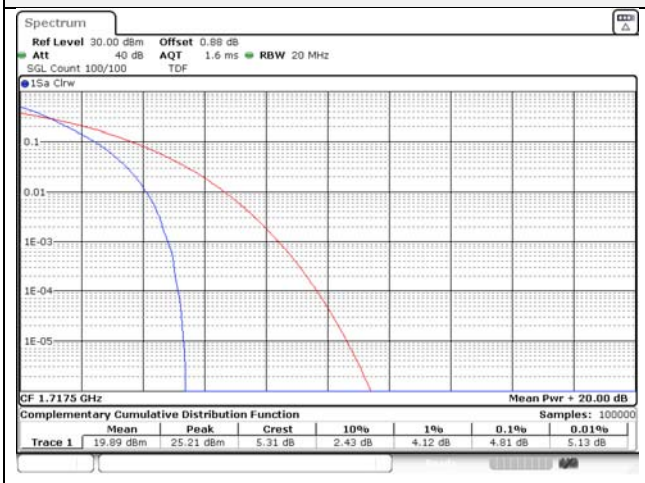

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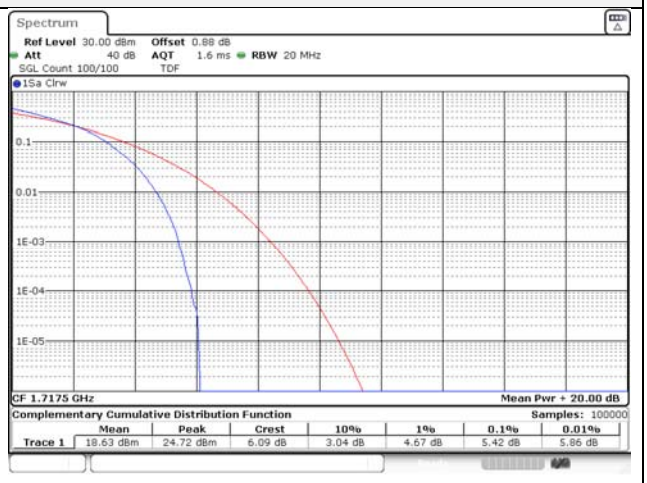

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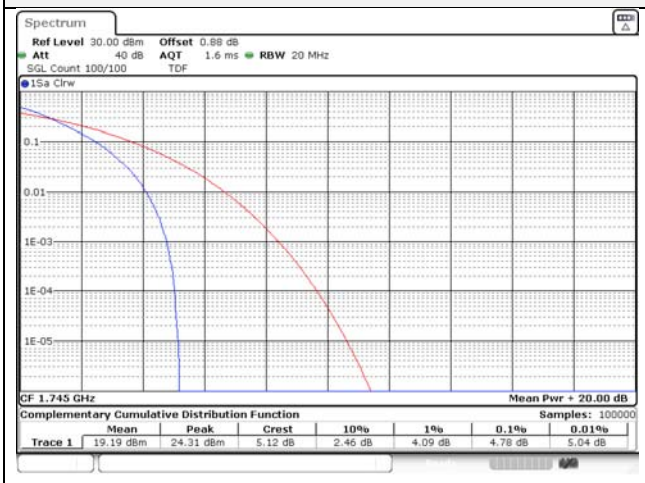

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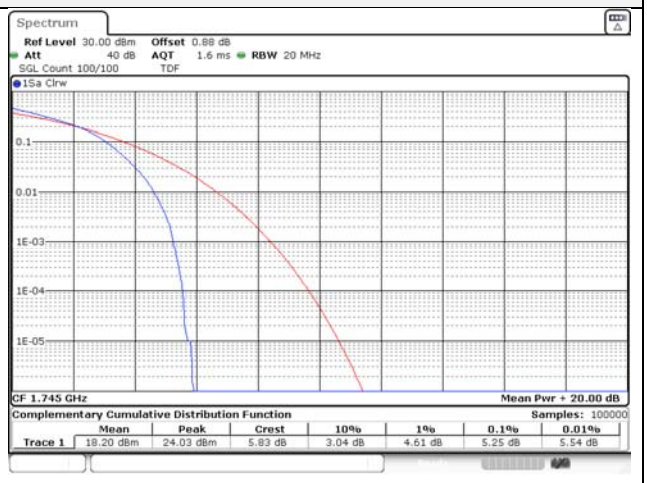

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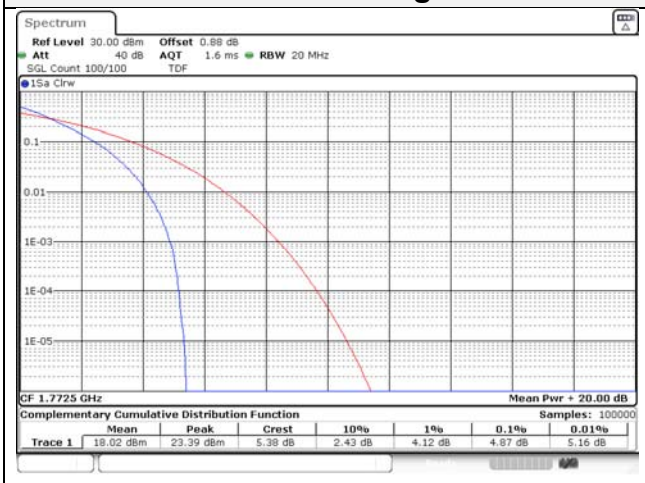

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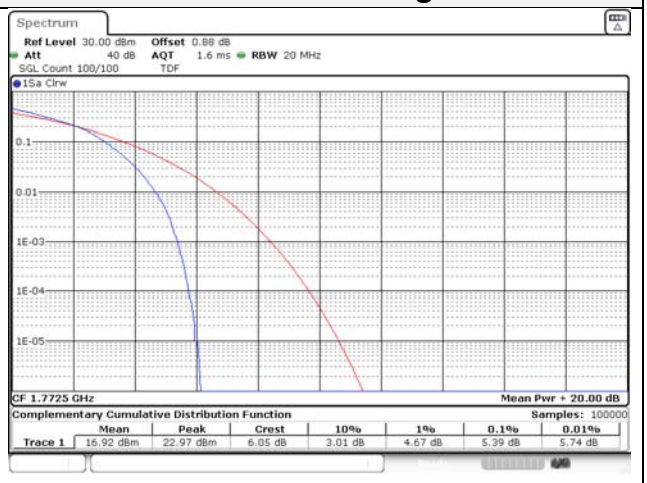

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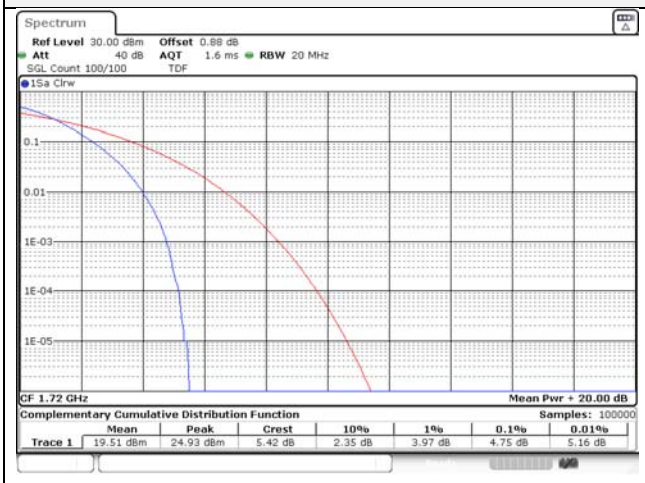
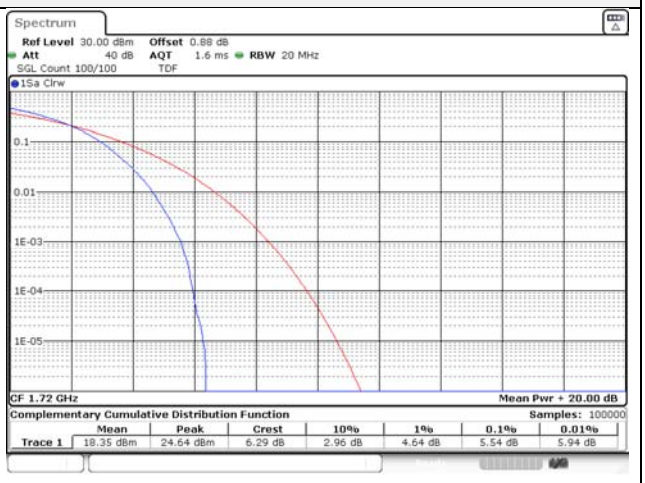
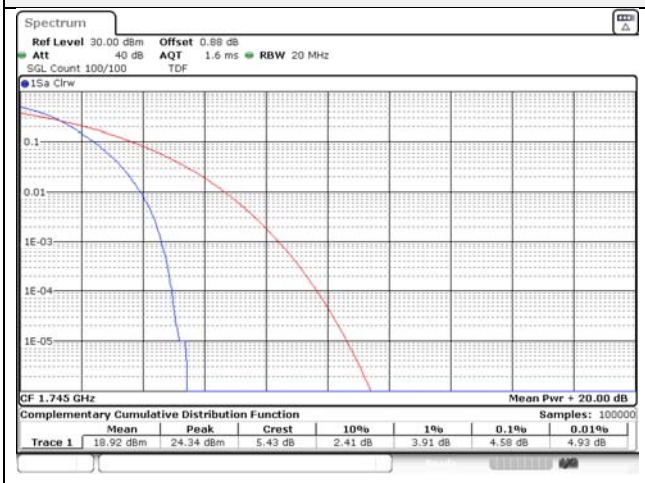


20M BW 16QAM Low ch.



20M BW QPSK Mid ch.



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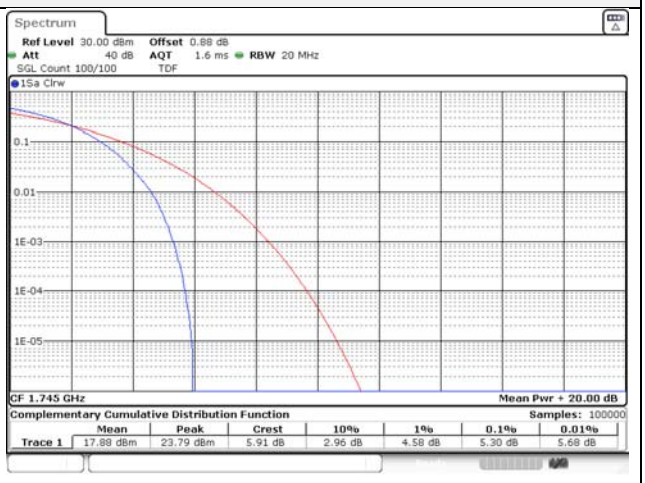

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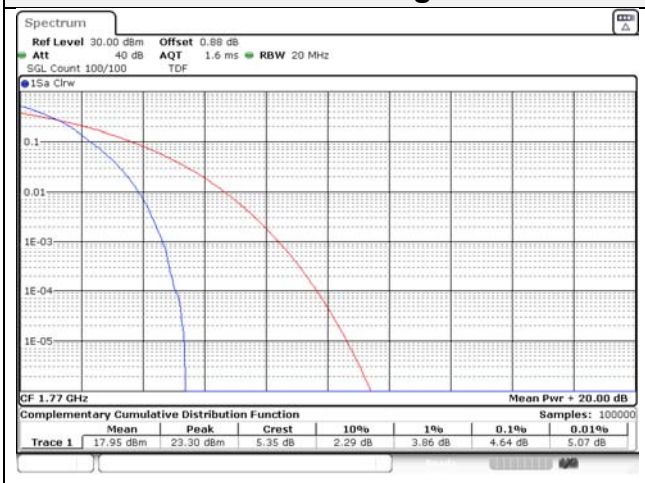

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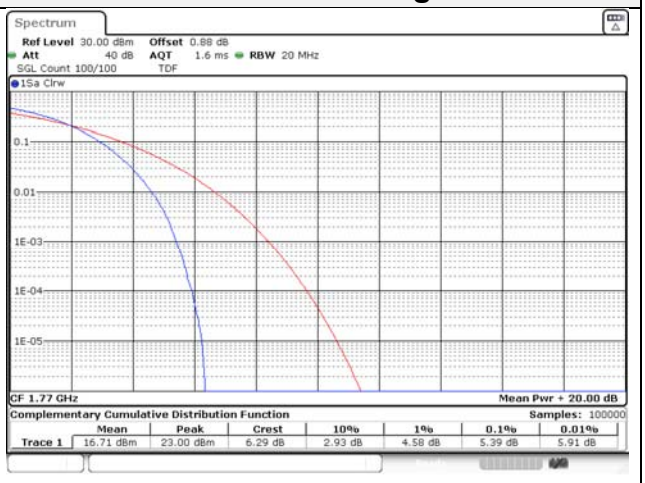
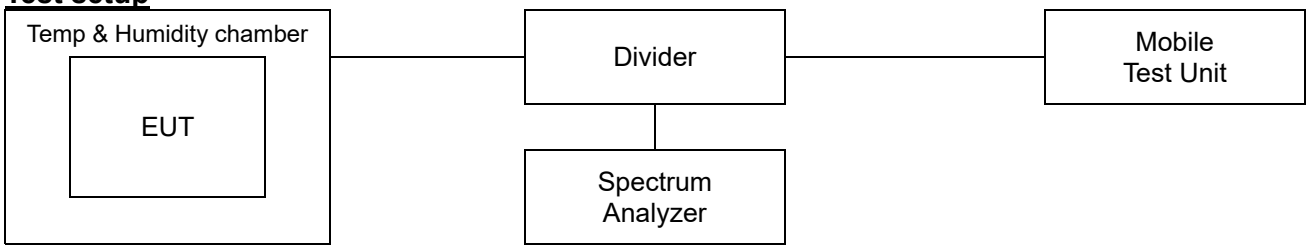


7.6. Frequency stability

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 and RSS-132(5.3),

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.

According to §24.235 and RSS-133(6.3),
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.
The carrier frequency shall not depart from the reference frequency, in excess of ±2.5 ppm for mobile stations and ±1.0 ppm for base stations.

According to §27.54 and RSS-130(4.5),
The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

According to §27.54 and RSS-139(6.4),
The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the Authorized bands of operation.

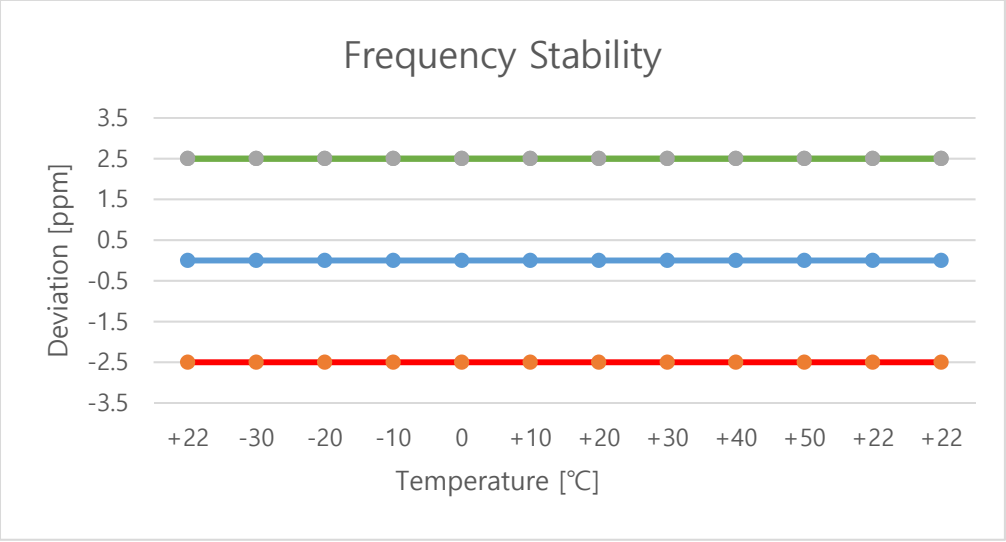
Test procedure
ANSI 63.26-2015 – Section 5.6

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

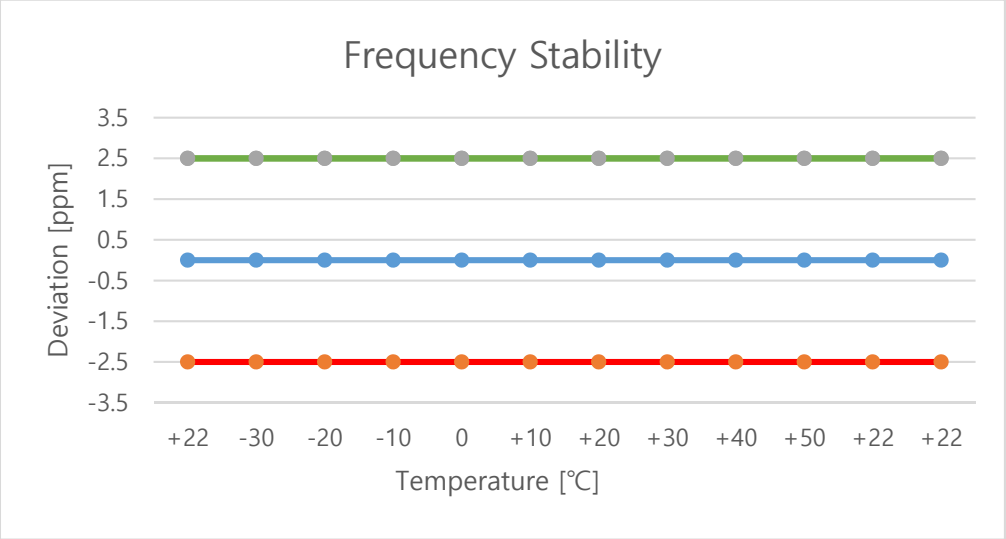
Test mode : LTE Band 2
Frequency (㎐) : 1 880 000 000
Channel : 18900
Deviation limit(FCC) : The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.
Deviation limit(IC) : ±0.00025% or 2.5ppm

Voltage (%)	Power (V)	Temp. (°C)	Frequency (㎐)	Frequency error (㎐)	Deviation	
					(ppm)	(%)
100%	3.88	+22(Ref)	1,879,999,995	-4.53	0.0	0.000000
		-30	1,879,999,995	-4.53	0.0	0.000000
		-20	1,879,999,996	-4.03	0.0	0.000000
		-10	1,879,999,996	-4.35	0.0	0.000000
		0	1,879,999,996	-4.27	0.0	0.000000
		+10	1,879,999,996	-4.29	0.0	0.000000
		+20	1,879,999,996	-4.19	0.0	0.000000
		+30	1,879,999,996	-4.24	0.0	0.000000
		+40	1,879,999,996	-4.18	0.0	0.000000
		+50	1,879,999,995	-4.51	0.0	0.000000
115%	4.46	+22(Ref)	1,879,999,996	-4.03	0.0	0.000000
End point	3.40	+22(Ref)	1,879,999,995	-4.56	0.0	0.000000



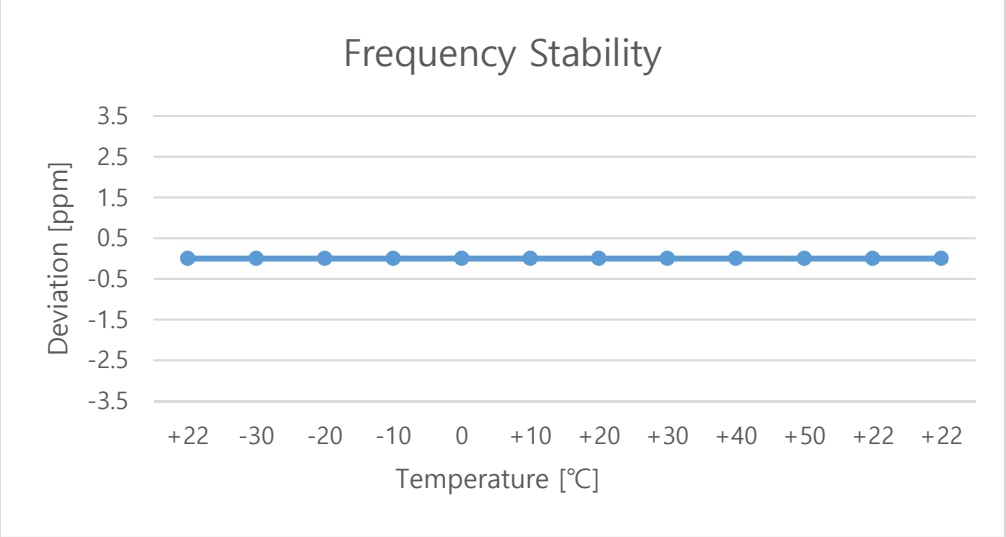
Test mode : LTE Band 5
Frequency (㎐) : 836 500 000
Channel : 20525
Deviation limit : ±0.00025% or 2.5ppm

Voltage (%)	Power (V)	Temp. (°C)	Frequency (㎐)	Frequency error (㎐)	Deviation	
					(ppm)	(%)
100%	3.88	+22(Ref)	836,499,998	-1.66	0.0	0.000000
		-30	836,499,999	-1.43	0.0	0.000000
		-20	836,499,998	-1.64	0.0	0.000000
		-10	836,499,999	-1.23	0.0	0.000000
		0	836,499,998	-1.62	0.0	0.000000
		+10	836,499,999	-1.40	0.0	0.000000
		+20	836,499,998	-1.89	0.0	0.000000
		+30	836,499,999	-1.47	0.0	0.000000
		+40	836,499,999	-1.42	0.0	0.000000
		+50	836,499,999	-1.40	0.0	0.000000
115%	4.46	+22(Ref)	836,499,999	-1.23	0.0	0.000000
End point	3.40	+22(Ref)	836,499,998	-1.93	0.0	0.000000



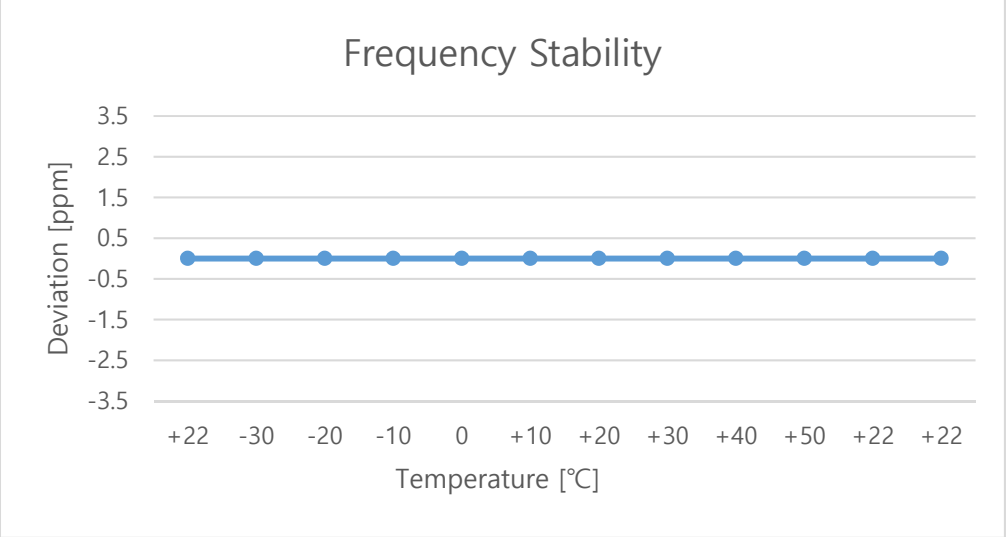
Test mode : LTE Band 12
Frequency (㎐) : 707 500 000
Channel : 23095
Deviation limit(FCC&IC) : The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized bands of operation

Voltage (%)	Power (V)	Temp. (°C)	Frequency (㎐)	Frequency error (㎐)	Deviation	
					(ppm)	(%)
100%	3.88	+22(Ref)	707,499,997	-2.82	0.0	0.000000
		-30	707,499,997	-2.69	0.0	0.000000
		-20	707,499,997	-2.59	0.0	0.000000
		-10	707,499,998	-2.45	0.0	0.000000
		0	707,499,997	-2.57	0.0	0.000000
		+10	707,499,997	-2.70	0.0	0.000000
		+20	707,499,998	-2.47	0.0	0.000000
		+30	707,499,997	-2.57	0.0	0.000000
		+40	707,499,997	-2.71	0.0	0.000000
		+50	707,499,998	-2.47	0.0	0.000000
115%	4.46	+22(Ref)	707,499,998	-2.36	0.0	0.000000
End point	3.40	+22(Ref)	707,499,997	-2.76	0.0	0.000000



Test mode : LTE Band 13
Frequency (㎐) : 782 000 000
Channel : 23230
Deviation limit(FCC&IC) : The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized bands of operation

Voltage (%)	Power (V)	Temp. (°C)	Frequency (㎐)	Frequency error (㎐)	Deviation	
					(ppm)	(%)
100%	3.88	+22(Ref)	781,999,999	-1.22	0.0	0.000000
		-30	781,999,998	-1.71	0.0	0.000000
		-20	781,999,998	-1.53	0.0	0.000000
		-10	781,999,999	-1.24	0.0	0.000000
		0	781,999,998	-1.70	0.0	0.000000
		+10	781,999,998	-1.54	0.0	0.000000
		+20	781,999,998	-1.81	0.0	0.000000
		+30	781,999,999	-1.37	0.0	0.000000
		+40	781,999,998	-1.51	0.0	0.000000
		+50	781,999,999	-1.49	0.0	0.000000
115%	4.46	+22(Ref)	781,999,998	-1.80	0.0	0.000000
End point	3.40	+22(Ref)	781,999,998	-1.85	0.0	0.000000



Test mode : LTE Band 25

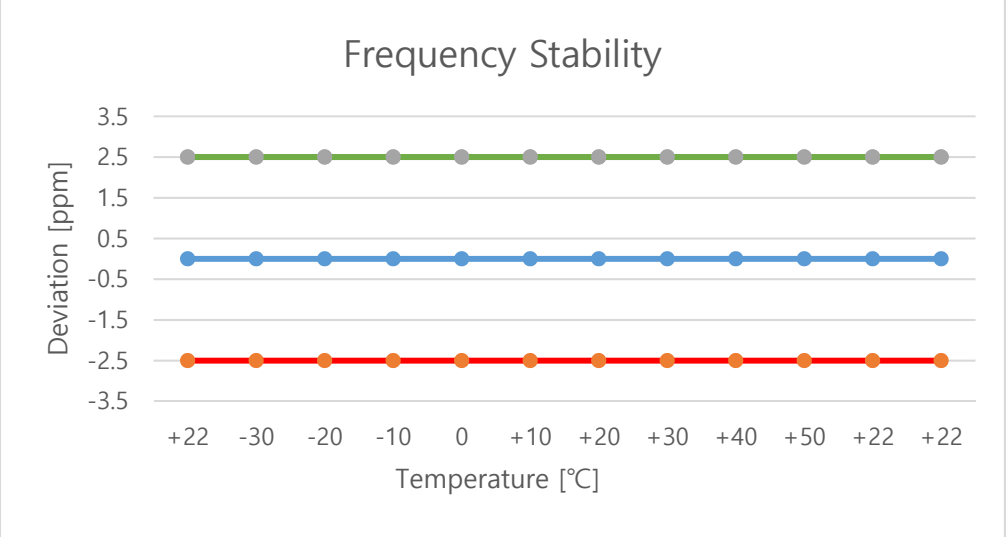
Frequency (㎐) : 1 882 500 000

Channel : 26365

Deviation limit(FCC) : The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

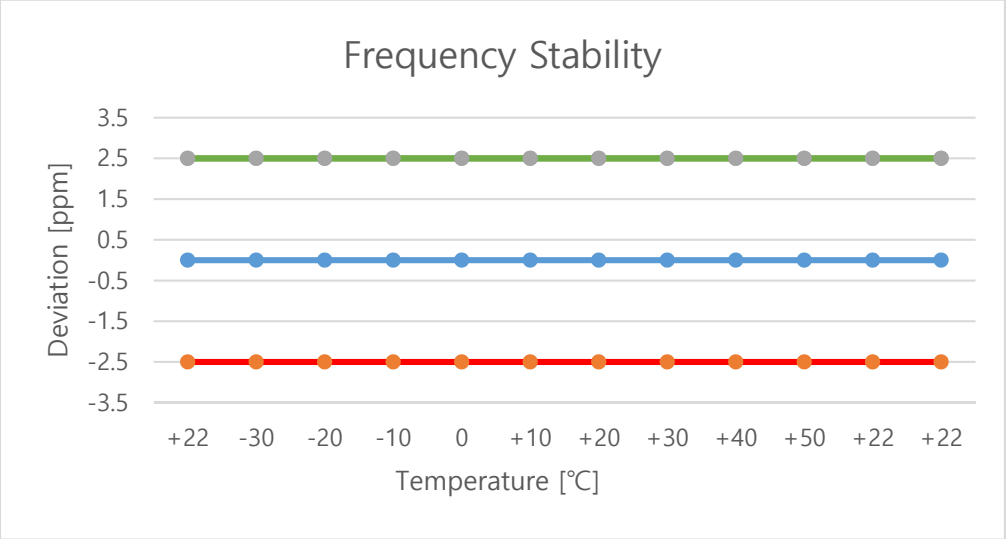
Deviation limit(IC) : ±0.00025% or 2.5ppm

Voltage (%)	Power (V)	Temp. (°C)	Frequency (㎐)	Frequency error (㎐)	Deviation	
					(ppm)	(%)
100%	3.88	+22(Ref)	1,882,499,998	-1.53	0.0	0.000000
		-30	1,882,499,998	-1.75	0.0	0.000000
		-20	1,882,499,998	-1.56	0.0	0.000000
		-10	1,882,499,998	-1.72	0.0	0.000000
		0	1,882,499,998	-1.66	0.0	0.000000
		+10	1,882,499,998	-1.56	0.0	0.000000
		+20	1,882,499,998	-1.60	0.0	0.000000
		+30	1,882,499,998	-1.53	0.0	0.000000
		+40	1,882,499,998	-1.68	0.0	0.000000
		+50	1,882,499,998	-1.66	0.0	0.000000
115%	4.46	+22(Ref)	1,882,499,998	-1.75	0.0	0.000000
End point	3.40	+22(Ref)	1,882,500,002	1.59	0.0	0.000000



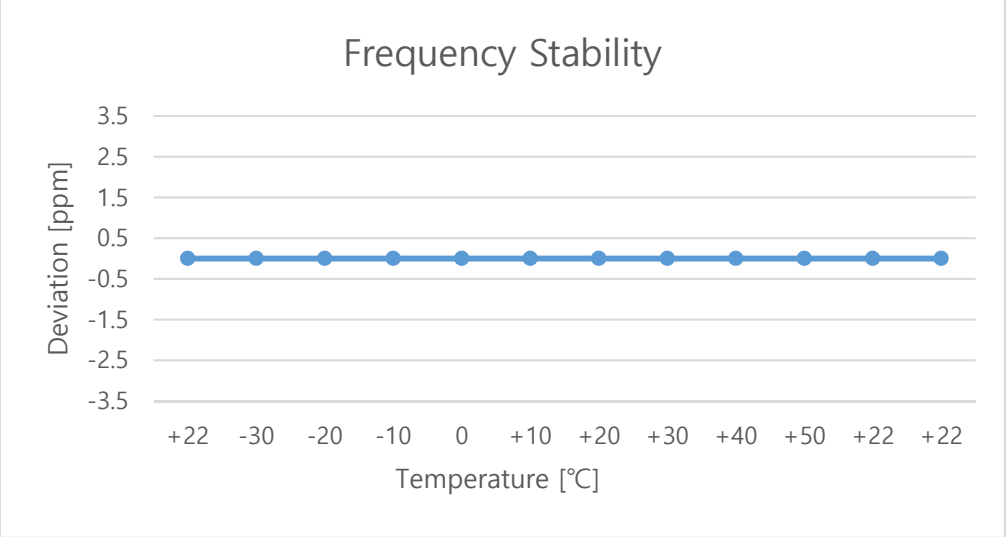
Test mode : LTE Band 26
Frequency (㎐) : 836 500 000
Channel : 26915
Deviation limit(FCC&IC) : ±0.00025% or 2.5ppm

Voltage (%)	Power (V)	Temp. (°C)	Frequency (㎐)	Frequency error (㎐)	Deviation	
					(ppm)	(%)
100%	3.88	+22(Ref)	836,499,998	-2.02	0.0	0.000000
		-30	836,499,998	-2.12	0.0	0.000000
		-20	836,499,998	-2.13	0.0	0.000000
		-10	836,499,998	-2.04	0.0	0.000000
		0	836,499,998	-2.12	0.0	0.000000
		+10	836,499,998	-2.15	0.0	0.000000
		+20	836,499,998	-2.09	0.0	0.000000
		+30	836,499,998	-2.05	0.0	0.000000
		+40	836,499,998	-2.11	0.0	0.000000
		+50	836,499,998	-2.03	0.0	0.000000
115%	4.46	+22(Ref)	836,499,998	-2.15	0.0	0.000000
End point	3.40	+22(Ref)	836,499,998	-2.09	0.0	0.000000



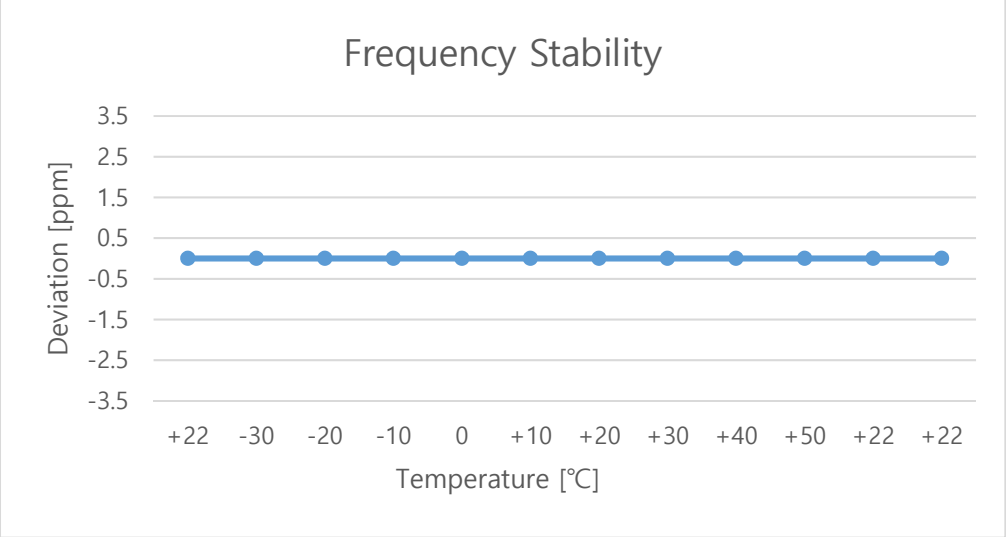
Test mode : LTE Band 66/4
Frequency (㎐) : 1 745 000 000
Channel : 132322
Deviation limit(FCC&IC) : The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized bands of operation.

Voltage (%)	Power (V)	Temp. (°C)	Frequency (㎐)	Frequency error (㎐)	Deviation	
					(ppm)	(%)
100%	3.88	+22(Ref)	1,744,999,998	-1.73	0.0	0.000000
		-30	1,744,999,998	-1.57	0.0	0.000000
		-20	1,744,999,999	-1.41	0.0	0.000000
		-10	1,744,999,999	-1.49	0.0	0.000000
		0	1,744,999,998	-1.62	0.0	0.000000
		+10	1,744,999,998	-1.51	0.0	0.000000
		+20	1,744,999,999	-1.37	0.0	0.000000
		+30	1,744,999,998	-1.71	0.0	0.000000
		+40	1,744,999,998	-1.56	0.0	0.000000
		+50	1,744,999,998	-1.62	0.0	0.000000
115%	4.46	+22(Ref)	1,744,999,998	-1.54	0.0	0.000000
End point	3.40	+22(Ref)	1,744,999,999	-1.36	0.0	0.000000



Test mode : LTE Band 71
Frequency (㎐) : 680 500 000
Channel : 133297
Deviation limit(FCC&IC) : The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized bands of operation.

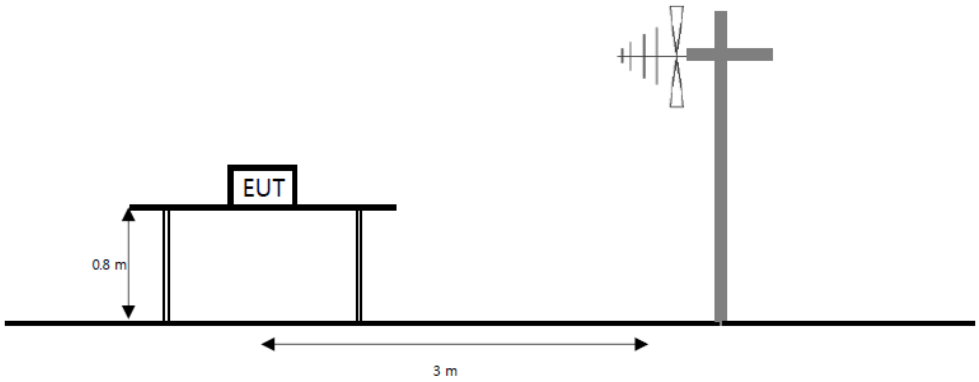
Voltage (%)	Power (V)	Temp. (°C)	Frequency (㎐)	Frequency error (㎐)	Deviation	
					(ppm)	(%)
100%	3.88	+22(Ref)	680,499,998	-1.86	0.0	0.000000
		-30	680,499,998	-1.57	0.0	0.000000
		-20	680,499,998	-1.75	0.0	0.000000
		-10	680,499,998	-1.65	0.0	0.000000
		0	680,499,998	-1.80	0.0	0.000000
		+10	680,499,999	-1.41	0.0	0.000000
		+20	680,499,998	-1.71	0.0	0.000000
		+30	680,499,999	-1.49	0.0	0.000000
		+40	680,499,998	-1.79	0.0	0.000000
		+50	680,499,998	-1.76	0.0	0.000000
115%	4.46	+22	680,499,999	-1.36	0.0	0.000000
End point	3.40	+22	680,499,998	-1.83	0.0	0.000000



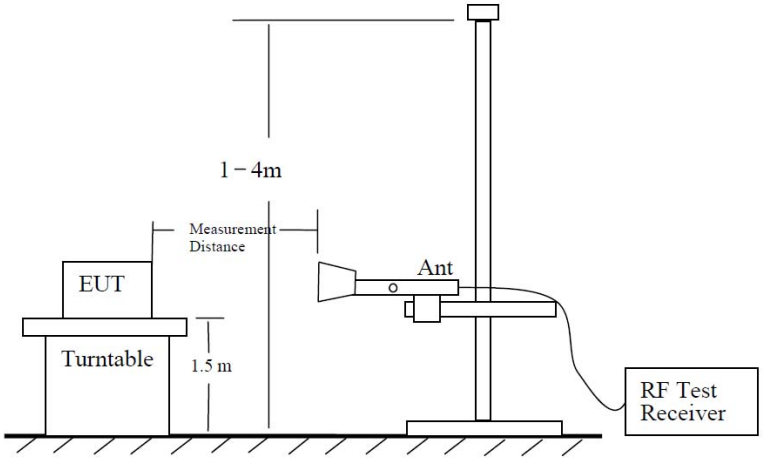
7.7. Radiated Power (ERP/EIRP)

Test setup

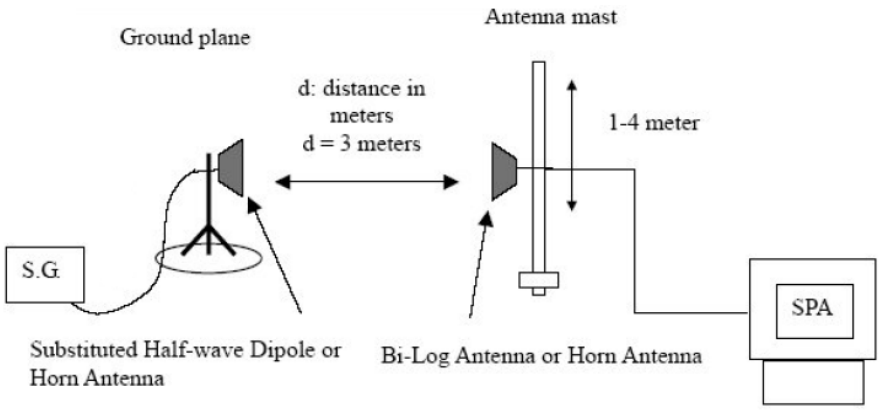
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.



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 RSS-132(5.4), the equivalent isotropically radiated power (e.i.r.p) for mobile equipment shall not exceed 11.5 watts. Refer to SRSP-503 for base stations e.i.r.p limits.

According to §24.232(c) and RSS-133(6.4), 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) and RSS-130(4.6), 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) and RSS-139(6.5), Fixed, mobile and portable (hand-held) stations operating in the 1710-1755 ㎒ and 1755-1780 ㎒ bands are limited to 1 watt EIRP.

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 or 1.5 m height on a turn table, and in the position close to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to Correspond to the fundamental frequency of the transmitter.
3. The 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	V	5.46	7.86	15.26	12.86	0.019
		1 880.0	V	5.39	7.96	15.95	13.38	0.022
		1 909.3	V	5.32	7.87	19.45	16.90	0.049
	16QAM	1 850.7	V	5.46	7.86	14.31	11.91	0.016
		1 880.0	V	5.39	7.96	15.00	12.43	0.017
		1 909.3	V	5.32	7.87	18.77	16.22	0.042
3 M	QPSK	1 851.5	V	5.46	7.88	16.65	14.23	0.026
		1 880.0	V	5.39	7.96	14.91	12.34	0.017
		1 908.5	V	5.32	7.87	17.21	14.66	0.029
	16QAM	1 851.5	V	5.46	7.88	15.49	13.07	0.020
		1 880.0	V	5.39	7.96	13.97	11.40	0.014
		1 908.5	V	5.32	7.87	16.01	13.46	0.022
5 M	QPSK	1 852.5	V	5.45	7.89	16.46	14.02	0.025
		1 880.0	V	5.39	7.96	14.70	12.13	0.016
		1 907.5	V	5.32	7.97	17.40	14.75	0.030
	16QAM	1 852.5	V	5.45	7.89	15.07	12.63	0.018
		1 880.0	V	5.39	7.96	13.72	11.15	0.013
		1 907.5	V	5.32	7.97	16.52	13.87	0.024
10 M	QPSK	1 855.0	V	5.45	7.87	16.82	14.40	0.028
		1 880.0	V	5.39	7.96	17.21	14.64	0.029
		1 905.0	V	5.33	7.98	17.80	15.15	0.033
	16QAM	1 855.0	V	5.45	7.87	15.62	13.20	0.021
		1 880.0	V	5.39	7.96	15.86	13.29	0.021
		1 905.0	V	5.33	7.98	16.44	13.79	0.024
15 M	QPSK	1 857.5	V	5.44	7.90	16.10	13.64	0.023
		1 880.0	V	5.39	7.96	15.95	13.38	0.022
		1 902.5	V	5.33	7.97	18.08	15.44	0.035
	16QAM	1 857.5	V	5.44	7.90	14.81	12.35	0.017
		1 880.0	V	5.39	7.96	15.15	12.58	0.018
		1 902.5	V	5.33	7.97	16.94	14.30	0.027
20 M	QPSK	1 860.0	V	5.44	7.89	15.92	13.47	0.022
		1 880.0	V	5.39	7.96	15.84	13.27	0.021
		1 900.0	V	5.34	7.99	17.99	15.34	0.034
	16QAM	1 860.0	V	5.44	7.89	14.65	12.20	0.017
		1 880.0	V	5.39	7.96	15.07	12.50	0.018
		1 900.0	V	5.34	7.99	17.17	14.52	0.028

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

Test mode: LTE Band 5

Bandwidth	Modulation	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	ERP		EIRP Note.1	
		[㎒]	[V/H]	[dBd]	[dB]	[dBm]	[dBm]	[W]	[dBm]	[W]
1.4 M	QPSK	824.7	H	-1.98	5.28	17.39	10.13	0.010	12.28	0.017
		836.5	H	-2.43	5.29	17.59	9.87	0.010	12.02	0.016
		848.3	H	-2.78	5.29	17.31	9.24	0.008	11.39	0.014
	16QAM	824.7	H	-1.98	5.28	16.23	8.97	0.008	11.12	0.013
		836.5	H	-2.43	5.29	16.33	8.61	0.007	10.76	0.012
		848.3	H	-2.78	5.29	16.32	8.25	0.007	10.40	0.011
3 M	QPSK	825.5	H	-1.90	5.26	17.52	10.36	0.011	12.51	0.018
		836.5	H	-2.43	5.29	17.72	10.00	0.010	12.15	0.016
		847.5	H	-2.80	5.28	16.87	8.79	0.008	10.94	0.012
	16QAM	825.5	H	-1.90	5.26	16.35	9.19	0.008	11.34	0.014
		836.5	H	-2.43	5.29	16.68	8.96	0.008	11.11	0.013
		847.5	H	-2.80	5.28	16.01	7.93	0.006	10.08	0.010
5 M	QPSK	826.5	H	-1.80	5.26	17.54	10.48	0.011	12.63	0.018
		836.5	H	-2.43	5.29	17.78	10.06	0.010	12.21	0.017
		846.5	H	-2.82	5.28	17.69	9.59	0.009	11.74	0.015
	16QAM	826.5	H	-1.80	5.26	16.30	9.24	0.008	11.39	0.014
		836.5	H	-2.43	5.30	16.58	8.85	0.008	11.00	0.013
		846.5	H	-2.82	5.28	16.39	8.29	0.007	10.44	0.011
10 M	QPSK	829.0	H	-1.55	5.28	18.02	11.19	0.013	13.34	0.022
		836.5	H	-2.43	5.29	18.30	10.58	0.011	12.73	0.019
		844.0	H	-2.87	5.33	17.57	9.37	0.009	11.52	0.014
	16QAM	829.0	H	-1.55	5.28	16.89	10.06	0.010	12.21	0.017
		836.5	H	-2.43	5.29	17.30	9.58	0.009	11.73	0.015
		844.0	H	-2.87	5.33	16.21	8.01	0.006	10.16	0.010

Note.
1. The E.I.R.P conversion formula for IC : E.I.R.P result (dBm)
   = E.R.P result (dBm) + 2.15 (dB)
2. E.R.P & E.I.R.P(dBm) = Substitute Level(dB) + Antenna gain(dBi&dBd) - C.L(Cable loss) (dB)

Test mode: LTE Band 12

Bandwidth	Modulation	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	ERP	
		[㎒]	[V/H]	[dBd]	[dB]	[dBm]	[dBm]	[W]
1.4 M	QPSK	699.7	H	-2.85	4.90	16.89	9.14	0.008
		707.5	H	-2.55	4.88	16.58	9.15	0.008
		715.3	H	-2.66	4.90	16.07	8.51	0.007
	16QAM	699.7	H	-2.85	4.90	15.44	7.69	0.006
		707.5	H	-2.55	4.88	15.22	7.79	0.006
		715.3	H	-2.66	4.90	14.83	7.27	0.005
3 M	QPSK	700.5	H	-2.83	4.90	16.80	9.07	0.008
		707.5	H	-2.55	4.88	16.65	9.22	0.008
		714.5	H	-2.63	4.90	16.46	8.93	0.008
	16QAM	700.5	H	-2.83	4.90	15.71	7.98	0.006
		707.5	H	-2.55	4.88	15.94	8.51	0.007
		714.5	H	-2.63	4.90	14.91	7.38	0.005
5 M	QPSK	701.5	H	-2.79	4.88	17.90	10.23	0.011
		707.5	H	-2.55	4.88	17.52	10.09	0.010
		713.5	H	-2.59	4.89	17.11	9.63	0.009
	16QAM	701.5	H	-2.79	4.88	15.99	8.32	0.007
		707.5	H	-2.55	4.88	15.51	8.08	0.006
		713.5	H	-2.59	4.89	15.37	7.89	0.006
10 M	QPSK	704.0	H	-2.69	4.92	17.27	9.66	0.009
		707.5	H	-2.55	4.88	17.03	9.60	0.009
		711.0	H	-2.49	4.89	17.45	10.07	0.010
	16QAM	704.0	H	-2.69	4.92	15.46	7.85	0.006
		707.5	H	-2.55	4.88	14.94	7.51	0.006
		711.0	H	-2.49	4.89	15.04	7.66	0.006

Test mode: LTE Band 13

Bandwidth	Modulation	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	ERP	
		[㎒]	[V/H]	[dBd]	[dB]	[dBm]	[dBm]	[W]
5 M	QPSK	779.5	H	-1.57	5.11	17.05	10.37	0.011
		782.0	H	-1.65	5.08	17.00	10.27	0.011
		784.5	H	-1.78	5.10	16.82	9.94	0.010
	16QAM	779.5	H	-1.57	5.11	15.81	9.13	0.008
		782.0	H	-1.65	5.08	15.34	8.61	0.007
		784.5	H	-1.78	5.10	15.76	8.88	0.008
10 M	QPSK	782.0	H	-1.65	5.08	17.19	10.46	0.011
	16QAM	782.0	H	-1.65	5.08	15.71	8.98	0.008

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

Test mode: LTE Band 25

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	V	5.46	7.86	15.83	13.43	0.022
		1 882.5	V	5.38	7.96	16.20	13.62	0.023
		1 914.3	V	5.31	7.85	19.67	17.12	0.052
	16QAM	1 850.7	V	5.46	7.86	14.85	12.45	0.018
		1 882.5	V	5.38	7.96	15.27	12.69	0.019
		1 914.3	V	5.31	7.85	18.90	16.35	0.043
3 M	QPSK	1 851.5	V	5.46	7.88	16.01	13.59	0.023
		1 882.5	V	5.38	7.96	16.73	14.15	0.026
		1 913.5	V	5.31	7.85	19.55	17.01	0.050
	16QAM	1 851.5	V	5.46	7.88	15.20	12.78	0.019
		1 882.5	V	5.38	7.96	15.57	12.99	0.020
		1 913.5	V	5.31	7.85	18.23	15.69	0.037
5 M	QPSK	1 852.5	V	5.45	7.89	16.11	13.67	0.023
		1 882.5	V	5.38	7.96	16.45	13.87	0.024
		1 912.5	V	5.31	7.84	19.15	16.62	0.046
	16QAM	1 852.5	V	5.45	7.89	15.03	12.59	0.018
		1 882.5	V	5.38	7.96	15.30	12.72	0.019
		1 912.5	V	5.31	7.84	18.29	15.76	0.038
10 M	QPSK	1 855.0	V	5.45	7.87	16.02	13.60	0.023
		1 882.5	V	5.38	7.96	15.33	12.75	0.019
		1 910.0	V	5.32	7.85	18.07	15.54	0.036
	16QAM	1 855.0	V	5.45	7.87	14.94	12.52	0.018
		1 882.5	V	5.38	7.96	14.38	11.80	0.015
		1 910.0	V	5.32	7.85	17.32	14.79	0.030
15 M	QPSK	1 857.5	V	5.44	7.90	16.05	13.59	0.023
		1 882.5	V	5.38	7.96	15.55	12.97	0.020
		1 907.5	V	5.32	7.97	18.20	15.55	0.036
	16QAM	1 857.5	V	5.44	7.90	14.92	12.46	0.018
		1 882.5	V	5.38	7.96	14.27	11.69	0.015
		1 907.5	V	5.32	7.97	17.31	14.66	0.029
20 M	QPSK	1 860.0	V	5.44	7.89	15.62	13.17	0.021
		1 882.5	V	5.38	7.96	15.45	12.87	0.019
		1 905.0	V	5.33	7.98	17.97	15.32	0.034
	16QAM	1 860.0	V	5.44	7.89	14.75	12.30	0.017
		1 882.5	V	5.38	7.96	14.64	12.06	0.016
		1 905.0	V	5.33	7.98	16.80	14.15	0.026

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

Test mode: LTE Band 26

Bandwidth	Modulation	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	ERP	
		[㎒]	[V/H]	[dBd]	[dB]	[dBm]	[dBm]	[W]
1.4 M	QPSK	824.7	H	-1.98	5.28	17.70	10.44	0.011
		836.5	H	-2.43	5.29	17.83	10.11	0.010
		848.3	H	-2.78	5.29	17.93	9.86	0.010
	16QAM	824.7	H	-1.98	5.28	16.69	9.43	0.009
		836.5	H	-2.43	5.29	16.78	9.06	0.008
		848.3	H	-2.78	5.29	16.82	8.75	0.007
3 M	QPSK	825.5	H	-1.90	5.26	17.81	10.65	0.012
		836.5	H	-2.43	5.29	17.81	10.09	0.010
		847.5	H	-2.80	5.28	17.13	9.05	0.008
	16QAM	825.5	H	-1.90	5.26	16.51	9.35	0.009
		836.5	H	-2.43	5.29	16.93	9.21	0.008
		847.5	H	-2.80	5.28	15.63	7.55	0.006
5 M	QPSK	826.5	H	-1.80	5.26	17.50	10.44	0.011
		836.5	H	-2.43	5.29	17.75	10.03	0.010
		846.5	H	-2.82	5.28	17.79	9.69	0.009
	16QAM	826.5	H	-1.80	5.26	16.52	9.46	0.009
		836.5	H	-2.43	5.29	16.62	8.90	0.008
		846.5	H	-2.82	5.28	16.74	8.64	0.007
10 M	QPSK	829.0	H	-1.55	5.28	17.97	11.14	0.013
		836.5	H	-2.43	5.29	18.35	10.63	0.012
		844.0	H	-2.87	5.33	17.80	9.60	0.009
	16QAM	829.0	H	-1.55	5.28	16.78	9.95	0.010
		836.5	H	-2.43	5.29	17.29	9.57	0.009
		844.0	H	-2.87	5.33	16.83	8.63	0.007
15 M	QPSK	831.5	H	-1.68	5.31	18.38	11.39	0.014
		836.5	H	-2.43	5.29	18.39	10.67	0.012
		841.5	H	-2.92	5.33	17.95	9.70	0.009
	16QAM	831.5	H	-1.68	5.31	17.14	10.15	0.010
		836.5	H	-2.43	5.29	17.32	9.60	0.009
		841.5	H	-2.92	5.33	16.93	8.68	0.007

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

Test mode: LTE Band 66/4

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	5.79	7.58	14.88	13.09	0.020
		1 745.0	H	5.71	7.64	15.71	13.78	0.024
		1 779.3	H	5.63	7.76	17.17	15.04	0.032
	16QAM	1 710.7	H	5.79	7.58	13.83	12.04	0.016
		1 745.0	H	5.71	7.64	14.29	12.36	0.017
		1 779.3	H	5.63	7.76	16.06	13.93	0.025
3 M	QPSK	1 711.5	H	5.79	7.58	14.82	13.03	0.020
		1 745.0	H	5.71	7.64	15.64	13.71	0.023
		1 778.5	H	5.63	7.76	17.28	15.15	0.033
	16QAM	1 711.5	H	5.79	7.58	13.53	11.74	0.015
		1 745.0	H	5.71	7.64	14.58	12.65	0.018
		1 778.5	H	5.63	7.76	16.13	14.00	0.025
5 M	QPSK	1 712.5	H	5.79	7.57	14.73	12.95	0.020
		1 745.0	H	5.71	7.64	15.31	13.38	0.022
		1 777.5	H	5.63	7.74	17.20	15.09	0.032
	16QAM	1 712.5	H	5.79	7.57	13.61	11.83	0.015
		1 745.0	H	5.71	7.64	14.49	12.56	0.018
		1 777.5	H	5.63	7.74	16.47	14.36	0.027
10 M	QPSK	1 715.0	H	5.78	7.57	14.27	12.48	0.018
		1 745.0	H	5.71	7.64	14.96	13.03	0.020
		1 775.0	H	5.64	7.74	16.54	14.44	0.028
	16QAM	1 715.0	H	5.78	7.57	12.99	11.20	0.013
		1 745.0	H	5.71	7.64	14.02	12.09	0.016
		1 775.0	H	5.64	7.74	15.44	13.34	0.022
15 M	QPSK	1 717.5	H	5.78	7.58	14.45	12.65	0.018
		1 745.0	H	5.71	7.64	13.28	11.35	0.014
		1 772.5	H	5.65	7.73	15.69	13.61	0.023
	16QAM	1 717.5	H	5.78	7.58	13.49	11.69	0.015
		1 745.0	H	5.71	7.64	12.48	10.55	0.011
		1 772.5	H	5.65	7.73	15.08	13.00	0.020
20 M	QPSK	1 720.0	H	5.77	7.58	14.06	12.25	0.017
		1 745.0	H	5.71	7.64	12.82	10.89	0.012
		1 770.0	H	5.65	7.74	14.28	12.19	0.017
	16QAM	1 720.0	H	5.77	7.58	13.25	11.44	0.014
		1 745.0	H	5.71	7.64	12.36	10.43	0.011
		1 770.0	H	5.65	7.74	13.31	11.22	0.013

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

Test mode: LTE Band 71

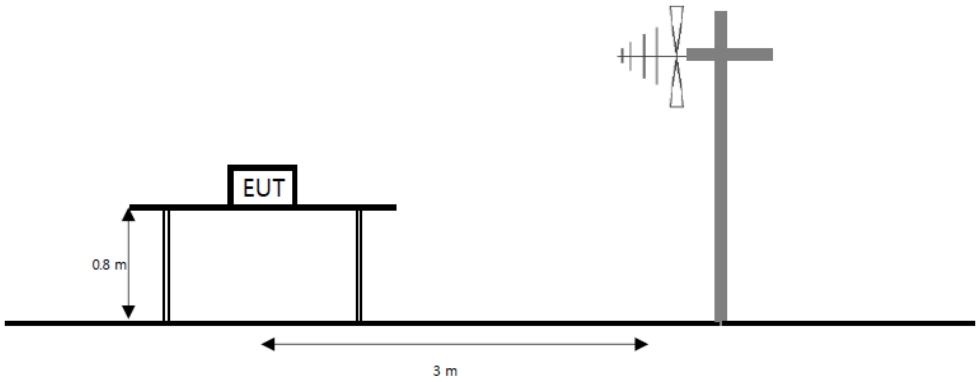
Bandwidth	Modulation	Frequency	Pol.	Antenna Gain	C.L	Substitute Level	ERP	
		[㎒]	[V/H]	[dBd]	[dB]	[dBm]	[dBm]	[W]
5 M	QPSK	665.50	H	-3.24	4.81	14.34	6.29	0.004
		680.50	H	-3.04	4.85	15.35	7.46	0.006
		695.50	H	-2.85	4.89	16.27	8.53	0.007
	16QAM	665.50	H	-3.24	4.81	12.99	4.94	0.003
		680.50	H	-3.04	4.85	14.02	6.13	0.004
		695.50	H	-2.85	4.89	14.99	7.25	0.005
10 M	QPSK	668.00	H	-3.41	4.80	14.55	6.34	0.004
		680.50	H	-3.04	4.85	15.13	7.24	0.005
		693.00	H	-2.85	4.88	16.39	8.66	0.007
	16QAM	668.00	H	-3.41	4.80	13.27	5.06	0.003
		680.50	H	-3.04	4.85	14.57	6.68	0.005
		693.00	H	-2.85	4.88	15.14	7.41	0.006
15 M	QPSK	670.50	H	-3.53	4.84	14.38	6.01	0.004
		680.50	H	-3.04	4.85	15.25	7.36	0.005
		690.50	H	-2.85	4.87	16.23	8.51	0.007
	16QAM	670.50	H	-3.53	4.84	13.39	5.02	0.003
		680.50	H	-3.04	4.85	14.54	6.65	0.005
		690.50	H	-2.85	4.87	15.16	7.44	0.006
20 M	QPSK	673.00	H	-3.40	4.82	14.98	6.76	0.005
		680.50	H	-3.04	4.85	15.86	7.97	0.006
		688.00	H	-2.89	4.85	16.30	8.56	0.007
	16QAM	673.00	H	-3.40	4.82	13.79	5.57	0.004
		680.50	H	-3.04	4.85	14.90	7.01	0.005
		688.00	H	-2.89	4.85	15.12	7.38	0.005

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

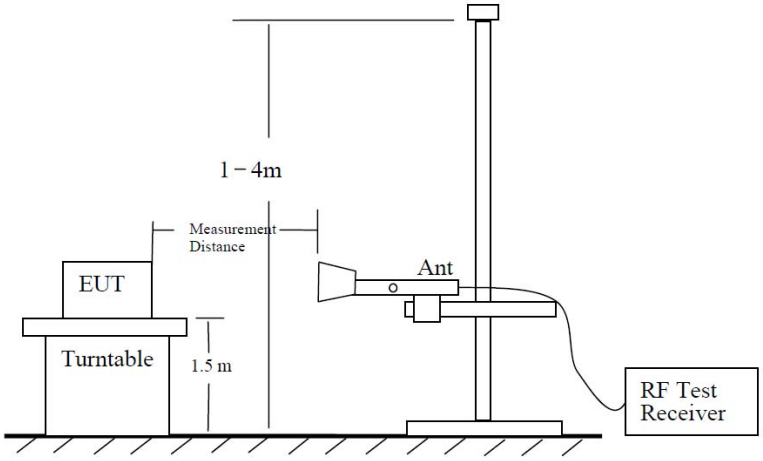
7.8. Radiated Spurious Emissions

Test setup

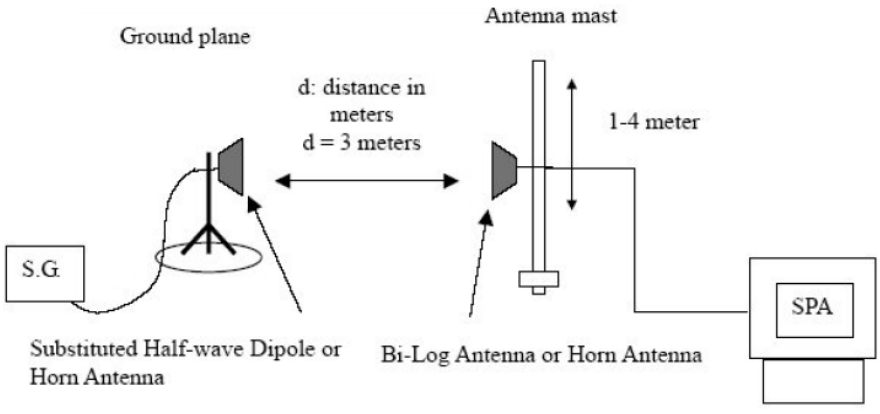
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.



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), §24.238(a) and RSS-132(5.5), RSS-133(6.5), 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(c)(2) and RSS-130(4.7), 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($P_{[Watts]}$) dB.
According to §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 dBW/㎒ equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW 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) and RSS-130(4.7), 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($P_{[Watts]}$) dB.

According to §27.53(h) and RSS-139(6.6), 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($P_{[Watts]}$) 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 = 100 ㎑ 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 cm or 1.5 m height on a turn table, and in the position close to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3 m from EUT to correspond to the fundamental frequency of the transmitter.
3. The 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.

Test results (Above 1 000 ㎒)

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

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 702.34	V	8.54	11.23	-50.11	-52.80	-13.00	39.80
	5 556.29	H	10.51	14.09	-50.52	-54.10	-13.00	41.10
	7 402.53	V	11.96	16.18	-45.88	-50.10	-13.00	37.10
	9 258.01	V	13.20	17.92	-43.38	-48.10	-13.00	35.10

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

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 760.81	H	8.61	11.29	-49.82	-52.50	-13.00	39.50
	5 643.21	V	10.53	13.98	-48.95	-52.40	-13.00	39.40
	7 522.54	H	12.12	16.20	-46.32	-50.40	-13.00	37.40
	9 401.10	H	13.20	18.11	-42.89	-47.80	-13.00	34.80

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

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 825.43	H	8.69	11.35	-50.84	-53.50	-13.00	40.50
	5 730.91	V	10.55	14.10	-48.75	-52.30	-13.00	39.30
	7 638.70	V	12.21	16.28	-46.43	-50.50	-13.00	37.50
	9 551.10	V	13.19	18.22	-42.67	-47.70	-13.00	34.70

Note.
1. ERP & EIRP(㏈m)= Substitute Level(㏈) + Antenna gain(㏈i) – Cable Loss(㏈)

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

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 658.09	H	5.92	7.42	-47.00	-48.50	-13.00	35.50
	2 487.67	V	6.17	9.02	-51.45	-54.30	-13.00	41.30
	3 319.71	H	7.80	10.57	-51.93	-54.70	-13.00	41.70
	4 144.78	V	8.81	11.97	-52.14	-55.30	-13.00	42.30

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

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 664.24	H	5.91	7.43	-46.38	-47.90	-13.00	34.90
	2 495.46	H	6.19	9.04	-50.65	-53.50	-13.00	40.50
	3 326.68	V	7.81	10.58	-52.53	-55.30	-13.00	42.30
	4 155.85	H	8.81	11.78	-51.63	-54.60	-13.00	41.60

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

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 679.01	H	5.87	7.47	-42.70	-44.30	-13.00	31.30
	2 518.44	H	6.23	9.13	-51.30	-54.20	-13.00	41.20
	3 355.81	H	7.90	10.63	-52.07	-54.80	-13.00	41.80
	4 194.42	V	8.78	11.85	-50.63	-53.70	-13.00	40.70

Note.
1. ERP & EIRP(㏈m)= Substitute Level(㏈) + Antenna gain(㏈i) – Cable Loss(㏈)

Test mode : LTE Band 12
Frequency(㎒) : 701.5
Channel : 23035
Bandwidth(㎒) : 5

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 403.30	H	5.66	6.88	-52.78	-54.00	-13.00	41.00
	2 104.88	H	5.33	8.24	-43.39	-46.30	-13.00	33.30
	2 806.86	V	6.63	9.68	-40.55	-43.60	-13.00	30.60
	3 508.85	H	8.31	10.90	-51.51	-54.10	-13.00	41.10

Test mode : LTE Band 12
Frequency(㎒) : 707.5
Channel : 23095
Bandwidth(㎒) : 5

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 410.69	V	5.71	6.89	-54.22	-55.40	-13.00	42.40
	2 115.96	H	5.36	8.27	-33.99	-36.90	-13.00	23.90
	2 821.22	V	6.65	9.70	-39.55	-42.60	-13.00	29.60
	3 526.08	H	8.33	10.93	-50.80	-53.40	-13.00	40.40

Test mode : LTE Band 12
Frequency(㎒) : 713.5
Channel : 23155
Bandwidth(㎒) : 5

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 422.59	H	5.79	6.92	-55.67	-56.80	-13.00	43.80
	2 134.01	H	5.39	8.31	-36.28	-39.20	-13.00	26.20
	2 845.43	V	6.68	9.74	-43.44	-46.50	-13.00	33.50
	3 556.44	V	8.37	10.83	-50.94	-53.40	-13.00	40.40

Note.
1. ERP & E.I.R.P(㏈ ㎷)= Substitute Level(㏈) + Antenna gain(㏈i) – Cable Loss(㏈)

Test mode : LTE Band 13
Frequency(㎒) : 782.0
Channel : 23230
Bandwidth(㎒) : 10

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	2 350.22	H	5.87	8.71	-52.96	-55.80	-13.00	42.80
	3 128.93	V	7.26	10.24	-51.72	-54.70	-13.00	41.70
	3 910.10	V	8.79	11.44	-49.35	-52.00	-13.00	39.00

Test mode : LTE Band 13
Frequency(㎒) : 782.0 (1 559 – 1 610 ㎒)
Channel : 23230
Bandwidth(㎒) : 10

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 564.19	H	6.15	7.21	-75.64	-76.70	-50.00	26.70

Note.
1. Limit Calculation(dBm)= 43 + 10log($P_{[Watts]}$)
   Limit Calculation of wide-band (dBm/㎒) = -70dBW/㎒ (-40 dBm/㎒)
   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 25
Frequency(㎒) : 1 850.7
Channel : 26047
Bandwidth(㎒) : 1.4

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 706.19	V	8.55	11.24	-49.11	-51.80	-13.00	38.80
	5 500.90	H	10.50	14.03	-49.67	-53.20	-13.00	40.20
	7 399.46	H	11.96	16.08	-47.18	-51.30	-13.00	38.30
	9 249.55	V	13.20	17.91	-42.09	-46.80	-13.00	33.80

Test mode : LTE Band 25
Frequency(㎒) : 1 882.5
Channel : 26365
Bandwidth(㎒) : 1.4

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 763.12	H	8.62	11.29	-50.53	-53.20	-13.00	40.20
	5 649.37	V	10.53	13.99	-50.04	-53.50	-13.00	40.50
	7 524.85	H	12.12	16.20	-46.72	-50.80	-13.00	37.80
	9 411.87	V	13.20	18.12	-42.78	-47.70	-13.00	34.70

Test mode : LTE Band 25
Frequency(㎒) : 1 914.3
Channel : 26683
Bandwidth(㎒) : 1.4

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 827.74	H	8.69	11.35	-51.04	-53.70	-13.00	40.70
	5 736.29	V	10.55	14.11	-49.44	-53.00	-13.00	40.00
	7 652.55	V	12.22	16.29	-47.13	-51.20	-13.00	38.20
	9 575.72	H	13.18	18.24	-41.34	-46.40	-13.00	33.40

Note.
1. ERP & E.I.R.P(㏈m)= Substitute Level(㏈) + Antenna gain(㏈i) – Cable Loss(㏈)

Test mode : LTE Band 26
Frequency(㎒) : 831.5
Channel : 26885
Bandwidth(㎒) : 15

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 649.88	H	5.94	7.48	-45.66	-47.20	-13.00	34.20
	2 474.54	H	6.14	8.99	-49.05	-51.90	-13.00	38.90
	3 292.22	V	7.72	10.52	-51.20	-54.00	-13.00	41.00
	4 122.62	H	8.83	11.94	-50.99	-54.10	-13.00	41.10

Test mode : LTE Band 26
Frequency(㎒) : 836.5
Channel : 26915
Bandwidth(㎒) : 15

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 659.73	H	5.92	7.42	-44.90	-46.40	-13.00	33.40
	2 486.44	V	6.17	9.02	-51.45	-54.30	-13.00	41.30
	3 317.66	H	7.79	10.57	-52.12	-54.90	-13.00	41.90
	4 145.60	V	8.81	11.97	-50.74	-53.90	-13.00	40.90

Test mode : LTE Band 26
Frequency(㎒) : 841.5
Channel : 26965
Bandwidth(㎒) : 15

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 683.52	H	5.86	7.48	-43.08	-44.70	-13.00	31.70
	2 527.87	H	6.24	9.15	-51.19	-54.10	-13.00	41.10
	3 360.33	H	7.91	10.64	-51.97	-54.70	-13.00	41.70
	4 204.68	V	8.78	11.89	-51.89	-55.00	-13.00	42.00

Note.
1. ERP & E.I.R.P(㏈m)= Substitute Level(㏈) + Antenna gain(㏈i) – Cable Loss(㏈)

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

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 423.10	V	8.08	10.75	-52.53	-55.20	-13.00	42.20
	5 135.49	V	10.21	14.09	-50.12	-54.00	-13.00	41.00
	6 847.12	V	11.22	15.52	-47.50	-51.80	-13.00	38.80
	8 561.82	H	13.02	17.47	-45.05	-49.50	-13.00	36.50

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

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 486.95	V	8.26	10.86	-51.50	-54.10	-13.00	41.10
	5 230.88	V	10.28	13.46	-50.42	-53.60	-13.00	40.60
	6 972.51	V	11.37	15.48	-47.89	-52.00	-13.00	39.00
	8 720.29	H	13.09	17.13	-44.46	-48.50	-13.00	35.50

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

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	3 560.03	V	8.37	10.86	-51.01	-53.50	-13.00	40.50
	5 340.89	V	10.37	13.74	-50.73	-54.10	-13.00	41.10
	7 120.98	V	11.57	15.70	-46.67	-50.80	-13.00	37.80
	8 904.15	H	13.16	17.95	-44.01	-48.80	-13.00	35.80

Note.
1. ERP & E.I.R.P(dB m)= Substitute Level(dB) + Antenna gain(dBi) – Cable Loss(dB)

Test mode : LTE Band 71
Frequency(㎒) : 668.0
Channel : 133172
Bandwidth(㎒) : 10

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 326.99	H	5.16	6.71	-52.55	-54.10	-13.00	41.10
	1 990.82	H	5.12	8.01	-47.31	-50.20	-13.00	37.20
	2 647.26	H	6.41	9.32	-50.59	-53.50	-13.00	40.50
	3 316.02	V	7.78	10.56	-52.02	-54.80	-13.00	41.80

Test mode : LTE Band 71
Frequency(㎒) : 680.5
Channel : 133297
Bandwidth(㎒) : 10

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 369.66	H	5.44	6.79	-50.65	-52.00	-13.00	39.00
	2 054.41	H	5.22	8.14	-52.28	-55.20	-13.00	42.20
	2 741.22	V	6.54	9.56	-50.98	-54.00	-13.00	41.00
	3 423.10	V	8.08	10.75	-51.53	-54.20	-13.00	41.20

Test mode : LTE Band 71
Frequency(㎒) : 693.0
Channel : 133422
Bandwidth(㎒) : 10

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 394.69	H	5.60	6.85	-53.45	-54.70	-13.00	41.70
	2 092.16	H	5.30	8.22	-47.38	-50.30	-13.00	37.30
	2 789.63	V	6.61	9.65	-51.16	-54.20	-13.00	41.20
	3 491.20	H	8.28	10.87	-51.61	-54.20	-13.00	41.20

Note.
1. ERP & E.I.R.P(㏈ m)= Substitute Level(㏈) + Antenna gain(㏈i) – Cable Loss(㏈)

8. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
Biconical VHF-UHF Broadband Antenna	SCHWARZBECK	VUBA9117	275	22.04.09
Bilog Antenna	ETS.LINDGREN	3143B	00228420	21.09.30
Horn Antenna	ETS.lindgren	3117	161225	22.05.11*
Horn Antenna	ETS.LINDGREN	3117	00227509	21.09.23
Horn Antenna	ETS.lindgren	3116	00086632	22.01.29
Horn Antenna	ETS.lindgren	3116	00086635	22.05.17*
High pass Filter	Wainwright Instruments GmbH	WHKX12-2805-3000-18000-40SS	32	21.08.20
High pass Filter	Wainwright Instruments GmbH	WHKX10-900-1000-15000-40SS	11	21.08.20
Broadband Amplifier	SONOMA INSTRUMENT	310N	186280	22.04.01
Amplifier	L-3 Narda-MITEQ	AFS5-00101800-25-S-5	2054571	21.08.28
Amplifier	L-3 Narda-MITEQ	JS44-18004000-33-8P	2000996	22.01.21
Spectrum Analyzer	KEYSIGHT	N9040B	US55230151	21.07.29
Widebnad Radio Communication Tester	R&S	CMW500	141780	22.04.01
Spectrum Analyzer	R&S	FSV40	100988	21.12.23
Spectrum Analyzer	R&S	FSV30	100807	21.07.29
Power Divider	Aeroflex/ Weinschel,Inc	1580-1	PE430	21.07.29
Vector Signal Generator	R&S	SMBV100A	257566	21.07.13
Signal Generator	R&S	SMB100A	176206	22.01.20
Antenna Stand	innco systems GmbH	AS1500-EP-10kg	N/A	N/A
Antenna Stand	innco systems GmbH	AS1500-EP-10kg	N/A	N/A
Turn Device	innco systems GmbH	DE3700-RH	N/A	N/A

* Tests related to this equipment were progressed after the calibration was completed.

End of test report