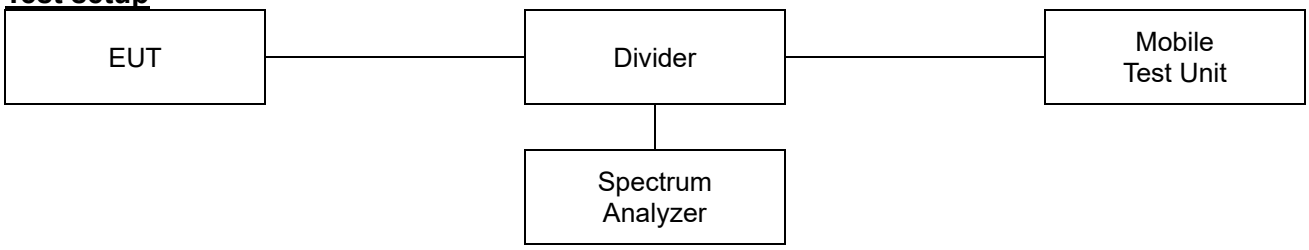
7.3. Band Edge Emissions at Antenna Terminal

Test setup



Limit

According to §90.543(e),

For operations in the 758-768 ㎒ and the 788-798 ㎒ bands, the power of any emission outside the 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, in accordance with the following:

(1) On all frequencies between 769-775 ㎒ and 799-805 ㎒, by a factor not less than 76+10log(P) ㏈ in a 6.25 ㎑ band segment, for base and fixed stations.

(2) On all frequencies between 769-775 ㎒ and 799-805 ㎒, by a factor not less than 65+10log(P) ㏈ in a 6.25 ㎑ band segment, for mobile and portable stations.

(3) On any frequency between 775-788 ㎒, above 805 ㎒, and below 758 ㎒, by at least 43+10log(P) ㏈.

(4) Compliance with the provisions of paragraphs (e)(1) and (2) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 ㎑ segment.

(5) Compliance with the provisions of paragraph (e)(3) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 ㎑ or greater. However, in the 100 ㎑ bands immediately outside and adjacent to the frequency block, a resolution bandwidth of 30 ㎑ may be employed.

According to §90.691(a),

Out-of-band emission requirement shall apply only to the "outer" channels Included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 ㎑, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log_{10}(f/6.1) decibels or 50 + 10Log_{10}(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz where f is greater than 12.5 ㎑.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 ㎑, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log_{10}(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 ㎑.

Test procedure

971168 D01 v03r01 - Section 6
971168 D02 v02r02 – Section VIII
ANSI C63.26-2015 – Section 5.7

Test settings

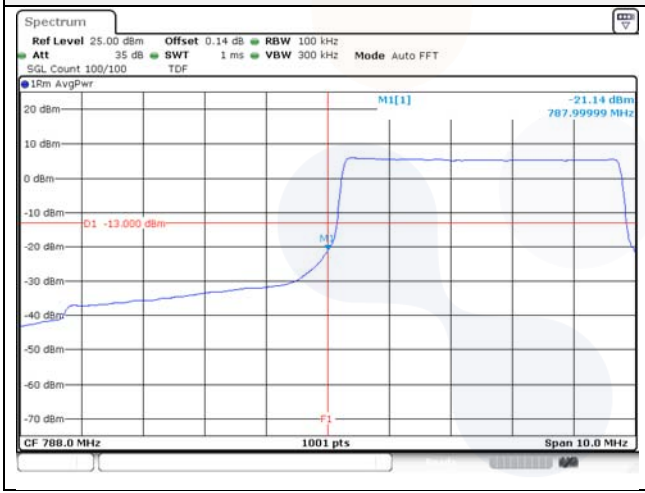
1) Start and stop frequency were set such that the band edge would be placed in the center of the plot
2) Span was set large enough so as to capture all out of band emissions near the band edge.
3) Set the RBW > 1% of the emission bandwidth.
4) Set the VBW ≥ 3 x RBW.
5) Set the number of sweep points ≥ 2 x Span/RBW
6) Detector = RMS
7) Trace mode = trace average
8) Sweep time should be auto for peak detection. For RMS detection the sweep time should be set as follows:
   - If the device can be configured to transmit continuously (duty cycle ≥ 98%), set the (sweep time) > (number of points in sweep) x (symbol period) (e.g., by a factor of 10 x symbol period x number of points) Increasing the sweep time (i.e., slowing the sweep speed) will allow for averaging over multiple symbols.
   - If the device cannot transmit continuously (duty cycle < 98%), a gated sweep shall be used when possible (i.e., gate triggered such that the analyzer only sweeps when the device is transmitting at full power), set the sweep time > (number of points in sweep) x (symbol period) but the sweep time shall always be maintained at a value that is less than or equal to the minimum transmission time
   - If the device cannot be configured to transmit continuously (duty cycle > 98%), and a free-running sweep must be used, set the sweep time so that the averaging is performed over multiple on/off cycles by setting the sweep time > (number of points in sweep) × (transmitter period) (i.e., the transmit on-time + the off-time). The spectrum analyzer readings shall subsequently be corrected by [10 log (1/duty cycle)]. This assumes that the transmission period and duty cycle is relatively constant (duty cycle variation ≤ ±2%).
   - If the device cannot be configured to transmit continuously and a free-running sweep must be used, and if the transmissions exhibit a non-constant duty cycle (duty cycle variations > ±2%), set the sweep time so that the averaging is performed over the on-period by setting the sweep time > (symbol period) × (number of points), while also maintaining the sweep time < (transmitter on-time). The trace mode shall be set to max hold, since not every display point will be averaged only over just the on-time. Thus, multiple sweeps (e.g., 100) in maximum hold art necessary to ensure that the maximum power is measured.
9) Allow trace to fully stabilize.

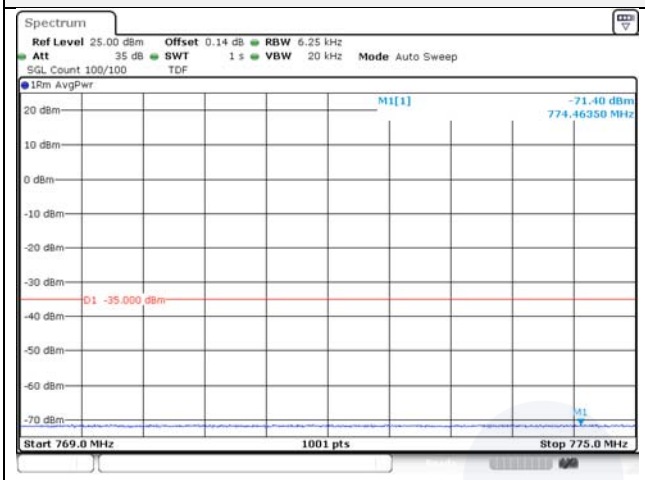
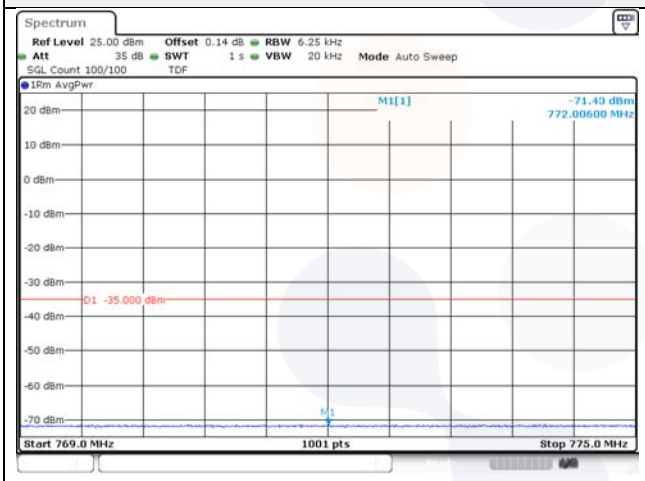
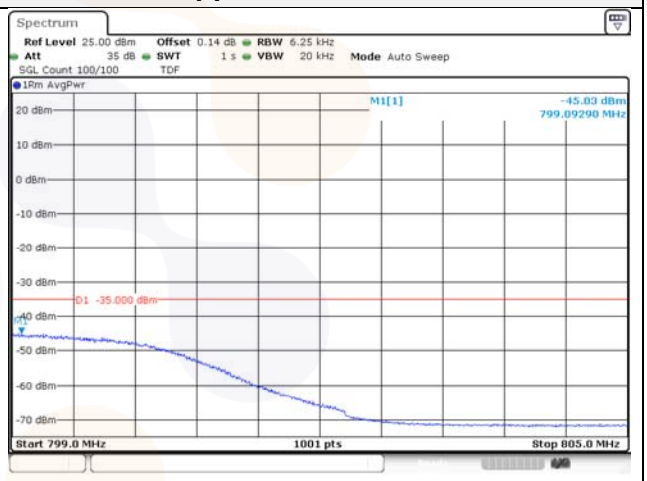
Notes:

1. For Section 90.691(a) compliance testing, use RBW = 300 ㎐ for offsets less than 37.5 ㎑ from a channel edge; RBW = 100 ㎑ for offsets greater than 37.5 ㎑ is allowed.
2. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 ㎒ or greater. however in the 1 ㎒ bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 ㏈ below the transmitter power.
3. The EUT was setup to maximum output power as its lowest and highest channel with all bandwidth, modulation and RB configurations.

Test results

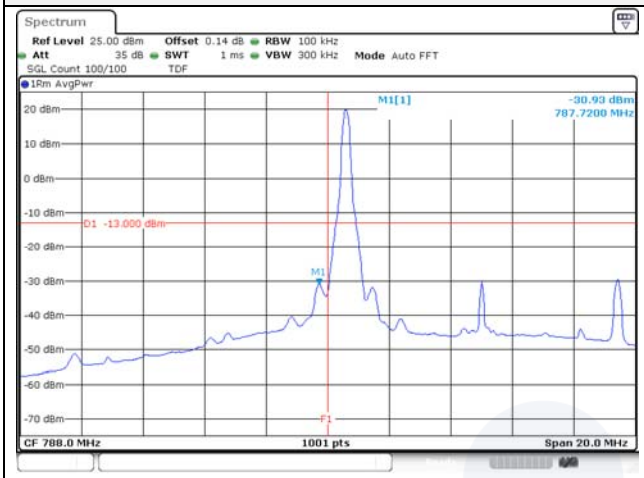
Test mode: LTE B14

5M BW QPSK	
Low channel 1RB	High channel 1RB
	
Low channel FRB	High channel FRB
	

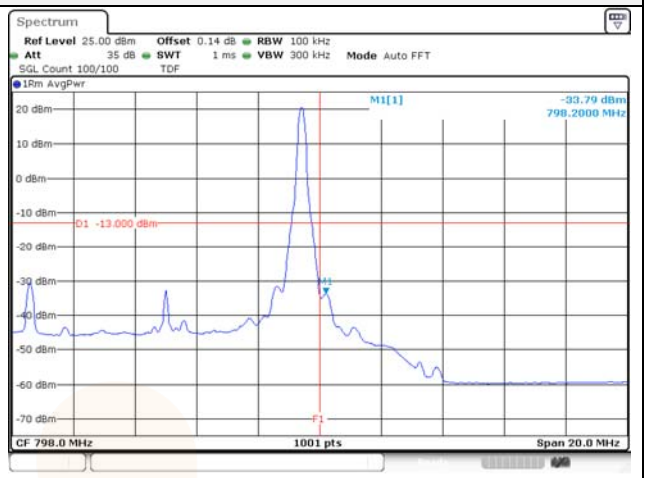
5M BW QPSK	
Lower extended 1RB	**Upper extended 1RB**
	
Lower extended FRB	**Upper extended FRB**
	

10M BW QPSK

Middle channel Lower 1RB

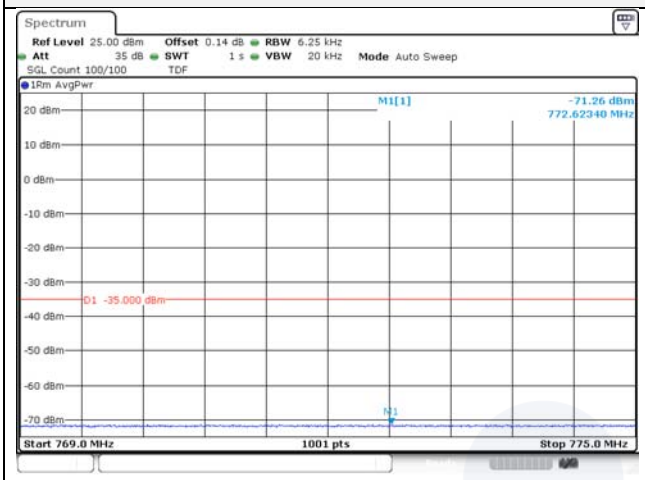
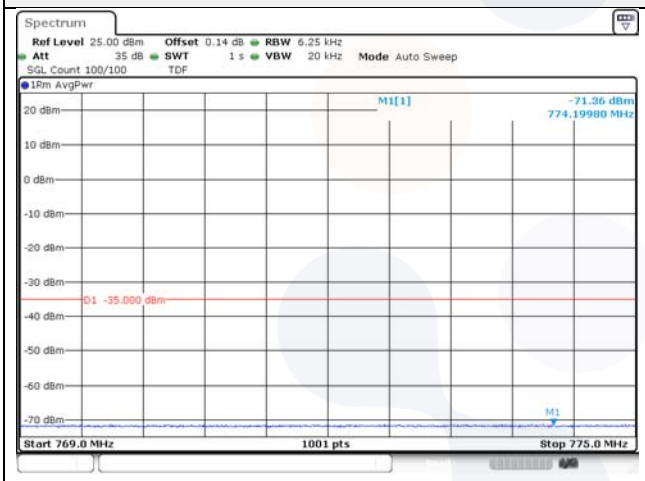
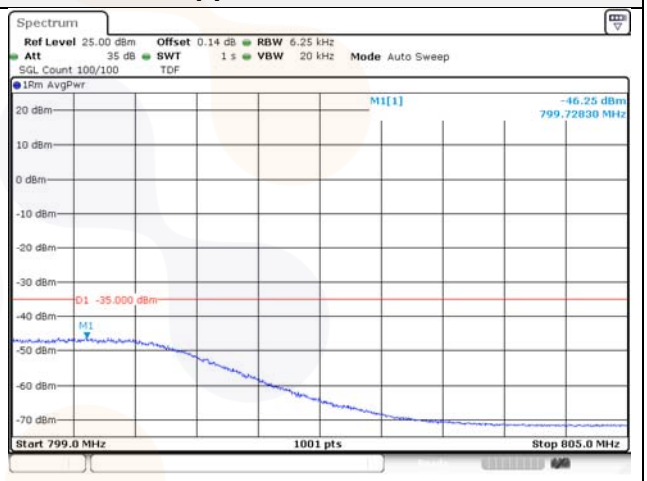


Middle channel Upper 1RB

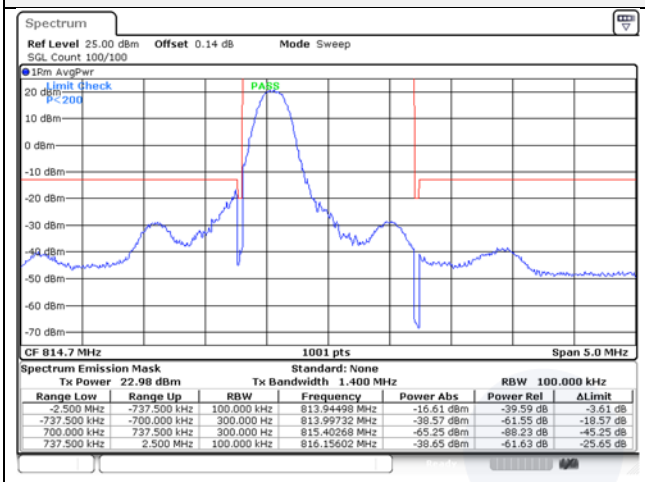
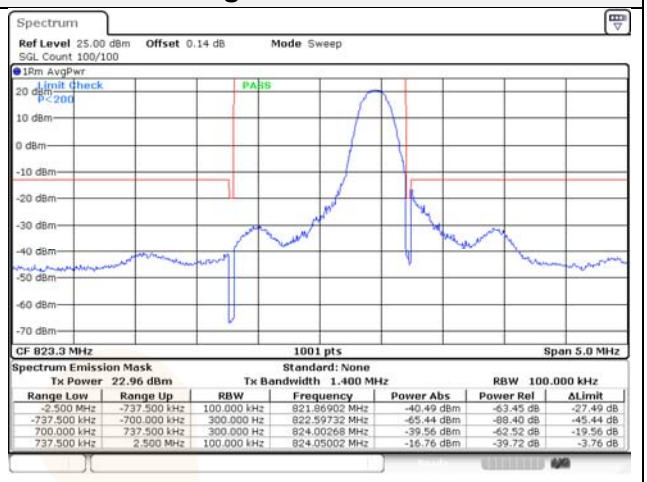
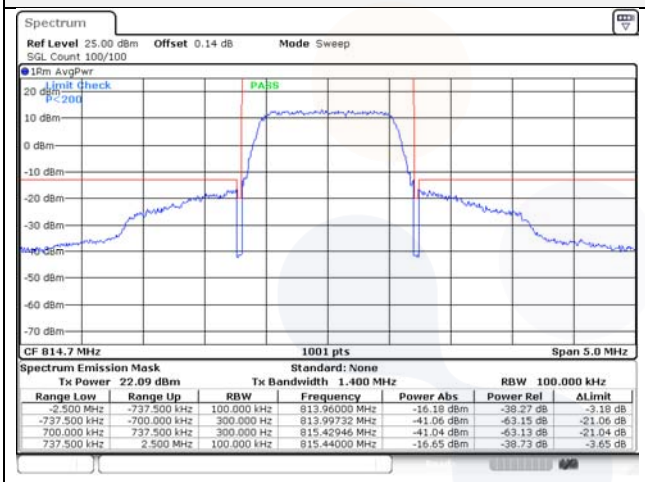
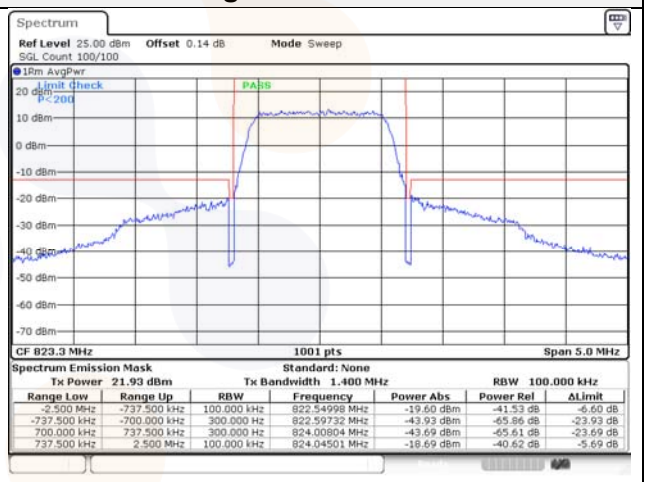


Middle channel Lower FRB

Middle channel Upper FRB

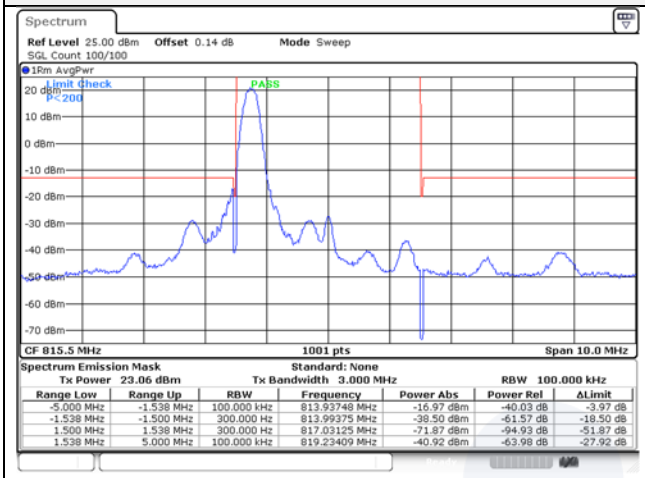
10M BW QPSK	
Lower extended 1RB	**Upper extended 1RB**
	
Lower extended FRB	**Upper extended FRB**
	

Test mode: LTE B26

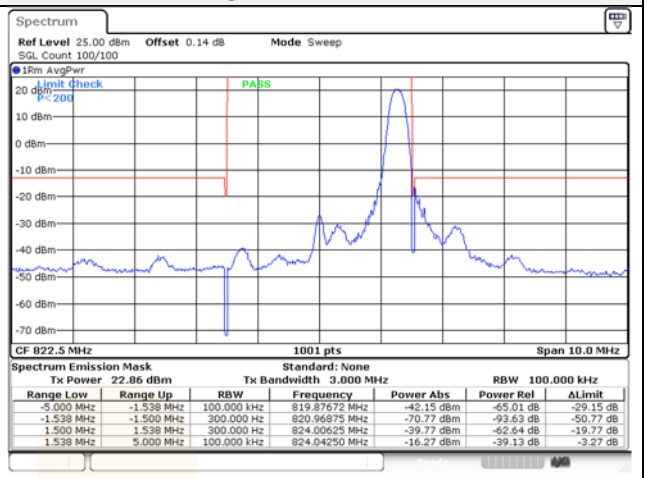
1.4M BW QPSK	
Low channel 1RB	**High channel 1RB**
	
Low channel FRB	**High channel FRB**
	

3M BW QPSK

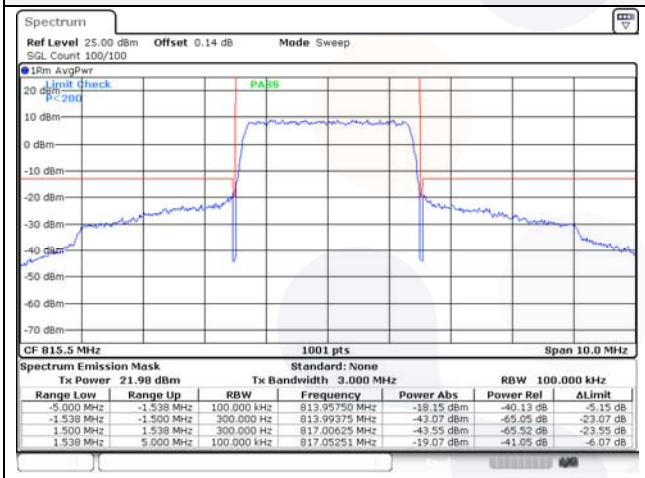
Low channel 1RB



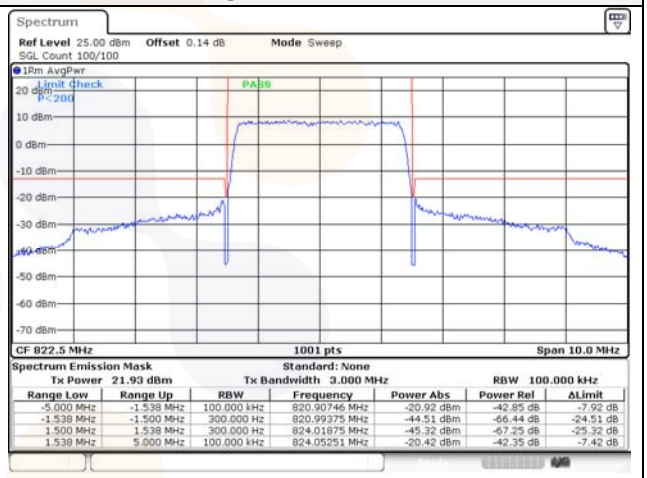
High channel 1RB



Low channel FRB

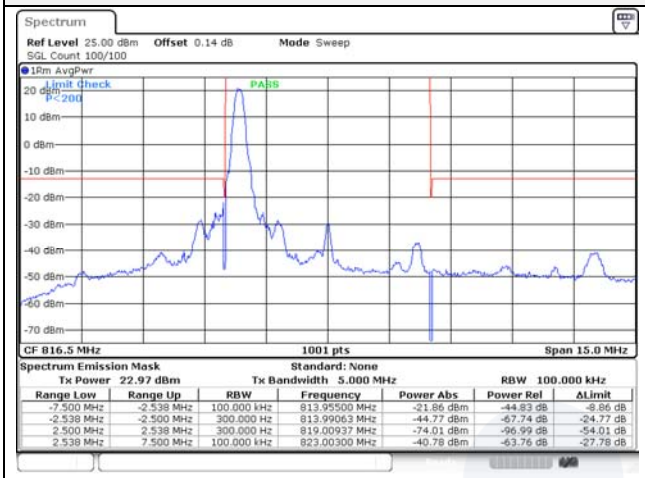


High channel FRB

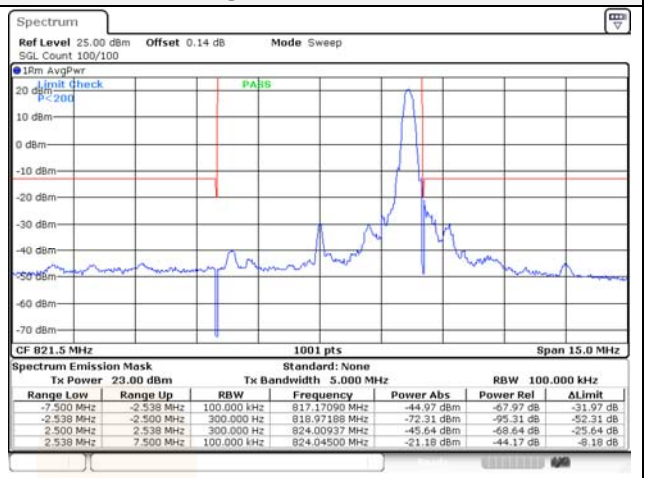


5M BW QPSK

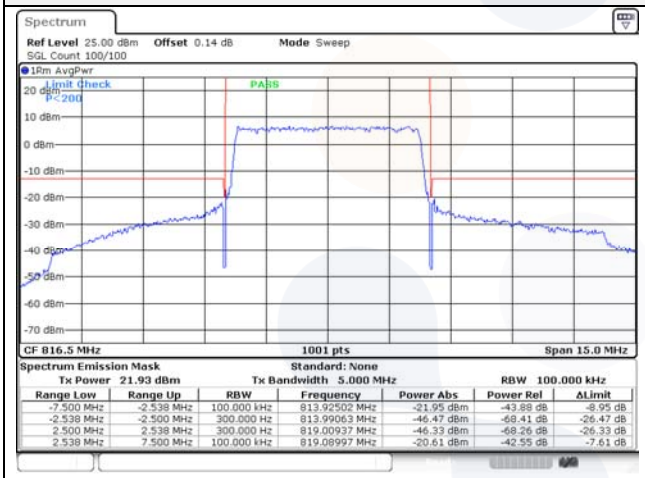
Low channel 1RB



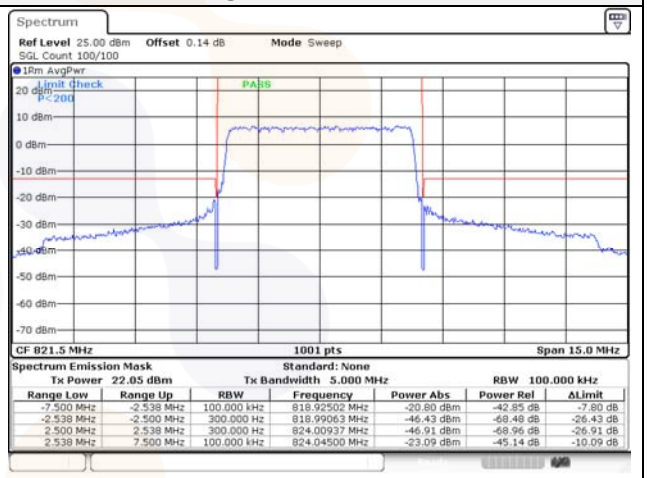
High channel 1RB



Low channel FRB

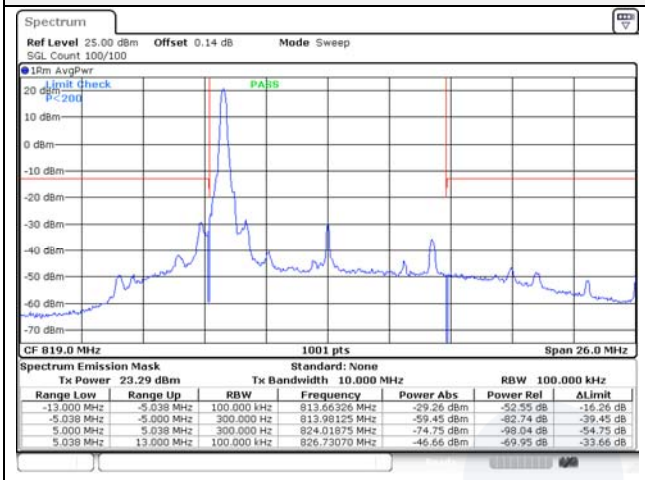


High channel FRB

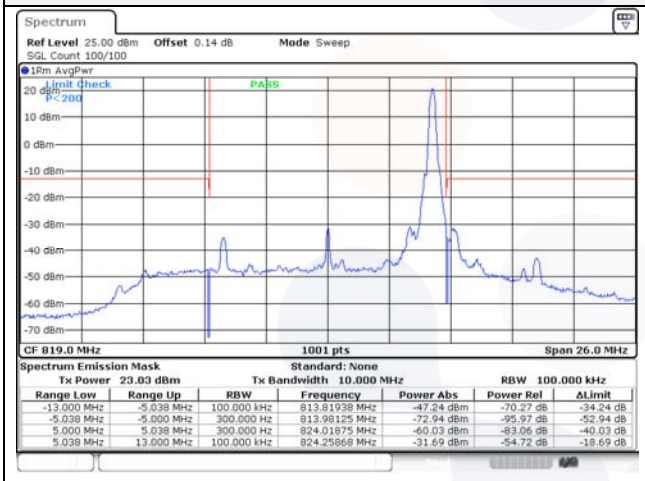


10M BW QPSK

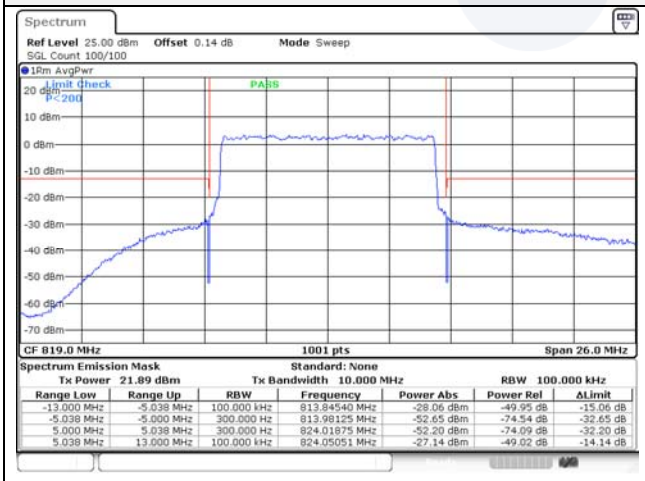
Middle channel Lower 1RB



Middle channel Upper 1RB

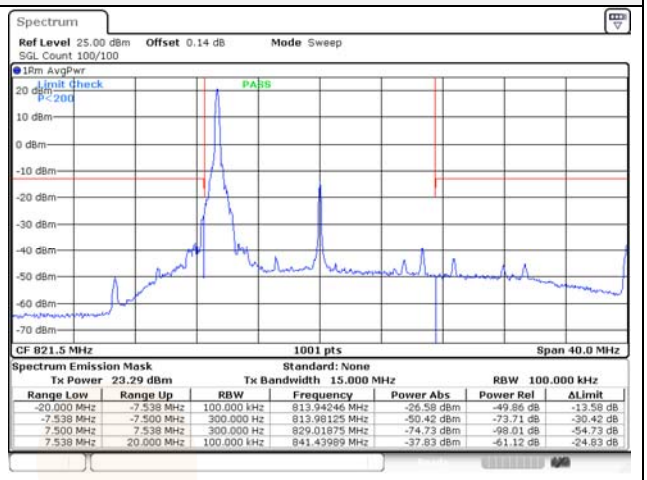


Middle channel FRB

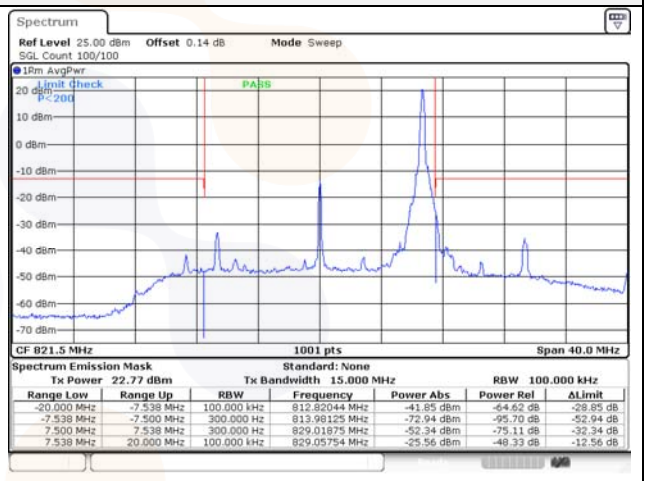


15M BW QPSK

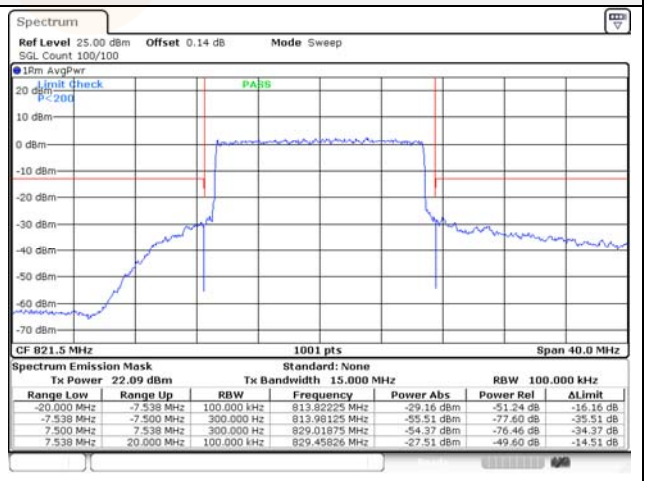
Middle channel Lower 1RB



Middle channel Upper 1RB



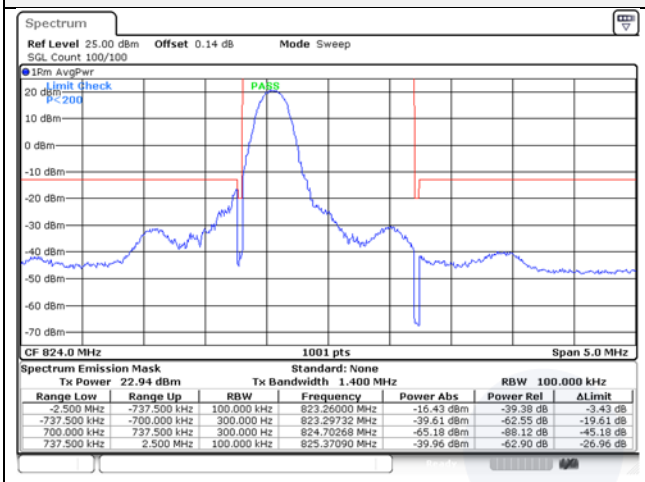
Middle channel FRB



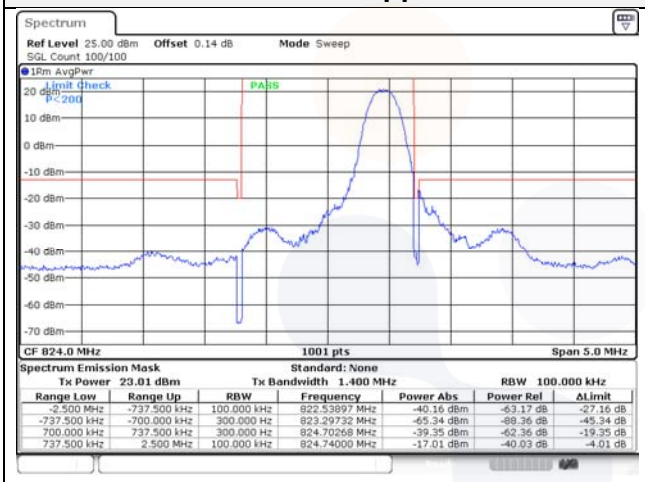
LTE B26 (Straddle channel)

1.4M BW QPSK

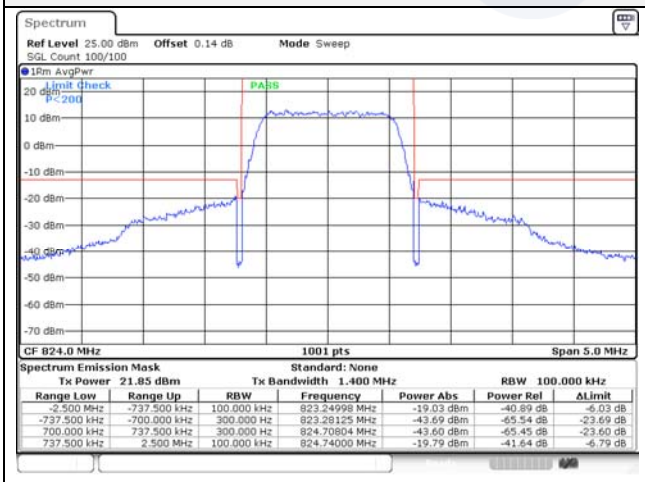
Middle channel Lower 1RB



Middle channel Upper 1RB

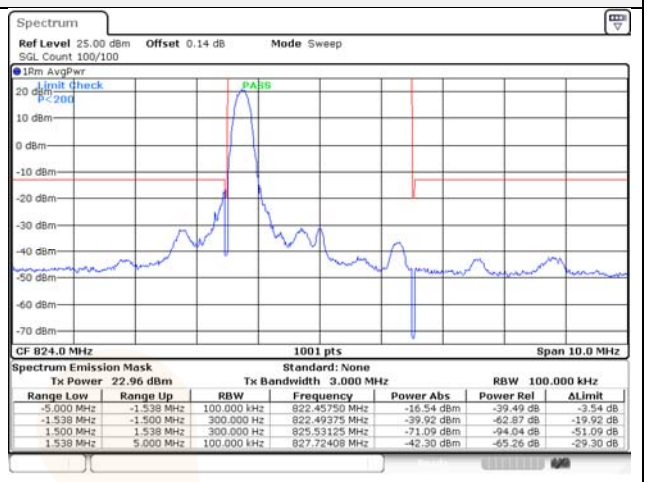


Middle channel FRB

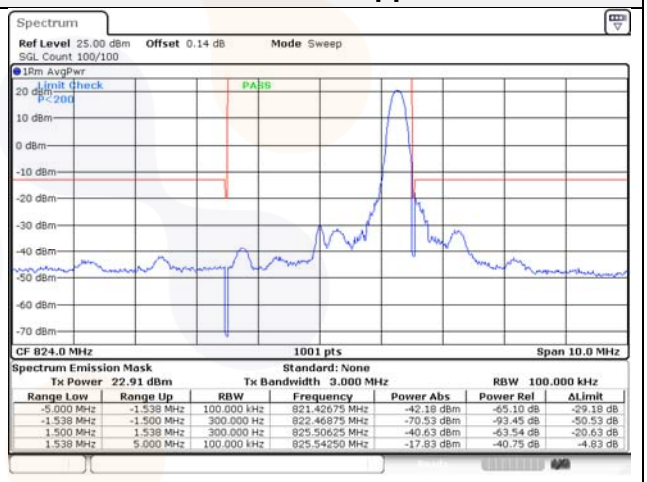


3M BW QPSK

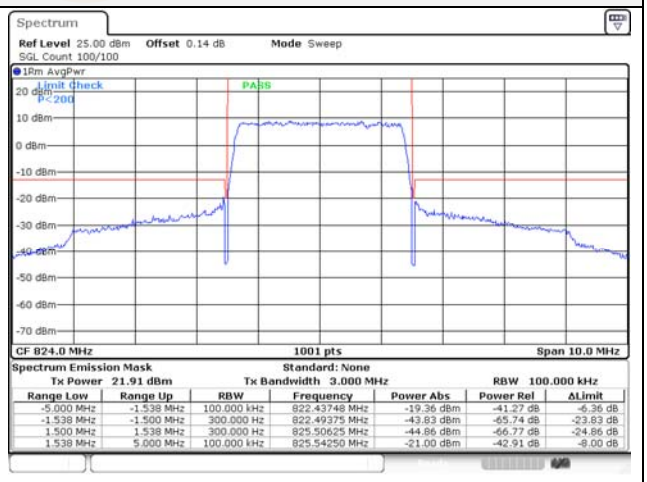
Middle channel Lower 1RB

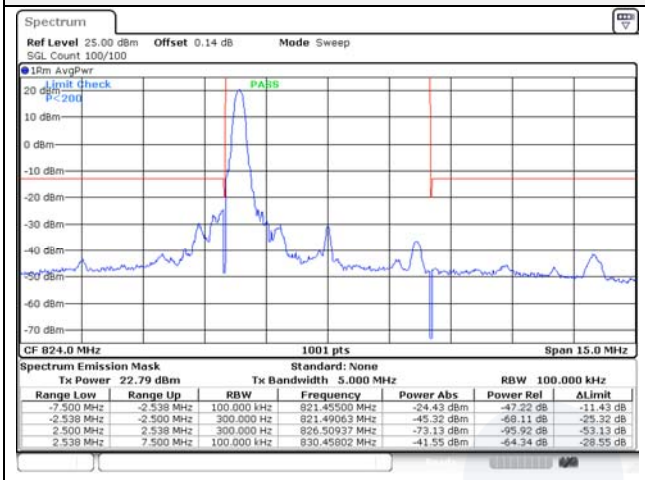
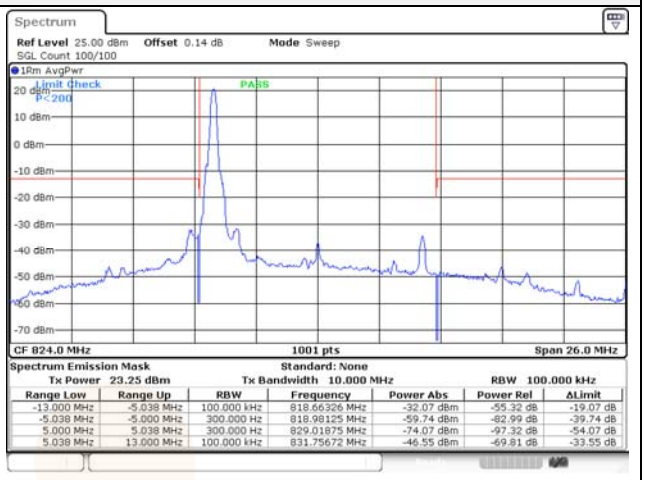
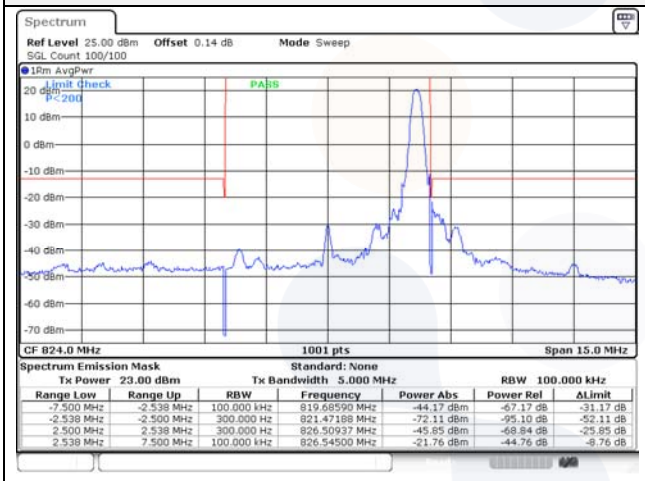
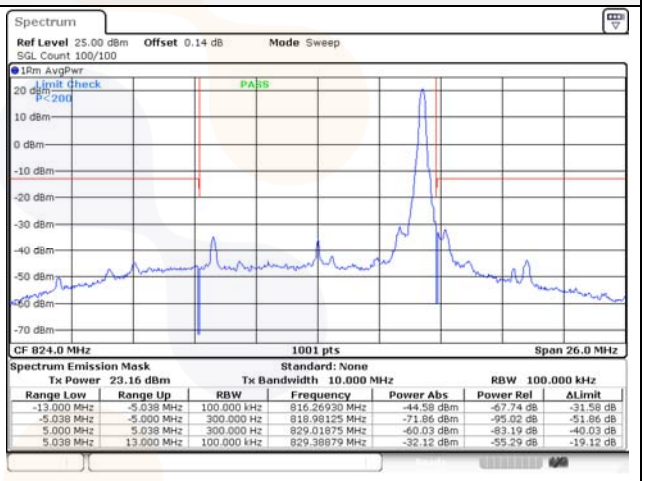
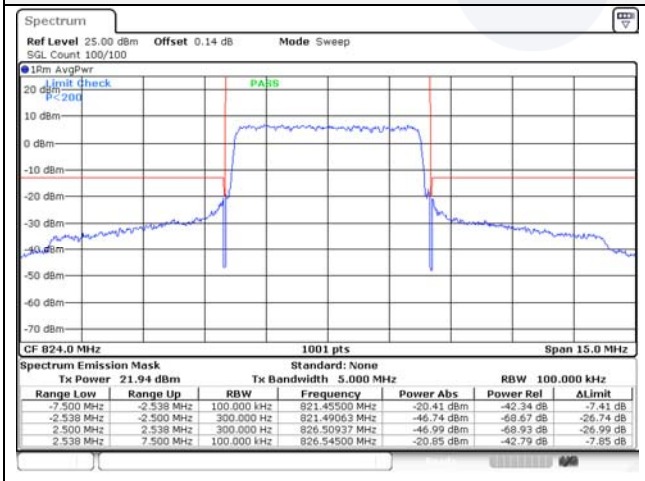
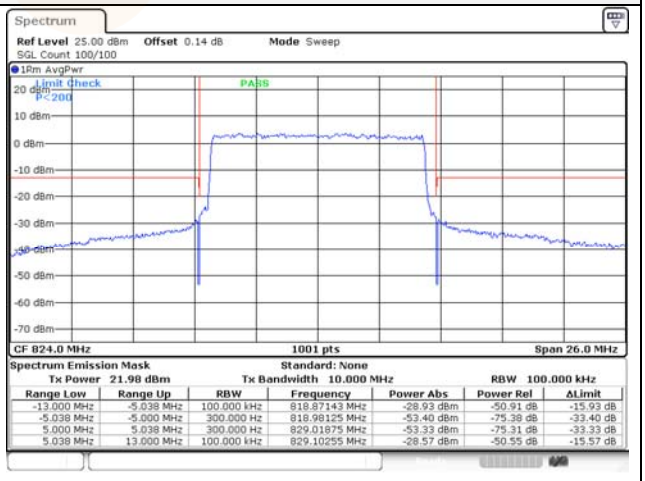


Middle channel Upper 1RB



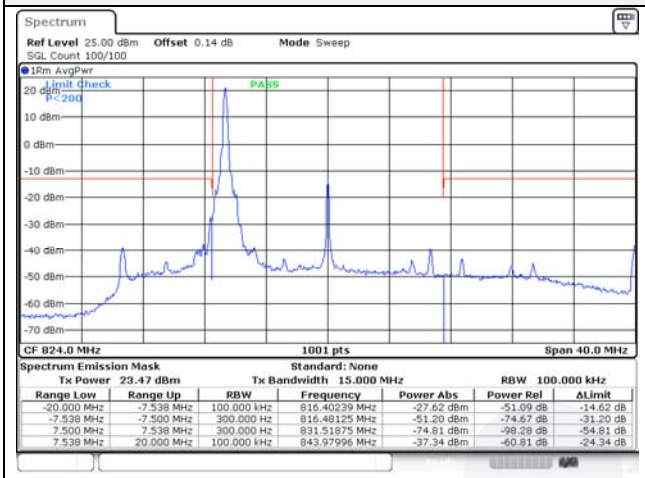
Middle channel FRB



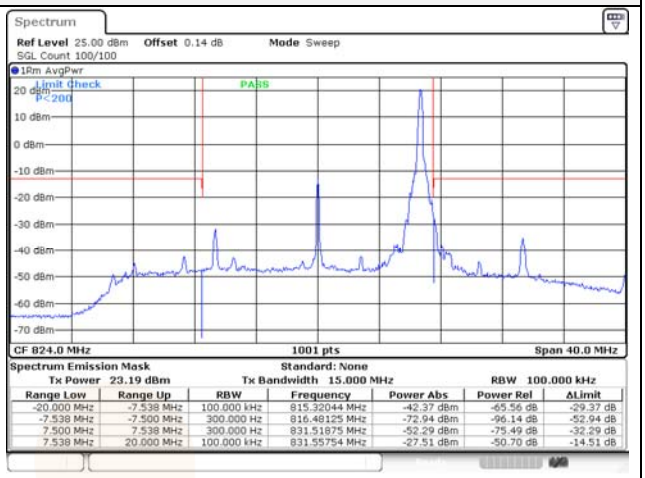
5M BW QPSK	10M BW QPSK
Middle channel Lower 1RB	**Middle channel Lower 1RB**
	
Middle channel Upper 1RB	**Middle channel Upper 1RB**
	
Middle channel FRB	**Middle channel FRB**
	

15M BW QPSK

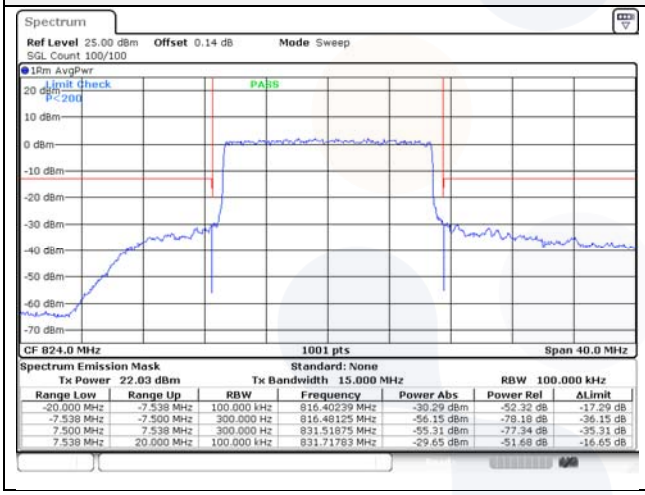
Middle channel Lower 1RB



Middle channel Upper 1RB



Middle channel FRB



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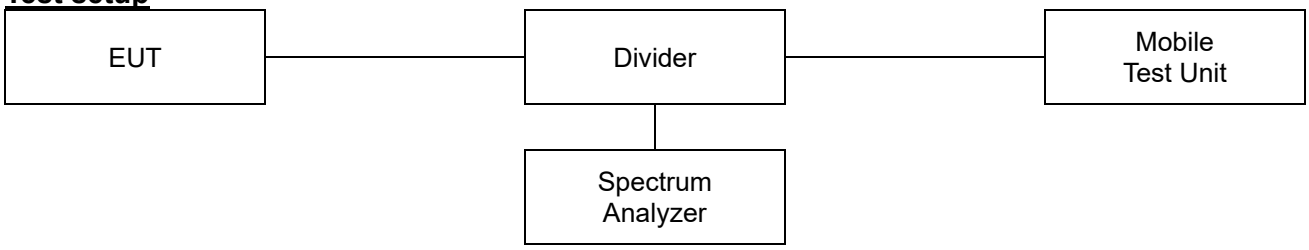
Blank

7.4. Spurious Emissions at Antenna Terminal

Test setup



Limit

According to §90.543(e),

for operations in the 758-768 ㎒ and the 788-798 ㎒ bands, the power of any emission outside the 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, in accordance with the following:

(1) On all frequencies between 769-775 ㎒ and 799-805 ㎒, by a factor not less than 76+10log(P) ㏈ in a 6.25 ㎑ band segment, for base and fixed stations.

(2) On all frequencies between 769-775 ㎒ and 799-805 ㎒, by a factor not less than 65+10log(P) ㏈ in a 6.25 ㎑ band segment, for mobile and portable stations.

(3) On any frequency between 775-788 ㎒, above 805 ㎒, and below 758 ㎒, by at least 43+10log(P) ㏈.

(4) Compliance with the provisions of paragraphs (e)(1) and (2) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 ㎑ segment.

(5) Compliance with the provisions of paragraph (e)(3) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 ㎑ or greater. However, in the 100 ㎑ bands immediately outside and adjacent to the frequency block, a resolution bandwidth of 30 ㎑ may be employed.

According to §90.691(a),

Out-of-band emission requirement shall apply only to the "outer" channels Included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 ㎑, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log_{10}(f/6.1) decibels or 50 + 10Log_{10}(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz where f is greater than 12.5 ㎑.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 ㎑, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log_{10}(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 ㎑.

Test procedure

971168 D01 v03r01 - Section 6
ANSI 63.26-2015 – Section 5.7

Test settings

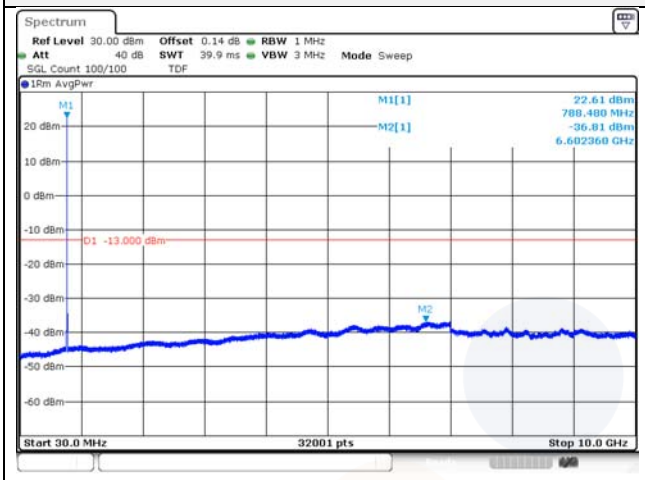
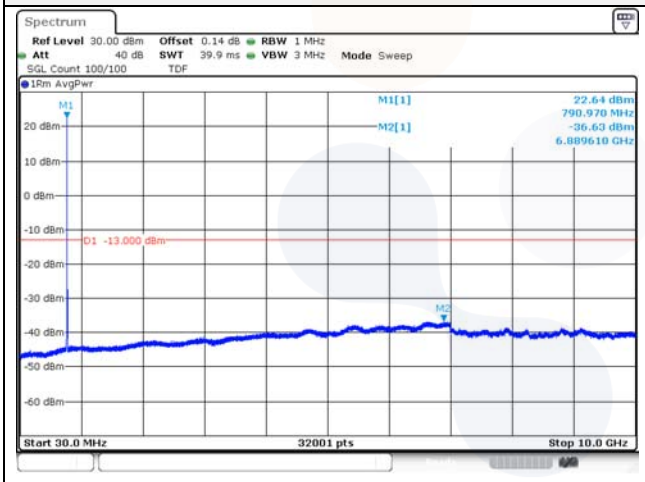
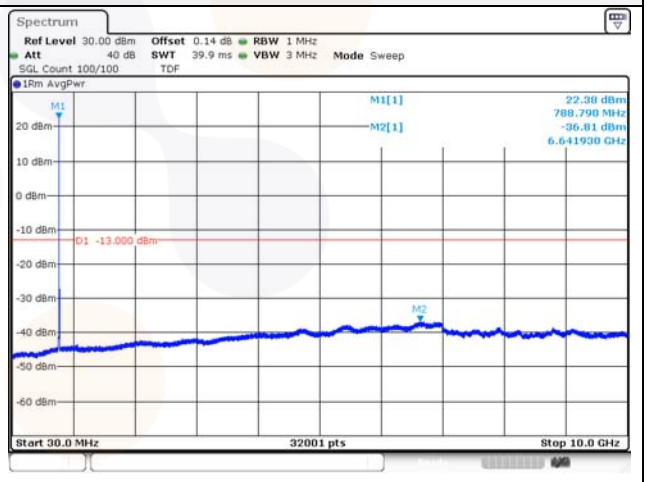
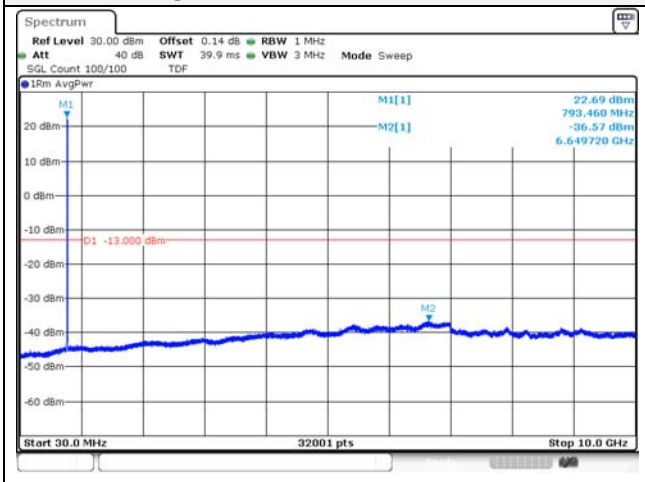
1) Start frequency was set to 30 ㎒ and stop frequency was set to at least 10th the fundamental frequency.
2) Detector = RMS
3) Sweep time = auto couple.
4) Trace mode = trace average
5) Allow trace to fully stabilize.
6) Please see test notes below RBW and VBW settings.

Notes:

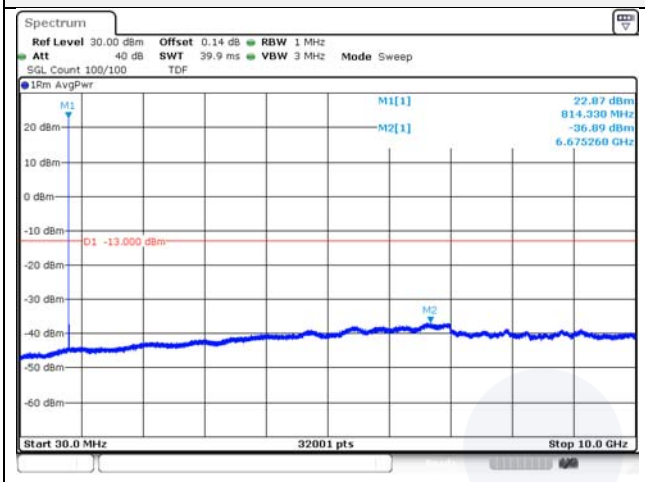
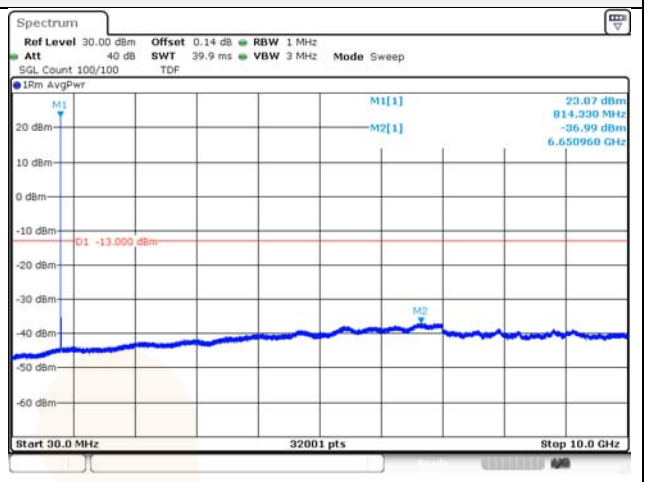
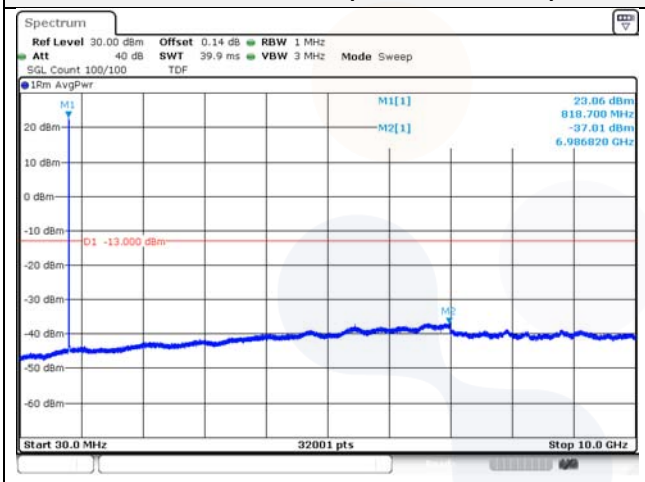
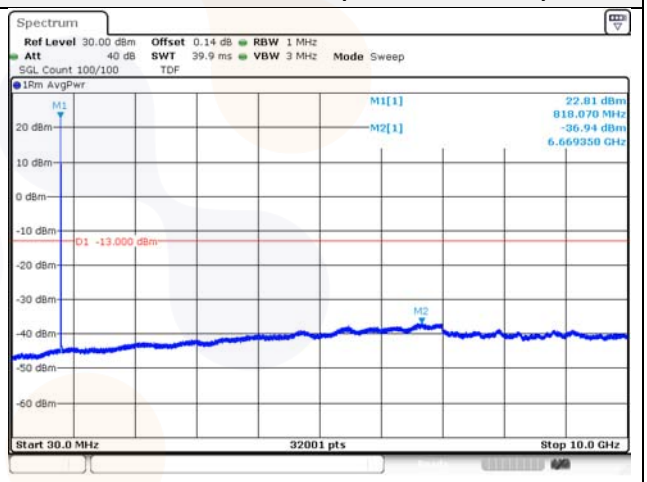
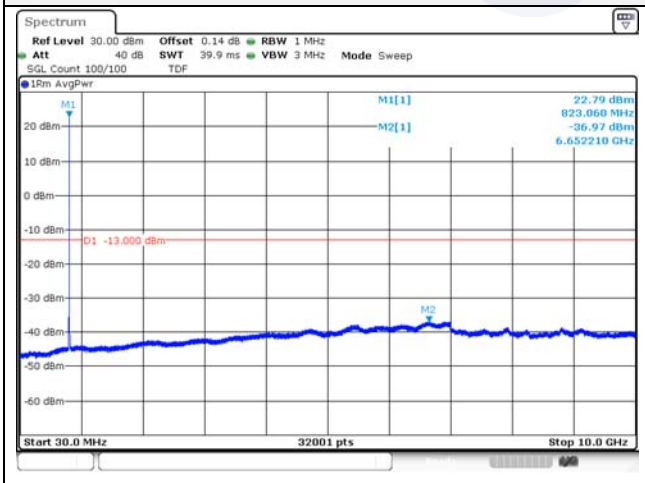
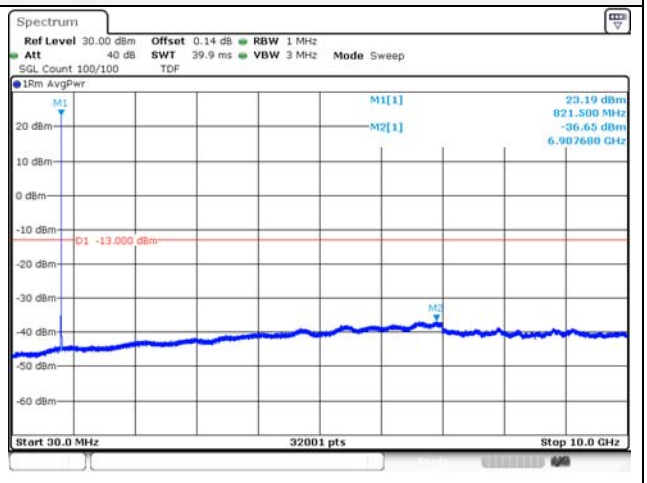
1. Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 100 ㎑ or greater for frequencies less than 1 ㎓ and 1 ㎒ or greater for frequencies greater than 1 ㎓.
   The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 ㏈ below the transmitter power.
2. All modes of operation were investigated and the worst-case configuration results are reported.

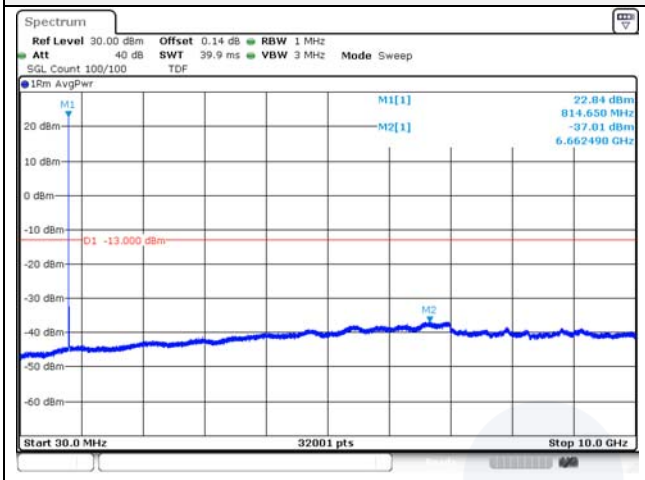
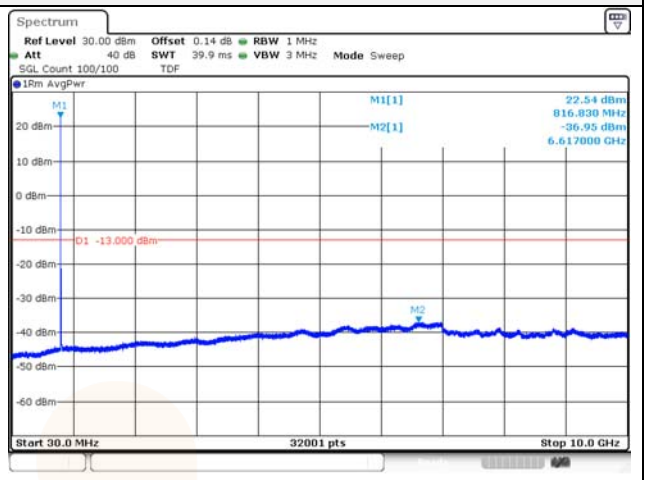
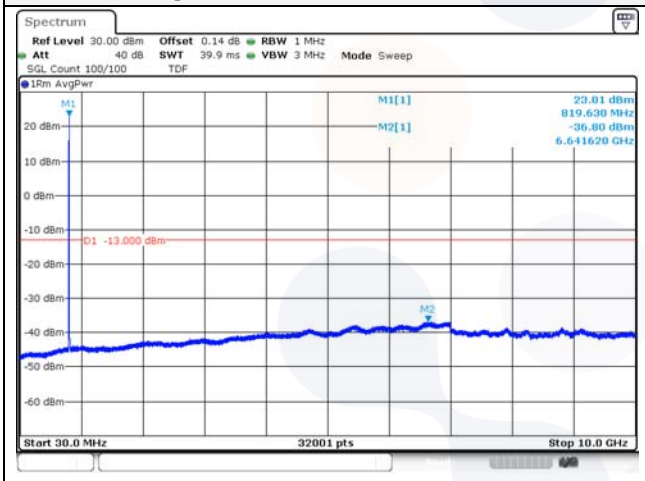
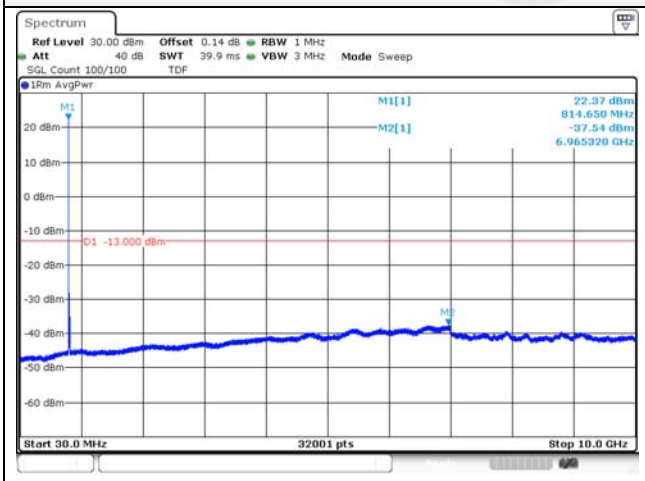
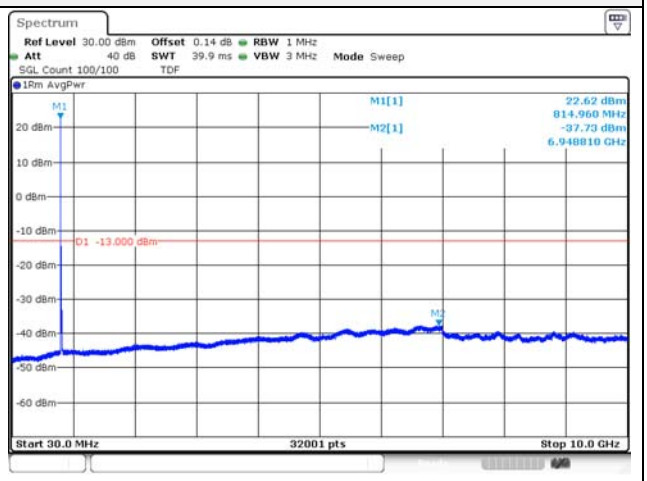
Test results

Test mode: LTE B14

5M BW QPSK	10M BW QPSK
Low channel (30 ㎒ ~ 10 ㎓)	-
	Blank
Middle channel (30 ㎒ ~ 10 ㎓)	Middle channel (30 ㎒ ~ 10 ㎓)
	
High channel (30 ㎒ ~ 10 ㎓)	-
	Blank

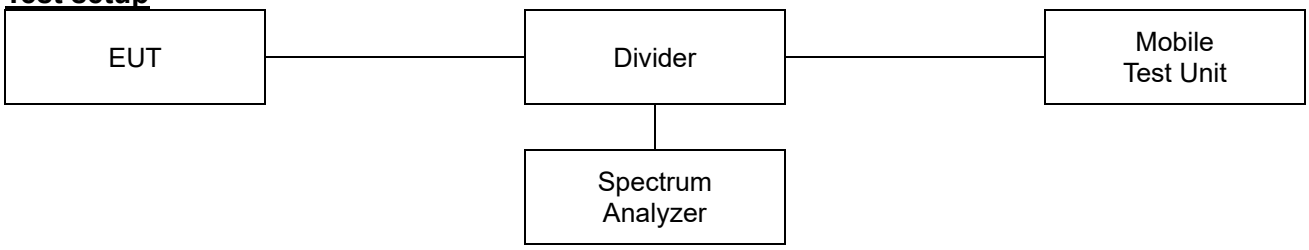
Test mode: LTE B26

1.4M BW QPSK	3M BW QPSK
Low channel (30 ㎒ ~ 10 ㎓)	**Low channel (30 ㎒ ~ 10 ㎓)**
	
Middle channel (30 ㎒ ~ 10 ㎓)	**Middle channel (30 ㎒ ~ 10 ㎓)**
	
High channel (30 ㎒ ~ 10 ㎓)	**High channel (30 ㎒ ~ 10 ㎓)**
	

5M BW QPSK	
Low channel (30 ㎒ ~ 10 ㎓)	**Middle channel (30 ㎒ ~ 10 ㎓)**
	
High channel (30 ㎒ ~ 10 ㎓)	**-**
	Blank
10M BW QPSK	**15M BW QPSK**
Middle channel (30 ㎒ ~ 10 ㎓)	**Middle channel (30 ㎒ ~ 10 ㎓)**
	

7.5. Peak to Average Power Ratio (PAPR)

Test setup



Test procedure

971168 D01 v03r01 - Section 5.7.2
971168 D02 v02r02 – Section VII
ANSI 63.26-2015 – Section 5.2.3.4

Test settings

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

1) Set resolution/measurement bandwidth ≥ OBW or specified reference bandwidth
2) Set the number of counts to a value that stabilizes the measured CCDF curve.
3) Set the measurement interval as follows:
   a) For continuous transmissions, set to the greater of [10 x (number of points in sweep) x (transmission symbol period)] or 1 ms.
   b) For burst transmissions, employ an external trigger that is synchronized with the EUT burst timing sequence, or use the internal burst trigger with a trigger level that allows the burst to stabilize. Set the measurement internal to a time that is less than or equal to the burst duration.
   c) If there are several carriers in a single antenna port, the peak power shall be determined for each individual carrier (by disabling the other carriers while measuring the required carrier) and the total peak power calculated from the sum of the individual carrier peak powers.
4) Record the maximum PAPR level associated with a probability of 0.1%

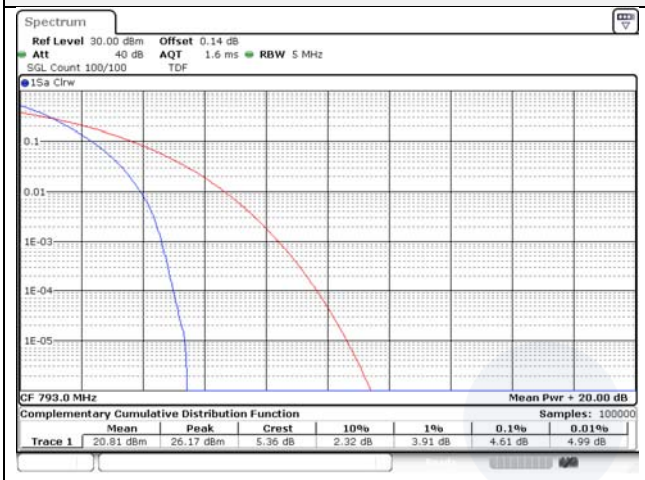
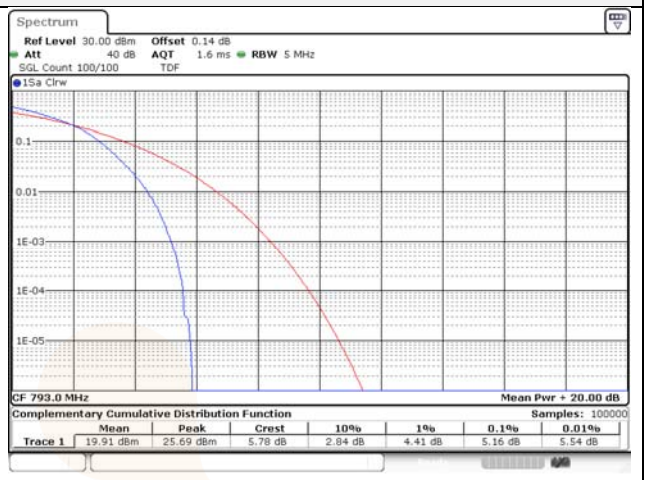
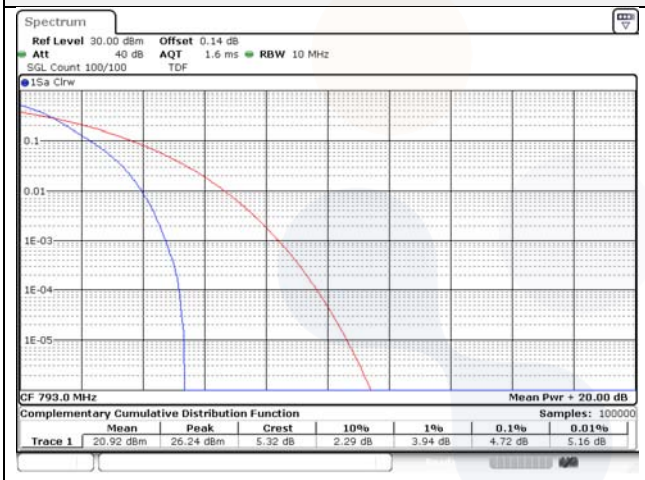
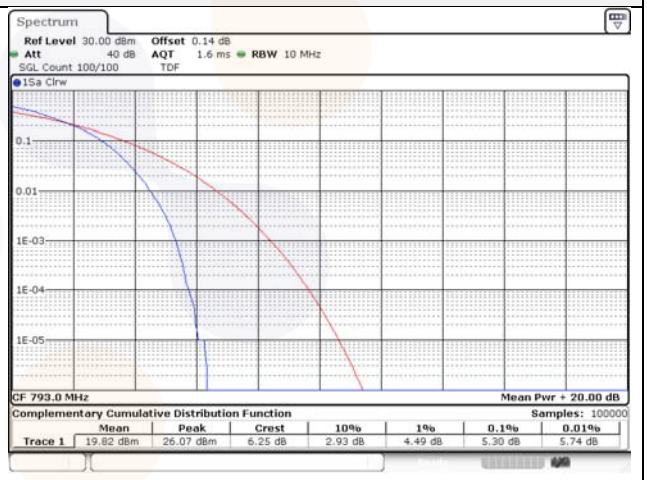
5.2.6 Peak-to-average power ratio

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

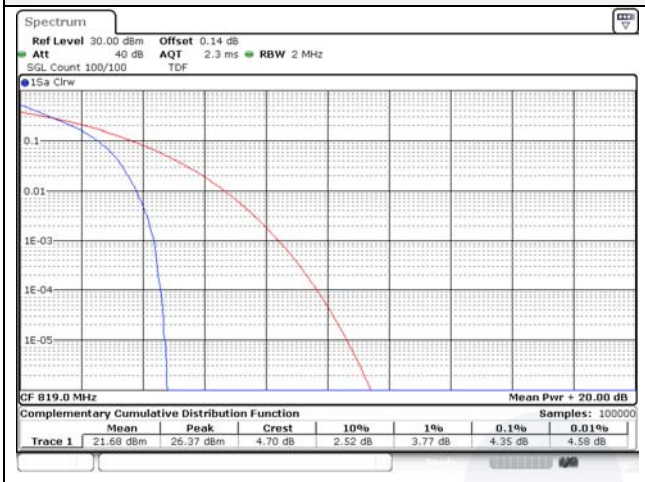
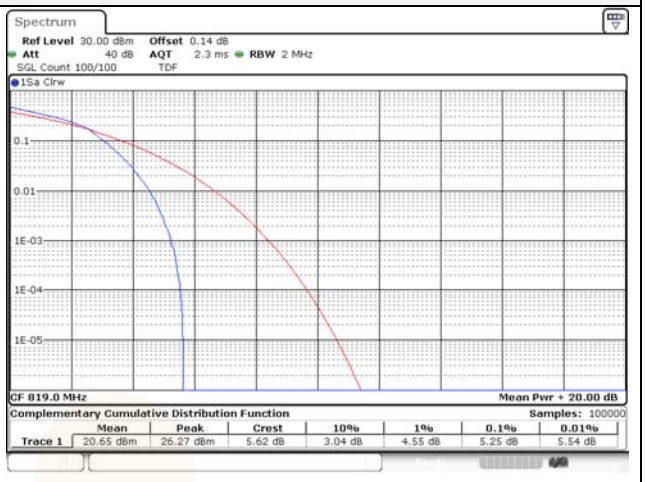
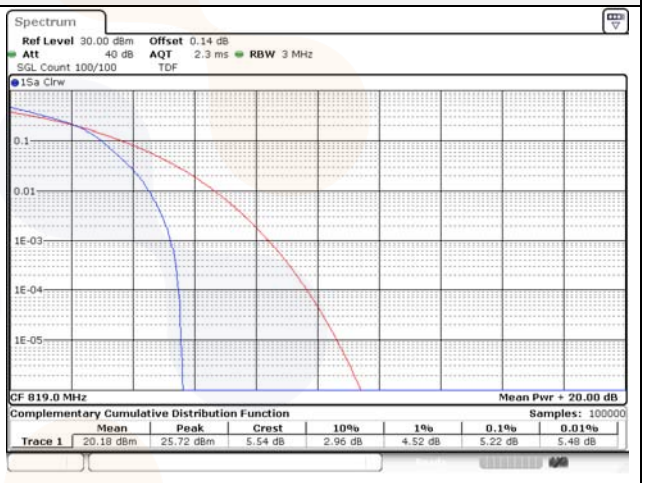
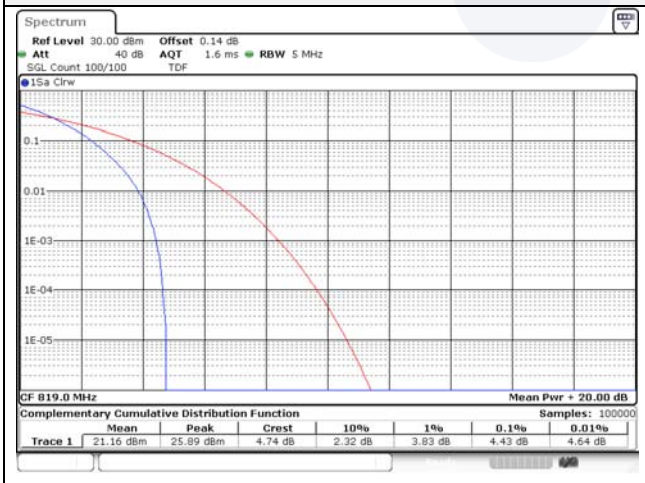
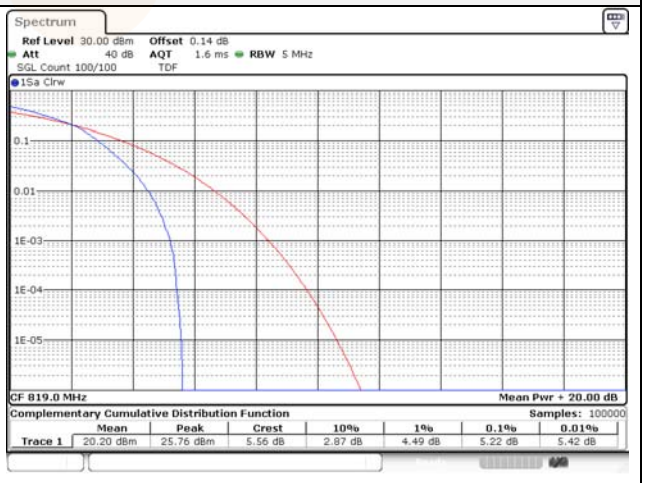
PAPR(dB) = P_{PK} (dBm or dBW) - P_{AG}(dBm or dBW)

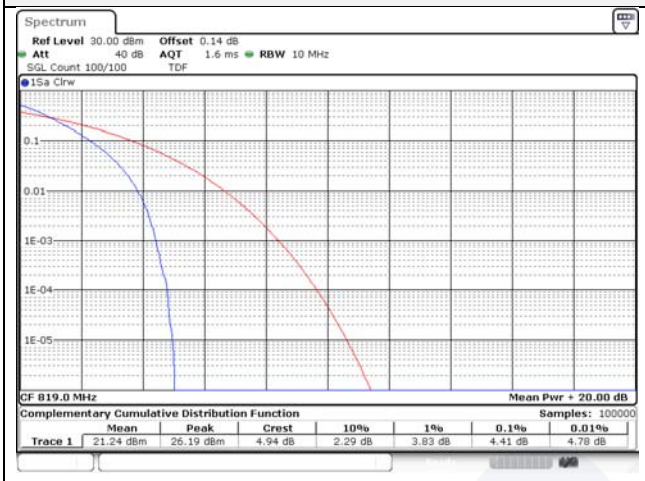
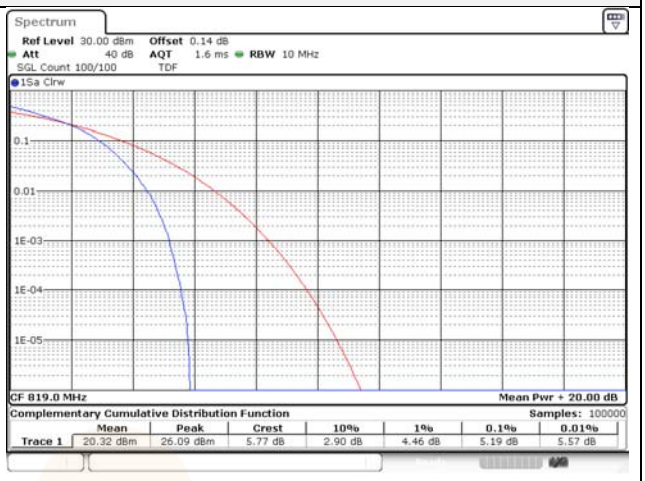
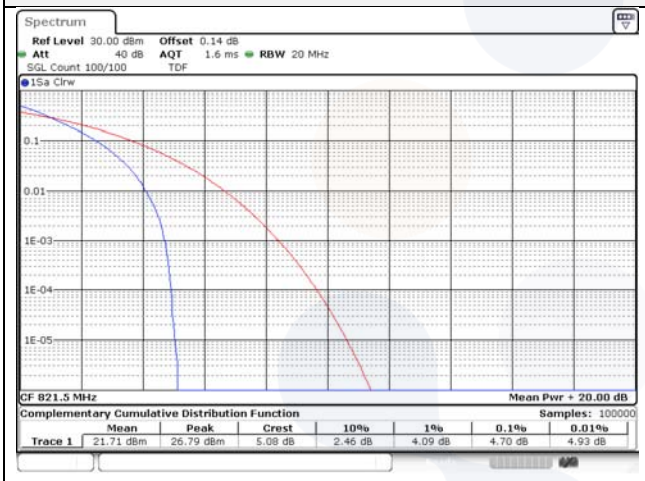
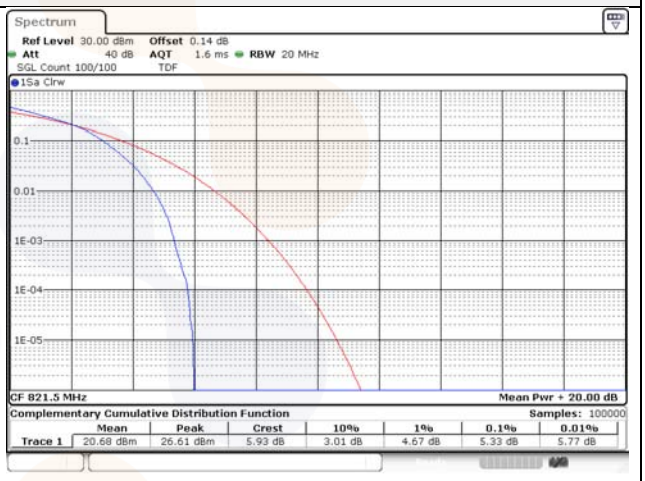
Test results

Test mode: LTE B14

5M BW QPSK Middle channel	5M BW 16QAM Middle channel
	
10M BW QPSK Middle channel	**10M BW 16QAM Middle channel**
	

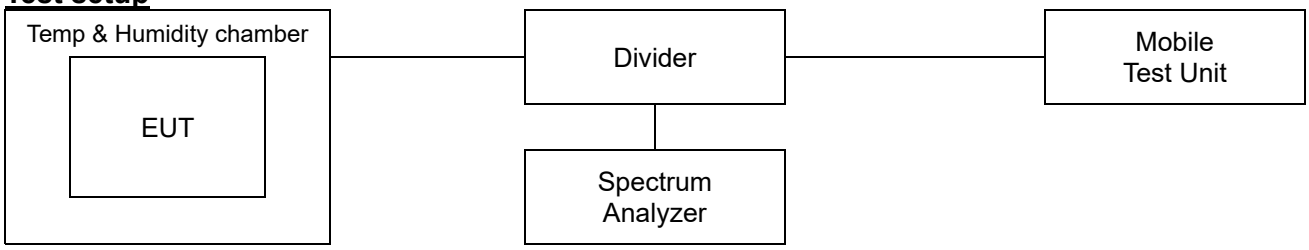
Test mode: LTE B26

1.4M BW QPSK Middle channel	1.4M BW 16QAM Middle channel
	
3M BW QPSK Middle channel	**3M BW 16QAM Middle channel**
	
5M BW QPSK Middle channel	**5M BW 16QAM Middle channel**
	

10M BW QPSK Middle channel	10M BW 16QAM Middle channel
	
15M BW QPSK Middle channel	**15M BW 16QAM Middle channel**
	

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 §90.539(e),

The frequency stability of mobile, portable and control transmitters operating in the wideband segment must be 1.25 parts per million or better when AFC is locked to a base station, and 5 parts per million or better when AFC is not locked.

According to §90.213,

For mobile devices operating in the 809 to 824 ㎒ band at a power level 2 Watts or less, the limit specified in Table is ±2.5 ppm.

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

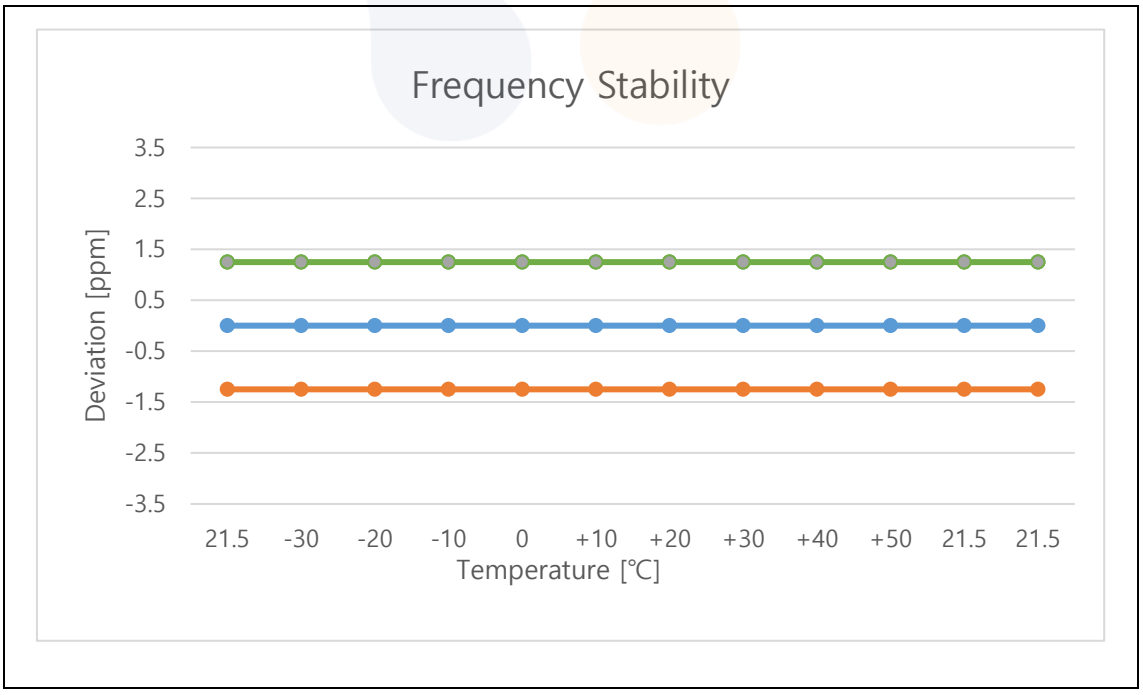
Test mode : LTE B14

Frequency (㎐) : 793 000 000

Channel : 23330

Deviation limit : The frequency stability of mobile, portable and control transmitters operating in the wideband segment must be 1.25 parts per million or better when AFC is locked to a base station, and 5 parts per million or better when AFC is not locked.

Voltage (%)	Power (V)	Temp. (°C)	Frequency (㎐)	Frequency error (㎐)	Deviation		Limit (ppm)
					(ppm)	(%)	
100%	3.88	+21.5(Ref)	793,000,000	0.06	0.0	0.000000	1.25
		-30	792,999,998	-2.09	0.0	0.000000	
		-20	792,999,999	-0.92	0.0	0.000000	
		-10	793,000,000	-0.14	0.0	0.000000	
		0	793,000,000	0.21	0.0	0.000000	
		+10	793,000,003	3.05	0.0	0.000000	
		+20	792,999,999	-0.62	0.0	0.000000	
		+30	793,000,003	3.3	0.0	0.000000	
		+40	793,000,001	1.17	0.0	0.000000	
		+50	793,000,003	2.52	0.0	0.000000	
115%	4.46	+21.5(Ref)	793,000,000	0.3	0.0	0.000000	
End point	3.40	+21.5(Ref)	793,000,000	0.29	0.0	0.000000	



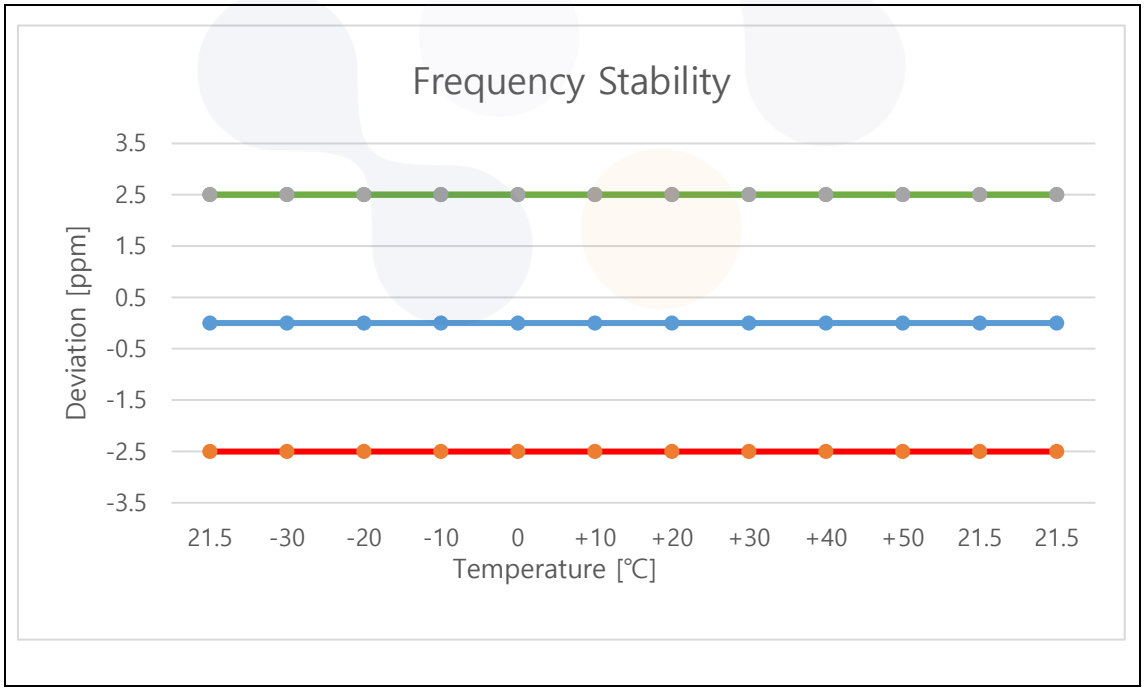
Test mode : LTE B26

Frequency (㎐) : 819 000 000

Channel : 26740

Deviation limit : ±0.000 25% or 2.5ppm

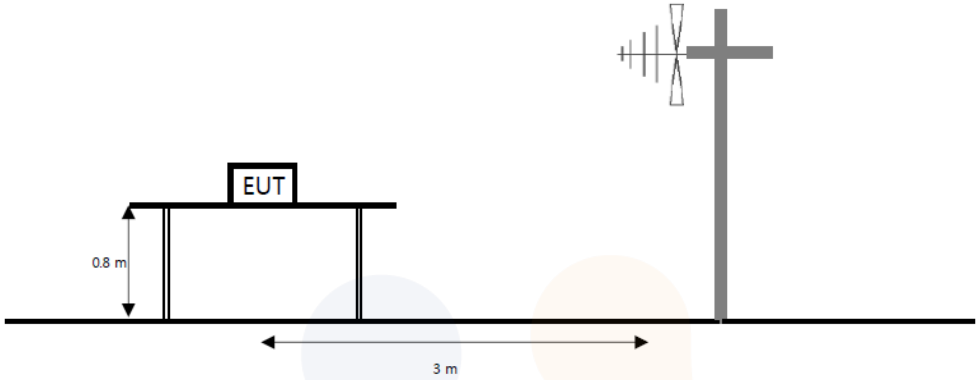
Voltage (%)	Power (V)	Temp. (°C)	Frequency (㎐)	Frequency error (㎐)	Deviation	
					(ppm)	(%)
100%	3.88	+21.5(Ref)	819,000,000	0.40	0.0	0.000000
		-30	819,000,002	2.16	0.0	0.000000
		-20	819,000,002	1.59	0.0	0.000000
		-10	819,000,001	1.10	0.0	0.000000
		0	819,000,002	1.69	0.0	0.000000
		+10	819,000,000	-0.24	0.0	0.000000
		+20	819,000,000	-0.10	0.0	0.000000
		+30	819,000,001	0.77	0.0	0.000000
		+40	819,000,003	3.43	0.0	0.000000
		+50	819,000,003	2.55	0.0	0.000000
115%	4.46	+21.5(Ref)	819,000,001	0.66	0.0	0.000000
End point	3.40	+21.5(Ref)	818,999,999	-0.96	0.0	0.000000



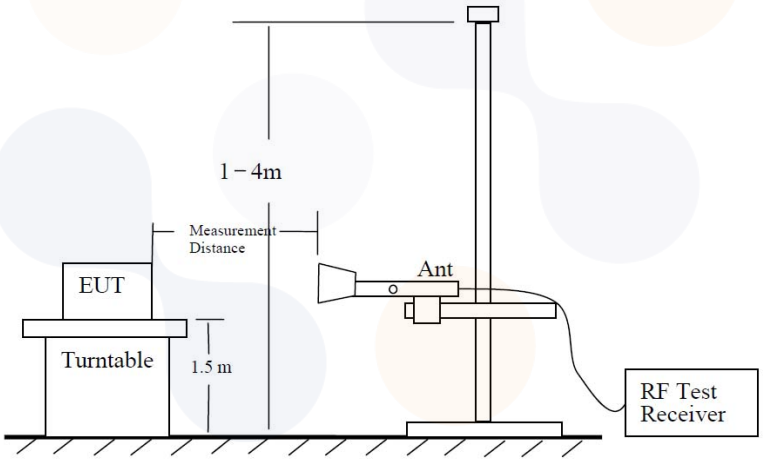
7.7. Radiated Power (ERP)

Test setup

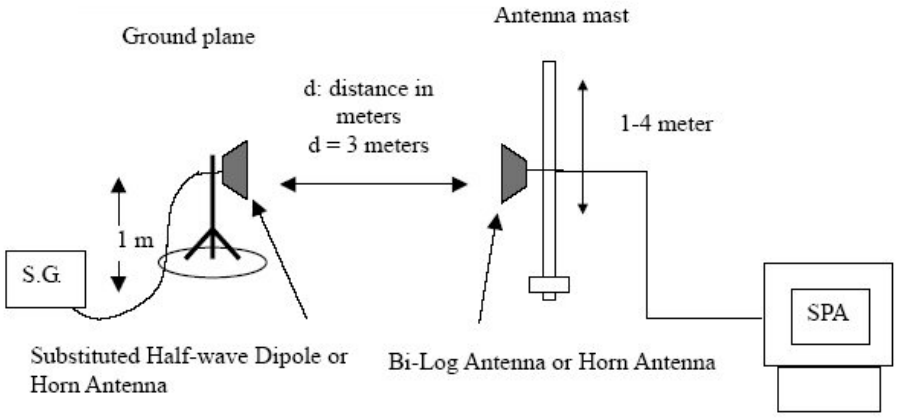
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.



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 §90.542(a)(7),

Portable stations (hand-held devices) transmitting in the 758-768 ㎒ band and the 788-798 ㎒ band are limited to 3 watts ERP.

According to §90.635(b),

The maximum output power of the transmitter for mobile stations is 100 watts(20 ㏈w).

Test procedure

412172 D01 v01r01
971168 D01 v03r01 - Section 5.2 and 5.8
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 B14

Bandwidth [㎒]	Modulation	Channel	Pol.	Antenna Gain	C.L	Substitute Level	ERP	
			[V/H]	[dBd]	[dB]	[dBm]	[dBm]	[W]
5	QPSK	Low	H	3.15	5.90	13.37	10.62	0.012
		Middle	H	3.15	5.92	12.78	10.01	0.010
		High	H	3.15	5.91	12.31	9.55	0.009
	16QAM	Low	H	3.15	5.90	12.47	9.72	0.009
		Middle	H	3.15	5.92	11.92	9.15	0.008
		High	H	3.15	5.91	11.42	8.66	0.007
10	QPSK	Middle	H	3.15	5.92	12.99	10.22	0.011
	16QAM	Middle	H	3.15	5.92	12.03	9.26	0.008

Note.

1. E.R.P(dBm) = Substitute Level(dB) + Antenna gain(dBd) – C.L(Cable loss) (dB)

Test mode: LTE B26

Bandwidth [㎒]	Modulation	Channel	Pol.	Antenna Gain	C.L	Substitute Level	ERP	
			[V/H]	[dBd]	[dB]	[dBm]	[dBm]	[W]
1.4	QPSK	Low	H	3.19	6.01	13.22	10.40	0.011
		Middle	H	3.32	6.03	12.98	10.27	0.011
		High	H	3.38	6.07	13.58	10.89	0.012
	16QAM	Low	H	3.19	6.01	12.14	9.33	0.009
		Middle	H	3.32	6.03	11.87	9.16	0.008
		High	H	3.38	6.07	12.59	9.90	0.010
3	QPSK	Low	H	3.22	6.01	13.45	10.66	0.012
		Middle	H	3.32	6.03	13.04	10.33	0.011
		High	H	3.38	6.05	13.52	10.85	0.012
	16QAM	Low	H	3.22	6.01	12.21	9.41	0.009
		Middle	H	3.32	6.03	12.08	9.37	0.009
		High	H	3.38	6.05	12.25	9.58	0.009
5	QPSK	Low	H	3.25	6.03	13.27	10.49	0.011
		Middle	H	3.32	6.03	12.76	10.05	0.010
		High	H	3.37	6.04	13.44	10.76	0.012
	16QAM	Low	H	3.25	6.03	12.20	9.41	0.009
		Middle	H	3.32	6.03	11.67	8.96	0.008
		High	H	3.37	6.04	12.56	9.89	0.010
10	QPSK	Middle	H	3.32	6.03	13.09	10.38	0.011
	16QAM	Middle	H	3.32	6.03	11.97	9.26	0.008
15	QPSK	Middle	H	3.37	6.04	13.30	10.63	0.012
	16QAM	Middle	H	3.37	6.04	12.32	9.64	0.009

Test mode: LTE B26 (Straddle channel)

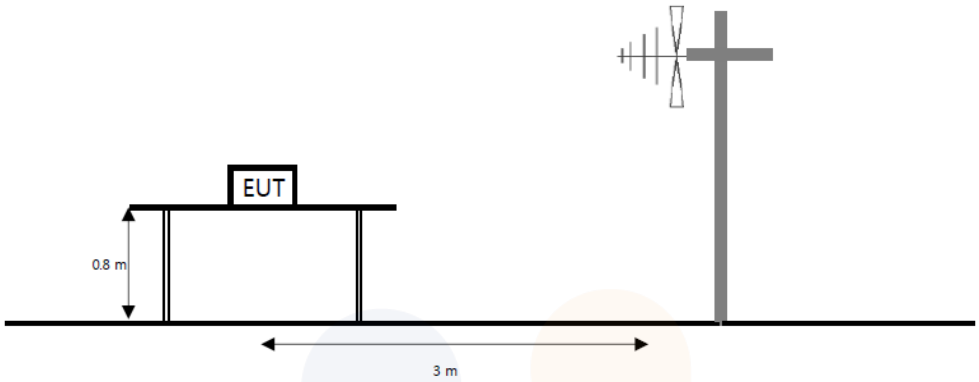
Bandwidth [㎒]	Modulation	Channel	Pol.	Antenna Gain	C.L	Substitute Level	ERP	
			[V/H]	[dBd]	[dB]	[dBm]	[dBm]	[W]
1.4	QPSK	Middle	H	3.39	6.08	13.62	10.93	0.012
	16QAM		H	3.39	6.08	12.69	10.01	0.010
3	QPSK		H	3.39	6.08	13.70	11.02	0.013
	16QAM		H	3.39	6.08	12.82	10.13	0.010
5	QPSK		H	3.39	6.08	13.77	11.09	0.013
	16QAM		H	3.39	6.08	12.67	9.98	0.010
10	QPSK		H	3.39	6.08	13.83	11.15	0.013
	16QAM		H	3.39	6.08	12.71	10.03	0.010
15	QPSK		H	3.39	6.08	13.40	10.71	0.012
	16QAM		H	3.39	6.08	12.27	9.58	0.009

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

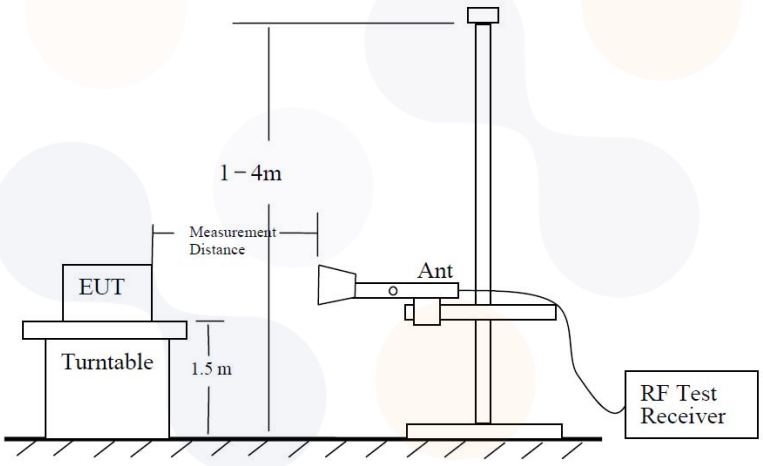
7.8. Radiated Spurious Emissions

Test setup

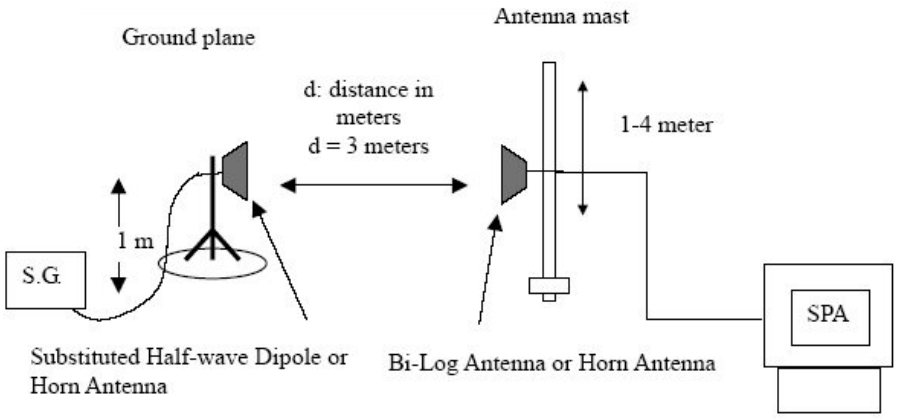
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 ㎒ to 1 ㎓ emissions.



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 §90.543(e),

for operations in the 758-768 ㎒ and the 788-798 ㎒ bands, the power of any emission outside the 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, in accordance with the following:

(1) On all frequencies between 769-775 ㎒ and 799-805 ㎒, by a factor not less than 76+10log(P) ㏈ in a 6.25 ㎑ band segment, for base and fixed stations.

(2) On all frequencies between 769-775 ㎒ and 799-805 ㎒, by a factor not less than 65+10log(P) ㏈ in a 6.25 ㎑ band segment, for mobile and portable stations.

(3) On any frequency between 775-788 ㎒, above 805 ㎒, and below 758 ㎒, by at least 43+10log(P) ㏈.

(4) Compliance with the provisions of paragraphs (e)(1) and (2) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 ㎑ segment.

(5) Compliance with the provisions of paragraph (e)(3) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 ㎑ or greater. However, in the 100 ㎑ bands immediately outside and adjacent to the frequency block, a resolution bandwidth of 30 ㎑ may be employed.

According to §90.543(f),

for operations in the 758-775 ㎒ and the 788-805 ㎒ bands, all emissions including harmonics 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 §90.691(a),

Out-of-band emission requirement shall apply only to the "outer" channels Included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(1) For any frequency removed from the EA licensee's frequency block by up to and including 37.5 ㎑, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 116 Log_{10}(f/6.1) decibels or 50 + 10Log_{10}(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz where f is greater than 12.5 ㎑.

(2) For any frequency removed from the EA licensee's frequency block greater than 37.5 ㎑, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least 43 + 10Log_{10}(P) decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 ㎑.

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.

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 B14
Frequency(㎒) : 790.5
Channel : 23305
Bandwidth(㎒) : 5

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 575.62	H	5.97	8.42	-51.65	-54.10	-40.00	14.10
	2 363.35	V	5.64	10.45	-41.99	-46.80	-13.00	33.80
	3 150.26	H	7.60	12.15	-37.65	-42.20	-13.00	29.20
	3 939.64	V	9.09	13.64	-35.25	-39.80	-13.00	26.80

Test mode : LTE B14
Frequency(㎒) : 793
Channel : 23300
Bandwidth(㎒) : 5

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 582.18	V	5.95	8.44	-51.01	-53.50	-40.00	13.50
	2 369.10	V	5.66	10.46	-42.10	-46.90	-13.00	33.90
	3 165.03	H	7.63	12.18	-39.25	-43.80	-13.00	30.80
	3 954.41	V	9.12	13.91	-33.61	-38.40	-13.00	25.40

Test mode : LTE B14
Frequency(㎒) : 795.5
Channel : 23355
Bandwidth(㎒) : 5

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 587.93	V	5.94	8.45	-53.39	-55.90	-40.00	15.90
	2 377.30	V	5.68	10.48	-42.80	-47.60	-13.00	34.60
	3 172.83	H	7.65	12.20	-40.35	-44.90	-13.00	31.90
	3 965.90	V	9.14	13.93	-34.81	-39.60	-13.00	26.60

Note.
1. For the range 1 559 ~ 1 610 MHz, Limit Calculation(dBm)= 43 + 10log($P_{[Watts]}$)
   Limit Calculation of wide-band (dBm/㎒) = -70 dBW/㎒ (-40 dBm/㎒)
   Limit Calculation of narrow-band (dBm) = -80 dBW (-50 dBm)
2. E.I.R.P(dBm) = Substitute Level(dB) + Antenna gain(dBi) - C.L(Cable loss) (dB)

Test mode : LTE B26
Frequency(㎒) : 819
Channel : 26740
Bandwidth(㎒) : 10

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 637.57	H	5.79	8.64	-51.25	-54.10	-13.00	41.10
	2 457.72	H	5.89	10.62	-42.67	-47.40	-13.00	34.40
	3 276.63	H	7.85	12.43	-39.42	-44.00	-13.00	31.00
	4 097.18	V	9.28	13.96	-36.72	-41.40	-13.00	28.40

Test mode : LTE B26
Frequency(㎒) : 824
Channel : 26790
Bandwidth(㎒) : 10

Mode	Frequency	Pol.	Antenna Gain	Cable loss	Substitute Level	Level	Limit	Margin
	[㎒]	[V/H]	[dBi]	[dB]	[dBm]	[dBm]	[dBm]	[dB]
QPSK	1 658.91	V	5.72	8.62	-50.90	-53.80	-13.00	40.80
	2 488.90	H	5.97	10.68	-41.39	-46.10	-13.00	33.10
	3 314.38	V	7.93	12.51	-37.62	-42.20	-13.00	29.20
	4 148.06	V	9.32	14.14	-35.68	-40.50	-13.00	27.50

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

8. Measurement equipment

Equipment Name	Manufacturer	Model No.	Serial No.	Next Cal. Date
Spectrum Analyzer	R&S	FSV40-N	101462	24.10.12
Signal Generator	R&S	SMB100A	176206	25.01.18
DC Power Supply	AGILENT	E3632A	KR75304571	24.04.27
Divider	Marki Microwave, Inc.	PD-0040	D0006	24.07.04
Wideband Radio Communication Tester	R&S	CMW500	132120	24.04.25
Temp & Humid Chamber	Myeongseong R&P	CTHC-50P-DT	20150824-2	25.01.18
Spectrum Analyzer	AGILENT	N9040B	US55230151	24.07.03
Wideband Radio Communication Tester	R&S	CMW500	141780	25.01.18
Bilog Antenna	Teseq GmbH	CBL 6112D	62027	24.11.17
Bilog Antenna	ETS-LINDGREN	3143B	00228420	25.07.20
Horn Antenna	ETS-LINDGREN	3117	00251528	25.01.26
Horn Antenna	ETS-LINDGREN	3117	00227509	24.07.12
Horn Antenna	ETS-LINDGREN	3116	00086635	25.01.25
Horn Antenna	ETS-LINDGREN	3116C	00251516	25.02.01
Amplifier	SONOMA INSTRUMENT	310N	421822	24.10.12
Amplifier	C&K Technologies, Inc.	BZR-00504000-551028-252525	27736	24.07.04
Amplifier	C&K Technologies, Inc.	BZRT-00504000-481055-382525	26299-27735	24.07.04
High Pass Filter	Wainwright Instruments GmbH	WHKX10-900-1000-15000-40SS	11	24.07.04
High Pass Filter	Wainwright Instruments GmbH	WHKX12-2805-3000-18000-40SS	32	24.07.04

End of test report