9 SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Test Requirement:	FCC Part 2.1051, 24.238(a), 27.53(h)
Test Method:	ANSI C63.4:2009, TIA/EIA-603-D:2010
Test Mode:	Transmitting

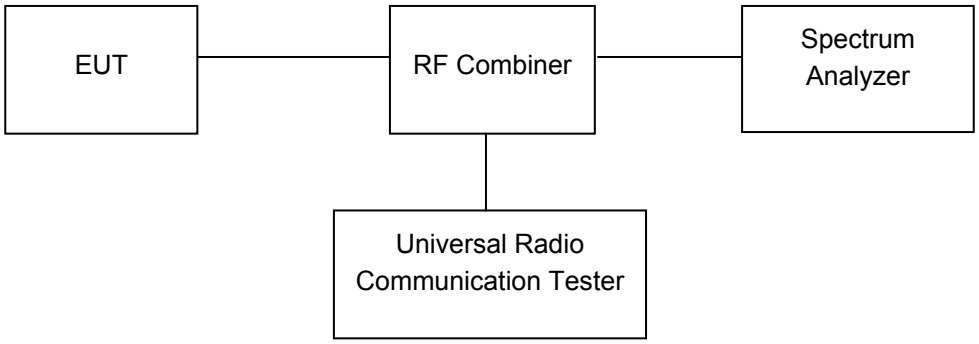
9.1 EUT Operation

Operating Environment **:**

Temperature:	23.5 °C
Humidity:	52.1 % RH
Atmospheric Pressure:	101.3kPa

9.2 Test Procedure

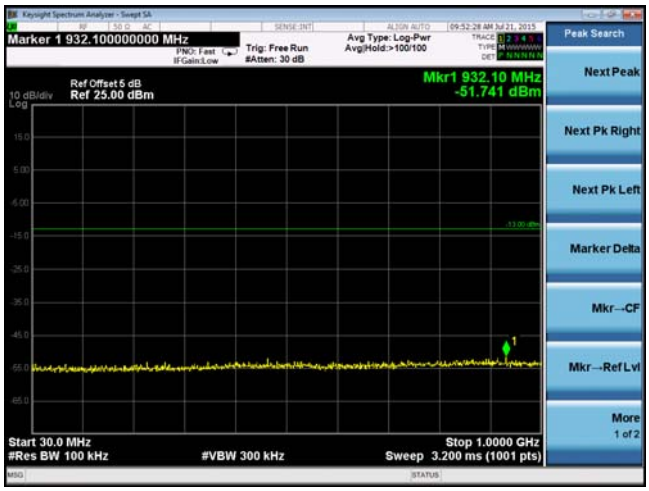
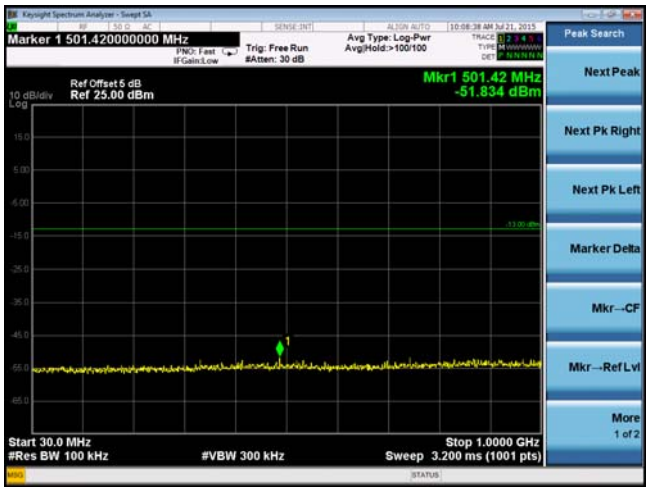
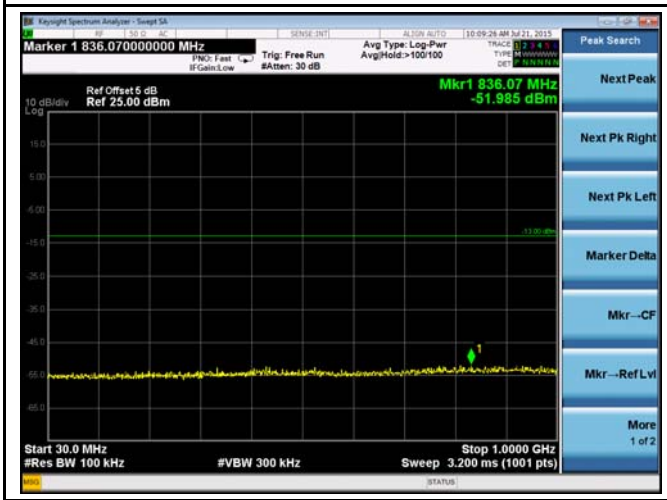
The RF output of the transceiver was connected to a spectrum analyzer and simulator through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 1MHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonics.

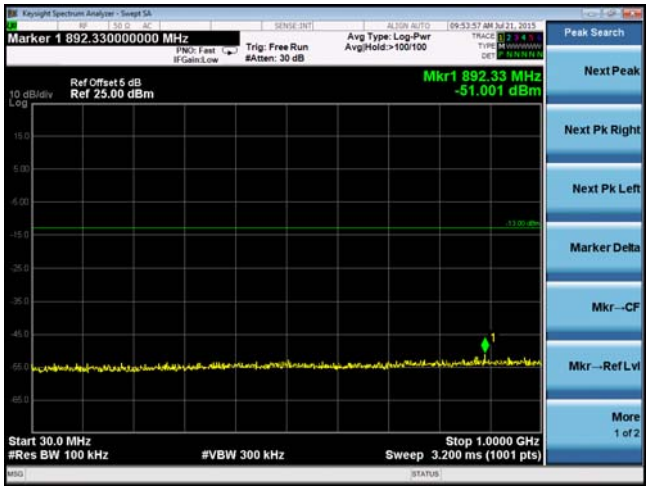


9.3 Test Result

Remark: only the worst data were recorded.

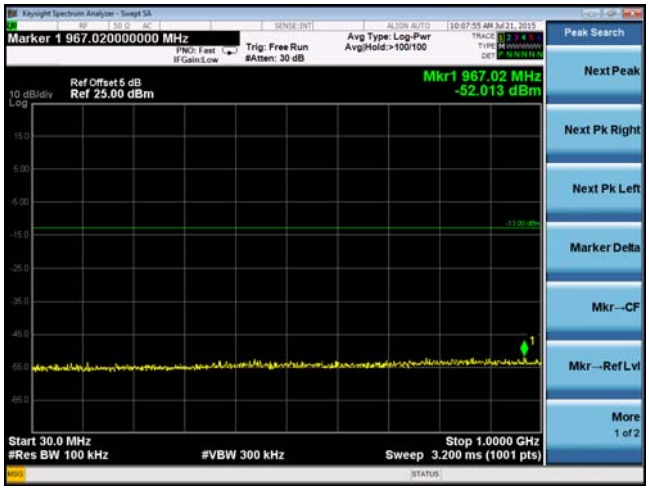
LTE Band 2(Part 24E):

	
LTE band 2 –Low CH 30MHz~1GHz QPSK	LTE band 2 – Low CH Above 1GHz QPSK
	
LTE band 2 - Middle CH 30MHz~1GHz QPSK	LTE band 2 - Middle CH Above 1GHz QPSK
	
LTE band 2 - High CH 30MHz~1GHz QPSK	LTE band 2 - High CH Above 1GHz QPSK



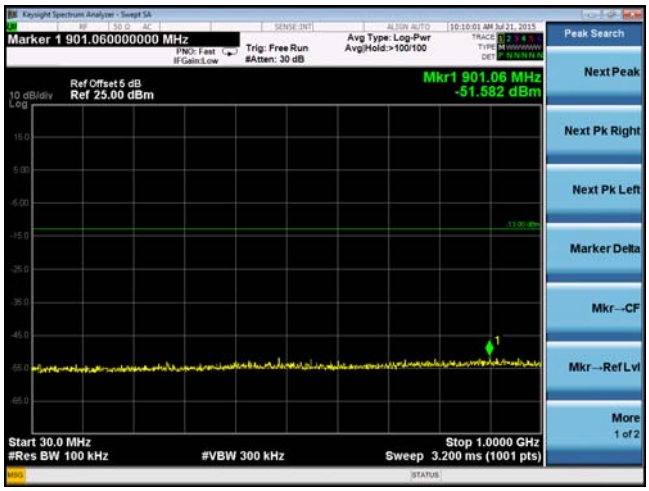
LTE band 2 –Low CH 30MHz~1GHz 16QAM

LTE band 2 – Low CH Above 1GHz 16QAM



LTE band 2 - Middle CH 30MHz~1GHz 16QAM

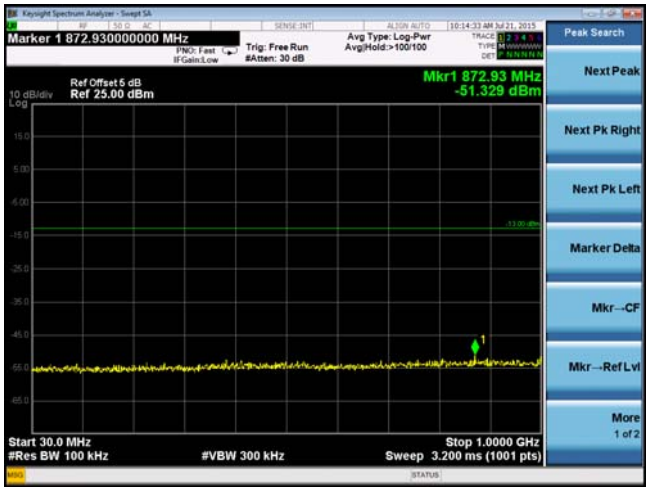
LTE band 2 - Middle CH Above 1GHz 16QAM



LTE band 2 - High CH 30MHz~1GHz 16QAM

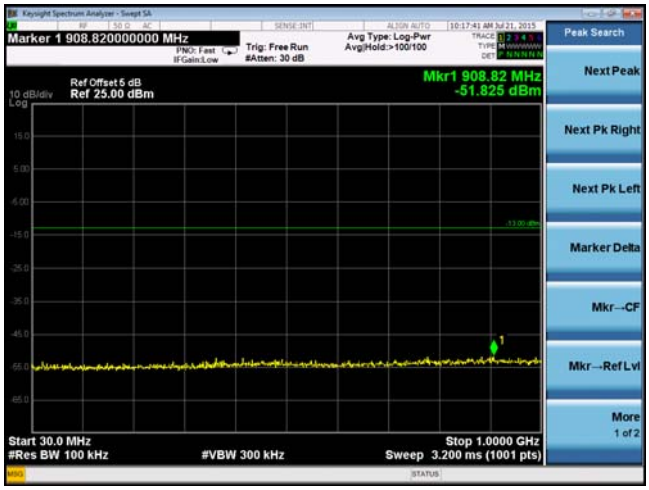
LTE band 2 - High CH Above 1GHz 16QAM

LTE Band 4(Part 27):



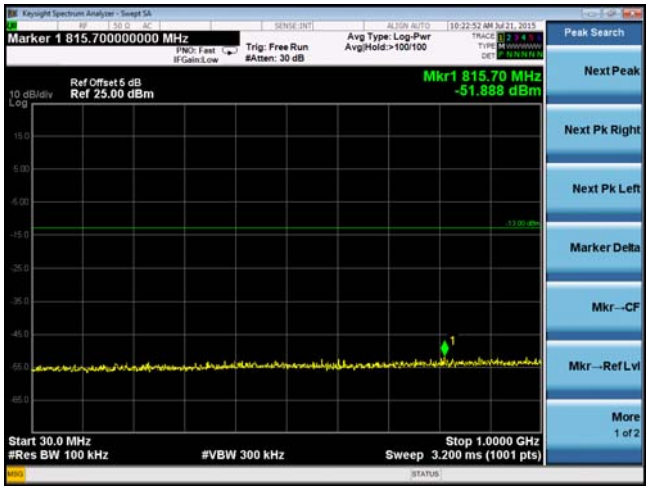
LTE band 4 –Low CH 30MHz~1GHz QPSK

LTE band 4 – Low CH Above 1GHz QPSK



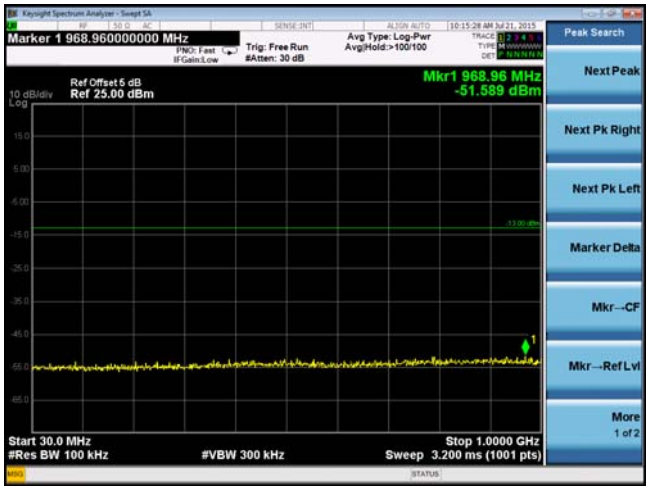
LTE band 4 - Middle CH 30MHz~1GHz QPSK

LTE band 4 - Middle CH Above 1GHz QPSK



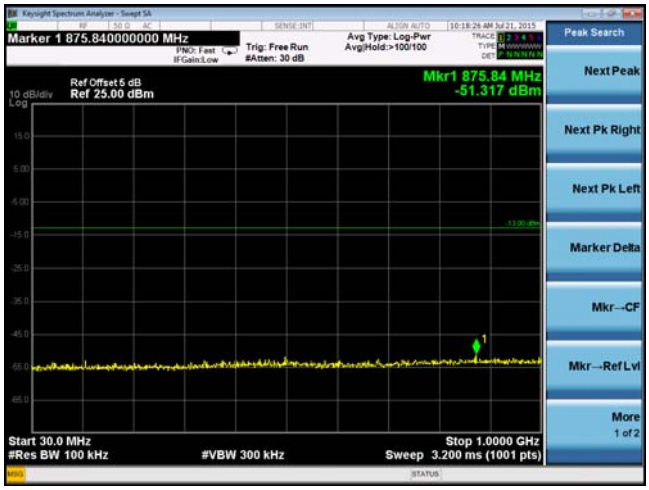
LTE band 4 - High CH 30MHz~1GHz QPSK

LTE band 4 - High CH Above 1GHz QPSK



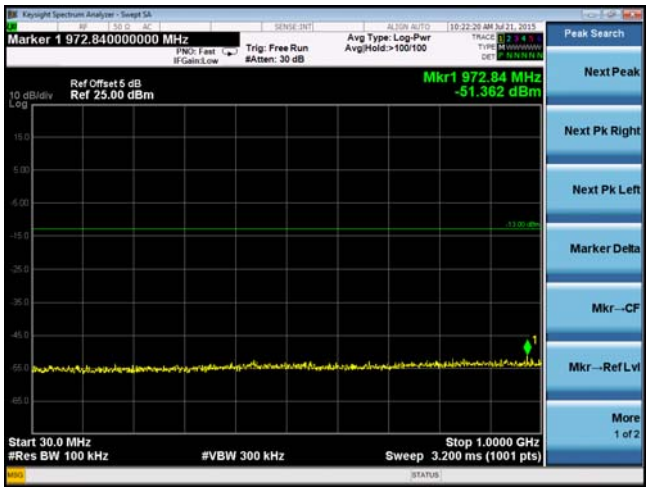
LTE band 4 –Low CH 30MHz~1GHz 16QAM

LTE band 4 – Low CH Above 1GHz 16QAM

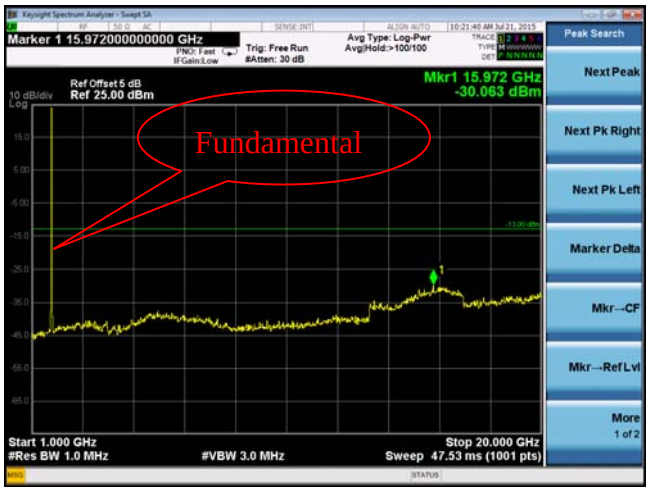


LTE band 4 - Middle CH 30MHz~1GHz 16QAM

LTE band 4 - Middle CH Above 1GHz 16QAM

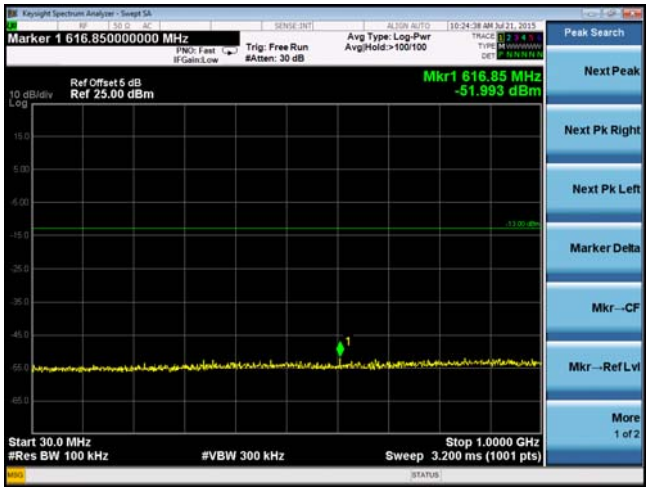


LTE band 4 - High CH 30MHz~1GHz 16QAM



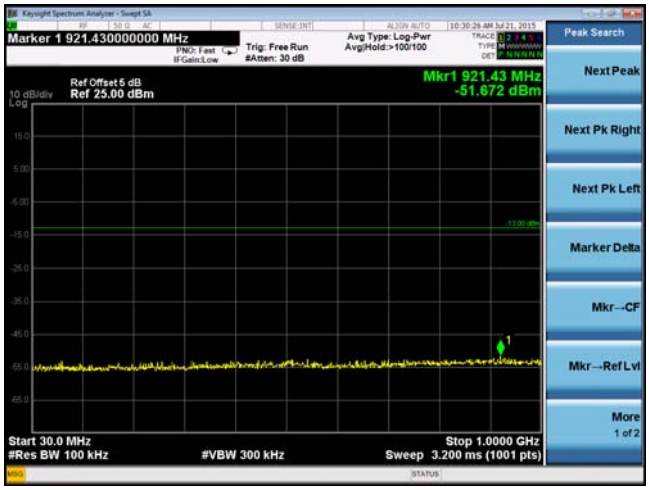
LTE band 4 - High CH Above 1GHz 16QAM

LTE Band 7(Part 27):



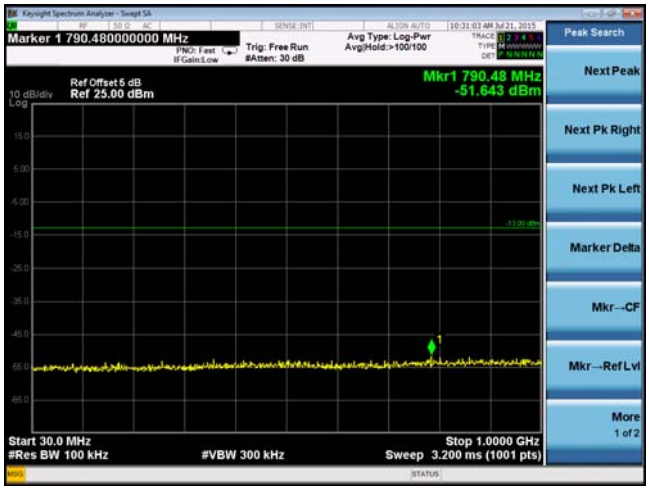
LTE band 7 –Low CH 30MHz~1GHz QPSK

LTE band 7 – Low CH Above 1GHz QPSK



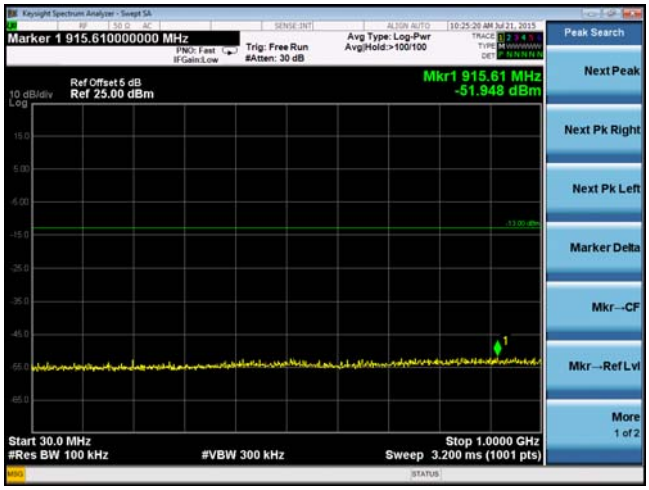
LTE band 7 - Middle CH 30MHz~1GHz QPSK

LTE band 7 - Middle CH Above 1GHz QPSK



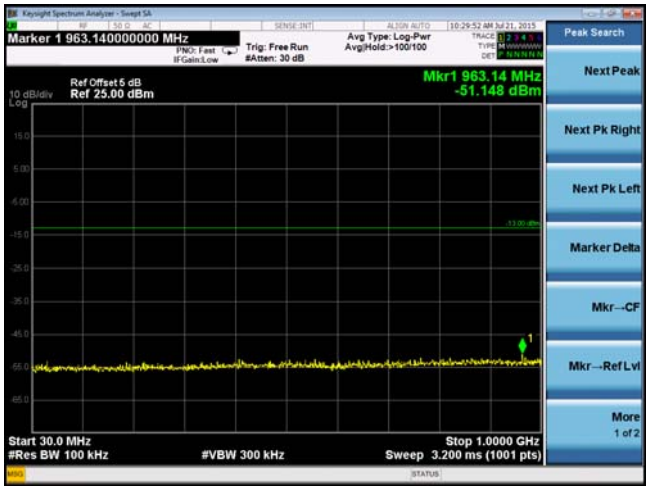
LTE band 7 - High CH 30MHz~1GHz QPSK

LTE band 7 - High CH Above 1GHz QPSK



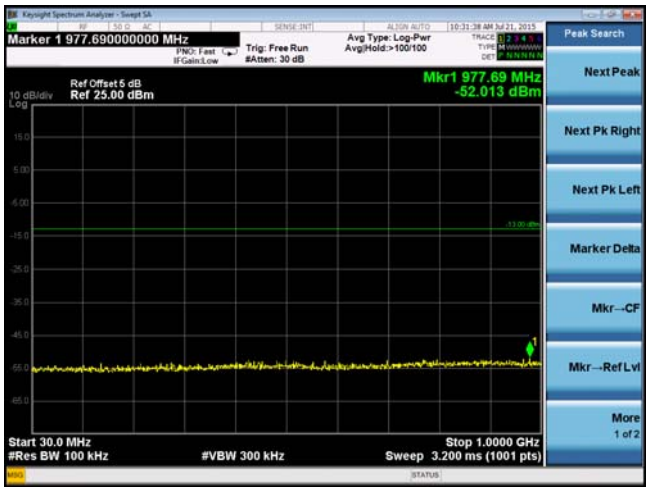
LTE band 7 –Low CH 30MHz~1GHz 16QAM

LTE band 7 – Low CH Above 1GHz 16QAM



LTE band 7 - Middle CH 30MHz~1GHz 16QAM

LTE band 7 - Middle CH Above 1GHz 16QAM



LTE band 7 - High CH 30MHz~1GHz 16QAM

LTE band 7 - High CH Above 1GHz 16QAM

10 SPURIOUS RADIATED EMISSIONS

Test Requirement:	FCC Part 2.1053,24.238, 27.53(h)
Test Method:	ANSI C63.4:2009, TIA/EIA-603-D:2010
Test Mode:	Transmitting

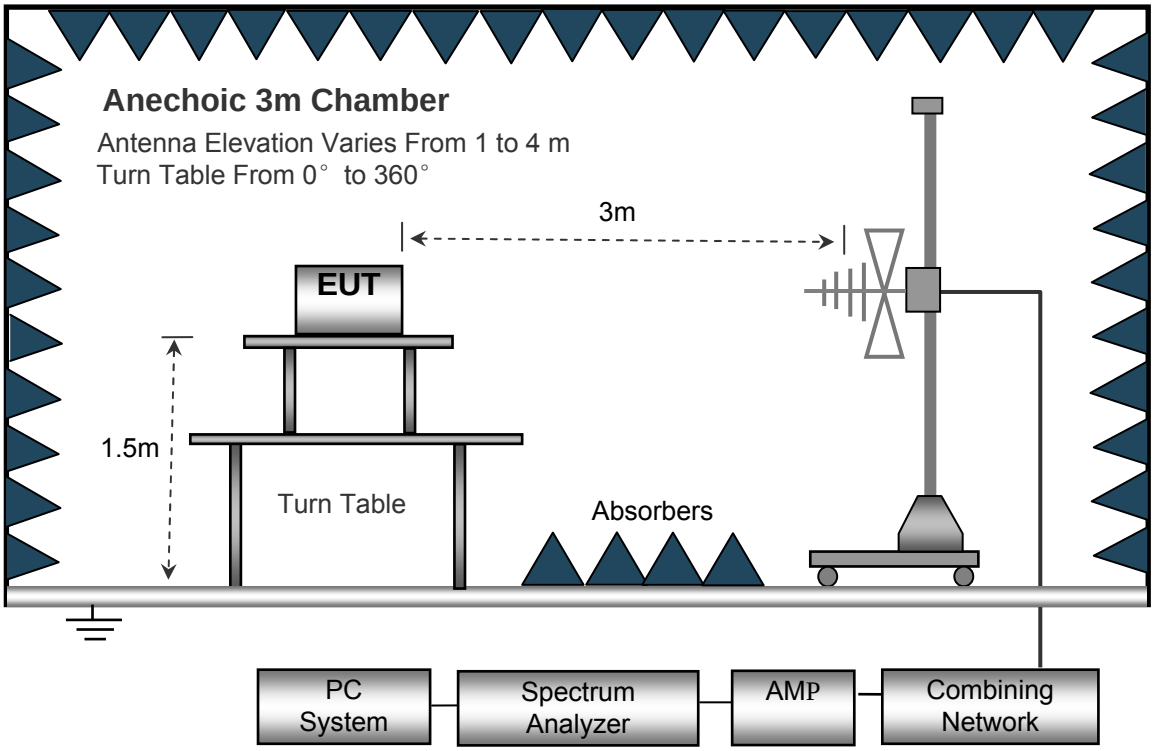
10.1 EUT Operation

Operating Environment **:**

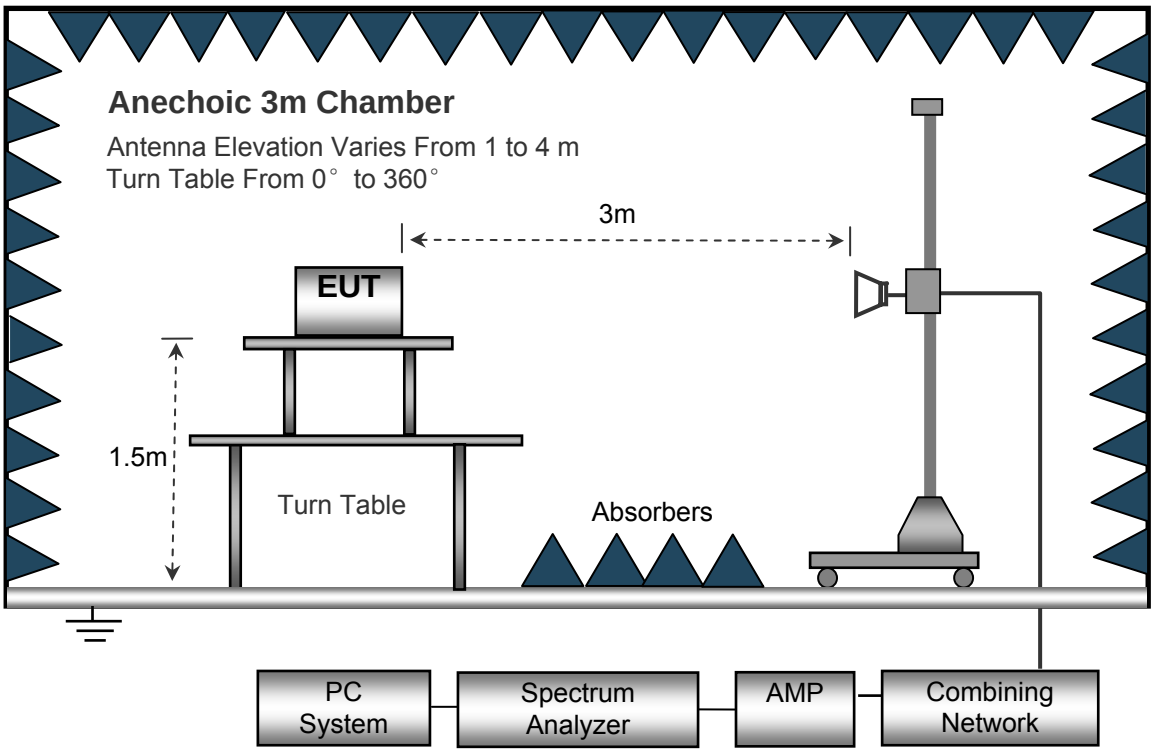
Temperature:	23.5 °C
Humidity:	52.1 % RH
Atmospheric Pressure:	101.2kPa

10.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4: 2009.
The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



10.3 Spectrum Analyzer Setup

30MHz ~ 1GHz

Sweep Speed ..... Auto
Detector ..... PK
Resolution Bandwidth 100kHz
Video Bandwidth 300kHz

Above 1GHz

Sweep Speed ..... Auto
Detector ..... PK
Resolution Bandwidth 1MHz
Video Bandwidth 3MHz
Detector ..... Ave.
Resolution Bandwidth 1MHz
Video Bandwidth 10Hz

10.4 Test Procedure

1. The EUT is placed on a turntable, which is 1.5m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from 30MHz up to the tenth harmonic of the highest fundamental frequency.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.
7. Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.
   Spurious emissions in dB = 10 lg (TXpwr in Watts/0.001) – the absolute level
   Spurious attenuation limit in dB = 43 + 10 Log10 (power out in Watts)
8. Repeat above procedures until the measurements for all frequencies are completed.

10.5 Summary of Test Results

Remark: Test performed from 30MHz to 10th harmonics with low/middle/high channels, only the worst data were recorded.

LTE Band 2 (Part 24E)

Frequency	Receiver Reading	Turn table Angle	RX Antenna		Substituted			Absolute Level	Result	
			Height	Polar	SG Level	Cable	Antenna Gain		Limit	Margin
(MHz)	(dBμV)	Degree	(m)	(H/V)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)
LTE Band 2 Channel 18900 (1880MHz)										
202.36	46.07	16	1.8	H	-64.44	0.15	0.00	-64.59	-13.00	-51.59
202.36	37.75	3	1.8	V	-69.84	0.15	0.00	-69.99	-13.00	-56.99
3760.00	59.55	290	1.7	H	-51.99	2.37	12.50	-41.86	-13.00	-28.86
3760.00	53.63	205	1.5	V	-56.18	2.37	12.50	-46.05	-13.00	-33.05
5640.00	46.22	291	1.4	H	-63.39	2.86	12.90	-53.35	-13.00	-40.35
5640.00	36.82	190	1.5	V	-72.06	2.86	12.90	-62.02	-13.00	-49.02
202.36	46.07	16	1.8	H	-64.44	0.15	0.00	-64.59	-13.00	-51.59

LTE Band 4/7 (Part 27)

Frequency	Receiver Reading	Turn table Angle	RX Antenna		Substituted			Absolute Level	Result	
			Height	Polar	SG Level	Cable	Antenna Gain		Limit	Margin
(MHz)	(dBμV)	Degree	(m)	(H/V)	(dBm)	(dB)	(dB)	(dBm)	(dBm)	(dB)
LTE Band 4 Channel 20025(1717.5MHz)										
202.36	39.81	318	1.3	H	-70.70	0.15	0.00	-70.85	-13.00	-57.85
202.36	32.74	205	1.6	V	-74.85	0.15	0.00	-75.00	-13.00	-62.00
3435.00	65.95	296	1.4	H	-47.10	2.34	12.40	-37.04	-13.00	-24.04
3435.00	59.98	182	2.0	V	-51.17	2.34	12.40	-41.11	-13.00	-28.11
5152.50	53.58	307	2.1	H	-55.83	2.79	12.70	-45.92	-13.00	-32.92
5152.50	44.73	22	1.5	V	-64.04	2.79	12.70	-54.13	-13.00	-41.13
LTE Band 7 Channel 20800(2505MHz)										
202.36	39.17	26	1.6	H	-71.34	0.15	0.00	-71.49	-13.00	-58.49
202.36	30.78	265	1.1	V	-76.81	0.15	0.00	-76.96	-13.00	-63.96
5010.00	65.95	37	1.3	H	-43.29	2.79	12.70	-33.38	-13.00	-20.38
5010.00	59.98	264	1.7	V	-48.79	2.79	12.70	-38.88	-13.00	-25.88
7515.00	53.58	155	2.2	H	-52.96	3.12	11.50	-44.58	-13.00	-31.58
7515.00	44.73	276	1.3	V	-60.70	3.12	11.50	-52.32	-13.00	-39.32

Note: 1) Absolute Level = SG Level - Cable loss + Antenna Gain

2) Margin = Limit- Absolute Level

11 Band Edge Measurement

Test Requirement:	FCC Part 2.1051, 24.238(a), 27.53(h)
Test Method:	ANSI C63.4:2009, TIA/EIA-603-D:2010
Test Mode:	Transmitting

11.1 EUT Operation

Operating Environment **:**

Temperature:	23.5 °C
Humidity:	52.3 % RH
Atmospheric Pressure:	101.3kPa

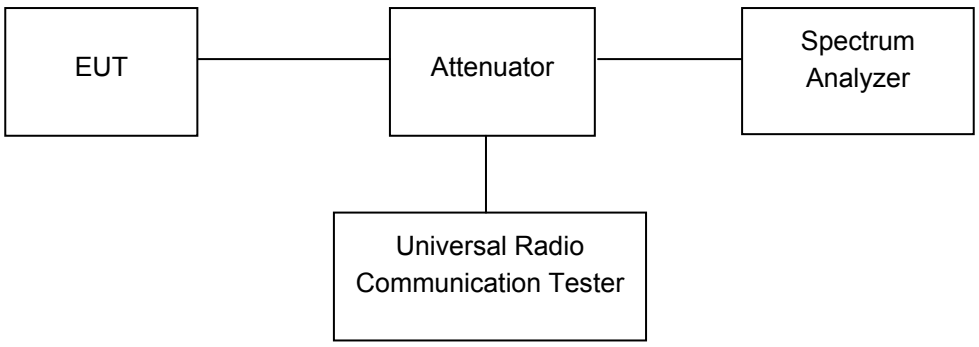
11.2 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

According to FCC Part 22.917(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

According to FCC Part 24.238(a), the power of any emissions outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

The center of the spectrum analyzer was set to block edge frequency



11.3 Test Result

Test Plots
LTE Band 2 (Part 24E)

LTE Band 2 - Low Channel QPSK-1.4

LTE Band 2 - High Channel QPSK-1.4

LTE Band 2 - Low Channel 16QAM-1.4

LTE Band 2 - High Channel 16QAM-1.4

LTE Band 2 - Low Channel QPSK-3

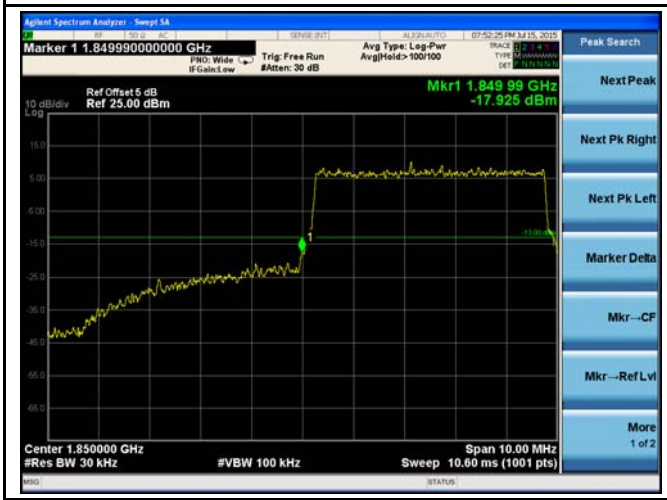
LTE Band 2 - High Channel QPSK-3

LTE Band 2 - Low Channel 16QAM-3

LTE Band 2 - High Channel 16QAM-3

LTE Band 2 - Low Channel QPSK-5

LTE Band 2 - High Channel QPSK-5



LTE Band 2 - Low Channel 16QAM-5

LTE Band 2 - High Channel 16QAM-5

LTE Band 2 - Low Channel QPSK-10

LTE Band 2 - High Channel QPSK-10

LTE Band 2 - Low Channel 16QAM-10

LTE Band 2 - High Channel 16QAM-10

LTE Band 2 - Low Channel QPSK-15

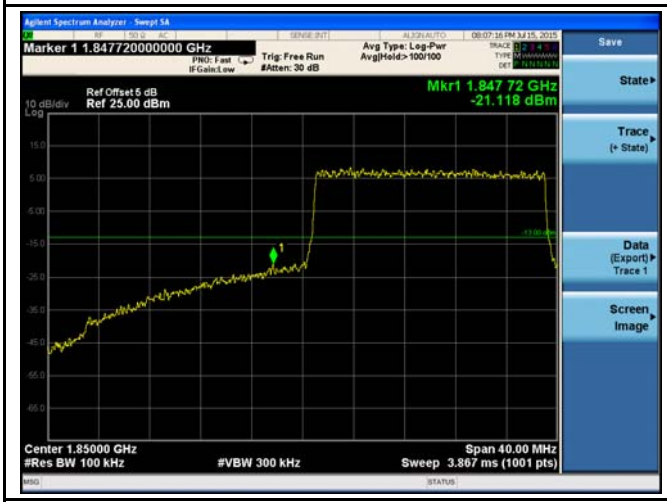
LTE Band 2 - High Channel QPSK-15

LTE Band 2 - Low Channel 16QAM-15

LTE Band 2 - High Channel 16QAM-15

LTE Band 2 - Low Channel QPSK-20

LTE Band 2 - High Channel QPSK-20



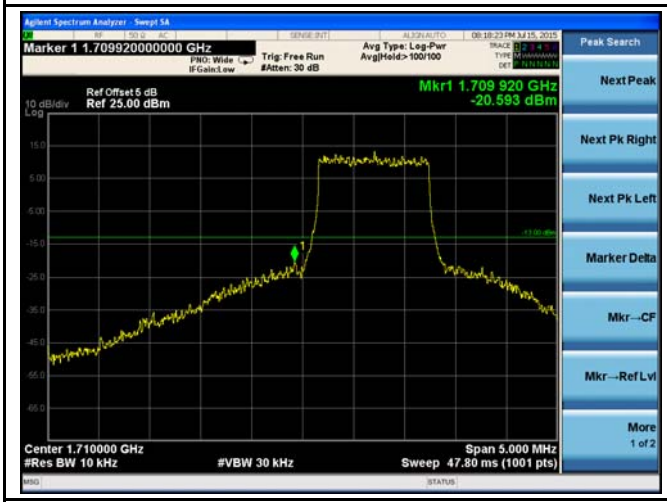
LTE Band 2 - Low Channel 16QAM-20

LTE Band 2 - High Channel 16QAM-20

LTE Band 4 (Part 27)

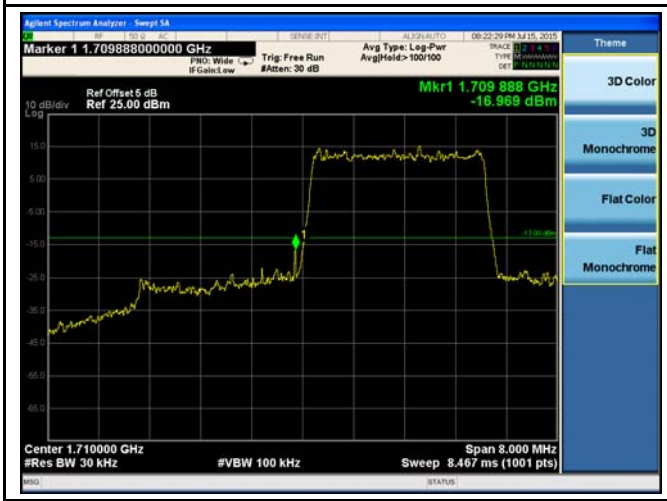
LTE Band 4 - Low Channel QPSK-1.4

LTE Band 4 - High Channel QPSK-1.4



LTE Band 4 - Low Channel 16QAM-1.4

LTE Band 4 - High Channel 16QAM-1.4



LTE Band 4 - Low Channel QPSK-3

LTE Band 4 - High Channel QPSK-3

LTE Band 4 - Low Channel 16QAM-3

LTE Band 4 - High Channel 16QAM-3

LTE Band 4 - Low Channel QPSK-5

LTE Band 4 - High Channel QPSK-5

LTE Band 4 - Low Channel 16QAM-5

LTE Band 4 - High Channel 16QAM-5

LTE Band 4 - Low Channel QPSK-10

LTE Band 4 - High Channel QPSK-10

LTE Band 4 - Low Channel 16QAM-10

LTE Band 4 - High Channel 16QAM-10

LTE Band 4 - Low Channel QPSK-15

LTE Band 4 - High Channel QPSK-15

LTE Band 4 - Low Channel 16QAM-15

LTE Band 4 - High Channel 16QAM-15

LTE Band 4 - Low Channel QPSK-20

LTE Band 4 - High Channel QPSK-20

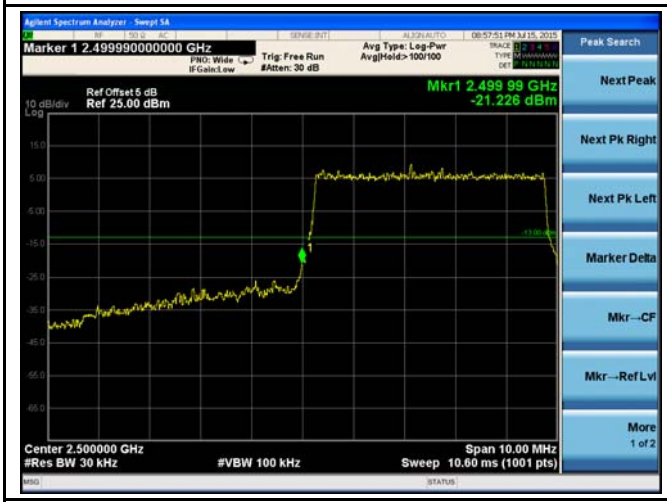
LTE Band 4 - Low Channel 16QAM-20

LTE Band 4 - High Channel 16QAM-20

LTE Band 7 (Part 27)

LTE Band 7 - Low Channel QPSK-5

LTE Band 7 - High Channel QPSK-5



LTE Band 7 - Low Channel 16QAM-5

LTE Band 7 - High Channel 16QAM-5

LTE Band 7 - Low Channel QPSK-10

LTE Band 7 - High Channel QPSK-10

LTE Band 7 - Low Channel 16QAM-10

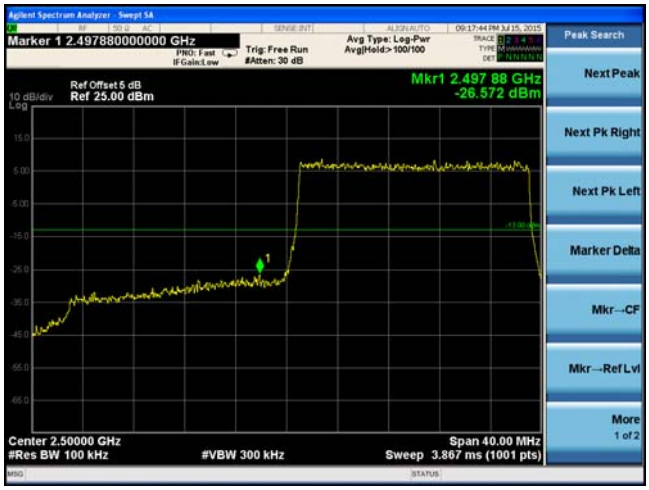
LTE Band 7 - High Channel 16QAM-10

LTE Band 7 - Low Channel QPSK-15

LTE Band 7 - High Channel QPSK-15

LTE Band 7 - Low Channel 16QAM-15

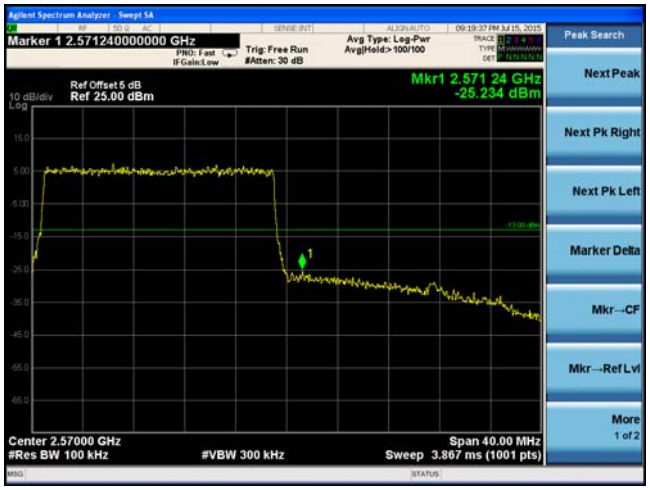
LTE Band 7 - High Channel 16QAM-15



LTE Band 7 - Low Channel QPSK-20

LTE Band 7 - High Channel QPSK-20

LTE Band 7 - Low Channel 16QAM-20



LTE Band 7 - High Channel 16QAM-20

12 FREQUENCY STABILITY

Test Requirement: FCC Part 2.1055, 24.235, 27.5(h),27.54

Test Method: ANSI C63.4:2009, TIA/EIA-603-D:2010

Test Mode: Transmitting

12.1 EUT Operation

Operating Environment **:**

Temperature: 22.9 °C

Humidity: 52.0 % RH

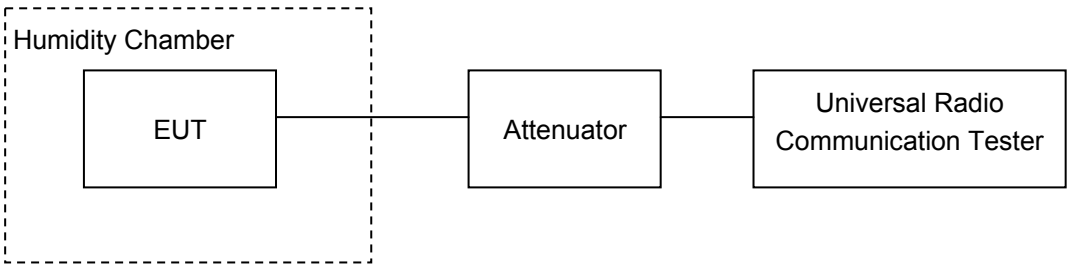
Atmospheric Pressure: 101.3kPa

12.2 Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to communication test set via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the communication test set.

Frequency Stability vs. Voltage: For hand carried, battery powered equipment; reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.



12.3 Test Result

LTE Band 2 (Part 24E)

Test Frequency:1880.0MHz				
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.7	3	0.0016	2.5
40		-6	-0.0032	2.5
30		6	0.0032	2.5
20		1	0.0005	2.5
10		1	0.0005	2.5
0		-2	-0.0011	2.5
-10		-5	-0.0027	2.5
-20		1	0.0005	2.5
-30		-7	-0.0037	2.5
20	3.3	1	0.0005	2.5
20	4.2	7	0.0037	2.5

LTE Band 4 (Part 27)

Test Frequency:1732.5MHz				
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.7	3	0.0017	2.5
40		0	0.0000	2.5
30		-4	-0.0023	2.5
20		2	0.0010	2.5
10		6	0.0035	2.5
0		-4	-0.0023	2.5
-10		4	0.0023	2.5
-20		-1	-0.0006	2.5
-30		1	0.0006	2.5
20	3.3	3	0.0017	2.5
20	4.2	2	0.0012	2.5

LTE Band 7 (Part 27)

Test Frequency:2535MHz				
Temperature (℃)	Power Supply (VDC)	Frequency Error (Hz)	Frequency Error (ppm)	Limit (ppm)
50	3.7	6	0.0024	2.5
40		-3	-0.0012	2.5
30		1	0.0004	2.5
20		3	0.0012	2.5
10		2	0.0008	2.5
0		2	0.0008	2.5
-10		3	0.0012	2.5
-20		-3	-0.0012	2.5
-30		-4	-0.0016	2.5
20	3.3	-2	-0.0008	2.5
20	4.2	-5	-0.0020	2.5

13 RF Exposure

Remark: refer to SAR test report: WTS15S0628456E

====== End of Report ======