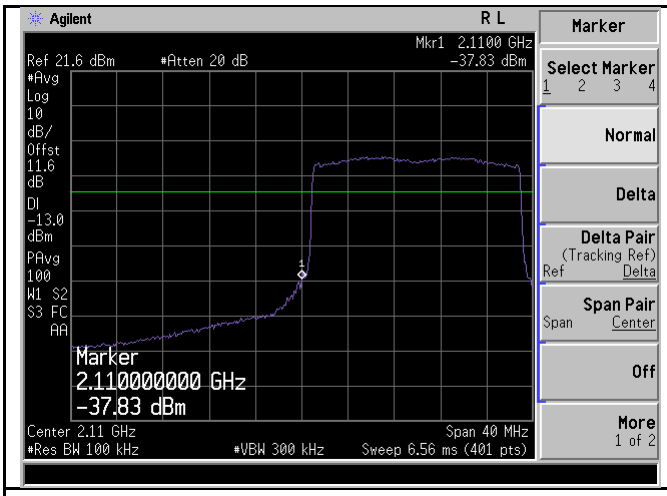
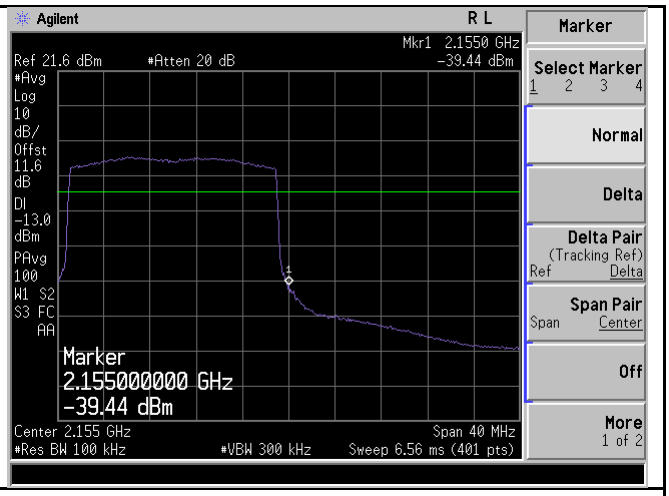
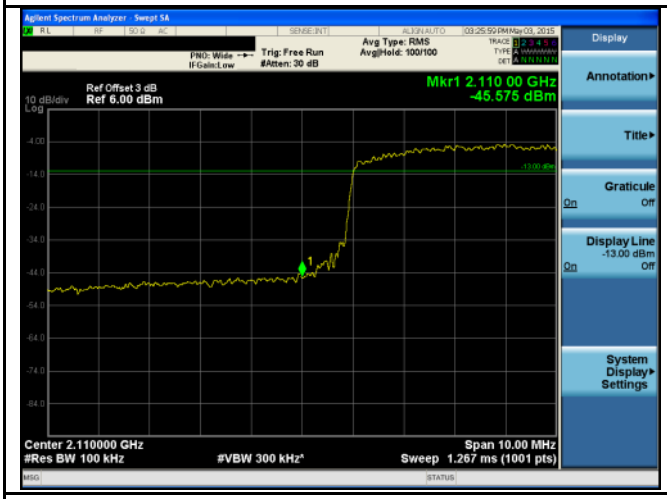


BandEdge-LTE-Band4-20MHz-QPSK-Low

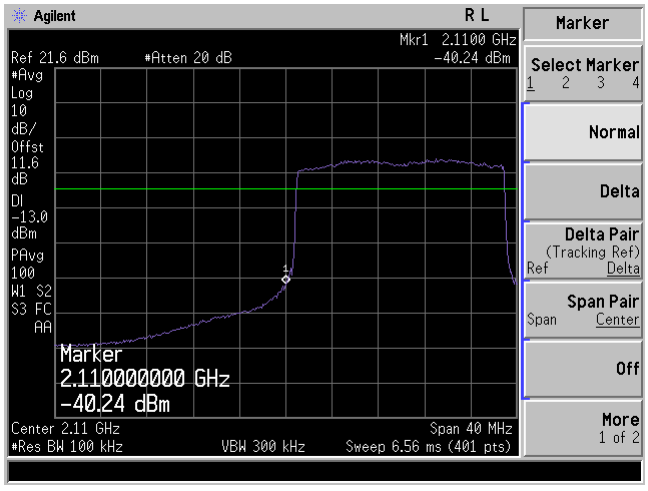


BandEdge-LTE-Band4-20MHz-QPSK-High

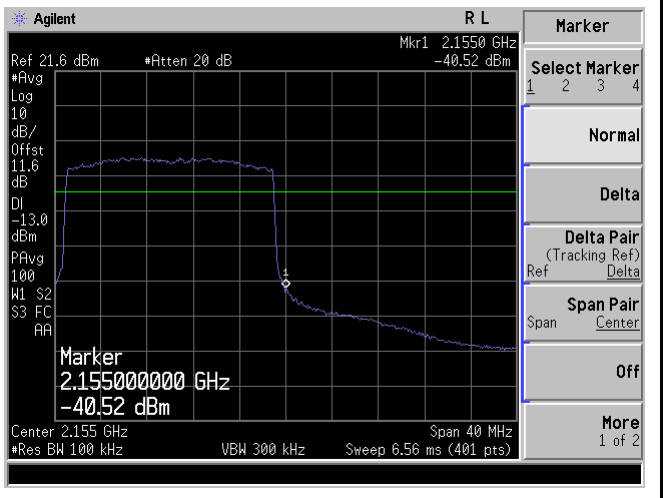


BandEdge-LTE-Band4-20MHz-16QAM-Low

BandEdge-LTE-Band4-20MHz-16QAM-High

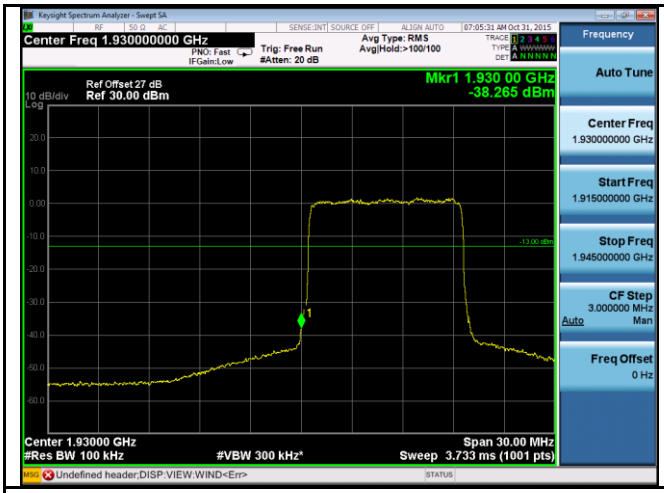


BandEdge-LTE-Band4-20MHz-64QAM-Low

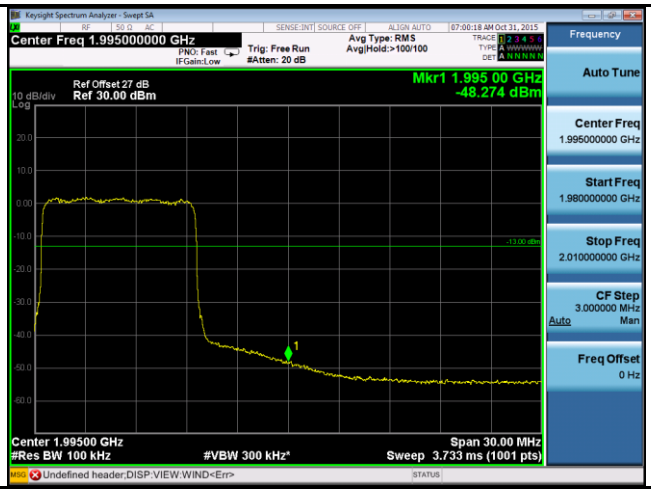


BandEdge-LTE-Band4-20MHz-64QAM-High

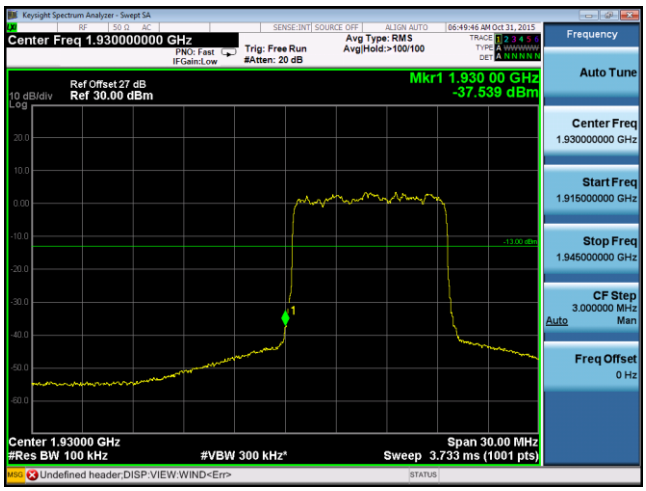
Test Plots for Band 2:



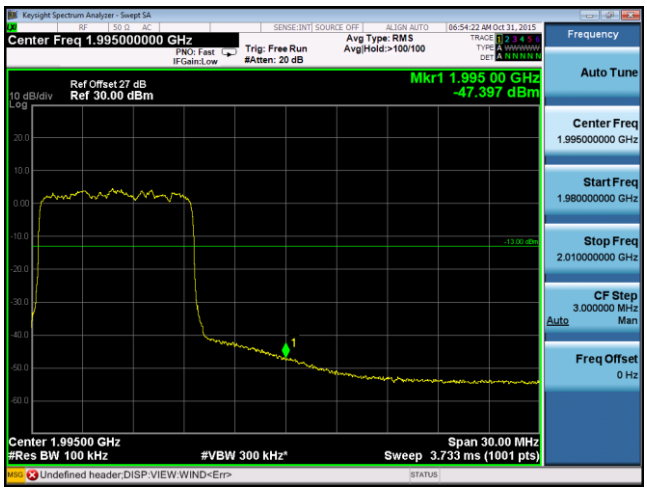
BandEdge-LTE-Band2-10MHz-QPSK-Low



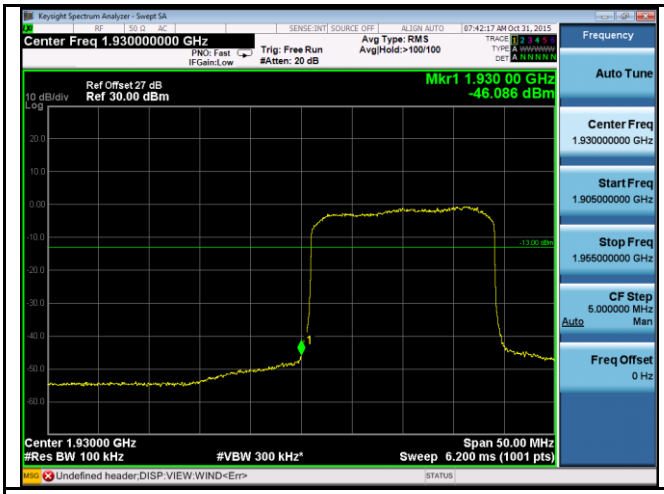
BandEdge-LTE-Band2-10MHz-QPSK-High



BandEdge-LTE- Band2-10MHz-64QAM-Low

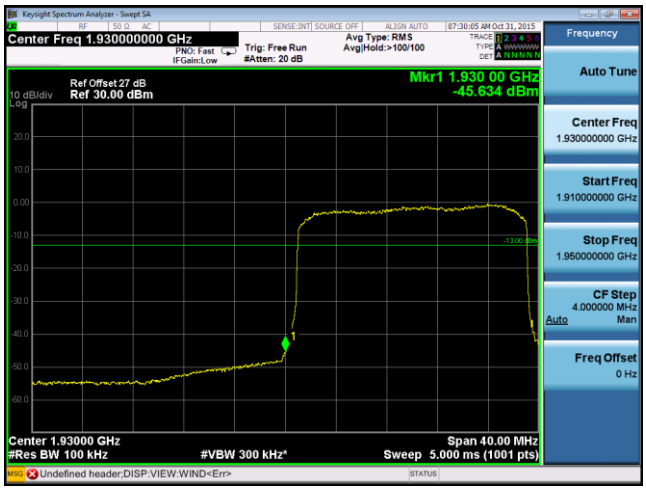


BandEdge-LTE- Band2-10MHz-64QAM-High

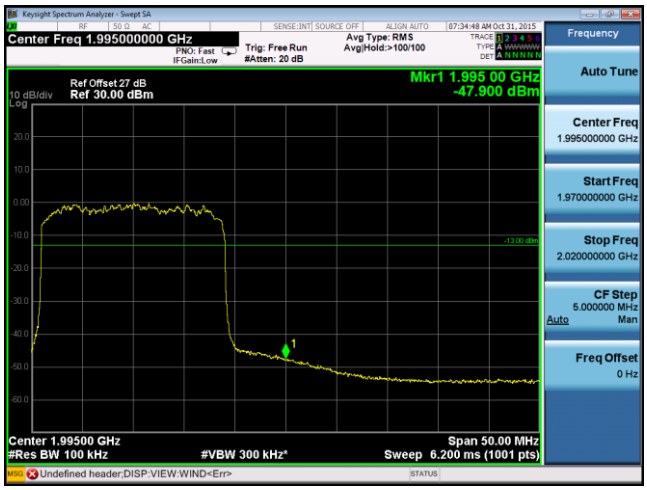


BandEdge-LTE- Band2-20MHz-QPSK-Low

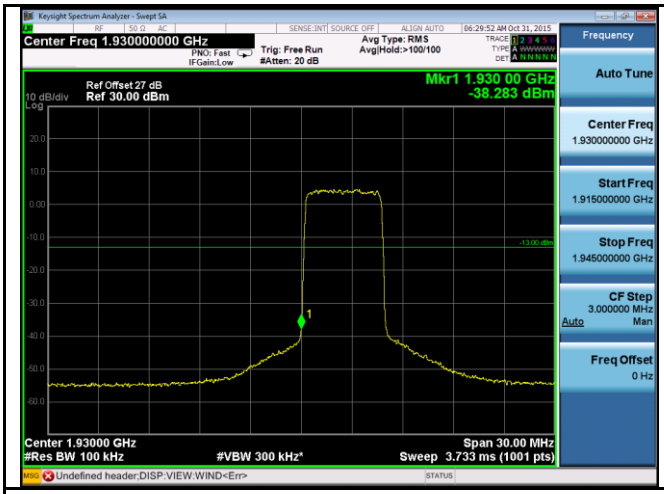
BandEdge-LTE- Band2-20MHz-QPSK-High



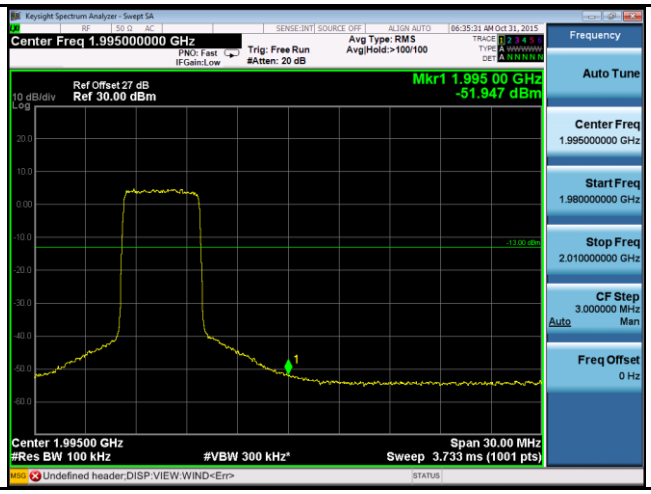
BandEdge-LTE- Band2-20MHz-64QAM-Low



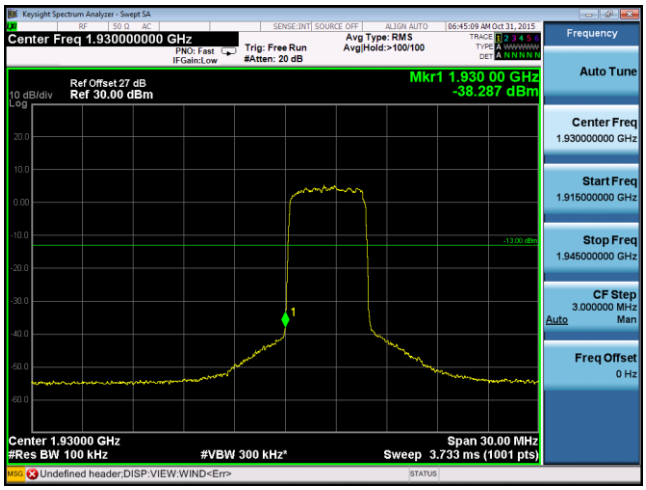
BandEdge-LTE- Band2-20MHz-64QAM-High



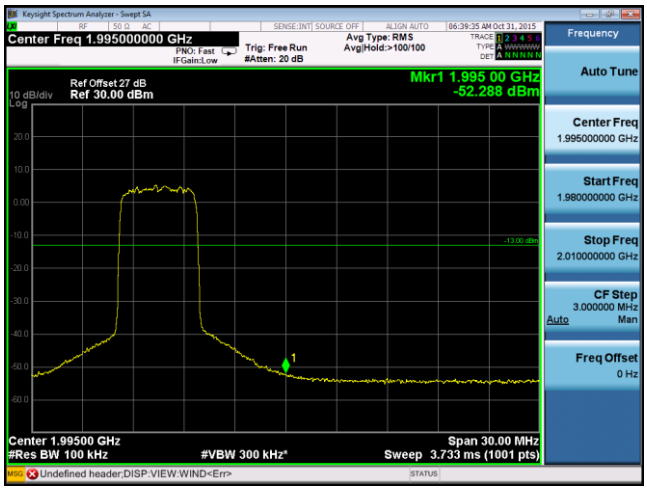
BandEdge-LTE- Band2-5MHz-QPSK-Low



BandEdge-LTE- Band2-5MHz -QPSK-High



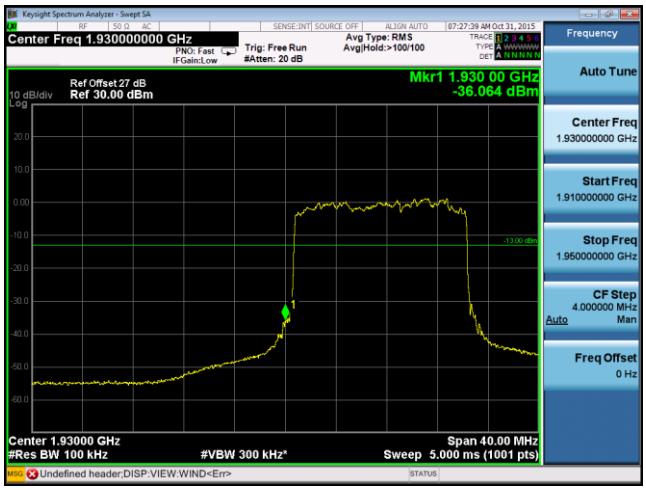
BandEdge-LTE- Band2-5MHz -64QAM-Low



BandEdge-LTE- Band2-5MHz -64QAM-High

BandEdge-LTE- Band2-15MHz-QPSK-Low

BandEdge-LTE- Band2-15MHz -QPSK-High



BandEdge-LTE- Band2-15MHz -64QAM-Low

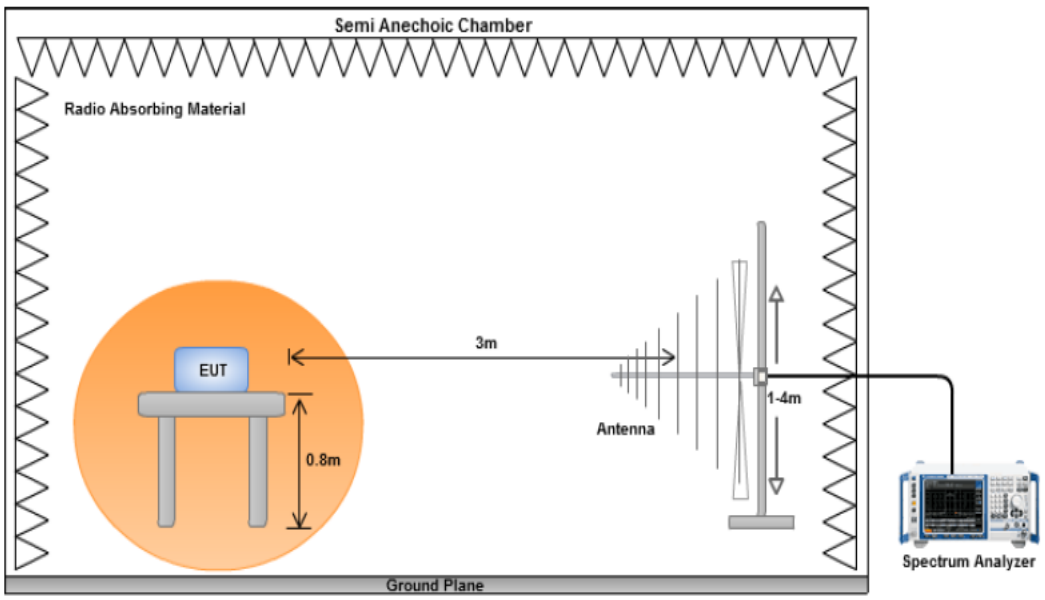
BandEdge-LTE- Band2-15MHz -64QAM-High

10.5 Radiated Spurious Emission below 1GHz

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR27.53	-	Out of band emissions. 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 + 10 log(P) dB.	☒

Test Setup



Test Procedure

Substitution method:

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
   a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
   b. The EUT was then rotated to the direction that gave the maximum emission.
   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter.
4. Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a nonradiating cable. With the antennas at both ends horizontally polarized, and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained.
5. Steps 4 were repeated for the next frequency point, until all selected frequency points were measured.

Test Date		Environmental condition		
	04/30/2015 10/26/2015 – 11/02/2015		Temperature Relative Humidity Atmospheric Pressure	23°C 48% 1008mbar

Remark

The EUT was scanned up to 25GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case.

Limit calculation:
Emission limit = PdBm – [43+ 10 log (PW)] = 10log(1000 x PW) - 43 - 10log(PW) = 30 dBm - 43 = -13 dBm
All different modulation and bandwidth configuration has been verified and only the test data of worst case with QPSK modulation and greatest bandwidth was presented in this report.

Result ☒Pass ☐Fail

Test Data ☒Yes (See below) ☐N/A

Test Plot ☒Yes (See below) ☐N/A

Radiated Emission Test Results for LTE band 4

Test specification	below 1GHz		Result	Pass
Environmental Conditions:	Temp (°C):	22		
	Humidity (%)	45		
	Atmospheric (mbar):	1008		
Mains Power:	48VDC			
Tested by:	David Zhang			
Test Date:	04/30/2015			
Remarks:	LTE band4-Mid CH-20MHz BW, QPSK			

Frequency MHz	SG Level dBm	Cable Loss dB	Antenna Gain dBd	Substituted Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass /Fail
492.52	-65.94	4.11	0	-70.82	RMS Max	H	186.00	315.00	-13.00	-57.82	Pass
500.22	-62.48	4.15	0	-66.17	RMS Max	H	133.00	293.00	-13.00	-53.17	Pass
486.57	-58.12	4.09	0	-61.8	RMS Max	H	159.00	224.00	-13.00	-48.8	Pass
68.95	-43.67	1.44	0	-47.33	RMS Max	V	284.00	344.00	-13.00	-34.33	Pass
125.01	-46.92	2.03	0	-50.6	RMS Max	V	359.00	305.00	-13.00	-37.6	Pass
224.41	-57.08	2.65	0	-60.8	RMS Max	H	332.00	356.00	-13.00	-47.8	Pass

Note: Dipole antenna was used for substitution method.

Radiated Emission Test Results for LTE band 2

Test specification	below 1GHz		Result	Pass
Environmental Conditions:	Temp (°C):	24		
	Humidity (%)	39		
	Atmospheric (mbar):	1012		
Mains Power:	48VDC			
Tested by:	Chen Ge			
Test Date:	10/26/2015 – 11/02/2015			
Remarks:	LTE band2-Mid CH-20MHz BW, QPSK			

Frequency MHz	SG Level dBm	Cable Loss dB	Antenna Gain dBd	Substituted Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass /Fail
750.05	-46.23	4.88	0	-51.11	RMS Max	H	109	27	-13	-38.11	Pass
454.18	-48.19	3.69	0	-51.88	RMS Max	V	178	29	-13	-38.88	Pass
456.81	-48.84	3.68	0	-52.52	RMS Max	V	100	228	-13	-39.52	Pass
444.73	-50.38	3.66	0	-54.04	RMS Max	V	170	302	-13	-41.04	Pass
448.66	-51.86	3.68	0	-55.54	RMS Max	V	196	269	-13	-42.54	Pass
463.42	-51.86	3.72	0	-55.58	RMS Max	V	154	260	-13	-42.58	Pass

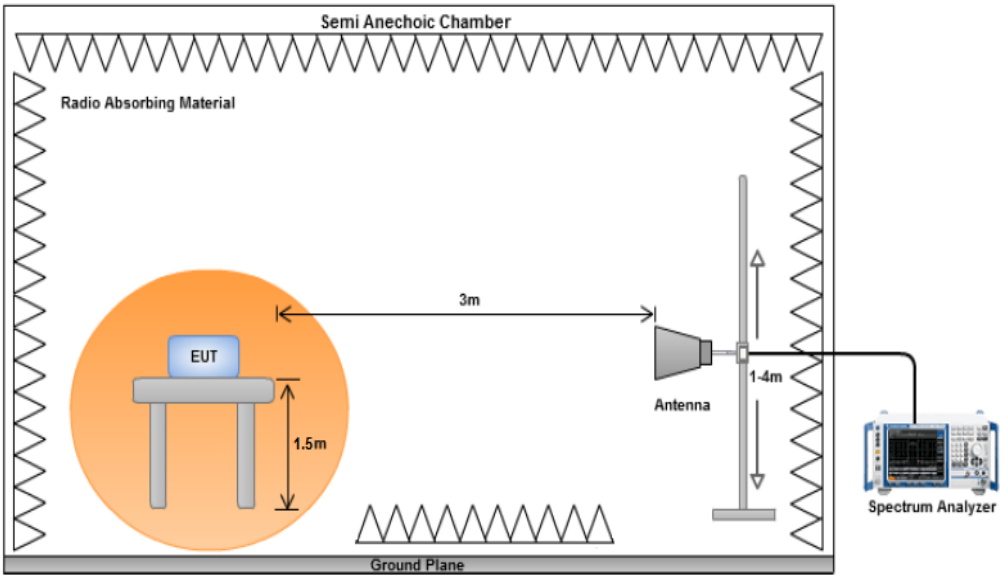
Note: Dipole antenna was used for substitution method.

10.6 Radiated Spurious Emissions above 1GHz

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR27.53	-	Out of band emissions. 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 + 10 log(P) dB.	☒

Test Setup



Test Procedure

Substitution method:

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
   a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
   b. The EUT was then rotated to the direction that gave the maximum emission.
   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter.
4. Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a nonradiating cable. With the antennas at both ends horizontally polarized, and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained.
5. Steps 4 were repeated for the next frequency point, until all selected frequency points were measured.

Test Date	04/30/2015 – 05/03/2015 10/26/2015 – 11/02/2015	Environmental condition	Temperature 23°C Relative Humidity 48% Atmospheric Pressure 1008mbar

Remark

The EUT was scanned up to 25GHz. Both horizontal and vertical polarities were investigated. The results show only the worst case.
Limit calculation:
Emission limit = PdBm – [43+ 10 log (PW)] = 10log(1000 x PW) - 43 - 10log(PW) = 30 dBm - 43 = -13 dBm

All different modulation and bandwidth configuration has been verified and only the test data of worst case with QPSK modulation and greatest bandwidth was presented in this report.

Result ☒Pass ☐Fail

Test Data ☒Yes (See below) ☐N/A

Test Plot ☐Yes (See below) ☒N/A

Radiated Emission Test Results (Above 1GHz)

LTE band 4 Low Channel, 20MHz BW, QPSK

Frequency MHz	SG Level dBm	Cable Loss dB	Antenna Gain dBd	Substituted Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass /Fail
8009.29	-54.63	14.97	9.97	-59.63	RMS Max	V	223.00	254.00	-13.00	-46.63	Pass
2143.31	-62.91	13.36	6.28	-69.99	RMS Max	H	150.00	211.00	-13.00	-56.99	Pass
1001.19	-65.54	12.51	3.61	-74.44	RMS Max	H	153.00	267.00	-13.00	-61.44	Pass

LTE band 4 Mid Channel, 20MHz BW, QPSK

Frequency MHz	SG Level dBm	Cable Loss dB	Antenna Gain dBd	Substituted Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass /Fail
8662.96	-53.92	14.97	8.93	-59.96	RMS Max	V	187.00	290.00	-13.00	-40.92	Pass
4091.46	-60.34	13.36	7.99	-65.71	RMS Max	V	283.00	88.00	-13.00	-47.34	Pass
1001.19	-59.83	12.51	3.61	-68.73	RMS Max	H	153.00	267.00	-13.00	-46.83	Pass

LTE band 4 High Channel, 20MHz BW, QPSK

Frequency MHz	SG Level dBm	Cable Loss dB	Antenna Gain dBd	Substituted Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass /Fail
6997.09	-54.13	15.45	9.65	-59.93	RMS Max	H	162.00	261.00	-13.00	-46.93	Pass
3167.55	-63.65	13.67	7.15	-70.17	RMS Max	V	297.00	183.00	-13.00	-57.17	Pass
12661.61	-54.88	16.26	10.08	-61.06	RMS Max	H	137.00	161.00	-13.00	-48.06	Pass

LTE band 2 Low Channel, 20MHz BW, QPSK

Frequency MHz	SG Level dBm	Cable Loss dB	Antenna Gain dBd	Substituted Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass /Fail
3863.68	-52.02	17.51	15.51	-54.02	Average Max	V	108	57	-13	-41.02	Pass
7743.91	-48.54	20.44	12.39	-56.59	Average Max	V	100	283	-13	-43.59	Pass
2395.48	-53.64	16.53	14.27	-55.9	Average Max	V	166	216	-13	-42.9	Pass

LTE band 4 Mid Channel, 20MHz BW, QPSK

Frequency MHz	SG Level dBm	Cable Loss dB	Antenna Gain dBd	Substituted Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass /Fail
5292.43	-52.9	18.21	12.63	-58.48	Average Max	H	126	133	-13	-45.48	Pass
3896.89	-51.79	17.54	15.57	-53.76	Average Max	V	108	220	-13	-40.76	Pass
7814.57	-48.12	20.45	12.43	-56.14	Average Max	V	118	324	-13	-43.14	Pass

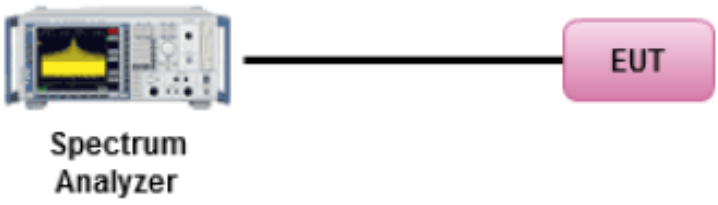
LTE band 4 High Channel, 20MHz BW, QPSK

Frequency MHz	SG Level dBm	Cable Loss dB	Antenna Gain dBd	Substituted Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass /Fail
5291.34	-52.89	18.21	12.63	-58.47	Average Max	H	189	0	-13	-45.47	Pass
7916.86	-42.82	20.46	12.49	-50.79	Average Max	V	125	317	-13	-37.79	Pass
3962.08	-40.16	17.58	15.69	-42.05	Average Max	V	102	323	-13	-29.05	Pass
2398.59	-53.39	16.54	14.27	-55.66	Average Max	H	100	103	-13	-42.66	Pass

10.7 Frequency Stability

Requirement(s):

Spec	Item	Requirement	Applicable
47 CFR 2.1055, 47 CFR	-	The frequency stability of the transmitter shall be maintained within ±0.0001 percent (±1 ppm) of the center frequency over a temperature variation of −30 °Celsius to +50 °Celsius at normal supply voltage, and over a variation in the primary supply voltage of 85 percent to 115 percent of the rated supply voltage at a temperature of 20 °Celsius.	☒
47 CFR 2.1055, 47 CFR 27.54	-	The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.	☒

Test Setup				
Test Procedure	The carrier frequency of the transmitter is measured at room temperature (20°C to provide a reference). 1. 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. 2. 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 Date	04/30/2015 10/26/2015 – 11/02/2015	Environmental condition	Temperature Relative Humidity Atmospheric Pressure	23°C 48% 1008mbar
Remark	NONE			
Result	☒Pass ☐Fail			

Test Data ☒Yes ☐N/A

Test Plot ☐Yes (See below) ☒N/A

Test Data for LTE Band 4:

Voltage (%)	Power (VDC)	Temp. (°)	Frequency (KHz)	Frequency Error (Hz)	Deviation (ppm)
100%	48	20 (ref)	2132000.006	0	0.000
100%		0	2132000.008	2	0.001
100%		10	2132000.025	19	0.009
100%		30	2132000.024	18	0.008
100%		40	2132000.018	12	0.006
115%	55.2	20	2132000.019	13	0.006
85%	40.8	20	2132000.024	18	0.008

Test Data for LTE Band 2:

Voltage (%)	Power (VDC)	Temp. (°)	Frequency (KHz)	Frequency Error (Hz)	Deviation (ppm)
100%	48	20 (ref)	1960000.016	0	0.000
100%		0	1960000.022	6	0.003
100%		10	1960000.023	7	0.004
100%		30	1960000.018	2	0.001
100%		40	1960000.026	10	0.005
115%	55.2	20	1960000.026	10	0.005
85%	40.8	20	1960000.025	9	0.005

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
Radiated Emissions						
EMI Test Receiver	ESIB 40	100179	06/03/2015	1 Year	06/03/2016	☑
Bi-Log antenna (30MHz~2GHz)	JB1	A030702	08/15/2015	1 Year	08/15/2016	☑
Horn Antenna (1-18GHz)	3115	10SL0059	08/25/2015	1 Year	08/25/2016	☑
Horn Antenna (18-40 GHz)	AH-840	101013	08/28/2015	1 Year	08/28/2016	☑
Pre-Amplifier	LPA-6-30	11140711	02/19/2015	1 Year	02/19/2016	☑
Microwave Preamplifier (18-40 GHz)	PA-840	181251	02/19/2015	1 Year	02/19/2016	☑
3 Meters SAC	3M	N/A	08/08/2015	1 Year	08/08/2016	☑
10 Meters SAC	10M	N/A	09/05/2015	1 Year	09/05/2016	☑
RF Conducted Measurement						
Spectrum Analyzer	N9010A	MY51440112	08/20/2015	1 Year	08/20/2016	☑
EMI Test Receiver	ESIB 40	100179	06/03/2015	1 Year	06/03/2016	☑
Agilent Signal Generator	MXG N5182A	MY47071065	04/06/2015	1 Year	04/06/2016	☑

Annex B. SIEMIC Accreditation

Accreditations	Document	Scope / Remark
ISO 17025 (A2LA)		Please see the documents for the detailed scope
ISO Guide 65 (A2LA)		Please see the documents for the detailed scope
TCB Designation		A1, A2, A3, A4, B1, B2, B3, B4, C
FCC DoC Accreditation		FCC Declaration of Conformity Accreditation
FCC Site Registration		3 meter site
FCC Site Registration		10 meter site
IC Site Registration		3 meter site
IC Site Registration		10 meter site
EU NB		**Radio & Telecommunications Terminal Equipment:** EN45001 – EN ISO/IEC 17025
		Electromagnetic Compatibility: EN45001 – EN ISO/IEC 17025
Singapore iDA CB(Certification Body)		Phase I, Phase II
Vietnam MIC CAB Accreditation		Please see the document for the detailed scope
HongKong OFCA		**(Phase II)** OFCA Foreign Certification Body for Radio and Telecom
		(Phase I) Conformity Assessment Body for Radio and Telecom
Industry Canada CAB		**Radio:** Scope A – All Radio Standard Specification in Category I
		Telecom: CS-03 Part I, II, V, VI, VII, VIII

Japan Recognized Certification Body Designation		**Radio** : A1. Terminal equipment for purpose of calling **Telecom** : B1. Specified radio equipment specified in Article 38-2, Paragraph 1, Item 1 of the Radio Law
Korea CAB Accreditation		**EMI:** KCC Notice 2008-39, RRL Notice 2008-3: CA Procedures for EMI KN22: Test Method for EMI**EMS:** KCC Notice 2008-38, RRL Notice 2008-4: CA Procedures for EMS KN24, KN61000-4-2, -4-3, -4-4, -4-5, -4-6, -4-8, -4-11: Test Method for EMS
		Radio: RRL Notice 2008-26, RRL Notice 2008-2, RRL Notice 2008-10, RRL Notice 2007-49, RRL Notice 2007-20, RRL Notice 2007-21, RRL Notice 2007-80, RRL Notice 2004-68
		Telecom: President Notice 20664, RRL Notice 2007-30, RRL Notice 2008-7 with attachments 1, 3, 5, 6; President Notice 20664, RRL Notice 2008-7 with attachment 4
Taiwan NCC CAB Recognition		LP0002, PSTN01, ADSL01, ID0002, IS6100, CNS14336, PLMN07, PLMN01, PLMN08
Taiwan BSMI CAB Recognition		CNS 13438
Japan VCCI		R-3083: Radiation 3 meter site C-3421: Main Ports Conducted Interference Measurement T-1597: Telecommunication Ports Conducted Interference Measuremet
Australia CAB Regocnition		**EMC:** AS/NZS CISPR 11, AS/NZS CISPR 14.1, AS/NZS CISPR22, AS/NZS 61000.6.3, AS/NZS 61000.6.4
		Radiocommunications: AS/NZS 4281, AS/NZS 4268, AS/NZS 4280.1, AS/NZS 4280.2, AS/NZS 4295, AS/NZS 4582, AS/NZS 4583, AS/NZS 4769.1, AS/NZS 4769.2, AS/NZS 4770, AS/NZS 4771
		Telecommunications: AS/ACIF S002:05, AS/ACIF S003:06, AS/ACIF S004:06 AS/ACIF S006:01, AS/ACIF S016:01, AS/ACIF S031:01, AS/ACIF S038:01, AS/ACIF S040:01, AS/ACIF S041:05, AS/ACIF S043.2:06, AS/ACIF S60950.1
Australia NATA Recognition		AS/ACIF S002, AS/ACIF S003, AS/ACIF S004, AS/ACIF S006, AS/ACIF S016,AS/ACIF S031, AS/ACIF S038, AS/ACIF S040, AS/ACIF S041, AS/ACIF S043.2