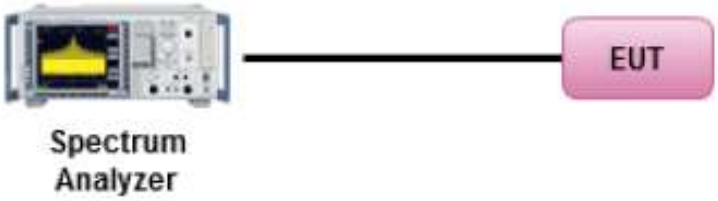
10.4 Band Edge

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR24.238	-	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.	☒
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	1. EUT was set for low , mid, high channel with modulated mode and highest RF output power. 2. The spectrum analyzer was connected to the antenna terminal. 3. A RBW of 1% greater than the 26 dB emission bandwidth should be used for band edge measurement or if narrower RBW is used, a correct factor calculated with formula 10*log (EBW/BW_{meas}) will be added to the result.		
Test Date	06/01/2017 – 06/13/2017	Environmental condition	Temperature 22°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 100KHz RBW was used to make measurement for LTE Band 4 with 20MHz BW, so the correction factor will be added to correct the result to be using 200 KHz RBW.		
Result	☒ Pass ☐ Fail		

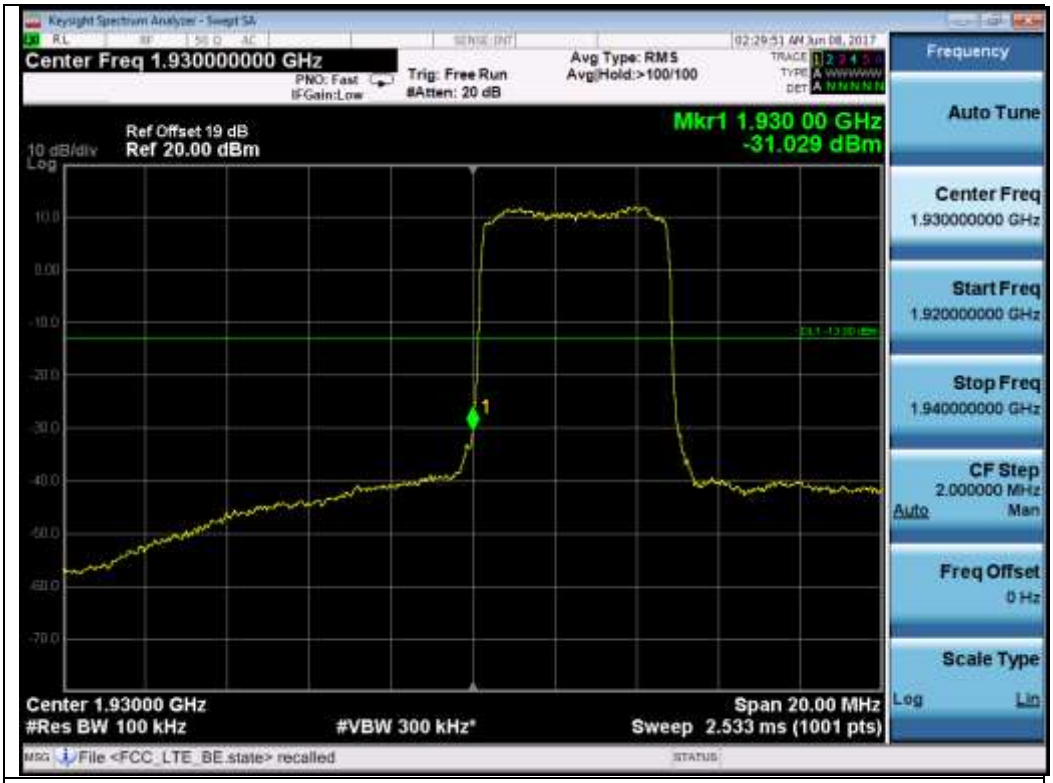
Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test was done by Chen Ge at RF Test Site.

Test Plots for band 2:

Chain 1:



5M QPSK Low

5M QPSK High

10M QPSK Low

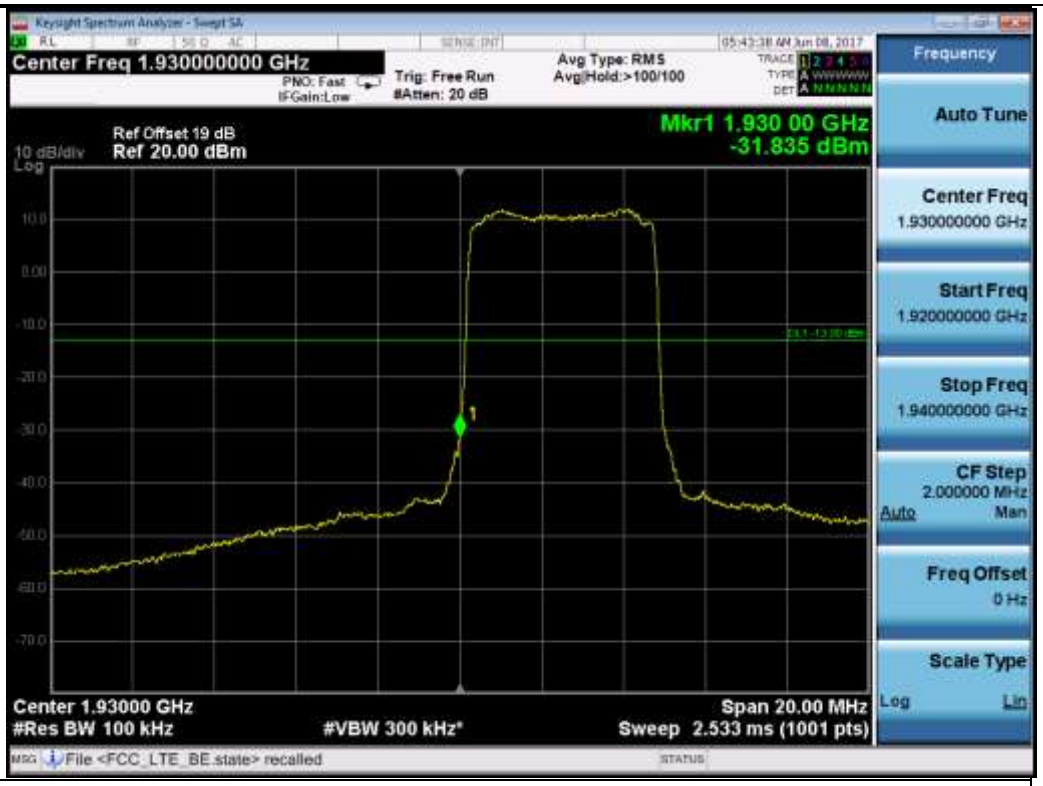
10M QPSK High

15M QPSK Low

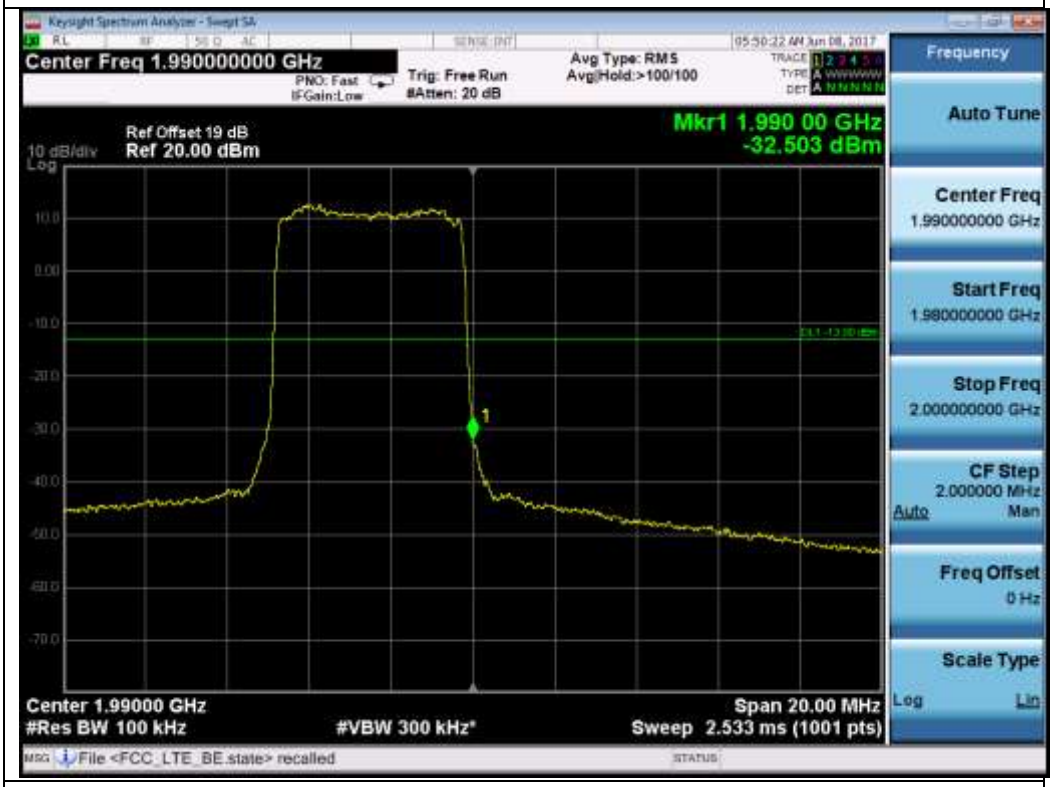
15M QPSK High

20M QPSK Low

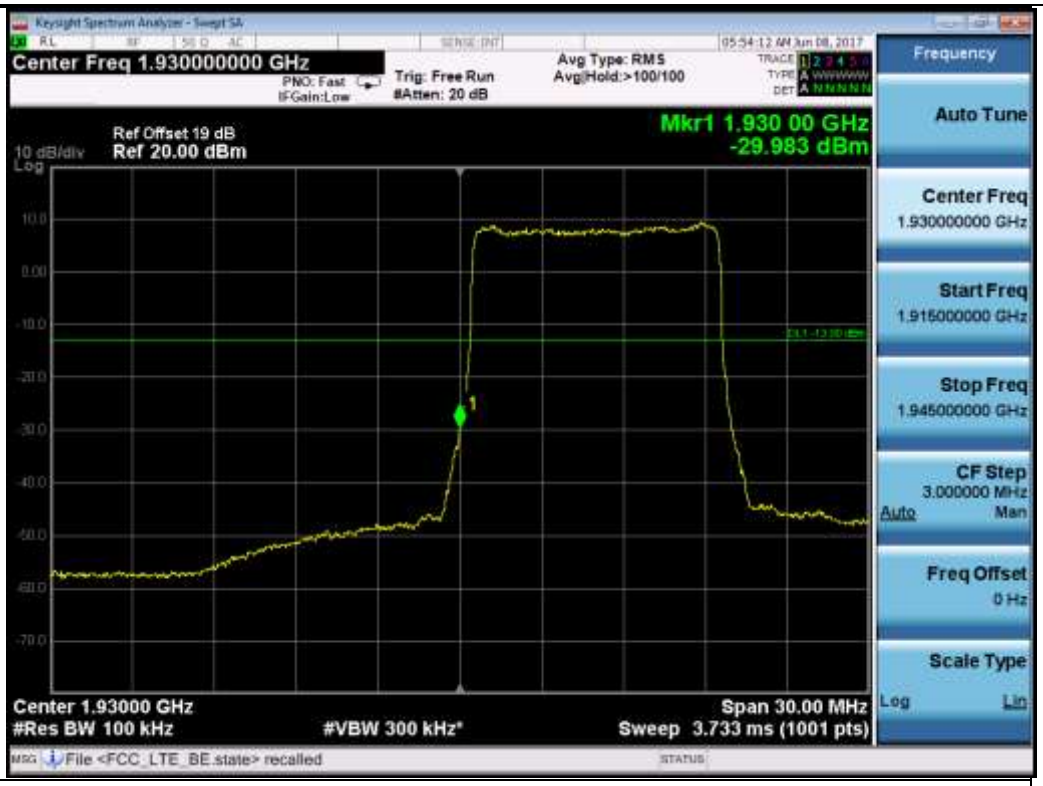
20M QPSK High



5M 64QAM Low



5M 64QAM High



10M 64QAM Low

10M 64QAM High

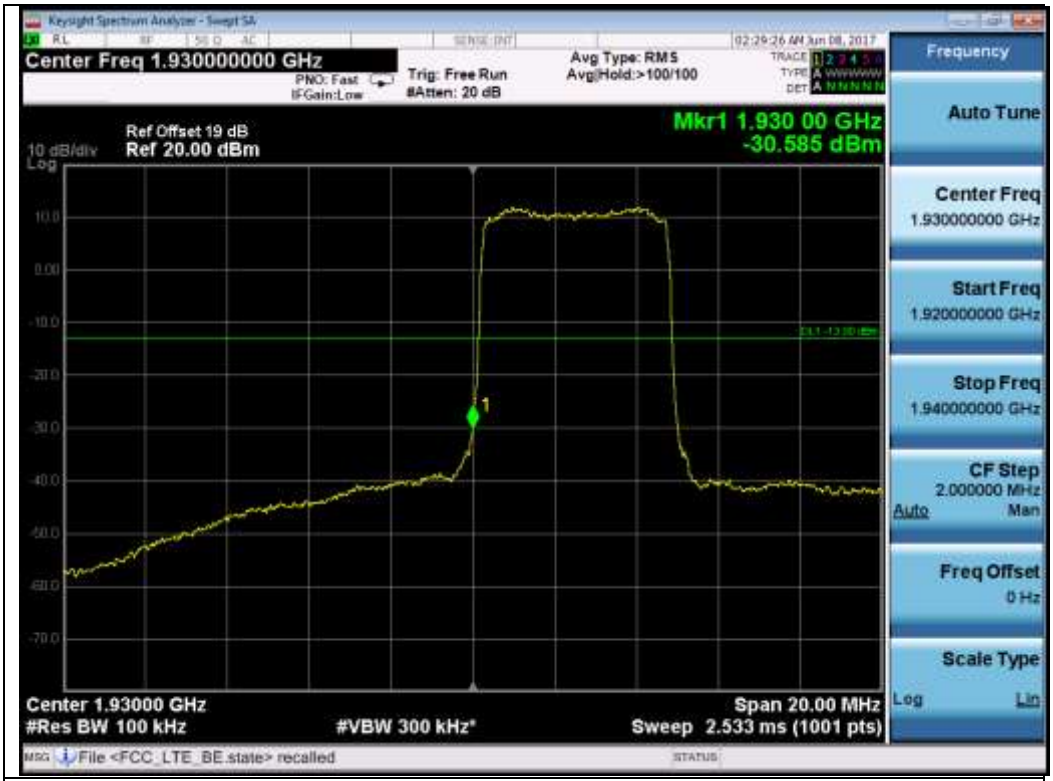
15M 64QAM Low

15M 64QAM High

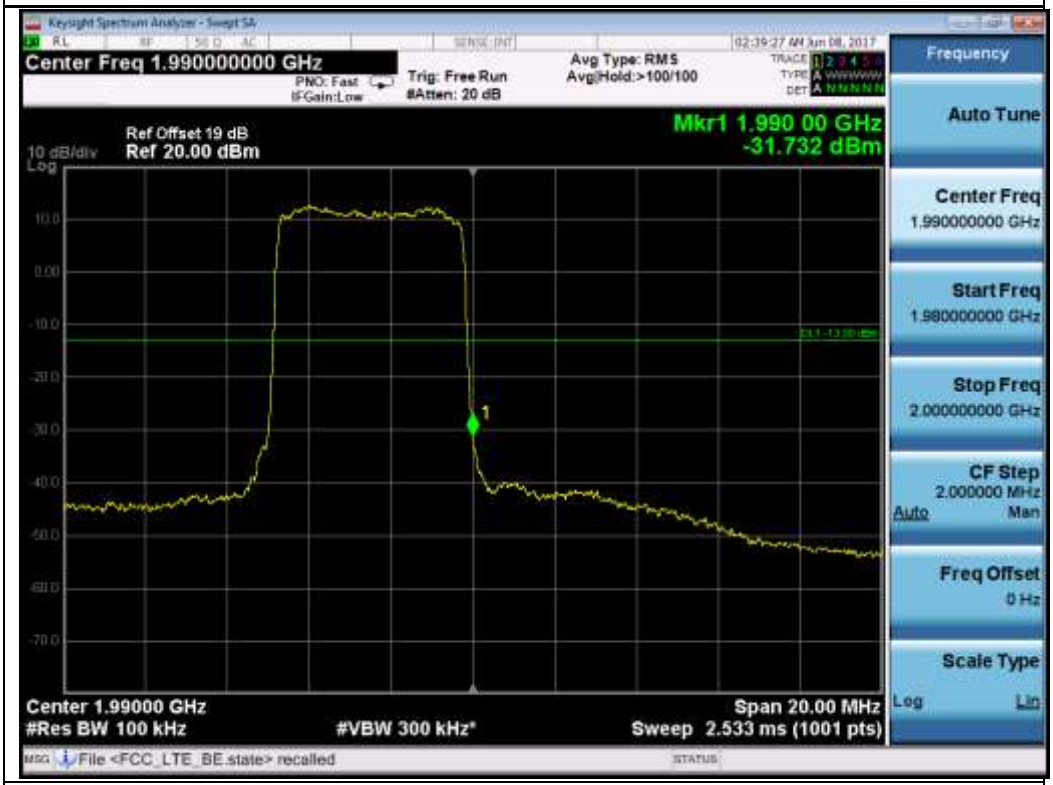
20M 64QAM Low

20M 64QAM High

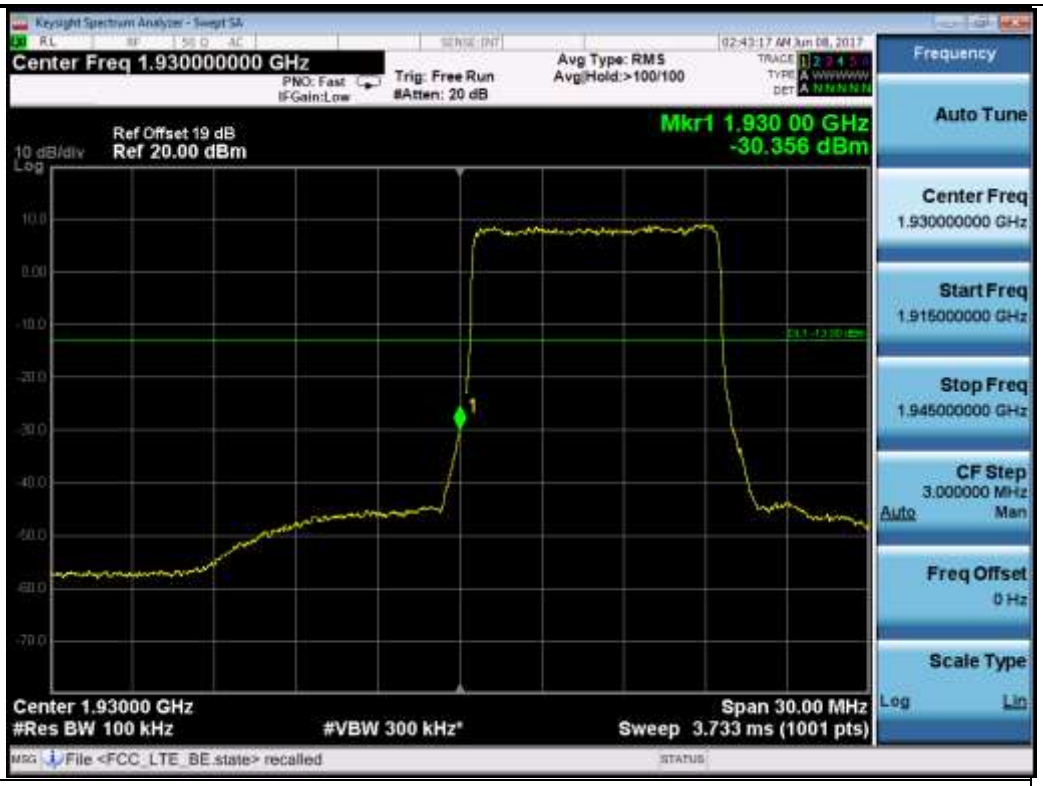
Chain 2:



5M QPSK Low



5M QPSK High



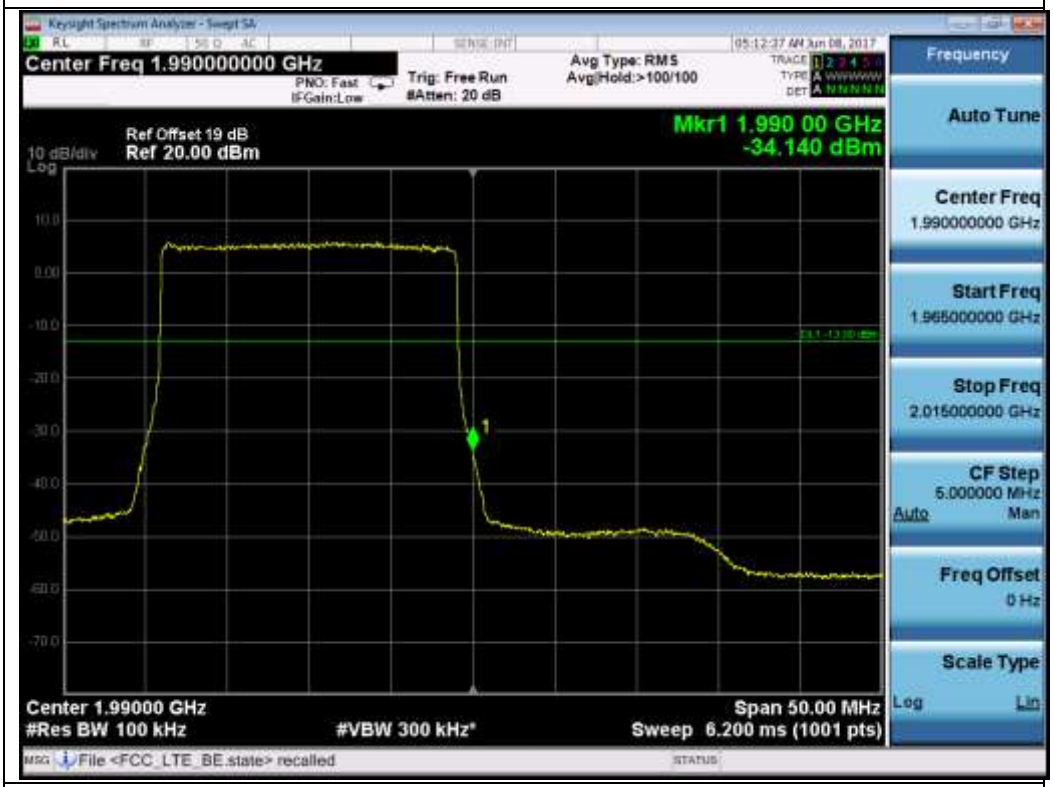
10M QPSK Low

10M QPSK High

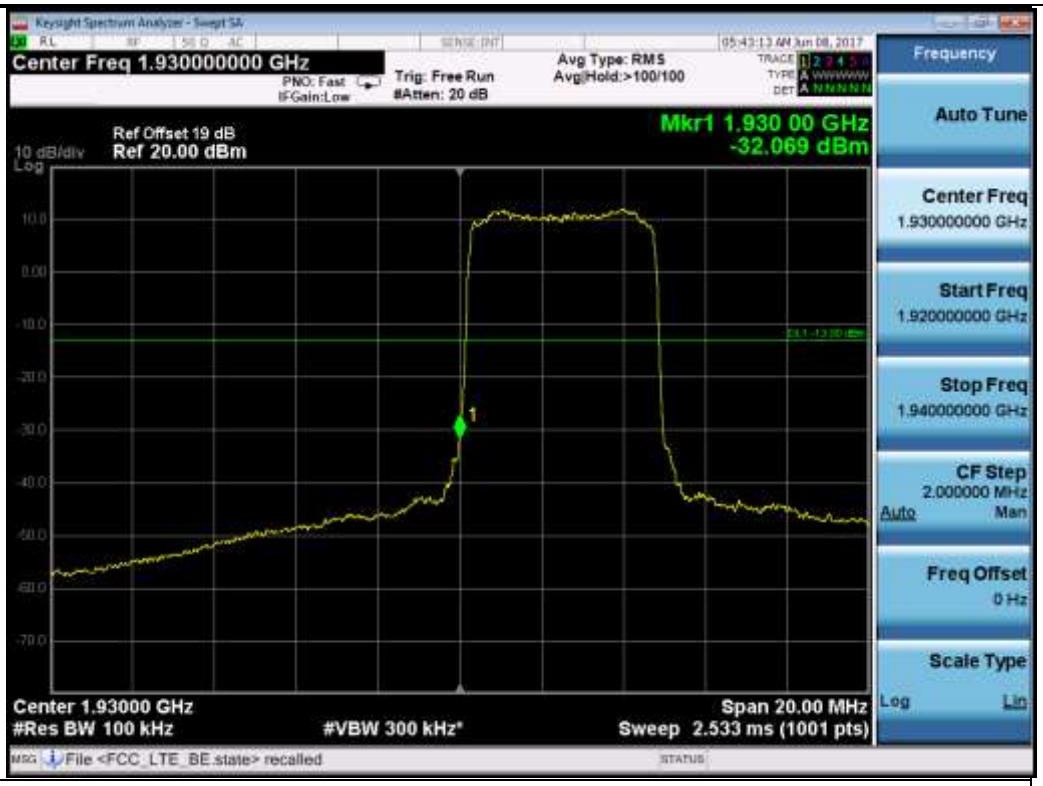
15M QPSK Low

15M QPSK High

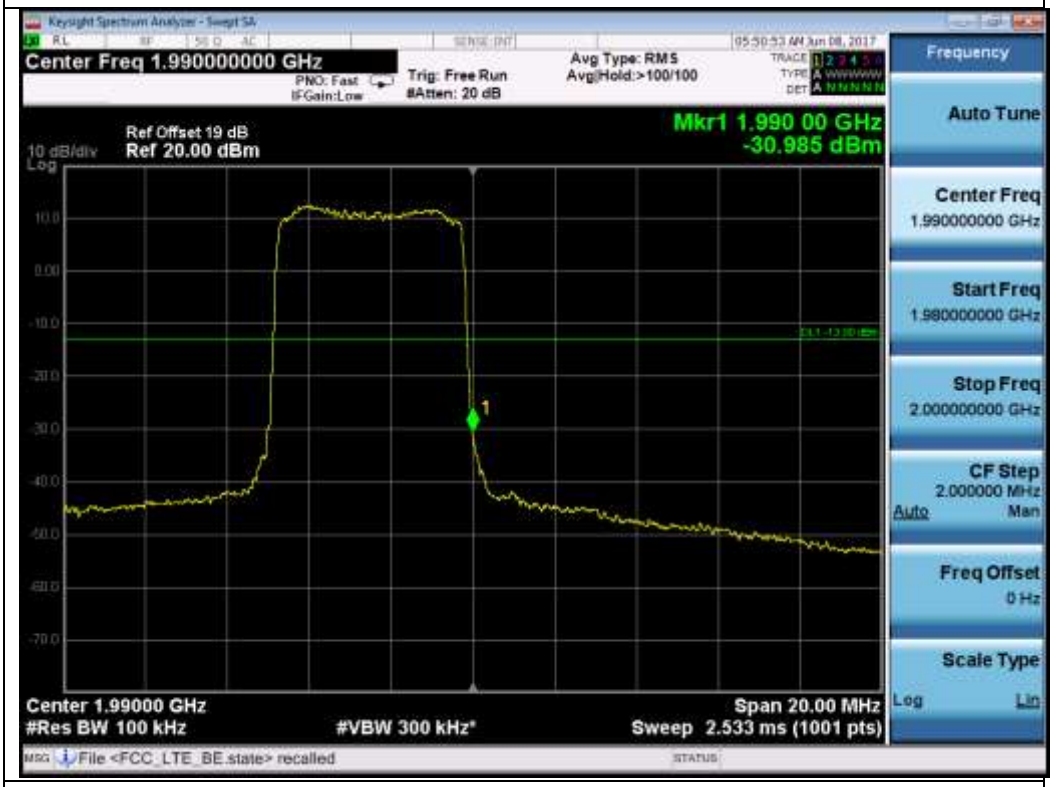
20M QPSK Low



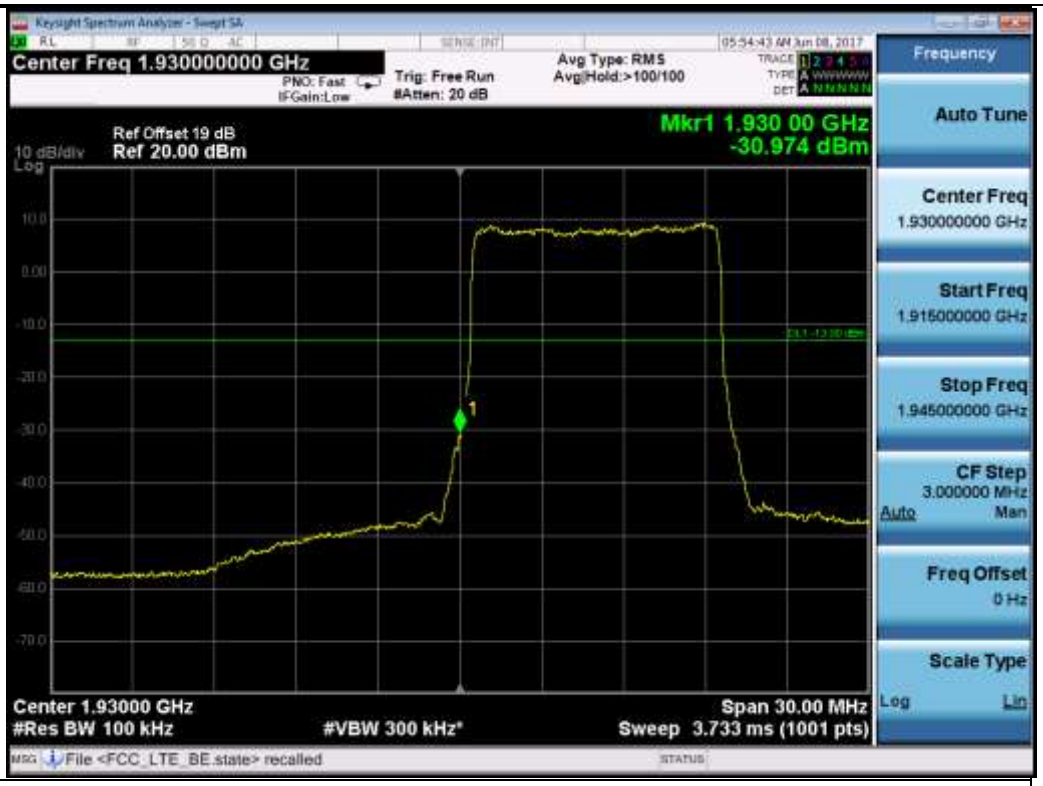
20M QPSK High



5M 64QAM Low

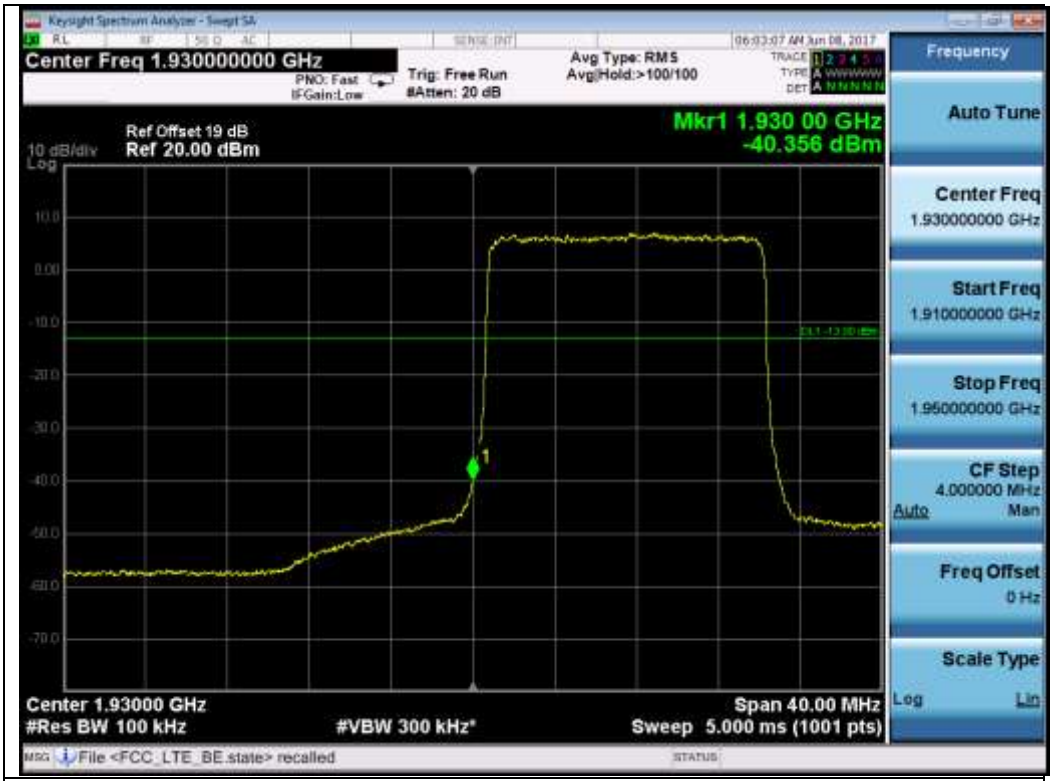


5M 64QAM High



10M 64QAM Low

10M 64QAM High



15M 64QAM Low

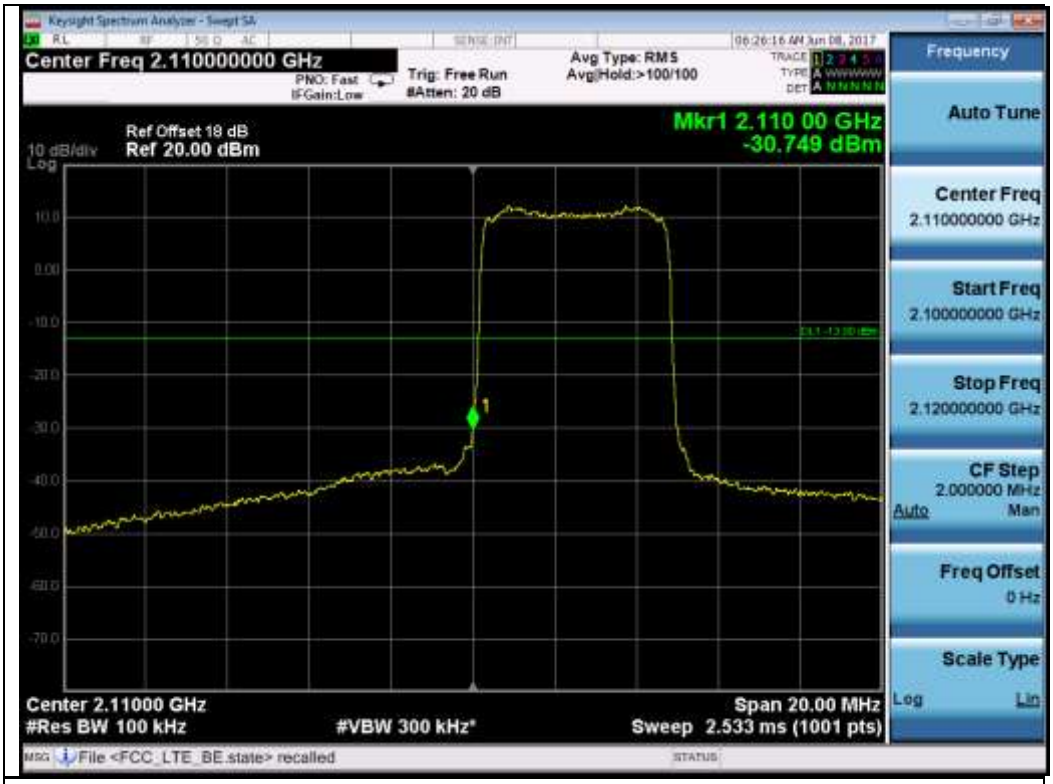
15M 64QAM High

20M 64QAM Low

20M 64QAM High

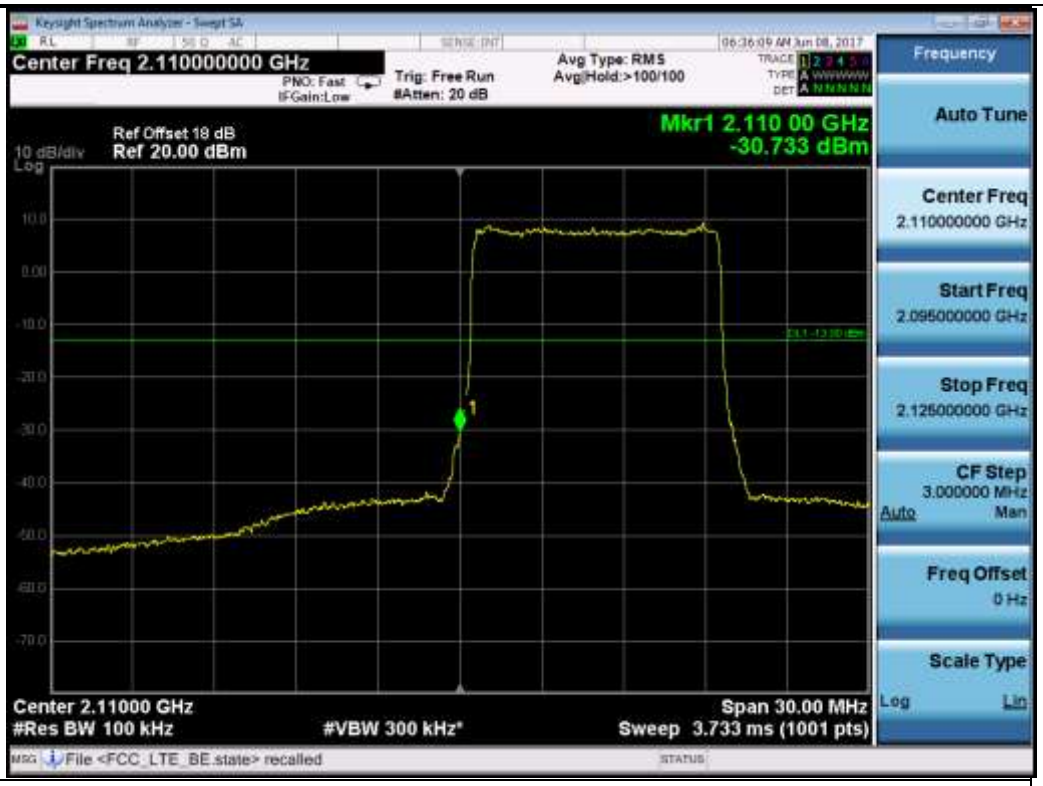
Test Plots for band 4:

Chain 1:

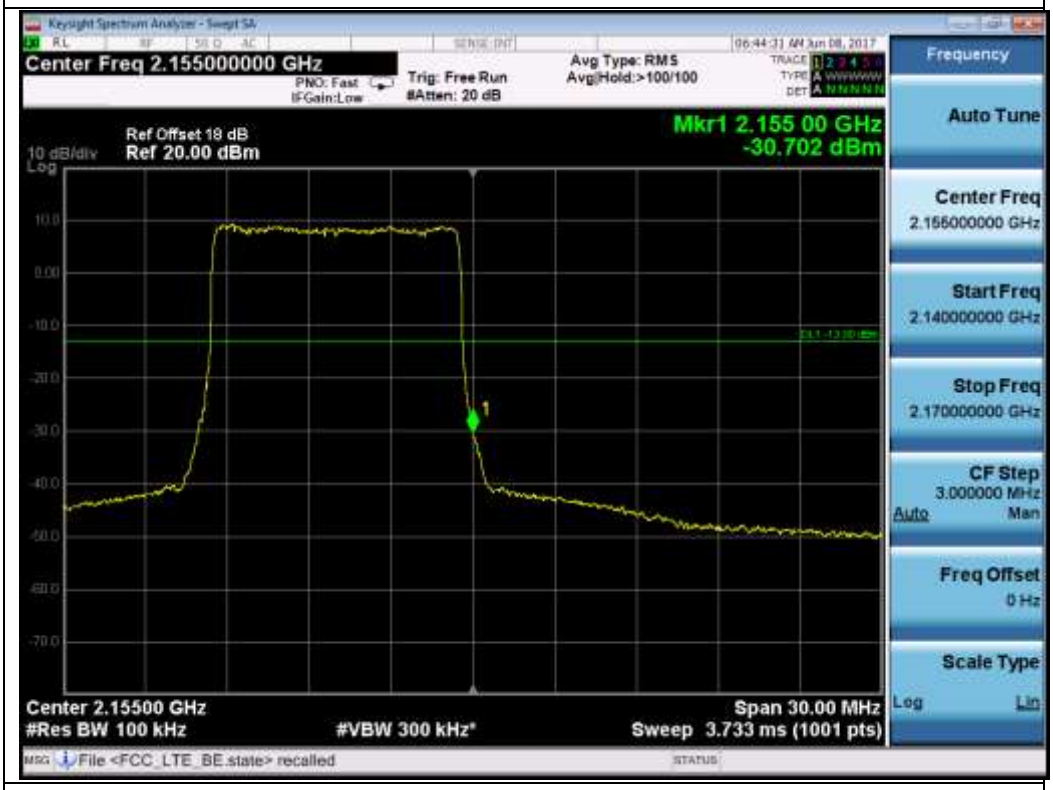


5M QPSK Low

5M QPSK High



10M QPSK Low



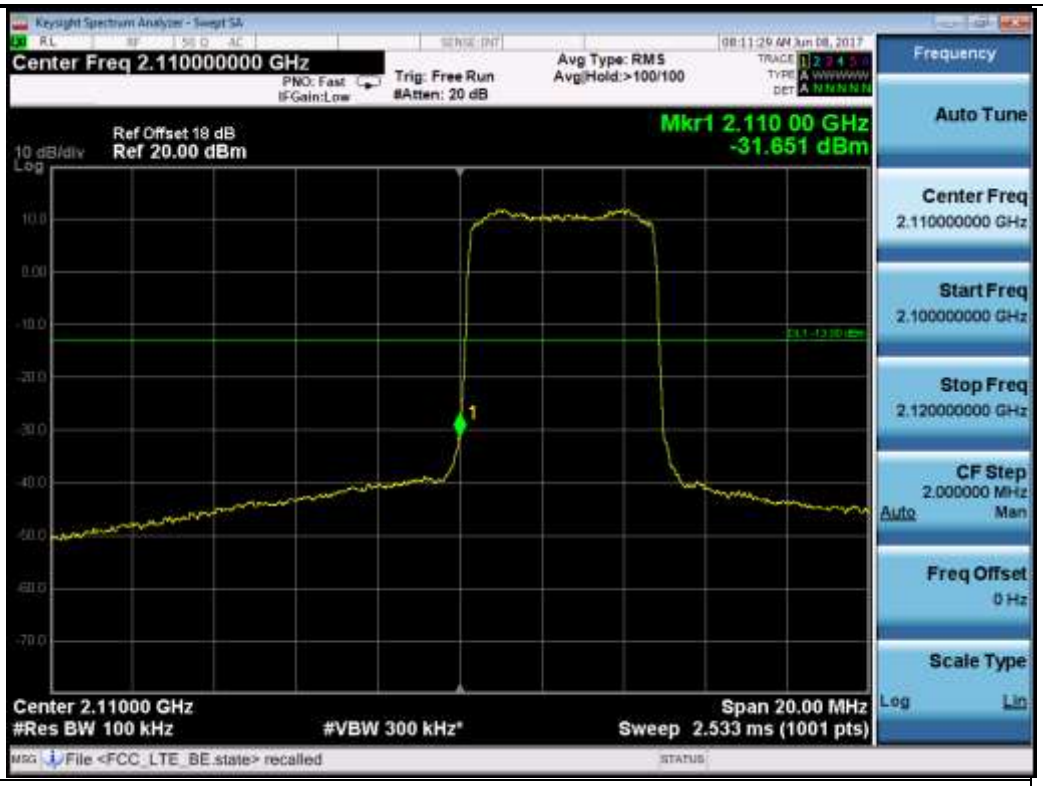
10M QPSK High

15M QPSK Low

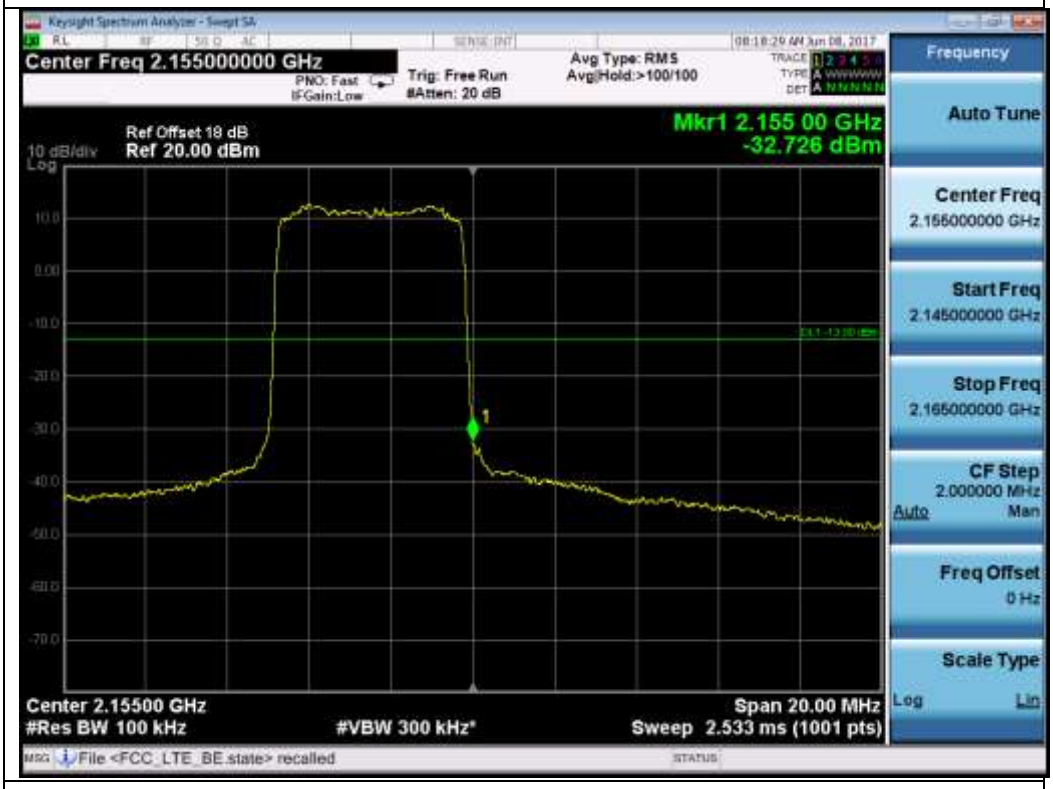
15M QPSK High

20M QPSK Low

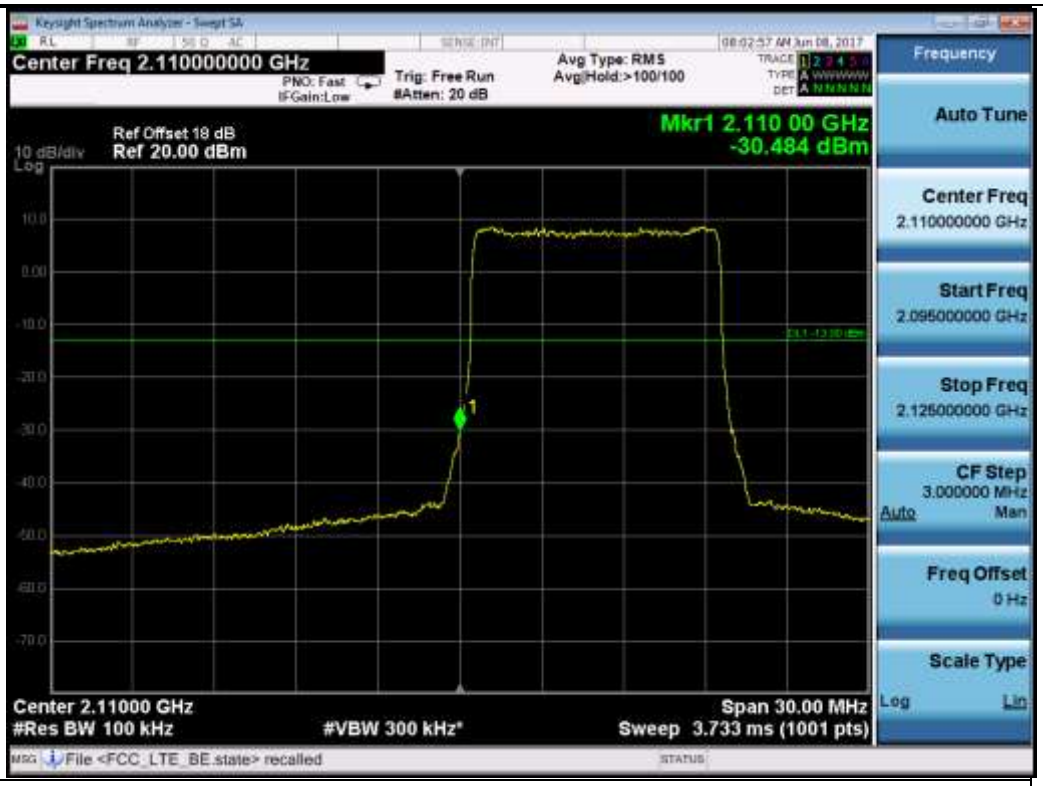
20M QPSK High



5M 64QAM Low



5M 64QAM High



10M 64QAM Low

10M 64QAM High

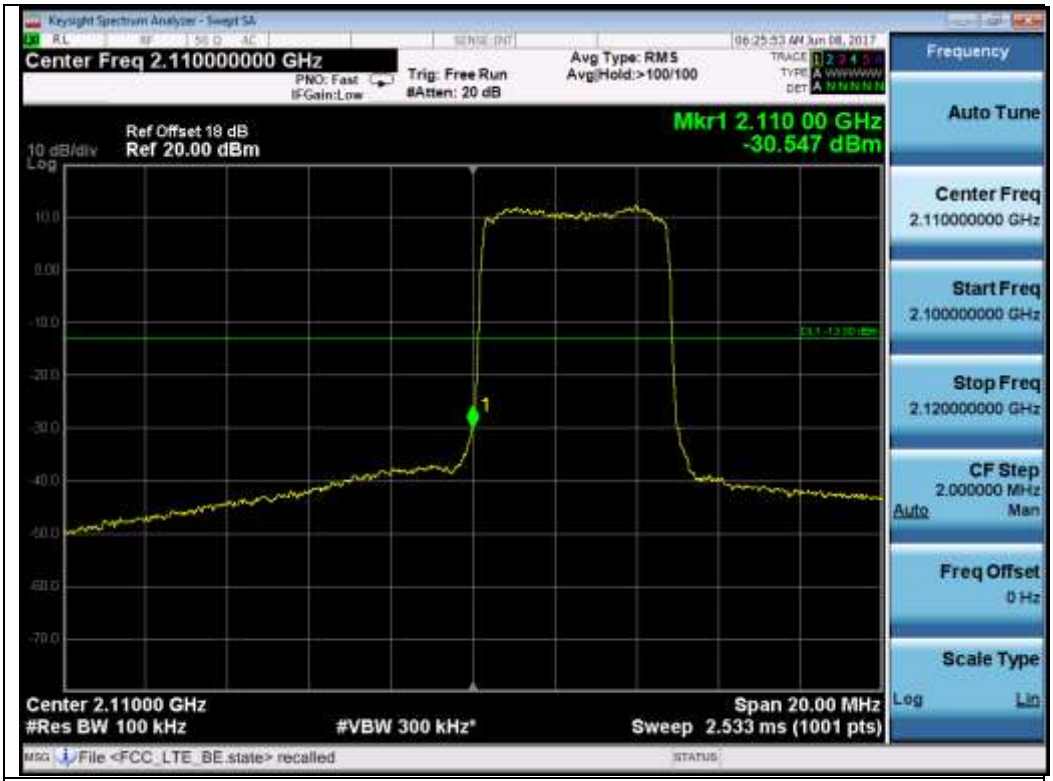
15M 64QAM Low

15M 64QAM High

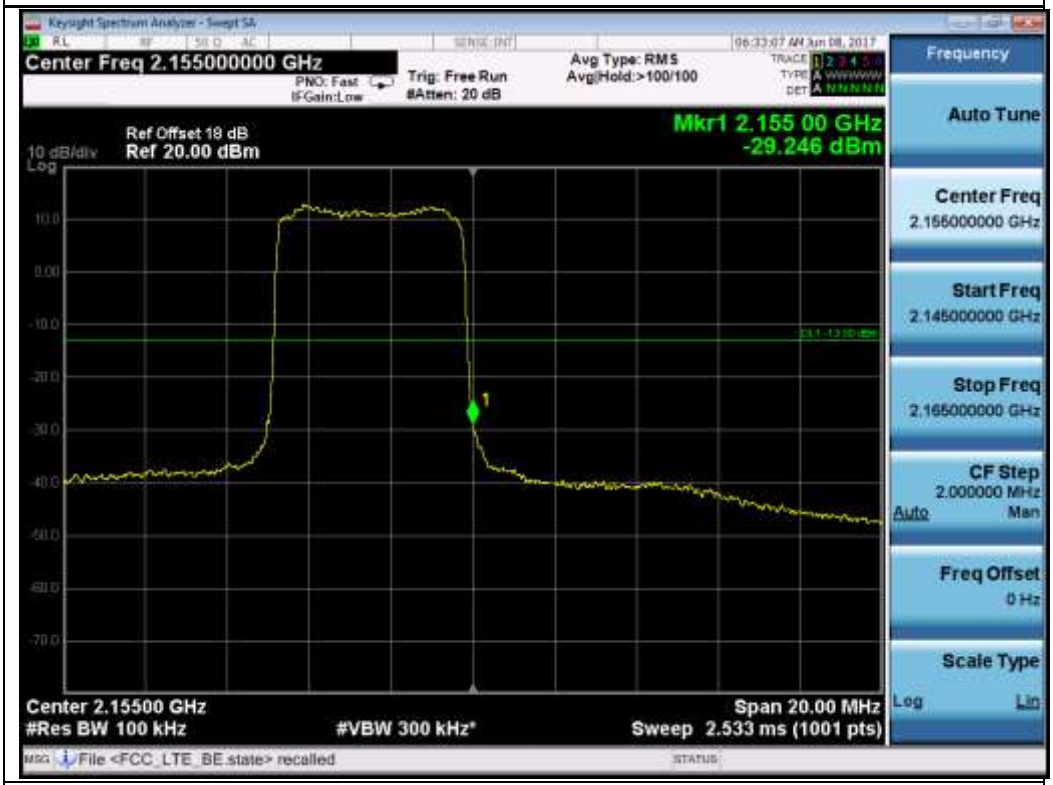
20M 64QAM Low

20M 64QAM High

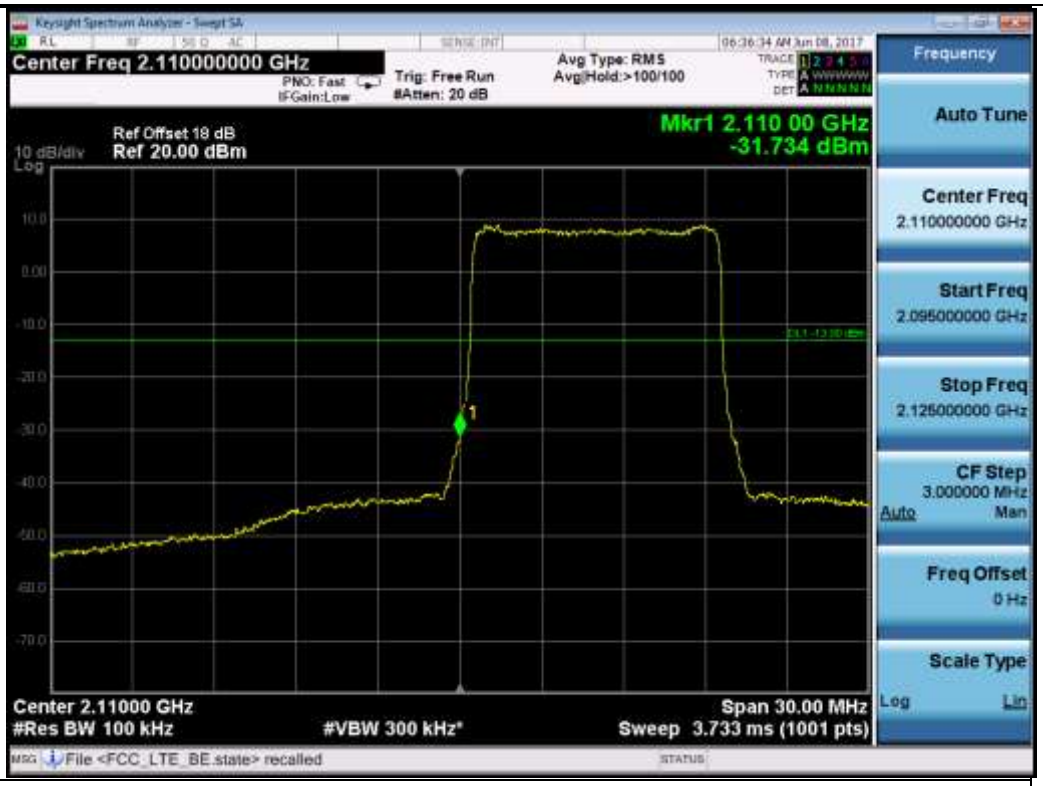
Chain 2:



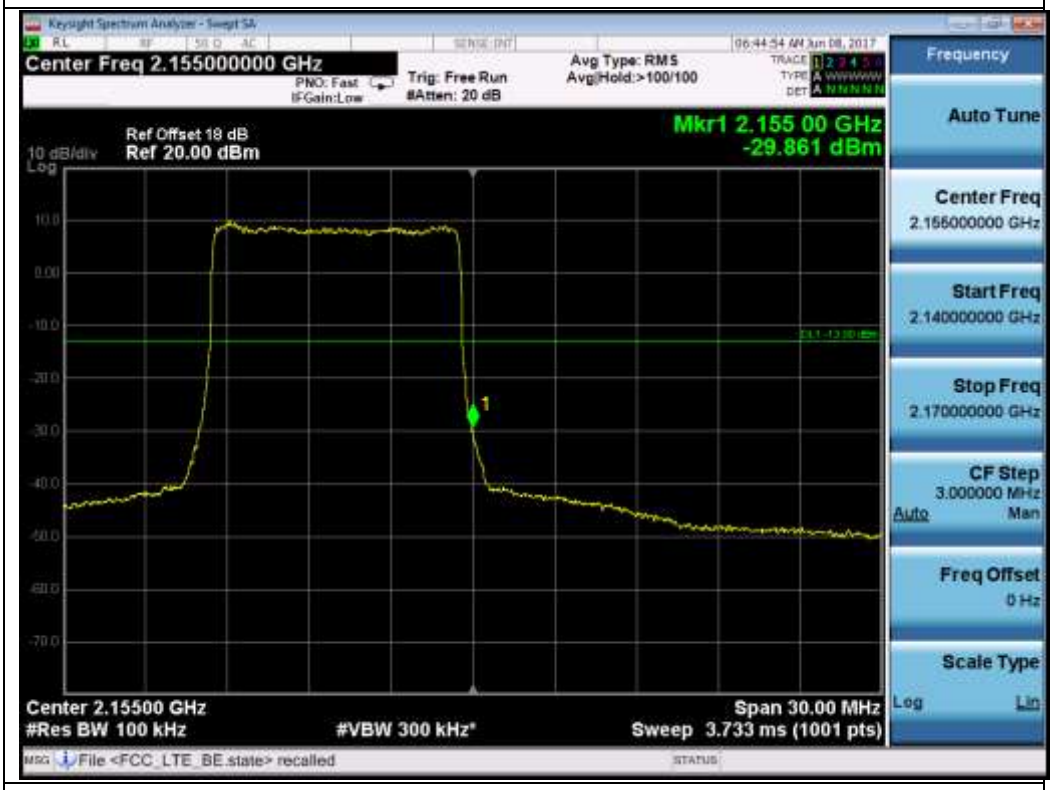
5M QPSK Low



5M QPSK High



10M QPSK Low



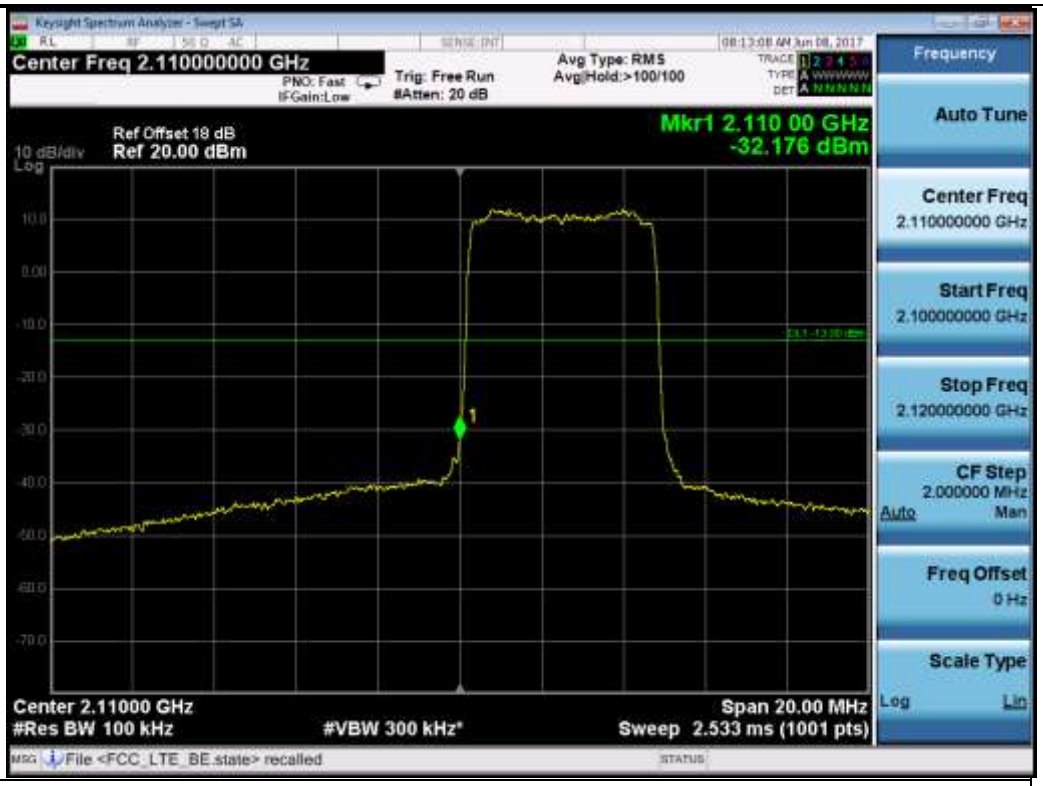
10M QPSK High

15M QPSK Low

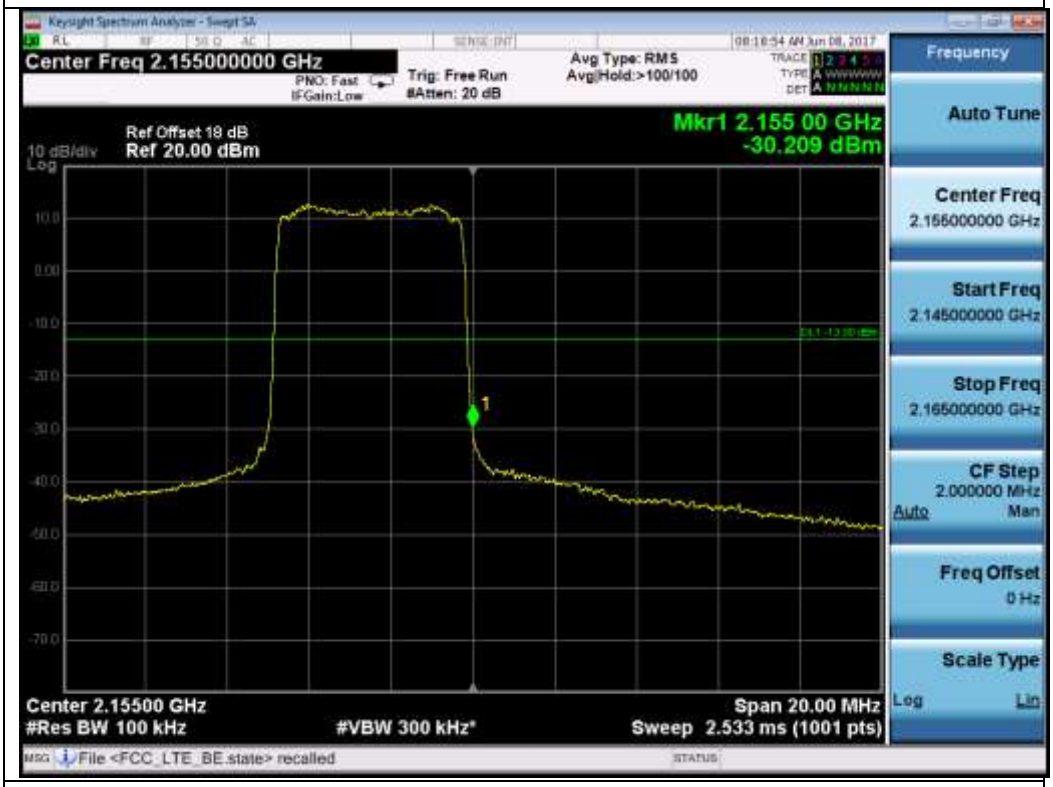
15M QPSK High

20M QPSK Low

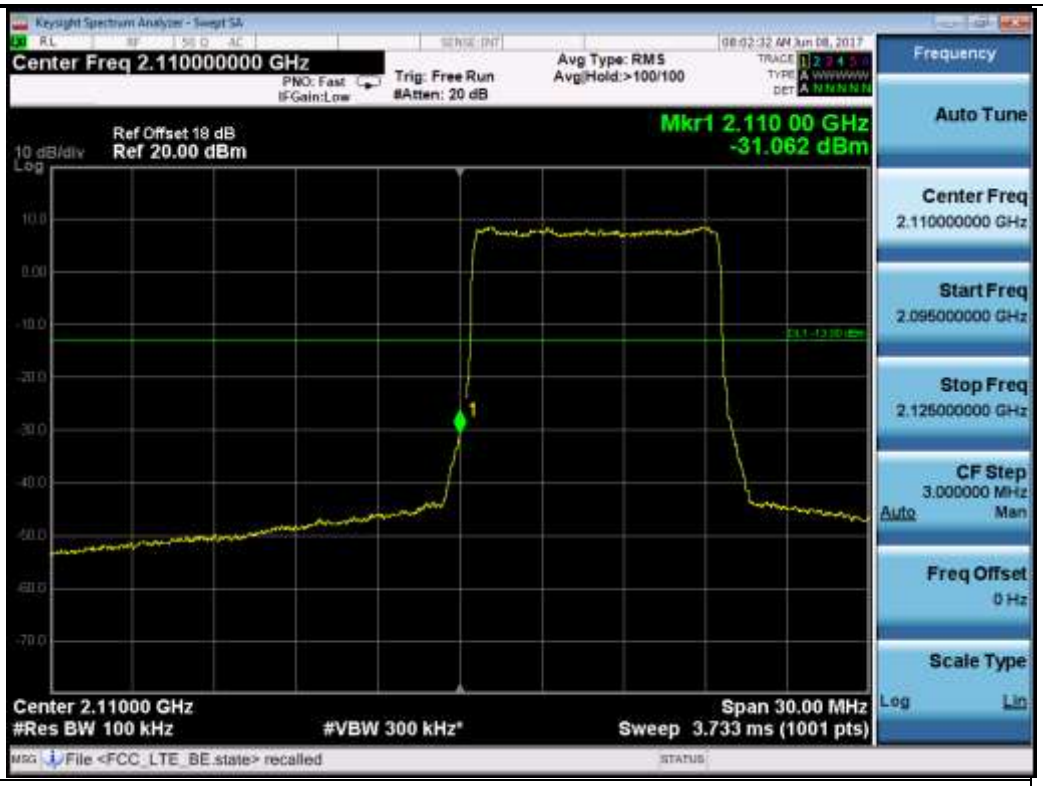
20M QPSK High



5M 64QAM Low



5M 64QAM High



10M 64QAM Low

10M 64QAM High

15M 64QAM Low

15M 64QAM High

20M 64QAM Low

20M 64QAM High

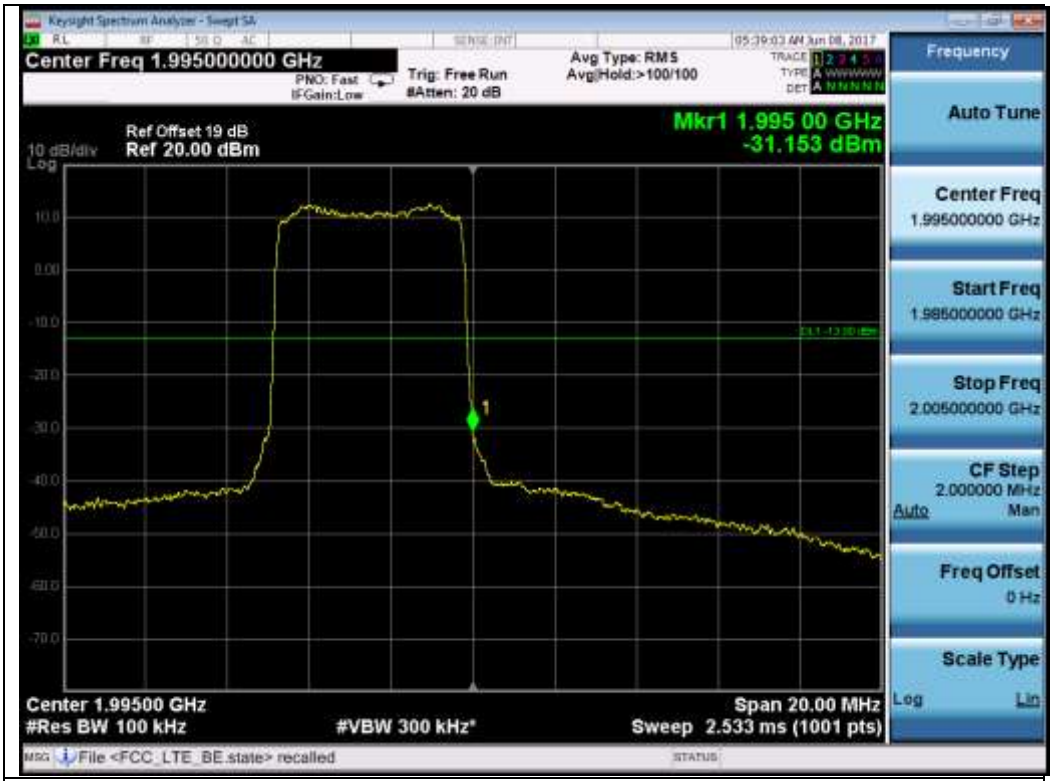
Test Plots for LTE band 25:

5M QPSK High

10M QPSK High

15M QPSK High

20M QPSK High



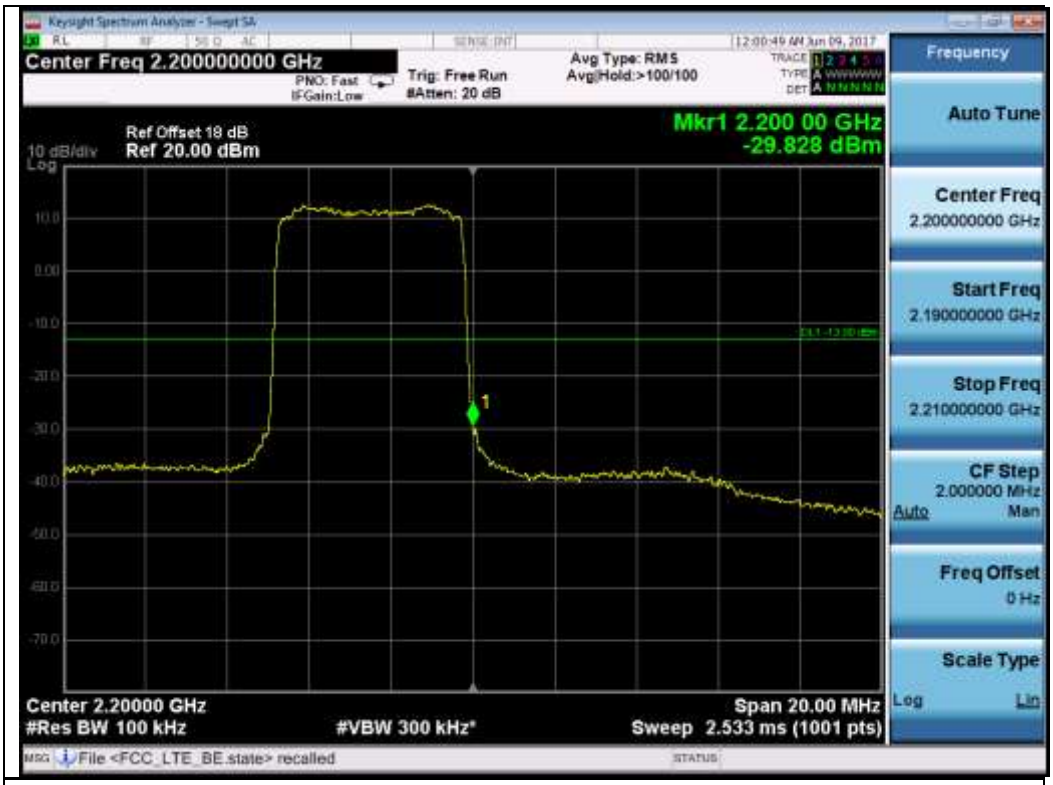
5M 64QAM High

10M 64QAM High

15M 64QAM High

20M 64QAM High

Test Plots for LTE band 66:

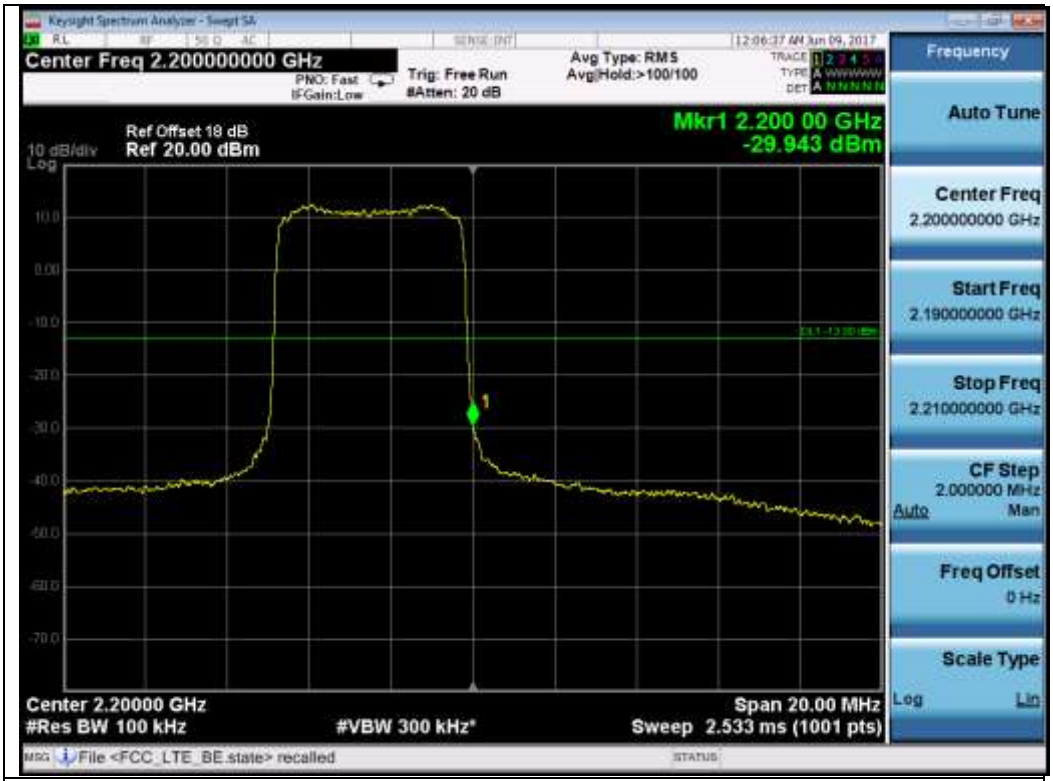


5M QPSK High

10M QPSK High

15M QPSK High

20M QPSK High



5M 64QAM High

10M 64QAM High

15M 64QAM High

20M 64QAM High

Test Plots for band 13:
Chain 1:

10M QPSK Low

10M QPSK High

Chain 2:

10M QPSK Low

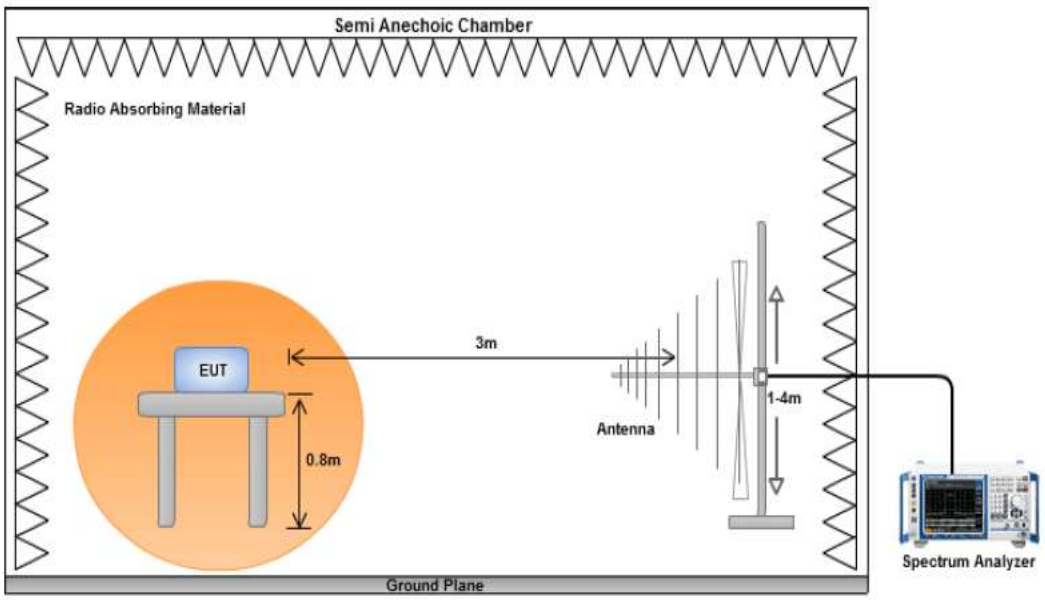
10M QPSK High

10.5 Radiated Spurious Emission below 1GHz

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR24.238	-	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.	☒
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	06/10/2017 – 06/13/2017	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

Test was done by Gary Chou at 10m chamber.

Internal Antenna:

Radiated Emission Test Results for LTE band 2

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
70.01	-59.21	0.47	0	-58.74	RMS Max	V	186.00	315.00	-13.00	-45.74	Pass
70.01	-61.7	0.47	0	-61.23	RMS Max	H	133.00	293.00	-13.00	-48.23	Pass
165.19	-58.15	1.24	0	-56.91	RMS Max	V	159.00	224.00	-13.00	-43.91	Pass
165.19	-59.6	1.24	0	-58.36	RMS Max	H	284.00	344.00	-13.00	-45.36	Pass
240.06	-59.39	1.45	0	-57.94	RMS Max	V	359.00	305.00	-13.00	-44.94	Pass
240.06	-61.08	1.45	0	-59.63	RMS Max	H	332.00	356.00	-13.00	-46.63	Pass

Radiated Emission Test Results for LTE band 4

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
70.01	-58.82	0.47	0	-58.35	RMS Max	V	186.00	315.00	-13.00	-45.35	Pass
70.01	-61.9	0.47	0	-61.43	RMS Max	H	133.00	293.00	-13.00	-48.43	Pass
165.19	-57.5	1.24	0	-56.26	RMS Max	V	159.00	224.00	-13.00	-43.26	Pass
165.19	-59.63	1.24	0	-58.39	RMS Max	H	284.00	344.00	-13.00	-45.39	Pass
240.06	-58.87	1.45	0	-57.42	RMS Max	V	359.00	305.00	-13.00	-44.42	Pass
240.06	-60.99	1.45	0	-59.54	RMS Max	H	332.00	356.00	-13.00	-46.54	Pass

Radiated Emission Test Results for LTE band 25

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
70.01	-59.06	0.47	0	-58.59	RMS Max	V	186.00	315.00	-13.00	-45.59	Pass
70.01	-61.7	0.47	0	-61.23	RMS Max	H	133.00	293.00	-13.00	-48.23	Pass
165.19	-57.7	1.24	0	-56.46	RMS Max	V	159.00	224.00	-13.00	-43.46	Pass
165.19	-60.08	1.24	0	-58.84	RMS Max	H	284.00	344.00	-13.00	-45.84	Pass
240.06	-58.74	1.45	0	-57.29	RMS Max	V	359.00	305.00	-13.00	-44.29	Pass
240.06	-60.81	1.45	0	-59.36	RMS Max	H	332.00	356.00	-13.00	-46.36	Pass

Radiated Emission Test Results for LTE band 66

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
70.01	-58.92	0.47	0	-58.45	RMS Max	V	186.00	315.00	-13.00	-45.45	Pass
70.01	-61.83	0.47	0	-61.36	RMS Max	H	133.00	293.00	-13.00	-48.36	Pass
165.19	-57.77	1.24	0	-56.53	RMS Max	V	159.00	224.00	-13.00	-43.53	Pass
165.19	-59.51	1.24	0	-58.27	RMS Max	H	284.00	344.00	-13.00	-45.27	Pass
240.06	-58.63	1.45	0	-57.18	RMS Max	V	359.00	305.00	-13.00	-44.18	Pass
240.06	-60.9	1.45	0	-59.45	RMS Max	H	332.00	356.00	-13.00	-46.45	Pass

Radiated Emission Test Results for LTE band 13

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
70.01	-59.92	0.47	0	-59.45	RMS Max	V	186.00	315.00	-13.00	-46.45	Pass
70.01	-62.74	0.47	0	-62.27	RMS Max	H	133.00	293.00	-13.00	-49.27	Pass
165.19	-58.93	1.24	0	-57.69	RMS Max	V	159.00	224.00	-13.00	-44.69	Pass
165.19	-60.77	1.24	0	-59.53	RMS Max	H	284.00	344.00	-13.00	-46.53	Pass
240.06	-59.72	1.45	0	-58.27	RMS Max	V	359.00	305.00	-13.00	-45.27	Pass
240.06	-62.3	1.45	0	-60.85	RMS Max	H	332.00	356.00	-13.00	-47.85	Pass

External Antenna:

Radiated Emission Test Results for LTE band 2

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
70.01	-58.74	0.47	0	-58.27	RMS Max	V	186.00	315.00	-13.00	-45.27	Pass
70.01	-61.85	0.47	0	-61.38	RMS Max	H	133.00	293.00	-13.00	-48.38	Pass
165.19	-57.69	1.24	0	-56.45	RMS Max	V	159.00	224.00	-13.00	-43.45	Pass
165.19	-59.88	1.24	0	-58.64	RMS Max	H	284.00	344.00	-13.00	-45.64	Pass
240.06	-58.98	1.45	0	-57.53	RMS Max	V	359.00	305.00	-13.00	-44.53	Pass
240.06	-60.63	1.45	0	-59.18	RMS Max	H	332.00	356.00	-13.00	-46.18	Pass

Radiated Emission Test Results for LTE band 4

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
70.01	-58.93	0.47	0	-58.46	RMS Max	V	186.00	315.00	-13.00	-45.46	Pass
70.01	-61.75	0.47	0	-61.28	RMS Max	H	133.00	293.00	-13.00	-48.28	Pass
165.19	-57.61	1.24	0	-56.37	RMS Max	V	159.00	224.00	-13.00	-43.37	Pass
165.19	-59.66	1.24	0	-58.42	RMS Max	H	284.00	344.00	-13.00	-45.42	Pass
240.06	-58.98	1.45	0	-57.53	RMS Max	V	359.00	305.00	-13.00	-44.53	Pass
240.06	-60.93	1.45	0	-59.48	RMS Max	H	332.00	356.00	-13.00	-46.48	Pass

Radiated Emission Test Results for LTE band 25

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
70.01	-58.76	0.47	0	-58.29	RMS Max	V	186.00	315.00	-13.00	-45.29	Pass
70.01	-61.84	0.47	0	-61.37	RMS Max	H	133.00	293.00	-13.00	-48.37	Pass
165.19	-57.87	1.24	0	-56.63	RMS Max	V	159.00	224.00	-13.00	-43.63	Pass
165.19	-59.82	1.24	0	-58.58	RMS Max	H	284.00	344.00	-13.00	-45.58	Pass
240.06	-58.92	1.45	0	-57.47	RMS Max	V	359.00	305.00	-13.00	-44.47	Pass
240.06	-60.74	1.45	0	-59.29	RMS Max	H	332.00	356.00	-13.00	-46.29	Pass

Radiated Emission Test Results for LTE band 66

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
70.01	-58.83	0.47	0	-58.36	RMS Max	V	186.00	315.00	-13.00	-45.36	Pass
70.01	-61.91	0.47	0	-61.44	RMS Max	H	133.00	293.00	-13.00	-48.44	Pass
165.19	-57.43	1.24	0	-56.19	RMS Max	V	159.00	224.00	-13.00	-43.19	Pass
165.19	-59.7	1.24	0	-58.46	RMS Max	H	284.00	344.00	-13.00	-45.46	Pass
240.06	-58.67	1.45	0	-57.22	RMS Max	V	359.00	305.00	-13.00	-44.22	Pass
240.06	-60.63	1.45	0	-59.18	RMS Max	H	332.00	356.00	-13.00	-46.18	Pass

Radiated Emission Test Results for LTE band 13

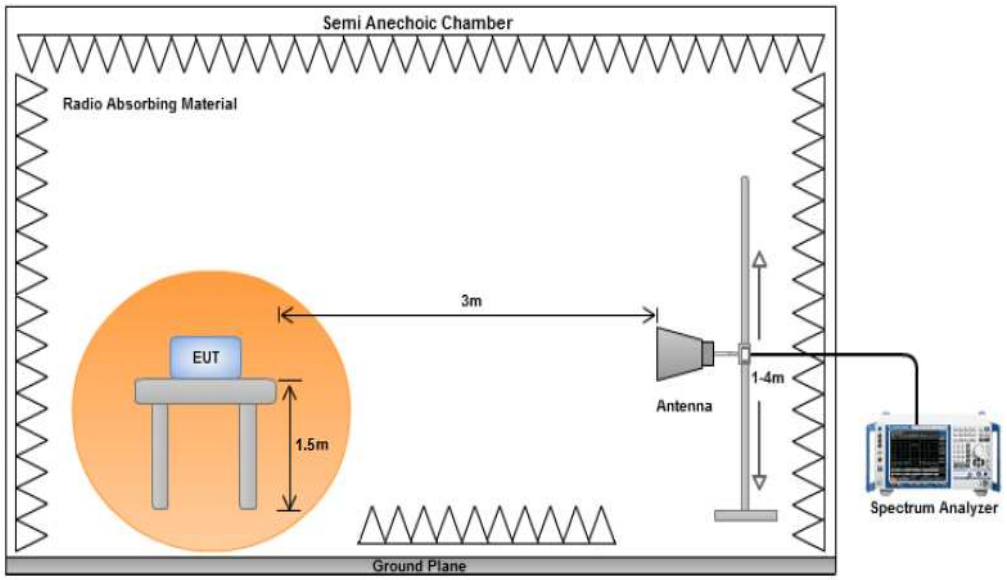
Frequency MHz	SG Level dBm	Cable Loss dB	Antenna Gain dBd	Substituted Level dBm	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBm	Margin dB	Pass /Fail
70.01	-59.74	0.47	0	-59.27	RMS Max	V	186.00	315.00	-13	-46.27	Pass
70.01	-62.98	0.47	0	-62.51	RMS Max	H	133.00	293.00	-13	-49.51	Pass
165.19	-59.07	1.24	0	-57.83	RMS Max	V	159.00	224.00	-13	-44.83	Pass
165.19	-60.69	1.24	0	-59.45	RMS Max	H	284.00	344.00	-13	-46.45	Pass
240.06	-59.63	1.45	0	-58.18	RMS Max	V	359.00	305.00	-13	-45.18	Pass
240.06	-62.14	1.45	0	-60.69	RMS Max	H	332.00	356.00	-13	-47.69	Pass

10.6 Radiated Spurious Emissions above 1GHz

Requirement(s):

Spec	Item	Requirement	Applicable
47CFR24.238	-	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.	☒
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	06/10/2017 – 06/13/2017	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

Test was done by Gary Chou at 10m chamber.

Radiated Emission Test Results (Above 1GHz)

Internal Antenna:

LTE band 2 Low Channel, 20MHz BW, QPSK

Frequency MHz	Degree	Height	Pol	Frequency MHz	Level dBm	Antenna Gain dBi	Cable Loss dB	Absolute Level dBm	Limit	Margin
3880	30	150	V	3880	-19.38	10.38	3.83	-25.93	-13	-12.93
3880	25	153	H	3880	-21.24	10.38	3.83	-27.79	-13	-14.79
5820	29	150	V	5820	-20.53	12.35	3.68	-29.2	-13	-16.2
5820	27	149	H	5820	-22.62	12.35	3.68	-31.29	-13	-18.29

LTE band 2 Mid Channel, 20MHz BW, QPSK

Frequency MHz	Degree	Height	Pol	Frequency MHz	Level dBm	Antenna Gain dBi	Cable Loss dB	Absolute Level dBm	Limit	Margin
3920	30	150	V	3920	-19.29	10.38	3.83	-25.84	-13	-12.84
3920	25	153	H	3920	-21.45	10.38	3.83	-28	-13	-15
5880	29	150	V	5880	-20.26	11.83	3.68	-28.41	-13	-15.41
5880	27	149	H	5880	-22.39	11.83	3.68	-30.54	-13	-17.54

LTE band 2 High Channel, 20MHz BW, QPSK

Frequency MHz	Degree	Height	Pol	Frequency MHz	Level dBm	Antenna Gain dBi	Cable Loss dB	Absolute Level dBm	Limit	Margin
3960	30	150	V	3960	-19.37	10.78	3.83	-26.32	-13	-13.32
3960	25	153	H	3960	-21.46	10.78	3.83	-28.41	-13	-15.41
5940	29	150	V	5940	-20.39	11.83	3.68	-28.54	-13	-15.54
5940	27	149	H	5940	-22.24	11.83	3.68	-30.39	-13	-17.39

LTE band 4 Low Channel, 20MHz BW, QPSK

Frequency MHz	Degree	Height	Pol	Frequency MHz	Level dBm	Antenna Gain dBi	Cable Loss dB	Absolute Level dBm	Limit	Margin
4240	30	150	V	4240	-19.45	10.56	3.83	-26.18	-13	-13.18
4240	25	153	H	4240	-21.37	10.56	3.83	-28.1	-13	-15.1
6360	29	150	V	6360	-19.51	11.49	3.68	-27.32	-13	-14.32
6360	27	149	H	6360	-21.69	11.49	3.68	-29.5	-13	-16.5

LTE band 4 Mid Channel, 20MHz BW, QPSK

Frequency MHz	Degree	Height	Pol	Frequency MHz	Level dBm	Antenna Gain dBi	Cable Loss dB	Absolute Level dBm	Limit	Margin
4265	30	150	V	4265	-19.43	10.54	3.83	-26.14	-13	-13.14
4265	25	153	H	4265	-21.27	10.54	3.83	-27.98	-13	-14.98
6397.5	29	150	V	6397.5	-19.39	11.49	4.04	-26.84	-13	-13.84
6397.5	27	149	H	6397.5	-21.42	11.49	4.04	-28.87	-13	-15.87

LTE band 4 High Channel, 20MHz BW, QPSK

Frequency MHz	Degree	Height	Pol	Frequency MHz	Level dBm	Antenna Gain dBi	Cable Loss dB	Absolute Level dBm	Limit	Margin
4830	30	150	V	4830	-19.56	10.54	4.35	-25.75	-13	-12.75
4830	25	153	H	4830	-21.49	10.54	4.35	-27.68	-13	-14.68
7245	29	150	V	7245	-19.23	10.13	4.19	-25.17	-13	-12.17
7245	27	149	H	7245	-21.46	10.13	4.19	-27.4	-13	-14.4

LTE band 25 High Channel, 20MHz BW, QPSK

Frequency MHz	Degree	Height	Pol	Frequency MHz	Level dBm	Antenna Gain dBi	Cable Loss dB	Absolute Level dBm	Limit	Margin
3907	30	150	V	3907	-19.38	10.38	3.83	-25.93	-13	-12.93
3907	25	153	H	3907	-21.42	10.38	3.83	-27.97	-13	-14.97
5955	29	150	V	5955	-20.56	11.83	3.68	-28.71	-13	-15.71
5955	27	149	H	5955	-22.68	11.83	3.68	-30.83	-13	-17.83

LTE band 66 High Channel, 20MHz BW, QPSK

Frequency MHz	Degree	Height	Pol	Frequency MHz	Level dBm	Antenna Gain dBi	Cable Loss dB	Absolute Level dBm	Limit	Margin
4380	30	150	V	4380	-19.45	10.68	3.83	-26.3	-13	-13.3
4380	25	153	H	4380	-21.53	10.68	3.83	-28.38	-13	-15.38
6570	29	150	V	6570	-20.41	11.45	3.68	-28.18	-13	-15.18
6570	27	149	H	6570	-22.52	11.45	3.68	-30.29	-13	-17.29

LTE band 13 Mid Channel, 10MHz BW, QPSK

Frequency MHz	Degree	Height	Pol	Frequency MHz	Level dBm	Antenna Gain dBi	Cable Loss dB	Absolute Level dBm	Limit	Margin
1502	30	150	V	1502	-20.5	9.57	1.78	-28.29	-13	-15.29
1502	25	153	H	1502	-22.54	9.57	1.78	-30.33	-13	-17.33
2253	29	150	V	2253	-20.61	9.66	2.07	-28.2	-13	-15.2
2253	27	149	H	2253	-22.65	9.66	2.07	-30.24	-13	-17.24

External Antenna:

LTE band 2 Low Channel, 20MHz BW, QPSK

Frequency MHz	Degree	Height	Pol	Frequency MHz	Level dBm	Antenna Gain dBi	Cable Loss dB	Absolute Level dBm	Limit	Margin
3880	30	150	V	3880	-19.45	10.38	3.83	-26	-13	-13
3880	25	153	H	3880	-21.67	10.38	3.83	-28.22	-13	-15.22
5820	29	150	V	5820	-20.83	12.35	3.68	-29.5	-13	-16.5
5820	27	149	H	5820	-22.64	12.35	3.68	-31.31	-13	-18.31

LTE band 2 Mid Channel, 20MHz BW, QPSK

Frequency MHz	Degree	Height	Pol	Frequency MHz	Level dBm	Antenna Gain dBi	Cable Loss dB	Absolute Level dBm	Limit	Margin
3920	30	150	V	3920	-19.32	10.38	3.83	-25.87	-13	-12.87
3920	25	153	H	3920	-21.47	10.38	3.83	-28.02	-13	-15.02
5880	29	150	V	5880	-20.86	11.83	3.68	-29.01	-13	-16.01
5880	27	149	H	5880	-22.54	11.83	3.68	-30.69	-13	-17.69

LTE band 2 High Channel, 20MHz BW, QPSK

Frequency MHz	Degree	Height	Pol	Frequency MHz	Level dBm	Antenna Gain dBi	Cable Loss dB	Absolute Level dBm	Limit	Margin
3960	30	150	V	3960	-19.33	10.78	3.83	-26.28	-13	-13.28
3960	25	153	H	3960	-21.27	10.78	3.83	-28.22	-13	-15.22
5940	29	150	V	5940	-20.45	11.83	3.68	-28.6	-13	-15.6
5940	27	149	H	5940	-22.38	11.83	3.68	-30.53	-13	-17.53

LTE band 4 Low Channel, 20MHz BW, QPSK

Frequency MHz	Degree	Height	Pol	Frequency MHz	Level dBm	Antenna Gain dBi	Cable Loss dB	Absolute Level dBm	Limit	Margin
4240	30	150	V	4240	-19.53	10.56	3.83	-26.26	-13	-13.26
4240	25	153	H	4240	-21.28	10.56	3.83	-28.01	-13	-15.01
6360	29	150	V	6360	-19.49	11.49	3.68	-27.3	-13	-14.3
6360	27	149	H	6360	-21.64	11.49	3.68	-29.45	-13	-16.45

LTE band 4 Mid Channel, 20MHz BW, QPSK

Frequency MHz	Degree	Height	Pol	Frequency MHz	Level dBm	Antenna Gain dBi	Cable Loss dB	Absolute Level dBm	Limit	Margin
4265	30	150	V	4265	-19.25	10.54	3.83	-25.96	-13	-12.96
4265	25	153	H	4265	-21.33	10.54	3.83	-28.04	-13	-15.04
6397.5	29	150	V	6397.5	-19.41	11.49	4.04	-26.86	-13	-13.86
6397.5	27	149	H	6397.5	-21.82	11.49	4.04	-29.27	-13	-16.27

LTE band 4 High Channel, 20MHz BW, QPSK

Frequency MHz	Degree	Height	Pol	Frequency MHz	Level dBm	Antenna Gain dBi	Cable Loss dB	Absolute Level dBm	Limit	Margin
4830	30	150	V	4830	-19.11	10.54	4.35	-25.3	-13	-12.3
4830	25	153	H	4830	-21.26	10.54	4.35	-27.45	-13	-14.45
7245	29	150	V	7245	-19.36	10.13	4.19	-25.3	-13	-12.3
7245	27	149	H	7245	-21.53	10.13	4.19	-27.47	-13	-14.47

LTE band 25 High Channel, 20MHz BW, QPSK

Frequency MHz	Degree	Height	Pol	Frequency MHz	Level dBm	Antenna Gain dBi	Cable Loss dB	Absolute Level dBm	Limit	Margin
3907	30	150	V	3907	-19.16	10.38	3.83	-25.71	-13	-12.71
3907	25	153	H	3907	-21.27	10.38	3.83	-27.82	-13	-14.82
5955	29	150	V	5955	-20.3	11.83	3.68	-28.45	-13	-15.45
5955	27	149	H	5955	-22.08	11.83	3.68	-30.23	-13	-17.23

LTE band 66 High Channel, 20MHz BW, QPSK

Frequency MHz	Degree	Height	Pol	Frequency MHz	Level dBm	Antenna Gain dBi	Cable Loss dB	Absolute Level dBm	Limit	Margin
4380	30	150	V	4380	-19.41	10.68	3.83	-26.26	-13	-13.26
4380	25	153	H	4380	-21.28	10.68	3.83	-28.13	-13	-15.13
6570	29	150	V	6570	-20.37	11.45	3.68	-28.14	-13	-15.14
6570	27	149	H	6570	-22.29	11.45	3.68	-30.06	-13	-17.06

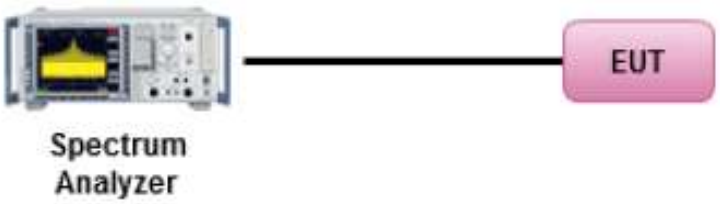
LTE band 13 Mid Channel, 10MHz BW, QPSK

Frequency MHz	Degree	Height	Pol	Frequency MHz	Level dBm	Antenna Gain dBi	Cable Loss dB	Absolute Level dBm	Limit	Margin
1502	30	150	V	1502	-20.42	9.57	1.78	-28.21	-13	-15.21
1502	25	153	H	1502	-22.73	9.57	1.78	-30.52	-13	-17.52
2253	29	150	V	2253	-20.28	9.66	2.07	-27.87	-13	-14.87
2253	27	149	H	2253	-22.36	9.66	2.07	-29.95	-13	-16.95

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 24.135(a),	-	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 was done by Shuo Zhang at RF test site.

Test Data for LTE Band 2 and Band 25:

Reference Frequency: 1960MHz

Voltage (%)	Power (VDC)	Temp. (°)	Frequency (kHz)	Frequency Error (Hz)	Deviation (ppm)
100%	56	20	1960000.018	18	0.009
100%		0	1960000.024	24	0.012
100%		10	1960000.020	20	0.010
100%		30	1960000.018	18	0.009
100%		40	1960000.034	34	0.017
115%	64.4	20	1960000.018	18	0.009
85%	47.6	20	1960000.018	18	0.009

Test Data for LTE Band 4 and Band 66:

Reference Frequency: 2132MHz

Voltage (%)	Power (VDC)	Temp. (°)	Frequency (KHz)	Frequency Error (Hz)	Deviation (ppm)
100%	56	20	2132000.016	16	0.008
100%		0	2132000.028	28	0.013
100%		10	2132000.020	20	0.009
100%		30	2132000.024	24	0.011
100%		40	2132000.020	20	0.009
115%	64.4	20	2132000.016	16	0.008
85%	47.6	20	2132000.016	16	0.008

Test Data for LTE Band 13:

Reference Frequency: 751MHz

Voltage (%)	Power (VDC)	Temp. (°)	Frequency (KHz)	Frequency Error (Hz)	Deviation (ppm)
100%	56	20	751000.020	20	0.027
100%		0	751000.028	28	0.037
100%		10	751000.020	20	0.027
100%		30	751000.028	28	0.037
100%		40	751000.028	28	0.037
115%	64.4	20	751000.016	16	0.021
85%	47.6	20	751000.016	16	0.021

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Cycle	Cal Due	In use
Radiated Emissions						
EMI Test Receiver	ESIB 40	100179	05/13/2017	1 Year	05/13/2018	☑
Bi-Log antenna (30MHz~2GHz)	JB1	A030702	08/15/2016	1 Year	08/15/2017	☑
Horn Antenna (1-18GHz)	3115	10SL0059	08/25/2016	1 Year	08/25/2017	☑
Horn Antenna (18-40 GHz)	AH-840	101013	08/28/2016	1 Year	08/28/2017	☑
Pre-Amplifier	LPA-6-30	11140711	02/19/2017	1 Year	02/19/2018	☑
Microwave Preamplifier (18-40 GHz)	PA-840	181251	02/19/2017	1 Year	02/19/2018	☑
10 Meters SAC	10M	N/A	09/05/2016	1 Year	09/05/2017	☑
RF Conducted Measurement						
Spectrum Analyzer	N9010A	MY51440112	08/20/2016	1 Year	08/20/2017	☑

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