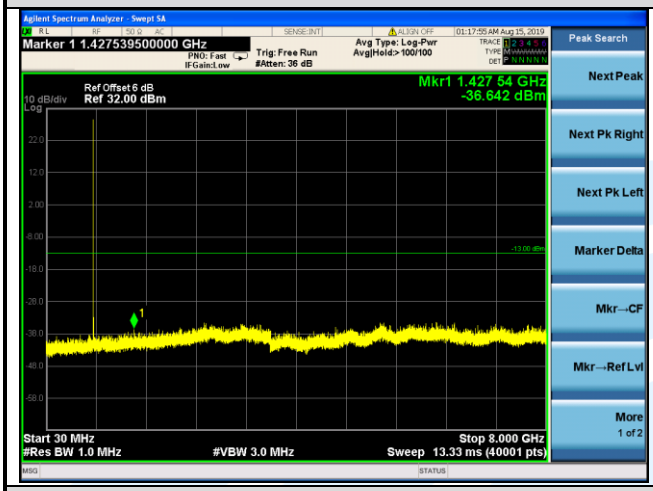
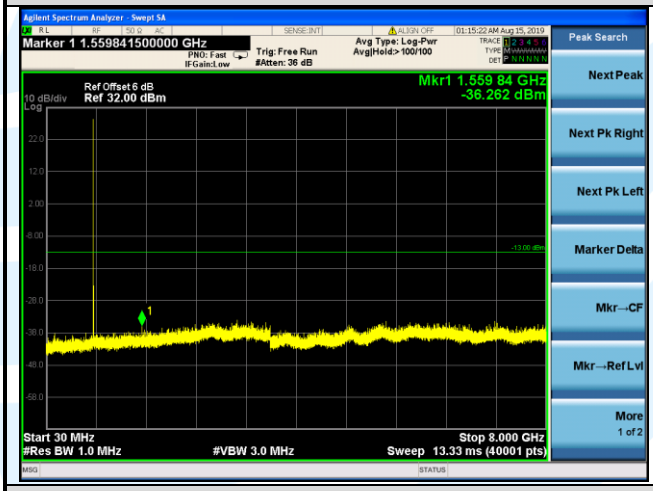
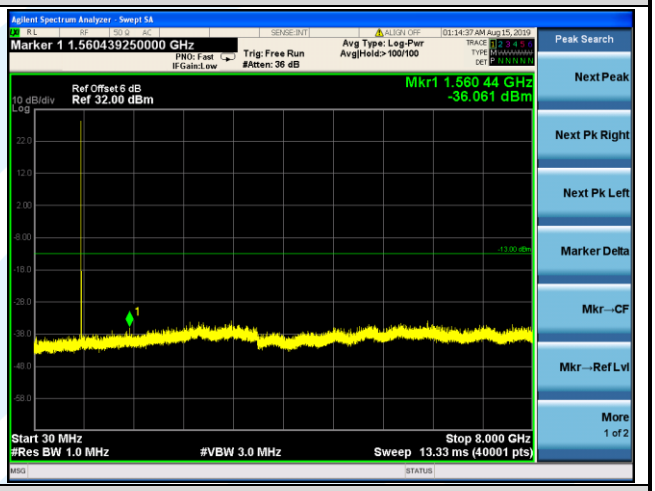
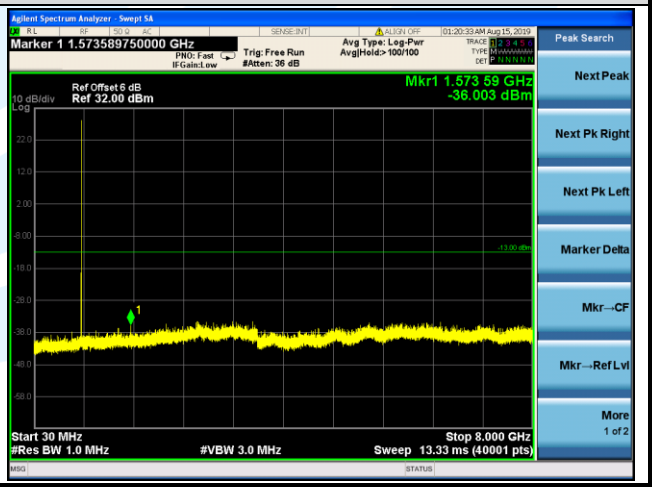
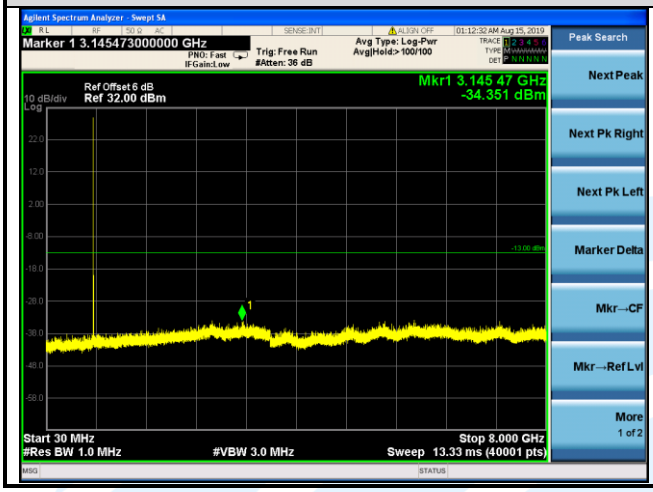
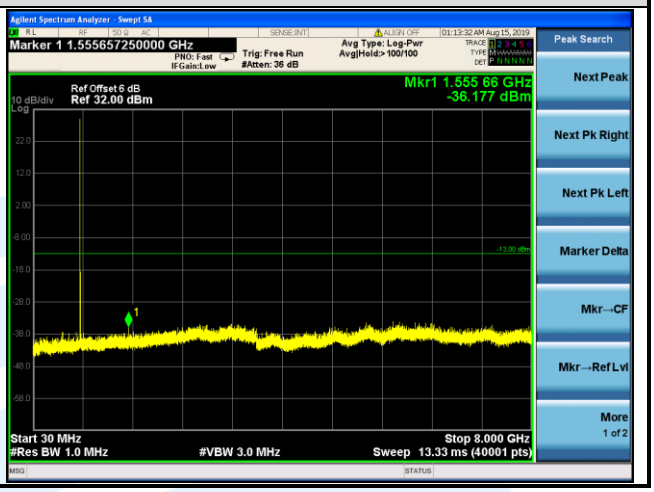
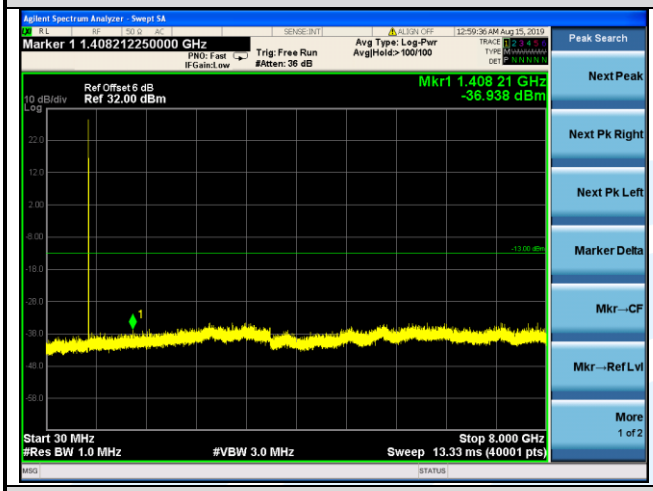
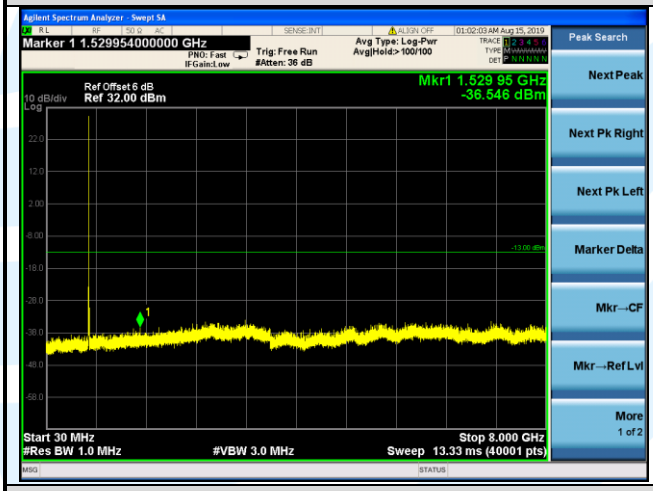
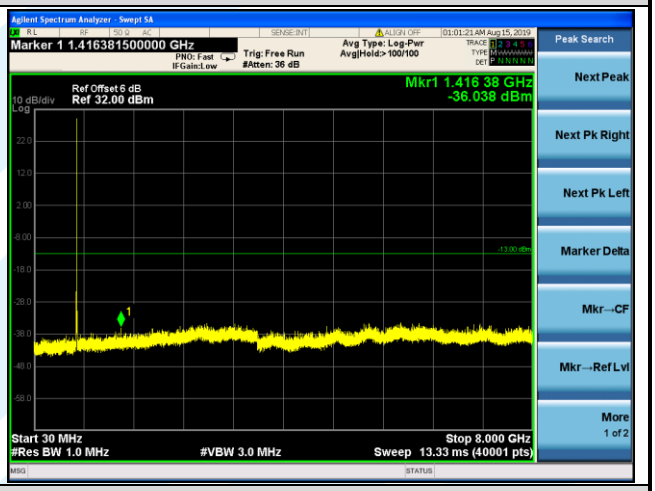
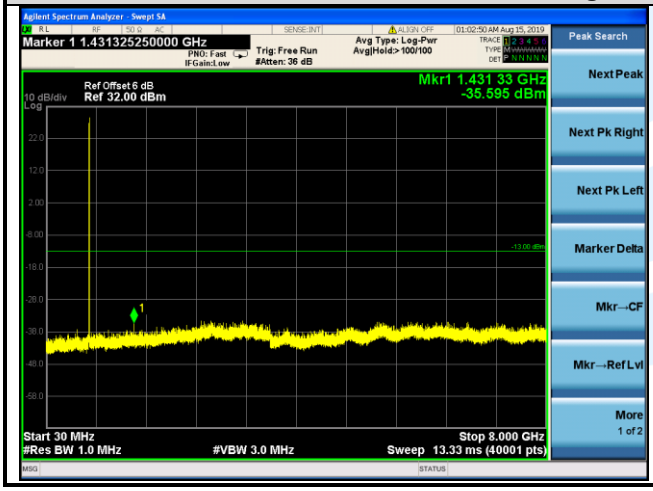
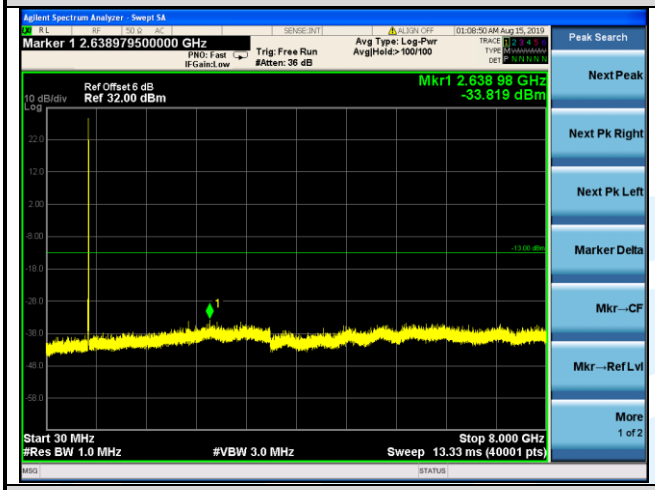
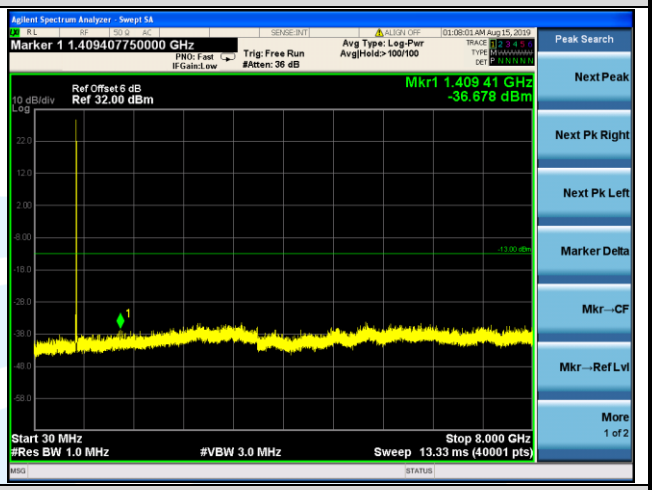
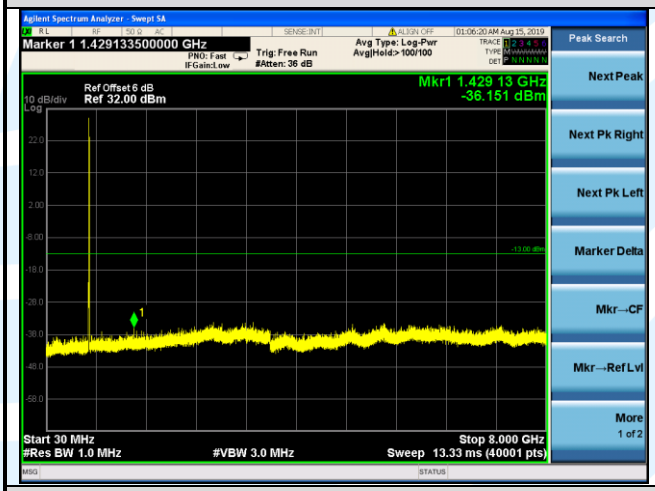
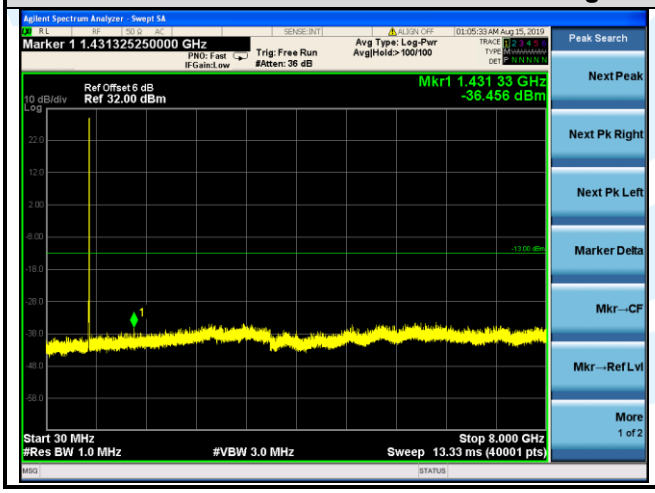
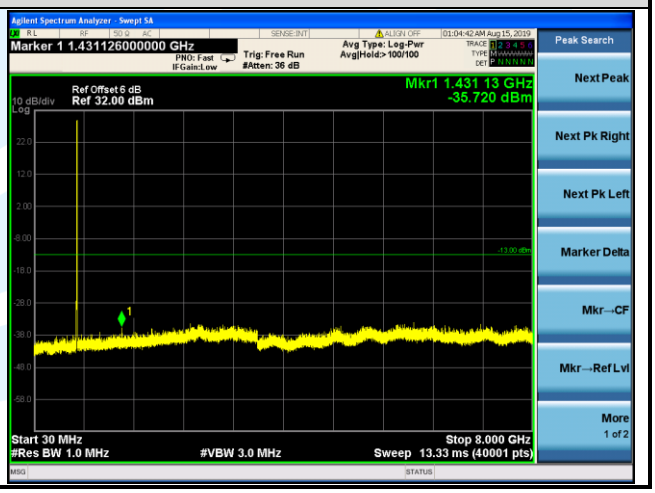
5.7.5 LTE Band 13

LTE Band 13_ Channel Bandwidth: 5 MHz	
QPSK	16QAM
Lowest Channel	
	
Middle Channel	
	
Highest Channel	
	

LTE Band 13_ Channel Bandwidth: 10 MHz	
QPSK	16QAM
Middle Channel	
	

5.7.6 LTE Band 17

LTE Band 17_ Channel Bandwidth: 5 MHz	
QPSK	16QAM
Lowest Channel	
	
Middle Channel	
	
Highest Channel	
	

LTE Band 17_ Channel Bandwidth: 10 MHz	
QPSK	16QAM
Lowest Channel	
	
Middle Channel	
	
Highest Channel	
	

5.8 FIELD STRENGTH OF SPURIOUS RADIATION

Test Requirement: **LTE Band 2:** FCC 47 CFR Part 24.238(a)
LTE Band 4: FCC 47 CFR Part 27.53(h)
LTE Band 5: FCC 47 CFR Part 22.917(a)
LTE Band 12&17: FCC 47 CFR Part 27.53(g)
LTE Band 13: FCC 47 CFR Part 27.53

Test Method: ANSI C63.26-2015 & KDB 971168 D01v03r01

Receiver Setup:

Frequency	Detector	RBW	VBW	Remark
0.009 MHz-30 MHz	Peak	10 kHz	30 KHz	Peak
30 MHz-1 GHz	Quasi-peak	100 kHz	300 KHz	Peak
Above 1 GHz	Peak	1 MHz	3 MHz	Peak

Limits:

FCC 47 CFR Part 24.238(a), 27.53(h)(1), 22.917(a), 27.53(g), 27.53(c)(2), 90.691:
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. The emission limit equal to -13 dBm.

FCC 47 CFR Part 27.53(m)(4):
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 55 + 10 log(P) dB. The emission limit equal to -25 dBm.

FCC 47 CFR Part 27.53:
(c) 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.
(f) Emissions in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals. (-70 dBW/MHz = -40dBm/MHz).

Test Setup: Refer to section 4.2.1 for details.

Test Procedures: KDB 971168 D01v03r01 Section 7

Equipment Used: Refer to section 3 for details.

Test Result: Pass

The measurement data as follows:

5.8.1 LTE Band 2

LTE Band 2_ 20 MHz_ QPSK							
No.	Frequency (MHz)	SA Reading (dBm)	Correction factor (dB/m)	EIRP Result (dBm)	Limit (dBm)	Margin (dB)	Ant. Pol.
Lowest Channel							
1	3720.000	-67.48	13.80	-53.68	-13.00	-40.68	Horizontal
2	5580.000	-70.09	15.98	-54.11	-13.00	-41.11	Horizontal
3	1589.152	46.09	-8.42	37.67	50.00	-12.33	Vertical
4	1589.152	66.09	-8.42	57.67	70.00	-12.33	Vertical
Middle Channel							
1	3760.000	-67.47	13.87	-53.60	-13.00	-40.60	Horizontal
2	5640.000	-70.51	16.10	-54.41	-13.00	-41.41	Horizontal
3	3760.000	-66.73	15.28	-51.45	-13.00	-38.45	Vertical
4	5640.000	-66.44	16.97	-49.47	-13.00	-36.47	Vertical
Highest Channel							
1	3800.000	-65.93	13.95	-51.98	-13.00	-38.98	Horizontal
2	5700.000	-66.62	16.28	-50.34	-13.00	-37.34	Horizontal
3	3760.000	-66.73	15.28	-51.45	-13.00	-38.45	Vertical
4	5640.000	-66.44	16.97	-49.47	-13.00	-36.47	Vertical

5.8.2 LTE Band 4

LTE Band 4_ 20 MHz_ QPSK							
No.	Frequency (MHz)	SA Reading (dBm)	Correction factor (dB/m)	EIRP Result (dBm)	Limit (dBm)	Margin (dB)	Ant. Pol.
Lowest Channel							
1	3440.000	-69.47	12.56	-56.91	-13.00	-43.91	Horizontal
2	5160.000	-69.27	16.14	-53.13	-13.00	-40.13	Horizontal
3	3440.000	-68.47	13.80	-54.67	-13.00	-41.67	Vertical
4	5160.000	-69.34	17.11	-52.23	-13.00	-39.23	Vertical
Middle Channel							
1	3465.000	-68.10	12.74	-55.36	-13.00	-42.36	Horizontal
2	5197.500	-71.18	16.21	-54.97	-13.00	-41.97	Horizontal
3	3465.000	-69.12	13.97	-55.15	-13.00	-42.15	Vertical
4	5197.500	-67.63	17.17	-50.46	-13.00	-37.46	Vertical
Highest Channel							
1	3490.000	-68.66	12.93	-55.73	-13.00	-42.73	Horizontal
2	5235.000	-71.52	16.20	-55.32	-13.00	-42.32	Horizontal
3	3490.000	-68.39	14.14	-54.25	-13.00	-41.25	Vertical
4	5235.000	-67.89	17.16	-50.73	-13.00	-37.73	Vertical

5.8.3 LTE Band 5

LTE Band 5_ 10 MHz_ QPSK							
No.	Frequency (MHz)	SA Reading (dBm)	Correction factor (dB/m)	EIRP Result (dBm)	Limit (dBm)	Margin (dB)	Ant. Pol.
Lowest Channel							
1	1658.000	-68.89	2.47	-66.42	-13.00	-53.42	Horizontal
2	2487.000	-68.93	9.16	-59.77	-13.00	-46.77	Horizontal
3	1658.000	-69.11	4.14	-64.97	-13.00	-51.97	Vertical
4	2487.000	-69.01	11.48	-57.53	-13.00	-44.53	Vertical
Middle Channel							
1	1673.000	-69.11	2.59	-66.52	-13.00	-53.52	Horizontal
2	2509.500	-68.26	9.17	-59.09	-13.00	-46.09	Horizontal
3	1673.000	-69.72	4.31	-65.41	-13.00	-52.41	Vertical
4	2509.500	-68.64	11.46	-57.18	-13.00	-44.18	Vertical
Highest Channel							
1	1688.000	-69.91	2.71	-67.20	-13.00	-54.20	Horizontal
2	2532.000	-68.61	9.21	-59.40	-13.00	-46.40	Horizontal
3	1688.000	-69.15	4.49	-64.66	-13.00	-51.66	Vertical
4	2532.000	-68.82	11.46	-57.36	-13.00	-44.36	Vertical

5.8.4 LTE Band 7

LTE Band 7_ 20 MHz_ QPSK							
No.	Frequency (MHz)	SA Reading (dBm)	Correction factor (dB/m)	EIRP Result (dBm)	Limit (dBm)	Margin (dB)	Ant. Pol.
Lowest Channel							
1	5020.000	-67.61	15.89	-51.72	-25.00	-26.72	Horizontal
2	7530.000	-65.51	19.08	-46.43	-25.00	-21.43	Horizontal
3	5020.000	-66.04	16.89	-49.15	-25.00	-24.15	Vertical
4	7530.000	-65.77	18.48	-47.29	-25.00	-22.29	Vertical
Middle Channel							
1	5070.000	-67.66	15.98	-51.68	-25.00	-26.68	Horizontal
2	7605.000	-65.95	19.09	-46.86	-25.00	-21.86	Horizontal
3	5070.000	-67.71	16.97	-50.74	-25.00	-25.74	Vertical
4	7605.000	-65.98	18.47	-47.51	-25.00	-22.51	Vertical
Highest Channel							
1	5120.000	-67.45	16.07	-51.38	-25.00	-26.38	Horizontal
2	7680.000	-64.96	19.10	-45.86	-25.00	-20.86	Horizontal
3	5070.000	-67.71	16.97	-50.74	-25.00	-25.74	Vertical
4	7605.000	-65.98	18.47	-47.51	-25.00	-22.51	Vertical

5.8.5 LTE Band 12

LTE Band 12_ 10 MHz_ QPSK							
No.	Frequency (MHz)	SA Reading (dBm)	Correction factor (dB/m)	EIRP Result (dBm)	Limit (dBm)	Margin (dB)	Ant. Pol.
Lowest Channel							
1	1408.000	-65.50	0.94	-64.56	-13.00	-51.56	Horizontal
2	2112.000	-67.56	5.78	-61.78	-13.00	-48.78	Horizontal
3	5070.000	-67.71	16.97	-50.74	-25.00	-25.74	Vertical
4	7605.000	-65.98	18.47	-47.51	-25.00	-22.51	Vertical
Middle Channel							
1	1415.000	-67.18	0.96	-66.22	-13.00	-53.22	Horizontal
2	2122.500	-68.47	5.83	-62.64	-13.00	-49.64	Horizontal
3	1415.000	-67.82	1.99	-65.83	-13.00	-52.83	Vertical
4	2122.500	-69.00	8.58	-60.42	-13.00	-47.42	Vertical
Highest Channel							
1	1422.000	-67.98	0.99	-66.99	-13.00	-53.99	Horizontal
2	2133.000	-69.61	5.89	-63.72	-13.00	-50.72	Horizontal
3	1422.000	-65.90	2.02	-63.88	-13.00	-50.88	Vertical
4	2133.000	-68.43	8.63	-59.80	-13.00	-46.80	Vertical

5.8.6 LTE Band 13

LTE Band 13_ 5 MHz_ QPSK							
No.	Frequency (MHz)	SA Reading (dBm)	Correction factor (dB/m)	EIRP Result (dBm)	Limit (dBm)	Margin (dB)	Ant. Pol.
Lowest Channel							
1	1559.000	-69.19	1.69	-67.50	-13.00	-54.50	Horizontal
2	2338.500	-68.60	8.25	-60.35	-13.00	-47.35	Horizontal
3	1559.000	-67.45	3.00	-64.45	-13.00	-51.45	Vertical
4	2338.500	-67.12	10.74	-56.38	-13.00	-43.38	Vertical
Middle Channel							
1	1564.000	-69.16	1.74	-67.42	-13.00	-54.42	Horizontal
2	2346.000	-67.94	8.36	-59.58	-13.00	-46.58	Horizontal
3	1564.000	-68.45	3.07	-65.38	-13.00	-52.38	Vertical
4	2346.000	-68.75	10.84	-57.91	-13.00	-44.91	Vertical
Highest Channel							
1	1569.000	-67.28	1.77	-65.51	-13.00	-52.51	Horizontal
2	2353.500	-68.13	8.46	-59.67	-13.00	-46.67	Horizontal
3	1569.000	-68.66	3.12	-65.54	-13.00	-52.54	Vertical
4	2353.500	-67.55	10.94	-56.61	-13.00	-43.61	Vertical

5.8.7 LTE Band 17

LTE Band 17_ 10 MHz_ QPSK							
No.	Frequency (MHz)	SA Reading (dBm)	Correction factor (dB/m)	EIRP Result (dBm)	Limit (dBm)	Margin (dB)	Ant. Pol.
Lowest Channel							
1	1418.000	-63.40	0.94	-62.46	-13.00	-49.46	Horizontal
2	2127.000	-67.23	5.78	-61.45	-13.00	-48.45	Horizontal
3	1418.000	-67.34	3.12	-64.22	-13.00	-51.22	Vertical
4	2127.000	-65.45	10.94	-54.51	-13.00	-41.51	Vertical
Middle Channel							
1	1420.000	-66.28	0.96	-65.32	-13.00	-52.32	Horizontal
2	2130.000	-67.54	5.83	-61.71	-13.00	-48.71	Horizontal
3	1420.000	-66.65	1.99	-64.66	-13.00	-51.66	Vertical
4	2130.000	-68.43	8.58	-59.85	-13.00	-46.85	Vertical
Highest Channel							
1	1422.000	-66.43	0.99	-65.44	-13.00	-52.44	Horizontal
2	2133.000	-68.42	5.89	-62.53	-13.00	-49.53	Horizontal
3	1422.000	-64.60	2.02	-62.58	-13.00	1422.000	Vertical
4	2133.000	-67.63	8.63	-59.00	-13.00	2133.000	Vertical

Remark:

1. Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain, the value was added to Original Receiver Reading by the software automatically.
2. Result = Reading + Correct Factor.
3. Margin = Result – Limit
4. Below 1GHz radiated emission margin more than 20dB.

5.9 FREQUENCY STABILITY

Test Requirement: FCC 47 CFR Part 2.1055 & FCC 47 CFR Part 22.355 & FCC 47 CFR Part 24.235 & FCC 47 CFR Part 27.54,

Test Method: ANSI C63.26-2015 & KDB 971168 D01v03r01

Limits:

FCC 47 CFR Part 22.355, FCC 47 CFR Par 90.213

The carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations.

FCC 47 CFR Part 24.235, FCC 47 CFR Part 27.54

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Test Setup: Refer to section 4.2.2 for details.

Test Procedures:

1) Use CMW 500 or CMU 200 with Frequency Error measurement capability.
   a) Temp. = −30° to + 50°C
   b) Voltage =low voltage, 3.5 Vdc, Normal, 3.7 Vdc and High voltage, 4.25 Vdc.
2) Frequency Stability vs Temperature:

The EUT is place inside a temperature chamber. The temperature is set to 20ºC and allowed to stabilize. After sufficient soak time, the transmitting frequency error is measured. The temperature is increased by 10 degrees, allowed to stabilize and soak, and then the measurement is repeated. This is repeated until +50ºC is reached.

3) Frequency Stability vs Voltage:

The peak frequency error is recorded (worst-case).

Equipment Used: Refer to section 3 for details.

Test Result: Pass

5.9.1 LTE Band 2

Modulation	Channel/ Frequency (MHz)	Voltage (Vdc)	Temperature (℃)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Pass/ Fail
LTE Band 2 / 20MHz / Full RB							
QPSK	18900 / 1880.0	VL	TN	17	0.0090	N/A	Pass
		VN		14	0.0074		Pass
		VH		12	0.0064		Pass
		VN	50	24	0.0128		Pass
			40	22	0.0117		Pass
			30	16	0.0085		Pass
			20	14	0.0074		Pass
			10	14	0.0074		Pass
			0	16	0.0085		Pass
			-10	20	0.0106		Pass
			-20	22	0.0117		Pass
			-30	26	0.0138		Pass

5.9.2 LTE Band 4

Modulation	Channel/ Frequency (MHz)	Voltage (Vdc)	Temperature (℃)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Pass/ Fail
LTE Band 4 / 20MHz / Full RB							
QPSK	20175 / 1732.5	VL	TN	12	0.0069	N/A	Pass
		VN		11	0.0063		Pass
		VH		13	0.0075		Pass
		VN	50	21	0.0121		Pass
			40	18	0.0104		Pass
			30	16	0.0092		Pass
			20	16	0.0092		Pass
			10	17	0.0098		Pass
			0	16	0.0092		Pass
			-10	20	0.0115		Pass
			-20	23	0.0133		Pass
			-30	25	0.0144		Pass

5.9.3 LTE Band 5

Modulation	Channel/ Frequency (MHz)	Voltage (Vdc)	Temperature (℃)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Result
LTE Band 5 / 10MHz / Full RB							
QPSK	20525 / 836.5	VL	TN	-27	-0.0323	± 2.5	Pass
		VN		-25	-0.0299	± 2.5	Pass
		VH		-26	-0.0311	± 2.5	Pass
		VN	50	-26	-0.0311	± 2.5	Pass
			40	-23	-0.0275	± 2.5	Pass
			30	-20	-0.0239	± 2.5	Pass
			20	-20	-0.0239	± 2.5	Pass
			10	-18	-0.0215	± 2.5	Pass
			0	-14	-0.0167	± 2.5	Pass
			-10	-16	-0.0191	± 2.5	Pass
			-20	-18	-0.0215	± 2.5	Pass
			-30	-14	-0.0167	± 2.5	Pass

5.9.4 LTE Band 12

Modulation	Channel/ Frequency (MHz)	Voltage (Vdc)	Temperature (℃)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Result
LTE Band 12 / 10MHz / Full RB							
QPSK	23095 / 707.5	VL	TN	-10	-0.0141	N/A	Pass
		VN		-13	-0.0184		Pass
		VH		-12	-0.0170		Pass
		VN	50	-14	-0.0198		Pass
			40	-12	-0.0170		Pass
			30	-13	-0.0184		Pass
			20	-10	-0.0141		Pass
			10	-12	-0.0170		Pass
			0	-17	-0.0240		Pass
			-10	-16	-0.0226		Pass
			-20	-13	-0.0184		Pass
			-30	-17	-0.0240		Pass

5.9.5 LTE Band 13

Modulation	Channel/ Frequency (MHz)	Voltage (Vdc)	Temperature (℃)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Result
LTE Band 13 / 10MHz / Full RB							
QPSK	23230 / 782	VL	TN	-18	-0.0230	N/A	Pass
		VN		-16	-0.0205		Pass
		VH		-20	-0.0256		Pass
		VN	50	-22	-0.0281		Pass
			40	-20	-0.0256		Pass
			30	-11	-0.0141		Pass
			20	-10	-0.0128		Pass
			10	-12	-0.0153		Pass
			0	-14	-0.0179		Pass
			-10	-16	-0.0205		Pass
			-20	-16	-0.0205		Pass
			-30	-10	-0.0128		Pass

5.9.6 LTE Band 17

Modulation	Channel/ Frequency (MHz)	Voltage (Vdc)	Temperature (℃)	Deviation (Hz)	Deviation (ppm)	Limit (ppm)	Result
LTE Band 17 / 10MHz / Full RB							
QPSK	26340 / 1880.0	VL	TN	23	0.0122	N/A	Pass
		VN		20	0.0106		Pass
		VH		18	0.0096		Pass
		VN	50	22	0.0117		Pass
			40	20	0.0106		Pass
			30	18	0.0096		Pass
			20	18	0.0096		Pass
			10	16	0.0085		Pass
			0	14	0.0074		Pass
			-10	13	0.0069		Pass
			-20	14	0.0074		Pass
			-30	16	0.0085		Pass

APPENDIX 1 PHOTOS OF TEST SETUP

See test photos attached in Appendix 1 for the actual connections between Product and support equipment.

APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photos.

*** End of Report ***

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