

Test Plots

6 dB Bandwidth

GFSK (BLE 1Mbps) LOW CHANNEL



GFSK (BLE 1Mbps) MIDDLE CHANNEL



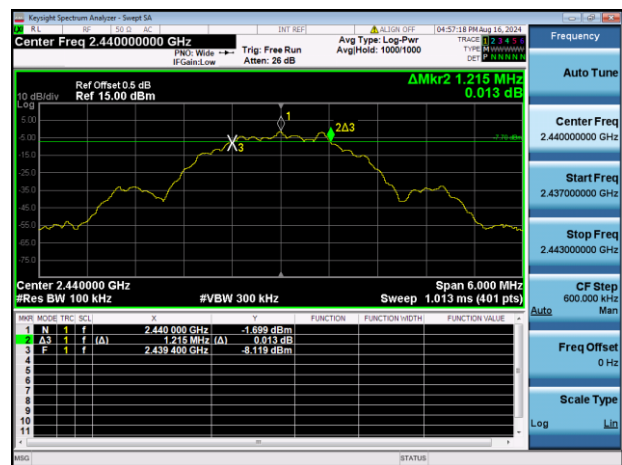
GFSK (BLE 1Mbps) HIGH CHANNEL



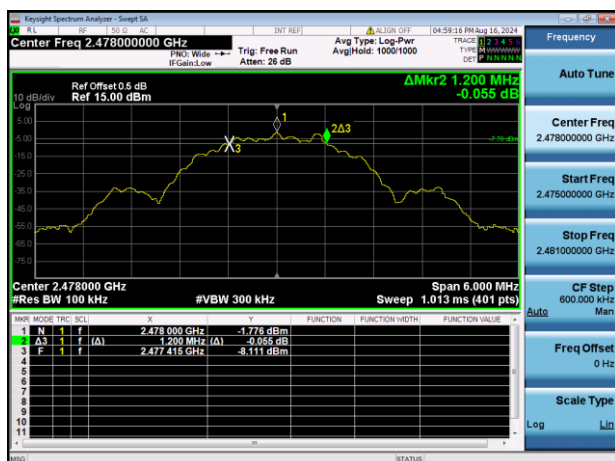
GFSK (BLE 2Mbps) LOW CHANNEL



GFSK (BLE 2Mbps) MIDDLE CHANNEL

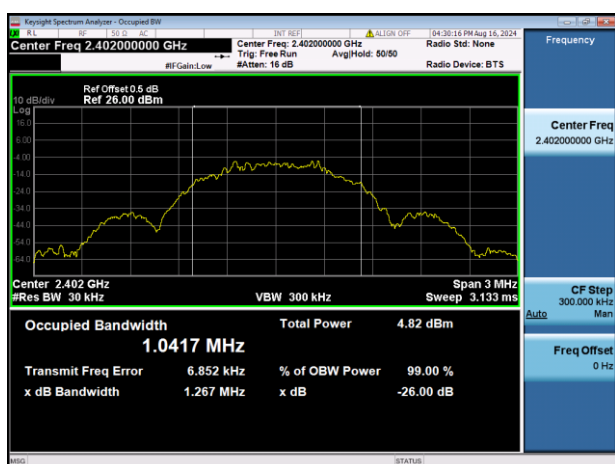


GFSK (BLE 2Mbps) HIGH CHANNEL



99% Bandwidth

GFSK (BLE 1Mbps) LOW CHANNEL



GFSK (BLE 1Mbps) MIDDLE CHANNEL



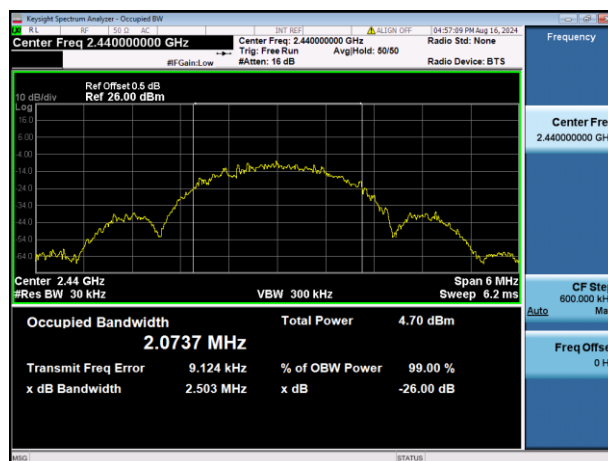
GFSK (BLE 1Mbps) HIGH CHANNEL



GFSK (BLE 2Mbps) LOW CHANNEL



GFSK (BLE 2Mbps) MIDDLE CHANNEL



GFSK (BLE 2Mbps) HIGH CHANNEL



A.3 Conducted Spurious Emissions

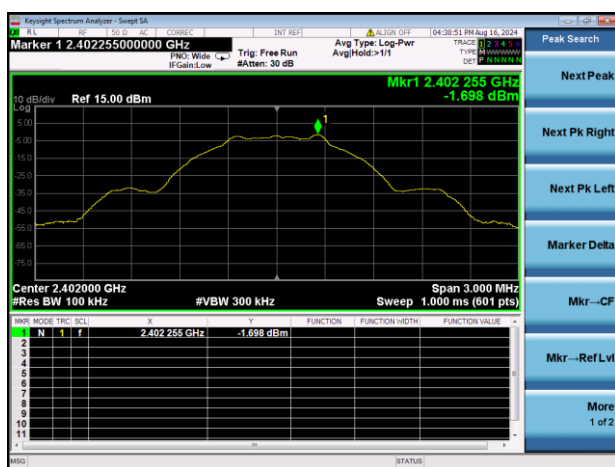
Test Data

GFSK (BLE 1Mbps)				
Channel	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low	-48.36	-1.70	-21.70	Pass
Middle	-47.38	-1.11	-21.11	Pass
High	-48.40	-1.18	-21.18	Pass

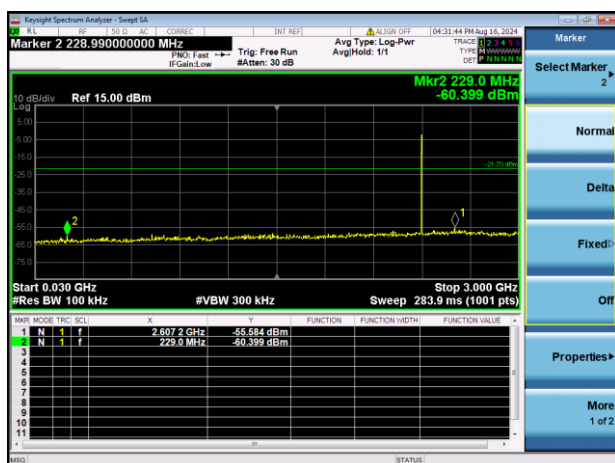
GFSK (BLE 2Mbps)				
Channel	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low	-48.18	-2.30	-22.30	Pass
Middle	-47.40	-1.74	-21.74	Pass
High	-48.47	-1.78	-21.78	Pass

Test Plots

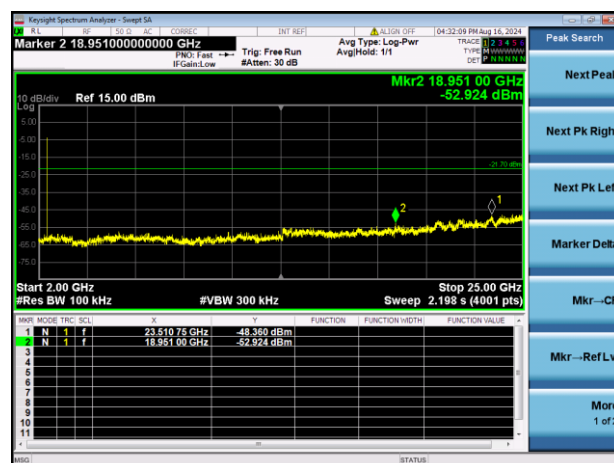
GFSK (BLE 1Mbps) LOW CHANNEL, CARRIER LEVEL



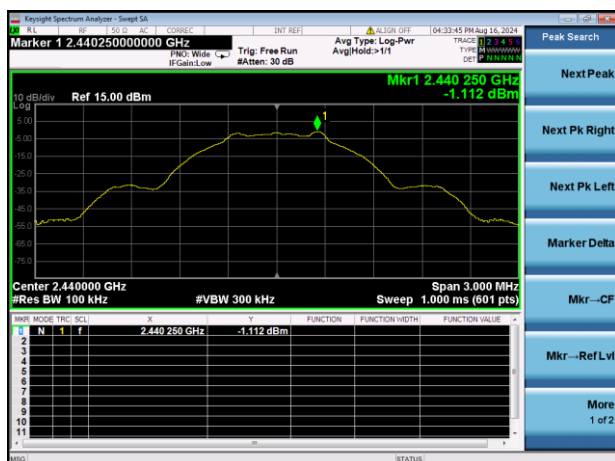
GFSK (BLE 1Mbps) LOW CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



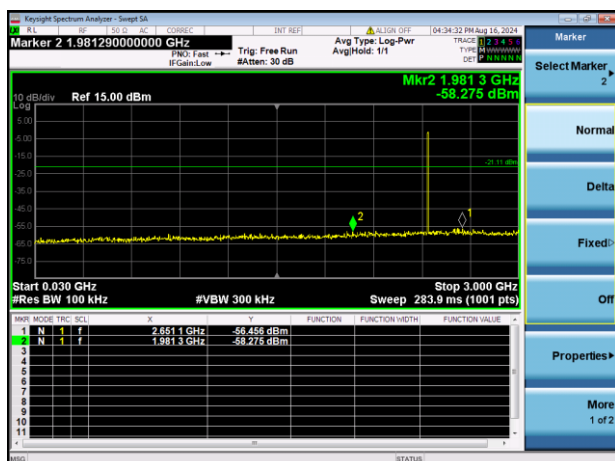
GFSK (BLE 1Mbps) LOW CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



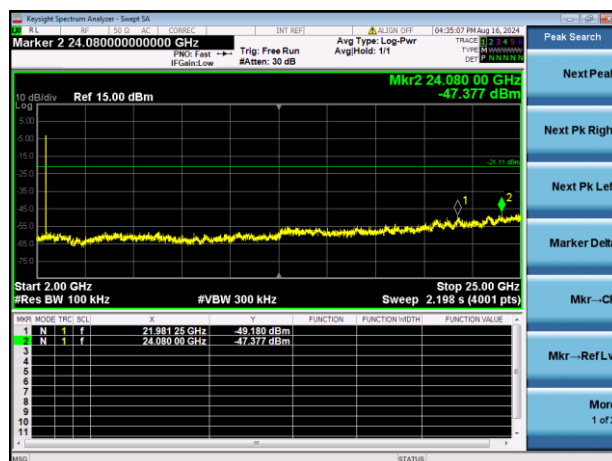
GFSK (BLE 1Mbps) MIDDLE CHANNEL, CARRIER LEVEL



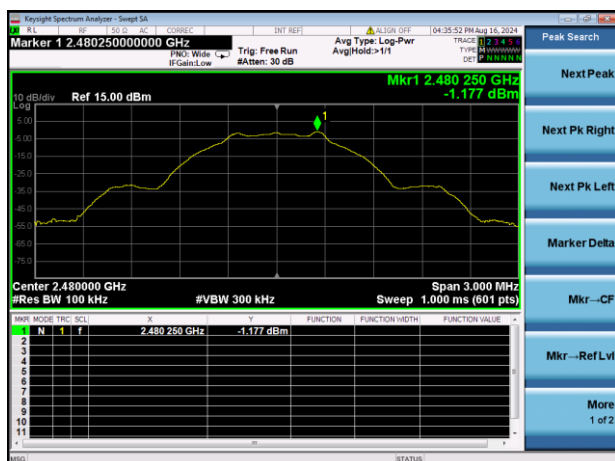
GFSK (BLE 1Mbps) MIDDLE CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



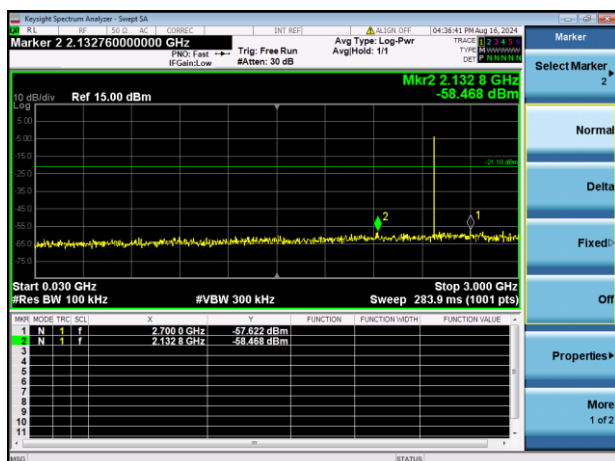
GFSK (BLE 1Mbps) MIDDLE CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



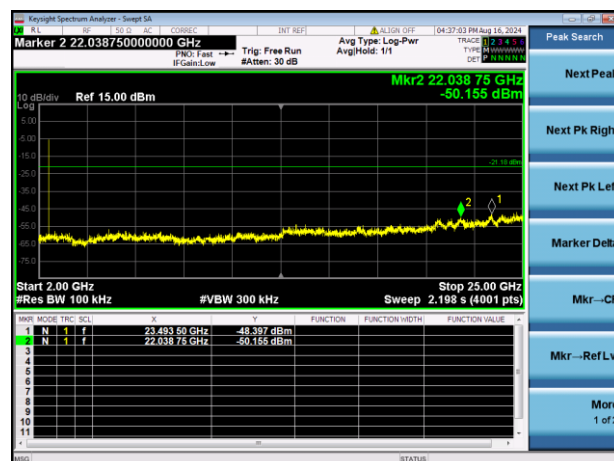
GFSK (BLE 1Mbps) HIGH CHANNEL, CARRIER LEVEL



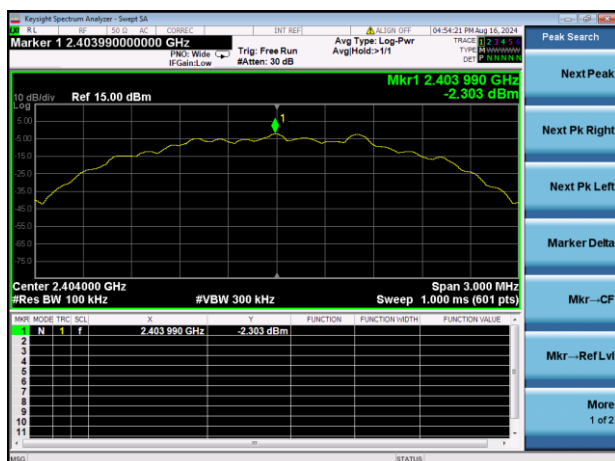
GFSK (BLE 1Mbps) HIGH CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



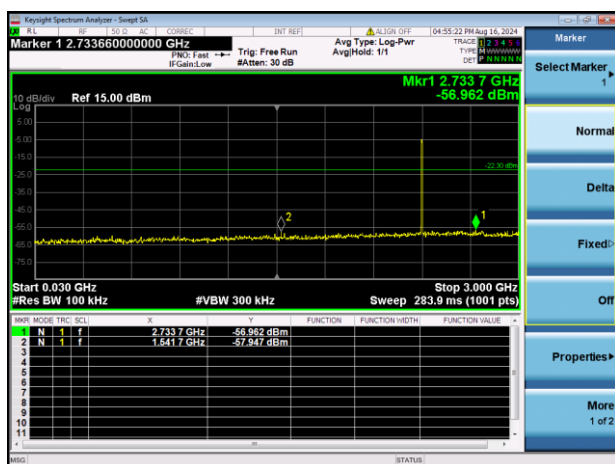
GFSK (BLE 1Mbps) HIGH CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



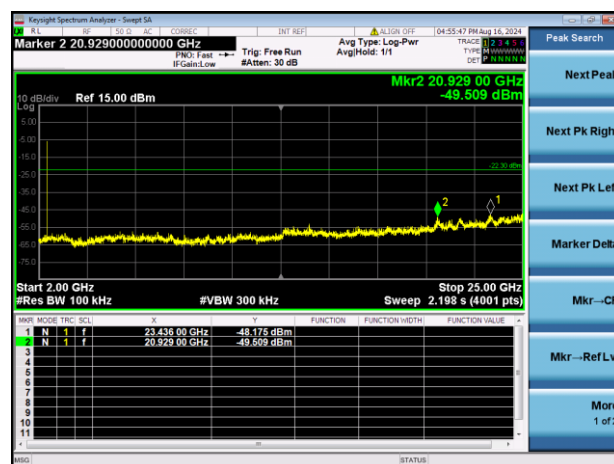
GFSK (BLE 2Mbps) LOW CHANNEL, CARRIER LEVEL



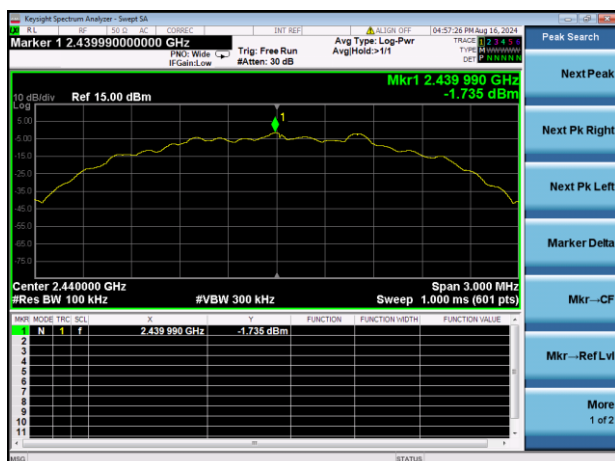
GFSK (BLE 2Mbps) LOW CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



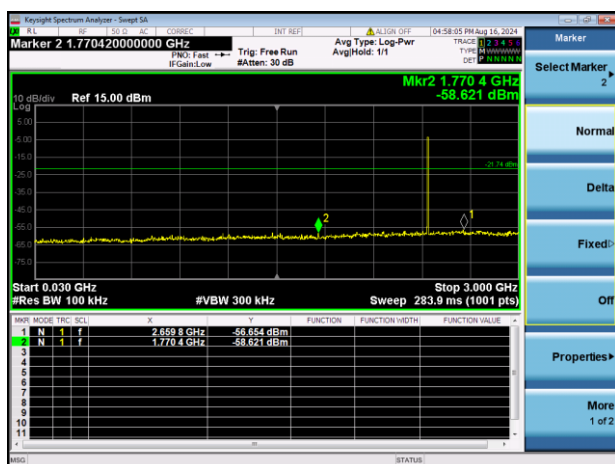
GFSK (BLE 2Mbps) LOW CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



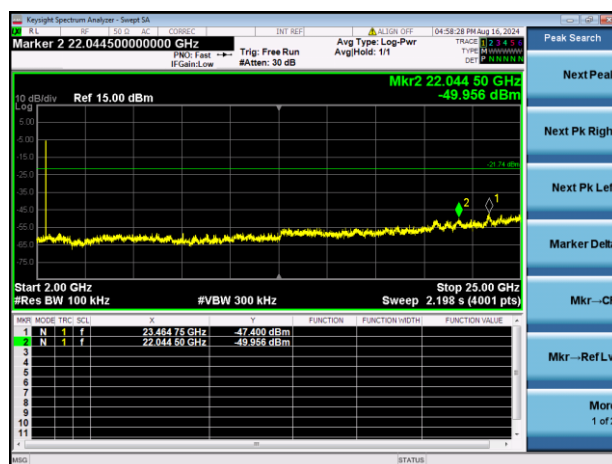
GFSK (BLE 2Mbps) MIDDLE CHANNEL, CARRIER LEVEL



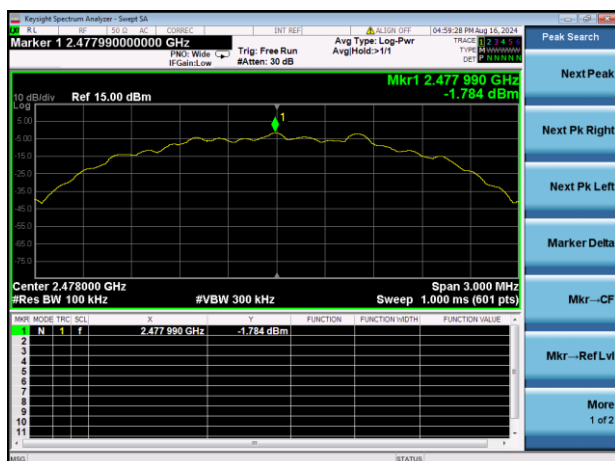
GFSK (BLE 2Mbps) MIDDLE CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



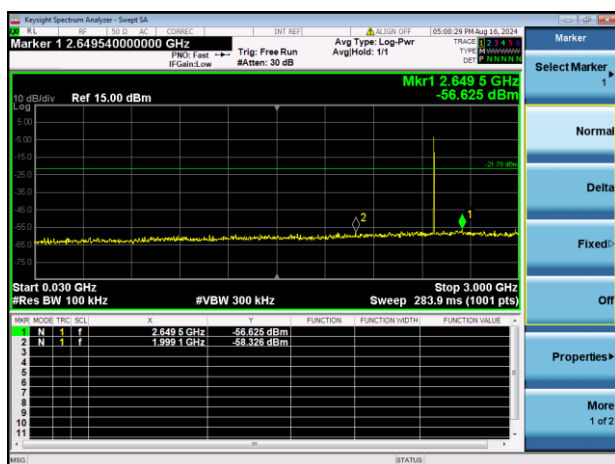
GFSK (BLE 2Mbps) MIDDLE CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



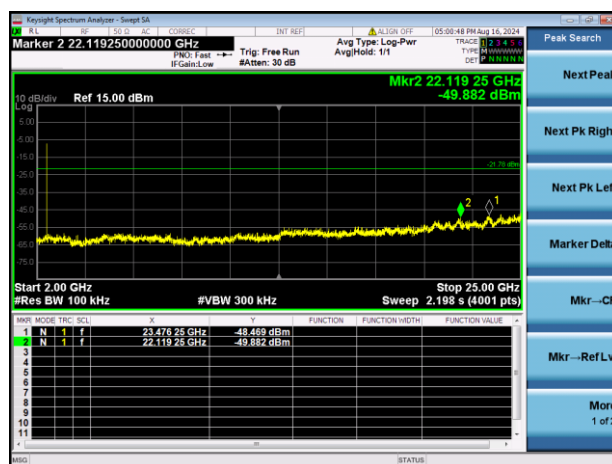
GFSK (BLE 2Mbps) HIGH CHANNEL, CARRIER LEVEL



GFSK (BLE 2Mbps) HIGH CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



GFSK (BLE 2Mbps) HIGH CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



A.4 Band Edge (Authorized-band band-edge)

Note: The lowest and highest channels are tested to verify the band edge emissions. Please refer to the following the plots for emissions values.

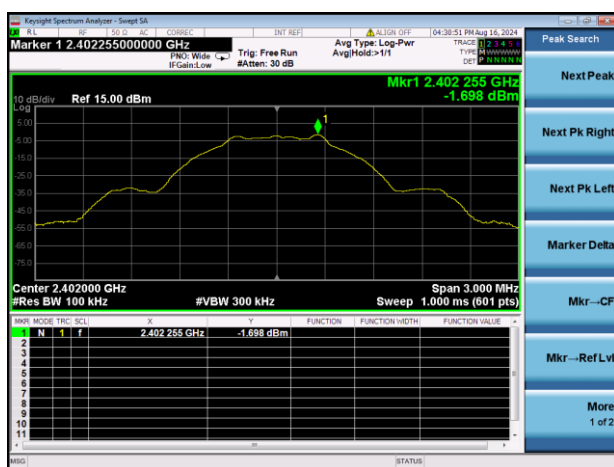
Test Data

GFSK (BLE 1Mbps)				
Channel	Measured Max. Band Edge Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low Channel	-58.05	-1.70	-21.70	Pass
High Channel	-57.55	-1.18	-21.18	Pass

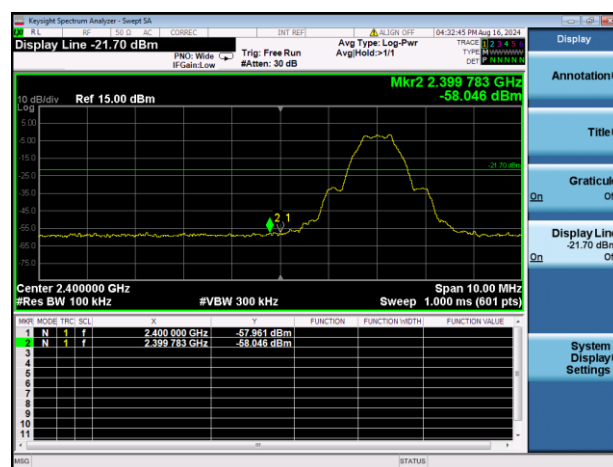
GFSK (BLE 2Mbps)				
Channel	Measured Max. Band Edge Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low Channel	-58.88	-2.30	-22.30	Pass
High Channel	-57.91	-1.78	-21.78	Pass

Test Plots

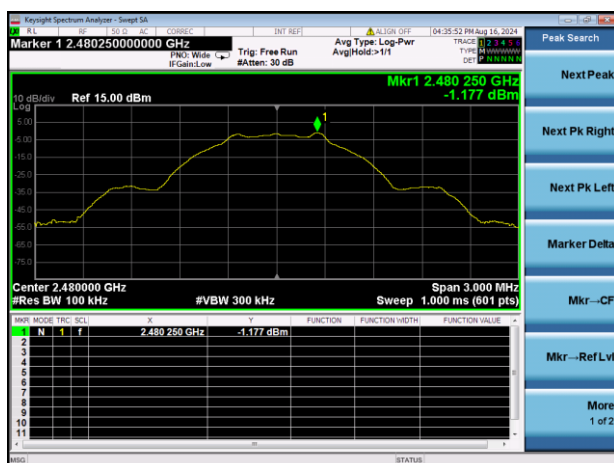
GFSK (BLE 1Mbps) LOW CHANNEL, CARRIER LEVEL



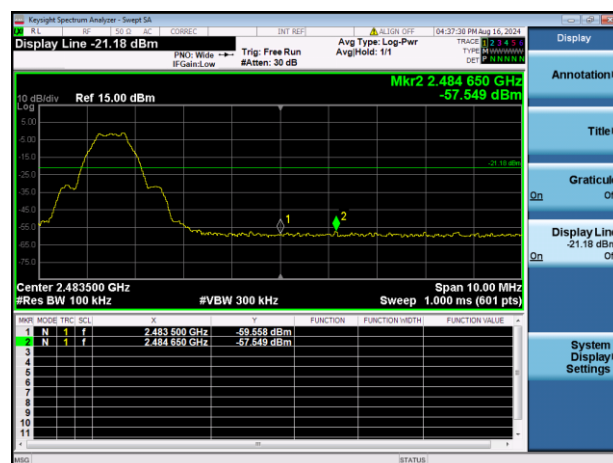
GFSK (BLE 1Mbps) LOW CHANNEL, BAND EDGE



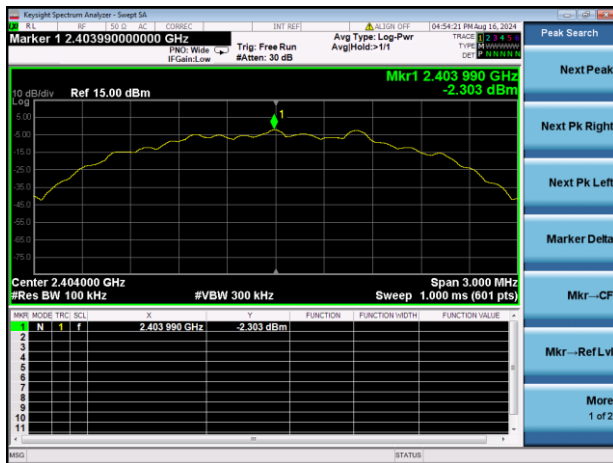
GFSK (BLE 1Mbps) HIGH CHANNEL, CARRIER LEVEL



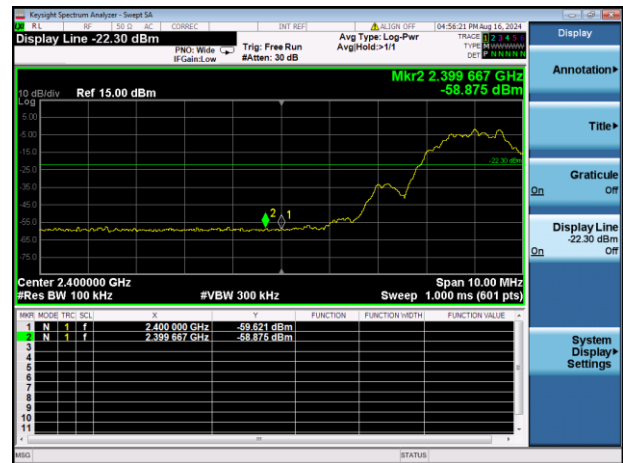
GFSK (BLE 1Mbps) HIGH CHANNEL, BAND EDGE



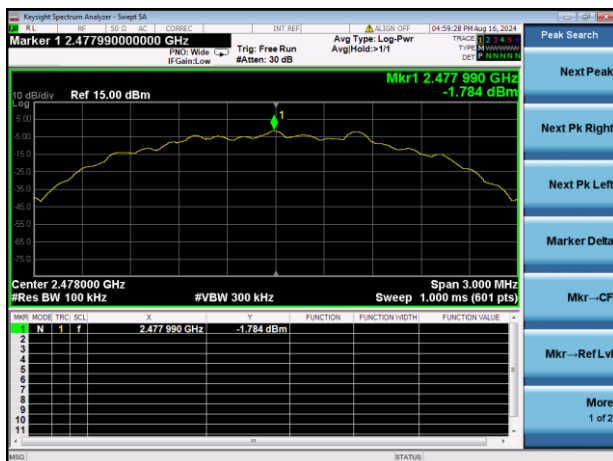
GFSK (BLE 2Mbps) LOW CHANNEL, CARRIER LEVEL



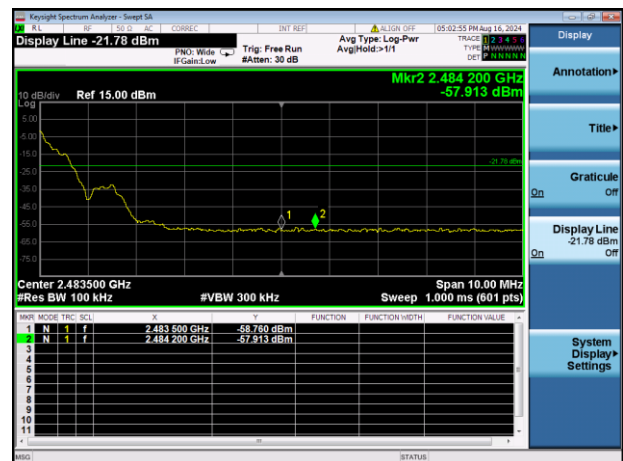
GFSK (BLE 2Mbps) LOW CHANNEL, BAND EDGE



GFSK (BLE 2Mbps) HIGH CHANNEL, CARRIER LEVEL



GFSK (BLE 2Mbps) HIGH CHANNEL, BAND EDGE



A.5 Conducted Emissions

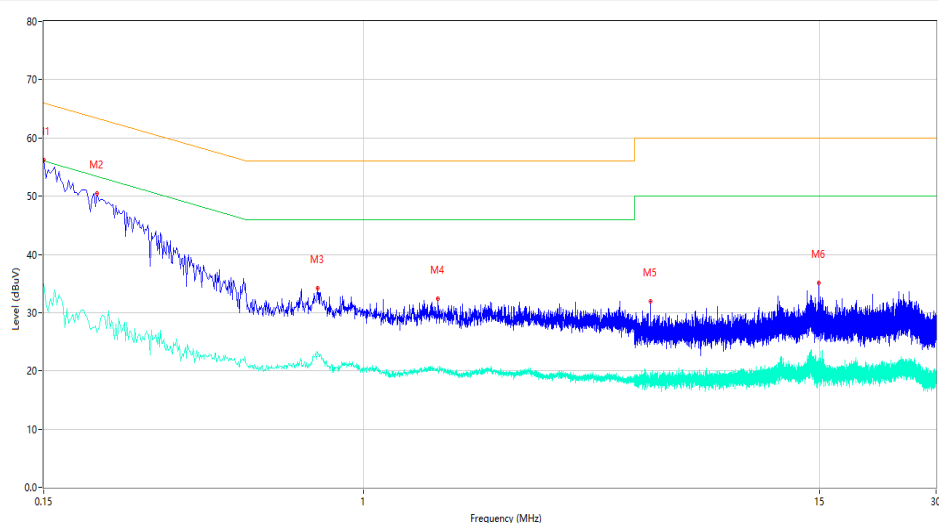
Note ¹: The EUT is working in the Normal link mode.

Note ²: Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a nominal 120 VAC, 60 Hz and 240 VAC, 50 Hz) for which the device is capable of operation. So, The configuration 120 VAC, 60 Hz and 240 VAC, 50 Hz were tested respectively, but only the worst configuration (120 VAC, 60 Hz) shown here.

Note ³: Results (dBuV) = Original reading level of Spectrum Analyzer (dBuV) + Factor (dB)

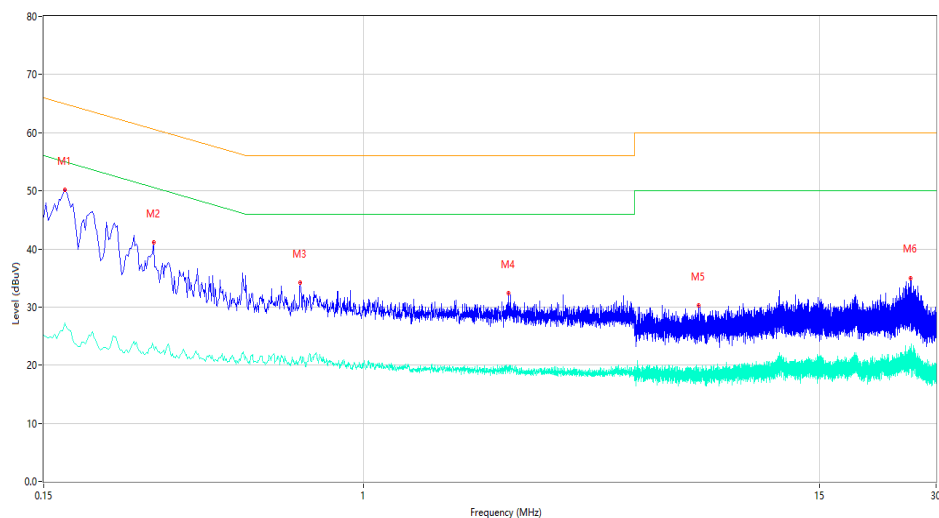
Test Data and Plots

PHASE L



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.150	56.24	9.75	66.00	9.76	Peak	L	Pass
1**	0.150	34.99	9.75	56.00	21.01	AV	L	Pass
2	0.206	50.51	9.75	63.37	12.86	Peak	L	Pass
2**	0.206	26.48	9.75	53.37	26.89	AV	L	Pass
3	0.764	34.17	9.72	56.00	21.83	Peak	L	Pass
3**	0.764	23.27	9.72	46.00	22.73	AV	L	Pass
4	1.560	32.37	9.69	56.00	23.63	Peak	L	Pass
4**	1.560	20.58	9.69	46.00	25.42	AV	L	Pass
5	5.498	31.98	9.62	60.00	28.02	Peak	L	Pass
5**	5.498	19.13	9.62	50.00	30.87	AV	L	Pass
6	14.972	35.07	9.26	60.00	24.93	Peak	L	Pass
6**	14.972	22.07	9.26	50.00	27.93	AV	L	Pass

PHASE N



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.170	50.11	9.75	64.96	14.85	Peak	N	Pass
1**	0.170	27.32	9.75	54.96	27.64	AV	N	Pass
2	0.288	41.09	9.74	60.58	19.49	Peak	N	Pass
2**	0.288	23.21	9.74	50.58	27.37	AV	N	Pass
3	0.688	34.16	9.72	56.00	21.84	Peak	N	Pass
3**	0.688	21.19	9.72	46.00	24.81	AV	N	Pass
4	2.364	32.34	9.68	56.00	23.66	Peak	N	Pass
4**	2.364	19.63	9.68	46.00	26.37	AV	N	Pass
5	7.336	30.24	9.56	60.00	29.76	Peak	N	Pass
5**	7.336	18.28	9.56	50.00	31.72	AV	N	Pass
6	25.794	34.88	8.82	60.00	25.12	Peak	N	Pass
6**	25.794	22.50	8.82	50.00	27.50	AV	N	Pass

A.6 Radiated Spurious Emission

Note ¹: The symbol of “--” in the table which means not application.

Note ²: For the test data above 1 GHz, according the ANSI C63.4-2014, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

Note ³: The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

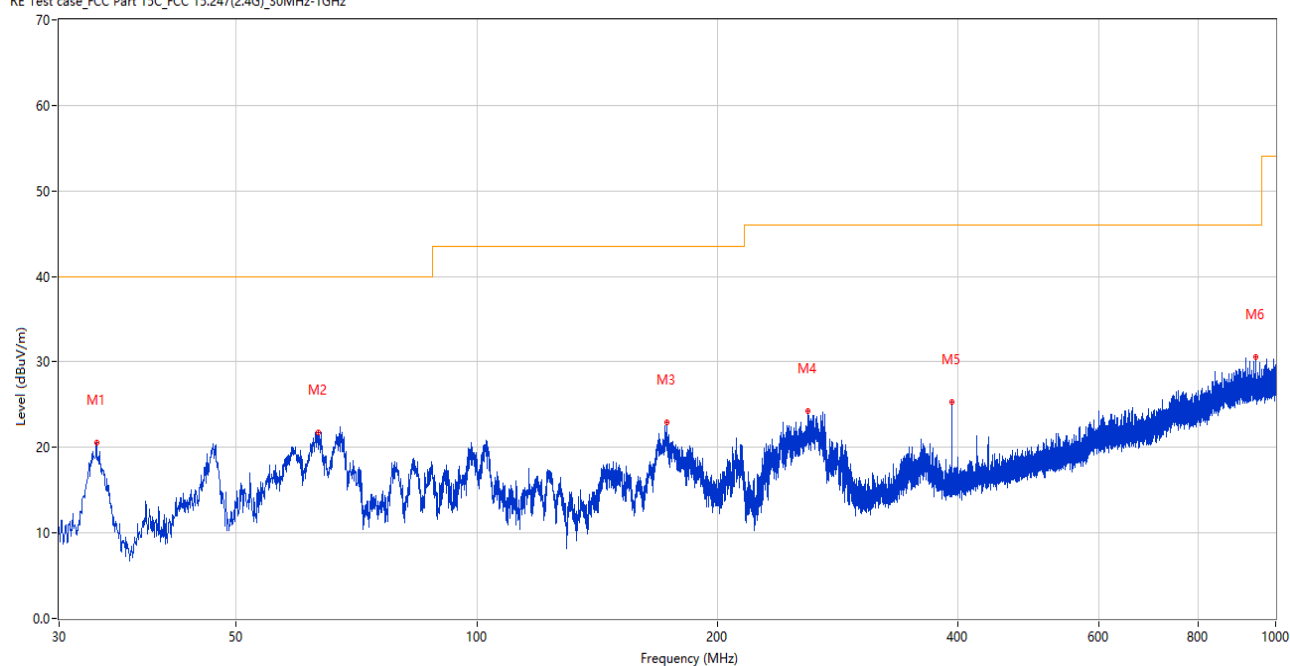
Note ⁴: The EUT is working in the Normal link mode below 1 GHz. All modes have been tested and BLE 1M-High channel mode is the worst.

Note ⁵: Results (dBuV/m) = Original reading level of Spectrum Analyzer (dBuV/m) + Factor (dB)

Test Data and Plots

30 MHz to 1 GHz, ANT H

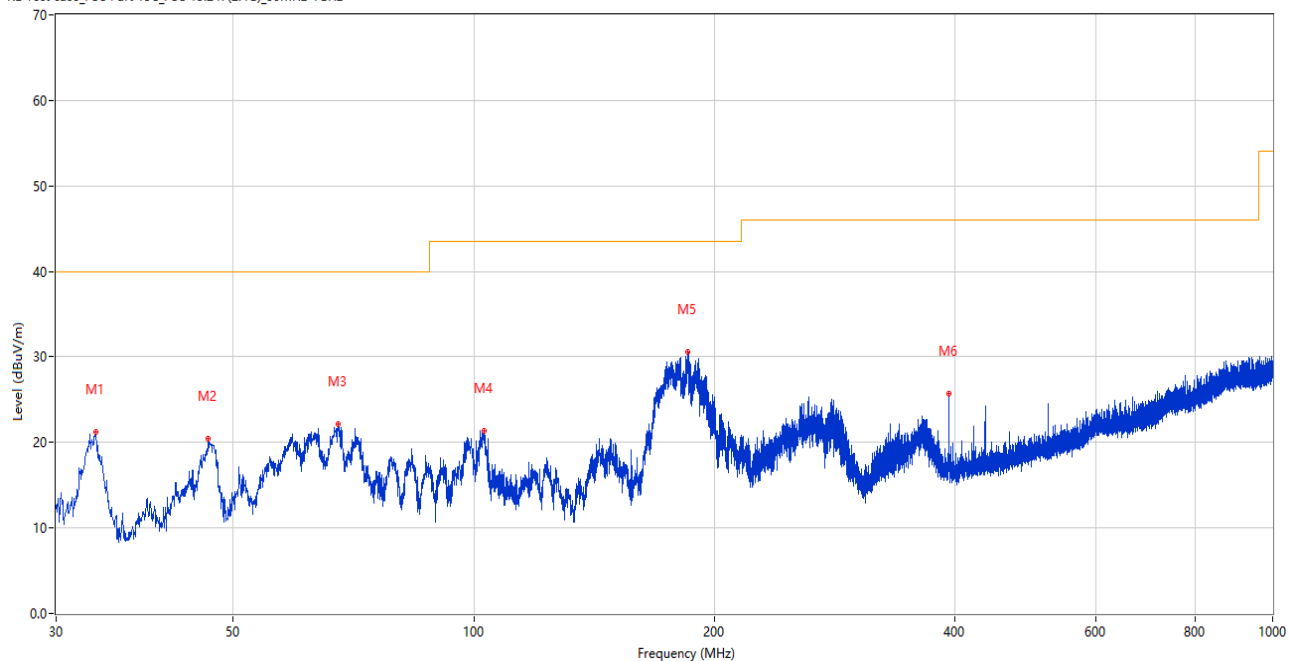
RE Test case_FCC Part 15C_FCC 15.247(2.4G)_30MHz-1GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	33.444	20.53	-28.29	40.0	19.47	Peak	154.00	100	Horizontal	Pass
2	63.271	21.81	-26.83	40.0	18.19	Peak	66.00	200	Horizontal	Pass
3	172.978	22.97	-28.33	43.5	20.53	Peak	154.00	200	Horizontal	Pass
4	260.035	24.31	-24.12	46.0	21.69	Peak	127.00	200	Horizontal	Pass
5	393.022	25.35	-20.55	46.0	20.65	Peak	282.00	200	Horizontal	Pass
6	945.146	30.54	-9.07	46.0	15.46	Peak	301.00	200	Horizontal	Pass

30 MHz to 1 GHz, ANT V

RE Test case_FCC Part 15C_FCC 15.247(2.4G)_30MHz-1GHz



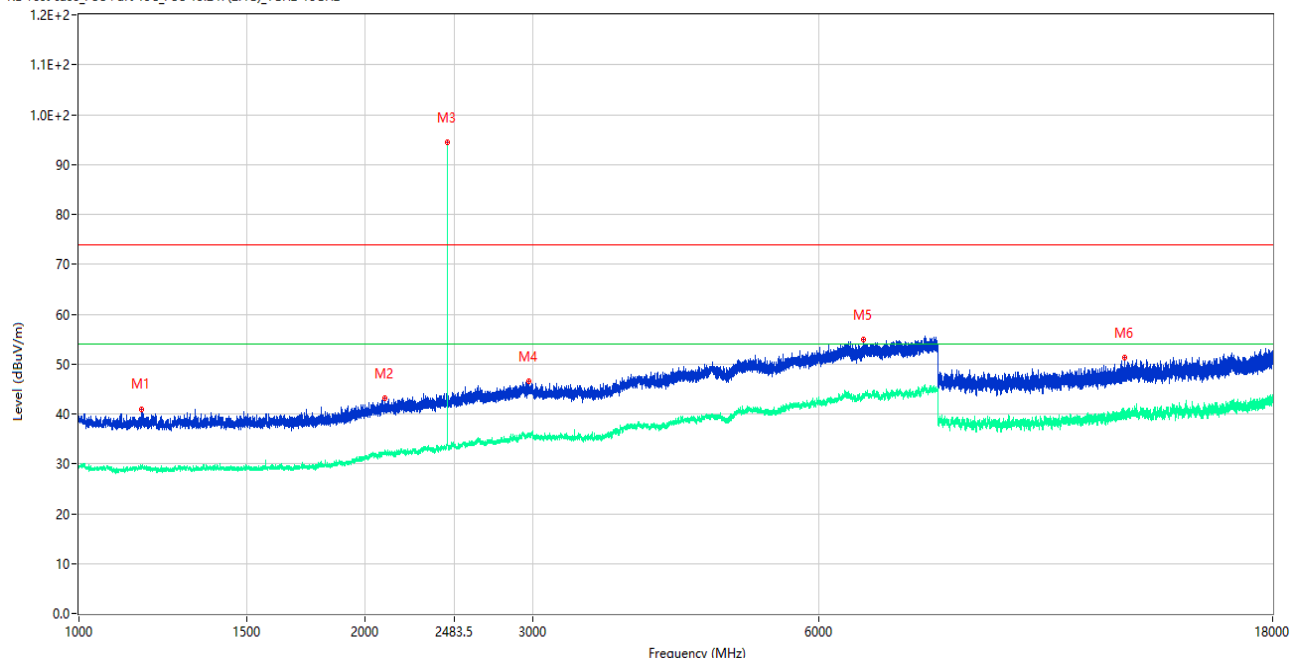
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	33.686	21.24	-28.22	40.0	18.76	Peak	268.00	200	Vertical	Pass
2	46.538	20.47	-24.55	40.0	19.53	Peak	301.00	200	Vertical	Pass
3	67.685	22.10	-28.22	40.0	17.90	Peak	360.00	200	Vertical	Pass
4	103.041	21.41	-26.12	43.5	22.09	Peak	333.00	200	Vertical	Pass
5	185.200	30.60	-27.14	43.5	12.90	Peak	288.00	200	Vertical	Pass
6	393.022	25.68	-20.55	46.0	20.32	Peak	360.00	200	Vertical	Pass

Note 1: The marked spikes near 2400 MHz with circle should be ignored because they are Fundamental signal.

Note 2: The spurious from 18GHz-25GHz is noise only, do not show on the report.

GFSK (BLE 1Mbps) MIDDLE CHANNEL 1 GHz to 18 GHz, ANT H

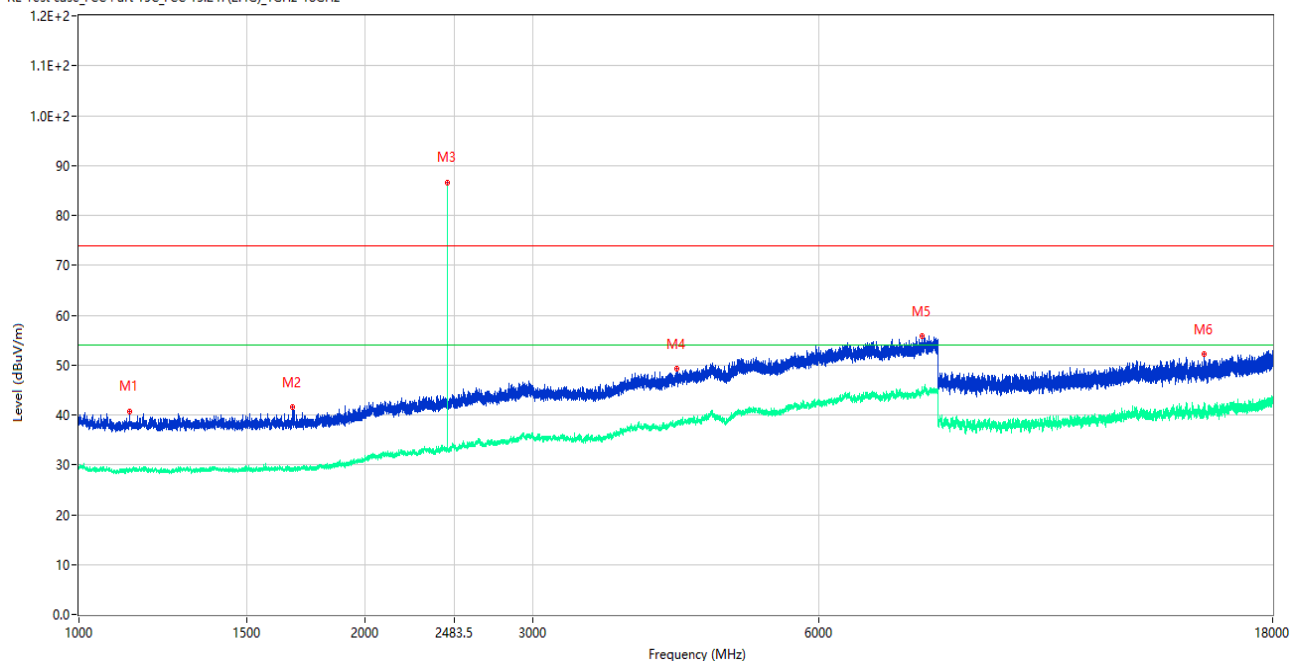
RE Test case_FCC Part 15C_FCC 15.247(2.4G)_1GHz-18GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1162.500	41.00	-14.55	74.0	33.00	Peak	0.00	150	Horizontal	Pass
1**	1162.500	29.05	-14.55	54.0	24.95	AV	0.00	150	Horizontal	Pass
2	2096.750	43.27	-12.34	74.0	30.73	Peak	228.00	150	Horizontal	Pass
2**	2096.750	32.34	-12.34	54.0	21.66	AV	228.00	150	Horizontal	Pass
3	2440.250	94.38	-11.37	74.0	-20.38	Peak	9.00	150	Horizontal	N/A
3**	2440.250	93.83	-11.37	54.0	-39.83	AV	9.00	150	Horizontal	N/A
4	2972.250	46.65	-7.27	74.0	27.35	Peak	345.00	150	Horizontal	Pass
4**	2972.250	35.81	-7.27	54.0	18.19	AV	345.00	150	Horizontal	Pass
5	6677.000	54.98	1.84	74.0	19.02	Peak	5.00	150	Horizontal	Pass
5**	6677.000	43.37	1.84	54.0	10.63	AV	5.00	150	Horizontal	Pass
6	12588.000	51.22	-0.17	74.0	22.78	Peak	316.00	150	Horizontal	Pass
6**	12588.000	39.64	-0.17	54.0	14.36	AV	316.00	150	Horizontal	Pass

GFSK (BLE 1Mbps) MIDDLE CHANNEL 1 GHz to 18 GHz, ANT V

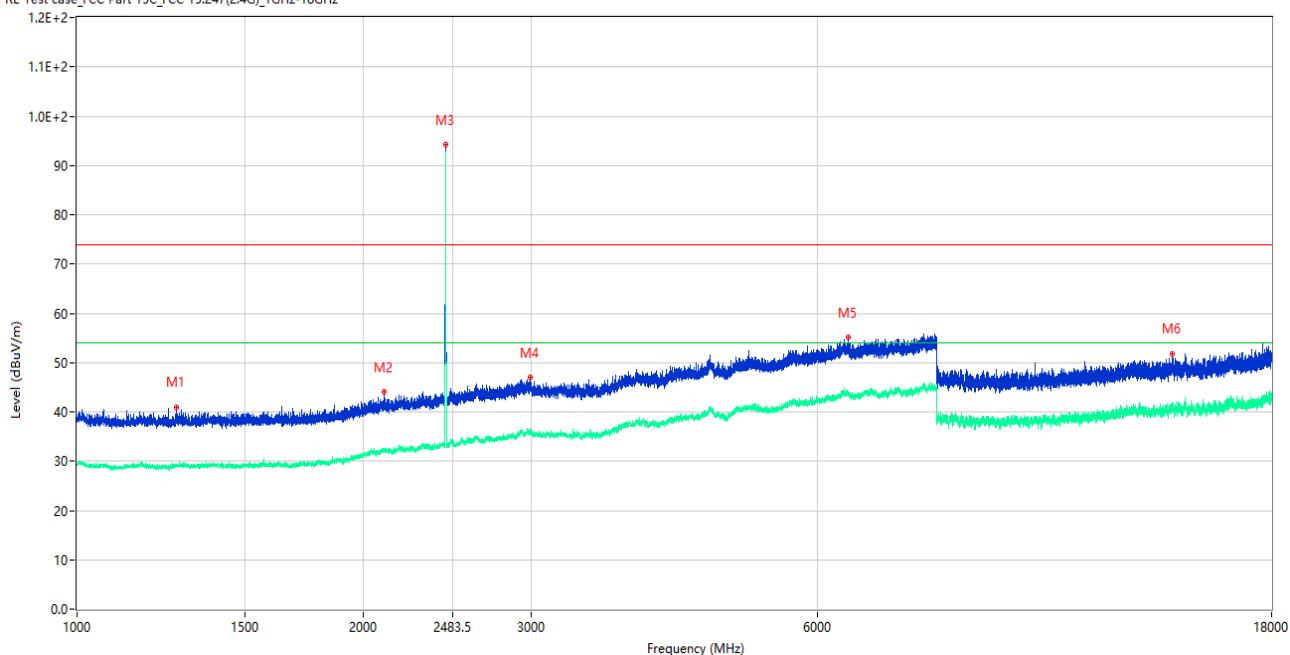
RE Test case_FCC Part 15C_FCC 15.247(2.4G)_1GHz-18GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1131.500	40.79	-14.70	74.0	33.21	Peak	26.00	150	Vertical	Pass
1**	1131.500	29.01	-14.70	54.0	24.99	AV	26.00	150	Vertical	Pass
2	1678.000	41.52	-15.24	74.0	32.48	Peak	197.00	150	Vertical	Pass
2**	1678.000	28.78	-15.24	54.0	25.22	AV	197.00	150	Vertical	Pass
3	2439.750	86.64	-11.35	74.0	-12.64	Peak	218.00	150	Vertical	N/A
3**	2439.750	83.61	-11.35	54.0	-29.61	AV	218.00	150	Vertical	N/A
4	4253.500	49.20	-2.98	74.0	24.80	Peak	0.00	150	Vertical	Pass
4**	4253.500	38.38	-2.98	54.0	15.62	AV	0.00	150	Vertical	Pass
5	7702.000	55.81	3.82	74.0	18.19	Peak	200.00	150	Vertical	Pass
5**	7702.000	44.93	3.82	54.0	9.07	AV	200.00	150	Vertical	Pass
6	15265.500	52.25	1.99	74.0	21.75	Peak	348.00	150	Vertical	Pass
6**	15265.500	41.37	1.99	54.0	12.63	AV	348.00	150	Vertical	Pass

GFSK (BLE 2Mbps) MIDDLE CHANNEL 1 GHz to 18 GHz, ANT H

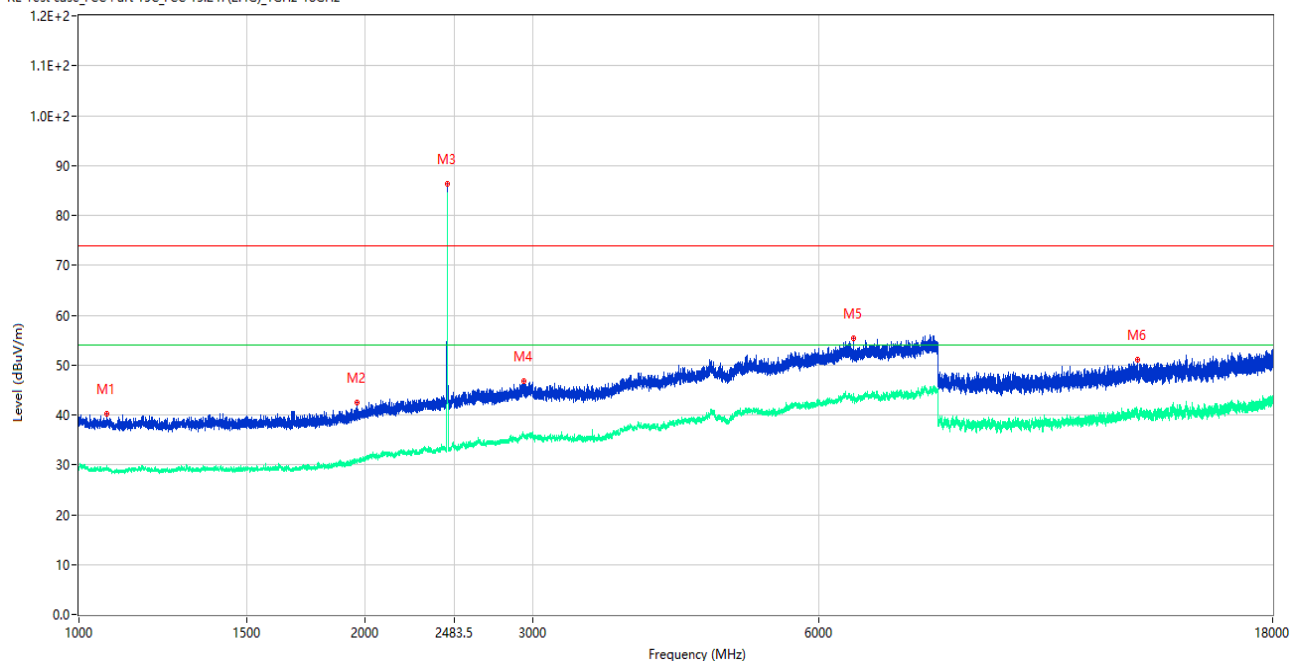
RE Test case_FCC Part 15C_FCC 15.247(2.4G)_1GHz-18GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1272.000	40.99	-14.95	74.0	33.01	Peak	193.00	150	Horizontal	Pass
1**	1272.000	29.31	-14.95	54.0	24.69	AV	193.00	150	Horizontal	Pass
2	2101.500	44.11	-12.35	74.0	29.89	Peak	360.00	150	Horizontal	Pass
2**	2101.500	32.19	-12.35	54.0	21.81	AV	360.00	150	Horizontal	Pass
3	2440.500	94.20	-11.38	74.0	-20.20	Peak	15.00	150	Horizontal	N/A
3**	2440.500	92.27	-11.38	54.0	-38.27	AV	15.00	150	Horizontal	N/A
4	2995.750	46.91	-7.59	74.0	27.09	Peak	360.00	150	Horizontal	Pass
4**	2995.750	36.03	-7.59	54.0	17.97	AV	360.00	150	Horizontal	Pass
5	6467.500	55.16	1.71	74.0	18.84	Peak	347.00	150	Horizontal	Pass
5**	6467.500	43.45	1.71	54.0	10.55	AV	347.00	150	Horizontal	Pass
6	14143.000	51.70	0.66	74.0	22.30	Peak	0.00	150	Horizontal	Pass
6**	14143.000	41.68	0.66	54.0	12.32	AV	0.00	150	Horizontal	Pass

GFSK (BLE 2Mbps) MIDDLE CHANNEL 1 GHz to 18 GHz, ANT V

RE Test case_FCC Part 15C_FCC 15.247(2.4G)_1GHz-18GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1070.750	40.16	-14.29	74.0	33.84	Peak	359.00	150	Vertical	Pass
1**	1070.750	29.30	-14.29	54.0	24.70	AV	359.00	150	Vertical	Pass
2	1960.750	42.41	-13.76	74.0	31.59	Peak	167.00	150	Vertical	Pass
2**	1960.750	30.75	-13.76	54.0	23.25	AV	167.00	150	Vertical	Pass
3	2440.500	86.28	-11.38	74.0	-12.28	Peak	223.00	150	Vertical	N/A
3**	2440.500	84.29	-11.38	54.0	-30.29	AV	223.00	150	Vertical	N/A
4	2937.500	46.79	-7.08	74.0	27.21	Peak	341.00	150	Vertical	Pass
4**	2937.500	35.85	-7.08	54.0	18.15	AV	341.00	150	Vertical	Pass
5	6530.500	55.37	1.85	74.0	18.63	Peak	1.00	150	Vertical	Pass
5**	6530.500	43.14	1.85	54.0	10.86	AV	1.00	150	Vertical	Pass
6	12977.000	51.15	-0.09	74.0	22.85	Peak	0.00	150	Vertical	Pass
6**	12977.000	40.25	-0.09	54.0	13.75	AV	0.00	150	Vertical	Pass

A.7 Band Edge (Restricted-band band-edge)

Note ¹: The lowest and highest channels are tested to verify the band edge emissions. Please refer to the following the plots for emissions values.

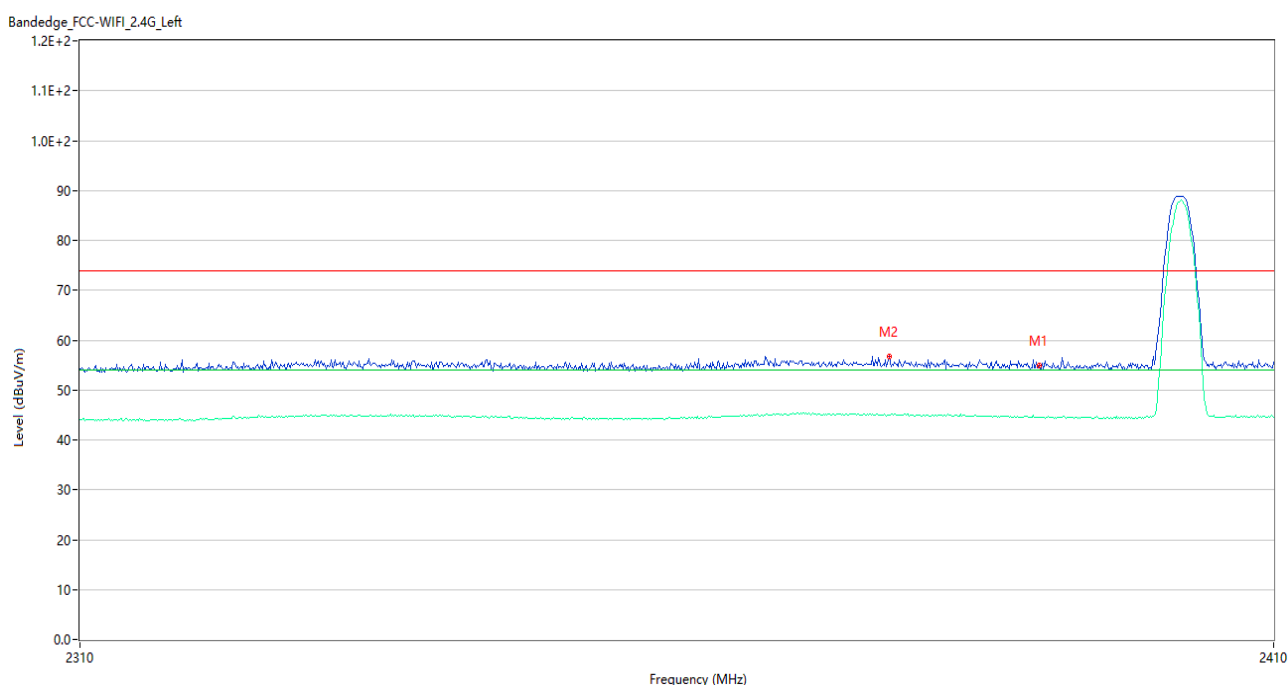
Note ²: The test data all are tested in the vertical and horizontal antenna which the trace is max hold. So these plots have shown the worst case.

Note ³: According the ANSI C63.10-2013, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

Note ⁴: The Level (dBuV/m) has been corrected by factor.

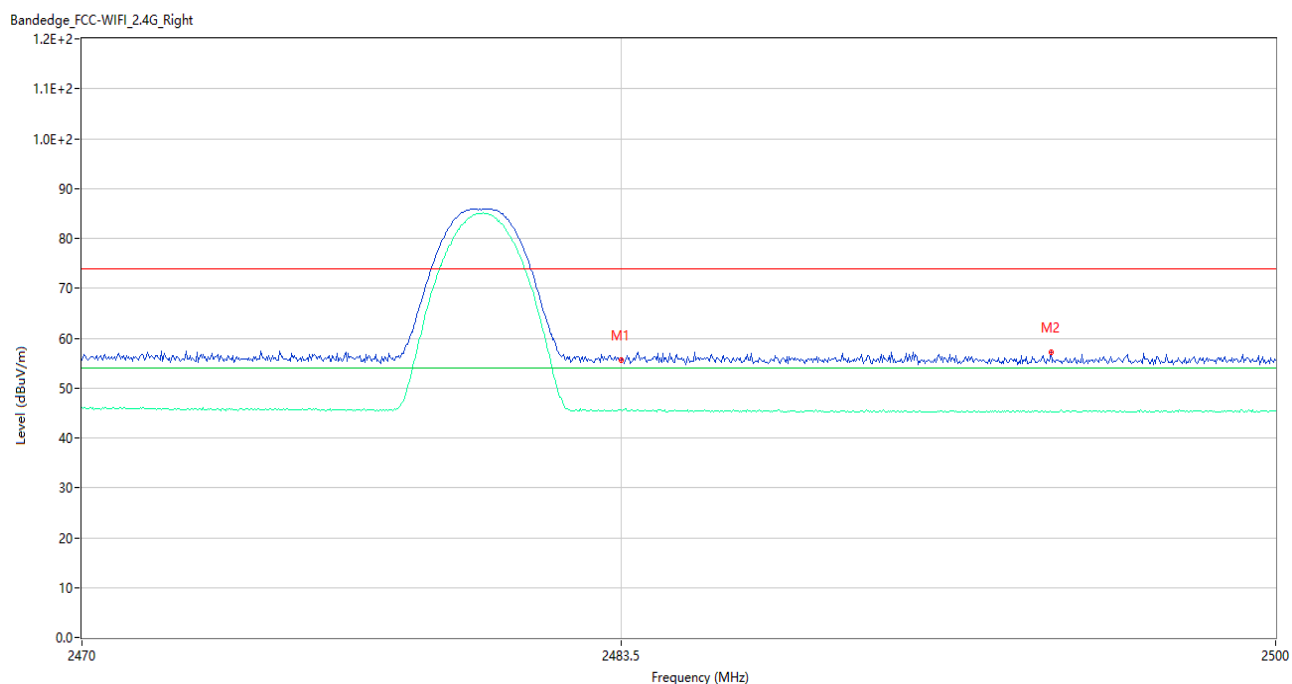
Test Data and Plots

GFSK (BLE 1Mbps) LOW CHANNEL



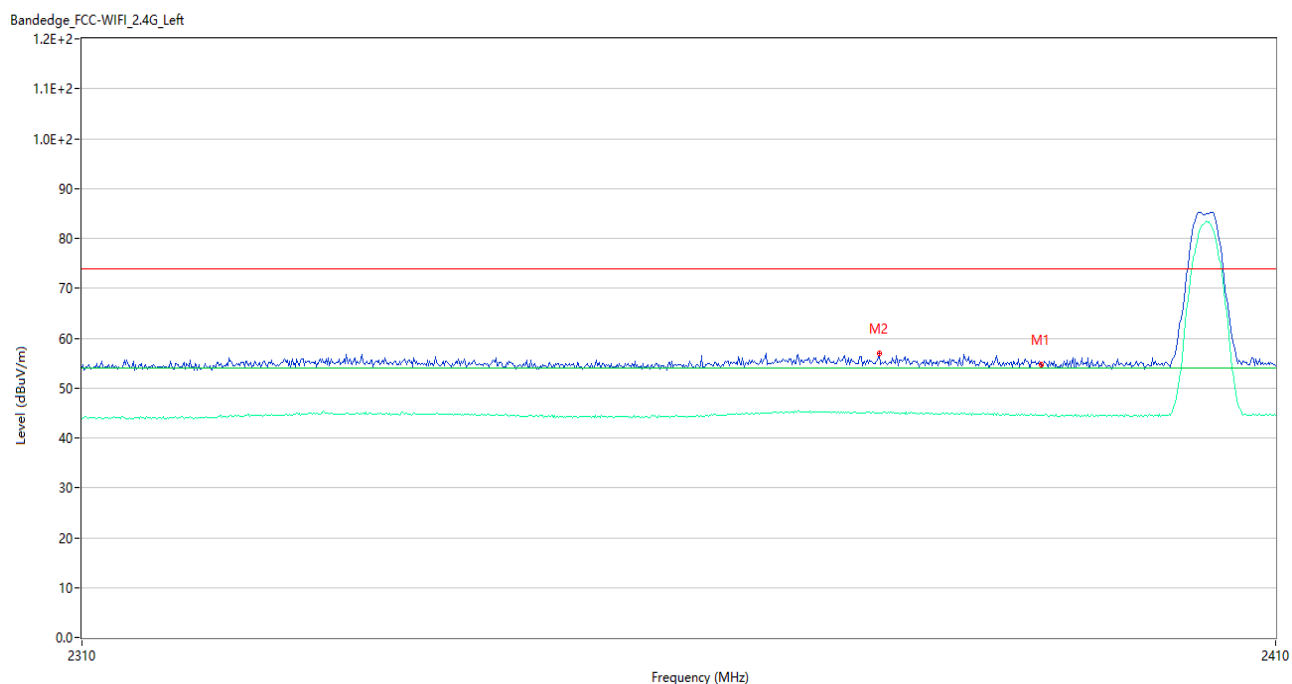
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	2390.000	54.97	-3.73	74.0	19.03	Peak	72.17	150	Horizontal	Pass
1**	2390.000	44.47	-3.73	54.0	9.53	AV	72.17	150	Horizontal	Pass
2	2377.300	56.65	-3.02	74.0	17.35	Peak	82.00	150	Horizontal	Pass
2**	2377.300	44.89	-3.02	54.0	9.11	AV	82.00	150	Horizontal	Pass

GFSK (BLE 1Mbps) HIGH CHANNEL



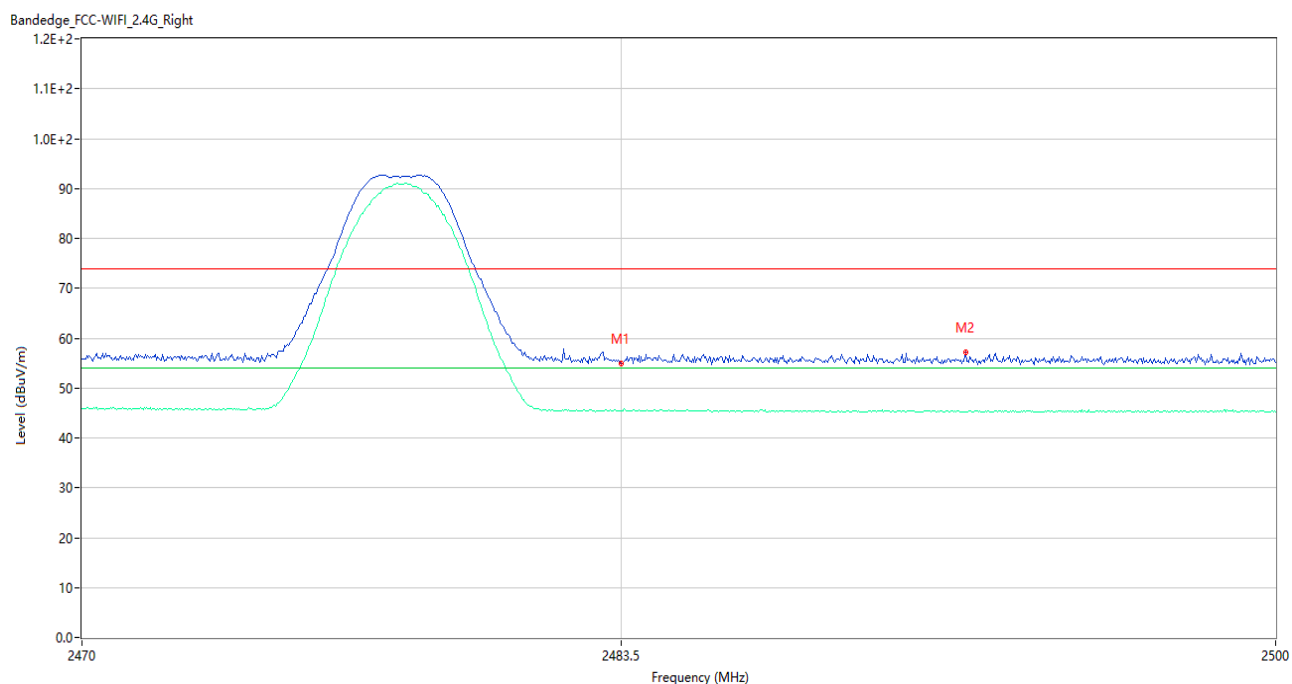
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	2483.500	55.65	-2.60	74.0	18.35	Peak	172.00	150	Vertical	Pass
1**	2483.500	45.63	-2.60	54.0	8.37	AV	172.00	150	Vertical	Pass
2	2494.330	57.24	-2.79	74.0	16.76	Peak	98.00	150	Vertical	Pass
2**	2494.330	45.22	-2.79	54.0	8.78	AV	98.00	150	Vertical	Pass

GFSK (BLE 2Mbps) LOW CHANNEL



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	2390.000	54.69	-3.73	74.0	19.31	Peak	359.60	150	Vertical	Pass
1**	2390.000	44.62	-3.73	54.0	9.38	AV	359.60	150	Vertical	Pass
2	2376.300	57.02	-3.00	74.0	16.98	Peak	194.00	150	Vertical	Pass
2**	2376.300	45.02	-3.00	54.0	8.98	AV	194.00	150	Vertical	Pass

GFSK (BLE 2Mbps) HIGH CHANNEL



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	2483.500	54.85	-2.60	74.0	19.15	Peak	107.00	150	Horizontal	Pass
1**	2483.500	45.53	-2.60	54.0	8.47	AV	107.00	150	Horizontal	Pass
2	2492.170	57.11	-2.74	74.0	16.89	Peak	167.00	150	Horizontal	Pass
2**	2492.170	45.26	-2.74	54.0	8.74	AV	167.00	150	Horizontal	Pass

A.8 Power Spectral Density (PSD)

Test Data

GFSK (BLE 1Mbps)			
Channel	Spectral power density (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
Low Channel	-17.556	8	Pass
Middle Channel	-17.182	8	Pass
High Channel	-17.252	8	Pass

GFSK (BLE 2Mbps)			
Channel	Spectral power density (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
Low Channel	-20.581	8	Pass
Middle Channel	-19.636	8	Pass
High Channel	-19.738	8	Pass

Test Plots

GFSK (BLE 1Mbps) LOW CHANNEL



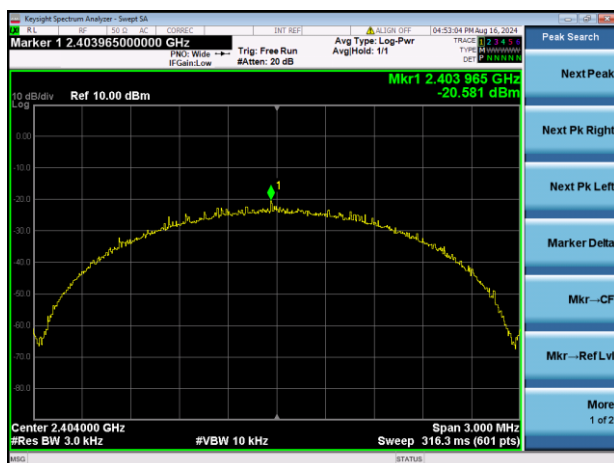
GFSK (BLE 1Mbps) MIDDLE CHANNEL



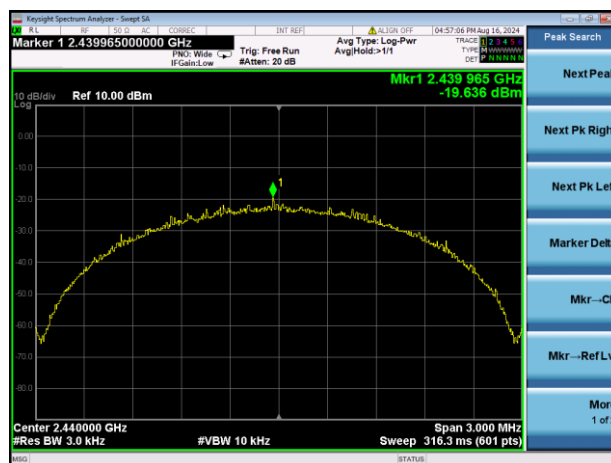
GFSK (BLE 1Mbps) HIGH CHANNEL



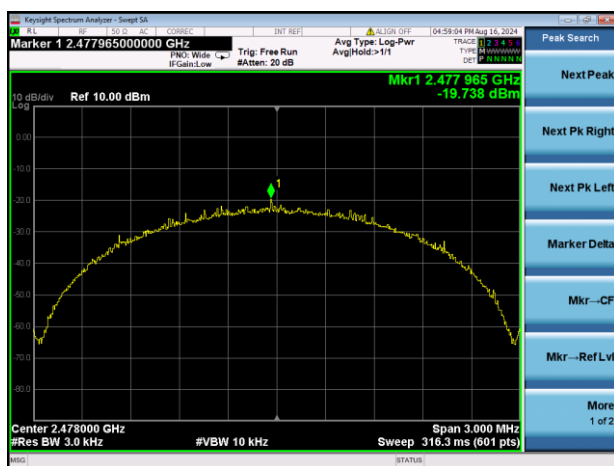
GFSK (BLE 2Mbps) LOW CHANNEL



GFSK (BLE 2Mbps) MIDDLE CHANNEL



GFSK (BLE 2Mbps) HIGH CHANNEL



ANNEX B TEST SETUP PHOTOS

Please refer the document “BL-SH2470490-AR-1.PDF”.

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document “BL-SH2470490-AW.PDF”.

ANNEX D EUT INTERNAL PHOTOS

Please refer the document “BL-SH2470490-AI.PDF”.

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--END OF REPORT--