

A.2 Occupied Bandwidth

Test Data

Test Mode	GFSK (BLE 1Mbps)		
Channel	6 dB Bandwidth (kHz)	99% Bandwidth (kHz)	6 dB Bandwidth Limits (kHz)
Low	682.60	1040.50	≥500
Middle	682.60	1041.20	≥500
High	689.90	1040.60	≥500

Test Mode	GFSK (BLE 2Mbps)		
Channel	6 dB Bandwidth (kHz)	99% Bandwidth (kHz)	6 dB Bandwidth Limits (kHz)
Low	1200.00	2018.90	≥500
Middle	1185.00	2018.70	≥500
High	1215.00	2032.70	≥500

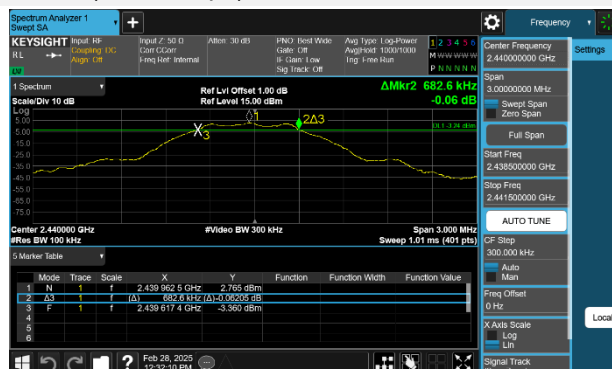
Test Plots

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

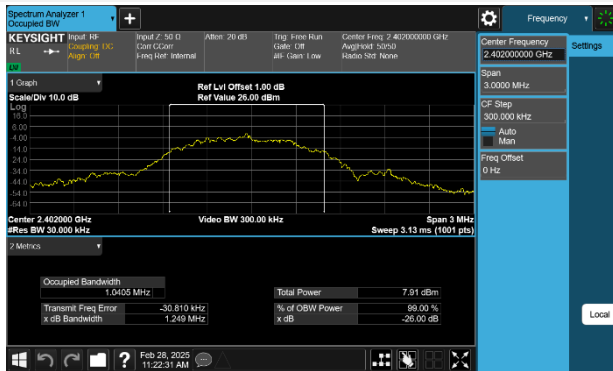


GFSK (BLE 2Mbps) HIGH CHANNEL

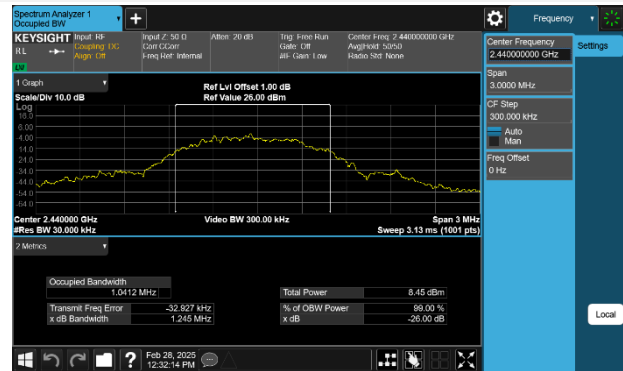


99% Bandwidth

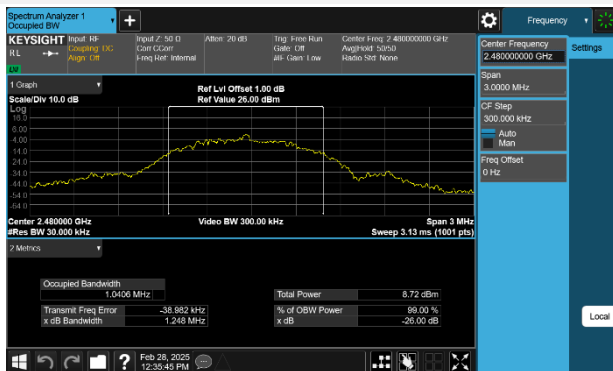
GFSK (BLE 1Mbps) LOW CHANNEL



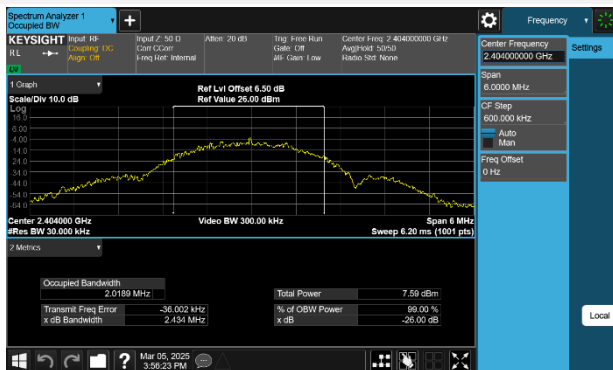
GFSK (BLE 1Mbps) MIDDLE CHANNEL



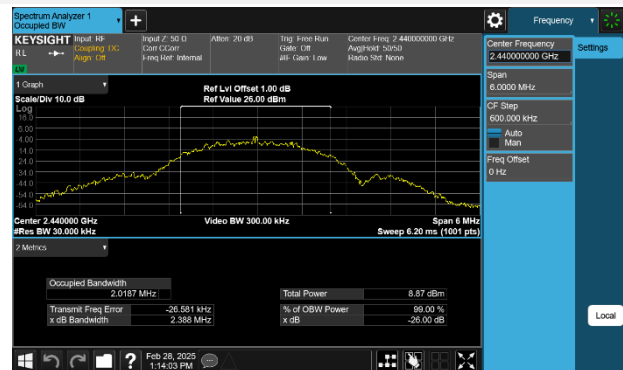
GFSK (BLE 1Mbps) HIGH CHANNEL



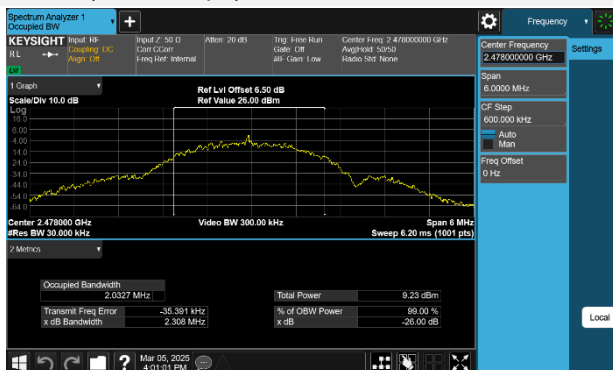
GFSK (BLE 2Mbps) LOW CHANNEL



GFSK (BLE 2Mbps) MIDDLE CHANNEL



GFSK (BLE 2Mbps) HIGH CHANNEL



A.3 Conducted Spurious Emission

Test Data

GFSK (BLE 1Mbps)				
Channel	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low	-50.38	1.51	-18.49	Pass
Middle	-49.58	2.77	-17.23	Pass
High	-50.25	2.67	-17.33	Pass

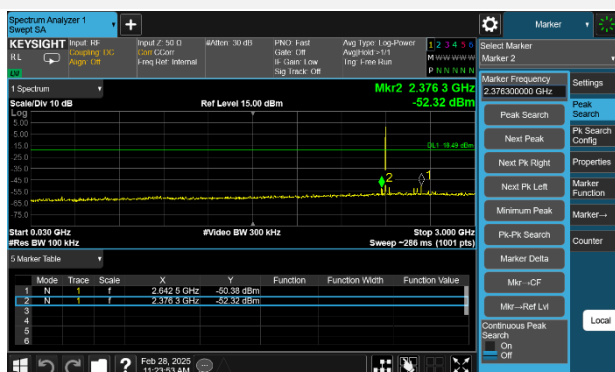
GFSK (BLE 2Mbps)				
Channel	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low	-46.24	1.46	-18.54	Pass
Middle	-51.01	2.85	-17.15	Pass
High	-47.14	2.83	-17.17	Pass

Test Plots

GFSK (BLE 1Mbps) LOW CHANNEL, CARRIER LEVEL



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



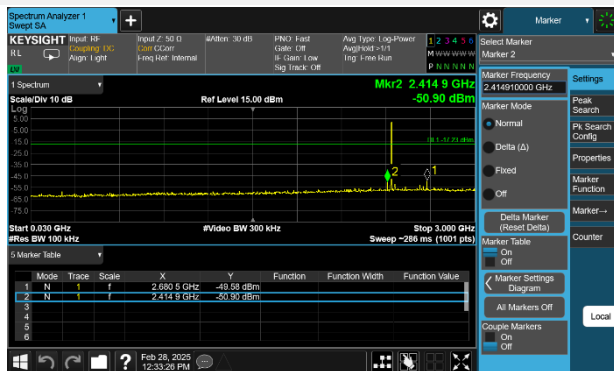
GFSK (BLE 1Mbps) LOW CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



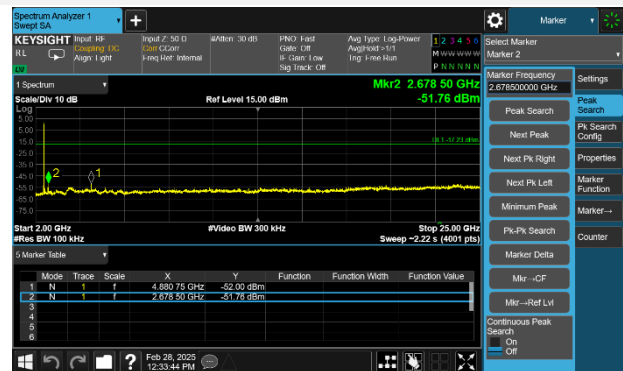
GFSK (BLE 1Mbps) MIDDLE CHANNEL, CARRIER LEVEL



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



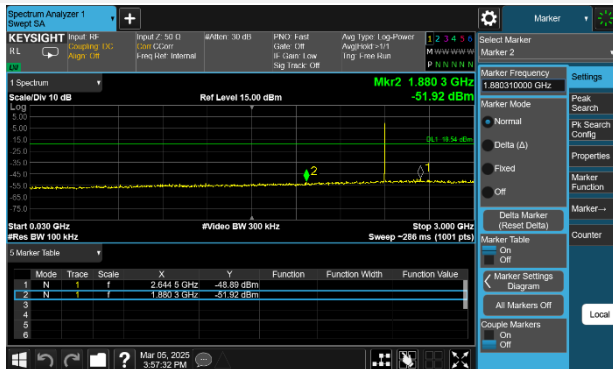
GFSK (BLE 1Mbps) HIGH CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



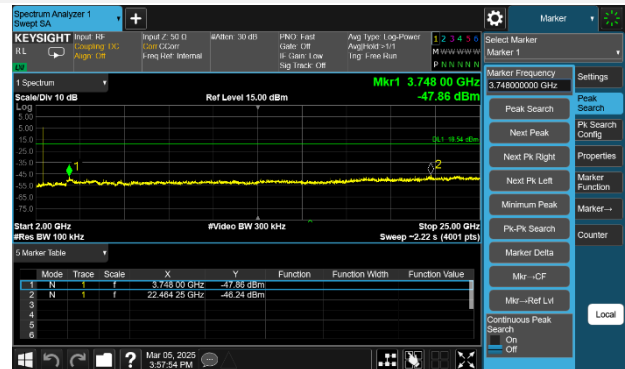
GFSK (BLE 2Mbps) LOW CHANNEL, CARRIER LEVEL



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



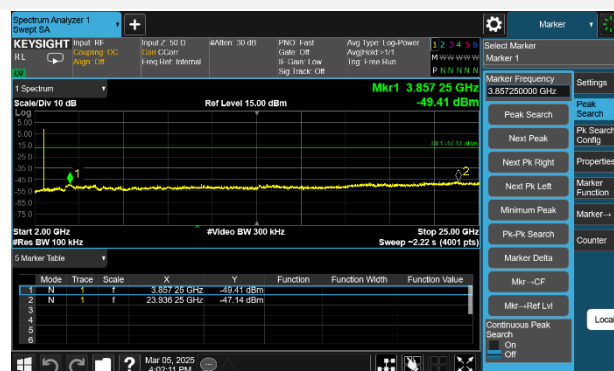
GFSK (BLE 2Mbps) HIGH CHANNEL, CARRIER LEVEL



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	-46.35	1.51	-18.49	Pass
High	-57.44	2.67	-17.33	Pass

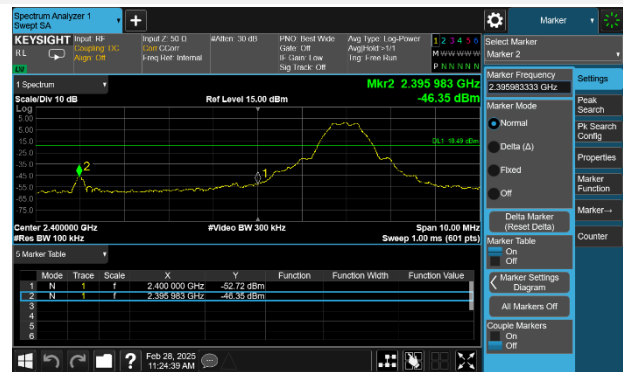
GFSK (BLE 2Mbps)				
Channel	Measured Max. Band Edge Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low	-48.68	1.46	-18.54	Pass
High	-51.66	2.83	-17.17	Pass

Test Plots

GFSK (BLE 1Mbps) LOW CHANNEL, CARRIER LEVEL



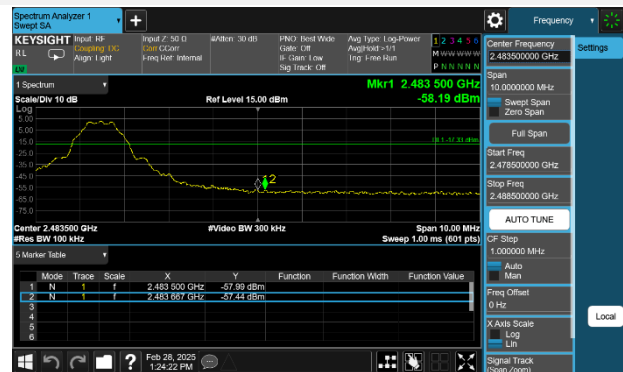
GFSK (BLE 1Mbps) LOW CHANNEL, BAND EDGE



GFSK (BLE 1Mbps) HIGH CHANNEL, CARRIER LEVEL



GFSK (BLE 1Mbps) HIGH CHANNEL, BAND EDGE



GFSK (BLE 2Mbps) LOW CHANNEL, CARRIER LEVEL



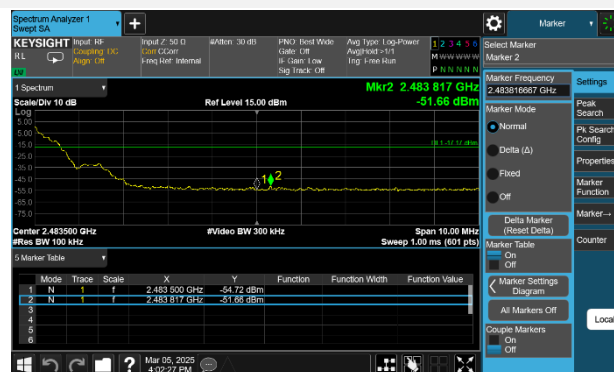
GFSK (BLE 2Mbps) LOW CHANNEL, BAND EDGE



GFSK (BLE 2Mbps) HIGH CHANNEL, CARRIER LEVEL



GFSK (BLE 2Mbps) HIGH CHANNEL, BAND EDGE



A.5 Conducted Emission

Note 1: The EUT is working in the Normal link mode. All modes have been tested and normal link mode is worst.

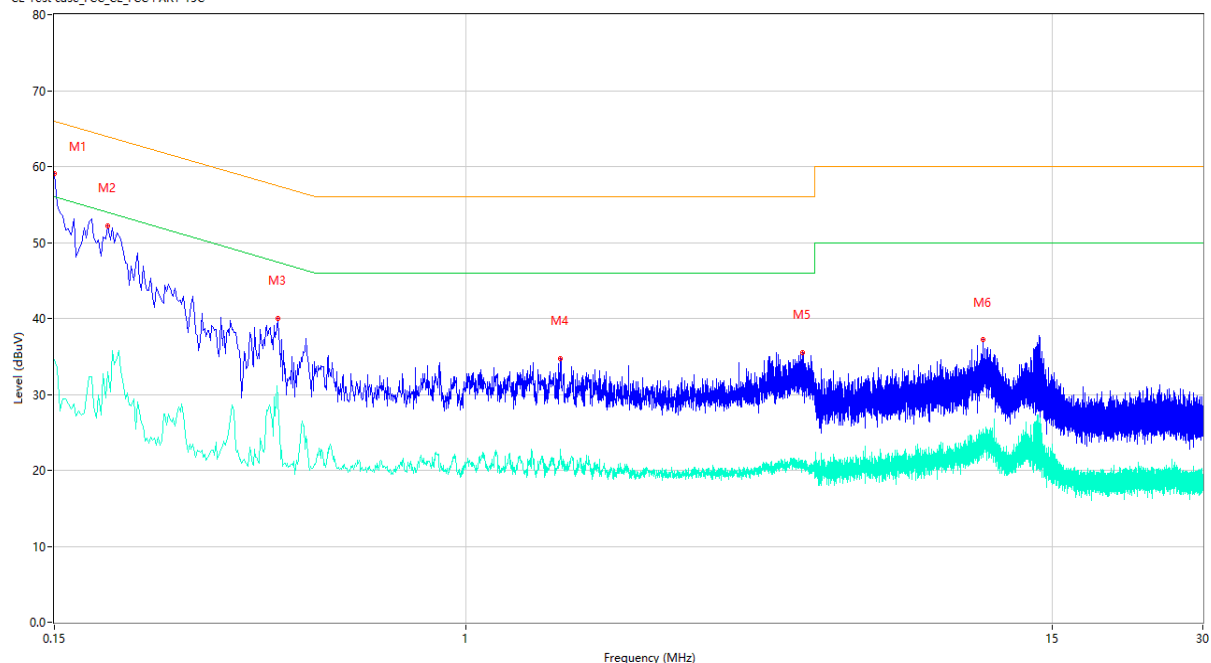
Note 2: Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a nominal 120 VAC, 60 Hz and 240 VAC, 50 Hz) for which the device is capable of operation. So, The configuration 120 VAC, 60 Hz and 240 VAC, 50 Hz were tested respectively, but only the worst configuration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

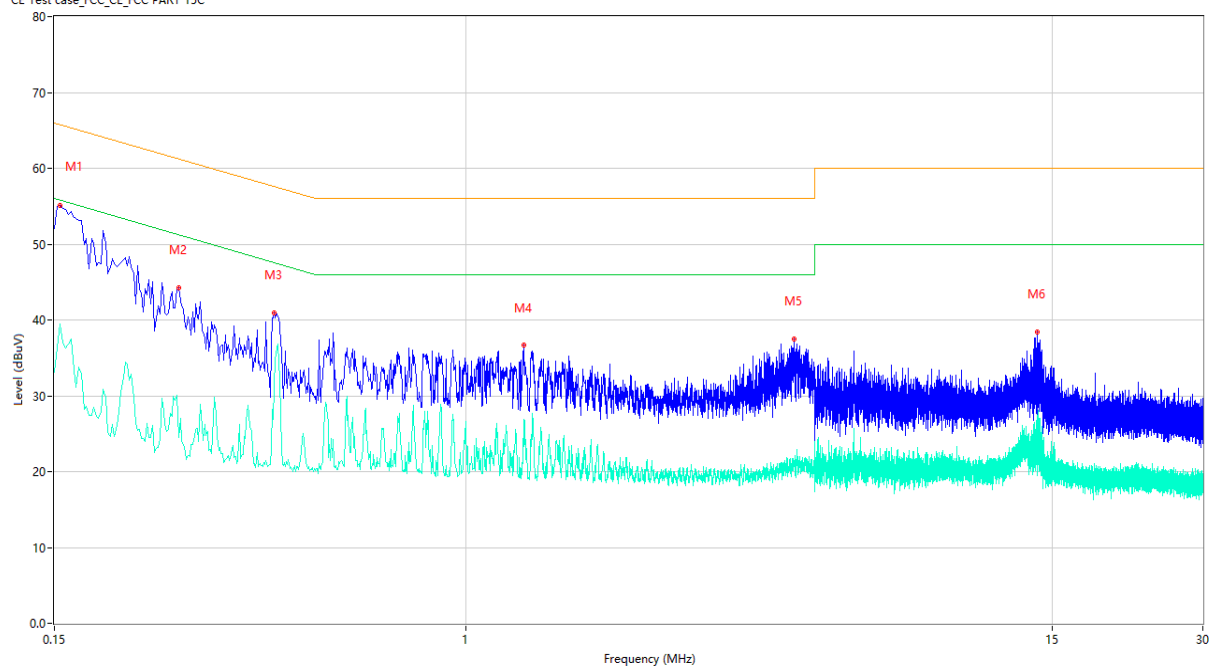
CE Test case_FCC_CE_FCC PART 15C



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.150	59.06	9.75	66.00	6.94	Peak	L	Pass
1**	0.150	34.63	9.75	56.00	21.37	AV	L	Pass
2	0.192	52.19	9.75	63.95	11.76	Peak	L	Pass
2**	0.192	32.92	9.75	53.95	21.03	AV	L	Pass
3	0.420	40.03	9.74	57.45	17.42	Peak	L	Pass
3**	0.420	29.49	9.74	47.45	17.96	AV	L	Pass
4	1.546	34.68	9.70	56.00	21.32	Peak	L	Pass
4**	1.546	21.96	9.70	46.00	24.04	AV	L	Pass
5	4.742	35.55	9.64	56.00	20.45	Peak	L	Pass
5**	4.742	20.54	9.64	46.00	25.46	AV	L	Pass
6	10.894	37.16	9.44	60.00	22.84	Peak	L	Pass
6**	10.894	24.24	9.44	50.00	25.76	AV	L	Pass

PHASE N

CE Test case_FCC_CE_FCC PART 15C



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.154	55.16	9.75	65.78	10.62	Peak	N	Pass
1**	0.154	39.47	9.75	55.78	16.31	AV	N	Pass
2	0.266	44.20	9.74	61.24	17.04	Peak	N	Pass
2**	0.266	24.45	9.74	51.24	26.79	AV	N	Pass
3	0.414	40.93	9.74	57.57	16.64	Peak	N	Pass
3**	0.414	31.28	9.74	47.57	16.29	AV	N	Pass
4	1.306	36.63	9.70	56.00	19.37	Peak	N	Pass
4**	1.306	23.26	9.70	46.00	22.74	AV	N	Pass
5	4.560	37.46	9.64	56.00	18.54	Peak	N	Pass
5**	4.560	21.49	9.64	46.00	24.51	AV	N	Pass
6	13.970	38.38	9.30	60.00	21.62	Peak	N	Pass
6**	13.970	27.11	9.30	50.00	22.89	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.

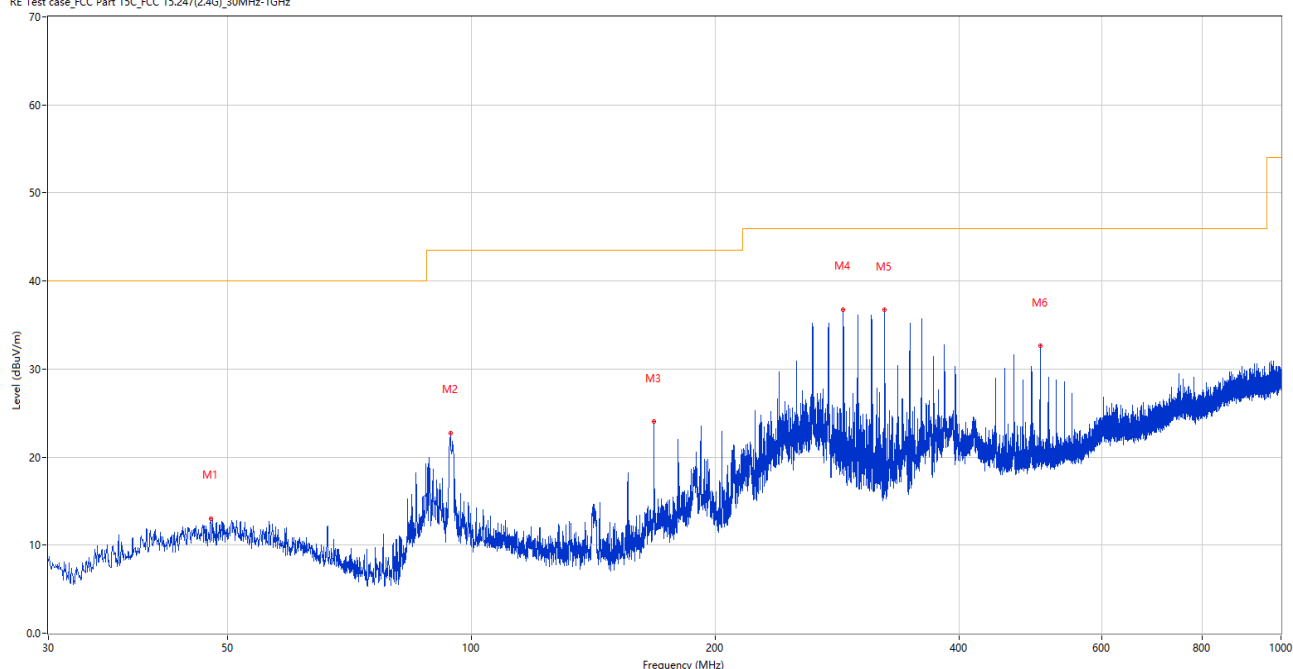
Note 4: The EUT is working in the Normal link mode below 1 GHz. All modes have been tested and BLE 2M-High channel mode is the worst

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

Test Data and Plots

30 MHz to 1 GHz, ANT H

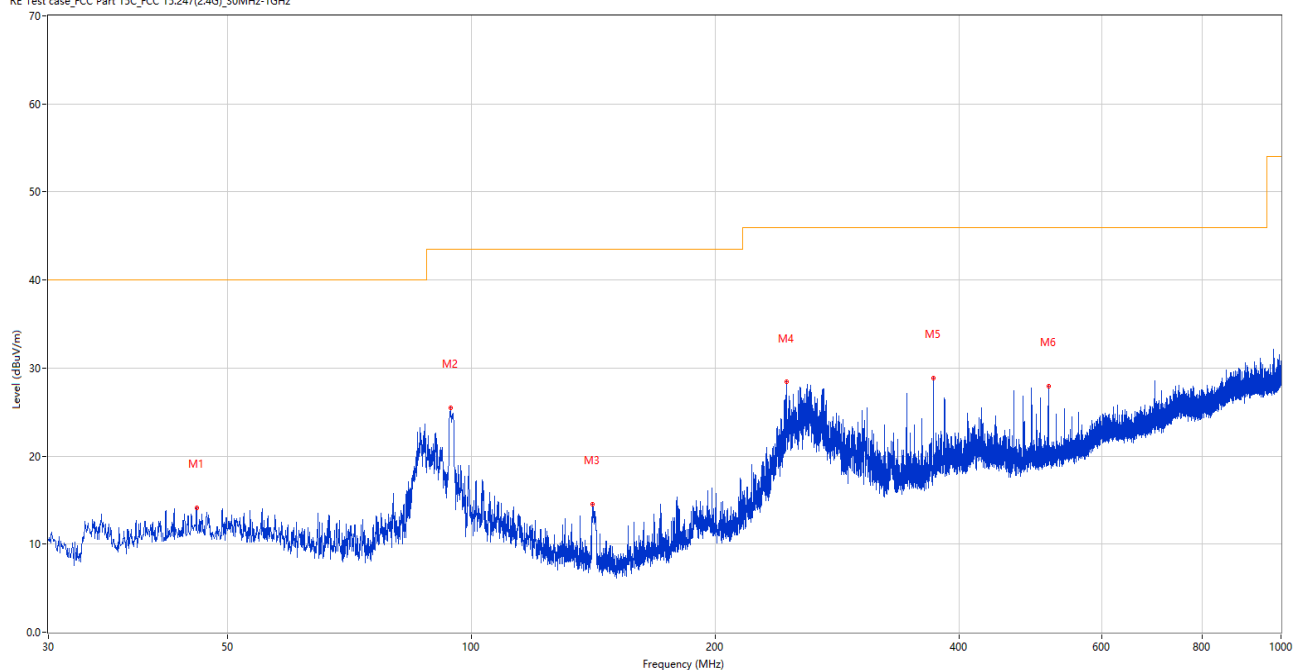
RE Test case_FCC Part 15C_FCC 15.247(2.4G)_30MHz-1GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	47.605	12.99	-24.54	40.0	27.01	Peak	168.00	100	Horizontal	Pass
2	94.165	22.76	-26.95	43.5	20.74	Peak	229.00	200	Horizontal	Pass
3	167.982	24.00	-28.45	43.5	19.50	Peak	169.00	200	Horizontal	Pass
4	287.923	36.73	-23.23	46.0	9.27	Peak	187.00	100	Horizontal	Pass
5	323.958	36.69	-22.59	46.0	9.31	Peak	181.00	100	Horizontal	Pass
6	503.942	32.61	-17.89	46.0	13.39	Peak	273.00	200	Horizontal	Pass

30 MHz to 1 GHz, ANT V

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

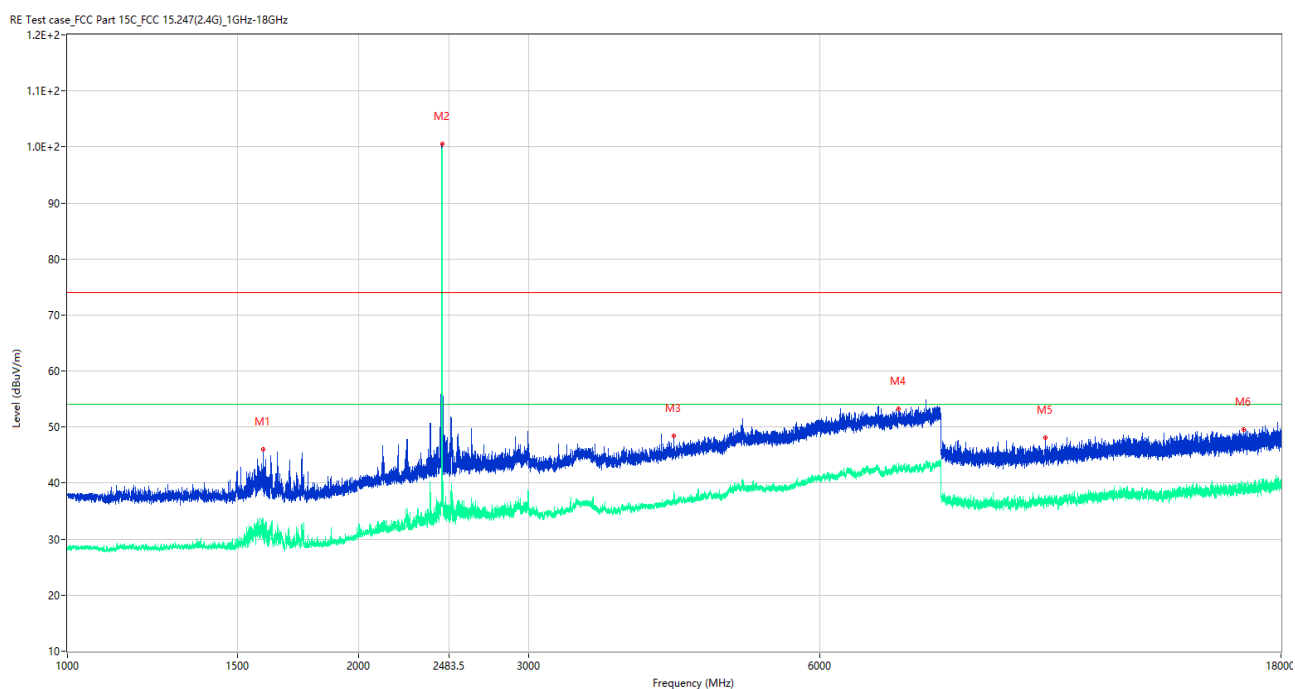


No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	45.763	14.17	-24.65	40.0	25.83	Peak	276.00	100	Vertical	Pass
2	94.262	25.52	-26.94	43.5	17.98	Peak	349.00	100	Vertical	Pass
3	141.065	14.57	-29.52	43.5	28.93	Peak	359.00	100	Vertical	Pass
4	245.243	28.41	-24.26	46.0	17.59	Peak	203.00	100	Vertical	Pass
5	372.022	28.87	-21.32	46.0	17.13	Peak	251.00	100	Vertical	Pass
6	515.970	27.91	-17.65	46.0	18.09	Peak	233.00	100	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.

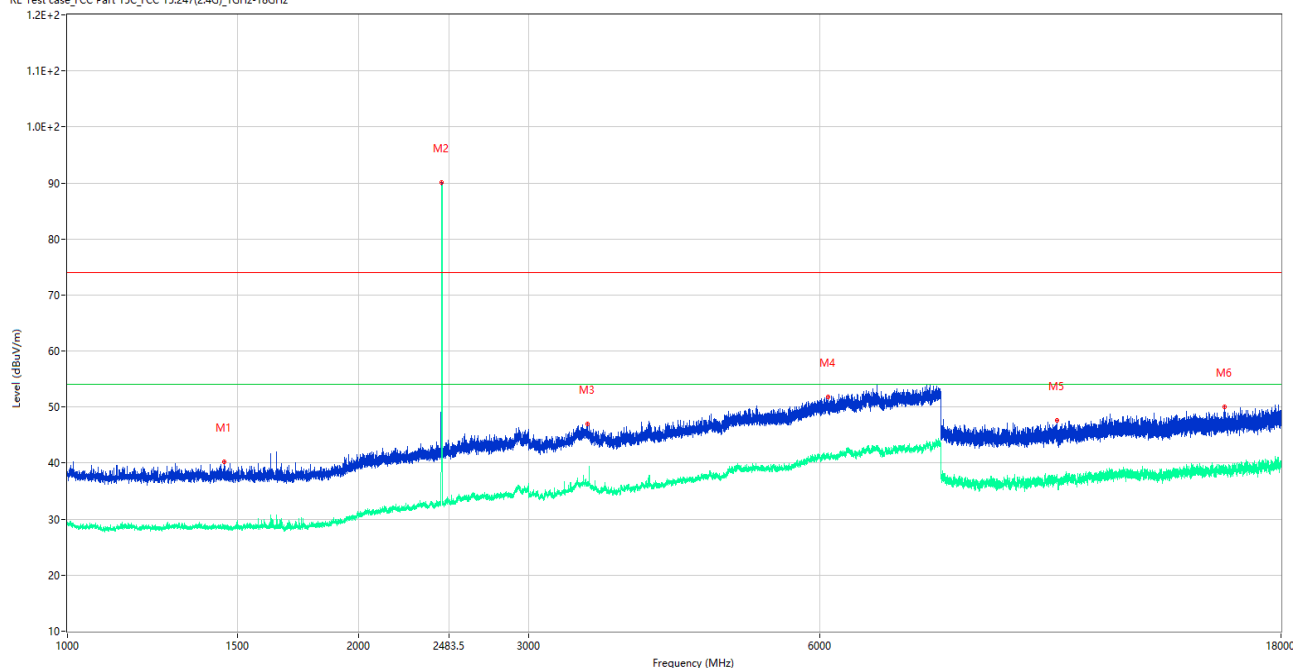
GFSK (BLE 1Mbps) MIDDLE CHANNEL 1 GHz to 18 GHz, ANT H



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1594.250	46.00	-16.22	74.0	28.00	Peak	340.00	150	Horizontal	Pass
1**	1594.250	32.19	-16.22	54.0	21.81	AV	340.00	150	Horizontal	Pass
2	2440.250	100.54	-12.37	74.0	-26.54	Peak	12.00	150	Horizontal	N/A
2**	2440.250	99.88	-12.37	54.0	-45.88	AV	12.00	150	Horizontal	N/A
3	4242.000	48.51	-3.38	74.0	25.49	Peak	259.00	150	Horizontal	Pass
3**	4242.000	37.43	-3.38	54.0	16.57	AV	259.00	150	Horizontal	Pass
4	7234.500	53.22	0.92	74.0	20.78	Peak	120.00	150	Horizontal	Pass
4**	7234.500	42.62	0.92	54.0	11.38	AV	120.00	150	Horizontal	Pass
5	10276.500	48.05	-3.29	74.0	25.95	Peak	360.00	150	Horizontal	Pass
5**	10276.500	36.64	-3.29	54.0	17.36	AV	360.00	150	Horizontal	Pass
6	16454.500	49.50	-1.94	74.0	24.50	Peak	294.00	150	Horizontal	Pass
6**	16454.500	38.25	-1.94	54.0	15.75	AV	294.00	150	Horizontal	Pass

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

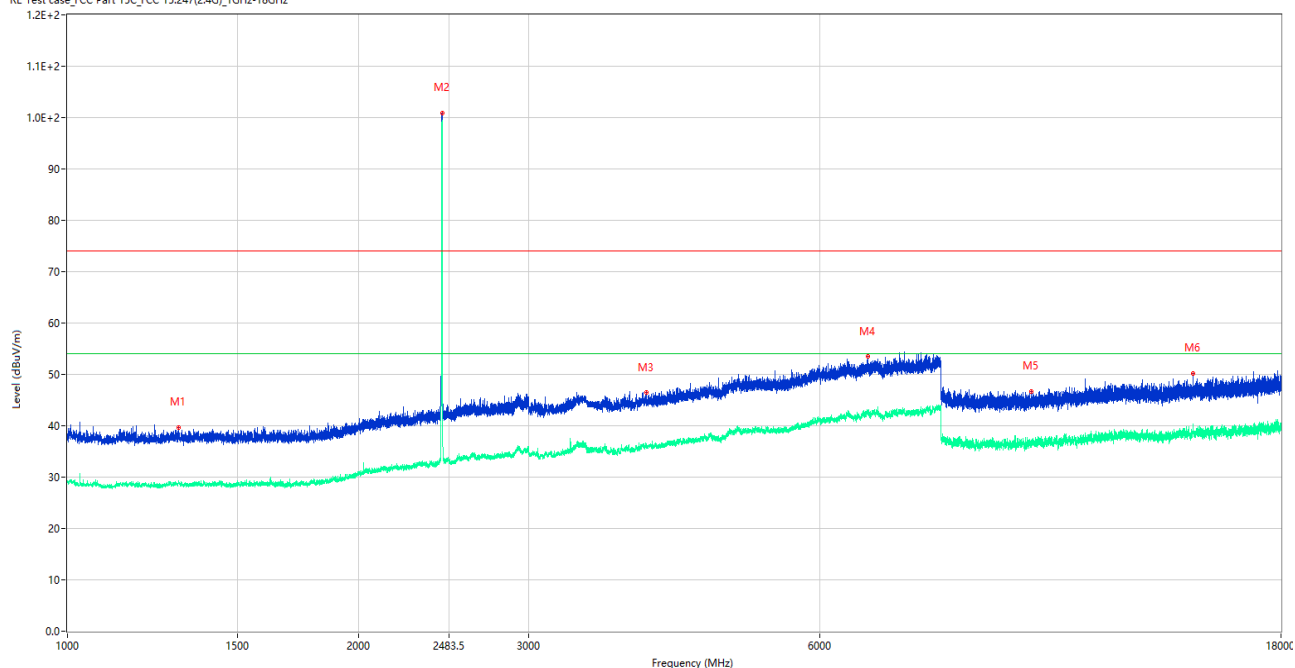
RE Test case_FCC Part 15C_FCC 15.247(2.4G)_1GHz-18GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1451.250	40.17	-16.00	74.0	33.83	Peak	162.00	150	Vertical	Pass
1**	1451.250	28.98	-16.00	54.0	25.02	AV	162.00	150	Vertical	Pass
2	2439.750	90.06	-12.37	74.0	-16.06	Peak	267.00	150	Vertical	N/A
2**	2439.750	87.37	-12.37	54.0	-33.37	AV	267.00	150	Vertical	N/A
3	3448.000	46.94	-5.12	74.0	27.06	Peak	360.00	150	Vertical	Pass
3**	3448.000	36.00	-5.12	54.0	18.00	AV	360.00	150	Vertical	Pass
4	6115.500	51.86	-0.08	74.0	22.14	Peak	360.00	150	Vertical	Pass
4**	6115.500	40.95	-0.08	54.0	13.05	AV	360.00	150	Vertical	Pass
5	10563.000	47.65	-3.25	74.0	26.35	Peak	359.00	150	Vertical	Pass
5**	10563.000	36.85	-3.25	54.0	17.15	AV	359.00	150	Vertical	Pass
6	15723.500	50.01	-1.89	74.0	23.99	Peak	360.00	150	Vertical	Pass
6**	15723.500	38.89	-1.89	54.0	15.11	AV	360.00	150	Vertical	Pass

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

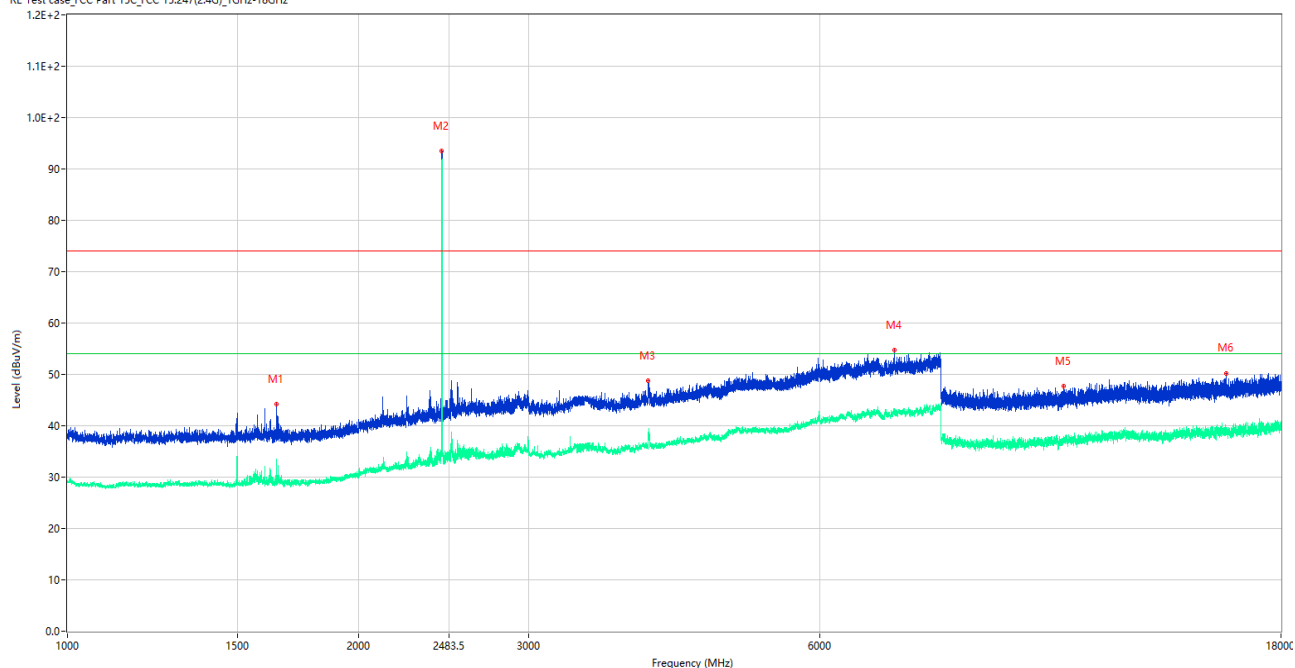
RE Test case_FCC Part 15C_FCC 15.247(2.4G)_1GHz-18GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1302.750	39.60	-15.59	74.0	34.40	Peak	228.00	150	Horizontal	Pass
1**	1302.750	29.01	-15.59	54.0	24.99	AV	228.00	150	Horizontal	Pass
2	2440.500	100.89	-12.38	74.0	-26.89	Peak	314.00	150	Horizontal	N/A
2**	2440.500	99.05	-12.38	54.0	-45.05	AV	314.00	150	Horizontal	N/A
3	3973.500	46.50	-4.27	74.0	27.50	Peak	359.00	150	Horizontal	Pass
3**	3973.500	36.15	-4.27	54.0	17.85	AV	359.00	150	Horizontal	Pass
4	6730.000	53.48	0.68	74.0	20.52	Peak	279.00	150	Horizontal	Pass
4**	6730.000	42.35	0.68	54.0	11.65	AV	279.00	150	Horizontal	Pass
5	9923.000	46.71	-4.23	74.0	27.29	Peak	175.00	150	Horizontal	Pass
5**	9923.000	36.05	-4.23	54.0	17.95	AV	175.00	150	Horizontal	Pass
6	14596.000	50.22	-2.19	74.0	23.78	Peak	321.00	150	Horizontal	Pass
6**	14596.000	39.14	-2.19	54.0	14.86	AV	321.00	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	1646.250	44.24	-16.29	74.0	29.76	Peak	320.00	150	Vertical	Pass
1**	1646.250	29.34	-16.29	54.0	24.66	AV	320.00	150	Vertical	Pass
2	2439.500	93.46	-12.37	74.0	-19.46	Peak	156.00	150	Vertical	N/A
2**	2439.500	88.55	-12.37	54.0	-34.55	AV	156.00	150	Vertical	N/A
3	3990.000	48.80	-4.85	74.0	25.20	Peak	360.00	150	Vertical	Pass
3**	3990.000	37.41	-4.85	54.0	16.59	AV	360.00	150	Vertical	Pass
4	7168.000	54.67	0.06	74.0	19.33	Peak	217.00	150	Vertical	Pass
4**	7168.000	43.01	0.06	54.0	10.99	AV	217.00	150	Vertical	Pass
5	10727.500	47.70	-3.74	74.0	26.30	Peak	300.00	150	Vertical	Pass
5**	10727.500	37.54	-3.74	54.0	16.46	AV	300.00	150	Vertical	Pass
6	15798.000	50.09	-1.59	74.0	23.91	Peak	155.00	150	Vertical	Pass
6**	15798.000	39.00	-1.59	54.0	15.00	AV	155.00	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.

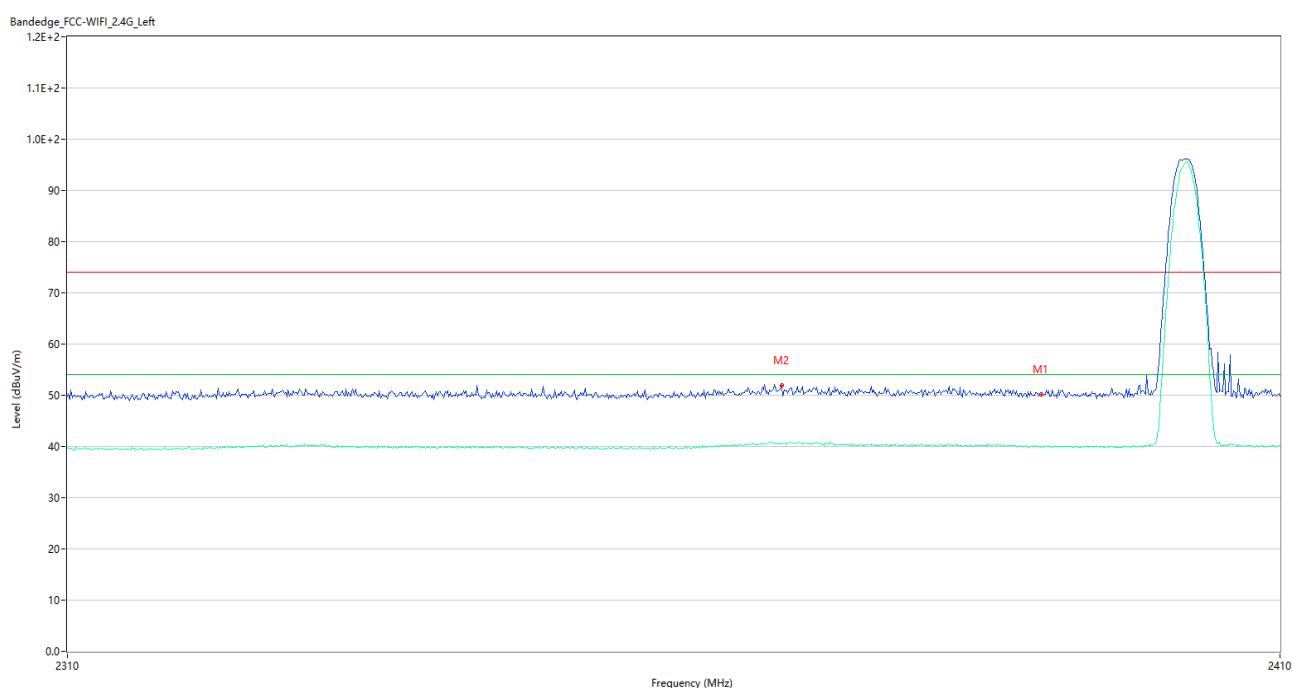
Note 2: The test data all are tested in the vertical and horizontal antenna which the trace is max hold. So these plots have shown the worst case.

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.

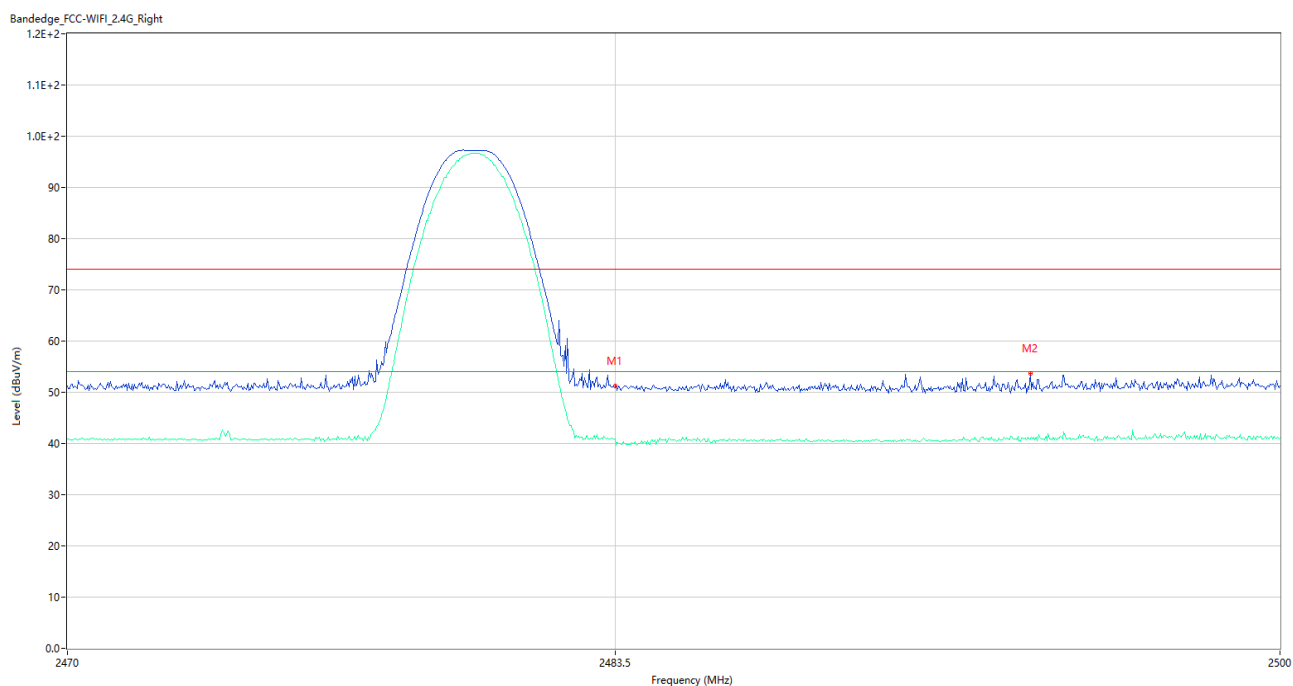
Test Data and Plots

GFSK (BLE 1Mbps) LOW CHANNEL



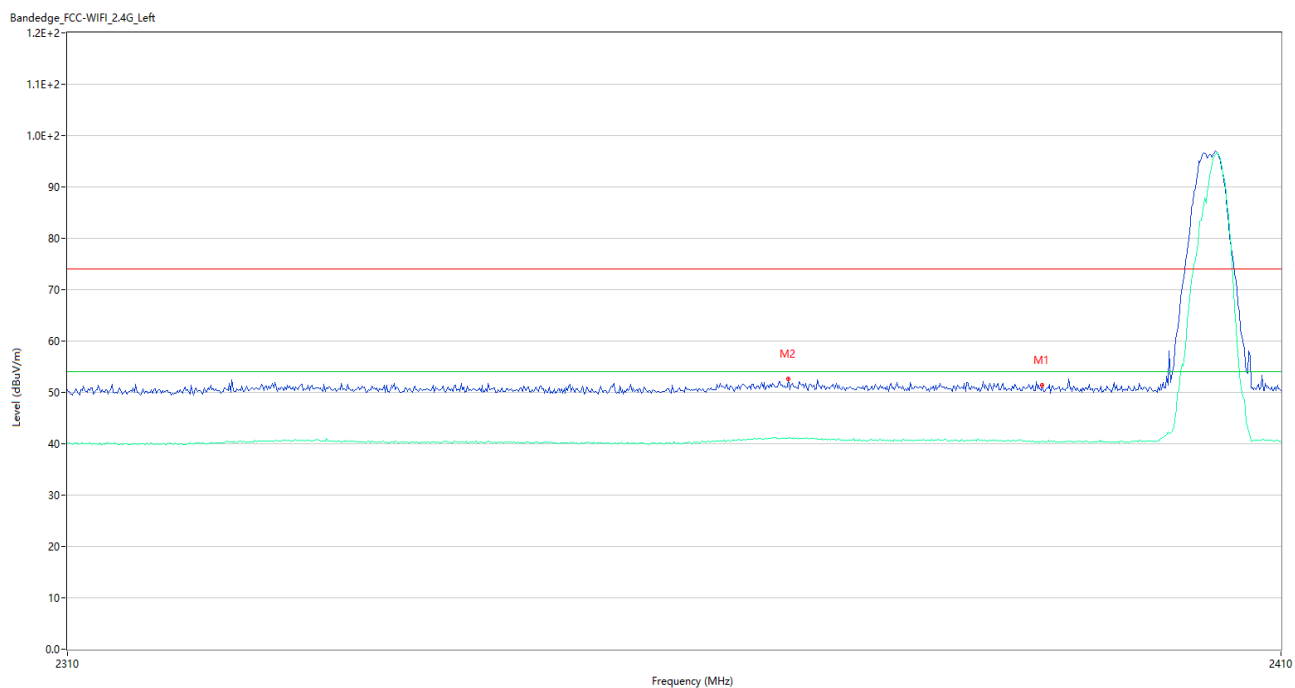
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	2390.000	50.15	-4.87	74.0	23.85	Peak	0.00	150	Horizontal	Pass
1**	2390.000	39.95	-4.87	54.0	14.05	AV	0.00	150	Horizontal	Pass
2	2368.400	51.95	-4.18	74.0	22.05	Peak	295.00	150	Horizontal	Pass
2**	2368.400	40.57	-4.18	54.0	13.43	AV	295.00	150	Horizontal	Pass

GFSK (BLE 1Mbps) HIGH CHANNEL



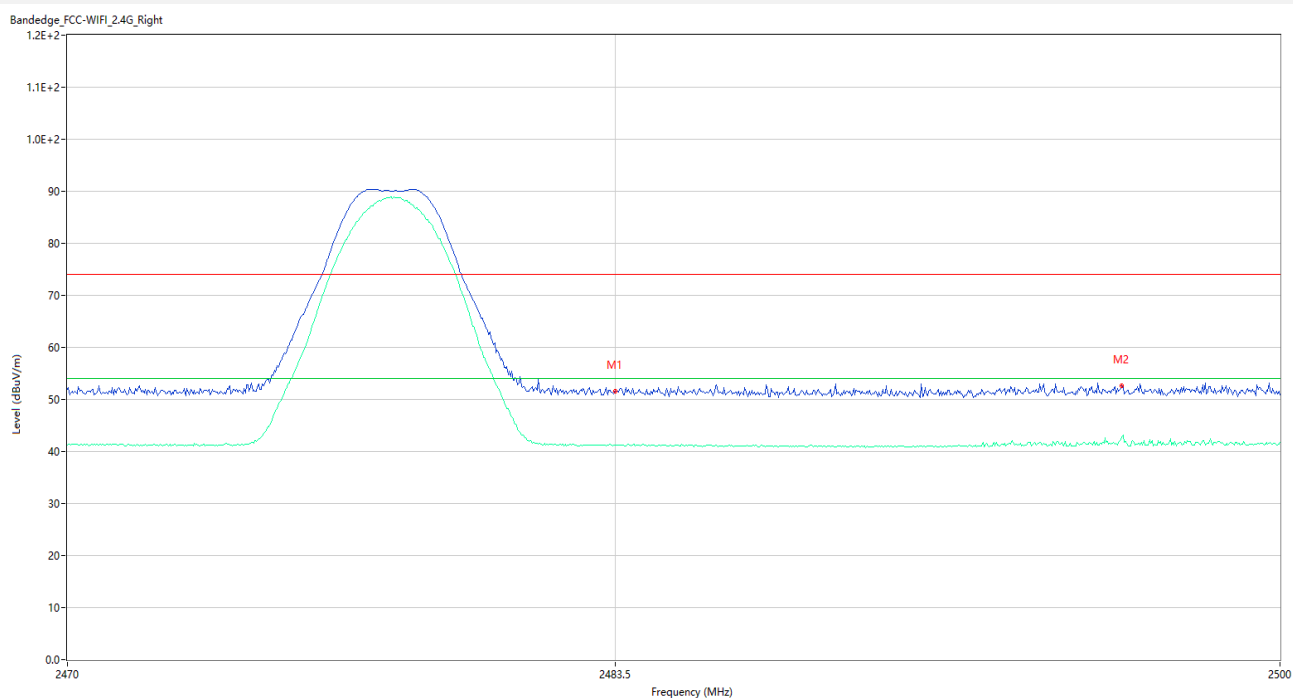
No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	2483.500	51.22	-3.78	74.0	22.78	Peak	272.00	150	Horizontal	Pass
1**	2483.500	40.94	-3.78	54.0	13.06	AV	272.00	150	Horizontal	Pass
2	2493.790	53.77	-3.90	74.0	20.23	Peak	295.00	150	Horizontal	Pass
2**	2493.790	40.92	-3.90	54.0	13.08	AV	295.00	150	Horizontal	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	51.44	-4.87	74.0	22.56	Peak	349.00	150	Horizontal	Pass
1**	2390.000	40.54	-4.87	54.0	13.46	AV	349.00	150	Horizontal	Pass
2	2368.900	52.59	-4.12	74.0	21.41	Peak	231.00	150	Horizontal	Pass
2**	2368.900	41.11	-4.12	54.0	12.89	AV	231.00	150	Horizontal	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	51.56	-3.78	74.0	22.44	Peak	360.00	150	Vertical	Pass
1**	2483.500	41.23	-3.78	54.0	12.77	AV	360.00	150	Vertical	Pass
2	2496.070	52.57	-3.94	74.0	21.43	Peak	5.00	150	Vertical	Pass
2**	2496.070	42.86	-3.94	54.0	11.14	AV	5.00	150	Vertical	Pass

A.8 Power Spectral Density (PSD)

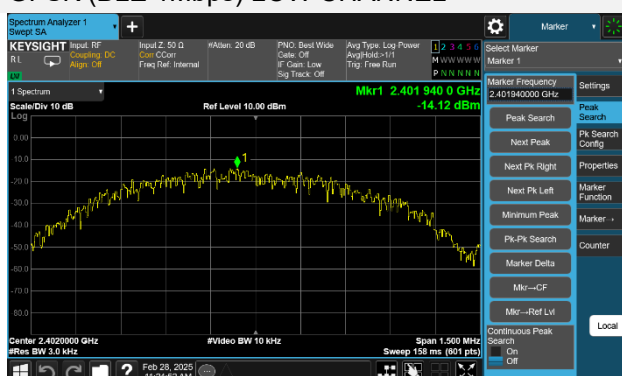
Test Data

GFSK (BLE 1Mbps)			
Channel	Spectral power density (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
Low	-14.12	8	Pass
Middle	-13.26	8	Pass
High	-12.99	8	Pass

GFSK (BLE 2Mbps)			
Channel	Spectral power density (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
Low	-16.19	8	Pass
Middle	-14.62	8	Pass
High	-15.60	8	Pass

Test Plots

GFSK (BLE 1Mbps) LOW CHANNEL



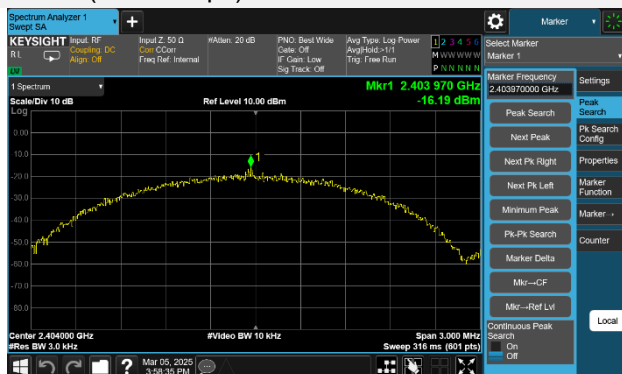
GFSK (BLE 1Mbps) MIDDLE CHANNEL



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-SH2520075-AR-1.PDF”.

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document “BL-SH2520075-AW.PDF”.

ANNEX D EUT INTERNAL PHOTOS

Please refer the document “BL-SH2520075-AI.PDF”.

Statement

1. The Testing Center guarantees the scientificity, accuracy and impartiality of the test, and is responsible for all the information in the report, except the information provided by the customer. The customer is responsible for the impact of the information provided on the validity of the results.
2. For the report with Accreditation Symbol, the items marked with "☆" are not within the accredited scope.
3. This report is invalid if it is altered, without the signature of the testing and approval personnel, or without the test report stamp.
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5. This report shall not be partially reproduced without the written permission of the Testing Center.
6. Any objection shall be raised to the Testing Center within 30 days after receiving the report.

--END OF REPORT--