Appendix A: Test Results of BLE

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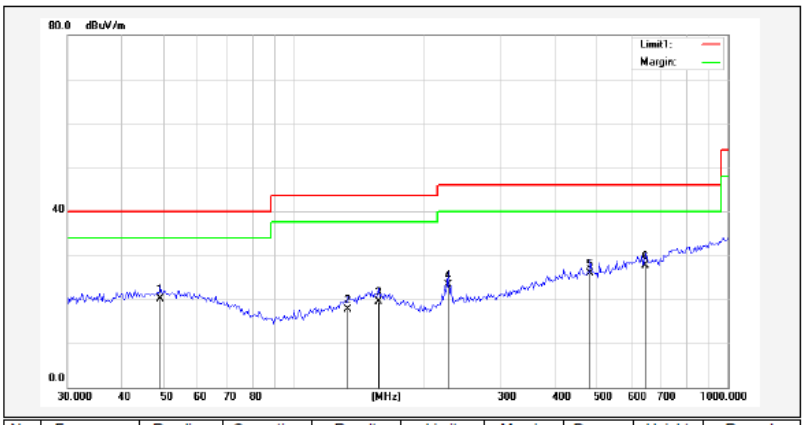
Appendix A.1 Test Results of Radiated Spurious Emission

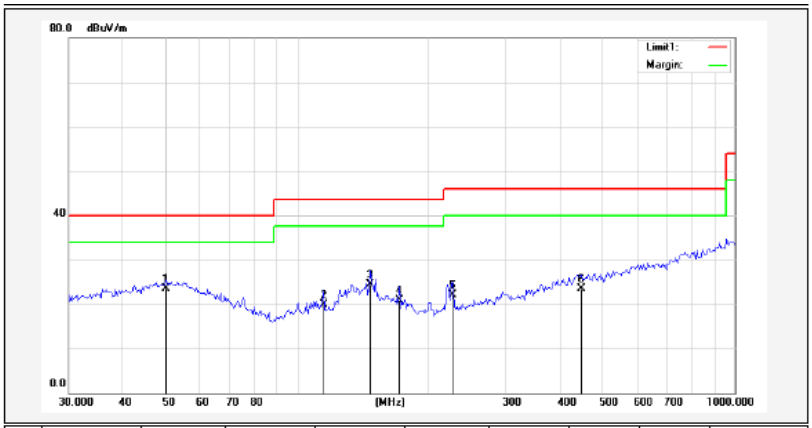
Below 1G: **Note: All modes have been tested, and the report only reflects the worst mode.**			
Test Mode：	Mode 4	Test Voltage ：	DC 3V

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Remark
1	49.0626	25.20	-5.19	20.01	40.00	-19.99			QP
2	133.0810	24.34	-6.64	17.70	43.50	-25.80			QP
3	156.4260	24.64	-5.23	19.41	43.50	-24.09			QP
4	227.0164	30.56	-7.29	23.27	46.00	-22.73			QP
5	481.5111	26.21	-0.29	25.92	46.00	-20.08			QP
6*	646.8216	24.72	2.92	27.64	46.00	-18.36			QP

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Remark
1*	50.1080	28.57	-5.10	23.47	40.00	-16.53			QP
2	114.8224	28.37	-8.37	20.00	43.50	-23.50			QP
3	146.8392	30.02	-5.50	24.52	43.50	-18.98			QP
4	171.3890	26.75	-5.90	20.85	43.50	-22.65			QP
5	227.0164	29.45	-7.29	22.16	46.00	-23.84			QP
6	445.6931	24.23	-0.73	23.50	46.00	-22.50			QP

Correction Factor = antenna factor + cable loss – amplifier gain;
Reading = Reading Amplitude in the instrument;
Result = Correction Factor + Reading;
Margin = Result – Limit

Above 1GHz：

All modes have been tested, and the report only reflects the worst mode(1Mbps)

GFSK-Low Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3992	66.47	-15.01	51.46	74	-22.54	peak
2	4808	61.63	-13.33	48.3	74	-25.7	peak
3	5590	59.19	-12.1	47.09	60.68	-13.59	peak
4	7188	54.83	-8.03	46.8	60.68	-13.88	peak
5	11404	52.66	-1.87	50.79	74	-23.21	peak
6	12424	52.91	-1.81	51.1	74	-22.9	peak

GFSK-Low Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3992	62.77	-15.01	47.76	74	-26.24	peak
2	6134	55.08	-9.98	45.1	60.68	-15.58	peak
3	7494	53.79	-7.13	46.66	74	-27.34	peak
4	10486	53.2	-3.53	49.67	60.68	-11.01	peak
5	11438	53.15	-2.04	51.11	74	-22.89	peak
6	12492	52.54	-1.38	51.16	74	-22.84	peak

GFSK- Middle Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4128	62.98	-15.15	47.83	74	-26.17	peak
2	4944	60.65	-12.85	47.8	74	-26.2	peak
3	6916	54.88	-8.8	46.08	60.68	-14.60	peak
4	7426	54.11	-7.09	47.02	74	-26.98	peak
5	8378	54.96	-7.1	47.86	74	-26.14	peak
6	11268	53.33	-2.21	51.12	74	-22.88	peak

GFSK-Middle Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4944	58.17	-12.85	45.32	74	-28.68	peak
2	6440	55.14	-10.05	45.09	60.68	-15.59	peak
3	7562	54.02	-7.22	46.8	74	-27.2	peak
4	7902	55.71	-8.06	47.65	60.68	-13.03	peak
5	10010	53.8	-4.79	49.01	60.68	-11.67	peak
6	11404	52.88	-1.87	51.01	74	-22.99	peak

GFSK-High Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4128	63.76	-15.15	48.61	74	-25.39	peak
2	4944	59.37	-12.85	46.52	74	-27.48	peak
3	6916	55.36	-8.8	46.56	60.68	-14.12	peak
4	7698	54.27	-7.74	46.53	74	-27.47	peak
5	10044	54.25	-4.59	49.66	60.68	-11.02	peak
6	10554	52.73	-2.97	49.76	60.68	-10.92	peak

GFSK-High Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4944	58.01	-12.85	45.16	74	-28.84	peak
2	6168	55.2	-9.92	45.28	60.68	-15.40	peak
3	6916	55.09	-8.8	46.29	60.68	-14.39	peak
4	7970	54.84	-7.86	46.98	60.68	-13.70	peak
5	8854	55.13	-7.88	47.25	60.68	-13.43	peak
6	11404	53.19	-1.87	51.32	74	-22.68	peak

Node:

1、Testing was carried out within frequency range 9kHz to the tenth harmonics. The measurement results below 30MHz and 18GHz - 26.5GHz were greater than 20dB below the limit, so only the radiated spurious emissions from 30MHz to 18GHz were reported..

2、Radiated emissions measured in frequency above 1GHz were made with an instrument using peak/average detector mode.

3、Average test would be performed if the peak result were greater than the average limit or as required by the applicant.

4、Margin (dB), result in dBuV/m – limit in dBuV/m.

5、According to section part 15.247(d), frequencies other than those required by part 15.205(a) are limited to the level of the intended emission (min. 80.68) minus 20dB.

Restricted band Requirements

GFSK Low

All modes have been tested, and the report only reflects the worst mode(1Mbps)

Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2362.44	61.7	-21.15	40.55	74	-33.45	peak
2	2362.44	42.79	-21.15	21.64	54	-32.36	AVG
3	2390	70.47	-21.03	49.44	74	-24.56	peak
4	2390	52.23	-21.03	31.2	54	-22.8	AVG
5	2401.96	114.39	-20.99	93.4	125.2	-31.8	peak

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2358.64	65.39	-21.16	44.23	74	-29.77	peak
2	2358.64	46.85	-21.16	25.69	54	-28.31	AVG
3	2390	60.92	-21.03	39.89	74	-34.11	peak
4	2390	42.36	-21.03	21.33	54	-32.67	AVG
5	2402.34	102.43	-20.99	81.44	125.2	-43.76	peak

GFSK-High

Horizontal

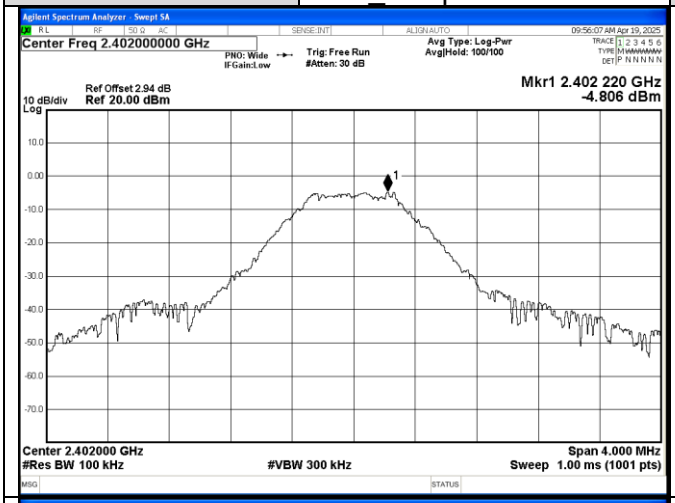
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2480.05	114.99	-20.91	94.08	125.2	-31.12	peak
2	2483.5	84.74	-20.91	63.83	74	-10.17	peak
3	2483.5	65.41	-20.91	44.5	54	-9.5	AVG
4	2485	80.85	-20.91	59.94	74	-14.06	peak
5	2485	62.47	-20.91	41.56	54	-12.44	AVG

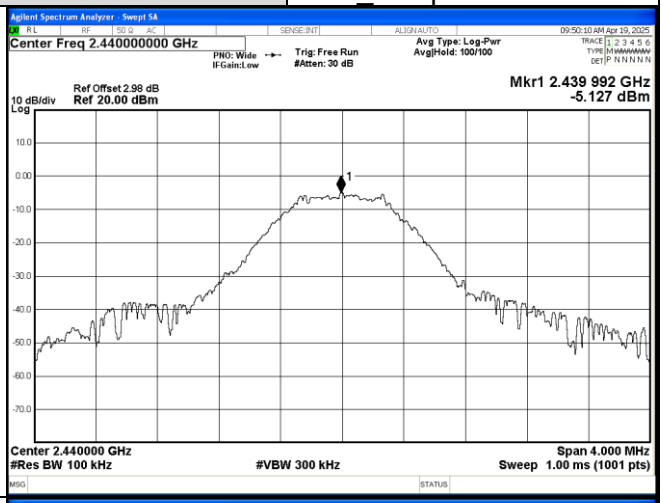
Vertical

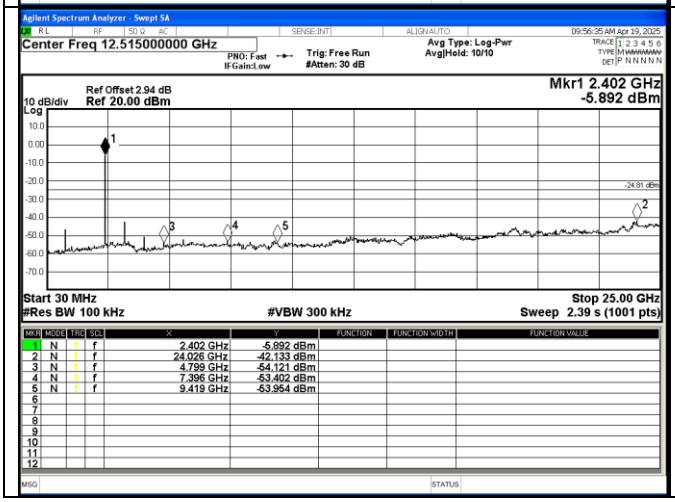
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2480	101.59	-20.91	80.68	125.2	-44.52	peak
2	2483.5	72.68	-20.91	51.77	74	-22.23	peak
3	2483.5	53.8	-20.91	32.89	54	-21.11	AVG
4	2495.3	68.55	-20.92	47.63	74	-26.37	peak
5	2495.3	48.93	-20.92	28.01	54	-25.99	AVG

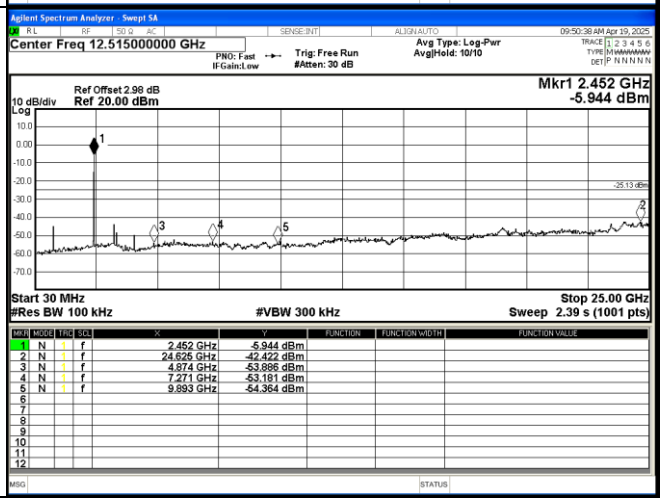
Appendix A.2 Test Results of Conducted Spurious Emissions Measured in 100 kHz Bandwidth

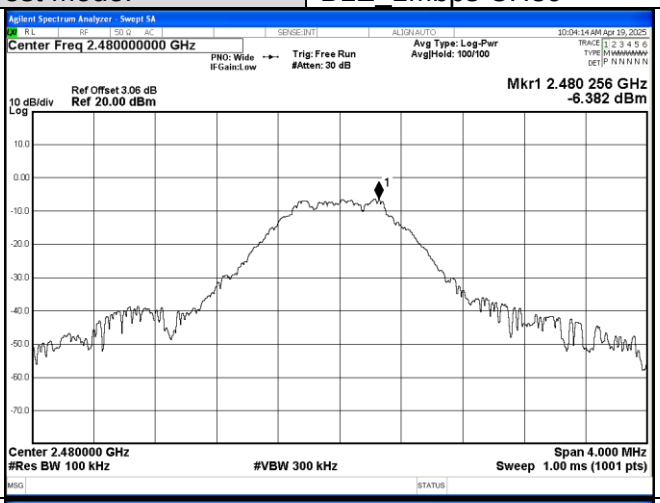
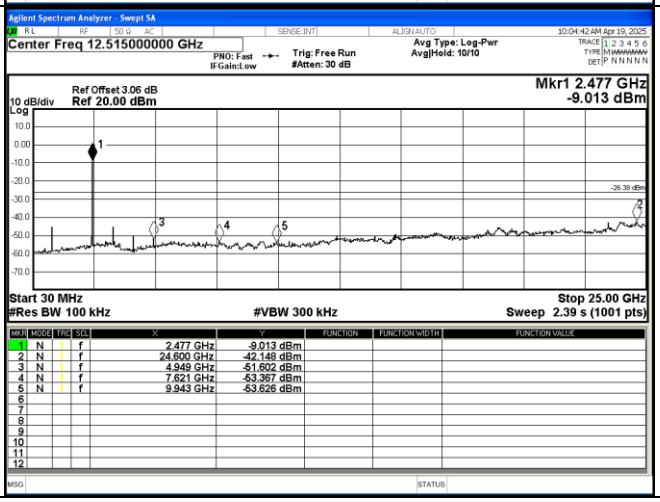
Conducted spurious emission			
Test Mode:	BLE_1Mbps CH00	Test Mode:	BLE_1Mbps CH19



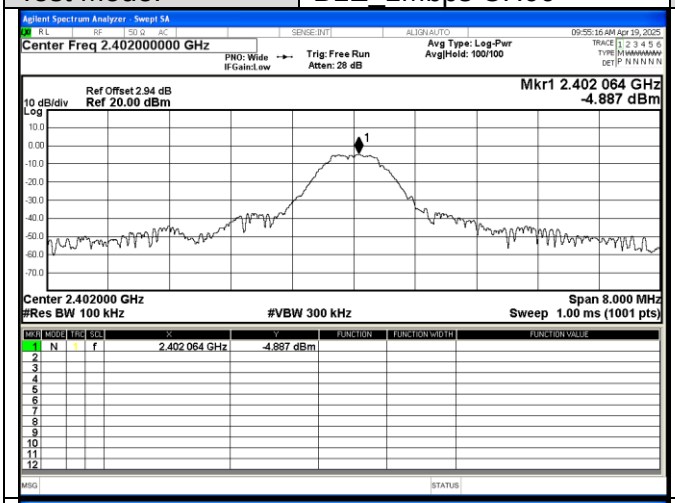


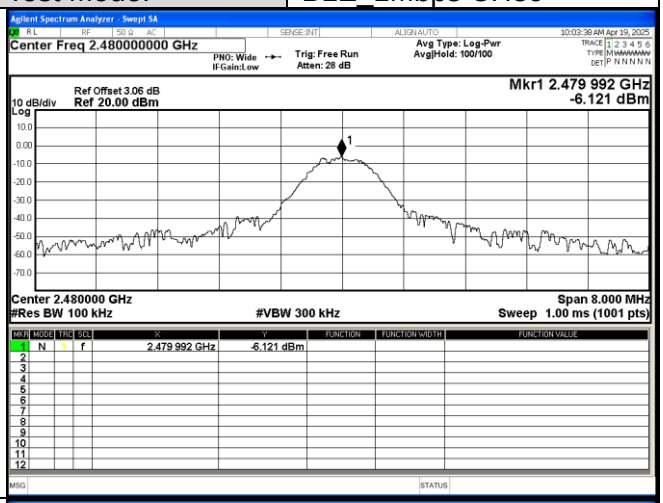


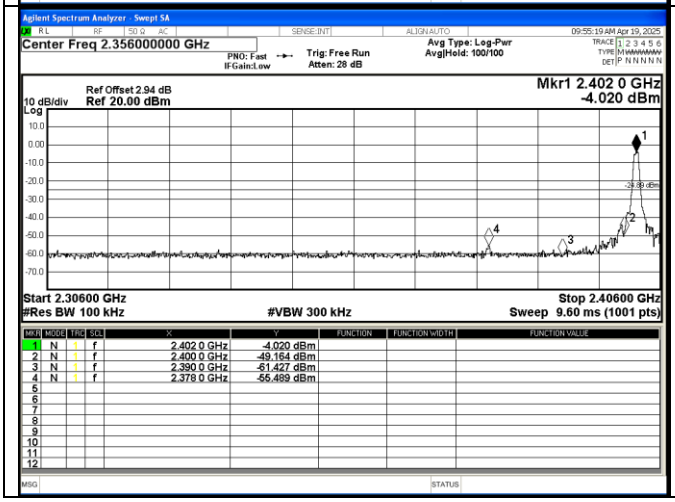


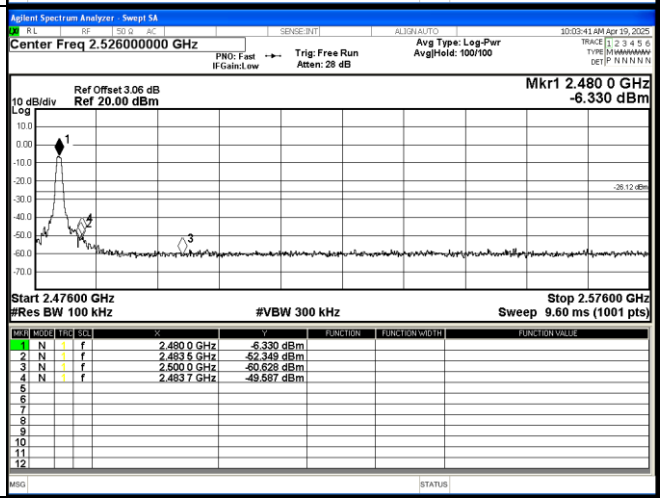
Test Mode:	BLE_1Mbps CH39		
			
			

For Band edge(it's also the reference level for conducted spurious emission)			
Test Mode:	BLE_1Mbps CH00	Test Mode:	BLE_1Mbps CH39





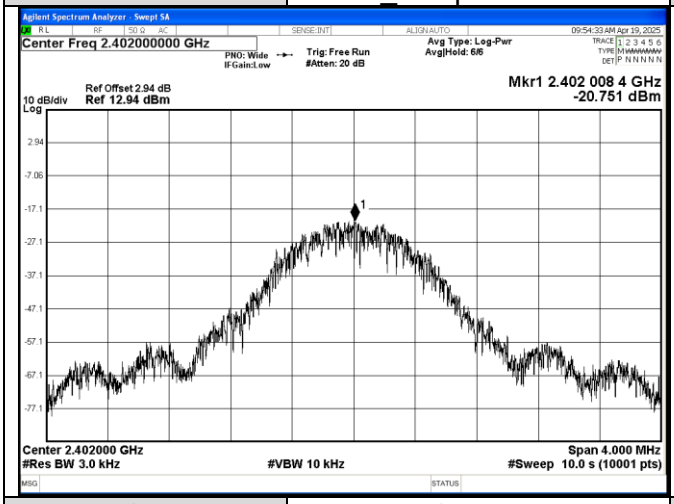


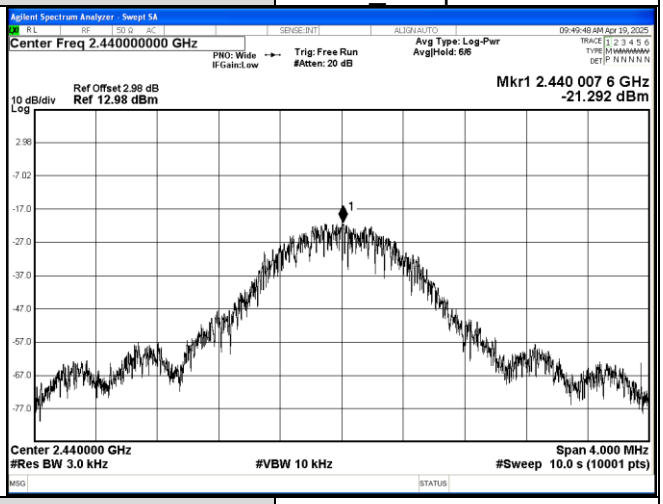


Appendix A.3 Test Results of Conducted Power Spectral Density

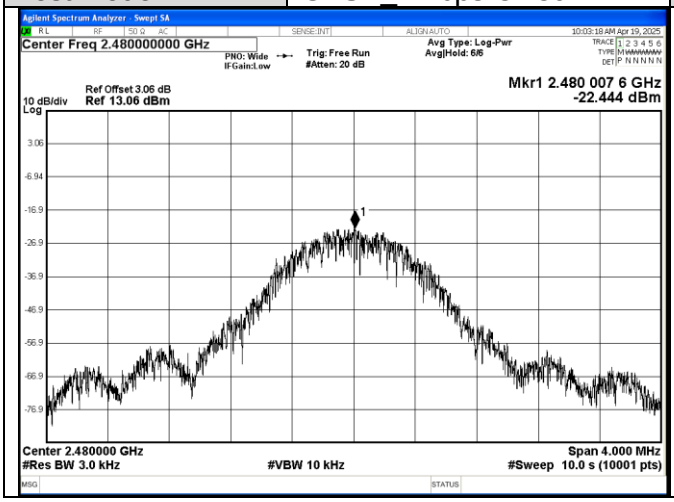
GFSK_1Mbps			
Frequency	Power Density (dBm/3kHz)	Limit (dBm/3KHz)	Result
CH00	-20.751	8	Pass
CH19	-21.292	8	Pass
CH39	-22.444	8	Pass

Test Mode:	GFSK_1Mbps CH00	Test Mode:	GFSK_1Mbps CH19





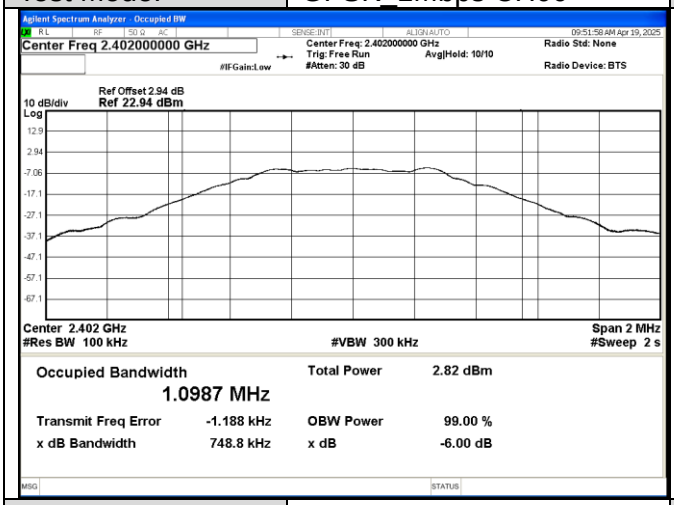
Test Mode:	GFSK_1Mbps CH39		

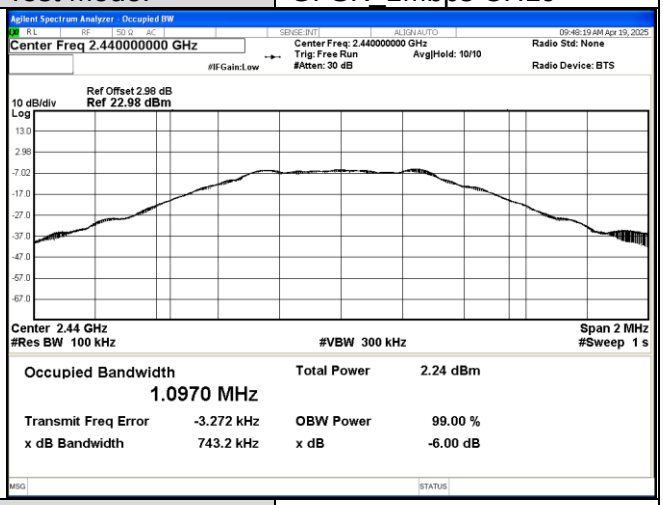


Appendix A.4 Test Results of 6dB BANDWIDTH

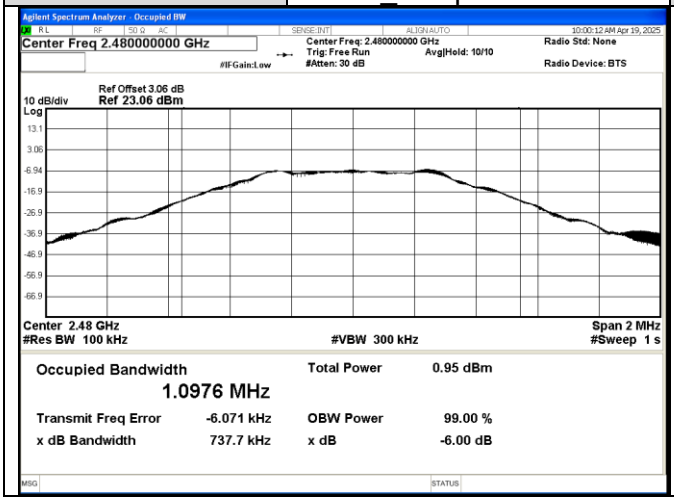
GFSK_1Mbps			
Frequency	Bandwidth (MHz)	6dB limit (MHz)	Result
	6dB		
CH00	0.7488	0.5	Pass
CH19	0.7432	0.5	Pass
CH39	0.7377	0.5	Pass

6dB Bandwidth			
Test Mode:	GFSK_1Mbps CH00	Test Mode:	GFSK_1Mbps CH19





Test Mode:	GFSK_1Mbps CH39		



Appendix A.5 Test Results of Maximum Conducted Power

Mode	Frequency [MHz]	Measured of Conducted Power		Limit [W]
		Conducted [dBm]	W	
BLE_1Mbps	2402	-0.844	0.0008	≤ 1.0
	2440	-1.222	0.0008	≤ 1.0
	2480	-2.458	0.0006	≤ 1.0

Note:
1) The cable loss is taken into account in results.
2) Antenna gain(G) BLE: 1.92 dBi
e.i.r.p.=P (peak power) + G, which is far below the 4 W