

Appendix A: Test Results of BLE

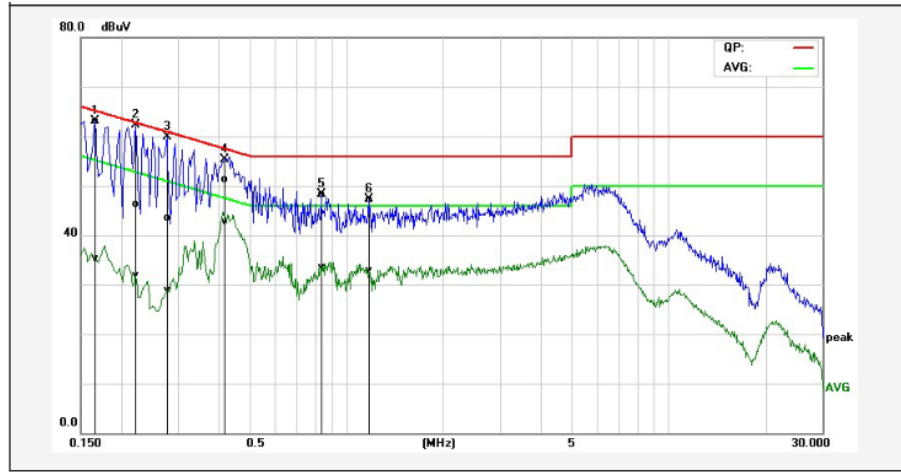
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Appendix A.1 Test Results of Conducted Emission on AC Mains

Test Mode:

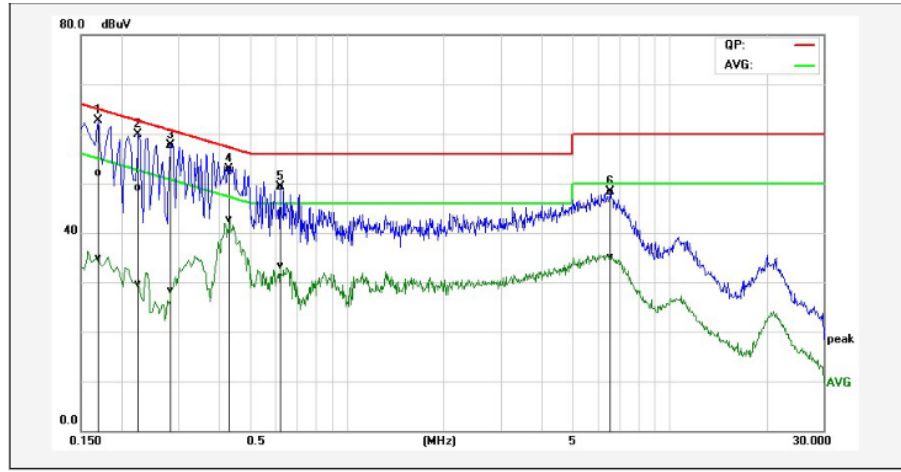
Mode4

L



No.	Frequency	QuasiPeak	Average	Correction	QuasiPeak	Average	QuasiPeak	Average	QuasiPeak	Average	Remark
	(MHz)	reading	reading	factor	result	result	limit	limit	margin	margin	
		(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)	
1*	0.1660	52.27	25.56	9.80	62.07	35.36	65.15	55.16	-3.08	-19.80	Pass
2P	0.2220	36.65	22.41	9.59	46.24	32.00	62.74	52.74	-16.50	-20.74	Pass
3P	0.2779	33.86	19.33	9.58	43.44	28.91	60.88	50.88	-17.44	-21.97	Pass
4P	0.4140	41.70	33.20	9.54	51.24	42.74	57.57	47.57	-6.33	-4.83	Pass
5P	0.8380	38.70	23.94	9.61	48.31	33.55	56.00	46.00	-7.69	-12.45	Pass
6P	1.1740	37.56	23.29	9.69	47.25	32.98	56.00	46.00	-8.75	-13.02	Pass

N



No.	Frequency	QuasiPeak	Average	Correction	QuasiPeak	Average	QuasiPeak	Average	QuasiPeak	Average	Remark
	(MHz)	reading	reading	factor	result	result	limit	limit	margin	margin	
		(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)	
1P	0.1700	42.42	25.22	9.60	52.02	34.82	64.96	54.96	-12.94	-20.14	Pass
2P	0.2260	39.42	20.07	9.59	49.01	29.66	62.59	52.60	-13.58	-22.94	Pass
3*	0.2860	47.89	18.67	9.58	57.47	28.25	60.64	50.64	-3.17	-22.39	Pass
4P	0.4340	43.29	33.24	9.53	52.82	42.77	57.18	47.18	-4.36	-4.41	Pass
5P	0.6220	39.66	23.75	9.57	49.23	33.32	56.00	46.00	-6.77	-12.68	Pass
6P	6.5780	38.74	25.48	9.62	48.36	35.10	60.00	50.00	-11.64	-14.90	Pass

Appendix A.2 Test Results of Radiated Spurious Emission

Below 1GHz:

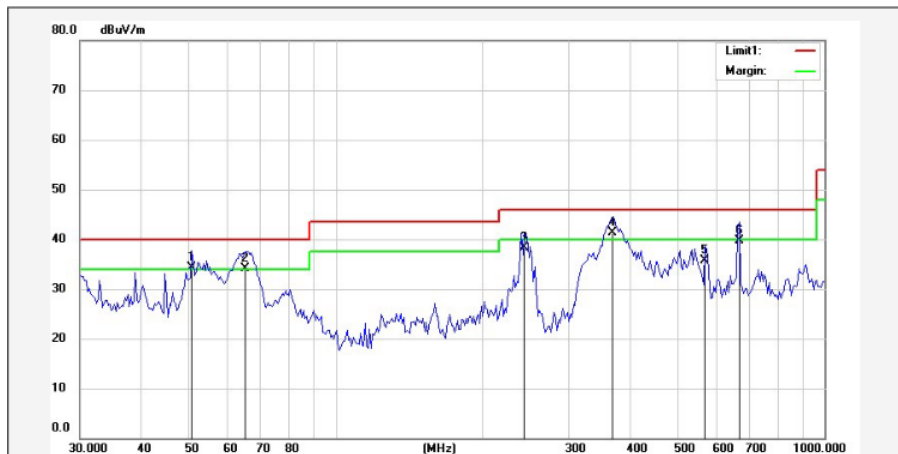
Test Mode: Mode 2(worst mode)

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Remark
1	68.2634	40.90	-14.32	26.58	40.00	-13.42	---	---	QP
2	132.1490	43.95	-14.49	29.46	43.50	-14.04	---	---	QP
3	208.6580	47.96	-15.81	32.15	43.50	-11.35	---	---	QP
4I	241.8377	55.70	-14.67	41.03	46.00	-4.97	---	---	QP
5*	371.2680	54.64	-11.43	43.21	46.00	-2.79	---	---	QP
6	665.2610	41.32	-6.21	35.11	46.00	-10.89	---	---	QP

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Remark
1I	50.8171	46.72	-12.44	34.28	40.00	-5.72	---	---	QP
2I	65.4450	47.90	-13.88	34.02	40.00	-5.98	---	---	QP
3	243.5431	52.88	-14.62	38.26	46.00	-7.74	---	---	QP
4*	368.6681	52.75	-11.49	41.26	46.00	-4.74	---	---	QP
5	569.9687	43.41	-7.78	35.63	46.00	-10.37	---	---	QP
6	669.9523	45.86	-6.18	39.68	46.00	-6.32	---	---	QP

Above 1GHz:
GFSK-Low Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5004.1481	62	-15.59	46.41	74	-27.59	peak
2	5004.1481	44.75	-15.59	29.16	54	-24.84	AVG
3	5521.9817	58.48	-13.67	44.81	74	-29.19	peak
4	5521.9817	39.82	-13.67	26.15	54	-27.85	AVG
5	6093.401	58.18	-11.78	46.4	74	-27.6	peak
6	6093.401	41.19	-11.78	29.41	54	-24.59	AVG
7	8879.1668	56.89	-7.81	49.08	74	-24.92	peak
8	8879.1668	39.96	-7.81	32.15	54	-21.85	AVG
9	11523.2011	53.98	-4.51	49.47	74	-24.53	peak
10	11523.2011	37.37	-4.51	32.86	54	-21.14	AVG
11	14782.3307	53.22	-0.99	52.23	74	-21.77	peak
12	14782.3307	35.01	-0.99	34.02	54	-19.98	AVG

GFSK-Low Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4695.2511	60.34	-16.16	44.18	74	-29.82	peak
2	4695.2511	42.52	-16.16	26.36	54	-27.64	AVG
3	5033.2181	62.2	-15.48	46.72	74	-27.28	peak
4	5033.2181	42.8	-15.48	27.32	54	-26.68	AVG
5	6881.5594	57.41	-10.04	47.37	74	-26.63	peak
6	6881.5594	40.3	-10.04	30.26	54	-23.74	AVG
7	7334.292	56.58	-9.32	47.26	74	-26.74	peak
8	7334.292	39.9	-9.32	30.58	54	-23.42	AVG
9	9034.8083	57.22	-7.68	49.54	74	-24.46	peak
10	9034.8083	39.84	-7.68	32.16	54	-21.84	AVG
11	12281.304	56.07	-3.28	52.79	74	-21.21	peak
12	12281.304	36.97	-3.28	33.69	54	-20.31	AVG

GFSK- Middle Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5004.1481	62.76	-15.59	47.17	74	-26.83	peak
2	5004.1481	45.22	-15.59	29.63	54	-24.37	AVG
3	6419.4813	57.13	-11.08	46.05	74	-27.95	peak
4	6419.4813	39.54	-11.08	28.46	54	-25.54	AVG
5	7419.7514	56.42	-9.08	47.34	74	-26.66	peak
6	7419.7514	38.96	-9.08	29.88	54	-24.12	AVG
7	9087.2926	57.87	-7.75	50.12	74	-23.88	peak
8	9087.2926	40.71	-7.75	32.96	54	-21.04	AVG
9	12424.4058	54.22	-3.18	51.04	74	-22.96	peak
10	12424.4058	37.14	-3.18	33.96	54	-20.04	AVG
11	13165.3191	55.74	-2.80	52.94	74	-21.06	peak
12	13165.3191	37.32	-2.80	34.52	54	-19.48	AVG

GFSK-Middle Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5004.1481	59.5	-15.59	43.91	74	-30.09	peak
2	5004.1481	41.55	-15.59	25.96	54	-28.04	AVG
3	6802.2987	57.96	-10.25	47.71	74	-26.29	peak
4	6802.2987	39.71	-10.25	29.46	54	-24.54	AVG
5	8282.955	57.79	-8.51	49.28	74	-24.72	peak
6	8282.955	39.77	-8.51	31.26	54	-22.74	AVG
7	9354.3238	55.93	-6.45	49.48	74	-24.52	peak
8	9354.3238	39.3	-6.45	32.85	54	-21.15	AVG
9	12069.7352	56.18	-3.09	53.09	74	-20.91	peak
10	12069.7352	37.67	-3.09	34.58	54	-19.42	AVG
11	14782.3307	53.57	-0.99	52.58	74	-21.42	peak
12	14782.3307	36.45	-0.99	35.46	54	-18.54	AVG

GFSK-High Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3946.3132	62.33	-17.54	44.79	74	-29.21	peak
2	3946.3132	45.1	-17.54	27.56	54	-26.44	AVG
3	5033.2181	60.9	-15.48	45.42	74	-28.58	peak
4	5033.2181	43.89	-15.48	28.41	54	-25.59	AVG
5	5618.7757	59.31	-13.53	45.78	74	-28.22	peak
6	5618.7757	42.18	-13.53	28.65	54	-25.35	AVG
7	7771.663	57.8	-9.21	48.59	74	-25.41	peak
8	7771.663	40.47	-9.21	31.26	54	-22.74	AVG
9	8726.2065	57.83	-8.20	49.63	74	-24.37	peak
10	8726.2065	40.35	-8.20	32.15	54	-21.85	AVG
11	9969.7378	56.54	-6.07	50.47	74	-23.53	peak
12	9969.7378	39.76	-6.07	33.69	54	-20.31	AVG

GFSK-High Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4695.2511	61.35	-16.16	45.19	74	-28.81	peak
2	4695.2511	44.79	-16.16	28.63	54	-25.37	AVG
3	4975.2461	62.03	-15.60	46.43	74	-27.57	peak
4	4975.2461	45.23	-15.60	29.63	54	-24.37	AVG
5	5817.4834	59.48	-12.75	46.73	74	-27.27	peak
6	5817.4834	42.61	-12.75	29.86	54	-24.14	AVG
7	7002.185	58.13	-9.93	48.2	74	-25.8	peak
8	7002.185	41.19	-9.93	31.26	54	-22.74	AVG
9	8776.8981	58.58	-8.09	50.49	74	-23.51	peak
10	8776.8981	40.24	-8.09	32.15	54	-21.85	AVG
11	11523.2011	54.93	-4.51	50.42	74	-23.58	peak
12	11523.2011	38.2	-4.51	33.69	54	-20.31	AVG

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. Both rates mode(1Mbps and 2Mbps) have been tested, and the worst mode(2Mbps) is reflected in the report.
5. Margin (dB), result in dBuV/m – limit in dBuV/m.

Restricted band Requirements GFSK Low

Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2382.1543	74.52	-19.95	54.57	74	-19.43	peak
2	2382.1543	56.9	-19.95	36.95	54	-17.05	AVG
3	2390	70.65	-19.91	50.74	74	-23.26	peak
4	2390	53.8	-19.91	33.89	54	-20.11	AVG

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2381.964	71.68	-19.95	51.73	74	-22.27	peak
2	2381.964	53.8	-19.95	33.85	54	-20.15	AVG
3	2390	71.84	-19.91	51.93	74	-22.07	peak
4	2390	53.37	-19.91	33.46	54	-20.54	AVG

GFSK-High

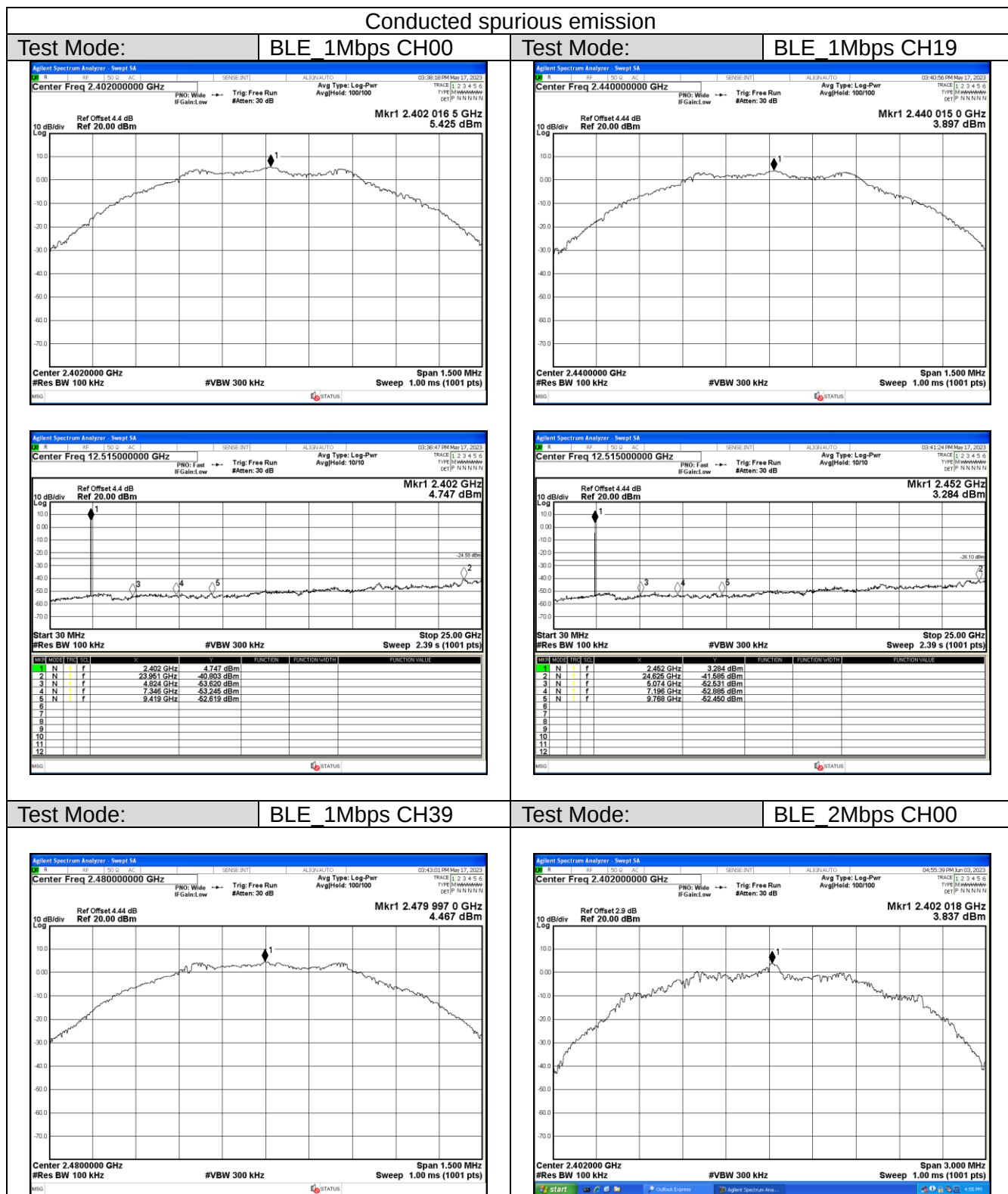
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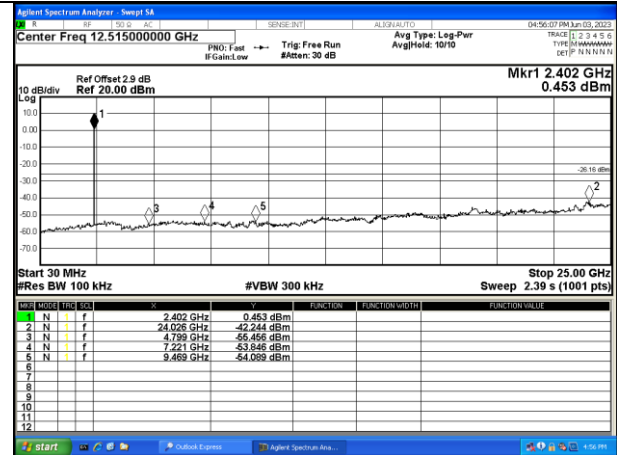
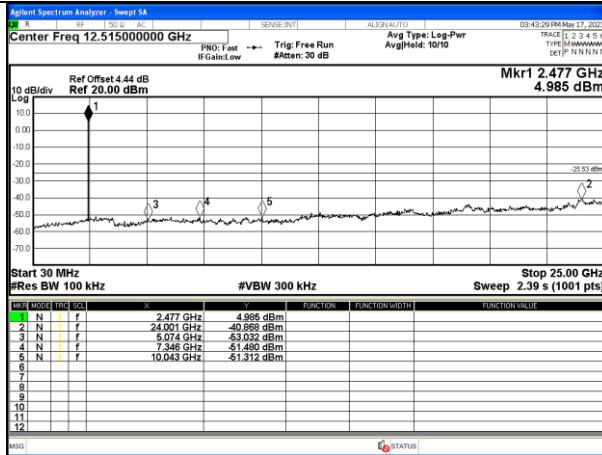
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.5	72.52	-19.91	52.61	74	-21.39	peak
2	2483.5	54.97	-19.91	35.06	54	-18.94	AVG
3	2499.8957	74.46	-19.88	54.58	74	-19.42	peak
4	2499.8957	56.83	-19.88	36.95	54	-17.05	AVG

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.5	73.96	-19.91	54.05	74	-19.95	peak
2	2483.5	56.06	-19.91	36.15	54	-17.85	AVG
3	2497.7073	74.28	-19.88	54.4	74	-19.6	peak
4	2497.7073	56.46	-19.88	36.58	54	-17.42	AVG

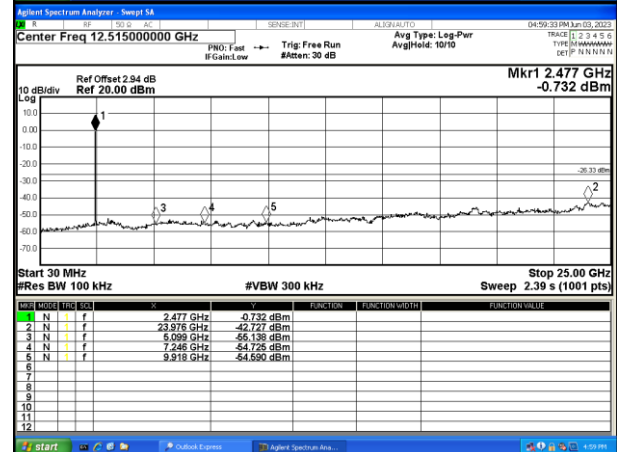
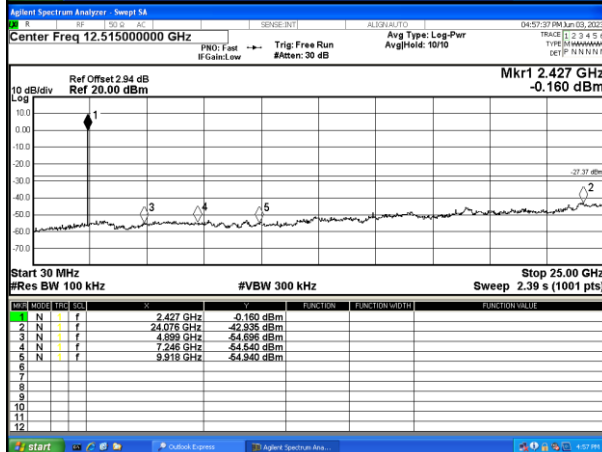
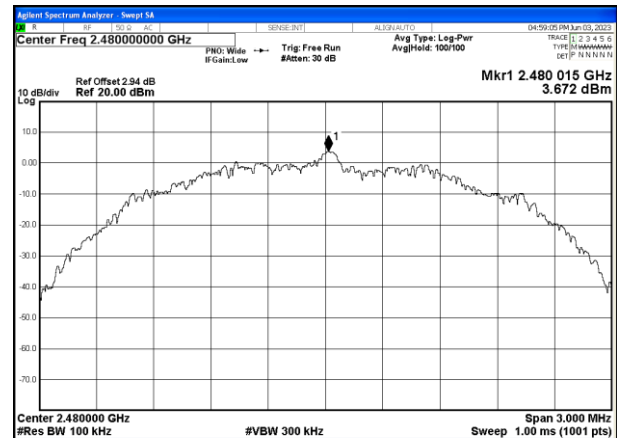
Appendix A.3 Test Results of Conducted Spurious Emissions Measured in 100 kHz Bandwidth





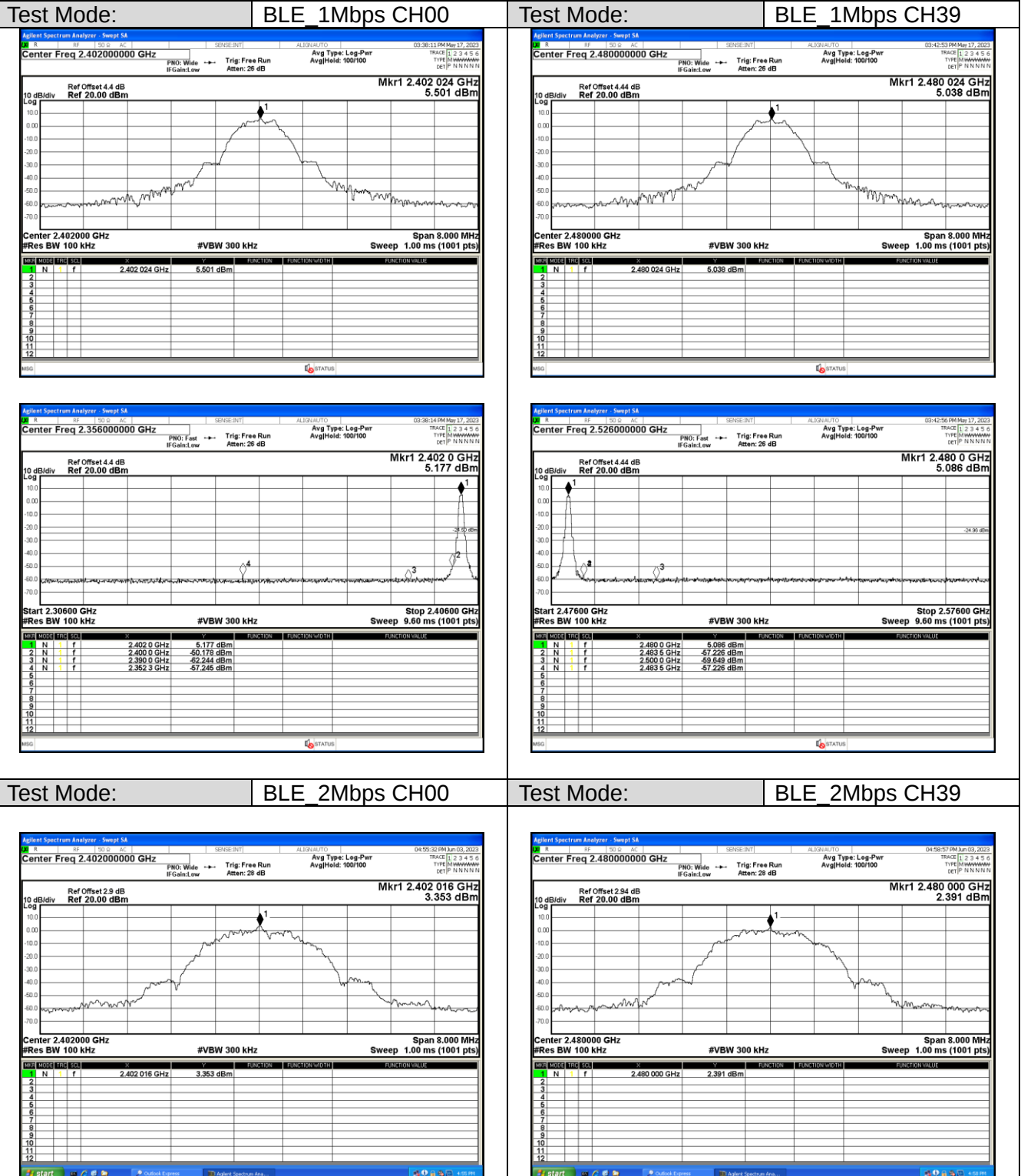
Test Mode: BLE_2Mbps CH19

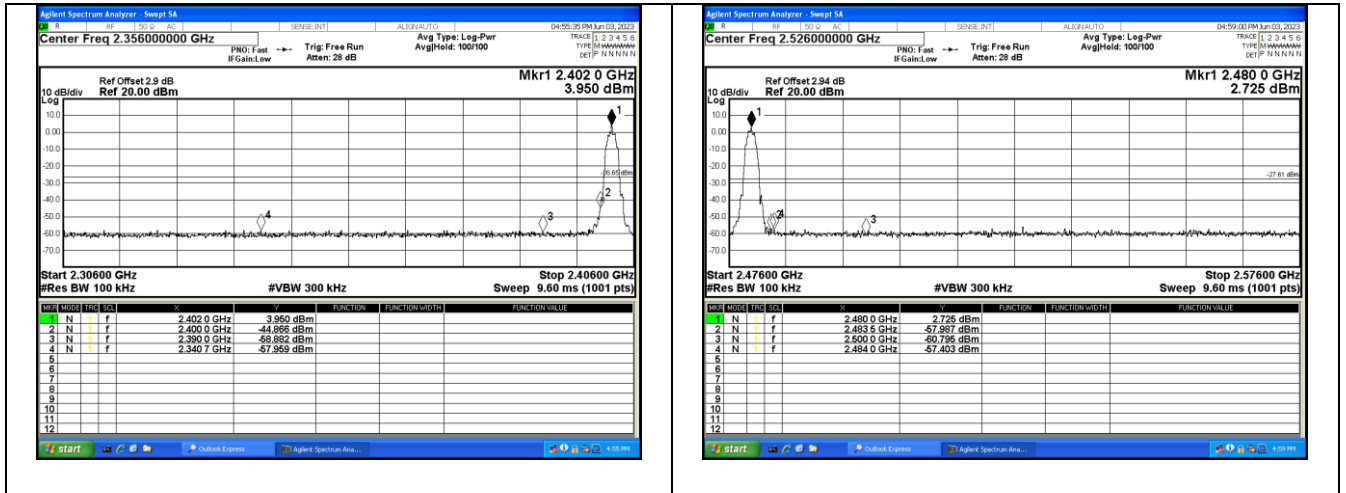
Test Mode: BLE_2Mbps CH39





For Band edge(it's also the reference level for conducted spurious emission)

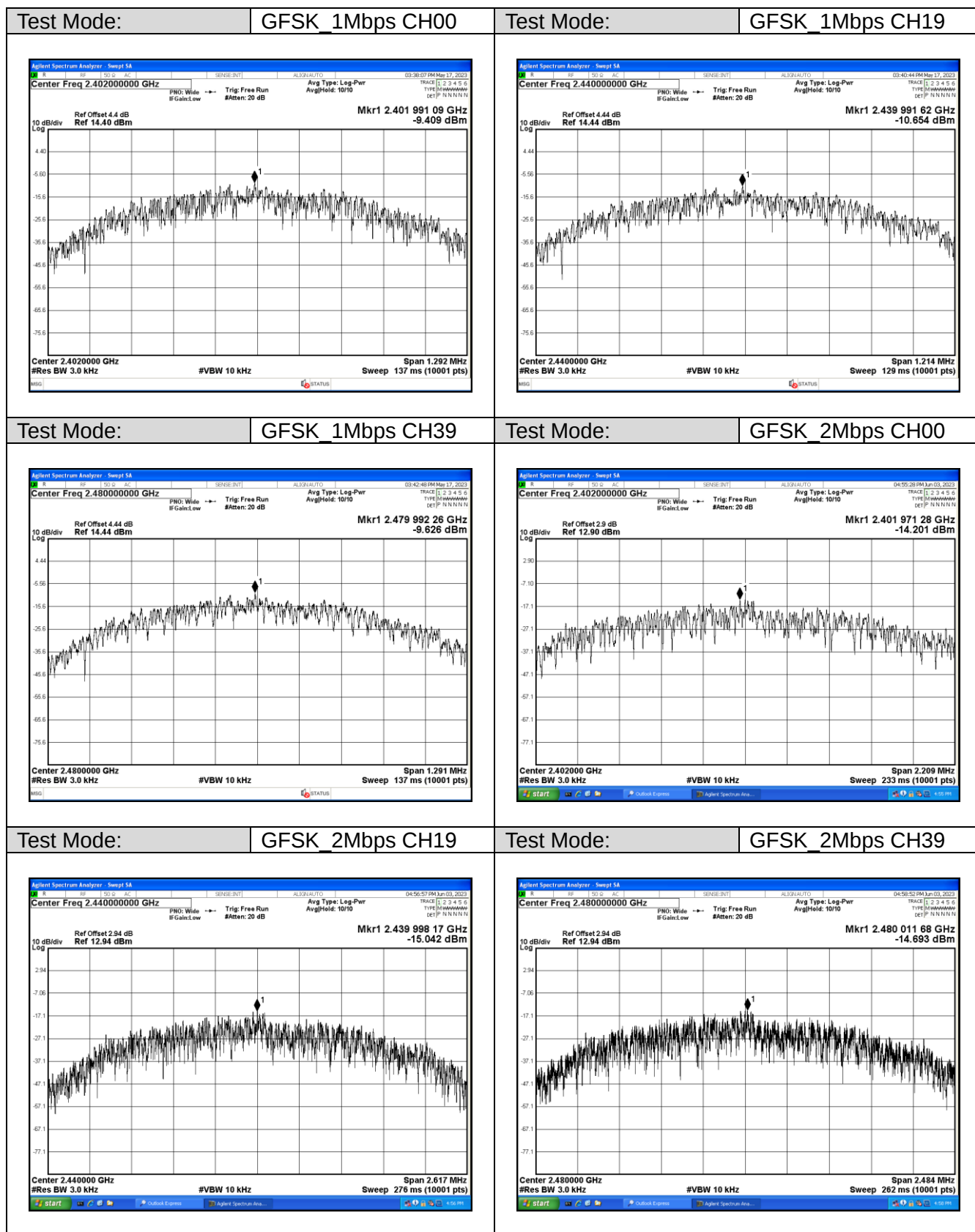




Appendix A.4 Test Results of Conducted Power Spectral Density

GFSK_1Mbps			
Frequency	Power Density	Limit (dBm/3KHz)	Result
	(dBm/3kHz)		
CH00	-9.409	8	Pass
CH19	-10.654	8	Pass
CH39	-9.626	8	Pass

GFSK_2Mbps			
Frequency	Power Density	Limit (dBm/3KHz)	Result
	(dBm/3kHz)		
CH00	-14.201	8	Pass
CH19	-15.042	8	Pass
CH39	-14.693	8	Pass

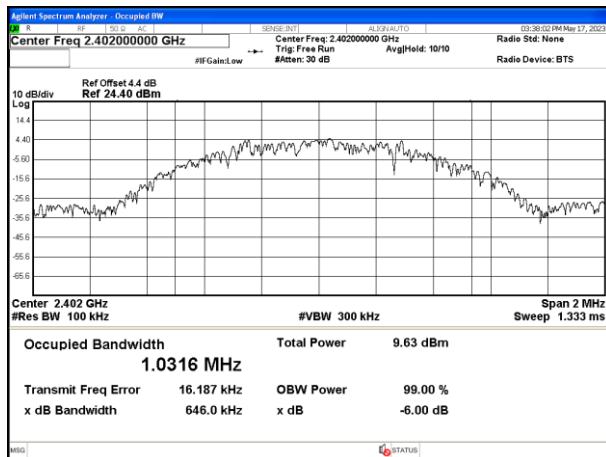


Appendix A.5 Test Results of 6dB BANDWIDTH

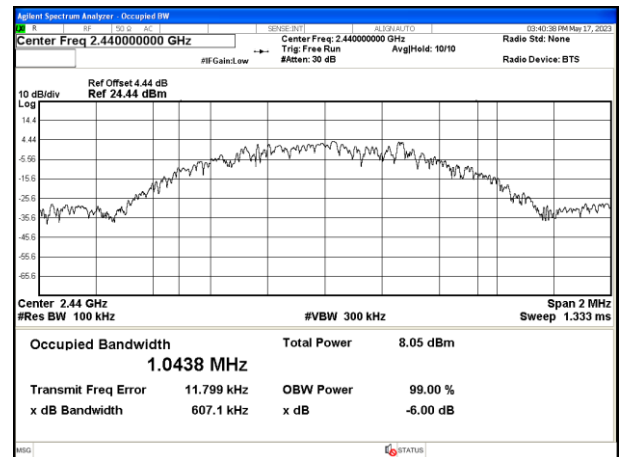
GFSK_1Mbps			
Frequency	6dB Bandwidth (MHz)	6dB limit (KHz)	Result
CH00	0.646	0.5	Pass
CH19	0.6071	0.5	Pass
CH39	0.6454	0.5	Pass

GFSK_2Mbps			
Frequency	6dB Bandwidth (MHz)	6dB limit (KHz)	Result
CH00	1.1046	0.5	Pass
CH19	1.3083	0.5	Pass
CH39	1.2422	0.5	Pass

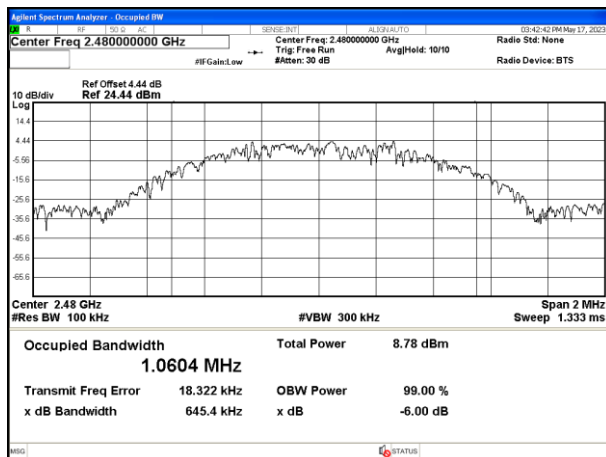
Test Mode: GFSK_1Mbps CH00



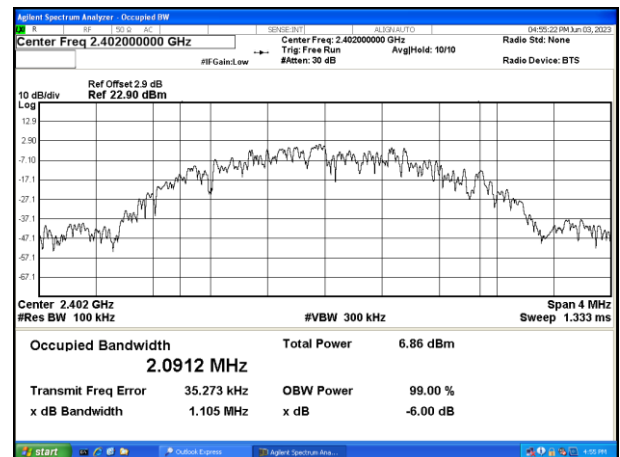
Test Mode: GFSK_1Mbps CH19



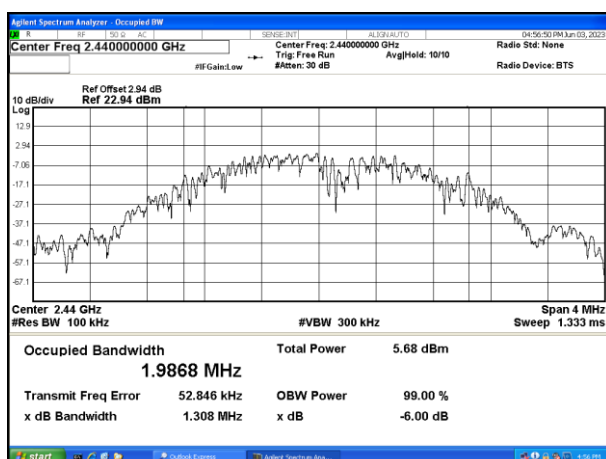
Test Mode: GFSK_1Mbps CH39



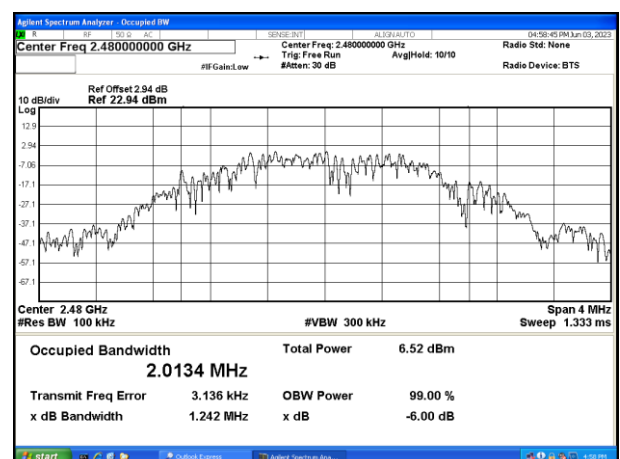
Test Mode: GFSK_2Mbps CH00



Test Mode: GFSK_2Mbps CH19



Test Mode: GFSK_2Mbps CH39



Appendix A.6 Test Results of Maximum Conducted Output Power

Mode	Frequency [MHz]	Measured of Output Power		Limit [W]
		dBm	W	
BLE_1Mbps	2402	6.963	0.0050	< 1.0
	2440	5.549	0.0036	< 1.0
	2480	6.425	0.0044	< 1.0
BLE_2Mbps	2402	10.545	0.0113	< 1.0
	2440	9.636	0.0092	< 1.0
	2480	10.474	0.0112	< 1.0

Note:

1) The cable loss is taken into account in results.

2) Antenna gain(G) BLE: 3.54 dBi

e.i.r.p.=P(Peak power)+ G, which is far below the 4 W