

Appendix A: Test Results of BLE

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

Note: All modes have been tested, and the report only reflects the worst mode.

Test Mode:Mode 7

Test Voltage :AC 110V/60Hz

L

No.	Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
1*	0.1500	45.57	28.11	9.50	55.07	37.61	65.99	56.00	-10.92	-18.39	Pass
2P	0.2100	36.90	21.29	9.50	46.40	30.79	63.20	53.21	-16.80	-22.42	Pass
3P	0.5020	28.90	25.39	9.50	38.40	34.89	56.00	46.00	-17.60	-11.11	Pass
4P	0.7860	27.82	23.81	9.47	37.29	33.28	56.00	46.00	-18.71	-12.72	Pass
5P	1.0900	25.58	17.89	9.39	34.97	27.28	56.00	46.00	-21.03	-18.72	Pass
6P	5.4980	29.06	19.29	9.05	38.11	28.34	60.00	50.00	-21.89	-21.66	Pass

N

No.	Frequency (MHz)	QuasiPeak reading (dBuV)	Average reading (dBuV)	Correction factor (dB)	QuasiPeak result (dBuV)	Average result (dBuV)	QuasiPeak limit (dBuV)	Average limit (dBuV)	QuasiPeak margin (dB)	Average margin (dB)	Remark
1P	0.1740	37.14	18.71	9.40	46.54	28.11	64.76	54.77	-18.22	-26.66	Pass
2P	0.2300	33.94	17.59	9.40	43.34	26.99	62.45	52.45	-19.11	-25.46	Pass
3*	0.5140	27.26	23.52	9.40	36.66	32.92	56.00	46.00	-19.34	-13.08	Pass
4P	0.7860	26.33	22.55	9.37	35.70	31.92	56.00	46.00	-20.30	-14.08	Pass
5P	2.6260	23.55	9.71	9.14	32.69	18.85	56.00	46.00	-23.31	-27.15	Pass
6P	9.3700	28.54	17.58	9.08	37.62	26.66	60.00	50.00	-22.38	-23.34	Pass

Correction Factor = insertion loss of LISN + cable loss;

Reading = Reading Amplitude in the instrument;

Result = Correction Factor + Reading;

Margin = Result – Limit

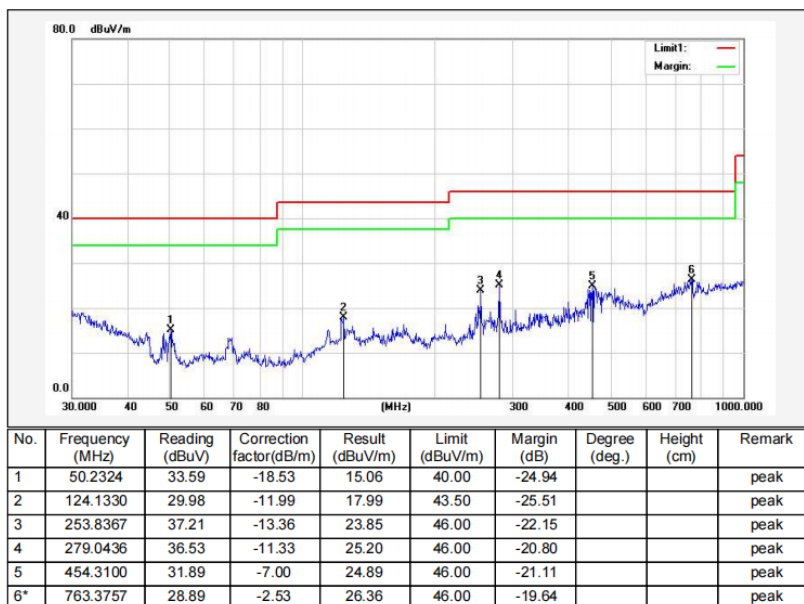
Appendix A.2 Test Results of Radiated Spurious Emission

Below 1G:

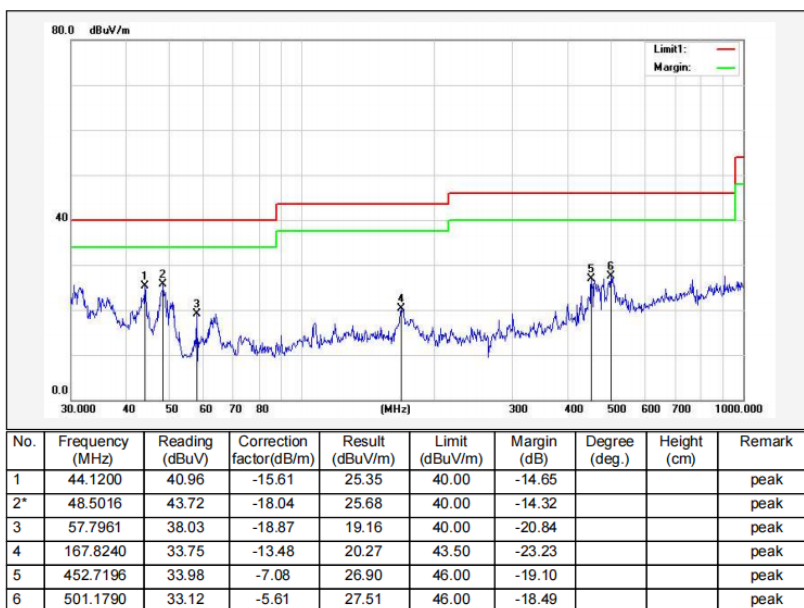
Note: All modes have been tested, and the report only reflects the worst mode.

Test Mode :	Mode 1	Test Voltage :	DC 5V
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Horizontal



Vertical



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	4808	57.81	-13.33	44.48	74	-29.52	peak
2	6168	56.39	-9.92	46.47	56.20	-9.73	peak
3	6780	55.24	-8.99	46.25	56.20	-9.95	peak
4	7800	55.94	-8.32	47.62	56.20	-8.58	peak
5	8208	54.36	-7.62	46.74	74	-27.26	peak
6	8820	53.98	-7.83	46.15	56.20	-10.05	peak

GFSK-Low Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5046	56.37	-12.62	43.75	74	-30.25	peak
2	5692	56.07	-11.75	44.32	56.20	-11.88	peak
3	5998	55.42	-10.12	45.3	56.20	-10.9	peak
4	6916	54.95	-8.8	46.15	56.20	-10.05	peak
5	7562	54.19	-7.22	46.97	74	-27.03	peak
6	8378	54.85	-7.1	47.75	74	-26.25	peak

GFSK- Middle Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4876	59.33	-13	46.33	74	-27.67	peak
2	5998	55.11	-10.12	44.99	56.20	-11.21	peak
3	6950	55.18	-8.79	46.39	56.20	-9.81	peak
4	7494	53.86	-7.13	46.73	74	-27.27	peak
5	8208	54.44	-7.62	46.82	74	-27.18	peak
6	8820	54.71	-7.83	46.88	56.20	-9.32	peak

GFSK-Middle Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	6032	54.82	-10.1	44.72	56.20	-11.48	peak
2	6304	54.67	-9.91	44.76	56.20	-11.44	peak
3	6882	54.69	-8.82	45.87	56.20	-10.33	peak
4	7460	55.02	-7.09	47.93	74	-26.07	peak
5	8004	54.64	-7.81	46.83	56.20	-9.37	peak
6	8276	53.68	-7.36	46.32	74	-27.68	peak

GFSK-High Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4944	59.28	-12.85	46.43	74	-27.57	peak
2	5964	55.67	-10.23	45.44	56.20	-10.76	peak
3	6304	54.56	-9.91	44.65	56.20	-11.55	peak
4	7052	54.27	-8.58	45.69	56.20	-10.51	peak
5	7494	53.9	-7.13	46.77	74	-27.23	peak
6	8242	54.99	-7.48	47.51	74	-26.49	peak

GFSK-High Vertical

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	4910	56.88	-12.91	43.97	74	-30.03	peak
2	6134	54.73	-9.98	44.75	56.20	-11.45	peak
3	6440	55.01	-10.05	44.96	56.20	-11.24	peak
4	6950	53.81	-8.79	45.02	56.20	-11.18	peak
5	7562	53.6	-7.22	46.38	74	-27.62	peak
6	8344	53.42	-7.2	46.22	74	-27.78	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. 76.20) 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	2365.8	59.48	-21.13	38.35	74	-35.65	peak
2	2365.8	44.7	-21.13	23.57	54	-30.43	AVG
3	2390	59.26	-21.03	38.23	74	-35.77	peak
4	2390	43.89	-21.03	22.86	54	-31.14	AVG
5	2401.6	116.32	-20.99	95.33	125.2	-29.87	peak

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2370.8	59.67	-21.12	38.55	74	-35.45	peak
2	2370.8	45.38	-21.12	24.26	54	-29.74	AVG
3	2390	57.83	-21.03	36.8	74	-37.2	peak
4	2390	44.17	-21.03	23.14	54	-30.86	AVG
5	2401.6	106.06	-20.99	85.07	125.2	-40.13	peak

GFSK-High

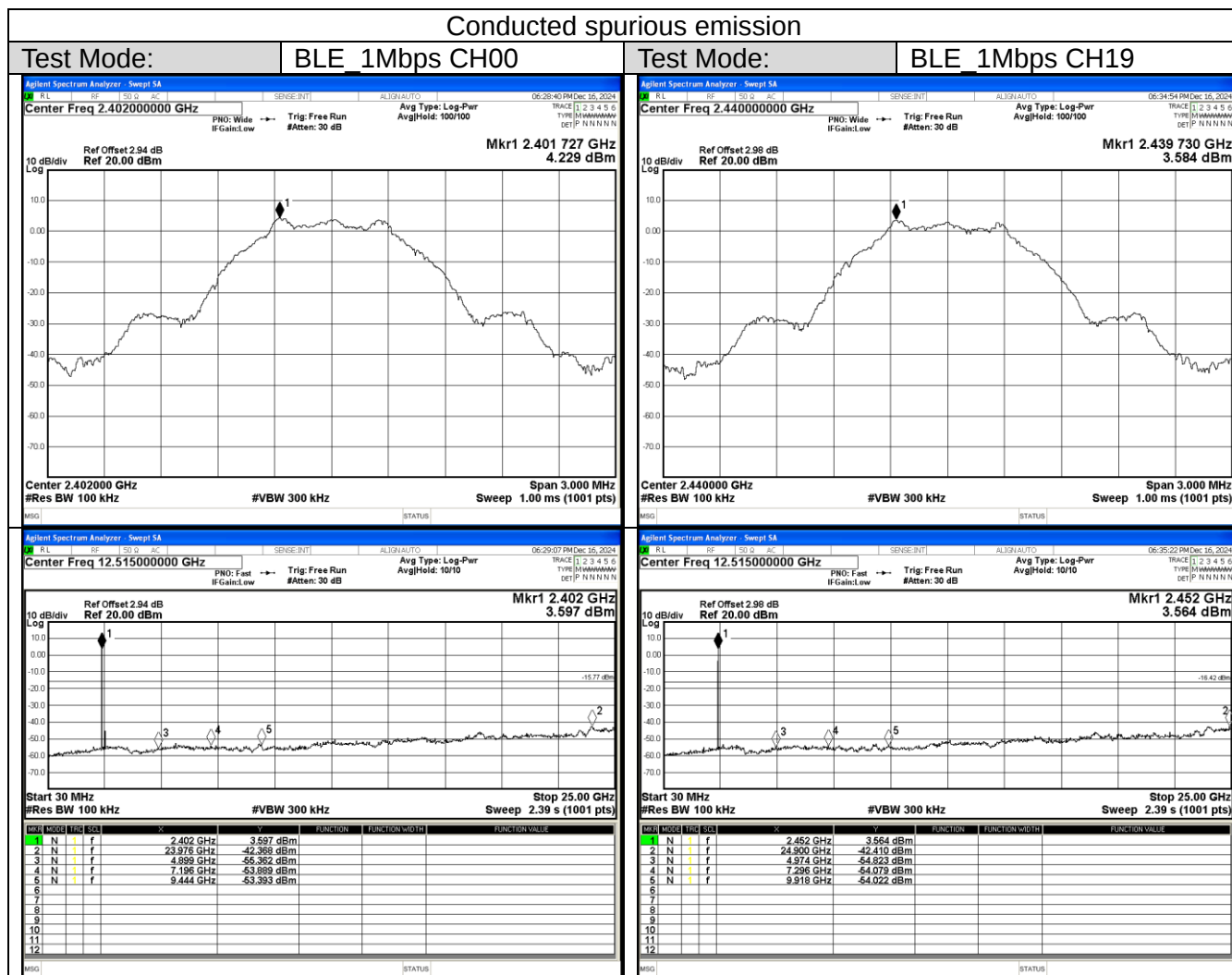
Horizontal

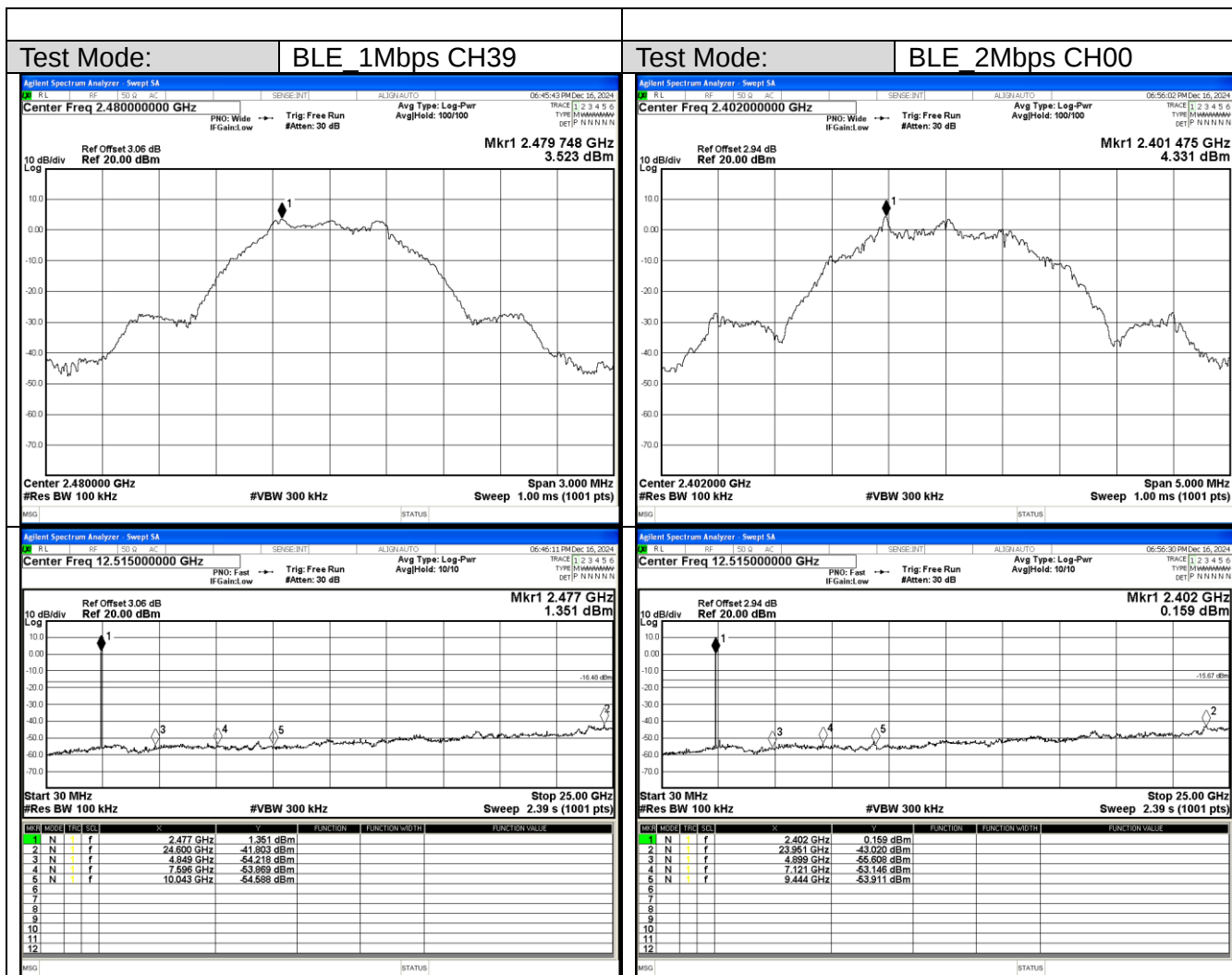
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2480.02	112.36	-20.91	91.45	125.2	-33.75	peak
2	2483.5	68.1	-20.91	47.19	74	-26.81	peak
3	2483.5	53.69	-20.91	32.78	54	-21.22	AVG
4	2484.82	65.89	-20.91	44.98	74	-29.02	peak
5	2484.82	51.78	-20.91	30.87	54	-23.13	AVG

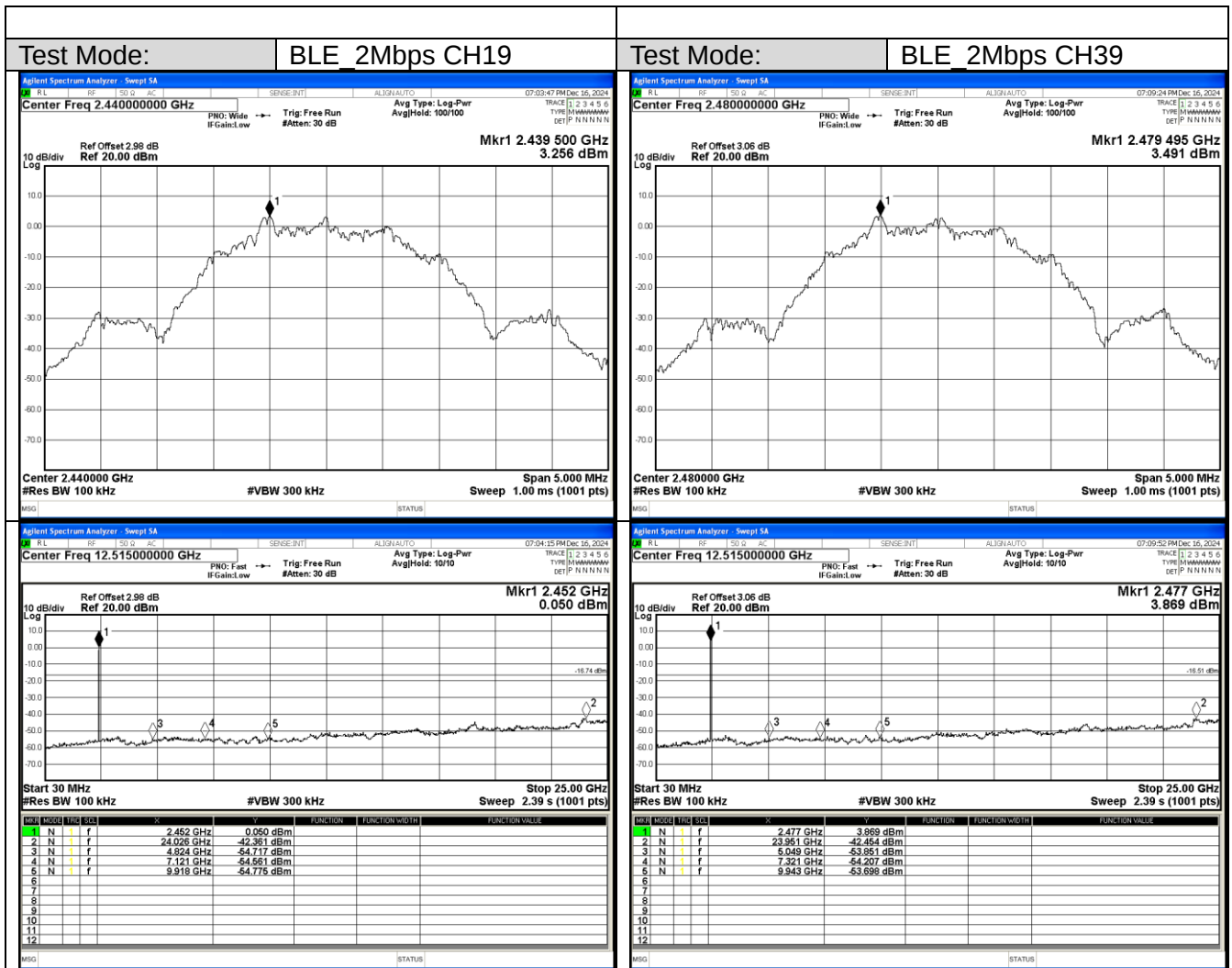
Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2479.48	97.11	-20.91	76.2	125.2	-49	peak
2	2483.5	59.78	-20.91	38.87	74	-35.13	peak
3	2483.5	43.87	-20.91	22.96	54	-31.04	AVG
4	2490.88	62.34	-20.92	41.42	74	-32.58	peak
5	2490.88	50.16	-20.92	29.24	54	-24.76	AVG

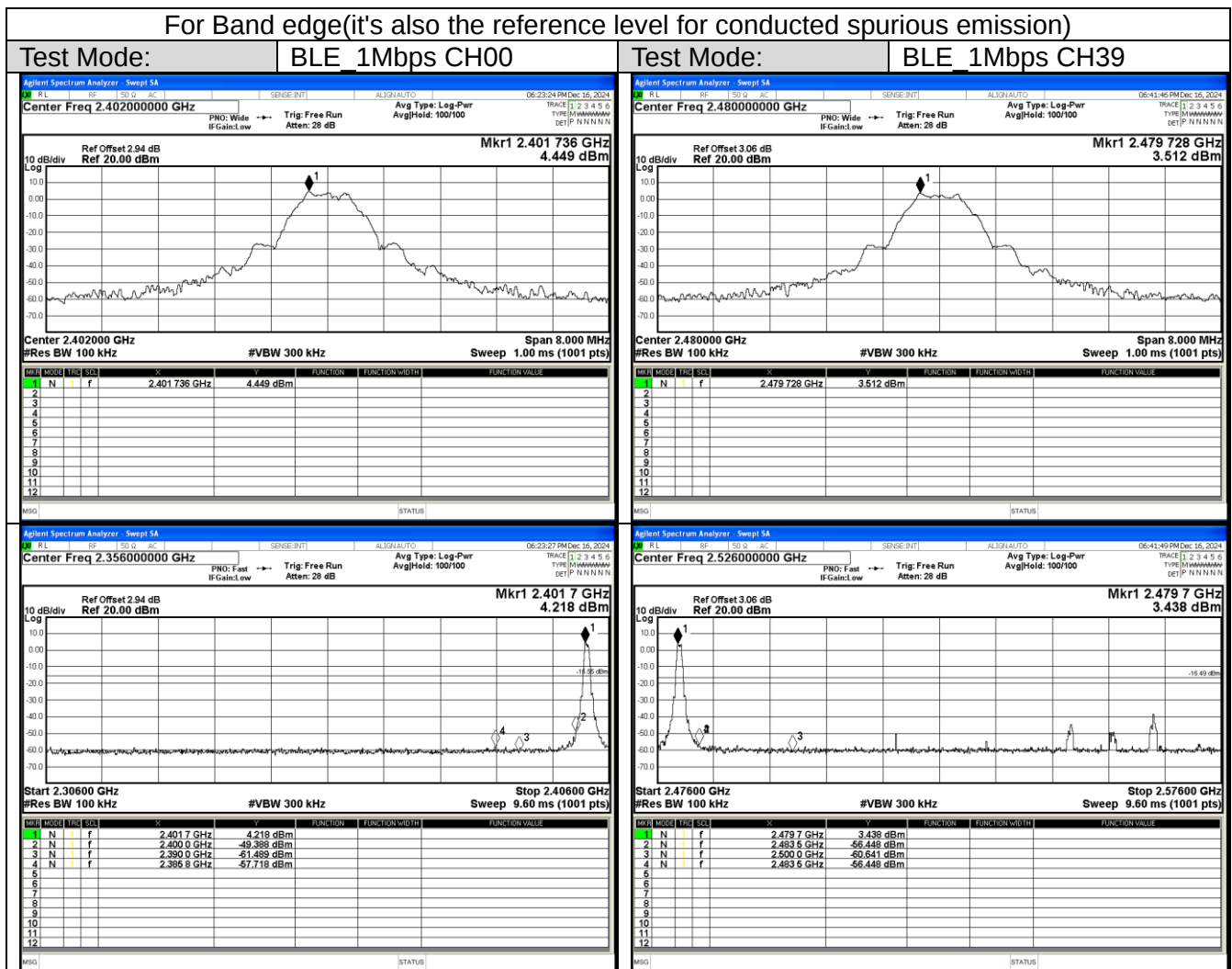
Appendix A.3 Test Results of Conducted Spurious Emissions Measured in 100 kHz Bandwidth

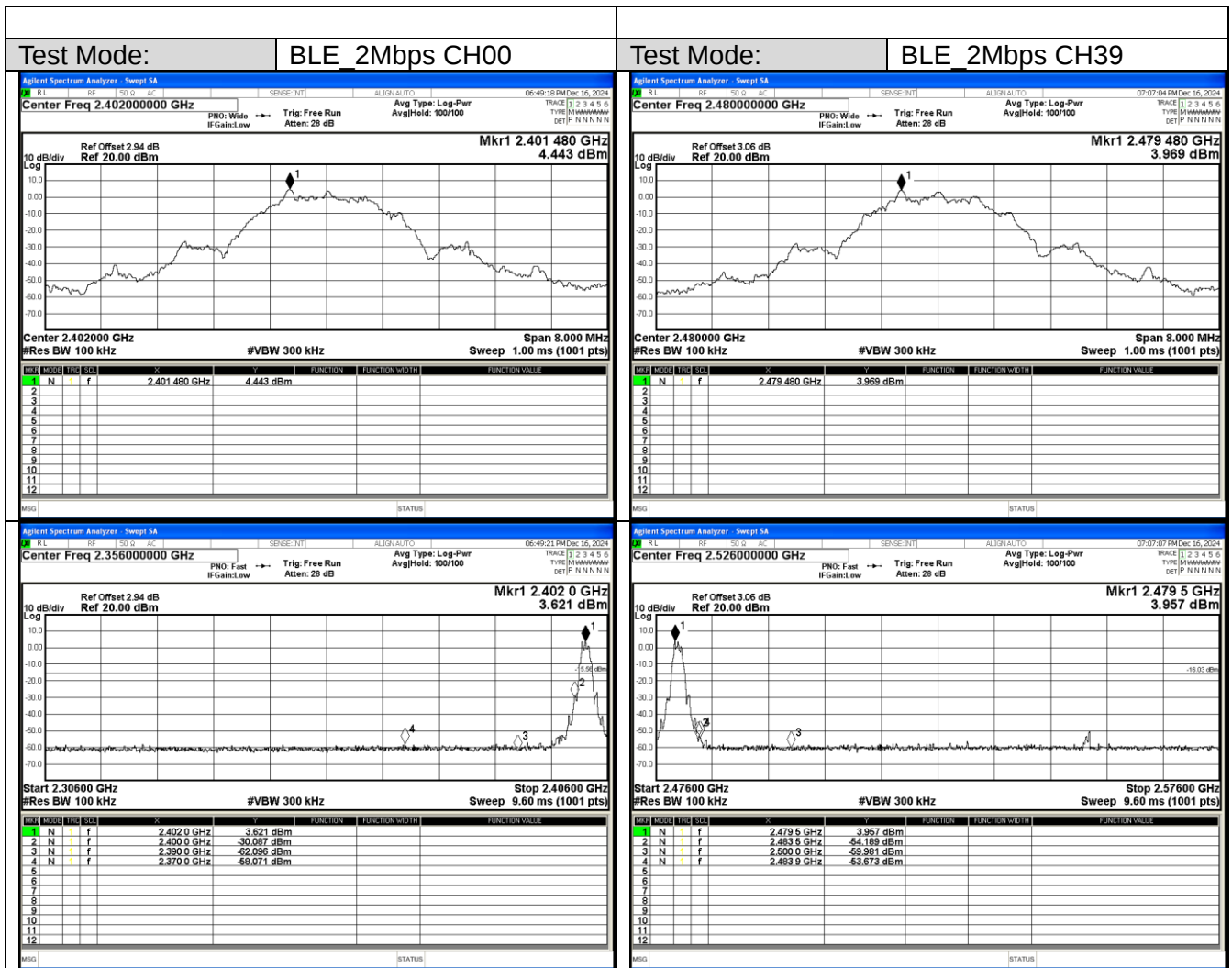






For Band edge(it's also the reference level for conducted spurious emission)

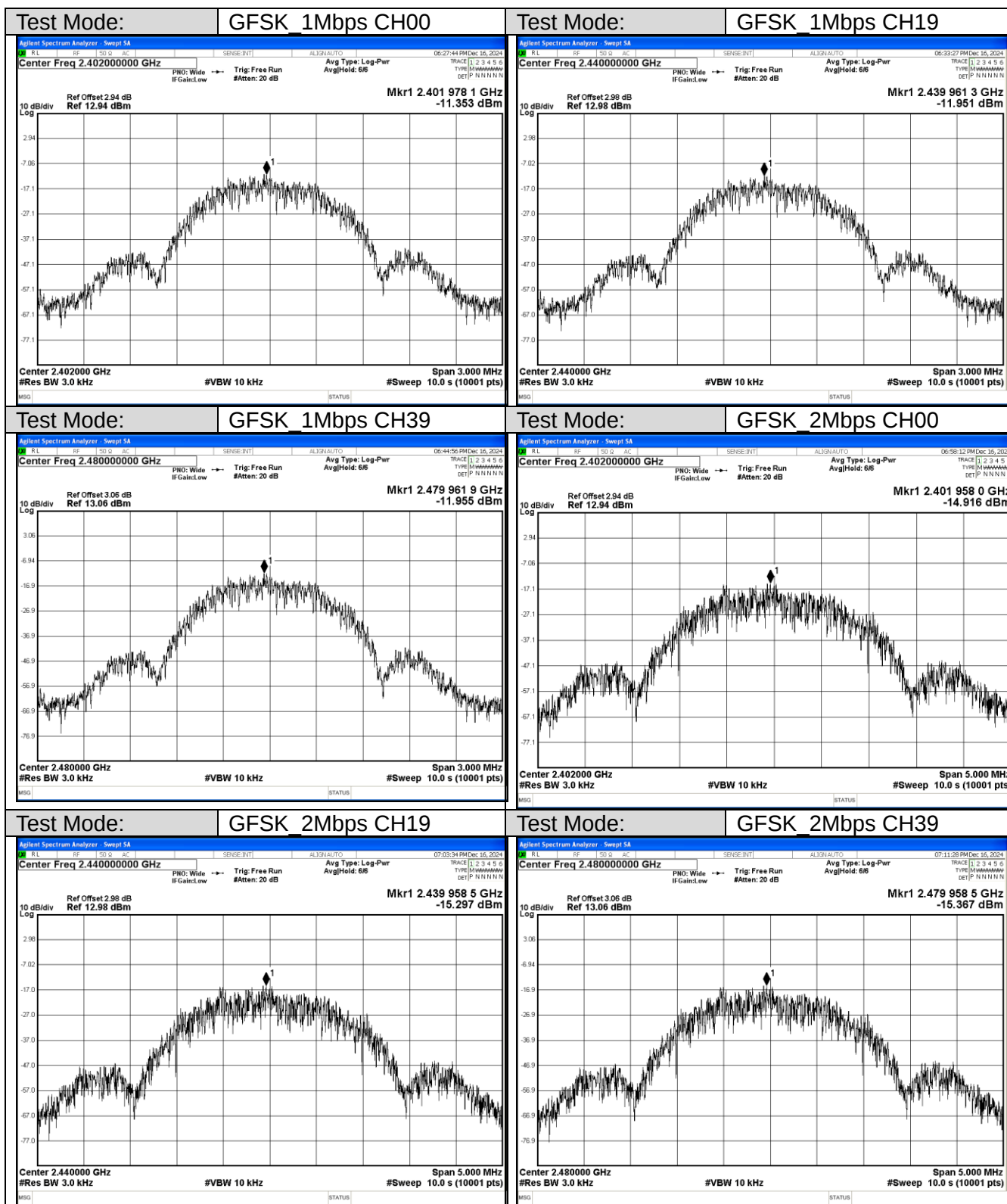




Appendix A.4 Test Results of Conducted Power Spectral Density

GFSK_1Mbps			
Frequency	Power Density	Limit (dBm/3KHz)	Result
	(dBm/3kHz)		
CH00	-11.353	8	Pass
CH19	-11.951	8	Pass
CH39	-11.955	8	Pass

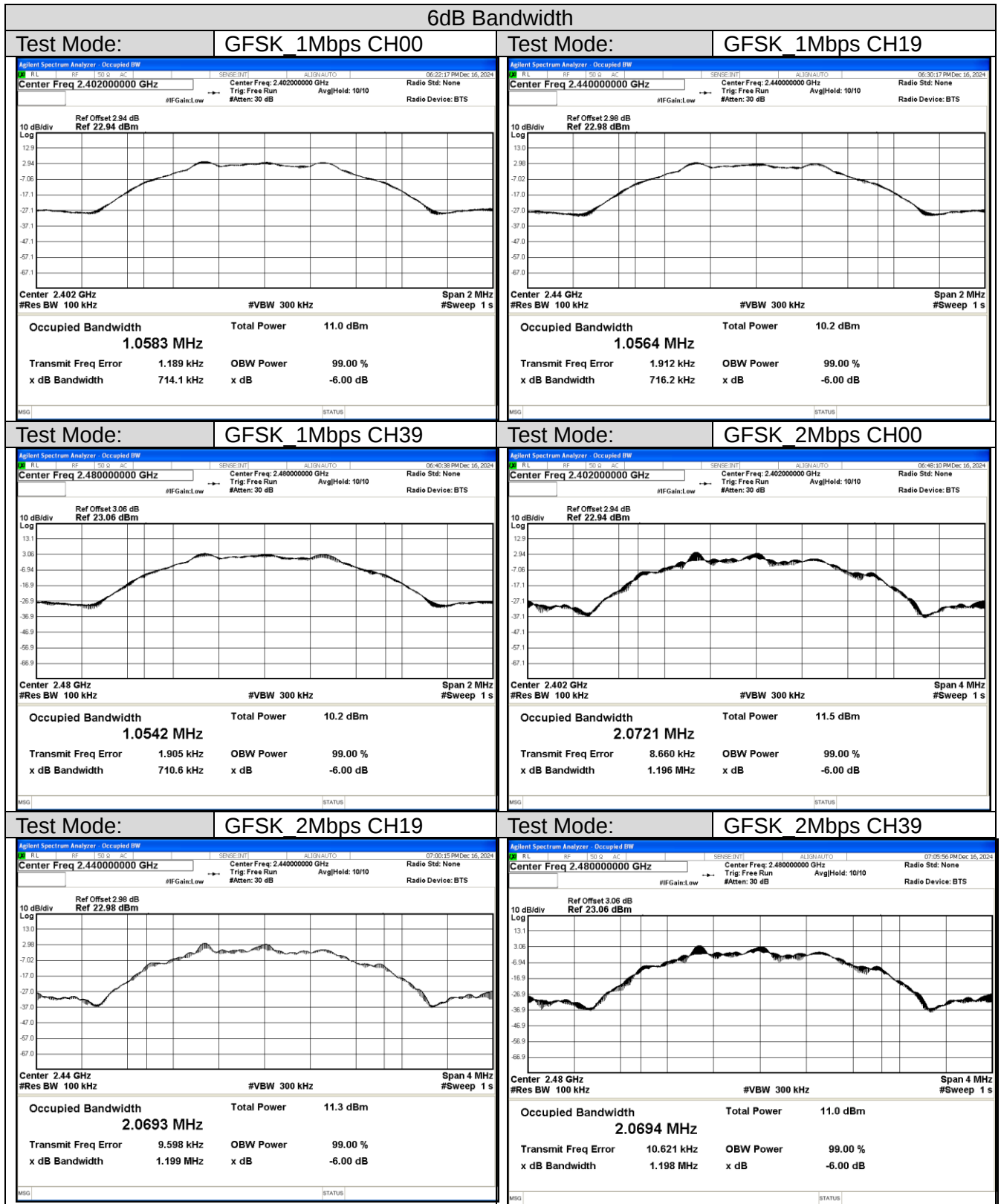
GFSK_2Mbps			
Frequency	Power Density	Limit (dBm/3KHz)	Result
	(dBm/3kHz)		
CH00	-14.916	8	Pass
CH19	-15.297	8	Pass
CH39	-15.367	8	Pass



Appendix A.5 Test Results of 6dB BANDWIDTH

GFSK_1Mbps			
Frequency	Bandwidth (MHz)	6dB limit (MHz)	Result
	6dB		
CH00	0.7141	0.5	Pass
CH19	0.7162	0.5	Pass
CH39	0.7106	0.5	Pass

GFSK_2Mbps			
Frequency	Bandwidth (MHz)	6dB limit (MHz)	Result
	6dB		
CH00	1.1957	0.5	Pass
CH19	1.1985	0.5	Pass
CH39	1.1984	0.5	Pass



Appendix A.6 Test Results of Maximum Conducted Power

Mode	Frequency [MHz]	Measured of Conducted Power		Limit [W]
		Conducted [dBm]	W	
BLE_1Mbps	2402	4.47	0.0028	≤ 1.0
	2440	3.783	0.0024	≤ 1.0
	2480	3.786	0.0024	≤ 1.0
BLE_2Mbps	2402	4.556	0.0029	≤ 1.0
	2440	4.066	0.0026	≤ 1.0
	2480	4.073	0.0026	≤ 1.0

Note:

- 1) The cable loss is taken into account in results.
- 2) Antenna gain(G) BLE: 2.67 dBi