

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

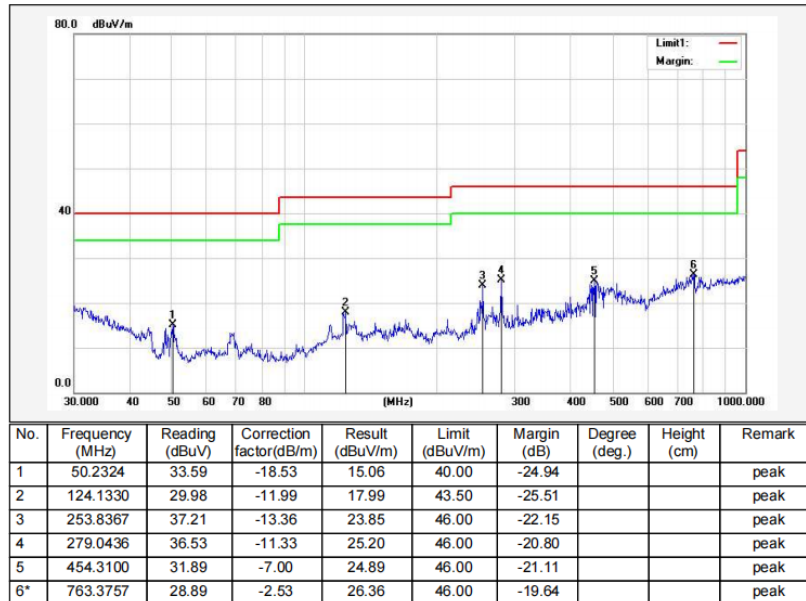
Appendix A.2 Test Results of Radiated Spurious Emission

Below 1G:

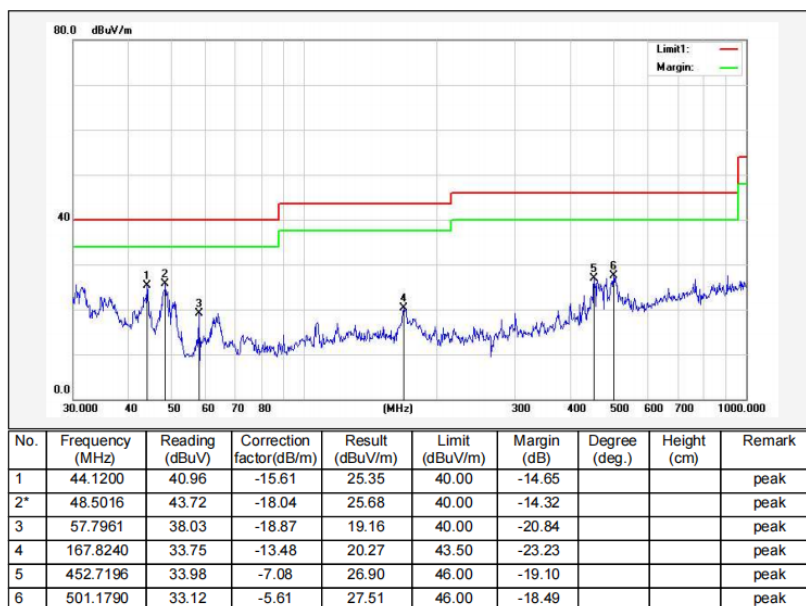
Note: All modes have been tested, and the report only reflects the worst mode.

Test Mode :	Mode 7	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	63.84	-13.33	50.51	74	-23.49	peak
2	6440	56.64	-10.05	46.59	62.07	-15.48	peak
3	6916	55.87	-8.8	47.07	62.07	-15	peak
4	7732	56.28	-7.92	48.36	74	-25.64	peak
5	8344	55.46	-7.2	48.26	74	-25.74	peak
6	8854	56.62	-7.88	48.74	62.07	-13.33	peak

GFSK-Low Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5046	57.76	-12.62	45.14	74	-28.86	peak
2	5556	56.88	-12.09	44.79	62.07	-17.28	peak
3	6168	56.63	-9.92	46.71	62.07	-15.36	peak
4	6916	56.2	-8.8	47.4	62.07	-14.67	peak
5	7698	57.07	-7.74	49.33	74	-24.67	peak
6	8378	55.33	-7.1	48.23	74	-25.77	peak

GFSK- Middle Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3958	59.13	-15.09	44.04	74	-29.96	peak
2	4876	65.85	-13	52.85	74	-21.15	peak
3	6066	56.32	-10.07	46.25	62.07	-15.82	peak
4	6882	55.89	-8.82	47.07	62.07	-15	peak
5	7562	56.22	-7.22	49	74	-25	peak
6	8378	56.28	-7.1	49.18	74	-24.82	peak

GFSK-Middle Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3958	61.14	-15.09	46.05	74	-27.95	peak
2	5998	56.64	-10.12	46.52	62.07	-15.55	peak
3	7290	55.62	-7.54	48.08	74	-25.92	peak
4	7562	56.18	-7.22	48.96	74	-25.04	peak
5	8208	56.42	-7.62	48.8	74	-25.2	peak
6	8854	55.93	-7.88	48.05	62.07	-14.02	peak

GFSK-High Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4944	66.05	-12.85	53.2	74	-20.8	peak
2	4944	62.89	-12.85	50.04	54	-3.96	AVG
3	6168	57.52	-9.92	47.6	62.07	-14.47	peak
4	6814	56.36	-8.86	47.5	62.07	-14.57	peak
5	7562	55.85	-7.22	48.63	74	-25.37	peak
6	8480	56.24	-7.61	48.63	74	-25.37	peak
7	8854	56.69	-7.88	48.81	62.07	-13.26	peak

GFSK-High Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3992	59.69	-15.01	44.68	74	-29.32	peak
2	6134	56.64	-9.98	46.66	62.07	-15.41	peak
3	7018	55.62	-8.69	46.93	62.07	-15.14	peak
4	7562	56.14	-7.22	48.92	74	-25.08	peak
5	8174	56.09	-7.68	48.41	74	-25.59	peak
6	8820	57.26	-7.83	49.43	62.07	-12.64	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. 82.07) 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	2363.273	64.19	-21.14	43.05	74	-30.95	peak
2	2363.273	52.43	-21.14	31.29	54	-22.71	AVG
3	2390	64.69	-21.03	43.66	74	-30.34	peak
4	2390	51.61	-21.03	30.58	54	-23.42	AVG
5	2401.436	117.48	-20.99	96.49	125.2	-28.71	peak

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2323.746	60.96	-21.25	39.71	74	-34.29	peak
2	2323.8	49.81	-21.25	28.56	54	-25.44	AVG
3	2390	58.13	-21.03	37.1	74	-36.9	peak
4	2390	48.64	-21.03	27.61	54	-26.39	AVG
5	2401.436	108.96	-20.99	87.97	125.2	-37.23	peak

GFSK-High

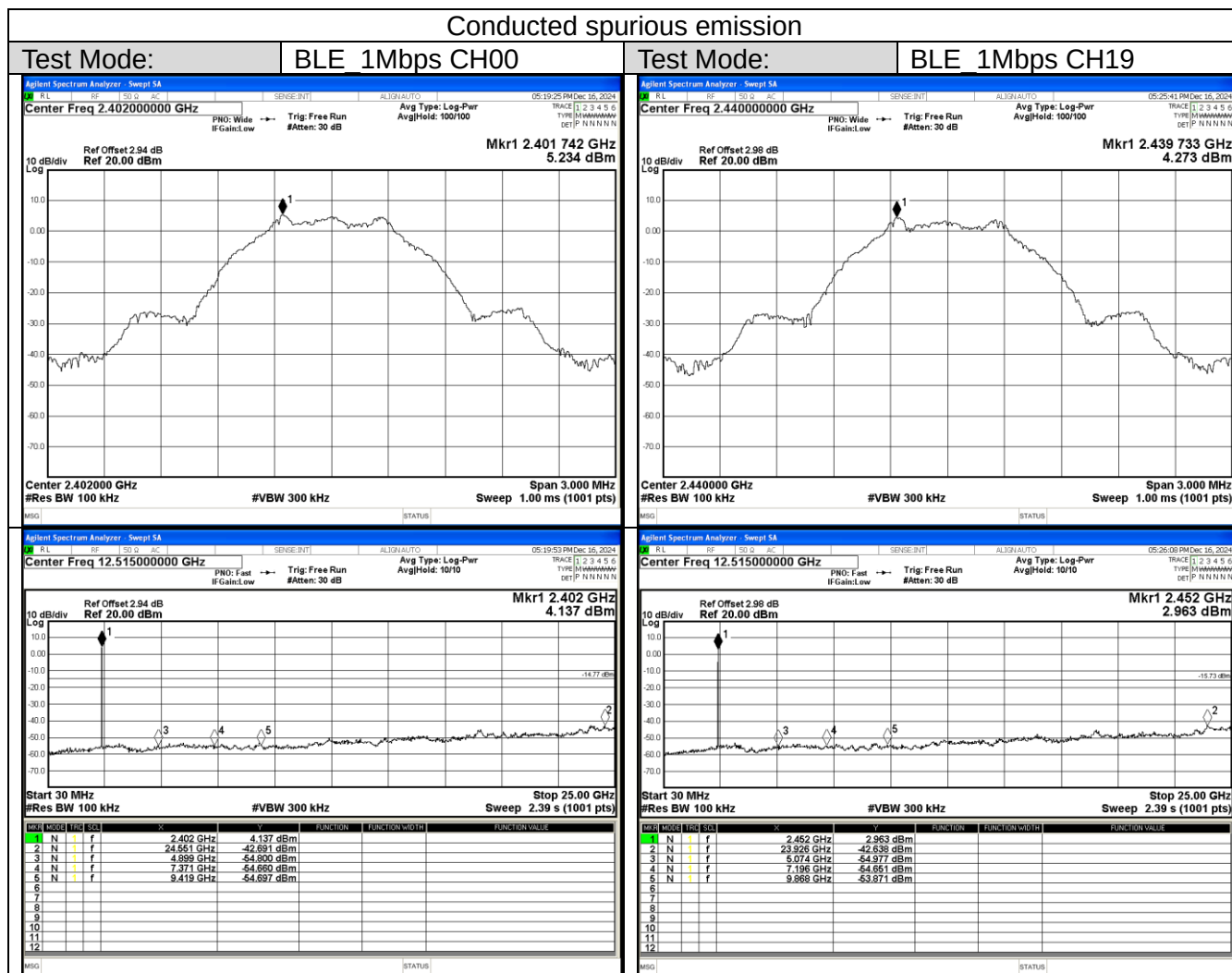
Horizontal

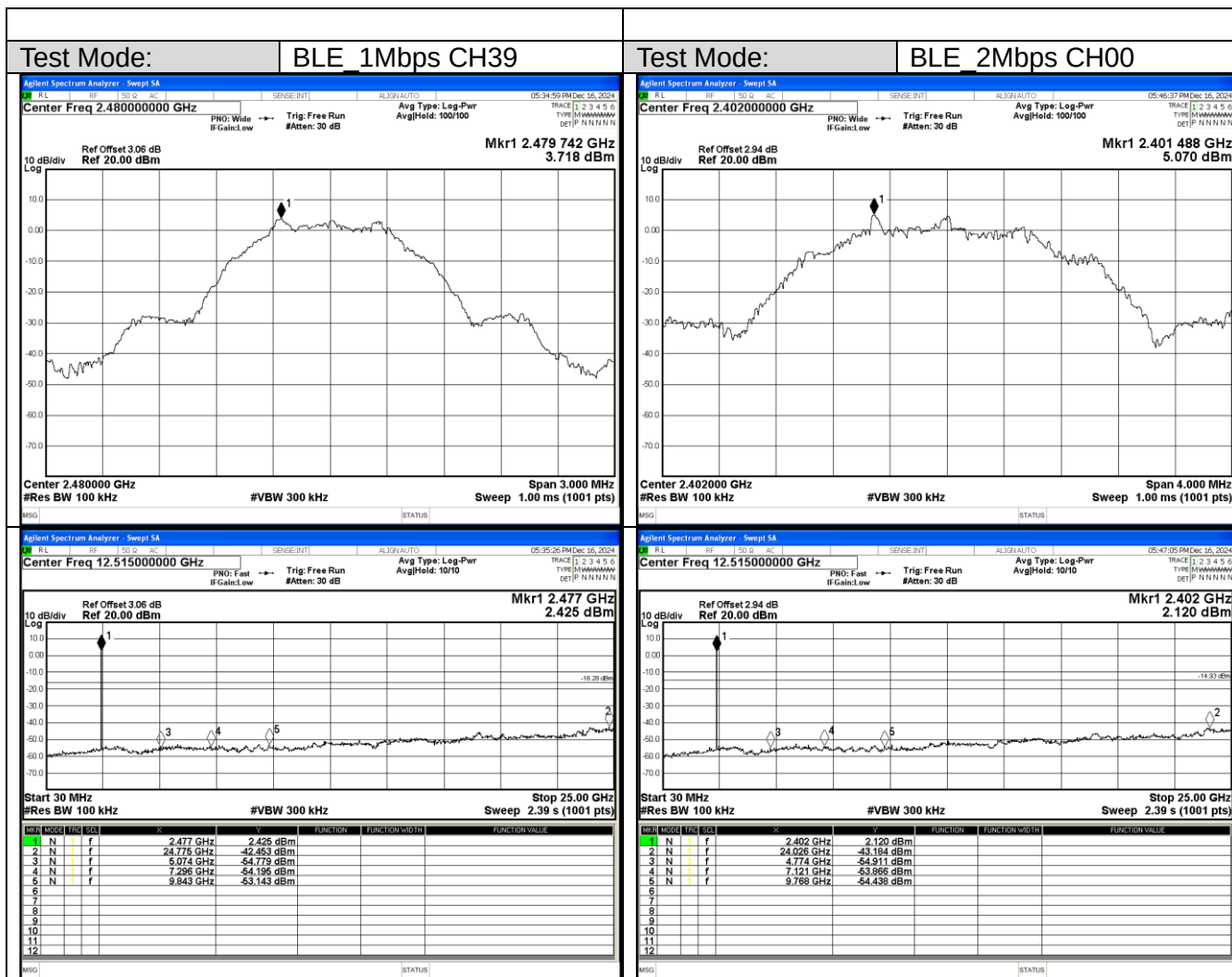
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2479.441	111.57	-20.91	90.66	125.2	-34.54	peak
2	2483.5	70.05	-20.91	49.14	74	-24.86	peak
3	2483.5	56.77	-20.91	35.86	54	-18.14	AVG
4	2484.295	67.1	-20.91	46.19	74	-27.81	peak
5	2484.295	56.18	-20.91	35.27	54	-18.73	AVG

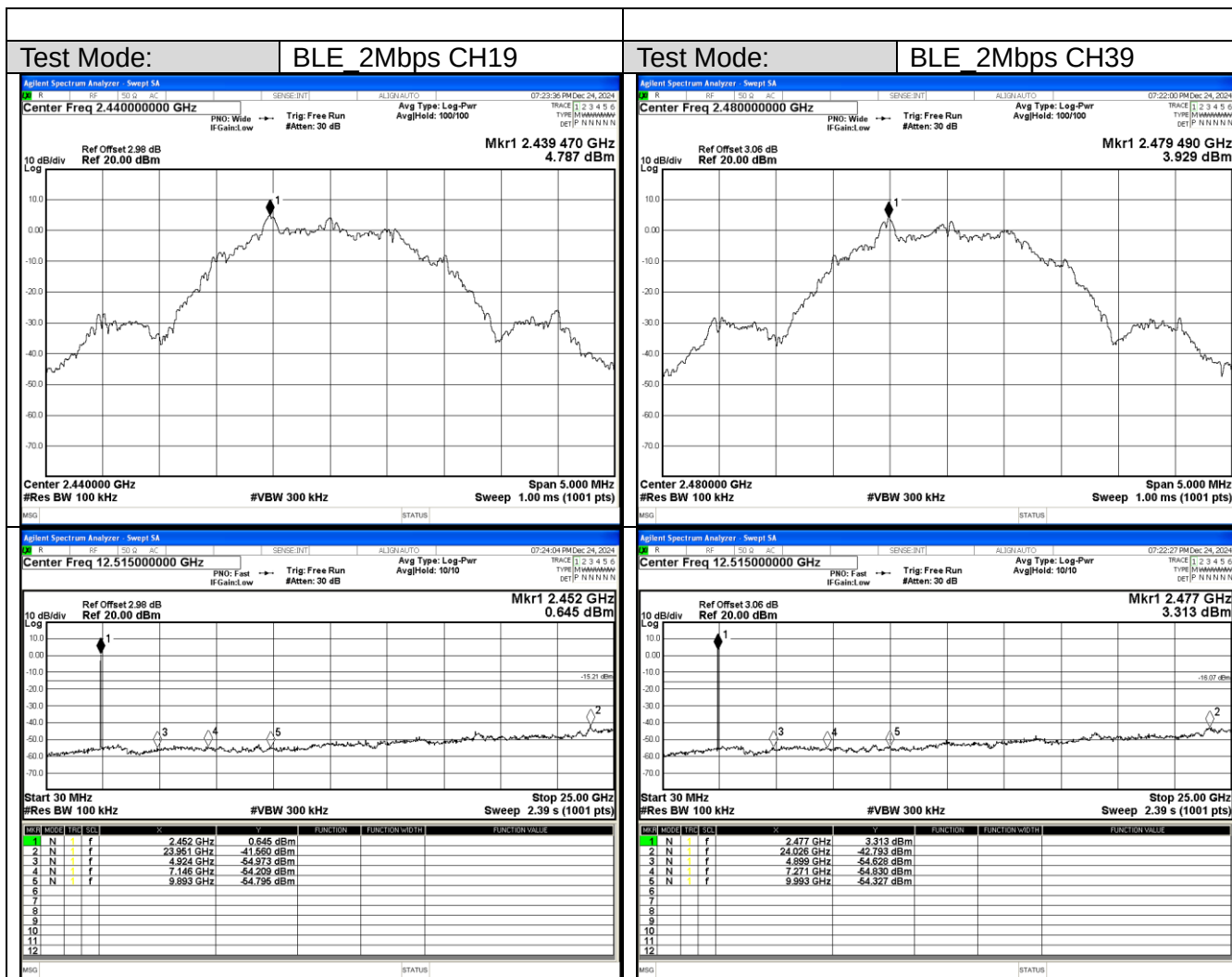
Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2479.441	102.98	-20.91	82.07	125.2	-43.13	peak
2	2483.5	62.63	-20.91	41.72	74	-32.28	peak
3	2483.5	50.47	-20.91	29.56	54	-24.44	AVG
4	2484.415	60.94	-20.91	40.03	74	-33.97	peak
5	2484.415	48.15	-20.91	27.24	54	-26.76	AVG

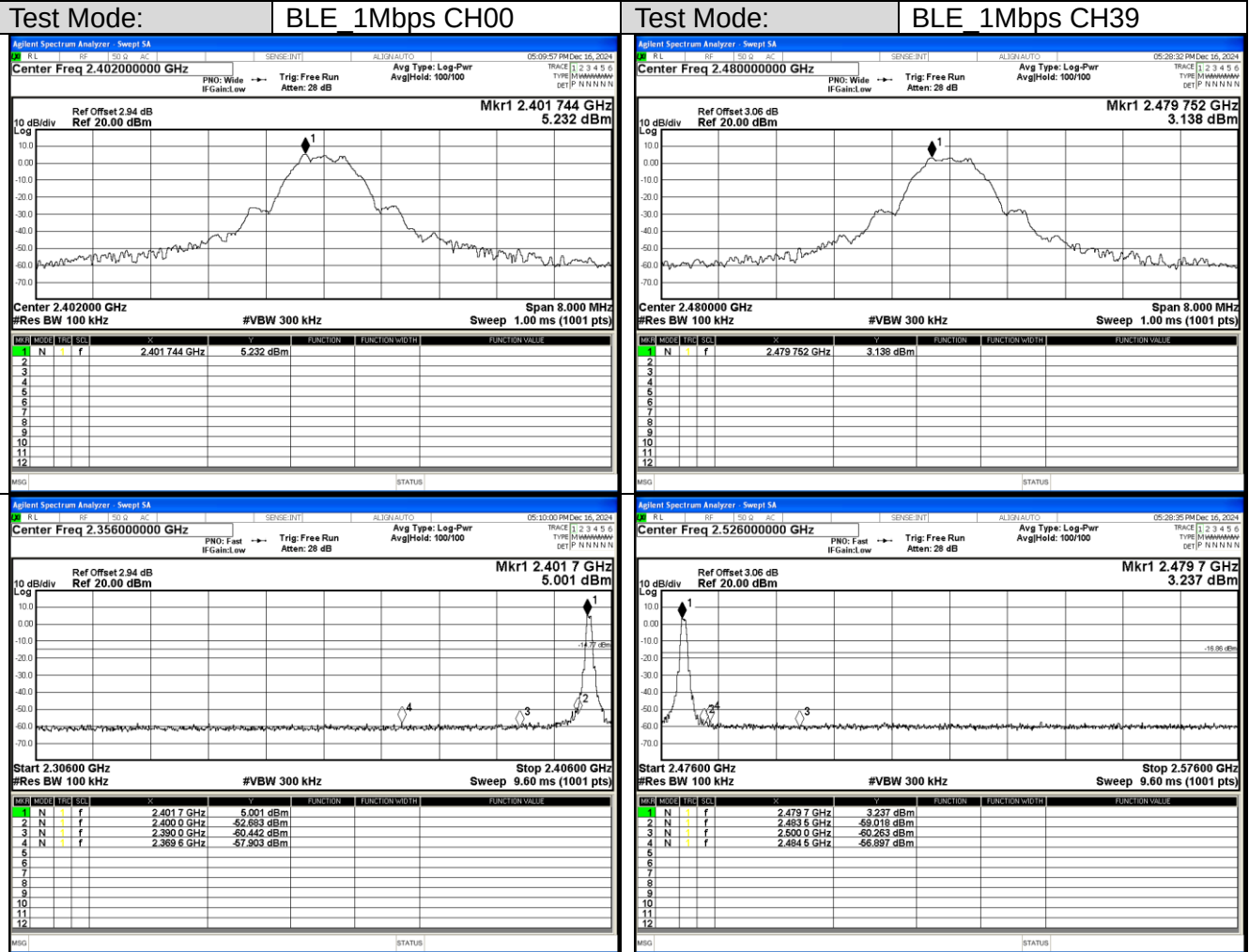
Appendix A.3 Test Results of Conducted Spurious Emissions Measured in 100 kHz Bandwidth

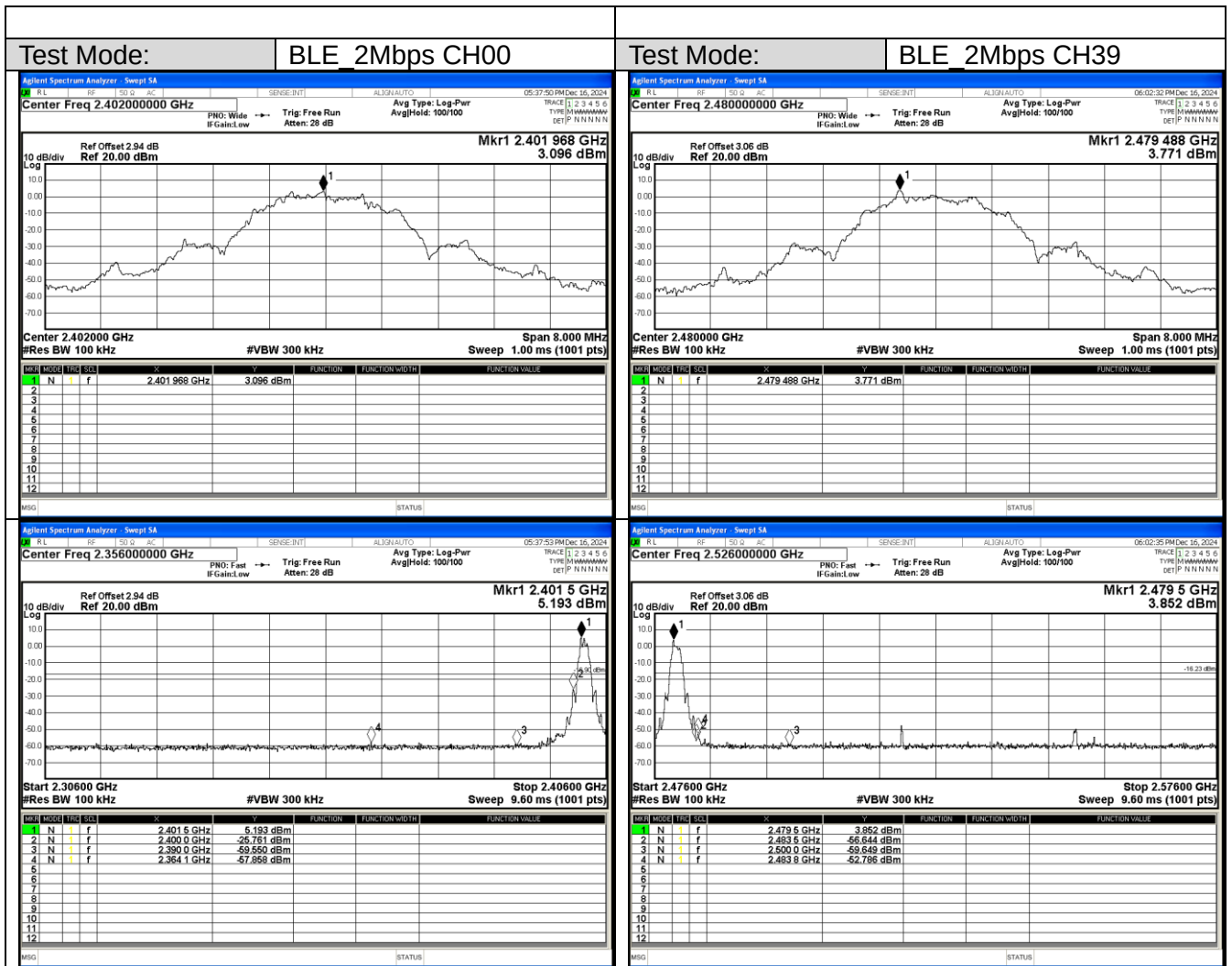






For Band edge(it's also the reference level for conducted spurious emission)

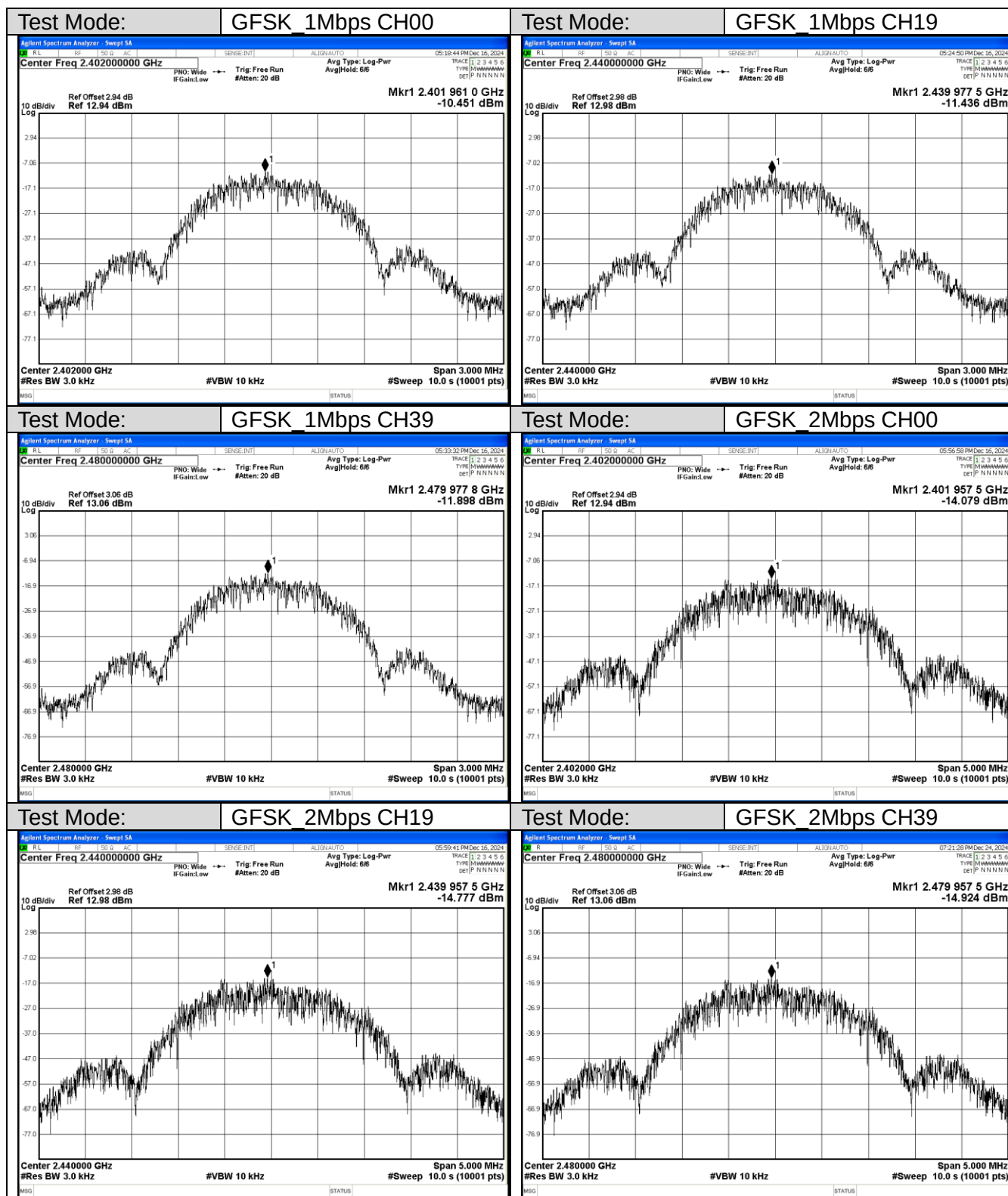




Appendix A.4 Test Results of Conducted Power Spectral Density

GFSK_1Mbps			
Frequency	Power Density	Limit (dBm/3KHz)	Result
	(dBm/3kHz)		
CH00	-10.451	8	Pass
CH19	-11.436	8	Pass
CH39	-11.898	8	Pass

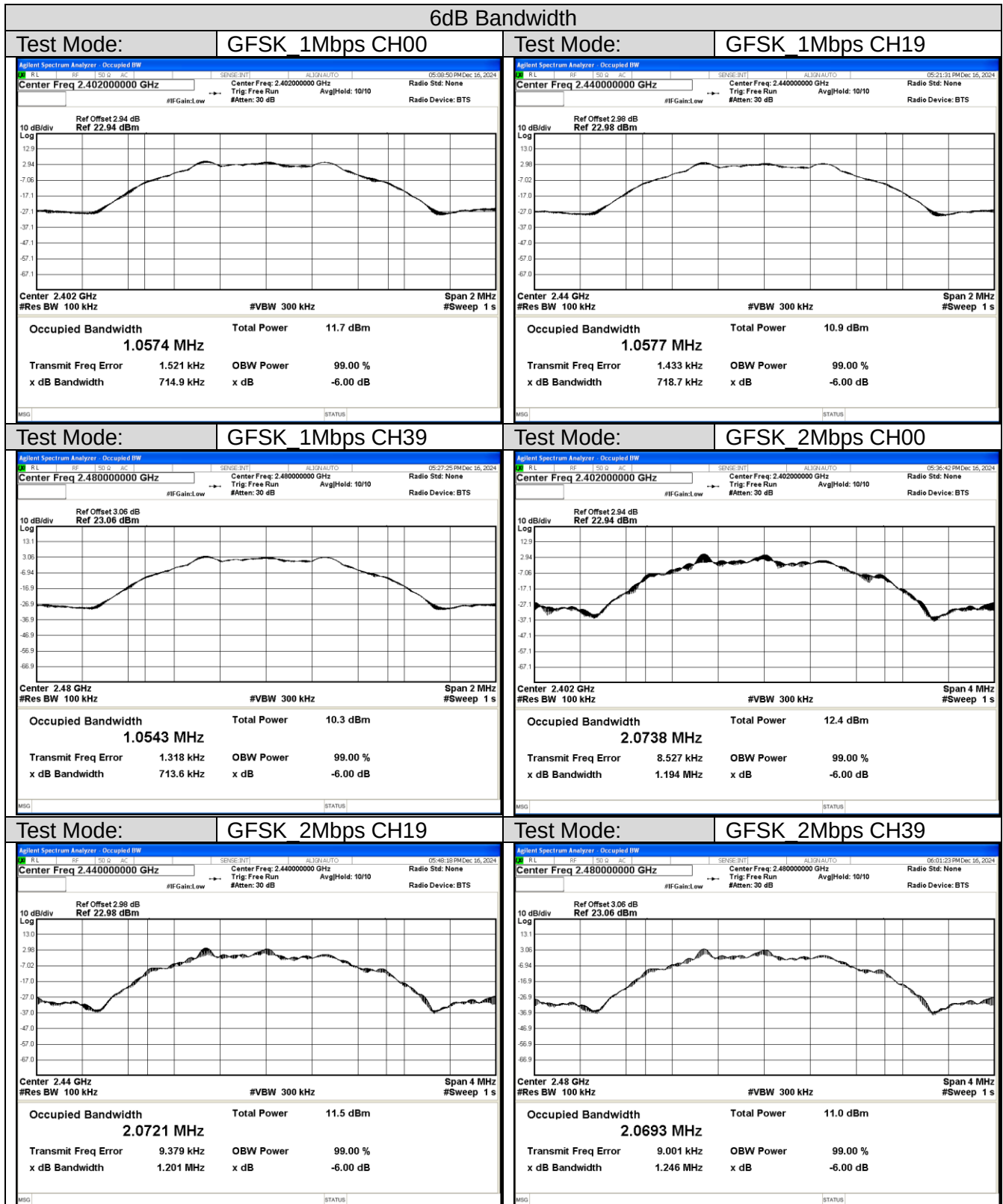
GFSK_2Mbps			
Frequency	Power Density	Limit (dBm/3KHz)	Result
	(dBm/3kHz)		
CH00	-14.079	8	Pass
CH19	-14.777	8	Pass
CH39	-14.924	8	Pass



Appendix A.5 Test Results of 6dB BANDWIDTH

GFSK_1Mbps			
Frequency	Bandwidth (MHz)	6dB limit (MHz)	Result
	6dB		
CH00	0.7149	0.5	Pass
CH19	0.7187	0.5	Pass
CH39	0.7136	0.5	Pass

GFSK_2Mbps			
Frequency	Bandwidth (MHz)	6dB limit (MHz)	Result
	6dB		
CH00	1.1936	0.5	Pass
CH19	1.2006	0.5	Pass
CH39	1.2462	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	5.273	0.0034	≤ 1.0
	2440	4.441	0.0028	≤ 1.0
	2480	3.873	0.0024	≤ 1.0
BLE_2Mbps	2402	5.429	0.0035	≤ 1.0
	2440	4.483	0.0028	≤ 1.0
	2480	3.919	0.0025	≤ 1.0

Note:

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