

Appendix A: Test Results of BLE

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Appendix A.1 Test Results of Radiated Spurious Emission

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

Below 1GHz:

Test Mode:

Mode 2(worst mode)

Horizontal

The graph displays the radiated spurious emission for the horizontal mode. The y-axis is labeled 'dBuV/m' and ranges from 0.0 to 80.0. The x-axis is labeled '[MHz]' and ranges from 30.000 to 1000.000. A red line represents the Limit, and a green line represents the Margin. The blue line shows the measured emission, with several peaks labeled 1 through 6. The results are summarized in the table below.

No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Remark
1	65.3431	34.15	-18.62	15.53	40.00	-24.47			QP
2	71.5806	34.01	-18.67	15.34	40.00	-24.66			QP
3	93.4402	35.45	-18.66	16.79	43.50	-26.71			QP
4	167.2366	27.23	-13.48	13.75	43.50	-29.75			QP
5*	881.4067	24.65	-1.23	23.42	46.00	-22.58			QP
6	986.0716	23.58	0.19	23.77	54.00	-30.23			QP

Vertical

The graph displays the radiated spurious emission for the vertical mode. The y-axis is labeled 'dBuV/m' and ranges from 0.0 to 80.0. The x-axis is labeled '[MHz]' and ranges from 30.000 to 1000.000. A red line represents the Limit, and a green line represents the Margin. The blue line shows the measured emission, with several peaks labeled 1 through 6. The results are summarized in the table below.

No.	Frequency (MHz)	Reading (dBuV)	Correction factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree (deg.)	Height (cm)	Remark
1*	30.1054	31.51	-6.26	25.25	40.00	-14.75			QP
2	36.0007	29.50	-9.73	19.77	40.00	-20.23			QP
3	48.5016	38.61	-18.04	20.57	40.00	-19.43			QP
4	59.4405	35.60	-18.83	16.77	40.00	-23.23			QP
5	522.7180	27.92	-5.67	22.25	46.00	-23.75			QP
6	833.3171	26.61	-1.74	24.87	46.00	-21.13			QP

Correction Factor = insertion loss of LISN + cable loss;

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	3924	58.16	-15.19	42.97	74	-31.03	peak
2	4808	60.63	-13.33	47.3	74	-26.7	peak
3	5930	56.06	-10.34	45.72	73.4	-27.68	peak
4	7188	58.93	-8.03	50.9	73.4	-22.5	peak
5	11132	53.39	-2.48	50.91	74	-23.09	peak
6	12458	53.77	-1.59	52.18	74	-21.82	peak

GFSK-Low Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2938	62.55	-19.89	42.66	73.4	-30.74	peak
2	4808	61.44	-13.33	48.11	74	-25.89	peak
3	7188	58.49	-8.03	50.46	73.4	-22.94	peak
4	8242	55.61	-7.48	48.13	74	-25.87	peak
5	11370	53.86	-1.94	51.92	74	-22.08	peak
6	12424	54.24	-1.81	52.43	74	-21.57	peak

GFSK- Middle Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3992	57.68	-15.01	42.67	74	-31.33	peak
2	4876	59.81	-13	46.81	74	-27.19	peak
3	7324	59.43	-7.38	52.05	74	-21.95	peak
4	11098	52.84	-2.54	50.3	74	-23.7	peak
5	12356	53.96	-2.09	51.87	74	-22.13	peak
6	13070	53	-0.16	52.84	73.4	-20.56	peak

GFSK-Middle Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3210	60.06	-18.98	41.08	73.4	-32.32	peak
2	4876	60.49	-13	47.49	74	-26.51	peak
3	7324	58.52	-7.38	51.14	74	-22.86	peak
4	10588	52.93	-2.7	50.23	73.4	-23.17	peak
5	11404	52.28	-1.87	50.41	74	-23.59	peak
6	12390	54.08	-1.99	52.09	74	-21.91	peak

GFSK-High Horizontal

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	4944	59.5	-12.85	46.65	74	-27.35	peak
2	7426	57.47	-7.09	50.38	74	-23.62	peak
3	10214	53.79	-3.78	50.01	73.4	-23.39	peak
4	11098	53.7	-2.54	51.16	74	-22.84	peak
5	12458	54.8	-1.59	53.21	74	-20.79	peak
6	12696	53.71	-0.74	52.97	74	-21.03	peak

GFSK-High Vertical

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	3142	60.77	-19.25	41.52	73.4	-31.88	peak
2	4944	59.65	-12.85	46.8	74	-27.2	peak
3	7426	57.41	-7.09	50.32	74	-23.68	peak
4	8990	55.58	-8.13	47.45	73.4	-25.95	peak
5	10690	53.08	-2.89	50.19	74	-23.81	peak
6	12458	54.11	-1.59	52.52	74	-21.48	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. 93.40) 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	2326.8	60.54	-21.24	39.3	74	-34.7	peak
2	2326.8	50.21	-21.24	28.97	54	-25.03	AVG
3	2390	59.47	-21.03	38.44	74	-35.56	peak
4	2390	49.36	-21.03	28.33	54	-25.67	AVG
5	2402.4	116.43	-20.99	95.44	125.2	-29.76	peak

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2329	65.99	-21.23	44.76	74	-29.24	peak
2	2329	54.52	-21.23	33.29	54	-20.71	AVG
3	2390	63.83	-21.03	42.8	74	-31.2	peak
4	2390	52.35	-21.03	31.32	54	-22.68	AVG
5	2402.4	114.57	-20.99	93.58	125.2	-31.62	peak

GFSK-High

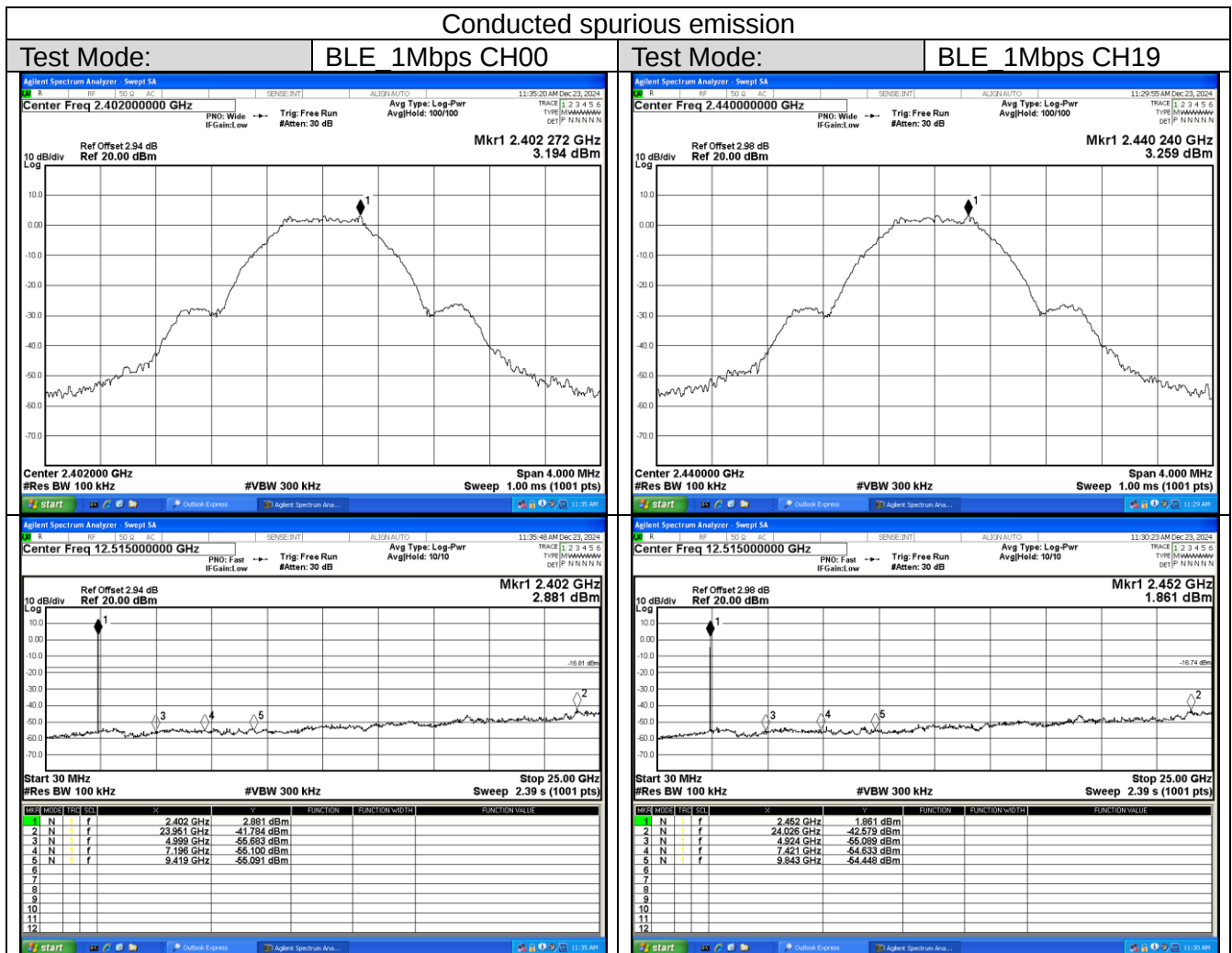
Horizontal

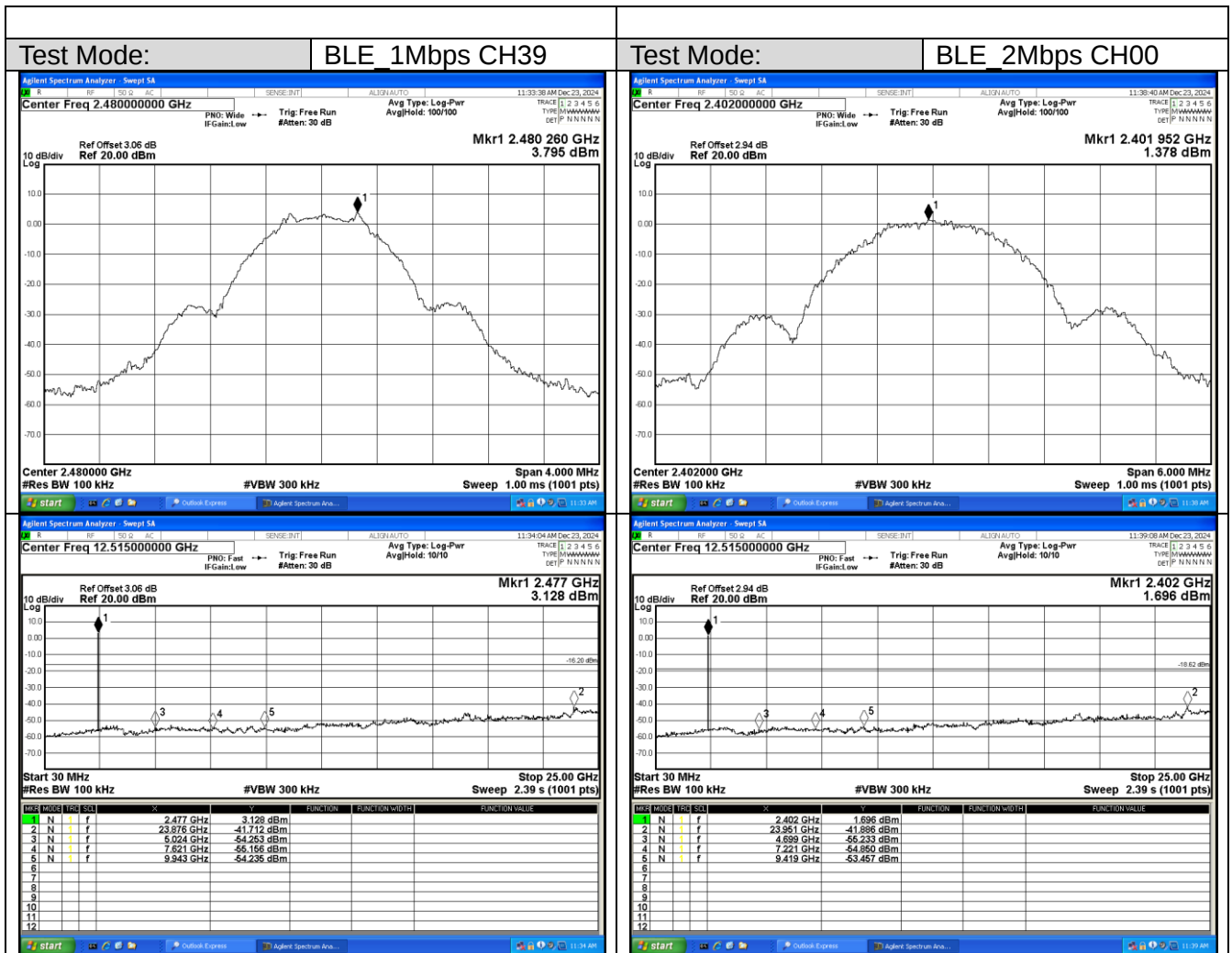
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2479.75	118.07	-20.91	97.16	125.2	-28.04	peak
2	2483.5	62.97	-20.91	42.06	74	-31.94	peak
3	2483.5	52.07	-20.91	31.16	54	-22.84	AVG
4	2499.25	67.15	-20.92	46.23	74	-27.77	peak
5	2499.25	55.69	-20.92	34.77	54	-19.23	AVG

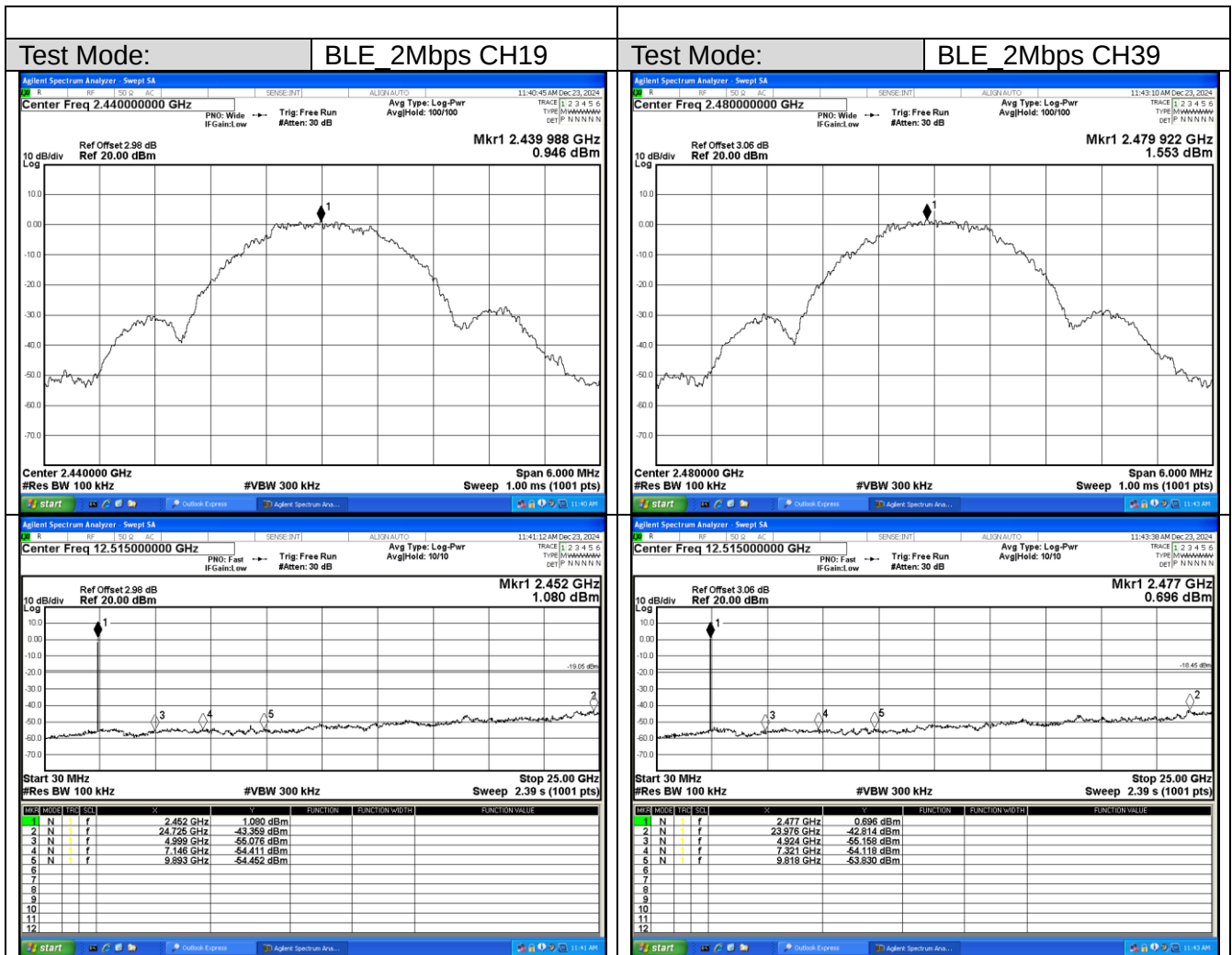
Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2479.75	117.1	-20.91	96.19	125.2	-29.01	peak
2	2483.5	64.29	-20.91	43.38	74	-30.62	peak
3	2483.5	54.54	-20.91	33.63	54	-20.37	AVG
4	2499.6	72.83	-20.92	51.91	74	-22.09	peak
5	2499.6	59.84	-20.92	38.92	54	-15.08	AVG

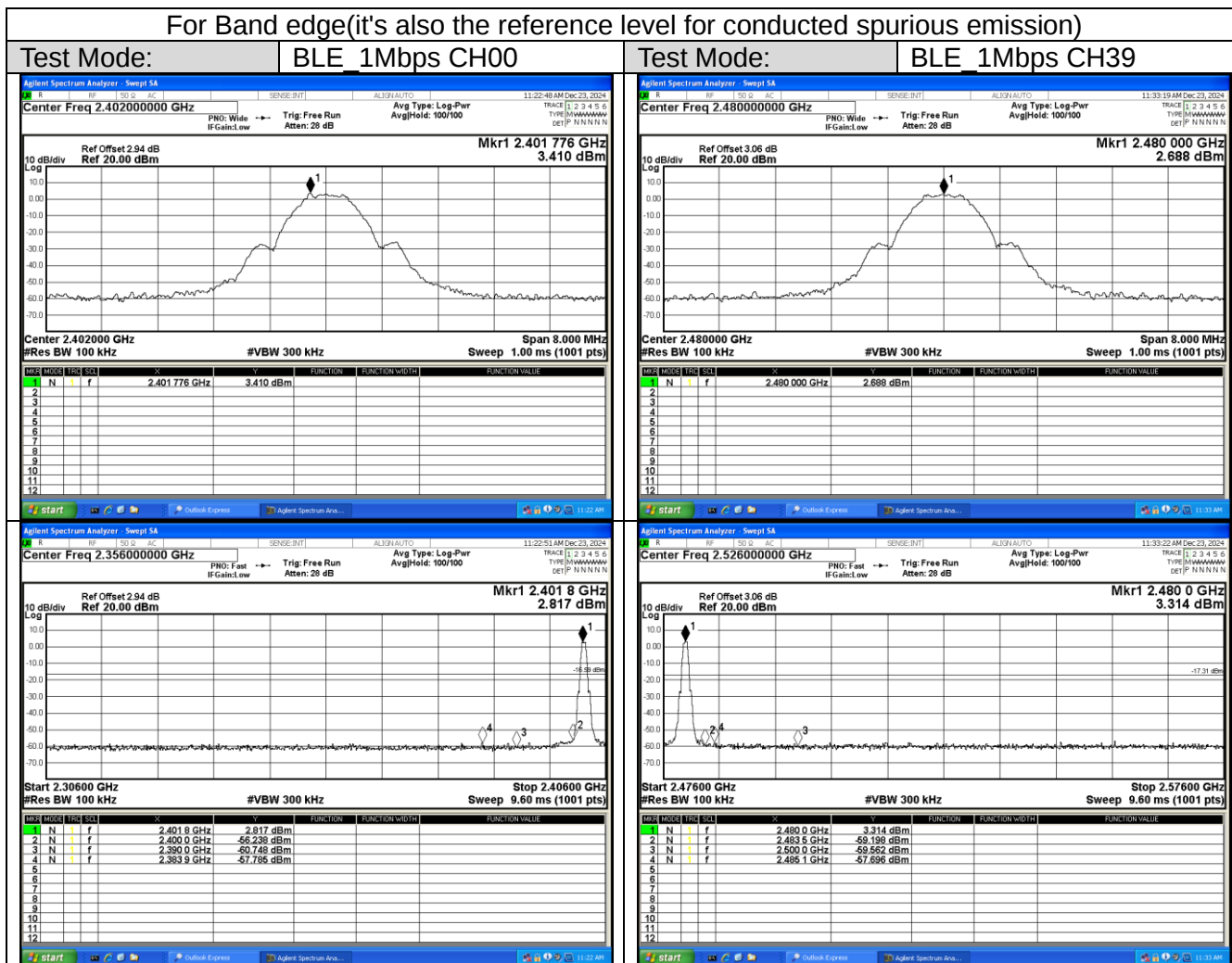
Appendix A.2 Test Results of Conducted Spurious Emissions Measured in 100 kHz Bandwidth

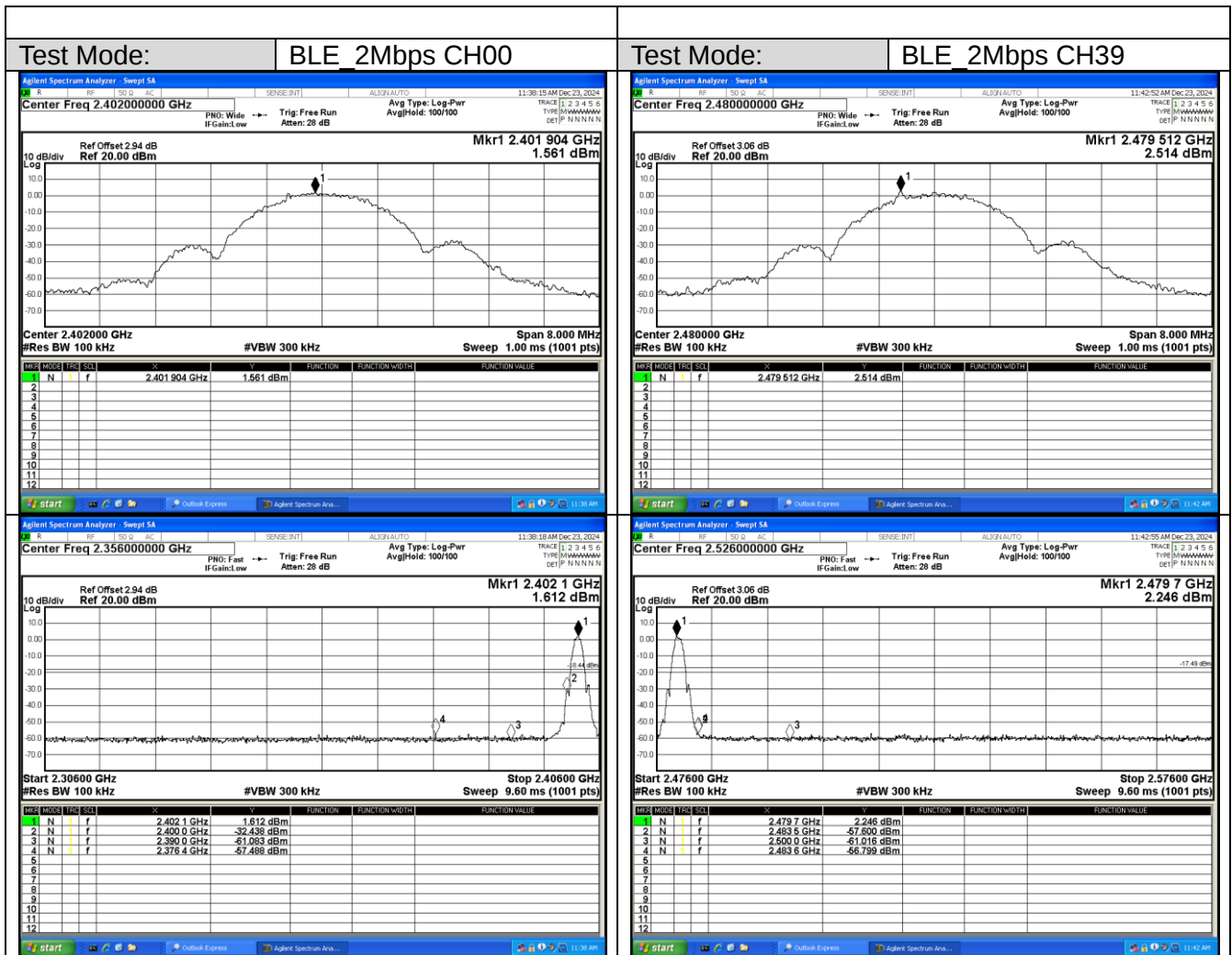






For Band edge(it's also the reference level for conducted spurious emission)

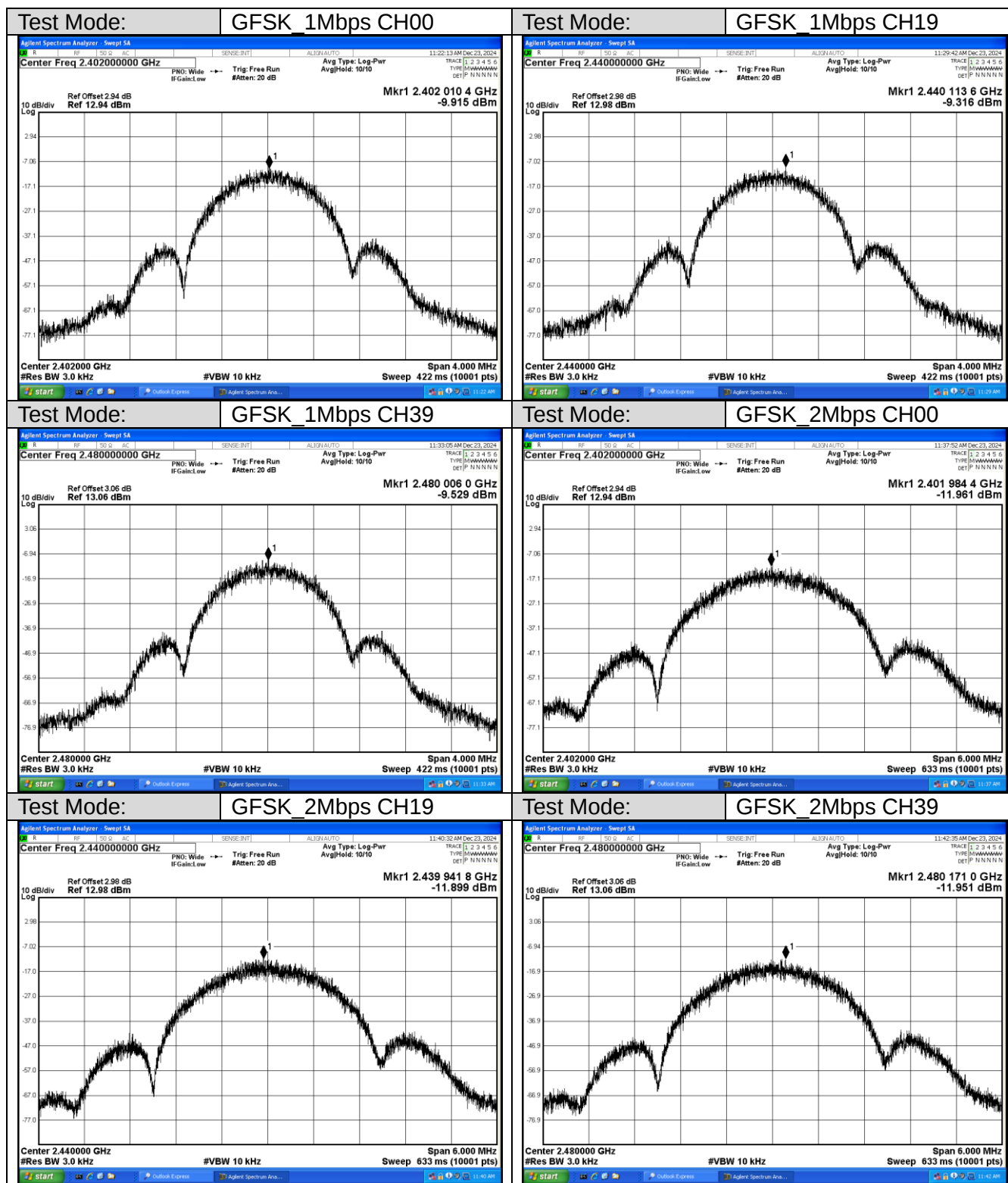




Appendix A.3 Test Results of Conducted Power Spectral Density

GFSK_1Mbps			
Frequency	Power Density	Limit (dBm/3KHz)	Result
	(dBm/3kHz)		
CH00	-9.529	8	Pass
CH19	-9.915	8	Pass
CH39	-9.316	8	Pass

GFSK_2Mbps			
Frequency	Power Density	Limit (dBm/3KHz)	Result
	(dBm/3kHz)		
CH00	-11.961	8	Pass
CH19	-11.899	8	Pass
CH39	-11.951	8	Pass



Appendix A.4 Test Results of 6dB BANDWIDTH

GFSK_1Mbps			
Frequency	Bandwidth (MHz)	6dB limit (KHz)	Result
	6dB		
CH00	0.684	0.5	Pass
CH19	0.6947	0.5	Pass
CH39	0.6307	0.5	Pass

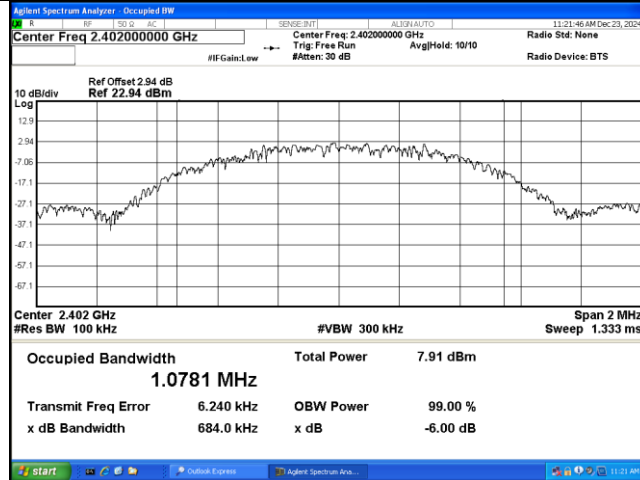
GFSK_2Mbps			
Frequency	Bandwidth (MHz)	6dB limit (KHz)	Result
	6dB		
CH00	1.3987	0.5	Pass
CH19	1.1945	0.5	Pass
CH39	1.3225	0.5	Pass



6dB Bandwidth

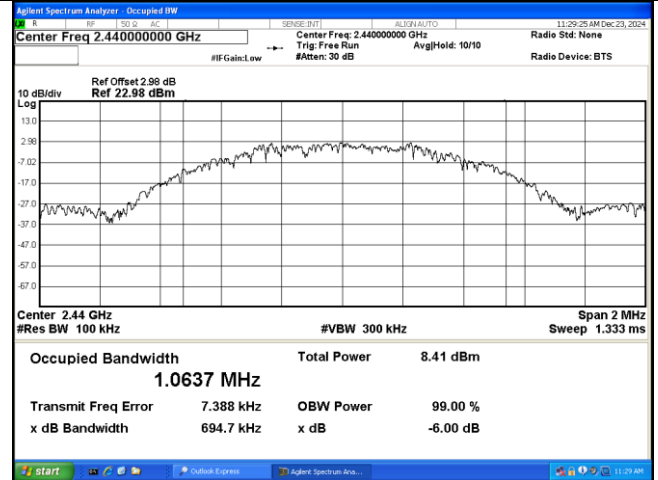
Test Mode:

GFSK 1Mbps CH00



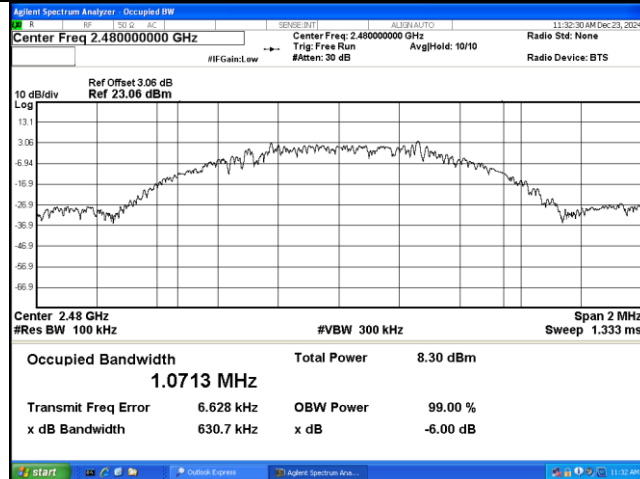
Test Mode:

GFSK 1Mbps CH19



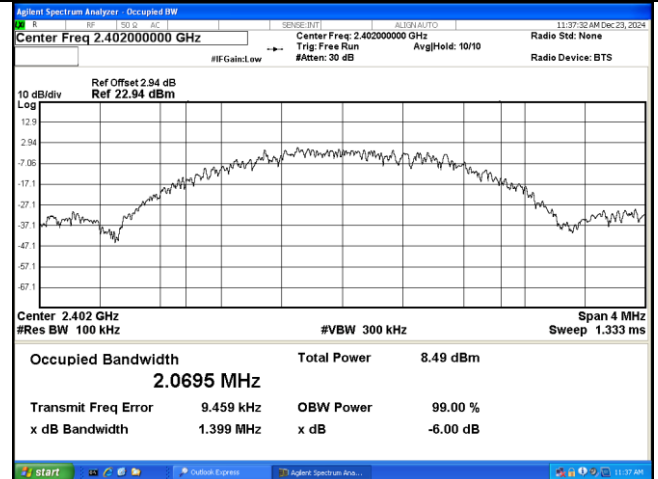
Test Mode:

GFSK 1Mbps CH39



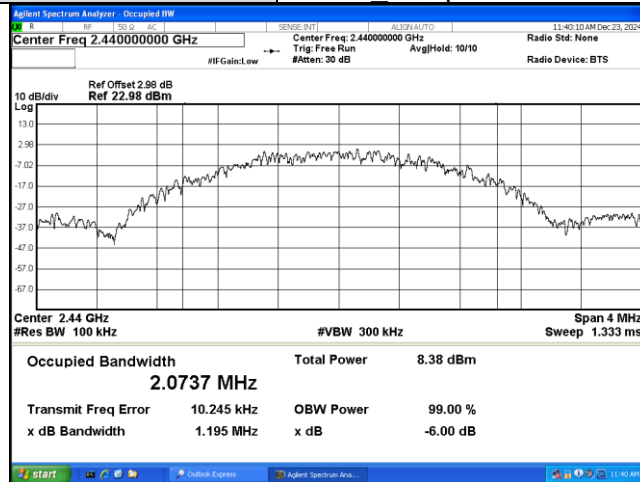
Test Mode:

GFSK 2Mbps CH00



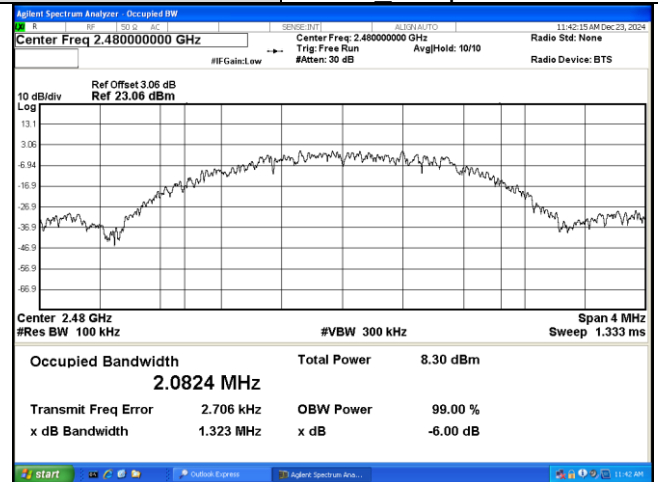
Test Mode:

GFSK 2Mbps CH19



Test Mode:

GFSK 2Mbps CH39



Appendix A.5 Test Results of Maximum Conducted Power

For FCC:

Mode	Frequency [MHz]	Measured of Conducted Power		Limit [W]
		Conducted [dBm]	W	
BLE_1Mbps	2402	3.673	0.0023	≤ 1.0
	2440	3.959	0.0025	≤ 1.0
	2480	3.958	0.0025	≤ 1.0
BLE_2Mbps	2402	3.958	0.0025	≤ 1.0
	2440	3.966	0.0025	≤ 1.0
	2480	3.999	0.0025	≤ 1.0

Note:

- 1) The cable loss is taken into account in results.
- 2) Antenna gain(G) BLE: -0.84 dBi