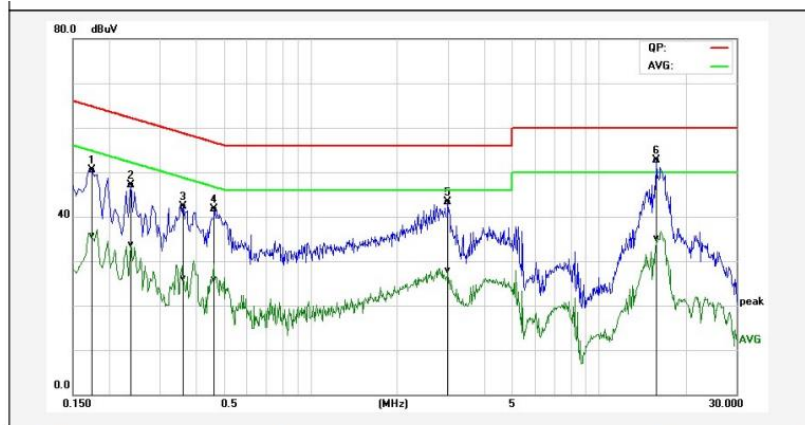
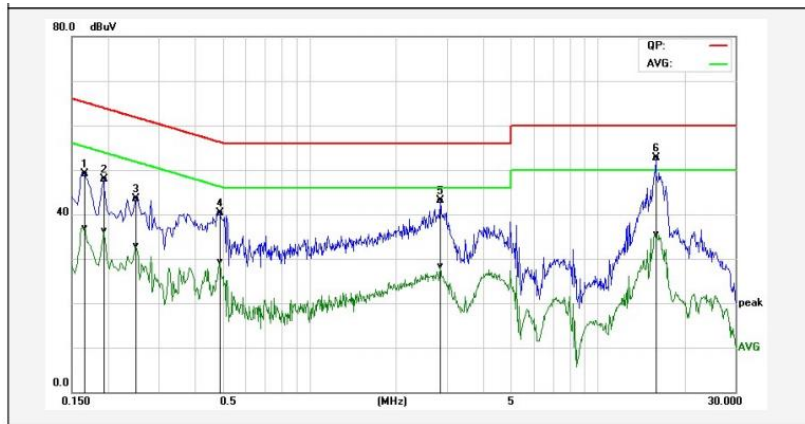


Appendix A: Test Results of BLE

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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 :	Working	Test Voltage :	AC 110V/60Hz																																																																																																												
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 <table><tr><th>No.</th><th>Frequency</th><th>QuasiPeak</th><th>Average</th><th>Correction</th><th>QuasiPeak</th><th>Average</th><th>QuasiPeak</th><th>Average</th><th>QuasiPeak</th><th>Average</th><th>Remark</th></tr><tr><th></th><th>(MHz)</th><th>reading</th><th>reading</th><th>factor</th><th>result</th><th>result</th><th>limit</th><th>limit</th><th>margin</th><th>margin</th><th></th></tr><tr><th></th><th></th><th>(dBuV)</th><th>(dBuV)</th><th>(dB)</th><th>(dBuV)</th><th>(dBuV)</th><th>(dBuV)</th><th>(dBuV)</th><th>(dB)</th><th>(dB)</th><th></th></tr><tr><td>1P</td><td>0.1740</td><td>41.10</td><td>26.30</td><td>9.50</td><td>50.60</td><td>35.80</td><td>64.76</td><td>54.77</td><td>-14.16</td><td>-18.97</td><td>Pass</td></tr><tr><td>2P</td><td>0.2380</td><td>37.65</td><td>24.15</td><td>9.50</td><td>47.15</td><td>33.65</td><td>62.16</td><td>52.17</td><td>-15.01</td><td>-18.52</td><td>Pass</td></tr><tr><td>3P</td><td>0.3620</td><td>32.75</td><td>16.68</td><td>9.50</td><td>42.25</td><td>26.18</td><td>58.68</td><td>48.68</td><td>-16.43</td><td>-22.50</td><td>Pass</td></tr><tr><td>4P</td><td>0.4660</td><td>32.13</td><td>16.36</td><td>9.50</td><td>41.63</td><td>25.86</td><td>56.58</td><td>46.58</td><td>-14.95</td><td>-20.72</td><td>Pass</td></tr><tr><td>5P</td><td>3.0020</td><td>34.10</td><td>18.62</td><td>9.20</td><td>43.30</td><td>27.82</td><td>56.00</td><td>46.00</td><td>-12.70</td><td>-18.18</td><td>Pass</td></tr><tr><td>6*</td><td>15.8780</td><td>43.22</td><td>25.76</td><td>9.42</td><td>52.64</td><td>35.18</td><td>60.00</td><td>50.00</td><td>-7.36</td><td>-14.82</td><td>Pass</td></tr></table>				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	0.1740	41.10	26.30	9.50	50.60	35.80	64.76	54.77	-14.16	-18.97	Pass	2P	0.2380	37.65	24.15	9.50	47.15	33.65	62.16	52.17	-15.01	-18.52	Pass	3P	0.3620	32.75	16.68	9.50	42.25	26.18	58.68	48.68	-16.43	-22.50	Pass	4P	0.4660	32.13	16.36	9.50	41.63	25.86	56.58	46.58	-14.95	-20.72	Pass	5P	3.0020	34.10	18.62	9.20	43.30	27.82	56.00	46.00	-12.70	-18.18	Pass	6*	15.8780	43.22	25.76	9.42	52.64	35.18	60.00	50.00	-7.36	-14.82	Pass
No.	Frequency	QuasiPeak	Average	Correction	QuasiPeak	Average	QuasiPeak	Average	QuasiPeak	Average	Remark																																																																																																				
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1P	0.1740	41.10	26.30	9.50	50.60	35.80	64.76	54.77	-14.16	-18.97	Pass																																																																																																				
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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	0.1660	39.71	27.47	9.40	49.11	36.87	65.15	55.16	-16.04	-18.29	Pass																																																																																																				
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4P	0.4900	30.99	20.00	9.40	40.39	29.40	56.17	46.17	-15.78	-16.77	Pass																																																																																																				
5P	2.8540	34.03	19.12	9.11	43.14	28.23	56.00	46.00	-12.86	-17.77	Pass																																																																																																				
6*	15.9140	43.56	26.29	9.12	52.68	35.41	60.00	50.00	-7.32	-14.59	Pass																																																																																																				

Correction Factor = insertion loss of LISN + cable loss;

Reading = Reading Amplitude in the instrument;

Result = Correction Factor + Reading;

Margin = Result – Limit

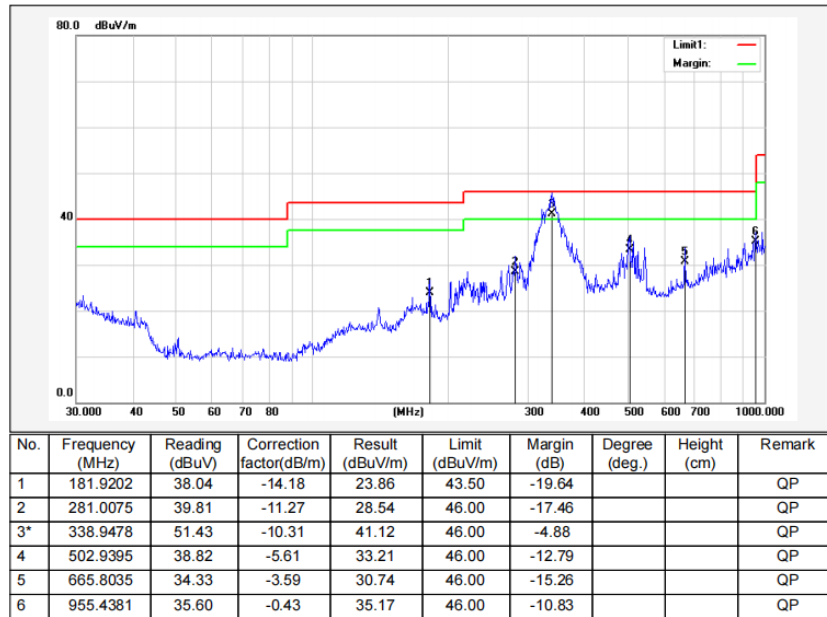
Appendix A.2 Test Results of Radiated Spurious Emission

Below 1GHz:

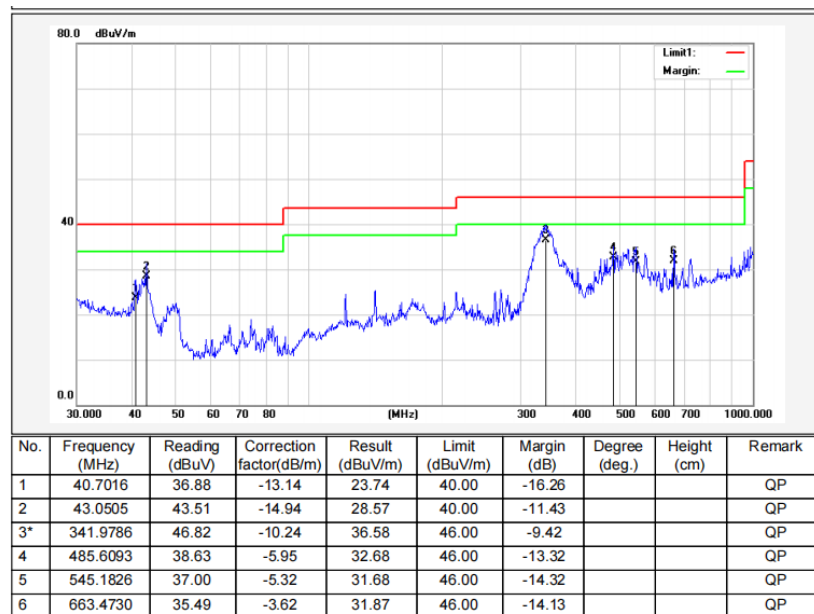
All modes have been tested, and the report only reflects the worst mode.

Test Mode: Working

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:
Note: 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	57.96	-15.01	42.95	74	-31.05	peak
2	4332	56.01	-14.54	41.47	74	-32.53	peak
3	5182	55.75	-12.66	43.09	71.1	-28.01	peak
4	6066	54.39	-10.07	44.32	71.1	-26.78	peak
5	7494	54.25	-7.13	47.12	74	-26.88	peak
6	8174	54.93	-7.68	47.25	74	-26.75	peak

GFSK-Low Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3992	57.88	-15.01	42.87	74	-31.13	peak
2	4984	55.63	-12.85	42.78	74	-31.22	peak
3	5692	55.58	-11.75	43.83	71.1	-27.27	peak
4	6304	54.25	-9.91	44.34	71.1	-26.76	peak
5	7494	54.3	-7.13	47.17	74	-26.83	peak
6	8242	54.88	-7.48	47.4	74	-26.6	peak

GFSK- Middle Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3958	57.67	-15.09	42.58	74	-31.42	peak
2	5046	55.49	-12.62	42.87	74	-31.13	peak
3	5998	54.43	-10.12	44.31	71.1	-26.79	peak
4	7562	54.93	-7.22	47.71	74	-26.29	peak
5	8378	53.64	-7.1	46.54	74	-27.46	peak
6	9772	53.01	-6.07	46.94	71.1	-24.16	peak

GFSK-Middle Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3992	58.99	-15.01	43.98	74	-30.02	peak
2	4264	57.52	-14.85	42.67	74	-31.33	peak
3	5182	56.09	-12.66	43.43	71.1	-27.67	peak
4	5998	54.74	-10.12	44.62	71.1	-26.48	peak
5	7426	53.64	-7.09	46.55	74	-27.45	peak
6	8208	54.74	-7.62	47.12	74	-26.88	peak

GFSK-High Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3992	58.28	-15.01	43.27	74	-30.73	peak
2	5046	56.1	-12.62	43.48	74	-30.52	peak
3	5998	55.36	-10.12	45.24	71.1	-25.86	peak
4	6950	54.49	-8.79	45.7	71.1	-25.4	peak
5	7562	54.25	-7.22	47.03	74	-26.97	peak
6	8412	54.82	-7.14	47.68	74	-26.32	peak

GFSK-High Vertical

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	4798	55.52	-13.33	42.19	74	-31.81	peak
2	5216	55.73	-12.66	43.07	71.1	-28.03	peak
3	5998	54.46	-10.12	44.34	71.1	-26.76	peak
4	6814	54.01	-8.86	45.15	71.1	-25.95	peak
5	7562	53.89	-7.22	46.67	74	-27.33	peak
6	8684	55.71	-8.17	47.54	71.1	-23.56	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. 91.10) 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	2377.6	59.9	-21.07	38.83	74	-35.17	peak
2	2377.6	53.48	-21.07	32.41	54	-21.59	AVG
3	2390	58.89	-21.03	37.86	74	-36.14	peak
4	2390	52.62	-21.03	31.59	54	-22.41	AVG
5	2402.4	115.25	-20.99	94.26	125.2	-30.94	peak

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2387.4	59.35	-21.04	38.31	74	-35.69	peak
2	2387.4	54.06	-21.04	33.02	54	-20.98	AVG
3	2390	58.14	-21.03	37.11	74	-36.89	peak
4	2390	52.07	-21.03	31.04	54	-22.96	AVG
5	2402.4	112.09	-20.99	91.1	125.2	-34.10	peak

GFSK-High

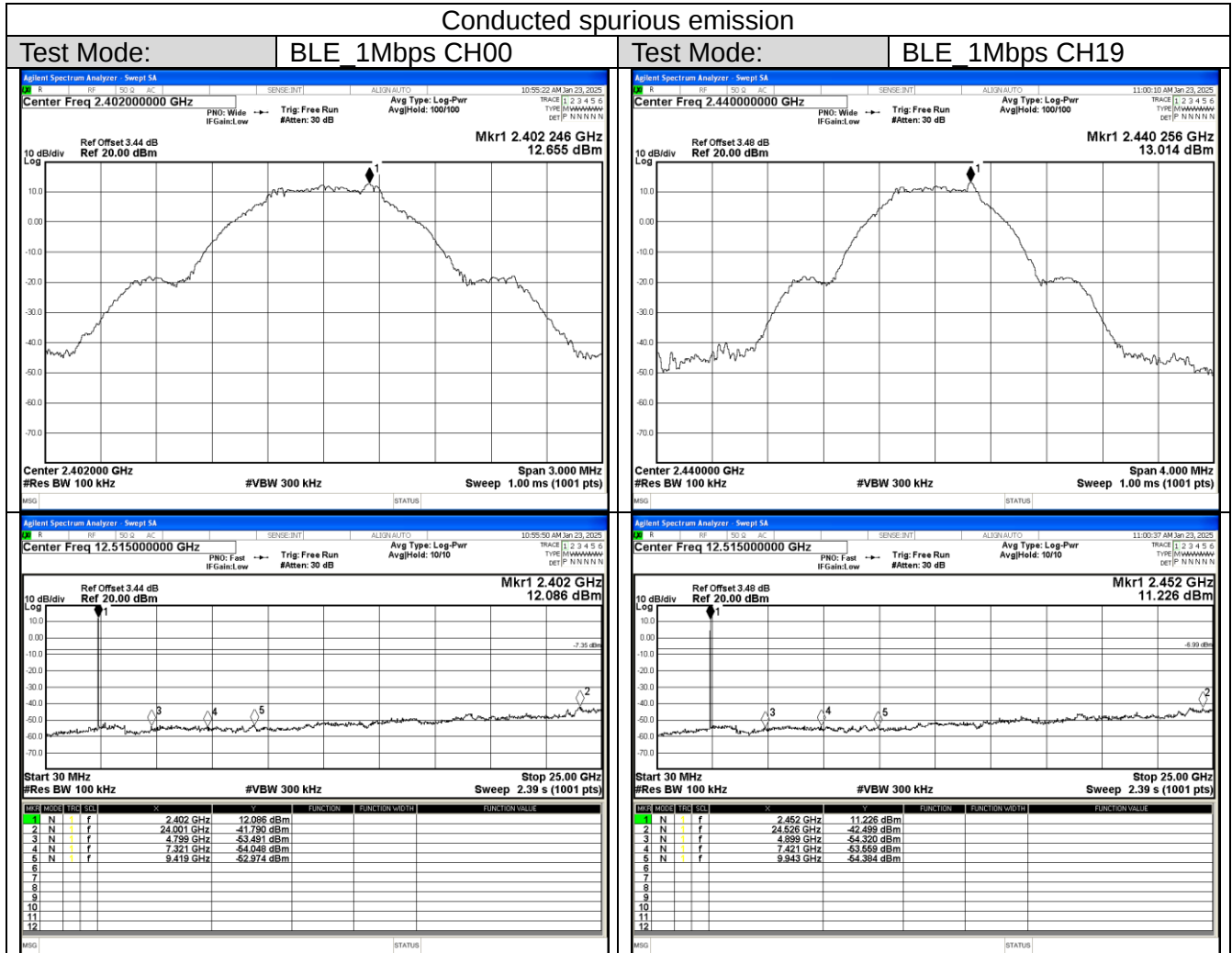
Horizontal

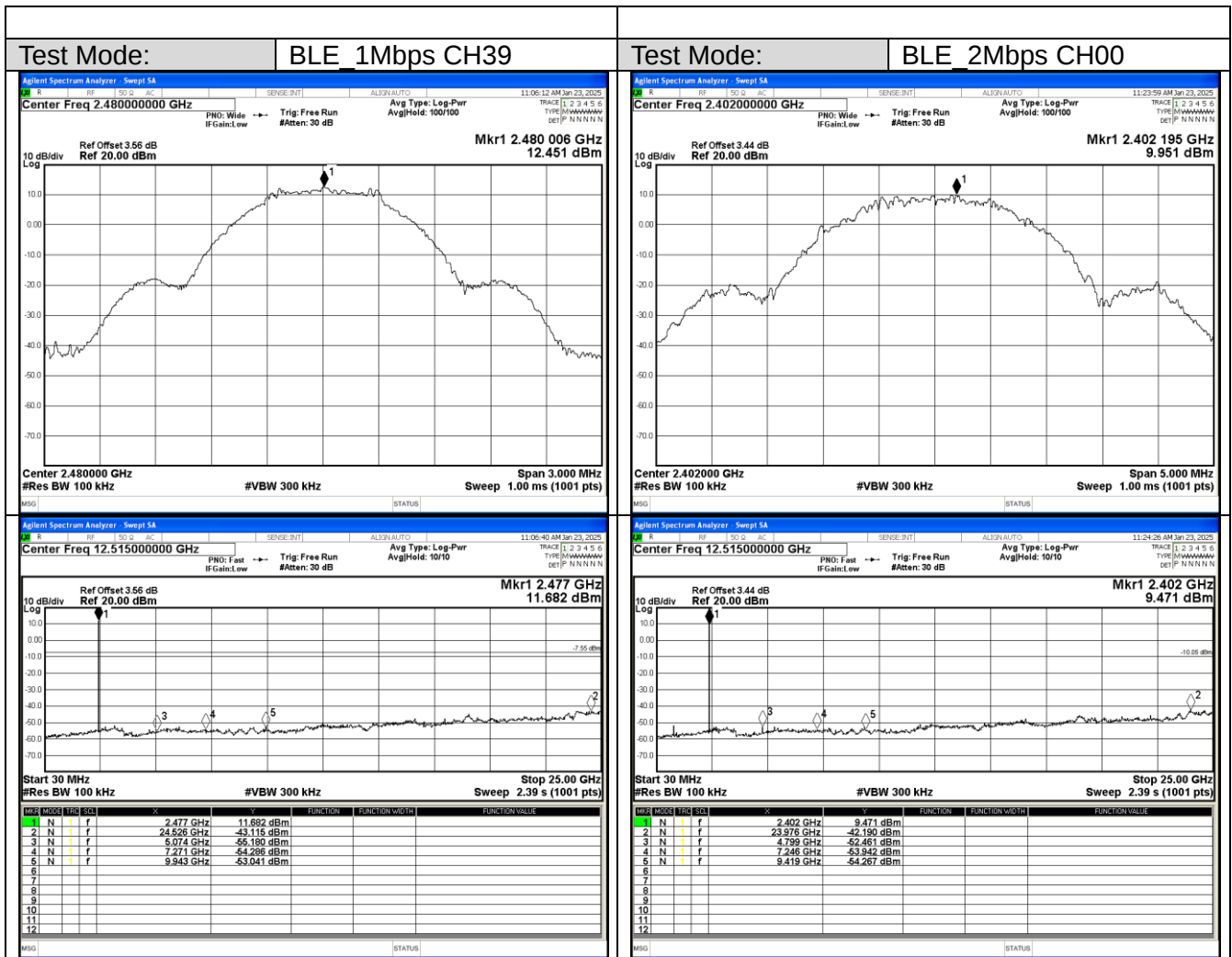
No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2480.26	118.86	-20.91	97.95	125.2	-27.25	peak
2	2483.5	69.04	-20.91	48.13	74	-25.87	peak
3	2483.5	61.68	-20.91	40.77	54	-13.23	AVG
4	2485.06	68.5	-20.91	47.59	74	-26.41	peak
5	2485.06	60.89	-20.91	39.98	54	-14.02	AVG

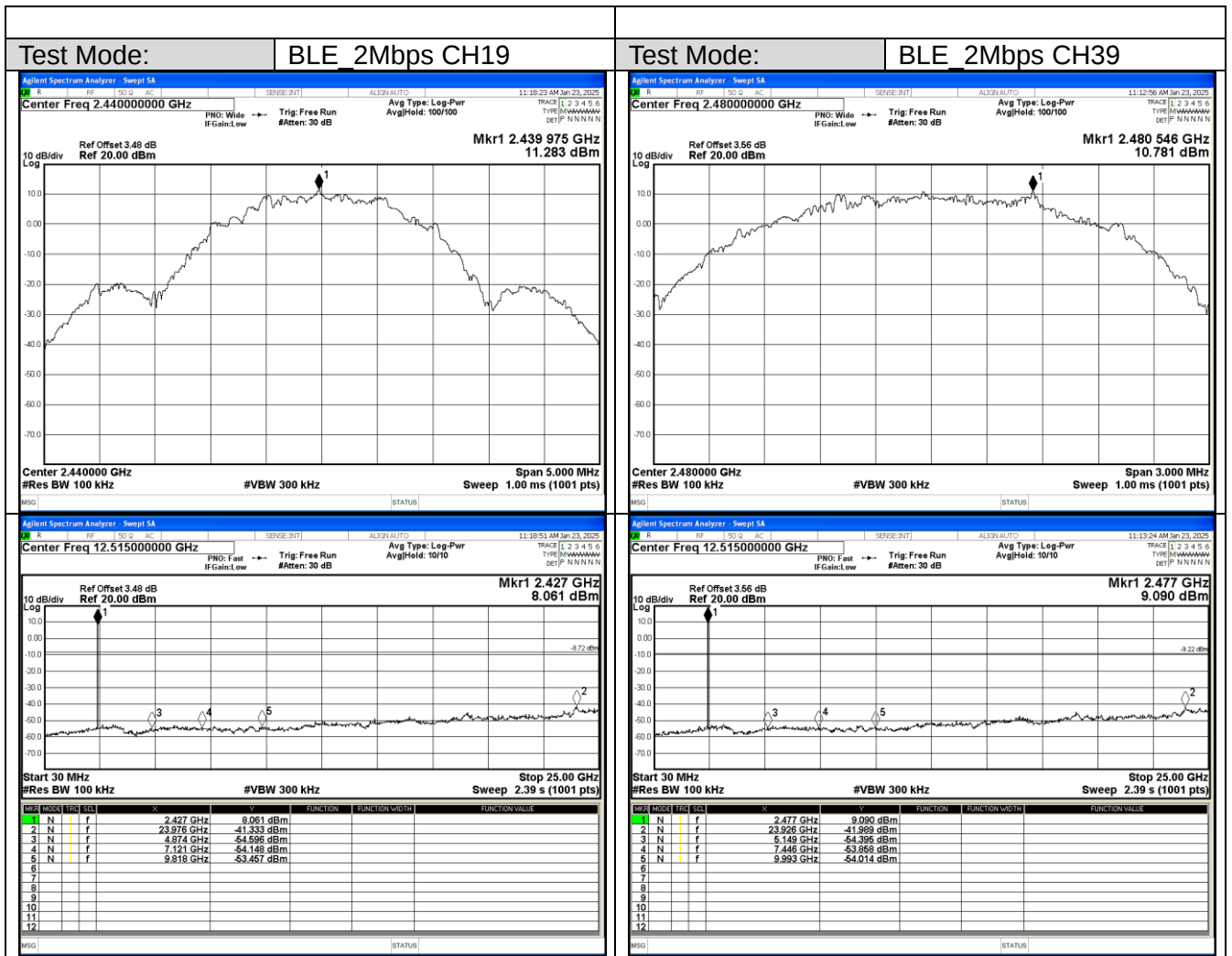
Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2479.78	114.57	-20.91	93.66	125.2	-31.54	peak
2	2483.5	64.08	-20.91	43.17	74	-30.83	peak
3	2483.5	59.45	-20.91	38.54	54	-15.46	AVG
4	2485.6	65.45	-20.91	44.54	74	-29.46	peak
5	2485.6	59.97	-20.91	39.06	54	-14.94	AVG

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

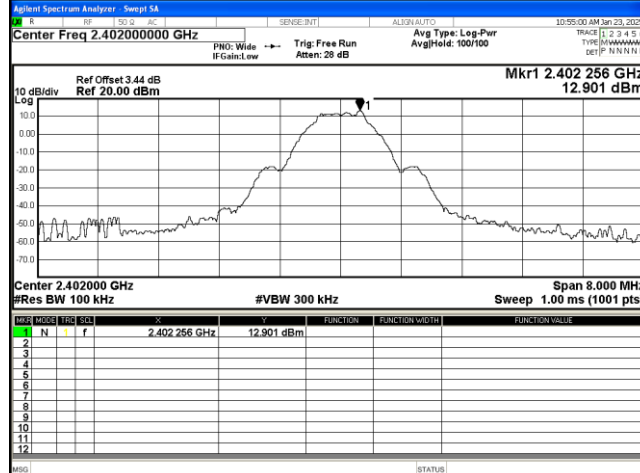




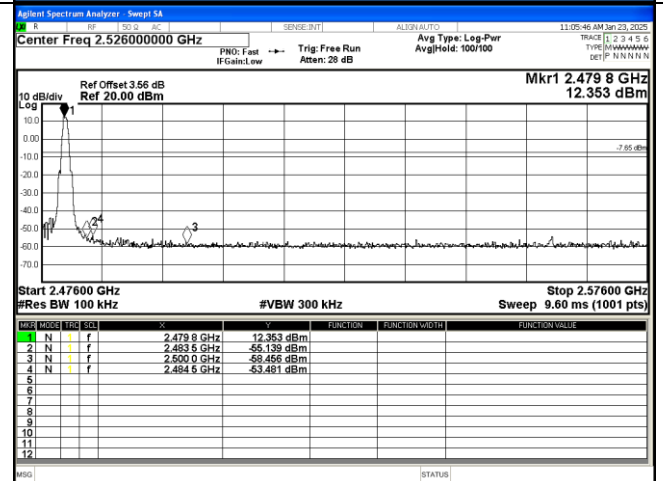
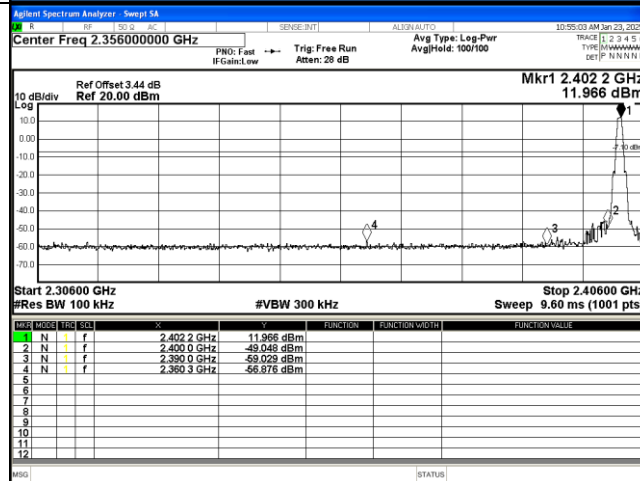
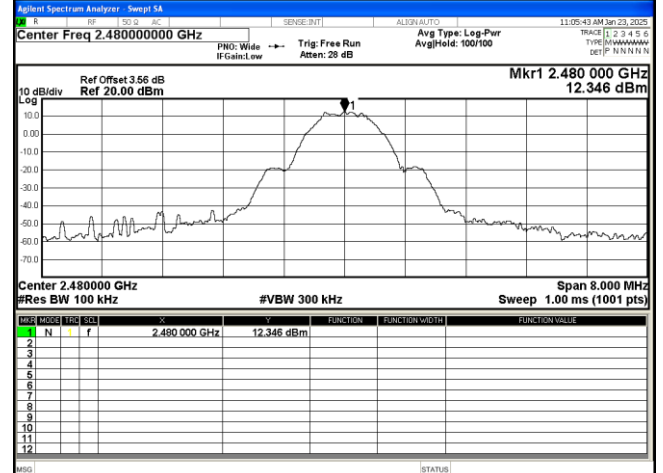


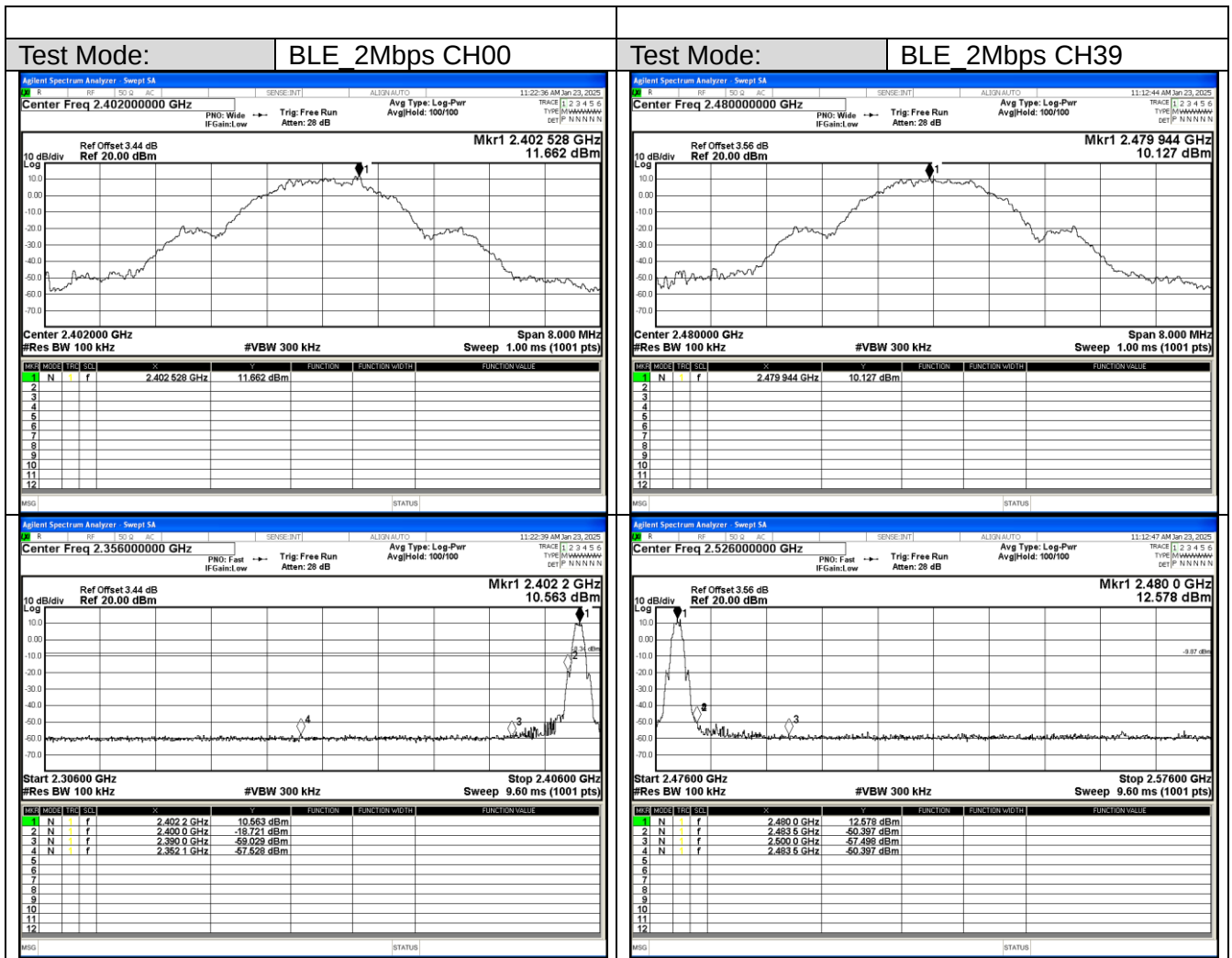
For Band edge(it's also the reference level for conducted spurious emission)

Test Mode: BLE_1Mbps CH00



Test Mode: BLE_1Mbps CH39

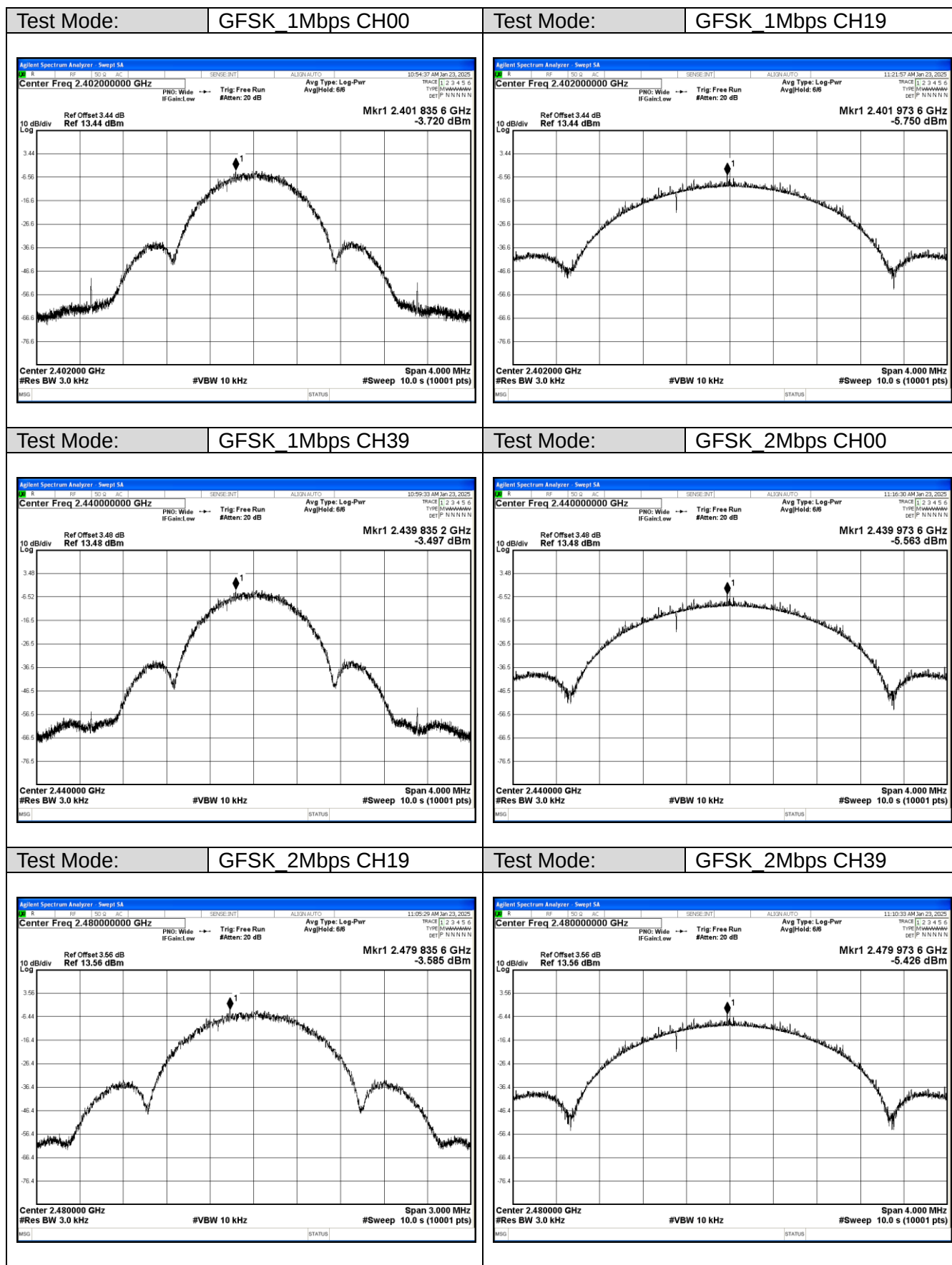




Appendix A.4 Test Results of Conducted Power Spectral Density

GFSK_1Mbps			
Frequency	Power Density	Limit (dBm/3KHz)	Result
	(dBm/3kHz)		
CH00	-3.72	8	Pass
CH19	-3.497	8	Pass
CH39	-3.585	8	Pass

GFSK_2Mbps			
Frequency	Power Density	Limit (dBm/3KHz)	Result
	(dBm/3kHz)		
CH00	-5.75	8	Pass
CH19	-5.563	8	Pass
CH39	-5.426	8	Pass



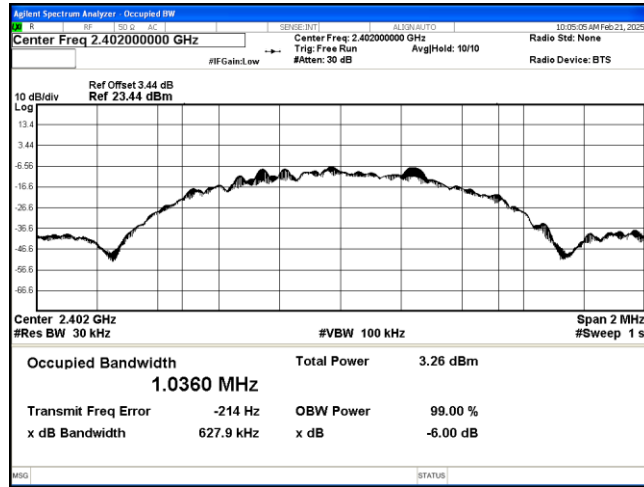
Appendix A.5 Test Results of 6dB and 99% BANDWIDTH

GFSK_1Mbps				
Frequency	99% Bandwidth (MHz)	6dB Bandwidth (MHz)	6dB limit (MHz)	Result
CH00	1.0360	0.6629	0.5	Pass
CH19	1.0358	0.6631	0.5	Pass
CH39	1.0344	0.6643	0.5	Pass

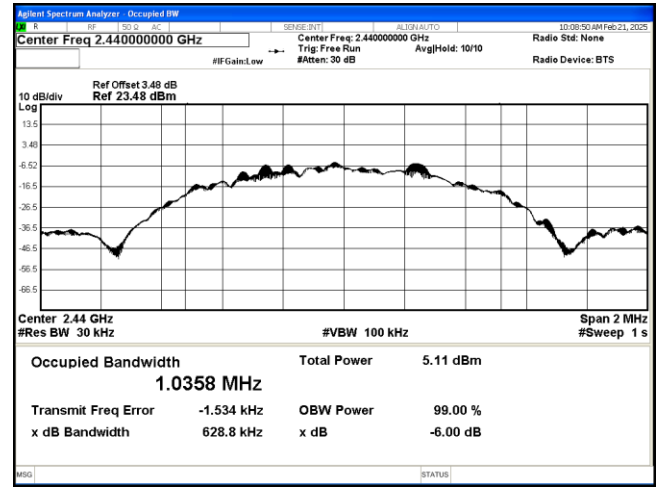
GFSK_2Mbps				
Frequency	99% Bandwidth (MHz)	6dB Bandwidth (MHz)	6dB limit (MHz)	Result
CH00	2.0649	1.156	0.5	Pass
CH19	2.0671	1.155	0.5	Pass
CH39	2.0633	1.155	0.5	Pass

99% Bandwidth

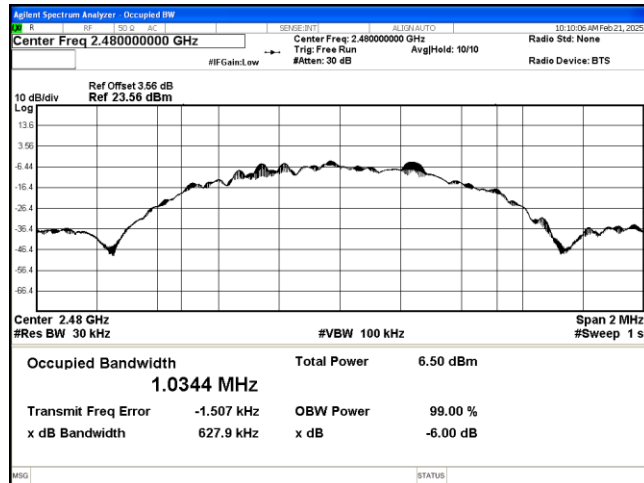
Test Mode: GFSK_1Mbps CH00



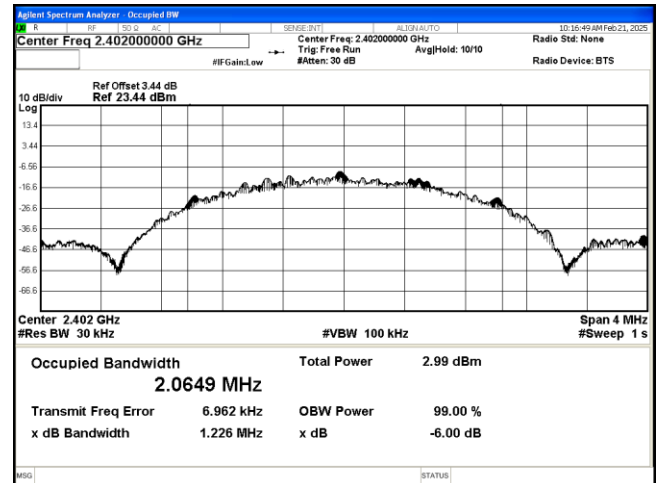
Test Mode: GFSK_1Mbps CH19



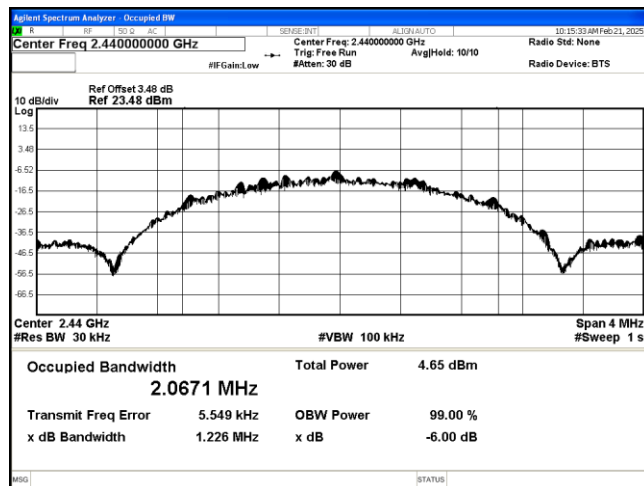
Test Mode: GFSK_1Mbps CH39



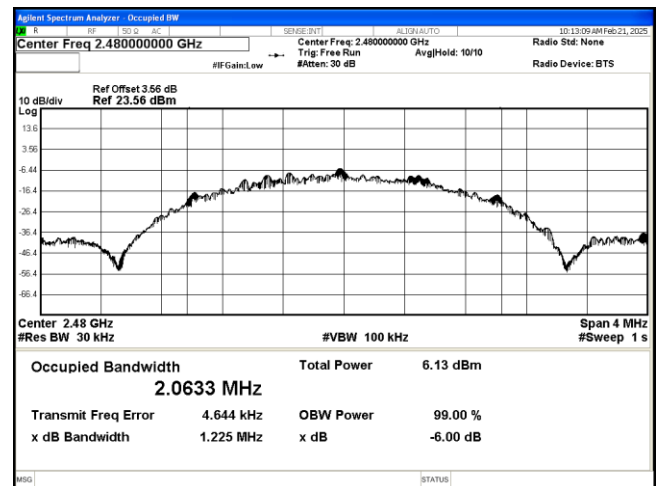
Test Mode: GFSK_2Mbps CH00



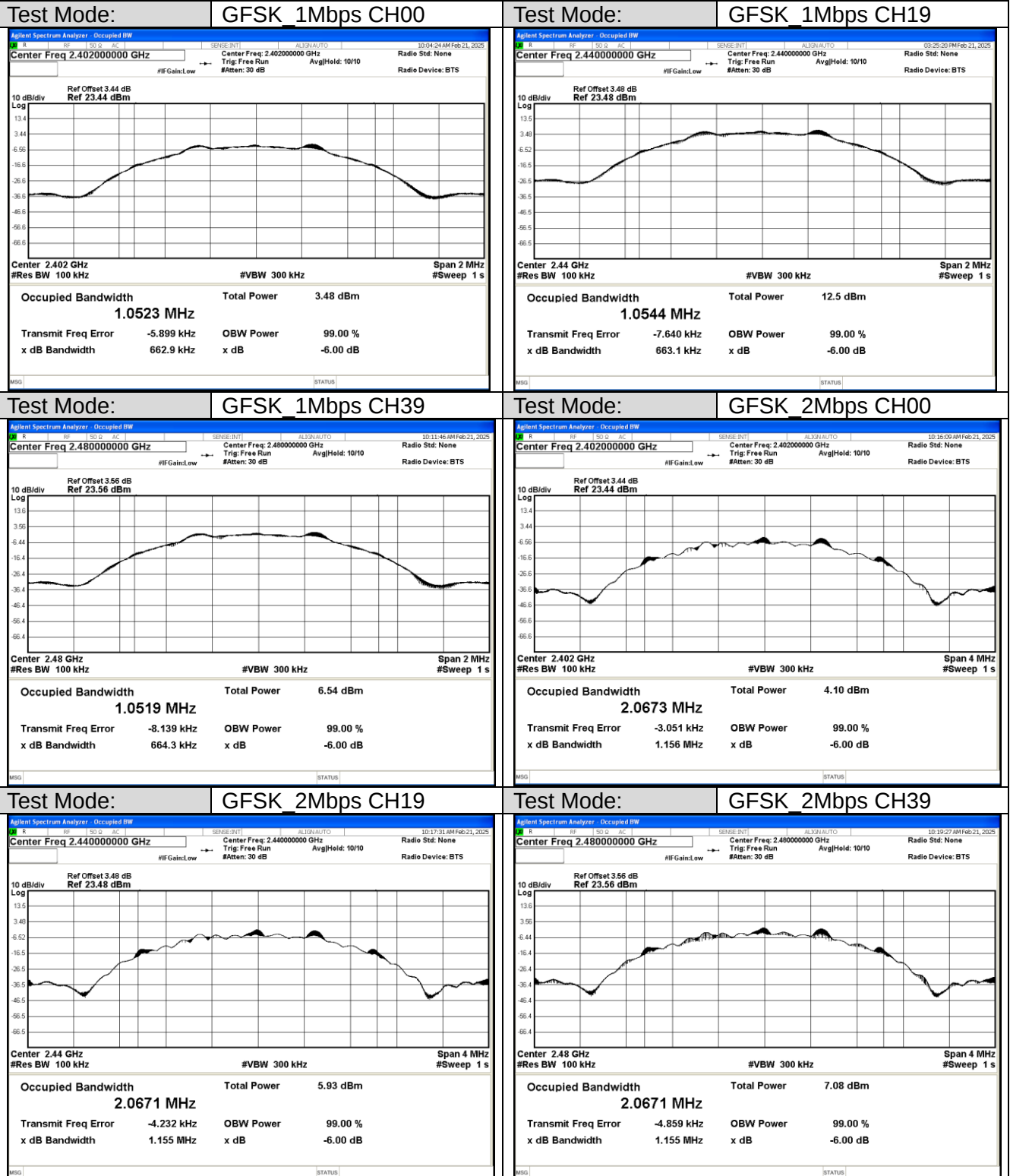
Test Mode: GFSK_2Mbps CH19



Test Mode: GFSK_2Mbps CH39



6dB Bandwidth



Appendix A.6 Test Results of Maximum Conducted Power

For FCC:

Mode	Frequency [MHz]	Measured Power	Limit [dBm]
		Conducted [dBm]	
BLE_1Mbps	2402	13.024	≤ 30
	2440	12.954	≤ 30
	2480	13.189	≤ 30
BLE_2Mbps	2402	13.189	≤ 30
	2440	13.221	≤ 30
	2480	13.401	≤ 30

Note:

- 1) The cable loss is taken into account in results.
- 2) Antenna gain(G) BLE: 4.30 dBi

For IC:

Mode	Frequency [MHz]	Measured Power		Limit [dBm]
		Conducted [dBm]	EIRP [dBm]	
BLE_1Mbps	2402	13.024	17.324	≤ 36
	2440	12.954	17.254	≤ 36
	2480	13.189	17.489	≤ 36
BLE_2Mbps	2402	13.189	17.489	≤ 36
	2440	13.221	17.521	≤ 36
	2480	13.401	17.701	≤ 36

Note:

- 1) The cable loss is taken into account in results.
 - 2) Antenna gain(G) BLE: 4.30 dBi.
- e.i.r.p.=P(peak power)+ G, which is far below the 4 W.