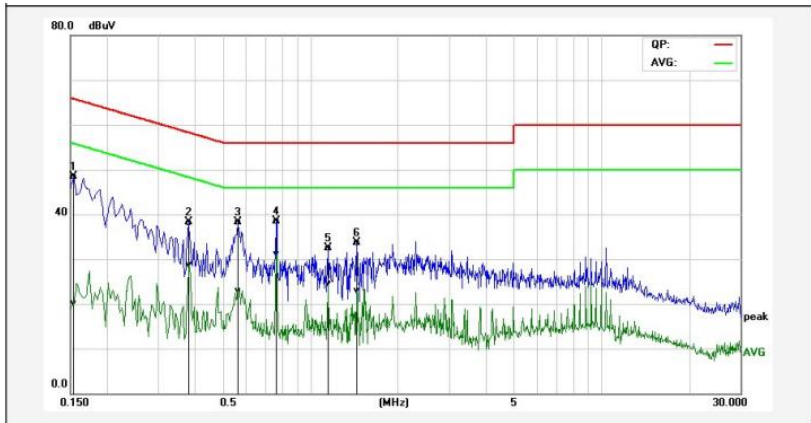
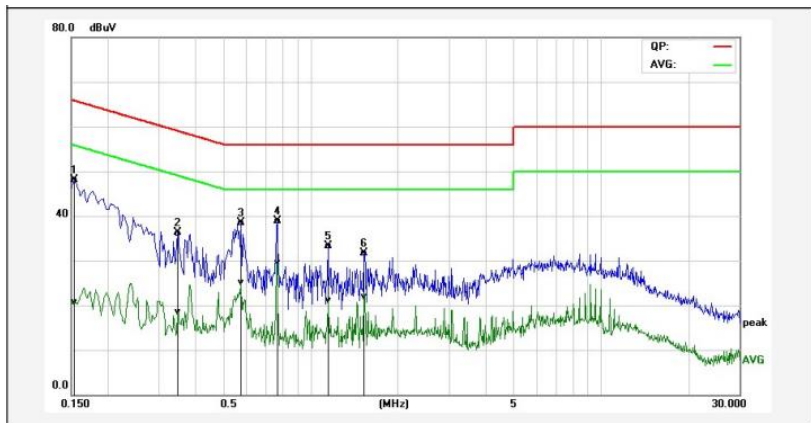


Appendix A: Test Results of BLE

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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 :	Mode7	Test Voltage :	AC 120V/60Hz																																																																																																
L																																																																																																			
 <table><tr><th>No.</th><th>Frequency</th><th>QuasiPeak reading</th><th>Average reading</th><th>Correction factor</th><th>QuasiPeak result</th><th>Average result</th><th>QuasiPeak limit</th><th>Average limit</th><th>QuasiPeak margin</th><th>Average margin</th><th>Remark</th></tr><tr><td></td><td>(MHz)</td><td>(dBuV)</td><td>(dBuV)</td><td>(dB)</td><td>(dBuV)</td><td>(dBuV)</td><td>(dBuV)</td><td>(dBuV)</td><td>(dB)</td><td>(dB)</td><td></td></tr><tr><td>1P</td><td>0.1539</td><td>38.94</td><td>10.61</td><td>9.50</td><td>48.44</td><td>20.11</td><td>65.78</td><td>55.79</td><td>-17.34</td><td>-35.68</td><td>Pass</td></tr><tr><td>2P</td><td>0.3820</td><td>28.70</td><td>19.13</td><td>9.50</td><td>38.20</td><td>28.63</td><td>58.23</td><td>48.24</td><td>-20.03</td><td>-19.61</td><td>Pass</td></tr><tr><td>3P</td><td>0.5660</td><td>28.84</td><td>13.44</td><td>9.50</td><td>38.34</td><td>22.94</td><td>56.00</td><td>46.00</td><td>-17.66</td><td>-23.06</td><td>Pass</td></tr><tr><td>4*</td><td>0.7660</td><td>29.06</td><td>21.55</td><td>9.48</td><td>38.54</td><td>31.03</td><td>56.00</td><td>46.00</td><td>-17.46</td><td>-14.97</td><td>Pass</td></tr><tr><td>5P</td><td>1.1539</td><td>23.17</td><td>15.05</td><td>9.38</td><td>32.55</td><td>24.43</td><td>56.00</td><td>46.00</td><td>-23.45</td><td>-21.57</td><td>Pass</td></tr><tr><td>6P</td><td>1.4460</td><td>24.30</td><td>13.53</td><td>9.36</td><td>33.66</td><td>22.89</td><td>56.00</td><td>46.00</td><td>-22.34</td><td>-23.11</td><td>Pass</td></tr></table>				No.	Frequency	QuasiPeak reading	Average reading	Correction factor	QuasiPeak result	Average result	QuasiPeak limit	Average limit	QuasiPeak margin	Average margin	Remark		(MHz)	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)		1P	0.1539	38.94	10.61	9.50	48.44	20.11	65.78	55.79	-17.34	-35.68	Pass	2P	0.3820	28.70	19.13	9.50	38.20	28.63	58.23	48.24	-20.03	-19.61	Pass	3P	0.5660	28.84	13.44	9.50	38.34	22.94	56.00	46.00	-17.66	-23.06	Pass	4*	0.7660	29.06	21.55	9.48	38.54	31.03	56.00	46.00	-17.46	-14.97	Pass	5P	1.1539	23.17	15.05	9.38	32.55	24.43	56.00	46.00	-23.45	-21.57	Pass	6P	1.4460	24.30	13.53	9.36	33.66	22.89	56.00	46.00	-22.34	-23.11	Pass
No.	Frequency	QuasiPeak reading	Average reading	Correction factor	QuasiPeak result	Average result	QuasiPeak limit	Average limit	QuasiPeak margin	Average margin	Remark																																																																																								
	(MHz)	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)																																																																																									
1P	0.1539	38.94	10.61	9.50	48.44	20.11	65.78	55.79	-17.34	-35.68	Pass																																																																																								
2P	0.3820	28.70	19.13	9.50	38.20	28.63	58.23	48.24	-20.03	-19.61	Pass																																																																																								
3P	0.5660	28.84	13.44	9.50	38.34	22.94	56.00	46.00	-17.66	-23.06	Pass																																																																																								
4*	0.7660	29.06	21.55	9.48	38.54	31.03	56.00	46.00	-17.46	-14.97	Pass																																																																																								
5P	1.1539	23.17	15.05	9.38	32.55	24.43	56.00	46.00	-23.45	-21.57	Pass																																																																																								
6P	1.4460	24.30	13.53	9.36	33.66	22.89	56.00	46.00	-22.34	-23.11	Pass																																																																																								
N																																																																																																			
 <table><tr><th>No.</th><th>Frequency</th><th>QuasiPeak reading</th><th>Average reading</th><th>Correction factor</th><th>QuasiPeak result</th><th>Average result</th><th>QuasiPeak limit</th><th>Average limit</th><th>QuasiPeak margin</th><th>Average margin</th><th>Remark</th></tr><tr><td></td><td>(MHz)</td><td>(dBuV)</td><td>(dBuV)</td><td>(dB)</td><td>(dBuV)</td><td>(dBuV)</td><td>(dBuV)</td><td>(dBuV)</td><td>(dB)</td><td>(dB)</td><td></td></tr><tr><td>1P</td><td>0.1539</td><td>38.61</td><td>11.24</td><td>9.40</td><td>48.01</td><td>20.64</td><td>65.78</td><td>55.79</td><td>-17.77</td><td>-35.15</td><td>Pass</td></tr><tr><td>2P</td><td>0.3500</td><td>26.80</td><td>9.07</td><td>9.40</td><td>36.20</td><td>18.47</td><td>58.96</td><td>48.96</td><td>-22.76</td><td>-30.49</td><td>Pass</td></tr><tr><td>3P</td><td>0.5780</td><td>29.02</td><td>15.64</td><td>9.40</td><td>38.42</td><td>25.04</td><td>56.00</td><td>46.00</td><td>-17.58</td><td>-20.96</td><td>Pass</td></tr><tr><td>4*</td><td>0.7700</td><td>29.57</td><td>20.10</td><td>9.38</td><td>38.95</td><td>29.48</td><td>56.00</td><td>46.00</td><td>-17.05</td><td>-16.52</td><td>Pass</td></tr><tr><td>5P</td><td>1.1500</td><td>24.01</td><td>11.85</td><td>9.28</td><td>33.29</td><td>21.13</td><td>56.00</td><td>46.00</td><td>-22.71</td><td>-24.87</td><td>Pass</td></tr><tr><td>6P</td><td>1.5339</td><td>22.43</td><td>12.64</td><td>9.25</td><td>31.68</td><td>21.89</td><td>56.00</td><td>46.00</td><td>-24.32</td><td>-24.11</td><td>Pass</td></tr></table>				No.	Frequency	QuasiPeak reading	Average reading	Correction factor	QuasiPeak result	Average result	QuasiPeak limit	Average limit	QuasiPeak margin	Average margin	Remark		(MHz)	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)		1P	0.1539	38.61	11.24	9.40	48.01	20.64	65.78	55.79	-17.77	-35.15	Pass	2P	0.3500	26.80	9.07	9.40	36.20	18.47	58.96	48.96	-22.76	-30.49	Pass	3P	0.5780	29.02	15.64	9.40	38.42	25.04	56.00	46.00	-17.58	-20.96	Pass	4*	0.7700	29.57	20.10	9.38	38.95	29.48	56.00	46.00	-17.05	-16.52	Pass	5P	1.1500	24.01	11.85	9.28	33.29	21.13	56.00	46.00	-22.71	-24.87	Pass	6P	1.5339	22.43	12.64	9.25	31.68	21.89	56.00	46.00	-24.32	-24.11	Pass
No.	Frequency	QuasiPeak reading	Average reading	Correction factor	QuasiPeak result	Average result	QuasiPeak limit	Average limit	QuasiPeak margin	Average margin	Remark																																																																																								
	(MHz)	(dBuV)	(dBuV)	(dB)	(dBuV)	(dBuV)	(dBuV)	(dBuV)	(dB)	(dB)																																																																																									
1P	0.1539	38.61	11.24	9.40	48.01	20.64	65.78	55.79	-17.77	-35.15	Pass																																																																																								
2P	0.3500	26.80	9.07	9.40	36.20	18.47	58.96	48.96	-22.76	-30.49	Pass																																																																																								
3P	0.5780	29.02	15.64	9.40	38.42	25.04	56.00	46.00	-17.58	-20.96	Pass																																																																																								
4*	0.7700	29.57	20.10	9.38	38.95	29.48	56.00	46.00	-17.05	-16.52	Pass																																																																																								
5P	1.1500	24.01	11.85	9.28	33.29	21.13	56.00	46.00	-22.71	-24.87	Pass																																																																																								
6P	1.5339	22.43	12.64	9.25	31.68	21.89	56.00	46.00	-24.32	-24.11	Pass																																																																																								

Correction Factor = insertion loss of LISN + cable loss;

Reading = Reading Amplitude in the instrument;

Result = Correction Factor + Reading;

Margin = Result – Limit

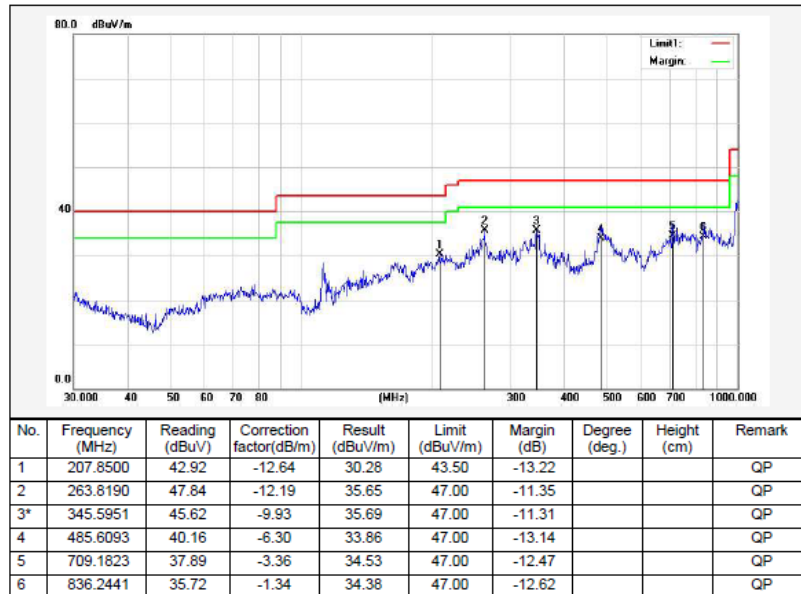
Appendix A.2 Test Results of Radiated Spurious Emission

Below 1GHz:

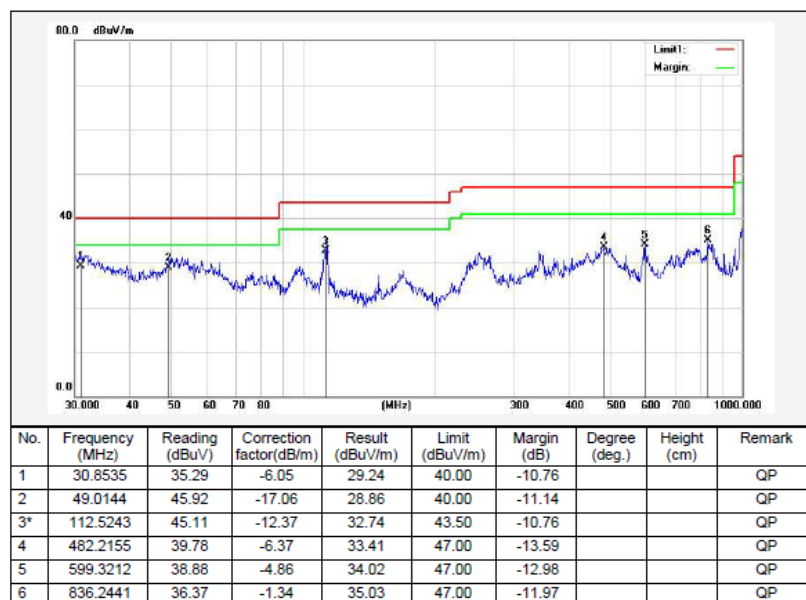
All modes have been tested, and the report only reflects the worst mode.

Test Mode: Mode7

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	3958	60.88	-15.09	45.79	74	-28.21	peak
2	7562	57.09	-7.22	49.87	74	-24.13	peak
3	9602	61.27	-7.4	53.87	82.49	-28.52	peak
4	10452	55.6	-3.8	51.8	82.49	-30.59	peak
5	11132	55.55	-2.48	53.07	74	-20.93	peak
6	13036	54.8	-0.29	54.51	82.49	-27.88	peak

GFSK-Low Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3992	61.4	-15.01	46.39	74	-27.61	peak
2	5522	60.39	-12.1	48.29	82.49	-34.1	peak
3	8242	57.57	-7.48	50.09	74	-23.91	peak
4	9602	59.85	-7.4	52.45	82.49	-29.94	peak
5	11744	55.31	-2.66	52.65	74	-21.35	peak
6	13070	54.94	-0.16	54.78	82.49	-27.61	peak

GFSK- Middle Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3992	62.2	-15.01	47.19	74	-26.81	peak
2	6882	60.33	-8.82	51.51	82.49	-30.88	peak
3	8378	58.98	-7.1	51.88	74	-22.12	peak
4	9772	60.48	-6.07	54.41	82.49	-27.98	peak
5	10690	55.98	-2.89	53.09	74	-20.91	peak
6	11404	54.35	-1.87	52.48	74	-21.52	peak

GFSK-Middle Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	4978	60.95	-12.84	48.11	74	-25.89	peak
2	5794	61.17	-12.18	48.99	82.49	-33.4	peak
3	6882	59.29	-8.82	50.47	82.49	-31.92	peak
4	8004	57.94	-7.81	50.13	82.49	-32.26	peak
5	9738	61	-6.35	54.65	82.49	-27.74	peak
6	10486	56.93	-3.53	53.4	82.49	-28.99	peak

GFSK-High Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	3992	59.75	-15.01	44.74	74	-29.26	peak
2	6168	57.18	-9.92	47.26	82.49	-35.13	peak
3	9908	62.04	-5.28	56.76	82.49	-25.63	peak
4	11132	55.27	-2.48	52.79	74	-21.21	peak
5	13070	56.32	-0.16	56.16	82.49	-26.23	peak
6	13716	54.59	1.55	56.14	82.49	-26.25	peak

GFSK-High Vertical

No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	Factor(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
1	4604	61.54	-14.62	46.92	74	-27.08	peak
2	7426	56.53	-7.09	49.44	74	-24.56	peak
3	9908	63.14	-5.28	57.86	82.49	-24.53	peak
4	11132	55.81	-2.48	53.33	74	-20.67	peak
5	13036	55.96	-0.29	55.67	82.49	-26.72	peak
6	13716	54.86	1.55	56.41	82.49	-25.98	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. 102.49) 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	2387.25	56.62	-21.04	35.58	54	-18.42	AVG
2	2387.33	64.32	-21.04	43.28	74	-30.72	peak
3	2390	61.16	-21.03	40.13	74	-33.87	peak
4	2390	51.06	-21.03	30.03	54	-23.97	AVG
5	2402.34	123.81	-20.99	102.82	125.2	-22.38	peak

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2387.201	55.42	-21.04	34.38	54	-19.62	AVG
2	2387.52	63.73	-21.03	42.7	74	-31.3	peak
3	2390	60.26	-21.03	39.23	74	-34.77	peak
4	2390	50.55	-21.03	29.52	54	-24.48	AVG
5	2402.34	123.78	-20.99	102.79	125.2	-22.41	peak

GFSK-High

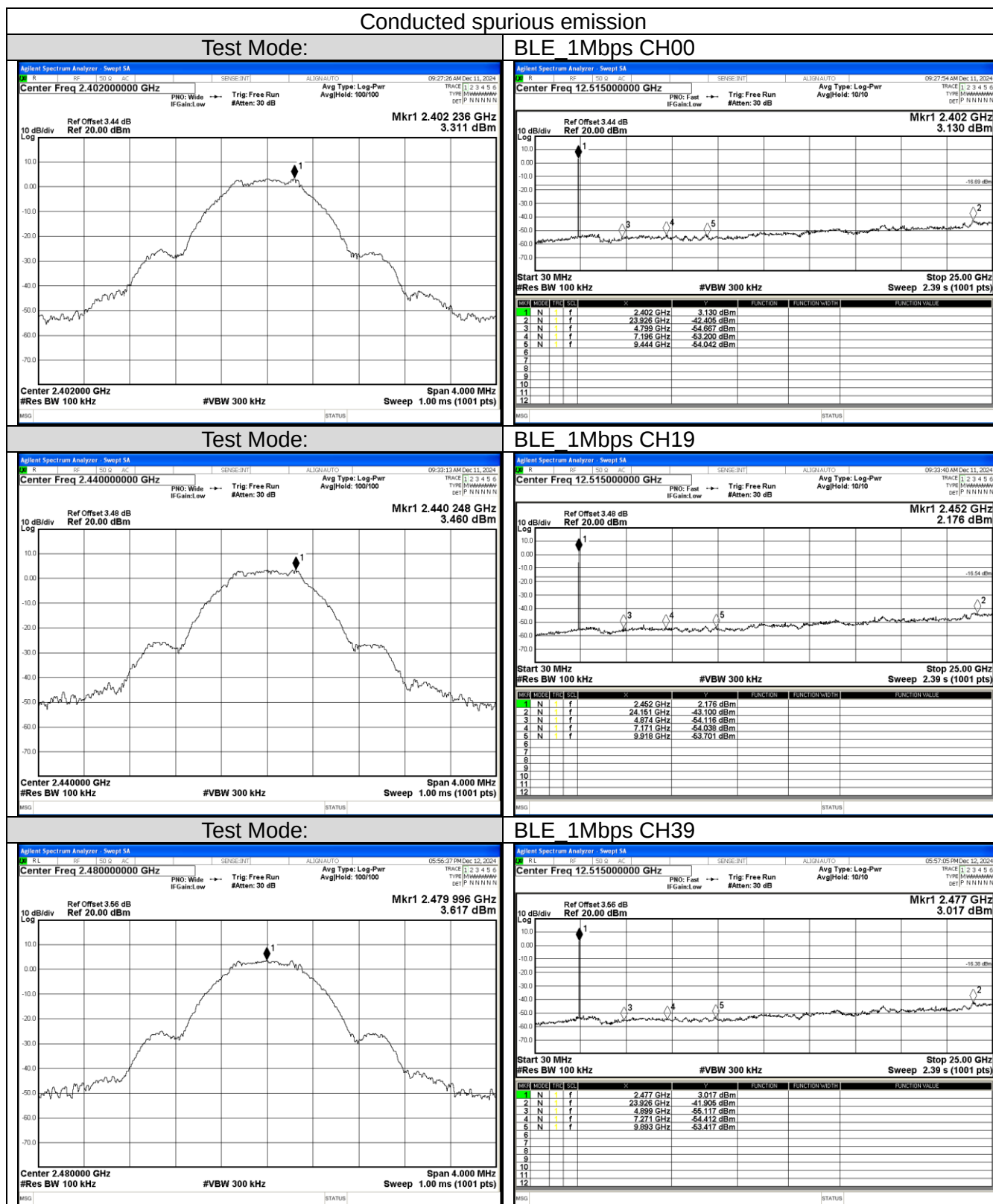
Horizontal

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2479.8	123.73	-20.91	102.82	125.2	-22.38	peak
2	2483.5	71.69	-20.91	50.78	74	-23.22	peak
3	2483.5	60.89	-20.91	39.98	54	-14.02	AVG
4	2498.75	68.63	-20.92	47.71	74	-26.29	peak
5	2498.95	61.62	-20.92	40.7	54	-13.3	AVG

Vertical

No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2479.75	123.4	-20.91	102.49	125.2	-22.71	peak
2	2483.5	71.19	-20.91	50.28	74	-23.72	peak
3	2483.5	60.56	-20.91	39.65	54	-14.35	AVG
4	2498.93	61.06	-20.92	40.14	54	-13.86	AVG
5	2499.05	68.86	-20.92	47.94	74	-26.06	peak

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

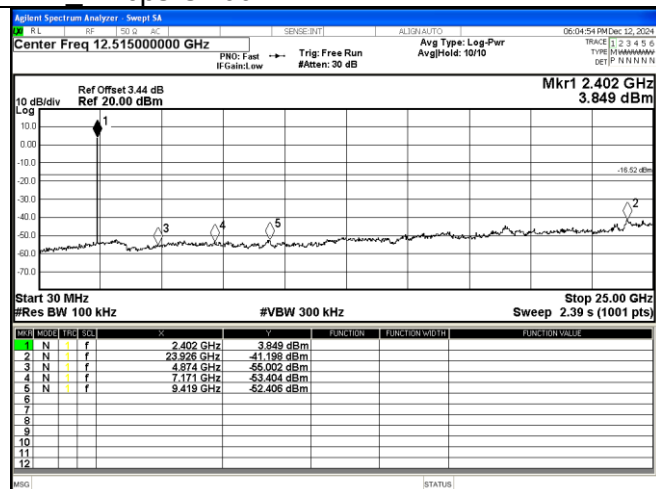


Conducted spurious emission

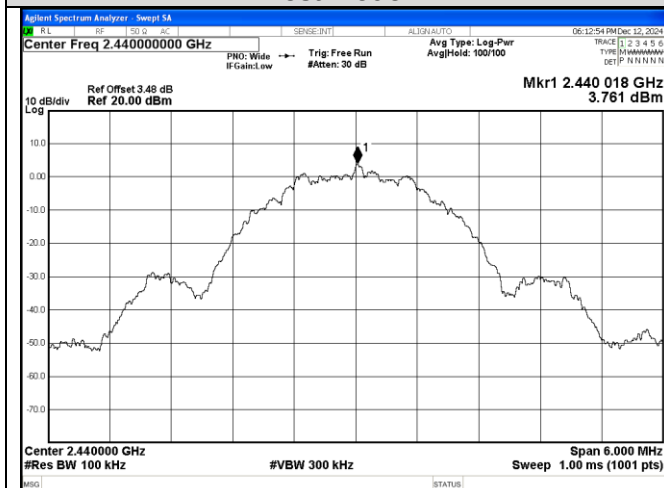
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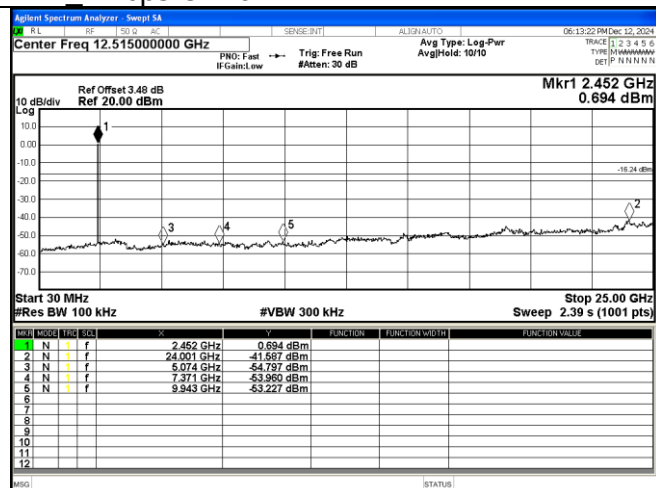
BLE 2Mbps CH00



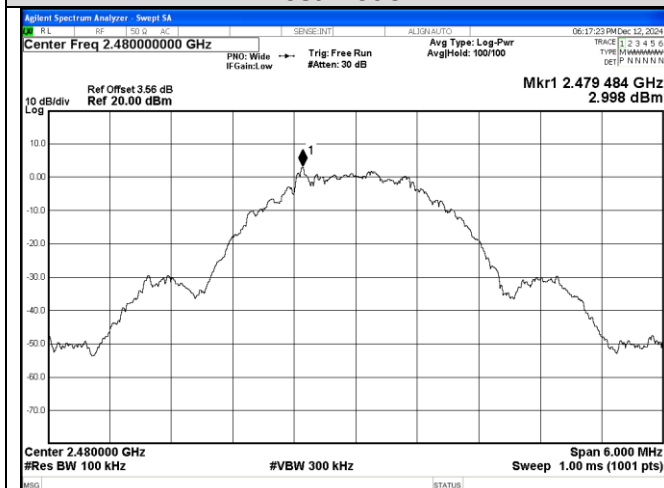
Test Mode:



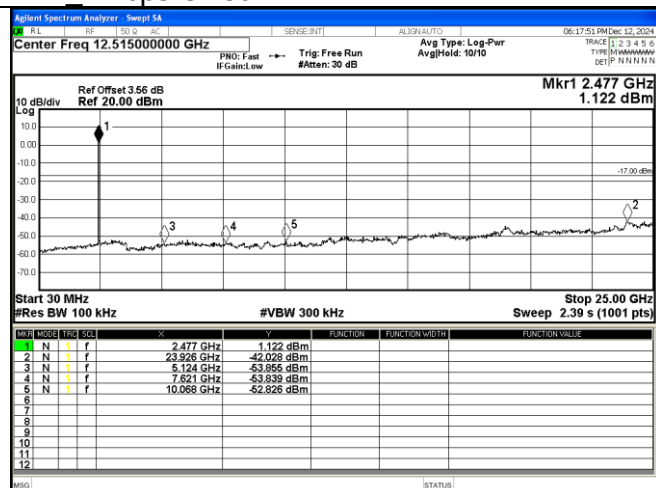
BLE 2Mbps CH19



Test Mode:



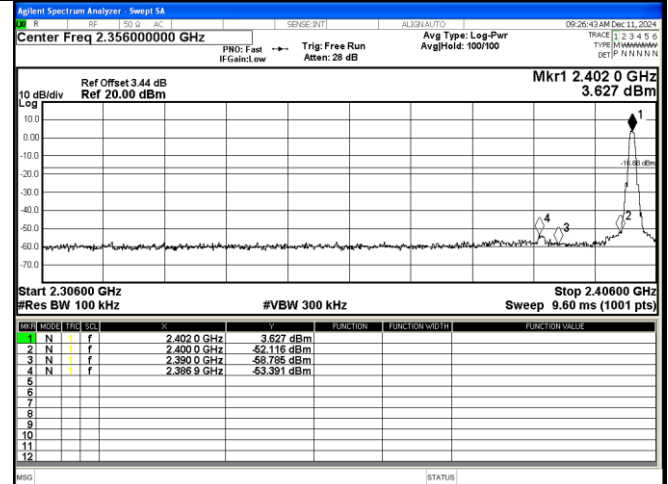
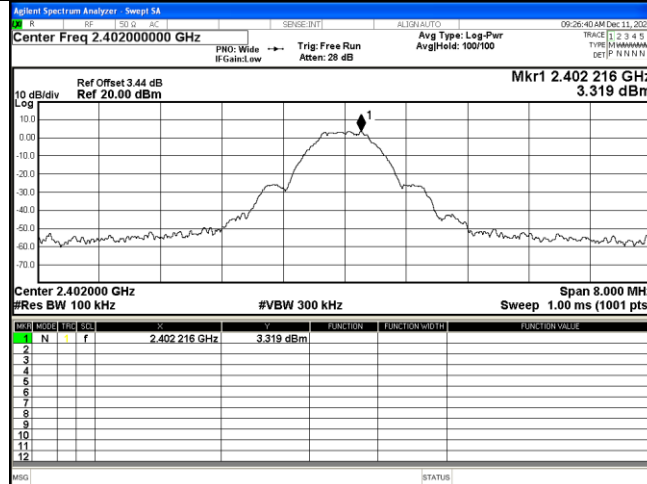
BLE 2Mbps CH39



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

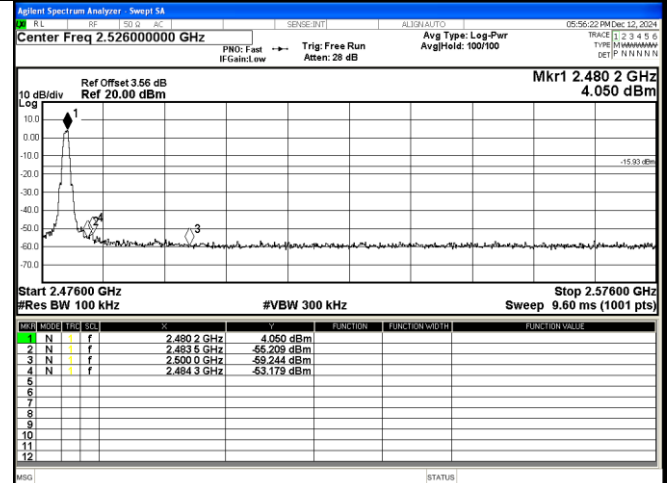
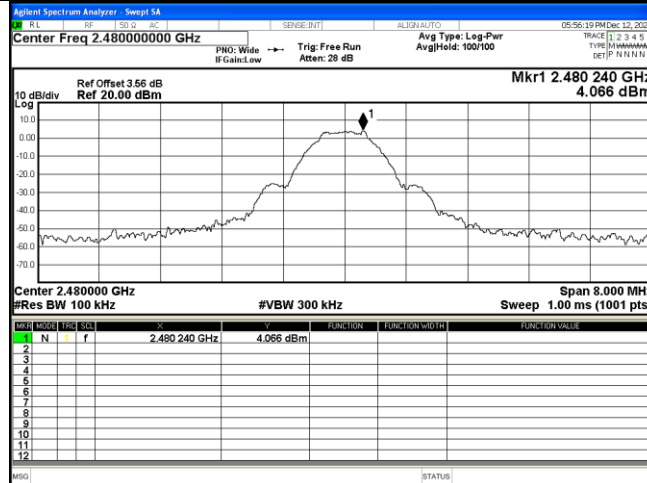
Test Mode:

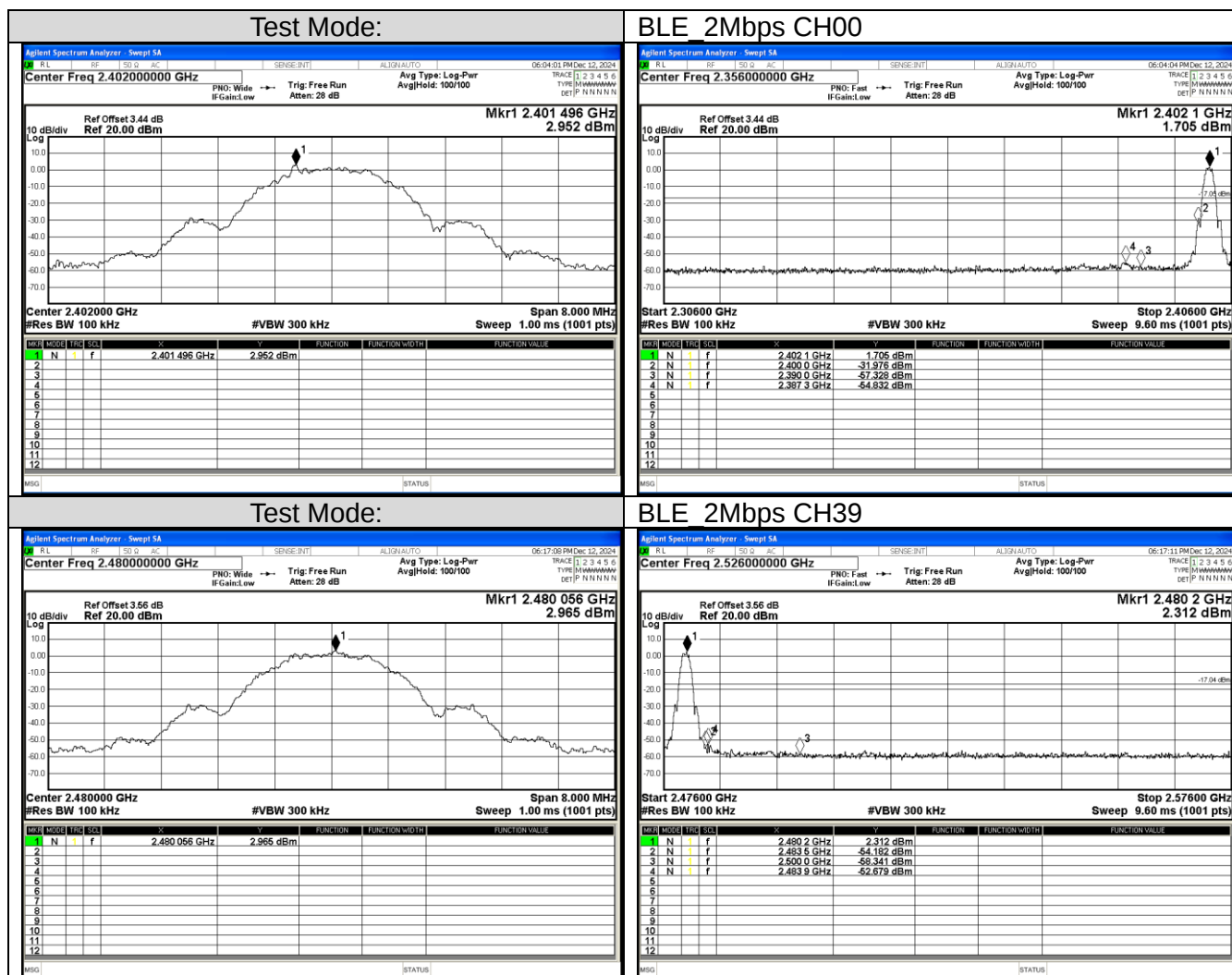
BLE 1Mbps CH00



Test Mode:

BLE 1Mbps CH39

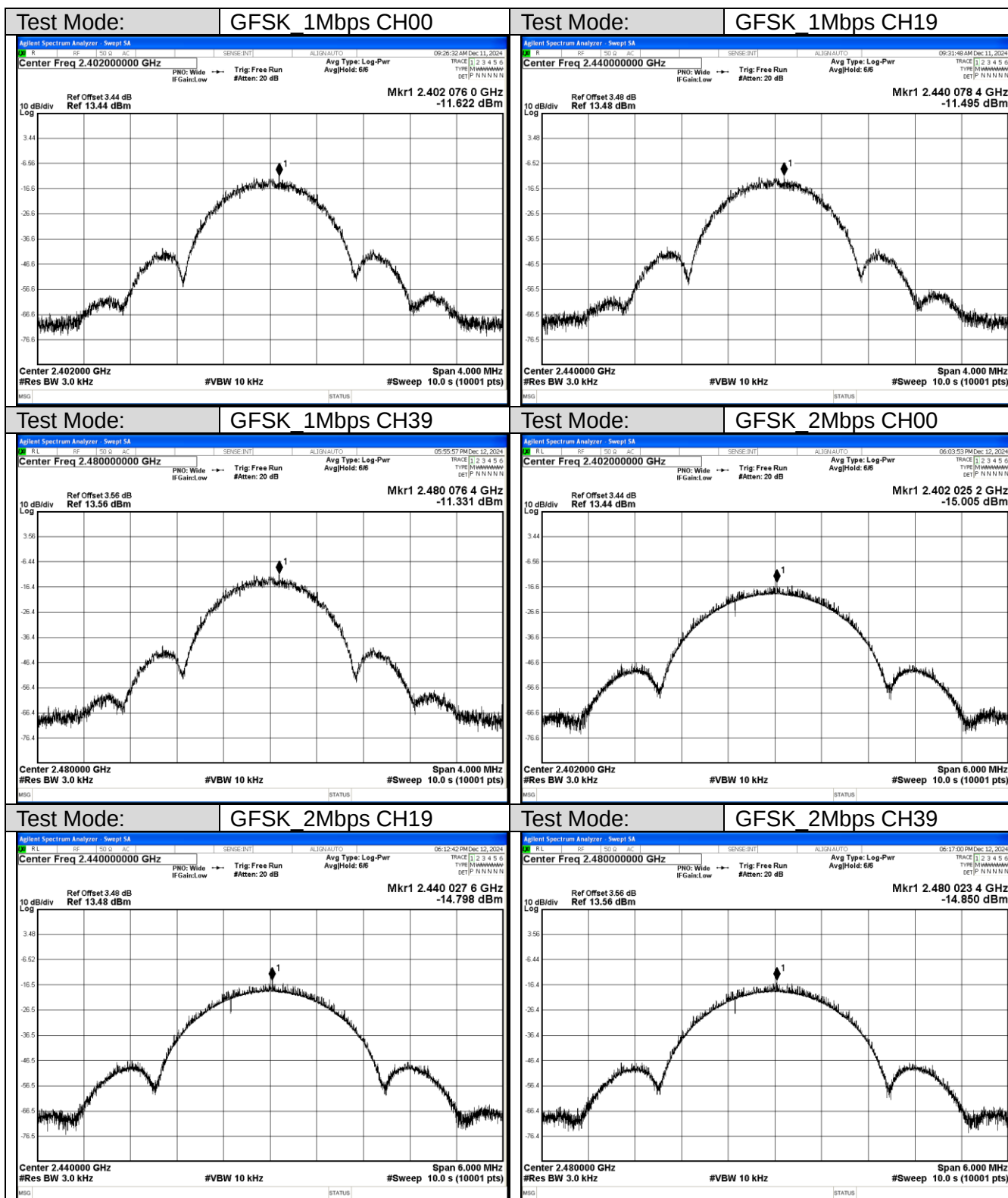




Appendix A.4 Test Results of Conducted Power Spectral Density

GFSK_1Mbps			
Frequency	Power Density	Limit (dBm/3KHz)	Result
	(dBm/3kHz)		
CH00	-11.622	8	Pass
CH19	-11.495	8	Pass
CH39	-11.331	8	Pass

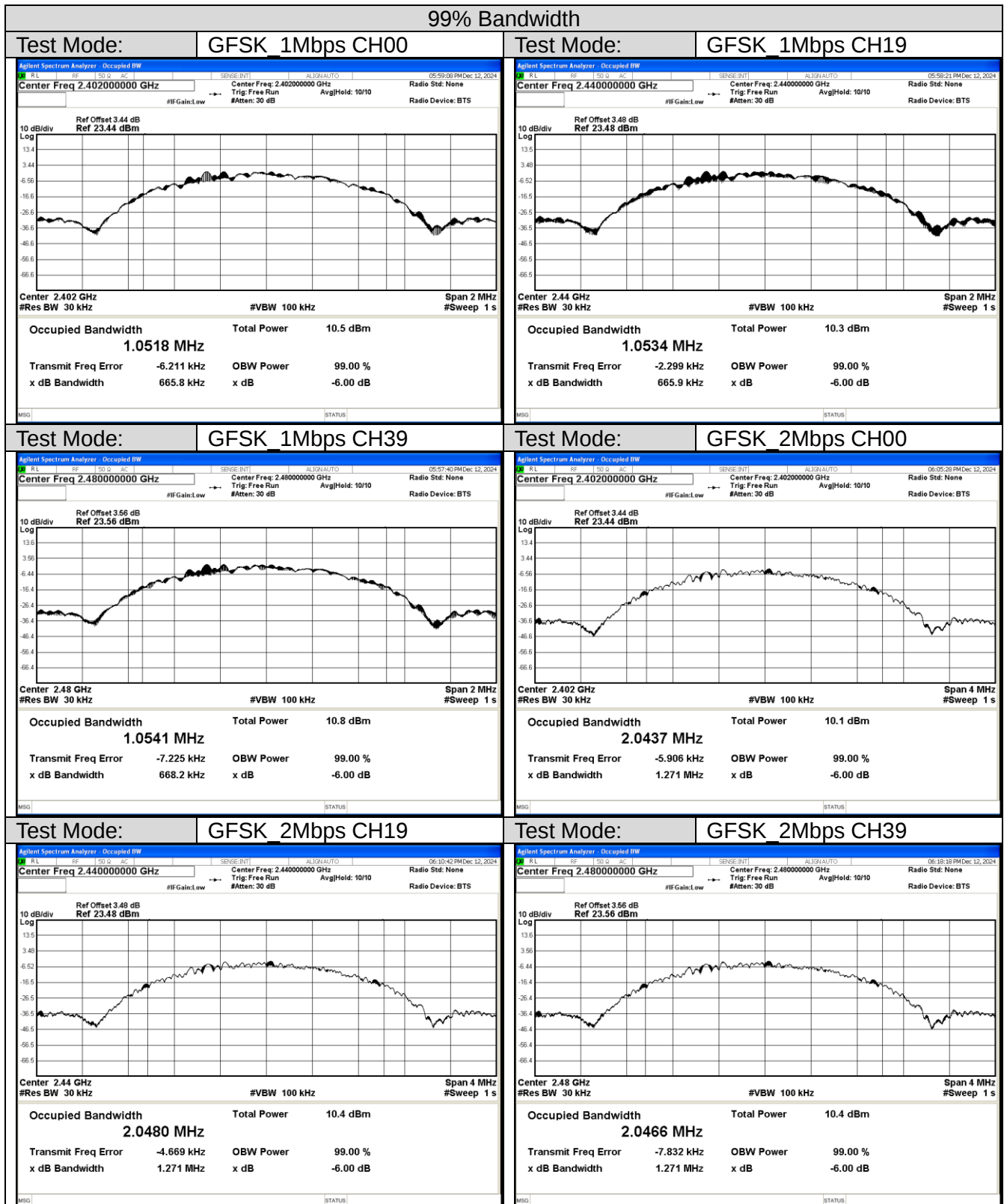
GFSK_2Mbps			
Frequency	Power Density	Limit (dBm/3KHz)	Result
	(dBm/3kHz)		
CH00	-15.005	8	Pass
CH19	-14.798	8	Pass
CH39	-14.85	8	Pass

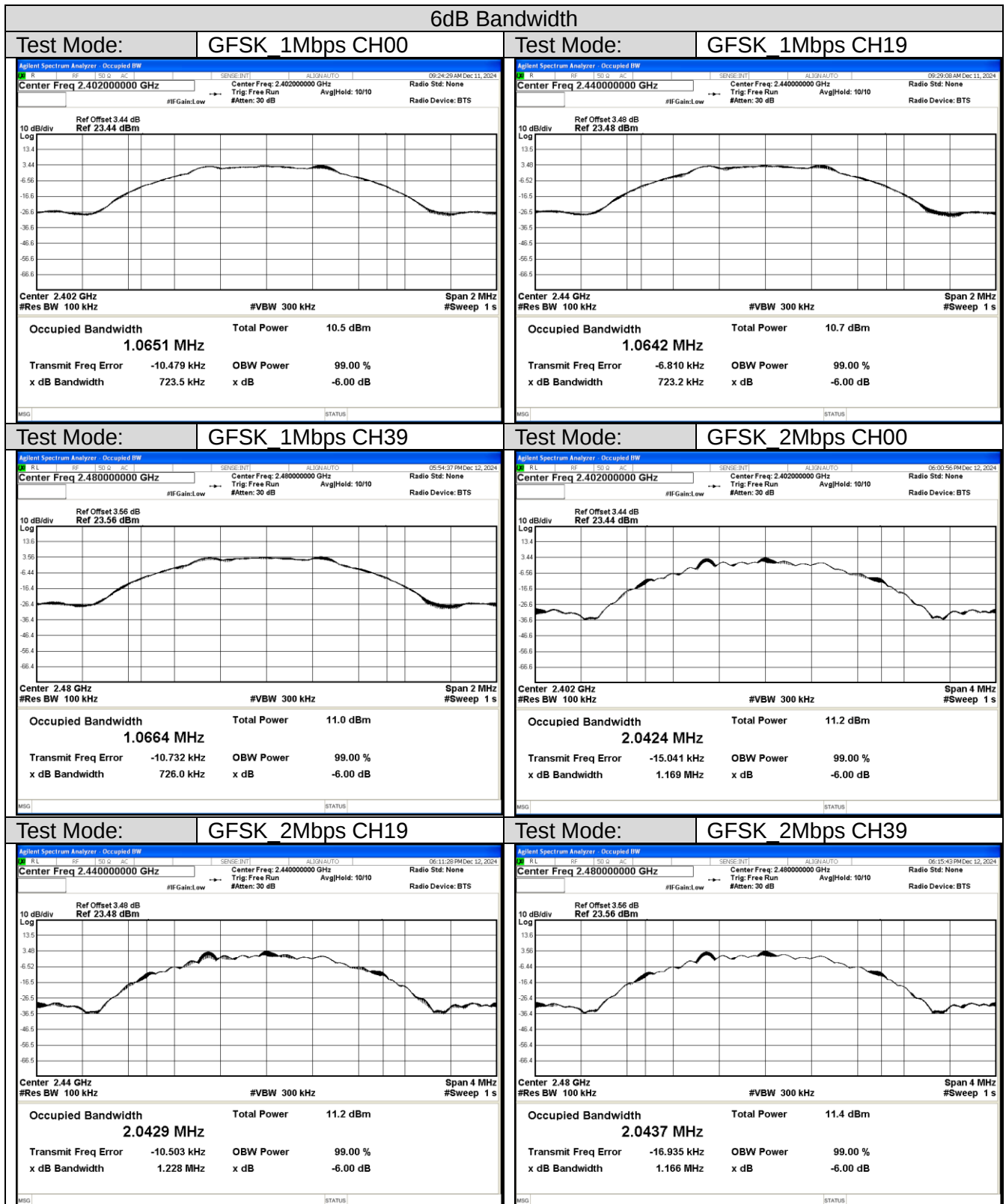


Appendix A.5 Test Results of 6dB and 99% BANDWIDTH

GFSK_1Mbps				
Frequency	99% Bandwidth (MHz)	6dB Bandwidth (MHz)	6dB limit (MHz)	Result
CH00	1.0518	0.7235	0.5	Pass
CH19	1.0534	0.7232	0.5	Pass
CH39	1.0541	0.726	0.5	Pass

GFSK_2Mbps				
Frequency	99% Bandwidth (MHz)	6dB Bandwidth (MHz)	6dB limit (MHz)	Result
CH00	2.0437	1.1689	0.5	Pass
CH19	2.048	1.2276	0.5	Pass
CH39	2.0466	1.1662	0.5	Pass





Appendix A.6 Test Results of Maximum Conducted Power

For FCC:

Mode	Frequency [MHz]	Measured of Conducted Power	Limit [dBm]
		Conducted [dBm]	
BLE_1Mbps	2402	4.682	≤ 30
	2440	4.682	≤ 30
	2480	4.888	≤ 30
BLE_2Mbps	2402	4.888	≤ 30
	2440	4.921	≤ 30
	2480	4.921	≤ 30

Note:

- 1) The cable loss is taken into account in results.
 - 2) Antenna gain(G) BLE: 2.69 dBi
- e.i.r.p.=P(Peak power)+ G, which is far below the 4 W