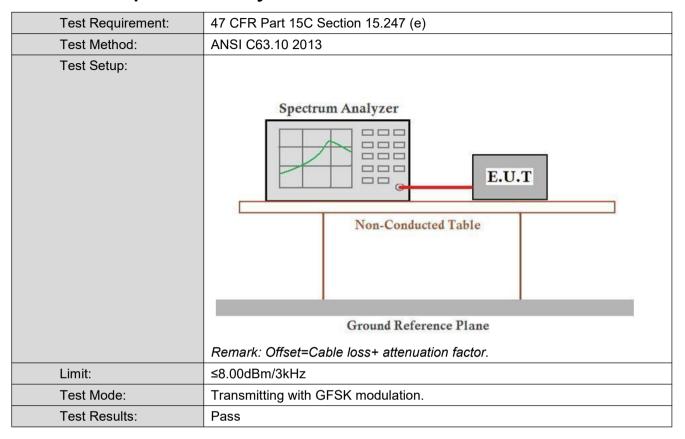




# 5.5 Power Spectral Density



#### **Measurement Data**

#### Ant1:

Allt1.								
GFSK mode (1Mbps)								
Test channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result					
Lowest	-18	≤8.00	Pass					
Middle	-18.19	≤8.00	Pass					
Highest	-18.56	≤8.00	Pass					
	GFSK mode (2Mbps)							
Test channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result					
Lowest	-20.57	≤8.00	Pass					
Middle	-20.25	≤8.00	Pass					
Highest	-20.63	≤8.00	Pass					



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# Ant2:

	GFSK mode (1Mbps)								
Test channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result						
Lowest	-18.99	≤8.00	Pass						
Middle	-18.43	≤8.00	Pass						
Highest	-18.83	≤8.00	Pass						
	GFSK mode (2Mbps)								
Test channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result						
Lowest	-20.97	≤8.00	Pass						
Middle	-20.21	≤8.00	Pass						
Highest	-20.93	≤8.00	Pass						

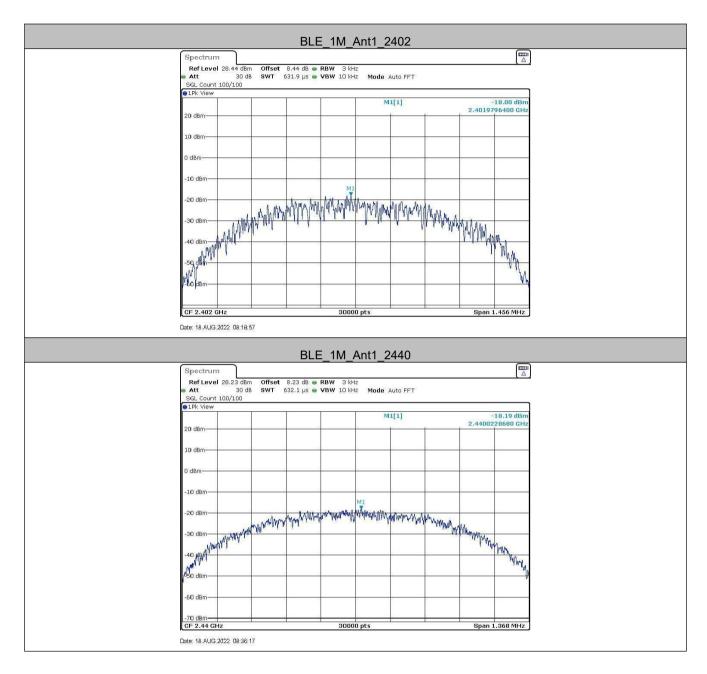
#### Ant1+Ant2:

	GFSK mode (1Mbps)								
Test channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result						
Lowest	-15.46	≤8.00	Pass						
Middle	-15.30	≤8.00	Pass						
Highest	-15.68	≤8.00	Pass						
	GFSK mode (2Mbps)								
Test channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result						
Lowest	-17.76	≤8.00	Pass						
Middle	-17.22	≤8.00	Pass						
Highest	-17.77	≤8.00	Pass						

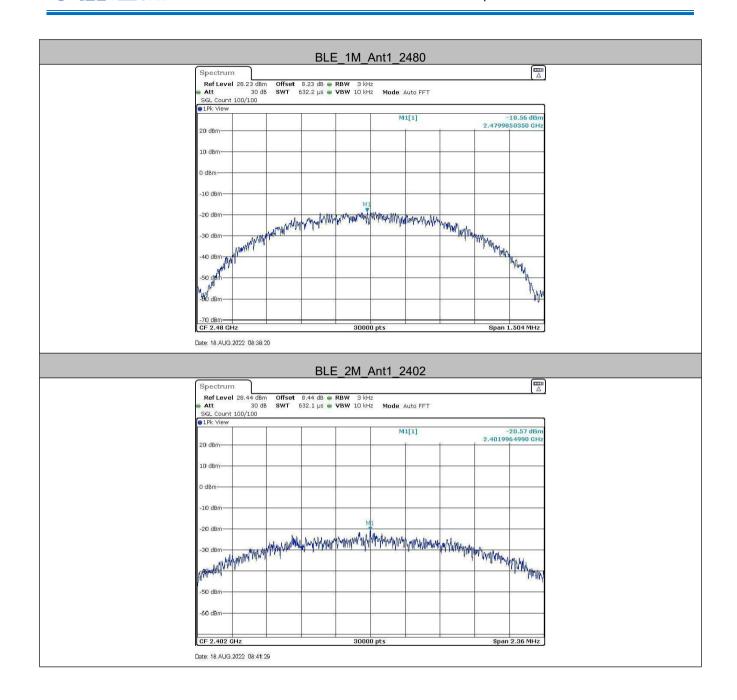




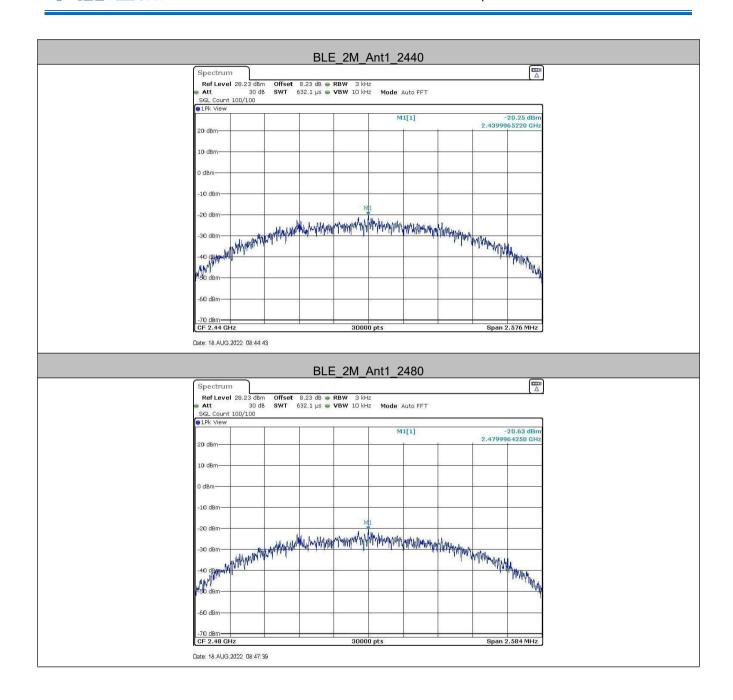
#### Test plot as follows:



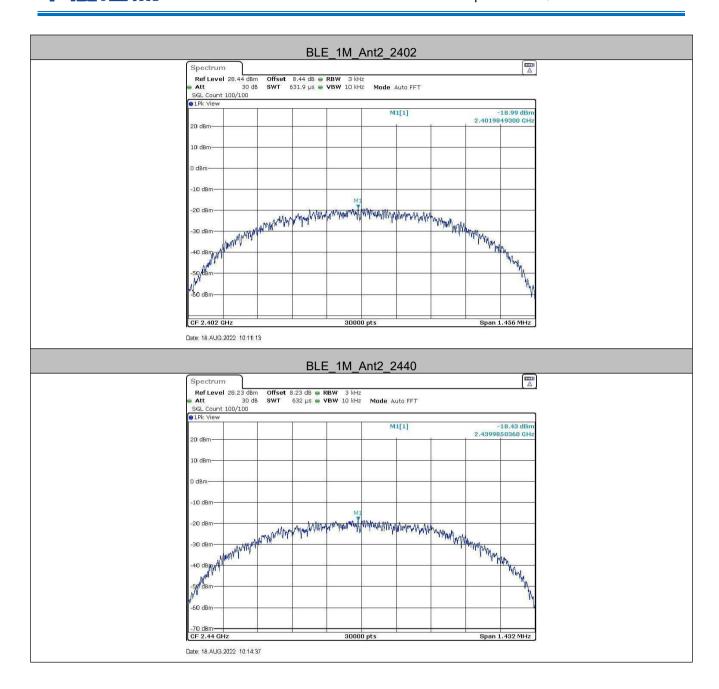




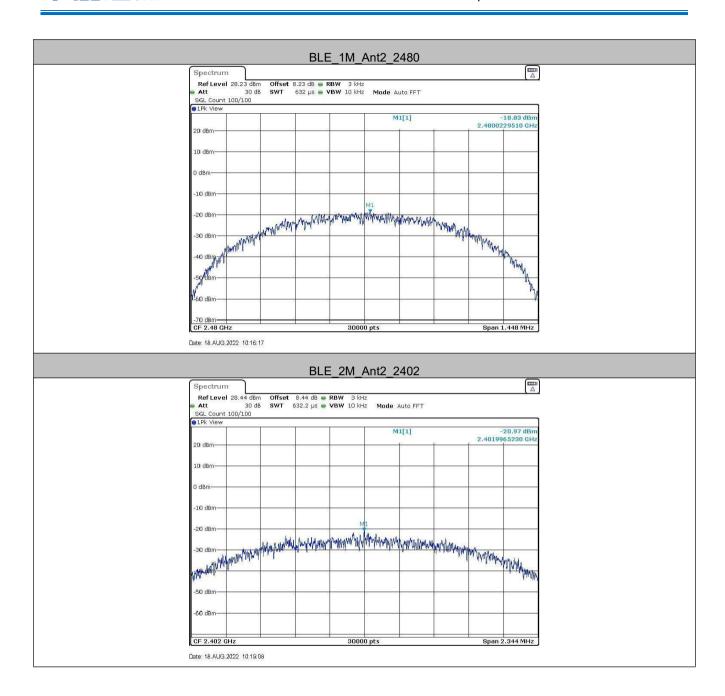




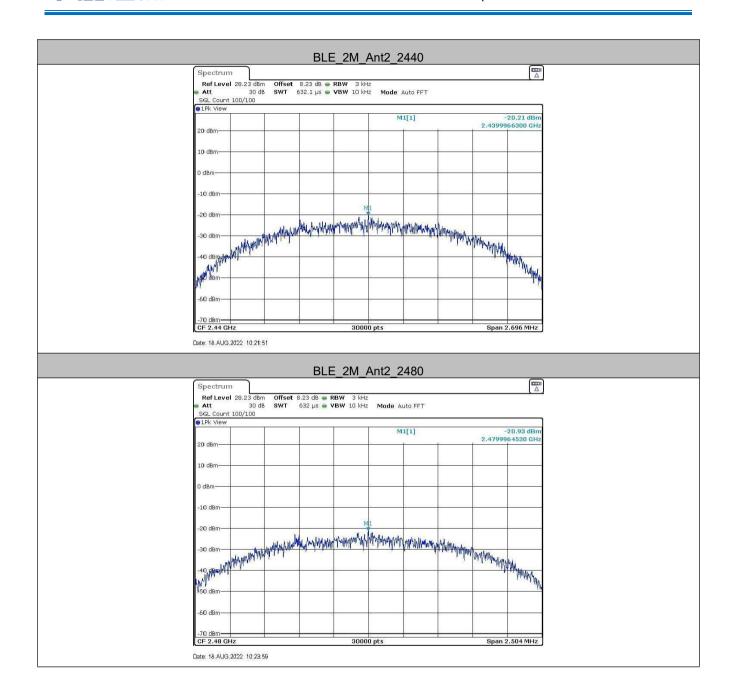








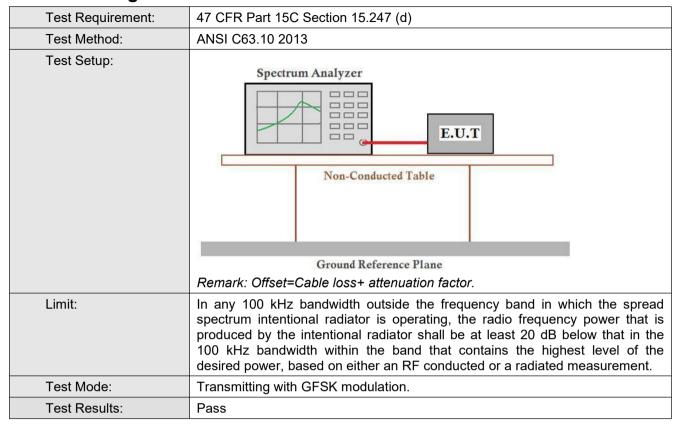






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# 5.6 Band-edge for RF Conducted Emissions



#### Ant1:

TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
		Low	2402	-2.22	-50.47	≤-22.22	PASS
BLE_1M Ant1	Ant1	High	2480	-1.89	-49	≤-21.89	PASS
		Low	2402	-2.46	-36.51	≤-22.46	PASS
BLE_2M	Ant1	High	2480	-2.66	-49.87	≤-22.66	PASS

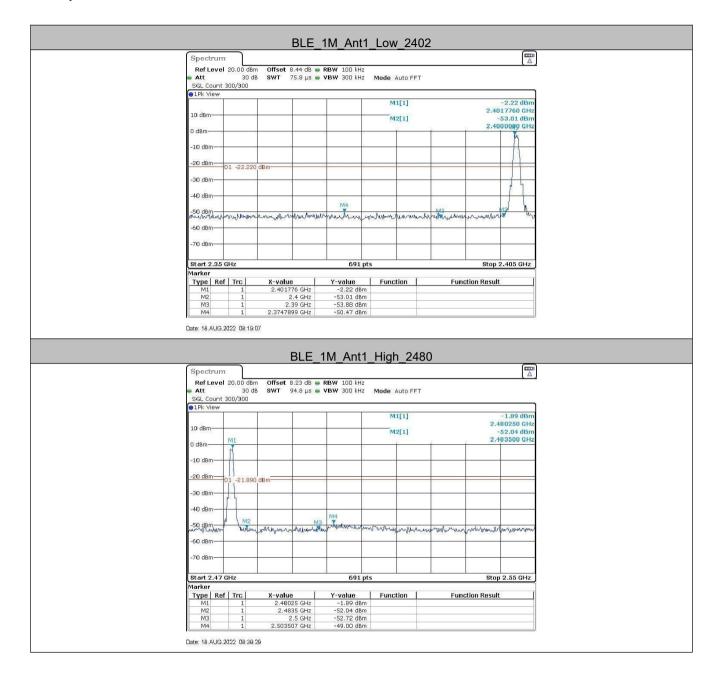
#### Ant2:

TestMode	Antenna	ChName	Channel	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
515.44		Low	2402	-2.17	-50.55	≤-22.17	PASS
BLE_1M	Ant2	High	2480	-2.11	-49.71	≤-22.11	PASS
		Low	2402	-2.86	-34.06	≤-22.86	PASS
BLE_2M	Ant2	High	2480	-2.62	-49.01	≤-22.62	PASS

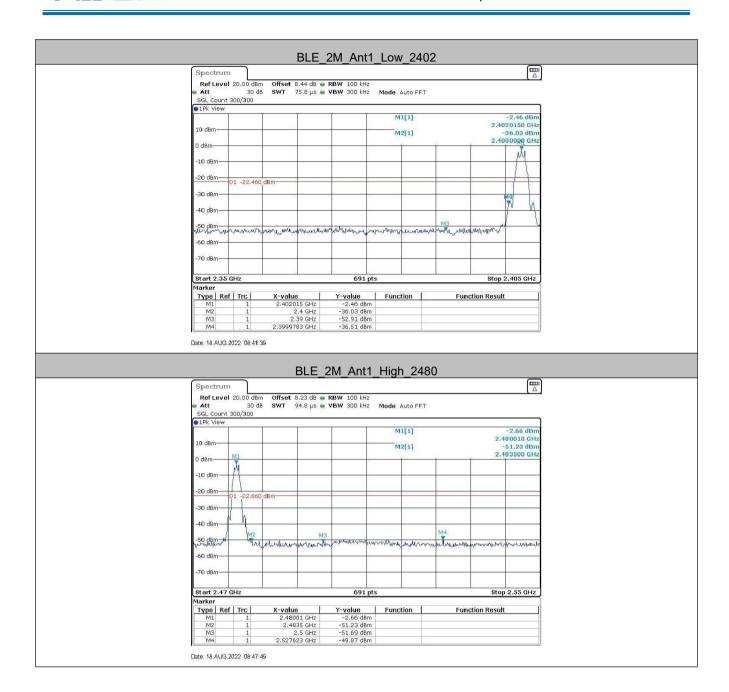


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#### Test plot as follows:



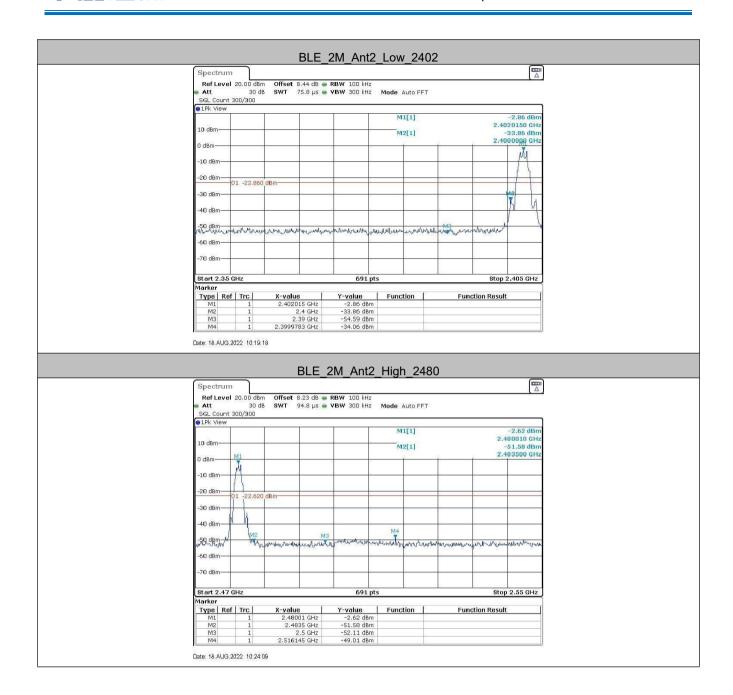








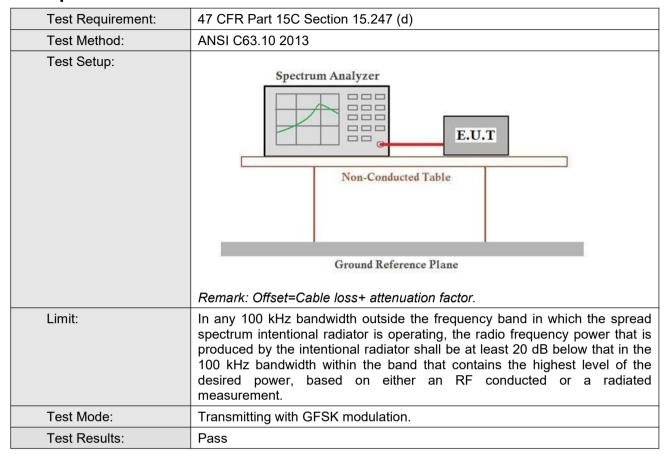




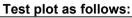


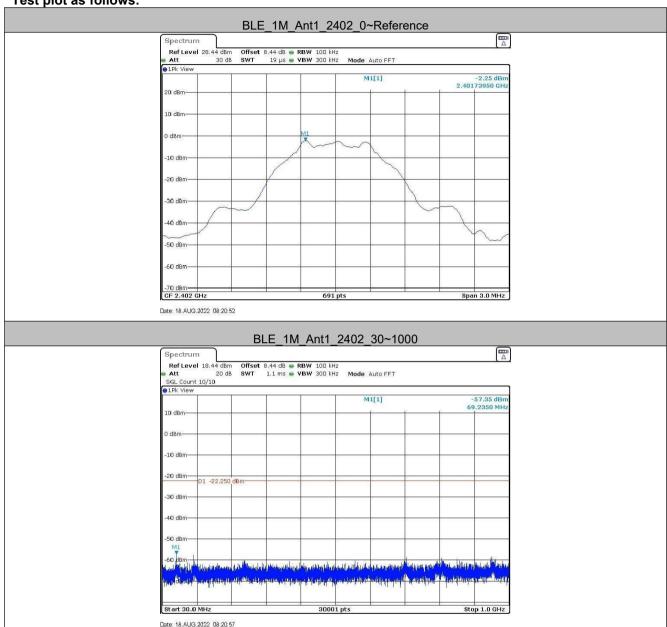


## 5.7 Spurious RF Conducted Emissions

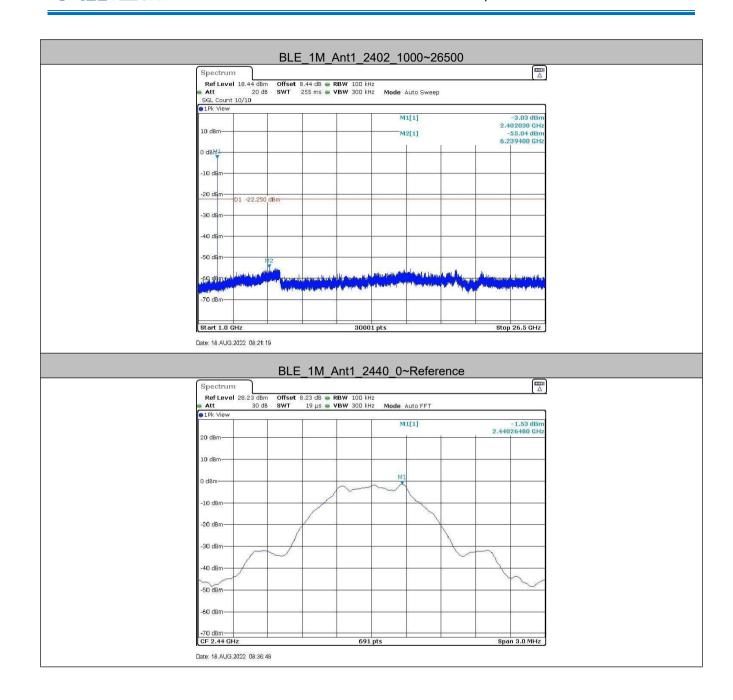




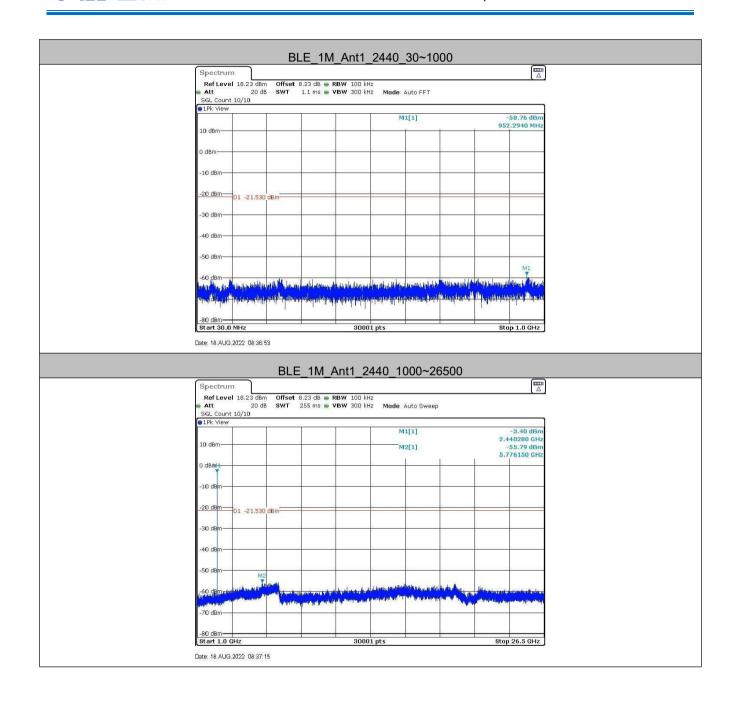




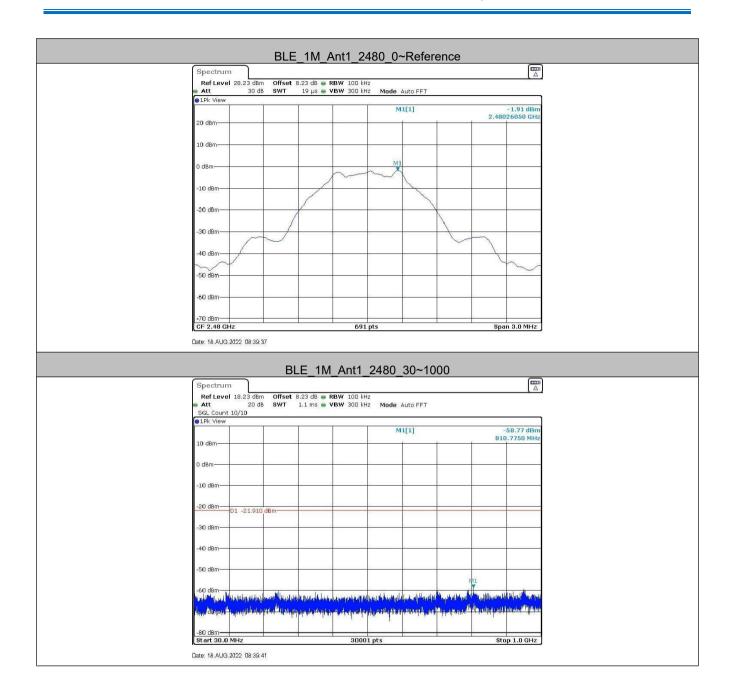




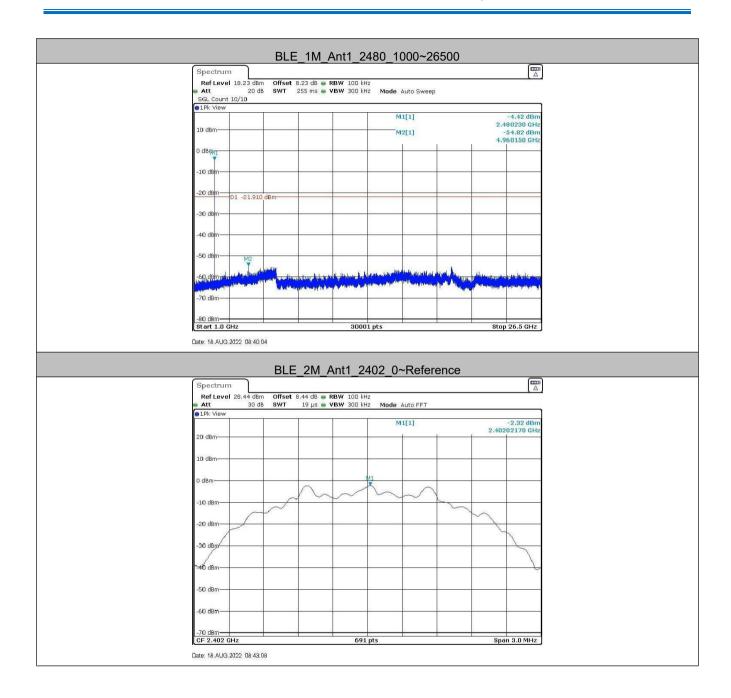




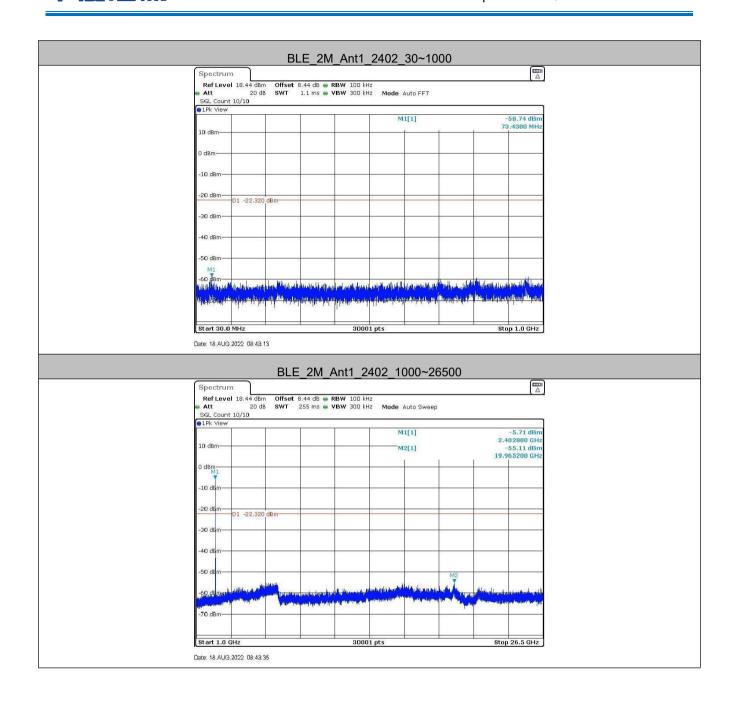




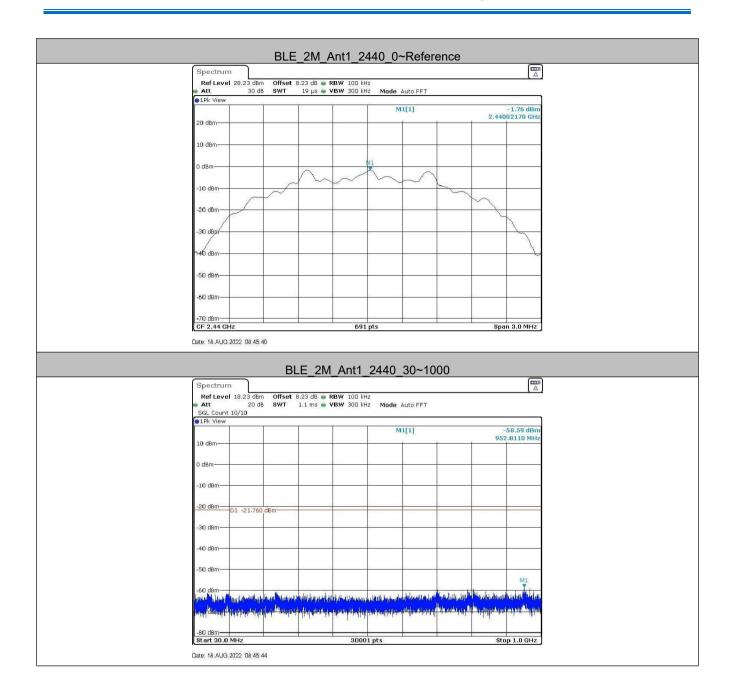




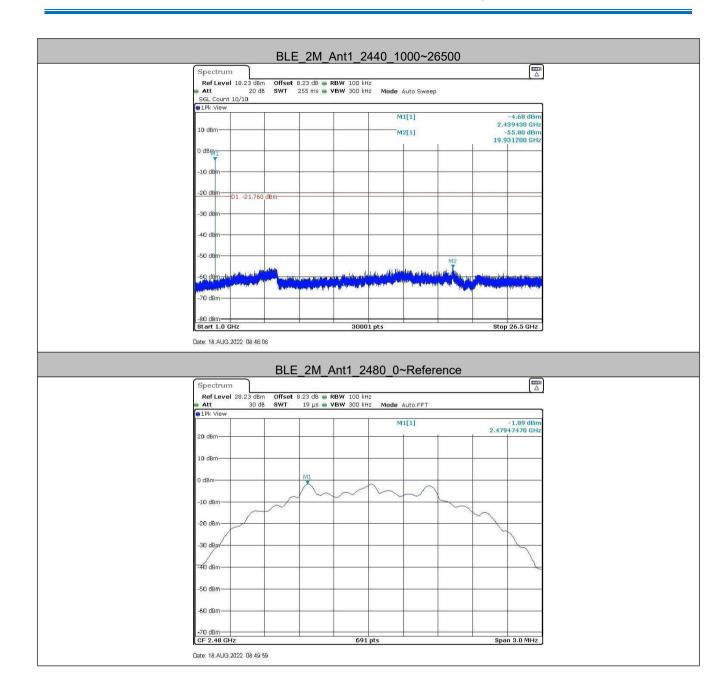




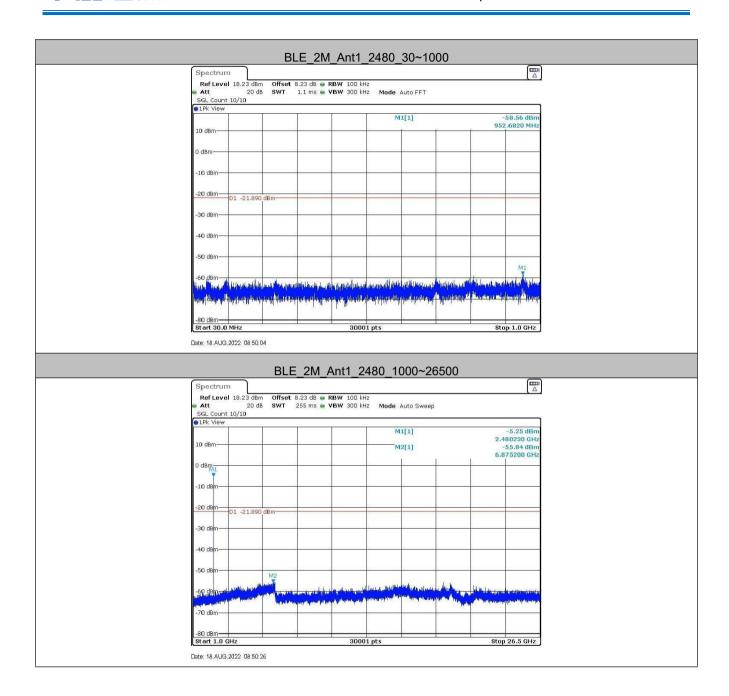




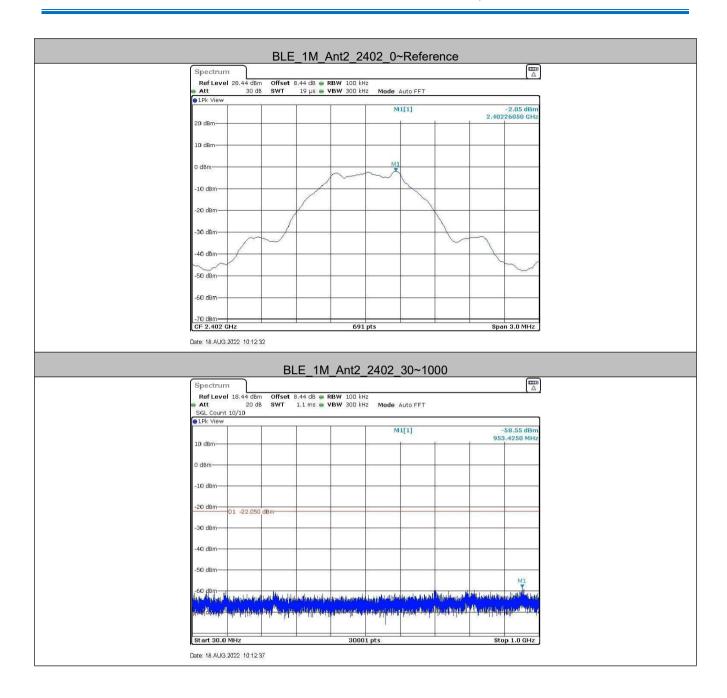




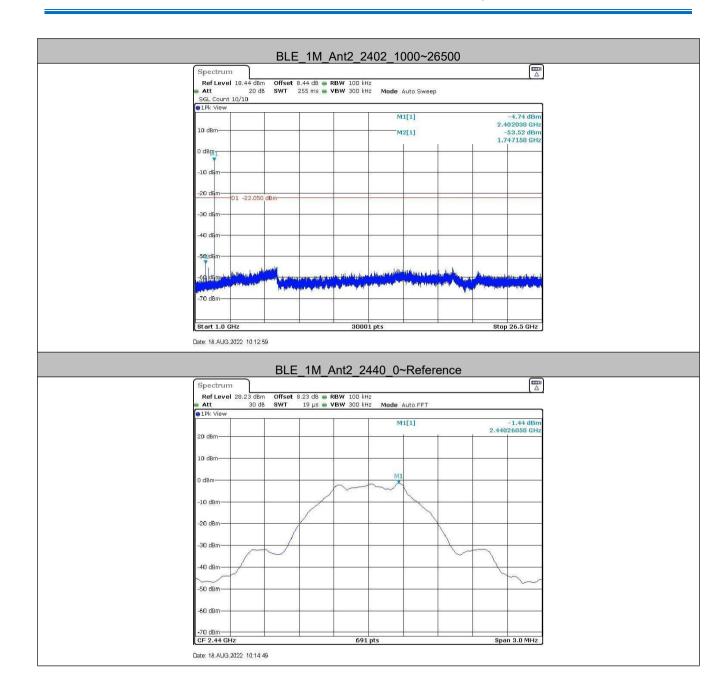




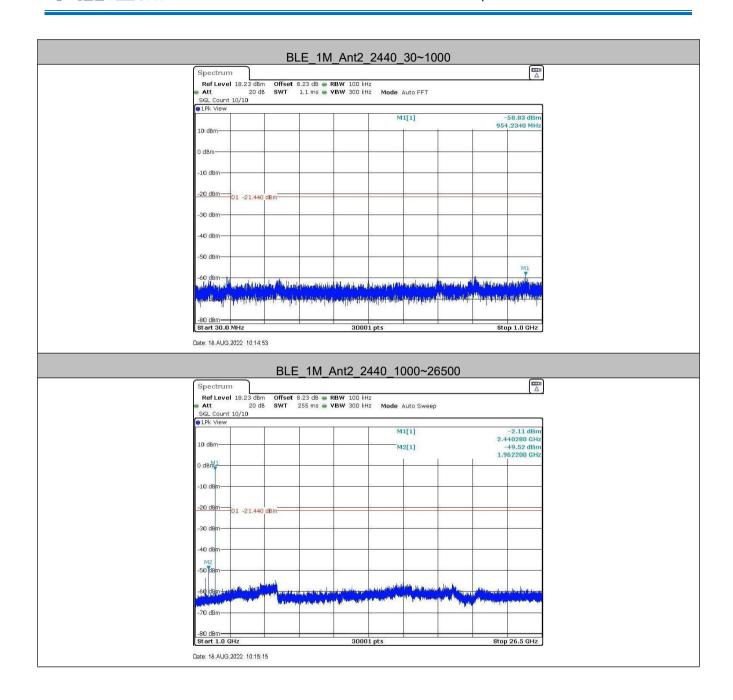




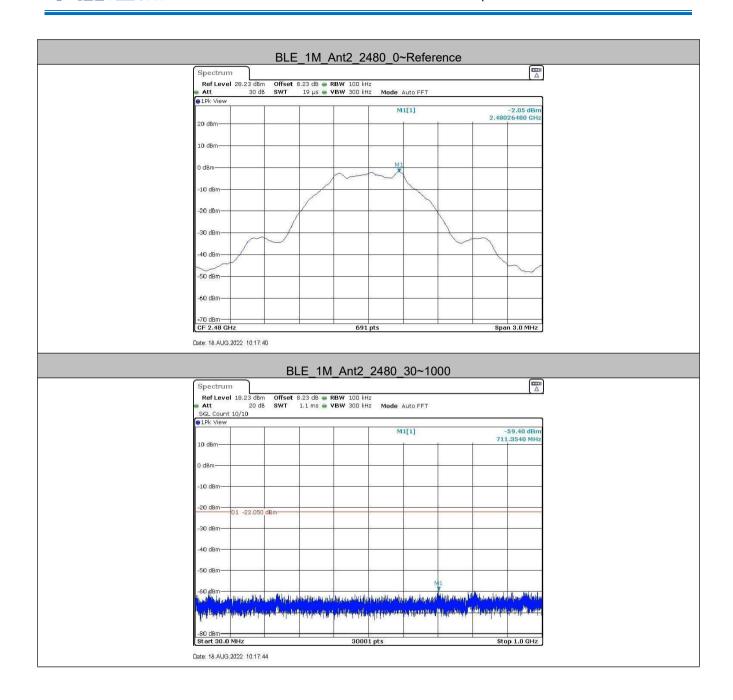




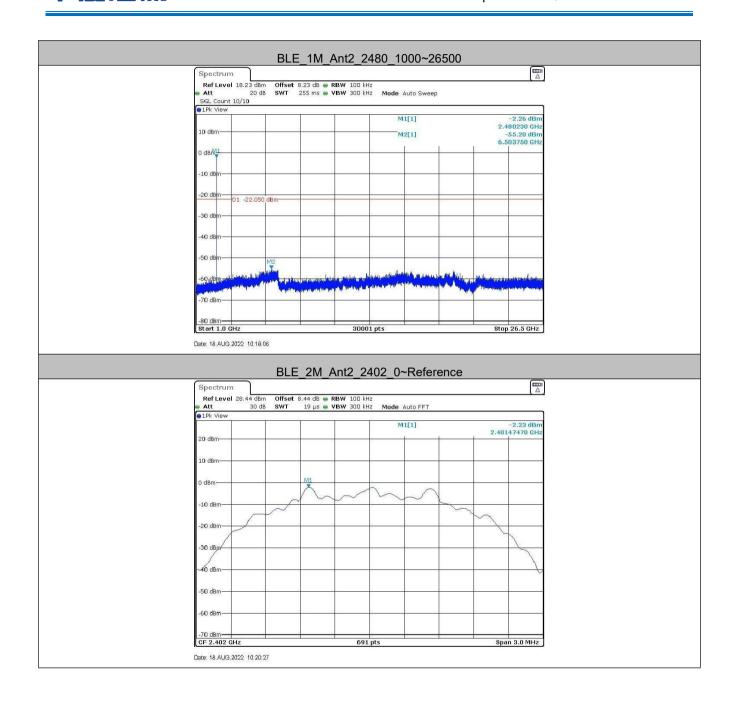




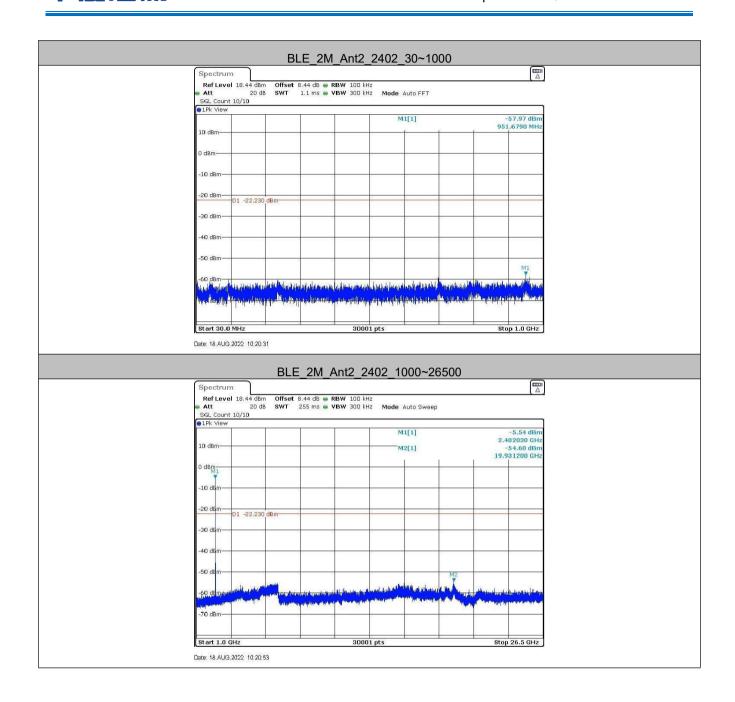




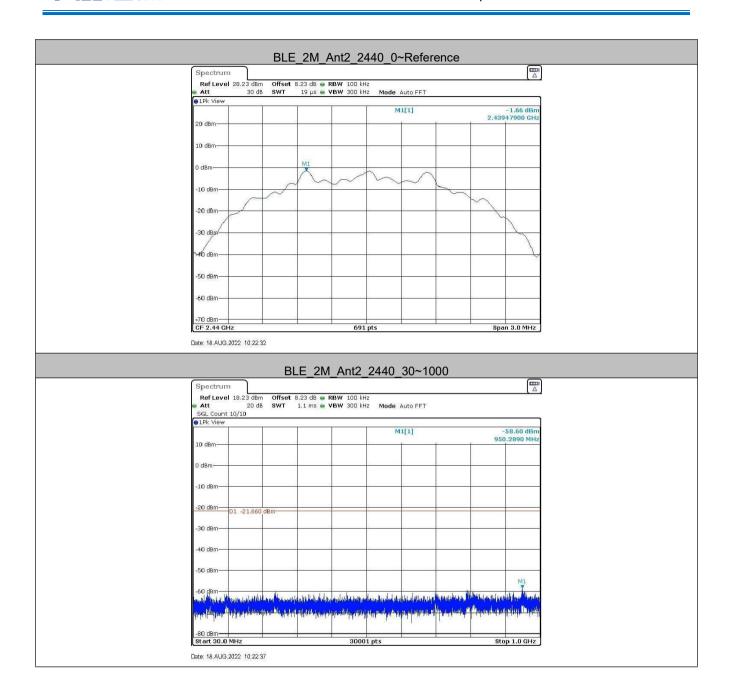




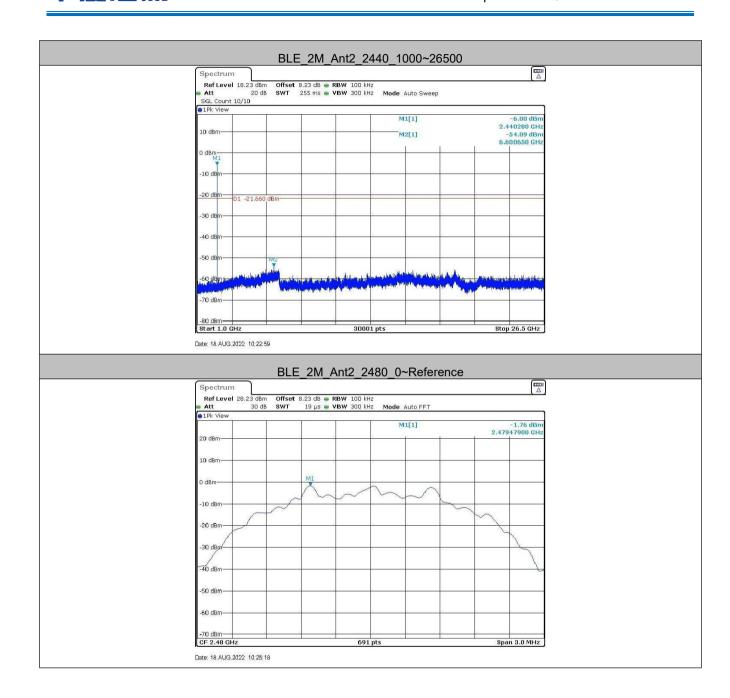






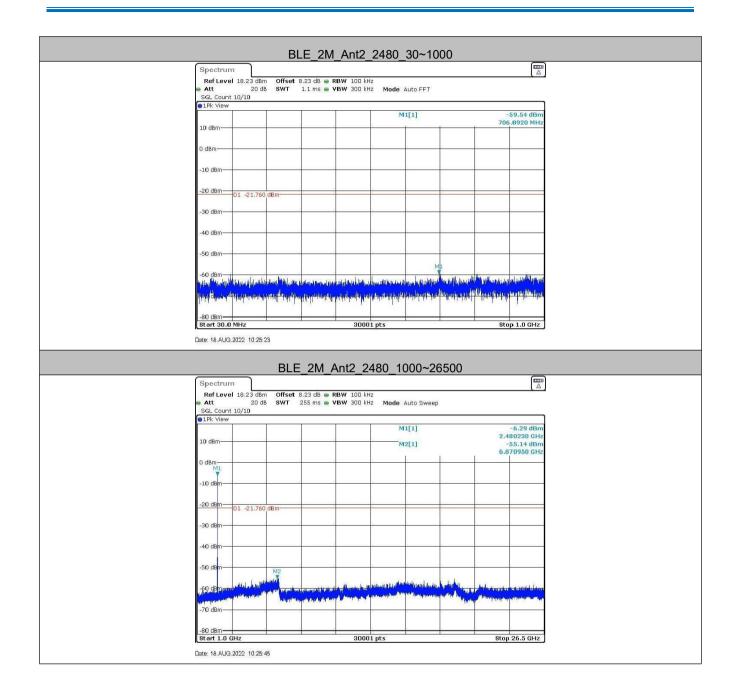








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#### Remark:

Pretest 9kHz to 25GHz, find the highest point when testing, so only the worst data were shown in the test report. Per FCC Part 15.33 (a) and 15.31 (o) ,The amplitude of spurious emissions from intentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.



# 5.8 Radiated Spurious Emission & Restricted bands

5.8.1 Spurious Emissions									
Test Requirement:	47 CFR Part 15C Section 15.209 and 15.205								
Test Method:	ANSI C63.10 2013								
Test Site:	Measurement Distance	: 3m	n (Semi-Anecl	noic Cham	ber)				
Receiver Setup:	Frequency		Detector	RBW	VBW	Remark			
	0.009MHz-0.090MH	z	Peak	10kHz	z 30kHz	Peak			
	0.009MHz-0.090MH	z	Average	10kHz	z 30kHz	Average			
	0.090MHz-0.110MH	z	Quasi-peak	10kHz	z 30kHz	Quasi-peak			
	0.110MHz-0.490MH	Z	Peak	10kHz	z 30kHz	Peak			
	0.110MHz-0.490MH	z	Average	10kHz	z 30kHz	Average			
	0.490MHz -30MHz		Quasi-peak	10kHz	z 30kHz	Quasi-peak			
	30MHz-1GHz		Quasi-peak	100 kH	z 300kHz	Quasi-peak			
	AL 4011-		Peak	1MHz	3MHz	Peak			
	Above 1GHz		Peak	1MHz	10Hz	Average			
Limit:	Frequency		eld strength crovolt/meter)	Limit (dBuV/m)	Remark	Measuremen distance (m)			
	0.009MHz-0.490MHz	2	400/F(kHz)	-	-	300			
	0.490MHz-1.705MHz	24	1000/F(kHz)	-	-	30			
	1.705MHz-30MHz		30	-	ı	30			
	30MHz-88MHz		100	40.0	Quasi-peak	3			
	88MHz-216MHz		150	43.5	Quasi-peal	3			
	216MHz-960MHz		200	46.0	Quasi-peal	3			
	960MHz-1GHz		500	54.0	Quasi-peal	3			
	Above 1GHz		500	54.0	Average	3			
	Note: 15.35(b), Unless otherwise specified, the limit on perference of the equipment under test. This peak limit applies to peak emission level radiated by the device.								





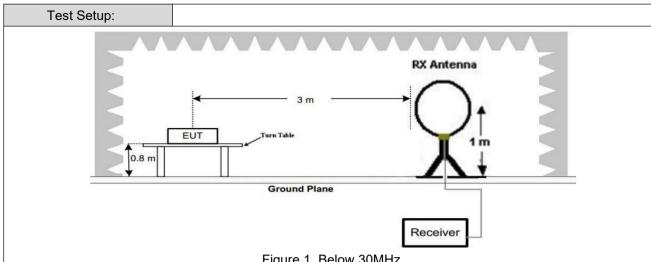
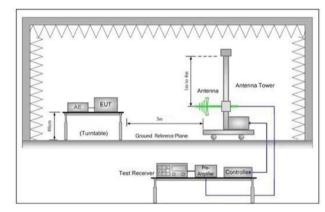


Figure 1. Below 30MHz



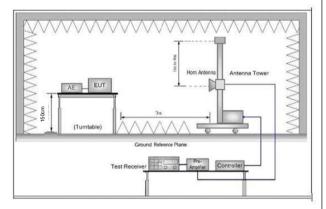


Figure 2. 30MHz to 1GHz

Figure 3. Above 1 GHz

#### Test Procedure:

- 1) Below 1G: The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
  - 2) Above 1G: The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.

Note: For the radiated emission test above 1GHz:

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

- The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both



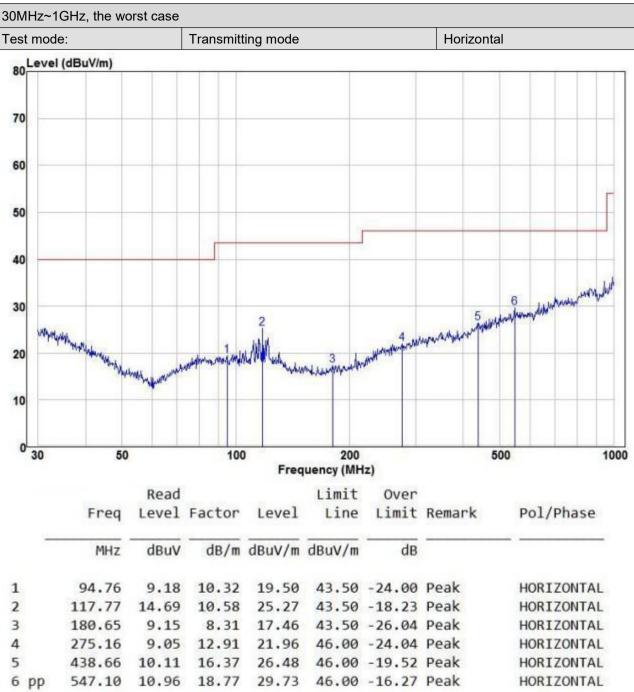
	horizontal and vertical polarizations of the antenna are set to make the measurement.
	d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
	e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
	<ul> <li>f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</li> <li>g. Test the EUT in the lowest channel (2402MHz),the middle channel (2440MHz),the Highest channel (2480MHz)</li> </ul>
	h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
	i. Repeat above procedures until all frequencies measured was complete.
Exploratory Test Mode:	Transmitting with GFSK modulation. Transmitting mode.
Final Test Mode:	Through Pre-scan, find the 1Mbps of data type and GFSK modulation is the worst case.
	For below 1GHz part, through pre-scan, the worst case is the highest channel.
	Only the worst case is recorded in the report.
Test Results:	Pass





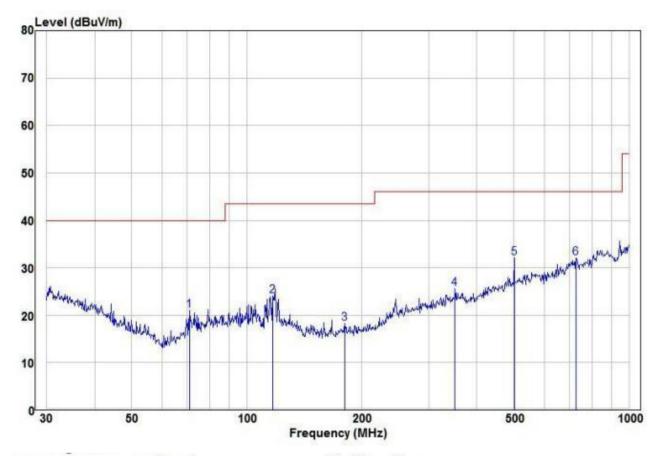
#### Radiated Emission below 1GHz

#### Ant1:





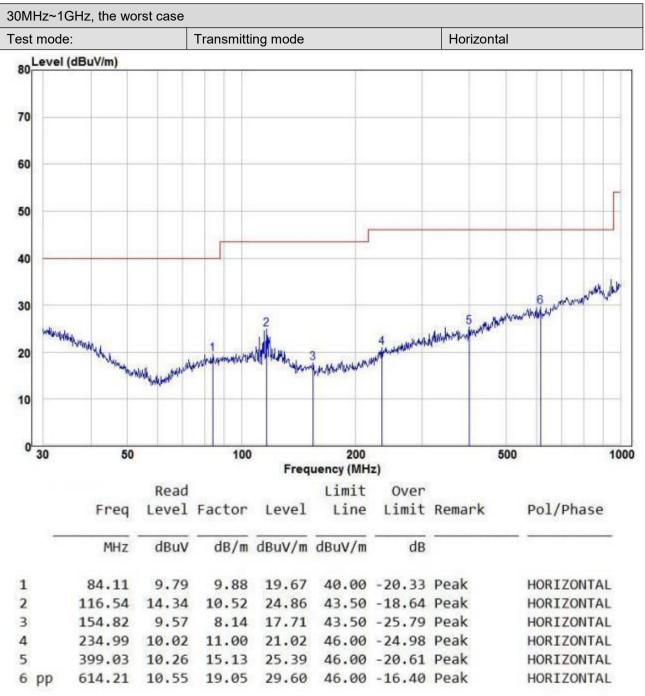
30MHz~1GHz, the worst case					
Test mode:	Transmitting mode	Vertical			



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark	Pol/Phase
	MHZ	dBuV	dB/m	dBuV/m	dBuV/m	dB		_
1	70.83	12.66	8.29	20.95	40.00	-19.05	Peak	VERTICAL
2	116.95	13.59	10.54	24.13	43.50	-19.37	Peak	VERTICAL
3	180.65	9.93	8.31	18.24	43.50	-25.26	Peak	VERTICAL
4	350.48	10.67	14.96	25.63	46.00	-20.37	Peak	VERTICAL
5	501.18	13.75	18.29	32.04	46.00	-13.96	Peak	VERTICAL
6 pp	726.81	10.79	21.27	32.06	46.00	-13.94	Peak	VERTICAL



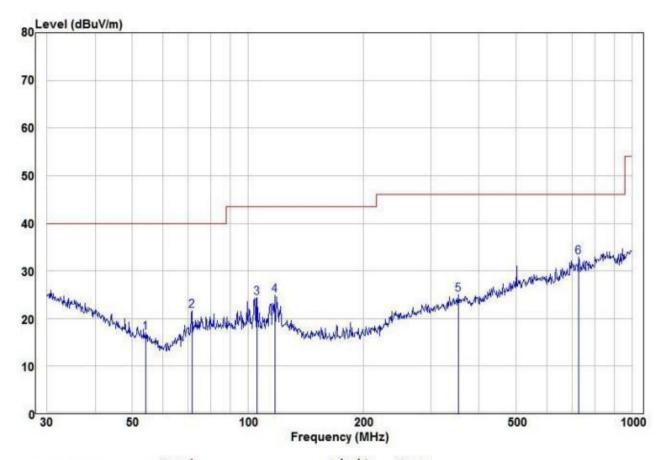
#### Ant2:







30MHz~1GHz, the worst case				
Test mode:	Transmitting mode	Vertical		



	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark	Pol/Phase
2	MHZ	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1	54.26	9.87	7.20	17.07	40.00	-22.93	Peak	VERTICAL
2	71.58	13.31	8.41	21.72	40.00	-18.28	Peak	VERTICAL
3	105.64	14.03	10.38	24.41	43.50	-19.09	Peak	VERTICAL
4	117.36	14.31	10.56	24.87	43.50	-18.63	Peak	VERTICAL
5	354.18	10.05	15.05	25.10	46.00	-20.90	Peak	VERTICAL
6 pp	726.81	11.63	21.27	32.90	46.00	-13.10	Peak	VERTICAL





## Transmitter Emission above 1GHz

#### Ant1:

Worse case mode:		GFSK(1Mbps)		Test channel:		Lowest	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)		H/V
2390	53.39	-9.2	44.19	74	-29.81	Peak	Н
2400	56.87	-9.39	47.48	74	-26.52	Peak	Н
4804	51.98	-4.33	47.65	74	-26.35	Peak	Н
7206	48.38	1.01	49.39	74	-24.61	Peak	Н
2390	54.90	-9.2	45.70	74	-28.30	Peak	V
2400	52.46	-9.39	43.07	74	-30.93	Peak	V
4804	53.18	-4.33	48.85	74	-25.15	Peak	V
7206	48.39	1.01	49.40	74	-24.60	Peak	V

Worse case mode:		GFSK(1Mbps)		Test channel:		Middle	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)		H/V
4880	53.08	-4.11	48.97	74	-25.03	peak	Н
7320	49.64	1.51	51.15	74	-22.85	peak	Н
4880	53.01	-4.11	48.90	74	-25.10	peak	V
7320	50.72	1.51	52.23	74	-21.77	peak	V

Worse case mode:		GFSK(1Mbps)		Test channel:		Highest	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)		H/V
2483.5	56.04	-9.29	46.75	74	-27.25	Peak	Н
4960	52.88	-4.04	48.84	74	-25.16	Peak	Н
7440	50.86	1.57	52.43	74	-21.57	Peak	Н
2483.5	58.17	-9.29	48.88	74	-25.12	Peak	V
4960	52.10	-4.04	48.06	74	-25.94	Peak	V
7440	50.01	1.57	51.58	74	-22.42	Peak	V



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#### Ant2:

Worse case mode:		GFSK(1Mbps)		Test channel:		Lowest	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)		H/V
2390	54.38	-9.2	45.18	74	-28.82	Peak	Н
2400	56.42	-9.39	47.03	74	-26.97	Peak	Н
4804	52.22	-4.33	47.89	74	-26.11	Peak	Н
7206	51.02	1.01	52.03	74	-21.97	Peak	Н
2390	53.41	-9.2	44.21	74	-29.79	Peak	V
2400	50.59	-9.39	41.20	74	-32.80	Peak	V
4804	52.69	-4.33	48.36	74	-25.64	Peak	V
7206	49.59	1.01	50.60	74	-23.40	Peak	V

Worse case mode:		GFSK(1Mbps)		Test channel:		Middle	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)		H/V
4880	50.80	-4.11	46.69	74	-27.31	peak	Н
7320	50.92	1.51	52.43	74	-21.57	peak	Н
4880	53.25	-4.11	49.14	74	-24.86	peak	V
7320	48.91	1.51	50.42	74	-23.58	peak	V

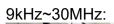
Worse case mode:		GFSK(1Mbps)		Test channel:		Highest	
Frequency	Meter Reading	Factor	Emission Level	Limits	Over	Detector Type	Ant. Pol.
(MHz)	(dBµV)	(dB)	(dBµV/m)	(dBµV/m)	(dB)		H/V
2483.5	56.70	-9.29	47.41	74	-26.59	Peak	Н
4960	51.59	-4.04	47.55	74	-26.45	Peak	Н
7440	48.33	1.57	49.90	74	-24.10	Peak	Н
2483.5	56.92	-9.29	47.63	74	-26.37	Peak	V
4960	49.94	-4.04	45.90	74	-28.10	Peak	V
7440	49.43	1.57	51.00	74	-23.00	Peak	V

#### Remark:

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
  - Final Test Level =Receiver Reading + Antenna Factor + Cable Factor Preamplifier Factor
- 2) Scan from 9kHz to 25GHz, the disturbance above 10GHz and below 30MHz was very low. As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. So, only the peak measurements were shown in the report.

# 6 Photographs - EUT Test Setup

# 6.1 Radiated Spurious Emission



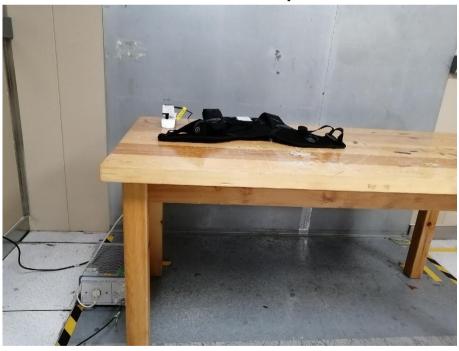


30MHz~1GHz:





# **6.2 Conducted Emissions Test Setup**







# 7 Photographs - EUT Constructional Details

Refer to Photographs - EUT Constructional Details OF EUT for CQASZ20220801388E-01.

\*\*\* END OF REPORT \*\*\*