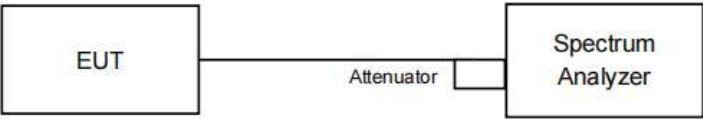
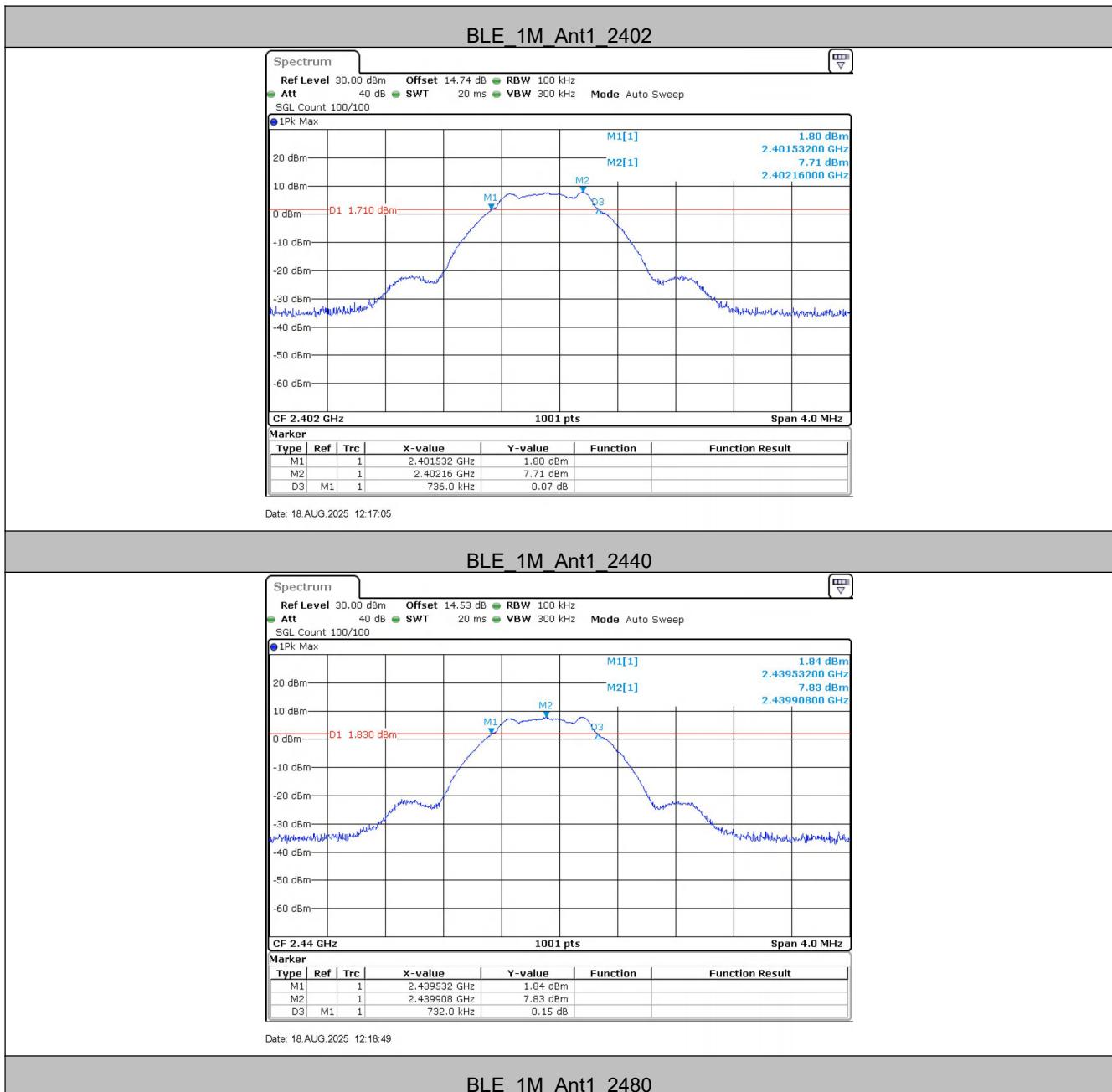


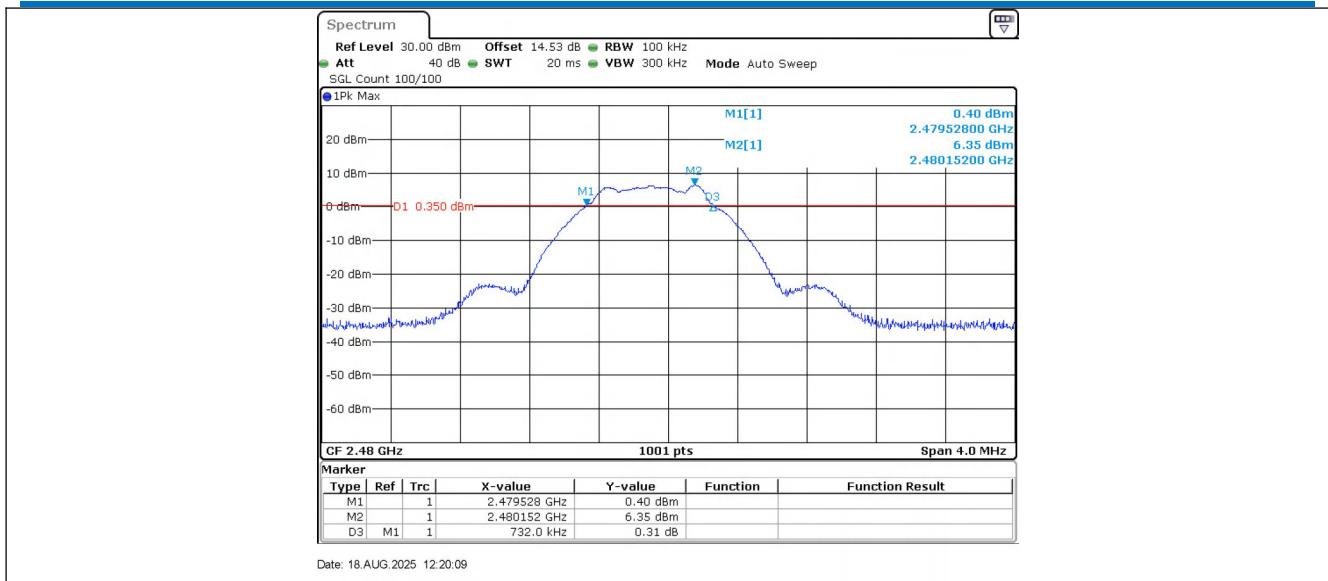
5.4 6dB Occupy Bandwidth

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(2)	
Test Method:	ANSI C63.10 2013	
Test Setup:	 <i>Remark: Offset=Cable loss+ attenuation factor.</i>	
Limit:	≥ 500 kHz	
Instruments Used:	Refer to section 4.11 for details.	
Test Results:	Pass	

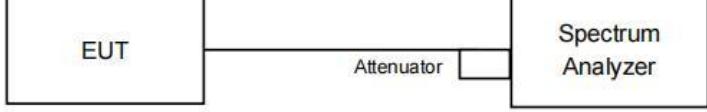
Measurement Data

GFSK mode (1Mbps)			
Test channel	6dB Occupy Bandwidth (MHz)	Limit (kHz)	Result
Lowest	0.74	≥ 500	Pass
Middle	0.73	≥ 500	Pass
Highest	0.73	≥ 500	Pass





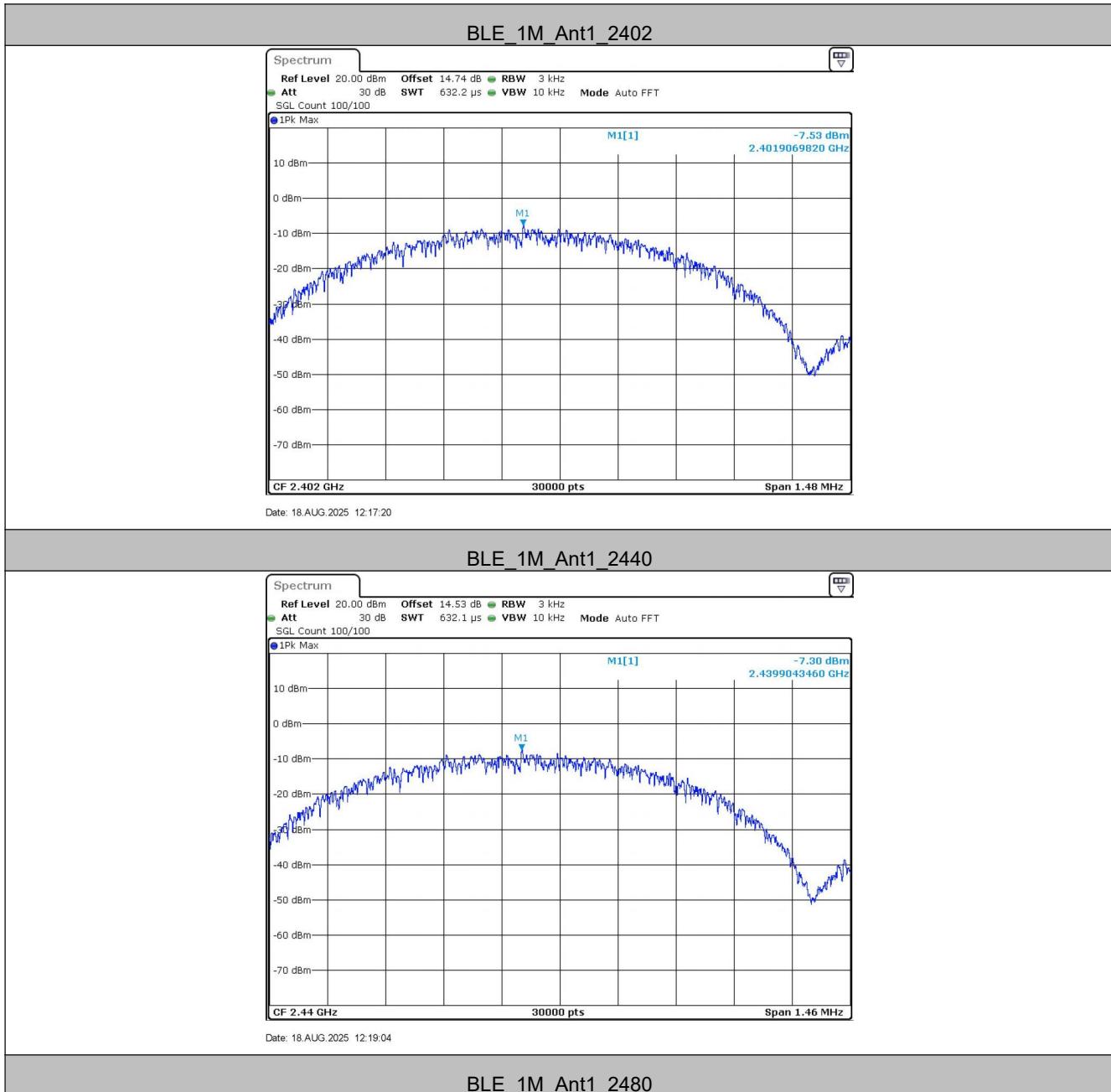
5.5 Power Spectral Density

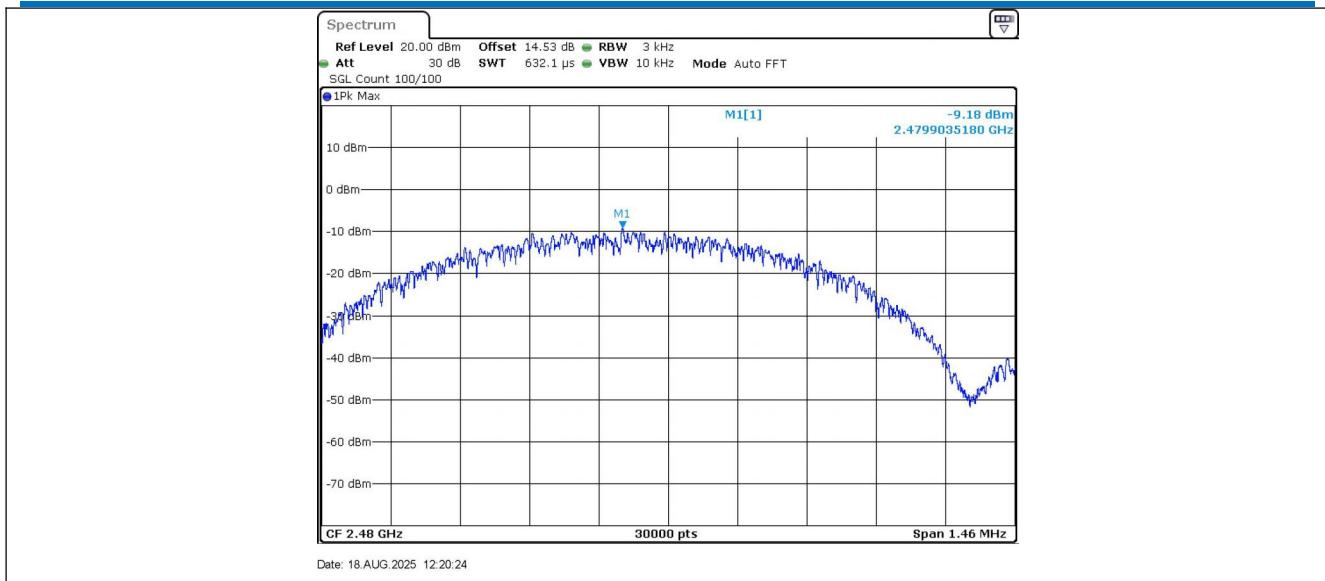
Test Requirement:	47 CFR Part 15C Section 15.247 (e)	
Test Method:	ANSI C63.10 2013	
Test Setup:	 <i>Remark: Offset=Cable loss+ attenuation factor.</i>	
Limit:	$\leq 8.00 \text{dBm}/3\text{kHz}$	
Test Mode:	Transmitting with GFSK modulation.	
Test Results:	Pass	

Measurement Data

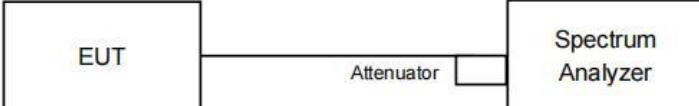
GFSK mode (1Mbps)			
Test channel	Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
Lowest	-7.53	≤ 8.00	Pass
Middle	-7.30	≤ 8.00	Pass
Highest	-9.18	≤ 8.00	Pass

Test plot as follows:



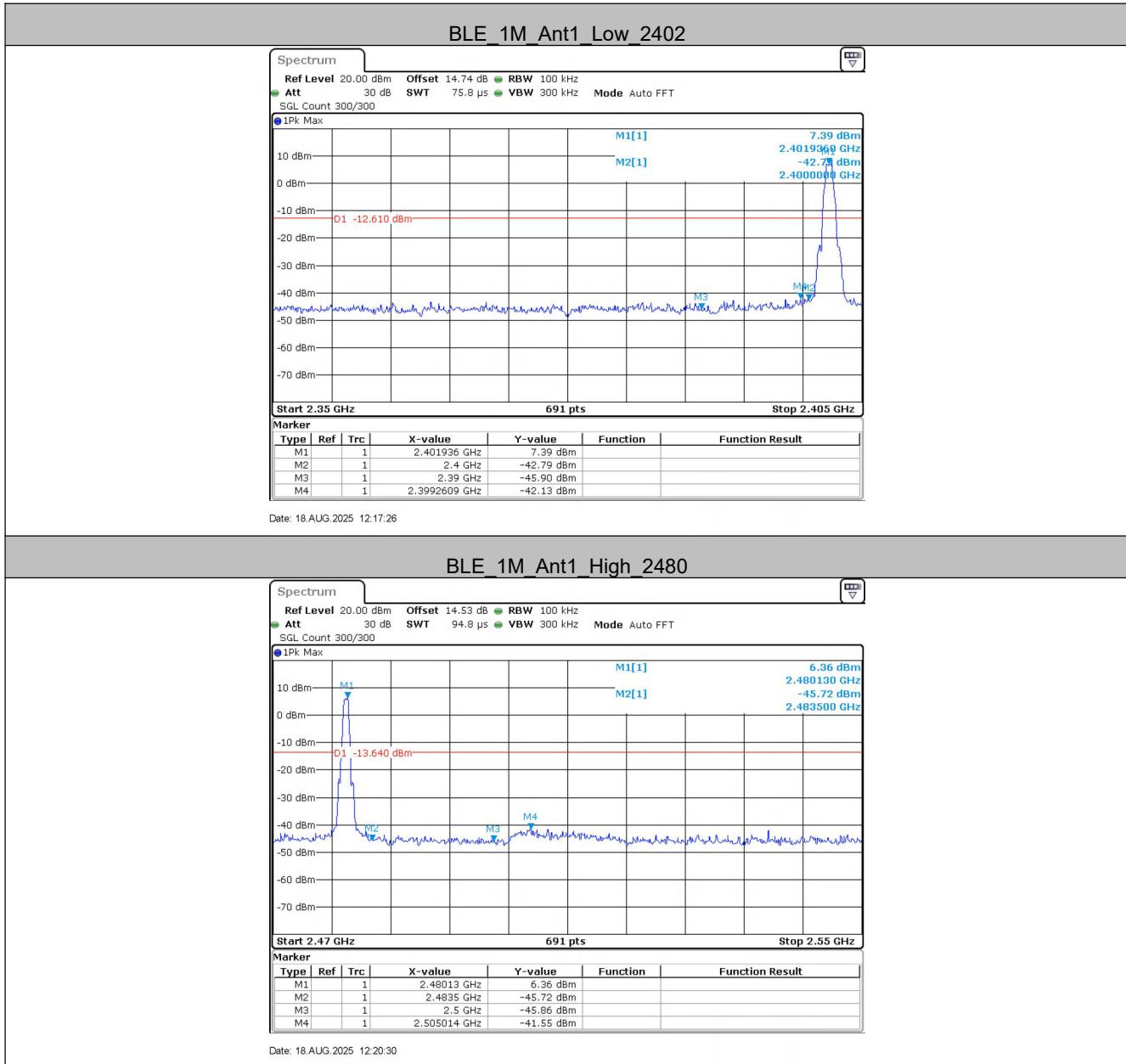


5.6 Band-edge for RF Conducted Emissions

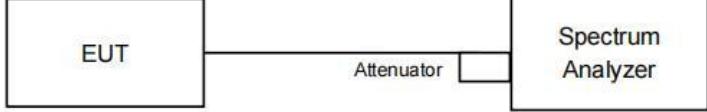
Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10 2013
Test Setup:	 <i>Remark: Offset=Cable loss+ attenuation factor.</i>
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test Mode:	Transmitting with GFSK modulation.
Test Results:	Pass

TestMode	ChName	Freq(MHz)	RefLevel[dBm]	Result[dBm]	Limit[dBm]	Verdict
BLE_1M	Low	2402	7.39	-42.13	≤-12.61	PASS
	High	2480	6.36	-41.55	≤-13.64	PASS

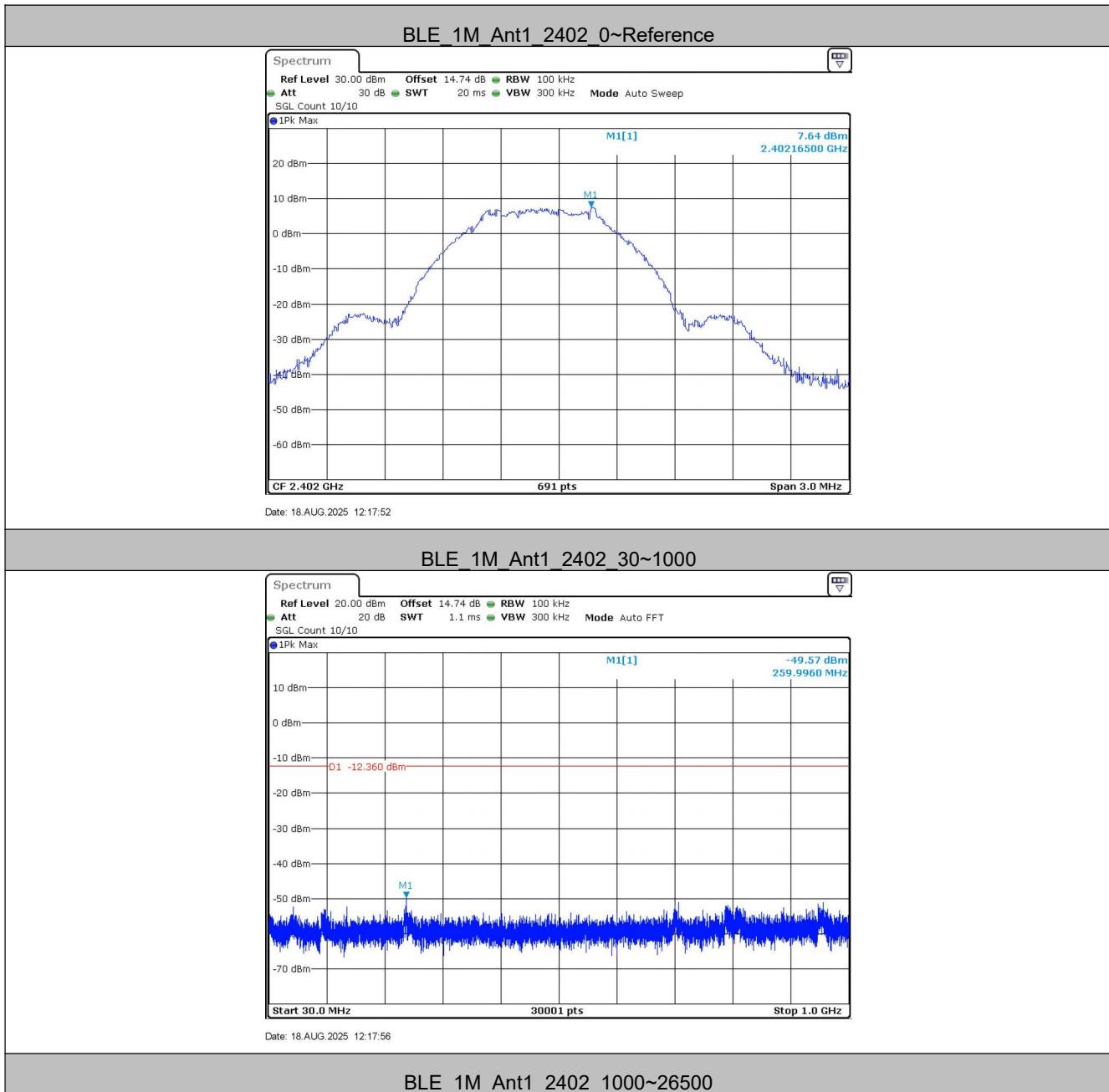
Test plot as follows:

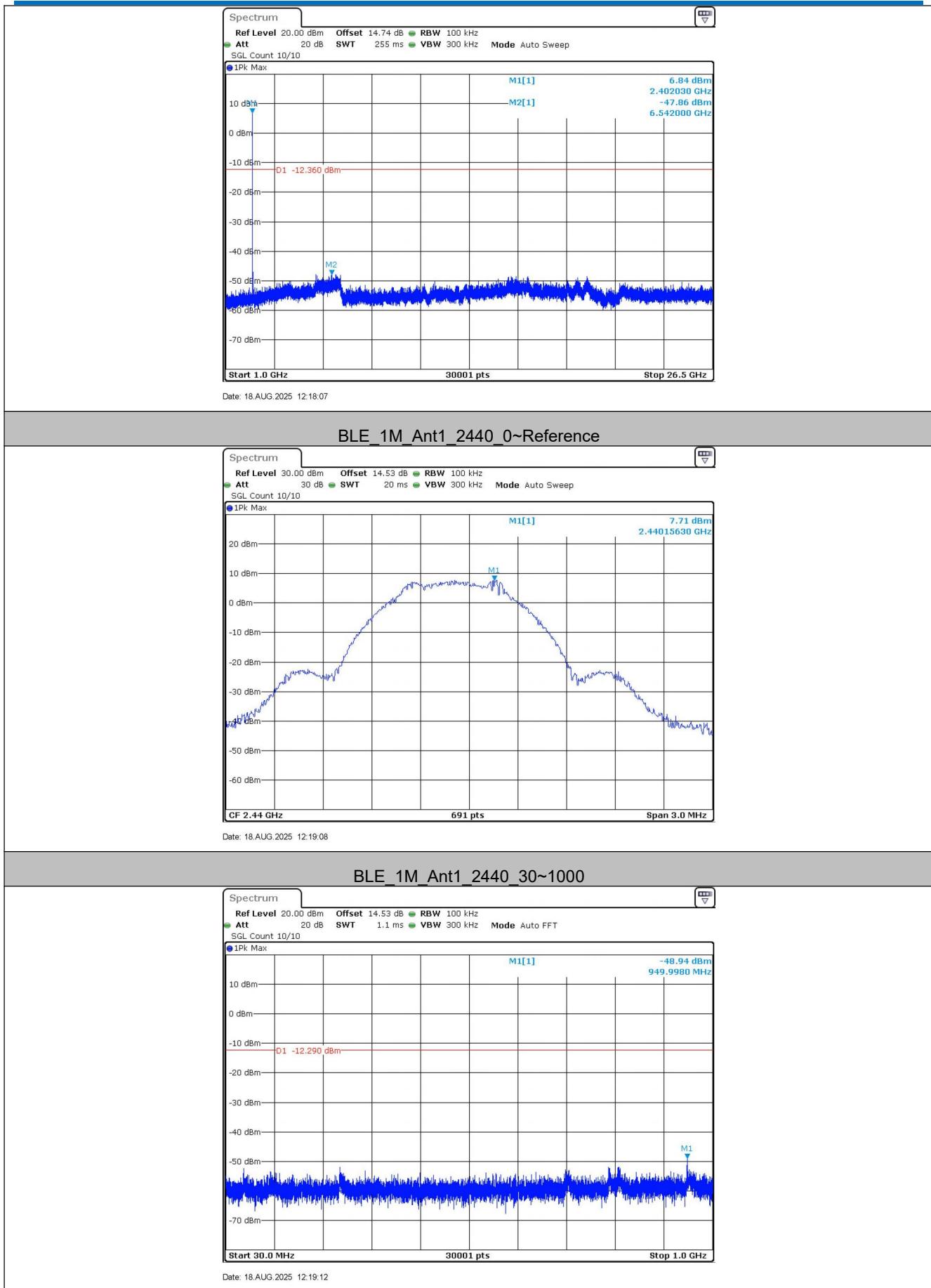


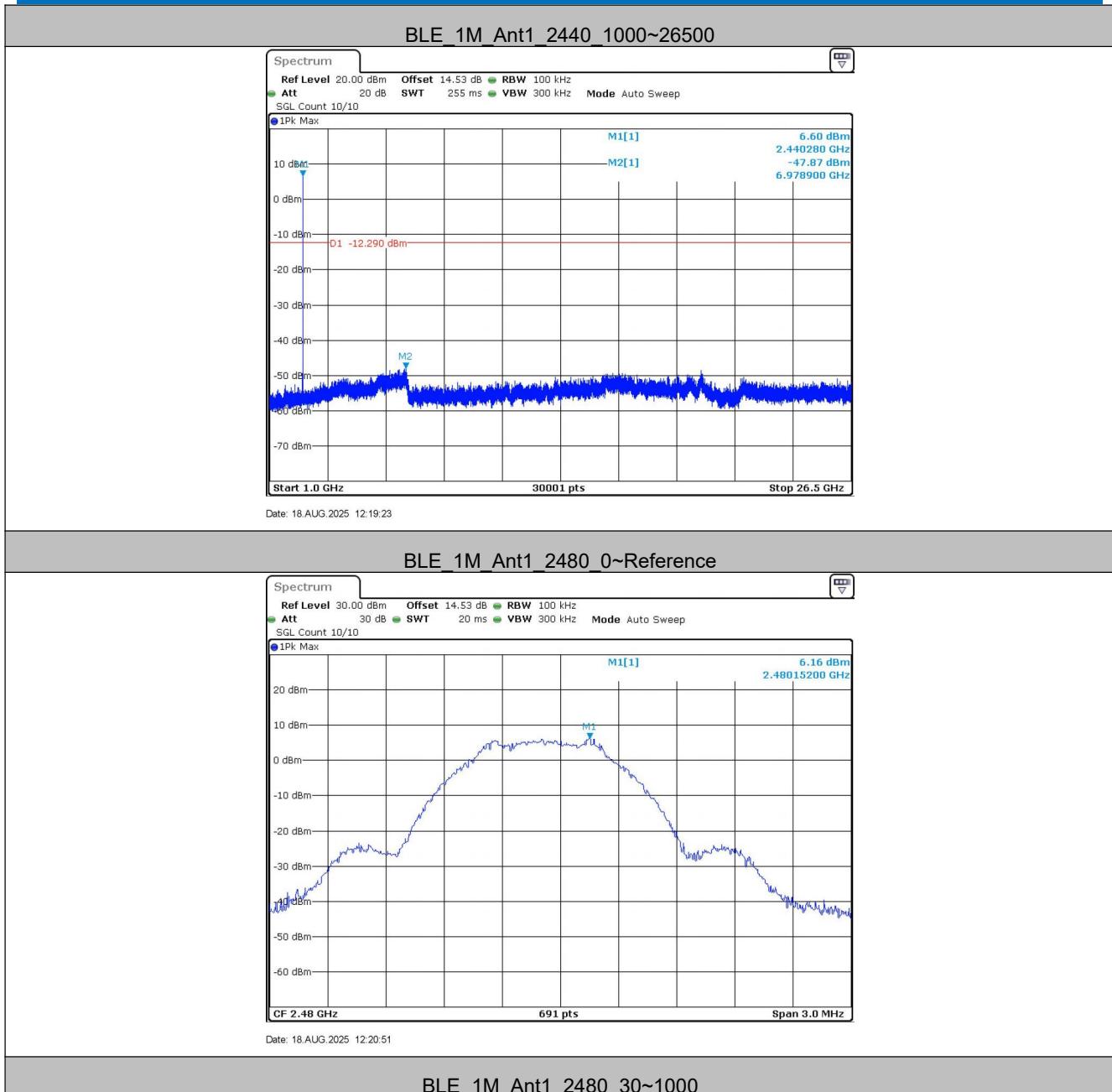
5.7 Spurious RF Conducted Emissions

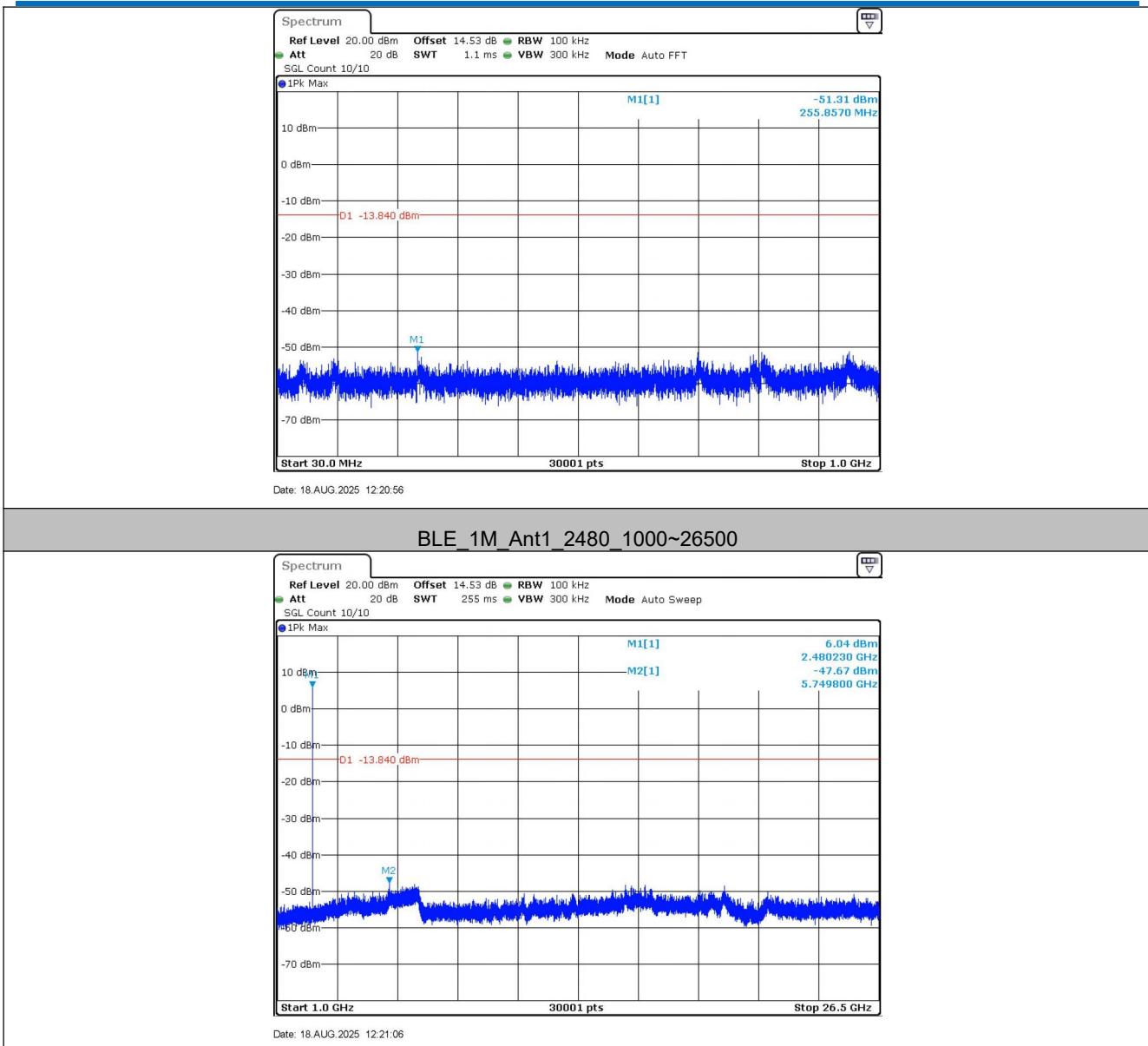
Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10 2013
Test Setup:	
<i>Remark: Offset=Cable loss+ attenuation factor.</i>	
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test Mode:	Transmitting with GFSK modulation.
Test Results:	Pass

Test plot as follows:








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 (Semi-Anechoic Chamber)				
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
	0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
	0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
	0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
	0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	100 kHz	300kHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Peak	1MHz	10Hz	Average
Limit:	Frequency	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz-88MHz	100	40.0	Quasi-peak	3
	88MHz-216MHz	150	43.5	Quasi-peak	3
	216MHz-960MHz	200	46.0	Quasi-peak	3
	960MHz-1GHz	500	54.0	Quasi-peak	3
	Above 1GHz	500	54.0	Average	3

Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

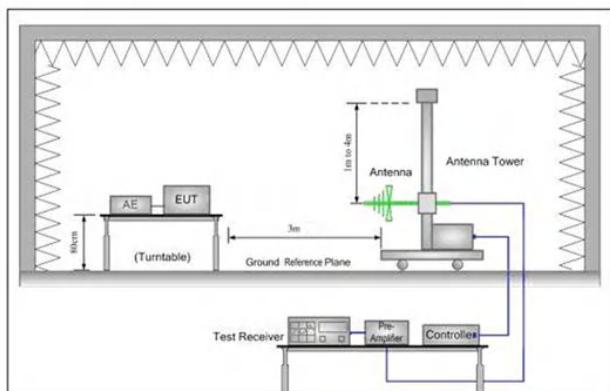
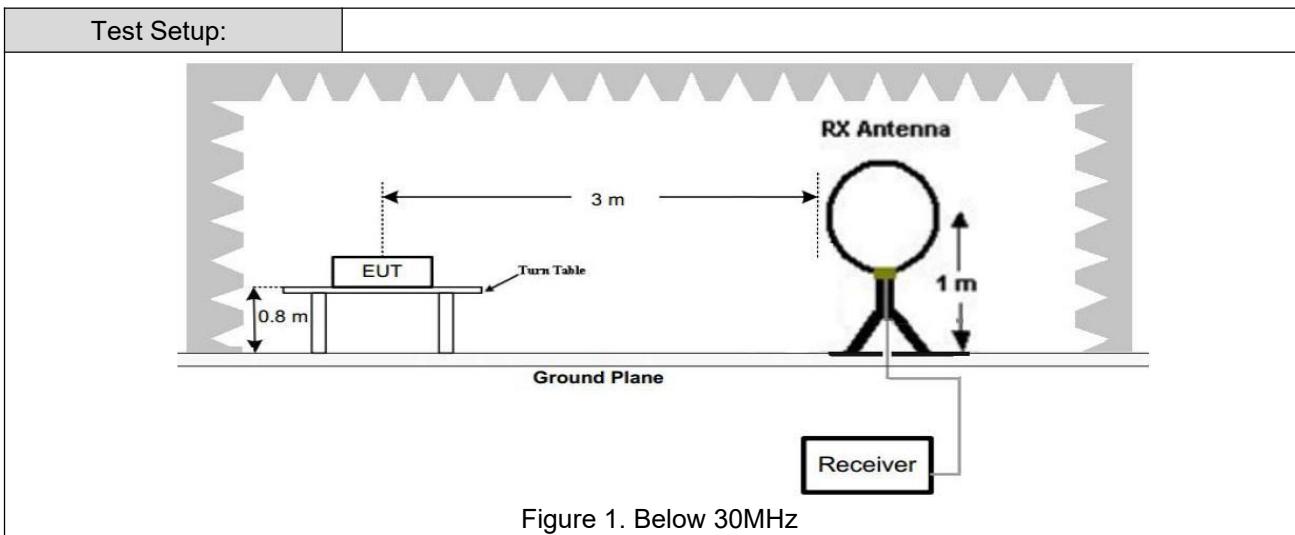


Figure 2. 30MHz to 1GHz

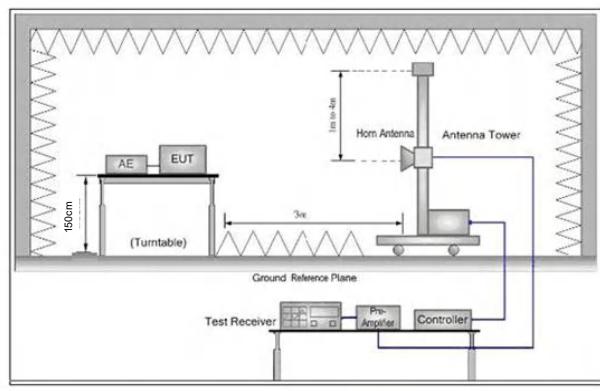


Figure 3. Above 1 GHz

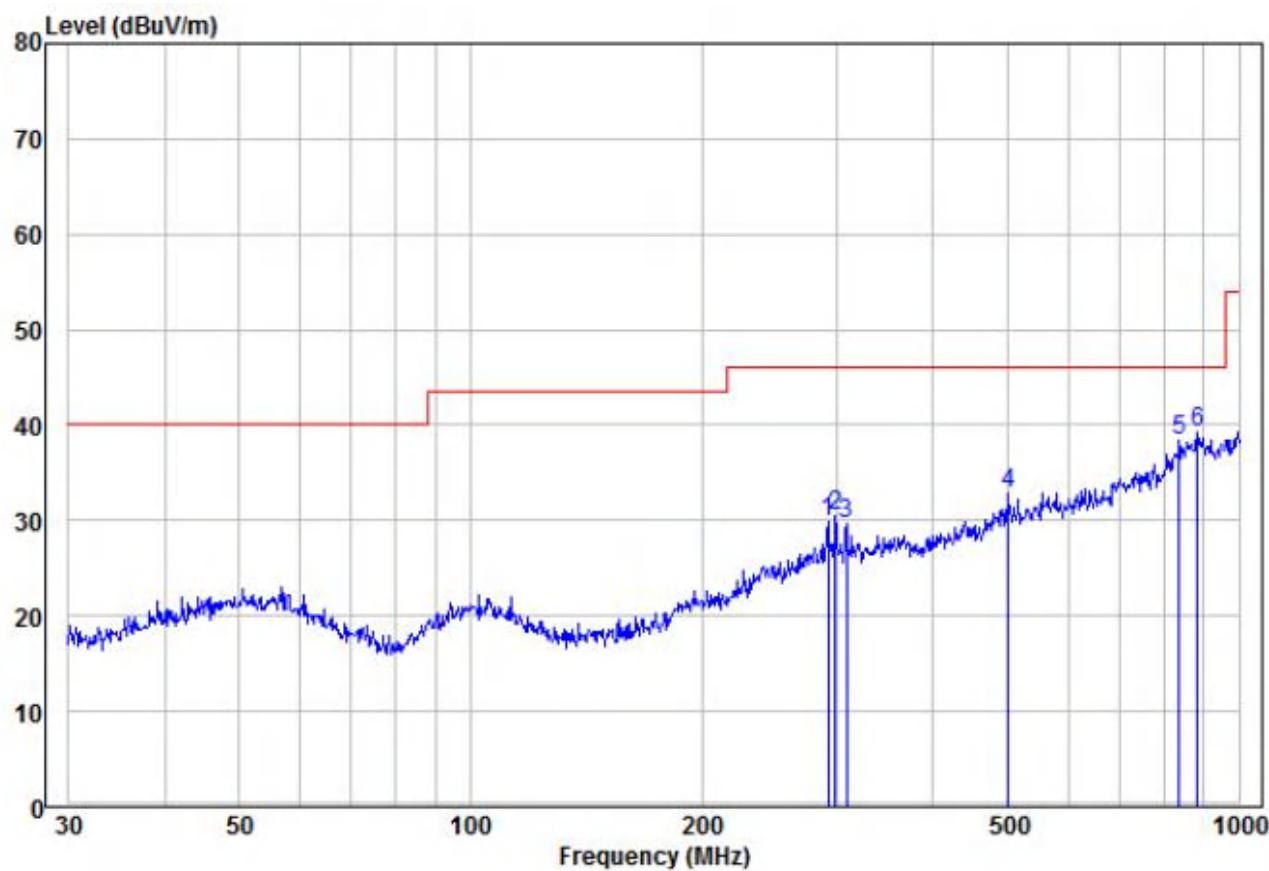
Test Procedure:	<p>a. 1) Below 1G: The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.</p> <p>2) Above 1G: The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.</p> <p>Note: For the radiated emission test above 1GHz:</p> <p>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.</p> <p>b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</p> <p>c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both</p>
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	<p>horizontal and vertical polarizations of the antenna are set to make the measurement.</p> <ul style="list-style-type: none"> 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. 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. g. Test the EUT in the lowest channel (2402MHz), the middle channel (2440MHz), the Highest channel (2480MHz) 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:	<p>Transmitting with GFSK modulation.</p> <p>Transmitting mode.</p>
Final Test Mode:	<p>Through Pre-scan, find the 1Mbps of data type and GFSK modulation is the worst case.</p> <p>For below 1GHz part, through pre-scan, the worst case is the highest channel.</p> <p>Only the worst case is recorded in the report.</p>
Test Results:	Pass

Radiated Emission below 1GHz

30MHz~1GHz, the worst case

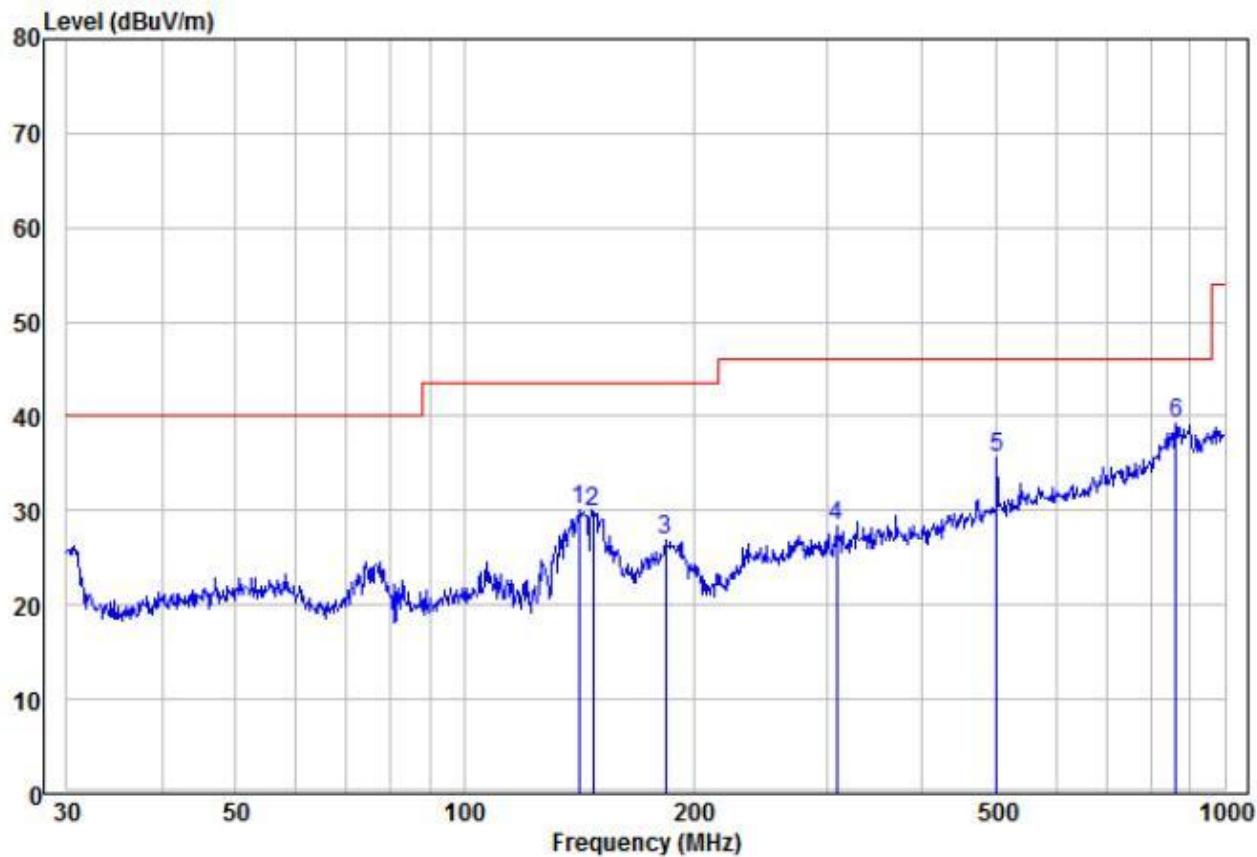
Test mode:	Transmitting mode	Horizontal
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Freq	Read			Limit	Over	APos	TPos
	Freq	Level	Factor				
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	cm	deg
1	292.06	12.39	17.55	29.94	46.00 -16.06 Peak	HORIZONTAL	100 45
2	298.27	12.84	17.72	30.56	46.00 -15.44 Peak	HORIZONTAL	100 15
3	308.91	11.59	17.99	29.58	46.00 -16.42 Peak	HORIZONTAL	100 106
4	501.18	10.93	21.84	32.77	46.00 -13.23 Peak	HORIZONTAL	100 225
5	836.24	9.46	28.84	38.30	46.00 -7.70 Peak	HORIZONTAL	100 310
6 pp	884.50	9.66	29.58	39.24	46.00 -6.76 Peak	HORIZONTAL	100 12

30MHz~1GHz, the worst case

Test mode:	Transmitting mode	Vertical
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Freq	Read			Limit	Over	Over	APOS	TPOS		
	Level	Factor	Level							
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	deg		
1	141.33	20.60	9.59	30.19	43.50	-13.31	Peak	VERTICAL	100	58
2	147.40	20.18	9.75	29.93	43.50	-13.57	Peak	VERTICAL	100	177
3	183.84	14.97	11.90	26.87	43.50	-16.63	Peak	VERTICAL	100	223
4	308.91	10.31	17.99	28.30	46.00	-17.70	Peak	VERTICAL	100	314
5	501.18	13.84	21.84	35.68	46.00	-10.32	Peak	VERTICAL	100	10
6 pp	863.06	9.91	29.25	39.16	46.00	-6.84	Peak	VERTICAL	100	22

Transmitter Emission above 1GHz

Worse case mode:		GFSK(1Mbps)		Test channel:		Lowest			
Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Over (dB)	Detect or Type	Ant. Pol.	Antenna Height (m)	Table Angle (Degree)
							H/V	(m)	(Degree)
2390	53.82	-9.2	44.62	74	-29.38	Peak	H	1.5	203
2400	54.29	-9.39	44.90	74	-29.10	Peak	H	1.5	185
4804	53.48	-4.33	49.15	74	-24.85	Peak	H	1.5	347
7206	49.09	1.01	50.10	74	-23.90	Peak	H	1.5	90
2390	53.35	-9.2	44.15	74	-29.85	Peak	V	1.5	101
2400	53.10	-9.39	43.71	74	-30.29	Peak	V	1.5	115
4804	55.10	-4.33	50.77	74	-23.23	Peak	V	1.5	319
7206	50.61	1.01	51.62	74	-22.38	Peak	V	1.5	0

Worse case mode:		GFSK(1Mbps)		Test channel:		Middle			
Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Over (dB)	Detect or Type	Ant. Pol.	Antenna Height (m)	Table Angle (Degree)
							H/V	(m)	(Degree)
4880	51.23	-4.11	47.12	74	-26.88	peak	H	1.5	305
7320	50.83	1.51	52.34	74	-21.66	peak	H	1.5	58
4880	52.12	-4.11	48.01	74	-25.99	peak	V	1.5	108
7320	48.93	1.51	50.44	74	-23.56	peak	V	1.5	309

Worse case mode:		GFSK(1Mbps)		Test channel:		Highest			
Frequency (MHz)	Meter Reading (dB μ V)	Factor (dB)	Emission Level (dB μ V/m)	Limits (dB μ V/m)	Over (dB)	Detect or Type	Ant. Pol.	Antenna Height (m)	Table Angle (Degree)
							H/V	(m)	(Degree)
2483.5	55.16	-9.29	45.87	74	-28.13	Peak	H	1.5	132
4960	50.64	-4.04	46.60	74	-27.40	Peak	H	1.5	3
7440	48.83	1.57	50.40	74	-23.60	Peak	H	1.5	274
2483.5	57.37	-9.29	48.08	74	-25.92	Peak	V	1.5	17
4960	50.28	-4.04	46.24	74	-27.76	Peak	V	1.5	70
7440	48.64	1.57	50.21	74	-23.79	Peak	V	1.5	333

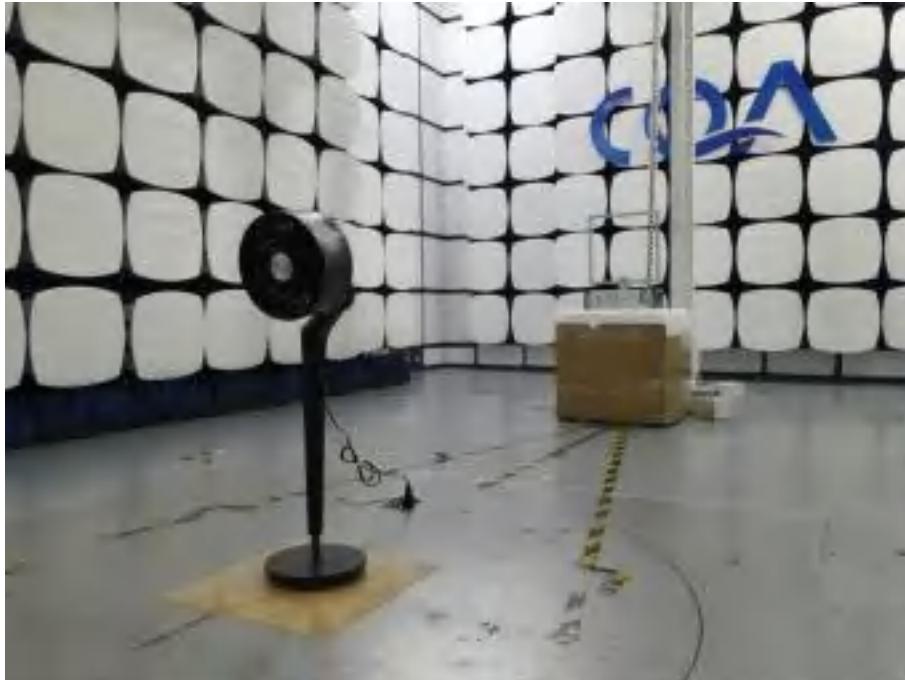
Remark:

- 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

9kHz~30MHz:



30MHz~1GHz:



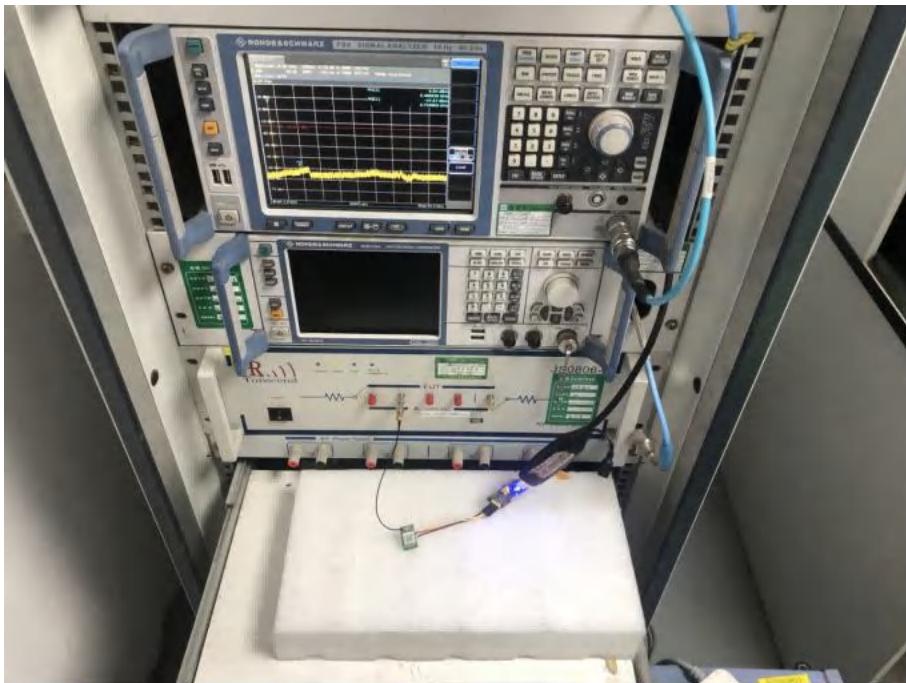
Above 1GHz:



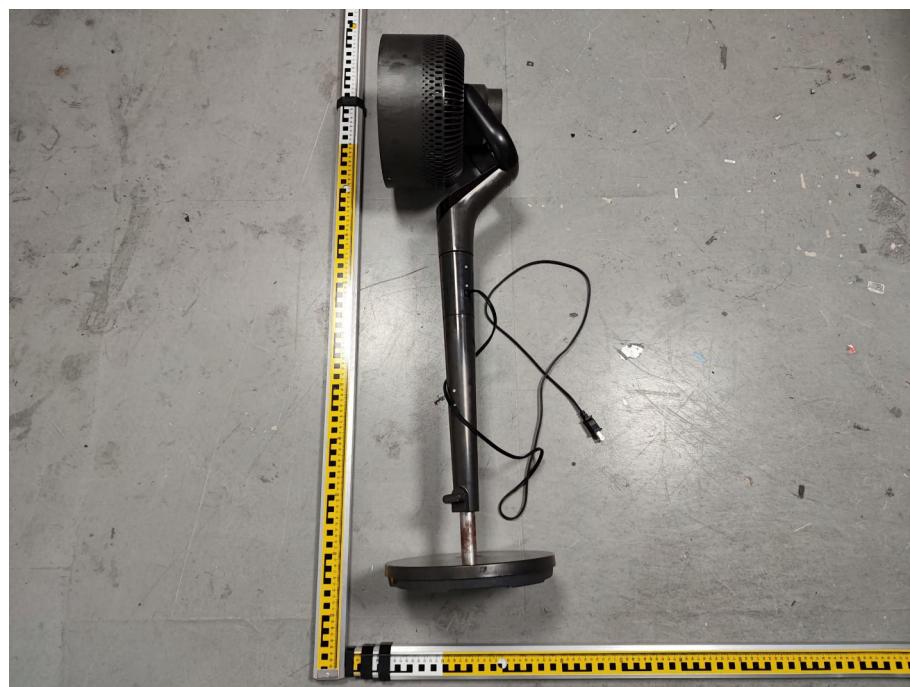
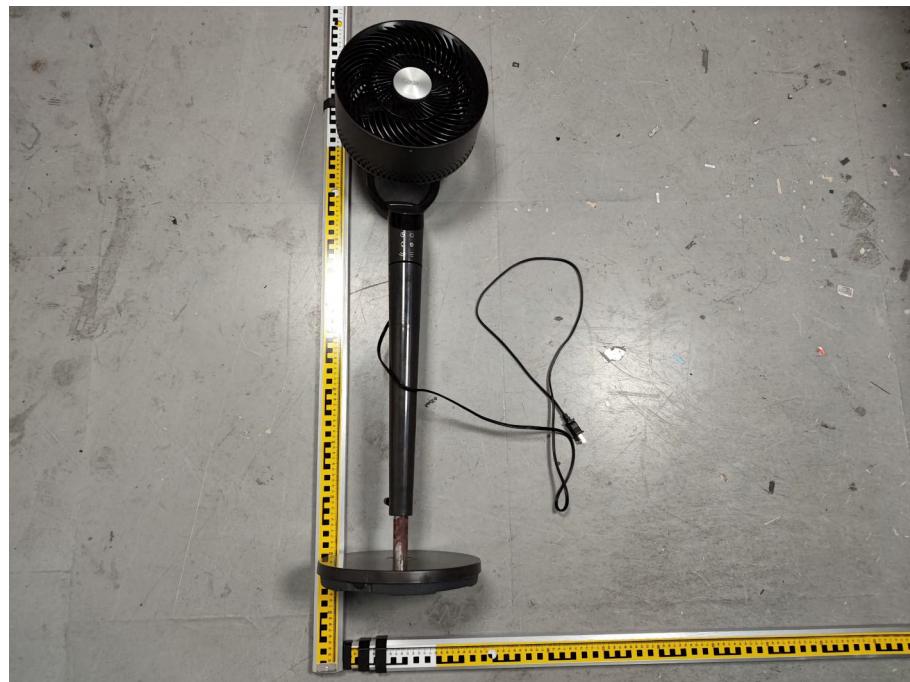
6.2 Conducted Emissions Test Setup

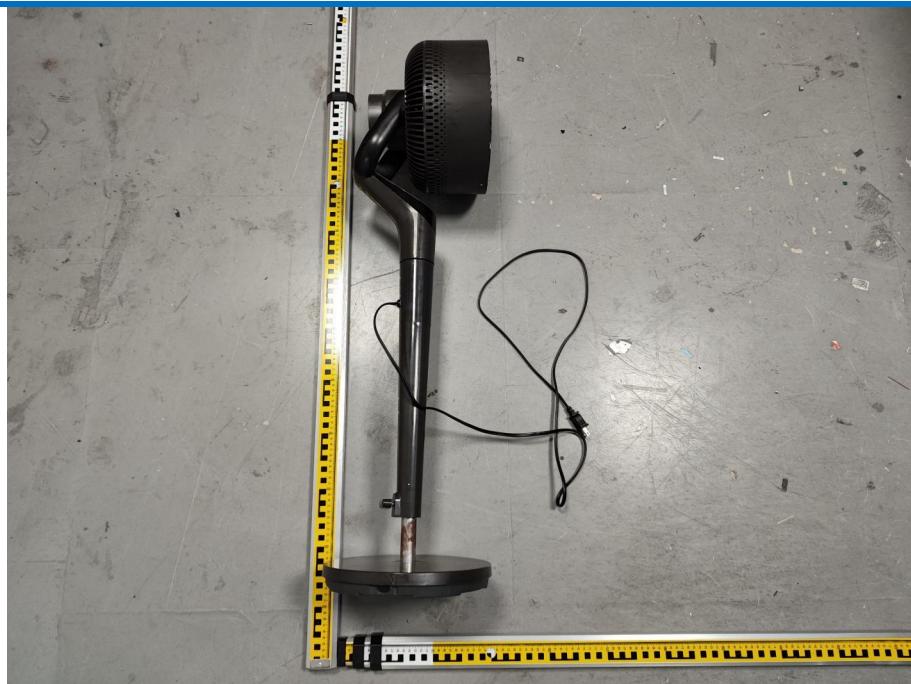


6.3 RF Conducted measurement

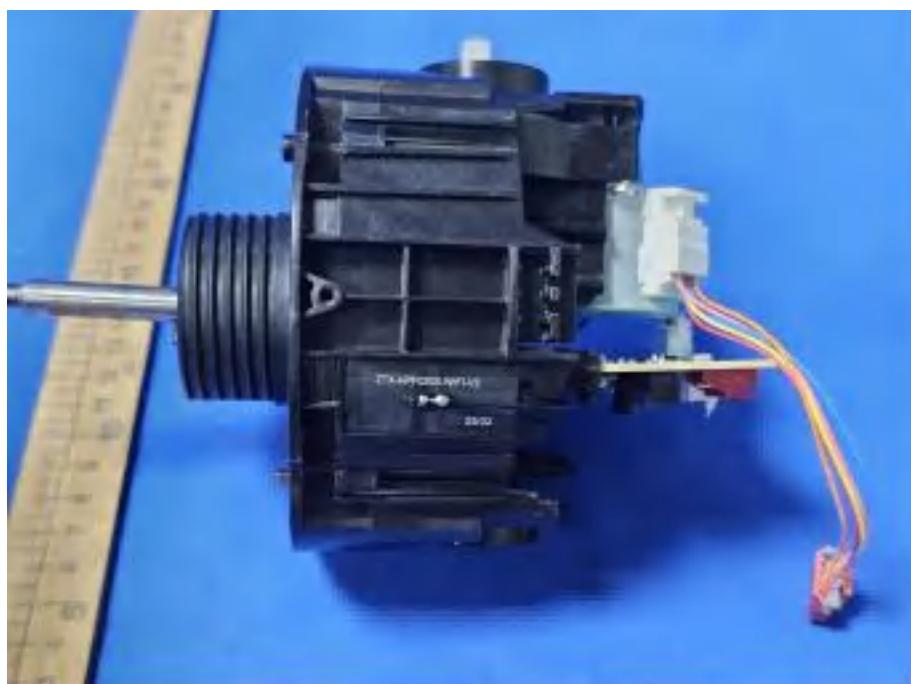
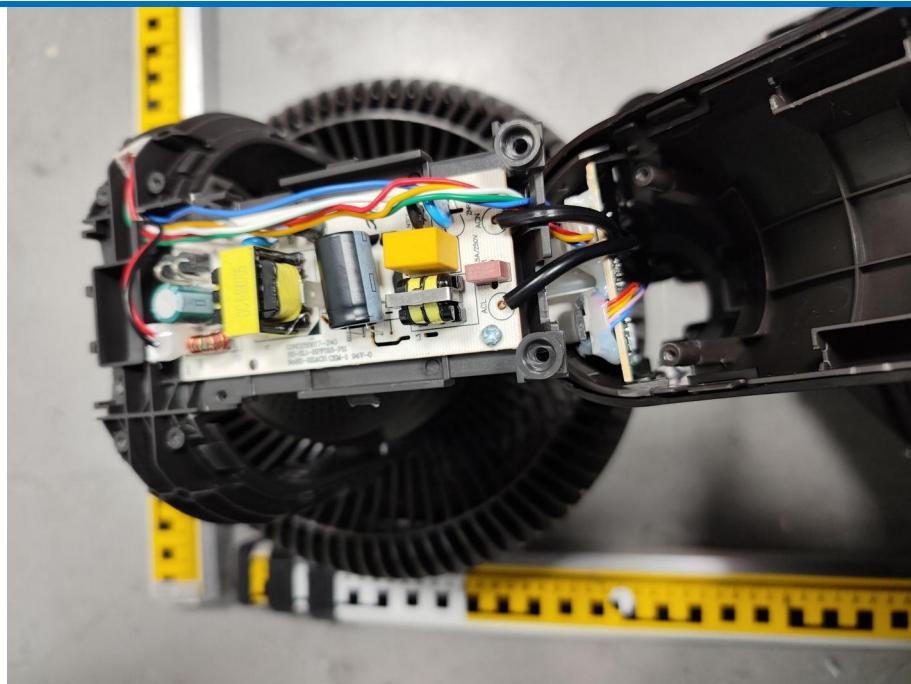


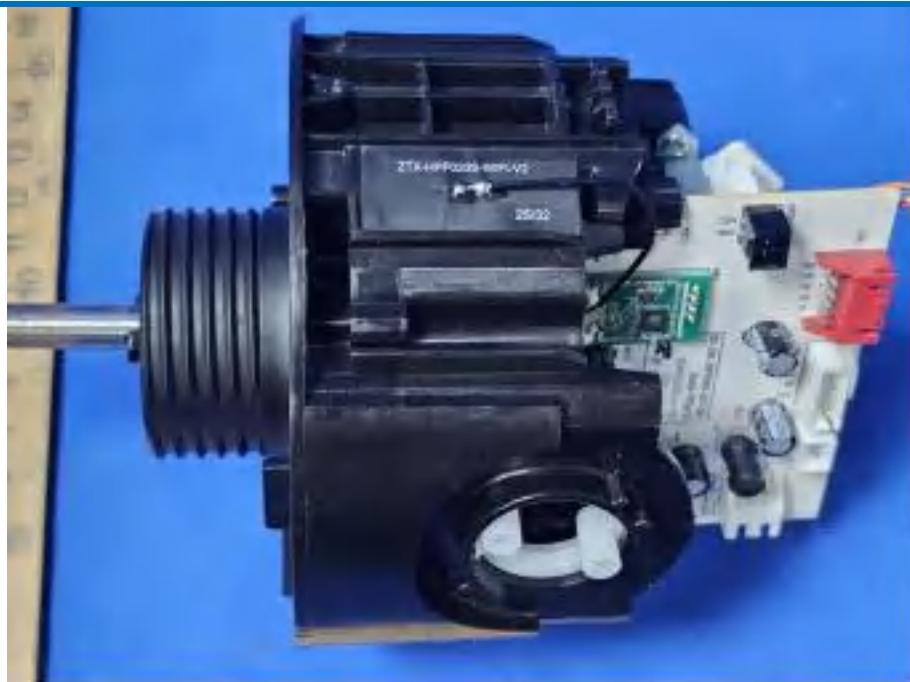
7 Photographs - EUT Constructional Details

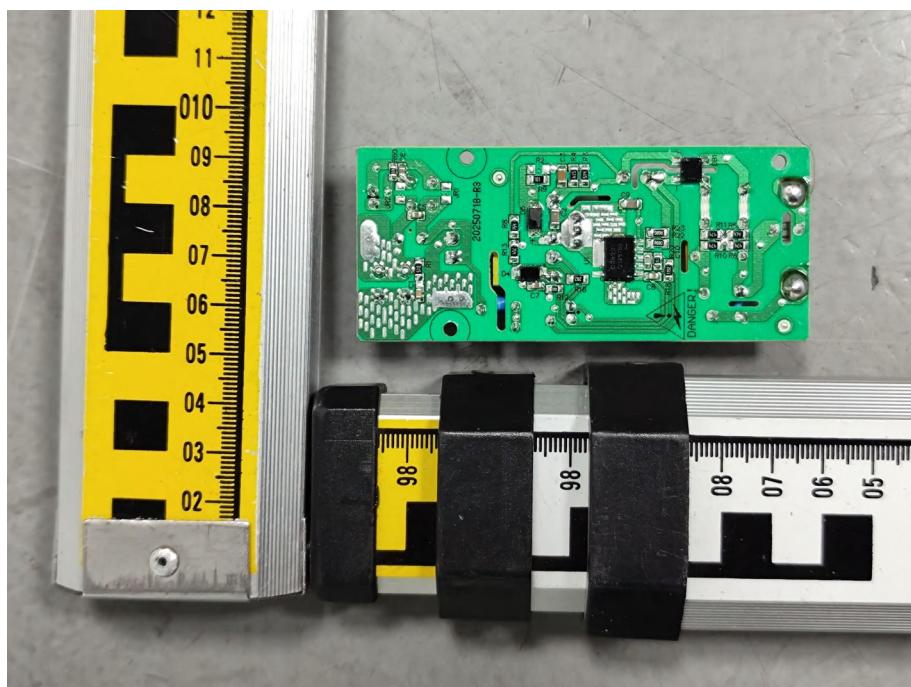
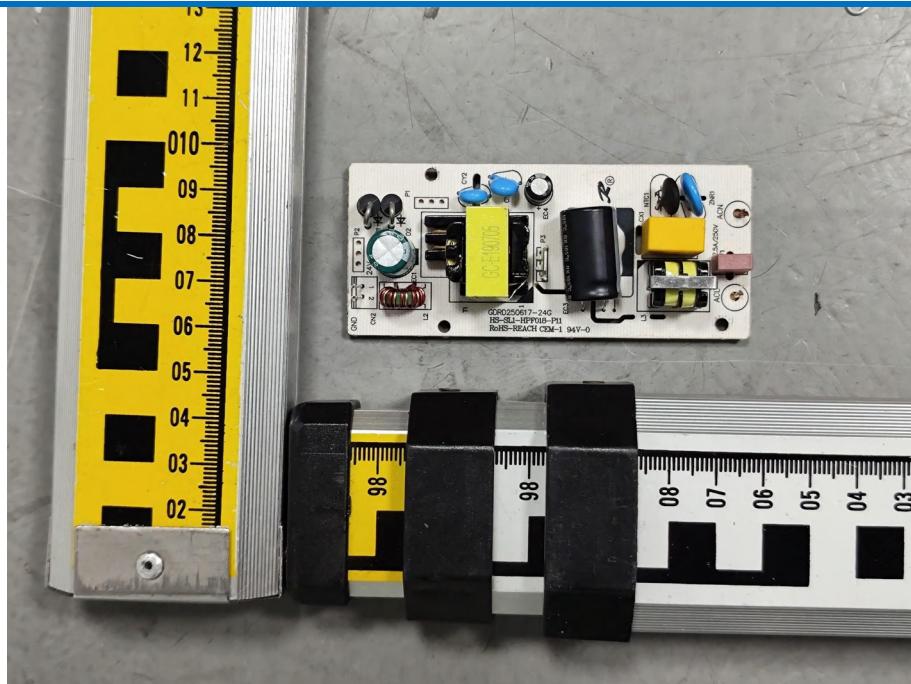


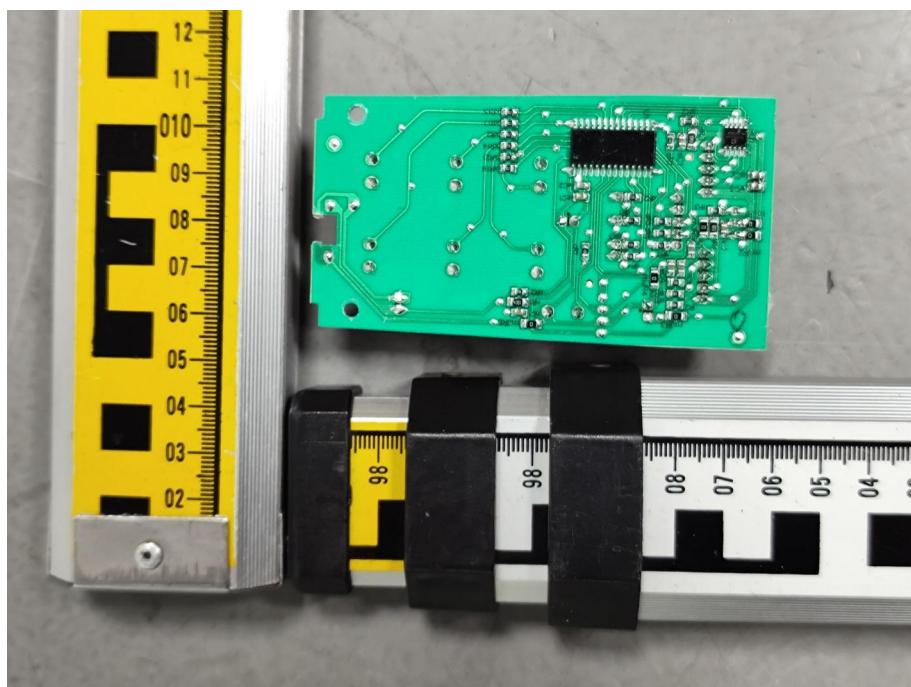
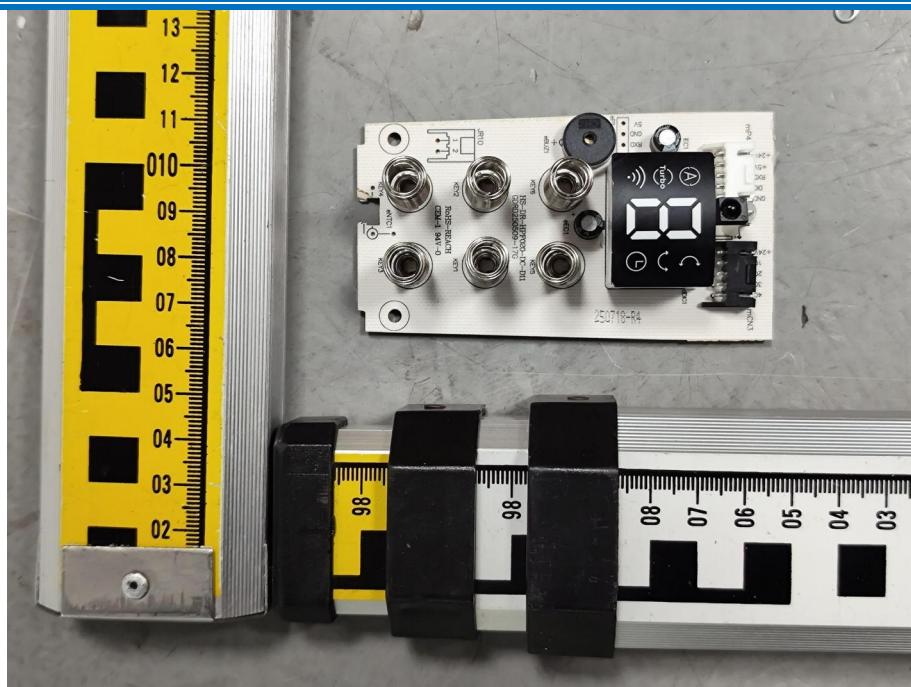


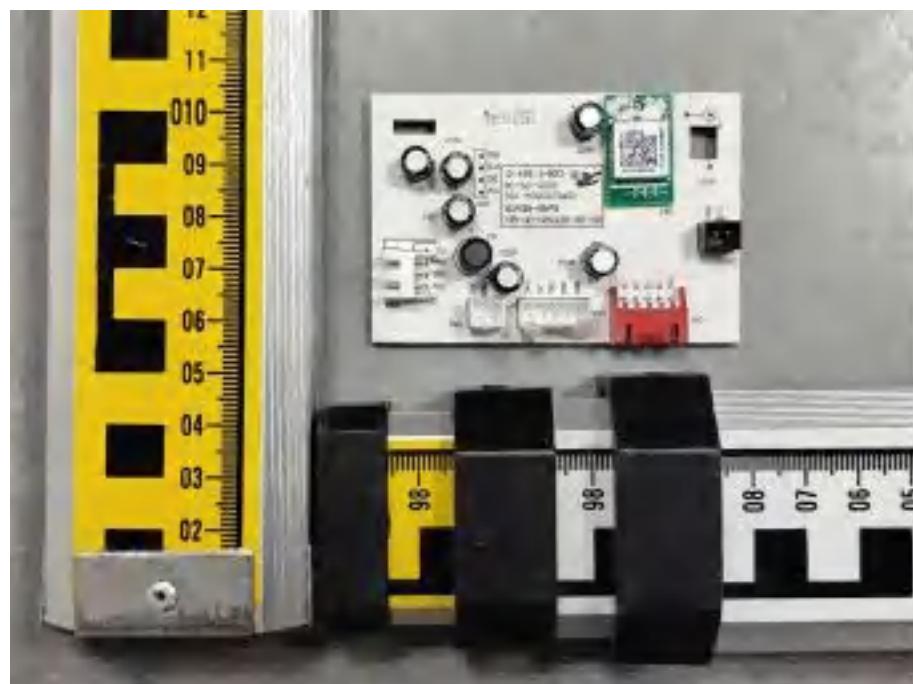
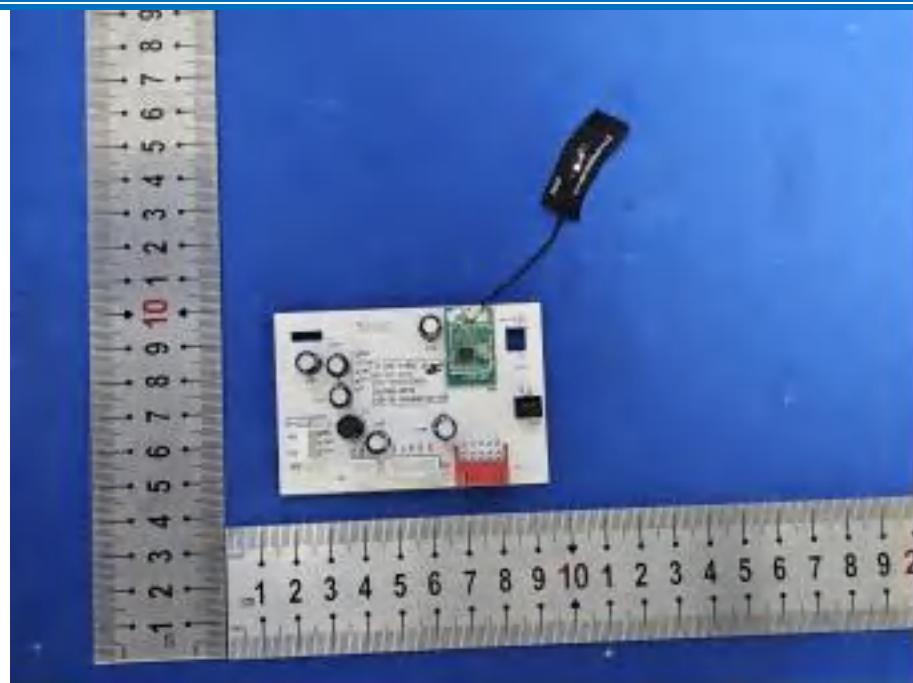


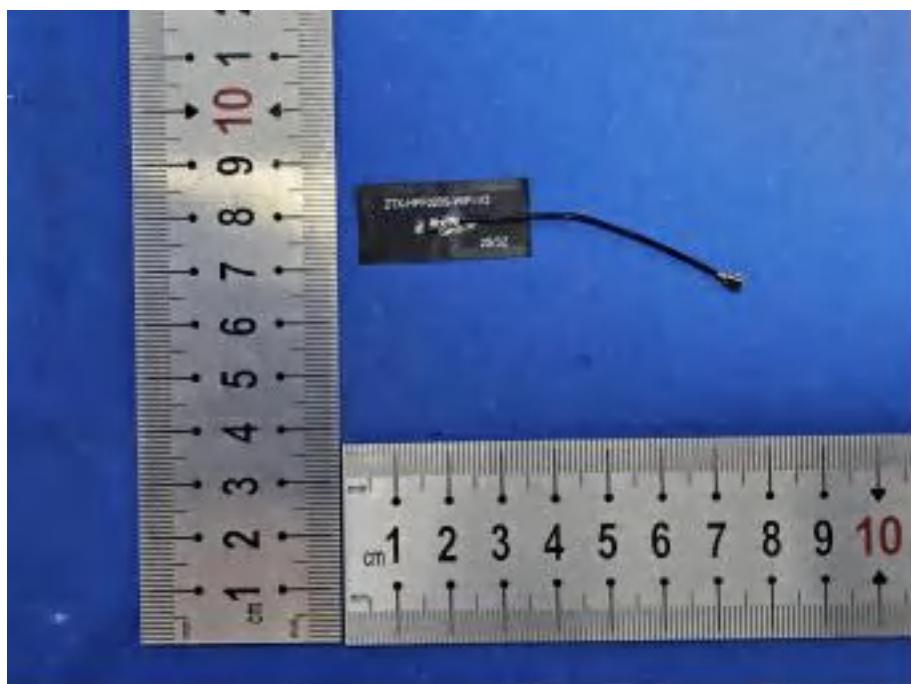
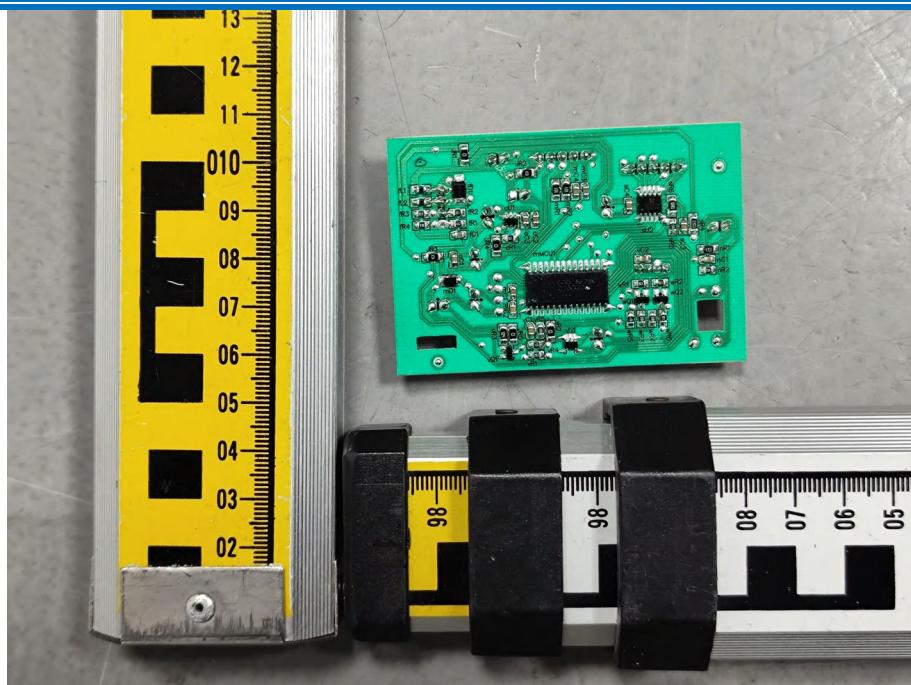


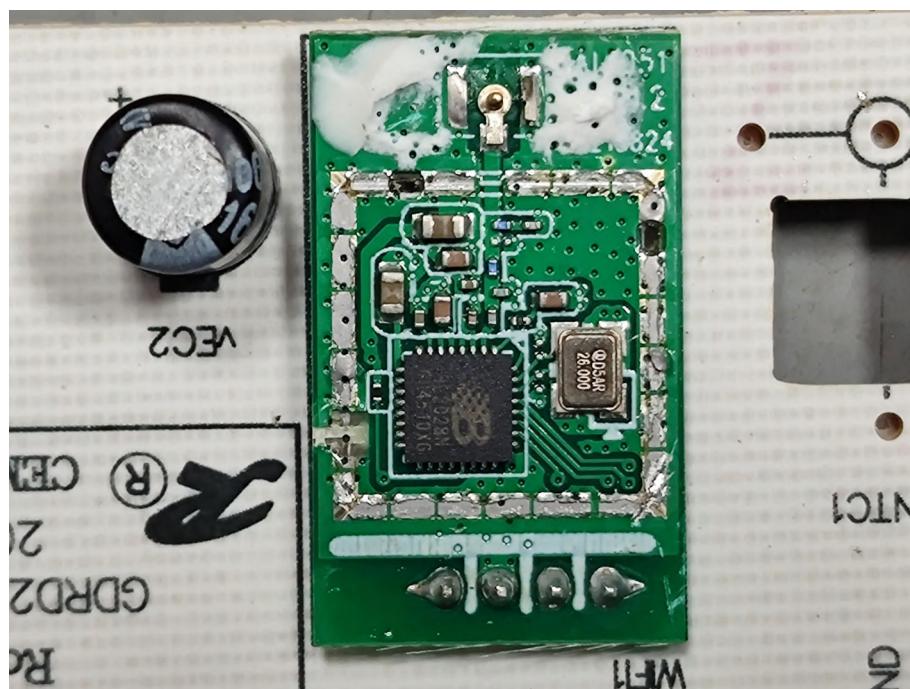












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