

5.11. Radiated Spurious Emission Measurement

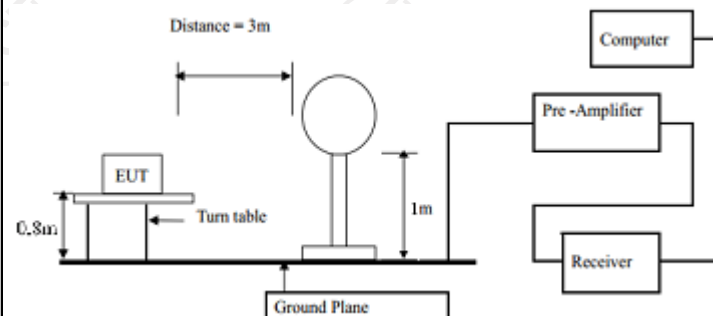
5.11.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.209			
Test Method:	ANSI C63.10:2013			
Frequency Range:	9 kHz to 25 GHz			
Measurement Distance:	3 m			
Antenna Polarization:	Horizontal & Vertical			
Receiver Setup:	Frequency	Detector	RBW	VBW
	9kHz- 150kHz	Quasi-peak	200Hz	1kHz
	150kHz- 30MHz	Quasi-peak	9kHz	30kHz
	30MHz-1GHz	Quasi-peak	120KHz	300KHz
	Above 1GHz	Peak	1MHz	3MHz
Limit:	Remark			
	Quasi-peak Value			
	Quasi-peak Value			
	Quasi-peak Value			
	Peak Value			
Test setup:	Average Value			

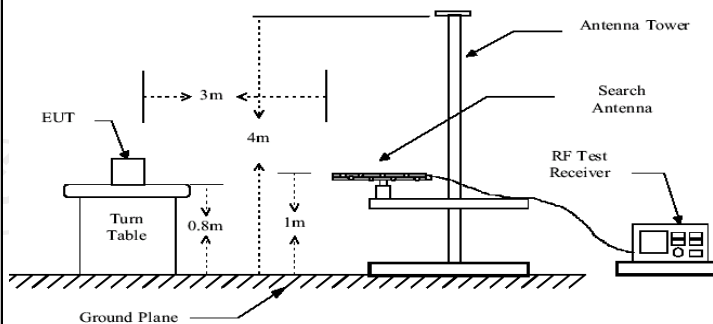
Limit:

Test setup:

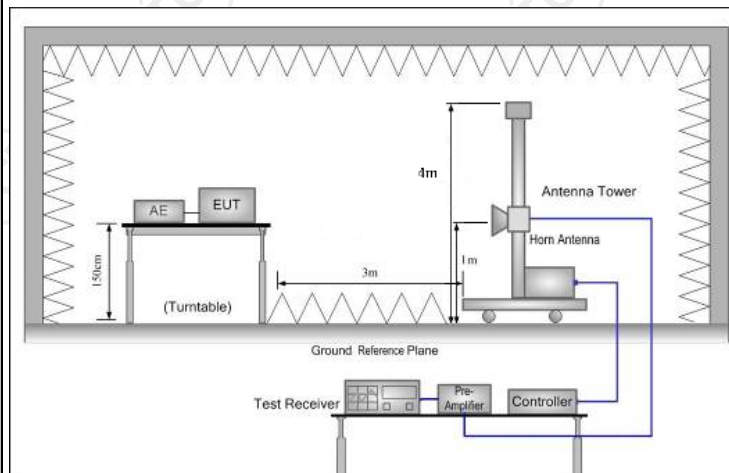
For radiated emissions below 30MHz



30MHz to 1GHz



Above 1GHz



Test Mode:

Transmitting mode with modulation

Test Procedure:

1. The testing follows the guidelines in Spurious Radiated Emissions of ANSI C63.10:2013 Measurement Guidelines.
2. For the radiated emission test below 1GHz:
The EUT was placed on a turntable with 0.8 meter above ground. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high PASS filter are used for the test in order to get better signal level.
For the radiated emission test above 1GHz:
Place the measurement antenna on a turntable with 1.5 meter above ground, which is 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. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Use the following spectrum analyzer settings: (1) Span shall wide enough to fully capture the emission being measured; (2) Set RBW=120 kHz for $f < 1$ GHz, RBW=1MHz for $f > 1$GHz ; VBW$\geq$RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak (3) For average measurement: use duty cycle correction factor method per 15.35(c). Duty cycle = On time/100 milliseconds On time = $N_1 \cdot L_1 + N_2 \cdot L_2 + \dots + N_{n-1} \cdot L_{n-1} + N_n \cdot L_n$ Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc. Average Emission Level = Peak Emission Level + $20 \cdot \log(\text{Duty cycle})$ Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
Test results:	PASS

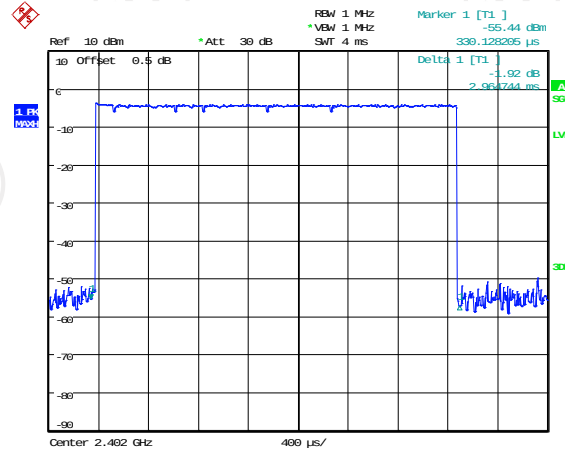
5.11.2. Test Instruments

Radiated Emission Test Site (966)				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Test Receiver	ROHDE&SCHW ARZ	ESIB7	100197	Jul. 27, 2021
Spectrum Analyzer	ROHDE&SCHW ARZ	FSQ40	200061	Sep. 11, 2021
Pre-amplifier	EM Electronics Corporation CO.,LTD	EM30265	07032613	Sep. 02, 2021
Pre-amplifier	HP	8447D	2727A05017	Sep. 02, 2021
Loop antenna	ZHINAN	ZN30900A	12024	Sep. 05, 2022
Broadband Antenna	Schwarzbeck	VULB9163	340	Sep. 04, 2022
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Sep. 04, 2022
Horn Antenna	A-INFO	LB-180400-KF	J211020657	Sep. 04, 2022
Antenna Mast	Keleto	RE-AM	N/A	N/A
Line-4	TCT	RE-high-04	N/A	Sep. 02, 2021
Line-8	TCT	RE-01	N/A	Jul. 27, 2021
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A

5.11.3. Test Data

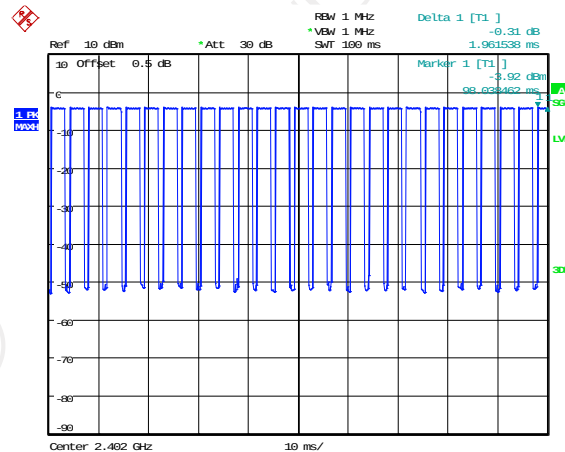
Duty cycle correction factor for average measurement

2DH5 on time (One Pulse) Plot on Channel 00



Date: 9 JUN 2021 12:15:41

2DH5 on time (Count Pulses) Plot on Channel 00



Date: 9 JUN 2021 12:16:23

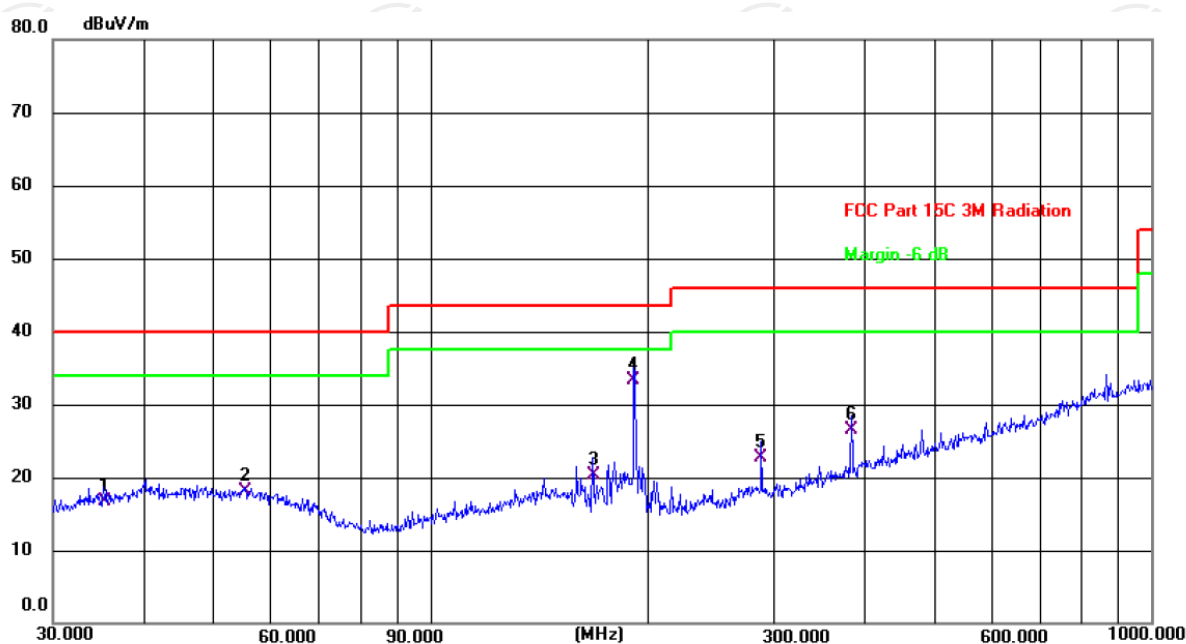
Note:

1. Worst case Duty cycle = on time/100 milliseconds = $(2.965 \times 26 + 1.962) / 100 = 0.7905$
2. Worst case Duty cycle correction factor = $20 \times \log(\text{Duty cycle}) = -2.04 \text{ dB}$
3. 2DH5 has the highest duty cycle worst case and is reported.
4. The average levels were calculated from the peak level corrected with duty cycle correction factor (-2.04dB) derived from $20 \log(\text{dwell time}/100 \text{ ms})$. This correction is only for signals that hop with the fundamental signal, such as band-edge and harmonic. Other spurious signals that are independent of the hopping signal would not use this correction.

Please refer to following diagram for individual

Below 1GHz

Horizontal:



Site

Polarization: **Horizontal**

Temperature: 24.9(C)

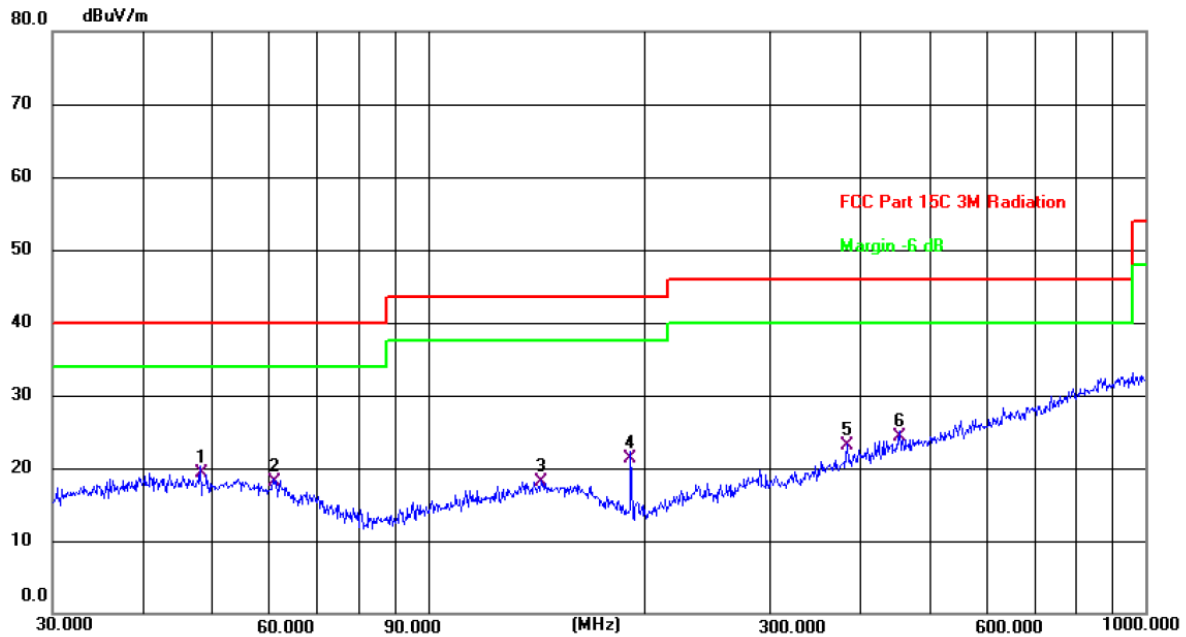
Limit: FCC Part 15C 3M Radiation

Power: DC 3.7 V

Humidity: 55 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1	35.2512	3.40	13.22	16.62	40.00	-23.38	QP	P	
2	55.4147	4.77	13.43	18.20	40.00	-21.80	QP	P	
3	167.8243	7.77	12.59	20.36	43.50	-23.14	QP	P	
4 *	191.7450	22.53	10.70	33.23	43.50	-10.27	QP	P	
5	287.9904	8.67	14.01	22.68	46.00	-23.32	QP	P	
6	383.9318	9.90	16.69	26.59	46.00	-19.41	QP	P	

Vertical:



Site: Polarization: **Vertical** Temperature: 24.9(C)
 Limit: FCC Part 15C 3M Radiation Power: DC 3.7 V Humidity: 55 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	P/F	Remark
1 *	48.1626	5.41	13.82	19.23	40.00	-20.77	QP	P	
2	60.9176	5.17	12.95	18.12	40.00	-21.88	QP	P	
3	143.8295	4.74	13.28	18.02	43.50	-25.48	QP	P	
4	191.7450	10.66	10.70	21.36	43.50	-22.14	QP	P	
5	383.9318	6.34	16.69	23.03	46.00	-22.97	QP	P	
6	454.3100	5.84	18.41	24.25	46.00	-21.75	QP	P	

Note: 1. The low frequency, which started from 9KHz~30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported

2. Measurements were conducted in all three channels (high, middle, low) and two modulation (GFSK, Pi/4 DQPSK) and the worst case Mode (middle channel and Pi/4 DQPSK) was submitted only.

3. Freq. = Emission frequency in MHz

Measurement (dBμV/m) = Reading level (dBμV) + Corr. Factor (dB)

Correction Factor= Antenna Factor + Cable loss – Pre-amplifier

Limit (dBμV/m) = Limit stated in standard

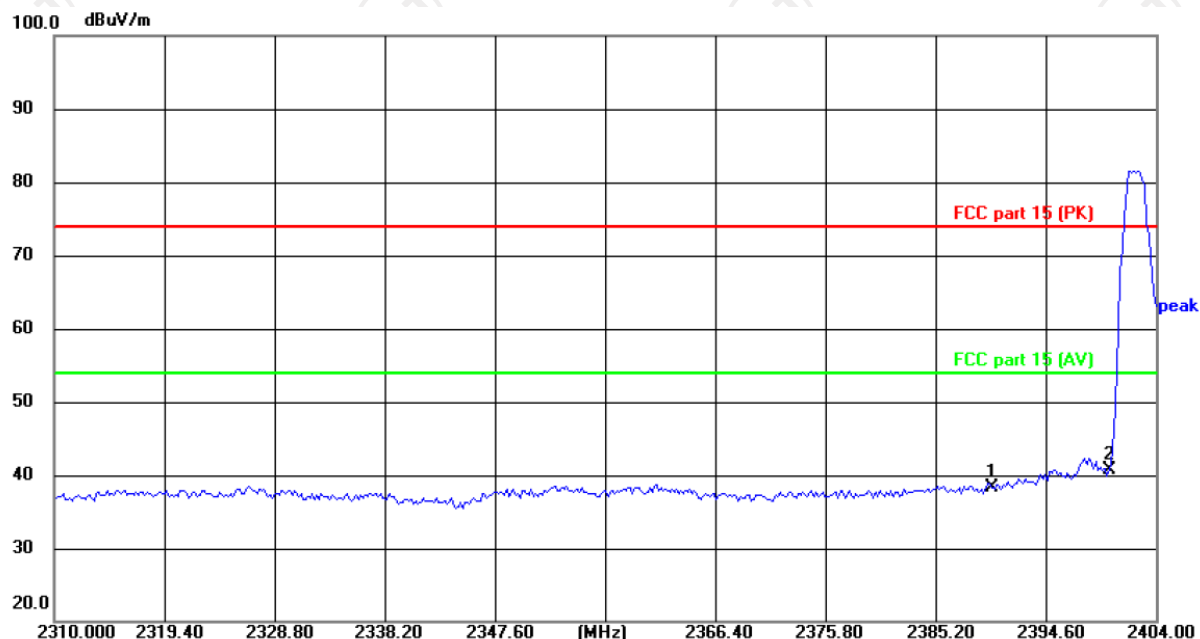
Margin (dB) = Measurement (dBμV/m) – Limits (dBμV/m)

* is meaning the worst frequency has been tested in the test frequency range

Test Result of Radiated Spurious at Band edges

Lowest channel 2402:

Horizontal:



Site

Polarization: **Horizontal**

Temperature: 25(°C)

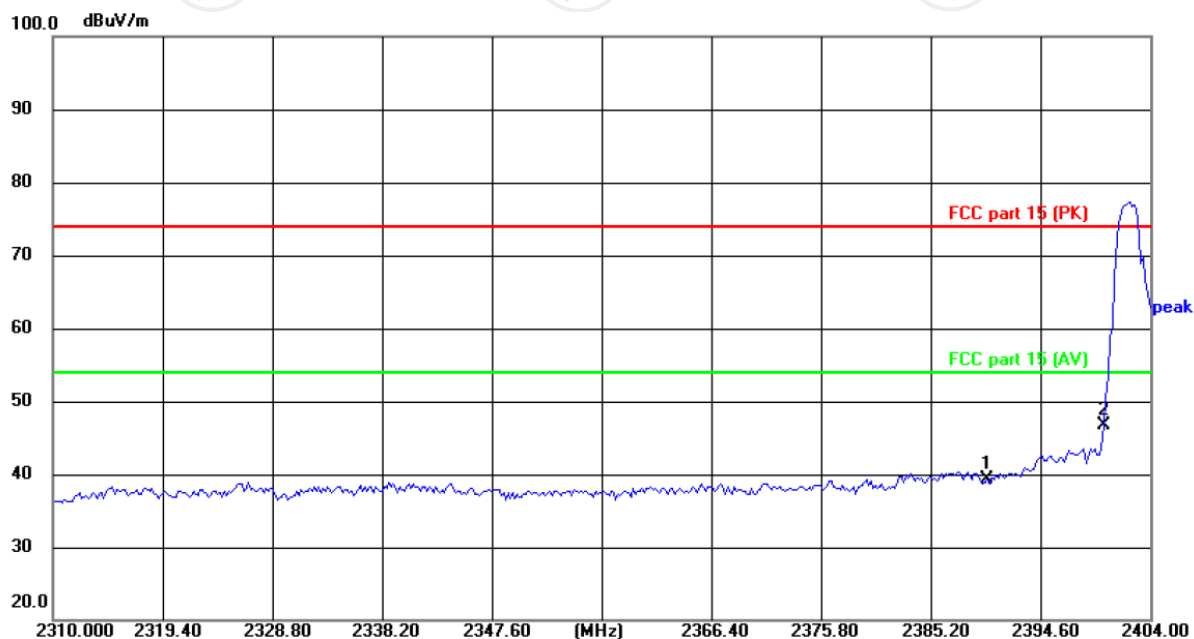
Limit: FCC part 15 (PK)

Power:

Humidity: 55 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2390.000	51.42	-13.15	38.27	74.00	-35.73	peak
2 *	2400.000	53.92	-13.12	40.80	74.00	-33.20	peak

Vertical:



Site

Polarization: **Vertical**

Temperature: 25(°C)

Limit: FCC part 15 (PK)

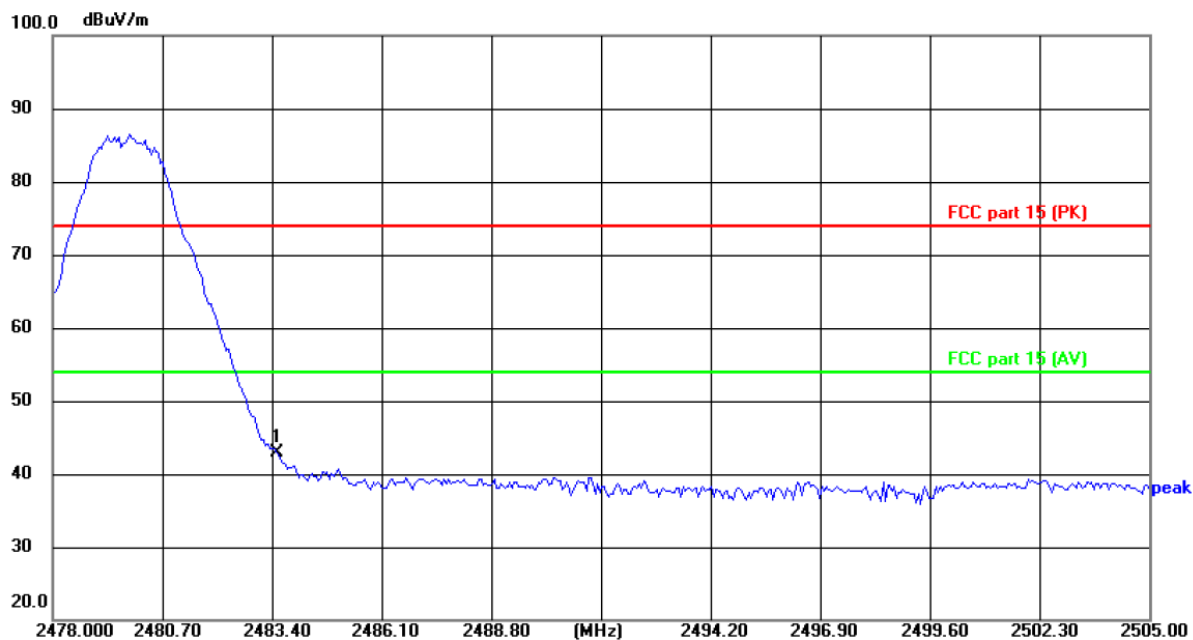
Power:

Humidity: 55 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	2390.000	52.54	-13.15	39.39	74.00	-34.61	peak
2 *	2400.000	59.81	-13.12	46.69	74.00	-27.31	peak

Highest channel 2480:

Horizontal:



Site

Polarization: **Horizontal**

Temperature: 25(°C)

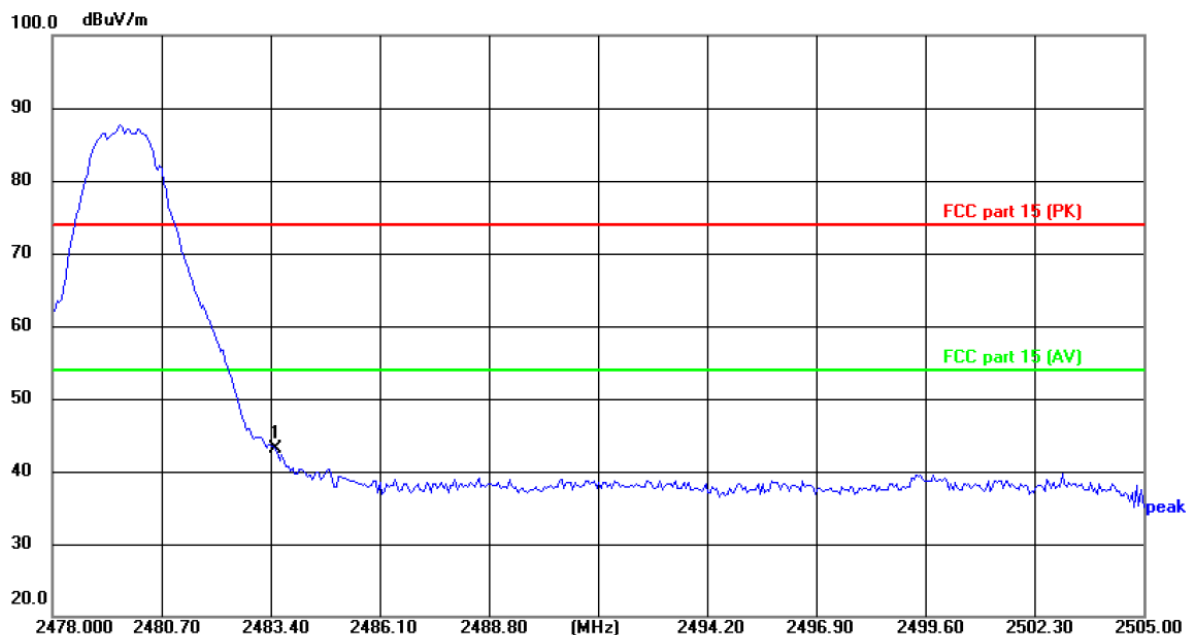
Limit: FCC part 15 (PK)

Power:

Humidity: 55 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	2483.500	55.69	-12.84	42.85	74.00	-31.15	peak

Vertical:



Site

Polarization: **Vertical**

Temperature: 25(°C)

Limit: FCC part 15 (PK)

Power:

Humidity: 55 %

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1 *	2483.500	56.03	-12.84	43.19	74.00	-30.81	peak

Note: Measurements were conducted in all two modulation (GFSK, Pi/4DQPSK), and the worst case Mode (Pi/4DQPSK) was submitted only.

Above 1GHz

Modulation Type: Pi/4DQPSK									
Low channel: 2402 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4804	H	45.27	---	0.66	45.93	---	74	54	-8.07
7206	H	35.54	---	9.5	45.04	---	74	54	-8.96
---	H	---	---	---	---	---	---	---	---
4804	V	43.96	---	0.66	44.62	---	74	54	-9.38
7206	V	36.31	---	9.5	45.81	---	74	54	-8.19
---	V	---	---	---	---	---	---	---	---

Middle channel: 2441 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4882	H	46.63	---	0.99	47.62	---	74	54	-6.38
7323	H	37.44	---	9.87	47.31	---	74	54	-6.69
---	H	---	---	---	---	---	---	---	---
4882	V	45.82	---	0.99	46.81	---	74	54	-7.19
7323	V	37.11	---	9.87	46.98	---	74	54	-7.02
---	V	---	---	---	---	---	---	---	---

High channel: 2480 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dBμV)	AV reading (dBμV)	Correction Factor (dB/m)	Emission Level		Peak limit (dBμV/m)	AV limit (dBμV/m)	Margin (dB)
					Peak (dBμV/m)	AV (dBμV/m)			
4960	H	46.45	---	1.33	47.78	---	74	54	-6.22
7440	H	35.77	---	10.22	45.99	---	74	54	-8.01
---	H	---	---	---	---	---	---	---	---
4960	V	46.93	---	1.33	48.26	---	74	54	-5.74
7440	V	35.59	---	10.22	45.81	---	74	54	-8.19
---	V	---	---	---	---	---	---	---	---

Note:

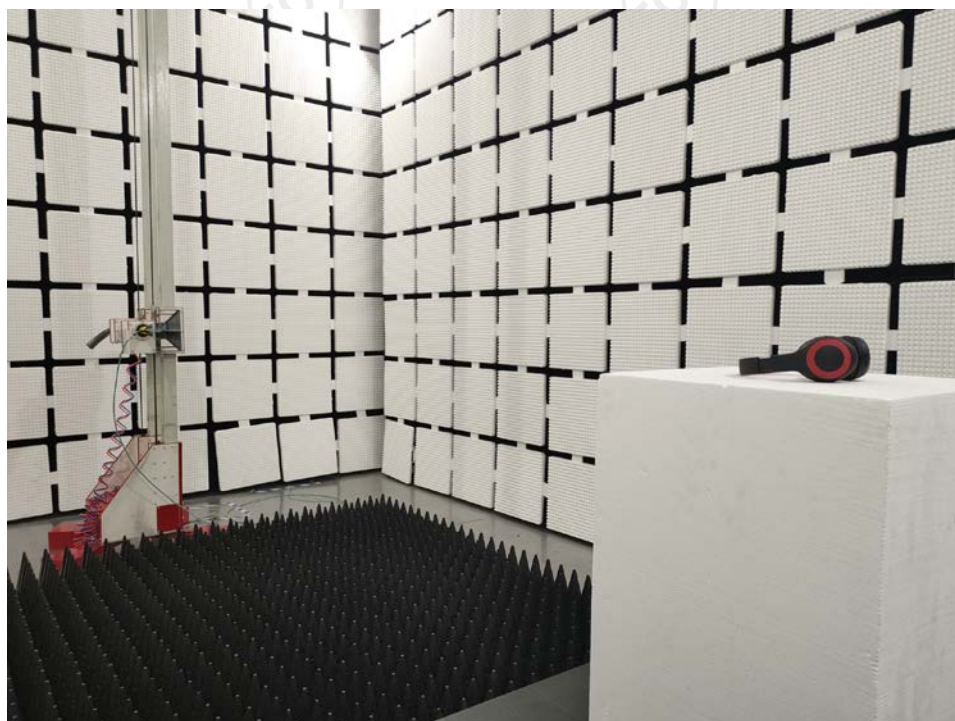
1. Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier
2. Margin (dB) = Emission Level (Peak) (dBμV/m)-Average limit (dBμV/m)
3. The emission levels of other frequencies are very lower than the limit and not show in test report.
4. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency.
5. Data of measurement shown "----" in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.
6. Measurements were conducted in all two modulation (GFSK, Pi/4 DQPSK), and the worst case Mode (Pi/4 DQPSK) was submitted only.
7. All the restriction bands are compliance with the limit of 15.209.

Appendix A: Photographs of Test Setup

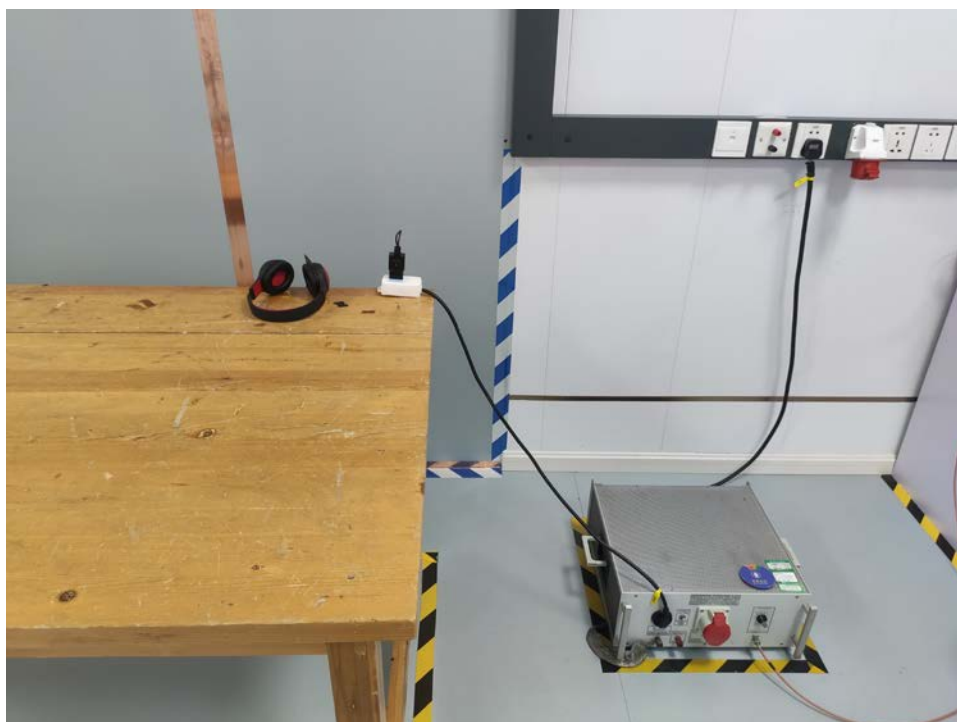
Product: Wireless Headphone

Model: LK20

Radiated Emission



Conducted Emission



Appendix B: Photographs of EUT
Product: Wireless Headphone
Model: LK20
External Photos

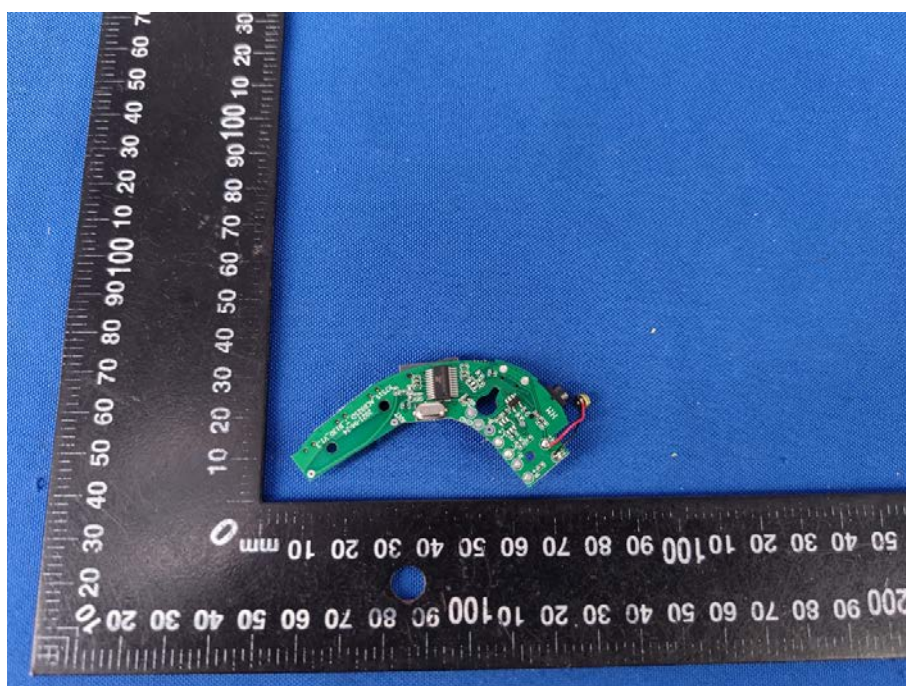
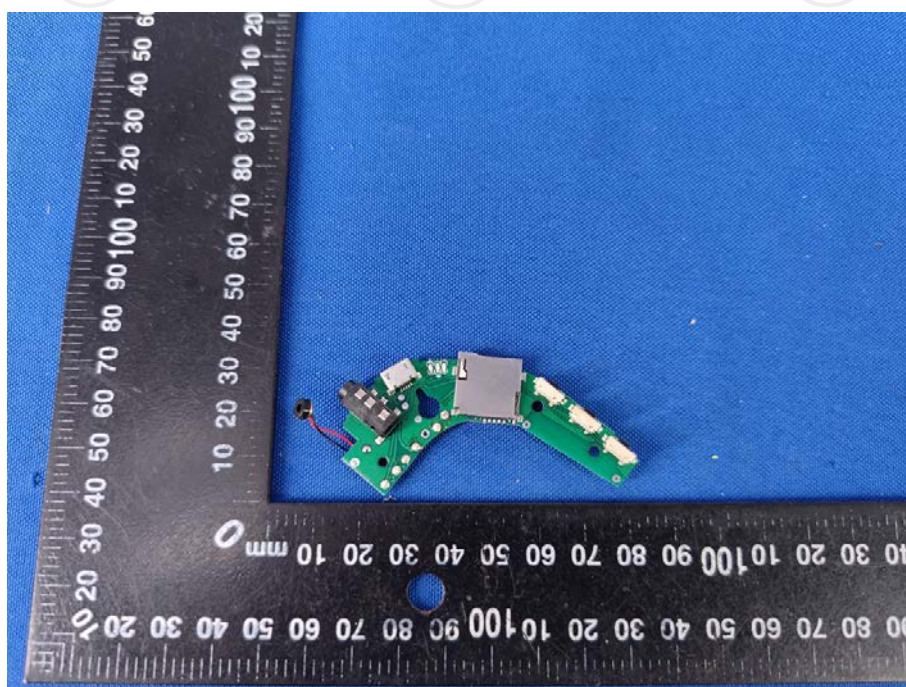


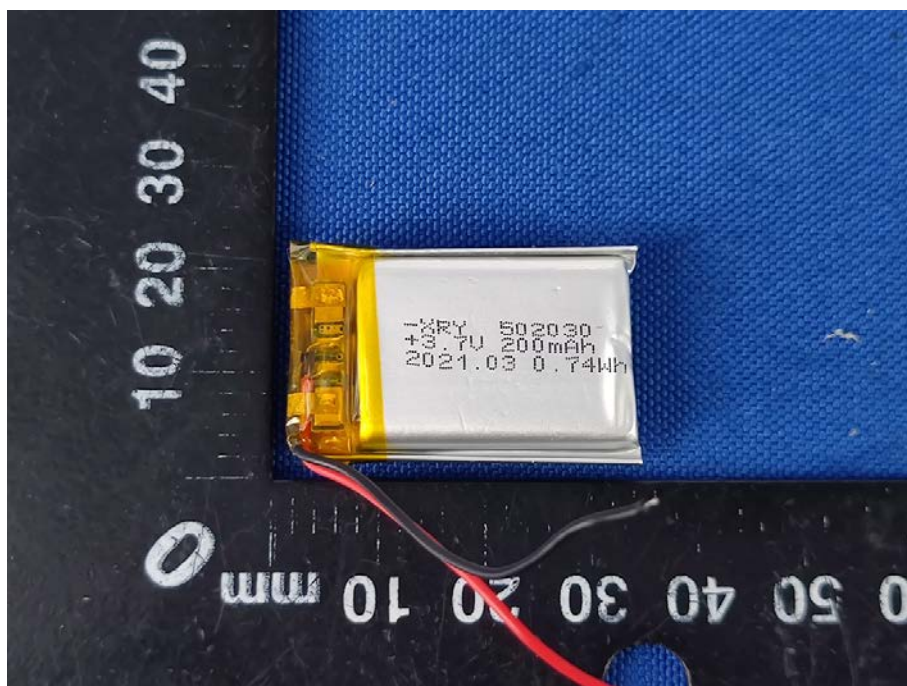
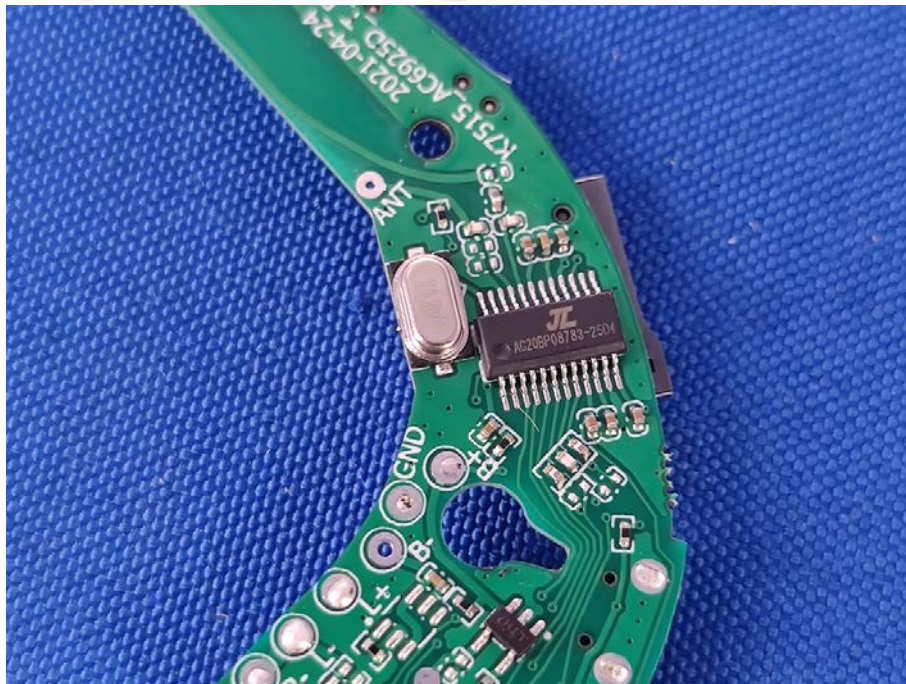


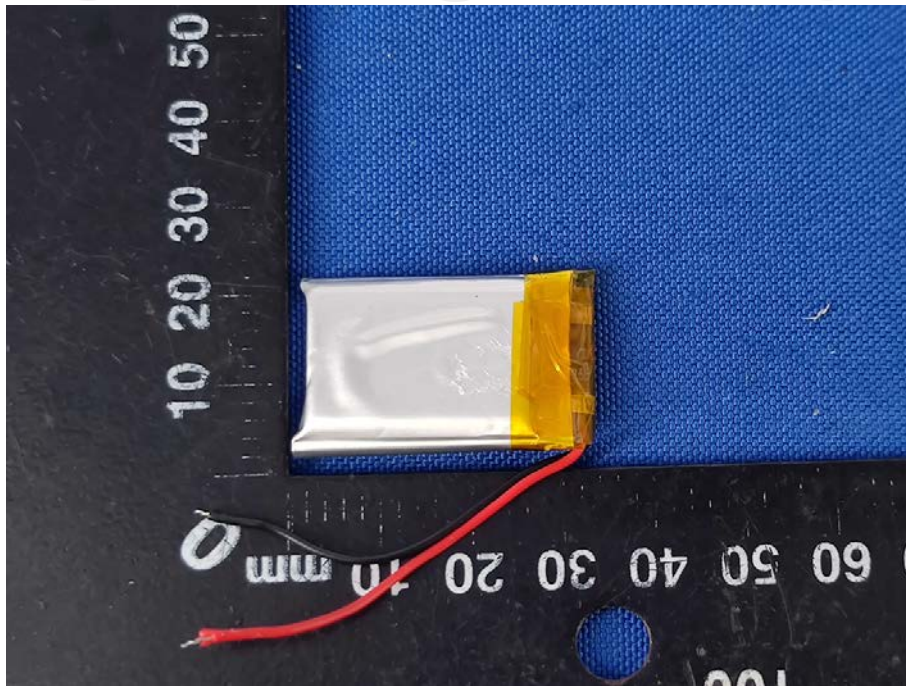


Product: Wireless Headphone
Model: LK20
Internal Photos









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