TEST REPORT

Report No.:	BCTC2406853479-1E
Applicant:	Byrne Electrical Specialists, Inc.
Product Name:	Thesis
Test Model:	BE010566-XX
Tested Date:	2024-06-20 to 2024-07-15
Issued Date:	2024-07-15

Shenzhen BCTC Testing Co., Ltd.

FCC ID: 2AJX5-BE010566

Product Name:	Thesis
Trademark:	Byrne
Model/Type Reference:	BE010566-XX
Prepared For:	Byrne Electrical Specialists, Inc.
Address:	320 BYRNE INDUSTRIAL DR. ROCKFORD, MI 49341
Manufacturer:	Shenzhen Beeste Technology Co., Ltd.
Address:	No.602, Building A, Kangrui Times Square, Dalang Street, Longhua District, Shenzhen CHINA
Prepared By:	Shenzhen BCTC Testing Co., Ltd.
Address:	1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Zhancheng, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China.
Sample Received Date:	2024-06-20
Sample Tested Date:	2024-06-20 to 2024-07-15
Issue Date:	2024-07-15
Report No.:	BCTC2406853479-1E
Test Standards:	FCC Part15.209 ANSI C63.10-2013
Test Results:	PASS

Tested by:

Brave Zeng/ Project Handler

Approved by:

Zero Zhou/Reviewer

The test report is effective only with both signature and specialized stamp. This result(s) shown in this report refer only to the sample(s) tested. Without written approval of Shenzhen BCTC Testing Co., Ltd, this report can't be reproduced except in full. The tested sample(s) and the sample information are provided by the client.

Table Of Content

(Note: N/A Means Not Applicable)

1. Version

Report No.	Issue Date	Description	Approved
BCTC2406853479-1E	2024-07-15	Original	Valid

2. Test Summary

The Product has been tested according to the following specifications:

No.	Test Parameter	Clause No.	Results
1	Conducted Emission	15.207	PASS
2	Radiated Emission	15.209	PASS
3	20dB Bandwidth	15.215	PASS
4	Antenna Requirement	15.203	PASS

3. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Uncertainty
1	3m chamber Radiated spurious emission(30MHz-1GHz)	U=4.3dB
2	Conducted Emission (150kHz-30MHz)	U=3.2dB
3	humidity uncertainty	U=5.3%
4	Temperature uncertainty	U=0.59℃

4. Product Information And Test Setup

4.1 Product Information

Model/Type Reference:	BE010566-XX
Model Differences:	N/A
Hardware Version:	N/A
Software Version:	N/A
Modulation:	ASK
Operation Frequency:	115kHz-205kHz
Antenna installation:	loop coil antenna
Ratings:	Input: USB-C 1:5V/3A,9V3A,12V/3A,15V/3A,20V/5A Output: USB-C 1:3.3V-21V/5A USB-C 2:3.3V-21V/5A USB-C 3: 5V/3A, 9V/2.22A, 12V/1.67A USB-A:5V2.4A Wireless Charging:15W/10W/7.5W/5W

4.2 Support Equipment

No.	Device Type	Brand	Model	Series No.	Note
E-1	Mobile Power	Byrne	BE010566-XX	N/A	EUT
E-2	Adapter	---	---	N/A	Auxiliary
E-3	Wireless charging load	---	---	N/A	Auxiliary

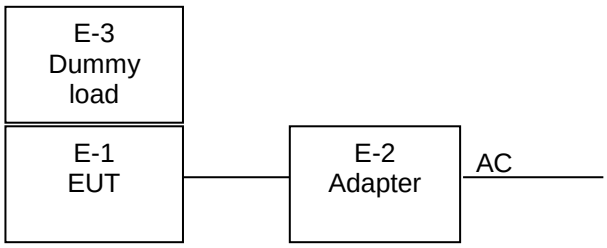
Notes:
1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

4.3 Test Setup Configuration

See test photographs attached in *EUT TEST SETUP PHOTOGRAPHS* for the actual connections between Product and support equipment.

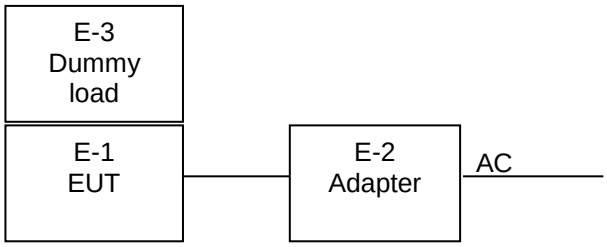
Conducted Emission:

Test Mode 1, 2, 3

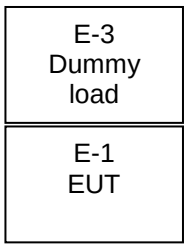


Radiated Spurious Emission:

Test Mode 1, 2, 3



Test Mode 4, 5, 6



4.4 Test Mode

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

AC Mode	Mode 1	Charging+Full Load
	Mode 2	Charging+Half Load
	Mode 3	Charging+Null Load
DC Mode	Mode 4	Full Load
	Mode 5	Half Load
	Mode 6	Null Load

Note:
1)All test mode were tested and passed, only shows the worst case mode which were recorded in this report.

2) The prototype has two different battery output voltages, one is DC 21.6V, and the other is DC 22.14V. The difference test is carried out on the two different battery voltages, and the data only reflects the worst battery voltage, which is 22.14V.

5. Test Facility And Test Instrument Used

5.1 Test Facility

All measurement facilities used to collect the measurement data are located at Shenzhen BCTC Testing Co., Ltd. Address:1-2/F., Building B, Pengzhou Industrial Park, No.158, Fuyuan 1st Road, Zhancheng, Fuhai Subdistrict, Bao'an District, Shenzhen, Guangdong, China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards.
FCC Test Firm Registration Number: 712850
A2LA certificate registration number is: CN1212
ISED Registered No.: 23583
ISED CAB identifier: CN0017

5.2 Test Instrument Used

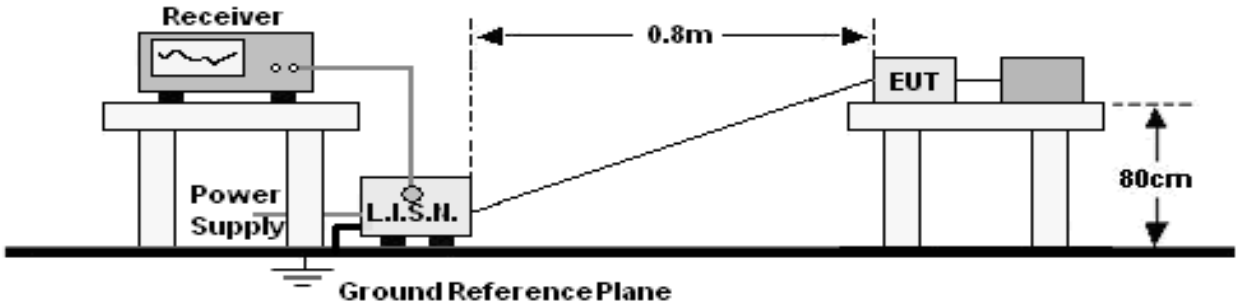
Conducted Emissions Test					
Equipment	**Manufacturer**	**Model#**	**Serial#**	**Last Cal.**	**Next Cal.**
Receiver	R&S	ESR3	102075	May 16, 2024	May 15, 2025
LISN	R&S	ENV216	101375	May 16, 2024	May 15, 2025
Software	Frad	EZ-EMC	EMC-CON 3A1	\	\
Pulse limiter	Schwarzbeck	VTSD9561-F	01323	May 16, 2024	May 15, 2025

RF Conducted Test					
Equipment	**Manufacturer**	**Model#**	**Serial#**	**Last Cal.**	**Next Cal.**
Power Meter	Keysight	E4419	\	May 16, 2024	May 15, 2025
Power Sensor (AV)	Keysight	E9300A	\	May 16, 2024	May 15, 2025
Signal Analyzer 20kHz-26.5GHz	Keysight	N9020A	MY49100060	May 16, 2024	May 15, 2025
Spectrum Analyzer 9kHz-40GHz	R&S	FSP 40	\	May 16, 2024	May 15, 2025

Radiated Emissions Test (966 Chamber01)					
Equipment	**Manufacturer**	**Model#**	**Serial#**	**Last Cal.**	**Next Cal.**
966 chamber	ChengYu	966 Room	966	May 16, 2024	May 15, 2025
Receiver	R&S	ESR3	102075	May 16, 2024	May 15, 2025
Receiver	R&S	ESRP	101154	May 16, 2024	May 15, 2025
Amplifier	Schwarzbeck	BBV9744	9744-0037	May 16, 2024	May 15, 2025
TRILOG Broadband Antenna	Schwarzbeck	VULB9163	942	May 21, 2024	May 20, 2025
Loop Antenna(9KHz -30MHz)	Schwarzbeck	FMZB1519B	00014	May 21, 2024	May 20, 2025
Amplifier	SKET	LAPA_01G18G-45dB	SK2021040901	May 16, 2024	May 15, 2025
Horn Antenna	Schwarzbeck	BBHA9120D	1541	May 21, 2024	May 20, 2025
Amplifier(18GHz-40GHz)	MITEQ	TTA1840-35-HG	2034381	May 16, 2024	May 15, 2025
Horn Antenna(18GHz-40GHz)	Schwarzbeck	BBHA9170	00822	May 21, 2024	May 20, 2025
Spectrum Analyzer9kHz-40GHz	R&S	FSP40	100363	May 16, 2024	May 15, 2025
Software	Frad	EZ-EMC	FA-03A2 RE	\	\

6. Conducted Emissions

6.1 Block Diagram Of Test Setup



6.2 Limit

Frequency (MHz)	Limit (dBuV)	
	Quas-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00
Notes: 1. *Decreasing linearly with logarithm of frequency. 2. The lower limit shall apply at the transition frequencies.		

6.3 Test procedure

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

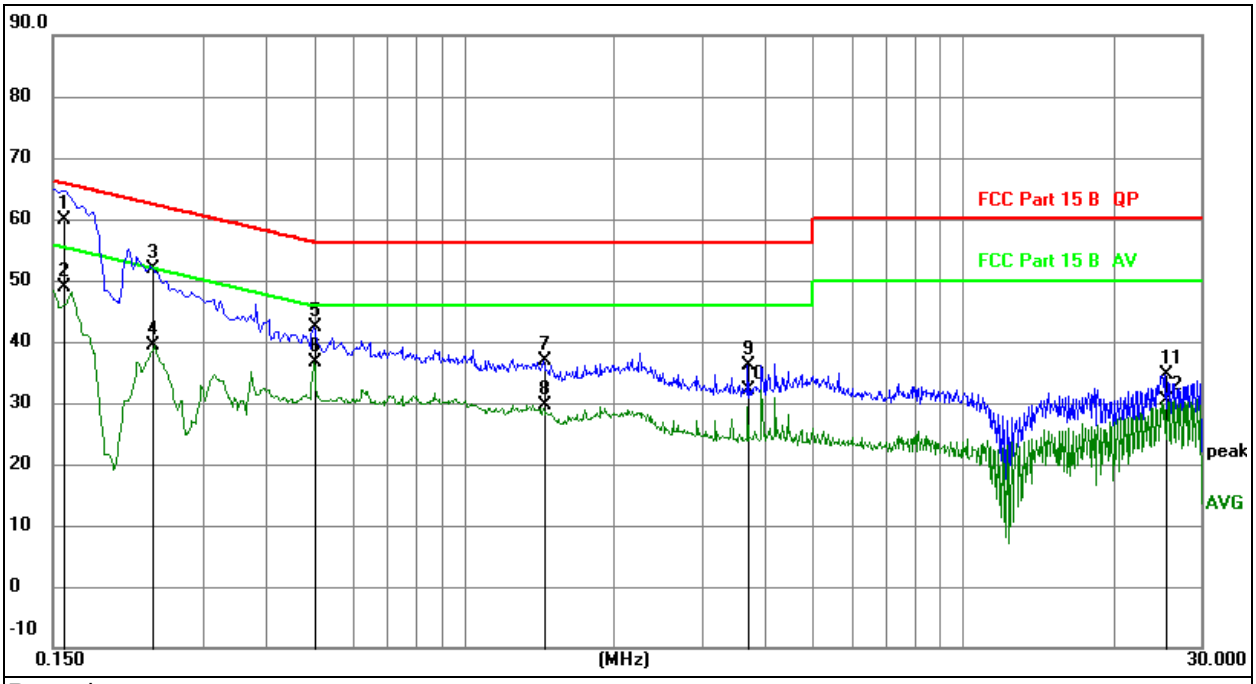
a. The Product was placed on a nonconductive table 0.8 m above the horizontal ground reference plane, and 0.4 m from the vertical ground reference plane, and connected to the main through Line Impedance Stability Network (L.I.S.N).
b. The RBW of the receiver was set at 9 kHz in 150 kHz ~ 30MHz with Peak and AVG detector in Max Hold mode. Run the receiver's pre-scan to record the maximum disturbance generated from Product in all power lines in the full band.
c. For each frequency whose maximum record was higher or close to limit, measure its QP and AVG values and record.

6.4 EUT operating Conditions

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

6.5 Test Result

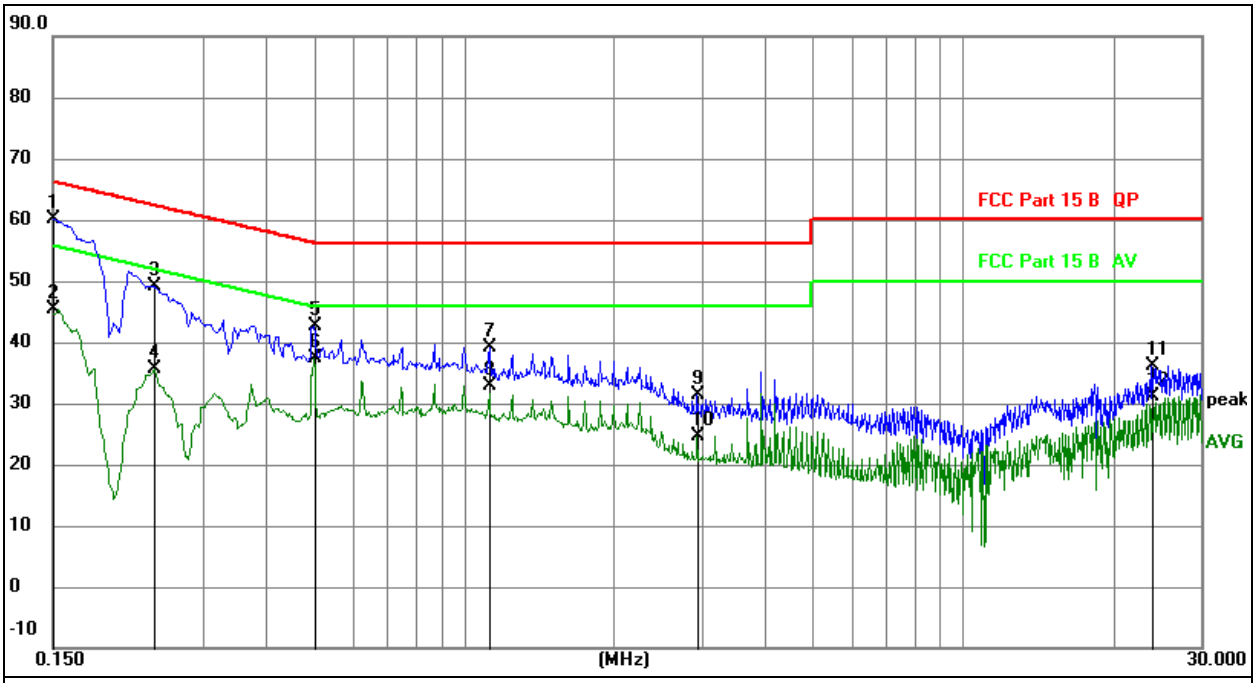
Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101KPa	Phase :	L
Test Mode:	Mode 1	Test Voltage:	AC 120V/60Hz



Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.
3. Measurement = Reading Level + Correct Factor
4. Over = Measurement - Limit

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz		dB	dBuV	dBuV	dB	Detector
1	*	0.1580	39.84	20.07	59.91	65.57	-5.66	QP
2		0.1580	28.83	20.07	48.90	55.57	-6.67	AVG
3		0.2378	31.75	20.07	51.82	62.17	-10.35	QP
4		0.2378	19.24	20.07	39.31	52.17	-12.86	AVG
5		0.5010	22.18	20.08	42.26	56.00	-13.74	QP
6		0.5010	16.66	20.08	36.74	46.00	-9.26	AVG
7		1.4460	16.70	20.09	36.79	56.00	-19.21	QP
8		1.4460	9.58	20.09	29.67	46.00	-16.33	AVG
9		3.7050	16.06	20.13	36.19	56.00	-19.81	QP
10		3.7050	12.04	20.13	32.17	46.00	-13.83	AVG
11		25.5660	14.25	20.30	34.55	60.00	-25.45	QP
12		25.5660	10.02	20.30	30.32	50.00	-19.68	AVG

Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101KPa	Phase :	N
Test Mode:	Mode 1	Test Voltage:	AC 120V/60Hz



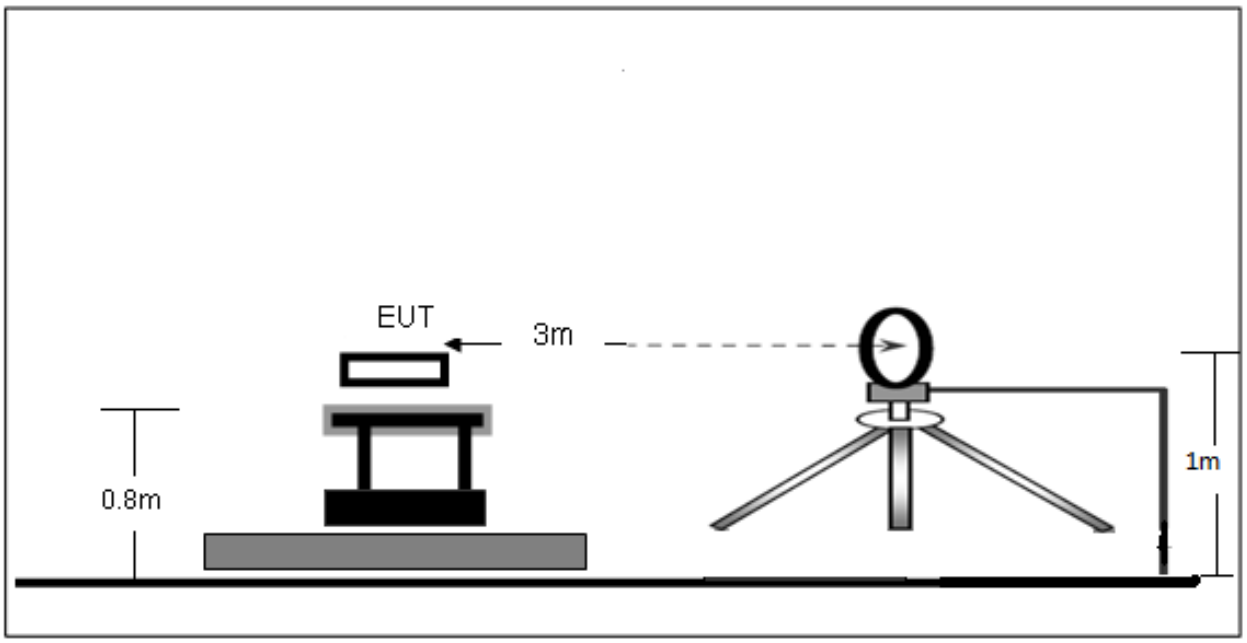
Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.
3. Measurement = Reading Level + Correct Factor
4. Over = Measurement - Limit

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz		dB	dBuV	dBuV	dB	Detector
1	*	0.1500	40.12	20.07	60.19	66.00	-5.81	QP
2		0.1500	25.24	20.07	45.31	56.00	-10.69	AVG
3		0.2400	29.11	20.07	49.18	62.10	-12.92	QP
4		0.2400	15.62	20.07	35.69	52.10	-16.41	AVG
5		0.5010	22.58	20.08	42.66	56.00	-13.34	QP
6		0.5010	17.23	20.08	37.31	46.00	-8.69	AVG
7		1.1265	18.96	20.09	39.05	56.00	-16.95	QP
8		1.1265	12.89	20.09	32.98	46.00	-13.02	AVG
9		2.9355	11.32	20.12	31.44	56.00	-24.56	QP
10		2.9355	4.58	20.12	24.70	46.00	-21.30	AVG
11		24.0000	15.92	20.31	36.23	60.00	-23.77	QP
12		24.0000	10.75	20.31	31.06	50.00	-18.94	AVG

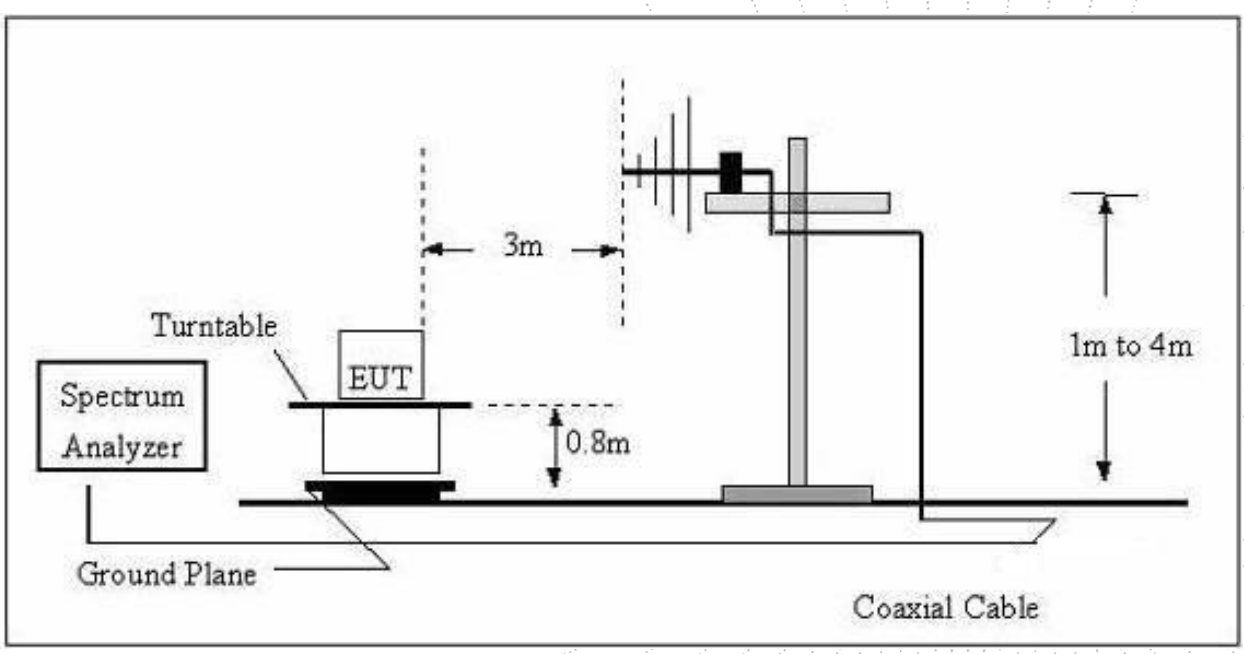
7. Radiated Emissions

7.1 Block Diagram Of Test Setup

（A）Radiated Emission Test-Up Frequency Below 30MHz



（B）Radiated Emission Test-Up Frequency 30MHz~1GHz



7.2 Limit

FCC §15.209; §15.205.

Test Standard	FCC Part15 C Section 15.209 and 15.205				
Test Limit	Frequency (MHz)	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~1000MHz	500	54.0	Quasi-peak	3
	Above 1000MHz	500	54.0	Average	3
		-	74.0	Peak	3

7.3 Test procedure

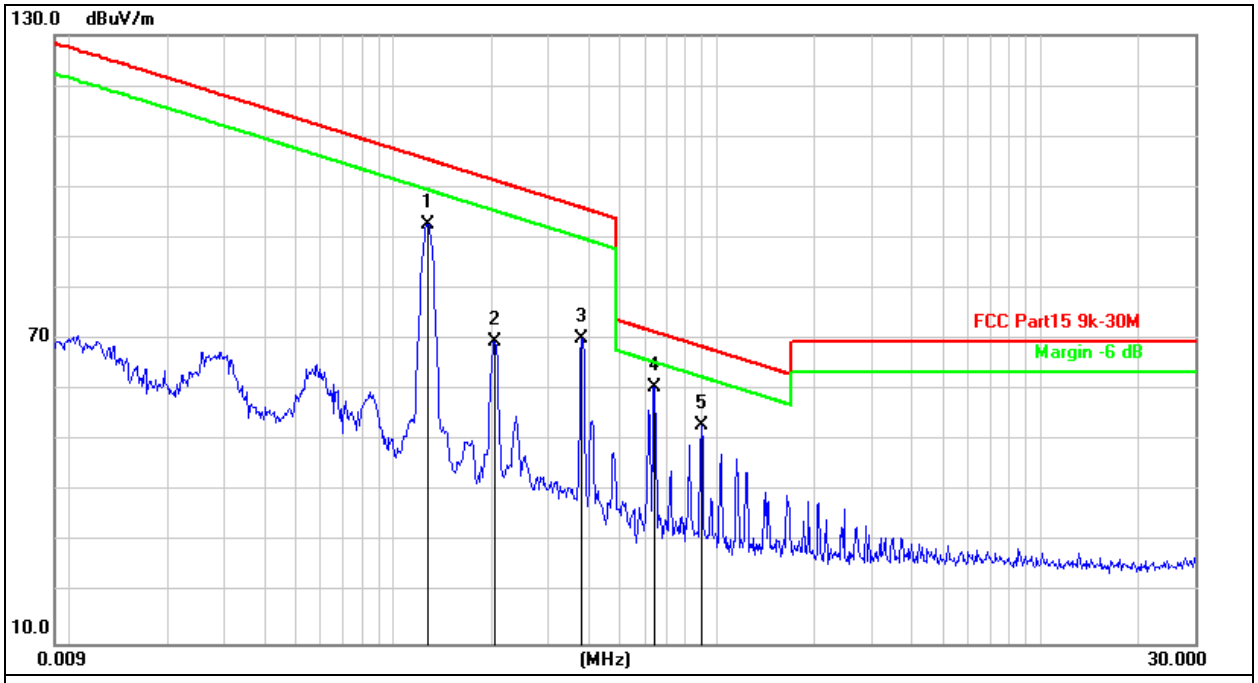
Receiver Parameter	Setting
Attenuation	Auto
9kHz~150kHz	RBW 200Hz for QP
150kHz~30MHz	RBW 9kHz for QP
30MHz~1000MHz	RBW 120kHz for QP

Below 1GHz test procedure as below:
a. 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.
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.
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 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.
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.
Above 1GHz test procedure as below:
g. Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 metre to 1.5 metre(Above 18GHz the distance is 1 meter and table is 1.5 metre).
h. Test the EUT in the lowest channel ,the middle channel ,the Highest channel.
Note: Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

7.4 Test Result

9kHz-30MHz

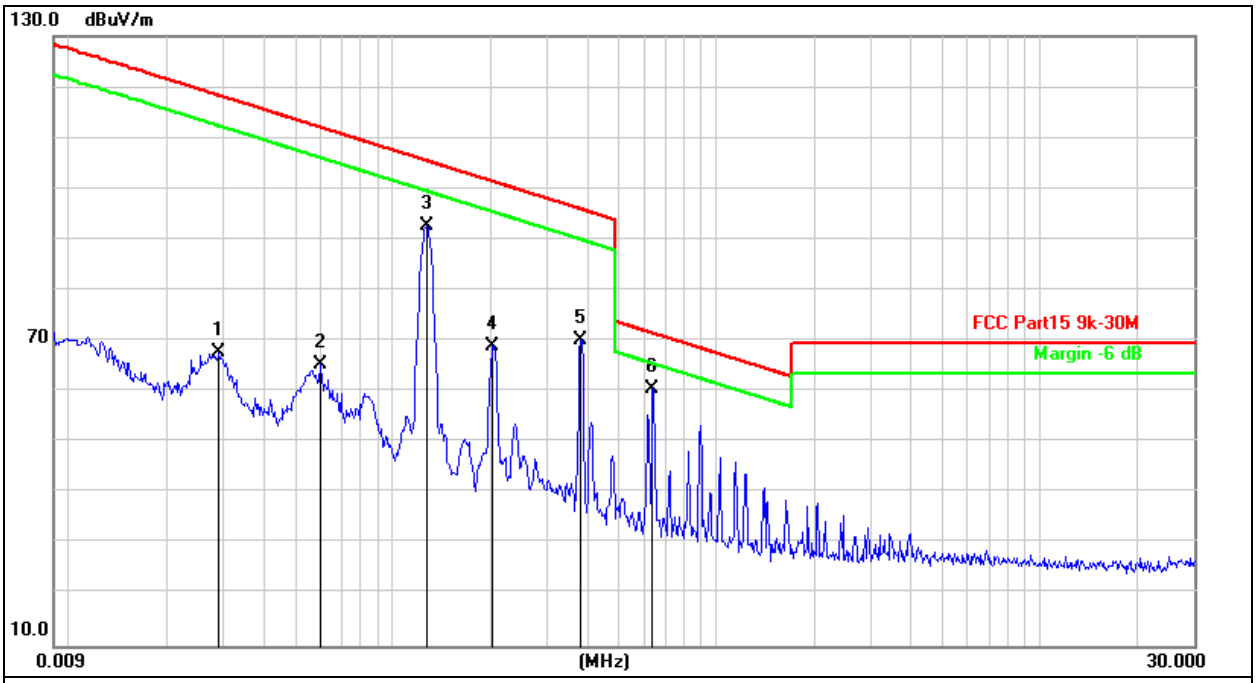
Temperature:	26℃	Relative Humidity:	54%
Pressure:	101 kPa	Test Voltage:	AC 120V/60Hz
Test Mode:	Mode 1	Polarization:	Coaxial(Worst)



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		0.1276	100.30	-7.54	92.76	105.4	-12.73	peak
2		0.2061	77.44	-7.78	69.66	101.3	-31.66	peak
3		0.3818	77.86	-7.65	70.21	95.97	-25.76	peak
4	*	0.6416	67.95	-7.42	60.53	71.47	-10.94	peak
5		0.8948	60.51	-7.36	53.15	68.58	-15.43	peak

Note: Both Coaxial and Coplanar are tested to reflect only the worst-mode data, which is Coaxia.

Temperature:	26℃	Relative Humidity:	54%
Pressure:	101 kPa	Test Voltage:	DC 22.14V
Test Mode:	Mode 4	Polarization:	Coaxial(Worst)

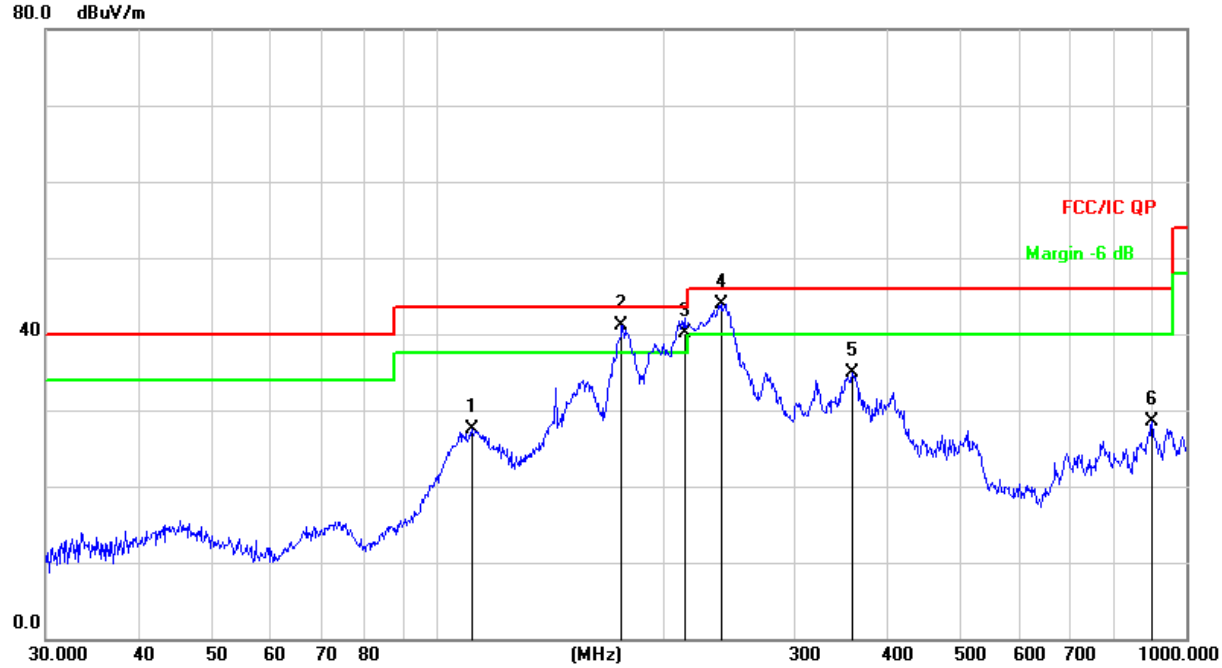


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		0.0292	75.23	-7.43	67.80	118.3	-50.50	peak
2		0.0601	72.72	-7.49	65.23	112.0	-46.80	peak
3		0.1276	100.10	-7.54	92.56	105.4	-12.93	peak
4		0.2044	76.79	-7.78	69.01	101.3	-32.38	peak
5		0.3818	77.75	-7.65	70.10	95.97	-25.87	peak
6	*	0.6363	68.02	-7.43	60.59	71.54	-10.95	peak

Note: Both Coaxial and Coplanar are tested to reflect only the worst-mode data, which is Coaxia.

Between 30MHz – 1GHz

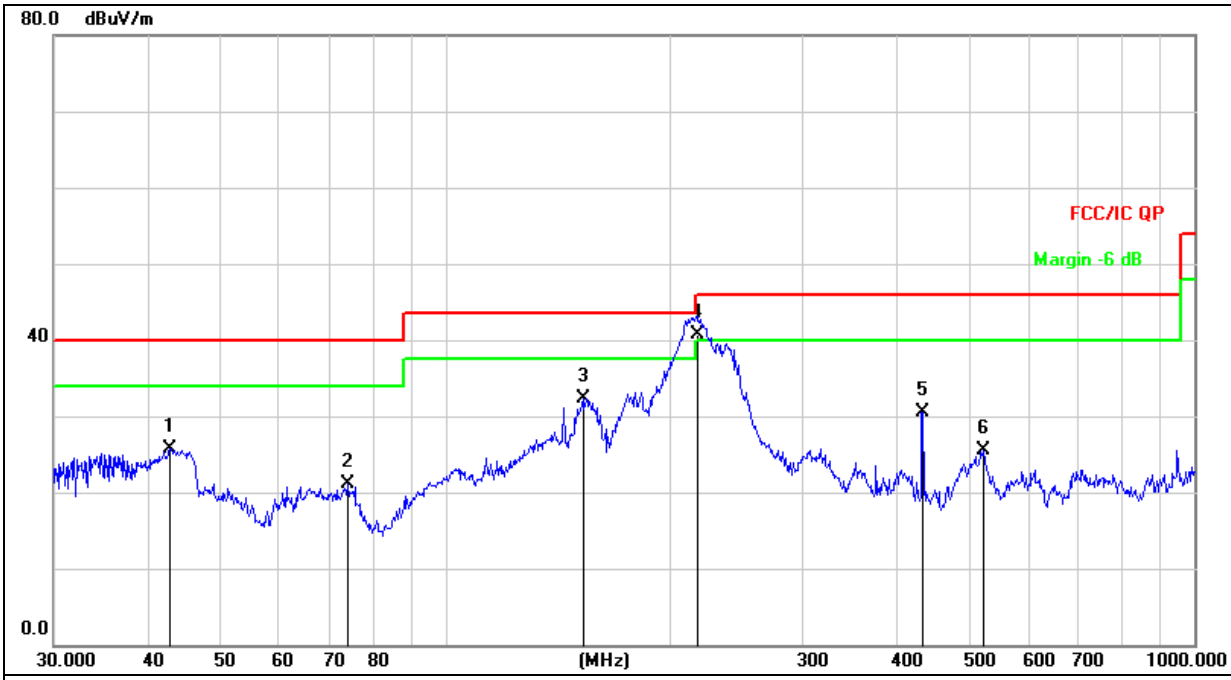
Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101KPa	Phase:	Horizontal
Test Mode:	Mode 1	Test Voltage:	AC 120V/60Hz



Remark:
1. Factor = Antenna Factor + Cable Loss – Pre-amplifier.
2. Measurement = Reading Level + Correct Factor
3. Over = Measurement - Limit

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		111.3468	44.24	-16.72	27.52	43.50	-15.98	QP
2	!	176.2686	58.64	-17.48	41.16	43.50	-2.34	QP
3	!	213.7834	55.44	-15.33	40.11	43.50	-3.39	QP
4	*	239.1473	58.56	-14.60	43.96	46.00	-2.04	QP
5		357.9286	46.23	-11.38	34.85	46.00	-11.15	QP
6		900.1472	31.64	-3.12	28.52	46.00	-17.48	QP

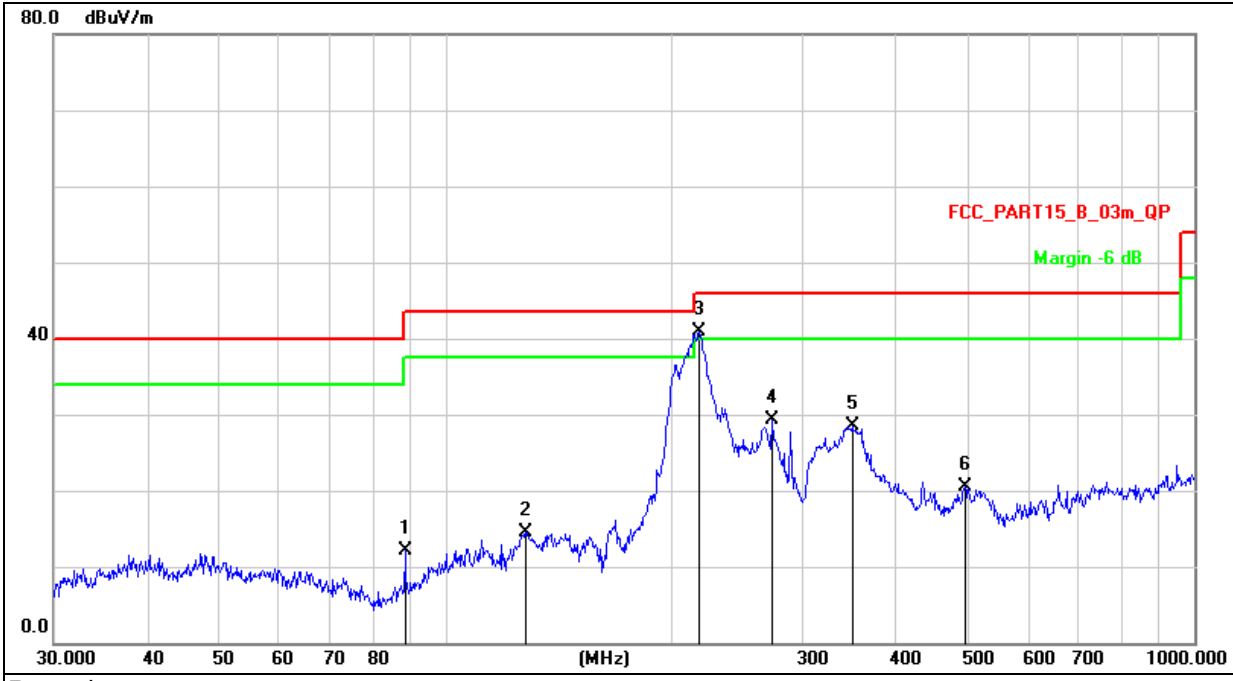
Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101KPa	Phase :	Vertical
Test Mode:	Mode 1	Test Voltage:	AC 120V/60Hz



Remark:
1. Factor = Antenna Factor + Cable Loss – Pre-amplifier.
2. Measurement = Reading Level + Correct Factor
3. Over = Measurement - Limit

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		42.8997	40.25	-14.48	25.77	40.00	-14.23	QP
2		74.1350	39.82	-18.72	21.10	40.00	-18.90	QP
3		152.6640	51.58	-19.23	32.35	43.50	-11.15	QP
4	*	216.5628	56.04	-15.25	40.79	46.00	-5.21	QP
5		434.0650	40.66	-10.17	30.49	46.00	-15.51	QP
6		522.7179	34.89	-9.41	25.48	46.00	-20.52	QP

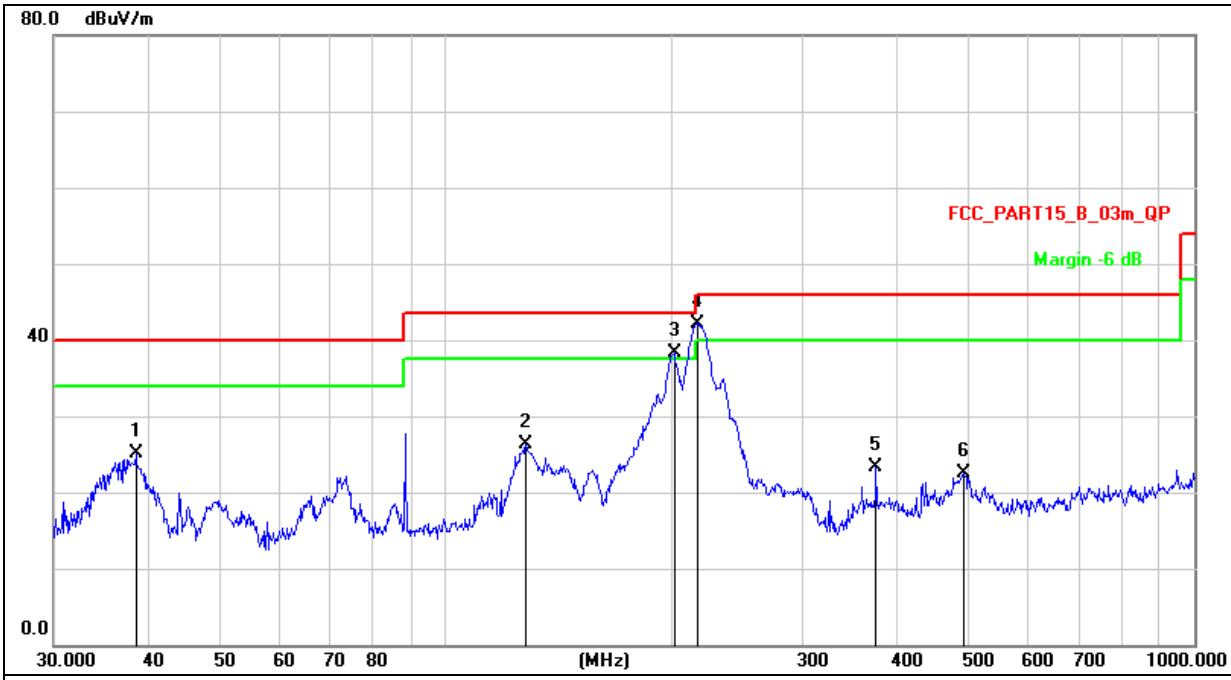
Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101KPa	Phase :	Horizontal
Test Mode:	Mode 4	Test Voltage:	DC 22.14V



Remark:
1. Factor = Antenna Factor + Cable Loss – Pre-amplifier.
2. Measurement = Reading Level + Correct Factor
3. Over = Measurement - Limit

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		88.3421	29.92	-17.79	12.13	43.50	-31.37	QP
2		128.1130	32.40	-17.90	14.50	43.50	-29.00	QP
3	*	218.3085	56.07	-15.20	40.87	46.00	-5.13	QP
4		273.2341	43.20	-13.80	29.40	46.00	-16.60	QP
5		349.2500	39.98	-11.51	28.47	46.00	-17.53	QP
6		494.1983	29.28	-8.75	20.53	46.00	-25.47	QP

Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	101KPa	Phase :	Vertical
Test Mode:	Mode 4	Test Voltage:	DC 22.14V



Remark:
1. Factor = Antenna Factor + Cable Loss – Pre-amplifier.
2. Measurement = Reading Level + Correct Factor
3. Over = Measurement - Limit

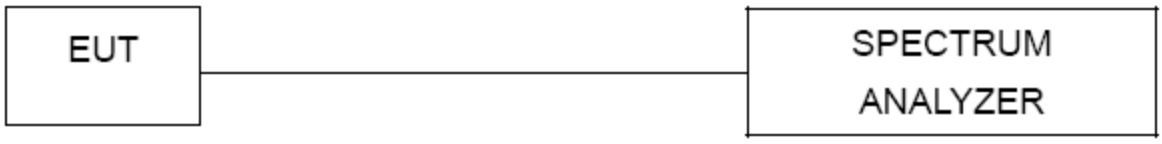
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		38.6160	40.11	-14.99	25.12	40.00	-14.88	QP
2		128.1130	44.13	-17.90	26.23	43.50	-17.27	QP
3	!	202.1005	53.91	-15.66	38.25	43.50	-5.25	QP
4	*	216.7828	57.35	-15.24	42.11	46.00	-3.89	QP
5		375.9384	34.46	-11.15	23.31	46.00	-22.69	QP
6		492.4685	31.31	-8.80	22.51	46.00	-23.49	QP

8. Bandwidth Test

8.1 Test Procedure

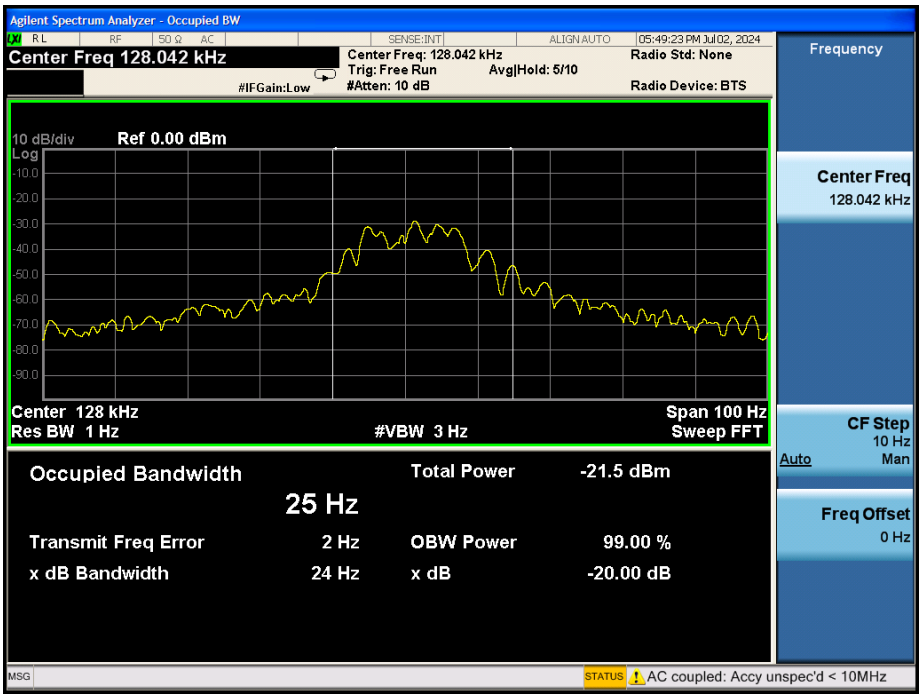
1. Set RBW = 1%~5% OBW.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

8.2 Test Setup



8.3 Test Result

Frequency (kHz)	20dB bandwidth (kHz)	Result
128	0.024	Pass



9. Antenna Requirements

9.1 Limit

For intentional device, according to FCC 47 CFR Section 15.203, An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

9.2 Test Result

The antenna used for this product is Inductive Loop coil antenna.

10. EUT Photographs

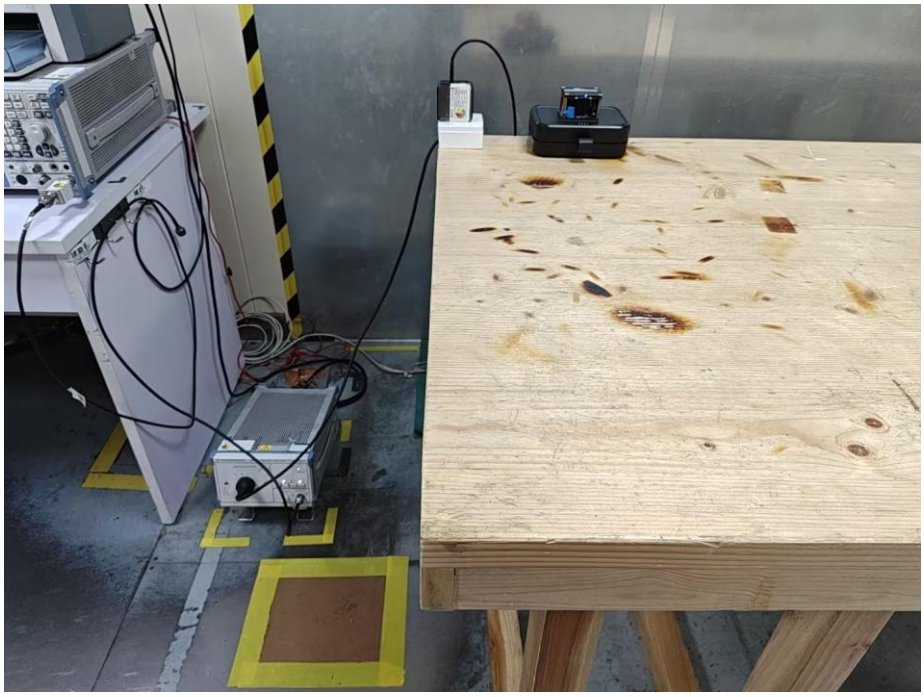
EUT Photo 1

EUT Photo 1

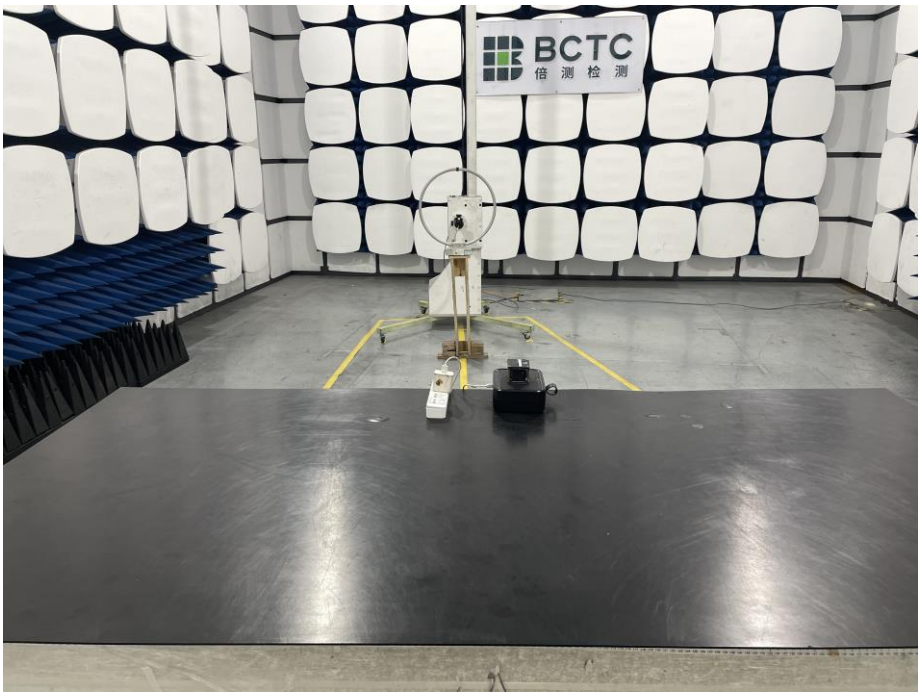
NOTE: Appendix-Photographs Of EUT Constructional Details

11. EUT Test Setup Photographs

Conducted emissions



Radiated Measurement Photos
9kHz-30MHz



30MHz-1GHz

STATEMENT

1. The equipment lists are traceable to the national reference standards.

2. The test report can not be partially copied unless prior written approval is issued from our lab.

3. The test report is invalid without the "special seal for inspection and testing".

4. The test report is invalid without the signature of the approver.

5. The test process and test result is only related to the Unit Under Test.

6. Sample information is provided by the client and the laboratory is not responsible for its authenticity.

7. The quality system of our laboratory is in accordance with ISO/IEC17025.

8. If there is any objection to this test report, the client should inform issuing laboratory within 15 days from the date of receiving test report.

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