CFR 47 FCC PART 15 SUBPART C

TEST REPORT

For

Bluetooth Speaker

MODEL NUMBER: BT2939

REPORT NUMBER: E04A23080261F01001

ISSUE DATE: Dec. 15, 2023

FCC ID: 2BC7S-BT2939

Prepared for

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Revision History

Rev.	Issue Date	Revisions	Revised By
V0	Dec. 15, 2023	Initial Issue	Dyson

Summary of Test Results

Test Item	Clause	Limit/Requirement	Result
Antenna Requirement	N/A	FCC Part 15.203/15.247 (c)	Pass
AC Power Line Conducted Emission	ANSI C63.10-2013 Clause 6.2	FCC Part 15.207	Pass
Conducted Output Power	ANSI C63.10-2013 Clause 7.8.5	FCC Part 15.247 (b)(1)	Pass
20 dB Bandwidth	ANSI C63.10-2013 Clause 6.9.2	FCC Part 15.247 (a)(1)	Pass
Carrier Hopping Channel Separation	ANSI C63.10-2013 Clause 7.8.2	FCC Part 15.247 (a)(1)	Pass
Number of Hopping Frequency	ANSI C63.10-2013 Clause 7.8.3	FCC Part 15.247 (b)(1)	Pass
Time of Occupancy (Dwell Time)	ANSI C63.10-2013 Clause 7.8.4	FCC Part 15.247 (a)(1)	Pass
Conducted Bandedge and Spurious Emission	ANSI C63.10-2013 Clause 6.10.4 & Clause 7.8.8	FCC Part 15.247(d)	Pass
Radiated Band edge and Spurious Emission	ANSI C63.10-2013 Clause 6.3 & 6.5 & 6.6	FCC Part 15.205/15.209	Pass
Duty Cycle	ANSI C63.10-2013, Clause 11.6	None; for reporting purposes only.	Pass

*This test report is only published to and used by the applicant, and it is not for evidence purpose in China.
*The measurement result for the sample received is <Pass> according to <CFR 47 FCC PART 15 SUBPART C (DSS)> when <Accuracy Method> decision rule is applied.

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1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name:	Shenzhen KAFEIN intelligent technology co.,ltd
Address:	Bohua Tech Park,Shangwei Industrial Zone,Zhangken Path,Guanhu Street,Longhua Street,Shenzhen,China

Manufacturer Information

Company Name:	Shenzhen KAFEIN intelligent technology co.,ltd
Address:	Bohua Tech Park,Shangwei Industrial Zone,Zhangken Path,Guanhu Street,Longhua Street,Shenzhen,China

EUT Information

Product Description:	Bluetooth Speaker
Model:	BT2939
Serial Model:	N/A
Brand:	N/A
Sample Received Date:	Aug. 09, 2023
Sample Status:	Normal
Sample ID:	A23080261 003
Date of Tested:	Aug. 09, 2023 to Dec. 15, 2023

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 FCC PART 15 SUBPART C **ISED RSS-247 ISSUE 2 (DSS)**	**Pass**

Prepared By:

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Project Engineer

Checked By:

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Approved By:

Tiger Xu

Tiger Xu

Laboratory Supervisor

2. TEST METHODOLOGY

All tests were performed in accordance with the standard CFR 47 FCC PART 15 SUBPART C (DSS)

3. FACILITIES AND ACCREDITATION

Accreditation Certificate	**A2LA (Certificate No.: 4422.01)** Dong Guan Anci Electronic Technology Co., Ltd. has been assessed and proved to be in compliance with A2LA. **FCC (FCC Designation No.: CN1230)** DongGuan Anci Electronic Technology Co., Ltd. has been recognized to perform compliance testing on equipment subject to Supplier's Declaration of Conformity (SDoC) and Certification rules **ISED (Company No.: 22768)** DONGGUAN ANCI ELECTRONIC TECHNOLOGY CO.,LTD has been registered and fully described in a report filed with ISED. The Company Number is 22768 and the test lab Conformity Assessment Body Identifier (CABID) is CN0079.

Note: All tests measurement facilities use to collect the measurement data are located at 1-2 Floor, Building A, No. 11, Headquarters 2 Road Songsha Lake, Hi-tech Industrial Development Zone, Dongguan, China

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations and is traceable to recognized national standards.

4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test Items	k	Uncertainty
DTS Bandwidth	1.96	±9.2 PPM
20dB Emission Bandwidth	1.96	±9.2 PPM
Carrier Frequency Separation	1.96	±9.2 PPM
Time of Occupancy	1.96	±0.57%
Conducted Output Power	1.96	±1.5 dB
Power Spectral Density Level	1.96	±1.9 dB
Conducted Spurious Emission	1.96	9 kHz-30 MHz: ± 0.95 dB 30 MHz-1 GHz: ± 1.5 dB 1GHz-12.75GHz: ± 1.8 dB 12.75 GHz-26.5 GHz: ± 2.1dB
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.		

Test Item	Measurement Frequency Range	K	U(dB)
Conducted emissions from the AC mains power ports (AMN)	150 kHz ~ 30 MHz	2	3.37
Radiated emissions	9 kHz ~ 30 MHz	2	4.16
Radiated emissions	30 MHz ~ 1 GHz	2	3.79
Radiated emissions	1 GHz ~ 18 GHz	2	5.62
Radiated emissions	18 GHz ~ 40 GHz	2	5.54
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.			

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

EUT Name		Bluetooth Speaker
Model		BT2939
Hardware Version		V1.0
Software Version		V1.0
Ratings		DC 5V
Power Supply	DC	5V
	Battery	DC 3.7V, 1200mAh

Frequency Band:	2400 MHz to 2483.5 MHz
Frequency Range:	2402 MHz to 2480 MHz
Bluetooth Version:	Bluetooth 5.3
Bluetooth Mode:	Bluetooth BR + EDR
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)
Type of Modulation:	GFSK, π/4-DQPSK, 8DPSK
Number of Channels:	79
Channel Separation:	1 MHz
Maximum Peak Power:	-0.74 dBm
Antenna Type:	PCB Antenna
Antenna Gain:	-0.58 dBi
Normal Test Voltage:	3.7 Vdc
EUT Test software:	FCC_assist_1.0.2.2

5.2. CHANNEL LIST

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	2402	20	2422	40	2442	60	2462
01	2403	21	2423	41	2443	61	2463
02	2404	22	2424	42	2444	62	2464
03	2405	23	2425	43	2445	63	2465
04	2406	24	2426	44	2446	64	2466
05	2407	25	2427	45	2447	65	2467
06	2408	26	2428	46	2448	66	2468
07	2409	27	2429	47	2449	67	2469
08	2410	28	2430	48	2450	68	2470
09	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477

16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461	/	/

5.3. MAXIMUM CONDUCTED OUTPUT POWER

Test Mode	Frequency (MHz)	Channel Number	Maximum Peak Output Power (dBm)	Maximum EIRP (dBm)
GFSK	2402 ~ 2480	0-78[79]	-1.86	/
π/4-DQPSK	2402 ~ 2480	0-78[79]	-1.14	/
8DPSK	2402 ~ 2480	0-78[79]	-0.74	/

5.4. TEST CHANNEL CONFIGURATION

Test Mode	Test Channel	Frequency
GFSK	CH 0(Low Channel), CH 39(MID Channel), CH 78(High Channel)	2402 MHz, 2441 MHz, 2480 MHz
π/4-DQPSK	CH 0(Low Channel), CH 39(MID Channel), CH 78(High Channel)	2402 MHz, 2441 MHz, 2480 MHz
8DPSK	CH 0(Low Channel), CH 39(MID Channel), CH 78(High Channel)	2402 MHz, 2441 MHz, 2480 MHz

Note: The hop is hopping mode.

PACKET TYPE CONFIGURATION

Test Mode	Packet Type	Setting (Packet Length)
GFSK	DH1	27
	DH3	183
	DH5	339
π/4-DQPSK	2-DH1	54
	2-DH3	367
	2-DH5	679
8DPSK	3-DH1	83
	3-DH3	552
	3-DH5	1021

5.5. THE WORSE CASE POWER SETTING PARAMETER

WORST-CASE CONFIGURATIONS

Bluetooth Mode	Modulation Technology	Modulation Type	Data Rate (Mbps)
BR	FHSS	GFSK	1Mbit/s

EDR	FHSS	π/4-DQPSK	2Mbit/s
EDR	FHSS	8DPSK	3Mbit/s

Note: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates.

The Worse Case Power Setting Parameter under 2400 ~ 2483.5MHz Band				
Test Software		FCC_assist_1.0.2.2		
Modulation Type	Transmit Antenna Number	Test Software setting value		
		CH 00	CH 39	CH 78
GFSK	1	10	10	10
π/4-DQPSK	1	10	10	10
8DPSK	1	10	10	10

5.6. DESCRIPTION OF AVAILABLE ANTENNAS

Antenna	Frequency (MHz)	Antenna Type	MAX Antenna Gain (dBi)
1	2402-2480	PCB	-0.58 dBi

Test Mode	Transmit and Receive Mode	Description
GFSK	☒1TX, 1RX	Antenna 1 can be used as transmitting/receiving antenna.
π/4-DQPSK	☒1TX, 1RX	Antenna 1 can be used as transmitting/receiving antenna.
8DPSK	☒1TX, 1RX	Antenna 1 can be used as transmitting/receiving antenna.
Note:		

5.7. SUPPORT UNITS FOR SYSTEM TEST

The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
E-1	Adapter	Xiaomi	MDY-11-EX	N/A	GTG Support
E-2	PC	Lenovo	B4650-D002	M90601U3	GTG Support
E-3	USB cable	N/A	N/A	N/A	GTG Support

5.8. SETUP DIAGRAM

Radiated emissions:

6. MEASURING EQUIPMENT AND SOFTWARE USED

Test Equipment of Conducted RF					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Due Date**
Spectrum Analyzer	Rohde & Schwarz	FSV40	US40240623	2023-09-18	2024-09-17
RF Test Software	MWRF-test	MTS 8310	N/A	N/A	N/A
Radio Frequency control box	MWRF-test	MW200-RFCB	MW220111ANCI	2023/05/10	2024/05/09
Radio Frequency control box	MWRF-test	MW200-RFCB 2#	/	2023/05/10	2024/05/09
Test Equipment of Radiated emissions below 1GHz					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Due Date**
EMI Test Receiver	ROHDE&SCHWARZ	ESCI	100302	2023/05/10	2024/05/09
Bilog Antenna	Schwarzbeck	VULB9163	VULB9163-1290	2023-09-18	2024-09-17
RF Cable	ZKJC	ZT06S-NJ-NJ-11M	19060398	2023/05/10	2024/05/09
RF Cable	ZKJC	ZT06S-NJ-NJ-0.5M	19060400	2023/05/10	2024/05/09
RF Cable	ZKJC	ZT06S-NJ-NJ-2.5M	19060404	2023/05/10	2024/05/09
EMI Test Receiver	ROHDE&SCHWARZ	ESPI7	100502	2023-09-18	2024-09-17
3m Semi-anechoic Chamber	Keysight	9m*6m*6m	N/A	2021/11/13	2024/11/12
Test Equipment of Radiated emissions above 1GHz					
Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal.**	**Due Date**
Low noise Amplifiers	A-INFO	LA1018N4009	J1013130524001	2023/05/10	2024/05/09
Horn antenna	A-INFO	LB-10180-SF	J2031090612123	2023/05/10	2024/05/09
RF Cable	ZKJC	ZT26-NJ-NJ-11M	19060401	2023/05/10	2024/05/09
RF Cable	ZKJC	ZT26-NJ-NJ-2.5M	19060402	2023/05/10	2024/05/09
RF Cable	ZKJC	ZT26-NJ-NJ-0.5M	19060403	2023/05/10	2024/05/09
Spectrum Analyzer	Rohde & Schwarz	FSV40	US40240623	2023-09-18	2024-09-17
3m Semi-anechoic Chamber	Keysight	9m*6m*6m	N/A	2021/11/13	2024/11/12
Test Software	Farad	EZ-EMC (Ver.FA-03A2 RE)	N/A	N/A	N/A
Test Equipment of Conducted emissions					

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Due Date
EMI Test Receiver	ROHDE&SCHWARZ	ESCI	101358	2023/05/10	2024/05/09
1# Shielded Room	chengyu	8m*4m*3.3m	N/A	2022/11/22	2025/11/21
LISN	ROHDE&SCHWARZ	ENV216	101413	2023-09-18	2024-09-17
Test Software	Farad	EZ-EMC (Ver.ANCI-3A1)	N/A	N/A	N/A
RF Cable	N/A	ZT06S-NJ-NJ-2.5M	19044022	2023/05/10	2024/05/09

7. ANTENNA PORT TEST RESULTS

7.1. CONDUCTED OUTPUT POWER

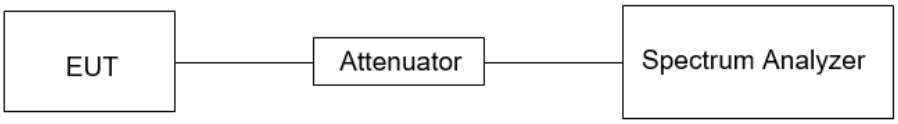
LIMITS

CFR 47 FCC Part15 (15.247) Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
CFR 47 FCC 15.247(b)(3)	Peak Conduct Output Power	1 watt or 30 dBm	2400-2483.5

TEST PROCEDURE

Connect the EUT to a low loss RF cable from the antenna port to the power sensor (video bandwidth is greater than the occupied bandwidth).
Measure peak emission level, the indicated level is the peak output power, after any corrections for external attenuators and cables.

TEST SETUP



TEST ENVIRONMENT

Temperature	23℃	Relative Humidity	45.1%
Atmosphere Pressure	101kPa		

TEST RESULTS

Please refer to section "Test Data" - Appendix A

7.2. 20 DB BANDWIDTH

LIMITS

CFR 47FCC Part15 (15.247) Subpart C			
Section	Test Item	Limit	Frequency Range (MHz)
CFR 47 FCC 15.247 (a) (1)	20 dB Bandwidth	None; for reporting purposes only.	2400-2483.5

TEST PROCEDURE

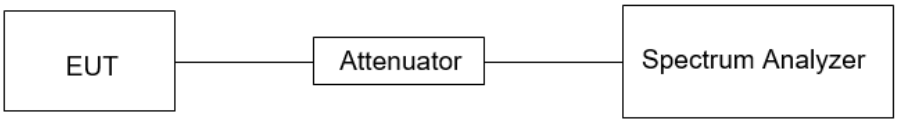
Refer to ANSI C63.10-2013 clause 6.9.2.

Connect the EUT to the spectrum analyser and use the following settings:

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	For 20 dB Bandwidth: 1 % to 5 % of the 20 dB bandwidth
VBW	For 20 dB Bandwidth: approximately 3×RBW
Span	Approximately 2 to 3 times the 20dB bandwidth
Trace	Max hold
Sweep	Auto couple

a) Use the occupied bandwidth function of the instrument, allow the trace to stabilize and report the measured 20 dB Bandwidth.

TEST SETUP



TEST ENVIRONMENT

Temperature	23℃	Relative Humidity	45.1%
Atmosphere Pressure	101kPa		

TEST RESULTS

Please refer to section "Test Data" - Appendix A

7.3. CARRIER HOPPING CHANNEL SEPARATION

LIMITS

CFR 47 FCC Part15 (15.247)			
Section	Test Item	Limit	Frequency Range (MHz)
CFR 47 FCC 15.247 (a) (1)	Carrier Frequency Separation	Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel.	2400-2483.5

TEST PROCEDURE

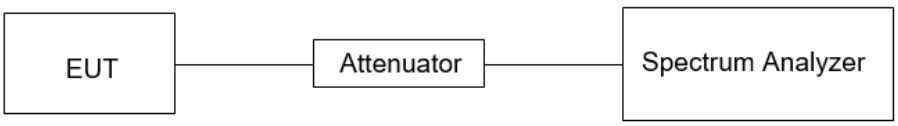
Refer to ANSI C63.10-2013 clause 7.8.2.

Connect the EUT to the spectrum analyzer and use the following settings:

Center Frequency	The center frequency of the channel under test
Span	wide enough to capture the peaks of two adjacent channels
Detector	Peak
RBW	Start with the RBW set to approximately 30 % of the channel spacing; adjust as necessary to best identify the center of each individual channel.
VBW	≥RBW
Trace	Max hold
Sweep time	Auto couple

Allow the trace to stabilize and use the marker-delta function to determine the separation between the peaks of the adjacent channels.
Compliance of an EUT with the appropriate regulatory limit shall be determined.

TEST SETUP



TEST ENVIRONMENT

Temperature	23℃	Relative Humidity	45.1%
Atmosphere Pressure	101kPa		

TEST RESULTS

Please refer to section "Test Data" - Appendix A

7.4. NUMBER OF HOPPING FREQUENCY

LIMITS

CFR 47 FCC Part15 (15.247), Subpart C		
Section	Test Item	Limit
CFR 47 15.247 (a) (1) III	Number of Hopping Frequency	at least 15 hopping channels

TEST PROCEDURE

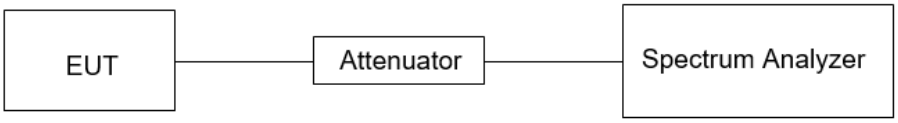
Refer to ANSI C63.10-2013 clause 7.8.3.

Connect the EUT to the spectrum Analyzer and use the following settings:

Detector	Peak
RBW	To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
VBW	≥RBW
Span	The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
Trace	Max hold
Sweep time	Auto couple

Set EUT to transmit maximum output power and switch on frequency hopping function. then set enough count time (larger than 5000 times) to get all the hopping frequency channel displayed on the screen of spectrum analyzer, count the quantity of peaks to get the number of hopping channels.

TEST SETUP



TEST ENVIRONMENT

Temperature	23℃	Relative Humidity	45.1%
Atmosphere Pressure	101kPa		

TEST RESULTS

Please refer to section "Test Data" - Appendix A

7.5. TIME OF OCCUPANCY (DWELL TIME)

LIMITS

CFR 47 FCC Part15 (15.247), Subpart C		
Section	Test Item	Limit
CFR 47 15.247 (a) (1) III	Time of Occupancy (Dwell Time)	The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds, multiplied by the number of hopping channels employed.

TEST PROCEDURE

Refer to ANSI C63.10-2013 clause 7.8.4.

Connect the EUT to the spectrum Analyzer and use the following settings:

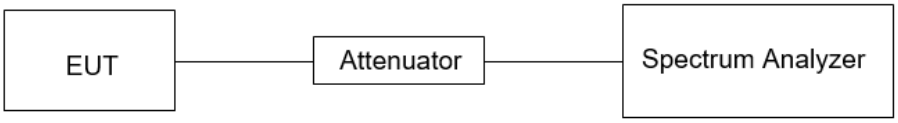
Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	1 MHz
VBW	≥RBW
Span	Zero span, centered on a hopping channel
Trace	Max hold
Sweep time	As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel

Use the marker-delta function to determine the transmit time per hop (Burst Width). If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

For FHSS Mode (79 Channel):
DH1/3DH1 Dwell Time: Burst Width * (1600/2) * 31.6 / (channel number)
DH3/3DH3 Dwell Time: Burst Width * (1600/4) * 31.6 / (channel number)
DH5/3DH5 Dwell Time: Burst Width * (1600/6) * 31.6 / (channel number)

For AFHSS Mode (20 Channel):
DH1/3DH1 Dwell Time: Burst Width * (1600/2) * 8 / (channel number)
DH3/3DH3 Dwell Time: Burst Width * (1600/4) * 8 / (channel number)
DH5/3DH5 Dwell Time: Burst Width * (1600/6) * 8 / (channel number)

TEST SETUP



TEST ENVIRONMENT

Temperature	23℃	Relative Humidity	45.1%
Atmosphere Pressure	101kPa		

TEST RESULTS

Please refer to section "Test Data" - Appendix A

7.6. CONDUCTED BANDEDGE AND SPURIOUS EMISSION

LIMITS

CFR 47 FCC Part15 (15.247), Subpart C		
Section	Test Item	Limit
CFR 47 FCC §15.247 (d)	Conducted Spurious Emission	at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power

TEST PROCEDURE

Refer to ANSI C63.10-2013 clause 7.8.6 and 7.8.8.

Connect the EUT to the spectrum analyser and use the following settings for reference level measurement:

Center Frequency	The center frequency of the channel under test
Detector	Peak
RBW	100 kHz
VBW	≥3 × RBW
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple.

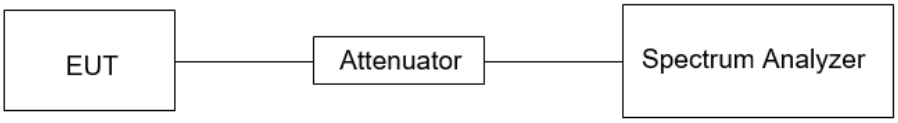
Allow trace to fully stabilize and use the peak marker function to determine the maximum PSD level.

Change the settings for emission level measurement:

Span	Set the center frequency and span to encompass frequency range to be measured
Detector	Peak
RBW	100 kHz
VBW	≥3 × RBW
measurement points	≥span/RBW
Trace	Max hold
Sweep time	Auto couple.

Allow trace to fully stabilize and use the peak marker function to determine the maximum PSD level. Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) is attenuated by at least the minimum

TEST SETUP



TEST ENVIRONMENT

Temperature	23℃	Relative Humidity	45.1%
Atmosphere Pressure	101kPa		

TEST RESULTS

Please refer to section "Test Data" - Appendix A

7.7. DUTY CYCLE

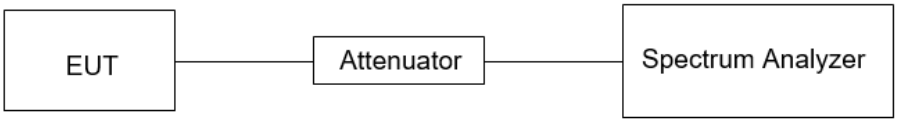
LIMITS

None; for reporting purposes only.

TEST PROCEDURE

Refer to ANSI C63.10-2013 Zero – Span Spectrum Analyzer method.

TEST SETUP



TEST ENVIRONMENT

Temperature	23℃	Relative Humidity	45.1%
Atmosphere Pressure	101kPa		

TEST RESULTS

Please refer to section "Test Data" - Appendix A

8. RADIATED TEST RESULTS

LIMITS

Please refer to CFR 47 FCC §15.205 and §15.209.

Radiation Disturbance Test Limit for FCC (Class B) (9 kHz-1 GHz)

Emissions radiated outside of the specified frequency bands above 30 MHz			
Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m	
		Quasi-Peak	
30 - 88	100	40	
88 - 216	150	43.5	
216 - 960	200	46	
Above 960	500	54	
Above 1000	500	Peak	Average
		74	54

FCC Emissions radiated outside of the specified frequency bands below 30 MHz		
Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30

FCC Restricted bands of operation refer to FCC §15.205 (a):

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
[1]0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	([2])
13.36-13.41			

Note: [1]Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2]Above 38.6c

TEST PROCEDURE

Below 30 MHz

The setting of the spectrum analyser

RBW	200 Hz (From 9 kHz to 0.15 MHz)/ 9 kHz (From 0.15 MHz to 30 MHz)
VBW	200 Hz (From 9 kHz to 0.15 MHz)/ 9 kHz (From 0.15 MHz to 30 MHz)
Sweep	Auto

1. The testing follows the guidelines in ANSI C63.10-2013 clause 6.4.

2. The EUT was arranged to its worst case and then 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. Both Horizontal, Face-on and Face-off polarizations of the antenna are set to make the measurement.

3. The EUT was placed on a turntable with 80 cm above ground.

4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a 1 m height antenna tower.

5. The radiated emission limits are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector.

6. For measurement below 1 GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak and average detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak and average detector and reported.

7. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field site based on KDB 414788.

8. The limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω. For example, the measurement frequency X KHz resulted in a level of Y dBuV/m, which is equivalent to Y-51.5 = Z dBuA/m, which has the same margin, W dB, to the corresponding RSS-GEN Table 6 limit as it has to be 15.209(a) limit.

Below 1 GHz and above 30 MHz

The setting of the spectrum analyser

RBW	120 kHz
VBW	300 kHz
Sweep	Auto
Detector	Peak/QP
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013 clause 6.5.

2. 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. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

3. The EUT was placed on a turntable with 80 cm above ground.

4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

5. For measurement below 1 GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

Above 1 GHz

The setting of the spectrum analyser

RBW	1 MHz
VBW	PEAK: 3 MHz AVG: see note 6
Sweep	Auto
Detector	Peak
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013 clause 6.6.

2. 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. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

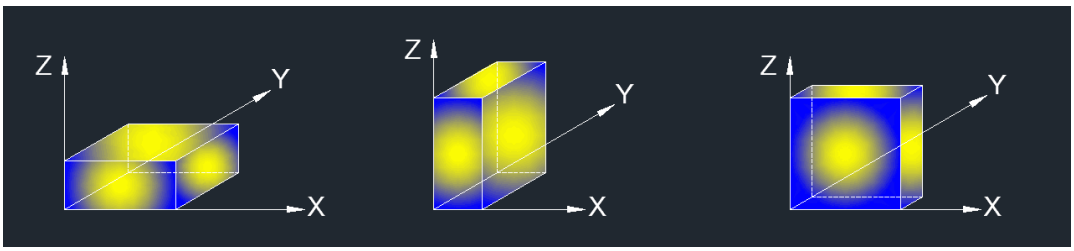
3. The EUT was placed on a turntable with 1.5 m above ground.

4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.

5. For measurement above 1 GHz, the emission measurement will be measured by the peak detector. This peak level, once corrected, must comply with the limit specified in Section 15.209.

6. For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector for average measurements. For the Duty Cycle please refer to clause 7.1.ON TIME AND DUTY CYCLE.

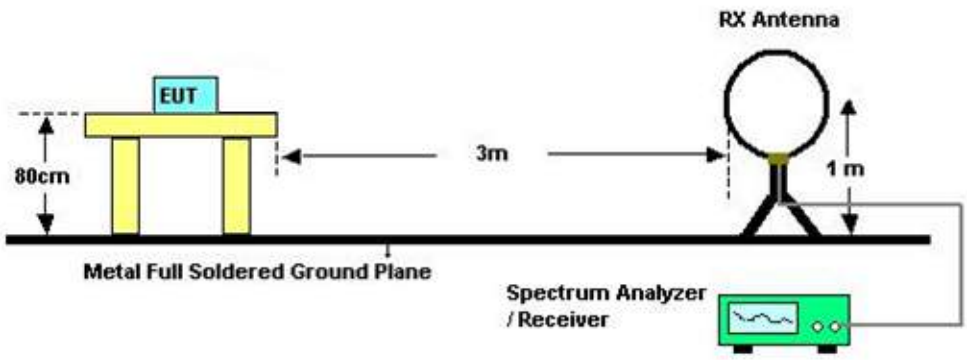
X axis, Y axis, Z axis positions:

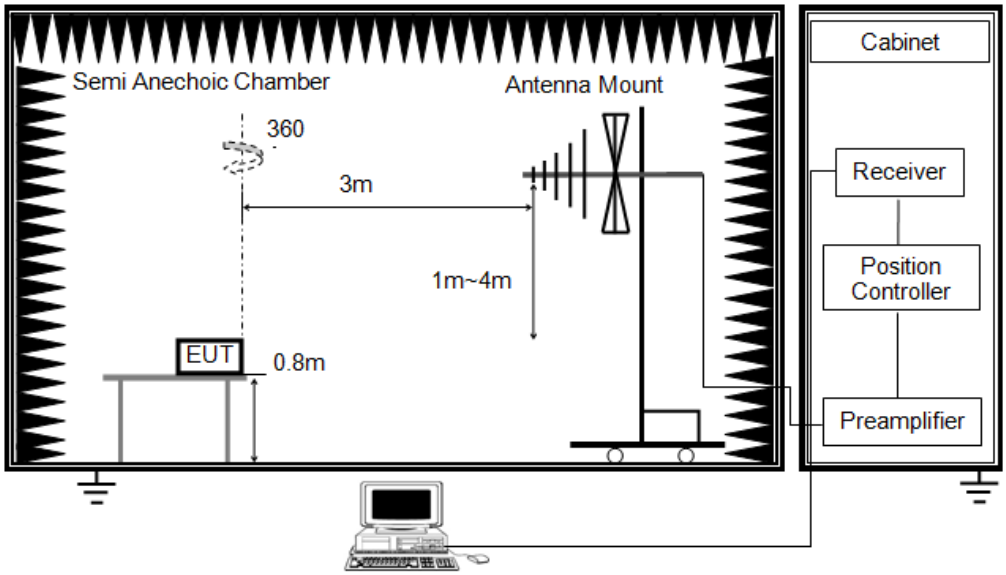


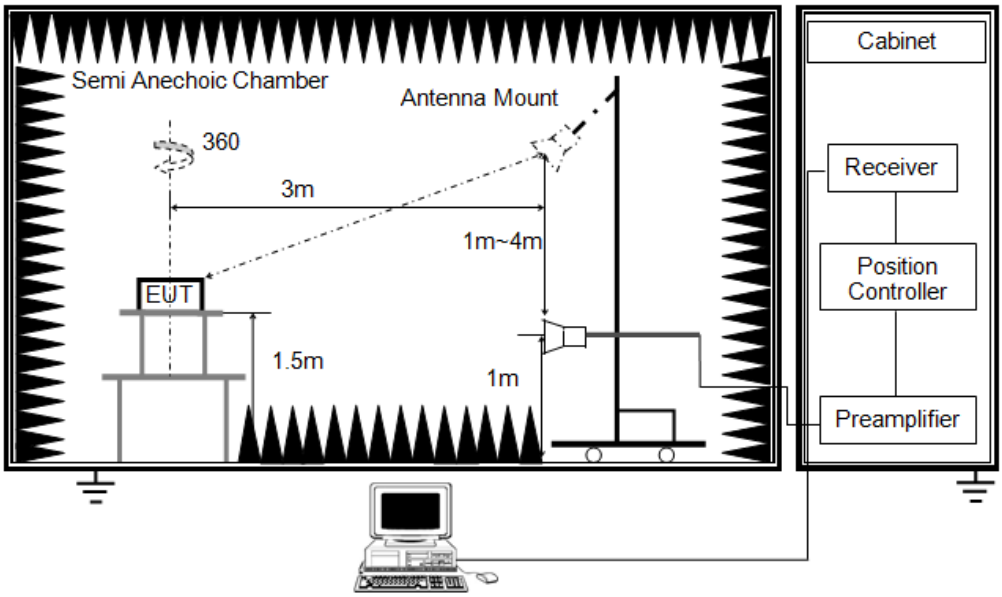
Note 1: For all radiated test, EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

Note 2: The EUT was fully exercised with external accessories during the test. In the case of multiple accessory external ports, an external accessory shall be connected to one of each type of port.

TEST SETUP







TEST ENVIRONMENT

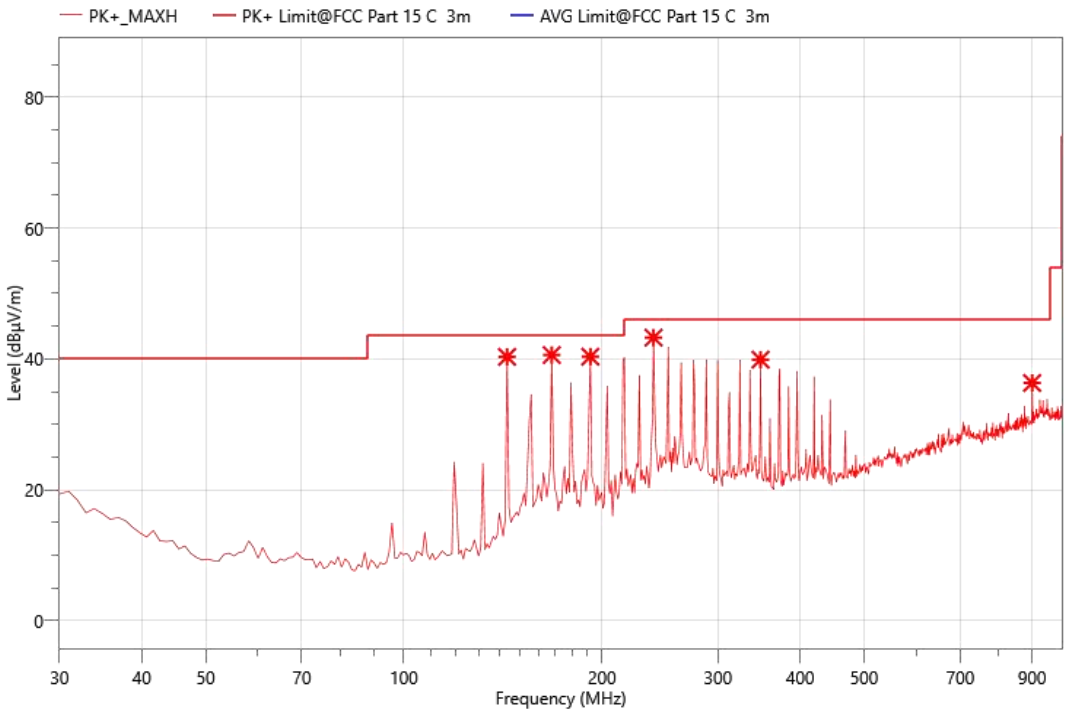
Temperature	24.5℃	Relative Humidity	54%
Atmosphere Pressure	101kPa		

TEST RESULTS

- Undesirable radiated Spurious Emission below 1GHz (30MHz to 1GHz)

The worst result as bellow:

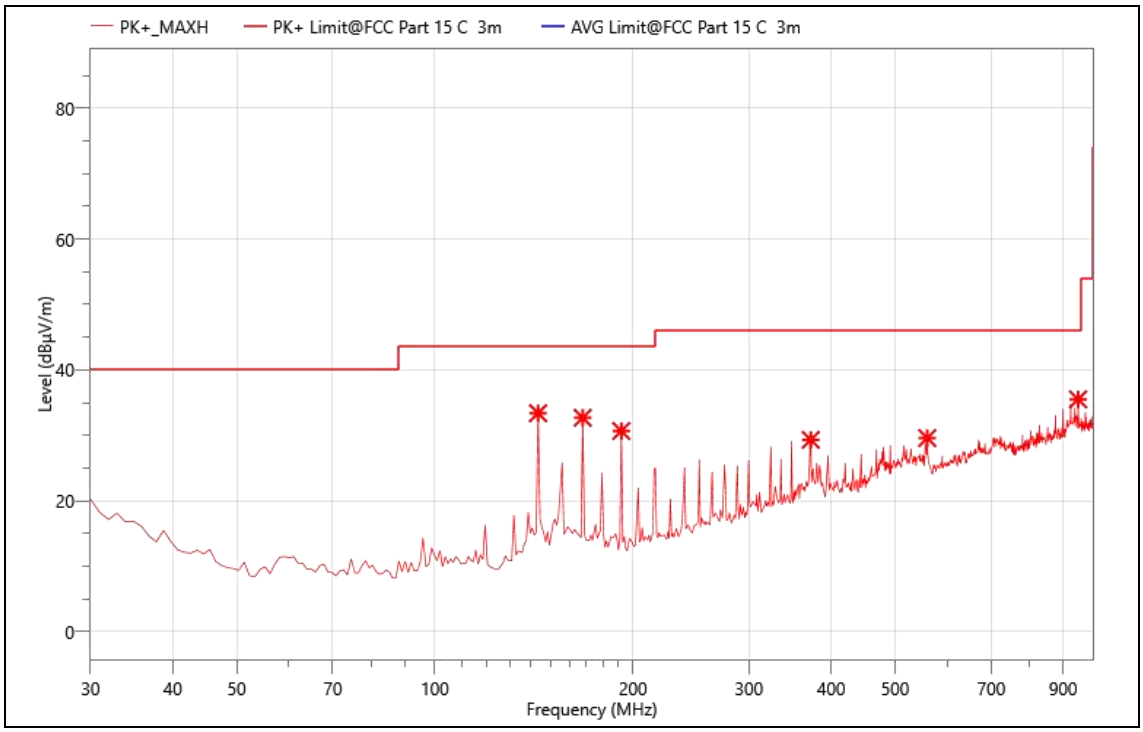
Mode:	3DH5 2402MHz
Power:	DC 5V
TE:	Vier
Date	2023/10/16
T/A/P	24.5℃/54%/101Kpa



Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Det.	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)
1	143.490	57.22	40.31	43.50	3.19	PK+	100.1	H	-0.6	-16.91
2	167.740	56.79	40.59	43.50	2.91	PK+	100.1	H	-0.6	-16.2
3	191.990	56.83	40.34	43.50	3.16	PK+	100.1	H	-0.6	-16.49
4	239.520	56.41	43.25	46.00	2.75	PK+	100.1	H	-0.6	-13.16
5	348.160	50.11	39.89	46.00	6.11	PK+	100.1	H	-0.6	-10.22
6	900.090	34.47	36.32	46.00	9.68	PK+	100.1	H	-0.6	1.85

Mode:	3DH5 2402MHz
Power:	DC 5V
TE:	Vier
Date	2023/10/16
T/A/P	24.5℃/54%/101Kpa



Critical_Freqs

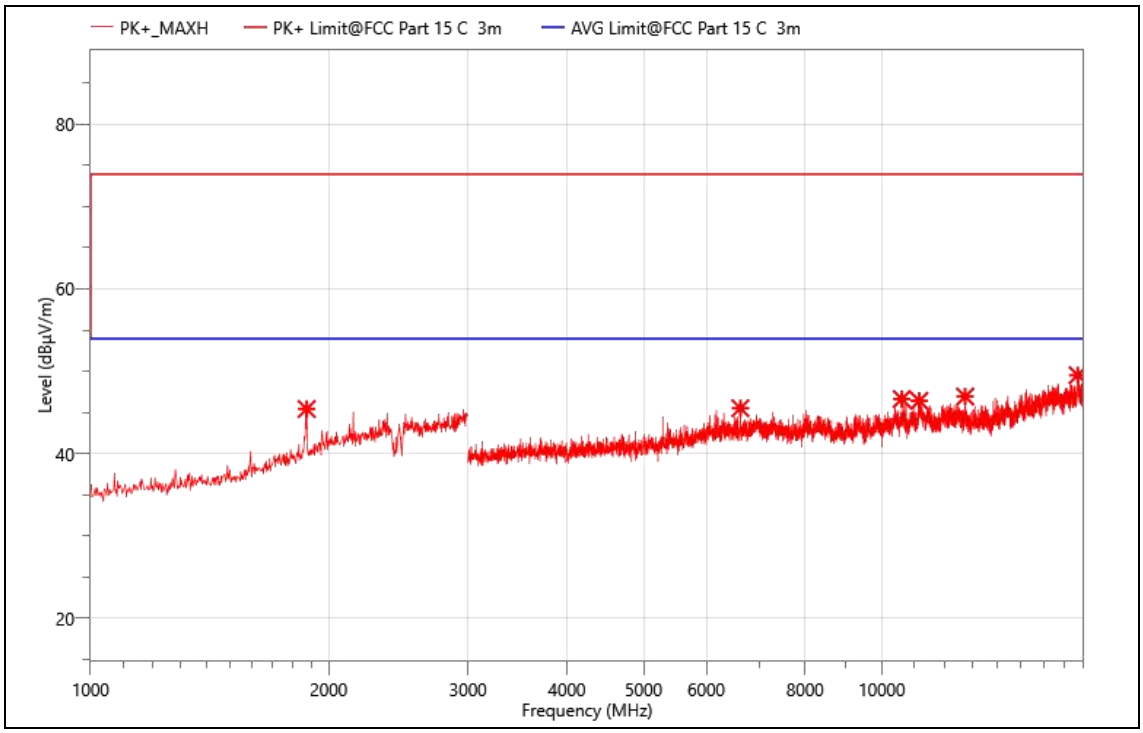
No.	Freq. (MHz)	Reading (dBµV)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Det.	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)
1	143.490	50.29	33.38	43.50	10.12	PK+	100.1	V	-0.6	-16.91
2	167.740	48.88	32.68	43.50	10.82	PK+	100.1	V	-0.6	-16.2
3	191.990	47.15	30.66	43.50	12.84	PK+	100.1	V	-0.6	-16.49
4	372.410	38.32	29.31	46.00	16.69	PK+	100.1	V	-0.6	-9.01
5	559.620	33.39	29.59	46.00	16.41	PK+	100.1	V	-0.6	-3.8
6	948.590	31.61	35.50	46.00	10.50	PK+	100.1	V	-0.6	3.89

Note: 1. Result Level = Read Level+ Antenna Factor+ Cable Loss- Amp. Factor

- Undesirable radiated Spurious Emission Above 1GHz (1GHz to 40GHz)

The worst result as bellow:

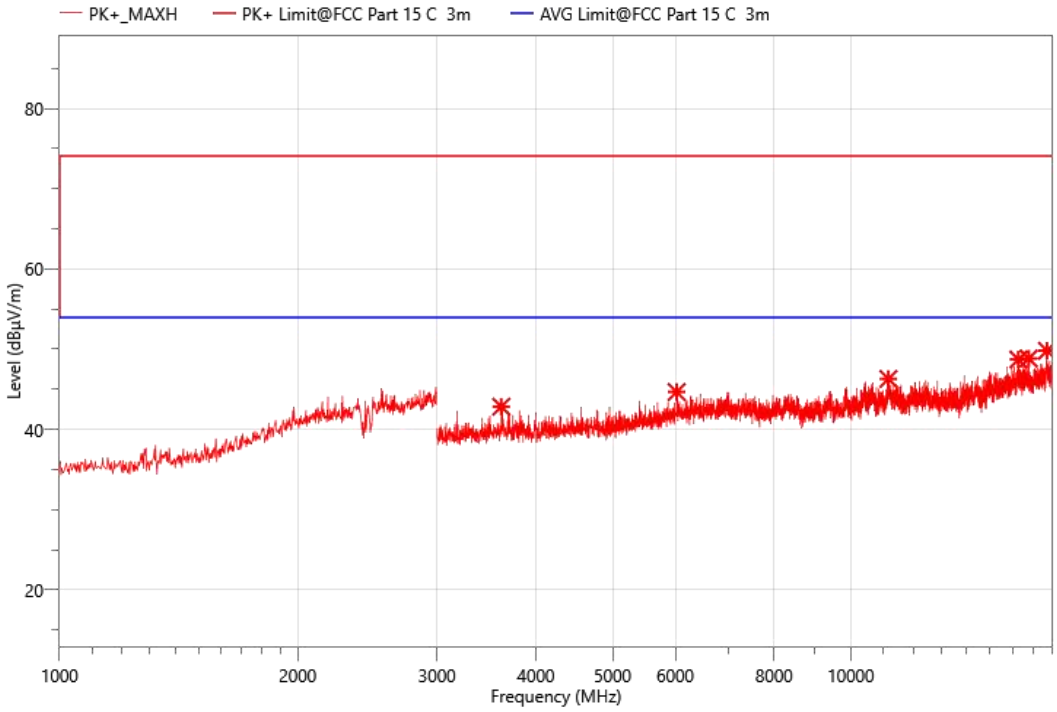
Mode:	3DH5 2402
Power:	DC 5V
TE:	Vier
Date	2023/10/16
T/A/P	24.5℃/54%/101Kpa



Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Det.	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)
1	1876.000	55.75	45.41	74.00	28.59	PK+	150.1	V	360.1	-10.34
2	6627.000	52.55	45.51	74.00	28.49	PK+	150.1	V	360.1	-7.04
3	10600.500	49.87	46.62	74.00	27.38	PK+	150.1	V	360.1	-3.25
4	11154.000	48.66	46.40	74.00	27.60	PK+	150.1	V	360.1	-2.26
5	12747.000	49.26	46.93	74.00	27.07	PK+	150.1	V	360.1	-2.33
6	17685.000	47.26	49.52	74.00	24.48	PK+	150.1	V	360.1	2.26

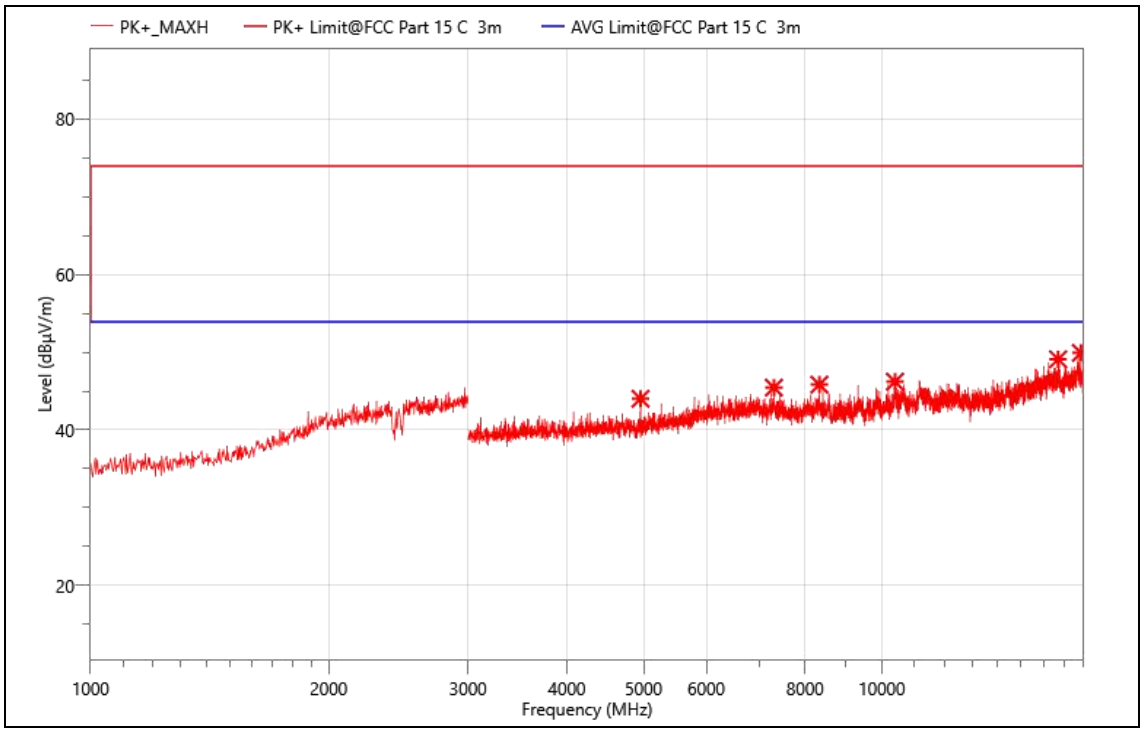
Mode:	3DH5 2402
Power:	DC 5V
TE:	Vier
Date	2023/10/16
T/A/P	24.5℃/54%/101Kpa



Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Det.	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)
1	3616.500	56.36	42.83	74.00	31.17	PK+	150.1	H	0.0	-13.53
2	6024.000	52.18	44.67	74.00	29.33	PK+	150.1	H	0.0	-7.51
3	11157.000	48.57	46.30	74.00	27.70	PK+	150.1	H	0.0	-2.27
4	16287.000	48.33	48.72	74.00	25.28	PK+	150.1	H	0.0	0.39
5	16783.500	48.44	48.84	74.00	25.16	PK+	150.1	H	0.0	0.4
6	17701.500	47.67	49.81	74.00	24.19	PK+	150.1	H	0.0	2.14

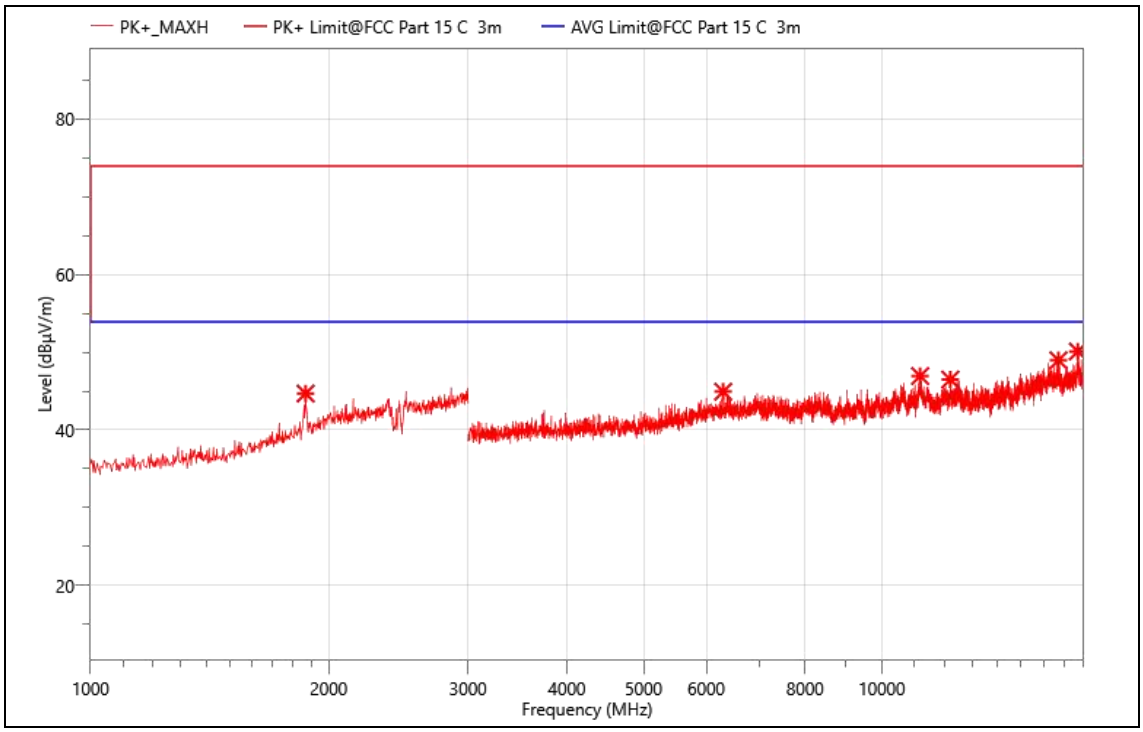
Mode:	3DH5 2441
Power:	DC 5V
TE:	Vier
Date	2023/10/16
T/A/P	24.5℃/54%/101Kpa



Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Det.	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)
1	4956.000	55.38	44.01	74.00	29.99	PK+	150.1	H	360.0	-11.37
2	7306.500	51.39	45.45	74.00	28.55	PK+	150.1	H	360.0	-5.94
3	8338.500	51.58	45.84	74.00	28.16	PK+	150.1	H	360.0	-5.74
4	10392.000	49.81	46.22	74.00	27.78	PK+	150.1	H	360.0	-3.59
5	16707.000	47.80	49.10	74.00	24.90	PK+	150.1	H	360.0	1.3
6	17853.000	47.96	49.92	74.00	24.08	PK+	150.1	H	360.0	1.96

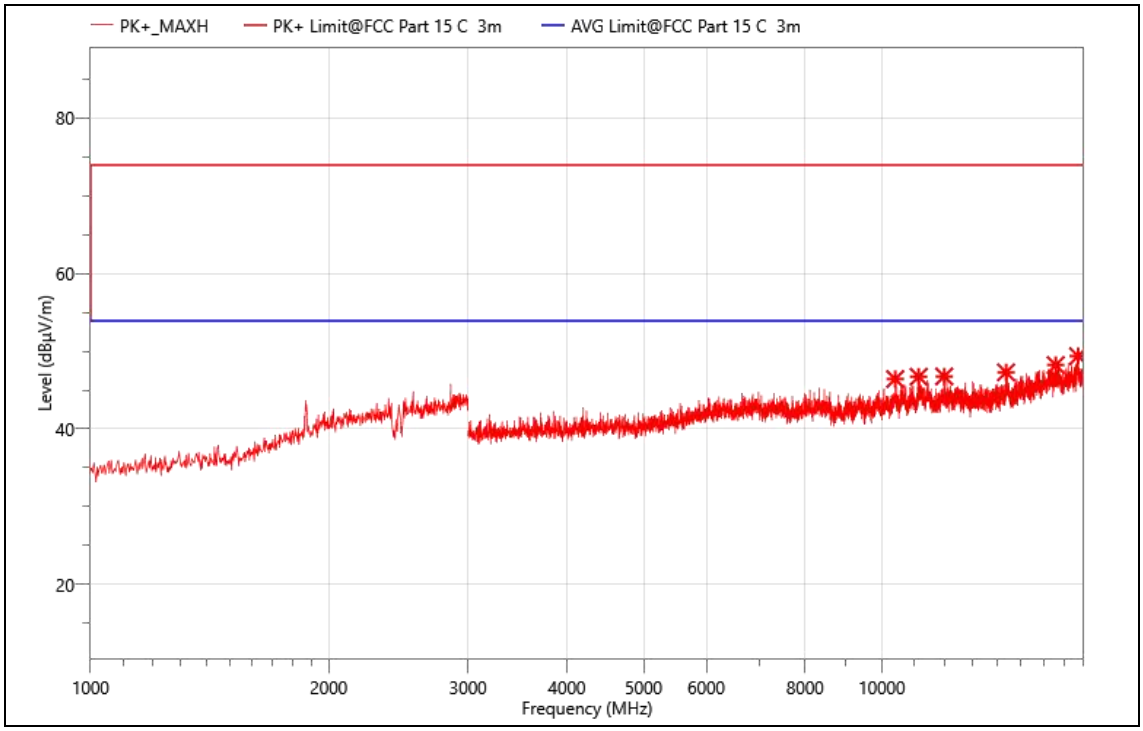
Mode:	3DH5 2441
Power:	DC 5V
TE:	Vier
Date	2023/10/16
T/A/P	24.5℃/54%/101Kpa



Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Det.	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)
1	1870.000	55.06	44.69	74.00	29.31	PK+	150.1	V	0.0	-10.37
2	6303.000	51.38	44.93	74.00	29.07	PK+	150.1	V	0.0	-6.45
3	11181.000	49.46	46.94	74.00	27.06	PK+	150.1	V	0.0	-2.52
4	12207.000	49.08	46.49	74.00	27.51	PK+	150.1	V	0.0	-2.59
5	16720.500	47.99	48.97	74.00	25.03	PK+	150.1	V	0.0	0.98
6	17692.500	47.88	50.10	74.00	23.90	PK+	150.1	V	0.0	2.22

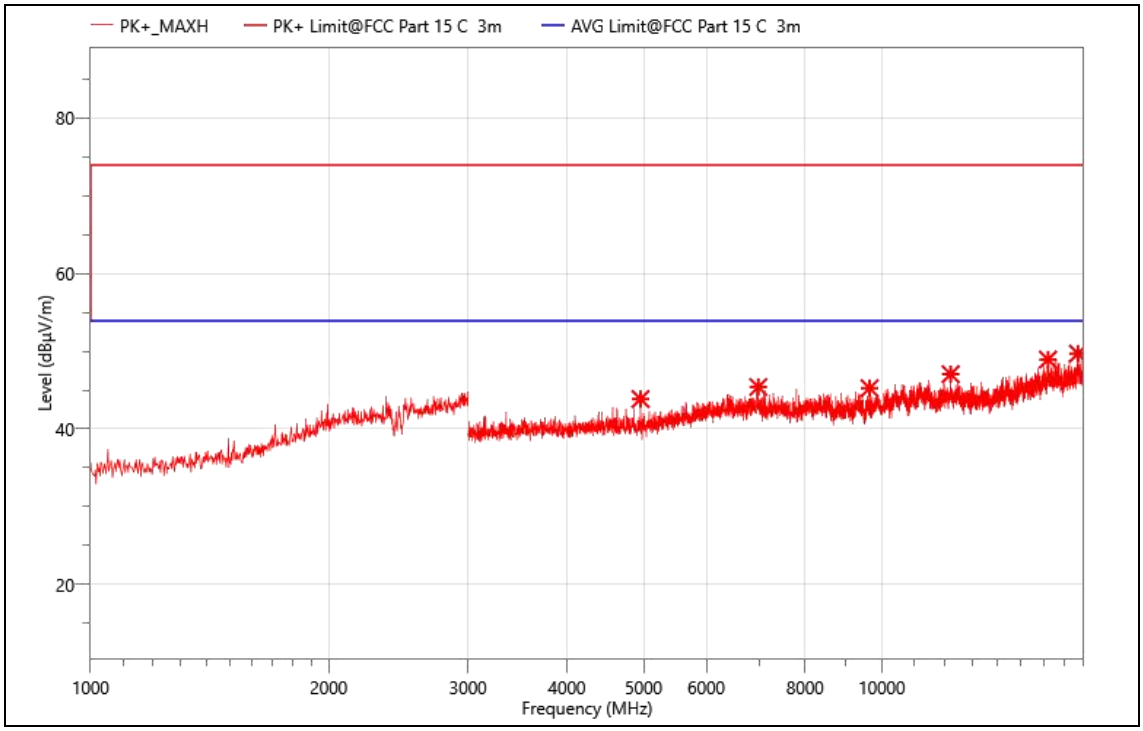
Mode:	3DH5 2480
Power:	DC 5V
TE:	Vier
Date	2023/10/16
T/A/P	24.5℃/54%/101Kpa



Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Det.	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)
1	10398.000	49.98	46.42	74.00	27.58	PK+	150.1	V	360.1	-3.56
2	11133.000	49.00	46.72	74.00	27.28	PK+	150.1	V	360.1	-2.28
3	11992.500	48.92	46.76	74.00	27.24	PK+	150.1	V	360.1	-2.16
4	14356.500	48.62	47.29	74.00	26.71	PK+	150.1	V	360.1	-1.33
5	16590.000	47.85	48.23	74.00	25.77	PK+	150.1	V	360.1	0.38
6	17706.000	47.32	49.37	74.00	24.63	PK+	150.1	V	360.1	2.05

Mode:	3DH5 2480
Power:	DC 5V
TE:	Vier
Date	2023/10/16
T/A/P	24.5℃/54%/101Kpa



Critical_Freqs

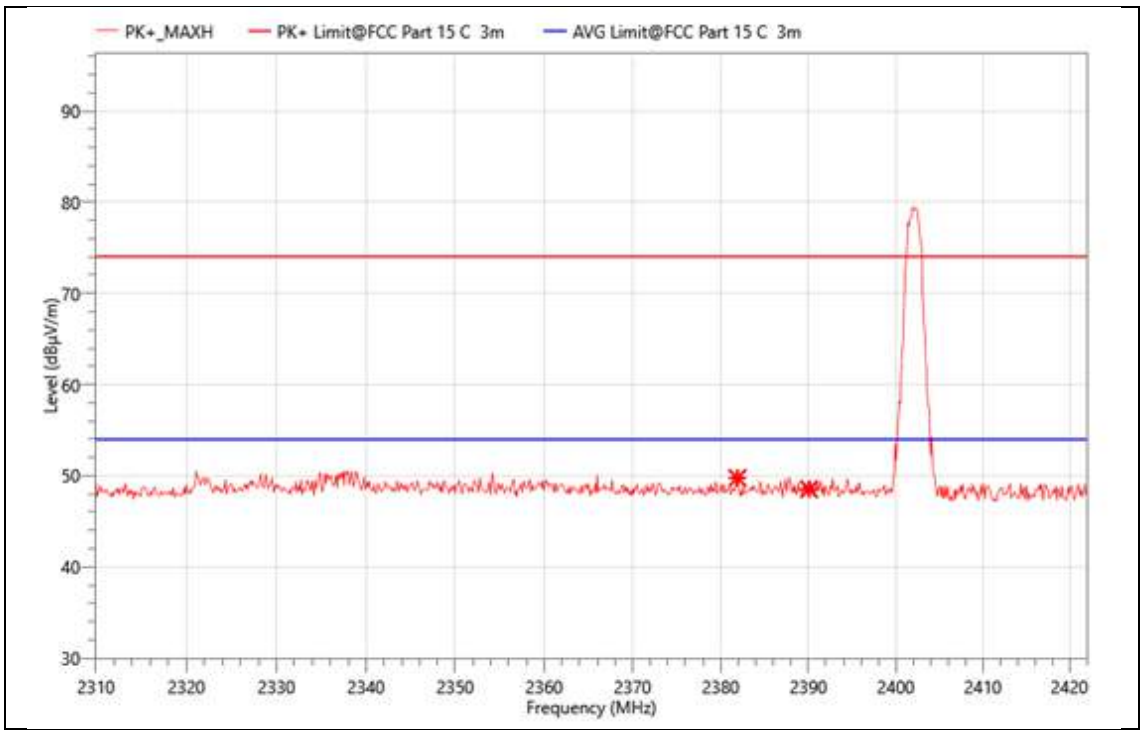
No.	Freq. (MHz)	Reading (dBµV)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Det.	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)
1	4956.000	55.22	43.85	74.00	30.15	PK+	150.1	H	-0.1	-11.37
2	6982.500	51.55	45.40	74.00	28.60	PK+	150.1	H	-0.1	-6.15
3	9652.500	49.97	45.25	74.00	28.75	PK+	150.1	H	-0.1	-4.72
4	12219.000	49.48	47.05	74.00	26.95	PK+	150.1	H	-0.1	-2.43
5	16221.000	48.14	48.93	74.00	25.07	PK+	150.1	H	-0.1	0.79
6	17697.000	47.50	49.70	74.00	24.30	PK+	150.1	H	-0.1	2.2

Other harmonics emissions are lower than 20dB below the allowable limit.

Note: (1) All Readings are Peak Value and AV.
(2) Emission Level= Reading Level+ Probe Factor +Cable Loss.
(3) The average measurement was not performed when the peak measured data under the limit of average detection.
(4) Measuring frequencies from 1GHz to 25GHz.

- Band Edge

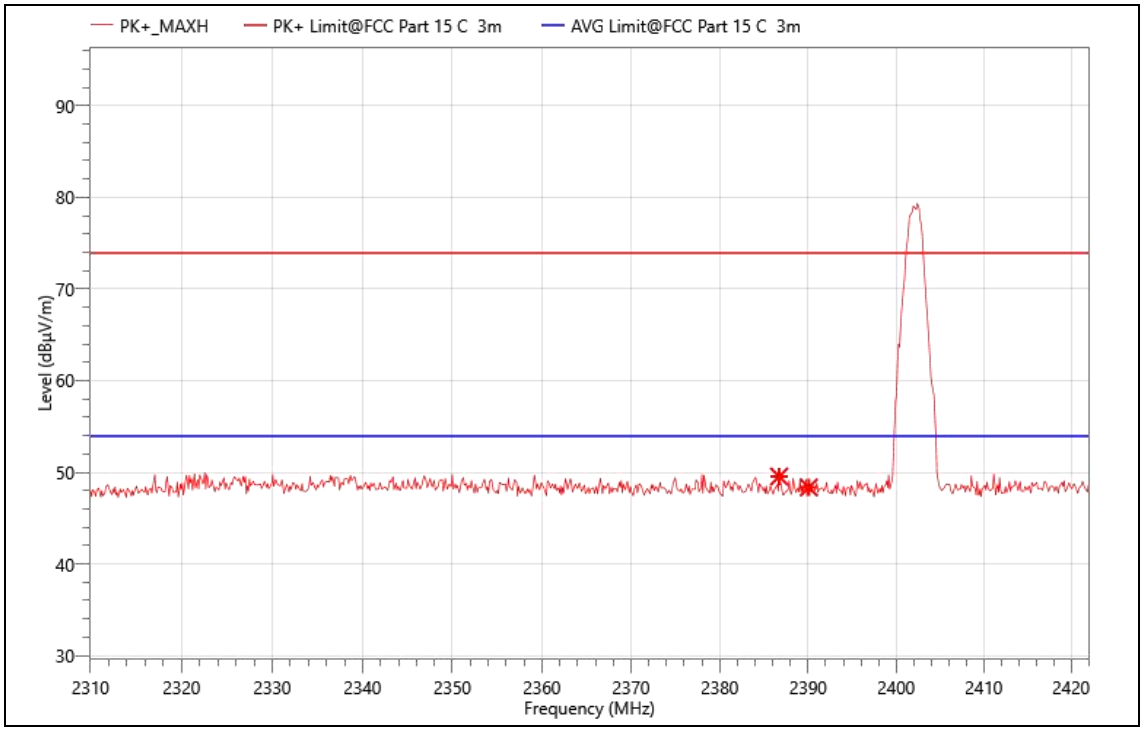
Mode:	3DH5 2402
Power:	DC 5V
TE:	Vier
Date	2023/10/16
T/A/P	24.5℃/54%/101Kpa



Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Det.	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)
1	2381.90	11.97	49.76	74.00	24.24	PK	150.1	H	360.1	37.7
2	2390.08	10.75	48.53	74.00	25.47	PK	150.1	H	360.1	37.7

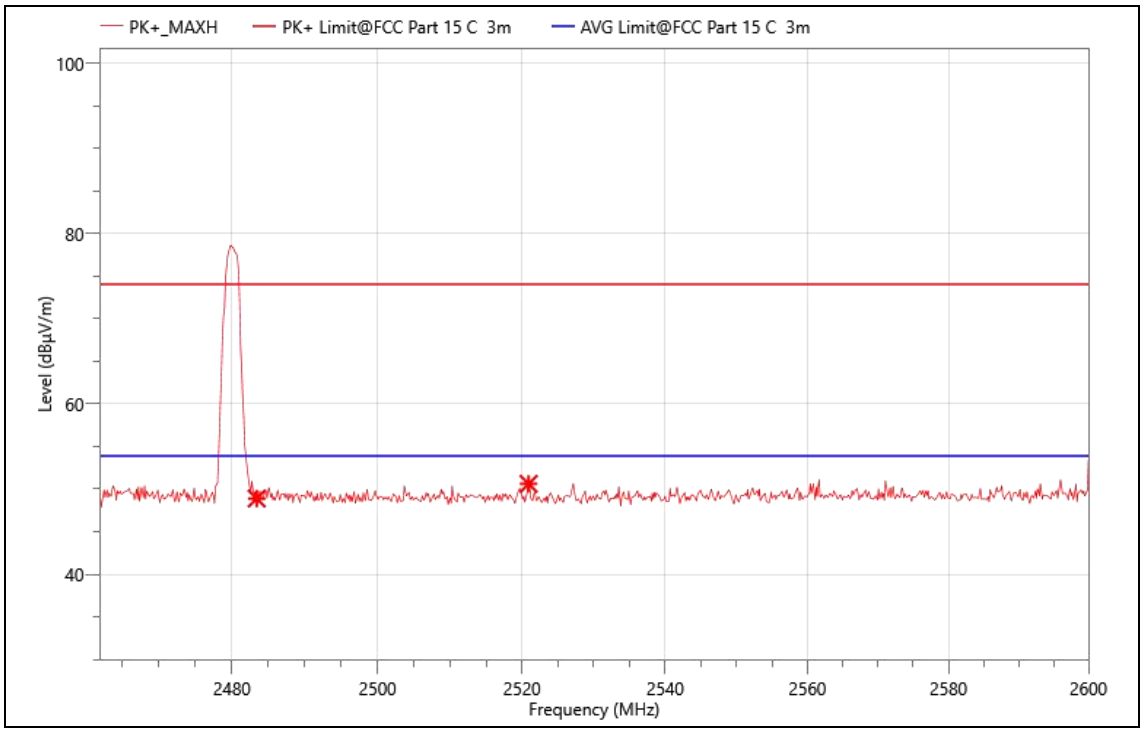
Mode:	3DH5 2402
Power:	DC 5V
TE:	Vier
Date	2023/10/16
T/A/P	24.5℃/54%/101Kpa



Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Det.	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)
1	2386.720	11.76	49.54	74.00	24.46	PK+	150.1	V	0.0	37.78
2	2390.080	10.57	48.35	74.00	25.65	PK+	150.1	V	0.0	37.78

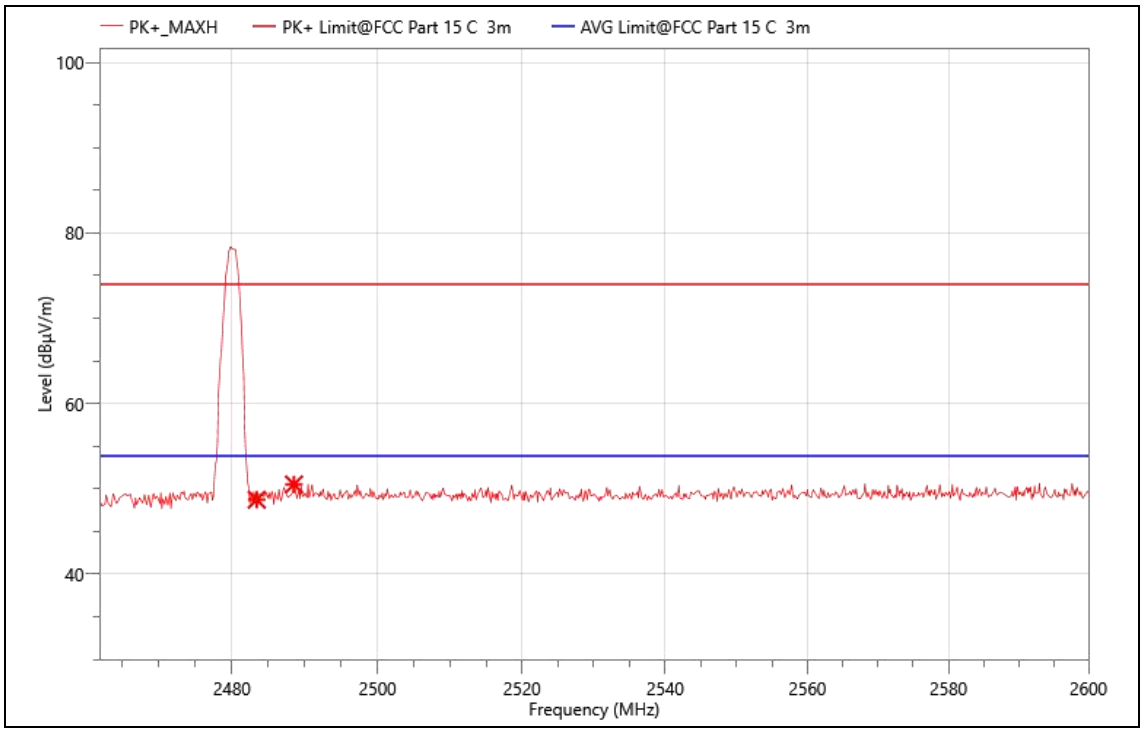
Mode:	3DH5 2480
Power:	DC 5V
TE:	Vier
Date	2023/10/16
T/A/P	24.5℃/54%/101Kpa



Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Det.	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)
1	2483.390	10.63	48.88	74.00	25.12	PK+	150.1	H	360.0	38.25
2	2520.926	12.45	50.61	74.00	23.39	PK+	150.1	H	360.0	38.16

Mode:	3DH5 2480
Power:	DC 5V
TE:	Vier
Date	2023/10/16
T/A/P	24.5℃/54%/101Kpa



Critical_Freqs

No.	Freq. (MHz)	Reading (dBµV)	Meas. (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Det.	Height (cm)	Pol.	Azimuth (deg)	Corr. (dB)
1	2483.390	10.47	48.72	74.00	25.28	PK+	150.1	V	-0.1	38.25
2	2488.496	12.27	50.52	74.00	23.48	PK+	150.1	V	-0.1	38.25

9. ANTENNA REQUIREMENT

REQUIREMENT

Please refer to FCC §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.

Please refer to FCC §15.247(b)(4)
The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DESCRIPTION

Pass

10. AC POWER LINE CONDUCTED EMISSION

LIMITS

Please refer to CFR 47 FCC §15.207 (a)

FREQUENCY (MHz)	Quasi-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

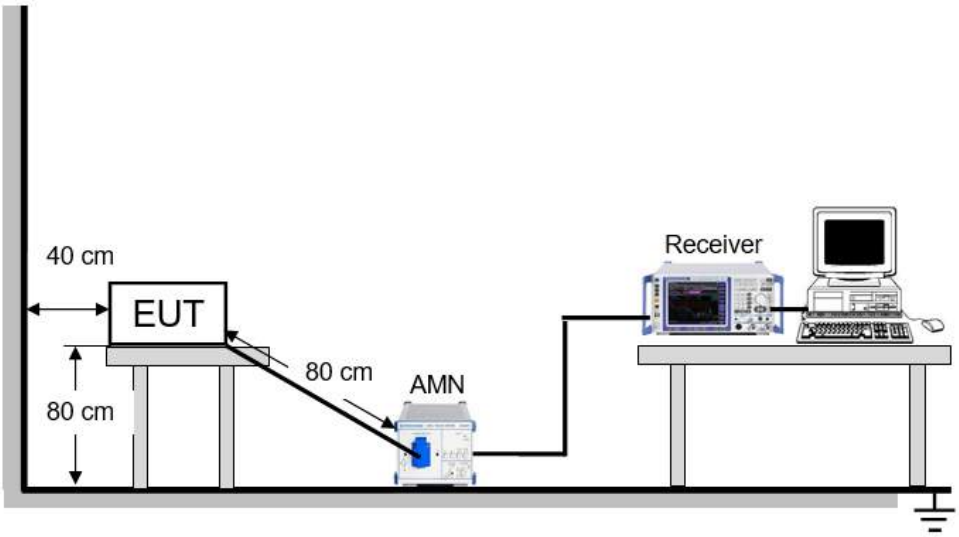
TEST PROCEDURE

Refer to ANSI C63.10-2013 clause 6.2.

The EUT is put on a table of non-conducting material that is 80 cm high. The vertical conducting wall of shielding is located 40 cm to the rear of the EUT. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.). A EMI Measurement Receiver is used to test the emissions from the AC line. According to the requirements in Section 6.2 of ANSI C63.10-2013.Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode. The bandwidth of EMI test receiver is set at 9 kHz.

The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application.

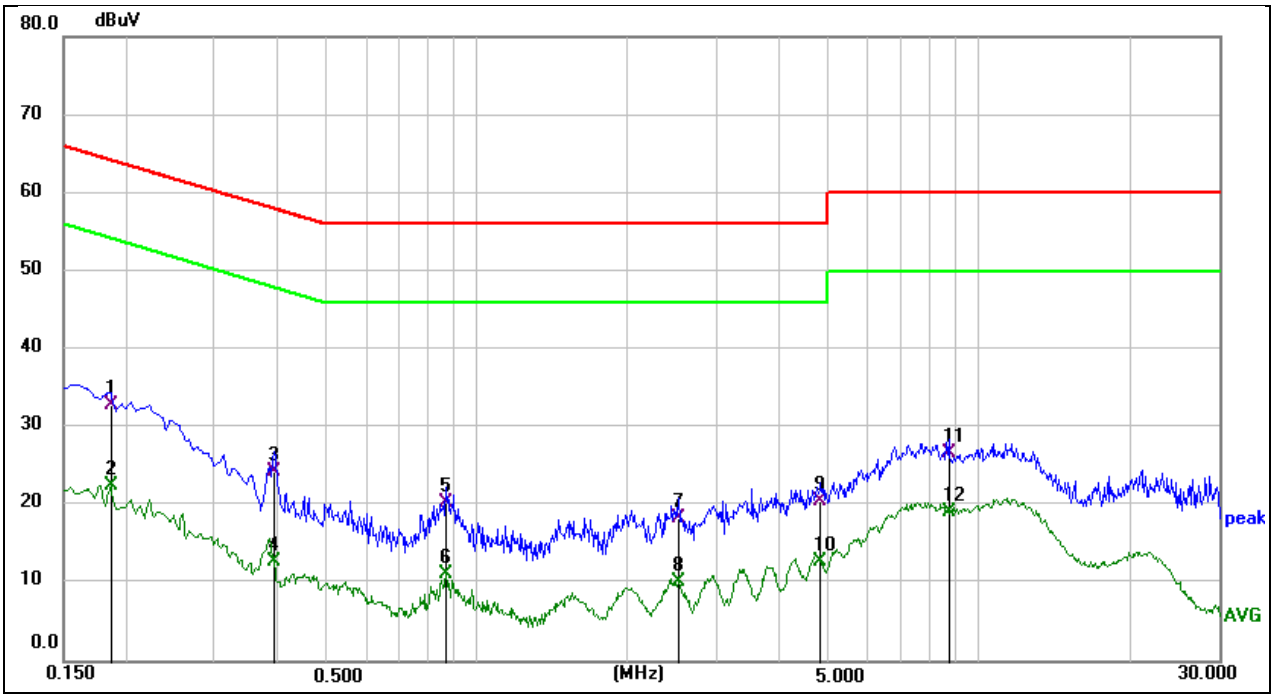
TEST SETUP



TEST ENVIRONMENT

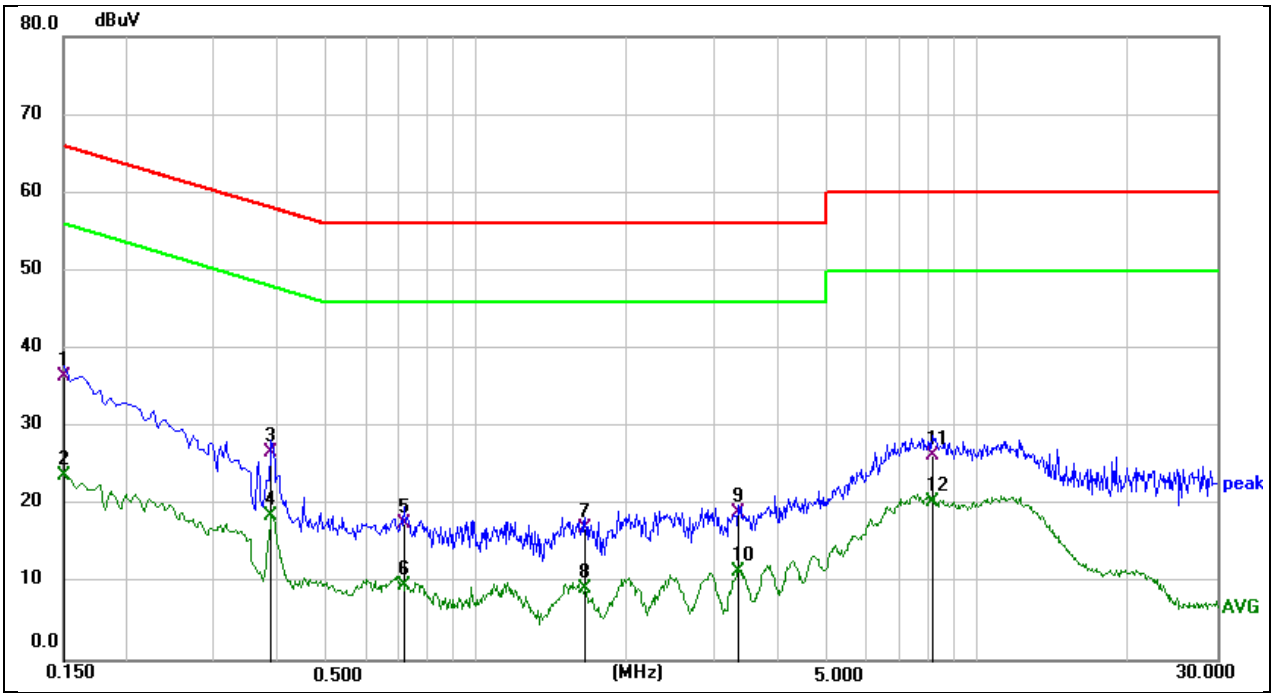
Temperature	26℃	Relative Humidity	54%
Atmosphere Pressure	101kPa		

TEST RESULTS



Phase: N	Mode: 3DH5 2402MHz

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1860	23.05	9.75	32.80	64.21	-31.41	QP
2	0.1860	12.77	9.75	22.52	54.21	-31.69	AVG
3	0.3930	14.65	9.75	24.40	58.00	-33.60	QP
4	0.3930	2.96	9.75	12.71	48.00	-35.29	AVG
5	0.8700	10.51	9.79	20.30	56.00	-35.70	QP
6	0.8700	1.34	9.79	11.13	46.00	-34.87	AVG
7	2.5170	8.34	9.96	18.30	56.00	-37.70	QP
8	2.5170	0.28	9.96	10.24	46.00	-35.76	AVG
9	4.8300	10.67	9.93	20.60	56.00	-35.40	QP
10	4.8300	2.87	9.93	12.80	46.00	-33.20	AVG
11	8.7134	16.72	9.98	26.70	60.00	-33.30	QP
12	8.7134	9.24	9.98	19.22	50.00	-30.78	AVG



Phase: L1	Mode: 3DH5 2402MHz

No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1500	26.74	9.76	36.50	66.00	-29.50	QP
2	0.1500	13.96	9.76	23.72	56.00	-32.28	AVG
3	0.3885	16.80	9.90	26.70	58.10	-31.40	QP
4	0.3885	8.76	9.90	18.66	48.10	-29.44	AVG
5	0.7170	7.71	9.79	17.50	56.00	-38.50	QP
6	0.7170	-0.15	9.79	9.64	46.00	-36.36	AVG
7	1.6485	7.07	9.83	16.90	56.00	-39.10	QP
8	1.6485	-0.61	9.83	9.22	46.00	-36.78	AVG
9	3.3450	8.93	9.97	18.90	56.00	-37.10	QP
10	3.3450	1.47	9.97	11.44	46.00	-34.56	AVG
11	8.1240	16.35	10.05	26.40	60.00	-33.60	QP
12	8.1240	10.20	10.05	20.25	50.00	-29.75	AVG

Note: 1. Result = Reading + Correct Factor.
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 200 Hz (9 kHz ~ 150 kHz), 9 kHz (150 kHz ~ 30 MHz).
4. Step size: 80 Hz (0.009 MHz ~ 0.15 MHz), 4 kHz (0.15 MHz ~ 30 MHz), Scan time: auto.

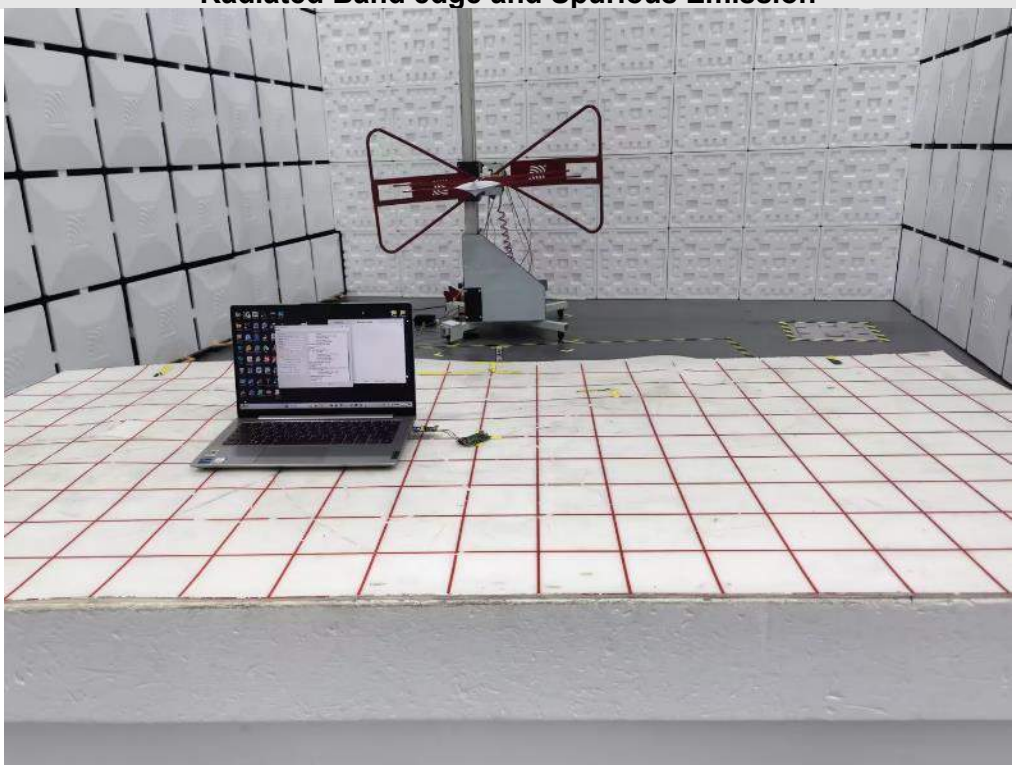
11. TEST DATA

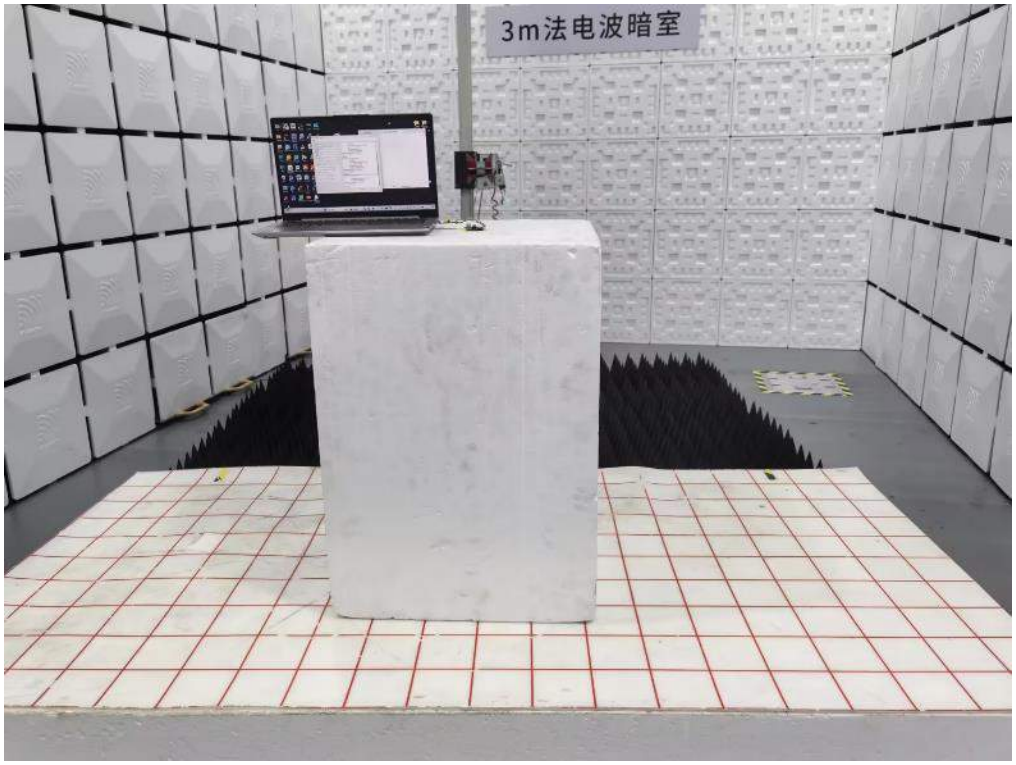
Please refer to section "Test Data" - Appendix A.

APPENDIX: PHOTOGRAPHS OF TEST CONFIGURATION

AC Power Line Conducted Emission

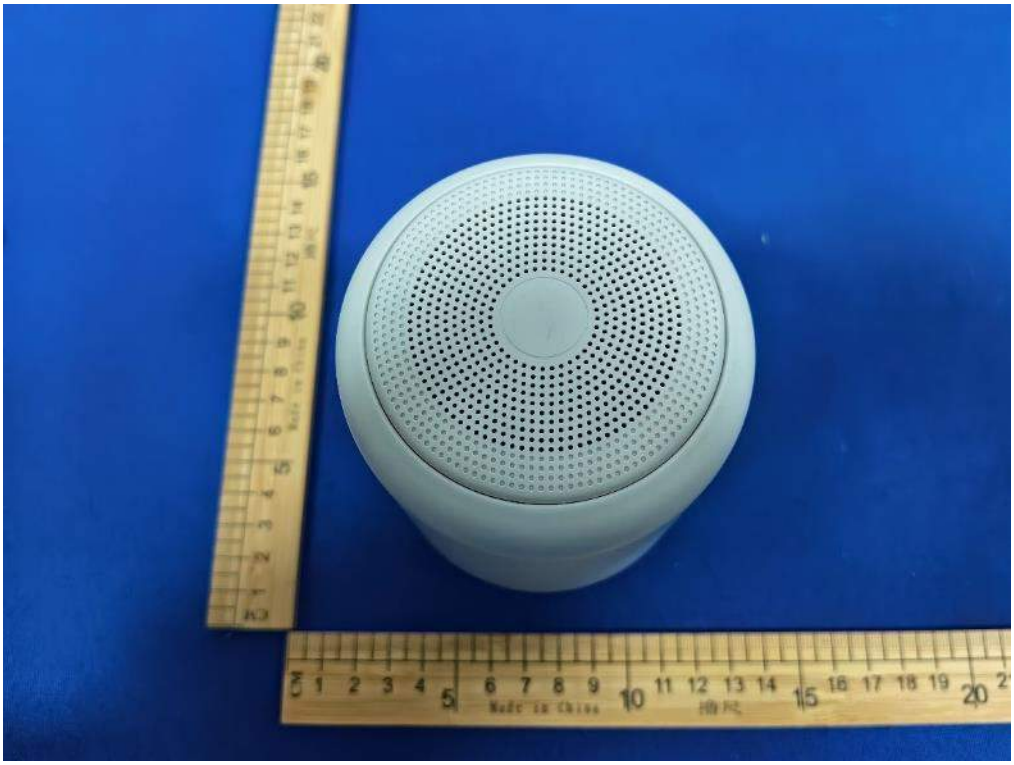
Radiated Band edge and Spurious Emission

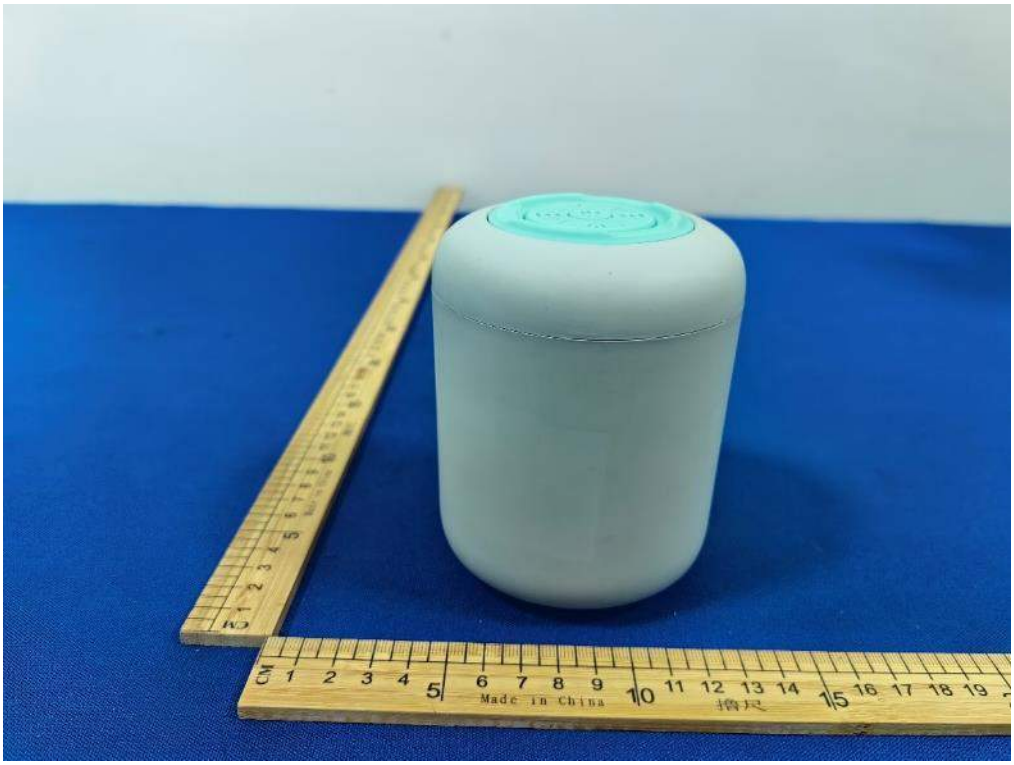


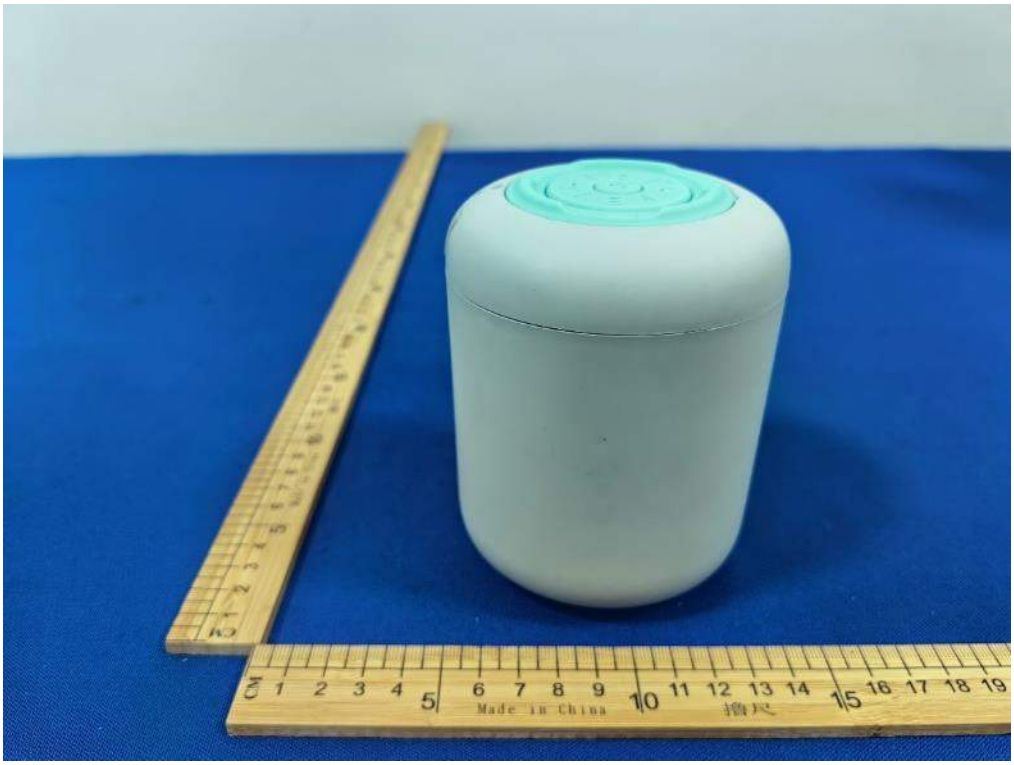

3m法电波暗室

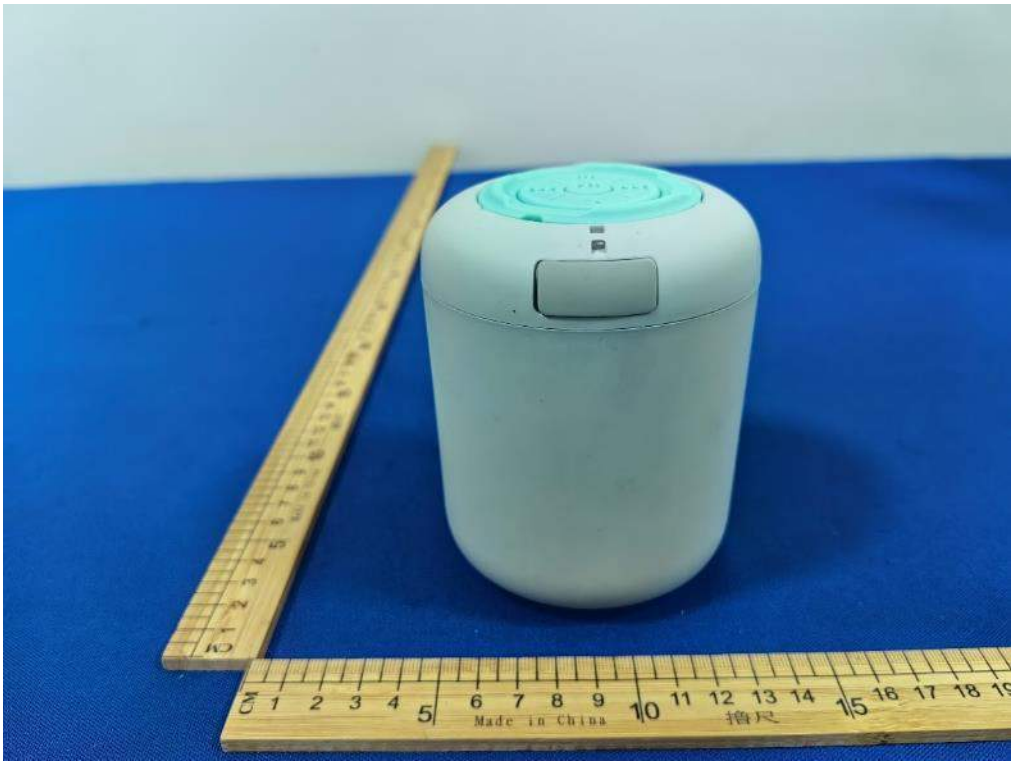
APPENDIX: PHOTOGRAPHS OF THE EUT

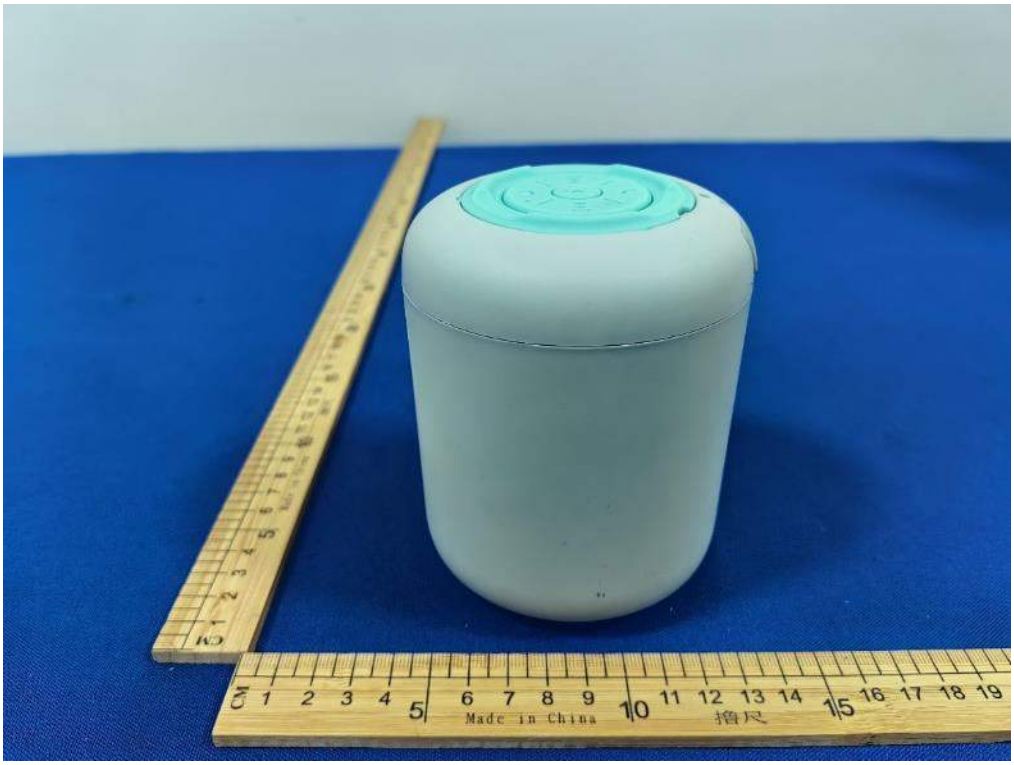
External



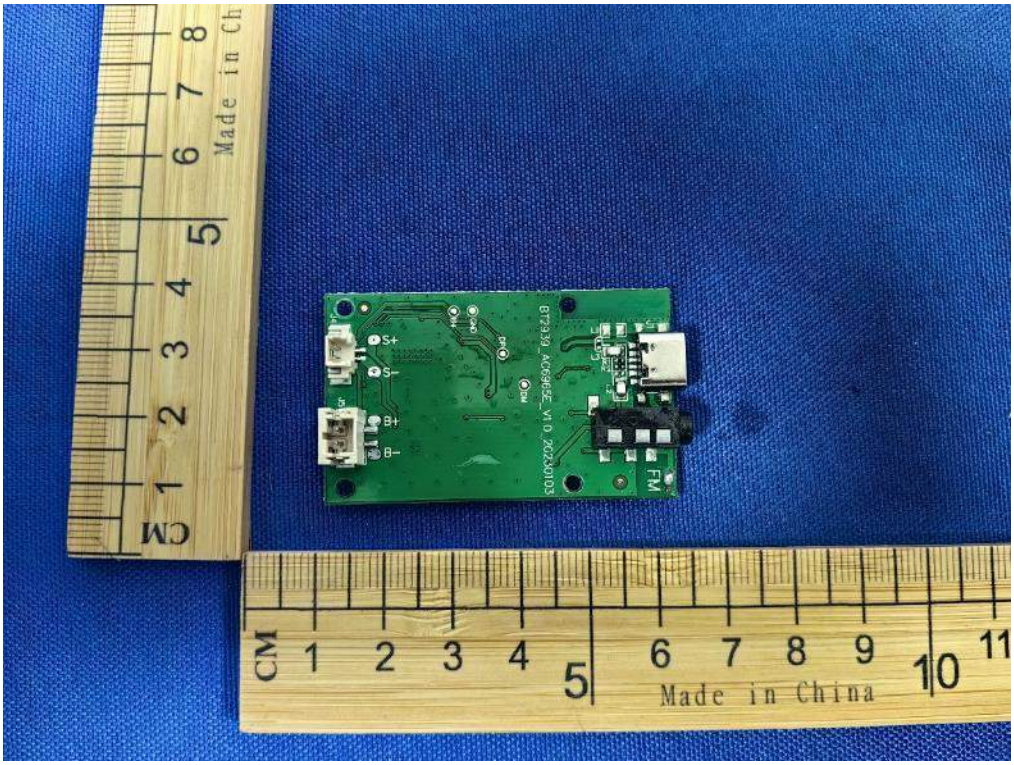


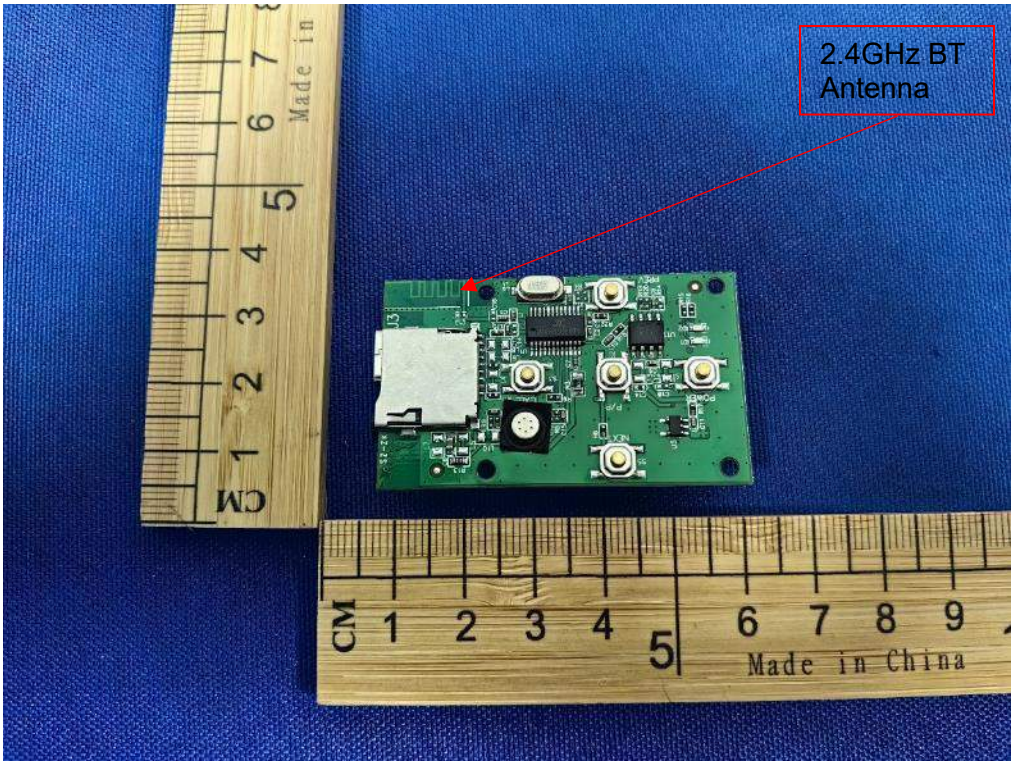

CM 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
Made in China

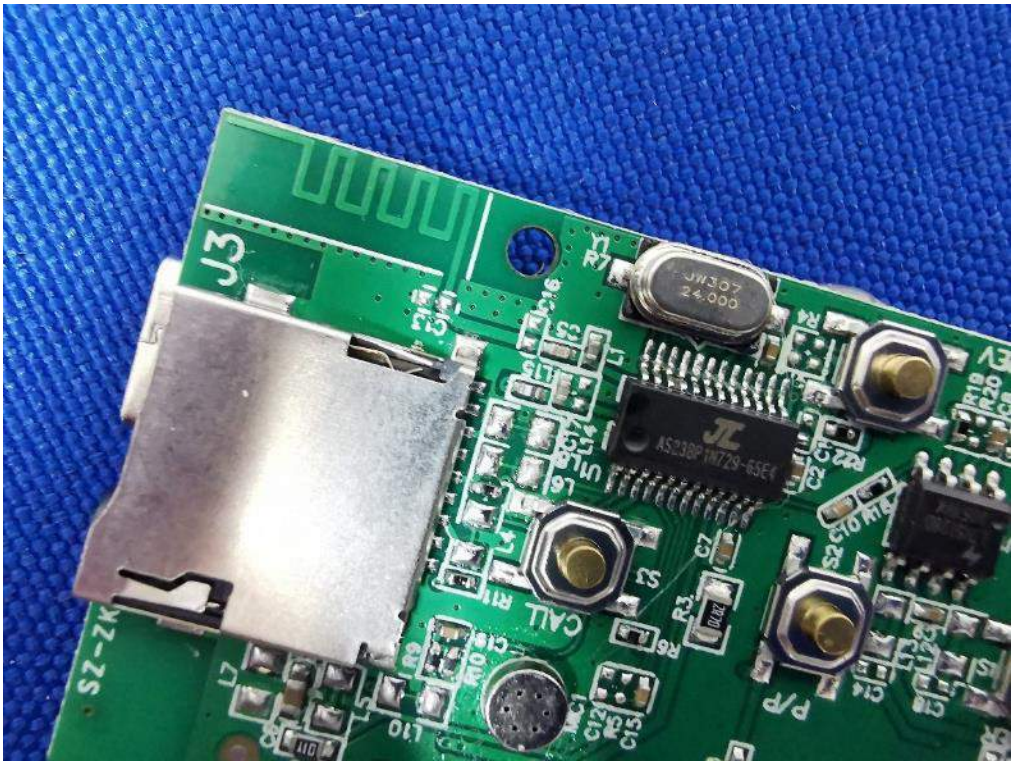

CM 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Made in China


Made in China

Internal




2.4GHz BT
Antenna
Made in China


J3
CALL
P/P

END OF REPORT