



# FCC Part 15 EMI TEST REPORT (CLASS II PERMISSIVE CHANGE)

of

E.U.T. : FM RDS/AM DIGITAL TUNING  
CLOCK RADIO WITH BLUETOOTH  
PLAYBACK

Model No. : RCR-20

FCC ID : BYGR20

for

APPLICANT : SANGEAN ELECTRONICS INC.

ADDRESS : NO.18, LANE 7, LI-DE STREET, CHUNG HO  
DISTRICT, NEW TAIPEI CITY, 23584,  
TAIWAN, R.O.C.

Test Performed by

## **Taiwan Testing and Certification Center**

No.34, Dingfu, Linkou Dist., New Taipei City 244, Taiwan (R.O.C.)

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Report Number :22-04-RBF-001-02

# TEST REPORT CERTIFICATION

Applicant : SANGEAN ELECTRONICS INC.  
NO.18, LANE 7, LI-DE STREET, CHUNG HO DISTRICT, NEW  
TAIPEI CITY, 23584, TAIWAN, R.O.C.

Manufacture : SANGEAN ELECTRONICS (DONG GUAN) LTD.  
No.1Binjiang street.Lianhu Road.Qiao Tou Town.Dong Guan City.

Description of Device :

a) Type of EUT : FM RDS/AM DIGITAL TUNING CLOCK RADIO WITH  
BLUETOOTH PLAYBACK

b) Trade Name : SANGEAN

c) Model No. : RCR-20

d) Power Supply : Adaptor Model: HKP24-0902000dU  
Input: 100-240V~50/60Hz 0.68A  
Output: 9V, 2A

Regulation Applied : FCC Rules and Regulations Part 15 Subpart C


I HEREBY CERTIFY THAT: The data shown in this report were made in accordance with the procedures given in ANSI C63.10-2013, and the energy emitted by the device was founded to be within the limits applicable. I assume full responsibility for accuracy and completeness of these data.

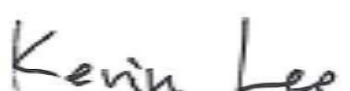
Note: 1. The result of the testing report relate only to the item tested.  
2. The testing report shall not be reproduced expect in full, without the written approval of ETC.

## Summary of Tests

Test	Results
Radiated Emission	<b>Pass</b>
Conducted Emission	<b>Pass</b>

*Date Test Item Received* : Apr. 01, 2022  
*Date Test Campaign Completed* : Apr. 16, 2022  
*Date of Issue* : Jun. 20, 2022

*Test Engineer* :   
\_\_\_\_\_  
(Vincent Chang, Engineer)

*Approve & Authorized* :   
\_\_\_\_\_  
Kevin Lee, Section Manager  
EMC Dept. II of TAIWAN TESTING  
AND CERTIFICATION CENTER



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## 1 GENERAL INFORMATION

### 1.1 Product Description

- a) Type of EUT : FM RDS/AM DIGITAL TUNING CLOCK RADIO WITH  
BLUETOOTH PLAYBACK
- b) Trade Name : SANGEAN
- c) Model No. : RCR-20
- d) Power Supply : Adaptor Model: HKP24-0902000dU  
Input: 100-240V~50/60Hz 0.68A  
Output: 9V, 2A
- e) Class II permissive : Software change for LCD Driver  
change description

#### Report Version History :

The following revisions have been made to ETC report No. 16-08-RBF-005-02

Report No.	Date of issue	Description
16-08-RBF-005-01	Sep. 10, 2016	First Version.
22-04-RBF-001-02	Jun. 20, 2022	1. Reference Test Report (Data from ETC Report No.: 16-08-RBF-005-02). 2. The software change for LCD driver as following the KDB Publication 178919 D01 (C2PC) which describes general permissive change policies.

### 1.2 Test Methodology

Both conducted and radiated emissions were performed according to the procedures illustrated in ANSI C63.10-2013. Other required measurements were illustrated in separate sections of this test report for details. For RF test the measurement procedure was referred to FCC KDB 558074 D01 15.247 Meas Guidance v05r02

#### Measurement Software

Software	Version	Note
e3	Version 6.100618f	Radiated Emission Test
e3	Version 6.100421	Conducted Emission Test

### 1.3 Test Facility

Location of the Test site: No.34, Lin 5, Dingfu Vil., Linkou Dist., New Taipei City, Taiwan  
24442, R.O.C.

Designation Number: TW2628.

## 2 PROVISIONS APPLICABLE

### 2.1 Definition

**Unintentional radiator:**

A device that intentionally generates and radio frequency energy for use within the device, or that sends radio frequency signals by conduction to associated equipment via connecting wiring, but which is not intended to emit RF energy by radiation or induction.

**Class A Digital Device:**

A digital device which is marketed for use in commercial or business environment; exclusive of a device which is market for use by the general public, or which is intended to be used in the home.

**Class B Digital Device :**

A digital device which is marketed for use in a residential environment notwithstanding use in a commercial, business of industrial environment. Example of such devices that are marketed for the general public.

Note : A manufacturer may also qualify a device intended to be marketed in a commercial, business, or industrial environment as a Class B digital device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B Digital Device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B Digital Device, Regardless of its intended use.

**Intentional radiator:**

A device that intentionally generates and emits radio frequency energy by radiation or induction.

## 2.2 Requirement for Compliance

### (1) Conducted Emission Requirement

Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency MHz	Quasi Peak dBμV	Average dBμV
0.15 - 0.5	66-56*	56-46*
0.5 - 5.0	56	46
5.0 - 30.0	60	50

\* Decreases with the logarithm of the frequency

For intentional device, according to §15.207(a) Line Conducted Emission Limits is same as above table.

### (2) Radiated Emission Requirement

For unintentional device, according to §15.109(a), except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency MHz	Distance Meters	Radiated dBμV/m	Radiated μV/m
30 - 88	3	40.0	100
88 - 216	3	43.5	150
216 - 960	3	46.0	200
Above 960	3	54.0	500

For intentional device, according to §15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

## 2.3 Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below :

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42-16.423	399.9-410	4.5-5.15
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	2655-2900	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	3360-4400	Above 38.6
13.36-13.41			

\*\* : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz



## 2.4 Labeling Requirement

The device shall bear the following statement in a conspicuous location on the device :

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions : (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

## 2.5 User Information

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual.

In the users manual, the Federal Communications Commission Radio Frequency Interference Statement includes the following paragraph.

This equipment has been tested and found to comply with the limits for a Class B Digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio / TV technician for help.

## 2.6 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Uncertainty
Conducted emissions	9kHz ~ 30MHz	±3.34dB (Mains)(LISN)
Radiated emissions	9kHz ~ 30MHz	±4.22dB
Radiated emissions	30MHz ~ 1GHz	±4.2dB (30MHz ≤ f ≤ 300MHz)
		±4.44dB (300MHz < f ≤ 1GHz)
	Above 1GHz	±4.44dB (1GHz ≤ f ≤ 18GHz)
		±3.02dB (18GHz ≤ f ≤ 40GHz)
Conducted Measurement	9kHz ~ 40GHz	±0.88dB (9kHz ≤ f ≤ 30MHz)
		±0.88dB (30MHz < f ≤ 1GHz)
		±1.04dB (1GHz ≤ f ≤ 18GHz)
		±1.2dB (18GHz ≤ f ≤ 40GHz)
Frequencies Tolerance	9kHz ~ 40GHz	±4.04×10 <sup>-8</sup>
Occupied Bandwidth	9kHz ~ 40GHz	±5%

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

The test result(s) does not consider the uncertainty of measurement when the test standard(s) and/or test method which refer by the labs has the limit or judgments for the test result(s).

### 3 SYSTEM TEST CONFIGURATION

#### 3.1 Justification

For both radiated and conducted emissions, the system was configured for testing in a typical fashion as a customer would normally use it. The peripherals other than EUT were connected in normally standing by situation. Measurement was performed under the condition that a computer program was exercised to simulate data communication of EUT, and the transmission rate was set to maximum allowed by EUT. Three highest emissions were verified with varying placement of the transmitting antenna connected to EUT (if applicable) to maximize the emission from EUT.

For conducted and radiated emissions, whichever RF channel is operated, the digital circuits' function identically. As the reason, measurement of emissions from digital circuits is performed with the highest, middle and the lowest channel by transmitting mode.

All measurement were intentional to maximum the emissions from EUT by varying the connection cables (if applicable), therefore, the test result is sure to meet the applicable requirement.

For portable device (if applicable), the EUT was pretested in three orthogonal plans: put on table horizontally, stands vertically and side up vertically. The worst case was chosen for final test.

The following modes were investigated and the worst cases (mode 1 and 3) were chosen for final test.

1. Basic Rate (BR) 1 Mbps uses GFSK modulation
2. Enhanced Data Rate (EDR) 2Mbps uses  $\pi/4$ -DQPSK modulation
3. Enhanced Data Rate (EDR) 3Mbps uses 8DPSK modulation

### 3.2 Devices for Tested System

EUT & accessories.

Device	Manufacture	Model	Description
FM RDS/AM DIGITAL TUNING CLOCK RADIO WITH BLUETOOTH PLAYBACK *	SANGEAN ELECTRONICS (DONG GUAN) LTD.	RCR-20	---
ADAPTER	SANGEAN	HKP24-0902000dU	1.5m Unshielded Cable Input:100-240V , 50/60Hz , 0.68A Output:9V , 2A

Remark “\*” means equipment under test.

#### The EUT connected with the following peripheral devices.

Device	Manufacture	Model	Description
Earphone	---	---	0.8m Unshielded Cable
Cell Phone	OPPO	CPH1605	---
3.5mm Audio Cable	UGREEN	50366	1.0m Unshielded Cable
USB Cable	UGREEN	10368	1.0m Unshielded Cable
LOAD	Hangzhou Ruideng Technology Co.,Ltd	HD35	---

## 4 RADIATED EMISSION MEASUREMENT

### 4.1 Applicable Standard

For unintentional radiator, the radiated emission shall comply with §15.109(a).

For intentional radiators, according to §15.247 (a), operation under this provision is limited to frequency hopping and direct sequence spread spectrum, and the out band emission shall be comply with §15.247 (c)

### 4.2 Measurement Procedure

#### A. Preliminary Measurement For Portable Devices

For portable devices, the following procedure was performed to determine the maximum emission axis of EUT:

1. With the receiving antenna is H polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
2. With the receiving antenna is V polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
3. Compare the results derived from above two steps. So, the axis of maximum emission from EUT was determined and the configuration was used to perform the final measurement.

#### B. Final Measurement

1. Setup the configuration per figure 1 and 2 for frequencies measured below and above 1 GHz respectively. Turn on EUT and make sure that it is in normal function.
2. For emission frequencies measured below 1 GHz and above 1 GHz, testing in a 966 RF shielded chamber #2.
3. For emission frequencies measured below and above 1 GHz, set the spectrum analyzer on a 100 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.
4. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0 ° to 360 ° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.
5. Repeat step 4 until all frequencies need to be measured were complete.
6. Repeat step 5 with search antenna in vertical polarized orientations.
7. Check the three frequencies of highest emission with varying the placement of cables (if any) associated with EUT to obtain the worse case and record the result.

Figure 1 : Frequencies measured below 1 GHz configuration

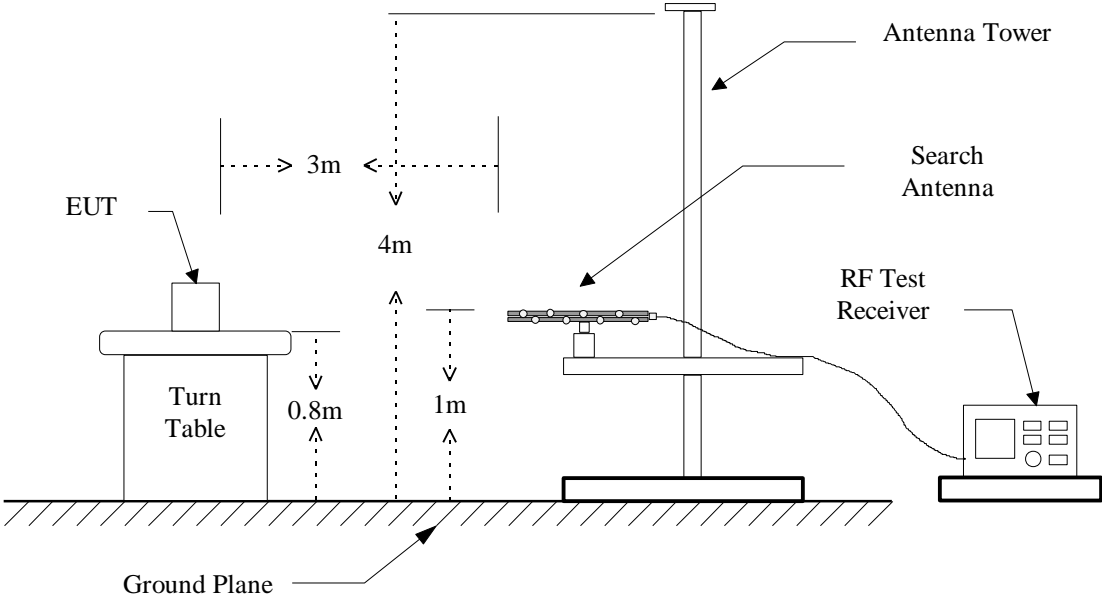
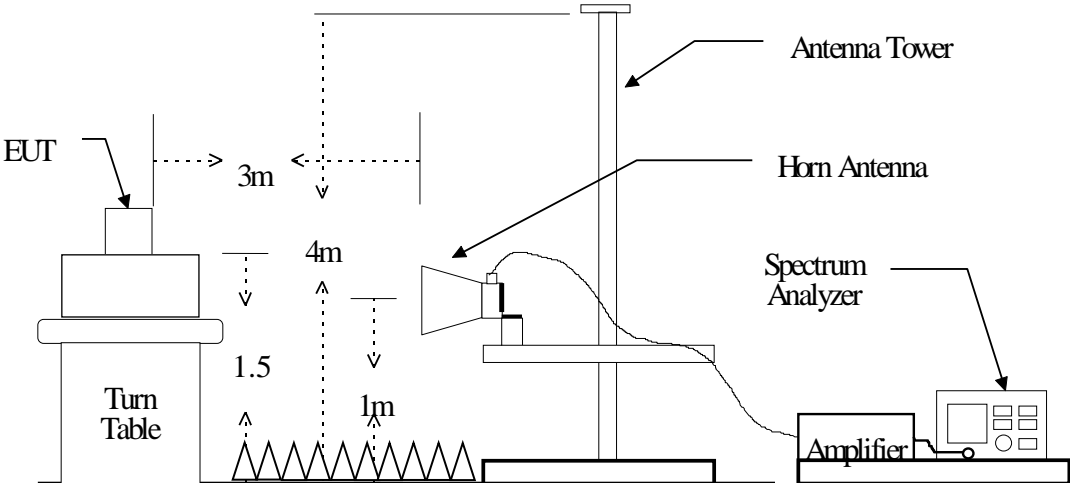


Figure 2 : Frequencies measured above 1 GHz configuration



### 4.3 Measuring Instrument

The following instrument are used for radiated emissions measurement:

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
EMI Test Receiver	Rohde & Schwarz	ESU 40	2022/03/16	2023/03/15
Bi-Log Antenna	ETC & JYEBAO	MCTD 2786B & FAT- NM5NF5T3G 2W5	2021/09/10	2022/09/09
Amplifier	HP	8447D	2021/09/22	2022/09/21
Horn Antenna (1-18G)	EMCO	3117	2022/04/08	2023/04/07
Amplifier (1G-18G)	HP	8449B	2021/09/22	2022/09/21
Horn Antenna (18-40G)	EMCO	3116	2021/08/27	2022/08/26
Amplifier (1G-40G)	Keysight	83051A	2021/09/09	2022/09/08

Measuring instrument setup in measured frequency band when specified detector function is used :

Frequency Band (MHz)	Instrument	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	RF Test Receiver	Quasi-Peak	120 kHz	N/A
	Spectrum Analyzer	Peak	100 kHz	100 kHz
Above 1000	Spectrum Analyzer	Peak	1 MHz	1 MHz
	Spectrum Analyzer	Average	1 MHz	10 Hz or $\geq 1/T$ (Note 1)

Note 1:

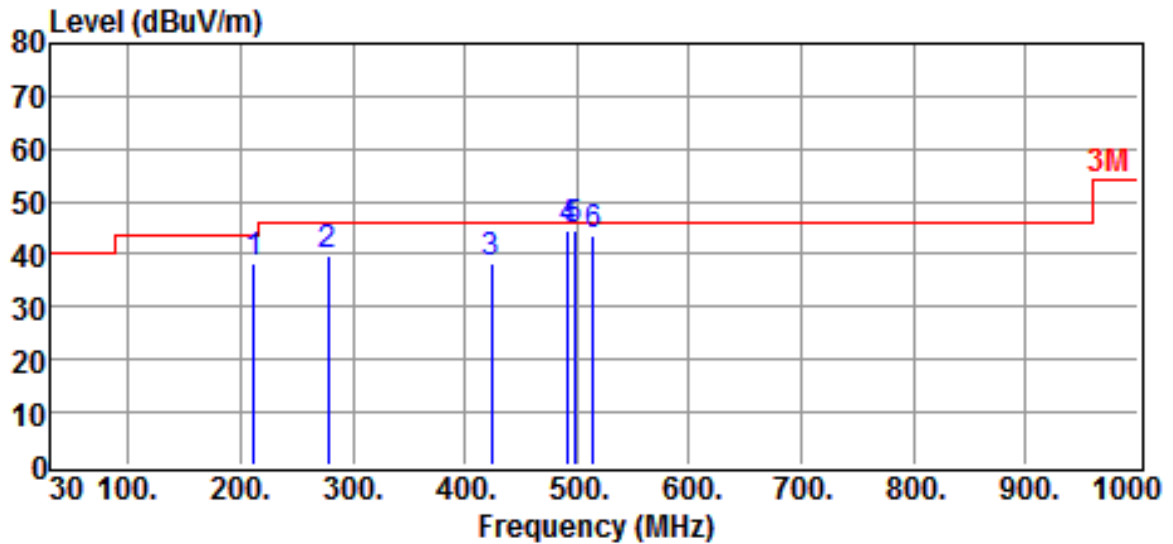
VBW = 10 Hz, when the duty cycle is no less than 98%.

VBW  $\geq 1/T$ , when duty cycle is less than 98% where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

### 4.4 Radiated Emission Data

#### 4.4.1 Other Emissions

##### a) Emission frequencies below 1 GHz



Site :Chamber#2 Date :2022-04-15  
 Limit :3M Ant. Pol. :HORIZONTAL  
 EUT:FM RDS/AM DIGITAL TUNING CLOCK RADIO WITH BLUETOOTH PLAYBACK  
 Model :RCR-20  
 Power Rating :120Vac / 60Hz Temp. :22° C  
 Engineer :VINCENT Humi. :68 %  
 Test Mode :FM & USB 5V LOAD

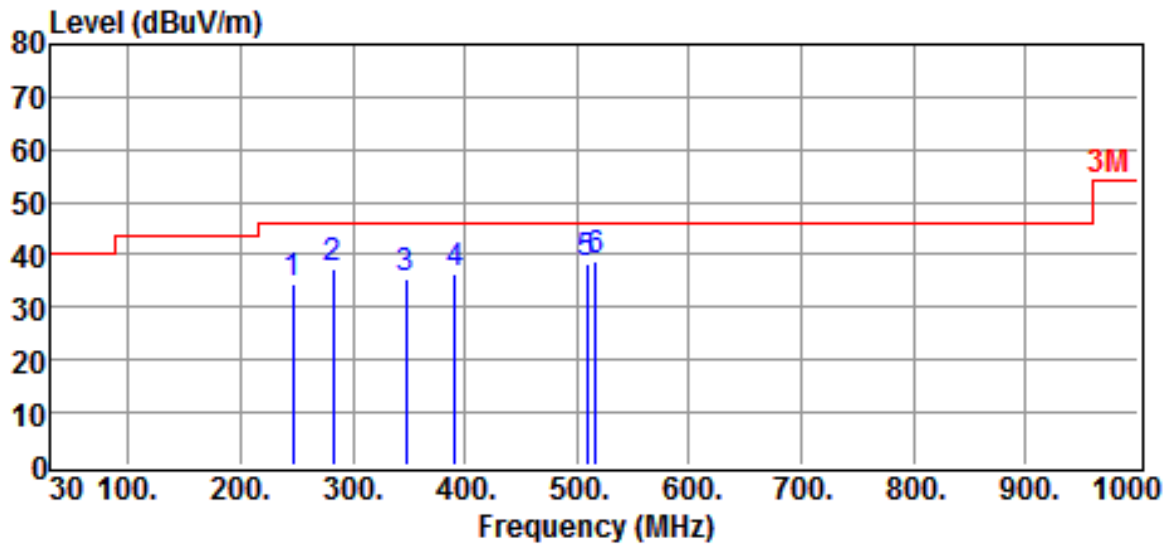
	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
	212.3600	46.03	-7.51	38.52	43.50	-4.98	QP
	278.3200	45.12	-5.39	39.73	46.00	-6.27	QP
	423.8200	39.76	-1.66	38.10	46.00	-7.90	QP
*	491.7200	45.35	-0.62	44.73	46.00	-1.27	QP
	497.5400	45.22	-0.55	44.67	46.00	-1.33	QP
	515.0000	43.70	-0.30	43.40	46.00	-2.60	QP

Note :

1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ( )
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result



5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. ” \* ” mean this data is the worst emission level.

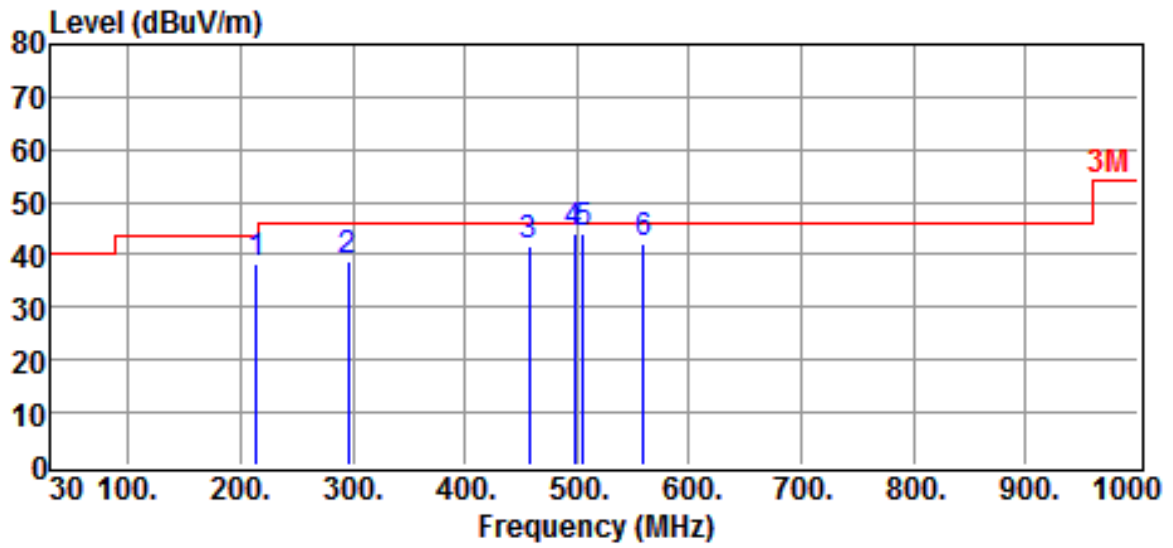


Site :Chamber#2 Date :2022-04-15  
 Limit :3M Ant. Pol. :VERTICAL  
 EUT:FM RDS/AM DIGITAL TUNING CLOCK RADIO WITH BLUETOOTH PLAYBACK  
 Model :RCR-20  
 Power Rating :120Vac / 60Hz Temp. :22 °C  
 Engineer :VINCENT Humi. :68 %  
 Test Mode :FM & USB 5V LOAD

	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
	247.2800	41.18	-6.50	34.68	46.00	-11.32	QP
	282.2000	42.74	-5.14	37.60	46.00	-8.40	QP
	347.1900	38.86	-3.40	35.46	46.00	-10.54	QP
	390.8400	38.53	-2.04	36.49	46.00	-9.51	QP
	509.1800	38.97	-0.44	38.53	46.00	-7.47	QP
*	516.9400	39.15	-0.26	38.89	46.00	-7.11	QP

Note :

1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ( )
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. ” \* ” mean this data is the worst emission level.

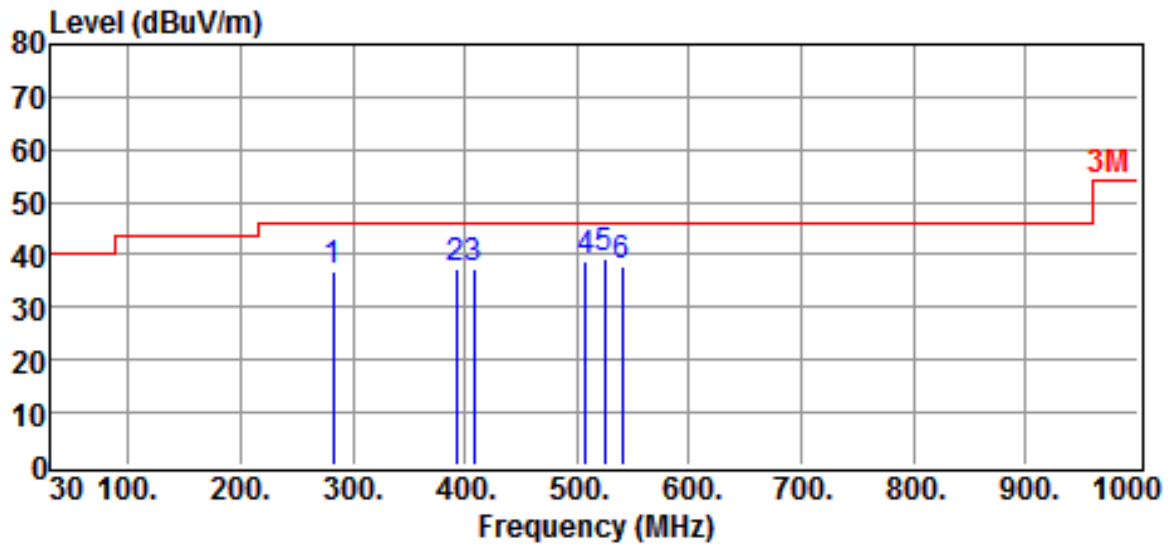


Site :Chamber#2 Date :2022-04-15  
 Limit :3M Ant. Pol. :HORIZONTAL  
 EUT:FM RDS/AM DIGITAL TUNING CLOCK RADIO WITH BLUETOOTH PLAYBACK  
 Model :RCR-20  
 Power Rating :120Vac / 60Hz Temp. :22 °C  
 Engineer :VINCENT Humi. :68 %  
 Test Mode :AM & USB 5V LOAD

	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
	214.3000	46.06	-7.61	38.45	43.50	-5.05	QP
	295.7800	43.04	-4.19	38.85	46.00	-7.15	QP
	456.8000	42.78	-1.29	41.49	46.00	-4.51	QP
*	497.5400	44.81	-0.55	44.26	46.00	-1.74	QP
	505.3000	44.72	-0.52	44.20	46.00	-1.80	QP
	559.6200	41.93	0.34	42.27	46.00	-3.73	QP

Note :

1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ( )
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. ” \* ” mean this data is the worst emission level.

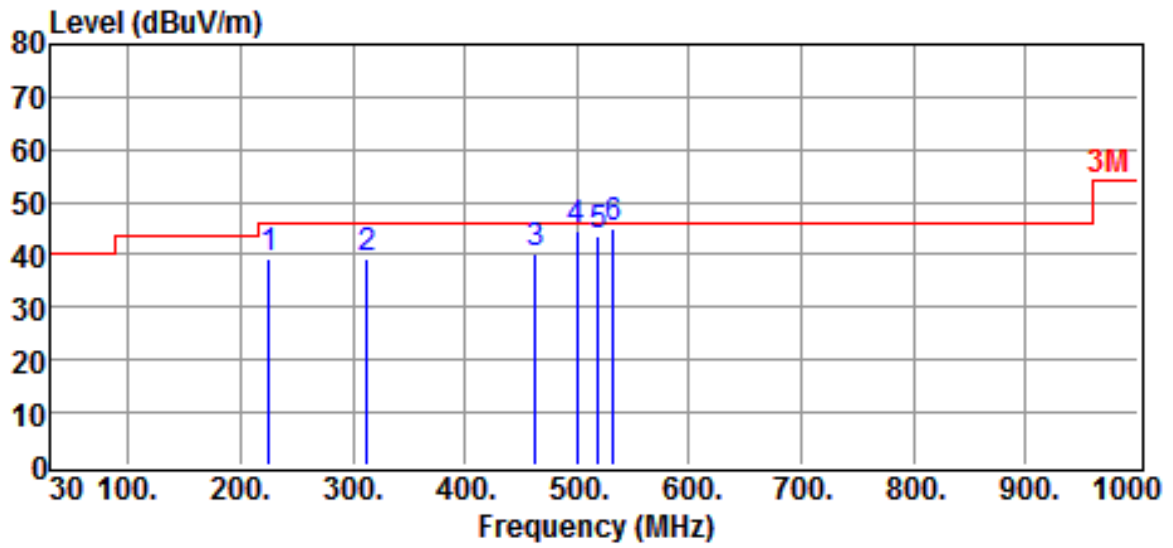


Site :Chamber#2 Date :2022-04-15  
 Limit :3M Ant. Pol. :VERTICAL  
 EUT:FM RDS/AM DIGITAL TUNING CLOCK RADIO WITH BLUETOOTH PLAYBACK  
 Model :RCR-20  
 Power Rating :120Vac / 60Hz Temp. :22 °C  
 Engineer :VINCENT Humi. :68 %  
 Test Mode :AM & USB 5V LOAD

	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
	282.2000	41.88	-5.14	36.74	46.00	-9.26	QP
	392.7800	39.15	-1.96	37.19	46.00	-8.81	QP
	408.3000	39.21	-1.78	37.43	46.00	-8.57	QP
	507.2400	39.29	-0.48	38.81	46.00	-7.19	QP
*	524.7000	39.31	-0.17	39.14	46.00	-6.86	QP
	540.2200	37.63	0.08	37.71	46.00	-8.29	QP

Note :

1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ( )
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. ” \* ” mean this data is the worst emission level.

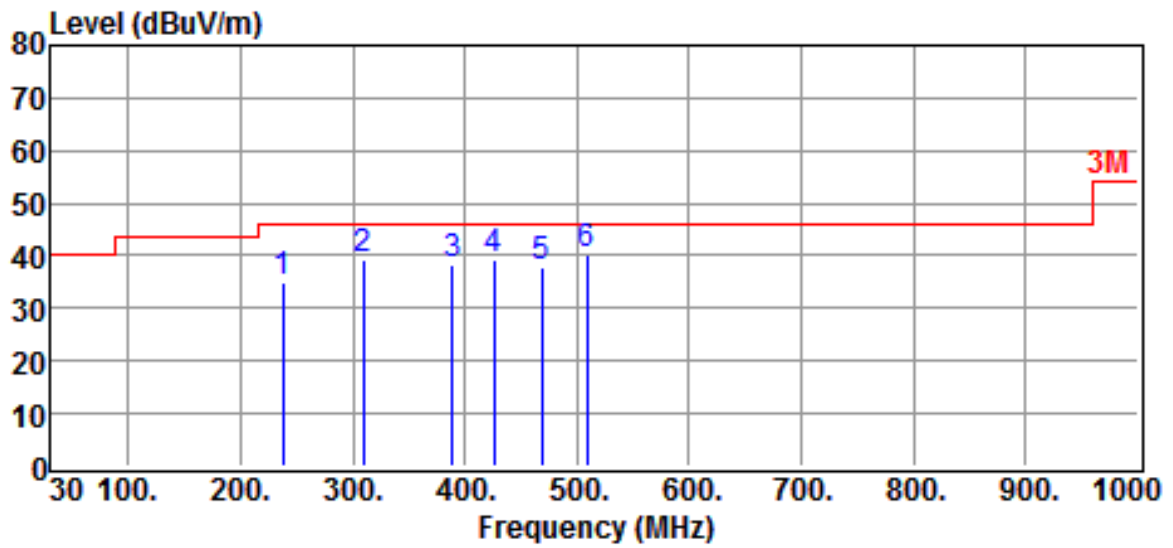


Site :Chamber#2 Date :2022-04-15  
 Limit :3M Ant. Pol. :HORIZONTAL  
 EUT:FM RDS/AM DIGITAL TUNING CLOCK RADIO WITH BLUETOOTH PLAYBACK  
 Model :RCR-20  
 Power Rating :120Vac / 60Hz Temp. :22 °C  
 Engineer :VINCENT Humi. :68 %  
 Test Mode :AUX & USB 5V LOAD

	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
	225.9400	47.30	-8.06	39.24	46.00	-6.76	QP
	313.2400	43.03	-3.90	39.13	46.00	-6.87	QP
	462.6200	41.55	-1.16	40.39	46.00	-5.61	QP
	499.4800	45.10	-0.55	44.55	46.00	-1.45	QP
	518.8800	43.75	-0.21	43.54	46.00	-2.46	QP
*	532.4600	44.80	0.00	44.80	46.00	-1.20	QP

Note :

1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ( )
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. ” \* ” mean this data is the worst emission level.

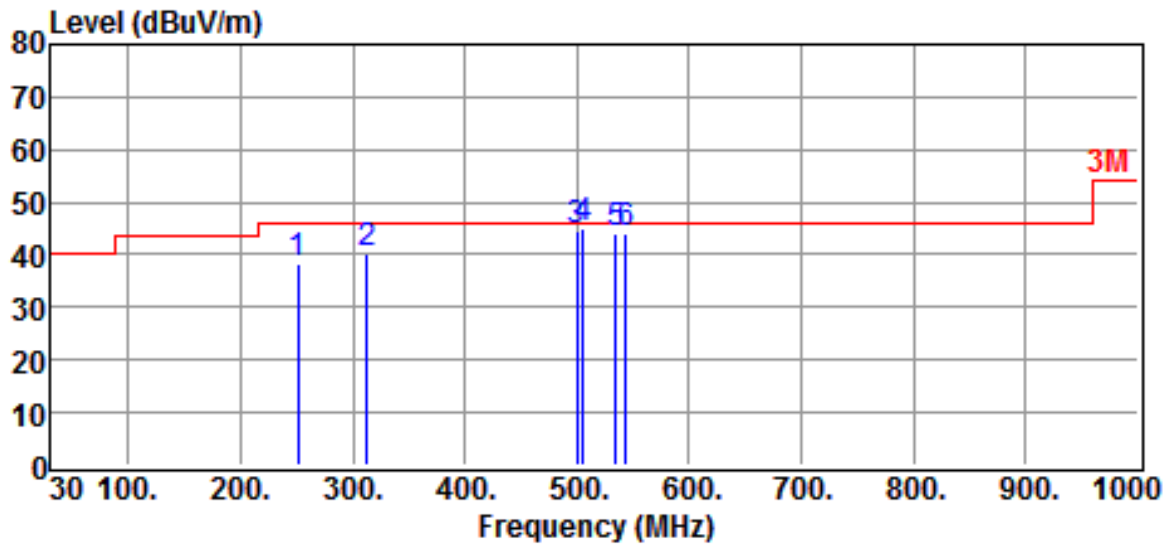


Site :Chamber#2 Date :2022-04-15  
 Limit :3M Ant. Pol. :VERTICAL  
 EUT:FM RDS/AM DIGITAL TUNING CLOCK RADIO WITH BLUETOOTH PLAYBACK  
 Model :RCR-20  
 Power Rating :120Vac / 60Hz Temp. :22 °C  
 Engineer :VINCENT Humi. :68 %  
 Test Mode :AUX & USB 5V LOAD

	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
	237.5800	42.57	-7.77	34.80	46.00	-11.20	QP
	309.3600	43.01	-3.90	39.11	46.00	-6.89	QP
	388.9000	40.28	-2.11	38.17	46.00	-7.83	QP
	425.7600	40.74	-1.68	39.06	46.00	-6.94	QP
	468.4400	39.09	-1.09	38.00	46.00	-8.00	QP
*	509.1800	40.75	-0.44	40.31	46.00	-5.69	QP

Note :

1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ( )
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. ” \* ” mean this data is the worst emission level.

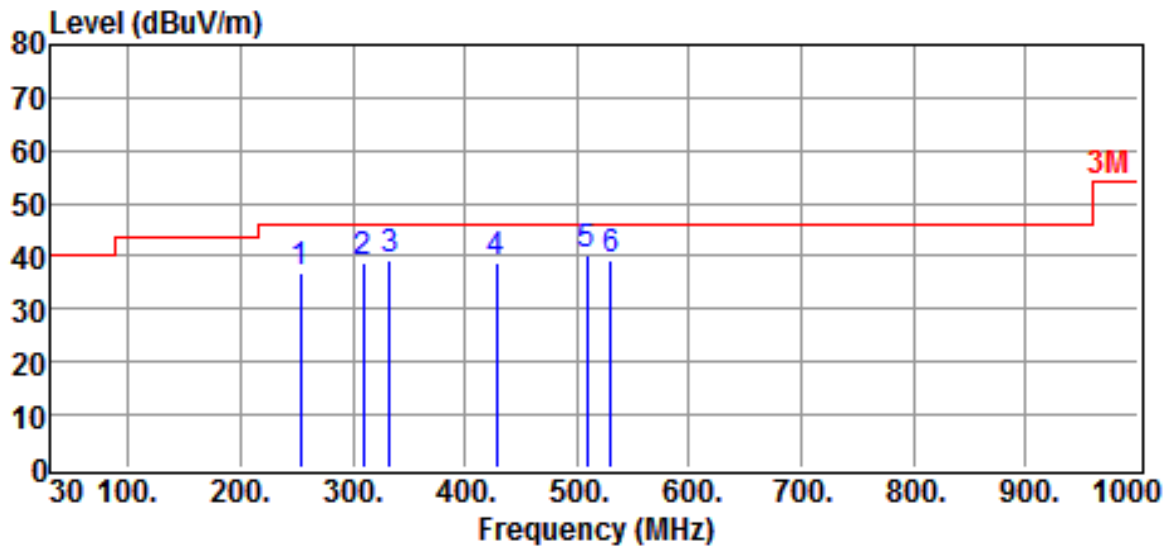


Site :Chamber#2 Date :2022-04-15  
 Limit :3M Ant. Pol. :HORIZONTAL  
 EUT:FM RDS/AM DIGITAL TUNING CLOCK RADIO WITH BLUETOOTH PLAYBACK  
 Model :RCR-20  
 Power Rating :120Vac / 60Hz Temp. :22 °C  
 Engineer :VINCENT Humi. :68 %  
 Test Mode :BT & USB 5V LOAD

	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
	251.1600	44.30	-5.81	38.49	46.00	-7.51	QP
	313.2400	44.11	-3.90	40.21	46.00	-5.79	QP
	499.4800	45.33	-0.55	44.78	46.00	-1.22	QP
*	505.3000	45.39	-0.52	44.87	46.00	-1.13	QP
	534.4000	44.07	0.05	44.12	46.00	-1.88	QP
	544.1000	43.76	0.18	43.94	46.00	-2.06	QP

Note :

1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ( )
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. ” \* ” mean this data is the worst emission level.



Site :Chamber#2 Date :2022-04-15  
 Limit :3M Ant. Pol. :VERTICAL  
 EUT:FM RDS/AM DIGITAL TUNING CLOCK RADIO WITH BLUETOOTH PLAYBACK  
 Model :RCR-20  
 Power Rating :120Vac / 60Hz Temp. :22 °C  
 Engineer :VINCENT Humi. :68 %  
 Test Mode :BT & USB 5V LOAD

	Freq MHz	Reading dBuV	Correction Factor dB/m	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
	253.1000	42.76	-5.73	37.03	46.00	-8.97	QP
	309.3600	42.75	-3.90	38.85	46.00	-7.15	QP
	332.6400	42.98	-3.57	39.41	46.00	-6.59	QP
	427.7000	40.53	-1.68	38.85	46.00	-7.15	QP
*	509.1800	40.75	-0.44	40.31	46.00	-5.69	QP
	530.5200	39.24	-0.04	39.20	46.00	-6.80	QP

Note :

1. Result = Reading + Correction Factor
2. Average Result = Peak Result + Duty Factor ( )
3. Correction Factor = Antenna Factor + Cable Loss - Amplifier Gain (if any)
4. The margin value=Limit - Result
5. Above 1Ghz : Peak measurements are compared to the average limit - as peak measurements are below the average limit, they also comply with the peak limit.
6. ” \* ” mean this data is the worst emission level.



**b) Emission frequencies above 1 GHz**

According to exploratory test no any obvious emissions were detected from above 1 GHz to 26.5 GHz.

**c) Emission frequencies below 30MHz (9kHz - 30MHz)**

According to exploratory test no any obvious emissions were detected from 9kHz to 30MHz.

**4.5 Field Strength Calculation**

The field strength is calculated by adding the Antenna Factor, High Pass Filter Loss (if used) and Cable Loss, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation calculation is as follows:

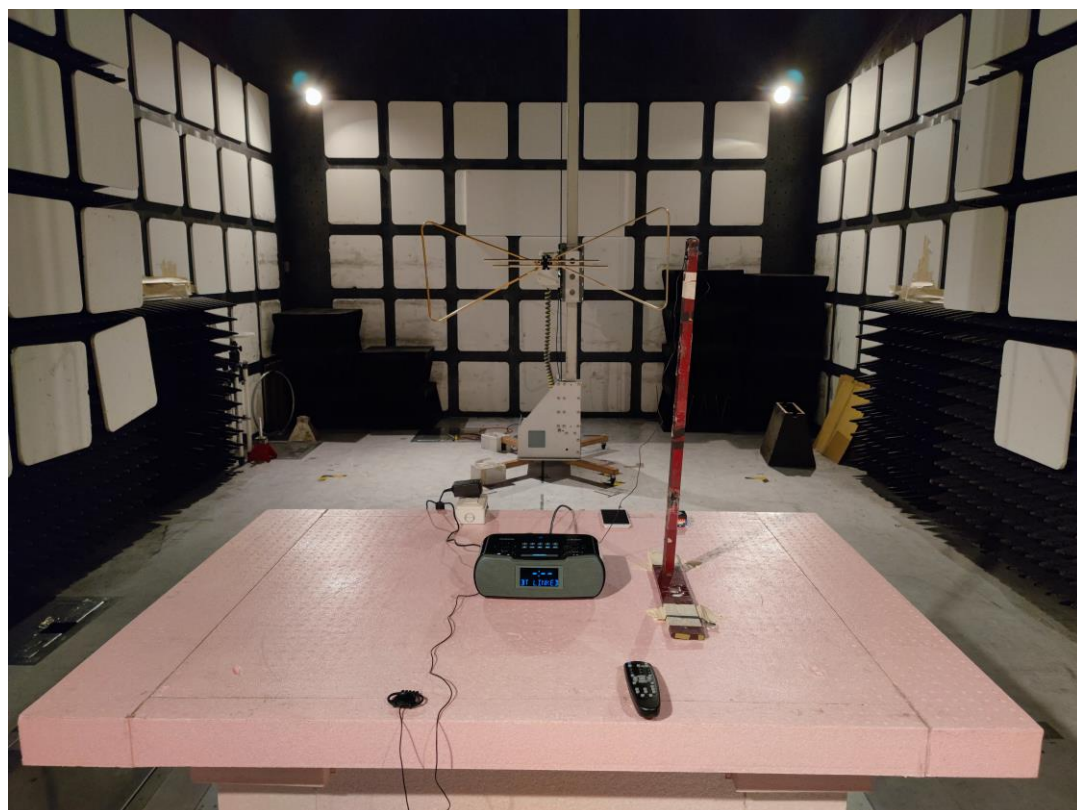
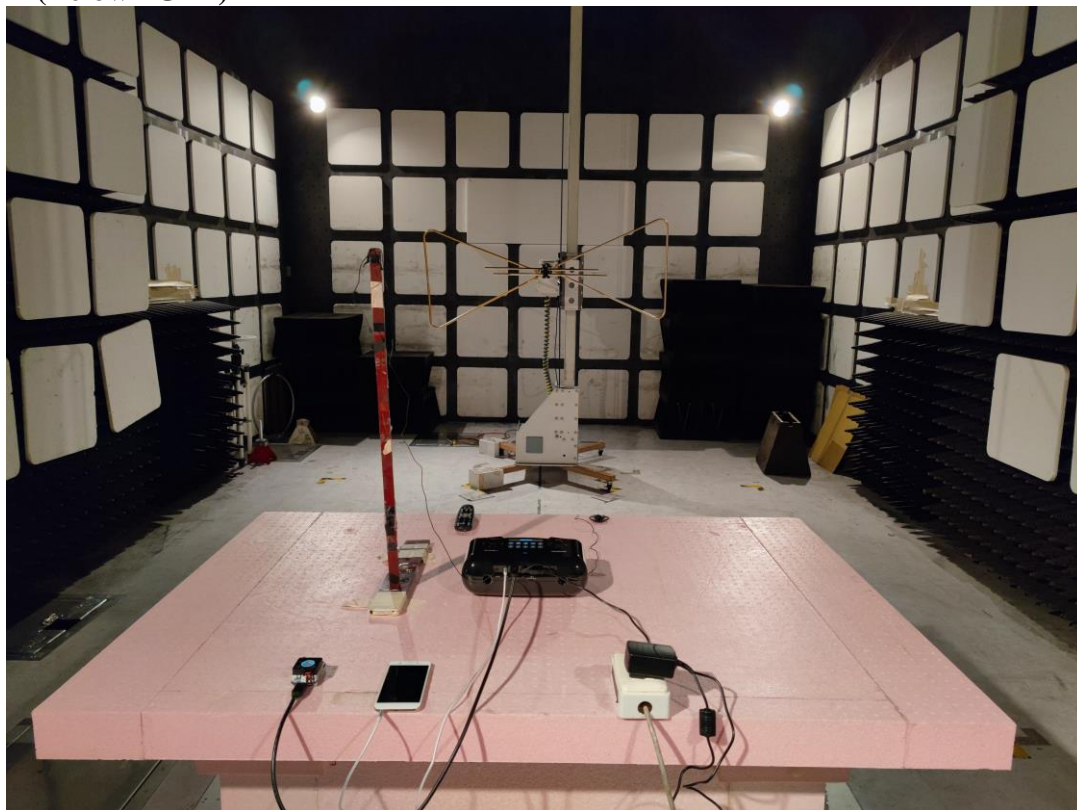
$$\text{Result} = \text{Reading} + \text{Corrected Factor}$$

where Corrected Factor

$$= \text{Antenna FACTOR} + \text{Cable Loss} + \text{High Pass Filter Loss} - \text{Amplifier Gain}$$

### 4.6 Photos of Radiation Measuring Setup

(Below 1GHz)



**(1-6GHz)**



(Above 6GHz)



## 5 CONDUCTED EMISSION MEASUREMENT

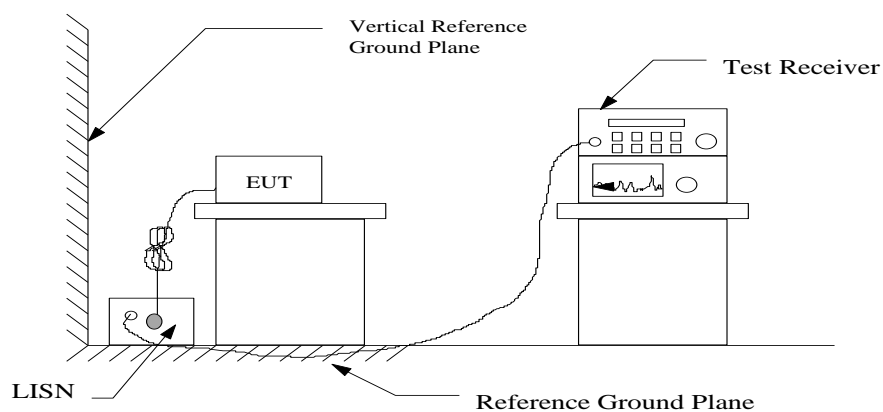
### 5.1 Standard Applicable

For unintentional and intentional device, Line Conducted Emission Limits are in accordance to §15.107(a) and §15.207(a) respectively. Both Limits are identical specification.

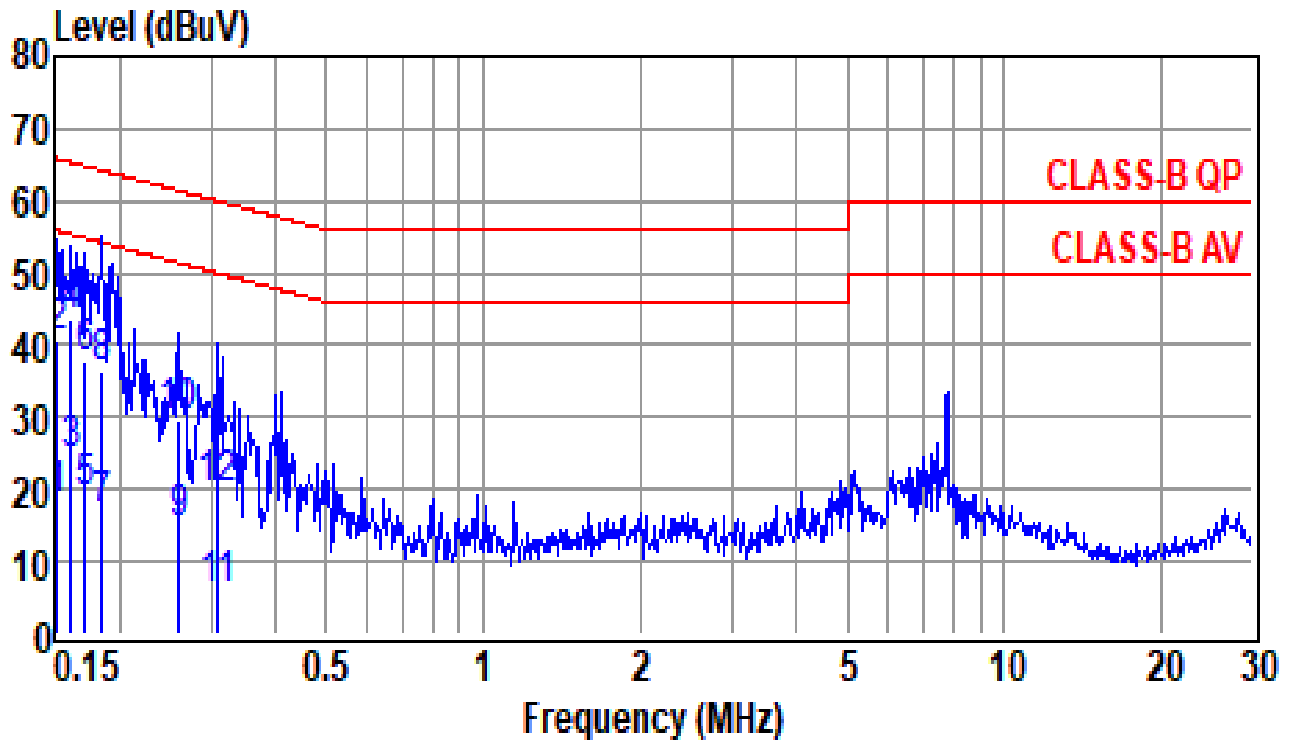
### 5.2 Measurement Procedure

1. Setup the configuration per figure 3.
2. A preliminary scan with a spectrum monitor is performed to identify the frequency of emission that has the highest amplitude relative to the limit by operating the EUT in selected modes of operation, typical cable positions, and with a typical system configuration.
3. Record the 6 or 8 highest emissions relative to the limit.
4. Measure each frequency obtained from step 3 by a test receiver set on quasi peak detector function, and then record the accuracy frequency and emission level. If all emissions measured in the specified band are attenuated more than 20 dB from the limit, this step would be ignored, and the peak detector function would be used.
5. Confirm the highest three emissions with variation of the EUT cable configuration and record the final data.
6. Repeat all above procedures on measuring each operation mode of EUT.

Figure 3 : Conducted emissions measurement configuration



### 5.3 Conducted Emission Data



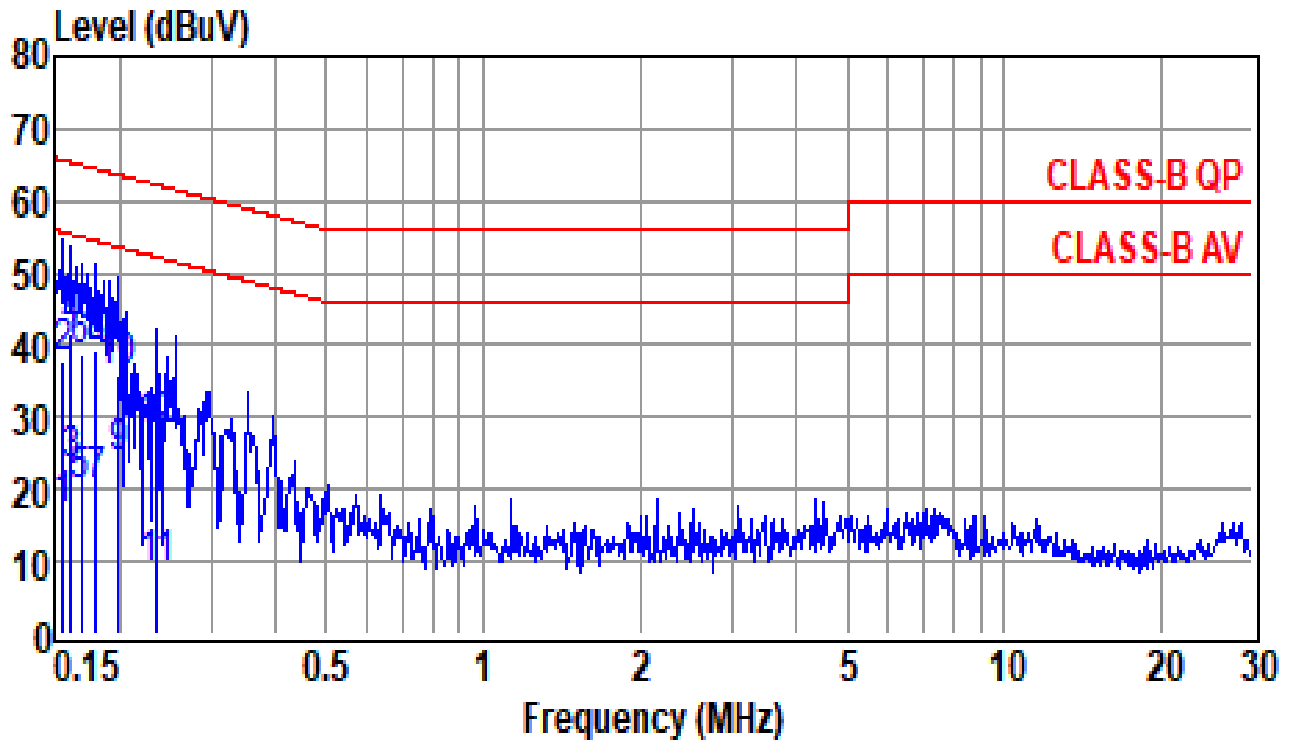
Site : conducted #1 Date : 2022-04-16  
 Condition : CLASS-B QP LISN : NEUTRAL  
 Tem / Hum : 22 °C / 66%  
 Test Mode : FM & USB 5V LOAD  
 EUT:FM RDS/AM DIGITAL TUNING CLOCK RADIO WITH BLUETOOTH PLAYBACK L  
 Power Rating : 120V / 60Hz  
 Engineer : Vincent Model : RCR-20

	Freq (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV)	Limit Line (dBuV)	Over Limit (dB)	Remark
	0.1524	8.40	10.00	18.40	55.87	-37.47	Average
	0.1524	30.93	10.00	40.93	65.87	-24.94	QP
	0.1624	14.40	10.00	24.40	55.34	-30.94	Average
*	0.1624	33.41	10.00	43.41	65.34	-21.93	QP
	0.1722	9.14	10.00	19.14	54.86	-35.72	Average
	0.1722	27.96	10.00	37.96	64.86	-26.90	QP
	0.1854	6.60	10.00	16.60	54.24	-37.64	Average
	0.1854	26.25	10.00	36.25	64.24	-27.99	QP
	0.2616	4.87	10.00	14.87	51.38	-36.51	Average
	0.2616	19.75	10.00	29.75	61.38	-31.63	QP

	0.3100	-4.21	10.00	5.79	49.97	-44.18	Average
	0.3100	9.66	10.00	19.66	59.97	-40.31	QP

Note :

1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss+ Pulse Limiter Factor
3. " \* " mean this data is the worst emission level



Site : conducted #1 Date : 2022-04-16  
 Condition : CLASS-B QP LISN : LINE  
 Tem / Hum : 22 °C / 66%  
 Test Mode : FM & USB 5V LOAD  
 EUT:FM RDS/AM DIGITAL TUNING CLOCK RADIO WITH BLUETOOTH PLAYBACK  
 Power Rating : 120V / 60Hz  
 Engineer : Vincent Model : RCR-20

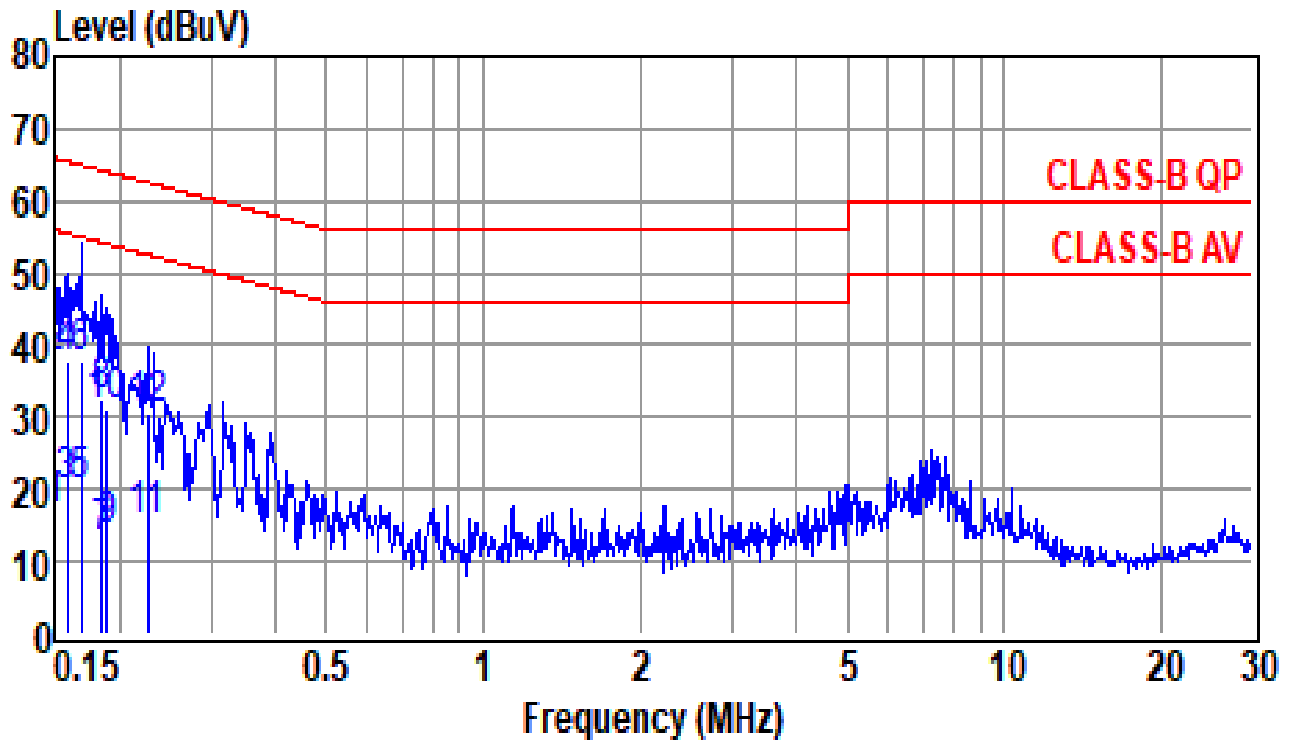
	Freq (MHz)	Reading (dBUV)	Factor (dB)	Emission Level (dBUV)	Limit Line (dBUV)	Over Limit (dB)	Remark
	0.1565	6.74	10.00	16.74	55.65	-38.91	Average
	0.1565	28.07	10.00	38.07	65.65	-27.58	QP
	0.1616	12.90	10.00	22.90	55.38	-32.48	Average
*	0.1616	31.63	10.00	41.63	65.38	-23.75	QP
	0.1694	10.24	10.00	20.24	54.99	-34.75	Average
	0.1694	28.89	10.00	38.89	64.99	-26.10	QP
	0.1806	10.00	10.00	20.00	54.46	-34.46	Average
	0.1806	29.34	10.00	39.34	64.46	-25.12	QP
	0.1997	13.75	10.00	23.75	53.62	-29.87	Average
	0.1997	26.09	10.00	36.09	63.62	-27.53	QP



	0.2366	-1.24	10.00	8.76	52.22	-43.46	Average
	0.2366	17.79	10.00	27.79	62.22	-34.43	QP

Note :

1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss+ Pulse Limiter Factor
3. " \* " mean this data is the worst emission level



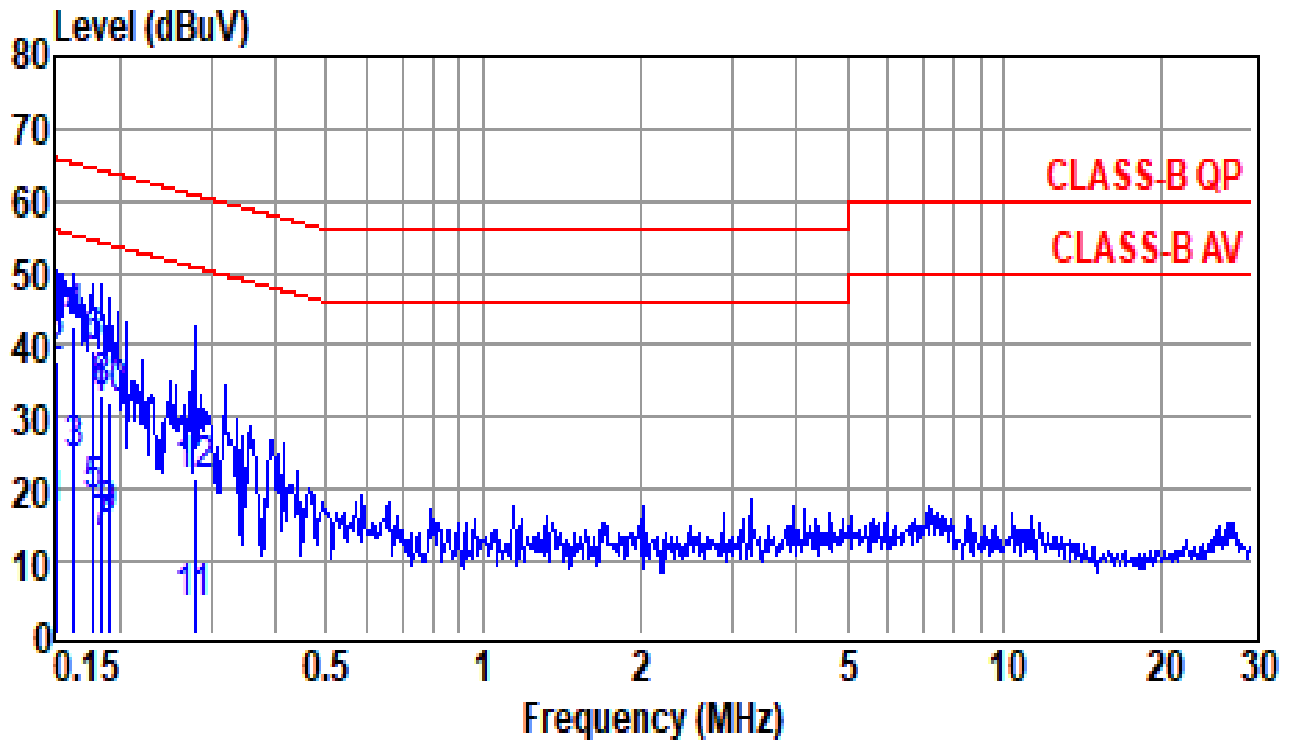
Site : conducted #1 Date : 2022-04-16  
 Condition : CLASS-B QP LISN : NEUTRAL  
 Tem / Hum : 22 °C / 66%  
 Test Mode : AM & USB 5V LOAD  
 EUT:FM RDS/AM DIGITAL TUNING CLOCK RADIO WITH BLUETOOTH PLAYBACK  
 Power Rating : 120V / 60Hz  
 Engineer : Vincent Model : RCR-20

	Freq (MHz)	Reading (dBUV)	Factor (dB)	Emission Level (dBUV)	Limit Line (dBUV)	Over Limit (dB)	Remark
	0.1508	6.63	10.00	16.63	55.96	-39.33	Average
	0.1508	27.68	10.00	37.68	65.96	-28.28	QP
	0.1590	10.31	10.00	20.31	55.52	-35.21	Average
	0.1590	27.73	10.00	37.73	65.52	-27.79	QP
	0.1685	10.26	10.00	20.26	55.03	-34.77	Average
*	0.1685	27.96	10.00	37.96	65.03	-27.07	QP
	0.1854	2.95	10.00	12.95	54.24	-41.29	Average
	0.1854	22.71	10.00	32.71	64.24	-31.53	QP
	0.1904	3.89	10.00	13.89	54.02	-40.13	Average
	0.1904	21.34	10.00	31.34	64.02	-32.68	QP

	0.2268	5.29	10.00	15.29	52.57	-37.28	Average
	0.2268	20.76	10.00	30.76	62.57	-31.81	QP

Note :

1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss+ Pulse Limiter Factor
3. ” \* ” mean this data is the worst emission level



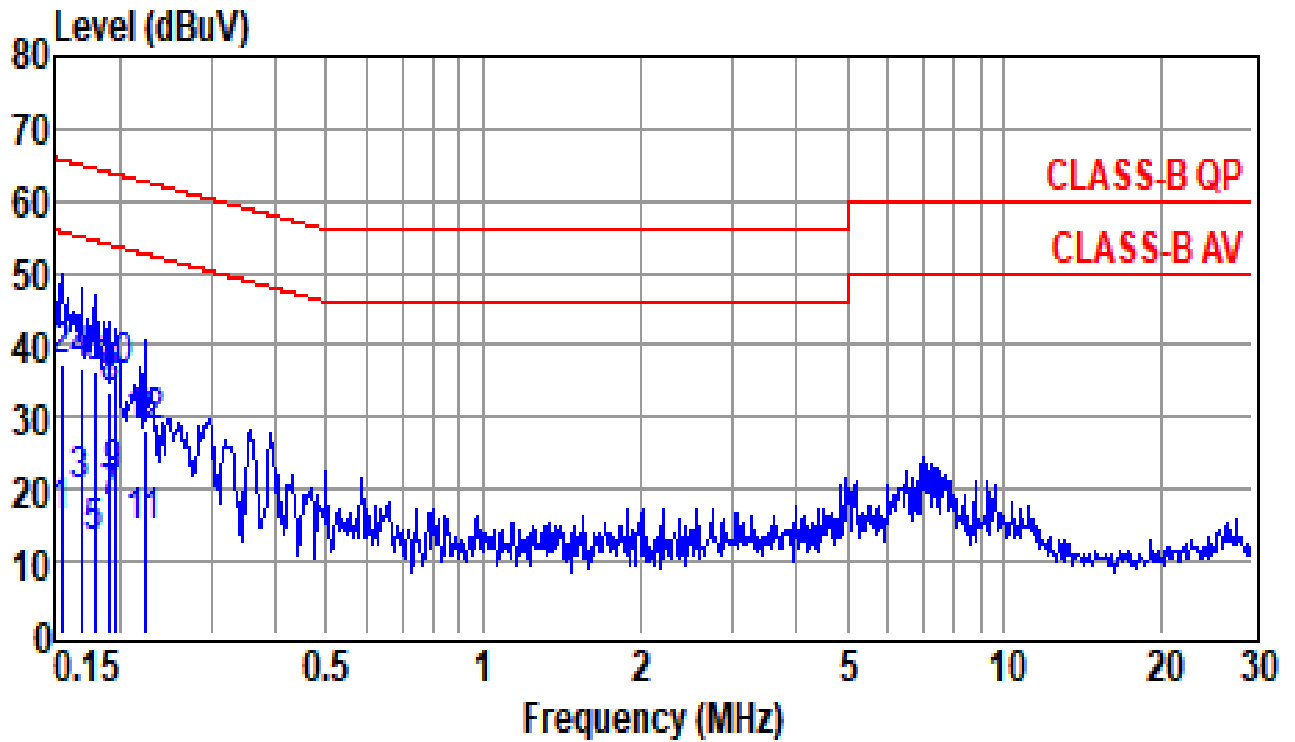
Site : conducted #1 Date : 2022-04-16  
 Condition : CLASS-B QP LISN : LINE  
 Tem / Hum : 22 °C / 66%  
 Test Mode : AM & USB 5V LOAD  
 EUT:FM RDS/AM DIGITAL TUNING CLOCK RADIO WITH BLUETOOTH PLAYBACK  
 Power Rating : 120V / 60Hz  
 Engineer : Vincent Model : RCR-20

	Freq (MHz)	Reading (dBUV)	Factor (dB)	Emission Level (dBUV)	Limit Line (dBUV)	Over Limit (dB)	Remark
	0.1516	6.58	10.00	16.58	55.91	-39.33	Average
	0.1516	27.97	10.00	37.97	65.91	-27.94	QP
	0.1641	14.24	10.00	24.24	55.25	-31.01	Average
*	0.1641	32.79	10.00	42.79	65.25	-22.46	QP
	0.1787	8.65	10.00	18.65	54.55	-35.90	Average
	0.1787	29.21	10.00	39.21	64.55	-25.34	QP
	0.1854	3.47	10.00	13.47	54.24	-40.77	Average
	0.1854	23.24	10.00	33.24	64.24	-31.00	QP
	0.1914	5.28	10.00	15.28	53.98	-38.70	Average
	0.1914	22.08	10.00	32.08	63.98	-31.90	QP

	0.2788	-6.31	10.00	3.69	50.85	-47.16	Average
	0.2788	11.51	10.00	21.51	60.85	-39.34	QP

Note :

1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss+ Pulse Limiter Factor
3. " \* " mean this data is the worst emission level



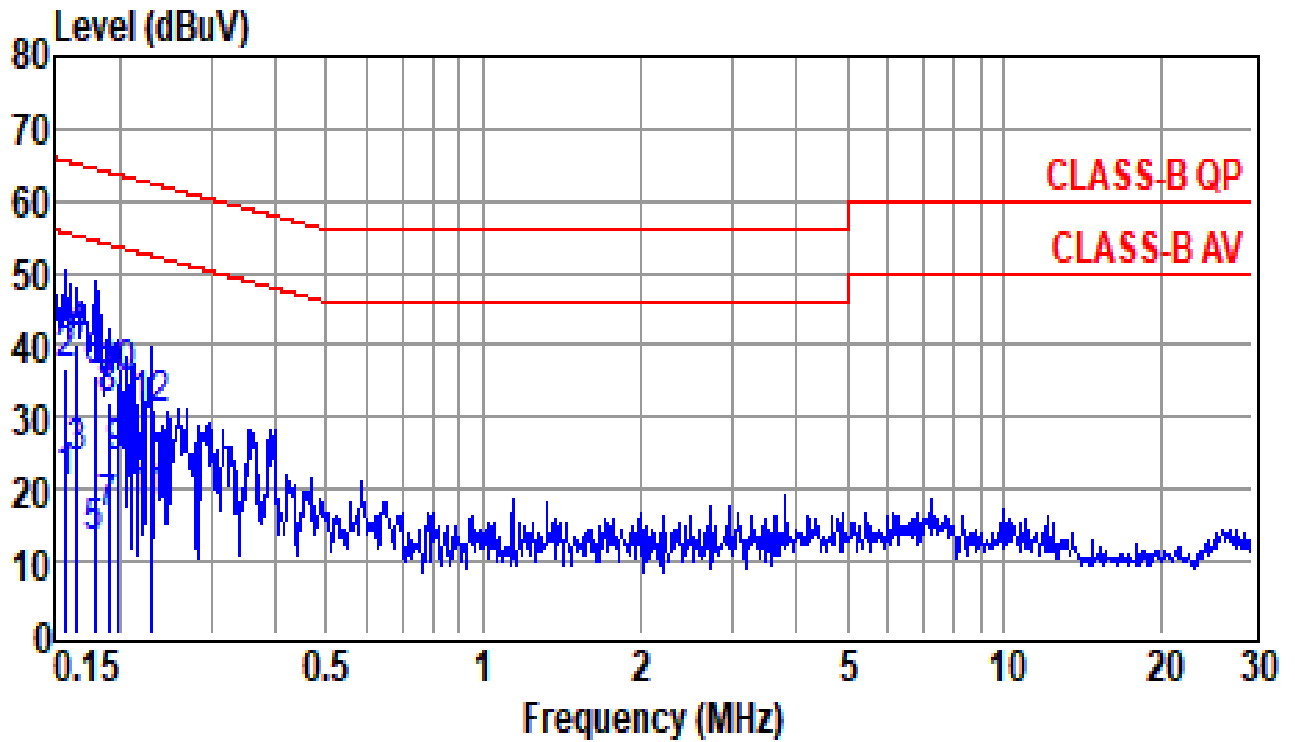
Site : conducted #1 Date : 2022-04-16  
 Condition : CLASS-B QP LISN : NEUTRAL  
 Tem / Hum : 22 °C / 66%  
 Test Mode : AUX & USB 5V LOAD  
 EUT:FM RDS/AM DIGITAL TUNING CLOCK RADIO WITH BLUETOOTH PLAYBACK  
 Power Rating : 120V / 60Hz  
 Engineer : Vincent Model : RCR-20

	Freq (MHz)	Reading (dBUV)	Factor (dB)	Emission Level (dBUV)	Limit Line (dBUV)	Over Limit (dB)	Remark
	0.1549	5.58	10.00	15.58	55.74	-40.16	Average
	0.1549	27.29	10.00	37.29	65.74	-28.45	QP
	0.1685	10.26	10.00	20.26	55.03	-34.77	Average
	0.1685	26.89	10.00	36.89	65.03	-28.14	QP
	0.1796	2.85	10.00	12.85	54.50	-41.65	Average
	0.1796	26.29	10.00	36.29	64.50	-28.21	QP
	0.1924	7.70	10.00	17.70	53.93	-36.23	Average
	0.1924	23.34	10.00	33.34	63.93	-30.59	QP
	0.1955	11.03	10.00	21.03	53.80	-32.77	Average
*	0.1955	26.05	10.00	36.05	63.80	-27.75	QP

	0.2244	4.21	10.00	14.21	52.66	-38.45	Average
	0.2244	18.23	10.00	28.23	62.66	-34.43	QP

Note :

1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss+ Pulse Limiter Factor
3. ” \* ” mean this data is the worst emission level



Site : conducted #1 Date : 2022-04-16  
 Condition : CLASS-B QP LISN : LINE  
 Tem / Hum : 22 °C / 66%  
 Test Mode : AUX & USB 5V LOAD  
 EUT:FM RDS/AM DIGITAL TUNING CLOCK RADIO WITH BLUETOOTH PLAYBACK  
 Power Rating : 120V / 60Hz  
 Engineer : Vincent Model : RCR-20

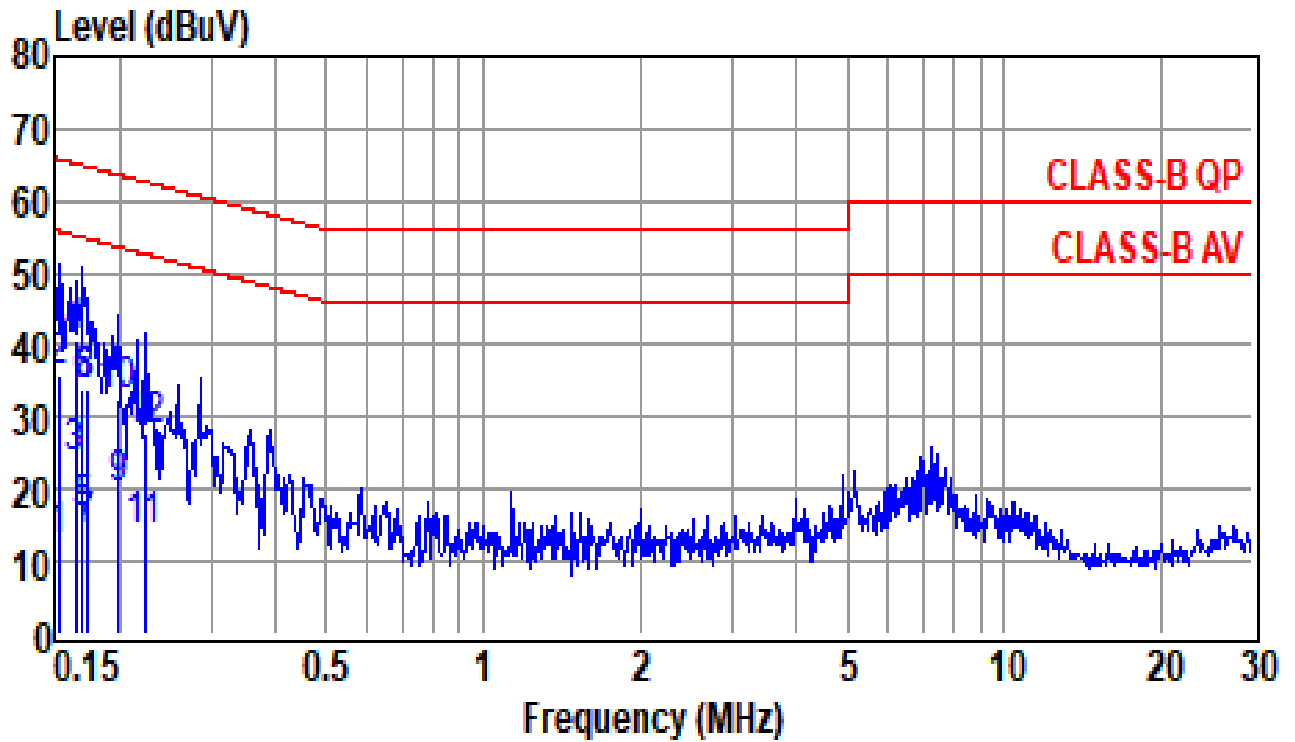
	Freq (MHz)	Reading (dBUV)	Factor (dB)	Emission Level (dBUV)	Limit Line (dBUV)	Over Limit (dB)	Remark
	0.1582	10.81	10.00	20.81	55.56	-34.75	Average
	0.1582	26.83	10.00	36.83	65.56	-28.73	QP
	0.1659	13.86	10.00	23.86	55.16	-31.30	Average
*	0.1659	30.39	10.00	40.39	65.16	-24.77	QP
	0.1796	2.90	10.00	12.90	54.50	-41.60	Average
	0.1796	25.80	10.00	35.80	64.50	-28.70	QP
	0.1914	6.47	10.00	16.47	53.98	-37.51	Average
	0.1914	22.00	10.00	32.00	63.98	-31.98	QP
	0.1986	13.92	10.00	23.92	53.67	-29.75	Average
	0.1986	24.75	10.00	34.75	63.67	-28.92	QP



	0.2292	7.74	10.00	17.74	52.48	-34.74	Average
	0.2292	20.81	10.00	30.81	62.48	-31.67	QP

Note :

1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss+ Pulse Limiter Factor
3. ” \* ” mean this data is the worst emission level



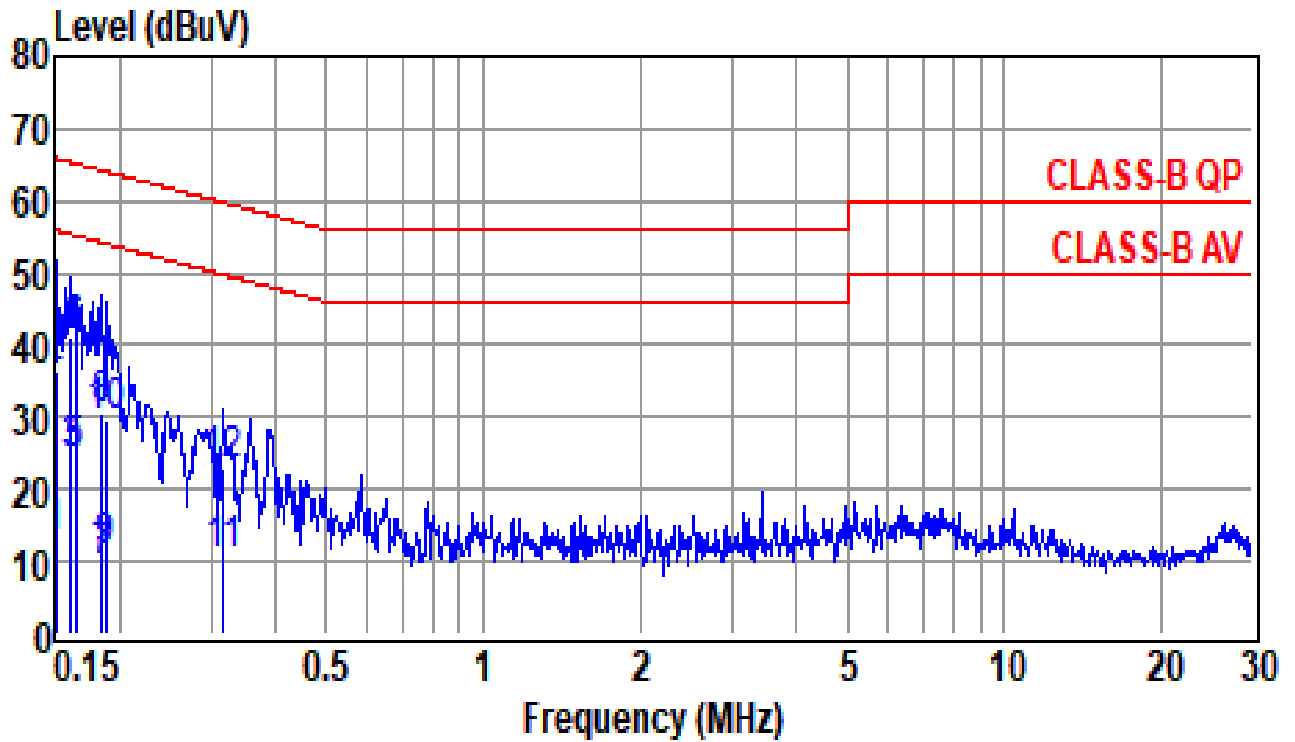
Site : conducted #1 Date : 2022-04-16  
 Condition : CLASS-B QP LISN : NEUTRAL  
 Tem / Hum : 22 °C / 66%  
 Test Mode : BT & USB 5V LOAD  
 EUT:FM RDS/AM DIGITAL TUNING CLOCK RADIO WITH BLUETOOTH PLAYBACK  
 Power Rating : 120V / 60Hz  
 Engineer : Vincent Model : RCR-20

	Freq (MHz)	Reading (dBUV)	Factor (dB)	Emission Level (dBUV)	Limit Line (dBUV)	Over Limit (dB)	Remark
	0.1532	2.58	10.00	12.58	55.82	-43.24	Average
	0.1532	26.13	10.00	36.13	65.82	-29.69	QP
	0.1650	14.02	10.00	24.02	55.21	-31.19	Average
*	0.1650	30.73	10.00	40.73	65.21	-24.48	QP
	0.1703	6.27	10.00	16.27	54.94	-38.67	Average
	0.1703	23.95	10.00	33.95	64.94	-30.99	QP
	0.1731	3.88	10.00	13.88	54.81	-40.93	Average
	0.1731	24.04	10.00	34.04	64.81	-30.77	QP
	0.1997	9.60	10.00	19.60	53.62	-34.02	Average
	0.1997	22.78	10.00	32.78	63.62	-30.84	QP

	0.2244	4.04	10.00	14.04	52.66	-38.62	Average
	0.2244	17.80	10.00	27.80	62.66	-34.86	QP

Note :

1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss+ Pulse Limiter Factor
3. " \* " mean this data is the worst emission level



Site : conducted #1 Date : 2022-04-16  
 Condition : CLASS-B QP LISN : LINE  
 Tem / Hum : 22 °C / 66%  
 Test Mode : BT & USB 5V LOAD  
 EUT:FM RDS/AM DIGITAL TUNING CLOCK RADIO WITH BLUETOOTH PLAYBACK  
 Power Rating : 120V / 60Hz  
 Engineer : Vincent Model : RCR-20

	Freq (MHz)	Reading (dBUV)	Factor (dB)	Emission Level (dBUV)	Limit Line (dBUV)	Over Limit (dB)	Remark
	0.1516	2.93	10.00	12.93	55.91	-42.98	Average
	0.1516	26.28	10.00	36.28	65.91	-29.63	QP
	0.1616	14.52	10.00	24.52	55.38	-30.86	Average
	0.1616	31.10	10.00	41.10	65.38	-24.28	QP
	0.1650	14.23	10.00	24.23	55.21	-30.98	Average
*	0.1650	30.99	10.00	40.99	65.21	-24.22	QP
	0.1854	-0.40	10.00	9.60	54.24	-44.64	Average
	0.1854	20.75	10.00	30.75	64.24	-33.49	QP
	0.1884	0.90	10.00	10.90	54.11	-43.21	Average
	0.1884	19.89	10.00	29.89	64.11	-34.22	QP

	0.3183	0.67	10.02	10.69	49.75	-39.06	Average
	0.3183	13.19	10.02	23.21	59.75	-36.54	QP

Note :

1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss+ Pulse Limiter Factor
3. ” \* ” mean this data is the worst emission level

## 5.4 Result Data Calculation

The result data is calculated by adding the LISN Factor to the measured reading. The basic equation with a sample calculation is as follows:

$$\mathbf{RESULT = READING + LISN FACTOR}$$

Assume a receiver reading of 22.5 dB $\mu$ V is obtained, and LISN Factor is 0.1 dB, then the total of disturbance voltage is 22.6 dB $\mu$ V.

$$\text{RESULT} = 22.5 + 0.1 = 22.6 \text{ dB}\mu\text{V}$$

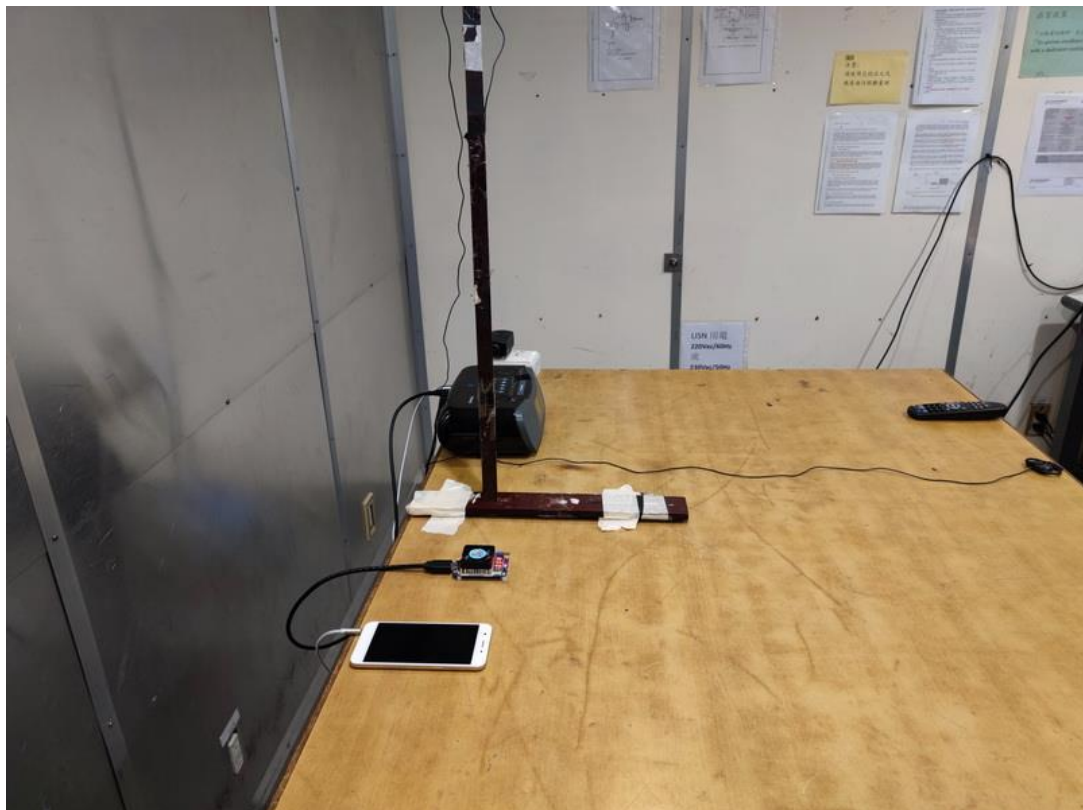
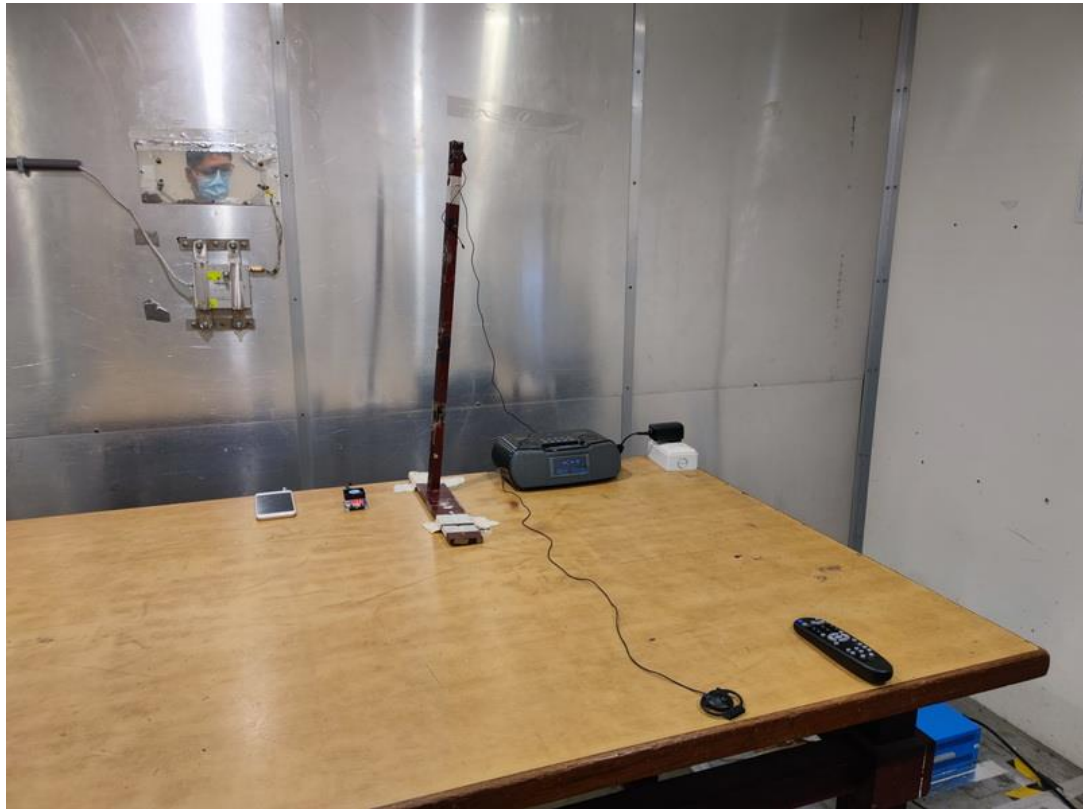
$$\begin{aligned} \text{Level in } \mu\text{V} &= \text{Common Antilogarithm}[(22.6 \text{ dB}\mu\text{V})/20] \\ &= 13.48 \mu\text{V} \end{aligned}$$

## 5.5 Conducted Measurement Equipment

The following test equipment are used during the conducted test .

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
EMI Test Receiver	Rohde & Schwarz	ESCI	2021/12/01	2022/11/30
LISN	Schwarzbeck	NSLK 8127 PLC	2022/02/27	2023/02/26
PLUSE LIMITER (10dB)	Schwarzbeck	VTSD 9561 F-N	2022/04/13	2023/04/12

### 5.6 Photos of Conduction Measuring Setup



## CONSTRUCTION PHOTOS OF EUT

### (A)EUT

1.



2.





### CONSTRUCTION PHOTOS OF EUT

3.



4.



### CONSTRUCTION PHOTOS OF EUT

5.



6.

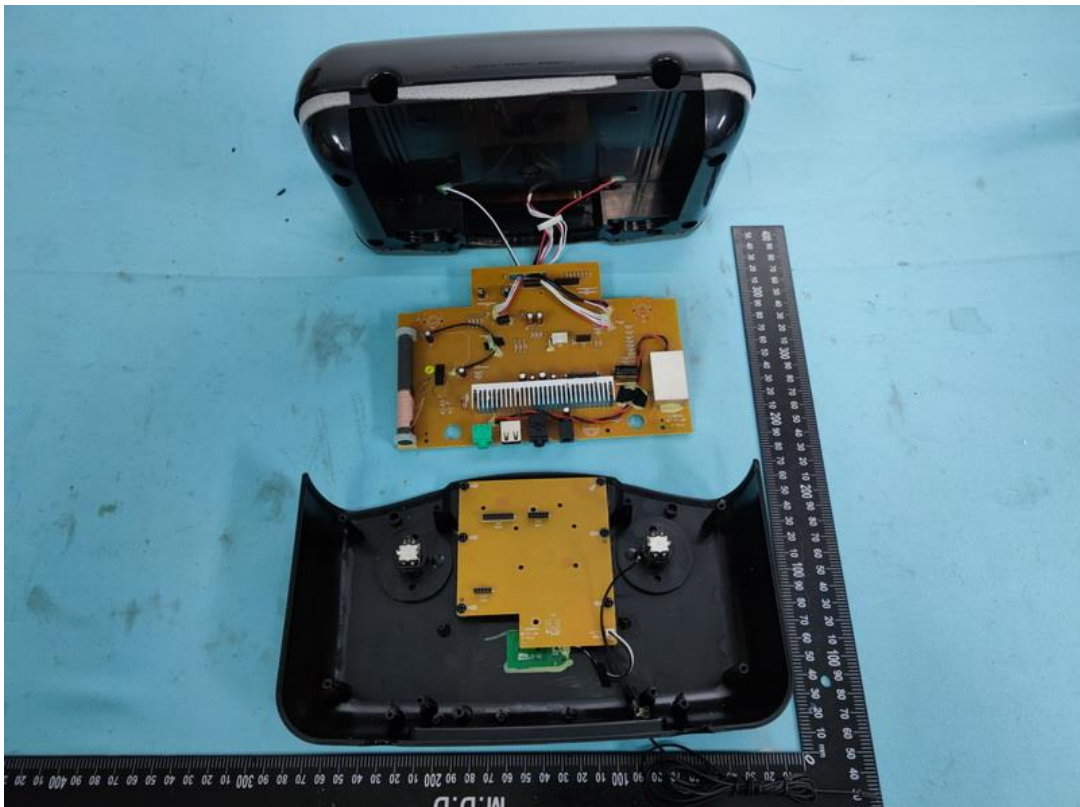


## CONSTRUCTION PHOTOS OF EUT

7.



8.



### CONSTRUCTION PHOTOS OF EUT

9.

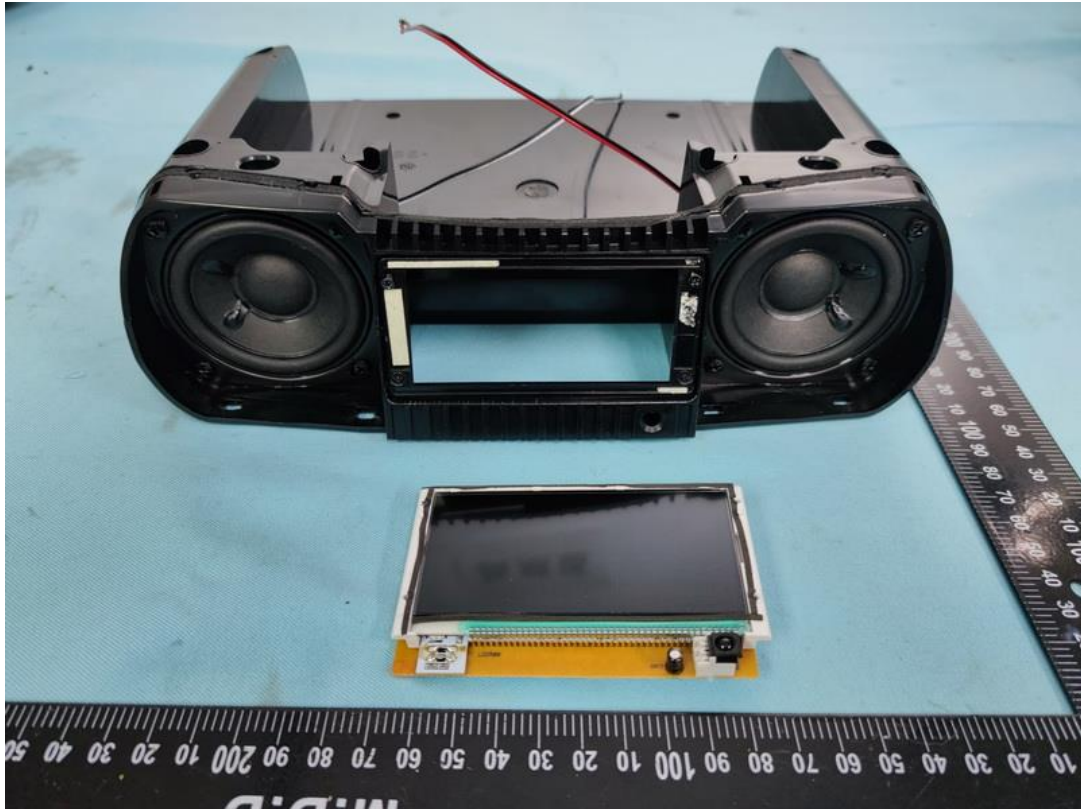


10.



### CONSTRUCTION PHOTOS OF EUT

11.

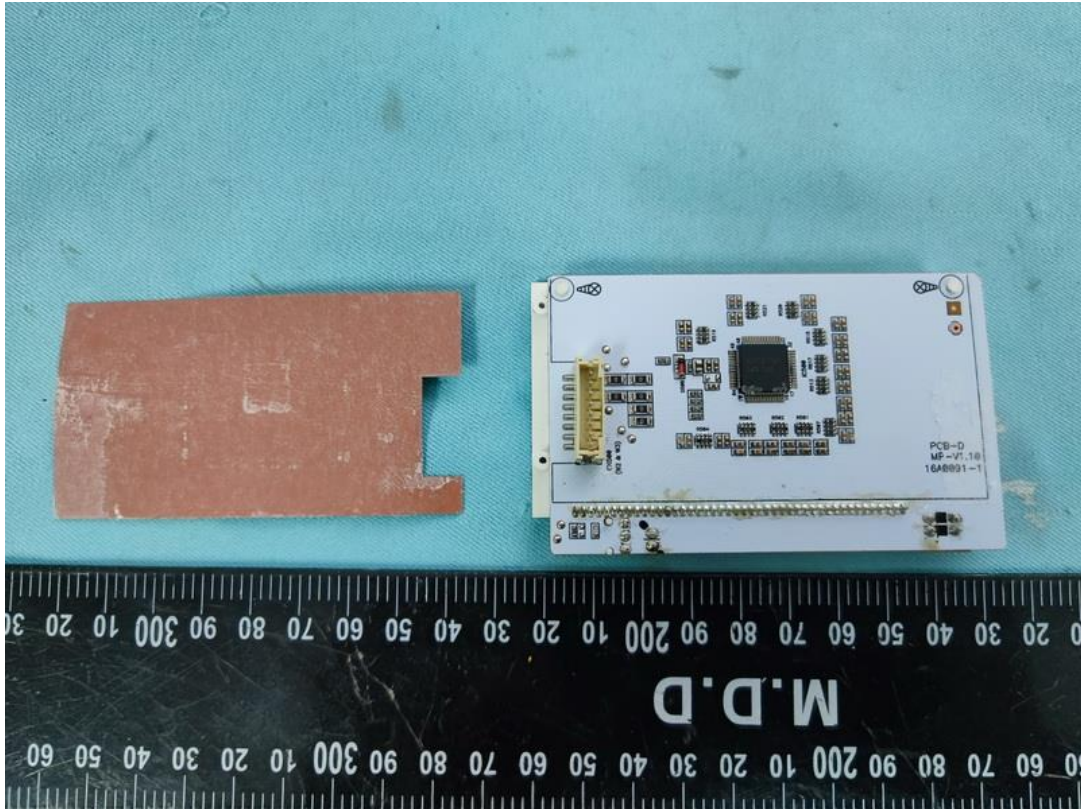


12.

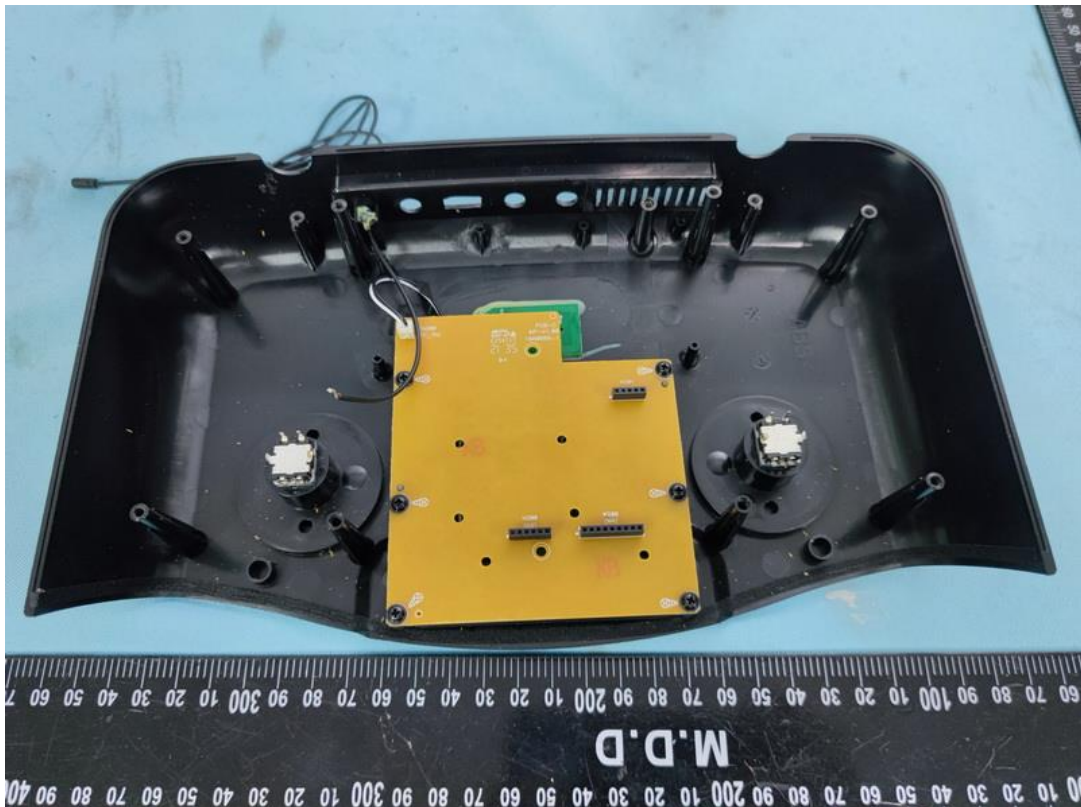


### CONSTRUCTION PHOTOS OF EUT

13.

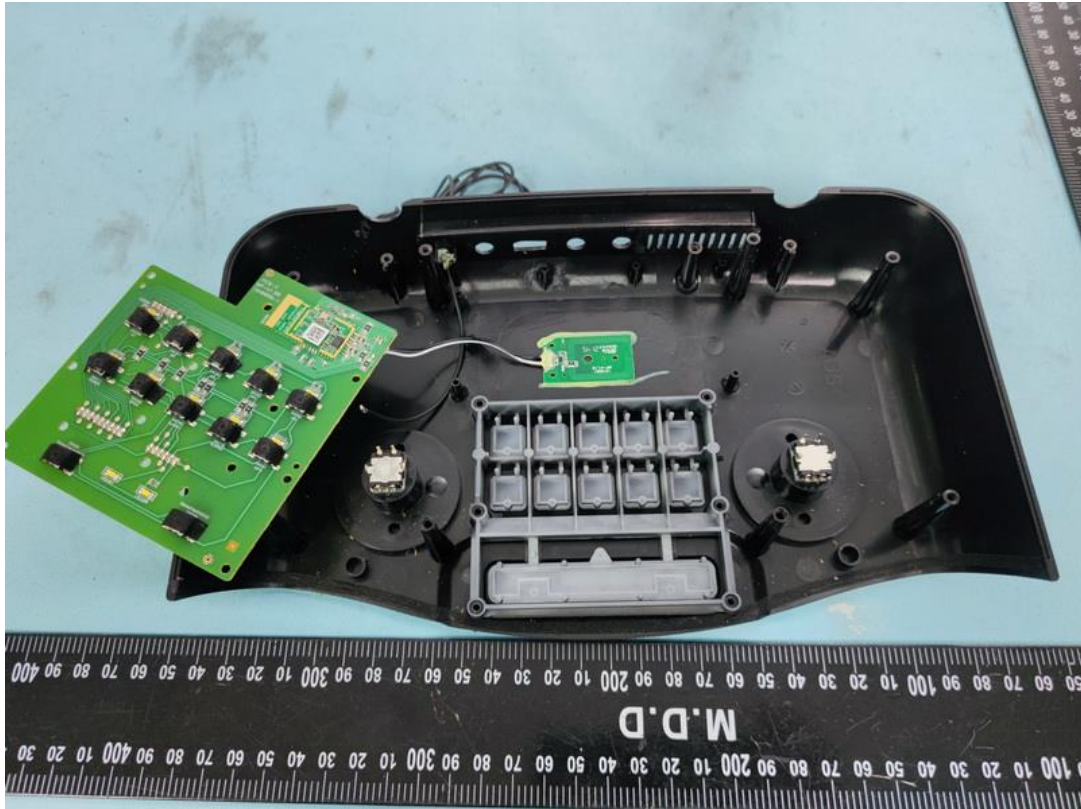


14.



### CONSTRUCTION PHOTOS OF EUT

15.



16.

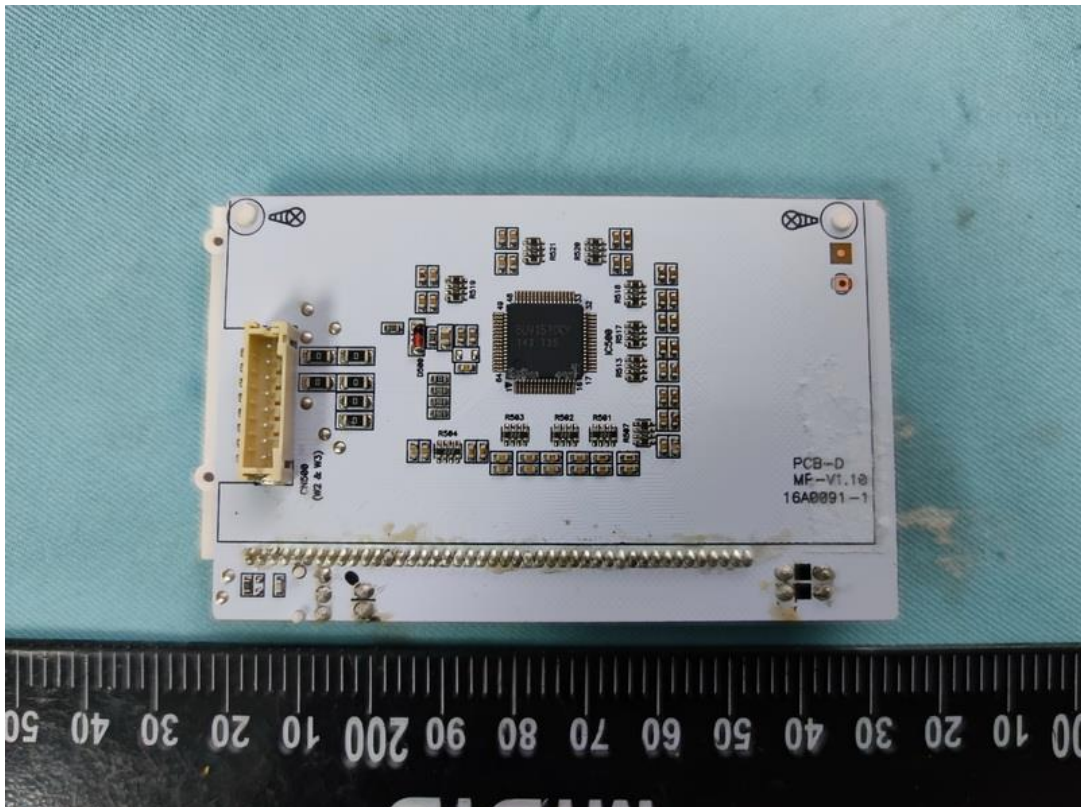


### CONSTRUCTION PHOTOS OF EUT

17.



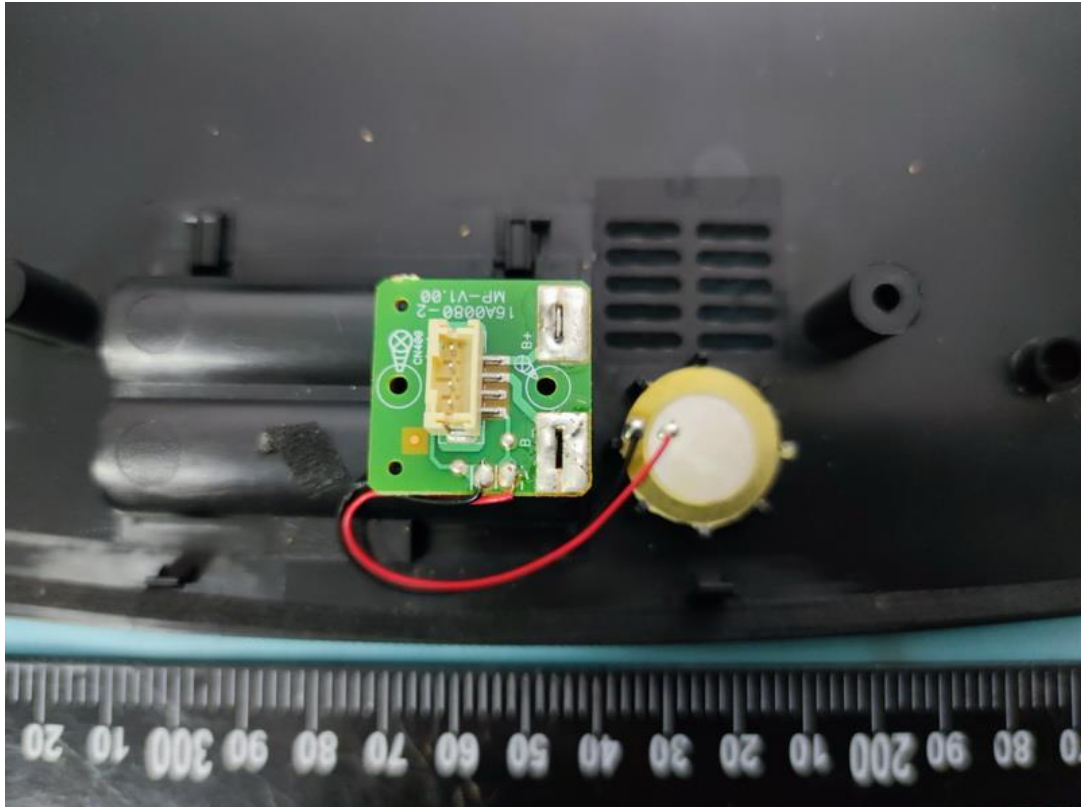
18.



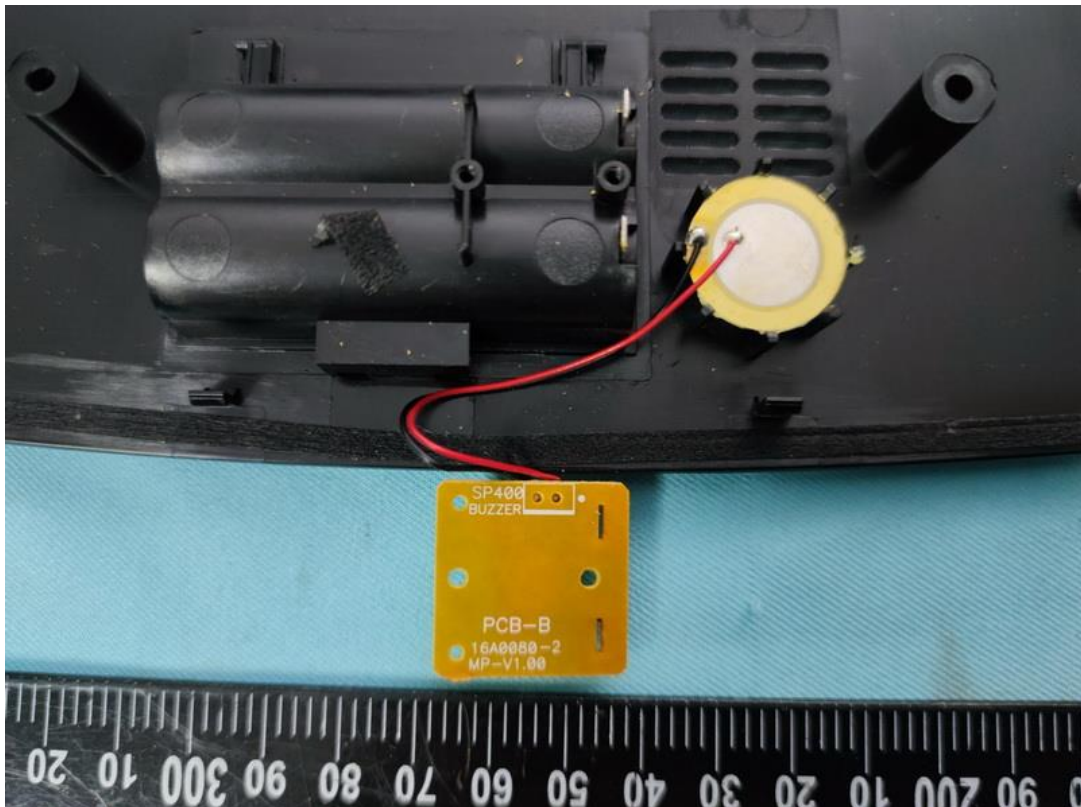


### CONSTRUCTION PHOTOS OF EUT

19.

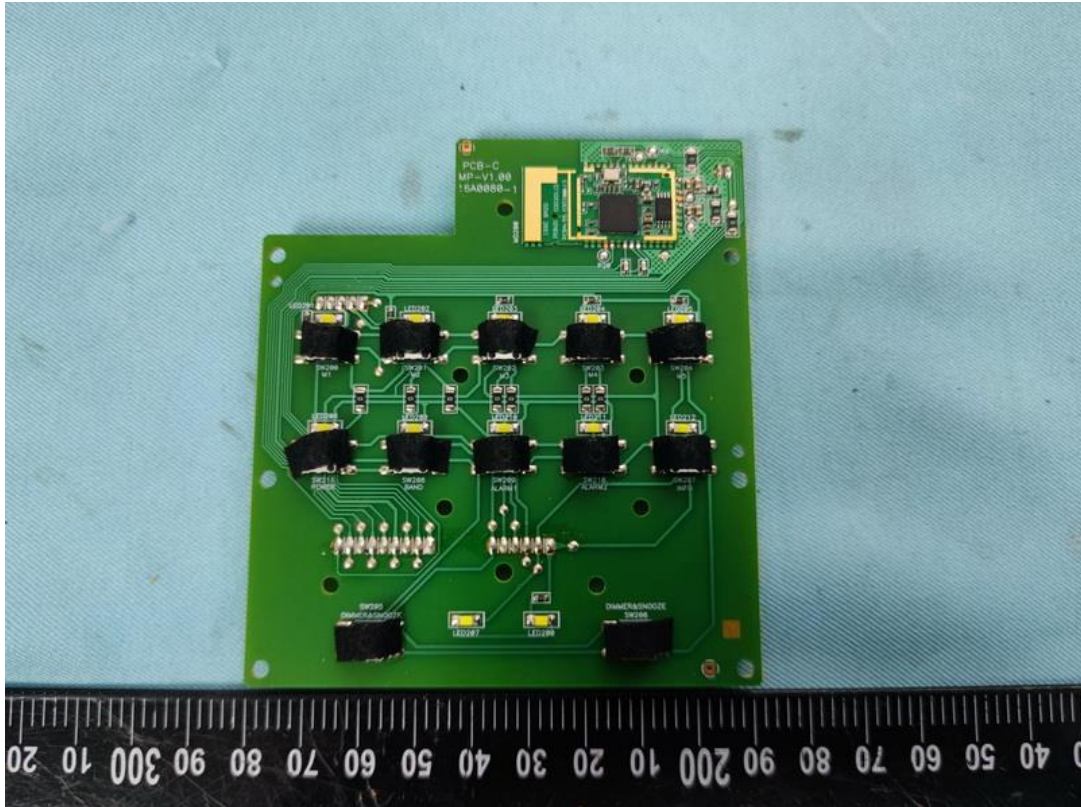


20.

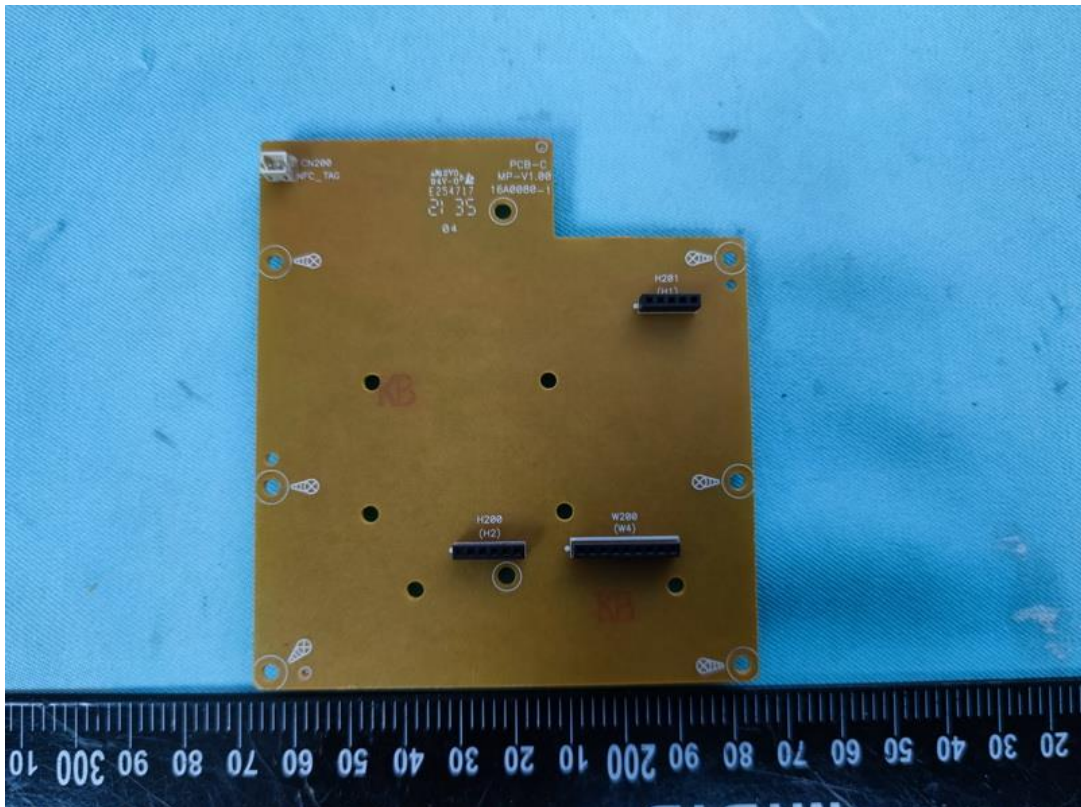


### CONSTRUCTION PHOTOS OF EUT

21.

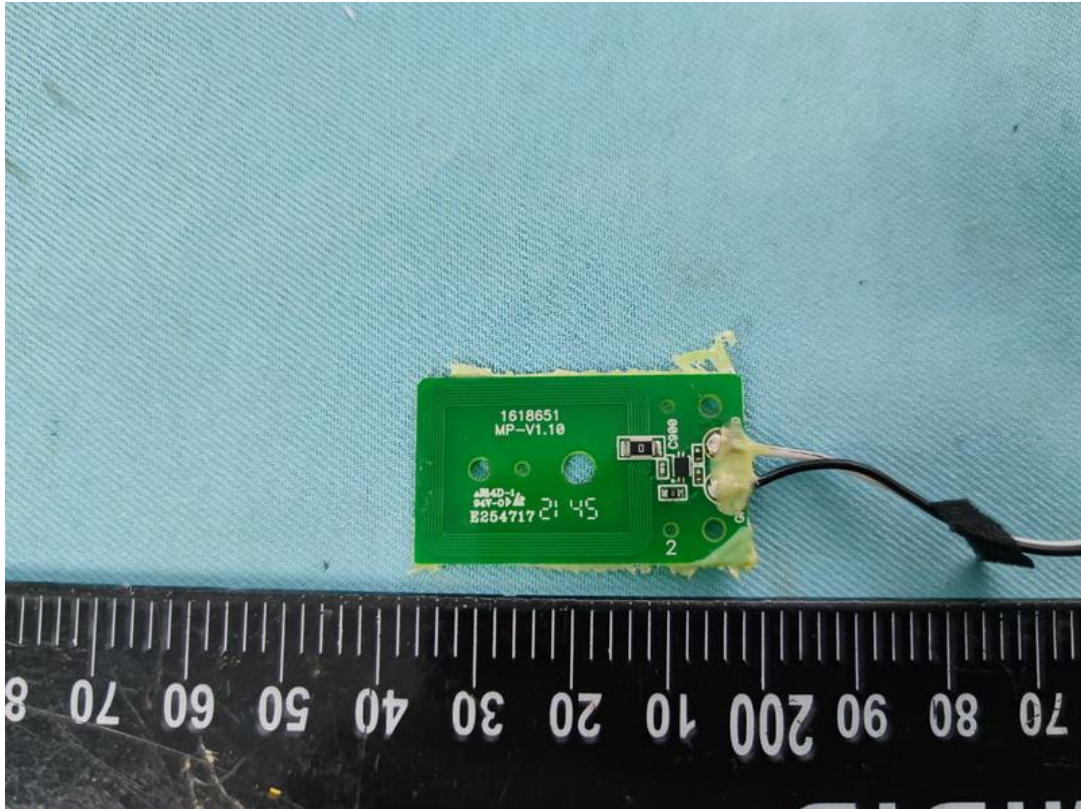


22.

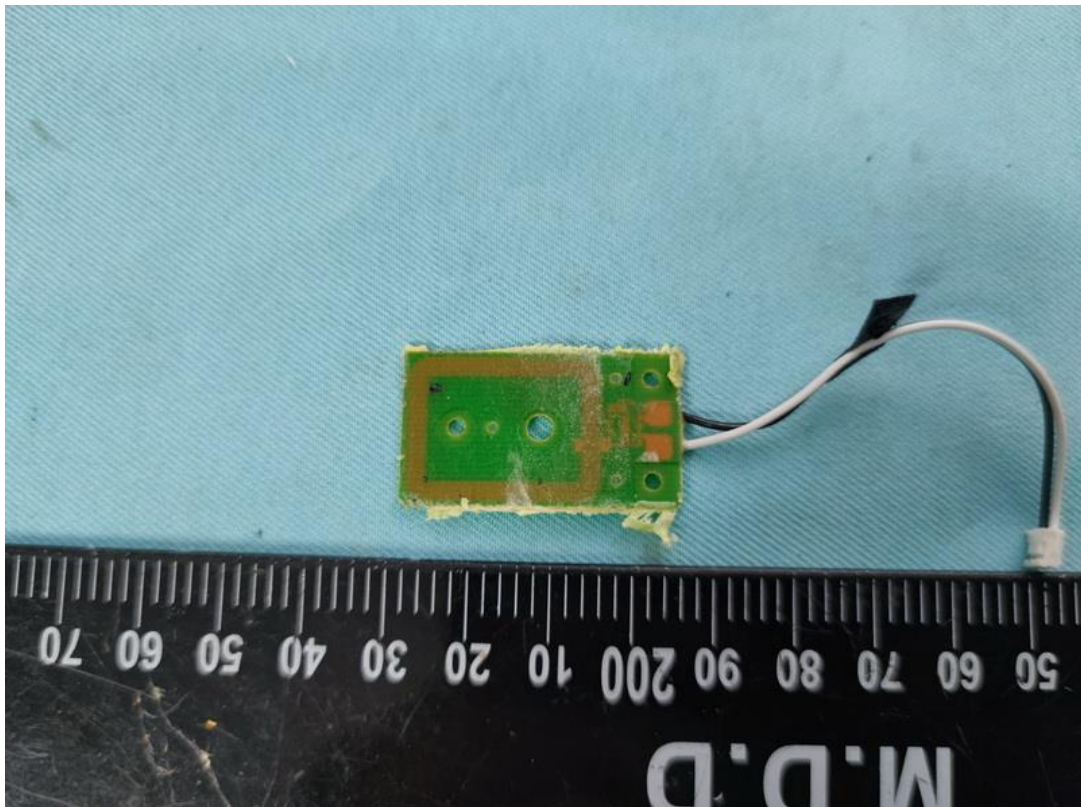


### CONSTRUCTION PHOTOS OF EUT

23.

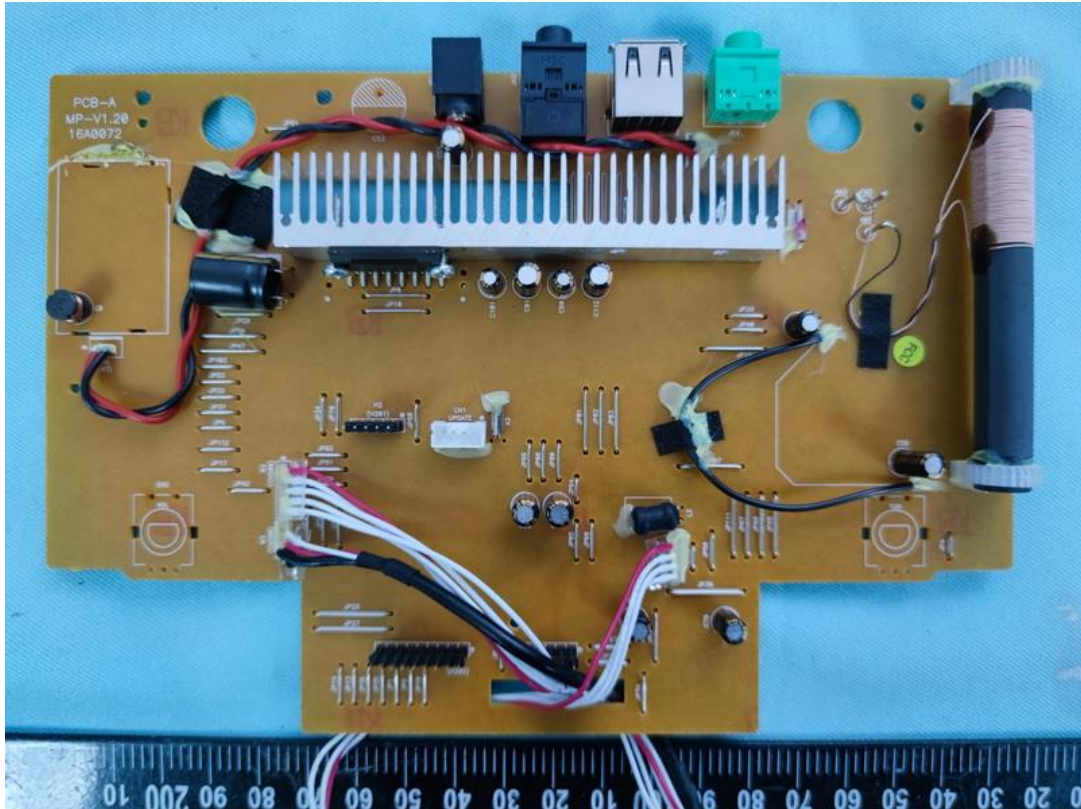


24.

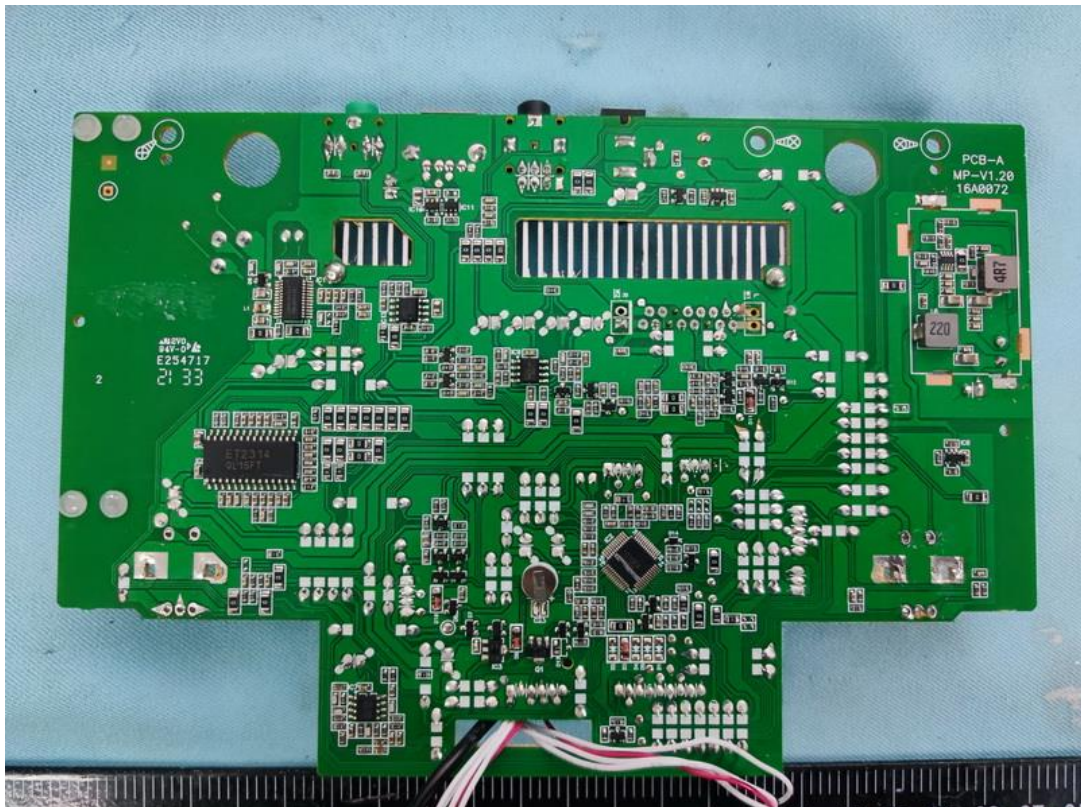


## CONSTRUCTION PHOTOS OF EUT

25.



26.



## CONSTRUCTION PHOTOS OF EUT

### (B)Adapter

1.



2.



### CONSTRUCTION PHOTOS OF EUT

3.



4.



## CONSTRUCTION PHOTOS OF EUT

### (C) Remote controller

1.



2.



### CONSTRUCTION PHOTOS OF EUT

3.



4.



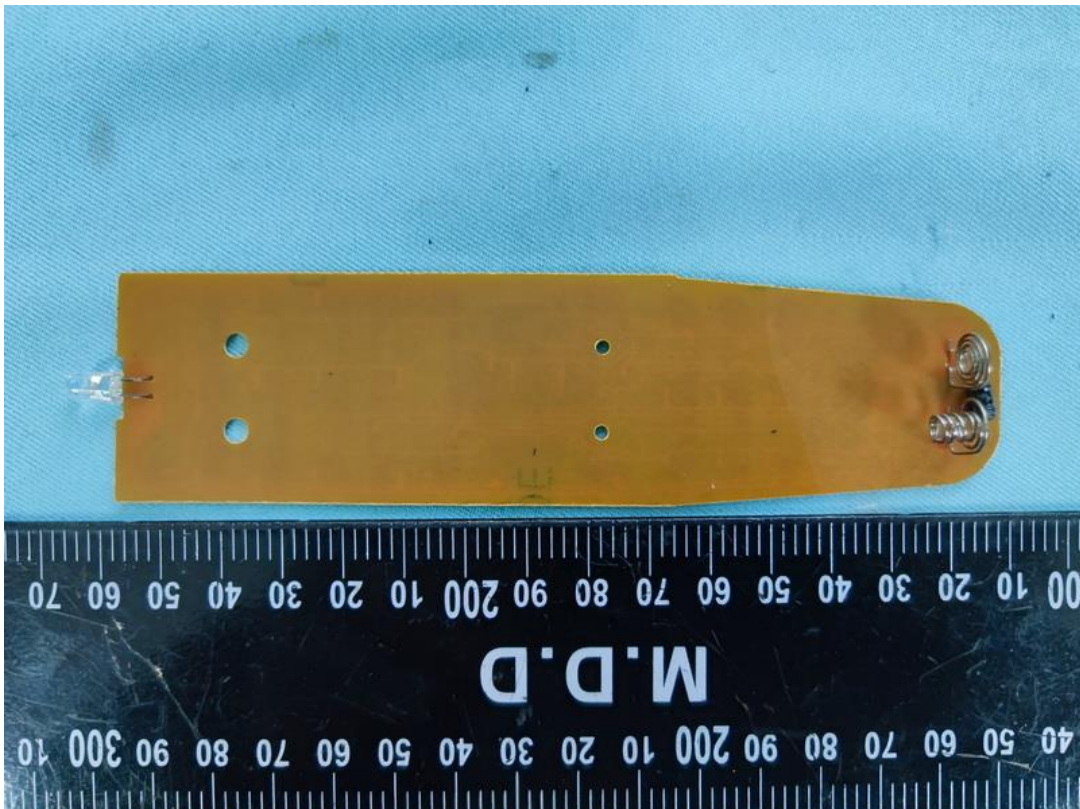


### CONSTRUCTION PHOTOS OF EUT

5.



6.



## CONSTRUCTION PHOTOS OF EUT

7.

