

TECHNICAL REPORT



Report No.: TW2109147E
File reference No.: 2021-09-30

Applicant: Ningbo Free Trade Zone Rising Sun Electrical Co.,Ltd.

Product: Remote Control Transmitter

Model No.: RSL020T-A, RSL020T-B

Trademark: Risingsun

Test Standards: FCC Part 15 Subpart C, Paragraph 15.231

Test result: It is herewith confirmed and found to comply with the requirements set up by ANSI C63.4&FCC Part 15 Subpart C, Paragraph 15.231 for the evaluation of electromagnetic compatibility

Approved By

Jack Chung

Jack Chung
Manager

Dated: September 30, 2021

Results appearing herein relate only to the sample tested

The technical reports is issued errors and omissions exempt and is subject to withdrawal at

SHENZHEN TIMEWAY TESTING LABORATORIES

Zone C, 1st Floor, Block B, Jun Xiang Da Building, Zhongshan Park Road West, Tong Le Village, Nanshan District, Shenzhen, China

Tel (755) 83448688, Fax (755) 83442996, E-Mail:info@timeway-lab.com



Special Statement:

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19.

The testing quality system of our laboratory meets with ISO/IEC-17025 requirements, which is approved by CNAS. This approval result is accepted by MRA of APLAC.

Our test facility is recognized, certified, or accredited by the following organizations:

CNAS-LAB Code: L2292

The EMC Laboratory has been assessed and in compliance with CNAS-CL01 accreditation criteria for testing Laboratories (identical to ISO/IEC 17025:1999 General Requirements) for the Competence of testing Laboratories.

FCC-Registration No.: 744189

The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission. The acceptance letter from the FCC is maintained in our files. Registration No.:744189.

Industry Canada (IC) —Registration No.:5205A

The EMC Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 5205A.

A2LA (Certification Number:5013.01)

The EMC Laboratory has been accredited by the American Association for Laboratory Accreditation (A2LA). Certification Number:5013.01

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Test Report Conclusion

Content

1.0	General Details	4
1.1	Test Lab Details.....	4
1.2	Applicant Details.....	4
1.3	Description of EUT	4
1.4	Submitted Sample.....	4
1.5	Test Duration.....	5
1.6	Test Uncertainty.....	5
1.7	Test By.....	5
2.0	List of Measurement Equipment	6
3.0	Technical Details	7
3.1	Summary of Test Results.....	7
3.2	Test Standards.....	7
4.0	EUT Modification	7
5.0	Power Line Conducted Emission Test	8
5.1	Schematics of the Test.....	8
5.2	Test Method and Test Procedure.....	8
5.3	Configuration of the EUT.....	8
5.4	EUT Operating Condition	9
5.5	Conducted Emission Limit	9
5.6	Test Result	9
6.0	Radiated Emission test	10
6.1	Test Method and Test Procedure.....	10
6.2	Configuration of the EUT.....	11
6.3	EUT Operation Condition.....	11
6.4	Radiated Emission Limit.....	11
6.5	Test Result.....	13
7.0	20dB Bandwidth Test.....	18
8.0	Deactivate Test	20
9.0	Duty Cycle.....	22
10.0	Antenna Requirement.....	27
11.0	FCC Label.....	28
12.0	Photo of Testing.....	29

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1.0 General Details

1.1 Test Lab Details

Name : SHENZHEN TIMEWAY TESTING LABORATORIES.
Address: Zone C, 1st Floor, Block B, Jun Xiang Da Building, Zhongshan Park Road West, Tong Le Village, Nanshan District, Shenzhen, China
Telephone: +86 755 83448688
Fax: +86 755 83442996
Site on File with the Federal Communications Commission – United States
Registration Number: 744189
For 3m Anechoic Chamber

1.2 Applicant Details

Applicant: Ningbo Free Trade Zone Rising Sun Electrical Co.,Ltd.
Address: No.17, Chuanye 1 Road, West Part of Free Trade Zone, Ningbo, China
Telephone: 0574-27688066
Fax: 0574-27688063

1.3 Description of EUT

Product: Remote Control Transmitter
Manufacturer: Ningbo Free Trade Zone Rising Sun Electrical Co.,Ltd.
Address: No.17, Chuanye 1 Road, West Part of Free Trade Zone, Ningbo, China
Trademark: Risingsun
Model Number: RSL020T-A
Additional Model Name RSL020T-B
Additional Trade Name N/A
Hardware Version: 1.0
Software Version: 1.0
Serial No.: 020T
Rating: DC3V, 1pc CR2032 button battery
Operation Frequency: 433.92MHz
Modulation Type: ASK
Antenna Designation PCB Antenna with Gain -5.0dBi Maximum

1.4 Submitted Sample

1 Samples

1.5 Test Duration

2021-09-14 to 2021-09-30

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1.6 Test Uncertainty

Conducted Emissions Uncertainty =3.6dB

Radiated Emissions below 1GHz Uncertainty =4.7dB

Radiated Emissions above 1GHz Uncertainty =6.0dB

Conducted Power Uncertainty =6.0dB

Occupied Channel Bandwidth Uncertainty =5%

Note: The measurement uncertainty is for coverage factor of $k=2$ and a level of confidence of 95%.

1.7 Test Engineer

A handwritten signature in black ink that reads "Terry Tang".

The sample tested by _____

Print Name: Terry Tang

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2.0 Test Equipment					
Instrument Type	Manufacturer	Model	Serial No.	Date of Cal.	Due Date
ESPI Test Receiver	R&S	ESPI 3	100379	2021-06-18	2022-06-17
Loop Antenna	EMCO	6507	00078608	2021-06-18	2024-06-17
Spectrum	R&S	FSIQ26	100292	2021-06-18	2022-06-17
Horn Antenna	A-INFO	LB-180400-KF	J211060660	2021-06-18	2022-06-17
Horn Antenna	R&S	BBHA 9120D	9120D-631	2021-07-02	2024-07-01
Bilog Antenna	Schwarebeck	VULB9163	9163/340	2021-07-02	2024-07-01
9*6*6 Anechoic	--	--	N/A	2021-07-02	2022-07-01
EMI Test Receiver	RS	ESVB	826156/011	2021-06-18	2022-06-17
EMI Test Receiver	RS	ESH3	860904/006	2021-06-18	2022-06-17
Spectrum	HP/Agilent	ESA-L1500A	US37451154	2021-06-18	2022-06-17
Spectrum	HP/Agilent	E4407B	MY50441392	2021-06-18	2022-06-17
Spectrum	RS	FSP	1164.4391.38	2020-01-16	2022-01-15
RF Cable	Zhengdi	ZT26-NJ-NJ-8 M/FA	--	2021-06-18	2022-06-17
RF Cable	Zhengdi	7m	--	2021-06-18	2022-06-17
RF Switch	EM	EMSW18	060391	2021-06-18	2022-06-17
Pre-Amplifier	Schwarebeck	BBV9743	#218	2021-06-18	2022-06-17
Pre-Amplifier	HP/Agilent	8449B	3008A00160	2021-06-18	2022-06-17
LISN	SCHAFFNER	NNB42	00012	2021-01-06	2022-01-05

2.2 Automation Test Software

For Conducted Emission Test

Name	Version
EZ-EMC	Ver.EMC-CON 3A1.1

For Radiated Emissions

Name	Version
EMI Test Software BL410-EV18.91	V18.905
EMI Test Software BL410-EV18.806 High Frequency	V18.06

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3.0 Technical Details

3.1 Summary of test results

The EUT has been tested according to the following specifications:			
Standard	Test Type	Result	Notes
FCC Part 15, Paragraph 15.203	Antenna requirements	Pass	Compliant
FCC Part 15, Paragraph 15.207	Conducted Emission Test	N/A	N/A
FCC Part 15, Paragraph 15.209	General Requirement	Pass	Compliant
FCC Part 15, Paragraph 15.231 (b)	Radiated Emission Test	Pass	Compliant
FCC Part 15, Paragraph 15.231 (c)	20dB Bandwidth Testing	Pass	Compliant
FCC Part 15, Paragraph 15.231 (a1)	Deactivate Testing	Pass	Compliant

3.2 Test Standards

FCC Part 15 Subpart C, Paragraph 15.231 , ANSI C63.4 :2014 and ANSI C63.10 :2013

4.0 EUT Modification

No modification by SHENZHEN TIMEWAY TESTING LABORATORIES

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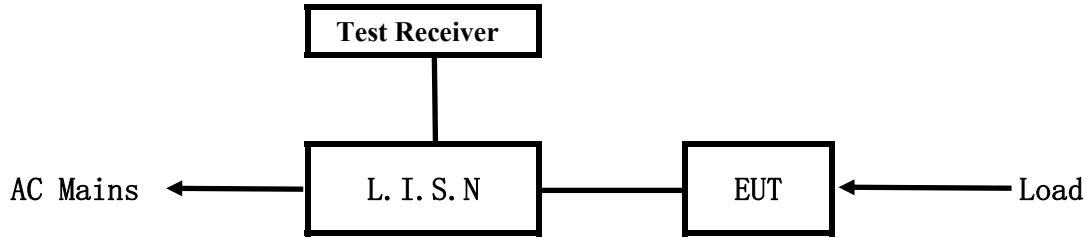
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5. Power Line Conducted Emission Test

5.1 Schematics of the test

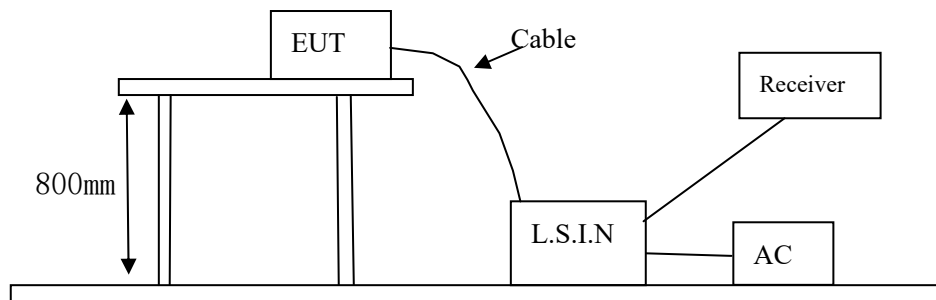


EUT: Equipment Under Test

5.2 Test Method and test Procedure

The EUT was tested according to ANSI C63.4-2014. The Frequency spectrum From 0.15MHz to 30MHz was investigated. The LISN used was 50ohm/50uH as specified by section 5.1 of ANSI C63.4 –2014.

Block diagram of Test setup



5.3 Configuration of the EUT

The EUT was configured according to ANSI C63.4-2014. All interface ports were connected to the appropriate peripherals. All peripherals and cables are listed below.

A. EUT

Device	Manufacturer	Model	FCC ID
Remote Control Transmitter	Ningbo Free Trade Zone Rising Sun Electrical Co.,Ltd.	RSL020T-A, RSL020T-B	2A2XV-020T

B. Internal Device

Device	Manufacturer	Model	FCC ID/DOC
N/A			

C. Peripherals

Device	Manufacturer	Model	FCC ID/DOC	Cable
N/A				

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5.4 EUT Operating Condition

Operating condition is according to ANSI C63.4 -2014.

A Setup the EUT and simulators as shown on follow

B Enable AF signal and confirm EUT active to normal condition

5.5 Power line conducted Emission Limit according to Paragraph 15.207

Frequency (MHz)	Limits (dB μ V)	
	Quasi-peak Level	Average Level
0.15 ~ 0.50	66.0~56.0*	56.0~46.0*
0.50 ~ 5.00	56.0	46.0
5.00 ~ 30.00	60.0	50.0

- Notes:
1. *Decreasing linearly with logarithm of frequency.
 2. The tighter limit shall apply at the transition frequencies

5.6 Test Results

The frequency spectrum from 0.15MHz to 30MHz was investigated. All reading are quasi-peak values with a resolution bandwidth of 9kHz. (The average detector is necessary when the Quasi-peak emission level beyond the average Limit.)

Note: Due to CR2032 button battery operation, this test item not applicable.

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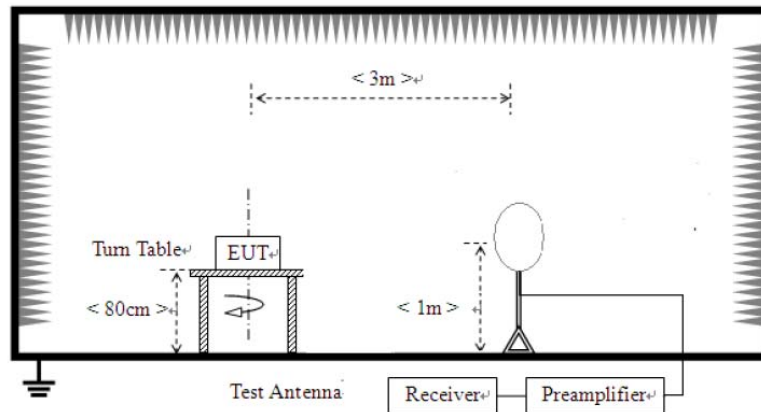
6 Radiated Emission Test

6.1 Test Method and test Procedure:

- (1) The EUT was tested according to ANSI C63.10-2013. The radiated test was performed at TIMEWAY EMC Laboratory. This site is on file with the FCC laboratory division, Registration No.744189
- (2) The EUT, peripherals were put on the turntable which table size is 1m x 1.5 m, table high 0.8 m. All set up is according to ANSI C63.10-2013.
- (3) The frequency spectrum from 30 MHz to 5GHz was investigated. All readings from 30 MHz to 1 GHz are quasi-peak values with a resolution bandwidth of 120 kHz. All readings are above 1 GHz, peak values with a resolution bandwidth of 1 MHz. Measurements were made at 3 meters.
- (4) The antenna high is varied from 1 m to 4 m high to find the maximum emission for each frequency.
- (5) Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB of specification limit), and are distinguished with a "QP" in the data table.
- (6) The antenna polarization: Vertical polarization and Horizontal polarization.

Block diagram of Test setup

For radiated emissions from 9kHz to 30MHz



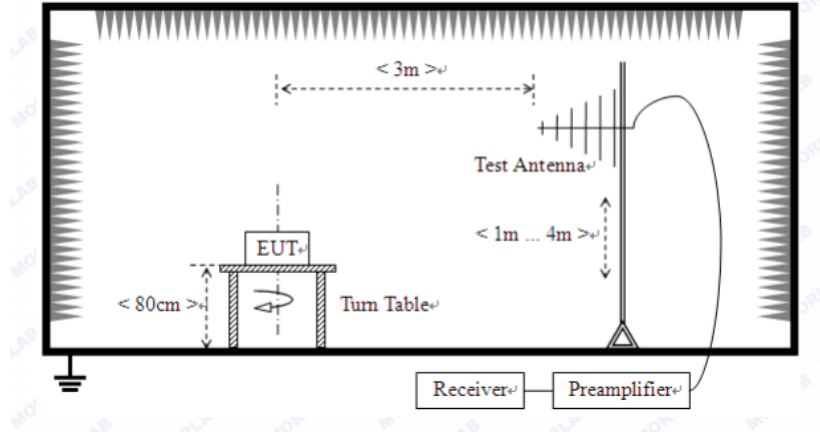
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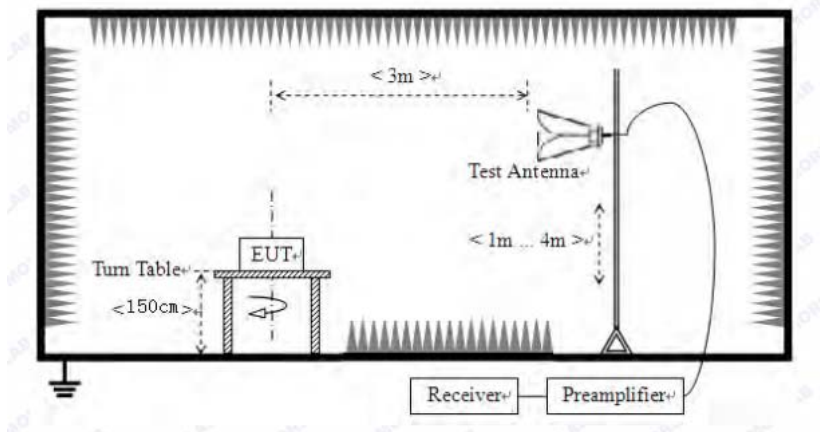
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For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



6.2 Configuration of The EUT

Same as section 5.3 of this report

6.3 EUT Operating Condition

Same as section 5.4 of this report.

6.4 Radiated Emission Limit

All emission from a digital device, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strength specified below:

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A FCC Part 15 Subpart C Paragraph 15.231(a) Limit

Fundamental Frequency (MHz)	Field Strength of Fundamental		Field Strength of Spurious Emission	
	uV/m	dBuV/m	uV/m	dBuV/m
40.66-40.70	2250	67.04	225	47.04
70-130	1250	61.94	125	41.94
130-174	1250-3750	61.94-71.48	125-375	41.94-51.48
174-260	3750	71.48	375	51.48
260-470	3750-12500	71.48-81.94	375-1250	51.48-61.94
Above 470	12500	81.94	1250	61.94

- Note:
1. RF Field Strength (dBuV) = 20 log RF Voltage (uV)
 2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
 3. The emission limit in this paragraph is based on measurement instrumentation employing an average detector.
 4. Linear interpolations for frequency ranges 130-174MHz and 260-470MHz
 5. the above field strength limits are specified at a distance of 3-meters and the tighter limits apply at the band edges
 6. New batteries were installed in the equipment under test for radiated emission testing.
 7. This is a handheld device. The radiated emissions should be tested under 3-axes position (Lying, Side, and Stand), After pre-test. It was found that the worse radiated emission was get at the lying position.

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B. Frequencies in restricted band are compiled to limit on Paragraph 15.209.

Frequency Range (MHz)	Distance (m)	Field strength (dB μ V/m)
30-88	3	40.0
88-216	3	43.5
216-960	3	46.0
Above 960	3	54.0

- Note:
1. RF Voltage (dBuV) = 20 log RF Voltage (uV)
 2. In the Above Table, the tighter limit applies at the band edges.
 3. Distance refers to the distance in meters between the measuring instrument antenna and the EUT
 4. All scanning using PK detector. And the final emission level was get using QP detector for frequency range from 30-1000MHz.As to 1G-5G, the final emission level got using PK detector. And Average = peak(dBuV/m) – | duty cycle | (dB)

6.5 Test result

A Fundamental and Harmonics Radiated emission data

Product:	Remote Control Transmitter	Test Mode:	Keep Transmitting
Test Item:	Fundamental Radiated Emission and Spurious Emission Data	Temperature:	25°C
Test Voltage:	DC3V	Humidity:	56%
Test Result:	Pass		
Frequency (MHz)	Emission PK/AV (dBuV/m)	Hor / Vert	Limits PK/AV (dBuV/m)
433.92	86.79 (PK)/78.90(AV)	H	100.8/80.8
433.92	85.13 (PK)/77.24(AV)	V	100.8/80.8
867.84	60.44 (PK)/52.55 (AV)	H	80.8/60.8
867.84	43.78 (PK)/35.89 (AV)	V	80.8/60.8
1301.76	43.86 (PK)/35.97 (AV)	H	80.8/60.8
1301.76	45.65 (PK)/37.76 (AV)	V	80.8/60.8
1735.68	48.94 (PK)/41.05 (AV)	H	74/54
1735.68	44.16 (PK)/36.27(AV)	V	74/54
2169.60	49.98 (PK)/42.09 (AV)	H	74/54
2169.60	50.53 (PK)/42.64 (AV)	V	74/54
2603.52	44.45 (PK)/36.56 (AV)	H	80.8/60.8
2603.52	42.15 (PK)/34.26 (AV)	V	80.8/60.8
3037.44	46.75 (PK)/38.86 (AV)	H	80.8/60.8
3037.44	--	V	80.8/60.8
3471.36	47.39 (PK)/39.50(AV)	H	80.8/60.8

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3471.36	43.59 (PK)/35.70 (AV)	V	80.8/60.8
3905.28	45.80(PK)/37.91 (AV)	H	74/54
3905.28	--	V	74/54
4339.2	46.34(PK)/38.45 (AV)	H	80.8/60.8
4339.2	--	V	80.8/60.8

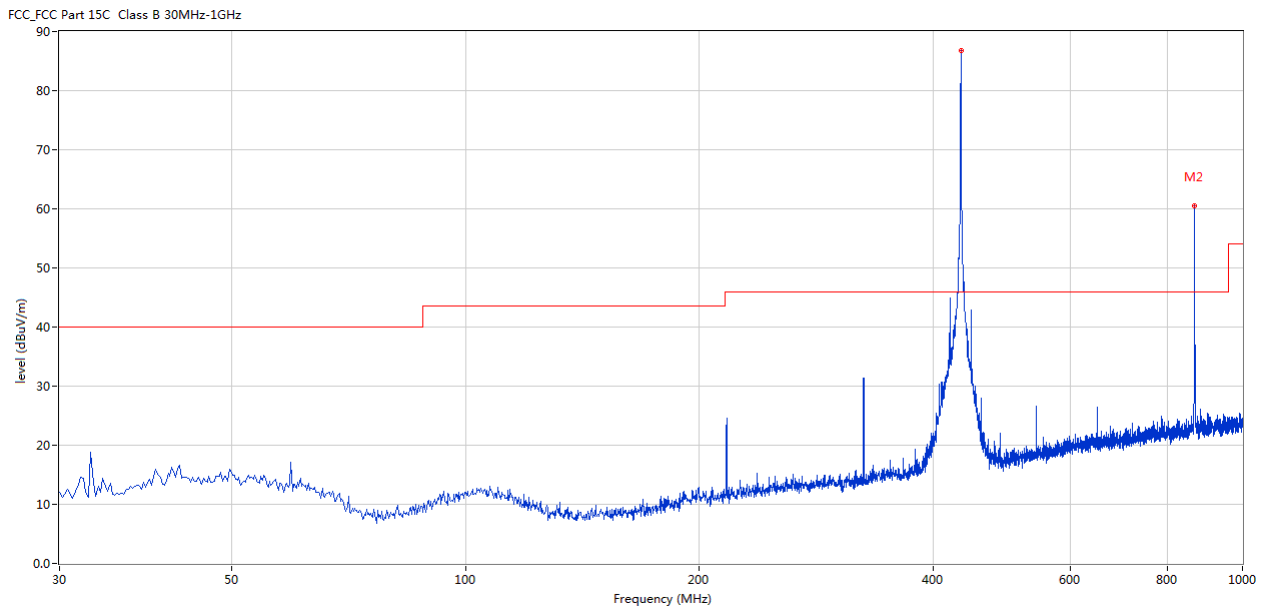
Note: H=Horizontal, V=Vertical, AV=PK- | duty cycle factor | =PK-7.89

B. General Radiated Emission Data
Radiated Emission In Horizontal (30MHz----1000MHz)

EUT set Condition: Keep Transmitting

Results: Pass

Please refer to following diagram for individual



No	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	433.904	86.79	-8.03	46.0	40.79	Peak	226.00	100	Horizontal	N/A
2	867.871	60.44	-2.31	46.0	14.44	Peak	75.00	100	Horizontal	N/A

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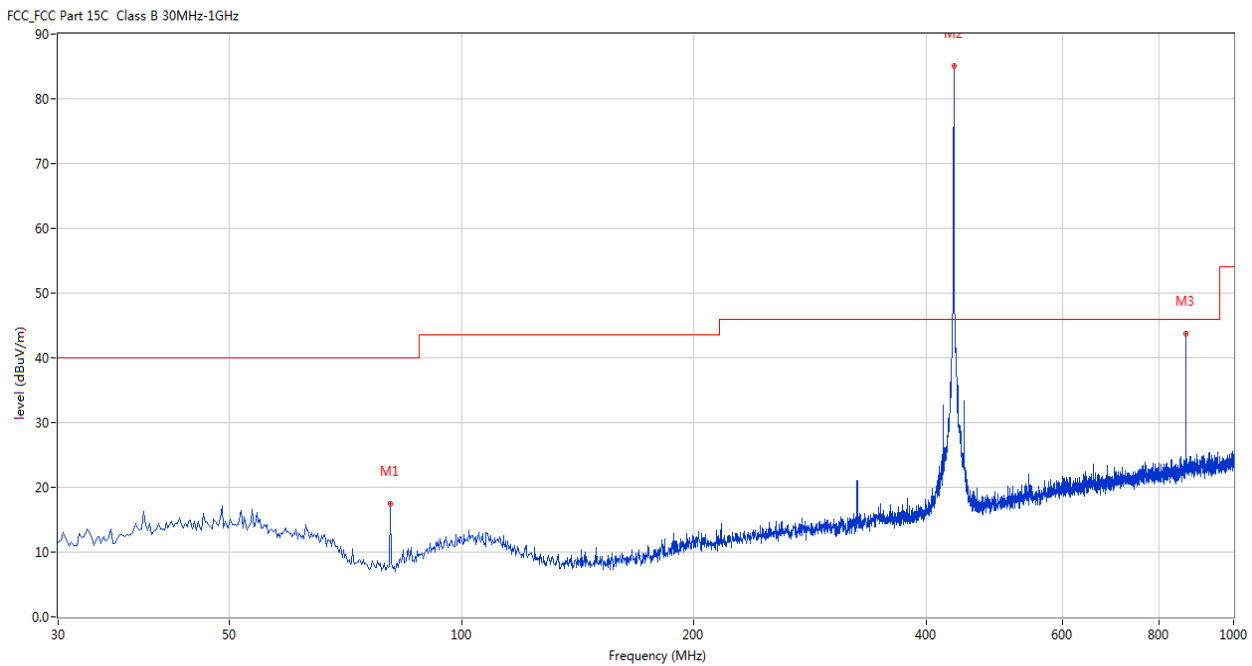
B. General Radiated Emission Data

Radiated Emission In Vertical (30MHz----1000MHz)

EUT set Condition: Keep Transmitting

Results: Pass

Please refer to following diagram for individual



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	80.912	17.51	-17.30	40.0	-22.49	Peak	190.00	100	Vertical	Pass
2	433.904	85.13	-8.03	46.0	39.13	Peak	171.00	100	Vertical	N/A
3	867.871	43.78	-2.31	46.0	-2.22	Peak	343.00	100	Vertical	Pass

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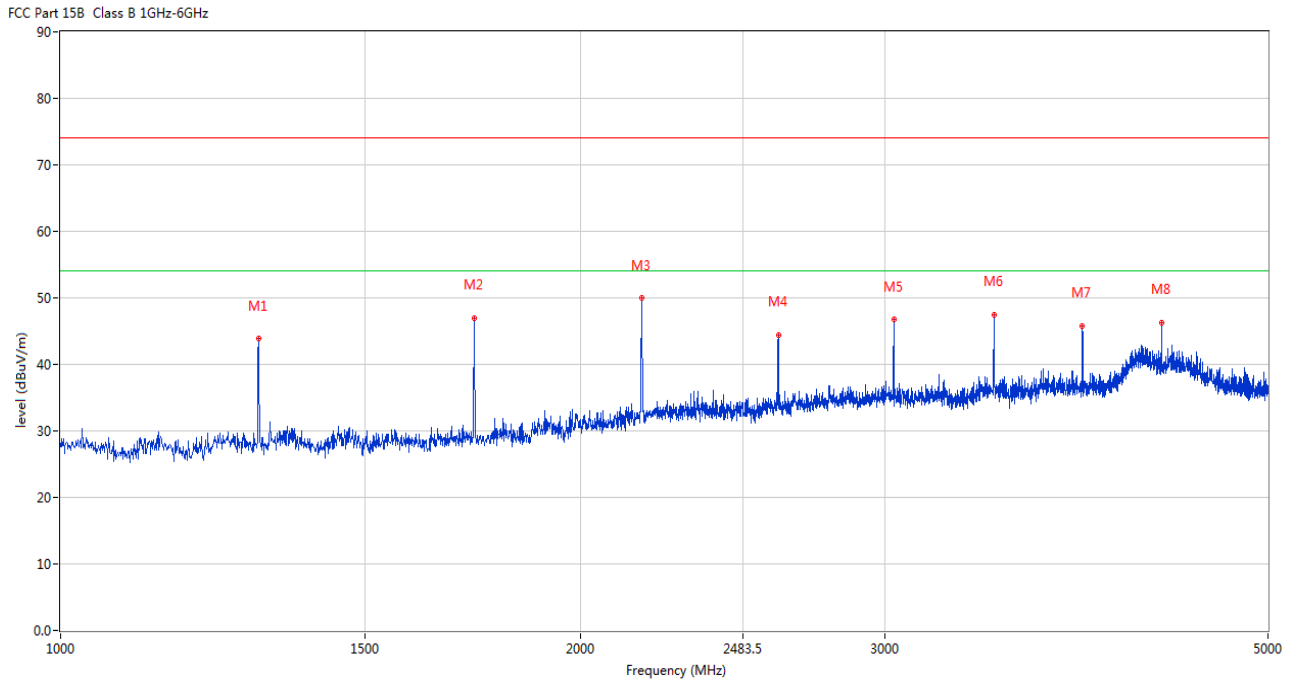
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Test Plot above 1G

Horizontal



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1301.925	43.86	-8.24	74.0	-30.14	Peak	37.00	100	Horizontal	Pass
2	1735.816	48.94	-7.28	74.0	-25.06	Peak	29.00	100	Horizontal	Pass
3	2169.708	49.98	-3.55	74.0	-24.02	Peak	33.00	100	Horizontal	Pass
4	2603.599	44.45	-3.31	74.0	-29.55	Peak	0.00	100	Horizontal	Pass
5	3036.491	46.75	-2.48	74.0	-27.25	Peak	41.00	100	Horizontal	Pass
6	3469.383	47.39	-1.30	74.0	-26.61	Peak	0.00	100	Horizontal	Pass
7	3904.274	45.80	0.83	74.0	-28.20	Peak	6.00	100	Horizontal	Pass
8	4338.165	46.34	1.90	74.0	-27.66	Peak	33.00	100	Horizontal	Pass

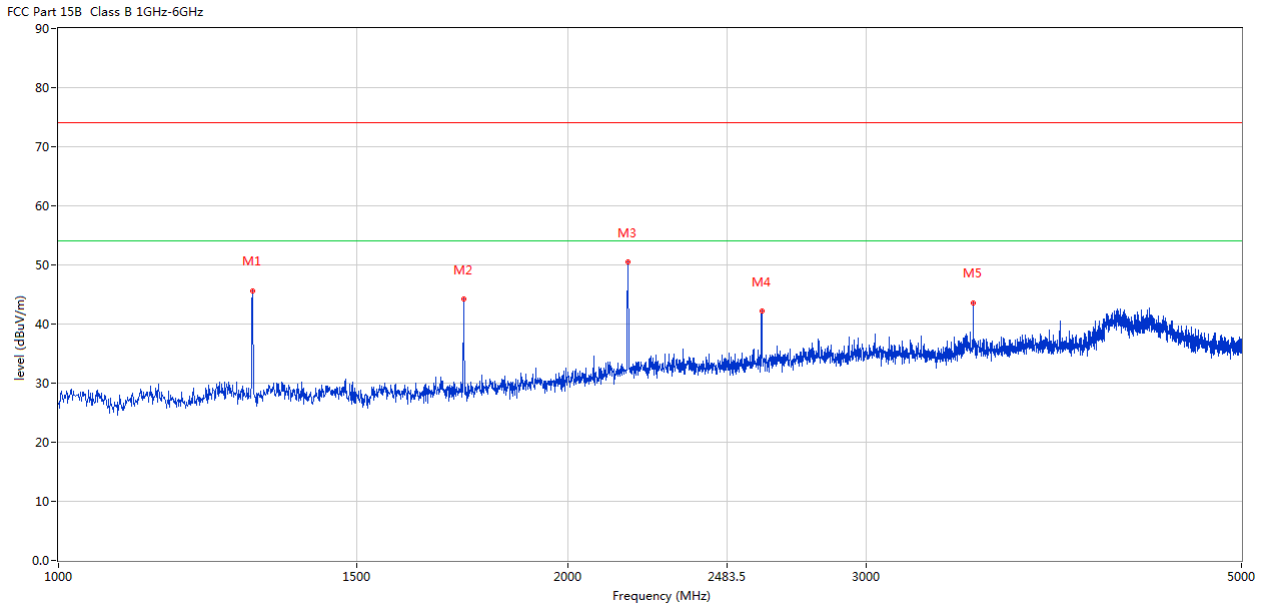
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Vertical



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	1301.925	45.65	-8.24	74.0	-28.35	Peak	360.00	100	Vertical	Pass
2	1735.816	44.16	-7.28	74.0	-29.84	Peak	360.00	100	Vertical	Pass
3	2169.708	50.53	-3.55	74.0	-23.47	Peak	347.00	100	Vertical	Pass
4	2603.599	42.15	-3.31	74.0	-31.85	Peak	347.00	100	Vertical	Pass
5	3470.382	43.59	-1.29	74.0	-30.41	Peak	329.00	100	Vertical	Pass

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7.0 20dB and Bandwidth Testing

7.1 Requirement

Per 15.231(c), The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

7.2 Test Procedure

With the EUT's antenna attached, the EUT's 20dB Bandwidth power was received by the test antenna which was connected to the spectrum analyzer with the START and STOP frequencies set to the EUT's operation band.

7.3 Test Data

Frequency (MHz)	20dB Bandwidth Emission (kHz)	Limit (kHz)	Result
433.92	214.48	1084.75	Pass

$$\text{Limit} = \text{Frequency} \times 0.25\% = 433.9 \times 0.25\% = 1084.75 \text{ kHz}$$

Refer to attached plots:

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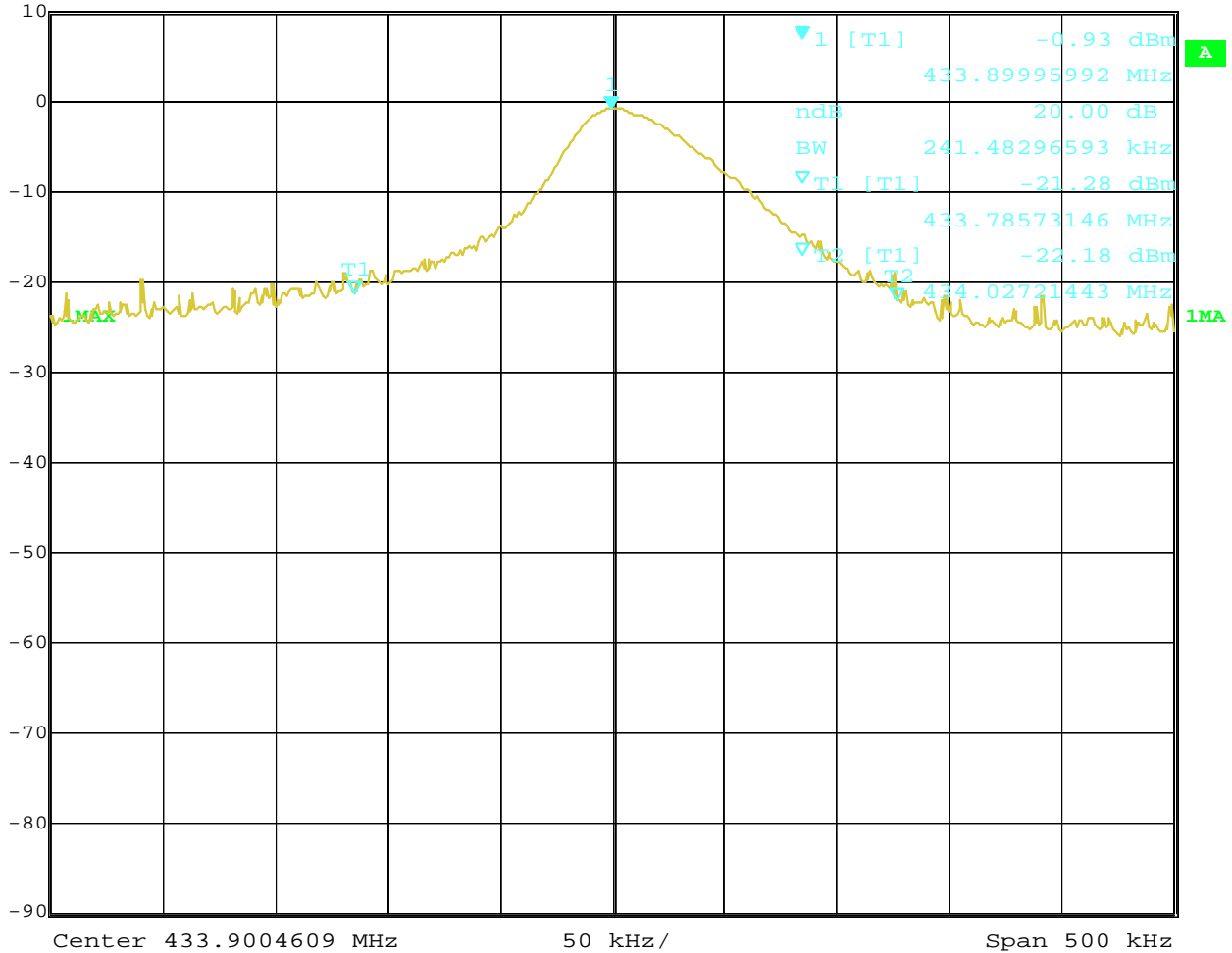
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20dB Bandwidth



Ref Lvl	Marker 1 [T1 ndB]	RBW	30 kHz	RF Att	20 dB
10 dBm	ndB 20.00 dB	VBW	100 kHz		
	BW 241.48296593 kHz	SWT	5 ms	Unit	dBm



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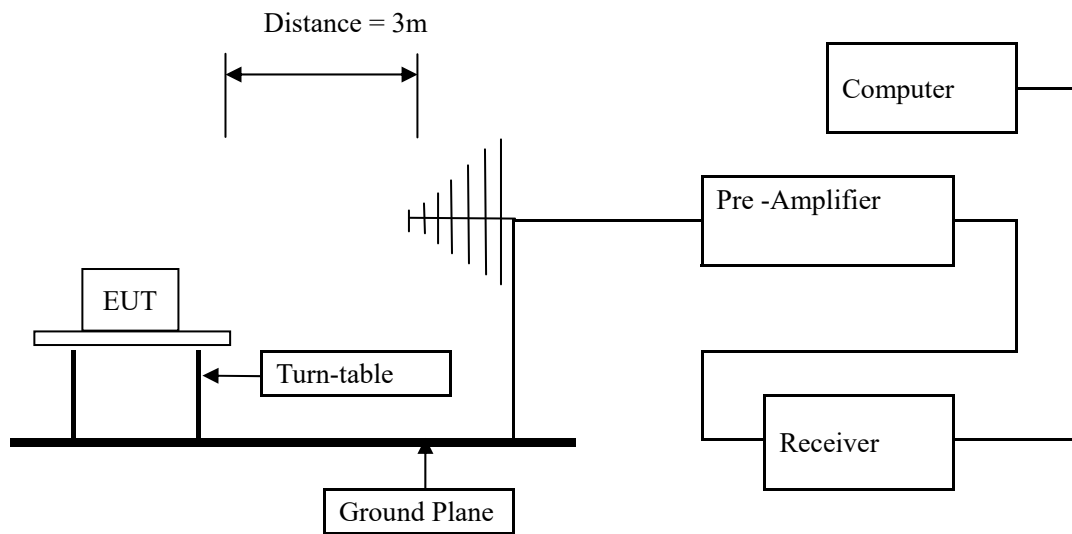
8.0 Deactivate Test

8.1 Requirement

Per 15.231(a) (1)

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

8.2 Radiated Test Setup



For the actual test configuration, please refer to the related items – Photos of Testing

The deactivation test was performed in the 3 meters chamber B test site, using the setup accordance with the ANSI C63.10-2013.

8.3 Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

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8.4 Test Data

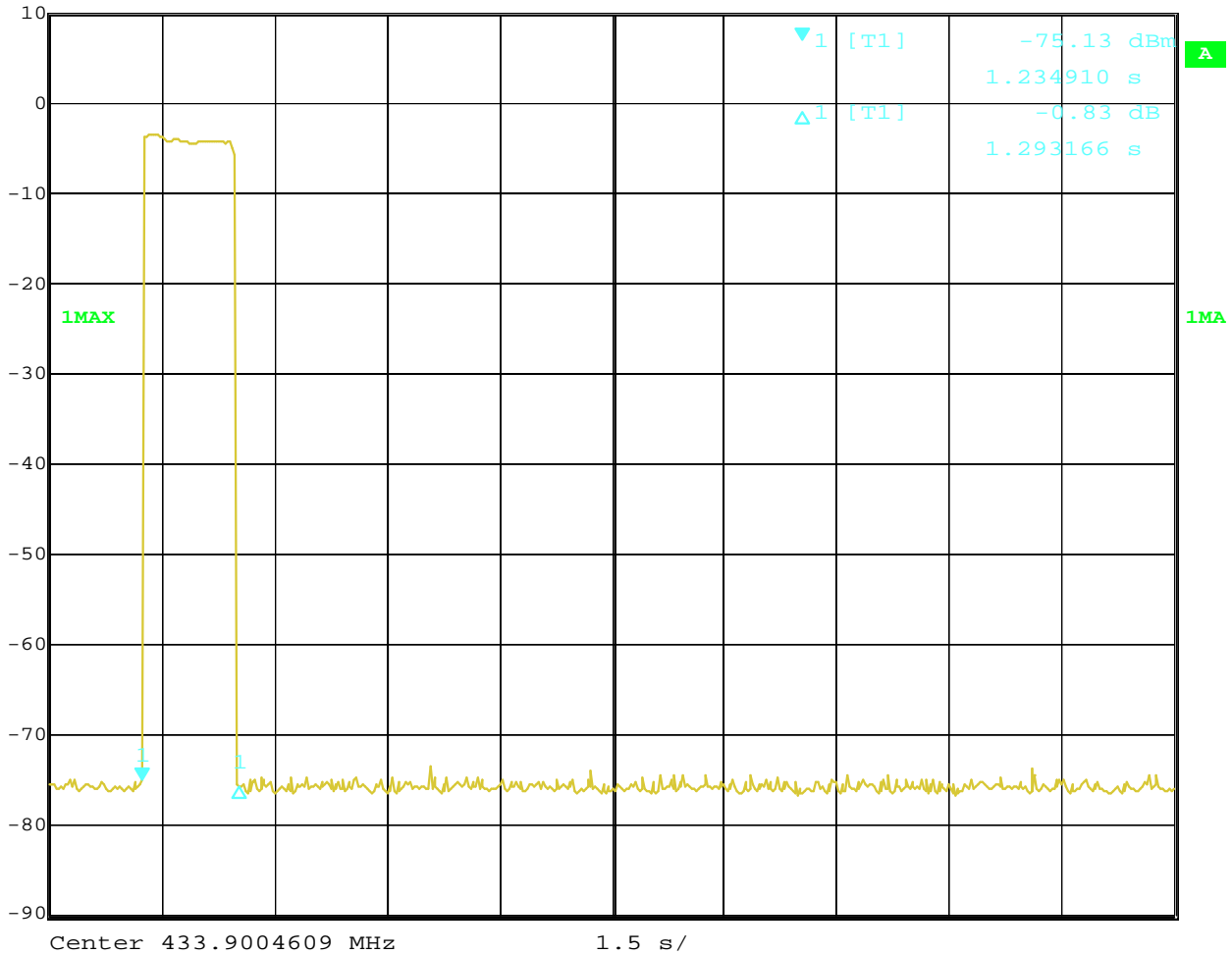
Refer to attached plots:



Marker 1 [T1]

RBW 30 kHz RF Att 20 dB
 VBW 100 kHz
 SWT 15 s Unit dBm

Ref Lvl 10 dBm
 -75.13 dBm
 1.234910 s



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8.5 Test result

Pass

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9.0 Duty Cycle

9.1 Limit

No dedicated limit specified in the Rules

9.2 Test Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer=operating frequency.
4. Set the spectrum analyzer as RBW = VBW=100kHz, Span=0Hz, Adjust Sweep=100ms.
5. Repeat above procedures until all frequency measured were complete.

9.3 Test Data

Base on the worst case

$$T_p = 6.4.259\text{ms}$$

$$T_{on1} = 1.192 * 11 = 13.112 \text{ (ms)}$$

$$T_{on2} = 0.581 * 22 = 12.782 \text{ (ms)}$$

$$\text{Duty cycle} = T_{on} / T_p = 25.894 / 64.259 = 0.403 = 40.30\%$$

$$\text{Duty cycle factor} = 20 * \log(\text{duty cycle}) = 20 * \log(0.4030) = -7.89\text{dB}$$

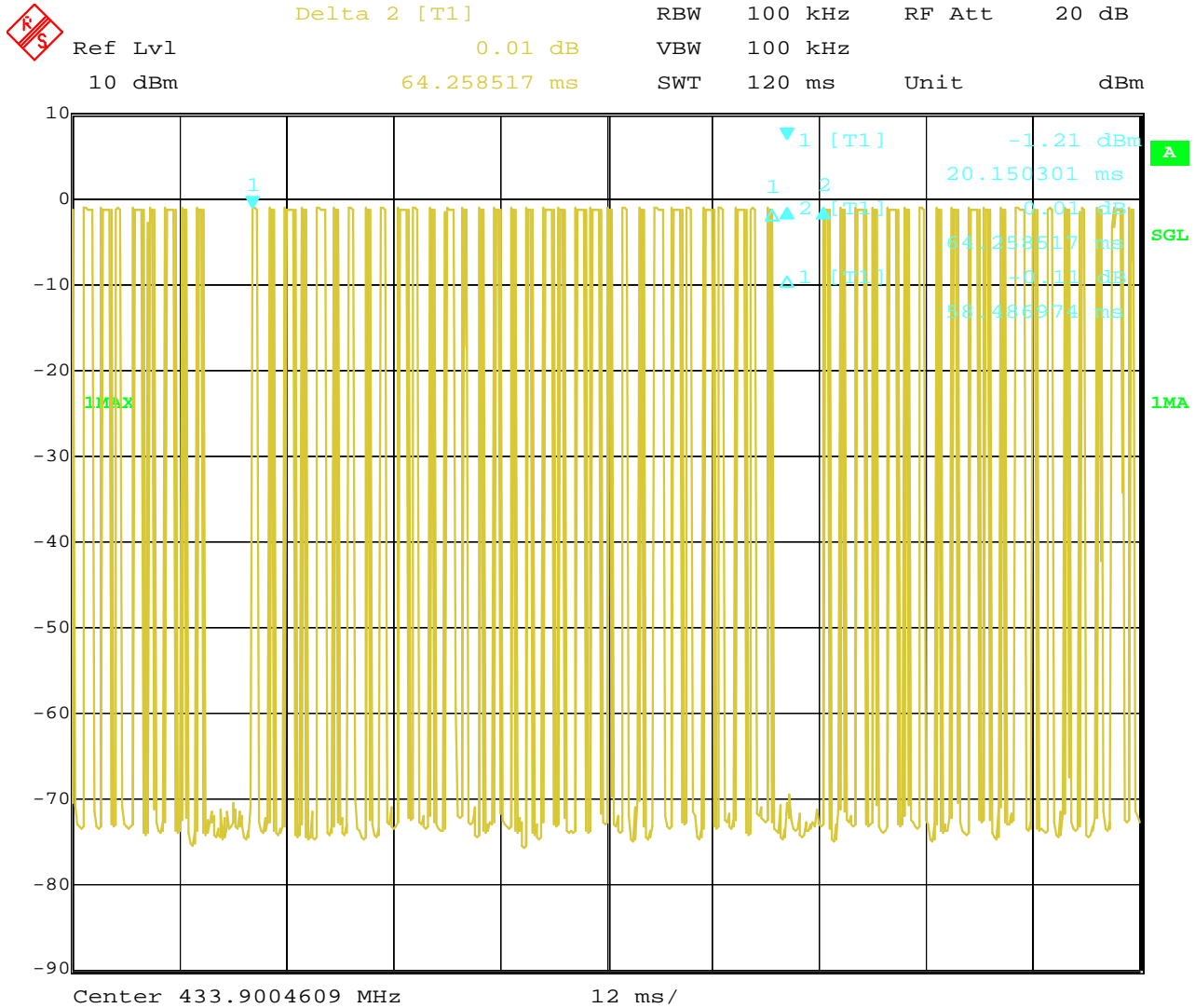
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Testing Plots:

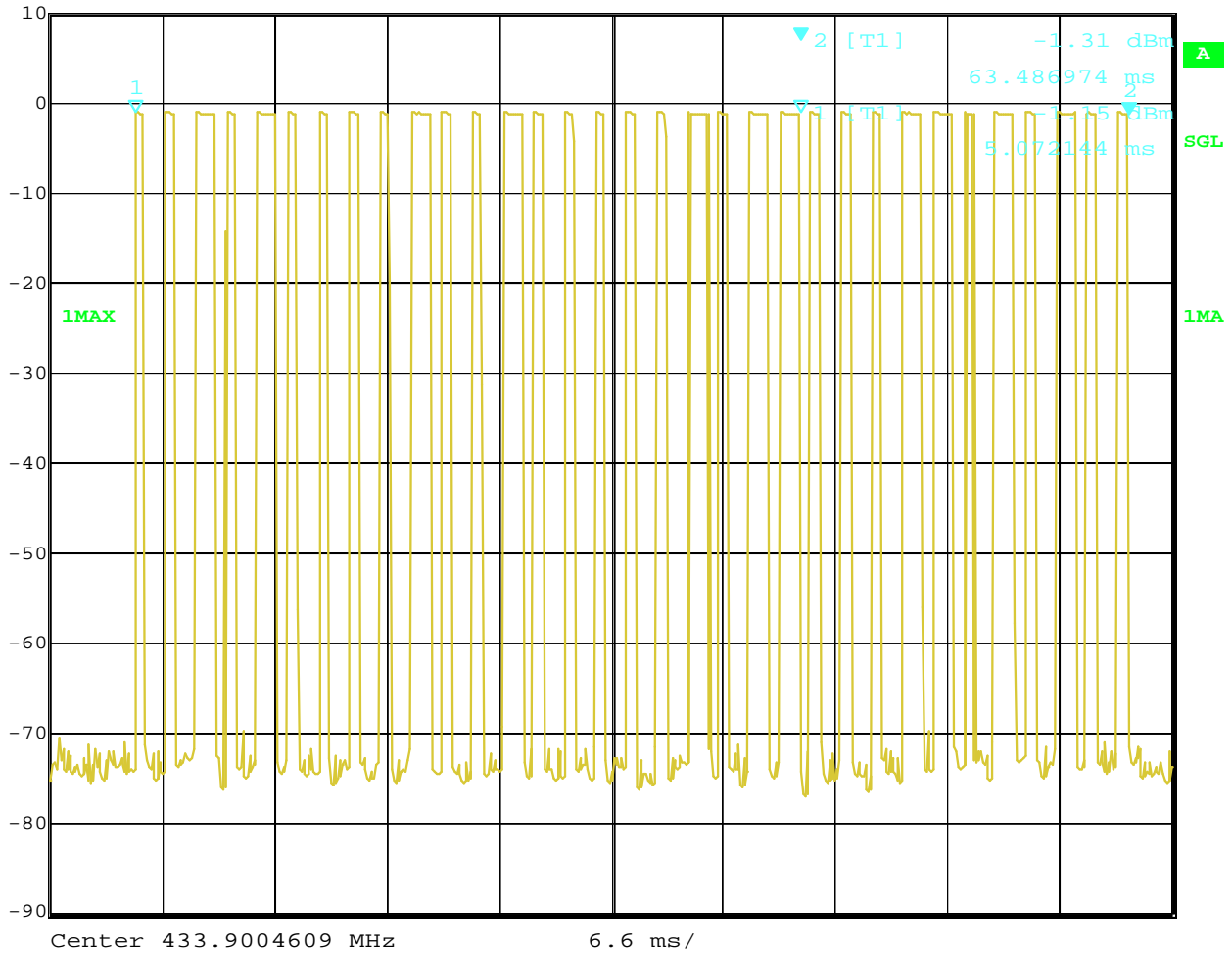


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	Marker 2 [T1]	RBW	100 kHz	RF Att	20 dB
Ref Lvl	-1.31 dBm	VBW	100 kHz		
10 dBm	63.486974 ms	SWT	66 ms	Unit	dBm



Date: 28.SEP.2021 10:42:09

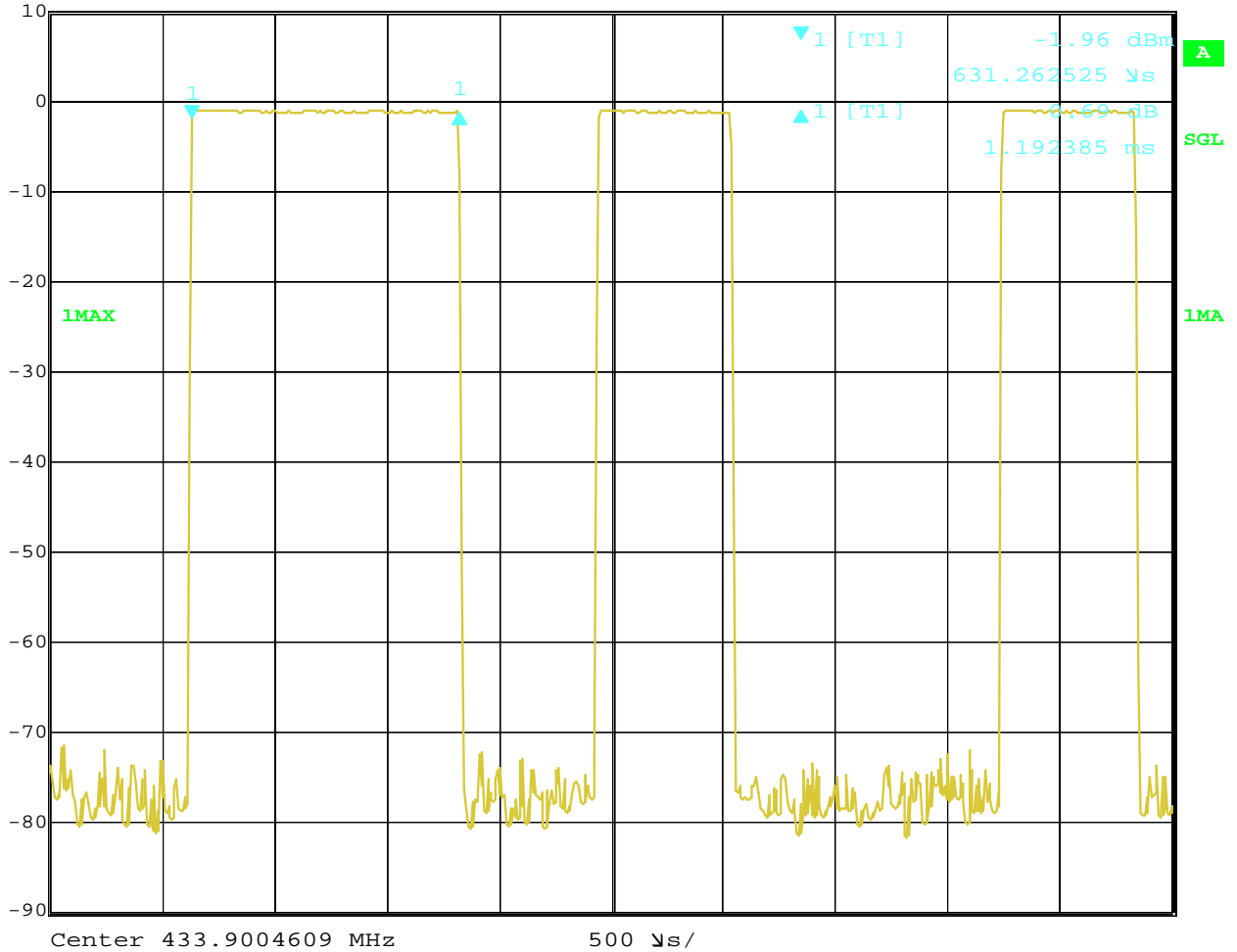
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T_{on1}



	Delta 1 [T1]	RBW	100 kHz	RF Att	20 dB
Ref Lvl	0.69 dB	VBW	100 kHz		
10 dBm	1.192385 ms	SWT	5 ms	Unit	dBm



Date: 28.SEP.2021 10:43:28

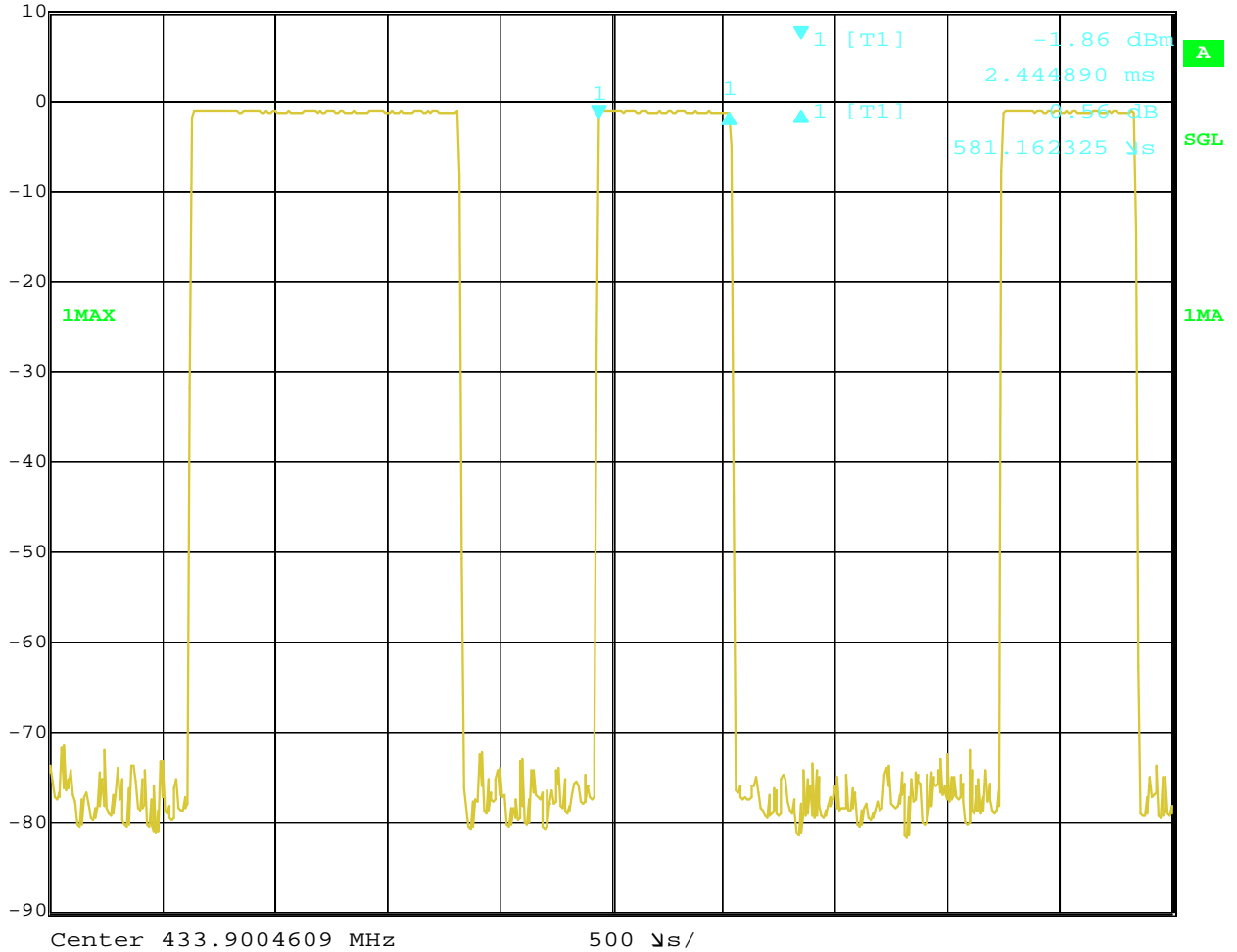
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T_{on2}



	Delta 1 [T1]	RBW	100 kHz	RF Att	20 dB
Ref Lvl	0.56 dB	VBW	100 kHz		
10 dBm	581.162325 μ s	SWT	5 ms	Unit	dBm



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10.0 Antenna Requirement

10.1 Standard Applicable

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. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

10.2 Antenna Connected constructions

The antenna is PCB Printed antenna which is built-in. The antenna gain is -5.0dBi maximum. So, it meets the requirement of 15.203

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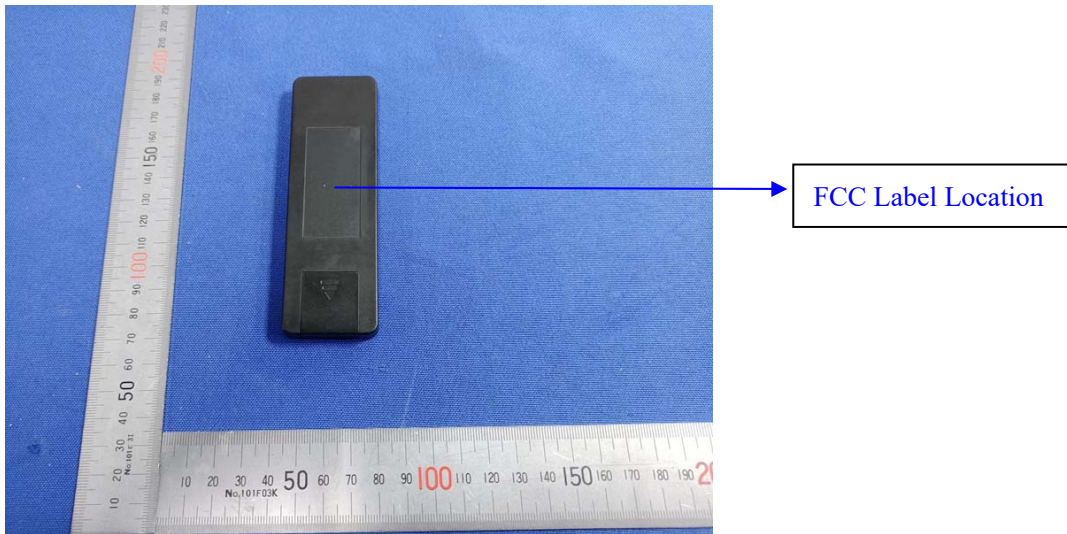


11.0 FCC ID Label

FCC ID: 2A2XV-020T

The label must not be a stick-on paper label. The label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.

Mark Location:



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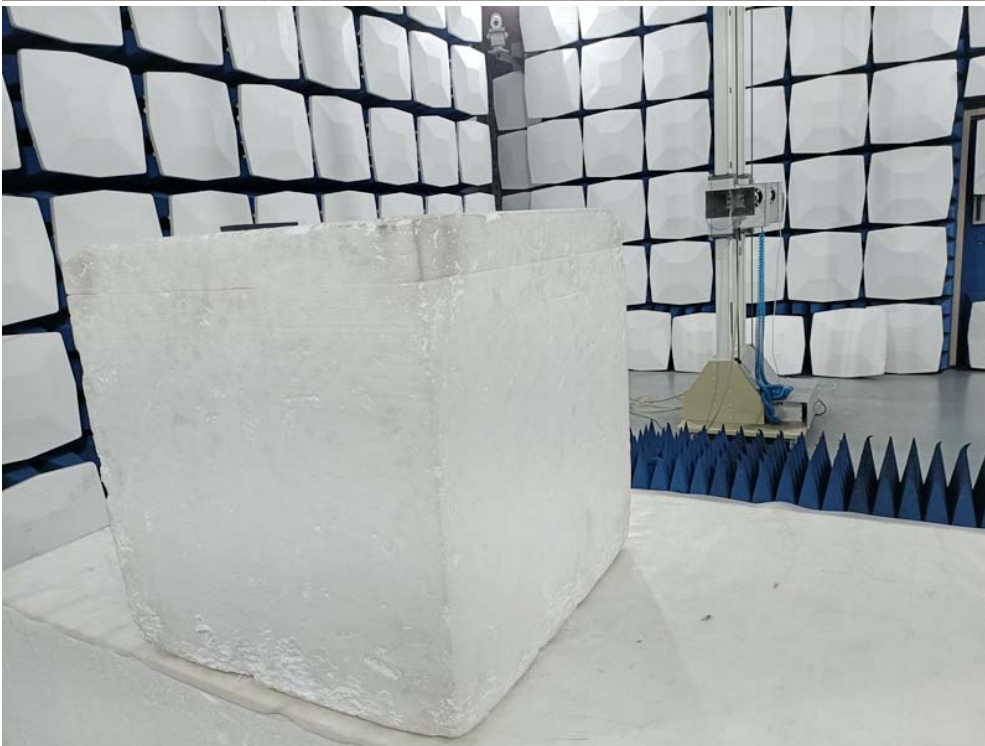
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12.0. Photo of testing

12.1 Conducted test View—N/A

12.2 Radiated emission test view



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Photo for the EUT



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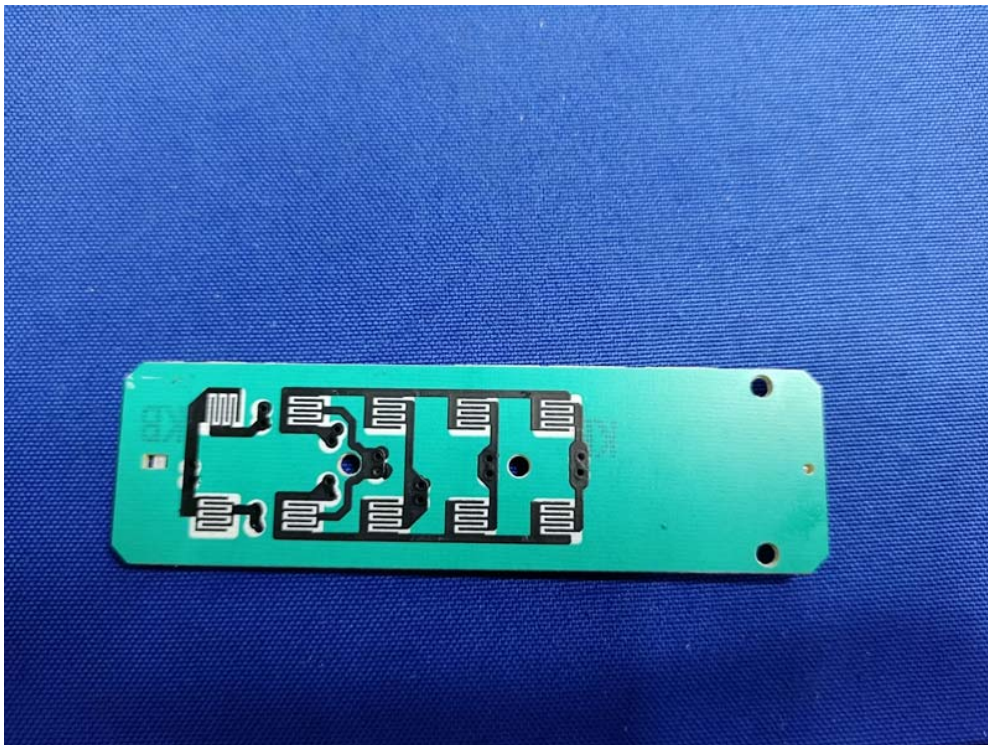
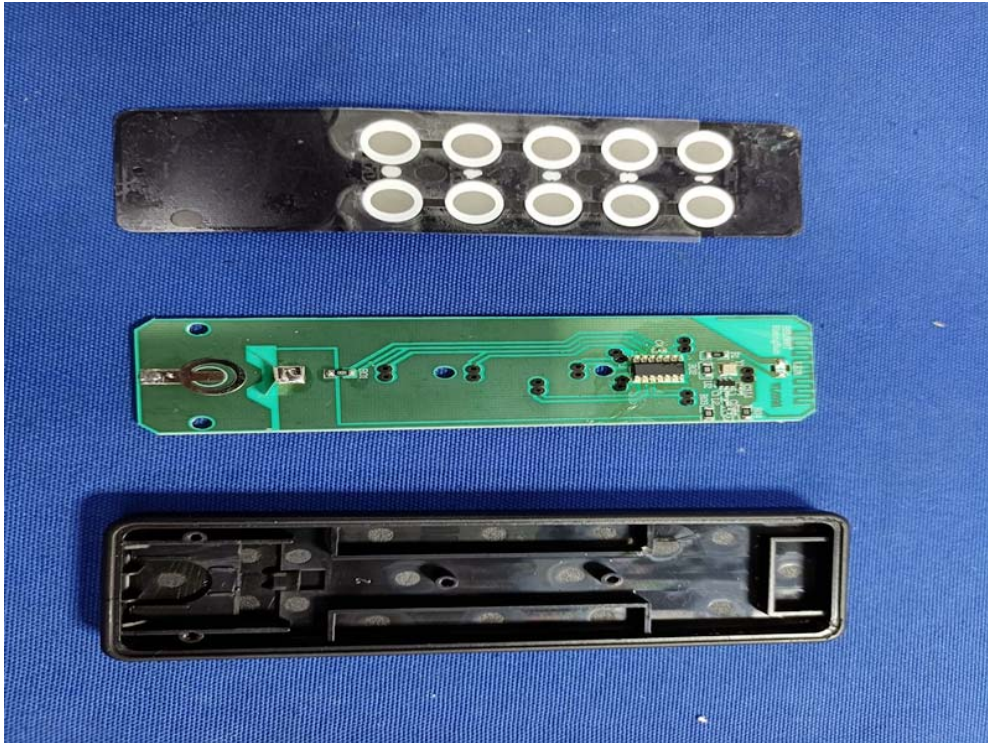


Photo for the EUT



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Photo for the EUT



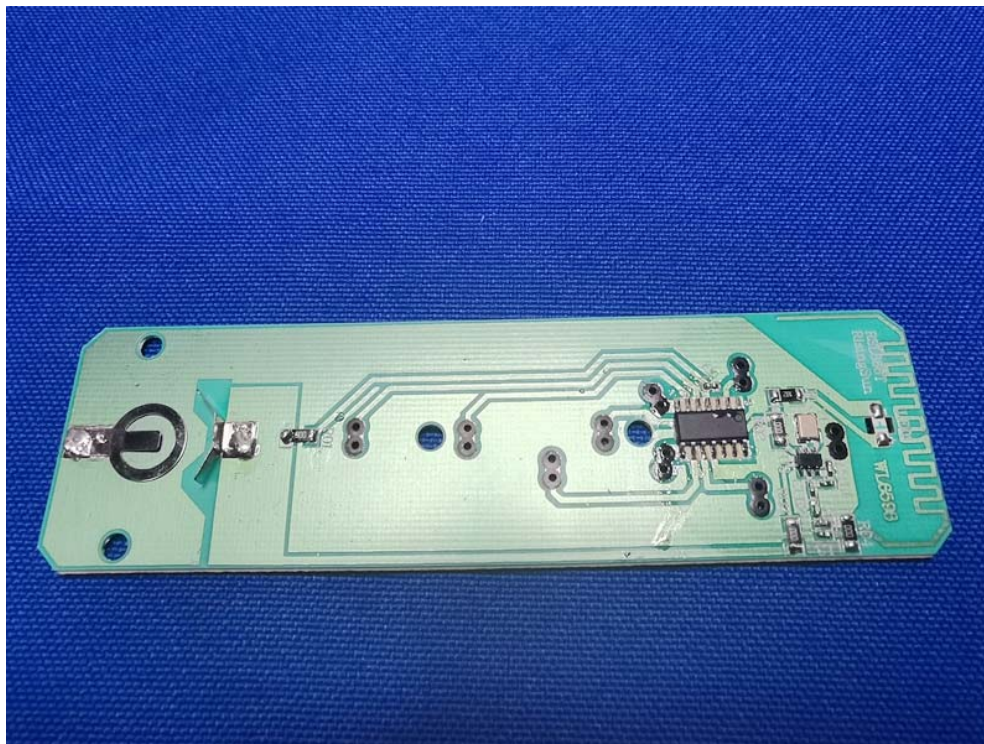
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Photo for the EUT



-End of the report-

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