TEST REPORT

FCC ID: FU5AN184

Product Name	:	Z-wave Mini plug with metering
Model Name	:	AN184-1
Brand Name	:	EVERSPRING Smarter Safer Greener
Report No.	:	PTC18083020901E-FC01

Prepared for

Everspring Industry Co Ltd

3F., No.50, Sec. 1, Zhonghua Rd. Tucheng Dist., New Taipei City 236, Taiwan (R.O.C.)

Prepared by

DongGuan Precise testing &Certification Corp. Ltd

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1TEST RESULT CERTIFICATION

Applicant's name	:	Everspring Industry Co Ltd
Address	:	3F., No.50, Sec. 1, Zhonghua Rd. Tucheng Dist., New Taipei City 236, Taiwan (R.O.C.)
Manufacture's name	:	Everspring Industry Co Ltd
Address	:	3F., No.50, Sec. 1, Zhonghua Rd. Tucheng Dist., New Taipei City 236, Taiwan (R.O.C.)
Product name	:	Z-wave Mini plug with metering
Model name	:	AN184-1
Standards	:	FCC CFR47 Part 15 Section 15.249
Test procedure	:	ANSI C63.10: 2013
Test Date	:	January 14, 2020 to February 25, 2020
Date of Issue	:	February 25, 2020
Test Result	:	Pass

This device described above has been tested by PTC, and the test results show that the equipment under test (EUT) is in compliance with the requirements. And it is applicable only to the tested sample identified in the report.
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Test Engineer:

Leo Yang

Leo Yang / Engineer

Technical Manager:

Chris Du / Manager

Contents

2 Test Summary

Test Items	Test Requirement	Result
AC Power Conducted Emission	15.207	PASS
20dB Bandwidth	15.215(c)	PASS
Field Strength of Fundamental Emissions	15.249(a) 15.249(c) 15.205(a) 15.209(a)	PASS
Radiated Spurious Emissions		PASS
Antenna Requirement	15.203	PASS

3 TEST FACILITY

DongGuan Precise testing &Certification Corp. Ltd

Building D,Baoding Technology Park,Guangming Road2, Dongcheng District, Dongguan, Guangdong, China, Dongguan, 523129

FCC Registration Number: 790290

A2LA Certificate No.: 4408.01

IC Registration Number: 12191A-1

4 General Information

4.1 General Description of E.U.T.

Product Name	:	Z-wave Mini plug with metering
Model Name	:	AN184-1
Operating frequency	:	908.4MHz, 908.42MHz, 916MHz
Numbers of Channel	:	3
Antenna Type	:	Internal Antenna
Antenna Gain	:	0dBi
Type of Modulation	:	FSK
Power supply	:	AC 100-120V, 60Hz
Hardware Version	:	V1.0
Software Version	:	V1.0

4.2 Test Mode

While testing transmitting mode of EUT, the internal modulation and continuously transmission was applied.

Radiated test mode: EUT transmitted signal with antenna; so three axes (X, Y, Z) were observed while the test receiver worked as “max hold” continuously and the highest reading among the whole test procedure was recorded.

Within this test report, EUT was tested with modulation and tested under its rating voltage and frequency.

5 Equipment During Test

5.1 Equipments List

RF Conducted Test

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Due
MXG Signal Analyzer	Agilent	N9020A	MY56070279	10Hz-30GHz	July 15, 2019
Coaxial Cable	CDS	79254	46107086	10Hz-30GHz	July 15, 2019
Power Meter	Anritsu	ML2495A	0949003	300MHz-40GHz	July 15, 2019
Power Sensor	Anritsu	MA2411B	0917017	300MHz-40GHz	July 15, 2019

Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

Radiated Emissions

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	EMI Test Receiver	Rohde & Schwarz	ESCI	101417	July 15, 2019	July 14, 2020	1 year
2	EMC Analyzer (9k~26.5GHz)	Agilent	E4407B	MY45109572	Aug.04, 2019	Aug.03, 2020	1 year
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3355	July 15, 2019	July 14, 2020	1 year
4	Amplifier	EM	EM-30180	060538	July 15, 2019	July 14, 2020	1 year
5	Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-1246	July 15, 2019	July 14, 2020	1 year
6	Coaxial Cable(below 1GHz)	LARGE	CALB1	-	July 15, 2019	July 14, 2020	1 year
7	Coaxial Cable(above 1GHz)	LARGE	CALB2	-	July 15, 2019	July 14, 2020	1 year

Conducted Emission

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Due
EMI Test Receiver	Rohde&Schwarz	ESCI	101417	9KHz-3GHz	July 15, 2019
Artificial Mains Network	Rohde&Schwarz	ENV216	102453	9KHz-300MHz	July 15, 2019
Artificial Mains Network	Rohde&Schwarz	ENV216	101342	9KHz-300MHz	July 15, 2019

5.2 Measurement Uncertainty

Parameter	Uncertainty
RF output power, conducted	±1.0dB
Power Spectral Density, conducted	±2.2dB
Radio Frequency	± 1 x 10^{-6}
Bandwidth	± 1.5 x 10^{-6}
Time	±2%
Duty Cycle	±2%
Temperature	±1°C
Humidity	±5%
DC and low frequency voltages	±3%
Conducted Emissions (150kHz~30MHz)	±3.64dB
Radiated Emission(30MHz~1GHz)	±5.03dB
Radiated Emission(1GHz~25GHz)	±4.74dB
Remark: The coverage Factor (k=2), and measurement Uncertainty for a level of Confidence of 95%	

5.3 Description of Support Units

Equipment	Model No.	Series No.
Lighting	N/A	N/A

6 Conducted Emission

Test Requirement	:	FCC CFR 47 Part 15 Section 15.207
Test Method	:	ANSI C63.10: 2013
Test Result	:	PASS
Frequency Range	:	150kHz to 30MHz
Class/Severity	:	Class B

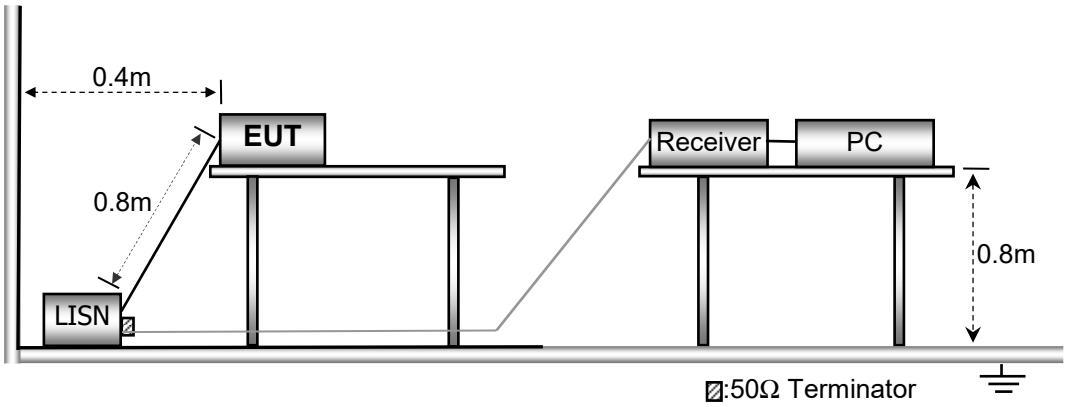
6.1 E.U.T. Operation

Operating Environment :

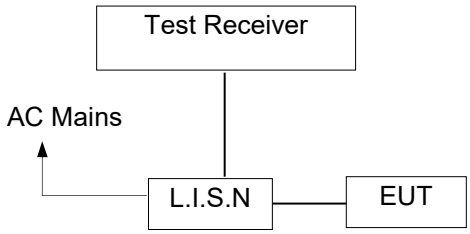
Temperature	:	25.5 °C
Humidity	:	51 % RH
Atmospheric Pressure	:	101.2kPa

6.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10:2013.



6.3 Test SET-UP (Block Diagram of Configuration)



6.4 Measurement Procedure

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured was complete.

6.5 Conducted Emission Limit

Conducted Emission

Frequency(MHz)	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

Note:
1. The lower limit shall apply at the transition frequencies
2.The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

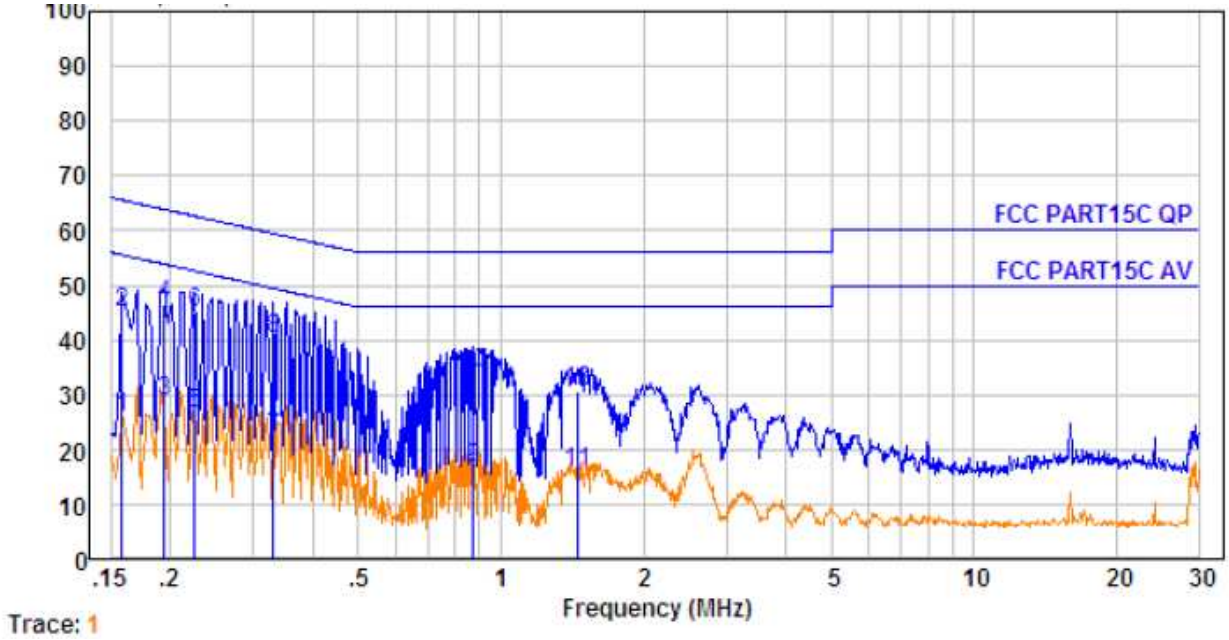
6.6 Measurement Description

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

6.7 Conducted Emission Test Result

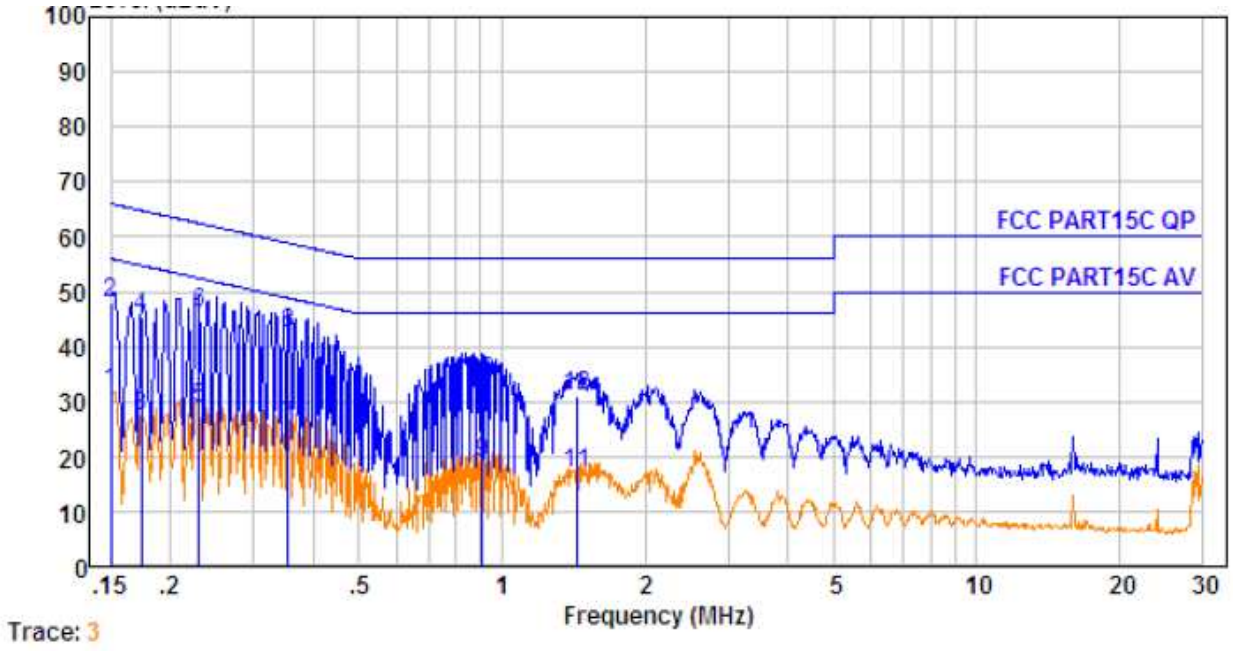
Pass. Please find below test graphs.

Line:



No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBµV	Emission Level dBµV	Limit dBµV	Over Limit dB	Remark
1.	0.158	0.22	9.59	15.89	25.70	55.56	-29.86	Average
2.	0.158	0.22	9.59	35.22	45.03	65.56	-20.53	QP
3.	0.194	0.27	9.59	18.77	28.63	53.84	-25.21	Average
4.	0.194	0.27	9.59	36.48	46.34	63.84	-17.50	QP
5.	0.226	0.31	9.59	16.73	26.63	52.61	-25.98	Average
6.	0.226	0.31	9.59	35.14	45.04	62.61	-17.57	QP
7.	0.330	0.38	9.60	12.05	22.03	49.44	-27.41	Average
8.	0.330	0.38	9.60	30.28	40.26	59.44	-19.18	QP
9.	0.876	0.45	9.61	6.51	16.57	46.00	-29.43	Average
10.	0.876	0.45	9.61	23.83	33.89	56.00	-22.11	QP
11.	1.449	0.47	9.61	5.79	15.87	46.00	-30.13	Average
12.	1.449	0.47	9.61	20.62	30.70	56.00	-25.30	QP

Netural



No.	Freq MHz	Cable Loss dB	AMN Factor dB	Receiver Reading dBµV	Emission Level dBµV	Limit dBµV	Over Limit dB	Remark
1.	0.150	0.21	9.60	22.03	31.84	56.00	-24.16	Average
2.	0.150	0.21	9.60	38.32	48.13	66.00	-17.87	QP
3.	0.174	0.24	9.60	17.46	27.30	54.77	-27.47	Average
4.	0.174	0.24	9.60	35.71	45.55	64.77	-19.22	QP
5.	0.230	0.31	9.61	19.04	28.96	52.44	-23.48	Average
6.	0.230	0.31	9.61	36.34	46.26	62.44	-16.18	QP
7.	0.354	0.39	9.62	15.45	25.46	48.87	-23.41	Average
8.	0.354	0.39	9.62	32.39	42.40	58.87	-16.47	QP
9.	0.909	0.45	9.64	8.76	18.85	46.00	-27.15	Average
10.	0.909	0.45	9.64	23.60	33.69	56.00	-22.31	QP
11.	1.433	0.47	9.64	6.89	17.00	46.00	-29.00	Average
12.	1.433	0.47	9.64	20.90	31.01	56.00	-24.99	QP

7 Field Strength of Fundamental Emission and Radiated Spurious Emissions

Test Requirement: : FCC Part C section 15.205 & 15.209 & 15.249

Test Method: : ANSI C63.10: 2013

Test Result: : PASS

Measurement Distance: : 3m

Limit: : See the follow table

15.209 limit:

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	$20\log^{(2400/F(kHz))}$ + 80
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(kHz))}$ + 40
1.705 ~ 30	30	30	100 * 30	$20\log^{(30)}$ + 40
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

Note: 1. Emission level in dBuV/m=20 log (uV/m)

2. Measurement was performed at an antenna to the closed point of EUT distance of meters.

The field strength of emission from intentional radiators operated within these frequency bands shall comply with the following:

15.249(a) Limit:

Fundamental Frequency	Field strength of fundamental		Field strength of harmonics	
(MHz)	mV/m	dBuV/m	uV/m	dBuV/m
902-928	50	94	500	54
2400-2483.5	50	94	500	54
5725-5875	50	94	500	54
24000-24250	250	108	2500	68

7.1 EUT Operation

Operating Environment :

Temperature: : 23.8 °C

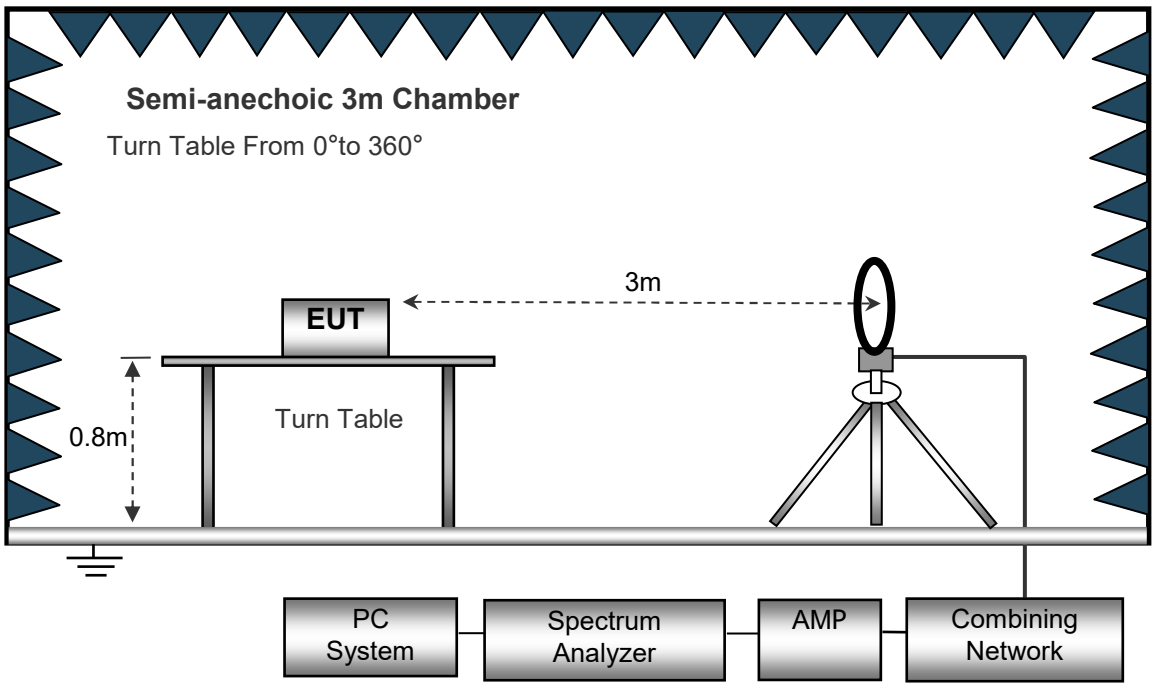
Humidity: : 50 % RH

Atmospheric Pressure: : 101.12kPa

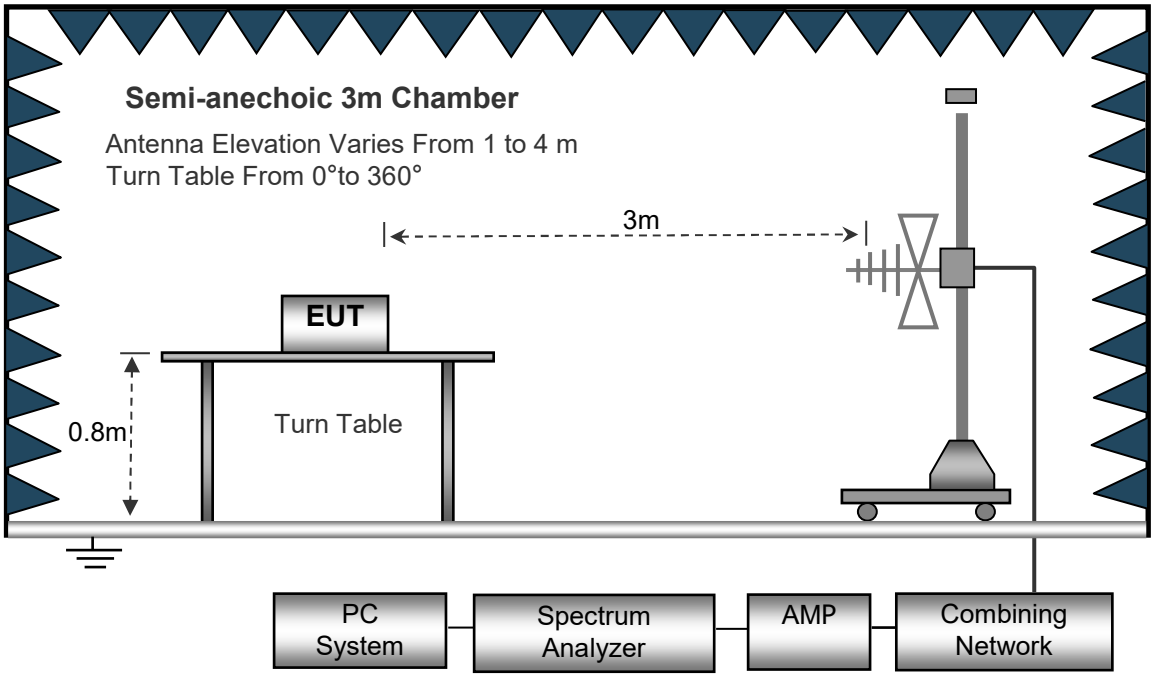
7.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site

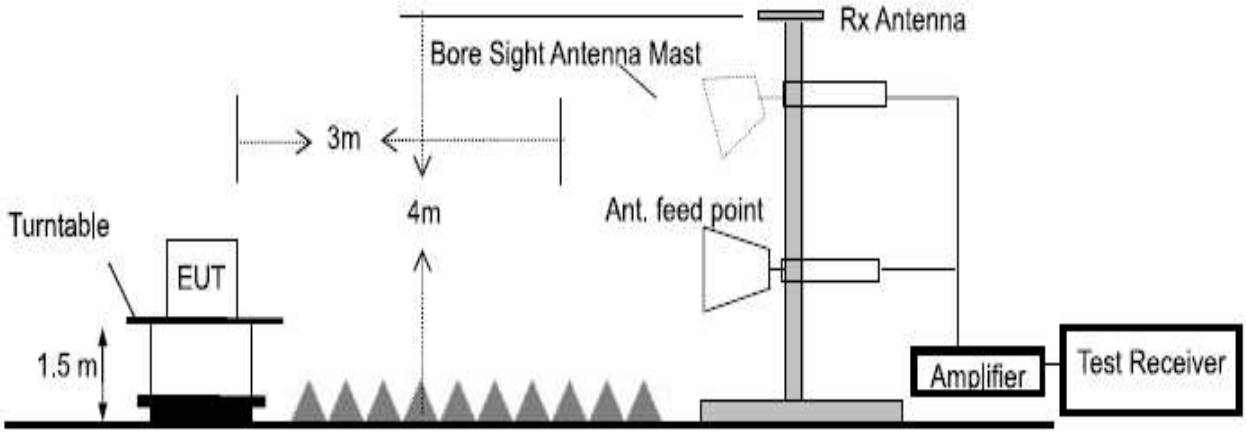
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



7.3 Spectrum Analyzer Setup

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1 MHz / 1 MHz for Peak, 1 MHz / *10Hz* for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

7.4 Test Procedure

1. The testing follows the guidelines in Spurious Radiated Emissions of ANSI C63.10: 2013.

2. Below 1000MHz, The EUT was placed on a turn table which is 0.8m above ground plane. And above 1000MHz, The EUT was placed on a styrofoam table which is 1.5m above ground plane.

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

4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (From 1m to 4m) and turntable (from 0 degree to 360 degree) 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 to comply with the guidelines.

5. Set to the maximum power setting and enable the EUT transmit continuously.

6. Test Procedure of measurement (For Above 1GHz): Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

7.5 Summary of Test Results

Test Frequency: 9KHz-30MHz

Freq. (MHz)	Ant.Pol. H/V	Emission Level (dBuV/m)	Limit 3m (dBuV/m)	Over (dB)
--	--	--	--	>20

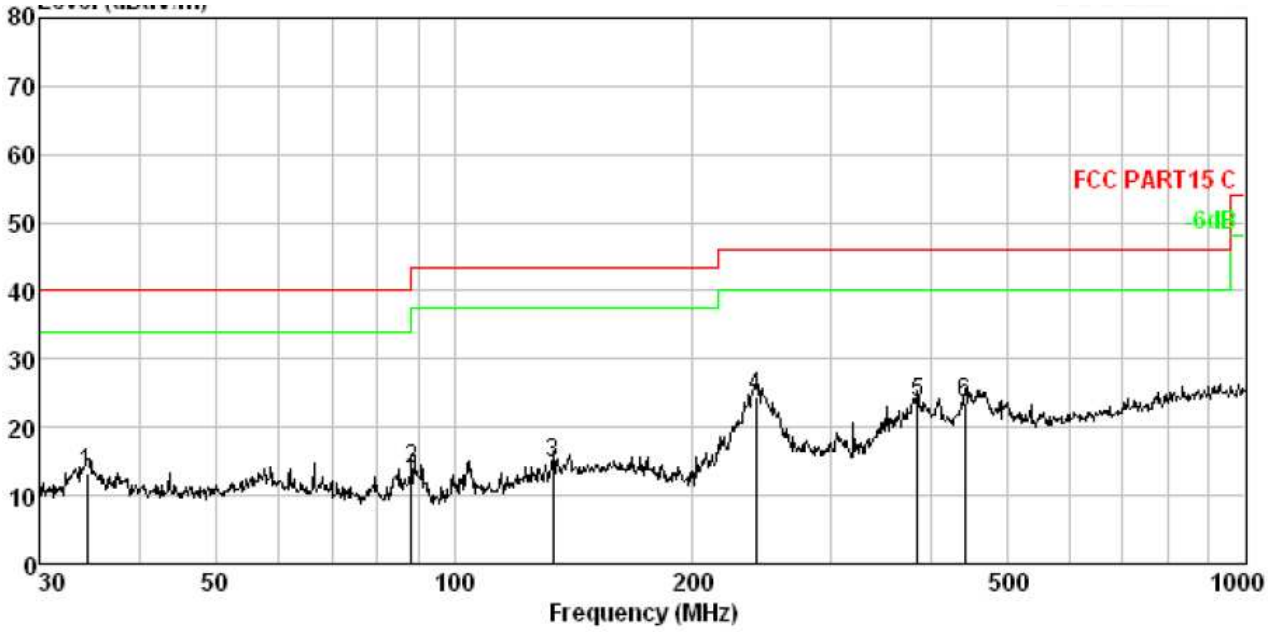
Note:

The amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

Distance extrapolation factor =40log(Specific distance/ test distance)(dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor.

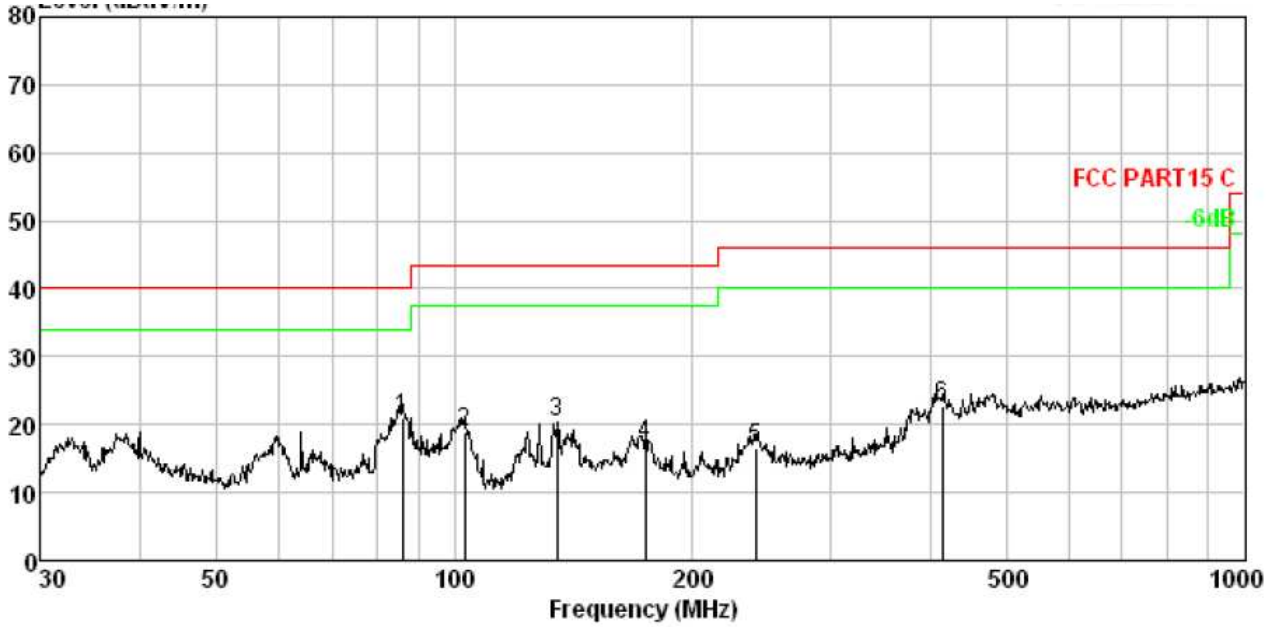
Test Frequency: 30MHz ~ 1GHz

Test plot for Horizontal: (Worst test case: 908.42MHz)



No.	Freq MHz	Cable Loss dB	ANT Factor dB/m	Receiver Reading dBuV	Preamp Factor dB	Emission Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark
1.	34.396	1.44	12.14	29.71	29.90	13.39	40.00	-26.61	QP
2.	88.342	3.06	9.04	31.80	29.98	13.92	43.50	-29.58	QP
3.	133.151	3.77	12.88	28.01	30.01	14.65	43.50	-28.85	QP
4.	240.830	4.78	12.25	37.77	30.17	24.63	46.00	-21.37	QP
5.	385.281	5.59	14.69	33.88	30.65	23.51	46.00	-22.49	QP
6.	441.743	5.83	15.73	32.96	30.79	23.73	46.00	-22.27	QP

Test plot for Vertical: (Worst test case: 908.42MHz)



No.	Freq MHz	Cable Loss dB	ANT Factor dB/m	Receiver Reading dBuV	Preamp Factor dB	Emission Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark
1.	85.898	3.01	8.79	39.11	29.97	20.94	40.00	-19.06	QP
2.	103.080	3.32	9.98	35.69	29.99	19.00	43.50	-24.50	QP
3.	135.032	3.79	13.00	33.69	30.01	20.47	43.50	-23.03	QP
4.	174.424	4.23	12.93	29.94	30.03	17.07	43.50	-26.43	QP
5.	240.830	4.78	12.25	29.80	30.17	16.66	46.00	-29.34	QP
6.	414.722	5.72	15.14	32.47	30.73	22.60	46.00	-23.40	QP

Fundamental and Harmonics Average Result

Frequency (MHz)	Emission Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Ant. Polar (H/V)	Detector
908.40	78.23	94	-15.77	H	QP
908.40	79.18	94	-14.82	V	QP
908.42	80.23	94	-13.77	H	QP
908.42	79.44	94	-14.56	V	QP
916.00	80.46	94	-13.54	H	QP
916.00	78.18	94	-15.82	V	QP

Test Frequency Above 1GHz:

Frequency	Ant. Polar	Emission Level (dBμV/m)		Limit (dBμV/m)		Margin (dB)	
(MHz)	(H/V)	PK	AV	PK	AV	PK	AV
908.40MHz							
1816.80	H	61.25	43.35	74.00	54.00	-12.75	-10.65
2725.20	H	60.41	42.56	74.00	54.00	-13.59	-11.44
3633.60	H	58.32	40.12	74.00	54.00	-15.68	-13.88
4542.00	H	54.85	39.64	74.00	54.00	-19.15	-14.36
1816.80	V	59.34	41.22	74.00	54.00	-14.66	-12.78
2725.20	V	57.93	40.63	74.00	54.00	-16.07	-13.37
3633.60	V	54.12	39.46	74.00	54.00	-19.88	-14.54
4542.00	V	52.46	37.52	74.00	54.00	-21.54	-16.48
908.42MHz							
1816.84	H	62.19	43.12	74.00	54.00	-11.81	-10.88
2725.26	H	60.35	41.00	74.00	54.00	-13.65	-13.00
3633.68	H	58.56	39.14	74.00	54.00	-15.44	-14.86
4542.10	H	52.47	37.12	74.00	54.00	-21.53	-16.88
1816.84	V	61.39	42.35	74.00	54.00	-12.61	-11.65
2725.26	V	59.55	40.26	74.00	54.00	-14.45	-13.74
3633.68	V	54.12	38.93	74.00	54.00	-19.88	-15.07
4542.10	V	50.73	37.16	74.00	54.00	-23.27	-16.84
916.00MHz							
1832.00	H	60.11	44.22	74.00	54.00	-13.89	-9.78
2748.00	H	59.52	43.98	74.00	54.00	-14.48	-10.02
3664.00	H	58.17	41.12	74.00	54.00	-15.83	-12.88
4580.00	H	56.12	39.16	74.00	54.00	-17.88	-14.84
1832.00	V	59.67	42.57	74.00	54.00	-14.33	-11.43
2748.00	V	58.41	40.12	74.00	54.00	-15.59	-13.88
3664.00	V	55.67	39.79	74.00	54.00	-18.33	-14.21
4580.00	V	53.78	37.93	74.00	54.00	-20.22	-16.07

Remark:
1. Margin= Emission Level - Limit
2. “*” means the test results were attenuated more than 20dB below the permissible limits, so the results don’t record in the report.

8 20 dB Bandwidth Measurement

Test Method : ANSI C63.10: 2013

8.1 Test Procedure

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator.

2. Set the EUT work on the top, the middle and the bottom operation frequency individually.

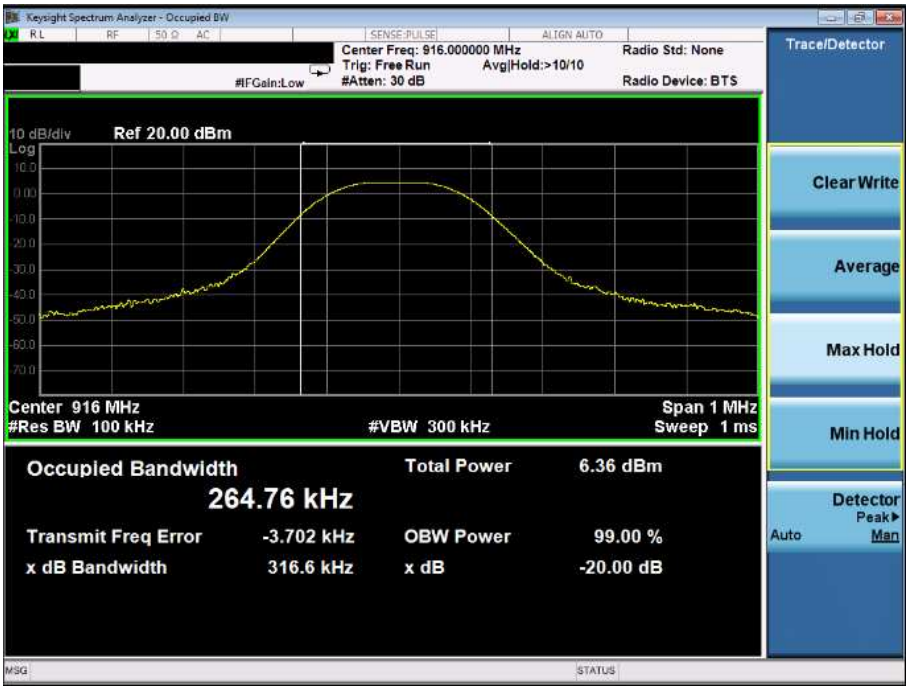
3. Set Span= approximately 2 to 5 times the 20dB bandwidth, centered on a hopping channel

The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth(VBW) shall be approximately three times RBW; Sweep = auto; Detector function= peak

8.2 Test Result

Channel number	Channel frequency (MHz)	20dB Down BW(KHz)
1	908.40	310.8
2	908.42	302.9
3	916.00	316.6


Keysight Spectrum Analyzer - Occupied BW
Span 2.0000 MHz
Center Freq: 908.420000 MHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 10 dB
Radio Std: None
Radio Device: BTS
#IFGain:Low
10 dB/div
Ref 0.00 dBm
Center 908.420 MHz
#Res BW 100 kHz
#VBW 300 kHz
Span 2.000 MHz
Sweep 1 ms
Occupied Bandwidth
258.00 kHz
Total Power
-19.4 dBm
Transmit Freq Error
-4.046 kHz
% of OBW Power
99.00 %
x dB Bandwidth
302.9 kHz
x dB
-20.00 dB
File <Screen_0057.png> saved
Span
Span
2.0000 MHz
Full Span
Last Span


Keysight Spectrum Analyzer - Occupied BW
Center Freq: 916.000000 MHz
Trig: Free Run
Avg|Hold:>10/10
#Atten: 30 dB
Radio Std: None
Radio Device: BTS
#IFGain:Low
10 dB/div
Ref 20.00 dBm
Center 916 MHz
#Res BW 100 kHz
#VBW 300 kHz
Span 1 MHz
Sweep 1 ms
Occupied Bandwidth
264.76 kHz
Total Power
6.36 dBm
Transmit Freq Error
-3.702 kHz
OBW Power
99.00 %
x dB Bandwidth
316.6 kHz
x dB
-20.00 dB
Trace/Detector
Clear Write
Average
Max Hold
Min Hold
Detector
Peak
Auto
Man

9 Antenna Requirement

9.1 Antenna Requirement

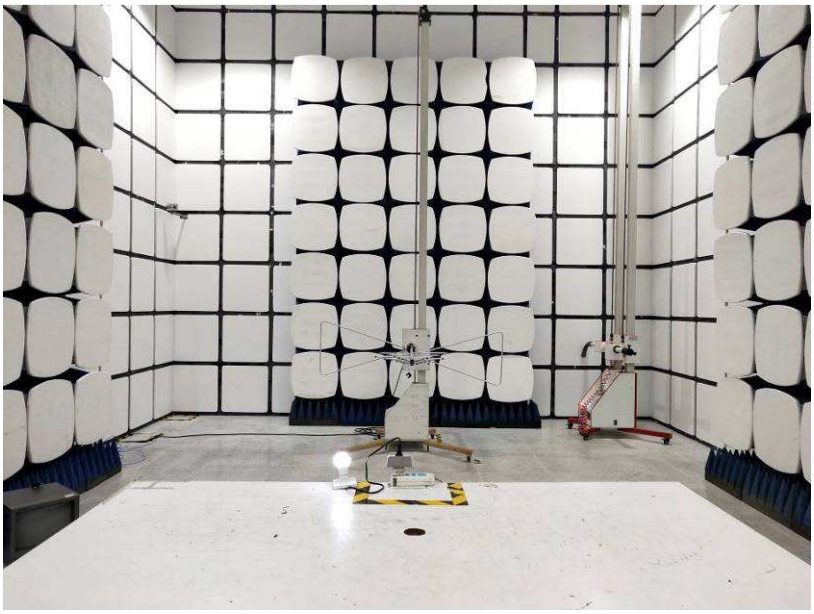
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

9.2 Result

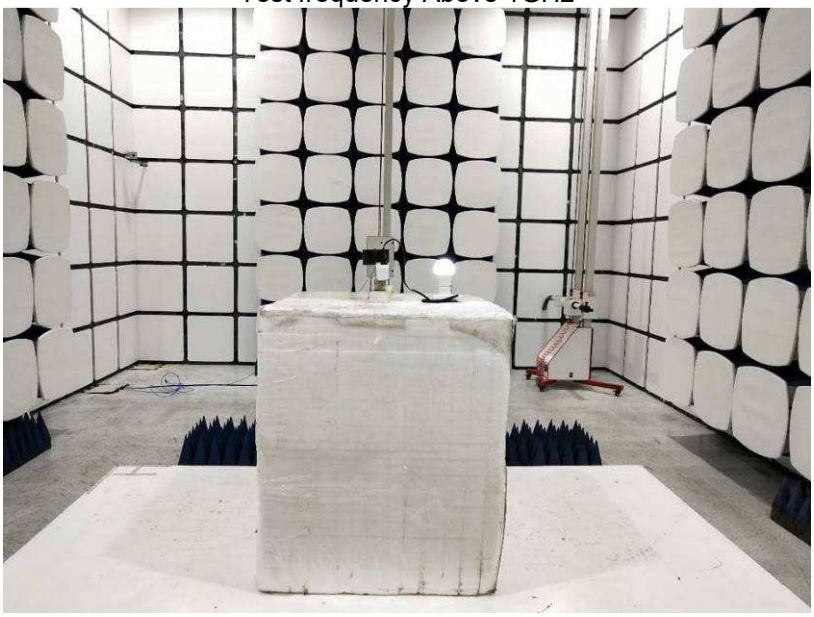
The EUT'S antenna, permanent attached antenna, is internal antenna. The antenna's gain is 0dBi and meets the requirement.

10 TEST PHOTOS

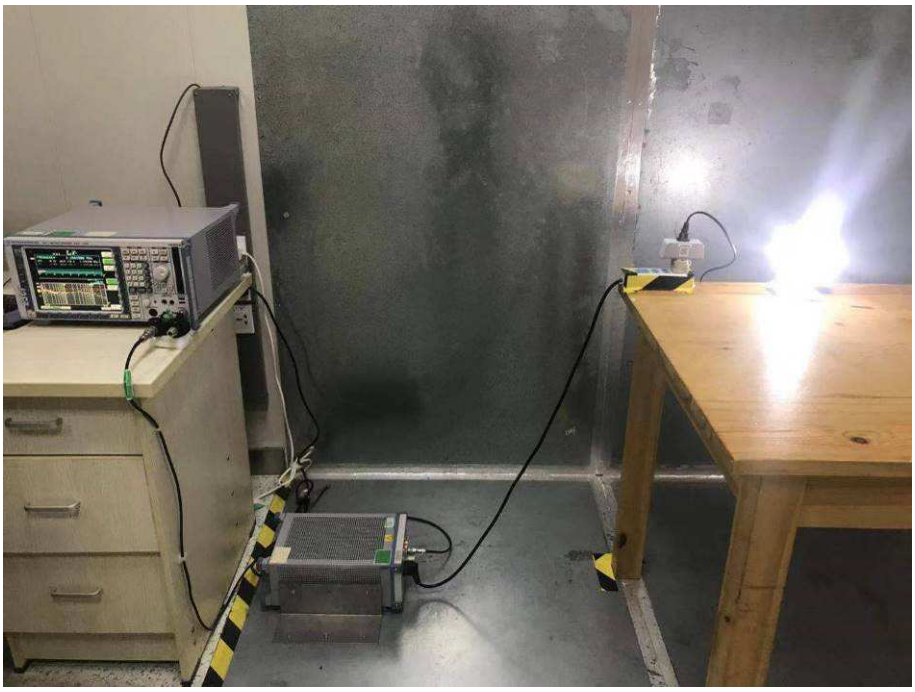
Radiated Spurious Emissions
From 30MHz-1000MHz



Test frequency Above 1GHz

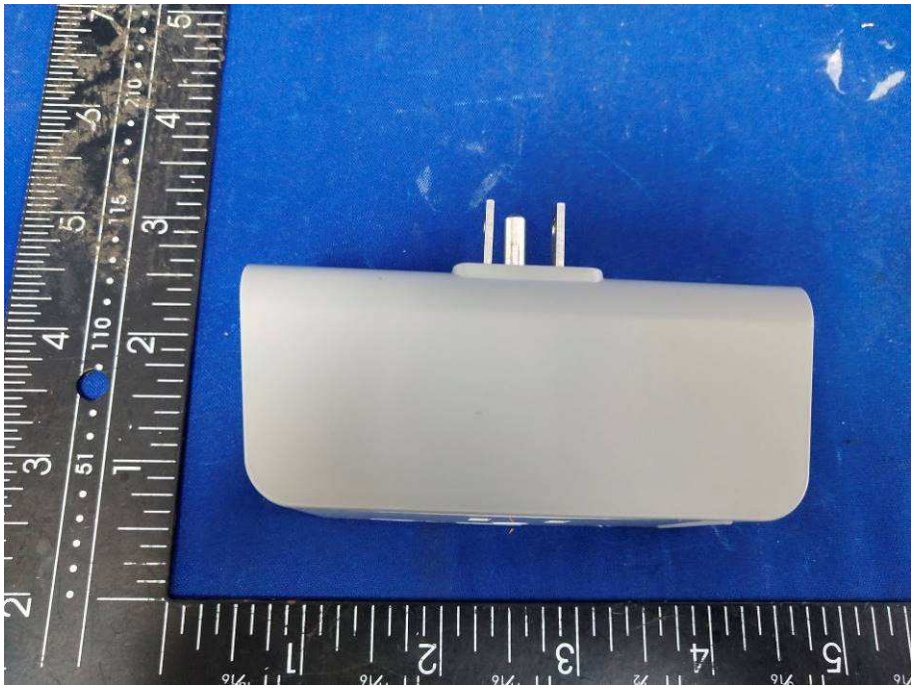


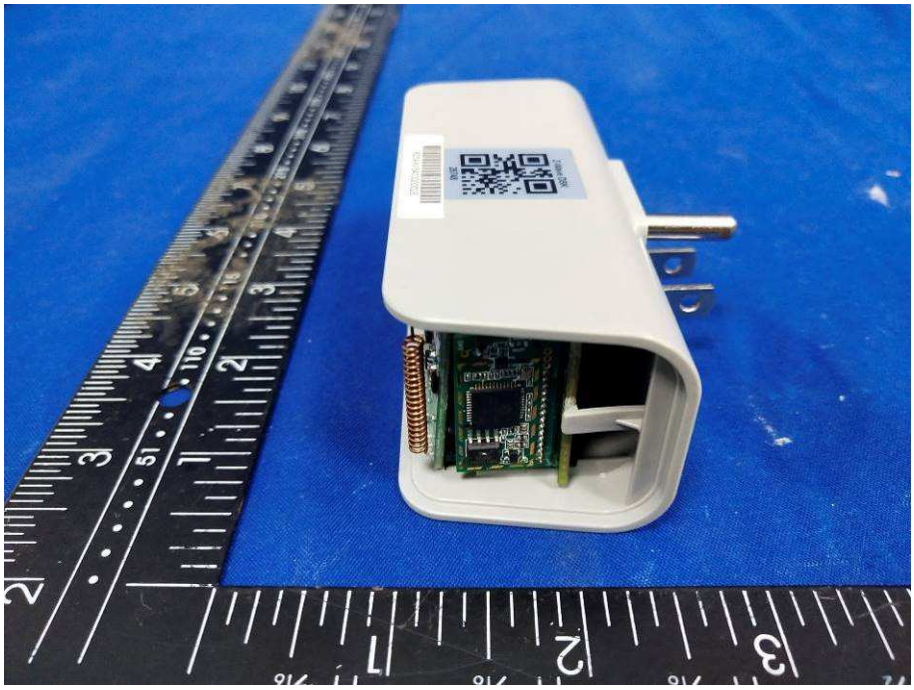
Conducted Emission

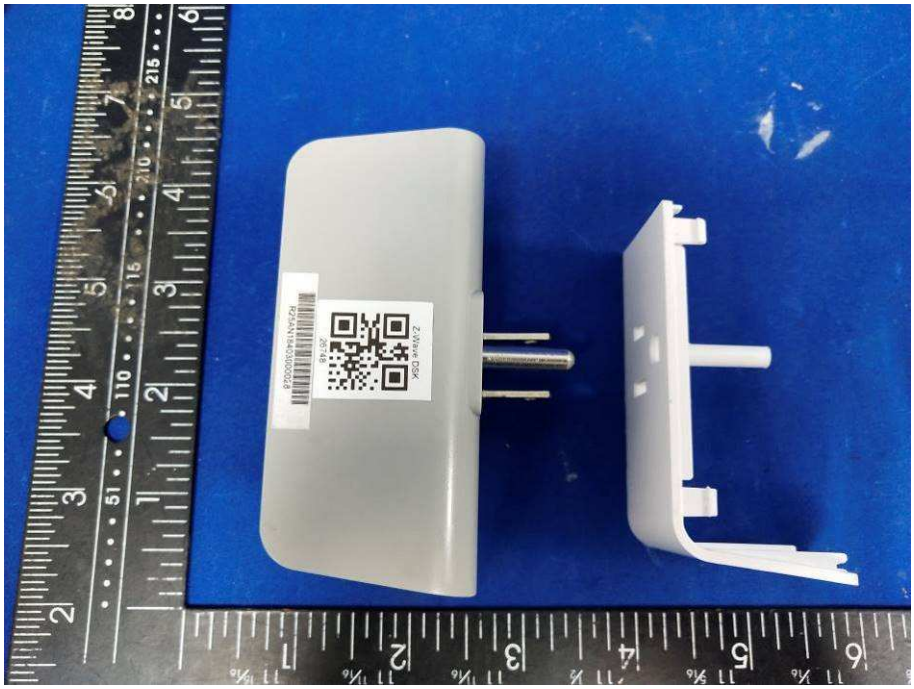


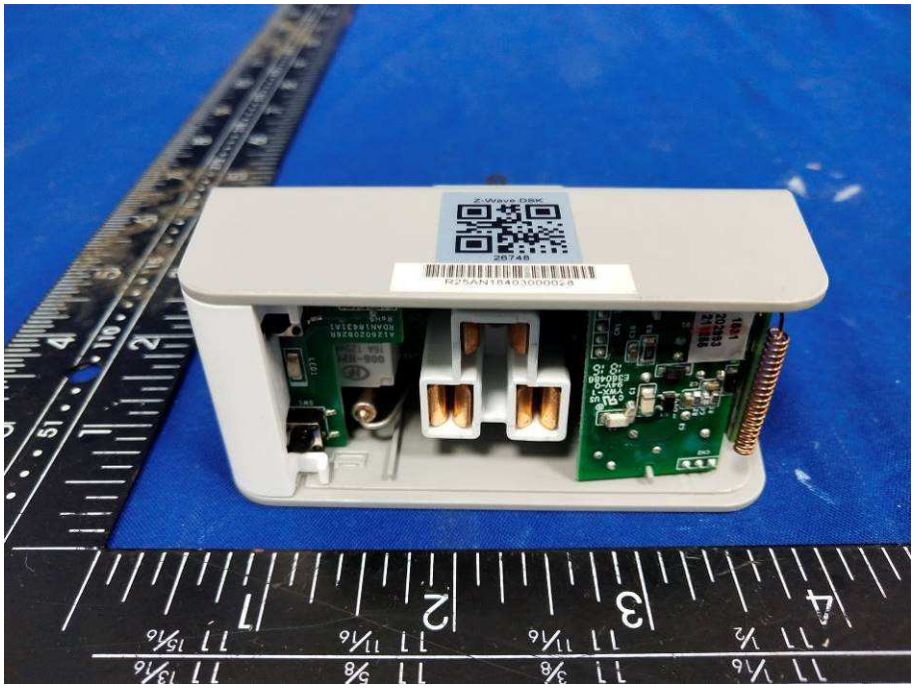
11 EUT PHOTOS

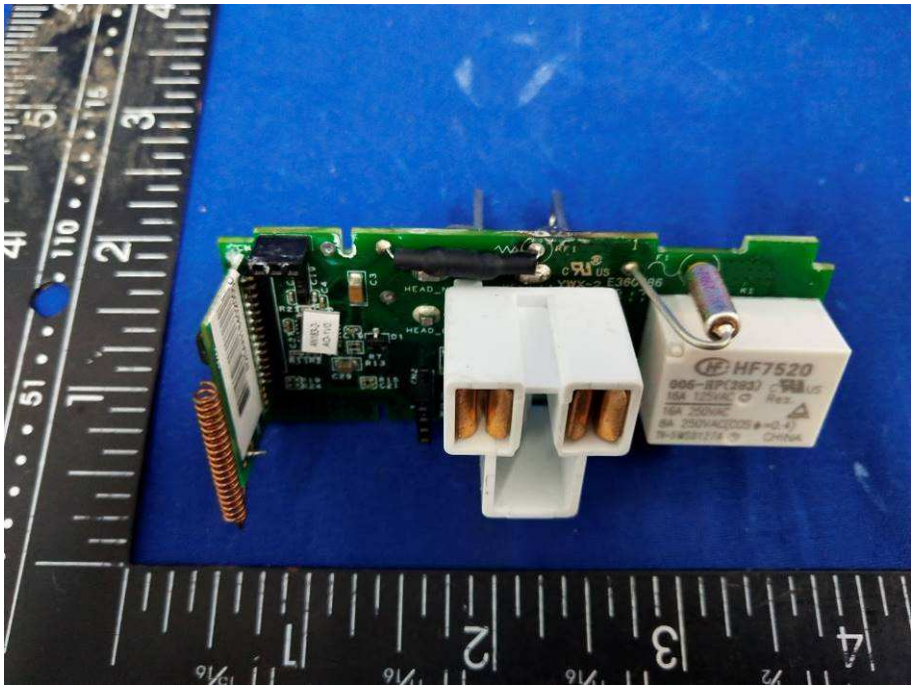

EVERSPRING

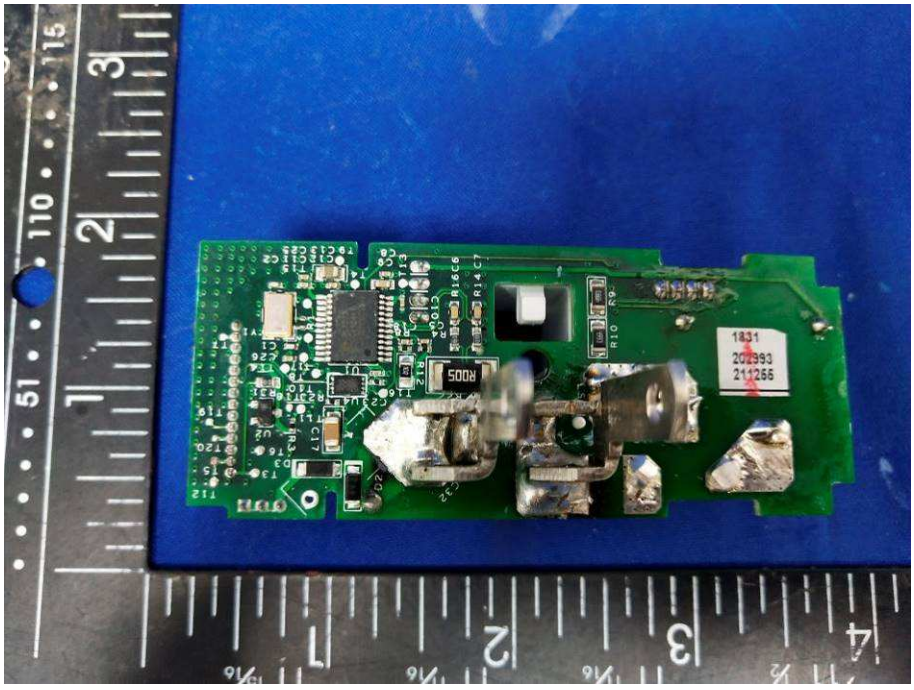


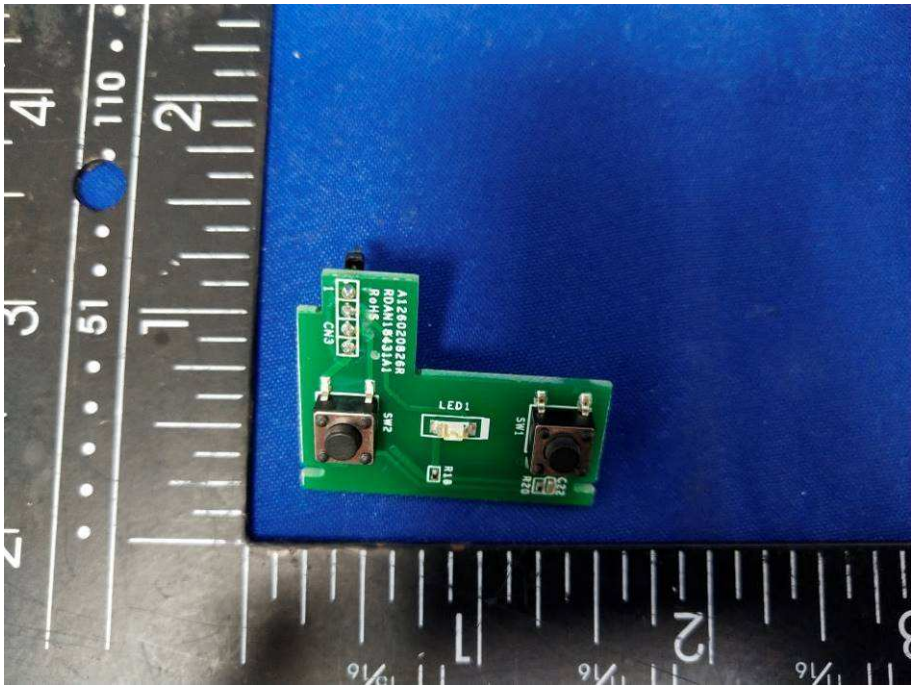


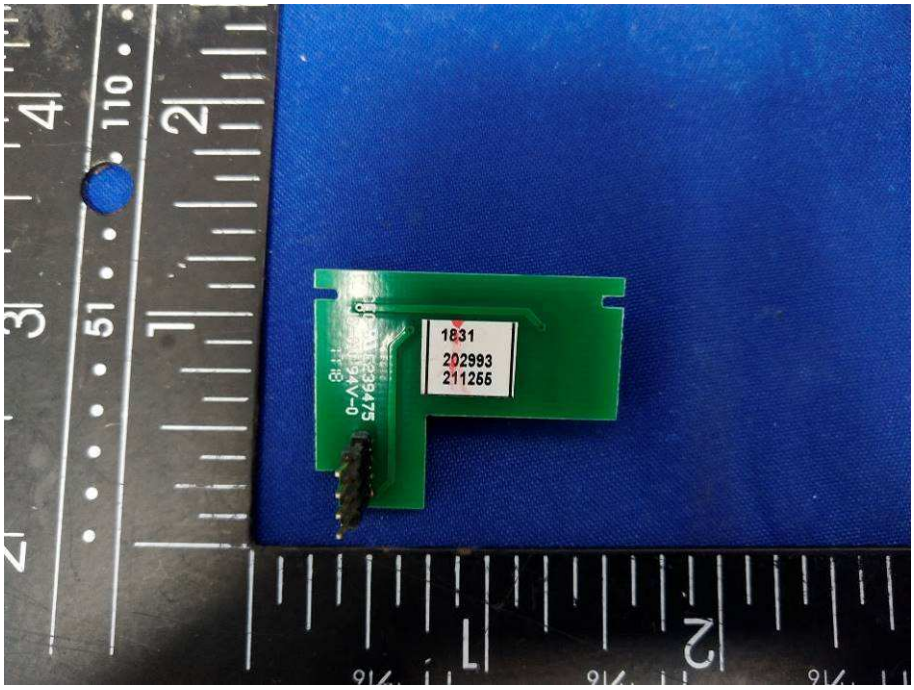





HF7520


1831
202393
211256


LED1
SW1
SW2
CN3


1831
202993
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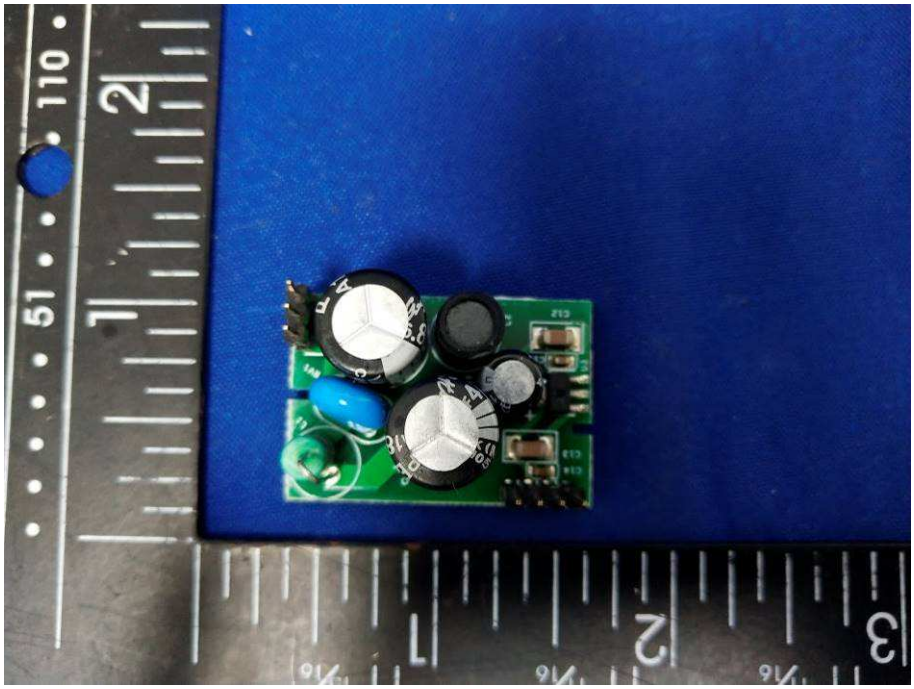

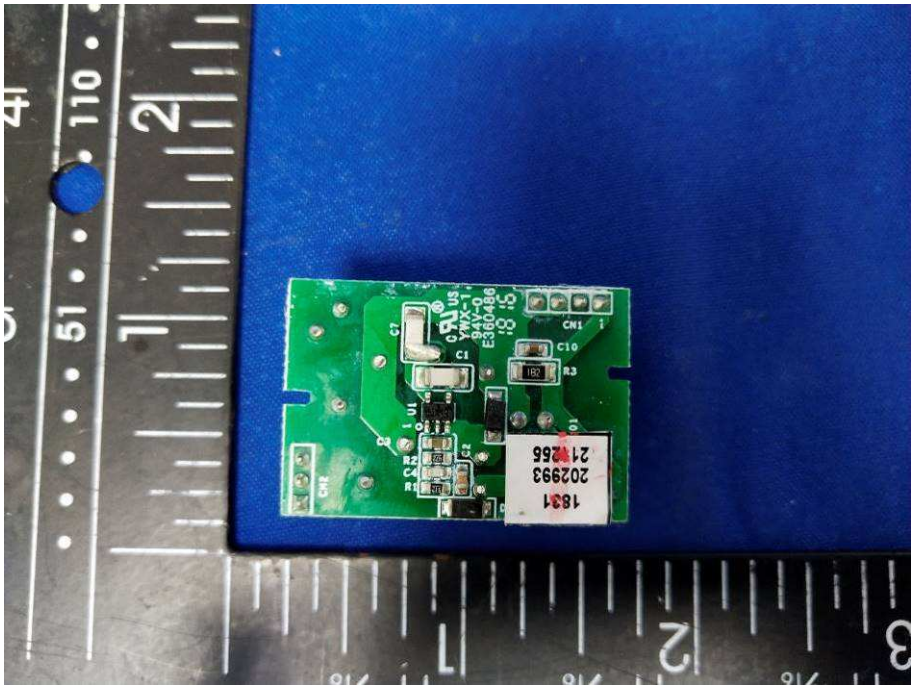

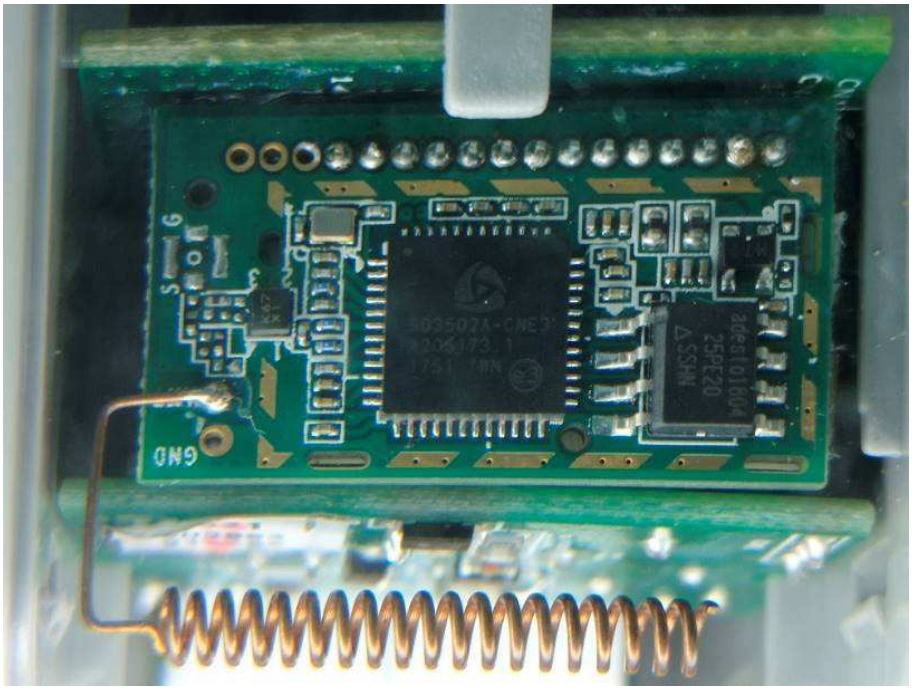

******THE END REPORT******