

TEST REPORT

FCC ID: FU5SP816

Product Name	:	Z-Wave 500 series Outdoor PIR
Model Name	:	SP816-2
Brand Name	:	 EVERSPRING <i>Smarter. Safer. Greener.</i>
Report No.	:	PTC18083020903E-FC01
Prepared for		
Everspring Industry Co Ltd		
3F., No.50, Sec. 1, Zhonghua Rd. Tucheng Dist., New Taipei City 236, Taiwan		
Prepared by		
DongGuan Precise testing & Certification Corp. Ltd		
Building D, Baoding Technology Park, Guangming Road 2, Guangming Community, Dongcheng District, Dongguan, Guangdong, China		



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

Manufacture's name : Everspring Industry Co Ltd

Address : 3F., No.50, Sec. 1, Zhonghua Rd. Tucheng Dist., New Taipei City 236, Taiwan

Product name : Z-Wave 500 series Outdoor PIR

Model name : SP816-2

Standards : FCC CFR47 Part 15 Section 15.249 (Part 15C)

Test procedure : ANSI C63.10: 2013

Test Date : September 18, 2018 to October 12, 2018

Date of Issue : October 12, 2018

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 / Engineer

Technical Manager:

Chris Du / Manager



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2 Test Summary

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

Remark:

1. The EUT only powered by battery, no need to evaluate AC Power Conducted Emission.
2. The EUT is powered by new batteries during the test.



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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 500 series Outdoor PIR
Model Name	:	SP816-2
Operating frequency	:	908.42MHz
Numbers of Channel	:	1
Antenna Type	:	Internal Antenna
Antenna Gain	:	-5dBi
Type of Modulation	:	FSK
Power supply	:	Battery AA 1.5V*3



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	Sep.19, 2019
Coaxial Cable	CDS	79254	46107086	10Hz-30GHz	Sep.19, 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(9KHz-18GHz)

Name of Equipment	Manufacturer	Model	Serial No.	Characteristics	Calibration Due
EMI Test Receiver	Rohde&Schwarz	ESCI	101417	9KHz-3GHz	Sep.19, 2019
Loop Antenna	Schwarzbeck	FMZB 1519	012	9 KHz -30MHz	Sep.19, 2019
Bilog Antenna	SCHWARZBECK	VULB9160	9160-3355	25MHz-2GHz	Sep.19, 2019
Preamplifier (low frequency)	SCHWARZBECK	BBV 9475	9745-0013	1MHz-1GHz	Sep.19, 2019
Cable	Schwarzbeck	PLF-100	549489	9KHz-3GHz	Sep.19, 2019
Spectrum Analyzer	Agilent	E4407B	MY45109572	9KHz-40GHz	Sep.19, 2019
Horn Antenna	SCHWARZBECK	9120D	9120D-1246	1GHz-18GHz	Sep.19, 2019
Power Amplifier	LUNAR EM	LNA1G18-40	J10100000081	1GHz-26.5GHz	Sep.19, 2019
Cable	H+S	CBL-26	N/A	1GHz-26.5GHz	Sep.19, 2019



5.2 Measurement Uncertainty

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



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5.3 Description of Support Units

Equipment	Model No.	Series No.
N/A	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
Detector: : Peak for pre-scan (9kHz Resolution Bandwidth)

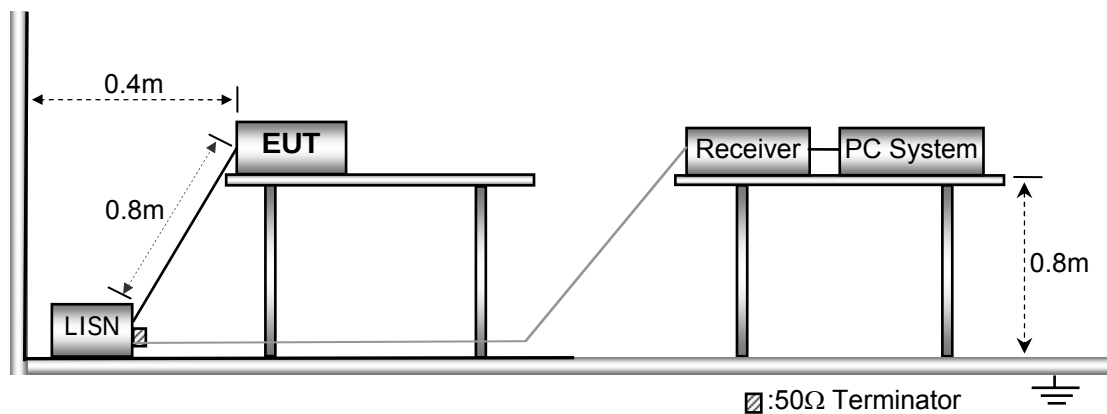
6.1 E.U.T. Operation

Operating Environment :

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

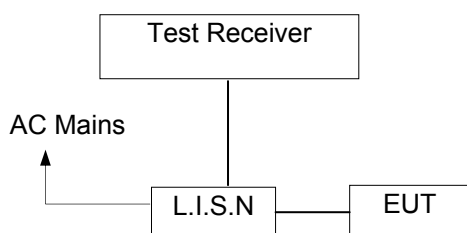
6.2 EUT Setup

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

N/A.



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	$2400/F(\text{kHz})$	300	$10000 * 2400/F(\text{kHz})$	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	$24000/F(\text{kHz})$	30	$100 * 24000/F(\text{kHz})$	$20\log^{(24000/F(\text{kHz}))} + 40$
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 (MHz)	Field strength of fundamental		Field strength of harmonics	
	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: : 23.5 °C

Humidity: : 51.1 % RH

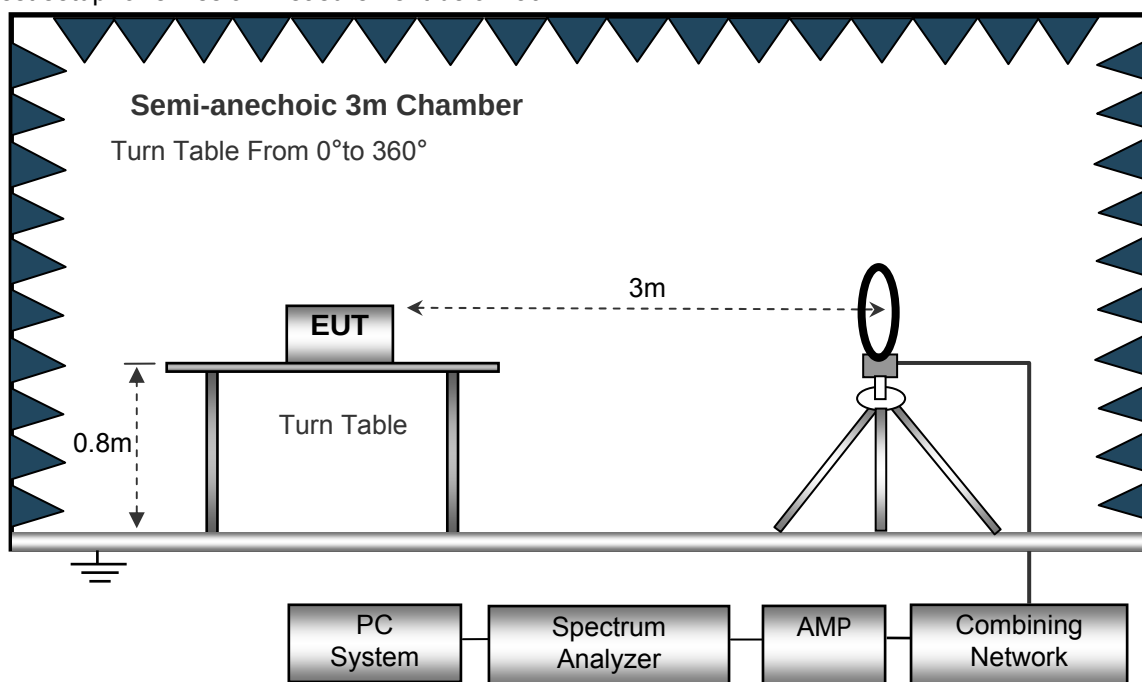
Atmospheric Pressure: : 101.2kPa

Test Voltage : DC 4.5V Battery

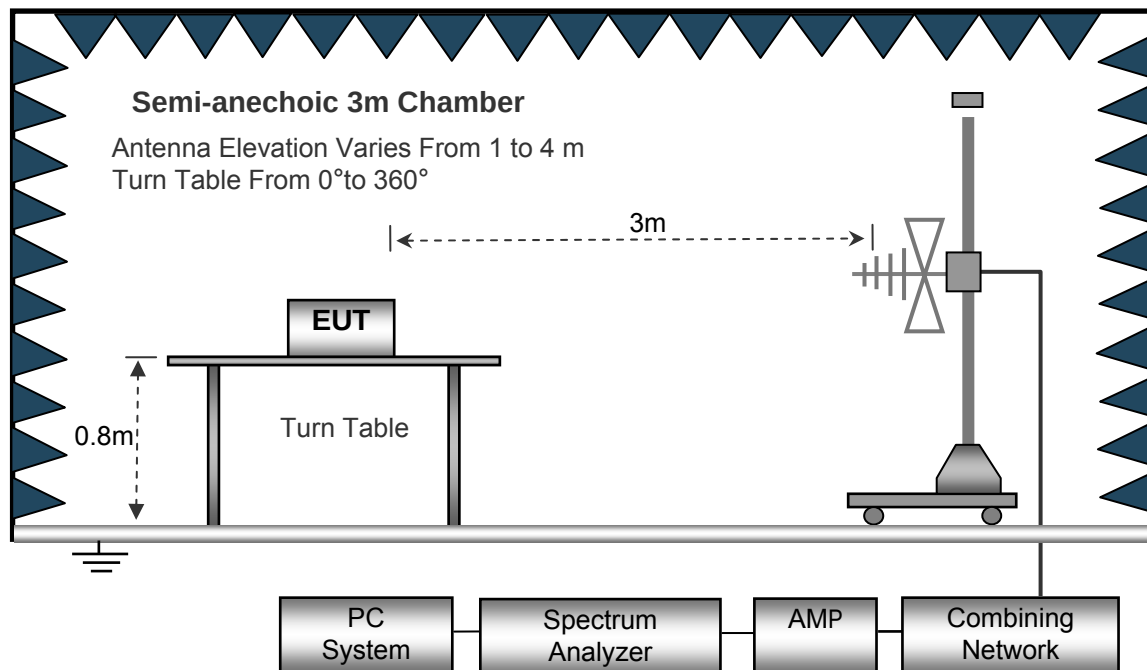
7.2 Test Setup

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

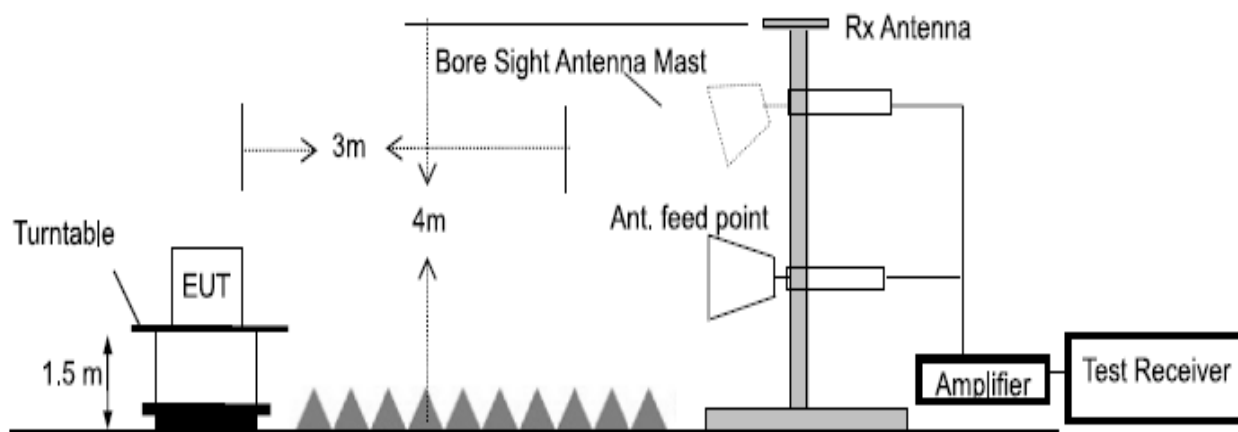
The test setup for emission measurement below 30MHz.



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

Receiver Setup	Frequency	Detector	RBW	VBW	Remark
	Below 30MHz	--	10kHz	10kHz	--
	30MHz ~ 1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		RMS	1MHz	3MHz	Average Value

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. Final measurement (Above 1GHz): The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1MHz. The measurement will be performed in horizontal and vertical polarization of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 degree to 360 degree in order to have the antenna inside the cone of radiation.
7. Test Procedure of measurement (For Above 1GHz):
 - 1) Monitor the frequency range at horizontal polarization and move the antenna over all sides of the EUT(if necessary move the EUT to another orthogonal axis).
 - 2) Change the antenna polarization and repeat 1) with vertical polarization.
 - 3) Make a hardcopy of the spectrum.
 - 4) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
 - 5) Change the analyser mode to Clear/ Write and found the cone of emission.
 - 6) Rotate and move the EUT, so that the measuring distance can be enlarged to 3m and the antenna will be still inside the cone of emission.



- 7) Measure the level of the detected frequency with the correct resolution bandwidth, with the antenna polarization and azimuth and the peak and average detector, which causes the maximum emission.
- 8) Repeat steps 1) to 7) for the next antenna spot if the EUT is larger than the antenna beamwidth.
8. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

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:

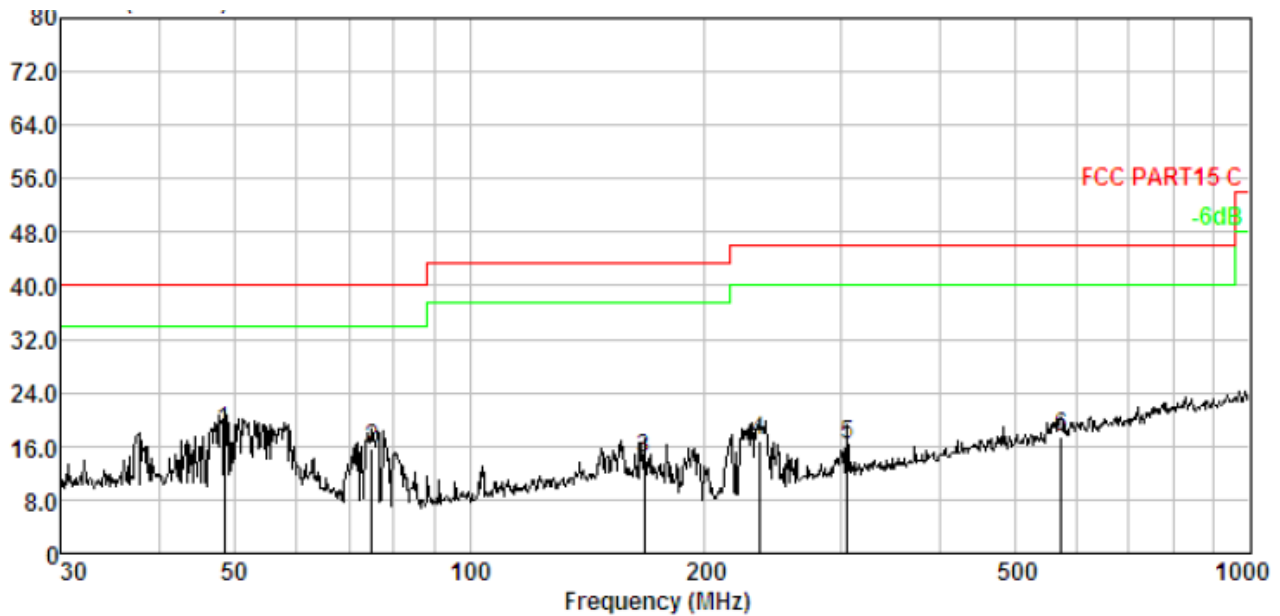
The amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

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

Test Frequency: 30MHz ~ 1GHz



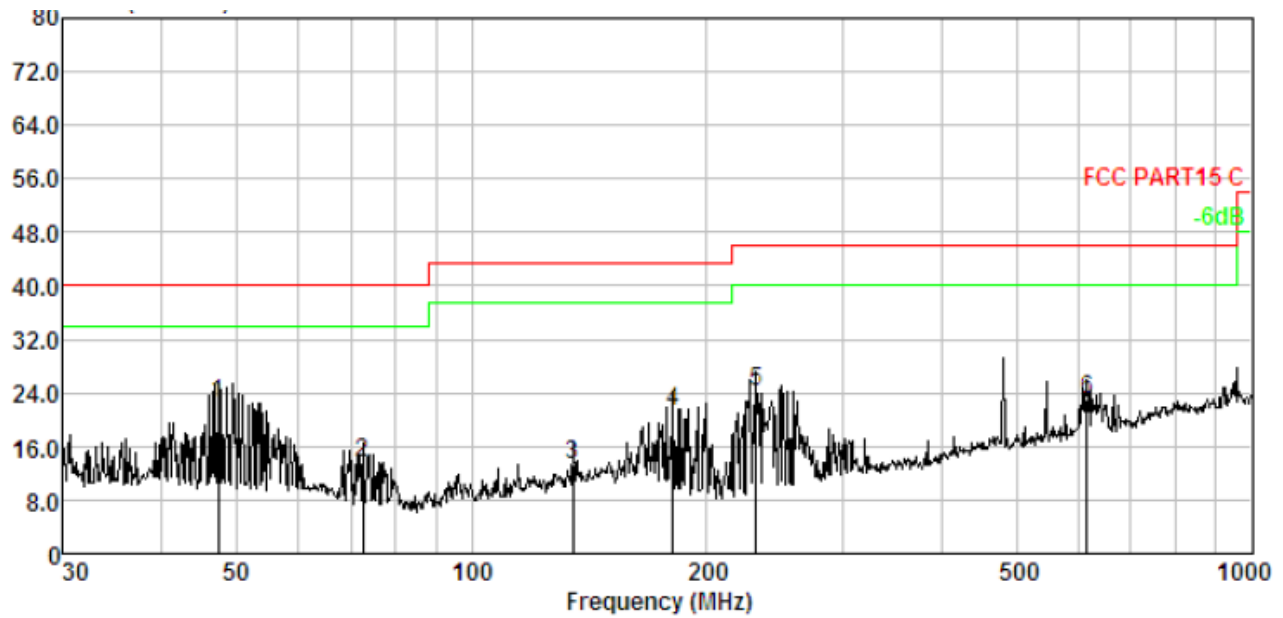
Horizontal:



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.	48.502	1.49	12.55	34.32	30.14	18.22	40.00	-21.78	QP
2.	74.919	1.88	9.87	34.05	30.29	15.51	40.00	-24.49	QP
3.	167.237	2.61	13.48	28.54	30.57	14.06	43.50	-29.44	QP
4.	234.991	2.92	11.48	33.09	30.69	16.80	46.00	-29.20	QP
5.	304.610	3.15	13.30	30.57	30.78	16.24	46.00	-29.76	QP
6.	572.614	3.73	18.46	26.11	31.00	17.30	46.00	-28.70	QP



Vertical:



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.	47.326	1.47	12.78	38.32	30.13	22.44	40.00	-17.56	QP
2.	72.592	1.86	9.93	32.06	30.28	13.57	40.00	-26.43	QP
3.	135.032	2.42	13.00	28.46	30.49	13.39	43.50	-30.11	QP
4.	181.283	2.68	12.26	36.91	30.60	21.25	43.50	-22.25	QP
5.	231.718	2.91	11.33	40.61	30.68	24.17	46.00	-21.83	QP
6.	614.214	3.79	19.19	30.97	31.02	22.93	46.00	-23.07	QP



Fundamental and Harmonics Average Result

Frequency	Emission Level	Limit	Margin	Ant. Polar	Detector
(MHz)	(dB μ V/m)	(dB μ V/m)	(dB)	H/V	
908.420	84.66	94	-9.34	H	QP
908.420	85.09	94	-8.91	V	QP

Test Frequency 1GHz-10GHz:

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Margin(dB)	
		PK	AV	PK	AV	PK	AV
1816.84	V	54.32	45.62	74.00	54.00	-19.68	-8.38
2725.26	V	53.05	43.29	74.00	54.00	-20.95	-10.71
3633.68	V	51.62	42.05	74.00	54.00	-22.38	-11.95
4542.10	V	50.29	41.72	74.00	54.00	-23.71	-12.28
5450.52	V	48.72	38.65	74.00	54.00	-25.28	-15.35
6358.94	V	46.35	37.21	74.00	54.00	-27.65	-16.79
1816.84	H	55.07	44.19	74.00	54.00	-18.93	-9.81
2725.26	H	54.16	43.06	74.00	54.00	-19.84	-10.94
3633.68	H	52.09	42.58	74.00	54.00	-21.91	-11.42
4542.10	H	51.47	40.62	74.00	54.00	-22.53	-13.38
5450.52	H	48.37	37.58	74.00	54.00	-25.63	-16.42
6358.94	H	46.22	35.69	74.00	54.00	-27.78	-18.31

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

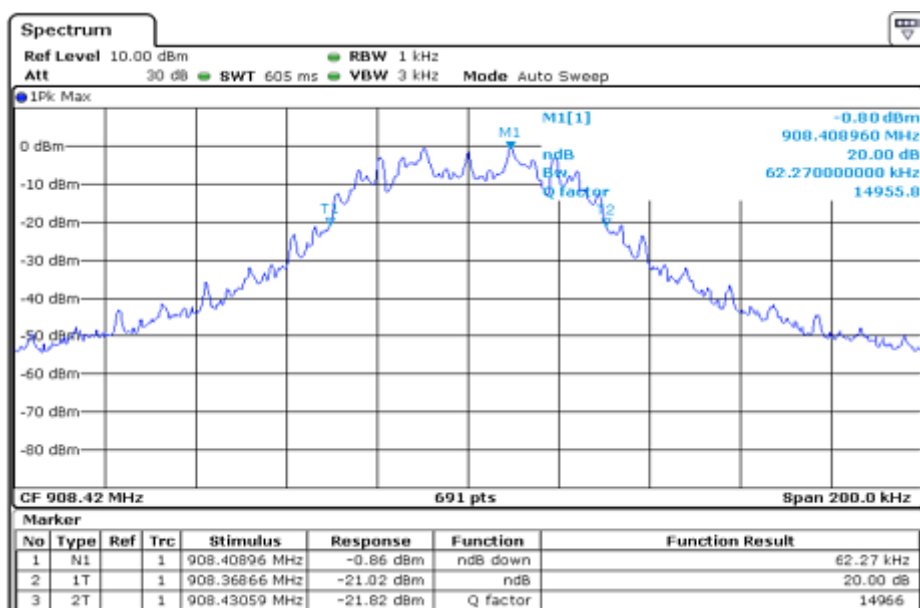
Test Method : ANSI C63.10: 2013

8.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 1kHz, VBW = 3kHz

8.2 Test Result

Channel frequency (MHz)	20dB Down BW(KHz)
908.42	62.27

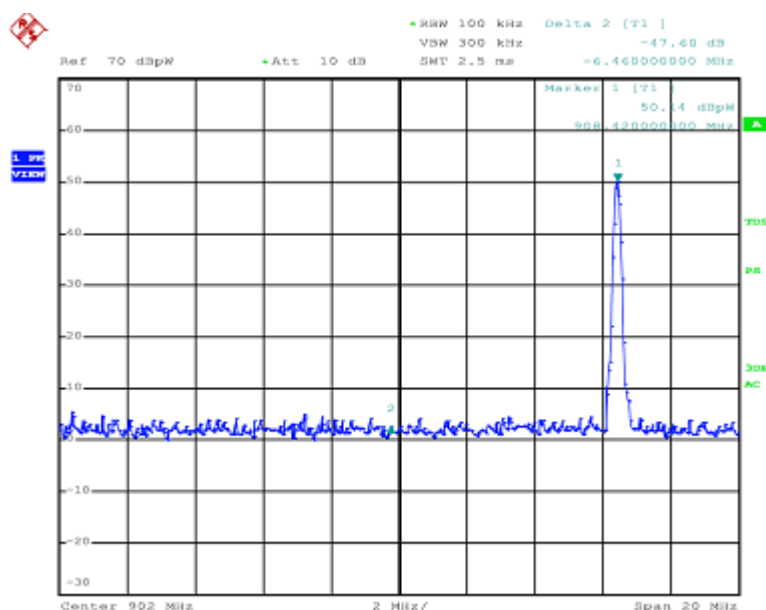




9 Band edges Requirement

Test Requirement:	FCC Part 15 C section 15.249(d) (d) Emission radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in 15.209, whichever is the lesser attenuation.
Test Method:	ANSI C63.10: Clause 6.10
Test Status:	Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports(if EUT with antenna diversity architecture). The lowest, middle and highest channels were selected for the final test as listed below.

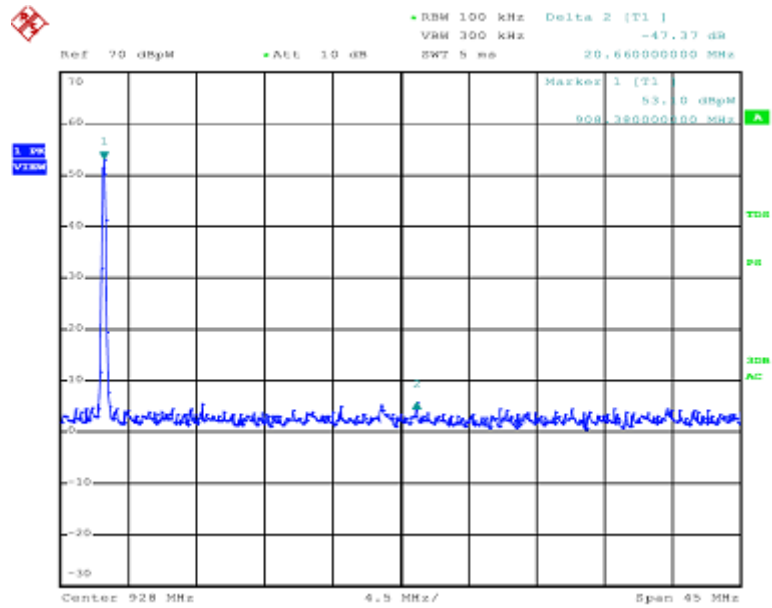
9.1 Test Result





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10 Antenna Requirement

The antenna is permanently attached on PCB, no consideration of replacement. Please refer to internal Photos for details.



11 TEST PHOTOS

Test Frequency From 30MHz-1000MHz



Test frequency from 1GHz-10GHz

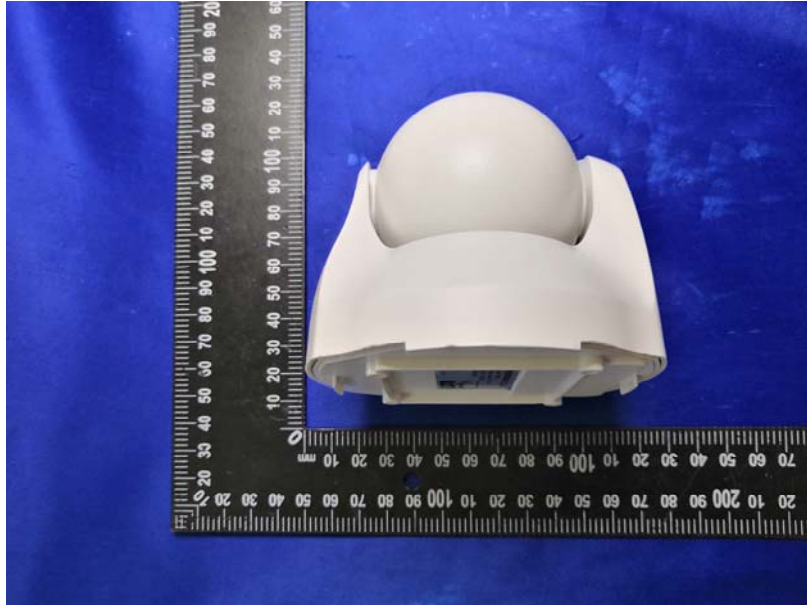




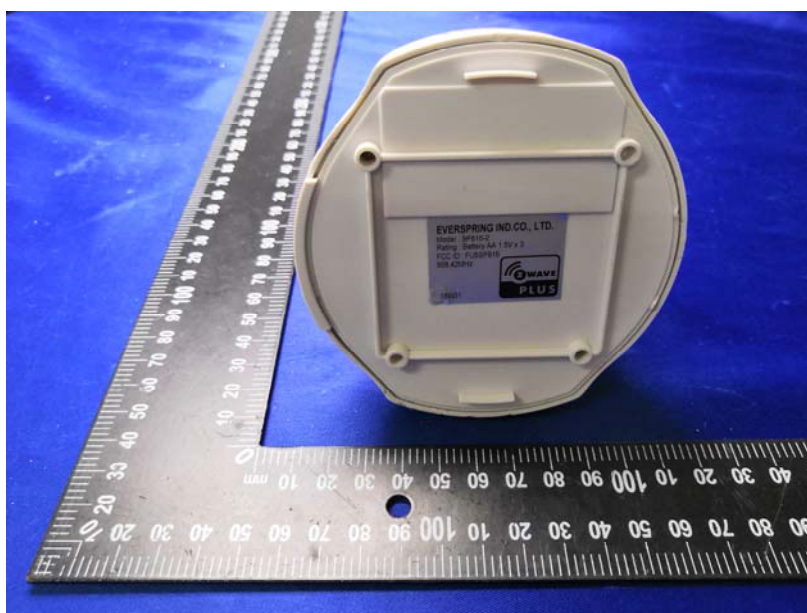
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12 EUT PHOTOS



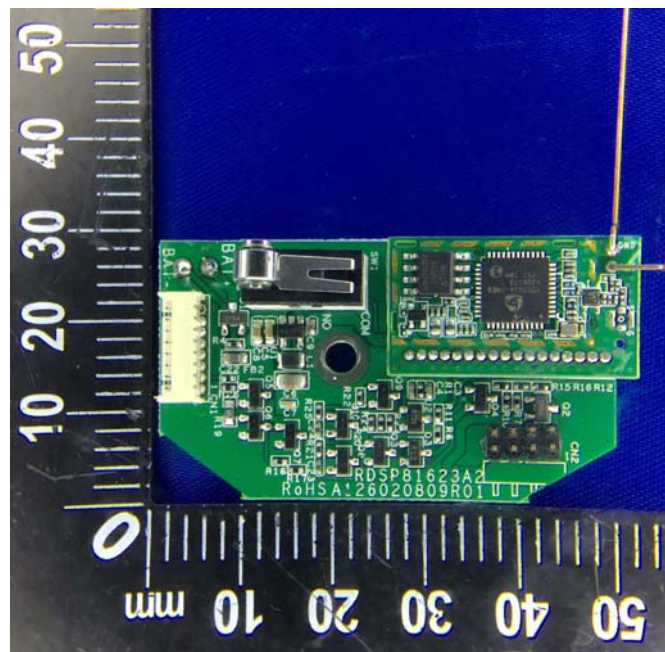
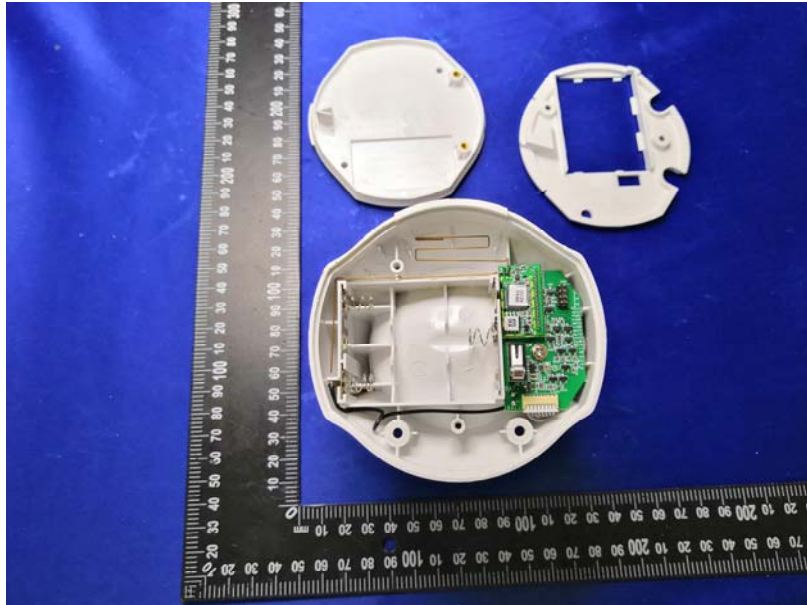


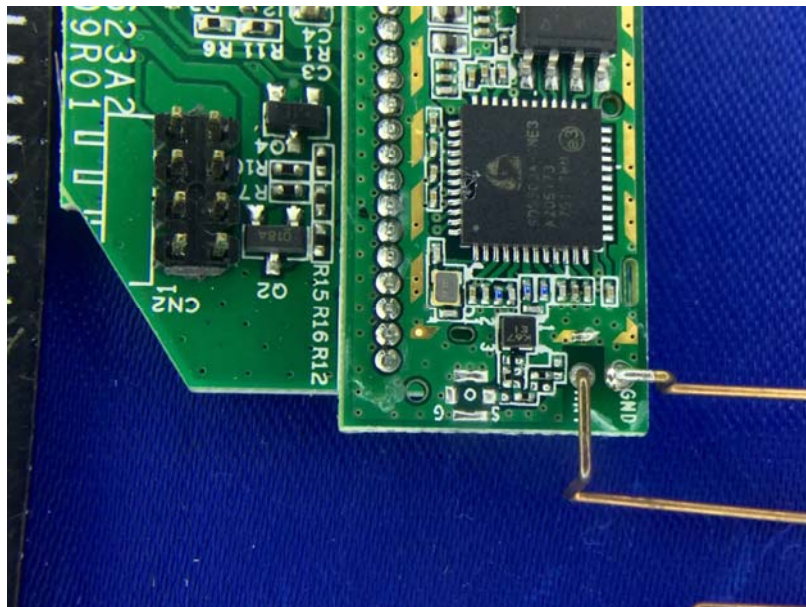
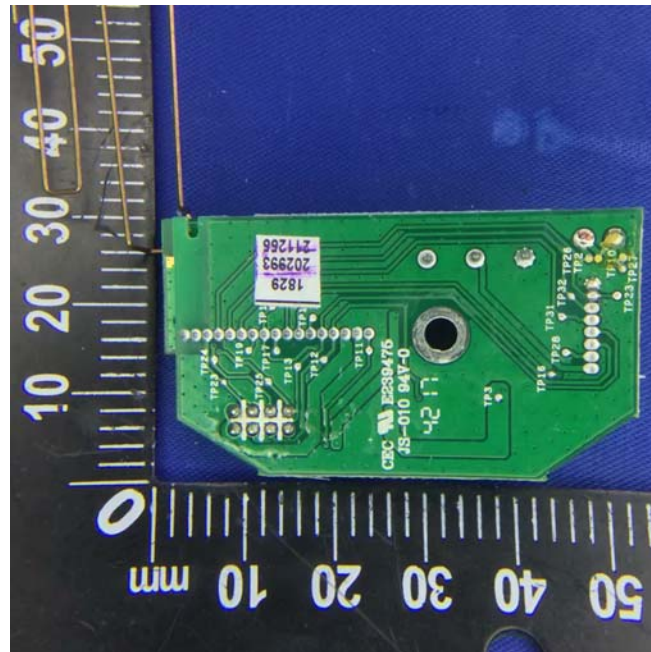




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*****THE END REPORT*****