TEST REPORT

Reference No.....................	:	WTF20F08051641W
FCC ID	:	2ALP4-CWF0001B2
Applicant...........................	:	Neocontrol US LLC
Address.............................	:	3259, Progress Drive – Room 166 Orlando FL 32826 USA
Manufacturer	:	The same as above
Address.............................	:	The same as above
Product Name....................	:	Box 98
Model No.	:	CWF0001B2
Standards..........................	:	FCC CFR47 Part 15 Subpart C (Section 15.231): 2019
Date of Receipt sample	:	2020-08-04
Date of Test	:	2020-08-10
Date of Issue......................	:	2020-09-04
Test Result........................	:	**Pass**

Remarks:
The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

Prepared By:
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Compiled by: Roy Hong

Roy Hong / Project Engineer

Approved by: Danny zhou

WALTEK TESTING GROUP CO., LTD. WALTEK (02) TEST REPORT

Danny Zhou / Manager

1 Revision History

Test Report No.	Date of Issue	Description	Status
WTF20F08051641W	2020-09-04	Original	Valid

2 Contents

3 General Information

3.1 General Description of E.U.T

Product Name	:	Box 98
Model No.	:	CWF0001B2
Model Description	:	---
Rated Voltage................................	:	DV 5V, 2.5A powered by switching power adapter
Battery Capacity	:	---
Power Adapter	:	Sales without adapter

3.2 Technical Characteristics of EUT

Frequency Range	:	433.92MHz
Max. Field Strength	:	84.55dBuV/m (at 3m distance)
Modulation	:	OOK
Type of Antenna	:	Reverse Threads External Antenna
Antenna Gain	:	-8dBi
Lowest Oscillation.......................	:	32MHz

3.3 Standards Applicable for Testing

The tests were performed according to following standards:

FCC Rules Part 15.231	Periodic operation in the band 40.66–40.70 MHz and above 70 MHz.
558074 D01 15.247 Meas Guidance v05r02	Guidance For Compliance Measurements On Digital Transmission System, Frequency Hopping Spread Spectrum System, And Hybrid System Devices Operating Under Section 15.247 Of The FCC Rules
ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

3.4 Test Facility

The test facility has a test site registered with the following organizations:

- **IC – Registration No.: 21895-1**

Waltek Testing Group (Foshan) Co., Ltd. has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration IC number:21895-1, Nov. 14, 2016.

- **FCC – Registration No.: 820106**

Waltek Testing Group (Foshan) Co., Ltd. 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 820106, August 16, 2018

- **FCC – Designation No.: CN5034**

Waltek Testing Group (Foshan) Co., Ltd. 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. Designation No. CN5034.

- **NVLAP – Lab Code: 600191-0**

Waltek Testing Group (Foshan) Co., Ltd. EMC Laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 600191-0.
This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

3.5 Subcontracted

Whether parts of tests for the product have been subcontracted to other labs:

☐ Yes ☒ No

If Yes, list the related test items and lab information:

Test items: ---

Lab information: ---

3.6 Abnormalities from Standard Conditions

None.

4 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List

Test Mode	Description	Remark
TM1	Transmitting	With modulation(433.92MHz)

Test Conditions

Temperature:	22~25℃
Relative Humidity:	50~55%
Atmospheric pressure:	101.9kPa

5 Equipment Used during Test

5.1 Equipment List

Conducted Emissions						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Cal Date**	**Cal Due Date**
1.	EMI Test Receiver	RS	ESCI	101178	2020-01-09	2021-01-08
2.	LISN	RS	ENV216	101215	2020-01-09	2021-01-08
3.	Cable	HUBER+SUHNER	CBL2-NN-3M	223NN322	2020-01-09	2021-01-08
4.	Test Software	FARATRONIC	EZ-EMC CON-03A1	-	-	-

3m Semi-anechoic Chamber for Radiation Emissions						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	EMI Test Receiver	RS	ESR7	101566	2020-01-09	2021-01-08
2.	EMC Analyzer	Agilent	N9020A	MY48011796	2020-01-09	2021-01-08
3.	Active Loop Antenna	SCHWARZBECK	FMZB1519B	00004	2020-01-09	2021-01-08
4.	Trilog Broadband Antenna	SCHWARZBECK	VULB 9162	9162-117	2020-01-09	2021-01-08
5.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	01561	2020-01-09	2021-01-08
6.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	2020-01-09	2021-01-08
7.	Amplifier	Lunar E M	LNA1G18-40	20160501002	2020-01-09	2021-01-08
8.	Coaxial Cable (below 1GHz)	H+S	CBL3-NN-12+3 m	214NN320	2020-01-09	2021-01-08
9.	Coaxial Cable (above 1GHz)	Times-Micorwave	CBL5-NN	-	2020-01-09	2021-01-08
10.	Test Software	FARATRONIC	EZ-EMC RA-03A1-1	-	-	-

RF Conducted Testing						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	Spectrum Analyzer	Agilent	N9020A	MY48011796	2020-01-09	2021-01-08
2.	Spectrum Analyzer	R&S	FSP40	100501	2020-01-09	2021-01-08
3.	Vector Signal Generator	Agilent	N5182A	MY50141533	2020-01-09	2021-01-08
4.	Analog Signal Generator	Agilent	N5181A	MY48180720	2020-01-09	2021-01-08
5.	Environmental Chamber	KSON	THS-D4C-100	5244K	2020-01-09	2021-01-08
6.	RF Control Unit	CHANGCHUANG	JS0806-2	-	2020-01-09	2021-01-08

5.2 Special Accessories and Auxiliary Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.
1.	/	/	/	/

5.3 Measurement Uncertainty

Parameter	Uncertainty
RF Output Power	±0.95dB
Occupied Bandwidth	±1.5%
Conducted Spurious Emission	±2.7dB
Conducted Emission	±2.7dB
Transmitter Spurious Emission	±3.8dB (for 25MHz-1GHz)
	±5.0dB (for 1GHz-18GHz)

6 Summary of Test Result

Test Items	FCC Rules	Result
Antenna Requirement	§15.203	Compliance
Restricted Band of Operation	§15.205	Compliance
Conducted Emissions	§15.207(a)	Compliance
Radiated Spurious Emissions	§15.209	Compliance
Deactivation Testing	§15.231(a)	Compliance
Radiated Emissions	§15.231(b)	Compliance
20dB Bandwidth Testing	§15.231(c)	Compliance

Remark:

Pass	Test item meets the requirement
Fail	Test item does not meet the requirement
N/A	Test case does not apply to the test object

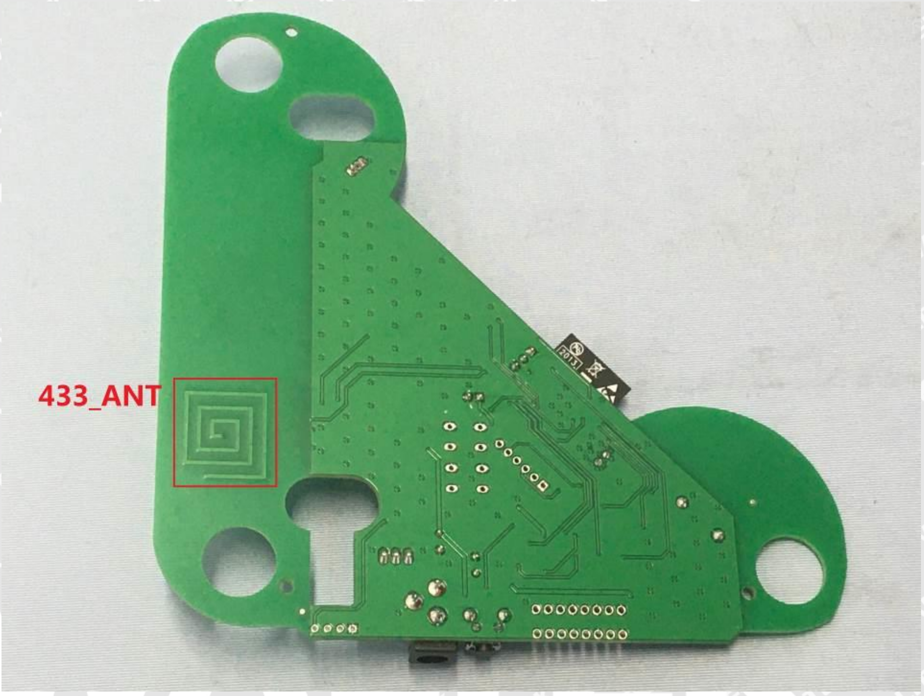
6.1 Antenna Requirement

6.1.1 Standard Applicable

According to FCC Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

6.1.2 Evaluation Information

The EUT has an PCB Printed Antenna, the gain is -8dBi, fulfil the requirement of this section.



6.2 Conducted Emission

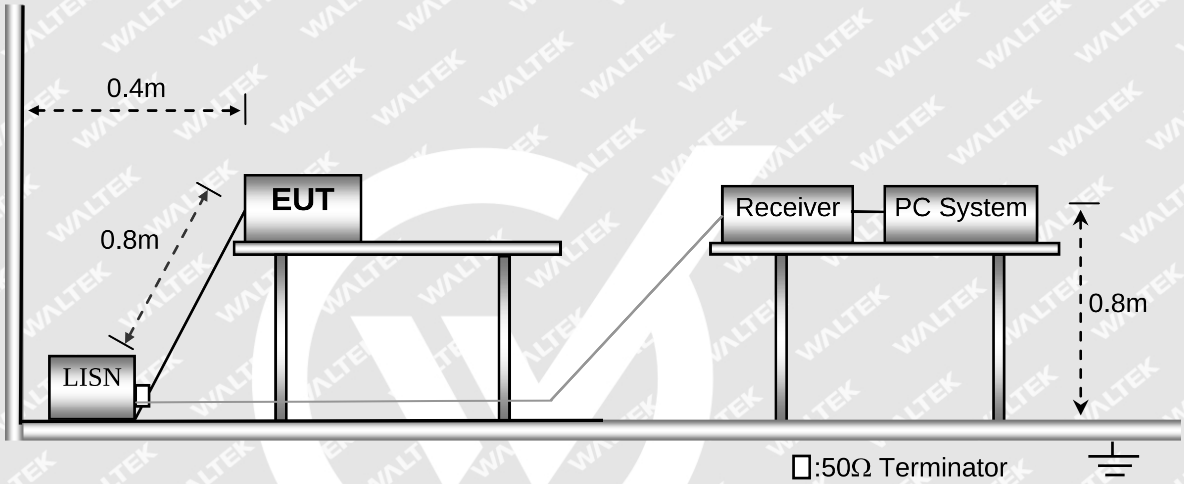
6.2.1 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013measurement procedure. The specification used was with the FCC Part 15.207Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle. The spacing between the peripherals was 10 cm.

6.2.2 EUT Setup

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



6.2.3 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

Start Frequency..150 kHz
Stop Frequency..30 MHz
Sweep Speed..Auto
IF Bandwidth..10 kHz
Quasi-Peak Adapter Bandwidth...9 kHz
Quasi-Peak Adapter Mode..Normal

6.2.4 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.

6.2.5 Corrected Factor & Margin Calculation

The Corrected factor is calculated by adding LISN VDF(Voltage Division Facotr), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Measurement=Reading Level+Correct Factor

Correct Facotor=LISN VDF+Cable Loss

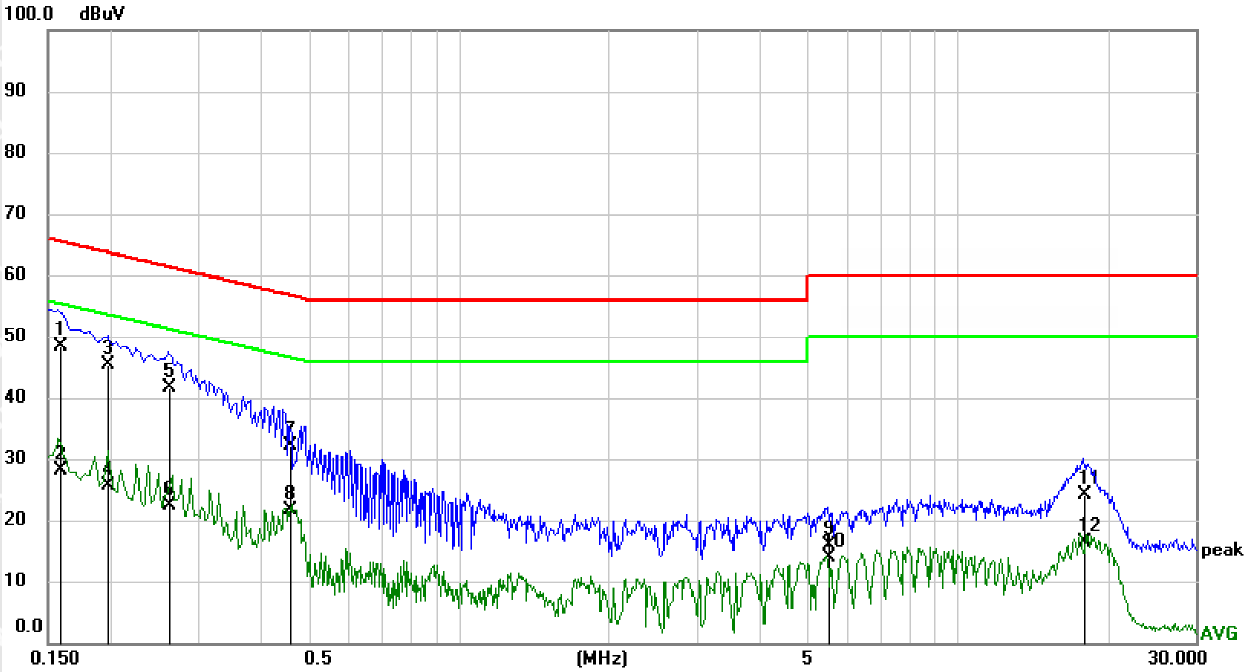
The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin=Limit-Measurement

6.2.6 Test Result

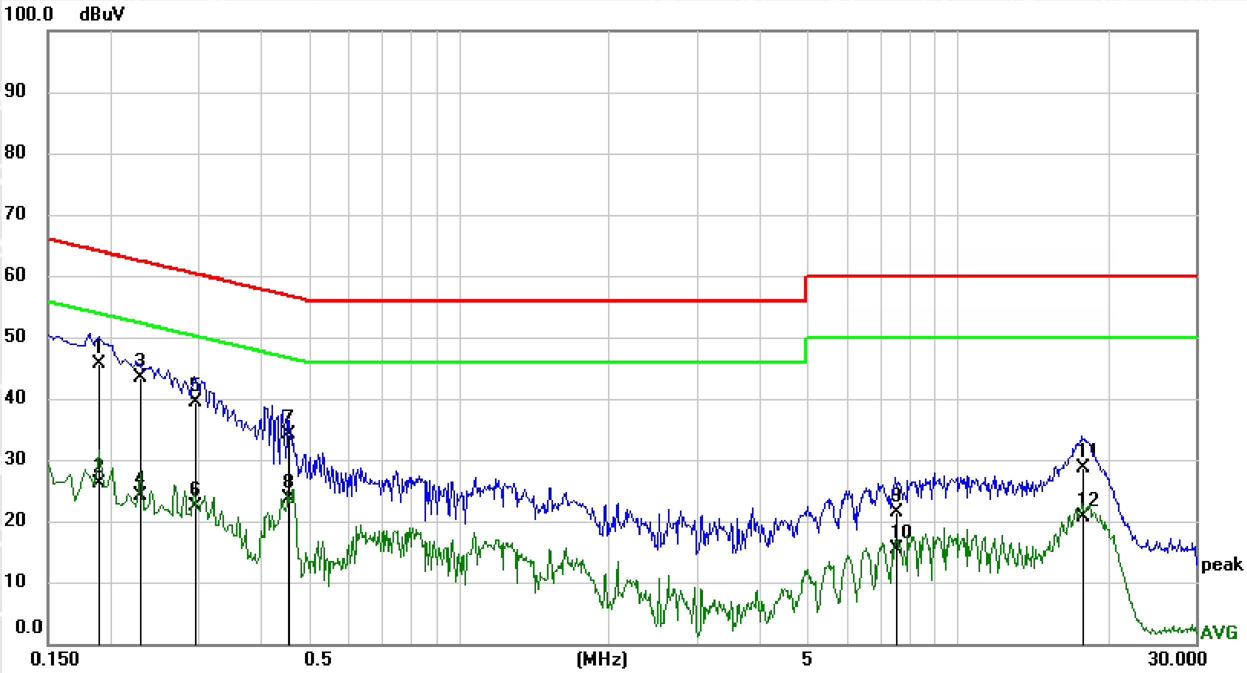
An initial pre-scan was performed on the live and neutral lines.

Test Mode Communication **Test Voltage** AC 120V/60Hz **Phase** Live



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1582	38.64	9.64	48.28	65.56	-17.28	QP	
2		0.1582	18.56	9.64	28.20	55.56	-27.36	AVG	
3		0.1980	35.74	9.64	45.38	63.69	-18.31	QP	
4		0.1980	16.01	9.64	25.65	53.69	-28.04	AVG	
5		0.2620	32.09	9.64	41.73	61.37	-19.64	QP	
6		0.2620	12.80	9.64	22.44	51.37	-28.93	AVG	
7		0.4580	22.48	9.65	32.13	56.73	-24.60	QP	
8		0.4580	11.90	9.65	21.55	46.73	-25.18	AVG	
9		5.4780	6.06	9.78	15.84	60.00	-44.16	QP	
10		5.4780	4.20	9.78	13.98	50.00	-36.02	AVG	
11		17.8500	14.16	10.02	24.18	60.00	-35.82	QP	
12		17.8500	6.33	10.02	16.35	50.00	-33.65	AVG	

Test Mode Communication **Test Voltage** AC 120V/60Hz **Phase** Neutral



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1900	36.13	9.61	45.74	64.04	-18.30	QP	
2		0.1900	16.47	9.61	26.08	54.04	-27.96	AVG	
3		0.2304	33.65	9.61	43.26	62.44	-19.18	QP	
4		0.2304	14.62	9.61	24.23	52.44	-28.21	AVG	
5		0.2940	29.82	9.61	39.43	60.41	-20.98	QP	
6		0.2940	12.80	9.61	22.41	50.41	-28.00	AVG	
7		0.4540	24.39	9.63	34.02	56.80	-22.78	QP	
8		0.4540	14.03	9.63	23.66	46.80	-23.14	AVG	
9		7.5100	11.50	9.82	21.32	60.00	-38.68	QP	
10		7.5100	5.56	9.82	15.38	50.00	-34.62	AVG	
11		17.8460	18.55	10.12	28.67	60.00	-31.33	QP	
12		17.8460	10.59	10.12	20.71	50.00	-29.29	AVG	

6.3 Radiated Spurious Emissions

6.3.1 Standard Applicable

According to §15.231(b), the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66 - 40.70	2,250	225
70 - 130	1,250	125
130 - 174	1,250 to 3,750 **	125 to 375 **
174 - 260	3,750	375
260 - 470	3,750 to 12,500 **	375 to 1,250 **
Above 470	12,500	1,250

** linear interpolations

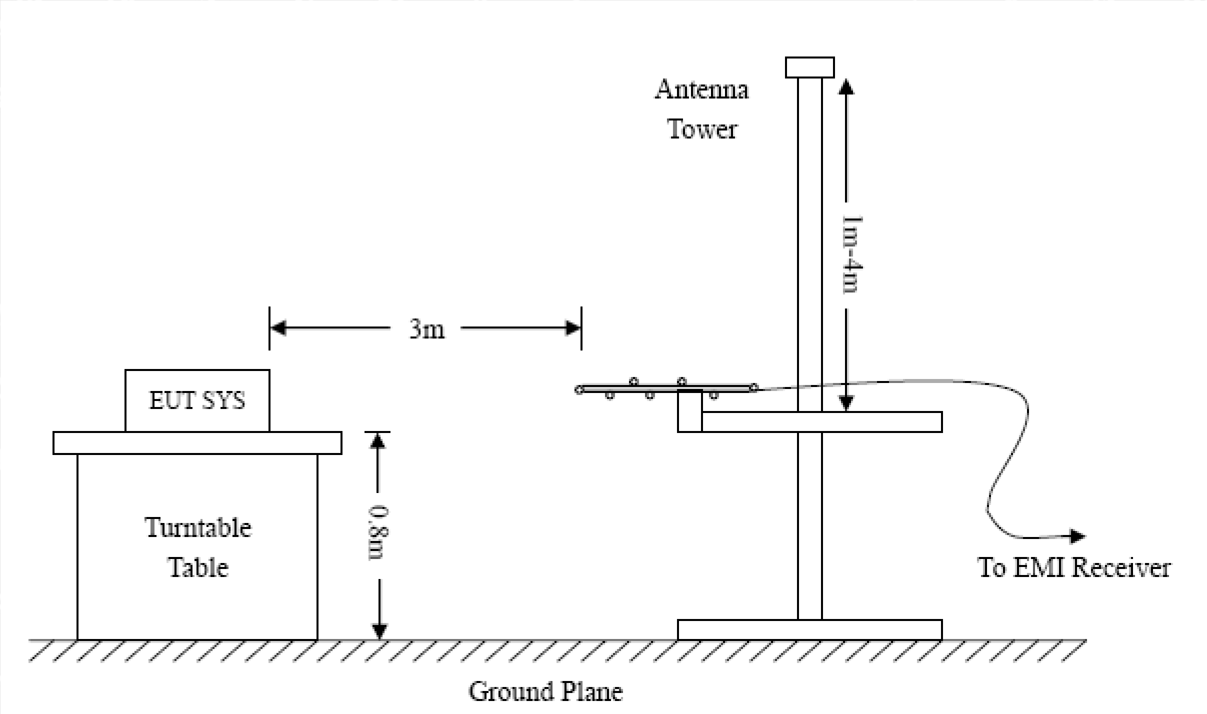
The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

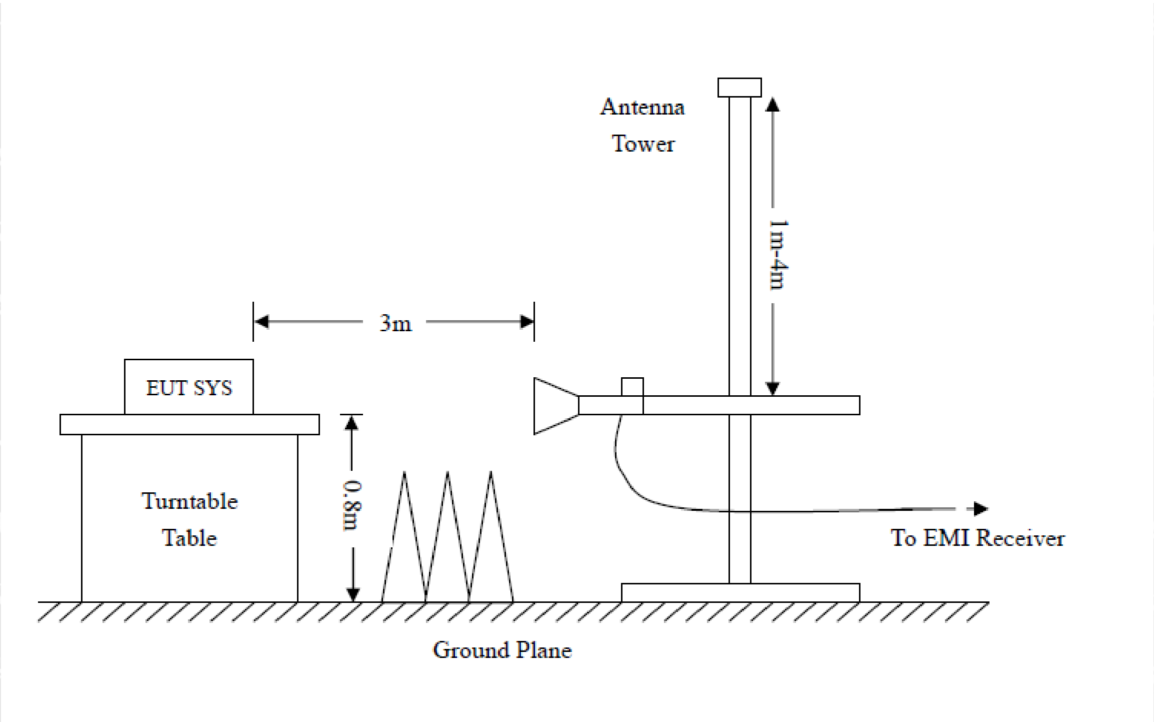
The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

Compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.

6.3.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.231(b) and FCC Part 15.209 Limit.





6.3.3 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading +Ant.Loss +Cab. Loss – Ampl.Gain

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dB V means the emission is 6dB V below the maximum limit. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – FCC Part 15C Limit

6.3.4 Test Results

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 6th Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured. The fundamental frequency is 433.92MHz, so the fundamental and spurious emissions radiated limit base on the the operating frequency 433.92MHz.

Frequency	Receiver Reading (PK)	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude (PK)	FCC Part 15.231/15.209/205	
			Height	Polar			Limit	Margin
(MHz)	(dBμV)	Degree	(m)	(H/V)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)
433.91	64.90	280	1.5	H	19.65	84.55	100.82	-16.27
433.91	61.98	168	1.9	V	19.65	81.63	100.82	-19.19
867.84	0.81	203	1.8	H	26.98	27.79	80.82	-53.03
867.84	0.38	209	1.3	V	26.98	27.36	80.82	-53.46
1300.00	53.49	253	1.1	H	-14.01	39.48	74.00	-34.52
1300.00	51.74	117	1.7	V	-14.01	37.73	74.00	-36.27
3376.00	50.16	113	1	H	-7.59	42.57	74.00	-31.43
3376.00	49.85	115	1.5	V	-7.59	42.26	74.00	-31.74

AV = Peak +20Log$_{10}$(duty cycle) =PK+(-6.06) [refer to section 6.6 for more detail]

Frequency	PK	RX Antenna Polar	Duty cycle Factor	Calculated AV	FCC Part 15.231/209/205	
					Limit	Margin
(MHz)	(dBμV/m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
433.91	84.55	H	-6.06	78.49	80.82	-2.33
433.91	81.63	V	-6.06	75.57	80.82	-5.25
867.84	27.79	H	-6.06	21.73	60.82	-39.09
867.84	27.36	V	-6.06	21.30	60.82	-39.52
1300.00	39.48	H	-6.06	33.42	54.00	-20.58
1300.00	37.73	V	-6.06	31.67	54.00	-22.33
3376.00	42.57	H	-6.06	36.51	54.00	-17.49
3376.00	42.26	V	-6.06	36.20	54.00	-17.80

6.4 20dB Bandwidth

6.4.1 Standard Applicable

According to FCC Part 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.

6.4.2 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.

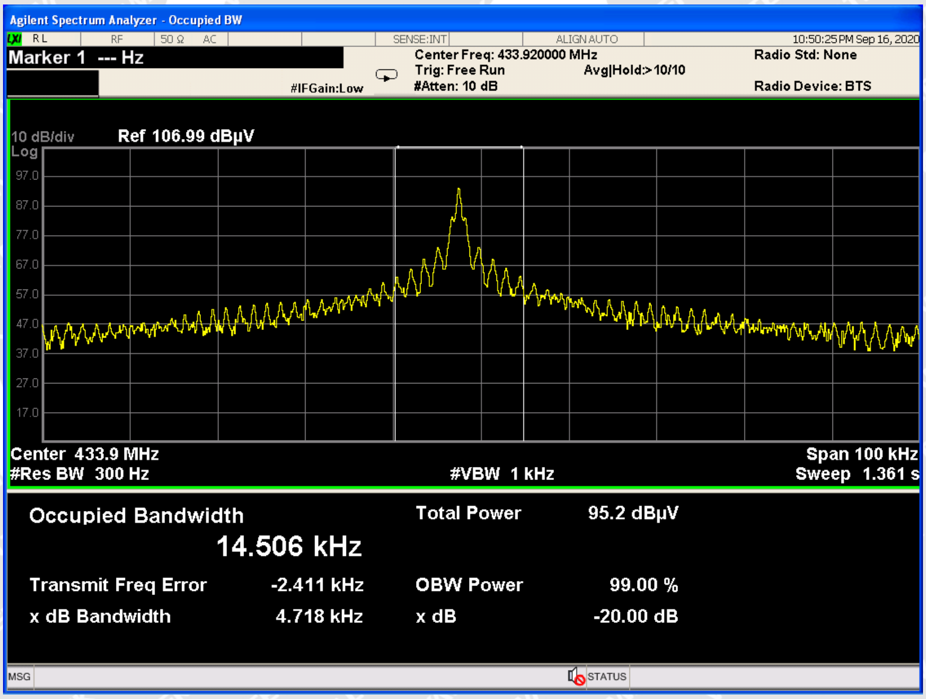
6.4.3 Test Result

Test Frequency (MHz)	20dB Bandwidth (kHz)	Limit (kHz)	Result
433.92MHz	4.718	1084.8	Pass

Limit = Fundamental Frequency X 0.25% = 433.92 MHz X 0.25% = 1084 kHz

Test Plots:

20dB Bandwidth Test Plot



6.5 Transmission Time

6.5.1 Standard Applicable

According to FCC Part 15.231 (a), the transmitter shall be complied the following requirements:
1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
(2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.
(3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

6.5.2 Test Procedure

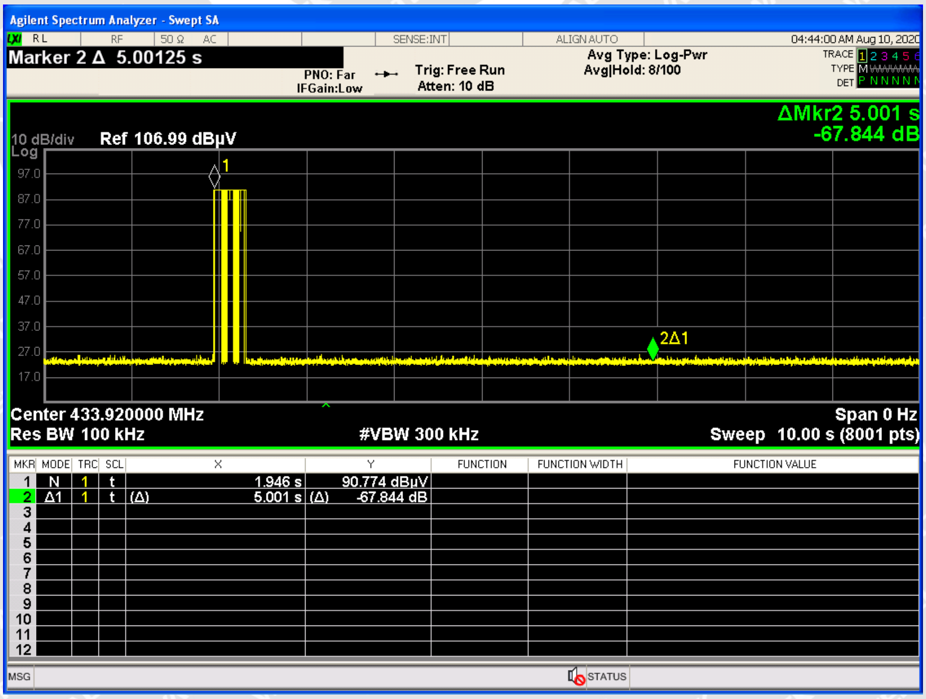
With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer. Set the center frequency to 433.92MHz, than set the spectrum analyzer to Zero Span for the release time reading. During the testing, the switch was released then the EUT automatically deactivated.

6.5.3 Test Result

Transmission Type	Test Frequency (MHz)	Transmission Time seconds	Limit (s)	Result
Manually	433.92	1.946	5	Pass

Test Plots:

Transmission Time



6.6 Duty Cycle

6.6.1 Standard Applicable

According to FCC Part 15.231 (b)(2) and 15.35 (c), For pulse operation transmitter, the averaging pulsed emissions are calculated by peak value of measured emission plus duty cycle factor.

6.6.2 Test Procedure

With the EUT’s antenna attached, the EUT’s output signal was received by the test antenna, which was connected to the spectrum analyzer. Set the center frequency to 433.92MHz, than set the spectrum analyzer to Zero Span for the release time reading. During the testing, the switch was released then the EUT automatically deactivated.

6.6.3 Test Result

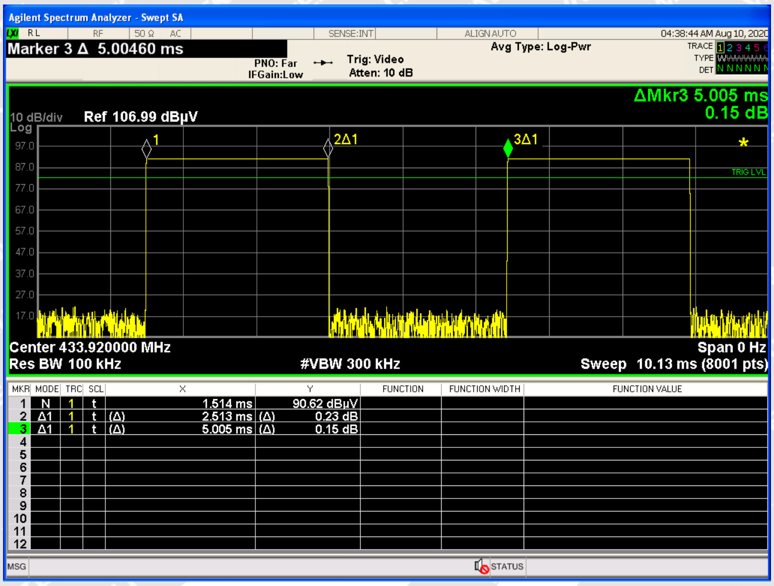
Type of Pulse	Width of Pulse (ms)	Quantity of Pulse	Transmission Time (ms)	Total Time (T_{on}) (ms)
Pulse 1 (Narrow)	0.6392	20	12.78	49.78
Pulse 2 (Middle)	1.303	13	16.94	
Pulse 3 (Wide)	2.507	8	20.06	

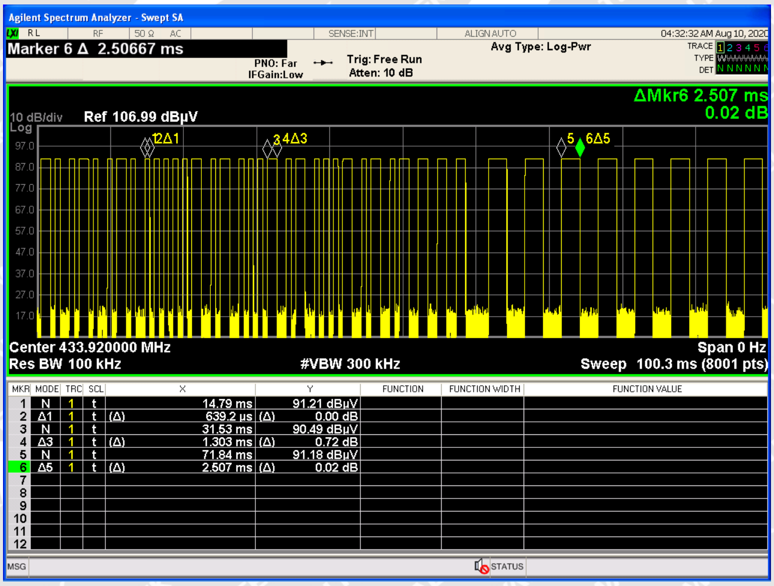
Test Period (T_p) (ms)	Total Time(T_{on}) (ms)	Duty Cycle (%)	Duty Cycle Factor (dB)
100*	49.78	49.78	-6.06

Remark: Duty Cycle Factor=20*log(Duty Cycle)

*FCC part 15.35(c) required that a complete pulse train is more than 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.

Test Plots:


Agilent Spectrum Analyzer - Swept SA
Marker 3 Δ 5.00460 ms
PNO: Far
IFGain:Low
Trig: Video
Atten: 10 dB
Avg Type: Log-Pwr
04:38:44 AM Aug 10, 2020
ΔMkr3 5.005 ms
0.15 dB
10 dB/div Ref 106.99 dBµV
Log
TRIG LVL
Center 433.920000 MHz
Res BW 100 kHz
#VBW 300 kHz
Span 0 Hz
Sweep 10.13 ms (8001 pts)
1 N 1 t 1.514 ms 90.62 dBµV
2 Δ1 1 t (Δ) 2.513 ms (Δ) 0.23 dB
3 Δ1 1 t (Δ) 5.005 ms (Δ) 0.15 dB
STATUS

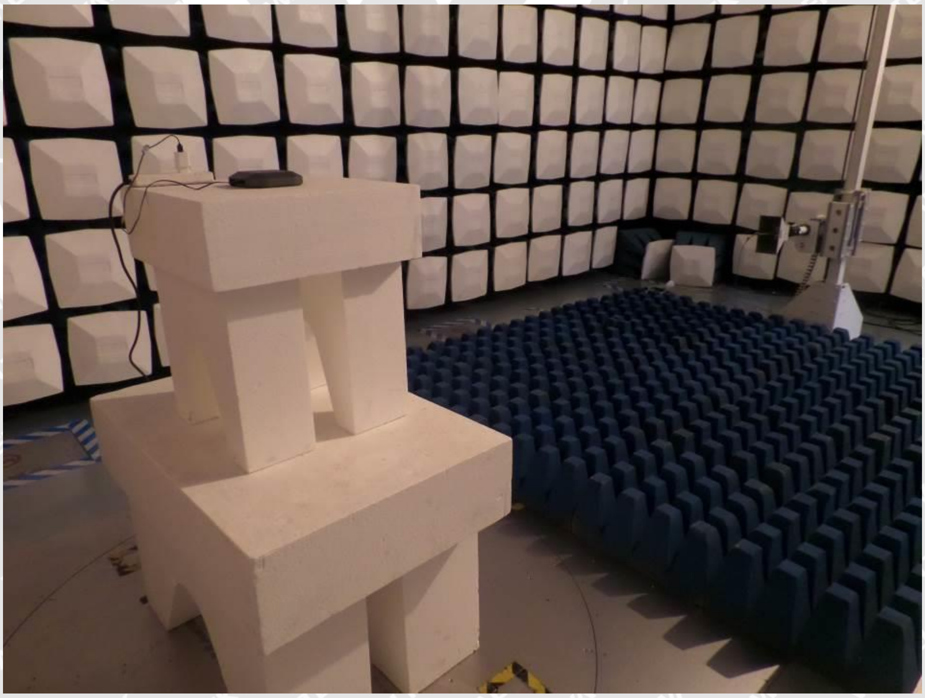

Agilent Spectrum Analyzer - Swept SA
Marker 6 Δ 2.50667 ms
PNO: Far
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
04:32:32 AM Aug 10, 2020
ΔMkr6 2.507 ms
0.02 dB
10 dB/div Ref 106.99 dBµV
Log
Center 433.920000 MHz
Res BW 100 kHz
#VBW 300 kHz
Span 0 Hz
Sweep 100.3 ms (8001 pts)
1 N 1 t 14.79 ms 91.21 dBµV
2 Δ1 1 t (Δ) 639.2 µs (Δ) 0.00 dB
3 N 1 t 31.53 ms 90.49 dBµV
4 Δ3 1 t (Δ) 1.303 ms (Δ) 0.72 dB
5 N 1 t 71.84 ms 91.18 dBµV
6 Δ5 1 t (Δ) 2.507 ms (Δ) 0.02 dB
STATUS

7 Photographs Test Setup

7.1 Photographs - Radiated Emission Test Setup

30MHz-1GHz

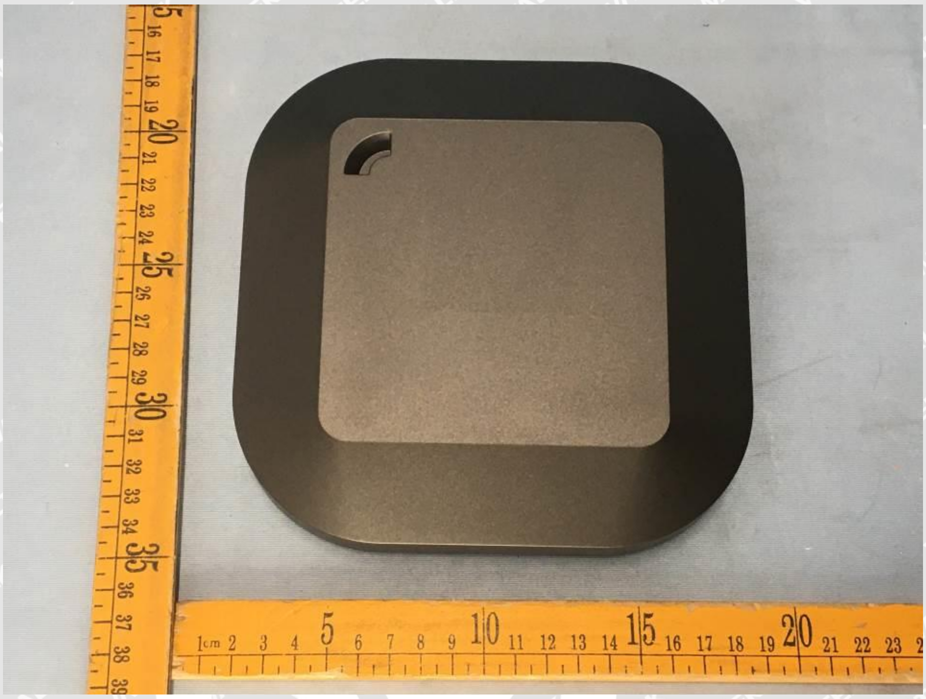
Above 1GHz

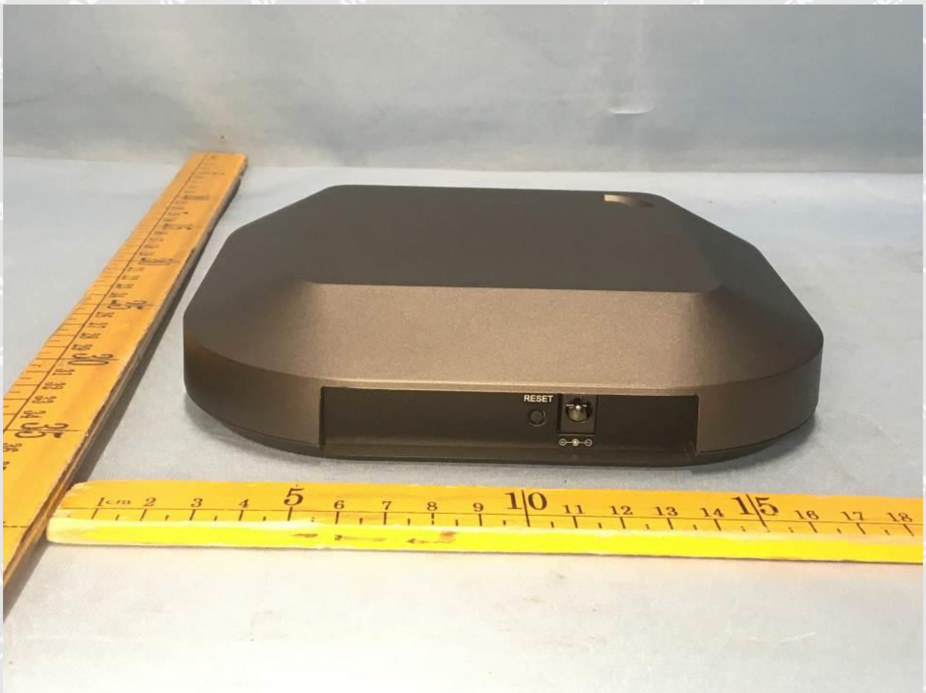


7.2 Photographs – Conducted Emission Test Setup

8 Photographs - Constructional Details

8.1 EUT - External View

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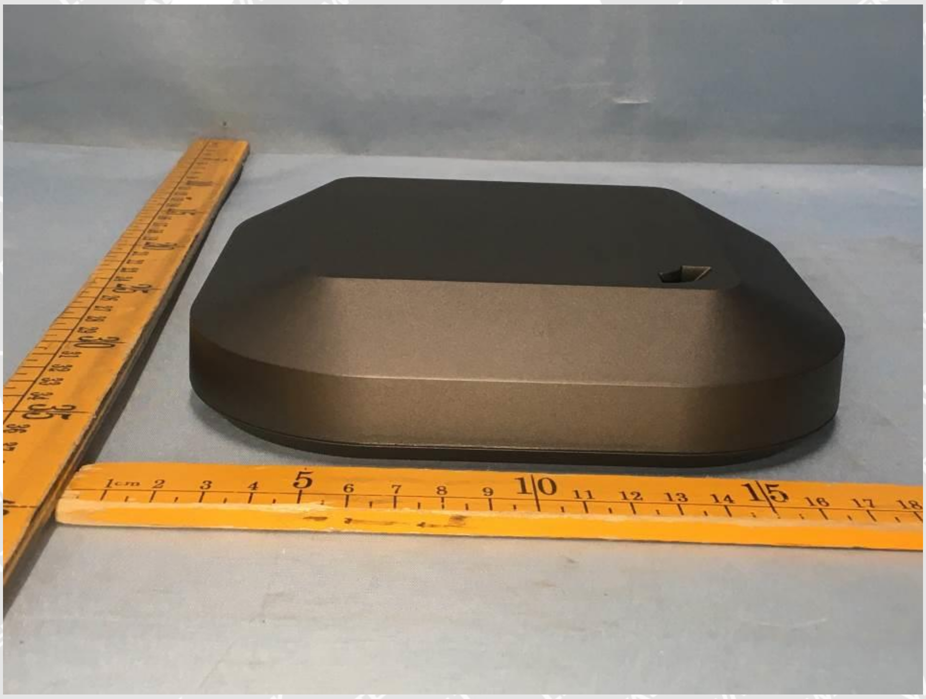
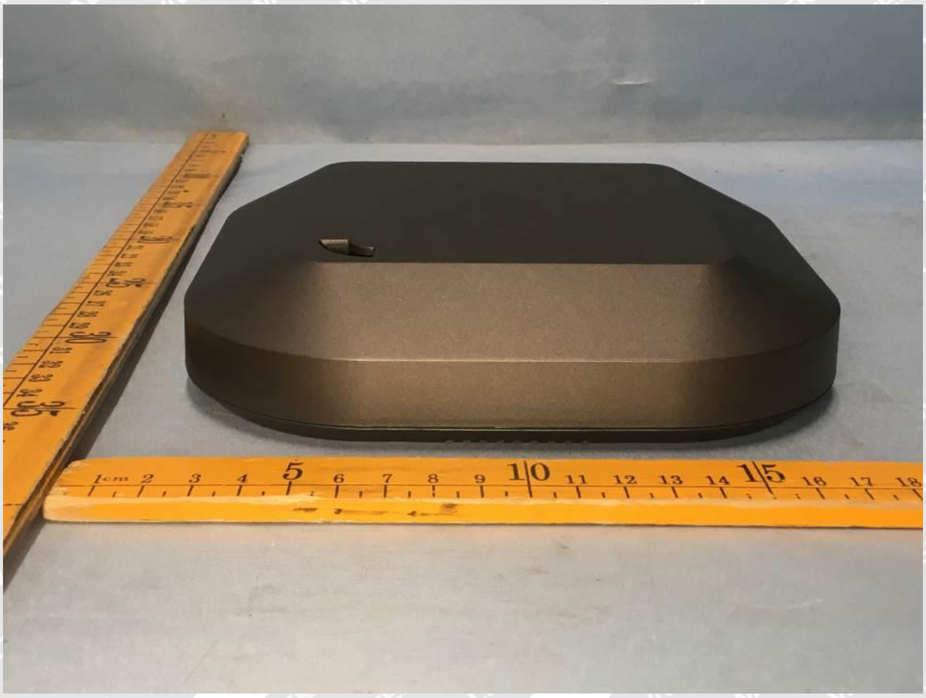
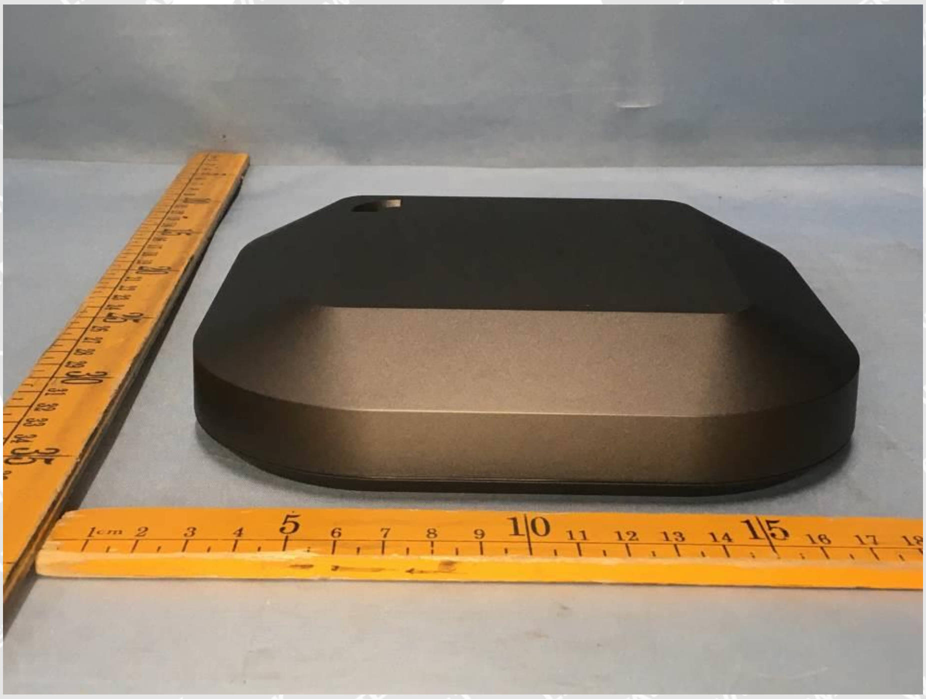
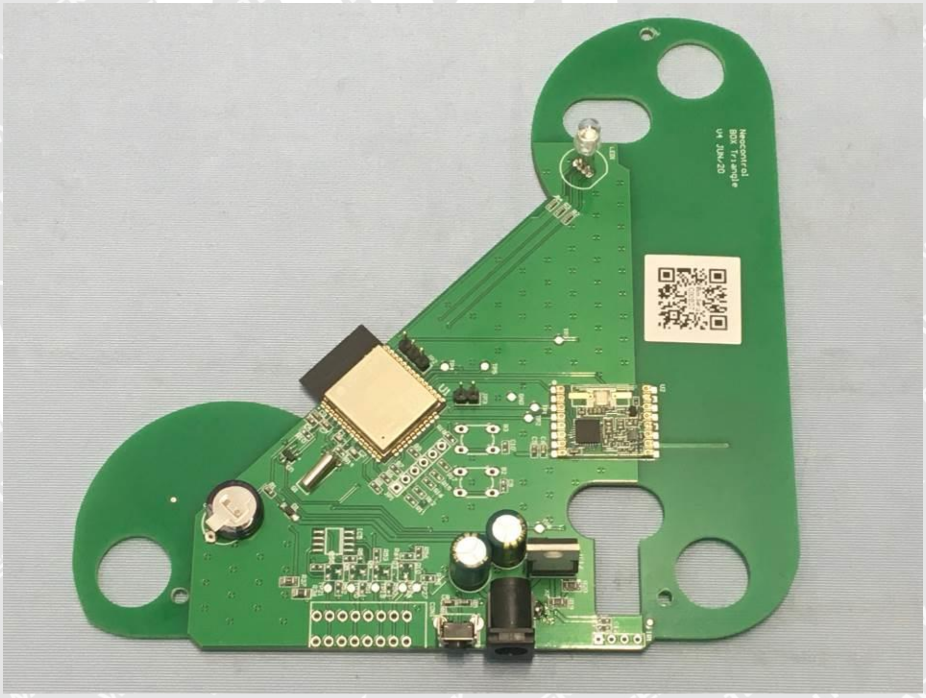
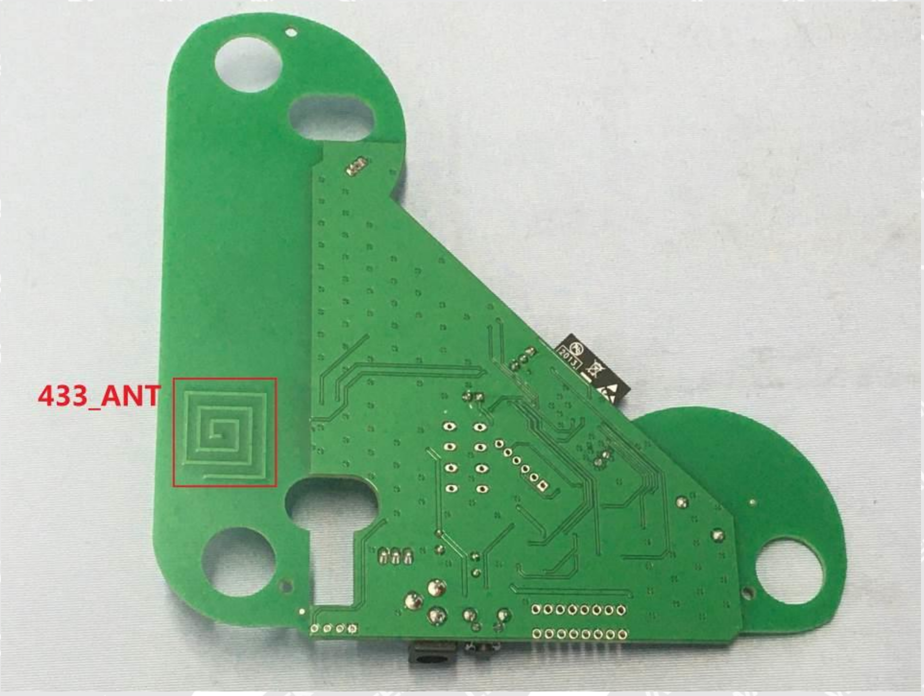






8.2 EUT - Internal View

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乐鑫信息科技（上海）
股份有限公司
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JP2
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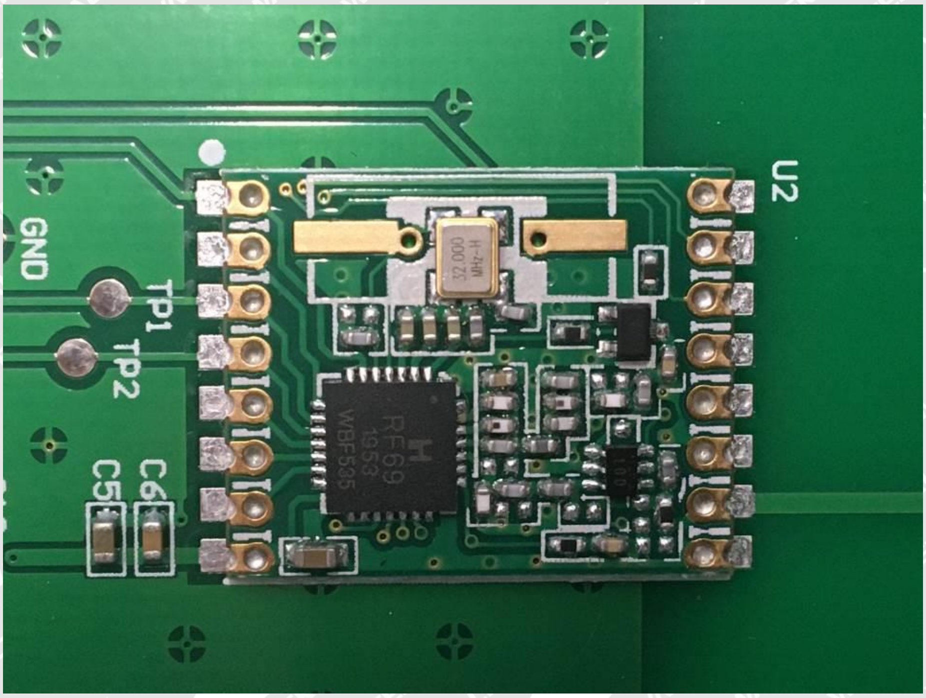

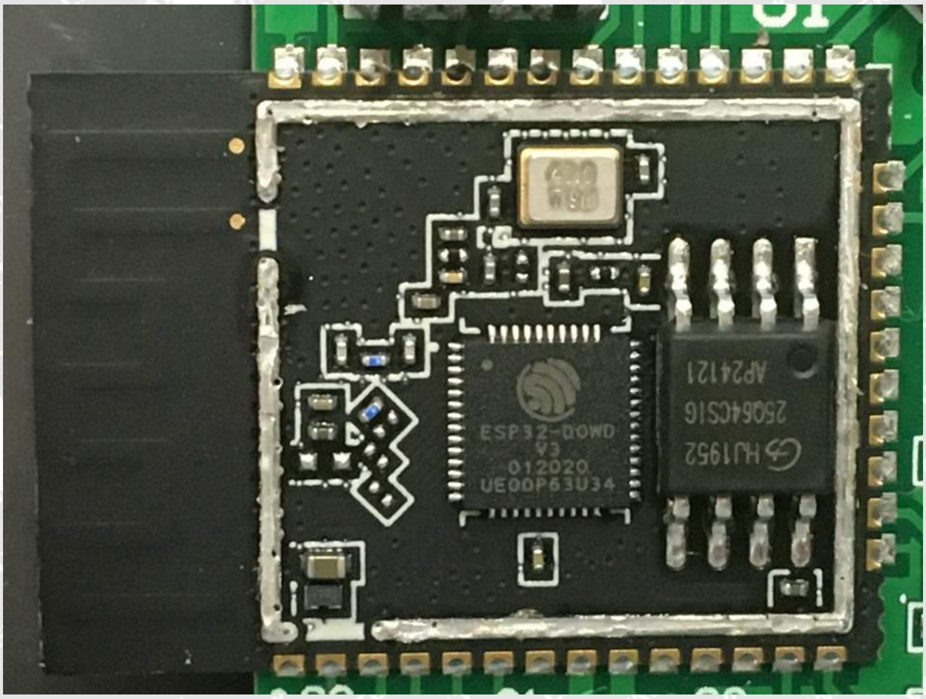

======End of Report======