

TEST REPORT

Reference No...... : WTF19S12085922W001 V1
FCC ID : 2ALP4-CWF0001B
Applicant..... : Neocontrol US LLC
Address..... : 3259, Progress Drive - Room 166 Orlando FL 32826 USA
Manufacturer : Neocontrol US LLC
Address..... : 3259, Progress Drive - Room 166 Orlando FL 32826 USA
Product..... : Box 98
Model(s) : CWF0001B
Standards..... : FCC CFR47 Part 15 Section 15.231
Date of Receipt sample : 2019-12-10
Date of Test : 2019-12-11 to 2019-12-19
Date of Issue..... : 2019-12-31
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.

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2 Contents

	Page
1 COVER PAGE.....	1
2 CONTENTS	2
3 REVISION HISTORY	3
4 GENERAL INFORMATION.....	4
4.1 GENERAL DESCRIPTION OF E.U.T.....	4
4.2 DETAILS OF E.U.T.....	4
5 EQUIPMENT USED DURING TEST	5
5.1 EQUIPMENTS LIST	5
5.2 MEASUREMENT UNCERTAINTY.....	5
5.3 SUBCONTRACTED.....	5
6 TEST SUMMARY	7
7 CONDUCTED EMISSION	8
7.1 E.U.T. OPERATION	8
7.2 EUT SETUP	8
7.3 MEASUREMENT DESCRIPTION	8
7.4 CONDUCTED EMISSION TEST RESULT.....	9
8 RADIATED SPURIOUS EMISSIONS.....	11
8.1 EUT OPERATION.....	11
8.2 TEST SETUP	12
8.3 SPECTRUM ANALYZER SETUP	13
8.4 TEST PROCEDURE.....	14
8.5 SUMMARY OF TEST RESULTS	15
9 PERIODIC OPERATION	16
10 20DB BANDWIDTH	20
10.1 TEST PROCEDURE.....	20
10.2 TEST RESULT	20
11 ANTENNA REQUIREMENT	21
12 PHOTOGRAPHS OF TEST SETUP AND EUT.....	22

3 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTF19S12085922 W001	2019-12-10	2019-12-11 to 2019-12-19	2019-12-20	original	-	Replaced
WTF19S12085922 W001 V1	2019-12-10	2019-12-11 to 2019-12-19	2019-12-31	Version 1	Updated	Valid

4 General Information

4.1 General Description of E.U.T

Product:	Box 98
Model(s):	CWF0001B
Model Difference:	N/A
Type of Modulation:	OOK
Frequency Range:	433.92MHz
Antenna installation:	PCB Printed Antenna
Other modules:	
BT/Wi-Fi Transmitter Module: Contains Transmitter Module FCC ID: 2AC7Z-ESPWROOM32D	

4.2 Details of E.U.T

Ratings:	DC 5V, 2.5A powered by Switching Power Adapter (Sale without adapter)
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5 Equipment Used during Test

5.1 Equipments List

3m Semi-anechoic Chamber for Radiated Spurious Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Spectrum Analyzer	R&S	FSP30	100091	2019-04-07	2020-04-06
2	Active Loop Antenna	Laplace	RF300	9057	2019-09-15	2020-09-14
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	2019-05-18	2020-05-17
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	2019-10-15	2020-10-14
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	2019-05-18	2020-05-17
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	2019-10-25	2020-10-24
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	2019-04-07	2020-04-06
8	Coaxial Cable (above 1GHz)	ZT26-NJ-NJ-8M/FA	1GHz-18GHz	EW02014-7	2019-04-07	2020-04-06

5.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (30M~1000MHz)
	± 5.47 dB (1000M~25000MHz)
Conducted Emissions test	± 3.64 dB (AC mains 150KHz~30MHz)
Confidence interval: 95%. Confidence factor:k=2	

5.3 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 Lab: N/A

Lab address: N/A

Test items: N/A

5.4 Test Facility

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

ISED CAB identifier: CN0013. Test Firm Registration No.: 7760A.

Waltek Services(Shenzhen) 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 number 7760A, October 15, 2016.

FCC Designation No.: CN1201. Test Firm Registration No.: 523476.

Waltek Services(Shenzhen) 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 number 523476, September 10, 2019.

6 Test Summary

Test Items	Test Requirement	Result
Conducted Emissions	15.207	PASS
Radiated Spurious Emissions	15.205(a) 15.209 15.231(a)	PASS
Periodic Operation	15.231(a)	PASS
20dB Bandwidth	15.231(c)	PASS
Antenna Requirement	15.203	PASS
Note: Pass=Compliance; NC=Not Compliance; NT=Not Tested; N/A=Not Applicable.		

7 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

Limit:

Frequency (MHz)	Conducted Limit (dB μ V)	
	Qsi-peak	Average
0.15 to 0.5	66 t 56*	6 to 46*
0.5 to 5.0	56	46
5.0 to 30	60	0

*Decreases with the logarithm of the frequency.

7.1 E.U.T. Operation

Operating Environment :

Temperature: 24.6 °C

Humidity: 56.2 % RH

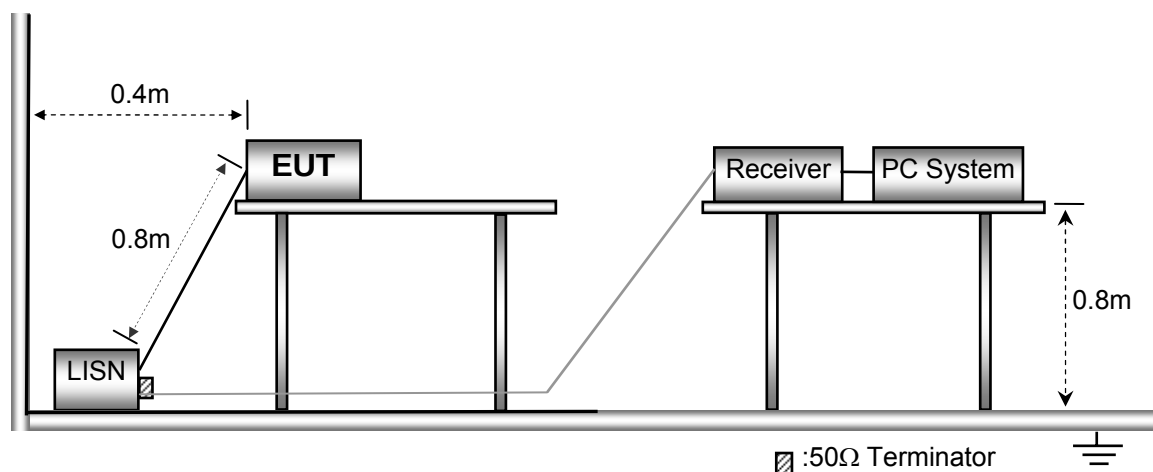
Atmospheric Pressure: 102.5kPa

Test Voltage: AC 120V, 60Hz

EUT Operation : transmitting

7.2 EUT Setup

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

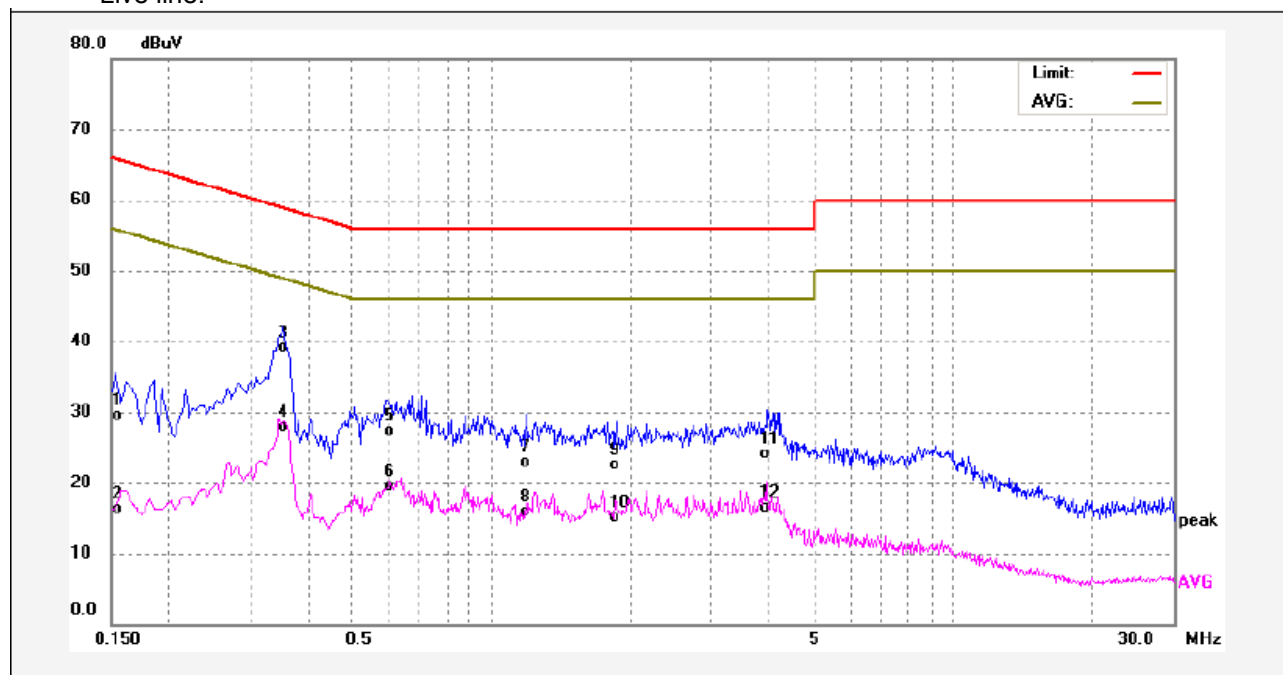


7.3 Measurement Description

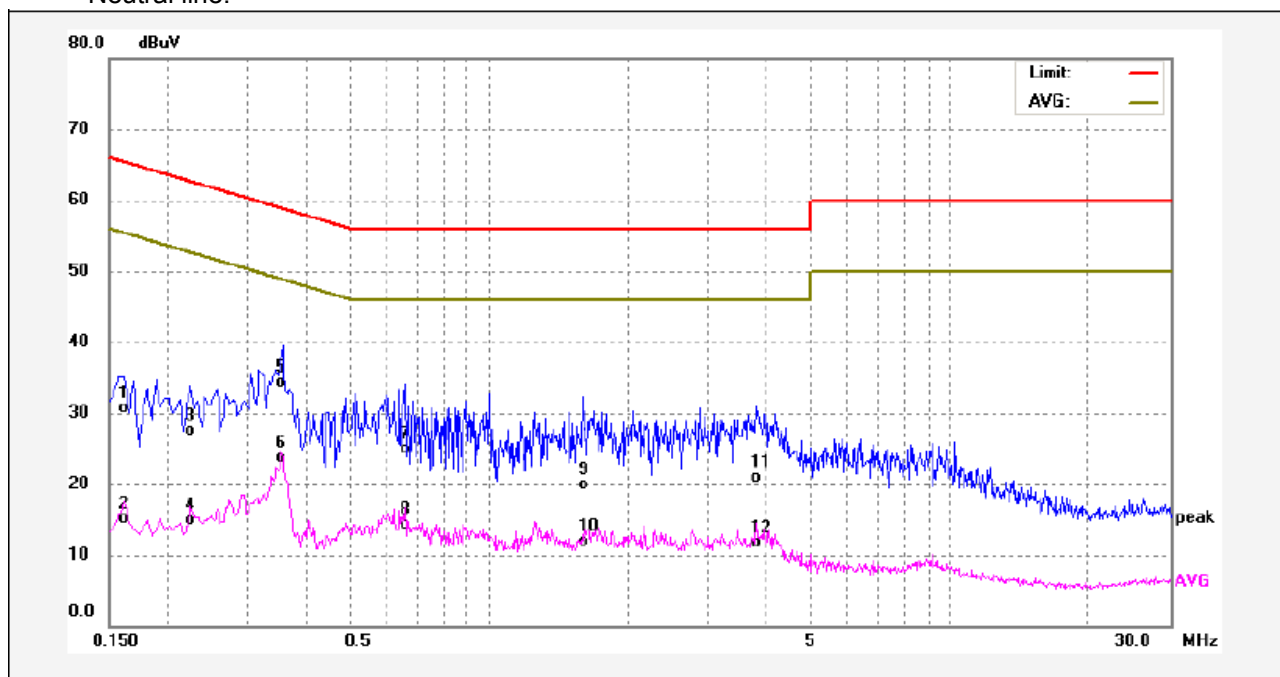
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

7.4 Conducted Emission Test Result

Live line:



Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1620	20.91	9.77	30.68	65.36	-34.68	QP	
2	0.1620	5.33	9.77	15.10	55.36	-40.26	AVG	
3	0.2260	17.81	9.76	27.57	62.59	-35.02	QP	
4	0.2260	5.14	9.76	14.90	52.59	-37.69	AVG	
5	0.3580	24.58	9.80	34.38	58.77	-24.39	QP	
6	0.3580	13.96	9.80	23.76	48.77	-25.01	AVG	
7	0.6580	15.11	9.83	24.94	56.00	-31.06	QP	
8	0.6580	4.54	9.83	14.37	46.00	-31.63	AVG	
9	1.5980	9.98	9.91	19.89	56.00	-36.11	QP	
10	1.5980	2.00	9.91	11.91	46.00	-34.09	AVG	
11	3.8060	10.99	9.94	20.93	56.00	-35.07	QP	
12	3.8060	1.69	9.94	11.63	46.00	-34.37	AVG	

8 Radiated Spurious Emissions

Test Requirement: FCC Part15 Paragraph 15.231(a)

Test Method: ANSI C63.4:2014

Test Result: PASS

Measurement Distance: 3m

Limit:

Fundamental Frequency (MHz)	Field Strength of Fundamental (uV/m)	Field Strength of Fundamental (dBuV/m)	Field Strength of Spurious Emission (uV/m)	Field Strength of Spurious Emission (dBuV/m)
44.66-40.70	2250	67	225	47
70-130	1250	62	125	42
130-174	1250 to 3750	62 to 71.48	125 to 375	42 to 51.48
174-260	3750	71.48	375	51.48
260-470	3750 to 12500	71.48 to 81.94	375 to 1250	51.48 to 61.94
Above 470	12500	81.94	1250	61.94
** linear interpolations				

8.1 EUT Operation

Operating Environment :

Temperature: 24.1 °C

Humidity: 53.7 % RH

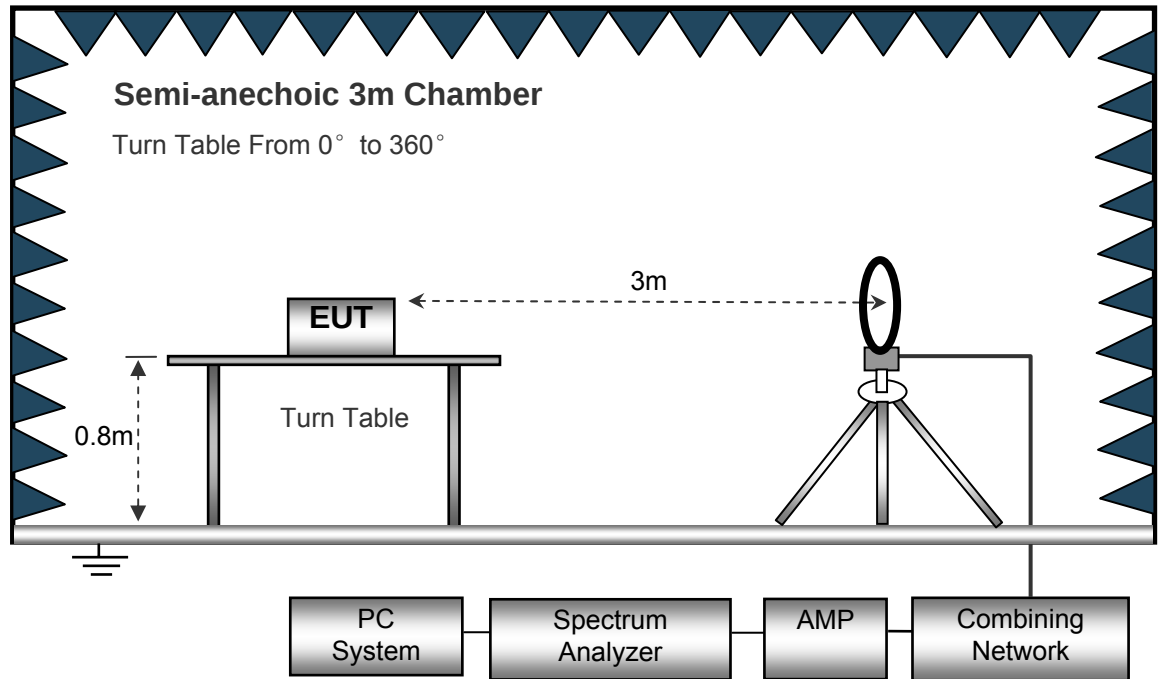
Atmospheric Pressure: 102.4kPa

EUT Operation : transmitting

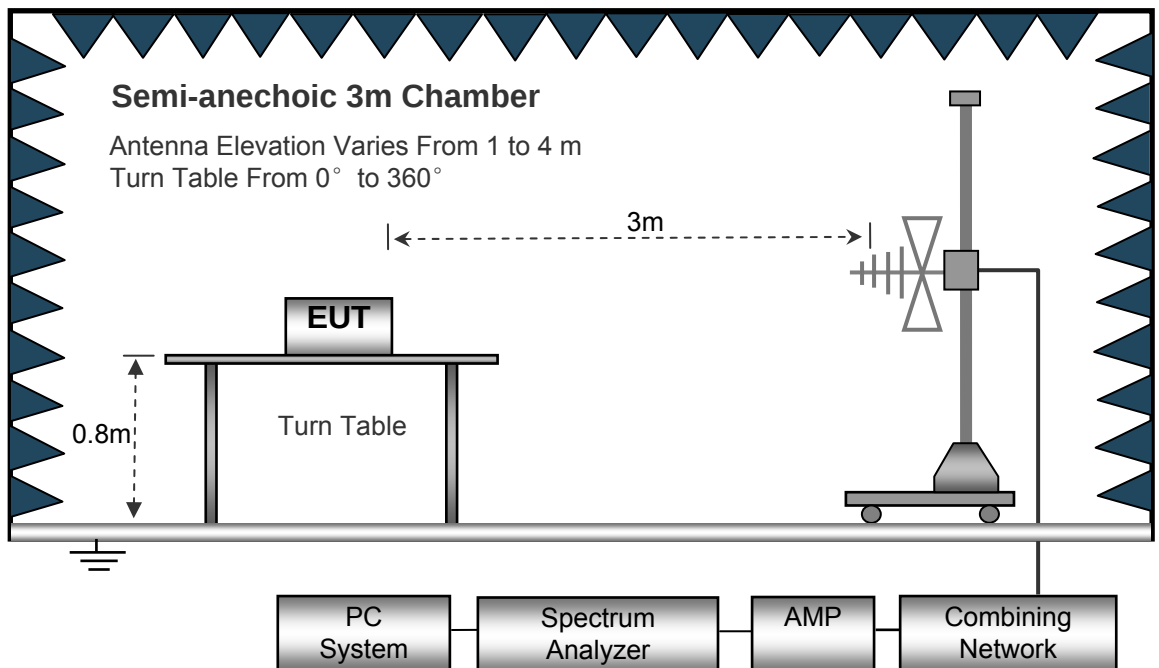
8.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4: 2014.

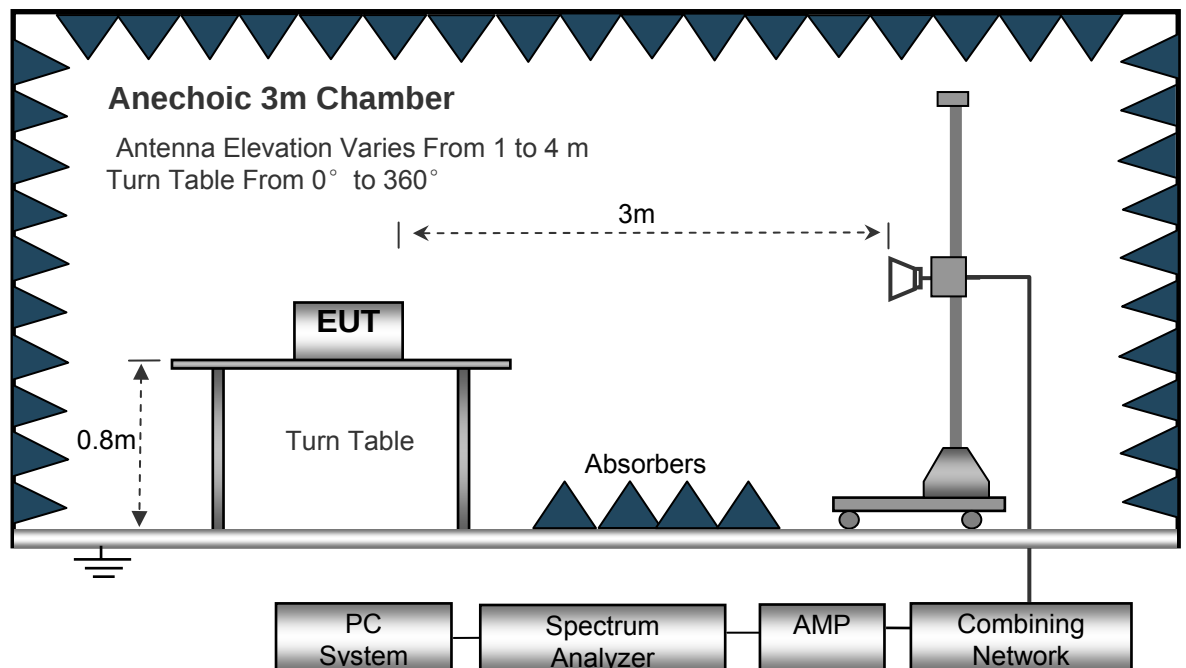
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



8.3 Spectrum Analyzer Setup

Below 30MHz

Sweep SpeedAuto
 IF Bandwidth.....10kHz
 Video Bandwidth.....10kHz
 Resolution Bandwidth.....10kHz

30MHz ~ 1GHz

Sweep SpeedAuto
 DetectorPK
 Resolution Bandwidth.....100kHz
 Video Bandwidth.....300kHz

Above 1GHz

Sweep SpeedAuto
 DetectorPK
 Resolution Bandwidth.....1MHz
 Video Bandwidth.....3MHz

8.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. 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.

8.5 Summary of Test Results

AV = Peak +20Log₁₀(duty cycle)

Test Frequency: Below 30MHz

The measurements were more than 20 dB below the limit and not reported.

Test Frequency: 30MHz ~ 5GHz

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.231/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)
433.92	73.25	PK	199	1.2	H	-7.28	81.84	100.82	-18.98
433.92	89.62	PK	286	1.8	V	-7.28	86.50	100.82	-14.32
867.84	41.26	PK	196	1.1	H	0.04	23.21	80.82	-57.61
867.84	45.36	PK	57	2.0	V	0.04	23.54	80.82	-57.28
1301.76	44.25	PK	213	1.5	H	-14.38	35.21	74.00	-38.79
1301.76	49.56	PK	132	1.3	V	-14.38	35.18	74.00	-38.82
1735.68	43.36	PK	346	1.5	H	-12.87	34.65	74.00	-39.35
1735.68	47.16	PK	140	1.6	V	-12.87	34.29	74.00	-39.71

Frequency	PK	Turn table Angle	RX Antenna		Duty cycle Factor	AV	FCC Part 15.231/209/205	
			Height	Polar			Limit	Margin
(MHz)	(dBμV/m)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
433.92	81.84	317	1.2	H	-6.34	75.5	80.82	-5.32
433.92	86.50	147	1.8	V	-6.34	80.16	80.82	-0.66
867.84	23.21	71	1.1	H	-6.34	16.87	60.82	-43.95
867.84	23.54	76	2.0	V	-6.34	17.2	60.82	-43.62
1301.76	35.21	79	1.5	H	-6.34	28.87	54.00	-25.13
1301.76	35.18	316	1.3	V	-6.34	28.84	54.00	-25.16
1735.68	34.65	325	1.5	H	-6.34	28.31	54.00	-25.69
1735.68	34.29	159	1.6	V	-6.34	27.95	54.00	-26.05

9 Periodic Operation

The duty cycle was determined by the following equation:

To calculate the actual field intensity, The duty cycle correction factor in decibel is needed for later use and can be obtained from following conversion

Duty Cycle(%)=Total On interval in a complete pulse train/ Length of a complete pulse train *100 %

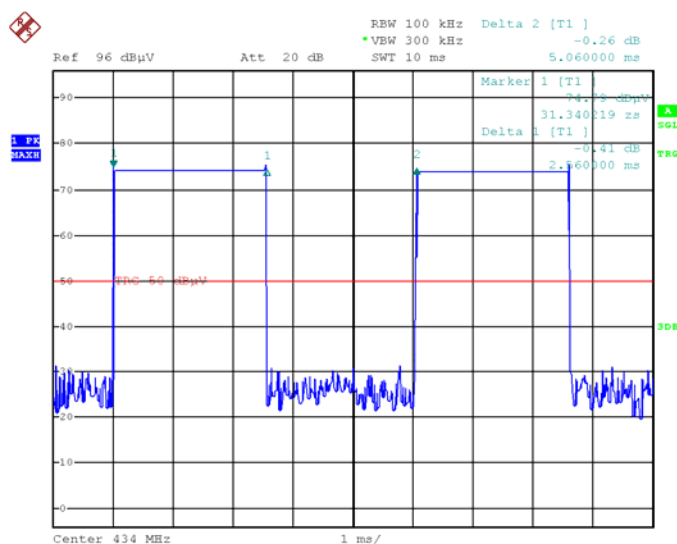
Duty Cycle Correction Factor(dB)=20 * Log₁₀(Duty Cycle(%))

Total transmission time(ms)	18*0.6+13*1.4+8*2.4=48.2
Length of a complete transmission period(ms)	100*
Duty Cycle(%)	48.2
Duty Cycle Correction Factor(dB)	-6.34

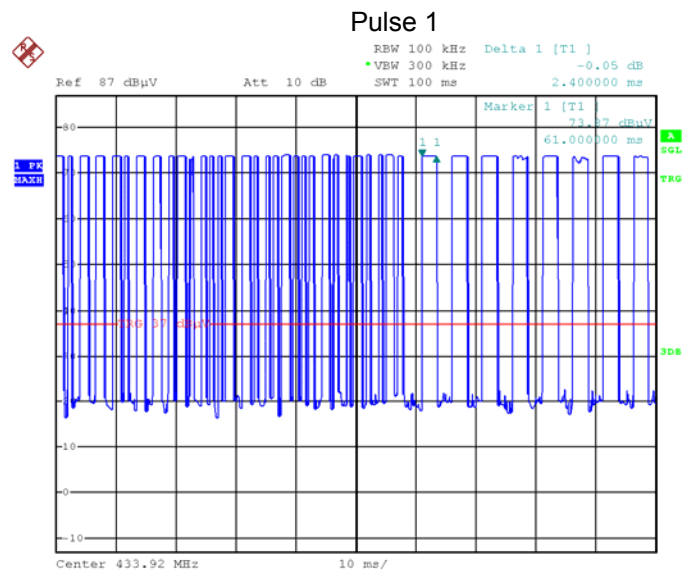
Refer to the duty cycle plot (as below),This device meets the FCC requirement.

Length of a complete pulse train:

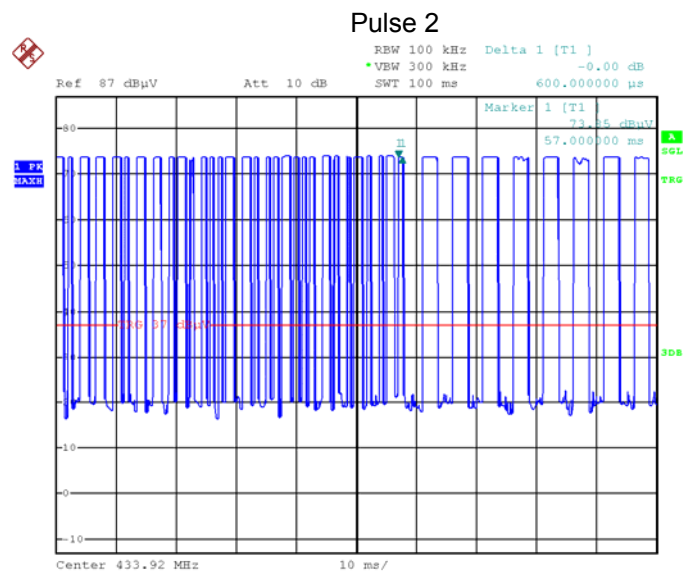
Remark: FCC part15.35(c) required that a complete pulse train is more than 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.



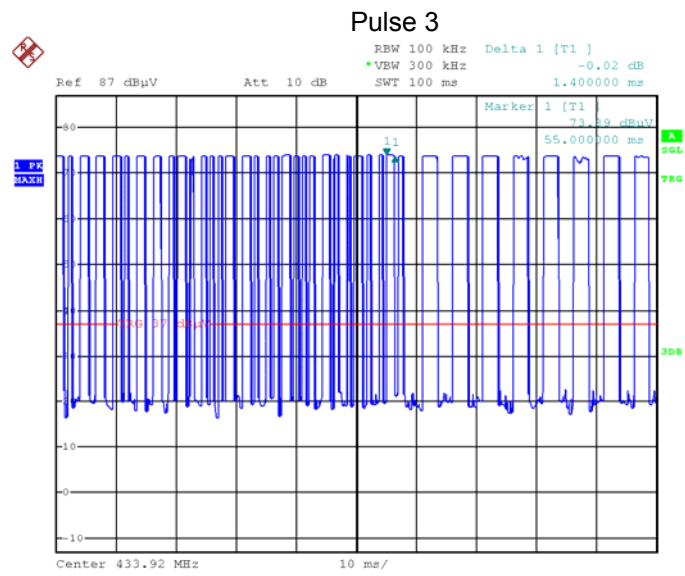
Date: 19.DEC.2019 19:43:08



Date: 19.DEC.2019 03:51:57



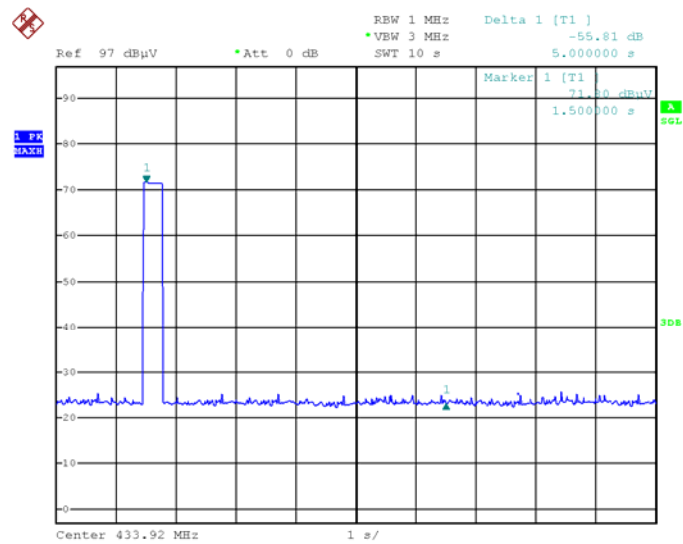
Date: 19.DEC.2019 03:52:20



Date: 19.DEC.2019 03:52:34

FCC Part15.231(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.

(2)A transmitter activated automatically shall cease transmission within 5 seconds after activation.



Date: 19.DEC.2019 05:51:57

10 20dB Bandwidth

Test Requirement:	FCC Part15.231(c)
Test Method:	FCC Part15.231(c)
Limit	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. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency.

10.1 Test Procedure

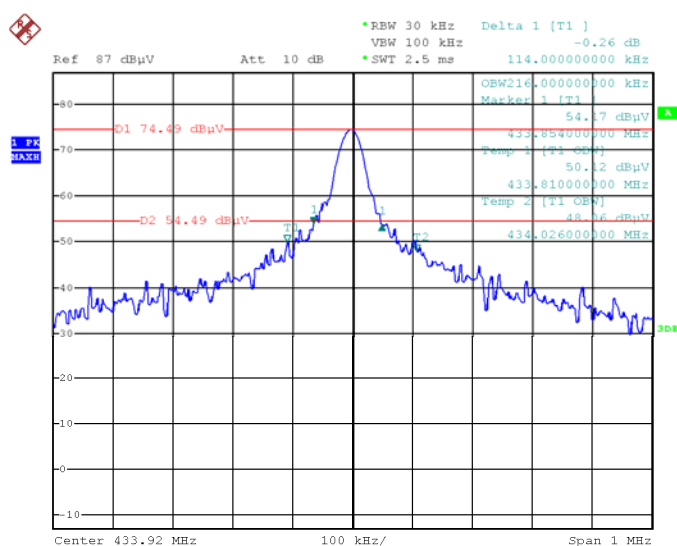
1. The transmitter output (antenna port) was connected to the spectrum analyzer. EUT and its simulators are placed on a table, let EUT working in test mode, then test it.
2. The bandwidth of the fundamental frequency was measure by spectrum analyser with 3kHz RBW and 10kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power 20dB.

10.2 Test Result

Frequency (MHz)	Bandwidth Emission (kHz)	Limit (kHz)	Result
433.92	114	1084.8	Pass

Limit=Center Frequency*0.25%

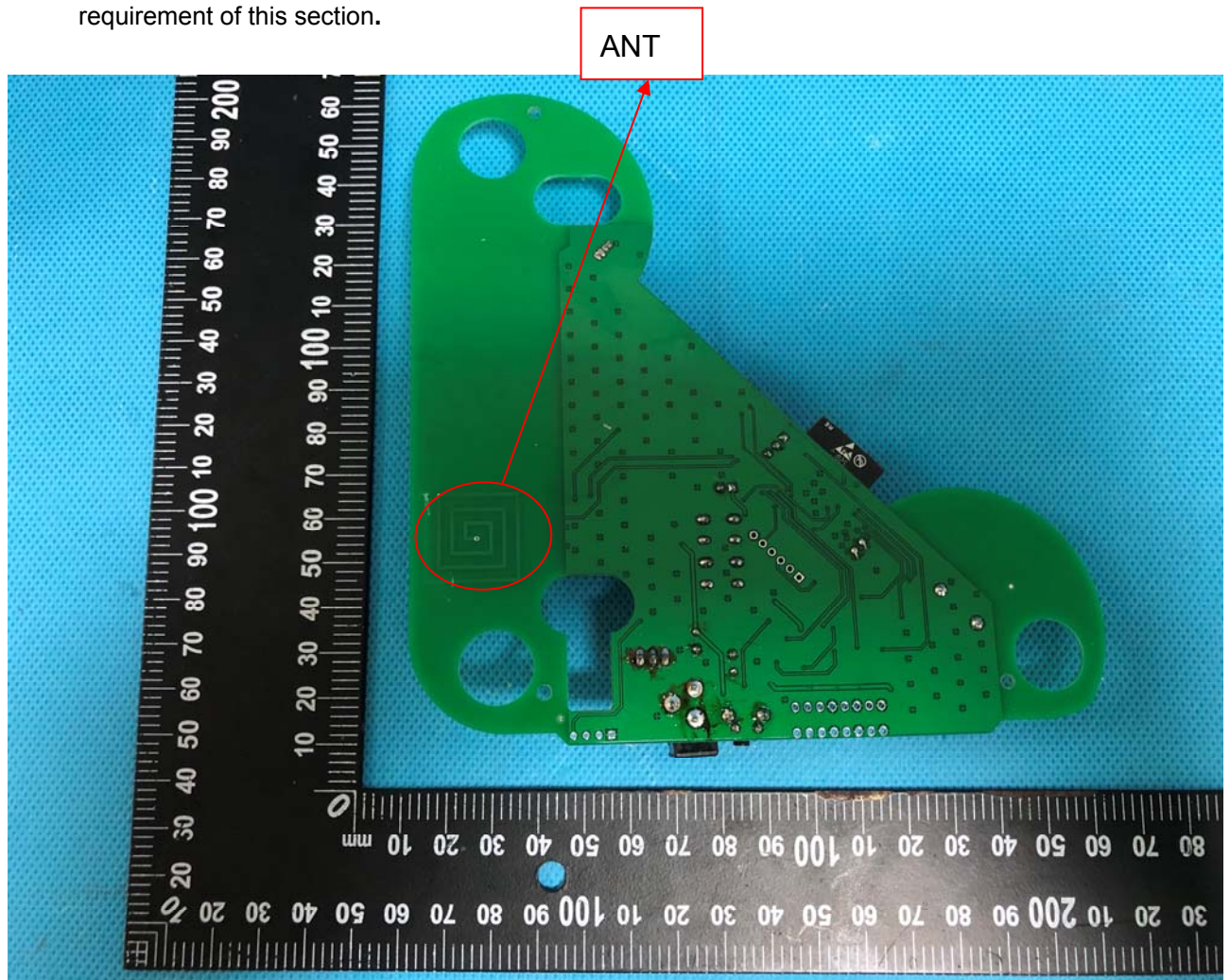
Test Plot



Date: 19.DEC.2019 02:54:02

11 Antenna Requirement

According to the FCC Part 15 Paragraph 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 to the intentional radiator shall be considered sufficient to comply with the provisions of this section. This product use a permanent Spring antenna, fulfill the requirement of this section.



12 Photographs of test setup and EUT.

Note: Please refer to appendix: Appendix-Box 98-Photos

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