TEST REPORT

Reference No.	:	WTD16S0551596E
FCC ID	:	XAB-HEDDI-U220S5
Applicant	:	Heddolf Products Ltd.
Address	:	Unit 7, 22/F., Futura Plaza,111-113 How Ming Street, Kwun Tong, Kowloon, Hong Kong
Manufacturer	:	Heddolf Products Ltd
Address	:	Xian Sha No.2Industrial Zone, Gao Bu Town,Dongguan City, Guangdong Province, PRC
Product Name	:	Remote Controtler
Model No.	:	U220S5
Series Model No.	:	U220S5-1,U220S5-2,U220S5-3
Standards	:	FCC CFR47 Part 15 Section 15.231: 2015
Date of Receipt sample	:	May. 26, 2016
Date of Test	:	May. 27, 2016 ~ Aug. 04, 2016
Date of Issue	:	Aug. 26, 2016
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:
Waltek Services (Shenzhen) Co., Ltd.
Address: 1/F., Fukangtai Building, West Baima Road, Songgang Street, Baoan District, Shenzhen, Guangdong, China
Tel :+86-755-83551033
Fax:+86-755-83552400

Tested by:

Zero Zhou / Tested Engineer

Approved by:

Philo Zhong / Manager

2 Contents

3 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTD16S0551596E	May. 26, 2016	May. 27, 2016 ~ Aug. 04, 2016	Aug. 05, 2016	original	-	Replaced
WTD16S0551596E	May. 26, 2016	May. 27, 2016 ~ Aug. 04, 2016	Aug. 26, 2016	Revision1	Update internal photos and software version	Valid

4 General Information

4.1 General Description of E.U.T.

Product Name:	Remote Controtler
Model No.:	U220S5
Series Model No.:	U220S5-1,U220S5-2,U220S5-3
Model Difference:	All the models are exactly the same(Including circuit schematics,PCB),except the key and the model name.
Type of Modulation:	ASK
Frequency Range:	300MHz-433.92MHz
The Lowest Oscillator:	6MHz
Adjust Frequency Softwave Name:	AN370;Si4010
Adjust Frequency Softwave Version:	0x02
Antenna installation:	PCB Loop Antenna

4.2 Details of E.U.T.

Technical Data: DC 3V by CR2032 Battery

4.3 Channel List

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
0	300	1	304	2	310	3	311
4	312	5	315	6	318	7	340
8	360	9	372.5	10	390	11	433.92

4.4 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode	Lower channel	Middle channel	Upper channel
Transmitting	300.00MHz	360.00MHz	433.92MHz

4.5 Test Facility

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

- **IC – Registration No.: 7760A-1**

  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 7760A-1, Oct. 15, 2015.

- **FCC Test Site 1#– Registration No.: 880581**

  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 880581, April 29, 2014.

- **FCC Test Site 2#– Registration No.: 328995**

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 328995, December 3, 2014.

5 Equipment Used during Test

5.1 Equipments List

3m Semi-anechoic Chamber for Radiation Emissions Test site 1#						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1	EMC Analyzer	Agilent	E7405A	MY45114943	Sep.15,2015	Sep.14,2016
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Sep.15,2015	Sep.14,2016
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Apr.19,2016	Apr.18,2017
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	Sep.15,2015	Sep.14,2016
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Apr.19,2016	Apr.18,2017
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	Apr.19,2016	Apr.18,2017
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Mar.17,2016	Mar.16,2017
8	Coaxial Cable (above 1GHz)	Top	1GHz-25GHz	EW02014-7	Apr.10,2016	Apr.09,2017
3m Semi-anechoic Chamber for Radiation Emissions Test site 2#						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No**	**Last Calibration Date**	**Calibration Due Date**
1	Test Receiver	R&S	ESCI	101296	Sep.15,2015	Sep.14,2016
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	Sep.15,2015	Sep.14,2016
3	Amplifier	Compliance pirection systems inc	PAP-0203	22024	Sep.15,2015	Sep.14,2016
4	Cable	HUBER+SUHNER	CBL2	525178	Sep.15,2015	Sep.14,2016
RF Conducted Testing						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	EMC Analyzer (9k~26.5GHz)	Agilent	E7405A	MY45114943	Sep.15,2015	Sep.14,2016
2.	Spectrum Analyzer (9k-6GHz)	R&S	FSL6	100959	Sep.15,2015	Sep.14,2016
3.	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	Sep.15,2015	Sep.14,2016

5.2 Measurement Uncertainty

Test Item	Frequency Range	Uncertainty	Note
Conducted Emissions	150kHz~30MHz	±3.64dB	(1)
Radiated Spurious Emissions	30MHz~1000MHz	±5.03dB	(1)
	1000M~5000MHz	± 5.47 dB	(1)

(1)This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

5.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

6 Test Summary

Test Items	Test Requirement	Result
Conducted Emissions	15.207	NA
Radiated Spurious Emissions	15.205(a) 15.209 15.231(a)	C
Periodic Operation	15.231(a)	C
20dB Bandwidth	15.231(c)	C
Antenna Requirement	15.203	C
Note: C=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&ANSI C63.4:2014
Test Result:	N/A
Frequency Range:	150kHz to 30MHz
Class/Severity:	Class B
Limit:	66-56 dBμV between 0.15MHz & 0.5MHz
	56 dBμV between 0.5MHz & 5MHz
	60 dBμV between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth)
Remark	The EUT is power By DC 3V CR2032 Battery.

8 Radiated Spurious Emissions

Test Requirement: FCC Part15 Paragraph 15.231(a)

Test Method: ANSI C63.10:2013&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: 23.5 °C

Humidity: 51.1 % RH

Atmospheric Pressure: 101.2kPa

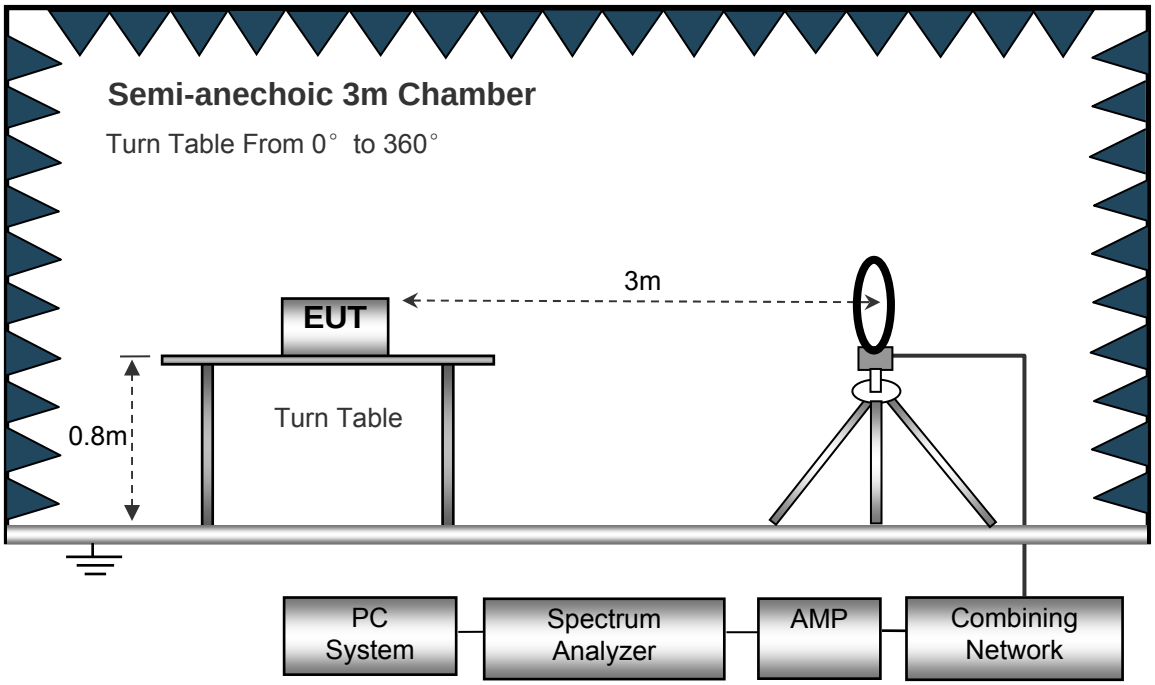
EUT Operation **:**

The test was performed in transmitting mode, the test data were shown in the report.

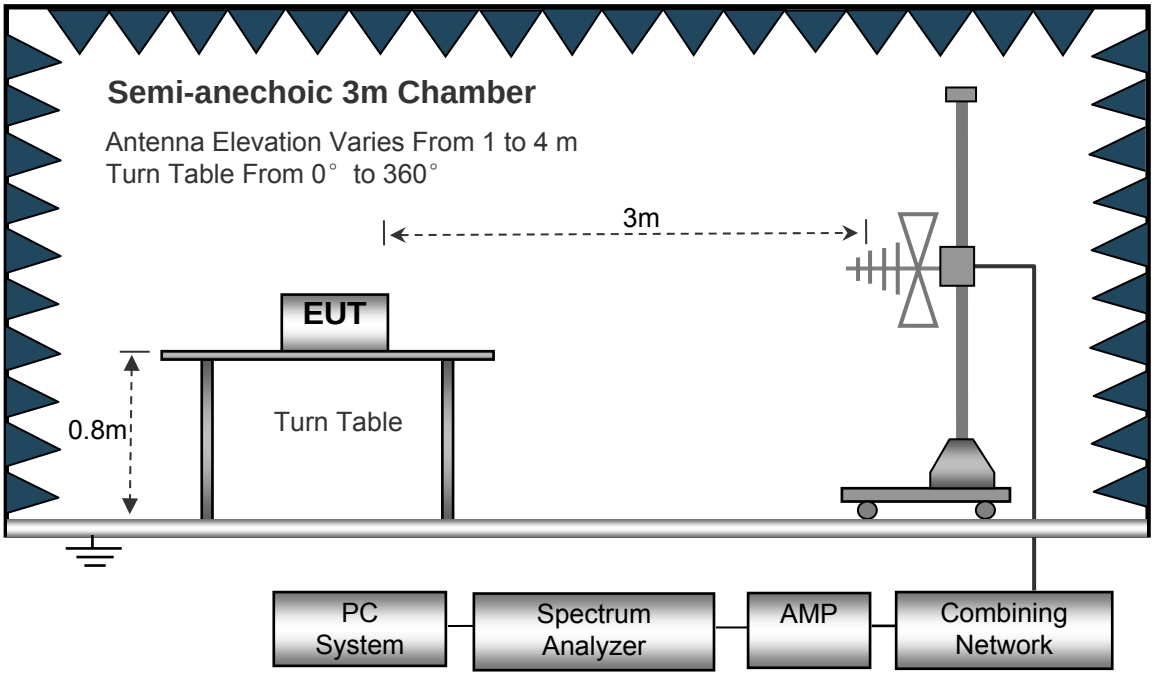
8.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.10:2013.

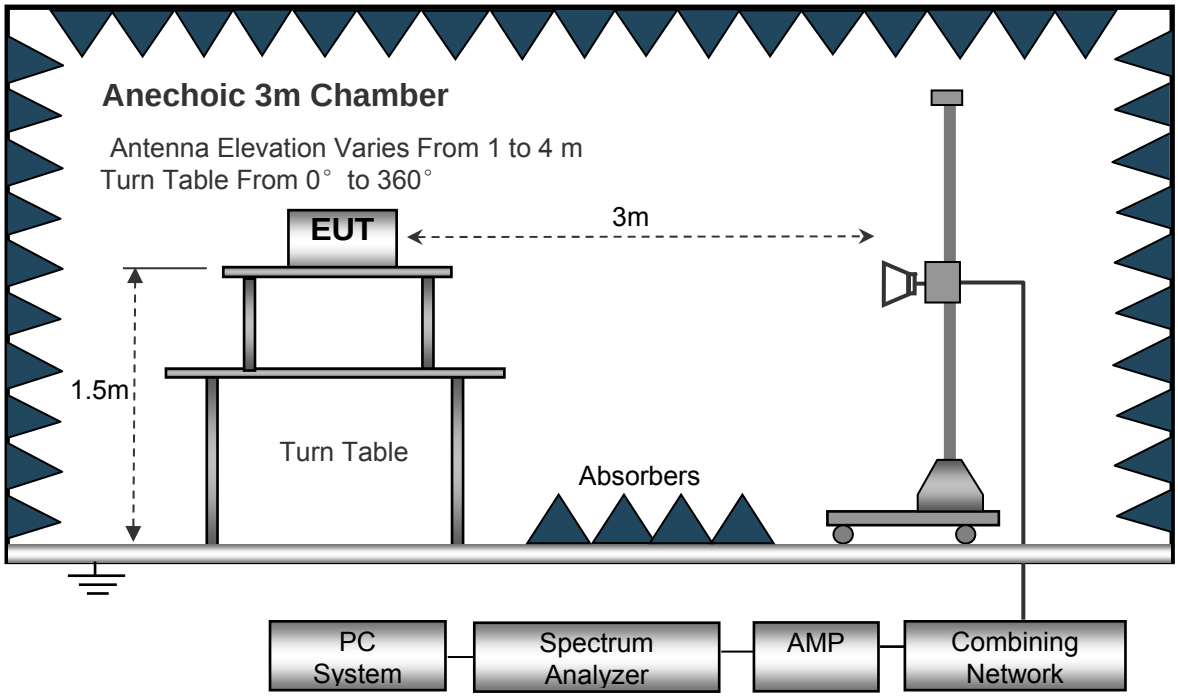
The test setup for emission measurement below 30MHz.



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 Speed ..... Auto
IF Bandwidth..... 10kHz
Video Bandwidth..... 10kHz

Resolution Bandwidth..... 10kHz

30MHz ~ 1GHz

Sweep Speed ..... Auto
Detector ..... PK
Resolution Bandwidth..... 100kHz
Video Bandwidth..... 300kHz

Above 1GHz

Sweep Speed ..... Auto
Detector ..... PK
Resolution Bandwidth..... 1MHz
Video Bandwidth..... 3MHz

8.4 Test Procedure

1. The EUT is placed on a turntable. For below 1GHz, the EUT is 0.8m above ground plane; For above1GHz, the EUT is 1.5m 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

Test Frequency: 6MHz to 30MHz

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

Test Frequency: 30MHz ~ 5GHz {AV = Peak +20Log$_{10}$(duty cycle)}

Low channel

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)
300.00	72.56	PK	351	1.6	H	-13.08	59.48	94.67	-35.19
300.00	58.22	PK	282	1.5	V	-13.08	45.14	94.67	-49.53
600.00	50.23	PK	319	1.6	H	0.09	50.32	74.67	-24.35
600.00	55.28	PK	270	1.4	V	0.09	55.37	74.67	-19.30
900.00	51.12	PK	160	1.9	H	3.01	54.13	74.67	-20.54
900.00	48.98	PK	206	1.9	V	3.01	51.99	74.67	-22.68
1213.00	49.23	PK	7	1.7	H	5.39	54.62	74.00	-19.38
1213.00	48.45	PK	46	1.0	V	5.39	53.84	74.00	-20.16

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)
300.00	59.48	351	1.6	H	-6.73	52.75	74.67	-21.92
300.00	45.14	282	1.5	V	-6.73	38.41	74.67	-36.26
600.00	50.32	319	1.6	H	-6.73	43.59	54.67	-11.08
600.00	55.37	270	1.4	V	-6.73	48.64	54.67	-6.03
900.00	54.13	160	1.9	H	-6.73	47.40	54.67	-7.27
900.00	51.99	206	1.9	V	-6.73	45.26	54.67	-9.41
1213.00	54.62	7	1.7	H	-6.73	47.89	54.00	-6.11
1213.00	53.84	46	1.0	V	-6.73	47.11	54.00	-6.89

Middle channel

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)
360.00	72.56	PK	203	1.2	H	-13.08	59.48	97.97	-38.49
360.00	58.22	PK	163	1.8	V	-13.08	45.14	97.97	-52.83
720.00	50.23	PK	245	1.3	H	0.09	50.32	77.97	-27.65
720.00	55.28	PK	315	1.3	V	0.09	55.37	77.97	-22.60
1080.00	51.12	PK	335	1.0	H	3.01	54.13	77.97	-23.84
1080.00	48.98	PK	293	1.1	V	3.01	51.99	77.97	-25.98
1213.00	49.23	PK	302	1.6	H	5.39	54.62	74.00	-19.38
1213.00	48.45	PK	186	1.1	V	5.39	53.84	74.00	-20.16

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)
360.00	59.48	203	1.2	H	-5.43	54.05	77.97	-23.92
360.00	45.14	163	1.8	V	-5.43	39.71	77.97	-38.26
720.00	50.32	245	1.3	H	-5.43	44.89	57.97	-13.08
720.00	55.37	315	1.3	V	-5.43	49.94	57.97	-8.03
1080.00	54.13	335	1.0	H	-5.43	48.70	57.97	-9.27
1080.00	51.99	293	1.1	V	-5.43	46.56	57.97	-11.41
1213.00	54.62	302	1.6	H	-5.43	49.19	54.00	-4.81
1213.00	53.84	186	1.1	V	-5.43	48.41	54.00	-5.59

High channel

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	72.56	PK	33	1.4	H	-13.08	59.48	100.83	-41.35
433.92	58.22	PK	225	1.8	V	-13.08	45.14	100.83	-55.69
867.84	50.23	PK	167	1.7	H	0.09	50.32	80.83	-30.51
867.84	55.28	PK	151	1.6	V	0.09	55.37	80.83	-25.46
1301.76	51.12	PK	60	1.6	H	3.01	54.13	80.83	-26.70
1301.76	48.98	PK	129	1.7	V	3.01	51.99	80.83	-28.84
1213.00	49.23	PK	67	2.0	H	5.39	54.62	74.00	-19.38
1213.00	48.45	PK	284	1.6	V	5.39	53.84	74.00	-20.16

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	59.48	33	1.4	H	-6.55	52.93	80.83	-27.90
433.92	45.14	225	1.8	V	-6.55	38.59	80.83	-42.24
867.84	50.32	167	1.7	H	-6.55	43.77	60.83	-17.06
867.84	55.37	151	1.6	V	-6.55	48.82	60.83	-12.01
1301.76	54.13	60	1.6	H	-6.55	47.58	60.83	-13.25
1301.76	51.99	129	1.7	V	-6.55	45.44	60.83	-15.39
1213.00	54.62	67	2.0	H	-6.55	48.07	54.00	-5.93
1213.00	53.84	284	1.6	V	-6.55	47.29	54.00	-6.71

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 transmitting time(ms)/ Complete transmission period(ms) *100 %

Duty Cycle Correction Factor(dB)=20 * Log_{10}(Duty Cycle(%))

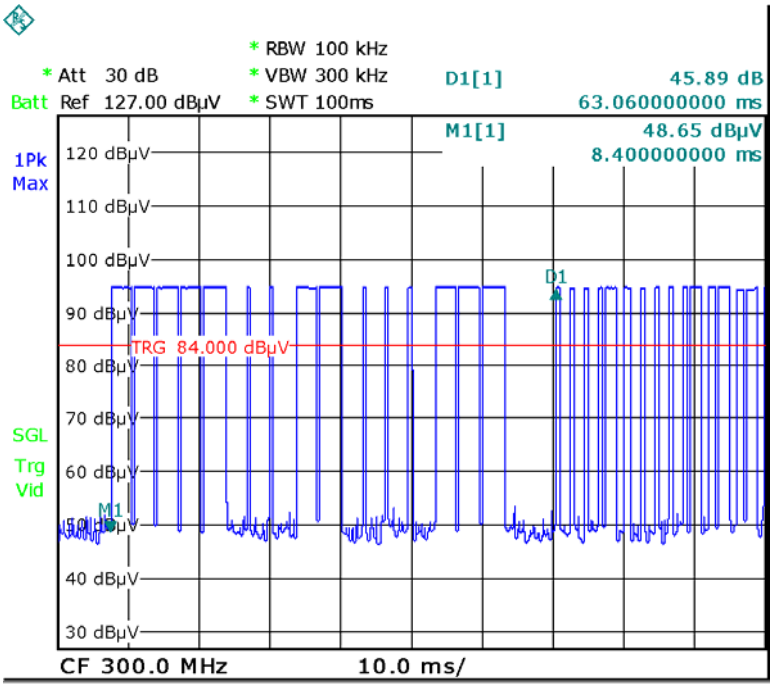
	Low channel	Middle channel	High channel
Total transmitting time(ms)	10*3.22+1.46*4+16*0.5 =46.04	10*3.26+2.9*5+17*0.38 =53.50	10*3.3+1.5*4+16*0.5 =47.00
Complete transmission period(ms)	100	100	100
Duty Cycle(%)	46.04	53.50	47.00
Duty Cycle Correction Factor(dB)	-6.73	-5.43	-6.55

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

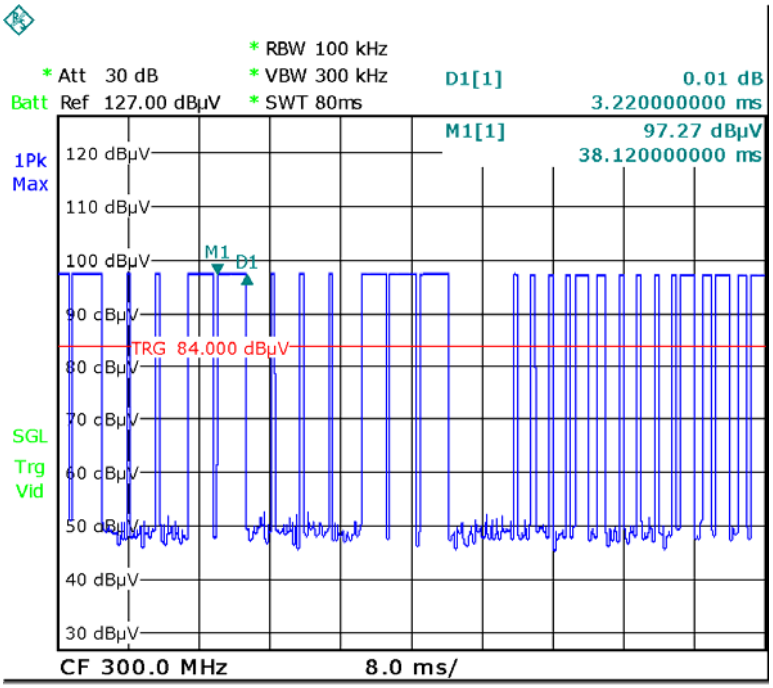
Length of a complete pulse train:

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.

Low channel



Pulse 1



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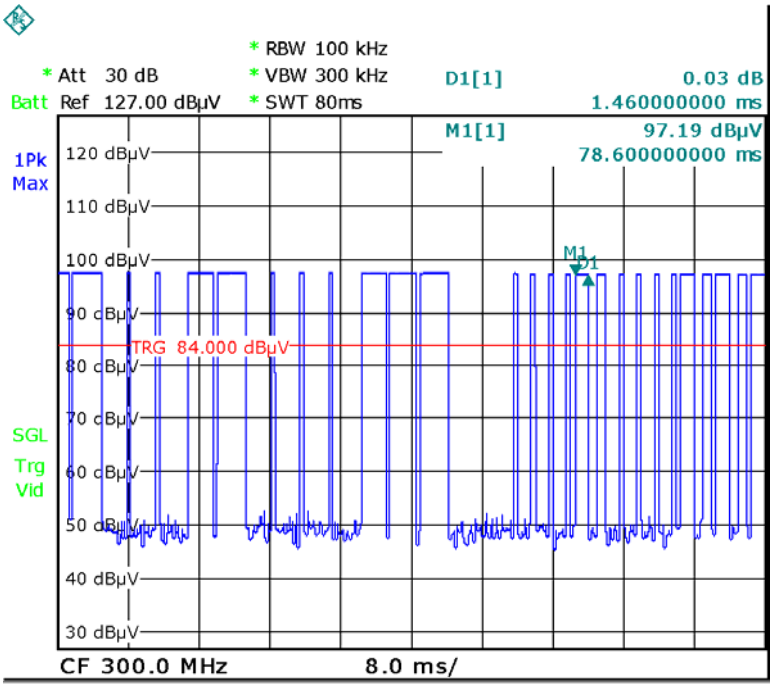

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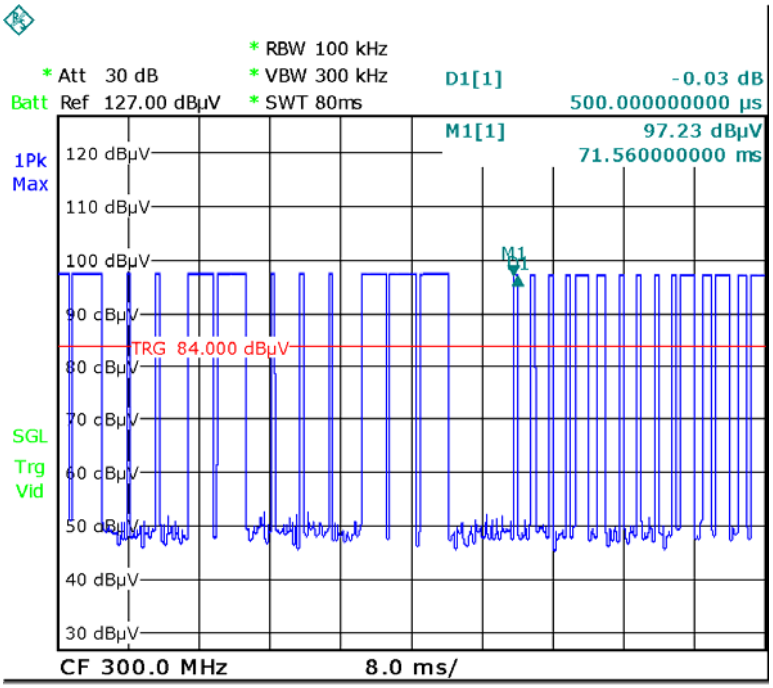
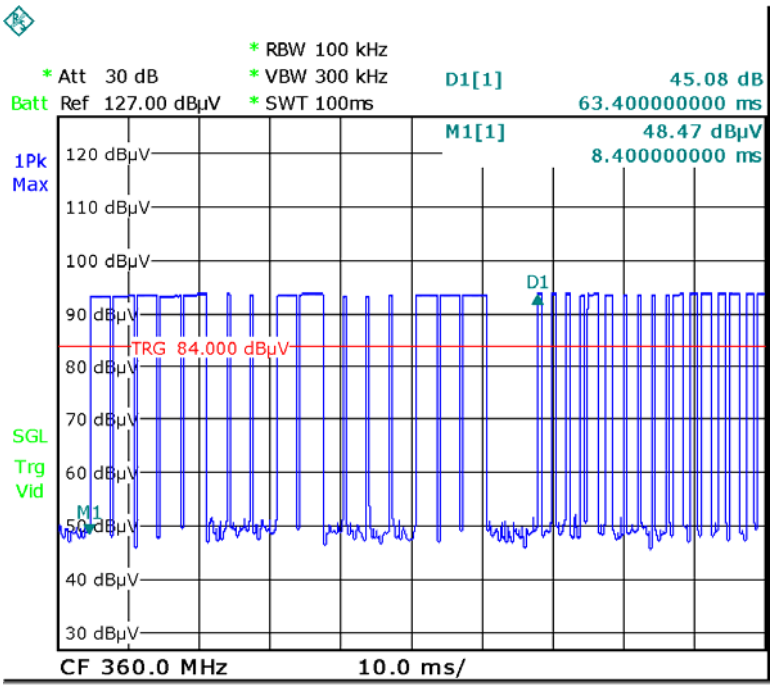


Middle channel



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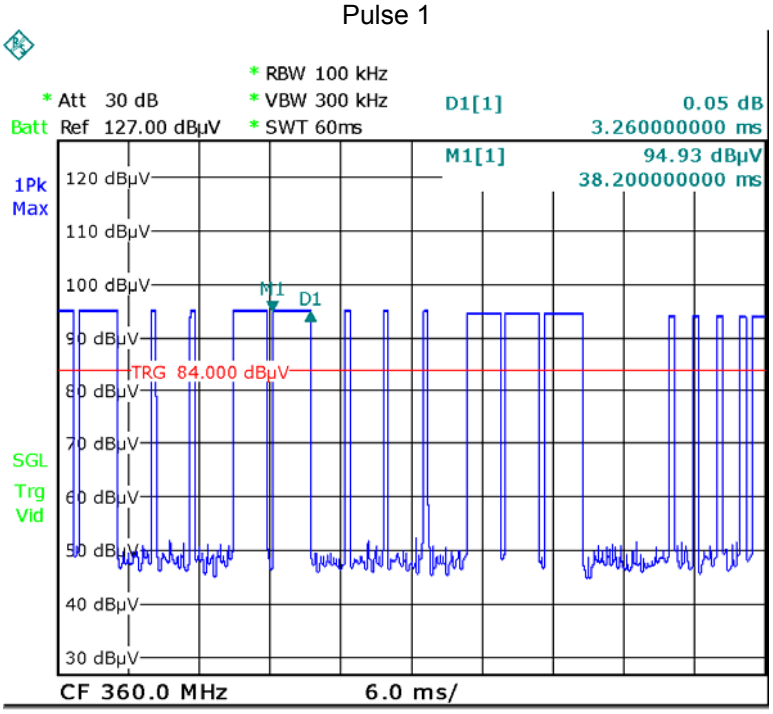

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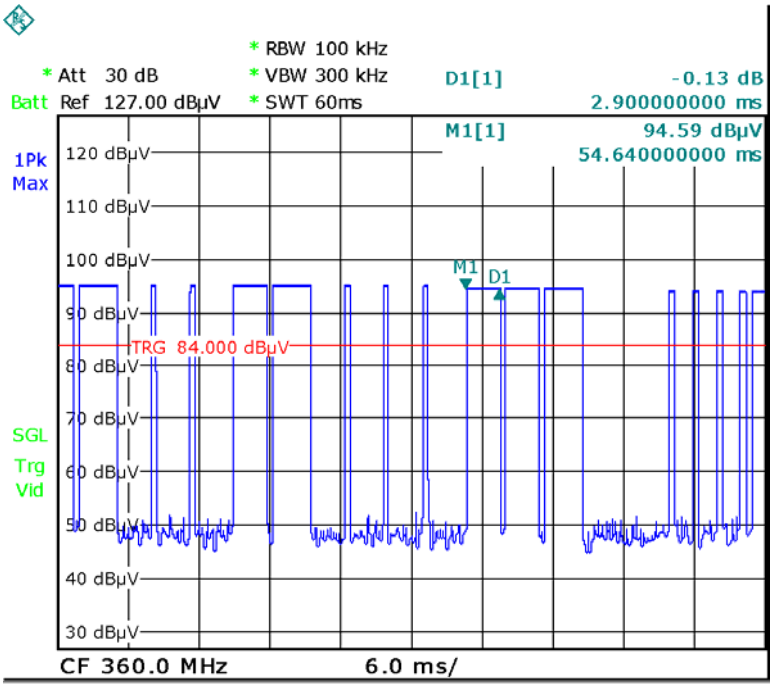

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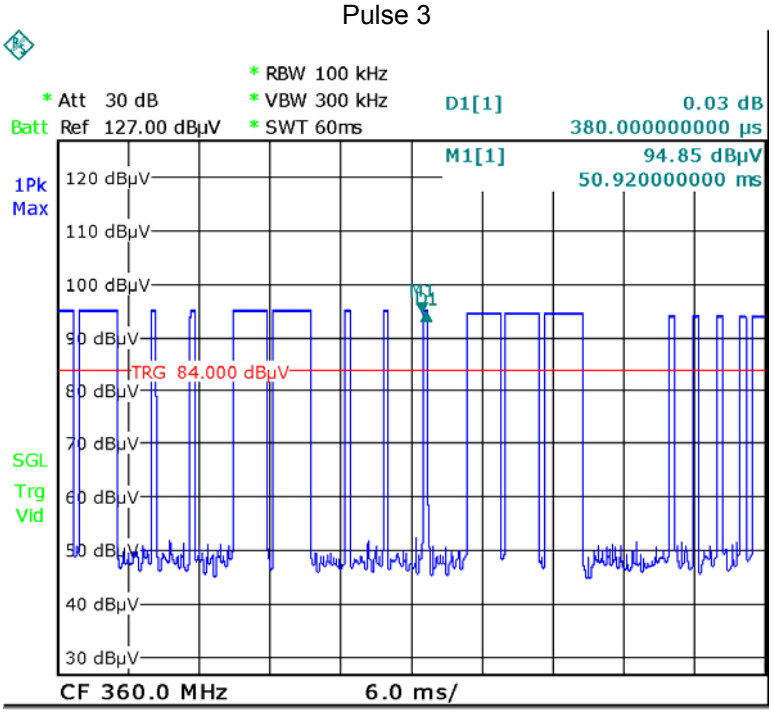
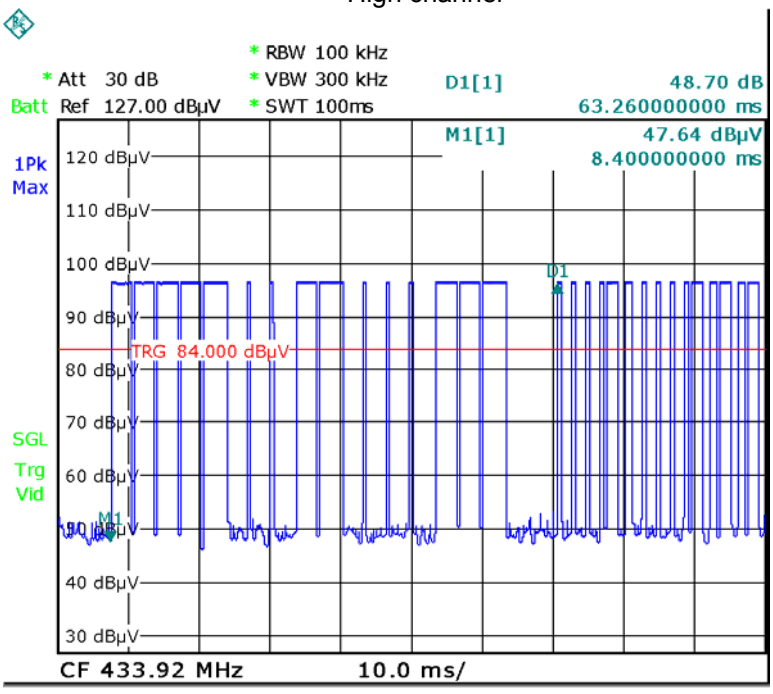


High channel



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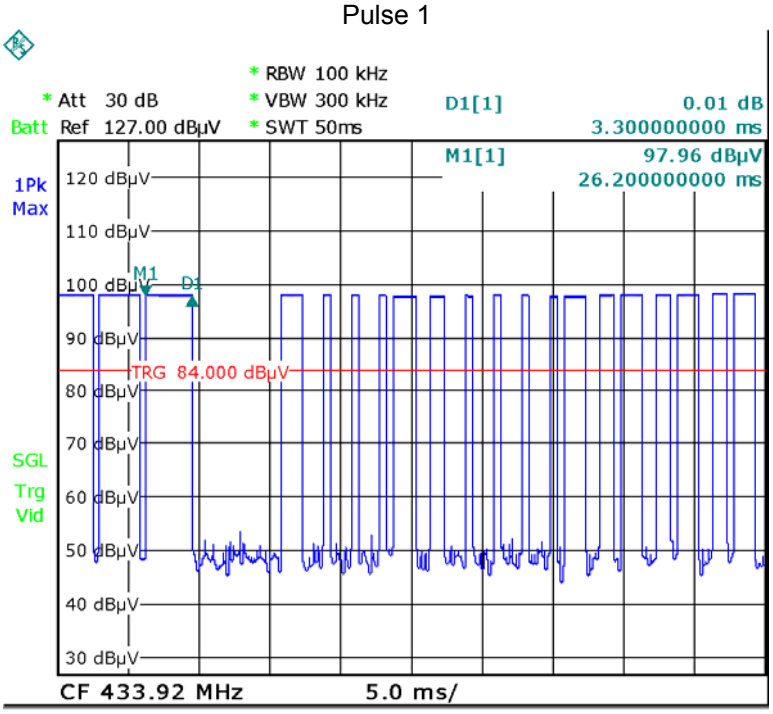

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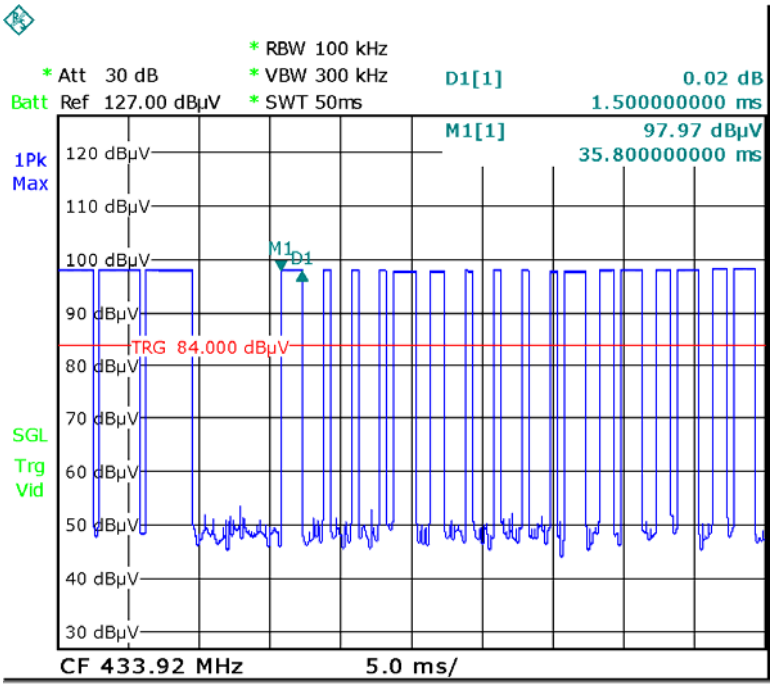

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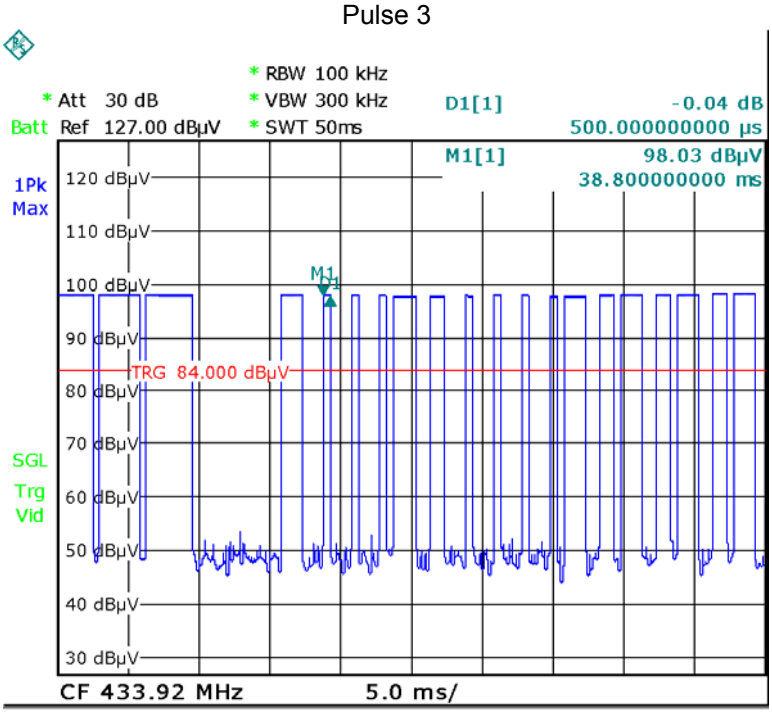
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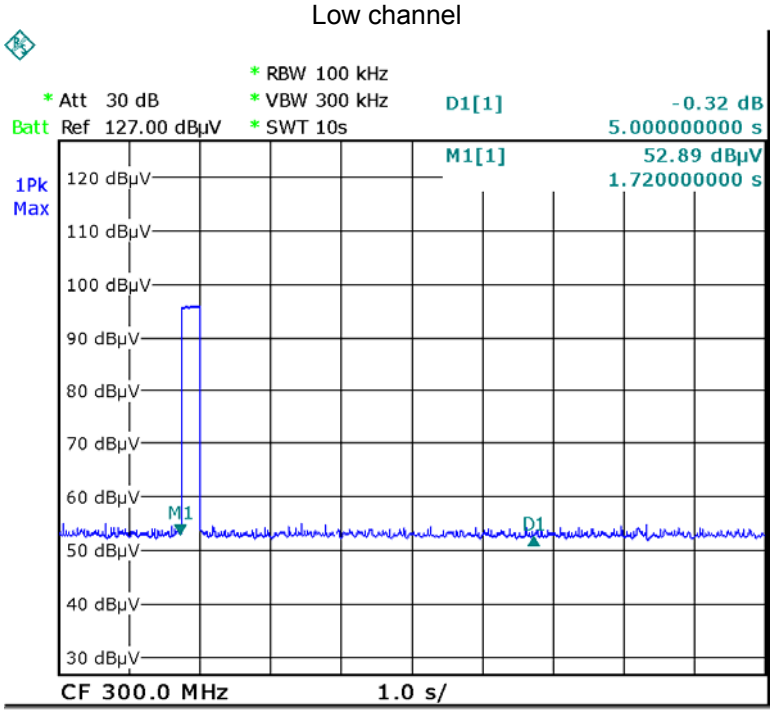
* Att 30 dB
* VBW 300 kHz
D1[1]
-0.04 dB
Batt Ref 127.00 dBµV
* SWT 50ms
500.000000000 µs
M1[1]
98.03 dBµV
38.800000000 ms
1Pk
Max
120 dBµV
110 dBµV
100 dBµV
90 dBµV
TRG 84.000 dBµV
80 dBµV
70 dBµV
SGL
Trg
Vid
60 dBµV
50 dBµV
40 dBµV
30 dBµV
M1
D1
CF 433.92 MHz
5.0 ms/

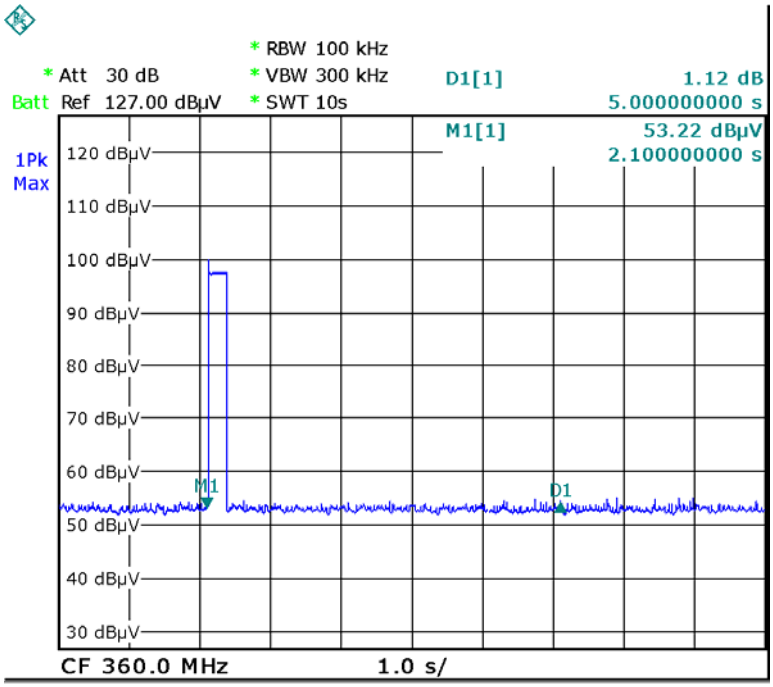
FCC Part15.231(a)(1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

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

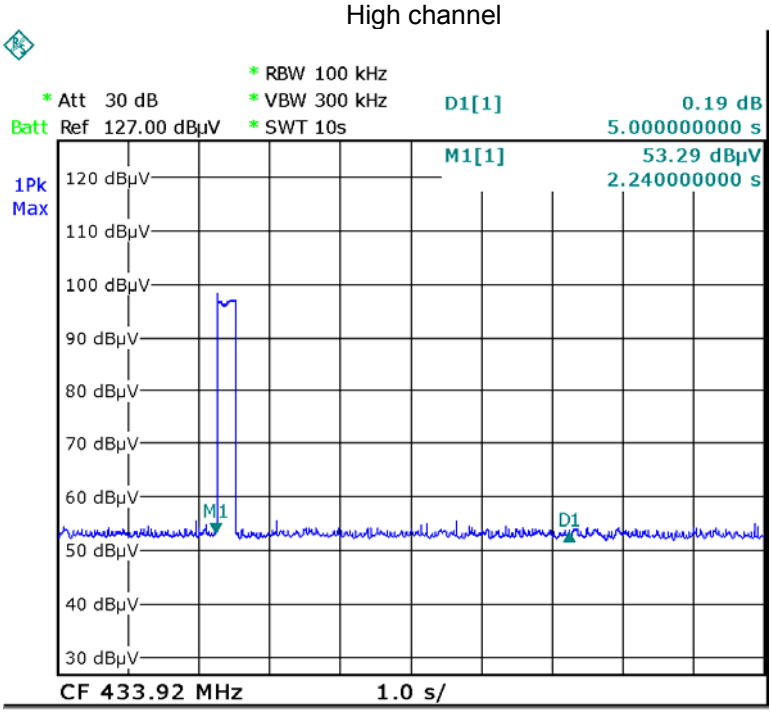
Low channel



Middle channel



High channel



10 20dB Bandwidth

Test Requirement:	FCC Part15.231(c)
Test Method:	FCC Part15.231(c)&ANSI C63.10:2013
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 1kHz RBW and 3kHz VBW.The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power 20dB.

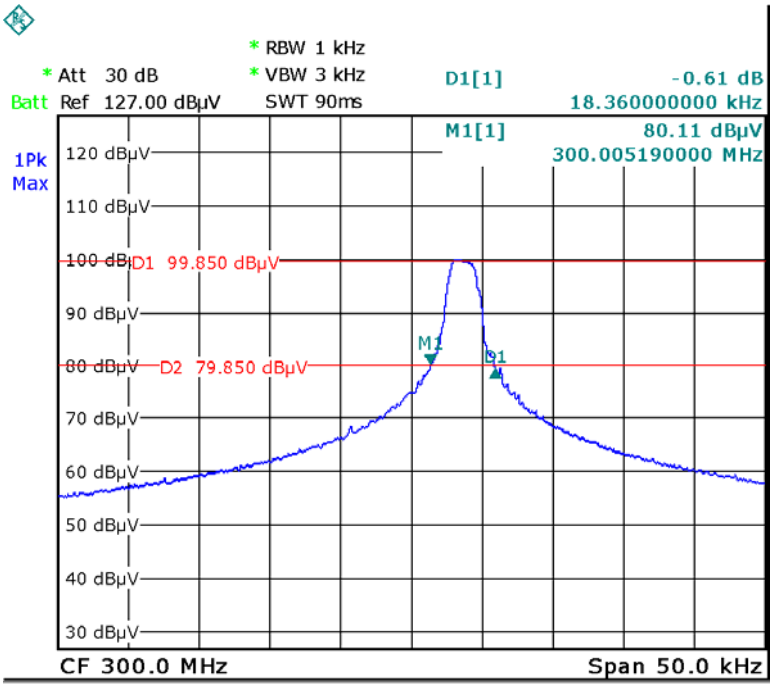
10.2 Test Result

Frequency (MHz)	Bandwidth Emission (kHz)	Limit (kHz)	Result
300.00	18.36	750	Compliance
360.00	15.97	900	Compliance
433.92	17.96	1085	Compliance

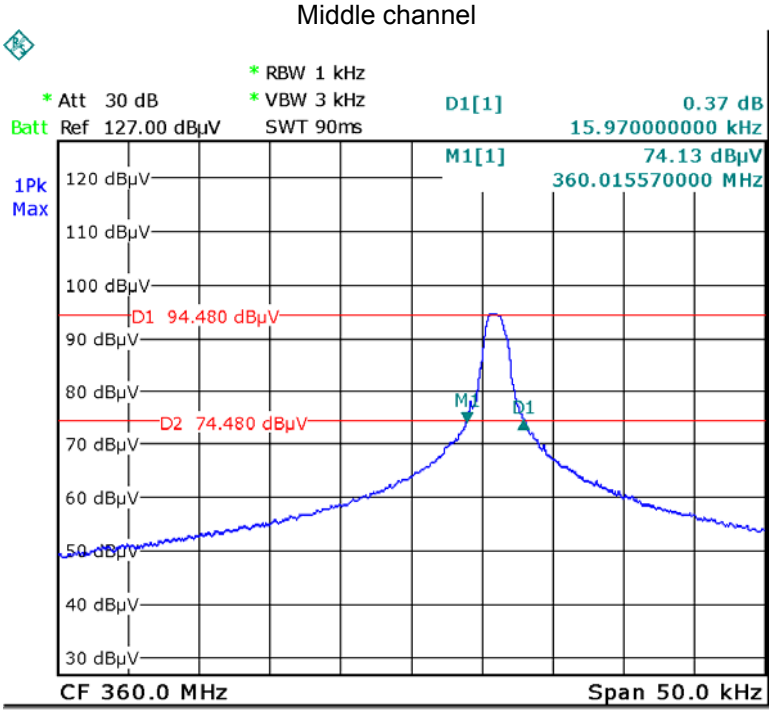
Limit=Center Frequency*0.25%

Test Plot

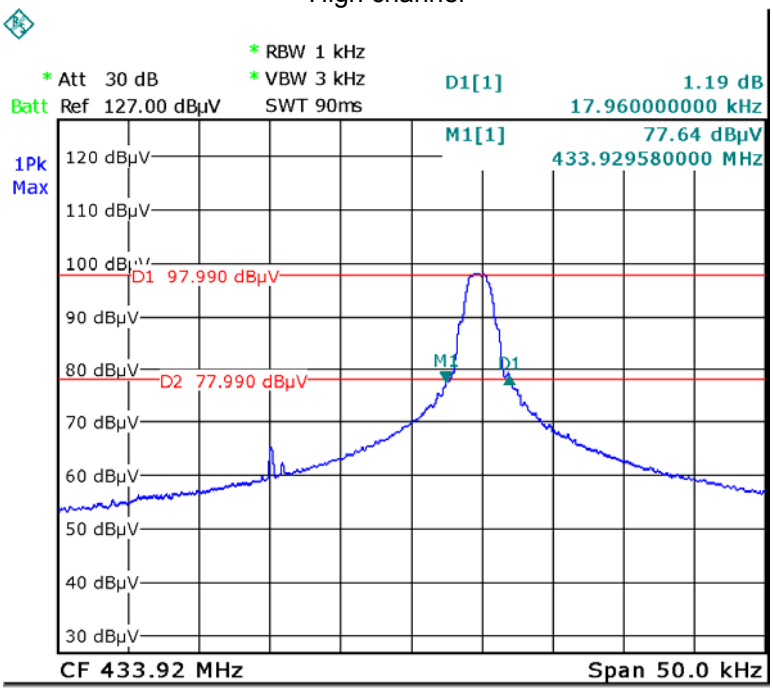
Low channel



Middle channel



High channel



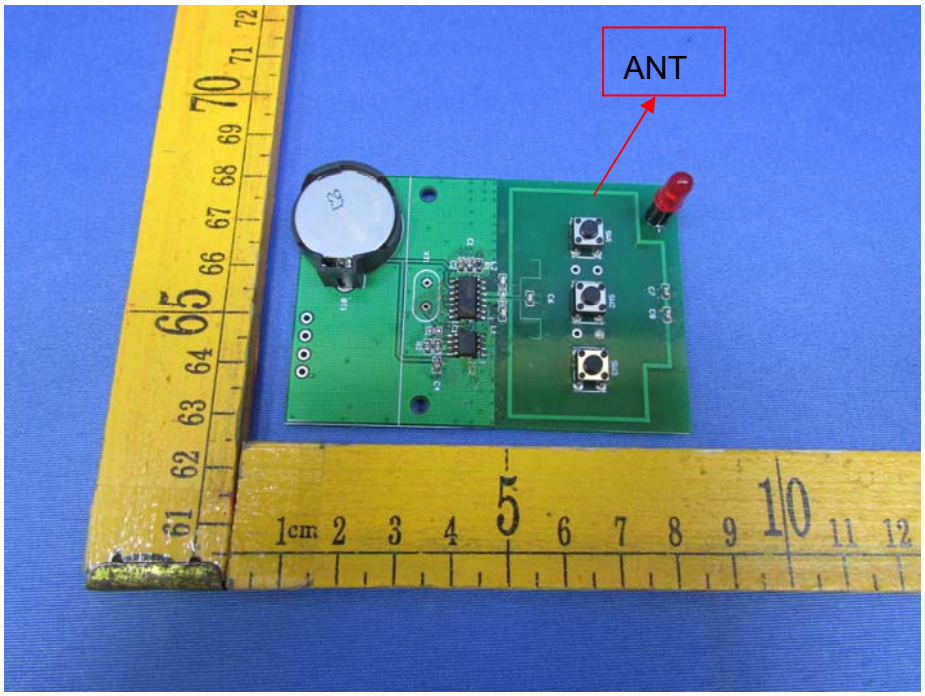
11 Antenna Requirement

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 §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 §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.

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.

Result:

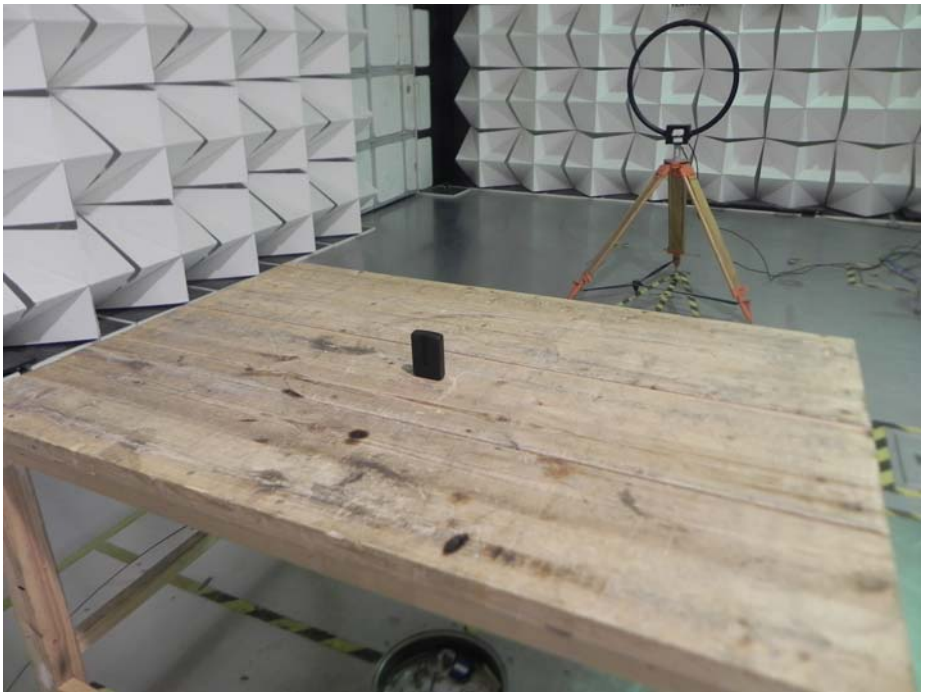
The EUT has one PCB Loop Antenna, the gain is -3dBi. meets the requirements of FCC 15.203.



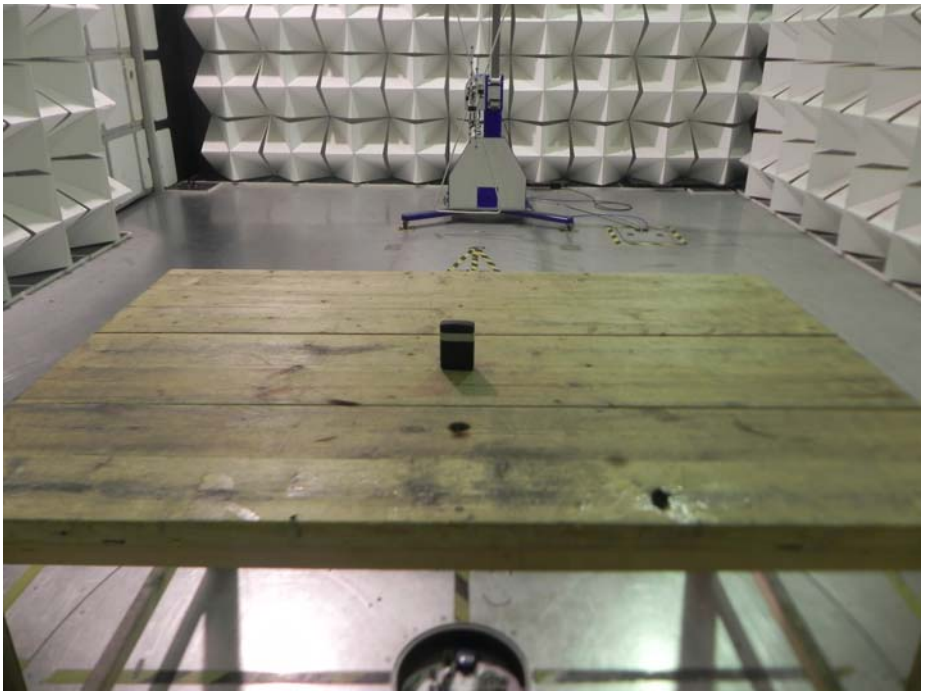
12 Photographs- Model U220S5 Test Setup Photos

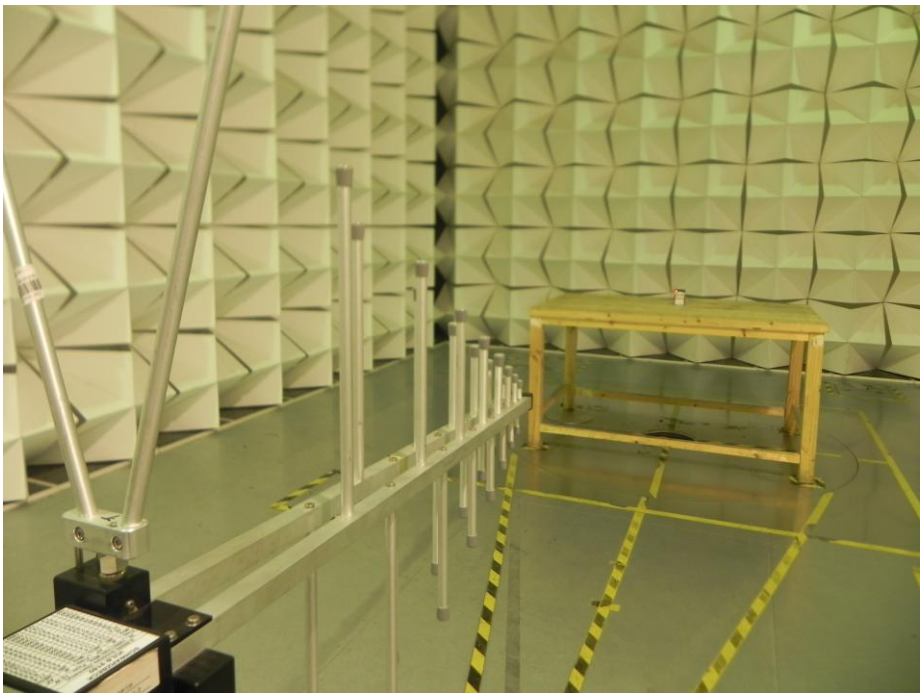
12.1 Radiated Emission Test Setup

6MHz to 30MHz Test site 2#

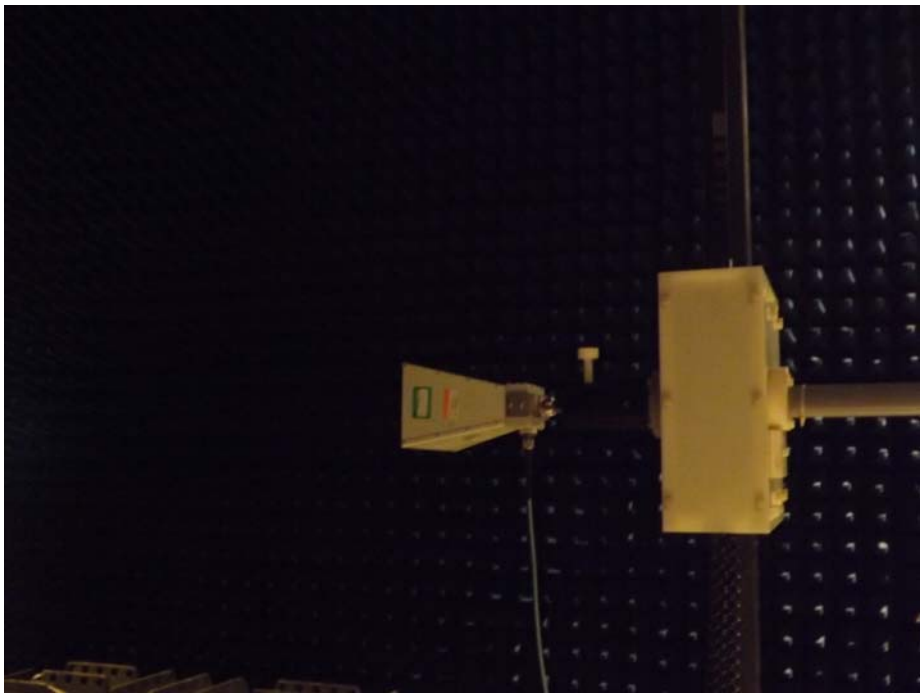


From 30MHz to 1GHz Test site 2#





Above 1GHz Test site 1#



13 Photographs - Constructional Details

13.1 Model U220S5 - Internal Photos

Model No.:U220S5-1

Model No.:U220S5-2

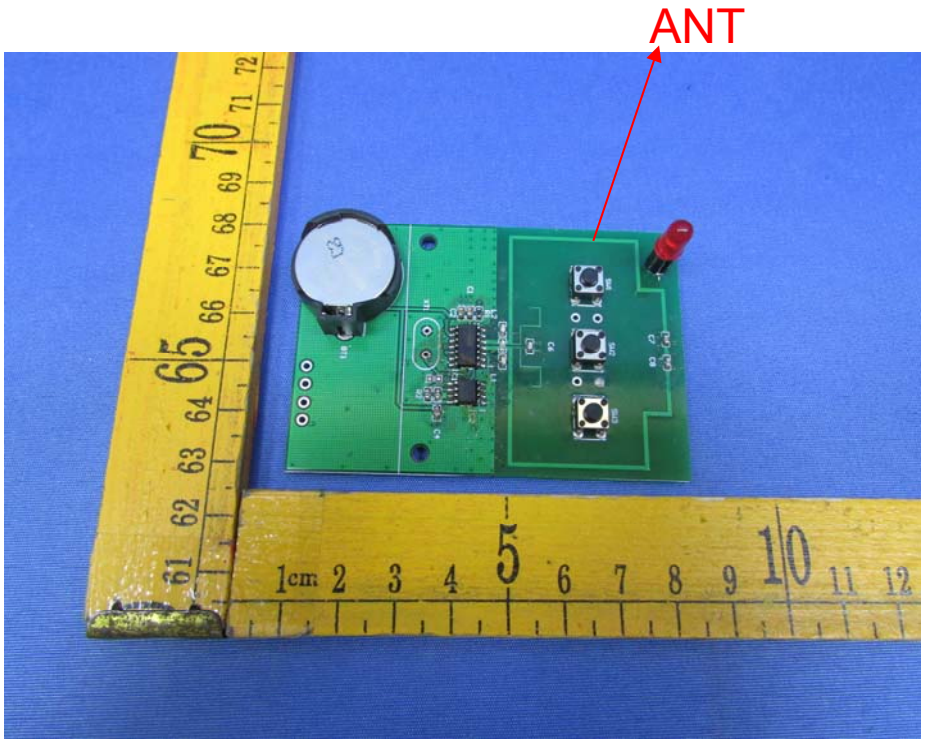
Model No.:U220S5-3

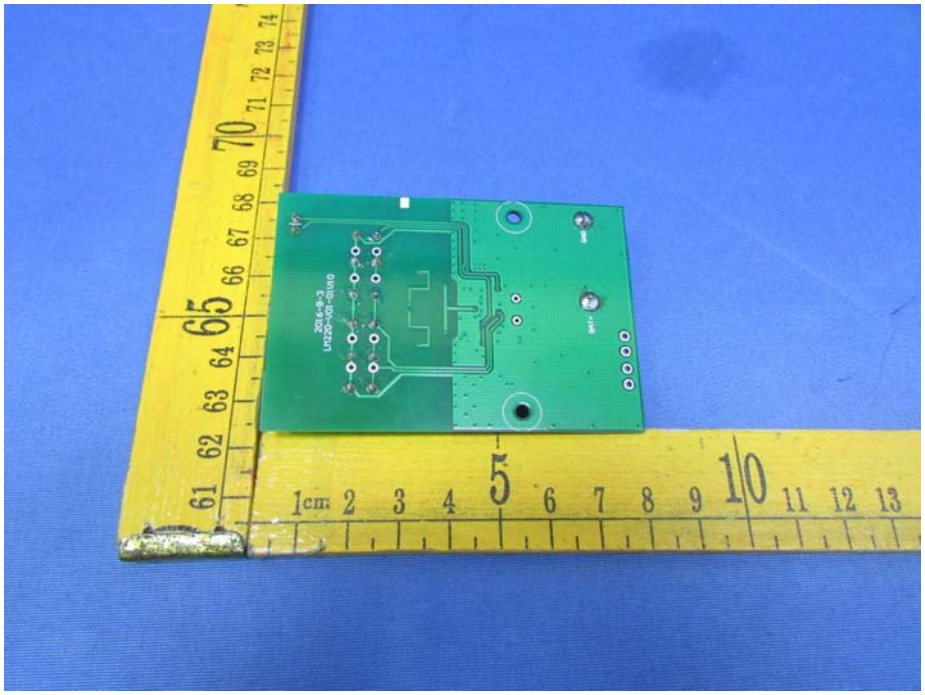

1cm 2 3 4 5 6 7 8 9 10 11
61 62 63 64 65 66 67 68 69 70


1cm 2 3 4 5 6 7 8 9 10 11 12 13
61 62 63 64 65 66 67 68 69 70

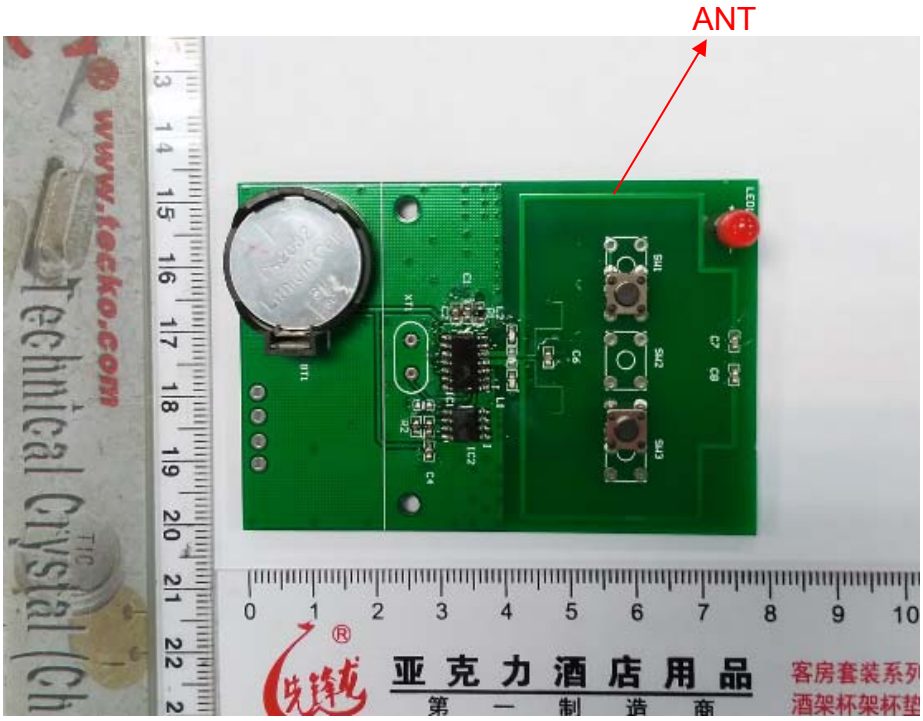
13.2 Model U220S5-Internal Photos

Model No.:U220S5-3





Model No.:U220S5-2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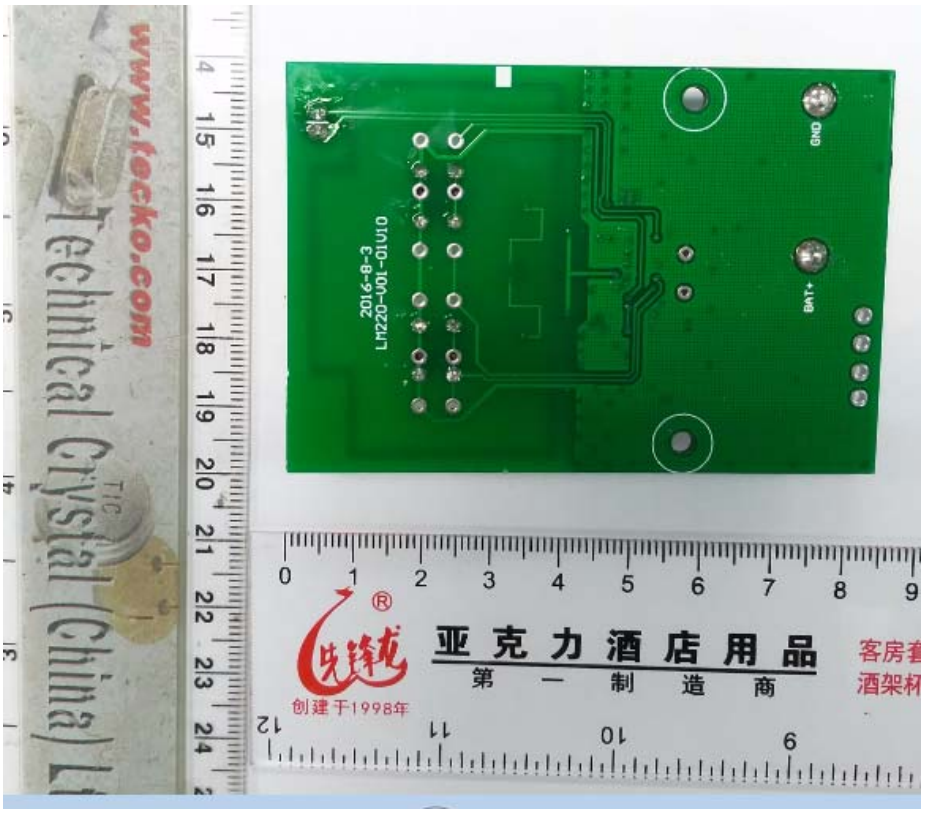
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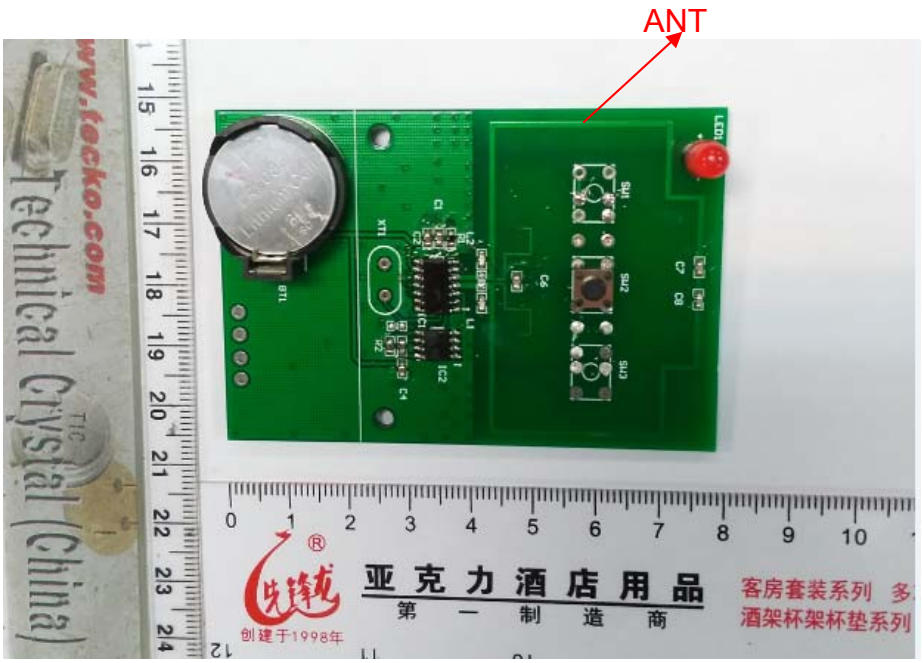
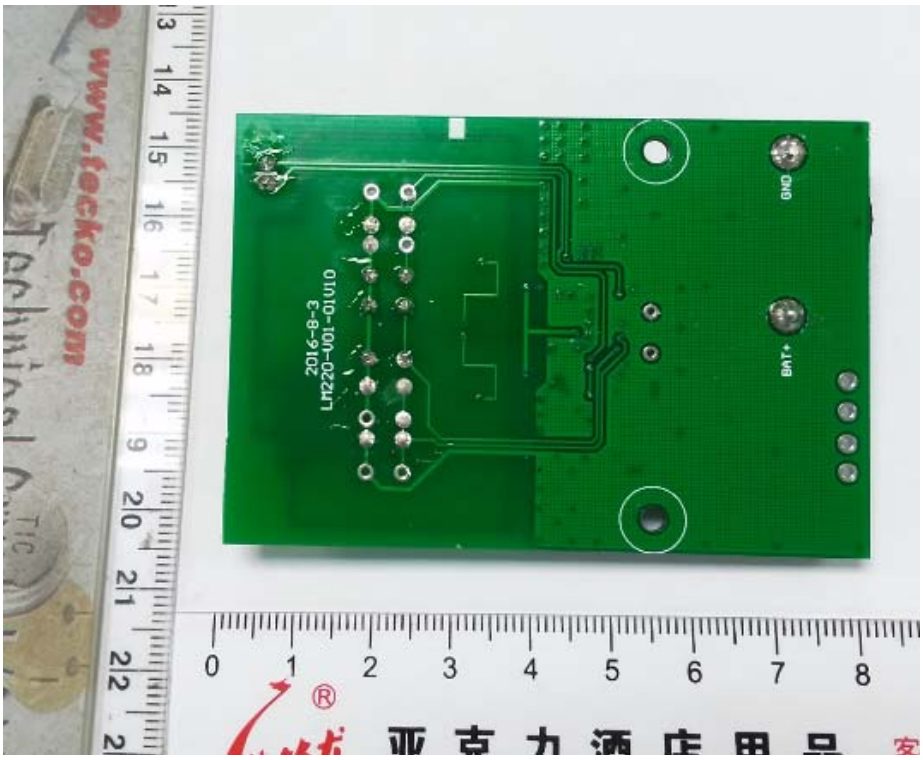
Model No.:U220S5-1





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