FCC Test Report

FCC Rule(s):	FCC Part 15.231
Applicant:	Ningbo DoWell Tools Co., Ltd.
Product Name:	Remote Control
Model:	9164-6001
FCC ID:	2AHRT9164-6001
Report No.:	ZKS16030061E
Tested Date:	2016-03-22 to 2016-03-24
Issued Date:	2016-03-29
Tested By :	William Liu (Engineer)
Approved By:	Lahm Peng (Manager)
Prepared By:	

Shenzhen ZRLK Testing Technology Co., Ltd.

6F, Fuxinfa Industrial Park, Liuxiandong, Xili Street, Nanshan District, Shenzhen, China

Tel.: +86-755-29305110 Fax.: +86-755-36602376 Website: www.zrlklab.com

CONTENTS

1. General Information

1.1 Product Information

Applicant and Manufacturer	
Applicant:	Ningbo DoWell Tools Co., Ltd.
Address of Applicant:	9# Yunhuan Road, Industrial Park, Simen Town, Yuyao City,
	Zhejiang Province, China
Manufacturer:	Ningbo DoWell Tools Co., Ltd.
Address of Manufacturer:	9# Yunhuan Road, Industrial Park, Simen Town, Yuyao City,
	Zhejiang Province, China

General Description of EUT	
Product Name:	Remote Control
Model No.:	9164-6001
Trade Name:	WEN
Adding Model(s):	3410T-As03
Class of Equipment:	SRD
Rated Voltage:	DC 3V
TX Frequency:	433.92MHz
Modulation:	ASK
Type of Antenna:	PCB Antenna
Antenna Gain:	0 dBi
Note 1: The test data is gathered from a production sample, provided by the manufacturer.	

1.2 Compliance Standards

Compliance Standards or Rules	
FCC Part 15 Subpart C	FEDERAL COMMUNICATIONS COMMISSION, RADIO FREQUENCY DEVICES, Intentional Radiators
FCC Part 15.231	Periodic operation in the band 40.66 - 40.70 MHz and above 70 MHz.
The objective of the manufacturer or applicant is to demonstrate compliance with the above standards.	
According to standards for test methodology	
ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices Accredited Standards Committee C63®—Electromagnetic Compatibility
All measurements contained in this report were conducted with all above standards	
Maintenance of compliance is the responsibility of the manufacturer or applicant. Any modification of the product, which result is lowering the emission, should be checked to ensure compliance has been maintained.	

1.3 Test Facilities

Testing Lab: Shenzhen BALUN Technology Co., Ltd.
The laboratory is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is **L6791**.
The laboratory has been listed by US Federal Communications Commission to perform electromagnetic emission measurements. The recognition numbers of test site are **832625**.
The laboratory has been listed by Industry Canada to perform electromagnetic emission measurements. The recognition numbers of test site are **11524A-1**.
All measurement facilities used to collect the measurement data are located at Block B, FL 1, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China 518055

1.4 Test Setup Information

List of Test Modes			
Test Mode	Description	Remark	
TM1	Transmitting	--	
List and Details of Auxiliary Equipment			
Description	Manufacturer	Model	Serial Number
--	--	--	--
The equipment under test (EUT) was configured to measure its highest possible emission and immunity level. The test modes were adapted according to the operation manual for use.			

1.5 Measurement Uncertainty

Parameter	Conditions	Uncertainty
Conducted Emissions	9kHz ~30MHz	±2.79 dB
Radiated Emissions	30MHz ~ 1GHz	±3.45 dB
Radiated Emissions	1Hz ~ 6GHz	±3.67dB

1.6 List of Test and Measurement Instruments

Description	**Manufacturer**	**Model**	**Serial Number**	**Due. Date**
EMI Receiver	ROHDE&SCHWARZ	ESRP	101036	2016-07-13
Test Antenna-Bi-Log	SCHWARZBECK	VULB 9163	9163-624	2016-07-21
Test Antenna-Horn	SCHWARZBECK	BBHA 9120D	9120D-1148	2016-07-21
Test Antenna-Loop	SCHWARZBECK	FMZB 1519	1519-037	2016-07-21
Anechoic Chamber	RAINFORD	9m*6m*6m	N/A	2017-02-27
Spectrum Analyzer	Agilent	E4407B	US40521006	2016-07-13
Amplifier	Mini-Circuits	ZHL-42W+	N/A	2016-07-13
Wideband Amplifier	Mini-Circuits	ZVA-213-S+	N/A	2016-07-13
Test Cable	BALUN	BLEMC001	N/A	2016-07-13

2. Summary of Test Results

FCC Rules	Description of Test Items	Result
FCC Part 15.203	Antenna Requirement	Passed
FCC Part 15.205	Restricted Band of Operation	Passed
FCC Part 15.209	Radiated Spurious Emissions	Passed
FCC Part 15.231(a)	Deactivation Testing	Passed
FCC Part 15.231(b)	Radiated Emissions	Passed
FCC Part 15.231(c)	20dB Bandwidth Testing	Passed
FCC Part 15.207(a)	Conducted Emissions	N/A
Passed: The EUT complies with the essential requirements in the standard Failed: The EUT does not comply with the essential requirements in the standard N/A: Not applicable		

3. Antenna Requirement

3.1 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.

3.2 Test Result

This product has a permanent antenna, fulfill the requirement of this section.

4. Radiated Emissions

4.1 Standard and Limit

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

Frequency of Emission (MHz)	Field Strength of Fundamental (uV/m)	Field Strength of Spurious Emissions (uV/m)
40.66-40.70	2250	225
70-130	1250	125
130-174	1250 to 3750**	125 to 375**
174-260	3750	375
260-470	3750 to 12500**	375 to 1250**
Above 470	12500	1250
** linear interpolations Limits at a measurement distance of 3 m		

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 general limits in FCC Part 15.209

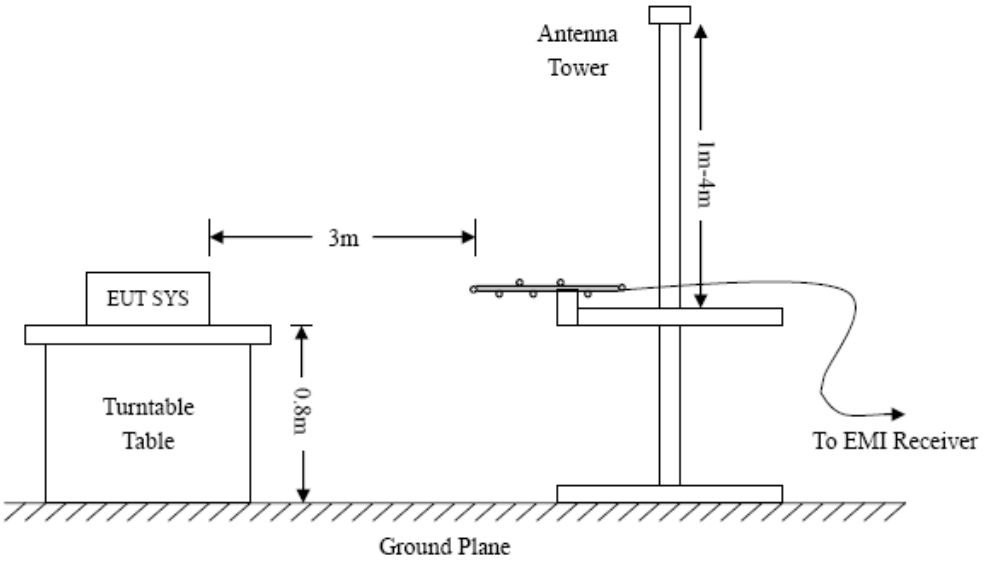
Frequency of Emission (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	
	QP	QP	AV
30-88	100	40	--
88-216	150	43.5	--
216-960	200	46	--
Above 960	500	54	74
Limits at a measurement distance of 3 m			

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.

4.2 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.



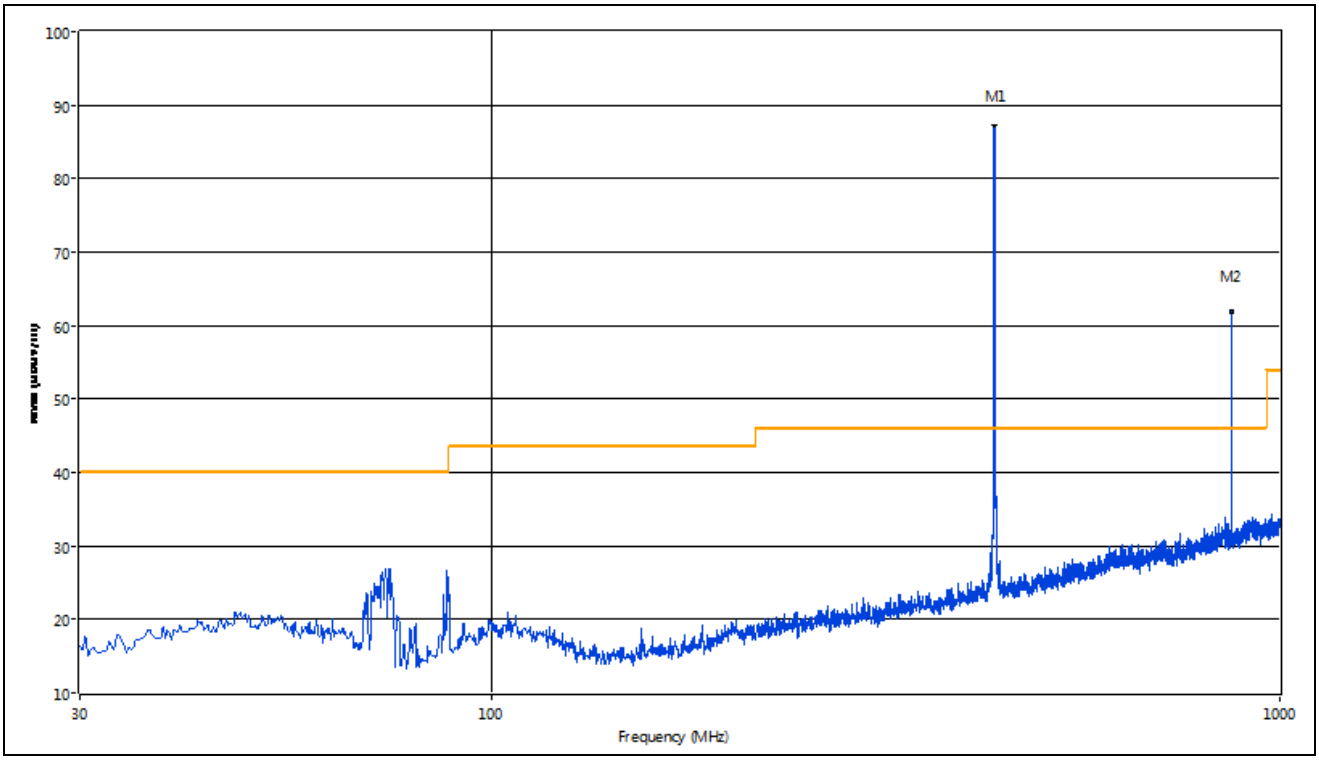
4.3 Test Data and Results

According to the data below, the FCC Part 15.205, 15.209 and 15.231 standards, and had the worst margin of:

-1.22 dB at **3905.28 MHz** in the **Horizontal** polarization, **Average Detector**, **9 kHz to 5 GHz**, **3 Meters**

Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.

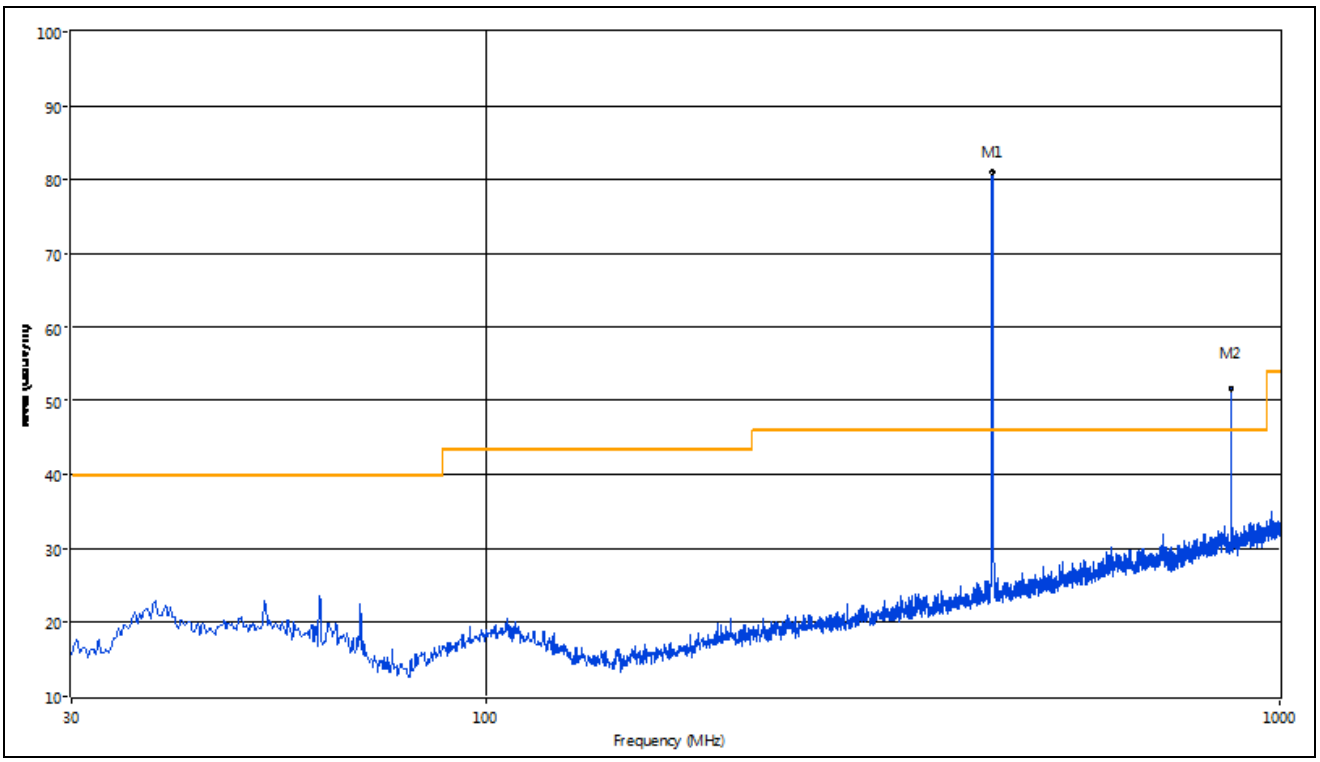
Test Plots and Data of Radiated Emissions (30MHz to 1GHz)	
Tested Model:	9164-6001
Tested Mode:	TM1
Test Power Specification:	DC 3V
Test Antenna Polarization:	Horizontal



No.	Frequency	Results	Factor	Limit	Margin	Detector	Table	Height	ANT
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dB)		(°)	(cm)	
1	433.92	86.63	-14.67	100.8	14.17	Peak	234.10	100	Horizontal
2	867.84	61.83	-6.30	80.8	18.97	Peak	279.30	100	Horizontal

No.	Frequency	PK Results	$Factor_{DC}$	AV Results	Limit	Margin	Detector	ANT
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)		
1	433.92	86.63	-8.59	78.04	80.8	2.76	Peak	Horizontal
2	867.84	61.83	-8.59	53.24	60.8	7.56	Peak	Horizontal

Test Plots and Data of Radiated Emissions (30MHz to 1GHz)	
Tested Model:	9164-6001
Tested Mode:	TM1
Test Power Specification:	DC 3V
Test Antenna Polarization:	Vertical



No.	Frequency	Results	Factor	Limit	Margin	Detector	Table	Height	ANT
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dB)		(°)	(cm)	
1	433.92	81.11	-14.67	100.8	19.69	Peak	92.90	100	Vertical
2	867.84	51.66	-6.30	80.8	29.14	Peak	87.70	100	Vertical

No.	Frequency	PK Results	$Factor_{DC}$	AV Results	Limit	Margin	Detector	ANT
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)		
1	433.92	81.11	-8.59	72.52	80.8	8.28	Peak	Vertical
2	867.84	51.66	-8.59	43.07	60.8	7.73	Peak	Vertical

Test Plots and Data of Radiated Emissions (1GHz to 5GHz)	
Tested Model:	9164-6001
Tested Mode:	TM1
Test Power Specification:	DC 3V
Test Antenna Polarization:	Horizontal

No.	Frequency	Results	Factor	Limit	Margin	Detector	Table	Height	ANT
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dB)		(°)	(cm)	
1	2169.60	59.48	-1.01	80.8	21.32	Peak	324.10	100	Horizontal
2	2603.52	63.33	0.51	80.8	17.47	Peak	134.00	100	Horizontal
3	3037.44	61.01	9.07	80.8	19.79	Peak	117.90	100	Horizontal
4	3471.36	54.72	9.52	80.8	26.08	Peak	122.30	100	Horizontal
5	3905.28	61.37	10.87	74.0	12.63	Peak	113.40	100	Horizontal
6	4339.20	52.85	12.19	74.0	21.15	Peak	1.20	100	Horizontal
7	4772.12	55.92	13.62	74.0	18.08	Peak	359.70	100	Horizontal

No.	Frequency	PK Results	$Factor_{DC}$	AV Results	Limit	Margin	Detector	ANT
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)		
1	2169.60	59.48	-8.59	50.89	60.8	9.91	Peak	Horizontal
2	2603.52	63.33	-8.59	54.74	60.8	6.06	Peak	Horizontal
3	3037.44	61.01	-8.59	52.42	60.8	8.38	Peak	Horizontal
4	3471.36	54.72	-8.59	46.13	60.8	14.67	Peak	Horizontal
5	3905.28	61.37	-8.59	52.78	54.0	1.22	Peak	Horizontal
6	4339.20	52.85	-8.59	44.26	54.0	9.74	Peak	Horizontal
7	4772.12	55.92	-8.59	47.33	54.0	6.67	Peak	Horizontal

Test Plots and Data of Radiated Emissions (1GHz to 5GHz)	
Tested Model:	9164-6001
Tested Mode:	TM1
Test Power Specification:	DC 3V
Test Antenna Polarization:	Vertical

No.	Frequency	Results	Factor	Limit	Margin	Detector	Table	Height	ANT
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dB)		(°)	(cm)	
1	2169.60	67.12	-1.01	80.8	13.68	Peak	317.90	100	Vertical
2	2603.52	62.34	0.51	80.8	18.46	Peak	286.00	100	Vertical
3	3037.44	62.18	9.07	80.8	18.62	Peak	289.70	100	Vertical
4	3471.36	56.24	9.52	80.8	24.56	Peak	280.80	100	Vertical
5	3905.28	60.99	10.84	74.0	13.01	Peak	155.20	100	Vertical
6	4339.20	55.14	12.19	74.0	18.86	Peak	299.00	100	Vertical
7	4772.12	54.96	13.54	74.0	19.04	Peak	105.20	100	Vertical

No.	Frequency	PK Results	$Factor_{DC}$	AV Results	Limit	Margin	Detector	ANT
	(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dBuV/m)	(dB)		
1	2169.60	67.12	-8.59	58.53	60.8	2.27	Peak	Vertical
2	2603.52	62.34	-8.59	53.75	60.8	7.05	Peak	Vertical
3	3037.44	62.18	-8.59	53.59	60.8	7.21	Peak	Vertical
4	3471.36	56.24	-8.59	47.65	60.8	13.15	Peak	Vertical
5	3905.28	60.99	-8.59	52.40	54.0	1.60	Peak	Vertical
6	4339.20	55.14	-8.59	46.55	54.0	7.45	Peak	Vertical
7	4772.12	54.96	-8.59	46.37	54.0	7.63	Peak	Vertical

Note 1: Testing is carried out with frequency rang 9kHz to the tenth harmonics, which 3rd and 4th Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
The measurements greater than 20dB below the limit from 9kHz to 30MHz.
Note 2: Average Result = Peak Result + $Factor_{DC}$ (Duty Cycle Correction Factor)
Note 3: Duty Cycle Correction Factor = 20log (Duty Cycle) =20log(0.372)=-8.59

5. 20dB Bandwidth

5.1 Standard and Limit

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.

5.2 Test Procedure

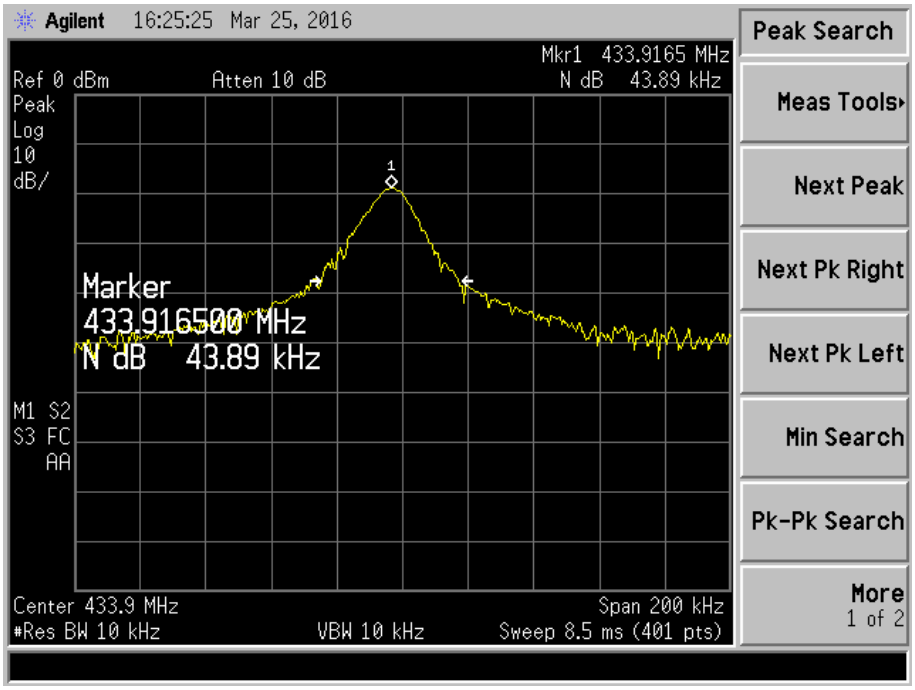
With the EUT's antenna attached, the EUT's 20dB Bandwidth power was received by the test antenna, which was connected to the spectrum analyzer with the START, and STOP frequencies set to the EUT's operation band.

5.3 Test Data and Results

Test Frequency MHz	20dB Bandwidth kHz	Limit kHz	Result
433.92	43.89	1084	Passed
Limit = Fundamental Frequency X 0.25% = 433.92 MHz X 0.25% = 1084 kHz			

Please refer to the attached plots.

20dB Bandwidth



6. Transmission Time

6.1 Standard and Limit

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.

6.2 Test Procedure

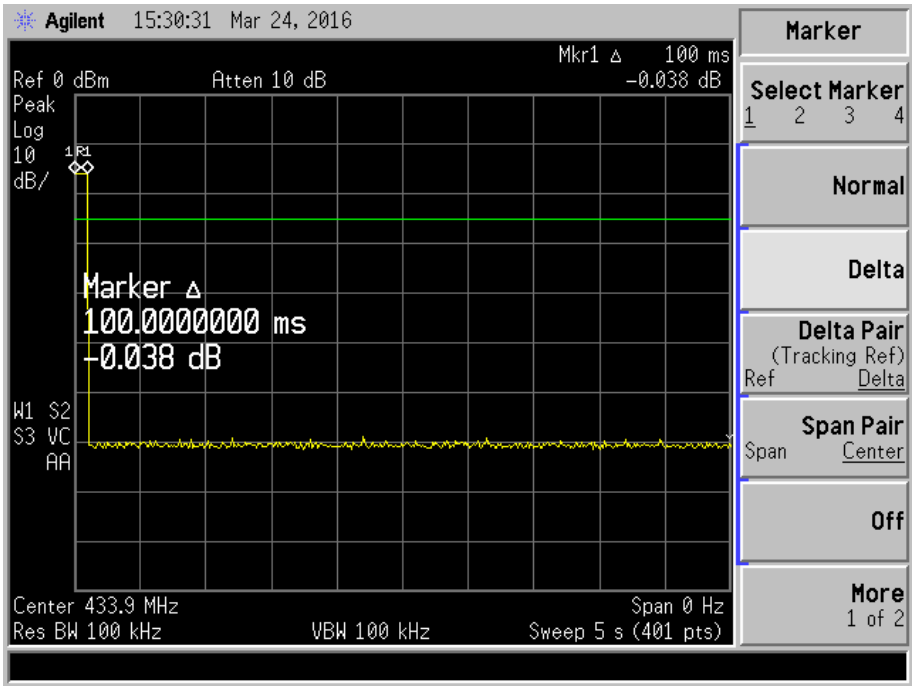
With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer. Set the center frequency to 433.92MHz, than set the spectrum analyzer to Zero Span for the release time reading. During the testing, the switch was released then the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

6.3 Test Data and Results

Transmission Type	Test Frequency MHz	Transmission Time s	Limit s	Result
Manually	433.92	0.1	5	Passed

Please refer to the attached plots.

Transmission Time



7. Duty Cycle

7.1 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.

7.2 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.

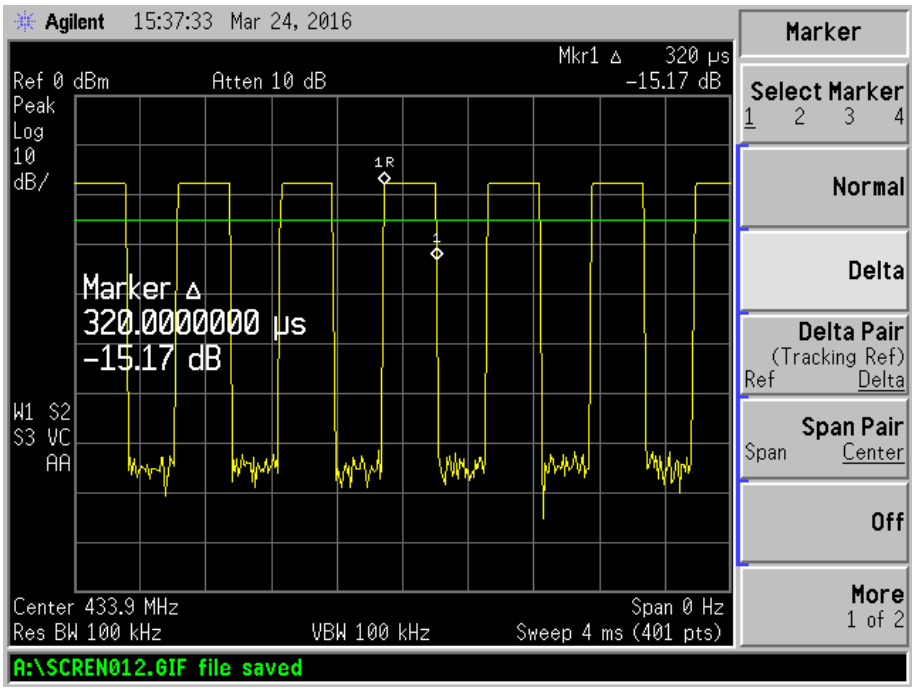
7.3 Test Data and Results

Type of Pulse	Width of Pulse ms	Quantity of Pulse	Transmission Time ms	Total Time (Ton) ms
Pulse 1	0.32	24	7.68	37.2
Pulse 2	0.93	24	22.32	
Pulse 3	0.30	24	7.2	
Quantity of pulse 2 or pulse 3 = 8 * 3 (period) = 24				

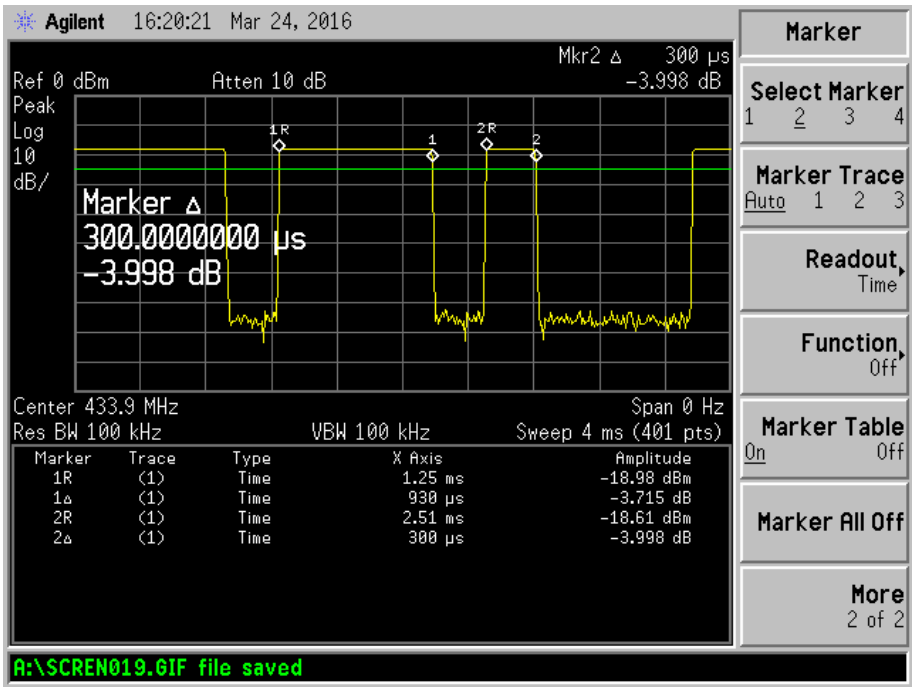
Test Period (Tp) ms	Total Time (Ton) ms	Duty Cycle	Duty Cycle Factor dB
100	37.2	0.372	-8.59
Duty cycle factor = 20 * Log(Duty cycle)			

Please refer to the attached test plots

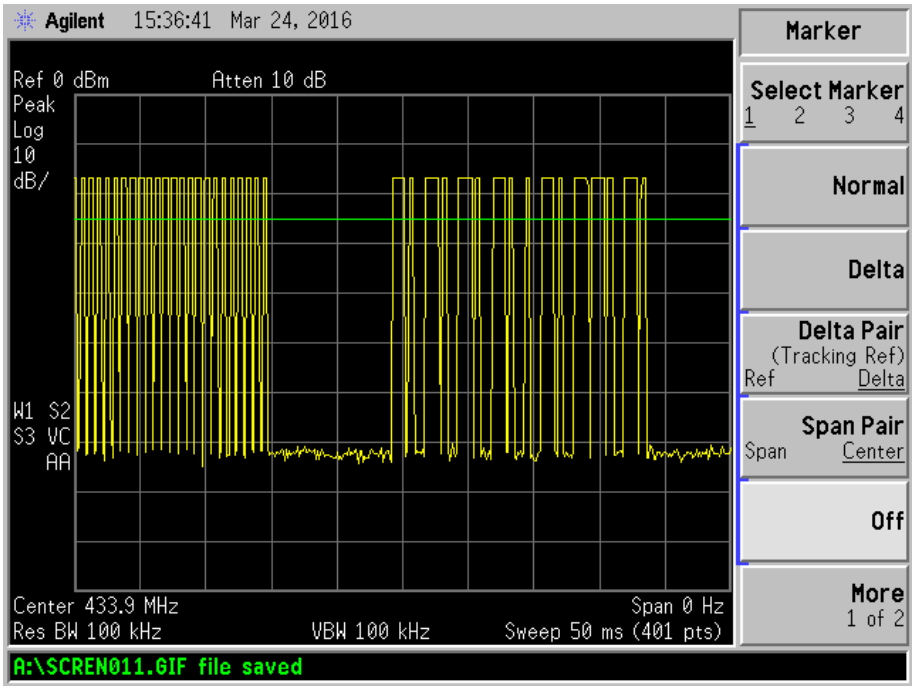
Width of Pulse1

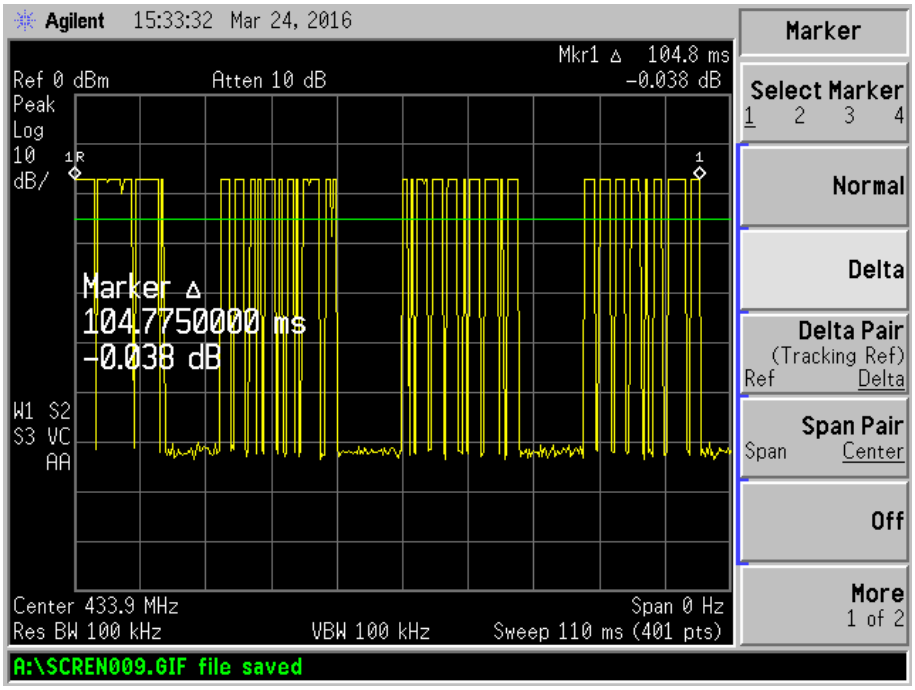


Width of Pulse 2 and Pulse 3



Quantity of Pulse





Annex A. EUT External Photos

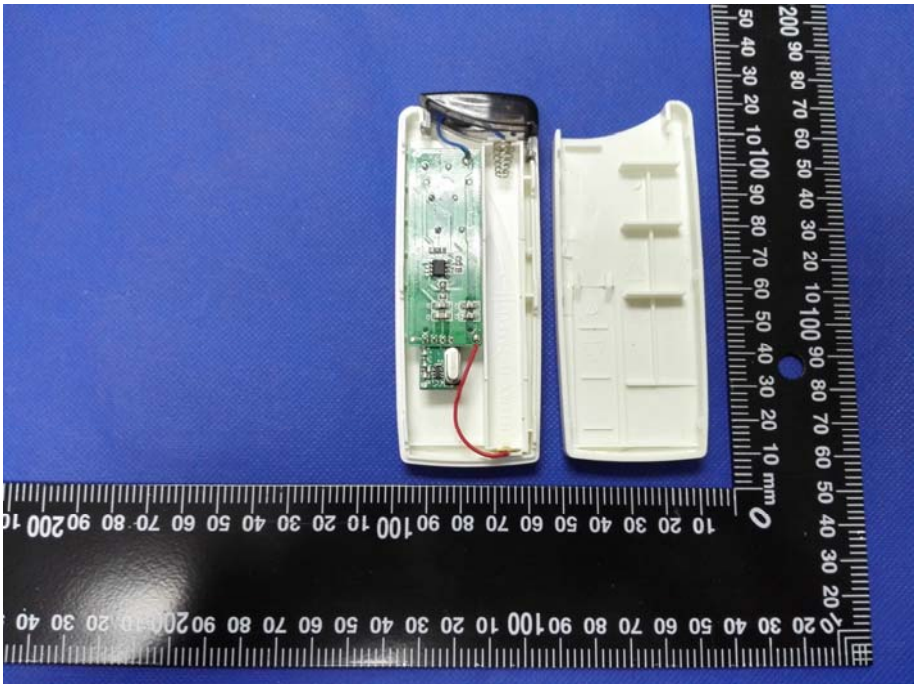
EUT View 1

EUT View 2

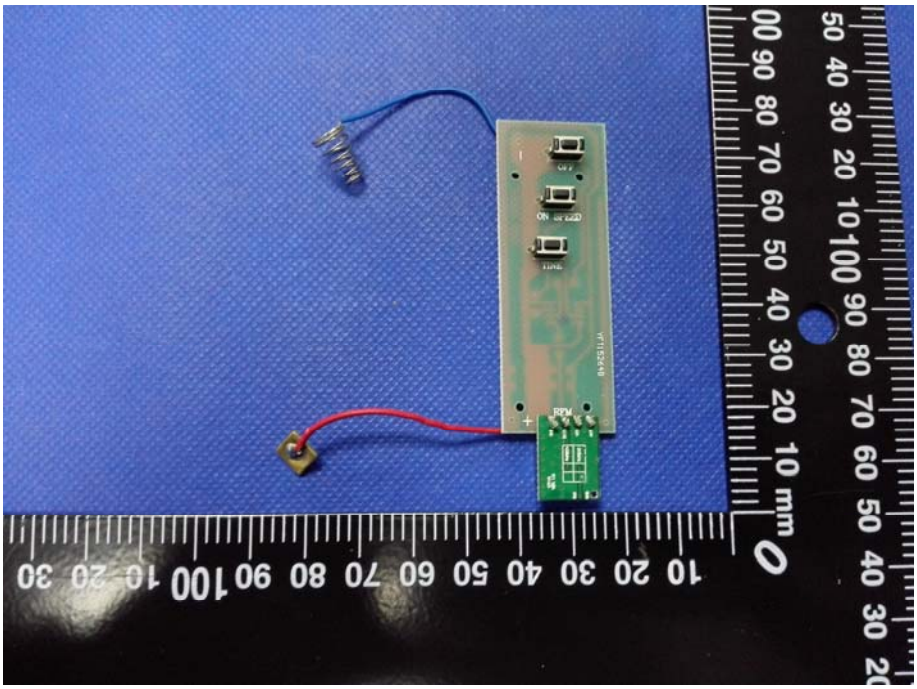
EUT View 3

Annex B. EUT Internal Photos

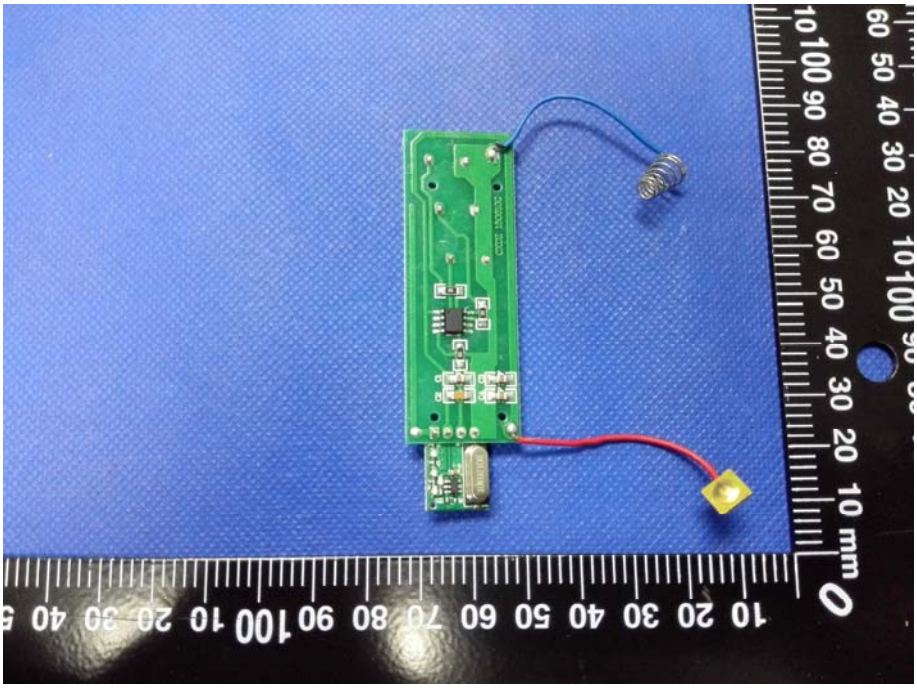
EUT Housing View



PCB View 1



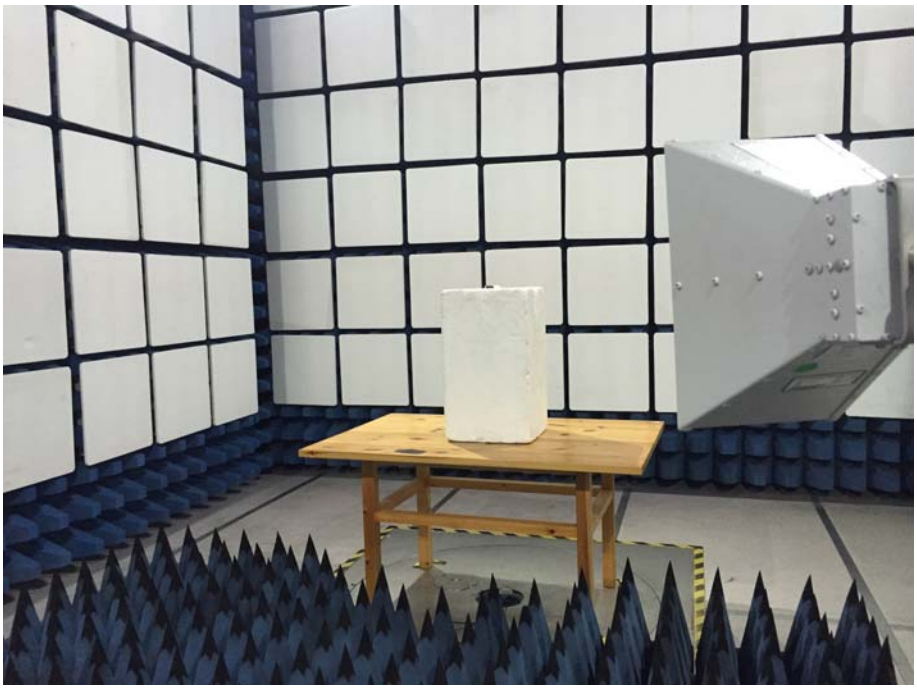
PCB View 2



Annex C. Test Photos

Radiated Emissions (30MHz to 1GHz)

Radiated Emissions (1GHz to 5GHz)



Radiated Emissions (Zoom in)

Annex D. Label and Information

FCC Label Sample

Remote Control

Model No.: 9164-6001
FCC ID: 2AHRT9164-6001

Ningbo DoWell Tools Co., Ltd.

FCC Label Specifications

Text is Black in color and is justified. Labels are printed in indelible ink on permanent adhesive backing or silk-screened onto the EUT or shall be affixed at a conspicuous location on the EUT. Where the EUT is constructed in two or more sections connected by wires and marketed together, the above statement is required to be affixed only to the main control unit. When the EUT is so small or for such use that it is not practicable to place the statement on it, the above information shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed.

FCC Label Location

Information to User

FCC Warning

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Any changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

******* END OF REPORT *******