

TEST REPORT

Reference No...... : WTD17S0169580E
FCC ID..... : XAB-HEDDI-KP220A
Applicant..... : Heddolf Products Ltd.
Address..... : Unit 7, 22/F., Futura Plaza, 111-113 How Ming Street, Kwun Tong, Kowloon, Hong Kong
Manufacturer..... : SAP Products Ltd
Address : Xian Sha No.2 Industrial Zone, Gao Bu Town, Dongguan City, Guangdong Province, PRC
Product Name..... : Remote Controller
Model No. : KG220A, KG220, KP220A, KP220, KL220, KL220A, KS220, KS220A, KX220, KX220A, KO220, KO220A, KC220, KC220A, KM220, KM220A
Standards..... : FCC CFR47 Part 15 Section 15.231: 2016
Date of Receipt sample.... : Jan. 16, 2017
Date of Test..... : Jan. 16, 2017– Feb. 10, 2017
Date of Issue..... : Feb. 14, 2017
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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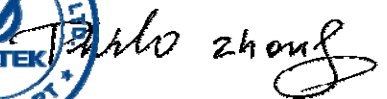
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Compiled by:



Zero Zhou /Test Engineer

Approved by:



Philo Zhong / Manager

2 Test Summary

Test Items	Test Requirement	Result
Radiated Spurious Emissions	15.205(a) 15.209 15.231(a)	PASS
Periodic Operation	15.231(a)	PASS
Emission Bandwidth	15.231(c)	PASS
Antenna Requirement	15.203	PASS
Maximum Permissible Exposure (Exposure of Humans to RF Fields)	1.1307(b)(1)	PASS

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4 General Information

4.1 General Description of E.U.T.

Product Name	: Remote Controller
Model No.	: KG220A, KG220, KP220A, KP220, KL220, KL220A, KS220, KS220A, KX220, KX220A, KO220, KO220A, KC220, KC220A, KM220, KM220A
Model Difference	: Refer to section 4.5, the model KP220A is the tested sample.
Type of Modulation	: OOK
Frequency Range	: 433.92 MHz
The Lowest Oscillator	: 13.56 MHz
Antenna installation	: PCB Printed Antenna

4.2 Details of E.U.T.

Technical Data	: DC 3V 13mA power by batteries
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4.3 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	/	433.92MHz	/

4.4 Test Facility

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

- **IC – 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 7760A, October 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.

4.5 Model Difference

	KP220A	KP220	KO220A	KO220	KC220A
Buzzer components: SW2 Q4 Q5 R15 R23 R5 C23 R36 C26 C24 C27 L3 B1 R48 R49	√	X	√	X	√
SW1	3 condition 9 bits	3 condition 9 bits	3 conditon 9 bits	3 condition 9 bits	3 condition 9 bits
R6	X	X	X	X	X
R7	√	√	√	√	√
D5	√	√	√	√	√
D4, IC6 HC300	X	X	X	X	X

	KC220	KG220A	KG220	KL220A	KL220
Buzzer components: SW2 Q4 Q5 R15 R23 R5 C23 R36 C26 C24 C27 L3 B1 R48 R49	X	√	X	√	X
SW1	3 condition 9 bits	2 condition 12 bits	2 conditon 12 bits	2 condition 8 bits	2 condition 8 bits
R6	X	√	√	√	√
R7	√	X	X	X	X
D5	√	√	√	√	√
D4, IC6 HC300	X	X	X	X	X

	KM220A	KM220	KS220A	KS220	KX220A	KX220
Buzzer components: SW2 Q4 Q5 R15 R23 R5 C23 R36 C26 C24 C27 L3 B1 R48 R49	√	X	√	X	√	X
SW1	2 condition 10 bits	2 condition 10 bits	2 conditon 10 bits	2 condition 10 bits	X	X
R6	√	√	√	√	X	X
R7	X	X	X	X	X	X
D5	√	√	√	√	X	X
D4, IC6 HC300	X	X	X	X	√	√

Mark: √ means has the element, X means has not the element.

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.15,2016	Sep.14,2017
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Sep.15,2016	Sep.14,2017
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Apr.19,2016	Apr.18,2017
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	Sep.15,2016	Sep.14,2017
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	Apr.13, 2016	Apr.12, 2017
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	Apr.09, 2016	Apr.08, 2017
3	Amplifier	Compliance pirection systems inc	PAP-0203	22024	Sep.15,2016	Sep.14,2017
4	Cable	HUBER+SUHNER	CBL2	525178	Apr.13, 2016	Apr.12, 2017
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.15,2016	Sep.14,2017
2.	Spectrum Analyzer (9k-6GHz)	R&S	FSL6	100959	Sep.12, 2016	Sep.11, 2017
3.	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	Apr.29, 2016	Apr.28, 2017

5.2 Measurement Uncertainty

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

Test Requirement: FCC Part15 Paragraph 15.231(a)

Test Method: ANSI C63.10:2013

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
aa** linear interpolations				

6.1 EUT Operation

Operating Environment :

Temperature: 23.5 °C

Humidity: 51.1 % RH

Atmospheric Pressure: 101.2kPa

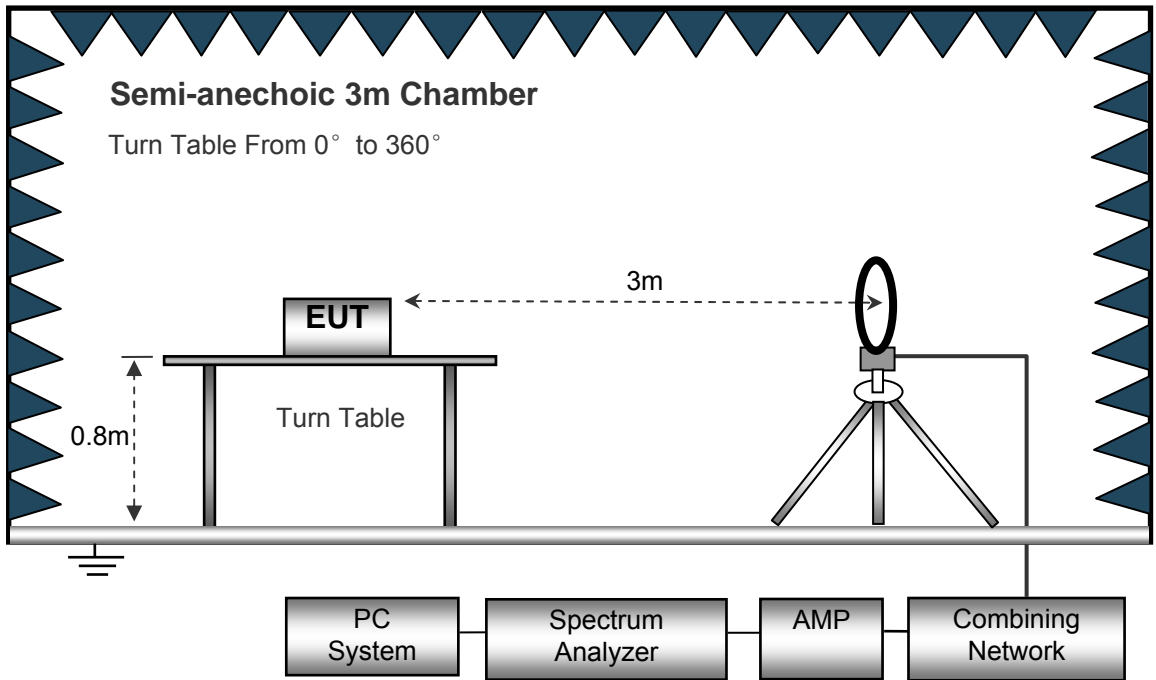
EUT Operation :

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

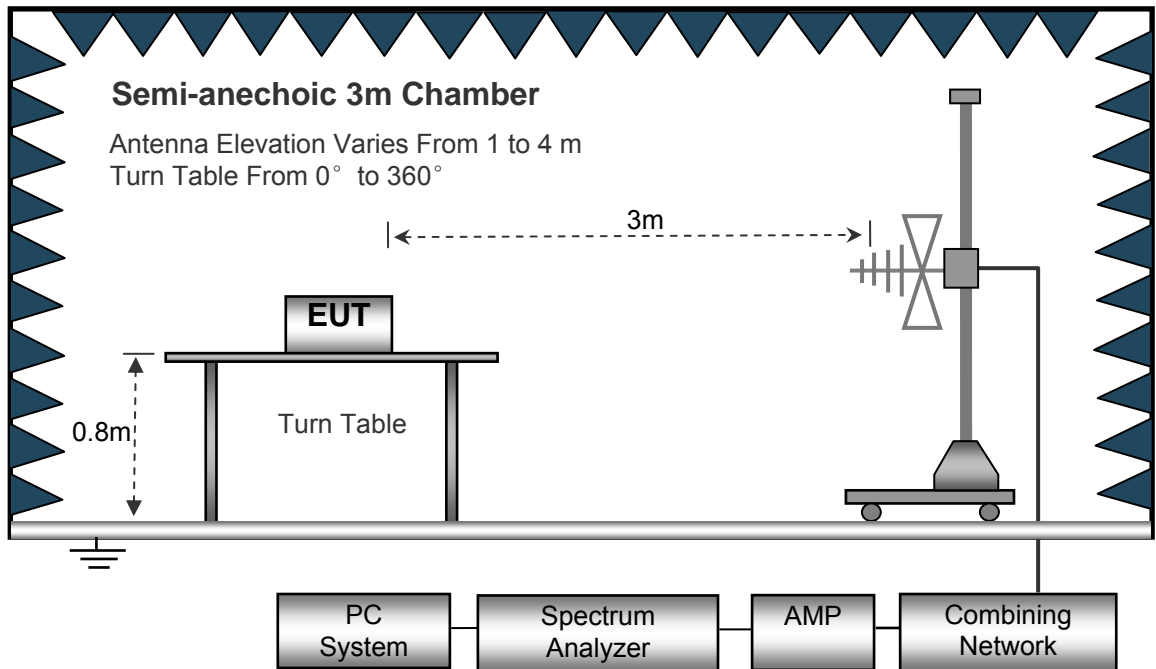
6.2 Test Setup

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

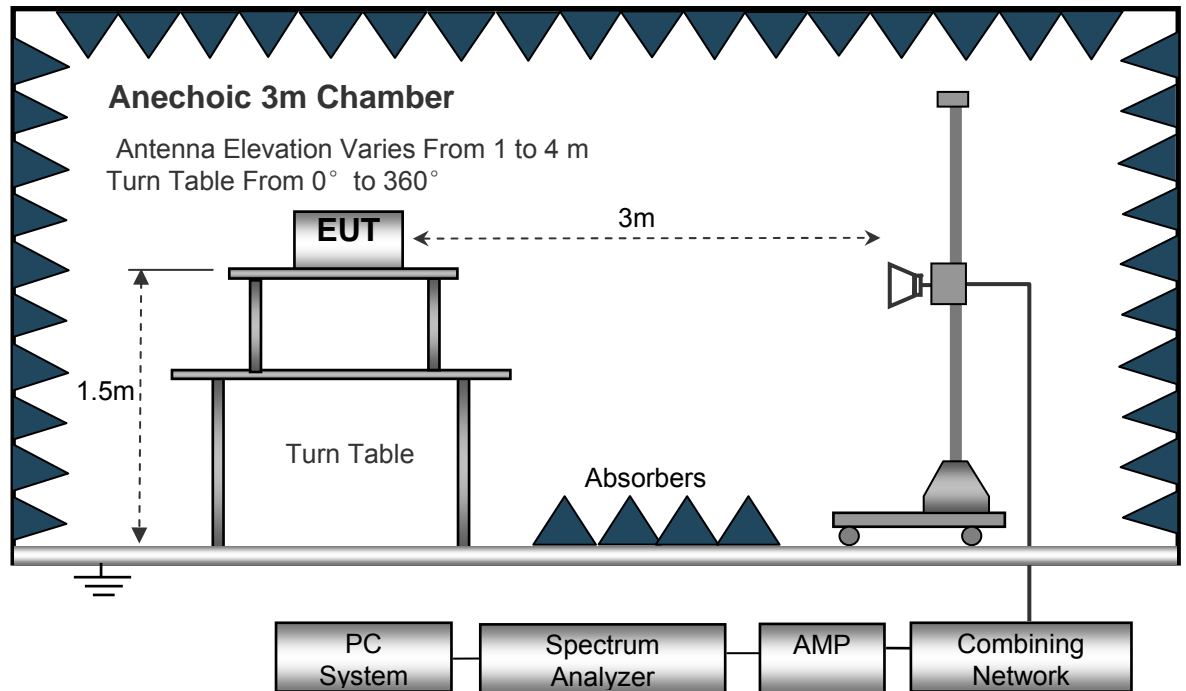
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



6.3 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

6.4 Test Procedure

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

6.5 Summary of Test Results

Test Frequency : 4MHz ~ 5GHz

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)	(dB μ V)	Degree	(m)	(H/V)	(dB/m)	(dB μ V/m)	(dB μ V/m)	(dB)
433.92	77.11	176	1.8	H	-7.31	69.80	100.82	-31.02
433.92	69.21	131	1.6	V	-7.31	61.90	100.82	-38.92
867.84	59.76	216	1.8	H	0.04	59.80	80.82	-21.02
867.84	55.59	304	1.4	V	0.04	55.63	80.82	-25.19
1816.80	35.73	233	1.6	H	-14.38	21.35	74.00	-52.65
1816.80	33.51	231	1.1	V	-14.38	19.13	74.00	-54.87
2725.20	36.72	6	1.9	H	-12.87	23.85	74.00	-50.15
2725.20	34.24	147	1.5	V	-12.87	21.37	74.00	-52.63

AV = Peak +20Log₁₀(duty cycle) =PK+(-5.40) [refer to section 8 for more detail]

Frequency	PK	RX Antenna Polar	Duty cycle Factor	Calculated AV	FCC Part 15.231/209/205	
					Limit	Margin
(MHz)	(dB μ V/m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
433.92	69.80	H	-5.40	64.40	80.82	-16.42
433.92	61.90	V	-5.40	56.50	80.82	-24.32
867.84	59.80	H	-5.40	54.40	60.82	-6.42
867.84	55.63	V	-5.40	50.23	60.82	-10.59
1816.80	21.35	H	-5.40	15.95	54.00	-38.05
1816.80	19.13	V	-5.40	13.73	54.00	-40.27
2725.20	23.85	H	-5.40	18.45	54.00	-35.55
2725.20	21.37	V	-5.40	15.97	54.00	-38.03

7 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

$$\text{Duty Cycle(\%)} = \text{Total On interval in a complete pulse train} / \text{Length of a complete pulse train} * \%$$

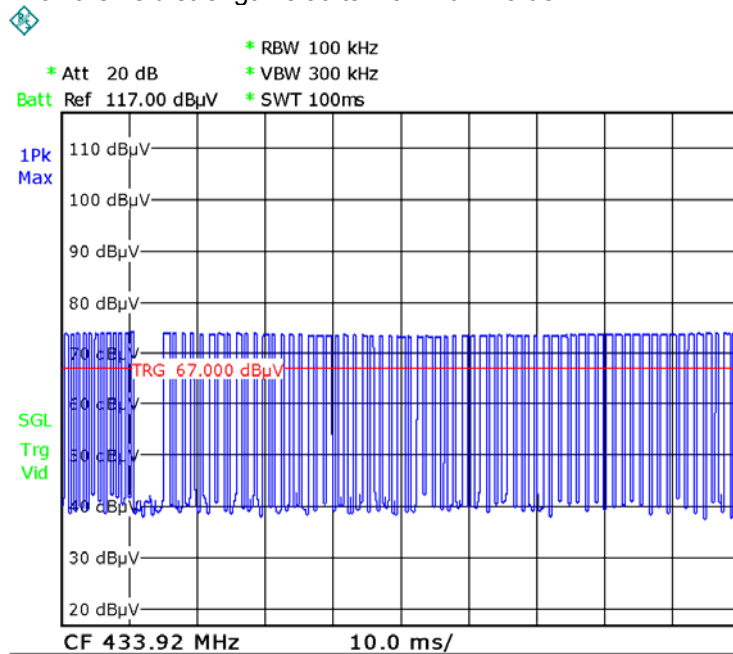
$$\text{Duty Cycle Correction Factor(dB)} = 20 * \text{Log}_{10}(\text{Duty Cycle(\%)})$$

Total transmission time(ms)	0.44*30+0.88*46=53.68
Length of a complete transmission period(ms)	100
Duty Cycle(%)	53.68
Duty Cycle Correction Factor(dB)	-5.40

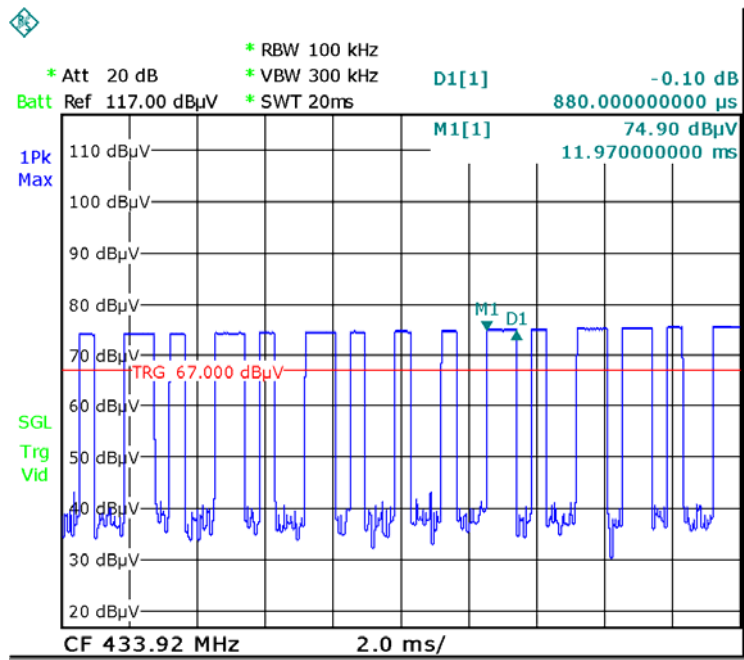
Refer to the duty cycle plot (as below), This device meets the FCC requirement.

Length of a complete pulse train:

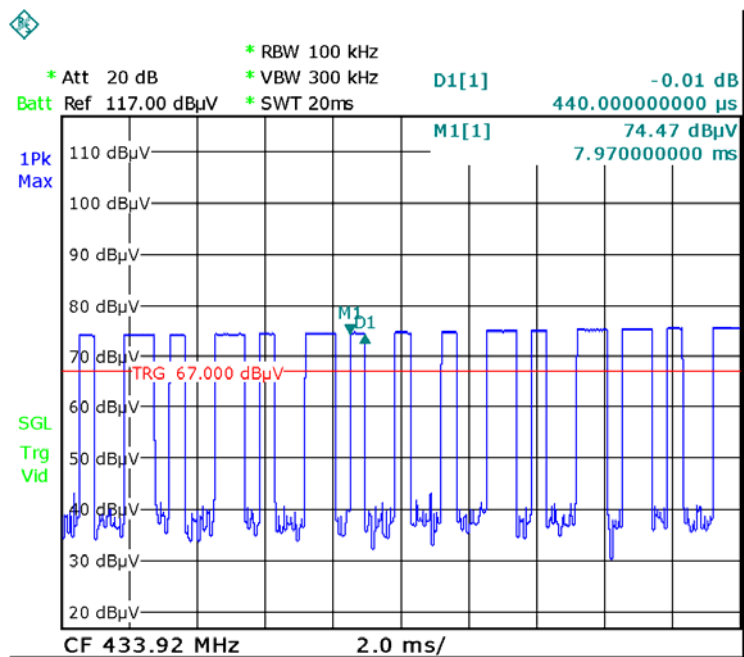
Remark: FCC part15.35(c) required that a complete pulse train is more than 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.



Pulse 1

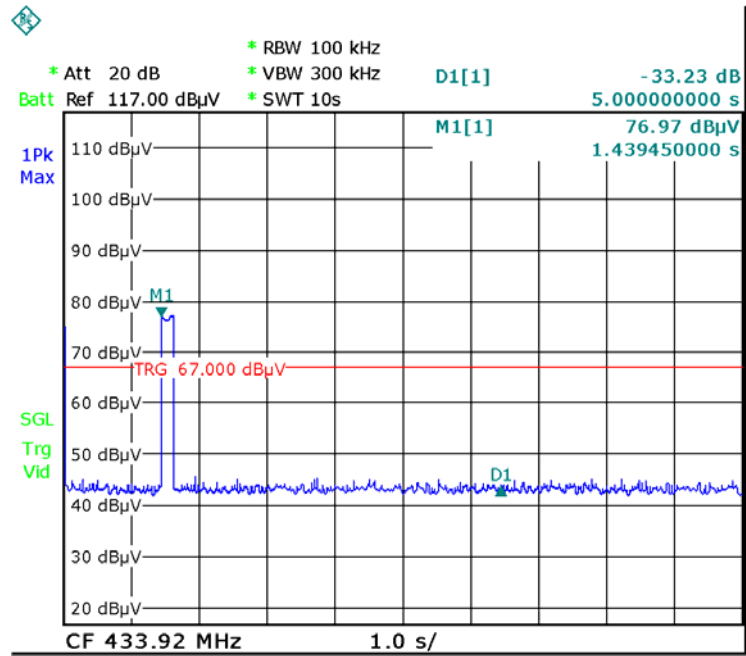


Pulse 2



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.



8 Emission 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.

8.1 Test Procedure

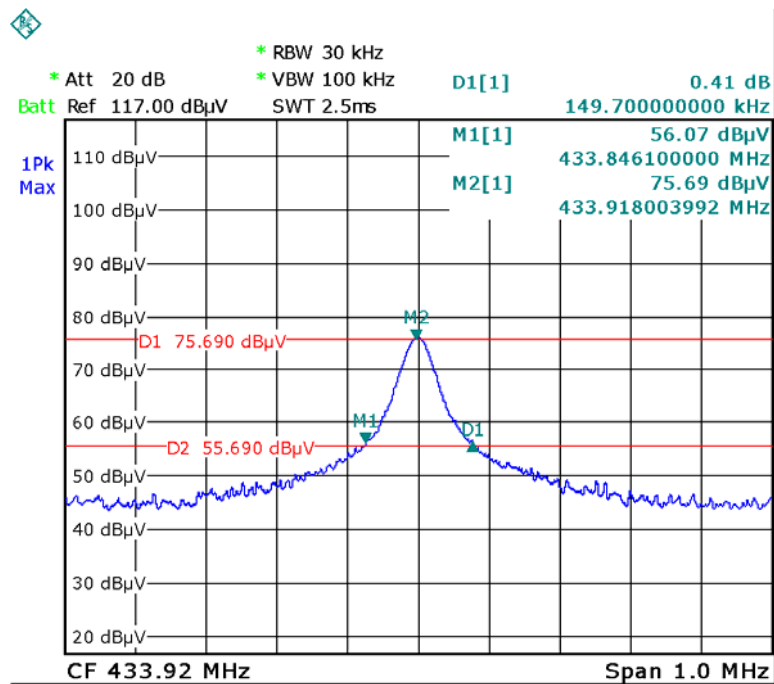
1. The transmitter output (antenna port) was connected to the spectrum analyzer.EUT and its simulators are placed on a table, let EUT working in test mode, then test it.
2. The bandwidth of the fundamental frequency was measure by spectrum analyser with 30kHz RBW and 100kHz VBW. The 20 dB bandwidth was recorded.

8.2 Test Result

Frequency (MHz)	20 dB Bandwidth Emission(KHz)	Limit (KHz)	Result
433.92	149.70	1084.80	Pass

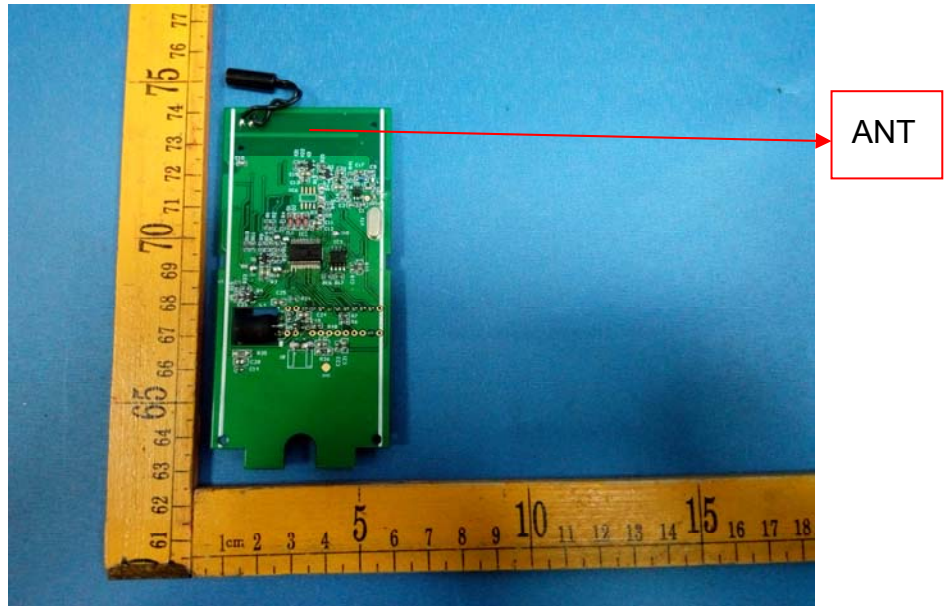
Limit=Center Frequency*0.25%

Test Plot



9 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 PCB printed antenna, it only apply to this model, fulfill the requirement of this section.



10 RF Exposure

Test Requirement: FCC Part 1.1307

Evaluation Method 447498 D01 General RF Exposure Guidance v06

2.1 Requirements

1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR and ≤ 7.5 for 10-g extremity SAR where

1. $f(\text{GHz})$ is the RF channel transmit frequency in GHz
2. Power and distance are rounded to the nearest mW and mm before calculation
3. The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

2.2 The procedures / limit

Source-based time-averaged maximum output power(dBm)	Source-based time-averaged maximum output power(mW)	Minimum test separation distance required for the exposure conditions(mm)	SAR Test Exclusion Thresholds(mW)	Evaluation Result
-18.15	0.015	5	22.77	Complies

Note: the following is Source-based time-averaged maximum output power Calculation

Frequency	Source-based time-averaged maximum output power	Substituted (0dBm)	Source-based time-averaged maximum output power
(MHz)	(dB μ V/m)	(dB μ V/m)	(dBm)
433.92	77.11	95.26	-18.15

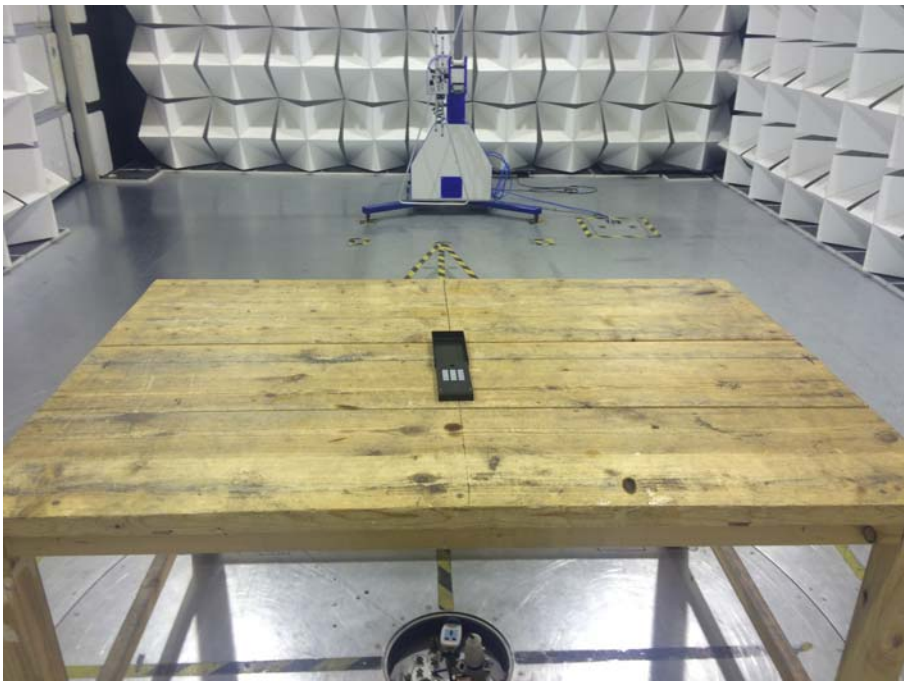
11 Photographs – Model KG220A Test Setup

11.1 Photograph – Radiation Spurious Emission Test Setup

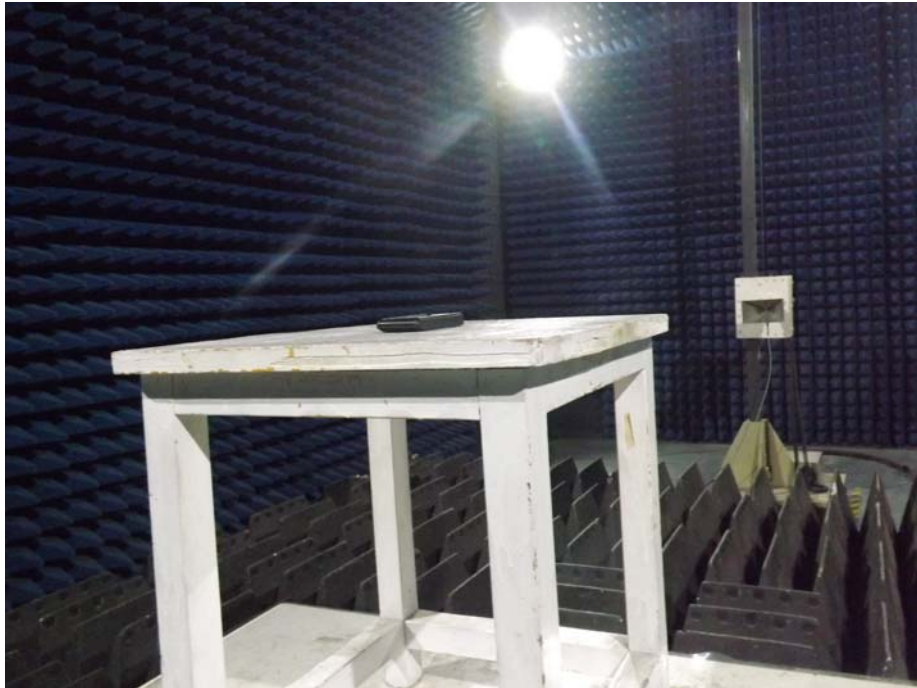
From 4MHz to 30MHz



From 30MHz to 1GHz



From 1GHz to 5GHz



12 Photographs - Constructional Details

12.1 External Photos

Model: KP220A



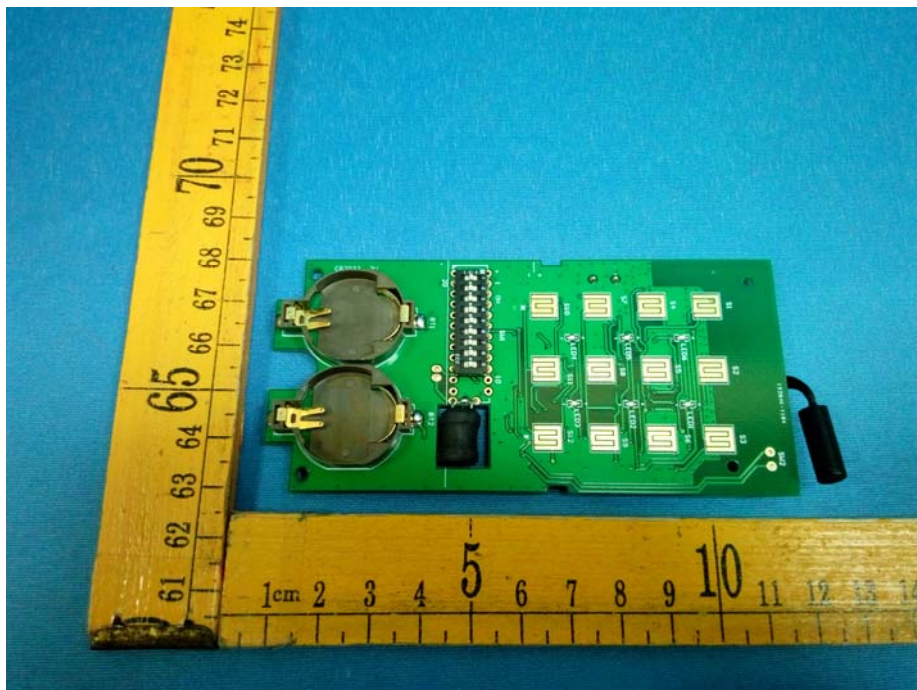


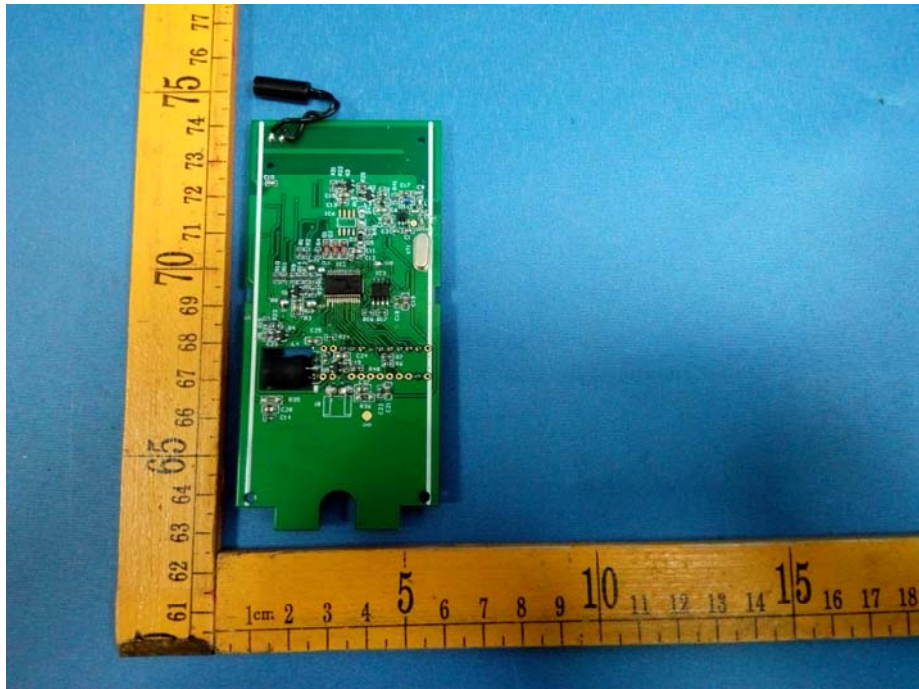


12.2 Internal Photos

Model: KP220A









====End of Report====