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FCC PART 15 SUBPART C TEST REPORT

FCC Part 15.231

Report Reference No. **CTL1508072223-WF**

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Date of issue Aug. 13, 2015

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Address Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen 518055 China.

Applicant's name **Shenzhen Flamingo Technology Co., Ltd**

Address 305 Bld A, Arcadia Innovation Park, Pingshan Road 1, Taoyuan of Nanshan, Shenzhen 518055, China

Test specification:

Standard **FCC Part 15.231: Periodic operation in the band 40.66–40.70 MHz and above 70 MHz.**

TRF Originator Shenzhen CTL Testing Technology Co., Ltd.

Master TRF Dated 2011-01

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Test item description Wireless Thermometer and Hygrometer

Trade Mark N/A

Models/Type reference SH340, SH310, SH260, SH253, SH250, SH210

Modulation ASK

Work Frequency 433.92MHz

Antenna Type internal

FCC ID 2AFM6-SH340

Result **Positive**

TEST REPORT

Test Report No. :	CTL1508072223-WF	Aug. 13, 2015
		Date of issue

Equipment under Test : Wireless Thermometer and Hygrometer

Type / Model(s) : SH340

Listed Models : SH310, SH260, SH253, SH250, SH210

Difference Description : Only the color and model's name is different

Applicant : **Shenzhen Flamingo Technology Co., Ltd**

Address : 305 Bld A, Arcadia Innovation Park, Pingshan Road 1, Taoyuan of Nanshan, Shenzhen 518055, China

Manufacturer : **Shenzhen Flamingo Technology Co., Ltd**

Address : 305 Bld A, Arcadia Innovation Park, Pingshan Road 1, Taoyuan of Nanshan, Shenzhen 518055, China

Test Result according to the standards on page 4:

Positive

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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1. TEST STANDARDS

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.

[**ANSI C63.10-2013 and ANSI C63.4-2014**](#)



2. SUMMARY

2.1. General Remarks

Date of receipt of test sample : Aug. 07, 2015

Testing commenced on : Aug. 07, 2015

Testing concluded on : Aug. 13, 2015

2.2. Equipment Under Test

Power supply system utilised

Power supply voltage : 120V / 60 Hz 115V / 60Hz
 12 V DC 24 V DC
 Other (specified in blank below)

DC 3.0V from battery(2*AAA)

2.3. Short description of the Equipment under Test (EUT)

The EUT is a Wireless Thermometer and Hygrometer at 433.92MHz.
 For more details, refer to the user's manual of the EUT.

Serial number: Prototype

2.4. EUT operation mode

The EUT has been tested under typical operating condition.

2.5. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

- supplied by the manufacturer
- supplied by the lab

2.6. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: 2AFM6-SH340 filing to comply with Section 15.231 of the FCC Part 15, Subpart C Rules.

2.7. Modifications

No modifications were implemented to meet testing criteria.

2.8. Test Result Summary

Transmitter field strength of emissions	15.209&FCC 15.231(e)	PASS
Conducted Measurement at (AC) Power Line	FCC 15.207	N/A
Bandwidth of Emission	FCC 15.231(c)	PASS
Duty cycle	FCC 15.231(e)	PASS
Antenna Requirement	FCC 15.203	PASS

3. TEST ENVIRONMENT

3.1. Address of the test laboratory

Shenzhen CTL Testing Technology Co., Ltd.
Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen 518055 China

There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.10 and CISPR 22/EN 55022 requirements.

3.2. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

IC Registration No.: 9618B

The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration No.: 9618B on November 13, 2013.

FCC-Registration No.: 970318

Shenzhen CTL Testing Technology 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 970318, December 19, 2013.

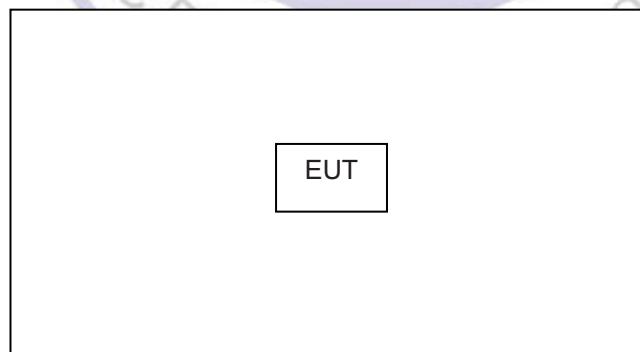
3.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

3.4. Configuration of Tested System

Fig. 2-1 Configuration of Tested System



Cable List and Details

Cable Description	Length (M)	Shielded/Unshielded	With Core/Without Core
/	/	/	/

3.5. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen CTL Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for CTL laboratory is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.10dB	(1)
Radiated Emission	1~26.5GHz	4.32dB	(1)
Conducted Disturbance	0.15~30MHz	3.20dB	(1)

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



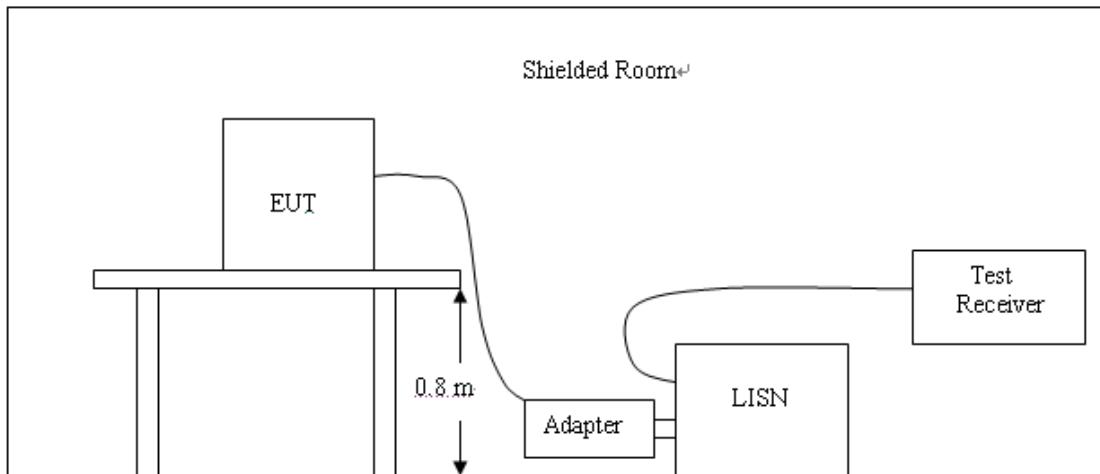
3.6. Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
ULTRA-ROADBAND ANTENNA	Sunol Sciences Corp.	JB1	A061713	2015/06/02	2016/06/01
EMI Test Receiver	R&S	ESCI	103710	2015/06/02	2016/06/01
Spectrum Analyzer	Agilent	E4407B	MY41440676	2015/05/21	2016/05/20
Controller	EM Electronics	Controller EM 1000	N/A	2015/05/21	2016/05/20
Horn Antenna	Sunol Sciences Corp.	DRH-118	A062013	2015/05/19	2016/05/18
Active Loop Antenna	Daze	ZN30900A	N/A	2015/05/19	2016/05/18
LISN	R&S	ENV216	3560.6550.12	2015/06/02	2016/06/01
LISN	R&S	ESH2-Z5	860014/010	2015/06/02	2016/06/01
ISN	FCC	F-071115-1057-1-09	11229	2015/05/19	2016/05/18
Amplifier	Agilent	8349B	3008A02306	2015/05/19	2016/05/18
Amplifier	Agilent	8447D	2944A10176	2015/05/19	2016/05/18
Transient Limiter	SCHWARZCECK	VTSD 9561F	9666	2015/06/02	2016/06/01
Radio Communication Tester	R&S	CMU200	115419	2015/05/22	2016/05/21
Temperature/Humidity Meter	Gangxing	CTH-608	02	2015/05/20	2016/05/19
SIGNAL GENERATOR	Agilent	E4421B	US40051744	2015/05/20	2016/05/19
Wideband Peak Power Meter	Anritsu	ML2495A	220.23.35	2015/05/20	2016/05/19
Climate Chamber	ESPEC	EL-10KA	A20120523	2015/05/20	2016/05/19
High-Pass Filter	K&L	9SH10-2700/X12750-O/O	N/A	2015/05/20	2016/05/19
High-Pass Filter	K&L	41H10-1375/U12750-O/O	N/A	2015/05/20	2016/05/19
RF Cable	HUBER+SUHNER	RG214	N/A	2015/05/20	2016/05/19

4. TEST CONDITIONS AND RESULTS

4.1. Conducted Emissions Test

TEST CONFIGURATION



TEST PROCEDURE

- 1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10.
- 2 Support equipment, if needed, was placed as per ANSI C63.10.
- 3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
- 4 If a EUT received DC power from the USB Port of Notebook PC, the PC's adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
- 5 All support equipments received AC power from a second LISN, if any.
- 6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
- 7 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
- 8 During the above scans, the emissions were maximized by cable manipulation.

The RBW/VBW for 150KHz to 30MHz: 9KHz

CONDUCTED POWER LINE EMISSION LIMIT

For unintentional device, according to § 15.107(a) Line Conducted Emission Limits is as following :

Frequency (MHz)	Maximum RF Line Voltage (dB μ V)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

* Decreasing linearly with the logarithm of the frequency

For intentional device, according to §15.207(a) Line Conducted Emission Limit is same as above table.

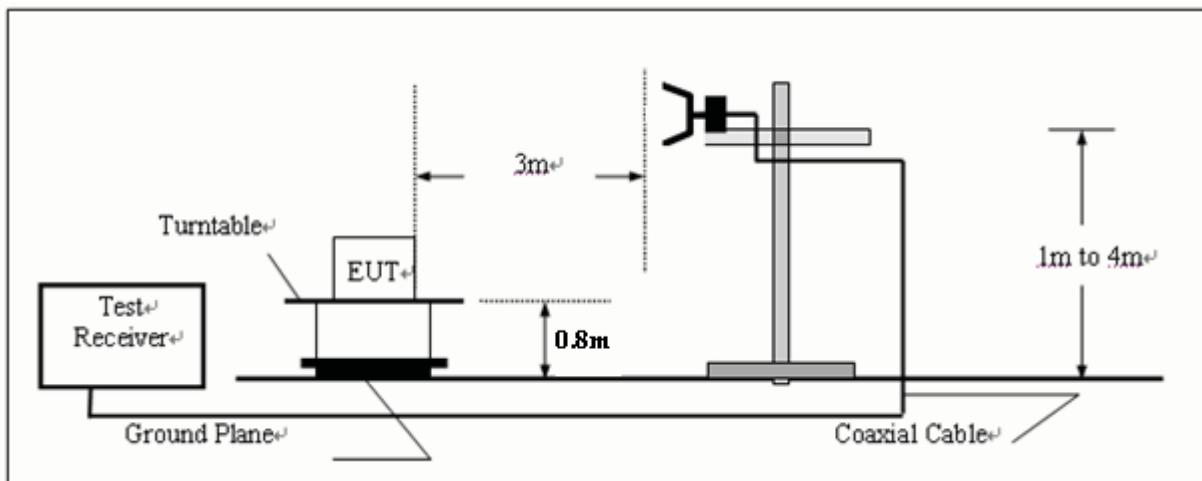
TEST RESULTS

Not applicable to this device.



4.2. Fundamental Emissions

TEST CONFIGURATION



Fundamental Emissions Limit

Fundamental Frequency (MHz)	Field strength of fundamental, limit $\mu\text{V/m}$
40.66 – 40.70	1,000
70 – 130	500
130 – 174	500 to 1,500
174 – 260	1,500
260 – 470	1,500 to 5,000** (433 MHz: $72.80 \text{ dB}\mu\text{V/m} = 4383.348 \mu\text{V/m}$)
Above 470	5,000

** linear interpolation

Refer as ANSI C63.10, clause 4.2.3.2.2 measurement procedure peak limit.

TEST RESULTS

Field Strength of Fundamental Emissions Result					
Modulation	Frequency (MHz)	Max.Fundamental (dBuV/m)@3m	Margin (dB)	Limit (dBuV/m)@3m	Type
Mode					
ASK	433.92	68.22	24.58	92.8	peak
ASK	433.92	59.99	12.81	72.8	average

Note: Horizontal and Vertical polarity all have been tested, only worse case Vertical is reported.

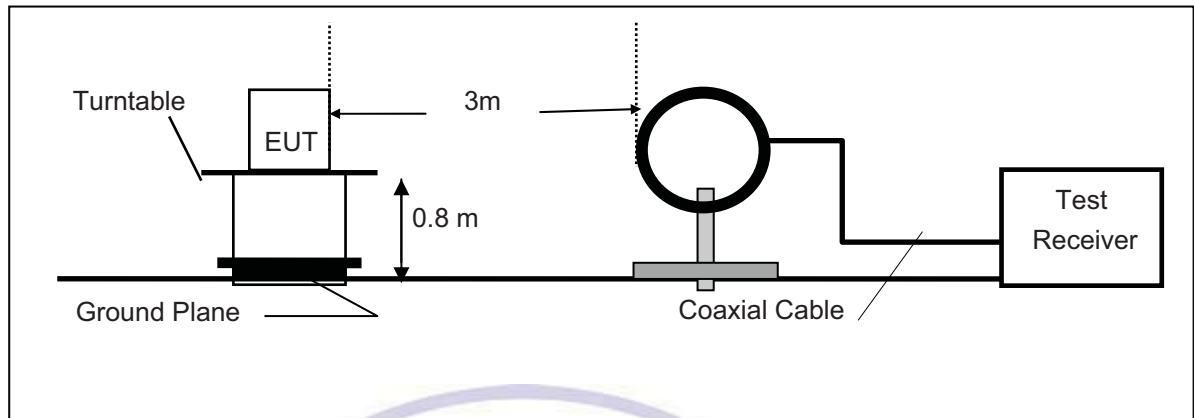
Duty Cycle factor=-8.23 dB

Note: AV = PK -8.23

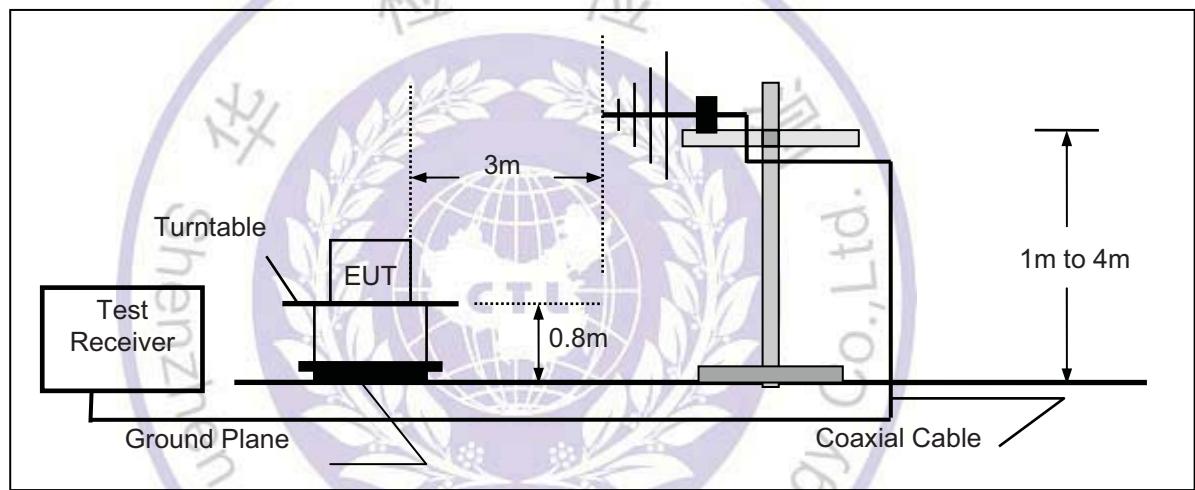
4.3. Radiated Emission Test

TEST CONFIGURATION

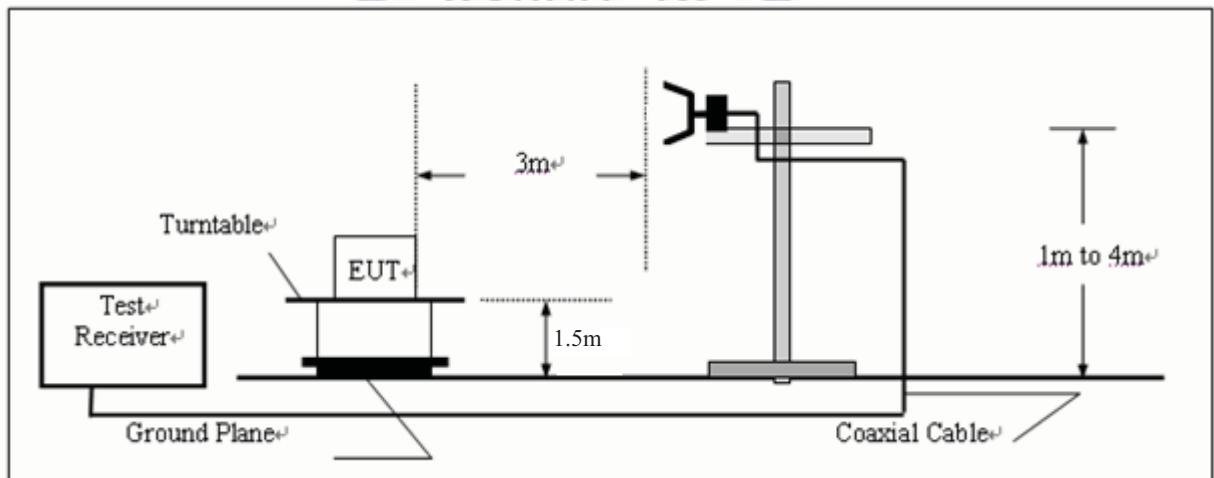
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

RADIATION LIMIT

For unintentional device, according to § 15.109(a), except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency (MHz)	Distance (Meters)	Radiated (dB μ V/m)	Radiated (μ V/m)
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

Max permitted average Limits = Max permitted Fundamental limit – 20 dB

For example for 433 MHz fundamental carrier: Max permitted average Limit: 72.80 dB μ V/m - 20 dB= 52.80 dB μ V/m

Modified Limits for peak conform 15.35 (b) = Max Permitted average Limits + 20dB (because Peak detector is used)

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 varied from 1m to 4m to find out the highest emissions.
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. Based on the Frequency Generator in the device include 315MHz. The test frequency range from 30MHz to 4GHz per FCC PART 15.33(a).

Note:

Three axes are chosen for pretest, the Y axis is the worst mode for final test.

For battery operated equipment, the equipment tests shall be performed using a new battery.

TEST RESULTS

Freq. (MHz)	Ant.Pol. H/V	DetectorMode (PK/AV)	Reading (dBuV)	Ant./CL/ Amp. CF(dB)	Actual FS (dBuV/m)	Limit3m (dBuV/m)	Safe Margin (dB)
867.84	V	PK	34.19	22.90	57.09	72.80	-15.71
867.84	V	AV			48.86	52.80	-3.94
867.84	H	PK	32.42	22.90	55.32	72.80	-17.48
867.84	H	AV			47.09	52.80	-5.71
1301.76	V	PK	26.87	25.40	52.27	74.00	-21.73
1301.76	V	AV			44.04	54.00	-9.96
1301.76	H	PK	25.78	25.40	51.18	74.00	-22.82
1301.76	H	AV			42.95	54.00	-11.05
1735.68	V		---				
1735.68	H		---				
127.40	H	PK	20.64	15.60	36.24	43.50	-7.26
127.40	V	PK	21.53	15.60	37.13	43.50	-6.37
Others			---				

Note: AV = PK -8.23

Remark:

- (1) Measuring frequencies from 30 MHz to the 5GHz.
- (2) "F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency.
- (3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
- (4) Datas of measurement within this frequency range shown " - " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz and 1 MHz for measuring above 1 GHz
- (6) Duty Cycle factor=-8.23 dB

4.4. Occupied Bandwidth

Measurement Procedure

1. Set EUT as normal operation.
2. RBW $\geq 1\%$ of the 20 dB bandwidth, VBW \geq RBW.
3. The useful radiated emission from the EUT was detected by the spectrum analyser with peak detector.

Test SET-UP (Block Diagram of Configuration)

Same as Radiated Emission Measurement.

Measurement Equipment Used:

Same as Radiated Emission Measurement.

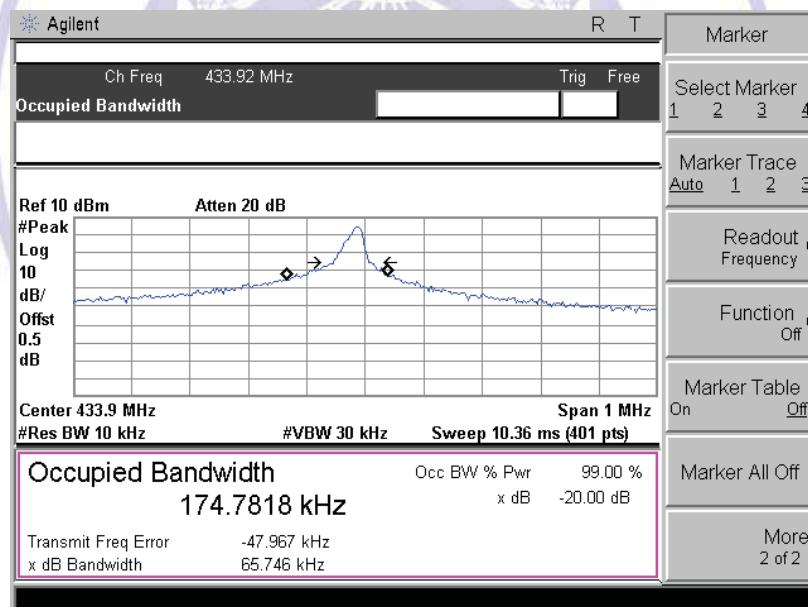
Limits:

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. Bandwidth is determined at the points 20 dB down from the modulated carrier.

Occupied Bandwidth $\leq 433.92\text{MHz} \times 0.25\% = 1.0848\text{MHz}$

Measurement Results: PASS

The graph as below, represents the emissions take for this device.



4.5. Duty Cycle

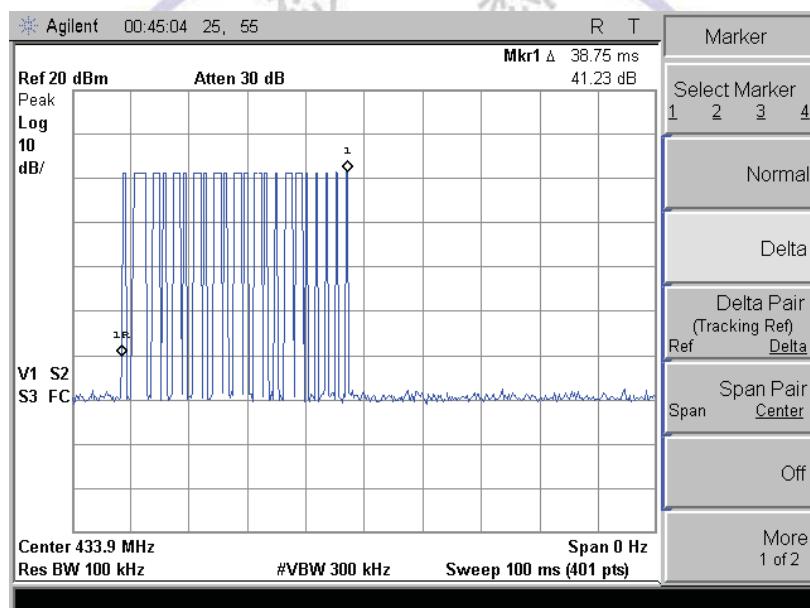
Measurement Procedure

According To FCC Part 15 Section 15.231(e).

1. Set SPA Center Frequency = Fundamental frequency, RBW = 100 kHz, VBW =300 kHz, Span = 0Hz. Sweep time =100ms
2. Set EUT as normal operation and press Transmitter button.
3. Set SPA View. Delta Mark time.

Measurement Results:

Testing Mode	T period (ms)	T on (ms)	Duty Cycle	Duty Cycle Correction $20 \log(\text{Duty Cycle})$
Transmitting mode	100	38.75	0.3875	-8.23



4.6. Duration of Transmission and Silent Period

Measurement Procedure

According To FCC Part 15 Section 15.231(e).

1. Set SPA Center Frequency = Fundamental frequency, RBW = 100 kHz, VBW =300 kHz, Span = 0Hz. Sweep time =60seconds.
2. Set EUT as normal operation and press Transmitter button.
3. Set SPA View. Delta Mark time.

Limits

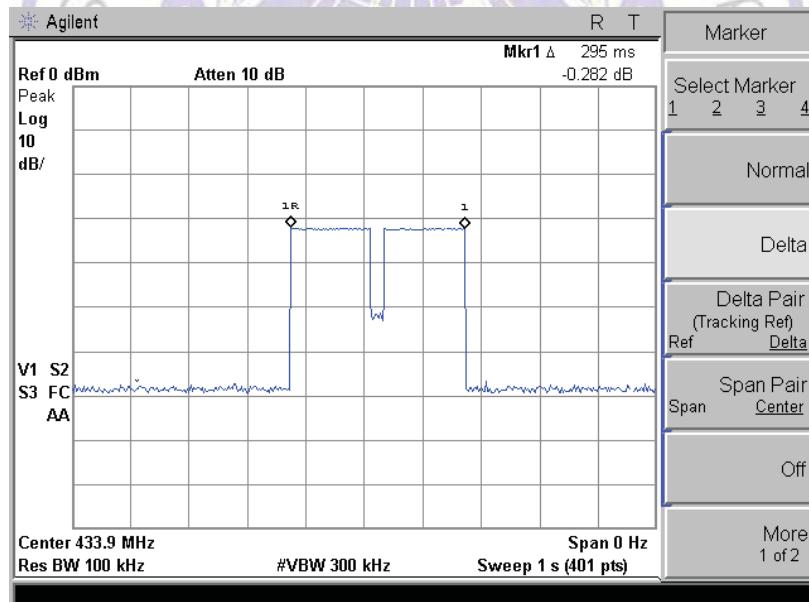
devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that the duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

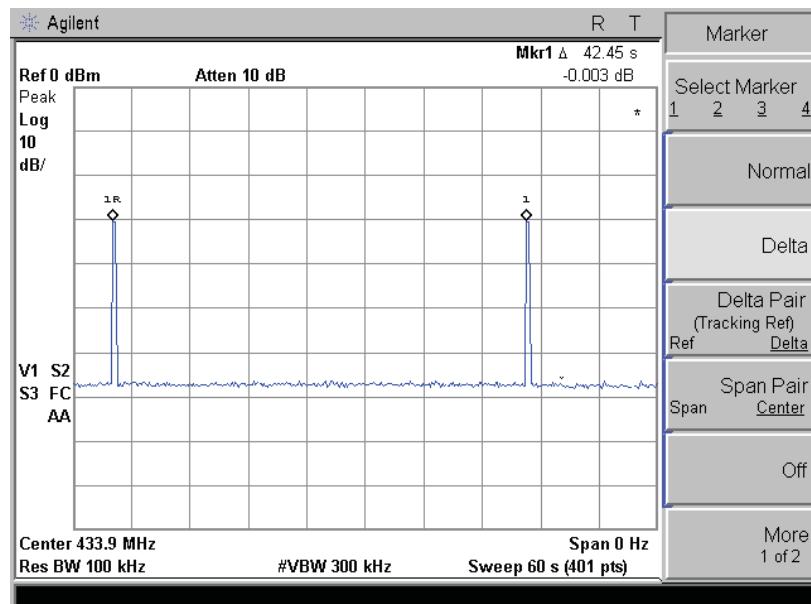
Measurement Results

duration of each transmission=295 ms<1 s PASS

Silent period between transmissions=42.45 s>10 s PASS

30 times the duration of the transmission=8.85 s<42.45 s PASS





5. Antenna Requirement

Standard Applicable

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.

And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Refer to statement below for compliance.

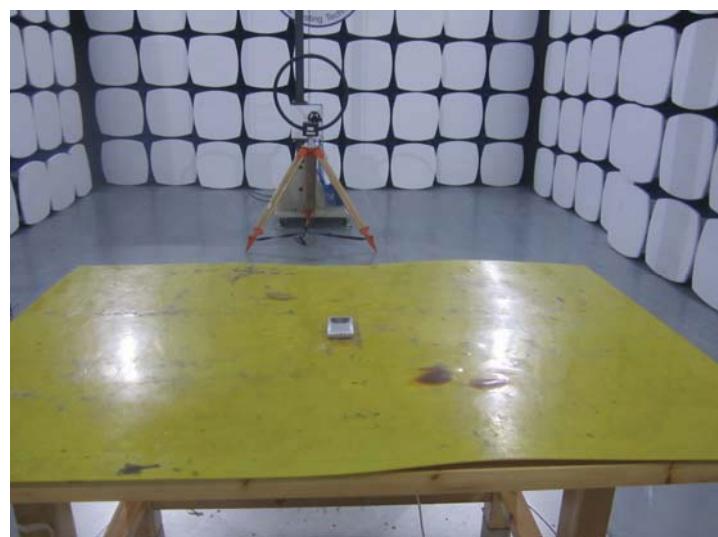
The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

Antenna Connected Construction

The antenna used in this product is an internal Antenna, The directional gains of antenna used for transmitting is 1.0 dBi. Please see EUT photo for details.



6. Test Setup Photos of the EUT



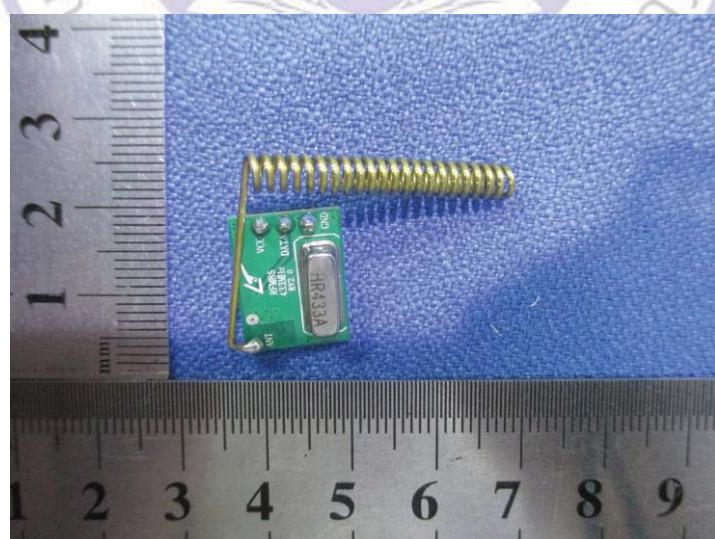
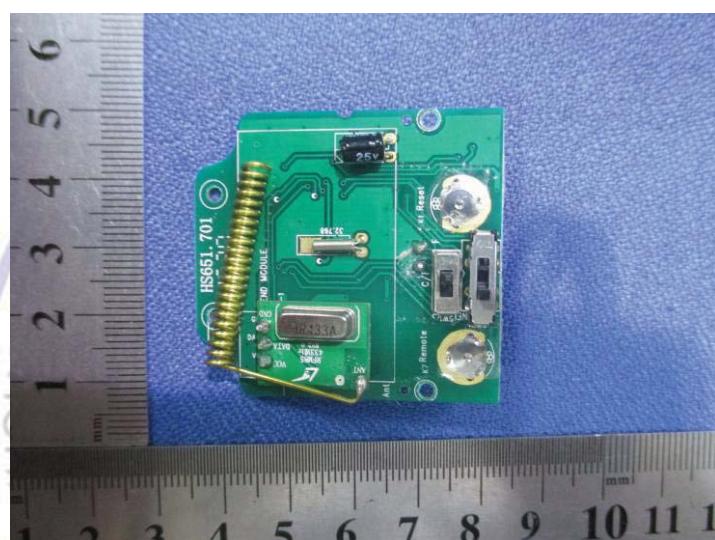
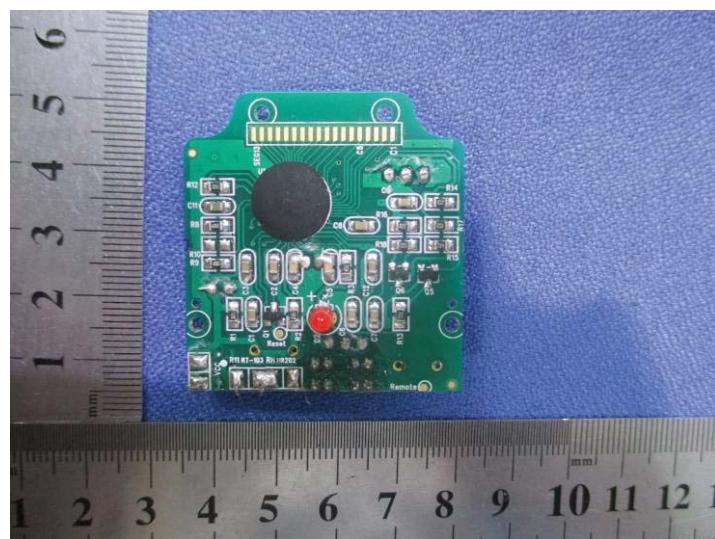
7. External and Internal Photos of the EUT

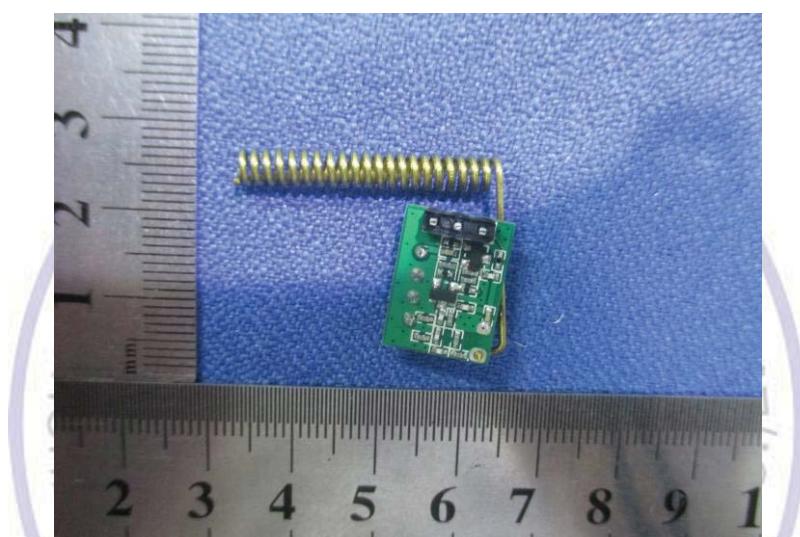
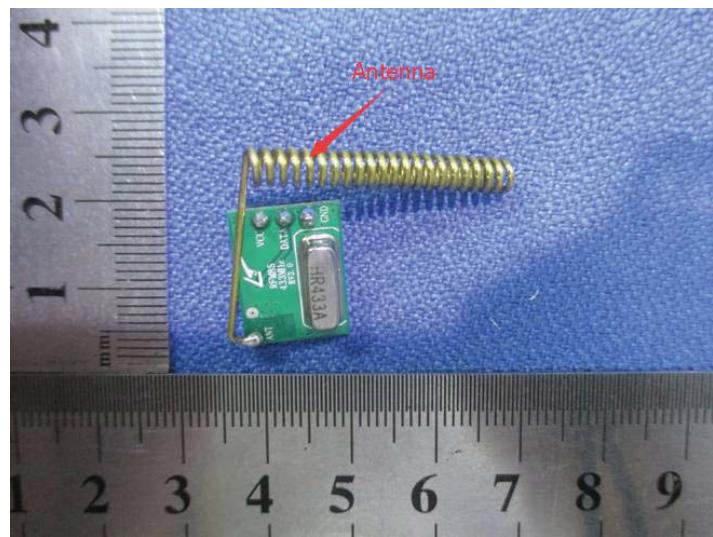
External Photos of EUT





Internal Photos of EUT





..End of Report..