



FCC TEST REPORT

Report No: STS1412074F01

Issued for

CHAO CHAO INDUSTRIAL CO., LTD
No.215, 2nd Floor, New Taipei, Banciao district three
sections of the public road

Product Name:	Wireless Door Bell
Brand Name:	N/A
Model No.:	TH-2015
Series Model:	N/A
FCC ID:	2ADW2-TH-2015
Test Standard:	FCC Part 15.231

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TEST RESULT CERTIFICATION

Applicant's name CHAO CHAO INDUSTRIAL CO., LTD
Address No.215, 2nd Floor, New Taipei, Banciao district three sections of the public road
Manufacture's Name Shenzhen Lighting Delight Electronics Development Co., Ltd
Address 4th floor, Bldg B1, Tianrui Industrial Park, Fuyuan 1st Road, Bao'an district, Shenzhen

Product description

Product name Wireless Door Bell
Band name N/A
Model and/or type reference TH-2015
Ratings DC12V

Standards FCC Part 15.231

Test procedure ANSI C63.10-2009

This device described above has been tested by STS, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Date of Test

Date (s) of performance of tests .. 30 Dec. 2014 ~31 Dec. 2014

Date of Issue 05 Jan. 2015

Test Result **Pass**

Testing Engineer :

(Tony Liu)

Technical Manager :

(Vita Li)

Authorized Signatory :

(Bovey Yang)





Table of Contents	Page
1. SUMMARY OF TEST RESULTS	5
1.1 TEST FACILITY	6
1.2 MEASUREMENT UNCERTAINTY	6
2. GENERAL INFORMATION	7
2.1 GENERAL DESCRIPTION OF EUT	7
2.2 DESCRIPTION OF TEST MODES	8
2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED	9
2.4 DESCRIPTION OF SUPPORT UNITS	10
2.5 EQUIPMENTS LIST FOR ALL TEST ITEMS	11
3. EMC EMISSION TEST	12
3.1 CONDUCTED EMISSION MEASUREMENT	12
3.1.1 POWER LINE CONDUCTED EMISSION LIMITS	12
3.1.2 TEST PROCEDURE	13
3.1.3 TEST SETUP	13
3.1.4 EUT OPERATING CONDITIONS	13
3.1.5 TEST RESULTS	14
3.2 RADIATED EMISSION MEASUREMENT	15
3.2.1 RADIATED EMISSION LIMITS	15
3.2.2 TEST PROCEDURE	16
3.2.3 DEVIATION FROM TEST STANDARD	16
3.2.4 TEST SETUP	17
3.2.5 EUT OPERATING CONDITIONS	18
3.2.6 TEST RESULTS	19
4. BANDWIDTH TEST	22
4.1 APPLIED PROCEDURES / LIMIT	22
4.2 TEST REQUIREMENTS	22
4.3 TEST PROCEDURE	22
4.4 TEST SETUP	22
4.5 EUT OPERATION CONDITIONS	22
4.6 TEST RESULTS	23
5. PERIODIC OPERATION	24
5.1 TEST PROCEDURE	24
5.2 TEST SETUP	24
5.3 EUT OPERATION CONDITIONS	24
5.4 TEST RESULTS	25
6. ANTENNA REQUIREMENT	27



Table of Contents	Page
6.1 STANDARD REQUIREMENT	27
6.2 EUT ANTENNA	27
APPENDIX- PHOTOS OF TEST SETUP	28





1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

FCC Part15 (15.231) , Subpart C			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	N/A	
15.205(a)/15.209/ 15.231.(b)	Radiated Spurious Emission	PASS	
15.231(b)	Periodic Operation	PASS	
15.231(C)	20 dB Bandwidth	PASS	
15.203	Antenna Requirement	PASS	

NOTE:

(1) "N/A" denotes test is not applicable in this Test Report





1.1 TEST FACILITY

Shenzhen STS Test Services Co., Ltd.

Add. : 1/F, Building 2, Zhuoke Science Park, Chongqing Road, Fuyong, Baoan District, Shenzhen, China.

FCC Registration No.: 842334; IC Registration No.: 12108A-1

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately **95 %**.

No.	Item	Uncertainty
1	Conducted Emission Test	$\pm 3.18\text{dB}$
2	RF power,conducted	$\pm 0.16\text{dB}$
3	Spurious emissions,conducted	$\pm 0.21\text{dB}$
4	All emissions,radiated(<1G)	$\pm 4.68\text{dB}$
5	All emissions,radiated(>1G)	$\pm 4.71\text{dB}$
6	Temperature	$\pm 0.5^{\circ}\text{C}$
7	Humidity	$\pm 2\%$



2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Equipment	Wireless Door Bell
Trade Name	N/A
Model Name	TH-2015
Serial Model	N/A
Model Difference	N/A
Channel List	Please refer to the Note 2.
Frequency band	315MHz
Battery	Rated Voltage: 12V
Hardware version number	--
Software versioning number	--
Connecting I/O Port(s)	Please refer to the User's Manual

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

2.

Channel List					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	315				

3. Table for Filed Antenna

Ant	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	N/A	N/A	(Inner fixed)	NA	0	Antenna (Inner fixed)

The EUT antenna is integral Antenna. no antenna other than that furnished by the responsible party shall be used with the device.



2.2 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generated from EUT, the test system was pre-scanning tested based on the consideration of following EUT operation mode or test configuration mode which possibly have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Mode	Description
Mode 1	TX Mode

For Conducted Emission	
Final Test Mode	Description
Mode 1	N/A

For Radiated Emission	
Final Test Mode	Description
Mode 1	TX Mode

Note:

(1) The measurements are performed at the highest, middle, lowest available channels.



2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters

Radiated Spurious Emission Test

E-1
EUT





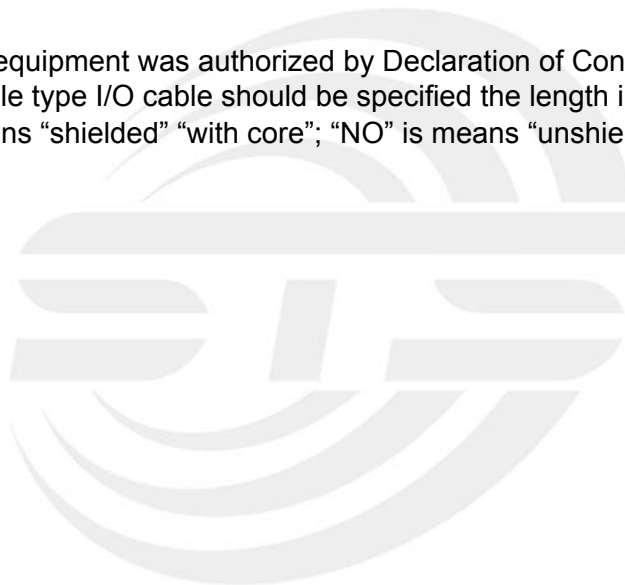
2.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
E-1	Wireless Door Bell	N/A	TH-2015	N/A	EUT

Note:

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in cm in 『Length』 column.
- (3) “YES” is means “shielded” “with core”; “NO” is means “unshielded” “without core”.





2.5 EQUIPMENTS LIST FOR ALL TEST ITEMS

Test Equipment

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until
Spectrum Analyzer	Agilent	E4407B	MY50140340	2014.10.25	2015.10.24
Test Receiver	R&S	ESCI	101427	2014.10.25	2015.10.24
Bilog Antenna	TESEQ	CBL6111D	34678	2014.10.27	2015.10.26
50Ω Coaxial Switch	Anritsu	MP59B	6200264416	2014.06.06	2015.06.05
Horn Antenna	R&S	9120D	152265	2014.10.27	2015.10.26
Horn Ant	Schwarzbeck	BBHA 9170	9170-181	2014.07.06	2015.07.05
Amplifier	EM	EM-30180	060538	2014.10.25	2015.10.24
Loop Antenna	ARA	PLA-1030/B	1029	2014.06.08	2015.06.07



3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

Operating frequency band. In case the emission fall within the restricted band specified on Part 15.231.207(a) limit in the table below has to be followed.

FREQUENCY (MHz)	Class B (dBuV)		Standard
	Quasi-peak	Average	
0.15 -0.5	66 - 56 *	56 - 46 *	CISPR
0.50 -5.0	56.00	46.00	CISPR
5.0 -30.0	60.00	50.00	CISPR

0.15 -0.5	66 - 56 *	56 - 46 *	FCC
0.50 -5.0	56.00	46.00	FCC
5.0 -30.0	60.00	50.00	FCC

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

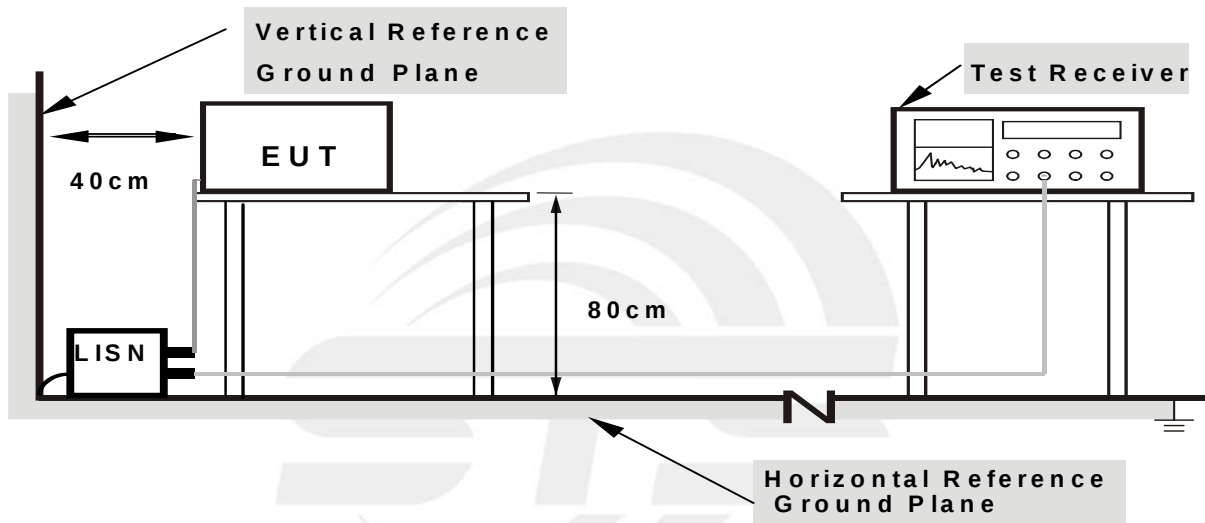
The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

3.1.2 TEST PROCEDURE

- The EUT was placed 0.4 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- LISN at least 80 cm from nearest part of EUT chassis.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.1.3 TEST SETUP



Note: 1. Support units were connected to second LISN.

2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

3.1.4 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.



3.1.5 TEST RESULTS

EUT :	Wireless Door Bell	Model Name. :	TH-2015
Temperature :	23 °C	Relative Humidity :	50%
Pressure :	1010hPa	Phase :	N/A
Test Voltage :	N/A	Test Mode :	N/A

The built-in battery, do not apply





3.2 RADIATED EMISSION MEASUREMENT

3.2.1 RADIATED EMISSION LIMITS

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on Part 15.205(a), then the Part 15.209(a) and Part 15.231(b) limit in the table below has to be followed.

LIMITS OF RADIATED EMISSION MEASUREMENT (0.009MHz - 1000MHz)

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~40.66	100	3
40.70~70	100	3

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66-40.70	2,250	225
70-130	1,250	125
130-174	¹ 1,250 to 3,750	¹ 125 to 375
174-260	3,750	375
260-470	¹ 3,750 to 12,500	¹ 375 to 1,250
Above 470	12,500	1,250

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Class B (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) Emission level (dBuV/m)=20log Emission level (uV/m).

Spectrum Parameter	Setting
Detector	Peak
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1 MHz / 1 MHz



Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
	150kHz~30MHz / RB 9kHz for QP
	30MHz~1000MHz / RB 100kHz for QP
	Above 1GHz / RB 1MHz VB 1M for PK

3.2.2 TEST PROCEDURE

- The measuring distance of at 3 m shall be used for measurements at frequency up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- The height of the equipment or of the substitution antenna shall be 0.8 m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit,
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

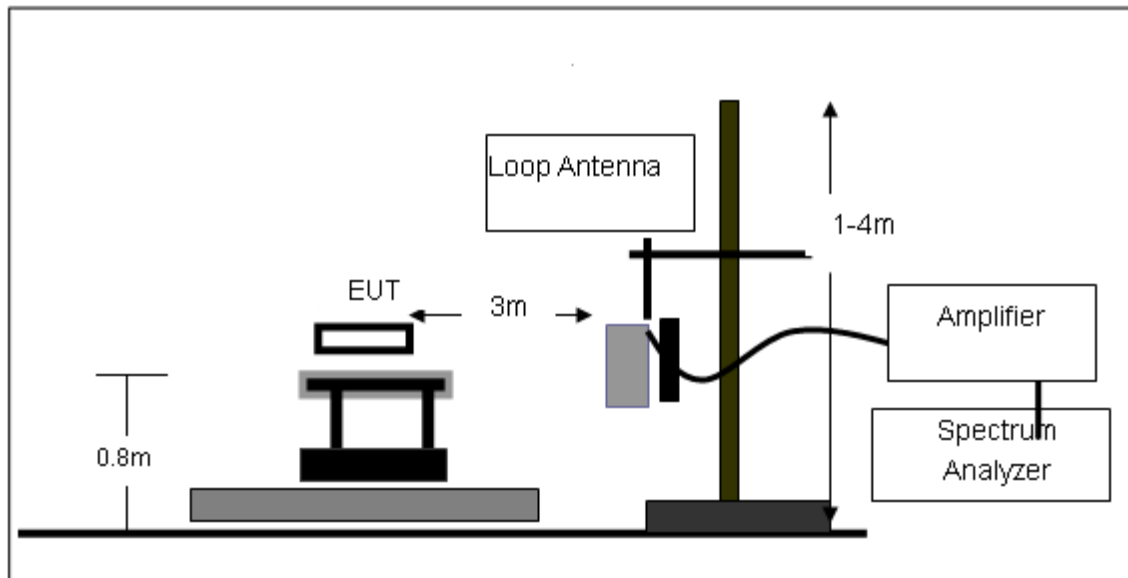
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

3.2.3 DEVIATION FROM TEST STANDARD

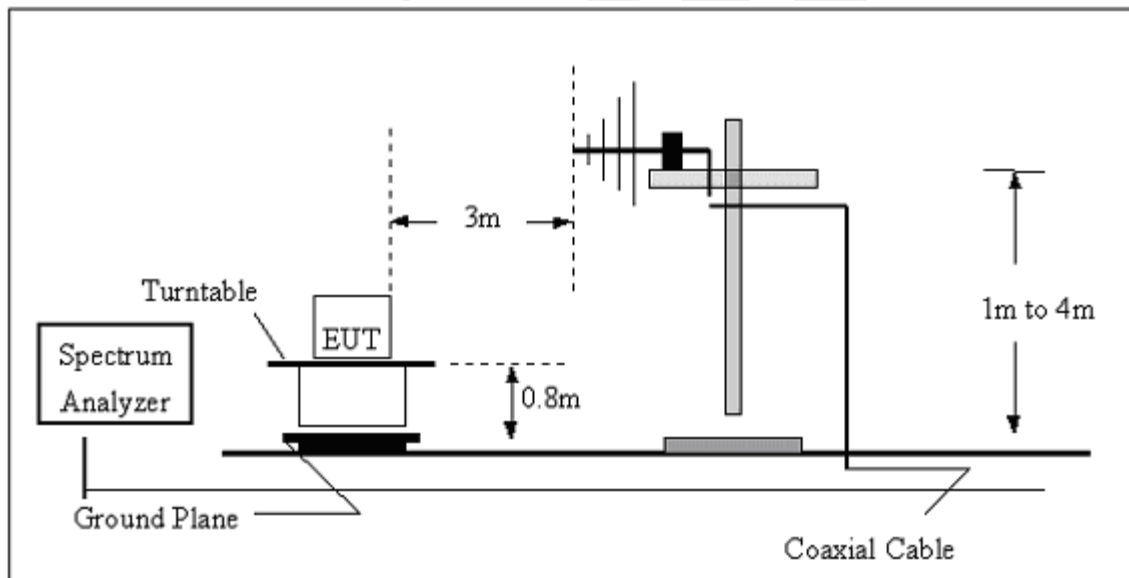
No deviation

3.2.4 TEST SETUP

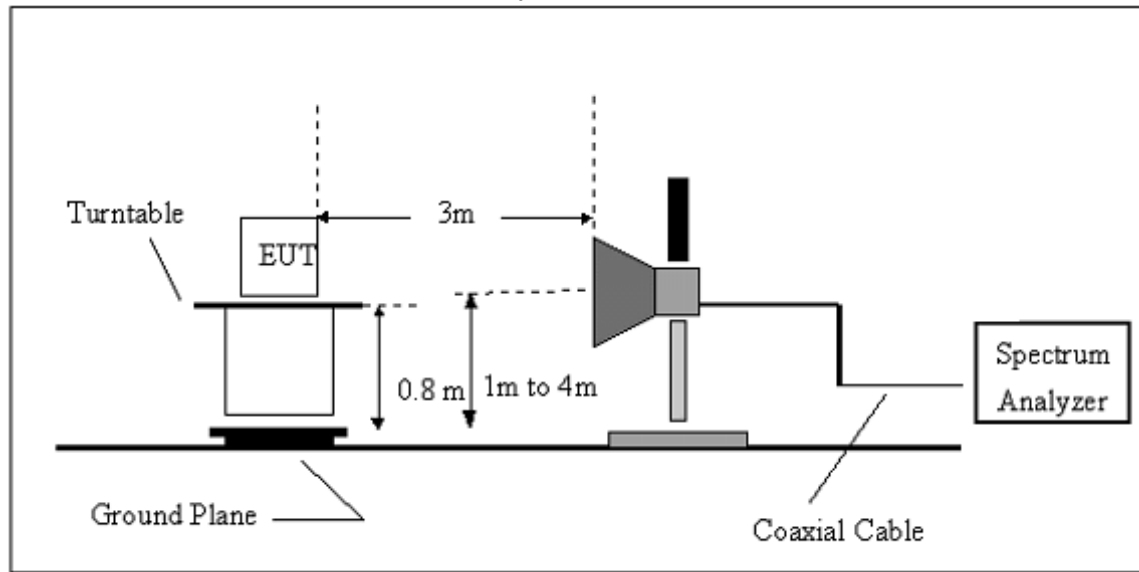
(A) Radiated Emission Test-Up Frequency Below 30MHz



(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz



3.2.5 EUT OPERATING CONDITIONS

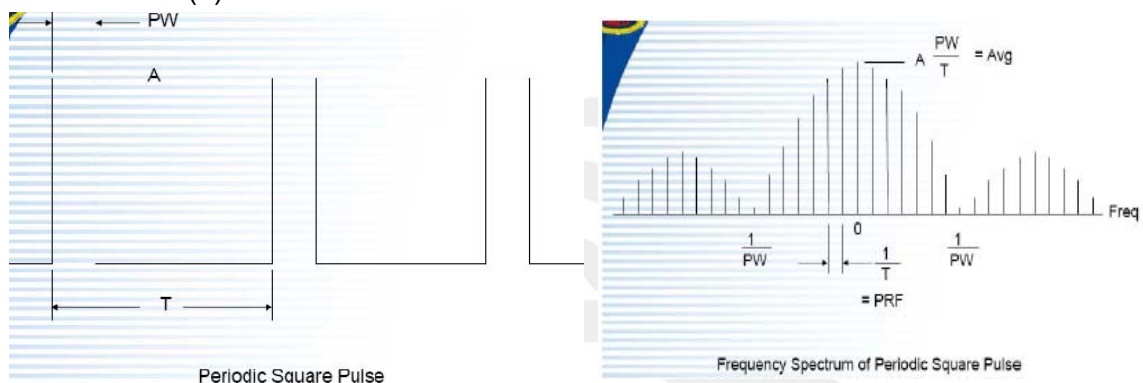
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

3.2.6 TEST RESULTS

INTRODUCTION TO PDCF

reference: (§15.35 Measurement detector functions and bandwidths.)

- a. Part 15 of the FCC Rules provides for the operation of low power communication devices without an individual license (e.g., intrusion detectors, pulsed water tank level gauges, etc.), subject to certain requirements. Some of these devices use extremely narrow pulses to generate wideband emissions, which are measured to determine compliance with the rules. These measurements are typically performed with a receiver or spectrum analyzer. Depending on a number of factors (e.g., resolution bandwidth, pulsewidth, etc.), the spectrum analyzer may not always display the true peak value of the measured emission. This effect, called “pulse desensitization,” relates to the capabilities of the measuring instrument. For the measurement and reporting of the true peak of pulsed emissions, it may be necessary to apply a “pulse desensitization correction factor” (PDCF) to the measured value, pursuant to 47 CFR 15.35(a).



If using spectrum analyzer to measure pulse signal, it have to make sure the RBW use is at least $2/PW$.

•When RBW is less than $2/PW$, you are able to measure the true peak level of the pulse signal. If this is the case, PDCF is required to compensate to determine true peak value.

Pulse desensitization:

$PW = 217.5 \mu\text{sec}$, $\text{Period} = 483.8 \mu\text{sec}$, $\text{Level} = A$

$RBW > 2/PW = 9.2K$, $PRF = 1/T = 2.1K$,

Not: $2 / PW < RBW$, first don't need

- b. For the actual test, please refer to the ANSI C63.10, Annex C refer to section 5 for more detail



Below 30 MHz

EUT :	Wireless Door Bell	Model Name. :	TH-2015
Temperature :	23 °C	Relative Humidity :	50%
Pressure :	1010 hPa	Polarization :	---
Test Voltage :	DC12V		
Test Mode :	TX Mode		

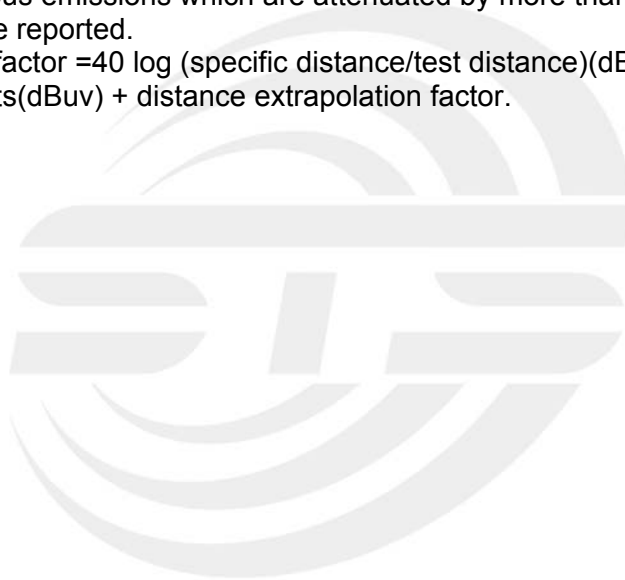
Freq.	Reading	Limit	Margin	State
(MHz)	(dBuV/m)	(dBuV/m)	(dB)	P/F
--	--	--	--	PASS
--	--	--	--	PASS

NOTE:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor = $40 \log (\text{specific distance}/\text{test distance})$ (dB);

Limit line = specific limits(dBuv) + distance extrapolation factor.





Between 30MHz – 4000 MHz

EUT :	Wireless Door Bell	Model Name. :	TH-2015
Temperature :	23 °C	Relative Humidity :	50%
Pressure :	1010 hPa	Polarization :	Horizontal/ vertical
Test Voltage :	DC12V		
Test Mode :	TX Mode		

The Following Table Is The Worst case Y Direction, EUT had been tested at X,Y,Z Orientation

Frequency	Meter Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.231/15.209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV/m)	(PK/QP/Av)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
315	64.12	PK	316	2.1	H	15.88	80.00	95.62	-15.62
315	65.12	PK	243	1.5	V	15.88	81.00	95.62	-14.62
630	35.21	PK	345	2.2	H	24.43	59.64	75.62	-15.98
630	36.20	PK	243	1.6	V	24.43	60.63	75.62	-14.99
945	33.44	PK	335	2.3	H	27.32	60.76	75.62	-14.86
945	34.39	PK	244	1.1	V	27.32	61.71	75.62	-13.91
1260	72.32	PK	344	2.2	H	-16.12	56.20	74	-17.8
1260	72.89	PK	213	1.1	V	-16.12	56.77	74	-17.23
1575	69.58	PK	314	2.4	H	-15.03	54.55	74	-19.45
1575	70.39	PK	245	1	V	-15.03	55.36	74	-18.64

NOTE:

Above 1.5GHz The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

AV = Peak +20Log10(duty cycle) =PK+(-6.94) [refer to section 5 for more detail]

Frequency	PK Reading	Turn table Angle	RX Antenna		Duty cycle Factor	AVG	FCC Part 15.231/15.209/205	
			Height	Polar			Limit	Margin
(MHz)	(dBμV/m)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
315	80.00	316	2.1	H	-6.94	73.06	75.62	-2.56
315	81.00	243	1.5	V	-6.94	74.06	75.62	-1.56
630	59.64	345	2.2	H	-6.94	52.70	55.62	-2.92
630	60.63	243	1.6	V	-6.94	53.69	55.62	-1.93
945	60.76	335	2.3	H	-6.94	53.82	55.62	-1.80
945	61.71	244	1.1	V	-6.94	54.77	55.62	-0.85
1260	56.20	344	2.2	H	-6.94	49.26	54	-4.74
1260	56.77	213	1.1	V	-6.94	49.83	54	-4.17
1575	54.55	314	2.4	H	-6.94	47.61	54	-6.39
1575	55.36	245	1	V	-6.94	48.42	54	-5.58



4. BANDWIDTH TEST

4.1 APPLIED PROCEDURES / LIMIT

FCC Part15 (15.231) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.231(C)	20 Bandwidth	The 20dB bandwidth of the emissions shall not exceed 0.25% of the center frequency	315	PASS

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> Measurement Bandwidth
RB	10 kHz (20dB Bandwidth)
VB	30 kHz (20dB Bandwidth)
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

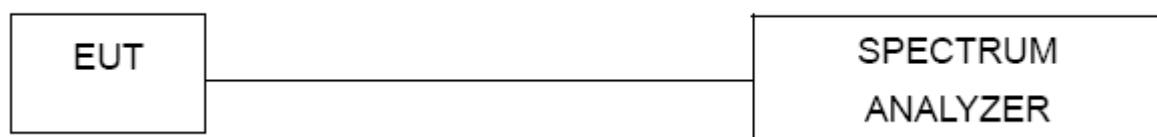
4.2 TEST REQUIREMENTS

1. 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.

4.3 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- b. Spectrum Setting : RBW= 10KHz, VBW=30KHz, Sweep time = Auto.

4.4 TEST SETUP



4.5 EUT OPERATION CONDITIONS

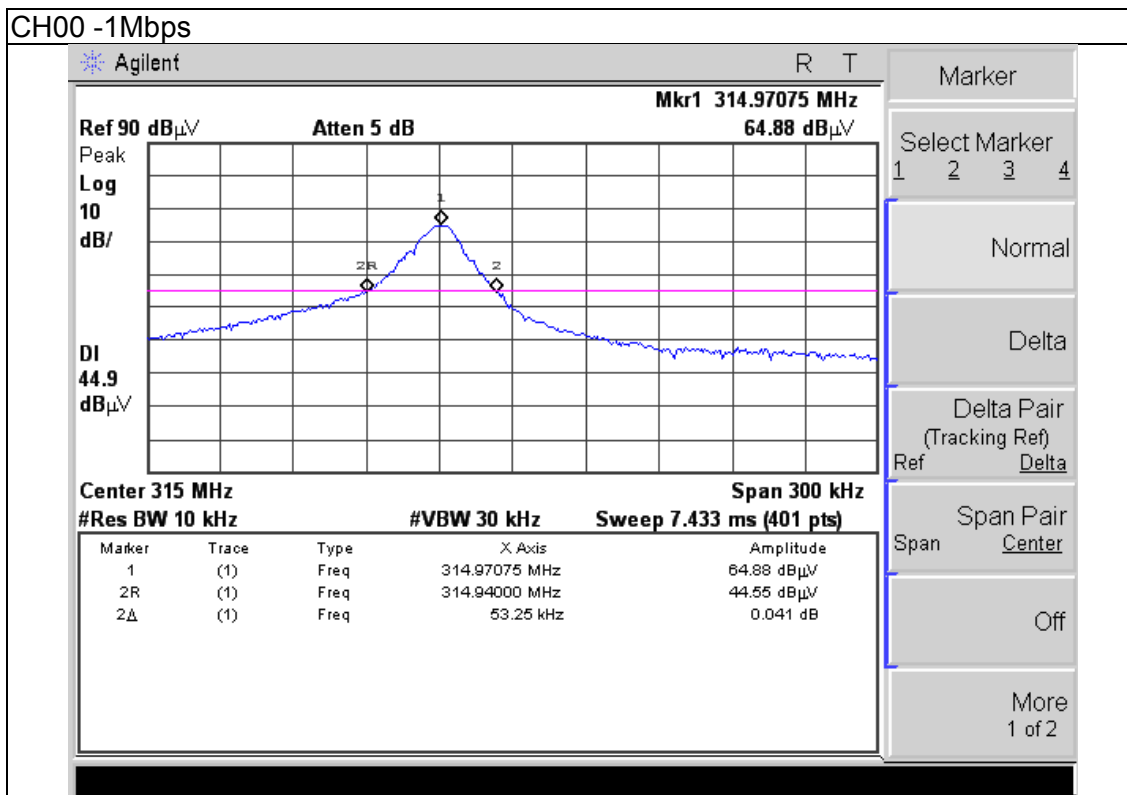
The EUT tested system was configured as the statements of 315 Unless otherwise a special operating condition is specified in the follows during the testing.



4.6 TEST RESULTS

EUT :	Wireless Door Bell	Model Name :	TH-2015
Temperature :	25 °C	Relative Humidity :	50%
Pressure :	1012 hPa	Test Voltage :	DC 12V
Test Mode :	TX Mode		

Frequency	20dB Bandwidth(kHz)	Limit(kHz)	Result
315 MHz	53.25	787.5	PASS



5. PERIODIC OPERATION

5.1 TEST PROCEDURE

- a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,

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 * %

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

5.2 TEST SETUP



5.3 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 0.315 Unless otherwise a special operating condition is specified in the follows during the testing.



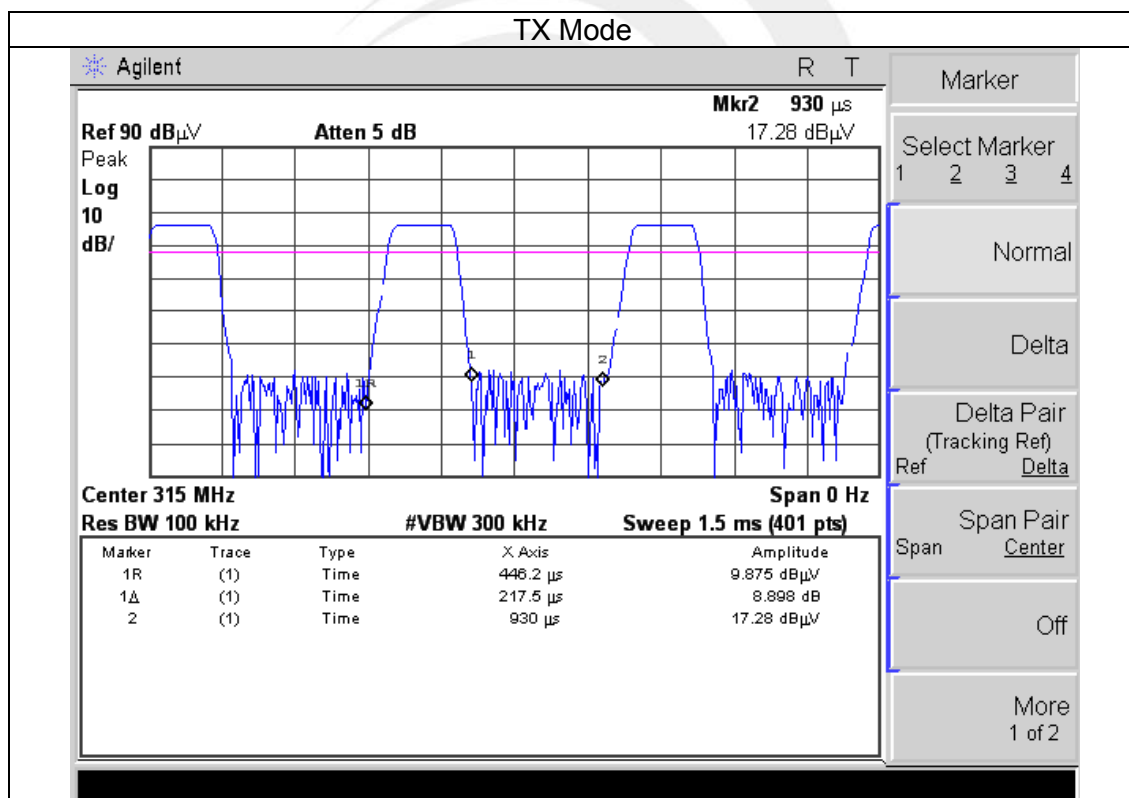
5.4 TEST RESULTS

EUT :	Wireless Door Bell	Model Name :	TH-2015
Temperature :	25 °C	Relative Humidity :	60%
Pressure :	1012 hPa	Test Voltage :	DC 12V
Test Mode :	TX Mode		

FCC Part15 (15.231(a))	
Total On interval in a complete pulse train(ms)	0.2175
Length of a complete pulse train(ms)	0.4838=(0.93-0.4462)
Duty Cycle(%)	44.96%
Duty Cycle Correction Factor(dB)	-6.94

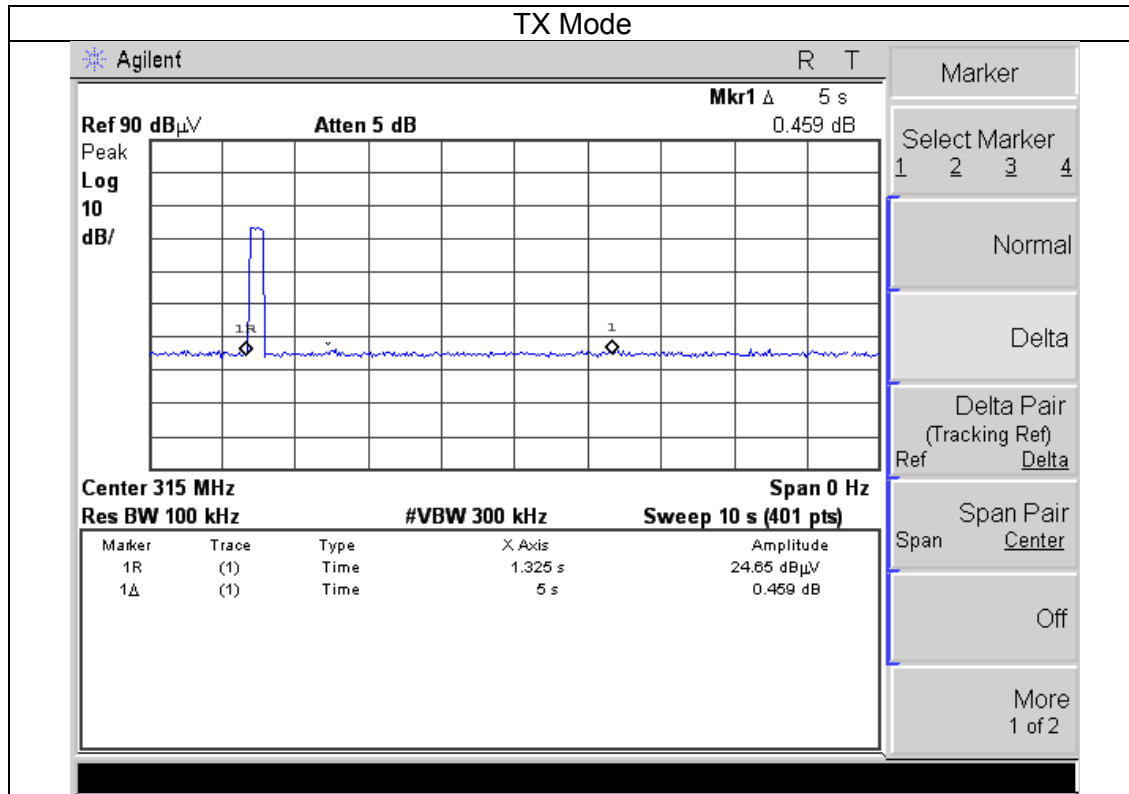
Refer to the duty cycle plot (as below), This device meets the FCC requirement. Length of a complete pulse train

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.





Refer to the plot (As Below), We find a manually operated transmitter shall employ a switch that will automatically deactivate the transmitter immediately, within not more than 5 seconds of being released.





6. ANTENNA REQUIREMENT

6.1 STANDARD 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 PCB printed antenna, fulfill the requirement of this section

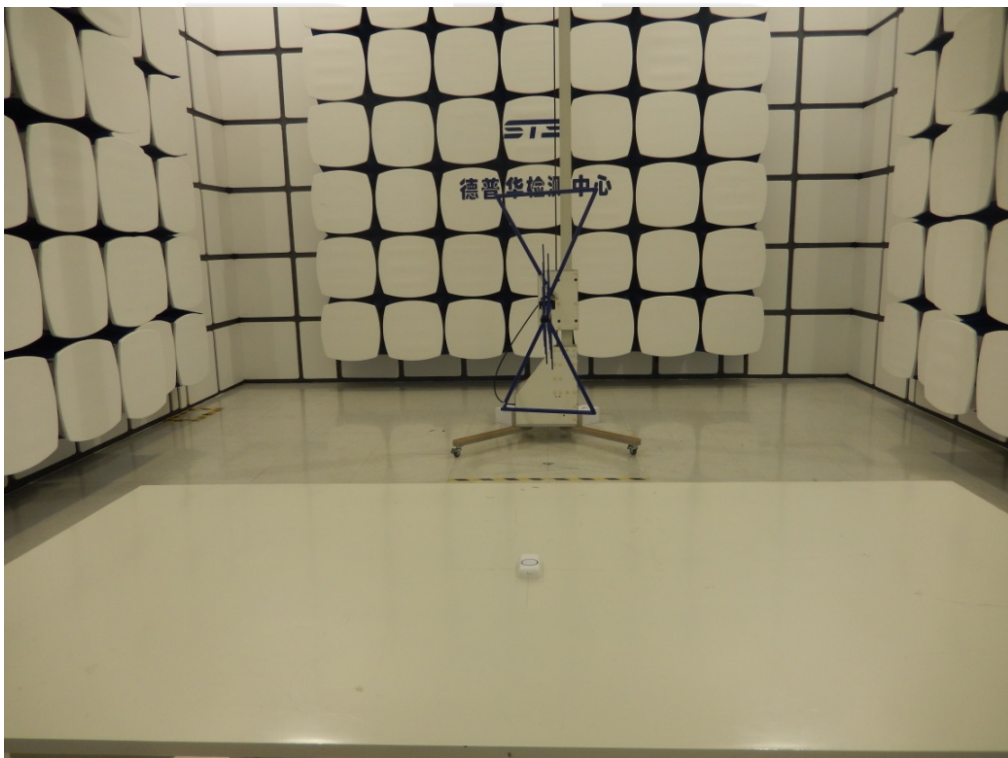
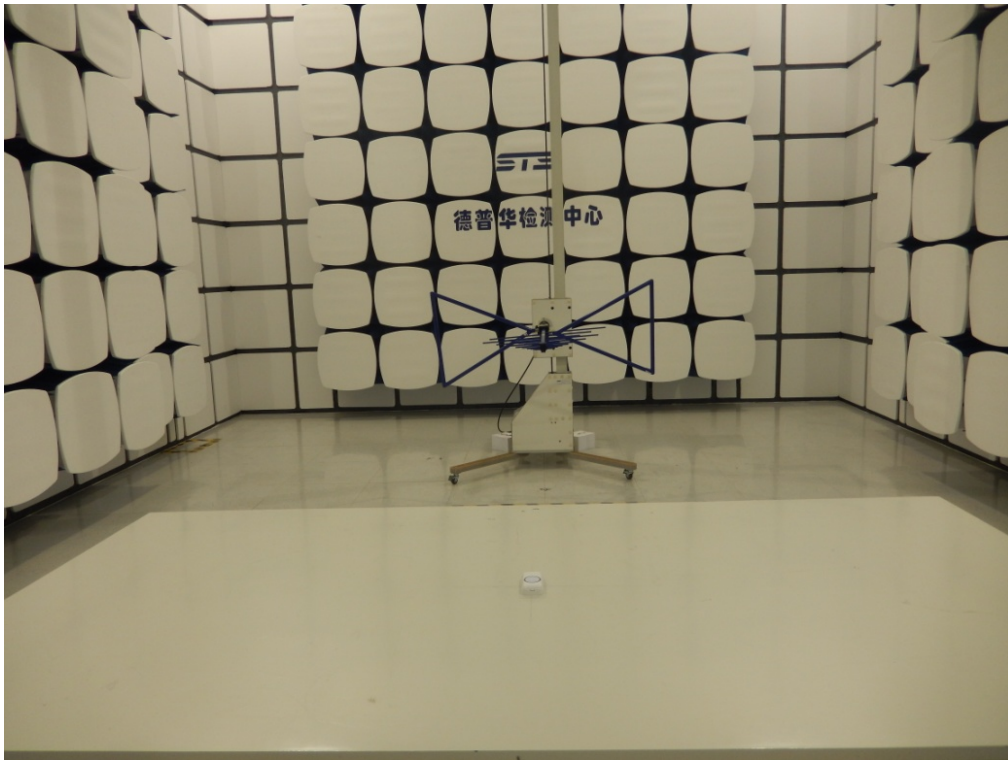
6.2 EUT ANTENNA

The EUT antenna is internal fixation.It conforms to the standard requirements.



APPENDIX- PHOTOS OF TEST SETUP

Radiated Measurement Photos Above 30M



Radiated Measurement Photos Above 1000M

