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FCC PART 15 SUBPART C TEST REPORT

FCC Part 15.225

Report Reference No.....:	**CTL1505131231-WF**
Compiled by (position+printed name+signature)..:	File administrators Jacky Chen
Name of the organization performing the tests (position+printed name+signature)..:	Test Engineer Tracy Qi
Approved by (position+printed name+signature)..:	Manager Tracy Qi
Date of issue.....:	June 06, 2015
Test Firm.....:	**Shenzhen CTL Testing Technology Co., Ltd.**
Address.....:	Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, China 518055
Applicant's name.....:	**Guangzhou Haoyun Security Technology Co., Ltd**
Address.....:	Room 2201, Headquarter Center Tower 2, 555 Panyu Avenue North, Panyu District,Guangzhou, China
Test specification:	
Standard .....:	FCC Part 15.225: Operation within the band 13.110–14.010 MHz.
Master TRF.....:	Dated 2011-01

Test item description ..... :	Card Reader
FCC ID……..:	**2AEXDTSS-CTB391**
Trade Mark .....:	N/A
Model/Type reference.....:	TSS-CTB391, TSS-CTB394, TSS-CTB396-X, TSS-CTB396, TSS-CTB398, TSS-ACVC01, TSS-ACVC02
Transmit Frequency.....:	13.56MHz
Number of channels .....:	1
Modulation Type .....:	ASK
Antenna type .....:	Loop antenna
Result.....:	**Positive**

TEST REPORT

Test Report No. :	CTL1505131231-WF	June 06, 2015 Date of issue

Equipment under Test	:	Card Reader
Model /Type	:	TSS-CTB391
Listed Models	:	TSS-CTB394, TSS-CTB396-X, TSS-CTB396, TSS-CTB398, TSS-ACVC01, TSS-ACVC02
Difference Description	:	Only the color and model's name is different
Applicant	:	**Guangzhou Haoyun Security Technology Co., Ltd**
Address	:	Room 2201, Headquarter Center Tower 2, 555 Panyu Avenue North, Panyu District,Guangzhou, China
Manufacturer	:	**Guangzhou Haoyun Security Technology Co., Ltd**
Address	:	Room 2201, Headquarter Center Tower 2, 555 Panyu Avenue North, Panyu District,Guangzhou, 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.

Contents

1. TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.225: Operation within the band of 13.110–14.010 MHz.

ANSI C63.4-2009

2 . SUMMARY

2.1. General Remarks

Date of receipt of test sample	:	May 13, 2015
Testing commenced on	:	May 13, 2015
Testing concluded on	:	June 06, 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)		

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

A Card Reader work frequency at 13.56MHz.
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. The Applicant provides communication tools software to control the EUT for staying in continuous transmitting mode for testing.

2.5. EUT configuration

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

○ - supplied by the manufacturer
● - supplied by the lab

●	AC adapter (FCC VOC approved)	Manufacturer :	SHENZHEN PENGSHENGYE ELECTRONIC CO.,LTD
		Model No. :	SAPA12010EUU

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

This submittal(s) (test report) is intended for **FCC ID: 2AEXDTSS-CTB391** filing to comply with Section 15.225 of the FCC Part 15, Subpart C Rules.

2.7. Modifications

No modifications were implemented to meet testing criteria.

2.8. NOTE

1. The EUT is a/an RFID Reader, The functions of the EUT listed as below:

	Test Standards	Reference Report
Radio	FCC Part 15 Subpart C (Section15.225)	CTL1505131231-WF

2. The frequency bands used in this EUT are listed as follows:

Frequency Band(MHz)	13.110–14.010 MHz
	√

3. The EUT provides one completed transmitter.

Modulation Mode	TX Function
ASK	1TX

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 C63.4 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. 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	Above 1GHz	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.

3.5. Test Description

FCC PART 15 Subpart C		
FCC Part 15.207	AC Power Conducted Emission	PASS
FCC Part 15.225(a)(b)(c)(d)	Radiated Emission (9kHz ~ 30MHz)	PASS
FCC Part 15.225(d),15.209	Radiated Emission (30MHz ~ 1GHz)	PASS
FCC §15.225(e)	Frequency stability	PASS
FCC Part 2.1049	20dB Bandwidth	PASS

Remark: The measurement uncertainty is not included in the test result.

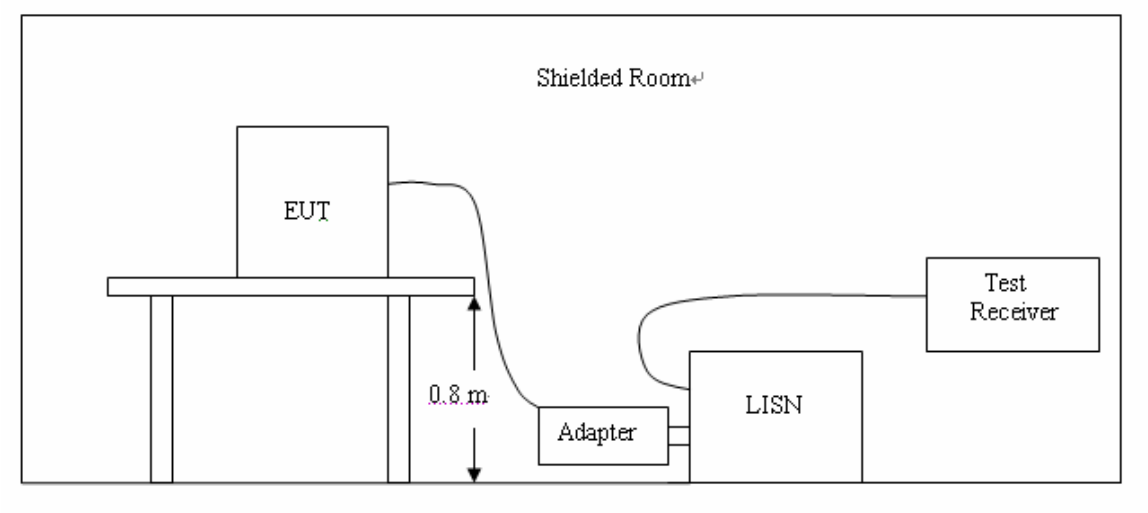
3.6. Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
Bilog Antenna	Sunol Sciences Corp.	JB1	A061713	2014/07/12	2015/07/11
EMI Test Receiver	R&S	ESCI	103710	2014/07/10	2015/07/09
Spectrum Analyzer	Agilent	E4407B	MY45108355	2014/07/06	2015/07/05
Controller	EM Electronics	Controller EM 1000	N/A	2014/07/06	2015/07/05
Horn Antenna	Sunol Sciences Corp.	DRH-118	A062013	2014/07/12	2015/07/11
Horn Antenna	SCHWARZBECK	BBHA9170	1562	2014/07/12	2015/07/11
Active Loop Antenna	SCHWARZBECK	FMZB1519	1519-037	2014/07/12	2015/07/11
LISN	R&S	ENV216	101316	2014/07/10	2015/07/09
LISN	SCHWARZBECK	NSLK8127	8127687	2014/07/10	2015/07/09
Microwave Preamplifier	HP	8349B	3155A00882	2014/07/10	2015/07/09
Amplifier	HP	8447D	3113A07663	2014/07/10	2015/07/09
Transient Limiter	Com-Power	LIT-153	532226	2014/07/10	2015/07/09
Radio Communication Tester	R&S	CMU200	3655A03522	2014/07/06	2015/07/05
Temperature/Humidity Meter	zhicheng	ZC1-2	22522	2014/07/10	2015/07/09
SIGNAL GENERATOR	HP	8647A	3200A00852	2014/07/10	2015/07/09
Wideband Peak Power Meter	Anritsu	ML2495A	220.23.35	2014/07/06	2015/07/05
Climate Chamber	ESPEC	EL-10KA	A20120523	2014/07/06	2015/07/05
High-Pass Filter	K&L	9SH10-2700/X12750-O/O	/	2014/07/06	2015/07/05
High-Pass Filter	K&L	41H10-1375/U12750-O/O	/	2014/07/06	2015/07/05

4. TEST CONDITIONS AND RESULTS

4.1. AC Power Conducted Emission

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 C63.10-2009.
2 Support equipment, if needed, was placed as per ANSI C63.10-2009
3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2009
4 The EUT received DC5V power from the adapter, the 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.
Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following：

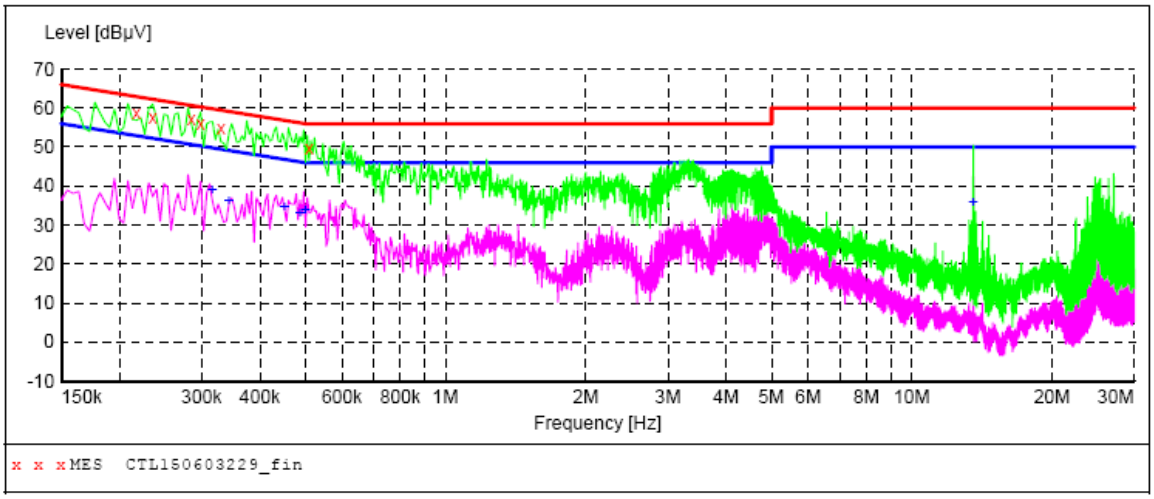
Frequency (MHz)	Maximum RF Line Voltage (dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

* Decreasing linearly with the logarithm of the frequency

TEST RESULTS

SCAN TABLE: "Voltage (9K-30M)FIN"

Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "CTL150603229_fin"

6/6/2015 4:05PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.217500	58.60	10.2	63	4.3	QP	N	GND
0.235500	57.70	10.2	62	4.6	QP	N	GND
0.285000	57.10	10.2	61	3.6	QP	N	GND
0.298500	56.10	10.2	60	4.2	QP	N	GND
0.330000	54.80	10.2	60	4.7	QP	N	GND
0.510000	49.50	10.2	56	6.5	QP	N	GND

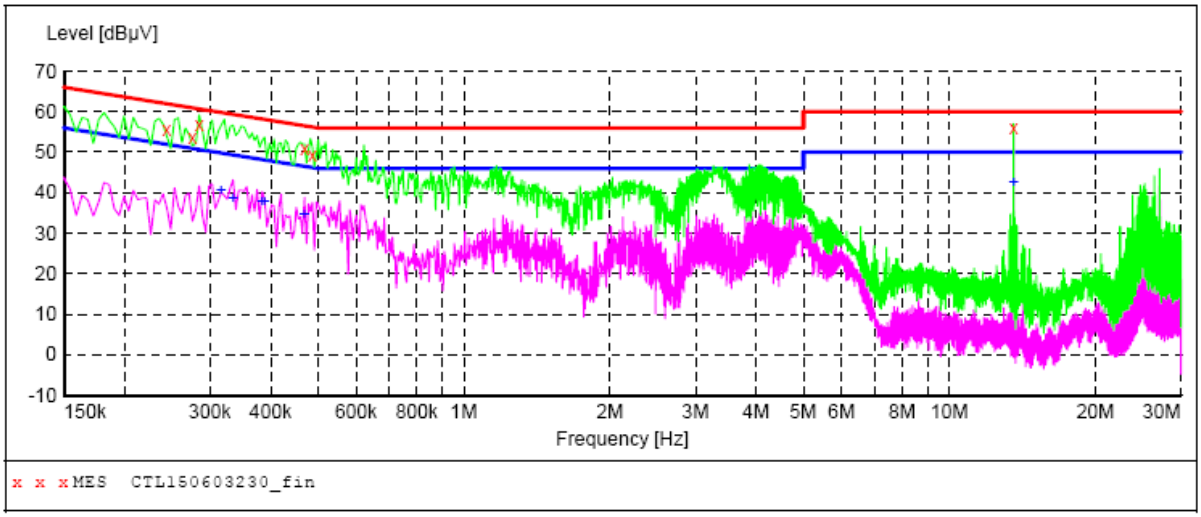
MEASUREMENT RESULT: "CTL150603229_fin2"

6/6/2015 4:05PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.316500	38.80	10.2	50	11.0	AV	N	GND
0.343500	36.10	10.2	49	13.0	AV	N	GND
0.451500	34.60	10.2	47	12.2	AV	N	GND
0.487500	33.20	10.2	46	13.0	AV	N	GND
0.501000	33.90	10.2	46	12.1	AV	N	GND
13.555500	35.60	10.6	50	14.4	AV	N	GND

SCAN TABLE: "Voltage (9K-30M)FIN"

Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "CTL150603230_fin"

6/6/2015 4:08PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.244500	55.40	10.2	62	6.5	QP	L1	GND
0.276000	53.60	10.2	61	7.3	QP	L1	GND
0.285000	56.60	10.2	61	4.1	QP	L1	GND
0.469500	50.70	10.2	57	5.8	QP	L1	GND
0.487500	49.40	10.2	56	6.8	QP	L1	GND
13.560000	56.00	10.6	60	4.0	QP	L1	GND

MEASUREMENT RESULT: "CTL150603230_fin2"

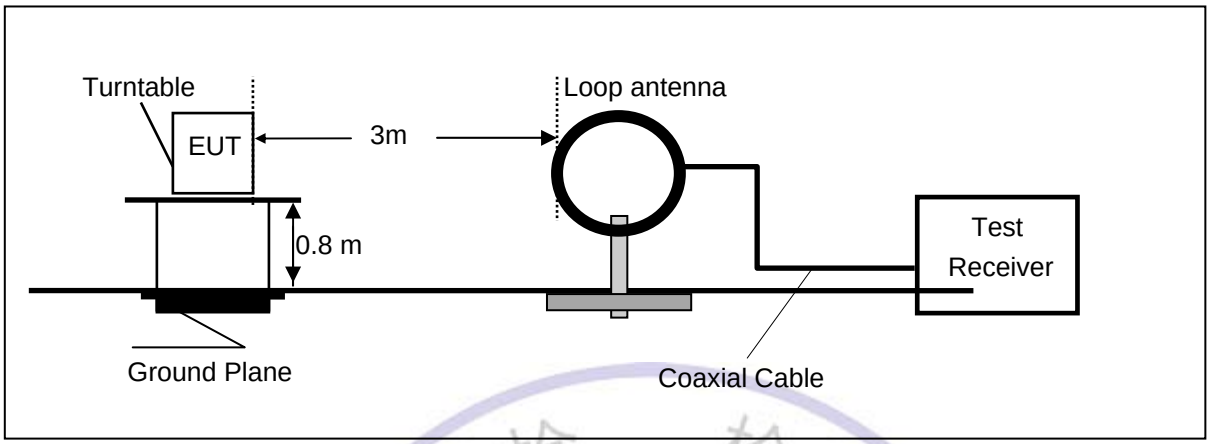
6/6/2015 4:08PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.316500	40.70	10.2	50	9.1	AV	L1	GND
0.334500	38.60	10.2	49	10.7	AV	L1	GND
0.384000	37.80	10.2	48	10.4	AV	L1	GND
0.388500	37.80	10.2	48	10.3	AV	L1	GND
0.469500	34.60	10.2	47	11.9	AV	L1	GND
13.564500	42.60	10.6	50	7.4	AV	L1	GND

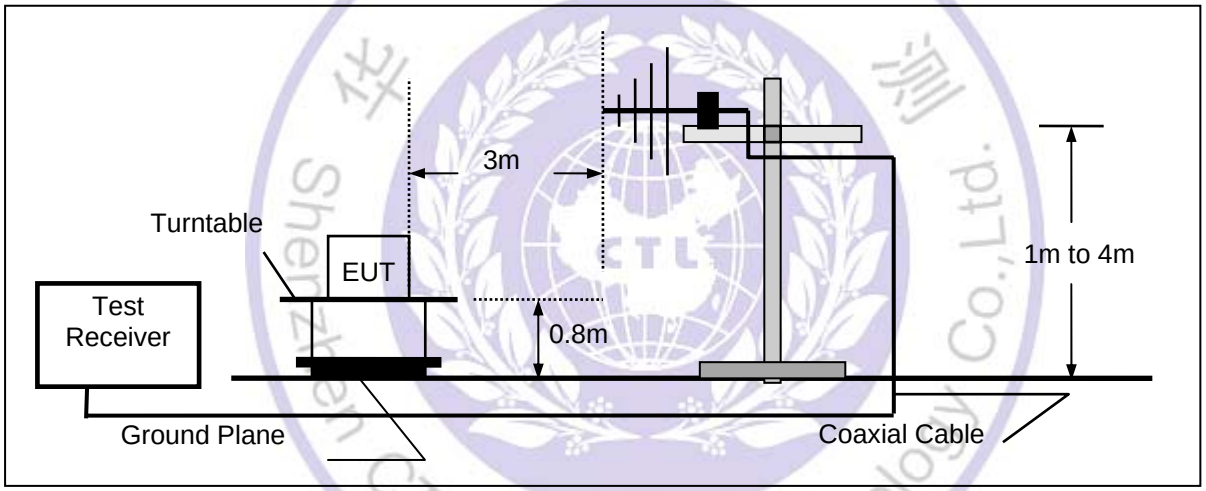
4.2. Radiated Emission

TEST CONFIGURATION

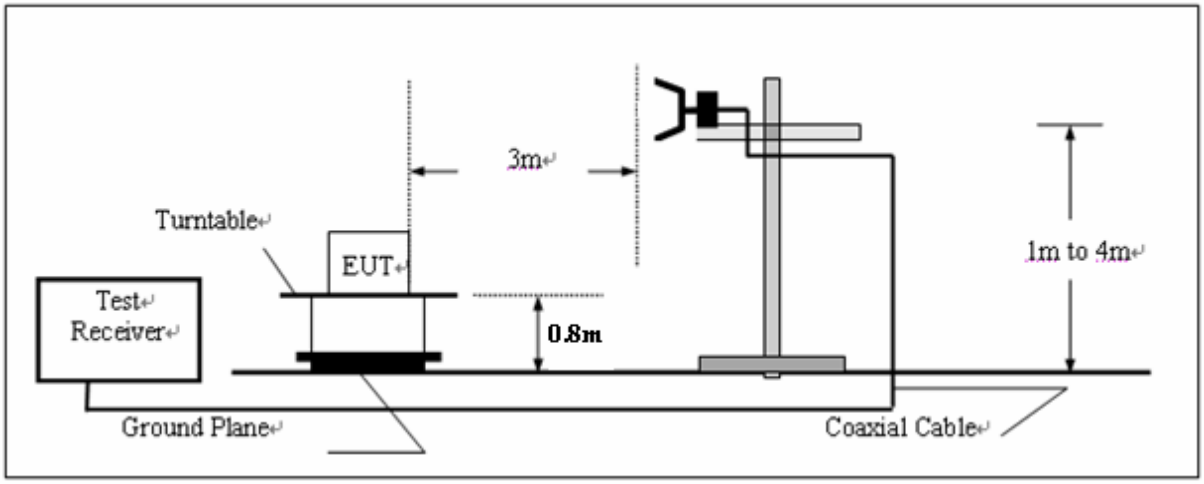
Radiated Emission Test Set-Up
Frequency range 9KHz – 30MHz



Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-25GHz



TEST PROCEDURE

1 The EUT was placed on a turn table which is 0.8m above ground plane.
2 Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT
3 And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4 Repeat above procedures until all frequency measurements have been completed.

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	

For example

Frequency (MHz)	FS (dBμV/m)	RA (dBμV/m)	AF (dB)	CL (dB)	AG (dB)	Transd (dB)
300.00	40	58.1	12.2	1.6	31.90	-18.1

Transd=AF +CL-AG

RADIATION LIMIT

Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength @30m (uV/m)	Field strength @30m (dBuV/m)	Field strength @3m (dBuV/m)
Below 13.110	30	29.5	69.5
13.110 ~13.410	106	40.5	80.5
13.410~13.553	334	50.5	90.5
13.553~13.567	15,848	84	124
13.567~13.710	334	50.5	90.5
13.710~14.010	106	40.5	80.5
Above 14.010	30	29.5	69.5

Note:
(1) The tighter limit shall apply at the edge between two frequency bands.
(2) dBuV/m = 20*log(uV/m)
(3) Distance factor = 40dB / decade(15.31(f))

FCC Part15, Subpart C Section 15.209 limit of radiated emission for frequency below1000MHz. The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Distance (Meters)	Field Strengths Limits (dBμV/m)
0.009 -0.490	300	2400/F(KHz)
0.490 -1.705	30	24000/F(KHz)
1.705 -30	30	30
30 -88	3	40.0
88 -216	3	43.5
216 -960	3	46.0
Above 960	3	54.0

Note:
(1) The tighter limit shall apply at the edge between two frequency bands.
(2) Distance refers to the distance in meters between the test instrument antenna and the closest point of any part of the E.U.T.

TEST RESULTS

WORST-CASE RADIATED EMISSION BELOW 30 MHz

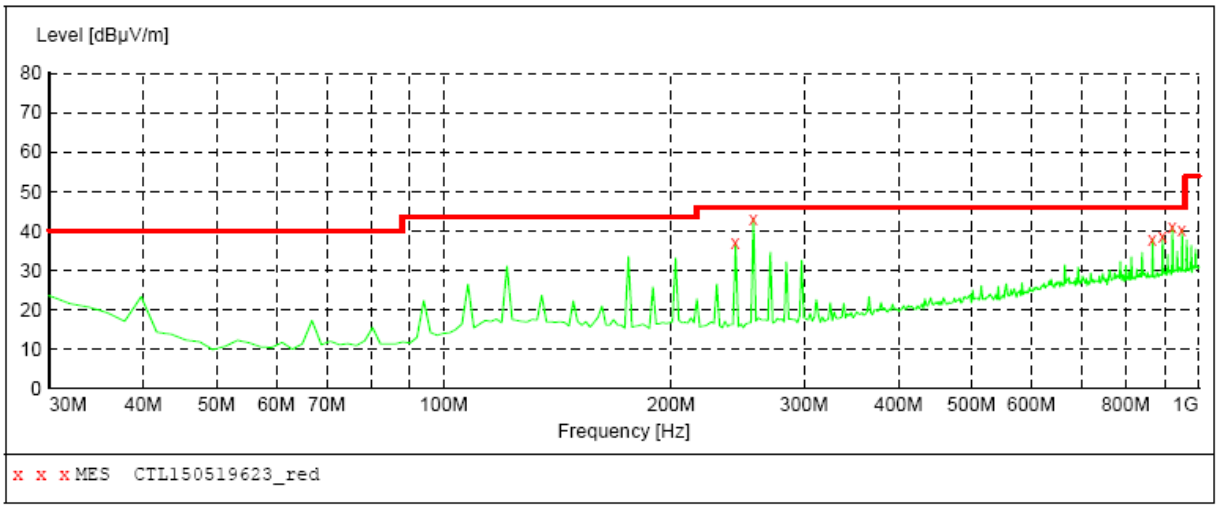
Frequency	Meter Reading	Polar	Antenna Factor	Cable Loss	Emission Levels	Limits at 3m	Margin	DetectorMode
(MHz)	(dBμV)	H/V	(dB/m)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	QP /AV
13.41	40.89	V	25.36	0.34	66.59	80.5	13.91	QP
13.56	69.73	V	25.36	0.34	95.43	124	28.57	QP
13.55	51.06	V	25.36	0.35	76.77	90.5	13.73	QP
13.569	49.63	V	25.36	0.34	75.33	90.5	15.17	QP
13.71	41.38	V	25.41	0.34	67.13	80.5	13.37	QP
24.653	21.52	V	22.71	0.59	44.82	69.5	24.68	QP

Remark: 1. Data 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.
2. The test limit distance is 3m limit.
3. PK means Peak Value, QP means Quasi Peak Value, AV means Average Value.

Radiated Emission Test Data 30-1000MHz:

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	300.0 ms	120 kHz	JB1



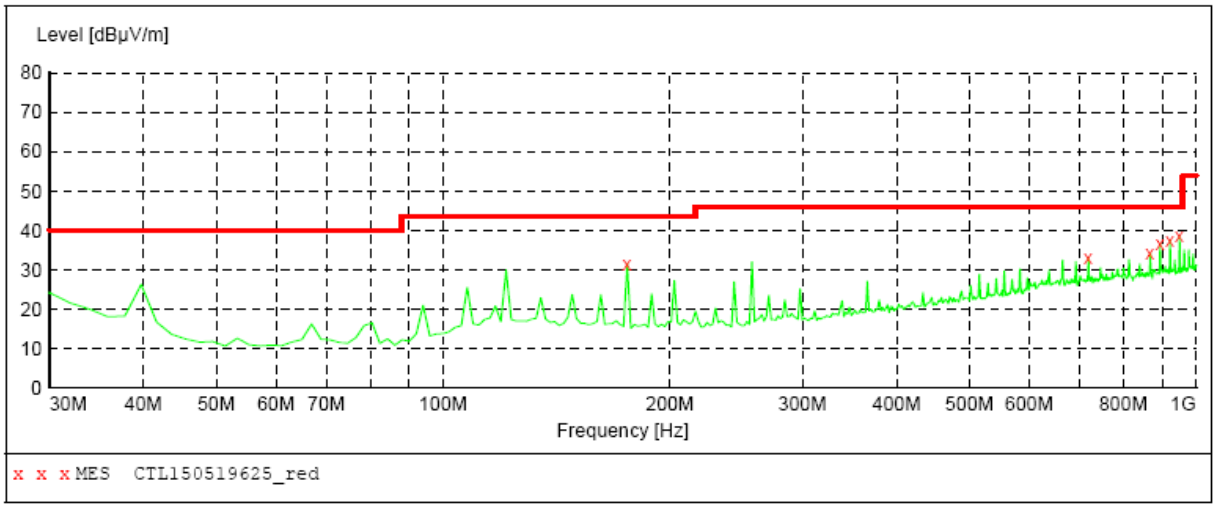
MEASUREMENT RESULT: "CTL150519623_red"

5/19/2015 6:53PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
243.400000	36.90	14.1	46.0	9.1	---	0.0	0.00	HORIZONTAL
256.980000	43.00	14.7	46.0	3.0	---	0.0	0.00	HORIZONTAL
868.080000	37.90	25.5	46.0	8.1	---	0.0	0.00	HORIZONTAL
895.240000	38.70	26.0	46.0	7.3	---	0.0	0.00	HORIZONTAL
922.400000	41.20	26.3	46.0	4.8	---	0.0	0.00	HORIZONTAL
949.560000	40.20	26.6	46.0	5.8	---	0.0	0.00	HORIZONTAL

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	300.0 ms	120 kHz	JB1



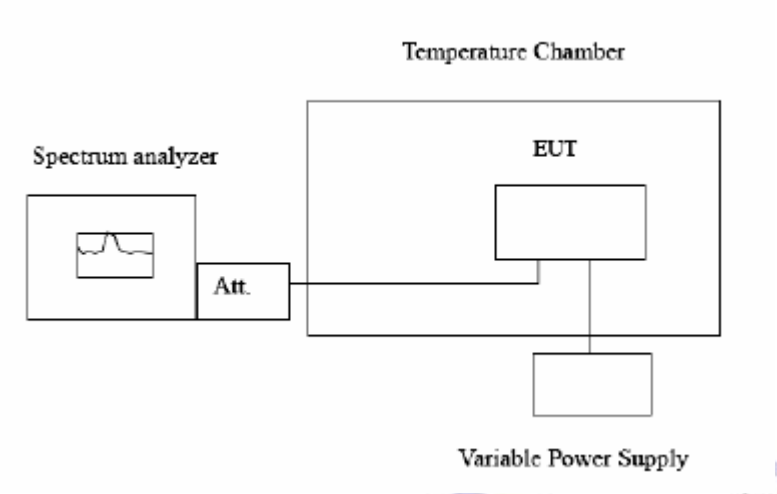
MEASUREMENT RESULT: "CTL150519625_red"

5/19/2015 6:56PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
175.500000	31.50	13.2	43.5	12.0	---	0.0	0.00	VERTICAL
718.700000	33.00	23.7	46.0	13.0	---	0.0	0.00	VERTICAL
868.080000	34.10	25.5	46.0	11.9	---	0.0	0.00	VERTICAL
895.240000	36.60	26.0	46.0	9.4	---	0.0	0.00	VERTICAL
922.400000	37.50	26.3	46.0	8.5	---	0.0	0.00	VERTICAL
949.560000	38.50	26.6	46.0	7.5	---	0.0	0.00	VERTICAL

4.3. Frequency Tolerance

TEST CONFIGURATION



TEST PROCEDURE

The frequency stability of the transmitter is measured by: (a) Temperature: The temperature is varied from -20 to ℃ +50℃ using an environmental chamber. (b) Primary Supply Voltage: The primary supply voltage is varied from 85% to 115% of the voltage normally input to the device or at the power supply terminals if cables are not normally supplied.

LIMIT

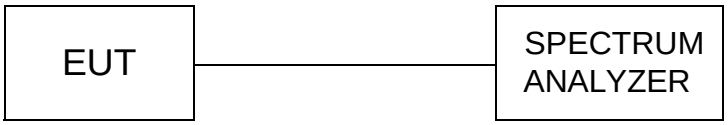
The frequency tolerance of the carrier shall be maintained within ±0.01% of the operating frequency.

TEST RESULTS

Voltage (%)	Power (VDC)	Temperature (℃)	Frequency (MHz)	Deviation (%)
100	12.0	+20℃(Ref)	13.560077	0.000568
100	12.0	-20	13.560251	0.001851
100	12.0	-10	13.560188	0.001386
100	12.0	0	13.560229	0.001689
100	12.0	10	13.560237	0.001748
100	12.0	25	13.560083	0.000612
100	12.0	30	13.560095	0.000701
100	12.0	40	13.560183	0.001350
100	12.0	50	13.560281	0.002072
85	10.2	20	13.560463	0.003414
115	13.8	20	13.560528	0.003894

4.4. 20dB Bandwidth

TEST CONFIGURATION



TEST PROCEDURE

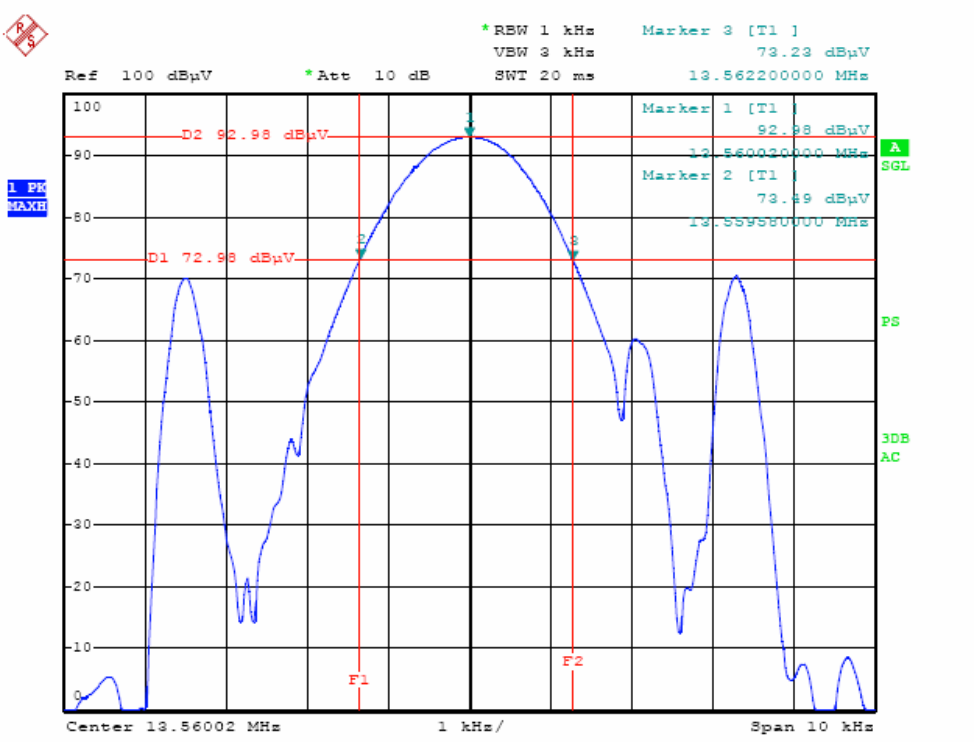
The bandwidth of the fundamental frequency was measured by spectrum analyzer with 1KHz RBW and 3KHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

LIMIT

The 20dB bandwidth shall be specified in operating frequency band.

TEST RESULTS

20dBc point (low)	20dBc point (High)	20dB Bandwidth (KHz)	Operating frequency band (MHz)	PASS/FAIL
13.55958MHz	13.56220MHz	2.62	13.553~13.567	PASS



4.5. ANTENNA REQUIREMENT

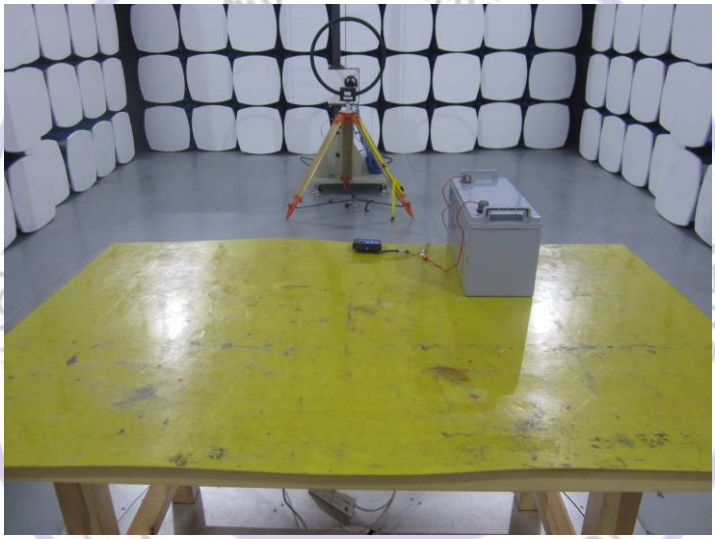
STANDARD APPLICABLE

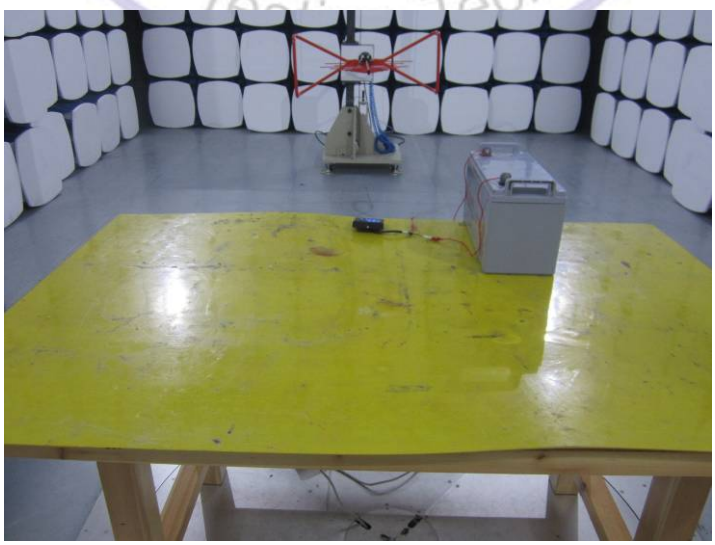
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling 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.

ANTENNA CONNECTED CONSTRUCTION

The antenna is a loop antenna and connector is designed with permanent attachment no consideration of replacement. The antenna used in this product is complied with Standard. The maximum Gain of the antenna lower than 6.0dBi and has the definite antenna Specification.

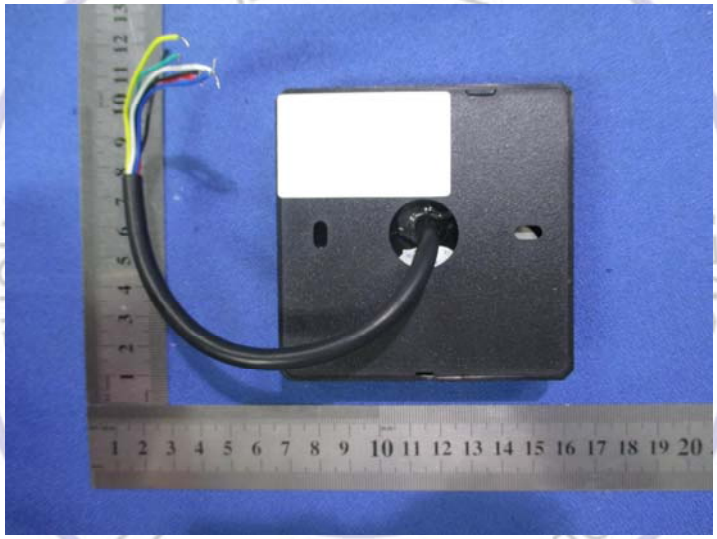
5. Test Setup Photos of the EUT

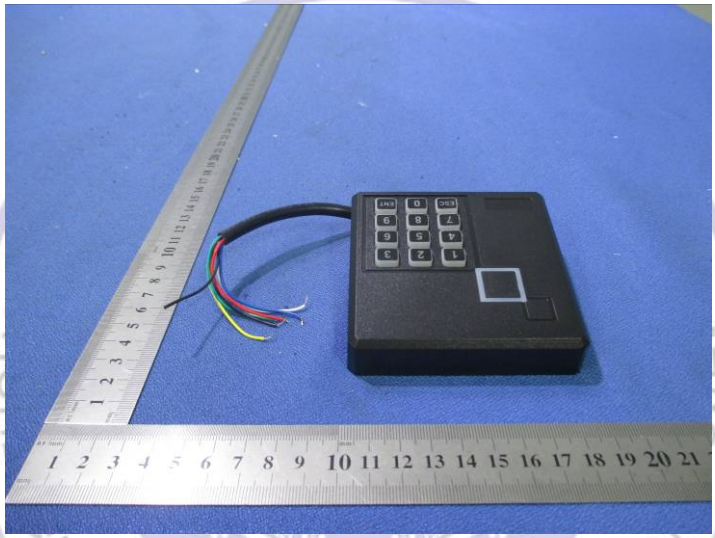


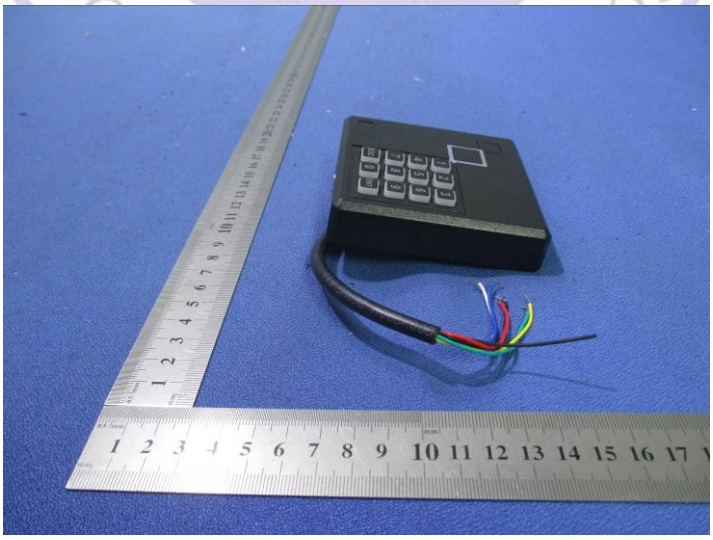


6. External and Internal Photos of the EUT

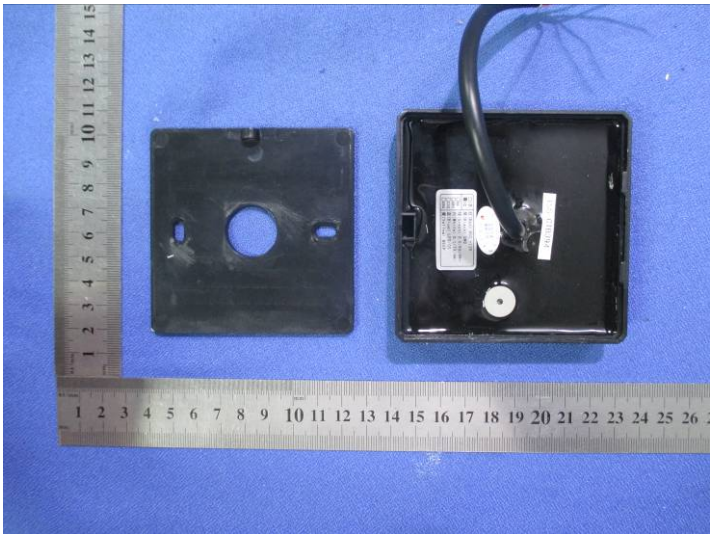
External Photos of EUT

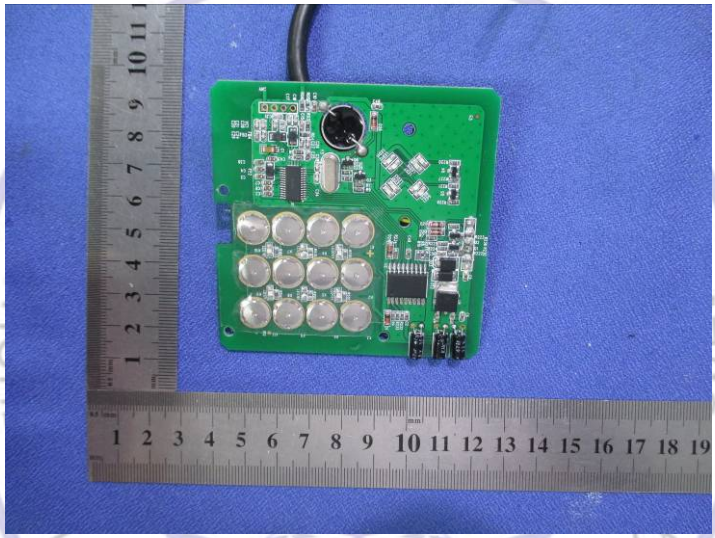


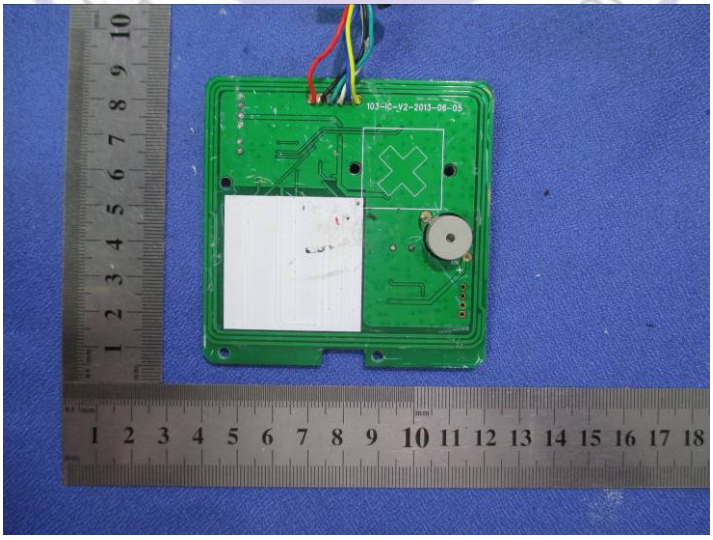


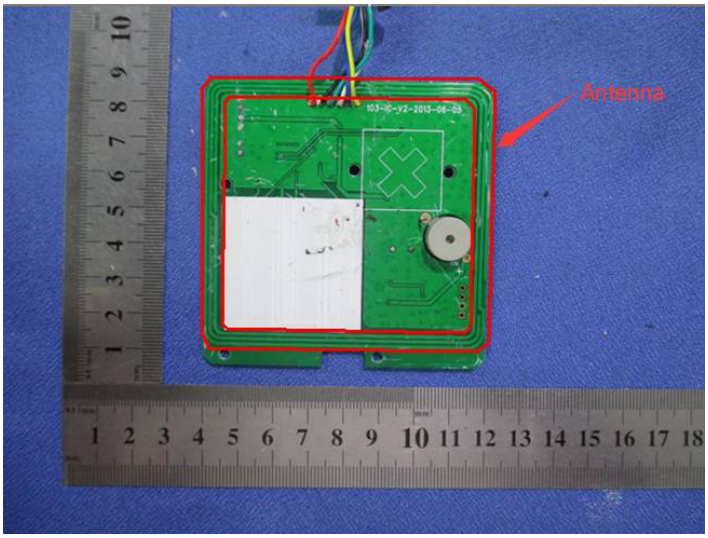


Internal Photos of EUT









.....End of Report.....