FCC RADIO TEST REPORT
FCC ID:XLY-2455SP

Product：	RFID&KEYPAD LOCKER LOCK
Trade Name：	N/A
Model Name：	2455SP
Serial Model：	N/A
Report No.：	NTEK- 2015NT0817531F

Prepared for

Zephyrlock,LLC

14 Finance Drive, Danbury, Connecticut, United States 06810

Prepared by

Shenzhen NTEK Testing Technology Co., Ltd.

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Website:www.ntek.org.cn

TEST RESULT CERTIFICATION

Applicant's name	:	Zephyrlock,LLC
Address	:	14 Finance Drive, Danbury, Connecticut, United States 06810
Manufacture's Name	:	Thumb Technology Co.,Limited
Address	:	Fuda Fifth Road, Fuda Industrial, Futian Town, Bolou County, Huizhou Municipality, Guangdong, China

Product description

Product name	:	RFID&KEYPAD LOCKER LOCK
Model and/or type reference	:	2455SP
Serial Model：		N/A
Standards	:	FCC Part15.225:01 Oct. 2014
Test procedure		ANSI C63.4-2003

This device described above has been tested by NTEK, 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	:	17 Aug. 2015 ~07 Sep. 2015
Date of Issue	:	07 Sep. 2015
Test Result	:	**Pass**

Testing Engineer : Jason chen

(Jason Chen)

Technical Manager : Brown Lu

(Brown Lu)

Authorized Signatory : Sam . chen

(Sam Chen)

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1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

FCC Part15, Subpart C (15.231)			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	Pass	
15.205(a) 15.209 15.225	Radiated Spurious Emission	Pass	
15.225	20dB Bandwidth	Pass	
15.225	Frequency Tolerance	Pass	
15.203	Antenna Requirement	Pass	

NOTE:
(1) ” N/A” denotes test is not applicable in this Test Report.

1.1 TEST FACILITY

NTEK Testing Technology Co., Ltd
Add. : 1/F, Building E, Fenda Science Park, Sanwei Community, Xixiang Street, Bao'an District, Shenzhen P.R. China.
FCC Registration No.:238937; IC Registration No.:9270A-1
CNAS Registration No.:L5516

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement **y ± U**，where expended 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	±1.38dB
2	RF power,conducted	±0.16dB
3	Spurious emissions,conducted	±0.21dB
4	All emissions,radiated(<1G)	±4.68dB
5	All emissions,radiated(>1G)	±4.89dB
6	Temperature	±0.5°C
7	Humidity	±2%

2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

Equipment	RFID&KEYPAD LOCKER LOCK
Trade Name	N/A
Model Name	2455SP
Serial Model	N/A
Model Difference	N/A
Product Description	The EUT is a RFID&KEYPAD LOCKER LOCK Operation Frequency: 13.56MHz Modulation Type: ASK Number Of Channel 1CH. Antenna Designation: Loop Antenna Antenna Gain(Peak) 0 dBi
Channel List	N/A
Power Suplly	DC 5V
Battery	N/A

Note:

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

2. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	NOTE
1	N/A	N/A	Loop Antenna	N/A	0	Antenna

2.2 DESCRIPTION OF TEST MODES

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

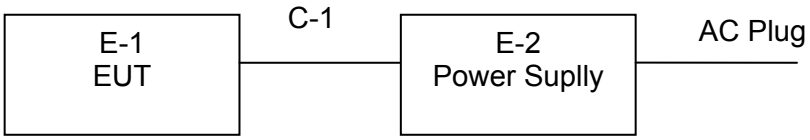
Pretest Mode	Description
Mode 1	TX

For Conducted Emission	
Final Test Mode	Description
Mode 1	TX

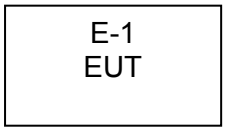
For Radiated Emission	
Final Test Mode	Description
Mode 1	TX

2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Conducted Emission Test



Radiated Spurious Emission Test



2.4 DESCRIPTION OF SUPPORT UNITS(CONDUCTED MODE)

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	Brand	Model/Type No.	Series No.	Note
E-1	RFID&KEYPAD LOCKER LOCK	N/A	2455SP	N/A	EUT
E-2	Power Suplly	N/A	KA23-1200800USS	N/A	

Item	Shielded Type	Ferrite Core	Length	Note
C-1	NO	NO	1.2m	

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.

2.5 EQUIPMENTS LIST FOR ALL TEST ITEMS

Radiation Test equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	Spectrum Analyzer	Agilent	E4407B	MY45108040	2015.07.06	2016.07.05	1 year
2	Test Receiver	R&S	ESPI	101318	2015.06.07	2016.06.06	1 year
3	Bilog Antenna	TESEQ	CBL6111D	31216	2015.07.06	2016.07.05	1 year
4	50Ω Coaxial Switch	Anritsu	MP59B	6200264416	2015.06.07	2016.06.06	1 year
5	Spectrum Analyzer	ADVANTEST	R3132	150900201	2015.06.07	2016.06.06	1 year
6	Horn Antenna	EM	EM-AH-10180	2011071402	2015.07.06	2016.07.05	1 year
7	Horn Ant	Schwarzbeck	BBHA 9170	9170-181	2015.07.06	2016.07.05	1 year
8	Amplifier	EM	EM-30180	060538	2014.12.22	2015.12.21	1 year
9	Loop Antenna	ARA	PLA-1030/B	1029	2015.06.08	2016.06.07	1 year
10	Power Meter	R&S	NRVS	100696	2015.07.06	2016.07.05	1 year
11	Power Sensor	R&S	URV5-Z4	0395.1619.05	2015.07.06	2016.07.05	1 year

Conduction Test equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	Test Receiver	R&S	ESCI	101160	2015.06.06	2016.06.05	1 year
2	LISN	R&S	ENV216	101313	2015.08.24	2016.08.23	1 year
3	LISN	EMCO	3816/2	00042990	2015.08.24	2016.08.23	1 year
4	50Ω Coaxial Switch	Anritsu	MP59B	6200264417	2015.06.07	2016.06.06	1 year
5	Passive Voltage Probe	R&S	ESH2-Z3	100196	2015.06.07	2016.06.06	1 year
6	Absorbing clamp	R&S	MOS-21	100423	2015.06.08	2016.06.07	1 year

2	LISN	R&S	ENV216	101313	2014.08.24	2015.08.23	1 year
3	LISN	EMCO	3816/2	00042990	2014.08.24	2015.08.23	1 year

3. ANTENNA REQUIREMENT

3.1 STANDARD REQUIREMENT

15.203 requirement: For intentional device, according to 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.

3.2 EUT ANTENNA

The EUT antenna is permanent attached antenna. It comply with the standard requirement.

4. EMC EMISSION TEST

4.1 CONDUCTED EMISSION MEASUREMENT

4.1.1 POWER LINE CONDUCTED EMISSION Limits (Frequency Range 150KHz-30MHz)

FREQUENCY (MHz)	Class A (dBuV)		Class B (dBuV)		Standard
	Quasi-peak	Average	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 *	LP002.
0.50 -5.0			56.00	46.00	LP002.
5.0 -30.0			60.00	50.00	LP002.

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

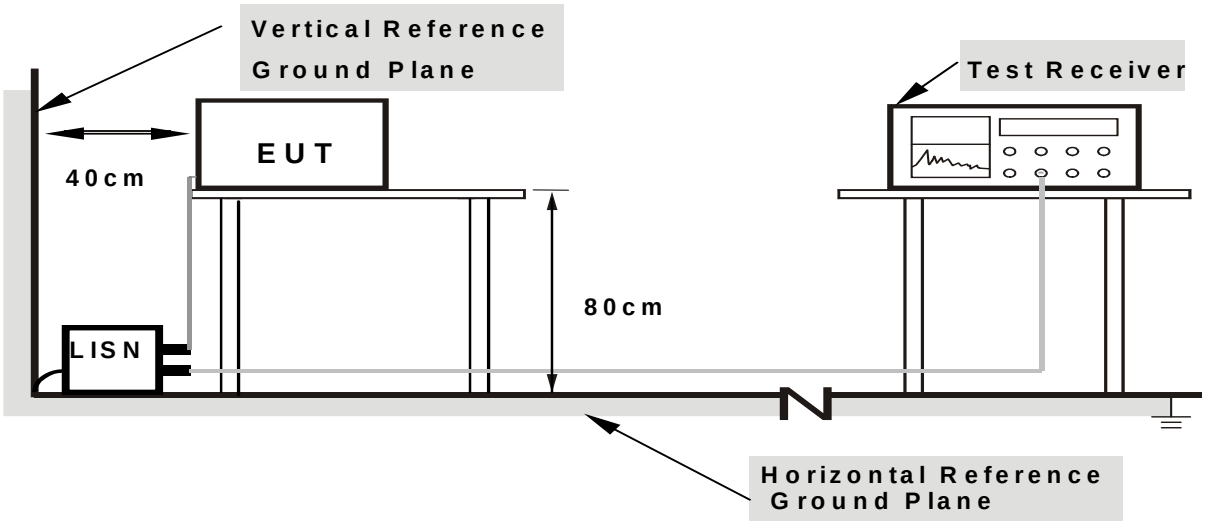
4.1.2 TEST PROCEDURE

a. The EUT was placed 0.8 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.
b. 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.
c. 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.
d. LISN at least 80 cm from nearest part of EUT chassis.
e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

4.1.3 DEVIATION FROM TEST STANDARD

No deviation

4.1.4 TEST SETUP



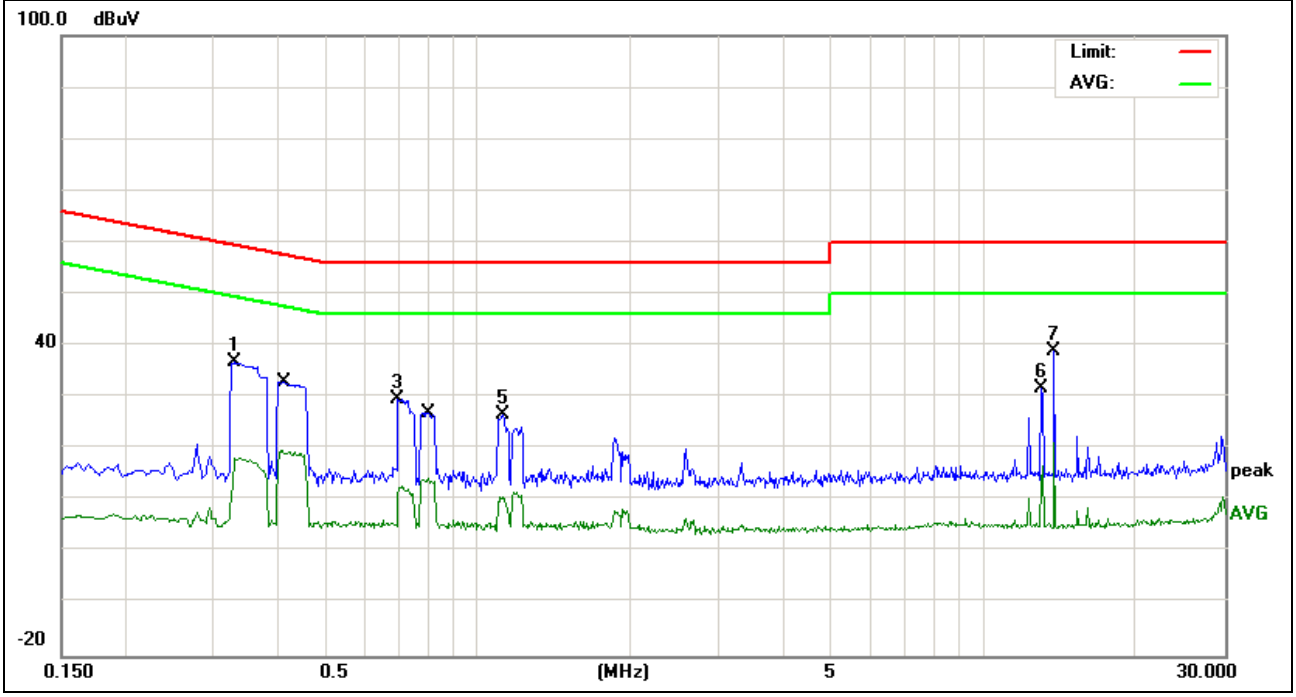
Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

4.1.5 TEST RESULT

EUT：	RFID&KEYPAD LOCKER LOCK	Model Name. ：	2455SP
Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	1010hPa	Phase：	L
Test Voltage ：	DC 5V for Power source AC 120V/60Hz	Test Mode：	Mode 1

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Remark
(MHz)	(dBμV)	(dB)	(dBμV)	(dBμV)	(dB)	
0.3300	27.13	9.63	36.76	59.45	-22.69	peak
0.4099	10.44	9.40	19.84	47.65	-27.81	AVG
0.6939	19.99	9.78	29.77	56.00	-26.23	peak
0.7980	4.62	9.77	14.39	46.00	-31.61	AVG
1.1180	16.79	9.72	26.51	56.00	-29.49	peak
13.0539	22.10	9.77	31.87	60.00	-28.13	peak
13.8338	29.26	9.79	39.05	60.00	-20.95	peak
13.8338	11.54	9.79	21.33	50.00	-28.67	AVG

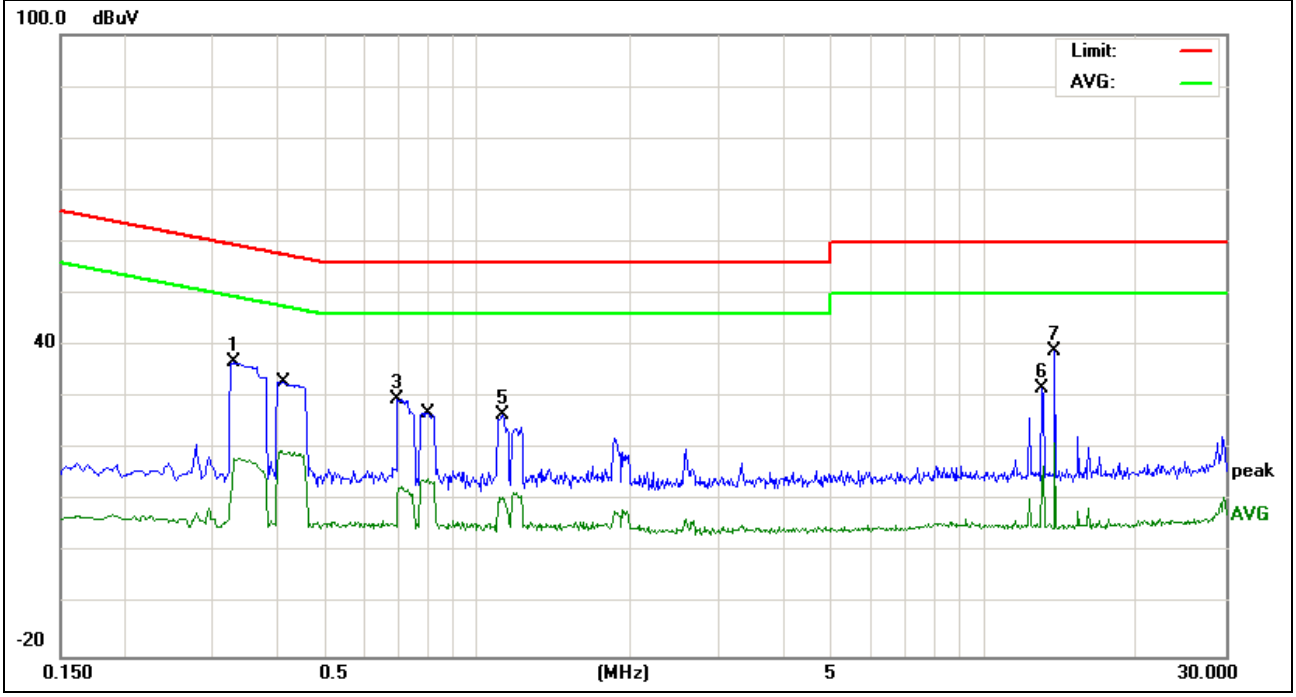
Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



EUT：	RFID&KEYPAD LOCKER LOCK	Model Name. ：	2455SP
Temperature：	26 ℃	Relative Humidity：	54%
Pressure：	1010hPa	Phase：	N
Test Voltage ：	DC 5V for Power source AC 120V/60Hz	Test Mode：	Mode 1

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Remark
(MHz)	(dBμV)	(dB)	(dBμV)	(dBμV)	(dB)	
0.3300	27.13	9.63	36.76	59.45	-22.69	peak
0.4099	10.44	9.40	19.84	47.65	-27.81	AVG
0.6939	19.99	9.78	29.77	56.00	-26.23	peak
0.7980	4.62	9.77	14.39	46.00	-31.61	AVG
1.1180	16.79	9.72	26.51	56.00	-29.49	peak
13.0539	22.10	9.77	31.87	60.00	-28.13	peak
13.8338	29.26	9.79	39.05	60.00	-20.95	peak
13.8338	11.54	9.79	21.33	50.00	-28.67	AVG

Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



4.2 RADIATED EMISSION MEASUREMENT

4.2.1 Radiated Emission Limits (FCC 15.209)

Frequencies (MHz)	Field Strength (micorvolts/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
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Note:

(1) The tighter limit applies at the band edges.

(2) Emission level (dBuV/m)=20log Emission level (uV/m).

LIMITS OF RADIATED EMISSION MEASUREMENT (FCC 15.225)

(a)The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters, equal to 124dBuV/m at 3 meters.

(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters, equal to 90.5dBuV/m at 3 meters.

(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters, equal to 80.5dBuV/m at 3 meters..

(d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

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

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

4.2.2 TEST PROCEDURE

a. The measuring distance of at 3 m shall be used for measurements at frequency up to 1GHz And above 1GHz,
b. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3m meter test site. The table was rotated 360 degrees to determine the position of the highest radiation.
c. 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.
d. 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.
e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

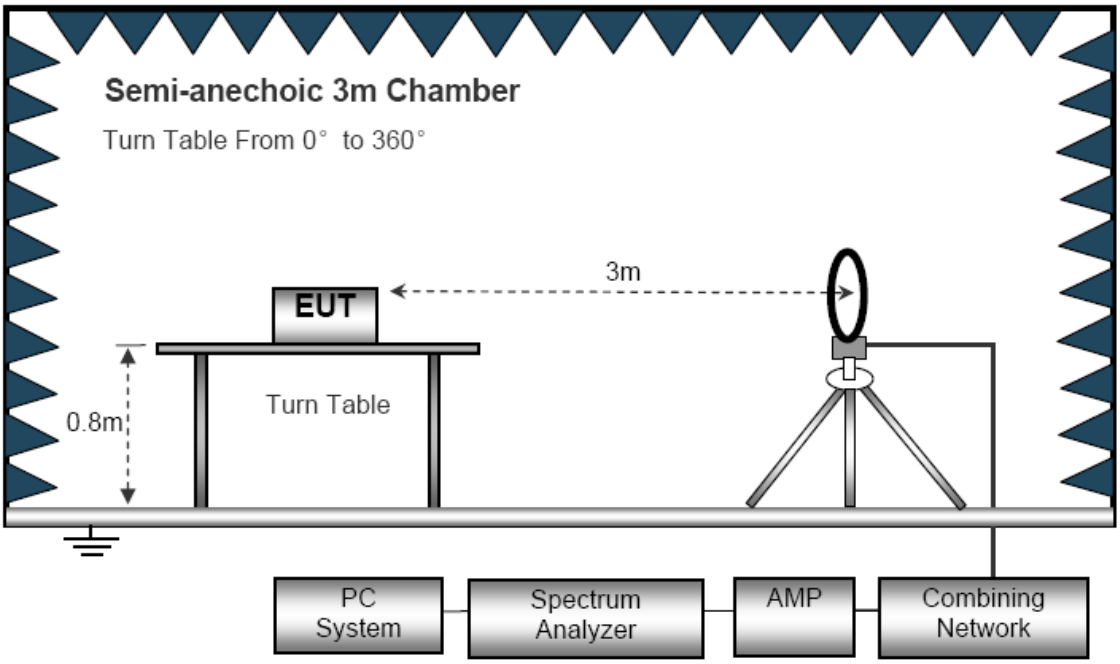
Both horizontal and vertical antenna polarities were tested
and performed pretest to three orthogonal axis. The worst case emissions were reported

4.2.3 DEVIATION FROM TEST STANDARD

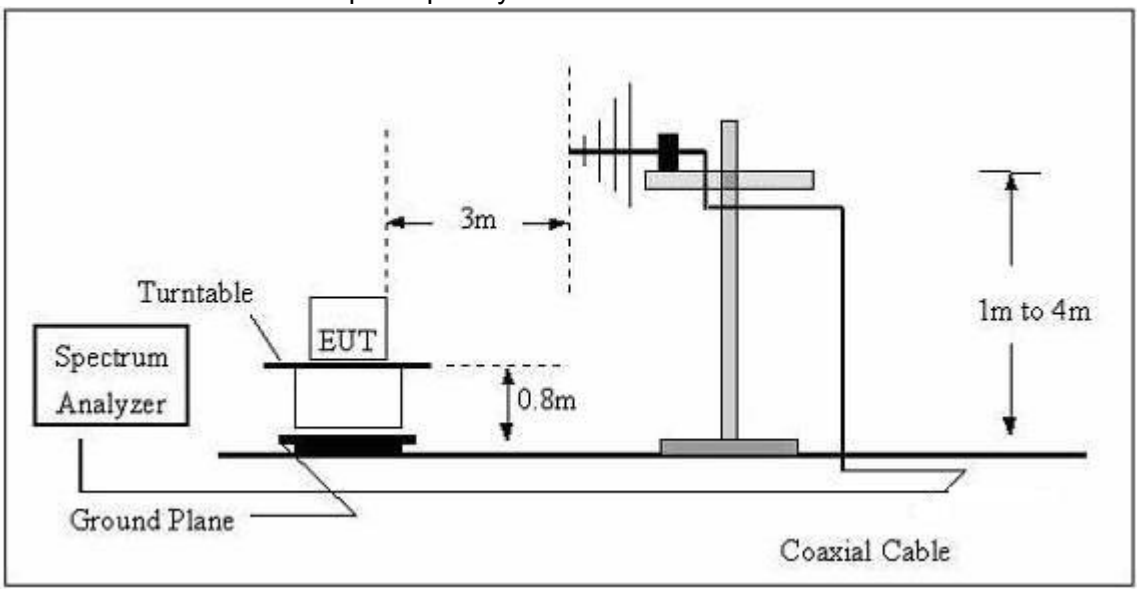
No deviation

4.2.4 TEST SETUP

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



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



4.2.5 TEST RESULTS (BELOW 30MHz)

EUT：	RFID&KEYPAD LOCKER LOCK	Model Name. ：	2455SP
Temperature：	20 ℃	Relative Humidtity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC 5V for Power source AC 120V/60Hz
Test Mode ：	TX		

Freq.	Reading	Factor	Emission Level	Limit	Margin	Polar
(MHz)	(dBuV/m)	(dB)	(dBuV/m)	(dBuV/@3m)	(dB)	
13.56	63.54	13.03	76.57	124	-47.43	H
13.56	61.35	13.03	76.38	124	-47.62	V

Freq.	Reading	Factor	Emission Level	Extrapolation factor	Measurement results (calculated)	Limits	Margin
(MHz)	dBμV@3m	(dB)	(dBuV/m)	(dB)	dBμV/m @300m&30m	dBμV/m @300m	(dB)
26.69	14.46	13.14	27.60	40	-12.40	29.54	-41.94

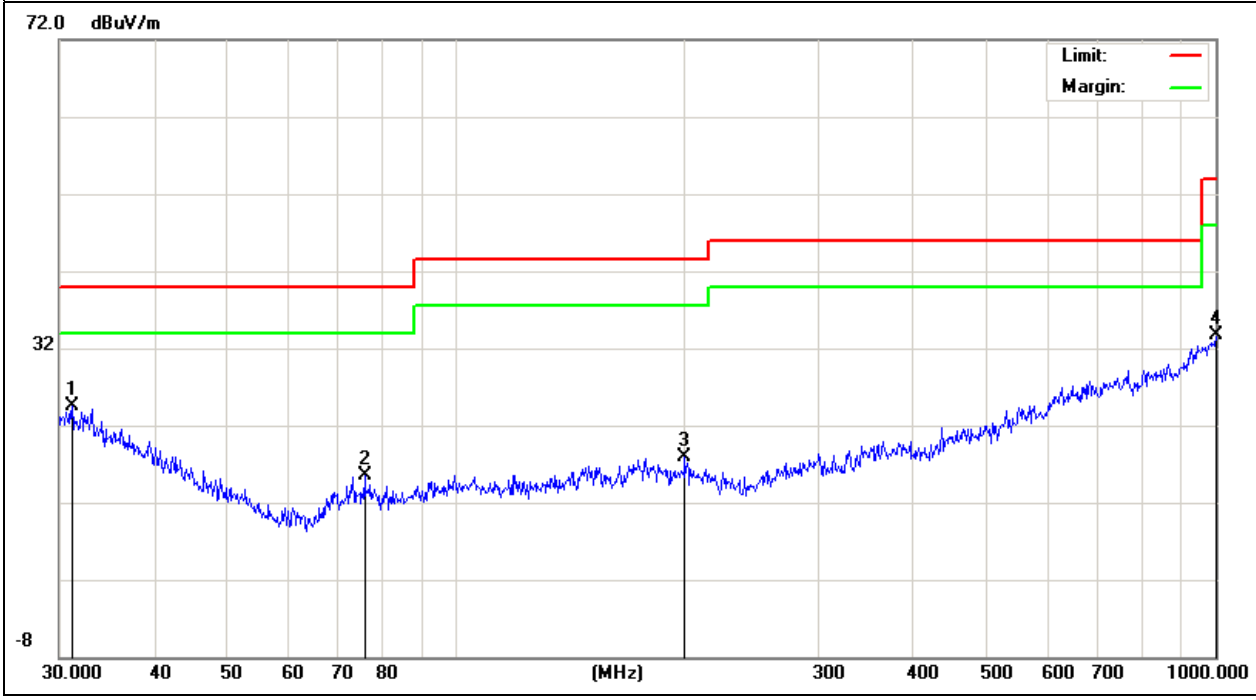
Frequency Range	Frequency	Reading	Factor	Extrapolation factor	Measurement results (calculated)	Limits	Margin
(MHz)	(MHz)	dBμV @3m	(dB)	(dB)	dBμV/m &30m	dBμV/m @30m	(dB)
13.110~13.41	13.362	28.47	21.55	40	10.02	40.50	-30.48
13.410~13.553	13.542	38.52	21.55	40	20.07	50.50	-30.43
13.553~13.567	13.536	66.33	21.55	40	47.88	84.00	-36.12
13.567~13.71	13.552	39.61	21.55	40	21.16	50.50	-29.34
13.710~14.01	13.818	29.95	21.55	40	11.50	40.50	-29.00

4.2.6 TEST RESULTS (BETWEEN 30 – 1000 MHZ)

EUT：	RFID&KEYPAD LOCKER LOCK	Model Name ：	2455SP
Temperature：	20 ℃	Relative Humidity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC 5V for Power source AC 120V/60Hz
Test Mode ：	TX	Polarization：	Horizontal

Freq. (MHz)	Reading (dBμV/m)	Factor (dB)	Measurement (dBμV/m)	Limit (dBμV/m)	Over (dB)	Detector
31.18	5.38	19.14	24.52	40.00	-15.48	peak
75.71	5.95	9.60	15.55	40.00	-24.45	peak
199.99	6.37	11.47	17.84	43.50	-25.66	peak
1000.00	5.91	27.76	33.67	54.00	-20.33	peak

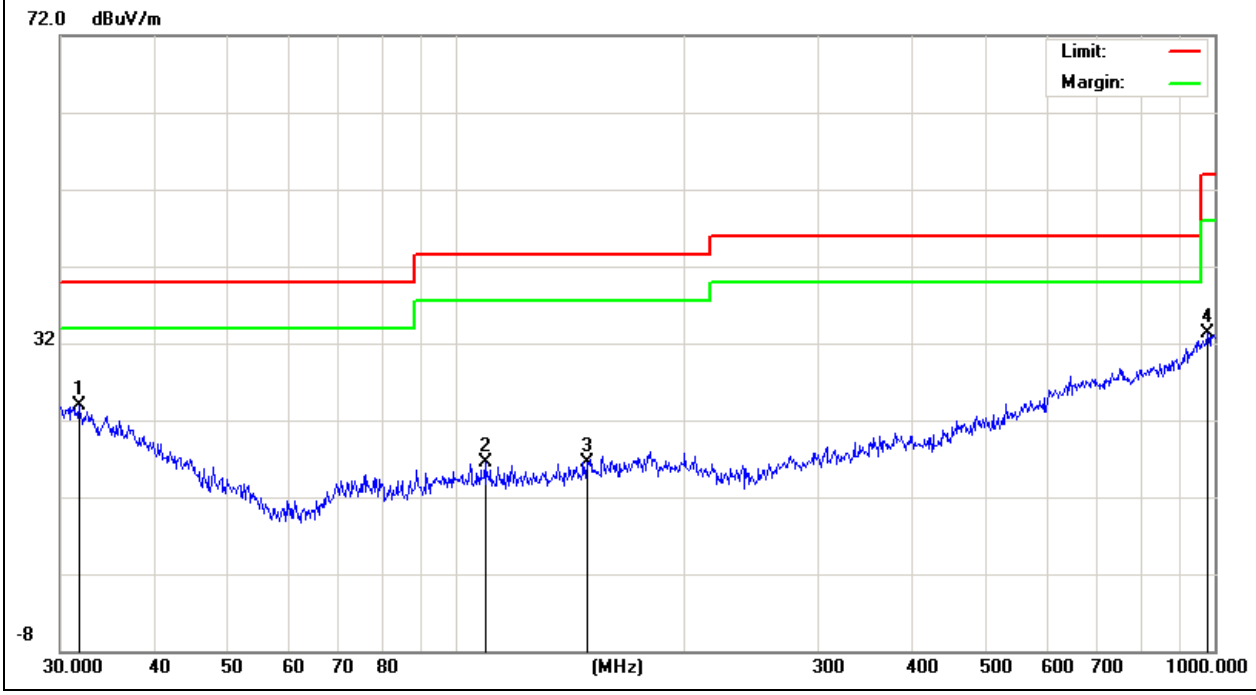
Remark:
Factor = Antenna Factor + Cable Loss.



EUT：	RFID&KEYPAD LOCKER LOCK	Model Name ：	2455SP
Temperature：	20 ℃	Relative Humidity：	48%
Pressure：	1010 hPa	Test Voltage ：	DC 5V for Power source AC 120V/60Hz
Test Mode ：	TX	Polarization：	Vertical

Freq. (MHz)	Reading (dBμV/m)	Factor (dB)	Measurement (dBμV/m)	Limit (dBμV/m)	Over (dB)	Detector
31.73	5.01	18.95	23.96	40.00	-16.04	peak
109.03	6.21	10.24	16.45	43.50	-27.05	peak
148.44	4.99	11.57	16.56	43.50	-26.94	peak
979.18	6.16	27.07	33.23	54.00	-20.77	peak

Remark:
Factor = Antenna Factor + Cable Loss.



5. BANDWIDTH TEST

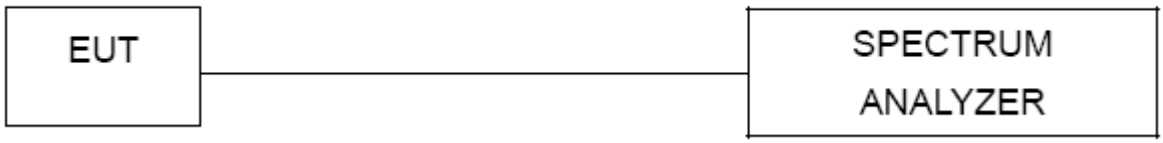
5.1 TEST PROCEDURE

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak mode.
2. 20dB Bandwidth the resolution bandwidth of 1 kHz and the video bandwidth of 1 kHz were used.
3. Measured the spectrum width with power higher than 20dB below carrier.

5.2 DEVIATION FROM STANDARD

FCC Part15.225

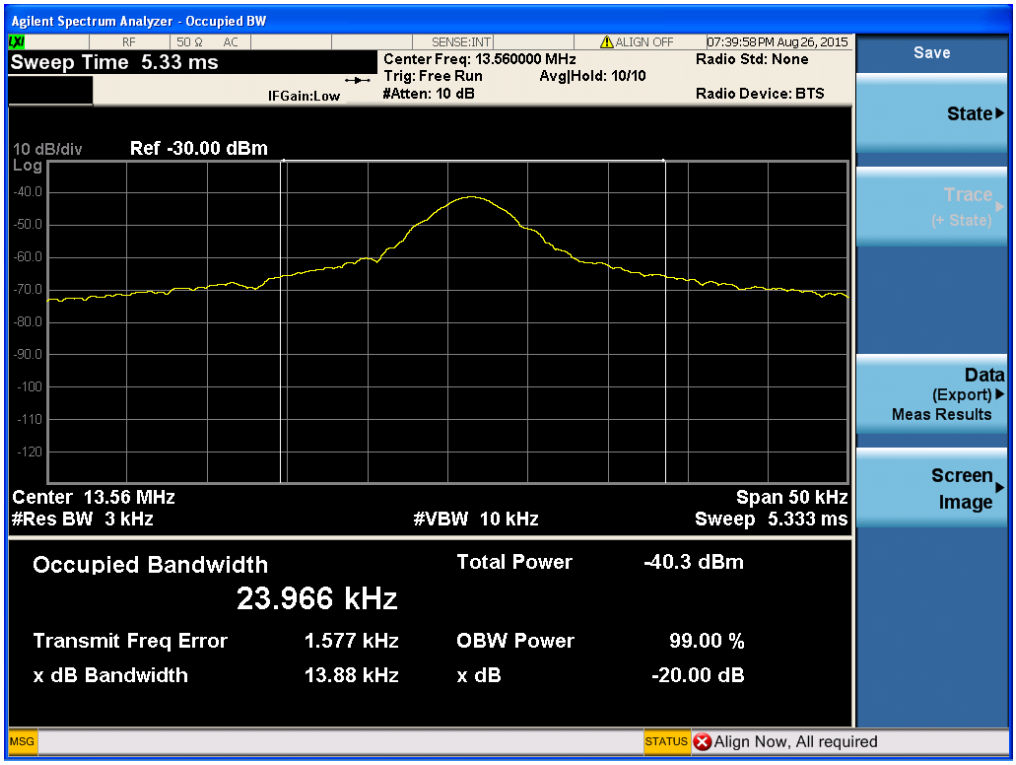
5.3 TEST SETUP



5.4 TEST RESULTS

EUT：	RFID&KEYPAD LOCKER LOCK	Model Name ：	2455SP
Temperature：	26 ℃	Relative Humidity：	53%
Pressure：	1020 hPa	Test Power ：	DC 5V for Power source AC 120V/60Hz
Test Mode ：	TX CH 1		

Test Channel	Frequency (MHz)	20 dBc Bandwidth (kHz)
CH01	13.56	13.88



6. FREQUENCY TOLERANCE

6.1 Requirement:

Test Requirement:	FCC Part15.225
Test Method:	ANSI C63.4:2003
Requirement:	The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of –20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

6.2 Test Procedure

1.The EUT was placed on a turn table which is 0.8m above ground plane.

2.Set EUT as normal operation

3.Set SPA Center Frequency = fundamental frequency, RBW, VBW= 10kHz, Span =100kHz.

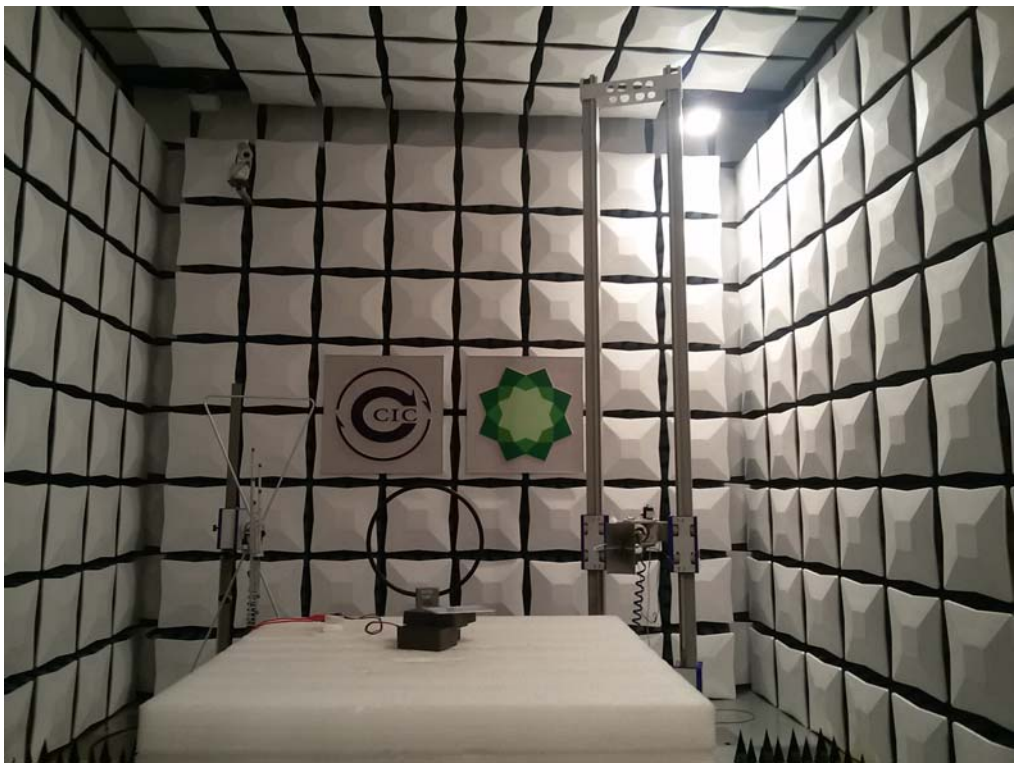
4.Set SPA Max hold. Mark peak.

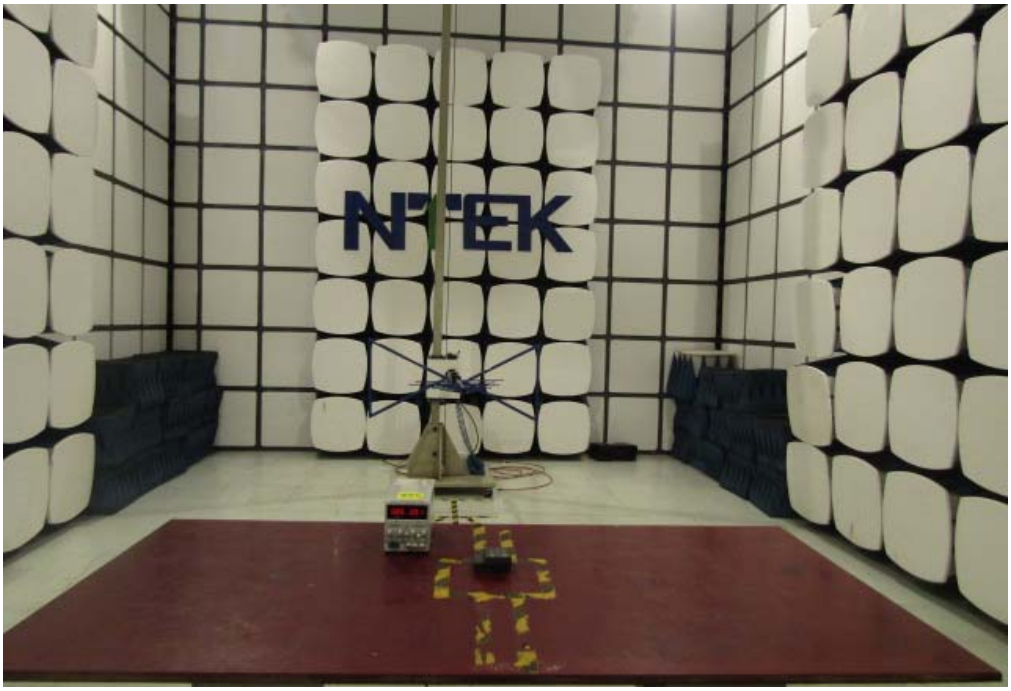
Test Result

Power Supply	Temperature (℃)	Measured Frequency (MHz)	Frequency Error	Part 15.225 Limit
DC 5.0V	-20	13.56075	0.0055%	13.56075
	20	13.56079	0.0058%	13.56079
	50	13.56073	0.0053%	13.56073
DC 4.25V	-20	13.56077	0.0056%	13.56077
	20	13.56071	0.0052%	13.56071
	50	13.56073	0.0054%	13.56073
DC 5.75V	-20	13.56071	0.0052%	13.56071
	20	13.56072	0.0053%	13.56072
	50	13.56066	0.0049%	13.56066

7. EUT TEST PHOTO

Radiated Measurement Photos





Conducted Measurement Photos