

FCC - TEST REPORT

Report Number : **64.790.19.06206.01** Date of Issue: 2020-05-21

Model : M2700TP-


Product Type : Standalone Transponder module

Applicant : ABB Xiamen Smart Technology Co., Ltd.

Production Facility : ABB Xiamen Smart Technology Co., Ltd.

Address : NO.7 Fangshan South Road,Torch High Technology Development Zone (Xiang An) Industrial Zone,Xiamen S.E.Z,Fujian Province,P.R.China

Test Result : **Positive** **Negative**



Total pages including Appendices : 27

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2 Details about the Test Laboratory

Details about the Test Laboratory

Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
Building 12&13, Zhiheng Wisdomland Business Park,
Nantou Checkpoint Road 2, Nanshan District,
Shenzhen City, 518052,
P. R. China

FCC Registration Number: 514049

IC Registration Number: 10320A

Telephone: 86 755 8828 6998

Fax: 86 755 8828 5299

3 Description of the Equipment Under Test

Product:	Standalone Transponder module
Model no.:	M2700TP-.
FCC ID:	2AEBL-M2700TP
Options and accessories:	N/A
Rating:	DC 24V
RF Transmission Frequency:	13.56MHz
Modulation:	ASK
Antenna Type:	PCB layout loop antenna
Description of the EUT:	EUT is a Standalone Transponder module, it can be grouped with other modules to act as a part of door entry system.

4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2019 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

5 Summary of Test Results

Technical Requirements				
Test Condition		Pages	Test Site	Test Result
FCC Rules	Test Item	10	1	Pass
§15.207	Conducted emission AC power port			
§15.225(a), (b), (c), (d), 15.209, 15.205	Filed Strength Measurement	13	1	Pass
§15.225 (e)	Frequency Stability	16	1	Pass
§15.215(c)	Occupied Bandwidth	17	1	Pass

Note 1: N/A=Not Applicable.

6 General Remarks

SUMMARY:

All tests according to the regulations cited on page 5 were

■ - Performed

□ - **Not** Performed

The Equipment Under Test

■ - **Fulfills** the general approval requirements.

□ - **Does not** fulfill the general approval requirements.

Sample Received Date: 2019-12-01

Testing Start Date: 2019-12-02

Testing End Date: 2020-01-13

- TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch -

Reviewed by:

Prepared by:

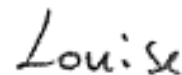
Tested by:



Tony Liu



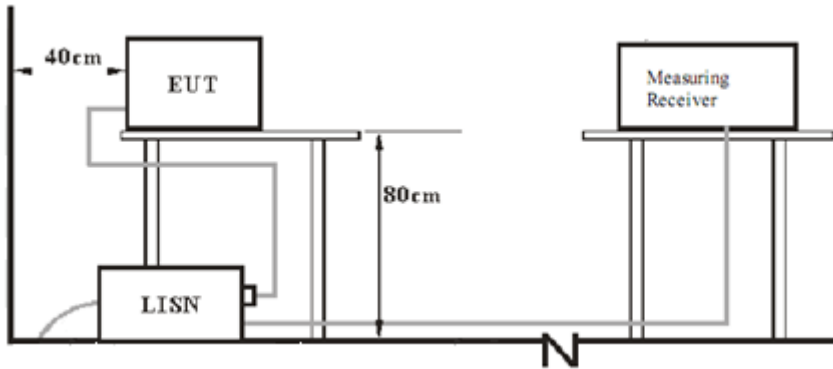
Kevin Ouyang



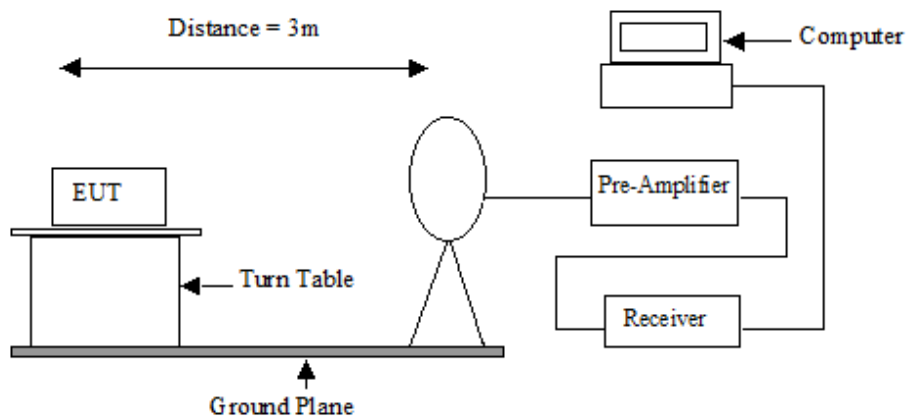
Louise Liu

7 Test Setups

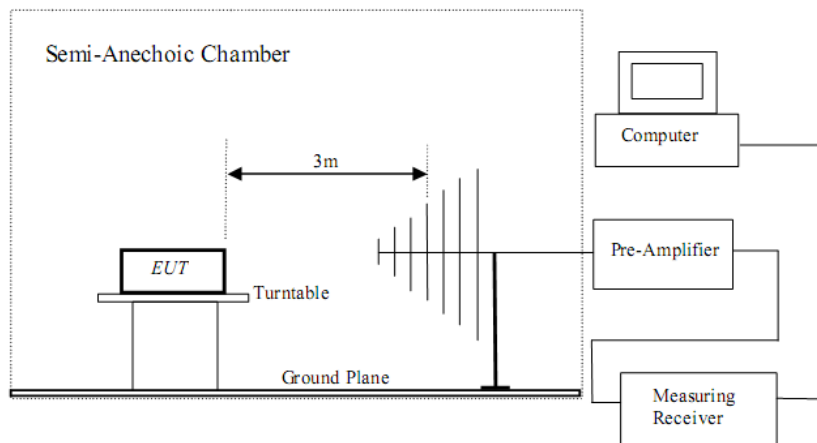
7.1 AC Power Line Conducted Emission test setups



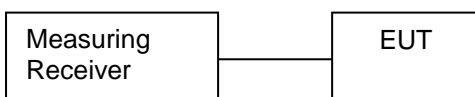
7.2 Radiated test setups 9KHz-30MHz



30MHz-1000MHz



7.3 Conducted RF test setups



8 Test Methodology

8.1 Conducted Emission

The EUT was placed on a table, which is 0.8m above ground plane, the power line of the EUT is connected to the AC mains through an Artificial Mains Network (A.M.N.).

Maximum procedure was performed to ensure EUT compliance, A EMI test receiver is used to test the emissions from both sides of AC line.

8.2 Radiated Emission

The sample was placed 0.8m above the ground plane on a standard emission test site *. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, considered typical configuration, manipulating interconnecting cables, rotating turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

*On a standard emission test site with a metal ground plane filed with the FCC pursuant to section 2.948 of the FCC rules.

8.3 Field Strength Calculation

The field strength at 3 m was established by adding the meter reading of the spectrum analyzer to the factors associated with antenna correction factor, cable loss, preamplifiers and filter attenuation.

The equation is expressed as follow:

$FS = R + \text{System Factor}$

$\text{System Factor} = AF + CF + FA - PA$

Where FS = Net Field Strength in dBuV/m at 3 meters.

R = Reading of Spectrum Analyzer / Test Receiver in dBuV.

AF = Antenna Factor in dB.

CF = Cable Attenuation Factor in dB.

FA = Filter Attenuation Factor in dB.

PA = Preamplifier Factor in dB.

FA and PA are only be used for the measuring frequency above 1 GHz.

9 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MODEL NO.	MANUFACTURER
System controller	M2300	ABB
Video outdoor station, with keypad, with ID card	M21381K-.	ABB
Video outdoor station, with keypad, with IC/DESfire card	M21382K-.	ABB
Video outdoor station, for vigik application	M21383K-.	ABB
Audio/video module	M25138.M	ABB
Display module with IC card reader, for Vigik application	51383CR	ABB
Standalone keypad module	M2700KP-.	ABB
Audio module	M251381A-.	ABB
Standalone fingerprint module	M2700FP-.	ABB

Remark: All the auxiliary equipment are used to make this "Standalone Transponder module" works as its representative configuration for conducted emission test.

10 Technical Requirement

10.1 Conducted Emission Measurement

Test Requirement: FCC part 15 section 15.207
Limits of 15.207:

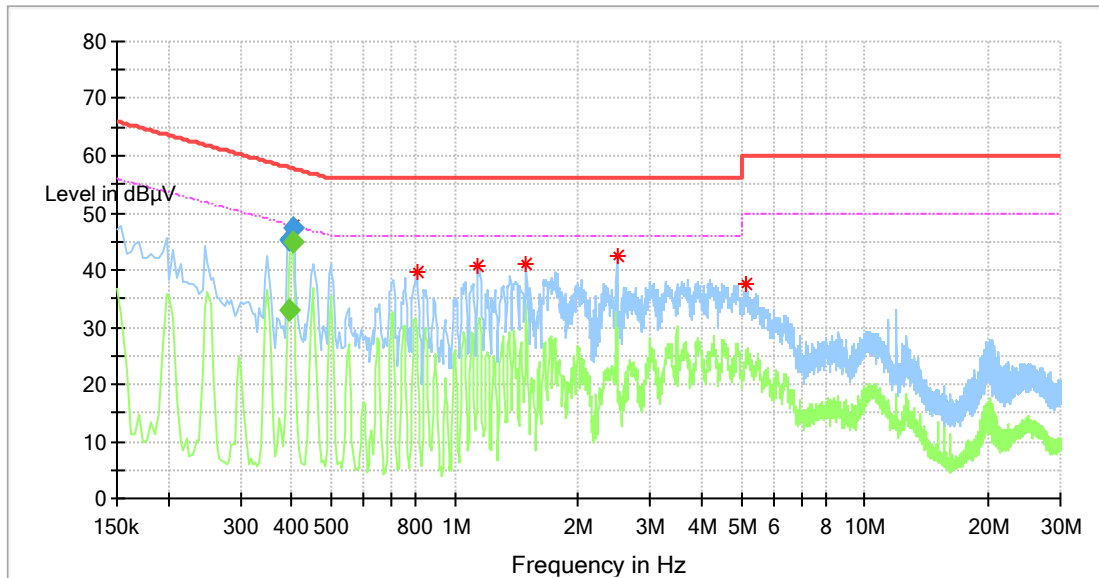
Frequency (MHz)	Conducted limit(dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

Test Method: ANSI C63.4:2014
Test Date: 2019-12-02
Mode of Operation: Test EUT in a representative configuration that can read card.
Detector Function: Quasi-peak and Average

Test data:

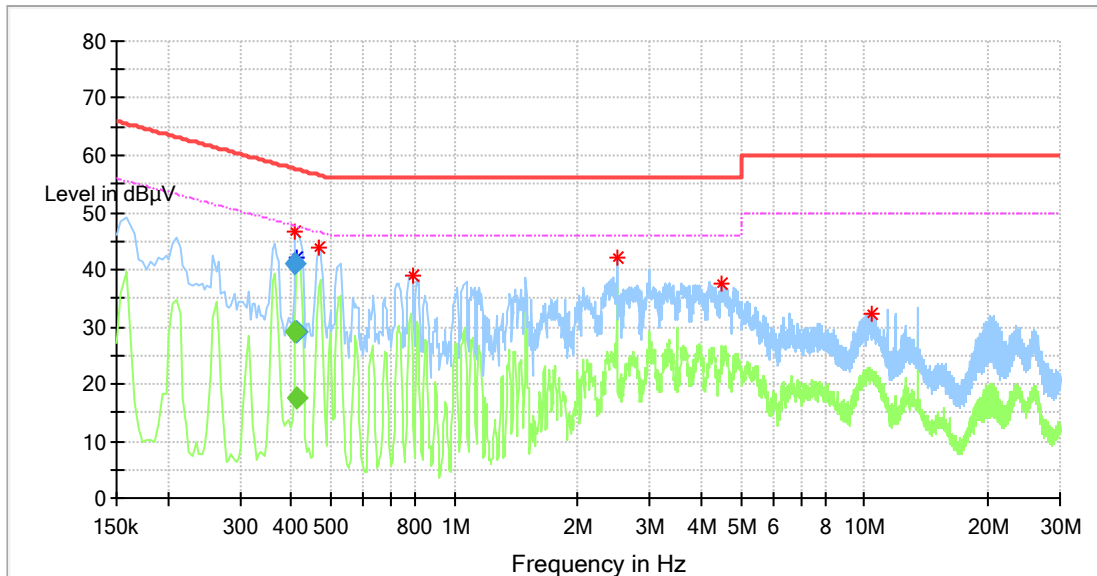
Conducted emission



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.393500	---	32.95	47.99	15.04	L1	10.3
0.393500	45.31	---	57.99	12.68	L1	10.3
0.401500	---	44.92	47.82	2.90	L1	10.3
0.401500	47.23	---	57.82	10.59	L1	10.3

Operating Mode : Test EUT in a representative configuration with reading card.
 Conduct Line/Port : L
 Test Date : 2019-12-02

Conducted emission



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.409500	---	29.29	47.66	18.37	N	10.3
0.409500	41.04	---	57.66	16.62	N	10.3
0.413500	---	17.53	47.58	30.05	N	10.3
0.413500	29.12	---	57.58	28.46	N	10.3

Operating Mode : Test EUT in a representative configuration with reading card.
 Conduct Line/Port : N
 Test Date : 2019-12-02

Remark:

Level=Reading Level + Correction Factor

Correction Factor=Cable Loss + LISN Factor

(The Reading Level is recorded by software which is not shown in the sheet)

Test result: PASS

10.2 Filed Strength Measurement

Test Requirement: FCC part 15 section 15.225 (a),(b),(c),(d), 15.205
 (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. (124 dB μ V/m@3m)
 (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. (90.5 dB μ V/m@3m)
 (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. (80.5 dB μ V/m@3m)
 (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.

Limits of 15.209:

Frequency (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
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

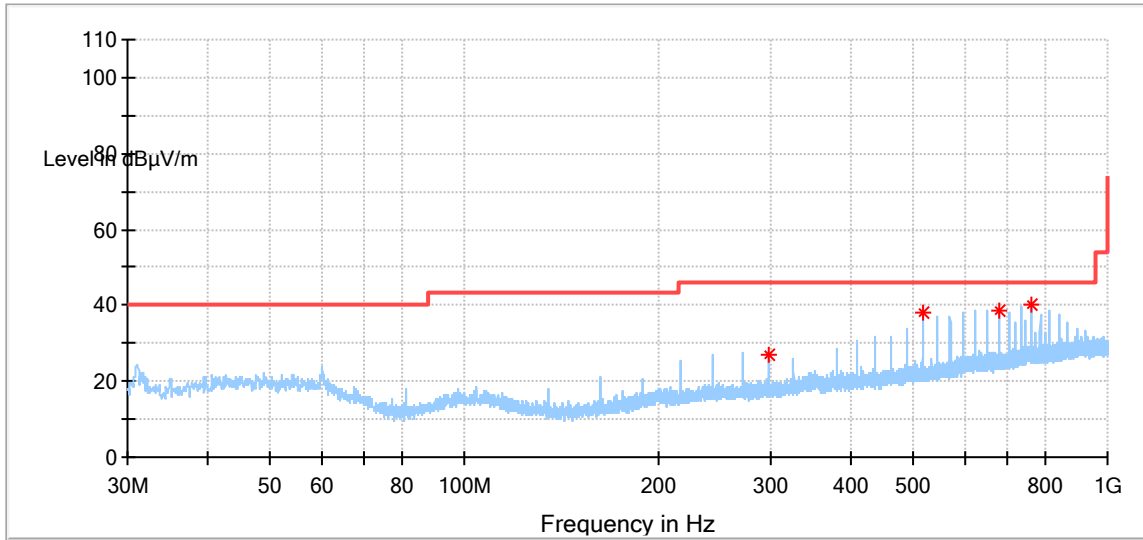
Test Method: ANSI C63.4:2014
 Test Date: 2020-01-13
 Mode of Operation: Continuously transmitting mode.
 Detector Function: Quasi-peak (Below 1000 MHz)
 Average and Peak (Above 1000 MHz)
 Measurement BW: 200Hz(9KHz-150KHz)
 9KHz(150KHz-30MHz)
 120 kHz (30MHz-1000 MHz)
 1 MHz (Above 1000 MHz)

Test data:

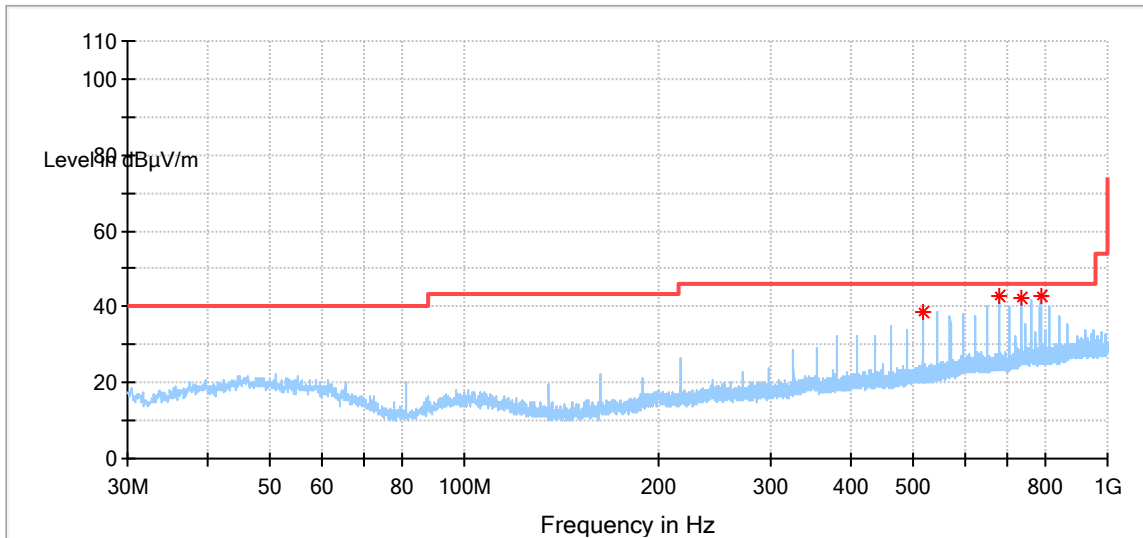
Emission 9KHz-30MHz

Frequency (MHz)	MaxPeak (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pol	Corr. (dB/m)
0.135994	56.24	105.22	48.98	H	20
0.179850	53.46	102.78	49.32	H	20
0.229600	52.16	100.64	48.48	H	20
0.503225	44.55	73.77	29.21	H	20
0.533075	43.11	73.26	30.15	H	20
3.080275	40.17	70.00	29.83	H	20
6.930925	35.61	70.00	34.39	H	20
1.692250	35.71	63.07	27.36	H	20
2.164875	42.16	70.00	27.84	H	20
12.657500	32.36	69.5	37.14	H	20
12.968000	32.02	69.5	37.48	H	20
13.183000	31.89	80.5	48.61	H	20
13.423500	31.93	90.5	58.57	H	20
13.559500	48.18	124	75.82	H	20
13.869500	32.56	80.50	47.94	H	20
14.097000	32.02	69.5	37.48	H	20
14.320500	32.76	69.5	36.74	H	20
14.561500	32.06	69.5	37.44	H	20
14.884500	32.36	69.5	37.14	H	20
Frequency (MHz)	MaxPeak (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pol	Corr. (dB/m)
0.088007	50.84	109.03	58.20	V	20
0.103987	50.03	107.57	57.54	V	20
0.120014	49.39	106.32	56.93	V	20
0.135994	48.65	105.22	56.57	V	20
0.518150	36.06	73.51	37.44	V	20
1.662400	33.96	63.22	29.27	V	20
2.955900	37.36	70.00	32.64	V	20
7.010525	34.64	70.00	35.36	V	20
1.154950	33.52	66.44	32.92	V	20
12.158500	32.32	69.50	37.18	V	20
12.624500	31.94	69.50	37.56	V	20
12.844000	33.21	69.50	36.29	V	20
13.311500	31.64	80.50	48.86	V	20
13.560000	49.30	124	74.7	V	20
13.819500	31.71	80.50	48.79	V	20
14.128500	32.13	69.50	37.37	V	20
14.276000	31.62	69.50	37.88	V	20
14.347500	32.38	69.50	37.12	V	20
14.895500	31.63	69.50	37.87	V	20

Emission 30MHz -1GHz



Frequency (MHz)	QP (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Corr. (dB)
298.312778	27.04	46.00	18.96	V	-26.1
515.269444	38.08	46.00	7.92	V	-21.9
678.013889	38.52	46.00	7.48	V	-19.1
759.386111	40.09	46.00	5.91	V	-17.5



Frequency (MHz)	QP (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Corr. (dB)
515.269444	38.69	46.00	7.31	H	-21.9
678.013889	42.71	46.00	3.29	H	-19.1
732.226111	42.17	46.00	3.83	H	-18.1
786.492222	42.64	46.00	3.36	H	-17.7

Remark:
 Corrected Amplitude= Read level + Corrector factor
 Below 1GHz: Corrector factor = Antenna Factor + Cable Loss

Test result: PASS

10.3 Frequency Stability

Test Requirement:	FCC Part 15 C Section 15.225(e) 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.
Test Method:	ANSI C63.4:2014
Test Date:	2020-01-13
Mode of Operation:	Continuously transmitting mode.
Detector Function	Maxpeak
Measurement BW	RBW:1KHz VBW:3KHz

Test data:

Nominal Operating Frequency: 13.56MHz,
Limit: within +/- 1.356KHz of the operating frequency.

Frequency stability vs. temperature		
Temperature (°C)	Measured Frequency (MHz)	Frequency error (KHz)
50	13.55994	0.06
40	13.55997	0.03
30	13.55994	0.06
20	13.55994	0.06
10	13.55998	0.02
0	13.55998	0.02
-10	13.55998	0.02
-20	13.55994	0.06

Frequency stability vs. voltage		
Voltage (VDC)	Measured Frequency (MHz)	Frequency error (KHz)
20.4	13.55997	0.03
21.6	13.55998	0.02
22.8	13.55998	0.02
24	13.55998	0.02
25.2	13.55994	0.06
26.4	13.55997	0.03
27.6	13.55997	0.03

Result: PASS

10.4 Occupied Bandwidth

Test Requirement:

FCC Part 15 C Section 15.215 (c)

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the 20 dB bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Test Method:

ANSI C63.4:2014

Test Date:

2020-01-13

Mode of Operation:

Continuously transmitting mode.

Detector Function

Maxpeak

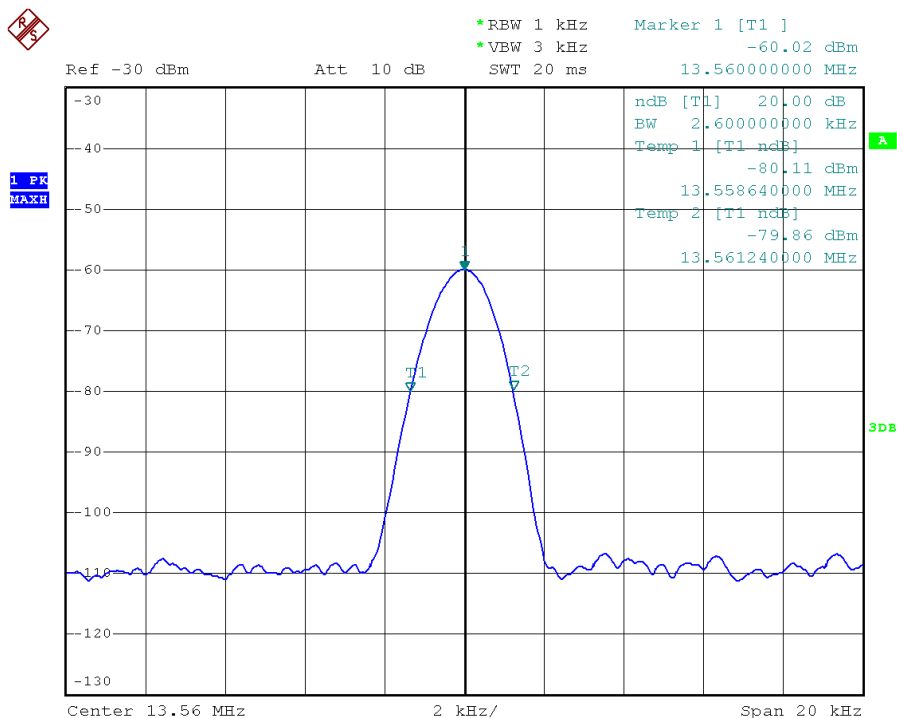
Measurement BW

RBW:1KHz

VBW:3KHz

Test data:

20dB bandwidth:



Result: PASS

Report Number: 64.790.19.06206.01

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11 Test Equipment List

List of Test Instruments

	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	CAL. DUE DATE
C	Signal Analyzer	Rohde & Schwarz	FSV40	101030	2020-6-28
	Programmable temperature and humidity chamber	MHG-408CASI	TaiLi	A81002	2020-6-28
	DC power supply	INSTEK	GPR-30600	EH873394	N/A
CE	EMI Test Receiver	Rohde & Schwarz	ESR 3	101782	2020-6-28
	LISN	Rohde & Schwarz	ENV432	101318	2020-7-19
RE	EMI Test Receiver	Rohde & Schwarz	ESR 26	101269	2020-6-28
	Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	707	2020-8-20
	Horn Antenna	Rohde & Schwarz	HF907	102294	2020-6-22
	Loop Antenna	Rohde & Schwarz	HFH2-Z2	100398	2020-7-7
	Pre-amplifier	Rohde & Schwarz	SCU 18	102230	2020-6-28
	Signal Generator	Rohde & Schwarz	SMY01	839369/005	2020-6-28
	Attenuator	Agilent	8491A	MY39264334	2020-6-28
	3m Semi-anechoic chamber	TDK	9X6X6	----	2020-7-7
Test software	Rohde & Schwarz	EMC32	Version9.15.0 0	N/A	

C - Conducted RF tests

- Occupied bandwidth
- Frequency Stability

12 System Measurement Uncertainty

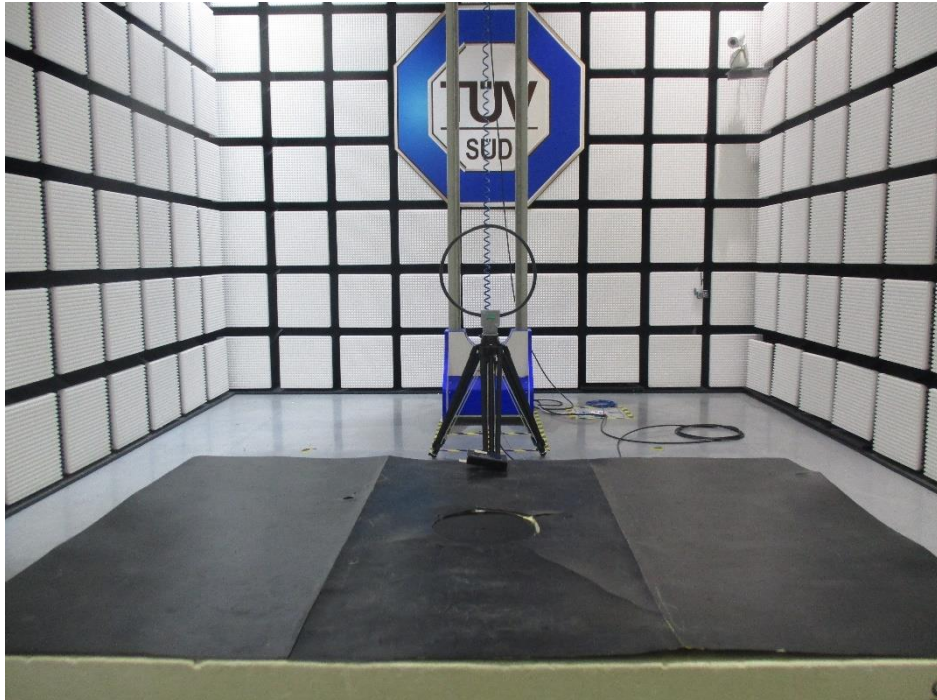
For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncertainty

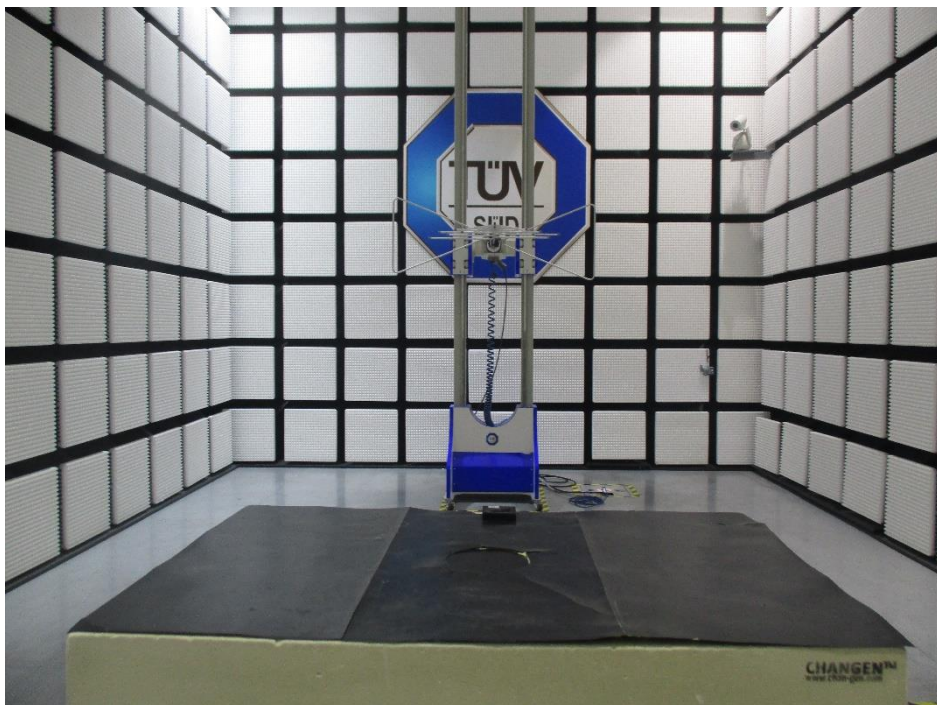
Items	Extended Uncertainty
Uncertainty for Conducted Emission 150kHz-30MHz	3.21dB
Uncertainty for Radiated Emission in 3m chamber 9kHz-30MHz	4.76dB
Uncertainty for Radiated Emission in 3m chamber 30MHz-1000MHz	Horizontal: 5.12dB Vertical: 5.10dB
Uncertainty for Conducted RF test with TS 8997	RF Power Conducted: 1.16dB Frequency test involved: 0.6×10^{-7} or 1%

13 Appendix A – Setup Photos

Setup photo of radiated emission (9KHz-30MHz)



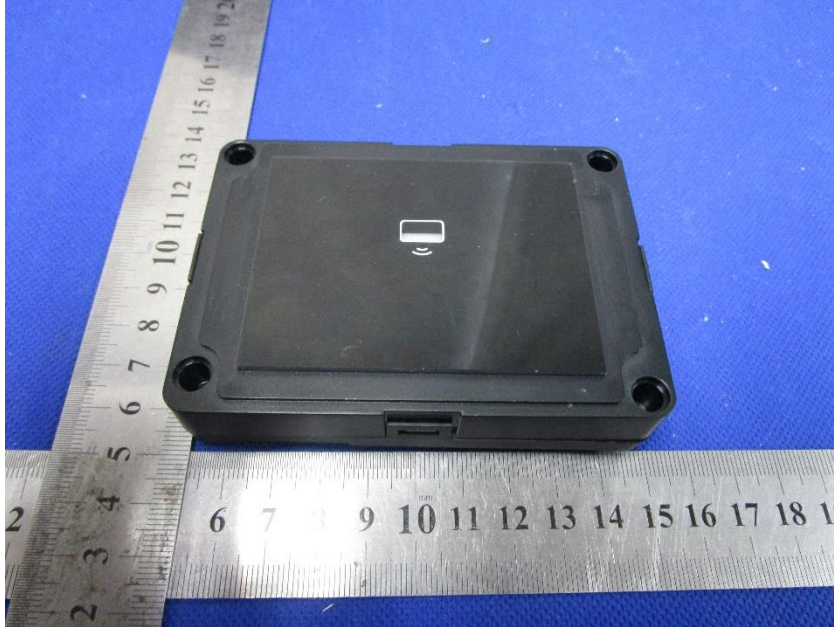
Setup photo of radiated emission (30MHz-1GHz)



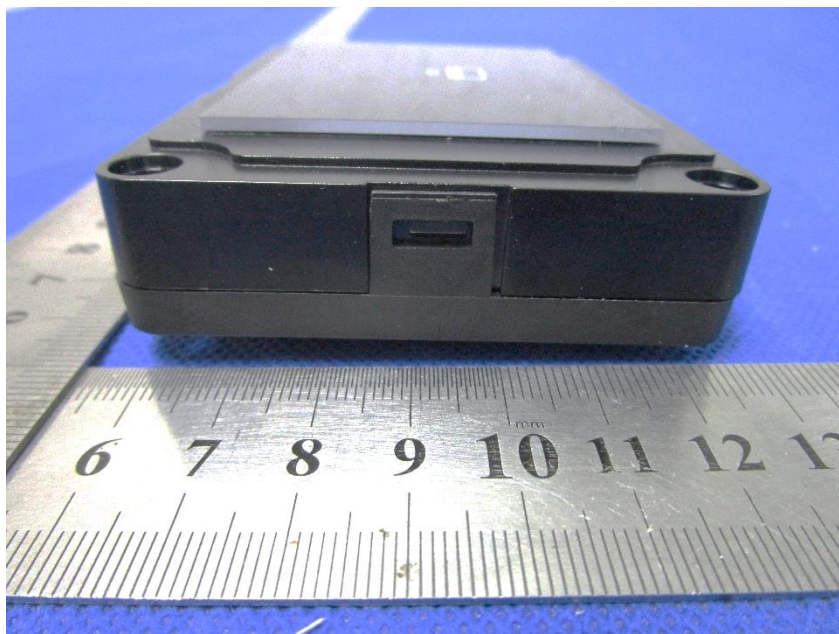
Setup photo of conducted emission (150KHz-30MHz)

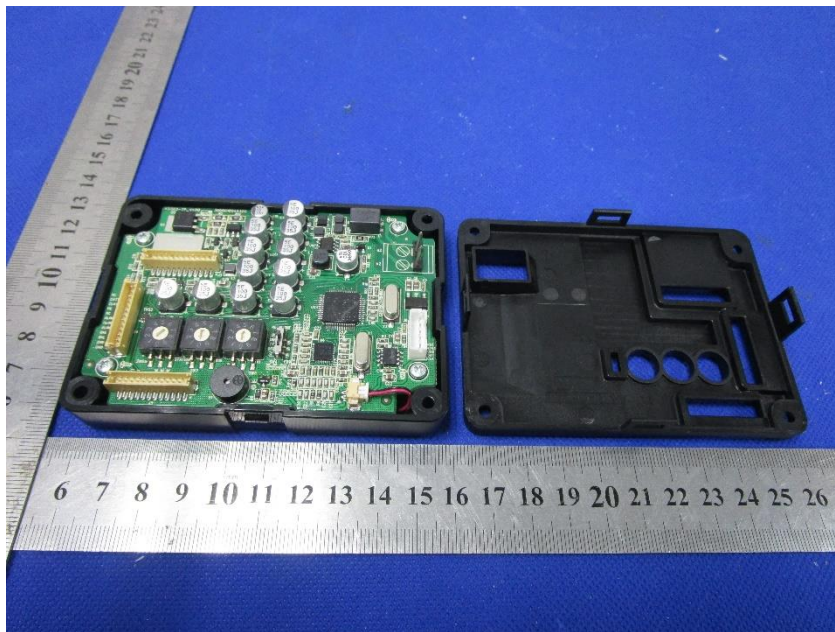


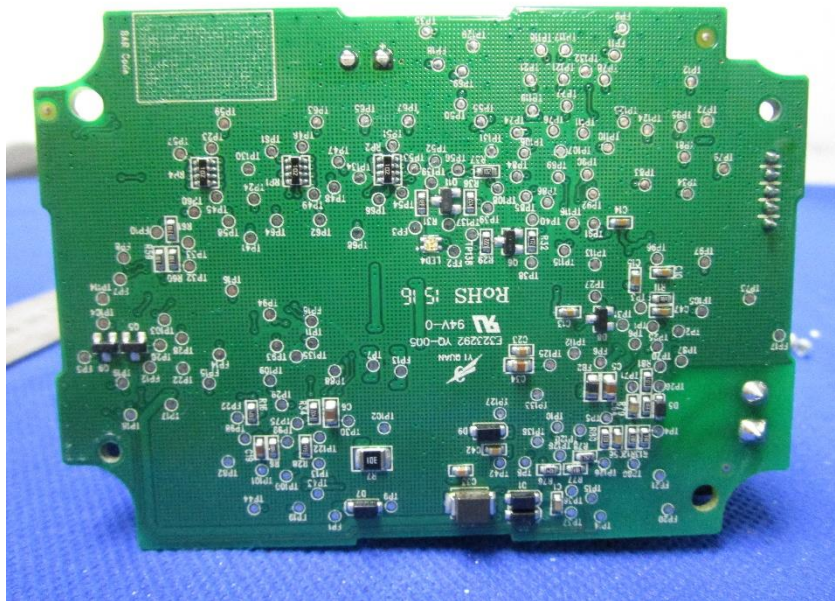
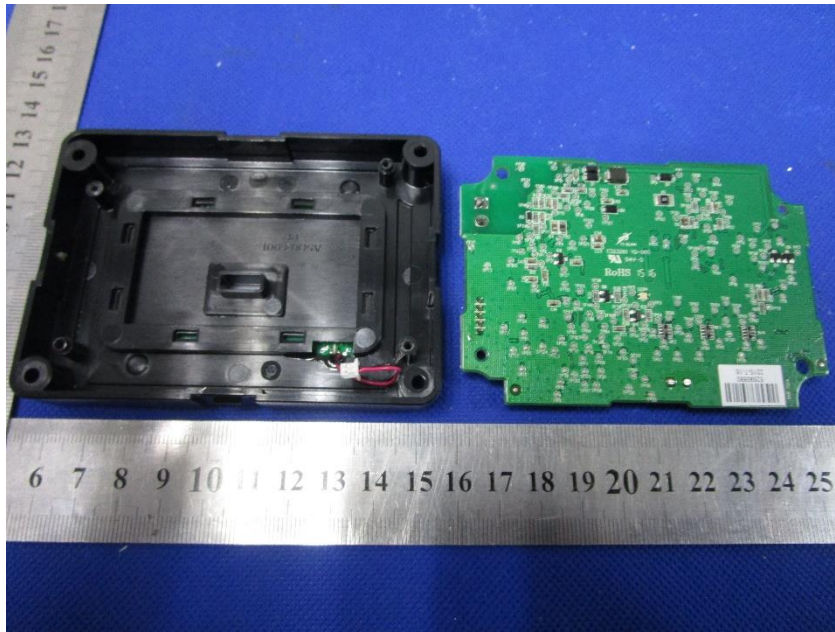
14 Appendix B – EUT Photos

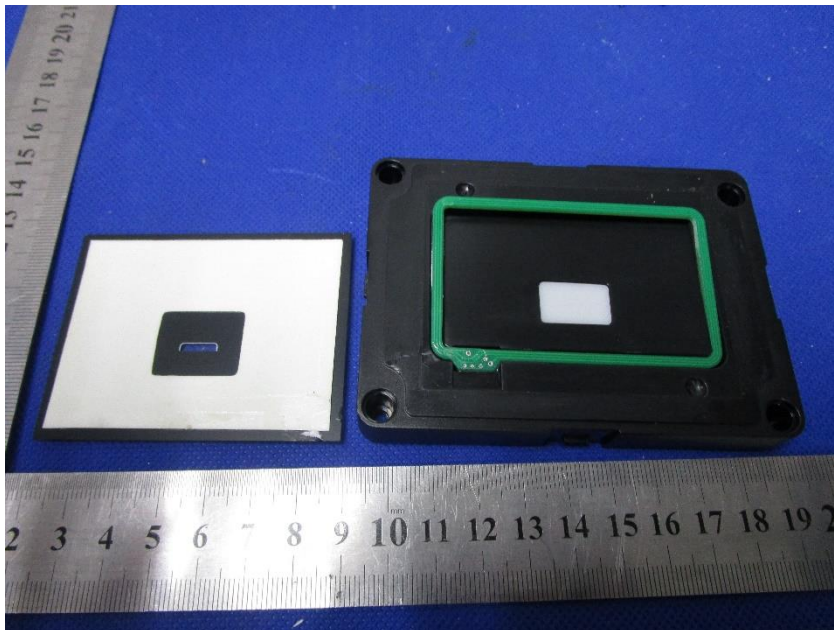
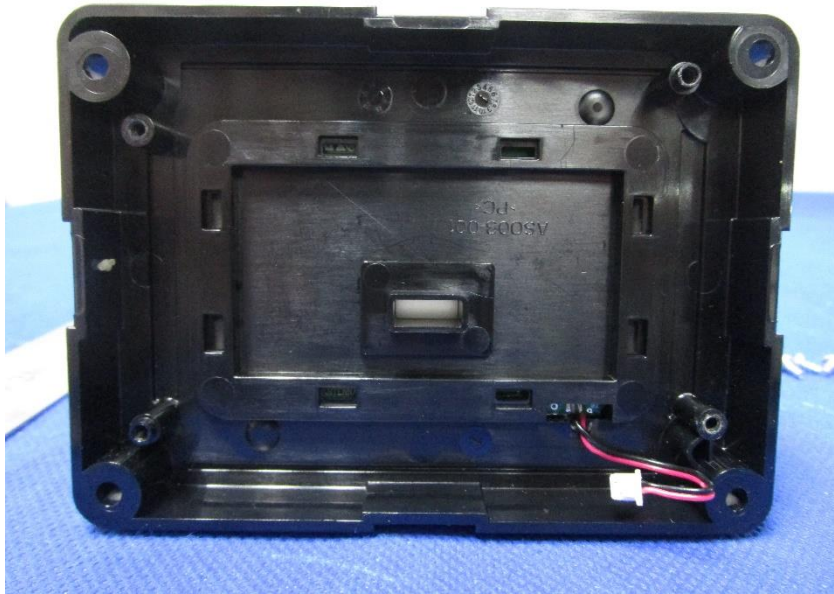


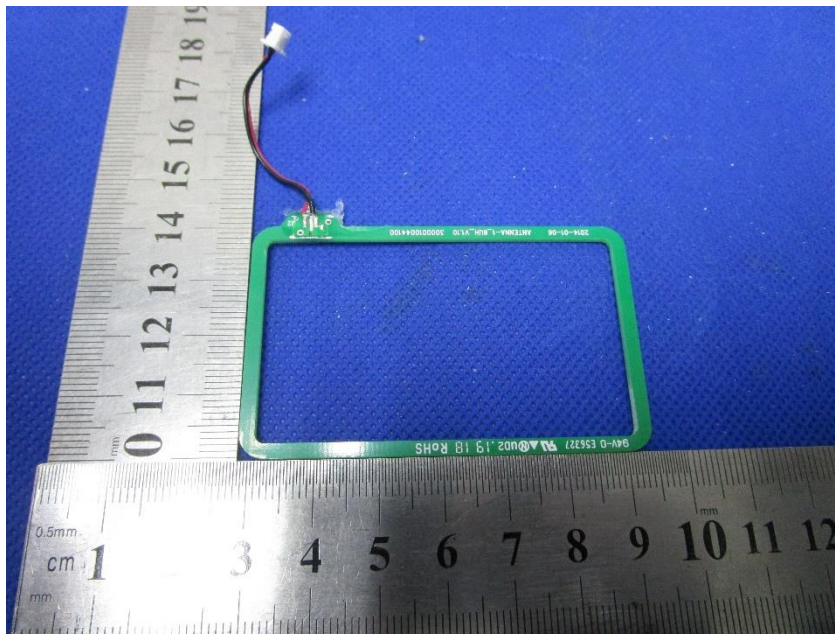












Antenna

