TEST REPORT

Applicant	:	STONEX SRL
Address of Applicant	:	Via Zucchi 1,Monza(MB) 20900,italy
Product Name	:	Handheld data collection terminal
Model No.	:	SH5A
Sample No.	:	E20080008-01#01; E20080008-01#02
FCC ID	:	Y44-SH5A
ISED Number	:	9932A-SH5A
Standards	:	FCC CFR47 Part 15, Subpart C RSS-Gen (Issue 5, March 2019) RSS-247 (Issue 2, February 2017)
Date of Receipt	:	2020-08-05
Date of Test	:	2020-08-22 ~ 2020-08-25
Date of Issue	:	2020-09-07

Remark:

This report details the results of the testing carried out on one sample, the results contained in this report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

Prepared by: Jennifer Zhou (Jennifer Zhou) Reviewed by: Oliver Xiang (Oliver Xiang) Approved by: Guoyou Chi (Authorized signatory: Guoyou Chi)

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1 General Information

1.1 Testing Laboratory

Company Name	ICAS Testing Technology Service (Shanghai) Co., Ltd.
Address	No.1298 Pingan Rd, Minhang District, Shanghai, China
Telephone	0086 21-51682999
Fax	0086 21-54711112
Homepage	www.icasiso.com

1.2 Details of Application

Company Name	STONEX SRL
Address	Via Zucchi 1,Monza(MB) 20900,italy
Contact Person	Ivana Bucci
Telephone	+390278619201
Email	Ivana.Bucci@stonex.it

1.3 Details of EUT

Product Name	Handheld data collection terminal
Brand Name	Stonex
Model No.	SH5A
FCC ID	Y44-SH5A
ISED Number	9932A-SH5A
Mode of Operation	Bluetooth BR/EDR
Frequency Range	2400MHz ~ 2483.5MHz
Number of Channels	79 (at intervals of 1 MHz)
Modulation Type	GFSK, π/4-DQPSK, 8-DPSK
Antenna Type	Internal Antenna
Antenna Gain	2.80 dBi
Extreme Temperature Range	-20℃~ +55℃
Test Voltage	DC 3.8V

1.4 Test Methodology

47 CFR Part 15, Subpart C (10-1-16 Edition)	Miscellaneous Wireless Communications Services

FCC PUBLIC NOTICE DA 00-705 (Mar.30, 2000)	Filling and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
RSS-Gen (Issue 5, March 2019)	General Requirements for Compliance of Radio Apparatus
RSS-247 (Issue 2, February 2017)	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

Note(s):

All test items were verified and recorded according to the standards and without any addition/deviation/exclusion during the test.

2 Test Condition

2.1 Environmental conditions

Temperature (°C)	18-25
Humidity (%RH)	40-65
Barometric Pressure (mbar)	960-1060

2.2 Equipment List

Name of Equipment	Manufacturer	Model	Serial No.	Cal. Due Date
Spectrum Analyzer	Keysight	N9020B	MY59260184	2021-08-18
Spectrum Analyzer	Rohde & Schwarz	FSV40N	101450	2021-06-08
EMI Test Receiver	Rohde & Schwarz	ESPI3	100173	2021-06-08
EMI Test Receiver	Rohde & Schwarz	ESR 7	101911	2021-06-08
V-network	SCHWARZBECK	NSLK 8127	8127-902	2021-02-20
Wideband Radio Communication Tester	Rohde & Schwarz	CMW 500	100687	2021-08-18
Broadband Antenna	SCHWARZBECK	VULB9163	9163-1037	2021-06-08
Horn Antenna-18G	SCHWARZBECK	BBHA9120D	9120D-1775	2021-06-08
Loop Antenna	SCHWARZBECK	FMZB 1513	N/A	2021-03-19
Horn Antenna-40G	YINGLIAN	LB-180400-KF	N/A	2021-07-26
EMC chamber 9*6*6（L*W*H)	CHANGNING	966	N/A	2021-06-08
Shielded Enclosure 8*5*4（L*W*H)	CHANGNING	854	N/A	2021-06-08
Test Software	BL	BL410_E	N/A	N/A

2.3 Measurement Uncertainty

Parameter	Frequency	Uncertainty
Antenna Port Conducted Emission	< 1GHz	± 1.5 dB
	> 1GHz	± 1.5 dB
Radiated Emission	30 MHz – 1 GHz	± 3 dB
	> 1GHz	± 3 dB

3 Test Set-up and Operation Modes

3.1 Details of Test Mode

Using test software was control EUT work in continuous transmitter and receiver mode. Select test channel as below:

Channel	Frequency
The lowest channel(CH0)	2402MHz
The middle channel(CH39)	2441MHz
The Highest channel(CH78)	2480MHz

The basic operation modes are:

A. On
   1. BR/EDR mode
      a. Transmitting
         i. Low Channel
         ii. Middle Channel
         iii. High Channel
         iv. Hopping mode
      b. Receiving
   2. Normal working with Bluetooth on

B. Standby

C. Off

3.2 Special Accessories and Auxiliary Equipment

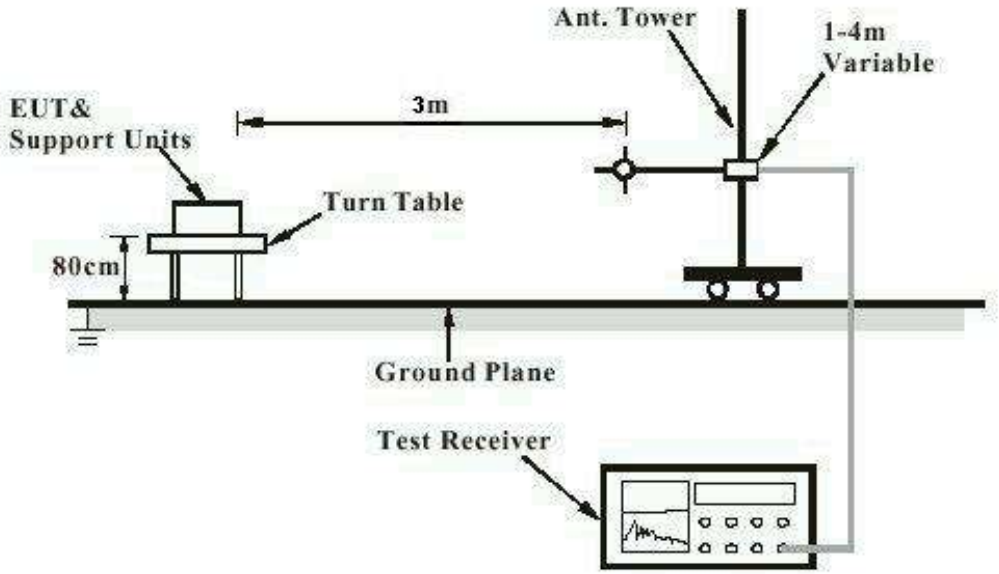
Description	Manufacturer	Model No.	Serial No.
Laptop	Lenovo	TP00083A	N/A

3.3 Support Software

Description	Manufacturer	Software Name
Software	UniStrong	mtk

3.4 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test



Note: Measurements above 1GHz are done with a table height of 1.5m. In addition, there is RF absorbing material on the floor of the test site for above 1GHz measurement.

Diagram of Measurement Equipment Configuration for Conduction Measurement

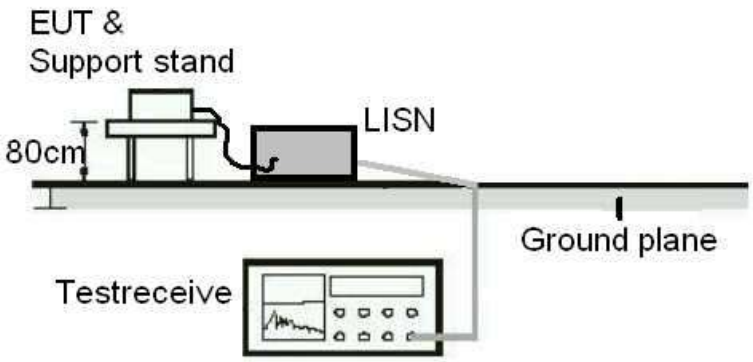
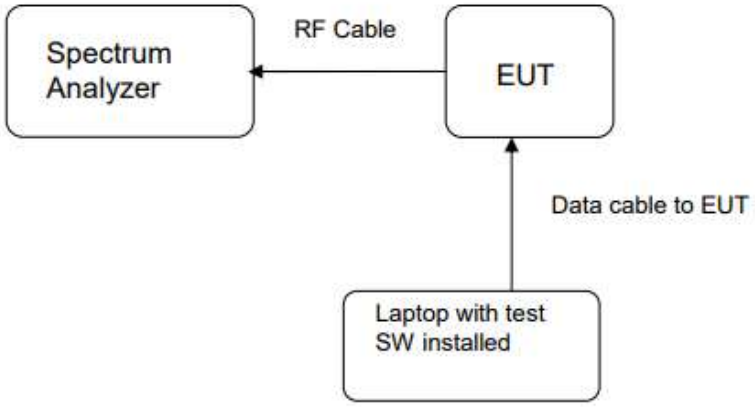


Diagram of Measurement Equipment Configuration for Transmitter Measurement



4 Test Results

4.1 Transmitter Requirement & Test Suites

4.1.1 Antenna Requirement

RESULT: **PASS**

Test standard	:	FCC Part 15.247(b)(4), Part 15.203 RSS-247 5.4(6)
Requirement	:	The use of approved antennas only with directional gains that do not exceed 6 dBi

According to the manufacturer declaration, the EUT has an antenna with a directional gain of 2.80 dBi. The antenna is an internal antenna with no possibility of replacement with a non-approvrd antenna by the end-user.

Therefore, the EUT is considered to comply with this provision.

4.1.2 Maximum Conducted Output Power and E.I.R.P

RESULT: **PASS**

Test standard : FCC Part 15.247(b)(1)
RSS-247 5.4(2)
Requirement : ANSI C63.10-2013
Kind of test site : Shielded room

Test setup

Test Channel : Low/Middle/High
Operation Mode : A.1.a
Ambient temperature : 25°C
Relative humidity : 52%

Table 1: Maximum Conducted Output Power

Test Mode	Test Channel (MHz)	Measured Peak Power		Limit (W)
		(dBm)	(mW)	
GFSK	2402	**4.75**	2.99	< 1
	2441	4.46	2.79	
	2480	4.14	2.59	
π/4-DQPSK	2402	4.55	2.85	< 0.125
	2441	3.92	2.47	
	2480	3.56	2.27	
8-DPSK	2402	4.73	2.97	< 0.125
	2441	4.12	2.58	
	2480	3.86	2.43	

Table 2: E.I.R.P

Test Mode	Test Channel (MHz)	E.I.R.P		Limit (W)
		(dBm)	(mW)	
GFSK	2402	7.55	5.69	< 4
	2441	7.26	5.32	
	2480	6.94	4.94	
π/4-DQPSK	2402	7.35	5.43	
	2441	6.72	4.70	
	2480	6.36	4.33	
8-DPSK	2402	7.53	5.66	
	2441	6.92	4.92	
	2480	6.66	4.63	

Figure 1: Maximum Conducted Output Power, 2402MHz, GFSK

Figure 2: Maximum Conducted Output Power, 2441MHz, GFSK

Figure 3: Maximum Conducted Output Power, 2480MHz, GFSK

Figure 4: Maximum Conducted Output Power, 2402MHz, π/4-DQPSK

Figure 5: Maximum Conducted Output Power, 2441MHz, π/4-DQPSK

Figure 6: Maximum Conducted Output Power, 2480MHz, π/4-DQPSK

Figure 7: Maximum Conducted Output Power, 2402MHz, 8-DPSK

Figure 8: Maximum Conducted Output Power, 2441MHz, 8-DPSK

Figure 9: Maximum Conducted Output Power, 2480MHz, 8-DPSK

4.1.3 20dB Bandwidth and 99% Bandwidth

RESULT: **PASS**

Test standard	:	FCC Part 15.247(a)(1) RSS-247 5.1(1) RSS-Gen 6.7
Requirement	:	ANSI C63.10-2013
Kind of test site	:	Shielded room

Test setup

Test Channel	:	Low/Middle/High
Operation Mode	:	A.1.a
Ambient temperature	:	25°C
Relative humidity	:	52%

Table 3: 20dB Bandwidth and 99% Bandwidth

Test Mode	Test Channel (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
GFSK	2402	0.836	0.846
	2441	0.835	0.847
	2480	0.836	0.847
8-DPSK	2402	1.115	1.057
	2441	1.115	1.058
	2480	1.114	1.058

Figure 10: 20dB Bandwidth and 99% Bandwidth, 2402MHz, GFSK

Figure 11: 20dB Bandwidth and 99% Bandwidth, 2441MHz, GFSK

Figure 12: 20dB Bandwidth and 99% Bandwidth, 2480MHz, GFSK

Figure 13: 20dB Bandwidth and 99% Bandwidth, 2402MHz, 8-DPSK

Figure 14: 20dB Bandwidth and 99% Bandwidth, 2441MHz, 8-DPSK

“

Figure 15: 20dB Bandwidth and 99% Bandwidth, 2480MHz, 8-DPSK

4.1.4 Conducted Spurious Emission & Authorized-band band-edge

RESULT: **PASS**

Test standard	:	FCC Part 15.247(d) RSS-247 5.5
Requirement	:	ANSI C63.10-2013
Kind of test site	:	Shielded room

Test setup

Test Channel	:	Low/Middle/High for spurious, Low/High for Band Edge
Operation Mode	:	A.1.a
Ambient temperature	:	25°C
Relative humidity	:	52%

For details refer to following test plot.

Figure 16: Conducted Spurious Emission & Authorized-band band-edge, 2402MHz, GFSK Carrier Level

Band Edge

Conducted spurious emissions 30MHz-25GHz

Figure 17: Conducted Spurious Emission & Authorized-band band-edge, 2441MHz, GFSK Carrier Level

Conducted spurious emissions 30MHz-25GHz

Figure 18: Conducted Spurious Emission & Authorized-band band-edge, 2480MHz, GFSK

Carrier Level

Band Edge

Conducted spurious emissions 30MHz-25GHz

Figure 19: Conducted Spurious Emission & Authorized-band band-edge, 2402MHz, 8-DPSK

Carrier Level

Band Edge

Conducted spurious emissions 30MHz-25GHz

Figure 20: Conducted Spurious Emission & Authorized-band band-edge, 2441MHz, 8-DPSK Carrier Level

Conducted spurious emissions 30MHz-25GHz

Figure 21: Conducted Spurious Emission & Authorized-band band-edge, 2480MHz, 8-DPSK Carrier Level

Band Edge

Conducted spurious emissions 30MHz-25GHz

Figure 22: Conducted Spurious Emission & Authorized-band band-edge, Hopping Mode, GFSK Carrier Level

Band Edge(Low)

Band Edge(High)

Conducted spurious emissions 30MHz-25GHz

Figure 23: Conducted Spurious Emission & Authorized-band band-edge, Hopping Mode, 8-DPSK Carrier Level

Band Edge(Low)

Band Edge(High)

Conducted spurious emissions 30MHz-25GHz


Spectrum Analyzer 1
Swept SA
KEYSIGHT
Input: RF
Coupling: AC
Align: Off
Input Z: 50 Ω
Corrections: Off
Freq Ref: Internal
#Atten: 30 dB
Preamp: Off
PNO: Fast
Gate: Off
IF Gain: Low
Sig Track: Off
Avg Type: Log-Power
Avg|Hold: 10/10
Trig: Free Run
1 Spectrum
Scale/Div 10 dB
Ref Lvl Offset 1.00 dB
Ref Level 15.00 dBm
Mkr3 14.000 0 GHz
-59.69 dBm
Start 3.00 GHz
#Res BW 100 kHz
#Video BW 300 kHz
Stop 25.00 GHz
Sweep ~2.12 s (4001 pts)
5 Marker Table
Mode Trace Scale X Y Function Function Width Function Value
1 N 1 f 24.807 5 GHz -47.60 dBm
2 N 1 f 1.515 0 GHz — dBm
3 N 1 f 14.000 0 GHz -59.69 dBm
Display
Select Display Line
Display Line 1
Display Line
-14.73 dBm
On
Off
Select Freq Line
Freq Line 1
Freq Line
1.0000 GHz
On
Off
Meas Display
View
Annotation
Aug 25, 2020
4:11:04 PM

4.1.5 Spurious Emission

RESULT: **PASS**

Test standard	:	FCC Part 15.247(d), 15.205, 15.209 RSS-247 5.5
Requirement	:	ANSI C63.10-2013
Kind of test site	:	3m Semi-Anechoic Chamber

Test setup

Test Channel	:	Low/Middle/High
Operation Mode	:	A
Ambient temperature	:	25°C
Relative humidity	:	52%

Notes

Test plots please refer to the annex document "BDEDR-TX EXHIBIT A of SHE20080008-02HE".

1. For 9 kHz ~ 30 MHz, the amplitude of spurious emissions that are attenuated by more than 20dB below the permissible. The value has no need to be reported.
2. The spurious above 18GHz is noise only and 20dB below the limit. The value has no need to be reported.
3. The EUT is working in the Normal link mode below 1 GHz.

4.1.6 Band Edge (Restricted-band band-edge)

RESULT: **PASS**

Test standard	:	FCC Part 15.247(d), 15.205, 15.209 RSS-247 5.5
Requirement	:	ANSI C63.10-2013
Kind of test site	:	3m Semi-Anechoic Chamber

Test setup

Test Channel	:	Low/Middle/High
Operation Mode	:	A.1
Ambient temperature	:	25°C
Relative humidity	:	52%

Notes

Test plots please refer to the annex document “BDEDR-TX EXHIBIT A of SHE20080008-02HE”.

4.1.7 Hopping Frequency Separation

RESULT: **PASS**

Test standard	:	FCC Part 15.247(a)(1) RSS-247 5.1(2)
Requirement	:	ANSI C63.10-2013
Kind of test site	:	Shielded room

Test setup

Test Channel	:	Hopping
Operation Mode	:	A.1.a.iv
Ambient temperature	:	25°C
Relative humidity	:	52%

Table 4: Hopping Frequency Separation

Mode	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)
GFSK	2441	0.990	≥ 25kHz or two-thirds of 20dB bandwidth
8-DPSK	2441	0.978	

*Note: The systems operate with an output power no greater than 125mW.

Figure 24: Hopping Frequency Separation, Hopping Mode, GFSK

Figure 25: Hopping Frequency Separation, Hopping Mode, 8DPSK

4.1.8 Number of Hopping Frequency

RESULT: **PASS**

Test standard	:	FCC Part 15.247(a)(1)(iii) RSS-247 5.1(4)
Requirement	:	ANSI C63.10-2013
Kind of test site	:	Shielded room

Test setup

Test Channel	:	Hopping
Operation Mode	:	A.1.a.iv
Ambient temperature	:	25°C
Relative humidity	:	52%

Table 5: Number of Hopping Frequency

Mode	Frequency Range	Measured Quantity of Hopping Channel	Limit
GFSK	2400 – 2483.5	79	≥15
8-DPSK	2400 – 2483.5	79	≥15

Figure 26: Number of Hopping Frequency, Hopping Mode, GFSK

Figure 26: Number of Hopping Frequency, Hopping Mode, 8-DPSK

4.1.9 Time of Occupancy

RESULT: **PASS**

Test standard : FCC Part 15.247(a)(1)(iii)
RSS-247 5.1(4)
Requirement : ANSI C63.10-2013
Kind of test site : Shielded room

Test setup

Test Channel : Middle
Operation Mode : A.1.a
Ambient temperature : 25°C
Relative humidity : 52%

Table 6: Time of Occupancy

Mode	Packet Type	Pulse Time (ms)	Total of Dwell (ms)	Limit (s)
GFSK	DH1	0.3183	101.856	0.4
	DH3	1.1600	185.600	0.4
	DH5	2.9280	312.320	0.4
8-DPSK	DH1	0.3933	125.856	0.4
	DH3	1.1700	187.200	0.4
	DH5	2.9130	310.720	0.4

Note:
For DH1 package type:
Total of Dwell = Pulse Time*(1600/2)/Number of Hopping Frequency*Period
Period = 0.4* Number of Hopping Frequency
For DH3 package type:
Total of Dwell = Pulse Time*(1600/4)/Number of Hopping Frequency*Period
Period = 0.4* Number of Hopping Frequency
For DH5 package type:
Total of Dwell = Pulse Time*(1600/6)/Number of Hopping Frequency*Period
Period = 0.4* Number of Hopping Frequency

Figure 28: Time of Occupancy, 2441MHz, GFSK DH1

Figure 27: Time of Occupancy, 2441MHz, GFSK DH3

Figure 30: Time of Occupancy, 2441MHz, GFSK DH5

Figure 31: Time of Occupancy, 2441MHz, 8-DPSK DH1

Figure 32: Time of Occupancy, 2441MHz, 8-DPSK DH3

Figure 33: Time of Occupancy, 2441MHz, 8-DPSK DH5

4.2 Mains Emissions

4.2.1 Conducted Emission on AC Mains

RESULT: **PASS**

Test standard	:	FCC Part 15.207(a) RSS-Gen 8.8
Requirement	:	ANSI C63.10-2013
Kind of test site	:	Shielded room

Test setup

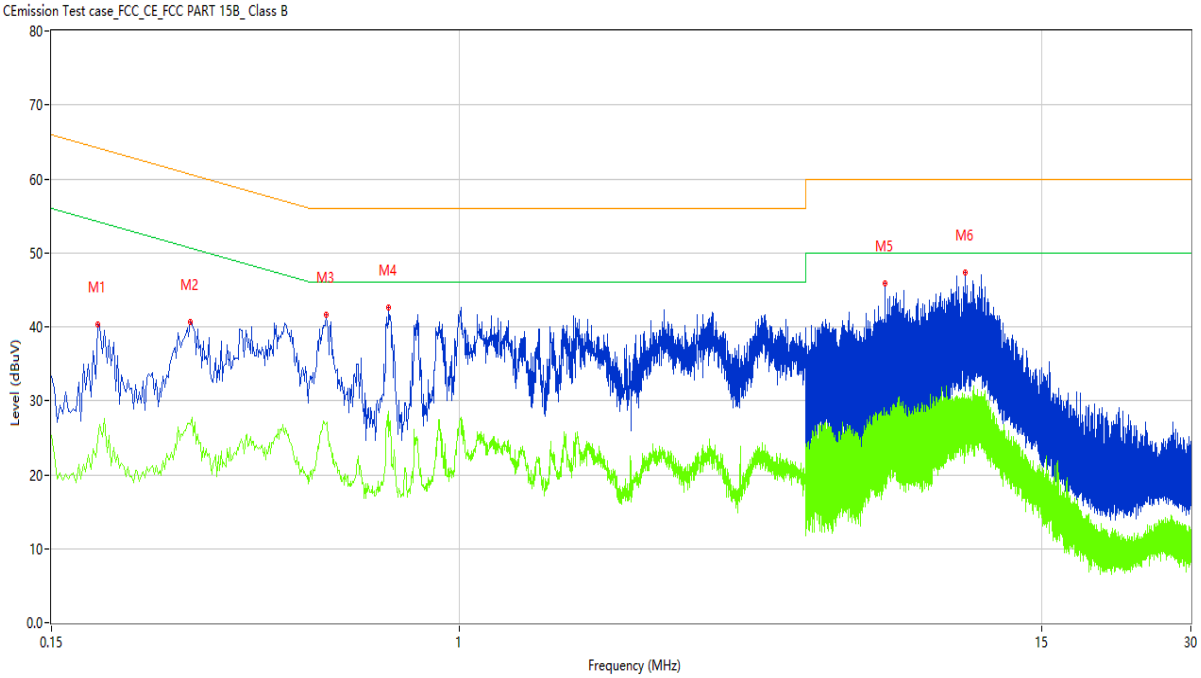
Input Voltage	:	AC 120V, 60Hz; AC 240V, 50Hz
Operation Mode	:	A.1.a
Earthing	:	Not Connected
Ambient temperature	:	25°C
Relative humidity	:	52%

For details refer to following test plot.

Note:

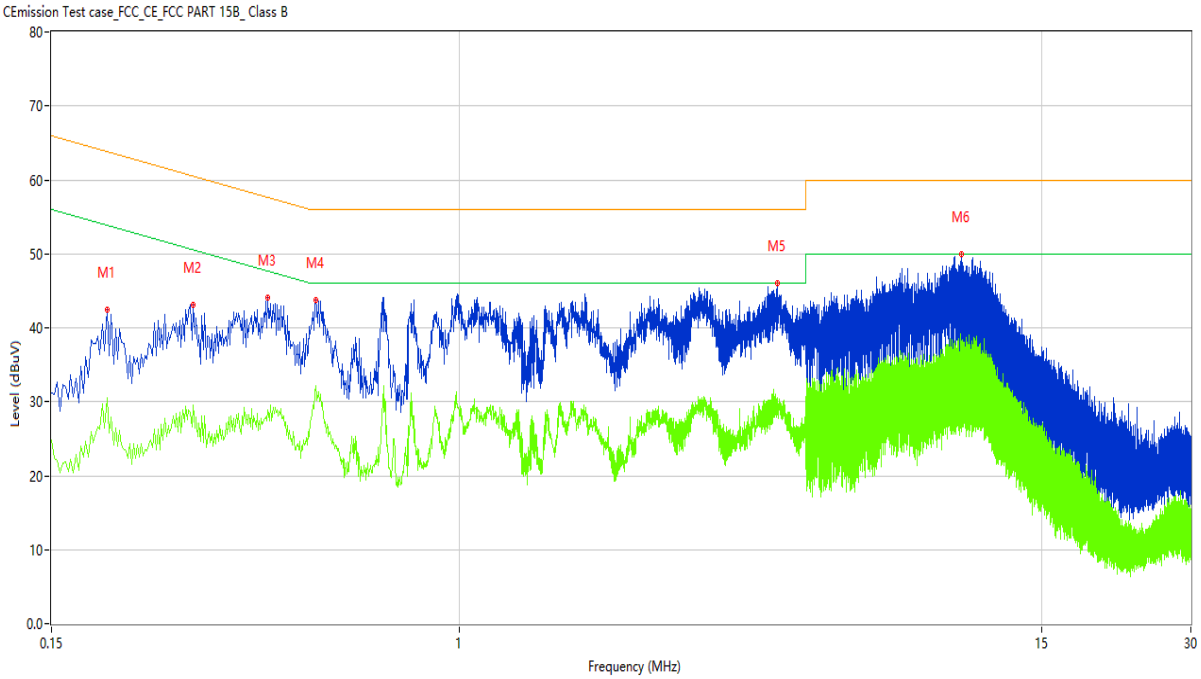
The all configurations were tested respectively, but only the worst configuration shown here.

Figure 34: Conducted Emission on AC Mains, L Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.186	41.38	10.15	64.21	-22.83	Peak	L	Pass
1*	0.186	34.74	10.15	64.21	-29.47	QP	L	Pass
1**	0.186	24.88	10.15	54.21	-29.33	AV	L	Pass
2	0.286	41.98	10.14	60.64	-18.66	Peak	L	Pass
2*	0.286	36.64	10.14	60.64	-24.00	QP	L	Pass
2**	0.286	26.78	10.14	50.64	-23.86	AV	L	Pass
3	0.538	41.54	10.15	56.00	-14.46	Peak	L	Pass
3*	0.538	36.48	10.15	56.00	-19.52	QP	L	Pass
3**	0.538	27.01	10.15	46.00	-18.99	AV	L	Pass
4	0.720	42.13	10.15	56.00	-13.87	Peak	L	Pass
4*	0.720	36.69	10.15	56.00	-19.31	QP	L	Pass
4**	0.720	28.59	10.15	46.00	-17.41	AV	L	Pass
5	7.228	44.20	10.31	60.00	-15.80	Peak	L	Pass
5*	7.228	36.32	10.31	60.00	-23.68	QP	L	Pass
5**	7.228	27.97	10.31	50.00	-22.03	AV	L	Pass
6	10.514	48.17	10.42	60.00	-11.83	Peak	L	Pass
6*	10.514	36.70	10.42	60.00	-23.30	QP	L	Pass
6**	10.514	28.78	10.42	50.00	-21.22	AV	L	Pass

Figure 35: Conducted Emission on AC Mains, N Phase



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Over Limit (dB)	Detector	Line	Verdict
1	0.194	42.29	10.15	63.86	-21.57	Peak	N	Pass
1*	0.194	37.24	10.15	63.86	-26.62	QP	N	Pass
1**	0.194	30.48	10.15	53.86	-23.38	AV	N	Pass
2	0.290	44.64	10.14	60.52	-15.88	Peak	N	Pass
2*	0.290	37.98	10.14	60.52	-22.54	QP	N	Pass
2**	0.290	29.58	10.14	50.52	-20.94	AV	N	Pass
3	0.410	44.71	10.15	57.65	-12.94	Peak	N	Pass
3*	0.410	38.27	10.15	57.65	-19.38	QP	N	Pass
3**	0.410	28.91	10.15	47.65	-18.74	AV	N	Pass
4	0.512	45.76	10.15	56.00	-10.24	Peak	N	Pass
4*	0.512	40.05	10.15	56.00	-15.95	QP	N	Pass
4**	0.512	32.08	10.15	46.00	-13.92	AV	N	Pass
5	4.380	46.94	10.25	56.00	-9.06	Peak	N	Pass
5*	4.380	39.59	10.25	56.00	-16.41	QP	N	Pass
5**	4.380	30.57	10.25	46.00	-15.43	AV	N	Pass
6	10.346	50.51	10.41	60.00	-9.49	Peak	N	Pass
6*	10.346	43.12	10.41	60.00	-16.88	QP	N	Pass
6**	10.346	30.51	10.41	50.00	-19.49	AV	N	Pass

5 Appendixes

5.1 Photographs of the Sample

Front of the sample

Rear of the sample

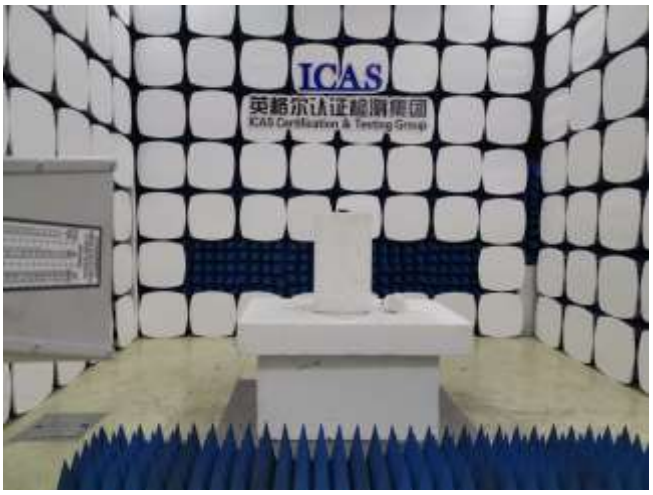
5.2 Set-up for Conducted Emissions

5.3 Set-up for Conducted RF test at Antenna Port

5.4 Set-up for Spurious Emissions below 1GHz

Below 1 GHz

5.5 Set-up for Spurious Emissions above 1GHz



Above 1GHz

End of the report