FCC PART 15 SUBPART C TEST REPORT

FCC PART 15 SUBPART E 15.407

Report Reference No..... :	**MTEB23060092-R4**	
FCC ID. ..... :	**2ATYP-HK5910**	
Compiled by (position+printed name+signature):	File administrators Alisa Luo	Alisa Luo
Supervised by (position+printed name+signature):	Test Engineer Sunny Deng	Sunny Deng
Approved by (position+printed name+signature):	Manager Yvette Zhou	Yvette Zhou
Date of issue..... :	Jun.09,2023	
Representative Laboratory Name ..... :	**Shenzhen Most Technology Service Co., Ltd.**	
Address ..... :	No.5, 2nd Langshan Road, North District, Hi-tech Industrial Park, Nanshan, Shenzhen, Guangdong, China.	
Applicant's name..... :	**Shiji (US) Inc.**	
Address ..... :	730 Peachtree Street NE, Suite 375, Atlanta, Georgia, 30319, United States	
Test specification ..... **:**		
Standard ..... :	**FCC Part 15 Subpart E 15.407**	

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Test item description..... :	POS COMPUTER
Trade Mark .....:	Shiji
Manufacturer.....:	Shiji (US) Inc.
Model/Type reference.....:	HK5910
Listed Models .....:	HK578
Ratings .....:	DC 24V (by Adapter)
Modulation .....:	OFDM
Frequency	From 5745MHz-5825MHz
Hardware version .....:	HS-J6412
Software version .....:	MEHL0401
Result .....:	**PASS**

T E S T R E P O R T

Equipment under Test	:	POS COMPUTER
Model /Type	:	HK5910
Listed Models		HK578
Remark		Only the model name is different, the others are the same.
Applicant	:	**Shiji (US) Inc.**
Address	:	730 Peachtree Street NE, Suite 375, Atlanta, Georgia, 30319, United States
Manufacturer	:	**Shiji (US) Inc.**
Address	:	730 Peachtree Street NE, Suite 375, Atlanta, Georgia, 30319, United States

Test Result:	**PASS**

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.

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1 Revision History

Revision	Issue Date	Revisions	Revised By
00	2023-06-09	Initial Issue	Alisa Luo

2 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15 Subpart E—Unlicensed National Information Infrastructure Devices
ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices
KDB789033 D02: General UNII Test Procedures New Rules v01r02

3 SUMMARY

3.1 General Remarks

Date of receipt of test sample	:	2023.06.02
Testing commenced on	:	2023.06.05
Testing concluded on	:	2023.06.09

3.2 Product Description

Product Description:	POS COMPUTER			
Model:	HK5910			
Power supply:	DC 24V (by Adapter)			
Testing sample ID：	MTYP01607-1609			
WIFI				
Supported type:	20MHz system	40MHz system	80MHz system	160MHz system
	802.11a 802.11n 802.11ac	802.11n 802.11ac	N/A	N/A
Operation frequency:	5745MHz-5825MHz	5755MHz-5795MHz	N/A	N/A
Modulation:	OFDM	OFDM	N/A	N/A
Antenna type:	Intergral Antenna			
Antenna gain:	Antenna A: 5.6dBi(MAIN), Antenna B:5.3dBi(AUX) Remark:Antenna A and Antenna B do not support simultaneous firing.			

3.3 Equipment Under Test

Power supply system utilised

Power supply voltage	:	○	230V / 50 Hz	○	120V / 60Hz
		○	12 V DC	○	24 V DC
		●	Other (specified in blank below)		

DC 24V (by Adapter)

3.4 Short description of the Equipment under Test (EUT)

This is a VT 31
For more details, refer to the user's manual of the EUT.

3.5 EUT operation mode

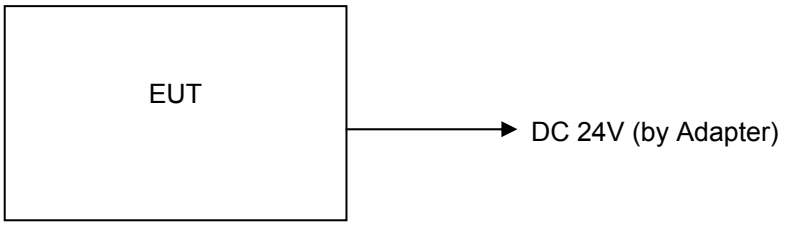
The Applicant provides communication tools software (AT command) to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing.
All test performed at the low, middle and high of operational frequency range of each mode.

Operation Frequency List WIFI on 5G Band：

Operating band	20MHz		40MHz	
	Channel	Frequency (MHz)	Channel	Frequency (MHz)
U-NII 3 (5725MHz-5850MHz)	**149**	**5745**	**151**	**5755**
	153	5765		
	157	**5785**	**159**	**5795**
	161	5805		
	165	**5825**	--	--

Note: The line display in grey is those Channels/Frequencies select to test in this report for each operation mode.

3.6 Block Diagram of Test Setup



3.1 Test Item (Equipment Under Test) Description*

Short designation	EUT Name	EUT Description	Serial number	Hardware status	Software status
EUT A	Adapter	GM60-240250-F			
EUT B	Adapter	FSP060-DAAN3			
EUT C	Adapter	FSP120-AAAN3			

*: declared by the applicant. According to customers information EUTs A and B are the same devices.

3.2 Auxiliary Equipment (AE) Description

AE short designation	EUT Name (if available)	EUT Description	Serial number (if available)	Software (if used)
AE 1				
AE 2	-			

3.3 Antenna Information*

Short designation	Antenna Name	Antenna Type	Frequency Range	Serial number	Antenna Peak Gain
Antenna 1	---	Intergral Antenna	5745MHz-5825MHz	---	Antenna A: 5.6dBi(MAIN)
Antenna 2	---	Intergral Antenna	5745MHz-5825MHz	---	Antenna B:5.3dBi(AUX)

*: declared by the applicant.

3.4 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended to comply with Section 15.407 of the FCC Part 15, Subpart E Rules.

3.5 EUT configuration

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

● - supplied by the manufacturer

○ - Supplied by the lab

●	ADAPTER 1	M/N:	GM60-240250-F
		Manufacturer:	Foshan Shunde GUANYUDA Power Supply Co., Ltd.
●	ADAPTER 2	M/N:	FSP060-DAAN3
		Manufacturer:	FSP Group Inc.
●	ADAPTER 3	M/N:	FSP120-AAAN3
		Manufacturer:	FSP Group Inc.

3.6 Modifications

No modifications were implemented to meet testing criteria.

4 TEST ENVIRONMENT

4.1 Address of the test laboratory

Shenzhen Most Technology Service Co., Ltd.
No.5, 2nd Langshan Road, North District, Hi-tech Industrial Park, Nanshan, Shenzhen, Guangdong, China.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.4:2014 and CISPR 16-1-4:2010 SVSWR requirement for radiated emission above 1GHz.

4.2 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

The test facility is recognized, certified, or accredited by the following organizations:

FCC-Registration No.: 0031192610

Shenzhen Most Technology Service 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.

A2LA-Lab Cert. No.: 6343.01

Shenzhen Most Technology Service Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

4.3 Environmental conditions

Radiated Emission:

Temperature:	23 ° C
Humidity:	48 %
Atmospheric pressure:	950-1050mbar

AC Main Conducted testing：

Temperature:	24 ° C
Humidity:	45 %
Atmospheric pressure:	950-1050mbar

Conducted testing：

Temperature:	24 ° C
Humidity:	45 %
Atmospheric pressure:	950-1050mbar

4.4 Test Description

FCC Requirement		
FCC Part 15.207	AC Power Conducted Emission	N/A
FCC Part 15.407(a)	Emission Bandwidth(26dBm Bandwidth)	N/A Note1
FCC Part 15.407(e)	Minimum Emission Bandwidth(6dBm Bandwidth)	PASS Note2
FCC Part 15.407(a)	Maximum Conducted Output Power	PASS
FCC Part 15.407(a)	Peak Power Spectral Density	PASS
FCC Part 15.407(g)	Frequency Stability	PASS
FCC Part 15.407(b)	Undesirable emission	PASS
FCC Part 15.407(b)/15.205/15.209	Radiated Emissions	PASS
FCC Part 15.407(h)	Dynamic Frequency Selection	N/A Note 3
FCC Part 15.203/15.247(b)	Antenna Requirement	PASS

Note 1: Apply to U-NII 1, U-NII 2A, and U-NII 2C band.
Note 2: Apply to U-NII 3 band only.
Note 3: This device not work in DFS band.

Data Rate Used:
Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	Mode	Data Rate
Maximum Conducted Output Power Power Spectral Density Emission Bandwidth(26dBm Bandwidth) Minimum Emission Bandwidth(6dBm Bandwidth) Undesirable emission Frequency Stability	11a/OFDM	54 Mbps
	11n(20MHz) /OFDM	MCS0
	11n(40MHz) /OFDM	MCS0

4.5 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 Most Technology Service 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 Shenzhen Most Technology Service Co., Ltd. is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.10 Db	(1)
Radiated Emission	1~18GHz	4.32 Db	(1)
Radiated Emission	18-40GHz	5.54 dB	(1)
Conducted Disturbance	0.15~30MHz	3.12 dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

4.6 Equipments Used during the Test

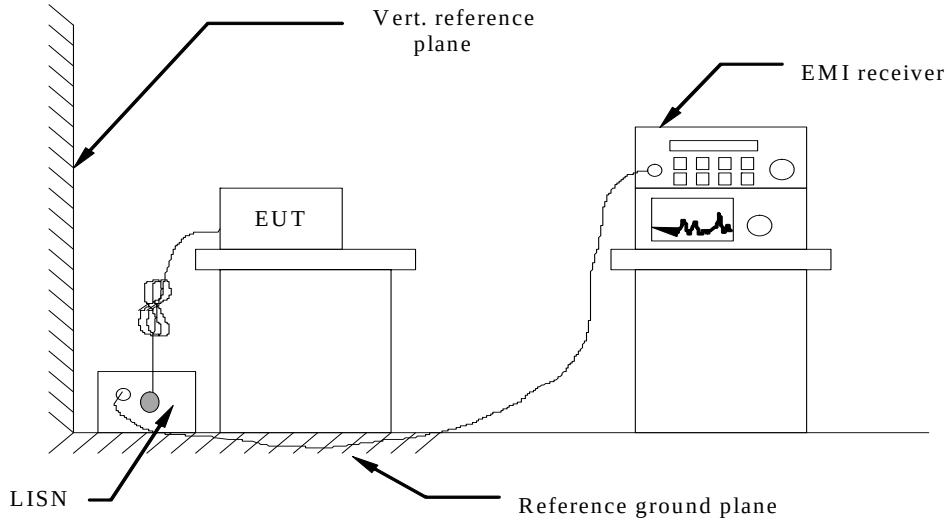
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N.	R&S	ENV216	100093	2023/03/17	1 Year
2	Three-phase artificial power network	Schwarzback Mess	NNLK8129	8129178	2023/03/17	1 Year
3.	Receiver	R&S	ESCI	100492	2023/03/17	1 Year
4	Receiver	R&S	ESPI	101202	2023/03/17	1 Year
5	Spectrum analyzer	Agilent	9020A	MT-E306	2023/03/17	1 Year
6	Bilong Antenna	Sunol Sciences	JB3	A121206	2023/03/17	1 Year
7	Horn antenna	HF Antenna	HF Antenna	MT-E158	2023/03/17	1 Year
8	Loop antenna	Beijing Daze	ZN30900B	/	2023/03/17	1 Year
9	Horn antenna	R&S	OBH100400	26999002	2023/03/17	1 Year
10	Wireless Communication Test Set	R&S	CMW500	/	2023/03/17	1 Year
11	Spectrum analyzer	R&S	FSP	100019	2023/03/17	1 Year
12	High gain antenna	Schwarzbeck	LB-180400KF	MT-E389	2023/03/17	1 Year
13	Preamplifier	Schwarzbeck	BBV 9743	MT-E390	2023/03/17	1 Year
14	Pre-amplifier	EMCI	EMC051845SE	MT-E391	2023/03/17	1 Year
15	Pre-amplifier	Agilent	83051A	MT-E392	2023/03/17	1 Year
16	High pass filter unit	Tonscend	JS0806-F	MT-E393	2023/03/17	1 Year
17	RF Cable(below1GHz)	Times	9kHz-1GHz	MT-E394	2023/03/17	1 Year
18	RF Cable(above 1GHz)	Times	1-40G	MT-E395	2023/03/17	1 Year
19	RF Cable (9KHz-40GHz)	Tonscend	170660	N/A	2023/03/17	1 Year

Note: The Cal.Interval was one year.

5 TEST CONDITIONS AND RESULTS

5.1 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 C63.10-2013.
2 Support equipment, if needed, was placed as per ANSI C63.10-2013
3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2013
4 The EUT received DC 12V power from adapter, the adapter received AC120V/60Hz and AC 240V/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.

AC Power Conducted Emission Limit

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

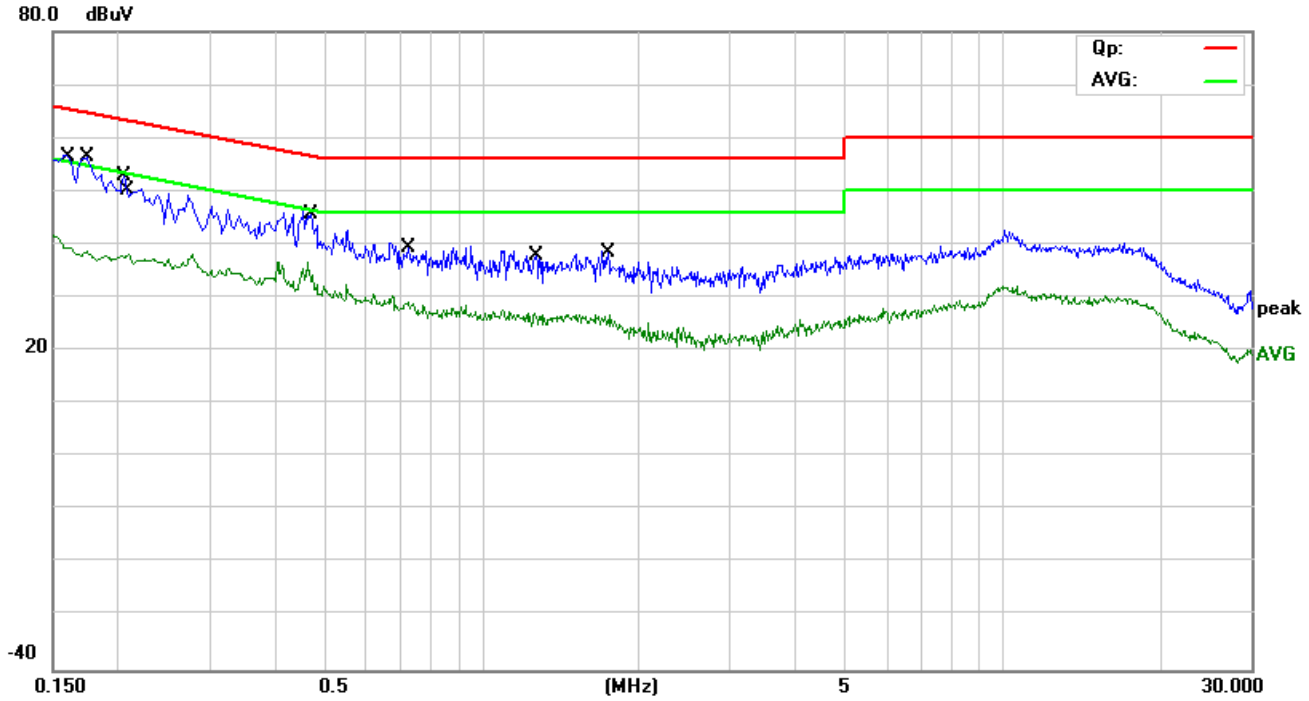
Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

TEST RESULTS

Remark:

1. WIFI 5G modes were test at 802.11a, 802.11n(20), 802.11n(40), 802.11ac (20), 802.11ac (40) , 802.11ac (80) (Low, Middle, and High channel); only the worst result of 802.11a Middle Channel was reported as below:
2. GM60-240250-F, FSP060-DAAN3, FSP120-AAAN3 three adapters have been tested, and only the worst adapter(GM60-240250-F) test data is shown

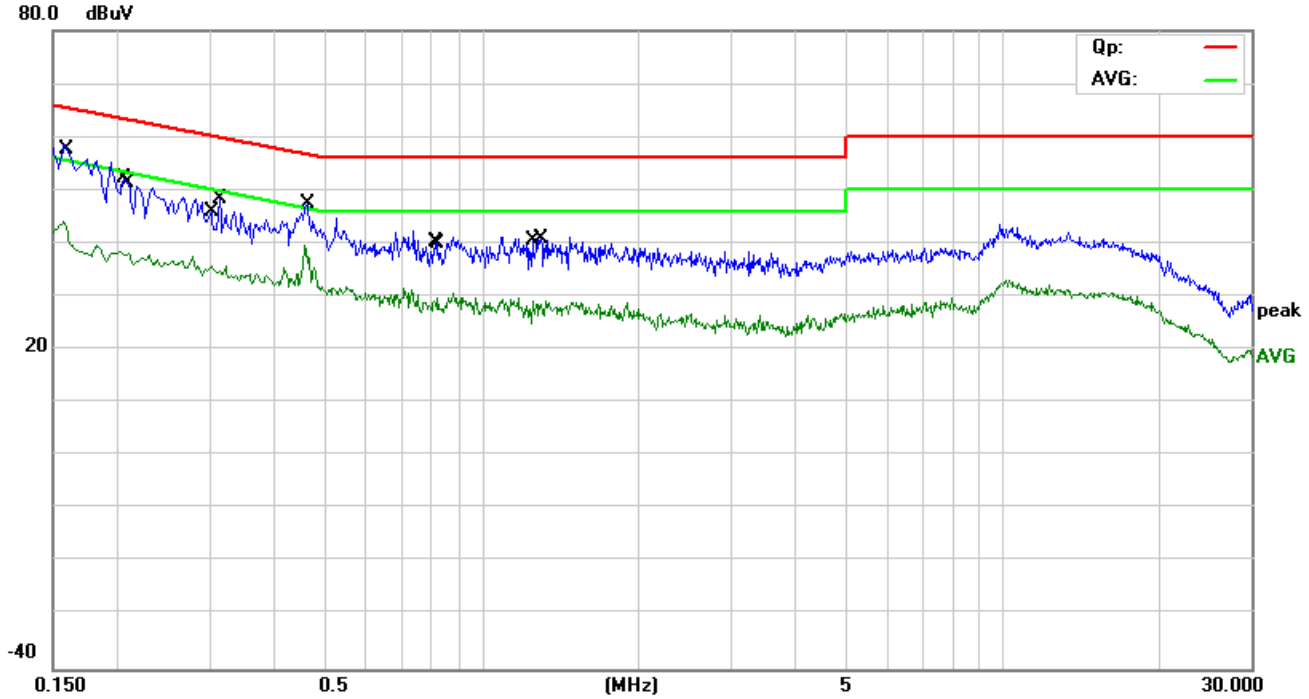
Power supply:	DC 24V (by Adapter)	Polarization	L
M/N:	HK5910(second display: 10.4 inch)		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1624	29.71	9.61	39.32	55.34	-16.02	AVG	
2	*	0.1740	46.70	9.61	56.31	64.77	-8.46	QP	
3		0.2060	43.21	9.60	52.81	63.37	-10.56	QP	
4		0.2100	28.52	9.60	38.12	53.21	-15.09	AVG	
5		0.4620	26.92	9.59	36.51	46.66	-10.15	AVG	
6		0.4700	36.03	9.59	45.62	56.51	-10.89	QP	
7		0.7220	29.75	9.60	39.35	56.00	-16.65	QP	
8		0.7220	19.44	9.60	29.04	46.00	-16.96	AVG	
9		1.2660	17.54	9.60	27.14	46.00	-18.86	AVG	
10		1.2740	28.26	9.60	37.86	56.00	-18.14	QP	
11		1.7500	28.77	9.60	38.37	56.00	-17.63	QP	
12		1.7620	17.27	9.60	26.87	46.00	-19.13	AVG	

*:Maximum data x:Over limit !:over margin

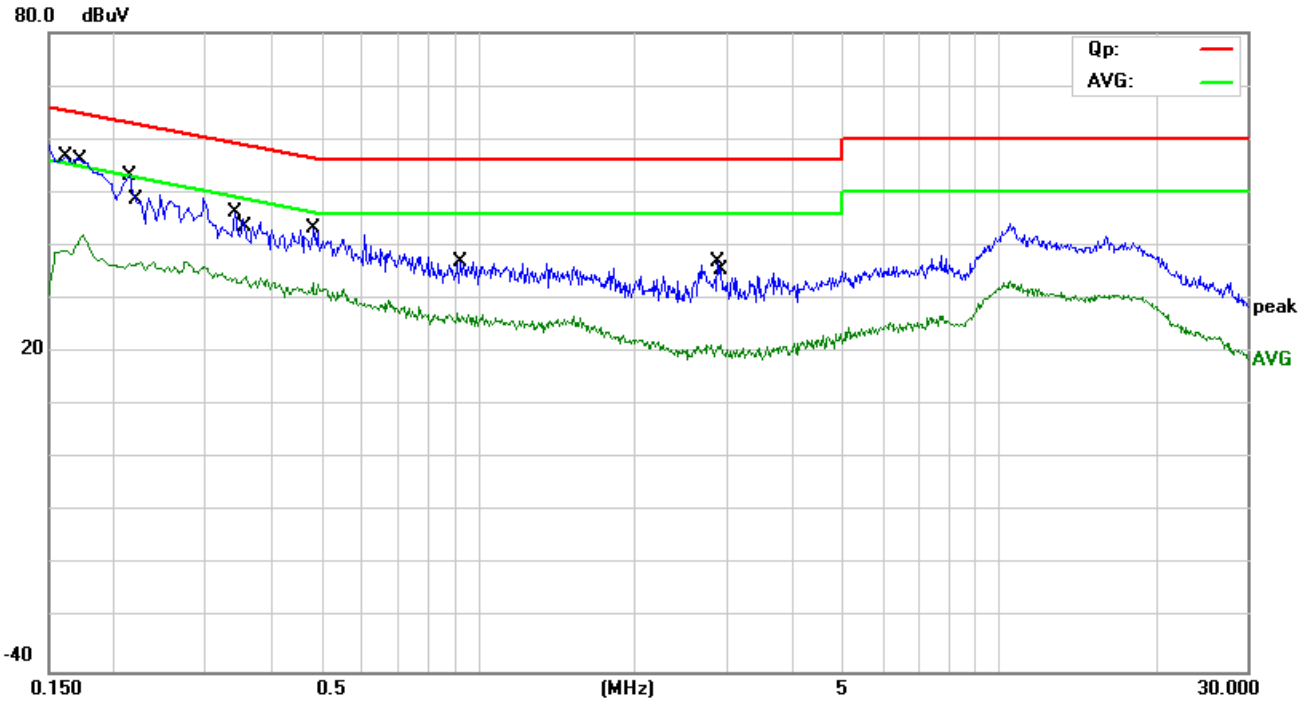
Power supply:	DC 24V (by Adapter)	Polarization	N
M/N:	HK5910(second display: 10.4 inch)		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.1607	47.43	9.61	57.04	65.43	-8.39	QP	
2		0.1607	31.60	9.61	41.21	55.43	-14.22	AVG	
3		0.2072	42.16	9.60	51.76	63.32	-11.56	QP	
4		0.2100	28.46	9.60	38.06	53.21	-15.15	AVG	
5		0.3020	26.11	9.59	35.70	50.19	-14.49	AVG	
6		0.3140	38.72	9.59	48.31	59.86	-11.55	QP	
7	*	0.4580	29.92	9.59	39.51	46.73	-7.22	AVG	
8		0.4620	37.75	9.59	47.34	56.66	-9.32	QP	
9		0.8140	30.69	9.60	40.29	56.00	-15.71	QP	
10		0.8220	20.03	9.60	29.63	46.00	-16.37	AVG	
11		1.2500	19.46	9.60	29.06	46.00	-16.94	AVG	
12		1.3020	31.29	9.60	40.89	56.00	-15.11	QP	

*:Maximum data x:Over limit !:over margin

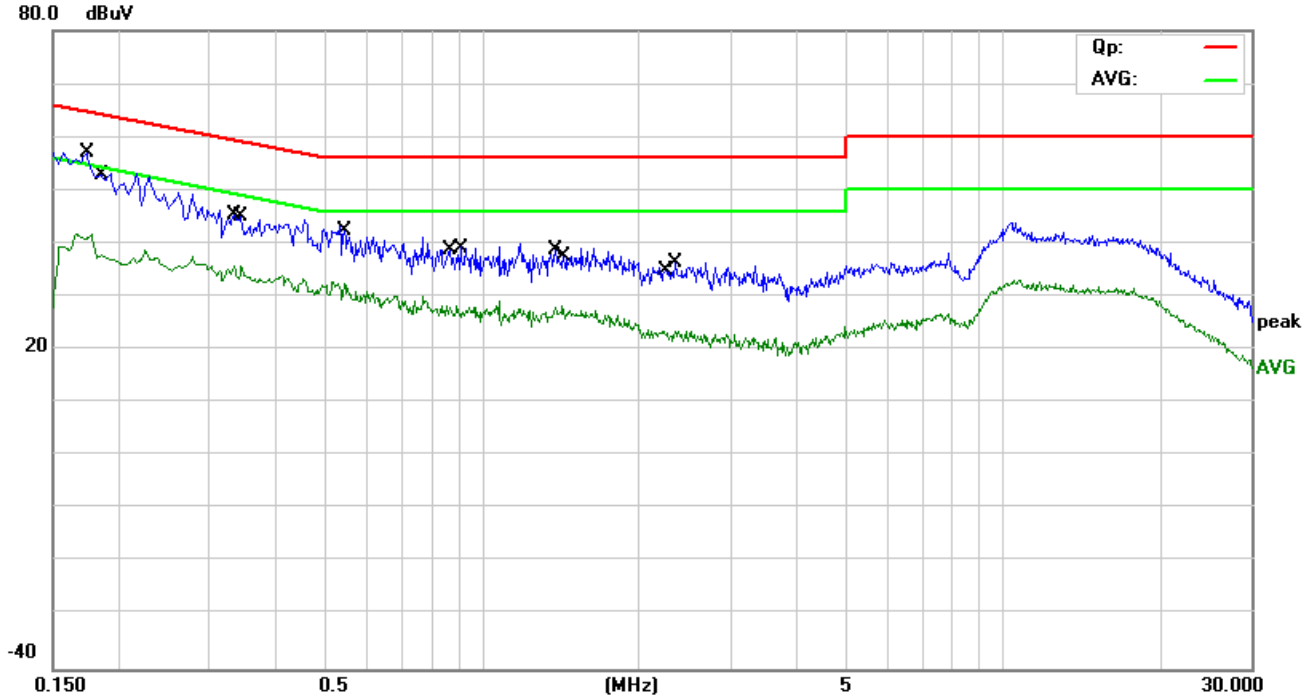
Power supply:	DC 24V (by Adapter)	Polarization	L
M/N:	HK5910(second display: 15 inch)		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1620	47.00	9.61	56.61	65.36	-8.75	QP	
2		0.1740	32.45	9.61	42.06	54.77	-12.71	AVG	
3		0.2140	43.62	9.60	53.22	63.05	-9.83	QP	
4		0.2232	27.20	9.60	36.80	52.70	-15.90	AVG	
5		0.3420	36.55	9.59	46.14	59.15	-13.01	QP	
6		0.3580	24.79	9.59	34.38	48.77	-14.39	AVG	
7		0.4820	23.34	9.59	32.93	46.30	-13.37	AVG	
8		0.4860	33.52	9.59	43.11	56.24	-13.13	QP	
9		0.9180	17.75	9.60	27.35	46.00	-18.65	AVG	
10		0.9260	27.31	9.60	36.91	56.00	-19.09	QP	
11		2.8980	27.24	9.61	36.85	56.00	-19.15	QP	
12		2.9460	11.77	9.61	21.38	46.00	-24.62	AVG	

*:Maximum data x:Over limit !:over margin

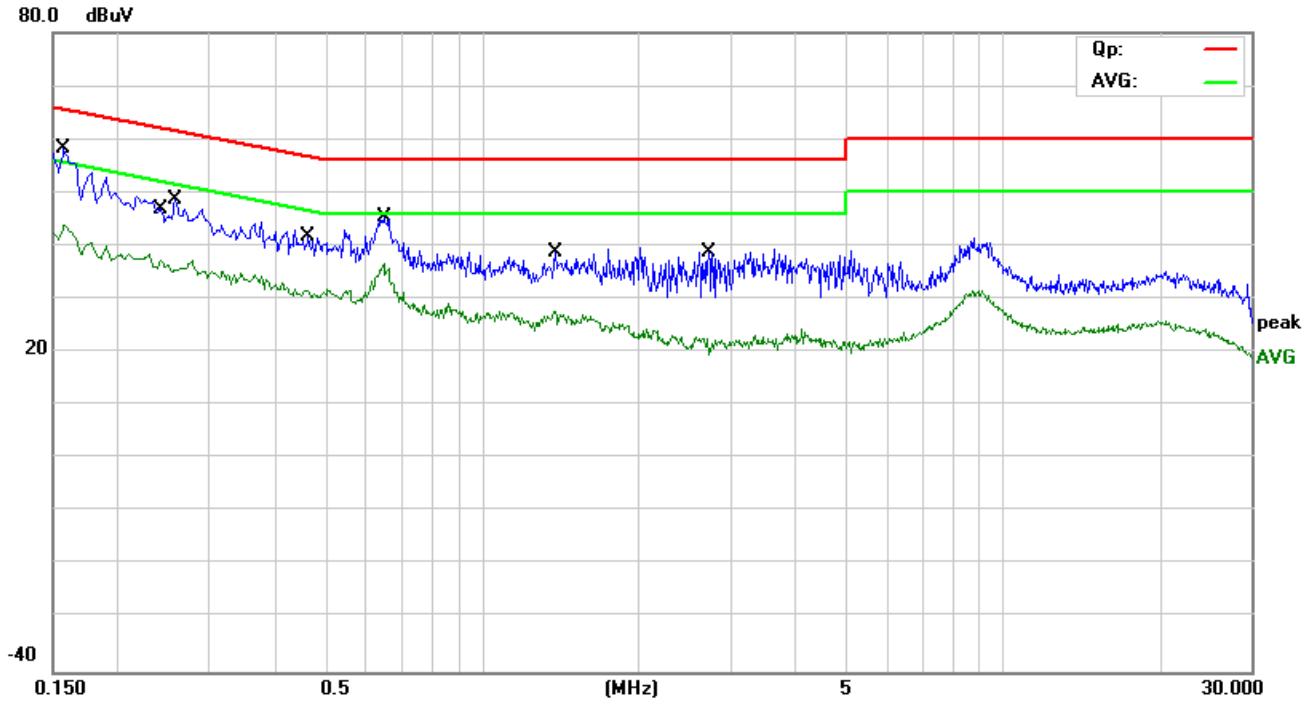
Power supply:	DC 24V (by Adapter)	Polarization	N
M/N:	HK5910(second display: 15 inch)		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1740	47.50	9.61	57.11	64.77	-7.66	QP	
2		0.1860	28.15	9.60	37.75	54.21	-16.46	AVG	
3		0.3340	35.76	9.59	45.35	59.35	-14.00	QP	
4		0.3460	26.23	9.59	35.82	49.06	-13.24	AVG	
5		0.5460	32.84	9.59	42.43	56.00	-13.57	QP	
6		0.5460	22.80	9.59	32.39	46.00	-13.61	AVG	
7		0.8700	29.20	9.60	38.80	56.00	-17.20	QP	
8		0.8980	18.72	9.60	28.32	46.00	-17.68	AVG	
9		1.3860	29.06	9.60	38.66	56.00	-17.34	QP	
10		1.4260	18.59	9.60	28.19	46.00	-17.81	AVG	
11		2.2380	13.85	9.60	23.45	46.00	-22.55	AVG	
12		2.3500	26.68	9.61	36.29	56.00	-19.71	QP	

*:Maximum data x:Over limit !:over margin

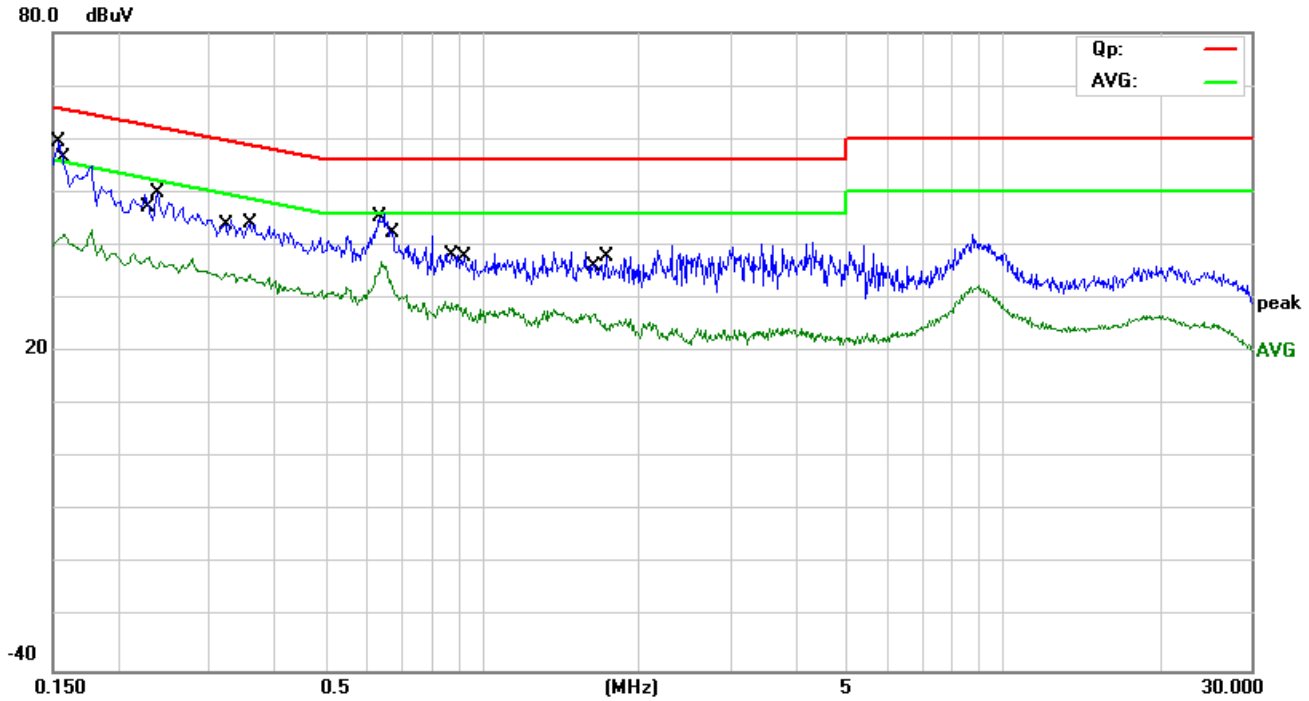
Power supply:	DC 24V (by Adapter)	Polarization	L
M/N:	HK5910(second display: VFD)		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1580	48.63	9.60	58.23	65.57	-7.34	QP	
2		0.1580	34.17	9.60	43.77	55.57	-11.80	AVG	
3		0.2430	27.34	9.60	36.94	51.99	-15.05	AVG	
4		0.2580	39.06	9.60	48.66	61.50	-12.84	QP	
5		0.4580	21.99	9.59	31.58	46.73	-15.15	AVG	
6		0.4660	32.09	9.59	41.68	56.58	-14.90	QP	
7		0.6500	35.65	9.60	45.25	56.00	-10.75	QP	
8		0.6500	27.00	9.60	36.60	46.00	-9.40	AVG	
9		1.3780	18.07	9.60	27.67	46.00	-18.33	AVG	
10		1.3820	29.04	9.60	38.64	56.00	-17.36	QP	
11		2.7140	13.07	9.61	22.68	46.00	-23.32	AVG	
12		2.7260	29.10	9.61	38.71	56.00	-17.29	QP	

*:Maximum data x:Over limit !:over margin

Power supply:	DC 24V (by Adapter)	Polarization	N
M/N:	HK5910(second display: VFD)		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1556	47.74	9.60	57.34	65.70	-8.36	QP	
2		0.1580	32.41	9.60	42.01	55.57	-13.56	AVG	
3		0.2316	27.44	9.60	37.04	52.39	-15.35	AVG	
4		0.2380	40.20	9.60	49.80	62.17	-12.37	QP	
5		0.3220	25.24	9.59	34.83	49.66	-14.83	AVG	
6		0.3580	34.66	9.59	44.25	58.77	-14.52	QP	
7		0.6340	25.73	9.59	35.32	46.00	-10.68	AVG	
8		0.6740	32.83	9.60	42.43	56.00	-13.57	QP	
9		0.8740	19.56	9.60	29.16	46.00	-16.84	AVG	
10		0.9260	28.33	9.60	37.93	56.00	-18.07	QP	
11		1.6580	17.47	9.60	27.07	46.00	-18.93	AVG	
12		1.7380	28.23	9.60	37.83	56.00	-18.17	QP	

*:Maximum data x:Over limit !:over margin

5.2 Radiated Emissions

Limit

The maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(4) For transmitters operating in the 5.725-5.85 GHz band: All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

Undesirable emission limits

Requirement	Limit(EIRP)	Limit (Field strength at 3m) Note1
15.407(b)(1)	PK:-27(dBm/MHz)	PK:68.2(dBμV/m)
15.407(b)(2)		
15.407(b)(3)		
15.407(b)(4)		

Note1: The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

$$E = \frac{1000000\sqrt{30P}}{3}$$ μV/m, where P is the eirp (Watts)

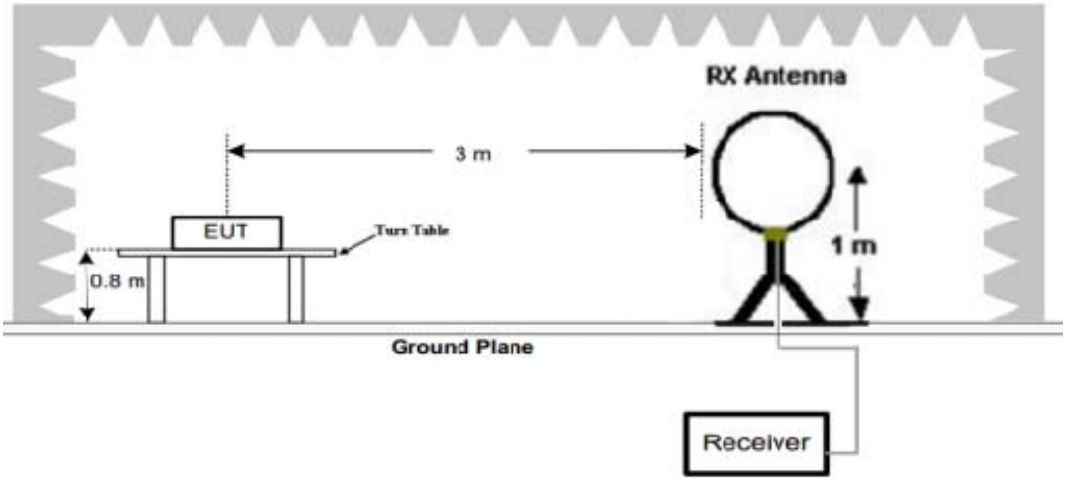
(5) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209
(6)In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a)

Radiated emission limits

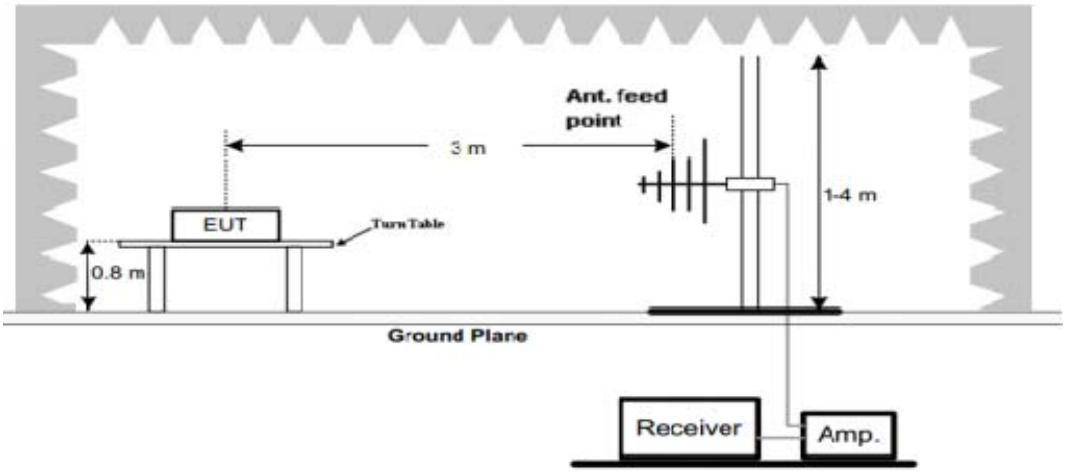
Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

TEST CONFIGURATION

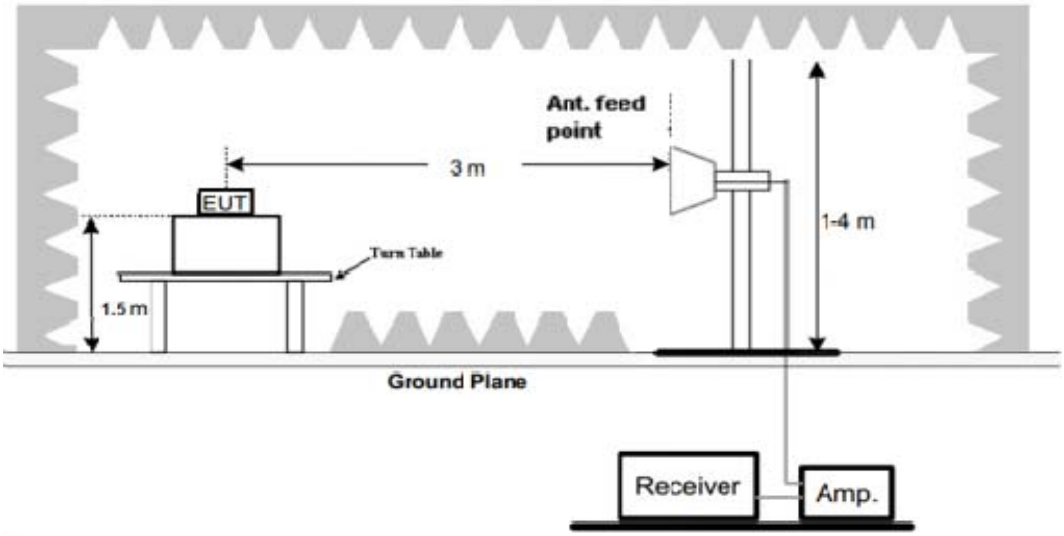
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



Test Procedure

1. Below 1GHz measurement the EUT is placed on a turntable which is 0.8m above ground plane, and above 1GHz measurement EUT was placed on a low permittivity and low loss tangent turn table which is 1.5m 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.
5. Radiated emission test frequency band from 9KHz to 40GHz.
6. The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3
30MHz-1GHz	Bilog Antenna	3
1GHz-18GHz	Horn Antenna	3
18GHz-25GHz	Horn Anternna	1

7. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
9KHz-150KHz	RBW=200Hz/VBW=3KHz,Sweep time=Auto	QP
150KHz-30MHz	RBW=9KHz/VBW=100KHz,Sweep time=Auto	QP
30MHz-1GHz	RBW=120KHz/VBW=1000KHz,Sweep time=Auto	QP
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

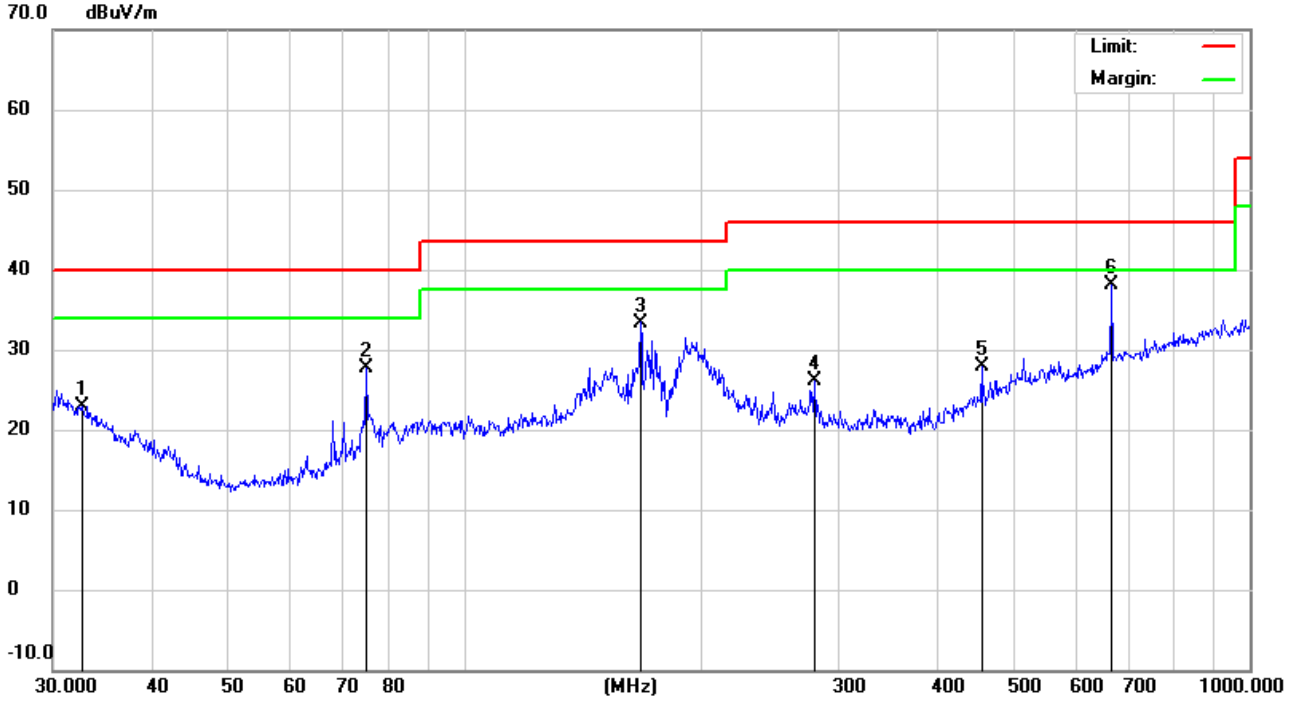
TEST RESULTS

Remark:
1. This test was performed with EUT in X, Y, Z position and the worse case was found when EUT in X position.
2. All 802.11a, 802.11n(20), 802.11n(40), 802.11ac (20), 802.11ac (40) , 802.11ac (80) modes have been tested for below 1GHz test, only the worst case 802.11a low channel of U-NII 1 band was recorded.
3. All 802.11a, 802.11n(20), 802.11n(40), 802.11ac (20), 802.11ac (40) , 802.11ac (80) modes have been tested for above 1GHz test, only the worst case 802.11a was recorded.
4. Radiated emission test from 9 KHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9 KHz to 30MHz and not recorded in this report.
5. Remark: Result=Reading value+Factor
6. GM60-240250-F, FSP060-DAAN3, FSP120-AAAN3 three adapters have been tested, and only the worst adapter(GM60-240250-F) test data is shown

For 30MHz-1GHz

Horizontal

HK5910(second display: 10.4 inch)

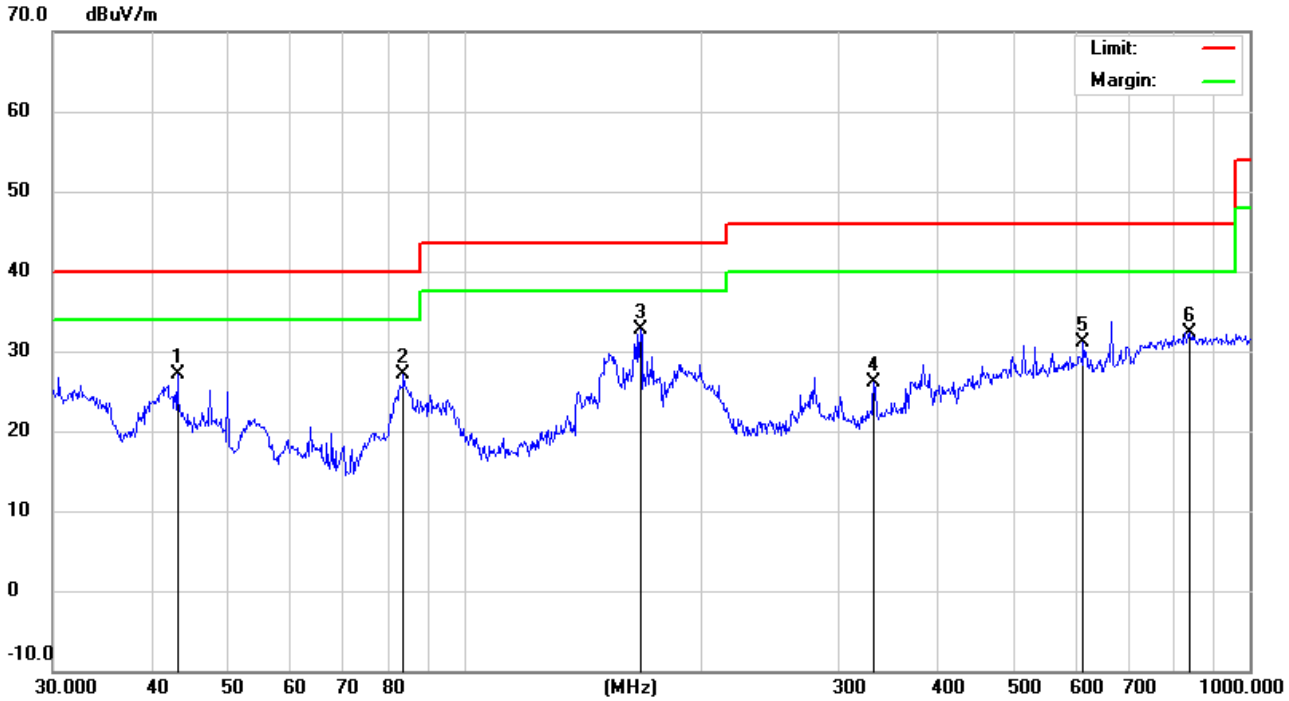


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		32.7486	3.94	19.03	22.97	40.00	-17.03	QP	200	19	
2		75.1822	18.05	9.71	27.76	40.00	-12.24	QP	200	86	
3		167.8242	16.36	17.04	33.40	43.50	-10.10	QP	200	134	
4		279.0436	11.37	14.79	26.16	46.00	-19.84	QP	200	199	
5		455.9057	7.55	20.36	27.91	46.00	-18.09	QP	200	253	
6	*	668.1422	13.32	24.69	38.01	46.00	-7.99	QP	200	305	

*:Maximum data x:Over limit !:over margin

Vertical

HK5910(second display: 10.4 inch)

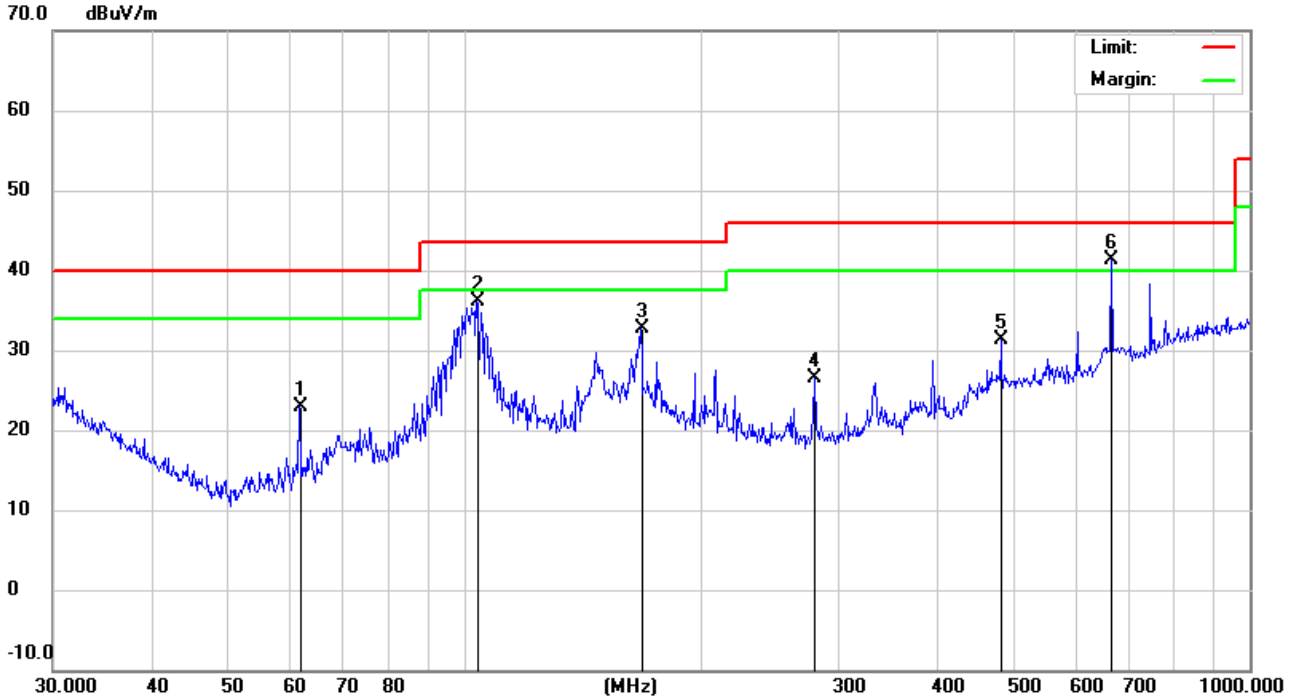


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		43.2014	15.34	11.69	27.03	40.00	-12.97	QP	100	23	
2		83.8155	17.02	10.02	27.04	40.00	-12.96	QP	100	96	
3	*	167.8242	15.63	17.04	32.67	43.50	-10.83	QP	100	153	
4		332.5187	9.96	16.12	26.08	46.00	-19.92	QP	100	199	
5		614.2142	7.06	23.98	31.04	46.00	-14.96	QP	100	263	
6		839.1818	4.01	28.33	32.34	46.00	-13.66	QP	100	320	

*:Maximum data x:Over limit !:over margin

Horizontal

HK5910(second display: 15 inch)

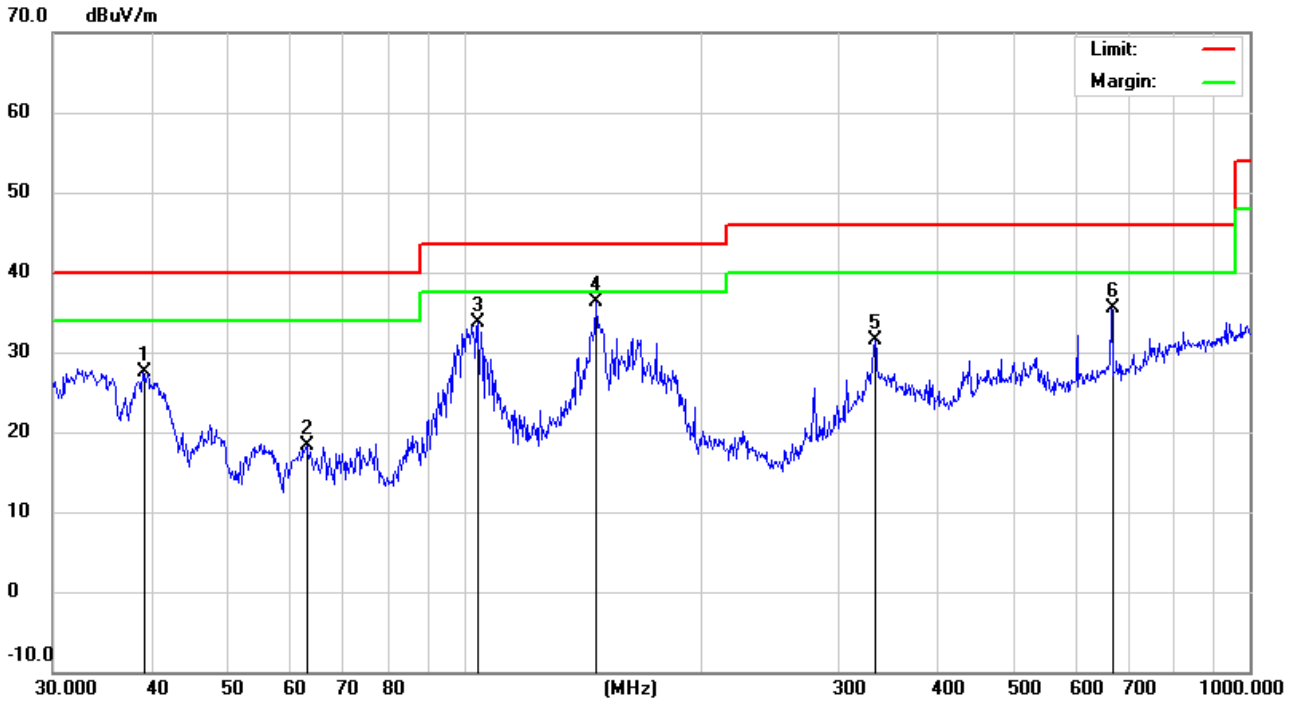


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		61.7781	14.20	8.72	22.92	40.00	-17.08	QP	200	27	
2		103.8055	22.08	14.02	36.10	43.50	-7.40	QP	200	95	
3		167.8243	15.75	17.04	32.79	43.50	-10.71	QP	200	154	
4		280.0237	11.77	14.82	26.59	46.00	-19.41	QP	200	237	
5		482.2156	9.59	21.76	31.35	46.00	-14.65	QP	200	296	
6	*	665.8035	16.72	24.66	41.38	46.00	-4.62	QP	200	341	

*:Maximum data x:Over limit !:over margin

Vertical

HK5910(second display: 15 inch)

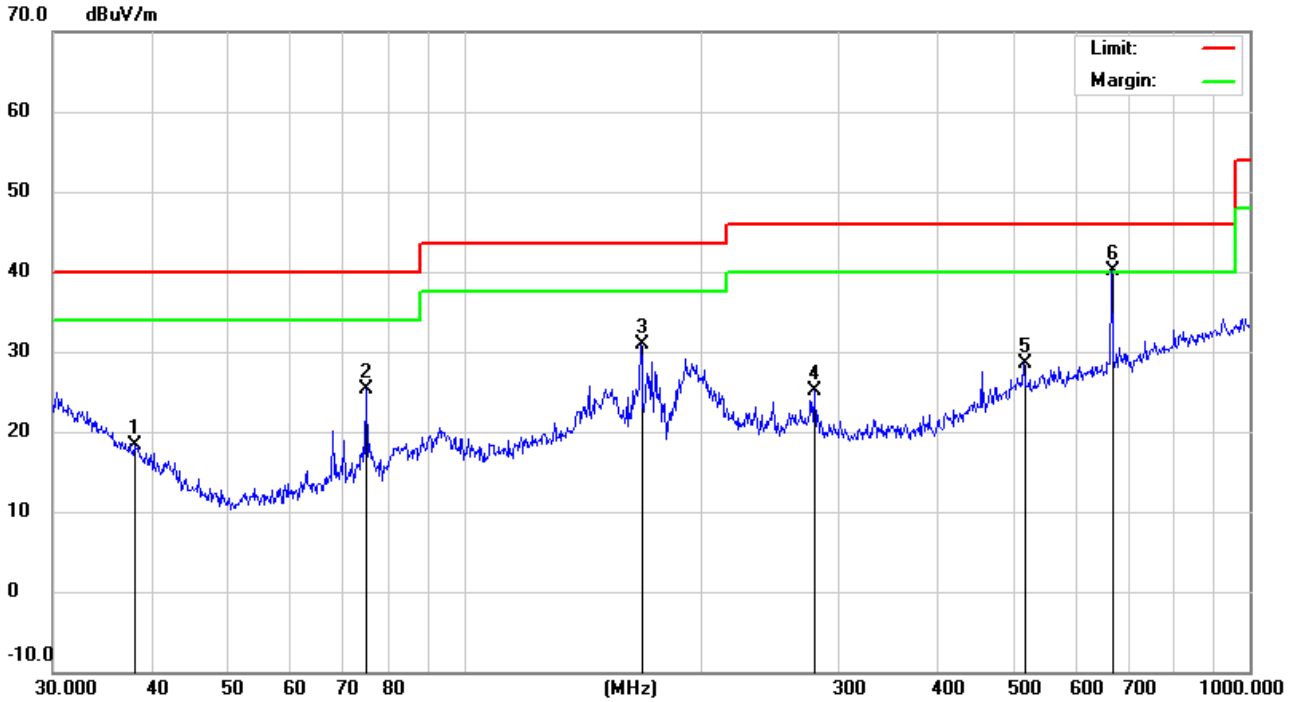


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		39.0245	12.89	14.52	27.41	40.00	-12.59	QP	100	24	
2		63.0916	9.55	8.82	18.37	40.00	-21.63	QP	100	99	
3		104.1701	19.67	14.06	33.73	43.50	-9.77	QP	100	136	
4	*	147.4036	18.98	17.36	36.34	43.50	-7.16	QP	100	179	
5		333.6867	15.29	16.14	31.43	46.00	-14.57	QP	100	225	
6		668.1423	10.90	24.69	35.59	46.00	-10.41	QP	100	296	

*:Maximum data x:Over limit !:over margin

Horizontal

HK5910(second display: VFD)

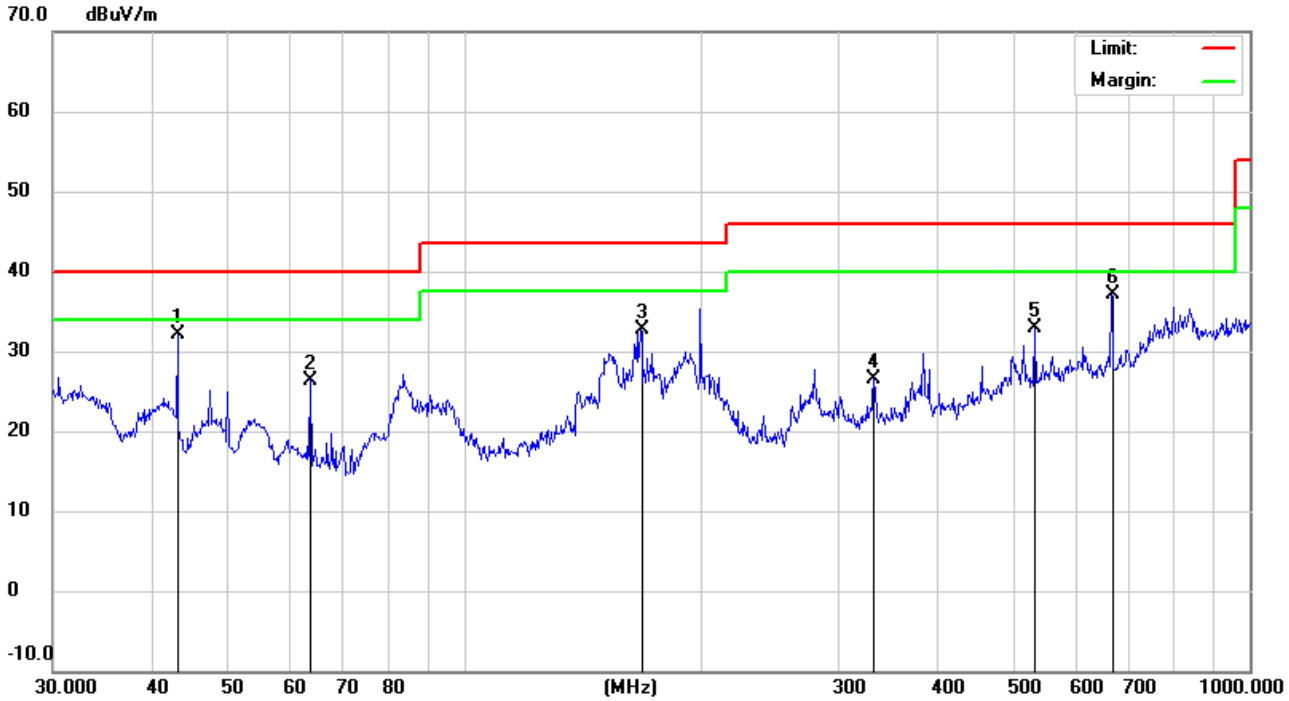


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		38.0783	3.17	15.22	18.39	40.00	-21.61	QP	200	22	
2		75.1822	15.55	9.71	25.26	40.00	-14.74	QP	200	69	
3		167.8243	13.86	17.04	30.90	43.50	-12.60	QP	200	130	
4		279.0436	10.37	14.79	25.16	46.00	-20.84	QP	200	188	
5		515.4374	5.62	22.87	28.49	46.00	-17.51	QP	200	251	
6	*	668.1423	15.32	24.69	40.01	46.00	-5.99	QP	200	305	

*:Maximum data x:Over limit !:over margin

Vertical

HK5910(second display: VFD)



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	43.2017	20.34	11.69	32.03	40.00	-7.97	QP	100	42	
2		63.7588	17.54	8.86	26.40	40.00	-13.60	QP	100	99	
3		167.8243	15.63	17.04	32.67	43.50	-10.83	QP	100	134	
4		332.5187	10.46	16.12	26.58	46.00	-19.42	QP	100	166	
5		531.9635	9.79	23.05	32.84	46.00	-13.16	QP	100	205	
6		668.1423	12.47	24.69	37.16	46.00	-8.84	QP	100	299	

*:Maximum data x:Over limit !:over margin

For 1GHz to 40GHz
Note: 802.11a, 802.11n(20), 802.11n(40), 802.11ac (20), 802.11ac (40) , 802.11ac (80) modes have been tested for above 1GHz test, only the worst case 802.11a was recorded. Antenna A, antenna B and antenna A+B are all tested, and the data shows the worst antenna A+B.

U-NII 3

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable loss (dB)	Preamp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
***802.11a Mode* -5500MHz**									
V	5086	58.36	32.84	5.24	36.4	60.04	74	13.96	PK
V	5086	39.76	32.84	5.24	36.4	41.44	54	12.56	AV
H	5086	55.28	32.84	5.24	36.4	56.96	74	17.04	PK
H	5086	43.39	32.84	5.24	36.4	45.07	54	8.93	AV
V	11490	41.05	39.52	11.47	34.28	57.76	74	16.24	PK
V	11490	24.15	39.52	11.47	34.28	40.86	54	13.14	AV
H	11490	42.05	39.52	11.47	34.28	58.76	74	15.24	PK
H	11490	26.7	39.52	11.47	34.28	43.41	54	10.59	AV
***802.11a Mode* -5600MHz**									
V	5086	54.92	32.84	5.24	36.4	56.6	74	17.4	PK
V	5086	38.89	32.84	5.24	36.4	40.57	54	13.43	AV
H	5086	54.32	32.84	5.24	36.4	56	74	18	PK
H	5086	42.89	32.84	5.24	36.4	44.57	54	9.43	AV
V	11570	43.01	39.52	11.47	34.28	59.72	74	14.28	PK
V	11570	27.13	39.52	11.47	34.28	43.84	54	10.16	AV
H	11570	41.01	39.52	11.47	34.28	57.72	74	16.28	PK
H	11570	27.3	39.52	11.47	34.28	44.01	54	9.99	AV
802.11a *Mode* -5700MHz									
V	5086	55.45	32.84	5.24	36.4	57.13	74	16.87	PK
V	5086	39.91	32.84	5.24	36.4	41.59	54	12.41	AV
H	5086	55.26	32.84	5.24	36.4	56.94	74	17.06	PK
H	5086	44.19	32.84	5.24	36.4	45.87	54	8.13	AV
V	11650	42.35	39.52	11.47	34.28	59.06	74	14.94	PK
V	11650	25.83	39.52	11.47	34.28	42.54	54	11.46	AV
H	11650	42.72	39.52	11.47	34.28	59.43	74	14.57	PK
H	11650	26.4	39.52	11.47	34.28	43.11	54	10.89	AV

REMARKS:

1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
3. Margin value = Limit value- Emission level.
4. -- Mean the other emission levels were very low against the limit.
5. RBW1MHz VBW3MHz Peak detector is for PK value; RBW 1MHz VBW10Hz Peak detector is for AV value.

Radiated Band Edge Test:
All 802.11a / 802.11n (HT20) / 802.11n (HT40modes have been tested for above 1GHz test, only the worst case 802.11a was recorded.

U-NII 3

Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Antenna Factor (dB)	Cable loss (dB)	Preamp factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Detector Type
802.11a									
V	5460	56.35	31.22	7.62	36.5	58.69	74	15.31	PK
V	5460	37.77	31.22	7.62	36.5	40.11	54	13.89	AV
H	5460	55.85	31.22	7.62	36.5	58.19	74	15.81	PK
H	5460	43.45	31.22	7.62	36.5	45.79	54	8.21	AV
V	5850	54.76	31.56	7.83	35.82	58.33	74	15.67	PK
V	5850	39.11	31.56	7.83	35.82	42.68	54	11.32	AV
H	5850	53.56	31.56	7.83	35.82	57.13	74	16.87	PK
H	5850	40.05	31.56	7.83	35.82	43.62	54	10.38	AV

5.3 Conduction spurious emission

Limit

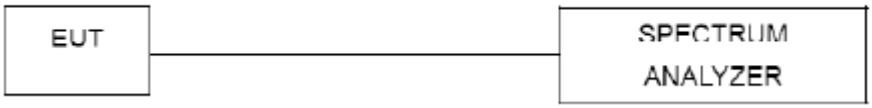
The maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(4) For transmitters operating in the 5.725-5.85 GHz band: All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

Test Procedure

Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
RBW = 1 MHz for f ⩾ 1 GHz, 100 kHz for f < 1 GHz
VBW ⩾ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize

Test Configuration



TEST RESULTS

See APPENDIX VI.

5.4 Maximum Conducted Average Output Power

Limit

For the band 5.15-5.25 GHz.
(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.

(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi.

(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

(iv) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi.

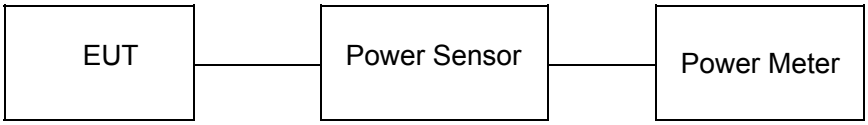
For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz.

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W

Test Procedure

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power sensor.

Test Configuration



Test Results

See APPENDIX II.

5.5 Power Spectral Density

Limit

(1) For the band 5.15 - 5.25 GHz.

(i) For an outdoor access point operating in the band 5.15 - 5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 MHz band.[note1]

(ii) For an indoor access point operating in the band 5.15 - 5.25 GHz, the maximum power spectral density shall not exceed 17 dBm in any 1 MHz band.[note1]

(iii) For fixed point-to-point access points operating in the band 5.15 - 5.25 GHz, transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi.

(iv) For mobile and portable client devices in the 5.15 - 5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 MHz band. [note1]

(2) For the 5.25 - 5.35 GHz and 5.47 - 5.725 GHz bands, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. [note1]

(3) For the band 5.725 - 5.85 GHz, the maximum power spectral density shall not exceed 30 dBm in any 500 kHz band. [note1, note2]

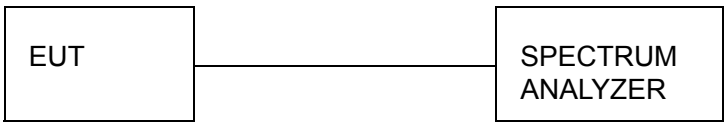
Note1: If transmitting antennas of directional gain greater than 6 dBi are used, the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note2: Fixed point - to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information.

Test Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW = 1MHz for U-NII 1, U-NII 2A, U-NII C band and 510KHz for U-NII 3 band.
3. Set the VBW ≥ 3× RBW.
4. Set the span to encompass the entire EBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum power level.

Test Configuration



Test Results

See APPENDIX VIII

5.6 Emission Bandwidth (26dBm Bandwidth)

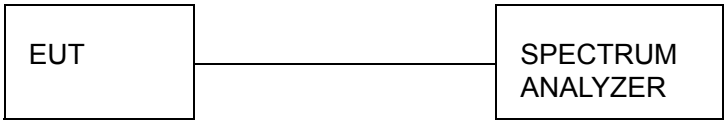
Limit

N/A

Test Procedure

1. Set resolution bandwidth (RBW) = approximately 1 % of the EBW.
2. Set the video bandwidth (VBW) > RBW.
3. Detector = Peak.
4. Trace mode = Max hold.
5. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW / EBW ratio is approximately 1 %.

Test Configuration



Test Results

N/A

5.7 Minimum Emission Bandwidth (6dBm Bandwidth)

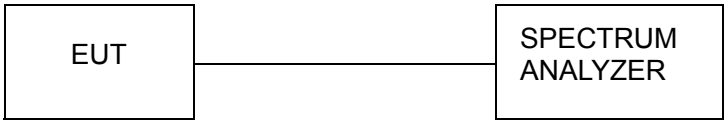
Limit

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

Test Procedure

1. Set resolution bandwidth (RBW) = 100 kHz
2. Set the video bandwidth 3 x RBW.
3. Detector = Peak.
4. Trace mode = Max hold.
5. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Test Configuration



Test Results

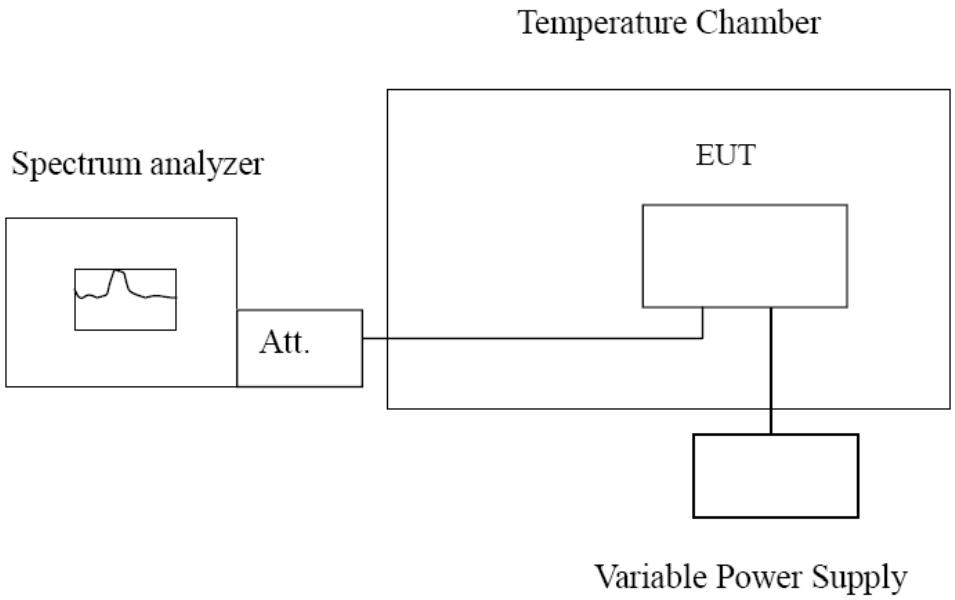
See APPENDIX IV.

5.8 Frequency Stability

LIMIT

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

TEST CONFIGURATION



TEST PROCEDURE

Frequency Stability under Temperature Variations:
The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20℃ operating frequency as reference frequency. Turn EUT off and set the chamber temperature to -30℃. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10℃ increased per stage until the highest temperature of +50℃ reached.

Frequency Stability under Voltage Variations:
Set chamber temperature to 20℃. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.
Reduce the input voltage to specify extreme voltage variation (±15%) and endpoint, record the maximum frequency change.

TEST RESULTS

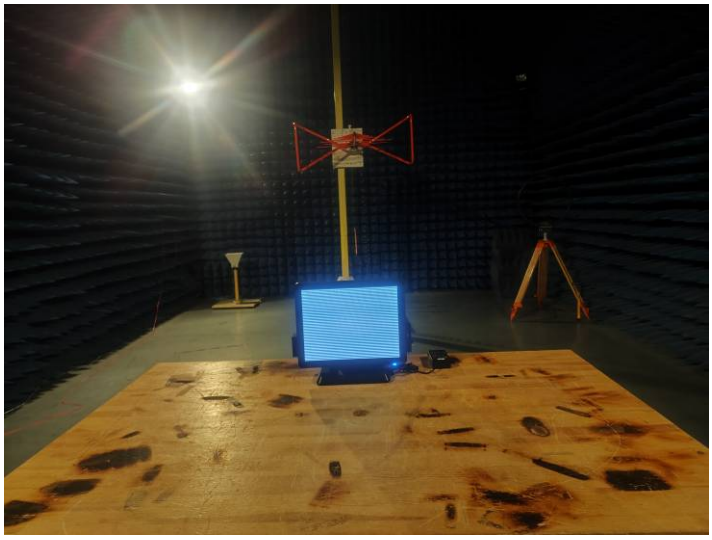
See APPENDIX I.

5.9 Duty Cycle Information

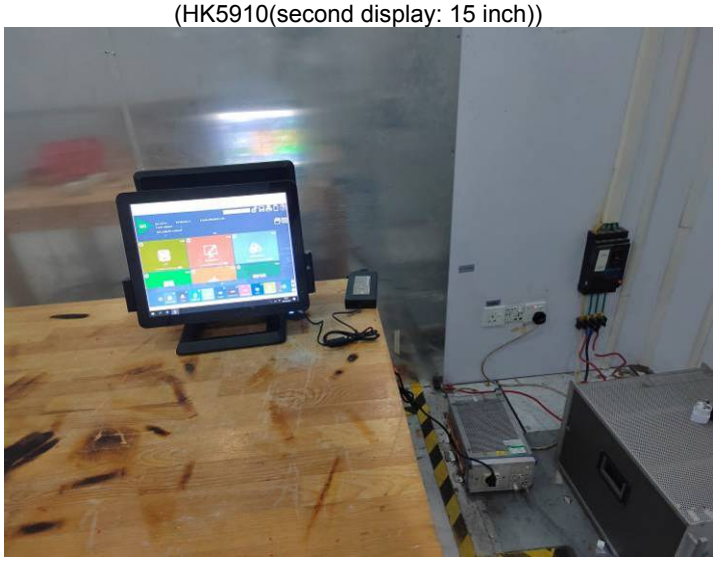
See APPENDIX VII.

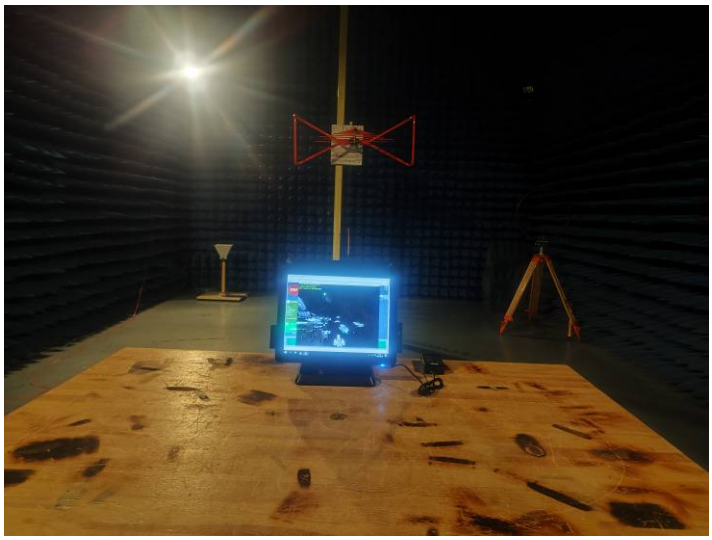
6 Test Setup Photos of the EUT

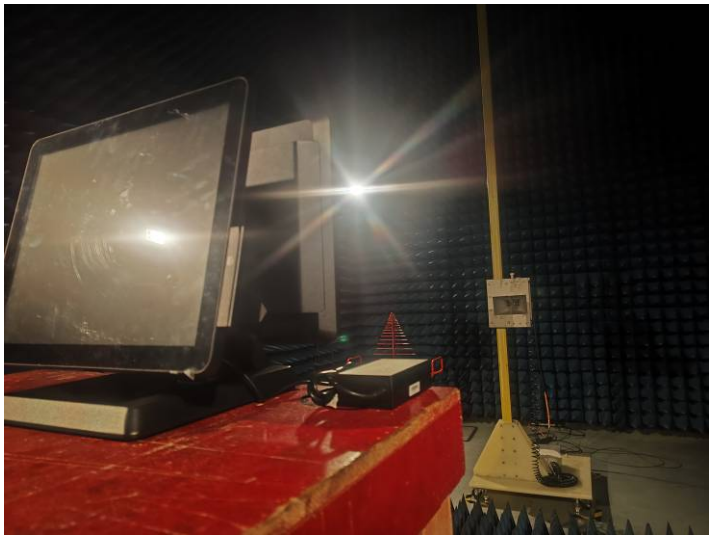
(HK5910(second display: 10.4 inch))



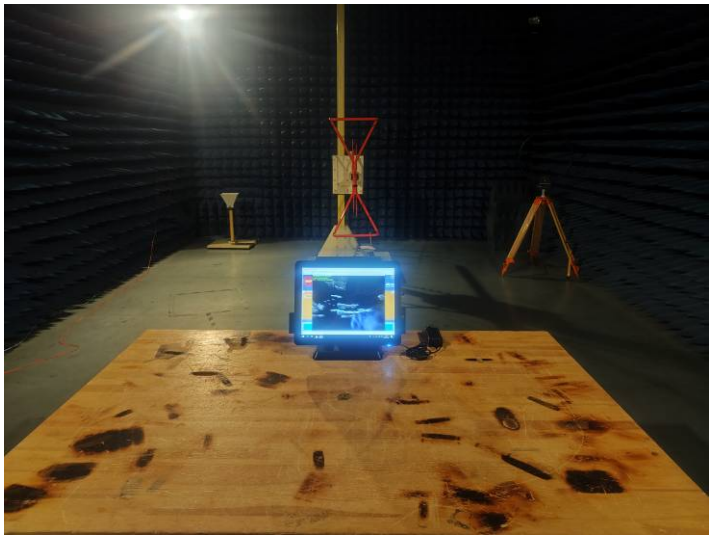
(HK5910(second display: 15 inch))







(HK5910(second display: VFD))



7 Photos of the EUT

see photo report.