Certificate #6613.01

EMC TEST REPORT

Applicant:	BARTEC GmbH
Address:	Max-Eyth-Str.16 , 97980 Bad Mergentheim, Germany

Manufacturer or Supplier:	BARTEC GmbH
Address:	Max-Eyth-Str.16 , 97980 Bad Mergentheim, Germany
Product:	Smartscanner / Smartphone
Brand Name:	BARTEC
Model Name:	SP9EX1/SC9EX1/SP9EX2/SC9EX2
FCC ID:	TBUSX9EX
Date of tests:	Jan. 02, 2024~ Jul. 26, 2024

The submitted sample of the above equipment has been tested for according to the requirements of the following standards:

☐ **FCC Part 15, Subpart B, Class A**
☒ **FCC Part 15, Subpart B, Class B**
☒ **ANSI C63.4:2014**

CONCLUSION: The submitted sample was found to <u>COMPLY</u> with the test requirement

Prepared by Hanwen Xu Engineer / Mobile Department	Approved by Peibo Sun Manager / Mobile Department
Xu Hanwen	Sun Peibo
Date: Jul. 26, 2024	Date: Jul. 26, 2024

This report is governed by, and incorporates by reference, the Conditions of Testing as posted at the date of issuance of this report at http://www.bureauveritas.com/home/about-us/our-business/cps/about-us/terms-conditions/ and is intended for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. Measurement uncertainty is only provided upon request for accredited tests. Statements of conformity are based on simple acceptance criteria without taking measurement uncertainty into account, unless otherwise requested in writing. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence or if you require measurement uncertainty; provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents.

TABLE OF CONTENTS

TABLE OF CONTENTS **2**

RELEASE CONTROL RECORD **3**

1 GENERAL INFORMATION **4**

1.1 GENERAL DESCRIPTION OF EUT 4
1.2 SUMMARY OF TEST RESULTS 9
1.3 MEASUREMENT UNCERTAINTY 11
1.4 DESCRIPTION OF TEST MODES 12
1.4 DESCRIPTION OF SUPPORT UNITS 13

2 EMISSION TEST **14**

2.1 CONDUCTED EMISSION MEASUREMENT 14
2.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT 14
2.1.2 TEST INSTRUMENTS 14
2.1.3 TEST PROCEDURES 16
2.1.4 DEVIATION FROM TEST STANDARD 16
2.1.5 TEST SETUP 17
2.1.6 EUT OPERATING CONDITIONS 17
2.1.7 TEST RESULTS 18
2.2 RADIATED EMISSION MEASUREMENT 20
2.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT 20
2.2.2 TEST INSTRUMENTS 21
2.2.3 TEST PROCEDURE 23
2.2.4 DEVIATION FROM TEST STANDARD 24
2.2.5 TEST SETUP 25
2.2.6 EUT OPERATING CONDITIONS 26
2.2.7 TEST RESULTS 27

3 APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB **31**

RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
PSU-QSU2312140113EM01	Original release	Jul. 26, 2024

1 GENERAL INFORMATION

1.1 GENERAL DESCRIPTION OF EUT

PRODUCT*	Smartscanner / Smartphone	
BRAND NAME*	BARTEC	
MODEL NAME*	SP9EX1/SC9EX1/SP9EX2/SC9EX2	
NOMINAL VOLTAGE*	5.0V/9.0V/12.0Vdc (adapter) 3.2V/3.8V/4.2V/dc (battery)	
MODULATION TYPE*	**BT_LE**	GFSK
	Bluetooth	GFSK, π/4-DQPSK, 8DPSK
	NFC	ASK
	WLAN	DSSS, OFDM, OFDMA
	GPS/GALILEO/ GLONASS/BDS	BPSK
	GSM/GPRS/EDGE	GMSK, 8PSK
	WCDMA	BPSK/QPSK
	LTE	QPSK/16QAM/64QAM/256QAM
OPERATING FREQUENCY	**Bluetooth/BT_LE**	2402MHz ~ 2480MHz
	NFC	13.56 MHz
	WLAN	2412 ~ 2462MHz for 11b/g/n(HT20/40)/ax(20/40)/ax(20M RU26/52/106/242)/ax(40M RU26/52/106/242/484) 5180 ~ 5240MHz, 5260 ~ 5320 MHz, 5500 ~ 5720MHz, 5745 ~ 5825 MHz for 11a/ n(HT20)/ n(HT40) / ac(VHT20)/ ac(VHT40) / ac(VHT80)/ ac(VHT160)/ax(20/40/80/160)/ ax(20M RU26/52/106/242)/ ax(40M RU26/52/106/242/484)/ ax(80M RU26/52/106/242/484/996)/ ax(160M RU26/52/106/242/484/996/1992)
	GPS/GALILEO/ GLONASS/BDS	1559MHz ~ 1610MHz
	GSM	824.2MHz ~ 848.8MHz (FOR GSM 850) 1850.2MHz ~ 1909.8MHz (FOR GSM 1900)

OPERATING FREQUENCY*	**WCDMA**	1852.4MHz ~ 1907.6MHz(FOR WCDMA Band 2) 1712.4MHz ~ 1752.6MHz(FOR WCDMA Band 4) 826.4MHz ~ 846.6MHz (FOR WCDMA Band 5)
	LTE	1850.7MHz ~ 1909.3MHz (FOR LTE Band2) 1710.7MHz ~ 1754.3MHz (FOR LTE Band4) 824.7MHz ~ 848.3MHz (FOR LTE Band5) 2502.5MHz ~ 2567.5MHz (FOR LTE Band7) 699.7MHz ~ 715.3MHz (FOR LTE Band12) 779.5MHz ~ 784.5MHz (FOR LTE Band13) 706.5MHz ~ 713.5MHz (FOR LTE Band17) 2572.5MHz ~ 2617.5MHz (FOR LTE Band38) 2498.5MHz ~2687.5MHz (FOR LTE Band41) 3552.5MHz ~ 3697.5MHz (FOR LTE Band48) 1710.7MHz ~ 1779.3MHz (FOR LTE Band66) 665.5MHz ~695.5MHz (FOR LTE Band71) The following only support downlink: CA_2A-2A CA_2A-4A CA_2A-5A CA_2A-12A CA_2A-17A CA_2A-48A CA_2A-66A CA_2A-71A CA_2C CA_4A-4A CA_4A-5A CA_4A-12A CA_4A-17A CA_4A-48A CA_4A-71A CA_5A-48A CA_5A-66A CA_5B CA_7C CA_12A-66A CA_13A-48A CA_13A-66A CA_48A-48A CA_48A-66A CA_48C CA_66A-66A CA_66A-71A CA_66B CA_66C CA_2A-2A-4A CA_2A-2A-5A CA_2A-2A-12A

		CA_2A-2A-13A CA_2A-2A-66A CA_2A-2A-71A CA_2A-4A-4A CA_2A-4A-5A CA_2A-4A-12A CA_2A-4A-13A CA_2A-4A-71A CA_2A-5A-48A CA_2A-5A-66A CA_2A-12A-66A CA_2A-13A-48A CA_2A-13A-66A CA_2A-48A-48A CA_2A-48A-66A CA_2A-48C CA_2A-66A-66A CA_2A-66A-71A CA_2A-66B CA_2A-66C CA_2C-66A CA_4A-4A-5A CA_4A-4A-12A CA_4A-4A-13A CA_4A-4A-71A CA_5A-48A-66A CA_5A-48C CA_5A-66A-66A CA_5A-66B CA_5A-66C CA_12A-66A-66A CA_12A-66C CA_13A-48A-66A CA_13A-48C CA_13A-66A-66A CA_13A-66B CA_13A-66C CA_48A-48A-66A CA_48A-48C CA_48A-66A-66A CA_48A-66B CA_48A-66C CA_48C-66A CA_48D CA_66A-66A-66A CA_66A-66A-71A CA_66A-66C CA_66C-71A CA_66D CA_4A-48C CA_13A-48A-66B CA_13A-48A-66C

		CA_13A-48C-66A CA_13A-48D CA_2A-12A-66A-66A CA_2A-12A-66C CA_2A-13A-48C CA_2A-13A-66A-66A CA_2A-13A-66B CA_2A-13A-66C CA_2A-2A-12A-66A CA_2A-2A-13A-66A CA_2A-2A-4A-4A CA_2A-2A-4A-5A CA_2A-2A-4A-71A CA_2A-2A-5A-66A CA_2A-2A-66A-66A CA_2A-2A-66A-71A CA_2A-2A-66B CA_2A-2A-66C CA_2A-48C-66A CA_2A-48D CA_2A-4A-4A-5A CA_2A-5A-48C CA_2A-5A-66A-66A CA_2A-5A-66B CA_2A-5A-66C CA_2A-5B-66A CA_2A-66A-66A-66A CA_2A-66A-66A-71A CA_2A-66C-71A CA_2C-66A-66A CA_48C-66A-66A CA_48C-66B CA_48C-66C CA_48D-66A CA_48E CA_4A-48D CA_5A-48C-66A CA_5A-48D CA_5B-66A-66A
	5G NR	SA: n2 (1852.5MHz ~1907.5MHz) n5(826.5MHz ~ 846.5MHz) n7(2502.5MHz ~ 2567.5MHz) n25(1852.5MHz ~ 1912.5MHz) n38(2582.52MHz ~ 2607.48MHz) n41(2506.02 ~ 2679.99MHz) n48(3555 ~ 3694.98MHz) n66(1712.5 ~ 1777.5MHz) n71(665.5 ~ 695.5MHz) n77(Part27Q)(3460.02 ~ 3540MHz) n77(Part27O)(3710.01 ~ 3969.99MHz)

		n78(Part27Q)(3460.02 ~ 3540MHz) n78(Part27O)(3710.01 ~ 3789.99MHz) ENDC: DC_2A_n5A DC_2A_n71A DC_5A_n66A DC_7A_n78A DC_13A_n66A DC_66A_n5A DC_66A_n71A DC_2A-66A_n41A DC_2A-66A_n71A CA_n66A-n71A CA_n66(2A)
HW VERSION*	E	
SW VERSION*	TWG1.240820.261	
I/O PORTS*	Refer to user's manual	
CABLE SUPPLIED*	USB cable: non-shielded cable, with w/o ferrite core, 0.8 meter	
ACCESSORY DEVICES*	Refer to note as below	

NOTE:

1. ***Since the above data and/or information is provided by the client relevant results or conclusions of this report are only made for these data and/or information, Test Lab is not responsible for the authenticity, integrity and results of the data and information and/or the validity of the conclusion.

2. For a more detailed features description, please refer to the manufacturer's specifications or the user's manual.

3. For the test results, the EUT had been tested with all conditions. But only the worst case was shown in the test report.

4. **List of Accessory:**

ACCESSORIES	BRAND	MANUFACTURER	MODEL	SPECIFICATION
Display(AMOLED)	Xiao Xin	N/A	XX611OLED-A002.1	N/A
Back cover	IV Techmould	N/A	N/A	N/A
Bezel	IV Techmould	N/A	N/A	N/A
Photo/Video Camera 1	Sunny Optical	N/A	F48N03A (Auto focus)	N/A
Photo/Video Camera 2	TrulyOpto	N/A	CSF208-B8BF-E(Fix focus)	N/A
CPU	Qualcomm	N/A	QCM6490	N/A
UFS	Kioxia	N/A	THGJFAT0T44BAIL	N/A
BT/WLAN Module	Murata	N/A	LBEE5QG2CX-830	N/A
NFC chipset	NXP	N/A	SN110TUK1	N/A
Battery	BARTEC	N/A	17-S1Z0-0020/****	4300 mAh, 3.68V
USB-C Cable	BARTEC	N/A	G7-A0Z0-0010	Length: 0.8m

1.2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

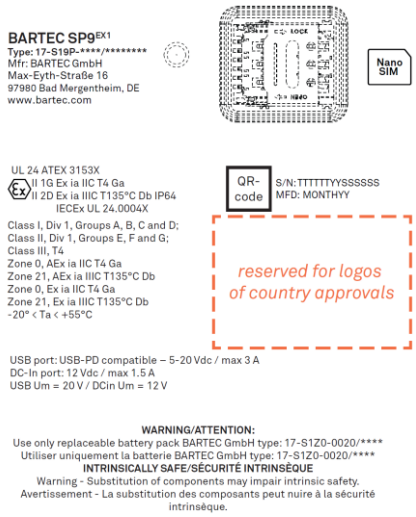
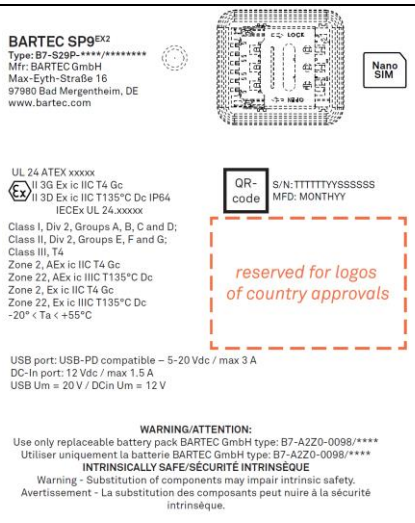
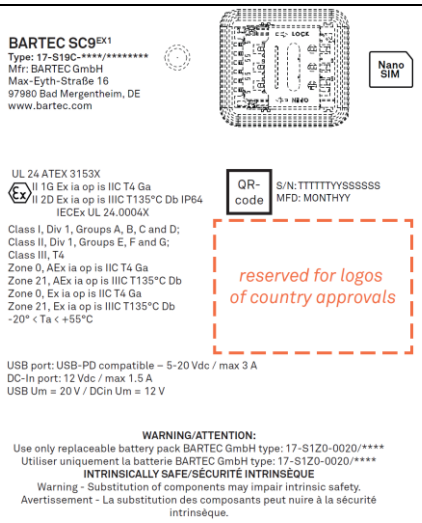
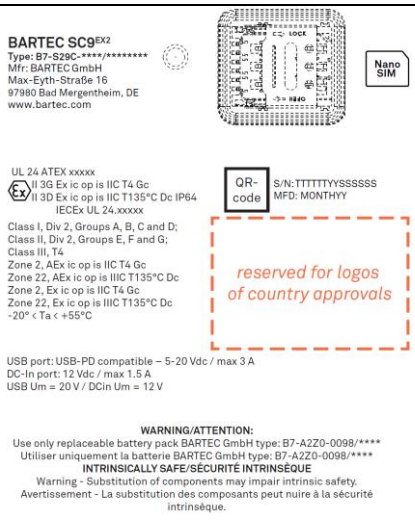
APPLIED STANDARD: FCC Part 15, Subpart B			
Standard Section	**Test Item**	**Result**	**Test lab***
FCC Part 15, Subpart B, Class B ANSI C63.4:2014	Conducted Test	Compliance	A
	Radiated Emission Test (30MHz ~ 1GHz)	Compliance	A
	Radiated Emission Test (Above 1GHz)	Compliance	A

NOTE:

1. In this report, the test EUT version is EVT, after the test is completed, the customer optimizes the product to DVT, and the final customer's shipment is PVT. For differences between EVT and DVT and PVT, please refer to the documentation provided by the customer (SC9EX1_SP9EX1 PCBA HW Release Note rev 2_0). We verified that the DVT &PVT EMC worst-case is better than the EVT data against the difference table, so only the worst-case EVT results are shown in the report.

2. There are no differences on the PCBA between the Model SC9EX1 (FCC ID: TBUSX9EX) and the variants SP9EX1 (FCC ID: TBUSX9EX). All mounted components are the same. No functionality related to any radio interface is affected. The only difference is the presence of the barcode scanner module and the “bump” on the back cover that incorporates the barcode scanner module.Testing has been run on parent product SC9EX1 and the worst cases of conducted emissions and radiated emissions have been verified also on SP9EX1 variant. Only the worst-case data (SC9EX1) have been reported.

3. The devices BARTEC SP9EX1 Smartphone and BARTEC SP9EX2 Smartphone share the same hardware and software. The same applies for the devices BARTEC SC9EX1 Smartscanner and BARTEC SC9EX2 Smartscanner. The only difference are the hazardous area marking of the devices, see table for clarification.

BARTEC SP9EX1 Smartphone	BARTEC SP9EX2 Smartphone
	
BARTEC SC9EX1 Smartscanner	BARTEC SC9EX2 Smartscanner
	

***Test Lab Information Reference**

Lab A:

Huarui 7Layers High Technology (Suzhou) Co., Ltd.

Lab Address:

Tower N, Innovation Center, 88 Zuyi Road, High-tech District, Suzhou City, Anhui Province

Accredited Test Lab Cert 6613.01

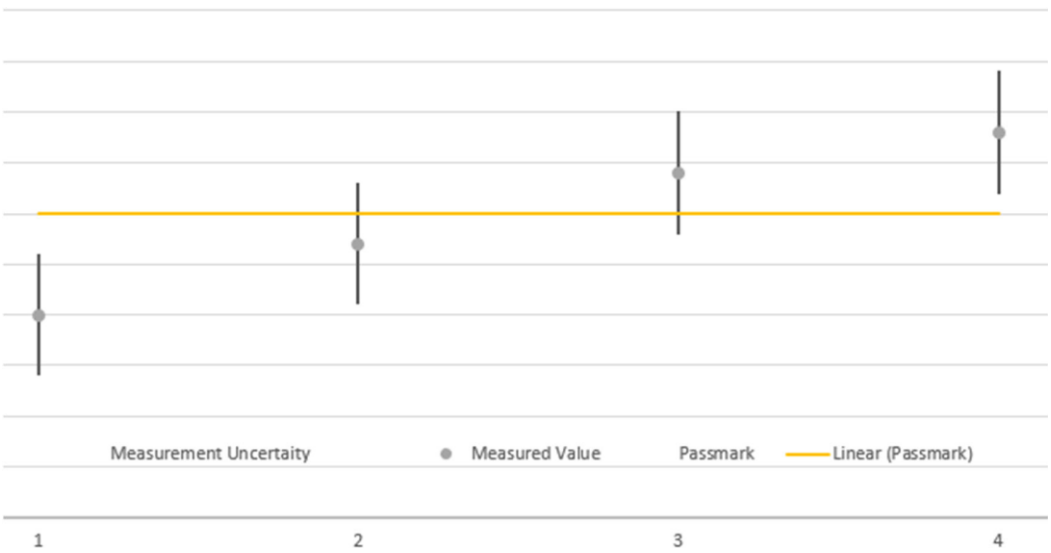
The FCC Site Registration No. is 434559; The Designation No. is CN1325.

1.3 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

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

MEASUREMENT	FREQUENCY	UNCERTAINTY
Conducted emissions	150kHz ~ 30MHz	±2.70dB
Radiated emissions	30MHz~1GHz	±4.98dB
	1GHz ~6GHz	±4.70dB
	6GHz ~18GHz	±4.60dB
	18GHz ~40GHz	±4.12dB



The verdicts in this test report are given according the above diagram:

Case	Measured Value	Uncertainty Range	Verdict
1	below pass mark	below pass mark	Passed
2	below pass mark	within pass mark	Passed
3	above pass mark	within pass mark	Failed
4	above pass mark	above pass mark	Failed

That means, the laboratory applies, as decision rule (see ISO/IEC 17025:2017), the so-called shared risk principle.

1.4 DESCRIPTION OF TEST MODES

Test Mode	Test Condition
Radiated emission test	
1	GSM850 Idle + Adapter + USB cable + BT Idle + WIFI Idle (2.4G) + Front Camera On + SIM1
2	WCDMA B5 Idle + Adapter + USB cable + BT Idle + WIFI Idle (5G) + Back Camera On + SIM2
3	LTE B5 Idle + Adapter + USB cable + BT Idle + WIFI Idle (2.4G) + flashlight on + SIM1
4	LTE B12 Idle + Adapter + USB cable + BT Idle + WIFI Idle (5G) + MPG4 + SIM2
5	LTE B13 Idle + Adapter + USB cable + BT Idle + WIFI Idle (2.4G) + NFC + SIM1
6	LTE B17 Idle + Adapter + USB cable + BT Idle + WIFI Idle (5G) + Scanning + SIM2
7	LTE B71 Idle + USB Link + Data Transmission + BT Idle + WIFI Idle (2.4G) + Notebook to EUT + Earphone + SIM1
8	DC_B12_N5 Link + Adapter + USB cable + BT Idle + WIFI Idle (5G) + SIM2
9	Powered by battery + BT Idle + WIFI Idle (5G) + MPG4 + SIM2

Test Mode	Test Condition
Conducted emission test	
1	GSM850 Idle + Adapter + USB cable + BT Idle + WIFI Idle (2.4G) + Front Camera On + SIM1
2	WCDMA B5 Idle + Adapter + USB cable + BT Idle + WIFI Idle (5G) + Back Camera On + SIM2
3	LTE B5 Idle + Adapter + USB cable + BT Idle + WIFI Idle (2.4G) + flashlight on + SIM1
4	LTE B12 Idle + Adapter + USB cable + BT Idle + WIFI Idle (5G) + MPG4 + SIM2
5	LTE B13 Idle + Adapter + USB cable + BT Idle + WIFI Idle (2.4G) + NFC + SIM1
6	LTE B17 Idle + Adapter + USB cable + BT Idle + WIFI Idle (5G) + Scanning + SIM2
7	LTE B71 Idle + USB Link + Data Transmission + USB cable + BT Idle + WIFI Idle (2.4G) + Notebook to EUT + SIM1
8	DC_B12_N5 Link + Adapter + USB cable + BT Idle + WIFI Idle (5G) + SIM2

NOTE:

1. For radiated emission test, test mode 6 was the verification case and only this mode was presented in this report
2. For conducted emission test, test mode 4 was the verification case and only this mode was presented in this report

1.4 DESCRIPTION OF SUPPORT UNITS

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.

FOR All TESTS

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	Laptop	Lenovo	Thinkpad E14	SL10W47313	N/A
2	Bluetooth	Rohde&Schwarz	SMBV100B	102176	N/A
3	GPS Simulator+Antenna	Rohde&Schwarz	SMBV100A	261436	N/A
4	Universal radio communication tester	Rohde&Schwarz	CMW500	169399	N/A
5	WIFI Router	HUAWEI	N/A	N/A	N/A
6	Adapter	N/A	N/A	N/A	N/A

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	USB Line: Shielded, Detachable 0.8m;

2 EMISSION TEST

2.1 CONDUCTED EMISSION MEASUREMENT

2.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

TEST STANDARD: FCC Part 15, Subpart B (Section: 15.107 a CLASS B)

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dBμV)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56	56 to 46
0.5 ~ 5	56	46
5 ~ 30	60	50

TEST STANDARD: FCC Part 15, Subpart B (Section: 15.107 b CLASS A)

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dBμV)	
	Quasi-peak	Average
0.15 ~ 0.5	79	66
0.5 ~ 30	73	60

NOTE: 1.The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

2.1.2 TEST INSTRUMENTS

Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Due Date
WIDEBANDRADIO COMMUNICATION TESTER	Rohde&Schwarz	CMW500	169399	Jun.27,22	Jun.26,24
WIDEBANDRADIO COMMUNICATION TESTER	Rohde&Schwarz	CMW500	169399	Jun.26,24	Jun.25,26
EMI Test Receiver	Rohde&Schwarz	ESR3	102749	Feb.25,22	Feb.24,24
EMI Test Receiver	Rohde&Schwarz	ESR3	102749	Feb.24,24	Feb.23,26
ELEKTRA test software	Rohde&Schwarz	ELEKTRA	NA	N/A	N/A
LISN network	Rohde&Schwarz	ENV216	102640	Feb.17,22	Feb.16,24
LISN network	Rohde&Schwarz	ENV216	102640	Feb.16,24	Feb.15,26
CABLE	Rohde&Schwarz	W61.01	N/A	Apr.28,23	Apr.27,24
CABLE	Rohde&Schwarz	W61.01	N/A	Apr.27,24	Apr.26,25
CABLE	Rohde&Schwarz	W601	N/A	Apr.28,23	Apr.27,24
CABLE	Rohde&Schwarz	W601	N/A	Apr.27,24	Apr.26,25

NOTE: 1. The test was performed in CE shielded room.

2.1.3 TEST PROCEDURES

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

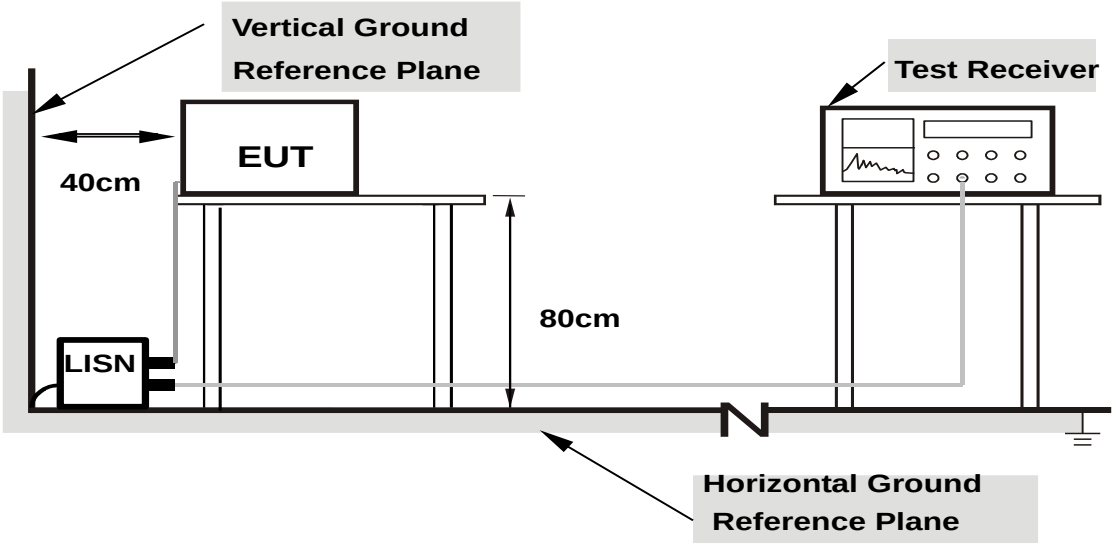
c. The frequency range from 150 kHz to 30MHz was searched. Emission levels under (Limit - 20dB) were not recorded.

NOTE: All modes of operation were investigated and the worst-case emissions are reported.

2.1.4 DEVIATION FROM TEST STANDARD

No deviation.

2.1.5 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

For the actual test configuration, please refer to the attached file (Test Setup Photo).

2.1.6 EUT OPERATING CONDITIONS

a. Turned on the power and connected of all equipment.
b. EUT was operated according to the use type described in the manufacturer's specifications or the user's manual.

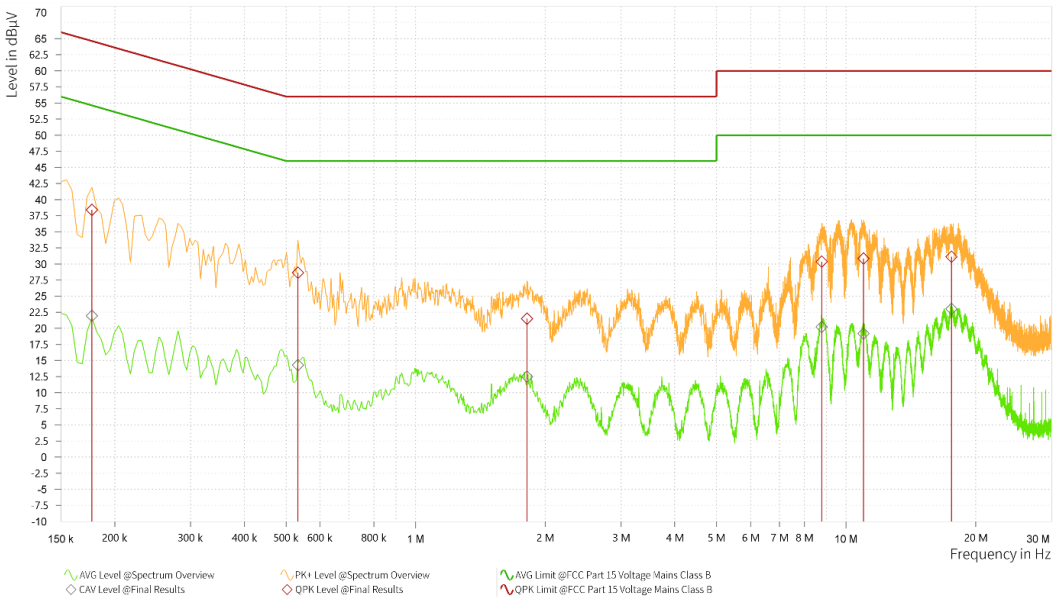
2.1.7 TEST RESULTS

Worst case data:

TEST VOLTAGE	Input 120 Vac, 60 Hz	**Detector Function & Resolution Bandwidth**	Quasi-Peak (QP) / Average (AV), 9 kHz
ENVIRONMENTAL CONDITIONS	26deg. C, 51%RH	**TESTED BY**	Hanwen Xu

Rg	Frequency [MHz]	QPK Level [dBμV]	QPK Limit [dBμV]	QPK Margin [dB]	CAV Level [dBμV]	CAV: AVG Limit [dBμV]	CAV Margin [dB]	Correction [dB]	Line	Meas. BW [kHz]
1	0.177	38.38	64.63	26.25	21.95	54.63	32.68	12.26	L1	9.000
1	0.533	28.65	56.00	27.35	14.28	46.00	31.72	11.75	L1	9.000
1	1.815	21.51	56.00	34.49	12.50	46.00	33.50	11.76	L1	9.000
1	8.781	30.37	60.00	29.63	20.20	50.00	29.80	11.82	L1	9.000
1	10.982	30.84	60.00	29.16	19.19	50.00	30.81	11.83	L1	9.000
1	17.565	31.11	60.00	28.89	23.03	50.00	26.97	11.86	L1	9.000

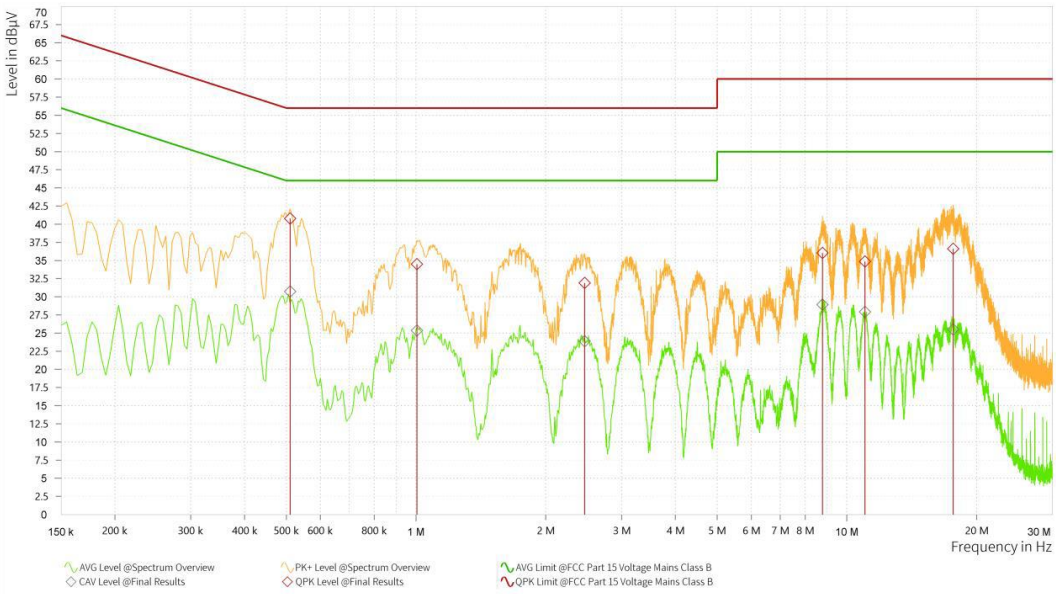
REMARKS: 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Limit value- Emission level
4. Correction factor = Insertion loss + Cable loss + Attenuate
5. Emission Level = Correction Factor + Reading Value.



TEST VOLTAGE	Input 120 Vac, 60 Hz	**Detector Function & Resolution Bandwidth**	Quasi-Peak (QP) / Average (AV), 9 kHz
ENVIRONMENTAL CONDITIONS	26deg. C, 51%RH	**TESTED BY**	Hanwen Xu

Rg	Frequency [MHz]	QPK Level [dBμV]	QPK Limit [dBμV]	QPK Margin [dB]	CAV Level [dBμV]	CAV: AVG Limit [dBμV]	CAV Margin [dB]	Correction [dB]	Line	Meas. BW [kHz]
1	0.510	40.77	56.00	15.23	30.74	46.00	15.26	12.78	N	9.000
1	1.005	34.49	56.00	21.51	25.36	46.00	20.64	12.73	N	9.000
1	2.463	31.89	56.00	24.11	23.87	46.00	22.13	12.74	N	9.000
1	8.777	36.04	60.00	23.96	28.92	50.00	21.08	12.78	N	9.000
1	11.018	34.85	60.00	25.15	27.93	50.00	22.07	12.80	N	9.000
1	17.646	36.61	60.00	23.39	25.51	50.00	24.49	12.84	N	9.000

REMARKS: 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Limit value- Emission level
4. Correction factor = Insertion loss + Cable loss + Attenuate
5. Emission Level = Correction Factor + Reading Value.



2.2 RADIATED EMISSION MEASUREMENT

2.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

TEST STANDARD: FCC Part 15, Subpart B (Section: 15.109)
Emissions radiated outside of the specified bands, shall be according to the general radiated limits as following:

Radiated Emissions Limits at 3 meters (dBμV/m)		
Frequencies (MHz)	**FCC 15B Class A**	**FCC 15B Class B**
30-88	49	40
88-216	53.5	43.5
216-960	56	46
960-1000	59.5	54
Above 1000	Avg: 59.5 Peak: 79.5	Avg: 54 Peak: 74

Frequency Range (For unintentional radiators)

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705-108	1000
108-500	2000
500-1000	5000
Above 1000	5th harmonic of the highest frequency or 40GHz, whichever is lower

NOTE:
1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.
4. QP detector shall be applied if not specified.

2.2.2 TEST INSTRUMENTS

Frequency range below 1GHz

Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Due Date
WIDEBANDRADIO COMMUNICATION TESTER	Rohde&Schwarz	CMW500	169399	Jun.27,22	Jun.26,24
WIDEBANDRADIO COMMUNICATION TESTER	Rohde&Schwarz	CMW500	169399	Jun.26,24	Jun.25,26
3m Semi-anechoic Chamber	TDK	9m*6m*6m	HRSW-SZ-EMC-02Chamber	Nov.24,22	Nov.23,25
Bilog Antenna	SCHWARZBECK	VULB 9163	1264	Feb.28,22	Feb.27,24
Bilog Antenna	SCHWARZBECK	VULB 9163	1264	Feb.27,24	Feb.26,26
EMI Test Receiver	R&S	ESW44	101973	Feb.25,22	Feb.24,24
EMI Test Receiver	R&S	ESW44	101973	Feb.24,24	Feb.23,26
Measurement Software	R&S	ELEKTRA	N/A	N/A	N/A
6DB attenuator	Tonscend Technology Co., Ltd	N/A	23062787	N/A	N/A
Pre-Amplifier	R&S	SCU08F1	101028	Sep.16,22	Sep.15,24
CABLE	R&S	W13.01	N/A	Apr.28,23	Apr.27,24
CABLE	R&S	W13.01	N/A	Apr.27,24	Apr.26,25
CABLE	R&S	W13.02	N/A	Apr.28,23	Apr.27,24
CABLE	R&S	W13.02	N/A	Apr.27,24	Apr.26,25
CABLE	R&S	W12.14	N/A	Apr.28,23	Apr.27,24
CABLE	R&S	W12.14	N/A	Apr.27,24	Apr.26,25

Frequency range above 1GHz

Instrument	Manufacturer	Model No.	Serial No.	Calibration Date	Due Date
WIDEBANDRADIO COMMUNICATION TESTER	Rohde&Schwarz	CMW500	169399	Jun.27,22	Jun.26,24
WIDEBANDRADIO COMMUNICATION TESTER	Rohde&Schwarz	CMW500	169399	Jun.26,24	Jun.25,26
3m Fully-anechoic Chamber	TDK	9m*6m*6m	HRSW-SZ-EMC-01Chamber	Nov.24,22	Nov.23,25
Horn Antenna	ETS-LINDGREN	3117	227836	Aug.22,22	Aug.21,24
EMI Test Receiver	R&S	ESW44	101973	Feb.25,22	Feb.24,24
EMI Test Receiver	R&S	ESW44	101973	Feb.24,24	Feb.23,26
Pre-Amplifier	R&S	SCU08F1	101028	Sep.16,22	Sep.15,24
Measurement Software	R&S	ELEKTRA	N/A	N/A	N/A
CABLE	R&S	W13.01	N/A	Apr.28,23	Apr.27,24
CABLE	R&S	W13.01	N/A	Apr.27,24	Apr.26,25
CABLE	R&S	W13.02	N/A	Apr.28,23	Apr.27,24

CABLE	R&S	W13.02	N/A	Apr.27,24	Apr.26,25
CABLE	R&S	W12.14	N/A	Apr.28,23	Apr.27,24
CABLE	R&S	W12.14	N/A	Apr.27,24	Apr.26,25

NOTE: 1. The calibration interval of the above test instruments is 12/ 24 /36 months and the calibrations are traceable to CEPREI/CHINA, GRGT/CHINA and NIM/CHINA.

2. The test was performed in 3m Chamber.

2.2.3 TEST PROCEDURE

<Frequency Range below 1GHz>

The basic test procedure was in accordance with ANSI C63.4:2014 (section 12).

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna is varied from 1 meter to 4 meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1GHz.

NOTE:

1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
3. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) (if the raw value not contains the amplifier);
4. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Amplifier Gain(dB) (if the raw value contains the amplifier).
5. Margin value = Limit value -Emission level.

<Frequency Range above 1GHz>

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter fully-anechoic chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. The bore sight should be used during the test above 1GHz.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz

NOTE:

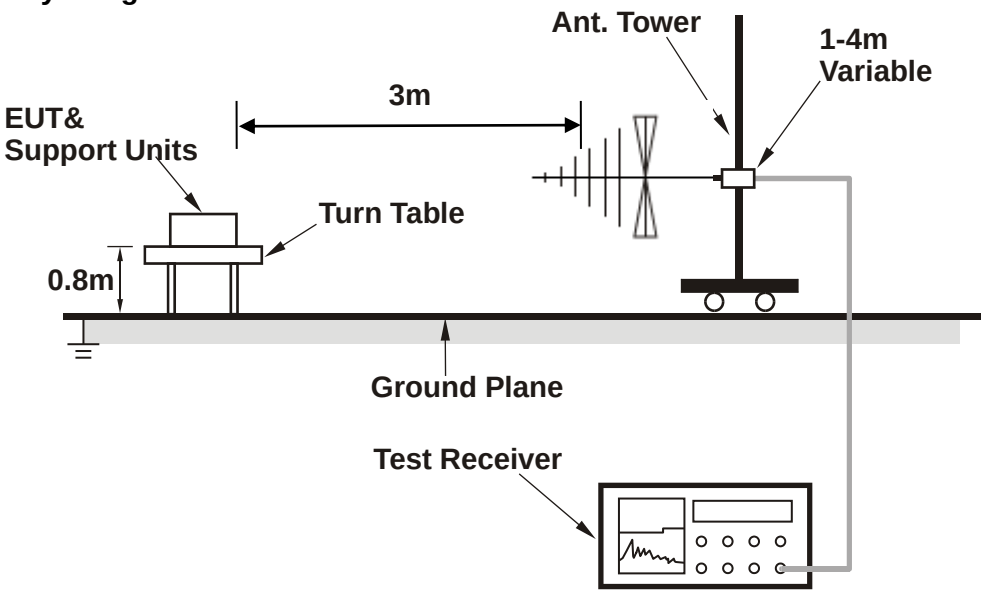
1. The resolution bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth is 1MHz and video bandwidth of test receiver/spectrum analyzer is 3MHz for Peak detection at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and video bandwidth of test receiver/spectrum analyzer is 1Hz for Average detection (AV) at frequency above 1GHz.
3. For measurement of frequency above 1000 MHz, the EUT was set 3 meters away from the receiver antenna.
4. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
5. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) (if the raw value not contains the amplifier);
6. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Amplifier Gain(dB) (if the raw value contains the amplifier)
7. Margin value = Limit value- Emission level.

2.2.4 DEVIATION FROM TEST STANDARD

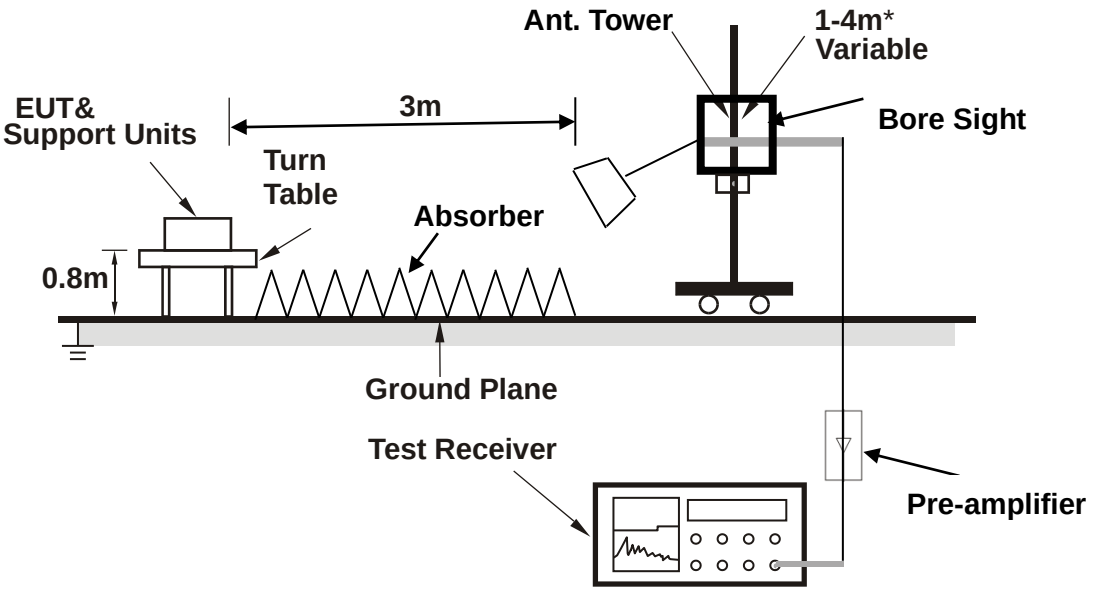
No deviation.

2.2.5 TEST SETUP

<Frequency Range below 1GHz>



<Frequency Range above 1GHz>



Note: Above 1G is a directional antenna

depends on the EUT height and the antenna 3dB bandwidth both, refer to section 7.3 of CISPR 16-2-3.

2.2.6 EUT OPERATING CONDITIONS

Same as item 2.1.6.

2.2.7 TEST RESULTS

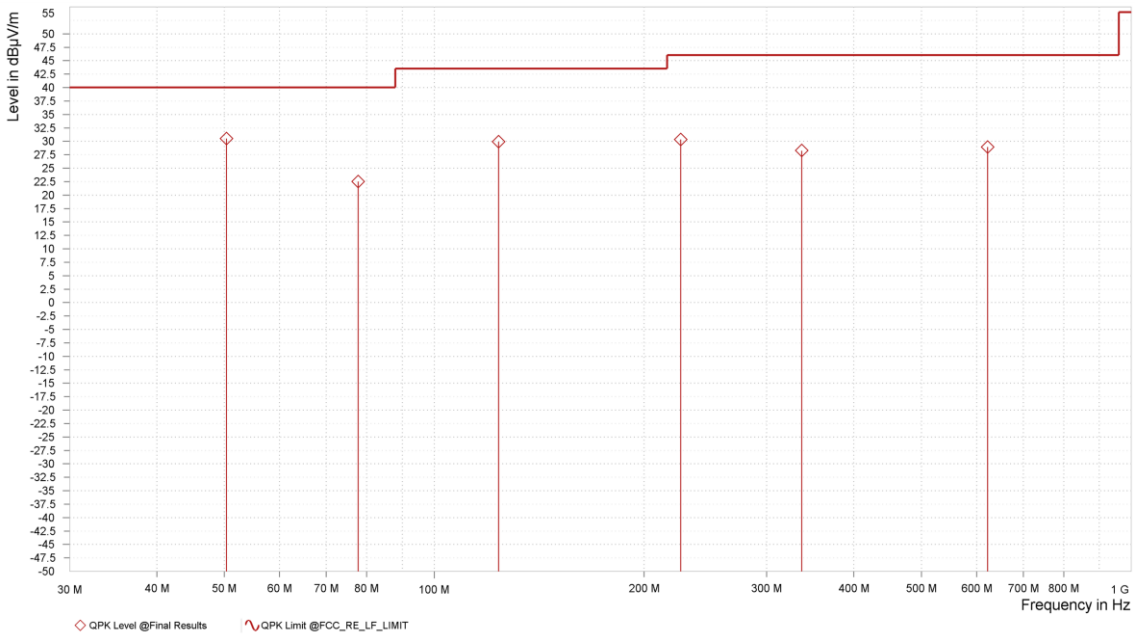
Worst case:

TEST VOLTAGE	Input 120 Vac, 60 Hz	**FREQUENCY RANGE**	30-1000 MHz
ENVIRONMENTAL CONDITIONS	23deg. C, 70%RH	**DETECTOR FUNCTION & RESOLUTION BANDWIDTH**	Quasi-Peak, 120 kHz
TESTED BY	Hanwen Xu		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

Rg	Frequency [MHz]	QPK Level [dBµV/m]	QPK Limit [dBµV/m]	QPK Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]
1	50.370	30.49	40.00	9.51	-3.57	H	1	2.00	120.000
1	77.746	22.50	40.00	17.50	-10.92	H	299.4	1.00	120.000
1	123.659	29.92	43.50	13.58	-8.21	H	212.4	2.00	120.000
1	225.832	30.32	46.00	15.68	-4.06	H	222.8	1.00	120.000
1	336.574	28.26	46.00	17.74	0.39	H	71	1.00	120.000
1	622.347	28.92	46.00	17.08	2.68	H	299.4	1.00	120.000

REMARKS:
1. Peak detector quick scan is shown on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
2. Negative sign (-) in the margin column signify levels below the limit.
3. Frequency range scanned: 30MHz to 1000MHz.
4. Only emissions significantly above the equipment noise floor are reported.

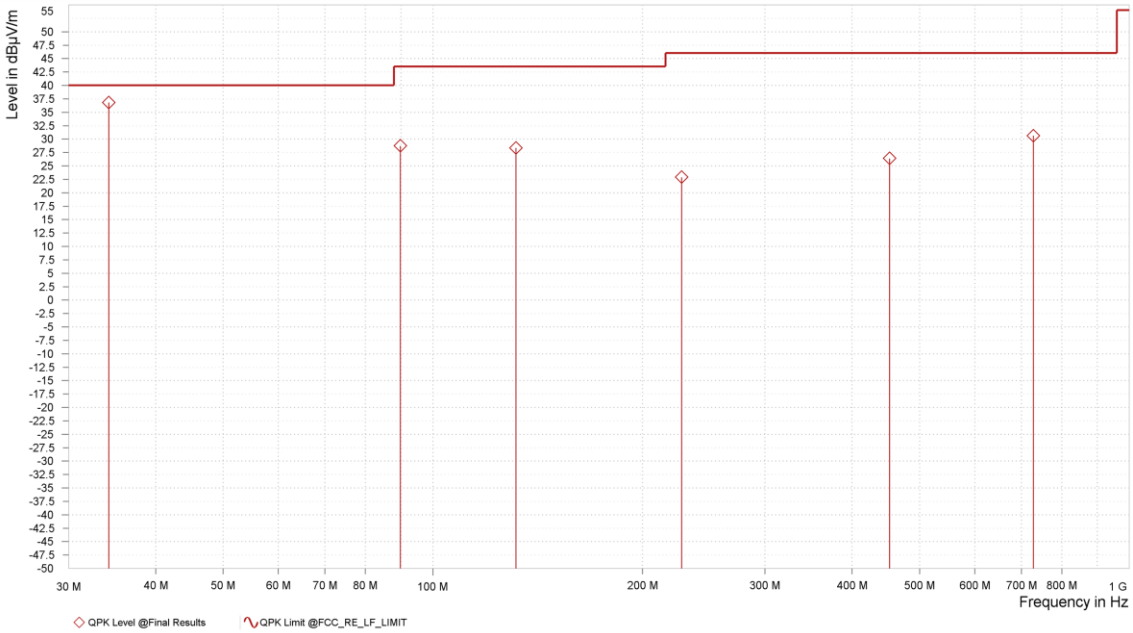


TEST VOLTAGE	Input 120 Vac, 60 Hz	**FREQUENCY RANGE**	30-1000 MHz
ENVIRONMENTAL CONDITIONS	23deg. C, 70 %RH	**DETECTOR FUNCTION & RESOLUTION BANDWIDTH**	Quasi-Peak, 120 kHz
TESTED BY	Hanwen Xu		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

Rg	Frequency [MHz]	QPK Level [dBµV/m]	QPK Limit [dBµV/m]	QPK Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]
1	34.257	36.81	40.00	3.19	-8.34	V	356.5	1.00	120.000
1	89.871	28.72	43.50	14.78	-7.37	V	298.2	1.00	120.000
1	131.581	28.33	43.50	15.17	-8.10	V	146.3	1.00	120.000
1	227.664	22.87	46.00	23.13	-4.48	V	137.1	2.00	120.000
1	452.920	26.38	46.00	19.62	2.74	V	146.3	1.00	120.000
1	728.777	30.63	46.00	15.37	4.15	V	221.7	1.00	120.000

REMARKS:
1. Peak detector quick scan is shown on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
2. Negative sign (-) in the margin column signify levels below the limit.
3. Frequency range scanned: 30MHz to 1000MHz.
4. Only emissions significantly above the equipment noise floor are reported.

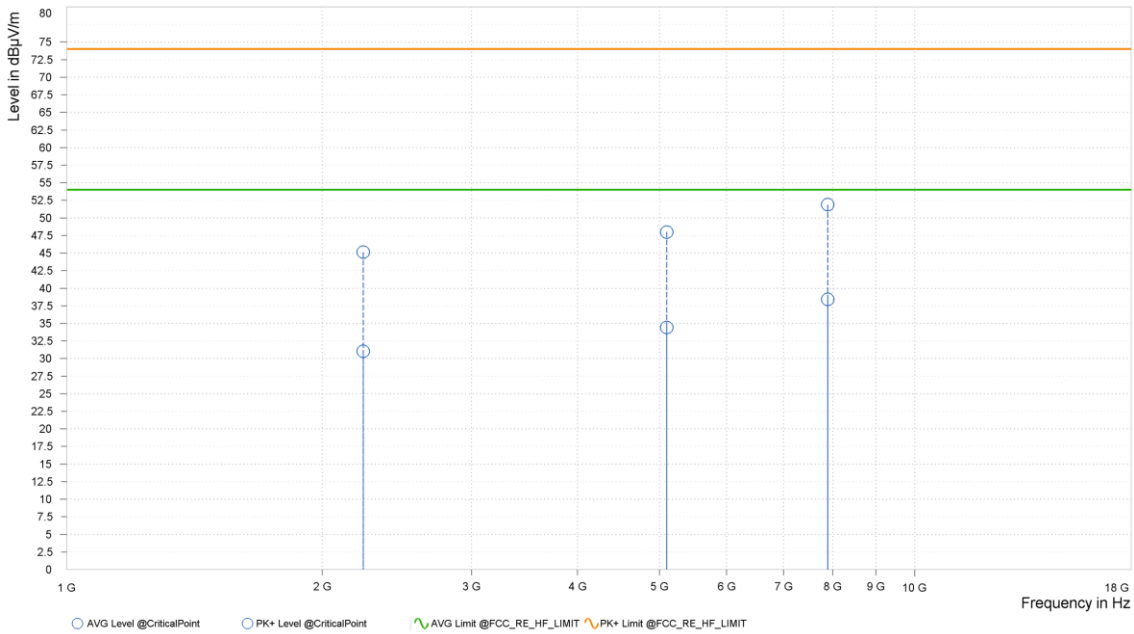


TEST VOLTAGE	Input 120 Vac, 60 Hz	**FREQUENCY RANGE**	1-18 GHz
ENVIRONMENTAL CONDITIONS	23deg. C, 70 %RH	**DETECTOR FUNCTION & RESOLUTION BANDWIDTH**	Peak/Average, 1 MHz
TESTED BY	Hanwen Xu		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M

Rg	Frequency [MHz]	PK+ Level [dBµV/m]	PK+ Limit [dBµV/m]	PK+ Margin [dB]	AVG Level [dBµV/m]	AVG Limit [dBµV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,235.500	45.13	74.00	28.87	31.03	54.00	22.97	5.42	H	192.2	2.00
1	5,099.000	47.99	74.00	26.01	34.41	54.00	19.59	10.70	H	359	2.00
1	7,891.000	51.88	74.00	22.12	38.42	54.00	15.58	14.69	H	0.9	2.00

REMARKS:
1. Peak detector quick scan is shown on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
2. Negative sign (-) in the margin column signify levels below the limit.
3. Frequency range scanned: 1GHz to 5th harmonic of the highest frequency or 40GHz, whichever is lower. For frequency above 18GHz, the emission was tested 20db below the limit so the data not recorded in the sheet.
4. Only emissions significantly above the equipment noise floor are reported.

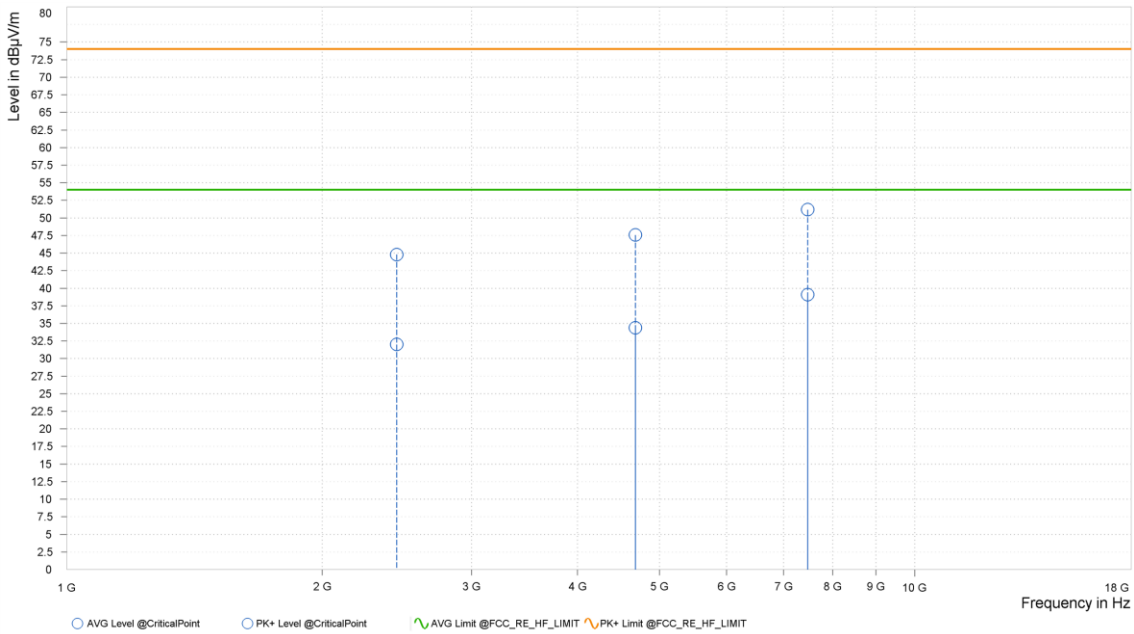


TEST VOLTAGE	Input 120 Vac, 60 Hz	**FREQUENCY RANGE**	1-18 GHz
ENVIRONMENTAL CONDITIONS	23deg. C, 70 %RH	**DETECTOR FUNCTION & RESOLUTION BANDWIDTH**	Peak/Average, 1 MHz
TESTED BY	Hanwen Xu		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M

Rg	Frequency [MHz]	PK+ Level [dBµV/m]	PK+ Limit [dBµV/m]	PK+ Margin [dB]	AVG Level [dBµV/m]	AVG Limit [dBµV/m]	AVG Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]
1	2,449.500	44.80	74.00	29.20	32.01	54.00	21.99	5.89	V	0.9	2.00
1	4,682.000	47.57	74.00	26.43	34.38	54.00	19.62	9.86	V	4.9	1.00
1	7,478.500	51.18	74.00	22.82	39.07	54.00	14.93	14.20	V	355	2.00

REMARKS:
1. Peak detector quick scan is shown on the graph and final quasi-peak detector data is measured corresponding to relevant limit and recorded in the data table.
2. Negative sign (-) in the margin column signify levels below the limit.
3. Frequency range scanned: 1GHz to 5th harmonic of the highest frequency or 40GHz, whichever is lower. For frequency above 18GHz, the emission was tested 20db below the limit so the data not recorded in the sheet.
4. Only emissions significantly above the equipment noise floor are reported.



3 APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications were made to the EUT by the lab during the test.

---END---