EMC TEST REPORT

Applicant	Shanghai Smawave Technology Co. ,Ltd
FCC ID	2AU8HSPH320-AQ
Product	Industrial smart handheld terminal
Brand	Smawave
Model	SPH320-aq
Report No.	R2212A1268-E1
Issue Date	January 11, 2023

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC Code CFR47 Part15B (2022)/ ANSI C63.4-2014**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

TA Technology (Shanghai) Co., Ltd.

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Summary of measurement results

Number	Test Case	Clause in FCC Rules	Conclusion
1	Radiated Emission	FCC Part15.109, ANSI C63.4-2014	PASS
2	Conducted Emission	FCC Part15.107, ANSI C63.4-2014	PASS
Date of Testing: December 15, 2022~January 4, 2023 Date of Sample Received: December 12, 2022			
Note: All indications of Pass/Fail in this report are opinions expressed by TA Technology (Shanghai) Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only.			

1 Test Laboratory

1.1 Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **TA Technology (Shanghai) Co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

1.2 Test Facility

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform measurements.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform measurement.

1.3 Testing Location

Company:	TA Technology (Shanghai) Co., Ltd.
Address:	Building 3, No.145, Jintang Rd, Pudong Shanghai, P.R.China
City:	Shanghai
Post code:	201201
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2 General Description of Equipment Under Test

2.1 Applicant and Manufacturer Information

Applicant	Shanghai Smawave Technology Co. ,Ltd
Applicant address	3/F, Building 8, 1001 North Qinzhou Road, Xuhui District, Shanghai, China
Manufacturer	Shanghai Smawave Technology Co. ,Ltd
Manufacturer address	3/F, Building 8, 1001 North Qinzhou Road, Xuhui District, Shanghai, China

2.2 General Information

EUT Description			
Device Type	Portable Device		
Model	SPH320-aq		
IMEI	862165040696625		
HW Version	V1.0.2		
SW Version	20230106_01_SPHX20-aq_NDAC_V1.0.23		
Power Rating	DC 3.8V		
Connecting I/O Port(s)	Please refer to the User's Manual.		
Antenna Type	Internal Antenna for LTE and NFC External Antenna for Bluetooth and Wi-Fi		
Frequency	Band	Tx (MHz)	Rx (MHz)
	LTE Band 41	2496 ~ 2690	2496 ~ 2690
	LTE Band 43	3650 ~ 3700	3650 ~ 3700
	LTE Band 48	3650 ~ 3700	3650 ~ 3700
	LTE Band 53	2483.5 ~ 2495	2483.5 ~ 2495
	Bluetooth	2400 ~ 2483.5	2400 ~ 2483.5
	Wi-Fi 2.4G	2400 ~ 2483.5	2400 ~ 2483.5
	Wi-Fi 5G(U-NII-1)	5150 ~ 5250	5150 ~ 5250
	Wi-Fi 5G(U-NII-2A)	5250 ~ 5350	5250 ~ 5350
	Wi-Fi 5G(U-NII-2C)	5470 ~ 5725	5470 ~ 5725
	Wi-Fi 5G(U-NII-3)	5725 ~ 5850	5725 ~ 5850
	NFC	13.56	13.56
EUT Accessory			
Adapter	Manufacturer: Zhuzhou Dachuan Electronic Technology Co., Ltd		

	Model: DCT12W050200ZZ-H1 (Adapters:94001-00001-EU; 94001-00002-UK;94001-00003-US Input: 100-240V~50/60Hz 0.3A Output: 5.0V ⎓ 2.0A 10.0W
Battery	Manufacturer: GuangDong FengHua New Energy Co., Ltd. Model: FHPK626263P DC 3.8V, 8000mAh
Auxiliary test equipment	
PC	PC Manufacturer: Microsoft Corporation Model: 1724 (032324771953)
Note: 1. The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant. 2. There are more than one Adapter, each one should be applied throughout the compliance test respectively, however, only the worst case (Adapters: 94001-00002-UK) will be recorded in this report.	

2.3 Applied Standards

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

Test standards
FCC Code CFR47 Part15B (2022)
ANSI C63.4-2014

2.4 Test Mode

Test Mode	
Mode 1	Adapter +USB cable + EUT+ Front camera On
Mode 2	Adapter +USB cable + EUT+ Rear camera On
Mode 3	Adapter + USB cable + EUT + FM + earphone
Mode 4	Adapter + USB cable + EUT + 1KHz(Color bar)
Mode 5	USB Copy(EUT with PC) + USB cable
Mode 6	USB Copy(PC with EUT) + USB cable

During the test, the preliminary test was performed in all modes, mode 1 for Radiated Emission and mode 6 for Conducted Emission is selected as the worst condition. The test data of the worst-case condition was recorded in this report.

3 Test Case Results

3.1 Radiated Emission

Ambient Condition

Temperature	Relative humidity	Pressure
15°C~35°C	30%~60%	101.5kPa

Methods of Measurement

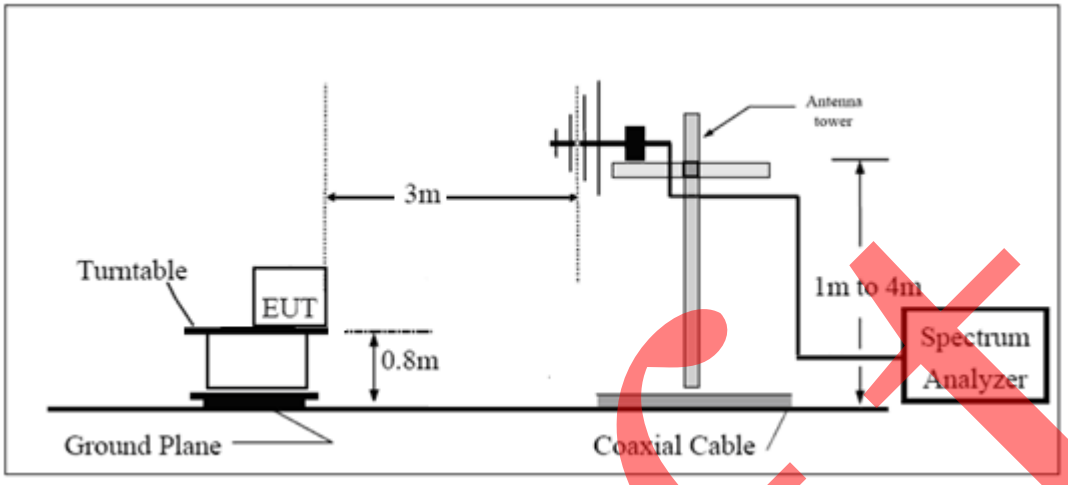
The EUT is placed on a non-metallic table 0.8m above the horizontal metal reference ground plane. The distance between EUT and receive antenna should be 3 meters. During the test, the EUT was operating in its typical mode. The test method is according to ANSI C63.4-2014. Sweep the whole frequency band through the range from 30MHz to the 5th harmonic of the carrier. During the test, the height of receive antenna shall be moved from 1 to 4 meters, and the antenna shall be performed under horizontal and vertical polarization. The turn table shall be rotated from 0 to 360 degrees for detecting the maximum of radiated signal level.
The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing. During the test, the EUT is worked at maximum output power.
Set the spectrum analyzer in the following:

Below 1GHz:
RBW=100 kHz / VBW=300 kHz / Sweep=AUTO
Above 1GHz:
(a) PEAK Detector: RBW=1MHz / VBW=3MHz/ Sweep=AUTO
(b) AVERAGE Detector: RBW=1MHz / VBW=3MHz / Sweep=AUTO

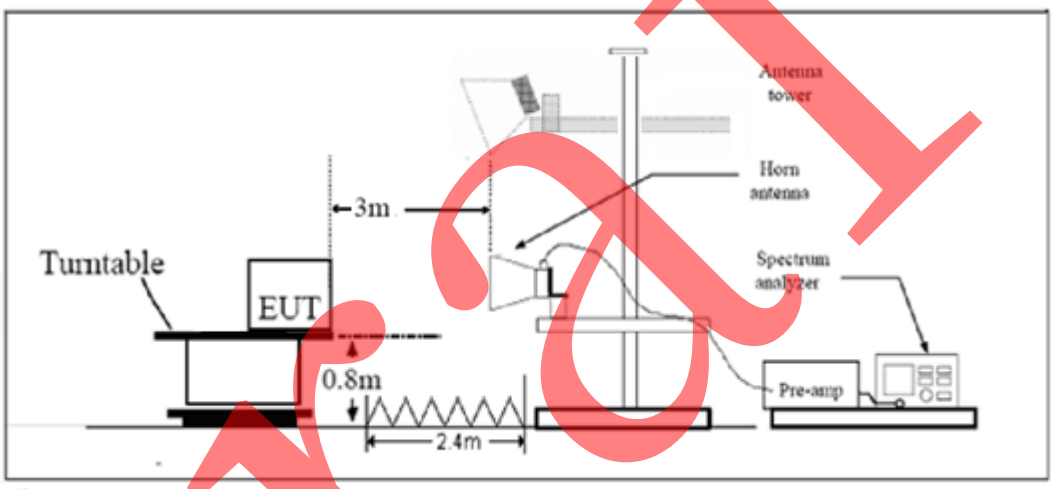
The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (X axis) and the worst case was recorded.

Test Setup

Below 1GHz



Above 1GHz



Note: Area side: 2.4mX3.6m

Antenna Tower meets ANSI C63.4 requirements for measurements above 1 GHz by keeping the antenna aimed at the EUT during the antenna's ascent/ descent along the antenna mast.

Limits

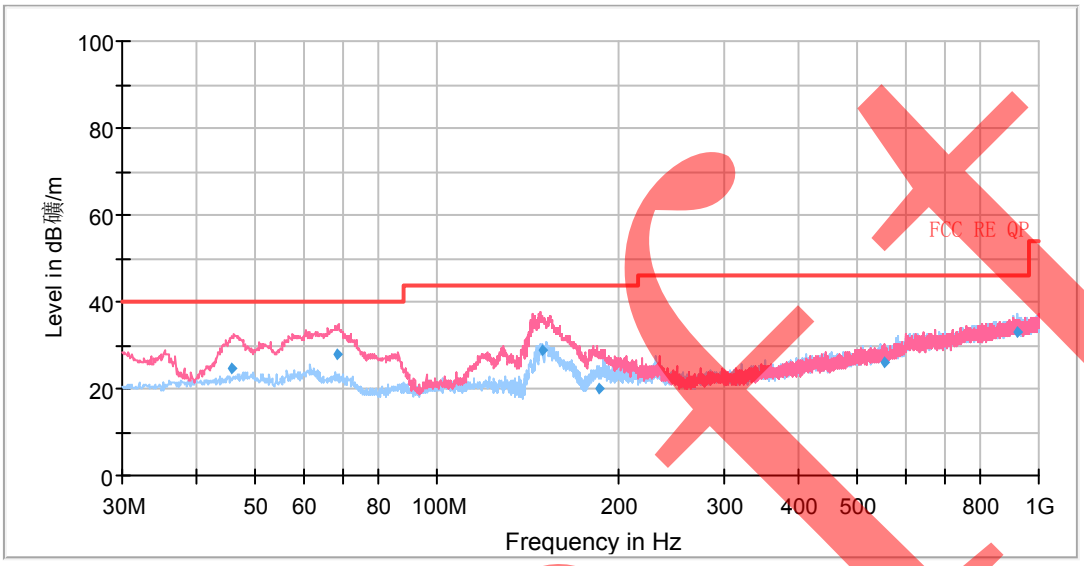
Class B

Frequency (MHz)	Field Strength (dBμV/m)	Detector
30 -88	40.0	Quasi-peak
88-216	43.5	Quasi-peak
216 – 960	46.0	Quasi-peak
960-1000	54.0	Quasi-peak
1000-5th harmonic of the highest frequency or 40GHz, which is lower	54 74	Average Peak

Test Results

Sweep the whole frequency band through the range from 30MHz to the 5th harmonic of the carrier.

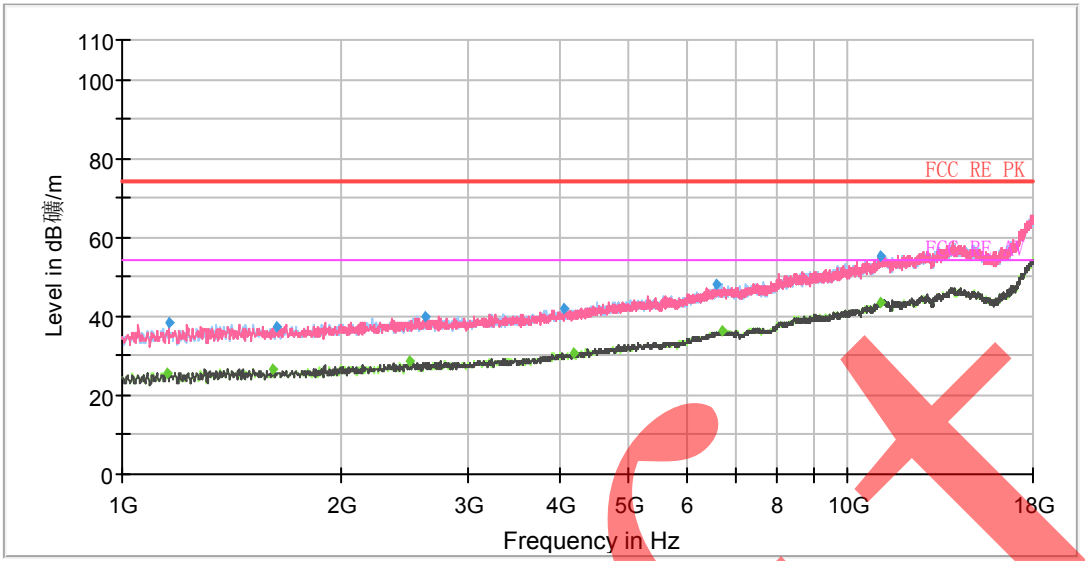
The following graphs display the maximum values of horizontal and vertical by software.
For above 1GHz, Blue trace uses the peak detection, Green trace uses the average detection.
A symbol (dBμV/m) in the test plot below means (dBμV/m)
A symbol (dB V/) in the test plot below means (dBμV/m)



Radiated Emission from 30MHz to 1GHz

Frequency (MHz)	Quasi-Peak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)
45.69	24.48	40.00	15.52	123.0	V	258.00	15
68.24	27.71	40.00	12.29	105.0	V	0.00	12
149.43	28.67	43.50	14.83	101.0	V	322.00	10
185.32	19.86	43.50	23.64	103.0	V	320.00	12
554.78	25.86	46.00	20.14	204.0	V	144.00	22
922.12	33.07	46.00	12.93	114.0	H	6.00	27

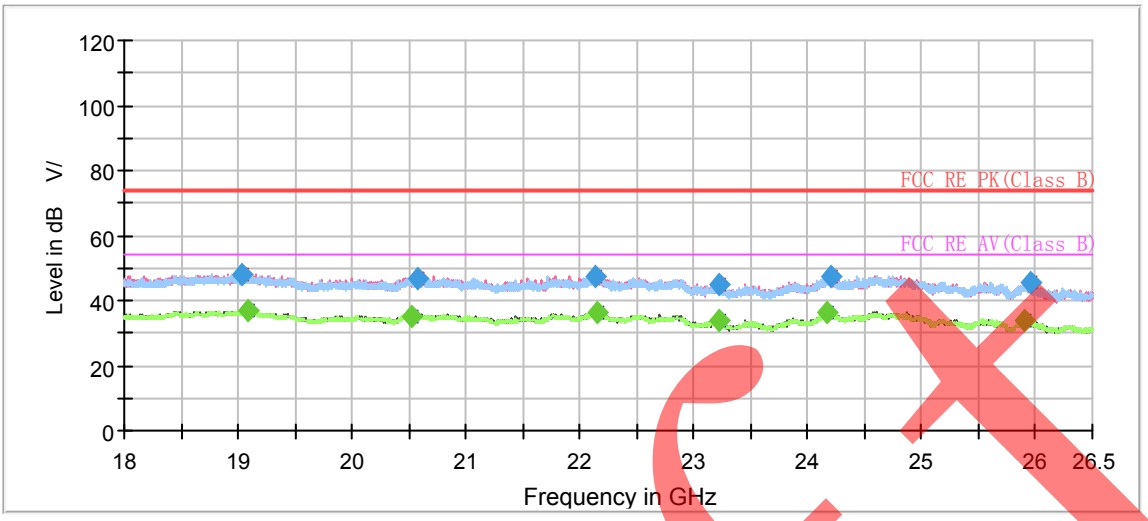
Remark: 1. Correction Factor = Antenna factor + Insertion loss(cable loss+amplifier gain)
2. Margin = Limit – Quasi-Peak



Radiated Emission from 1GHz to 18GHz

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dB µ V/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1153.00	---	25.35	54.00	28.65	500.00	100.0	H	152.00	-19
1159.38	38.15	---	74.00	35.85	500.00	200.0	V	56.00	-19
1614.13	---	26.68	54.00	27.32	500.00	200.0	H	0.00	-16
1631.13	37.39	---	74.00	36.61	500.00	100.0	H	318.00	-16
2483.25	---	28.43	54.00	25.57	500.00	100.0	V	1.00	-14
2612.88	40.04	---	74.00	33.96	500.00	100.0	V	0.00	-14
4051.50	41.80	---	74.00	32.20	500.00	200.0	H	134.00	-10
4196.00	---	30.70	54.00	23.30	500.00	100.0	H	144.00	-10
6576.00	48.04	---	74.00	25.96	500.00	200.0	V	323.00	-2
6731.13	---	36.35	54.00	17.65	500.00	100.0	H	217.00	-2
11072.50	---	43.61	54.00	10.39	500.00	200.0	V	352.00	5
11098.00	55.07	---	74.00	18.93	500.00	100.0	V	7.00	5

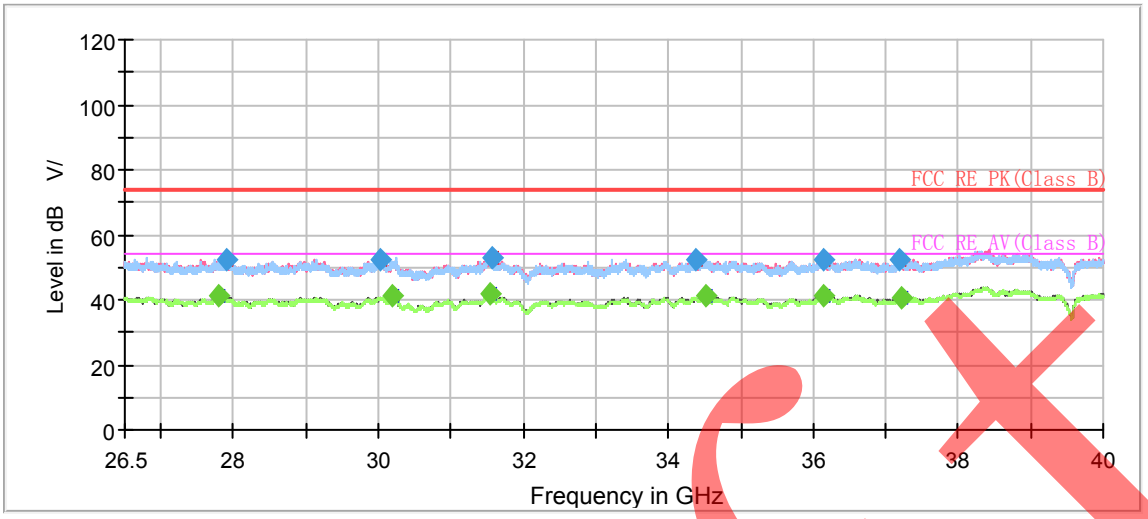
Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)
2. Peak Margin = Limit –MAX Peak/ Average



Radiated Emission from 18GHz to 26.5GHz

Frequency (MHz)	MaxPeak (dB μ V/m)	Average (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
19041.250000	48.11	---	74.00	25.89	500.0	200.0	H	0.0	-6.4
19083.750000	---	36.62	54.00	17.38	500.0	100.0	V	23.0	-6.4
20530.875000	---	35.37	54.00	18.64	500.0	100.0	V	176.0	-6.2
20571.250000	47.04	---	74.00	26.96	500.0	200.0	V	295.0	-6.2
22129.937500	47.64	---	74.00	26.36	500.0	200.0	H	272.0	-4.5
22149.062500	---	36.59	54.00	17.41	500.0	200.0	H	34.0	-4.5
23225.375000	45.14	---	74.00	28.86	500.0	200.0	H	55.0	-6.2
23226.437500	---	33.55	54.00	20.45	500.0	100.0	V	13.0	-6.2
24172.062500	---	36.26	54.00	17.74	500.0	100.0	V	13.0	-3.4
24211.375000	47.23	---	74.00	26.77	500.0	100.0	V	286.0	-3.2
25909.250000	---	33.88	54.00	20.12	500.0	200.0	H	44.0	-2.9
25949.625000	45.46	---	74.00	28.54	500.0	100.0	H	227.0	-3.1

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)
2. Peak Margin = Limit –MAX Peak/ Average



Radiated Emission from 26.5GHz to 40GHz

Frequency (MHz)	MaxPeak (dB µ V/m)	Average (dB µ V/m)	Limit (dB µ V/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
27804.437500	---	41.02	54.00	12.98	500.0	200.0	H	227.0	0.3
27892.187500	52.43	---	74.00	21.57	500.0	200.0	V	72.0	0.7
30035.312500	52.36	---	74.00	21.64	500.0	200.0	H	37.0	-0.4
30195.625000	---	40.99	54.00	13.01	500.0	200.0	V	236.0	-0.6
31540.562500	---	41.68	54.00	12.32	500.0	200.0	V	346.0	-0.2
31564.187500	52.75	---	74.00	21.25	500.0	200.0	V	127.0	-0.2
34375.562500	52.06	---	74.00	21.94	500.0	200.0	H	85.0	1.3
34505.500000	---	41.00	54.00	13.00	500.0	200.0	V	0.0	1.2
36140.687500	52.48	---	74.00	21.52	500.0	200.0	V	117.0	1.8
36147.437500	---	41.52	54.00	12.48	500.0	200.0	V	281.0	1.8
37183.562500	52.49	---	74.00	21.51	500.0	200.0	V	337.0	2.0
37224.062500	---	40.58	54.00	13.42	500.0	200.0	H	16.0	2.1

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)
2. Peak Margin = Limit –MAX Peak/ Average

3.2 Conducted Emission

Ambient Condition

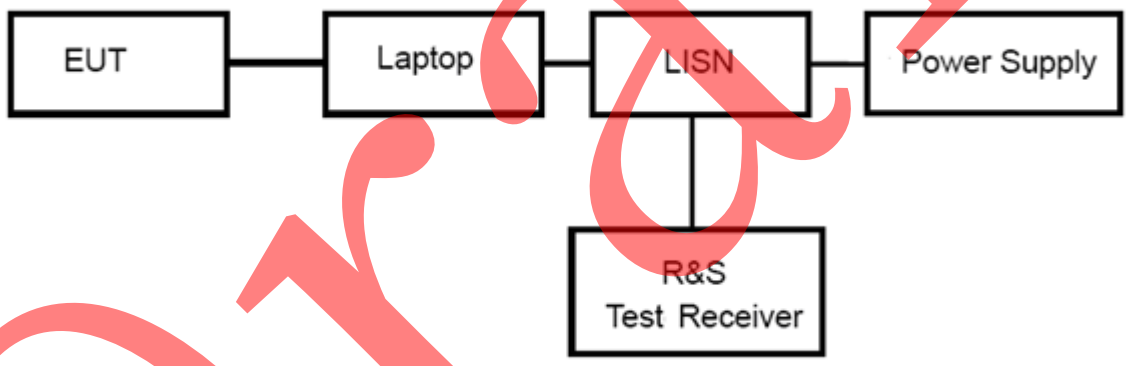
Temperature	Relative humidity	Pressure
15°C~35°C	30%~60%	101.5kPa

Methods of Measurement

The EUT is placed on a non-metallic table of 80cm height above the horizontal metal reference ground plane. During the test, the EUT was operating in its typical mode. The test method is according to ANSI C63.4-2014. Connect the AC power line of the EUT to the L.I.S.N. Use EMI receiver to detect the average and Quasi-peak value. RBW is set to 9 kHz, VBW is set to 30kHz. The measurement result should include both L line and N line.

During the test, EUT is connected to a laptop via a USB cable in the case of Transfer Data mode. The EUT is used as the peripheral equipment of the PC. The data is transferred from EUT to PC; PC is connected to server via a long LAN cable.

Test Setup



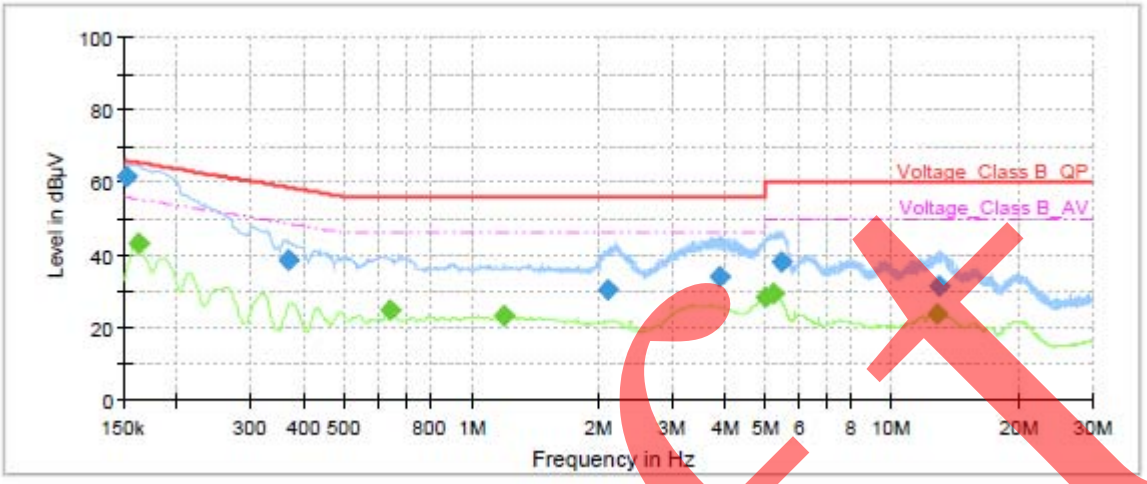
Note: Power Supply is AC Power source and it is used to change the voltage 120V/60Hz.

Limits

Frequency (MHz)	Conducted Limits(dBμV)	
	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

Following plots, Blue trace uses the peak detection; Green trace uses the average detection.

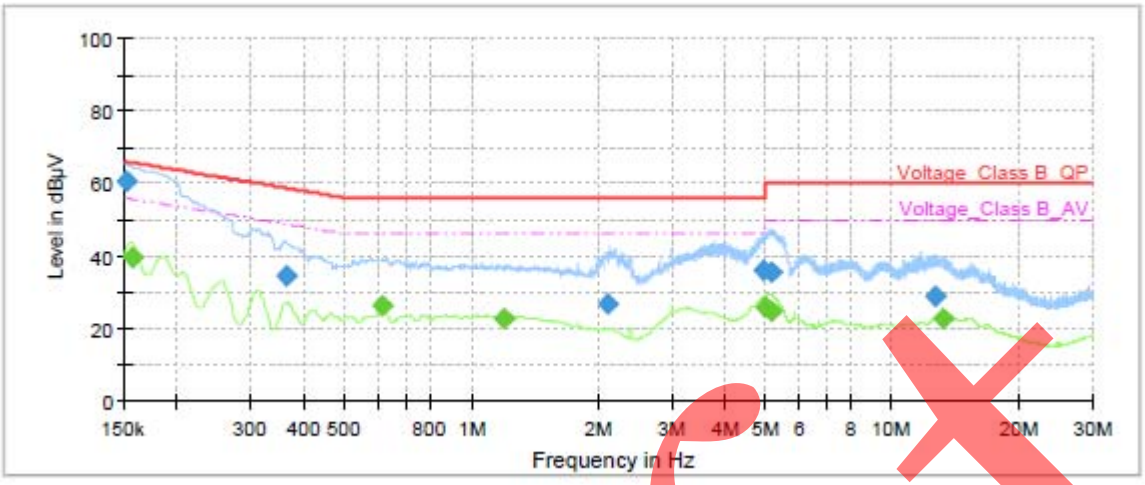


Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.15	61.55	---	65.88	4.33	1000.0	9.000	L1	ON	20.9
0.16	---	43.27	55.40	12.13	1000.0	9.000	L1	ON	20.9
0.37	38.57	---	58.54	19.97	1000.0	9.000	L1	ON	20.8
0.64	---	24.48	46.00	21.52	1000.0	9.000	L1	ON	20.5
1.20	---	23.15	46.00	22.85	1000.0	9.000	L1	ON	19.8
2.11	30.44	---	56.00	25.56	1000.0	9.000	L1	ON	19.4
3.88	33.86	---	56.00	22.14	1000.0	9.000	L1	ON	19.2
4.99	---	28.28	46.00	17.72	1000.0	9.000	L1	ON	19.2
5.23	---	29.23	50.00	20.77	1000.0	9.000	L1	ON	19.2
5.44	38.15	---	60.00	21.85	1000.0	9.000	L1	ON	19.2
12.77	---	23.84	50.00	26.16	1000.0	9.000	L1	ON	19.4
12.94	31.34	---	60.00	28.66	1000.0	9.000	L1	ON	19.4

Remark: Correct factor=cable loss + LISN factor

L line

Conducted Emission from 150 KHz to 30 MHz



Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.15	60.77	---	65.88	5.11	1000.0	9.000	N	ON	20.9
0.16	---	39.43	55.63	16.20	1000.0	9.000	N	ON	20.9
0.36	34.60	---	58.64	24.04	1000.0	9.000	N	ON	20.9
0.62	---	26.26	46.00	19.74	1000.0	9.000	N	ON	20.5
1.20	---	22.71	46.00	23.29	1000.0	9.000	N	ON	19.8
2.11	26.48	---	56.00	29.52	1000.0	9.000	N	ON	19.4
4.94	36.10	---	56.00	19.90	1000.0	9.000	N	ON	19.2
4.99	---	25.77	46.00	20.23	1000.0	9.000	N	ON	19.2
5.15	---	24.59	50.00	25.41	1000.0	9.000	N	ON	19.2
5.18	35.61	---	60.00	24.39	1000.0	9.000	N	ON	19.2
12.59	28.93	---	60.00	31.07	1000.0	9.000	N	ON	19.4
13.29	---	22.48	50.00	27.52	1000.0	9.000	N	ON	19.5

Remark: Correct factor=cable loss + LISN factor

N line

Conducted Emission from 150 KHz to 30 MHz

4 Uncertainty Measurement

Case	Uncertainty	Factor k
Radiated Emission 30MHz – 200MHz	4.17 dB	1.96
Radiated Emission 200MHz – 1GHz	4.84 dB	1.96
Radiated Emission 1GHz – 18GHz	4.35 dB	1.96
Radiated Emission 18GHz – 26.5GHz	5.90 dB	1.96
Radiated Emission 26.5GHz – 40GHz	5.92 dB	1.96
Conducted Emission	2.57 dB	2

5 Main Test Instruments

Name of Equipment	Manufacturer	Type/Model	Serial Number	Calibration Date	Expiration Time
Radiated Emission					
EMI Test Receiver	R&S	ESR	102389	2022-05-25	2023-05-24
Signal Analyzer	R&S	FSV40	101186	2022-05-14	2023-05-13
TRILOG Broadband Antenna	SCHWARZBECK	VULB 9163	1023	2020-05-05	2023-05-04
Horn Antenna	R&S	HF907	102723	2020-08-11	2023-08-10
Horn Antenna	ETS-Lindgren	3160-09	00102643	2021-10-10	2024-10-09
Horn Antenna	STEATITE	QSH-SL-26-40-K-15	16779	2019-12-24	2024-12-23
Software	R&S	EMC32	9.26.01	/	/
Conducted Emission					
Artificial main network	R&S	ENV216	102191	2022-12-13	2024-12-09
EMI Test Receiver	R&S	ESR	101667	2022-05-25	2023-05-24
Software	R&S	EMC32	10.35.10	/	/

********END OF REPORT ********

ANNEX A: The EUT Appearance

The EUT Appearance are submitted separately.

ANNEX B: Test Setup Photos

The Test Setup Photos are submitted separately.