

EMC TEST REPORT

Applicant Shanghai Smawave Technology Co. ,Ltd
FCC ID 2AU8HSC421
Product Cat12 Indoor CPE
Brand Smawave
Model SC421
Report No. R2404A0415-E1
Issue Date May 23, 2024

Eurofins TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC Code CFR47 Part15B (2023)/ 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.

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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: April 18, 2024 ~ April 30, 2024			
Date of Sample Received: April 15, 2024			
Note: All indications of Pass/Fail in this report are opinions expressed by Eurofins 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 **Eurofins 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)

Eurofins 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)

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

1.3 Testing Location

Company:	Eurofins TA Technology (Shanghai) Co., Ltd.
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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	Fixed Device		
Model	SC421		
SN	SC421X00241500011		
Hardware Version	/		
Software Version	/		
Power Rating	12 V		
Connecting I/O Port(s)	Please refer to the User's Manual.		
Antenna Type	WWAN: PCB Antenna/ External Antenna WLAN: PCB Antenna		
Frequency	Band	Tx (MHz)	Rx (MHz)
	WCDMA Band II	1850 ~ 1910	1930 ~ 1990
	WCDMA Band V	824 ~ 849	869 ~ 894
	LTE Band 4	1710 ~ 1755	2110 ~ 2155
	LTE Band 5	824 ~ 849	869 ~ 894
	LTE Band 12	699 ~ 716	729 ~ 746
	LTE Band 41	2496 ~ 2690	2496 ~ 2690
	LTE Band 66	1710 ~ 1780	2110 ~ 2180
	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-3)	5725 ~ 5850	5725 ~ 5850
EUT Accessory			
Adapter	Manufacturer: SHENZHEN TOPOW Model: TPA259-18120-US		

	Input: 100-240V 600mA Output: 12.0V 1500mA
Auxiliary test equipment	
PC 1	Manufacturer: DELL Model: Latitude 3301 (SN: DR6DJW2)
PC 2	Manufacturer: LENOVO Model: ThinkPad TP00067A (SN: PF-099YFU 15/06)
Note: The EUT is sent from the applicant to Eurofins TA and the information of the EUT is declared by the applicant.	

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 (2023)

ANSI C63.4-2014

2.4 Test Mode

Test Mode	
Mode 1	Adapter + EUT+ PC + TEL/LAN/WAN/Fiber + Streaming

Test Type	Test Mode	Worst Mode
Radiated Emission	Mode 1	/
Conducted Emission	Mode 1	/
During the test, the preliminary test was performed in all modes, 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
15°C ~ 35°C	30% ~ 60%

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:

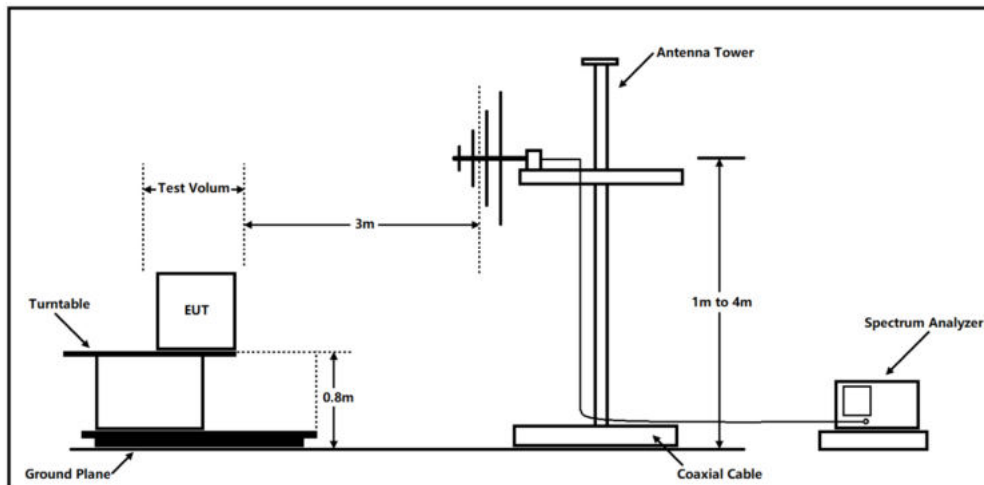
(a) PEAK Detector: RBW=1MHz / VBW=3MHz/ Sweep=AUTO

(b) AVERAGE Detector: RBW=1MHz / VBW=3MHz / Sweep=AUTO

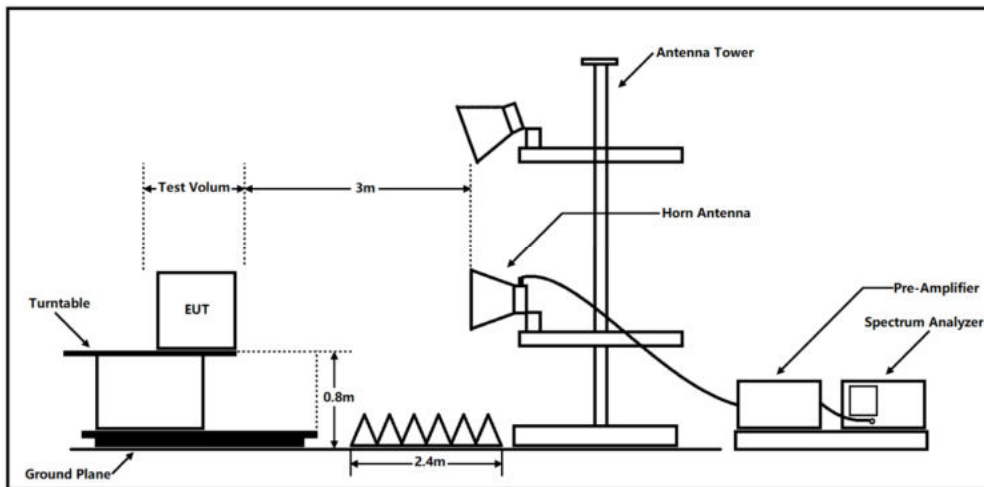
The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (X axis) and the worst case was recorded.

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 (dB μ V/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
1000-5 th harmonic of the highest frequency or 40GHz, which is lower	54 74	Average Peak

Frequency range of radiated measurements

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 40 GHz, whichever is lower.

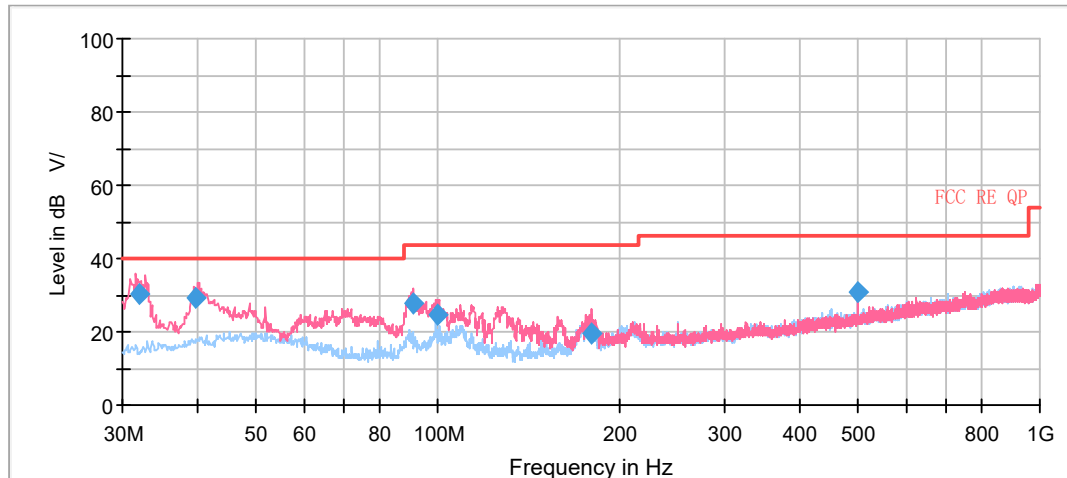
Test Results

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 () in the test plot below means (dB μ V/m)

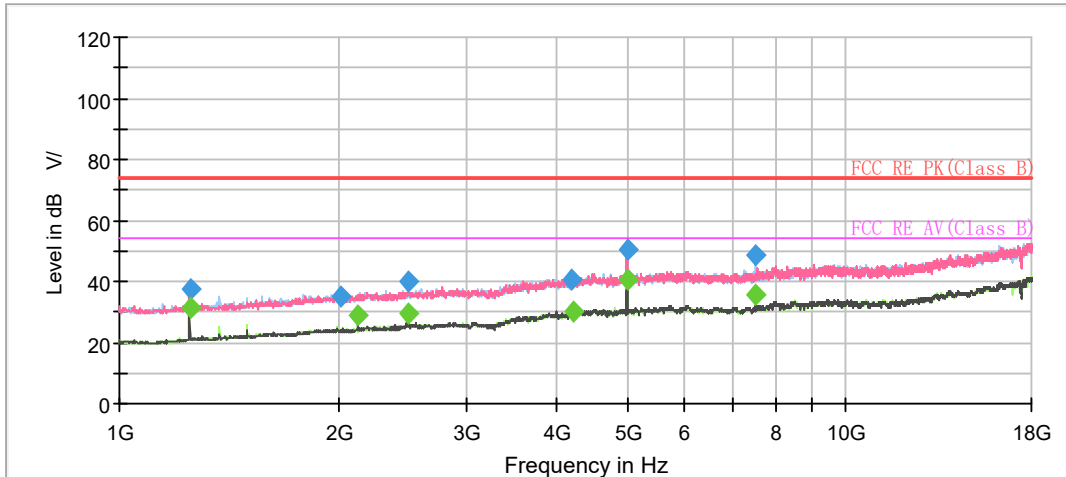


Radiated Emission from 30MHz to 1GHz

Frequency (MHz)	Quasi-Peak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)
31.976250	30.13	40.00	9.87	100.0	V	25.0	17.3
39.783750	29.13	40.00	10.87	100.0	V	317.0	19.7
91.390000	27.84	43.50	15.66	100.0	V	233.0	17.5
99.846250	24.63	43.50	18.87	100.0	V	126.0	19.0
180.343750	19.62	43.50	23.88	100.0	V	5.0	17.0
500.005000	30.84	46.00	15.16	185.0	H	145.0	25.1

Remark: 1. Correction Factor = Antenna factor + Insertion loss(cable loss+amplifier gain)

2. Margin = Limit – Quasi-Peak

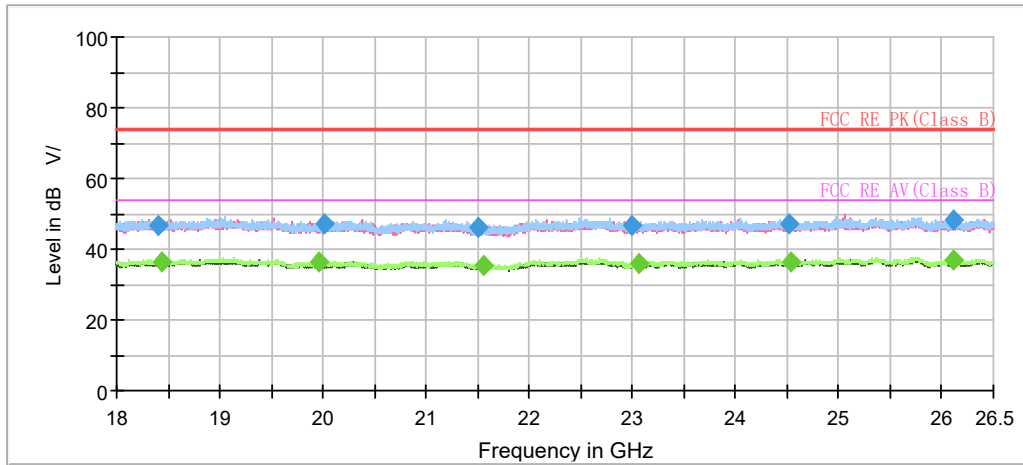


Radiated Emission from 1GHz to 18GHz

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)
1250.035000	---	31.64	54.00	22.36	500.0	100.0	V	257.0	-18.3
1250.086250	37.61	---	74.00	36.39	500.0	100.0	V	257.0	-18.3
2011.847500	35.24	---	74.00	38.76	500.0	100.0	H	145.0	-14.4
2124.966250	---	29.19	54.00	24.81	500.0	100.0	H	324.0	-13.9
2499.365000	39.79	---	74.00	34.21	500.0	200.0	H	309.0	-12.4
2500.071250	---	29.29	54.00	24.71	500.0	200.0	H	309.0	-12.4
4193.642500	40.83	---	74.00	33.17	500.0	200.0	H	15.0	-6.8
4221.162500	---	30.13	54.00	23.87	500.0	200.0	V	0.0	-6.8
4997.523750	---	40.89	54.00	13.11	500.0	100.0	V	5.0	-5.2
4998.632500	50.74	---	74.00	23.26	500.0	100.0	V	0.0	-5.2
7493.485000	48.56	---	74.00	25.44	500.0	100.0	H	56.0	-2.8
7494.651250	---	35.94	54.00	18.06	500.0	100.0	H	50.0	-2.8

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)

2. Peak Margin = Limit –MAX Peak/ Average

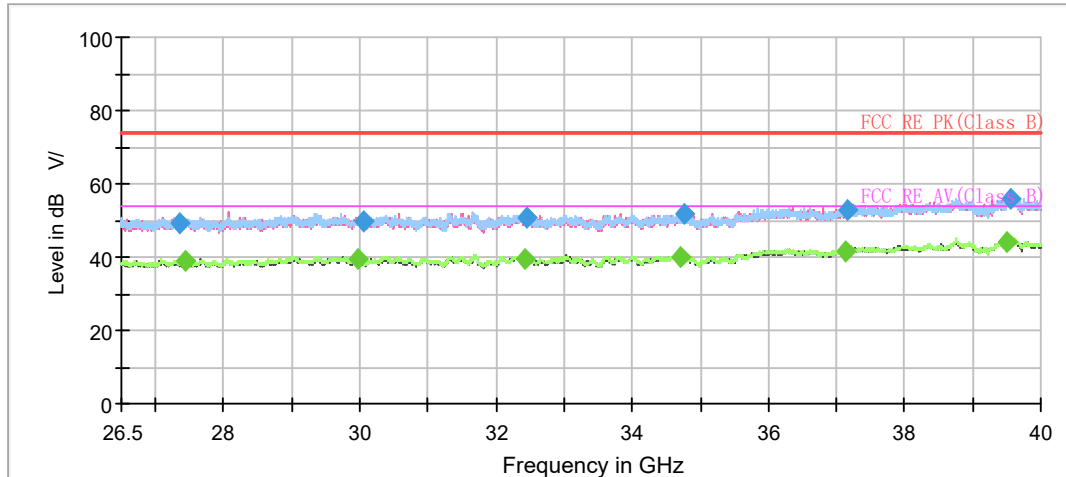


Radiated Emission from 18GHz to 26.5GHz

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)
18410.090000	46.58	---	74.00	27.42	500.0	200.0	H	0.0	-4.6
18442.222500	---	36.23	54.00	17.77	500.0	100.0	V	0.0	-4.6
19958.807500	---	36.39	54.00	17.61	500.0	100.0	H	0.0	-4.7
20006.767500	46.99	---	74.00	27.01	500.0	200.0	V	213.0	-4.6
21504.912500	46.25	---	74.00	27.75	500.0	200.0	H	234.0	-4.2
21558.178750	---	35.43	54.00	18.57	500.0	100.0	H	19.0	-4.1
22997.643750	46.55	---	74.00	27.45	500.0	200.0	V	81.0	-3.0
23058.302500	---	36.08	54.00	17.92	500.0	100.0	H	28.0	-2.9
24518.256250	47.10	---	74.00	26.90	500.0	100.0	H	28.0	-2.3
24533.748750	---	36.35	54.00	17.65	500.0	100.0	H	91.0	-2.3
26112.467500	---	36.89	54.00	17.11	500.0	100.0	H	187.0	-1.4
26115.561250	48.17	---	74.00	25.83	500.0	100.0	H	187.0	-1.4

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)
27345.383750	49.14	---	74.00	24.86	500.0	100.0	H	0.0	0.2
27426.461250	---	39.19	54.00	14.81	500.0	200.0	H	185.0	0.3
29975.921250	---	39.61	54.00	14.39	500.0	200.0	H	270.0	0.6
30045.258750	49.82	---	74.00	24.18	500.0	100.0	H	250.0	0.7
32429.481250	---	39.66	54.00	14.34	500.0	200.0	H	28.0	0.0
32463.142500	50.89	---	74.00	23.11	500.0	200.0	V	184.0	0.0
34709.998750	---	39.94	54.00	14.06	500.0	200.0	V	305.0	2.0
34774.473750	51.56	---	74.00	22.44	500.0	200.0	V	193.0	2.1
37127.757500	---	41.71	54.00	12.29	500.0	200.0	H	209.0	4.5
37153.331250	52.69	---	74.00	21.31	500.0	200.0	V	0.0	4.6
39497.856250	---	43.99	54.00	10.01	500.0	200.0	H	300.0	6.1
39551.326250	55.66	---	74.00	18.34	500.0	200.0	V	326.0	5.9

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

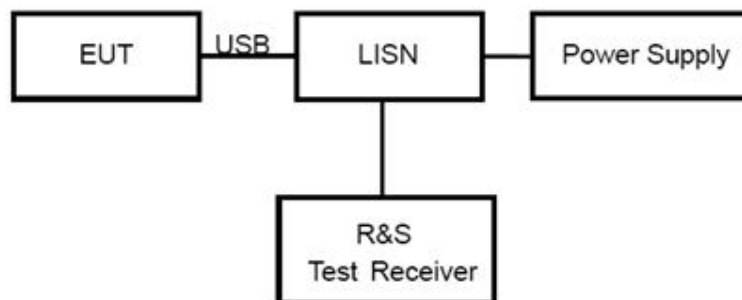
Temperature	Relative humidity
15°C ~ 35°C	30% ~ 60%

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.

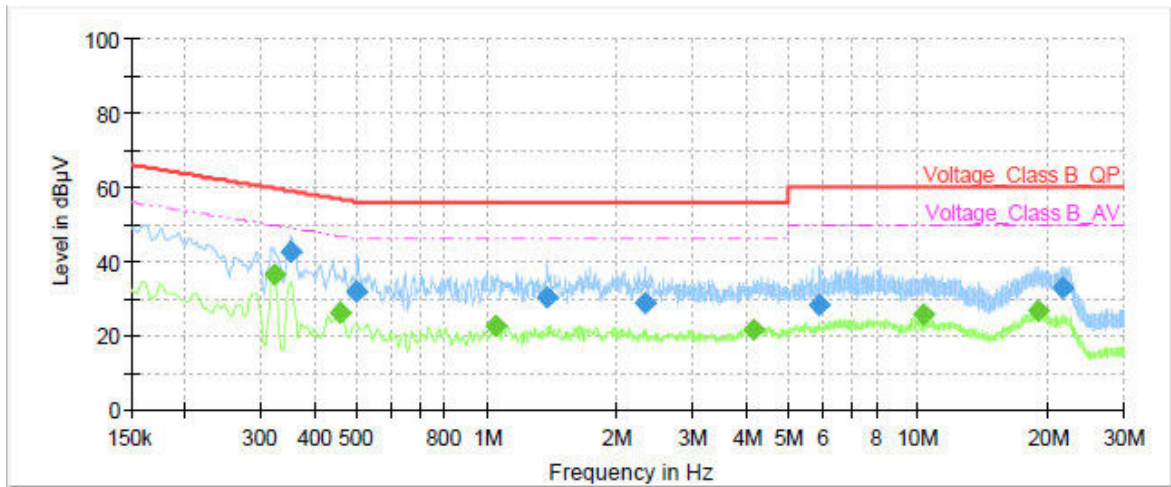
Limits

Frequency (MHz)	Class A (dBμV)		Class B (dBμV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.5	79	66	66 to 56 *	56 to 46*
0.5 - 5	73	60	56	46
5 - 30	73	60	60	50
*: Decreases with the logarithm of the frequency.				

Note: The EUT should meet CLASS B limit.

Test Results

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

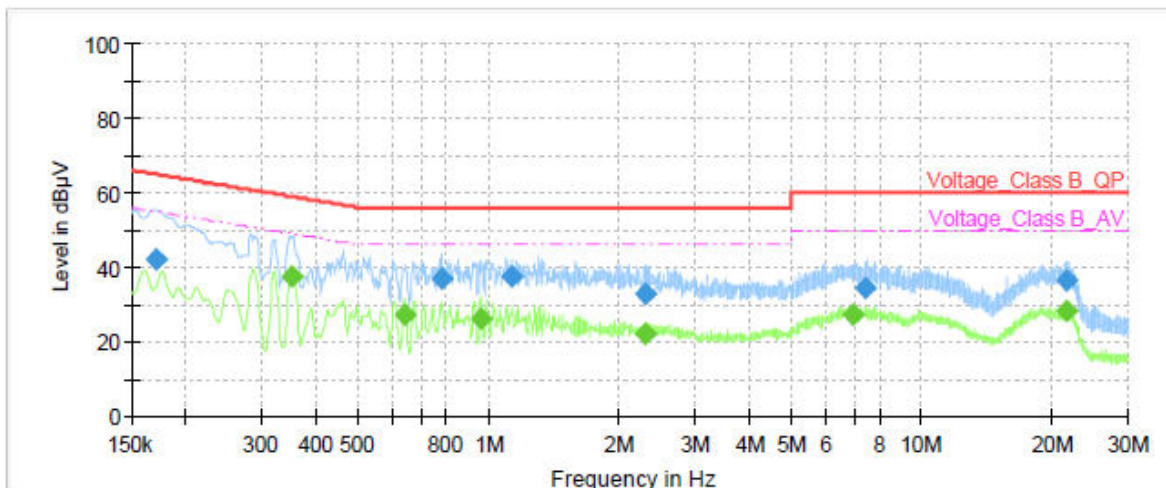


Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.32	---	36.38	49.68	13.30	1000.0	9.000	L1	ON	21.0
0.35	42.46	---	58.90	16.44	1000.0	9.000	L1	ON	21.0
0.46	---	26.17	46.77	20.60	1000.0	9.000	L1	ON	20.9
0.50	31.72	---	56.00	24.28	1000.0	9.000	L1	ON	20.9
1.05	---	22.73	46.00	23.27	1000.0	9.000	L1	ON	20.2
1.38	30.41	---	56.00	25.59	1000.0	9.000	L1	ON	20.0
2.32	28.62	---	56.00	27.38	1000.0	9.000	L1	ON	19.6
4.15	---	21.60	46.00	24.40	1000.0	9.000	L1	ON	19.5
5.91	28.45	---	60.00	31.55	1000.0	9.000	L1	ON	19.5
10.30	---	25.74	50.00	24.26	1000.0	9.000	L1	ON	19.6
18.90	---	26.82	50.00	23.18	1000.0	9.000	L1	ON	19.7
21.59	32.95	---	60.00	27.05	1000.0	9.000	L1	ON	19.7

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)
0.17	42.22	---	64.95	22.73	1000.0	9.000	N	ON	21.0
0.35	---	37.49	48.90	11.41	1000.0	9.000	N	ON	21.0
0.64	---	27.18	46.00	18.82	1000.0	9.000	N	ON	20.7
0.78	37.04	---	56.00	18.96	1000.0	9.000	N	ON	20.4
0.96	---	26.19	46.00	19.81	1000.0	9.000	N	ON	20.3
1.13	37.65	---	56.00	18.35	1000.0	9.000	N	ON	20.1
2.30	---	21.98	46.00	24.02	1000.0	9.000	N	ON	19.6
2.31	32.66	---	56.00	23.34	1000.0	9.000	N	ON	19.6
6.93	---	26.99	50.00	23.01	1000.0	9.000	N	ON	19.5
7.45	34.41	---	60.00	25.59	1000.0	9.000	N	ON	19.5
21.66	---	28.20	50.00	21.80	1000.0	9.000	N	ON	19.7
21.66	36.31	---	60.00	23.69	1000.0	9.000	N	ON	19.7

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					
Antenna Tower	ETS	2175	00095628	/	/
EMI Test Receiver	R&S	ESR	102389	2023-05-12	2024-05-11
Signal Analyzer	R&S	FSV40	101298	2023-05-12	2024-05-11
Signal Analyzer	R&S	FSV3044	103495	2023-09-19	2024-09-18
TRILOG Broadband Antenna	SCHWARZBECK	VULB 9163	1023	2023-07-14	2026-07-13
Horn Antenna	R&S	HF907	102723	2021-07-24	2024-07-23
Amplifier	R&S	SCU18	10034	2023-05-12	2024-05-11
Horn Antenna	ETS-Lindgren	3160-09	00102643	2021-10-10	2024-10-09
Horn Antenna	STEATITE	QSH-SL-26-40-K-15	16779	2023-01-17	2026-01-16
Amplifier	MicroWave	KLNA-18040050	220826001	2023-05-12	2024-05-11
Software	R&S	EMC32	9.26.01	/	/
Conducted Emission					
Artificial main network	R&S	ENV216	102191	2022-12-10	2024-12-09
EMI Test Receiver	R&S	ESR	101667	2023-05-12	2024-05-11
Software	R&S	EMC32	10.35.10	/	/

ANNEX A: The EUT Appearance

The EUT Appearance are submitted separately.

ANNEX B: Test Setup Photos

The Test Setup Photos are submitted separately.

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