



EMC TEST REPORT

Applicant Xiaomi Communications Co., Ltd.
FCC ID 2AFZZRN4DG
Product Mobile Phone
Brand Redmi
Model 23028RN4DG
Report No. R2211A1050-E1V1
Issue Date January 18, 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.

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Version	Revision description	Issue Date
Rev.0	Initial issue of report.	January 10, 2023
Rev.1	Update information.	January 18, 2023

Note: This revised report (Report No.: R2211A1050-E1V1) supersedes and replaces the previously issued report (Report No.: R2211A1050-E1). Please discard or destroy the previously issued report and dispose of it accordingly.

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 2, 2022 ~ December 4, 2022			
Date of Sample Received: November 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.			

23028RN4DG (Variant 4) is a variant model of 23028RN4DG (Variant 3), Variant 4 Add 2nd supplier RF PA;

23028RN4DG (Variant 3) is a variant model of 23026RN54G (Variant 2).

Tested Case refers to the following table.

Test Case	Variant 2 (R2211A1048-E1V1)	Variant 3 (R2211A1050-E1V1)	Variant 4 (R2211A1050-E1V1)
Radiated Emission	Pass	Tested Radiated Emission, and did not worsen, so they were not recorded in the report.	Tested Radiated Emission, and did not worsen, so they were not recorded in the report.

The detailed product change description please refers to the *Difference Declaration Letter (Variant 3) & Difference Declaration Letter (Variant 4)*.

23026RN54G (Variant 2) is a variant model of 23026RN54G (Variant 1), Variant 2 Add 2nd supplier RF PA;

23026RN54G (Variant 1) is a variant model of 220733SL (Original), Variant 1 replace adapter and add one memory, and new frequency bands are added (LTE Band 13/26/66).

Tested Case refers to the following table.

Original FCC ID: 2AFZZ33SL (R2206A0532-E1)	Variant 1 (R2211A1048-E1V1)	Variant 2 (R2211A1048-E1V1)
Pass	There is only tested Radiated Emission, and did not worsen, so they were not recorded in the report.	There is only tested Radiated Emission, and did not worsen, so they were not recorded in the report.

The detailed product change description please refers to the *Difference Declaration Letter (Variant 2) & Difference Declaration Letter (Variant 1)*.

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.
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2 General Description of Equipment Under Test

2.1 Applicant and Manufacturer Information

Applicant	Xiaomi Communications Co., Ltd.
Applicant address	#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085
Manufacturer	Xiaomi Communications Co., Ltd.
Manufacturer address	#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085

2.2 General Information

EUT Description			
Device Type	Portable Device		
Model	23028RN4DG		
IMEI	Original (220733SL)	IMEI1: 863698060055362 IMEI1: 863698060055370	
	Variant 1 (23026RN54G)	IMEI1: 863698060055362 IMEI1: 863698060055370	
	Variant 2 (23026RN54G)	IMEI1: 863698060076285 IMEI2: 863698060076293	
	Variant 3 (23028RN4DG)	IMEI1: 862656060025620 IMEI2: 862656060025638	
	Variant 4 (23028RN4DG)	IMEI1: 862656060009400 IMEI2: 862656060009418	
HW Version	P1.1		
SW Version	Android 13		
Power Rating	DC 3.85V		
Connecting I/O Port(s)	Please refer to the User's Manual.		
Antenna Type	PIFA Antenna		
Frequency	Band	Tx (MHz)	Rx (MHz)
	GSM 850	824 ~ 849	869 ~ 894
	GSM 1900	1850 ~ 1910	1930 ~ 1990
	WCDMA Band V	824 ~ 849	869 ~ 894
	LTE Band 5	824 ~ 849	869 ~ 894
	LTE Band 7	2500 ~ 2570	2620 ~ 2690
	LTE Band 38	2570 ~ 2620	2570 ~ 2620



	LTE Band 41	2496 ~ 2690	2496 ~ 2690
	Bluetooth	2400 ~ 2483.5	2400 ~ 2483.5
	Wi-Fi 2.4G	2400 ~ 2483.5	2400 ~ 2483.5
Auxiliary test equipment			
PC	PC Manufacturer: Microsoft Corporation Model: L20170076		
Note: 1. The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant.			

Item	Configure 1	Configure 2
WIFI test socket	support	remove
PL sensor	support	remove
Note: Configuration 2 only verifies Radiated Emission.		



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+ earphone + Front camera On +GSM/WCDMA/LTE/ Bluetooth/ WLAN receiver
Mode 2	Adapter +USB cable+ earphone + Front camera On +GSM/WCDMA/LTE/ Bluetooth/ WLAN Traffic
Mode 3	Adapter +USB cable+ earphone + Rear camera On +GSM/WCDMA/LTE/ Bluetooth/ WLAN receiver
Mode 4	Adapter +USB cable+ earphone + Rear camera On +GSM/WCDMA/LTE/ Bluetooth/ WLAN Traffic
Mode 5	Adapter + USB cable + earphone + Mp4
Mode 6	Adapter + USB cable + earphone + FM(98MHz)
Mode 7	Adapter + USB cable + earphone +GSM/WCDMA/LTE/ Bluetooth/ WLAN receiver
Mode 8	Adapter + USB cable + earphone +GSM/WCDMA/LTE/ Bluetooth/ WLAN Traffic
Mode 9	USB Copy(EUT with PC) + USB cable + earphone
Mode 10	Front Camera On +earphone + GSM/WCDMA/LTE/ Bluetooth/ WLAN receiver
Mode 11	Front Camera On +earphone + GSM/WCDMA/LTE/ Bluetooth/ WLAN Traffic
Mode 12	Rear camera On +earphone + GSM/WCDMA/LTE/ Bluetooth/ WLAN receiver
Mode 13	Rear camera On +earphone + GSM/WCDMA/LTE/ Bluetooth/ WLAN Traffic
Mode 14	Earphone + MP4
Mode 15	Earphone + GSM/WCDMA/LTE/ Bluetooth/ WLAN receiver
Mode 16	Earphone + GSM/WCDMA/LTE/ Bluetooth/ WLAN Traffic
Mode 17	Earphone + FM (98MHz)

During the test, the preliminary test was performed in all modes; mode 9 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

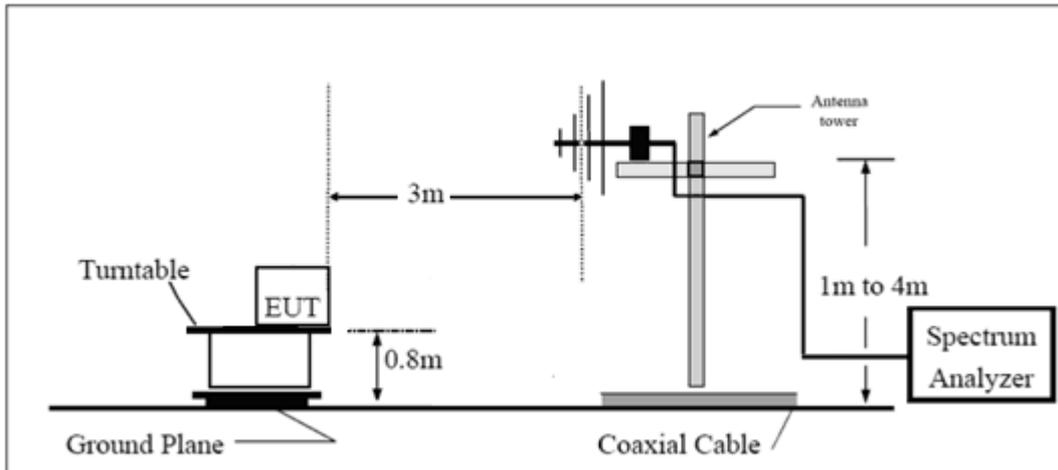
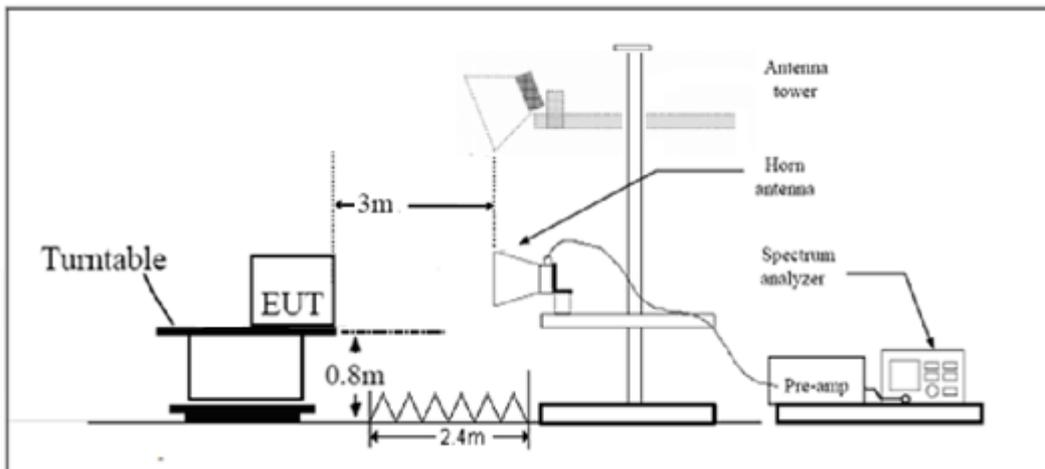
Above 1GHz:

(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.

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.

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**

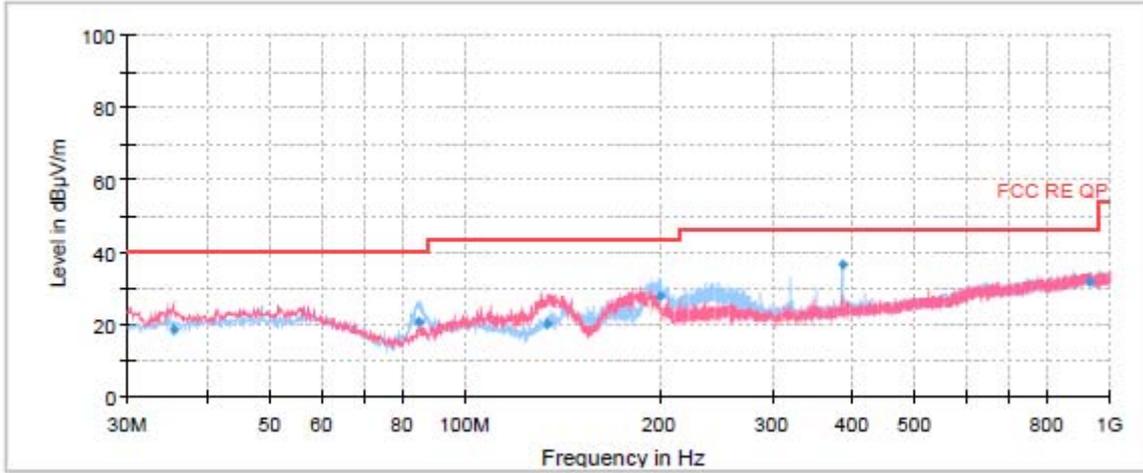
Frequency (MHz)	Field Strength (dB μ V/m)	Detector
30 -88	40.0	Quasi-peak
88-216	43.5	Quasi-peak
216 – 960	46.0	Quasi-peak
960-1000	54.0	Quasi-peak
1000-5 th harmonic of the highest frequency or 40GHz, which is lower	54 74	Average Peak

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.

Configure 1:

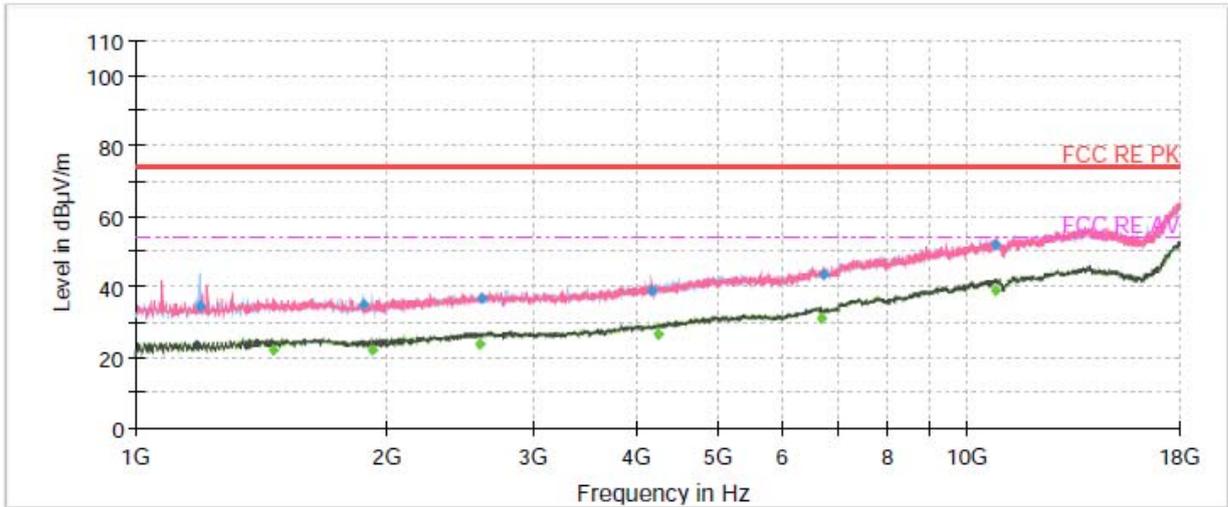


Radiated Emission from 30MHz to 1GHz

Frequency (MHz)	Quasi-Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)
35.34	18.51	40.00	21.49	1000.00	118.0	V	249.00	13
84.56	20.30	40.00	19.70	1000.00	207.0	H	183.00	10
134.15	20.18	40.00	19.82	1000.00	100.0	V	230.00	10
201.33	27.55	40.00	12.45	1000.00	175.0	H	255.00	12
384.05	36.32	47.00	10.68	1000.00	100.0	H	1.00	18
931.01	31.54	47.00	15.46	1000.00	125.0	H	252.00	26

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

2. Margin = Limit – Quasi-Peak



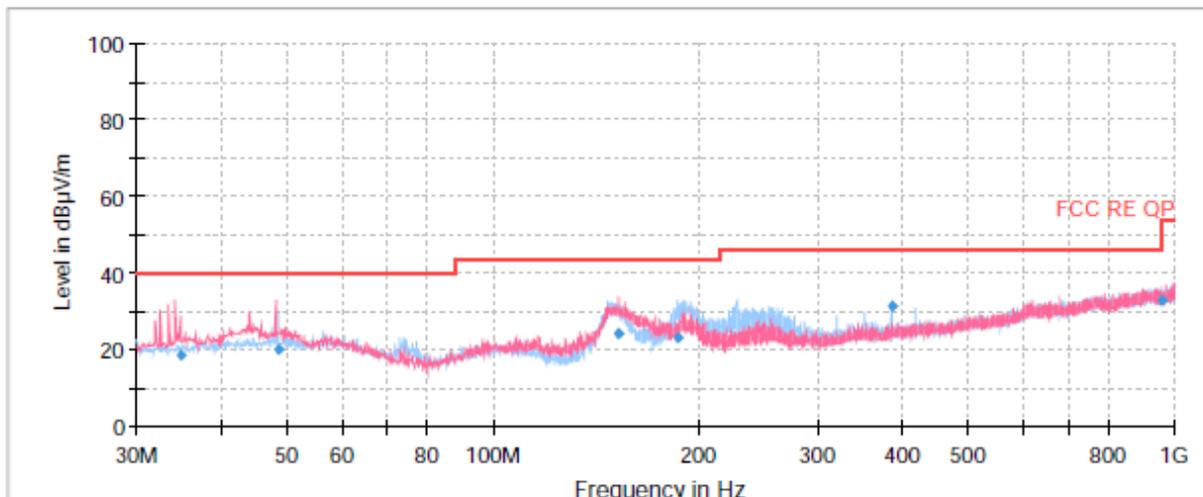
Radiated Emission from 1GHz to 18GHz

Frequency (MHz)	Peak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)
1193.38	34.44	---	74.00	39.56	1000.00	110.0	H	10.00	-20
1465.38	---	22.24	54.00	31.76	1000.00	198.0	V	283.00	-19
1881.88	34.78	---	74.00	39.22	1000.00	210.0	H	55.00	-18
1926.50	---	22.17	54.00	31.83	1000.00	206.0	H	187.00	-18
2583.13	---	23.92	54.00	30.08	1000.00	198.0	H	100.00	-16
2598.00	36.53	---	74.00	37.47	1000.00	110.0	V	29.00	-16
4179.00	38.68	---	74.00	35.32	1000.00	210.0	V	144.00	-12
4240.63	---	26.41	54.00	27.59	1000.00	197.0	H	6.00	-12
6650.38	---	30.77	54.00	23.23	1000.00	110.0	V	208.00	-3
6714.13	43.53	---	74.00	30.47	1000.00	106.0	V	245.00	-3
10781.38	---	39.15	54.00	14.85	1000.00	210.0	V	158.00	3
10783.50	51.78	---	74.00	22.22	1000.00	106.0	V	215.00	3

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

2. Peak Margin = Limit –MAX Peak/ Average

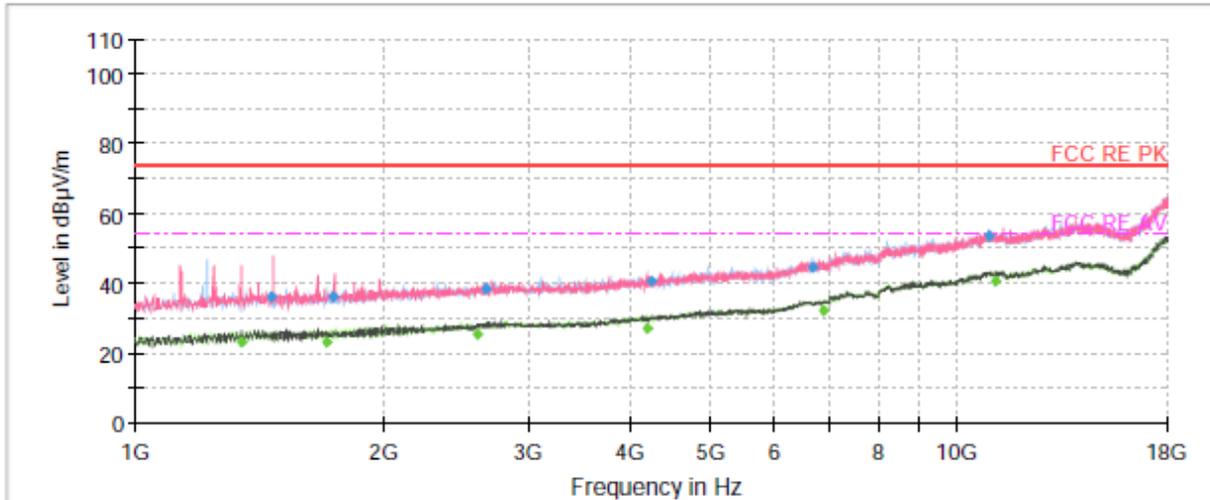
Configure 2:



Radiated Emission from 30MHz to 1GHz

Frequency (MHz)	Quasi-Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)
34.80	18.68	40.00	21.32	1000.00	180.0	V	320.00	14
48.39	19.96	40.00	20.04	1000.00	179.0	V	59.00	15
153.23	23.90	43.50	19.60	1000.00	100.0	V	349.00	10
187.22	23.05	43.50	20.45	1000.00	204.0	H	269.00	13
384.01	31.34	46.00	14.66	1000.00	100.0	H	356.00	18
957.89	33.06	46.00	12.94	1000.00	115.0	H	295.00	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)	Peak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)
1345.72	---	23.08	54.00	30.92	1000.00	100.0	V	10.00	-17
1466.82	36.04	---	74.00	37.96	1000.00	190.0	V	216.00	-17
1712.76	---	23.32	54.00	30.68	1000.00	100.0	H	109.00	-16
1743.15	36.20	---	74.00	37.80	1000.00	198.0	V	111.00	-16
2611.98	---	25.52	54.00	28.48	1000.00	210.0	H	46.00	-14
2675.33	38.61	---	74.00	35.39	1000.00	197.0	V	243.00	-14
4181.85	---	27.29	54.00	26.71	1000.00	106.0	V	0.00	-10
4233.21	40.58	---	74.00	33.42	1000.00	197.0	V	277.00	-10
6663.17	44.58	---	74.00	29.42	1000.00	210.0	H	12.00	-2
6857.23	---	32.18	54.00	21.82	1000.00	110.0	H	336.00	-1
10944.87	53.68	---	74.00	20.32	1000.00	197.0	H	18.00	4
11108.04	---	40.49	54.00	13.51	1000.00	110.0	V	0.00	5

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

2. Peak Margin = Limit - MAX Peak/ Average

3.2 Conducted Emission

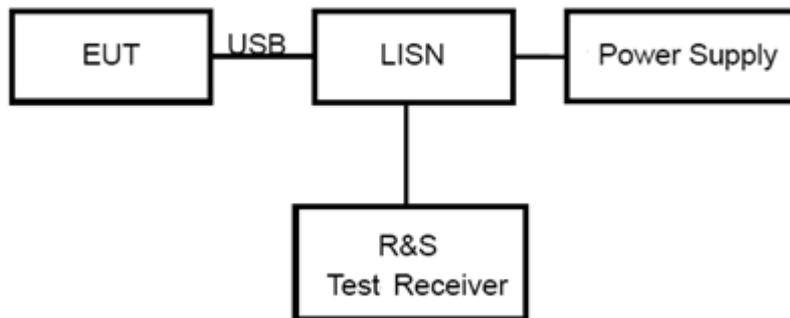
Ambient Condition

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.

Test Setup



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

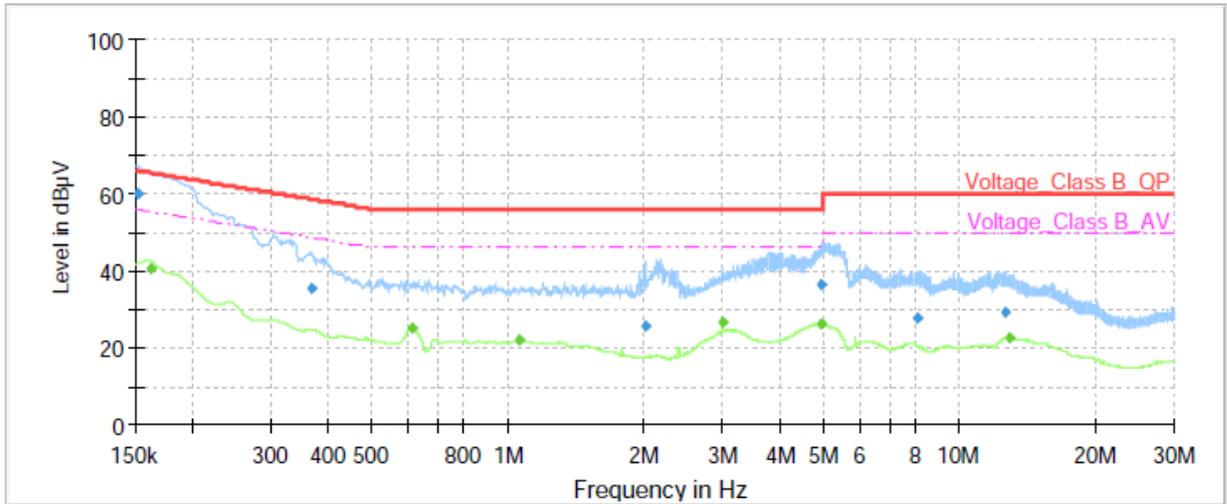
Limits

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.

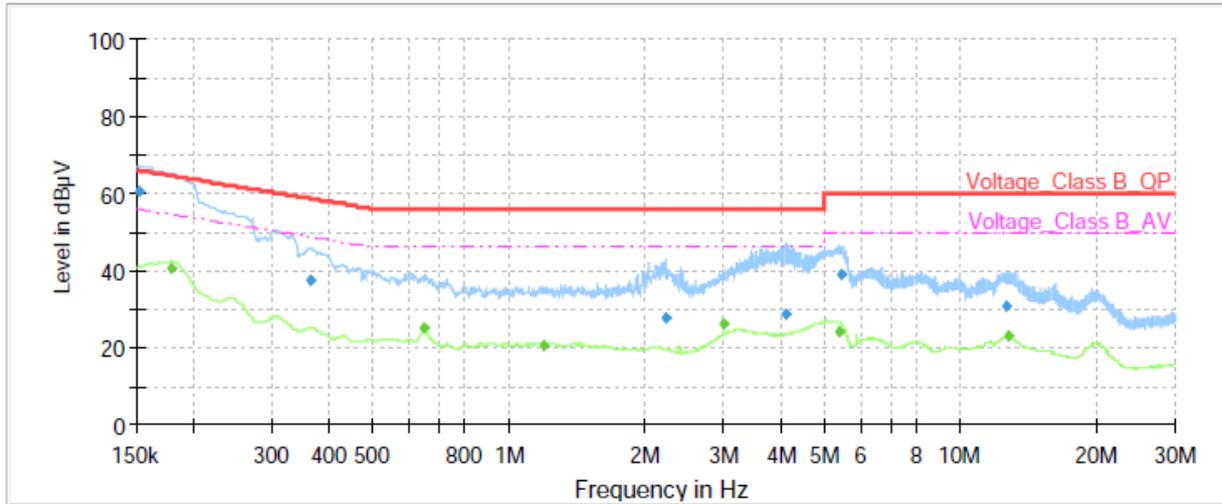


Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.15	59.78	---	65.88	6.10	1000.00	9.000	L1	ON	21
0.16	---	40.64	55.40	14.76	1000.00	9.000	L1	ON	21
0.37	35.58	---	58.59	23.01	1000.00	9.000	L1	ON	21
0.61	---	25.32	46.00	20.68	1000.00	9.000	L1	ON	20
1.05	---	21.92	46.00	24.08	1000.00	9.000	L1	ON	20
2.01	25.89	---	56.00	30.11	1000.00	9.000	L1	ON	20
2.99	---	26.46	46.00	19.54	1000.00	9.000	L1	ON	19
4.96	36.56	---	56.00	19.44	1000.00	9.000	L1	ON	19
4.97	---	26.17	46.00	19.83	1000.00	9.000	L1	ON	19
8.05	27.90	---	60.00	32.10	1000.00	9.000	L1	ON	20
12.72	29.33	---	60.00	30.67	1000.00	9.000	L1	ON	20
12.92	---	22.49	50.00	27.51	1000.00	9.000	L1	ON	20

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	60.72	---	65.88	5.16	1000.00	9.000	N	ON	21
0.18	---	40.72	54.52	13.80	1000.00	9.000	N	ON	21
0.36	37.31	---	58.64	21.33	1000.00	9.000	N	ON	21
0.65	---	25.12	46.00	20.88	1000.00	9.000	N	ON	20
1.20	---	20.62	46.00	25.38	1000.00	9.000	N	ON	20
2.22	27.89	---	56.00	28.11	1000.00	9.000	N	ON	20
2.99	---	25.90	46.00	20.10	1000.00	9.000	N	ON	19
4.11	28.97	---	56.00	27.03	1000.00	9.000	N	ON	19
5.38	---	23.95	50.00	26.05	1000.00	9.000	N	ON	19
5.44	38.91	---	60.00	21.09	1000.00	9.000	N	ON	19
12.65	30.89	---	60.00	29.11	1000.00	9.000	N	ON	20
12.76	---	22.88	50.00	27.12	1000.00	9.000	N	ON	20

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
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	ESCI7	100936	2021-12-12	2022-12-11
Signal Analyzer	R&S	FSV40	100816	2021-12-12	2022-12-11
Signal Analyzer	R&S	FSV30	103591	2021-12-12	2022-12-11
TRILOG Broadband Antenna	SCHWARZBECK	9163	391	2020-05-05	2023-05-04
Horn Antenna	Schwarzbeck	BBHA 9120D	430	2021-07-26	2024-07-25
Software	R&S	EMC32	9.26.01	/	/
Conducted Emission					
Artificial main network	R&S	ENV216	102191	2020-12-13	2022-12-12
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.



ANNEX C: Product Change Description (Variant 1)

The Product Change Description are submitted separately.



ANNEX D: Product Change Description (Variant 2)

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