

Prüfbericht-Nr.: Test report no.:	CN22XAYL 001	Auftrags-Nr.: Order no.:	180242579	Seite 1 von 25 Page 1 of 25
Kunden-Referenz-Nr.: Client reference no.:	N/A	Auftragsdatum: Order date:	2022.09.08	
Auftraggeber: Client:	Ningbo Dooya Mechanic & Electronic Technology Co., Ltd. No.168 Shengguang Road, Luotuo, Zhenhai, Ningbo 315202 Zhejiang P.R. China			
Prüfgegenstand: Test item:	P-Box			
Bezeichnung / Typ-Nr.: Identification / Type no.:	DD7006, DD7006A, DD7006B, DD7006C, DD7006E			
Auftrags-Inhalt: Order content:	TÜV Rheinland – FCC Service			
Prüfgrundlage: Test specification:	FCC 47 CFR Part 15.203 FCC 47 CFR Part 15.231 FCC 47 CFR Part 2.1091		FCC Part 15, Subpart B:2021	
Wareneingangsdatum: Date of sample receipt:	2022.09.30	Refer to Photo Documentation		
Prüfmuster-Nr.: Test sample no.:	A003353610			
Prüfzeitraum: Testing period:	2022.10.08 - 2022.11.16			
Ort der Prüfung: Place of testing:	Refer to section 1.1			
Prüflaboratorium: Testing laboratory:	TÜV Rheinland / CCIC (Ningbo) Co., Ltd.			
Prüfergebnis*: Test result*:	Pass			
geprüft von: tested by:	genehmigt von: authorized by:			
Datum: Date: 2023.01.10				
Stellung / Position: Keda Zhou/PE	Ausstelldatum: Issue date: 2023.01.10		Stellung / Position: Season Yang/Reviewer	
Sonstiges / Other:	FCC ID: VYY7006A01 Contains FCC ID: 2AC7Z-ESPWROOM32D			
Zustand des Prüfgegenstandes bei Anlieferung: Condition of the test item at delivery:	Prüfmuster vollständig und unbeschädigt Test item complete and undamaged			
* Legende:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	4 = ausreichend N/A = nicht anwendbar
* Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory F(ail) = failed a.m. test specification(s)	4 = sufficient N/A = not applicable
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.				

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Model List:

No.	Model	Input	Wireless Tech
1	DD7006	USB 5V, POE 42-57V	SRD (433MHz), 2.4GHz Wi-Fi
2	DD7006B	USB 5V, POE 42-57V	SRD (433MHz), 2.4GHz Wi-Fi
3	DD7006E	USB 5V, POE 42-57V	SRD (433MHz), 2.4GHz Wi-Fi
4	DD7006A	USB 5V	SRD (433MHz), 2.4GHz Wi-Fi
5	DD7006C	USB 5V	SRD (433MHz), 2.4GHz Wi-Fi

Other aspects:

1. In electrical characteristics, all above models have the same SRD (433MHz) module and 2.4GHz Wi-Fi module, No.1-No.3 have one more function of POE than No.4 and No.5.
2. The 2.4GHz Wi-Fi module have approved by FCC ID 2AC7Z-ESPWROOM32D.
3. Therefore, all the tests according to the standards listed in page one are performed on the model DD7006.

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Test Summary

4.1.1 ANTENNA REQUIREMENT

Result:

Pass

4.1.2 DEACTIVATION OF THE TRANSMISSION

Result:

Pass

4.1.3 20dB EMISSION BANDWIDTH

Result:

Pass

4.1.4 FIELD STRENGTH OF FUNDAMENTAL AND UNWANTED EMISSIONS

Result:

Pass

4.2.1 MAINS TERMINAL CONTINUOUS DISTURBANCE VOLTAGE

Result:

Pass

4.2.2 RADIATED DISTURBANCE

Result:

Pass

5.1.1 ELECTROMAGNETIC FIELDS

Result:

Pass

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1. Test Sites

1.1 Test Facilities

Laboratory: TÜV Rheinland /CCIC (Ningbo) Co., Ltd.

1st Floor, Building 11, Scholar Innovation Park, No.1188 Zhongguan Road, Zhenhai District, Ningbo 315200 P.R. China

The tests were conducted by TÜV Rheinland/CCIC's engineer directly in the above laboratory.

1.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment, Laboratory

Kind of Equipment	Type	Serial No.	Last cal. date	Cal. due date
EMI test receiver	ESR7	101929	2022.10.31	2023.10.30
Spectrum analyzer	FSV40	101412	2022.10.31	2023.10.30
Bilog Antenna	CBL6112D	49033	2021.03.15	2024.03.14
Horn antenna	HF907	102653	2020.11.25	2023.07.21
Pre-amplifier	SCU-18F	180051	2022.10.31	2023.10.30
EMI test receiver	ESR3	102331	2022.10.31	2023.10.30
LISN	ENV216	102250	2022.10.31	2023.10.30

1.3 Uncertainty of Measurement

Table 2: Measurement Uncertainty

Test Item	Expanded Measurement Uncertainty (k=2)
Conducted Emission (9-150kHz)	3.70dB
Conducted Emission (150k-30MHz)	3.30dB
Radiated Emission (30-1000MHz)	4.39dB
Radiated Emission (1-18GHz)	4.67dB

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2. General Product Information

2.1 Product Function and Intended Use

The EUT (equipment under test) is a P-Box operating at 433.05 - 434.79MHz.

For more detail information, refer to the user's manual.

2.2 Ratings and System Details

Table 3: General Description of EUT

General Description of EUT	
Model name:	P-Box
FCC ID:	VYY7006A01
Rated Voltage:	USB 5V / POE 42-57V
Protection Class:	Class III
Operating Temperature Range:	-5°C~50°C
Technical Specification of SRD (433MHz)	
Operating Frequency band	433.05 - 434.79MHz
Modulation	GFSK
Antenna Type	PCB Layout Antenna
Antenna Gain	0.79dBi

2.3 Independent Operation Modes

There are some modes:

Mode A: Transmitting on Operating Frequency Band: 433.05 - 434.79MHz

Mode B: Transmitting by 2.4GHz Wi-Fi module

Mode C: Normal Working powered by USB

Mode D: Normal Working powered by POE

Refer to the user's manual for further information.

2.4 Noise Generating and Noise Suppressing Parts

Refer to the Circuit Diagram for further information.

2.5 Submitted Documents

Circuit diagram, Schematics, PCB Layout, Label, User Manual etc.

3. Test Set-up and Operation Modes

3.1 Principle of Configuration Selection

Radio Spectrum: The equipment under test (EUT) was configured at its highest power output in order to measure its highest possible radiation and conducted level. The test modes were adapted accordingly in reference to the instructions for use.

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

3.2 Test Operation and Test Software

During testing, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power was selected according to the instruction given by the manufacturer. The setting of the RF output power expected by the customer shall be fixed on the firmware of the final end product.

All testing were performed according to the procedures in ANSI C63.10: 2013.

Test Software EMC32 V10.30 was used in the radiated emission test.

More details refer to the related paragraph of this report.

3.3 Special Accessories and Auxiliary Equipment

None.

3.4 Countermeasures to Achieve ERM Compliance

The test sample which has been tested contained the noise suppression parts as described in the Circuit Diagram. No additional measures were employed to achieve compliance.

3.5 Test set-up

Diagram of Measurement Configuration for Radiation Test (Below 1GHz)

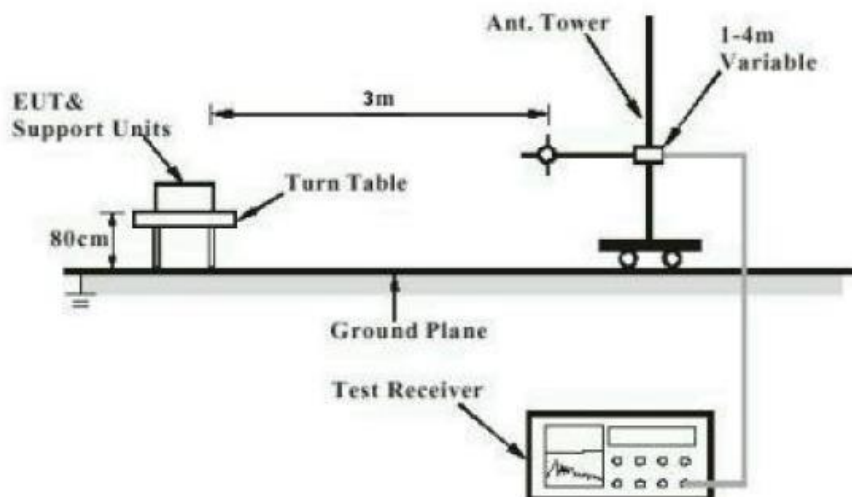


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

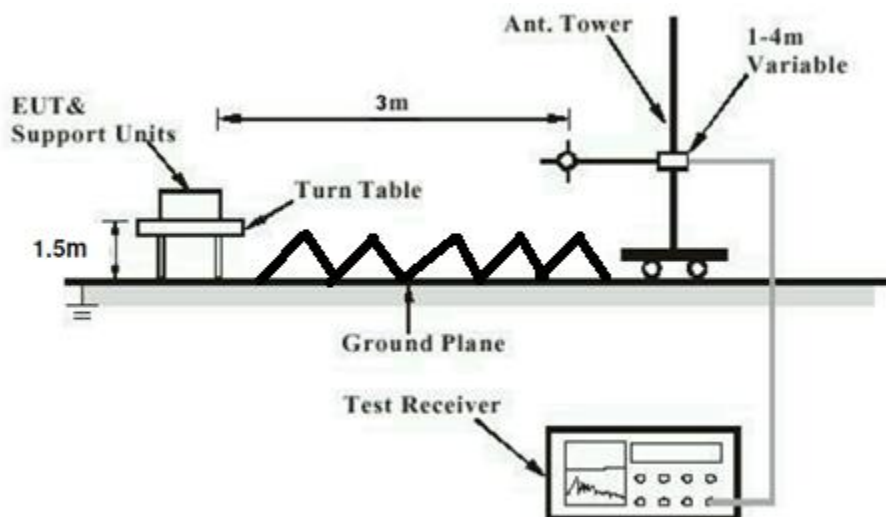
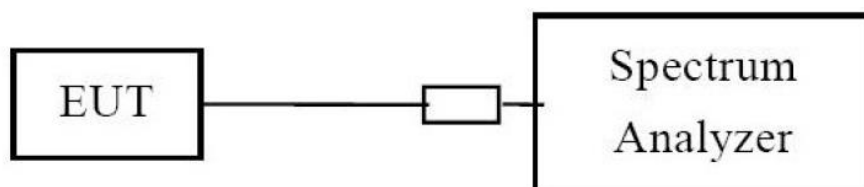


Diagram of Measurement Configuration for Conducted Transmitter Measurement



4. Test Results

4.1 Transmitter Requirement & Test Suites

4.1.1 Antenna Requirement

Result:

Pass

Test Specification

Test standard

: FCC 47 CFR Part 15.203

Limit

: the use of antennas with directional gains that do not exceed 6 dBi

According to the manufacturer declared, the EUT has an integral antenna (PCB antenna, Antenna Gain: 0.79dBi), and the antenna connector is designed with permanent attachment and no consideration of replacement. Therefore the EUT is considered sufficient to comply with the provision.

Refer to EUT Photo for further details.

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4.1.2 Deactivation of the Transmission

Result:

Pass

Test Specification

Test standard : FCC 47 CFR Part 15.231
Basic standard : ANSI C63.10: 2013
Test requirement : CFR47 FCC Part 15.231 (a)(1)
Limits : A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
A transmitter activated automatically shall cease transmission within 5 seconds after activation.

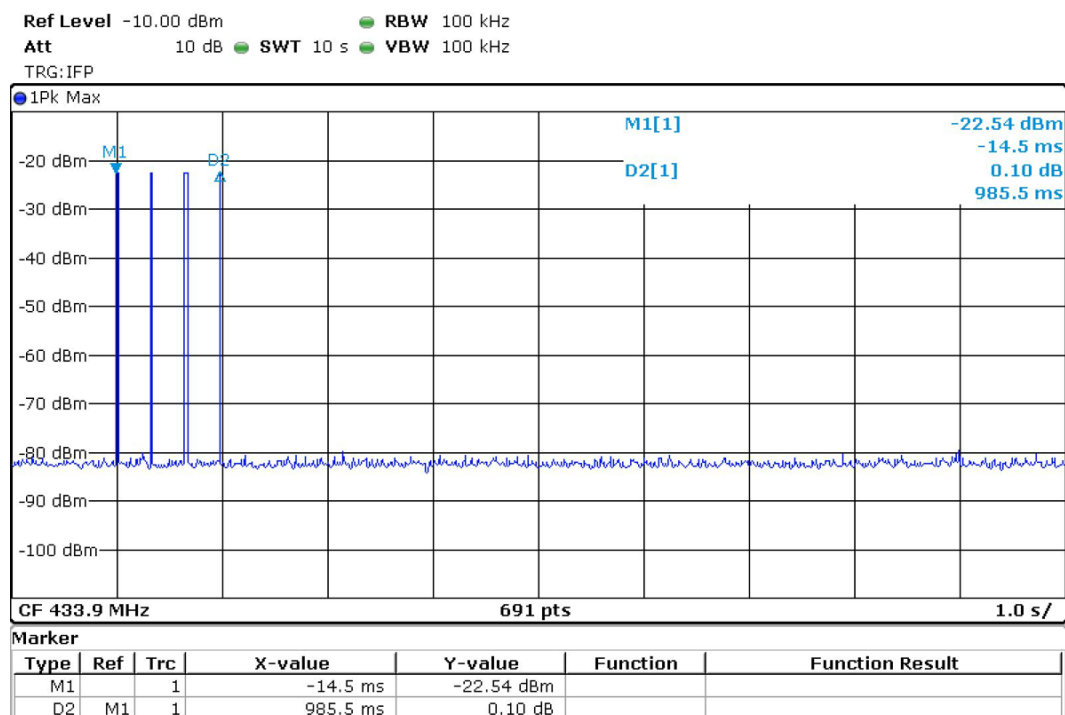
Test suite : Shielded Room

Test Setup

Date of testing : 2022.11.07
Test environment: : Normal test conditions
Operational mode : Mode A
Temperature : 23°C
Relative humidity : 56%
Atmospheric pressure : 101.2 kPa

Figure 1: Test Results of Deactivation of the Transmission

Duration Time (S) : 0.9855
Limit (S) : ≤5



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4.1.3 20dB Emission Bandwidth

Result:

Pass

Test Specification

Test standard : FCC 47 CFR Part 15.231
Basic standard : ANSI C63.10: 2013
Test requirement : CFR47 FCC Part 15.231 (c)
Limit : CFR47 FCC Part 15.231 (c)
Test suite : Shielded Room

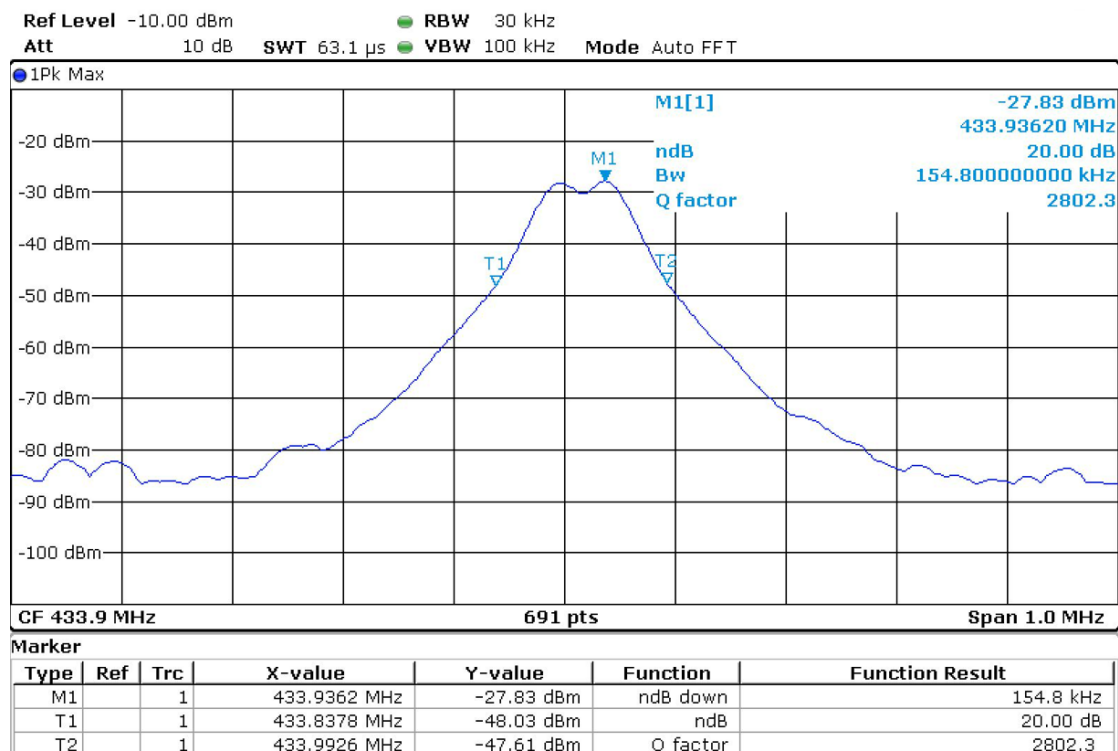
Test Setup

Date of testing : 2022.11.07
Test environment : Normal test conditions
Operational mode : Mode A
Temperature : 23°C
Relative humidity : 56%
Atmospheric pressure : 101.2 kPa

Figure 2: Test Results of 20dB Emission Bandwidth

Bandwidth (kHz)
154.8

Limit (kHz)
≤1085



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4.1.4 Field strength of fundamental and Unwanted Emissions

Result:

Pass

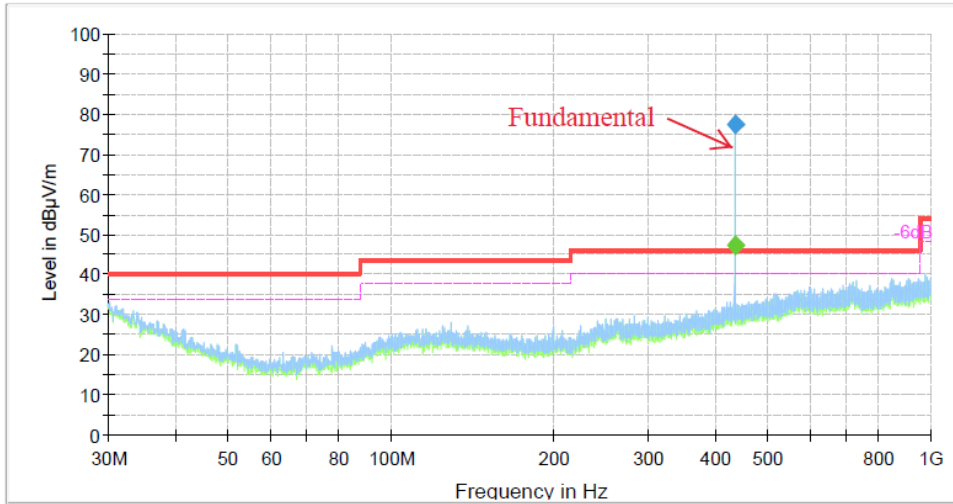
Test Specification	
Test standard	: FCC 47 CFR Part 15.231 CFR47 FCC Part 15.205 CFR47 FCC Part 15.209
Basic standard	: ANSI C63.10: 2013
Test requirement	: CFR47 FCC Part 15.231 (b)(1)(2)(3)
Limits	: CFR47 FCC Part 15.231 (b)
Test suite	: 3m Semi Anechoic Room

Test Setup

Date of testing	: 2022.11.08-2022.11.10
Test environment	: Normal test conditions
Operational mode	: Mode A, Mode A+Mode B
Temperature	: 23°C
Relative humidity	: 56%
Atmospheric pressure	: 101.2 kPa

Figure 3: Field strength of fundamental

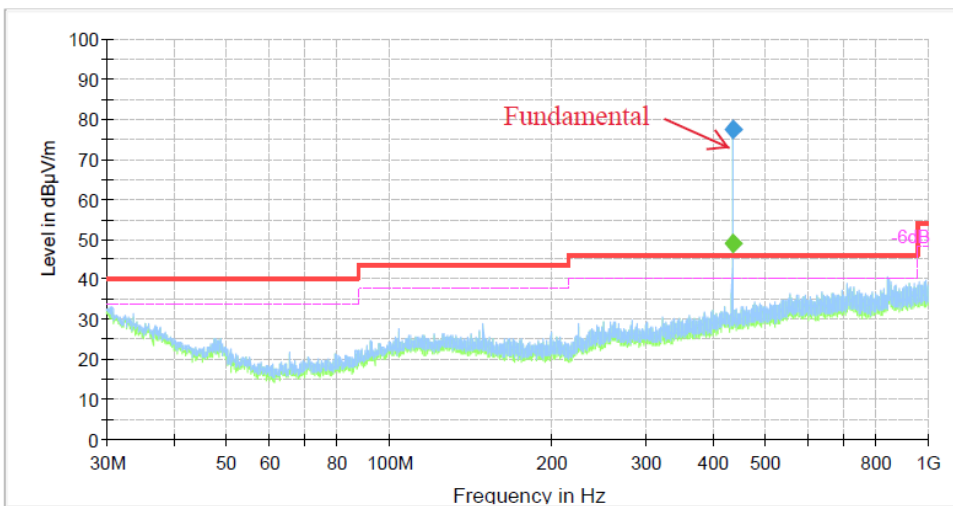
Fundamental, Horizontal



Final Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
433.971111	77.59	---	100.83	23.24	1000.0	120.000	223.0	H	132.0
433.971111	---	47.30	80.83	33.53	1000.0	120.000	223.0	H	132.0

Fundamental, Vertical



Final Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
433.917222	77.44	---	100.83	23.39	1000.0	120.000	217.0	V	327.0
433.917222	---	49.11	80.83	31.72	1000.0	120.000	217.0	V	327.0

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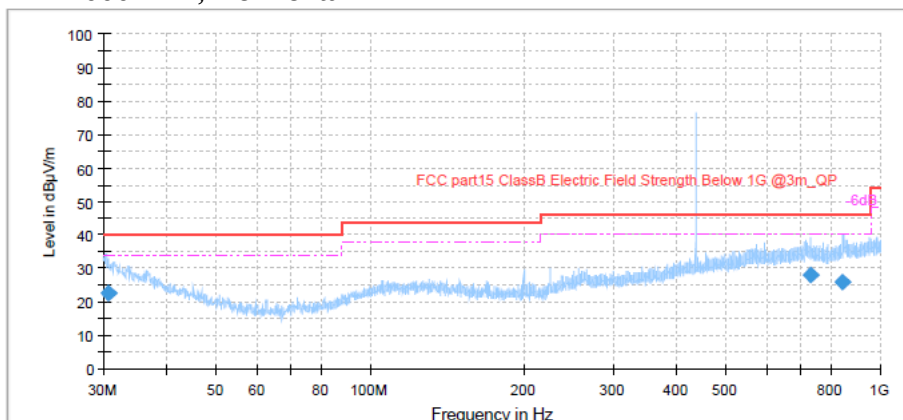
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Figure 4: Spectral Diagrams, Radiated Spurious Emission, Mode A

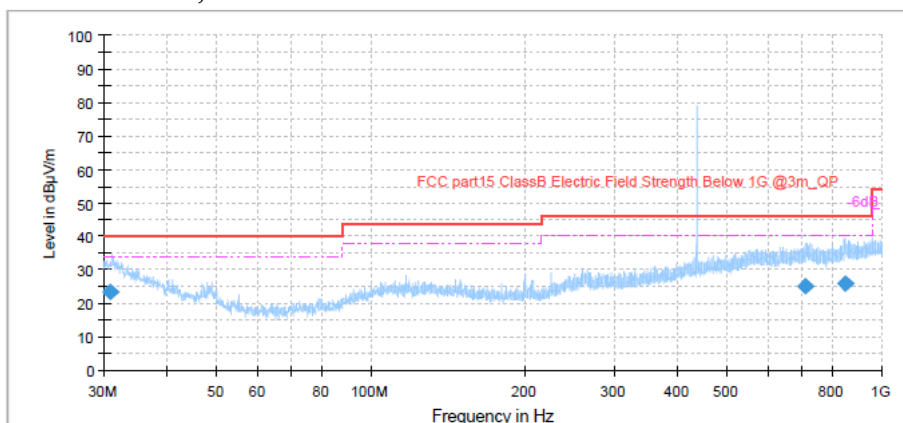
30MHz-1000MHz, Horizontal



Final Result

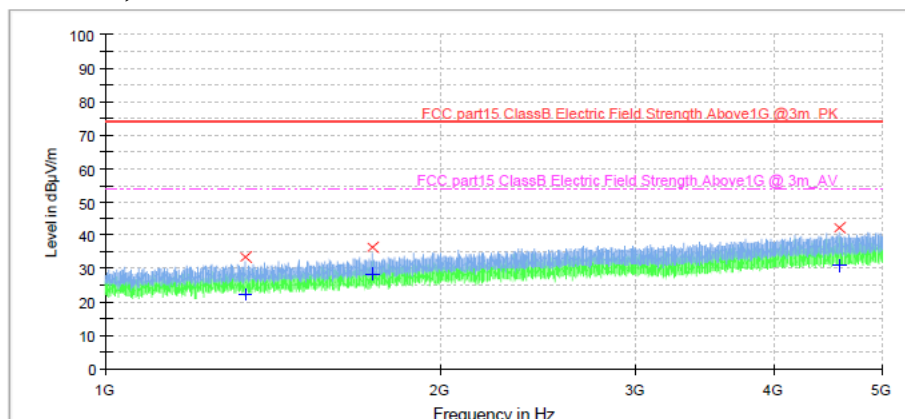
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.583333	22.80	40.00	17.20	1000.0	120.000	180.0	H	48.0	25.6
728.273889	28.02	46.00	17.98	1000.0	120.000	133.0	H	248.0	28.0
844.700000	25.83	46.00	20.17	1000.0	120.000	107.0	H	99.0	29.4

30MHz-1000MHz, Vertical



Final Result

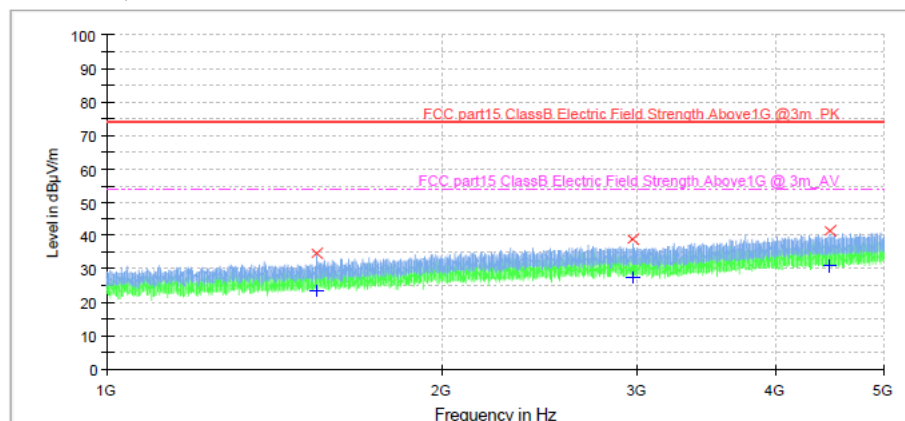
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.885556	23.53	40.00	16.47	1000.0	120.000	120.0	V	121.0	25.4
709.857778	25.30	46.00	20.70	1000.0	120.000	140.0	V	9.0	27.8
844.957222	25.75	46.00	20.25	1000.0	120.000	206.0	V	84.0	29.4

1GHz-5GHz, Horizontal

Limit and Margin-PK

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
1334.125000	33.4	1000.0	1000.000	150.0	H	0.0	-12.9	40.6	74.0
1736.625000	36.6	1000.0	1000.000	150.0	H	0.0	-10.5	37.4	74.0
4577.750000	42.2	1000.0	1000.000	150.0	H	0.0	0.2	31.9	74.0

Limit and Margin-AV

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
1334.125000	22.3	1000.0	1000.000	150.0	H	0.0	-12.9	31.7	54.0
1736.625000	28.6	1000.0	1000.000	150.0	H	0.0	-10.5	25.4	54.0
4577.750000	30.9	1000.0	1000.000	150.0	H	0.0	0.2	23.1	54.0

1GHz-5GHz, Vertical

Limit and Margin-PK

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
1543.000000	34.6	1000.0	1000.000	150.0	V	0.0	-11.9	39.4	74.0
2971.250000	38.9	1000.0	1000.000	150.0	V	0.0	-3.8	35.1	74.0
4465.750000	41.5	1000.0	1000.000	150.0	V	0.0	0.0	32.5	74.0

Limit and Margin-AV

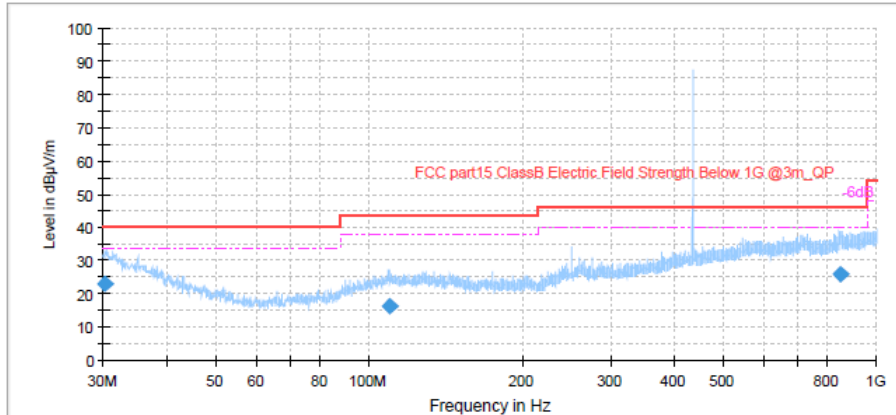
Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
1543.000000	23.4	1000.0	1000.000	150.0	V	0.0	-11.9	30.6	54.0
2971.250000	27.8	1000.0	1000.000	150.0	V	0.0	-3.8	26.3	54.0
4465.750000	30.8	1000.0	1000.000	150.0	V	0.0	0.0	23.2	54.0

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Figure 5: Spectral Diagrams, Radiated Spurious Emission, Mode A+Mode B

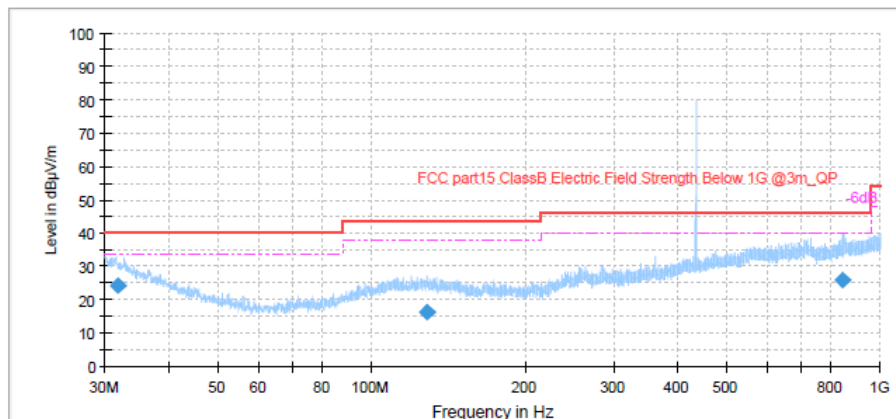
30MHz-1000MHz, Horizontal



Final Result

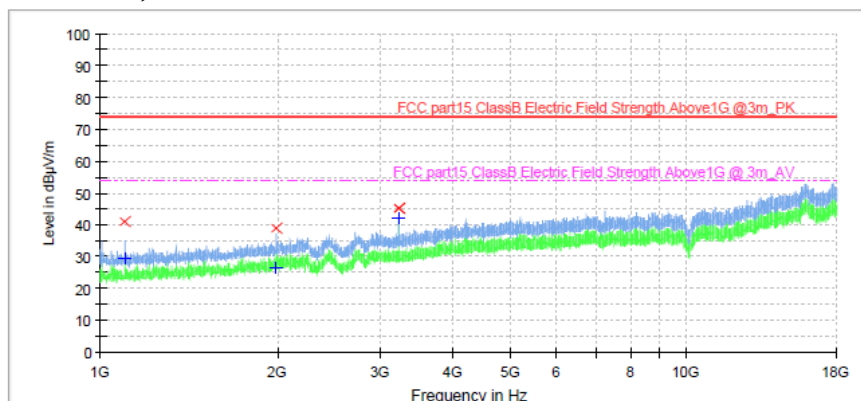
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.265000	23.22	40.00	16.78	1000.0	120.000	123.0	H	114.0	25.8
109.546111	16.28	43.50	27.22	1000.0	120.000	220.0	H	291.0	18.9
849.117222	25.89	46.00	20.11	1000.0	120.000	167.0	H	20.0	29.3

30MHz-1000MHz, Vertical



Final Result

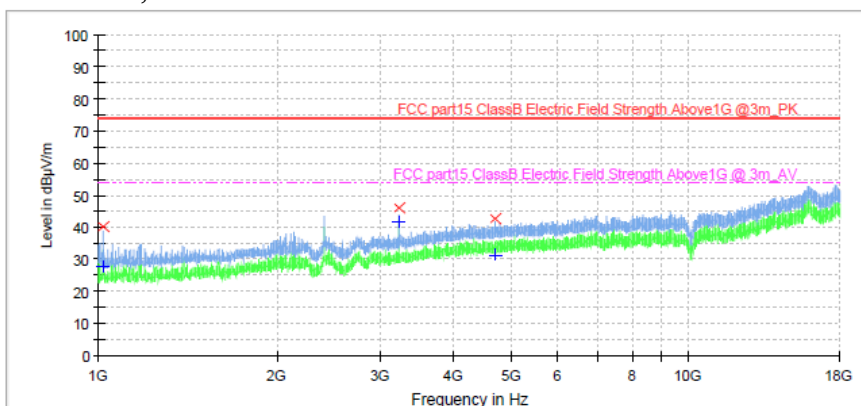
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
31.675000	24.22	40.00	15.78	1000.0	120.000	108.0	V	9.0	24.8
128.862778	16.49	43.50	27.01	1000.0	120.000	104.0	V	191.0	18.9
844.647778	25.97	46.00	20.03	1000.0	120.000	150.0	V	140.0	29.4

1GHz-18GHz, Horizontal

Limit and Margin-PK

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
1097.220000	41.2	1000.0	1000.000	150.0	H	0.0	-14.1	32.8	74.0
1994.500000	38.9	1000.0	1000.000	150.0	H	0.0	-8.8	35.1	74.0
3229.125000	45.3	1000.0	1000.000	150.0	H	0.0	-3.0	28.7	74.0
3229.125000	45.3	1000.0	1000.000	150.0	H	0.0	-3.0	28.7	74.0

Limit and Margin-AV

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
1097.220000	29.1	1000.0	1000.000	150.0	H	0.0	-14.1	24.9	54.0
1994.500000	26.4	1000.0	1000.000	150.0	H	0.0	-8.8	27.6	54.0
3229.125000	42.4	1000.0	1000.000	150.0	H	0.0	-3.0	11.6	54.0
3229.125000	42.4	1000.0	1000.000	150.0	H	0.0	-3.0	11.6	54.0

1GHz-18GHz, Vertical

Limit and Margin-PK

Frequency (MHz)	MaxPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - PK+ (dB)	Limit - PK+ (dBµV/m)
1018.595000	40.4	1000.0	1000.000	150.0	V	0.0	-14.5	33.6	74.0
3229.125000	45.9	1000.0	1000.000	150.0	V	0.0	-3.0	28.1	74.0
4698.030000	42.7	1000.0	1000.000	150.0	V	0.0	0.6	31.4	74.0

Limit and Margin-AV

Frequency (MHz)	Average (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)	Margin - AVG (dB)	Limit - AVG (dBµV/m)
1018.595000	27.7	1000.0	1000.000	150.0	V	0.0	-14.5	26.3	54.0
3229.125000	41.8	1000.0	1000.000	150.0	V	0.0	-3.0	12.2	54.0
4698.030000	31.3	1000.0	1000.000	150.0	V	0.0	0.6	22.7	54.0

4.2 Other Requirement & Test Suites

4.2.1 Mains Terminal Continuous Disturbance Voltage

Result:	Pass
---------	------

Date of testing	: 2023.01.03
Test procedure	: ANSI C63.4:2014 and CISPR 16-1 series standards
Frequency range	: 0.15 – 30MHz
Limits	: FCC Part 15, Subpart B:2021, Class B
Kind of test site	: Shielding Room
Operation modes	: Mode C
Port	: Mains
Temp.& Humidity	: 21°C, 63%

The measurement setup was made according to ANSI C63.4:2014 in a shielded room.

The measurement equipment like test receivers, quasi-peak detector and artificial mains network (AMN) are in compliance with ANSI C63.4:2014 and CISPR 16-1 series standards.

The tested object was set-up on a wooden table. The EUT was set 0.8m away from the AMN. The cord longer than necessary to be connected to the AMN was folded forth and back parallel so as to form a bundle with a length between 0.3m and 0.4m.

The disturbance voltage test was performed on the neutral line and phase line of the power supply of the EUT respectively.

Before measurement, a survey was made to determine in which state the maximum disturbance was obtained. And the measurement was made in the state the maximum disturbance was obtained.

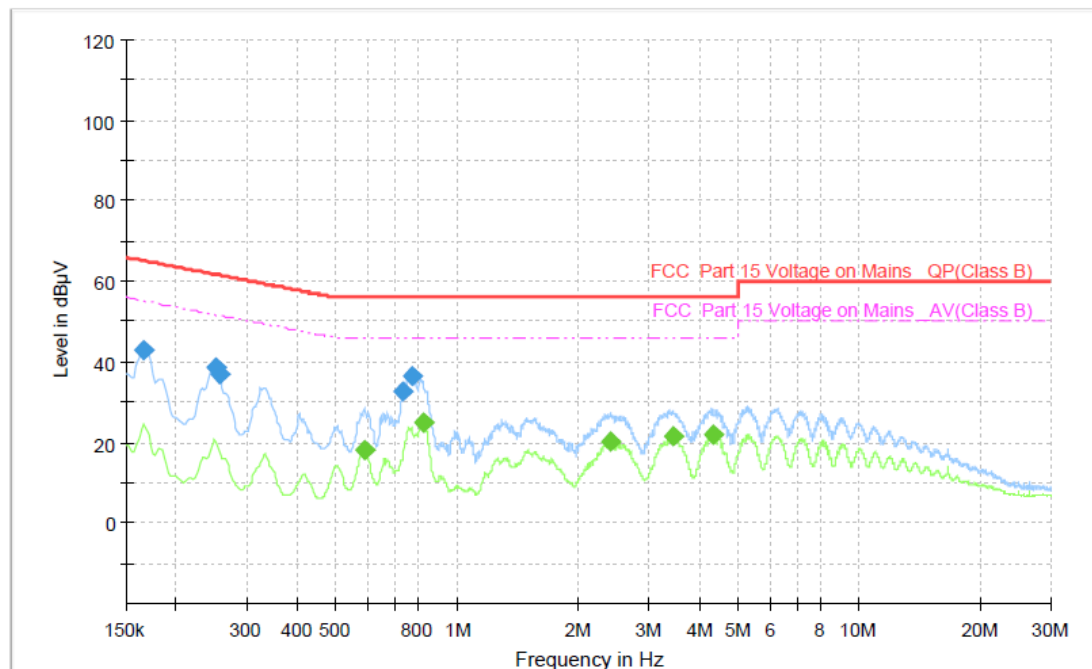
The following figures and tables were those measured by an automatic measuring system. Both Quasi Peak and Average Value were measured. Quasi-Peak and Average Value were measured and listed respectively where they had a maximum in previous scanning survey. In the Figures, “♦” means Quasi-Peak Value and Average Value which were measured in final measurement.

The measurement result is calculated based on the following formula by the test software:
Emission Level = Reading level + Correction (LISN factor + cable loss)

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Figure 6: Spectral Diagrams, Conducted Emission, 150KHz - 30MHz, L



Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.165750	42.83	---	65.17	22.34	1000.0	9.000	L1	ON	10.2
0.251250	38.44	---	61.72	23.27	1000.0	9.000	L1	ON	10.2
0.255750	36.86	---	61.57	24.70	1000.0	9.000	L1	ON	10.2
0.586500	---	18.28	46.00	27.72	1000.0	9.000	L1	ON	10.3
0.735000	32.58	---	56.00	23.42	1000.0	9.000	L1	ON	10.3
0.771000	36.68	---	56.00	19.32	1000.0	9.000	L1	ON	10.3
0.822750	---	25.01	46.00	20.99	1000.0	9.000	L1	ON	10.3
2.411250	---	20.13	46.00	25.87	1000.0	9.000	L1	ON	10.4
3.444000	---	21.42	46.00	24.58	1000.0	9.000	L1	ON	10.4
4.337250	---	22.02	46.00	23.98	1000.0	9.000	L1	ON	10.4

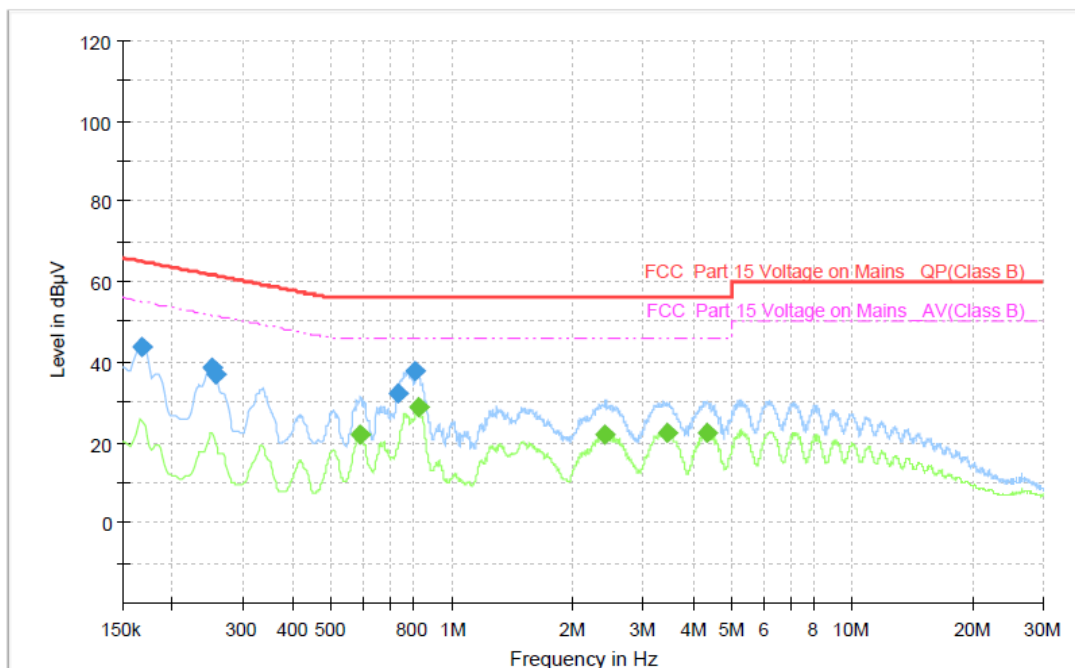
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Figure 7: Spectral Diagrams, Conducted Emission, 150KHz - 30MHz, N



Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.168000	43.84	---	65.06	21.21	1000.0	9.000	N	ON	10.2
0.251250	38.65	---	61.72	23.07	1000.0	9.000	N	ON	10.2
0.255750	37.12	---	61.57	24.45	1000.0	9.000	N	ON	10.2
0.588750	---	22.14	46.00	23.86	1000.0	9.000	N	ON	10.3
0.735000	32.43	---	56.00	23.57	1000.0	9.000	N	ON	10.3
0.809250	37.99	---	56.00	18.01	1000.0	9.000	N	ON	10.3
0.825000	---	28.60	46.00	17.40	1000.0	9.000	N	ON	10.3
2.418000	---	21.88	46.00	24.12	1000.0	9.000	N	ON	10.4
3.455250	---	22.56	46.00	23.44	1000.0	9.000	N	ON	10.4
4.353000	---	22.50	46.00	23.50	1000.0	9.000	N	ON	10.4

4.2.2 Radiated disturbance

Result:

Pass

Date of testing	: 2022.10.25-2022.11.15
Test standard	: FCC Part 15, Subpart B:2021, Class B
Test procedure	: ANSI C63.4:2014 and CISPR 16-1 series standards
Frequency range	: 30MHz– 5th harmonic of the highest frequency
Limits	: Quasi-peak limits (3m test distance): 30-88MHz, 40dB μ V/m; 88-216MHz, 43.5dB μ V/m; 216-960MHz, 46dB μ V/m; Above 960MHz, 54dB μ V/m. Average limits (3m test distance): Above 1000MHz, 54dB μ V/m.
Kind of test site	: Semi-anechoic chamber
Operation modes	: C, D
Temp.& Humidity	: 21°C, 56%

The radiated disturbance test was carried out in a semi-anechoic chamber. The test distance from the receiving antenna to the EUT is 3m. The normalized site attenuation of the semi-anechoic chamber is regularly calibrated to ensure the radiated disturbance test results are valid. During the test, the EUT was placed on a wooden table, which is 0.8m high. The wooden table was rotated 360° around and the antenna was varied from 1m to 4m to find the maximum disturbance. The test was performed with the antenna both in its horizontal and vertical polarizations.

According to the clause 15.33 “Frequency range of radiated measurements” of FCC Part 15, Subpart B:2021, the highest frequency in the EUT is below 108 MHz, therefore the EUT’s upper frequency of measurement range is 1000MHz.

The following figures and tables were those measured by an automatic measurement system. A preview test was firstly performed with peak detector. The final test was performed with quasi-peak at those critical frequencies during the preview test. In the following figures, “◆” mean final measurement results with quasi-peak detector.

Before measurement, a survey was made to determine in which state the maximum disturbance was obtained. And the measurement was made in the state the maximum disturbance was obtained.

The following figures were those measured and recorded by a test receiver. Peak Value were measured and listed respectively where they had a maximum in previous scanning survey. In the Figures, “◆” means Quasi-Peak Value which were measured in final measurement.

The measurement result is calculated based on the following formula by the test software:
Emission Level = Reading level + Correction (Antenna factor + Cable loss - preamplifier factor (if used))

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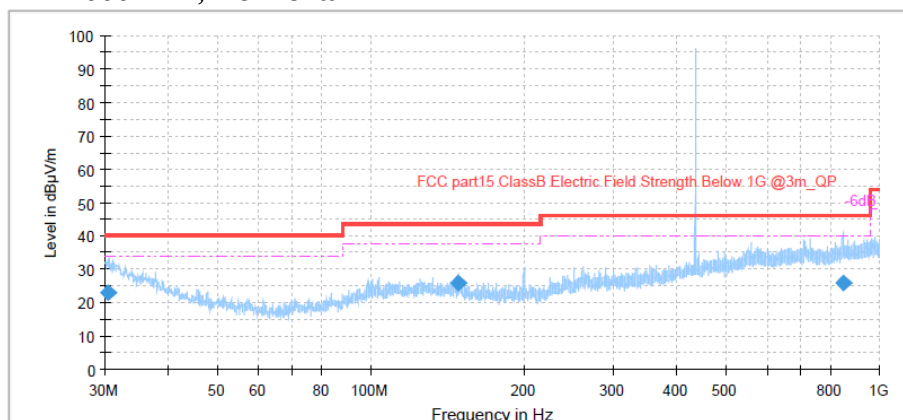
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Figure 8: Spectral Diagrams, Radiated disturbance, Mode C

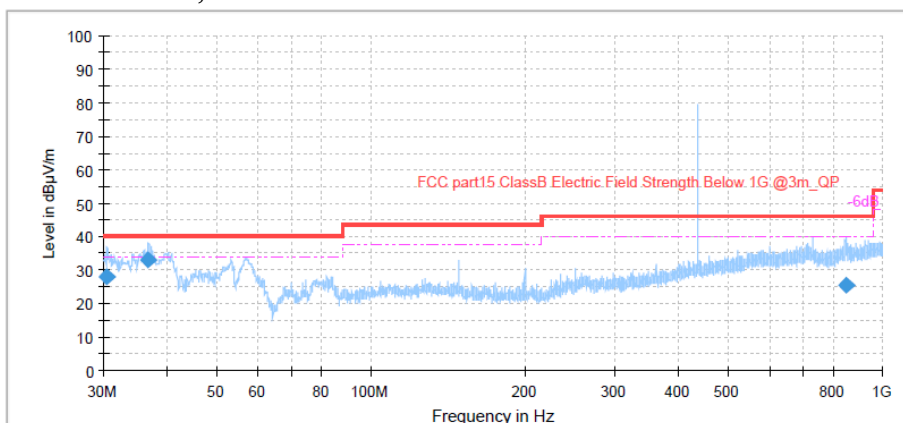
30MHz-1000MHz, Horizontal



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.440556	22.97	40.00	17.03	1000.0	120.000	150.0	H	336.0	25.7
148.481667	26.13	43.50	17.37	1000.0	120.000	211.0	H	47.0	17.9
845.626667	25.92	46.00	20.08	1000.0	120.000	181.0	H	201.0	29.3

30MHz-1000MHz, Vertical



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.505000	28.19	40.00	11.81	1000.0	120.000	104.0	V	275.0	25.6
36.596111	32.87	40.00	7.13	1000.0	120.000	107.0	V	79.0	22.2
845.477222	25.71	46.00	20.29	1000.0	120.000	188.0	V	189.0	29.3

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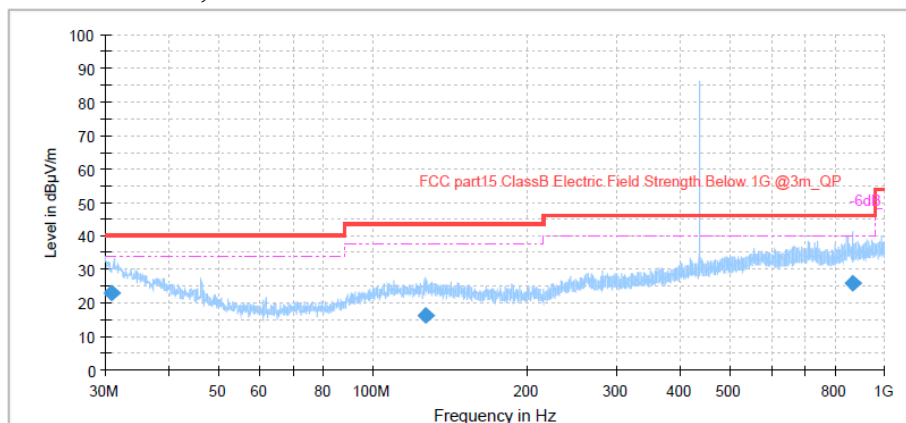
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Figure 9: Spectral Diagrams, Radiated disturbance, Mode D

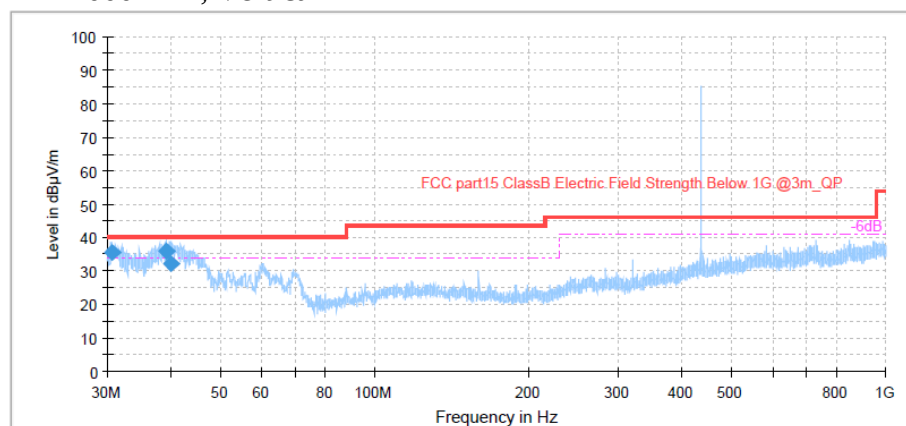
30MHz-1000MHz, Horizontal



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.979444	22.81	40.00	17.19	1000.0	120.000	182.0	H	338.0	25.3
126.995556	16.51	43.50	26.99	1000.0	120.000	114.0	H	207.0	19.1
867.964444	26.03	46.00	19.97	1000.0	120.000	146.0	H	301.0	29.5

30MHz-1000MHz, Vertical



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
30.652778	35.69	40.00	4.31	1000.0	120.000	150.0	V	44.0	25.6
39.099444	35.94	40.00	4.06	1000.0	120.000	119.0	V	327.0	20.8
40.027778	32.37	40.00	7.63	1000.0	120.000	150.0	V	258.0	19.9

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5. Safety Human Exposure

5.1 Radio Frequency Exposure Compliance

5.1.1 Electromagnetic Fields

Result:

Pass

Test Specification

Test standard : FCC 47 CFR Part 2.1091
CFR47 FCC Part 1.1310

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(i) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*(100)	≤6
3.0-30	1842/f	4.89/f	*(900/f ²)	<6
30-300	61.4	0.163	1.0	<6
300-1,500			f/300	<6
1,500-100,000			5	<6
(ii) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	<30
1.34-30	824/f	2.19/f	*(180/f ²)	<30
30-300	27.5	0.073	0.2	<30
300-1,500			f/1500	<30
1,500-100,000			1.0	<30

f = frequency in MHz. * = Plane-wave equivalent power density.

MPE Calculation:

The power Density (mW / CM^2) is calculated as follows:

$$S = \frac{PG}{4\pi R^2}$$

S=power density (mW / CM^2)

P=power input to the antenna (mW)

G=power input to the antenna in the direction of interest relative to an isotropic radiator

R=distance to the center of radiation of the antenna (CM)

Mode	Maximum Electric Field dBuV/m @3m	MAX E.I.R.P. (mW)	Distance (cm)	Power Density (mW/ cm ²)	Power Density Limit (mW/ cm ²)	Verdict
A	77.59	0.0017	20	3.38×10^{-7}	0.289	Pass
B	N/A	218.27	20	0.043	1.0	Pass

Remark: dBuV/m=dBm-20lg(d)+104.77; data for mode B comes from FCC ID 2AC7Z-ESPWROOM32D

Conclusion:

EUT is compliance with the RF exposure.

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