

RF TEST REPORT

FCC

APPLICANT

Socket Mobile, Inc.

MODEL NAME

XC100

FCC ID

LUBMA41-X

REPORT NUMBER

HA230821-SOC-002-R05-1

TEST REPORT

Date of Issue

June 17, 2024

Test Site

Hyundai C-Tech, Inc. dba HCT America, Inc.
1726 Ringwood Ave, San Jose, CA 95114.5, USA

Applicant	Socket Mobile, Inc.
Applicant Address	40675 Encyclopedia Cir., Fremont, CA 94538, U.S.A.
FCC ID	LUBMA41-X
Model Name	XC100
EUT Type	Qi Charging case
FCC Classification	Part15 Low Power Transmitter Below 175 kHz (DCD)
FCC Rule Part(s)	Part 15.209
Test Procedure	ANSI C63.10-2013, KDB 680106 D01 v04

The device bearing the trade name and model specified above, has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures required. The results of testing in this report apply only to the product which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Hyundai C-Tech, Inc. dba HCT America, Inc. certifies that no party to application has been denied the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C 862

Tested By

John park

Test Engineer

Reviewed By

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REVISION HISTORY

The revision history for this document is shown in table.

TEST REPORT NO.	DATE	DESCRIPTION
HA230821-SOC-002-R05	March 11, 2024	Initial Issue
HA230821-SOC-002-R05-1	June 17, 2024	1. Typo fixed 2. Removed all ISED requirements and measurement results

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1. GENERAL INFORMATION

EUT DESCRIPTION

Model	XC100
EUT Type	Qi Charging case
Serial Number	24148530001225432
Power Supply	5 V d.c., 3 A
RF Specification	Wireless Power Transfer
Operating Environment	Indoor and outdoor
Operating Temperature	0 °C ~ +45 °C

RF SPECIFICATION SUBJECT TO THE REPORT

RF Specification	Wireless Power Transfer
Transmitter Chain	1
Frequency Range	114.5 kHz
Max. Transmit Power	-0.3 dBuV/m @300 m
Number of Channels	1 Channel
Antenna Specification ¹⁾	Loop antenna
Firmware Version ²⁾	588
Hardware Version ²⁾	Rev A
Date(s) of Tests	December 05, 2023 ~ January 05, 2024

Note(s) :

1. Antenna information is based on the document provided.
2. Firmware and Hardware Versions are provided by the client.

2. METHODOLOGY

The measurement procedure described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Device (ANSI C63.10-2013) is used in the measurement of the test device.

EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207 and 15.209 under the FCC Rule Part 15 Subpart C.

GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2 of ANSI C63.10. (Version :2013) Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane below 1GHz. Above 1GHz with 1.5m using absorbers between the EUT and receive antenna. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3 m away from the receiving antenna, which varied from 1 m to 4 m to find out the highest emission. Also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emission, the relative positions of this hand-held transmitter (EUT) were rotated through three orthogonal axes according to the requirements in Section 8 of ANSI C63.10. (Version: 2013)

DESCRIPTION OF TEST MODES

The EUT has been tested at normal mode. The test was conducted using the cellular phone provided by the manufacturer as a wireless power receiver

3. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment's, which is traceable to recognized national standards. Especially, all antenna for measurement is calibrated in accordance with the requirements of C63.5 (Version : 2017).

4. FACILITIES AND ACCREDITATIONS

FACILITIES

The SAC (Semi-Anechoic Chamber) and conducted measurement facility used to collect the radiated data are located at 1726 Ringwood Avenue, San Jose, California 95114.5, USA. (LAB CODE : US0198)

The site is constructed in conformance with the requirements of ANSI C63.4. (Version :2014) and CISPR Publication 22.



EQUIPMENT

Radiated emissions are measured with one or more of the following types of Linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers. Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

5. ANTENNA REQUIREMENTS

According to FCC 47 CFR §15.203:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.”

- (1) The antenna of this E.U.T is permanently attached and there is no provision for connection to an external antenna.
- (2) The E.U.T Complies with the requirement of §15.203

6. MEASUREMENT UNCERTAINTY

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95 % level of confidence. The measurement data shown herein meets or exceeds the U_{CISPR} measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Parameter	Expanded Uncertainty
Occupied Bandwidth	± 12.4 kHz
Radiated Emissions (below 1 GHz)	± 6.09 dB
Conducted Emission	± 2.55 dB

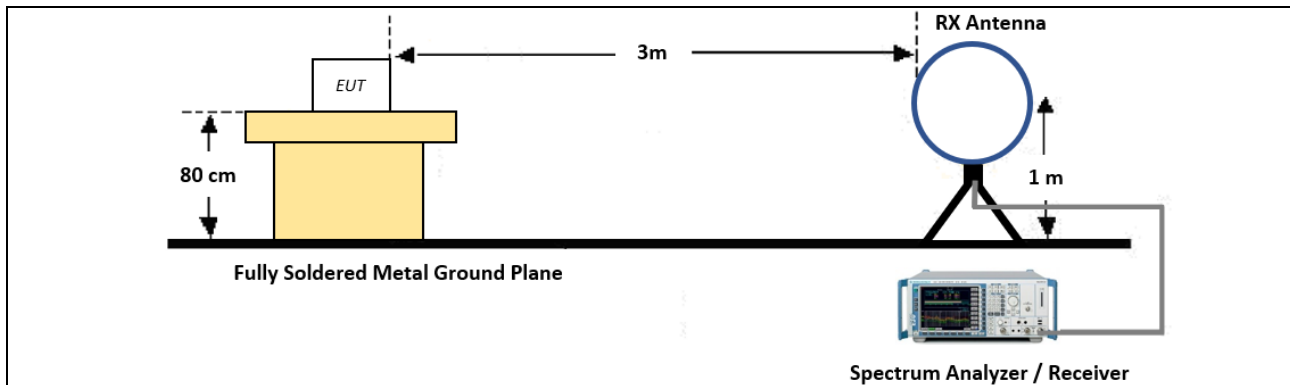
7. DESCRIPTION OF TESTS

7.1. 20 dB BANDWIDTH / 99 % OCCUPIED BANDWIDTH

LIMIT

20 dB bandwidth : According to §15.215(c), the bandwidth at 20 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the receive antenna while the EUT is operating in transmission mode at the appropriate frequencies.

TEST SETUP



TEST PROCEDURE (20 dB BANDWIDTH)

The Spectrum Analyzer setting :

- RBW = 1 kHz
- VBW $\geq 3 \times$ RBW
- Detector = Peak
- Trace mode = max hold
- Sweep = auto couple
- Allow the trace to stabilize
- Use X dB bandwidth measurement function from the spectrum analyzer by setting X dB to 20 dB

TEST PROCEDURE (99% Bandwidth)

The transmitter output is connected to the spectrum analyzer.

- RBW = 1 kHz
- VBW $\geq 3 \times$ RBW
- Detector = Peak
- Trace mode = max hold
- Sweep = auto couple
- Allow the trace to stabilize

Note(s) :

Bandwidth measurement feature in the spectrum analyzer was used to measure 99 % bandwidth

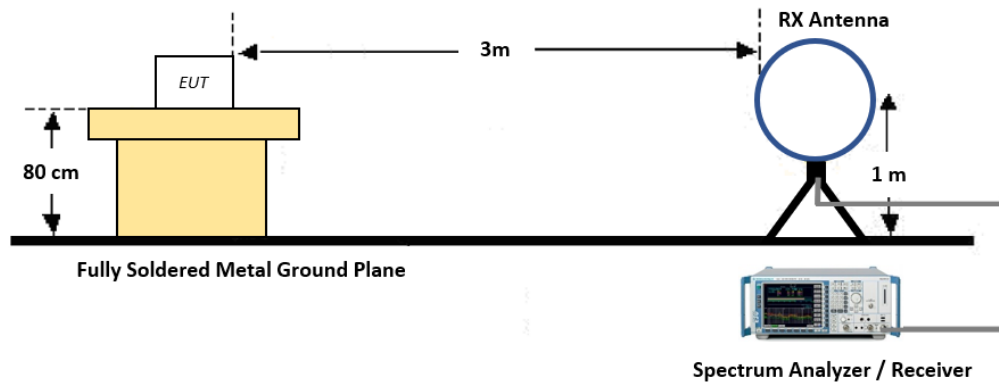
7.2. RADIATED EMISSIONS

RADIATION EMISSION LIMIT

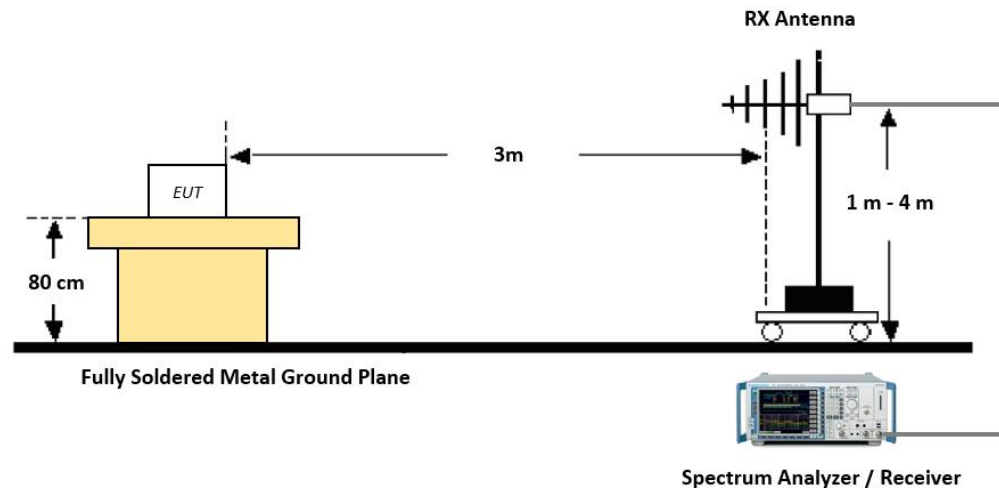
FCC : 47 CFR § 15.209		
Frequency (MHz)	Field Strength (uV/m)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

TEST SETUP

Below 30 MHz



30 MHz - 1 GHz



TEST PROCEDURE OF RADIATED SPURIOUS EMISSION (BELOW 30 MHz)

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The loop antenna was placed at a location 3m from the EUT
3. The EUT is placed on a turntable, which is 0.8m above ground plane.
4. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
5. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
6. Distance Correction Factor (0.009 MHz – 0.490 MHz) = $40 \cdot \log(3 \text{ m}/300 \text{ m}) = -80 \text{ dB}$
Measurement Distance: 3 m
7. Distance Correction Factor (0.490 MHz – 30 MHz) = $40 \cdot \log(3 \text{ m}/30 \text{ m}) = -40 \text{ dB}$
Measurement Distance: 3 m
8. Spectrum Setting
 - Frequency Range = 9 kHz ~ 30 MHz
 - Detector = Peak
 - Trace = Max hold
 - RBW = 9 kHz
 - VBW $\geq 3 \cdot \text{RBW}$
9. Total = Reading Value + Antenna Factor (A.F) + Cable Loss (C.L)
10. There is a comparison data both open-field test site and alternative test site – semi-Anechoic chamber according to 414788 D01. And the results are properly calibrated.

TEST PROCEDURE OF RADIATED SPURIOUS EMISSION (30 MHz – 1 GHz)

1. The EUT was placed on a non-conductive table located on semi-anechoic chamber.
2. The EUT is placed on a turntable, which is 0.8 m above ground plane.
3. We have done x, y, z planes in EUT and horizontal and vertical polarization in detecting antenna.
4. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
5. Spectrum Setting
 - (1) Measurement Type (Peak):
 - Measured Frequency Range: 30 MHz – 1 GHz
 - Detector = Peak
 - Trace = Max hold
 - RBW = 100 kHz
 - VBW $\geq 3 \cdot \text{RBW}$
 - (2) Measurement Type(Quasi-peak):
 - Measured Frequency Range: 30 MHz – 1 GHz
 - Detector = Quasi-Peak
 - RBW = 120 kHz
6. Total = Reading Value + Antenna Factor (A.F) + Cable Loss (C.L)

7.3. AC POWER LINE CONDUCTED EMISSIONS

LIMIT

47 CFR § 15.207

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN).

Frequency Range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

*Decreases with the logarithm of the frequency.

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

TEST SETUP

See test photographs attached in Annex A for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT is placed on a wooden table 80 cm above the reference ground plane.
2. The EUT is connected via LISN to a test power supply.
3. The measurement results are obtained as described below:
4. Detectors : Quasi Peak and Average Detector.

According to FCC KDB 174176 D01 Line Conducted FAQ v01r01 :

Devices Operating Above 30 MHz

For a device with a permanent or detachable antenna operating above 30 MHz, measurements must be performed with the antenna connected as specified in clause 6.2 of ANSI C63.10-2013.

Devices Operating Below 30 MHz

For a device with a permanent or detachable antenna operating at or below 30 MHz, the FCC will accept measurements performed with a suitable dummy load in lieu of the antenna under the following conditions:

- (1) Perform the AC power-line conducted tests with the antenna connected to determine compliance with Section 15.207 limits outside the transmitter's fundamental emission band;
- (2) Retest with a dummy load in lieu of the antenna to determine compliance with Section 15.207 limits within the transmitter's fundamental emission band. For a detachable antenna, remove the antenna and connect a suitable dummy load to the antenna connector. For a permanent antenna, remove the antenna and terminate the RF output with a dummy load or network which simulates the antenna in the fundamental frequency band. All measurements must be performed as specified in clause 6.2 of ANSI C63.10-2013.

Sample Calculation

Quasi-peak(Final Result) = Reading Value + Correction Factor

8. SUMMARY OF TEST RESULTS

Test Description	FCC Part Section(s)	Test Limit	Test Condition	Test Result
Occupied Bandwidth	§15.215	- 1)	Radiated	PASS
Radiated Spurious Emissions and Fundamental Emission	§15.209	cf. Section 7.2		PASS
AC Power line Conducted Emissions	§15.207	cf. Section 7.3	Conducted	PASS

Note(s) :

1. For reporting purposes only

WORST CASE CONFIGURATION

RADIATED TEST

1. EUT Axis

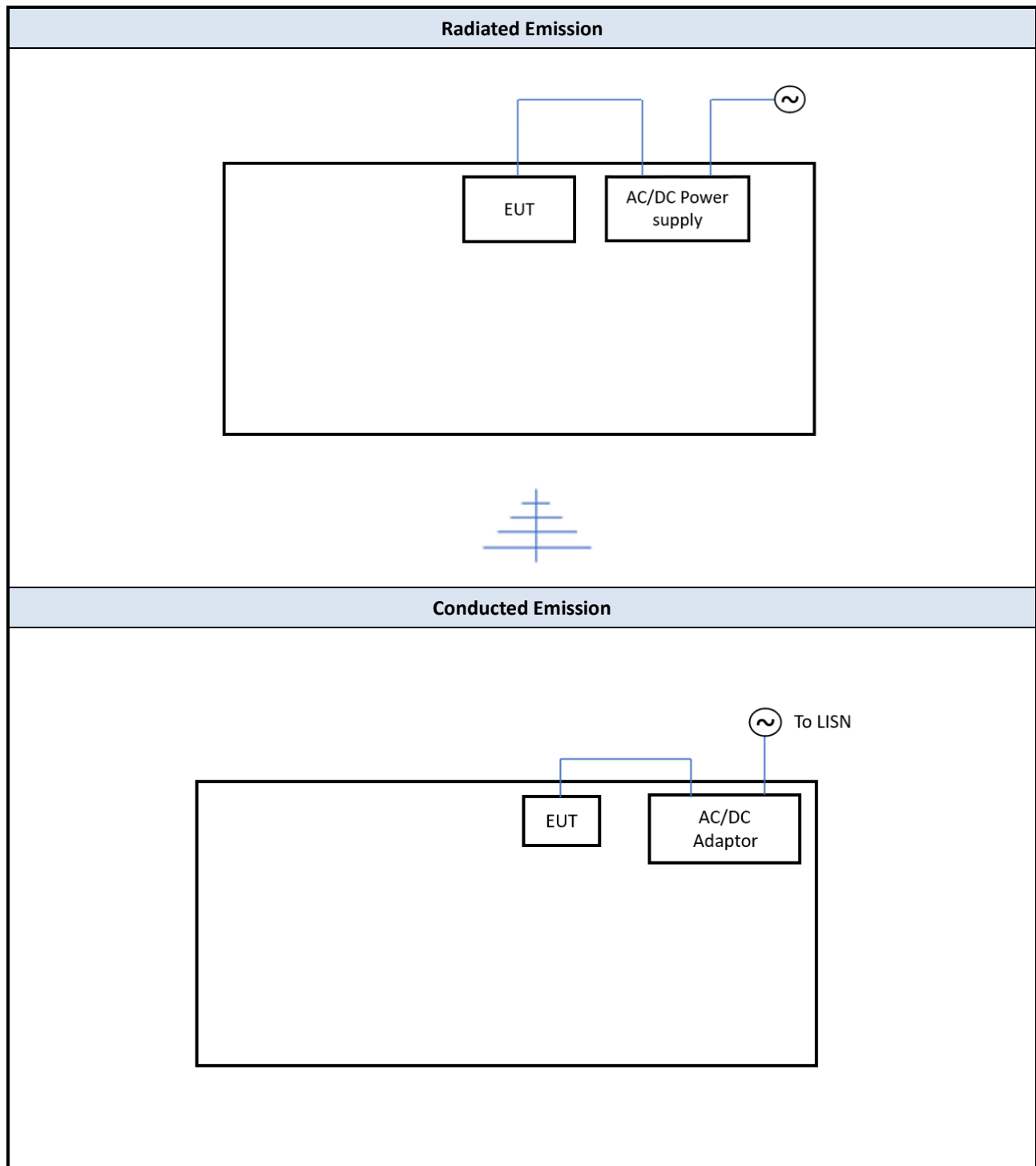
- All X, Y, and Z positions for horizontal / vertical antenna polarization were investigated to find the worst-case position.
 - Y position was selected for the final evaluation.

AC POWER LINE CONNECTED EMISSION TEST

AC Line conducted emission test was performed in two modes because the EUT operates below 30 MHz.

- Antenna connected to the EUT
- Antenna removed from the EUT

TEST CONFIGURATION



LIST OF SUPPORT EQUIPMENT

Equipment Type	Model No.	Serial Number	Manufacturer	Qty	Note
AC/DC Adaptor	F8M731	MSIP-REM-K7S-F8M731	Belkin	1	100-240 V~, 0.5 A, 50-60 Hz
Cellular phone	iPhone 14 Pro	V69CMQH44D	Apple	1	iOS 16.4.1

9. TEST RESULT

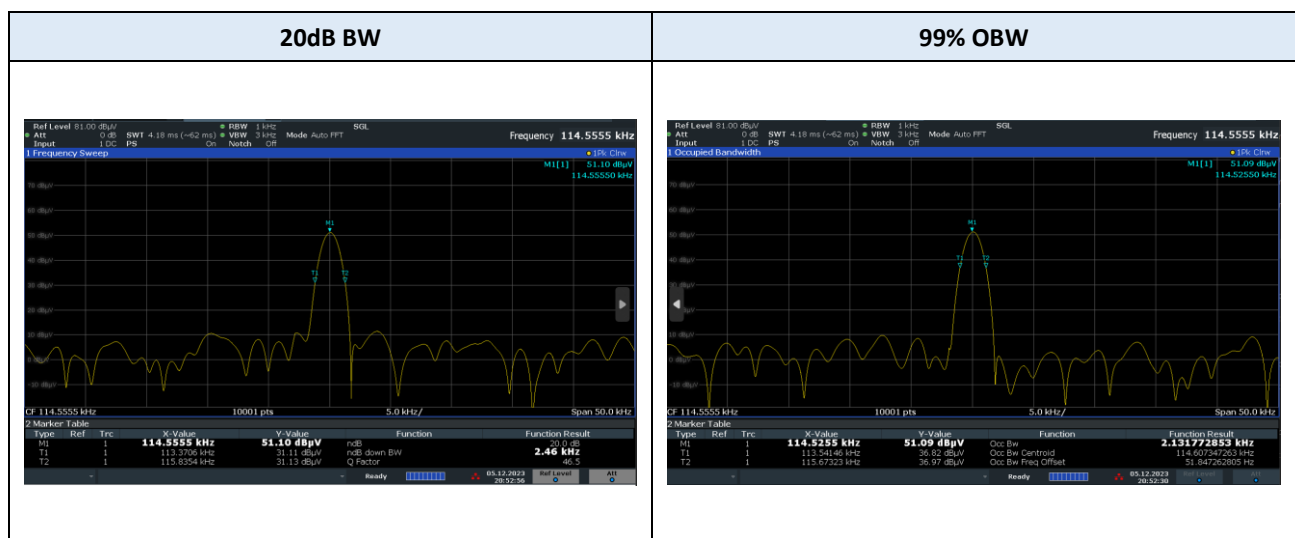
9.1 20 dB BANDWIDTH / 99 % OCCUPIED BANDWIDTH

Frequency (kHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
	Result	Result
114.5	2.46	2.13

Note(s) :

1. For reporting purposes only

■ TEST PLOTS



9.2. RADIATED SPURIOUS EMISSIONS AND FUNDAMENTAL EMISSION

Test Mode	WPT
Operating Frequency	114.5 kHz

Radiated Fundamental Emission

Frequency (MHz)	Polarization	Reading (dBuV)	Corr. ¹⁾ (dB)	Dis. ²⁾ (dB)	Total (dBuV/m) @ 300 m	Limit (dBuV/m)	Margin (dB)	Measurement Type
0.115	Bent over	50.1	20.5	-80	-9.4	26.4	35.8	26.4
0.115	180 °	59.2	20.5	-80	-0.3	26.4	26.7	26.4
0.115	90 °	55.2	20.5	-80	-4.3	26.4	30.7	26.4

Notes:

1. Correction Factor: Antenna Factor + Cable loss
2. Limit
 - specific Limits (uV/m) to (dBuV/m) = $20 \times \log(V/m) + 120$
3. Total (dBuV/m) = Reading (dBuV) + Correction Factor (dB) + Distance Extrapolation Factor (dB)
 - The measurement distance is 3 meters.
 - Distance extrapolation factor = $40 \log(\text{specific distance} / \text{test distance})$ (dB)
4. Max. fundamental level at 3 m is 79.7 dBuV/m

Radiated Spurious Emissions

Frequency Range : 9 kHz – 30MHz

Frequency (MHz)	Polarization	Reading (dBuV)	Corr. ¹⁾ (dB)	Dis. ²⁾ (dB)	Total (dBuV/m) @ 30 m	Limit (dBuV/m) ²⁾	Margin (dB)	Measurement Type
0.803	90 °	17.7	21	-40	-1.3	29.5	30.8	QP
0.816	180 °	5.7	21	-40	-13.3	29.4	42.7	QP

Notes:

1. Correction Factor: Antenna Factor + Cable loss
2. Limit
 - specific Limits (uV/m) to (dBuV/m) = $20 \times \log(V/m) + 120$
3. Total (dBuV/m) = Reading (dBuV) + Correction Factor (dB) + Distance Extrapolation Factor (dB)
 - The measurement distance is 3 meters.
 - Distance extrapolation factor = $40 \log(\text{specific distance} / \text{test distance})$ (dB)

Frequency Range : 30 MHz – 1 GHz

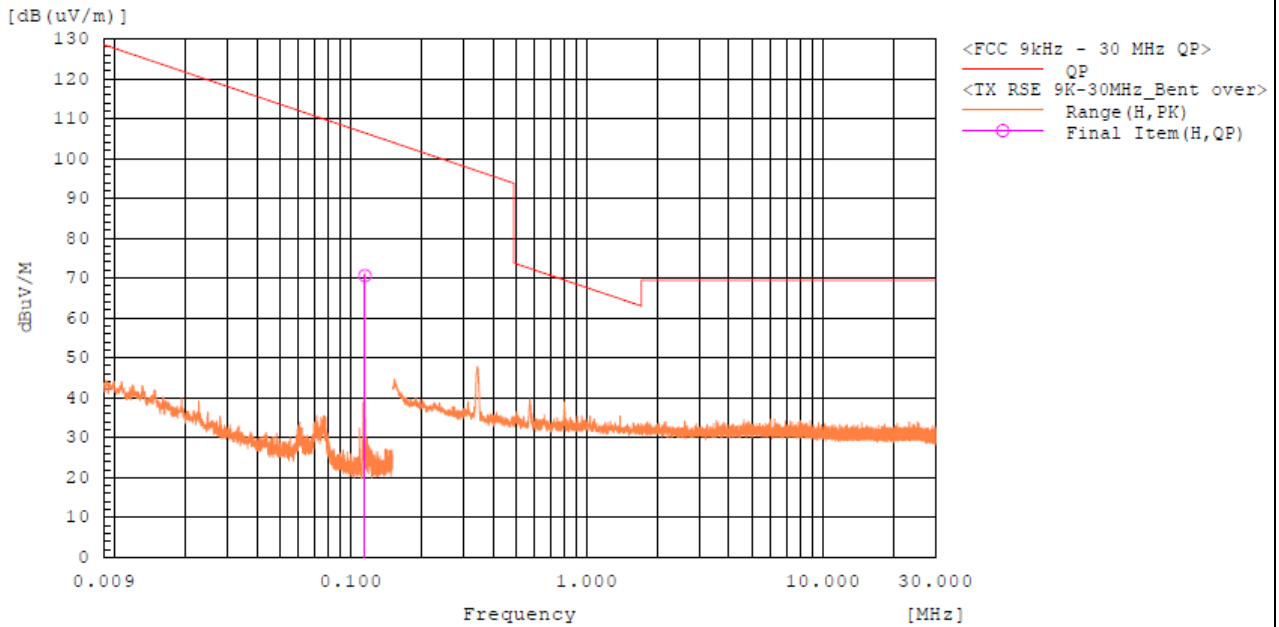
Frequency (MHz)	Polarization	Reading (dBuV)	Corr. ¹⁾ (dB)	Total (dBuV/m) @ 3 m	Limit (dBuV/m)	Margin (dB)	Measurement Type
42.646	V	14.3	18.3	32.6	40	7.4	QP
79.454	V	17.0	14.0	31.0	40	9.0	QP
84.692	H	15.2	13.9	29.1	40	10.9	QP
159.422	H	8.6	18.6	27.2	43.5	16.3	QP
164.316	V	17.2	18.4	35.6	43.5	7.9	QP
472.961	V	2.4	24.6	27.0	46	19.0	QP
510.346	H	-3.6	24.7	21.1	46	24.9	QP

Note(s) :

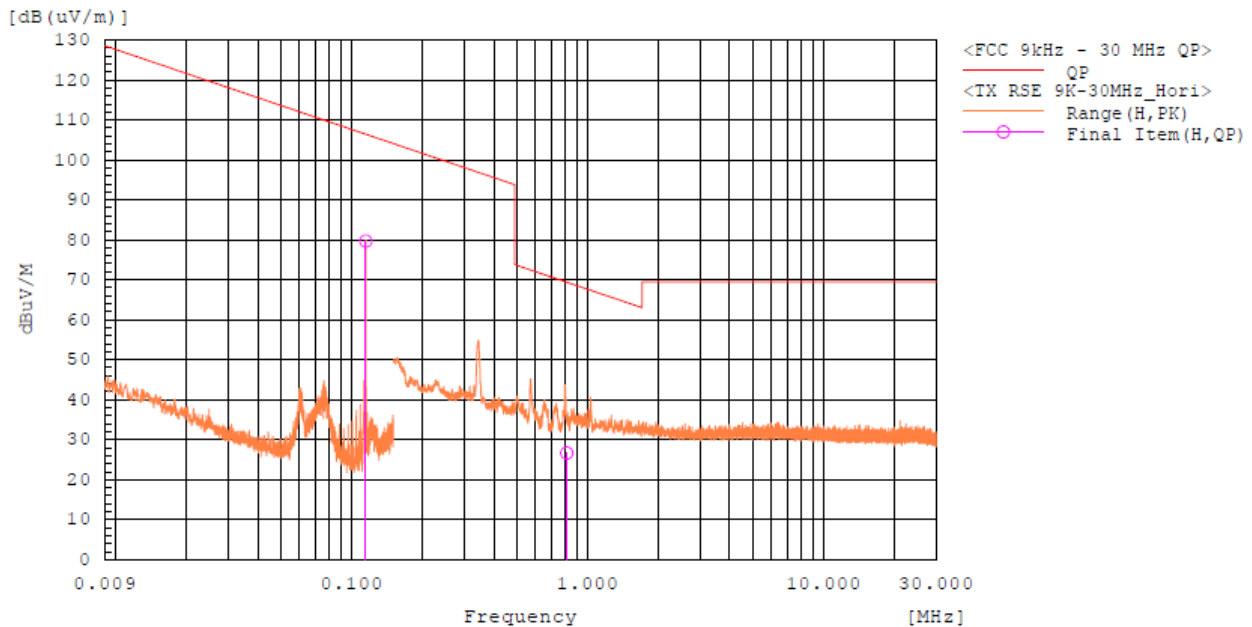
1. Correction Factor: Antenna Factor + Cable loss + Preamplifier Gain

■ TEST PLOTS

Radiated Spurious Emission 9 kHz – 30 MHz (Antenna Position Bent over)



Radiated Spurious Emission 9 kHz – 30 MHz (Antenna Position 90°)

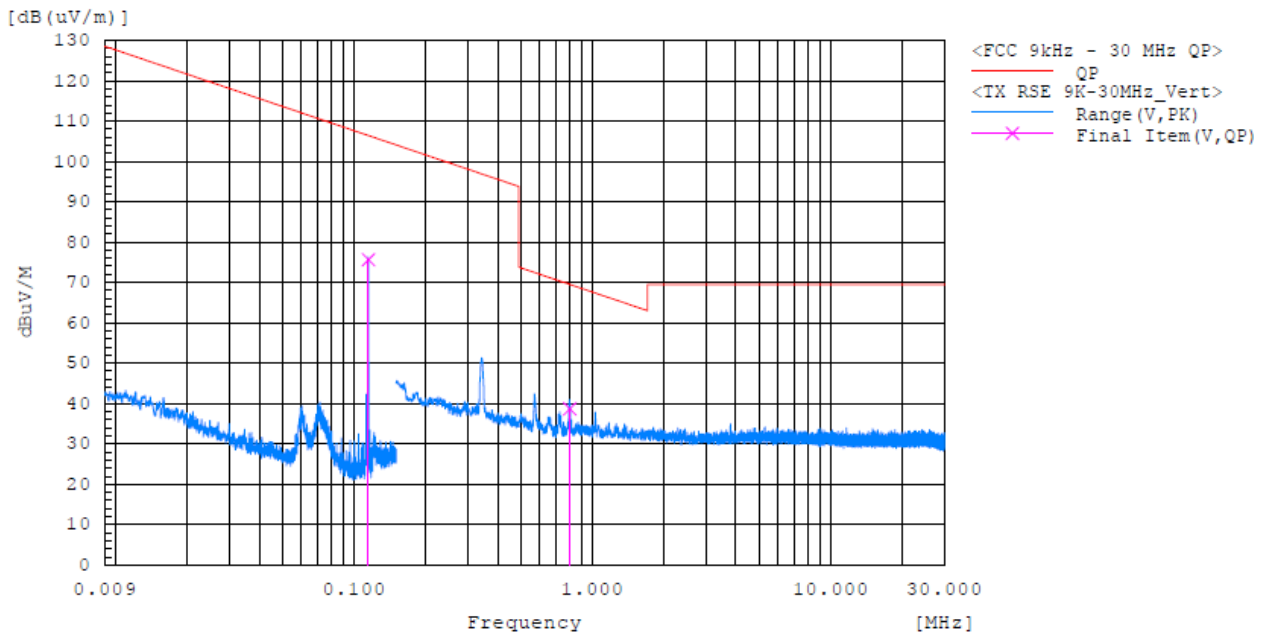


Note(s):

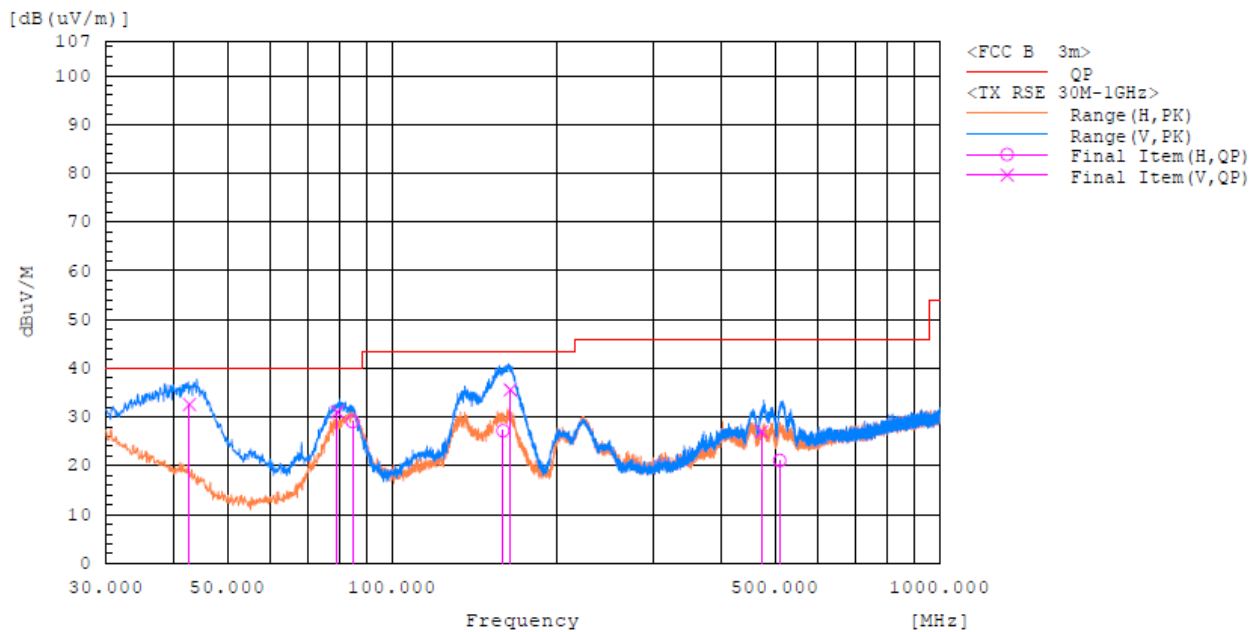
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■ TEST PLOTS

Radiated Spurious Emission 9 kHz – 30 MHz (Antenna Position 180°)



Radiated Spurious Emission 30 MHz – 1 GHz



Note(s):

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9.3. POWERLINE CONDUCTED EMISSIONS

AC Main : TX mode

Frequency (MHz)	Line	Reading (dBμV)		Corr. ¹⁾ (dB)	Level (dBμV)		Limit (dBμV)		Margin (dB)	
		QP	CAV		QP	CAV	QP	CAV	QP	CAV
0.153	L1	42.8	21.3	9.6	52.4	30.9	65.8	55.8	13.4	24.9
0.654	L1	30.2	18.8	9.6	39.8	28.4	56	46	16.2	17.6
1.450	L1	25.7	13.3	9.7	35.4	23.0	56	46	20.6	23.0
4.324	L1	18.7	8.3	9.8	28.5	18.1	56	46	27.5	27.9
15.118	L1	23.1	15.1	10.1	33.2	25.2	60	50	26.8	24.8

Frequency (MHz)	Line	Reading (dBμV)		Corr. ¹⁾ (dB)	Level (dBμV)		Limit (dBμV)		Margin (dB)	
		QP	CAV		QP	CAV	QP	CAV	QP	CAV
0.156	N	41.6	19.5	9.6	51.2	29.1	65.7	55.7	14.5	26.6
0.727	N	29.8	16.2	9.6	39.4	25.8	56	46	16.6	20.2
1.243	N	23.6	9.0	9.7	33.3	18.7	56	46	22.7	27.3
15.691	N	18.4	12.0	10.1	28.5	22.1	60	50	31.5	27.9

AC Main : : RF output terminated with dummy load

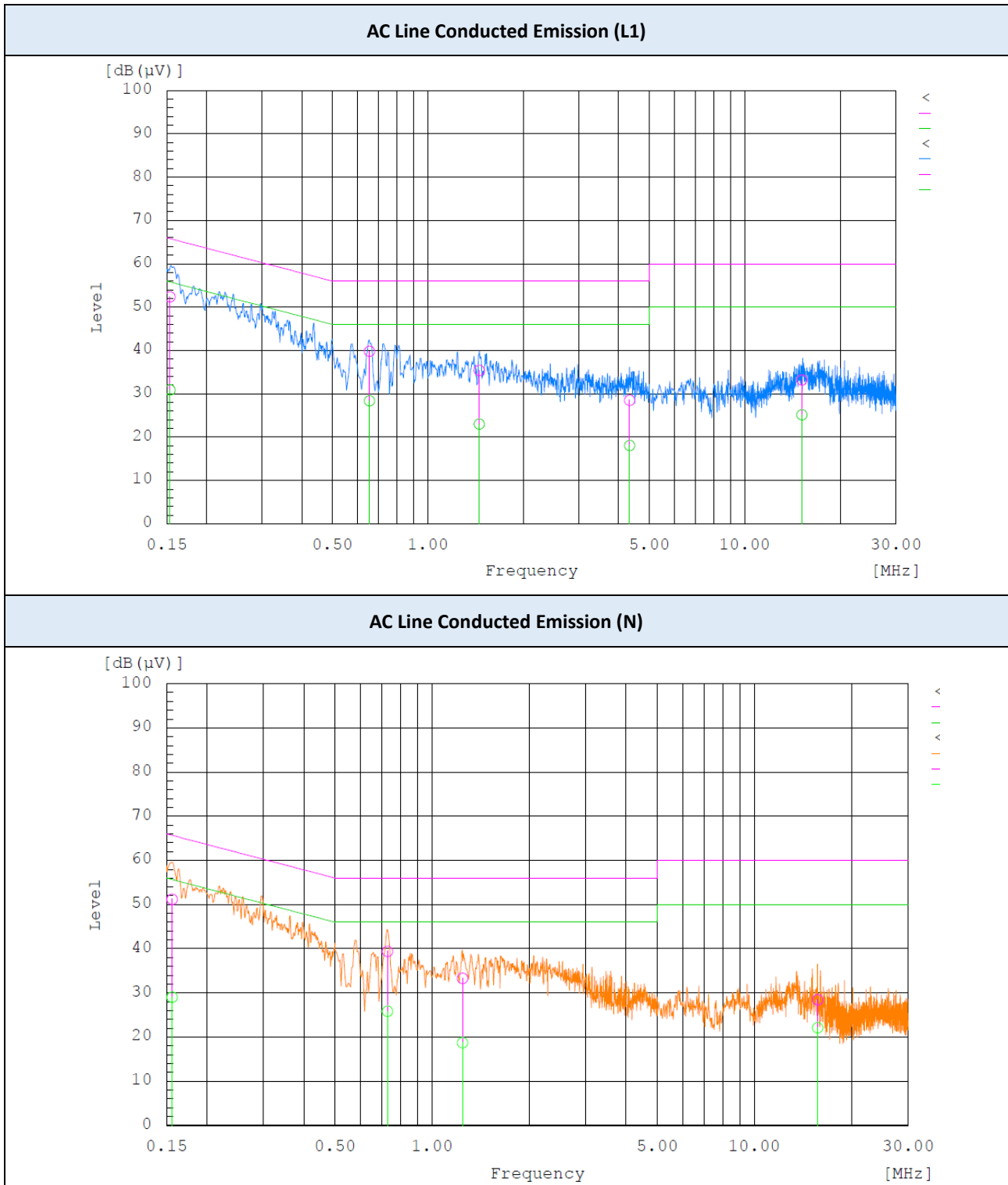
Frequency (MHz)	Line	Reading (dBμV)		Corr. ¹⁾ (dB)	Level (dBμV)		Limit (dBμV)		Margin (dB)	
		QP	CAV		QP	CAV	QP	CAV	QP	CAV
0.216	L1	5.4	-3.5	9.6	15.0	6.1	63	53	48.0	46.9
0.745	L1	17.2	1.5	9.6	26.8	11.1	56	46	29.2	34.9
1.163	L1	5.7	-4.0	9.7	15.4	5.7	56	46	40.6	40.3
12.763	L1	2.2	-3.0	10.1	12.3	7.1	60	50	47.7	42.9

Frequency (MHz)	Line	Reading (dBμV)		Corr. ¹⁾ (dB)	Level (dBμV)		Limit (dBμV)		Margin (dB)	
		QP	CAV		QP	CAV	QP	CAV	QP	CAV
0.152	N	7.7	-2.6	9.6	17.3	7.0	65.9	55.9	48.6	48.9
0.755	N	11.2	-1.4	9.6	20.8	8.2	56	46	35.2	37.8
1.061	N	2.0	-4.6	9.7	11.7	5.1	56	46	44.3	40.9
18.485	N	0.2	-5.3	10.2	10.4	4.9	60	50	49.6	45.1

Note :

1. Quasi-peak(Final Result) = Reading Value + Correction Factor

■ TEST PLOTS

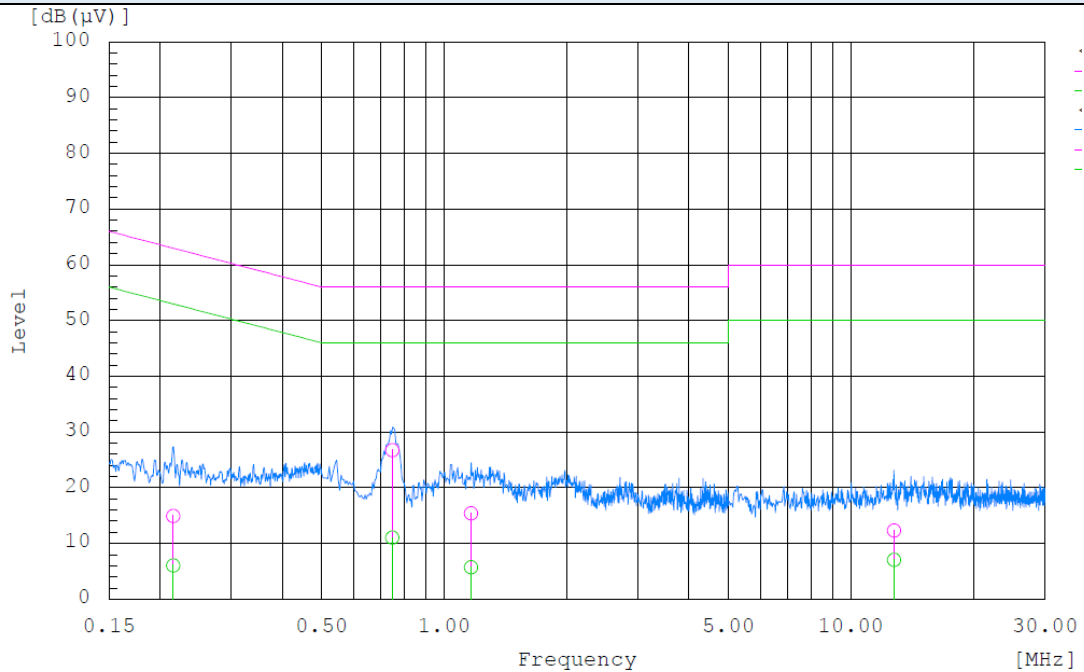


Note(s):

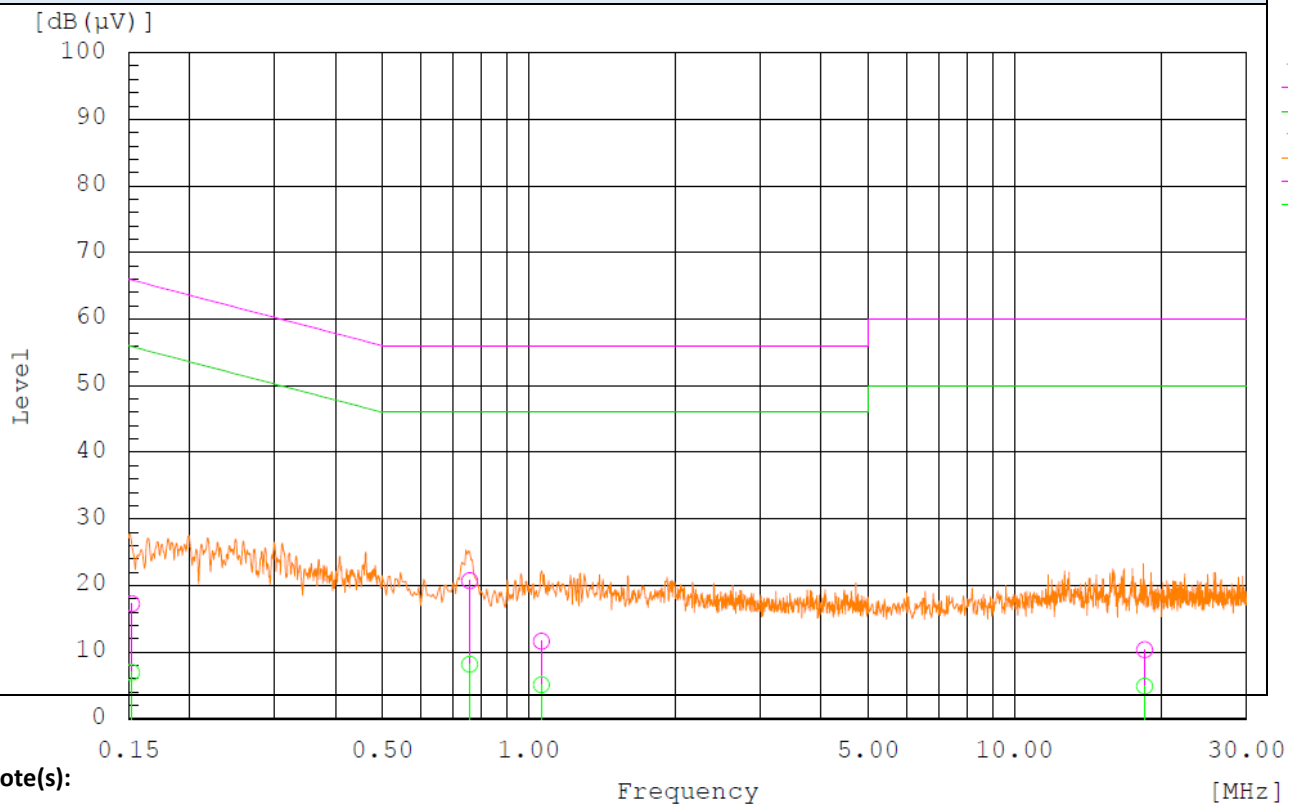
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■ TEST PLOTS

AC Line Conducted Emission (L1) : RF output terminated with dummy load



AC Line Conducted Emission (N) : RF output terminated with dummy load



Note(s):

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10. LIST OF TEST EQUIPMENT

No.	Instrument	Model No.	Calibration Due (mm/dd/yy)	Manufacture	Serial No.
<input checked="" type="checkbox"/>	Signal Analyzer (1 Hz ~ 40.0 GHz)	ESW44	10/24/2024	Rohde & Schwarz	102015
<input checked="" type="checkbox"/>	Loop Antenna (0.009 ~ 30 MHz)	HLA 6121	09/12/2025	TESEQ	43964
<input checked="" type="checkbox"/>	BI-LOG Antenna (30 MHz ~ 6 GHz)	JB6	03/06/2025	Sunol	A071116
<input checked="" type="checkbox"/>	EMI Test Receiver	ESR3	12/14/2024	Rohde & Schwarz	102363
<input checked="" type="checkbox"/>	LISN	ENV216	01/17/2024	Rohde & Schwarz	101349

Note(s) :

1. Equipment listed above that calibrated during the testing period was set for test after the calibration.
2. Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

APPENDIX A. TEST SETUP PHOTOS

The setup photos are provided as a separate document.

APPENDIX B. PHOTOGRAPHS OF EUT

B.1. EXTERNAL PHOTOS

The external photos are provided as a separate document.

B.2. INTERNAL PHOTOS

The internal photos are provided as a separate document.

END OF TEST REPORT