

Certificate of Test

NCT CO., LTD.

211-71, Geumgok-ro, Hwaseong-si, Gyeonggi-do, 18511, Republic of Korea
(Tel: +82-31-323-6070 / Fax: +82-31-323-6071)

Report No.:
NW2403-F003

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**1. Client**

- Name : G&I TECH CO., LTD.
- Address : 101-2311~2316, 92 Gwanmun-ro, Gwacheon-si, Gyeonggi-do, Rep. of Korea
- Date of Receipt : 2023-10-12

2. Use of Report : FCC Certification**3. Test Sample**

- Description / Model : GIWICS HUB / GIWICS-H
- FCC ID : 2BFGB-GIWICS-H

4. Place of Test : ■ Fixed test □ Field test

(Address:211-71, Geumgok-ro, Hwaseong-si, Gyeonggi-do, 18511, Republic of Korea)

5. Date of Test : 2024-03-08 ~ 2024-03-13**6. Test method used : FCC Part 15 Subpart C 15.203, 15.205, 15.209 and 15.231****7. Testing Environment :**

- Temperature: (25 ± 5) °C, Humidity: Less than 75 % R.H.

* Unless specified otherwise in the individual methods, the tests were conducted on ambient conditions.

8. Test Results : Refer to the test results

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.

This Test Report cannot be reproduced, except in full

This test report is not related to KOLAS recognition and RRA designation.

Affirmation

Tested by

Jungi, Sin

(signature)

Technical Manager

Il-shin, Kim

(signature)

Mar 18, 2024

NCT CO., LTD.



Contact us at report@nct.re.kr to confirm the authenticity of this report

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APPENDIX

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1. General Information's

1.1 Test Performed

Laboratory : NCT Co., Ltd.
Address : 211-71, Geumgok-ro, Hwaseong-si, Gyeonggi-do, 18511, Korea
Telephone : +82-31-323-6070
Facsimile : +82-31-323-6071
FCC Designation No. : KR0166
FCC Registration Number : 409631

2. Information's about Test Item

2.1 Applicant Information

Company name : G&I TECH CO., LTD.
Address : 101-2311~2316, 92 Gwanmun-ro, Gwacheon-si, Gyeonggi-do, Rep. of Korea
Telephone / Facsimile : +82 2 6242 0320 / +82 2 6243 0320

2.2 Equipment Under Test (EUT) description

Test item particulars : GIWICS HUB
Model and/or type reference : GIWICS-H
Additional model name : -
Serial number : Prototype
Antenna type and gain : Magnet CB Antenna with Max gain: 1.0 dBi
Date (s) of performance of tests: : 2024-03-08 ~ 2024-03-13
Date of receipt of test item : 2023-10-12
EUT condition : Pre-production, not damaged
Number of channel : 30
EUT Power Source : DC 5.00 V
Type of Modulation : FSK
Firmware version : 1.0
Hardware version : 1.0
Test software name(version) : Tera Term Version 4.106

2.3 Tested Frequency

Test frequency (MHz)		
Low frequency	Middle frequency	High frequency
434.060	434.410	434.785

2.4 Used Test Software Setting Value

Setting Item
Power
10

3. Test Report

3.1 Test Summary

Applied	FCC Rule	Test Items	Result
<input checked="" type="checkbox"/>	15.203	Antenna Requirement	C
<input checked="" type="checkbox"/>	15.231(c)	20 dB Bandwidth	C
<input checked="" type="checkbox"/>	15.231(a)	Deactivation Testing	C
<input checked="" type="checkbox"/>	15.205 & 15.209 15.231(b)	Radiated Spurious Emission	C
<input checked="" type="checkbox"/>	15.207	Conducted Emissions	C

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

The sample was tested according to the following specification: ANSI C63.10:2020.

Compliance was determined by specification limits of the applicable standard according to customer requirements.

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3.2 Test Report Version

Test Report No.	Date	Description
NW2403-F003	2024-03-18	Initial issue

Test Report No.: NW2403-F003

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3.3 Transmitter Requirements

3.3.1 Antenna Requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall 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.

3.3.1.1 Result

Complies

(The EUT has 1 external antenna with RP-SMA connector.)

3.3.2 20 dB Bandwidth

3.3.2.1 Test Setup

Refer to the APPENDIX I.

3.3.2.2 Limit

According to FCC 15.231(c) requirement:

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating between 70 MHz to 900 MHz. Those devices operating above 900 MHz, the emission spurious shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

3.3.2.3 Test Procedure

The waveform was received by the spectrum analyzer/EMI Test Receiver, plot the 20 dB bandwidth.

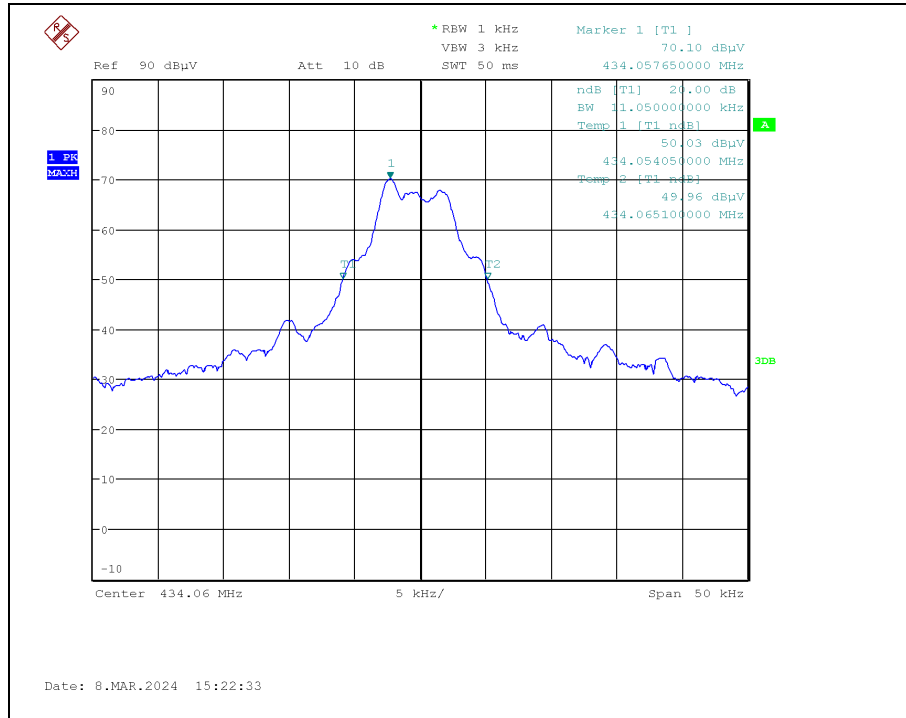
3.3.2.4 Test Result

Test Frequency (MHz)	20 dB Bandwidth (kHz)	Limit (kHz)
434.060	11.050	1085.150
434.410	11.000	1086.025
434.785	10.900	1086.963

3.3.2.5 Test Plot

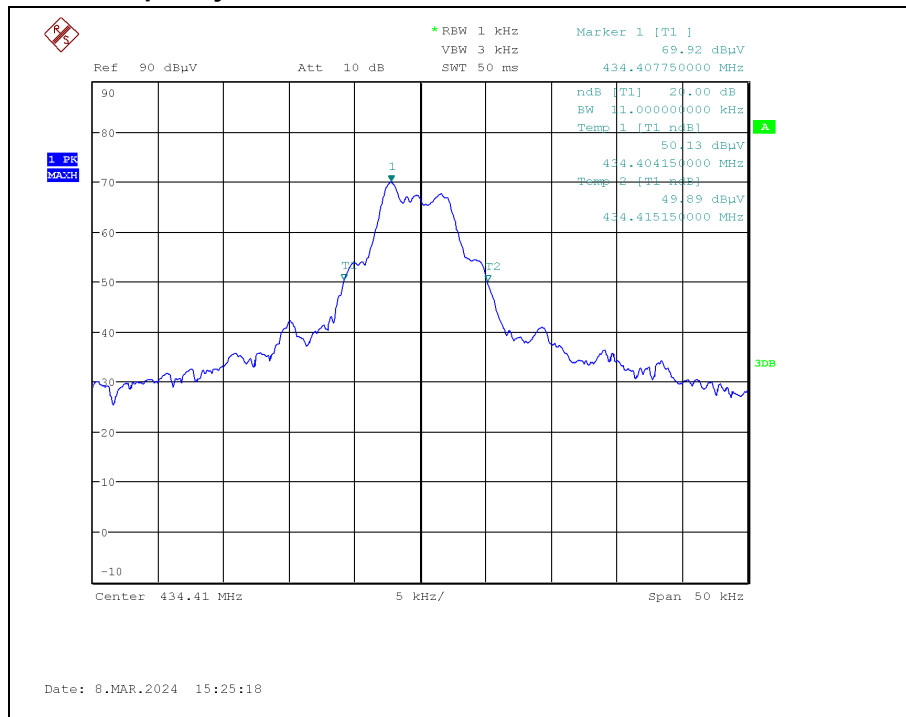
Low frequency

20 dB Bandwidth



Middle frequency

20 dB Bandwidth

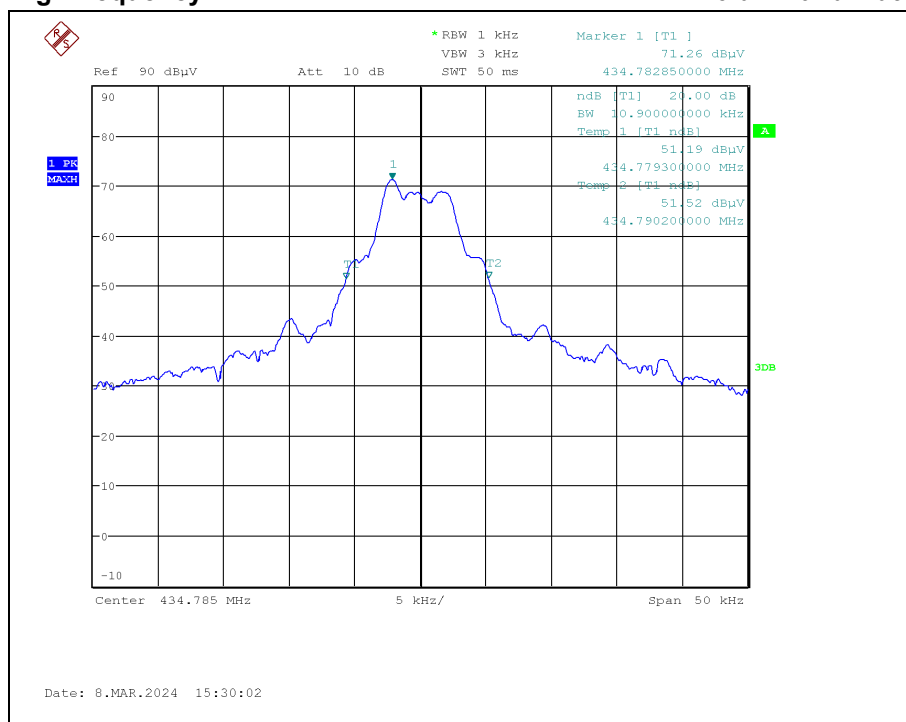


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High frequency

20 dB Bandwidth



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3.3.3 Deactivation Testing

3.3.3.1 Test Setup

Refer to the APPENDIX I.

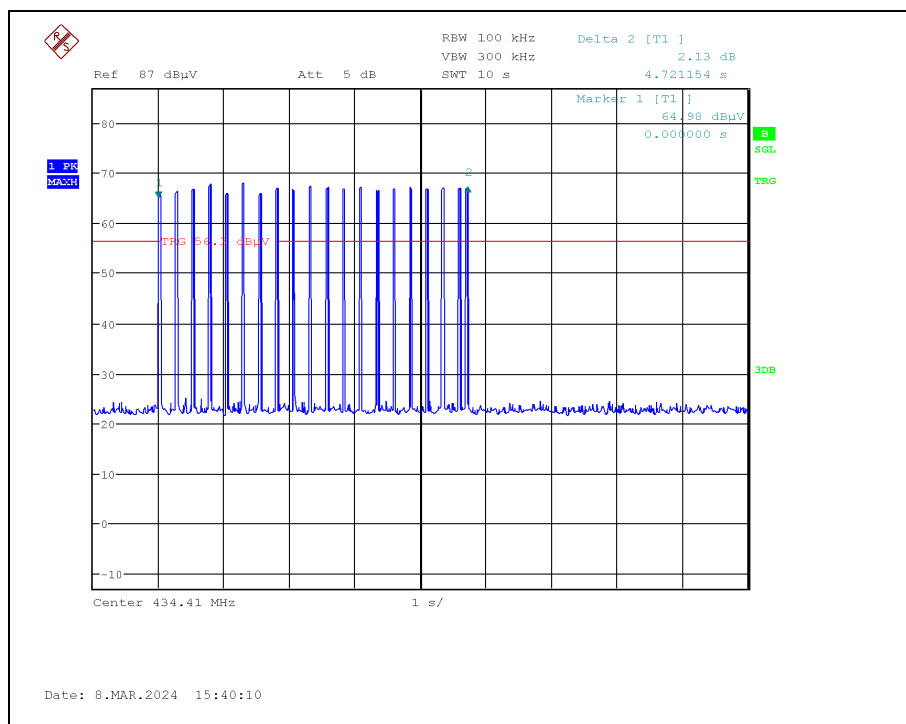
3.3.3.2 Limit

The EUT was complied with the requirement of FCC 15.231 (a)(1), which employed a switch that will automatically deactivate the transmitter within less than 5 seconds of being released.

3.3.3.3 Test Result

Maximum Deactivate Time (s)	Limit (s)	Result
4.721	< 5	Pass

3.3.3.4 Test Plot



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3.3.4 Radiated Spurious Emission

3.3.4.1 Test Setup

Refer to the APPENDIX I.

3.3.4.2 Limit

FCC §15.205, §15.209, §15.231 (b)

(b) In addition to the provisions of §15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental Frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (Microvolts/meter)
40.66-40.70	2,250	225
70-130	1,250	125
130-174	¹ 1,250 to 3,750	¹ 125 to 375
174-260	3,750	375
260-470	¹ 3 750 to 12,500	¹ 375 to 1,250
Above 470	12,500	1,250

¹ Linear interpolations.

- (1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.
- (2) Intentional radiators operating under the provisions of this section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in §15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.
- (3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

3.3.4.3 Test Procedure for Radiated Spurious Emission

Radiated emission measurements frequency range were performed from 30MHz to 5GHz. Spectrum Analyzer Resolution Bandwidth set to 100kHz or greater for frequencies from 30MHz to 1GHz, and set 1MHz Resolution Bandwidth for frequencies above 1GHz.

The EUT is place on non-conductive turntable for the test. If peripheral devices apply to the EUT, the peripheral devices will be connected to EUT and whole system. During the emission test, the signal is maximized through rotation and all cables were present worst-case emissions. The height of antenna and polarization is constantly changed for exploring maximum signal reading. The height of antenna can be up form reference ground to 4 meter and down to 1 meter.

3.3.4.4 Test Result

● Low frequency

Frequency (MHz)	Reading		Pol.	Factor (dB)	Limits		Result		Margin	
	(dBuV/m)				(dBuV/m)		(dBuV/m)		(dB)	
	AV / Peak				AV / Peak		AV / Peak		AV / Peak	
434.068	16.57	67.06	H	24.76	80.8	100.8	41.3	91.8	39.5	9.0
1 302.16	34.08	48.11	V	-13.79	54.0	74.0	20.3	34.3	33.7	39.7

● Middle frequency

Frequency (MHz)	Reading		Pol.	Factor (dB)	Limits		Result		Margin	
	(dBuV/m)				(dBuV/m)		(dBuV/m)		(dB)	
	AV / Peak				AV / Peak		AV / Peak		AV / Peak	
434.42	16.38	66.73	H	24.76	80.8	100.8	41.1	91.5	39.7	9.3
1 303.01	34.11	48.19	V	-13.79	54.0	74.0	20.3	34.4	33.7	39.6

● High frequency

Frequency (MHz)	Reading		Pol.	Factor (dB)	Limits		Result		Margin	
	(dBuV/m)				(dBuV/m)		(dBuV/m)		(dB)	
	AV / Peak				AV / Peak		AV / Peak		AV / Peak	
434.79	17.08	65.58	H	24.76	80.8	100.8	41.8	90.3	39.0	10.5
1 304.11	34.56	48.11	V	-13.79	54.0	74.0	20.8	34.3	33.2	39.7

Note 1: The radiated emissions were investigated 30 MHz to 5 GHz. And no other spurious and harmonic emissions were found above listed frequencies.

Note 2: Sample Calculation.

Level = Reading – Preamp + Correction Factor

Correction Factor = Antenna Factor + Cable Loss

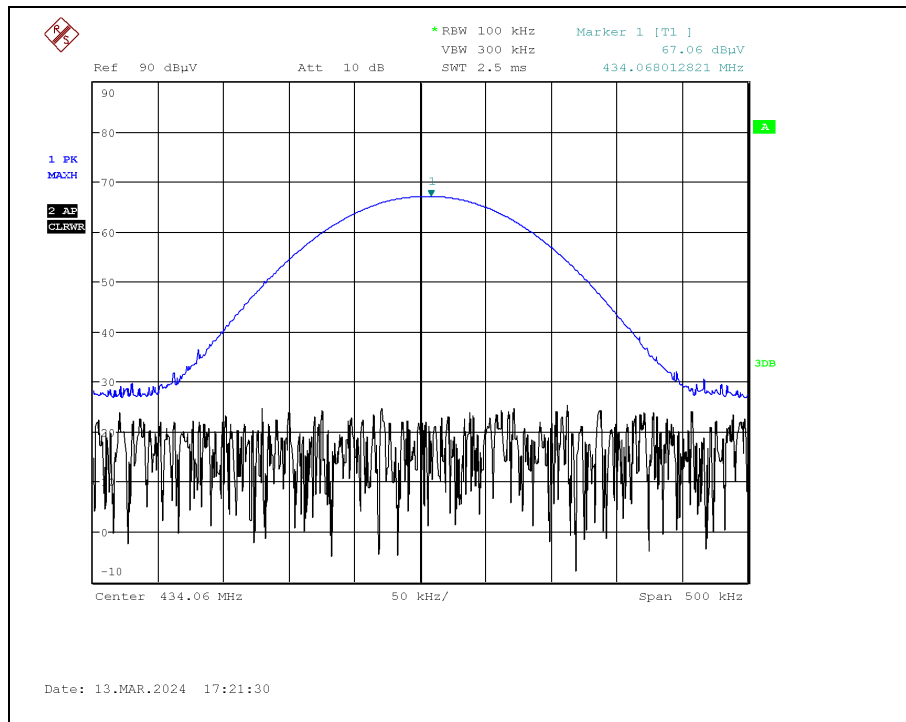
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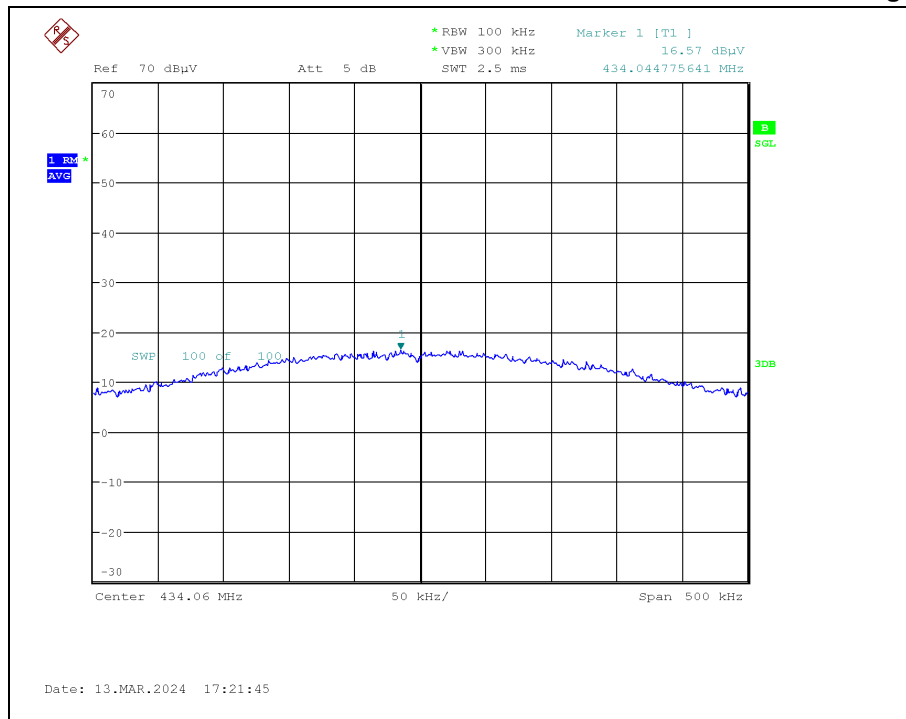
3.3.4.5 Test Plot for Radiated Spurious Emission

- Low frequency

Fundamental – Peak



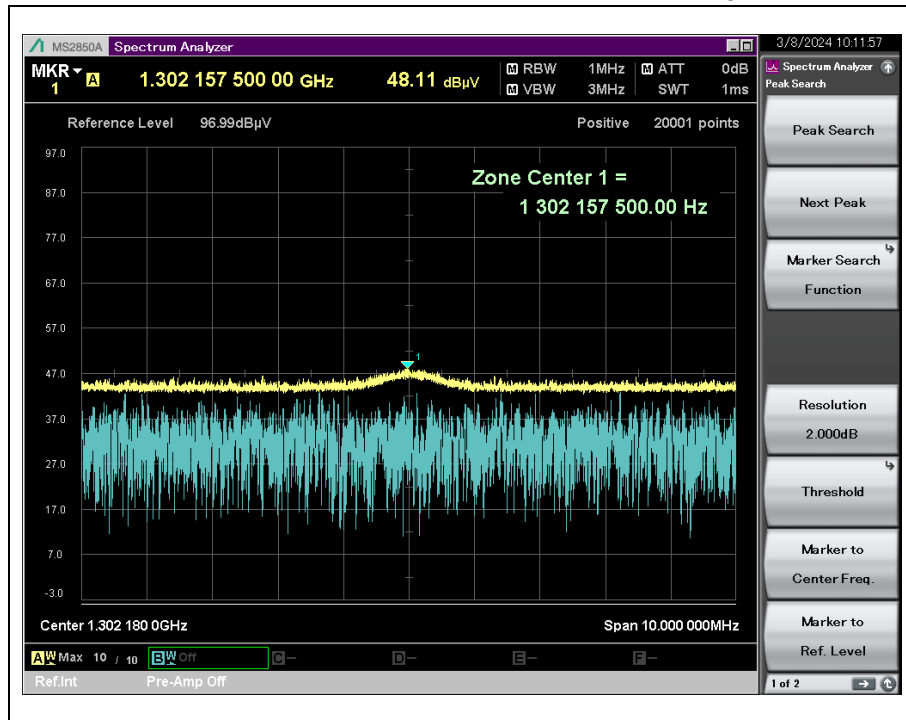
Fundamental – Average



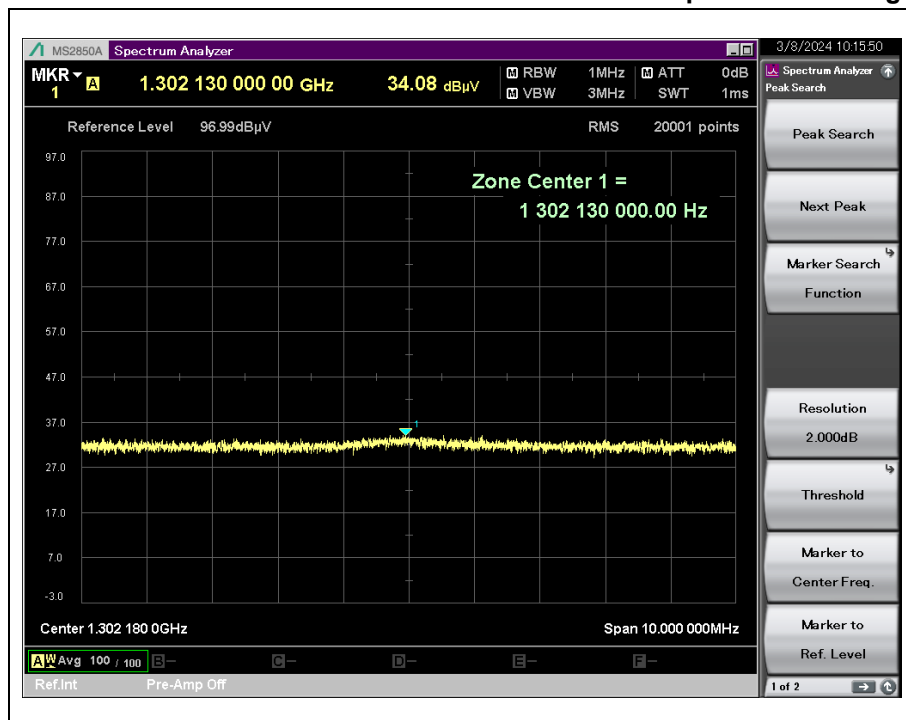
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Spurious – Peak



Spurious – Average

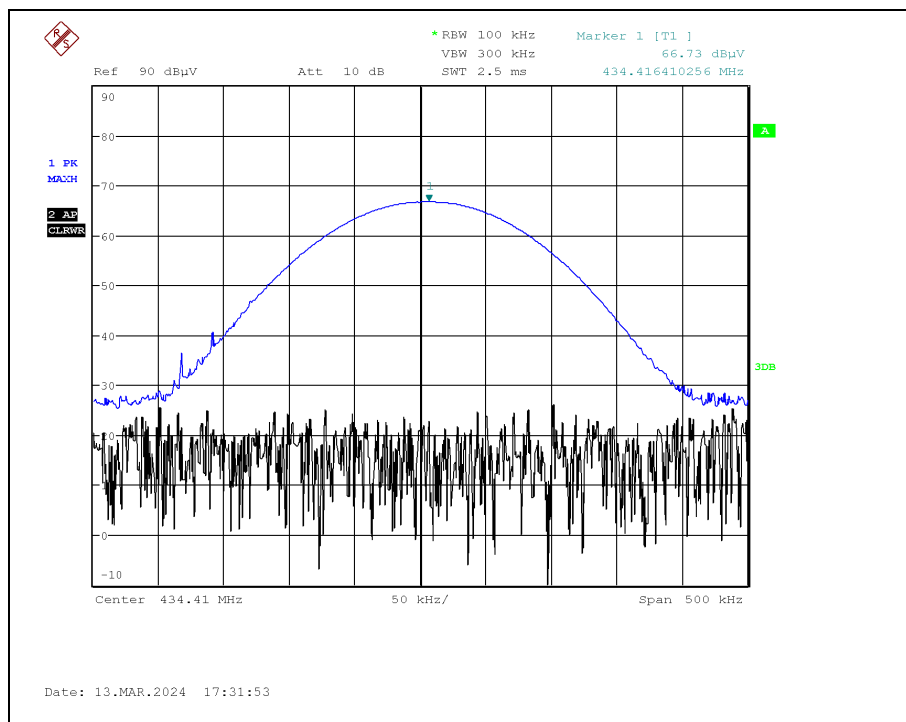


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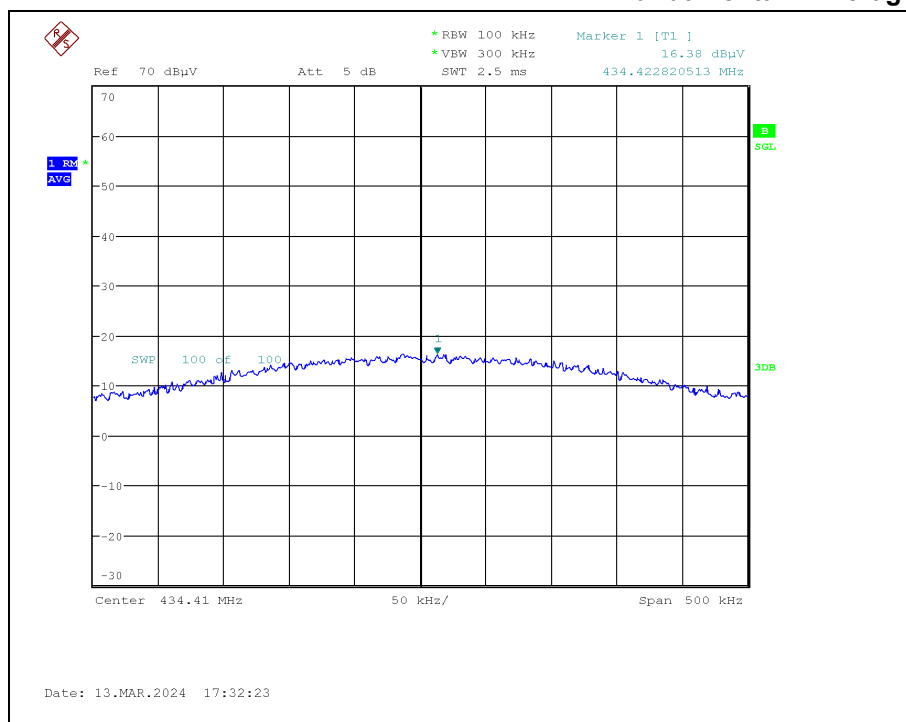
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- Middle frequency

Fundamental – Peak



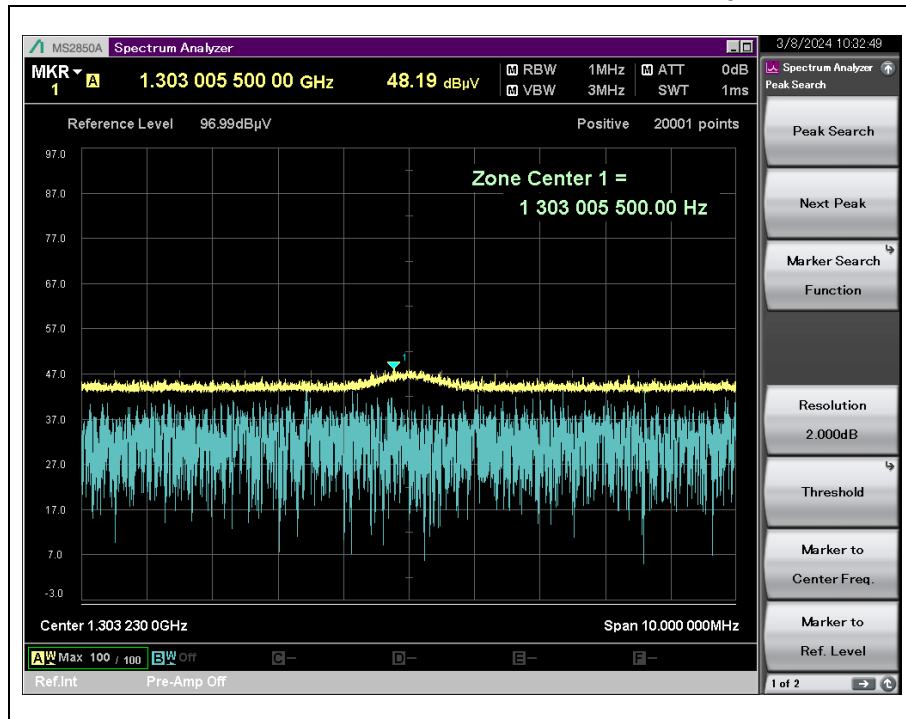
Fundamental – Average



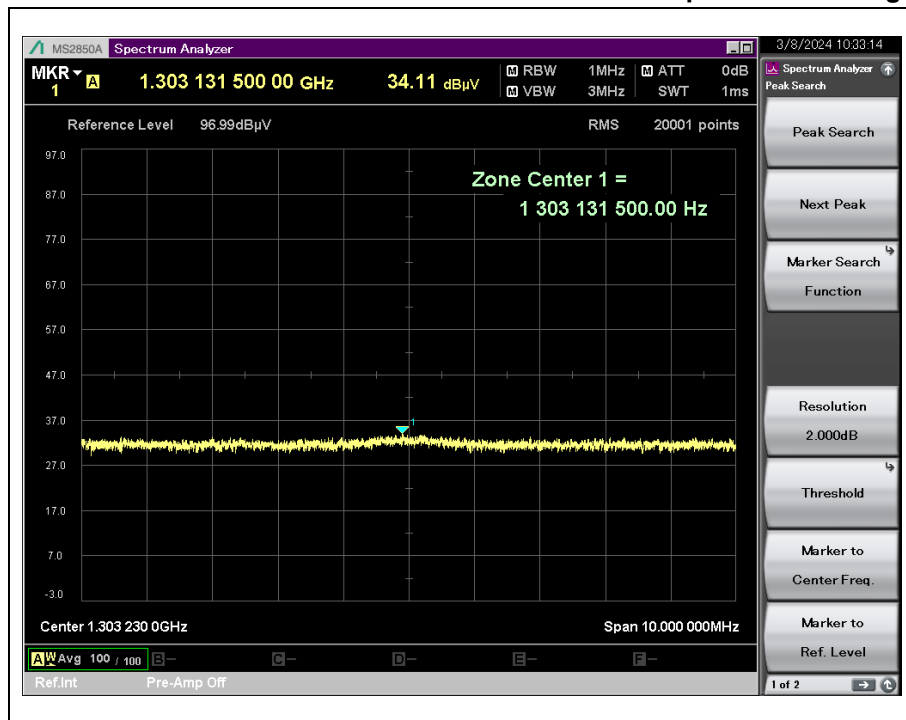
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Spurious – Peak



Spurious – Average

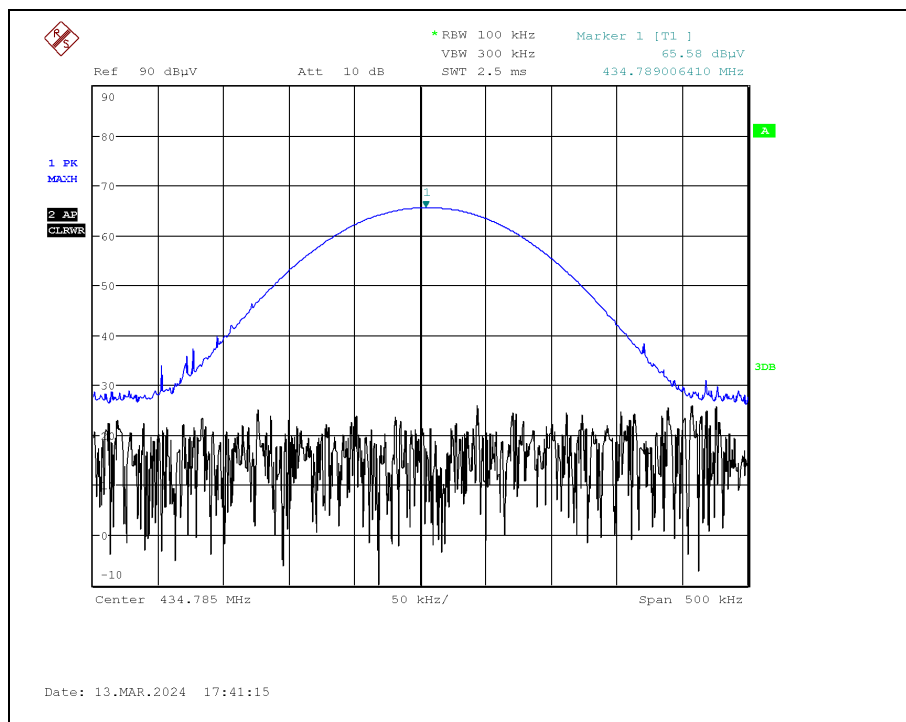


Test Report No.: NW2403-F003

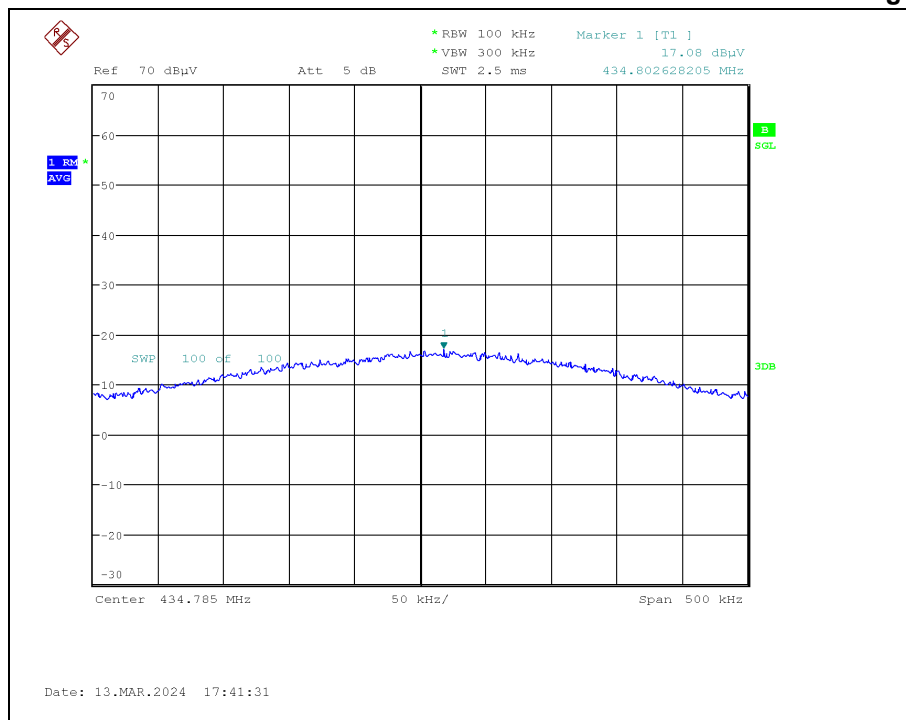
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- High frequency

Fundamental – Peak



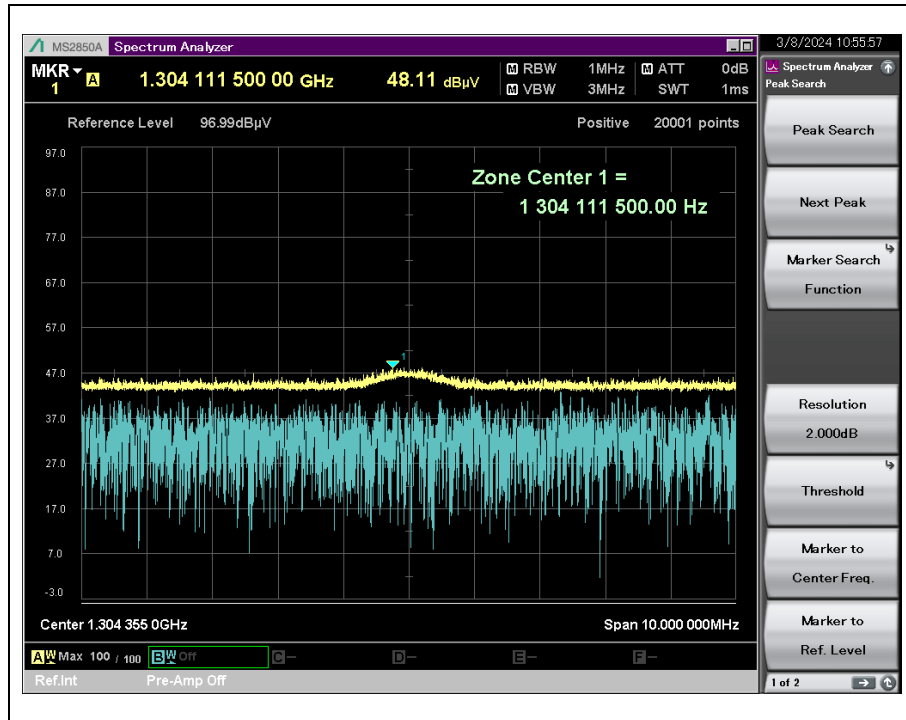
Fundamental – Average



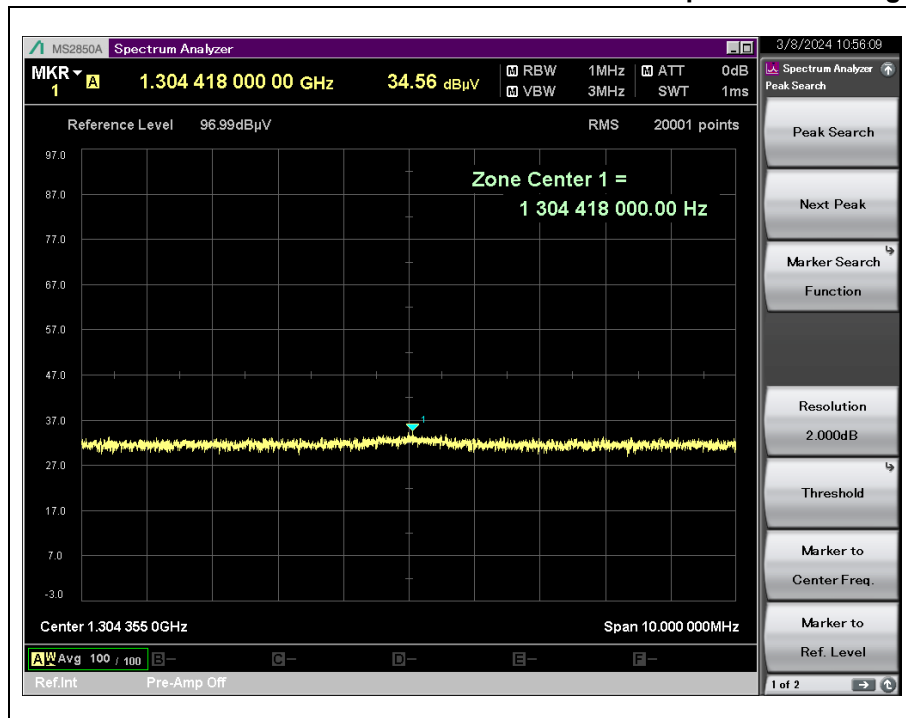
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Spurious – Peak



Spurious – Average



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3.3.5 Conducted Emission

3.3.5.1 Test Setup

See test photographs for the actual connections between EUT and support equipment.

3.3.5.2 Limit

According to §15.207(a) 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 ohm line impedance stabilization network (LISN).

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Conducted Limit (dBuV)	
	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

3.3.5.3 Test Procedure

Conducted emissions from the EUT were measured according to the ANSI C63.10.

1. The test procedure is performed in a 6.5 m \times 3.5 m \times 3.5 m (L \times W \times H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) \times 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

3.3.5.4 Test Result

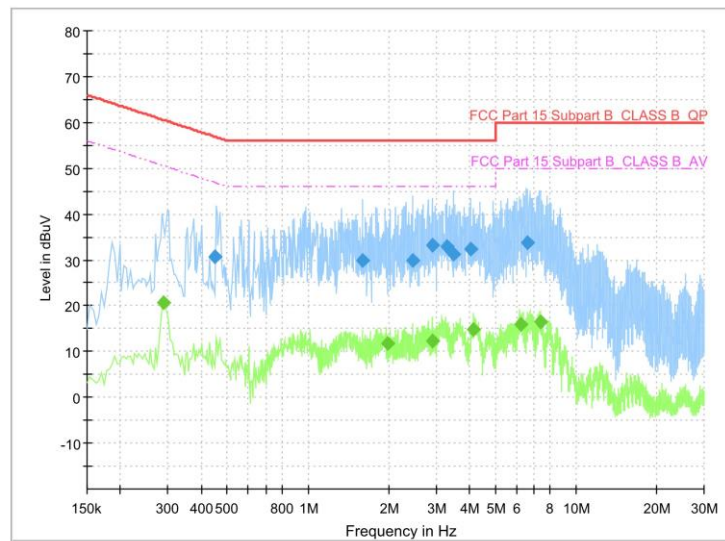
● AC Line Conducted Emission (Graph)

2024-03-13

Test Report

Common Information

Test Model: GIWICS-H
 Test Standard: FCC Part 15 Subpart B
 Test Mode: SRD
 Test Conditions: AC 120 V, 60 Hz / 22.1 °C, 54.1 % R. H.
 Operator Name: Jungi, Sin
 Comment: LINE



Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.288000	---	20.77	50.58	29.81	1000.0	9.000	L1	9.9
0.448000	30.61	---	56.91	26.30	1000.0	9.000	L1	9.9
1.592000	29.90	---	56.00	26.10	1000.0	9.000	L1	10.1
1.974000	---	11.69	46.00	34.31	1000.0	9.000	L1	10.2
2.452000	29.73	---	56.00	26.27	1000.0	9.000	L1	10.2
2.898000	---	12.44	46.00	33.56	1000.0	9.000	L1	10.2
2.900000	33.19	---	56.00	22.81	1000.0	9.000	L1	10.2
3.282000	32.84	---	56.00	23.16	1000.0	9.000	L1	10.2
3.484000	31.23	---	56.00	24.77	1000.0	9.000	L1	10.2
4.030000	32.42	---	56.00	23.58	1000.0	9.000	L1	10.3
4.126000	---	14.87	46.00	31.13	1000.0	9.000	L1	10.3
6.190000	---	16.02	50.00	33.98	1000.0	9.000	L1	10.3
6.570000	33.69	---	60.00	26.31	1000.0	9.000	L1	10.3
7.348000	---	16.51	50.00	33.49	1000.0	9.000	L1	10.4

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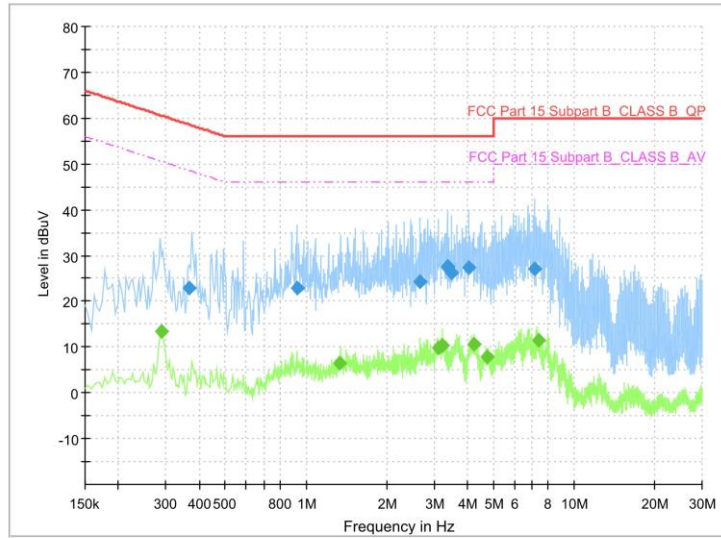
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2024-03-13

Test Report

Common Information

Test Model: GIWICS-H
 Test Standard: FCC Part 15 Subpart B
 Test Mode: SRD
 Test Conditions: AC 120 V, 60 Hz / 22.3 °C, 54.8 % R. H.
 Operator Name: Jungi, Sin
 Comment: NEUTRAL



Final Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.290000	---	13.54	50.52	36.98	1000.0	9.000	N	9.9
0.368000	23.03	---	58.55	35.52	1000.0	9.000	N	9.9
0.928000	22.91	---	56.00	33.09	1000.0	9.000	N	10.1
1.340000	---	6.44	46.00	39.56	1000.0	9.000	N	10.1
2.650000	24.31	---	56.00	31.69	1000.0	9.000	N	10.2
3.100000	---	9.94	46.00	36.06	1000.0	9.000	N	10.2
3.216000	---	10.32	46.00	35.68	1000.0	9.000	N	10.2
3.358000	27.30	---	56.00	28.70	1000.0	9.000	N	10.2
3.380000	27.61	---	56.00	28.39	1000.0	9.000	N	10.2
3.484000	26.15	---	56.00	29.85	1000.0	9.000	N	10.2
4.034000	27.30	---	56.00	28.70	1000.0	9.000	N	10.3
4.224000	---	10.59	46.00	35.41	1000.0	9.000	N	10.3
4.748000	---	7.80	46.00	38.20	1000.0	9.000	N	10.3
7.100000	27.20	---	60.00	32.80	1000.0	9.000	N	10.4
7.330000	---	11.48	50.00	38.52	1000.0	9.000	N	10.4

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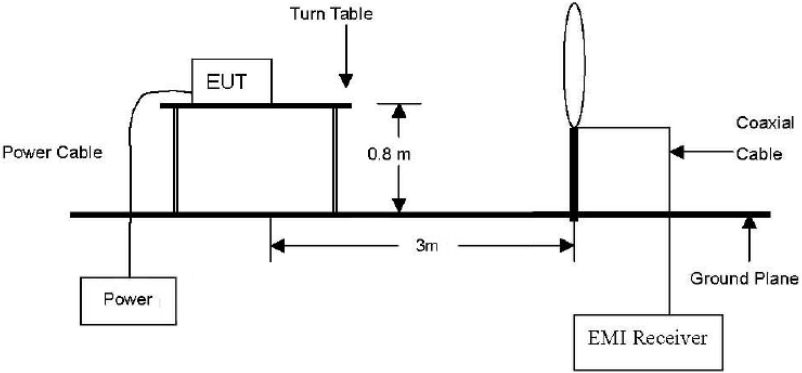
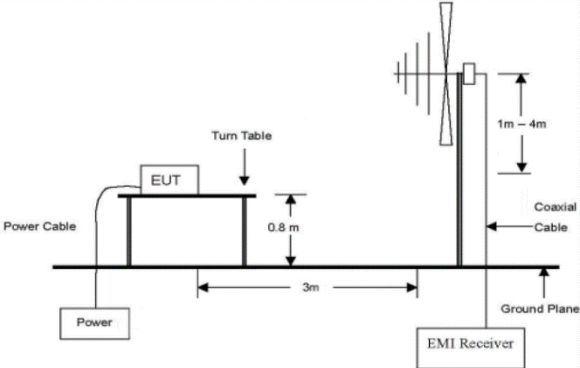
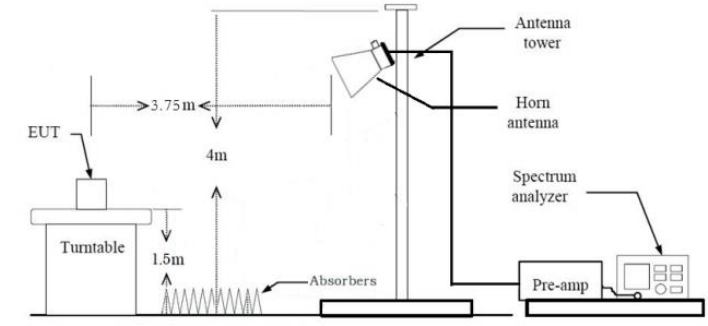
APPENDIX I

TEST SETUP


Test Repot No.: NW2403-F003

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- Radiated Measurement

<p>below 30 MHz</p>	
<p>below 1 GHz</p>	
<p>above 1 GHz</p>	<p>Above 1 GHz</p> 

- Conducted Measurement

<p>Conducted</p>	
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APPENDIX II

TEST EQUIPMENT USED FOR TESTS

Test Repot No.: NW2403-F003

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www.nct.re.kr TEL: +82-31-323-6070 FAX: +82-31-323-6071

	Description	Manufacturer	Serial No.	Model No.	Cal. Date	Next Cal. Date
1	SPECTRUM ANALYZER	R&S	100250	FSU26	2023-08-30	2024-08-30
2	Signal Analyzer	Anritsu	6261831920	MS2850A	2024-01-10	2025-01-10
3	Triple Output DC Power Supply	Agilent	MY40038816	E3631A	2024-02-27	2025-02-27
4	Vector SG	R&S	255563	SMBV100A	2024-02-27	2025-02-27
5	8360B SERIES SWEPT SIGNAL GENERATOR	HP	3614A00312	83640B	2023-08-30	2024-08-30
6	Humi./Baro/Temp. data recorder	Lutron	89503	MHB-382SD	2023-07-21	2024-07-21
7	Low Noise Amplifier	LTC MICROWAVE	143	LLA01185025Q	2023-08-30	2024-08-30
8	LOOP-ANTENNA	Schwarzbeck	00124	FMZB1519 B	2023-05-25	2025-05-25
9	TRILOG Broadband Antenna	01027	VULB 9168	VULB 9168	2023-05-23	2025-05-23
10	Double Ridged Broadband Horn Antenna	02087	BBHA 9120 D	BBHA 9120 D	2023-05-04	2024-05-04
11	LISN	00984	NSLK 8127	NSLK 8127	2023-05-22	2024-05-22
12	EMI Test Receiver	102116	ESRP3	ESRP3	2023-05-22	2024-05-22

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APPENDIX III

UNCERTAINTY

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Measurement Item	Expanded Uncertainty $U = kU_c (k=2)$
Conducted RF power	0.40 dB
Conducted Spurious Emissions	0.40 dB
Radiated Spurious Emissions	5.16 dB
Conducted Emissions	3.68 dB