

EVALUATION REPORT

for Certification of Conformity

Applicant: GOOIL SOLUTION Co., Ltd.
39174 1105-19, Sanho-daero, Sandong-myeon, Gumi-si
Gyeong-buk, South Korea
Attn: SM Lee / Senior Manager

Date of Issue: Oct. 24, 2024
Order Number: GETEC-C1-24-705
Test Report Number: GETEC-E3-24-125
Test Site: GUMI UNIVERSITY EMC CENTER
CAB Designation Number: KR0033

FCC ID. : 2BHKM-GIS-2011

Applicant : GOOIL SOLUTION Co., Ltd.

Rule Part(s) : FCC Part 15 Subpart B
Test Method : ANSI C63.4(2017)
EUT Type : EC Controller
Equipment Class : Part 15 Class B Digital Device (JAB)
Type of Authority : Certification
Model Name : GIS-2011
Family Model : GIS-2011A

This equipment has been shown to be in compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4 (2017)

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.

Tested by,

Reviewed by,



Sang-Hyun Park / Senior Engineer
GUMI UNIVERSITY EMC CENTER



Sung-Joo Park / Technical Manager
GUMI UNIVERSITY EMC CENTER



Revision History

Test Report No.	Issue Date	Description
GETEC-E3-24-125	Oct. 24, 2024	First Approval Test Report

※ This test report is not related to the accredited test result by ISO/IEC 17025 and KOLAS





CONTENTS

1. GENERAL INFORMATION	4
2. INTRODUCTION	5
3. PRODUCT INFORMATION	6
3.1 DESCRIPTION OF EUT.....	6
3.2 SUPPORT EQUIPMENT / CABLES USED	8
3.3 MODIFICATION ITEM(S)	9
3.4 IDENTIFICATION OF EUT(S).....	9
4. DESCRIPTION OF TESTS.....	10
4.1 TEST CONDITION.....	10
4.2 CONDUCTED EMISSION	11
4.3 RADIATED EMISSION.....	12
4.4 SUMMARY OF TEST RESULTS	12
5. CONDUCTED EMISSION.....	13
5.1 OPERATING ENVIRONMENT	13
5.2 MEASUREMENT UNCERTAINTY.....	13
5.3 LIMIT	14
5.4 TEST EQUIPMENT USED.....	14
5.5 TEST DATA FOR CONDUCTED EMISSION	14
6. RADIATED EMISSION	16
6.1 OPERATING ENVIRONMENT	16
6.2 MEASUREMENT UNCERTAINTY.....	16
6.3 LIMIT	17
6.4 TEST EQUIPMENT USED.....	18
6.5 TEST DATA FOR RADIATED EMISSION	19
7. SAMPLE CALCULATIONS.....	23
7.1 EXAMPLE 1:.....	23
7.2 EXAMPLE 2:.....	23
8. RECOMMENDATION & CONCLUSION.....	24
 APPENDIX A – ATTESTATION STATEMENT	
APPENDIX B – LABELLING	
APPENDIX C – BLOCK DIAGRAM	
APPENDIX D – SCHEMATIC DIAGRAM	
APPENDIX E – TEST SET-UP PHOTO	
APPENDIX F – EXTERNAL PHOTOS	
APPENDIX G – INTERNAL PHOTOS	
APPENDIX H – USER’S MANUAL	
APPENDIX I – OPERATIONAL DESCRIPTION	



Scope: Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and / or unintentional radiators for compliance with technical rules and regulations of the Federal Communications Commission.

1. General Information

Applicant: GOOIL SOLUTION Co., Ltd.

Applicant Address: 39174 1105-19, Sanho-daero, Sandong-myeon, Gumi-si, Gyeong-buk, South Korea

Manufacturer: GOOIL SOLUTION CO., Ltd.

Manufacturer Address: 39174 1105-19, Sanho-daero, Sandong-myeon, Gumi-si, Gyeong-buk, South Korea

Contact Person: SM Lee / Senior Manager

Telephone Number: +82-54-476-9138

- | | |
|----------------------|---|
| ● FCC ID. | 2BHKM-GIS-2011 |
| ● Equipment Class | Part 15 Class B Digital Device (JAB) |
| ● EUT Type | EC Controller |
| ● Model Name | GIS-2011 |
| ● Family Model | GIS-2011A |
| ● Rule Part(s) | FCC Part 15 Subpart B |
| ● Test Method | ANSI C63.4(2017) |
| ● Type of Authority | Certification |
| ● Dates of Test | Oct. 07, 2024 ~ Oct. 15, 2024 |
| ● Place of Test | GUMI UNIVERSITY EMC CENTER
(FCC Test firm Registration No.: 269701)
37 Yaeun-ro, Gumi-si, Gyeongsangbuk-do, 39213, Republic of Korea |
| ● Test Report Number | GETEC-E3-24-125 |
| ● Dates of Issue | Oct. 24, 2024 |



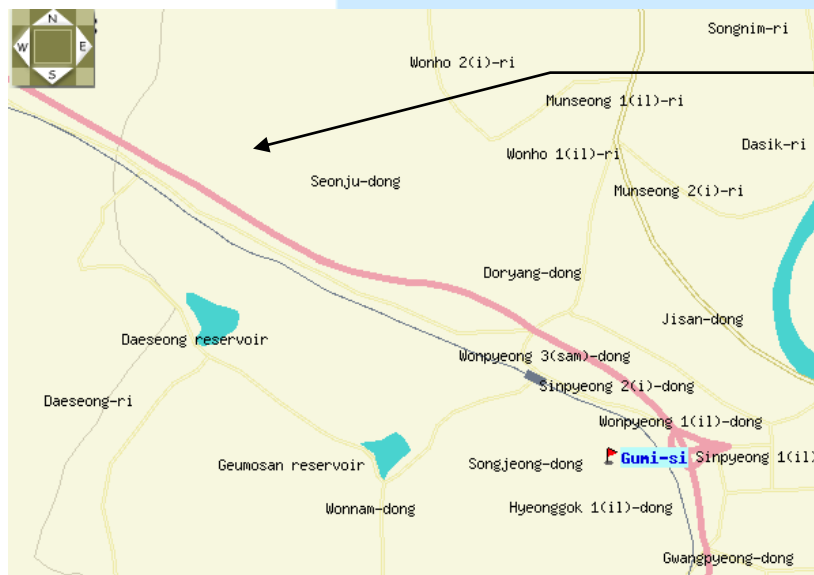
2. Introduction

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Nose Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2017) was used in determining radiated and conducted emissions emanating from **EC Controller(Model name: GIS-2011)**

These measurement tests were conducted at **GUMI UNIVERSITY EMC CENTER**

The site address is 37 Yaeun-ro, Gumi-si, Gyeongsangbuk-do, 39213, Republic of Korea.

This test site is one of the highest point of Gumi University at about 200 km away from Seoul city and 40 km away from Daegu city. It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures. The detailed description of the measurement facility was found to be in compliance with the requirements of §2.948 according to ANSI C63.4 (2017)



GUMI UNIVERSITY EMC CENTER
37 Yaeun-ro, Gumi-si,
Gyeongsangbuk-do, 39213,
Republic of Korea
Tel: +82-54-440-1195
Fax: +82-54-440-1199

Fig 1. The map above shows the Gumi University in vicinity area.



3. Product Information

3.1 Description of EUT

The Equipment under Test (EUT) is the **EC Controller (Model name: GIS-2011)**

FCC ID.: 2BHKM-GIS-2011

Separation		Contents
Product name		EC Controller
Model name		GIS-2011 / GIS-2011A
Dimension (Excluding antenna)		GIS-2011 - 146mm (L) x 47mm (W) x 44mm (H) GIS-2011A - 171.5mm (L) x 47mm (W) x 44mm (H)
Control steps		4 Steps (1~4 Level)
Control channel		4 Channel
Control Inputs		- External button - 2.4GHz RF transmitting / receiving (BLE) - 2.4GHz Wi-Fi transmitting / receiving
Antenna		- 3DBI ESP-02 2.4G - 9mm (Outer) x 110mm (L)
Rated input Voltage (V)	Input Terminals	DC Connector (Outer 5.5mm Inner 2.1mm)
	Input voltage to control	DC 15V, 2A
Output voltage (V)	Output terminals	Panel attached shield M8 connector
	Output voltage range (per port)	DC +3.3V, 0.91A DC -3.3V, 0.91A
Control	External buttons	OFF and 4-step control with external buttons
	Wireless Control	Control with a dedicated 'Web & App' and S/W
Addition	Operating temperature range	-20 — 50°C
	Operating humidity range	0 — 90%



Module name: ESP32-WROOM-32E

TX Frequency:	Wi-Fi: 2412-2472 MHz/2422-2462 MHz Bluetooth/BLE: 2402-2480 MHz
RX Frequency:	Wi-Fi: 2412-2472 MHz/2422-2462 MHz Bluetooth/BLE: 2402-2480 MHz
ITU Designation:	G1D, D1D, F1D
Output Power:	Wi-Fi: 19.19 dBm (802.11b), 19.68 dBm (802.11g) 19.52 dBm (802.11n20), 19.53 dBm (802.11n40) Bluetooth: 6.73 dBm; BLE: 8.23 dBm
Modulation:	Wi-Fi: DSSS, OFDM Bluetooth: GFSK, $\pi/4$ -DQPSK, 8DPSK BLE: GFSK
Antenna:	PCB Antenna, 3.4 dBi

Module name: ESP32-WROOM-32UE

TX Frequency:	Wi-Fi: 2412-2472 MHz/2422-2462 MHz Bluetooth/Bluetooth LE: 2402-2480 MHz
RX Frequency:	Wi-Fi: 2412-2472 MHz/2422-2462 MHz Bluetooth/Bluetooth LE: 2402-2480 MHz
ITU Designation:	F1D, G1D, D1D
Output Power (e.i.r.p):	Wi-Fi: 18.87 dBm (802.11b), 18.13 dBm (802.11g) 17.96 dBm (802.11n20), 18.38 dBm (802.11n40) Bluetooth: 6.03 dBm, Bluetooth LE: 7.67 dBm
Modulation:	Wi-Fi: DSSS, OFDM Bluetooth/Bluetooth LE: GFSK, $\pi/4$ -DQPSK, 8DPSK
Antenna:	Dipole Antenna with IPEX connector, 2.33 dBi

Highest Clock frequency	: 2 480 MHz
-------------------------	-------------



3.2 Support Equipment / Cables used

3.2.1 Used Support Equipment

Description	Manufacturer	Model Name	S/N & FCC ID.
AC Adapter ¹⁾	Guangdong Keerda Electronics Co.,Ltd	DZ048BDL150200F	S/N: N/A FCC ID.: N/A
notebook computer	Lenovo Information Products (ShenZhen) Co., Ltd.	TP00121F2	S/N: N/A FCC ID.: N/A
Galaxy S22	Samsung Electronics Co., Ltd.	SM-S901N	S/N: N/A FCC ID.: N/A

See “Appendix E– Test Setup Photographs” for actual system test set-up

3.2.2 System configuration

Description	Manufacturer	Model Name	S/N & FCC ID.
Wi-Fi & Bluetooth Internet of Things Module	ESPRESSIF SYSTEMS(SHANGHAI) CO., LTD	ESP32-WROOM-32E	S/N: N/A FCC ID.: 2AC7Z-ESP32WROOM32E
Wi-Fi & Bluetooth Internet of Things Module	ESPRESSIF SYSTEMS(SHANGHAI) CO., LTD	ESP32-WROOM-32UE	S/N: N/A FCC ID.: 2AC7Z-ESPWROOM32UE

3.2.3 Used Cable(s)

Cable Name	Condition	Description
AC power	Connected to the AC Adapter and AC Power source	1.50 m unshielded
DC power	Connected to the EUT and AC Adapter	1.50 m unshielded with a ferrite core
Chanel 1	Connected to the EUT and Resistance	3.50 m unshielded
Chanel 2	Connected to the EUT and Resistance	3.50 m unshielded
Chanel 3	Connected to the EUT and Resistance	3.50 m unshielded
Chanel 4	Connected to the EUT and Resistance	3.50 m unshielded



3.3 Modification Item(s)

None.

3.4 Identification of EUT(s)

Basic Model: GIS 2011

Family Model: GIS 2011A(The alternate model GIS-2011A identical to basic model GIS-2011 except for bottom enclosure design and model designation)

*This model name does not affect EMC performance, and all electrical characteristics are the same as the base model.



4. Description of tests

4.1 Test Condition

The EUT was installed, arranged and operated in a manner that is most representative of equipment as typically used. The measurements were carried out while varying operating modes and cable positions within typically arrangement to determine maximum emission level.

The representative and worst test mode(s) were noted in the test report.

The test conditions of the noted test mode(s) in this test report are;

- Test Voltage / Frequency : AC 120 V / 60 Hz
- Test Mode(s)

☒ A	☒ 1	Maximum operating mode: The test was conducted by connecting the EUT and resistance and setting it to the maximum load (level 4).
---------------------------------------	---------------------------------------	---



4.2 Conducted Emission

The AMN placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane. This distance was between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment were at least 0.8 m from the AMN. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on mains lines were made at the output of the AMN. The measuring port of the LISN for EUT was connected to spectrum analyzer. Using conducted emission test software, the emissions were scanned with peak detector mode. After scanning over the frequency range, suspected emissions were selected to perform final measurement.

When performing final measurement, the receiver was used which has Quasi-Peak detector and CISPR Average detector. For (0.15 ~ 30) MHz frequency range, Quasi-Peak detector with 10 kHz RBW and 30 kHz VBW was used. By varying the configuration of the test sample and the cable, routing it was attempted to maximize the emission.

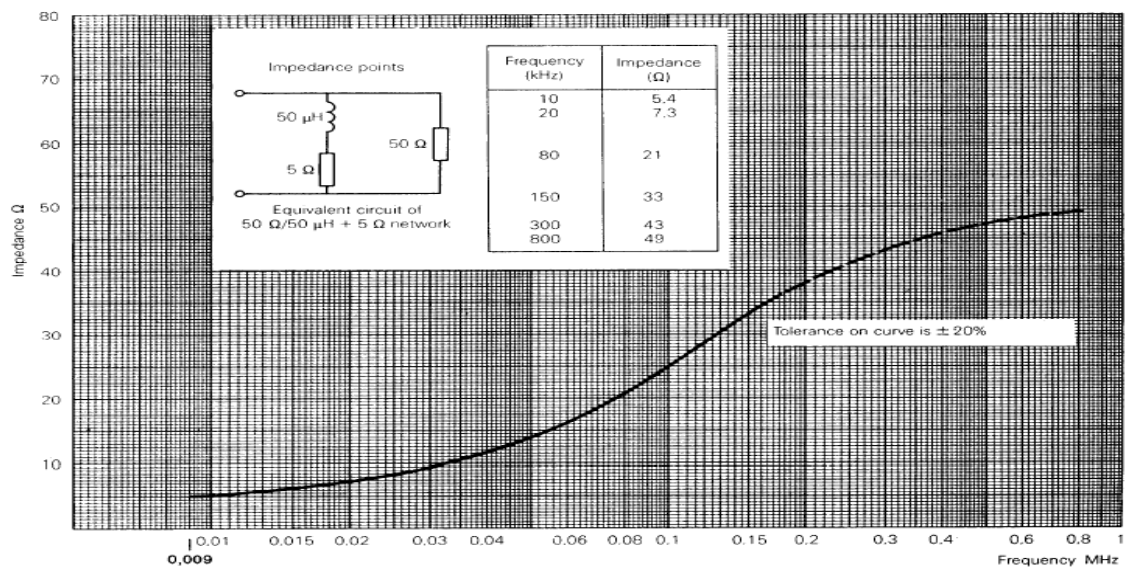


Fig 2. Impedance of LISN



4.3 Radiated Emission

Preliminary (peak) measurements were performed at an antenna to EUT separation distance of 10 or 3 meter below 1GHz and 3 meter above 1GHz. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in horizontal and vertical polarities. Final measurements were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1m to 4 m. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.

For final measurement below 1 GHz frequency range, Quasi-Peak detector with (RBW = 120 kHz Bandwidth) was used. For final measurement above 1 GHz frequency range, Peak detector with (RBW = 1 MHz Bandwidth) and CISPR Average detector with (RBW = 1 MHz Bandwidth) were used.

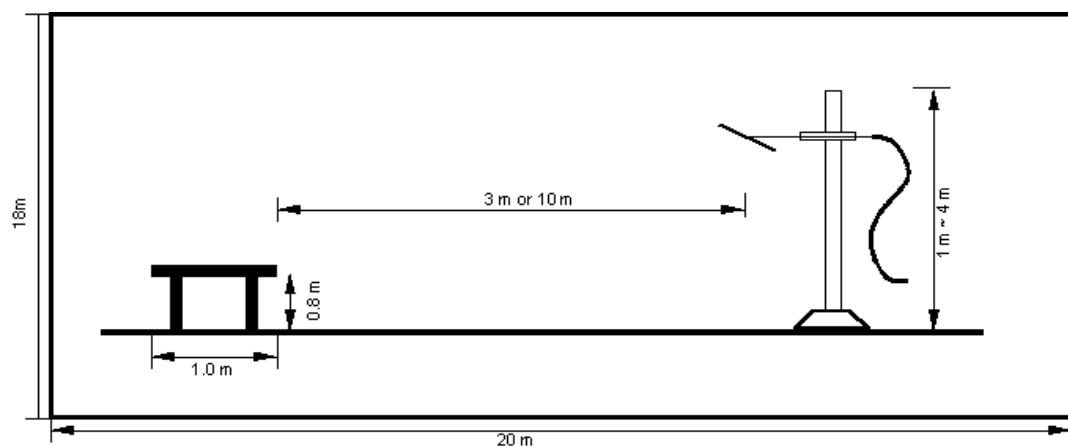


Fig 3. Dimensions of test site (Below 1 GHz)

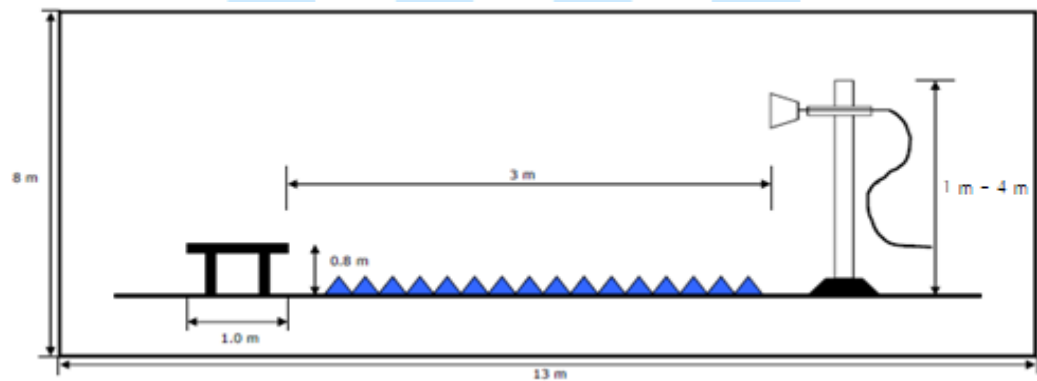


Fig 4. Dimensions of test site (Above 1 GHz)

4.4 Summary of Test Results

Standard	Test Description	Test Result
FCC Part 15 Subpart B ANSI C63.4 (2017)	Radiated Emission	Pass
	Conducted Emission	Pass



5. Conducted Emission

5.1 Operating Environment

Temperature : 22.4 °C
Relative Humidity : 50.4 %
Atmospheric pressure : 101.0 kPa

5.2 Measurement Uncertainty

The measurement uncertainty was calculated in accordance with ISO “Guide to the expression of uncertainty in measurement.” The measurement uncertainty was given with a confidence of 95 %.

Test Items	Uncertainty	Remark
Conducted emission (9 kHz ~ 150 kHz)	3.83 dB	Confidence level of approximately 95 % ($k = 2$)
Conducted emission (150 kHz ~ 30 MHz)	3.44 dB	Confidence level of approximately 95 % ($k = 2$)

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.

The listed uncertainties are the worst case uncertainty for the entire range of measurement. please note that the uncertainty values are provided for informational purposes only are not used in determining the PASS/FAIL results



5.3 Limit

RFI Conducted	FCC Limit(dB μ V/m) Class B	
Freq. Range	Quasi-Peak	Average
150 kHz ~ 0.5 MHz	66 ~ 56*	56 ~ 46*
0.5 MHz ~ 5 MHz	56	46
5 MHz ~ 30 MHz	60	50
*Limits decreases linearly with the logarithm of frequency.		

5.4 Test Equipment used

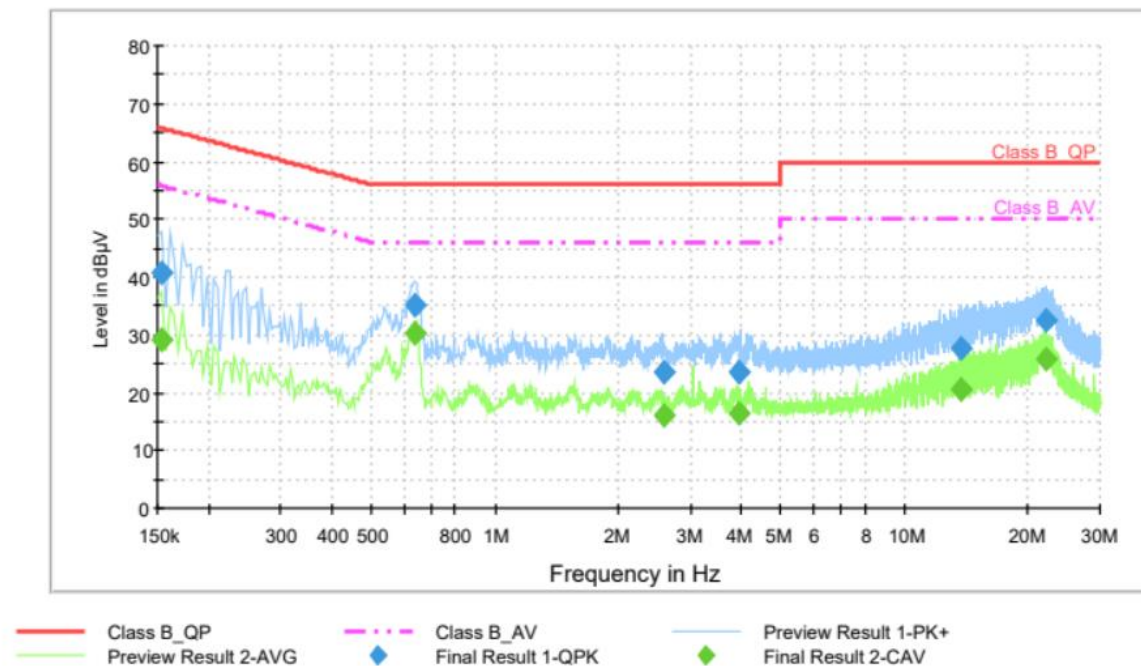
Model Name	Manufacturer	Description	Serial Number	Calibration Date
■ - ESCI	Rohde & Schwarz	EMI Test Receiver	100237	Apr. 03, 2024
■ - ENV216	Rohde & Schwarz	LISN	100172	Apr. 03, 2024
■ - EMC 32	Rohde & Schwarz	Software	Ver 8.53.0	N/A

5.5 Test data for Conducted Emission

- Test Date : Oct. 07, 2024
- Resolution Bandwidth : 9 kHz
- Frequency Range : 0.15 MHz ~ 30 MHz
- Line : L1: Live, N: Neutral
- Test Mode : A



▪ Test Mode: A



Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.154000	40.9	1000.0	9.000	Off	L1	9.5	24.9	65.8	
0.639562	35.2	1000.0	9.000	Off	L1	9.5	20.8	56.0	
2.572081	23.7	1000.0	9.000	Off	L1	9.6	32.3	56.0	
3.943031	23.5	1000.0	9.000	Off	N	9.7	32.5	56.0	
13.782638	27.5	1000.0	9.000	Off	N	10.3	32.5	60.0	
22.073981	32.4	1000.0	9.000	Off	N	10.6	27.6	60.0	

Final Result 2

Frequency (MHz)	CAverage (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)	Comment
0.154000	29.2	1000.0	9.000	Off	L1	9.5	26.6	55.8	
0.639562	30.2	1000.0	9.000	Off	L1	9.5	15.8	46.0	
2.572081	16.1	1000.0	9.000	Off	L1	9.6	29.9	46.0	
3.943031	16.3	1000.0	9.000	Off	N	9.7	29.7	46.0	
13.782638	20.4	1000.0	9.000	Off	N	10.3	29.6	50.0	
22.073981	25.9	1000.0	9.000	Off	N	10.6	24.1	50.0	

< Fig 5. Graph of continuous disturbance >



6. Radiated Emission

6.1 Operating Environment

Temperature : 23.6 °C
Relative Humidity : 50.3 %
Atmospheric pressure : 100.8 kPa

6.2 Measurement Uncertainty

The measurement uncertainty was calculated in accordance with ISO “Guide to the expression of uncertainty in measurement”. The measurement uncertainty was given with a confidence of 95 %.

Test Items(3 m Anechoic Chamber)	Uncertainty	Remark
Radiated emission (30 MHz ~ 300 MHz, 3 m, Vertical)	4.90 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (30 MHz ~ 300 MHz, 3 m, Horizontal)	4.79 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Vertical)	6.23 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (300 MHz ~ 1 000 MHz, 3 m, Horizontal)	5.16 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (1 000 MHz ~ 6 000 MHz, 3 m)	4.56 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (6 000 MHz ~ 18 000 MHz, 3 m)	4.89 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (6 000 MHz ~ 26 000 MHz, 3 m)	5.16 dB	Confidence level of approximately 95 % ($k = 2$)
Test Items(10 m Anechoic Chamber)	Uncertainty	Remark
Radiated emission (30 MHz ~ 300 MHz, 10 m, Vertical)	4.77 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (30 MHz ~ 300 MHz, 10 m, Horizontal)	4.79 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (300 MHz ~ 1 000 MHz, 10 m, Vertical)	4.91 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (300 MHz ~ 1 000 MHz, 10 m, Horizontal)	4.90 dB	Confidence level of approximately 95 % ($k = 2$)
Radiated emission (1 000 MHz ~ 6 000 MHz, 3 m)	4.64 dB	Confidence level of approximately 95 % ($k = 2$)

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. The listed uncertainties are the worst case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.



6.3 Limit

Frequency (MHz)	FCC Limit @ 3 m. dB μ V/m
30 ~ 88	40.0
88 ~ 216	43.5
216 ~ 230	46.0
230 ~ 960	
960 ~ 1 000	54.0

Frequency (MHz)	FCC Class B Peak Limit @ 3 m	FCC Class B Average Limit@ 3 m
> 1 000	74.0	54.0

Frequency range	30 MHz ~ 1 GHz	Above 1 GHz
Detector mode	Quasi peak	Peak / Average
Resolution bandwidth	120 kHz	1 MHz



6.4 Test Equipment used

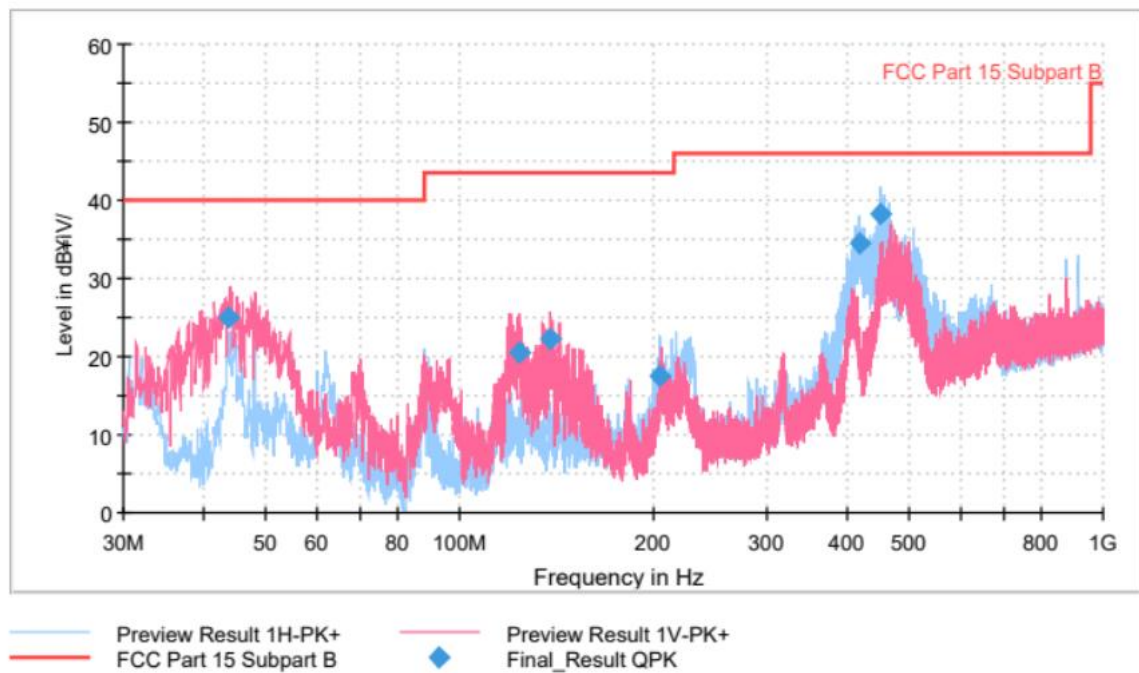
Model Name	Manufacturer	Description	Serial Number	Calibration Date
■ - ESW44	Rohde & Schwarz	EMI Test Receiver	103354	Apr. 03, 2024
■ - HF907	Rohde & Schwarz	DOUBLE-RIDGED WAVEGUIDE HORN ANTENNA	100538	Jan. 25, 2024
■ - MA4640-XP-ET	HD GmbH	Antenna Mast	MA4640/558	N/A
■ - BBHA 9170	Schwarzbeck	Horn ANT	766	Apr. 09, 2024
■ - MCU066	maturo GmbH	Position Controller	1390306	N/A
■ - TT2.5SI	maturo GmbH	Turntable	1390307	N/A
■ - TK-PA18H	Testek	Low Noise Amplifier	220107-L	Apr. 03, 2024.
■ - TK-PA1840H	Testek	Preamplifier	170007-L	Apr. 08, 2024
■ - CO3000	Innco system GmbH	Position Controller	CO3000/1084/42760218/P	N/A
■ - EMC 32	Rohde & Schwarz	Software	Ver. 10.50.10	N/A
■ - VULB9160	Rohde & Schwarz	Broadband Test Antenna	3313	Apr. 19, 2024
■ - WRCJV8-2350-2400- 2483.5-2533.5-40SS	AAMCS	Band reject filter	5	Apr. 04, 2024
■ - WHKX7.0/18G-10SS	Rohde & Schwarz	WAINWRIGHT INSTRUMENTS	SN33	Apr. 04, 2024
■ - 310N	Sonoma Instrument	Amplifier	187164	Apr. 04, 2024



6.5 Test data for Radiated Emission

- Test Date : Oct. 10, 2024
- Measurement Distance : 3 m (30 MHz ~ 40 GHz)
- Note : -
- Test Mode : A

▪ Test Mode: A



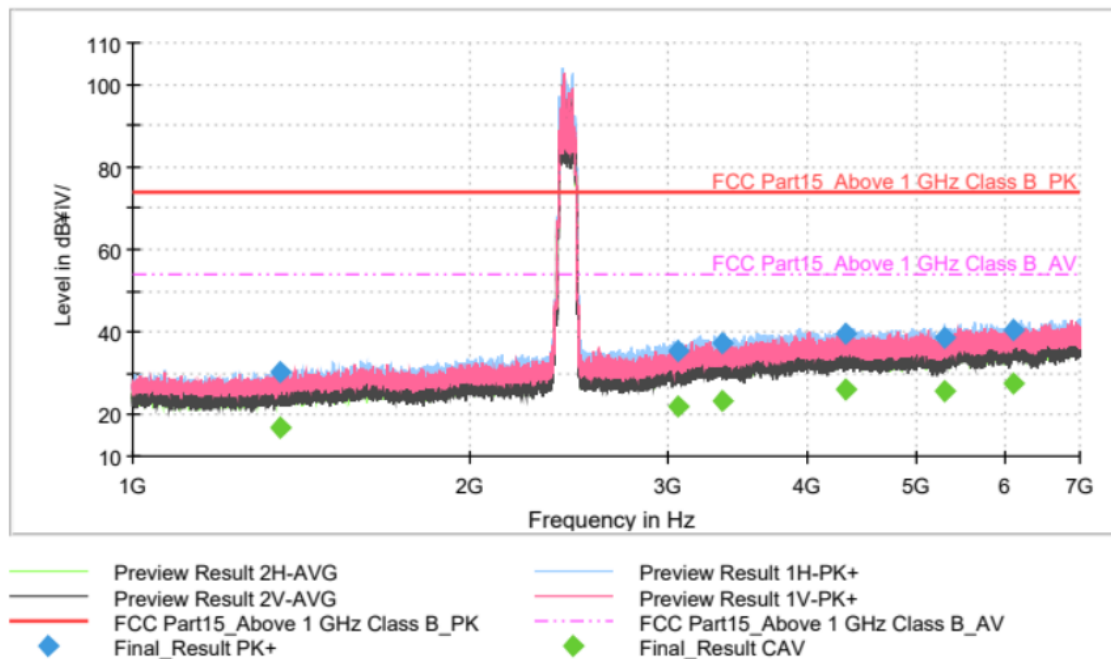
Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
43.712667	24.90	40.00	15.10	1000.0	120.000	107.0	V	318.0	-18.9
123.465333	20.55	43.52	22.97	1000.0	120.000	110.0	V	-8.0	-19.1
138.384667	22.34	43.52	21.18	1000.0	120.000	106.0	V	177.0	-17.7
204.758333	17.45	43.52	26.07	1000.0	120.000	203.0	H	296.0	-19.7
418.619333	34.57	46.02	11.45	1000.0	120.000	125.0	H	272.0	-11.8
450.303667	38.14	46.02	7.88	1000.0	120.000	114.0	H	108.0	-10.7

< Fig 6. Radiated emission result (30 MHz ~ 1 000 MHz) >



▪ Test Mode: A



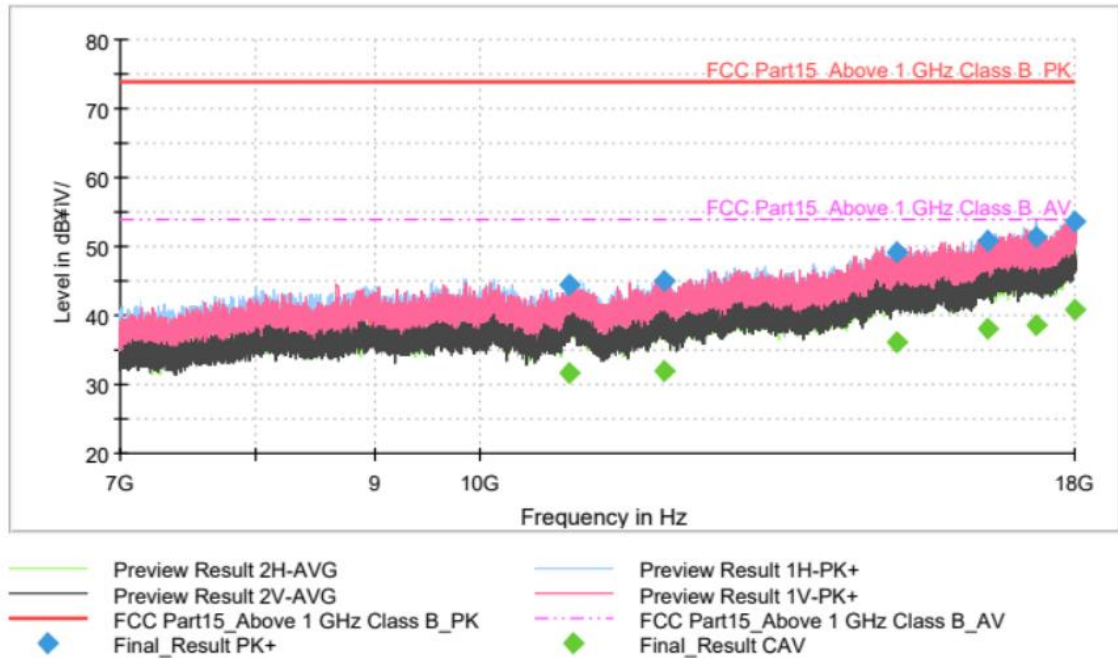
Final Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1354.6000	30.50	---	74.00	43.50	1000.0	1000.000	225.0	H	143.0	-16.9
1354.6000	---	16.72	54.00	37.28	1000.0	1000.000	225.0	H	143.0	-16.9
3065.2000	35.30	---	74.00	38.70	1000.0	1000.000	225.0	H	193.0	-8.0
3065.2000	---	21.86	54.00	32.14	1000.0	1000.000	225.0	H	193.0	-8.0
3363.0000	37.53	---	74.00	36.47	1000.0	1000.000	225.0	H	206.0	-6.5
3363.0000	---	23.38	54.00	30.62	1000.0	1000.000	225.0	H	206.0	-6.5
4330.2000	39.59	---	74.00	34.41	1000.0	1000.000	225.0	H	203.0	-3.6
4330.2000	---	26.11	54.00	27.89	1000.0	1000.000	225.0	H	203.0	-3.6
5298.8000	38.50	---	74.00	35.50	1000.0	1000.000	225.0	H	323.0	-1.8
5298.8000	---	25.55	54.00	28.45	1000.0	1000.000	225.0	H	323.0	-1.8
6100.0000	40.39	---	74.00	33.61	1000.0	1000.000	175.0	H	303.0	1.5
6100.0000	---	27.60	54.00	26.40	1000.0	1000.000	175.0	H	303.0	1.5

< Fig 7. Radiated emission result (1 000 MHz ~ 7 000 MHz) >



▪ Test Mode: A



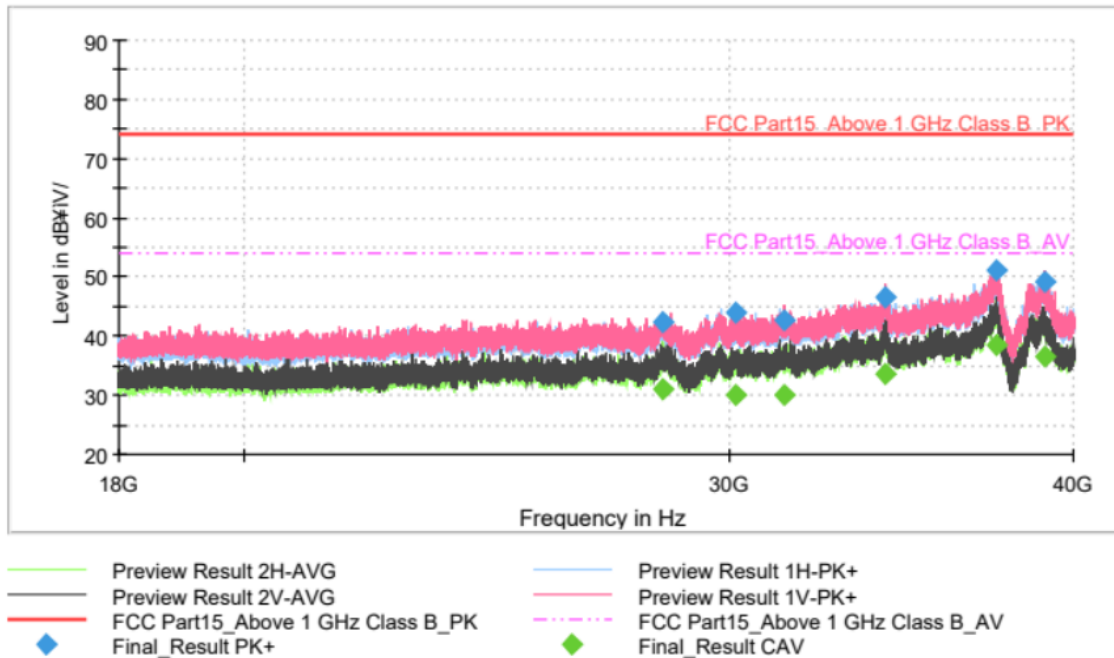
Final Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
10922.9000	44.33	---	74.00	29.67	1000.0	1000.000	180.0	H	331.0	5.9
10922.9000	---	31.69	54.00	22.31	1000.0	1000.000	180.0	H	331.0	5.9
11994.7333	---	31.85	54.00	22.15	1000.0	1000.000	225.0	H	14.0	8.6
11994.7333	45.09	---	74.00	28.91	1000.0	1000.000	225.0	H	14.0	8.6
15083.7667	---	36.01	54.00	17.99	1000.0	1000.000	125.0	V	-2.0	16.1
15083.7667	49.13	---	74.00	24.87	1000.0	1000.000	125.0	V	-2.0	16.1
16500.7667	---	37.95	54.00	16.05	1000.0	1000.000	202.0	V	16.0	17.7
16500.7667	50.71	---	74.00	23.29	1000.0	1000.000	202.0	V	16.0	17.7
17323.3667	51.39	---	74.00	22.61	1000.0	1000.000	196.0	H	33.0	19.3
17323.3667	---	38.68	54.00	15.32	1000.0	1000.000	196.0	H	33.0	19.3
17990.9333	---	40.87	54.00	13.13	1000.0	1000.000	114.0	H	37.0	22.1
17990.9333	53.72	---	74.00	20.28	1000.0	1000.000	114.0	H	37.0	22.1

< Fig 8. Radiated emission result (7 000 MHz ~ 18 000 MHz) >



▪ Test Mode: A



Final Result

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
28381.7333	---	31.12	54.00	22.88	1000.0	1000.000	110.0	V	14.0	-12.6
28381.7333	42.20	---	74.00	21.80	1000.0	1000.000	110.0	V	14.0	-12.6
30152.3333	---	30.05	54.00	23.95	1000.0	1000.000	125.0	V	75.0	-14.2
30152.3333	43.82	---	74.00	30.18	1000.0	1000.000	125.0	V	75.0	-14.2
31403.3333	42.77	---	74.00	31.23	1000.0	1000.000	225.0	V	17.0	-13.1
31403.3333	---	30.02	54.00	23.98	1000.0	1000.000	225.0	V	17.0	-13.1
34179.0000	46.69	---	74.00	27.31	1000.0	1000.000	125.0	V	303.0	-9.8
34179.0000	---	33.51	54.00	20.49	1000.0	1000.000	125.0	V	303.0	-9.8
37502.2000	---	38.36	54.00	15.64	1000.0	1000.000	125.0	V	290.0	-3.9
37502.2000	51.24	---	74.00	22.76	1000.0	1000.000	125.0	V	290.0	-3.9
39059.4000	---	36.49	54.00	17.51	1000.0	1000.000	125.0	V	295.0	-4.8
39059.4000	49.05	---	74.00	24.95	1000.0	1000.000	125.0	V	295.0	-4.8

< Fig 16. Radiated emission result (18 000 MHz ~ 40 000 MHz) >



7. Sample Calculations

$$\begin{aligned} \text{dB}\mu\text{V} &= 20 \text{ Log}_{10}(\mu\text{V}/\text{m}) \\ \text{dB}\mu\text{V} &= \text{dBm} + 107 \\ \mu\text{V} &= 10^{(\text{dB}\mu\text{V}/20)} \end{aligned}$$

7.1 Example 1:

■ 20.3 MHz

Class B Limit	= 250 μV = 48 dB μV
Reading	= 39.2 dB μV
$10^{(39.2\text{dB}\mu\text{V}/20)}$	= 91.2 μV
Margin	= 48 dB μV - 39.2 dB μV = 8.8 dB

7.2 Example 2:

■ 66.7 MHz

Class B Limit	= 100 $\mu\text{V}/\text{m}$ = 40.0 dB $\mu\text{V}/\text{m}$
Reading	= 31.0 dB μV
Antenna Factor + Cable Loss	= 5.8 dB
Total	= 36.8 dB $\mu\text{V}/\text{m}$
Margin	= 40.0 dB $\mu\text{V}/\text{m}$ - 36.8 dB $\mu\text{V}/\text{m}$ = 3.2 dB



8. Recommendation & Conclusion

The data collected shows that the **EC Controller (Model Name: GIS-2011)** was complies with §15.107, §15.109 of the FCC Rules

- The end -

