

TEST REPORT

Order Number : GETEC-C1-23-359
Test Report Number : GETEC-E5-23-005
Applicant : RNU Co., Ltd.
Applicant Address : 41065 58, Maeyeo-ro, Dong-gu, Daegu, Republic of Korea
Type of Equipment : RE-Merge
Model Name : RHS-B500
Trade Name : RNU Co., Ltd.
Classification of ITE : Class B
Classification Code : o2
Serial Number : Prototype
Date of Incoming : May 25, 2023
Date of Issue : Jun. 16, 2023
Measurement Facility : **GUMI UNIVERSITY EMC CENTER**
Radiated Test Site(Below 1 GHz) Number: R-14318
Radiated Test Site(Above 1 GHz) Number: G-10395, G-10921
Conducted Test Site Number: C-11872
Telecommunication Port Test Site Number: T-11846


SUMMARY

This device has been verified to comply with the requirement of following regulation.

VCCI-CISPR 32

The results shown in this test report refer only to the sample(s) tested unless otherwise stated.
It is not a generally valid assessment of the features of the respective products of the mass-production

It is not allowed to copy this report even partly without the approval of Gumi University EMC center.


Tested by: _____
Sung-Joo, Park / Associate Engineer
GUMI UNIVERSITY EMC CENTER


Approved by: _____
Hyun Kim / Technical Manager
GUMI UNIVERSITY EMC CENTER



Revision History

Date	Test Report No.	Description
Jun. 16, 2023	GETEC-E5-23-005	First Approval Test Report

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





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1. Client Information

1.1 Applicant

- Company : RNU Co., Ltd.
- Address : 41065 58, Maeyeo-ro, Dong-gu, Daegu, Republic of Korea
- Name of Contact : Wang Lok, Do / Senior Research Engineer
- Telephone Number : +82-10-2766-7264

1.2 Manufacturer

- Company : RNU Co., Ltd.
- Address : 41065 58, Maeyeo-ro, Dong-gu, Daegu, Republic of Korea
- Name of Contact : Wang Lok, Do / Senior Research Engineer
- Telephone Number : +82-10-2766-7264





2. Descriptions of EUT (Equipment under Test)

2.1 Identification of EUT

Product	RE-Merge
Product color & material	Body: white (ABS), head electrode: gold, moisture electrode: silver
Operating time	Continuous use of maximum power: about 1 hour 10 minute timer function
Weight	220g (body 175g, cradle 45g)
Size	body 172mm X 46.2 mm x 34.6mm cradle 16.5mm X 94.6mm
Power supply	3.7V 3000 mAh Li-polymer
LED	전Power, mode notification LED, battery status notification, step notification Used LED : Near-infrared ray, 3-color RGB LED (head part), UV LED
Operating KEY	Power & mode key, level control key function
Operating mode	Manual mode, automatic mode (automatic output according to moisture electrode measurement results)
Wireless charging frequency	150 kHz

Highest Clock frequency	: 16 MHz
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2.2 Support Equipment

2.2.1 Defined as equipment needed for correct operation of the EUT, but not considered as part of the testing and evaluation of the EUT:

Description	Manufacturer	Model Name	Serial Number
AC-DC Adapter	Apple	A1487	-

2.2.2 System configuration

Description	Manufacturer	Model Name	Serial Number
-	-	-	-

2.3 Used Cable(s)

The EUT was tested with following cables:

Cable Name	Condition	Description
USB cable	Connected to the EUT and AC-DC Adapter	1.20 m shielded
Multi tap	Connected to the AC-DC Adapter and AC power source	0.80 m unshielded



2.4 Operating condition during the test

AC 100 V, 50 Hz, DC 5 V

<input checked="" type="checkbox"/> A	Charge mode <input checked="" type="checkbox"/> After discharging the EUT battery, the test was carried out in a state of being charged.
<input checked="" type="checkbox"/> B	Wireless Charging <input checked="" type="checkbox"/> After discharging the EUT battery, the test was conducted in a wireless charging state.
<input checked="" type="checkbox"/> C	Operating Mode <input checked="" type="checkbox"/> After buffering the EUT battery, it was tested in the operating mode of the EUT.





3. Test Summary

3.1 Test Regulation

VCCI-CISPR 32:2016 TECHNICAL REQUIREMENTS

3.2 Test Results

STANDARDS		Result	Note
VCCI-CISPR 32	Conducted disturbance at the mains terminal	Pass	-
	Radiated disturbance (Below 1 GHz)	Pass	-
	Radiated disturbance (Above 1 GHz)	N/A	1)

Note. :

1) Excluded because the internal clock frequency is 16 MHz.

3.3 EUT Modifications

-. None.



3.4 List of Test and Measurement instruments

Test Equipment	Model	Manufacturer	Serial No.	Cal. Date	Cal. Until
GUMI UNIVERSITY EMC CENTER EMC Laboratory					
Conducted disturbance <input checked="" type="checkbox"/>					
EMI Test Receiver	ESCI	Rohde & Schwarz	100237	2023-04-05	2024-04-05
LISN	ENV216	Rohde & Schwarz	100172	2023-04-05	2024-04-05
LISN	ENV216	Rohde & Schwarz	100173	2023-04-05	2024-04-05
CDN	S1-50	EM Test	0004047C	2023-04-05	2024-04-05
Impedance Network	ST08	TESEQ	42870	2023-04-05	2024-04-05
Software	EMC 32	Rohde & Schwarz	Ver 8.53.0	N/A	N/A
Radiated disturbance <input checked="" type="checkbox"/>					
EMI Test Receiver	ESR7	Rohde & Schwarz	101382	2023-04-05	2024-04-05
Software	EMC 32	Rohde & Schwarz	Ver 10.40.10	N/A	N/A
Broadband Test Antenna	VULB9160	Schwarzbeck	3099	2021-10-12	2023-10-12
Horn Antenna	BBHA9120D	Schwarzbeck	597	2023-04-18	2024-04-18
Position Controller	CO3000	Innco system GmbH	CO3000/779/33050314/L	N/A	N/A
Turntable	DT3000	Innco system GmbH	1280314	N/A	N/A
Antenna Mast	MA4000-EP	Innco system GmbH	4420314	N/A	N/A
Antenna Mast	MA4640-XP-ET	HD CmbH	MA4640/558	N/A	N/A
Band reject filter	WRCJV8-2350-2400-2483.5-2533.5-40SS	AAMCS	5	2023-04-05	2024-04-05
Low Noise Amplifier	TK-PA06S	TESTEK	170038-L	2023-04-06	2024-04-06
Antenna Mast	MA4640-XP-ET	Innco system GmbH	MA4640/947/55 390822/P	N/A	N/A
Microwave Preamplifier	8449B	Agilent	3008A01828	2023-04-06	2024-04-06

※ All test equipment used is calibrated on a regular basis.

: **Not Used**

: **Used**



4. Description of tests

4.1 Conducted Emission

The Line conducted emission test facility is inside a 4 m × 8 m × 2.5 m shielded enclosure.

The EUT was placed on a non-conducting 1.0 m by 1.5 m table, which is 0.8 m in height and 0.4 m away from the vertical wall of the shielded enclosure.

The EUT is powered from the Rohde & Schwarz LISN (ENV216) and the support equipment is powered from the Rohde & Schwarz LISN (ENV216). Powers to the LISN are filtered by high-current high insertion loss power line filter.

Sufficient time for EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.

The RF output of the LISN was connected to the EMI test receiver (Rohde & Schwarz, ESCI).

Exploratory measurements were conducted to identify the highest emission by operating the EUT in a range of typical modes of operation, cable positions, system configuration and arrangement.

Based on exploratory measurements, the final measurements were conducted at the worst test conditions.

Exploratory measurements were scanned using Peak mode of EMI Test receiver from 150 kHz to 30 MHz with 20 ms sweep time. The final measurements were measured with Quasi-Peak and Average mode.

The bandwidth of EMI Test Receiver was set to 9 kHz. Interface cables were connected to the available interface ports of the test unit. Excess cable lengths were bundled at center with 30 cm ~ 40 cm.

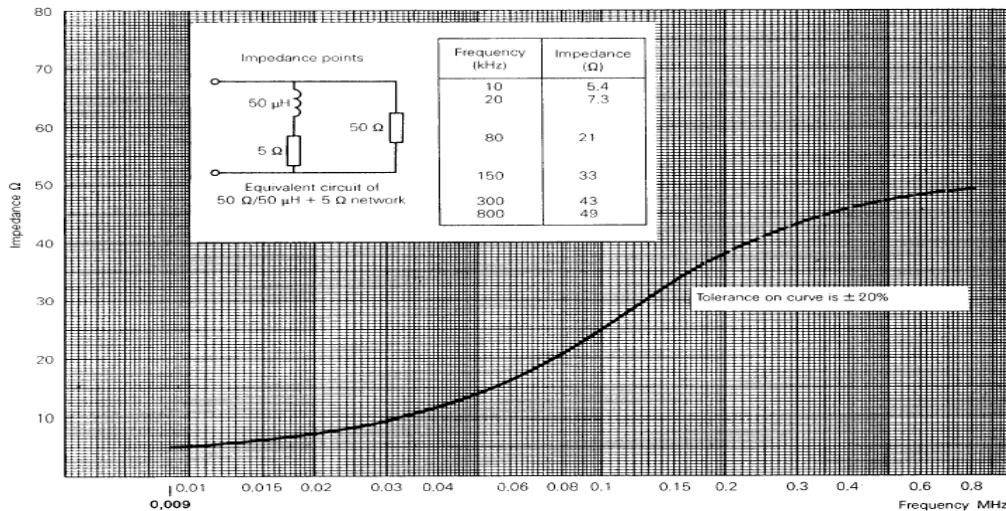


Fig 1. Impedance of LISN

4.2 Radiated Emission

Exploratory Radiated measurements were conducted at the 3 m semi anechoic chamber in order to identify the highest emission by operating the EUT in a range of typical modes of operation, cable positions, system configuration and arrangement.

Based on exploratory measurements, the final measurements were conducted at the worst test conditions. Final measurements of below 1 GHz were made at 10 m chamber that complies with CISPR 16. Above 1 GHz final measurements were conducted at the 3 m Chamber only.

For measurements above 1 GHz, the bottom side of 3 m chamber was installed with absorbers in order to meet SVSWR Limit.

Exploratory measurements were scanned using Peak mode of EMI Test receiver and final measurements were measured with Quasi-Peak mode (Below 1 GHz) and Peak & Average mode (Above 1 GHz).

The measurements were performed by rotating the EUT 360° and adjusting the receive antenna height from 1.0 m to 4.0 m. All frequencies were investigated in both horizontal and vertical antenna polarity.

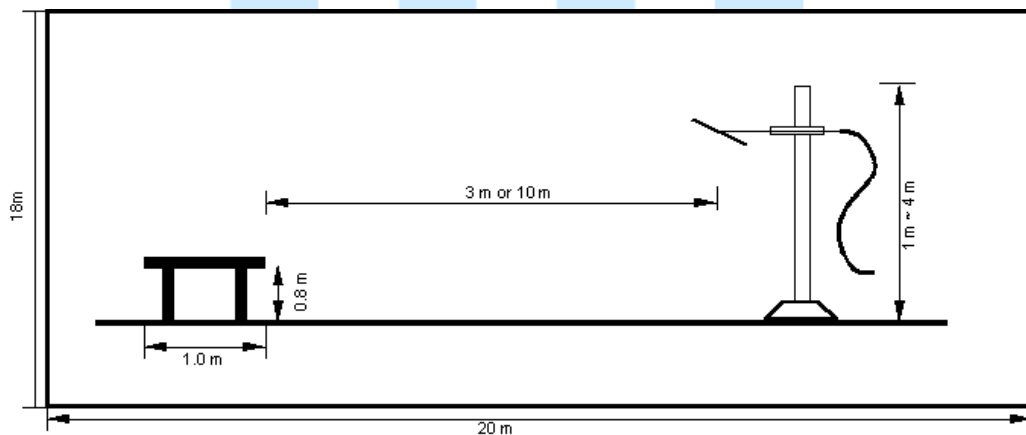


Fig 2. Dimensions of test site (Below 1 GHz)

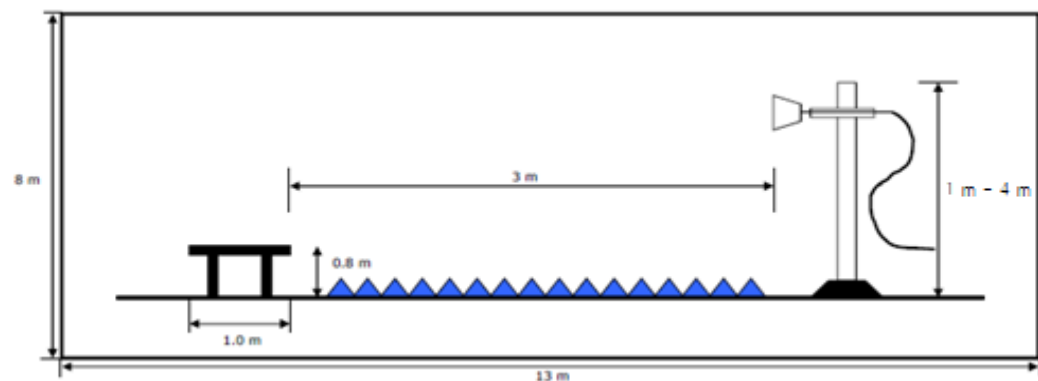


Fig 3. Dimensions of test site (Above 1 GHz)



5. Conducted Disturbance

5.1 Operating Environment

Temperature : 25.1 °C
 Relative Humidity : 45.1 %
 Air pressure : 100.8 kPa

5.2 Test Set-up

The conducted disturbance measurements were performed in the shielded room.

The EUT was placed on wooden table, 0.8 m heights above the floor, 0.4 m from the reference ground plane (GRP) wall and 0.8 m from AMN & ISN.

AMN is bonded on horizontal reference ground plane.

The ground plane, which was electrically bonded to the shield room, ground system and all power lines entering the shield room, was filtered.

5.3 Measurement Uncertainty

The measurement uncertainty was calculated in accordance with ISO “Guide to the expression of uncertainty in measurement.”

Test Items	Uncertainty	Remark
Conducted emission (9 kHz ~ 150 kHz)	3.69 dB	Confidence level of approximately 95 % ($k = 2$)
Conducted emission (150 kHz ~ 30 MHz)	3.32 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

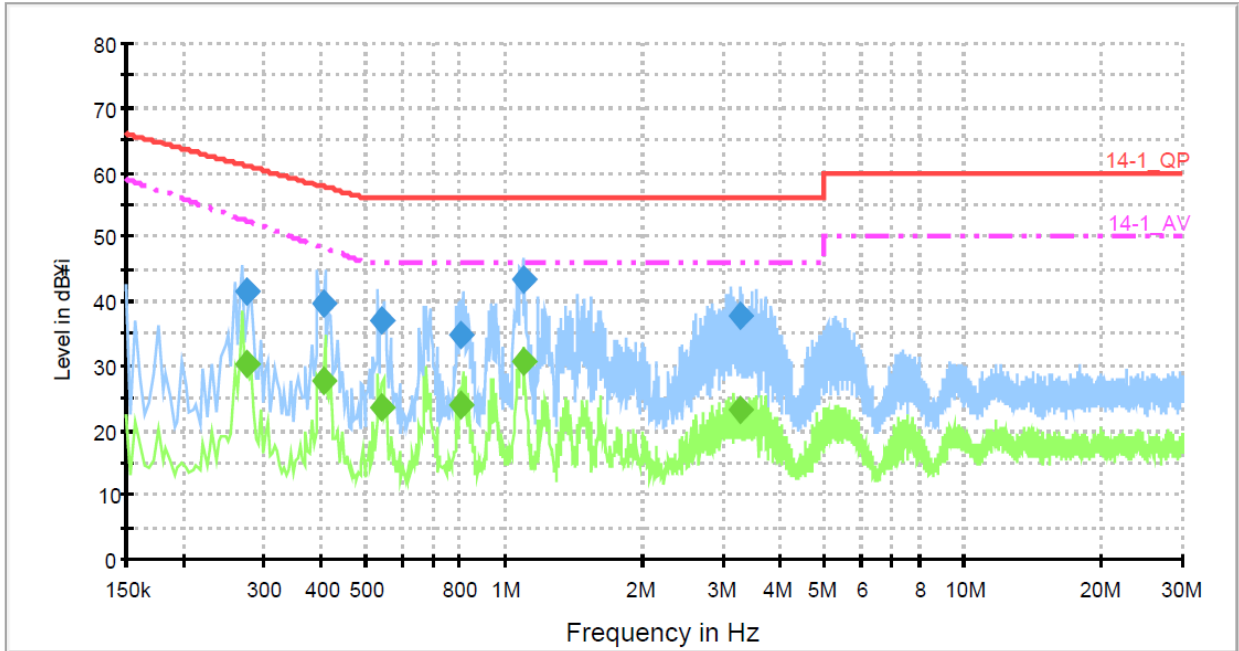
5.4 Test data for Conducted Disturbance

5.4.1 Mains terminal

-. Test Date : Jun. 13, 2023
 -. Resolution Bandwidth : 9 kHz
 -. Frequency Range : 0.15 MHz ~ 30 MHz
 -. Line : L1: Live line, N: Neutral line
 -. Test mode : A, B



Operating condition: A



— 14-1_QP - - - 14-1_AV — Preview Result 1-PK+
— Preview Result 2-AVG ◆ Final Result 1-QPK ◆ Final Result 2-CAV

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.273900	41.6	1000.0	9.000	Off	L1	9.7	19.4	61.0	
0.403956	39.8	1000.0	9.000	Off	L1	9.7	18.0	57.8	
0.539088	36.9	1000.0	9.000	Off	L1	9.7	19.1	56.0	
0.806931	34.9	1000.0	9.000	Off	L1	9.7	21.1	56.0	
1.098238	43.4	1000.0	9.000	Off	L1	9.7	12.6	56.0	
3.276750	37.7	1000.0	9.000	Off	L1	9.7	18.3	56.0	

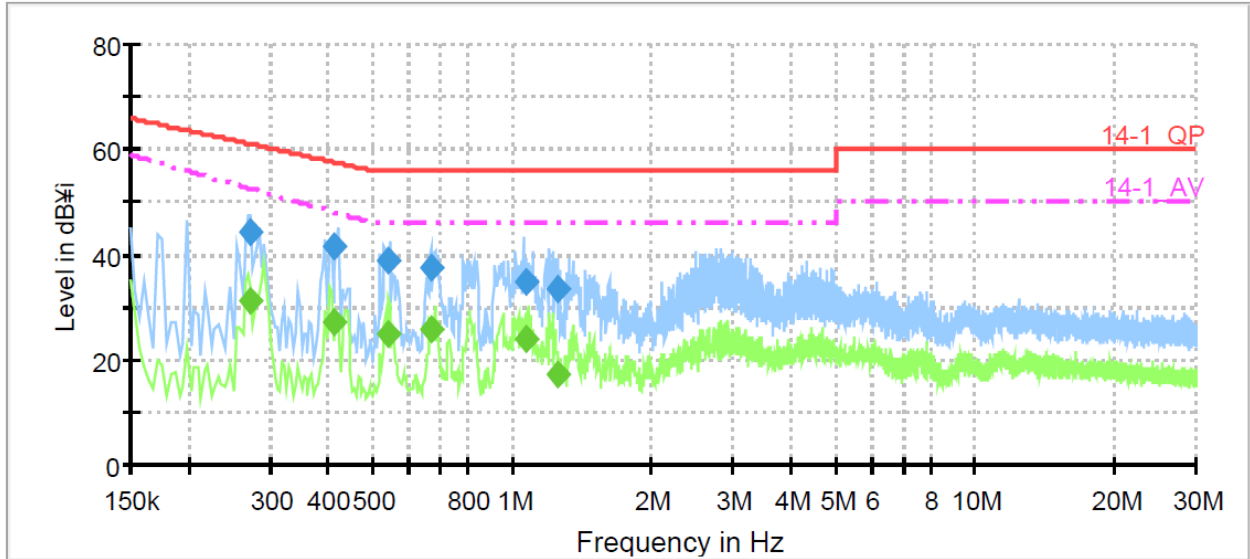
Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.273900	30.5	1000.0	9.000	Off	L1	9.7	22.0	52.5	
0.403956	27.8	1000.0	9.000	Off	L1	9.7	20.5	48.3	
0.539088	23.4	1000.0	9.000	Off	L1	9.7	22.6	46.0	
0.806931	24.1	1000.0	9.000	Off	L1	9.7	21.9	46.0	
1.098238	30.6	1000.0	9.000	Off	L1	9.7	15.4	46.0	
3.276750	23.1	1000.0	9.000	Off	L1	9.7	22.9	46.0	

< Fig 4. Graph of continuous disturbance >



Operating condition: B



— 14-1_QP - - - 14-1_AV — Preview Result 1-PK+
— Preview Result 2-AVG ◆ Final Result 1-QPK ◆ Final Result 2-CAV

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.273631	44.5	1000.0	9.000	Off	N	9.7	16.5	61.0	
0.410881	41.8	1000.0	9.000	Off	N	9.7	15.9	57.6	
0.538012	38.9	1000.0	9.000	Off	N	9.7	17.1	56.0	
0.672069	37.4	1000.0	9.000	Off	N	9.7	18.6	56.0	
1.077194	35.0	1000.0	9.000	Off	L1	9.7	21.0	56.0	
1.261875	33.5	1000.0	9.000	Off	L1	9.7	22.5	56.0	

Final Result 2

Frequency (MHz)	CAverage (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.273631	31.3	1000.0	9.000	Off	N	9.7	19.4	50.8	
0.410881	27.2	1000.0	9.000	Off	N	9.7	20.3	47.5	
0.538012	25.1	1000.0	9.000	Off	N	9.7	20.9	46.0	
0.672069	25.6	1000.0	9.000	Off	N	9.7	20.4	46.0	
1.077194	24.1	1000.0	9.000	Off	L1	9.7	21.9	46.0	
1.261875	17.1	1000.0	9.000	Off	L1	9.7	28.9	46.0	

< Fig 4. Graph of continuous disturbance >



6. Radiated Disturbance

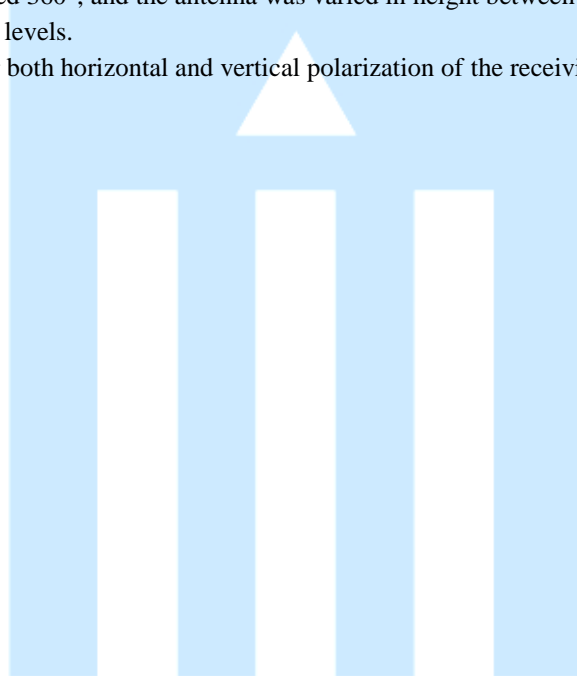
6.1 Operating Environment

Temperature : 23.3 °C
Relative Humidity : 45.0 %
Air pressure : 100.8 kPa

6.2 Test Set-up

A preliminary scan with peak mode was performed in the semi anechoic chamber and found frequency for test site. The formal radiated emission was measured at 10 m distance open area test site and 3 m distance anechoic chamber. The EUT was placed on a non-conductive turntable approximately 0.8 m above the ground plane. The turntable with EUT was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels.

This procedure was performed for both horizontal and vertical polarization of the receiving antenna.





6.3 Measurement Uncertainty

The measurement uncertainty was calculated in accordance with ISO “Guide to the expression of uncertainty in measurement”.

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.

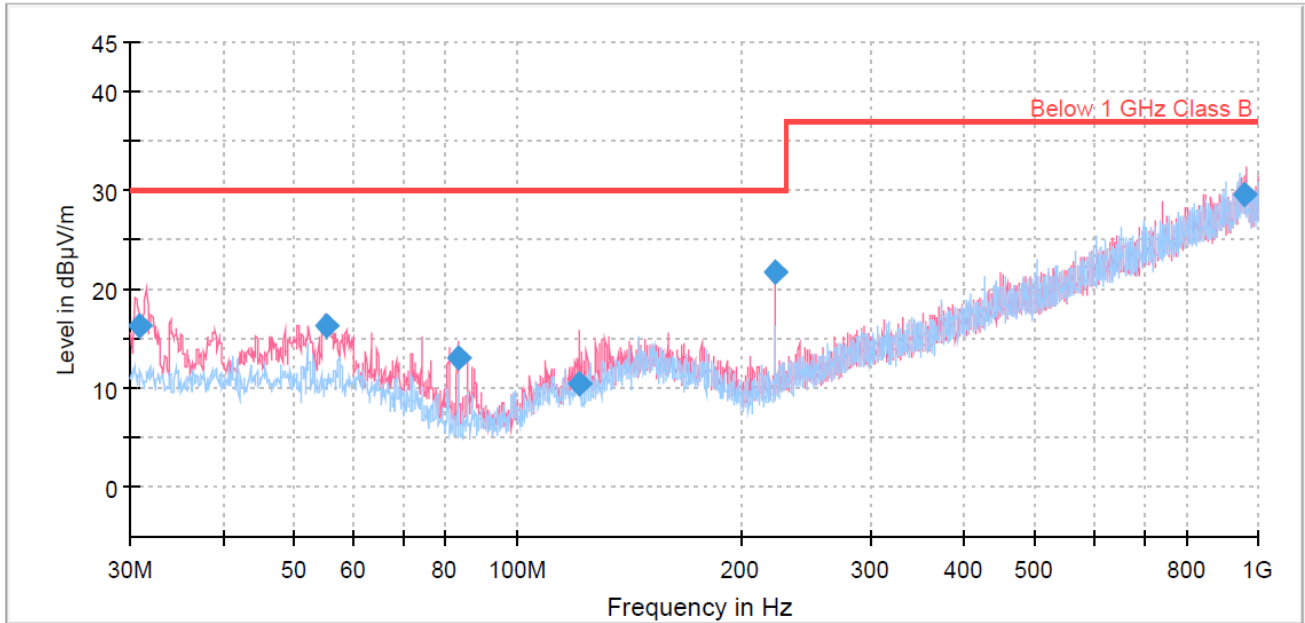
The listed uncertainties are the worst case uncertainty for the entire range of measurement. please note that the uncertainty values are provided for informational purposes only are not used in determining the PASS/FAIL results

6.4 Test data for Radiated Disturbance

- Test Date : Jun. 12, 2023
- Resolution Bandwidth : 120 kHz
- Frequency Range : 30 MHz ~ 1 000 MHz
- Measurement : 10 m
- Detector mode : Quasi-peak detector mode
- Test mode : A, B, C



▪ Operating condition: A



— Preview Result 1V-PK+ — Preview Result 1H-PK+
 — Below 1 GHz Class B ◆ Final_Result QPK

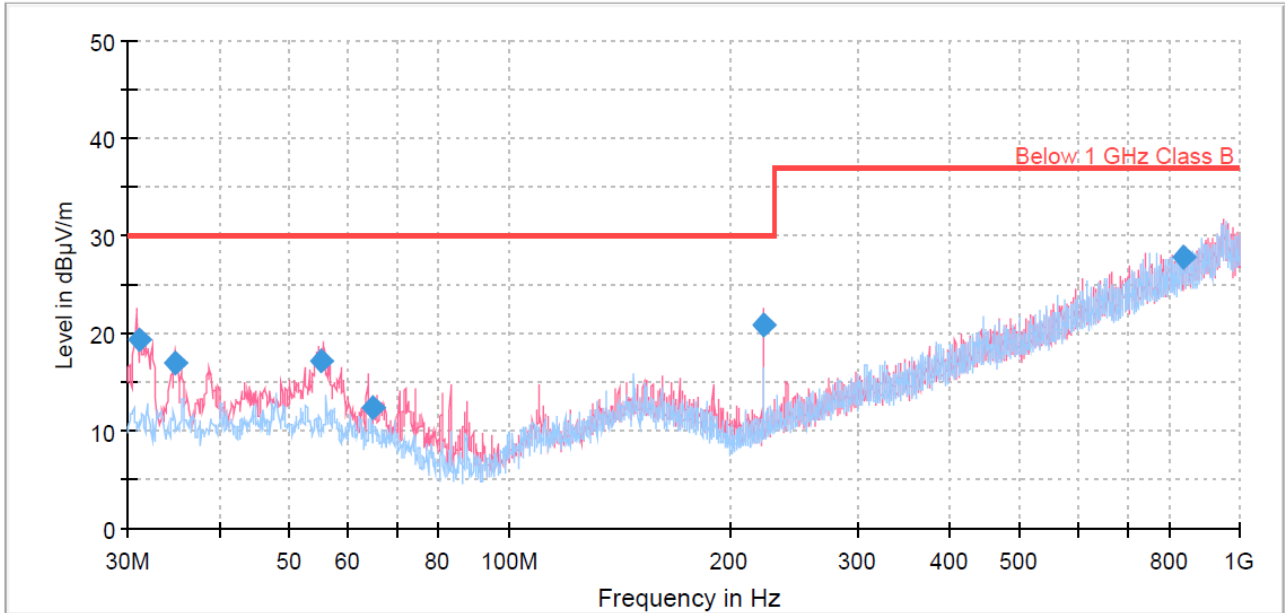
Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.835238	16.26	30.00	13.74	1000.0	120.000	107.0	V	236.0	-28.3
55.276379	16.29	30.00	13.71	1000.0	120.000	109.0	V	-35.0	-28.5
83.153638	13.13	30.00	16.87	1000.0	120.000	296.0	V	11.0	-33.1
121.037682	10.47	30.00	19.53	1000.0	120.000	209.0	V	5.0	-28.9
222.755546	21.67	30.00	8.33	1000.0	120.000	175.0	V	153.0	-28.1
959.340175	29.61	37.00	7.39	1000.0	120.000	188.0	V	306.0	-6.5

< Fig 5. Graph of radiated disturbance >



Operating condition: B



— Preview Result 1V-PK+ — Preview Result 1H-PK+
 — Below 1 GHz Class B ◆ Final_Result QPK

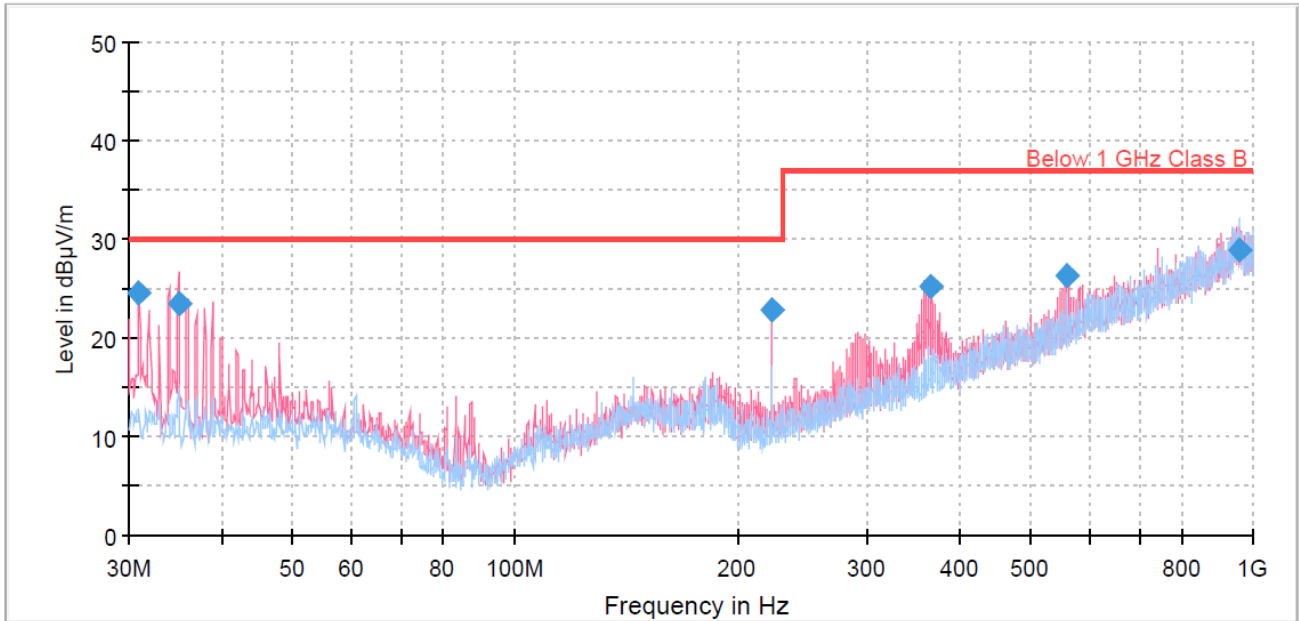
Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.989109	19.45	30.00	10.55	1000.0	120.000	111.0	V	123.0	-28.3
34.727015	16.98	30.00	13.02	1000.0	120.000	108.0	V	128.0	-28.8
55.073167	17.24	30.00	12.76	1000.0	120.000	114.0	V	208.0	-28.5
64.953532	12.30	30.00	17.70	1000.0	120.000	198.0	V	80.0	-29.4
222.765729	20.89	30.00	9.11	1000.0	120.000	175.0	V	149.0	-28.1
835.113684	27.73	37.00	9.27	1000.0	120.000	290.0	H	269.0	-9.3

< Fig 5. Graph of radiated disturbance >



Operating condition: C



— Preview Result 1V-PK+ — Preview Result 1H-PK+
 — Below 1 GHz Class B ◆ Final_Result QPK

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)
30.970000	24.50	30.00	5.50	1000.0	120.000	191.0	V	123.0	-28.4
35.007804	23.43	30.00	6.57	1000.0	120.000	107.0	V	136.0	-28.8
222.739000	22.72	30.00	7.28	1000.0	120.000	175.0	V	-28.0	-28.1
364.635483	25.19	37.00	11.81	1000.0	120.000	125.0	V	16.0	-22.2
559.205303	26.34	37.00	10.66	1000.0	120.000	325.0	V	281.0	-16.1
955.039118	29.00	37.00	8.00	1000.0	120.000	117.0	H	0.0	-6.2

< Fig 5. Graph of radiated disturbance >

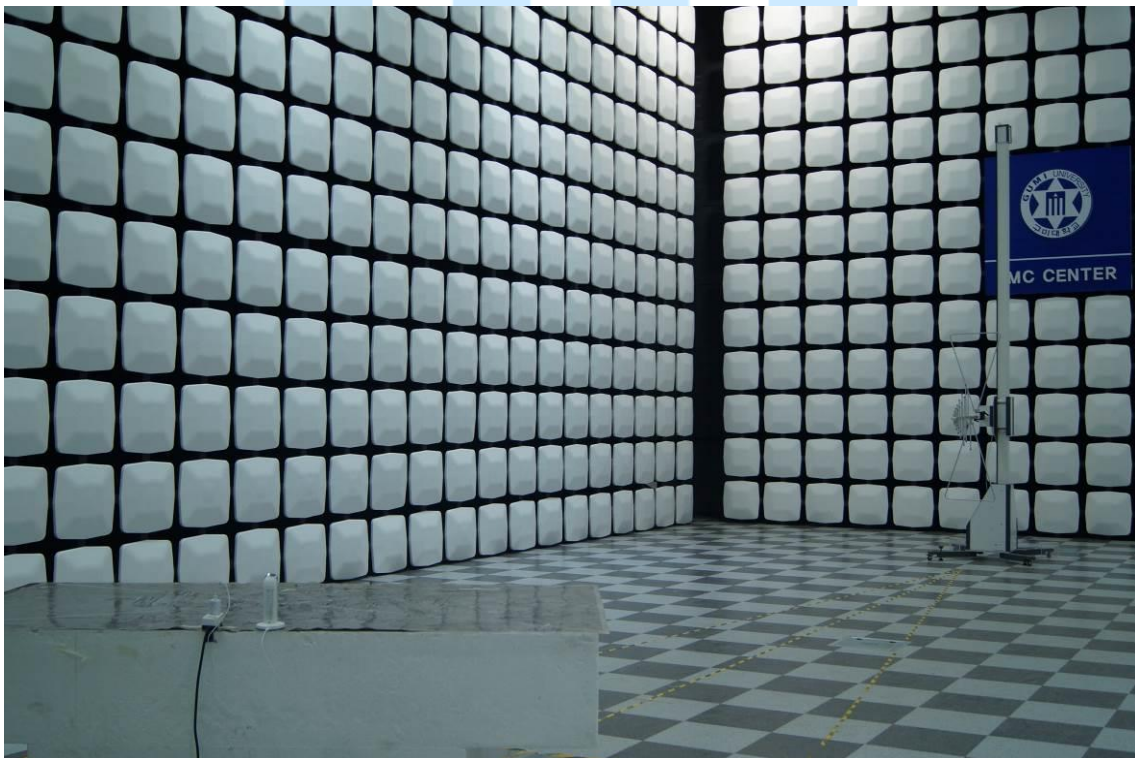
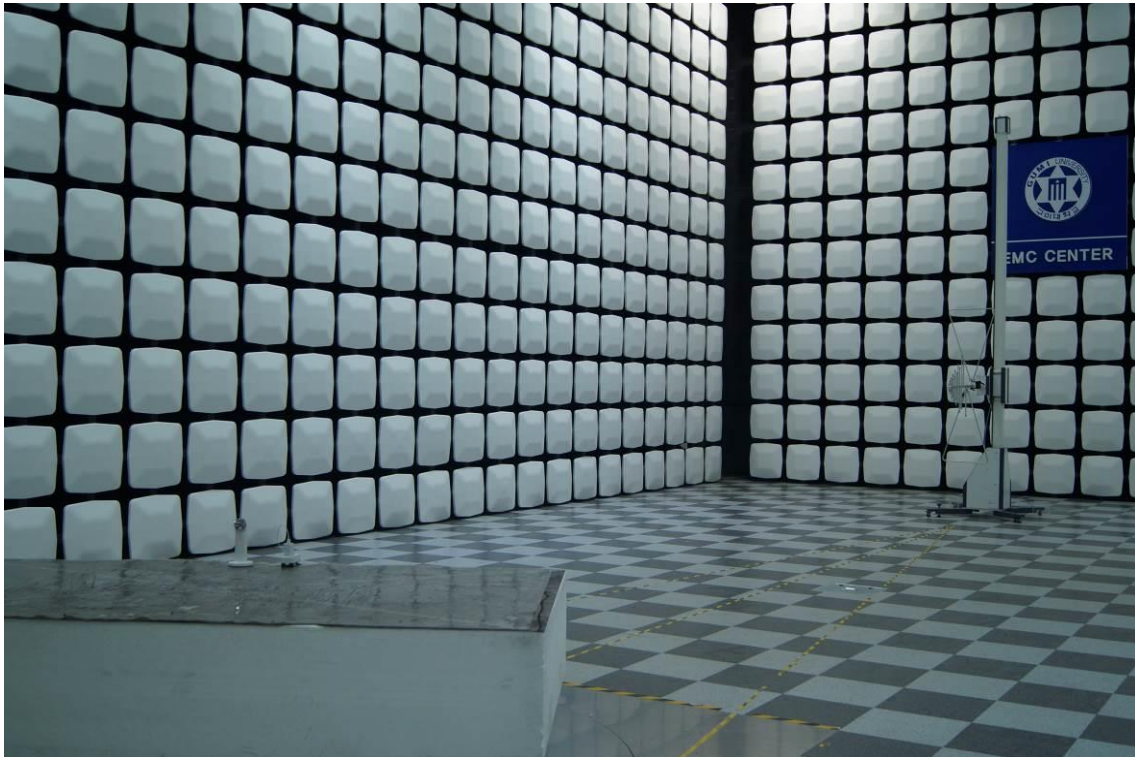


Appendix A - Photograph of test setup: Conducted Disturbance





Appendix B - Photograph of test setup: Radiated Disturbance (Below 1 GHz)



- The end -