

FCC TEST REPORT

Job No. : GPEM2205000212EC
Applicant : TAECHU ENGINEERING CO., LTD.
Equipment Under Test (EUT) :
Product Name : LASER MARKING MACHINE
Model Name : F230
FCC Authorization Type : Certification
Applied Standards : FCC Part 15 Subpart B, Class A
ANSI C63.4a:2017
FCC ID : 2A89W-F230
Date of Receipt : May 9, 2022
Date of Test : October 13, 2022 ~ November 1, 2022
Date of Issue : November 7, 2022
Test Results : Complied

Tested by

:



Luther Choi

Reviewed by

:



Julia Choi

This test report does not assure KOLAS accreditation.

- 1) The results of this test report are effective only to the items tested.
- 2) The SGS Korea is not responsible for the sampling, the results of this test report apply to the sample as received.

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Revision History

Revision	Report number	Description
0	F690501-RF-EMC000927	Initial

1. General Information

1.1 Client Information

Applicant	TAECHU ENGINEERING CO., LTD.
Applicant Address	1, Deokjeolchangmal-gil, Jeongnam-myeon, Hwaseong-si, Gyeonggi-do, 18515, Republic of Korea
Manufacturer	TAECHU ENGINEERING CO., LTD.
Manufacturer Address	1, Deokjeolchangmal-gil, Jeongnam-myeon, Hwaseong-si, Gyeonggi-do, 18515, Republic of Korea

1.2 Test Laboratory

Name and Address	SGS Korea Co., Ltd.
- Giheung Laboratory	35, Giheungdanji-ro 121beon-gil, Giheung-gu, Yongin-si, Gyeonggi-do, Republic of Korea
- Gunpo Laboratory	4, LS-ro 182beon-gil, Gunpo-si, Gyeonggi-do, 15807, Republic of Korea
- Dongtan Laboratory	12, Dongtansandan 10-gil, Hwaseong-si, Gyeonggi-do, 18487, Republic of Korea
FCC Registration No.	KR0150
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1.3 General Information of E.U.T.

Classification	Specification
Product Name	LASER MARKING MACHINE
Model Name	F230
Serial No.	-
EMI Classification	Class A
Test Voltage	AC 120 V, 60 Hz
Rated Power	AC (100-240) V, 50/60 Hz, 650 W
Internal Clock Frequency	2.3 GHz
H/W Version	IZI-CODE_V0
S/W Version	14.11
Port	USB Port 1~6, Encoder Port, Interlock/UI Port, Scanner Port, VGA Port, PC LAN Port 1~2, Power Plug Port (Not Use Port : Aux, DVI Port, HDMI Port, DC Port)
Components	AC Power Cable, SCANNER CABLE, UI CABLE
Function	A machine that engraves text using a laser

1.4 Operating Modes and Conditions

Operating mode	Operating Condition
1) Operating	The EUT is powered on, engraving with a laser through the scanner head, and communicating with a Notebook computer and LAN.

1.5 Peripheral Equipments

Description	Model	Serial No.	Manufacturer	Note.
Monitor	E2251VRT	111LTHR1P145	LG Electronics Inc.	-
Notebook Computer 1	NT740U5L	0MMN91BH800200Y	Samsung Electronics Co., Ltd.	-
Notebook Computer 2	NT740U5L	0MMN91BH800265L	Samsung Electronics Co., Ltd.	-
UI	SMY-4SL	-	-	-
Encoder	ROTARY ENCODER	-	AUTONICS CORPORATION	-
Keyboard	-	-	-	-
Mouse	AA-SM7PCP	CN57BA5903634ADV 8J3936752	Acrox Technologies Co., Ltd.	-
USB MEMORY 1	-	-	-	-
USB MEMORY 2	-	-	-	-
USB MEMORY 3	-	-	-	-
USB MEMORY 4	-	-	-	-

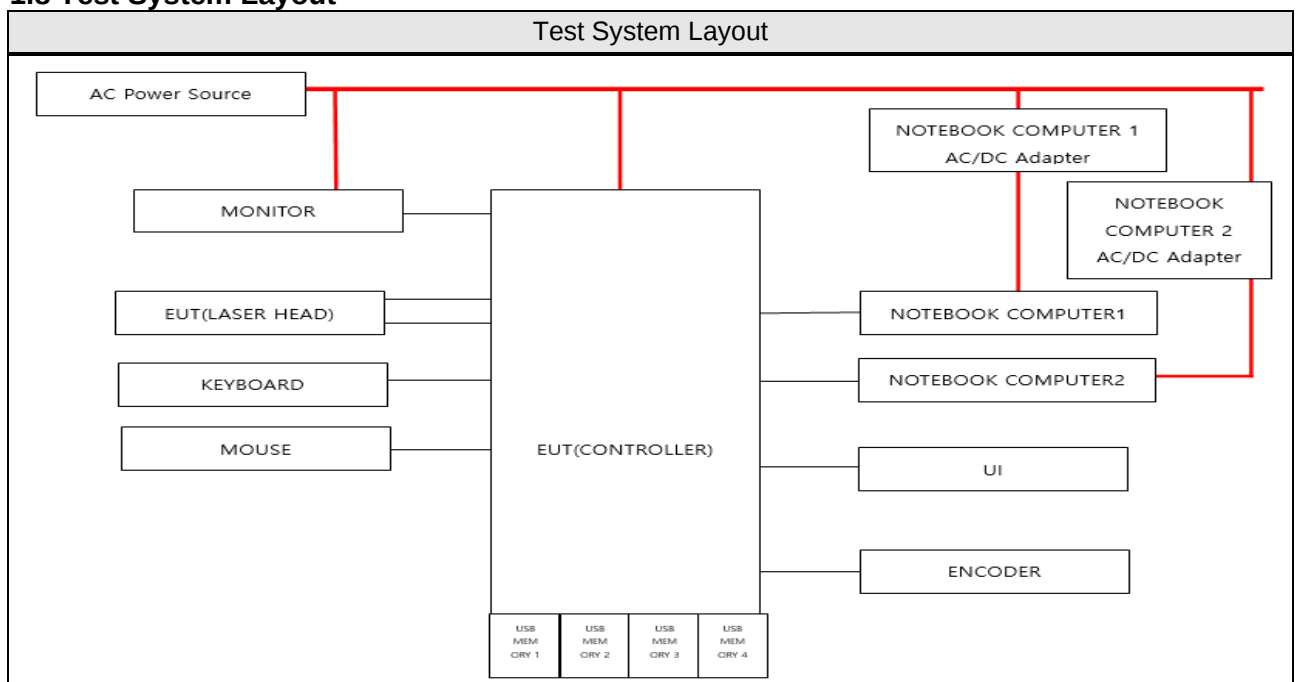
1.6 Cable List

Start		END		Cable Spec.		Used core
Name	I/O Port	Name	I/O Port	Length (m)	Shield	
EUT (CONTROLLER)	Fiber Optic Port	EUT (LASER HEAD)	Fiber Optic Port	2.5	Shield	No
	Scanner Port		Scanner Port	2.8	Shield	No
	VGA Port	MONITOR	VGA Port	1.8	Shield	No
	USB Port 1	KEYBOARD	USB	1.5	Unshield	No
	USB Port 2	MOUSE	USB	2.0	Unshield	No
	PC LAN PORT 1	NOTEBOOK COMPUTER 1	LAN	3.0	Unshield	No
	PC LAN PORT 2	NOTEBOOK COMPUTER 2	LAN	3.0	Unshield	No
	Interlock / UI Port	UI	25 Pin	2.5	Shield	No
	Encoder Port	ENCODER	9 Pin	2.0	Shield	No
	USB Port 3	USB MEMORY 1	USB	-	-	-
	USB Port 4	USB MEMORY 2	USB	-	-	-
	USB Port 5	USB MEMORY 3	USB	-	-	-
	USB Port 6	USB MEMORY 4	USB	-	-	-
	Power Plug Port	AC Power Source	-	1.2	Unshield	2 EA

1.7 System Configurations

Description	Model	Serial No.	Manufacturer	Note
Controller MAIN BOARD	J3455T-IM-A	MAMEKC006789WEZ	-	-
Controller Fan	AFB0924SH	-	DELTA ELECTRONICS, INC	2 EA
Controller FIBER LASER SOURCE BOARD	-	-	-	-
Controller FIBER LASER SOURCE Sub BOARD	-	-	-	-
Controller LASER CONTROLLER BOARD	LMCV4-FIBER REV:20170607	BJJCZ-32205FS40032B	Beijing JCZ Technology Co. Ltd	-
Controller REAR BOARD	FIBER LOW REV2.0	-	TAECHU CO.,LTD	-
LASER HEAD SCANNER MOTOR	-	-	-	-
LASER HEAD MOTOR CONTROLLER BOARD	-	-	-	-
LASER HEAD LENS	-	-	-	-
POWER CABLE FERRITE CORE	ZCAT2035-0930	-	TDK	2 EA
Controller SMPS1	LRS-50-12	-	MEAN WELL Enterprises Co., Ltd.	-
Controller SMPS2	LRS-75-15	-	MEAN WELL Enterprises Co., Ltd	2 EA
Controller SMPS3	RSP-320-24	-	MEAN WELL Enterprises Co., Ltd	-

1.8 Test System Layout



1.9 Modifications/Notes

- There was no modified item during the test.

1.10 Applicable Standards for Testing

Standards	Status	Deviation
FCC Part 15 : Subpart B ANSI C63.4a:2017	Applicable	No Deviation

1.11 Summary of Test Results

Test Item	Standards	Results
Conducted Emission	FCC Part 15 Subpart B Section 15.107 ANSI C63.4a:2017	Complied
Radiated Emission	FCC Part 15 Subpart B Section 15.109 ANSI C63.4a:2017	Complied

Note : Test methods of all test items are performed according to the basic standards in this table.

EMISSION

2.1 Test Results

Test Items	Standards	Test Results
Conducted Emission	FCC Part 15 Subpart B Section 15.107 ANSI C63.4a:2017	Complied
Radiated Emission	FCC Part 15 Subpart B Section 15.109 ANSI C63.4a:2017	Complied

2.2 Test Method and Limits

2.2.1 Test Method

Test Items	Measuring Frequency Range	RBW	Measuring Distance
Conducted Emission	0.15 MHz ~ 30 MHz	9 kHz	-
Radiated Emission	30 MHz ~ 1 GHz	120 kHz	10 m & 3 m
	Above 1 GHz	1 MHz	3 m

Note : 10 m method of radiated emission measurement is only applied to Class A equipment over the frequency range of 30 MHz ~ 1 GHz. Except this, 3 m method is applied to Class B equipment over the frequency range of 30 MHz ~ 1 GHz and Class A and Class B equipment above 1 GHz.

2.2.2 Test Limits

-Conducted Emission Limits

Frequency Range	Limits(dB μ V)		Class
	Quasi-peak	Average	
0.15 MHz ~ 0.5 MHz	79	66	Class A
0.5 MHz ~ 30 MHz	73	60	
0.15 MHz ~ 0.5 MHz	66 to 56	56 to 46	Class B
0.5 MHz ~ 5 MHz	56	46	
5 MHz ~ 30 MHz	60	50	

Note : The lower limit shall apply at the transition frequencies. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

-Radiated Emission Limits below 1 GHz

Frequency Range	Limits(dB μ V/m)	Class
	Quasi-peak	
30 MHz ~ 88 MHz	39.0	Class A (10 m method)
88 MHz ~ 216 MHz	43.5	
216 MHz ~ 960 MHz	46.4	
960 MHz ~ 1 GHz	49.5	
30 MHz ~ 88 MHz	40.0	Class B (3 m method)
88 MHz ~ 216 MHz	43.5	
216 MHz ~ 960 MHz	46.0	
960 MHz ~ 1 GHz	54.0	

-Radiated Emission Limits above 1 GHz (3 m method)

Frequency Range	Limits(dB μ V/m)		Class
	Average	Peak	
Above 1 GHz	59.5	79.5	Class A
Above 1 GHz	54.0	74.0	Class B

Note : The limits of class A equipment is extrapolated using an extrapolation factor of 20 dB/decade because it was measured at 3 m distance not 10 m distance.

2.3 Conducted Disturbance

The initial preliminary exploratory scans were performed over the measuring frequency range(0.15 MHz to 30 MHz) using a max hold mode incorporating a Peak detector and CISPR-Average detector and using the EMI measuring software. The final test data was measured using a Quasi-Peak detector and CISPR-Average detector.

Note. Measuring software

- Giheung Lab.: EMC32(V10.40.10) from R&S
- Gunpo Lab.: EMC32(V V8.52.0) from R&S
- Dongtan Lab.: EMC32(V10.40.00) from R&S

2.3.1 Test Equipments

Equipment	Model	Manufacturer	Serial No	Cal Due. Date
EMI TEST RECEIVER	ESU8	R&S	100128	2023.05.26
2-LINE V-NETWORK	ENV216	R&S	101180	2023.08.04
ARTIFICIAL MAIN NETWORK	ESH2-Z5	R&S	100303	2023.08.24
PULSE LIMITER	ESH3-Z2	R&S	100283	2023.08.22
EMH-1Lab-CE-01	-	-	-	2023.01.11

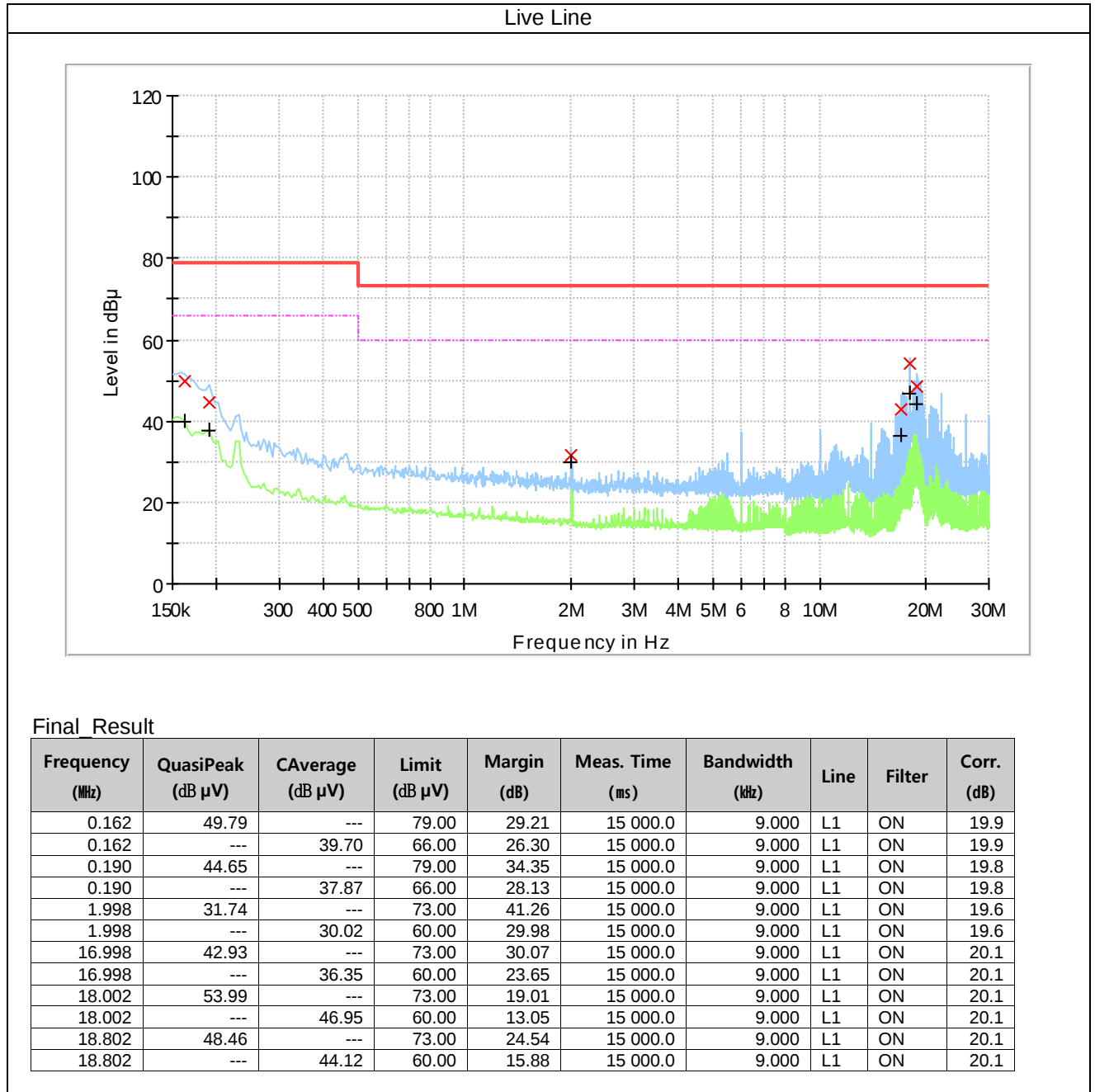
2.3.2 Test Site

Shield Room in Giheung Laboratory

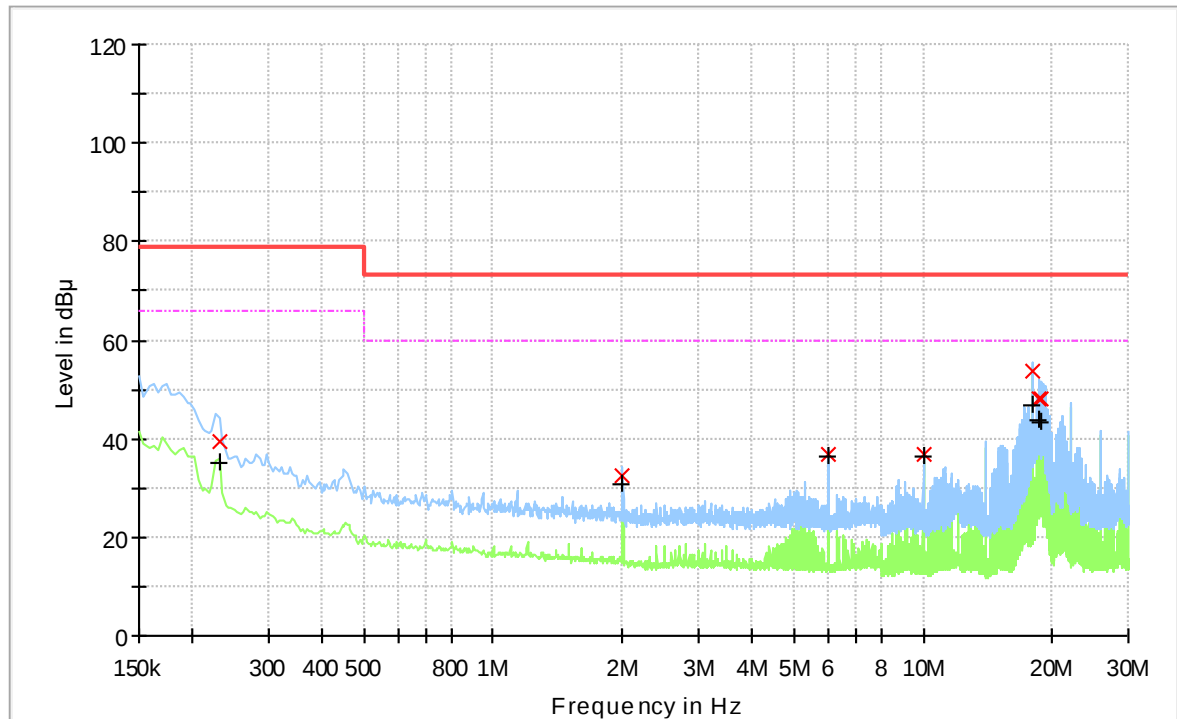
2.3.3 Environment Conditions

Temperature	(Minimum 20.5, Maximum 22.2) °C
Humidity	(Minimum 36.0, Maximum 38.0) % R.H.
Atmospheric Pressure	(Minimum 101.7, Maximum 101.7) kPa
Test Date	October 21, 2022

2.3.4 Test Results



Neutral Line



Final Result

Frequency (MHz)	QuasiPeak (dB μV)	CAverage (dB μV)	Limit (dB μV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.230	39.45	---	79.00	39.55	15 000.0	9.000	N	ON	19.7
0.230	---	35.28	66.00	30.72	15 000.0	9.000	N	ON	19.7
1.998	32.30	---	73.00	40.70	15 000.0	9.000	N	ON	19.6
1.998	---	30.73	60.00	29.27	15 000.0	9.000	N	ON	19.6
5.998	36.83	---	73.00	36.17	15 000.0	9.000	N	ON	19.8
5.998	---	36.29	60.00	23.71	15 000.0	9.000	N	ON	19.8
9.998	36.88	---	73.00	36.12	15 000.0	9.000	N	ON	19.8
9.998	---	36.31	60.00	23.69	15 000.0	9.000	N	ON	19.8
18.002	53.92	---	73.00	19.08	15 000.0	9.000	N	ON	20.1
18.002	---	46.96	60.00	13.04	15 000.0	9.000	N	ON	20.1
18.598	48.14	---	73.00	24.86	15 000.0	9.000	N	ON	20.1
18.598	---	43.94	60.00	16.06	15 000.0	9.000	N	ON	20.1
18.902	48.17	---	73.00	24.83	15 000.0	9.000	N	ON	20.1
18.902	---	43.30	60.00	16.70	15 000.0	9.000	N	ON	20.1

Measurement Uncertainty : See Appendix A

Note1 : • Line (L1) : Hot • Line (N) : Neutral

- Margin = Limit – Quasi Peak or CAverage
- Corr. = LISN Factor + Cable loss + Pulse Limiter Factor

Ex) In case

Freq ; 0.5 MHz, level ; 30 dB(μV), CL ; 0.2 dB, LISN ; 9.5 dB, P/L : 9.8 dB

Result = Level + CL + LISN + P/L

= 30 + 0.2 + 9.5 + 9.8

= 49.5

Margin = Limit – Result

= 79 - 49.5

= 29.5

2.4 Radiated Emission

The initial preliminary exploratory scans were performed over the measuring frequency range (30 MHz to 12 GHz) using a max hold mode incorporating a Peak detector by using the EMI measuring software. The final test data was measured using a Quasi-Peak detector below 1 GHz and using a Peak and Average detector above 1 GHz.

Measurements were made with the antenna positioned in both the horizontal and vertical planes of polarization. The antenna height was varied from 1 m to 4 m and the EUT was rotated 360° to find the maximum emitting point for each frequency.

Note. Measuring software

- Giheung Lab.: EMC32(V10.40.10) from R&S
- Gunpo Lab.: EP5RE(V5.3.70) from TOYO
- Dongtan Lab.: EMC32(V10.40.10) from R&S

2.4.1 Test Equipments

Equipment	Model	Manufacturer	Serial No	Cal Due. Date
EMI TEST RECEIVER	ESU40	R&S	100075	2023.01.19
Hybrid ANTENNA	VULB 9163	SCHWARZBECK	9163-396	2023.03.24
Double Ridged Horn Antenna	HF907	R&S	102578	2023.05.02
PREAMPLIFIER	AM-1431	MITEQ	1336160	2023.05.23
AMPLIFIER	SCU 18	R&S	10070	2023.08.25
EMH-1Lab-RE-01	-	-	-	2023.01.11
EMH-1Lab-RE-02	-	HUBER+SHUNER	-	2023.01.11
EMH-1Lab-RE-03	-	-	-	2023.01.11
EMH-1Lab-RE-04	-	-	-	2023.01.11
EMH-1Lab-RE-05	-	-	-	2023.01.11
EMH-1Lab-RE-06	-	-	-	2023.01.11

2.4.2 Test Site

10 m SEMI-ANECHOIC CHAMBER in Giheung Laboratory

2.4.3 Environment Conditions

Below 1 GHz

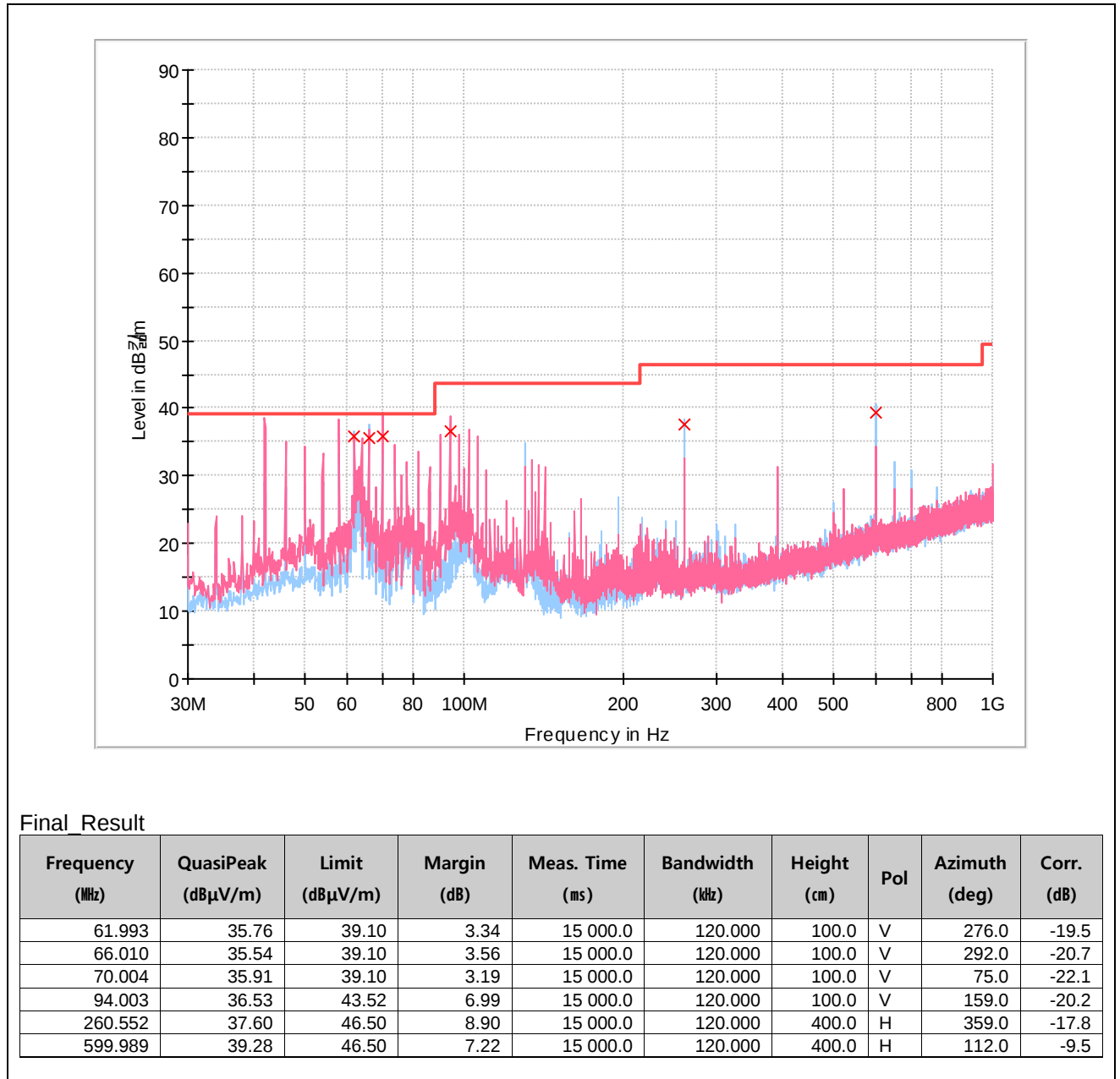
Temperature	(Minimum 22.6, Maximum 23.7) °C
Humidity	(Minimum 43.0, Maximum 45.0) % R.H.
Atmospheric Pressure	(Minimum 100.8, Maximum 100.8) kPa
Test Date	October 13, 2022

Above 1 GHz

Temperature	(Minimum 20.2, Maximum 21.0) °C
Humidity	(Minimum 43.0, Maximum 44.0) % R.H.
Atmospheric Pressure	(Minimum 101.4, Maximum 101.4) kPa
Test Date	November 1, 2022

2.4.4 Test Results

Below 1 GHz (10 m method)



Measurement Uncertainty : See Appendix A

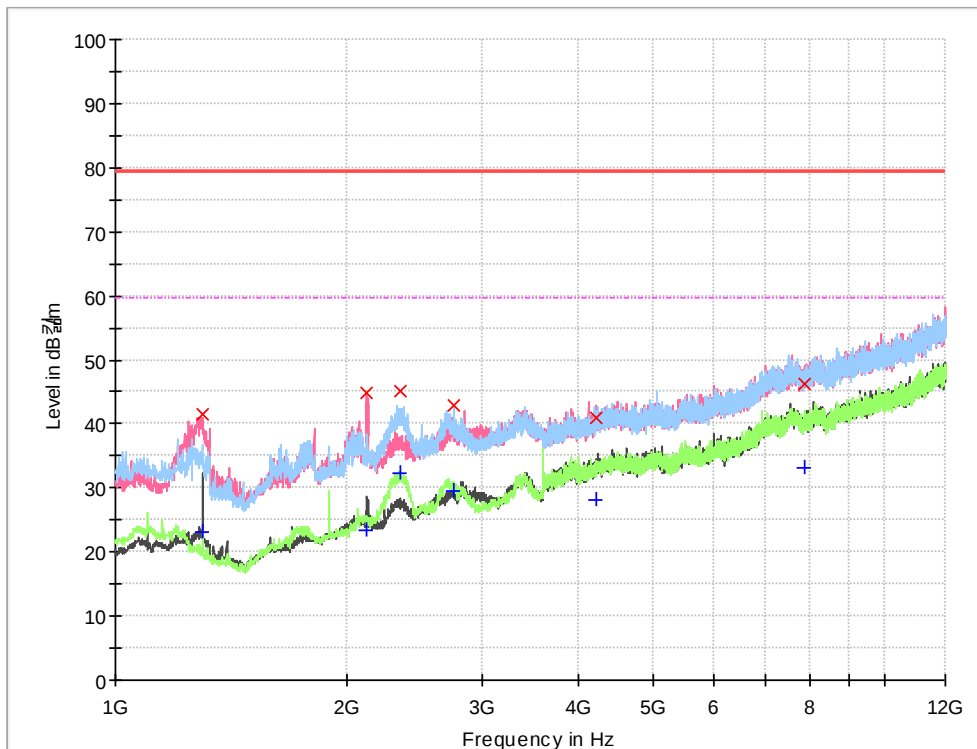
Note : • POL H = Horizontal

• Margin = Limit – Quasi Peak

• POL V = Vertical

• Corr. = Antenna Factor + Cable loss – Amplifier Gain

Above 1 GHz (3 m method)



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)
1 299.200	41.59	---	79.50	37.91	15 000.0	1 000.000	100.0	V	146.0	-14.5
1 299.200	---	23.16	59.50	36.34	15 000.0	1 000.000	100.0	V	146.0	-14.5
2 123.100	44.90	---	79.50	34.60	15 000.0	1 000.000	100.0	V	12.0	-7.9
2 123.100	---	23.27	59.50	36.23	15 000.0	1 000.000	100.0	V	12.0	-7.9
2 343.100	45.05	---	79.50	34.45	15 000.0	1 000.000	100.0	H	232.0	-7.5
2 343.100	---	32.25	59.50	27.25	15 000.0	1 000.000	100.0	H	232.0	-7.5
2 753.400	---	29.59	59.50	29.91	15 000.0	1 000.000	100.0	H	133.0	-5.3
2 753.400	42.77	---	79.50	36.73	15 000.0	1 000.000	100.0	H	133.0	-5.3
4 208.700	40.89	---	79.50	38.61	15 000.0	1 000.000	100.0	V	24.0	2.7
4 208.700	---	28.24	59.50	31.26	15 000.0	1 000.000	100.0	V	24.0	2.7
7 868.400	---	33.02	59.50	26.48	15 000.0	1 000.000	100.0	V	274.0	10.6
7 868.400	46.27	---	79.50	33.23	15 000.0	1 000.000	100.0	V	274.0	10.6

Measurement Uncertainty : See Appendix A

Note : • AF = Antenna Factor

• POL H = Horizontal

• H = Height

• Corr. = AF + CL – AMP

• CL = Cable Loss

• POL V = Vertical

• Margin = Limit – Result

** The value of 'Level' includes 'Corr.'.

• AMP = Amplifier Gain

• A = Angle

Ex) In case

Freq ; 100 MHz, level ; 30 dB(μV/m), AF ; 10 dB/m, CL ; 4 dB, Amp ; 25 dB

Result = Level + AF + CL – Amp

= 30 + 10 + 4 - 25

= 19

Margin = Limit – Result

= 43.5 – 19

= 24.5

Appendix A : Measurement Uncertainty

- Giheung Laboratory

[Test Date : October 13, 2022]

Test Method		Measurement Uncertainty	
Conducted Emission	ENV216	3.5 dB	(The confidential level is 95 %, $k=2$)
	ESH2-Z5	3.2 dB	(The confidential level is 95 %, $k=2$)
	ESH3-Z6	3.2 dB	(The confidential level is 95 %, $k=2$)
	NNLK8129	3.2 dB	(The confidential level is 95 %, $k=2$)
Conducted Emission - Signal	ISN T800	5.6 dB	(The confidential level is 95 %, $k=2$)
	ISNT8-Cat6	5.4 dB	(The confidential level is 95 %, $k=2$)
	ISN S751	5.6 dB	(The confidential level is 95 %, $k=2$)
Discontinuous		3.4 dB	(The confidential level is 95 %, $k=2$)
Disturbance Voltage at Antenna Terminal		2.0 dB	(The confidential level is 95 %, $k=2$)
Radiated Emission	9 kHz ~30 MHz (3m chamber)	Horizontal	3.4 dB (The confidential level is 95 %, $k=2$)
		Vertical	3.4 dB (The confidential level is 95 %, $k=2$)
	30 MHz ~ 1 000 MHz (10m chamber)	Horizontal	4.4 dB (The confidential level is 95 %, $k=2$)
		Vertical	4.6 dB (The confidential level is 95 %, $k=2$)
	1 GHz ~ 18 GHz (3m chamber)	Horizontal	4.0 dB (The confidential level is 95 %, $k=2$)
		Vertical	4.0 dB (The confidential level is 95 %, $k=2$)

[Test Date : October 21, 2022 ~ November 1, 2022]

Test Method		Measurement Uncertainty	
Conducted Emission	ENV216	3.7 dB	(The confidential level is 95 %, $k=2$)
	ESH2-Z5	3.2 dB	(The confidential level is 95 %, $k=2$)
	ESH3-Z6	3.2 dB	(The confidential level is 95 %, $k=2$)
	NNLK8129	3.1 dB	(The confidential level is 95 %, $k=2$)
Conducted Emission - Signal	ISN T800	5.4 dB	(The confidential level is 95 %, $k=2$)
	ISN ST08	6.6 dB	(The confidential level is 95 %, $k=2$)
Discontinuous		2.7 dB	(The confidential level is 95 %, $k=2$)
Radiated Emission	9 kHz ~30 MHz	Horizontal	3.3 dB (The confidential level is 95 %, $k=2$)
		Vertical	3.3 dB (The confidential level is 95 %, $k=2$)
	30 MHz ~ 1 000 MHz	Horizontal	4.3 dB (The confidential level is 95 %, $k=2$)
		Vertical	4.6 dB (The confidential level is 95 %, $k=2$)
	1 GHz ~ 18 GHz	Horizontal	3.9 dB (The confidential level is 95 %, $k=2$)
		Vertical	4.0 dB (The confidential level is 95 %, $k=2$)

- Gunpo Laboratory

Test Method		Measurement Uncertainty	
Conducted Emission		ENV216	3.4 dB (The confidential level is 95 %, k=2)
		ESH2-Z5	3.2 dB (The confidential level is 95 %, k=2)
		ESH3-Z6	3.4 dB (The confidential level is 95 %, k=2)
Conducted Emission - Signal		ISN T800	5.6 dB (The confidential level is 95 %, k=2)
		ISNT8-Cat6	5.6 dB (The confidential level is 95 %, k=2)
		ISN S751	7.3 dB (The confidential level is 95 %, k=2)
Disturbance Voltage at Antenna Terminal		2.4 dB (The confidential level is 95 %, k=2)	
Radiated Emission	9 kHz ~30 MHz (3 m chamber)	Horizontal	3.3 dB (The confidential level is 95 %, k=2)
		Vertical	3.3 dB (The confidential level is 95 %, k=2)
	30 MHz ~ 1 000 MHz (3 m chamber)	Horizontal	4.8 dB (The confidential level is 95 %, k=2)
		Vertical	5.2 dB (The confidential level is 95 %, k=2)
	1 GHz ~ 18 GHz (3 m chamber)	Horizontal	3.9 dB (The confidential level is 95 %, k=2)
		Vertical	4.0 dB (The confidential level is 95 %, k=2)

- Dongtan Laboratory

Test Method		Measurement Uncertainty	
Conducted Emission		ENV216	3.4 dB (The confidential level is 95 %, k=2)
		ESH2-Z5	3.1 dB (The confidential level is 95 %, k=2)
		ESH3-Z6	3.1 dB (The confidential level is 95 %, k=2)
		NNLK8129	3.1 dB (The confidential level is 95 %, k=2)
Conducted Emission - Signal		ISN T800	5.4 dB (The confidential level is 95 %, k=2)
		ISN ST08	5.4 dB (The confidential level is 95 %, k=2)
		ISN S751	5.6 dB (The confidential level is 95 %, k=2)
Discontinuous		3.1 dB (The confidential level is 95 %, k=2)	
disturbance Power		3.0 dB (The confidential level is 95 %, k=2)	
Radiated Emission	9 kHz ~30 MHz (Triple Loop Ant)	2.7 dB (The confidential level is 95 %, k=2)	
	9 kHz ~30 MHz	Horizontal	3.3 dB (The confidential level is 95 %, k=2)
		Vertical	3.3 dB (The confidential level is 95 %, k=2)
	30 MHz ~ 1 000 MHz	Horizontal	4.7 dB (The confidential level is 95 %, k=2)
		Vertical	4.7 dB (The confidential level is 95 %, k=2)
	1 GHz ~ 18 GHz	Horizontal	4.0 dB (The confidential level is 95 %, k=2)
		Vertical	4.0 dB (The confidential level is 95 %, k=2)

- End of Test Report -