Testing Laboratory 1190

FCC EMI TEST REPORT

Filing Type	:	Certification
FCC ID	:	2AXPF03220
Equipment	:	devolo Magic 2 LAN triple
Brand Name	:	devolo AG
Model Name	:	MT: 3220
Applicant/Manufacturer	:	devolo AG devolo AG Charlottenburger Allee 67 52068 Aachen, Germany
Standard	:	47 CFR FCC Rules and Regulations Part 15 Subpart B Class B Digital Device ICES-003, Issue 6 Class B

The product was received on Sep. 23, 2020, and testing was started from Oct. 06, 2020 and completed on Nov. 06, 2020. We, SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.4-2014 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Approved by: Sin Chang

SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory
No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issued Date
FC091814AA	01	Initial issue of report	Jan. 06, 2021

Summary of Test Result

Report Clause	Ref Std. Clause (FCC Part 15 Subpart B)	Test Items	Result (PASS/FAIL)	Remark
4	15.107	AC Power Port Conducted Emission	PASS	Under limit 4.45 dB at 442.5 kHz
5	15.109	Radiated Emission below 1GHz	PASS	Under limit 1.21 dB at 70.89 MHz
5	15.109	Radiated Emission above 1GHz	PASS	Under limit 19.93 dB at 4.862 GHz

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
None

Reviewed by: Sin Chang

Report Producer: Sandy Chuang

1. General Description of Equipment under Test

Product Detail	
Equipment Name	devolo Magic 2 LAN triple
Model Name	MT: 3220
Brand Name	devolo AG
Power Supply	From Internal power supply
Accessories	RJ-45 cable*1: Non-shielded, 2m

1.1. Feature of Equipment under Test

1. The EUT's highest operating frequency is 1GHz.

2. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

1.2. Modification of EUT

Please refer to the technical specifications of EUT.

2. Test Configuration of Equipment under Test

2.1. Test Mode

The following table is a list of the test modes shown in this test report.

Conducted Emissions	
Test Mode	Description
1	EUT_Idle (without data transmit)

Radiated Emissions	
Test Mode	Description
1	EUT in Y axis_Normal Link (with data transmit)
2	EUT in Z axis_Normal Link (with data transmit)
For Radiated Emission test below 1GHz: Mode 1 generated the worst test result, so it was recorded in this report. For Radiated Emission test above1GHz: Mode 1 generated the worst test result for Radiated emission below 1GHz test, thus the measurement for Radiated emission above 1GHz test will follow this same test configuration.	

2.2. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

For Conducted Emissions test:

No.	Support Unit	Brand	Model	FCC ID
A	LAN NB	DELL	E6430	N/A
B	AP Router	ASUS	RP-N53	MSQ-RPN53
C	Lighting	Philips	N/A	N/A

For Radiated Emissions test:

No.	Support Unit	Brand	Model	FCC ID
A	LAN NB	DELL	E6430	N/A
B	Device	devolo AG	MT: 3220	N/A
C	Device NB	DELL	E6430	N/A
D	Lighting	Philips	N/A	N/A
E	AP Router	ASUS	RP-N53	MSQ-RPN53

2.3. EUT Operation Condition

For AC Power Port Conducted emission test:

The PLC of EUT function performed "Idle Mode" for the test.

The remote notebook executed "ping.exe" under Win 7 to link with the EUT and device to maintain the connection by LAN.

For Radiated Emission test:

During the test, the following programs under WIN7 were executed:

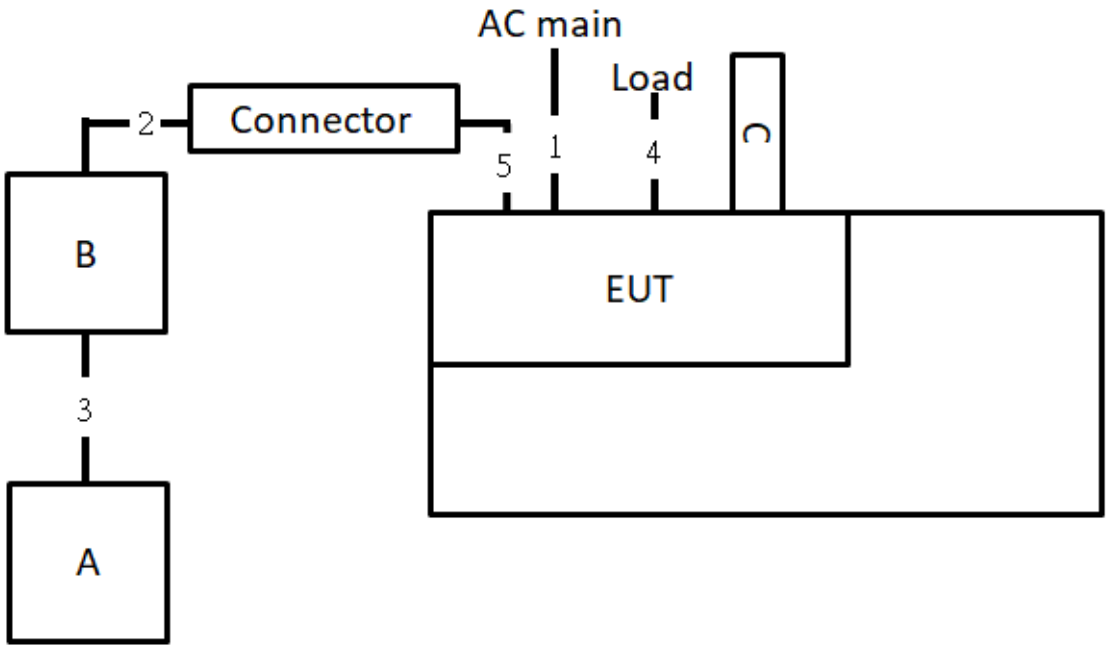
The remote notebooks executed “ping.exe” to link with the EUT and the device to maintain the connection by LAN.

The remote notebook executed "Iperf" to traffic packet data generated software and keep maximum traffic load by LAN.

The EUT and the device were connected through power network.

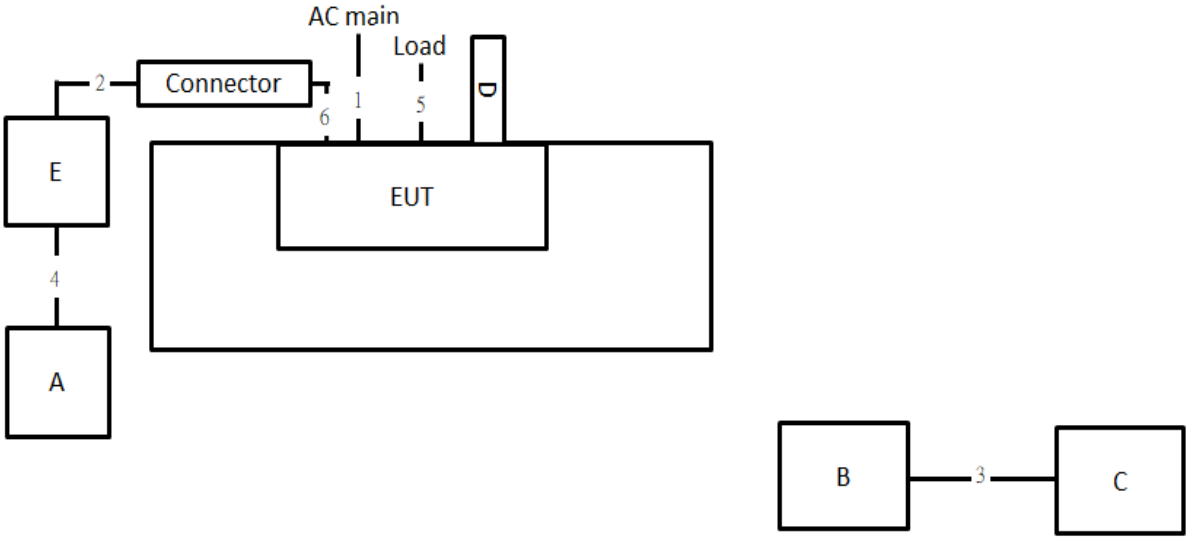
2.4. Connection Diagram of Test System

2.4.1. AC Power Line Conduction Emissions Test Configuration



Item	Connection	Shielded	Length
1	Power cable	No	0.8m
2	RJ-45 cable	No	10m
3	RJ-45 cable	No	3m
4	RJ-45 cable*2	No	1.5m
5	RJ-45 cable	No	2m

2.4.2. Radiation Emissions Test Configuration



Item	Connection	Shielded	Length
1	Power cable	No	10m
2	RJ-45 cable	No	10m
3	RJ-45 cable	No	3m
4	RJ-45 cable	No	3m
5	RJ-45 cable*2	No	1.5m
6	RJ-45 cable	No	2m

3. General Information of Test

3.1. Test Facility

EMI		
JHU BEI	ADD :	No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302, Taiwan (R.O.C.)
	TEL :	886-3-656-9065 FAX : 886-3-656-9085

3.2. Test Environment

Test Items	Test Site No.	Test Engineer	Test Environment			Test Date	Remark
			Temp (°C)	Humidity (%)	Pressure (kPa)		
AC Power Port Conducted Emission	CO01-CB	Max Lin	21~22	58~59	-	Oct. 06, 2020~ Nov. 06, 2020	-
Radiated Emission below 1GHz	10CH01-CB	Max Lin	21~22	60~61	-	Oct. 08, 2020~ Oct. 12, 2020	-
Radiated Emission above 1GHz	10CH01-CB	Max Lin	21~22	60~61	-	Oct. 08, 2020	-

3.3. Test Voltage

Power Type	Test Voltage
AC Power Supply	120 V / 60 Hz

3.4. Standard for Methods of Measurement

ANSI C63.4-2014

3.5. Frequency Range Investigated

Test Items	Frequency Range
Conducted emission test	150 kHz to 30 MHz
Radiated emission test	30 MHz to 5,000 MHz

3.6. Test Distance

Test Items	Test Distance
Radiated emission test below 1 GHz (30 MHz to 1,000 MHz)	10 m
Radiated emission test above 1 GHz (1,000 MHz to 5,000 MHz)	3 m

4. Test of Conducted Emission

4.1. Limit

Frequency (MHz)	QP Limit (dBuV)	AV Limit (dBuV)
0.15~0.5	66~56	56~46
0.5~5	56	46
5~30	60	50

4.2. Test Procedures

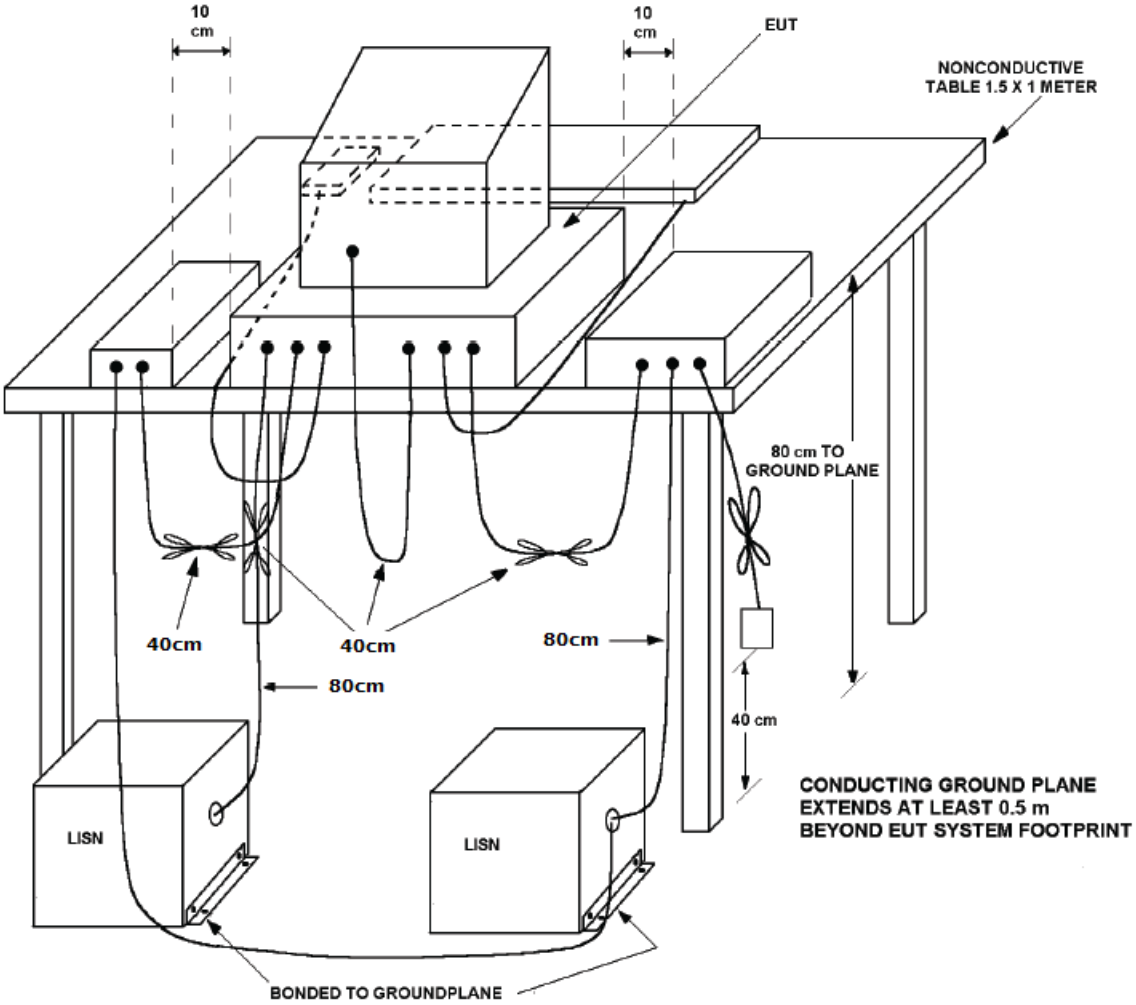
a. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
b. Connect EUT to the power mains through a line impedance stabilization network (LISN).
c. All the support units are connect to the other LISN.
d. The LISN provides 50 Ω coupling impedance for the measuring instrument.
e. The FCC states that a 50 Ω, 50 uH LISN should be used.
f. Both sides of AC line were checked for maximum conducted interference.
g. The frequency range from 150 kHz to 30 MHz was searched.
h. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

4.3. Measurement Results Calculation

The measured Level is calculated using:

a. Corrected Reading: LISN Factor (LISN) + Attenuator (AT/AUX) + Cable Loss (CL) + Read Level (Raw) = Level
b. Margin = -Limit + Level

4.4. Typical Test Setup Layout of Conducted Emission



4.5. Test Result of AC Power Ports

Refer as Appendix A

5. Test of Radiated Emission

5.1. Limit

Radiated Emission below 1 GHz test at 10 m:

Frequency (MHz)	QP (dBuV/m)
30~230	30
230~1,000	37

Radiated Emission 1~5 GHz test at 3 m:

Frequency (MHz)	PK (dBuV/m)	AV (dBuV/m)
1,000 to 5,000	74	54

5.2. Test Procedures

a. The EUT was placed on a rotatable table top 0.8 meter above ground.
b. The EUT was set 10m (below 1GHz) / 3m (1GHz-5GHz) meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
c. The table was rotated 360 degrees to determine the position of the highest radiation.
d. The antenna height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
e. For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turn table (from 0 degree to 360 degrees) to find the maximum reading.
f. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.
g. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.
h. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

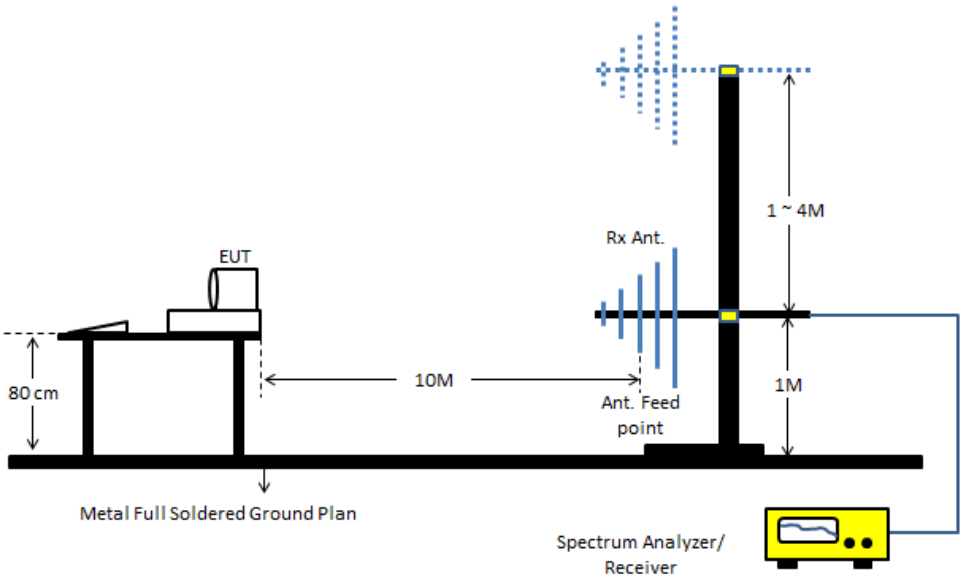
5.3. Measurement Results Calculation

The measured Level is calculated using:

a. Corrected Reading: Antenna factor (AF) + Cable loss (CL) + Read level (Raw) - Preamp factor (PA) = Level
b. Margin = -Limit + Level

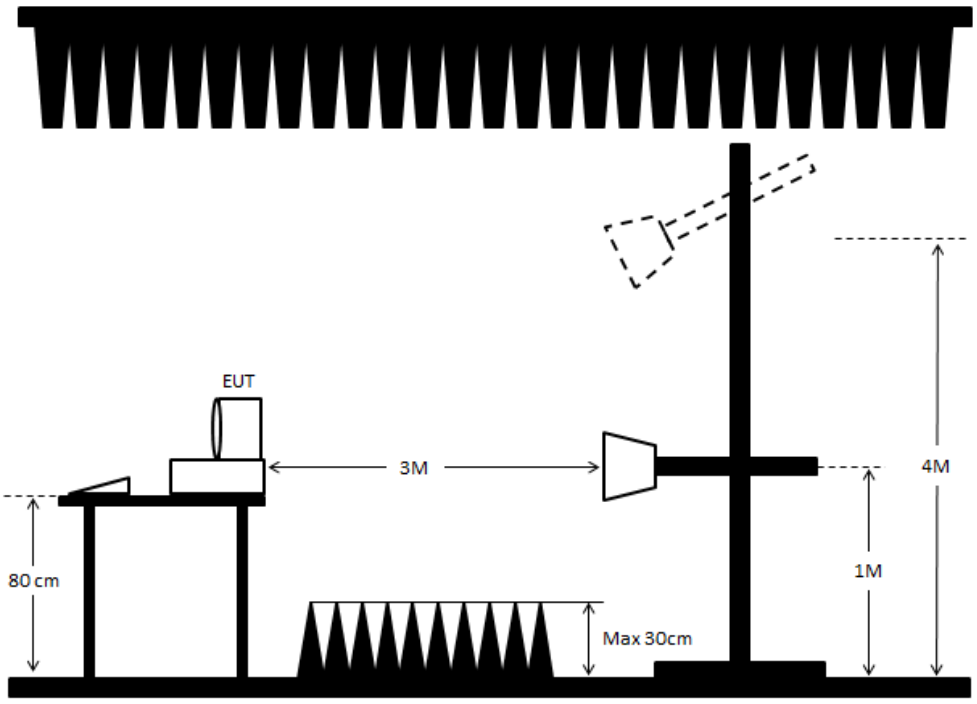
5.4. Typical Test Setup Layout of Radiated Emission

<Below 1 GHz>:



<Above 1 GHz>:

1,000~5,000 MHz



5.5. Test Result of Radiated Emission below 1 GHz

Refer as Appendix B

5.6. Test Result of Radiated Emission above 1 GHz

Refer as Appendix B

6. List of Measuring Equipment Used

Instrument	Brand	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Due Date	Remark
EMI Receiver	Agilent	N9038A	My52260123	9kHz ~ 8.4GHz	Feb. 26, 2020	Feb. 25, 2021	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150kHz ~ 100MHz	Dec. 25, 2019	Dec. 24, 2020	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Feb. 25, 2020	Feb. 24, 2021	Conduction (CO01-CB)
Pulse Limiter	Rohde&Schwarz	ESH3-Z2	100430	9kHz ~ 30MHz	Jan. 31, 2020	Jan. 30, 2021	Conduction (CO01-CB)
COND Cable	Woken	Cable	Low cable-CO01	9kHz ~ 30MHz	May 20, 2020	May 19, 2021	Conduction (CO01-CB)
Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Conduction (CO01-CB)
10m Semi Anechoic Chamber	TDK	NSA	10CH01-CB	30MHz~1GHz 10m,3m	Jan. 30, 2020	Jan. 29, 2021	Radiation (10CH01-CB)
10m Semi Anechoic Chamber	TDK	VSWR	10CH01-CB	1GHz ~18GHz 3m	Mar. 13, 2020	Mar. 12, 2021	Radiation (10CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10783	9kHz ~ 1.3GHz	Mar. 19, 2020	Mar. 18, 2021	Radiation (10CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10784	9kHz ~ 1.3GHz	Mar. 11, 2020	Mar. 10, 2021	Radiation (10CH01-CB)
Low Cable	Woken	SUCOFLEX 104	low cable-01	25MHz ~ 1GHz	Oct. 21, 2019	Oct. 20, 2020	Radiation (10CH01-CB)
High Cable	Woken	SUCOFLEX 104	low cable-02	25MHz ~ 1GHz	Oct. 21, 2019	Oct. 20, 2020	Radiation (10CH01-CB)
Biconical Antenna	Schwarzbeck	VHBB 9124	324	30MHz ~ 200MHz	Apr. 20, 2020	Apr. 19, 2021	Radiation (10CH01-CB)
Log Antenna	Schwarzbeck	VUSLP 9111	247	200MHz ~ 1GHz	May 25, 2020	May 24, 2021	Radiation (10CH01-CB)
EMI Test Receiver	Rohde&Schwarz	ESCI	100186	9kHz ~ 3GHz	Jul. 08, 2020	Jul. 07, 2021	Radiation (10CH01-CB)
Spectrum Analyzer	Rohde&Schwarz	FSV30	101026	9kHz ~ 30GHz	Mar. 03, 2020	Mar. 02, 2021	Radiation (10CH01-CB)
Horn Antenna	ESCO	3117	00081283	1GHz ~ 18GHz	Nov. 27, 2019	Nov. 26, 2020	Radiation (10CH01-CB)
Amplifier	Agilent	8449B	3008A02660	1GHz ~ 26.5GHz	May 21, 2020	May 20, 2021	Radiation (10CH01-CB)
CABLE(1~40G)	Woken	SUCOFLEX 104	high cable-01	1GHz ~ 40GHz	Oct. 21, 2019	Oct. 20, 2020	Radiation (10CH01-CB)

Software	SPORTON	SENSE	V5.10	-	N.C.R.	N.C.R.	Radiation (10CH01-CB)

※ Calibration Interval of instruments listed above is one year.

※ N.C.R. means Non-Calibration required.

7. Uncertainty of Test Site

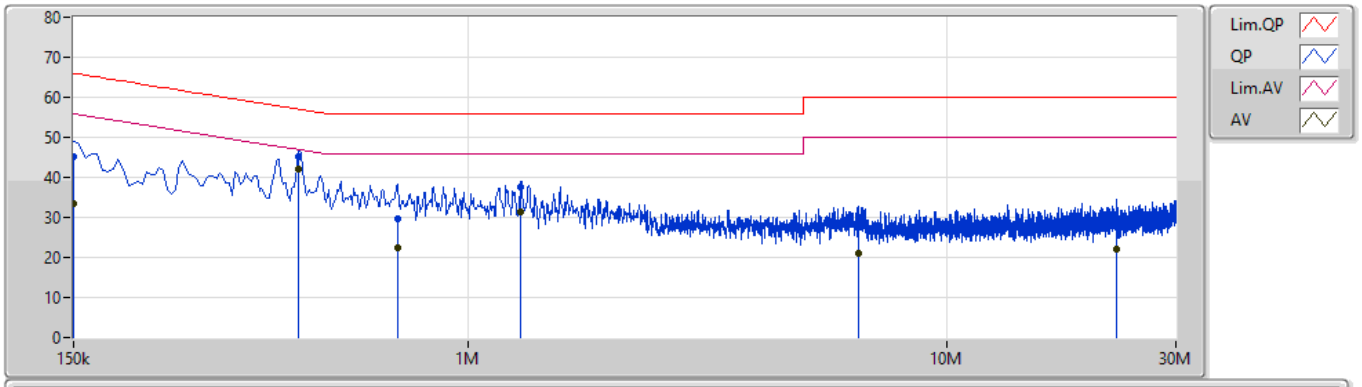
Test Items	Uncertainty	Remark
Conducted Emissions	2.0 dB	Confidence levels of 95%
Radiated Emissions below 1GHz	4.2 dB	Confidence levels of 95%
Radiated Emissions 1GHz ~ 40GHz	5.0 dB	Confidence levels of 95%

Summary

Mode	Result	Type	Freq (Hz)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Condition
Mode 1	Pass	AV	442.5k	42.56	47.01	-4.45	Neutral

Mode 1

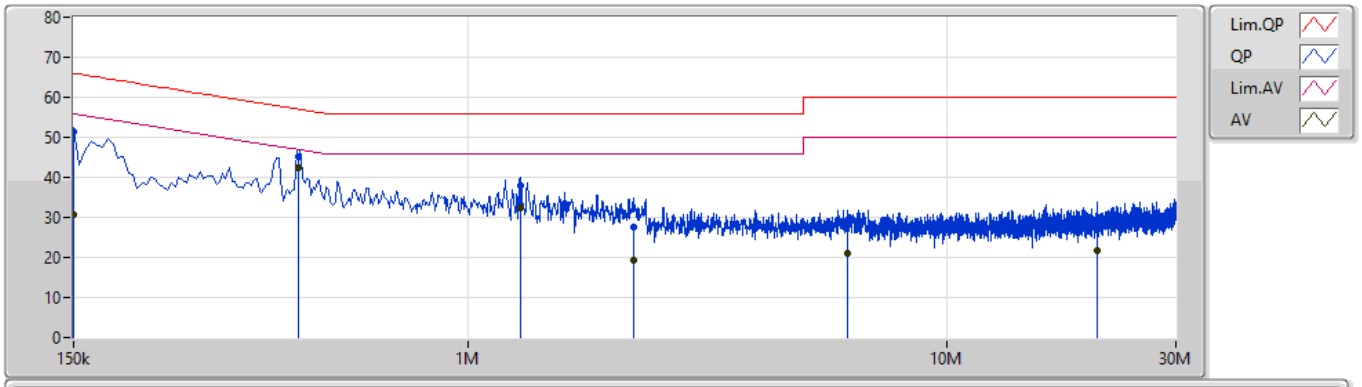
06/10/2020



Type	Freq	Level	Limit	Margin	Factor	Condition	Comment	Raw	LISN	CL	AT
	(Hz)	(dBuV)	(dBuV)	(dB)	(dB)			(dBuV)	(dB)	(dB)	(dB)
QP	150k	45.20	66.00	-20.80	9.87	Line	-	35.33	0.05	0.03	9.79
AV	150k	33.49	56.00	-22.51	9.87	Line	-	23.62	0.05	0.03	9.79
QP	442.5k	45.34	57.01	-11.67	9.88	Line	-	35.46	0.04	0.03	9.81
AV	442.5k	42.10	47.01	-4.91	9.88	Line	"Worst"	32.22	0.04	0.03	9.81
QP	712.5k	29.70	56.00	-26.30	9.91	Line	-	19.79	0.05	0.04	9.82
AV	712.5k	22.30	46.00	-23.70	9.91	Line	-	12.39	0.05	0.04	9.82
QP	1.289M	37.69	56.00	-18.31	9.92	Line	-	27.77	0.05	0.05	9.82
AV	1.289M	31.50	46.00	-14.50	9.92	Line	-	21.58	0.05	0.05	9.82
QP	6.531M	28.00	60.00	-32.00	10.14	Line	-	17.86	0.13	0.14	9.87
AV	6.531M	21.11	50.00	-28.89	10.14	Line	-	10.97	0.13	0.14	9.87
QP	22.592M	28.61	60.00	-31.39	10.60	Line	-	18.01	0.26	0.33	10.01
AV	22.592M	21.98	50.00	-28.02	10.60	Line	-	11.38	0.26	0.33	10.01

Mode 1

06/10/2020



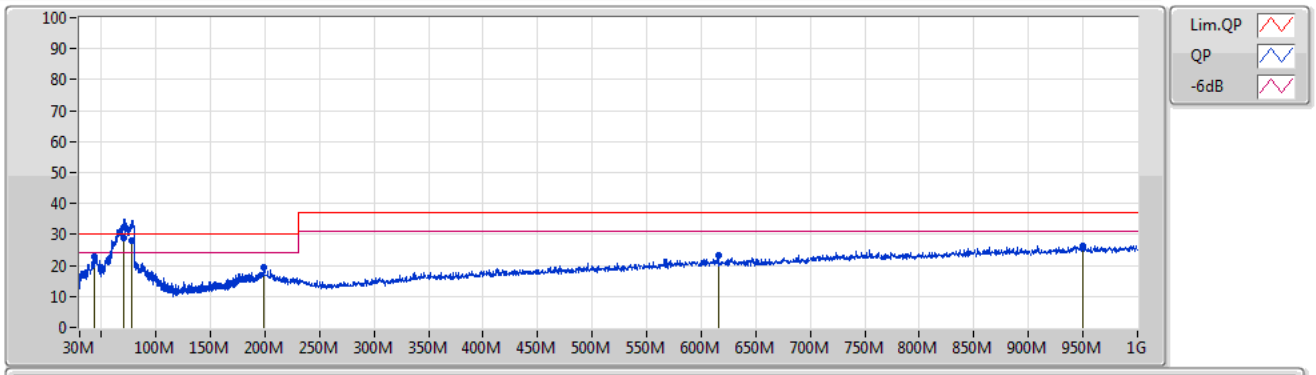
Type	Freq	Level	Limit	Margin	Factor	Condition	Comment	Raw	LISN	CL	AT
	(Hz)	(dBuV)	(dBuV)	(dB)	(dB)			(dBuV)	(dB)	(dB)	(dB)
QP	150k	51.53	66.00	-14.47	9.86	Neutral	-	41.67	0.04	0.03	9.79
AV	150k	30.71	56.00	-25.29	9.86	Neutral	-	20.85	0.04	0.03	9.79
QP	442.5k	45.34	57.01	-11.67	9.88	Neutral	-	35.46	0.04	0.03	9.81
AV	442.5k	42.56	47.01	-4.45	9.88	Neutral	"Worst"	32.68	0.04	0.03	9.81
QP	1.284M	37.86	56.00	-18.14	9.93	Neutral	-	27.93	0.06	0.05	9.82
AV	1.284M	32.47	46.00	-13.53	9.93	Neutral	-	22.54	0.06	0.05	9.82
QP	2.211M	27.60	56.00	-28.40	9.98	Neutral	-	17.62	0.07	0.08	9.83
AV	2.211M	19.28	46.00	-26.72	9.98	Neutral	-	9.30	0.07	0.08	9.83
QP	6.18M	27.96	60.00	-32.04	10.13	Neutral	-	17.83	0.13	0.14	9.86
AV	6.18M	21.17	50.00	-28.83	10.13	Neutral	-	11.04	0.13	0.14	9.86
QP	20.616M	28.30	60.00	-31.70	10.54	Neutral	-	17.76	0.22	0.33	9.99
AV	20.616M	21.64	50.00	-28.36	10.54	Neutral	-	11.10	0.22	0.33	9.99

Summary

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Condition
Mode 1	Pass	QP	70.89M	28.79	30.00	-1.21	Vertical

Mode 1

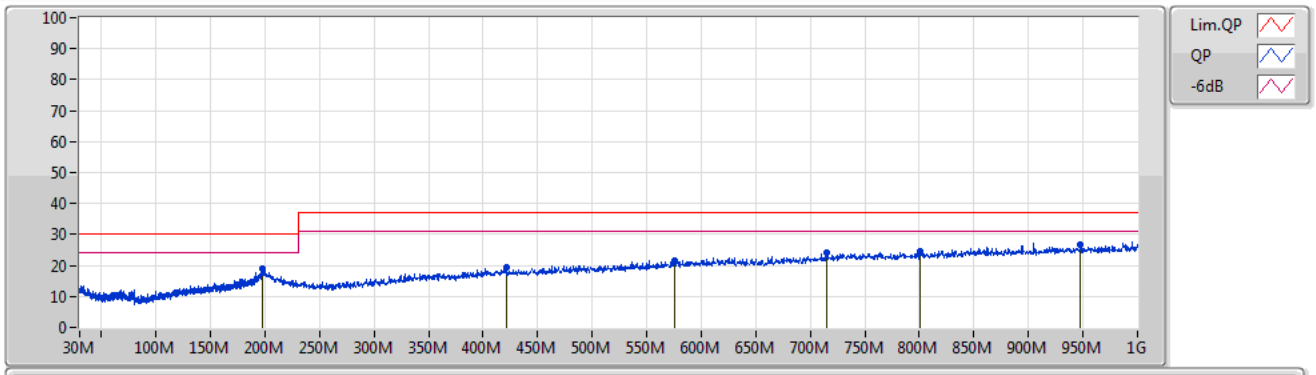
08/10/2020



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment	Raw	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)		(dBuV)	(dB)	(dB)	(dB)
PK	43.77M	22.78	30.00	-7.22	-16.89	10	Vertical	152	2.00	-	39.67	10.82	0.98	28.69
QP	70.89M	28.79	30.00	-1.21	-17.81	10	Vertical	279	1.00	"Worst"	46.60	9.30	1.52	28.63
QP	77.86M	27.86	30.00	-2.14	-17.94	10	Vertical	342	2.00	-	45.80	9.09	1.60	28.63
PK	199.32M	19.26	30.00	-10.74	-8.28	10	Vertical	199	3.00	-	27.54	16.61	3.19	28.08
PK	616M	23.26	37.00	-13.74	-4.37	10	Vertical	350	2.00	-	27.63	19.30	4.96	28.63
PK	950.4M	26.26	37.00	-10.74	1.20	10	Vertical	68	1.00	-	25.06	22.10	6.20	27.10

Mode 1

08/10/2020



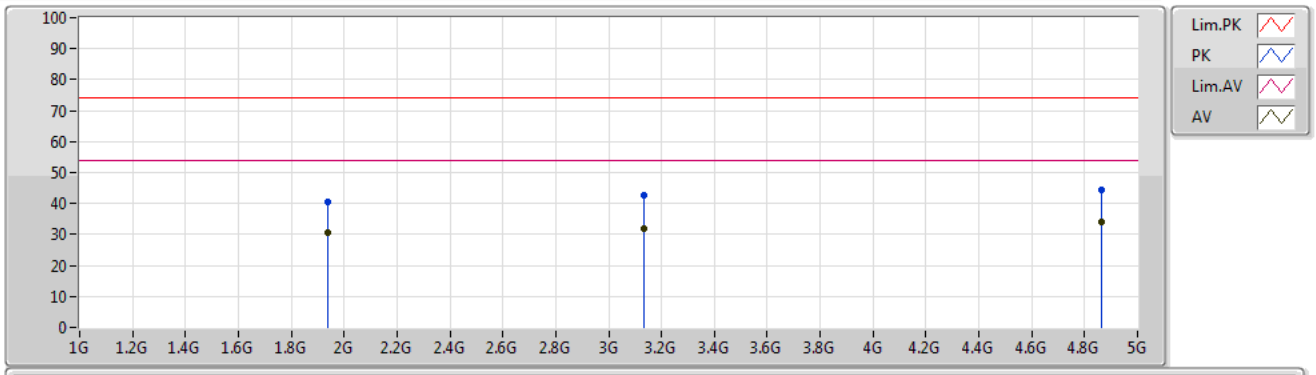
Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment	Raw	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)		(dBuV)	(dB)	(dB)	(dB)
PK	197.71M	18.92	30.00	-11.08	-8.77	10	Horizontal	104	2.00	-	27.69	16.16	3.17	28.10
PK	421.6M	19.44	37.00	-17.56	-7.56	10	Horizontal	0	1.00	-	27.00	16.58	4.07	28.21
PK	575.6M	21.67	37.00	-15.33	-5.03	10	Horizontal	360	3.00	-	26.70	18.81	4.80	28.64
PK	715.6M	24.16	37.00	-12.84	-2.52	10	Horizontal	295	2.00	-	26.68	20.37	5.36	28.25
PK	800.8M	24.44	37.00	-12.56	-1.59	10	Horizontal	2	4.00	-	26.03	20.62	5.70	27.91
PK	948M	26.70	37.00	-10.30	1.16	10	Horizontal	216	1.00	"Worst"	25.54	22.08	6.19	27.11

Summary

Mode	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Condition
Mode 1	Pass	AV	4.862G	34.07	54.00	-19.93	Vertical

Mode 1

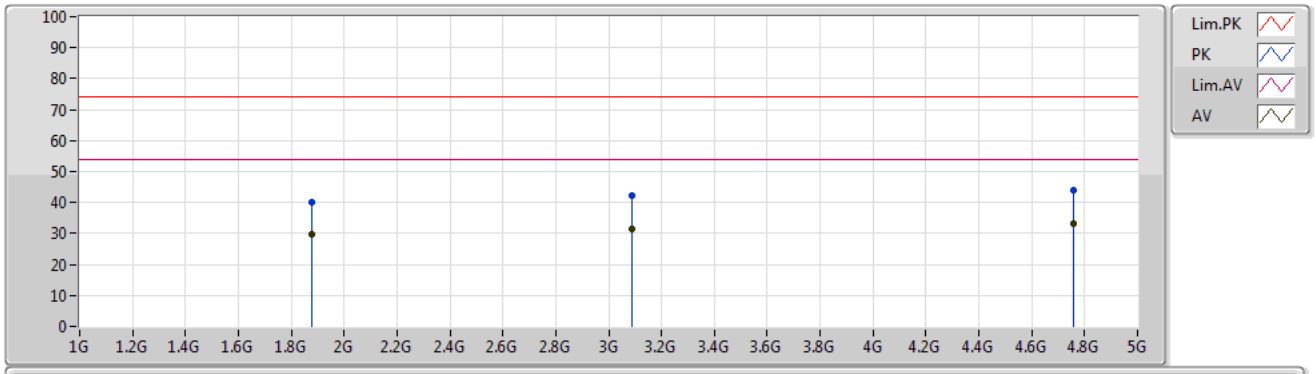
08/10/2020



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment	Raw	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)		(dBuV)	(dB)	(dB)	(dB)
PK	1.9385G	40.65	74.00	-33.35	0.23	3	Vertical	87	1.00	-	40.42	31.18	5.01	35.96
AV	1.9385G	30.59	54.00	-23.41	0.23	3	Vertical	87	1.00	-	30.36	31.18	5.01	35.96
PK	3.135G	42.69	74.00	-31.31	3.32	3	Vertical	49	2.00	-	39.37	33.10	6.50	36.28
AV	3.135G	31.87	54.00	-22.13	3.32	3	Vertical	49	2.00	-	28.55	33.10	6.50	36.28
PK	4.862G	44.52	74.00	-29.48	6.15	3	Vertical	127	3.00	-	38.37	34.16	8.29	36.30
AV	4.862G	34.07	54.00	-19.93	6.15	3	Vertical	127	3.00	"Worst"	27.92	34.16	8.29	36.30

08/10/2020

Mode 1



Type	Freq	Level	Limit	Margin	Factor	Dist	Condition	Azimuth	Height	Comment	Raw	AF	CL	PA
	(Hz)	(dBuV/m)	(dBuV/m)	(dB)	(dB)	(m)		(°)	(m)		(dBuV)	(dB)	(dB)	(dB)
PK	1.88G	39.91	74.00	-34.09	-0.13	3	Horizontal	285	1.00	-	40.04	30.94	4.92	35.99
AV	1.88G	29.84	54.00	-24.16	-0.13	3	Horizontal	285	1.00	-	29.97	30.94	4.92	35.99
PK	3.09G	42.35	74.00	-31.65	3.20	3	Horizontal	96	3.00	-	39.15	33.08	6.43	36.31
AV	3.09G	31.31	54.00	-22.69	3.20	3	Horizontal	96	3.00	-	28.11	33.08	6.43	36.31
PK	4.758G	44.15	74.00	-29.85	5.96	3	Horizontal	198	2.00	-	38.19	34.14	8.14	36.32
AV	4.758G	33.40	54.00	-20.60	5.96	3	Horizontal	198	2.00	"Worst"	27.44	34.14	8.14	36.32