EMC TEST REPORT

Test Report No.	:	KES-EM-23T0072
Date of Issue	:	Jan. 27, 2023
Product name	:	Brake light
Model/Type No.	:	BL-M100
Variant Mode	:	-
Applicant	:	UNITED SAFETY FRONT BRAKE LIGHT LLC
Applicant Address	:	4372 driving Range Rd, Corona CA, 9288
Manufacturer	:	UNITED SAFETY FRONT BRAKE LIGHT LLC
Manufacturer Address	:	4372 driving Range Rd, Corona CA, 9288
FCC ID	:	2A9HA-BM-100
Date of Receipt	:	Nov. 28, 2022
Test date	:	Dec. 22, 2022
Test Results	:	☒ **In Compliance** ☐ **Not in Compliance**

Tested by

Min Seong, Kim
EMC Test Engineer

Reviewed by

Dong Hun, Jang
EMC Technical Manager

REPORT REVISION HISTORY

Date	Test Report No.	Revision History
Jan. 27, 2023	KES-EM-23T0072	Issued

TABLE OF CONTENTS

1.0 General Product Description

Main Specifications of EUT are:

Division	Specification
Input power	DC 12 V
Size	(300 x 29 x 22) ㎜
I/O Port	DC Jack x 2

1.1 Test Voltage & Frequency

Unless indicated otherwise on the individual data sheet or test results, the test voltage and frequency was as indicated below.

☒ DC 12 V

1.2 Variant Model Differences

Not applicable

1.3 Device Modifications

Not applicable

1.4 Equipment Under Test

Description	Model Number	Serial Number	Manufacturer	Remarks
Brake light	BL-M100	-	UNITED SAFETY FRONT BRAKE LIGHT LLC	EUT
Cigar jack	DAS-CC24U5	-	DONGGUAN CTC ELECTRONICS CO.,LTD	-

1.5 Support Equipments

Description	Model Number	Serial Number	Manufacturer	Remarks
Display	BL-D100	-	UNITED SAFETY FRONT BRAKE LIGHT LLC	-

1.6 External I/O Cabling

Start		END		Cable Spec.	
Description	**I/O Port**	**Description**	**I/O Port**	**Length**	**Shield**
Brake light (EUT)	DC Jack	Cigar jack (EUT)	USB	1.5	U
	Wireless (GFSK 2.4 ㎓)	Display	Wireless (GFSK 2.4 ㎓)	-	-
Cigar jack (EUT)	DC In (2 Pin)	DC Main	DC Out (2 Pin)	1.5	U
Display	DC In (2 Pin)	DC Main	DC Out (2 Pin)	1.5	U

* Unshielded = U, Shielded = S

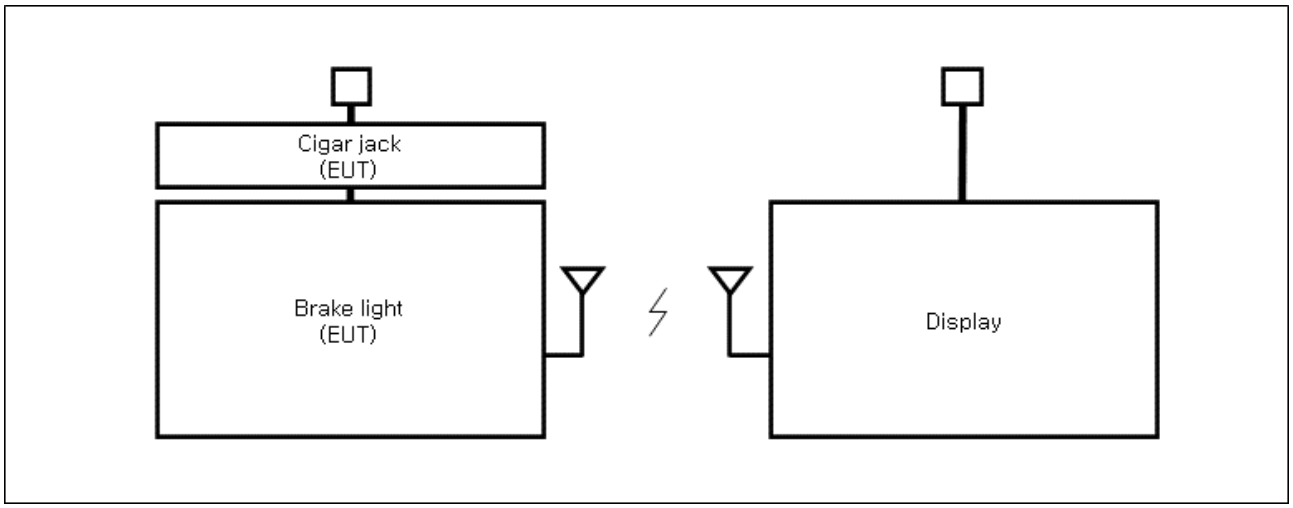
1.7 EUT Operating Mode(s)

Test mode	Normal operating	Test Voltages
Operating	After connecting the Brake light(EUT) and Display wirelessly(GFSK 2.4 ㎓), check whether it operates normally through the LED of Brake light(EUT).	DC 12 V

EUT Test operating S/W		
Name	**Version**	**Manufacture Company**
-	-	-

1.8 Configuration

■ AC Main
□ DC Main



1.9 Remarks when standards applied

N/A

1.10 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less.

1.11 Test Facility

The measurement facility is located at 473-21, Gayeo-ro, Yeoju-si, Gyeonggi-do, 12658, Korea, Republic of. The sites are constructed in conformance with the requirements of ANSI C63.4a-2017 and CISPR 16-1-4:2019

1.12 Measurement Procedure

- Conducted Emissions

The conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable). The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. If the conducted emission exceed the average limit with the instrument set to the quasi-peak mode, the measurements are made in the average mode. The emission spectrum was scanned from 150 ㎑ to 30 ㎒. The highest emission amplitudes relative to the appropriate limits were measured and have been recorded. Quasi-peak readings are distinguished with a "QP".

- Radiated Electric Field Emissions

The test was done at a SEMI ANECHOIC CHAMBER with quasi-peak detector. The final test data was measured using a Quasi-Peak detector below 1㎓ at 10 m or 3 m distance and a Peak and Average detector above 1 ㎓ at 3 m distance. Test was proceeded worst case test mode and cable configuration.
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.

Measurement procedures was In accordance with ANSI C63.4-2014 7.3.3, 7.3.4, 8.3.1.1, 8.3.1.2, 8.3.2.1, 8.3.2.2

1.13 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Logo
KOREA	**RRA**	EMI (3 m & 10 m Semi-Aechoic Chamber ,10 m Open Area and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	KR0100
International	**KOLAS**	EMI (3 m & 10 m Semi-Aechoic Chamber , and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	KT489
USA	**FCC**	3 m & 10 m Semi-Aechoic Chamber, 10 m Open Area and Conducted test site to perform FCC Part 15/18 measurements.	KR0100
Canada	**ISED**	3 m & 10 m Semi-Aechoic Chamber and Conducted test site	23298
JAPAN	**VCCI**	Mains Ports Conducted Interference Measurement, Telecommunication Ports Conducted Disturbance Measurement and Radiation 10 meter site, Facility for measuring radiated disturbance above 1 GHz	R-20056, C-20036 T-20040, G-20057
Europe	**TÜV SÜD**	EMI (3 m & 10 m Semi-Aechoic Chamber , 10 m Open Area and conducted test site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	CARAT 001633 0004

2.0 Test Regulations

The emissions tests were performed according to following regulations:

☒ **47 CFR Part 15, Subpart B**

☐ CISPR 22:2009 +A1:2010	☐ Class A	☐ Class B
☒ ANSI C63.4a-2017	☐ Class A	☒ Class B

2.1 Conducted Emissions at Mains Power Ports

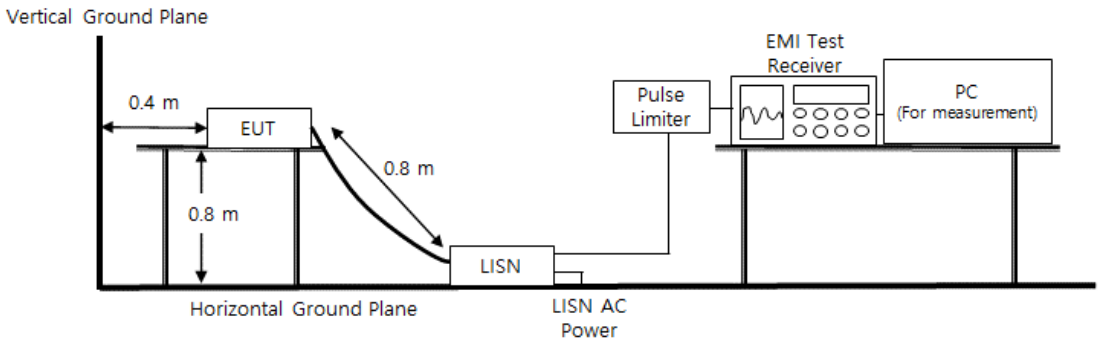
Test Date
N/A

Test Location
Electro wave Shieldroom #6

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due	calibration interval
☐	EMI Test S/W	EMC32	R & S	9.12.00	-	-
☐	EMI TEST RECEIVER	ESR3	R & S	101783	11, 11, 2023	1 Year
☐	LISN	ENV216	R & S	101787	11, 10, 2023	1 Year
☐	LISN	ESH2-Z5	R & S	100450	11, 10, 2023	1 Year
☐	PULSE LIMITER	ESH3-Z2	R & S	101915	11, 10, 2023	1 Year

Diagram of test setup



Test Conditions

Temperature: (±) ℃
Relative Humidity: (±) % R.H.

Frequency Range of Measurement

150 ㎑ to 30 ㎒

Instrument Settings

IF Band Width: 9 ㎑

Test Results

The requirements are:

☐ PASS
☐ NOT PASS
☒ NOT APPLICABLE

Remarks

It is not tested apply because it is powered by DC

2.2 Radiated Electric Field Emissions(Below 1 ㎓)

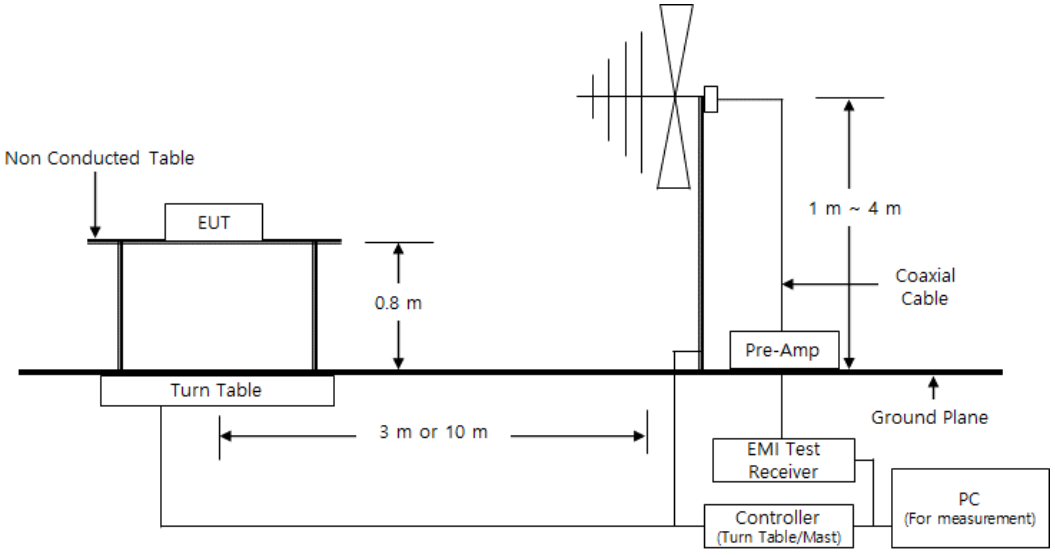
Test Date
Dec. 22, 2022

Test Location
☐ OPEN AREA TEST SITE #2 ☒ SEMI ANECHOIC CHAMBER #4(10m)

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due	calibration interval
☒	EMI Test S/W	EP5/RE	TOYO Corporation	6.0.0	-	-
☒	EMI TEST RECEIVER	ESU26	R & S	100551	03, 31, 2023	1 Year
☒	AMPLIFIER	SCU 01	R & S	100603	11, 10, 2023	1 Year
☒	TRILOG-BROADBAND ANTENNA	VULB9163	Schwarzbeck	715	11, 17, 2024	2 Year
☒	ATTENUATOR	8491A	HP	32173	03, 08, 2023	1 Year

Diagram of test setup



Test Conditions

Temperature: (22,9 ± 0,1) ℃
Relative Humidity: (44,0 ± 0,3) % R.H.

Frequency Range of Measurement

30 ㎒ to 1 ㎓

Instrument Settings

IF Band Width: 120 ㎑

Test Results

The requirements are:

☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks

See Appendix A for test data.

2.3 Radiated Electric Field Emissions(Above 1 ㎓)

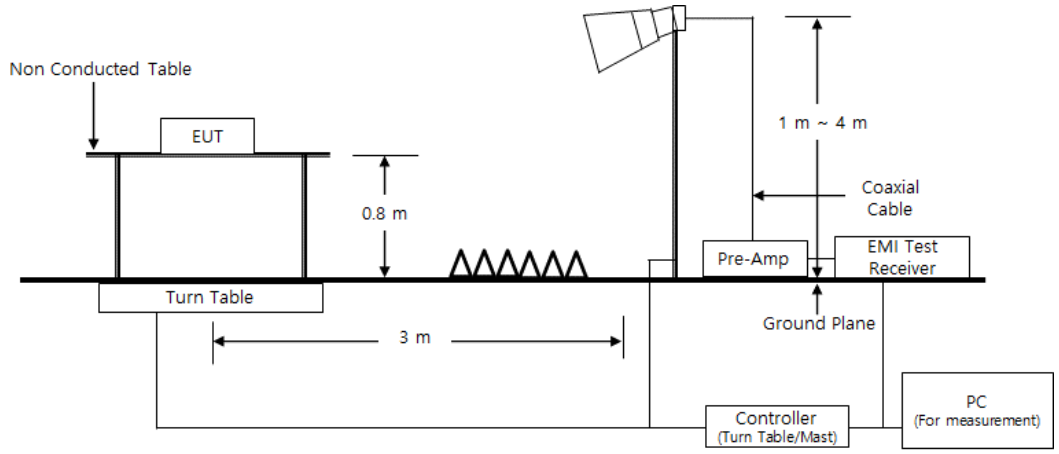
Test Date
Dec. 22, 2022

Test Location
SEMI ANECHOIC CHAMBER #5

Test Equipment

Used	Description	Model Number	Manufacturer	Serial Number	Cal. Due	calibration interval
☒	EMI Test S/W	ES10/RE	TOYO Corporation	2022.01.000	-	-
☒	EMI TEST RECEIVER	ESU26	Rohde & Schwarz	100552	03, 31, 2023	1 Year
☒	HORN ANTENNA	BBHA 9120D	SCHWARZBECK	9120D-1802	11, 08, 2023	1 Year
☒	PREAMPLIFIER	8449B	HP	3008A00538	06, 02, 2023	1 Year
☒	ATTENUATOR	8491B	HP	23094	04, 21, 2023	1 Year

Diagram of test setup



Test Conditions

Temperature: (22,5 ± 0,2) ℃
Relative Humidity: (44,0 ± 0,5) % R.H.

Frequency Range of Measurement

1 ㎓ to 5 ㎓

Instrument Settings

IF Band Width: 1 ㎒

Test Results

The requirements are:

☒ PASS
☐ NOT PASS
☐ NOT APPLICABLE

Remarks

See Appendix A for test data.

APPENDIX A – TEST DATA

Conducted Emissions at Mains Power Ports

HOT LINE

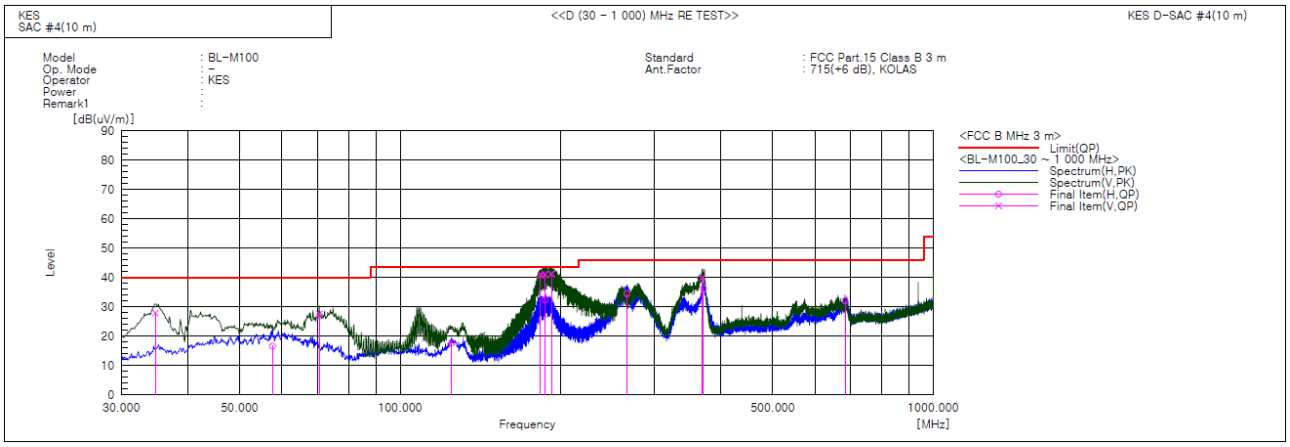
N/A

NEUTRAL LINE

N/A

♦ Calculation
QuasiPeak[dBuV] / CAverage [dBuV] = Reading Value[dBuV] + Corr. [dB]
QuasiPeak / CAverage : The Final Value
Reading Value : Not shown in the table.
Corr. : Correction values (LISN FACTOR + (Cable Loss + Pulse Limiter FACTOR))

Radiated Electric Field Emissions(Below 1 ㎓)



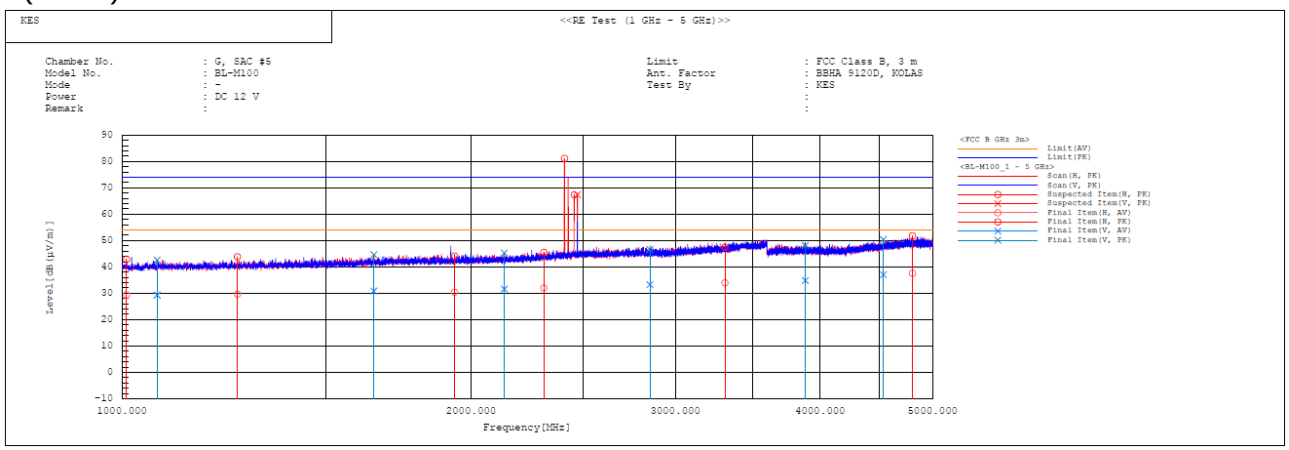
Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	34.729	V	52.4	-24.5	27.9	40.0	12.1	100.0	281.0	
2	57.645	H	38.1	-21.5	16.6	40.0	23.4	320.0	257.0	
3	70.498	V	52.6	-25.1	27.5	40.0	12.5	100.0	129.0	
4	124.818	H	42.5	-24.9	17.6	43.5	25.9	400.0	172.0	
5	183.381	V	64.4	-23.6	40.8	43.5	2.7	108.0	147.0	
6	186.898	V	64.2	-23.2	41.0	43.5	2.5	100.0	159.0	
7	187.140	H	55.6	-23.2	32.4	43.5	11.1	343.0	75.0	
8	192.354	V	63.8	-22.6	41.2	43.5	2.3	100.0	166.0	
9	266.316	H	53.9	-19.4	34.5	46.0	11.5	400.0	120.0	
10	368.773	V	55.1	-15.2	39.9	46.0	6.1	127.0	348.0	
11	370.591	H	51.4	-15.2	36.2	46.0	9.8	311.0	120.0	
12	683.659	H	40.9	-8.8	32.1	46.0	13.9	301.0	320.0	

♦ Calculation – SAC #4(10 m)
Result(QP) [㏈(㎶/m)] = (Reading(QP)[㏈(㎶)] + c.f[㏈(1/m)]
Margin(QP)[㏈] = Limit[㏈(㎶/m)] - Result(QP) [㏈(㎶/m)]
Reading(QP) : Reading value, Result(QP) : Reading value + Factor value
Limit(QP) : Limit value, c.f : (ANT Factor + Cable Loss - Preamp Factor), Margin: Margin value

Radiated Electric Field Emissions(Above 1 ㎓)

- (1 ~ 5) ㎓



Final Result

No.	Frequency [MHz]	Pol	Reading AV [dB(μV)]	Reading PK [dB(μV)]	c.f [dB(1/m)]	Result AV [dB(μV/m)]	Result PK [dB(μV/m)]	Limit AV [dB(μV/m)]	Limit PK [dB(μV/m)]	Margin AV [dB]	Margin PK [dB]	Height [cm]	Angle [deg]	Remark
1	1072.479	V	31.5	44.8	-2.2	29.3	42.6	54.0	74.0	24.7	31.4	100.0	79.9	
2	1649.548	V	30.4	44.1	0.5	30.9	44.6	54.0	74.0	23.1	29.4	114.0	287.9	
3	2136.797	V	29.2	42.9	2.4	31.6	45.3	54.0	74.0	22.4	28.7	141.0	332.5	
4	2853.221	V	28.7	42.0	4.6	33.3	46.6	54.0	74.0	20.7	27.4	100.0	159.3	
5	3884.008	V	28.3	41.6	6.5	34.8	48.1	54.0	74.0	19.2	25.9	109.0	274.6	
6	4534.742	V	28.1	41.4	8.9	37.0	50.3	54.0	74.0	17.0	23.7	135.0	0.4	
7	1009.393	H	31.9	45.4	-2.5	29.4	42.9	54.0	74.0	24.6	31.1	400.0	279.9	
8	1257.920	H	30.9	45.0	-1.2	29.7	43.8	54.0	74.0	24.3	30.2	357.0	103.9	
9	1936.221	H	28.7	42.4	1.7	30.4	44.1	54.0	74.0	23.6	29.9	400.0	102.7	
10	2310.953	H	29.0	42.5	3.0	32.0	45.5	54.0	74.0	22.0	28.5	349.0	9.9	
11	3312.093	H	28.6	42.1	5.4	34.0	47.5	54.0	74.0	20.0	26.5	334.0	268.2	
12	4804.420	H	27.6	41.8	10.0	37.6	51.8	54.0	74.0	16.4	22.2	371.0	209.1	
13	2408.000	H	---	---	3.3	---	---	---	---	---	---	400.0	188.7	
14	2454.800	H	---	---	3.4	---	---	---	---	---	---	400.0	70.6	
15	2471.200	V	---	---	3.4	---	---	---	---	---	---	100.0	150.0	

* Exclusion Bands
- Fundamental Frequency: 2 408 ㎒, 2 454 ㎒, 2 471 ㎒

- (5 ~ 12,4) GHz

PEAK

Frequency (MHz)	Reading PK (dBuV)	Polarization	Height (m)	ANT Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
6 773.821	41.200	V	1.000	34.800	10.610	34.810	51.800	74.000	22.200
6 807.884	41.000	H	4.000	34.930	11.090	34.810	52.210	74.000	21.790

CISPR AVERAGE

Frequency (MHz)	Reading CISPR AV (dBuV)	Polarization	Height (m)	ANT Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
6 773.821	27.800	V	1.000	34.800	10.610	34.810	38.400	54.000	15.600
6 807.884	27.800	H	4.000	34.930	11.090	34.810	39.010	54.000	14.990

♦ Calculation

Result(PK/CAV) [dB(μV/m)] = (Reading(PK/CAV)[dB(μV)] + c.f[dB(1/m)]

Margin(PK/CAV)[dB] = Limit[dB(μV/m)] - Result(PK/CAV) [dB(μV/m)]

Reading(PK/CAV) : Reading value, Result(PK/CAV) : Reading value + Factor value

Limit(QP) : Limit value, c.f : (ANT Factor + Cable Loss - Preamp Factor), Margin: Marjin value