

Certificate

Issue Date: August 17, 2021
Ref. Report No. ISL-21LR211FCCIC

Product Name : BLG840F/X BLE/802.15.4 to LTE Gateways
Model(s) : BLG840F; BLG840X; BLG40F; BLG840E; BLG840XE; BLG40E; BLE840F;
BLE840X; BLE40F; BLE840E; BLE840XE; BLE40E; BRX840XE; BRX840E;
BRX840F; BR840XE; BR840E; BR840F; BU840XE; BU840E; LN60G840F;
LN60G840X; LN60G40F; LN60G840E; LN60G840XE; LN60G40E;
LN60E840F; LN60E840X; LN60E40F; LN60E840E; LN60E840XE;
LN60E40E; M262X840XE; M262X840E; M262X840F; M262840XE;
M262840E; M262840F; M2840XE; M2840E
Brand : Fanstel
Applicant : Fanstel Corporation, Taipei
Address : 10F-10, No. 79, Sec. 1, Hsin Tai Wu Rd.,
Hsi-Chih, New Taipei City 221 Taiwan

We, **International Standards Laboratory Corp.**, hereby certify that:

The sample ISL received which bearing the trade name and model specified above has shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified. (refer to Test Report if any modifications were made for compliance). And Our laboratories is the accredited laboratories and are approved according to ISO/IEC 17025.

Standards:

FCC CFR Title 47 Part 15 Subpart B: Section 15.107 and 15.109
ANSI C63.4-2014
Industry Canada Interference-Causing Equipment Standard ICES-003 Issue 7: 2020
Class B

I attest to the accuracy of data and 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.

The determination of the test results is determined by customer agreement, regulations or standard document specifications.

The Laboratory evaluates measurement inaccuracies based on regulatory or standard document specifications and is listed in the report for reference. The quantitative project part judges the conformity of the test results based on the evaluation results of the standard cited uncertainty, and the qualitative project does not temporarily evaluate the measurement uncertainty.



Angus Chu / Sr. Manager

International Standards Laboratory Corp. LT Lab.

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No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist., Tao Yuan City 325, Taiwan

TEST REPORT

of

CFR 47 Part 15 Subpart B Class B & Industry Canada Interference-Causing Equipment Standard ICES-003 Class B

Application Type: Supplier's Declaration of Conformity

Product : **BLG840F/X BLE/802.15.4 to LTE Gateways**
Model(s): **BLG840F; BLG840X; BLG40F; BLG840E;
BLG840XE; BLG40E; BLE840F; BLE840X;
BLE40F; BLE840E; BLE840XE; BLE40E;
BRX840XE; BRX840E; BRX840F; BR840XE;
BR840E; BR840F; BU840XE; BU840E;
LN60G840F; LN60G840X; LN60G40F;
LN60G840E; LN60G840XE; LN60G40E;
LN60E840F; LN60E840X; LN60E40F;
LN60E840E; LN60E840XE; LN60E40E;
M262X840XE; M262X840E; M262X840F;
M262840XE; M262840E; M262840F; M2840XE;
M2840E**
Brand: **Fanstel**
Applicant: **Fanstel Corporation, Taipei**
Address: **10F-10, No. 79, Sec. 1, Hsin Tai Wu Rd.,
Hsi-Chih, New Taipei City 221 Taiwan**

Test Performed by:



International Standards Laboratory Corp. LT Lab.

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No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist., Tao Yuan City 325, Taiwan

Report No.: **ISL-21LR211FCCIC**
Issue Date : **August 17, 2021**



Test results given in this report apply only to the specific sample(s) tested and are traceable to national or international standard through calibration of the equipment and evaluating measurement uncertainty herein. The uncertainty of the measurement does not include in consideration of the test result unless the customer required the determination of uncertainty via the agreement, regulation or standard document specification. This test report shall not be reproduced except in full, without the written approval of International Standards Laboratory Corp.

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1. General

1.1 Certification of Accuracy of Test Data

Standards: FCC CFR Title 47 Part 15 Subpart B: Section 15.107 and 15.109
ANSI C63.4-2014
Industry Canada Interference-Causing Equipment Standard ICES-003 Issue 7: 2020
Class B

Equipment Tested: BLG840F/X BLE/802.15.4 to LTE Gateways

Model: BLG840F; BLG840X; BLG40F; BLG840E; BLG840XE;
BLG40E; BLE840F; BLE840X; BLE40F; BLE840E;
BLE840XE; BLE40E; BRX840XE; BRX840E; BRX840F;
BR840XE; BR840E; BR840F; BU840XE; BU840E;
LN60G840F; LN60G840X; LN60G40F; LN60G840E;
LN60G840XE; LN60G40E; LN60E840F; LN60E840X;
LN60E40F; LN60E840E; LN60E840XE; LN60E40E;
M262X840XE; M262X840E; M262X840F; M262840XE;
M262840E; M262840F; M2840XE; M2840E

Brand: Fanstel

Applicant: Fanstel Corporation, Taipei

Sample received Date: August 3, 2021

Final test Date: refer to the date of test data

Test Site: Chamber 19; Conduction 02; Immunity02

Test Distance: 3m; 3m (above 1GHz)

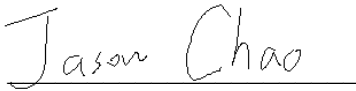
Temperature: refer to each site test data

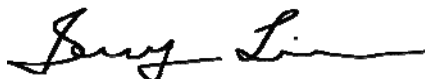
Humidity: refer to each site test data

Input power: Conduction input power: AC 120 V / 60 Hz
Radiation input power: AC 120 V / 60 Hz

Test Result: PASS

Report Engineer: Gigi Yeh

Test Engineer: 
Jason Chao

Approved By: 
Jerry Liu / Assistant Manager

1.2 Description of EUT

General:

Product Name	BLG840F/X BLE/802.15.4 to LTE Gateways
Model Name	BLG840F; BLG840X; BLG40F; BLG840E; BLG840XE; BLG40E; BLE840F; BLE840X; BLE40F; BLE840E; BLE840XE; BLE40E; BRX840XE; BRX840E; BRX840F; BR840XE; BR840E; BR840F; BU840XE; BU840E; LN60G840F; LN60G840X; LN60G40F; LN60G840E; LN60G840XE; LN60G40E; LN60E840F; LN60E840X; LN60E40F; LN60E840E; LN60E840XE; LN60E40E; M262X840XE; M262X840E; M262X840F; M262840XE; M262840E; M262840F; M2840XE; M2840E
Brand Name	Fanstel
Model Difference	Please see Gateway Summaries
Power adaptor	Model: GA-0502000 AC Input: 100-240V~ 0.6A,50-60Hz DC Output: 5V, 2A
Micro USB port	One provided
Antenna port	Two provided

Gateway Summaries

BLE to LTE Gateways		
BLG840F	LN60G840F	BT840F, nRF9160, integrated GPS antenna
BLG840X	LN60G840X	BT840X, nRF9160, integrated GPS antenna
BLG40F	LN60G40F	BT40F, nRF9160, integrated GPS antenna
BLG840E	LN60G840E	BT840E, nRF9160, integrated GPS antenna
BLG840XE	LN60G840XE	BT840XE, nRF9160, integrated GPS antenna
BLG40E	LN60G40E	BT40E, nRF9160, integrated GPS antenna
BLE840F	LN60E840F	BT840F, nRF9160, external GPS antenna (not included)
BLE840X	LN60E840X	BT840X, nRF9160, external GPS antenna (not included)
BLE40F	LN60E40F	BT40F, nRF9160, external GPS antenna (not included)
BLE840E	LN60E840E	BT840E, nRF9160, GPS not supported
BLE840XE	LN60E840XE	BT840XE, nRF9160, GPS not supported
BLE40E	LN60E40E	BT40E, nRF9160, GPS not supported
Gateway Base		
BLG-1	none	Gateway base without an LN module
BLG-1F	none	Gateway base with flash memory, without an LN module
LoRa to BLE Gateway		
BLRX840XE	M262X840XE	BT840XE, LR62XE
BLRX840E	M262X840E	BT840E, LR62XE
BLRX840F	M262X840F	BT840F, LR62XE
BLR840XE	M262840XE	BT840XE, LR62E
BLR840E	M262840E	BT840E, LR62E
BLR840F	M262840F	BT840F, LR62E
USB Dongle - Gateway		
BU840XE	M2840XE	BT840XE
BU840E	M2840E	BT840E

Description of test modes

Test Plan

Applicable standard		FCC 15B				
Test Configuration		Config 1	Config 2	Config 3	Config 4	Config 5
		EUT + Smart mobile phone+Wideband Radio Communication tester	EUT + Smart mobile phone+Wideband Radio Communication tester	EUT + Smart mobile phone+Wideband Radio Communication tester	EUT + Smart mobile phone+Wideband Radio Communication tester	EUT + Smart mobile phone+Wideband Radio Communication tester
Operation mode		LTE and BLE link(BLG840F)	LTE and BLE link(BLG840X)	LTE and BLE link(BLG40F)	LTE and BLE link(BLG840E)	LTE and BLE link(BLG840XE)
No.	Description					
1	Radiated emission(30M~1GHz)(above 1GHz)	Measured	Pretest	Pretest	Pretest	Pretest
2	Conducted emission (AC Power)	Measured	N/A	N/A	N/A	N/A

Applicable standard		FCC 15B				
Test Configuration		Config 6	Config 7	Config 8	Config 9	Config 10
		EUT + Smart mobile phone+Wideband Radio Communication tester	EUT + Smart mobile phone+Wideband Radio Communication tester	EUT + Smart mobile phone+Wideband Radio Communication tester	EUT + Smart mobile phone+Wideband Radio Communication tester	EUT + Smart mobile phone+Wideband Radio Communication tester
Operation mode						
No.	Description	LTE and BLE link(BLG40E)	LTE and BLE link(BLE840F)	LTE and BLE link(BLE840X)	LTE and BLE link(BLE40F)	LTE and BLE link(BLE840E)
1	Radiated emission(30M~1GHz)(above 1GHz)	Pretest	Pretest	Pretest	Pretest	Pretest
2	Conducted emission (AC Power)	N/A	N/A	N/A	N/A	N/A

Applicable standard		FCC 15B				
Test Configuration		Config 11	Config 12	Config 13	Config 14	Config 15
		EUT + Smart mobile phone+Wideband Radio Communication tester	EUT + Smart mobile phone+Wideband Radio Communication tester	EUT(Master) + Smart mobile phone+EUT(Slave)	EUT(Master) + Smart mobile phone+EUT(Slave)	EUT(Master) + Smart mobile phone+EUT(Slave)
Operation mode		LTE and BLE link(BLE840XE)	LTE and BLE link(BLE40E)	LoRa and BLE link(BLRX840XE)	LoRa and BLE link(BLRX840E)	LoRa and BLE link(BLRX840F)
No.	Description					
1	Radiated emission(30M~1GHz)(above 1GHz)	Pretest	Pretest	Pretest	Measured	Pretest
2	Conducted emission (AC Power)	N/A	N/A	N/A	Measured	N/A

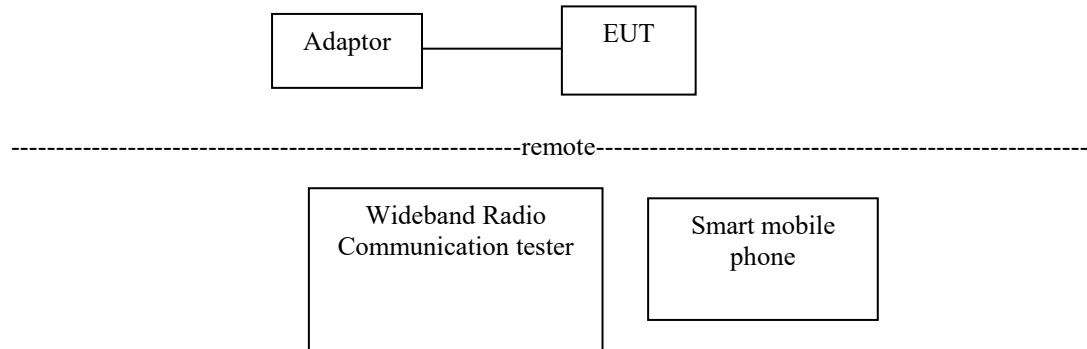
Applicable standard		FCC 15B				
Test Configuration		Config 16	Config 17	Config 18	Config 19	Config 20
		EUT(Master) + Smart mobile phone+EUT(Slave)	EUT(Master) + Smart mobile phone+EUT(Slave)	EUT(Master) + Smart mobile phone+EUT(Slave)	EUT + Smart mobile phone	EUT + Smart mobile phone
Operation mode						
No.	Description	LoRa and BLE link(BLR840XE)	LoRa and BLE link(BLR840E)	LoRa and BLE link(BLR840F)	BLE link(BU840XE)	BLE link(BU840E)
1	Radiated emission(30M~1GHz)(above 1GHz)	Pretest	Pretest	Pretest	Pretest	Pretest
2	Conducted emission (AC Power)	N/A	N/A	N/A	N/A	N/A

Note 1: the test plan was accept by the applicant

1.3 Description of Support Equipment

Fig. 1-1 Configuration

Config. 1



Config. 14

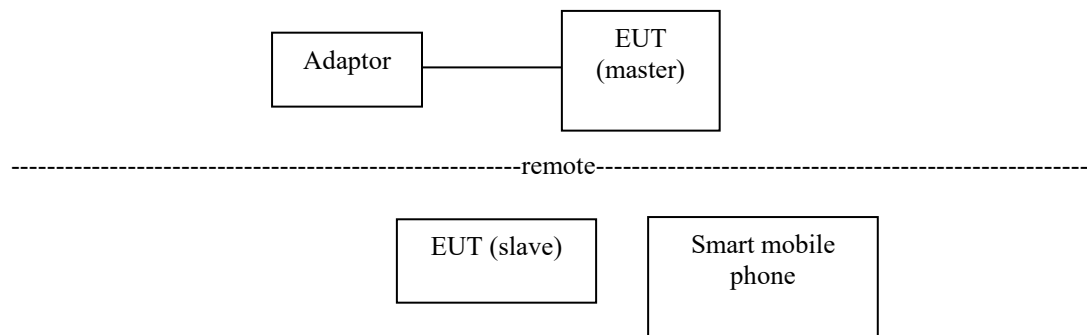


Table 1-1 Support Equipment Used in Tested System

Item	Equipment	Mrf/Brand	Model name	Series No	Data Cable	Power Cable
1	Wideband Radio Communication tester	R&S	CMW500	1201.002K50108793-J G	N/A	Non-Shielded /1.8m
2	Smart mobile phone	hTC	PL99110	N/A	N/A	N/A

I/O Cable Condition of EUT and Support Units

Description	Path	Cable Length	Cable Type	Connector Type
USB power cable	Adaptor USB port to EUT micro USB port	1m	Shielded	Metal

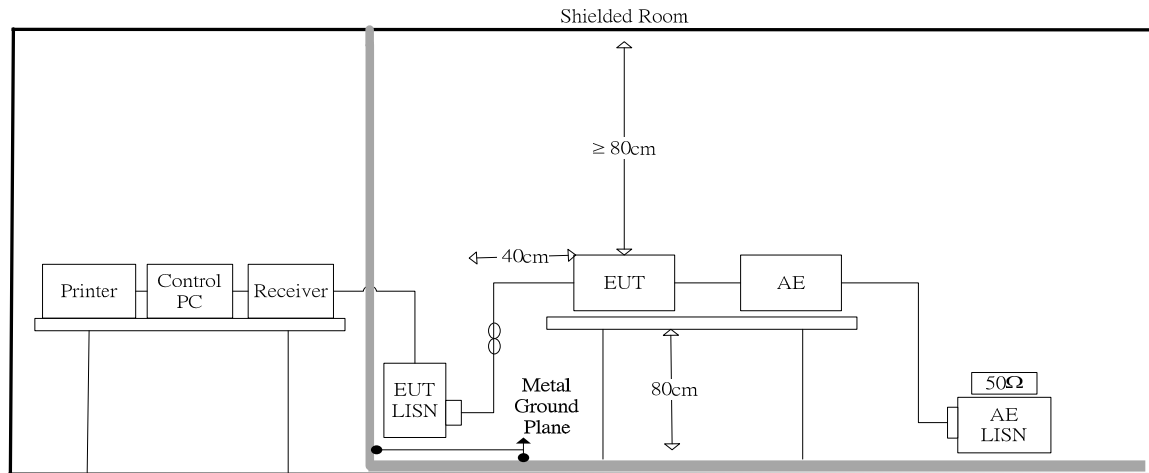
Note: All the above equipment/cables were placed in worse case positions to maximize emission signals during emission test.

Grounding: Grounding was in accordance with the manufacturer's requirements and conditions for the intended use.

2. Power Line Conducted Emissions

2.1 Test Setup and Procedure

2.1.1 Test Setup



2.1.2 Test Procedure

The measurements are performed in a shielded room test site. The EUT was placed on non-conduction 1.0m x 1.5m table, which is 0.8 meters above an earth-grounded.

Power to the EUT was provided through the LISN which has the Impedance (50ohm/50uH) vs. Frequency Characteristic in accordance with the standard. Power to the LISNs were filtered to eliminate ambient signal interference and these filters were bonded to the ground plane. Peripheral equipment required to provide a functional system (support equipment) for EUT testing was powered from the second LISN through a ganged, metal power outlet box which is bonded to the ground plane at the LISN.

The interconnecting cables were arranged and moved to get the maximum measurement. Both the line of power cord, hot and neutral, were measured. All of the interface cables were manipulated according to ANSI C63.4 requirements.

The highest emissions were analyzed in details by operating the spectrum analyzer in fixed tuned mode to determine the nature of the emissions and to provide information which could be useful in reducing their amplitude.

2.1.3 EMI Receiver/Spectrum Analyzer Configuration (for the frequencies tested)

Frequency Range:	150kHz~30MHz
Detector Function:	Quasi-Peak / Average Mode
Resolution Bandwidth:	9kHz

2.1.4 Limit

Conducted emissions limits of Class A equipment. (AC mains power terminals):

Frequency range (MHz)	Quasi-peak (dB μ V)	Average (dB μ V)
0.15-0.50	79	66
0.50-5.0	73	60
5.0-30	73	60

Note 1: Conducted emissions limits of FCC CFR Title 47 Part 15 Subpart B & Industry Canada Interference-Causing Equipment Standard ICES-003 are same.

Note2: The more stringent limit applies at transition frequencies.

Conducted emissions limits of Class B equipment. (AC mains power terminals):

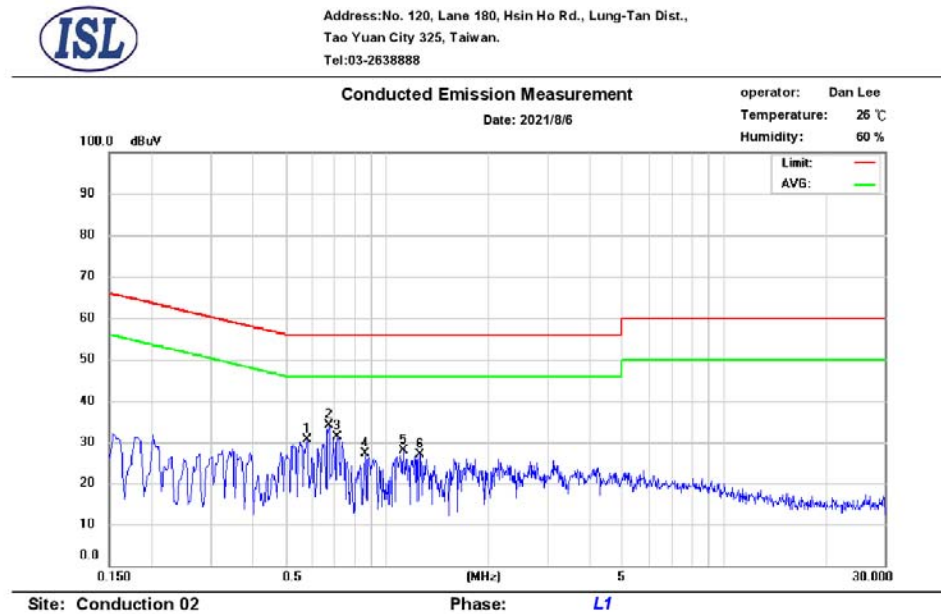
Frequency range (MHz)	Quasi-peak (dB μ V)	Average (dB μ V)
0.15-0.50	66 to 56*	56-46*
0.50-5.0	56	46
5.0-30	60	50
*The limit level in dB μ V decreases linearly with the logarithm of frequency.		

Note 1: Conducted emissions limits of FCC CFR Title 47 Part 15 Subpart B & Industry Canada Interference-Causing Equipment Standard ICES-003 are same.

Note2: The more stringent limit applies at transition frequencies.

2.2 Conduction Test Data: Configuration 1

- Line



No.	Frequency (MHz)	QP_R (dBuV)	AVG_R (dBuV)	Correct Factor (dB)	QP Emission (dBuV)	QP Limit (dBuV)	QP Margin (dB)	AVG Emission (dBuV)	AVG Limit (dBuV)	AVG Margin (dB)
1	0.582	16.16	7.26	9.72	25.88	56.00	-30.12	16.98	46.00	-29.02
2	0.674	20.74	11.04	9.72	30.46	56.00	-25.54	20.76	46.00	-25.24
3	0.714	17.24	5.65	9.73	26.97	56.00	-29.03	15.38	46.00	-30.62
4	0.866	11.82	4.34	9.73	21.55	56.00	-34.45	14.07	46.00	-31.93
5	1.118	14.00	4.05	9.74	23.74	56.00	-32.26	13.79	46.00	-32.21
6	1.254	11.20	3.10	9.75	20.95	56.00	-35.05	12.85	46.00	-33.15

Note:

Margin = QP/AVG Emission - Limit

QP/AVG Emission = QP_R/AVG_R + Correct Factor

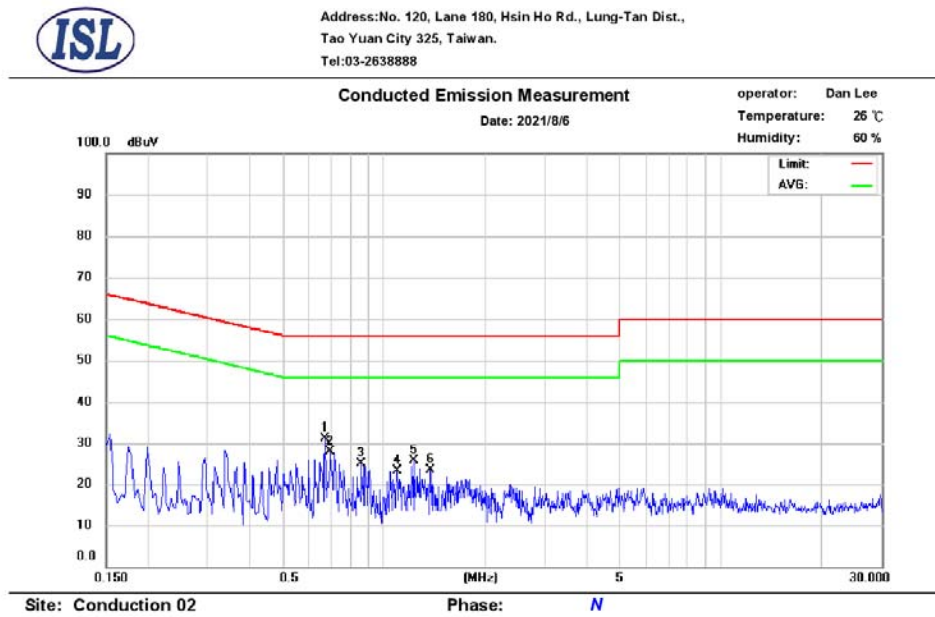
Correct Factor = LISN Loss + Cable Loss

A margin of -8dB means that the emission is 8dB below the limit

The frequency spectrum graph is for final peak graph, and the attached table is for QP/AVG test result.

If peak data can pass, it will be shown in "QP/AVG Correct" column, if not, QP/AVG data will instead.

- Neutral



No.	Frequency (MHz)	QP_R (dBuV)	AVG_R (dBuV)	Correct Factor (dB)	QP Emission (dBuV)	QP Limit (dBuV)	QP Margin (dB)	AVG Emission (dBuV)	AVG Limit (dBuV)	AVG Margin (dB)
1	0.670	11.22	1.29	9.72	20.94	56.00	-35.06	11.01	46.00	-34.99
2	0.694	13.28	4.31	9.72	23.00	56.00	-33.00	14.03	46.00	-31.97
3	0.858	9.00	0.42	9.72	18.72	56.00	-37.28	10.14	46.00	-35.86
4	1.094	7.11	-1.10	9.73	16.84	56.00	-39.16	8.63	46.00	-37.37
5	1.234	6.19	-1.30	9.74	15.93	56.00	-40.07	8.44	46.00	-37.56
6	1.378	4.26	-2.09	9.75	14.01	56.00	-41.99	7.66	46.00	-38.34

Note:

Margin = QP/AVG Emission - Limit

QP/AVG Emission = QP_R/AVG_R + Correct Factor

Correct Factor = LISN Loss + Cable Loss

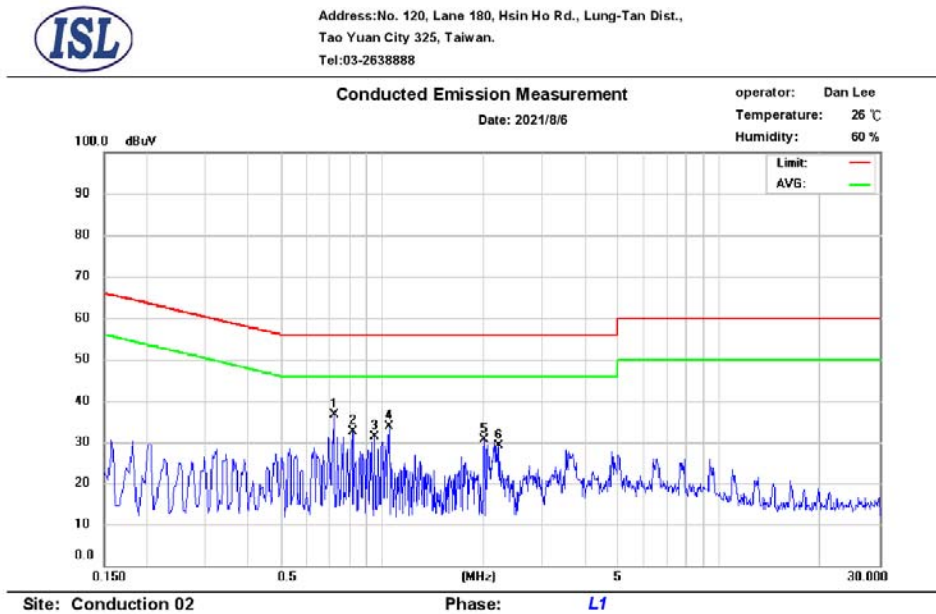
A margin of -8dB means that the emission is 8dB below the limit

The frequency spectrum graph is for final peak graph, and the attached table is for QP/AVG test result.

If peak data can pass, it will be shown in "QP/AVG Correct" column, if not, QP/AVG data will instead.

2.3 Conduction Test Data: Configuration 14

- Line



No.	Frequency (MHz)	QP_R (dBuV)	AVG_R (dBuV)	Correct Factor (dB)	QP Emission (dBuV)	QP Limit (dBuV)	QP Margin (dB)	AVG Emission (dBuV)	AVG Limit (dBuV)	AVG Margin (dB)
1	0.722	17.63	5.52	9.73	27.36	56.00	-28.64	15.25	46.00	-30.75
2	0.818	12.55	1.54	9.73	22.28	56.00	-33.72	11.27	46.00	-34.73
3	0.950	12.51	0.54	9.74	22.25	56.00	-33.75	10.28	46.00	-35.72
4	1.054	14.30	2.25	9.74	24.04	56.00	-31.96	11.99	46.00	-34.01
5	2.022	10.15	-2.83	9.78	19.93	56.00	-36.07	6.95	46.00	-39.05
6	2.226	12.07	1.07	9.78	21.85	56.00	-34.15	10.85	46.00	-35.15

Note:

Margin = QP/AVG Emission - Limit

QP/AVG Emission = QP_R/AVG_R + Correct Factor

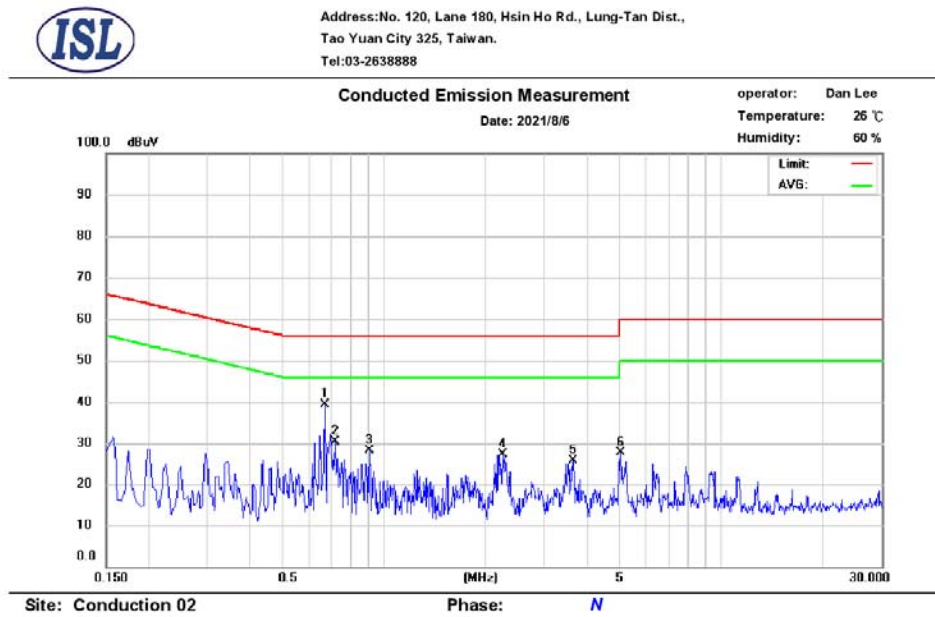
Correct Factor = LISN Loss + Cable Loss

A margin of -8dB means that the emission is 8dB below the limit

The frequency spectrum graph is for final peak graph, and the attached table is for QP/AVG test result.

If peak data can pass, it will be shown in "QP/AVG Correct" column, if not, QP/AVG data will instead.

- Neutral



No.	Frequency (MHz)	QP_R (dBuV)	AVG_R (dBuV)	Correct Factor (dB)	QP Emission (dBuV)	QP Limit (dBuV)	QP Margin (dB)	AVG Emission (dBuV)	AVG Limit (dBuV)	AVG Margin (dB)
1	0.670	13.33	-0.03	9.72	23.05	56.00	-32.95	9.69	46.00	-36.31
2	0.718	11.88	2.56	9.72	21.60	56.00	-34.40	12.28	46.00	-33.72
3	0.906	8.95	0.55	9.73	18.68	56.00	-37.32	10.28	46.00	-35.72
4	2.250	8.62	-0.55	9.78	18.40	56.00	-37.60	9.23	46.00	-36.77
5	3.650	5.76	-2.94	9.81	15.57	56.00	-40.43	6.87	46.00	-39.13
6	5.034	4.56	-4.48	9.84	14.40	60.00	-45.60	5.36	50.00	-44.64

Note:

Margin = QP/AVG Emission - Limit

QP/AVG Emission = QP_R/AVG_R + Correct Factor

Correct Factor = LISN Loss + Cable Loss

A margin of -8dB means that the emission is 8dB below the limit

The frequency spectrum graph is for final peak graph, and the attached table is for QP/AVG test result.

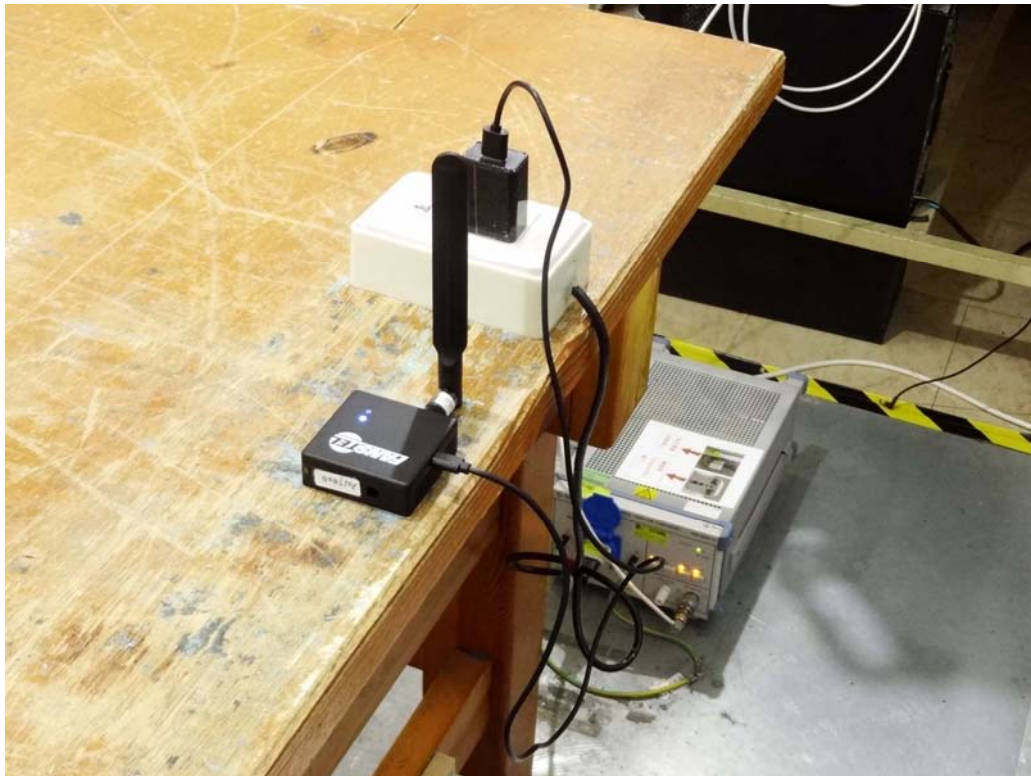
If peak data can pass, it will be shown in "QP/AVG Correct" column, if not, QP/AVG data will instead.

2.4 Test Setup Photo

Front View



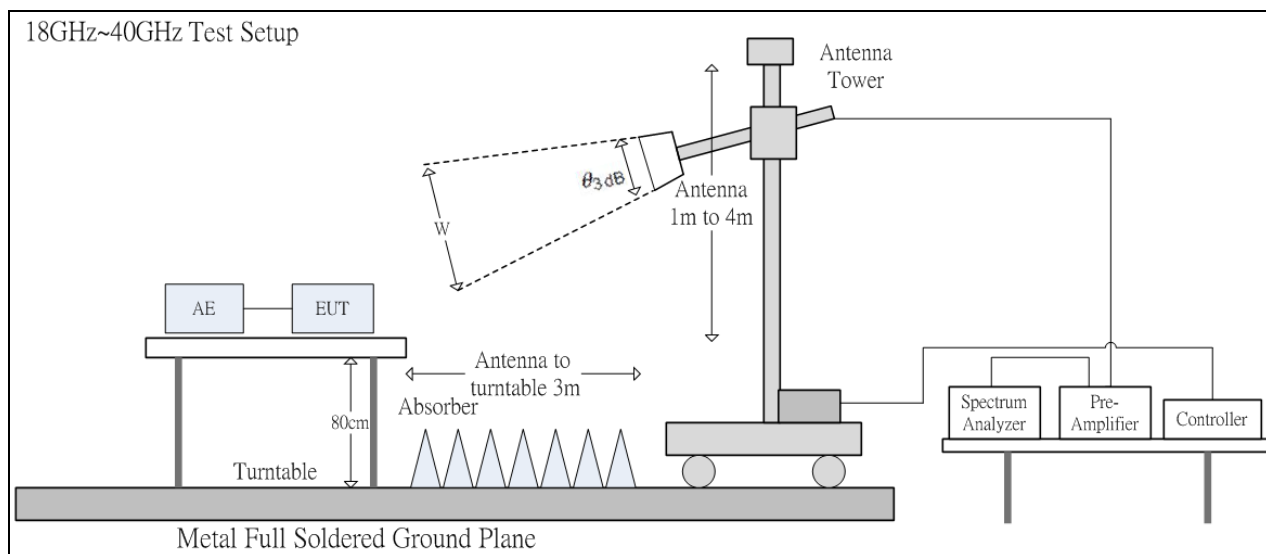
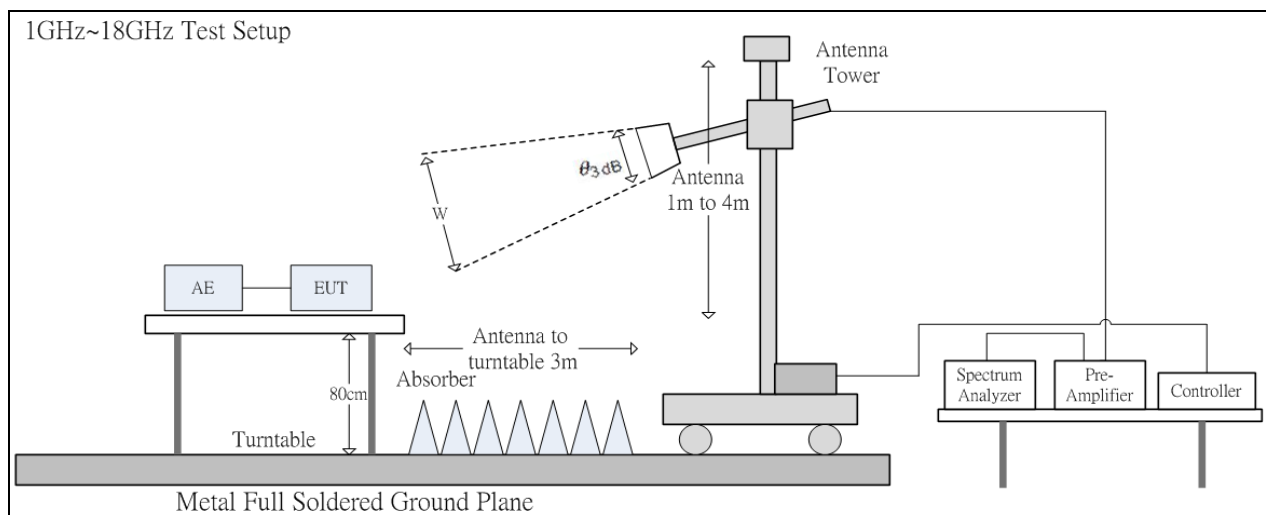
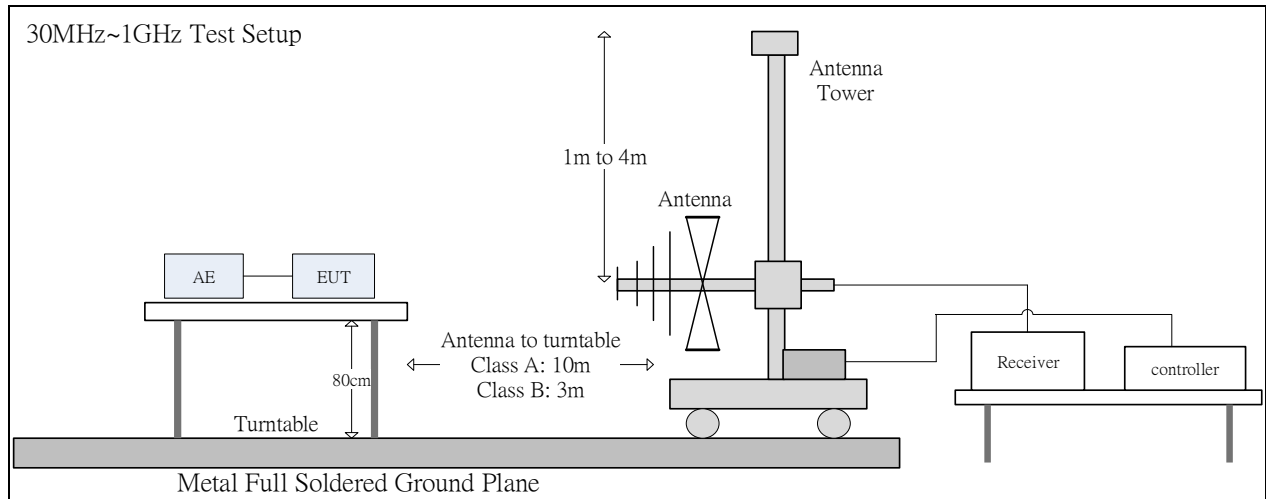
Back View



3. Radiated Emissions

3.1 Test Setup and Procedure

3.1.1 Test Setup



The 3dB beam width of the horn antenna used for the test is as shown in the table below.
 1GHz~18GHz

Frequency GHz	E-plane	H-plane	$\theta_{3\text{dB}}(\text{min})$	d= 3 m	
				w (m)	
1	88°	147°	88°	5.79	
2	68°	119°	68°	4.04	
3	73°	92°	73°	4.44	
4	70°	89°	70°	4.20	
5	55°	60°	55°	3.12	
6	63°	62°	62°	3.60	
7	48°	49°	48°	2.67	
8	39°	46°	39°	2.12	
9	32°	42°	32°	1.72	
10	30°	39°	30°	1.61	
11	32°	35°	32°	1.72	
12	35°	32°	35°	1.89	
13	34°	31°	31°	1.66	
14	32°	27°	27°	1.44	
15	36°	26°	26°	1.39	
16	40°	28°	28°	1.50	
17	43°	26°	26°	1.39	
18	41°	22°	22°	1.17	

18 GHz~26.5 GHz

Frequency GHz	E-plane	H-plane	$\theta_{3\text{dB}}(\text{min})$	d= 1 m	d= 3 m
				w (m)	w (m)
18	11.4°	12.7°	11.4°	0.199	0.598
19	10.9°	12.4°	10.9°	0.190	0.572
20	10.8°	12.4°	10.8°	0.189	0.567
21	9.8°	12°	9.8°	0.171	0.514
22	9.7°	11°	9.7°	0.169	0.509
23	10°	11.8°	10°	0.174	0.524
24	9°	11°	9°	0.157	0.472
25	10°	12.3°	10°	0.174	0.524
26	9.9°	11.1°	9.9°	0.173	0.519
26.5	9.4°	11.3°	9.4°	0.164	0.493

26 GHz~40 GHz

Frequency GHz	E-plane	H-plane	$\theta_{3\text{dB}}(\text{min})$	d= 1 m	d= 3 m
				w (m)	w (m)
26	12°	12.2°	12°	0.210	0.631
27	13°	10.5°	10.5°	0.184	0.551
28	13.2°	12.3°	12.3°	0.216	0.647
29	11.5°	12.8°	11.5°	0.201	0.604
30	12°	8°	8°	0.140	0.420
31	11.5°	10.1°	10.1°	0.177	0.530
32	11.8°	10°	10°	0.175	0.525
33	11.8°	9.5°	9.5°	0.166	0.499
34	11.6°	10°	10°	0.175	0.525
35	10.9°	9.8°	9.8°	0.171	0.514

36	11.8°	8.6°	8.6°	0.150	0.451
37	12.9°	10.5°	10.5°	0.184	0.551
38	12°	10.3°	10.3°	0.180	0.541
39	11.8°	9.8°	9.8°	0.171	0.514
40	12.5°	11.2°	11.2°	0.196	0.588

3.1.2 Test Procedure

The radiated emissions test will then be repeated on the chamber to measure the amplitudes accurately and without the multiple reflections existing in the shielded room. The EUT and support equipment are set up on the turntable of one of 10 meter chamber. Desktop EUT are set up on a wooden stand 0.8 meter above the ground or floor-standing arrangement shall be placed on the horizontal ground reference plane. The test volume for a height of up to 30 cm may be obstructed by absorber placed on the ground plane.

For the initial measurements, the receiving antenna is varied from 1-4 meter height and is changed in the vertical plane from vertical to horizontal polarization at each frequency. The highest emissions between 30 MHz to 1000 MHz were analyzed in details by operating the spectrum analyzer and/or EMI receiver in quasi-peak mode to determine the precise amplitude of the emissions. The highest emissions between 1 GHz to 40 GHz were analyzed in details by operating the spectrum analyzer in peak and average mode to determine the precise amplitude of the emissions.

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the antenna in the cone of radiation from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response. At the highest amplitudes observed, the EUT is rotated in the horizontal plane while changing the antenna polarization in the vertical plane to maximize the reading. The interconnecting cables were arranged and moved to get the maximum measurement. Once the maximum reading is obtained, the antenna elevation and polarization will be varied between specified limits to maximize the readings. All of the interface cables were manipulated according to ANSI C63.4 requirements.

The highest internal source of the EUT is defined as the highest frequency generated or used within the EUT or on which the EUT operates or tunes. If the highest frequency of the internal sources of the EUT is less than 108 MHz, the measurement shall only be made up to 1 GHz. If the highest frequency of the internal sources of the EUT is between 108 MHz and 500 MHz, the measurement shall only be made up to 2 GHz. If the highest frequency of the internal sources of the EUT is between 500 MHz and 1 GHz, the measurement shall only be made up to 5 GHz. If the highest frequency of the internal sources of the EUT is above 1 GHz, the measurement shall be made up to 5 times the highest frequency or 40 GHz, whichever is less.

3.1.3 Spectrum Analyzer Configuration (for the frequencies tested)

Frequency Range: 30MHz--1000MHz
 Detector Function: Quasi-Peak Mode
 Resolution Bandwidth: 120kHz

Frequency Range: Above 1000MHz
 Detector Function: Peak/Average Mode
 Resolution Bandwidth: 1MHz

3.1.4 Limit

Radiated emissions limits of Class A equipment. (30 MHz to 1 GHz)

Frequency range (MHz)	FCC Part 15 Subpart B 15.109(g)	ICES-003
	at 10 m distance Quasi-peak (dB μ V/m)	at 10 m distance Quasi-peak (dB μ V/m)
30-88	40	40.0
88-216	40	43.5
216-230	40	46.4
230-960	47	47.0
960-1000	47	49.5

Note 1: The test limit in this report is based on FCC CFR Title 47 Part 15 Subpart B 15.109(g).

Note 2: The more stringent limit applies at transition frequencies.

Note 3: Test data in this report has been taken against the FCC CFR Title 47 Part 15 Subpart B 15.109(g) limit as it is the most stringent limit. By complying with the more restrictive Part 15 Subpart B 15.109(g) limit compliance with the Industry Canada Interference-Causing Equipment Standard ICES-003 limit is also demonstrated.

Radiated emission limits of Class A equipment at 3 m distance (above 1 GHz)

Frequency range (GHz)	Average dB(μ V/m)	Peak dB(μ V/m)
1 – 40G	60	80

Note 1: Radiated emissions limits of FCC CFR Title 47 Part 15 Subpart B & Industry Canada Interference-Causing Equipment Standard ICES-003 are same.

Radiated emissions limits of Class B equipment. (30 MHz to 1 GHz)

Frequency range (MHz)	FCC Part 15 Subpart B 15.109(a)	ICES-003
	at 3 m distance Quasi-peak (dB μ V/m)	at 3 m distance Quasi-peak (dB μ V/m)
30-88	40	40
88-216	43.5	43.5
216-230	46	46
230-960	46	47
960-1000	54	54

Note 1: The test limit in this report is based on FCC CFR Title 47 Part 15 Subpart B 15.109(a).

Note 2: The more stringent limit applies at transition frequencies.

Note 3: Test data in this report has been taken against the FCC CFR Title 47 Part 15 Subpart B 15.109(a) limit as it is the most stringent limit. By complying with the more restrictive Part 15 Subpart B 15.109(a) limit compliance with the Industry Canada Interference-Causing Equipment Standard ICES-003 limit is also demonstrated.

Radiated emission limits of Class B equipment at 3 m distance (above 1 GHz)

Frequency range (GHz)	Average dB(μ V/m)	Peak dB(μ V/m)
1 – 40G	54	74

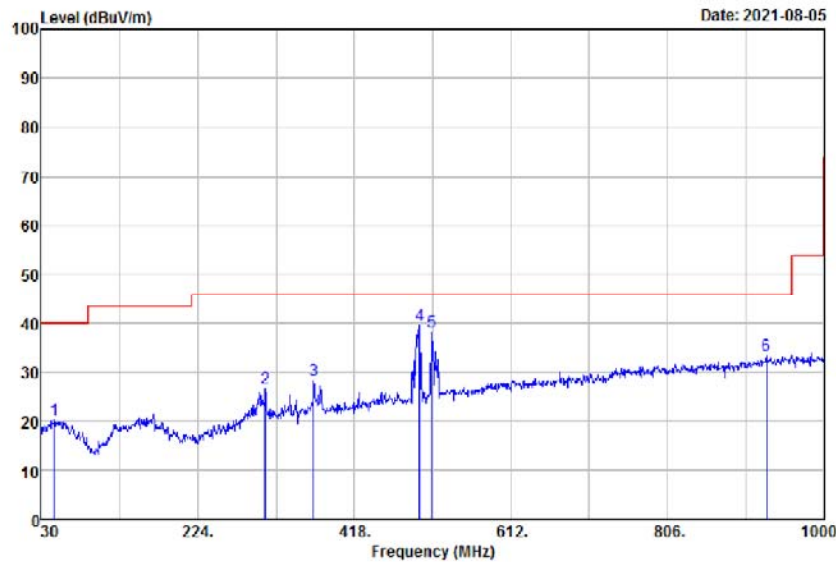
Note 1: Radiated emissions limits of FCC CFR Title 47 Part 15 Subpart B & Industry Canada Interference-Causing Equipment Standard ICES-003 are same.

3.2 Radiation Test Data: Configuration 1

- Radiated Emissions (Horizontal)



International Standard Laboratory Corp.
 Company Address: No. 120, Lane 180, Hsin Ho Rd.
 Lung-Tan Dist., Tao Yuan City 325, Taiwan
 Tel: (03) 4071718 ; Fax: (03) 4071738
 Web: www.isl.com.tw



Condition: FCC CLASS B 3M PK 3m HORIZONTAL
 Site : Chamber 19

Operator : Jason

	Freq	Read	Factor	Level	Limit	Over	Remark	Pol/Phase
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1	45.52	26.20	-6.05	20.15	40.00	-19.85	Peak	HORIZONTAL
2	307.42	31.29	-4.56	26.73	46.00	-19.27	Peak	HORIZONTAL
3	367.56	31.82	-3.60	28.22	46.00	-17.78	Peak	HORIZONTAL
4	499.48	40.69	-1.26	39.43	46.00	-6.57	Peak	HORIZONTAL
5	514.03	39.02	-0.96	38.06	46.00	-7.94	Peak	HORIZONTAL
6	929.19	26.93	6.41	33.34	46.00	-12.66	Peak	HORIZONTAL

- 1 -

* Note:

Margin = Level - Limit Line

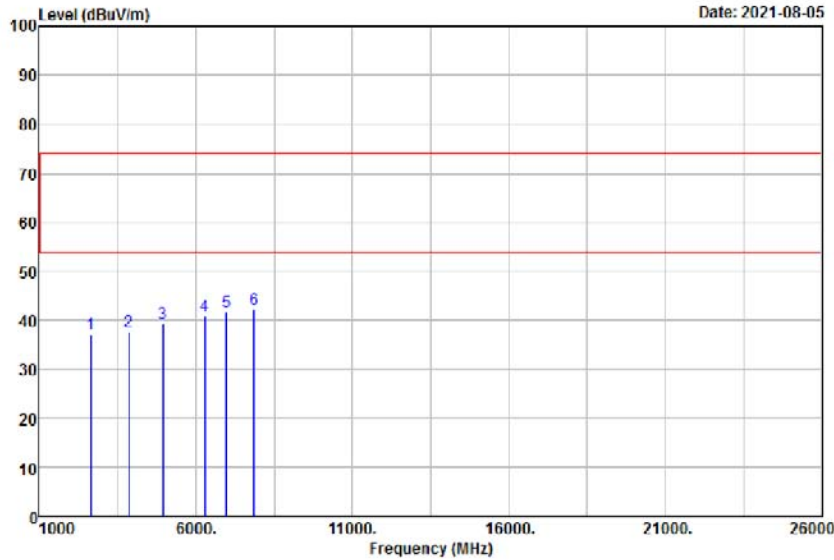
Level = Read Level + Factor

Antenna Distance: 3 meters

Below 1GHz test, if the peak measured value meets the QP limit, it is unnecessary to perform the QP measurement.



International Standard Laboratory Corp.
Company Address: No. 120, Lane 180, Hsin Ho Rd.
Lung-Tan Dist., Tao Yuan City 325, Taiwan
Tel: (03)4071718 ; Fax: (03)4071738
Web: www.isl.com.tw



Condition: FCC CLASS B 3M PK 3m HORIZONTAL
Site : Chamber 19

Operator : Jason

	Freq	Read	Factor	Level	Limit	Over	Remark	Pol/Phase
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1	2650.00	48.10	-11.11	36.99	74.00	-37.01	Peak	HORIZONTAL
2	3850.00	46.65	-9.16	37.49	74.00	-36.51	Peak	HORIZONTAL
3	4950.00	46.22	-7.10	39.12	74.00	-34.88	Peak	HORIZONTAL
4	6275.00	44.69	-4.02	40.67	74.00	-33.33	Peak	HORIZONTAL
5	6975.00	45.17	-3.67	41.50	74.00	-32.50	Peak	HORIZONTAL
6	7850.00	44.87	-2.79	42.08	74.00	-31.92	Peak	HORIZONTAL

- 1 -

* Note:

Margin = Level - Limit Line

Level = Read Level + Factor

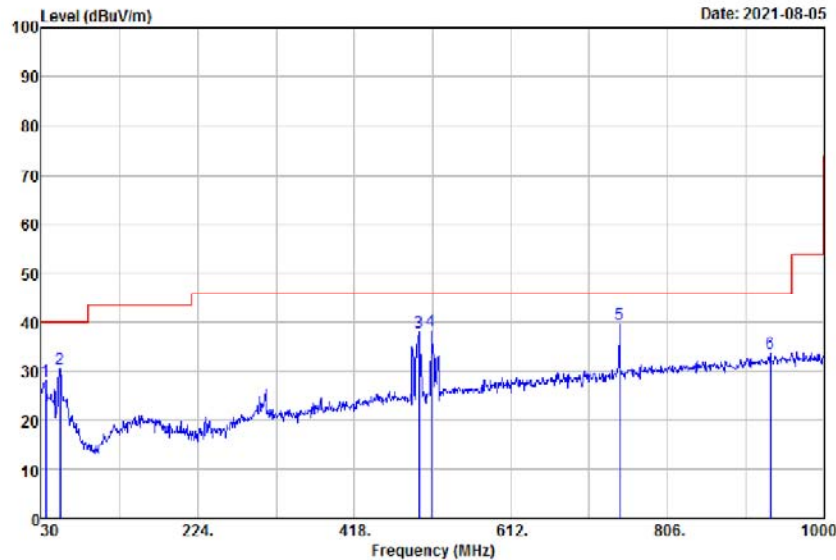
Antenna Distance: 3 meters

Above 1GHz test, if the peak measured value meets the average limit, it is unnecessary to perform the average measurement.

-Radiated Emissions (Vertical)



International Standard Laboratory Corp.
Company Address: No. 120, Lane 180, Hsin Ho Rd.
Lung-Tan Dist., Tao Yuan City 325, Taiwan
Tel: (03)4071718 ; Fax: (03)4071738
Web: www.isl.com.tw



Condition: FCC CLASS B 3M PK 3m VERTICAL
Site : Chamber 19

Operator : Jason

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark	Pol/Phase
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1	34.85	35.04	-7.04	28.00	40.00	-12.00	Peak	VERTICAL
2	53.28	36.83	-6.32	30.51	40.00	-9.49	Peak	VERTICAL
3	498.51	39.27	-1.27	38.00	46.00	-8.00	Peak	VERTICAL
4	513.06	39.20	-0.98	38.22	46.00	-7.78	Peak	VERTICAL
5	746.83	35.93	3.65	39.58	46.00	-6.42	Peak	VERTICAL
6	934.04	27.04	6.46	33.50	46.00	-12.50	Peak	VERTICAL

- 1 -

* Note:

Margin = Level - Limit Line

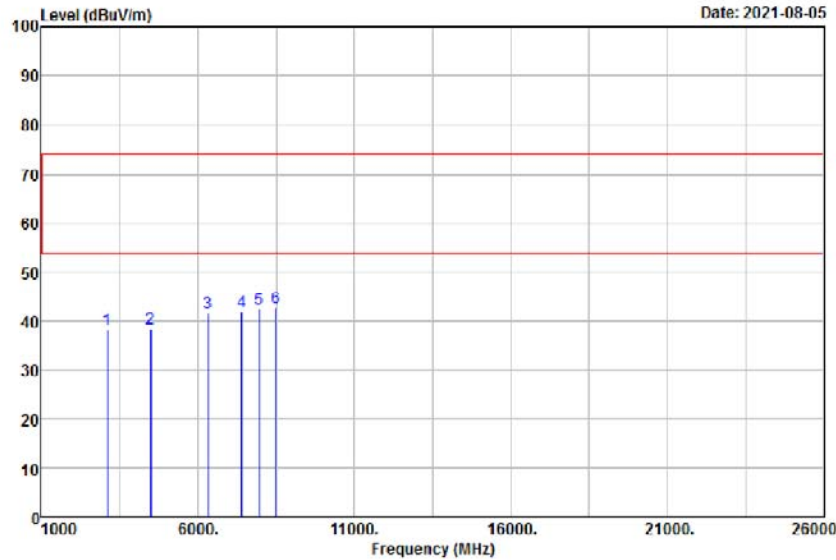
Level = Read Level + Factor

Antenna Distance: 3 meters

Below 1GHz test, if the peak measured value meets the QP limit, it is unnecessary to perform the QP measurement.



International Standard Laboratory Corp.
Company Address: No. 120, Lane 180, Hsin Ho Rd.
Lung-Tan Dist., Tao Yuan City 325, Taiwan
Tel: (03) 4071718 ; Fax: (03) 4071738
Web: www.isl.com.tw



Condition: FCC CLASS B 3M PK 3m VERTICAL
Site : Chamber 19

Operator : Jason

	Freq	Read	Factor	Level	Limit	Over	Remark	Pol/Phase
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1	3100.00	48.72	-10.50	38.22	74.00	-35.78	Peak	VERTICAL
2	4475.00	46.30	-7.82	38.48	74.00	-35.52	Peak	VERTICAL
3	6325.00	45.44	-3.94	41.50	74.00	-32.50	Peak	VERTICAL
4	7400.00	45.37	-3.58	41.79	74.00	-32.21	Peak	VERTICAL
5	7950.00	45.13	-2.67	42.46	74.00	-31.54	Peak	VERTICAL
6	8475.00	44.49	-1.73	42.76	74.00	-31.24	Peak	VERTICAL

- 1 -

* Note:

Margin = Level - Limit Line

Level = Read Level + Factor

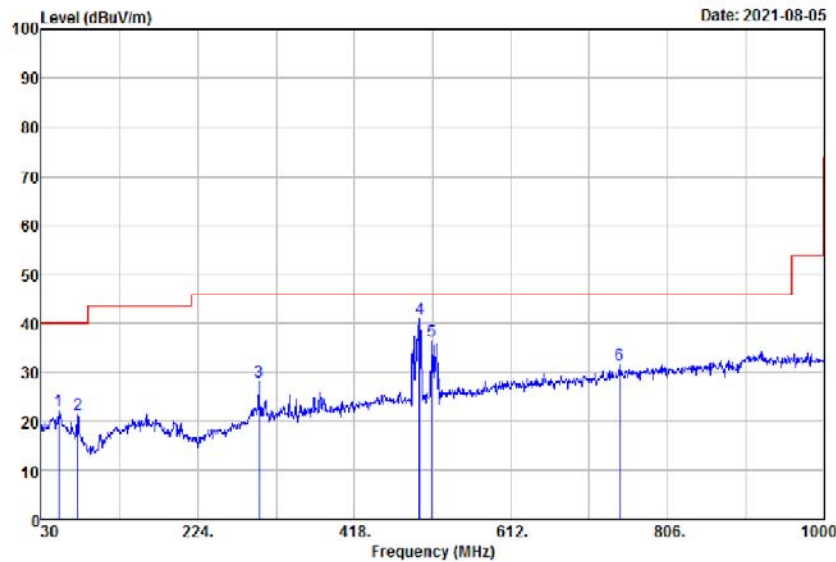
Antenna Distance: 3 meters

Above 1GHz test, if the peak measured value meets the average limit, it is unnecessary to perform the average measurement.

3.3 Radiation Test Data: Configuration 14 - Radiated Emissions (Horizontal)



International Standard Laboratory Corp.
Company Address: No. 120, Lane 180, Hsin Ho Rd.
Lung-Tan Dist., Tao Yuan City 325, Taiwan
Tel: (03) 4071718 ; Fax: (03) 4071738
Web: www.isl.com.tw



Condition: FCC CLASS B 3M PK 3m HORIZONTAL
Site : Chamber 19

Operator : Jason

	Freq	Read	Factor	Level	Limit	Over	Remark	Pol/Phase
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1	51.34	28.40	-6.29	22.11	40.00	-17.89	Peak	HORIZONTAL
2	74.62	30.33	-9.03	21.30	40.00	-18.70	Peak	HORIZONTAL
3	299.66	32.68	-4.72	27.96	46.00	-18.04	Peak	HORIZONTAL
4	499.48	42.15	-1.26	40.89	46.00	-5.11	Peak	HORIZONTAL
5	514.03	37.24	-0.96	36.28	46.00	-9.72	Peak	HORIZONTAL
6	746.83	27.72	3.65	31.37	46.00	-14.63	Peak	HORIZONTAL

- 1 -

* Note:

Margin = Level – Limit Line

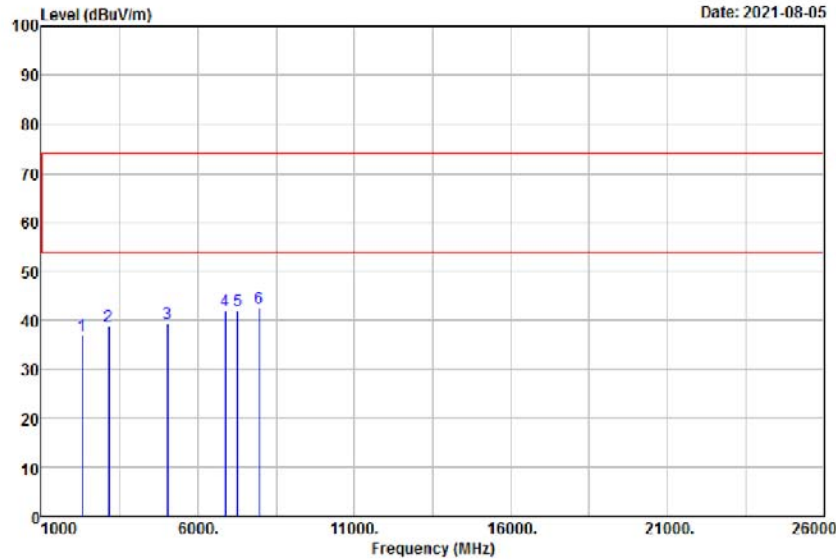
Level = Read Level + Factor

Antenna Distance: 3 meters

Below 1GHz test, if the peak measured value meets the QP limit, it is unnecessary to perform the QP measurement.



International Standard Laboratory Corp.
Company Address: No. 120, Lane 180, Hsin Ho Rd.
Lung-Tan Dist., Tao Yuan City 325, Taiwan
Tel: (03) 4071718 ; Fax: (03) 4071738
Web: www.isl.com.tw



Condition: FCC CLASS B 3M PK 3m HORIZONTAL
Site : Chamber 19

Operator : Jason

	Freq	Read	Factor	Level	Limit	Over	Remark	Pol/Phase
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1	2300.00	49.10	-12.27	36.83	74.00	-37.17	Peak	HORIZONTAL
2	3150.00	48.74	-10.13	38.61	74.00	-35.39	Peak	HORIZONTAL
3	5025.00	46.08	-6.95	39.13	74.00	-34.87	Peak	HORIZONTAL
4	6875.00	45.46	-3.62	41.84	74.00	-32.16	Peak	HORIZONTAL
5	7275.00	45.45	-3.56	41.89	74.00	-32.11	Peak	HORIZONTAL
6	7950.00	45.16	-2.67	42.49	74.00	-31.51	Peak	HORIZONTAL

- 1 -

* Note:

Margin = Level - Limit Line

Level = Read Level + Factor

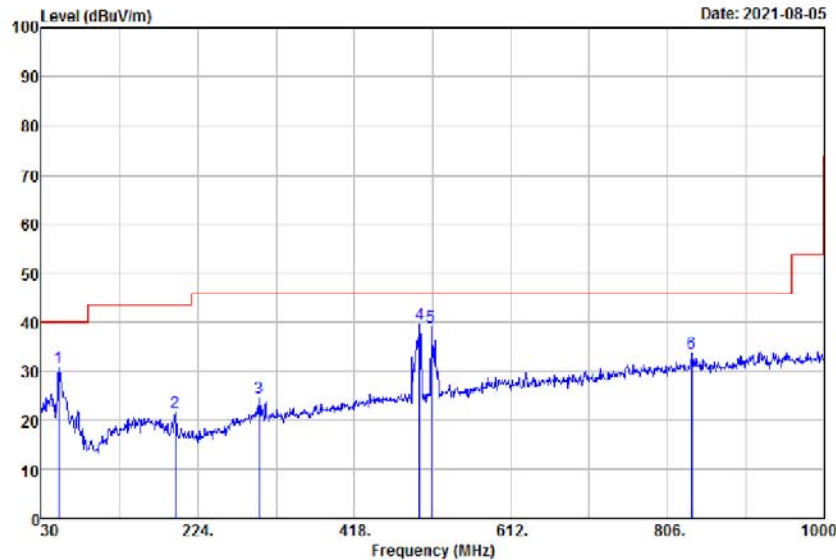
Antenna Distance: 3 meters

Above 1GHz test, if the peak measured value meets the average limit, it is unnecessary to perform the average measurement.

-Radiated Emissions (Vertical)



International Standard Laboratory Corp.
Company Address: No. 120, Lane 180, Hsin Ho Rd.
Lung-Tan Dist., Tao Yuan City 325, Taiwan
Tel: (03)4071718 ; Fax: (03)4071738
Web: www.isl.com.tw



Condition: FCC CLASS B 3M PK 3m VERTICAL
Site : Chamber 19

Operator : Jason

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark	Pol/Phase
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1	51.34	37.00	-6.29	30.71	40.00	-9.29	Peak	VERTICAL
2	195.87	30.26	-8.57	21.69	43.50	-21.81	Peak	VERTICAL
3	299.66	29.37	-4.72	24.65	46.00	-21.35	Peak	VERTICAL
4	499.48	40.76	-1.26	39.50	46.00	-6.50	Peak	VERTICAL
5	513.06	39.84	-0.98	38.86	46.00	-7.14	Peak	VERTICAL
6	836.07	28.85	4.71	33.56	46.00	-12.44	Peak	VERTICAL

- 1 -

* Note:

Margin = Level - Limit Line

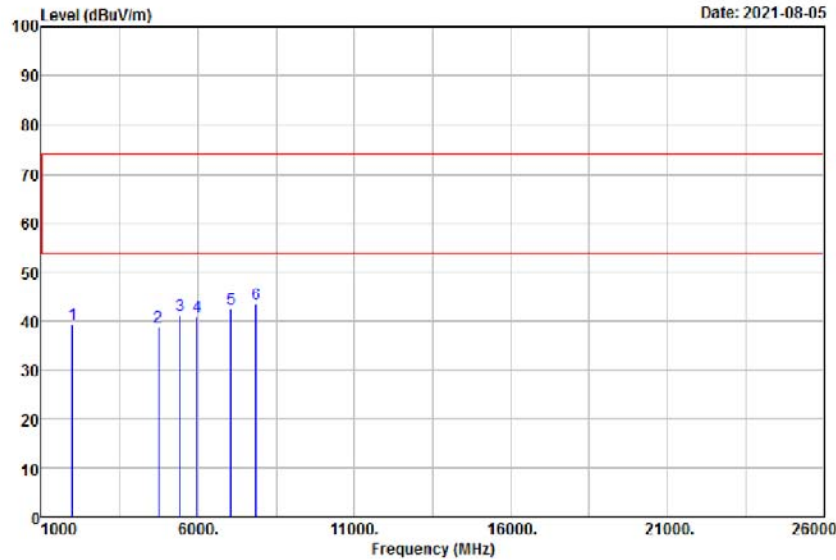
Level = Read Level + Factor

Antenna Distance: 3 meters

Below 1GHz test, if the peak measured value meets the QP limit, it is unnecessary to perform the QP measurement.



International Standard Laboratory Corp.
Company Address: No. 120, Lane 180, Hsin Ho Rd.
Lung-Tan Dist., Tao Yuan City 325, Taiwan
Tel: (03) 4071718 ; Fax: (03) 4071738
Web: www.isl.com.tw



Condition: FCC CLASS B 3M PK 3m VERTICAL
Site : Chamber 19

Operator : Jason

	Freq	Read	Factor	Level	Limit	Over	Remark	Pol/Phase
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1	2000.00	51.69	-12.49	39.20	74.00	-34.80	Peak	VERTICAL
2	4725.00	46.16	-7.42	38.74	74.00	-35.26	Peak	VERTICAL
3	5425.00	46.85	-5.90	40.95	74.00	-33.05	Peak	VERTICAL
4	5975.00	45.54	-4.65	40.89	74.00	-33.11	Peak	VERTICAL
5	7050.00	46.16	-3.67	42.49	74.00	-31.51	Peak	VERTICAL
6	7850.00	46.33	-2.79	43.54	74.00	-30.46	Peak	VERTICAL

- 1 -

* Note:

Margin = Level - Limit Line

Level = Read Level + Factor

Antenna Distance: 3 meters

Above 1GHz test, if the peak measured value meets the average limit, it is unnecessary to perform the average measurement.

3.4 Test Setup Photo

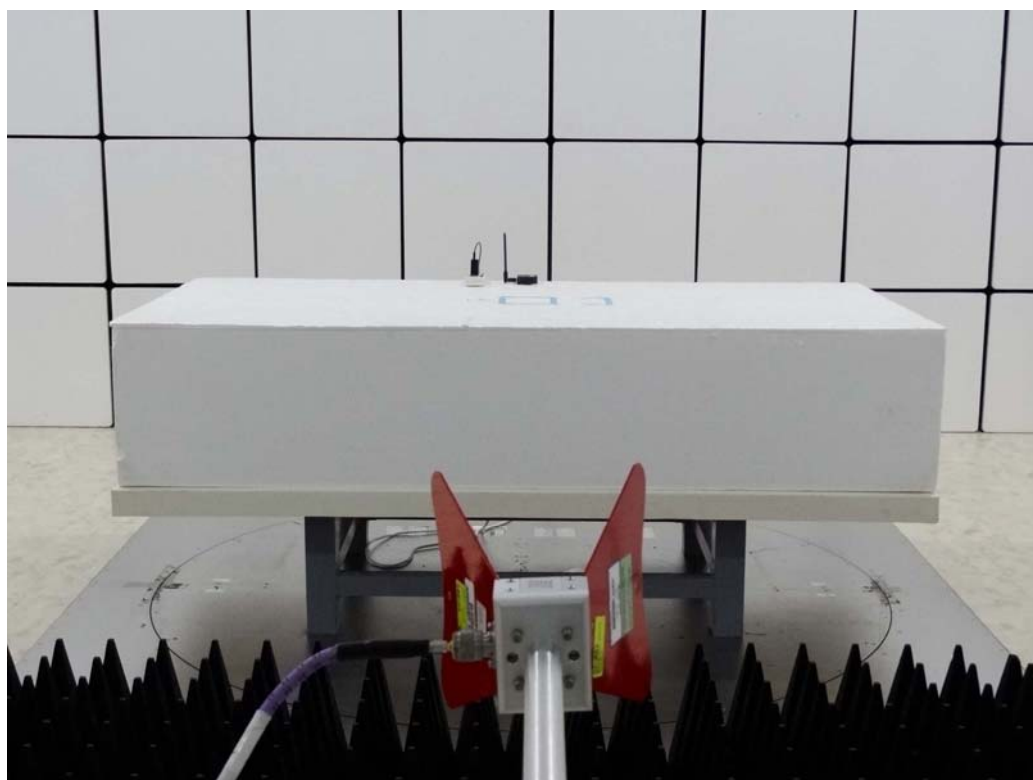
Front View (30MHz~1GHz)



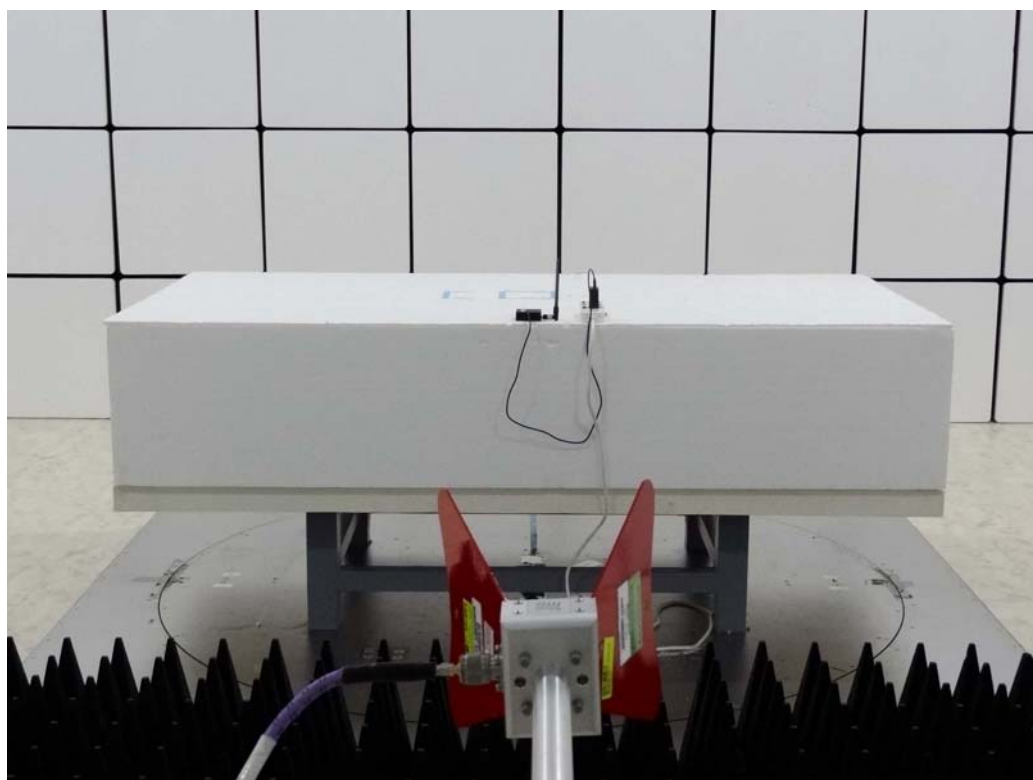
Back View (30MHz~1GHz)



Front View (above 1GHz)



Back View (above 1GHz)



4. Appendix

4.1 Appendix A: (FCC)Warning Labels

Label Requirements

A Class B digital device subject to authorization under Supplier's Declaration of Conformity of FCC shall carry a label which includes the following statement:

*** * * W A R N I N G * * ***

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Devices subject to authorization under Supplier's Declaration of Conformity may be labeled with FCC logo on a voluntary basis as a visual indication that the product complies with the applicable FCC requirements

The sample label shown shall be permanently affixed at a conspicuous location on the device and be readily visible to the user at the time of purchase.

When the device is so small or for such use that it is impracticable to label it with the statement specified under (§15.19 Labeling requirements) paragraph (a) of this section in a font that is four-point or larger, and the device does not have a display that can show electronic labeling, then the information required by this paragraph shall be placed in the user manual and must also either be placed on the device packaging or on a removable label attached to the device.

4.2 Appendix B: (FCC)Warning Statement

Statement Requirements

The operators' manual for a Class B digital device shall contain the following statements or their equivalent:

* * * W A R N I N G * * *

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Notice: The changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equivalent.

* * * * *

If the EUT was tested with special shielded cables the operator's manual for such product shall also contain the following statements or their equivalent:

Shielded interface cables and/or AC power cord, if any, must be used in order to comply with the emission limits.

4.3 Appendix C: (Canada ISED) Labelling and user manual requirements

The requirements specified in ICES-Gen shall apply. An example ISED compliance label, to be placed on each unit of an equipment model (or in the user manual, if allowed), is given below:

CAN ICES-003(*) / NMB-003(*)

* Insert either “A” or “B”, but not both, to identify the applicable Class of the device used for compliance verification.

The above label is only an example. The specific format is left to the manufacturer to decide, as long as the label includes the required information, in accordance with ICES-Gen.

4.4 Appendix D: Test Equipment

4.4.1 Test Equipment List

Location	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
Conduction 02	EMI Receiver 14	ROHDE&SCHWARZ	ESCI	101034	05/25/2021	05/25/2022
Conduction 02	Conduction 02-1 Cable	WOKEN	CFD 300-NL	Conduction 02 -1	09/18/2020	09/18/2021
Conduction 02	LISN 26	R&S	ENV216	102378	11/27/2020	11/27/2021
Conduction 02	LISN 21	R&S	ENV216	101476	07/05/2021	07/05/2022
Conduction 02	ISN T4 07	Teseq GmbH	ISN T400A	30449	07/16/2021	07/16/2022
Conduction 02	ISN T8 10	Teseq GmbH	ISN T800	42773	07/16/2021	07/16/2022
Conduction 02	ISN T8 CAT6A 01	SCHWARZBECK	NTFM 8158	8158 0123	01/17/2021	01/17/2022
Conduction 02	Capacitive Voltage Probe 01	SCHAFFNER	CVP 2200A	18711	08/05/2021	08/05/2022
Conduction 02	Current Probe	SCHAFFNER	SMZ 11	18030	03/04/2021	03/04/2022

Location Conducted	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
Chamber 19	Spectrum analyzer	R&S	FSV40	101919	08/13/2021	08/13/2022
Chamber 19	EMI Receiver	R&S	ESR3	102461	05/05/2021	05/05/2022
Chamber 19	Loop Antenna	EM	EM-6879	271	05/21/2021	05/21/2022
Chamber 19	Bilog Antenna (30MHz-1GHz)	Schwarzbeck	VULB9168 w 6dB Att.	9168-736	02/22/2021	02/22/2022
Chamber 19	Horn antenna (1GHz-18GHz)	ETS LINDGREN	3117	00218718	09/25/2020	09/25/2021
Chamber 19	Horn antenna (18GHz-26GHz)	Com-power	AH-826	081001	11/23/2020	11/23/2021
Chamber 19	Horn antenna (26GHz-40GHz)	Com-power	AH-640	100A	03/11/2021	03/11/2022
Chamber 19	Preamplifier (9kHz-1GHz)	HP	8447F	3113A04621	06/22/2021	06/22/2022
Chamber 19	Preamplifier (1GHz-26GHz)	EM	EM01M26G	060681	05/07/2021	05/07/2022
Chamber 19	Preamplifier (26GHz-40GHz)	MITEQ	JS4-26004000 -27-5A	818471	05/07/2021	05/07/2022
Chamber 19	RF Cable (9kHz-18GHz)	HUBER SUHNER	Sucoflex 104A & 18GHz SMA(M)-SMA(M)-10M	MY817/4A & 20200525	12/25/2020	12/25/2021
Chamber 19	RF Cable (18GHz-40GHz)	HUBER SUHNER	Sucoflex 102	27963/2&37421 /2	11/19/2020	11/19/2021
Chamber 19	Signal Generator	Anritsu	MG3692A	20311	01/03/2021	01/03/2022
Chamber 19	Test Software	Audix	E3 Ver:6.12023	N/A	N/A	N/A

4.4.2 Software for Controlling Spectrum/Receiver and Calculating Test Data

Site	Filename	Version	Issue Date
Conduction/Radiation	EZ EMC	ISL-03A2	3/6/2013

4.5 Appendix E: Uncertainty of Measurement

The laboratory measurement uncertainty accordance with refers to CISPR 16-4-2. If U_{lab} is less than or equal to U_{cispr} in Table 1, then the test report may either state the value of U_{lab} or state that U_{lab} is less than U_{cispr}.

The coverage factor $k = 2$ yields approximately a 95 % level of confidence.

<Conduction 02>

AMN: $\pm 2.94\text{dB}$

ISN T4: $\pm 3.11\text{dB}$

ISN T8: $\pm 3.09\text{dB}$

CVP: $\pm 3.62\text{dB}$

CP: $\pm 2.88\text{dB}$

<Chamber 19 (3m)>

30MHz~1000MHz: $\pm 4.22\text{ dB}$

1GHz~40GHz: $\pm 4.08\text{ dB}$

4.6 Appendix E: Photographs of EUT

Please refer to the File of **ISL-21LR211P**

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