

# TEST REPORT

of

## RE Directive (2014/53/EU)

### EN 301 489-1/17 & EN55032/35

**Product:** BLG840F/X BLE/802.15.4 to LTE Gateways  
**Brand:** Fanstel  
**Main Model:** BLG840F  
**Series Model:** BLG840X; BLG40F; BLG840E; BLG840XE; BLG40E; BLE840F; BLE840X; BLE40F; BLE840E; BLE840XE; BLE40E; BLG-1; BLG-1F; BU840XE; BU840E; LN60G840F; LN60G840X; LN60G40F; LN60G840E; LN60G840XE; LN60G40E; LN60E840F; LN60E840X; LN60E40F; LN60E840E; LN60E840XE; LN60E40E; M2840XE; M2840E  
**Model Difference:** Antenna difference  
**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.**

TEL: +886-3-263-8888 FAX: +886-3-263-8899

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

Report No.: **ISL-22LR0022E489A**  
Issue Date :**2022/06/08**



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.

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## VERIFICATION OF COMPLIANCE

**Applicant:** Fanstel Corporation, Taipei  
**Equipment Under Test:** BLG840F/X BLE/802.15.4 to LTE Gateways  
**Brand Name:** Fanstel  
**Main Model:** BLG840F  
**Series Model:** BLG840X; BLG40F; BLG840E; BLG840XE; BLG40E; BLE840F; BLE840X; BLE40F; BLE840E; BLE840XE; BLE40E; BLG-1; BLG-1F; BU840XE; BU840E; LN60G840F; LN60G840X; LN60G40F; LN60G840E; LN60G840XE; LN60G40E; LN60E840F; LN60E840X; LN60E40F; LN60E840E; LN60E840XE; LN60E40E; M2840XE; M2840E  
**Model Different:** Antenna difference  
**Date of Test:** 2022/05/19 ~ 2022/06/07  
**Date of EUT Received:** 2022/05/19

APPLICABLE STANDARDS	
EN301 489 -1 v2.2.3: 2019	EN301 489 -17 v3.2.4: 2020
EMI: EN 55032:2015+A11:2020	
EN IEC 61000-3-2:2019	EN 61000-3-3:2013+A1:2019
EMS: EN 55035:2017+A11:2020(CISPR 35:2016 modified)	
EN 61000-4-2:2009	EN 61000-4-3:2006+A1:2008 +A2:2010
EN 61000-4-4:2012	EN 61000-4-5:2014+A1:2017
EN 61000-4-6:2014+AC:2015	EN61000-4-8:2010
EN 61000-4-11:2004+A1:2017	

In the configuration tested, the EUT complied with the standards specified above.

### Remarks:

This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of **International Standards Laboratory Corp.** or testing done by in connection with distribution or use of the product described in this report must be approved by **International Standards Laboratory Corp.** in writing.

**Test By:**

*Jason Chao*

**Date:**

2022/06/08

*Jason Chao / Senior Engineer*

**Prepared By:**

*Gigi yeh*

**Date:**

2022/06/08

*Gigi Yeh / Senior Engineer*

**Approved By:**

*Jerry Liu*

**Date:**

2022/06/08

*Jerry Liu / Assistant Manager*

## Version

Version No.	Date	Description
00	2022/06/08	Initial creation of document

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# 1. General Description

## 1.1 Description of Equipment under Test (EUT)

General Information		
Product Name:	BLG840F/X BLE/802.15.4 to LTE Gateways	
Brand Name:	Fanstel	
Main Model:	BLG840F	
Series Model:	BLG840X; BLG40F; BLG840E; BLG840XE; BLG40E; BLE840F; BLE840X; BLE40F; BLE840E; BLE840XE; BLE40E; BLG-1; BLG-1F; BU840XE; BU840E; LN60G840F; LN60G840X; LN60G40F; LN60G840E; LN60G840XE; LN60G40E; LN60E840F; LN60E840X; LN60E40F; LN60E840E; LN60E840XE; LN60E40E; M2840XE; M2840E	
Model Difference:	Antenna difference	
Temperature Range:	-40°C to +80°C	
Power Supply:	5VDC	
	Adaptor:	Model: GA-0502000V; Supplier: Fanstel

### Antenna List:

Model Name	Antenna Type	Antenna Gain
BLE40E	Dipole ANT060	6dBi
BLE40F	PCB F type	0.88dBi
BLE840E	Dipole ANT0	0dBi
BLE840F	PCB F type	0.88dBi
BLE840X	PCB F type	0.88dBi
BLE840XE	Dipole ANT0	0dBi
BLG40E	Dipole ANT060	6dBi
BLG40F	PCB F type	0.88dBi
BLG840E	Dipole ANT0	0dBi
BLG840F	PCB F type	0.88dBi
BLG840X	PCB F type	0.88dBi
BLG840XE	Dipole ANT0	0dBi
BU840E	Dipole ANT0	0dBi
BU840XE	Dipole ANT0	0dBi

Remark: The above DUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

## 1.2 General Description of Applied Standards

The EUT According to the Specifications, it must comply with the requirements of the following standards:

ETSI EN301 489-1 V2.2.3: ElectroMagnetic Compatibility (EMC) standard for radio equipment and services;

Part 1: Common technical requirements; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU

ETSI EN301 489-17 V3.2.4:

Part 17: Specific conditions for Broadband Data Transmission Systems; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU

EN 55032 2015+A11:2020:

Electromagnetic compatibility of multimedia equipment - Emission requirements.

EN 55024:2010 – Information technology Equipment – Immunity Characteristics - Limits and methods of measurement

## 1.3 Description of Test Modes:

The transmitter shall be modulated with normal test modulation as specified for that type of equipment. Where transmitters do not have a modulation input port, the internal equipment modulation shall be used.

The wanted signals and/or controls required to establish a communications link shall be defined by the manufacturer.

The transmitter shall be operated at its maximum rated RF output power as specified for that type of equipment. The manufacturer may provide a suitable companion receiver that can be used to set up a communications link and/or to receive messages.

The tests shall be made exercising all primary functions in the most representative mode consistent with typical applications. The test sample shall be configured in a manner consistent with typical installation practice.

## Test Plan

Applicable standard		EN 301 489, CISPR 32/35		
Test Configuration		Config 1	Config 2	Config 3
		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 GPS and BLE link(BLG840F)	LTE and GPS and BLE link(BLG840X)	LTE and GPS and BLE link(BLG40F)
No.	Description			
1	radiated emission (30M-1GHz) (1-6GHz)	Pre-test	Pre-test	Pre-test
2	conducted emission (DC Power)	N/A	N/A	N/A
3	conducted emission (AC Power)	N/A	N/A	N/A
4	harmonic current emissions	N/A	N/A	N/A
5	voltage fluctuations and flicker	N/A	N/A	N/A
6	Conducted emission (wired network)	N/A	N/A	N/A
7	RF electromagnetic field (80MHz to 6GHz)	N/A	N/A	N/A
8	electrostatic discharge	N/A	N/A	N/A
9	fast transients common mode	N/A	N/A	N/A
10	RF common mode 0,15 MHz to 80 MHz	N/A	N/A	N/A
11	transients and surges	N/A	N/A	N/A
12	voltage dips and interruptions	N/A	N/A	N/A
13	surges, line to line and line to ground	N/A	N/A	N/A

Applicable standard		EN 301 489, CISPR 32/35		
Test Configuration		Config 4	Config 5	Config 6
		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 GPS and BLE link(BLG840E)	LTE and GPS and BLE link(BLG840XE)	LTE and GPS and BLE link(BLG40E)
No.	Description			
1	radiated emission (30M-1GHz) (1-6GHz)	Pre-test	Pre-test	Pre-test
2	conducted emission (DC Power)	N/A	N/A	N/A
3	conducted emission (AC Power)	N/A	N/A	N/A
4	harmonic current emissions	N/A	N/A	N/A
5	voltage fluctuations and flicker	N/A	N/A	N/A
6	Conducted emission (wired network)	N/A	N/A	N/A
7	RF electromagnetic field (80MHz to 6GHz)	N/A	N/A	N/A
8	electrostatic discharge	N/A	N/A	N/A
9	fast transients common mode	N/A	N/A	N/A
10	RF common mode 0,15 MHz to 80 MHz	N/A	N/A	N/A
11	transients and surges	N/A	N/A	N/A
12	voltage dips and interruptions	N/A	N/A	N/A
13	surges, line to line and line to ground	N/A	N/A	N/A



Applicable standard		EN 301 489, CISPR 32/35		
Test Configuration		Config 7	Config 8	Config 9
		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 GPS and BLE link(BLE840F)	LTE and GPS and BLE link(BLE840X)	LTE and GPS and BLE link(BLE40F)
No.	Description			
1	radiated emission (30M-1GHz) (1-6GHz)	Pre-test	Measured	Pre-test
2	conducted emission (DC Power)	N/A	N/A	N/A
3	conducted emission (AC Power)	N/A	Measured	N/A
4	harmonic current emissions	N/A	Measured	N/A
5	voltage fluctuations and flicker	N/A	Measured	N/A
6	Conducted emission (wired network)	N/A	N/A	N/A
7	RF electromagnetic field (80MHz to 6GHz)	N/A	Measured	N/A
8	electrostatic discharge	N/A	Measured	N/A
9	fast transients common mode	N/A	Measured	N/A
10	RF common mode 0,15 MHz to 80 MHz	N/A	Measured	N/A
11	transients and surges	N/A	N/A	N/A
12	voltage dips and interruptions	N/A	Measured	N/A
13	surges, line to line and line to ground	N/A	Measured	N/A

Applicable standard		EN 301 489, CISPR 32/35		
Test Configuration		Config 10	Config 11	Config 12
		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(BLE840E)	LTE and BLE link(BLE840XE)	LTE and BLE link(BLE40E)
No.	Description			
1	radiated emission (30M-1GHz) (1-6GHz)	Pre-test	Pre-test	Pre-test
2	conducted emission (DC Power)	N/A	N/A	N/A
3	conducted emission (AC Power)	N/A	N/A	N/A
4	harmonic current emissions	N/A	N/A	N/A
5	voltage fluctuations and flicker	N/A	N/A	N/A
6	Conducted emission (wired network)	N/A	N/A	N/A
7	RF electromagnetic field (80MHz to 6GHz)	N/A	N/A	N/A
8	electrostatic discharge	N/A	N/A	N/A
9	fast transients common mode	N/A	N/A	N/A
10	RF common mode 0,15 MHz to 80 MHz	N/A	N/A	N/A
11	transients and surges	N/A	N/A	N/A
12	voltage dips and interruptions	N/A	N/A	N/A
13	surges, line to line and line to ground	N/A	N/A	N/A

Applicable standard		EN 301 489, CISPR 32/35		
Test Configuration		Config 13	Config 14	
		EUT + Smart mobile phone	EUT + Smart mobile phone	
Operation mode		BLE link(BU840XE)	BLE link(BU840E)	
No.	Description			
1	radiated emission (30M-1GHz) (1-6GHz)	Pre-test	Pre-test	
2	conducted emission (DC Power)	N/A	N/A	
3	conducted emission (AC Power)	N/A	N/A	
4	harmonic current emissions	N/A	N/A	
5	voltage fluctuations and flicker	N/A	N/A	
6	Conducted emission (wired network)	N/A	N/A	
7	RF electromagnetic field (80MHz to 6GHz)	N/A	N/A	
8	electrostatic discharge	N/A	N/A	
9	fast transients common mode	N/A	N/A	
10	RF common mode 0,15 MHz to 80 MHz	N/A	N/A	
11	transients and surges	N/A	N/A	
12	voltage dips and interruptions	N/A	N/A	
13	surges, line to line and line to ground	N/A	N/A	

*Note 1: the test plan was accepted by the applicant*

#### **1.4 Test Facility:**

The 10m anechoic chamber radiated emission measurement facilities used to collect the data are located at <LT Lab.> Address: No. 120, Lane 180, Hsin Ho Rd. Lung-Tan Dist., Tao Yuan City 325, Taiwan, The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

The 966 anechoic chamber radiated emission measurement (Above 1GHz) facilities used to collect the data are located at <LT Lab.> Address: No. 120, Lane 180, Hsin Ho Rd. Lung-Tan Dist., Tao Yuan City 325, Taiwan, The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

The AC power line conducted emission, flicker and all of immunity measurement facilities used to collect the data are located at <LT Lab.> Address: No. 120, Lane 180, Hsin Ho Rd. Lung-Tan Dist., Tao Yuan City 325, Taiwan, The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

#### **1.5 Modification List:**

No modification by International Standards Laboratory Corp.

#### **1.6 Test Condition:**

Refer to EN 301 489-1, Section 4 and EN 301 489-17, Section4 for the details.

## 1.7 Equipment List:

Location	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
Conduction 03	EMI Receiver 15	ROHDE & SCHWARZ	ESCI	101166	07/07/2021	07/07/2022
Conduction 03	Chamber05 -1 Cable	WOKEN	CFD 300-NL	Chamber05 -1 Cable	08/30/2021	08/30/2022
Conduction 03	LISN 19	R&S	ENV216	101425	11/11/2021	11/11/2022
Conduction 03	LISN 22	R&S	ENV216	101478	10/28/2021	10/28/2022
Conduction 03	LISN 24	SCHWARZBEC K	NNLK 8121	8121-829	07/26/2021	07/26/2022
Conduction 03	ISN T4 09	Teseq GmbH	ISN T400A	49914	08/02/2021	08/02/2022
Conduction 03	ISN T8 09	Teseq GmbH	ISN T800	36190	09/30/2021	09/30/2022
Conduction 03	ISN T8 CAT6A_01	SCHWARZBEC K	NTFM 8158	8158 0123	01/25/2022	01/25/2023
Conduction 03	CDN ISN ST08A_1	Teseq GmbH	CDN ISN ST08A	43352	10/07/2021	10/07/2022
Conduction 03	Capacitive Voltage Probe 01	SCHAFFNER	CVP 2200A	18711	02/23/2022	02/23/2023
Conduction 03	Current Probe	SCHAFFNER	SMZ 11	18030	02/23/2022	02/23/2023

Location Chamber02	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
Radiation	BILOG Antenna 17 (30MHz~1GHz)	SCHWARZBEC K	VULB 9168+EMCI-N-6-05	645	05/18/2022	05/18/2023
Radiation	Preamplifier 25	EMCI	EMC9135	980295	03/31/2022	03/31/2023
Radiation	Coaxial Cable Chmb 02-10M-02	EMC	RG214U	Chmb 02-10M-02	10/13/2021	10/13/2022
Radiation	EMI Receiver 17	ROHDE&SCHWARZ	ESCI 7	100887	11/04/2021	11/04/2022

Location Conducted	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
Chamber 19	Spectrum analyzer	R&S	FSV40	101919	08/18/2021	08/18/2022
Chamber 19	EMI Receiver	R&S	ESR3	102461	05/10/2022	05/10/2023
Chamber 19	Loop Antenna	EM	EM-6879	271	09/29/2021	09/29/2022
Chamber 19	Bilog Antenna (30MHz-1GHz)	Schwarzbeck	VULB9168 6dB Att.	9168-736	03/09/2022	03/09/2023
Chamber 19	Horn antenna (1GHz-18GHz)	ETS	3117	00218718	10/12/2021	10/12/2022
Chamber 19	Horn antenna (18GHz-26GHz)	Com-power	AH-826	081001	11/30/2021	11/30/2022
Chamber 19	Horn antenna (26GHz-40GHz)	Com-power	AH-640	100A	03/18/2022	03/18/2023
Chamber 19	Preamplifier (9kHz-1GHz)	HP	8447F	3113A04621	06/22/2021	06/22/2022
Chamber 19	Preamplifier (1GHz-26GHz)	EM	EM01M26G	060681	05/12/2022	05/12/2022
Chamber 19	Preamplifier (26GHz-40GHz)	MITEQ	JS4-26004000-27-5A	818471	05/12/2022	05/12/2023
Chamber 19	RF Cable (100kHz-26.5GHz)	HUBER SUHNER	Sucoflex 104A	MY1394/4A & 50886/4A	08/30/2021	08/30/2022
Chamber 19	RF Cable (18GHz-40GHz)	HUBER SUHNER	Sucoflex 102	27963/2&37421/2	11/17/2021	11/17/2022
Chamber 19	Signal Generator	Anritsu	MG3692A	20311	12/28/2021	12/28/2022
Chamber 19	Test Software	Audix	E3 Ver:6.12023	N/A	N/A	N/A

Location	Equipment Name	Brand	Model	S/N	Last Cal. Date	Next Cal. Date
EN61K-4-2	ESD Gun 12	EM TEST	Dito	P1650188689	04/26/2022	04/26/2023
EN61K-4-2	ESD Gun 07	NoiseKen	ESS-2002EX	ESS0878638	01/14/2022	01/14/2023
EN61K-4-2	ESD Gun 11	TESEQ	NSG438	1278	11/02/2021	11/02/2022
EN61K-4-3	Broadband Log-Periodic Antenna	AR	AT1080	310698	N/A	N/A
EN61K-4-3	Horn Antenna RF-01	AR	ATS700M11G	0335864	N/A	N/A
EN61K-4-3	Amplifier 80Mz~1GHz 250W	AR	250W1000C	358877	N/A	N/A
EN61K-4-3	Amplifier 0.7~6GHz 60W	AR	60S1G6	358973	N/A	N/A
EN61K-4-3	Broadband Coupler 80M~1GHz	Amplifier Research	DC6180A	0341805	N/A	N/A
EN61K-4-3	Coaxial Cable	INSULATED	NPS-4806-2360-N P3	108599.003.01.03	N/A	N/A
EN61K-4-3	Broadband Coupler 0.8G~4.26GHz	AR	DC7144A	0335226	N/A	N/A
EN61K-4-3	Broadband Coupler 4G~8GHz	AR	DC7350A	0335817	N/A	N/A
EN61K-4-3	Signal Generator 07	ROHDE&SCHWARZ	SMB100A	107780	11/23/2021	11/23/2022
EN61K-4-3	Couditioning Amplifier 3	B&K	WH 3278	3011361	03/10/2022	03/10/2023
EN61K-4-3	Microphone Type 4192-5	B&K	4192	3259723	03/04/2022	03/04/2023
EN61K-4-4	Signal Generator 10	EMC Partner	IMU3000	1547	09/01/2021	09/01/2022
EN61K-4-4	EFT Clamp	EMC-PARTNER	CN-EFT1000	CNEFT1000-103	04/20/2022	04/20/2023
EN61K-4-5	CDN-UTP8 03	EMC-PARTNER	CDN-UPT8ESD3	1546	03/29/2022	03/29/2023
EN61K-4-5	Surge Tester	EMC Partner	MIG0603IN3	523	06/10/2021	06/10/2022
EN61K-4-6	CDN M2+M3 04	TESEQ	CDN M016	43257	09/01/2021	09/01/2022
EN61K-4-6	CDN T4 03	FCC Inc.	FCC-801-T4	02068	06/24/2021	06/24/2022
EN61K-4-6	CDN T8-10_1	Teseq GmbH	CDN T8 10	41242	01/04/2022	01/04/2023
EN61K-4-6	Coaxial Cable 4-6 02-1			4-6 02-1	N/A	N/A
EN61K-4-6	Conducted Immunity Test System 03	Frankonia	CIT-10-75	126B1151	01/14/2022	01/14/2023
EN61K-4-6	EM Clamp_02	Teseq GmbH	KEMZ801	41397	12/05/2021	12/05/2022
EN61K-4-6	Couditioning Amplifier_2	B&K	WH 3278	3003171	07/28/2021	07/28/2022
EN61K-4-6	Microphone Type 4192-1	B&K	4192	2752003	10/19/2021	10/19/2022
EN61K-4-8	Magnetic Field Immunity Loop	FCC	F-1000-4-8-L-1M	01037	05/31/2021	05/31/2022
EN61K-4-8	Magnetic Field Test Generator	FCC	F-1000-4-8-G-125 A	01038	05/31/2021	05/31/2022
EN61K-4-11	Voltage Dip and UP Simulator 01	NoiseKen	VDS-2002	VDS1750439	09/17/2021	09/17/2022
EN61K-4-34	Voltage Dip and UP Simulator 50A	PRIMA	DRP61011CX	PR17096386	06/04/2021	06/04/2022
EN61K-3-2/3, EN61K-3-11-12	(Harmonic/Flicker) MX Series CTS Compliance Test System	California Instruments	MX60T04GH10400	72793	08/05/2021	08/05/2022
EN61K-3-2/3, EN61K-3-11-12	Harmonics & Flickers Test System 04	PACIFIC*APS	ECTS2-3450F-n	550072	04/20/2022	04/20/2023

PS: N/A => The equipment does not need calibration.

## 1.8 Configuration of Tested System

Fig. 1-1 Configuration

### Configuration 8

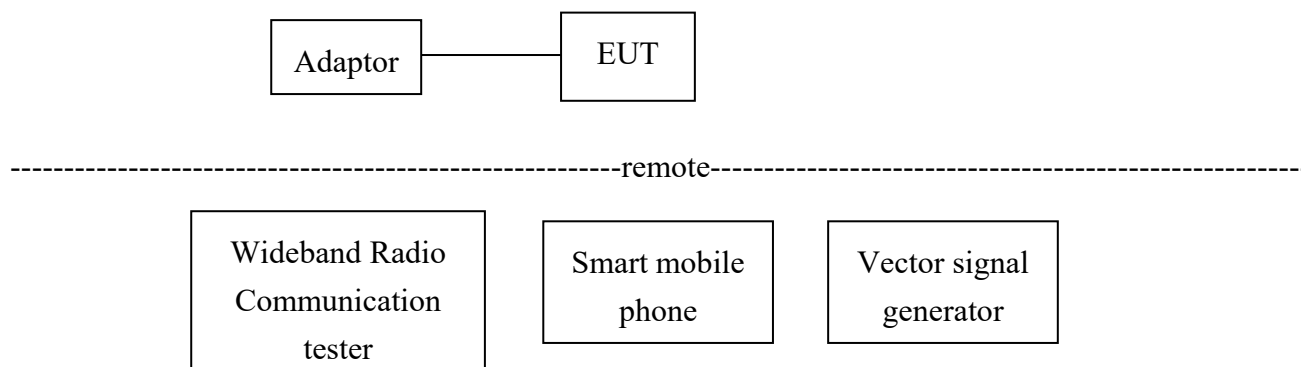


Table 1-1 Support Equipment Used in Tested System

Item	Equipment	Mrf/Brand	Model name	Series No	Data Cable	Power Cable
1	Wideband Radio Communication tester	R&S	CMW500	1201.002K50108793-JG	N/A	Non-Shielded /1.8m
2	Smart mobile phone	hTC	PL99110	N/A	N/A	N/A
3	Vector signal generator	R&S	SMBV100A	263246	N/A	Non-Shielded /1.8m

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	2m	Non-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.



## 1.9 Exclusion band

### For EN301489-1

Exclusion band for transmitters or the transmitter part of transceivers

Channelized Equipment

For channelized equipment the exclusion band shall extend 250 % of the channel width either side of the transmitter centre frequency.

NOTE: Exclusion band of 250 % is based on the definition from ITU Radio Regulations [i.8] 1.146, 1.146A and 1.146B.

Non-Channelized Equipment

For non-channelized equipment the exclusion band shall extend 250 % of the occupied bandwidth either side of the transmitter centre frequency.

NOTE: Exclusion band of 250 % is based on the definition from ITU Radio Regulations [i.8] 1.146, 1.146A and 1.146B.

Exclusion band for receivers or the receiver part of transceivers

Channelized Equipment

For channelized equipment the exclusion band shall be calculated by using the following formulae:

For the lower edge for the exclusion band:

$$EXband(lower) = BandRX(lower) - nChWRX$$

and for the upper edge of the exclusion band:

$$EXband(upper) = BandRX(upper) + nChWRX$$

Where n = number of channel widths required for exclusion band.

NOTE: For equipment that support multiple channel widths the Channel Width used is the widest supported by the EUT.

Where the present document is being used in a stand-alone basis, the value of n shall be 1.

Non-Channelized Equipment

For non-channelized equipment the exclusion band shall be calculated by using the following formula:

For the lower edge for the exclusion band:

$$EXband(lower) = BandRX(lower) - nBWRX$$

and for the upper edge of the exclusion band:

$$EXband(upper) = BandRX(upper) + nBWRX$$

Where n = multiple of whole bandwidths required to define exclusion band.

Bandwidth of Receiver is the occupied bandwidth of the corresponding transmitter signal.

Where the present document is being used in a stand-alone basis, the value of n shall be 1.

#### **For EN 301489-17**

The frequencies on which the transmitter part of the EUT is intended to operate shall be excluded from radiated emission measurements when performed in transmit mode of operation.

There shall be no frequency exclusion band applied to emission measurements of the receiver part of transceivers or the stand alone receiver under test, and/or associated ancillary equipment.

For EUT that operate above 6 GHz there is no exclusion band specified as test ranges stop at 6 GHz.

NOTE: All of the receiver exclusion band ranges detailed within clauses 4.3.2, 4.3.3 and 4.3.4 also cover the relevant blocking test ranges specified in the relevant product standards for the effective use of the radio spectrum.

The exclusion band for immunity testing of equipment operating in the 2,4 GHz band shall be:

- lower limit of exclusion band = lowest allocated band edge frequency -120 MHz, i.e. 2 280 MHz;
- upper limit of exclusion band = highest allocated band edge frequency +120 MHz, i.e. 2 603,5 MHz.

NOTE: This is based upon a channel size of 40 MHz and a value of  $n = 3$  from ETSI EN 301 489-1 [1], clause 4.3.3.

The exclusion band for immunity testing of equipment operating in the 5 GHz Wi-Fi band shall be:

- lower limit of exclusion band = lowest allocated band edge frequency -320 MHz, i.e. 4 830 MHz;
- as the immunity requirements have an upper frequency range of 6 GHz and any upper edge exclusion band would be greater than this for both the 5 470 MHz - 5 725 MHz and 5 725 MHz - 5 850 MHz bands. Therefore the test stops at the lower limit of exclusion band (i.e. 4 830 MHz).

NOTE: This is based upon a channel size of 80 MHz and a value of  $n = 4$  from ETSI EN 301 489-1 [1], clause 4.3.3.

The exclusion band for immunity testing of Broadband data transmitting systems operating in the 5,8 GHz band shall be:

- lower limit of exclusion band = lowest allocated band edge frequency -440 MHz, i.e. 5 285 MHz;
- as the immunity requirements have an upper frequency range of 6 GHz and any upper edge exclusion band would be greater than this for the 5,8 GHz band. Therefore the test stops at the lower limit of exclusion band (i.e. 5 285 MHz).

NOTE: This is based upon a channel size of 40 MHz and a value of  $n = 11$  from ETSI EN 301 489-1 [1], clause 4.3.3.

## 2. Radio Disturbance

EN 301 489-17

### 2.1 Test Configuration:

Refer to EN 301 489-1, Section 8.1.

### 2.2 Special Conditions:

No special conditions shall apply to UE in the scope of the present document.

### 2.3 Summary of Test Results

Test Items	Reference section	Result
Enclosure of ancillary equipment measured on a stand alone basis, EN 55032, Class B	EN 301 489-1 Section 8.2 EN 55032 Annex A.2	PASS
DC mains power input/output ports	EN 301 489-1 Section 8.3	N/A
AC mains power input/output ports EN 55032, Class B	EN 301 489-1 Section 8.4 EN 55032 Annex A.3	PASS
Harmonic current emission, Class A	EN 301 489-1 Section 8.5 EN 61000-3-2	PASS
Voltage fluctuations and flicker	EN 301 489-1 Section 8.6 EN 61000-3-3	PASS
Telecommunication Port	EN 301 489-1 Section 8.7 EN 55032 Annex B.2	N/A

## 2.4 Enclosure of ancillary equipment measured on a standalone basis.

### 2.4.1 Test Method:

Standard	Description
EN 55032 2015+A11:2020:	Electromagnetic compatibility of multimedia equipment – Emission requirements

### Limits: Class B

Frequency range MHz	Measurement		Class B limits dB(μV/m)
	Distance m	Detector type/ bandwidth	OATS/SAC
30 – 230	10	Quasi Peak / 120 kHz	30
230 – 1000	10		37
30 – 230	3		40
230 – 1000	3		47

Frequency range MHz	Measurement		Class B limits dB(μV/m)
	Distance m	Detector type/ bandwidth	FSOATS
1000 – 3000	3	Average / 1 MHz	50
3000 – 6000			54
1000 – 3000		Peak / 1 MHz	70
3000 – 6000			74

Highest internal frequency (F <sub>x</sub> )	Highest measured frequency
F <sub>x</sub> ≤ 108 MHz	1 GHz
108 MHz < F <sub>x</sub> ≤ 500 MHz	2 GHz
500 MHz < F <sub>x</sub> ≤ 1 GHz	5 GHz
F <sub>x</sub> > 1 GHz	5 × F <sub>x</sub> up to a maximum of 6 GHz

NOTE 1 For FM and TV broadcast receivers, F<sub>x</sub> is determined from the highest frequency generated or used excluding the local oscillator and tuned frequencies.

NOTE 2 F<sub>x</sub> is defined in 3.1.19. of EN 55032

The highest internal source of an EUT is above 1GHz.

#### **2.4.2 Test Procedure:**

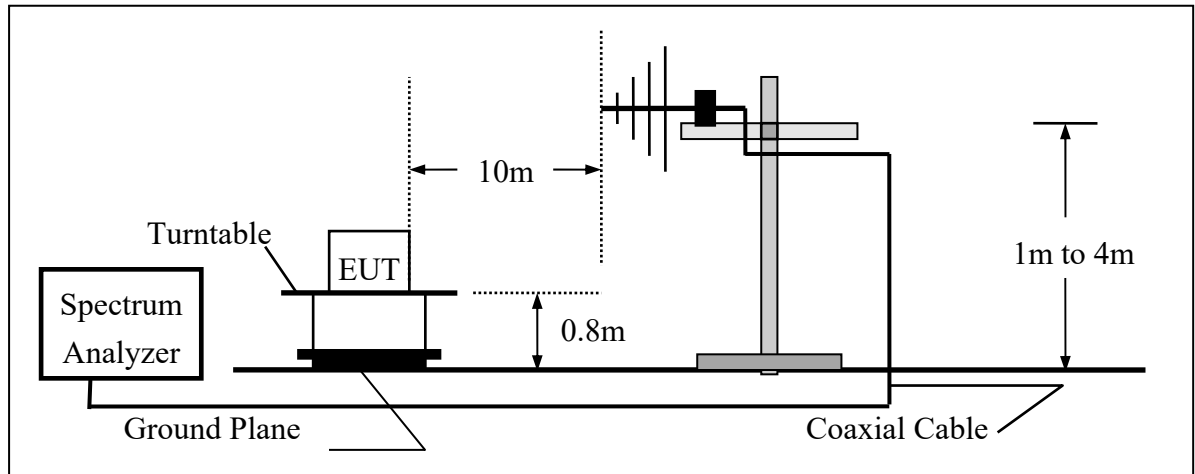
1. EUT was placed on an 0.8m wooden table.
2. Set up EUT with support units and turn on the power of all equipment.
3. Link the EUT with Telecommunication tester, setup the test mode. The transmitter operating at continuously mode and max output rated power.
4. The receive antenna is placed at 10m or 3m (3m for above 1GHz) distance from the EUT and search height from 1-4m.
5. The turntable was slowly rotated to locate the direction of maximum emission. Once maximum direction is determined, the search antenna was raised and lowered in both vertical and horizontal polarizations.

#### **2.4.3 Test Instruments:**

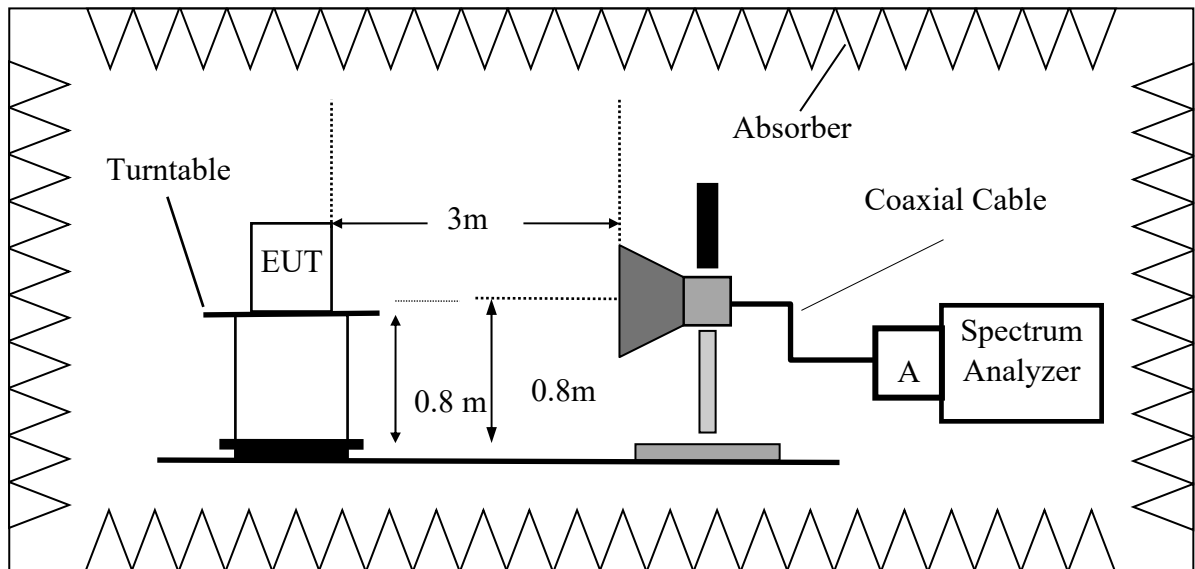
Refer to section 1.7 in this report

#### 2.4.4 Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(B) Radiated Emission Test Set-Up Frequency Over 1 GHz



## Radiated Emission Measurement Data



Address: No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist.,  
Tao Yuan City 325, Taiwan.  
Tel: 03-2638888

Radiated Emission Measurement  
Date: 2022/5/27

Operator: Ted Fan  
Temperature: 23 °C  
Humidity: 70 %



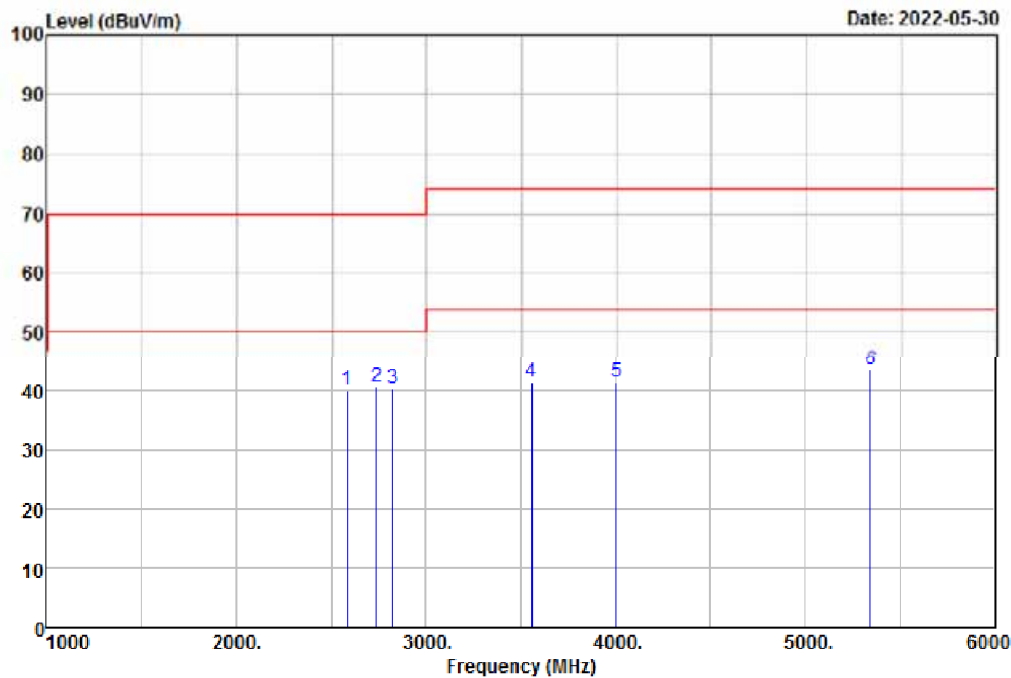
Site : Chamber 02

Polarization: Vertical

Mk.	Frequency (MHz)	RX_R (dBuV)	Correct Factor(dB/m)	Emission (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.Pos (cm)	Tab.Pos (deg.)	Detector
1	39.70	36.53	-17.44	19.09	30.00	-10.91	100	240	peak
2	57.16	34.36	-16.59	17.77	30.00	-12.23	200	0	peak
3	125.06	36.45	-17.93	18.52	30.00	-11.48	100	132	peak
4	260.86	32.69	-15.81	16.88	37.00	-20.12	100	134	peak
5	307.42	33.91	-13.74	20.17	37.00	-16.83	100	275	peak
6	470.38	29.90	-9.36	20.54	37.00	-16.46	100	360	peak
7	555.74	29.94	-7.64	22.30	37.00	-14.70	200	0	peak



International Standard Laboratory Corp.  
Company Address: No. 120, Lane 180, Hsin Ho Rd.  
Lung-Tan Dist., Tao Yuan City 325, Taiwan  
Tel: (03) 2638888 ; Fax: (03) 2638899  
Web: www.isl.com.tw



Condition: 55032 CLASS B PK 3m VERTICAL  
Site : Chamber 19

Operator : Jason Chao

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark	Pol/Phase
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1	2585.00	50.37	-10.38	39.99	70.00	-30.01	Peak	VERTICAL
2	2740.00	50.39	-9.95	40.44	70.00	-29.56	Peak	VERTICAL
3	2825.00	50.29	-10.10	40.19	70.00	-29.81	Peak	VERTICAL
4	3555.00	49.59	-8.16	41.43	74.00	-32.57	Peak	VERTICAL
5	4005.00	49.14	-7.76	41.38	74.00	-32.62	Peak	VERTICAL
6	5345.00	48.16	-4.71	43.45	74.00	-30.55	Peak	VERTICAL





Address: No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist.,  
Tao Yuan City 325, Taiwan.  
Tel: 03-2638888

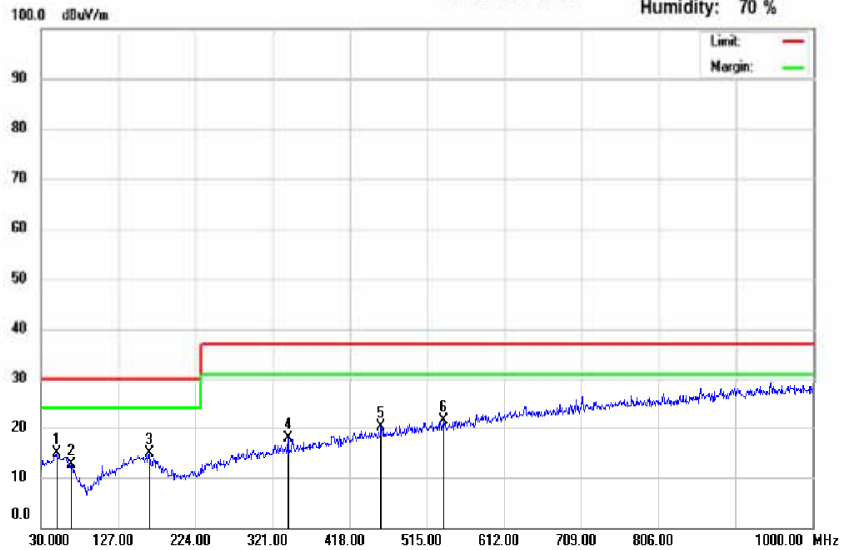
**Radiated Emission Measurement**

Date: 2022/5/27

Operator: Ted Fan

Temperature: 23 °C

Humidity: 70 %



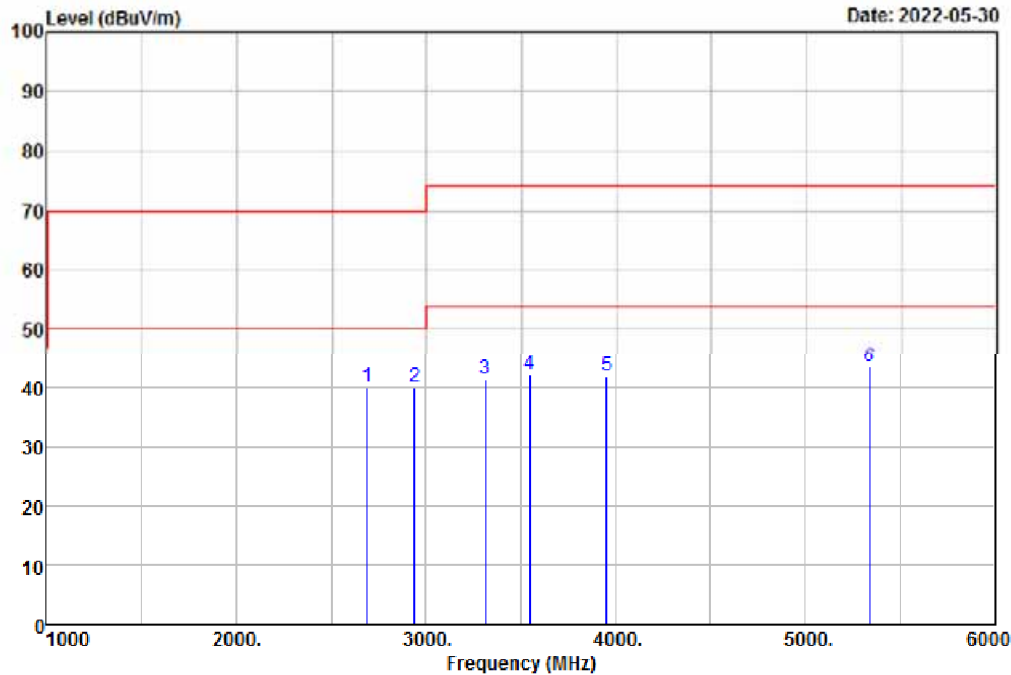
Site : Chamber 02

Polarization: *Horizontal*

Mk.	Frequency (MHz)	RX_R (dBuV)	Correct Factor (dB/m)	Emission (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant.Pos (cm)	Tab.Pos (deg.)	Detector
1	49.40	31.54	-16.65	14.89	30.00	-15.11	100	165	peak
2	67.83	30.75	-18.14	12.61	30.00	-17.39	200	87	peak
3	166.77	30.59	-15.66	14.93	30.00	-15.07	100	38	peak
4	340.40	30.71	-12.76	17.95	37.00	-19.05	200	304	peak
5	457.77	29.51	-9.50	20.01	37.00	-16.99	100	355	peak
6	536.34	29.63	-8.14	21.49	37.00	-15.51	300	358	peak



International Standard Laboratory Corp.  
Company Address: No. 120, Lane 180, Hsin Ho Rd.  
Lung-Tan Dist., Tao Yuan City 325, Taiwan  
Tel: (03) 2638888 ; Fax: (03) 2638899  
Web: www.isl.com.tw



Condition: 55032 CLASS B PK 3m HORIZONTAL  
Site : Chamber 19

Operator : Jason Chao

	Freq	Read Level	Factor	Level	Limit Line	Over Limit	Remark	Pol/Phase
	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		
1	2690.00	49.97	-9.91	40.06	70.00	-29.94	Peak	HORIZONTAL
2	2940.00	49.97	-10.04	39.93	70.00	-30.07	Peak	HORIZONTAL
3	3315.00	50.41	-9.17	41.24	74.00	-32.76	Peak	HORIZONTAL
4	3550.00	50.39	-8.14	42.25	74.00	-31.75	Peak	HORIZONTAL
5	3955.00	49.70	-7.71	41.99	74.00	-32.01	Peak	HORIZONTAL
6	5340.00	48.12	-4.70	43.42	74.00	-30.58	Peak	HORIZONTAL

## 2.5 DC power input/output ports measurement.

### 2.5.1 Test Method:

Standard	Description
EN 55032 2015+A11:2020:	Electromagnetic compatibility of multimedia equipment – Emission requirements

Refer to section 8.3.2 of EN301489-1 for detail.

### 2.5.2 Limit:

Frequency range	Limit (quasi-peak) (dBμV)	Limit (average) (dBμV)
0,15 MHz to 0,5 MHz	66 to 56	56 to 46
> 0,5 MHz to 5 MHz	56	46
> 5 MHz to 30 MHz	60	50
NOTE: The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz.		

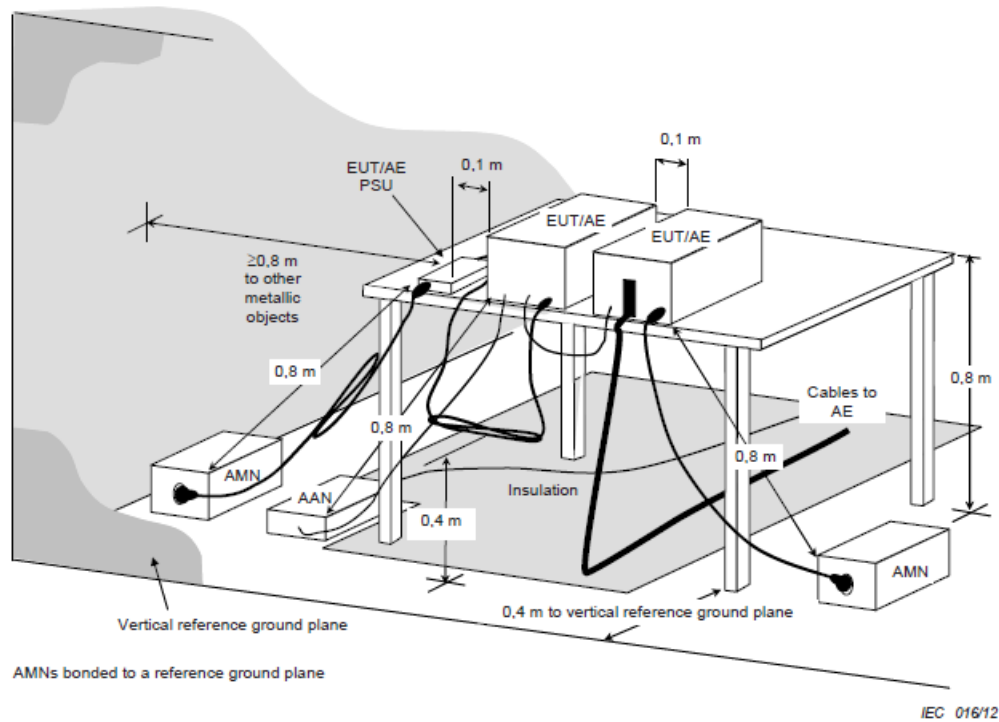
### 2.5.3 Test Procedure:

1. EUT was placed on an 0.8m wooden table above ground plane.
2. Set up EUT with support units and turn on the power of all equipment.
3. Link the EUT with Telecommunication tester, setup the test mode. The transmitter operating at continuously mode and max output rated power.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. Repeat above procedures until all frequency measured were complete.

### 2.5.4 Test Instruments:

Refer to section 1.7 in this report

### 2.5.5 Test SET-UP (Block Diagram of Configuration)



### 2.5.6 Measurement Result:

N/A,

## **2.6 AC Mains power input/output ports measurement.**

### **2.6.1 Test Method:**

Standard	Description
EN 55032 2015+A11:2020:	Electromagnetic compatibility of multimedia equipment – Emission requirements

Refer to section 8.4.2 of EN301489-1 and 55032 Annex A for detail.

### **2.6.2 Limit: Refer to 2.5.2**

### **2.6.3 Test Procedure: Refer to 2.5.3**

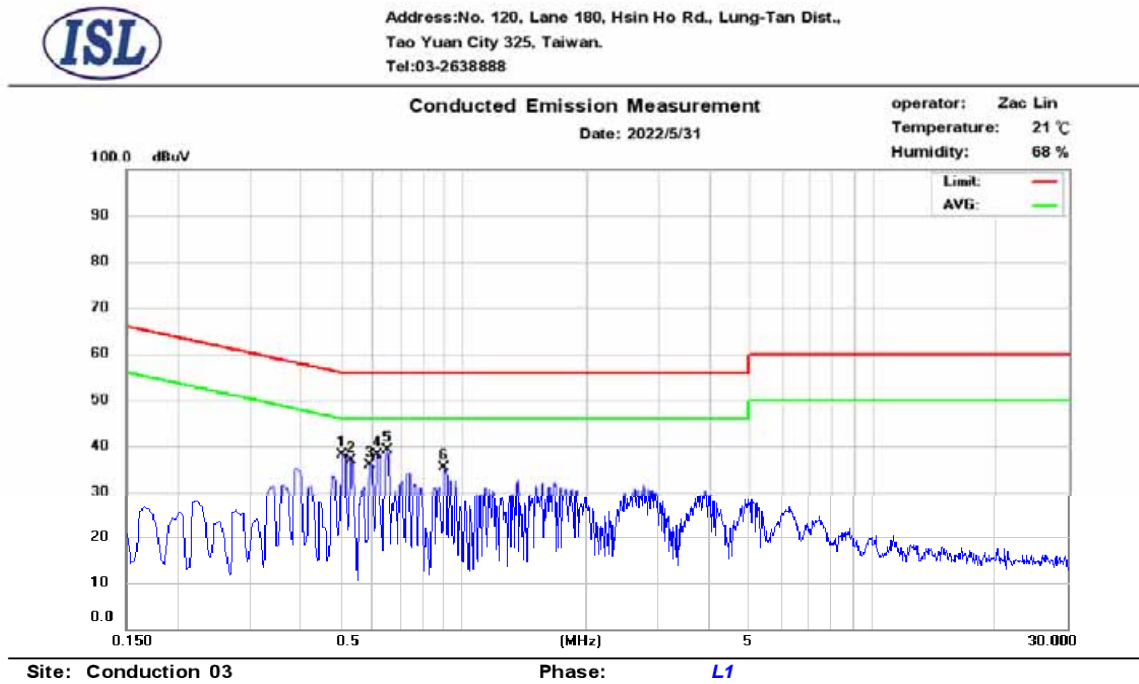
### **2.6.4 Test Instruments: Refer to 2.5.4**

### **2.6.5 Conduction Emission Test Set-up: Refer to 2.5.5**

### **2.6.6 Measurement Result:**

Refer to next page for details.

## 2.6.7 Measurement Data:



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	0.506	23.75	14.24	9.65	33.40	56.00	-22.60	23.89	46.00	-22.11
2	0.530	23.45	14.38	9.65	33.10	56.00	-22.90	24.03	46.00	-21.97
3	0.590	22.82	11.86	9.67	32.49	56.00	-23.51	21.53	46.00	-24.47
4	0.614	22.86	13.97	9.67	32.53	56.00	-23.47	23.64	46.00	-22.36
5	0.650	24.98	15.40	9.67	34.65	56.00	-21.35	25.07	46.00	-20.93
6	0.898	20.42	10.99	9.69	30.11	56.00	-25.89	20.68	46.00	-25.32

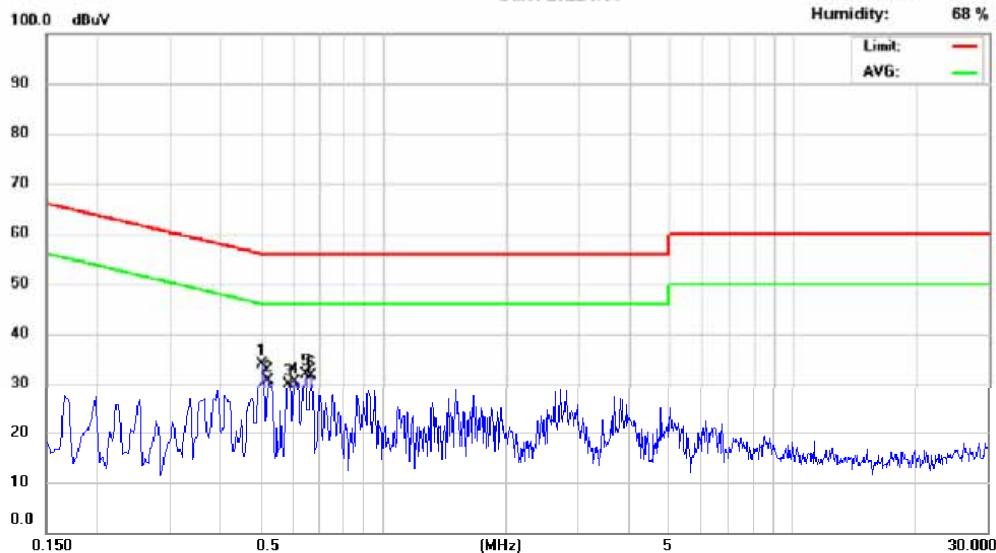


Address: No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist.,  
Tao Yuan City 325, Taiwan.  
Tel: 03-2638888

### Conducted Emission Measurement

Date: 2022/5/31

operator: Zac Lin  
Temperature: 21 °C  
Humidity: 68 %



Site: Conduction 03

Phase: N

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	0.506	16.74	9.87	9.67	26.41	56.00	-29.59	19.54	46.00	-26.46
2	0.526	17.08	10.24	9.67	26.75	56.00	-29.25	19.91	46.00	-26.09
3	0.586	14.66	6.18	9.68	24.34	56.00	-31.66	15.86	46.00	-30.14
4	0.606	16.18	9.49	9.69	25.87	56.00	-30.13	19.18	46.00	-26.82
5	0.646	17.12	9.86	9.69	26.81	56.00	-29.19	19.55	46.00	-26.45
6	0.662	17.86	11.29	9.69	27.55	56.00	-28.45	20.98	46.00	-25.02

## 2.7 Harmonic Current Emissions (AC mains input port) measurement. Refer to EN 301 489-1 Section 8.5

### 2.7.1 Test Method: Refer to 61000-3-2:2014 and IEC 61000-3-2:2014

### 2.7.2 Limit

**Table 1 – Limits for Class A equipment**

Harmonic order n	Maximum permissible harmonic current A
<b>Odd harmonics</b>	
3	2,30
5	1,14
7	0,77
9	0,40
11	0,33
13	0,21
$15 \leq n \leq 39$	$0,15 \frac{15}{n}$
<b>Even harmonics</b>	
2	1,08
4	0,43
6	0,30
$8 \leq n \leq 40$	$0,23 \frac{8}{n}$

**Note :**For Class B equipment, the harmonics of the input current shall not exceed the values given in table 1 multiplied by a factor of 1,5.



**Table 2 – Limits for Class C equipment**

Harmonic order n	Maximum permissible harmonic current expressed as a percentage of the input current at the fundamental frequency %
2	2
3	$30 \cdot \lambda^*$
5	10
7	7
9	5
$11 \leq n \leq 39$ (odd harmonics only)	3
* $\lambda$ is the circuit power factor	

**Table 3 – Limits for Class D equipment**

Harmonic order n	Maximum permissible harmonic current per watt mA/W	Maximum permissible harmonic current A
3	3,4	2,30
5	1,9	1,14
7	1,0	0,77
9	0,5	0,40
11	0,35	0,33
$13 \leq n \leq 39$ (odd harmonics only)	$\frac{3,85}{n}$	See Table 1

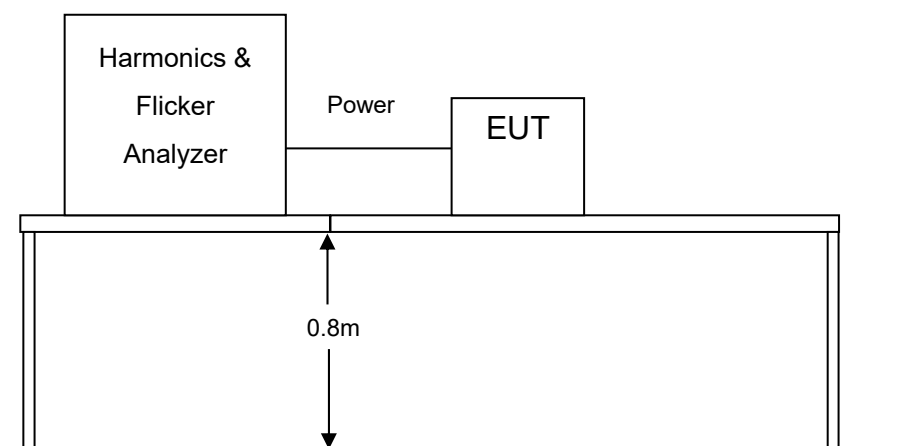
### 2.7.3 Test Procedure:

The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the maximum harmonic components under normal operating conditions for each successive harmonic component in turn.

### 2.7.4 Test Instruments:

Refer to section 1.7 in this report

### 2.7.5 Test Set-up



### 2.7.6 Measurement Result:

N/A

## **2.8 Voltage Fluctuations and Flicker (AC mains input port) measurement. Refer to EN 301 489-1 Section 8.6**

### **2.8.1 Test Method: Refer to EN 61000-3-3:2013 and IEC 61000-3-3:2013**

### **2.8.2 Limit**

TEST ITEM	LIMIT
$P_{st}$	1.0
$P_{lt}$	0.65
$D(t)(ms)$	500ms
$d_{max} (%)$	4%
dc (%)	3.3%

### **2.8.3 Test Procedure:**

The EUT was placed on the top of a wooden table 0.8 meters above the ground and operated to produce the most unfavorable sequence of voltage changes under normal operating conditions.

### **2.8.4 Test Instruments:**

Refer to section 1.7 in this report

### **2.8.5 Test Set-up**

Refer to 2.7.5

## 2.8.6 Measurement Result:

Test File: F-20220601\_3484

Test Standard: Test per IEC 61000-3-3 Ed. 3.1 : 2017

Test Class: Flicker Test, All Parameters

Test Result: PASS

Test Duration (min): 10

Source Qualification: Compliance with IEC 61000-3-3 Ed. 3.1 : 2017

Customer:

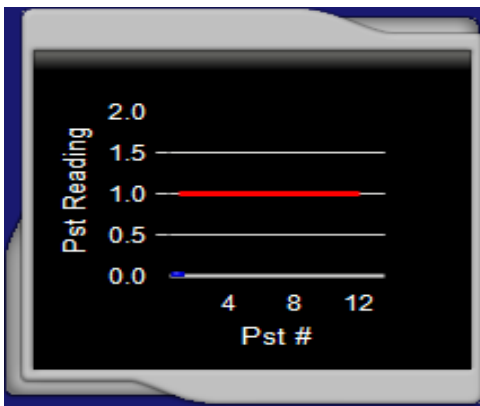
Test By:

Comments:

### Phase A

Vrms (Volts):	230.91	Frequency (Hz):	50.00
I <sub>rms</sub> (Amps):	0.004	Power (W):	0.1
V-THD (%):	0.349	T-Max (ms):	0 (500)
dmax (%):	0.000 (4.000)	Hi dmax (%):	0.000 (4.000)
dc (%):	0.000 (3.300)	Hi dc (%):	
Pst-1 :	0.039 (1.000)		
Plt :	0.017 (0.650)		

### Pst Spectrum



### Plt Spectrum



## 2.9 Telecommunication Port measurement. Refer to EN 301 489-1 Section 8.7

### 2.9.1 Test Method:

Standard	Description
EN 55032 2015+A11:2020:	Electromagnetic compatibility of multimedia equipment – Emission requirements

Refer to section 8.7.2 of EN301489-1 for detail.

### 2.9.2 Limit: Limits for conducted emissions from telecommunication ports

Frequency range	Voltage limits		Current limits	
	Quasi-peak	Average	Quasi-peak	Average
0.15 MHz to 0.5 MHz	84 dB $\mu$ V to 74 dB $\mu$ V	74 dB $\mu$ V to 64 dB $\mu$ V	40 dB $\mu$ A to 30 dB $\mu$ A	30 dB $\mu$ A to 20 dB $\mu$ A
0.5 MHz to 30 MHz	74 dB $\mu$ V	64 dB $\mu$ V	30 dB $\mu$ A	20 dB $\mu$ A
NOTE 1: The limits decrease linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.				
NOTE 2: The current and voltage disturbance limits are derived for use with an Impedance Stabilization Network (ISN) which presents a common mode (asymmetric mode) impedance of 150 $\Omega$ to the telecommunication port under test (conversion factor is $20 \log_{10} 150/I = 44\text{dB}$ )				
NOTE 3: The emission requirement only applies to telecommunication ports as specified in EN 55032 . The provisional relaxation of 10 dB will be reviewed no later than 3 years after the date of withdrawal based on the results and interference cases seen in this period. Wherever possible it is recommended to comply with the limits without the provisional relaxation.				

### 2.9.3 Test Procedure: Refer to EN 55032

### 2.9.4 Test Instruments: Refer to 2.5.4

### 2.9.5 Conduction Emission Test Set-up: Refer to 2.5.5

### 2.9.6 Measurement Result: N/A

## 3. IMMUNITY

EN 301 489-17

### 3.1 Test Configuration:

Refer to EN 301 489-1, Section 9.1.

### 3.2 Special Conditions:

No special conditions shall apply to UE in the scope of the present document.

### 3.3 Summary of Test Results:

Test Items	Reference Section	Result
Electrostatic discharge	EN 301 489-1 Section 9.3 EN 55035 Section 4.2.1	PASS
Radio frequency electromagnetic field (80 to 1000MHz and 1000MHz to 6000MHz)	EN 301 489-1 Section 9.2 EN 55035 Section 4.2.2.2	PASS
Fast transients, common mode	EN 301 489-1 Section 9.4 EN 55035 Section 4.2.4	PASS
Surges	EN 301 489-1 Section 9.8 EN 55035 Section 4.2.5	PASS
Radio Frequency, common mode	EN 301 489-1 Section 9.5 EN 55035 Section 4.2.2.3	PASS
Voltage Dips and interruptions	EN 301 489-1 Section 9.7 EN 5535 Section 4.2.6	PASS
Transients and surges in the vehicular environment	EN 301 489-1 Section 9.6	N/A
Power Frequency Magnetic Field (PFMF)	EN 55035 Section 4.2.3	PASS

### 3.4 Performance Criteria Description:

#### 3.4.1 EN 301 489-17

The performance criteria are:

- performance criteria A for immunity tests with phenomena of a continuous nature;
- performance criteria B for immunity tests with phenomena of a transient nature;
- performance criteria C for immunity tests with power interruptions exceeding a certain time.

The equipment shall meet the minimum performance criteria as specified in the following clauses.

Criteria	During test	After test (i.e. as a result of the application of the test)
A	<ul style="list-style-type: none"> <li>• Shall operate as intended. (See note).</li> <li>• Shall be no loss of function.</li> <li>• Shall be no unintentional transmissions.</li> </ul>	<ul style="list-style-type: none"> <li>• Shall operate as intended.</li> <li>• Shall be no degradation of performance.</li> <li>• Shall be no loss of function.</li> <li>• Shall be no loss of critical stored data.</li> </ul>
B	<ul style="list-style-type: none"> <li>• May be loss of function.</li> </ul>	<ul style="list-style-type: none"> <li>• Functions shall be self-recoverable.</li> <li>• Shall operate as intended after recovering.</li> <li>• Shall be no loss of critical stored data.</li> </ul>
C	<ul style="list-style-type: none"> <li>• May be loss of function.</li> </ul>	<ul style="list-style-type: none"> <li>• Functions shall be recoverable by the operator.</li> <li>• Shall operate as intended after recovering.</li> <li>• Shall be no loss of critical stored data.</li> </ul>
NOTE	<p>Operate as intended during the test allows a level of degradation:</p> <p>Minimum performance level:</p> <ul style="list-style-type: none"> <li>• For equipment that supports a PER or FER, the minimum performance level shall be a PER or FER less than or equal to 10 %.</li> <li>• For equipment that does not support a PER or a FER, the minimum performance level shall be no loss of the wireless transmission function needed for the intended use of the equipment.</li> </ul>	

### **Performance criteria for Continuous phenomena**

The performance criteria A shall apply.

Where the EUT is a transmitter in standby mode, unintentional transmission shall not occur during the test.

Where the EUT is a transceiver in receive mode, unintentional transmission shall not occur during the test.

### **Performance criteria for Transient phenomena**

The performance criteria B shall apply, except for voltage dips greater than or equal to 100 ms and voltage interruptions of 5000 ms duration, for which performance criteria C shall apply.

Where the EUT is a transmitter in standby mode, unintentional transmission shall not occur as a result of the application of the test.

Where the EUT is a transceiver in receive mode, unintentional transmission shall not occur as a result of the application of the test.



### 3.5 Electrostatic Discharge Measurement. Refer to EN 301 489-1 Section 9.3

#### 3.5.1 Test Method and Procedure:

EN 61000-4-2 and EN 301 489-1 Section 9.3.2.

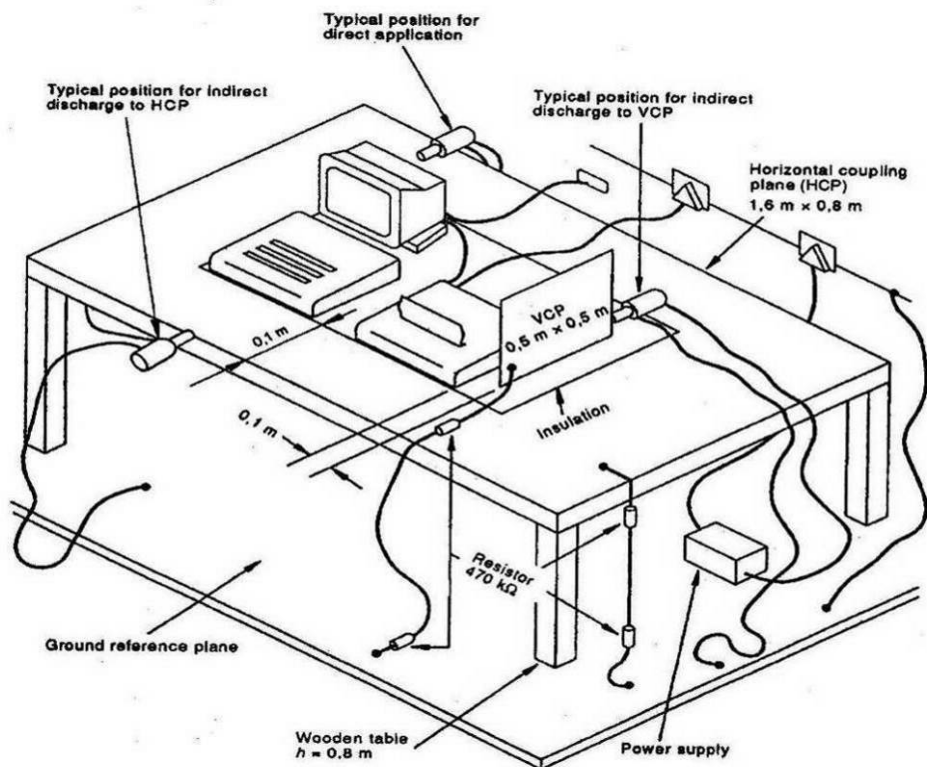
#### 3.5.2 Performance criteria:

Refer to EN 301 489-1 Section 9.3.3.

#### 3.5.3 Test Instruments:

Refer to section 1.7 in this report

#### 3.5.4 Test SET-UP (Block Diagram of Configuration)



### 3.5.5 Measurement Result:

Operation Mode:	Config 8	Test Date:	2022/5/27
Temperature:	23 °C	Humidity:	45%
		Test By:	Jason

Basic Standard	: EN61000-4-2
Discharge Impedance	: 330 ohm / 150 pF
Discharge Voltage	: Air Discharge:+/- 2 ~ 8 kV Contact Discharge:+/- 2 ~ 4 kV VCP/HCP:+/- 2 ~ 4 kV
Polarity	: Positive/Negative
Number of Discharge	: Minimum 10/50 times at each test point
Discharge Mode	: Single Discharge
Discharge Period	: 1 second minimum

Note 1: For contact discharge, the EUT shall be exposed to at least 50 discharges, 25 each at negative and positive polarity. For air discharge, A minimum of 10 single air discharges shall be applied

**Note 2:** Test point refer to test report Appendix 1

Air Discharge							
Test Levels						Results	
±2kV	Performance Criterion	±4kV	Performance Criterion	± 8kV	Performance Criterion	Pass	Fail
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Contact Discharge							
Test Levels						Results	
±2kV	Performance Criterion	±4kV	Performance Criterion	± 6kV	Performance Criterion	Pass	Fail
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	<input type="checkbox"/>	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Discharge To VCP							
Test Levels						Results	
±2kV	Performance Criterion	±4kV	Performance Criterion	± 6kV	Performance Criterion	Pass	Fail
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	<input type="checkbox"/>	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Discharge To HCP							
Test Levels						Results	
±2kV	Performance Criterion	±4kV	Performance Criterion	± 6kV	Performance Criterion	Pass	Fail
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	<input type="checkbox"/>	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C	<input checked="" type="checkbox"/>	<input type="checkbox"/>

**Remark:**

A: No degradation in the performance of the EUT was observed.

### 3.6 Radio Frequency Electromagnetic Field (80MHz to 6GHz) Measurement. Refer to EN 301 489-1 Section 9.2

#### 3.6.1 Test Method and Procedure:

EN 61000-4-3 and EN 301 489-1 Section 9.2.2.

#### 3.6.2 Performance criteria:

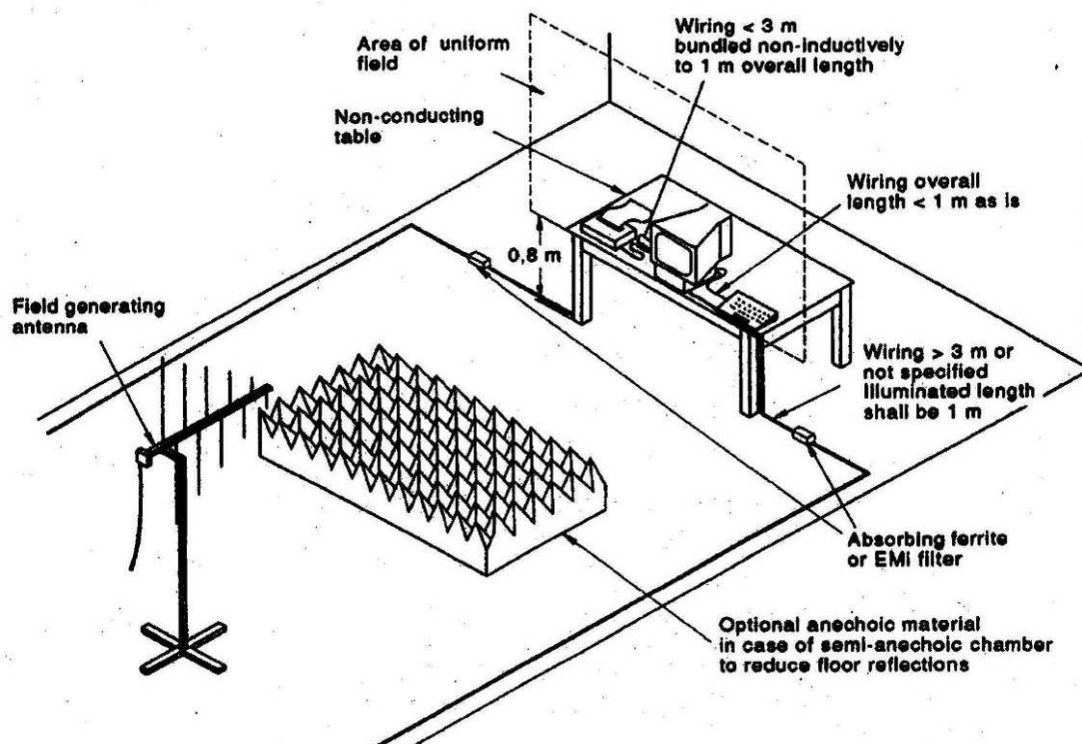
Refer to EN 301 489-1 Section 9.2.3.

#### 3.6.3 Test Instruments:

Refer to section 1.7 in this report

#### 3.6.4 Test SET-UP (Block Diagram of Configuration):

Test setup:



#### 3.6.5 Measurement Result:

Refer to below for results.

### 3.6.6 Measurement Data:

Operation Mode:	Config 8	Test Date:	2022/6/2
Temperature:	25 °C	Humidity:	62 %
		Test By:	Jason

Basic Standard : EN61000-4-3  
 Frequency range : 80MHz to 1GHz  
                           1.8GHz, 2.6GHz, 3.5GHz, 5GHz  
                           1GHz to 6GHz  
 Field strength : 3 V/m  
 Modulation : AM 80%, 1 kHz Sinewave.  
 Frequency step : 1 % of fundamental  
 Polarity of Antenna : Horizontal and Vertical  
 Test distance : 3 m (EUT to antenna reference point)

No.	Frequency (MHz)	Antenna Orientation	Observation	EUT Orientation
1	80 - 6000	Vertical/Horizontal	CT, CR and A, the EUT to be continuously received with no timeouts	0 degree
2	80 - 6000	Vertical/Horizontal		90 degree
3	80 - 6000	Vertical/Horizontal		180 degree
4	80 - 6000	Vertical/Horizontal		270 degree

#### Remark:

A : No degradation in the performance of the EUT was observed.  
 N/A : Not Applicable.

### 3.7 Fast Transients, Common Mode Measurement. Refer to EN 301 489-1 Section 9.4

#### 3.7.1 Test Method and Procedure:

EN 61000-4-4, and EN 301 489-1 Section 9.4.2.

#### 3.7.2 Performance criteria:

Refer to EN 301 489-1 Section 9.4.3.

#### 3.7.3 Test Instruments

Refer to section 1.7 in this report

#### 3.7.4 Test SET-UP (Block Diagram of Configuration):

Refer to Appendix 2 setup photo

#### 3.7.5 Measurement Result:

Operation Mode:	Config 8	Test Date:	2022/5/30
Temperature:	24 °C	Humidity:	60 %
		Test By:	Jason

Basic Standard : EN61000-4-4

Test Voltage : AC Input/Output – 1/2 kV; I/O Signal Cable – 0.5kV

Polarity : Positive/Negative

Impulse Frequency : 5 kHz

Tr/Tn : 5/50ns

Burst : 15ms/300ms

#### Mains; I/O cable

Test Point	Polarity	Test Level (kV)	Results
L	+/-	1	CT, CR and A
N	+/-	1	CT, CR and A
G	+/-	1	N/A
L-N	+/-	1	CT, CR and A
L-G	+/-	1	N/A
N-G	+/-	1	N/A
L-N-G	+/-	1	N/A
LAN	Speed=10M,100Mbps	0.5	N/A

#### Remark

A : No degradation in the performance of the EUT was observed.

N/A : Not Applicable.

### 3.8 Surges Measurement. Refer to EN 301 489-1 Section 9.8

#### 3.8.1 Test Method and Procedure:

EN 61000-4-5, and EN 301 489-1 Section 9.8.2.

#### 3.8.2 Performance criteria:

Refer to EN 301 489-1 Section 9.8.3.

#### 3.8.3 Test Instruments:

Refer to section 1.7 in this report

#### 3.8.4 Test SET-UP (Block Diagram of Configuration):

Refer to Appendix 2 setup photo

#### 3.8.5 Measurement Result:

Operation Mode:	Config 8	Test Date:	2022/6/1
Temperature:	24 °C	Humidity:	62 %
		Test By:	Jason

Basic Standard : EN61000-4-5

Test Rate : 1 pulse every minute

No. of Tests : 5 positive and 5 negative pulses

#### Observation Description

##### Mains

Test Point	Phase Angle (degree)	Polarity (+/-)	Test Level (kV)	Observation
L – N	0, 90, 180, 270	+/-	0.5, 1	CT, CR and A
L – G	0, 90, 180, 270	+/-	0.5, 1, 2	N/A
N – G	0, 90, 180, 270	+/-	0.5, 1, 2	N/A
LAN (Speed=100M / 10M / 1G bps)	0, 90, 180, 270	+/-	0.5	N/A

#### Remark

A : No degradation in the performance of the EUT was observed.

N/A : Not Applicable.

### 3.9 Radio Frequency, Common Mode Measurement. Refer to EN 301 489-1 Section 9.5

#### 3.9.1 Test Method and Procedure:

EN 61000-4-6, and EN 301 489-1 Section 9.5.2.

#### 3.9.2 Performance criteria:

Refer to EN 301 489-1 Section 9.5.3.

#### 3.9.3 Test Instruments:

Refer to section 1.7 in this report

#### 3.9.4 Test SET-UP (Block Diagram of Configuration):

Refer to Appendix 2 setup photo

#### 3.9.5 Measurement Result:

Operation Mode:	Config 8	Test Date:	2022/5/31
Temperature:	24 °C	Humidity:	61 %
		Test By:	Jason

Basic Standard : EN61000-4-6  
 Frequency range : 0.15 MHz - 80 MHz  
 Field strength : 3 V/rms  
 Modulation : AM 80%, 1 kHz Sinewave  
 Frequency step : 1 % of fundamental  
 Dwell Time : 2 seconds  
 Coupling Method : CDN M2

Port Description	Frequency (MHz)	Observation
AC input	0.15 – 80	CT, CR and A
LAN (Speed=100M / 10M / 1Gbps)	0.15 – 80	N/A

#### Remarks

A : No degradation in the performance of the EUT was observed.

N/A : Not Applicable.



### 3.10 Transients and surges in the vehicular environment measurement. Refer to EN 301 489-1 Section 9.6

#### 3.10.1 Test Method and Procedure:

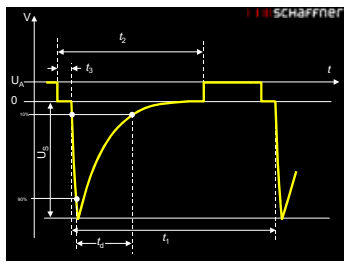
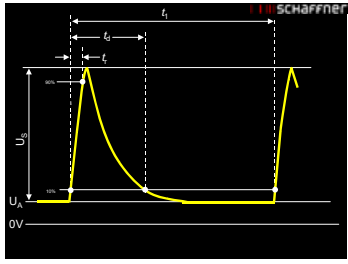
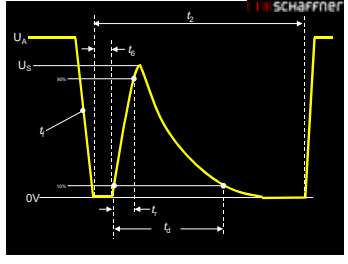
Refer to ISO 7637-2 for 12Vdc and 24Vdc equipment. , and EN 301 489-1 Section 9.6.2.

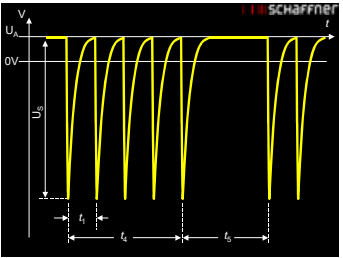
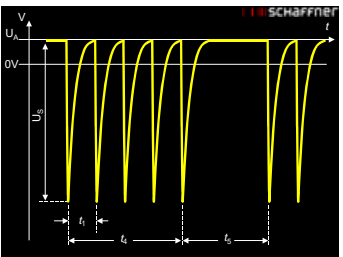
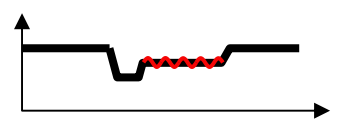
#### 3.10.2 Performance criteria:

Refer to EN 301 489-1 Section 9.6.3.

#### 3.10.3 Test Instruments:

Refer to section 1.7 in this report

Pulse	Us/Vs	Ri	Test parameters	Delay	Figure
ISO 7637-2 (2004) – Pulse 1	-450V	50.0 Ohm	td = 1.0ms, t1 = 2.5s, t2 = 200.0m	0.0 s	
ISO 7637-2 (2004) – Pulse 2A	37.5V	2.0 Ohm	td = 50.0us, t1 = 3.0s	0.0 s	
ISO 7637-2 (2004) – Pulse 2B	20.0V	0.0 Ohm	td = 1.0s	60.0 s	

ISO 7637-2 (2004) – Pulse 3A	-150V	50.0 Ohm	$t1 = 100.0\mu s$ , $t4 = 10.0ms$ , $t5 = 90.0ms$	0.0 s	
ISO 7637-2 (2004) – Pulse 3B	150V	50.0 Ohm	$t1 = 100.0\mu s$ , $t4 = 10.0ms$ , $t5 = 90.0ms$	0.0 s	
ISO 7637-2 (2004) – Pulse 4	-12V	0.0 Ohm	$Ua = -5.0V$ , $t7 = 70.0ms$ , $t8 = 30.0ms$ , $t9 = 10.0s$ , $t10 = 10.0ms$ , $t11 = 50.0ms$	60.0 s	

### 3.10.4 Test SET-UP (Block Diagram of Configuration):

Refer to Appendix 2 setup photo.

### 3.10.5 Measurement Result:

N/A.

### 3.11 Voltage Dips and Interruptions Measurement. Refer to EN 301 489-1 Section 9.7

#### 3.11.1 Test Method and Procedure:

EN 61000-4-11, and EN 301 489-1 Section 9.7.2.

#### 3.11.2 Performance criteria:

Refer to EN 301 489-1 Section 9.7.3.

#### 3.11.3 Test Instruments

Refer to section 1.7 in this report

#### 3.11.4 Test SET-UP:

Refer to Appendix 2 setup photo

#### 3.11.5 Measurement Result:

Operation Mode:	Config 8	Test Date:	2022/5/30
Temperature:	24 °C	Humidity:	60 %
		Test By:	Jason

Basic Standard : EN61000-4-11  
EUT Rated Voltage :230 Volts, 50Hz.  
Phase Angle :0, 45, 90, 135, 180, 225, 270 and 315 degree  
Total events : 3 dropouts  
Event interval :10 seconds

EN 301 489		
Events	Cycle(s)	Results
Voltage dip: 0 % residual voltage	0.5	CT, CR and A
Voltage dip: 0 % residual voltage	1	CT, CR and A
Voltage dip: 70 % residual voltage	25	CT, CR and A
Voltage interruption: 0 % residual voltage	250	TT, TR and C
EN 55035		
Events	Cycle(s)	Results
Voltage dip: 5 % residual voltage	0.5	CT, CR and A
Voltage dip: 70 % residual voltage	25	CT, CR and A
Voltage interruption: 5 % residual voltage	250	TT, TR and C

#### Remark

A : No degradation in the performance of the EUT was observed.

C :The EUT shutdown during test.

N/A : Not Applicable.

### 3.12 Power Frequency Magnetic Measurement, Refer to EN55035

#### 3.12.1 Test Method and Procedure:

EN61000-4-8: 2010, and EN 55035:2017+A11:2020.

#### 3.12.2 Performance criteria:

Refer to EN 55035: 2017+A11:2020.

#### 3.12.3 Test Instruments:

Refer to section 1.7 in this report

#### 3.12.4 Test SET-UP (Block Diagram of Configuration):

Refer to Appendix 2 setup photo

#### 3.12.5 Measurement Result:

Operation Mode:	Config 1	Test Date:	2022/5/31
Temperature:	24 °C	Humidity:	62 %
		Test By:	Jason

#### Test Level:

Power Frequency: 50Hz

Magnetic Field: 1 A/m(r.m.s)

EN 55035					
Antenna Polarization	Frequency Hz	Test Level	Magnetic Field Strength (A/m)	Test Duration	EUT Status
X	50	1	1	5 minutes	A
Y	50	1	1	5 minutes	A
Z	50	1	1	5 minutes	A

#### Remark:

A : No degradation in the performance of the EUT was observed.

N/A : Not Applicable.

## **APPENDIX 1**

### **ESD TEST POINT**

*Photo 1*



*Photo 2*



*Photo 3*

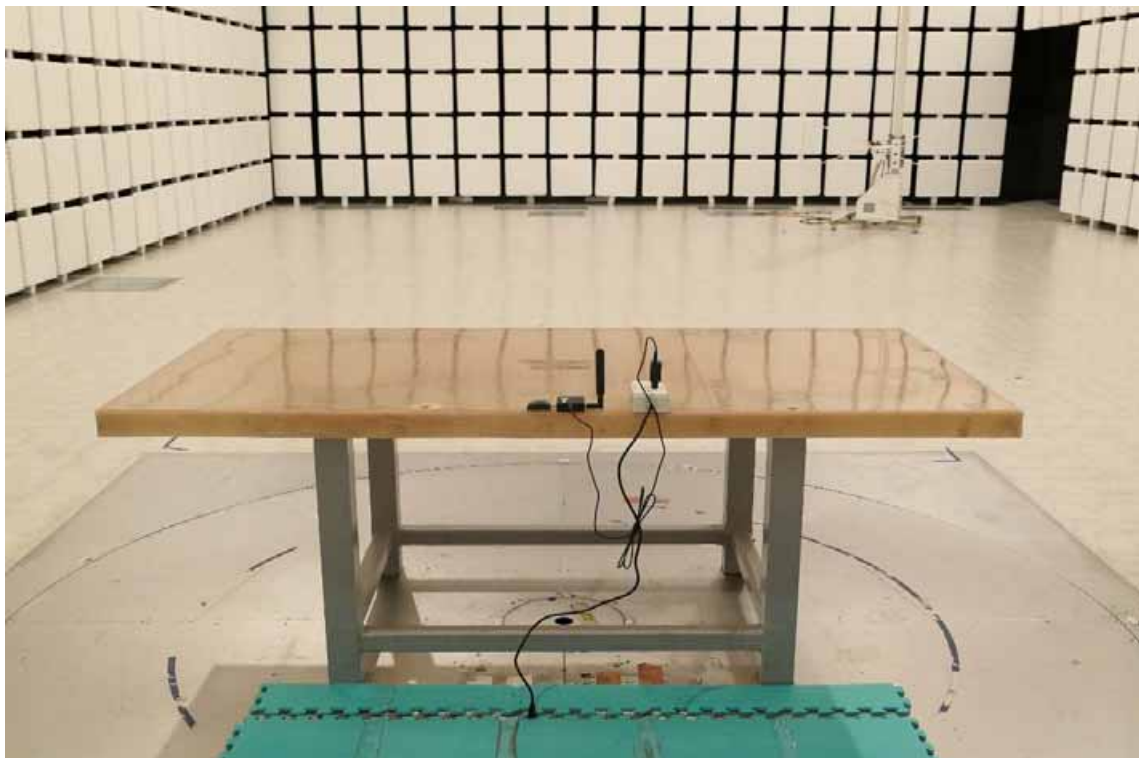


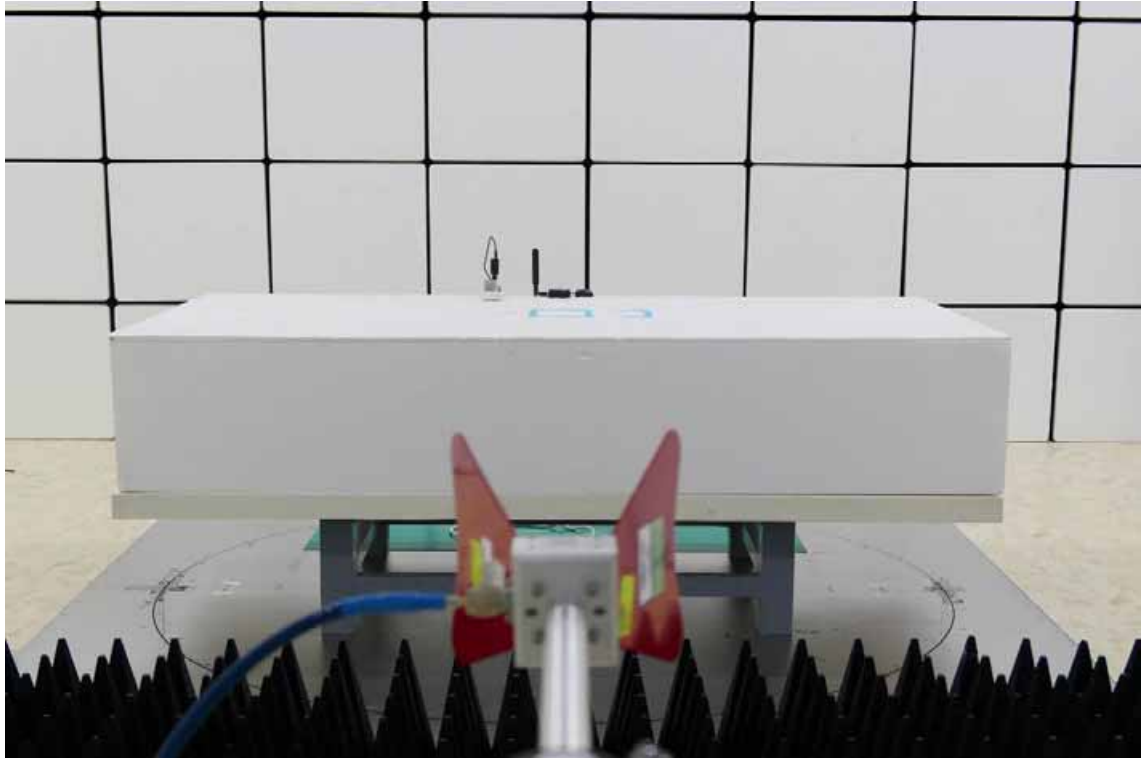
## **APPENDIX 2**

### **PHOTOGRAPHS OF TEST SETUP**

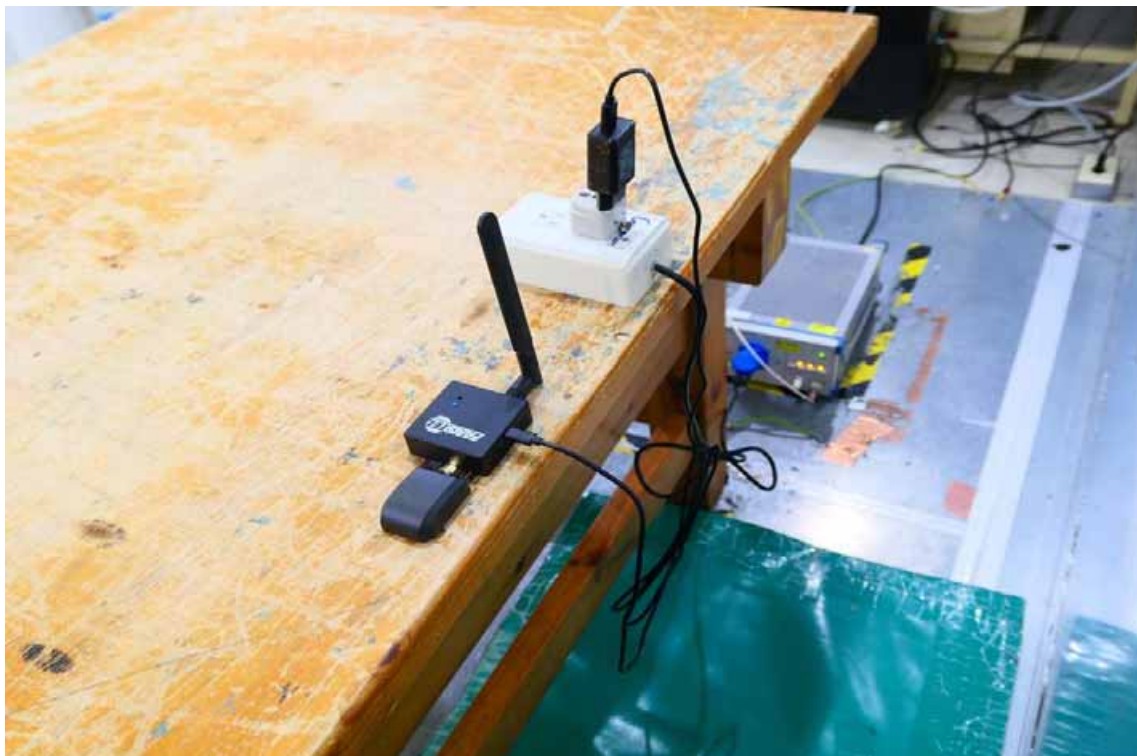


## RADIATED EMISSION TEST





## AC POWER LINE CONDUCTED EMISSION TEST





**ELECTROSTATIC DISCHARGE TEST (EN 61000-4-2) Config 8**



**RADIATED ELECTROMAGNETIC FIELD (EN 61000-4-3) Config 8**



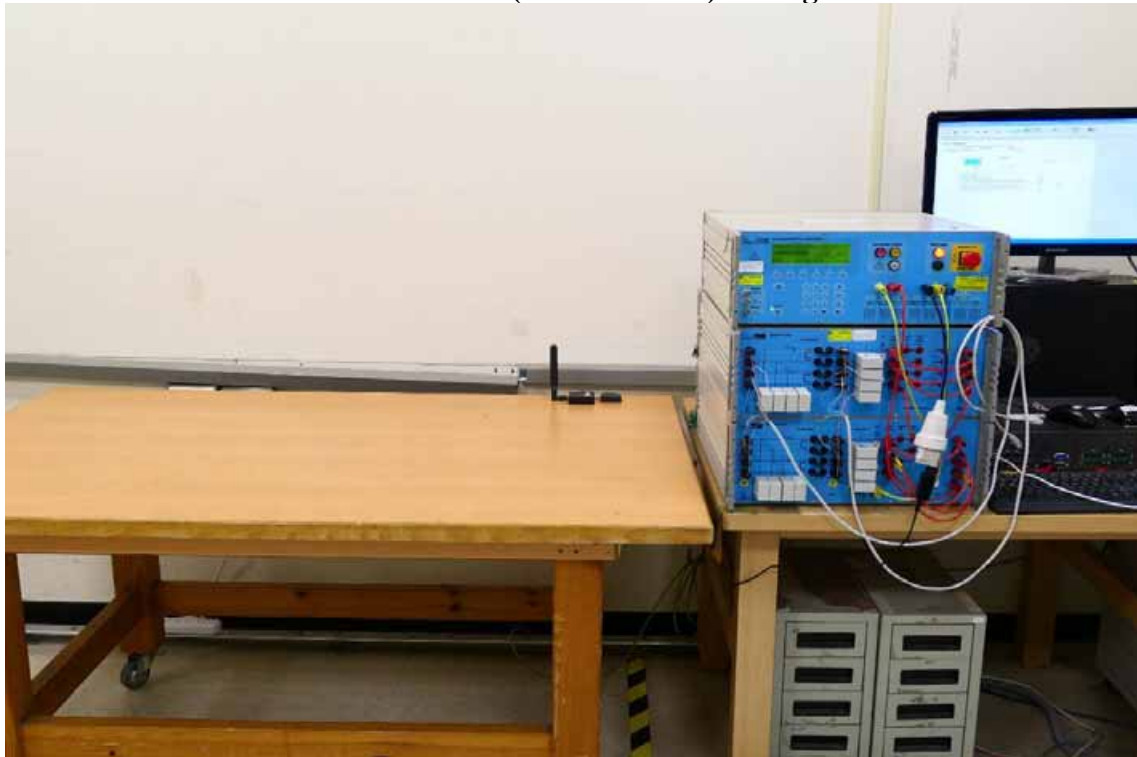
**VOLTAGE FLUCTUATION / FLICKER (EN 61000-3-2&EN 610003-3) Config 8**



**FAST TRANSIENTS/BURST TEST (EN 61000-4-4) Config 8**



**SURGE TEST (EN 61000-4-5) Config 8**



**CONDUCTED DISTURBANCE, INDUCED BY RADIO-FREQUENCY FIELDS TEST  
(EN 61000-4-6) Config 8**

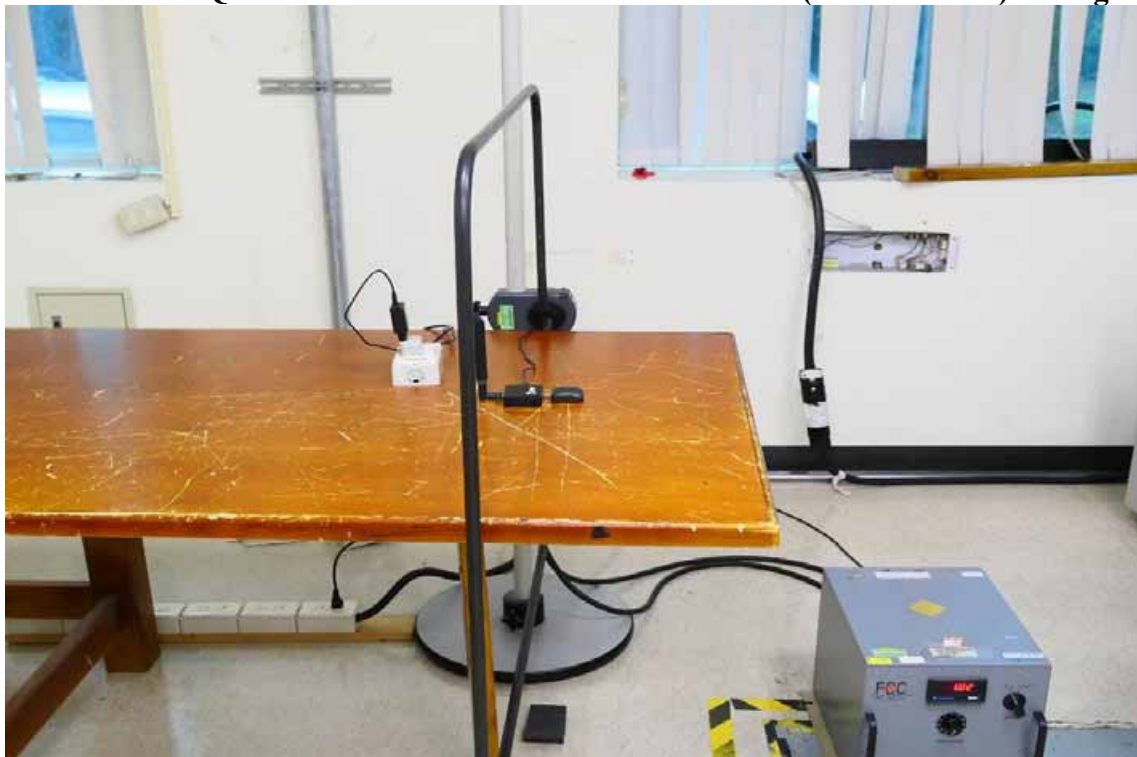




**VOLTAGE DIPS/ INTERRUPTION TEST(EN 61000-4-11) Config 8**



**POWER FREQUENCY MAGNETIC MEASUREMENT (EN 61000-4-8) Config 8**



## **APPENDIX 3**

### **PHOTOGRAPHS OF EUT**

Please refer to the file ISL-22LR0022P