Test Report

Report No.:	RMBCZY-WTW-P21050790C
Test Model:	ICR-1601G
Series Model:	Refer to section 3.1 note 3 for details
Received Date:	July 05, 2018
Test Date:	July 25 to Aug. 13, 2018; Aug. 01 to 06, 2018; May 27, 2021
Issued Date:	Apr. 08, 2022
Applicant:	Advantech Co., Ltd.
Address:	No. 1, Alley 20, Lane 26, Rueiguang Road, Neihu District, Taipei 11491, Taiwan
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory
Lab Address:	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan
Test Location (1):	E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan
Test Location (2):	No. 49, Ln. 206, Wende Rd., Shangshan Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan

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Release Control Record

Issue No.	Description	Date Issued
RMBCZY-WTW-P21050790C	Original release.	Apr. 08, 2022

1 Certificate of Conformity

Product:	Industrial Cellular Gateway
Brand:	Advantech
Test Model:	ICR-1601G
Series Model:	Refer to section 3.1 note 3 for details
Sample Status:	Engineering sample
Applicant:	Advantech Co., Ltd.
Test Date:	July 25 to Aug. 13, 2018; Aug. 01 to 06, 2018; May 27, 2021
Standards:	EN 301 489-1 V2.2.3 (2019-11) EN 301 489-17 V3.1.1 (2017-02) EN 301 489-19 V2.1.1 (2019-04) Draft EN 301 489-52 V1.1.2 (2020-12) EN 55032:2015 +A11:2020, Class B EN 61000-3-2:2014, Class A EN 61000-3-3:2013 EN 55024:2010+A1:2015 EN 55035:2017+A11:2020 EN 61000-4-2:2009 / IEC 61000-4-2:2008 ED. 2.0 EN 61000-4-3:2006 +A1:2008 +A2:2010 / IEC 61000-4-3:2010 ED. 3.2 EN 61000-4-4:2012 / IEC 61000-4-4:2012 ED. 3.0 EN 61000-4-5:2014 +A1:2017 / IEC 61000-4-5:2017 ED. 3.1 EN 61000-4-6:2014 / IEC 61000-4-6:2013 ED. 4.0 EN 61000-4-8:2010 / IEC 61000-4-8:2009 ED. 2.0 EN 61000-4-11:2004 +A1: 2017 / IEC 61000-4-11:2017 ED. 2.1 By the applicant's requirement, the RS test with standard EN 61000-4-3 of EN 301 489-19/-52 test is not performed.

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Phoenix Huang , **Date:** Apr. 08, 2022

Phoenix Huang / Specialist

Approved by : Ken Lu , **Date:** Apr. 08, 2022

Ken Lu / Manager

2 Summary of Test Results

EN 301 489-series, Emission					
Clause	Basic Standard	Phenomenon	Application	Result/Remarks	Verdict
8.2	EN 55032:2015 +AC:2016	Radiated emission 30-1000 MHz	Enclosure of ancillary equipment measured on a stand alone basis	Minimum passing Class B margin is -2.71 dB at 77.19MHz	Pass
		Radiated emission 1-6 GHz		Minimum passing Class B margin is -21.95 dB at 2604.12MHz	Pass
8.3	EN 55032:2015 +AC:2016	Conducted emission 150 kHz - 30 MHz	DC power input/output ports (fixed)	Not applicable, because the port is absent in the EUT	N/A
		Conducted emission 150 kHz - 30 MHz	DC power input ports (vehicular)	Not applicable, because the port is absent in the EUT	N/A
8.4	EN 55032:2015 +AC:2016	Conducted emission 150 kHz - 30 MHz	AC mains input/output ports	Minimum passing Class B margin is -4.98 dB at 0.29453MHz	Pass
8.5	EN 61000-3-2:2014	Harmonic current emissions	AC mains input port	The power consumption of EUT is less than 75W and no limits apply.	Pass
8.6	EN 61000-3-3:2013	Voltage fluctuations and flicker	AC mains input port	Meets the requirements. $P_{st} \leqq 1.0$ $d_{max} \leqq 4\%$ $P_{lt} \leqq 0.65$ $d_c \leqq 3.3\%$ $T_{max} \leqq 500ms$	Pass
8.7	EN 55032:2015 +AC:2016	Conducted disturbance 150 kHz - 30 MHz	Wired network ports	Minimum passing Class B margin is -5.29 dB at 18.24219MHz	Pass

EN 301 489-series, Immunity					
Clause	Basic Standard	Phenomenon	Application	Result/Remarks	Verdict
9.2	EN 61000-4-3:2006 +A1:2008 +A2:2010	RF Electromagnetic Field (80 MHz to 6000 MHz (RS)	Enclosure	Performance Criterion CT/CR for EN 301489-17 Refer below Note 2 For EN 301489-19/-52	Pass
9.3	EN 61000-4-2:2009	Electrostatic Discharges (ESD)	Enclosure	Performance Criterion TT/TR	Pass
9.4	EN 61000-4-4:2012	Fast Transients Common Mode (EFT)	Signal, telecommunication and control ports, DC and AC power ports	Performance Criterion TT/TR	Pass
9.5	EN 61000-4-6:2014	RF Common Mode 150 kHz to 80 MHz (CS)	Signal, telecommunication and control ports, DC and AC power ports	Performance Criterion CT/CR	Pass
9.6	ISO 7637-2:2011	Transients and Surges	DC power input ports (Vehicular)	Refer below Note 1	N/A
9.7	EN 61000-4-11:2004	Voltage Dips and Interruptions	AC mains power input ports	Voltage Dips: 0% residual – 0.5 cycle Performance Criterion TT/TR 0% residual – 1 cycle Performance Criterion TT/TR 70% residual – 25 cycles Performance Criterion TT/TR Voltage Interruptions: 0% residual – 250 cycles Performance Criterion TT/TR	Pass
9.8	EN 61000-4-5:2014	Surges	AC mains power input ports, line to line and line to ground Telecommunication ports, line to ground	Performance Criterion TT/TR	Pass

N/A: Not Applicable

Note:

1. The EUT is not appointed by clause 9.6 of EN 301 489-1, therefore the standard, ISO 7637-2, is not applicable.
2. By the applicant's requirement, the RS test with standard EN 61000-4-3 of EN 301 489-19/-52 test is not performed.

EN 55024, Immunity				
EN 55024 Clause	Basic standard	Test Item	Result/Remarks	Verdict
4.2.1	EN 61000-4-2:2009 / IEC 61000-4-2:2008 ED. 2.0	Electrostatic discharges (ESD)	Performance Criterion A	Pass
4.2.3.2	EN 61000-4-3:2006 +A1:2008 +A2:2010 / IEC 61000-4-3:2010 ED. 3.2	Continuous radiated disturbances (RS)	Performance Criterion A	Pass
4.2.2	EN 61000-4-4:2004 EN 61000-4-4:2012* / IEC 61000-4-4:2012 ED. 3.0*	Electrical fast transients (EFT)	Performance Criterion A	Pass
4.2.5	EN 61000-4-5:2006 EN61000-4-5:2014+A1: 2017* / IEC 61000-4-5:2017 ED. 3.1*	Surges	Performance Criterion A	Pass
4.2.3.3	EN 61000-4-6:2009 EN 61000-4-6:2014* / IEC 61000-4-6:2013 ED. 4.0*	Continuous conducted disturbances (CS)	Performance Criterion A	Pass
4.2.4	EN 61000-4-8:2010 / IEC 61000-4-8:2009 ED. 2.0	Power-frequency magnetic fields (PFMF)	Performance Criterion A	Pass
4.2.6	EN 61000-4-11:2004+A1:2017 / IEC 61000-4-11:2017 ED. 2.1	Voltage dips and interruptions	Voltage Dips: >95% reduction – 0.5 period, Performance Criterion A 30% reduction – 25 periods, Performance Criterion A Voltage Interruptions: >95% reduction – 250 periods, Performance Criterion B	Pass

* Both of specific and the latest version of the standard are referenced to fulfill the requirements.

EN 55035, Immunity			
Basic standard	Test Item	Result/Remarks	Verdict
EN 61000-4-2:2009 / IEC 61000-4-2:2008 ED2.0	Electrostatic discharges (ESD)	Performance Criteria A	Pass
EN 61000-4-3:2006+A1:2008+A2:2010 / IEC 61000-4-3:2010 ED3.2	Continuous RF electromagnetic field disturbances (RS)	Performance Criteria A	Pass
EN 61000-4-4:2012 / IEC 61000-4-4:2012 ED3.0*	Electrical fast transients / burs (EFT)	Performance Criteria A	Pass
EN 61000-4-5:2014+A1:2017* / IEC 61000-4-5:2017 ED3.1*	Surges	Performance Criteria A	Pass
EN 61000-4-6:2014+AC:2015* / IEC 61000-4-6:2013 ED4.0*	Continuous induced RF disturbances (CS)	Performance Criteria A	Pass
EN 61000-4-8:2010 / IEC 61000-4-8:2009 ED2.0	Magnetic field disturbance at power frequency (PFMF)	Performance Criteria A	Pass
EN 61000-4-11:2004+A1:2017 / IEC 61000-4-11:2017 ED2.1	Voltage dips and interruptions(at 50Hz)	Voltage Dips: <5% residual – 0.5 cycle, Performance Criteria A 70% residual – 25 cycles, Performance Criteria A Voltage Interruptions: <5% residual – 250 cycles, Performance Criteria B	Pass
EN 61000-4-6:2014+AC:2015* / IEC 61000-4-6:2013 ED4.0*	Broadband impulse noise disturbances, repetitive (Applicable only to xDSL ports.)	Refer below Note	N/A
	Broadband impulse noise disturbances, Isolated (Applicable only to xDSL ports.)	Refer below Note	N/A

N/A: Not Applicable

* Both of specific and the latest version of the basic standard are referenced to fulfill the requirements.

Note:

1. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
2. The above EN/IEC basic standards are applied with latest version if customer has no special requirement.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

The listed uncertainties are the worst case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.

Measurement	Expanded Uncertainty (k=2) (±)	Maximum allowable uncertainty (±)
Conducted disturbance at mains port using AMN, 150kHz ~ 30MHz	1.84 dB	3.4 dB (U_{cispr})
Conducted disturbance at wired network port using AAN, 150kHz ~ 30MHz	2.70 dB	5.0 dB (U_{cispr})
Radiated disturbance, 30MHz ~ 1GHz	3.95 dB	6.3 dB (U_{cispr})
Radiated disturbance, 1GHz ~ 6GHz	4.84 dB	5.2 dB (U_{cispr})

The other instruments specified are routine verified to remain within the calibrated levels, no measurement uncertainty is required to be calculated.

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Industrial Cellular Gateway		
Brand	Advantech		
Test Model	ICR-1601G		
Series Model	Refer to note 3 for details		
Sample Status	Engineering sample		
Operating Software	NA		
Power Supply Rating	5Vdc from power adapter		
Modulation Type	**WLAN:** CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM **WWAN:** GMSK, 8PSK, QPSK, 16QAM		
Operating Frequency	**WLAN:**		
	2.412 ~ 2.472GHz		
	WWAN:		
	Operating Band	Uplink (MHz)	Downlink (MHz)
	GSM 900	880~915	
	DCS 1800	1710~1785	
	WCDMA Band 1	1920~1980	2110~2170
	WCDMA Band 8	880~915	925~960
	LTE Band 1	1920~1980	2110~2170
	LTE Band 3	1710~1785	1805~1880
	LTE Band 7	2500~2570	2620~2690
	LTE Band 8	880~915	925~960
	LTE Band 20	832~862	791~821
Antenna Type	Refer to Note		
Antenna Connector	Refer to Note		
Accessory Device	Adapter x 1		
Data Cable Supplied	NA		

Note:

1. This report is issued as a duplicate report to BV CPS report no.: RM180705E02 and RMBCZY-WTW-P21050790. The differences compared with original report are change applicant, address, model names, brand name and product information. Therefore, there is no addition test has to be performed. All test data are copied from the original test report.
2. The test data are copied which have obtained authorization from applicant and brand company both of the original test report (Report No.: RM180705E02, RMBCZY-WTW-P21050790).

3. The EUT has below model names, which are identical to each other in all aspects except for the following:

Brand	Product name	Model	Different
Advantech	Industrial Cellular Gateway	ICR-1601G, ICR-1601GXXXXXXXXXXXXXXX, ICR1601GXXXXXXXXXXXXXXX	For marketing purpose, where“X”may be any alphanumeric character, blank or“-”
		ICR-1601W, ICR-1601WXXXXXXXXXXXXXXX, ICR1601WXXXXXXXXXXXXXXX	
		EKI-1642I-A, EKI-1642IXXXXXXXXXXXXXXX, EKI1642IXXXXXXXXXXXXXXX	
		EKI-1642WI-A, EKI-1642WIXXXXXXXXXXXXXXX, EKI1642WIXXXXXXXXXXXXXXX	
Note: From the above models, model: **ICR-1601G** was selected as representative model for the test and its data was recorded in this report.			

4. There are WLAN and WWAN technology used for the EUT. The EUT has two radios as following table:

Radio 1	Radio 2
WLAN (2.4GHz)	WWAN (LTE+WCDMA+GSM)

5. The EUT have two SKUs as following table:

SKU 1	SKU 2
with WiFi function, but w/o GPS function	with GPS function, but w/o WiFi function

6. Simultaneously transmission condition.

Condition	Technology	
1	WLAN (2.4GHz)	WWAN (LTE+WCDMA+GSM)

7. The EUT must be supplied with a power adapter as following table:

Brand	Model No.	Spec.
AMIGO	AMS135-0502000FV	Input: 100-240V, 0.5A, 50/60Hz Output: 5V, 2A DC output cable: 1.2m, unshielded

8. The antenna information is listed as below.

WLAN Antenna Spec.					
Antenna No.	Chain No.	Antenna Net Gain (dBi)	Frequency range (GHz)	Antenna type	Connector type
1	0	4.04	2.4~2.4835	Dipole	R-SMA
2	0	2.38	2.4~2.4835	Dipole	R-SMA

WWAN Antenna Spec.				
WWAN				
Antenna No.	Antenna Type	Band	Freq. Range (MHz)	Gain (dBi)
1	Dipole	GSM 900	880~915	0.87
		DCS 1800	1710~1785	3.05
		WCDMA I (B1)	1920~1980	2.2
		WCDMA VIII (B8)	880~915	0.87
		LTE Band (1)	1920~1980	2.2
		LTE Band (3)	1710~1785	3.05
		LTE Band (7)	2500~2570	2
		LTE Band (8)	880~915	0.87
		LTE Band (20)	832~862	1.57
2	Dipole	GSM 900	880~915	0.75
		DCS 1800	1710~1785	2.58
		WCDMA I (B1)	1920~1980	1.97
		WCDMA VIII (B8)	880~915	0.75
		LTE Band (1)	1920~1980	1.97
		LTE Band (3)	1710~1785	2.58
		LTE Band (7)	2500~2570	2.03
		LTE Band (8)	880~915	0.75
		LTE Band (20)	832~862	1.16

9. The EUT incorporates a SISO function.

MODULATION MODE	DATA RATE (MCS)	TX & RX CONFIGURATION	
802.11b	1 ~ 11Mbps	1TX Fixed Chan 0	1RX Fixed Chain 0
802.11g	6 ~ 54Mbps	1TX Fixed Chan 0	1RX Fixed Chain 0
802.11n (HT20)	MCS 0~7	1TX Fixed Chan 0	1RX Fixed Chain 0
802.11n (HT40)	MCS 0~7	1TX Fixed Chan 0	1RX Fixed Chain 0

10. The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

11. The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

3.2 Features of EUT

The tests reported herein were performed according to the method specified by Advantech Co., Ltd., for detailed feature description, please refer to the manufacturer's specifications or user's manual.

3.3 Operating Modes of EUT and Determination of Worst Case Operating Mode

There are both standby mode and normal mode to be pre-tested then normal mode has the highest emission value for conducted emission and radiated emission test.

For conducted emission and radiated emission test, the EUT has been pre-tested under following test modes, and test mode A, C were the worst case for final test.

Test Condition							
Conducted emission test							
Mode	Power In	SKU	WAN/LAN1 Speed	LAN2 Speed	2G/3G/4G	WiFi function	GPS function
A	**AC 230V / 50Hz**	**1**	**100Mbps**	**100Mbps**	**NA**	**with WiFi function**	**w/o GPS function**
B	AC 110V / 60Hz	1	100Mbps	100Mbps	NA	with WiFi function	w/o GPS function
Radiated emission test							
Mode	Power In	SKU	WAN/LAN1 Speed	LAN2 Speed	2G/3G/4G	WiFi function	GPS function
C	**AC 230V / 50Hz**	**1**	**100Mbps**	**100Mbps**	**NA**	**with WiFi function**	**w/o GPS function**
D	AC 110V / 60Hz	1	100Mbps	100Mbps	NA	with WiFi function	w/o GPS function
E	AC 230V / 50Hz	1	NA	100Mbps	4G	with WiFi function	w/o GPS function
F	AC 230V / 50Hz	1	NA	100Mbps	3G	with WiFi function	w/o GPS function
G	AC 230V / 50Hz	1	NA	100Mbps	2G	with WiFi function	w/o GPS function

Note: The test configurations are defined by the applicant requirement.

Test modes are presented in the report as below.

Test Condition							
Conducted emission / Radiated emission tests							
Mode	Power In	SKU	WAN/LAN1 Speed	LAN2 Speed	2G/3G/4G	WiFi function	GPS function
1	AC 230V / 50Hz	1	100Mbps	100Mbps	NA	with WiFi function	w/o GPS function
2	AC 230V / 50Hz	2	100Mbps	100Mbps	NA	w/o WiFi function	with GPS function
Asymmetric mode conducted emissions test							
Mode	Power In	SKU	WAN/LAN1 Speed	LAN2 Speed	2G/3G/4G	WiFi function	GPS function
1	AC 230V / 50Hz	1	100Mbps (be tested)	100Mbps	NA	with WiFi function	w/o GPS function
2	AC 230V / 50Hz	1	100Mbps	100Mbps (be tested)	NA	with WiFi function	w/o GPS function
3	AC 230V / 50Hz	2	100Mbps (be tested)	100Mbps	NA	w/o WiFi function	with GPS function
4	AC 230V / 50Hz	2	100Mbps	100Mbps (be tested)	NA	w/o WiFi function	with GPS function

Test Condition							
Harmonics / Flicker test							
Mode	Power In	SKU	WAN/LAN1 Speed	LAN2 Speed	2G/3G/4G	WiFi function	GPS function
1	AC 230V / 50Hz	1	100Mbps	100Mbps	NA	with WiFi function	w/o GPS function
For EN 301 489-17 & EN 55024 Immunity test							
Mode	Power In	SKU	WAN/LAN1 Speed	LAN2 Speed	2G/3G/4G	WiFi function	GPS function
1	AC 230V / 50Hz	1	100Mbps	100Mbps	NA	with WiFi function	w/o GPS function
For EN 301 489-19 & Draft EN 301 489-52 Immunity test (except for RS)							
Mode	Power In	SKU	WAN/LAN1 Speed	LAN2 Speed	2G/3G/4G	WiFi function	GPS function
1	AC 230V / 50Hz	2	NA	100Mbps	4G	w/o WiFi function	with GPS function

Test Condition							
EN 55035 Immunity tests							
Mode	Power In	SKU	WAN/LAN1 Speed	LAN2 Speed	2G/3G/4G	WiFi function	GPS function
1	AC 230V / 50Hz	1	100Mbps	100Mbps	NA	with WiFi function	w/o GPS function

Note: The test configurations are defined by the applicant requirement.

3.4 Test Program Used and Operation Descriptions

For Conducted emission / Asymmetric mode conducted emissions / Radiated emission tests:
SKU1
1. Turn on the power of all equipment.
2. Support units A & B (Laptop) run “TfGen.exe” program to communicate with EUT.
3. Support unit C (Laptop) runs “Ping.exe” program to communicate with EUT via wireless.

For Conducted emission / Asymmetric mode conducted emissions / Radiated emission tests:
SKU2
1. Turn on the power of all equipment.
2. Support units A & B (Laptop) run “TfGen.exe” program to communicate with EUT.
3. Support unit C (Laptop) runs “Ping.exe” program to communicate with EUT via wireless.
4. The EUT links support unit E (GPS Antenna) via support unit D (GPS Antenna).

For Harmonics / Flicker Tests:
SKU1
1. Turn on the power of all equipment.
2. Support units A & B (Laptop) run “Ping.exe” program to communicate with EUT.
3. Support unit C (Laptop) runs “Ping.exe” program to communicate with EUT via wireless.

For Immunity Test: (For EN 301 489-17 & EN 55024 & EN 301 489-19 & Draft EN 301 489-52)
SKU1
4. Turn on the power of all equipment.
5. Support units A & B (Laptop) run “Ping.exe” program to communicate with EUT.
6. Support unit C (Laptop) runs “Ping.exe” program to communicate with EUT via wireless.

SKU2
1. Turn on the power of all equipment.
2. Support unit B (Laptop) runs “Ping.exe” program to communicate with EUT.
3. Support unit C (Laptop) runs “Ping.exe” program to communicate with EUT via wireless.
4. The EUT links support unit E (GPS Antenna) via support unit D (GPS Antenna).
5. The EUT links support unit E (LTE W.C.T.S) via 4G.

For Immunity Test: (For EN 55035)

SKU1
1. Turn on the power of all equipment.
2. Support unit A (Laptop) runs “Ping.exe” program to communicate with EUT
3. Support unit B (Laptop) runs “Ping.exe” program to communicate with EUT.
4. Support unit C (Laptop) runs “Ping.exe” program to communicate with EUT via WiFi 2.4G
5. The EUT links support unit D (R.C.A) via 4G.

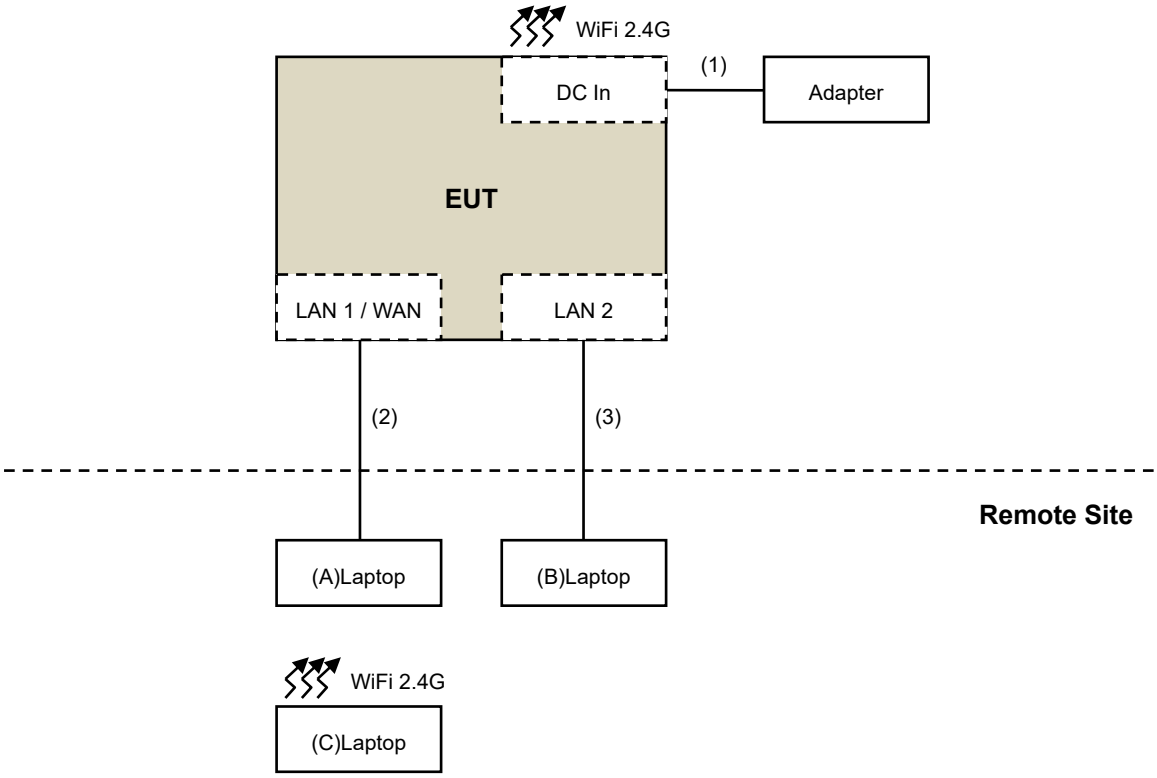
3.5 Primary Clock Frequencies of Internal Source

The EUT is provided by Advantech Co., Ltd., for detailed internal source, please refer to the manufacturer's specifications.

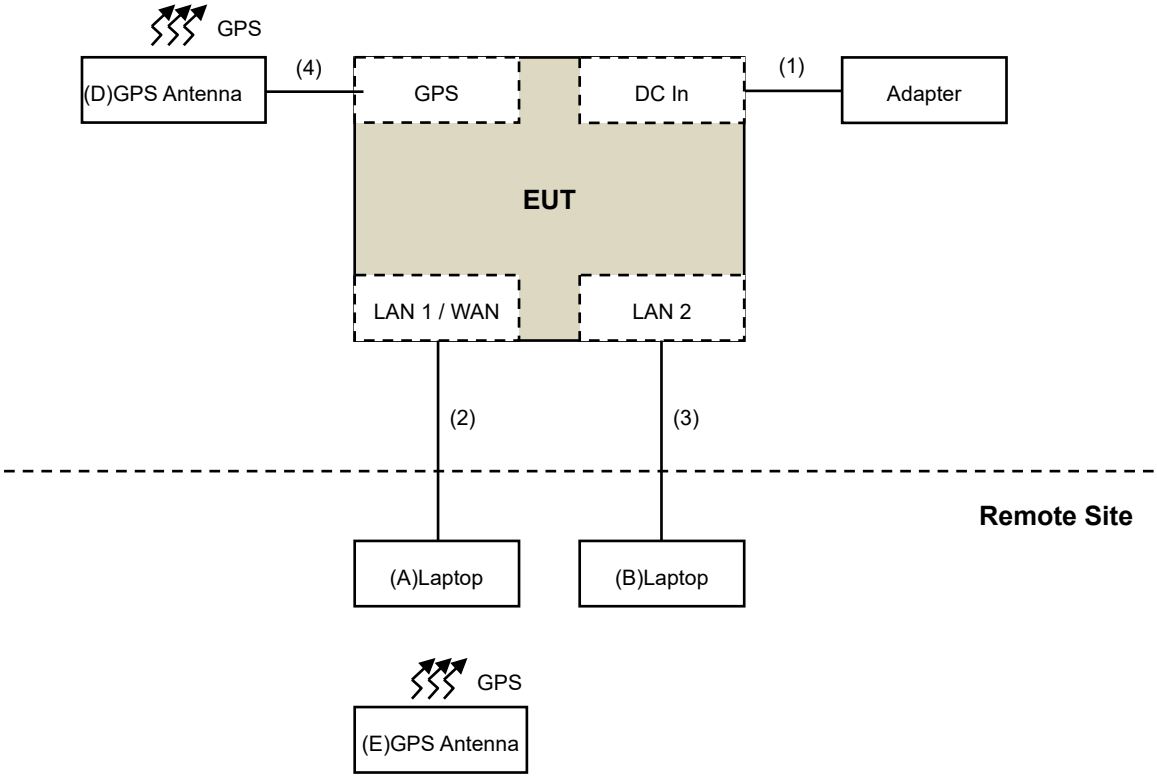
4 Configuration and Connections with EUT

4.1 Connection Diagram of EUT and Peripheral Devices

For Conducted emission / Asymmetric mode conducted emissions / Radiated emission / Harmonics / Flicker / Immunity (For EN 301 489-17 & EN 55024 & EN 301 489-19 & Draft EN 301 489-52) Tests:
SKU1



For Conducted / Asymmetric mode conducted emissions / Radiated Tests:
SKU2



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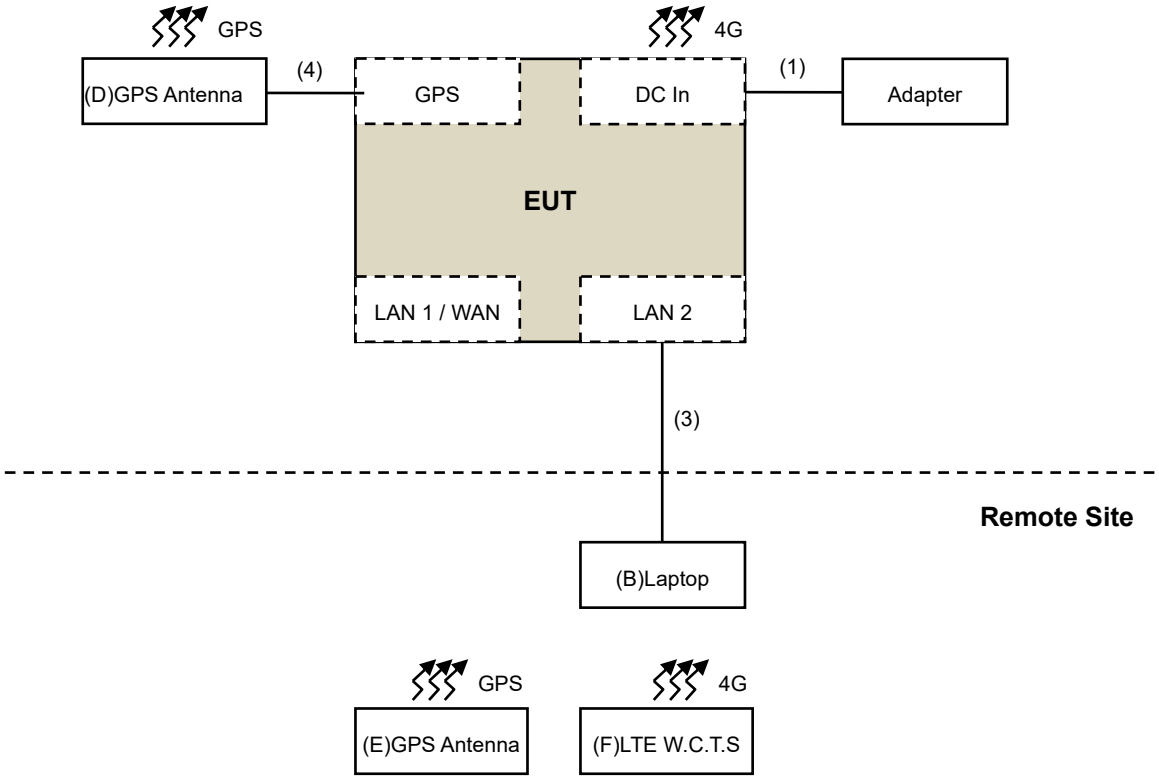
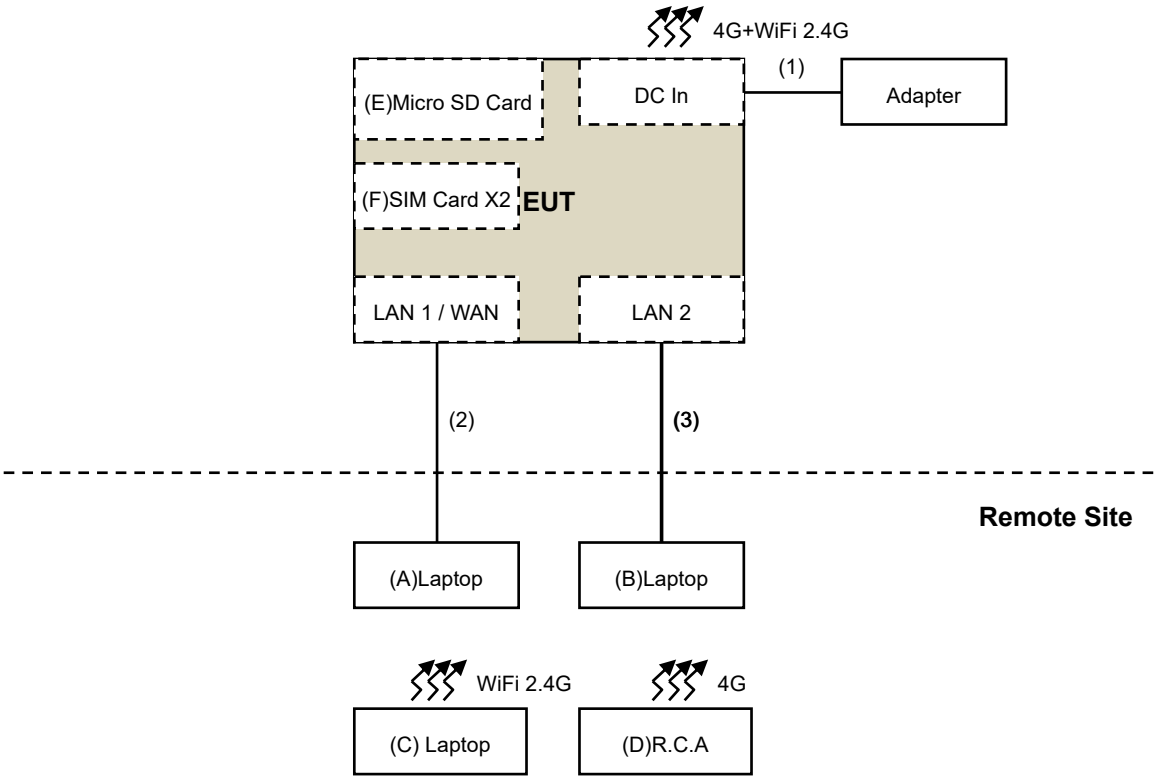
SKU2



For Immunity Test: (For EN 55035)

SKU1



4.2 Configuration of Peripheral Devices and Cable Connections

For Immunity Test: (For EN 55035)

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Laptop	DELL	P70F	1KY07L2	FCC DoC	Provided by Lab
B.	Laptop	ASUS	X413F	L3N0CX14V85713A	NA	Provided by Lab
C.	Laptop	ASUS	X413F	L3N0CX14V790133	NA	Provided by Lab
D.	R.C.A	Anritsu	MT8820C	6201127458	NA	Provided by Lab
E.	Micro SD Card	Kingston	NA	NA	NA	Provided by Lab
F.	SIM Card X 2	NA	NA	NA	NA	Provided by Lab

Note:

1. All power cords of the above support units are non-shielded (1.8m).

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC Power Cable	1	1.2	No	0	Supplied by applicant
2.	Cat 5e Cable	1	10	No	0	Provided by Lab
3.	Cat 5e Cable	1	10	No	0	Provided by Lab

For other test items

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
G.	Laptop	DELL	PP32LA	HSLB32S	FCC DoC	Provided by Lab
H.	Laptop	DELL	PP27L	6YLB32S	FCC DoC	Provided by Lab
I.	Laptop	DELL	PP27L	7YLB32S	FCC DoC	Provided by Lab
J.	GPS Antenna	NA	NA	NA	NA	Supplied by client
K.	GPS Antenna	NA	NA	NA	NA	Provided by Lab
L.	LTE W.C.T.S (Wireless Communication Test Set)	Keysight	E7515A	MY56030229	NA	Provided by Lab

Note:

1. All power cords of the above support units are non-shielded (1.8m).

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
4.	DC Power Cable	1	1.2	No	0	Supplied by client
5.	Cat 5e Cable	1	10	No	0	Provided by Lab
6.	Cat 5e Cable	1	10	No	0	Provided by Lab
7.	GPS Cable	1	3	No	0	Supplied by client

5 Conducted Emission from the AC Mains Power Port

5.1 Limits

Frequency (MHz)	Class A (dBuV)		Class B (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.5	79	66	66 - 56	56 - 46
0.50 - 5.0	73	60	56	46
5.0 - 30.0	73	60	60	50

Notes: 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases linearly with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

5.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver R&S	ESCS 30	100375	May 15, 2018	May 14, 2019
Line-Impedance Stabilization Network (for EUT) SCHWARZBECK	NSLK-8127	8127-522	Aug. 31, 2017	Aug. 30, 2018
Line-Impedance Stabilization Network (for Peripheral) R&S	ENV 216	10072	June 04, 2018	June 03, 2019
RF Cable	5D-FB	COACAB-002	Feb. 23, 2018	Feb. 22, 2019
10 dB PAD EMEC	STI02-2200-10	001	Mar. 16, 2018	Mar. 15, 2019
50 ohms Terminator	N/A	EMC-03	Sep. 22, 2017	Sep. 21, 2018
50 ohms Terminator	N/A	EMC-02	Sep. 22, 2017	Sep. 21, 2018
Software BVADT	BVADT_Cond_ V7.3.7.4	NA	NA	NA

Note:
1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Conducted Room C
3. The VCCI Con C Registration No. is C-3611.
4. Tested Date: July 31 to Aug. 13, 2018

5.3 Test Arrangement

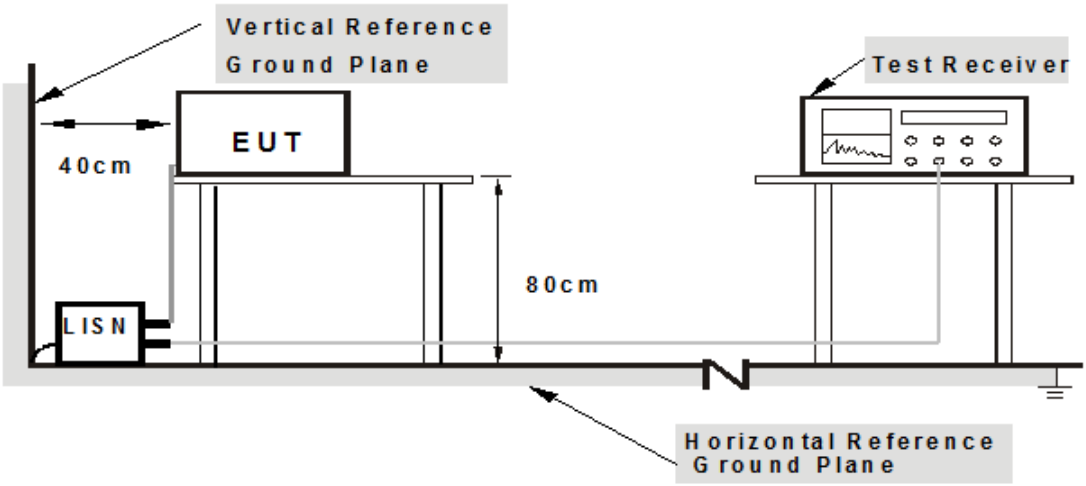
a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

c. The test results of conducted disturbance at mains ports are recorded of six worst margins for quasi-peak (mandatory) [and average (if necessary)] values against the limits at frequencies of interest unless the margin is 20 dB or greater.

Note:

The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.



Note: 1.Support units were connected to second LISN.

For the actual test configuration, please refer to the related Item – Photographs of the Test Configuration.

5.4 Supplementary Information

There is not any deviation from the test standards for the test method.

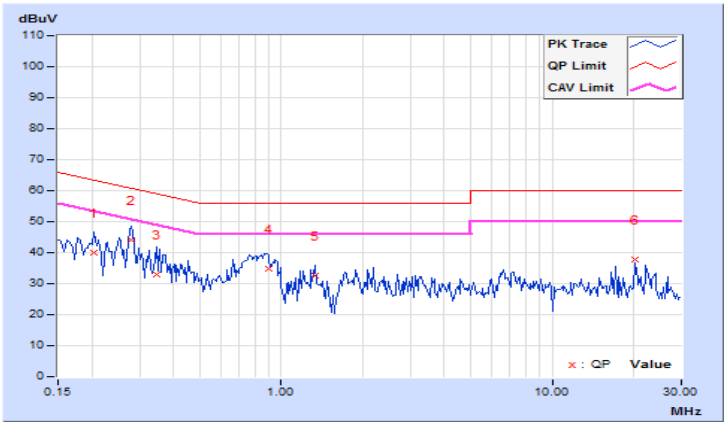
5.5 Test Results (Mode 1)

Frequency Range	150kHz ~ 30MHz	**Detector Function & Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	**Environmental Conditions**	26℃, 74%RH
Tested by	Eagle Chen		
Test Mode	Mode 1		

Phase Of Power : Line (L)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.20469	9.98	29.93	20.23	39.91	30.21	63.42	53.42	-23.51	-23.21
2	0.27891	9.98	34.22	31.01	44.20	40.99	60.85	50.85	-16.65	-9.86
3	0.34531	9.99	22.84	16.25	32.83	26.24	59.07	49.07	-26.24	-22.83
4	0.89609	10.04	24.87	14.58	34.91	24.62	56.00	46.00	-21.09	-21.38
5	1.32813	10.05	22.37	15.02	32.42	25.07	56.00	46.00	-23.58	-20.93
6	20.25781	10.59	27.16	18.82	37.75	29.41	60.00	50.00	-22.25	-20.59

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

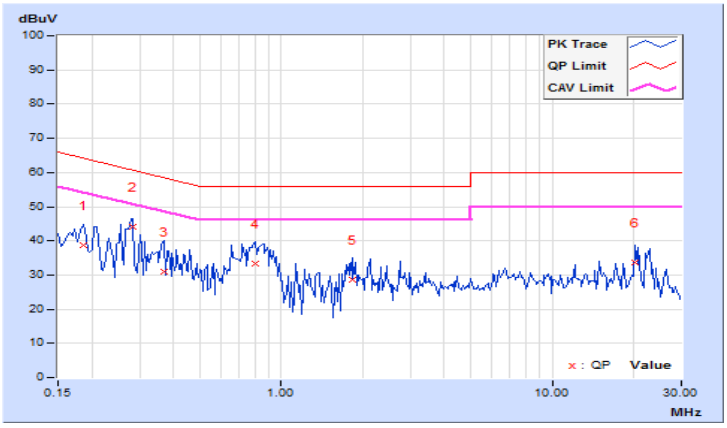


Frequency Range	150kHz ~ 30MHz	**Detector Function & Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	**Environmental Conditions**	26℃, 74%RH
Tested by	Eagle Chen		
Test Mode	Mode 1		

Phase Of Power : Neutral (N)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.18516	9.99	28.72	17.51	38.71	27.50	64.25	54.25	-25.54	-26.75
2	0.28281	10.00	34.27	27.79	44.27	37.79	60.73	50.73	-16.46	-12.94
3	0.36875	10.01	21.13	12.08	31.14	22.09	58.53	48.53	-27.39	-26.44
4	0.79844	10.04	23.29	13.66	33.33	23.70	56.00	46.00	-22.67	-22.30
5	1.82813	10.08	18.61	9.92	28.69	20.00	56.00	46.00	-27.31	-26.00
6	20.19922	10.64	23.14	13.89	33.78	24.53	60.00	50.00	-26.22	-25.47

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



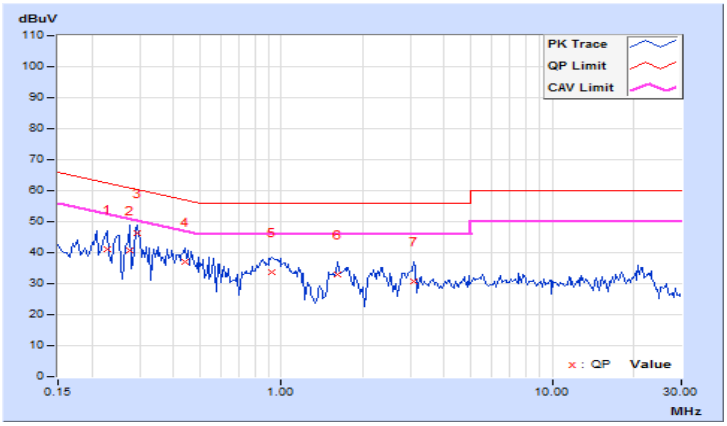
5.6 Test Results (Mode 2)

Frequency Range	150kHz ~ 30MHz	**Detector Function & Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	**Environmental Conditions**	26℃, 74%RH
Tested by	Eagle Chen		
Test Mode	Mode 2		

Phase Of Power : Line (L)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.22812	9.98	30.99	23.51	40.97	33.49	62.52	52.52	-21.55	-19.03
2	0.27500	9.98	30.78	23.72	40.76	33.70	60.97	50.97	-20.21	-17.27
3	0.29453	9.98	36.18	33.96	46.16	43.94	60.40	50.40	-14.24	-6.46
4	0.44297	9.99	27.02	20.11	37.01	30.10	57.01	47.01	-20.00	-16.91
5	0.92344	10.04	23.76	16.96	33.80	27.00	56.00	46.00	-22.20	-19.00
6	1.62109	10.06	22.98	20.46	33.04	30.52	56.00	46.00	-22.96	-15.48
7	3.07422	10.14	20.62	14.38	30.76	24.52	56.00	46.00	-25.24	-21.48

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

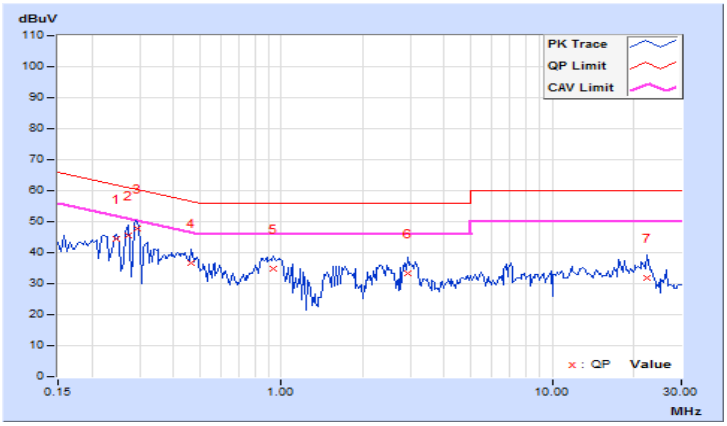


Frequency Range	150kHz ~ 30MHz	**Detector Function & Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	**Environmental Conditions**	26℃, 74%RH
Tested by	Eagle Chen		
Test Mode	Mode 2		

Phase Of Power : Neutral (N)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.24766	9.99	34.28	31.72	44.27	41.71	61.84	51.84	-17.57	-10.13
2	0.27109	10.00	35.48	30.78	45.48	40.78	61.08	51.08	-15.60	-10.30
3	**0.29453**	**10.00**	**37.95**	**35.42**	**47.95**	**45.42**	**60.40**	**50.40**	**-12.45**	**-4.98**
4	0.46250	10.02	26.67	16.42	36.69	26.44	56.65	46.65	-19.96	-20.21
5	0.93516	10.05	24.89	19.17	34.94	29.22	56.00	46.00	-21.06	-16.78
6	2.91797	10.14	23.34	15.43	33.48	25.57	56.00	46.00	-22.52	-20.43
7	22.48438	10.70	21.17	13.49	31.87	24.19	60.00	50.00	-28.13	-25.81

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



6 Asymmetric Mode Conducted Emissions

6.1 Limits

For Class A Equipment

Frequency (MHz)	Voltage Limit (dBuV)		Current limits (dBuA)	
	Quasi-peak	Average	Quasi-peak	Average
0.15-0.5	97-87	84-74	53-43	40-30
0.5-30	87	74	43	30

Note: The limits decrease linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

For Class B Equipment

Frequency (MHz)	Voltage Limit (dBuV)		Current limits (dBuA)	
	Quasi-peak	Average	Quasi-peak	Average
0.15-0.5	84-74	74-64	40-30	30-20
0.5-30	74	64	30	20

Note: The limits decrease linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

6.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver R&S	ESCS 30	100375	May 15, 2018	May 14, 2019
Line-Impedance Stabilization Network (for EUT) SCHWARZBECK	NSLK-8127	8127-522	Aug. 31, 2017	Aug. 30, 2018
Line-Impedance Stabilization Network (for Peripheral) R&S	ENV 216	10072	June 04, 2018	June 03, 2019
50 ohms Terminator	N/A	EMC-03	Sep. 22, 2017	Sep. 21, 2018
50 ohms Terminator	N/A	EMC-02	Sep. 22, 2017	Sep. 21, 2018
FCC-TLISN-C1-BNC-50 FCC ISN	FCC-TLISN-C1-BNC-50	20609	July 16, 2018	July 15, 2019
RF Cable	5D-FB	COACAB-002	Feb. 23, 2018	Feb. 22, 2019
Current Probe CHASE	SMZ 11	18013	Aug. 31, 2017	Aug. 30, 2018
Capacitive Voltage Probe CHASE	CVP 2200	18312	Aug. 25, 2017	Aug. 24, 2018
ISN T800 TESEQ	ISN T800	34442	Sep. 06, 2017	Sep. 05, 2018
ISN T8-Cat6 TESEQ ISN	ISN T8-Cat6	43901	May 07, 2018	May 06, 2019
ISN ST08-Cat6 TESEQ ISN	ISN ST08	34002	Nov. 24, 2017	Nov. 23, 2018
Software BVADT	BV ADT_ISN_ V7.3.7.4	NA	NA	NA

Note:

1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Conducted Room C
3. The VCCI ISN C Registration No. is T-1744.
4. Tested Date: July 31 to Aug. 13, 2018

6.3 Test Arrangement

Method of Using AANs:

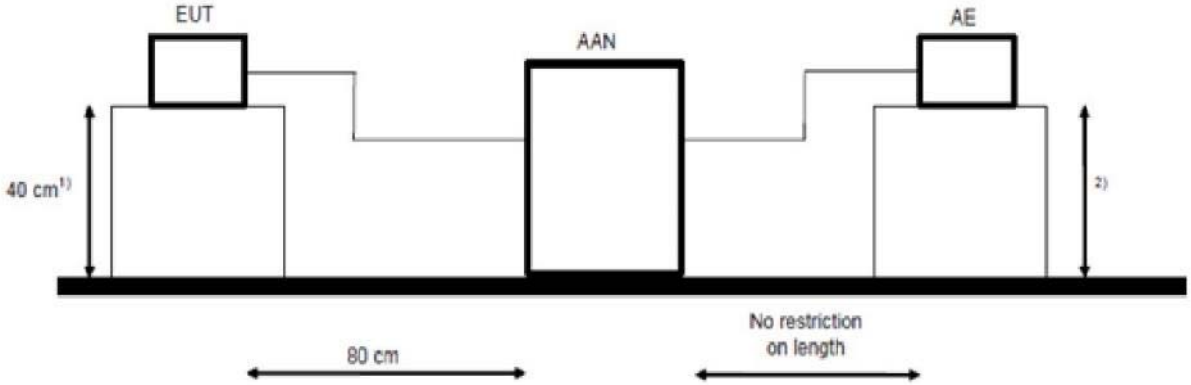
a. The EUT is placed 0.4 meters from the conducting wall of the shielded room and connected to AAN directly to reference ground plane.

b. If voltage measurement is used, measure voltage at the measurement port of the AAN, correct the reading by adding the AAN voltage division factor, and compare to the voltage limit.

c. It is not necessary to apply the voltage and the current limit if a AAN is used.

d. The test results of disturbance at wired network ports are recorded of six worst margins for quasi-peak (mandatory) [and average (if necessary)] values against the limits at frequencies of interest unless the margin is 20 dB or greater.

Note: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.



1) Distance to the reference groundplane (vertical or horizontal).
2) Distance to the reference groundplane is not critical.

Method of Using a 150 Ω load to the outside surface of the shield:

a. Break the insulation and connect a 150Ω resistor from the outside surface of the shield to ground.

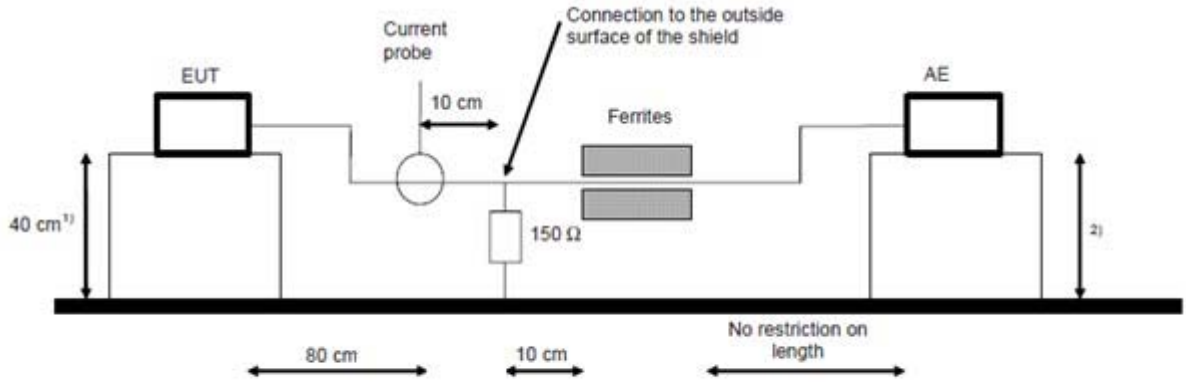
b. Apply a clamp between 150Ω connection and associated equipment.

c. Current probe shall be placed at 0.1 m from the AAN.

d. Measure current with a current probe and compare to the current limit.

e. The test results of disturbance at wired network ports are recorded of six worst margins for quasi-peak (mandatory) [and average (if necessary)] values against the limits at frequencies of interest unless the margin is 20 dB or greater.

Note: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.



1) Distance to the reference groundplane (vertical or horizontal).
2) Distance to the reference groundplane is not critical.

AE = Associated equipment
EUT = Equipment under test

Method of Using a combination of current probe and capacitive voltage probe:

a. Measure current with a current probe.

b. Compare the measured current with the applicable current limit.

c. Measure voltage with a capacitive probe as specified in 5.2.2 of CISPR 16-1-2.

d. Adjust the measured voltage as follows:

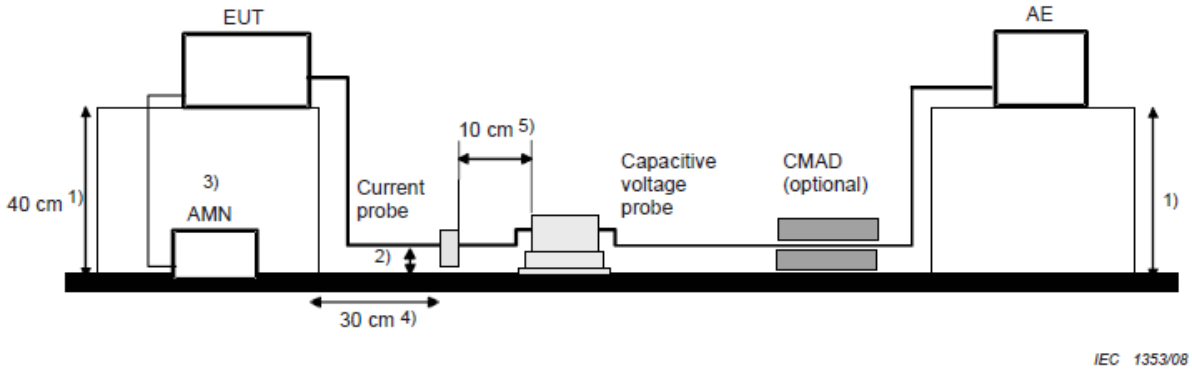
- current margin ≤ 6 dB – subtract the actual current margin from measured voltage;
- current margin > 6 dB – subtract 6 dB from measured voltage.

e. Compare adjusted voltage with the applicable voltage limit

f. Both the measured current and the adjusted voltage shall be below the applicable

g. The test results of disturbance at wired network ports are recorded of six worst margins for quasi-peak (mandatory) [and average (if necessary)] values against the limits at frequencies of interest unless the margin is 20 dB or greater.

Note: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.



AE = Associated equipment
EUT = Equipment under test
CMAD = Common mode Absorbing Device

6.4 Supplementary Information

There is not any deviation from the test standards for the test method.

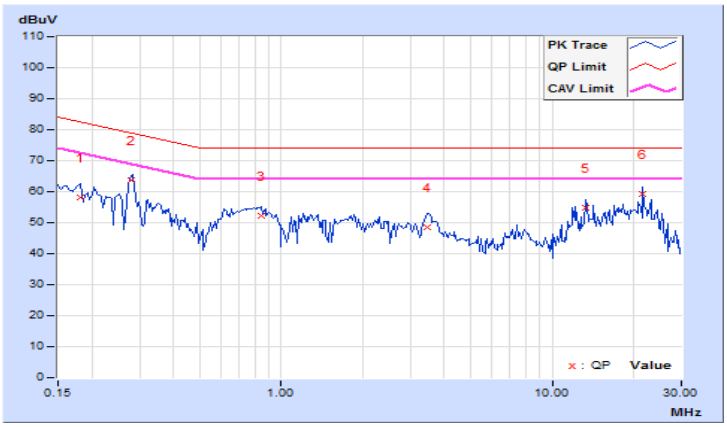
6.5 Test Results (Mode 1)

Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	Environmental Conditions	25℃, 71%RH
Tested by	Eagle Chen		
Test Mode	Mode 1		

No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.18125	10.09	48.07	41.02	58.16	51.11	82.43	72.43	-24.27	-21.32
2	0.28081	9.91	53.75	52.19	63.66	62.10	78.79	68.79	-15.13	-6.69
3	0.84531	9.72	42.47	35.77	52.19	45.49	74.00	64.00	-21.81	-18.51
4	3.47266	9.68	38.71	32.98	48.39	42.66	74.00	64.00	-25.61	-21.34
5	13.35938	9.75	45.16	40.49	54.91	50.24	74.00	64.00	-19.09	-13.76
6	21.66406	9.93	49.16	44.02	59.09	53.95	74.00	64.00	-14.91	-10.05

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



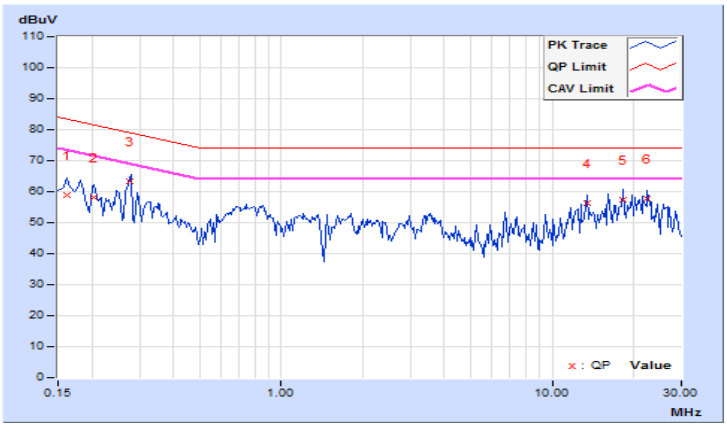
6.6 Test Results (Mode 2)

Frequency Range	150kHz ~ 30MHz	**Detector Function & Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	**Environmental Conditions**	25℃, 71%RH
Tested by	Eagle Chen		
Test Mode	Mode 2		

No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16172	10.15	48.77	39.45	58.92	49.60	83.38	73.38	-24.46	-23.78
2	0.20469	10.02	47.99	42.98	58.01	53.00	81.42	71.42	-23.41	-18.42
3	0.27691	9.92	53.33	52.31	63.25	62.23	78.91	68.91	-15.66	-6.68
4	13.48047	9.75	46.40	42.57	56.15	52.32	74.00	64.00	-17.85	-11.68
5	18.24219	9.84	47.52	46.68	57.36	56.52	74.00	64.00	-16.64	-7.48
6	22.45703	9.96	47.69	47.12	57.65	57.08	74.00	64.00	-16.35	-6.92

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



6.7 Test Results (Mode 3)

Frequency Range	150kHz ~ 30MHz	**Detector Function & Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	**Environmental Conditions**	25℃, 71%RH
Tested by	Eagle Chen		
Test Mode	Mode 3		

No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.21250	10.01	39.69	29.89	49.70	39.90	81.11	71.11	-31.41	-31.21
2	0.29172	9.90	50.65	49.92	60.55	59.82	78.48	68.48	-17.93	-8.66
3	0.87266	9.71	47.13	38.18	56.84	47.89	74.00	64.00	-17.16	-16.11
4	2.89844	9.66	39.21	34.30	48.87	43.96	74.00	64.00	-25.13	-20.04
5	7.60547	9.68	39.10	36.40	48.78	46.08	74.00	64.00	-25.22	-17.92
6	17.69531	9.83	35.70	31.33	45.53	41.16	74.00	64.00	-28.47	-22.84
7	23.12891	9.98	37.87	32.90	47.85	42.88	74.00	64.00	-26.15	-21.12

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

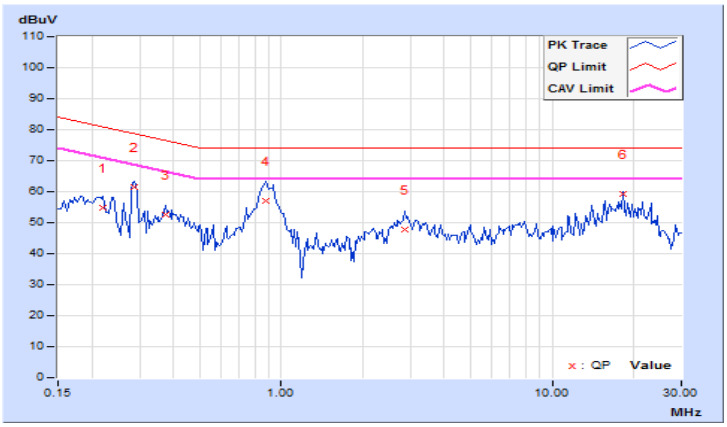
6.8 Test Results (Mode 4)

Frequency Range	150kHz ~ 30MHz	Detector Function & Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	230Vac, 50Hz	Environmental Conditions	25℃, 71%RH
Tested by	Eagle Chen		
Test Mode	Mode 4		

No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.22031	10.00	44.95	41.43	54.95	51.43	80.81	70.81	-25.86	-19.38
2	0.28672	9.90	51.73	51.38	61.63	61.28	78.62	68.62	-16.99	-7.34
3	0.37266	9.83	42.94	38.55	52.77	48.38	76.44	66.44	-23.67	-18.06
4	0.87266	9.71	47.35	38.28	57.06	47.99	74.00	64.00	-16.94	-16.01
5	2.87500	9.66	38.18	31.62	47.84	41.28	74.00	64.00	-26.16	-22.72
6	**18.24219**	**9.84**	**49.28**	**48.87**	**59.12**	**58.71**	**74.00**	**64.00**	**-14.88**	**-5.29**

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value



7 Radiated Emission at Frequencies up to 1GHz

7.1 Limits

Frequency (MHz)	Class A (dBuV/m)		Class B (dBuV/m)	
	at 3m	at 10m	at 3m	at 10m
30 - 230	50	40	40	30
230 - 1000	57	47	47	37

Notes: 1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

7.2 Test Instruments

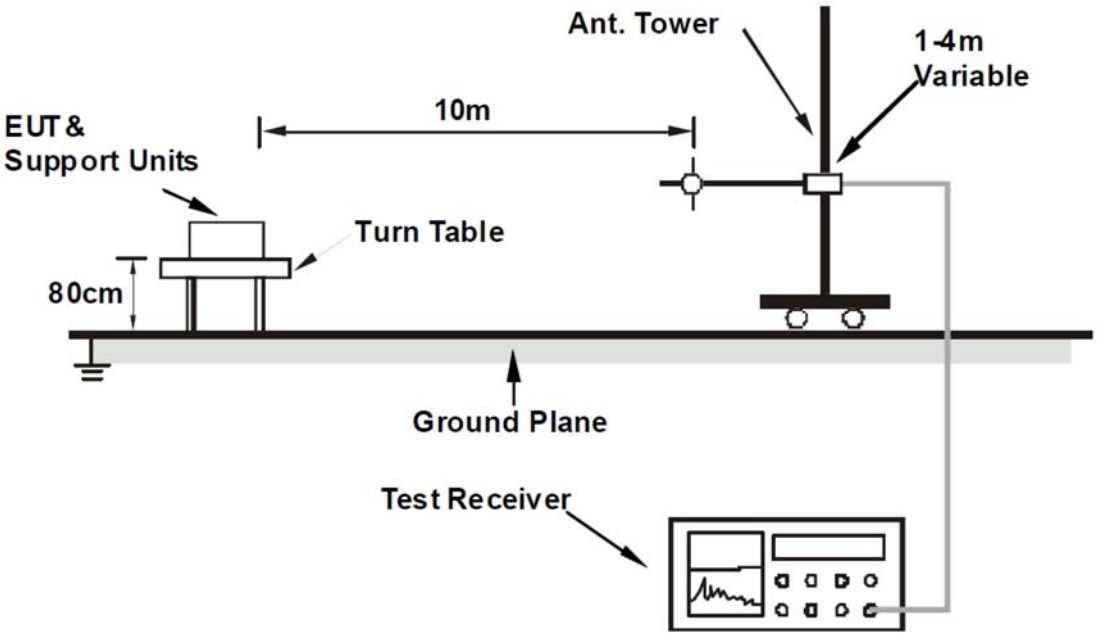
DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY50010125	Apr. 12, 2018	Apr. 11, 2019
	N9038A	MY50010132	June 06, 2018	June 05, 2019
Pre-Amplifier Sonoma	310N	352925	Aug. 28, 2017	Aug. 27, 2018
	310N	352926	Aug. 28, 2017	Aug. 27, 2018
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-359	Dec. 11, 2017	Dec. 10, 2018
	VULB 9168	9168-358	Dec. 06, 2017	Dec. 05, 2018
Fixed attenuator Mini-Circuits	UNAT-5+	CHF-001	Sep. 07, 2017	Sep. 06, 2018
	UNAT-5+	CHF-002	Sep. 07, 2017	Sep. 06, 2018
RF Cable	8D-FB	CHFCAB-001-1 CHFCAB-001-3 CHFCAB-001-4	Sep. 20, 2017	Sep. 19, 2018
		CHFCAB-002-1 CHFCAB-002-3 CHFCAB-002-4	Sep. 20, 2017	Sep. 19, 2018
Software BVADT	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table CT	NA	NA	NA	NA

Note:
1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Chamber F room
3. The VCCI Site Registration No. is R-3252.
4. The CANADA Site Registration No. is IC 7450H-1.
5. Tested Date: July 25 to Aug. 09, 2018

7.3 Test Arrangement

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at an accredited test facility. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is up to 1 GHz.

Note: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for quasi-peak detection (QP) at frequency up to 1GHz.



For the actual test configuration, please refer to the related Item – Photographs of the Test Configuration.

7.4 Supplementary Information

There is not any deviation from the test standards for the test method.

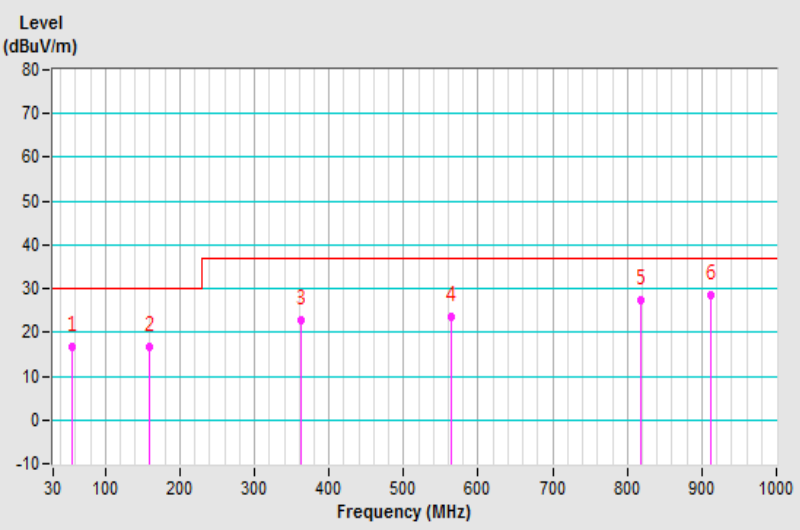
7.5 Test Results (Mode 1)

Frequency Range	30MHz ~ 1GHz	Detector Function & Bandwidth	Quasi-Peak (QP), 120kHz
Input Power	230Vac, 50Hz	Environmental Conditions	20℃, 62%RH
Tested by	Jay Chan		
Test Mode	Mode 1		

Antenna Polarity & Test Distance : Horizontal at 10 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	55.95	16.55 QP	30.00	-13.45	1.00 H	201	29.50	-12.95
2	159.57	16.77 QP	30.00	-13.23	4.00 H	217	29.15	-12.38
3	361.72	22.86 QP	37.00	-14.14	4.00 H	115	32.75	-9.89
4	564.08	23.60 QP	37.00	-13.40	3.00 H	298	28.96	-5.36
5	818.90	27.29 QP	37.00	-9.71	1.00 H	140	27.64	-0.35
6	911.49	28.62 QP	37.00	-8.38	2.02 H	114	26.99	1.63

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value

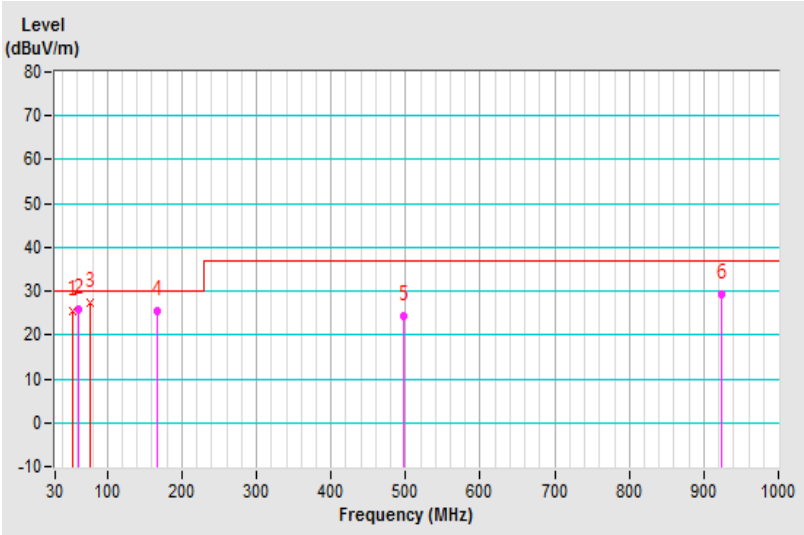


Frequency Range	30MHz ~ 1GHz	Detector Function & Bandwidth	Quasi-Peak (QP), 120kHz
Input Power	230Vac, 50Hz	Environmental Conditions	20℃, 62%RH
Tested by	Jay Chan		
Test Mode	Mode 1		

Antenna Polarity & Test Distance : Vertical at 10 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	54.20	25.37 QP	30.00	-4.63	1.00 V	8	38.05	-12.68
2	62.25	25.96 QP	30.00	-4.04	2.00 V	138	39.54	-13.58
3	**77.19**	**27.29 QP**	**30.00**	**-2.71**	**2.01 V**	**344**	**43.94**	**-16.65**
4	165.97	25.53 QP	30.00	-4.47	1.00 V	239	38.10	-12.57
5	497.93	24.29 QP	37.00	-12.71	4.00 V	253	30.00	-5.71
6	923.01	29.41 QP	37.00	-7.59	4.00 V	218	26.64	2.77

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value



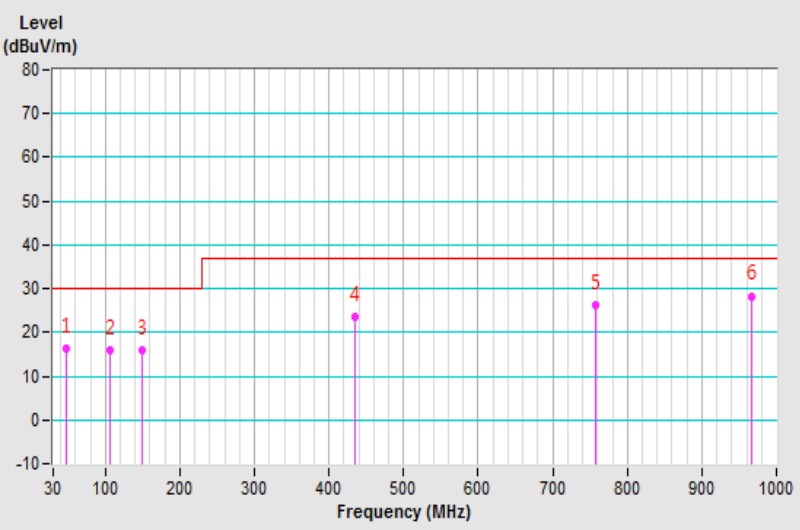
7.6 Test Results (Mode 2)

Frequency Range	30MHz ~ 1GHz	Detector Function & Bandwidth	Quasi-Peak (QP), 120kHz
Input Power	230Vac, 50Hz	Environmental Conditions	20℃, 62%RH
Tested by	Jay Chan		
Test Mode	Mode 2		

Antenna Polarity & Test Distance : Horizontal at 10 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	48.43	16.14 QP	30.00	-13.86	4.00 H	113	28.96	-12.82
2	106.22	15.98 QP	30.00	-14.02	3.00 H	174	32.16	-16.18
3	148.97	16.03 QP	30.00	-13.97	2.00 H	156	28.39	-12.36
4	434.68	23.39 QP	37.00	-13.61	2.00 H	24	31.02	-7.63
5	756.80	26.15 QP	37.00	-10.85	3.00 H	6	27.45	-1.30
6	966.37	28.30 QP	37.00	-8.70	1.01 H	103	25.71	2.59

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value

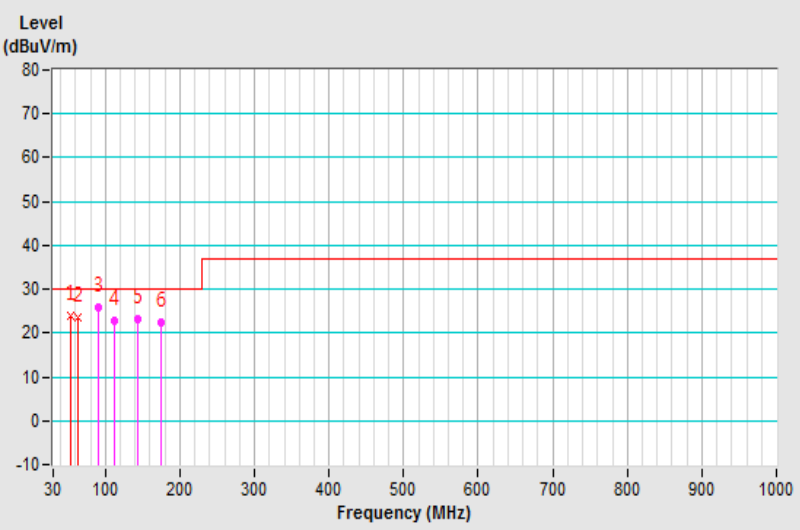


Frequency Range	30MHz ~ 1GHz	Detector Function & Bandwidth	Quasi-Peak (QP), 120kHz
Input Power	230Vac, 50Hz	Environmental Conditions	20℃, 62%RH
Tested by	Jay Chan		
Test Mode	Mode 2		

Antenna Polarity & Test Distance : Vertical at 10 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	54.06	23.79 QP	30.00	-6.21	1.00 V	8	36.46	-12.67
2	63.49	23.44 QP	30.00	-6.56	2.00 V	348	37.22	-13.78
3	91.30	25.86 QP	30.00	-4.14	3.99 V	358	44.24	-18.38
4	111.55	22.73 QP	30.00	-7.27	1.00 V	8	38.12	-15.39
5	143.30	23.24 QP	30.00	-6.76	2.00 V	221	35.92	-12.68
6	174.72	22.34 QP	30.00	-7.66	1.00 V	111	35.46	-13.12

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value



8 Radiated Emission at Frequencies above 1GHz

8.1 Limits

Frequency (GHz)	Class A (dBuV/m) (at 3m)		Class B (dBuV/m) (at 3m)	
	Average	Peak	Average	Peak
1 to 3	56	76	50	70
3 to 6	60	80	54	74

Notes: 1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

Frequency Range of Radiated Measurement (For unintentional radiators)

Highest frequency generated or used in the EUT or on which the EUT operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 108	1000
108-500	2000
500-1000	5000
Above 1000	Up to 5 times of the highest frequency or 6 GHz, whichever is less

8.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY50010125	Apr. 12, 2018	Apr. 11, 2019
Pre-Amplifier Agilent	8449B	3008A01975	Feb. 22, 2018	Feb. 21, 2019
Horn Antenna SCHWARZBECK	BBHA 9120D	D123	Dec. 01, 2017	Nov. 30, 2018
RF Coaxial Cable	EMC104-SM-SM-11000	170209	Mar. 06, 2018	Mar. 05, 2019
RF Coaxial Cable	EMC104-SM-SM-6000	170207	Mar. 06, 2018	Mar. 05, 2019
RF Coaxial Cable	EMC104-SM-SM-2500	170206	Mar. 06, 2018	Mar. 05, 2019
Software BVADT	ADT_Radiated_ V8.7.08	NA	NA	NA
Antenna Tower & Turn Table CT	NA	NA	NA	NA

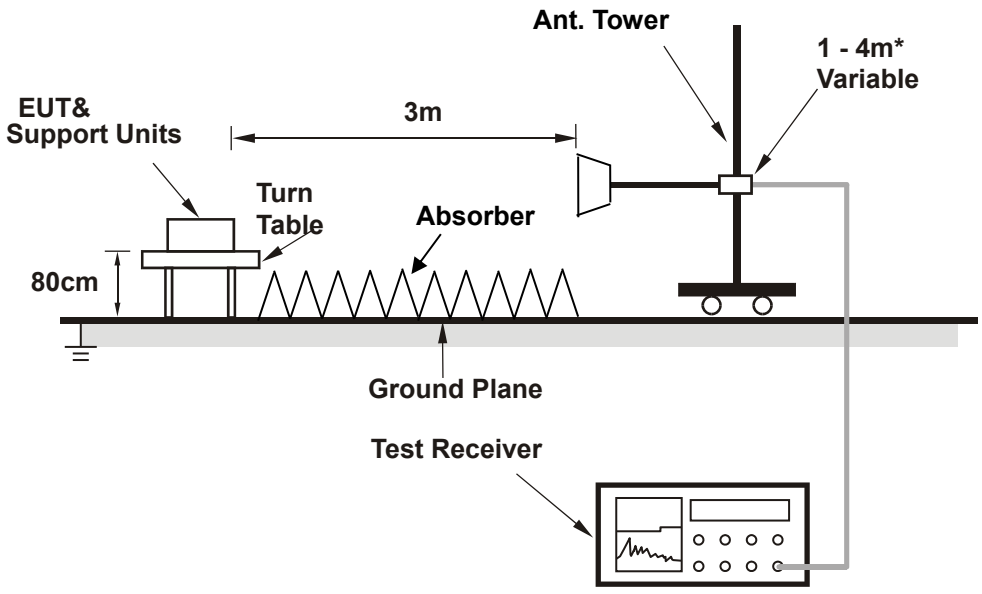
Note:
1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Chamber F room
3. The VCCI Site Registration No. is G-136.
4. The 3dB beamwidth of the horn antenna is minimum 27 degree (or w = 1.44m at 3m distance) for 1~6 GHz.
5. Tested Date: July 25 to Aug. 09, 2018

8.3 Test Arrangement

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at an accredited chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The height of antenna can be varied from one meter to four meters, the height of adjustment depends on the EUT height and the antenna 3dB beamwidth both, to detect the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The spectrum analyzer system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz.

Note:

1. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection (PK) at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz for Average detection (AV) at frequency above 1GHz.



* : depends on the EUT height and the antenna 3dB beamwidth both.
For the actual test configuration, please refer to the related Item – Photographs of the Test Configuration.

8.4 Supplementary Information

There is not any deviation from the test standards for the test method.

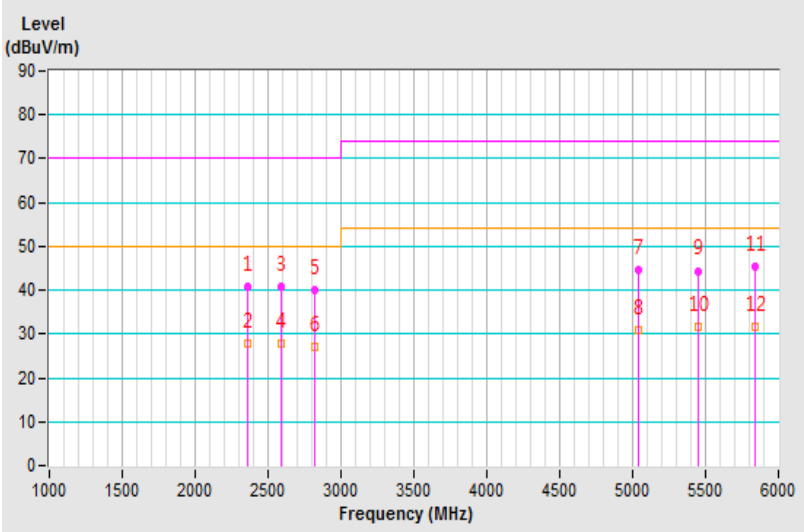
8.5 Test Results (Mode 1)

Frequency Range	1GHz ~ 6GHz	Detector Function & Bandwidth	Peak (PK) / Average (AV), 1MHz
Input Power	230Vac, 50Hz	Environmental Conditions	20℃, 62%RH
Tested by	Jay Chan		
Test Mode	Mode 1		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2356.00	40.63 PK	70.00	-29.37	1.00 H	181	39.94	0.69
2	2356.00	27.69 AV	50.00	-22.31	1.00 H	0	27.00	0.69
3	2593.50	40.64 PK	70.00	-29.36	1.00 H	195	39.82	0.82
4	2593.50	27.80 AV	50.00	-22.20	1.00 H	0	26.98	0.82
5	2817.75	39.89 PK	70.00	-30.11	1.00 H	278	38.13	1.76
6	2817.75	27.14 AV	50.00	-22.86	1.00 H	360	25.38	1.76
7	5040.87	44.53 PK	74.00	-29.47	1.00 H	85	36.30	8.23
8	5040.87	30.86 AV	54.00	-23.14	1.00 H	0	22.63	8.23
9	5447.75	44.40 PK	74.00	-29.60	1.00 H	228	35.59	8.81
10	5447.75	31.50 AV	54.00	-22.50	1.00 H	360	22.69	8.81
11	5835.62	45.40 PK	74.00	-28.60	1.00 H	117	35.88	9.52
12	5835.62	31.80 AV	54.00	-22.20	1.00 H	360	22.28	9.52

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value

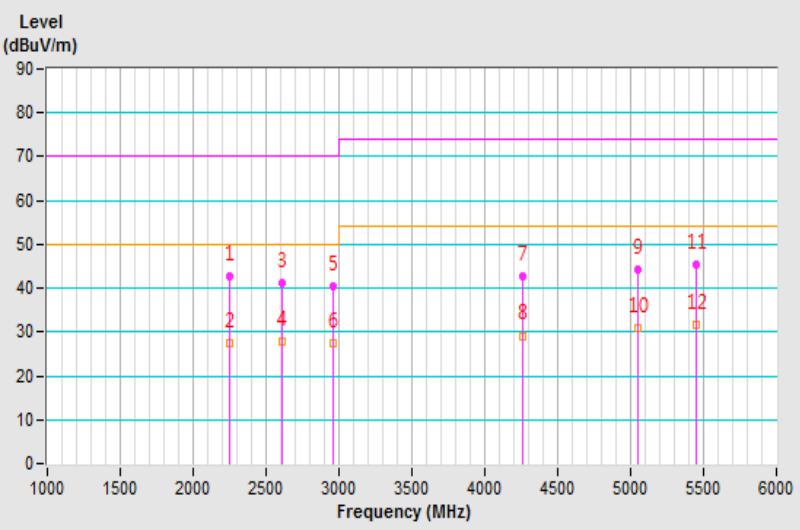


Frequency Range	1GHz ~ 6GHz	Detector Function & Bandwidth	Peak (PK) / Average (AV), 1MHz
Input Power	230Vac, 50Hz	Environmental Conditions	20℃, 62%RH
Tested by	Jay Chan		
Test Mode	Mode 1		

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2254.00	42.56 PK	70.00	-27.44	1.00 V	158	41.82	0.74
2	2254.00	27.55 AV	50.00	-22.45	1.00 V	360	26.81	0.74
3	2609.50	41.17 PK	70.00	-28.83	1.00 V	292	40.30	0.87
4	2609.50	27.92 AV	50.00	-22.08	1.00 V	0	27.05	0.87
5	2964.37	40.24 PK	70.00	-29.76	1.00 V	37	37.72	2.52
6	2964.37	27.60 AV	50.00	-22.40	1.00 V	360	25.08	2.52
7	4264.00	42.66 PK	74.00	-31.34	1.00 V	9	36.94	5.72
8	4264.00	29.17 AV	54.00	-24.83	1.00 V	0	23.45	5.72
9	5047.00	44.08 PK	74.00	-29.92	1.00 V	155	35.80	8.28
10	5047.00	30.99 AV	54.00	-23.01	1.00 V	360	22.71	8.28
11	5454.12	45.22 PK	74.00	-28.78	1.00 V	95	36.40	8.82
12	5454.12	31.63 AV	54.00	-22.37	1.00 V	0	22.81	8.82

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value



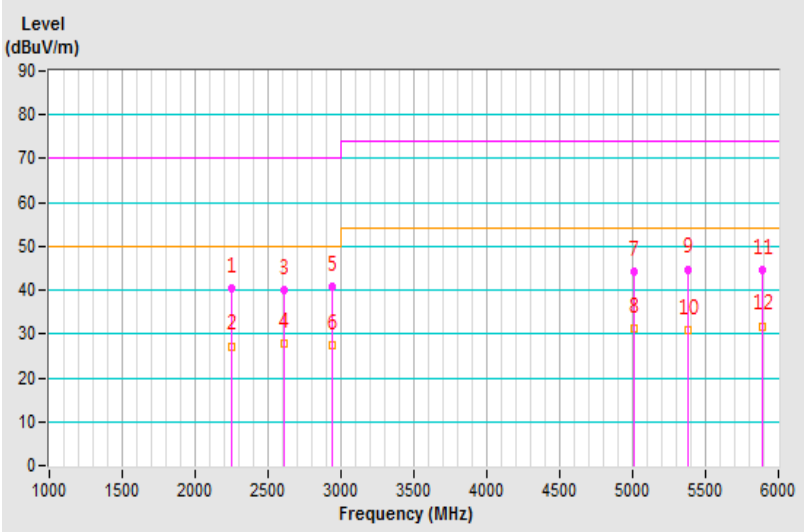
8.6 Test Results (Mode 2)

Frequency Range	1GHz ~ 6GHz	Detector Function & Bandwidth	Peak (PK) / Average (AV), 1MHz
Input Power	230Vac, 50Hz	Environmental Conditions	20℃, 62%RH
Tested by	Jay Chan		
Test Mode	Mode 2		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2253.75	40.33 PK	70.00	-29.67	1.00 H	145	39.59	0.74
2	2253.75	27.25 AV	50.00	-22.75	1.00 H	52	26.51	0.74
3	2606.37	40.17 PK	70.00	-29.83	1.00 H	133	39.31	0.86
4	2606.37	27.96 AV	50.00	-22.04	1.00 H	354	27.10	0.86
5	2943.50	40.87 PK	70.00	-29.13	1.00 H	277	38.39	2.48
6	2943.50	27.53 AV	50.00	-22.47	1.00 H	0	25.05	2.48
7	5007.62	44.37 PK	74.00	-29.63	1.00 H	82	36.44	7.93
8	5007.62	31.20 AV	54.00	-22.80	1.00 H	360	23.27	7.93
9	5378.75	44.80 PK	74.00	-29.20	1.00 H	35	36.44	8.36
10	5378.75	30.87 AV	54.00	-23.13	1.00 H	360	22.51	8.36
11	5894.37	44.76 PK	74.00	-29.24	1.00 H	360	35.10	9.66
12	5894.37	31.84 AV	54.00	-22.16	1.00 H	18	22.18	9.66

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value

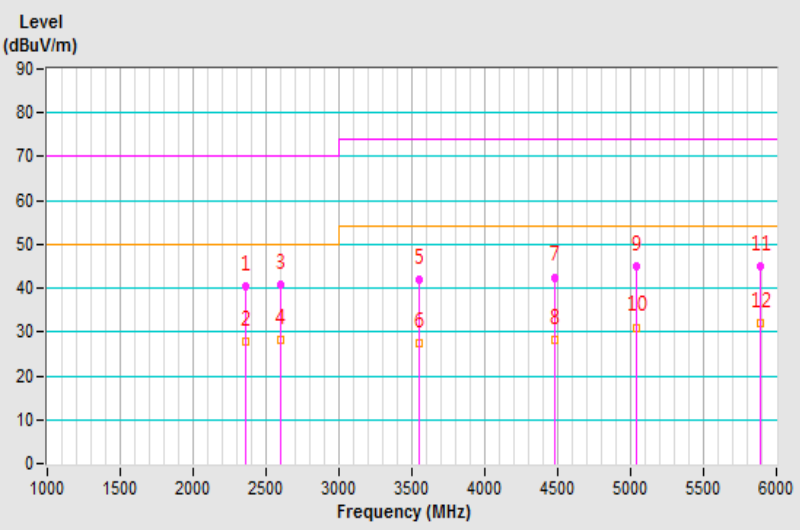


Frequency Range	1GHz ~ 6GHz	Detector Function & Bandwidth	Peak (PK) / Average (AV), 1MHz
Input Power	230Vac, 50Hz	Environmental Conditions	20℃, 62%RH
Tested by	Jay Chan		
Test Mode	Mode 2		

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	2358.87	40.30 PK	70.00	-29.70	1.00 V	126	39.62	0.68
2	2358.87	27.94 AV	50.00	-22.06	1.00 V	360	27.26	0.68
3	2604.12	40.80 PK	70.00	-29.20	1.00 V	360	39.95	0.85
4	**2604.12**	**28.05 AV**	**50.00**	**-21.95**	**1.00 V**	**117**	**27.20**	**0.85**
5	3551.75	41.78 PK	74.00	-32.22	1.00 V	201	38.34	3.44
6	3551.75	27.34 AV	54.00	-26.66	1.00 V	359	23.90	3.44
7	4475.75	42.49 PK	74.00	-31.51	1.00 V	166	36.19	6.30
8	4475.75	28.24 AV	54.00	-25.76	1.00 V	0	21.94	6.30
9	5035.00	45.03 PK	74.00	-28.97	1.00 V	320	36.86	8.17
10	5035.00	31.08 AV	54.00	-22.92	1.00 V	360	22.91	8.17
11	5888.87	44.97 PK	74.00	-29.03	1.00 V	310	35.31	9.66
12	5888.87	31.95 AV	54.00	-22.05	1.00 V	205	22.29	9.66

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) – Pre-Amplifier Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value



9 Harmonics Current Measurement

9.1 Limits of Harmonics Current Measurement

Limits for Class A equipment		Limits for Class D equipment		
Harmonic Order n	Max. permissible harmonics current A	Harmonic Order n	Max. permissible harmonics current per watt mA/W	Max. permissible harmonics current A
Odd harmonics		Odd Harmonics only		
3	2.30	3	3.4	2.30
5	1.14	5	1.9	1.14
7	0.77	7	1.0	0.77
9	0.40	9	0.5	0.40
11	0.33	11	0.35	0.33
13	0.21	13	0.30	0.21
15≦n≦39	0.15x15/n	15≦n≦39	3.85/n	0.15x15/n
Even harmonics				
2	1.08			
4	0.43			
6	0.30			
8≦n≦40	0.23x8/n			

Note: 1. Class A and Class D are classified according to section 5 of EN 61000-3-2.
2. According to section 7 of EN 61000-3-2, the above limits for all equipment except for lighting equipment having an active input power > 75 W and no limits apply for equipment with an active input power up to and including 75 W.

9.2 Classification of equipment

The EUT is Class A in accordance with EN 61000-3-2 as follows:

Class A	Class B	Class C	Class D
Balanced three-phase equipment; Household appliances excluding equipment as Class D; Tools excluding portable tools; Dimmers for incandescent lamps; Audio equipment; Equipment not specified in one of the three other classes.	Portable tools; Arc welding equipment which is not professional equipment.	Lighting equipment.	Equipment having a specified power less than or equal to 600 W of the following types: Personal computers and personal computer monitors; Television receivers; Refrigerators and freezers having one or more variable-speed drives to control compressor motor(s).

9.3 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
HARMONICS & FLICKER TEST SYSTEM EMC PARTNER	HARMONICS-1000-1P	086	Apr. 27, 2018	Apr. 26, 2019
Software EMC PARTNER	HARCS_V4.2	NA	NA	NA

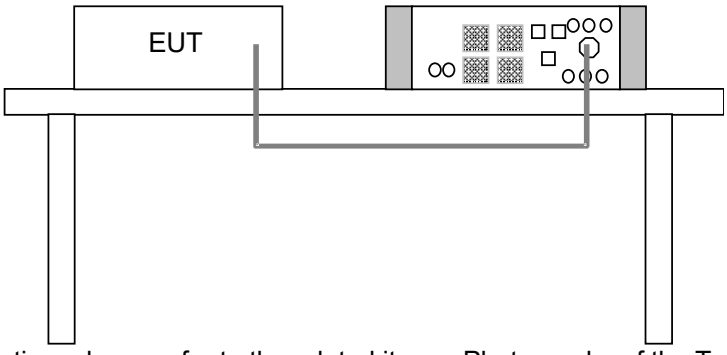
Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in EMS-1 room.
3. Tested Date: Aug. 01, 2018

9.4 Test Arrangement

a. 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.

b. The correspondent test program of test instrument to measure the current harmonics emanated from EUT is chosen. The measure time shall be not less than the time necessary for the EUT to be exercised.



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

9.5 Supplementary Information

There is not any deviation from the test standards for the test method.

9.6 Test Results

Test Duration (mins)	5	Power Frequency	50.013Hz
Fundamental Voltage/Ampere	230.3Vrms/ 0.026Arms	Power Factor	0.412
Power Consumption	2.466W	Tested by	Leon Wu
Enviromental Conditions	21 °C, 60%RH	Test Mode	Mode 1

Note:
1. Limits are not specified for equipment with a rated power of 75W or less (other than lighting equipment).
2. According to EN 61000-3-2 the manufacturer shall specify the power of the apparatus. This value shall be used for establishing limits. The specified power shall be within +/-10% of the measured power.

10 Voltage Fluctuations and Flicker Measurement

10.1 Limits

Test item	Limit	Note
P_{st}	1.0	P_{st}: short-term flicker severity.
P_{lt}	0.65	P_{lt}: long-term flicker severity.
T_{max} (ms)	500	T_{max}: maximum time duration during the observation period that the voltage deviation d(t) exceeds the limit for d_c .
d_{max} (%)	4	d_{max}: maximum absolute voltage change during an observation period.
d_c (%)	3.3	d_c: maximum steady state voltage change during an observation period.

10.2 Test instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
HARMONICS & FLICKER TEST SYSTEM EMC PARTNER	HARMONICS-1000-1P	086	Apr. 27, 2018	Apr. 26, 2019
Software EMC PARTNER	HARCS_V4.2	NA	NA	NA

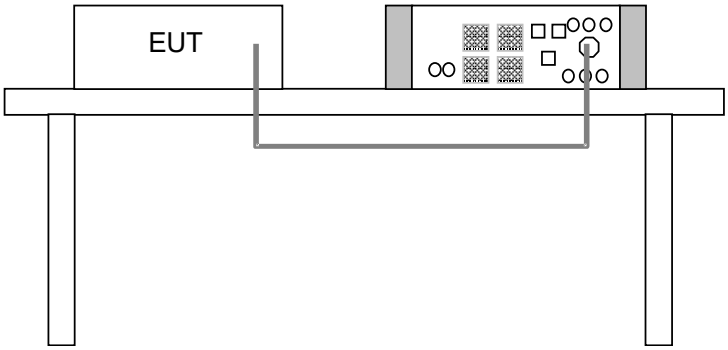
Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in EMS-1 room.
3. Tested Date: Aug. 01, 2018

10.3 Test Arrangement

a. 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.

b. During the flick measurement, the measure time shall include that part of whole operation cycle in which the EUT produce the most unfavorable sequence of voltage changes. The observation period for short-term flicker indicator is 10 minutes and the observation period for long-term flicker indicator is 2 hours.



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

10.4 Supplementary Information

There is not any deviation from the test standards for the test method.

10.5 Test Results

Observation (T_p)	10 min.	Power Frequency	50 Hz
Fundamental Voltage/Ampere	230.1 Vrms / 0.026 Arms	Power Factor	0.411
Power Consumption	2.473W	Tested by	Leon Wu
Enviromental Conditions	22 °C, 66 % RH	Test Mode	Mode 1

Test Parameter	Measurement Value	Limit	Remarks
P_{st}	0.072	1.00	Pass
P_{lt}	0.072	0.65	Pass
T_{max} (ms)	0.000	500	Pass
d_{max} (%)	0.000	4	Pass
d_c (%)	0.000	3.3	Pass

Note: (1) P_{st} means short-term flicker indicator.
(2) P_{lt} means long-term flicker indicator.
(3) T_{max} means accumulated time value of d(t) with a deviation exceeding 3.3 %.
(4) d_{max} means maximum relative voltage change.
(5) d_c means maximum relative steady-state voltage change.

11 General Immunity requirements (For standard: EN 301 489)

EN 301 489-series, Immunity requirements			
Clause	Reference standard	Test specification	Performance Criterion
9.3	EN 61000-4-2 ESD	Enclosure port: ±8kV Air discharge, ±4kV Contact discharge	TT/TR
9.2	EN 61000-4-3 RS	Enclosure port: 80-6000 MHz, 3V/m	CT/CR*
9.4	EN 61000-4-4 EFT	Signal ports, Wired network ports and control ports: xDSL port: ±0.5kV, 5/50 T_r/T_h ns, 100kHz other ports: ±0.5kV, 5/50 T_r/T_h ns, 5kHz Input DC power ports: ±0.5kV, 5/50 T_r/T_h ns, 5kHz Input AC Power ports: ±1kV, 5/50 T_r/T_h ns, 5kHz	TT/TR
9.8	EN 61000-4-5 Surge	For symmetrically operated, wired network ports (directly connected to outdoor cables): ±1kV, 10/700 T_r/T_h μs For non-symmetrically operated, wired network ports (directly connected to outdoor cables):±1kV and ±0.5kV, 1.2/50 T_r/T_h μs For wired network ports (indoor cables, longer than 30 m): ±0.5kV, 1.2/50 T_r/T_h μs	TT/TR
		Input AC Power ports: Wired network centres: line to line: ±0.5kV, 1.2/50 T_r/T_h μs line to ground: ±1kV, 1.2/50 T_r/T_h μs others: line to line: ±1kV, 1.2/50 T_r/T_h μs line to ground: ±2kV, 1.2/50 T_r/T_h μs	TT/TR
9.5	EN 61000-4-6 CS	Signal ports, Wired network ports, control ports and DC power ports(if cables length > 3m): 0.15-80 MHz, 3V, 80% AM (1kHz) AC Power ports: 0.15-80 MHz, 3V, 80% AM (1kHz)	CT/CR
9.7	EN 61000-4-11 Dips & Interruptions	AC Power ports: Voltage Dips: 0% residual, 0.5 cycle 0% residual, 1 cycle 70% residual, 25 cycles (at 50Hz) Voltage Interruptions: 0% residual, 250 cycles (at 50 Hz) EUT with battery back-up EUT without battery back-up	 TT/TR TT/TR TT/TR TT/TR Recoverable by user or better

* By the applicant's requirement, the RS test with standard EN 61000-4-3 of EN 301 489-19/-52 test is not performed.

11.1 Performance Criteria

General Performance Criteria

- Performance criteria for continuous phenomena applied to transmitters and receivers (CT/CR)

During and after the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer when the apparatus is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance.

During the test the EUT shall not unintentionally transmit or change its actual operating state and stored data.

If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

- Performance criteria for transient phenomena applied to transmitters and receivers (TT/TR)

After the test, the apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed below a permissible performance level specified by the manufacturer, when the apparatus is used as intended. In some cases this permissible performance level may be replaced by a permissible loss of performance.

During the EMC exposure to an electromagnetic phenomenon, a degradation of performance is, however, allowed. No change of the actual mode of operation (e.g. unintended transmission) or stored data is allowed.

If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be deduced from the product description and documentation and what the user may reasonably expect from the apparatus if used as intended.

- Performance criteria for equipment which does not provide a continuous communication link

For radio equipment which does not provide a continuous communication link, the performance criteria described in CT/CR and TT/TR are not appropriate, then the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation of performance during and/or after the immunity tests.

The performance criteria specified by the manufacturer shall give the same degree of immunity protection as called for in CT/CR and TT/TR.

- Performance criteria for ancillary equipment tested on a stand alone basis

If ancillary equipment is intended to be tested on a stand alone basis, the performance criteria described in CT/CR and TT/TR are not appropriate, then the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation of performance during and/or after the immunity tests.

The performance criteria specified by the manufacturer shall give the same degree of immunity protection as called for in CT/CR and TT/TR.

Product Specific Performance Criteria

The particular performance criteria which are specified in the relevant part of EN 301 489 series dealing with the particular type of radio equipment, take precedence over the corresponding parts of the general performance criteria.

Where particular performance criteria for specific functions are not given, then the general performance criteria shall apply.

EN 301 489-17, Broadband Data Transmission Systems

The performance criteria are:

- performance criteria A for immunity tests with phenomena of a continuous nature (CT/CR);
- performance criteria B for immunity tests with phenomena of a transient nature (TT/TR);
- performance criteria C for immunity tests with power interruptions exceeding a certain time.

Special conditions for EN 301489-17		
Criteria	During test	After test
A	Shall operate as intended. May show degradation of performance (see note1). Shall be no loss of function. Shall be no unintentional transmissions.	Shall operate as intended. Shall be no degradation of performance (see note 2). Shall be no loss of function. Shall be no loss of stored data or user programmable functions.
B	May show loss of function (one or more). May show degradation of performance (see note 1). No unintentional transmissions.	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no degradation of performance (see note 2). Shall be no loss of stored data or user programmable functions.
C	May be loss of function (one or more).	Functions shall be recoverable by the operator. Shall operate as intended after recovering. Shall be no degradation of performance (see note 2).

Note 1: Degradation of performance during the test is understood as a degradation to a level not below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance.

If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.

Note 2: No degradation of performance after the test is understood as no degradation below a minimum performance level specified by the manufacturer for the use of the apparatus as intended. In some cases the specified minimum performance level may be replaced by a permissible degradation of performance. After the test no change of actual operating data or user retrievable data is allowed.

If the minimum performance level or the permissible performance degradation is not specified by the manufacturer then either of these may be derived from the product description and documentation (including leaflets and advertising) and what the user may reasonably expect from the apparatus if used as intended.

EN 301 489-19, for Receive Only Mobile Earth Stations (ROMES) and GNSS receivers
General performance criteria
If the EUT is of a non specialized nature or the EUT is combined with an ancillary equipment, the test modulation, test arrangements, etc. as required in clause 4 shall apply.
The EUT, for all immunity tests according to the standard, except the spot frequency test of the immunity test with radiated RF electromagnetic fields (see ETSI EN 301 489-1, clause 9.2), shall be assessed for:

- the storage of messages in the memory of the EUT at the start of the test;
- unintentional responses of the EUT during the test;
- the maintenance of the EUT memory assessed at the conclusion of the test;
- the ability to receive and store messages at the conclusion of the test.

For the spot frequency test of the immunity test with radiated RF electromagnetic fields (see ETSI EN 301 489-1, clause 9.2) the EUT shall be assessed by monitoring the accuracy of the call received alert signal.
Performance criteria for Continuous phenomena applied to ROMES and ROGNSS receivers (CR)
For the EUT, excluding spot frequency tests as part of the immunity test with radiated RF electromagnetic fields (see ETSI EN 301 489-1, clause 9.2):

- the general performance criteria set out in ETSI EN 301 489-19, clause 6.1;
- during the test no false calls shall occur;
- at the conclusion of the test comprising the series of individual exposures the EUT shall operate as intended with no loss of functions or stored data (messages), as declared by the manufacturer.

For the spot frequency test as part of the immunity test with radiated RF electromagnetic fields (see ETSI EN 301 489-1, clause 9.2) the EUT shall be assessed by monitoring the accuracy of the call received alert signal.
Performance criteria for Transient phenomena applied to ROMES and ROGNSS receivers (TR)
For the EUT:

- the general performance criteria set out in ETSI EN 301 489-19, clause 6.1;
- during the test no false calls shall occur;

at the conclusion of the test comprising the series of individual exposures, the EUT shall operate as intended with no loss of function and/or stored data (messages), as declared by the manufacturer.
Performance criteria for equipment which does not provide a continuous communication link
For EUTs of a specialized nature and/or ancillary equipment tested on a stand alone basis the manufacturer shall define the method of test to determine the acceptable level of performance or degradation of performance during and/or after the test. Under these circumstances the manufacturer will also provide the following information:

- the primary functions of the equipment to be tested during and after EMC stress;
- the intended functions of the EUT which shall be in accordance with the documentation accompanying the equipment;
- the pass/failure criteria for the equipment;
- the method of observing a degradation of performance of the equipment.

The assessment of the performance or the degradation of performance which shall be carried out during and/or at the conclusion of the tests, shall be simple, but at the same time give adequate proof that the primary functions of the equipment are operational.

EN 301 489-52, GSM and DCS

The equipment shall meet the performance criteria specified in this clause.

Portable equipment intended for use whilst powered by the main battery of a vehicle shall additionally fulfill the applicable requirements set out in EN 301 489-1, clauses 7.1 and 7.2 for mobile equipment.

Portable or mobile equipment powered by the AC mains shall additionally fulfill the applicable requirements of EN 301 489-1, clauses 7.1 and 7.2 for radio and ancillary equipment for fixed use.

The establishment and maintenance of a communications link, the assessment of RXQUAL, and the assessment of the audio breakthrough by monitoring the speech output signal level, are used as performance criteria to ensure that all primary functions of the transmitter and receiver are evaluated during the immunity tests. In addition, the test shall also be performed in idle mode to ensure the transmitter does not unintentionally operate.

The maintenance of a communications link shall be assessed using an indicator which may be part of the test system or the EUT.

If equipment is of a specialized nature, such that the performance criteria described in the following clauses are not appropriate, then the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation of performance during and/or after the immunity tests. The performance specification shall be included in the product description and documentation.

The performance criteria specified by the manufacturer shall give the same degree of immunity protection as called for in the following clauses.

The phenomena allowed during and after test are stated in the following table.

Special conditions for Draft EN 301 489-52 V1.1.0	
Criteria	During / After Test
CT	A communication link shall be established at the start of the test, and maintained during the test, see clauses 4.2.3 and 4.2.4. During the test, the uplink speech output level shall be at least 35 dB less than the previously recorded reference levels, when measured through an audio band pass filter of width 200 Hz, centred on 1 kHz. Note: When there is a high level background noise present the filter bandwidth can be reduced down to a minimum of 40 Hz. At the conclusion of the test, the EUT shall operate as intended with no loss of user control functions or stored data, and the communication link shall have been maintained. In addition to confirming the above performance during a call, the test shall also be performed in idle mode, and the transmitter shall not unintentionally operate.
TT	A communications link shall be established at the start of the test, see clauses 4.2 to 4.2.4. At the conclusion of each exposure the EUT shall operate with no user noticeable loss of the communication link. At the conclusion of the total test comprising the series of individual exposures, the EUT shall operate as intended with no loss of user control functions or stored data, as declared by the manufacturer, and the communication link shall have been maintained. In addition to confirming the above performance during a call, the test shall also be performed in idle mode, and the transmitter shall not unintentionally operate.
CR	A communications link shall be established at the start of the test, clauses 4.2 to 4.2.6. During the test, the RXQUAL of the downlink shall not exceed the value of three, measured during each individual exposure in the test sequence. During the test, the downlink speech output level shall be at least 35 dB less than the previously recorded reference levels, when measured through an audio band pass filter of width 200 Hz, centred on 1 kHz. Note: When there is a high level background noise present the filter bandwidth can be reduced down to a minimum of 40 Hz. At the conclusion of the test, the EUT shall operate, as intended with no loss of user control functions or stored data, and the communication link shall have been maintained.
TR	A communications link shall be established at the start of the test, clauses 4.2 to 4.2.6. At the conclusion of each exposure the EUT shall operate with no user noticeable loss of the communication link. At the conclusion of the total test comprising the series of individual exposures, the EUT shall operate as intended with no loss of user control functions or stored data, as declared by the manufacturer, and the communication link shall have been maintained.
Ancillary equipment tested on a stand alone bases	The provision of EN 301 489-1, clause 6.4 shall apply.

EN 301 489-52, UTRA and E-UTRA, Mobile and Portable UE

The equipment shall meet the performance criteria specified in this clause.

The maintenance of a communications link shall be assessed by using an indicator, which may be part of the test system or the equipment under test.

If an equipment is of a specialized nature, that the performance criteria described in the following clauses are not appropriate, then the manufacturer shall declare, for inclusion in the test report, his own specification for an acceptable level of performance or degradation of performance during and/or after testing, as required by the present document.

The performance criteria specified by the manufacturer shall give the same degree of immunity protection as called for in the following clauses.

In addition, the test shall also be performed in idle mode to ensure the transmitter does not unintentionally operate.

The requirements apply to all types of UTRA and E-UTRA (FDD or TDD) for the UE.

Special conditions for Draft EN 301 489-52 V1.1.0	
Criteria	During / After Test
CT/CR	A communication link shall be established at the start of the test, and maintained during the test. In the speech mode, the performance criteria shall be that the Up Link and Down Link speech output levels shall be at least 35 dB less than the recorded reference levels, when measured through an audio band pass filter of width 200 Hz, centred on 1 kHz (annex B). Note: When there is a high level of background audio noise present, the filter bandwidth can be reduced down to a minimum of 40 Hz. At the conclusion of the test, the EUT shall operate as intended with no loss of user control functions or stored data, and the communication link shall have been maintained. In addition to confirming the above performance in traffic mode, the test shall be performed in idle mode, and the transmitter shall not unintentionally operate. ● UTRA In the data transfer mode, the performance criteria can be one of the following: • if the BER (as referred in TS 134 109) is used, it shall not exceed 0,001 during the test sequence; • if the BLER (as referred in TS 134 109) is used, it shall not exceed 0,01 during the test sequence. The BLER calculation shall be based on evaluating the CRC on each transport block. ● E-UTRA In the data transfer mode, the performance criteria shall be that the throughput shall be ≥ 95 % of the maximum throughput of the reference measurement channel as specified in annex C in TS 136 101 with parameters specified in tables 7.3.1-1 and 7.3.1-2 in TS 136 101 during the test sequence.
TT/TR	A communications link shall be established at the start of the test. At the conclusion of each exposure the EUT shall operate with no user noticeable loss of the communication link. At the conclusion of the total test comprising the series of individual exposures, the EUT shall operate as intended with no loss of user control functions or stored data, as declared by the manufacturer, and the communication link shall have been maintained. In addition to confirming the above performance in traffic mode, the test shall also be performed in idle mode, and the transmitter shall not unintentionally operate.

12 Electrostatic Discharge Immunity Test (ESD)

12.1 Test Specification

Basic Standard:	EN 61000-4-2
Discharge Impedance:	330 ohm / 150 pF
Discharge Voltage:	Air Discharge : ±2, ±4, ±8kV (Direct) Contact Discharge : ±2, ±4kV (Direct/Indirect)
Number of Discharge:	Minimum 20 times at each test point
Discharge Mode:	Single Discharge
Discharge Period:	1 second minimum

12.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
ESD Simulator NoiseKen	ESS-2002	ESS0625212/244	May 02, 2018	May 01, 2019

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in ESD-1 room
3. Tested Date: Aug. 06, 2018

12.3 Test Arrangement

a. Electrostatic discharges were applied only to those points and surfaces of the EUT that are accessible to users during normal operation.

b. The test was performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.

c. The time interval between two successive single discharges was at least 1 second.

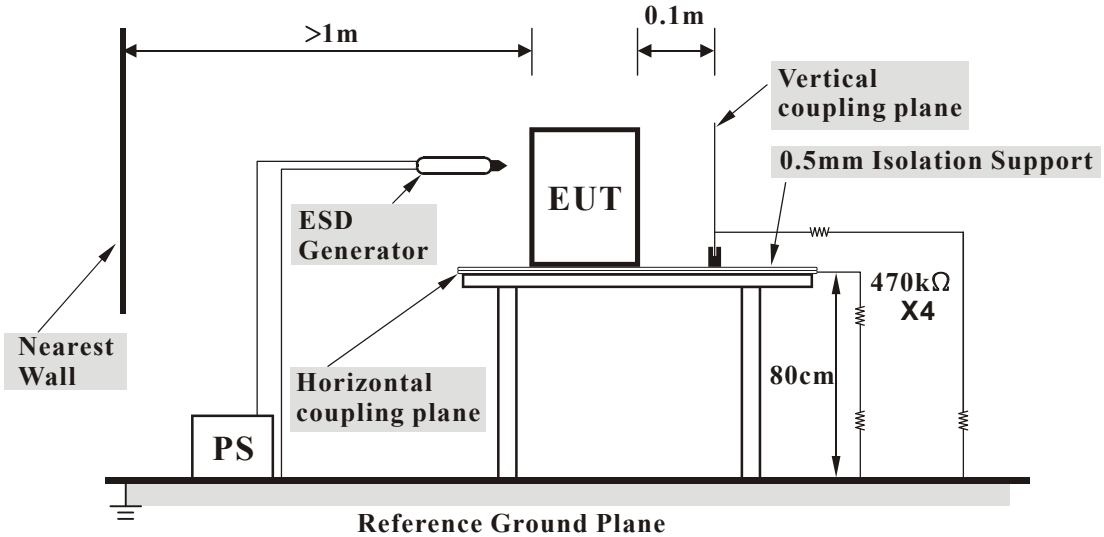
d. The ESD generator was held perpendicularly to the surface to which the discharge was applied and the return cable was at least 0.2 meters from the EUT.

e. Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.

f. Air discharges were applied with the round discharge tip of the discharge electrode approaching the EUT as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator was removed from the EUT and re-triggered for a new single discharge. The test was repeated until all discharges were complete.

g. At least ten single discharges (in the most sensitive polarity) were applied to the **H**orizontal **C**oupling **P**lane at points on each side of the EUT. The ESD generator was positioned at a distance of 0.1 meters from the EUT with the discharge electrode touching the **HCP.**

h. At least ten single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the **V**ertical **C**oupling **P**lane in sufficiently different positions that the four faces of the EUT were completely illuminated. The **VCP** (dimensions 0.5m x 0.5m) was placed vertically to and 0.1 meters from the EUT.



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

NOTE:

TABLE-TOP EQUIPMENT

The configuration consisted of a wooden table 0.8 meters high standing on the **G**round **R**eference **P**lane. The **GRP** consisted of a sheet of aluminum at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system. A **H**orizontal **C**oupling **P**lane (1.6m x 0.8m) was placed on the table and attached to the **GRP** by means of a cable with 940kΩ total impedance. The equipment under test, was installed in a representative system as described in section 7 of EN/IEC 61000-4-2, and its cables were placed on the **HCP** and isolated by an insulating support of 0.5mm thickness. A distance of 1-meter minimum was provided between the EUT and the walls of the laboratory and any other metallic structure.

FLOOR-STANDING EQUIPMENT

The equipment under test was installed in a representative system as described in section 7 of IEC 61000-4-2, and its cables were isolated from the Ground Reference Plane by an insulating support of 0.1-meter thickness. The GRP consisted of a sheet of aluminum that is at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system and extended at least 0.5 meters from the EUT on all sides.

12.4 Supplementary Information

There is not any deviation from the test standards for the test method.

12.5 Test Results

12.5.1 For Standard EN 301 489-1 V2.1.1 and EN 301 489-17 V3.1.1

Input Power	230Vac, 50Hz	Tested by	Leon Wu
Environmental Conditions	23 °C, 49% RH 1021 mbar	Test Mode	Mode 1

Test Results of Direct Application					
Discharge Level (kV)	Polarity (+/-)	Test Point	Contact Discharge	Air Discharge	Performance Criterion
2, 4	+/-	1~7	Note 1	NA	TT/TR
2, 4, 8	+/-	8~12	NA	Note 1	TT/TR

Description of test points of direct application: Please refer to following page for representative mark only.

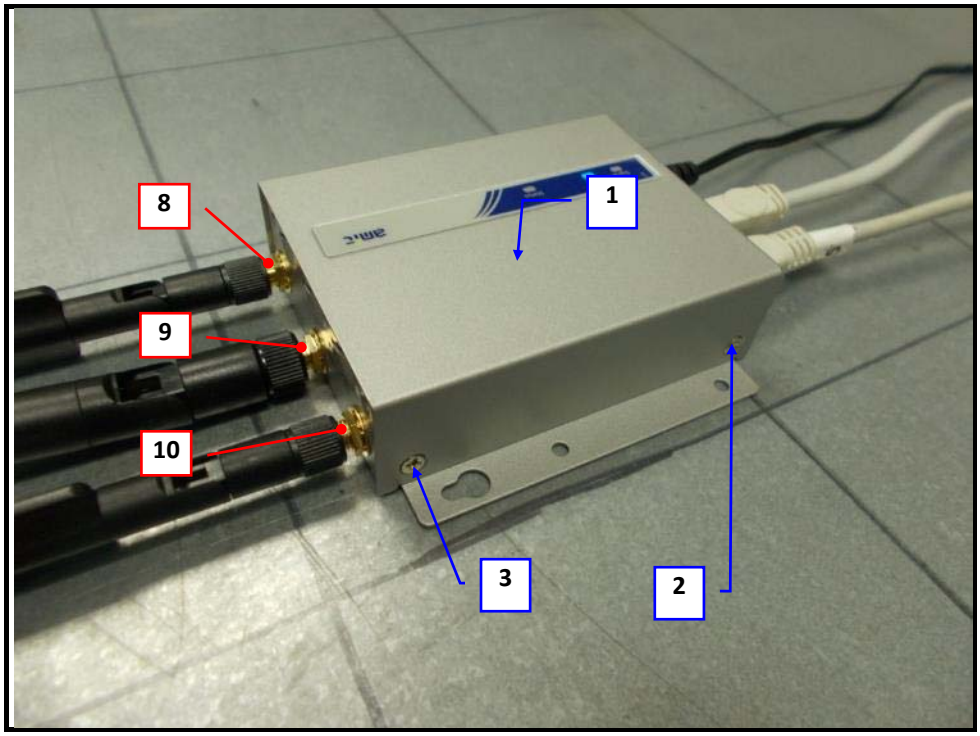
Test Results of Indirect Application					
Discharge Level (kV)	Polarity (+/-)	Test Point	Horizontal Coupling Plane	Vertical Coupling Plane	Performance Criterion
2, 4	+/-	Four Sides	Note 1	Note 1	TT/TR

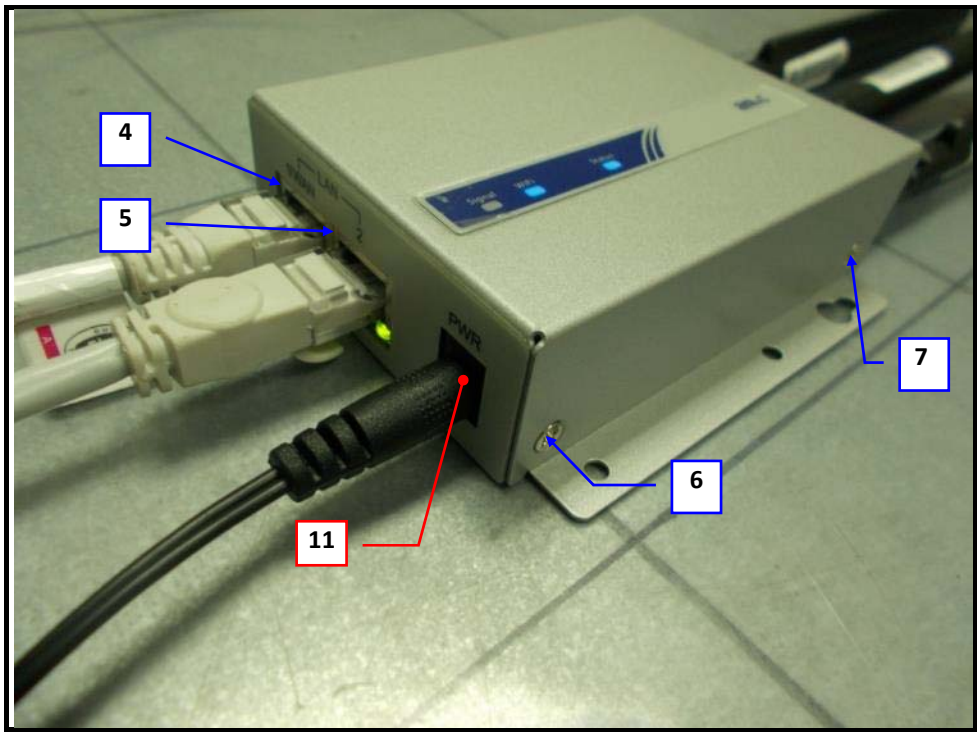
Description of test points of indirect application:

1. Front side 2. Rear side 3. Right side 4. Left side

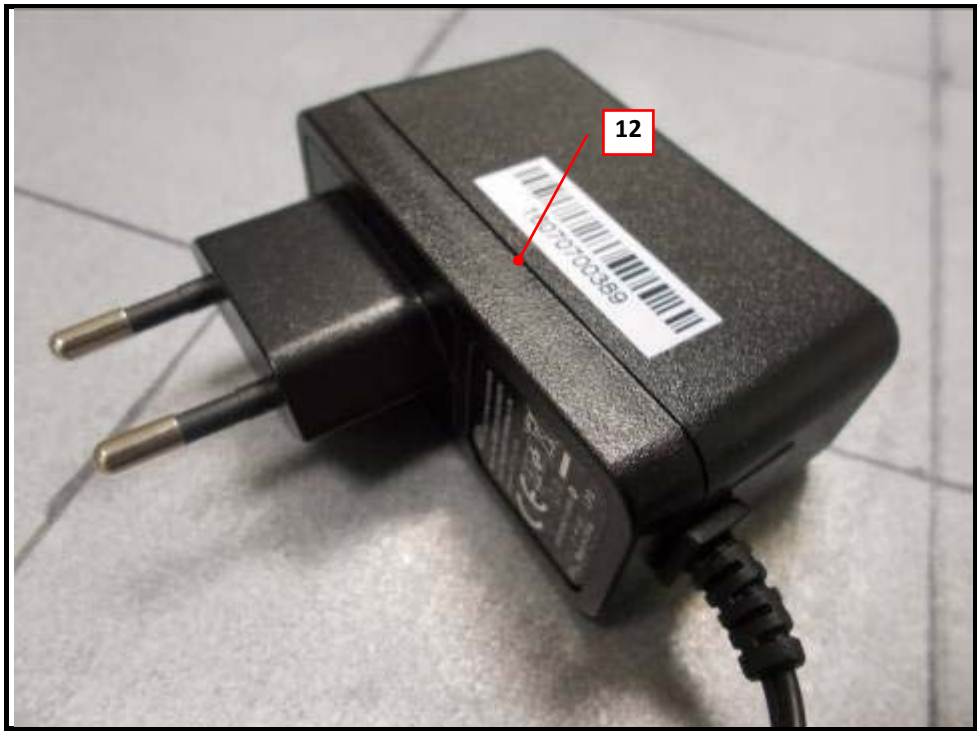
Note: 1. The EUT is operated normal during the test.

DESCRIPTION OF TEST POINT





DESCRIPTION OF TEST POINT



12.5.2 For Standard EN 301 489-1 V2.1.1 and draft EN 301 489-19 V2.1.0

Input Power	230Vac, 50Hz	Tested by	Leon Wu
Environmental Conditions	23 °C, 49% RH 1021 mbar	Test Mode	Mode 1

Test Results of Direct Application					
Discharge Level (kV)	Polarity (+/-)	Test Point	Contact Discharge	Air Discharge	Performance Criterion
2, 4	+/-	1~8	Note 1	NA	TT/TR
2, 4, 8	+/-	9~12	NA	Note 1	TT/TR

Description of test points of direct application: Please refer to following page for representative mark only.

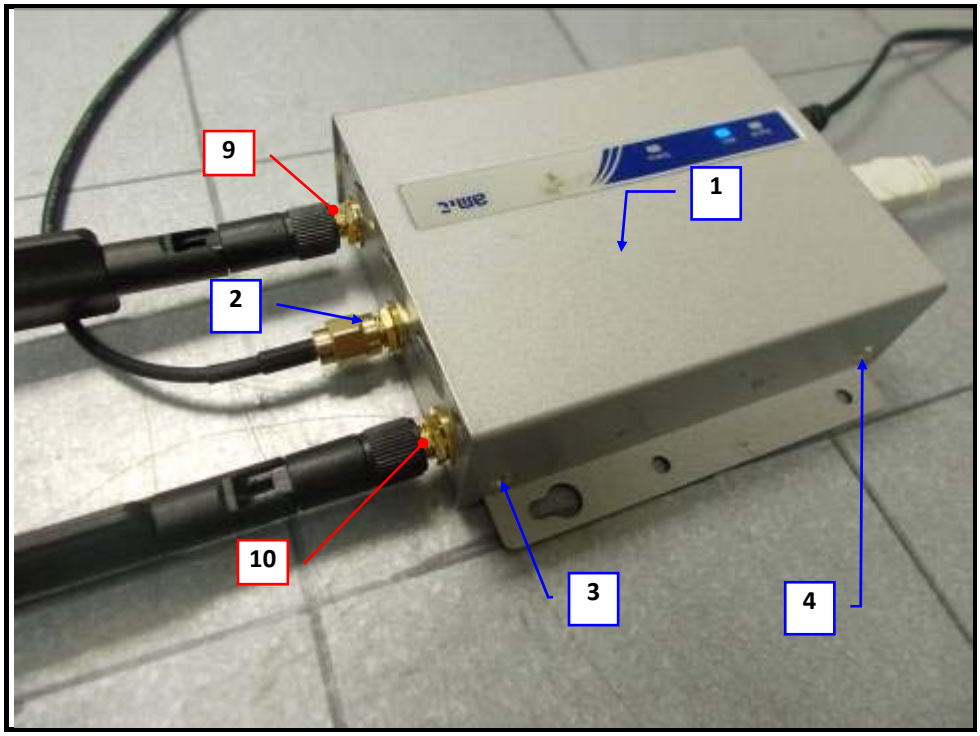
Test Results of Indirect Application					
Discharge Level (kV)	Polarity (+/-)	Test Point	Horizontal Coupling Plane	Vertical Coupling Plane	Performance Criterion
2, 4	+/-	Four Sides	Note 1	Note 1	TT/TR

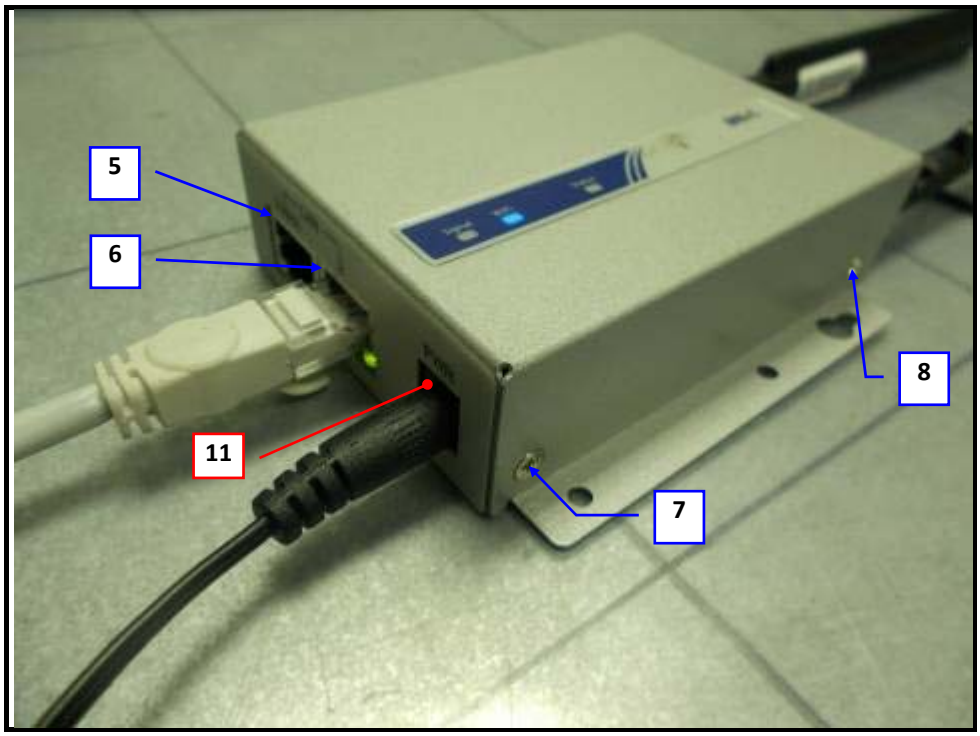
Description of test points of indirect application:

1. Front side 2. Rear side 3. Right side 4. Left side

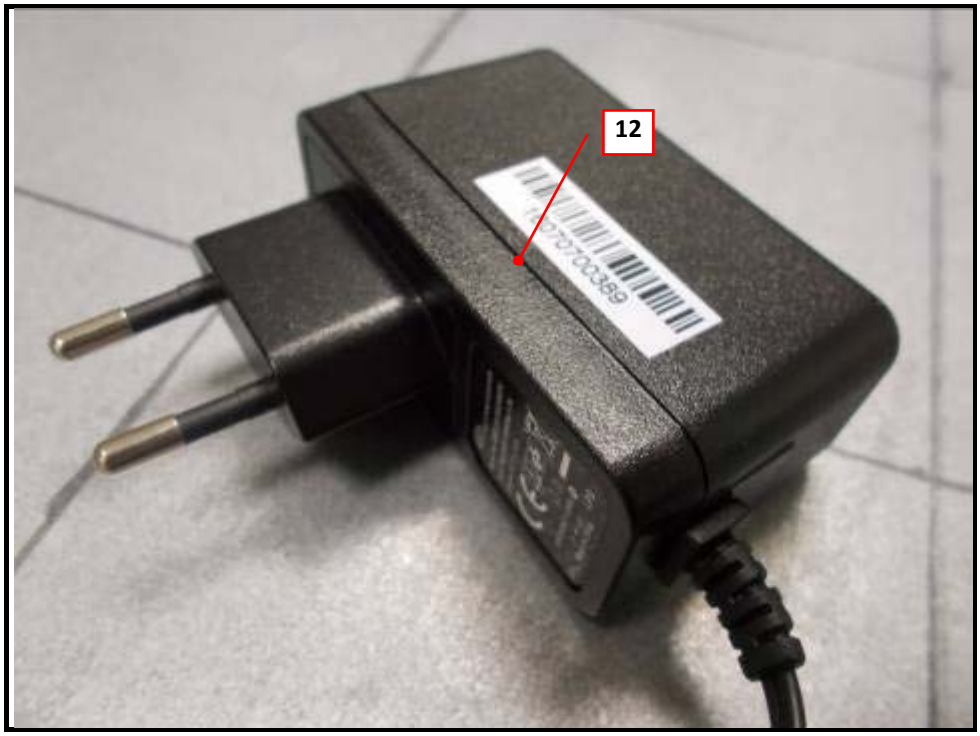
Note: 1. The EUT is operated normal during the test.

DESCRIPTION OF TEST POINT





DESCRIPTION OF TEST POINT



12.5.3 For Standard EN 301 489-1 V2.1.1 and draft EN 301 489-52 V1.1.0

Input Power	230Vac, 50Hz	Tested by	Leon Wu
Environmental Conditions	23 °C, 49% RH 1021 mbar	Test Mode	Mode 1

Test Results of Direct Application					
Discharge Level (kV)	Polarity (+/-)	Test Point	Contact Discharge	Air Discharge	Performance Criterion
2, 4	+/-	1~8	Note 1	NA	TT/TR
2, 4, 8	+/-	9~12	NA	Note 1	TT/TR

Description of test points of direct application: Please refer to following page for representative mark only.

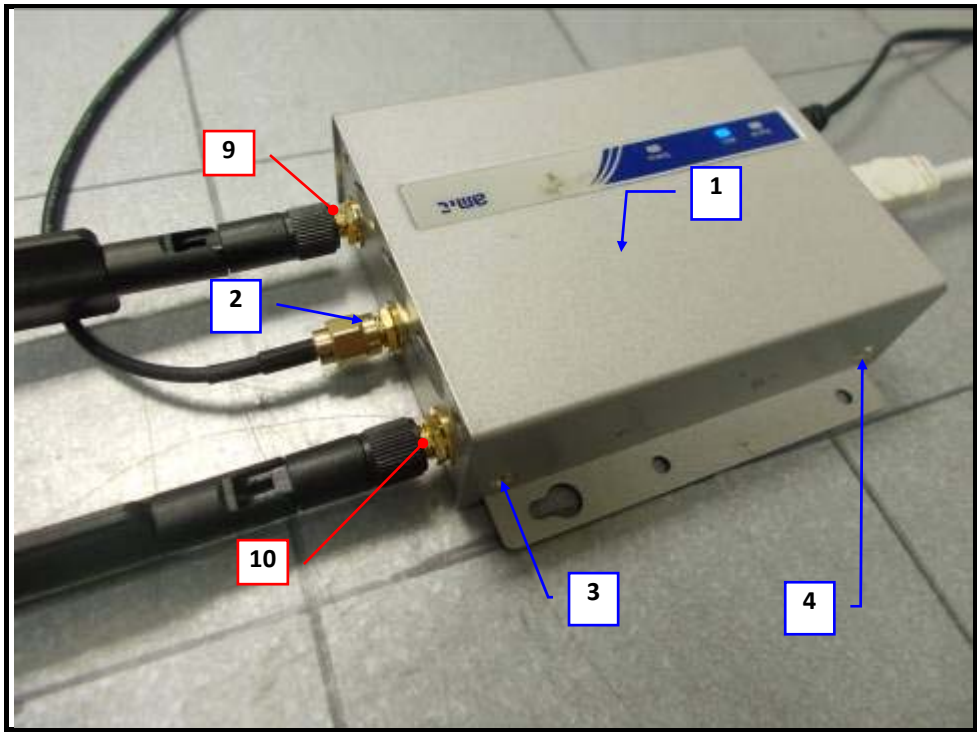
Test Results of Indirect Application					
Discharge Level (kV)	Polarity (+/-)	Test Point	Horizontal Coupling Plane	Vertical Coupling Plane	Performance Criterion
2, 4	+/-	Four Sides	Note 1	Note 1	TT/TR

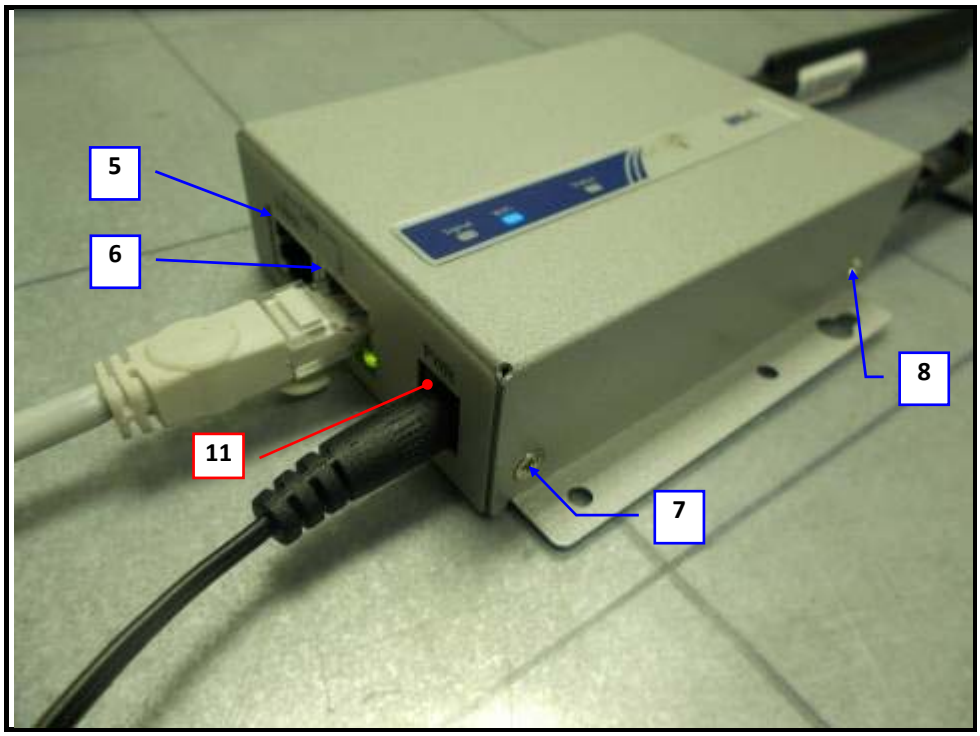
Description of test points of indirect application:

1. Front side 2. Rear side 3. Right side 4. Left side

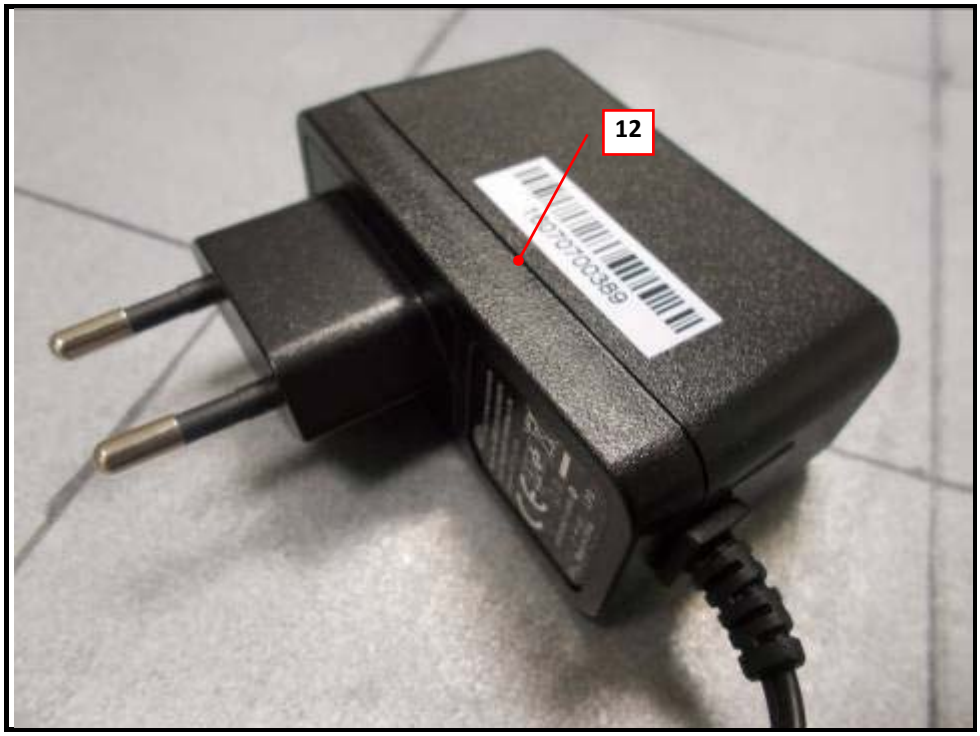
Note: 1. The EUT is operated normal during the test.

DESCRIPTION OF TEST POINT





DESCRIPTION OF TEST POINT



13 Radiated, Radio-frequency, Electromagnetic Field Immunity Test (RS)

13.1 Test Specification

Basic Standard:	EN 61000-4-3
Frequency Range:	80 MHz ~ 6000 MHz
Field Strength:	3 V/m
Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of preceding frequency value
Polarity of Antenna:	Horizontal and Vertical
Antenna Height:	1.5m
Dwell Time:	3 seconds

13.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Signal Generator KEYSIGHT	N5182B	MY53051971	Sep. 30, 2017	Sep. 29, 2018
Power Amplifier ETS-LINGREN	8100-002	00163537	NA	NA
Power Amplifier ETS-LINGREN	8100-008	00163547	NA	NA
RF Voltage Meter KEYSIGHT	N1914A	MY55326005	Sep. 26, 2017	Sep. 25, 2018
LOG ANTENNA ETS-LINGREN	3150B	00203052	NA	NA
LOG ANTENNA AR	AT5080ANT	309740	NA	NA
HORN ANTENNA ETS-LINGREN	3119	00203652	NA	NA
TILE!(Software) ETS-LINGREN	7.1.3.34	NA	NA	NA

Note:

1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Chamber RS-1Room.
3. The transmit antenna was located at a distance of 3.0 meters from the EUT.
4. Tested Date: Aug. 08, 2018

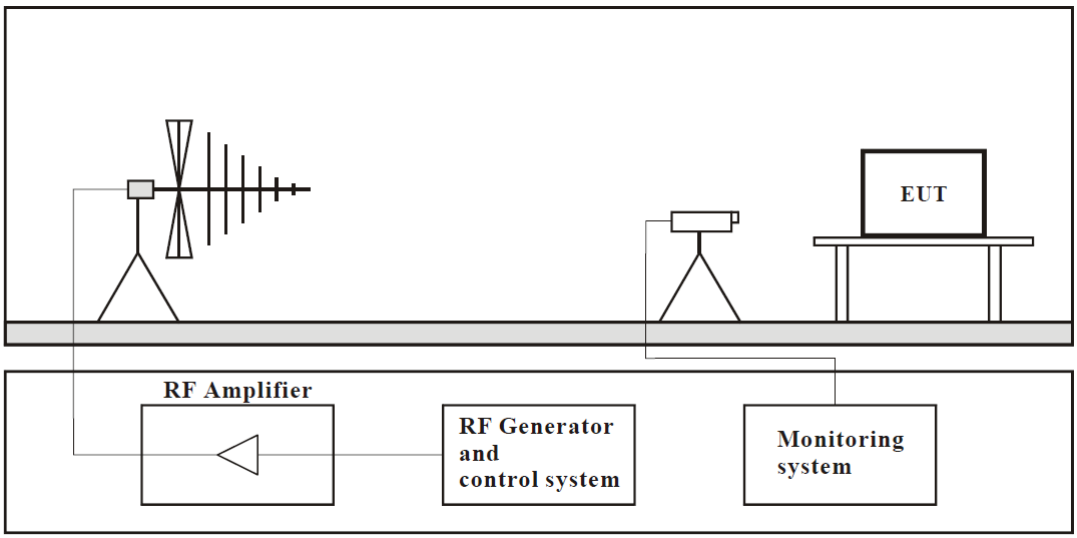
13.3 Test Arrangement

The test procedure was in accordance with EN 61000-4-3.

a. The testing was performed in a modified semi-anechoic chamber.

b. The field strength level was 3 V/m.

c. The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the two sides. (The cellular phone is like a lamina. When the EUT was placed on the table, the all sides of cellular phone have almost the same separation distance away from field generation antenna. The right (90°) and left (270°) sides are under the same field strength while the EUT was tested at front (0°) and back (180°) side. Therefore, we only tested at front and back sides of cellular phone for RS testing)



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

NOTE:

TABLETOP EQUIPMENT
The EUT installed in a representative system as described in section 7 of EN/IEC 61000-4-3 was placed on a non-conductive table 0.8 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

FLOOR STANDING EQUIPMENT
The EUT installed in a representative system as described in section 7 of EN/IEC 61000-4-3 was placed on a non-conductive wood support 0.1 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

13.4 Supplementary Information

There is not any deviation from the test standards for the test method.

13.5 Test Results

13.5.1 For Standard EN 301 489-1 V2.1.1 and EN 301 489-17 V3.1.1

Input Power	230Vac, 50Hz	Tested by	Leon Wu
Environmental Conditions	25 °C, 63% RH	Test Mode	Mode 1

Frequency (MHz)	Polarity	Azimuth(°)	Applied Field Strength		Observation	Remarks	Performance Criterion
			(V/m)	Modulation			
80 - 6000	V&H	0, 90, 180, 270	3	80% AM (1kHz)	Note 1*	Pass	CT/CR

Note: 1. The EUT is operated normal during the test.
* The EUT has function lost during 2280 MHz to 2603.5 MHz at “WIFI 2.4G” and 4880 MHz to 5995 MHz at ”WIFI 5G”. But this band is exclusion band in EN301489-17, under this condition (the function lost) that is acceptable.

14 Electrical Fast Transient/Burst Immunity Test (EFT)

14.1 Test Specification

Basic Standard:	EN 61000-4-4
Test Voltage:	Signal ports, wired network and control ports: ±0.5kV xDSL wired network ports : NA Input DC power port: NA Input AC Power ports: ±1kV
Impulse Repetition Frequency:	5kHz
Impulse Wave shape :	5/50 T_r/T_h ns
Burst Duration:	15 ms for 5kHz Repetition Frequency
Burst Period:	300 ms
Test Duration:	1 min.

14.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
TRANSIENT EMC PARTNER	TRA2000IN6	1121	Mar. 26, 2018	Mar. 25, 2019
CN-EFT100 EMC PARTNER	CN-EFT1000	352	Jan. 15, 2018	Jan. 14, 2019
Adapter	NA	SU1ADA-002	NA	NA
Software EMC PARTNER	Test Manger_V2.11	NA	NA	NA

Note:

1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in EMS-2 room
3. Tested Date: Aug. 01 to 07, 2018

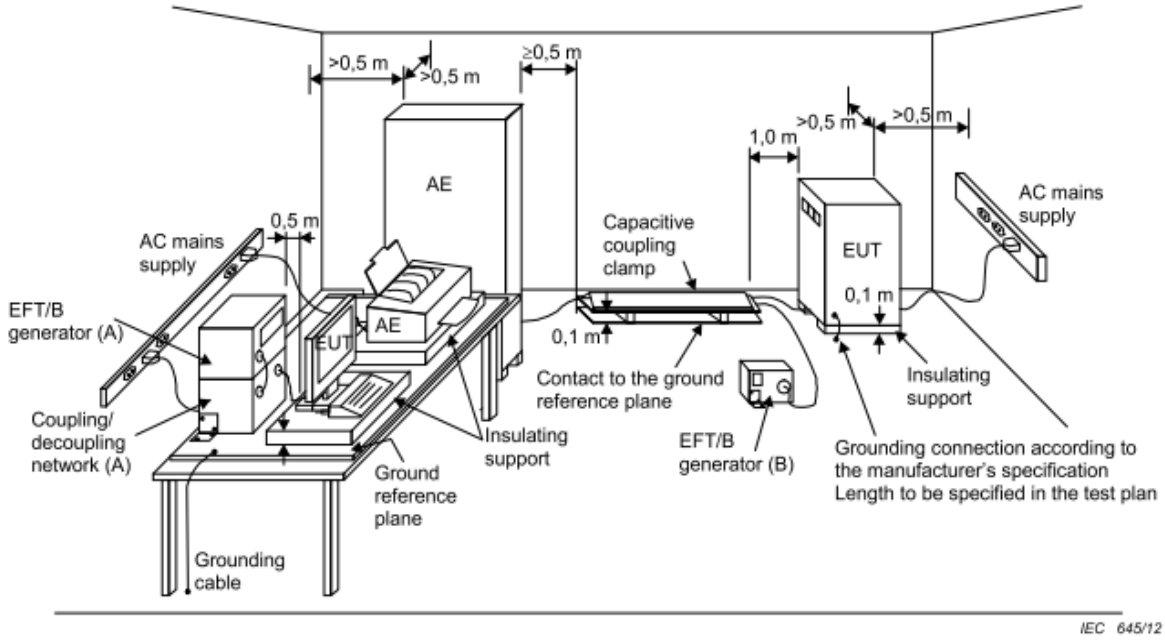
14.3 Test Arrangement

a. Both positive and negative polarity discharges were applied.

b. The distance between any coupling devices and the EUT should be 0.5 m for table-top equipment testing, and 1.0 m for floor standing equipment.

c. The duration time of each test sequential was 1 minute.

d. The transient/burst waveform was in accordance with EN 61000-4-4, 5/50 ns.



NOTE:
(A) location for supply line coupling
(B) location for signal lines coupling

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

14.4 Supplementary Information

There is not any deviation from the test standards for the test method.

14.5 Test Results

14.5.1 For Standard EN 301 489-1 V2.1.1 and EN 301 489-17 V3.1.1

Input Power	230Vac, 50Hz	Tested by	Barry Lee
Environmental conditions	26 °C, 60% RH	Test Mode	Mode 1

For input AC power port

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
1	L1	+/-	Note 1	TT/TR
1	L2	+/-	Note 1	TT/TR
1	L1-L2	+/-	Note 1	TT/TR

Signal / wired network port

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
0.5	LAN1/WAN	+/-	Note 1	TT/TR
0.5	LAN2	+/-	Note 1	TT/TR

Note: 1. The EUT is operated normal during the test.

14.5.2 For Standard EN 301 489-1 V2.1.1 and draft EN 301 489-19 V2.1.0

Input Power	230Vac, 50Hz	Tested by	Leon Wu
Environmental conditions	26 °C, 60% RH	Test Mode	Mode 1

For input AC power port

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
1	L1	+/-	Note 1	TT/TR
1	L2	+/-	Note 1	TT/TR
1	L1-L2	+/-	Note 1	TT/TR

Signal / wired network port

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
0.5	LAN2	+/-	Note 1	TT/TR

Note: 1. The EUT is operated normal during the test.

14.5.3 For Standard EN 301 489-1 V2.1.1 and draft EN 301 489-52 V1.1.0

Input Power	230Vac, 50Hz	Tested by	Leon Wu
Environmental conditions	26 °C, 60% RH	Test Mode	Mode 1

For input AC power port

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
1	L1	+/-	Note 1	TT/TR
1	L2	+/-	Note 1	TT/TR
1	L1-L2	+/-	Note 1	TT/TR

Signal / wired network port

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
0.5	LAN2	+/-	Note 1	TT/TR

Note: 1. The EUT is operated normal during the test.

15 Surge Immunity Test

15.1 Test Specification

Basic Standard:	EN 61000-4-5
Wave-Shape and Test Voltage:	Signal / wired network ports (direct to outdoor cables*): Symmetrically operated: 10/700 µs Open Circuit Voltage 5/320 µs Short Circuit Current lines to ground: NA Non-symmetrically operated: 1.2/50 µs Open Circuit Voltage 8/20 µs Short Circuit Current Line to line: NA Line to earth or ground: NA Signal / wired network ports (direct to indoor cables*): 1.2/50 µs Open Circuit Voltage 8/20 µs Short Circuit Current Line to earth or ground: ±0.5kV Input AC power port: 1.2/50 µs Open Circuit Voltage 8/20 µs Short Circuit Current Line to line: ±0.5kV, ±1kV Line to earth or ground: NA
AC Phase Angle (degree):	0°, 90°, 180°, 270°
Pulse Repetition Rate:	1 time / 20 sec.
Number of Tests:	5 positive and 5 negative at selected points

15.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Unshielded Symmetrical High-speed Interconnection Lines Coupling Decoupling Network 3ctest	CDN 405T8H	ES2761501	July 16, 2018	July 15, 2019
Adapter	NA	SU1ADA-002	NA	NA
TRANSIENT EMC PARTNER	TRA2000IN6	1121	Mar. 26, 2018	Mar. 25, 2019
Software EMC PARTNER	Test Manger_V2.11	NA	NA	NA

Note:

1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in EMS-2 room
3. Tested Date: Aug. 01 to 07, 2018

15.3 Test Arrangement

a. Input AC/DC Power ports:

The surge is to be applied to the EUT power supply terminals via the capacitive coupling network. Decoupling networks are required in order to avoid possible adverse effects on equipment not under test that may be powered by the same lines, and to provide sufficient decoupling impedance to the surge wave. The power cord between the EUT and the coupling/decoupling networks shall be 2 meters in length (or shorter).

For double-insulated products without PE or external earth connections, the test shall be done in a similar way as for grounded products but without adding any additional external grounded connections. If there are no other possible connections to earth, line-to-ground tests may be omitted.

b. Signal and telecommunication ports,

- Unshielded unsymmetrical interconnection lines:

The surge is applied to the lines via the capacitive coupling. The coupling / decoupling networks shall not influence the specified functional conditions of the EUT. The interconnection line between the EUT and the coupling/decoupling networks shall be 2 meters in length.

- Unshielded symmetrical interconnections communication lines:

The surge is applied to the lines via gas arrestors coupling. Test levels below the ignition point of the coupling arrestor cannot be specified. The interconnection line between the EUT and the coupling/decoupling networks shall be 2 meters in length.

- High speed communications lines

Prior to the test, the correct operation of the port shall be verified; the external connection shall then be removed and the surge applied directly to the port's terminals with no coupling /decoupling network. After the surge, the correct operation of the port shall again be verified.

- Shielded lines:

- Direct application,

The EUT is isolated from ground and the surge is applied to its metallic enclosure; the termination (or auxiliary equipment) at the port(s) under test is grounded. This test applies to equipment with single or multiple shielded cables.

Rules for application of the surge to shielded lines:

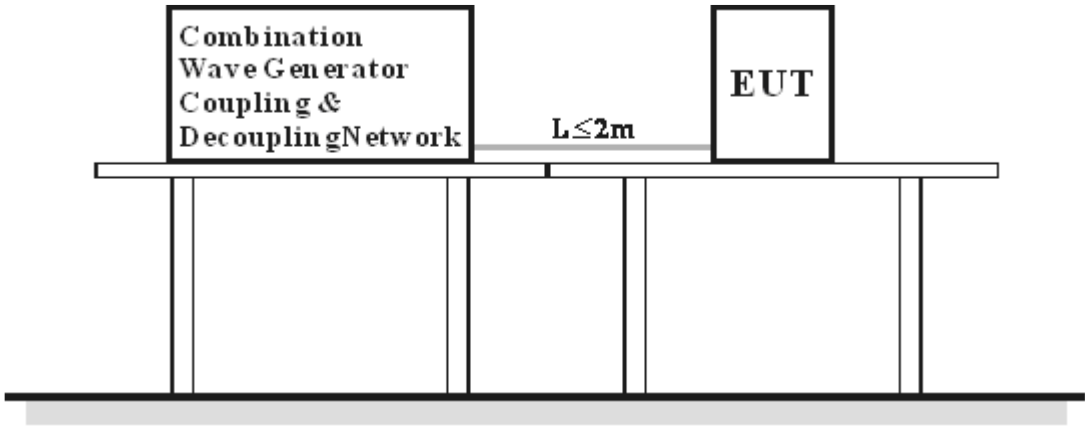
a) Shields grounded at both ends
> The surge injection on the shield.

b) Shields grounded at one end
> If in the installation the shield is connected only at the auxiliary equipment, test shall be done in that configuration but with the generator still connected to the EUT side. If cable lengths allow, the cables shall be on insulated supports 0,1 m above the ground plane or cable tray.

For products which do not have metallic enclosures, the surge is applied directly to the shielded cable.

- Alternative coupling method for testing single cables in a multi-shield configuration,

Surges are applied in close proximity to the interconnection cable under test by a wire. The length of the cable between the port(s) under test and the device attached to the other end of the cable shall be the lesser of: the maximum length permitted by the EUT's specification, or 20 m. Where the length exceeds 1 m, excess lengths of cables shall be bundled at the approximate centre of the cables with the bundles 30 cm to 40 cm in length.



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

15.4 Supplementary Information

There is not any deviation from the test standards for the test method.

15.5 Test Results

15.5.1 For Standard EN 301 489-1 V2.1.1 and EN 301 489-17 V3.1.1

Input Power	230 Vac, 50 Hz	Tested by	Barry Lee
Environmental conditions	26 °C, 60% RH	Test Mode	Mode 1

Input AC Power ports:

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
0.5, 1	L1-L2	+/-	Note 1	TT/TR

Signal and wired network ports (indoor cables, longer than 30m)

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
0.5	LAN1/WAN (indoor)	+/-	Note 2	TT/TR
0.5	LAN2 (indoor)	+/-	Note 2	TT/TR

Note: 1. The EUT is operated normal during the test.
2. The EUT appears a "request time out" message during the test, but it can be self-recoverable after the test.

15.5.2 For Standard EN 301 489-1 V2.1.1 and draft EN 301 489-19 V2.1.0

Input Power	230 Vac, 50 Hz	Tested by	Leon Wu
Environmental conditions	26 °C, 60% RH	Test Mode	Mode 1

Input AC Power ports:

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
0.5, 1	L1-L2	+/-	Note 1	TT/TR

Signal and wired network ports (indoor cables, longer than 30m)

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
0.5	LAN2 (indoor)	+/-	Note 2	TT/TR

Note: 1. The EUT is operated normal during the test.
2. The EUT appears a "request time out" message during the test, but it can be self-recoverable after the test.

15.5.3 For Standard EN 301 489-1 V2.1.1 and draft EN 301 489-52 V1.1.0

Input Power	230 Vac, 50 Hz	Tested by	Leon Wu
Environmental conditions	26 °C, 60% RH	Test Mode	Mode 1

Input AC Power ports:

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
0.5, 1	L1-L2	+/-	Note 1	TT/TR

Signal and wired network ports (indoor cables, longer than 30m)

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
0.5	LAN2 (indoor)	+/-	Note 2	TT/TR

Note: 1. The EUT is operated normal during the test.
2. The EUT appears a "request time out" message during the test, but it can be self-recoverable after the test.

16 Immunity to Conducted Disturbances Induced by RF Fields (CS)

16.1 Test Specification

Basic Standard:	EN 61000-4-6
Frequency Range:	0.15 MHz - 80 MHz
Voltage Level:	3 V
Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of preceding frequency value
Dwell Time	3 seconds

16.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Signal Generator R&S	SML01	102731	Dec. 04, 2017	Dec. 03, 2018
Amplifier AR	75A250AM2	307297	NA	NA
RF Voltage Meter BOONTON	4232A- 01	93801	Nov. 28, 2017	Nov. 27, 2018
LUTHIE EM Injection Clamp TESEQ	KEMZ801A	41344	Oct. 16, 2017	Oct. 15,2018
Coupling Decoupling Network M2 TESEQ	CDN M216	40667	Oct. 16, 2017	Oct. 15,2018
Coupling Decoupling Network M3 TESEQ	CDN M316	40119	Oct. 16, 2017	Oct. 15,2018
Coupling Decoupling Network T2 TESEQ	CDN T200A	38311	Oct. 16, 2017	Oct. 15,2018
Coupling Decoupling Network T4 TESEQ	CDN T400A	28587	Oct. 16, 2017	Oct. 15,2018
Coupling Decoupling Network T8 TESEQ	CDN T8-10	41249	Oct. 16, 2017	Oct. 15,2018
ADT CS Test Workbench(Software) BVADT	ADT_CS_7.6.4	NA	NA	NA

Note:

1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in CS-3 Room.
3. Tested Date: Aug. 01 to 07, 2018

16.3 Test Arrangement

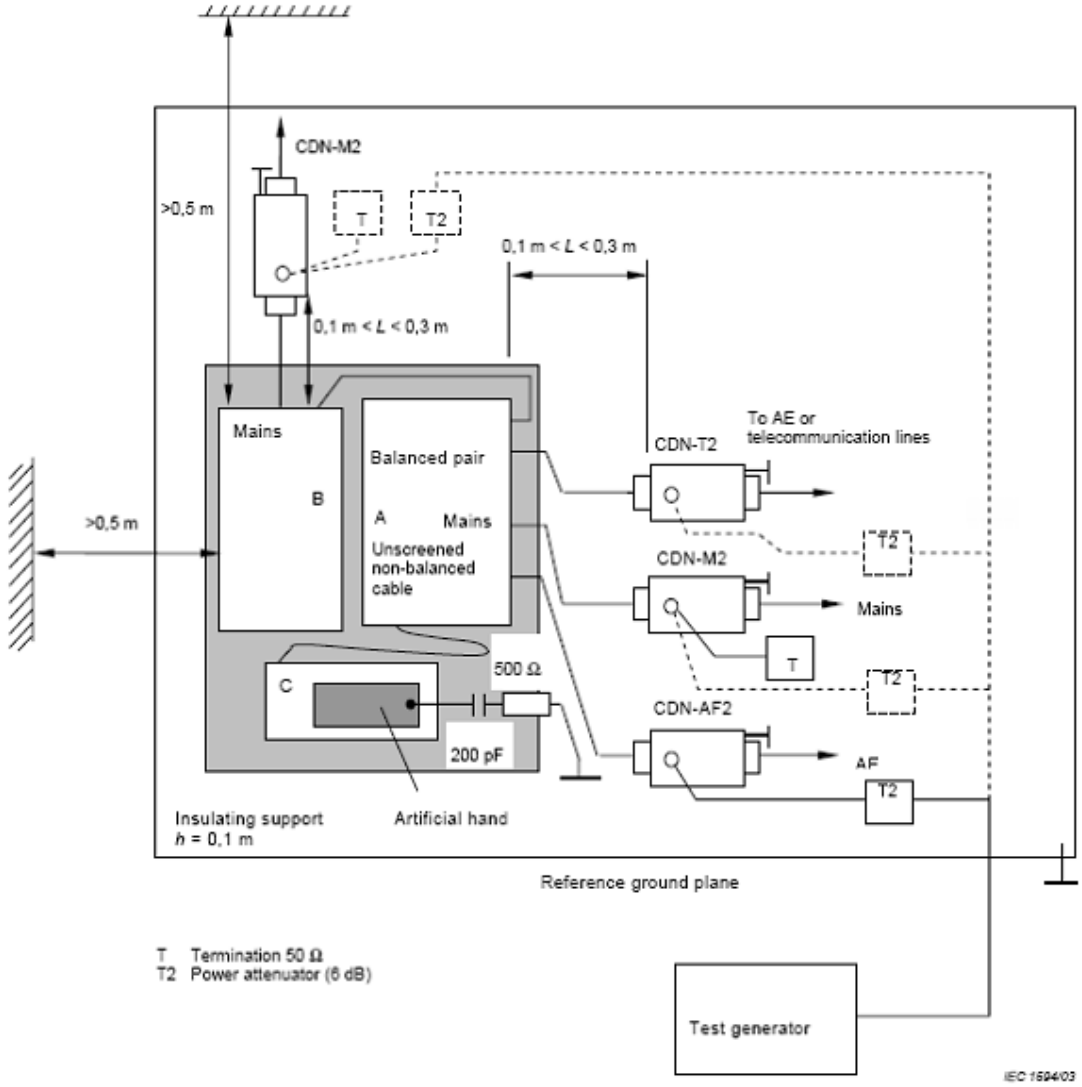
a. The EUT shall be tested within its intended operating and climatic conditions.

b. An artificial hand was placed on the hand-held accessory and connected to the ground reference plane.

c. One of the CDNs not used for injection was terminated with 50 ohm, providing only one return path. All other CDNs were coupled as decoupling networks.

d. The frequency range is swept from 150 kHz to 80 MHz, using the signal level established during the setting process and with a disturbance signal of 80 % amplitude. The signal is modulated with a 1 kHz sine wave, pausing to adjust the RF signal level or the switch coupling devices as necessary. Where the frequency is swept incrementally, the step size shall not exceed 1 % of the preceding frequency value.

e. Attempts should be made to fully exercise the EUT during testing, and to fully interrogate all exercise modes selected for susceptibility.



Note: 1.The EUT clearance from any metallic obstacles shall be at least 0,5 m.
2. Interconnecting cables (≦1 m) belonging to the EUT shall remain on the insulating support.

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

16.4 Supplementary Information

There is not any deviation from the test standards for the test method.

16.5 Test Results

16.5.1 For Standard EN 301 489-1 V2.1.1 and EN 301 489-17 V3.1.1

Input Power	230 Vac, 50 Hz	Tested by	Leon Wu
Environmental conditions	25 °C, 64% RH	Test Mode	Mode 1

Frequency (MHz)	Level (V rms)	Tested Line	Injection Method	Return Path	Observation	Remark	Performance Criterion
0.15 – 80	3	AC Power	CDN-M2	CDN-T4	Note 1	Pass	CT/CR
0.15 – 80	3	LAN1/WAN	CDN-T4	CDN-M2	Note 1	Pass	CT/CR
0.15 – 80	3	LAN2	CDN-T4	CDN-M2	Note 1	Pass	CT/CR

Note: 1. The EUT is operated normal during the test.

16.5.2 For Standard EN 301 489-1 V2.1.1 and draft EN 301 489-19 V2.1.0

Input Power	230 Vac, 50 Hz	Tested by	Leon Wu
Environmental conditions	25 °C, 64% RH	Test Mode	Mode 1

Frequency (MHz)	Level (V rms)	Tested Line	Injection Method	Return Path	Observation	Remark	Performance Criterion
0.15 – 80	3	AC Power	CDN-M2	CDN-T4	Note 1	Pass	CT/CR
0.15 – 80	3	LAN2	CDN-T4	CDN-M2	Note 1	Pass	CT/CR

Note: 1. The EUT is operated normal during the test.

16.5.3 For Standard EN 301 489-1 V2.1.1 and draft EN 301 489-52 V1.1.0

Input Power	230 Vac, 50 Hz	Tested by	Leon Wu
Environmental conditions	25 °C, 64% RH	Test Mode	Mode 1

Frequency (MHz)	Level (V rms)	Tested Line	Injection Method	Return Path	Observation	Remark	Performance Criterion
0.15 – 80	3	AC Power	CDN-M2	CDN-T4	Note 1	Pass	CT/CR
0.15 – 80	3	LAN2	CDN-T4	CDN-M2	Note 1	Pass	CT/CR

Note: 1. The EUT is operated normal during the test.

17 Voltage Dips and Interruptions

17.1 Test Specification

Basic Standard:	EN 61000-4-11
Test levels:	Voltage Dips: 0% residual voltage for 0.5 cycle 0% residual voltage for 1 cycle 70% residual voltage for 25 cycles Voltage Interruptions: 0% residual voltage for 250 cycles
Interval between Event:	10 seconds
Sync Angle (degrees):	0° / 180°
Test Cycle:	3 times

17.2 Test Instruments

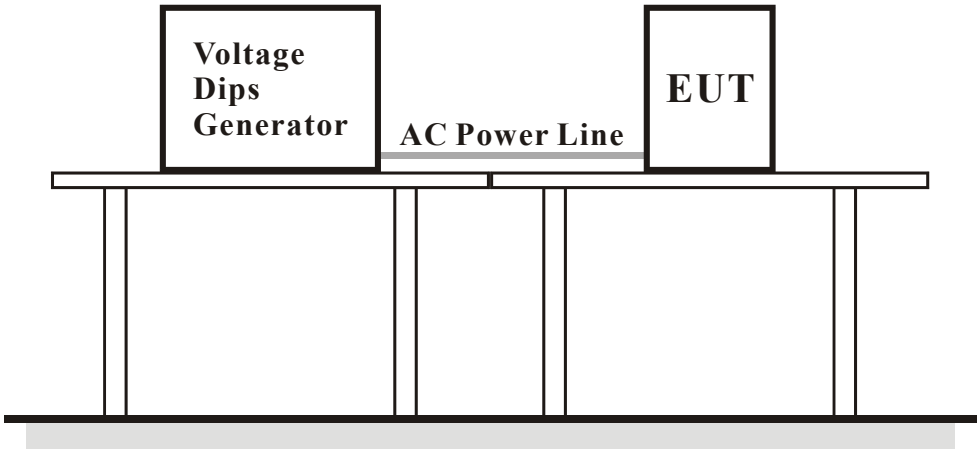
DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
TRANSIENT EMC PARTNER	TRA2000IN6	1121	Mar. 26, 2018	Mar. 25, 2019
Adapter	NA	SU1ADA-002	NA	NA
Software EMC PARTNER	Test Manger_V2.11	NA	NA	NA

Note:

1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in EMS-2 room
3. Tested Date: Aug. 01, 2018

17.3 Test Arrangement

The EUT was tested for each selected combination of test levels and duration with a sequence of three dips/interruptions with intervals of 10s minimum (between each test event). Each representative mode of operation shall be tested. Abrupt changes in supply voltage shall occur at zero crossings of the voltage waveform.



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

17.4 Supplementary Information

There is not any deviation from the test standards for the test method.

17.5 Test Results

17.5.1 For Standard EN 301 489-1 V2.1.1 and EN 301 489-17 V3.1.1

Input Power	230Vac / 240Vac / 100Vac, 50 Hz	Tested by	Barry Lee
Environmental Conditions	26 °C, 60% RH	Test mode	Mode 1

Input Power for testing: 230Vac, 50 Hz (Nominal input Voltage)					
Voltage Residual (%)	Duration (cycles)	Interval (sec)	Times	Observation	Performance Criterion
0	0.5	10	3	Note 1	TT/TR
0	1	10	3	Note 1	TT/TR
70	25	10	3	Note 1	TT/TR
0	250	10	3	Note 2	TT/TR

Input Power for testing: 240Vac, 50 Hz (Maximum rated input voltage)					
Voltage Residual (%)	Duration (cycles)	Interval (sec)	Times	Observation	Performance Criterion
0	0.5	10	3	Note 1	TT/TR
0	1	10	3	Note 1	TT/TR
70	25	10	3	Note 1	TT/TR
0	250	10	3	Note 2	TT/TR

Input Power for testing: 100Vac, 50 Hz (Minimum rated input voltage)					
Voltage Residual (%)	Duration (cycles)	Interval (sec)	Times	Observation	Performance Criterion
0	0.5	10	3	Note 1	TT/TR
0	1	10	3	Note 1	TT/TR
70	25	10	3	Note 1	TT/TR
0	250	10	3	Note 2	TT/TR

Note: 1. The EUT is operated normal during the test.
2. The EUT appears a “reboot” phenomena during the test, but it can be self-recoverable after the test.

17.5.2 For Standard EN 301 489-1 V2.1.1 and draft EN 301 489-19 V2.1.0

Input Power	230Vac / 240Vac / 100Vac, 50 Hz	Tested by	Barry Lee
Environmental Conditions	26 °C, 60% RH	Test mode	Mode 1

Input Power for testing: 230Vac, 50 Hz (Nominal input Voltage)					
Voltage Residual (%)	Duration (cycles)	Interval (sec)	Times	Observation	Performance Criterion
0	0.5	10	3	Note 1	TT/TR
0	1	10	3	Note 1	TT/TR
70	25	10	3	Note 1	TT/TR
0	250	10	3	Note 2	TT/TR

Input Power for testing: 240Vac, 50 Hz (Maximum rated input voltage)					
Voltage Residual (%)	Duration (cycles)	Interval (sec)	Times	Observation	Performance Criterion
0	0.5	10	3	Note 1	TT/TR
0	1	10	3	Note 1	TT/TR
70	25	10	3	Note 1	TT/TR
0	250	10	3	Note 2	TT/TR

Input Power for testing: 100Vac, 50 Hz (Minimum rated input voltage)					
Voltage Residual (%)	Duration (cycles)	Interval (sec)	Times	Observation	Performance Criterion
0	0.5	10	3	Note 1	TT/TR
0	1	10	3	Note 1	TT/TR
70	25	10	3	Note 1	TT/TR
0	250	10	3	Note 2	TT/TR

Note: 1. The EUT is operated normal during the test.
2. The EUT appears a “reboot” phenomena during the test, but it can be self-recoverable after the test.

17.5.3 For Standard EN 301 489-1 V2.1.1 and draft EN 301 489-52 V1.1.0

Input Power	230Vac / 240Vac / 100Vac, 50 Hz	Tested by	Barry Lee
Environmental Conditions	26 °C, 60% RH	Test mode	Mode 1

Input Power for testing: 230Vac, 50 Hz (Nominal input Voltage)					
Voltage Residual (%)	Duration (cycles)	Interval (sec)	Times	Observation	Performance Criterion
0	0.5	10	3	Note 1	TT/TR
0	1	10	3	Note 1	TT/TR
70	25	10	3	Note 1	TT/TR
0	250	10	3	Note 2	TT/TR

Input Power for testing: 240Vac, 50 Hz (Maximum rated input voltage)					
Voltage Residual (%)	Duration (cycles)	Interval (sec)	Times	Observation	Performance Criterion
0	0.5	10	3	Note 1	TT/TR
0	1	10	3	Note 1	TT/TR
70	25	10	3	Note 1	TT/TR
0	250	10	3	Note 2	TT/TR

Input Power for testing: 100Vac, 50 Hz (Minimum rated input voltage)					
Voltage Residual (%)	Duration (cycles)	Interval (sec)	Times	Observation	Performance Criterion
0	0.5	10	3	Note 1	TT/TR
0	1	10	3	Note 1	TT/TR
70	25	10	3	Note 1	TT/TR
0	250	10	3	Note 2	TT/TR

Note: 1. The EUT is operated normal during the test.
2. The EUT appears a “reboot” phenomena during the test, but it can be self-recoverable after the test.

18 General Immunity Requirements (For standard: EN 55024)

EN 55024:2010+A1:2015, Immunity requirements				
Clause	Reference standard	Table	Test specification	Performance Criterion
4.2.1	EN/IEC 61000-4-2 ESD	1.3	Enclosure port: ±8kV Air discharge, ±4kV Contact discharge	B
4.2.3.2	EN/IEC 61000-4-3 RS	1.2	Enclosure port: 80-1000 MHz, 3V/m, 80% AM (1kHz)	A
4.2.2	EN/IEC 61000-4-4 EFT	2.3	Signal ports and telecommunication ports: xDSL equipment: ±0.5kV, 5/50 (T_r/T_h) ns, 100kHz others: ±0.5kV, 5/50 (T_r/T_h) ns, 5kHz	B
		3.3	Input DC power port: ±0.5kV, 5/50 (T_r/T_h) ns, 5kHz	
		4.5	Input AC Power ports: ±1kV, 5/50 (T_r/T_h) ns, 5kHz	
4.2.5	EN/IEC 61000-4-5 Surge	2.2	Signal and telecommunication ports (direct to outdoor cables): 10/700 (5/320) (T_r/T_h) µs w/o primary protectors: ±1kV, or with primary protectors fitted: ±4kV	C
		3.2	Input DC power port (direct to outdoor cables): 1.2/50 (8/20) (T_r/T_h) µs Line to earth: ±0.5kV	B
		4.4	Input AC Power ports: 1.2/50 (8/20) (T_r/T_h) µs, Line to line: ±1kV Line to earth: ±2kV	
4.2.3.3	EN/IEC 61000-4-6 CS	2.1	Signal and telecommunication ports(cable length > 3m): 0.15-80 MHz, 3V, 80% AM (1kHz)	A
		3.1	Input DC power port: 0.15-80 MHz, 3V, 80% AM (1kHz)	
		4.1	Input AC Power ports: 0.15-80 MHz, 3V, 80% AM (1kHz)	
4.2.4	EN/IEC 61000-4-8 PFMF	1.1	Enclosure port: 50 or 60 Hz, 1A/m	A
4.2.6	EN/IEC 61000-4-11 Dips & Interruptions	4.2	Input AC Power ports: Voltage Dips: >95% reduction – 0.5 period 30% reduction – 25 periods	B C
		4.3	Input AC Power ports: Voltage Interruptions: >95% reduction – 250 periods	C

18.1 Performance Criteria

General Performance Criteria

Performance criterion A

The equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed below a performance level specified by the manufacturer when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

Performance criterion B

After the test, the equipment shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomena below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. During the test, degradation of performance is allowed. However, no change of operating state or stored data is allowed to persist after the test. If the minimum performance level (or the permissible performance loss) is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

Performance criterion C

Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions. Functions, and/or information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

Product Specific Performance Criteria

The particular performance criteria which are specified in the normative annexes of EN 55024 take precedence over the corresponding parts of the general performance criteria.

Where particular performance criteria for specific functions are not given, then the general performance criteria shall apply.

Function	Performance criteria A	Performance criteria B	Performance criteria C
Read, write and storage of data	During the test storage devices shall maintain normal operation both in read/write and in standby conditions.	During and after the test failures which can be recovered by read and write retries are permissible (temporary delay in processing caused by this process is acceptable). Normal operation of the EUT shall be restored after the test, self-recovery to the conditions immediately prior to the application of the test is accepted where this is a normal means of recovery. In these cases, operator response is permitted to re-initialise an operation.	Failures during test that result in a delay in processing or a system abort, which after testing can be recovered to normal operation by reset or reboot, are permissible.
Data display	During the test, when seen from the normal viewing distance, the EUT shall operate with no change beyond the manufacturer's specification, in flicker, colour, focus and jitter (except for the power frequency magnetic field test).	Screen disturbances during the application of the test are permissible if they self-recover after removal of the external disturbance.	Failures during the test that cannot self-recover after removal of the external disturbance, but which can be recovered after the test to normal operation by reset or reboot are permissible.
Data input	During testing unintended input from an input device is not allowed. During testing input devices shall maintain the specified quality image data.	During testing keyboard/mouse "lock up" is not allowed. For EUT with manually inputted data that can be confirmed by reading the display, errors are permissible during testing if they can be recognised by the operator and easily corrected.	Failures during test that result in a delay in processing or a system abort, which after testing can be recovered to normal operation by reset or reboot, are permissible.
Data printing	During testing printers shall maintain the specified printing quality and normal operation.	During testing no degradation of the printing quality beyond the manufacturer's specification (such as distortion of character(s) or missing pixels) is permissible. A paper feed failure is allowed if after removal of the jammed sheets the job is automatically recovered and there is no loss of printed information.	During testing printing errors or omission of character(s) which require reprinting are permissible. Input/output failures that occur during testing that can be recovered to normal operation after testing by reset or reboot are also permissible.
Data processing	During testing failures which do not influence the specified operation within the product specification, and which do not prevent automatic recovery are permissible.	During testing failures which are recovered automatically but cause temporary delay in processing are permissible.	Failures during testing that - result in a delay in processing after the external disturbance is removed, but which can be recovered after testing to normal operation by a reset or reboot - result in a system abort, which can be recovered to normal operation after testing by reset or reboot, - are followed by alarms and can be recovered to normal operation by the operator's intervention after testing are permissible.

19 Electrostatic Discharge Immunity Test (ESD)

19.1 Test Specification

Basic Standard:	EN/IEC 61000-4-2
Discharge Impedance:	330 ohm / 150 pF
Discharge Voltage:	Air Discharge: ±2, ±4, ±8kV (Direct) Contact Discharge: ±2, ±4kV (Direct /Indirect)
Number of Discharge:	Air – Direct: 10 discharges per location (each polarity) Contact – Direct & Indirect: 25 discharges per location (each polarity) and min. 200 times in total
Discharge Mode:	Single Discharge
Discharge Period:	1-second minimum

19.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
ESD Simulator NoiseKen	ESS-2002	ESS0625212/244	May 02, 2018	May 01, 2019

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in ESD-1 room
3. Tested Date: Aug. 06, 2018

19.3 Test Arrangement

The discharges shall be applied in two ways:

a. Contact discharges to the conductive surfaces and coupling planes:

The EUT shall be exposed to at least 200 discharges, 100 each at negative and positive polarity, at a minimum of four test points. One of the test points shall be subjected to at least 50 indirect discharges to the center of the front edge of the horizontal coupling plane. The remaining three test points shall each receive at least 50 direct contact discharges. If no direct contact test points are available, then at least 200 indirect discharges shall be applied in the indirect mode. Test shall be performed at a maximum repetition rate of one discharge per second.

b. Air discharges at slots and apertures and insulating surfaces:

On those parts of the EUT where it is not possible to perform contact discharge testing, the equipment should be investigated to identify user accessible points where breakdown may occur. Such points are tested using the air discharge method. This investigation should be restricted to those area normally handled by the user. A minimum of 10 single air discharges shall be applied to the selected test point for each such area.

The basic test procedure was in accordance with EN/IEC 61000-4-2:

a. Electrostatic discharges were applied only to those points and surfaces of the EUT that are accessible to users during normal operation.

b. The test was performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.

c. The time interval between two successive single discharges was at least 1 second.

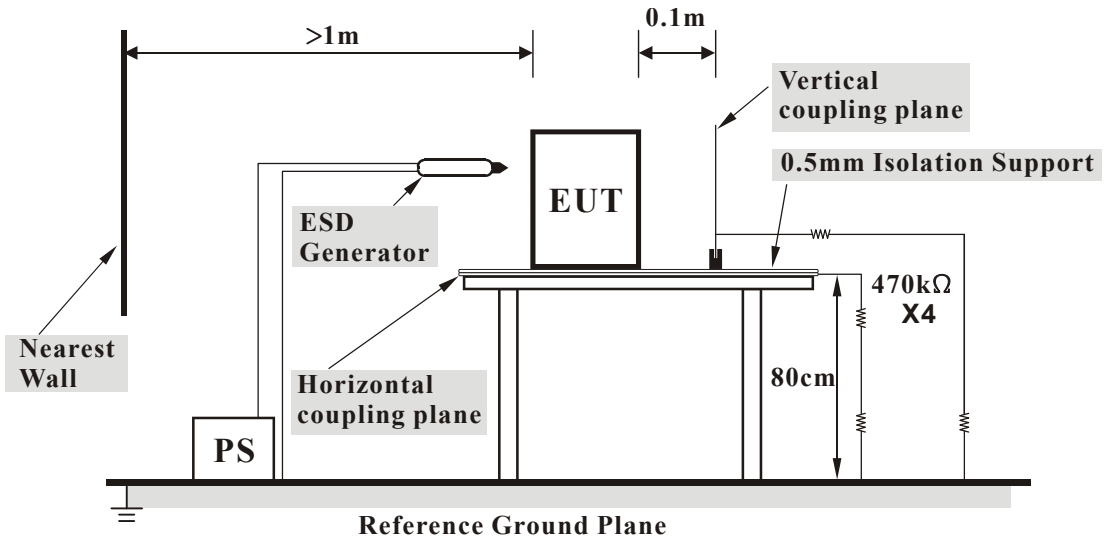
d. The ESD generator was held perpendicularly to the surface to which the discharge was applied and the return cable was at least 0.2 meters from the EUT.

e. Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.

f. Air discharges were applied with the round discharge tip of the discharge electrode approaching the EUT as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator was removed from the EUT and re-triggered for a new single discharge. The test was repeated until all discharges were complete.

g. At least ten single discharges (in the most sensitive polarity) were applied to the **H**orizontal **C**oupling **P**lane at points on each side of the EUT. The ESD generator was positioned at a distance of 0.1 meters from the EUT with the discharge electrode touching the **HCP.**

h. At least ten single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the **V**ertical **C**oupling **P**lane in sufficiently different positions that the four faces of the EUT were completely illuminated. The **VCP** (dimensions 0.5m x 0.5m) was placed vertically to and 0.1 meters from the EUT.



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

NOTE:

TABLE-TOP EQUIPMENT

The configuration consisted of a wooden table 0.8 meters high standing on the **G**round **R**eference **P**lane. The **GRP** consisted of a sheet of aluminum at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system. A **H**orizontal **C**oupling **P**lane (1.6m x 0.8m) was placed on the table and attached to the **GRP** by means of a cable with 940kΩ total impedance. The equipment under test, was installed in a representative system as described in section 7 of EN/IEC 61000-4-2, and its cables were placed on the **HCP** and isolated by an insulating support of 0.5mm thickness. A distance of 1-meter minimum was provided between the EUT and the walls of the laboratory and any other metallic structure.

FLOOR-STANDING EQUIPMENT

The equipment under test was installed in a representative system as described in section 7 of IEC 61000-4-2, and its cables were isolated from the Ground Reference Plane by an insulating support of 0.1-meter thickness. The GRP consisted of a sheet of aluminum that is at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system and extended at least 0.5 meters from the EUT on all sides.

19.4 Supplementary Information

There is not any deviation from the test standards for the test method.

19.5 Test Results

Input Power	230 Vac, 50 Hz	Tested by	Leon Wu
Environmental conditions	23 °C, 49% RH 1021 mbar	Test Mode	Mode 1

Test Results of Direct Application					
Discharge Level (kV)	Polarity (+/-)	Test Point	Contact Discharge	Air Discharge	Performance Criterion
2,4	+/-	1~7	Note 1	NA	A
2,4,8	+/-	8~12	NA	Note 1	A

Description of test points of direct application: Please refer to following page for representative mark only.

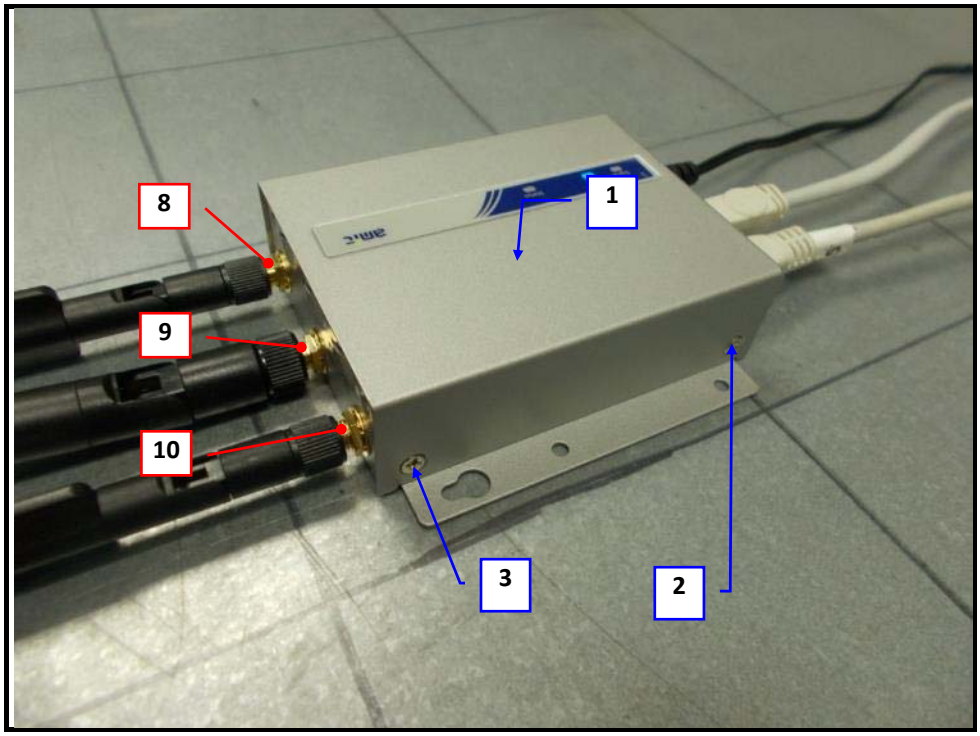
Test Results of Indirect Application					
Discharge Level (kV)	Polarity (+/-)	Test Point	Horizontal Coupling Plane	Vertical Coupling Plane	Performance Criterion
2, 4	+/-	Four Sides	Note 1	Note 1	A

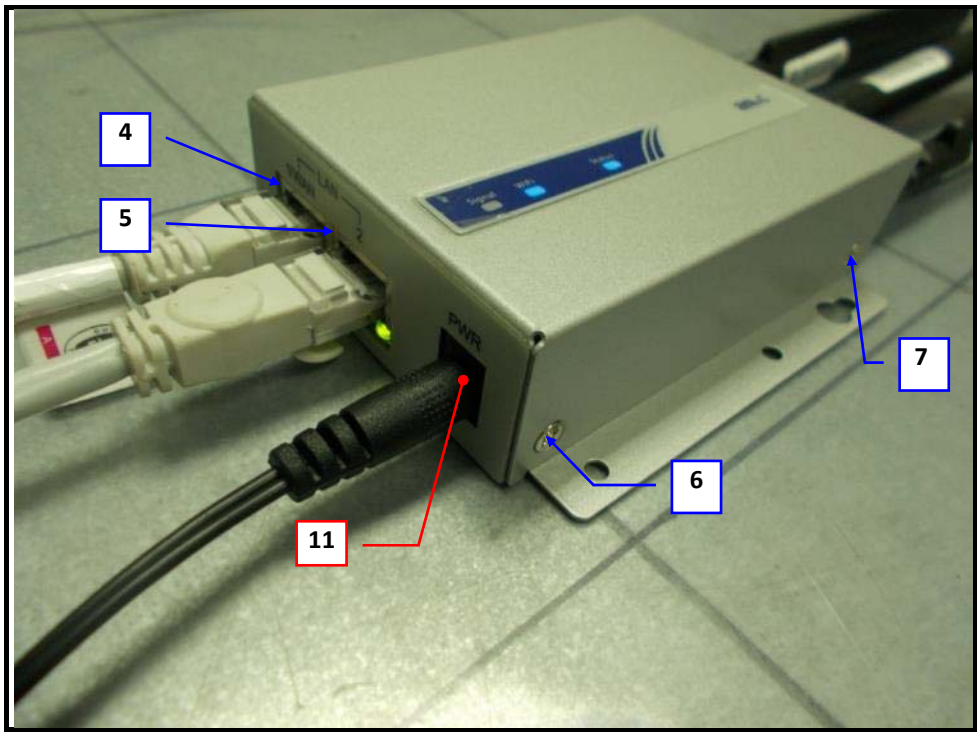
Description of test points of indirect application:

1. Front side 2. Rear side 3. Right side 4. Left side

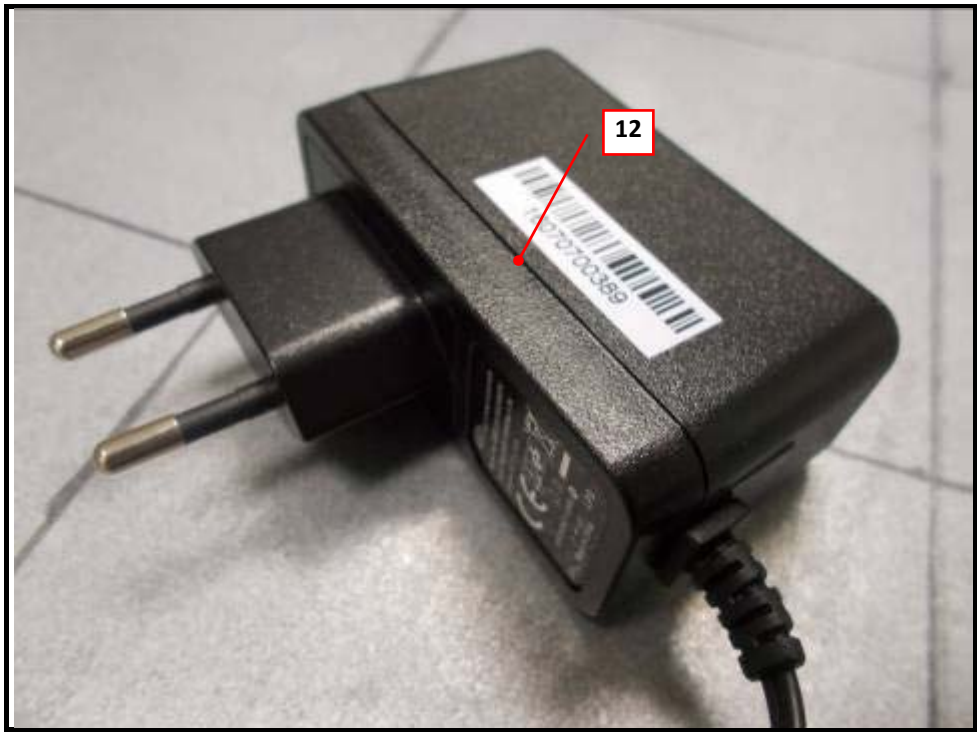
Note: 1. The EUT is operated normal during the test.

DESCRIPTION OF TEST POINT





DESCRIPTION OF TEST POINT



20 Radiated, Radio-frequency, Electromagnetic Field Immunity Test (RS)

20.1 Test Specification

Basic Standard:	EN/IEC 61000-4-3
Frequency Range:	80 MHz ~ 1000 MHz
Field Strength:	3 V/m
Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of preceding frequency value
Polarity of Antenna:	Horizontal and Vertical
Antenna Height:	1.5m
Dwell Time:	3 seconds

20.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Signal Generator KEYSIGHT	N5182B	MY53051971	Sep. 30, 2017	Sep. 29, 2018
Power Amplifier ETS-LINGREN	8100-002	00163537	NA	NA
Power Amplifier ETS-LINGREN	8100-008	00163547	NA	NA
RF Voltage Meter KEYSIGHT	N1914A	MY55326005	Sep. 26, 2017	Sep. 25, 2018
LOG ANTENNA ETS-LINGREN	3150B	00203052	NA	NA
LOG ANTENNA AR	AT5080ANT	309740	NA	NA
HORN ANTENNA ETS-LINGREN	3119	00203652	NA	NA
TILE!(Software) ETS-LINGREN	7.1.3.34	NA	NA	NA

Note:

1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Chamber RS-1Room.
3. The transmit antenna was located at a distance of 3.0 meters from the EUT.
4. Tested Date: Aug. 08, 2018

20.3 Test Arrangement

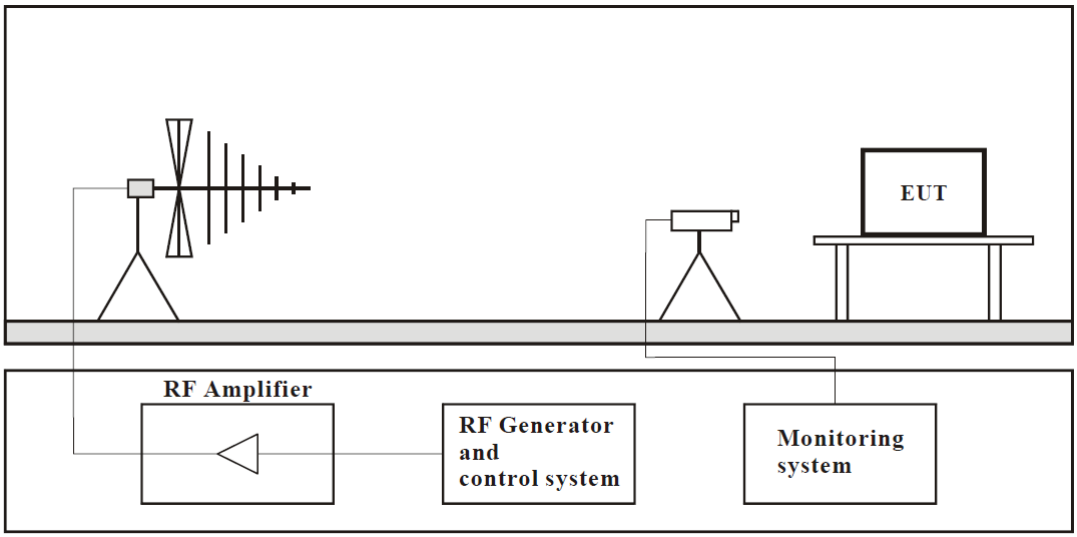
The test procedure was in accordance with EN/IEC 61000-4-3.

a. The testing was performed in a modified semi-anechoic chamber.

b. The frequency range is swept from 80 MHz to 1000 MHz, with the signal 80% amplitude modulated with a 1kHz sine wave.

c. The field strength level was 3 V/m.

d. The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

NOTE:

TABLETOP EQUIPMENT
The EUT installed in a representative system as described in section 7 of EN/IEC 61000-4-3 was placed on a non-conductive table 0.8 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

FLOOR STANDING EQUIPMENT
The EUT installed in a representative system as described in section 7 of EN/IEC 61000-4-3 was placed on a non-conductive wood support 0.1 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

20.4 Supplementary Information

There is not any deviation from the test standards for the test method.

20.5 Test Results

Input Power	230 Vac, 50 Hz	Tested by	Leon Wu
Environmental conditions	25 °C, 63% RH	Test Mode	Mode 1

Frequency (MHz)	Polarity	Azimuth(°)	Applied Field Strength		Observation	Performance Criterion
			(V/m)	Modulation		
80 -1000	V&H	0	3	80% AM (1kHz)	Note 1	A
80 -1000	V&H	90	3	80% AM (1kHz)	Note 1	A
80 -1000	V&H	180	3	80% AM (1kHz)	Note 1	A
80 -1000	V&H	270	3	80% AM (1kHz)	Note 1	A

Note: 1. The EUT is operated normal during the test.

21 Electrical Fast Transient/Burst Immunity Test (EFT)

21.1 Test Specification

Basic Standard:	EN/IEC 61000-4-4
Test Voltage:	Signal / telecommunication port: ±0.5kV Input DC power port: NA Input AC power port: ±1kV
Impulse Repetition Frequency:	xDSL telecommunication port: 100kHz others: 5kHz
Impulse Wave Shape:	5/50 ns
Burst Duration:	0.75 ms for 100kHz Repetition Frequency 15 ms for 5kHz Repetition Frequency
Burst Period:	300 ms
Test Duration:	1 min.

21.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
TRANSIENT EMC PARTNER	TRA2000IN6	1121	Mar. 26, 2018	Mar. 25, 2019
CN-EFT100 EMC PARTNER	CN-EFT1000	352	Jan. 15, 2018	Jan. 14, 2019
Adapter	NA	SU1ADA-002	NA	NA
Software EMC PARTNER	Test Manger_V2.11	NA	NA	NA

Note:

1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in EMS-2 room
3. Tested Date: Aug. 01, 2018

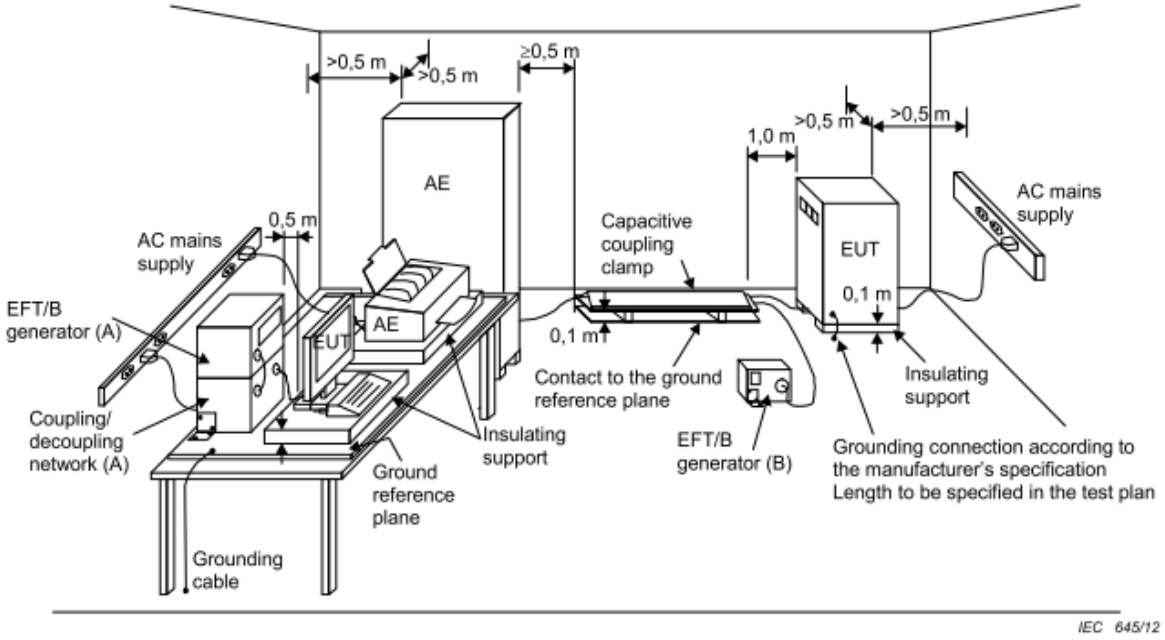
21.3 Test Arrangement

a. Both positive and negative polarity discharges were applied.

b. The distance between any coupling devices and the EUT should be 0.5 m for table-top equipment testing, and 1.0 m for floor standing equipment.

c. The duration time of each test sequential was 1 minute.

d. The transient/burst waveform was in accordance with EN/IEC 61000-4-4, 5/50 ns.



NOTE:
(A) location for supply line coupling
(B) location for signal lines coupling

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

21.4 Supplementary Information

There is not any deviation from the test standards for the test method.

21.5 Test Results

Input Power	230 Vac, 50 Hz	Tested by	Barry Lee
Environmental conditions	26 °C, 60% RH	Test Mode	Mode 1

Input AC power port

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
1	L1	+/-	Note 1	A
1	L2	+/-	Note 1	A
1	L1-L2	+/-	Note 1	A

Signal / telecommunication port

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
0.5	LAN1/WAN	+/-	Note 1	A
0.5	LAN2	+/-	Note 1	A

Note: 1. The EUT is operated normal during the test.

22 Surge Immunity Test

22.1 Test Specification

Basic Standard:	EN/IEC 61000-4-5
Wave-Shape:	Signal / telecommunication port (direct to outdoor cables*): 10/700 μs Open Circuit Voltage 5/320 μs Short Circuit Current Input DC power port / Coaxial port (direct to outdoor cables*): 1.2/50 μs Open Circuit Voltage 8/20 μs Short Circuit Current Input AC power port: 1.2/50 μs Open Circuit Voltage 8/20 μs Short Circuit Current
Test Voltage:	Signal and telecommunication ports**:(direct to outdoor cables*): w/o primary protectors: NA with primary protectors fitted: NA Signal and telecommunication ports**(direct to indoor cables*): w/o primary protectors: NA with primary protectors fitted: NA Input DC power port: Line to earth or ground:NA Input AC power ports: Line to line: ±0.5kV, ±1kV Line to earth or ground: NA
AC Phase Angle (degree):	0°, 90°, 180°, 270°
Pulse Repetition Rate:	1 time / 20 sec.
Number of Tests:	5 positive and 5 negative at selected points

* This test is only applicable only to ports, which according to the manufacturer's specification, may connect directly to outdoor cables.

** For ports where primary protection is intended, surges are applied at voltages up to 4 kV with the primary protectors fitted. Otherwise the 1 kV test level is applied without primary protection in place.

22.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Unshielded Symmetrical High-speed Interconnection Lines Coupling Decoupling Network 3ctest	CDN 405T8H	ES2761501	July 16, 2018	July 15, 2019
Adapter	NA	SU1ADA-002	NA	NA
TRANSIENT EMC PARTNER	TRA2000IN6	1121	Mar. 26, 2018	Mar. 25, 2019
Software EMC PARTNER	Test Manger_V2.11	NA	NA	NA

Note:

1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in EMS-2 room
3. Tested Date: Aug. 01, 2018

22.3 Test Arrangement

a. Input AC/DC Power ports:

The surge is to be applied to the EUT power supply terminals via the capacitive coupling network. Decoupling networks are required in order to avoid possible adverse effects on equipment not under test that may be powered by the same lines, and to provide sufficient decoupling impedance to the surge wave. The power cord between the EUT and the coupling/decoupling networks shall be 2 meters in length (or shorter).

For double-insulated products without PE or external earth connections, the test shall be done in a similar way as for grounded products but without adding any additional external grounded connections. If there are no other possible connections to earth, line-to-ground tests may be omitted.

b. Signal and Wired networkports,

- Unshielded unsymmetrical interconnection lines:

The surge is applied to the lines via the capacitive coupling. The coupling / decoupling networks shall not influence the specified functional conditions of the EUT. The interconnection line between the EUT and the coupling/decoupling networks shall be 2 meters in length.

- Unshielded symmetrical interconnections communication lines:

The surge is applied to the lines via gas arrestors coupling. Test levels below the ignition point of the coupling arrestor cannot be specified. The interconnection line between the EUT and the coupling/decoupling networks shall be 2 meters in length.

- High speed communications lines

Prior to the test, the correct operation of the port shall be verified; the external connection shall then be removed and the surge applied directly to the port's terminals with no coupling /decoupling network. After the surge, the correct operation of the port shall again be verified.

- Shielded lines:

- Direct application,

The EUT is isolated from ground and the surge is applied to its metallic enclosure; the termination (or auxiliary equipment) at the port(s) under test is grounded. This test applies to equipment with single or multiple shielded cables.

Rules for application of the surge to shielded lines:

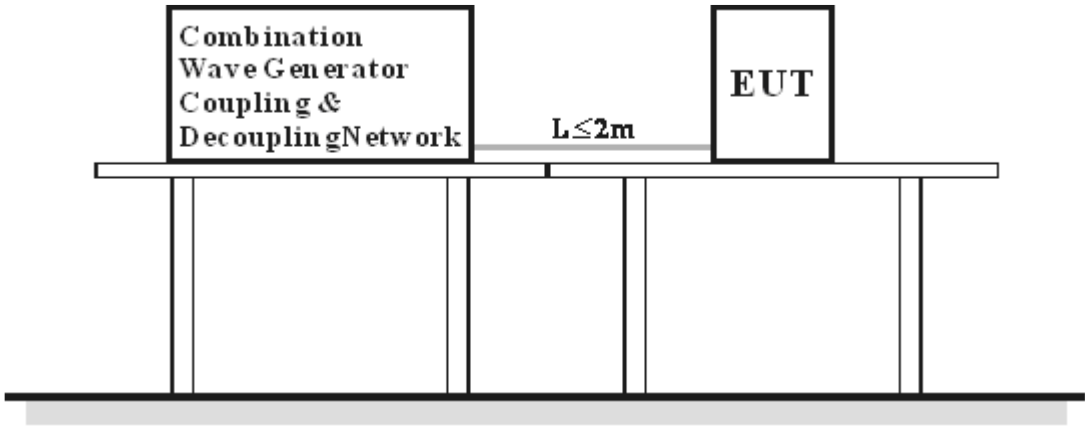
a) Shields grounded at both ends
> The surge injection on the shield.

b) Shields grounded at one end
> If in the installation the shield is connected only at the auxiliary equipment, test shall be done in that configuration but with the generator still connected to the EUT side. If cable lengths allow, the cables shall be on insulated supports 0,1 m above the ground plane or cable tray.

For products which do not have metallic enclosures, the surge is applied directly to the shielded cable.

- Alternative coupling method for testing single cables in a multi-shield configuration,

Surges are applied in close proximity to the interconnection cable under test by a wire. The length of the cable between the port(s) under test and the device attached to the other end of the cable shall be the lesser of: the maximum length permitted by the EUT's specification, or 20 m. Where the length exceeds 1 m, excess lengths of cables shall be bundled at the approximate centre of the cables with the bundles 30 cm to 40 cm in length.



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

22.4 Supplementary Information

There is not any deviation from the test standards for the test method

22.5 Test Results

Input Power	230 Vac, 50 Hz	Tested by	Barry Lee
Environmental conditions	26 °C, 60% RH	Test Mode	Mode 1

Input AC Power ports:

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
0.5, 1	L1 - L2	+/-	Note 1	A

Note: 1. The EUT is operated normal during the test..

23 Immunity to Conducted Disturbances Induced by RF Fields (CS)

23.1 Test Specification

Basic Standard:	EN/IEC 61000-4-6
Frequency Range:	0.15 MHz - 80 MHz
Voltage Level:	3 V
Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of preceding frequency value
Dwell Time	3 seconds

23.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Signal Generator R&S	SML01	102731	Dec. 04, 2017	Dec. 03, 2018
Amplifier AR	75A250AM2	307297	NA	NA
RF Voltage Meter BOONTON	4232A- 01	93801	Nov. 28, 2017	Nov. 27, 2018
LUTHIE EM Injection Clamp TESEQ	KEMZ801A	41344	Oct. 16, 2017	Oct. 15,2018
Coupling Decoupling Network M2 TESEQ	CDN M216	40667	Oct. 16, 2017	Oct. 15,2018
Coupling Decoupling Network M3 TESEQ	CDN M316	40119	Oct. 16, 2017	Oct. 15,2018
Coupling Decoupling Network T2 TESEQ	CDN T200A	38311	Oct. 16, 2017	Oct. 15,2018
Coupling Decoupling Network T4 TESEQ	CDN T400A	28587	Oct. 16, 2017	Oct. 15,2018
Coupling Decoupling Network T8 TESEQ	CDN T8-10	41249	Oct. 16, 2017	Oct. 15,2018
ADT CS Test Workbench(Software) BVADT	ADT_CS_7.6.4	NA	NA	NA

Note:

1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in CS-3 Room.
3. Tested Date: Aug. 01, 2018

23.3 Test Arrangement

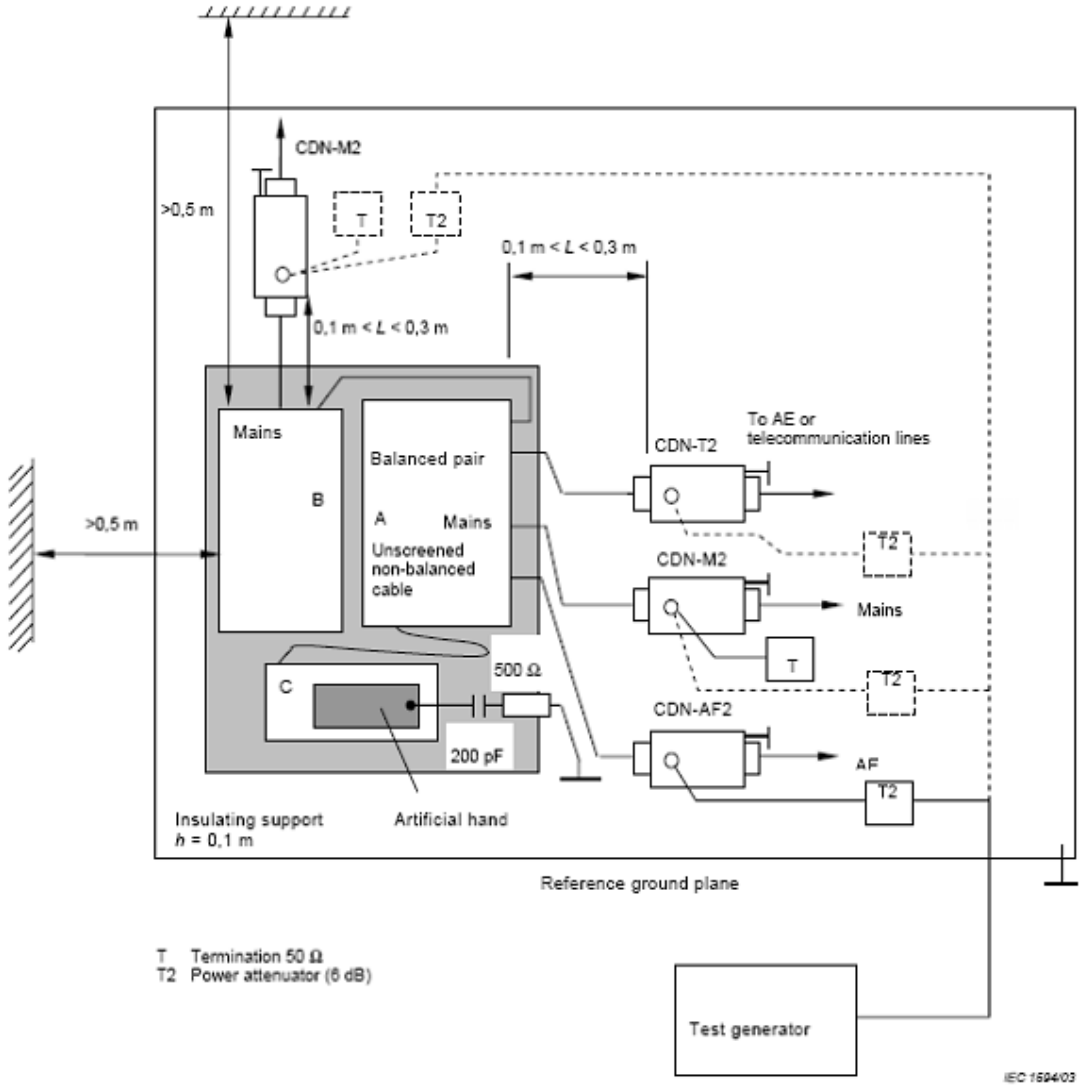
a. The EUT shall be tested within its intended operating and climatic conditions.

b. An artificial hand was placed on the hand-held accessory and connected to the ground reference plane.

c. One of the CDNs not used for injection was terminated with 50 ohm, providing only one return path. All other CDNs were coupled as decoupling networks.

d. The frequency range is swept from 150 kHz to 80 MHz, using the signal level established during the setting process and with a disturbance signal of 80 % amplitude. The signal is modulated with a 1 kHz sine wave, pausing to adjust the RF signal level or the switch coupling devices as necessary. Where the frequency is swept incrementally, the step size shall not exceed 1 % of the preceding frequency value.

e. Attempts should be made to fully exercise the EUT during testing, and to fully interrogate all exercise modes selected for susceptibility.



Note: 1.The EUT clearance from any metallic obstacles shall be at least 0,5 m.
2. Interconnecting cables (≦1 m) belonging to the EUT shall remain on the insulating support.

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

23.4 Supplementary Information

There is not any deviation from the test standards for the test method.

23.5 Test Results

Input Power	230 Vac, 50 Hz	Tested by	Leon Wu
Environmental conditions	25 °C, 64% RH	Test Mode	Mode 1

Frequency (MHz)	Level (V rms)	Tested Line	Injection Method	Return Path	Observation	Performance Criterion
0.15 – 80	3	AC Power	CDN-M2	CDN-T4	Note 1	A
0.15 – 80	3	LAN1/WAN	CDN-T4	CDN-M2	Note 1	A
0.15 – 80	3	LAN2	CDN-T4	CDN-M2	Note 1	A

Note: 1. The EUT is operated normal during the test.

24 Power Frequency Magnetic Field Immunity Test

24.1 Test Specification

Basic Standard:	EN/IEC 61000-4-8
Frequency Range:	50Hz
Field Strength:	1 A/m
Observation Time:	1 minute
Inductance Coil:	Rectangular coil, 1m x 1m (L x W)

24.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Triaxial Elf Magnetic Field Meter BELL	4090	NA	Feb. 08, 2018	Feb. 07, 2019
Power frequency magnetic filed coil 3ctest	TCX30	EC1281401	Mar. 05, 2018	Mar. 04, 2019
Power frequency magnetic filed generator 3ctest	PFMF-1200G	EC0111401	Mar. 05, 2018	Mar. 04, 2019

Note:

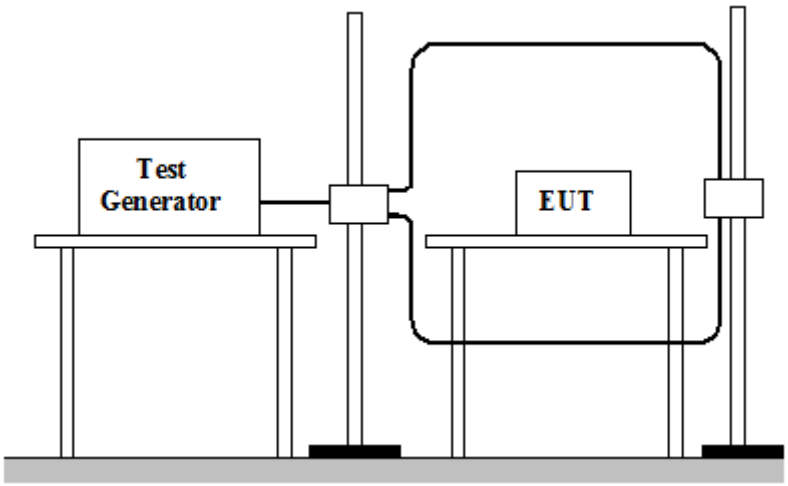
1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in EMS-1 room.
3. Tested Date: Aug. 01, 2018

24.3 Test Arrangement

a. The equipment is configured and connected to satisfy its functional requirements.

b. The power supply, input and output circuits shall be connected to the sources of power supply, control and signal.

c. The cables supplied or recommended by the equipment manufacturer shall be used. 1 meter of all cables used shall be exposed to the magnetic field.



Tabletop equipment

The equipment shall be subjected to the test magnetic field (see example as above).
The plane of the inductive coil shall then be rotated by 90° in order to expose the EUT to the test field with different orientations.

24.4 Supplementary Information

There is not any deviation from the test standards for the test method.

24.5 Test Results

Input Power	230 Vac, 50 Hz	Tested by	Leon Wu
Environmental conditions	25 °C, 67% RH	Test mode	Mode 1

Application	Frequency (Hz)	Field Strength (A/m)	Observation	Performance Criterion
X - Axis	50	1	Note 1	A
Y - Axis	50	1	Note 1	A
Z - Axis	50	1	Note 1	A

Note: 1. The EUT is operated normal during the test.

25 Voltage Dips and Interruptions

25.1 Test Specification

Basic Standard:	EN/IEC 61000-4-11
Test levels:	Voltage Dips: >95% reduction – 0.5 period 30% reduction – 25 periods Voltage Interruptions: >95% reduction – 250 periods
Interval between Event:	Minimum ten seconds
Sync Angle (degrees):	0° / 180°
Test Cycle:	3 times

25.2 Test Instruments

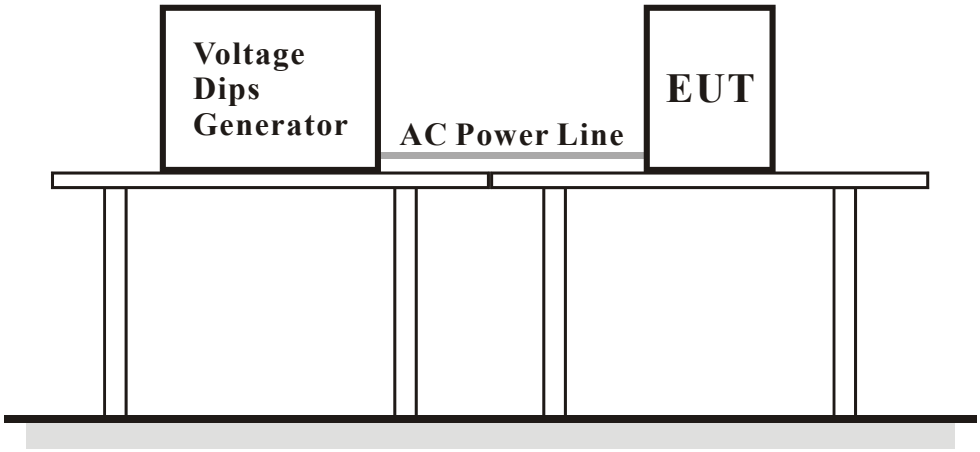
DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
TRANSIENT EMC PARTNER	TRA2000IN6	1121	Mar. 26, 2018	Mar. 25, 2019
Adapter	NA	SU1ADA-002	NA	NA
Software EMC PARTNER	Test Manger_V2.11	NA	NA	NA

Note:

1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in EMS-2 room
3. Tested Date: Aug. 01, 2018

25.3 Test Arrangement

The EUT shall be tested for each selected combination of test levels and duration with a sequence of 3 dips/interruptions with intervals of 10 s minimum (between each test event). Each representative mode of operation shall be tested. Abrupt changes in supply voltage shall occur at 0 dregee crossover point of the voltage waveform.



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

25.4 Supplementary Information

There is not any deviation from the test standards for the test method.

25.5 Test Results

Input Power	230 Vac / 240 Vac / 100 Vac 50 Hz	Tested by	Barry Lee
Environmental conditions	26 °C, 60% RH	Test mode	Mode 1

Input Power for testing: 230 Vac, 50 Hz (Nominal input Voltage)					
Voltage Reduction (%)	Duration (period)	Interval (sec)	Times	Observation	Performance Criterion
>95	0.5	10	3	Note 1	A
30	25	10	3	Note 1	A
>95	250	10	3	Note 2	B

Input Power for testing: 240 Vac, 50 Hz (Maximum rated input voltage)					
Voltage Reduction (%)	Duration (period)	Interval (sec)	Times	Observation	Performance Criterion
>95	0.5	10	3	Note 1	A
30	25	10	3	Note 1	A
>95	250	10	3	Note 2	B

Input Power for testing: 100 Vac, 50 Hz (Minimum rated input voltage)					
Voltage Reduction (%)	Duration (period)	Interval (sec)	Times	Observation	Performance Criterion
>95	0.5	10	3	Note 1	A
30	25	10	3	Note 1	A
>95	250	10	3	Note 2	B

Note: 1. The EUT is operated normal during the test.
2. The EUT appears a “reboot” phenomena during the test, but it can be self-recoverable after the test.

26 General Immunity Requirements (For standard: EN 55035)

EN 55035: 2017+A11:2020, Immunity requirements		
Reference standard	Test specification	Performance Criteria
EN/IEC 61000-4-2 ESD	Enclosure port: ±8kV Air discharge, ±4kV Contact discharge,	B
EN/IEC 61000-4-3 RS	Enclosure port: Swept freq. test : 80-1000 MHz, 3V/m, 80% AM (1kHz), Spot freq. test : 1800, 2600, 3500, 5000 MHz (±1 %), 3V/m, 80% AM (1kHz)	A
EN/IEC 61000-4-4 EFT	Analogue/digital data ports(cable length > 3m): xDSL equipment: ±0.5kV, 5/50 (t_r/t_w) ns, 100kHz others: ±0.5kV, 5/50(t_r/t_w) ns, 5kHz	B
	DC network power port(cable length > 3m): ±0.5kV, 5/50 (t_r/t_w) ns, 5kHz	
	AC mains power ports: ±1.0kV, 5/50 (t_r/t_w) ns, 5kHz	
EN/IEC 61000-4-5 Surge	Analogue/digital data ports(direct to outdoor cables): Port type: unshielded symmetrical (line to ground) 10/700(5/320) (T_f/T_d) μs, w/o primary protectors: ±1.0kV, or with primary protectors fitted: ±1.0kV, ±4.0kV,	C
	Port type: coaxial or shielded (shield to ground) 1.2/50(8/20) (T_f/T_d) μs, ±0.5kV,	B
	DC network power port(direct to outdoor cables): 1.2/50(8/20) (T_f/T_d) μs, Line to ground: ±0.5kV,	B
	AC mains power ports: 1.2/50(8/20) (T_f/T_d) μs, Line to line: ±1kV, Line to ground: ±2kV,	B
EN/IEC 61000-4-6 CS	Analogue/digital data ports (cable length > 3m) ; DC network power ports (cable length > 3m) ; AC mains power ports 0.15-10 MHz, 3V, 80% AM (1kHz), 10-30 MHz, 3V-1V, 80% AM (1kHz), 30-80 MHz, 1V, 80% AM (1kHz),	A
EN/IEC 61000-4-8 PFMF	Enclosure port: 50Hz, 1A/m,	A
EN/IEC 61000-4-11 Volage Dips & Interruptions	AC mains power ports: (at 50 Hz) Voltage Dips: <5% residual – 0.5 cycle, 70% residual – 25 cycles	B C
	AC mains power ports: Voltage Interruptions: <5% residual – 250 cycles	C

EN/IEC 61000-4-6 Broadband impulse noise disturbances, **Repetitive** (Applicable only to xDSL ports.)	Impulse frequency profile : 0.15 – 0.5 MHz, 107 dBuV ; 0. 5 – 10 MHz, 107 – 36 dBuV ; 10 – 30 MHz, 36 – 30 dBuV Burst duration : 0.70 ms Burst period :10 ms(for 50 Hz) At least 2 minutes for each port under test.	A
EN/IEC 61000-4-6 Broadband impulse noise disturbances, **Isolated** (Applicable only to xDSL ports.)	Impulse frequency profile : 0.15 –30 MHz, 110 dBuV Burst duration : 0.24 ms, 10 ms and 300 ms Isolated impulses : 5 times Interval : at least 60 seconds	B

26.1 Performance Criteria

General Performance Criteria
These criterions shall be used during the testing of primary functions where no specified in the normative annexes of EN 55035 is applicable.

Performance criterion A

The equipment shall continue to operate as intended without operator intervention. No degradation of performance, loss of function or change of operating state is allowed below a performance level specified by the manufacturer when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

Performance criterion B

During the application of the disturbance, degradation of performance is allowed. However, no unintended change of actual operating state or stored data is allowed to persist after the test.

After the test, the equipment shall continue to operate as intended without operator intervention; no degradation of performance or loss of function is allowed, below a performance level specified by the manufacturer, when the equipment is used as intended. The performance level may be replaced by a permissible loss of performance.

If the minimum performance level (or the permissible performance loss), or recovery time, is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and by what the user may reasonably expect from the equipment if used as intended.

Performance criterion C

Loss of function is allowed, provided the function is self-recoverable, or can be restored by the operation of the controls by the user in accordance with the manufacturer's instructions. A reboot or re-start operation is allowed.

Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

Product Specific Performance criteria for network functions
Equipment that provides these functions transmits and receives data through ports such as an analogue/digital data port. The networking functions are just like network switching and routing ; data transmission ; supervisory...etc.

The particular performance criteria which are specified in the normative annexes of CISPR 35/ EN 55035 take precedence over the corresponding parts of the general performance criteria.

Performance criterion A
Where relevant, during the application of the test the network function shall, as a minimum, operate ensuring that:

- established connections shall be maintained throughout the application of the test;
- no change of operational state or corruption of stored data occurs;
- no increase in error rate above the figure defined by the manufacturer occurs. The manufacturer should select the most appropriate performance measurement criteria for the product or system, for example bit error rate, block error rate;
- no request for retry above the figure defined by the manufacturer;
- the data transmission rate does not reduce below the figure defined by the manufacturer;
- no protocol failure occurs;
- other verifications are described in F.3.3.1 of CISPR 35/ EN 55035.

Performance criterion B
Established connections shall be maintained throughout the test, or shall self-recover in a way and timescale that is imperceptible to the user.

The error rate, request for retry and data transmission rates may be degraded during the application of the test. Degradation of the performance as described in criterion A is permitted, provided that the normal

operation of the EUT is self-recoverable to the condition established prior to the application of the test.

Where required, as defined in Clause 5 of CISPR 35/ EN 55035, the acceptable operation of the function shall be verified at the completion of the test as described in Table H.1 of CISPR 35/ EN 55035, by confirming the following:

- the EUT's ability to establish a connection,
- the EUT's ability to clear a connection.

During surge testing disconnection is allowed on the analogue/digital data port being tested.

If the EUT is a supervisory equipment, it shall not impact the normal operation of the network being monitored. In addition, any supervisory functions impacted during the period of the test shall return to the state prior to the test. Elements to consider include: alarms, signalling lamps, printer output, network traffic rates, network monitoring.

Performance criterion C
Degradation of performance as described in criteria A and B is permitted provided that the normal operation of the EUT is self-recoverable to the condition immediately before the application of the test, or can be restored after the test by the operator.

Product Specific Performance Criteria for xDSL
The particular performance criteria which are specified in the normative annexes of CISPR 35/ EN 55035 take precedence over the corresponding parts of the general performance criteria.

Performance criterion A
Applicable for the test requirement defined in table clause 2.1 of EN 55035
During the swept frequency test the established connection shall be maintained throughout the testing and the information transferred without any additional reproducible errors or loss of synchronisation. If a degradation in performance is observed and the system is adaptive, for example has the capability to automatically retrain in the presence of an interfering signal, then for conducted immunity tests only, the following procedure shall be followed:
a) For each range of interfering frequencies in which degradation in performance is observed, three frequencies (beginning, middle and end) shall be identified.
b) At each of the frequencies identified in step a), the interfering signal shall be turned on and the system is allowed to retrain.
c) If the system is able to retrain and then functions correctly for a dwell time of at least 60 seconds without any additional reproducible errors or loss of synchronisation, then the performance level of the system is considered acceptable.
d) The frequencies identified in step a) and the data rates achieved in step b) shall be recorded in the test report.
Applicable for the test requirement defined in table clause 2.2 of EN 55035
It is important that the modems are able to train in the presence of repetitive impulsive noise and minimize disruption to the end-user where a repetitive impulsive noise source starts after the link has synchronized. Therefore the following procedure and performance criteria shall apply.
The manufacturer shall select the class of impulsive noise protection (INP) to be used for the immunity test and should state this information in the technical documentation and in the test report. The maximum delay shall be set to 8 ms.
In the absence of impulsive noise: The modem shall operate without retraining at its target noise margin with a bit rate value depending on the line attenuation and the stationary noise being present on the line. (The actual value will be between the minimum and maximum bit rate values programmed in the port).
The impulsive noise source shall then be applied at the required test level.
With the impulsive noise applied: The modem shall operate without retraining and without SES at the bit rate established prior to the application of the impulsive noise. No extra CRC errors shall occur due to the impulsive noise.
After the test, the noise margin value shall return to the target noise margin.
Performance criterion B
Applicable for the test requirement defined in table clause 2.3 of EN 55035
Modems shall withstand the occurrence of isolated impulsive noise events. The performance criteria defined in below Table shall be applied.

Impulse duration (ms)	Performance criteria
0.24	The application of the impulse shall not cause the xDSL link to lose synchronisation. No CRC errors are permitted.
10	The application of the 5 impulses shall result in less than 75 CRC errors and shall not cause the link to lose synchronisation.
300	The application of the impulse shall not cause the xDSL link to lose synchronisation.

Applicable for the test requirements defined in table clauses 2.5 and 4.5 of EN 55035

For application of this test to the xDSL port, a repetition rate of 100 kHz (burst length 0.75 ms) shall be used. Degradation of the performance as described in criterion A is permitted in that errors are acceptable during the application of the test. However the application of the test shall not cause the system to lose the established connection or re-train. At the cessation of the test the system shall operate in the condition established prior to the application of the test without user intervention.

After the application of the EFT/B tests to the xDSL or AC mains port, the CRC error count shall not have increased by more than 600 when compared to the count prior to the application of the test.

Performance criterion C

Degradation of the performance as described in criteria A and B is permitted provided that the normal operation of the EUT is self-recoverable to the condition established prior to application of the test or can be restored after the test by the operator.

27 Electrostatic Discharge Immunity Test (ESD)

27.1 Test Specification

Discharge Impedance:	330 ohm / 150 pF
Discharge Voltage:	Air Discharge: ±2kV, ±4kV, ±8kV (Direct) Contact Discharge: ±2kV, ±4kV (Indirect)
Number of Discharge:	Minimum 20 times at each test point
Discharge Mode:	Single Discharge
Discharge Period:	1-second minimum

27.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
ESD Simulator NoiseKen	ESS-2002	ESS0625212/244	May 02, 2018	May 01, 2019

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in ESD-1 room
3. Tested Date: Aug. 06, 2018

27.3 Test Arrangement

a. Electrostatic discharges were applied only to those points and surfaces of the EUT that are accessible to users during normal operation.

b. The test was performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.

c. The time interval between two successive single discharges was at least 1 second.

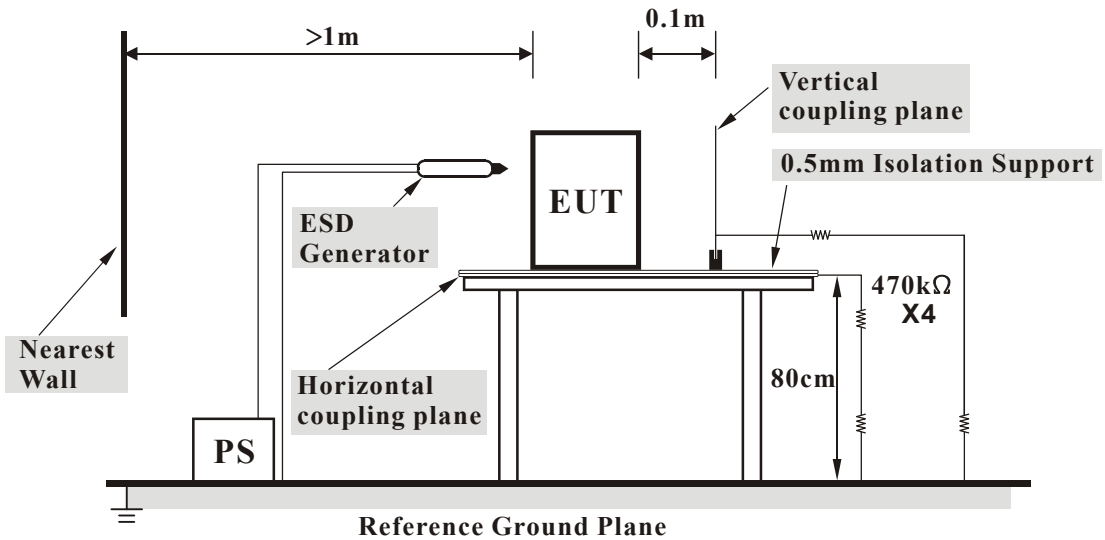
d. The ESD generator was held perpendicularly to the surface to which the discharge was applied and the return cable was at least 0.2 meters from the EUT.

e. Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.

f. Air discharges were applied with the round discharge tip of the discharge electrode approaching the EUT as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator was removed from the EUT and re-triggered for a new single discharge. The test was repeated until all discharges were complete.

g. At least ten single discharges (in the most sensitive polarity) were applied to the **H**orizontal **C**oupling **P**lane at points on each side of the EUT. The ESD generator was positioned at a distance of 0.1 meters from the EUT with the discharge electrode touching the **HCP.**

h. At least ten single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the **V**ertical **C**oupling **P**lane in sufficiently different positions that the four faces of the EUT were completely illuminated. The **VCP** (dimensions 0.5m x 0.5m) was placed vertically to and 0.1 meters from the EUT.



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

NOTE:

TABLE-TOP EQUIPMENT

The configuration consisted of a wooden table 0.8 meters high standing on the **G**round **R**eference **P**lane. The **GRP** consisted of a sheet of aluminum at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system. A **H**orizontal **C**oupling **P**lane (1.6m x 0.8m) was placed on the table and attached to the **GRP** by means of a cable with 940kΩ total impedance. The equipment under test, was installed in a representative system as described in section 7 of EN/IEC 61000-4-2, and its cables were placed on the **HCP** and isolated by an insulating support of 0.5mm thickness. A distance of 1-meter minimum was provided between the EUT and the walls of the laboratory and any other metallic structure.

FLOOR-STANDING EQUIPMENT

The equipment under test was installed in a representative system as described in section 7 of IEC 61000-4-2, and its cables were isolated from the Ground Reference Plane by an insulating support of 0.1-meter thickness. The GRP consisted of a sheet of aluminum that is at least 0.25mm thick, and 2.5 meters square connected to the protective grounding system and extended at least 0.5 meters from the EUT on all sides.

27.4 Supplementary Information

There is not any deviation from the test standards for the test method.

27.5 Test Results

Input Power	230 Vac, 50 Hz	Tested by	Leon Wu
Environmental conditions	23 °C, 49% RH 1021 mbar	Test Mode	Mode 1

Test Results of Direct Application					
Discharge Level (kV)	Polarity (+/-)	Test Point	Contact Discharge	Air Discharge	Performance Criteria
2,4	+/-	1~7	Note 1	NA	A
2,4,8	+/-	8~12	NA	Note 1	A

Description of test points of direct application: Please refer to following page for representative mark only.

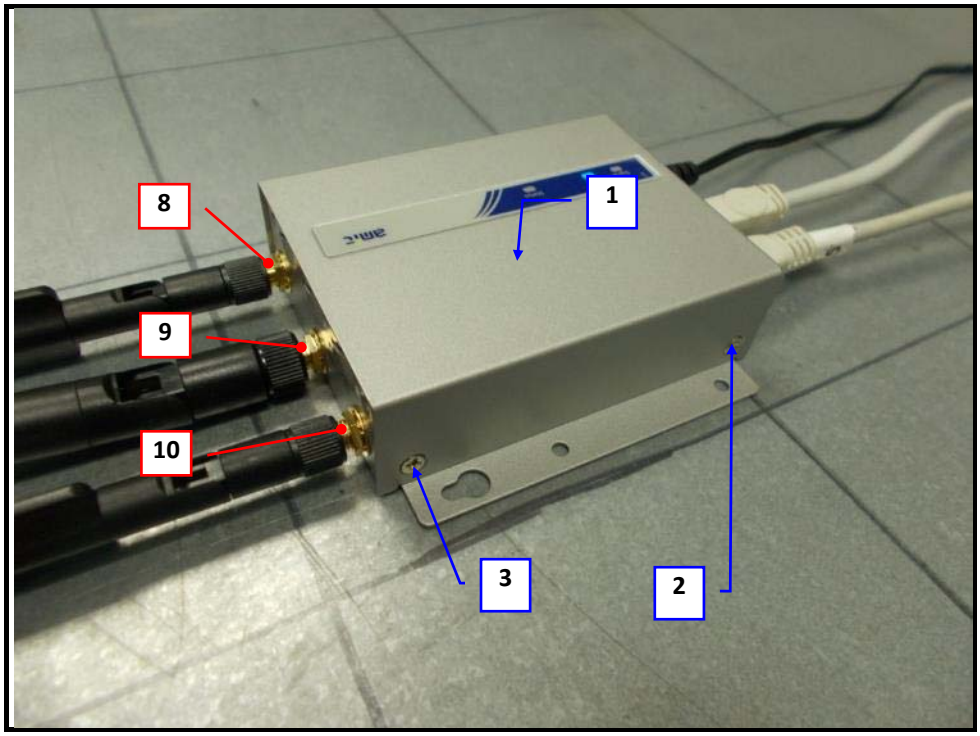
Test Results of Indirect Application					
Discharge Level (kV)	Polarity (+/-)	Test Point	Horizontal Coupling Plane	Vertical Coupling Plane	Performance Criteria
2, 4	+/-	Four Sides	Note 1	Note 1	A

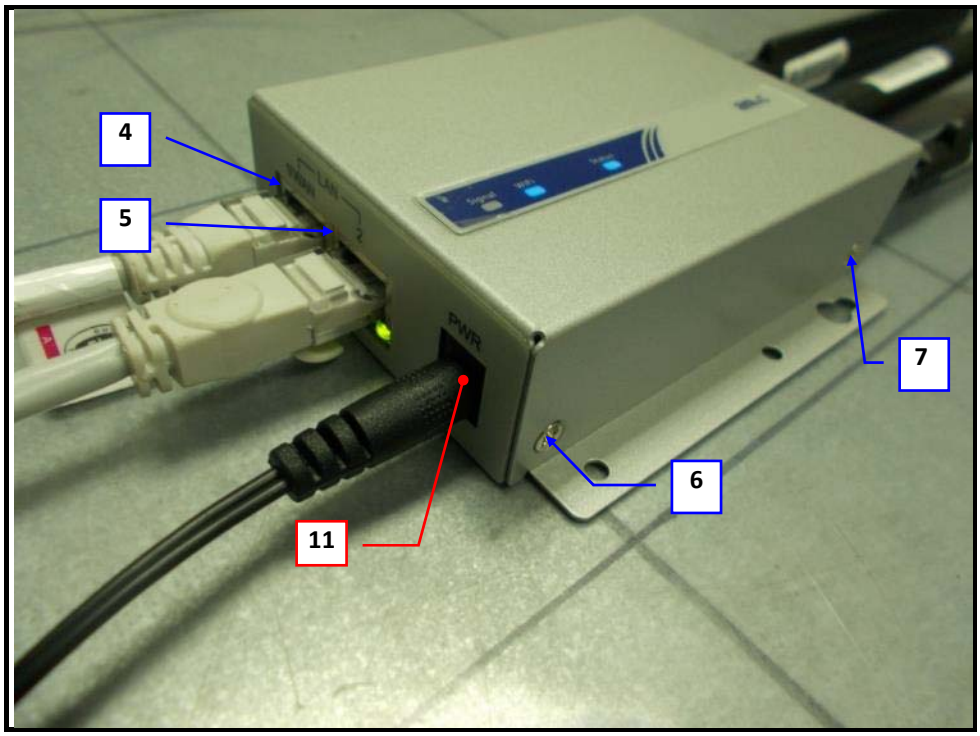
Description of test points of indirect application:

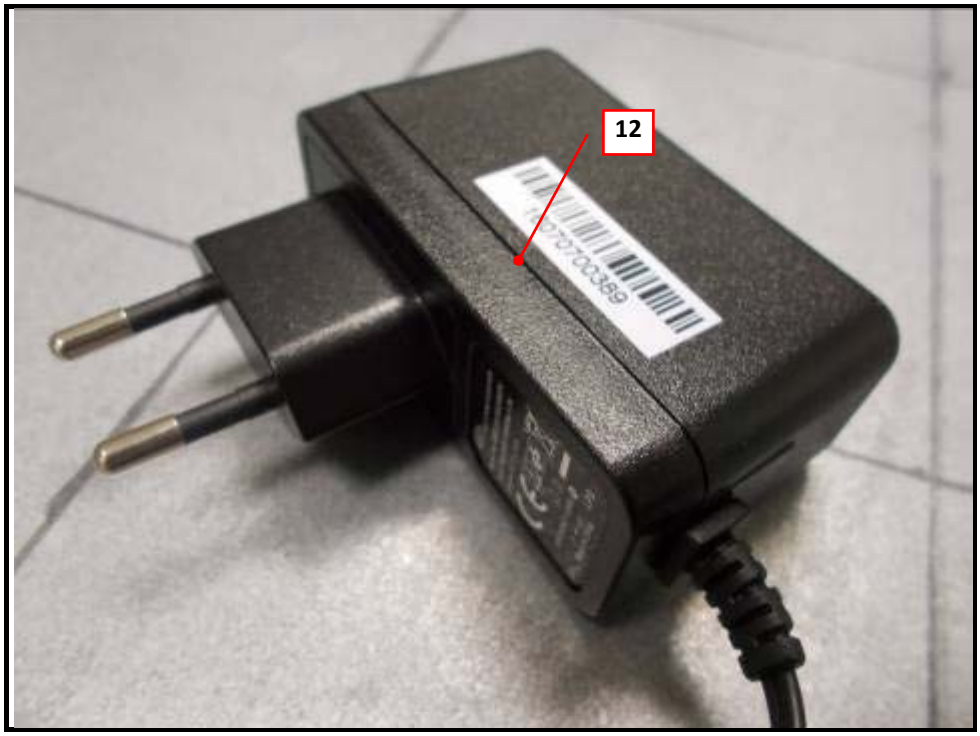
1. Front side 2. Rear side 3. Right side 4. Left side

Note: 1. The EUT is operated normal during the test.

DESCRIPTION OF TEST POINT






12

28 Radiated, Radio-frequency, Electromagnetic Field Immunity Test (RS)

28.1 Test Specification

Frequency Range:	80 MHz ~ 1000 MHz, 1800 MHz, 2600 MHz, 3500 MHz, 5000 MHz
Field Strength:	3 V/m
Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of preceding frequency value
Polarity of Antenna:	Horizontal and Vertical
Antenna Height:	1.5m
Dwell Time:	3 seconds

28.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Vector Signal Generator R&S	SMJ100A	101878	Sep. 16, 2020	Sep. 15, 2021
Amplifier	150W1000M3	311567	NA	NA
Power Amplifier	60S1G3M1	304334	NA	NA
Amplifier	AS1860-50	S-5944/1	NA	NA
RF Voltage Meter KEYSIGHT	N1914A	MY55326005	Sep. 23, 2020	Sep. 22, 2021
LOG ANTENNA ETS-LINGREN	3150B	00203052	NA	NA
LOG ANTENNA AR	AT5080ANT	309740	NA	NA
HORN ANTENNA ETS-LINGREN	3119	00203652	NA	NA
BVADT RS Test Workbench(Software) BVADT	BVADT_RS_ V7.6.9	NA	NA	NA

Note:

1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Chamber RS-1Room.
3 The transmit antenna was located at a distance of 3.0 meters from the EUT.
4. Tested Date: May 27, 2021

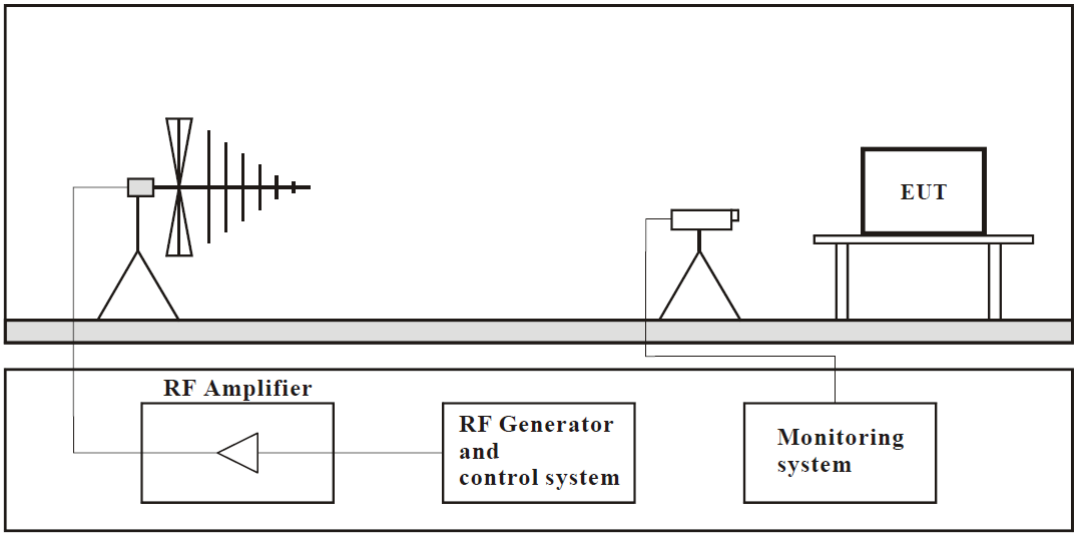
28.3 Test Arrangement

The test procedure was in accordance with EN/IEC 61000-4-3.

a. The testing was performed in a modified semi-anechoic chamber.

b. The field strength level was 3 V/m.

c. The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

NOTE:

TABLETOP EQUIPMENT
The EUT installed in a representative system as described in section 7 of EN/IEC 61000-4-3 was placed on a non-conductive table 0.8 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

FLOOR STANDING EQUIPMENT
The EUT installed in a representative system as described in section 7 of EN/IEC 61000-4-3 was placed on a non-conductive wood support 0.1 meters in height. The system under test was connected to the power and signal wire according to relevant installation instructions.

28.4 Supplementary Information

There is not any deviation from the test standards for the test method.

28.5 Test Results

Input Power	230 Vac 50 Hz	Test mode	Mode 1
Environmental conditions	25°C, 65% RH	Tested by	Allen Qin

Frequency (MHz)	Polarity	Azimuth(°)	Applied Field Strength		Observation	Performance Criteria
			(V/m)	Modulation		
80 - 1000	V&H	0, 90, 180, 270	3	80% AM (1kHz)	Note 1	A
1800, 2600, 3500, 5000	V&H	0, 90, 180, 270	3	80% AM (1kHz)	Note 1	A

Note: 1. The EUT is operated normal during the test.

29 Electrical Fast Transient/Burst Immunity Test (EFT)

29.1 Test Specification

Test Voltage:	Analogue/digital data port(cable length > 3m): ±0.5kV DC network power port(cable length > 3m): NA AC mains power port: ±1kV
Impulse Repetition Frequency:	100kHz : applicable only to analogue/digital data port of xDSL equipment: 5kHz : others
Impulse Wave Shape :	5/50 ns
Burst Duration:	0.75 ms for 100kHz Repetition Frequency 15 ms for 5kHz Repetition Frequency,
Burst Period:	300 ms
Test Duration:	1 min.

29.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
TRANSIENT EMC PARTNER	TRA2000IN6	1121	Mar. 26, 2018	Mar. 25, 2019
CN-EFT100 EMC PARTNER	CN-EFT1000	352	Jan. 15, 2018	Jan. 14, 2019
Adapter	NA	SU1ADA-002	NA	NA
Software EMC PARTNER	Test Manger_V2.11	NA	NA	NA

Note:

1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in EMS-2 room
3. Tested Date: Aug. 01, 2018

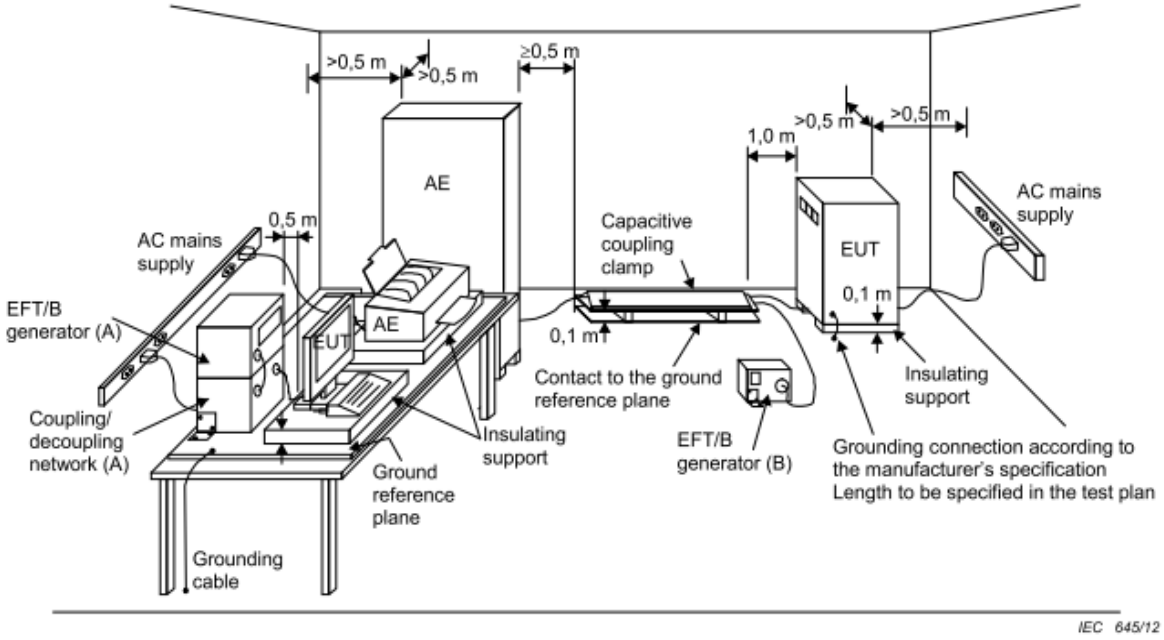
29.3 Test Arrangement

e. Both positive and negative polarity discharges were applied.

f. The distance between any coupling devices and the EUT should be 0.5 m for table-top equipment testing, and 1.0 m for floor standing equipment.

g. The duration time of each test sequential was 1 minute.

h. The transient/burst waveform was in accordance with EN/IEC 61000-4-4, 5/50 ns.



NOTE:
(A) location for supply line coupling
(B) location for signal lines coupling

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

29.4 Supplementary Information

There is not any deviation from the test standards for the test method.

29.5 Test Results

Input Power	230 Vac, 50 Hz	Tested by	Barry Lee
Environmental conditions	26 °C, 60% RH	Test Mode	Mode 1

Input AC power port

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
1	L1	+/-	Note 1	A
1	L2	+/-	Note 1	A
1	L1-L2	+/-	Note 1	A

Signal / telecommunication port

Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criterion
0.5	LAN1/WAN	+/-	Note 1	A
0.5	LAN2	+/-	Note 1	A

Note: 1. The EUT is operated normal during the test.

30 Surge Immunity Test

30.1 Test Specification

Wave-Shape:	Analogue/digital data ports** (direct to outdoor cables*): Port type: unshielded symmetrical 10/700 μs Open Circuit Voltage 5/320 μs Short Circuit Current
	Port type: coaxial or shielded 1.2/50 μs Open Circuit Voltage 8/20 μs Short Circuit Current
	DC network power port (direct to outdoor cables*): 1.2/50 μs Open Circuit Voltage 8/20 μs Short Circuit Current
	AC mains power port: 1.2/50 μs Open Circuit Voltage 8/20 μs Short Circuit Current
Test Voltage:	Analogue/digital ports**:(direct to outdoor cables*): w/o primary protectors: NA with primary protectors fitted: ±0.5kV, ±1kV
	Analogue/digital ports (indoor cables): Line to earth or ground: NA
	DC network power port: NA
	AC mains power ports: Line to line : ±0.5kV, ±1kV Line to earth/ Neutral to earth : NA
AC Phase Angle (degree):	Line to line : positive pulses at 90° / negative pulses at 270°
	Line to earth : positive pulses at 90° / negative pulses at 270°
	Neutral to earth : negative pulses at 90° / positive pulses at 270°
Pulse Repetition Rate:	1 time / 20 sec.
Number of Tests:	5 at selected points

* This test is only applicable only to ports, which according to the manufacturer's specification, may connect directly to outdoor cables.

** For ports where primary protection is intended, surges are applied at voltages up to 4 kV with the primary protectors fitted. Otherwise the 1 kV test level is applied without primary protection in place.

30.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Unshielded Symmetrical High-speed Interconnection Lines Coupling Decoupling Network 3ctest	CDN 405T8H	ES2761501	July 16, 2018	July 15, 2019
Adapter	NA	SU1ADA-002	NA	NA
TRANSIENT EMC PARTNER	TRA2000IN6	1121	Mar. 26, 2018	Mar. 25, 2019
Software EMC PARTNER	Test Manger_V2.11	NA	NA	NA

Note:

1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in EMS-2 room
3. Tested Date: Aug. 01, 2018

30.3 Test Arrangement

a. Input AC Power ports:

The surge is to be applied to the EUT power supply terminals via the capacitive coupling network. Decoupling networks are required in order to avoid possible adverse effects on equipment not under test that may be powered by the same lines, and to provide sufficient decoupling impedance to the surge wave. The power cord between the EUT and the coupling/decoupling networks shall be 2 meters in length (or shorter).

For double-insulated products without PE or external earth connections, the test shall be done in a similar way as for grounded products but without adding any additional external grounded connections. If there are no other possible connections to earth, line-to-ground tests may be omitted.

b. Signal and telecommunication ports,

- Unshielded unsymmetrical interconnection lines:

The surge is applied to the lines via the capacitive coupling. The coupling / decoupling networks shall not influence the specified functional conditions of the EUT. The interconnection line between the EUT and the coupling/decoupling networks shall be 2 meters in length.

- Unshielded symmetrical interconnections communication lines:

The surge is applied to the lines via gas arrestors coupling. Test levels below the ignition point of the coupling arrestor cannot be specified. The interconnection line between the EUT and the coupling/decoupling networks shall be 2 meters in length.

- High speed communications lines

Prior to the test, the correct operation of the port shall be verified; the external connection shall then be removed and the surge applied directly to the port's terminals with no coupling /decoupling network. After the surge, the correct operation of the port shall again be verified.

- Shielded lines:

- Direct application,

The EUT is isolated from ground and the surge is applied to its metallic enclosure; the termination (or auxiliary equipment) at the port(s) under test is grounded. This test applies to equipment with single or multiple shielded cables.

Rules for application of the surge to shielded lines:

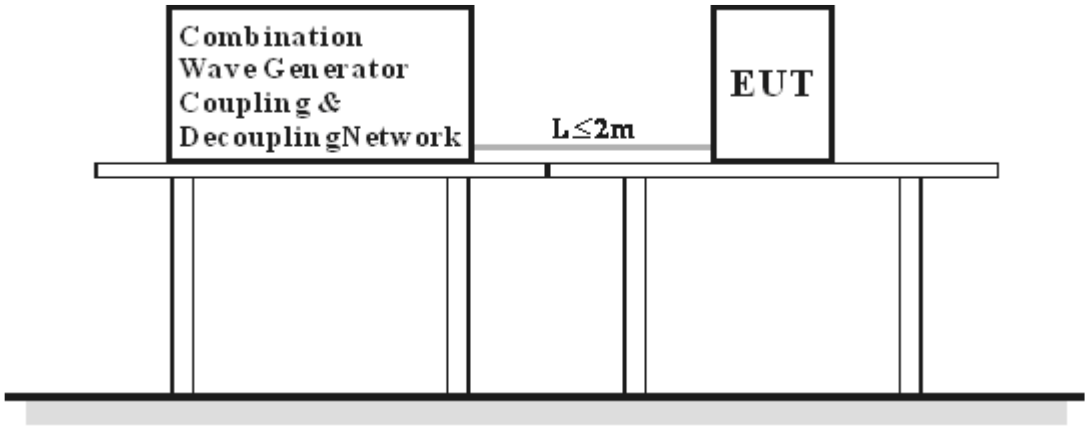
a) Shields grounded at both ends
> The surge injection on the shield.

b) Shields grounded at one end
> If in the installation the shield is connected only at the auxiliary equipment, test shall be done in that configuration but with the generator still connected to the EUT side. If cable lengths allow, the cables shall be on insulated supports 0,1 m above the ground plane or cable tray.

For products which do not have metallic enclosures, the surge is applied directly to the shielded cable.

- Alternative coupling method for testing single cables in a multi-shield configuration,

Surges are applied in close proximity to the interconnection cable under test by a wire. The length of the cable between the port(s) under test and the device attached to the other end of the cable shall be the lesser of: the maximum length permitted by the EUT's specification, or 20 m. Where the length exceeds 1 m, excess lengths of cables shall be bundled at the approximate centre of the cables with the bundles 30 cm to 40 cm in length.



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

30.4 Supplementary Information

There is not any deviation from the test standards for the test method

30.5 Test Results

Input Power	230 Vac, 50 Hz	Tested by	Barry Lee
Environmental conditions	26 °C, 60% RH	Test Mode	Mode 1

Input AC Power ports:

Voltage (kV)	Test Point	Azimuth(°)	Polarity (+/-)	Observation	Performance Criteria
0.5, 1	L1 – L2	90	+	Note 1	A
0.5, 1	L1 – L2	270	-	Note 1	A

Note: 1. The EUT is operated normal during the test..

31 Immunity to Conducted Disturbances Induced by RF Fields (CS)

31.1 Test Specification

Frequency Range:	0.15 MHz - 80 MHz
Voltage Level:	0.15 MHz - 10 MHz, 3V 10 MHz - 30 MHz, 3V-1V 30 MHz - 80 MHz, 1V
Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of preceding frequency value
Dwell Time	3 seconds

31.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Signal Generator R&S	SML01	102731	Nov. 18, 2020	Nov. 17, 2021
Amplifier AR	75A250AM1	307297	NA	NA
RF Voltage Meter BOONTON	4232A- 01	93801	Nov. 20, 2020	Nov. 19, 2021
LUTHIE EM Injection Clamp TESEQ	KEMZ801A	41344	Oct. 06, 2020	Oct. 05, 2021
Coupling Decoupling Network M2 TESEQ	M216S	40667	Oct. 06, 2020	Oct. 05, 2021
Coupling Decoupling Network M3 TESEQ	M316S	40119	Oct. 06, 2020	Oct. 05, 2021
Coupling Decoupling Network T2 TESEQ	T246AS	38311	Oct. 06, 2020	Oct. 05, 2021
Coupling Decoupling Network T4 TESEQ	T400A	28587	Oct. 06, 2020	Oct. 05, 2021
Coupling Decoupling Network T8 TESEQ	T8-10S	41249	Oct. 06, 2020	Oct. 05, 2021
BVADT CS Test Workbench(Software) BVADT	BVADT_CS_ V7.6.5	NA	NA	NA

Note:

1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in CS-3 Room.
3 Tested Date: May 27, 2021

31.3 Test Arrangement

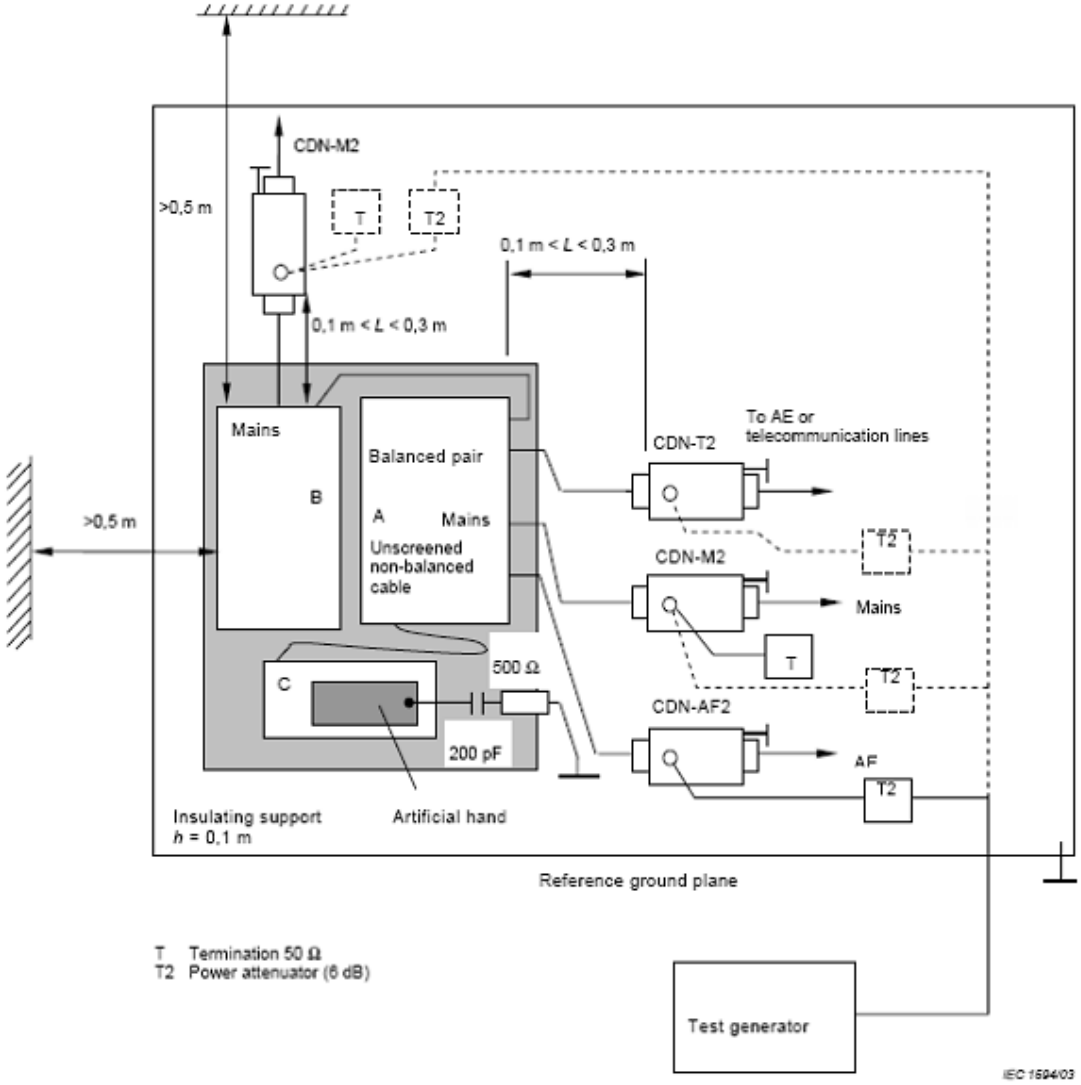
a. The EUT shall be tested within its intended operating and climatic conditions.

b. An artificial hand was placed on the hand-held accessory and connected to the ground reference plane.

c. One of the CDNs not used for injection was terminated with 50 ohm, providing only one return path. All other CDNs were coupled as decoupling networks.

d. The frequency range is swept from 150 kHz to 80 MHz, using the signal level established during the setting process and with a disturbance signal of 80 % amplitude. The signal is modulated with a 1 kHz sine wave, pausing to adjust the RF signal level or the switch coupling devices as necessary. Where the frequency is swept incrementally, the step size shall not exceed 1 % of the preceding frequency value.

e. Attempts should be made to fully exercise the EUT during testing, and to fully interrogate all exercise modes selected for susceptibility.



Note: 1.The EUT clearance from any metallic obstacles shall be at least 0,5 m.
2. Interconnecting cables (≦1 m) belonging to the EUT shall remain on the insulating support.
For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

31.4 Supplementary Information

There is not any deviation from the test standards for the test method.

31.5 Test Results

Input Power	230 Vac, 50 Hz	Tested by	Allen Qin
Environmental conditions	25 °C, 45% RH	Test Mode	Mode 1

Input AC power port							
Frequency (MHz)	Level (V rms)	Modulation	Tested Line	Injection Method	Return Path	Observation	Performance Criteria
0.15~10	3	80% AM (1kHz)	AC Power	CDN-M2	CDN-T4	Note 1	A
10~30	3~1	80% AM (1kHz)	AC Power	CDN-M2	CDN-T4	Note 1	A
30~80	1	80% AM (1kHz)	AC Power	CDN-M2	CDN-T4	Note 1	A

Wired network and signal/ control port							
Frequency (MHz)	Level (V rms)	Modulation	Tested Line	Injection Method	Return Path	Observation	Performance Criteria
0.15~10	3	80% AM (1kHz)	LAN1/WAN	CDN-T4	CDN-M2	Note 1	A
10~30	3~1	80% AM (1kHz)	LAN1/WAN	CDN-T4	CDN-M2	Note 1	A
30~80	1	80% AM (1kHz)	LAN1/WAN	CDN-T4	CDN-M2	Note 1	A
0.15~10	3	80% AM (1kHz)	LAN2	CDN-T4	CDN-M2	Note 1	A
10~30	3~1	80% AM (1kHz)	LAN2	CDN-T4	CDN-M2	Note 1	A
30~80	1	80% AM (1kHz)	LAN2	CDN-T4	CDN-M2	Note 1	A

Note: 1. The EUT is operated normal during the test.

32 Power Frequency Magnetic Field Immunity Test

32.1 Test Specification

Frequency Range:	50Hz
Field Strength:	1 A/m
Observation Time:	1 minute
Inductance Coil:	Rectangular coil, 1m x 1m (L x W)

32.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Triaxial Elf Magnetic Field Meter BELL	4090	NA	Feb. 08, 2018	Feb. 07, 2019
Power frequency magnetic filed coil 3ctest	TCX30	EC1281401	Mar. 05, 2018	Mar. 04, 2019
Power frequency magnetic filed generator 3ctest	PFMF-1200G	EC0111401	Mar. 05, 2018	Mar. 04, 2019

Note:

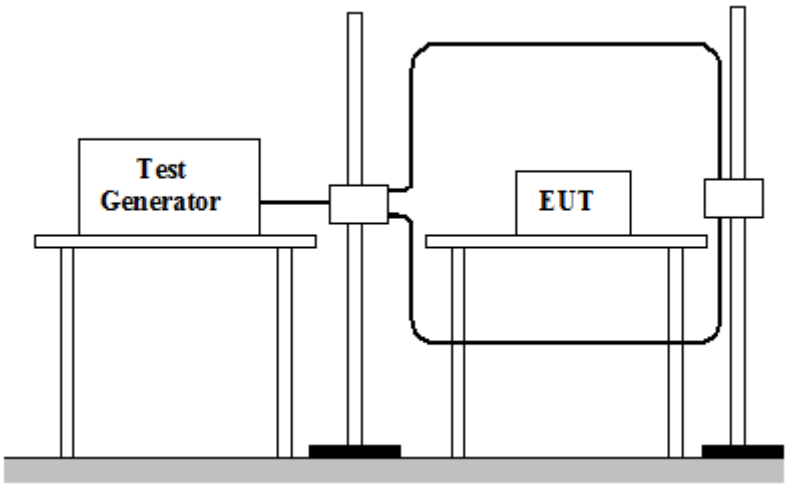
1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in EMS-1 room.
3. Tested Date: Aug. 01, 2018

32.3 Test Arrangement

d. The equipment is configured and connected to satisfy its functional requirements.

e. The power supply, input and output circuits shall be connected to the sources of power supply, control and signal.

f. The cables supplied or recommended by the equipment manufacturer shall be used. 1 meter of all cables used shall be exposed to the magnetic field.



Tabletop equipment
The equipment shall be subjected to the test magnetic field (see example as above).
The plane of the inductive coil shall then be rotated by 90° in order to expose the EUT to the test field with different orientations.

32.4 Supplementary Information

There is not any deviation from the test standards for the test method.

32.5 Test Results

Input Power	230 Vac, 50 Hz	Tested by	Leon Wu
Environmental conditions	25 °C, 67% RH	Test mode	Mode 1

Application	Frequency (Hz)	Field Strength (A/m)	Observation	Performance Criterion
X - Axis	50	1	Note 1	A
Y - Axis	50	1	Note 1	A
Z - Axis	50	1	Note 1	A

Note: 1. The EUT is operated normal during the test.

33 Voltage Dips and Interruptions

33.1 Test Specification

Test levels:	Voltage Dips: <5% residual – 0.5 cycle, 70% residual – 25 cycles Voltage Interruptions: <5% residual – 250 cycles
Interval between Event:	Minimum ten seconds
Sync Angle (degrees):	0°
Test Cycle:	3 times

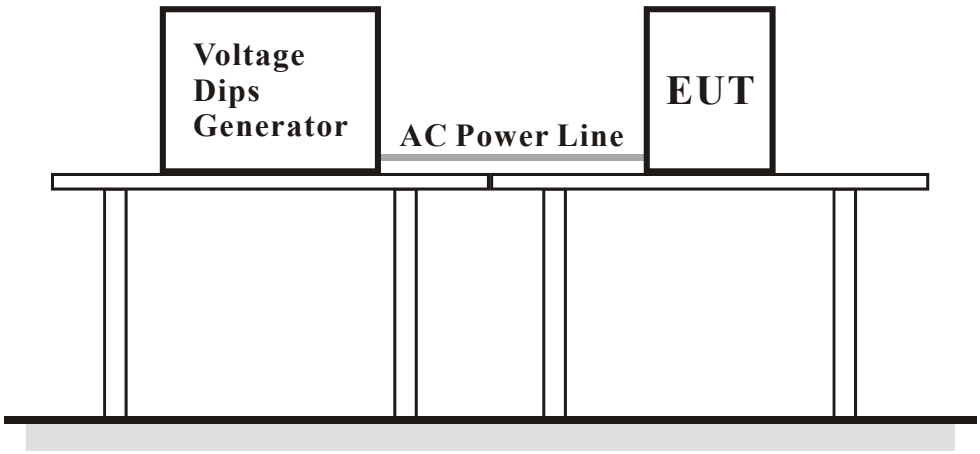
33.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
TRANSIENT EMC PARTNER	TRA2000IN6	1121	Mar. 26, 2018	Mar. 25, 2019
Adapter	NA	SU1ADA-002	NA	NA
Software EMC PARTNER	Test Manger_V2.11	NA	NA	NA

Note:
1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in EMS-2 room
3. Tested Date: Aug. 01, 2018

33.3 Test Arrangement

The EUT shall be tested for each selected combination of test levels and duration with a sequence of 3 dips/interruptions with intervals of 10 s minimum (between each test event). Each representative mode of operation shall be tested. Abrupt changes in supply voltage shall occur at 0 dregee crossover point of the voltage waveform.



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

33.4 Supplementary Information

There is not any deviation from the test standards for the test method.

33.5 Test Results

Input Power	230 Vac / 240 Vac / 100 Vac 50 Hz	Tested by	Barry Lee
Environmental conditions	26 °C, 60% RH	Test mode	Mode 1

Input Power for testing: 230 Vac, 50 Hz (Nominal input Voltage)					
Voltage Reduction (%)	Duration (period)	Interval (sec)	Times	Observation	Performance Criterion
< 5	0.5	10	3	Note 1	A
70	25	10	3	Note 1	A
< 5	250	10	3	Note 2	B

Input Power for testing: 240 Vac, 50 Hz (Maximum rated input voltage)					
Voltage Reduction (%)	Duration (period)	Interval (sec)	Times	Observation	Performance Criterion
< 5	0.5	10	3	Note 1	A
70	25	10	3	Note 1	A
< 5	250	10	3	Note 2	B

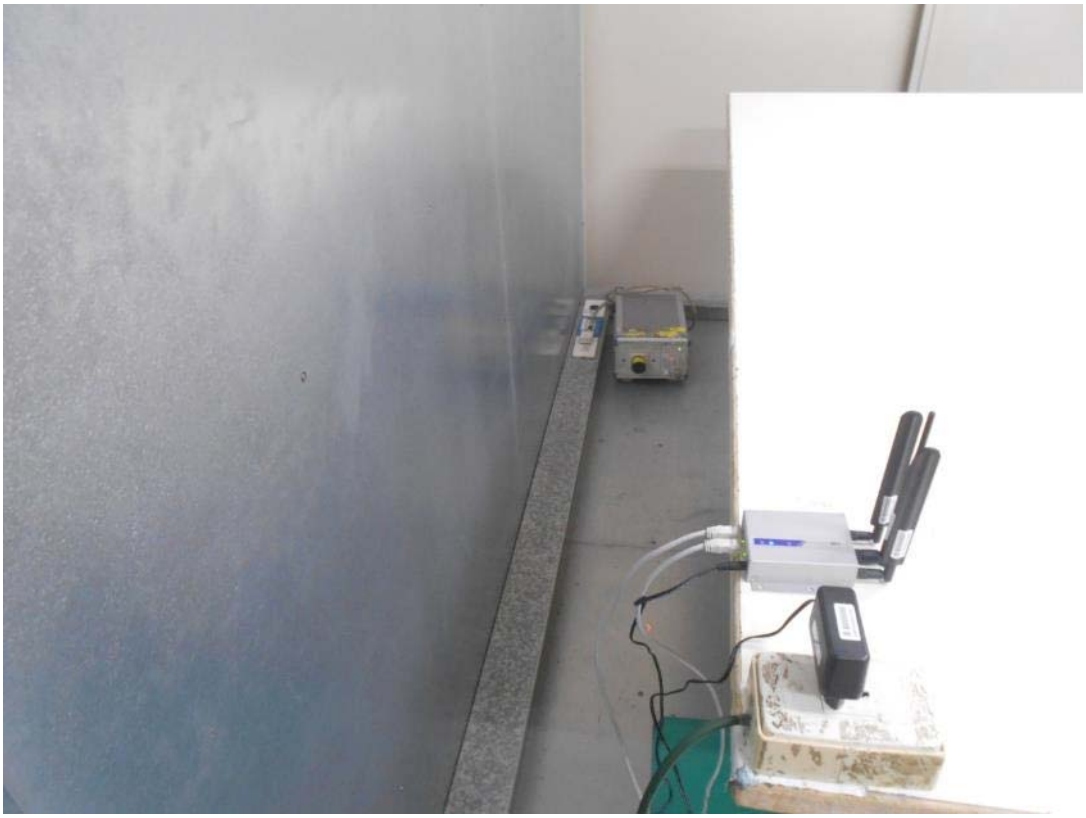
Input Power for testing: 100 Vac, 50 Hz (Minimum rated input voltage)					
Voltage Reduction (%)	Duration (period)	Interval (sec)	Times	Observation	Performance Criterion
< 5	0.5	10	3	Note 1	A
70	25	10	3	Note 1	A
< 5	250	10	3	Note 2	B

Note: 1. The EUT is operated normal during the test.
2. The EUT appears a “reboot” phenomena during the test, but it can be self-recoverable after the test.

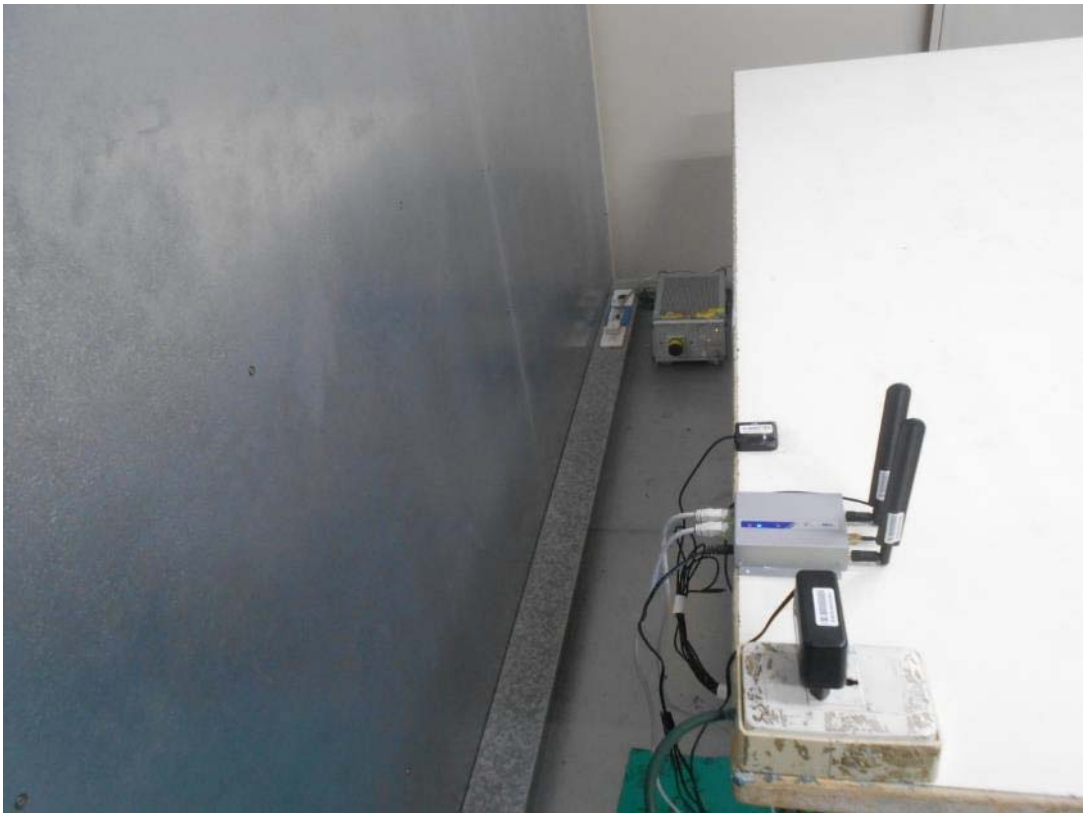
34 Pictures of Test Arrangements

34.1 Conducted Disturbance at Mains Ports

Mode 1



Mode 2

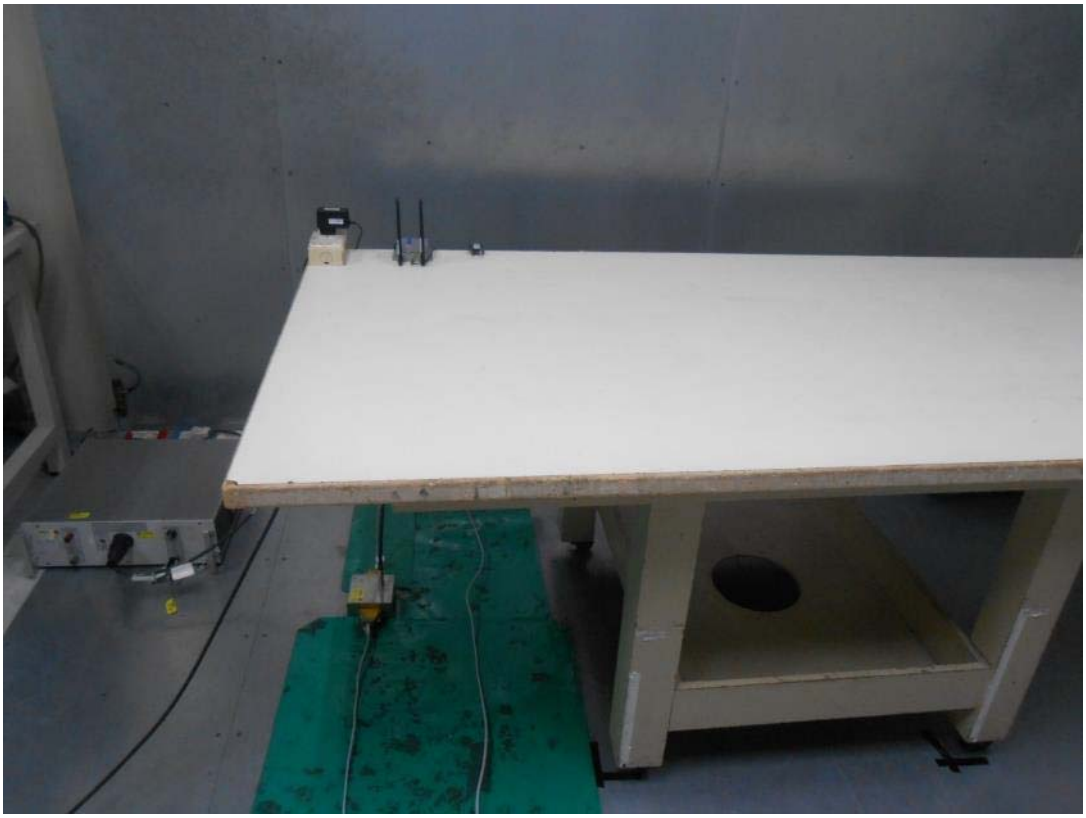


34.2 Asymmetric mode conducted emission

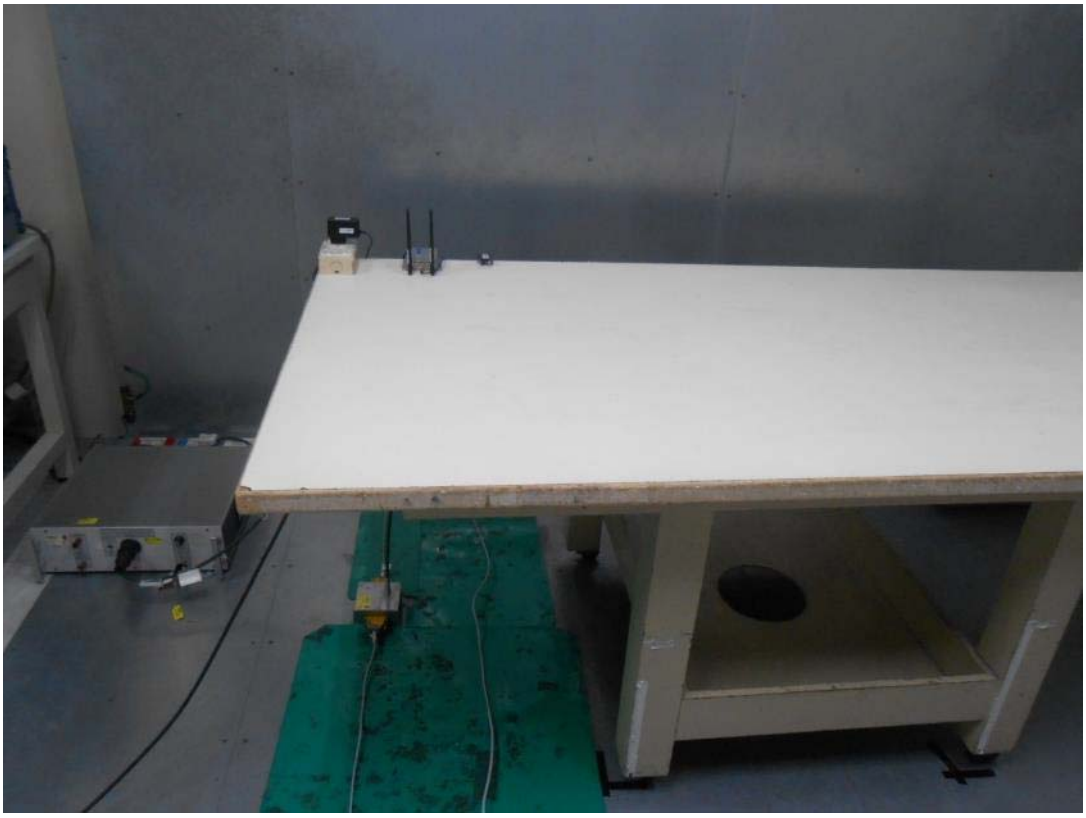
Mode 1

Mode 2

Mode 3

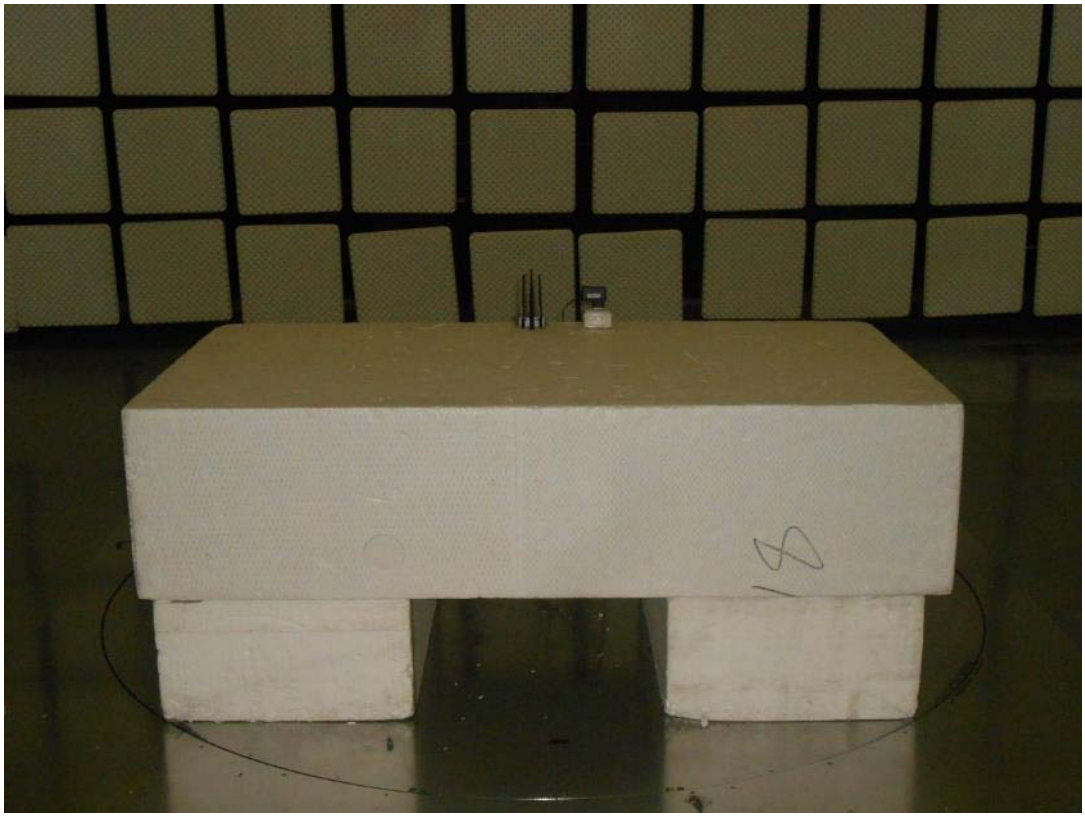


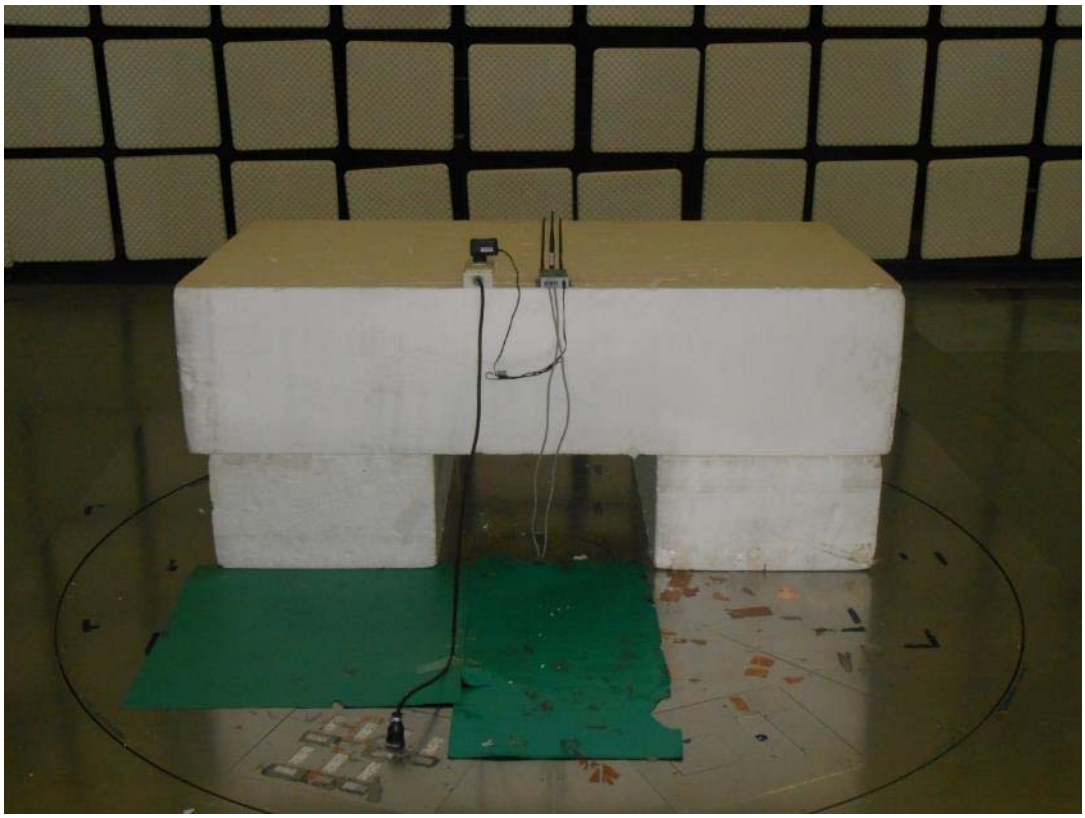
Mode 4



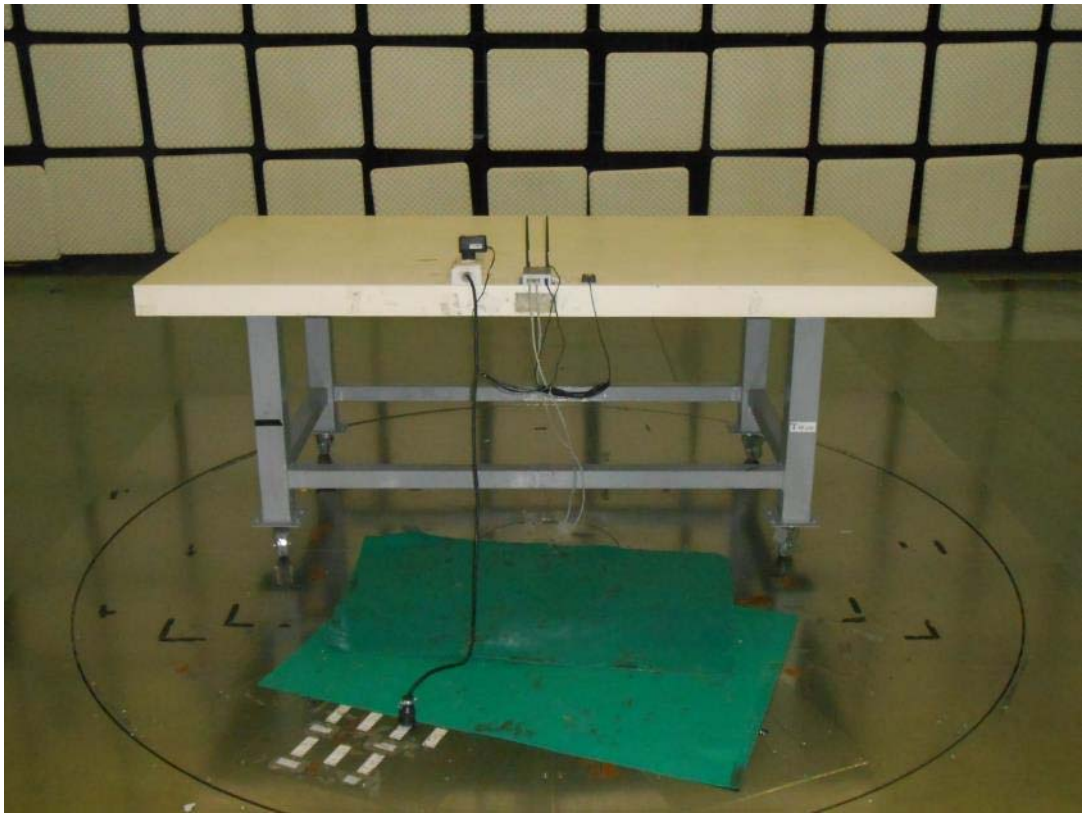
34.3 Radiated Disturbance up to 1 GHz

Mode 1



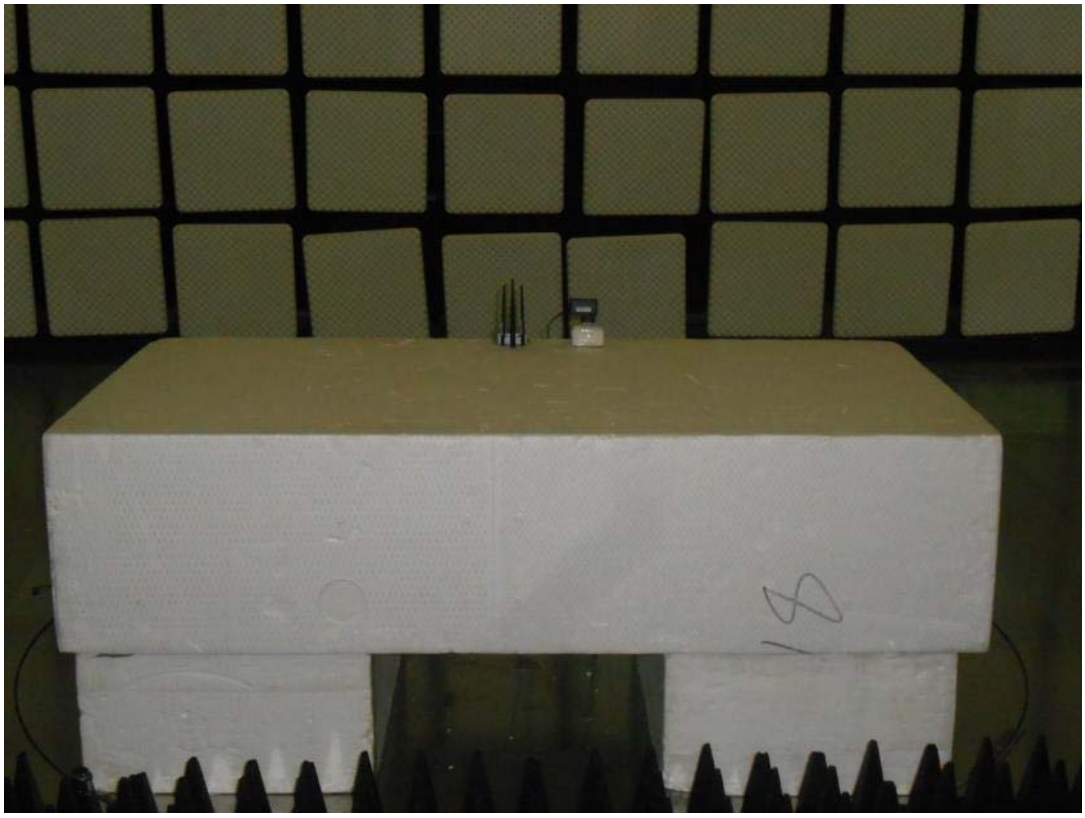


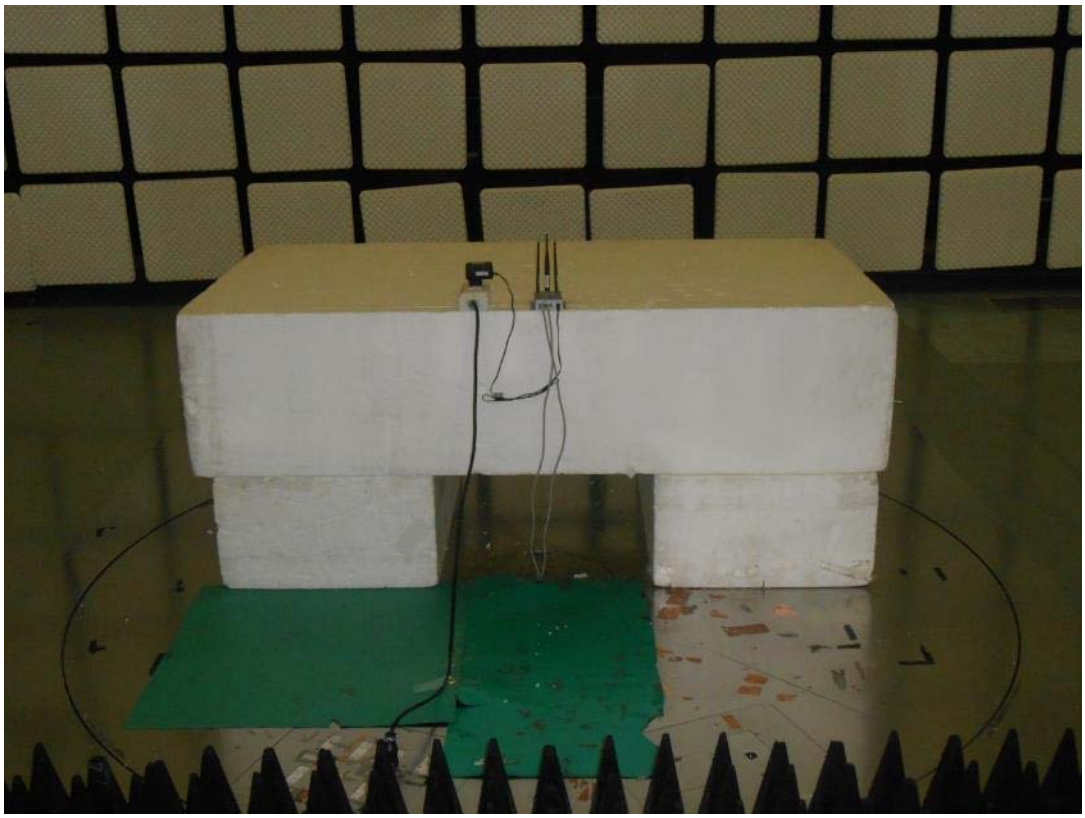
Mode 2



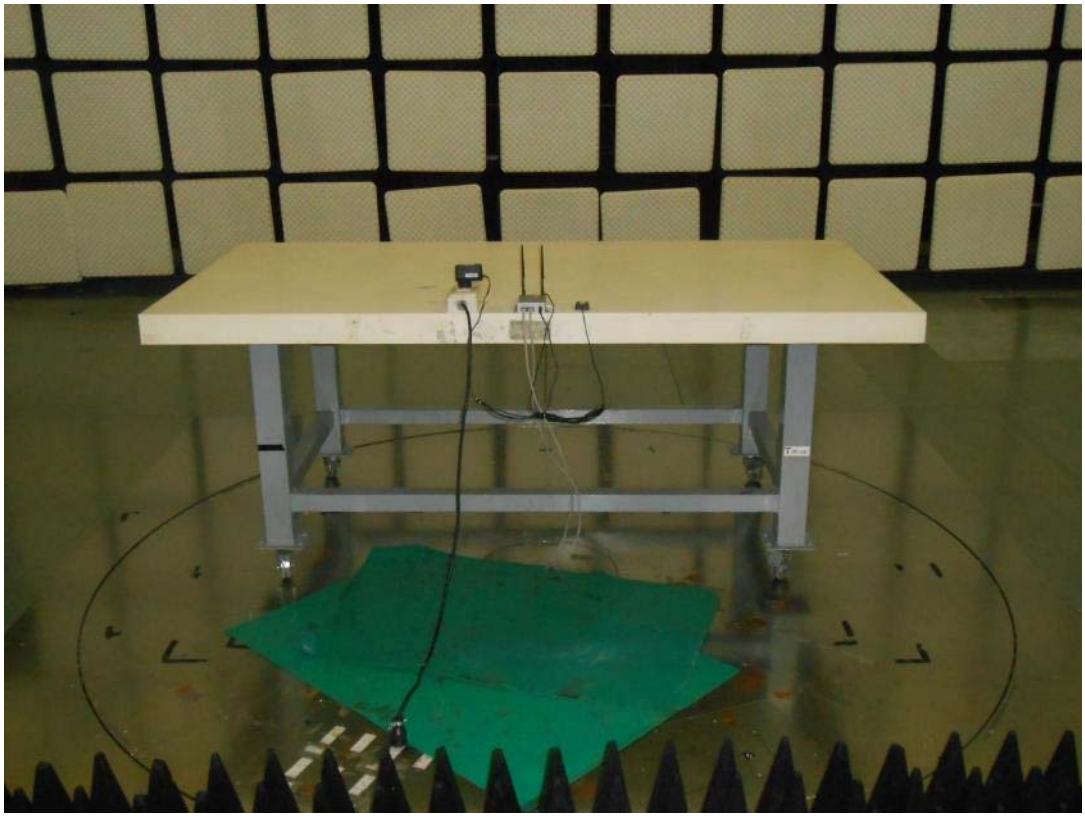
34.4 Radiated Disturbance above 1 GHz

Mode 1





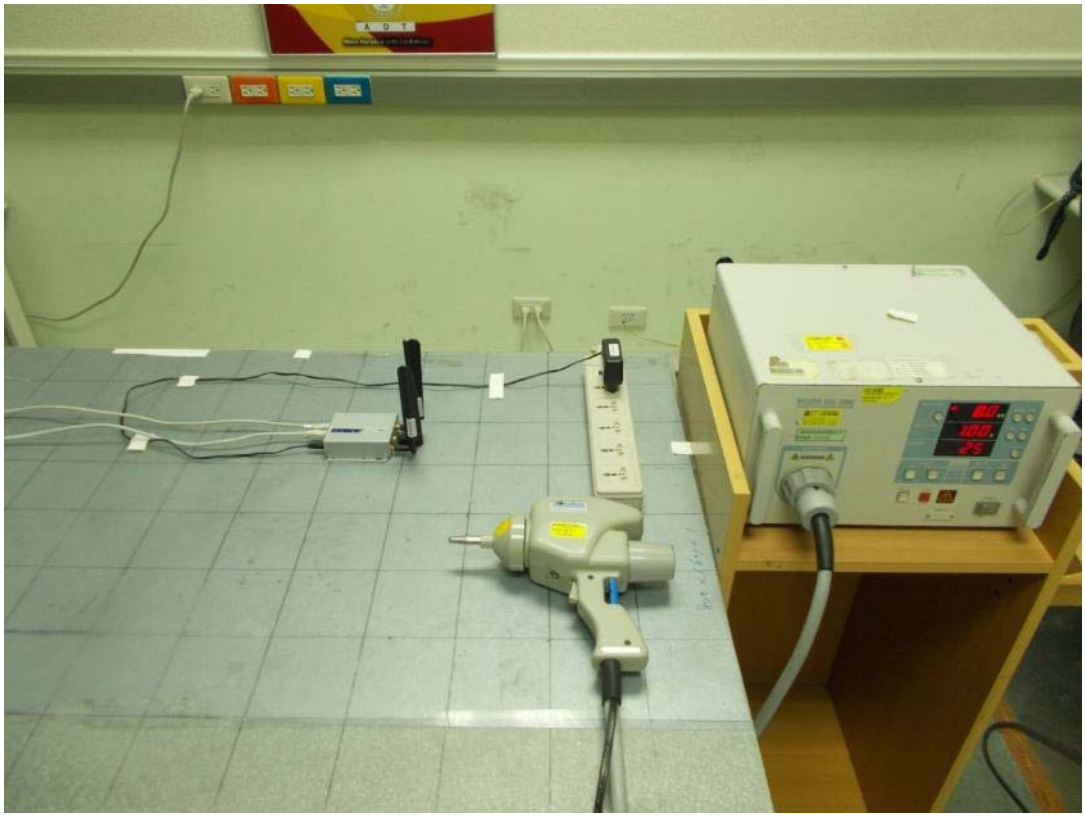
Mode 2



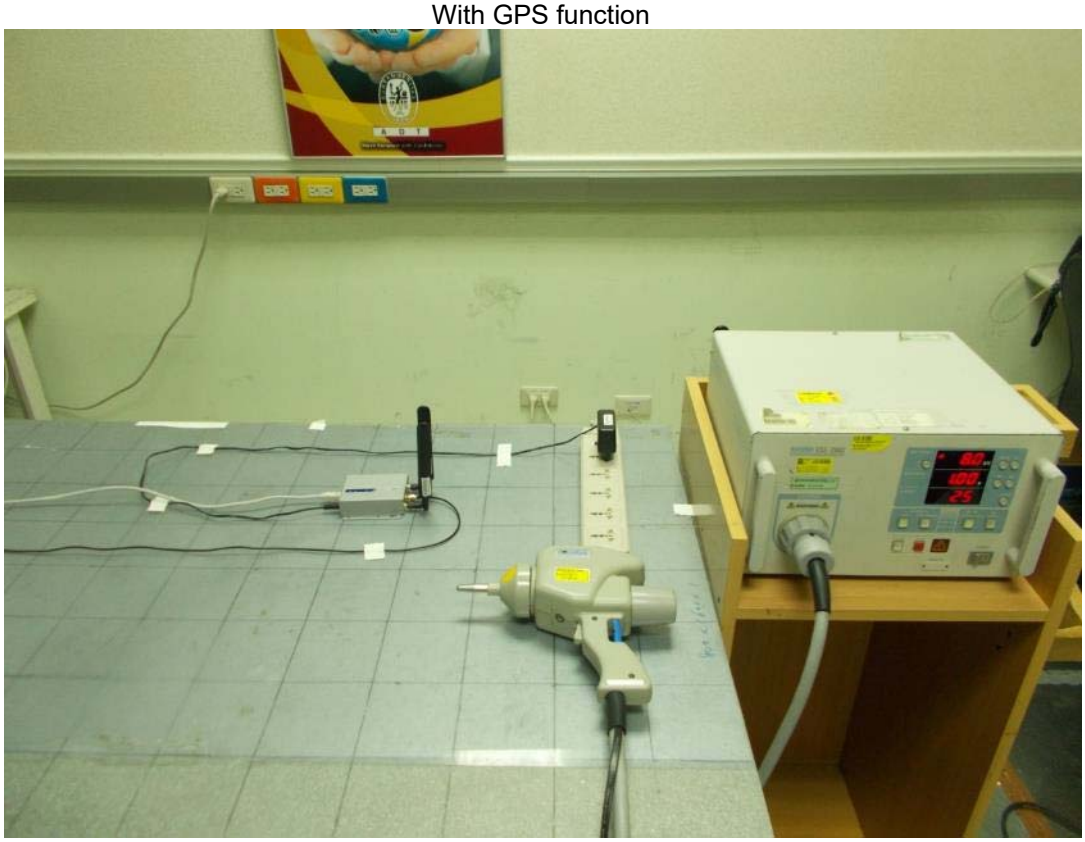
34.1 Harmonics Current, Voltage Fluctuations and Flicker Measurement

34.2 Electrostatic Discharge Immunity Test (ESD)

With Wifi function

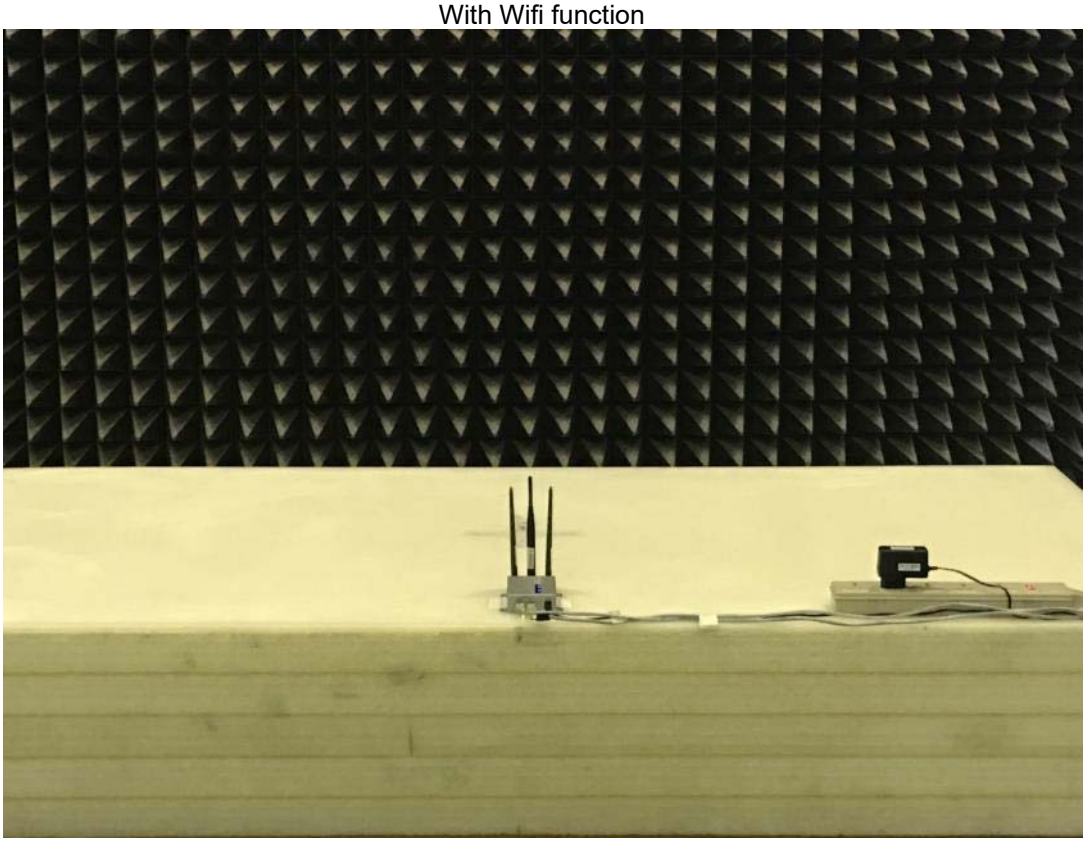


With GPS function



34.3 Radio-frequency, Electromagnetic Field Immunity Test (RS)

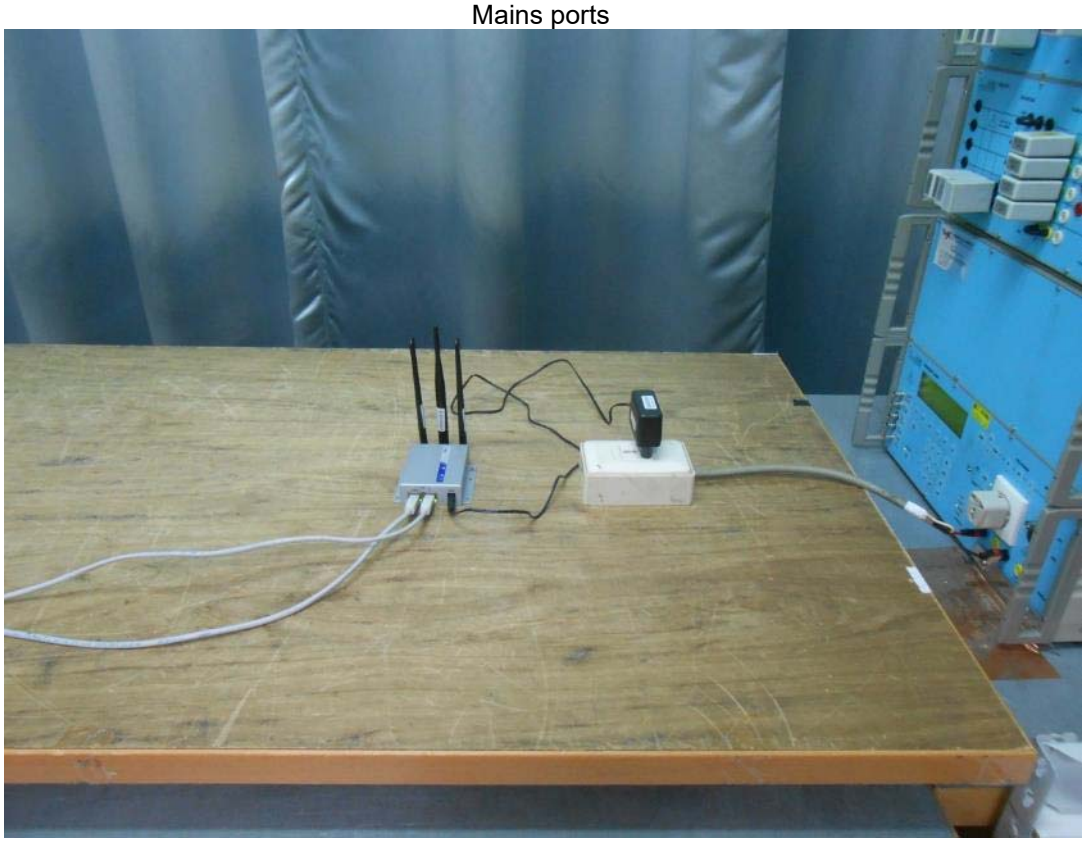
With Wifi function



34.4 Electrical Fast Transient/Burst Immunity Test (EFT)

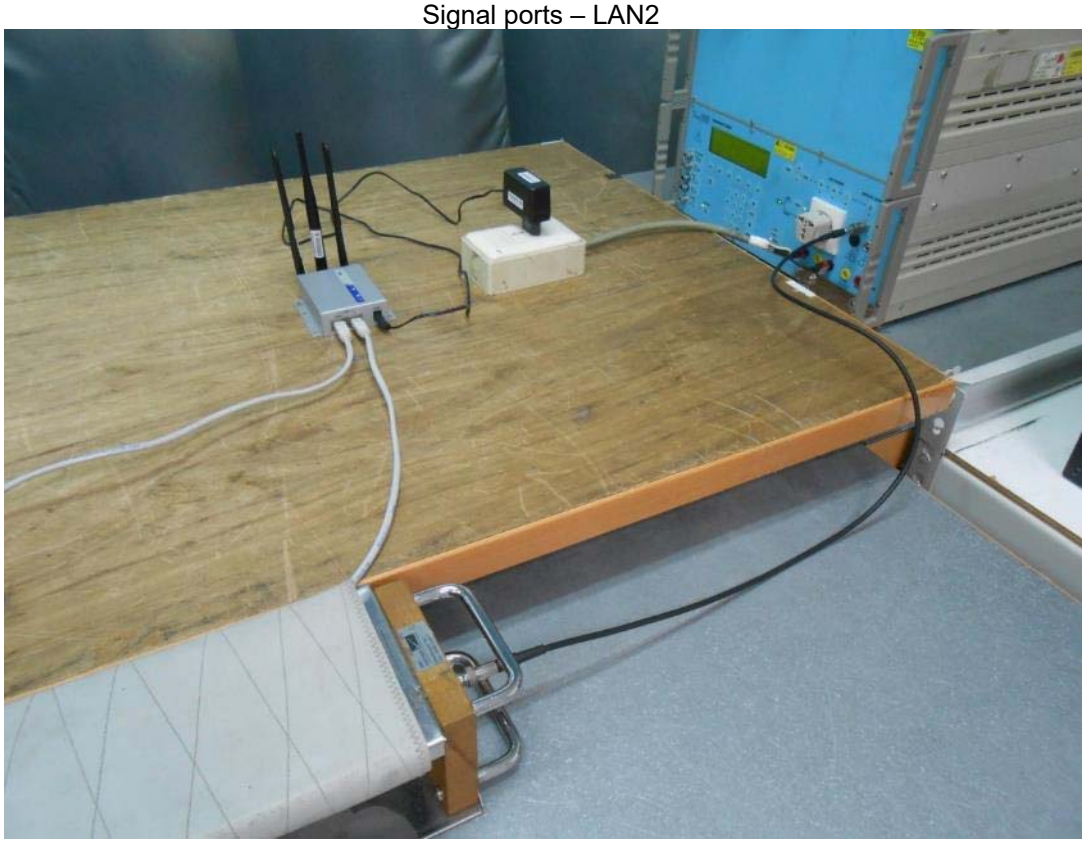
With Wifi function

Mains ports

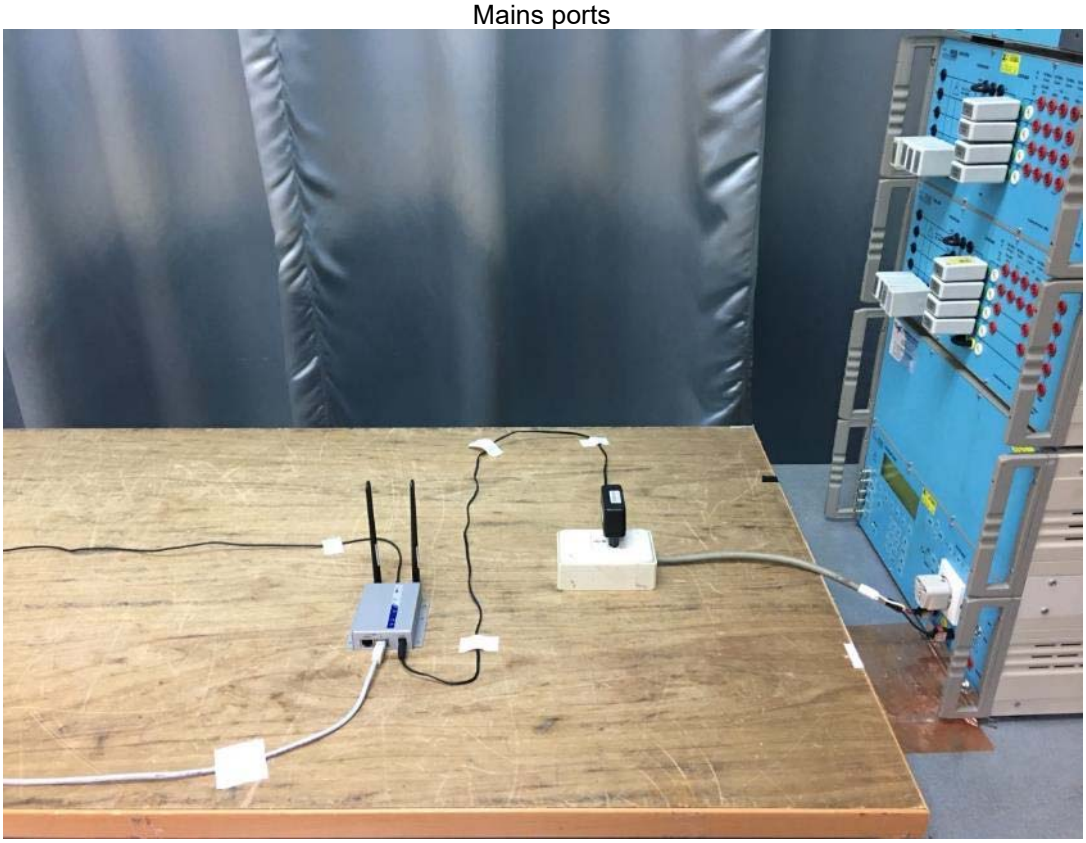


Signal ports – LAN1/WAN

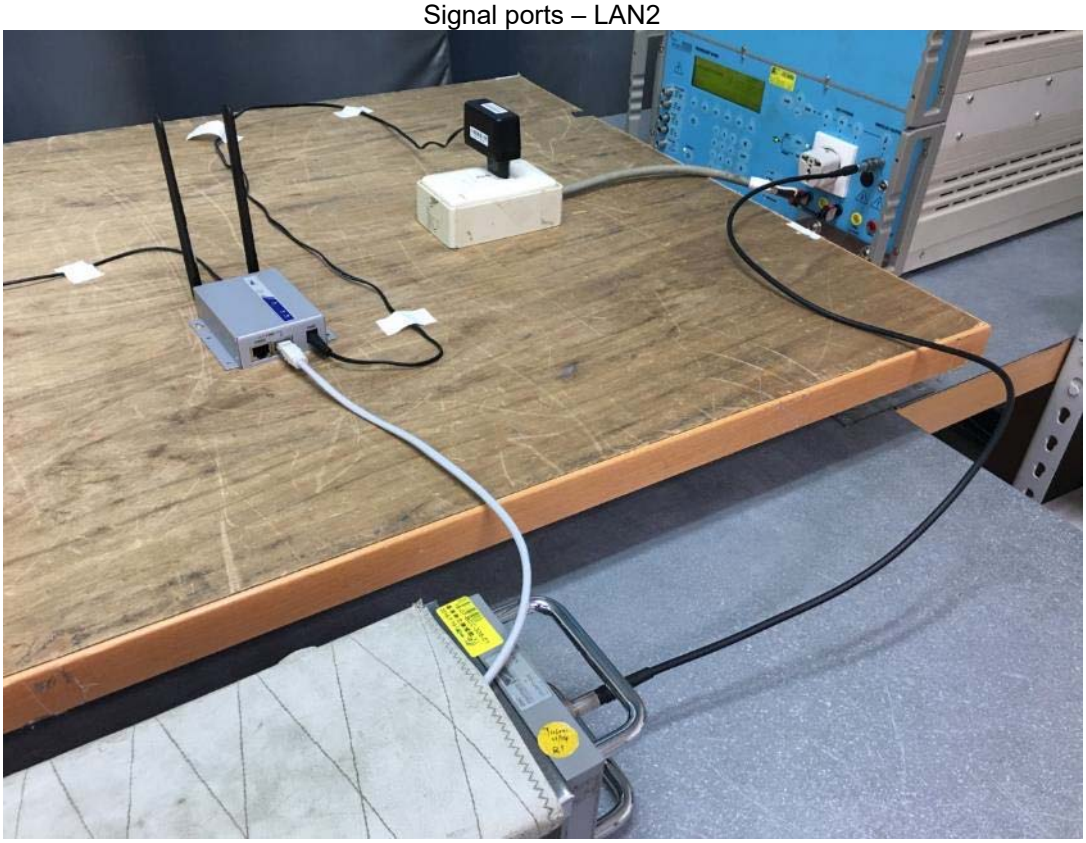
Signal ports – LAN2



With GPS function
Mains ports

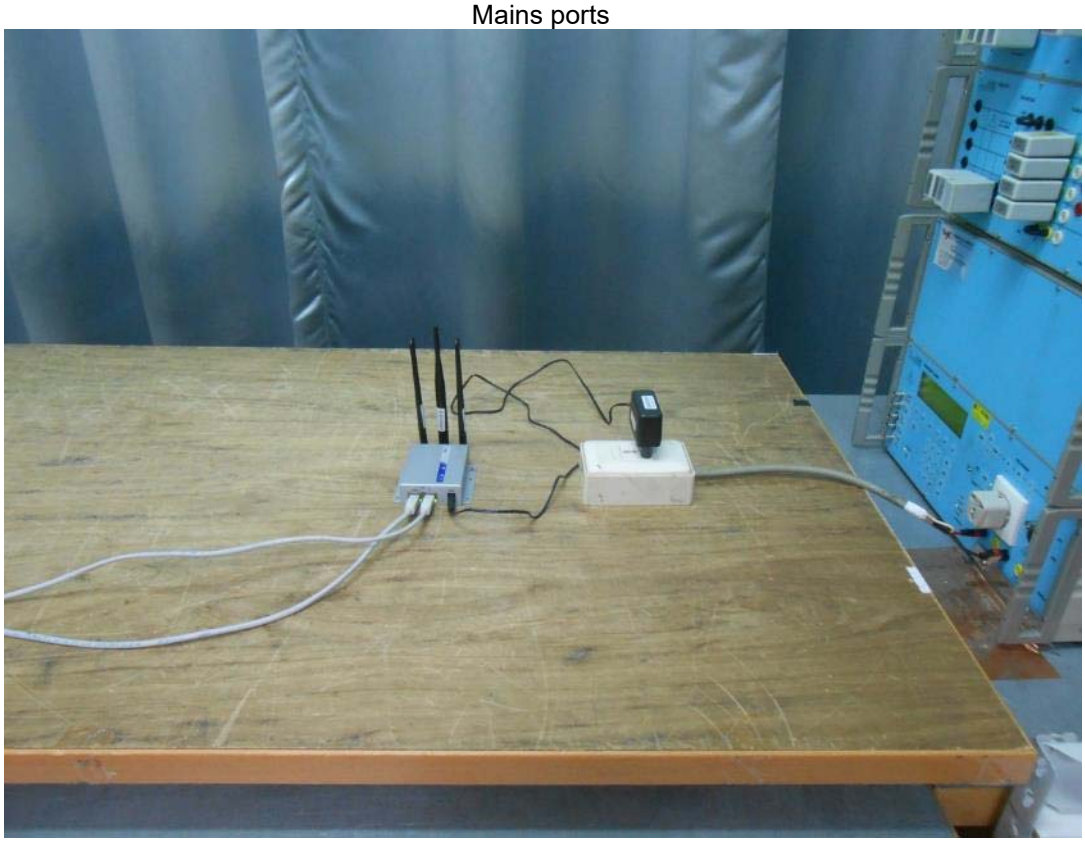


Signal ports – LAN2

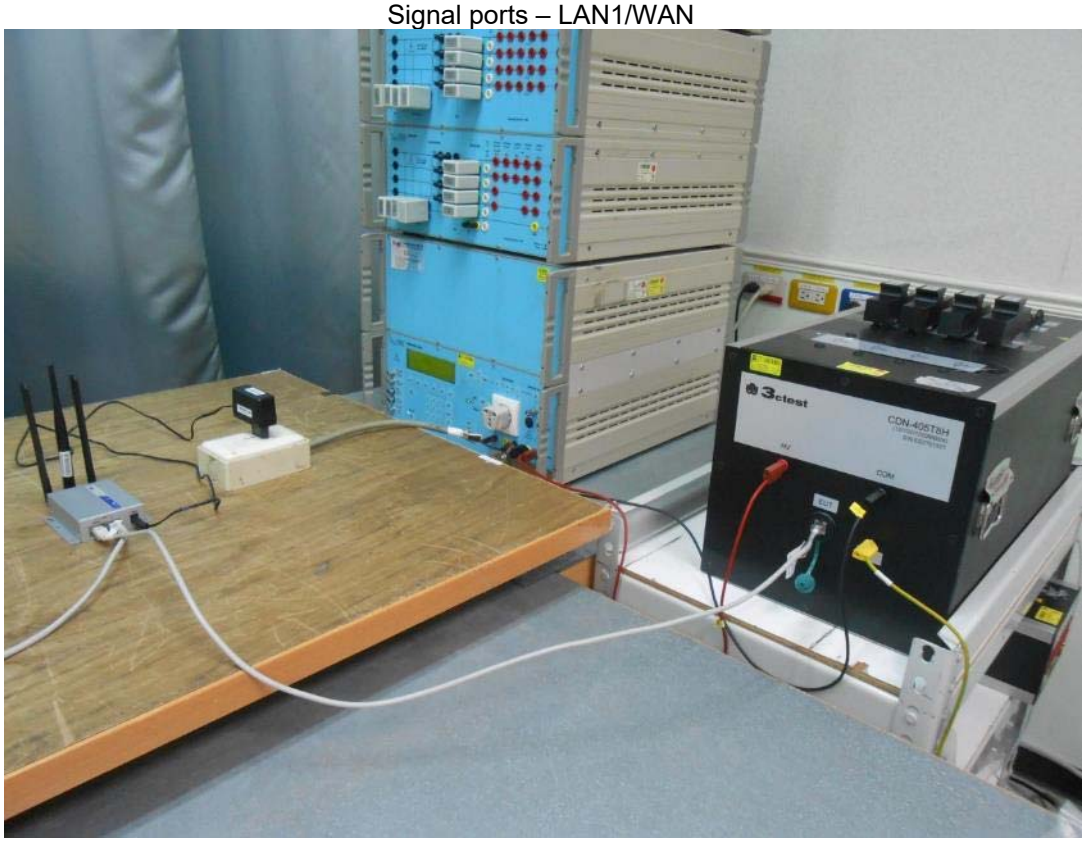


34.5 Surge Immunity Test

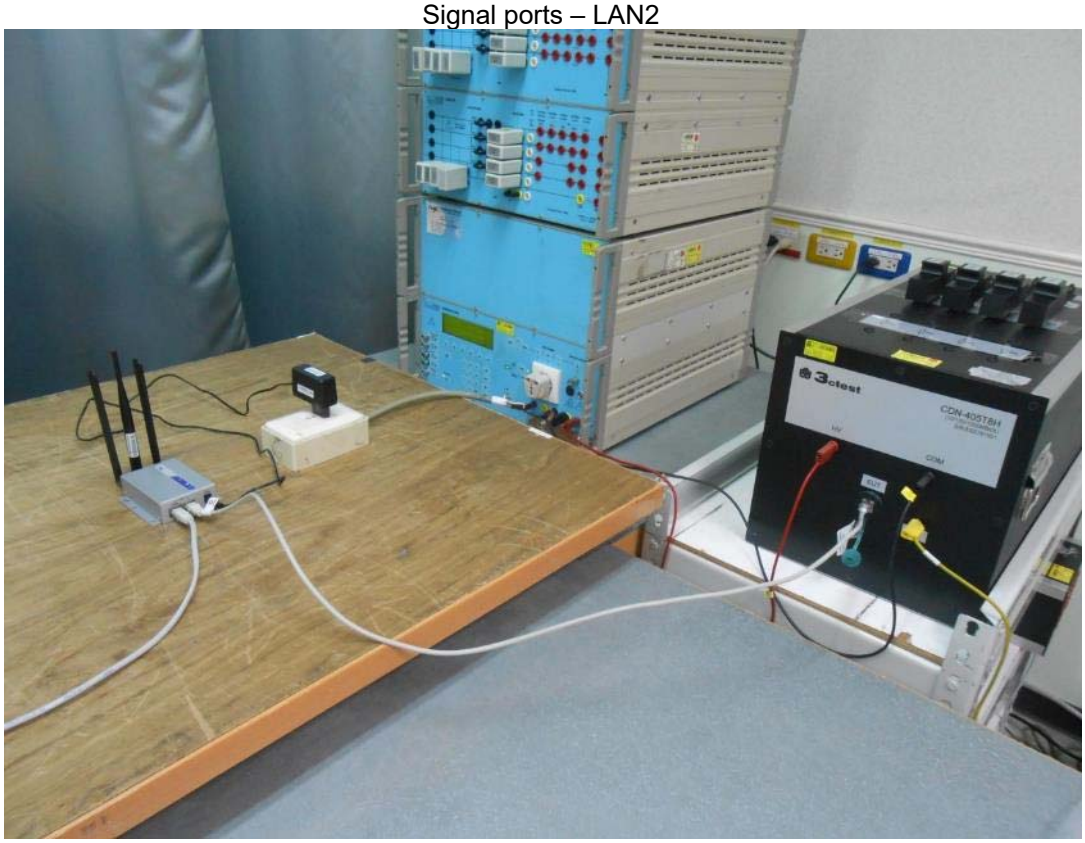
With Wifi function
Mains ports



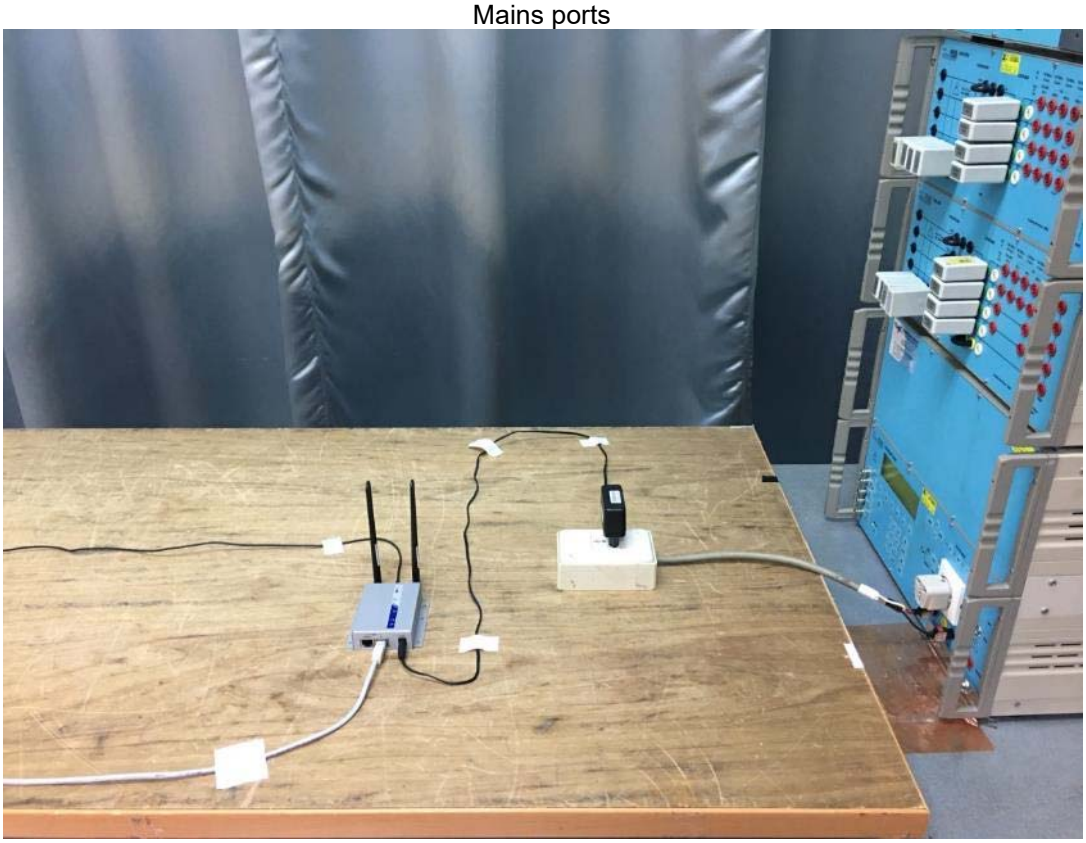
Signal ports – LAN1/WAN



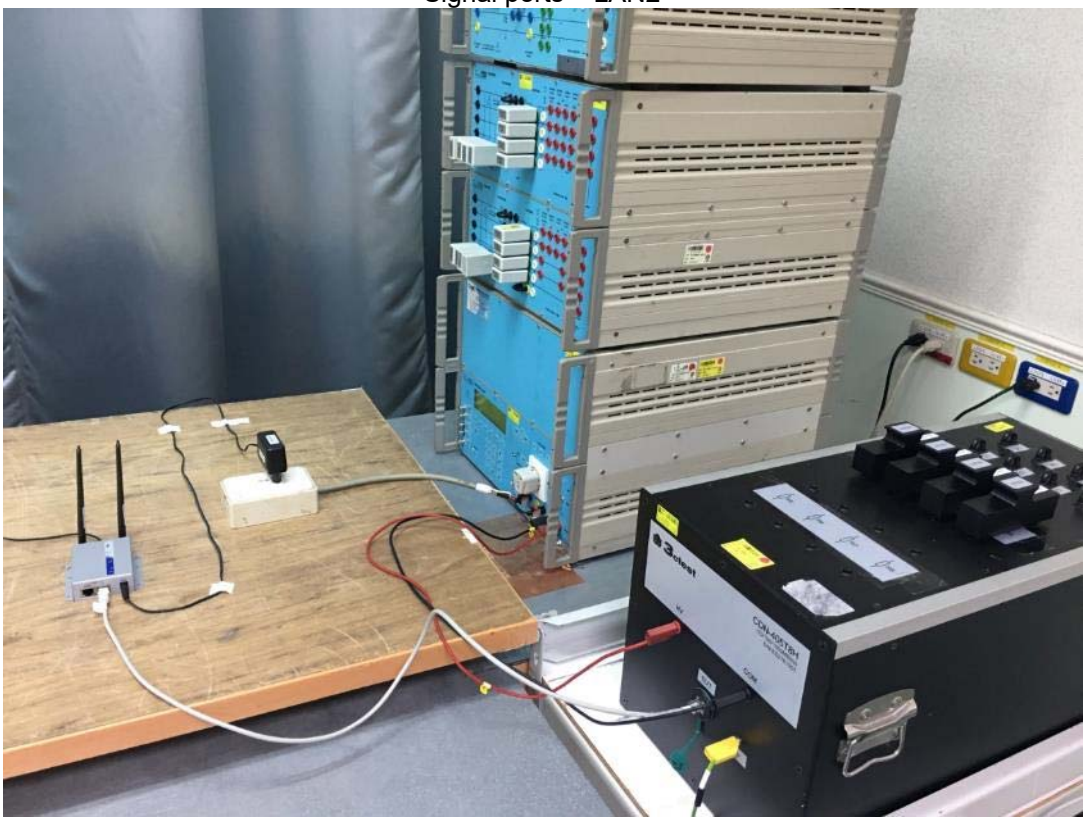
Signal ports – LAN2



With GPS function
Mains ports

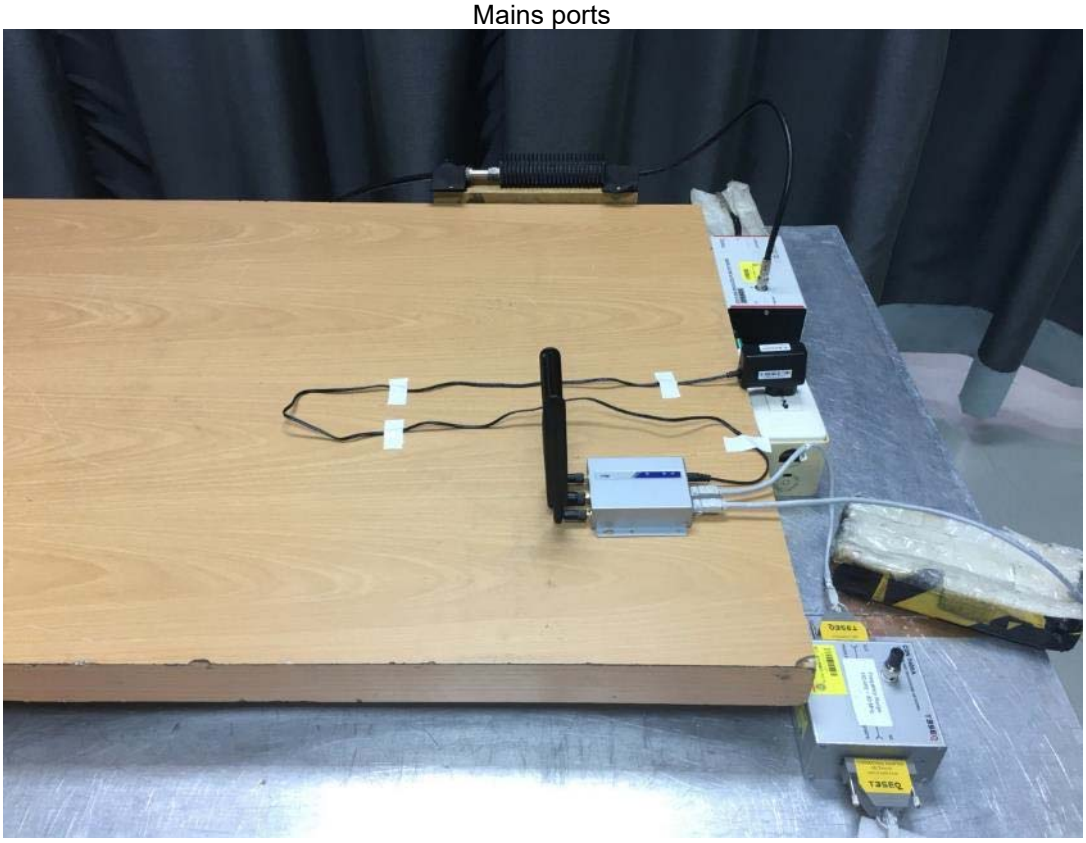


Signal ports – LAN2

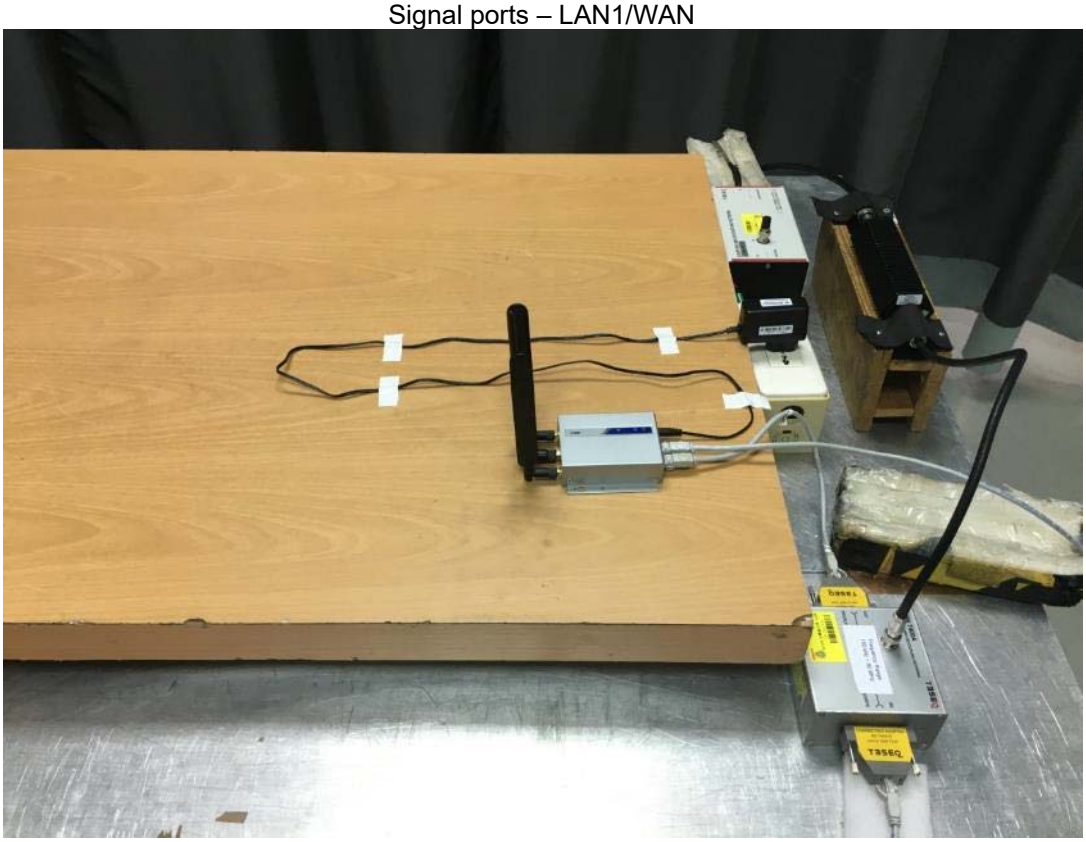


34.6 Conducted Disturbances Induced by RF Fields (CS)

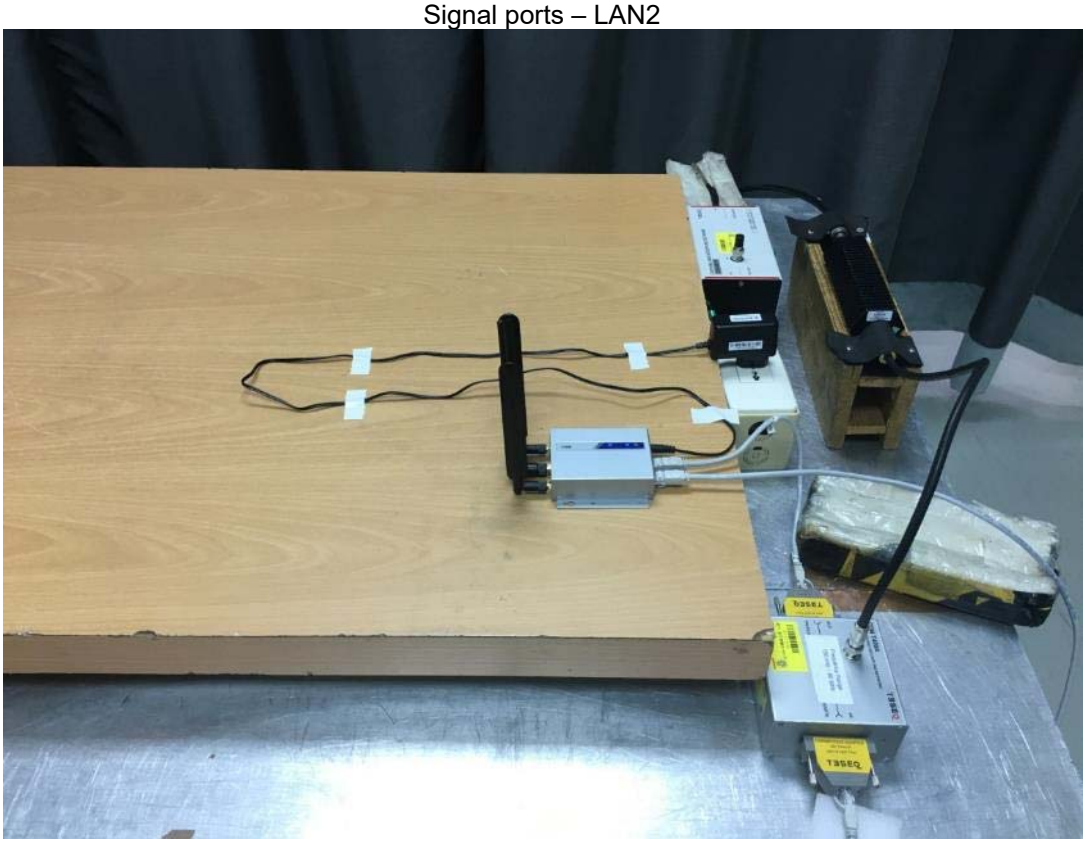
With Wifi function
Mains ports



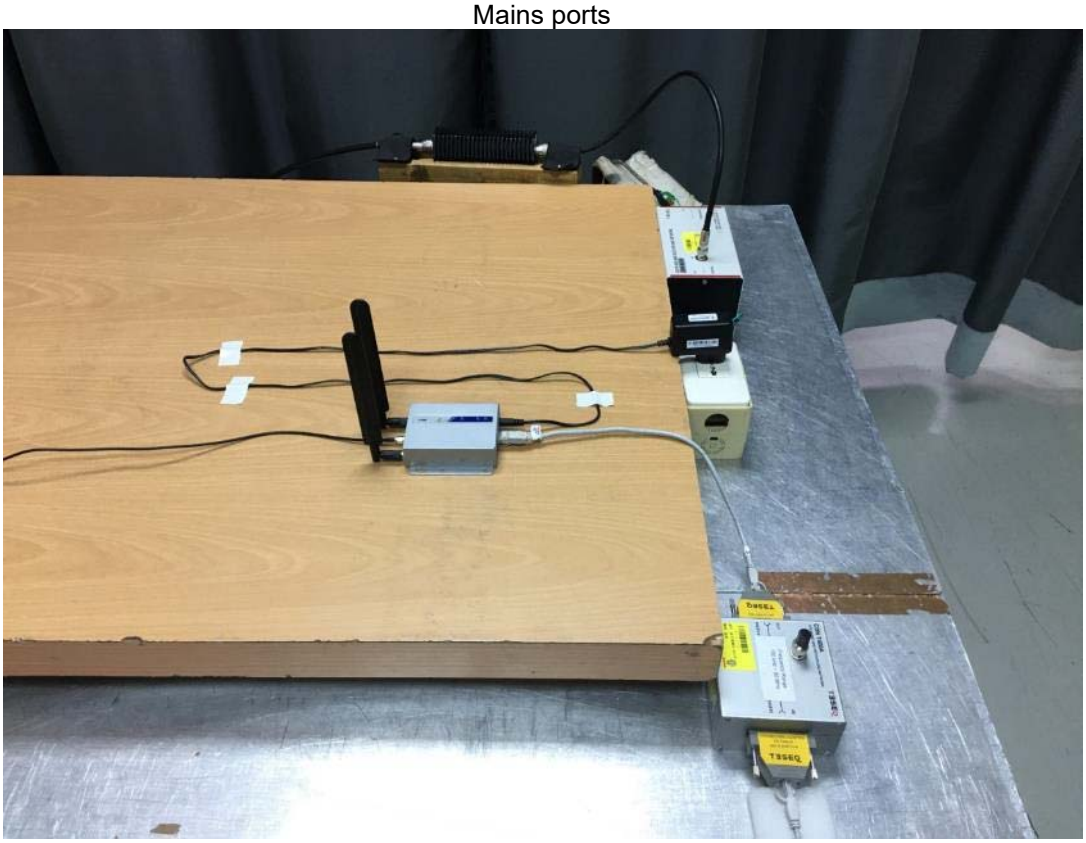
Signal ports – LAN1/WAN



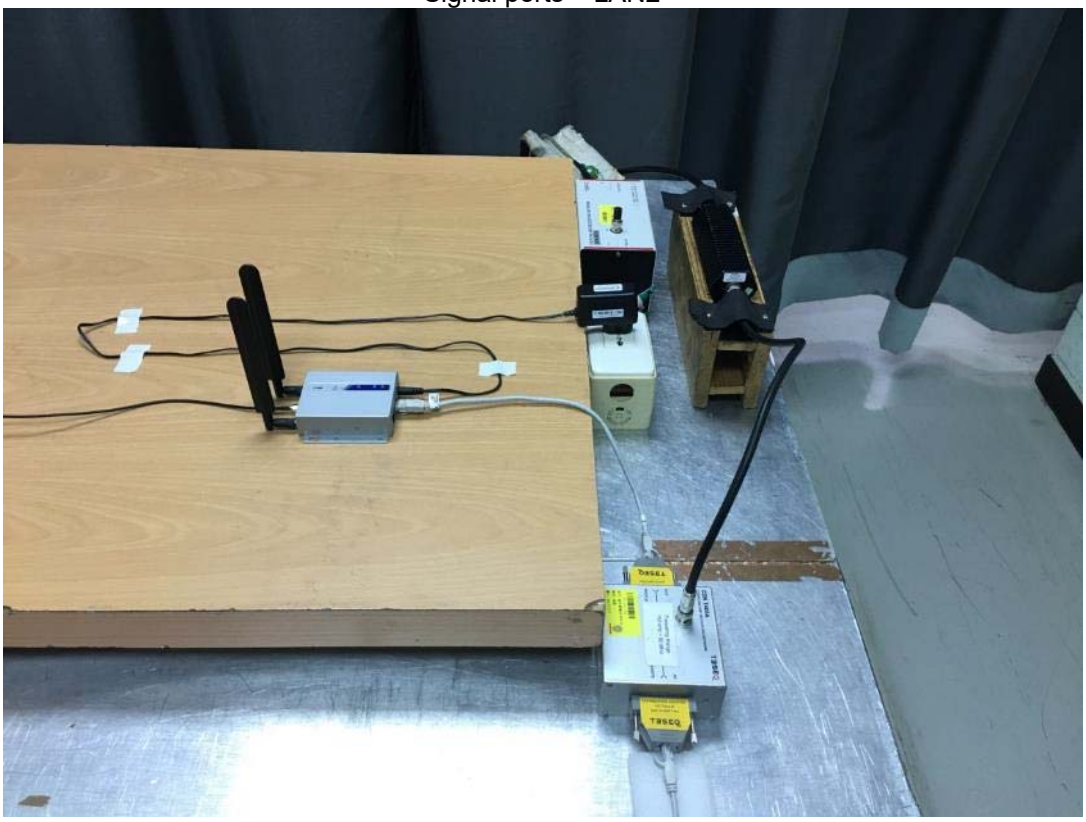
Signal ports – LAN2



With GPS function
Mains ports

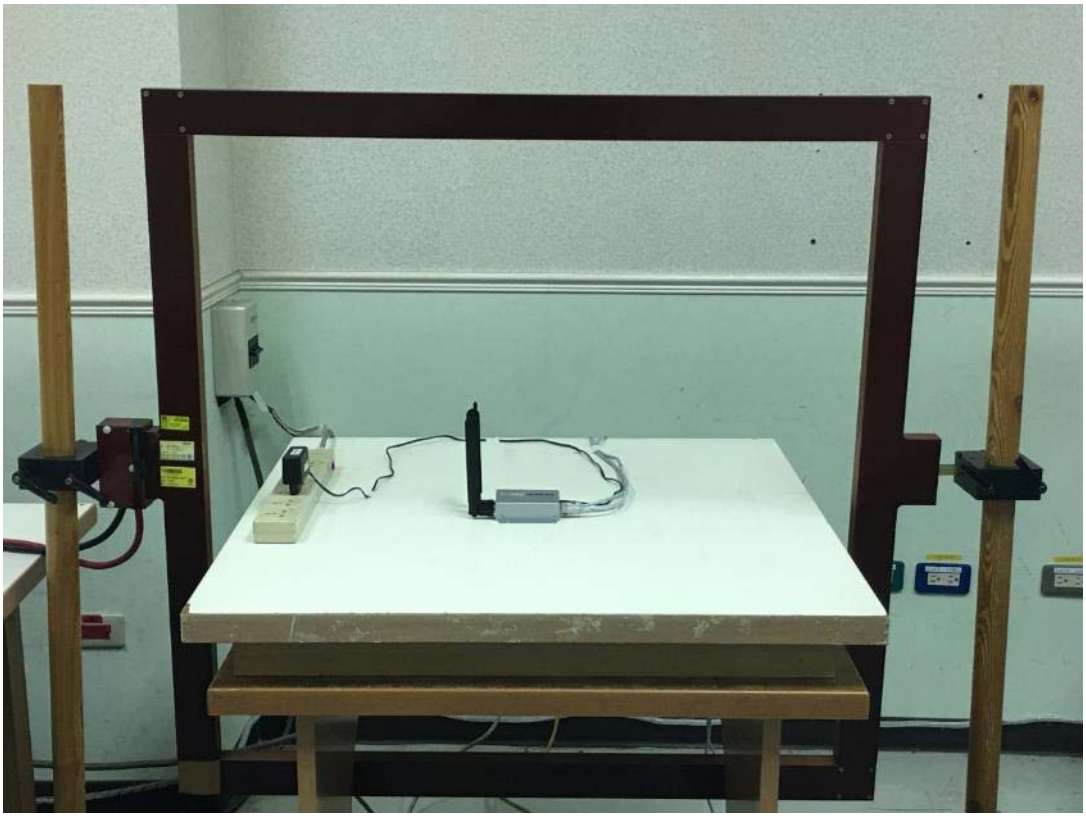


Signal ports – LAN2



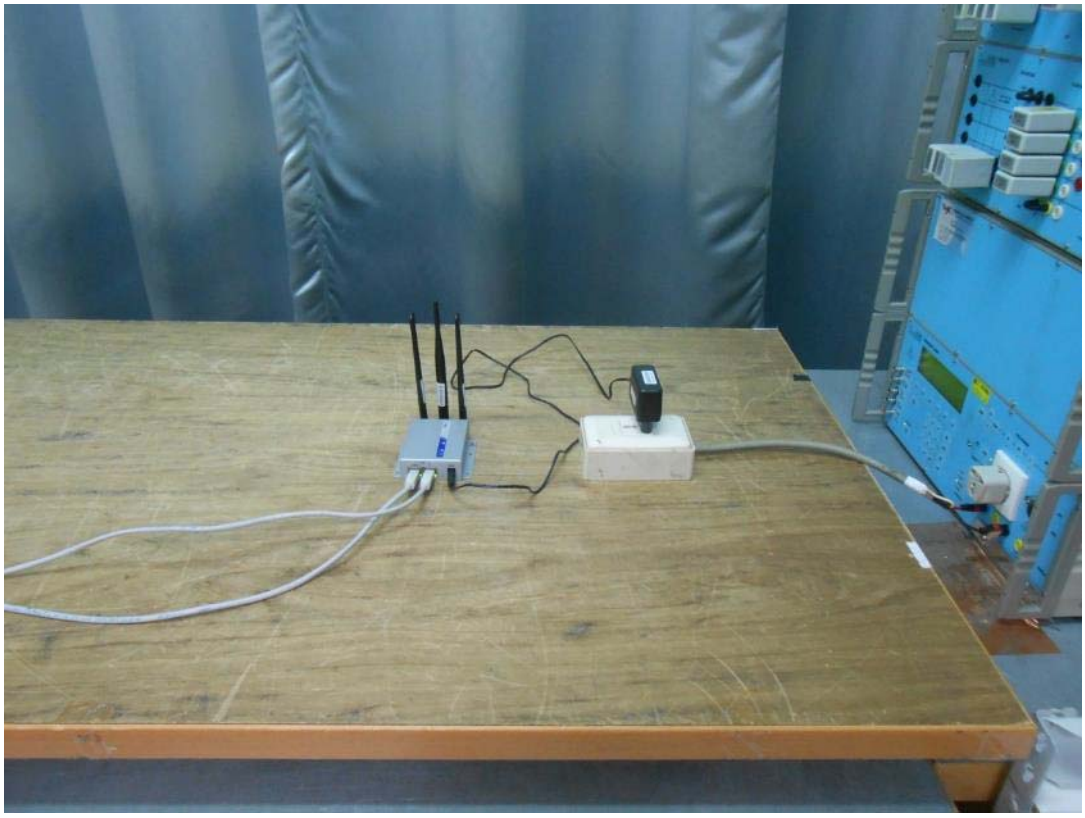
34.7 Power Frequency Magnetic Field Immunity Test (PFMF)

With Wifi function

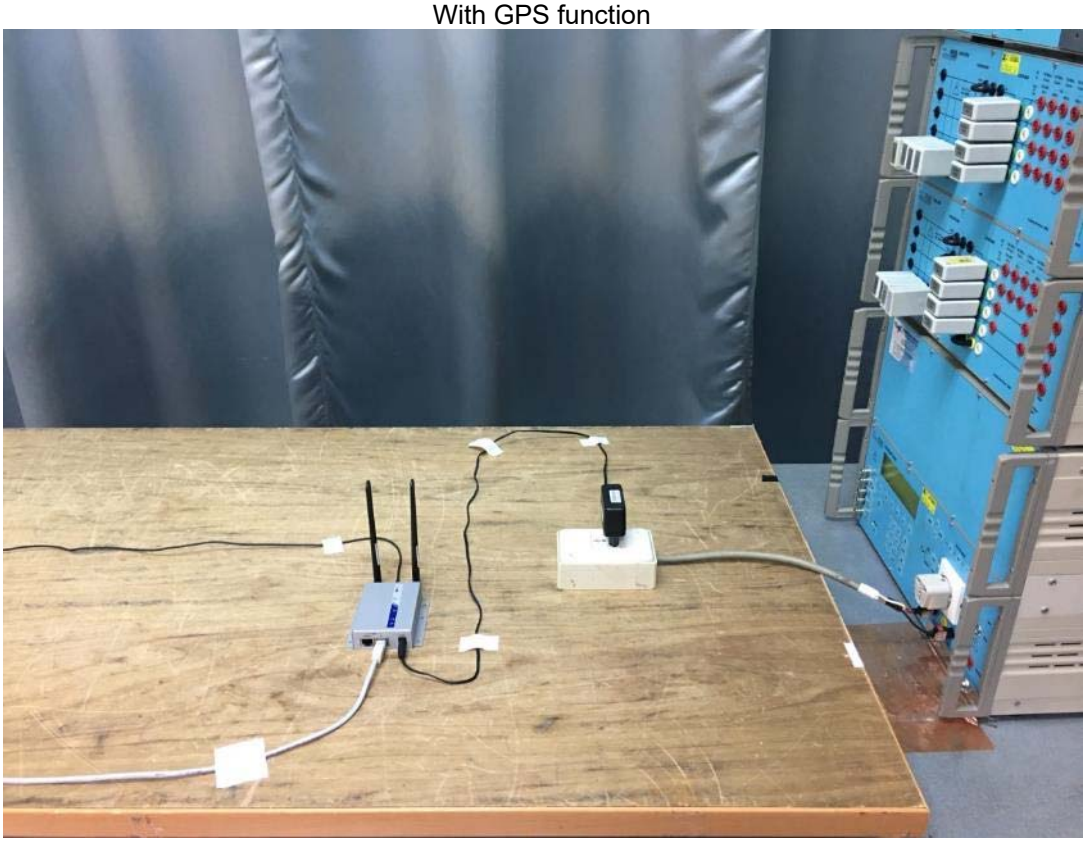


34.8 Voltage Dips and Interruptions

With Wifi function



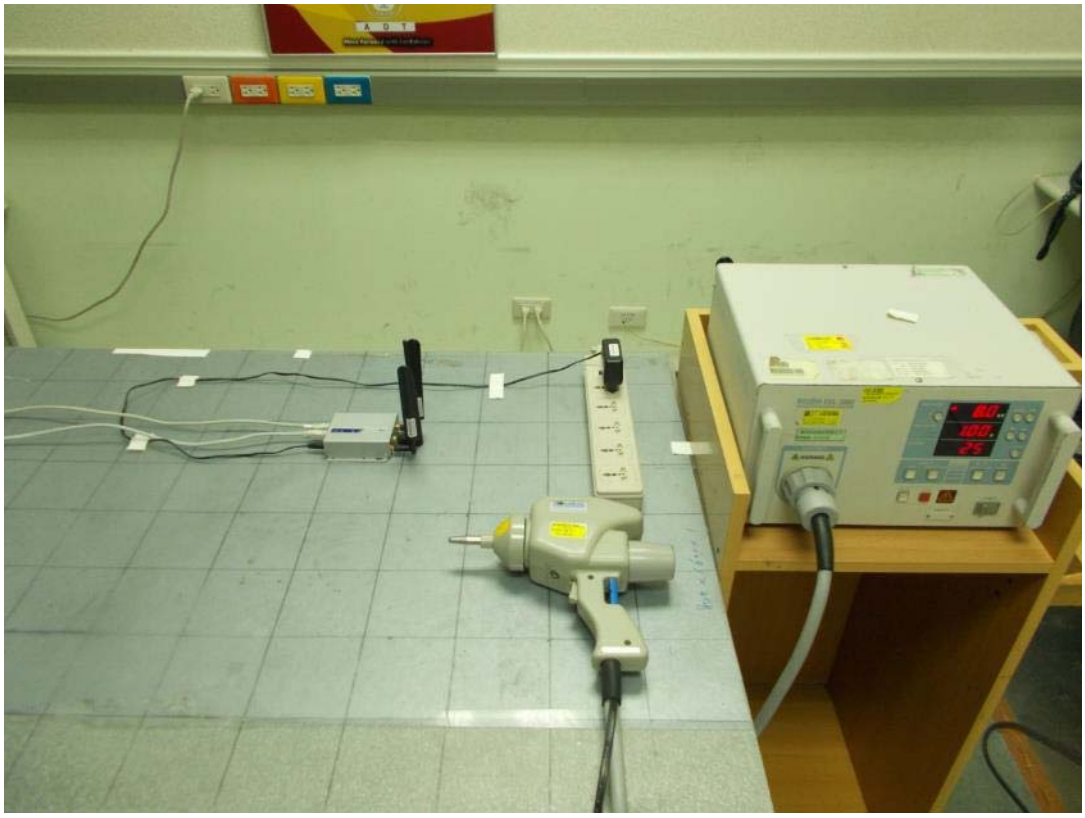
With GPS function



For Standard: EN 55035

34.9 Electrostatic Discharge Immunity Test (ESD)

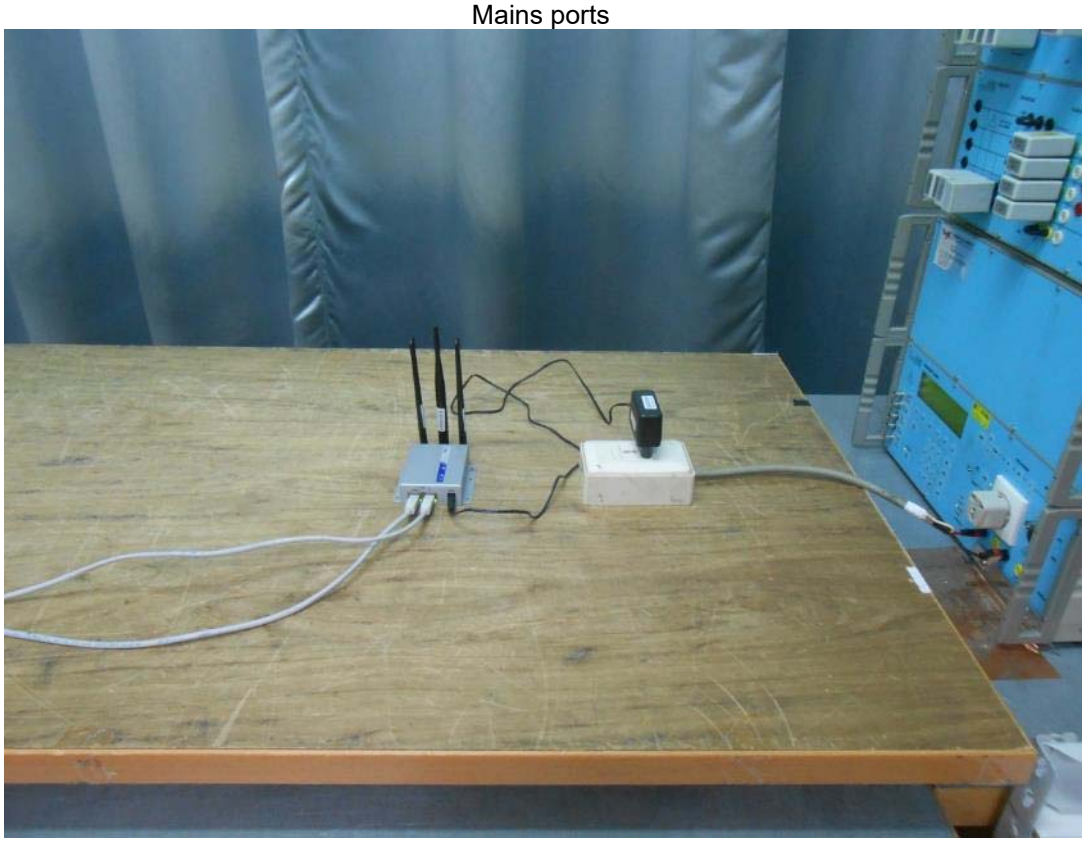
With Wifi function



34.10 Radio-frequency, Electromagnetic Field Immunity Test (RS)

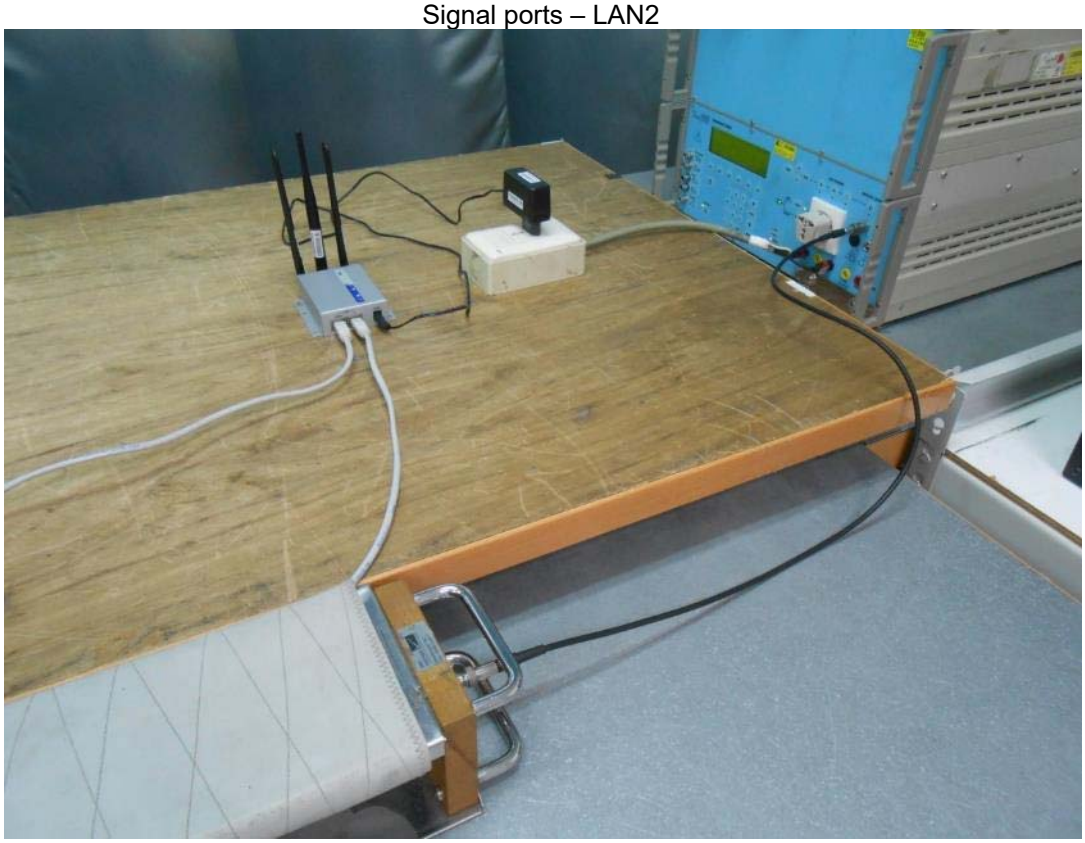
34.11 Electrical Fast Transient/Burst Immunity Test (EFT)

Mains ports



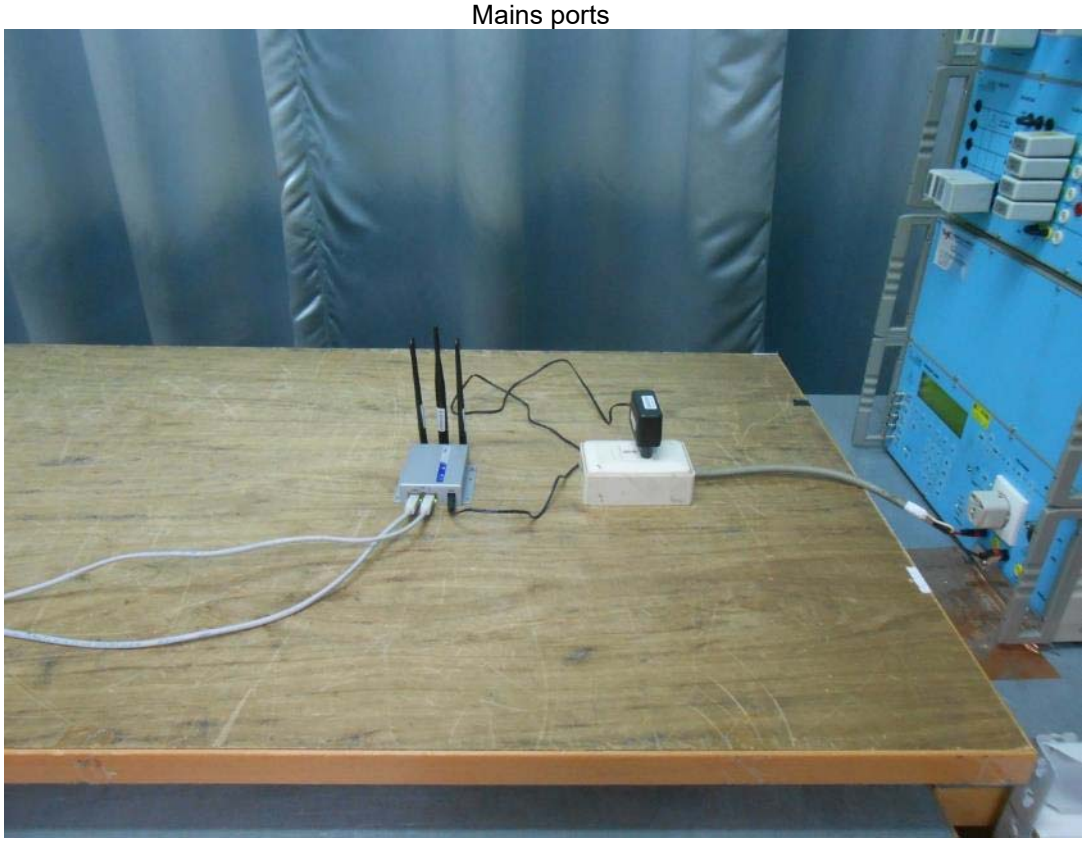
Signal ports – LAN1/WAN

Signal ports – LAN2

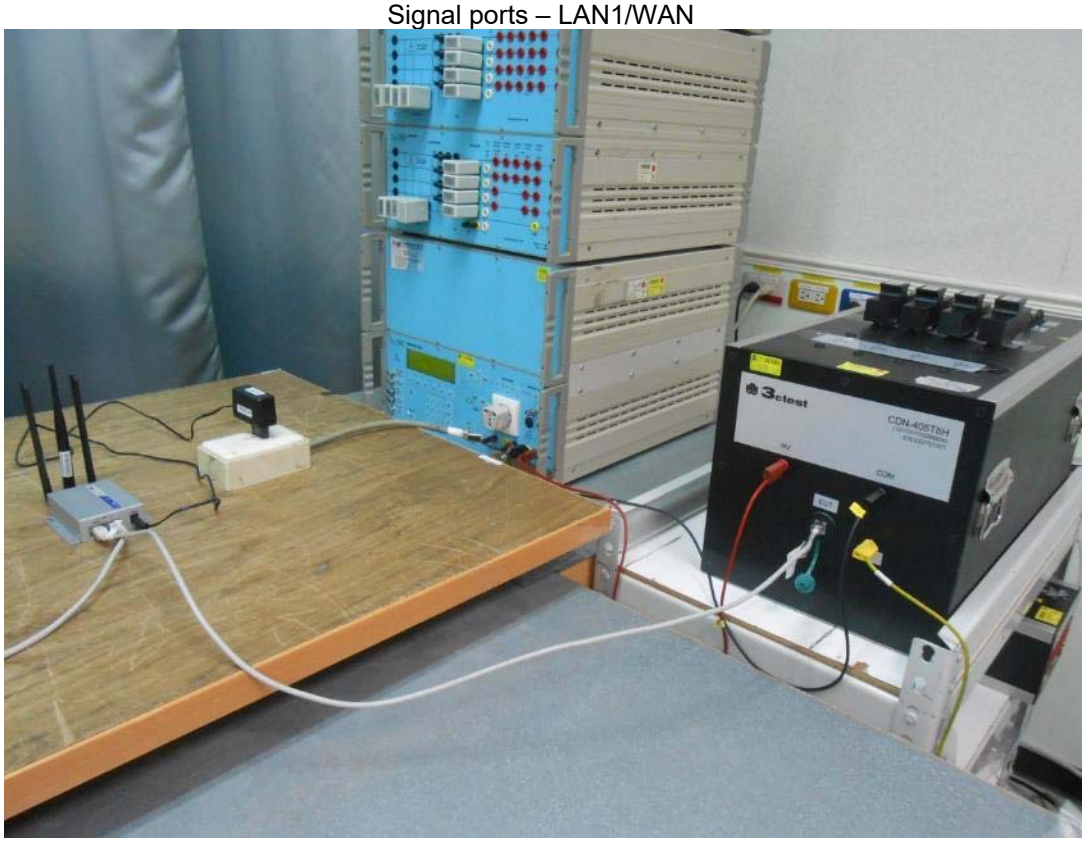


34.12 Surge Immunity Test

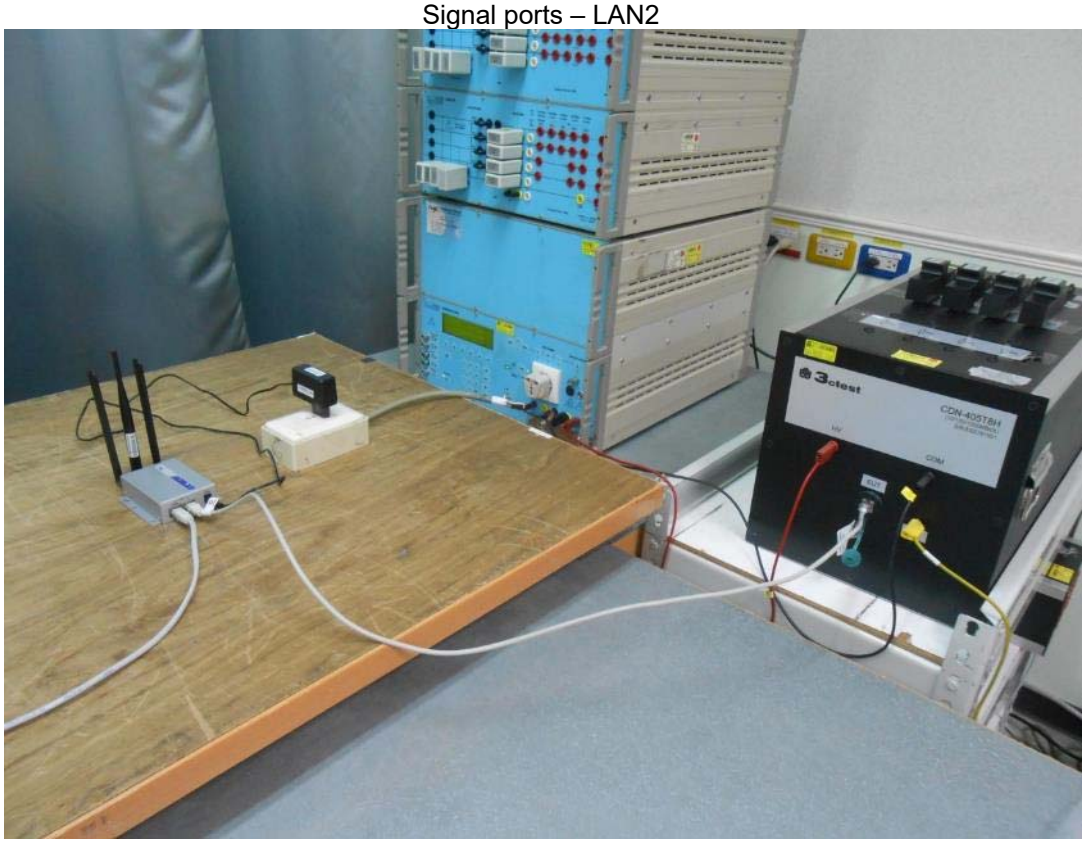
Mains ports



Signal ports – LAN1/WAN

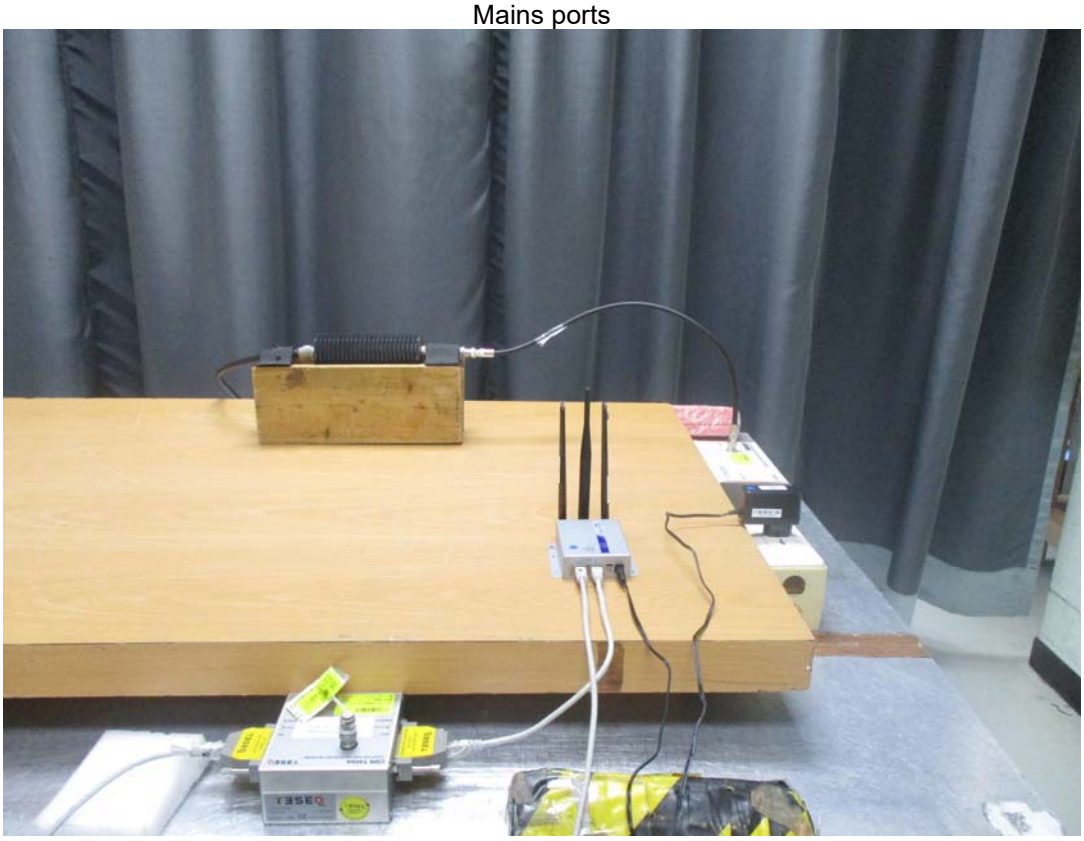


Signal ports – LAN2



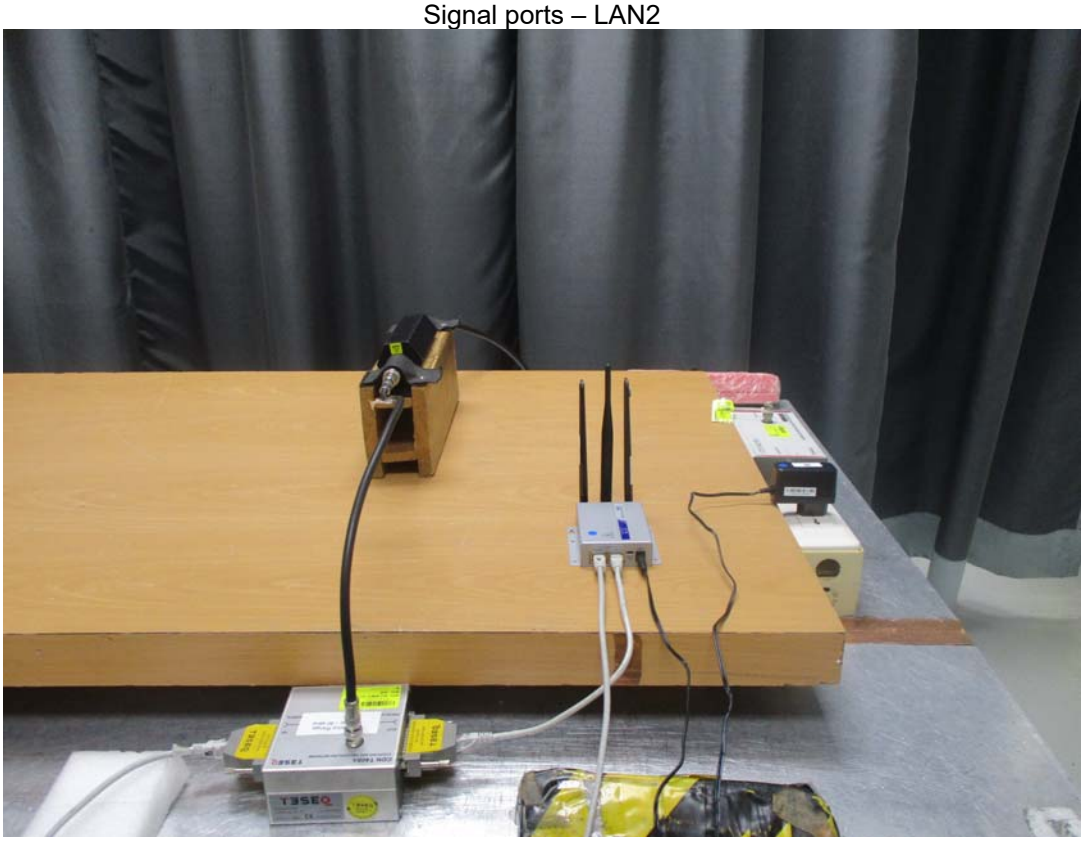
34.13 Conducted Disturbances Induced by RF Fields (CS)

Mains ports

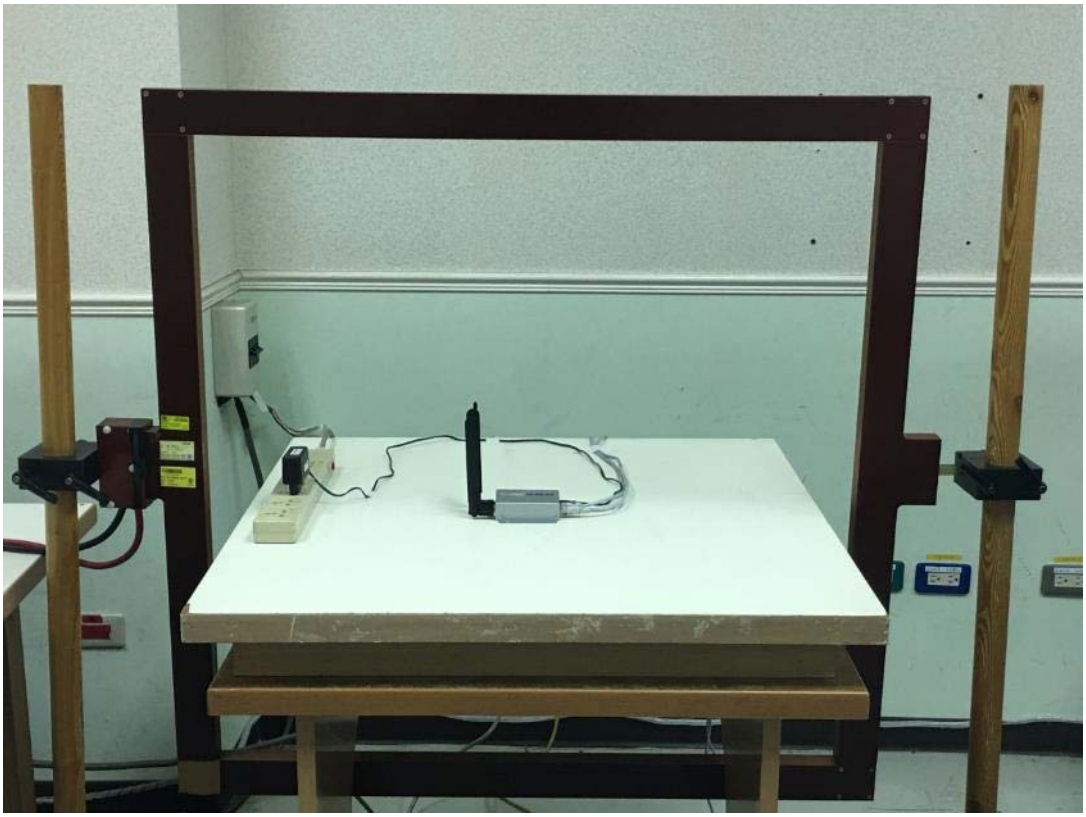


Signal ports – LAN1/WAN

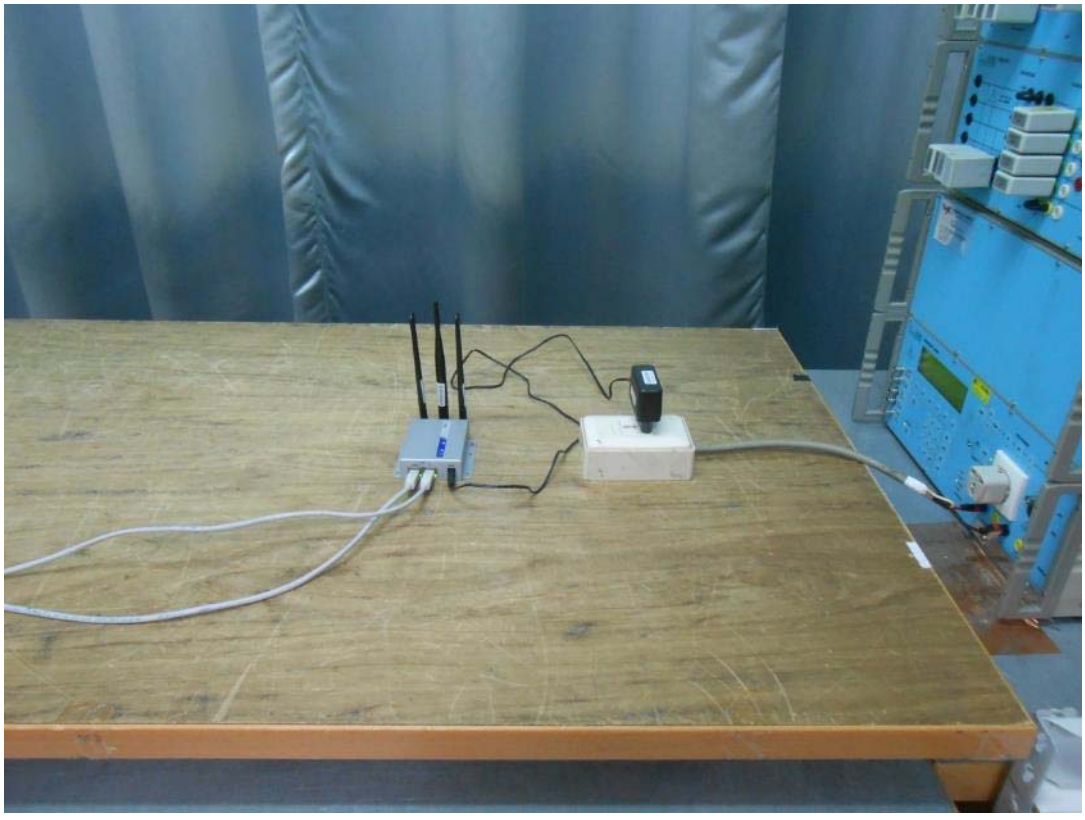
Signal ports – LAN2



34.1 Power Frequency Magnetic Field Immunity Test (PFMF)



34.2 Voltage Dips and Interruptions



Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

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