CE EMC Test Report

Equipment	:	**SentriusTM IG60 Serial & Wi-Fi Gateway**
Model No.	:	**SentriusTM IG60-SERIAL**
Brand Name	:	**Laird Connectivity**
Applicant	:	**Laird Connectivity, Inc.**
Address	:	**W66N220 Commerce Court, Cedarburg, Wisconsin 53012, USA**
Standard	:	**EN 55032:2015/AC:2016, Class A** **EN 61000-3-2:2014, Class A** **EN 61000-3-3:2013** **EN 55024:2010/A1:2015** IEC 61000-4-2:2008 ED 2.0 IEC 61000-4-3:2010 ED 3.2 IEC 61000-4-4:2012 ED 3.0 IEC 61000-4-5:2014 ED 3.0 IEC 61000-4-6:2013 ED 4.0 IEC 61000-4-8:2009 ED 2.0 IEC 61000-4-11:2004 ED 2.0
Received Date	:	**Jan. 10, 2020**
Tested Date	:	**Oct. 24, 2018 ~ Feb. 22, 2019 (for original test)** **Jan. 14 ~ Jan. 20, 2020 (for new test)**

We, International Certification Corp., would like to declare that the tested sample has been evaluated and in compliance with the requirement of the above standards. It may be duplicated completely for legal use with the approval of the applicant. It shall not be reproduced except in full without the written approval of our laboratory.

Reviewed by:

Peter Lin / Supervisor

Eason Chang / Assistant Manager

Approved by:

Kent Chen / Assistant Manager

Testing Laboratory 2732

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Release Record

Report No.	Version	Description	Issued Date
EC8N2101-06	Rev. 01	Initial issue	May 04, 2020
EC8N2101-06	Rev. 02	Updating brand name	May 27, 2020

Summary of Test Result

EN 55032 Emission Tests				
Ref. Std. Clause	**Test Standard**	**Test Items**	**Measured**	**Result**
A.3	EN 55032:2015/AC:2016, Class A	Conducted Emissions from the AC mains power ports	-11.61dB AV@ 0.327MHz.	Pass
A.3	EN 55032:2015/AC:2016, Class A	Asymmetric Mode Conducted Emissions	-23.05dB AV@ 0.387MHz.	Pass
A.2	EN 55032:2015/AC:2016, Class A	Radiated Emissions	-6.05dB PK@ 624.61MHz.	Pass
A.3	EN 55032:2015/AC:2016, Class A	Conducted Differential Voltage Emissions	Note[1]	N/A
-	EN 61000-3-2:2014, Class A	Harmonic Current Emissions	Note[2]	Pass
-	EN 61000-3-3:2013	Voltage Fluctuations and Flicker	Meet the requirement of limit.	Pass

N/A means Not Applicable.
Note[1]: The EUT w/o tuner port.
Note[2]: Equipment with a rated power is less than 75W than exempted harmonic current emissions test.

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

EN 55024 Immunity Tests					
Ref. Std. Clause	**Test Standard**	**Description of Test**		**Pass Criterion**	**Result**
4.2.1	IEC 61000-4-2:2008 ED 2.0	Electrostatic Discharge (ESD)		B	Pass
4.2.3	IEC 61000-4-3:2010 ED 3.2	Radio Frequency Electromagnetic Field (RS)		A	Pass*
4.2.2	IEC 61000-4-4:2012 ED 3.0	Electrical Fast Transient/Burst (EFT)		A	Pass
4.2.5	IEC 61000-4-5:2014 ED 3.0	Surge		A	Pass
4.2.3	IEC 61000-4-6:2013 ED 4.0	Conducted Disturbances (CS)		A	Pass
4.2.4	IEC 61000-4-8:2009 ED 2.0	Power Frequency Magnetic Field (PFMF)		A	Pass
4.2.6	IEC 61000-4-11:2004 ED 2.0	Voltage Dips	>95% reduction	A	Pass
			30% reduction	A	Pass
		Voltage Interruption	>95% reduction	C	Pass
"*": Test method reported herein was performed according to the method specified by applicant.					

Comments and Explanations:
The declared performance criteria of immunity test for EUT presented in the report are provided by manufacturer, and the manufacturer takes all the responsibilities for the judgement of the test result.

1 General Description

1.1 Information

This report is issued as a supplementary report to original ICC report no. EC8N2101. The only difference is adding an adapter. This report contains original data and new test for additional adapter.

1.1.1 Feature of Equipment under Test (EUT)

Power Supply Type	12Vdc from adapter 9Vdc ~ 36Vdc from DC Power Supply
Highest Frequency of the Internal Sources	5GHz

1.1.2 Accessories (New addition is marked in boldface)

Accessories		
No.	**Equipment**	**Description**
1	AC adapter	Brand: FRECOM Model: F30L2-120250SPACP Power Rating: I/P: 100-240Vac, 50/60Hz, 0.8A O/P: 12Vdc, 2.5A Power Line: 1.5m non-shielded without core
2	**AC Adapter**	**Brand Name: FRECOM** **Model Name: F48L-120400SPAV** **Power Rating: I/P: 100-240Vac, 50/60Hz, 1.4A** **O/P: 12Vdc, 4A** **Power Line: 1.5m non-shielded cable with one core**
3	**DC cable**	**3m non-shielded without core**
4	**Serial loopback adapter**	**Model : DB9 female** **Brand : Kingmate**

1.2 Test Equipment and Calibration Data

For original test

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Test Date	Oct. 25, 2018				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Receiver	R&S	ESR3	101657	Jan. 05, 2018	Jan. 04, 2019
LISN	SCHWARZBECK	Schwarzbeck 8127	8127-667	Nov. 13, 2017	Nov. 12, 2018
ISN	TESEQ	ISN T800	34406	Apr. 12, 2018	Apr. 11, 2019
RF Cable-CON	Woken	CFD200-NL	CFD200-NL-001	Oct. 23, 2018	Oct. 23, 2019
50 ohm terminal	NA	50	01	Apr. 11, 2018	Apr. 10, 2019
Measurement Software	AUDIX	e3	6.120210k	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Radiated Emission below 1GHz				
Test Site	966 chamber 2 / (03CH02-WS)				
Tested Date	Oct. 24, 2018				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Receiver	Agilent	N9038A	MY53290044	Sep. 17, 2018	Sep. 16, 2019
Loop Antenna	R&S	HFH2-Z2	100330	Nov. 13, 2017	Nov. 12, 2018
Bilog Antenna	SCHWARZBECK	VULB9168	VULB9168-523	Nov. 10, 2017	Nov. 09, 2018
Preamplifier	EMC	EMC02325	980194	Sep. 18, 2018	Sep. 17, 2019
LF cable 1M	EMC	EMCCFD400-NM-NM-1000	160501	Oct. 22, 2018	Oct. 21, 2019
LF cable 3M	Woken	CFD400NL-LW	CFD400NL-003	Oct. 22, 2018	Oct. 21, 2019
LF cable 10M	EMCC	CFD400-E	CFD400-001	Oct. 22, 2018	Oct. 21, 2019
Measurement Software	AUDIX	e3	6.120210g	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Radiated Emission above 1GHz				
Test Site	966 chamber 2 / (03CH02-WS)				
Tested Date	Oct. 28, 2018				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Spectrum Analyzer	Agilent	N9010A	MY53400091	Nov. 15, 2017	Nov. 14, 2018
Horn Antenna 1G-18G	SCHWARZBECK	BBHA 9120 D	BBHA 9120 D 1095	Sep. 22, 2018	Sep. 21, 2019
Preamplifier	Agilent	83017A	MY39501309	Sep. 25, 2018	Sep. 24, 2019
RF Cable	EMC	EMC105-SM-SM-8000	180512	Oct. 22, 2018	Oct. 21, 2019
RF Cable	HUBER+SUHNER	SUCOFLEX104	MY16018/4	Oct. 22, 2018	Oct. 21, 2019
Measurement Software	AUDIX	e3	6.120210g	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	ESD				
Test Site	ESD room 1 / (ES01-WS)				
Tested Date	Feb. 22, 2019				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
ESD Generator	EMTest	Dito	V1248114239	Aug. 23, 2018	Aug. 22, 2019
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Radiated Immunity (80 MHz - 6 GHz)				
Test Site	RS room 1 / (RS01-WS)				
Tested Date	Jan. 09, 2019				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Signal Generator	R&S	SMB100A	103924HA	Oct. 23, 2018	Oct. 22, 2019
Power Sensor	R&S	NRP-Z91	101094-UL	Oct. 16, 2018	Oct. 15, 2019
Power Sensor	R&S	NRP-Z91	101095-KY	Oct. 16, 2018	Oct. 15, 2019
Power Amplifier	BONN	BLWA 0810-160/100D	107972A	N/A	N/A
Power Amplifier	BONN	BLMA 1060-100D	107972B	N/A	N/A
Antenna	R&S	HL046E	100076-Cd	N/A	N/A
Note: Calibration Interval of instruments listed above is one year.					

Test Item	SURGE				
Test Site	EFT/SURGE room 1 / (SE01-WS)				
Tested Date	Jan. 03, 2019				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Surge Generator	TESEQ	NSG 3060	1527	Apr. 19, 2018	Apr. 18, 2019
Automated 1-Phase CDN	TESEQ	CDN 3061	1441	Apr. 19, 2018	Apr. 18, 2019
Telecom Surge Module	TESEQ	NSG 3060	1537	Apr. 19, 2018	Apr. 18, 2019
CDN for unshielded symmetrical high speed communication lines	TESEQ	CDN HSS-2	34284	Jan. 23, 2018	Jan. 22, 2019
CDN for unshielded symmetrical signal & data lines	TESEQ	CDN118,INA175	35347,N/A	Apr. 19, 2018	Apr. 18, 2019
CDN for unshielded symmetrical signal & data lines	TESEQ	CDN118,INA181	35347/35348/35907/ 35908	Apr. 19, 2018	Apr. 18, 2019
CDN for unshielded symmetrical signal & data lines	TESEQ	CDN118,INA183	35347/35926	Apr. 19, 2018	Apr. 18, 2019
Note: Calibration Interval of instruments listed above is one year.					

Test Item	EFT				
Test Site	EFT/SURGE room 1 / (SE01-WS)				
Tested Date	Jan. 03, 2019				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
EFT Generator	TESEQ	NSG 3060	1527	Apr. 19, 2018	Apr. 18, 2019
Automated 1-Phase CDN	TESEQ	CDN 3061	1441	Apr. 19, 2018	Apr. 18, 2019
Burst/EFT Data line Coupling Clamp	TESEQ	CDN 3425	1775	Jan. 12, 2018	Jan. 11, 2019
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Conducted Immunity				
Test Site	CS room 1 / (CS01-WS)				
Tested Date	Jan. 03, 2019				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Signal Generator	R&S	SMB-100A	107025	Dec. 21, 2018	Dec. 20, 2019
Conducted Immunity Test System Amplifier	A.R	75A250A	338329	N/A	N/A
Attenuator	BIRD	75-A-FFN-06	0128	N/A	N/A
AVG Power Sensor	R&S	NRP-Z91	101951	Jan. 08, 2018	Jan. 07, 2019
Coupling and Decoupling Network	TESEQ	CDN M016	25099	Dec. 27, 2018	Dec. 26, 2019
Coupling and Decoupling Network	TESEQ	CDN M016	25102	Dec. 22, 2018	Dec. 21, 2019
Coupling and Decoupling Network	TESEQ	CDN-T400A	28570	Feb. 06, 2018	Feb. 05, 2019
Coupling and Decoupling Network	TESEQ	CDN T8-10	40372	May 11, 2018	May 10, 2019
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Harmonic , Flicker, Magnetic , DIP				
Test Site	EMS room 1 / (EX01-WS)				
Tested Date	Jan. 03, 2019				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
AC Power Source	TESEQ	NSG 1007	1301A00159	Mar. 09, 2018	Mar. 08, 2019
Signal Conditioning Unit	TESEQ	CCN 1000-1	1301A00159	Mar. 09, 2018	Mar. 08, 2019
Induction Coil Interface	TESEQ	INA 2141	1418	Mar. 09, 2018	Mar. 08, 2019
Coil	TESEQ	INA 703	1981	Mar. 09, 2018	Mar. 08, 2019
Gauss/Tesla Meter	FW Bell	4190	1306003	Nov. 21, 2018	Nov. 20, 2019
Note: Calibration Interval of instruments listed above is one year.					

For new test

Test Item	Conducted Emission				
Test Site	Conduction room 1 / (CO01-WS)				
Test Date	Jan. 14, 2020				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Receiver	R&S	ESR3	101658	Dec. 12, 2019	Dec. 11, 2020
LISN	R&S	ENV216	101579	Mar. 08, 2019	Mar. 07, 2020
RF Cable-CON	Woken	CFD200-NL	CFD200-NL-001	Oct. 22, 2019	Oct. 21, 2020
Measurement Software	AUDIX	e3	6.120210k	NA	NA
Note: Calibration Interval of instruments listed above is one year.					

Test Item	ESD				
Test Site	ESD room 1 / (ES01-WS)				
Tested Date	Jan. 20. 2020				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
ESD Generator	EMTest	Dito	V1248114239	Aug. 17, 2019	Aug. 16, 2020
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Radiated Immunity (80 MHz - 6 GHz)				
Test Site	RS room 1 / (RS01-WS)				
Tested Date	Jan. 17. 2020				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Signal Generator	R&S	SMB100A	103924HA	Oct. 18, 2019	Oct. 17, 2020
Power Sensor	R&S	NRP-Z91	101094-UL	Oct. 16, 2019	Oct. 15, 2020
Power Sensor	R&S	NRP-Z91	101095-KY	Oct. 16, 2019	Oct. 15, 2020
Power Amplifier	BONN	BLWA 0810-160/100D	107972A	N/A	N/A
Power Amplifier	BONN	BLMA 1060-100D	107972B	N/A	N/A
Antenna	R & S	HL046E	100076-Cd	N/A	N/A
Note: Calibration Interval of instruments listed above is one year.					

Test Item	EFT				
Test Site	EFT/SURGE room 1 / (SE01-WS)				
Tested Date	Jan. 20. 2020				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
EFT Generator	TESEQ	NSG 3060	1527	Apr. 17, 2019	Apr. 16, 2020
Automated 1-Phase CDN	TESEQ	CDN 3061	1441	Apr. 17, 2019	Apr. 16, 2020
Burst/EFT Data line Coupling Clamp	TESEQ	CDN 3425	1775	Jan. 10, 2020	Jan. 09, 2021
Note: Calibration Interval of instruments listed above is one year.					

Test Item	SURGE				
Test Site	EFT/SURGE room 1 / (SE01-WS)				
Tested Date	Jan. 20. 2020				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Surge Generator	TESEQ	NSG 3060	1527	Apr. 17, 2019	Apr. 16, 2020
Automated 1-Phase CDN	TESEQ	CDN 3061	1441	Apr. 17, 2019	Apr. 16, 2020
Telecom Surge Module	TESEQ	NSG 3060	1537	Apr. 17, 2019	Apr. 16, 2020
CDN for unshielded symmetrical high speed communication lines	TESEQ	CDN HSS-2	34284	Jan. 10, 2020	Jan. 09, 2021
CDN for unshielded symmetrical signal & data lines	TESEQ	CDN118,INA175	35347,N/A	Apr. 17, 2019	Apr. 16, 2020
CDN for unshielded symmetrical signal & data lines	TESEQ	CDN118,INA181	35347/35348/35907/ 35908	Apr. 17, 2019	Apr. 16, 2020
CDN for unshielded symmetrical signal & data lines	TESEQ	CDN118,INA183	35347/35926	Apr. 17, 2019	Apr. 16, 2020
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Conducted Immunity				
Test Site	CS room 1 / (CS01-WS)				
Tested Date	Jan. 20. 2020				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
Signal Generator	R&S	SMB-100A	107025	Dec. 18, 2019	Dec. 17, 2020
Conducted Immunity Test System Amplifier	A.R	75A250A	338329	N/A	N/A
Attenuator	BIRD	75-A-FFN-06	0128	N/A	N/A
Power Sensor	R&S	NRP-Z91	101094-UL	Oct. 16, 2019	Oct. 15, 2020
Coupling and Decoupling Network	TESEQ	CDN M016	25099	Jan. 02, 2020	Jan. 01, 2021
Coupling and Decoupling Network	TESEQ	CDN M016	25102	Dec. 18, 2019	Dec. 17, 2020
Coupling and Decoupling Network	TESEQ	CDN-T400A	28570	Feb. 11, 2019	Feb. 10, 2020
Coupling and Decoupling Network	TESEQ	CDN T8-10	40372	May 14, 2019	May 13, 2020
Note: Calibration Interval of instruments listed above is one year.					

Test Item	Harmonic , Flicker, Magnetic , DIP				
Test Site	EMS room 1 / (EX01-WS)				
Tested Date	Jan. 17. 2020				
Instrument	**Manufacturer**	**Model No.**	**Serial No.**	**Calibration Date**	**Calibration Until**
AC Power Source	TESEQ	NSG 1007	1301A00159	Mar. 08, 2019	Mar. 07, 2020
Signal Conditioning Unit	TESEQ	CCN 1000-1	1301A00159	Mar. 08, 2019	Mar. 07, 2020
Induction Coil Interface	TESEQ	INA 2141	1418	Mar. 07, 2019	Mar. 06, 2020
Coil	TESEQ	INA 703	1981	Mar. 07, 2019	Mar. 06, 2020
Gauss/Tesla Meter	FW Bell	4190	1306003	Nov. 21, 2019	Nov. 20, 2020
Note: Calibration Interval of instruments listed above is one year.					

1.3 Testing Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

EN 55032:2015/AC:2016, Class A
EN 61000-3-2:2014, Class A
EN 61000-3-3:2013
EN 55024:2010/A1:2015
IEC 61000-4-2:2008 ED 2.0
IEC 61000-4-3:2010 ED 3.2
IEC 61000-4-4:2012 ED 3.0
IEC 61000-4-5:2014 ED 3.0
IEC 61000-4-6:2013 ED 4.0
IEC 61000-4-8:2009 ED 2.0
IEC 61000-4-11:2004 ED 2.0

1.4 Deviation from Test Standard and Measurement Procedure

None

1.5 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2).

Measurement Uncertainty		
Test Item	**Frequency**	**Uncertainty**
Conducted Emissions from the AC mains power ports	150kHz ~ 30MHz	±2.92 dB
Asymmetric Mode Conducted Emissions	150kHz ~ 30MHz	±3.26 dB
Radiated Emissions	30MHz ~ 1GHz	±4.34 dB
	Above 1GHz	±4.57 dB

Note: The results of measurements of emissions shall reference the measurement uncertainty considerations contained in CISPR 16-4-2.

2 Test Configuration

2.1 Testing Condition

For original test

Test Item	Test Site	Ambient Condition	Tested By
Conducted Emissions from the AC mains power ports	CO01-WS	25°C/57%	Alex Tsai
Asymmetric Mode Conducted Emissions	CO01-WS	25°C/57%	Alex Tsai
Radiated Emissions	03CH02-WS	24°C/57-58%	Alex Tsai
Harmonic / Flicker	EX01-WS	19°C/58%/100kPa	JN Chen
ESD	ES01-WS	19°C/48%/104kPa	JN Chen
RS	RS01-WS	20°C/58%/104kPa	JN Chen
EFT	SE01-WS	23°C/57%/100kPa	JN Chen
Surge	SE01-WS	23°C/57%/100kPa	JN Chen
CS	CS01-WS	24°C/59%/100kPa	JN Chen
Magnetic	EX01-WS	19°C/58%/100kPa	JN Chen
DIP	EX01-WS	19°C/58%/100kPa	JN Chen

For new test

Test Item	Test Site	Ambient Condition	Tested By
Conducted Emissions from the AC mains power ports	CO01-WS	20°C/60%	Alex Tsai
Harmonic / Flicker	EX01-WS	25°C/60%/101kPa	Zoe Yu
ESD	ES01-WS	20°C/45%/102kPa	Zoe Yu
RS	RS01-WS	21°C/58%/101kPa	Zoe Yu
EFT	SE01-WS	21°C/53%/102kPa	Zoe Yu
Surge	SE01-WS	20°C/52%/102kPa	Zoe Yu
CS	CS01-WS	21°C/52%/102kPa	Zoe Yu
Magnetic	EX01-WS	20°C/56%/101kPa	Zoe Yu
DIP	EX01-WS	19°C/56%/101kPa	Zoe Yu

2.2 The Worst Case Measurement Configuration

➢ **Pretest Mode 8 is new addition in this report.**

Radiation Pretested Mode	
Pretest Mode	**Operating Description**
1	LAN Speed 1G+100Mbps, Ping WiFi 5G, EUT orientation: X-axis, DC 9V
2	LAN Speed 1G+100Mbps, Ping WiFi 2.4G, EUT orientation: X-axis, DC 36V
3	LAN Speed 1G+100Mbps, Ping WiFi 2.4G, EUT orientation: X-axis, with adapter (F30L2-120250SPACP)
4	LAN Speed 1G+100Mbps, Ping WiFi 5G, EUT orientation: Y-axis, with adapter (F30L2-120250SPACP)
5	LAN Speed 1G+100Mbps, Ping WiFi 2.4G, EUT orientation: Z-axis, with adapter (F30L2-120250SPACP)
6	LAN Speed 1G+100Mbps, Standby Mode, EUT orientation: Y-axis, with adapter (F30L2-120250SPACP)
7	LAN Speed 1G+100Mbps, BT on, EUT orientation: Y-axis, with adapter (F30L2-120250SPACP)
8	LAN Speed 1G+100Mbps, BT on, EUT orientation: Y-axis, with adapter(F48L-120400SPAV)
For **Pretest Mode 4** is the worst case and only its data was record in this test report.	

The Worst Test Configurations	
Conducted Emissions from the AC mains power ports	
Test Mode	**Operating Description**
1	LAN Speed 1G+100Mbps, Ping WiFi 5G, EUT orientation: Y-axis, with adapter (F30L2-120250SPACP),230V/50Hz
2	LAN Speed 1G+100Mbps, Ping WiFi 5G, EUT orientation: Y-axis, with adapter (F30L2-120250SPACP),110V/60Hz
3	LAN Speed 1G+100Mbps, Ping WiFi 5G, EUT orientation: Y-axis, with adapter (F48L-120400SPAV),230V/50Hz
4	LAN Speed 1G+100Mbps, Ping WiFi 5G, EUT orientation: Y-axis, with adapter (F48L-120400SPAV),110V/60Hz
Asymmetric Mode Conducted Emissions	
Test Mode	**Operating Description**
1	LAN1 Speed 1Gbps, Ping WiFi 5G, EUT orientation: Y-axis, with adapter (F30L2-120250SPACP)
2	LAN2 Speed 100Mbps, Ping WiFi 5G, EUT orientation: Y-axis, with adapter (F30L2-120250SPACP)
Note: The determined worst condition of telecom ports test is under the worst case of conducted emission test.	

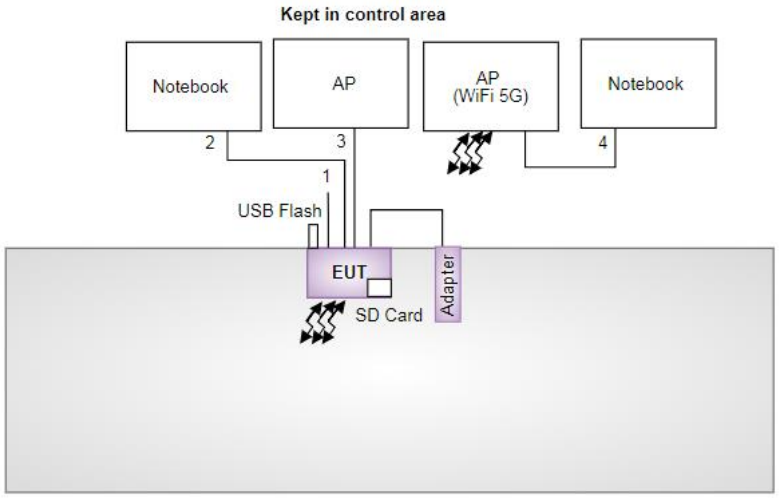
Radiated Emissions	
Test Mode	**Operating Description**
1	LAN Speed 1G+100Mbps, Ping WiFi 5G, EUT orientation: Y-axis, with adapter (F30L2-120250SPACP)
Harmonic Current Emissions / Voltage Fluctuation and Flicker	
Test Mode	**Operating Description**
1	LAN & WiFi 2.4G ping test, SD card & USB R/W, adapter mode (F30L2-120250SPACP)
2	LAN & WiFi 5G ping test, SD card & USB R/W, adapter mode (F30L2-120250SPACP)
3	BT on, Observe the BT function status, adapter mode (F30L2-120250SPACP)
4	LAN & WiFi 2.4G ping test, SD card R/W, adapter mode (F48L-120400SPAV)
Immunity Tests (ESD/ RS / EFT / CS / Magnetic Tests)	
Test Mode	**Operating Description**
1	LAN & WiFi 2.4G ping test, SD card & USB R/W, adapter mode (F30L2-120250SPACP)
2	LAN & WiFi 5G ping test, SD card & USB R/W, adapter mode (F30L2-120250SPACP)
3	BT on, Observe the BT function status, adapter mode (F30L2-120250SPACP)
4	LAN & WiFi 2.4G ping test, SD card & USB R/W, DC 12V mode.
5	LAN & WiFi 2.4G ping test, SD card R/W, adapter mode (F48L-120400SPAV)
Immunity Tests (SURGE / DIP Tests)	
Test Mode	**Operating Description**
1	LAN & WiFi 2.4G ping test, SD card & USB R/W, adapter mode (F30L2-120250SPACP)
2	LAN & WiFi 5G ping test, SD card & USB R/W, adapter mode (F30L2-120250SPACP)
3	BT on, Observe the BT function status, adapter mode (F30L2-120250SPACP)
4	LAN & WiFi 2.4G ping test, SD card R/W, adapter mode (F48L-120400SPAV)

2.3 Local Support Equipment List

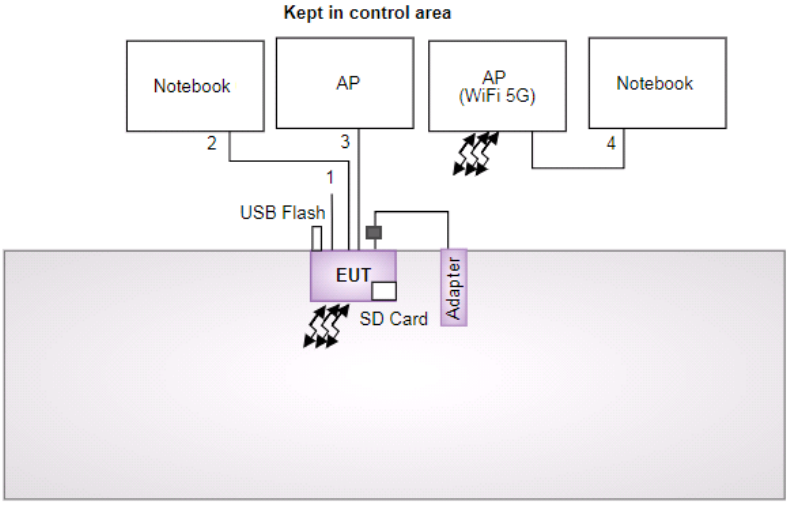
Support Equipment List (EMI)					
No.	**Equipment**	**Brand**	**Model**	**S/N**	**Remarks**
1	Notebook	DELL	Latitude E6440	8VXMD12	---
2	Notebook	DELL	Latitude E6440	2PXMD12	---
3	USB Flash	Kingston	DTSE9	FXVJ0	---
4	AP	D-LINK	DIR-850L	RZ1Q4G6000261	---
6	SD card	Silicon-power	16G	---	Provided by applicant.
7	AP	Buffalo	WZR-HP-AG300H	---	Provided by applicant.

Support Equipment List (EMS)					
No.	**Equipment**	**Brand**	**Model**	**S/N**	**Remarks**
1	Notebook	DELL	Latitude E5430	6R4RWW1	---
2	Notebook	DELL	Latitude E5430	264RWW1	---
3	Notebook	DELL	Latitude E5470	9FHCQF2	---
4	AP	D-LINK	DIR-815	3000228	---
5	USB Flash	Kingston	DTSE9	NXPAB	---
6	SD card	SONY	SR-32UY3	---	Provided by applicant. (only for Test mode3)
7	SD card	Silicon-power	16G	---	Provided by applicant.
8	DC Power Supply	GWINSTEK	GPC-60300	EM884797	---
9	AP	Buffalo	WZR-HP-AG300H	---	Provided by applicant.
10	BT Fixture	---	---	---	Provided by applicant.
11	AP	D-LINK	D-LINK	DIR-818LW	---

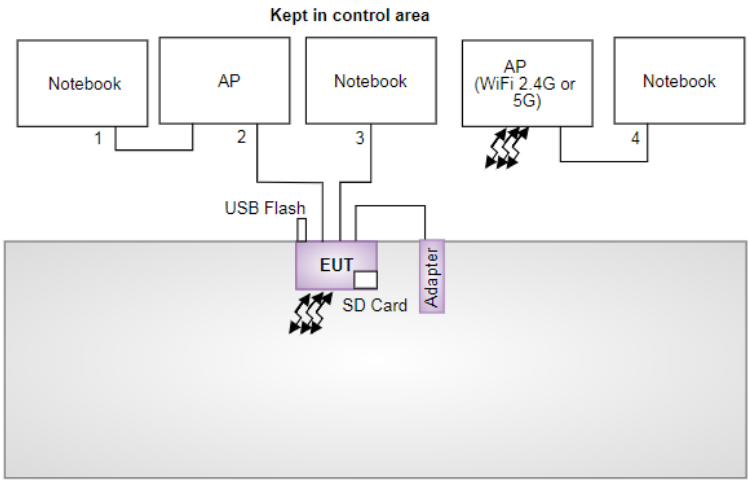
2.4 Test Setup Chart

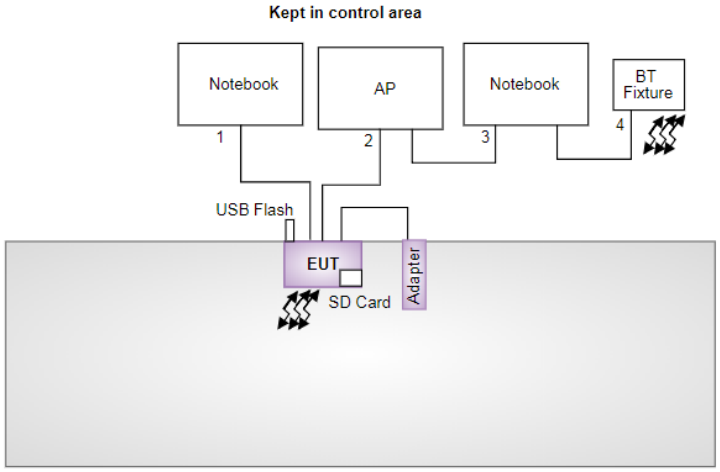
Test Setup Diagram (EMI_ Adapter: F30L2-120250SPACP)


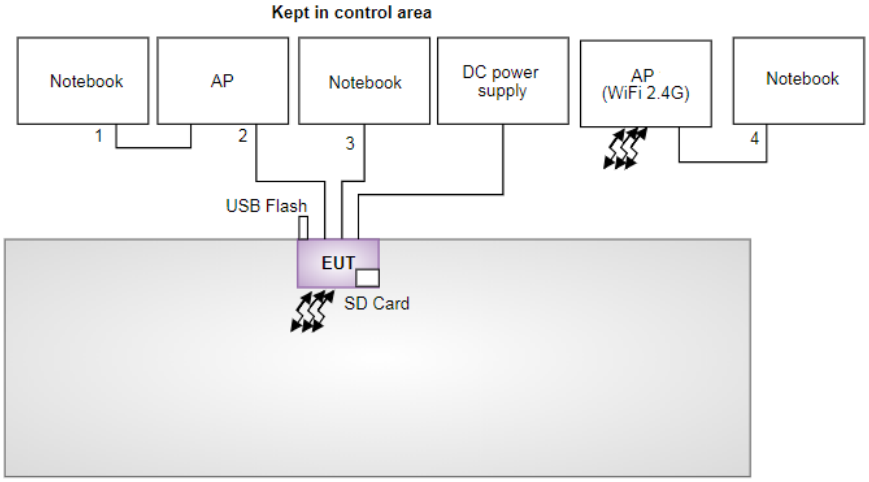
No.	Signal cable / Length (m)
1	RS232, 1.06m shielded.
2	RJ45, 10m non-shielded.
3	RJ45, 10m non-shielded.
4	RJ45, 3m non-shielded.

Test Setup Diagram (EMI _ Adapter: F48L-120400SPAV)


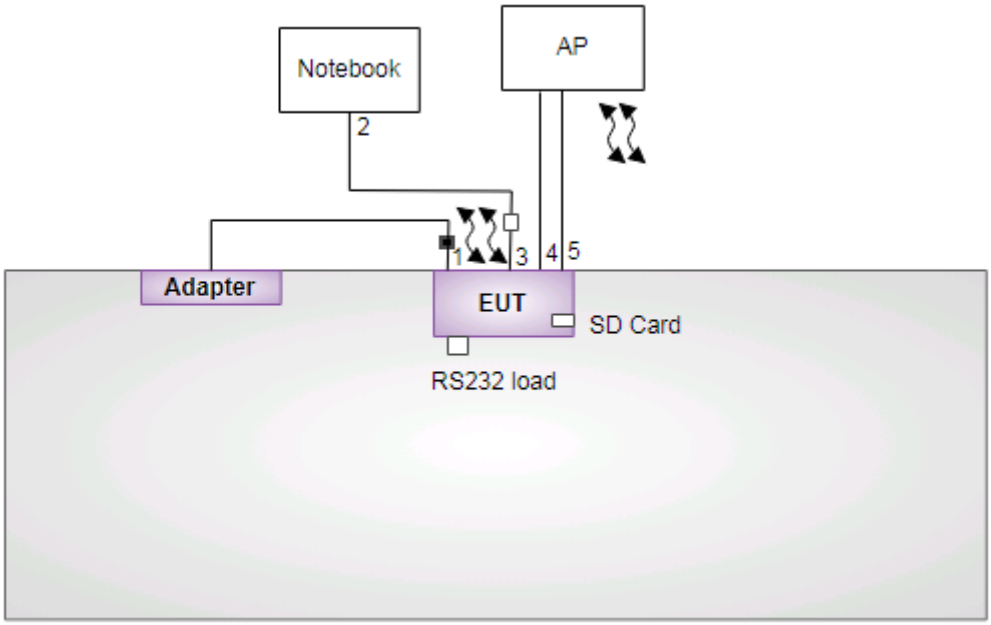
No.	Signal cable / Length (m)
1	RS232, 1.06m shielded.
2	RJ45, 10m non-shielded.
3	RJ45, 10m non-shielded.
4	RJ45, 3m non-shielded.

Test Setup Diagram (EMS, Test Mode 1, 2_ Adapter: F30L2-120250SPACP)	
	
No.	**Signal cable / Length (m)**
1-4	RJ45, 3m non-shielded.

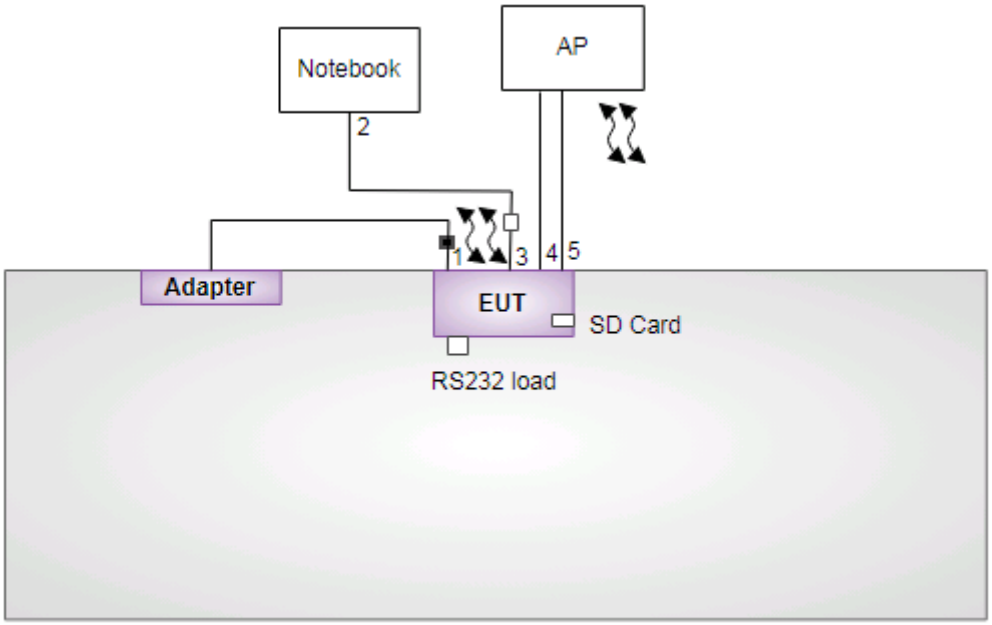
Test Setup Diagram (EMS, Test Mode 3_ Adapter: F30L2-120250SPACP)	
	
No.	**Signal cable / Length (m)**
1-3	RJ45, 3m non-shielded.
4	USB 1.8m shielded.

Test Setup Diagram (EMS (ESD/ RS / EFT / CS Tests), Test Mode 4 _ Adapter: F30L2-120250SPACP)


No.	Signal cable / Length (m)
1-4	RJ45, 3m non-shielded.

Test Setup Diagram (EMS (except ESD/ RS / EFT / CS Tests, Test Mode 4 _ Adapter: F48L-120400SPAV)


No.	Signal cable / Length (m)
1	DC, 1.5m non-shielded, with one core
2	USB to RS232, 1.8m shielded.
3	USB to RS232, 1.8m shielded.
4	RJ45, 3m non-shielded.
5	RJ45, 3m non-shielded.

Test Setup Diagram (EMS (ESD/ RS / EFT / CS Tests), Test Mode 5_ Adapter: F48L-120400SPAV)


No.	Signal cable / Length (m)
1	DC, 1.5m non-shielded, with one core
2	USB to RS232, 1.8m shielded.
3	USB to RS232, 1.8m shielded.
4	RJ45, 3m non-shielded.
5	RJ45, 3m non-shielded.

2.5 Test Software and Operating Condition

EMI

a. Enabled all function of test system.
b. Plugged the SD card (Silicon-power) into EUT to turn on the WiFi function.
c. The support notebooks communicated with support APs via EUT by using ping command to receive and transmit data by LAN & WLAN
d. The support notebook executed “teraterm.exe” to read and write data from USB Flash and SD card via console cable, and was disconnected from EUT and removed from test table after sending command.
e. During testing, the support notebook executed "TfGen.exe" to traffic packet data generated software and LAN utilization in excess of 950Mbps to link with the EUT by RJ45 cable.

EMS- (ESD/ RS / EFT / CS / Magnetic Tests)

Test Mode 1, 2, 4

a. Enabled all function of test system.
b. Plugged the SD card (Silicon-power) into EUT to turn on the WiFi function.
c. The support notebooks communicated with support APs via EUT by using ping command to receive and transmit data by LAN & WLAN
d. The support notebook executed “teraterm.exe” to read and write data from USB Flash and SD card via console cable, and was disconnected from EUT and removed from test table after sending command.

Test Mode 3

a. Enabled all function of test system.
b. Plugged the SD card (SONY) into EUT to turn on the BT function.
c. The support notebook executed "teraterm.exe" to monitor the status of BT connection between support notebook and EUT.
d. The support notebook executed “teraterm.exe” to read and write data from USB Flash and SD card via console cable, and was disconnected from EUT and removed from test table after sending command.

Test Mode 5

a. Enabled all function of test system.
b. Plugged the SD card (Silicon-power) into EUT to turn on the WiFi function.
c. The support notebooks communicated with support APs via EUT by using ping command to receive and transmit data by LAN & WLAN
d. The support notebook executed “teraterm.exe” to read and write data from SD card via console cable, and was disconnected from EUT and removed from test table after sending command.

EMS- (Harmonic Current Emissions / Voltage Fluctuation and Flicker, SURGE / DIP Tests)

Test Mode 1, 2

a. Enabled all function of test system.
b. Plugged the SD card (Silicon-power) into EUT to turn on the WiFi function.
c. The support notebooks communicated with support APs via EUT by using ping command to receive and transmit data by LAN & WLAN
d. The support notebook executed “teraterm.exe” to read and write data from USB Flash and SD card via console cable, and was disconnected from EUT and removed from test table after sending command.

Test Mode 3

a. Enabled all function of test system.
b. Plugged the SD card (SONY) into EUT to turn on the BT function.
c. The support notebook executed "teraterm.exe" to monitor the status of BT connection between support notebook and EUT.
d. The support notebook executed “teraterm.exe” to read and write data from USB Flash and SD card via console cable, and was disconnected from EUT and removed from test table after sending command.

Test Mode 4

a. Enabled all function of test system.
b. Plugged the SD card (Silicon-power) into EUT to turn on the WiFi function.
c. The support notebooks communicated with support APs via EUT by using ping command to receive and transmit data by LAN & WLAN
d. The support notebook executed “teraterm.exe” to read and write data from RS232 load and SD card via console cable, and was disconnected from EUT and removed from test table after sending command.

3 Emission Tests Results

3.1 Conducted Emissions from the AC mains power ports

3.1.1 Limits of Conducted Emissions from the AC mains power ports

Frequency range (MHz)	Limits values (dBµV)			
	Class A		Class B	
	Quasi-peak	Average	Quasi-peak	Average
0.15 to 0,50	79	66	66 to 56 *	56 to 46 *
0,50 to 5	73	60	56	46
5 to 30	73	60	60	50

Note 1: "*" Decreasing linearly with the logarithm of the frequency.
Note 2: If the limits for the average detector are met when using the quasi-peak detector, then the limits for the measurements with the average detector are considered to be met.
Note 3: The higher value measured with and without the outer conductor screen of the antenna terminal connected to earth is considered.

3.1.2 Test Procedures

a. The EUT was placed on a desk 0.8 meters height from the metal ground plane and 0.4 meter from the conducting wall of the shielding room and it was kept at least 0.8 meters from any other grounded conducting surface.

b. A thickness of ≤ 0.15m insulation should be placed between local AE and associated cabling and the RGP.

c. Connect EUT to the power mains through a line impedance stabilization network (LISN).

d. All the support units are connecting to the other LISN.

e. The LISN provides 50 ohm coupling impedance for the measuring instrument.

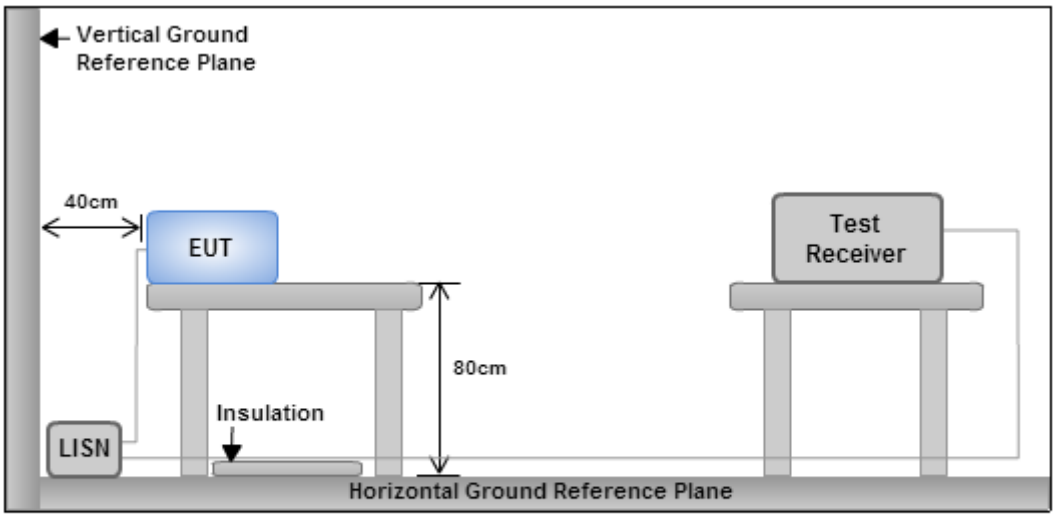
f. The CISPR states that a 50 ohm, 50 microhenry LISN should be used.

g. Both sides of AC line were checked for maximum conducted interference.

h. The frequency range from 150 kHz to 30 MHz was searched.

i. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

3.1.3 Test Setup

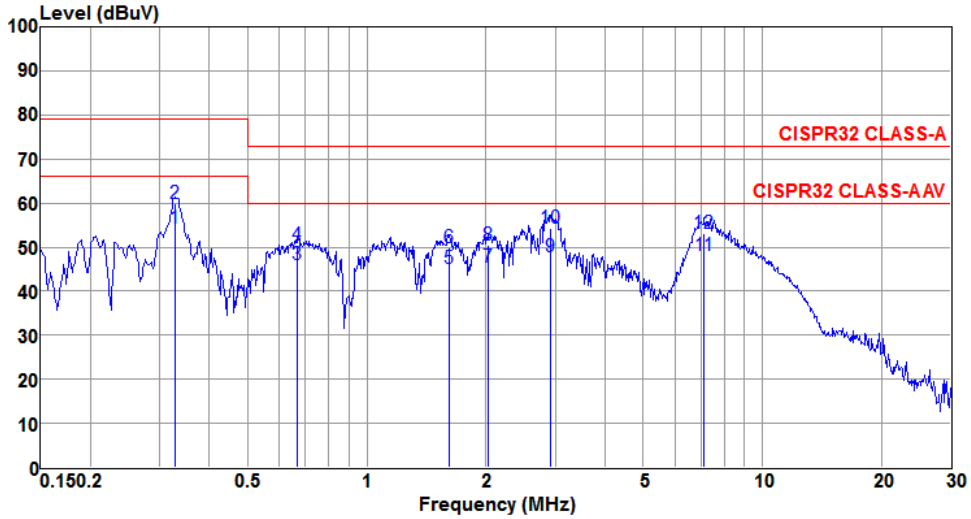


Note: 1. Support units were connected to second LISN.

2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 cm from other units and other metal planes

3.1.4 Test Result of Conducted Emissions from the AC mains power ports

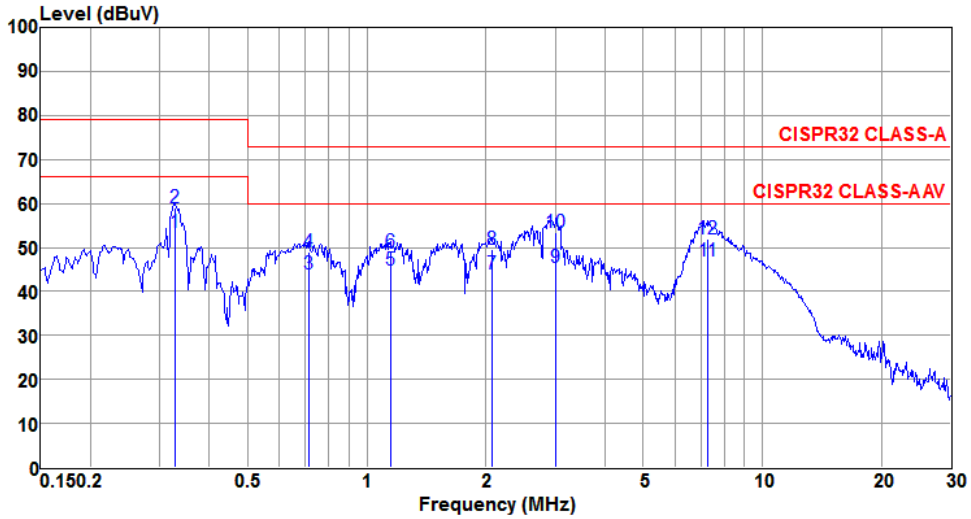
Power Phase	Line	Test Mode	1



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1*	0.327	54.39	66.00	-11.61	54.04	0.33	0.02	Average
2	0.327	59.86	79.00	-19.14	59.51	0.33	0.02	QP
3	0.665	45.97	60.00	-14.03	45.57	0.37	0.03	Average
4	0.665	50.57	73.00	-22.43	50.17	0.37	0.03	QP
5	1.619	45.17	60.00	-14.83	44.67	0.42	0.08	Average
6	1.619	49.82	73.00	-23.18	49.32	0.42	0.08	QP
7	2.033	45.48	60.00	-14.52	44.95	0.43	0.10	Average
8	2.033	50.40	73.00	-22.60	49.87	0.43	0.10	QP
9	2.915	47.74	60.00	-12.26	47.12	0.45	0.17	Average
10	2.915	54.27	73.00	-18.73	53.65	0.45	0.17	QP
11	7.137	48.00	60.00	-12.00	47.19	0.53	0.28	Average
12	7.137	53.09	73.00	-19.91	52.28	0.53	0.28	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Limit Line (dBuV) – Level (dBuV).

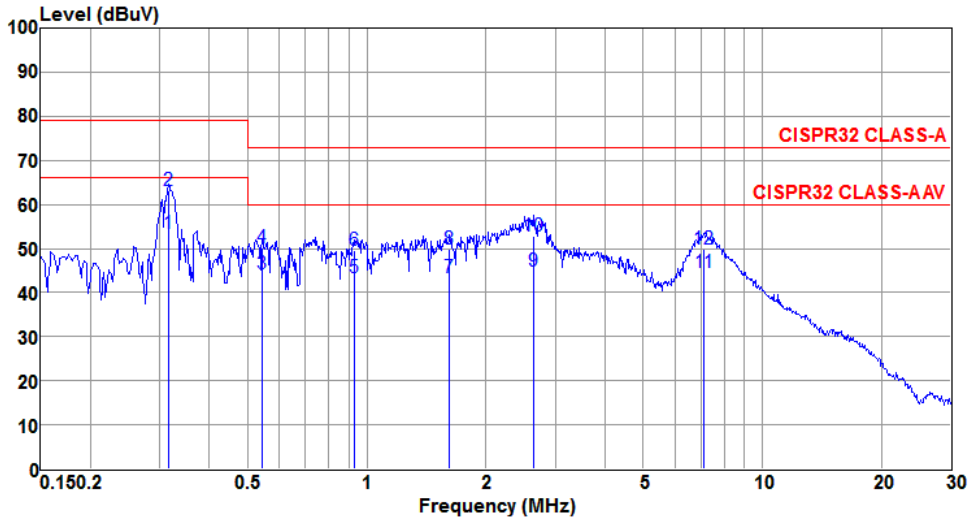
Power Phase	Neutral	Test Mode	1



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1*	0.327	53.52	66.00	-12.48	53.32	0.18	0.02	Average
2	0.327	59.03	79.00	-19.97	58.83	0.18	0.02	QP
3	0.712	44.01	60.00	-15.99	43.75	0.23	0.03	Average
4	0.712	48.90	73.00	-24.10	48.64	0.23	0.03	QP
5	1.147	44.99	60.00	-15.01	44.68	0.27	0.04	Average
6	1.147	48.90	73.00	-24.10	48.59	0.27	0.04	QP
7	2.066	44.03	60.00	-15.97	43.61	0.31	0.11	Average
8	2.066	49.47	73.00	-23.53	49.05	0.31	0.11	QP
9	3.009	45.50	60.00	-14.50	45.00	0.33	0.17	Average
10	3.009	53.29	73.00	-19.71	52.79	0.33	0.17	QP
11	7.290	46.91	60.00	-13.09	46.20	0.42	0.29	Average
12	7.290	52.04	73.00	-20.96	51.33	0.42	0.29	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Limit Line (dBuV) – Level (dBuV).

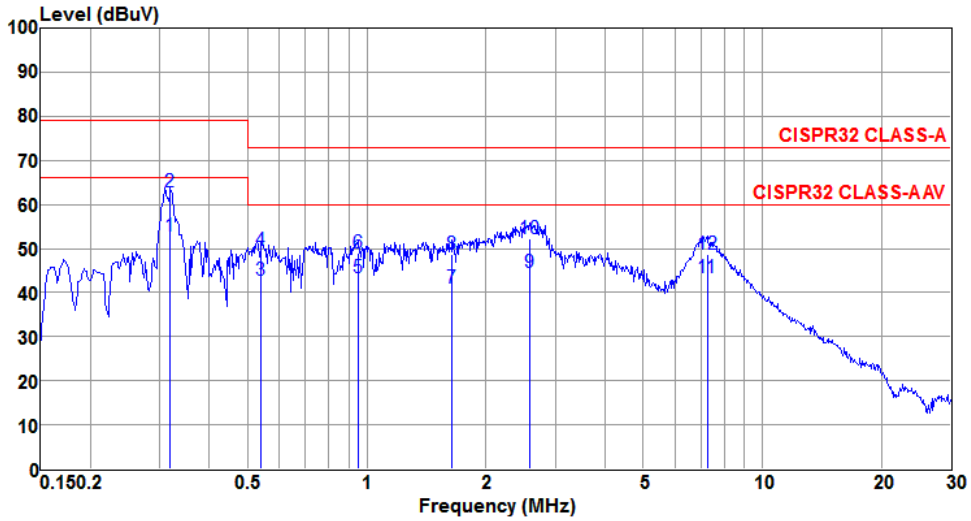
Power Phase	Line	Test Mode	2



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1*	0.315	53.46	66.00	-12.54	53.12	0.32	0.02	Average
2	0.315	63.08	79.00	-15.92	62.74	0.32	0.02	QP
3	0.544	44.18	60.00	-15.82	43.80	0.36	0.02	Average
4	0.544	50.24	73.00	-22.76	49.86	0.36	0.02	QP
5	0.928	43.48	60.00	-16.52	43.06	0.39	0.03	Average
6	0.928	49.53	73.00	-23.47	49.11	0.39	0.03	QP
7	1.619	43.31	60.00	-16.69	42.81	0.42	0.08	Average
8	1.619	49.78	73.00	-23.22	49.28	0.42	0.08	QP
9	2.636	44.75	60.00	-15.25	44.15	0.45	0.15	Average
10	2.636	52.85	73.00	-20.15	52.25	0.45	0.15	QP
11	7.137	44.41	60.00	-15.59	43.60	0.53	0.28	Average
12	7.137	49.77	73.00	-23.23	48.96	0.53	0.28	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

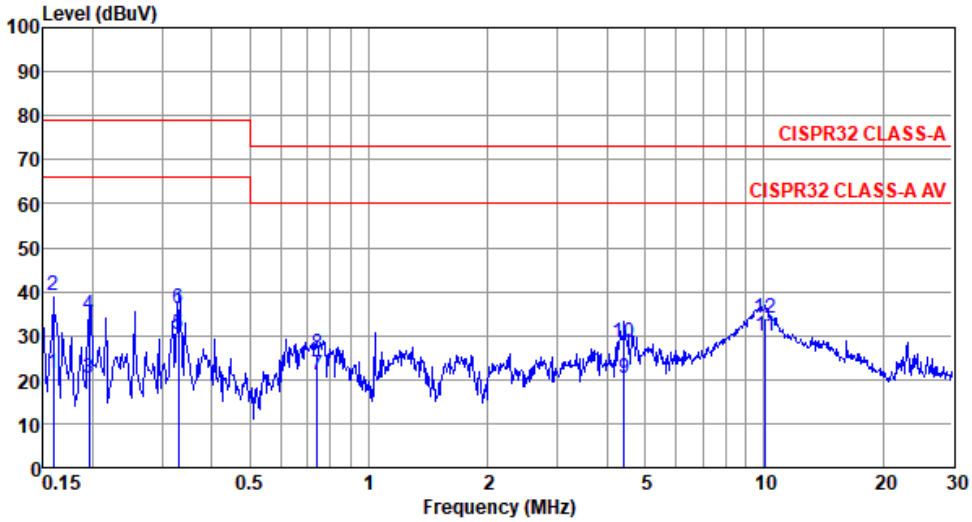
Power Phase	Neutral	Test Mode	2



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1*	0.318	52.92	66.00	-13.08	52.72	0.18	0.02	Average
2	0.318	62.86	79.00	-16.14	62.66	0.18	0.02	QP
3	0.541	42.83	60.00	-17.17	42.60	0.21	0.02	Average
4	0.541	49.49	73.00	-23.51	49.26	0.21	0.02	QP
5	0.948	43.29	60.00	-16.71	43.00	0.26	0.03	Average
6	0.948	49.12	73.00	-23.88	48.83	0.26	0.03	QP
7	1.645	41.07	60.00	-18.93	40.69	0.30	0.08	Average
8	1.645	48.65	73.00	-24.35	48.27	0.30	0.08	QP
9	2.581	44.68	60.00	-15.32	44.22	0.32	0.14	Average
10	2.581	52.24	73.00	-20.76	51.78	0.32	0.14	QP
11	7.252	43.31	60.00	-16.69	42.61	0.42	0.28	Average
12	7.252	48.81	73.00	-24.19	48.11	0.42	0.28	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

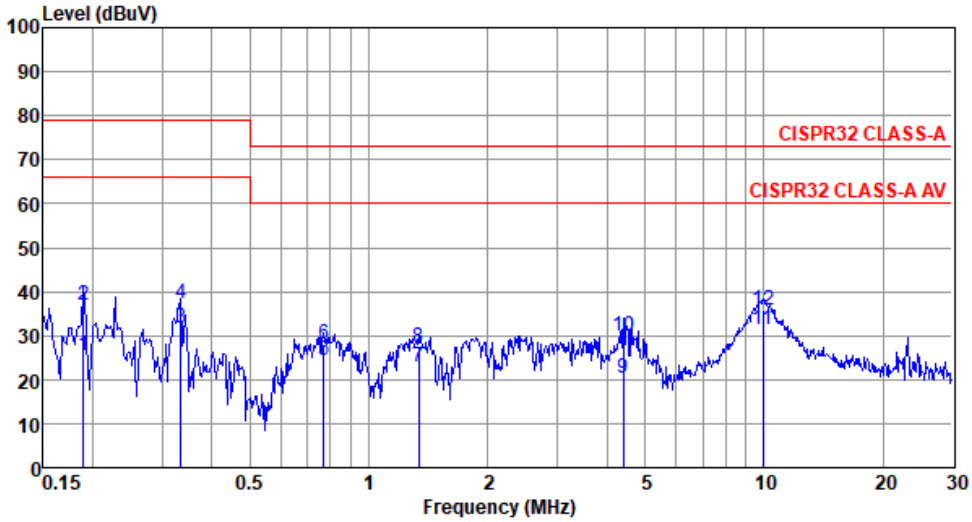
Power Phase	Line	Test Mode	3



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.159	21.43	66.00	-44.57	11.68	9.53	0.05	Average
2	0.159	38.99	79.00	-40.01	29.24	9.53	0.05	QP
3	0.195	20.26	66.00	-45.74	10.47	9.54	0.06	Average
4	0.195	34.65	79.00	-44.35	24.86	9.54	0.06	QP
5	0.330	30.26	66.00	-35.74	20.40	9.56	0.07	Average
6	0.330	36.21	79.00	-42.79	26.35	9.56	0.07	QP
7	0.739	20.86	60.00	-39.14	10.86	9.59	0.11	Average
8	0.739	25.78	73.00	-47.22	15.78	9.59	0.11	QP
9	4.430	20.48	60.00	-39.52	10.20	9.61	0.30	Average
10	4.430	28.55	73.00	-44.45	18.27	9.61	0.30	QP
11*	10.072	30.01	60.00	-29.99	19.57	9.65	0.39	Average
12	10.072	34.12	73.00	-38.88	23.68	9.65	0.39	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

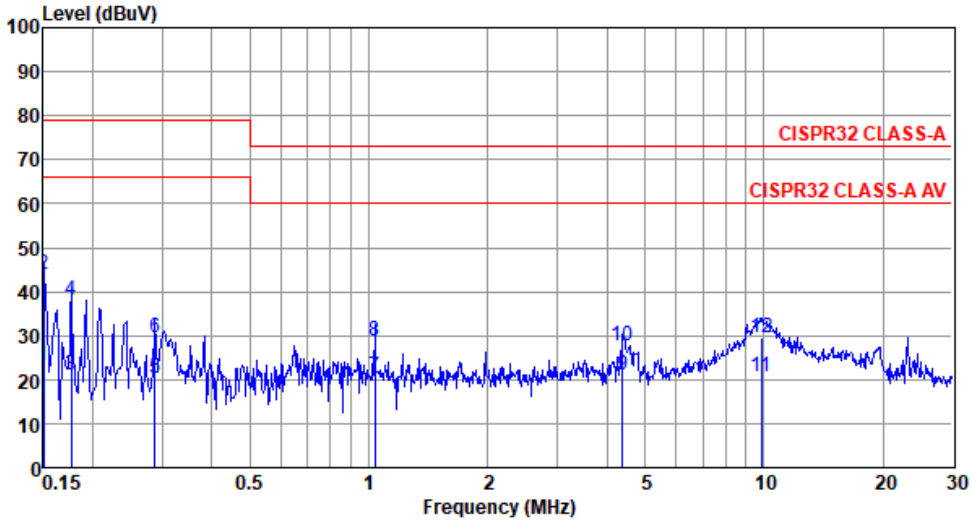
Power Phase	Neutral	Test Mode	3



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.189	25.34	66.00	-40.66	15.56	9.58	0.06	Average
2	0.189	36.94	79.00	-42.06	27.16	9.58	0.06	QP
3	0.334	31.84	66.00	-34.16	22.01	9.60	0.07	Average
4	0.334	37.35	79.00	-41.65	27.52	9.60	0.07	QP
5	0.767	24.18	60.00	-35.82	14.25	9.63	0.11	Average
6	0.767	27.94	73.00	-45.06	18.01	9.63	0.11	QP
7	1.338	23.00	60.00	-37.00	12.98	9.64	0.15	Average
8	1.338	27.36	73.00	-45.64	17.34	9.64	0.15	QP
9	4.407	20.46	60.00	-39.54	10.22	9.67	0.30	Average
10	4.407	29.92	73.00	-43.08	19.68	9.67	0.30	QP
11*	9.966	31.42	60.00	-28.58	20.99	9.71	0.39	Average
12	9.966	35.64	73.00	-37.36	25.21	9.71	0.39	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

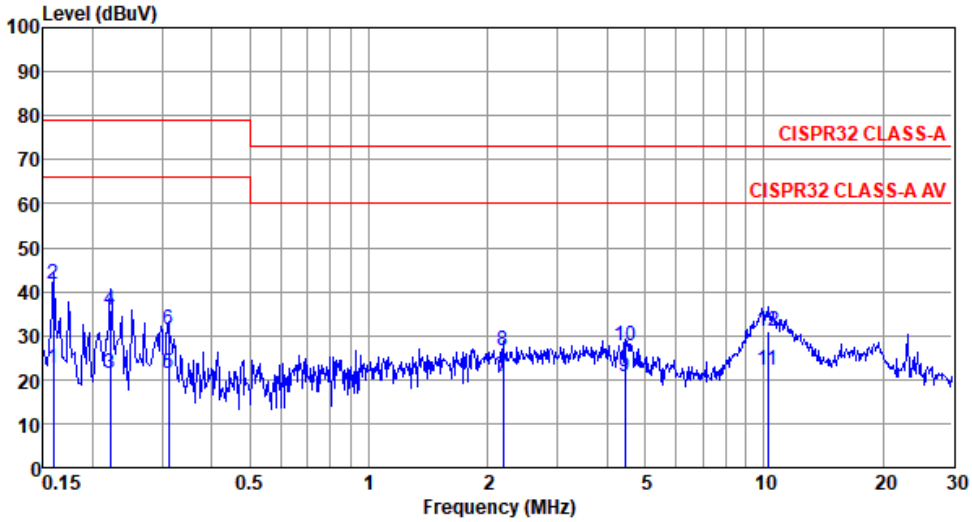
Power Phase	Line	Test Mode	4



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.150	23.33	66.00	-42.67	13.59	9.53	0.05	Average
2*	0.150	43.81	79.00	-35.19	34.07	9.53	0.05	QP
3	0.177	21.13	66.00	-44.87	11.35	9.54	0.06	Average
4	0.177	37.99	79.00	-41.01	28.21	9.54	0.06	QP
5	0.288	20.25	66.00	-45.75	10.40	9.56	0.07	Average
6	0.288	29.39	79.00	-49.61	19.54	9.56	0.07	QP
7	1.037	20.82	60.00	-39.18	10.78	9.60	0.12	Average
8	1.037	28.91	73.00	-44.09	18.87	9.60	0.12	QP
9	4.384	21.06	60.00	-38.94	10.78	9.61	0.30	Average
10	4.384	27.83	73.00	-45.17	17.55	9.61	0.30	QP
11	9.861	20.57	60.00	-39.43	10.13	9.65	0.39	Average
12	9.861	29.64	73.00	-43.36	19.20	9.65	0.39	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

Power Phase	Neutral	Test Mode	4



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.159	22.52	66.00	-43.48	12.77	9.57	0.05	Average
2*	0.159	41.69	79.00	-37.31	31.94	9.57	0.05	QP
3	0.222	21.26	66.00	-44.74	11.47	9.58	0.06	Average
4	0.222	35.81	79.00	-43.19	26.02	9.58	0.06	QP
5	0.312	21.57	66.00	-44.43	11.74	9.60	0.07	Average
6	0.312	31.25	79.00	-47.75	21.42	9.60	0.07	QP
7	2.190	20.77	60.00	-39.23	10.67	9.65	0.19	Average
8	2.190	26.67	73.00	-46.33	16.57	9.65	0.19	QP
9	4.454	20.48	60.00	-39.52	10.24	9.67	0.30	Average
10	4.454	27.53	73.00	-45.47	17.29	9.67	0.30	QP
11	10.233	21.96	60.00	-38.04	11.52	9.71	0.40	Average
12	10.233	31.13	73.00	-41.87	20.69	9.71	0.40	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

3.2 Asymmetric Mode Conducted Emissions

3.2.1 Limit of Asymmetric Mode Conducted Emissions

Asymmetric Mode Conducted Emissions Class A limits				
Frequency Range (MHz)	Voltage Limits (dBuV)		Current Limits (dBμA)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 to 0.50	97 to 87	84 to 74	53 to 43	40 to 30
0.50 to 30	87	74	43	30
Note 1: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.				

Asymmetric Mode Conducted Emissions Class B limits				
Frequency Range (MHz)	Voltage Limits (dBuV)		Current Limits (dBμA)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 to 0.50	84 to 74	74 to 64	40 to 30	30 to 20
0.50 to 30	74	64	30	20
Note 1: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.				

3.2.2 Test Procedures

Using ISN

a. Connect CDN/ISN directly to reference ground plane.

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

c. If current measurement is used, measure current with the current probe and compare to the current limit.

d. The disturbance levels and the frequencies of at least six highest disturbances are recorded from be measured each telecommunication port, which comprises the EUT.

e. It is not necessary to apply the voltage and the current limit if the ISN is used. A 50 ohm load has to be connected to the measurement port of the ISN during the current measurement.

Using a 150 ohm load to the outside surface of the shield ("in situ CDN/ISN")

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

b. Apply a ferrite tube or clamp between 150 ohm connection and AE.

c. The disturbance levels and the frequencies of at least six highest disturbances are recorded from be measured each telecommunication port, which comprises the EUT.

d. Measure current with a current probe and compare to the current limit. The common mode impedance towards the right of the 150 ohm resistor shall be sufficiently large as not to affect the measurement. Use Clause C.2 to measure this impedance which should be much greater than 150 ohm so as not to affect the measurement for frequencies emitted by the EUT.

Using a combination of current probe and capacitive voltage probe with a table top EUT

a. Connect to AE with a cable. The cable contains more than four balanced pairs or to unbalanced cable.

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

c. Measure voltage with a capacitive probe and 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.

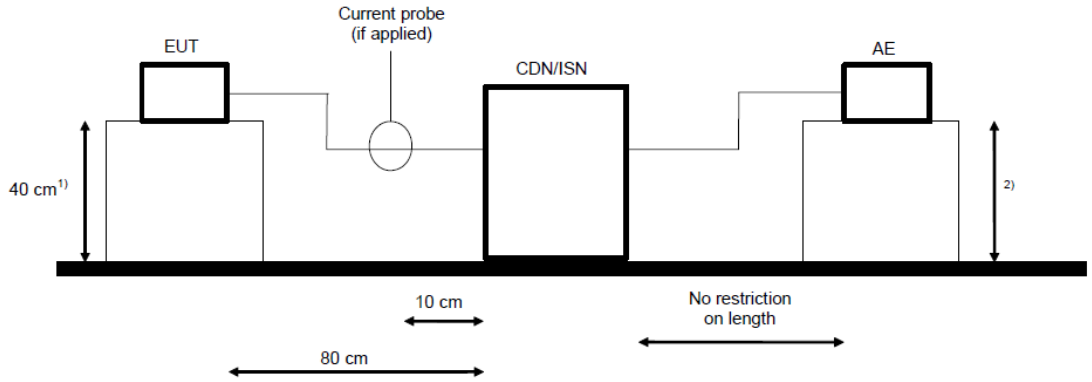
   Compare adjusted voltage with the applicable voltage limit.

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

e. The disturbance levels and the frequencies of at least six highest disturbances are recorded from be measured each telecommunication port, which comprises the EUT.

3.2.3 Test Setup

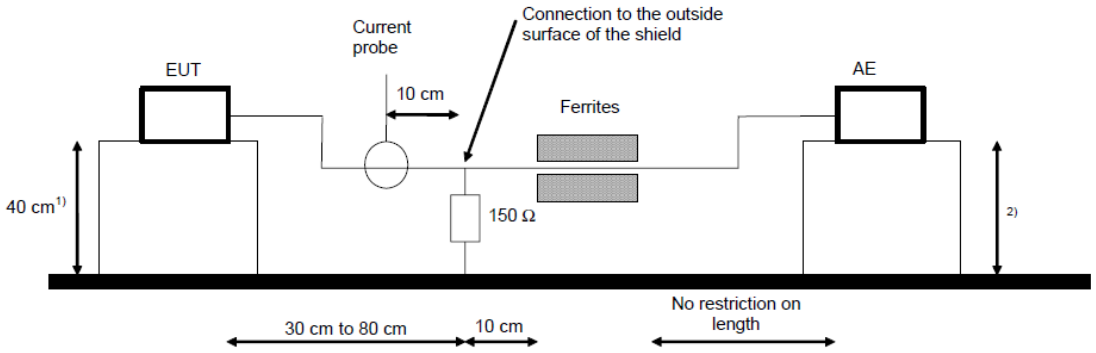
Using ISN



AE = Associated equipment
EUT = Equipment under test

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

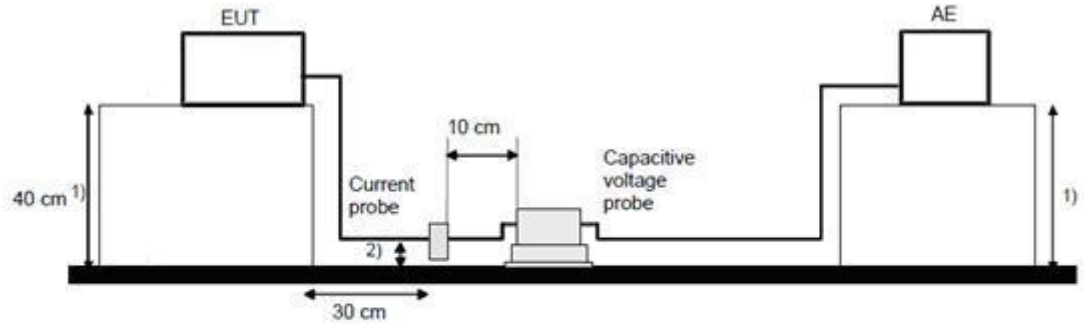
Using a 150 ohm load to the outside surface of the shield cable



AE = Associated equipment
EUT = Equipment under test

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

Using a combination of current probe and capacitive voltage probe

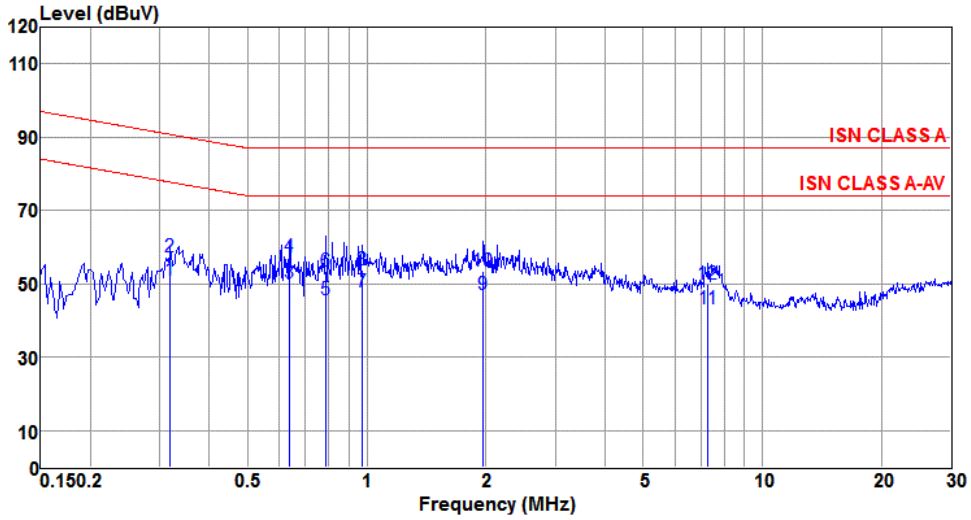


AE = Associated equipment
EUT = Equipment under test

1) Distance to the reference groundplane (vertical or horizontal)
2) Distance 4± 1 cm from the reference groundplane.

3.2.4 Test Result of Asymmetric Mode Conducted Emissions

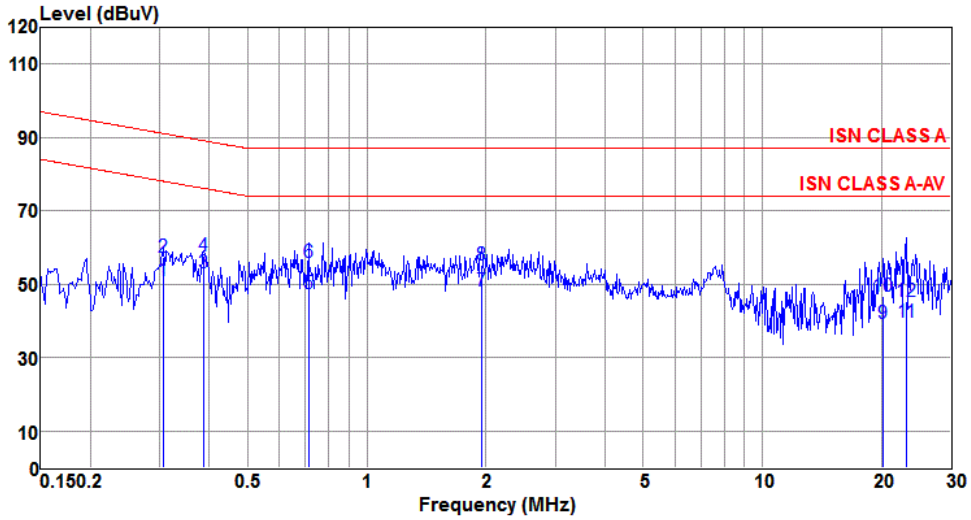
Test Mode	1. LAN1 Speed 1Gbps, Ping WiFi 5G, EUT orientation: Y-axis, with adapter (F30L2-120250SPACP)



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.318	50.88	77.75	-26.87	41.13	9.73	0.02	Average
2	0.318	57.22	90.75	-33.53	47.47	9.73	0.02	QP
3@	0.637	50.33	74.00	-23.67	40.70	9.60	0.03	Average
4	0.637	57.53	87.00	-29.47	47.90	9.60	0.03	QP
5	0.788	45.79	74.00	-28.21	36.20	9.56	0.03	Average
6	0.788	53.62	87.00	-33.38	44.03	9.56	0.03	QP
7	0.974	47.90	74.00	-26.10	38.33	9.54	0.03	Average
8	0.974	53.91	87.00	-33.09	44.34	9.54	0.03	QP
9	1.970	47.04	74.00	-26.96	37.46	9.48	0.10	Average
10	1.970	53.56	87.00	-33.44	43.98	9.48	0.10	QP
11	7.290	43.37	74.00	-30.63	33.66	9.42	0.29	Average
12	7.290	49.75	87.00	-37.25	40.04	9.42	0.29	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

Test Mode	2. LAN2 Speed 100Mbps, Ping WiFi 5G, EUT orientation: Y-axis, with adapter (F30L2-120250SPACP)



	Freq	Level	Limit Line	Over Limit	Read Level	LISN factor	cable loss	Remark
	MHz	dBuV	dBuV	dB	dBuV	dB	dB	
1	0.307	50.98	78.06	-27.08	41.22	9.74	0.02	Average
2	0.307	57.47	91.06	-33.59	47.71	9.74	0.02	QP
3@	0.387	53.07	76.12	-23.05	43.37	9.68	0.02	Average
4	0.387	57.62	89.12	-31.50	47.92	9.68	0.02	QP
5	0.712	47.40	74.00	-26.60	37.79	9.58	0.03	Average
6	0.712	55.85	87.00	-31.15	46.24	9.58	0.03	QP
7	1.949	48.15	74.00	-25.85	38.57	9.48	0.10	Average
8	1.949	55.26	87.00	-31.74	45.68	9.48	0.10	QP
9	20.270	39.37	74.00	-34.63	29.51	9.52	0.34	Average
10	20.270	46.66	87.00	-40.34	36.80	9.52	0.34	QP
11	23.140	39.70	74.00	-34.30	29.75	9.58	0.37	Average
12	23.140	45.50	87.00	-41.50	35.55	9.58	0.37	QP

Note 1: Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB).
2: Over Limit (dB) = Level (dBuV) – Limit Line (dBuV).

3.3 Radiated Emissions

3.3.1 Limit of Radiated Emissions

Frequency Range (MHz)	Class A		Class B	
	10m	3m	10m	3m
	Quasi-peak limits (dBμV/m)			
30 to 230	40	50	30	40
230 to 1000	47	57	37	47
Note 1: The lower limit shall apply at the transition frequency. Note 2: Additional provisions may be required for cases where interference occurs.				

Frequency range (GHz)	Class A (3 m)		Class B (3 m)	
	Average limit (dBμV/m)	Peak limit (dBμV/m)	Average limit (dBμV/m)	Peak limit (dBμV/m)
1 to 3	56	76	50	70
3 to 6	60	80	54	74
Note 1: The lower limit shall apply at the transition frequency. Note 2: Additional provisions may be required for cases where interference occurs.				

For an unintentional radiator is shown in the table below.

The highest internal source of an EUT is defined as the highest frequency generated or used within the EUT or on which the EUT operates or tunes.	Upper frequency of measurement range
Below 108 MHz	1 GHz
108 MHz to 500 MHz	2 GHz
500 MHz to 1 GHz	5 GHz
Above 1 GHz	5 times the highest frequency or 6 GHz, whichever is less.

3.3.2 Test Procedures

a. The EUT was placed on a rotatable table top with a height of 0.8 meters which is placed on the ground plane.

b. A thickness of ≤ 0.15m insulation should be placed between local AE and associated cabling and the RGP.

c. The EUT received DC power source from the outlet socket under the turntable. All support equipment power received from another socket under the turntable.

d. The EUT and local AE shall be arranged in the most compact practical arrangement within the test volume. The central point of the arrangement shall be positioned at the centre of the turntable. The measurement distance is the shortest horizontal distance between an imaginary circular periphery just encompassing this arrangement and calibration point of the antenna.

e. The table was rotated 360 degrees to determine the position of the highest radiation.

f. The antenna is a half wave dipole and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.

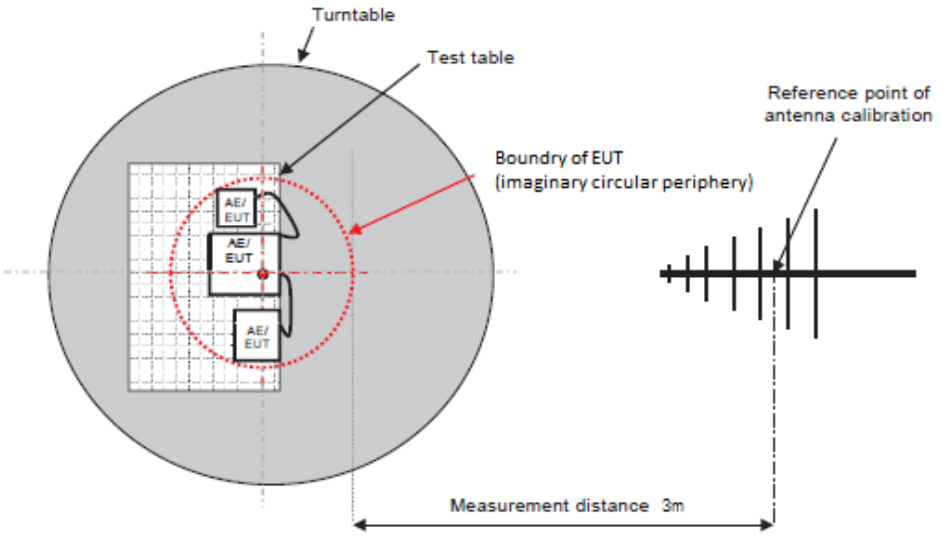
g. For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 to 4 meters) and turn table (from 0 to 360 degrees) to find the maximum reading.

h. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

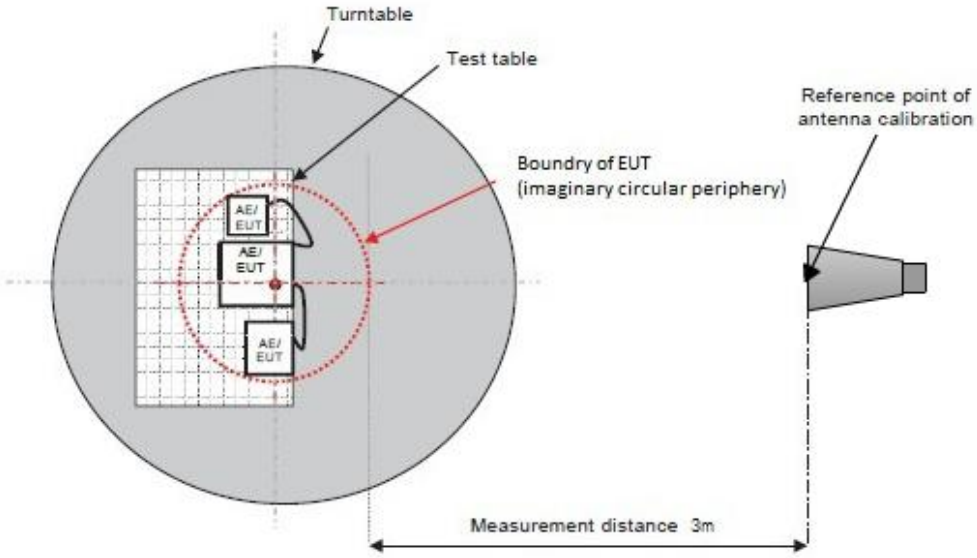
i. If the emission level of the EUT in peak mode was 2 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 2 dB margin will be repeated one by one using the quasi-peak method and reported.

3.3.3 Test Setup

Radiated Emissions below 1GHz

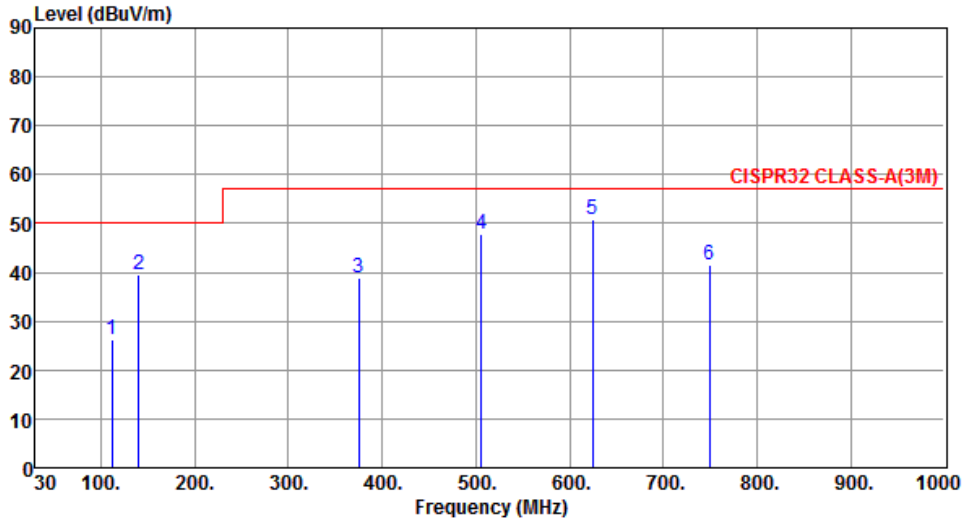


Radiated Emissions above 1GHz



3.3.4 Radiated Emissions (Below 1GHz)

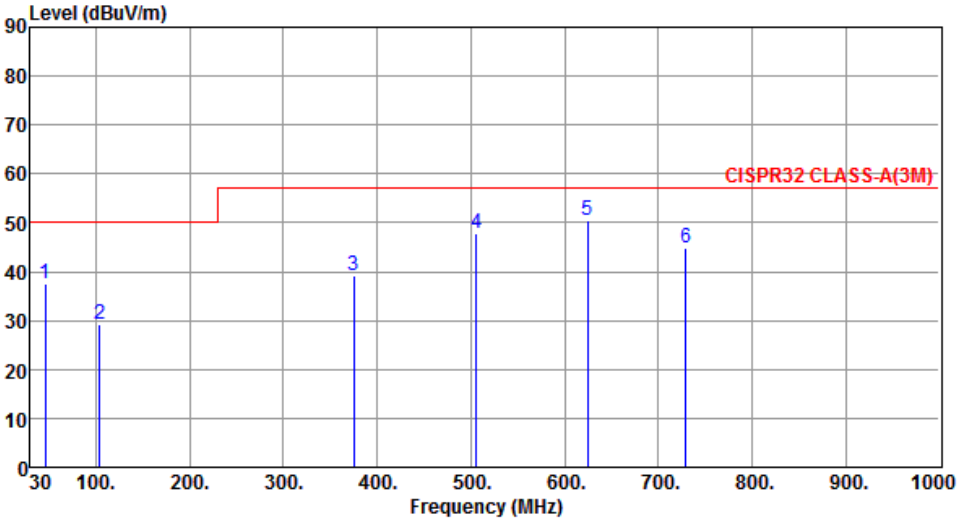
Polarization	Horizontal	Test Mode	1



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	111.48	26.13	50.00	-23.87	37.45	-11.32	Peak	---	---
2	140.58	39.55	50.00	-10.45	47.92	-8.37	Peak	---	---
3	375.32	38.92	57.00	-18.08	44.15	-5.23	Peak	---	---
4	506.27	47.96	57.00	-9.04	50.09	-2.13	Peak	---	---
5	624.61	50.95	57.00	-6.05	50.58	0.37	Peak	---	---
6	749.74	41.35	57.00	-15.65	38.56	2.79	Peak	---	---

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).
2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Polarization	Vertical	Test Mode	1

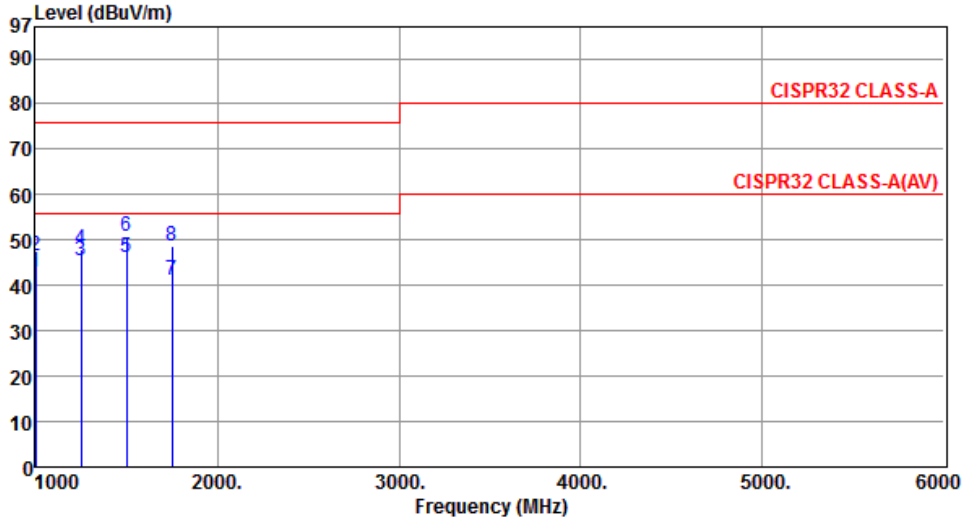


	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	45.52	37.59	50.00	-12.41	45.73	-8.14	Peak	---	---
2	103.72	29.26	50.00	-20.74	41.67	-12.41	Peak	---	---
3	375.32	39.31	57.00	-17.69	44.54	-5.23	Peak	---	---
4	506.27	47.91	57.00	-9.09	50.04	-2.13	Peak	---	---
5	624.61	50.46	57.00	-6.54	50.09	0.37	Peak	---	---
6	729.37	44.68	57.00	-12.32	42.39	2.29	Peak	---	---

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).
2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

3.3.5 Radiated Emissions (Above 1GHz)

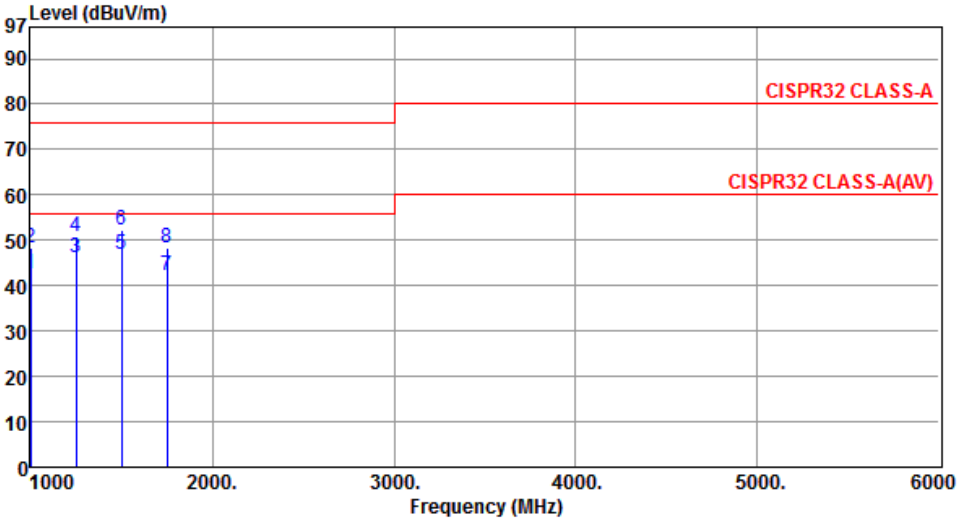
Polarization	Horizontal	Test Mode	1



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	1000.05	42.96	56.00	-13.04	53.10	-10.14	Average	100	330
2	1000.05	46.46	76.00	-29.54	56.60	-10.14	Peak	100	330
3	1250.00	45.47	56.00	-10.53	53.17	-7.70	Average	100	213
4	1250.00	48.09	76.00	-27.91	55.79	-7.70	Peak	100	213
5	1500.00	46.34	56.00	-9.66	52.79	-6.45	Average	142	44
6	1500.00	50.94	76.00	-25.06	57.39	-6.45	Peak	142	44
7	1750.00	41.10	56.00	-14.90	47.32	-6.22	Average	100	46
8	1750.00	48.67	76.00	-27.33	54.89	-6.22	Peak	100	46

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).
2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

Polarization	Vertical	Test Mode	1



	Freq. MHz	Emission level dBuV/m	Limit dBuV/m	Margin dB	SA reading dBuV	Factor dB	Remark	ANT High cm	Turn Table deg
1	1000.05	42.56	56.00	-13.44	52.70	-10.14	Average	100	140
2	1000.05	48.36	76.00	-27.64	58.50	-10.14	Peak	100	140
3	1250.00	46.24	56.00	-9.76	53.94	-7.70	Average	100	244
4	1250.00	50.76	76.00	-25.24	58.46	-7.70	Peak	100	244
5	1500.00	46.86	56.00	-9.14	53.31	-6.45	Average	100	294
6	1500.00	52.29	76.00	-23.71	58.74	-6.45	Peak	100	294
7	1750.00	42.08	56.00	-13.92	48.30	-6.22	Average	146	45
8	1750.00	48.48	76.00	-27.52	54.70	-6.22	Peak	146	45

Note 1: Emission level (dBuV/m) = SA reading (dBuV) + Factor (dB).
2: Margin (dB) = Emission level (dBuV/m) – Limit (dBuV/m).

3.4 Harmonic Current Emissions

3.4.1 Limit of Harmonic Current Emissions

Harmonics [n]	Class A [A]	Class D [mA/W]
Odd harmonics		
3	2.30	3.4
5	1.14	1.9
7	0.77	1.0
9	0.40	0.5
11	0.33	0.35
13	0.21	0.30
15 ≤ n ≤ 39	0.15 x 15/n	3.85/n
Even harmonics		
2	1.08	-
4	0.43	-
6	0.30	-
8 ≤ n ≤ 40	0.23 x 8/n	-

Note:
1) According to EN 61000-3-2, the above limits for all equipment except for lighting equipment having an active input power > 75W and no limits apply for equipment with an active input power up to and including 75W.

3.4.2 Test Procedures

a. The EUT was placed on the top of a wooden table with a height of 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.

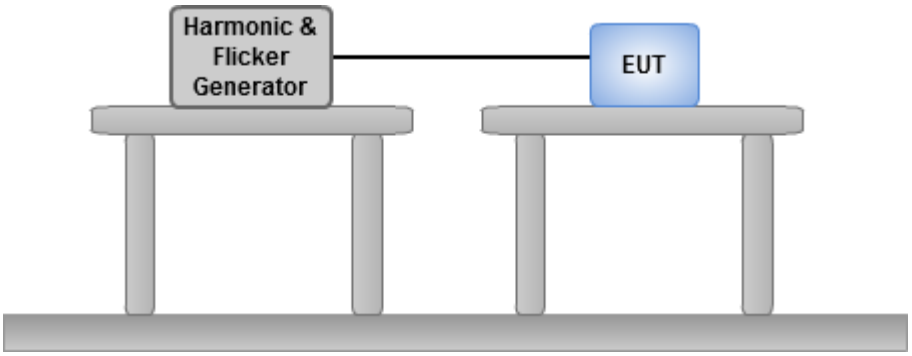
b. The classification of EUT is according to EN 61000-3-2.

The EUT is classified as follows:

- Class A: 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.
- Class B: Portable tools. Arc welding equipment which is not professional equipment.
- Class C: Lighting equipment.
- Class D: Equipment having a specified power less than or equal to 600 W of the following types: Personal computers, personal computer monitors and TV receivers.

c. 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.

3.4.3 Test Setup



3.4.4 Test Result of Harmonic Current Emissions

Test Mode	1				
Fundamental Voltage (Vrms)	**Ampere (Amps)**	**Power Frequency (Hz)**	**Rated Power Consumption (W)**	**Power Factor**	**Observation Period (Tp)**
229.9	0.027	50	3.1	0.295	3 mins

Note: The EUT is not required to meet the limits as its power consumption is less than 75W.

Test Mode	2				
Fundamental Voltage (Vrms)	**Ampere (Amps)**	**Power Frequency (Hz)**	**Rated Power Consumption (W)**	**Power Factor**	**Observation Period (Tp)**
229.89	0.027	50	3.1	0.291	3 mins

Note: The EUT is not required to meet the limits as its power consumption is less than 75W.

Test Mode	3				
Fundamental Voltage (Vrms)	**Ampere (Amps)**	**Power Frequency (Hz)**	**Rated Power Consumption (W)**	**Power Factor**	**Observation Period (Tp)**
229.9	0.027	50	3.1	0.291	3 mins

Note: The EUT is not required to meet the limits as its power consumption is less than 75W.

Test Mode	4				
Fundamental Voltage (Vrms)	**Ampere (Amps)**	**Power Frequency (Hz)**	**Rated Power Consumption (W)**	**Power Factor**	**Observation Period (Tp)**
229.87	0.029	50	4	0.3	3 mins

Note: The EUT is not required to meet the limits as its power consumption is less than 75W.

3.5 Voltage Fluctuation and Flicker

3.5.1 Limit of Voltage Fluctuation and Flicker

- ✧ The value of P_{st} shall not be greater than 1.0.
- ✧ The value of P_{lt} shall not be greater than 0.65.
- ✧ The value of Tdt during a voltage change shall not exceed 3.3 % for more than 500 ms.
- ✧ The relative steady-state voltage change, dc, shall not exceed 3.3 %.
- ✧ The maximum relative voltage change, dmax, shall not exceed 4.0 %.

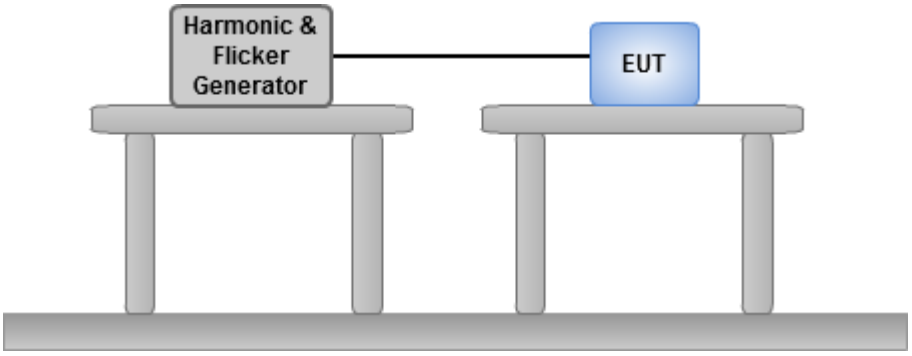
Note:
1) P_{st} means short-term flicker indicator.
2) P_{lt} means long-term flicker indicator.
3) Tdt (ms) means maximum time that dt exceeds 3.3 %.
4) dc (%) means relative steady-state voltage change.
5) dmax (%) means maximum relative voltage change.

3.5.2 Test Procedures

a. The EUT was placed on the top of a wooden table with a height of 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.

3.5.3 Test Setup



3.5.4 Test Result of Voltage Fluctuation and Flicker

Test Mode	1			
Fundamental Voltage (Vrms)	**Fundamental Ampere (Amps)**	**Power Frequency (Hz)**	**Observation Period (Tp)**	**Power Factor**
229.87	0.027	50	10 mins	0.295
Measurement Value				
P_{st}	**P_{lt}**	**T_{dt} (ms)**	**d_{max} (%)**	**dc (%)**
0.064	0.028	0	0	0

Test Mode	2			
Fundamental Voltage (Vrms)	**Fundamental Ampere (Amps)**	**Power Frequency (Hz)**	**Observation Period (Tp)**	**Power Factor**
229.84	0.027	50	10 mins	0.291
Measurement Value				
P_{st}	**P_{lt}**	**T_{dt} (ms)**	**d_{max} (%)**	**dc (%)**
0.064	0.028	0	0	0

Test Mode	3			
Fundamental Voltage (Vrms)	**Fundamental Ampere (Amps)**	**Power Frequency (Hz)**	**Observation Period (Tp)**	**Power Factor**
229.82	0.027	50	10 mins	0.291
Measurement Value				
P_{st}	**P_{lt}**	**T_{dt} (ms)**	**d_{max} (%)**	**dc (%)**
0.064	0.028	0	0	0

Test Mode	4			
Fundamental Voltage (Vrms)	**Fundamental Ampere (Amps)**	**Power Frequency (Hz)**	**Observation Period (Tp)**	**Power Factor**
229.76	0.029	50	10 mins	0.3
Measurement Value				
P_{st}	**P_{lt}**	**T_{dt} (ms)**	**d_{max} (%)**	**dc (%)**
0.064	0.028	0	0	0

4 Immunity Tests

4.1 General Description

Product Standard: EN 55024		
Basic Standard	**Spec. Requirement**	**Performance Criteria**
IEC 61000-4-2 (ESD)	Contact Discharge: ± 4 kV Air Discharge: ± 8 kV	B
IEC 61000-4-3 (RS)	80-1000 MHz, 3 V/m, 1 kHz Sine Wave, 80%, AM Modulation	A
IEC 61000-4-4 (EFT)	AC mains power: ± 1 kV, DC power: ± 0.5 kV, Signal ports: ± 0.5 kV	B
IEC 61000-4-5 (Surge)	AC mains power: line to line ± 1 kV, line to earth ± 2 kV, DC power line: line to earth ± 0.5 kV	B
	Outdoor signal line: without primary protectors: ± 1 kV with primary protectors: ± 4 kV	C
IEC 61000-4-6 (CS)	150 kHz - 80 MHz, 3 V_{rms}, 1 kHz Sine Wave, 80%, AM Modulation	A
IEC 61000-4-8 (PFMF)	50 Hz, 1 A/m, 1.0 Min duration	A
IEC 61000-4-11 (Dip)	Voltage Dips: >95% reduction – 0.5 period	B
	Voltage Dips: 30% reduction – 25 period	C
	Voltage Interruptions: >95% reduction – 250 period	C

4.2 Performance Criteria Description

General Performance Criteria	
Criteria A	During and after the test the EUT 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.
Criteria B	After the test, the EUT shall continue to operate as intended without operator intervention. No degradation of performance or loss of function is allowed, after the application of the phenomenon 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 if 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.
Criteria C	During and after testing, a temporary 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.

Particular Performance Criteria	
Performance Criteria Description for Local Area Networks (LAN)	
Criteria A	During and after the test, the EUT shall operate without: - error rate beyond the figure defined by the manufacturer; - requests for retry beyond the figure defined by the manufacturer; - speed of data transmission rate beyond the figure defined by the manufacturer; - protocol failure; - loss of link.
Criteria B	Error rate, request for retry and speed of data transmission rate may be degraded during the application of the test. During testing 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 immediately before the application of the test. In these cases, operator response is permitted to re-initiate an operation.
Criteria C	During testing 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 immediately before the application of the test or can be restored after the test by the operator.

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, than the general performance criteria shall apply.

Performance Criteria by Manufacturer (Test Mode 1, 2, 4)	
A	Without any ping error (request timed out) or any degradation of performance.
B	The ping error (request timed out) or degradation of performance. Functions shall be self-recoverable after the test.

Performance Criteria by Manufacturer (Test Mode 3)	
A	Without any “RSSI Return Value” loss or any degradation of performance.
B	The “RSSI Return Value” loss or degradation of performance. Functions shall be self-recoverable after the test.

4.3 Electrostatic Discharge (ESD)

4.3.1 Test Specification of Electrostatic Discharge (ESD)

Basic Standard	IEC 61000-4-2
Discharge Voltage	Contact Discharge: ± 2 kV / ± 4 kV Air Discharge: ± 2 kV / ± 4 kV / ± 8 kV
Discharge Impedance	330 ohm / 150 pF
Number of Discharge	Air Discharge: minimum 20 times at each test point Contact Discharge: minimum 50 times at each test point
Discharge Mode	Single Discharge
Discharge Period	1 second minimum

4.3.2 Test Procedures

a. In the case of air discharge testing the climatic conditions shall be within the following ranges:
- ambient temperature: 15°C to 35°C;
- relative humidity : 30% to 60%;
- atmospheric pressure : 86 kPa (860 mbar) to 106 kPa (1060 mbar).

b. Test programs and software shall be chosen so as to exercise all normal modes of operation of the EUT. The use of special exercising software is encouraged, but permitted only where it can be shown that the EUT is being comprehensively exercised.

c. The test voltage shall be increased from the minimum to the selected test severity level, in order to determine any threshold of failure. The final severity level should not exceed the product specification value in order to avoid damage to the equipment.

d. The test shall be performed with both air discharge and contact discharge. On preselected points at least 10 single discharges (in the most sensitive polarity) shall be applied on air discharge. On preselected points at least 25 single discharges (in the most sensitive polarity) shall be applied on contact discharge.

e. For the time interval between successive single discharges an initial value of one second is recommended. Longer intervals may be determined whether a system failure has occurred.

f. In the case of contact discharges, the tip of the discharge electrode shall touch the EUT before the discharge switch is operated.

g. In the case of painted surface covering a conducting substrate, the following procedure shall be adopted:
- If the coating is not declared to be an insulating coating by the equipment manufacturer, then the pointed tip of the generator shall penetrate the coating so as to make contact with the conducting substrate.
- Coating declared as insulating by the manufacturer shall only be submitted to the air discharge.
- The contact discharge test shall not be applied to such surfaces.

h. In the case of air discharges, the round discharge tip of the discharge electrode shall be approached as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator (discharge electrode) shall be removed from the EUT. The generator is then retriggered for a new single discharge. This procedure shall be repeated until the discharges are completed. In the case of an air discharge test, the discharge switch, which is used for contact discharge, shall be closed.

4.3.3 Test Setup

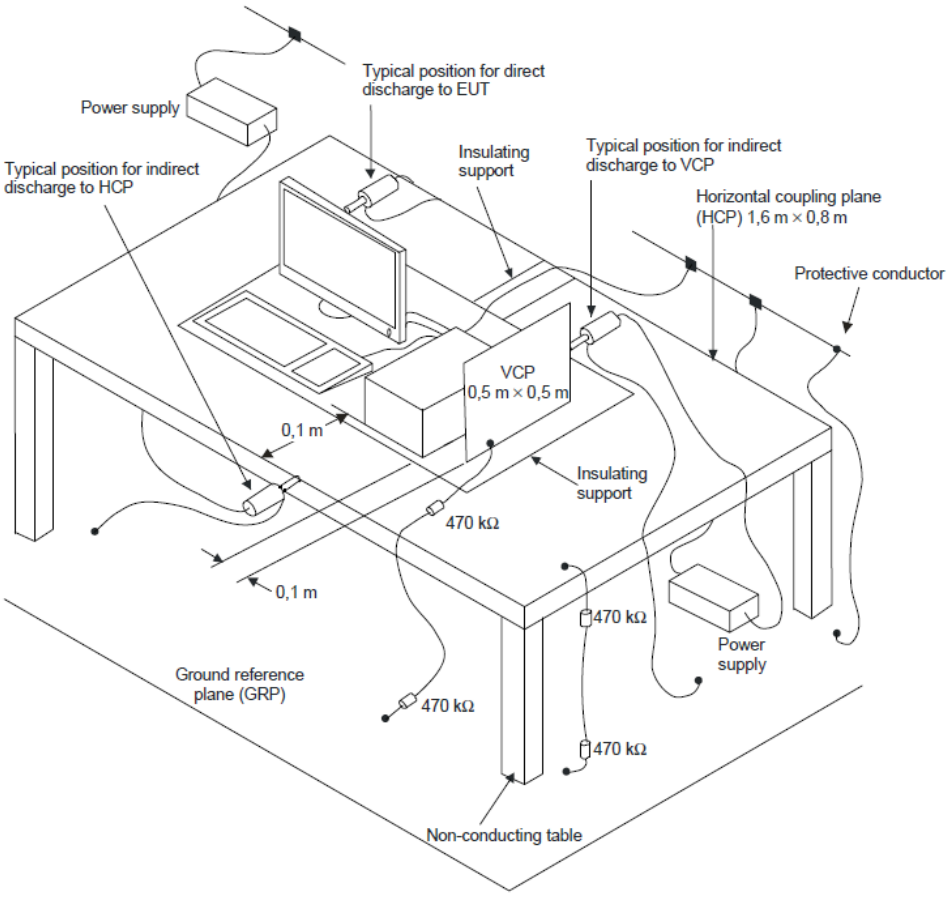


Table-top equipment:

The test setup shall consist of a non-conductive table, (0.8 ± 0.08) m high, standing on the ground reference plane.

A horizontal coupling plane (HCP), (1.6 ± 0.02) m × (0.8 ± 0.02) m, shall be placed on the table. The EUT and its cables shall be isolated from the coupling plane by an insulating support (0.5 ± 0.05) mm in thickness.

Floor-standing equipment:

The EUT shall be isolated from the ground reference plane by an insulating support of 0.05 m to 0.15 m thick. The EUT cables shall be isolated from the ground reference plane by an insulating support of (0.5 ± 0.05) mm. This cable isolation shall extend beyond the edge of the EUT isolation.

4.3.4 Test Result of Electrostatic Discharge (ESD)

Test Mode	1, 2, 3				
Direct Application					
Test Voltage (kV)	**Polarity**	**Test Point**	**Contact Discharge**	**Air Discharge**	**Performance Criteria**
2, 4	+/-	1 ~ 3	Note 1	N/A	A
2	+/-	4	Note 1	N/A	A
4	+/-	4	Note 2	N/A	B
2, 4, 8	+/-	5 ~ 10	N/A	Note 1	A
Indirect Application					
Test Voltage (kV)	**Polarity**	**Test Point**	**Horizontal Coupling Plane (HCP)**	**Vertical Coupling Plane (VCP)**	**Performance Criteria**
2, 4	+/-	At front, rear, left and right side	Note 1	Note 1	A

Note:
1) There was no abnormal situation during the test compared with initial operation.
2) The EUT's 1Gbps LAN had "request time out" message during the test, but could be self-recoverable after the test.

Test Mode	4				
Direct Application					
Test Voltage (kV)	**Polarity**	**Test Point**	**Contact Discharge**	**Air Discharge**	**Performance Criteria**
2, 4	+/-	1 ~ 3	Note 1	N/A	A
2	+/-	4	Note 1	N/A	A
4	+/-	4	Note 2	N/A	B
2, 4, 8	+/-	5 ~ 9	N/A	Note 1	A
Indirect Application					
Test Voltage (kV)	**Polarity**	**Test Point**	**Horizontal Coupling Plane (HCP)**	**Vertical Coupling Plane (VCP)**	**Performance Criteria**
2, 4	+/-	At front, rear, left and right side	Note 1	Note 1	A

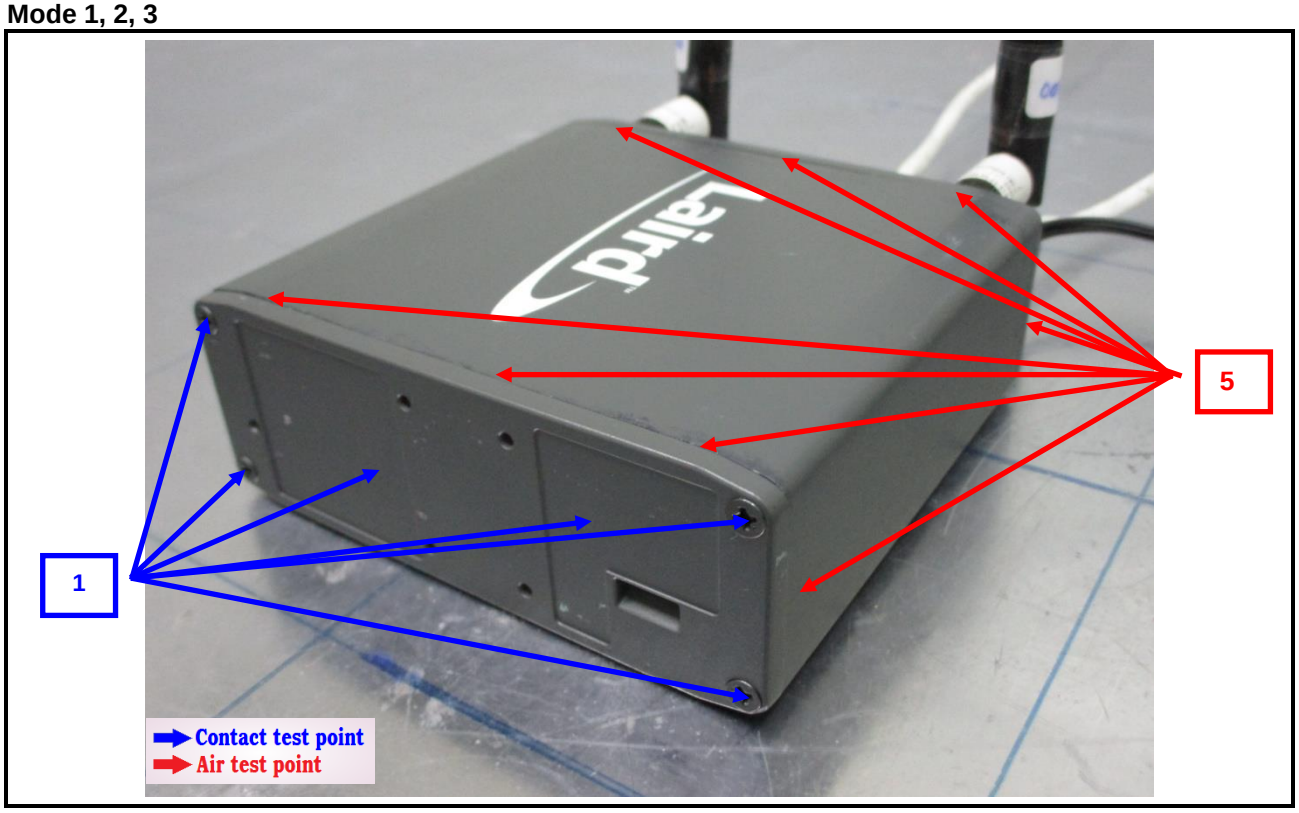
Note:
1) There was no abnormal situation during the test compared with initial operation.
2) The EUT's 1Gbps LAN had "request time out" message during the test, but could be self-recoverable after the test.

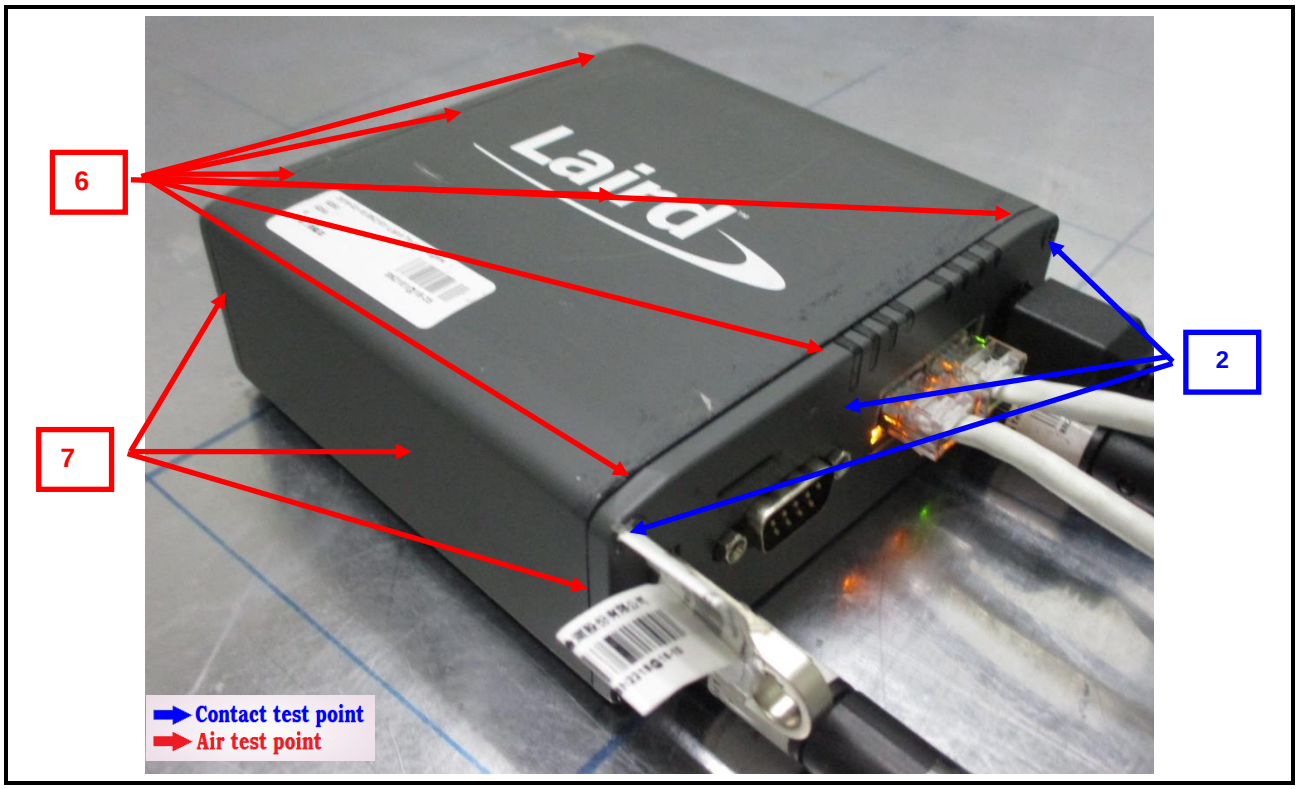
Test Mode	5				
Direct Application					
Test Voltage (kV)	**Polarity**	**Test Point**	**Contact Discharge**	**Air Discharge**	**Performance Criteria**
2, 4, 8	+/-	1 ~ 4	N/A	Note 1	A
2, 4	+/-	5, 6	N/A	Note 1	A
8	+/-	5, 6	N/A	Note 2	B
2	+/-	7 ~ 9	Note 1	N/A	A
4	+/-	7 ~ 9	Note 2	N/A	B
Indirect Application					
Test Voltage (kV)	**Polarity**	**Test Point**	**Horizontal Coupling Plane (HCP)**	**Vertical Coupling Plane (VCP)**	**Performance Criteria**
2, 4	+/-	At front, rear, left and right side	Note 1	Note 1	A

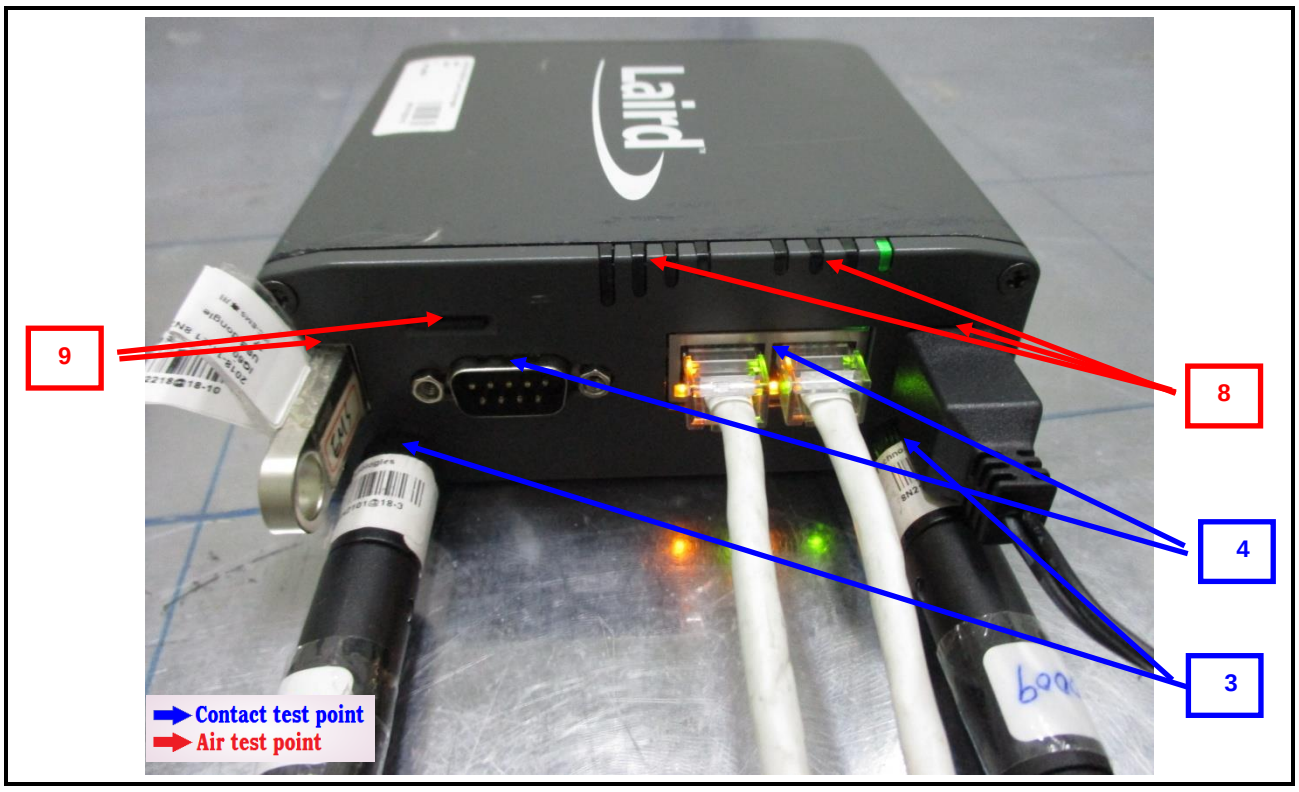
Note:
1) There was no abnormal situation during the test compared with initial operation.
2) The EUT had ping loss during the test, but could be self-recoverable after the test.

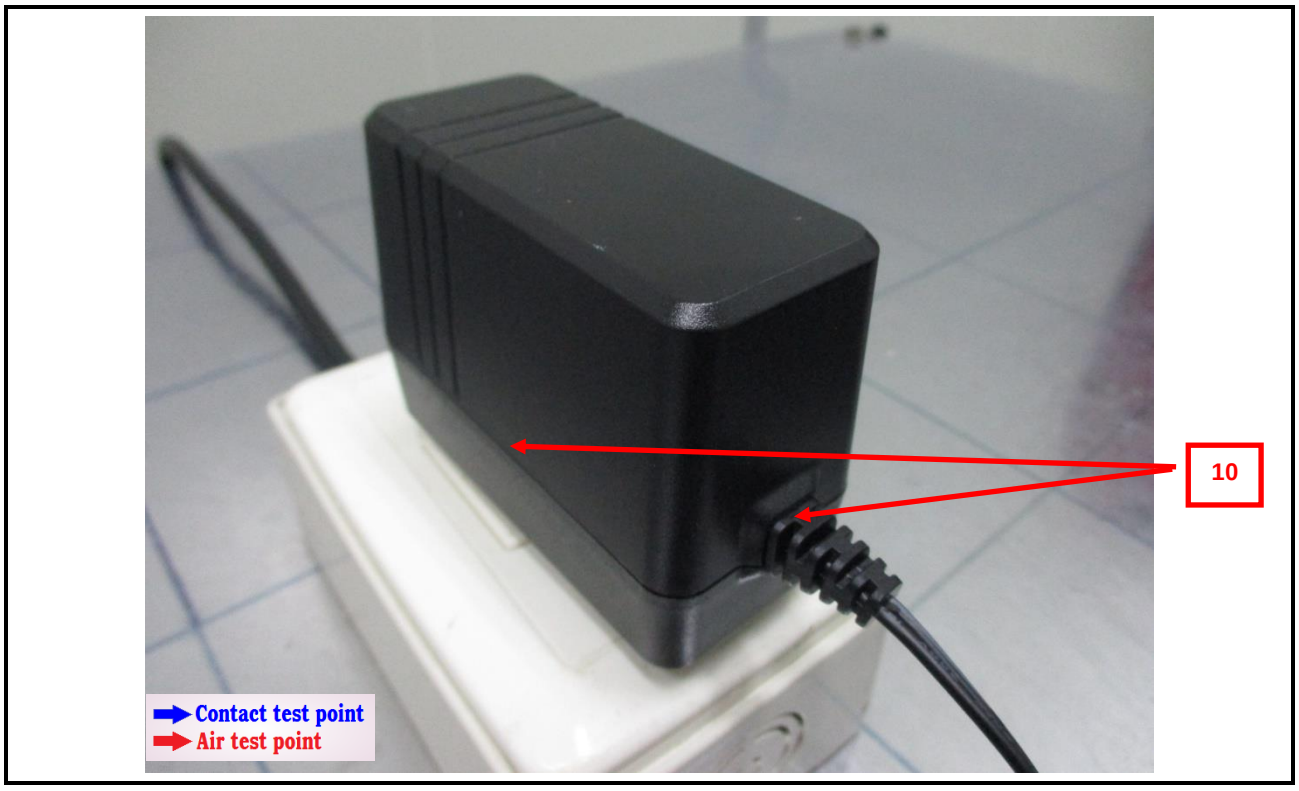
4.3.5 Test Point Photo

Mode 1, 2, 3

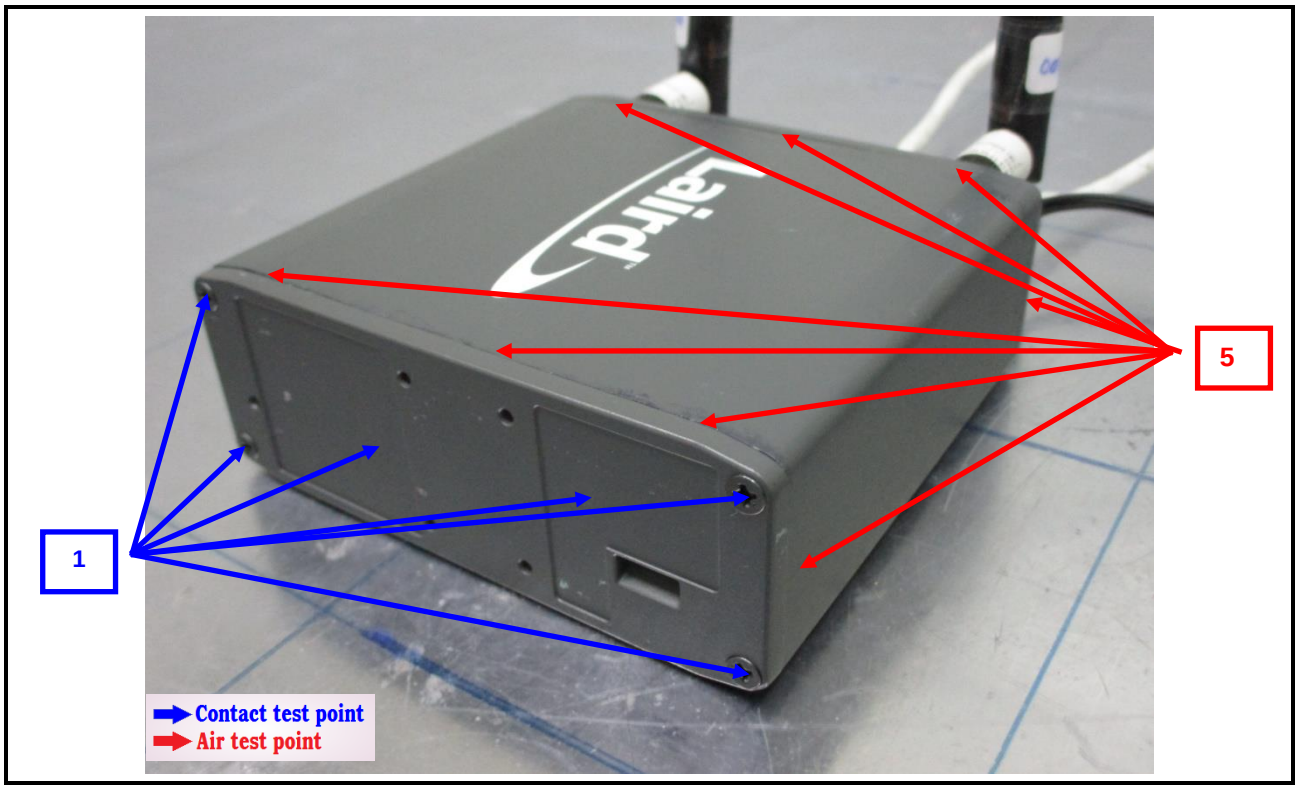


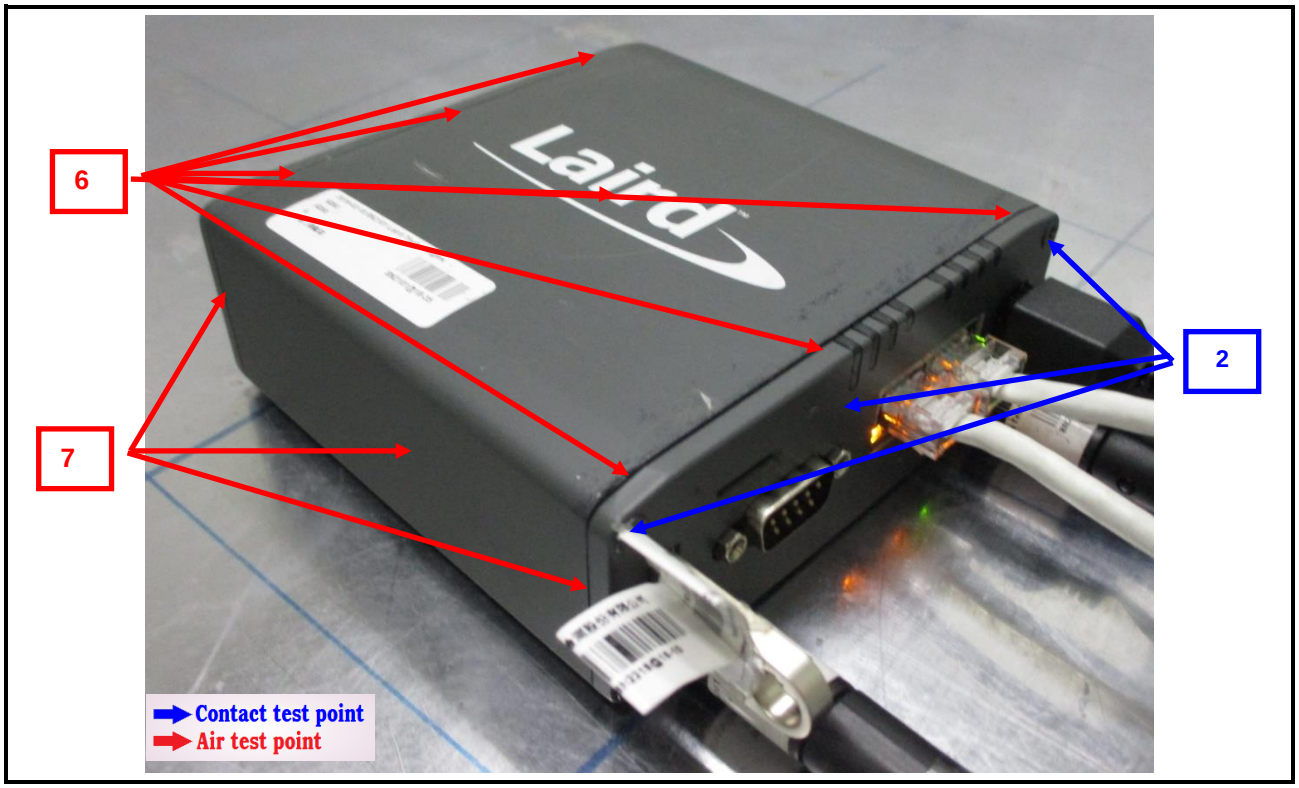


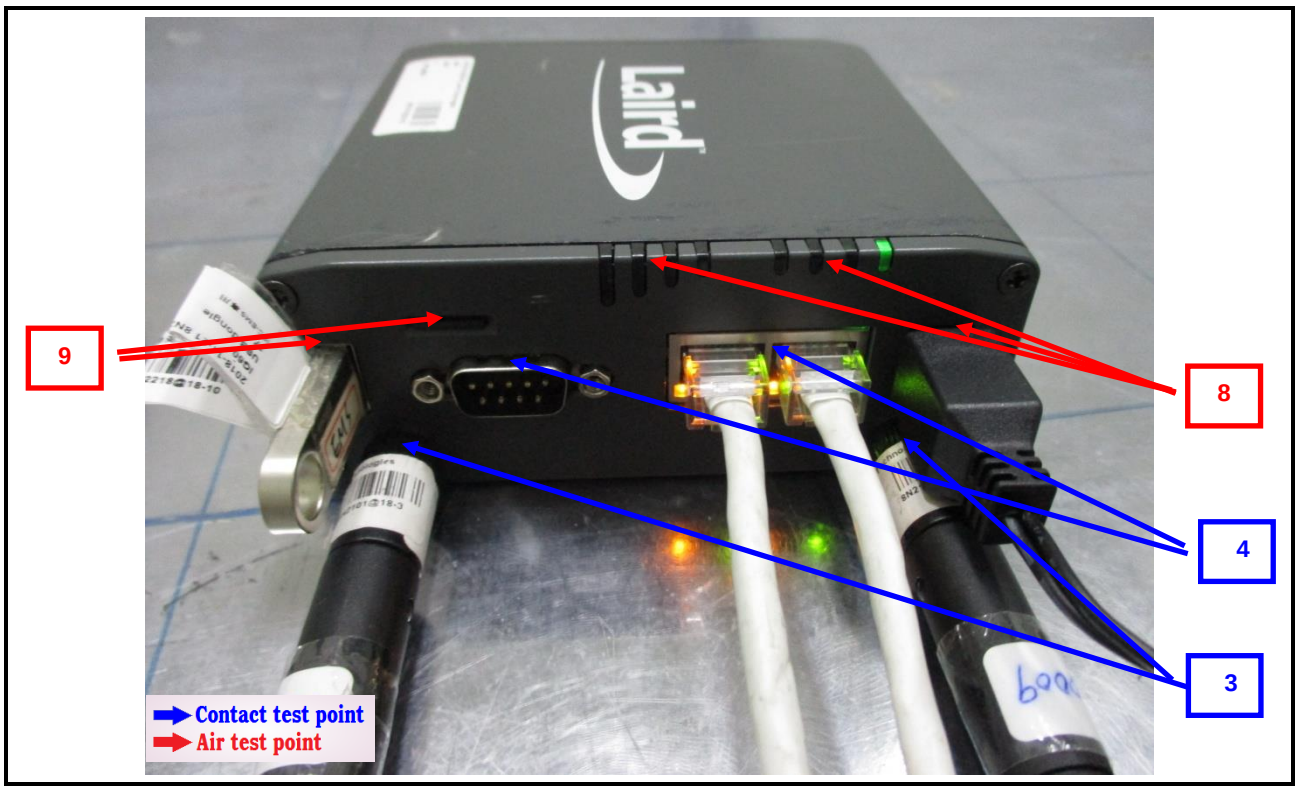

9
8
4
3
Contact test point
Air test point


10
Contact test point
Air test point

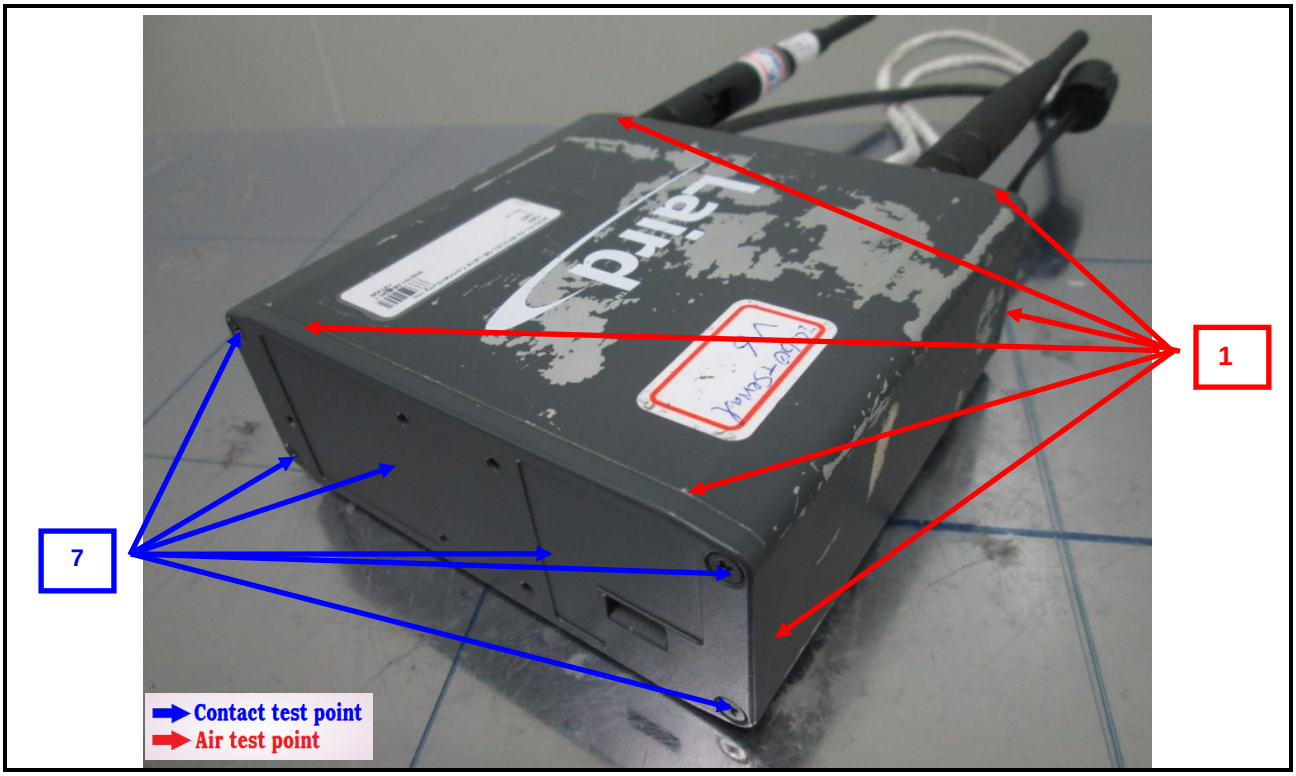
Mode 4

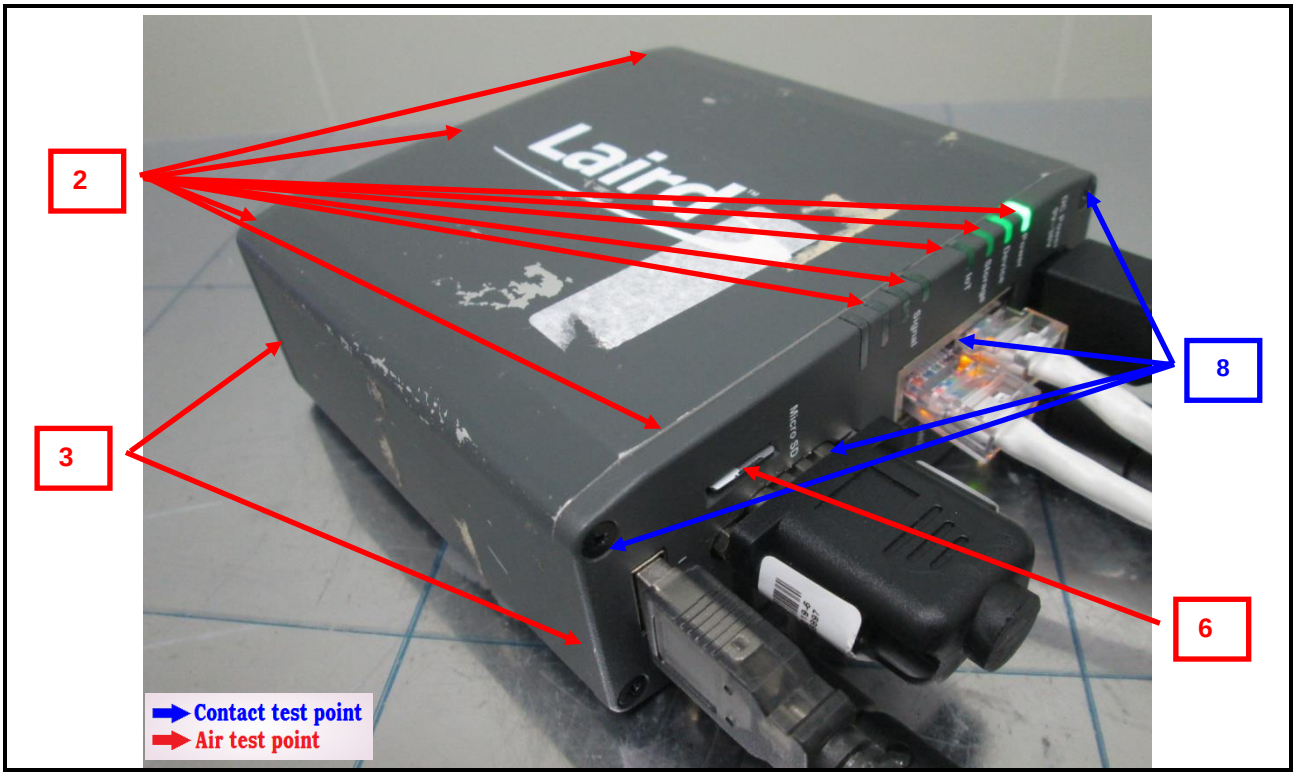

Laird
5
1
Contact test point
Air test point

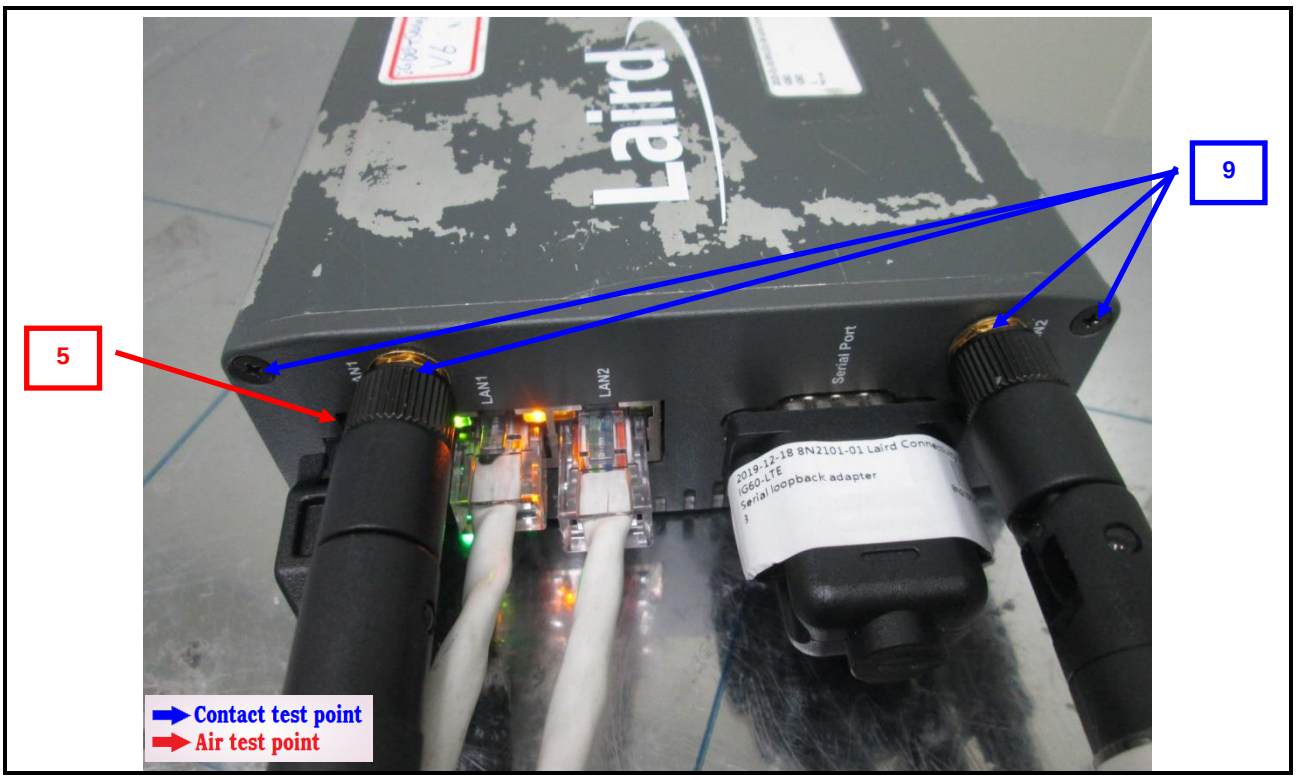

Laird
6
2
7
Contact test point
Air test point

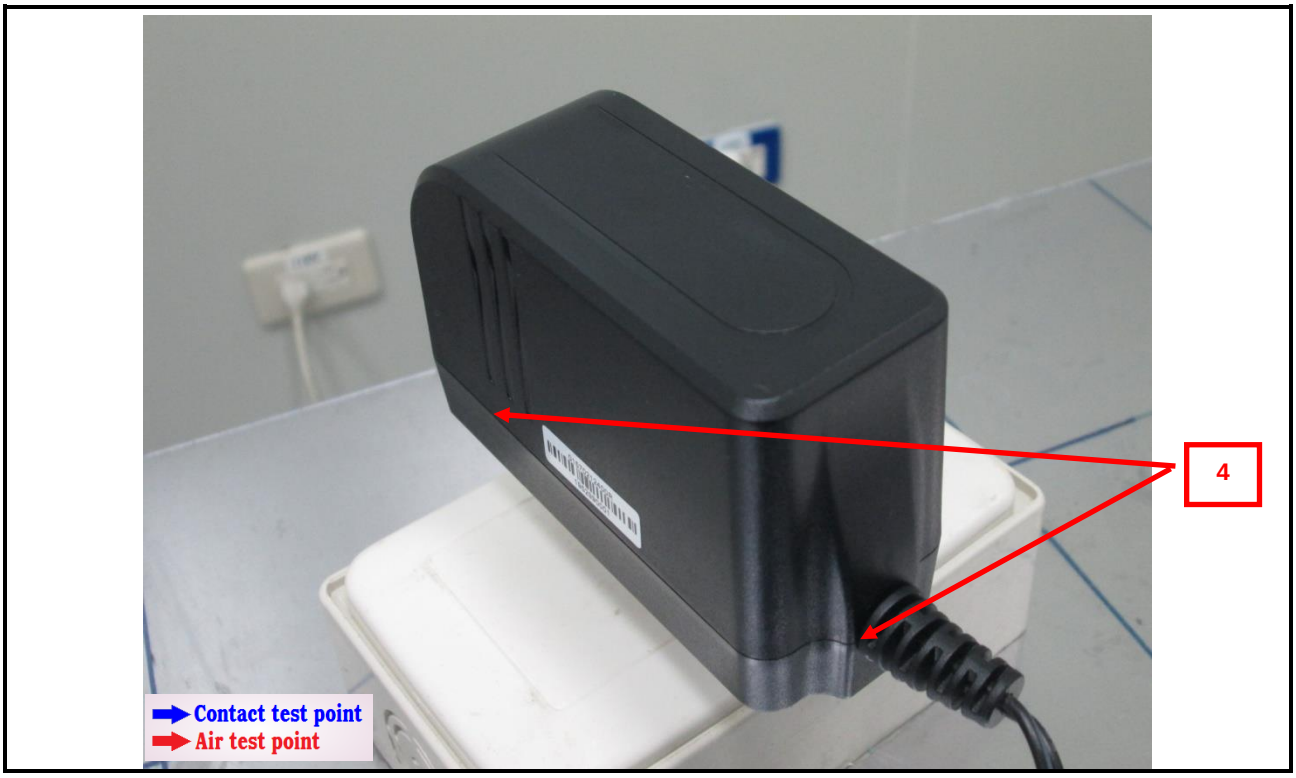

9
8
4
3
Contact test point
Air test point

Mode 5


1
7
Contact test point
Air test point


2
3
8
6
Contact test point
Air test point


9
5
LAN1
LAN2
Serial Port
Contact test point
Air test point


4
Contact test point
Air test point

4.4 Radio Frequency Electromagnetic Field (RS)

4.4.1 Test Specification of Radio Frequency Electromagnetic Field (RS)

Basic Standard	IEC 61000-4-3
Frequency Range	80 MHz ~ 1000 MHz
Field Strength	10 V/m
Modulation	1 kHz Sine Wave, 80%, AM Modulation
Frequency Step	1 % of preceding frequency value
Polarity of Antenna	Horizontal and Vertical
Antenna Height	1.5 m
Antenna Distance	3 m
Dwell Time	3 seconds

4.4.2 Test Procedures

a. The test level shall be 3 V/m (measured unmodulated). The test signal shall be amplitude modulated to a depth of 80 % by a sinusoidal audio signal of 1000 Hz. If the wanted signal is modulated at 1000 Hz, then an audio signal of 400 Hz shall be used.

b. The test shall be performed over the frequency range 80 MHz to 1000 MHz.

c. The dwell time at each frequency shall not be less than the time necessary for the EUT to be exercised and to respond, but shall in no case be less than 0.5s.

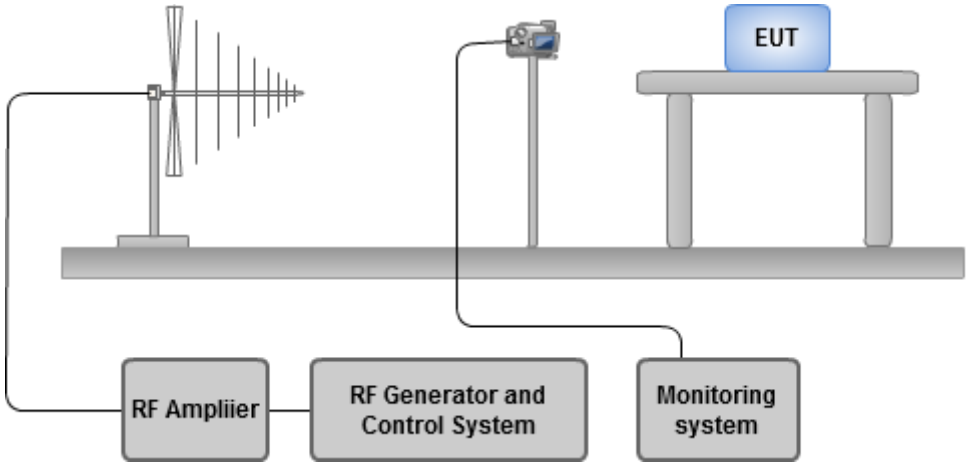
d. The test was performed with the EUT exposed to both vertically and horizontally polarized fields on each of the four sides.

e. When testing at frequencies above 1 GHz, the test distance shall be 1 m when using the independent windows method. Compliance with the field uniformity requirement shall be verified for the selected test distance.

f. The alternative method for frequencies above 1 GHz divides the calibration area into a suitable array of 0,5 m × 0,5 m windows such that the whole area to be occupied by the face of the EUT is covered. The field uniformity shall be independently calibrated over each window.

g. During the test, at each frequency the forward power shall be applied to the field-generating antenna. The test shall be repeated with the field-generating antenna repositioned to illuminate each of the required windows in turn.

4.4.3 Test Setup



Note: The procedure defined in this part requires the generation of electromagnetic fields within which the test sample is placed and its operation observed. To generate fields that are useful for simulation of actual (field) conditions may require significant antenna drive power and the resultant high field strength levels. To comply with local regulations and to prevent biological hazards to the testing personnel, it is recommended that these tests be carried out in a shielded enclosure or semi-anechoic chamber.

4.4.4 Test Result of Radio Frequency Electromagnetic Field (RS)

Test Mode	1, 2, 3, 4, 5				
Frequency Range (MHz)	**Azimuth**	**Polarity**	**Test Field Strength (V/m)**	**Observation**	**Performance Criteria**
80 – 1000	0	V&H	10	Note1, 2	A
80 – 1000	90	V&H	10	Note1, 2	A
80 – 1000	180	V&H	10	Note1, 2	A
80 – 1000	270	V&H	10	Note1, 2	A

Note:
1) There was no abnormal situation during the test compared with initial operation.
2) Test method reported herein was performed according to the method specified by applicant.

4.5 Electrical Fast Transient/Burst (EFT)

4.5.1 Test Specification of Electrical Fast Transient/Burst (EFT)

Basic Standard	IEC 61000-4-4
Test Voltage	AC power: ± 1 kV Signal ports: ± 0.5 kV
Impulse Frequency	100 kHz: only for signal lines of xDSL equipment 5 kHz: except for xDSL equipment
Impulse Waveshape	5/50 ns
Burst Duration	0.75 ms: only for signal lines of xDSL equipment 15 ms: except for xDSL equipment
Burst Period	300 ms
Test Duration	1 min.

4.5.2 Test Procedures

a. In order to minimize the effect of environmental parameters on test results, the electromagnetic environment of the laboratory shall not influence the test results.

b. Test shall not be performed if the relative humidity is so high as to cause condensation on the EUT or the test equipment.

c. The variety and diversity of equipment and systems to be tested make it difficult to establish general criteria for the evaluation of the effects of fast transients/bursts on equipment and systems.

d. The test results may be classified on the basic of the operating conditions and the functional specification of the equipment under test, according to the following performance criteria:

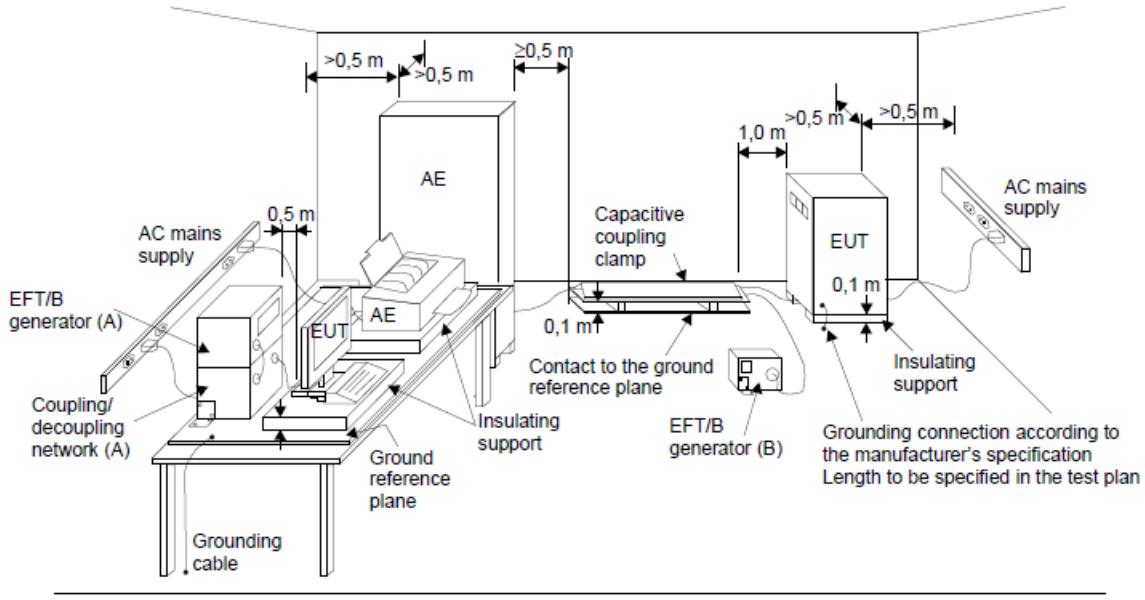
-Normal performance within the specification limits.

-Temporary degradation or loss of function or performance which is self-recoverable.

-Temporary degradation or loss of function or performance which requires operator intervention or system reset.

-Degradation or loss of function which is not recoverable due to damage of equipment (components).

4.5.3 Test Setup



(A) location for supply line coupling

(B) location for signal lines coupling

Table-top equipment and equipment normally mounted on ceilings or walls as well as built-in equipment shall be tested with the EUT located (0.1 ± 0.01) m above the ground reference plane (GRP)

Testing of large table-top equipment or multiple systems can be performed on the floor; maintaining the same distances as for the test setup of table-top equipment.

The test generator and the coupling/decoupling network shall be bonded to the GRP.

The GRP shall be a metallic sheet of 0.25 mm, minimum thickness; other metallic may be used but they shall have at least 0.65 mm thickness.

The minimum size of the GRP is 0.8 m × 1 m. The actual size depends on the dimensions of the EUT.

The GRP shall project beyond the EUT by at least 0.1m on all sides.

The GRP shall be connected to protective earth (PE) for safety reasons.

The EUT shall be arranged and connected to satisfy its functional requirements, according to the equipment installation specifications.

The minimum distance between the EUT and all other conductive structures (including the generator, AE and the walls of a shielded room), except the ground reference plane, shall be more than 0.5 m.

All cables to the EUT shall be placed on the insulation support 0.1 m above the GRP. Cables not subject to electrical fast transients shall be routed as far as possible from the cable under test to minimize the coupling between the cables.

4.5.4 Test Result of Electrical Fast Transient/Burst (EFT)

Test Mode	1			
Test Port	**Polarity**	**Test Voltage (kV)**	**Observation**	**Performance Criteria**
For power ports				
L1	+/-	1	Note	A
L2	+/-	1	Note	A
L1-L2	+/-	1	Note	A
For telecom & signal ports				
LAN10/100Mbps	+/-	0.5	Note	A
LAN1000Mbps	+/-	0.5	Note	A

Note: There was no abnormal situation during the test compared with initial operation.

Test Mode	2, 3, 4			
Test Port	**Polarity**	**Test Voltage (kV)**	**Observation**	**Performance Criteria**
For power ports				
L1	+/-	1	Note	A
L2	+/-	1	Note	A
L1-L2	+/-	1	Note	A

Note: There was no abnormal situation during the test compared with initial operation.

Test Mode	5			
Test Port	**Polarity**	**Test Voltage (kV)**	**Observation**	**Performance Criteria**
For power ports				
L1	+/-	1	Note	A
L2	+/-	1	Note	A
L1-L2	+/-	1	Note	A
For telecom & signal ports				
LAN10/100Mbps	+/-	0.5	Note	A
LAN1000Mbps	+/-	0.5	Note	A

Note: There was no abnormal situation during the test compared with initial operation.

4.6 Surge

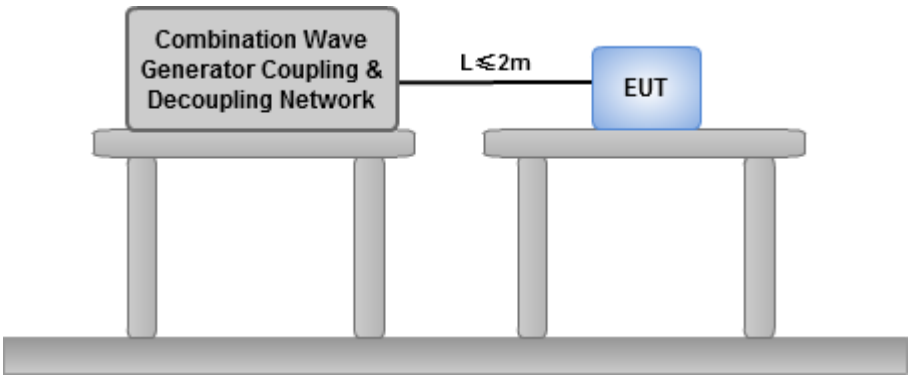
4.6.1 Test Specification of Surge

Basic Standard	IEC 61000-4-5
Wave-Shape	☒ Combination Wave Generator for power lines 1.2/50 µs Open Circuit Voltage 8/20 µs Short Circuit Current
	☐ Combination Wave Generator for shielded telecom & signal lines 1.2/50 µs Open Circuit Voltage 8/20 µs Short Circuit Current
	☐ Combination Wave Generator for telecom & signal lines 10/700 µs Wave for signal lines 10/700 µs Open Circuit Voltage 1.2/50 µs Open Circuit Voltage 8/20 µs Short Circuit Current
Test Voltage	Power line: ± 0.5 kV, ± 1 kV
Generator Source Impedance	2 ohm between networks
Phase Angle	0°/90°/180°/270°
Pulse Repetition Rate	60 sec.
Number of Tests	5 positive and 5 negative at selected points

4.6.2 Test Procedures

a. Electromagnetic conditions, the electromagnetic environment of the laboratory shall not influence the test results.
b. Test shall not be performed if the relative humidity is so high as to cause condensation on the EUT or the test equipment.
c. The test shall be performed according the test plan that shall specify the test set-up with
   -- generator and other equipment utilized;
   -- test level (voltage/current);
   -- generator source impedance;
   -- internal or external generator trigger;
   -- number of tests: at least five positive and five negative at the selected points;
   -- repetition rate: maximum 1/min.
   -- inputs and outputs to be tested;
   -- representative operating conditions of the EUT;
   -- sequence of application of the surge to the circuit;
   -- phase angle in the case of AC power supply;
   -- actual installation conditions, for example :
      AC : neutral earthed,
      DC : (+) or (-) earthed to simulated the actual earth conditions.
d. If not otherwise specified the surges have to be applied synchronized to the voltage phase at the zero crossing and the peak value of the a.c. voltage wave (positive and negative).
e. The surges have to be applied line to line and line(s) and earth. When testing line to earth, the test voltage has to be applied successively between each of the lines and earth, if there is no other specification.
f. The test procedure shall also consider the non-linear current-voltage characteristics of the equipment under test. Therefore the test voltage has to be increased by steps up to the test level specified in the product standard or test plan.
g. All lower levels including the selected test level shall be satisfied. For testing the secondary protection, the output voltage of the generator shall be increased up to the worst-case voltage breakdown level (let-through level) of the primary protection.
h. If the actual operating signal sources are not available, the may be simulated. Under no circumstances may the test level exceed the product specification. The test shall be carried out according to the test plan.
i. To find all critical points of the duty cycle of the equipment, a sufficient number of positive and negative test pulses shall be applied. For acceptance test previously unstressed equipment shall be used to the protection devices shall be replaced.

4.6.3 Test Setup



4.6.4 Test Result of Surge

Test Mode	1, 2, 3,4				
Test Port	**Polarity**	**Test Voltage (kV)**	**Phase Angle**	**Observation**	**Performance Criteria**
For power ports					
L1-L2	+/-	0.5, 1	0°/90°/180°/270°	Note	A

Note: There was no abnormal situation during the test compared with initial operation.

4.7 Conducted Disturbances (CS)

4.7.1 Test Specification of Conducted Disturbances (CS)

Basic Standard	IEC 61000-4-6
Frequency Range	150 kHz ~ 80 MHz
Induced by RF fields	3 V_{rms}
Modulation	1 kHz Sine Wave, 80%, AM Modulation
Frequency Step	1 % of preceding frequency value
Coupling Device	CDN-M2, CDN-T8-10, CDN-T400A
Dwell Time	3 seconds

4.7.2 Test Procedures

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

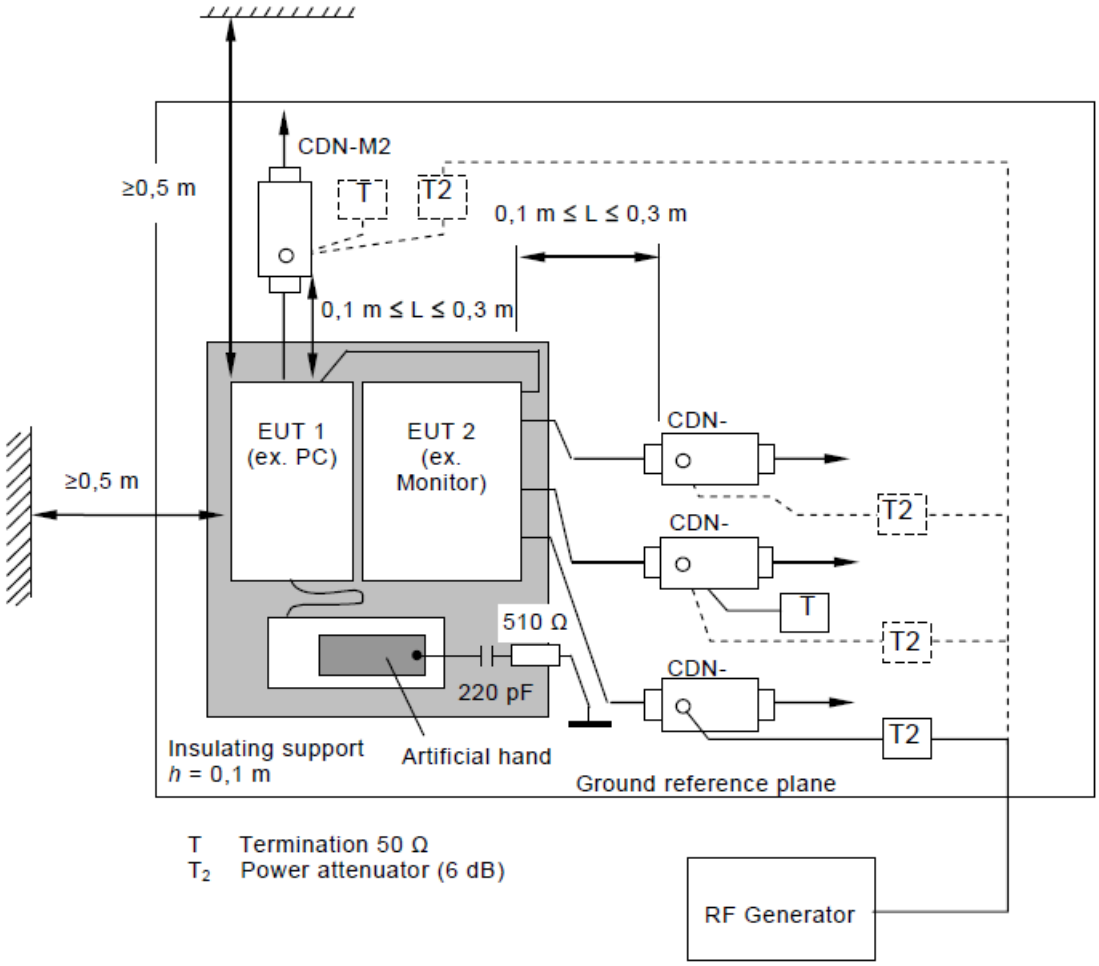
b. The frequency range is swept from 150 kHz to 80 MHz, using the signal levels established during the setting process, and with the disturbance signal 80 % amplitude modulated with a 1 kHz sine wave, pausing to adjust the RF signal level or to change coupling devices as necessary. Where the frequency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

c. The dwell time of the amplitude modulated carrier at each frequency shall not be less than the time necessary for the EUT to be exercised and to respond, but shall in no case be less than 0,5 s.

d. The sensitive frequencies (e.g. clock frequencies) shall be analyzed separately.

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

4.7.3 Test Setup



The EUT shall be placed on an insulating support 0.1 m above the ground reference plane (GRP).

On all cables to be tested, coupling and decoupling devices shall be inserted. The coupling and decoupling devices shall be placed on the GRP, making direct contact with it at a distance of 0.1 m to 0.3 m from the EUT.

4.7.4 Test Result of Conducted Disturbances (CS)

Test Mode	1					
Frequency Band (MHz)	**Induced by RF fields (V_{rms})**	**Test Port**	**Injection Method**	**Return Path**	**Observation**	**Performance Criteria**
0.15-80	3	Power line	CDN-M2	CDN-T8-10	Note	A
0.15-80	3	LAN 1000	CDN-T8-10	CDN-M2	Note	A
0.15-80	3	LAN 10/100	CDN-T400A	CDN-M2	Note	A

Note: There was no abnormal situation during the test compared with initial operation.

Test Mode	2, 3, 4					
Frequency Band (MHz)	**Induced by RF fields (V_{rms})**	**Test Port**	**Injection Method**	**Return Path**	**Observation**	**Performance Criteria**
0.15-80	3	Power line	CDN-M2	CDN-T8-10	Note	A

Note: There was no abnormal situation during the test compared with initial operation.

Test Mode	5					
Frequency Band (MHz)	**Induced by RF fields (V_{rms})**	**Test Port**	**Injection Method**	**Return Path**	**Observation**	**Performance Criteria**
0.15-80	3	Power line	CDN-M2	CDN-T8-10	Note	A
0.15-80	3	LAN 10/100	CDN-T400A	CDN-M2	Note	A
0.15-80	3	LAN 1000	CDN-T8-10	CDN-M2	Note	A

Note: There was no abnormal situation during the test compared with initial operation.

4.8 Power Frequency Magnetic Field (PFMF)

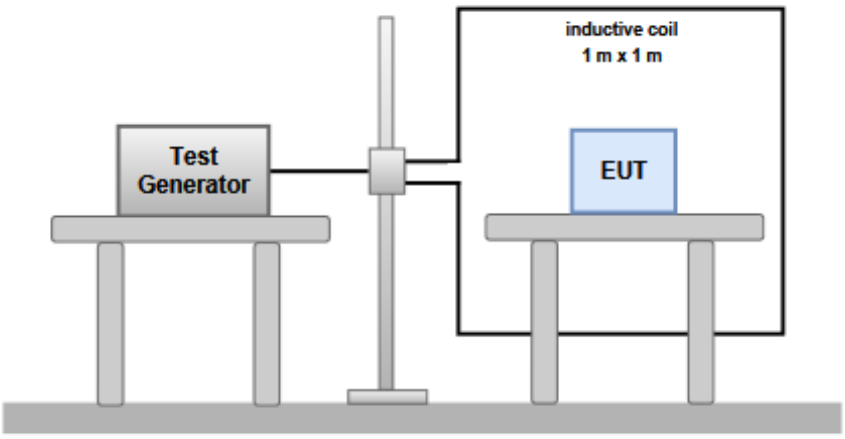
4.8.1 Test Specification of Power Frequency Magnetic Field

Basic Standard	IEC 61000-4-8
Frequency Range	50 Hz
Field Strength	1 A/m
Duration	1 Min
Inductance Coil	Square type, 1m x 1m

4.8.2 Test Procedures

a. Electromagnetic conditions, the electromagnetic environment of the laboratory shall not influence the test results.
b. Test shall not be performed if the relative humidity is so high as to cause condensation on the EUT or the test equipment.
c. The equipment shall be subjected to the test magnetic field by using the induction coil of standard dimensions (1m x 1m).
d. The EUT is powered up to a nominal voltage and then software-controlled power frequency magnetic field is generated by the coil.

4.8.3 Test Setup



4.8.4 Test Result of Power Frequency Magnetic Field

Test Mode	1, 2, 3, 4, 5			
Power Frequency Magnetic Field	**Testing duration**	**Coil Orientation**	**Observation**	**Performance Criteria**
50Hz, 1A/m	1 Min	X-axis	Note	A
50Hz, 1A/m	1 Min	Y-axis	Note	A
50Hz, 1A/m	1 Min	Z-axis	Note	A

Note: There was no abnormal situation during the test compared with initial operation.

4.9 Voltage Dips and Voltage Interruption

4.9.1 Test Specification of Voltage Dips and Voltage Interruption

Basic Standard	IEC 61000-4-11
Test Levels:	Voltage Dips: >95% reduction – 0.5 period 30% reduction – 25 period Voltage Interruptions: >95% reduction – 250 period
Test Duration Time:	3 test events in sequence
Interval between Event:	10 seconds
Phase Angle:	0°/180°

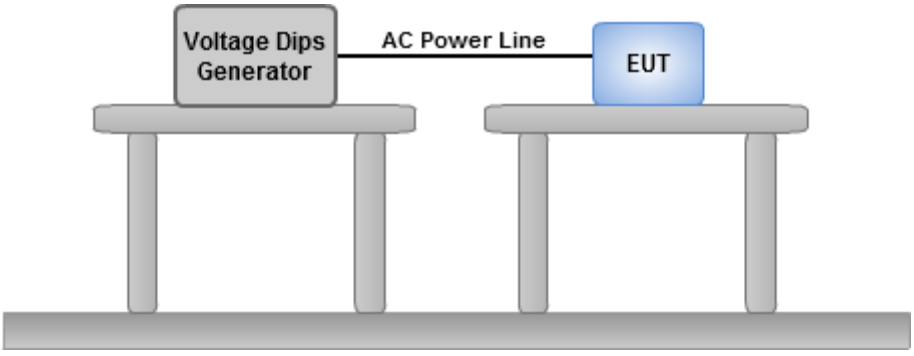
4.9.2 Test Procedures

a. Electromagnetic conditions, the electromagnetic environment of the laboratory shall not influence the test results.

b. Test shall not be performed if the relative humidity is so high as to cause condensation on the EUT or the test equipment.

c. The EUT is powered up to a nominal voltage of 240VAC/50Hz and 100VAC/50Hz and 230VAC/50Hz, and then software-controlled voltage dips and interruptions are introduced.

4.9.3 Test Setup



4.9.4 Test Result of Voltage Dips and Voltage Interruption

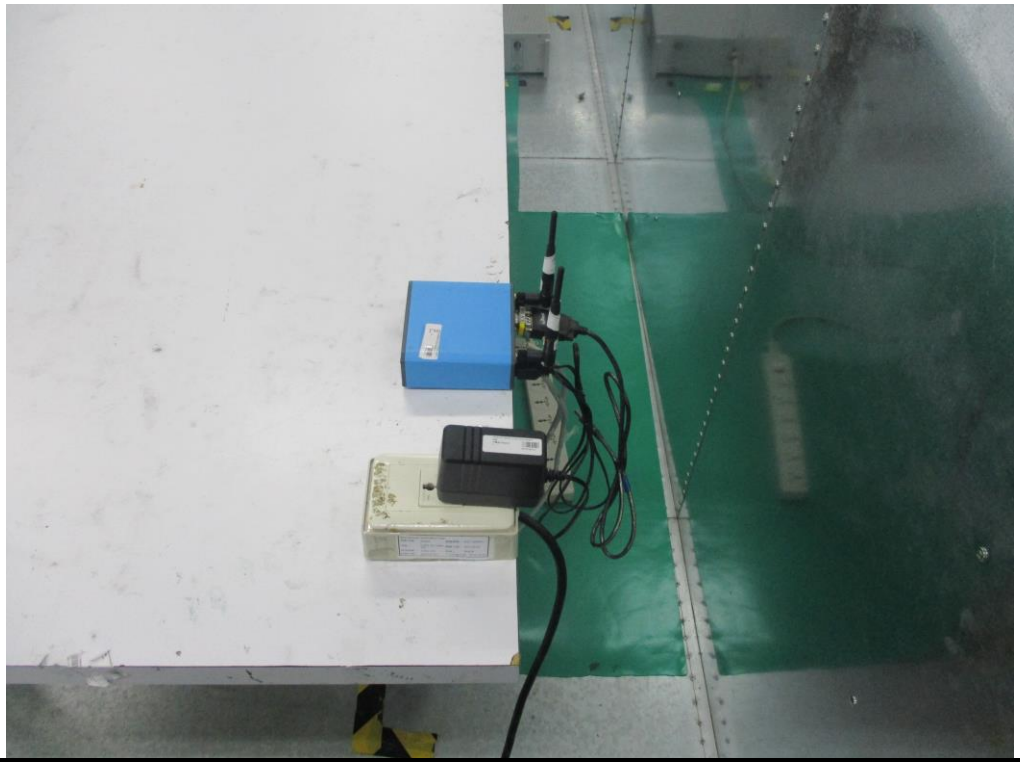
Test Mode	1, 2, 3, 4				
Test Voltage	**Item**	**Reduction Voltage (%)**	**Reduction Voltage Cycle**	**Observation**	**Performance Criteria**
240V/50Hz	Voltage Dip	>95	0.5	Note 1	A
240V/50Hz	Voltage Dip	30	25	Note 1	A
240V/50Hz	Voltage Interruption	>95	250	Note 2	C
230V/50Hz	Voltage Dip	>95	0.5	Note 1	A
230V/50Hz	Voltage Dip	30	25	Note 1	A
230V/50Hz	Voltage Interruption	>95	250	Note 2	C
100V/50Hz	Voltage Dip	>95	0.5	Note 1	A
100V/50Hz	Voltage Dip	30	25	Note 1	A
100V/50Hz	Voltage Interruption	>95	250	Note 2	C

Note
1) There was no abnormal situation during the test compared with initial operation.
2) The EUT lost power during the test and must be recovered manually.

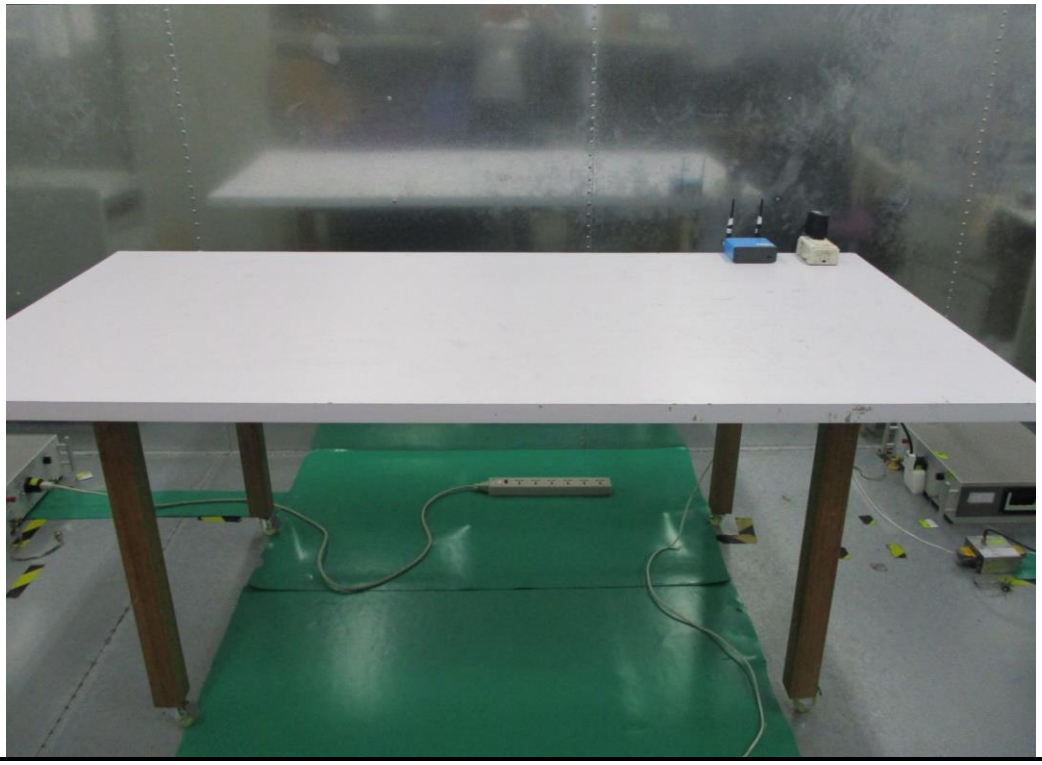
5 Photographs of the Test Configuration

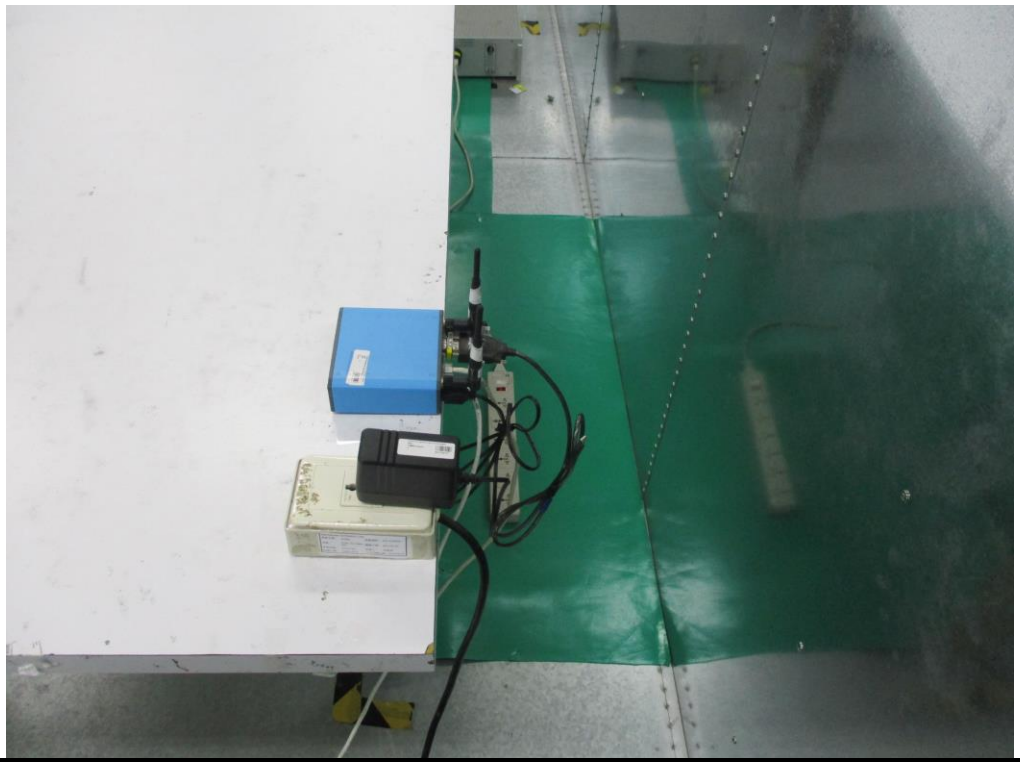
For original test (Adapter: F30L2-120250SPACP)

Conducted Emissions from the AC mains power ports

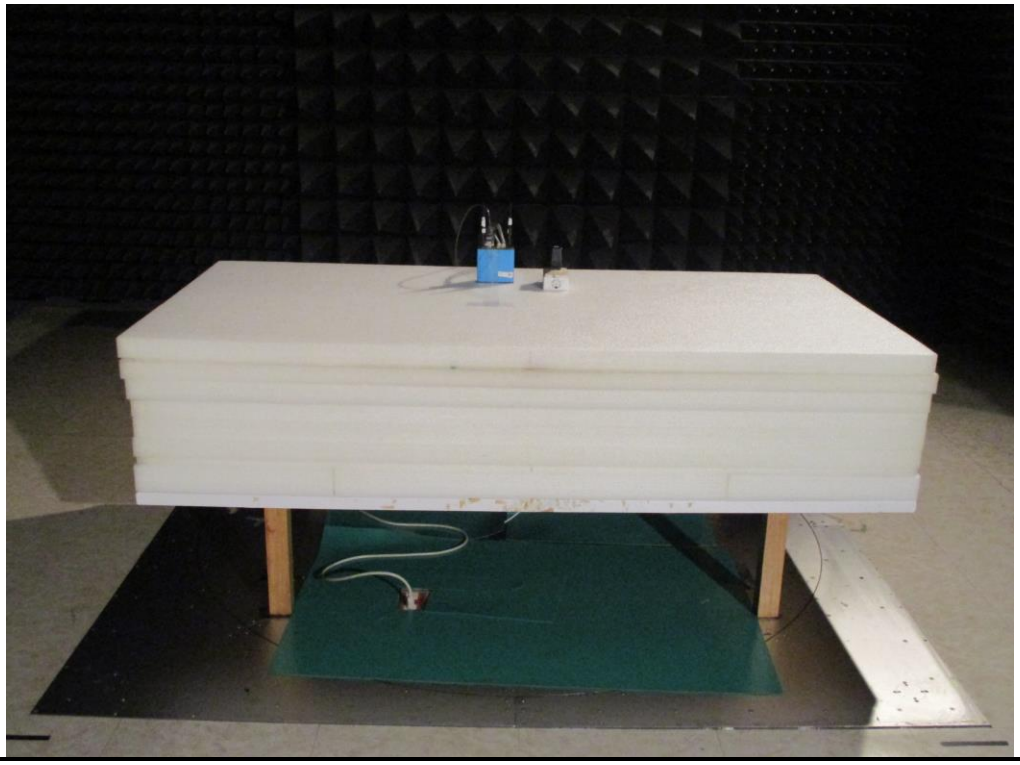


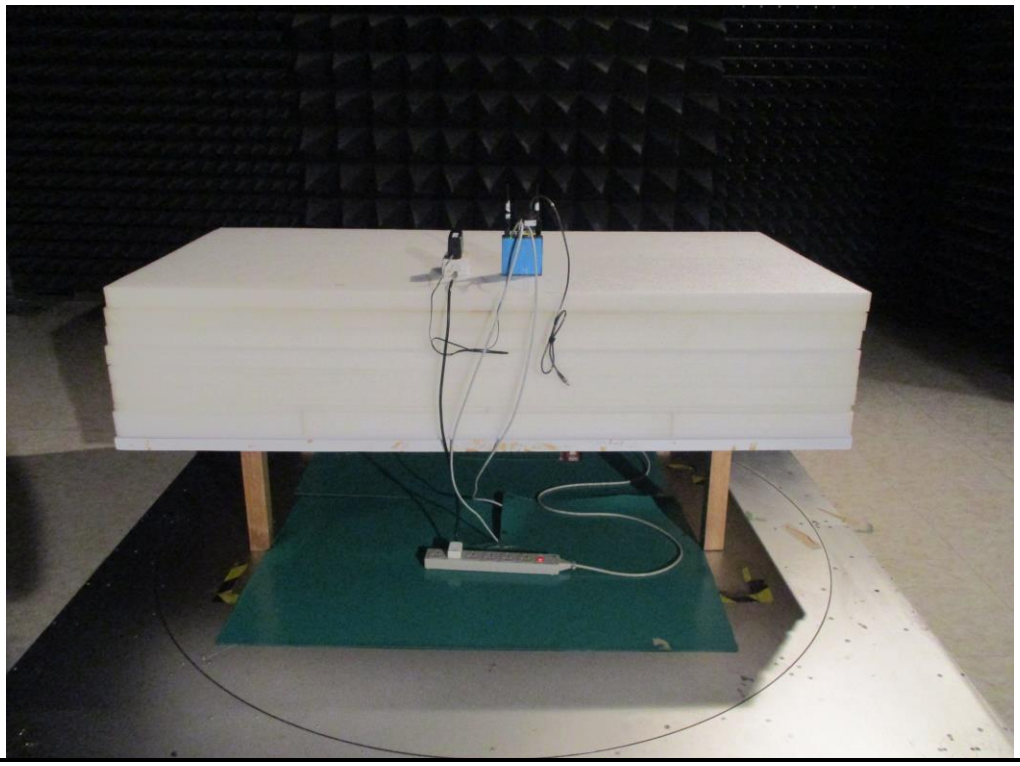
Asymmetric Mode Conducted Emissions



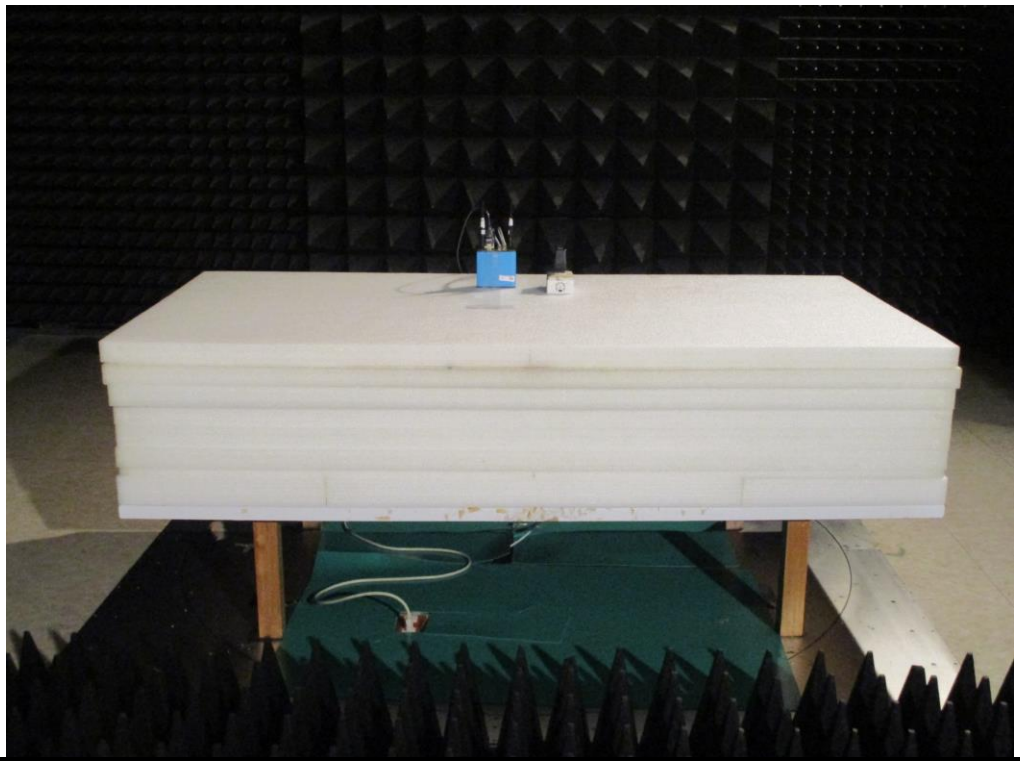


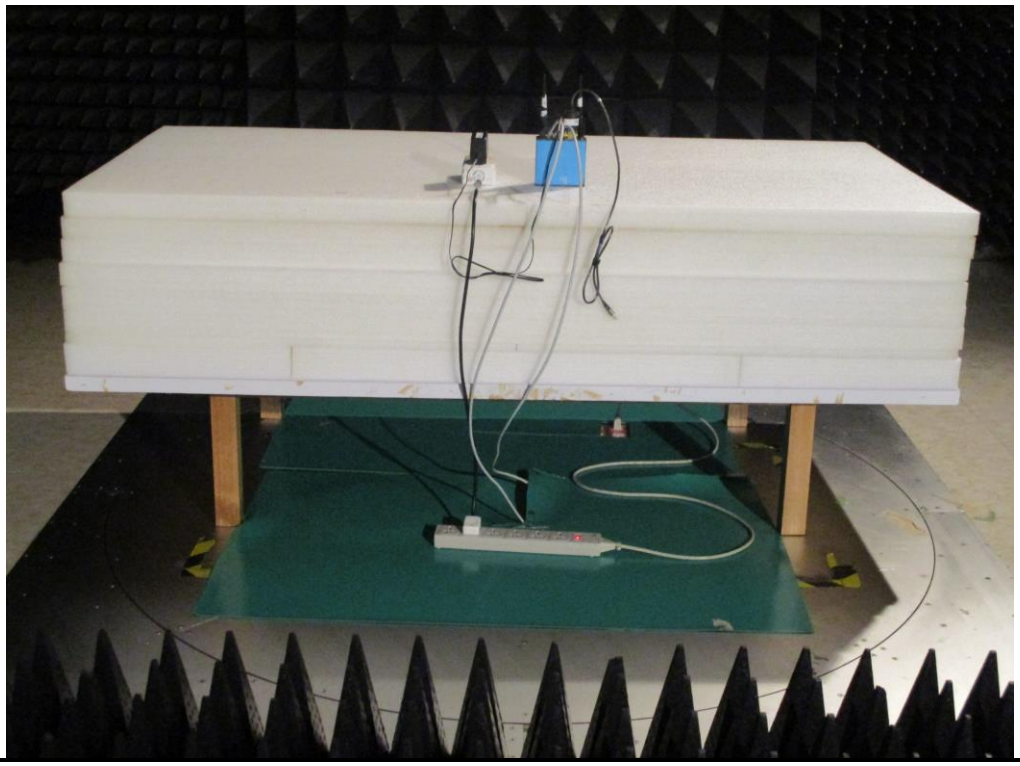
Radiated Emission Below 1GHz Test



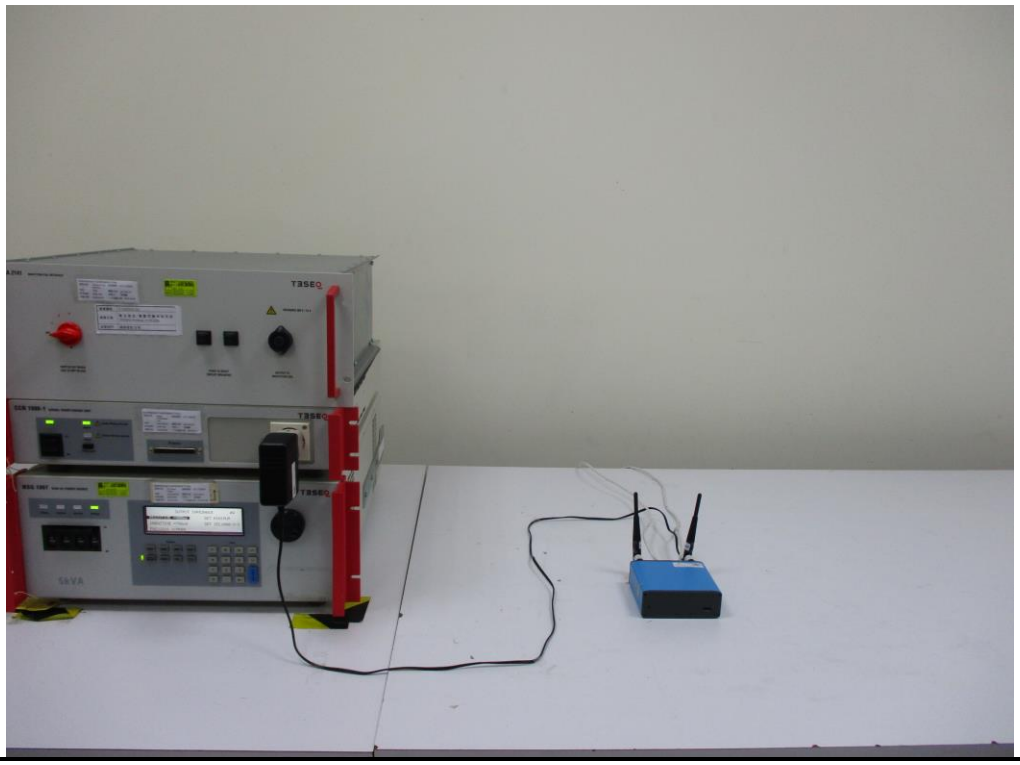


Radiated Emission Above 1GHz Test

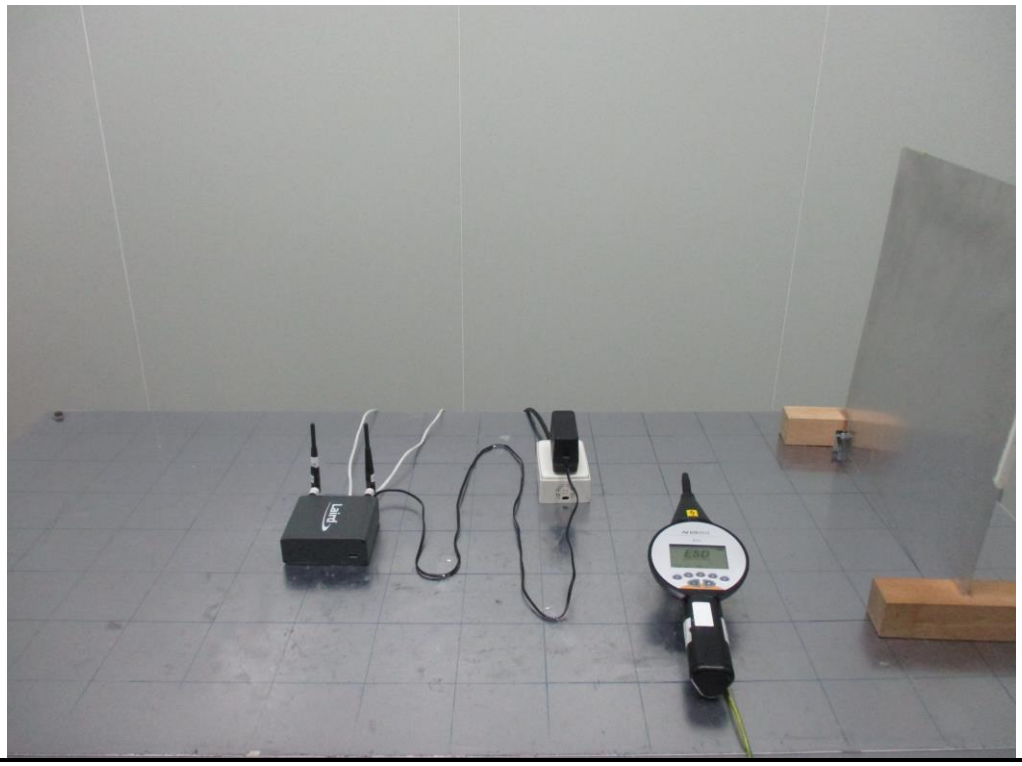




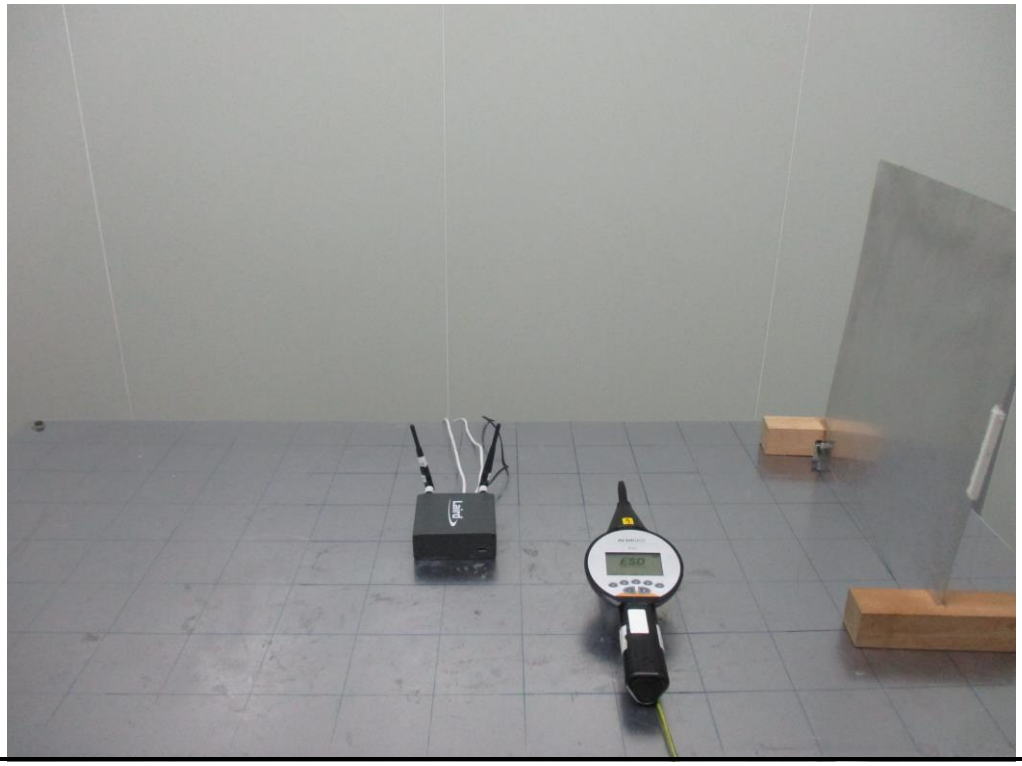
Harmonic & Flicker Test (Test mode 1, 2, 3)



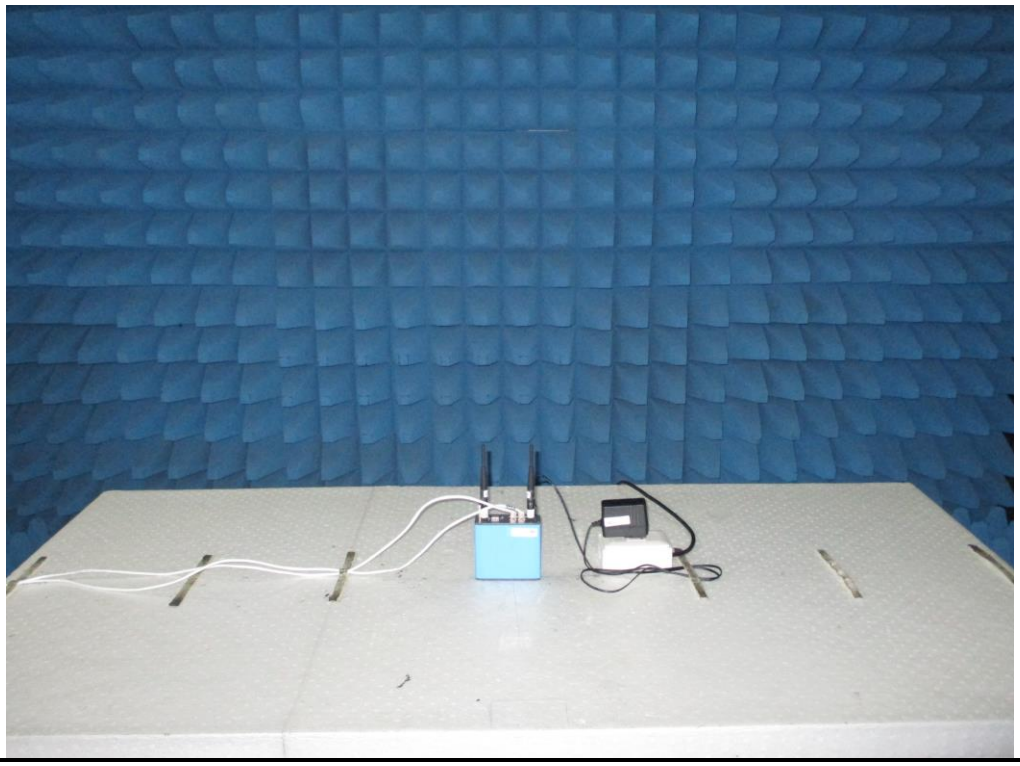
ESD Test (Test mode 1, 2, 3)



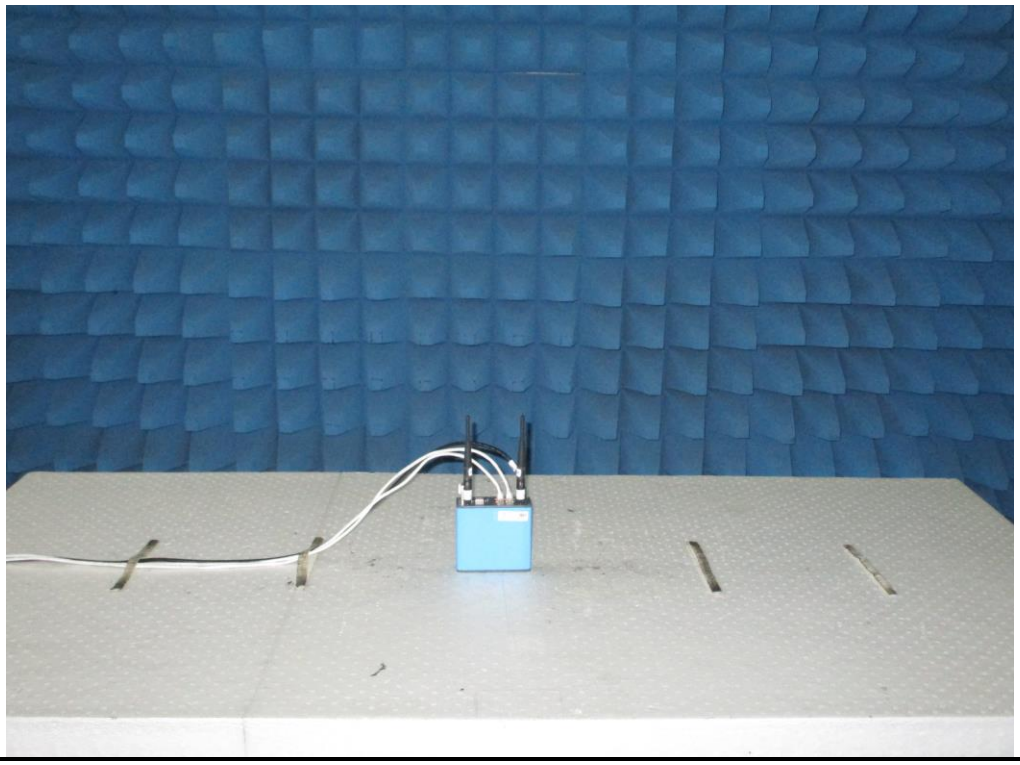
ESD Test (Test mode 4)



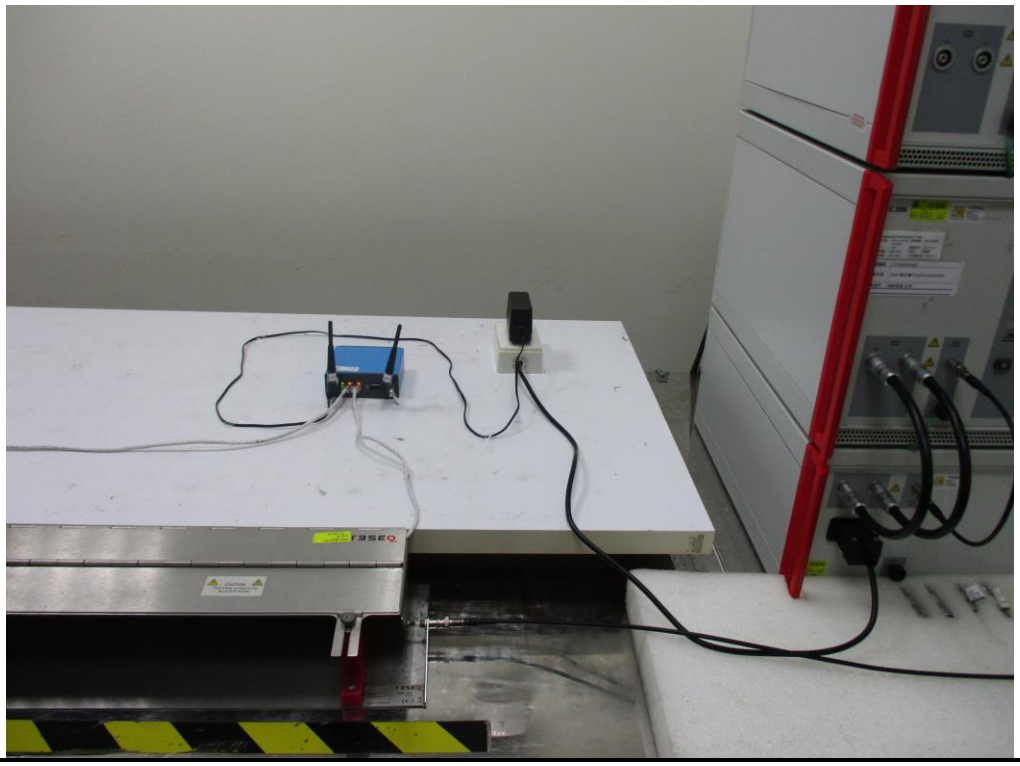
RS Test (Test mode 1, 2, 3)



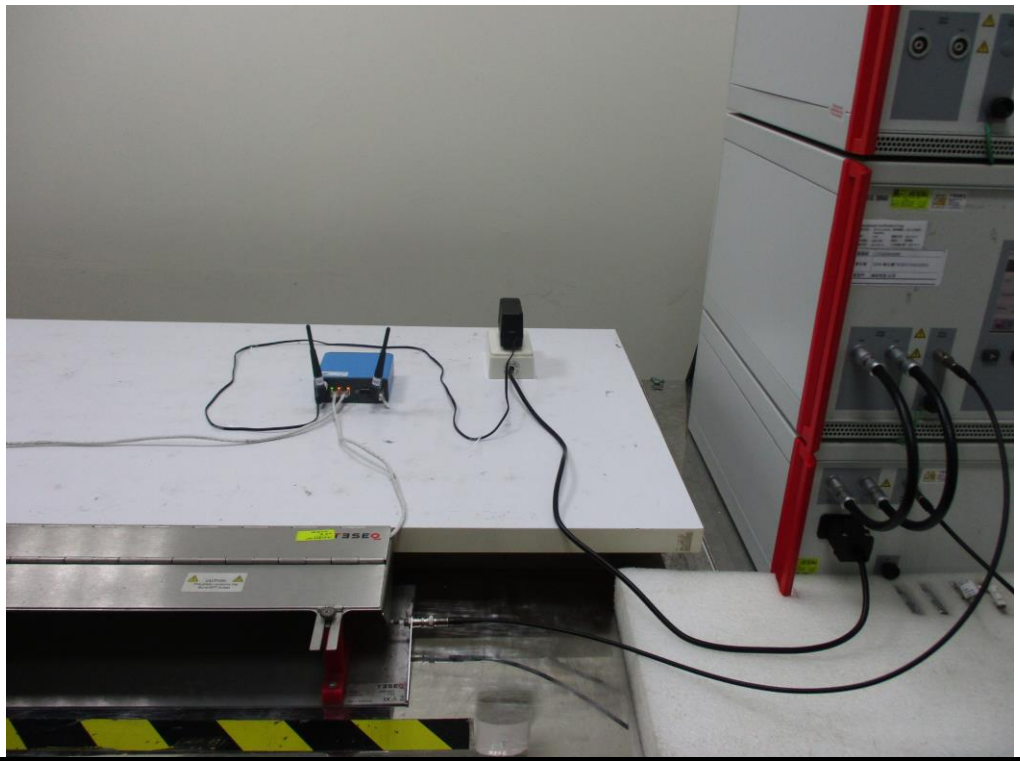
RS Test (Test mode 4)



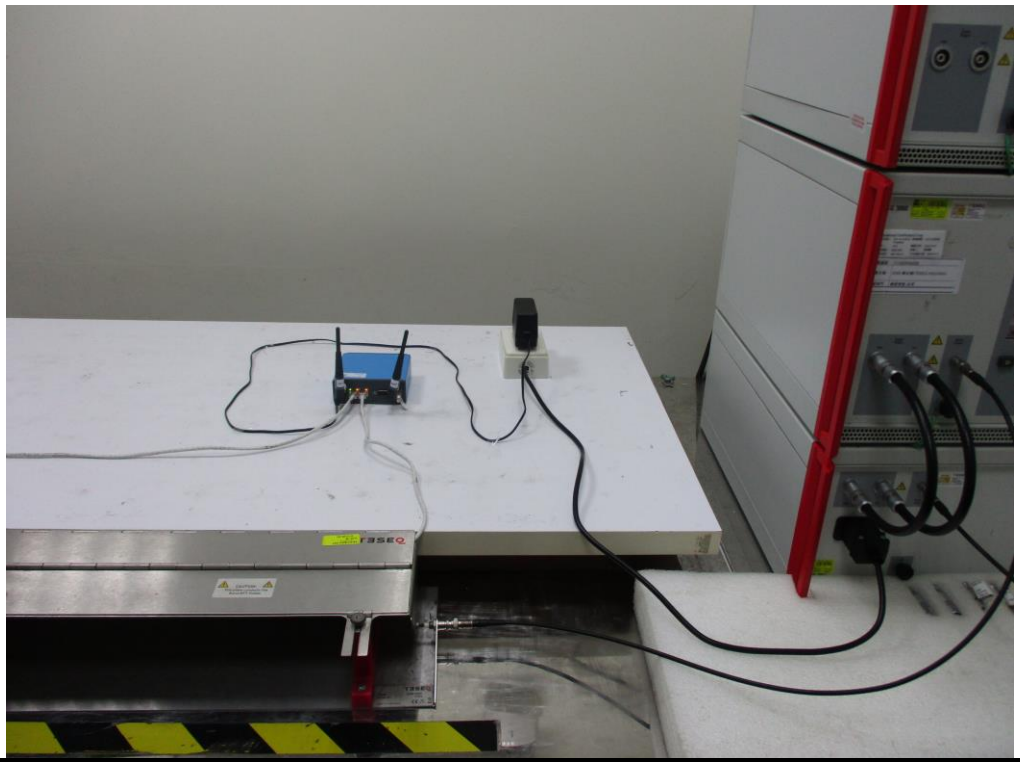
EFT Test (Power) (Test mode 1, 2, 3)



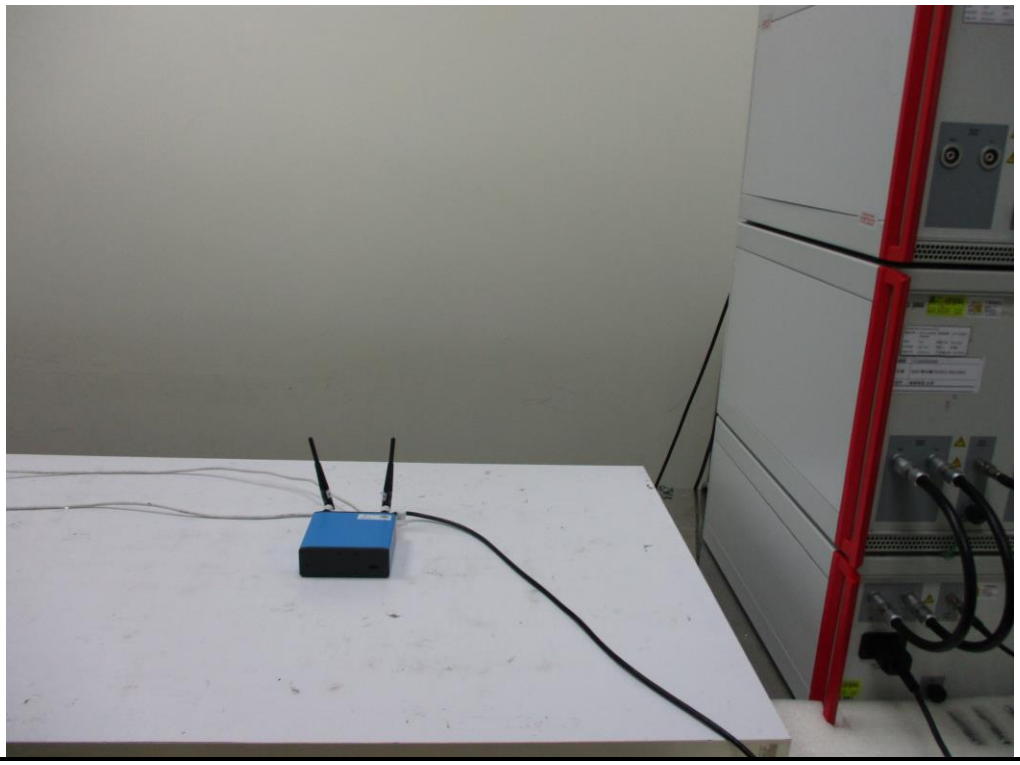
EFT Test (LAN 10&100Mbps) (Test mode 1)



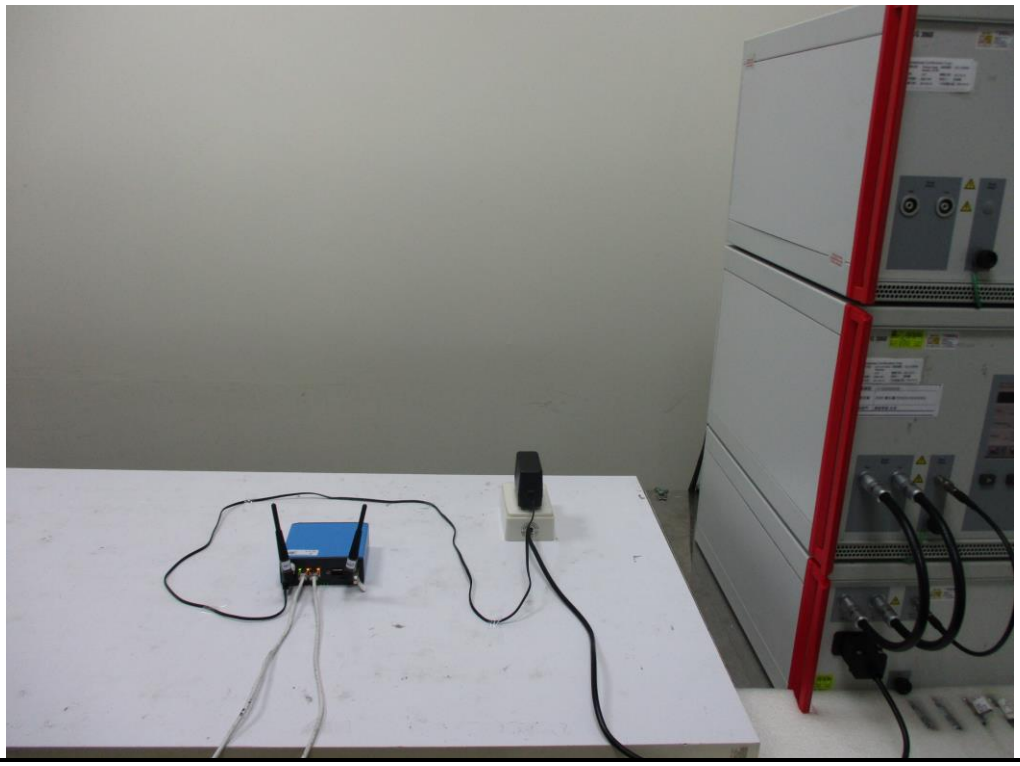
EFT Test (LAN 1000Mbps) (Test mode 1)



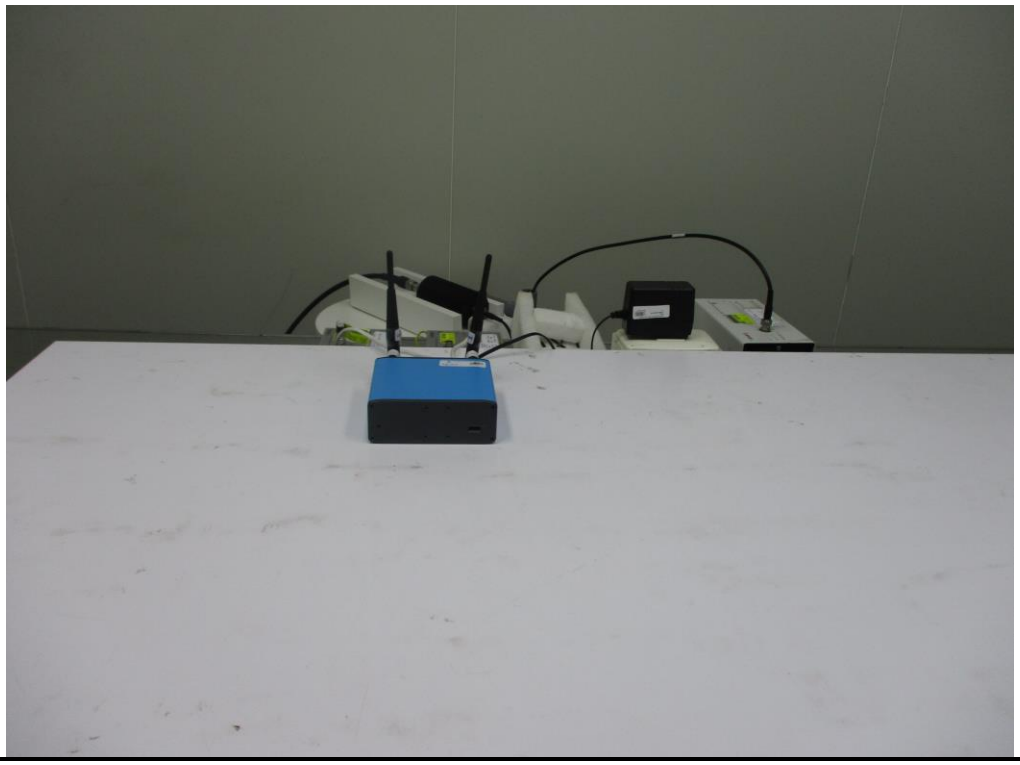
EFT Test (Power) (Test mode 4)



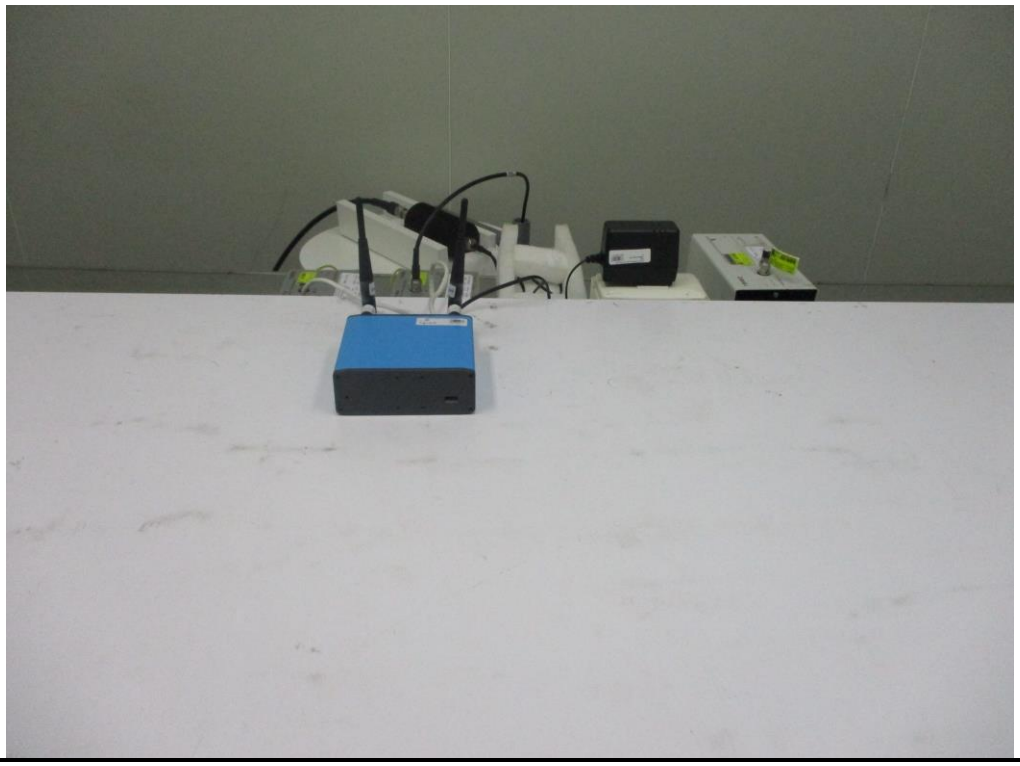
Surge Test (Power) (Test mode 1, 2, 3)



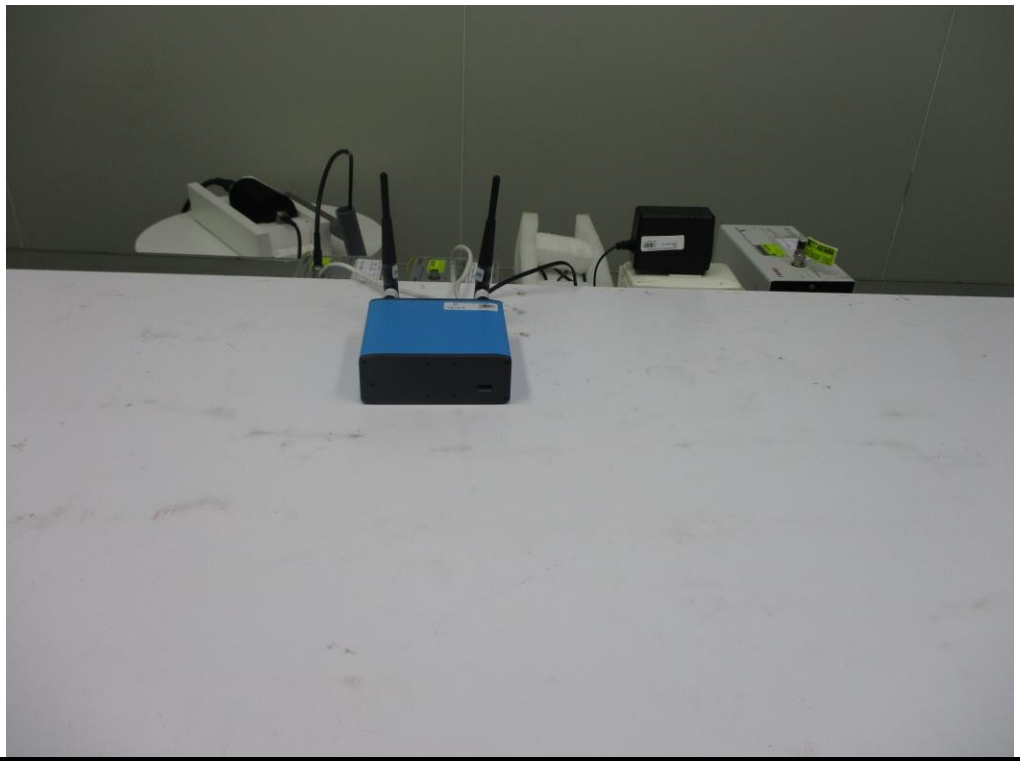
CS Test (Power) (Test mode 1, 2, 3)



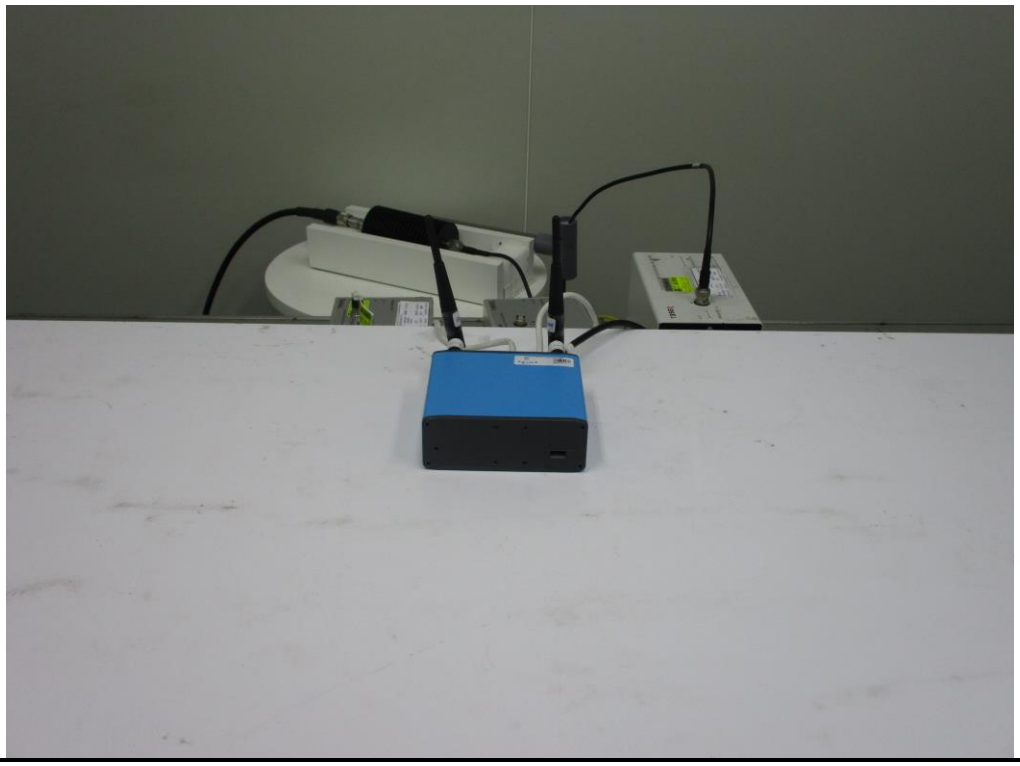
CS Test (LAN 10&100Mbps) (Test mode 1)



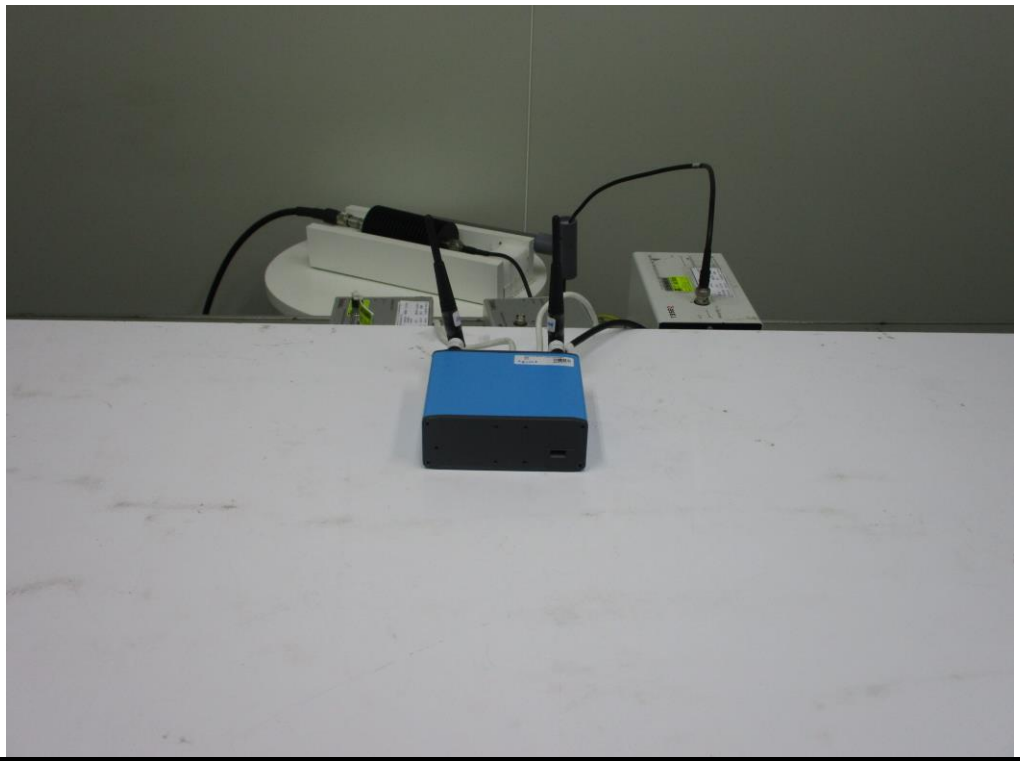
CS Test (LAN 1000Mbps) (Test mode 1)



CS Test (LAN) (Test mode 1)

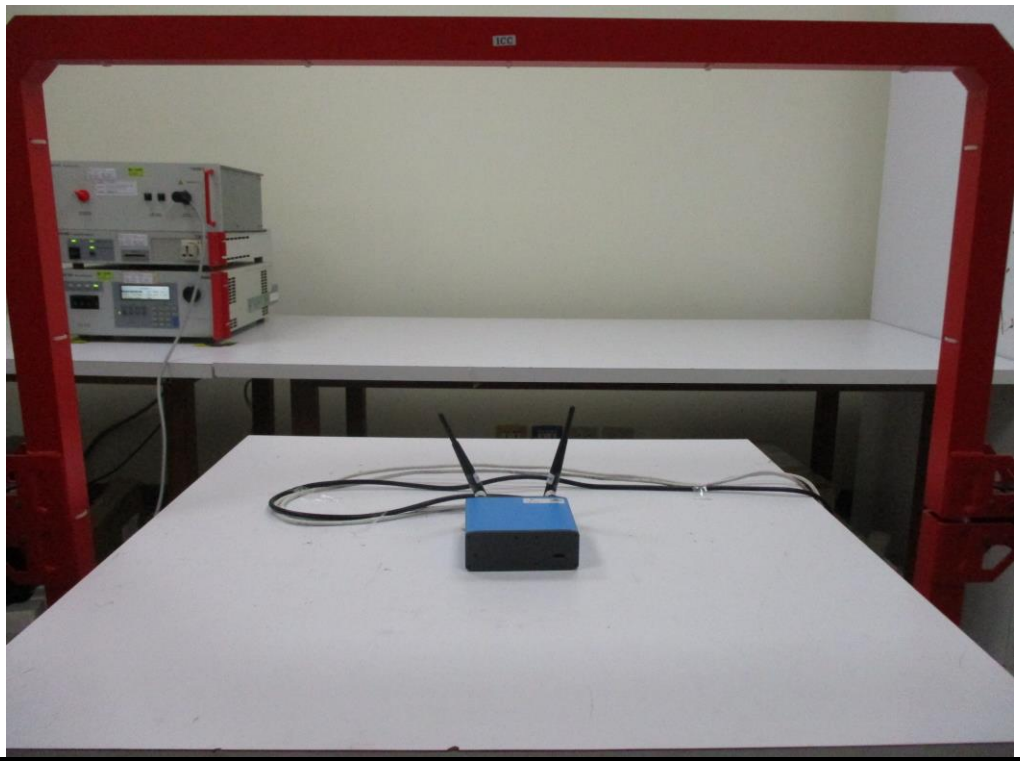


CS Test (Power) (Test mode 4)

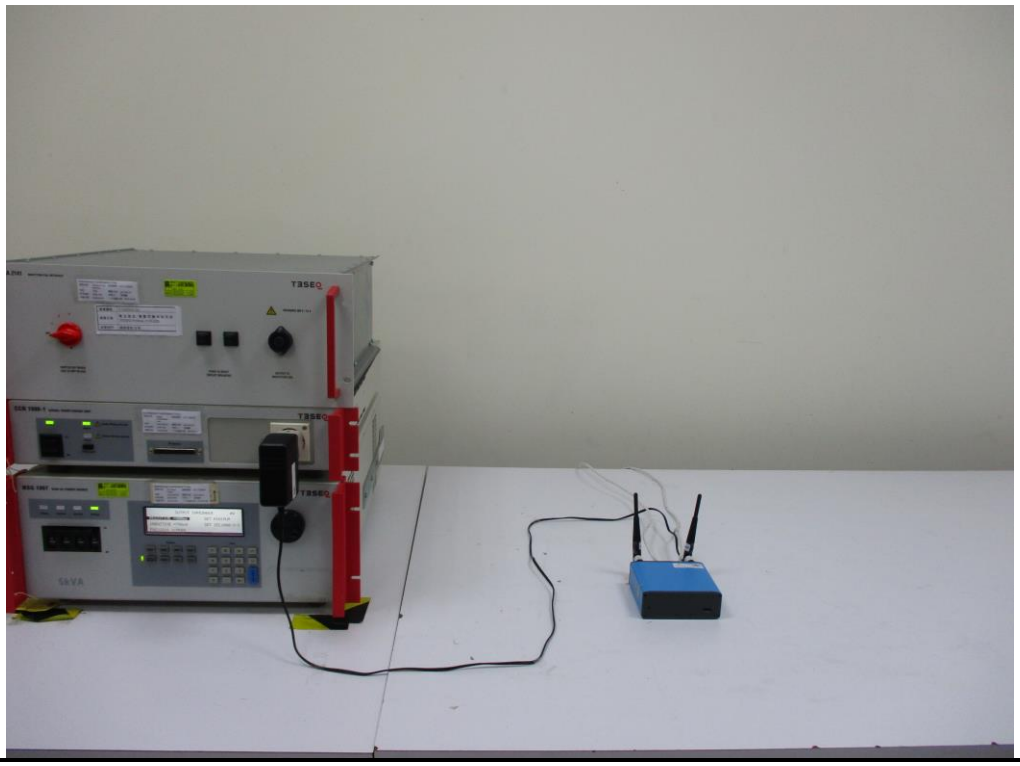


Magnetic Test (Test Mode 1, 2, 3)

Magnetic Test (Test Mode 4)

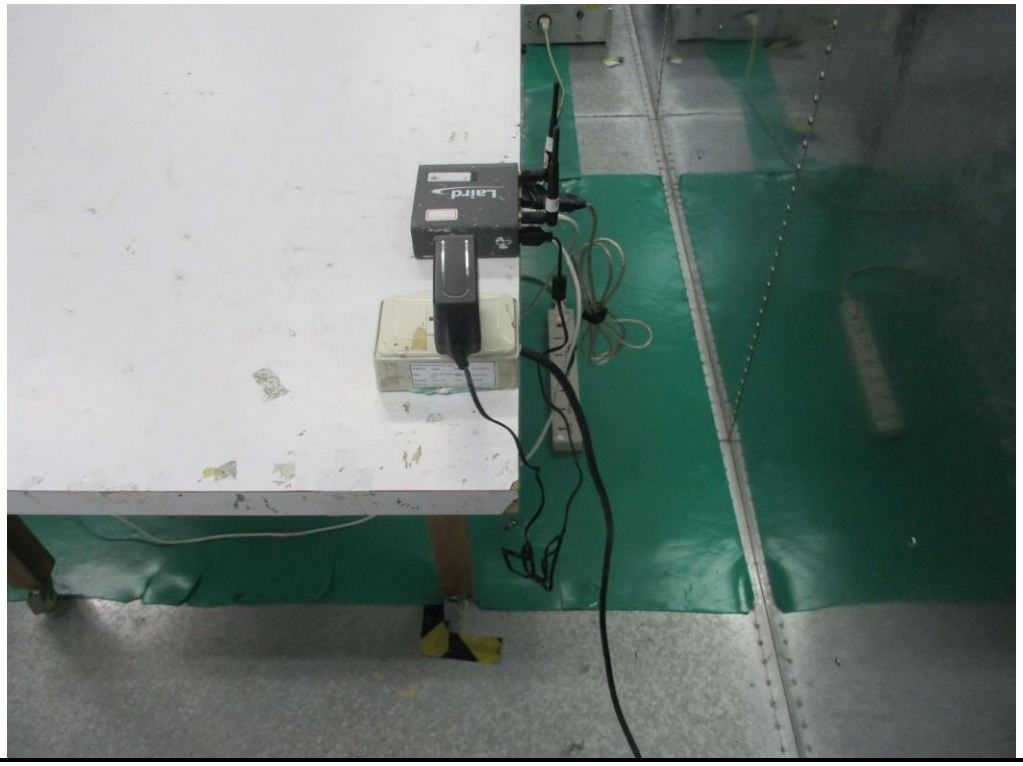


Dip Test (Test mode 1, 2, 3)



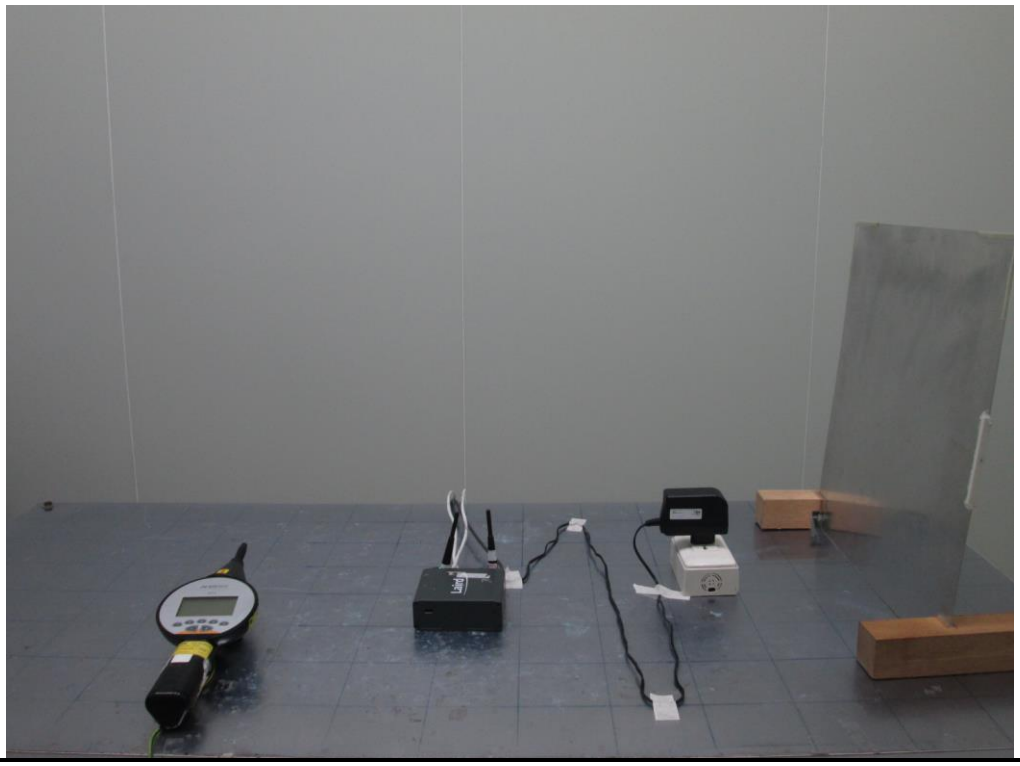
For new test (Adapter: F48L-120400SPAV)

Conducted Emissions from the AC mains power ports

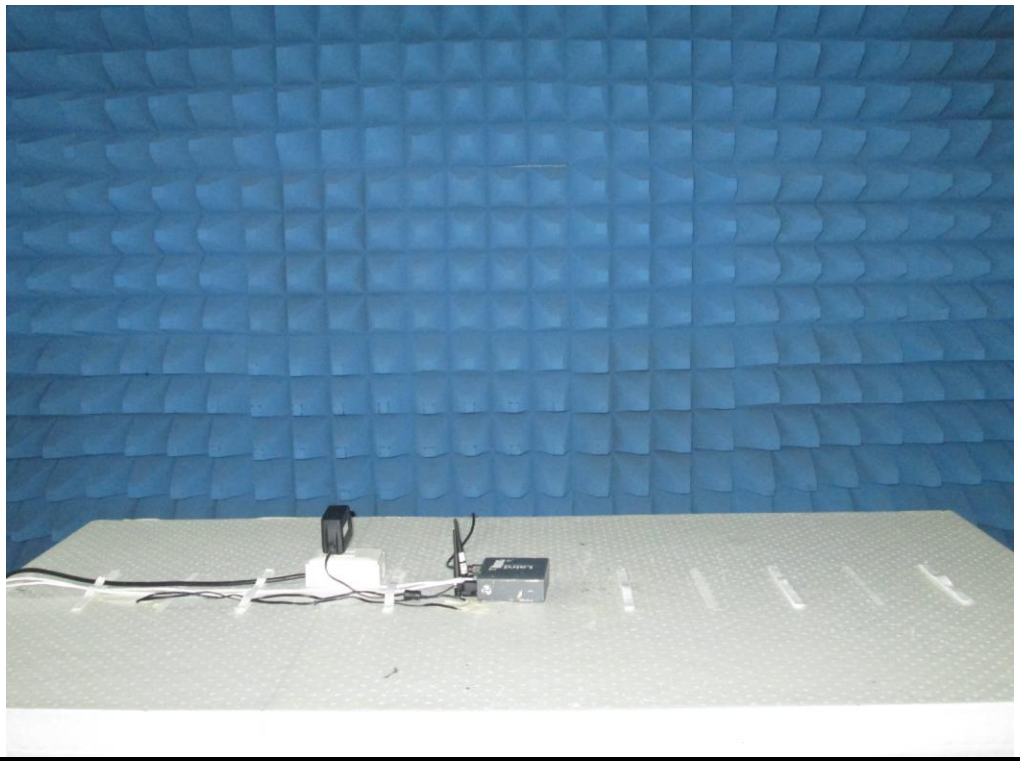


Harmonic & Flicker Test (Test mode 4)

ESD Test (Test mode 5)

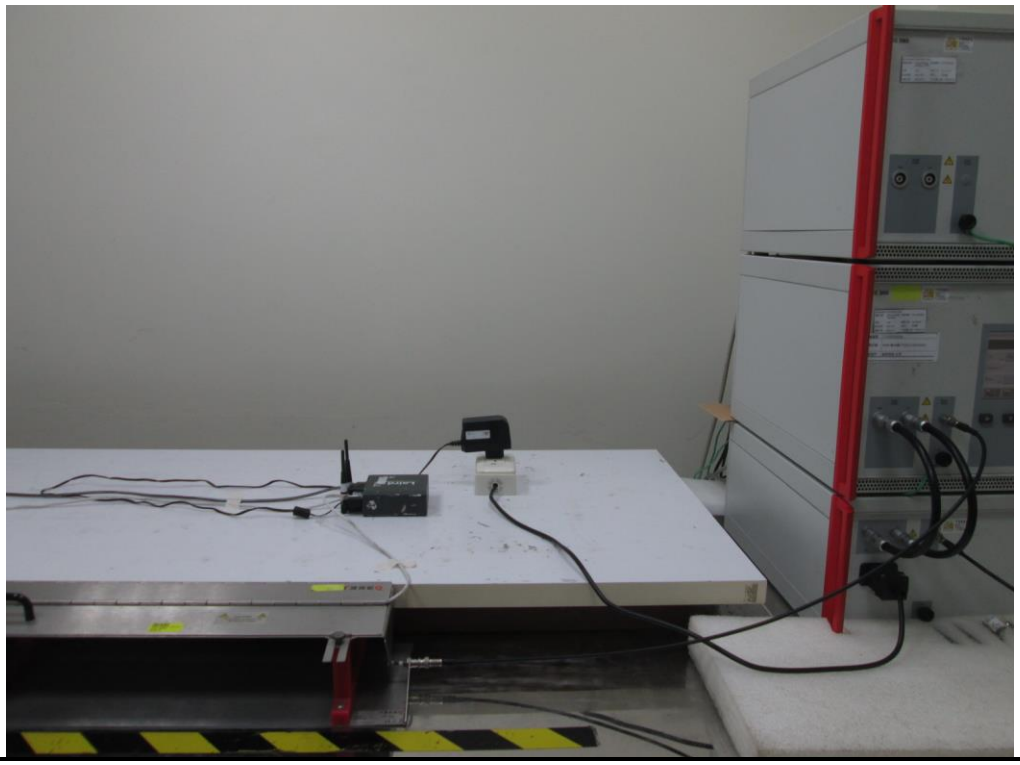


RS Test (Test mode 5)

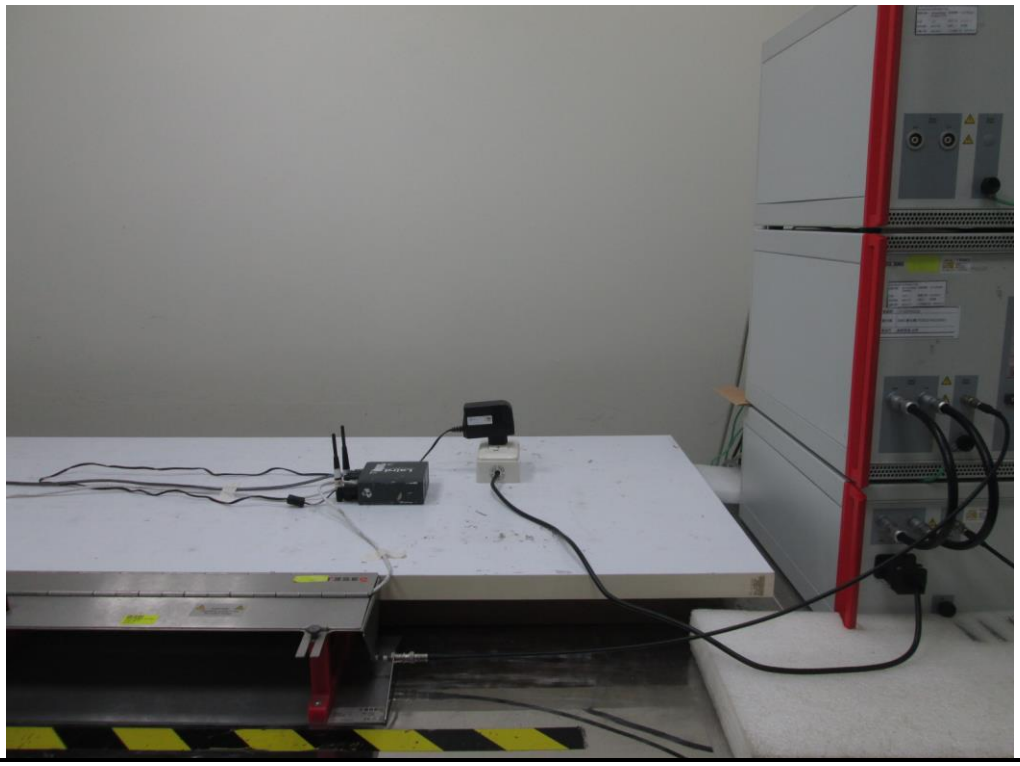


EFT Test (Power) (Test mode 5)

EFT Test (LAN 10&100Mbps) (Test mode 5)

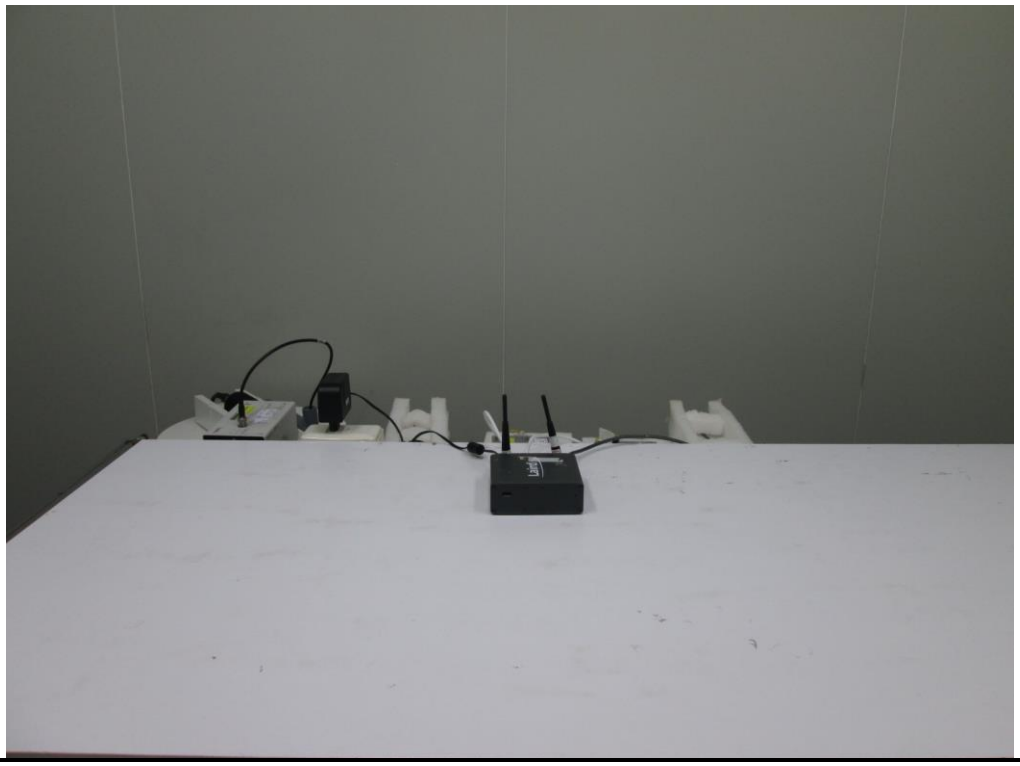


EFT Test (LAN 1000Mbps) (Test mode 5)

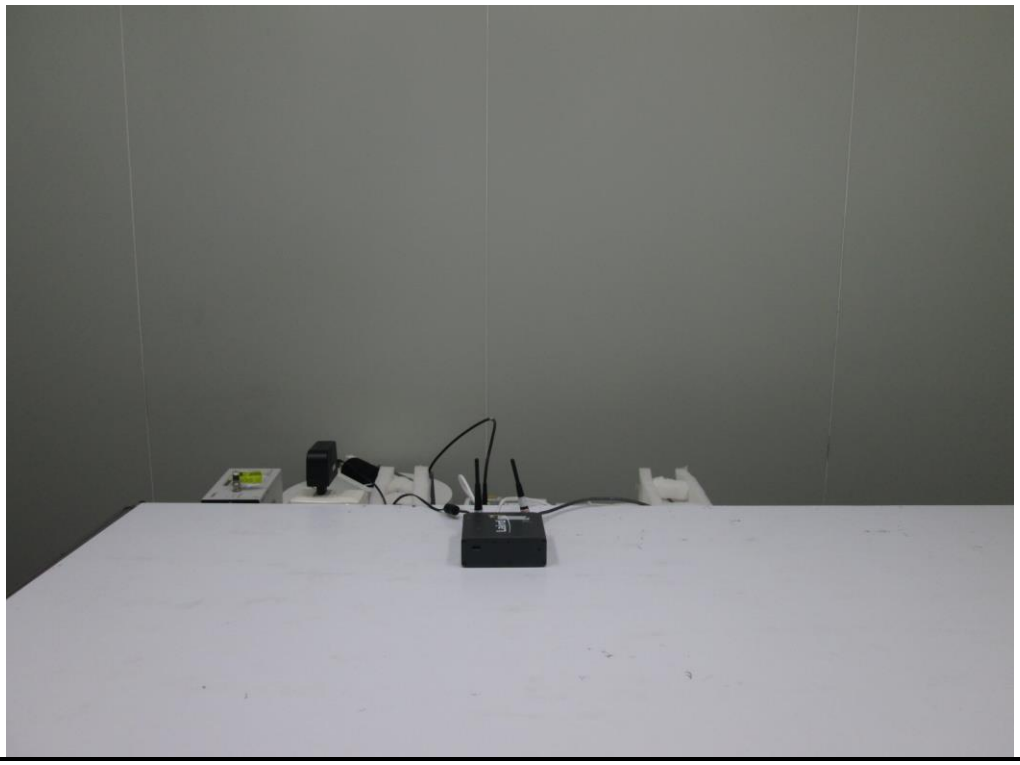


Surge Test (Power) (Test mode 4)

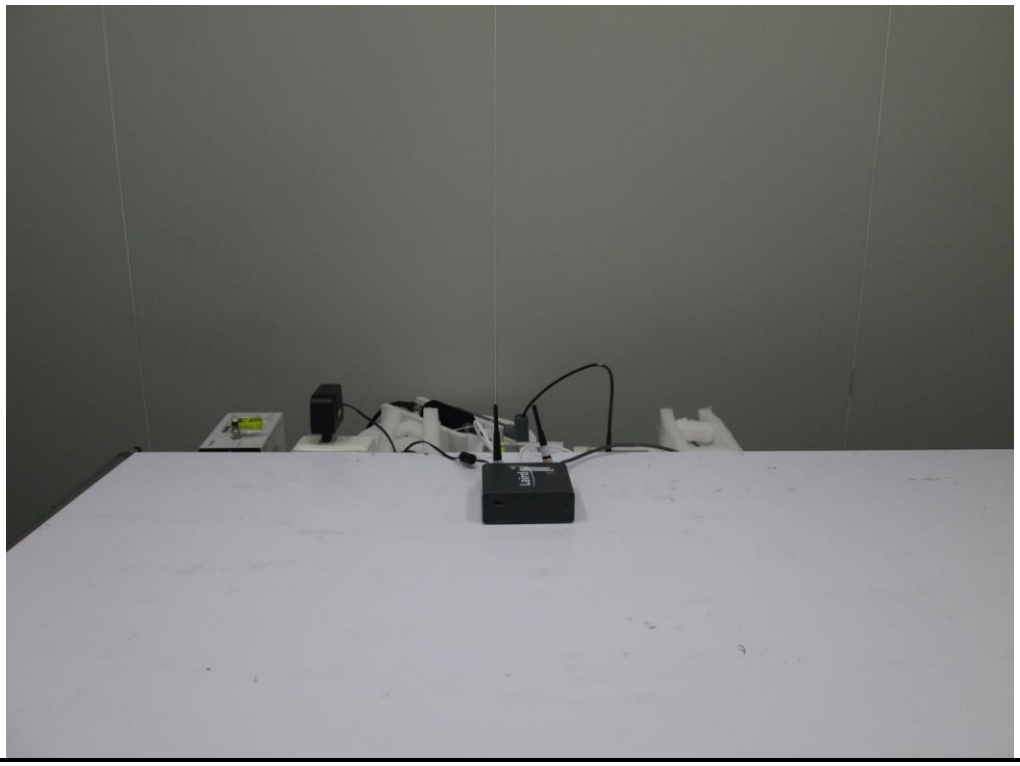
CS Test (Power) (Test mode 5)



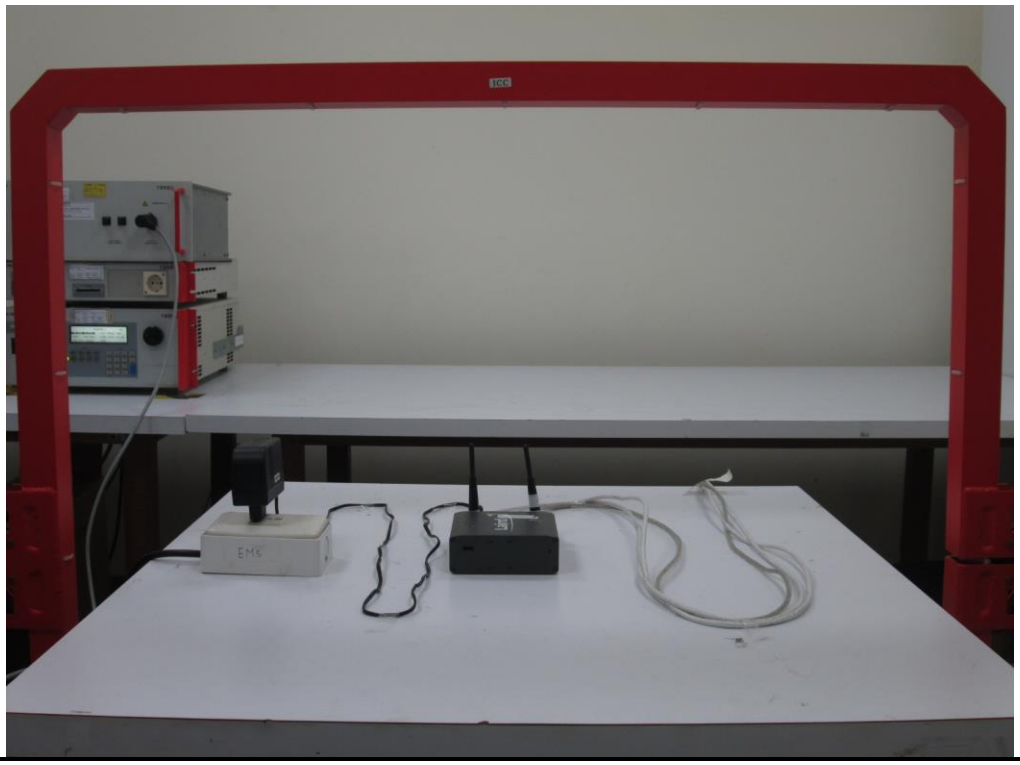
CS Test (LAN 10&100Mbps) (Test mode 5)



CS Test (LAN 1000Mbps) (Test mode 5)



Magnetic Test (Test Mode 5)



Dip Test (Test mode 4)

6 Test laboratory information

Established in 2012, ICC provides foremost EMC & RF Testing and advisory consultation services by our skilled engineers and technicians. Our services employ a wide variety of advanced edge test equipment and one of the widest certification extents in the business.

International Certification Corp (EMC and Wireless Communication Laboratory), it is our definitive objective is to institute long term, trust-based associations with our clients. The expectation we set up with our clients is based on outstanding service, practical expertise and devotion to a certified value structure. Our passion is to grant our clients with best EMC / RF services by oriented knowledgeable and accommodating staff.

Our Test sites are located at Linkou District and Kwei Shan District. Location map can be found on our website http://www.icertifi.com.tw.

Linkou	**Kwei Shan**	**Kwei Shan Site II**
Tel: 886-2-2601-1640	Tel: 886-3-271-8666	Tel: 886-3-271-8640
No. 30-2, Ding Fwu Tsuen, Lin Kou District, New Taipei City, Taiwan, R.O.C.	No. 3-1, Lane 6, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.	No. 14-1, Lane 19, Wen San 3rd St., Kwei Shan District, Tao Yuan City 333, Taiwan, R.O.C.

If you have any suggestion, please feel free to contact us as below information

Tel: 886-3-271-8666
Fax: 886-3-318-0155
Email: ICC_Service@icertifi.com.tw

==END==