TEST REPORT

CERTIFICATE OF CONFORMITY

Standard:	**EN 55032:2015 +A11:2020, Class A** **EN 61000-3-2:2014 (Not applicable)** **EN IEC 61000-3-2:2019 +A1:2021 (Not applicable)** **EN 61000-3-3: 2013+A1:2019+A2:2021 (Not applicable)** **EN 55035:2017 +A11:2020**
Report No.:	CEBCAE-WTW-P23080446
Product:	DC to DC Converter
Brand:	TRACO POWER
Model No.:	THL 25-1210
Series Model:	Refer to item 3.1
Received Date:	Mar. 17, 2016
Test Date:	Apr. 22 ~ 25, 2016, Mar. 18 ~ 21, 2017 & Jan. 10, 2023
Issued Date:	Oct. 3, 2023
Applicant:	TRACO ELECTRONIC AG
Address:	SIHLBRUGGSTRASS 111 CH-6340 BAAR, SWITZERLAND
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
Test Location:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan

Approved by: Jim Hsiang , **Date:** Oct. 3, 2023

Jim Hsiang / Associate Technical Manager

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Prepared by :Jessica Cheng/ Senior Specialist

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Release Control Record

Issue No.	Description	Date Issued
CEBCAE-WTW-P23080446	Original release.	Oct. 3, 2023

1 Certificate

Product:	DC to DC Converter
Brand:	TRACO POWER
Test Model:	THL 25-1210
Series Model:	Refer to item 3.1
Sample Status:	Engineering sample
Applicant:	TRACO ELECTRONIC AG
Test Date:	Apr. 22 ~ 25, 2016, Mar. 18 ~ 21, 2017 & Jan. 10, 2023
Standard:	EN 55032:2015 +A11:2020, Class A
	EN 61000-3-2:2014 (Not applicable)
	EN IEC 61000-3-2:2019 +A1:2021 (Not applicable)
	EN 61000-3-3: 2013+A1:2019+A2:2021 (Not applicable)
	EN 55035:2017 +A11:2020
Measurement procedure:	EN 61000-4-2:2009 / IEC 61000-4-2:2008 ED. 2.0
	EN IEC 61000-4-3:2020 / IEC 61000-4-3:2020 ED. 4.0
	EN 61000-4-4:2012 / IEC 61000-4-4:2012 ED. 3.0
	EN 61000-4-5:2014 +A1:2017 / IEC 61000-4-5:2017 ED. 3.1
	EN 61000-4-6:2014 +AC:2015 / IEC 61000-4-6:2013 ED. 4.0
	EN 61000-4-8:2010 / IEC 61000-4-8:2009 ED. 2.0
	EN IEC 61000-4-11: 2020+AC:2020 / IEC 61000-4-11: 2020 ED. 3.0 (Not applicable)

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

2 Summary of Test Results

The test items that the EUT need to perform in accordance with its interfaces, evaluated functions, are as follows:

Standard	Test Item	Result	Remark
EN 55032	Conducted Emissions from Power Ports	Pass	Minimum passing Class A margin is -8.41 dB at 0.85440 MHz
EN 55032	Radiated Emissions up to 1 GHz	Pass	Minimum passing Class A margin is -1.66 dB at 41.74 MHz
IEC 61000-4-2	Electrostatic Discharges (ESD)	Pass	For EN 55035 Performance Criteria A
IEC 61000-4-3	Radio Frequency Electromagnetic Field (RS)	Pass	For EN 55035 Performance Criteria A
IEC 61000-4-4	Fast Transients Common Mode (EFT)	Pass	For EN 55035 Performance Criteria A
IEC 61000-4-5	Surges	Pass	For EN 55035 Performance Criteria A
IEC 61000-4-6	Radio Frequency Common Mode (CS)	Pass	For EN 55035 Performance Criteria A
IEC 61000-4-8	Power Frequency Magnetic Field (PFMF)	Pass	For EN 55035 Performance Criteria A

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Performance Criteria

General Performance Criteria

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

Performance criterion A

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

Performance criterion B

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

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

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

Performance criterion C

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

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

Product Specific Performance criteria for network functions

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

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

Performance criterion A

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

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

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

The error rate, request for retry and data transmission rates may be degraded during the application of the test. Degradation of the performance as described in criterion A is permitted, provided that the normal operation of the EUT is self-recoverable to the condition established prior to the application of the test.

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

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

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

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

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

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

Performance criterion A
Applicable for the test requirement defined in table clause 2.1 of EN 55035
During the swept frequency test the established connection shall be maintained throughout the testing and the information transferred without any additional reproducible errors or loss of synchronisation. If a degradation in performance is observed and the system is adaptive, for example has the capability to automatically retrain in the presence of an interfering signal, then for conducted immunity tests only, the following procedure shall be followed:
a) For each range of interfering frequencies in which degradation in performance is observed, three frequencies (beginning, middle and end) shall be identified.
b) At each of the frequencies identified in step a), the interfering signal shall be turned on and the system is allowed to retrain.
c) If the system is able to retrain and then functions correctly for a dwell time of at least 60 seconds without any additional reproducible errors or loss of synchronisation, then the performance level of the system is considered acceptable.
d) The frequencies identified in step a) and the data rates achieved in step b) shall be recorded in the test report.

Applicable for the test requirement defined in table clause 2.2 of EN 55035
It is important that the modems are able to train in the presence of repetitive impulsive noise and minimize disruption to the end-user where a repetitive impulsive noise source starts after the link has synchronized. Therefore the following procedure and performance criteria shall apply.
The manufacturer shall select the class of impulsive noise protection (INP) to be used for the immunity test and should state this information in the technical documentation and in the test report. The maximum delay shall be set to 8 ms.
In the absence of impulsive noise: The modem shall operate without retraining at its target noise margin with a bit rate value depending on the line attenuation and the stationary noise being present on the line. (The actual value will be between the minimum and maximum bit rate values programmed in the port).
The impulsive noise source shall then be applied at the required test level.
With the impulsive noise applied: The modem shall operate without retraining and without SES at the bit rate established prior to the application of the impulsive noise. No extra CRC errors shall occur due to the impulsive noise.
After the test, the noise margin value shall return to the target noise margin.

Performance criterion B

Applicable for the test requirement defined in table clause 2.3 of EN 55035

Modems shall withstand the occurrence of isolated impulsive noise events. The performance criteria defined in below Table shall be applied.

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

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

For application of this test to the xDSL port, a repetition rate of 100 kHz (burst length 0.75 ms) shall be used.

Degradation of the performance as described in criterion A is permitted in that errors are acceptable during the application of the test. However the application of the test shall not cause the system to lose the established connection or re-train. At the cessation of the test the system shall operate in the condition established prior to the application of the test without user intervention.

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

Performance criterion C

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

2.2 Measurement Uncertainty

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

Measurement	Specification	Expanded Uncertainty (k=2) (±)	Maximum allowable uncertainty (±)
Conducted Emissions from Power Ports	150 kHz ~ 30 MHz	2.77 dB	3.4 dB (U_{cispr})
Radiated Emissions up to 1 GHz	30 MHz ~ 1 GHz	4.03 dB	6.3 dB (U_{cispr})

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

2.3 Supplementary Information

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

Specific Immunity Requirements by applicant.

standard	Test Item	Test Specification	Performance Criteria
IEC 61000-4-2	Electrostatic Discharges (ESD)	Enclosure port: ±6kV Contact discharge	A
IEC 61000-4-3	Radio Frequency Electromagnetic Field (RS)	Swept Frequency Test: 80 to 1000(MHz), 3/ 10V/m, 80 % AM (1 kHz) Spot Frequency Test: 1800, 2600, 3500, 5000 MHz, 3/ 10V/m, 80% AM (1kHz)	A
IEC 61000-4-4	Fast Transients Common Mode (EFT)	Input DC power port: ±2kV, 5/50 (Tr/Th) ns, 5kHz	A
IEC 61000-4-5	Surges	Input DC power port: ±1kV, 1.2/50 (8/20) (Tr/Th) μs,	A
IEC 61000-4-6	Radio Frequency Common Mode (CS)	Input DC power port: 0.15-80 MHz, 10V, 80% AM (1kHz)	A
IEC 61000-4-8	Power Frequency Magnetic Field (PFMF)	Enclosure port: 50 Hz, 3A/m,	A

3 General Information

3.1 Description of EUT

Product	DC to DC Converter
Brand	TRACO POWER
Test Model	THL 25-1210
Series Model	Refer to Note as below
Model Difference	Marketing Differentiation
Sample Status	Engineering sample
Operating Software	N/A
Power Supply Rating	Refer to note as below
Accessory Device	N/A
Data Cable Supplied	N/A

Note:

1. This report is issued as a duplicate report of BV CPS report no.: CEBCAE-WTW-P23010184. The difference compared with original report are changing applicant, brand and model for marketing purpose; therefore all test data was copied from the original test report.

2. The EUT is a DC to DC Converter, the specifications of standard models were listed as below.

Model Number	Input Voltage (Range)	Output Voltage
	Vdc	Vdc
THL 25-1210	12 (9 ~ 18)	3.3
THL 25-1211		5
THL 25-1212		12
THL 25-1213		15
THL 25-1222		±12
THL 25-1223		±15
THL 25-2410	24 (18 ~ 36)	3.3
THL 25-2411		5
THL 25-2412		12
THL 25-2413		15
THL 25-2422		±12
THL 25-2423		±15
THL 25-4810	48 (36 ~ 75)	3.3
THL 25-4811		5
THL 25-4812		12
THL 25-4813		15
THL 25-4822		±12
THL 25-4823		±15

Model Number	Input Voltage (Range)	Output Voltage
	Vdc	Vdc
THL 25-2410WI	24 (9 ~ 36)	3.3
THL 25-2411WI		5
THL 25-2412WI		12
THL 25-2413WI		15
THL 25-2422WI		±12
THL 25-2423WI		±15
THL 25-4810WI	48 (18 ~ 75)	3.3
THL 25-4811WI		5
THL 25-4812WI		12
THL 25-4813WI		15
THL 25-4822WI		±12
THL 25-4823WI		±15

3.2 Primary Clock Frequencies of Internal Source

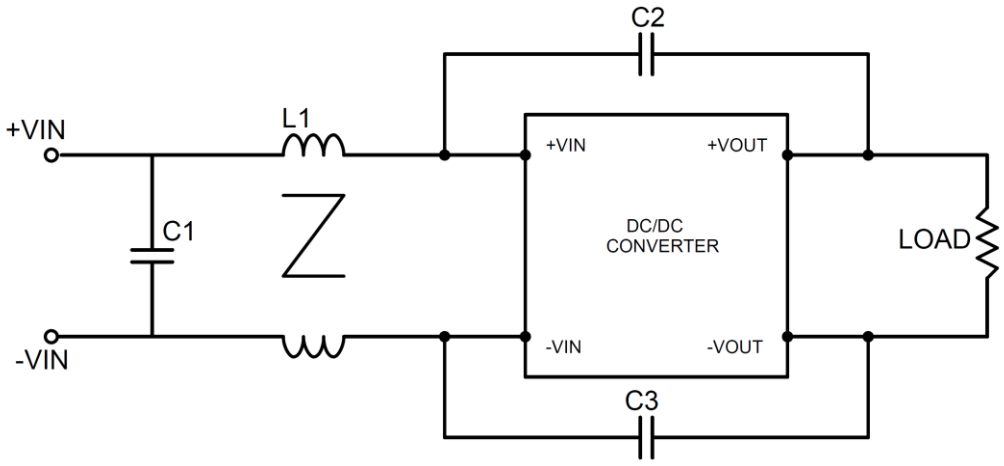
The highest frequency generated or used within the EUT or on which the EUT operates or tunes is below 108MHz, provided by TRACO ELECTRONIC AG, for detailed internal source, please refer to the manufacturer's specifications.

3.3 Features of EUT

The tests reported herein were performed according to the method specified by TRACO ELECTRONIC AG, for detailed feature description, please refer to the manufacturer's specifications or user's manual.
Please refer to appendix of the report if the applicant has provided additional descriptions of the EUT.

3.4 Solutions and Package Specifications by Manufacturer

(1) Conduction & Radiation Solution：



Class	Model	L1	C1	C2	C3
Class A	THL 25-1210	0.4mH//0.4mH 7448014501	3.3μF/100V 1210 X7S MLCC	1000pF/2KV 1206 X7R MLCC	1000pF/2KV 1206 X7R MLCC

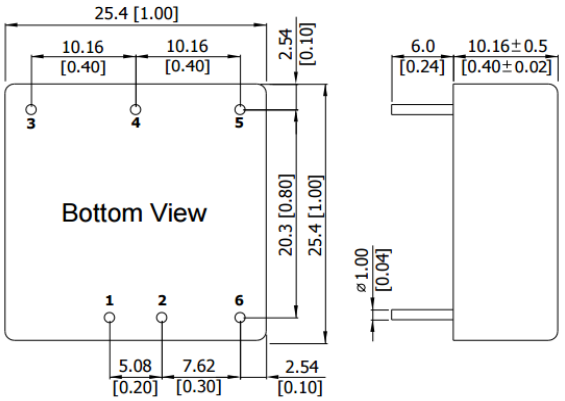
(2) EFT & Surge Solution：

To meet EN61000-4-4 & EN61000-4-5, an external capacitor across the input pins is required. Suggested capacitor: 220uF/100V.

(3) Package Specifications：

Package Specifications

Mechanical Dimensions



Pin Connections

Pin	Single Output	Dual Output
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	Trim	Common
5	-Vout	-Vout
6	Remote On/Off	Remote On/Off

- All dimensions in mm (inches)
- Tolerance: X.X±0.25 (X.XX±0.01)
  X.XX±0.13 (X.XXX±0.005)
- Pin diameter ∅ 1.0 ±0.05 (0.04±0.002)

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

1. The EUT was pre-tested under operating and standby condition and the worst emission level was found under **operating condition**.

2. As client's requirement, test modes are presented in the report as below.

Conducted emission test & Radiated emission test			
Mode	Model No.	Input	Output
1	THL 25-1210	12Vdc	3.3Vdc
Immunity tests			
Mode	Model No.	Input	Output
1	THL 25-1210	12Vdc	3.3Vdc

3.6 Test Program Used and Operation Descriptions

For Emission tests

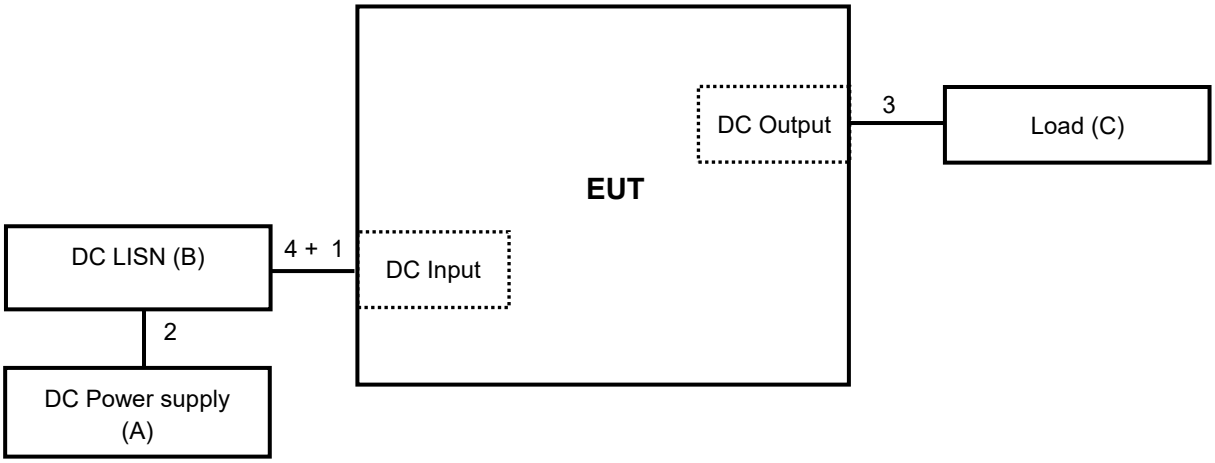
Set the EUT under full resistor load.

For Immunity tests

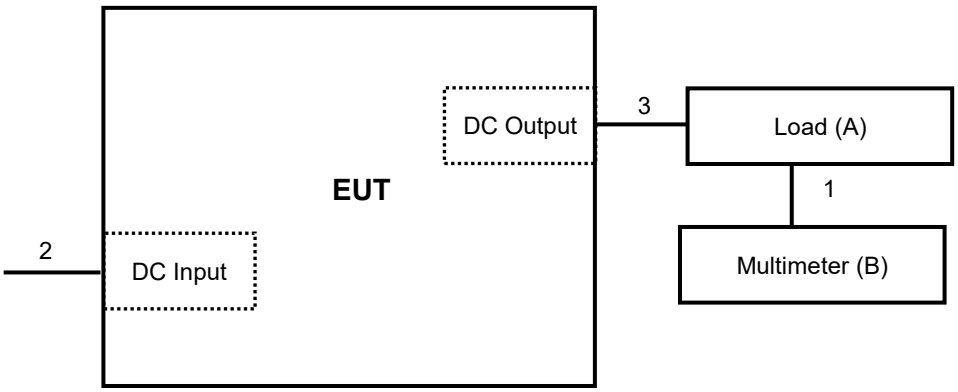
Connected a resistor load to DC output port of EUT to make EUT have maximum power consumption and installed both of them into a metal case then multimeter was used to monitor voltage of output.

3.7 Connection Diagram of EUT and Peripheral Devices

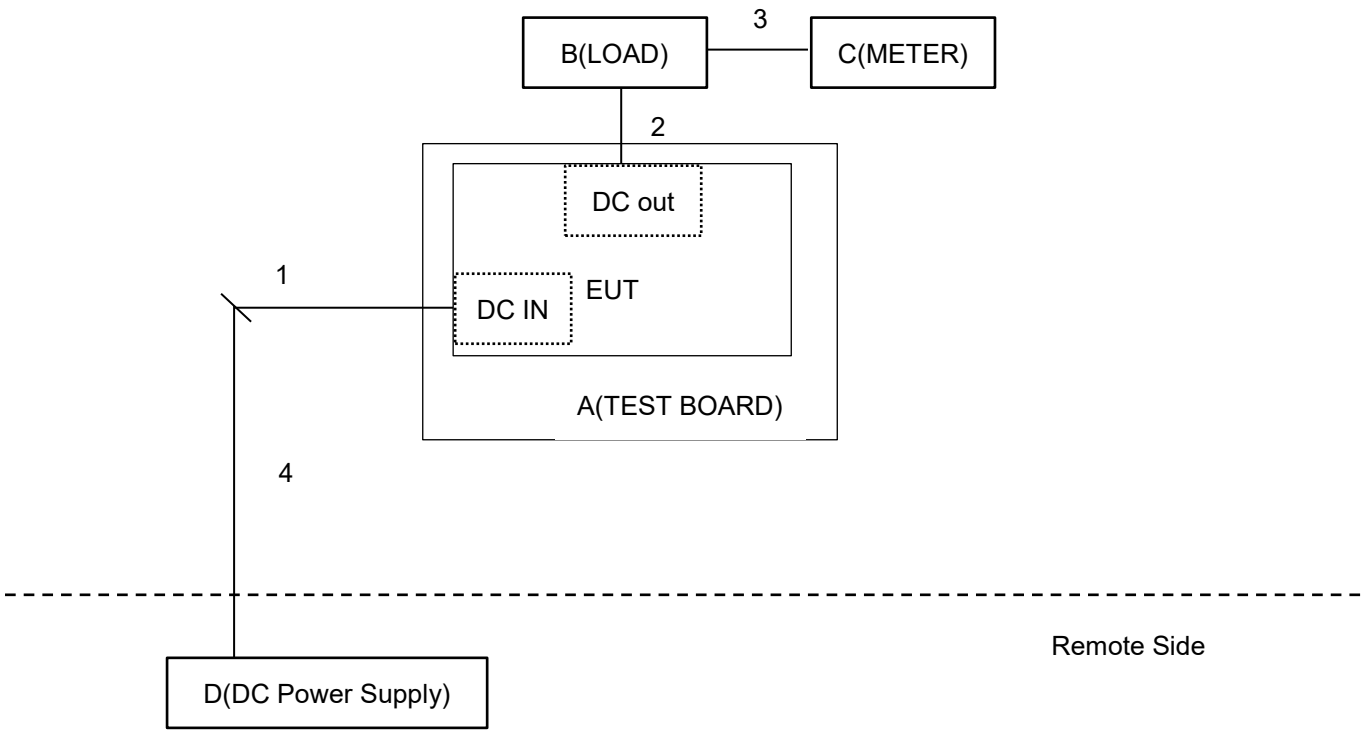
For Emission tests



For Immunity tests (RS & CS excluded)



For RS & CS tests



3.8 Configuration of Peripheral Devices and Cable Connections

For Emission tests

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A	DC Power Supply	Chroma	62024P-80-60	62024PA00674	N/A	Provided by Lab
B	DC LISN	SCHAFFNER	FN2200-75-34	N/A	N/A	Provided by Lab
C	DUMMY LOAD	N/A	N/A	N/A	N/A	Provided by Lab

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	DC cable	1	1.8	No	0	Provided by Lab
2	DC cable	1	1.2	No	0	Provided by Lab
3	DC cable	1	0.1	No	0	Provided by Lab
4	DC cable	1	7.0	No	0	Provided by Lab

For Harmonics, Flicker & Immunity tests (RS & CS excluded)

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A	DUMMY LOAD	N/A	N/A	N/A	N/A	Supplied by applicant
B	Multimeter	YFE	YF-370A	N/A	N/A	Provided by Lab

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	Data cable	1	0.6	No	0	Provided by Lab
2	DC cable	1	1.2	No	0	Provided by Lab
3	DC cable	1	0.1	No	0	Supplied by applicant

For RS & CS tests

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A	TEST BOARD	N/A	N/A	N/A	N/A	Supplied by applicant
B	DUMMY LOAD	N/A	N/A	N/A	N/A	Supplied by applicant
C	METER	YFE	YF-370A	N/A	N/A	Provided by Lab
D	DC Power Supply	Chroma	62024P-80-60	62024PA03093	N/A	Provided by Lab

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	DC power cable	1	0.2	No	0	Provided by Lab
2	DC power cable	2	0.05	No	0	Provided by Lab
3	DC power cable	1	0.8	No	0	Supplied by applicant
4	DC power cable	1	5	No	0	Provided by Lab

4 Test Instruments

The calibration interval of the all test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

4.1 Conducted Emissions from Power Ports

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ROHDE & SCHWARZ TEST RECEIVER	ESCS 30	100276	Apr. 12, 2016	Apr. 11, 2017
ROHDE & SCHWARZ Artificial Mains Network (for EUT)	ENV216	101197	May 04, 2016	May 03, 2017
LISN With Adapter (for EUT)	AD10	C10Ada-002	May 04, 2016	May 03, 2017
ROHDE & SCHWARZ Artificial Mains Network (for peripherals)	ESH3-Z5	100218	Nov. 23, 2016	Nov. 22, 2017
SCHWARZBECK Artificial Mains Network (For EUT)	NNLK8129	8129229	May 04, 2016	May 03, 2017
Software	Cond_V7.3.7.4	NA	NA	NA
RF cable (JYEBAO) With 10dB PAD	5D-FB	Cable-C10.01	Feb. 14, 2017	Feb. 13, 2018
SUHNER Terminator (For ROHDE & SCHWARZ LISN)	65BNC-5001	E1-011484	May 12, 2016	May 11, 2017
ROHDE & SCHWARZ Artificial Mains Network (For TV EUT)	ESH3-Z5	100220	Nov. 08, 2016	Nov. 07, 2017
LISN With Adapter (for TV EUT)	100220	N/A	Nov. 08, 2016	Nov. 07, 2017

Notes: 1. The test was performed in Shielded Room No. 10.
2. The VCCI Site Registration No. C-1852.
3. Tested Date: Mar. 18, 2017.

4.2 Radiated Emissions up to 1 GHz

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
ROHDE & SCHWARZ TEST RECEIVER	ESCI	100744	Apr. 28, 2016	Apr. 27, 2017
Schaffner BILOG Antenna	CBL6111D	22270	Dec. 28, 2016	Dec. 27, 2017
EMCI Preamplifier	EMC9135	980326	Feb. 21, 2017	Feb. 20, 2018
CT Turn Table	TT100	CT-080	NA	NA
CT Tower	AT100	CT-080	NA	NA
Software	Radiated_V7.6.15.9.5	NA	NA	NA
ANRITSU RF Switches	MP59B	N/A	Mar. 10, 2017	Mar. 09, 2018
WOKEN RF cable With 5dB PAD	8D	CABLE-ST3-01	Mar. 10, 2017	Mar. 09, 2018

Notes: 1. The test was performed in Open Site No. 3.
2. The VCCI Site Registration No. is R-269.
3. The FCC Site Registration No. 90424.
4. Tested Date: Mar. 21, 2017.

4.3 Electrostatic Discharges (ESD)

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
EM Test ESD Simulator	Dito	V0707102251	Apr. 16, 2016	Apr. 15, 2017

Notes: 1. The test was performed in ESD Room No. 3.
2. Tested Date: Apr. 25, 2016.

4.4 Radio Frequency Electromagnetic Field (RS)

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
RF Generator TESEQ	ITS 6006	37543	May 10, 2022	May 9, 2023
Amplifier TESEQ	CBA 1G-150	T44220	NA	NA
Amplifier TESTQ	CBA 3G-050	T44345	NA	NA
Amplifier TESTQ	AS1860-50	S-5944/1	NA	NA
Power Meter BOONTON	4232A	94901	June 6, 2022	June 5, 2023
Power Sensor BOONTON	51011-EMC	32807	June 6, 2022	June 5, 2023
RS antenna schwarzbeck mess-elektronik	STLP 9129	9129068	NA	NA
CHANCE MOST Compact Full Anechoic Chamber (7x3x3 m)	NA	NA	Jan. 18, 2022	Jan. 17, 2023
Software BVADT	RS_V7.6	NA	NA	NA
Wireless Connection Tester R&S	CMW270	101075	Apr. 18, 2022	Apr. 17, 2023
Audio analyzer R&S	UPV	104565	May 10, 2022	May 9, 2023
Ear Simulator Telephonometry B&K	4185	2553594	NA	NA
Pressure-field Microphone B&K	4192	2735408	Apr. 26, 2022	Apr. 25, 2023
Two channel microphone conditioning amplifier B&K	2690 A OS2	2645274	June 5, 2022	June 4, 2023
Band pass filter B&K	WH3278	NA	June 5, 2022	June 4, 2023
Software BVADT	BV ADT_ABMS_ V7.4.3	NA	NA	NA

Notes:

1. The test was performed in Linkou RS Room No.1.
2. Tested Date: Jan. 10, 2023

4.5 Fast Transients Common Mode (EFT)

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Haefely, EFT Generator	PEFT 4010	154954	Apr. 20, 2016	Apr. 19, 2017
Haefely,Capacitive Clamp	IP4A	155173	Apr. 20, 2016	Apr. 19, 2017

Notes: 1. The test was performed in EFT Room.
2. Tested Date: Apr. 22, 2016.

4.6 Surges

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
TESEQ, Surge Simulator	NSG 3060	1572	May 20, 2015	May 19, 2016
Coupling Decoupling Network	CDN-UTP8	028	Aug. 20, 2015	Aug. 19, 2016
TESEQ Coupling Decoupling Network	CDN HSS-2	41009	Aug. 05, 2015	Aug. 04,2016
TESEQ Coupling Decoupling Networ	CDN 118-T8	40386	Aug. 31, 2015	Aug. 30,2016

Notes: 1. The test was performed in Surge Room.
2. Tested Date: Apr. 25, 2016.

4.7 Radio Frequency Common Mode (CS)

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
R&S SML03 S.G R&S	SML03	101801	Jan. 11, 2022	Jan. 10, 2023
Amplifier AR	75A250AM1	306331	NA	NA
Digital Sweep Function Generator Topward	8120	984801	NA	NA
Power Sensor R & S	NRV-Z5	837878/039	Oct. 18, 2022	Oct. 17, 2023
Power Meter R & S	NRVD	837794/040	Oct. 18, 2022	Oct. 17, 2023
FCC EM Injection Clamp FCC	F-203I-23mm	455	NA	NA
Current Clamp FCC	F-120-9A	361	Aug. 17, 2022	Aug. 16, 2023
Coupling/Dcoupling Network EM TEST	CDN M1/32A	306508	Feb. 23, 2022	Feb. 22, 2023
CDN M2-16Amp FCC	FCC-801-M2-16A	01047	Feb. 23, 2022	Feb. 22, 2023
Coupling/Dcoupling Network TESEQ	CDN M232	37702	Feb. 23, 2022	Feb. 22, 2023
Coupling/Dcoupling Network TESEQ	CDN M332	41258	Feb. 23, 2022	Feb. 22, 2023
Coupling/Dcoupling Network TESEQ	CDN M332	41256	Feb. 23, 2022	Feb. 22, 2023
Coupling Decoupling Network TESEQ	CDN M432S	56519	Feb. 23, 2022	Feb. 22, 2023
CDN FCC	FCC-801-M5-50A	100018	Jan. 18, 2022	Jan. 17, 2023
Coupling Decoupling Network TESEQ	CDN T2A-10	54942	Feb. 22, 2022	Feb. 21, 2023
Coupling Decoupling Network TESEQ	CDN T400A	49918	Feb. 23, 2022	Feb. 22, 2023
Coupling Decoupling Network TESEQ	CDN T800	34428	Feb. 22, 2022	Feb. 21, 2023
Coupling Decoupling Network TESEQ	CDN T8-10	40376	Feb. 22, 2022	Feb. 21, 2023
Coupling Decoupling Network TESEQ	CDN T8-230	56641	Feb. 22, 2022	Feb. 21, 2023
Coupling Decoupling Network TESEQ	CDN T8-230	56642	Feb. 22, 2022	Feb. 21, 2023
Coupling Decoupling Network TESEQ	CDN T8-230	56643	Feb. 22, 2022	Feb. 21, 2023
CDN Calibration Kit TESEQ	CDN T8S	29459	Feb. 22, 2022	Feb. 21, 2023
Coupling Decoupling Network TESEQ	CDN ST08A	56527	Feb. 21, 2022	Feb. 20, 2023
Coupling Decoupling Network TESEQ	CDN ST08A	56525	Feb. 21, 2022	Feb. 20, 2023
CDN TESEQ	CDN S200	53490	Feb. 24, 2022	Feb. 23, 2023
CDN TESEQ	CDN S400	52115	Feb. 24, 2022	Feb. 23, 2023
Coupling Decoupling Network TESEQ	CDN S751A	56435	Feb. 21, 2022	Feb. 20, 2023
Coupling Decoupling Network TESEQ	CDN S751A	56436	Feb. 22, 2022	Feb. 21, 2023

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Software BVADT	CS_V7.4.2	NA	NA	NA
Wireless Connection Tester R&S	CMW270	101075	Apr. 18, 2022	Apr. 17, 2023
Audio analyzer R&S	UPV	104565	May 10, 2022	May 9, 2023
Ear Simulator Telephonometry B&K	4185	2553594	NA	NA
Pressure-field Microphone B&K	4192	2735407	Nov. 15, 2022	Nov. 14, 2023
Two channel microphone conditioning amplifier B&K	2690 OS2	3001996	Nov. 15, 2022	Nov. 14, 2023
POWER AMPLIFIER B&K	2716C	2610979	NA	NA
Mouth Simulator B&K	4227	2630632	NA	NA
Software BVADT	ABMS_ V7.4.3	NA	NA	NA

Notes:

1. The test was performed in Linkou CS Room No.1.
2. Tested Date: Jan. 10, 2023

4.8 Power Frequency Magnetic Field (PFMF)

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
HAEFELY Magnetic Field Tester	MAG 100	083794-06	NA	NA
COMBINOVA Magnetic Field Meter	MFM10	224	Apr. 21, 2016	Apr. 20, 2017

Notes: 1. The test was performed in EMS Room No. 1
2. Tested Date: Apr. 25, 2016.

5 Limits of Test Items

5.1 Conducted Emissions from Power Ports

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

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

5.2 Radiated Emissions up to 1 GHz

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

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

5.3 General immunity requirements

Port	Basic Standard	Test item	Test specification	Performance criteria
Power input (AC)	IEC 61000-4-4	Fast Transients, Common Mode (EFT)	±1 kV 5/50 ns (Tr/Th) 5 kHz, repetition frequency	B
	IEC 61000-4-5	Surge	Line to line: ±1 kV, 1.2/50 µs Line to earth: ±2 kV, 1.2/50 µs	B
	IEC 61000-4-6	Radio Frequency, Common Mode (CS)	0.15-10 MHz, 3V, 80% AM (1kHz), 10-30 MHz, 3V-1V, 80% AM (1kHz), 30-80 MHz, 1V, 80% AM (1kHz),	A
	IEC 61000-4-11	Voltage dips and interruptions (DIP)	**Voltage Dips:** < 5 % residual voltage, 0.5 cycle 70% residual voltage, 25 cycles (at 50Hz) **Voltage Interruption:** < 5 % residual voltage, 250 cycles (at 50 Hz)	B C C
DC power/ Wired network and Signal/ Control port	IEC 61000-4-4	Fast Transients, Common Mode (EFT)	±0.5 kV 5/50 ns (Tr/Th) 100 kHz, repetition frequency for xDSL port 5 kHz, repetition frequency for other port	B
	IEC 61000-4-5	Surge	**Wired network ports** (directly connected to outdoor cables): Symmetrically operated: 10/700µs w/o primary protectors: ±1.0kV, or with primary protectors fitted: ±1.0kV and ±4.0kV, Coaxial or shielded operated: 1.2/50µs shield to ground: ±0.5 kV, **DC power ports** (directly connected to outdoor cables): 1.2/50 µs each individual line to earth, or shield to ground: ±0.5 kV,	C B B
	IEC 61000-4-6	Radio Frequency, Common Mode (CS)	0.15-10 MHz, 3V, 80% AM (1kHz), 10-30 MHz, 3V-1V, 80% AM (1kHz), 30-80 MHz, 1V, 80% AM (1kHz),	A
		Broadband impulse noise disturbances (Applicable only to xDSL ports.)	**Repetitive :** Impulse frequency profile : 0.15 – 0.5 MHz, 107 dBuV ; 0. 5 – 10 MHz, 107 – 36 dBuV ; 10 – 30 MHz, 36 – 30 dBuV Burst duration : 0.70 ms Burst period :10 ms(for 50 Hz) At least 2 minutes for each port under test.	A
			Isolated : Impulse frequency profile : 0.15 –30 MHz, 110 dBuV Burst duration : 0.24 ms, 10 ms and 300 ms Isolated impulses : 5 times Interval : at least 60 seconds	B

Port	Basic Standard	Test item	Test specification	Performance criteria
Enclosure	IEC 61000-4-2	Electrostatic Discharge (ESD)	±4 kV (contact) ±8 kV (Air)	B
	IEC 61000-4-3	Radio Frequency Electromagnetic Field (RS)	Swept Frequency Test: 80 to 1000(MHz), 3 V/m, 80 % AM (1 kHz) Spot Frequency Test: 1800, 2600, 3500, 5000 MHz (±1 %), 3V/m, 80% AM (1kHz)	A
	IEC 61000-4-8	Power Frequency Magnetic Field (PFMF)	1A/m, 50Hz	A

6 Test Arrangements

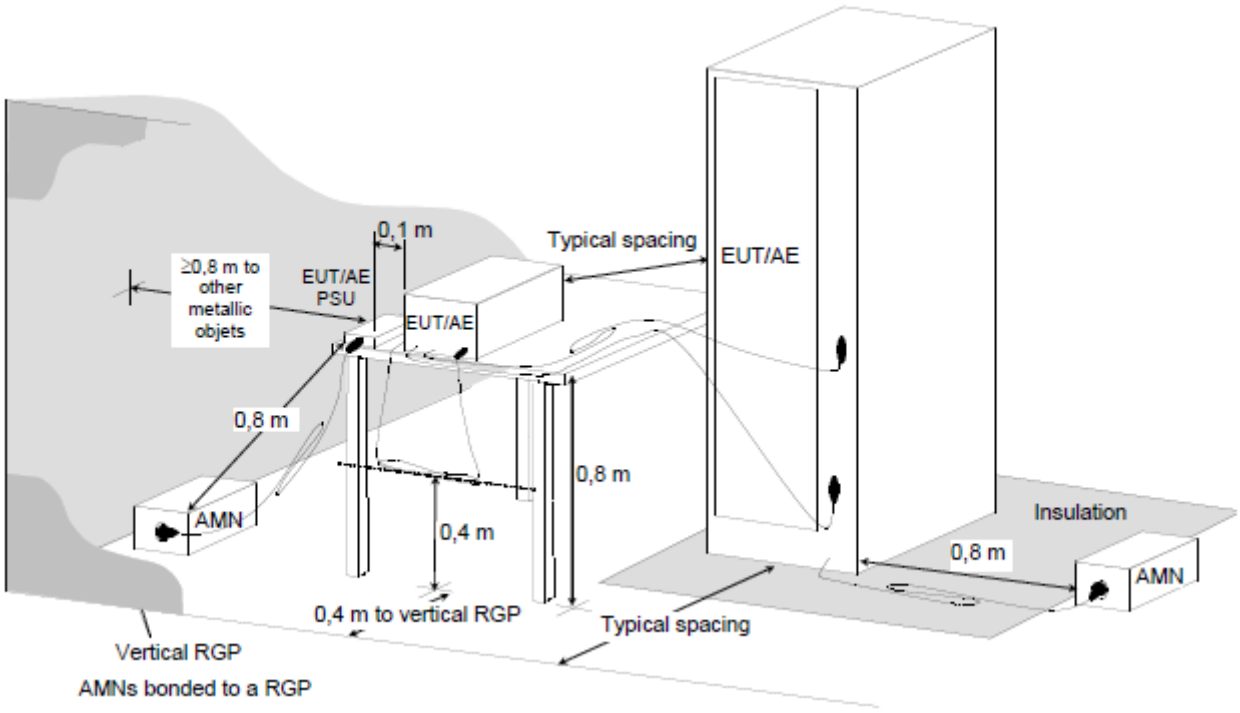
6.1 Conducted Emissions from Power Ports

a. The EUT is placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN), or an Artificial Network (AN) as specified in CISPR 25 if uses in a vehicle. Other support units are connected to the power mains through another LISN and/or AN. They provide coupling impedance for the measuring instrument.

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

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

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

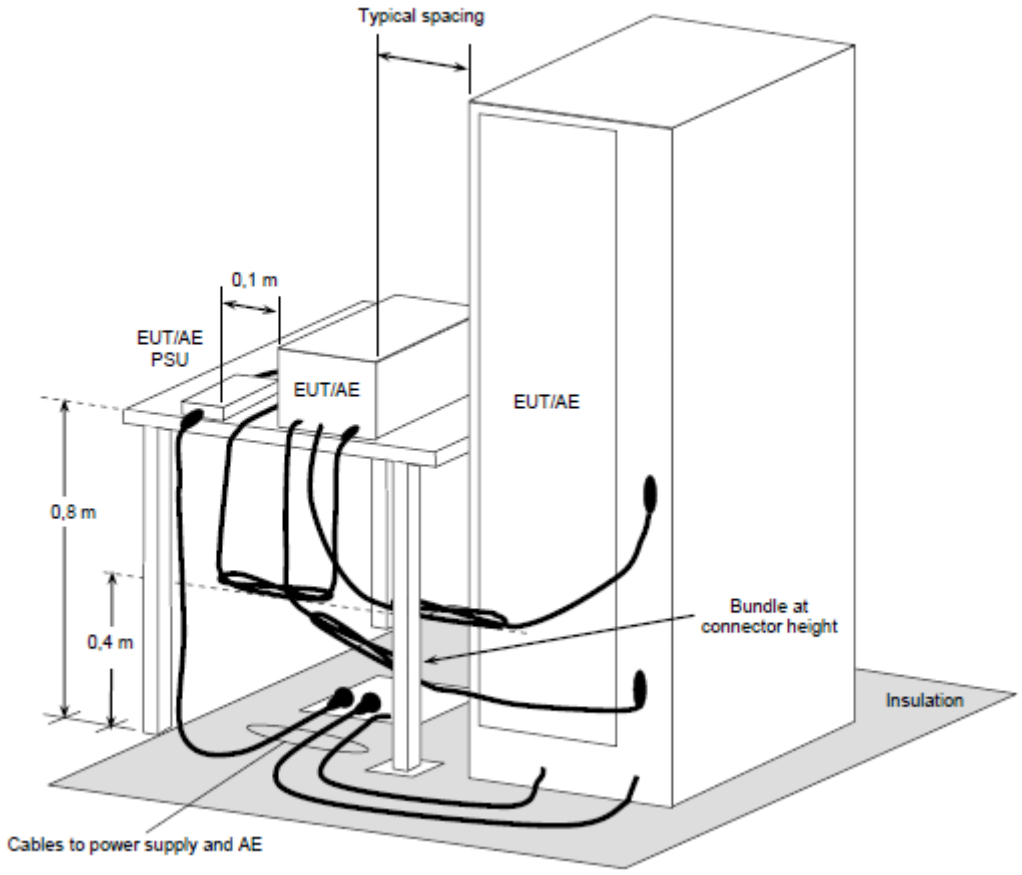


For the actual test configuration, please refer to the related Item – Photographs of the Test Configuration.

6.2 Radiated Emissions up to 1 GHz

a. For the table-top EUT is placed on a 0.8 meter to the top of rotating table; for the floor standing EUT shall be insulated (by insulation of maximum thickness of 150 mm) from the horizontal reference ground plane. The rotating table is rotated 360 degrees to determine the position of the highest radiation. If the equipment requires a dedicated ground connection, this shall be provided and bonded to the RGP.
b. The EUT is set 10 meters away from the interference-receiving antenna, which is mounted on the top of a variable-height antenna tower.
c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT is arranged to its worst case and then the antenna is tuned to heights from 1 m to 4 m and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system is set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is up to 1 GHz.

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



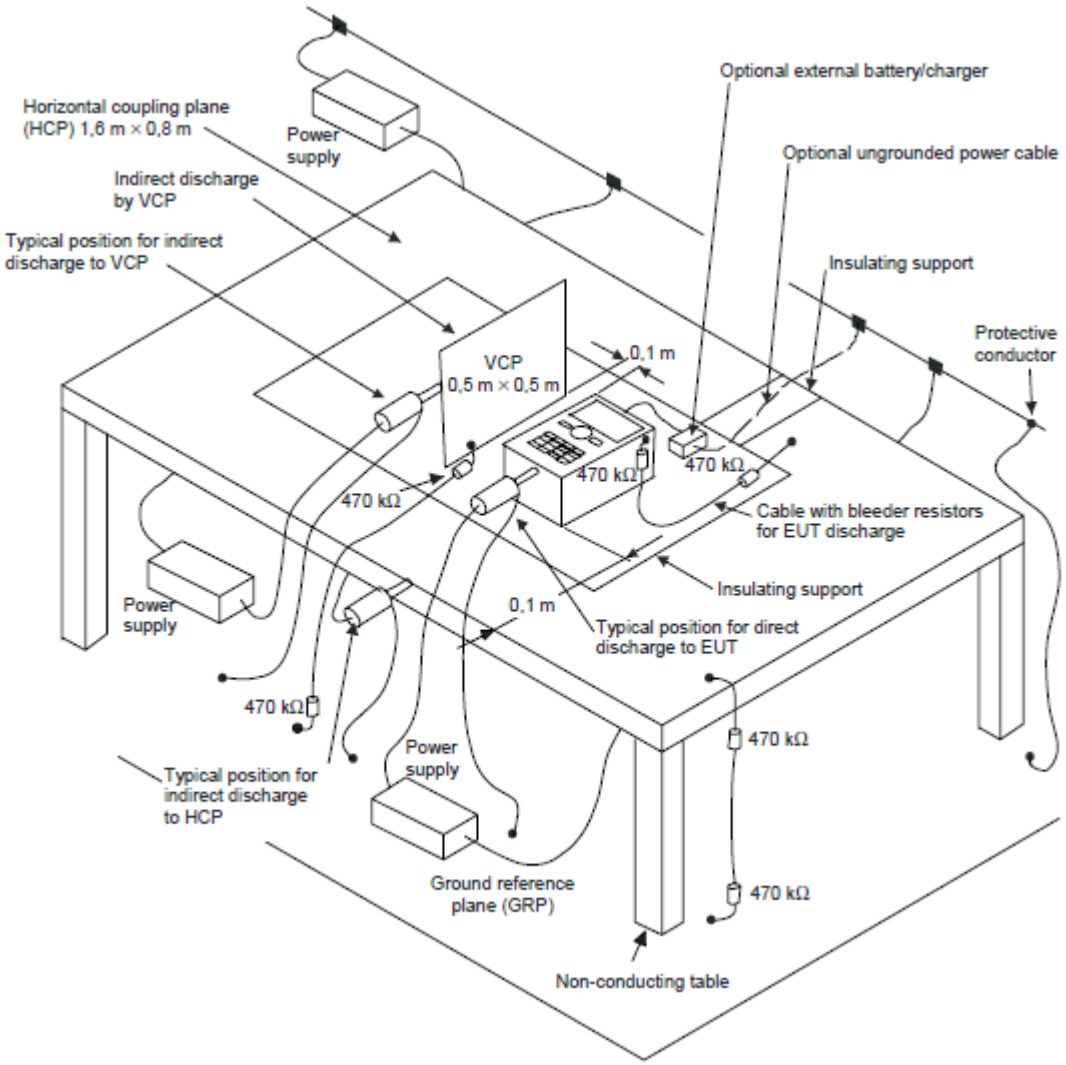
For the actual test configuration, please refer to the related Item – Photographs of the Test Configuration.

6.3 Electrostatic Discharges (ESD)

Discharge Impedance:	330 ohm / 150 pF
Number of Discharge:	Air – Direct: 10 discharges per location (each polarity) Contact – Direct & Indirect: 10 discharges per location (each polarity)
Discharge Period:	1-second minimum

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

a. Electrostatic discharges were applied only to those points and surfaces of the EUT that are accessible to users during normal operation.
b. The test was performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.
c. The time interval between two successive single discharges was at least 1 second.
d. The ESD generator was held perpendicularly to the surface to which the discharge was applied and the return cable was at least 0.2 meters from the EUT.
e. Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.
f. Air discharges were applied with the round discharge tip of the discharge electrode approaching the EUT as fast as possible (without causing mechanical damage) to touch the EUT. After each discharge, the ESD generator was removed from the EUT and re-triggered for a new single discharge. The test was repeated until all discharges were complete.
g. At least ten single discharges (in the most sensitive polarity) were applied to the **H**orizontal **C**oupling **P**lane at points on each side of the EUT. The ESD generator was positioned at a distance of 0.1 meters from the EUT with the discharge electrode touching the **HCP.**
h. At least ten single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the **V**ertical **C**oupling **P**lane in sufficiently different positions that the four faces of the EUT were completely illuminated. The **VCP** (dimensions 0.5m x 0.5m) was placed vertically to and 0.1 meters from the EUT.



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

NOTE:

TABLE-TOP EQUIPMENT

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

FLOOR-STANDING EQUIPMENT

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

6.4 Radio Frequency Electromagnetic Field (RS)

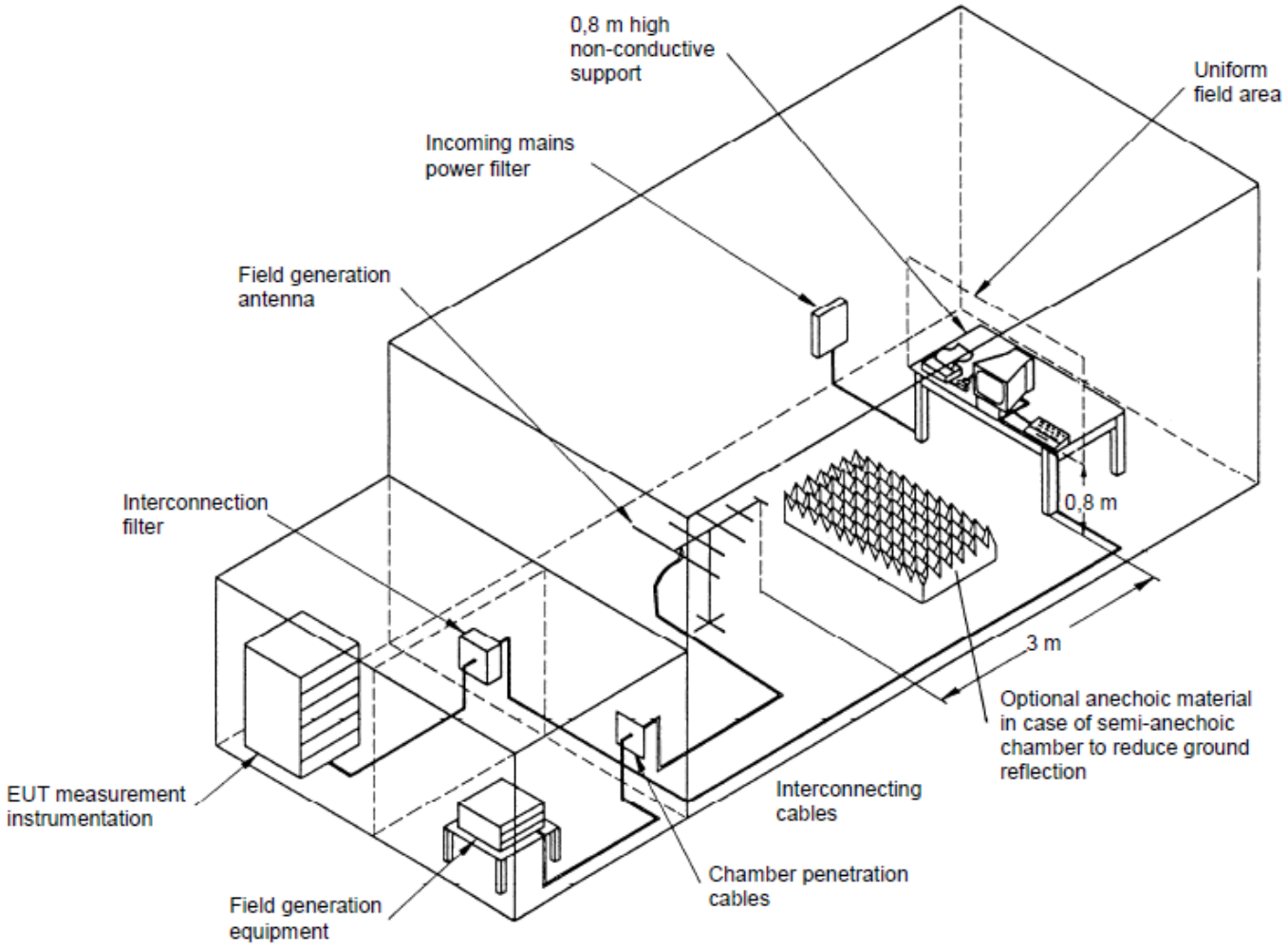
Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of preceding frequency value
Dwell Time:	3 seconds

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

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

b. The frequency range shall be swept, with the signal 80% amplitude modulated with a 1kHz sine wave.

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



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

NOTE:

TABLETOP EQUIPMENT

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

FLOOR STANDING EQUIPMENT

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

6.5 Fast Transients Common Mode (EFT)

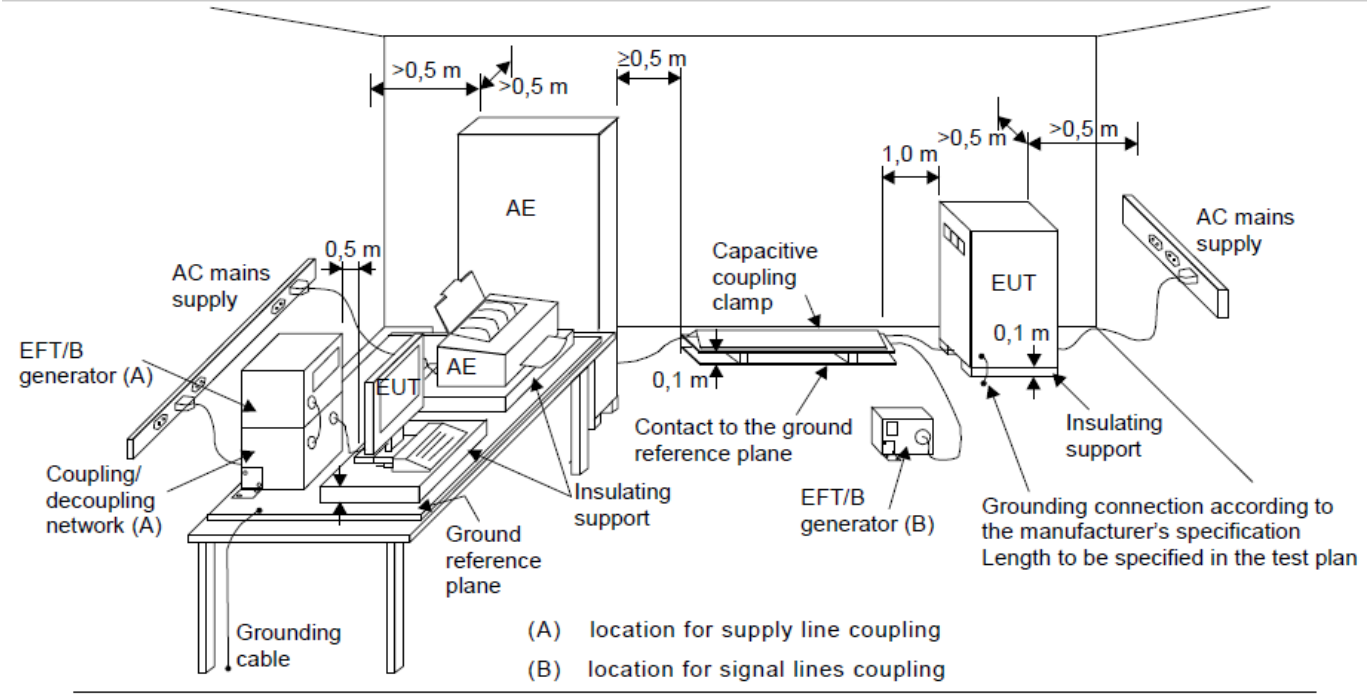
Impulse Repetition Frequency:	xDSL telecommunication port: 100kHz others: 5kHz
Impulse Wave Shape:	5/50 ns
Burst Duration:	0.75 ms for 100kHz Repetition Frequency 15 ms for 5kHz Repetition Frequency
Burst Period:	300 ms
Test Duration:	1 min.

a. Both positive and negative polarity discharges were applied.

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

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

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



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

6.6 Surges

Wave-Shape:	**Wired network ports (direct to outdoor cables):** **Symmetrically operated:** 10/700 μs Open Circuit Voltage 5/320 μs Short Circuit Current **Non-symmetrically operated:** 1.2/50 μs Open Circuit Voltage 8/20 μs Short Circuit Current **Shielded cables (direct to outdoor cables):** 1.2/50 μs Open Circuit Voltage 8/20 μs Short Circuit Current **Wired network ports (indoor cables, longer than 30m):** 1.2/50 μs Open Circuit Voltage 8/20 μs Short Circuit Current **Input DC power port (direct to outdoor cables):** 1.2/50 μs Open Circuit Voltage 8/20 μs Short Circuit Current **Input AC power port:** 1.2/50 μs Open Circuit Voltage 8/20 μs Short Circuit Current
Pulse Repetition Rate:	20 sec.
Number of Tests:	5 positive and 5 negative at selected points

a. EUT Power ports:

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

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

b. Wired network ports

- Unshielded unsymmetrical interconnection lines:

The coupling / decoupling networks shall not influence the specified functional conditions of the EUT. The interconnection line between the EUT and the coupling network shall not exceed 2 meters in length.

No line-to-ground surges are applied for double-insulated products (i.e. products without any dedicated earth terminal).

- Unshielded symmetrical interconnection lines:

For symmetrical interconnection lines and high-speed interconnection lines, the CDN shall be selected to match the number of lines/pairs existing the cable. If coupling arrestors are use, test levels below the ignition point of the coupling arrestor cannot be specified.

The interconnection line between the EUT and the coupling/decoupling networks shall not exceed 2 meters in length.

In order to avoid the coupling and decoupling capacitors having a filtering effect on the data transfer, a balanced high frequency design associating the coupling capacitors with coupling chokes is required. Where normal functioning of high speed communications lines cannot be achieved because of the impact of the CDN on the EUT, product committees should specify appropriate operation or that no surge immunity test is required.

- Shielded lines:

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

The length of the cable between the port(s) under test and the device attached to the other end of the cable (AE in Figure 12) shall be:

- 20 m (preferred length) or,
- the shortest length over 10 m, where the manufacturer provides pre-assembled cables used in actual installations.

No test shall be required for cables which according to the manufacturer's specification are ≤ 10 m.

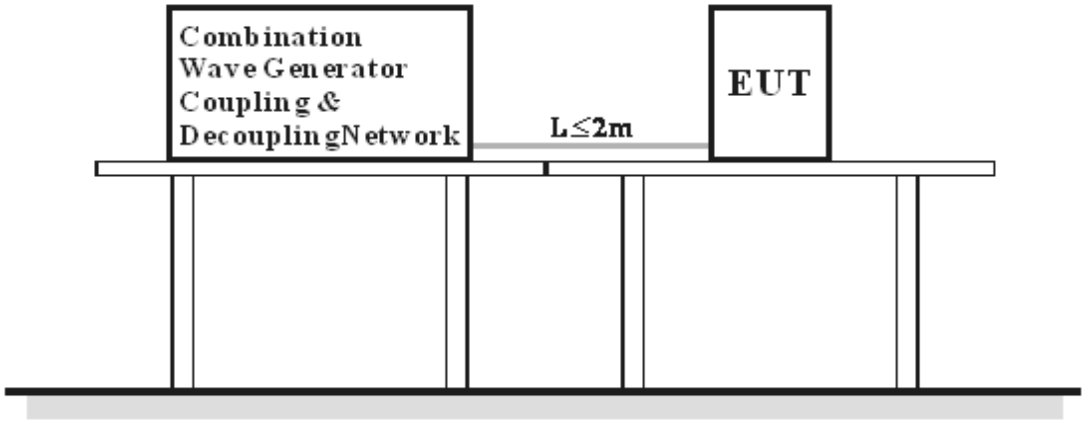
Rules for application of the surge to shielded lines:

a) Shields grounded at both ends:
- the test shall be carried out.

The test level is applied on shields with a 2 Ω generator source impedance and with the 18 μF capacitor.

b) Shields grounded at one end:
- the test shall be carried out according to unshielded unsymmetrical interconnection lines or unshielded symmetrical interconnection lines because the shield does not provide any protection against surges induced by magnetic fields.

For EUTs which do not have metallic enclosures, the surge is applied directly to the shielded cable at the EUT side.



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

6.7 Radio Frequency Common Mode (CS)

Modulation:	1kHz Sine Wave, 80%, AM Modulation
Frequency Step:	1 % of preceding frequency value
Dwell Time	3 seconds

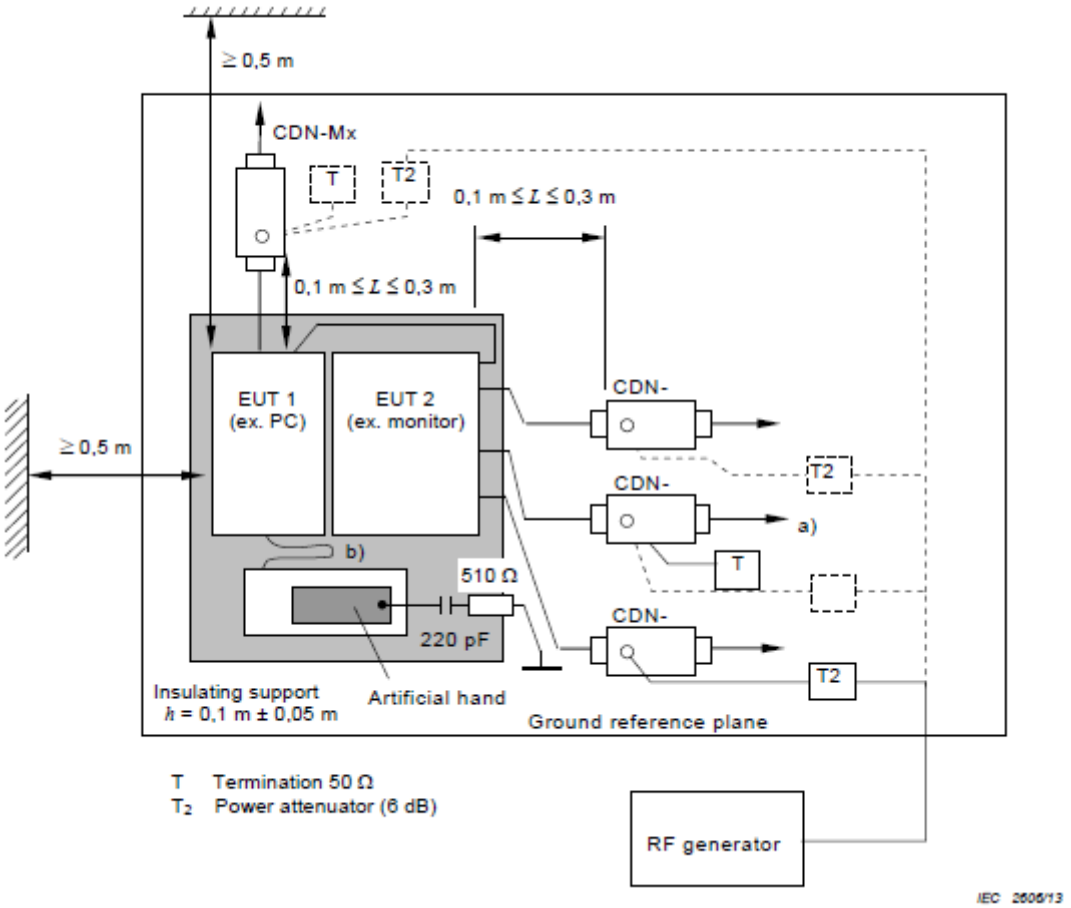
a. The EUT shall be tested within its intended operating and climatic conditions.

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

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

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

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



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

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

Broadband impulse noise disturbances, Repetitive and Isolated (Applicable only to xDSL ports.)

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

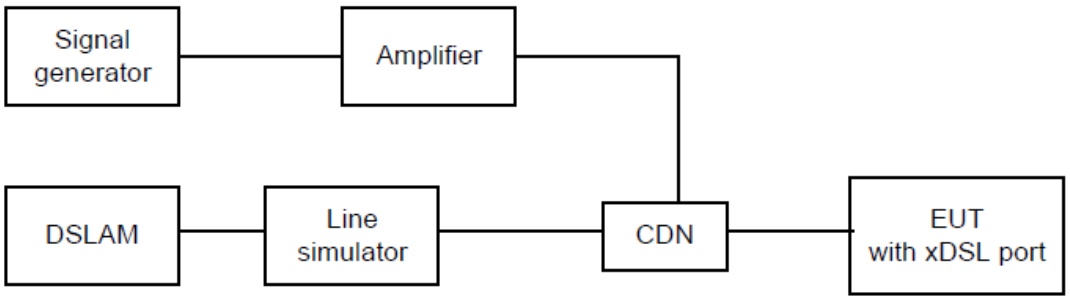
b. An artificial hand was placed on the hand-held accessory and connected to the ground reference plane.

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

d. For the repetitive impulse test the disturbance shall be applied for a period of at least 2 minutes for each port under test.

e. For the isolated impulse test a minimum of 5 isolated impulses shall be applied with an interval of at least 60 seconds between successive impulses.

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



Example schematic of the broadband impulsive conducted disturbances test setup

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

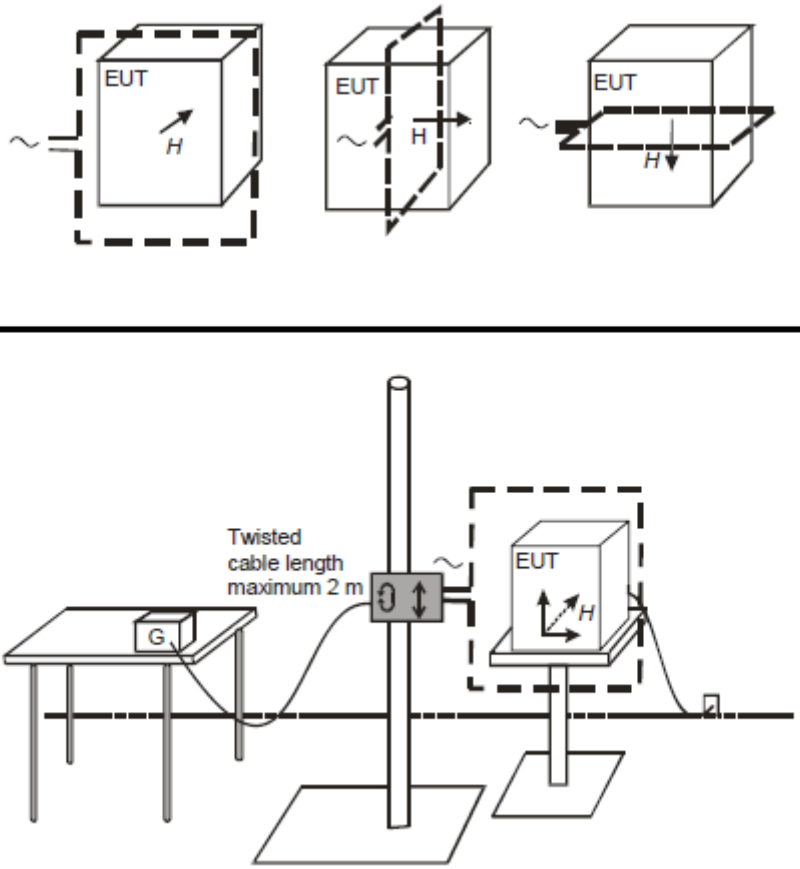
6.8 Power Frequency Magnetic Field (PFMF)

Observation Time:	1 minute
Inductance Coil:	Rectangular coil, 1 m x 1 m (L x W) or 2.6 m x 1 m (L x W)

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

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

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



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

7 Test Results of Test Item

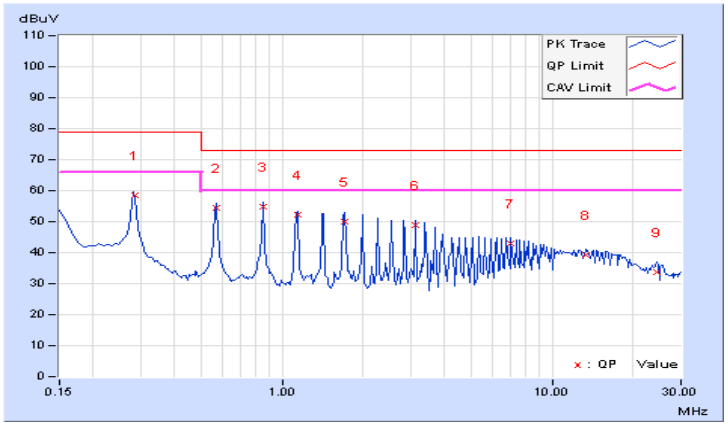
7.1 Conducted Emissions from Power Ports

Frequency Range	150kHz ~ 30MHz	**Detector Function & Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Voltage	12Vdc	**Environmental Conditions**	21℃, 73%RH, 1008mbar
Tested by	Tim Chen		
Test Mode	Mode 1		

Phase Of Power : Positive (+)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.28409	10.01	48.43	44.64	58.44	54.65	79.00	66.00	-20.56	-11.35
2	0.56926	10.05	44.44	41.30	54.49	51.35	73.00	60.00	-18.51	-8.65
3	0.85313	10.06	44.83	41.22	54.89	51.28	73.00	60.00	-18.11	-8.72
4	1.14063	10.07	42.05	38.68	52.12	48.75	73.00	60.00	-20.88	-11.25
5	1.71056	10.08	39.87	35.28	49.95	45.36	73.00	60.00	-23.05	-14.64
6	3.10547	10.16	38.55	31.15	48.71	41.31	73.00	60.00	-24.29	-18.69
7	7.05469	10.29	32.57	24.75	42.86	35.04	73.00	60.00	-30.14	-24.96
8	13.40625	10.44	28.79	26.32	39.23	36.76	73.00	60.00	-33.77	-23.24
9	24.53134	10.73	22.91	17.34	33.64	28.07	73.00	60.00	-39.36	-31.93

Remarks:

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

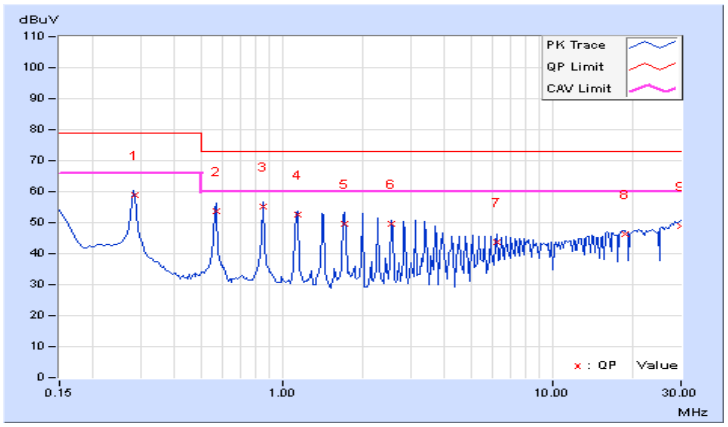


Frequency Range	150kHz ~ 30MHz	**Detector Function & Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Voltage	12Vdc	**Environmental Conditions**	21℃, 73%RH, 1008mbar
Tested by	Tim Chen		
Test Mode	Mode 1		

Phase Of Power : Negative (-)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.28409	10.00	49.06	45.47	59.06	55.47	79.00	66.00	-19.94	-10.53
2	0.57052	10.02	43.82	41.38	53.84	51.40	73.00	60.00	-19.16	-8.60
3	**0.85440**	**10.03**	**45.29**	**41.56**	**55.32**	**51.59**	**73.00**	**60.00**	**-17.68**	**-8.41**
4	1.14063	10.03	42.49	39.04	52.52	49.07	73.00	60.00	-20.48	-10.93
5	1.71056	10.04	39.55	35.22	49.59	45.26	73.00	60.00	-23.41	-14.74
6	2.54297	10.09	39.37	32.67	49.46	42.76	73.00	60.00	-23.54	-17.24
7	6.21094	10.24	33.36	25.95	43.60	36.19	73.00	60.00	-29.40	-23.81
8	18.54161	10.48	35.66	32.10	46.14	42.58	73.00	60.00	-26.86	-17.42
9	29.95300	10.79	38.27	33.76	49.06	44.55	73.00	60.00	-23.94	-15.45

Remarks:

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



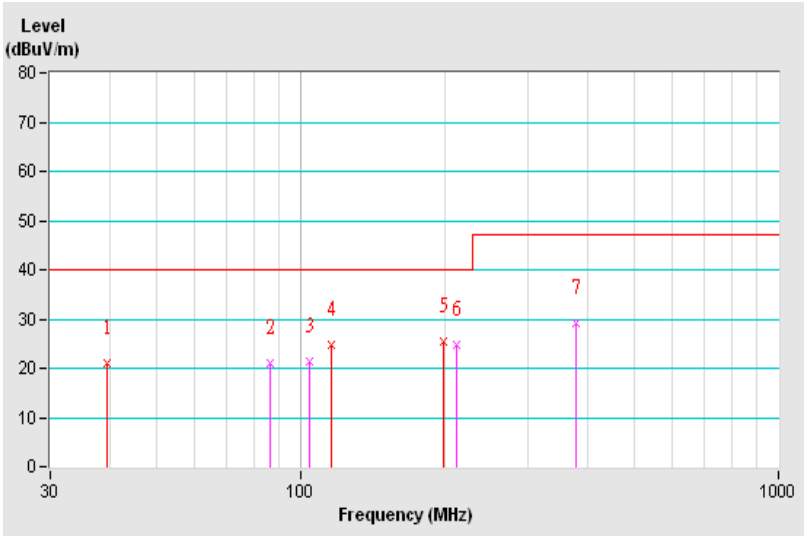
7.2 Radiated Emissions up to 1 GHz

Frequency Range	30MHz ~ 1GHz	**Detector Function & Bandwidth**	Quasi-Peak (QP), 120kHz
Input Voltage	12Vdc	**Environmental Conditions**	17℃, 78%RH, 1009mbar
Tested by	Vincent Lin		
Test Mode	Mode 1		

Antenna Polarity & Test Distance : Horizontal at 10 m								
No	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	39.57	21.06 QP	40.00	-18.94	4.00 H	252	39.22	-18.16
2	86.41	21.12 QP	40.00	-18.88	4.00 H	214	43.93	-22.81
3	104.50	21.51 QP	40.00	-18.49	4.00 H	59	41.54	-20.03
4	115.99	24.83 QP	40.00	-15.17	4.00 H	114	43.87	-19.04
5	198.64	25.38 QP	40.00	-14.62	4.00 H	86	46.00	-20.62
6	212.92	24.63 QP	40.00	-15.37	4.00 H	20	45.33	-20.70
7	378.37	29.31 QP	47.00	-17.69	3.60 H	101	43.13	-13.82

Remarks:

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

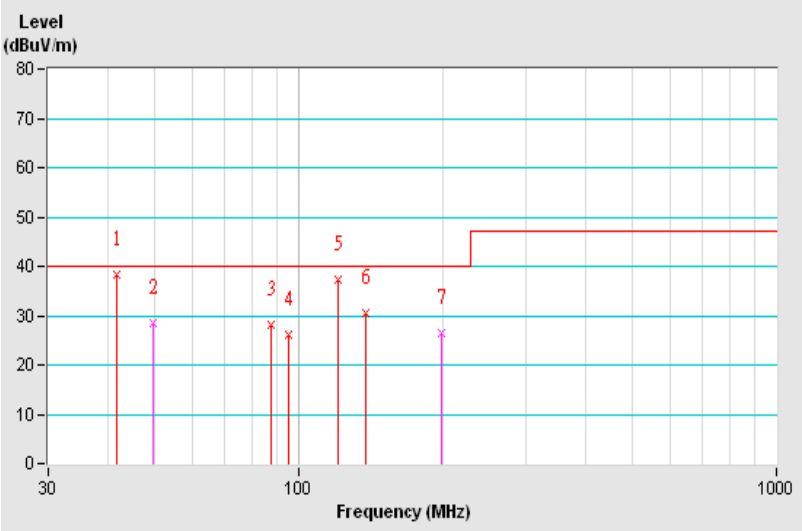


Frequency Range	30MHz ~ 1GHz	Detector Function & Bandwidth	Quasi-Peak (QP), 120kHz
Input Voltage	12Vdc	Environmental Conditions	17℃, 78%RH, 1009mbar
Tested by	Vincent Lin		
Test Mode	Mode 1		

Antenna Polarity & Test Distance : Vertical at 10 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	**41.74**	**38.34 QP**	**40.00**	**-1.66**	**1.00 V**	**86**	**57.72**	**-19.38**
2	49.58	28.35 QP	40.00	-11.65	1.00 V	161	51.83	-23.48
3	88.00	28.08 QP	40.00	-11.92	1.35 V	213	50.74	-22.66
4	95.10	26.15 QP	40.00	-13.85	1.00 V	30	47.45	-21.30
5	121.02	37.18 QP	40.00	-2.82	1.00 V	0	55.80	-18.62
6	138.03	30.39 QP	40.00	-9.61	1.00 V	47	49.05	-18.66
7	199.80	26.29 QP	40.00	-13.71	1.00 V	97	46.87	-20.58

Remarks:

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



7.3 Electrostatic Discharges (ESD)

Test mode	Mode 1	Input Voltage	12Vdc
Environmental Conditions	23 °C, 48% RH 1002 mbar	Tested by	Chiming Li

Test Results of Direct Application					
Discharge Level (kV)	Polarity (+/-)	Test Point	Contact Discharge	Air Discharge	Performance Criteria
2, 4, 8	+/-	1	NA	Note	A
2, 4, 6	+/-	2	Note	NA	A

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

Test Results of Indirect Application					
Discharge Level (kV)	Polarity (+/-)	Test Point	Horizontal Coupling Plane	Vertical Coupling Plane	Performance Criteria
2, 4, 6	+/-	Four Sides	Note	Note	A

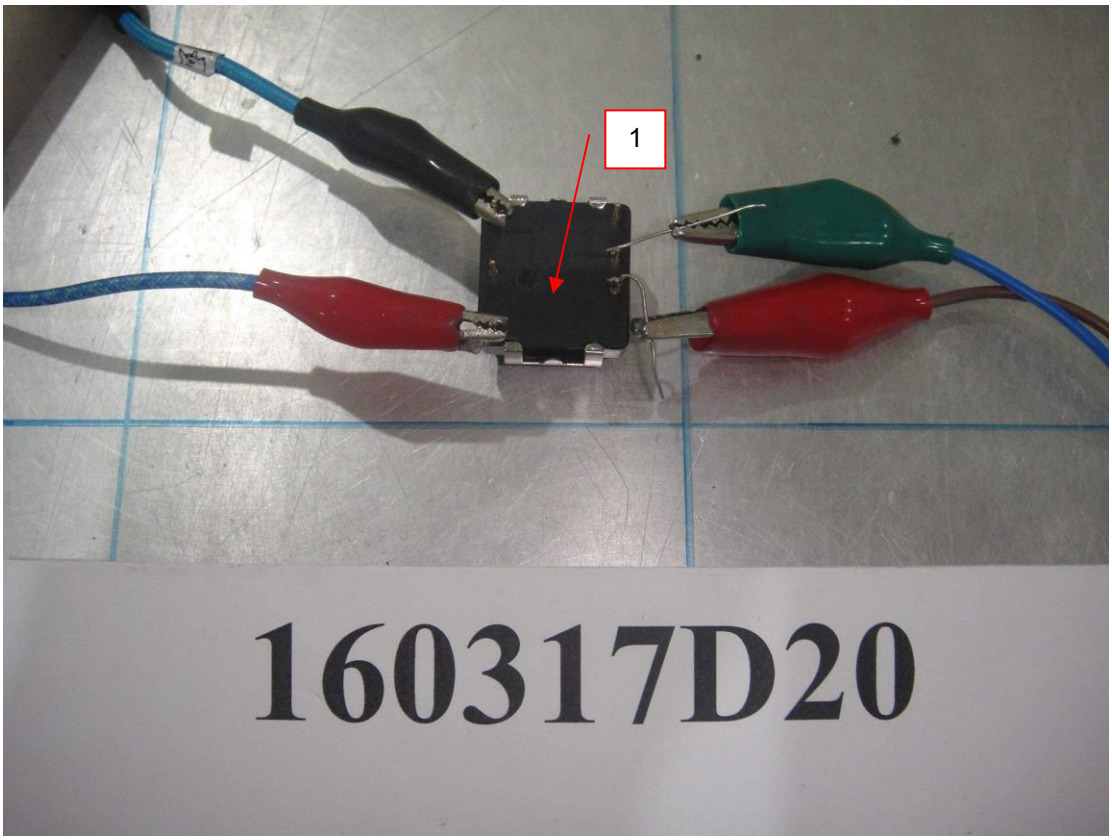
Description of test points of indirect application:

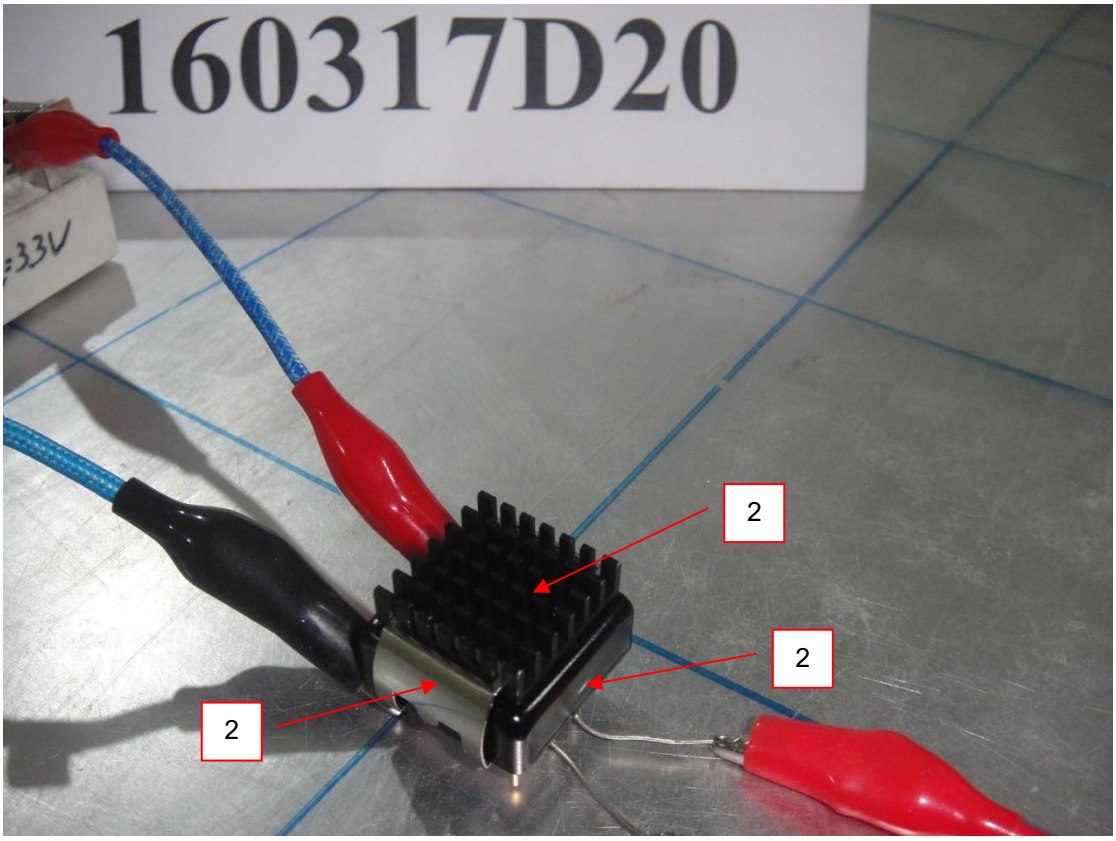
1. Front side 2. Rear side 3. Right side 4. Left side

Please refer to the attached page for description of test points.

Note: The EUT function was correct during the test.

Description of test point

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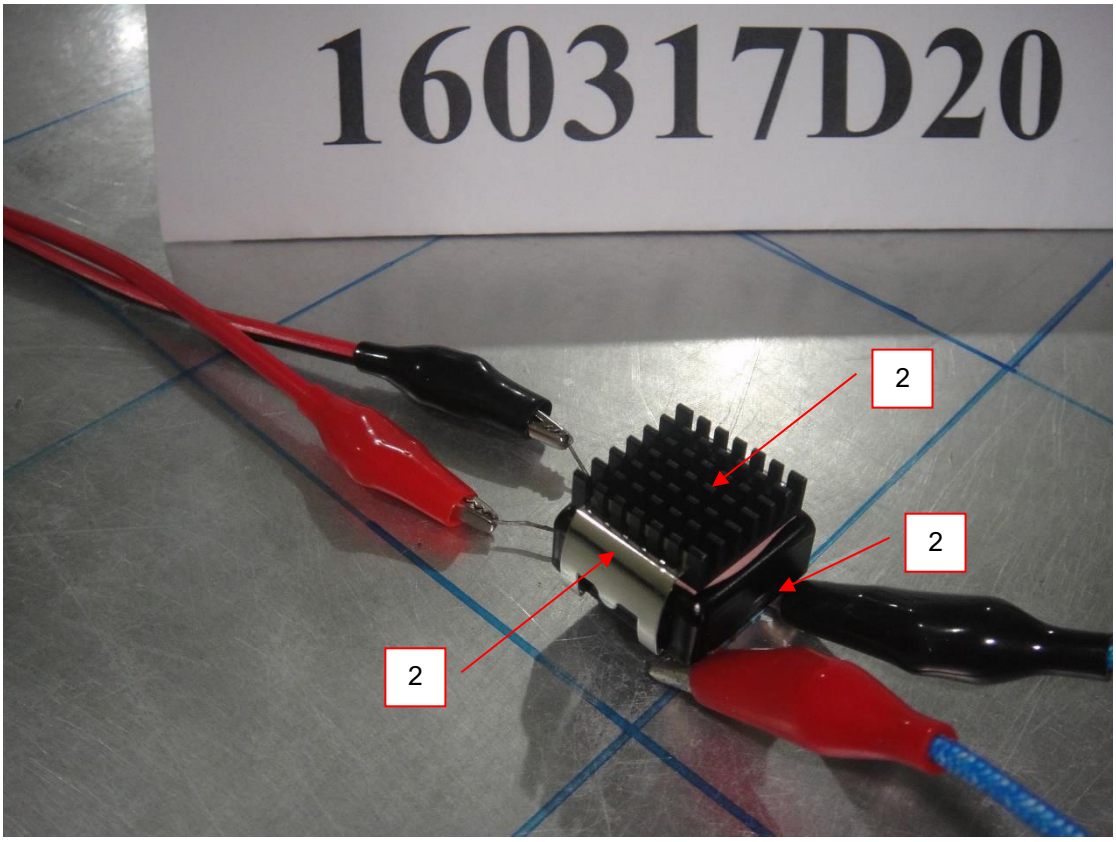
2
2
2


160317D20
2
2
2

7.4 Radio Frequency Electromagnetic Field (RS)

Test mode	Mode 1	Input Voltage	12Vdc
Environmental Conditions	23 °C, 69 % RH	Tested by	Aga Lin

Frequency (MHz)	Polarity	Azimuth(°)	Applied Field Strength		Observation	Performance Criteria
			(V/m)	Modulation		
80 - 1000	V&H	0, 90, 180, 270	3, 10	80% AM (1kHz)	Note	A
1800, 2600, 3500, 5000	V&H	0, 90, 180, 270	3, 10	80% AM (1kHz)	Note	A

Note: The EUT is operated normal during the test.

7.5 Fast Transients Common Mode (EFT)

Test mode	Mode 1	Input Voltage	12Vdc
Environmental Conditions	24°C, 66% RH	Tested by	Jiannren Hsieh

Input DC power port				
Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criteria
0.5, 2	(+)	+/-	Note	A
0.5, 2	(-)	+/-	Note	A
0.5, 2	(+)–(-)	+/-	Note	A

Note: The EUT function was correct during the test.

7.6 Surges

Test mode	Mode 1	Input Voltage	12Vdc
Environmental Conditions	25 °C, 56% RH	Tested by	Joey Liu

Input DC power port				
Voltage (kV)	Test Point	Polarity (+/-)	Observation	Performance Criteria
0.5, 1	(+)–(-)	+/-	Note	A

Note: The EUT function was correct during the test.

7.7 Radio Frequency Common Mode (CS)

Test mode	Mode 1	Input Voltage	12Vdc
Environmental Conditions	21 °C, 73 % RH	Tested by	Michael Cheng

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

Note: The EUT is operated normal during the test.

7.8 Power Frequency Magnetic Field (PFMF)

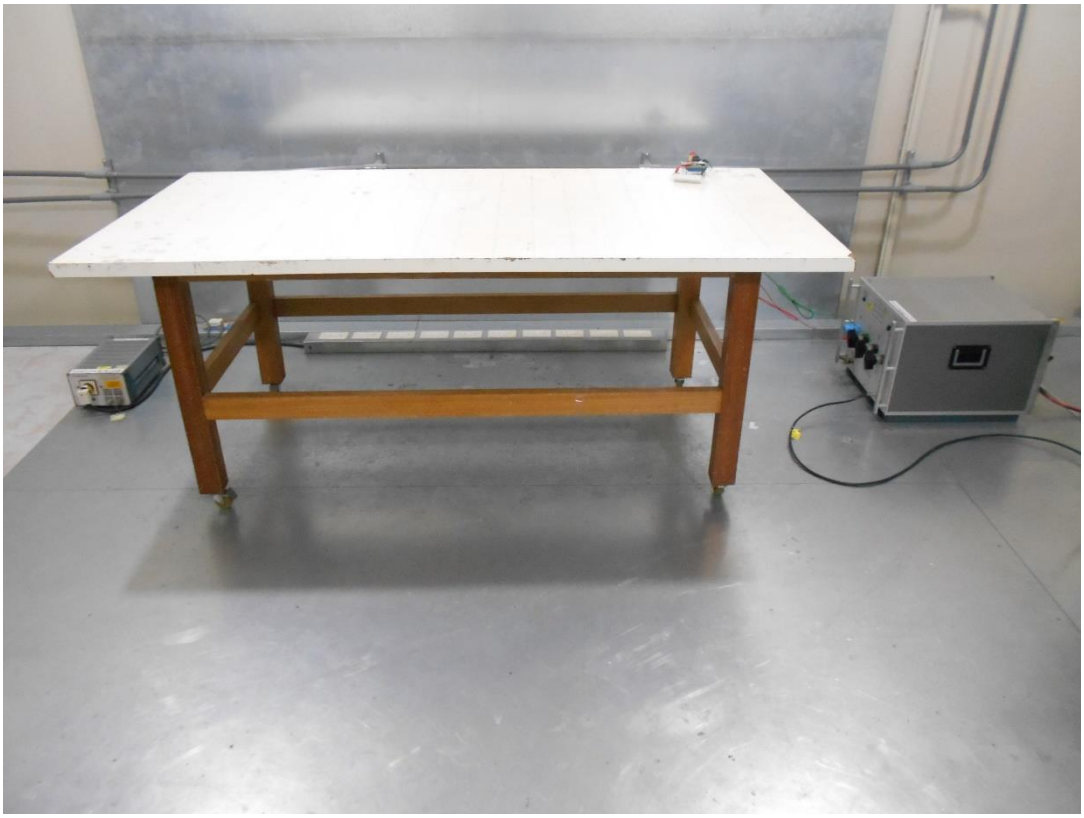
Test mode	Mode 1	Input Voltage	12Vdc
Environmental Conditions	26°C, 54% RH	Tested by	Joey Liu

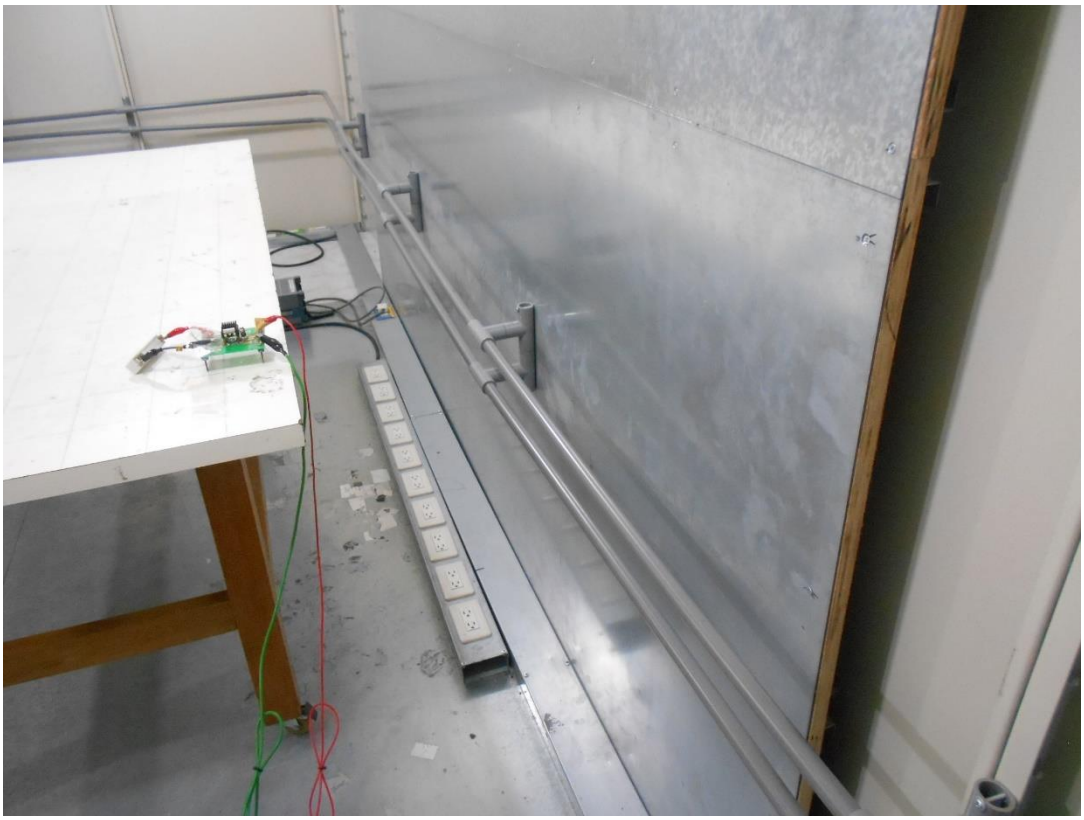
Application	Frequency (Hz)	Field Strength (A/m)	Observation	Performance Criteria
X - Axis	50	1, 3	Note	A
Y - Axis	50	1, 3	Note	A
Z - Axis	50	1, 3	Note	A

Note: The EUT function was correct during the test.

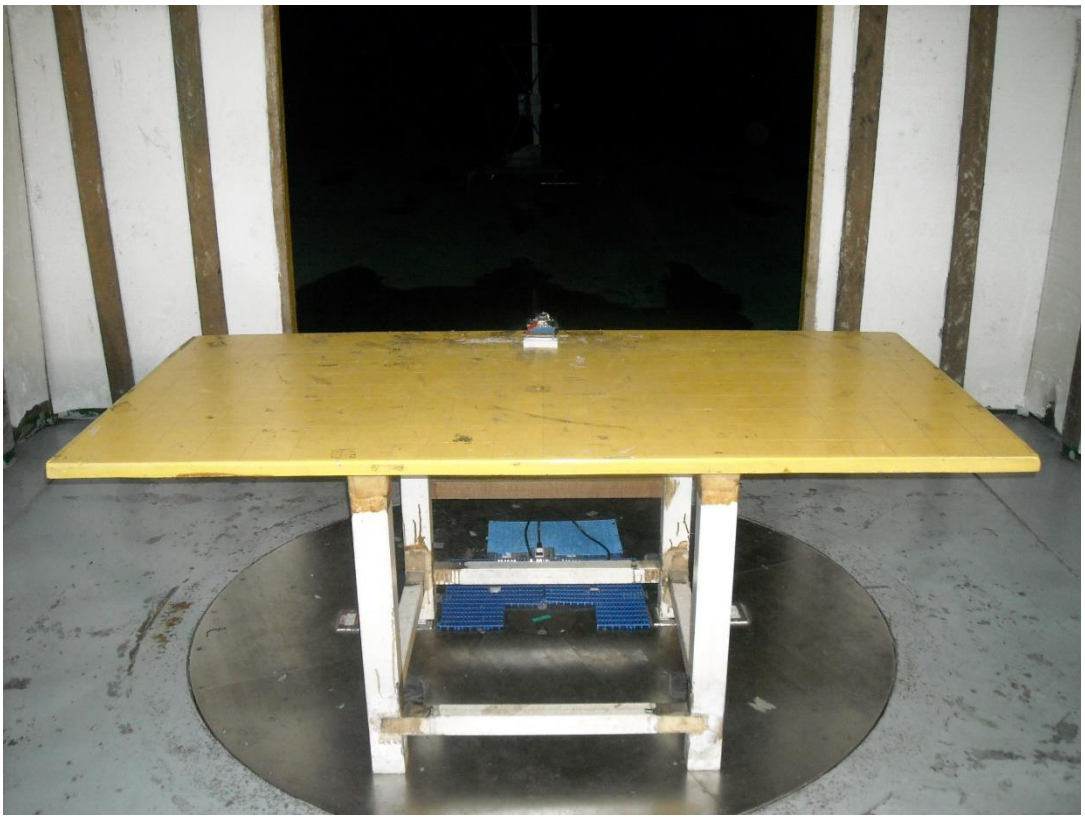
8 Pictures of Test Arrangements

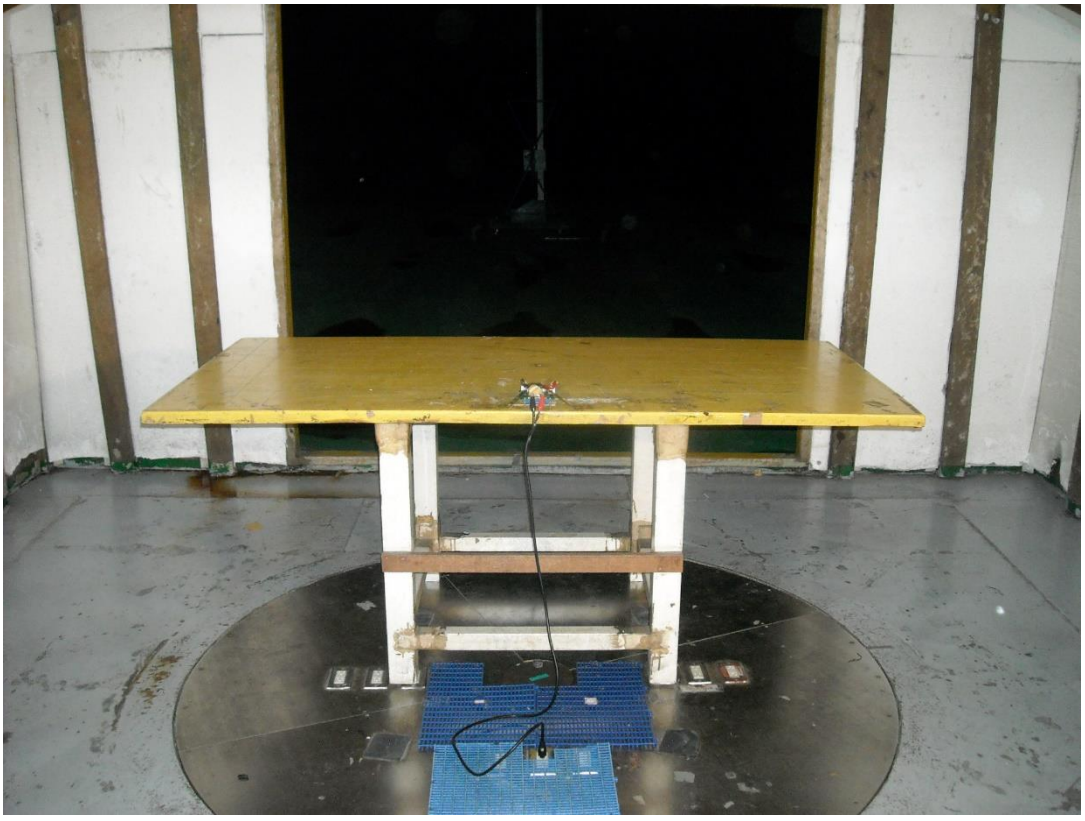
8.1 Conducted Emissions from Power Ports



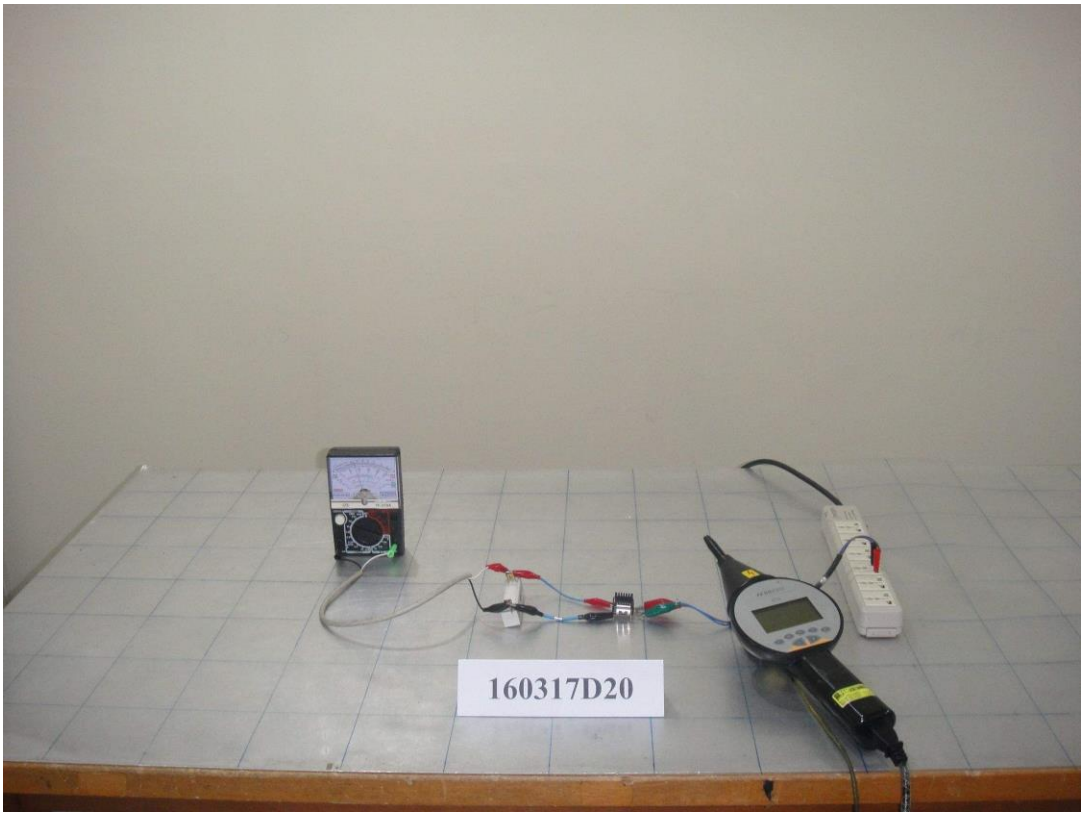


8.2 Radiated Emissions up to 1 GHz

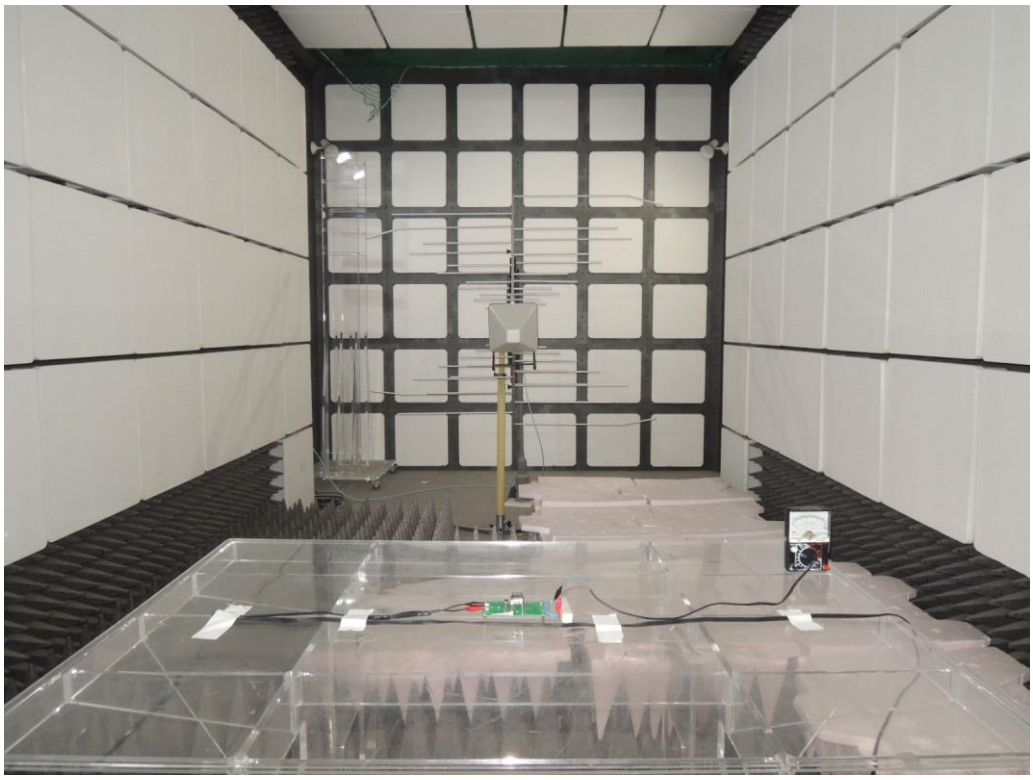


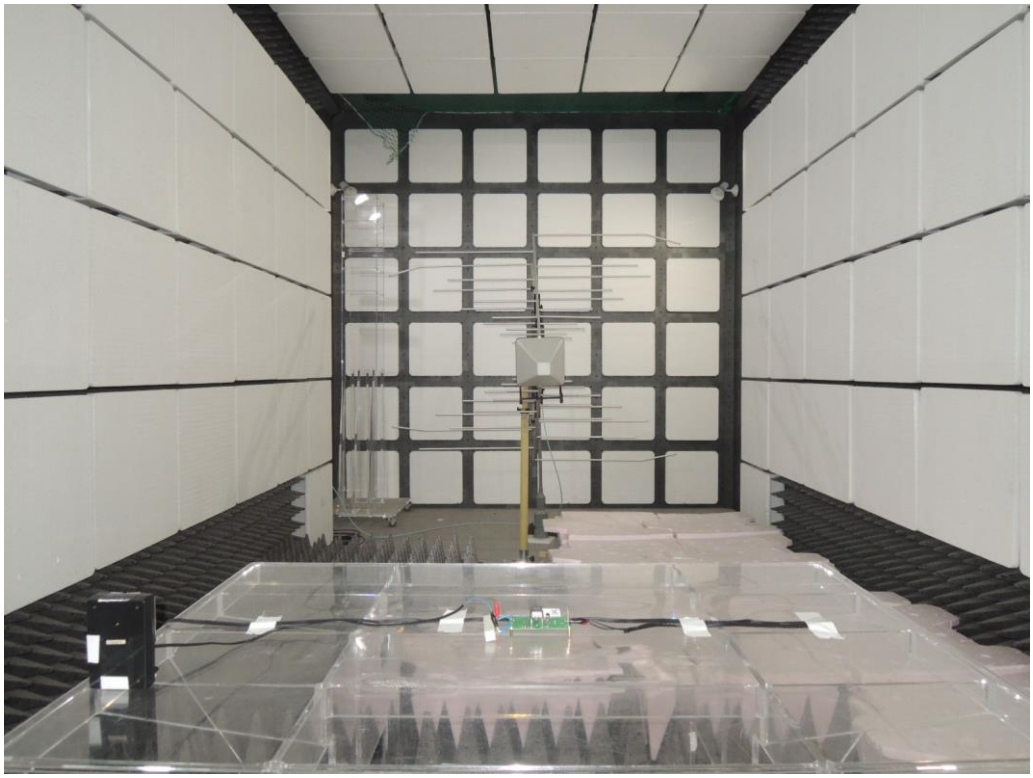


8.3 Electrostatic Discharges (ESD)



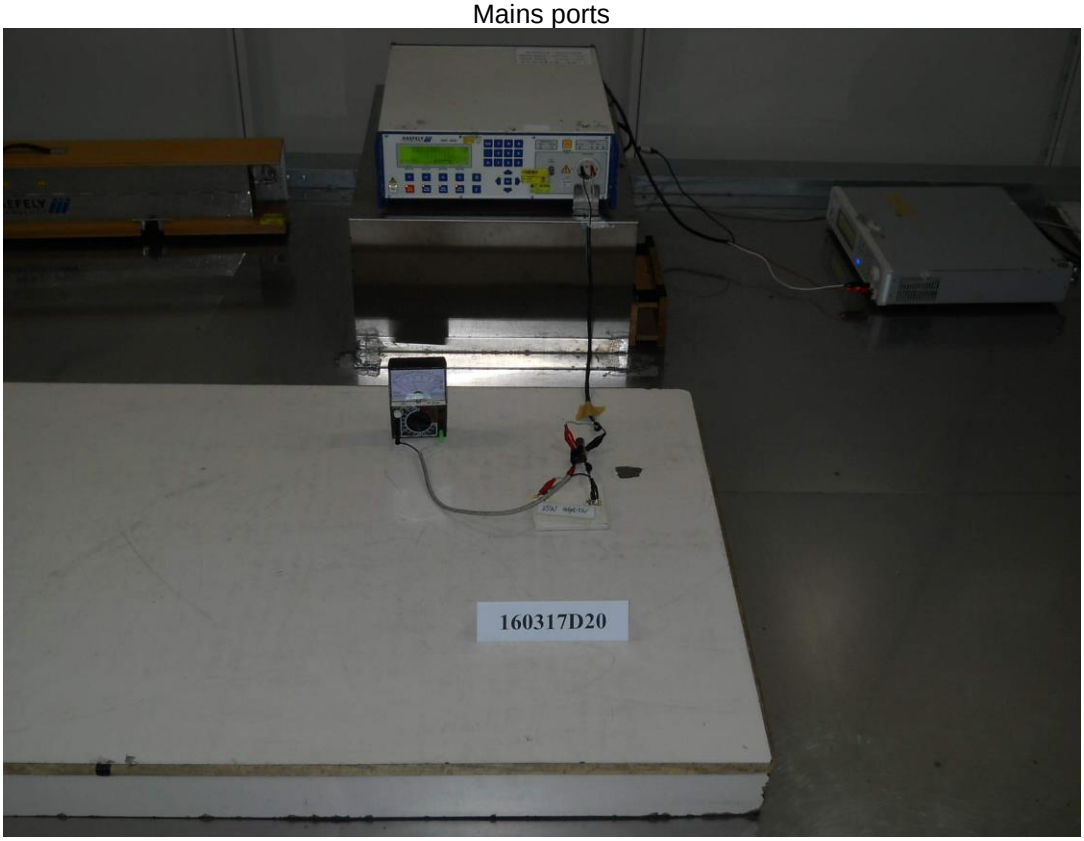
8.4 Radio Frequency Electromagnetic Field (RS)



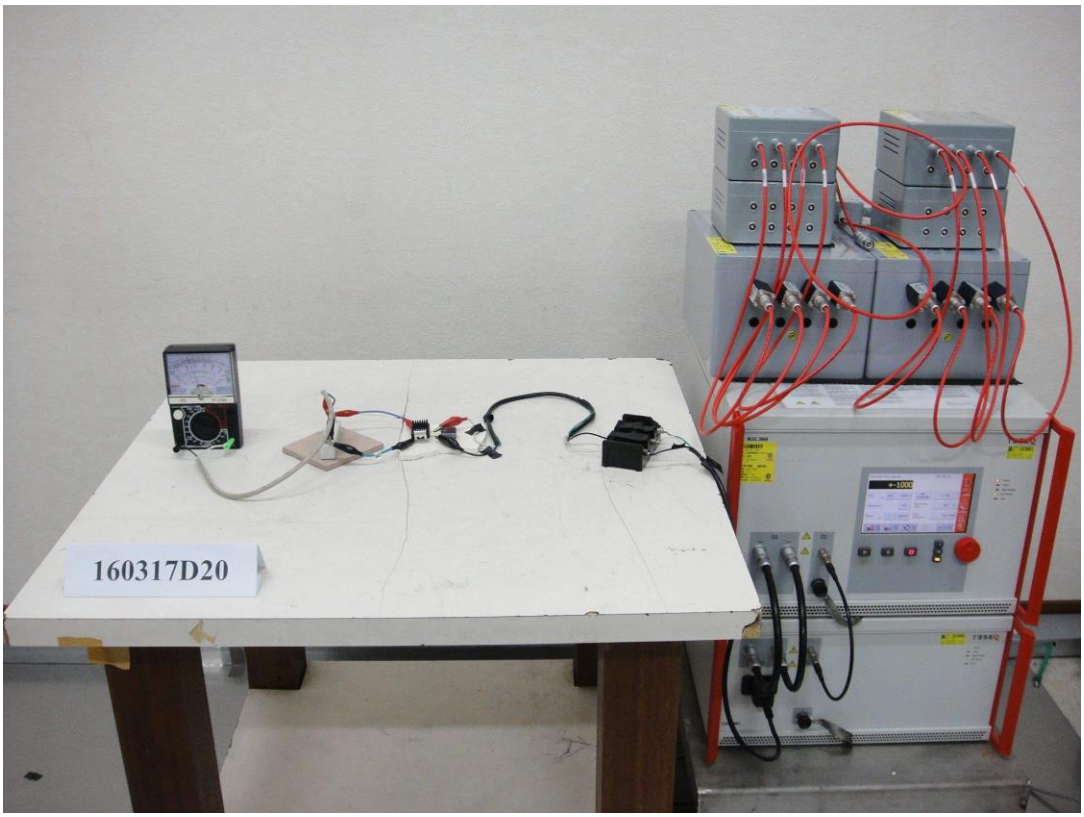


8.5 Fast Transients Common Mode (EFT)

Mains ports

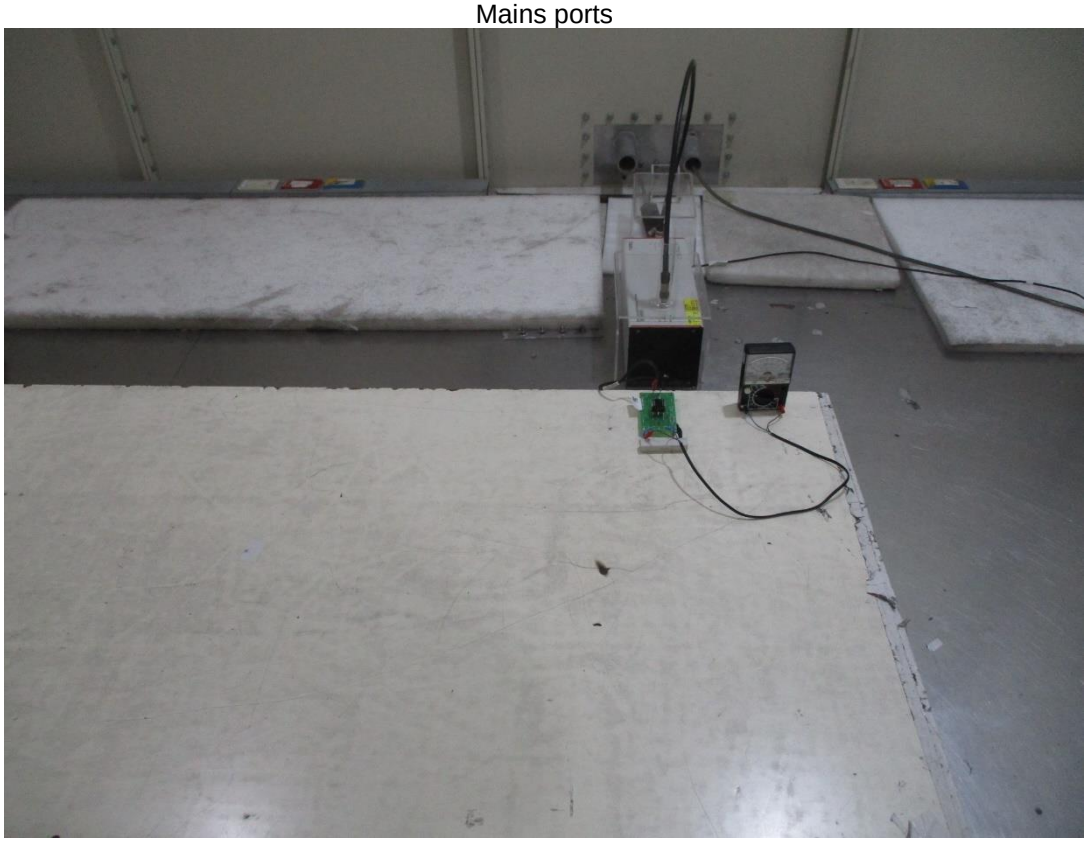


8.6 Surges

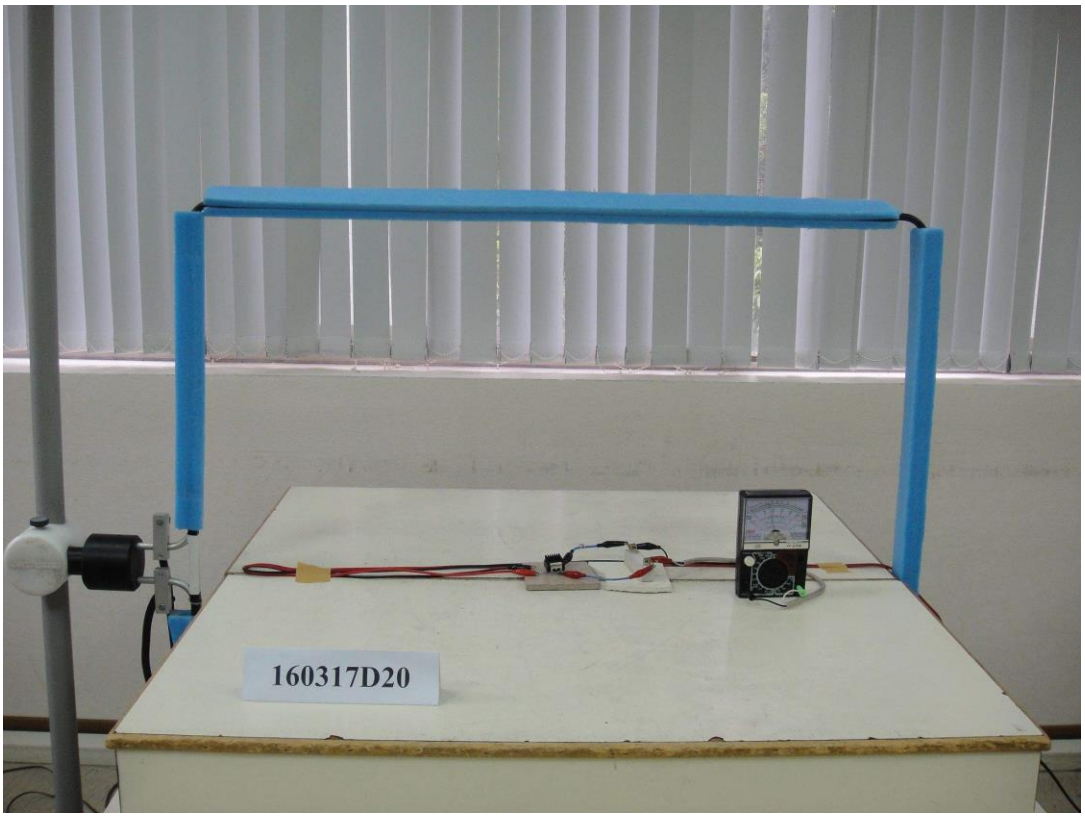


8.7 Radio Frequency Common Mode (CS)

Mains ports



8.8 Power Frequency Magnetic Field (PFMF)



9 Information of the Testing Laboratories

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

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

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