

TEST REPORT

CERTIFICATE OF CONFORMITY

Standards: EN 301 489-1 V2.2.3 (2019-11)
EN 301 489-17 V3.2.4 (2020-09)

Report No.: RMBBUI-WTW-P21040655

Model No.: RTL8852BE

Received Date: Apr. 21, 2021

Test Date: May 20 to 21, 2021

Issued Date: July 22, 2021

Applicant: Realtek Semiconductor Corp.

Address: No. 2, Innovation Road II, Hsinchu Science Park, Hsinchu 300, Taiwan

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory

Lab Address: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan

Test Location (1): E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300, Taiwan

Test Location (2): No. 49, Ln. 206, Wende Rd., Shangshan Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan.

Approved by :  , **Date:** July 22, 2021

Ken Lu / Manager

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Prepared by : Cherry Chuo / Specialist

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Release Control Record

Issue No.	Description	Date Issued
RMBBUI-WTW-P21040655	Original release.	July 22, 2021

1 Certification

Product: 11ax RTL8852BE Combo module

Brand: REALTEK

Test Model: RTL8852BE

Sample Status: Engineering sample

Applicant: Realtek Semiconductor Corp.

Test Date: May 20 to 21, 2021

Standards: EN 301 489-1 V2.2.3 (2019-11)

EN 301 489-17 V3.2.4 (2020-09)

Measurement procedure: EN 55032:2015 +A11:2020, Class B

EN 61000-4-2:2009

EN 61000-4-3:2006 +A1:2008 +A2:2010

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 needs to perform according to its interfaces and functions evaluation are as follows:

Standard	Test Item	Result	Remarks
EN 55032	Radiated Emissions up to 1 GHz	Pass	Minimum passing Class B margin is -3.03 dB at 99.94 MHz
	Radiated Emissions above 1 GHz	Pass	Minimum passing Class B margin is -22.74 dB at 5757.66 MHz
EN 61000-4-2	Electrostatic Discharges (ESD)	Pass	Performance Criteria A
EN 61000-4-3	Radio Frequency Electromagnetic Field (RS)	Pass	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

For the purpose of the present document two categories of performance criteria apply:

- Performance criteria for **Continuous Phenomena (CP)**.
- Performance criteria for **Transient Phenomena (TP)**.

NOTE: Normally, the performance criteria depends upon the type of radio equipment and/or its intended application.

Performance criteria for Continuous Phenomena (CP)

During the test, the equipment shall:

- continue to operate as intended;
- not unintentionally transmit;
- not unintentionally change its operating state;
- not unintentionally change critical stored data.

Performance criteria for Transient Phenomena (TP)

For all ports and transient phenomena with the exception described below, the following applies:

- The application of the transient phenomena shall not result in a change of the mode of operation (e.g. unintended transmission) or the loss of critical stored data.
- After application of the transient phenomena, the equipment shall operate as intended.

For surges applied to symmetrically operated wired network ports intended to be connected directly to outdoor lines the following criteria applies:

- For products with only one symmetrical port intended for connection to outdoor lines, loss of function is allowed, provided the function is self-recoverable, or can be otherwise restored. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.
- For products with more than one symmetrical port intended for connection to outdoor lines, loss of function on the port under test is allowed, provided the function is self-recoverable. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

For a 70 % residual voltage dip and voltage interruption tests, the following performance criteria apply:

- in the case where the equipment is fitted with or connected to a battery back-up, the performance criteria for transient phenomena (TP);
- in the case where the equipment is powered solely from the AC mains supply (without the use of a parallel battery back-up) volatile user data may have been lost and if applicable the communication link need not to be maintained and lost functions should be recoverable by user or operator;
- no unintentional responses shall occur at the end of the test, when the voltage is restored to nominal;
- in the event of loss of function(s) or in the event of loss of user stored data, this fact shall be recorded.

Product Specific Performance Criteria

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

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

EN 301 489-17, Broadband Data Transmission Systems

The Performance criteria are:

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

The equipment shall meet the minimum performance criteria as specified in the following below Table A.

Table A: Performance criteria

Criteria	During test	After test (i.e. as a result of the application of the test)
A	Shall operate as intended. (See NOTE). Shall be no loss of function. Shall be no unintentional transmissions.	Shall operate as intended. Shall be no degradation of performance. Shall be no loss of function. Shall be no loss of critical stored data.
B	May be loss of function.	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no loss of critical stored data.
C	May be loss of function.	Functions shall be recoverable by the operator. Shall operate as intended after recovering. Shall be no loss of critical stored data.

NOTE: Operate as intended during the test allows a level of degradation in accordance with minimum performance level.

● Minimum performance level

For equipment that supports a PER or FER, the minimum performance level shall be a PER or FER less than or equal to 10 %.

For equipment that does not support a PER or a FER, the minimum performance level shall be no loss of the wireless transmission function needed for the intended use of the equipment.

● Performance criteria for Continuous phenomena

The performance criteria A shall apply.

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

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

● Performance criteria for Transient phenomena

The performance criteria B shall apply, except for voltage dips greater than or equal to 100 ms and voltage interruptions of 5 000 ms duration, for which performance criteria C shall apply.

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

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

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	Expanded Uncertainty (k=2) (\pm)	Maximum allowable uncertainty (\pm)
Radiated Emissions up to 1 GHz	4.1 dB	6.3 dB (U_{CISPR})
Radiated Emissions above 1 GHz	4.5 dB	5.2 dB (U_{CISPR})

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

2.3 Supplementary Information

There is not any deviation from the test standards for the test method, and no modifications required for compliance.

3 General Information

3.1 Description of EUT

Product	11ax RTL8852BE Combo module
Brand	REALTEK
Test Model	RTL8852BE
Sample Status	Engineering sample
Operating Software	NA
Power Supply Rating	3.3Vdc from host equipment
Accessory Device	NA
Data Cable Supplied	NA

Note : The EUT does not support a PER or a FER when BT function is normal operation.

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 6000 MHz, provided by Realtek Semiconductor Corp., 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 Realtek Semiconductor Corp., for detailed feature description, please refer to the manufacturer's specifications or user's manual.

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

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

For Radiated emission test, EUT has been pre-tested under following test modes, test mode A was the worst case for final test.

Mode	Radiated emission test		
	Test Condition	Antenna Type	HW SKU Configuration
A	2.4G+BT	Dipole	USB interface + dual antenna port
B	5G+BT	Dipole	USB interface + dual antenna port
C	2.4G+BT	Dipole	UART interface + dual antenna port
D	2.4G+BT	Dipole	USB interface + single antenna port
E	2.4G+BT	PIFA	USB interface + dual antenna port

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

Test modes are presented in the report as below.

Mode	Radiated emission test		
	Test Condition	Antenna Type	HW SKU Configuration
1	2.4G+BT	Dipole	USB interface + dual antenna port
Mode	Immunity tests		
	Test Condition	Antenna Type	HW SKU Configuration
1	2.4G+BT	Dipole	USB interface + dual antenna port
2	5G+BT	Dipole	USB interface + dual antenna port

3.5 Test Program Used and Operation Descriptions

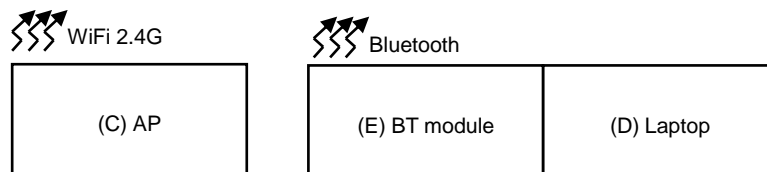
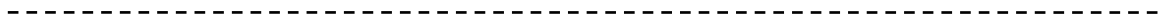
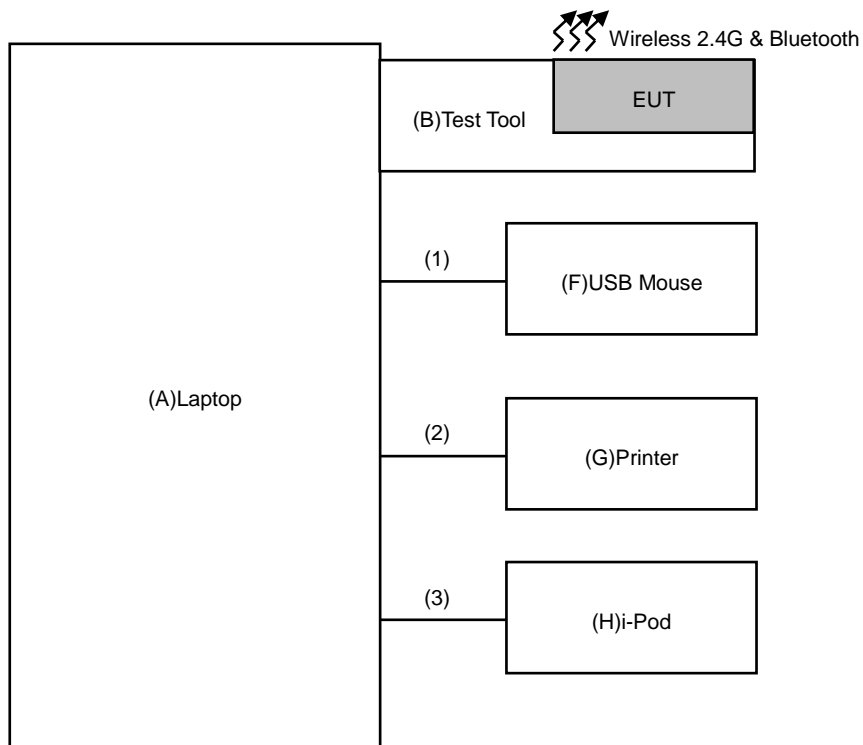
For Radiated Test

- 1 Turn on the power of all equipment.
- 2 Support unit A (Laptop) runs "ping.exe" programs to communicate with support unit C (AP) via EUT wireless 2.4G link.
- 3 Support units A & D (Laptop) runs "BTdebugTool.exe" programs to communicate via Bluetooth link.
- 4 Support unit A (Laptop) runs "EMC test.exe" then sends "Color bar" video to itself.

For Immunity Test

- 1 Turn on the power of all equipment.
- 2 Support unit A (Laptop) runs "iperf.exe" programs to communicate with support unit C (AP) via EUT wireless 2.4G or 5G link, and observed support unit A(Laptop)& support unit C (AP) a PER, the minimum performance level shall be a PER less than or equal to 10 %..
- 3 Support units A & D (Laptop) runs "BTdebugTool.exe" programs to communicate via Bluetooth link.

3.6 Connection Diagram of EUT and Peripheral Devices



3.7 Configuration of Peripheral Devices and Cable Connections

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A	Laptop	Dell	E5420	DRBHKV1	NA	Provided by Lab
B	Test tool	NA	NA	NA	NA	Supplied by applicant
C	AP	ASUS	RT-AX88U	NA	NA	Provided by Lab
D	BT module	Realtek	RTL8852AE	NA	NA	Supplied by applicant
E	Laptop	Dell	E5420	FHP94S1	NA	Provided by Lab
F	USB Mouse	DELL	M056UOA	FOROBF9	DoC	Provided by Lab
G	Printer	EPSON	LQ-300+II	G88Y074085	DoC	Provided by Lab
H	i-Pod	Apple	MD778TA/A	CC4JMH7LF4T1	NA	Provided by Lab

Note:

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

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1	USB Cable	1	1.8	Yes	0	Provided by Lab
2	USB Cable	1	1.8	Yes	0	Provided by Lab
3	USB Cable	1	0.1	Yes	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 Radiated Emissions up to 1 GHz

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY50010125	Apr. 09, 2021	Apr. 08, 2022
Test Receiver Agilent	N9038A	MY50010132	June 30, 2020	June 29, 2021
Pre-Amplifier Sonoma	310N	352925	Aug. 25, 2020	Aug. 24, 2021
	310N	352926	Aug. 25, 2020	Aug. 24, 2021
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-359	Nov. 05, 2020	Nov. 04, 2021
	VULB 9168	9168-358	Nov. 04, 2020	Nov. 03, 2021
Fixed attenuator Mini-Circuits	UNAT-5+	CHF-001	Sep. 02, 2020	Sep. 01, 2021
	UNAT-5+	CHF-002	Sep. 02, 2020	Sep. 01, 2021
RF Cable	8D-FB	CHFCAB-001-1 CHFCAB-001-3 CHFCAB-001-4	Sep. 14, 2020	Sep. 13, 2021
		CHFCAB-002-1 CHFCAB-002-3 CHFCAB-002-4	Sep. 14, 2020	Sep. 13, 2021
Software BVADT	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table CT	NA	NA	NA	NA

Note:

1. The test was performed in HC - 10m Chamber 1
2. The VCCI Site Registration No. is R-13252.
3. Tested Date: May 21, 2021

4.2 Radiated Emissions above 1 GHz

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY50010125	Apr. 09, 2021	Apr. 08, 2022
Pre-Amplifier Agilent	8449B	3008A01975	Feb. 18, 2021	Feb. 17, 2022
Horn Antenna SCHWARZBECK	BBHA 9120D	D123	Nov. 22, 2020	Nov. 21, 2021
RF Coaxial Cable EMCI	EMC104-SM-SM-11000	170209	Mar. 03, 2021	Mar. 02, 2022
RF Coaxial Cable EMCI	EMC104-SM-SM-6000	170207	Mar. 03, 2021	Mar. 02, 2022
RF Coaxial Cable EMCI	EMC104-SM-SM-2500	170206	Mar. 03, 2021	Mar. 02, 2022
Software BVADT	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table CT	NA	NA	NA	NA

Note:

1. The test was performed in HC - 10m Chamber 1
2. The VCCI Chamber F Registration No. is G-10136.
3. The 3dB beamwidth of the horn antenna is minimum 27 degree (or $w = 1.44m$ at 3m distance) for 1~6 GHz.
4. Tested Date: May 21, 2021

4.3 Electrostatic Discharge (ESD)

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
ESD Simulator NoiseKen	ESS-2002	ESS0625212/244	Apr. 07, 2021	Apr. 06, 2022

Note:

1. The test was performed in ESD-1 room
2. Tested Date: May 20, 2021

4.4 Radio Frequency Electromagnetic Field (RS)

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

1. The test was performed in Chamber RS-1Room.
2. The transmit antenna was located at a distance of 3.0 meters from the EUT.
- 3 Tested Date: May 20, 2021

5 Limits of Test Items

For equipment intended to be used exclusively in an industrial environment or a telecommunication centre the class A limits can be used.

5.1 Radiated Emissions up to 1 GHz

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

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

5.2 Radiated Emissions above 1 GHz

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

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

Frequency Range of Radiated Measurement (For unintentional radiators)

Highest internal frequency (F_x) (MHz)	Highest measurement frequency (F_M) (GHz)
$F_x \leq 108 \text{ MHz}$	1
$108 \text{ MHz} < F_x \leq 500 \text{ MHz}$	2
$500 \text{ MHz} < F_x \leq 1 \text{ GHz}$	5
$F_x > 1 \text{ GHz}$	$5 \times F_x$ up to a maximum of 6 GHz

F_x is the highest fundamental frequency generated and/or used in the ITE or digital apparatus under test.

5.3 General immunity requirements

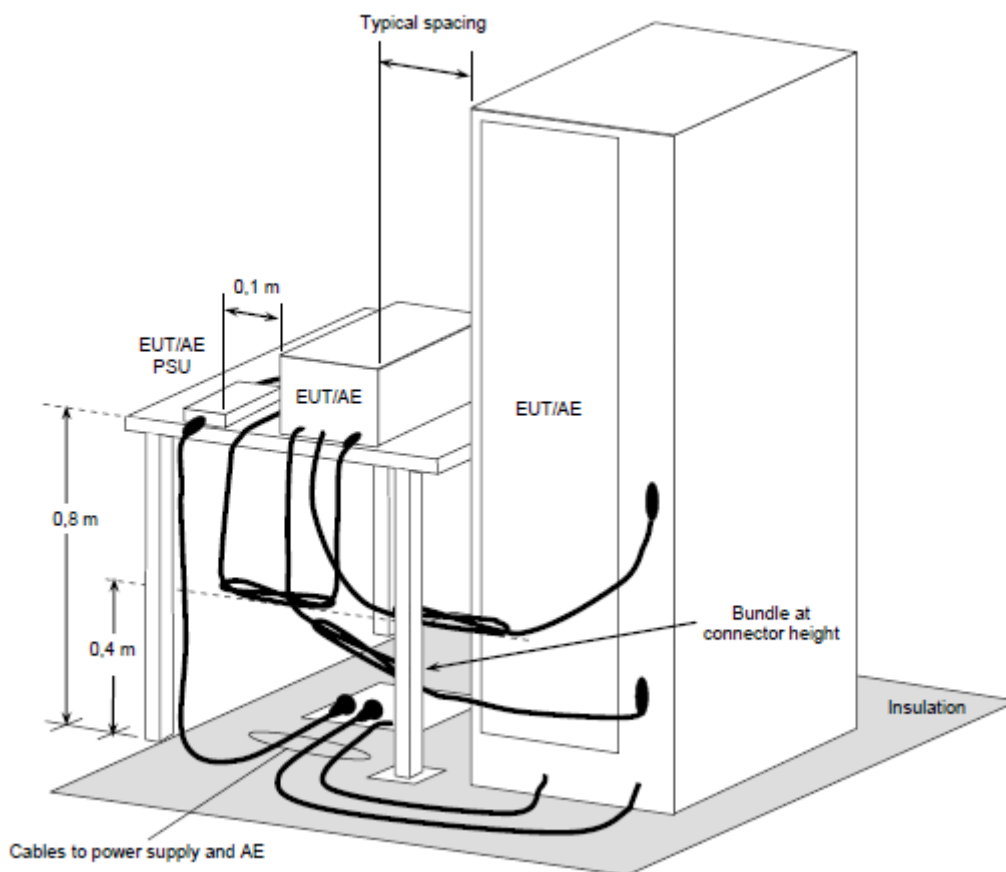
Port	Basic Standard	Test item	Test specification	Performance criteria
Enclosure	EN 61000-4-2	Electrostatic Discharge (ESD)	±4 kV (contact) ±8 kV (Air)	TP (B)
	EN 61000-4-3	Radio Frequency Electromagnetic Field (RS)	80 to 6000(MHz), 3 V/m, 80 % AM (1 kHz)	CP (A)
Power input (AC)	EN 61000-4-4	Fast Transients, Common Mode (EFT)	±1 kV 5/50 ns (Tr/Th) 5 kHz, repetition frequency	TP (B)
	EN 61000-4-5	Surge	In telecom centres: line to line: ±0.5 kV, 1.2/50 µs line to earth: ±1 kV, 1.2/50 µs In others location: line to line: ±1 kV, 1.2/50 µs line to earth: ±2 kV, 1.2/50 µs	TP (B)
	EN 61000-4-6	Radio Frequency, Common Mode (CS)	0.15 to 80(MHz), 3 V, 80 % AM (1 kHz)	CP (A)
	EN 61000-4-11	Voltage dips and interruptions (DIP)	Voltage Dips: 0% residual voltage, 0.5 cycle 0% residual voltage, 1 cycle 70% residual voltage, 25 cycles (at 50Hz) EUT with battery back-up EUT without battery back-up Voltage Interruption: 0% residual voltage, 250 cycles (at 50 Hz) EUT with battery back-up EUT without battery back-up	TP (B) TP (B) TP (B) C TP (B) C
DC power/ Wired network and Signal/ Control port	EN 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	TP (B)
	EN 61000-4-5	Surge	Wired network ports (directly connected to outdoor cables): Symmetrically operated: lines to earth: ±1 kV, 10/700 µs Non-symmetrically operated: line to line: ±0.5 kV, 1.2/50µs line to earth, or shield to ground: ±1 kV, 1.2/50µs Wired network ports (indoor cables, longer than 30 m): line to earth, or shield to ground: ±0.5 kV, 1.2/50 µs	TP (B)
	EN 61000-4-6	Radio Frequency, Common Mode (CS)	0.15 to 80(MHz), 3 V, 80 % AM (1 kHz)	CP (A)

6 Test Arrangements

6.1 Radiated Emissions up to 1 GHz

- For the table-top EUT is placed on a 0.8 meter to the top of rotating table; for the 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.
- The EUT is set 10 meters away from the interference-receiving antenna, which is mounted on the top of a variable-height antenna tower.
- 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.
- 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.
- 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.

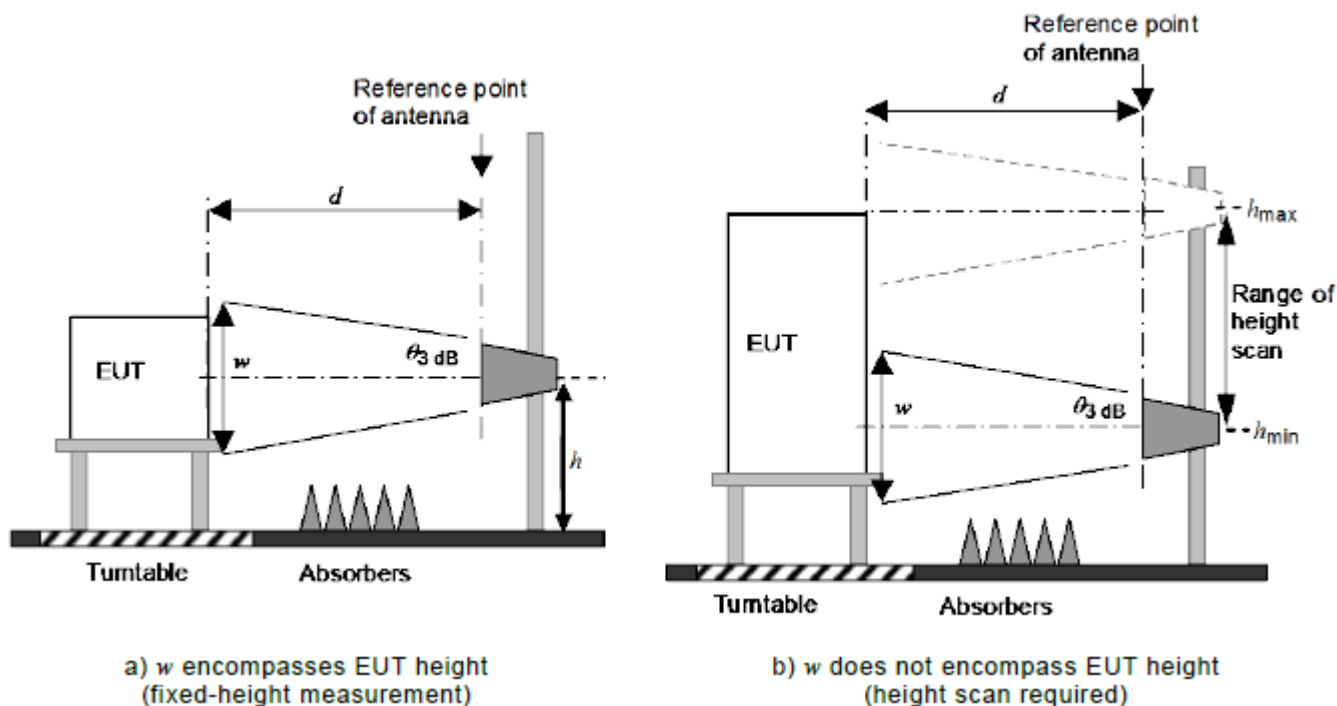


For the actual test configuration, please refer to the related Item – Photographs of the Test Configuration.

6.2 Radiated Emissions above 1 GHz

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

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



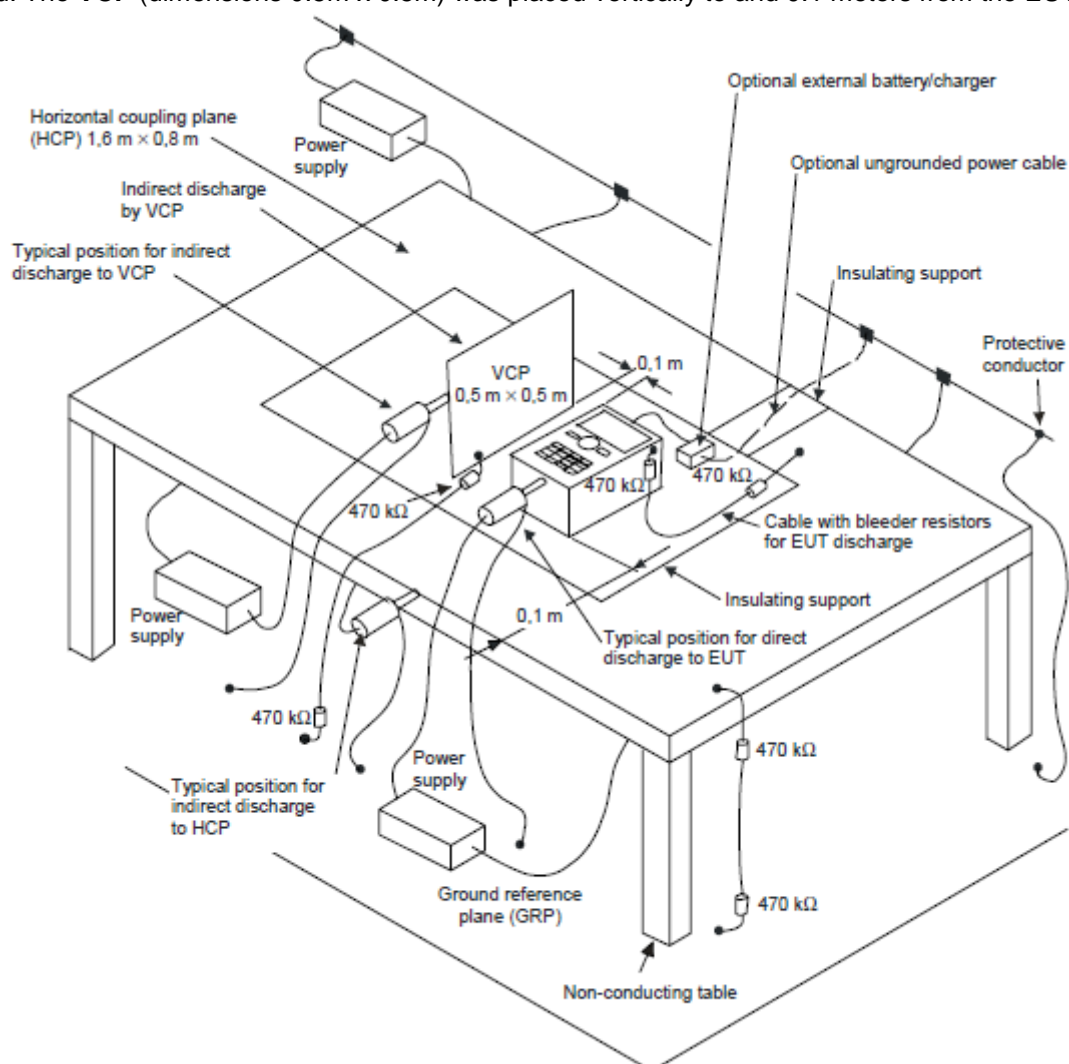
For the actual test configuration, please refer to the related Item – Photographs of the Test Configuration.

6.3 Electrostatic Discharge (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:

- Electrostatic discharges were applied only to those points and surfaces of the EUT that are accessible to users during normal operation.
- The test was performed with at least ten single discharges on the pre-selected points in the most sensitive polarity.
- The time interval between two successive single discharges was at least 1 second.
- 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.
- Contact discharges were applied to the non-insulating coating, with the pointed tip of the generator penetrating the coating and contacting the conducting substrate.
- 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.
- At least ten single discharges (in the most sensitive polarity) were applied to the **Horizontal Coupling Plane** 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**.
- At least ten single discharges (in the most sensitive polarity) were applied to the center of one vertical edge of the **Vertical Coupling Plane** 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 **Ground Reference Plane**. 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 **Horizontal Coupling Plane** (1.6m x 0.8m) was placed on the table and attached to the **GRP** by means of a cable with 940k Ω 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

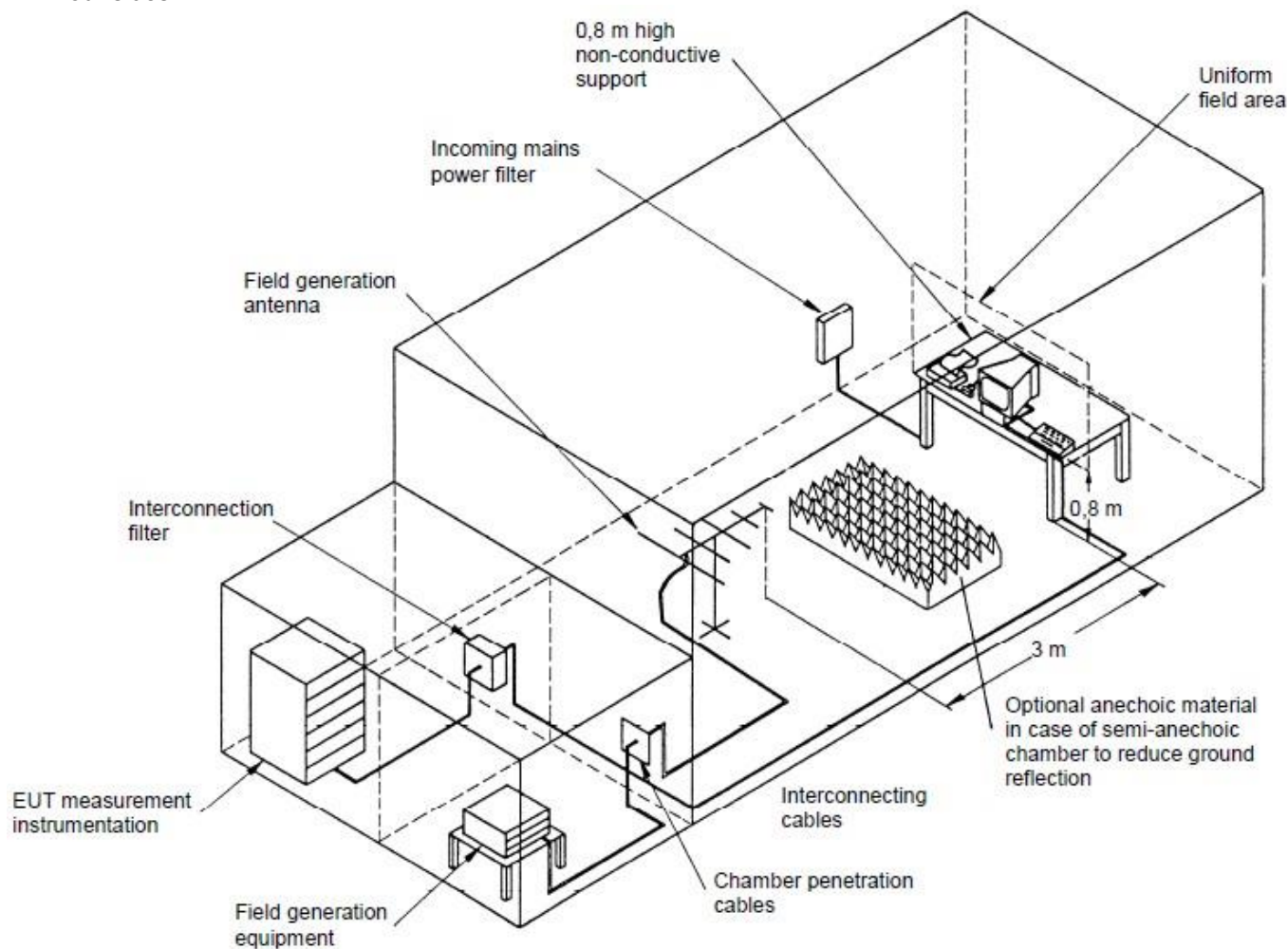
The equipment under test was installed in a representative system as described in section 7 of IEC 61000-4-2, and its cables were isolated from the Ground Reference Plane by an insulating support of 0.1-meter thickness. The GRP consisted of a sheet of aluminum that is at least 0.25mm thick, and 2.5 meters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

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.

- The testing was performed in a modified semi-anechoic chamber.
- The frequency range shall be swept, with the signal 80% amplitude modulated with a 1kHz sine wave.
- 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.

7 Test Results

7.1 Radiated Emissions up to 1 GHz

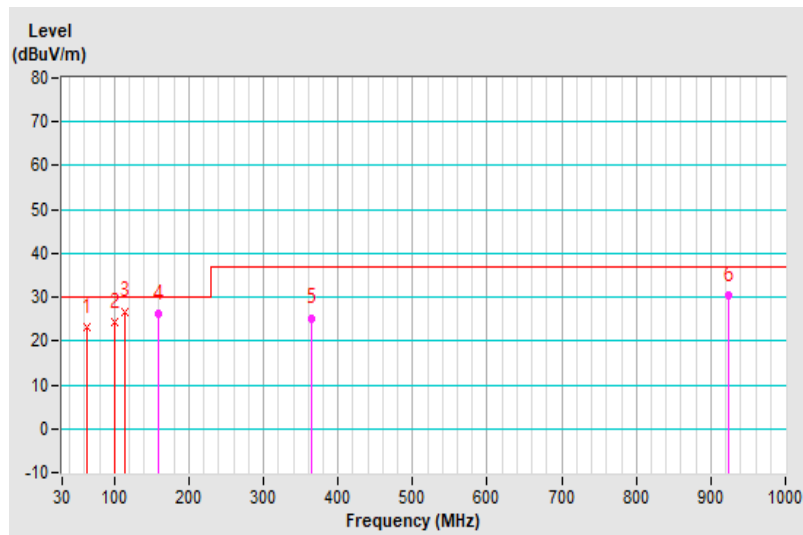
Mode 1

Frequency Range	30MHz ~ 1GHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP), 120kHz
Input Power	3.3Vdc from host equipment	Environmental Conditions	21°C, 63%RH
Tested By	Darren Lin		

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	63.71	23.00 QP	30.00	-7.00	4.00 H	268	36.59	-13.59
2	99.65	24.32 QP	30.00	-5.68	4.00 H	320	40.92	-16.60
3	113.57	26.80 QP	30.00	-3.20	3.67 H	287	41.46	-14.66
4	159.71	26.35 QP	30.00	-3.65	3.00 H	46	38.25	-11.90
5	365.18	25.24 QP	37.00	-11.76	2.00 H	32	34.11	-8.87
6	923.69	30.31 QP	37.00	-6.69	1.00 H	339	26.73	3.58

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

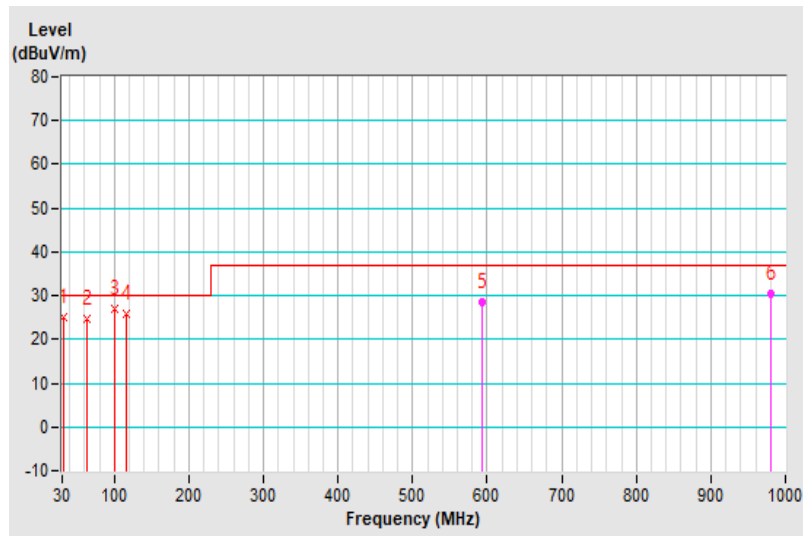


Frequency Range	30MHz ~ 1GHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP), 120kHz
Input Power	3.3Vdc from host equipment	Environmental Conditions	21°C, 63%RH
Tested By	Darren Lin		

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	31.36	25.09 QP	30.00	-4.91	1.00 V	344	39.53	-14.44
2	63.56	24.65 QP	30.00	-5.35	4.00 V	226	38.31	-13.66
3	99.94	26.97 QP	30.00	-3.03	2.11 V	210	43.70	-16.73
4	116.04	25.75 QP	30.00	-4.25	3.00 V	110	40.39	-14.64
5	593.98	28.34 QP	37.00	-8.66	4.00 V	169	31.37	-3.03
6	981.06	30.55 QP	37.00	-6.45	4.00 V	296	25.51	5.04

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



7.2 Radiated Emissions above 1 GHz

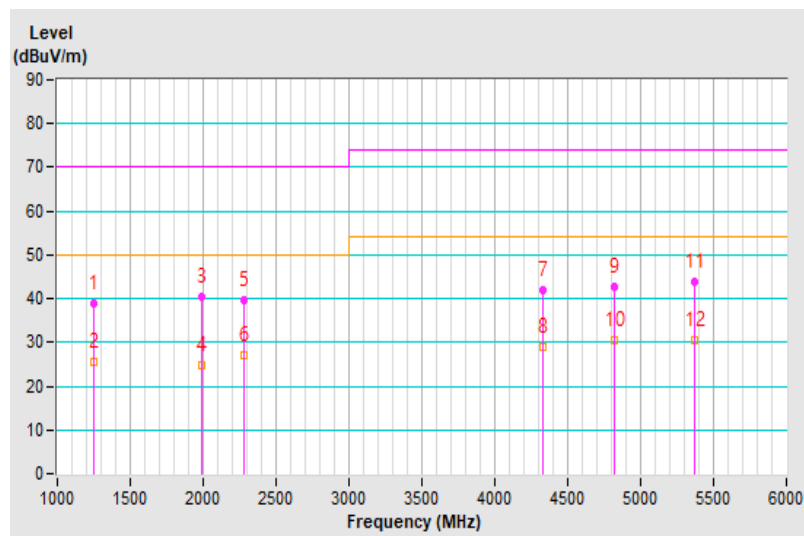
Mode 1

Frequency Range	1GHz ~ 6GHz	Detector Function & Resolution Bandwidth	Peak (PK) / Average (AV), 1MHz
Input Power	3.3Vdc from host equipment	Environmental Conditions	19°C, 63%RH
Tested By	Darren Lin		

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1246.00	38.97 PK	70.00	-31.03	1.00 H	257	46.11	-7.14
2	1246.00	25.57 AV	50.00	-24.43	1.00 H	24	32.71	-7.14
3	1991.33	40.55 PK	70.00	-29.45	1.00 H	225	46.18	-5.63
4	1991.33	24.80 AV	50.00	-25.20	1.00 H	125	30.43	-5.63
5	2280.06	39.78 PK	70.00	-30.22	1.00 H	343	43.17	-3.39
6	2280.06	27.14 AV	50.00	-22.86	1.00 H	312	30.53	-3.39
7	4334.15	41.99 PK	74.00	-32.01	1.00 H	353	42.38	-0.39
8	4334.15	29.10 AV	54.00	-24.90	1.00 H	307	29.49	-0.39
9	4824.93	42.82 PK	74.00	-31.18	1.00 H	249	41.65	1.17
10	4824.93	30.43 AV	54.00	-23.57	1.00 H	251	29.26	1.17
11	5370.04	43.76 PK	74.00	-30.24	1.00 H	360	42.15	1.61
12	5370.04	30.51 AV	54.00	-23.49	1.00 H	0	28.90	1.61

Remarks:

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

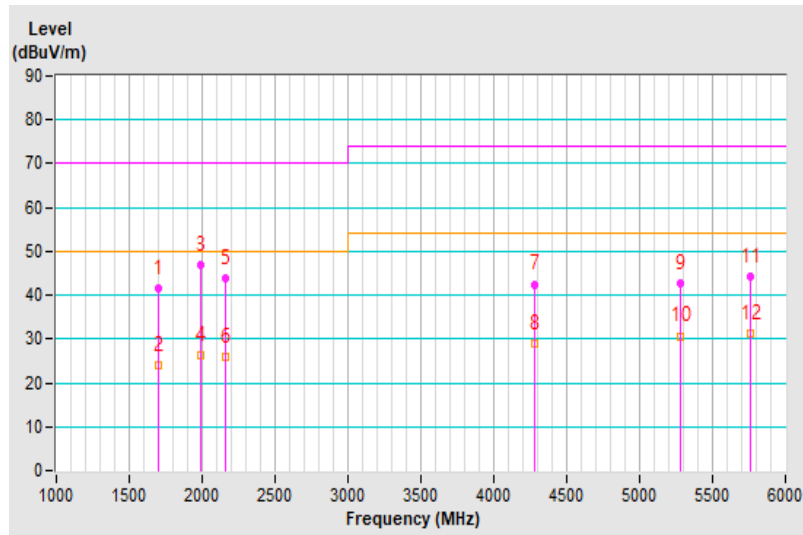


Frequency Range	1GHz ~ 6GHz	Detector Function & Resolution Bandwidth	Peak (PK) / Average (AV), 1MHz
Input Power	3.3Vdc from host equipment	Environmental Conditions	19°C, 63%RH
Tested By	Darren Lin		

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1703.82	41.39 PK	70.00	-28.61	1.00 V	0	48.19	-6.80
2	1703.82	24.14 AV	50.00	-25.86	1.00 V	248	30.94	-6.80
3	1991.33	46.79 PK	70.00	-23.21	1.00 V	108	52.42	-5.63
4	1991.33	26.35 AV	50.00	-23.65	1.00 V	107	31.98	-5.63
5	2162.86	43.67 PK	70.00	-26.33	1.00 V	152	47.61	-3.94
6	2162.86	26.05 AV	50.00	-23.95	1.00 V	154	29.99	-3.94
7	4280.43	42.48 PK	74.00	-31.52	1.00 V	47	43.04	-0.56
8	4280.43	28.81 AV	54.00	-25.19	1.00 V	45	29.37	-0.56
9	5279.09	42.73 PK	74.00	-31.27	1.00 V	183	41.23	1.50
10	5279.09	30.66 AV	54.00	-23.34	1.00 V	138	29.16	1.50
11	5757.66	44.17 PK	74.00	-29.83	1.00 V	54	41.82	2.35
12	5757.66	31.26 AV	54.00	-22.74	1.00 V	55	28.91	2.35

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 Discharge (ESD)

Test Mode 1

Input Power	DC 3.3V	Environmental conditions	24 °C, 52% RH 1028 mbar
Tested by	Vito Lung		

Note: No direct discharge surfaces, therefore no direct discharge was executed.

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

Description of test points of indirect application:

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

Note: 1. The EUT function was correct during the test.

Test Mode 2

Input Power	DC 3.3V	Environmental conditions	24 °C, 52% RH 1028 mbar
Tested by	Vito Lung		

Note: No direct discharge surfaces, therefore no direct discharge was executed.

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

Description of test points of indirect application:

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

Note: 1. The EUT function was correct during the test.

7.4 Radio Frequency Electromagnetic Field (RS)

Test Mode 1

Input Power	DC 3.3V	Environmental conditions	24 °C, 52% RH
Tested by	Allen Qin		

Frequency (MHz)	Polarity	Azimuth(°)	Applied Field Strength		Observation	Performance Criteria
			(V/m)	Modulation		
80 – 6000	V&H	0	3	80% AM (1kHz)	Note 1	A
80 – 6000	V&H	90	3	80% AM (1kHz)	Note 1	A
80 – 6000	V&H	180	3	80% AM (1kHz)	Note 1	A
80 – 6000	V&H	270	3	80% AM (1kHz)	Note 1	A

Note: 1. EUT has function lost during 2280 MHz to 2603.5 MHz at "WIFI 2.4G". But this band is exclusion band in EN301489-17, under this condition (the function lost) that is acceptable.

Test Mode 2

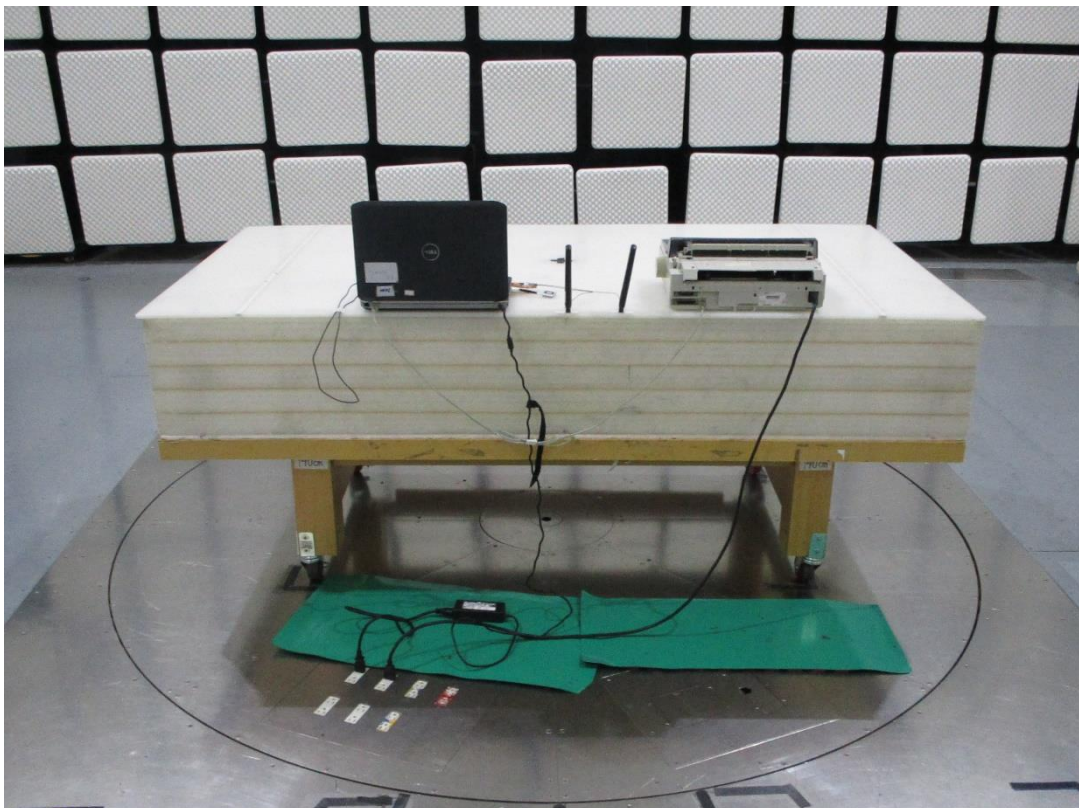
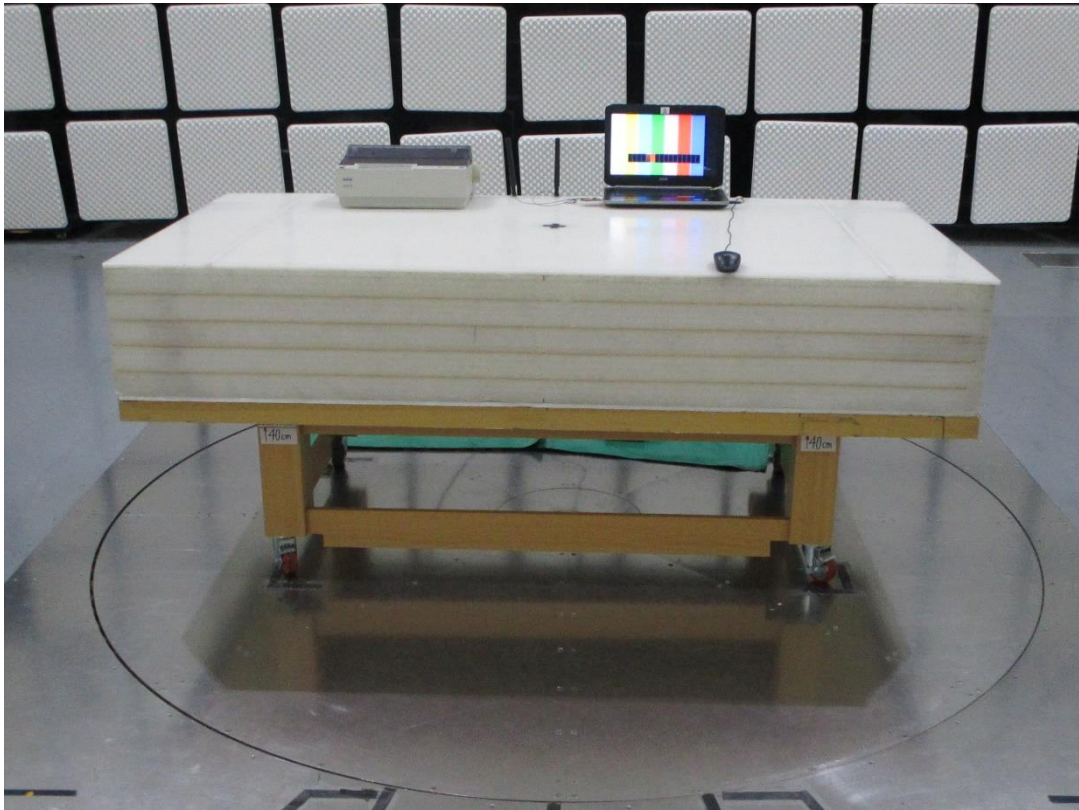
Input Power	DC 3.3V	Environmental conditions	24 °C, 52% RH
Tested by	Allen Qin		

Frequency (MHz)	Polarity	Azimuth(°)	Applied Field Strength		Observation	Performance Criteria
			(V/m)	Modulation		
80 – 6000	V&H	0	3	80% AM (1kHz)	Note 1	A
80 – 6000	V&H	90	3	80% AM (1kHz)	Note 1	A
80 – 6000	V&H	180	3	80% AM (1kHz)	Note 1	A
80 – 6000	V&H	270	3	80% AM (1kHz)	Note 1	A

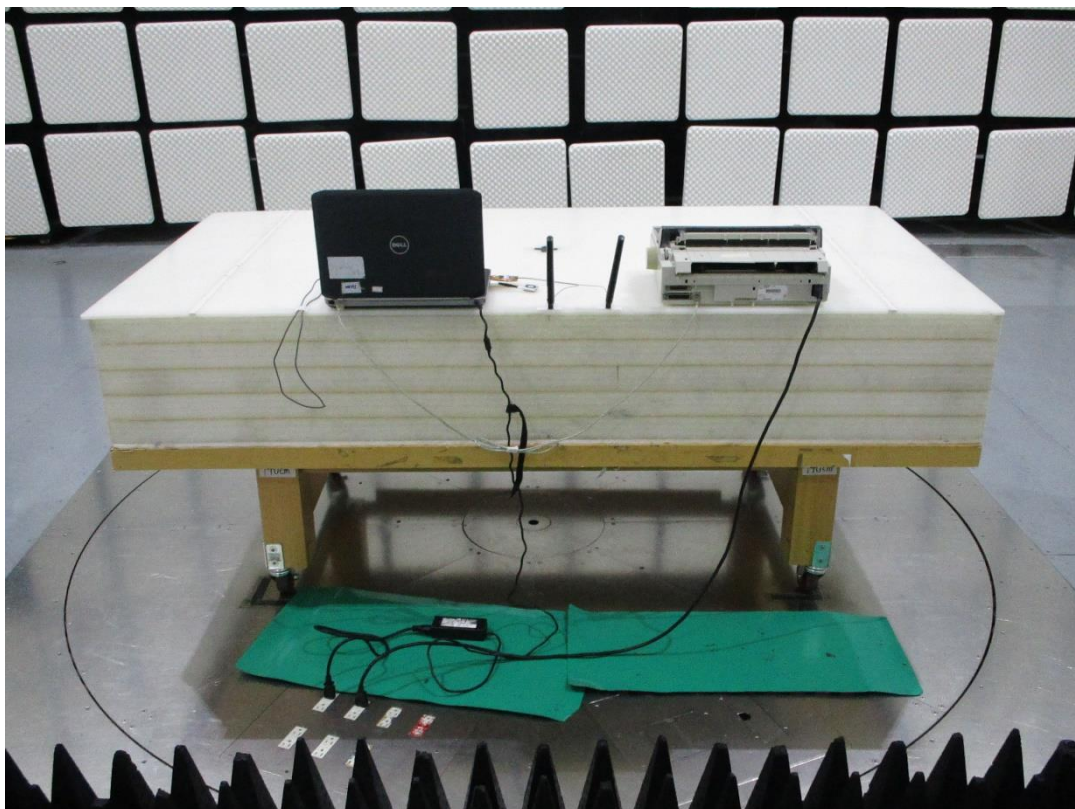
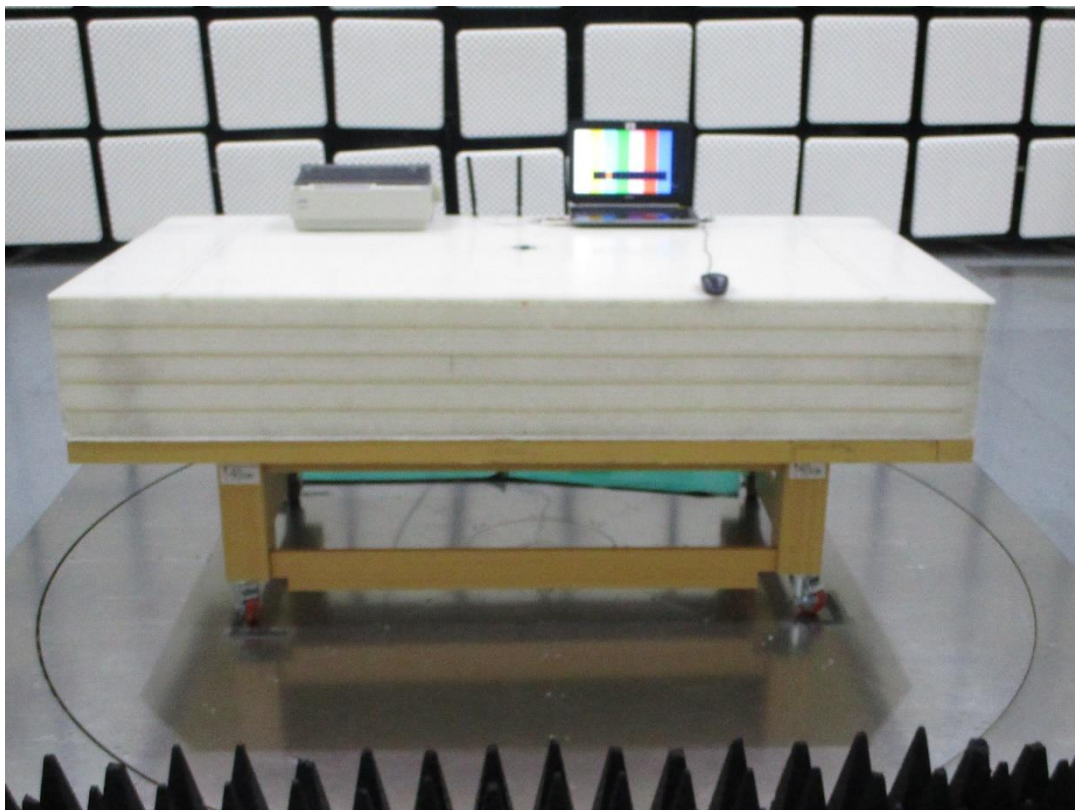
Note: 1. EUT has function lost during 4880 MHz to 5995 MHz at "WIFI 5G". But this band is exclusion band in EN301489-17, under this condition (the function lost) that is acceptable.

8 Pictures of Test Arrangements

8.1 Radiated Emissions up to 1 GHz

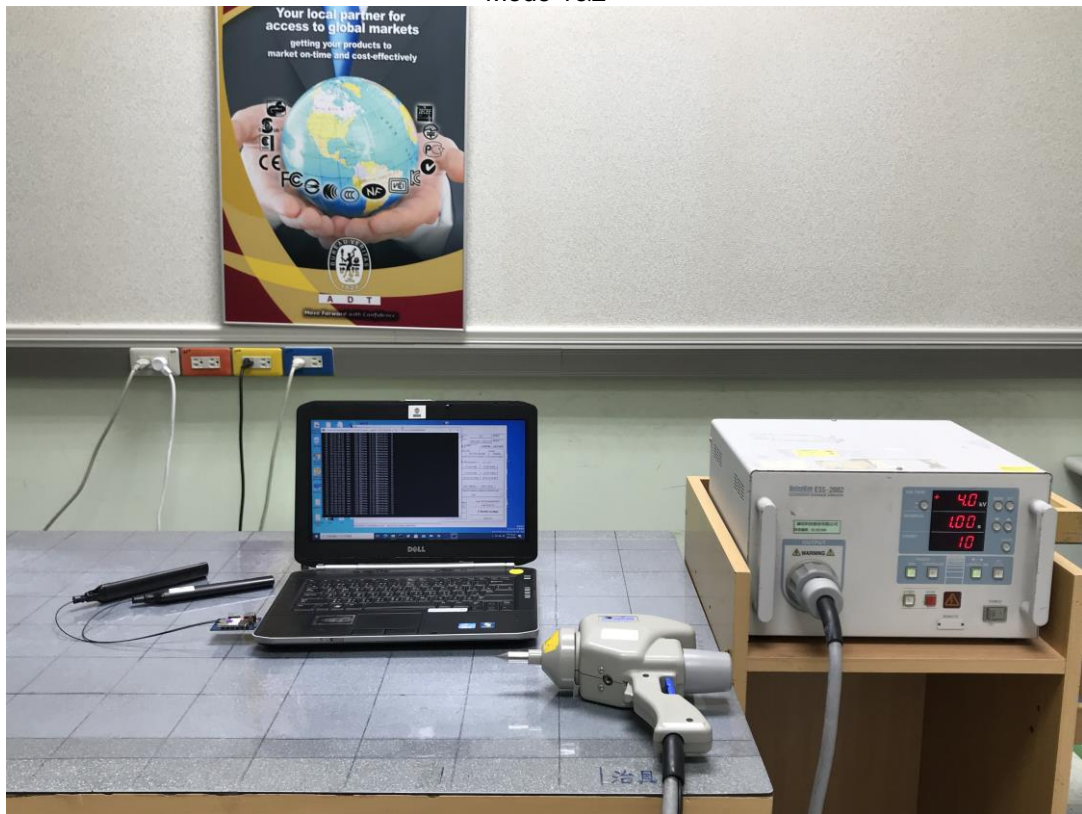


8.2 Radiated Emissions above 1 GHz



8.3 Electrostatic Discharge (ESD)

Mode 1&2



8.4 Radio Frequency Electromagnetic Field (RS)

Mode 1&2



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 accredited and approved according to ISO/IEC 17025.

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

Lin Kou EMC/RF Lab

Tel: 886-2-26052180

Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab

Tel: 886-3-6668565

Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab

Tel: 886-3-3183232

Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com

Web Site: www.bureauveritas-adt.com

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

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