

EMC Test Report

Applicant : REYAX TECHNOLOGY CO.,LTD.
 Product Name : RFID module
 Trade Name : REYAX
 Model Number : RYRR20D
 Applicable Standard : FCC 47 CFR PART 15 SUBPART B
 ANSI C63.4: 2014
 Received Date : Dec. 15, 2022
 Test Period : Dec. 21 ~ Dec. 26, 2022
 Issued Date : Feb. 02, 2023

Issued by

Eurofins E&E Wireless Taiwan Co., Ltd.
 No. 140-1, Changan Street, Bade District,
 Taoyuan City 334025, Taiwan (R.O.C.)
 Tel : +886-3-2710188 / Fax : +886-3-2710190



Taiwan Accreditation Foundation accreditation number: 1330

Test Firm MRA designation number: TW1062

Certified Scope: 9 kHz ~ 40 GHz

Note:

1. The test results are valid only for samples provided by customers and under the test conditions described in this report.
2. This report shall not be reproduced except in full, without the written approval of Eurofins E&E Wireless Taiwan Co., Ltd.
3. The relevant information is provided by customers in this test report. According to the correctness, appropriateness or completeness of the information provided by the customer, if there is any doubt or error in the information which affects the validity of the test results, the laboratory does not take the responsibility.

Revision History

Version	Issued Date	Revisions	Revised By
00	Feb. 02, 2023	Initial Issue	Yiying Chiang

Verification of Compliance

Applicant : REYAX TECHNOLOGY CO.,LTD.

Product Name : RFID module

Trade Name : REYAX

Model Number : RYRR20D

Applicable Standard : FCC 47 CFR PART 15 SUBPART B
ANSI C63.4: 2014

Test Result : Complied

Performing Lab. : Eurofins E&E Wireless Taiwan Co., Ltd.
No. 140-1, Changan Street, Bade District,
Taoyuan City 334025, Taiwan (R.O.C.)



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The above equipment has been tested by Eurofins E&E Wireless Taiwan Co., Ltd., and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved By : _____

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1 General Information

1.1. Summary of Test Result

Emission			
Standard	Item	Verdict	Remark
FCC 47 CFR PART 15 SUBPART B ANSI C63.4	Conducted Emission	PASS	Meet Class B limit Minimum margin is -11.67 dB at 14.649 MHz
	Radiated Emission below 1 GHz	PASS	Meet Class B limit Minimum margin is -1.20 dB at 408.3000 MHz
	Radiated Emission above 1 GHz	N/A	---

Decision Rule

- Uncertainty is not included.
- Uncertainty is included.

1.2. Testing Location

Lab Name: Eurofins E&E Wireless Taiwan Co., Ltd.

Site Address: No. 140-1, Changan Street, Bade District, Taoyuan City 334025, Taiwan (R.O.C.)

Site Address: No. 2, Wuquan 5th Rd. Wugu Dist., New Taipei City, Taiwan (R.O.C.)

1.3. Measurement Uncertainty

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

For Bade site

Test Item		Frequency Range	Uncertainty (dB)
Conducted Emission	AC Power Port	9 kHz ~ 150 kHz	± 3.7
		150 kHz ~ 30 MHz	± 2.9

Test Item	Test Site	Frequency Range	Uncertainty (dB)	
Radiated Emission	10M-BD	30 MHz ~ 1000 MHz	Horizontal	± 4.6
			Vertical	± 5.0
	96601-BD	30 MHz ~ 1000 MHz	30 MHz ~ 1000 MHz	± 5.1
			1000 MHz ~ 6000 MHz	± 4.8
			6000 MHz ~ 18000 MHz	± 5.2
			18000 MHz ~ 26500 MHz	± 4.9
			26500 MHz ~ 40000 MHz	± 4.8
	96602-BD	30 MHz ~ 1000 MHz	30 MHz ~ 1000 MHz	± 4.8
			1000 MHz ~ 6000 MHz	± 4.6
			6000 MHz ~ 18000 MHz	± 4.5
			18000 MHz ~ 26500 MHz	± 4.7
			26500 MHz ~ 40000 MHz	± 4.7

For Wugu site

Test Item		Frequency Range	Uncertainty (dB)
Conducted Emission	AC Power Port	9 kHz ~ 150 kHz	± 3.6
		150 kHz ~ 30 MHz	± 2.8
	Wired Network Port	150 kHz ~ 30 MHz	± 4.1
	Current Probe	150 kHz ~ 30 MHz	± 2.7

Test Item	Test Site	Frequency Range	Uncertainty (dB)
Radiated Emission	96601-WG	30 MHz ~ 1000 MHz	± 4.9
		1000 MHz ~ 6000 MHz	± 4.0
		6000 MHz ~ 18000 MHz	± 4.0
		18000 MHz ~ 26500 MHz	± 4.0
		26500 MHz ~ 40000 MHz	± 4.2

1.4. Test Site Environment

Test Item	Items	Required (IEC 60068-1)	Actual
Conducted Emission	Temperature (°C)	15-35	15-30
	Humidity (%RH)	25-75	45-75
	Barometric pressure (mbar)	860-1060	990-1005
Radiated Emission	Temperature (°C)	15-35	15-30
	Humidity (%RH)	25-75	45-75
	Barometric pressure (mbar)	860-1060	990-1005

2 EUT Description

Applicant	REYAX TECHNOLOGY CO.,LTD. 4F.-15, No.26, Ln. 321, Yangguang St., Neihu Dist. Taipei City Taiwan
Product Name	RFID module
Trade Name	REYAX
Model Number	RYRR20D
FCC ID	QLYRYRR20D
I/O Ports	Refer to the user manual provided by clients.
Highest Operating Frequency	13.56 MHz
EUT Power Rating	DC 5.0 V

3 Test Methodology

3.1. Decision of Test Mode

3.1.1. The following test mode(s) were scanned during the preliminary test:

Pre-Test Mode
Mode 1: Normal operation mode

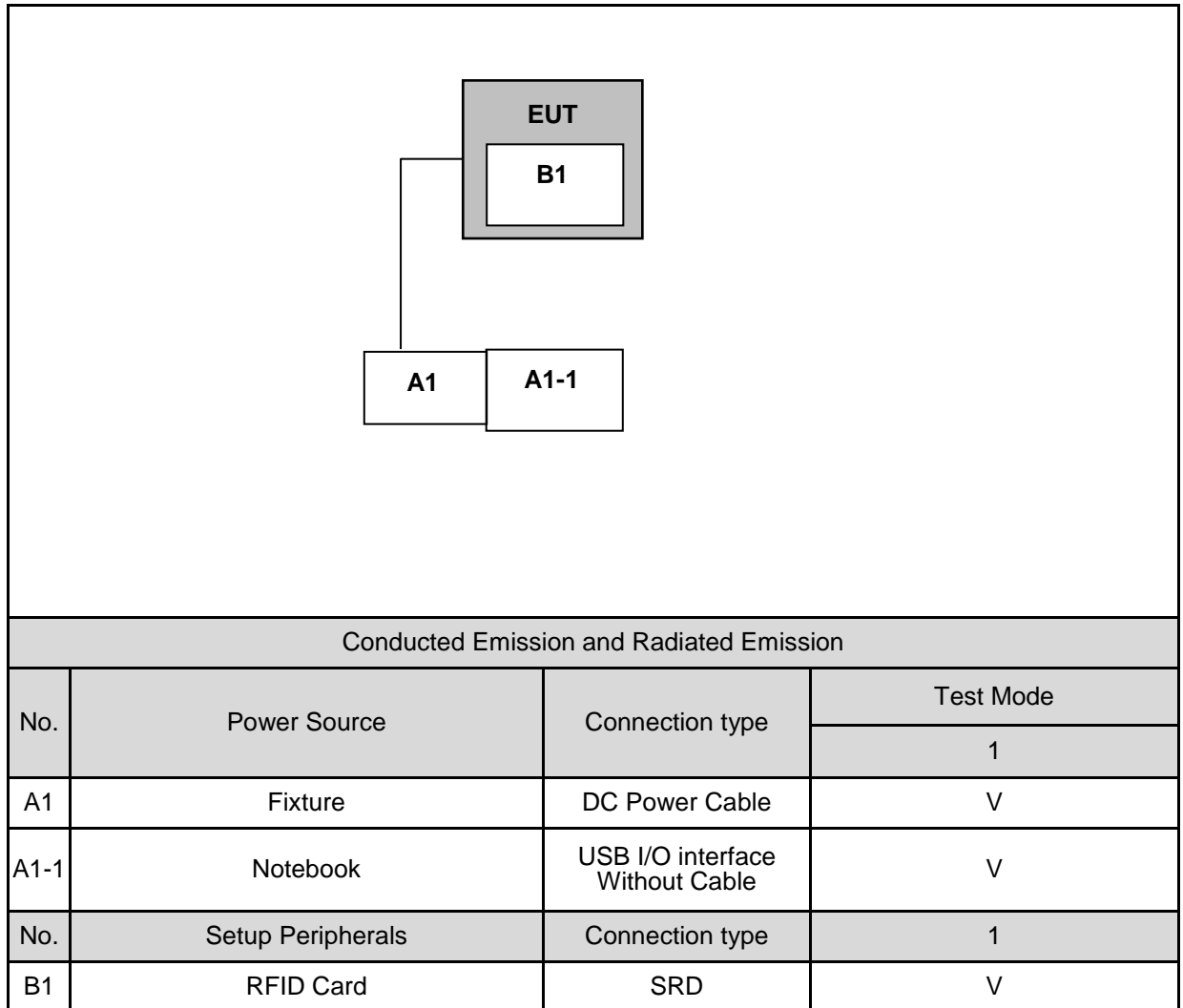
3.1.2. After the preliminary scan, the following test mode was final mode and found to produce the highest emission level.

Final Test Mode			
Emission	Conducted Emission		Mode1
	Radiated Emission	Below 1 GHz	Mode1
		Above 1 GHz	N/A

3.2. EUT Test Step

<ol style="list-style-type: none"> 1. Setup the EUT and simulators as shown on 3.3. 2. Turn on the power all equipment. 3. Turn on RFID function. 4. Start to test till get the worst reading.
--

3.3. Configuration of Test System Details



Support Unit used in test configuration and system						
	Product	Manufacturer	Model Number	Serial Number	Data Cable	Power Cord
(1)	Notebook	ASUS	PU401L	F7NXBC0044177294	N/A	Non-Shielded, 0.8 m
(2)	RFID Card	N/A	N/A	N/A	N/A	N/A
(3)	Fixture	Phoncoo	USB to RS485 422 Converter Upgrade Protection CH340 RS485 Converter	N/A	N/A	N/A

3.4. Test Instruments

Test Period: Dec. 26, 2022

Testing Engineer: David Hsu

Conducted Emission test site					
Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Test Receiver	R&S	ESR3	102919	Nov. 30, 2022	1 year
LISN	R&S	ENV216	101041	Apr. 15, 2022	1 year
Cable	EMCI	EMCCFD300-BM-NM-4000	220402	Jun. 09, 2022	1 year
Test Site	ATL	Conduction01-WG	Conduction01-WG	N.C.R.	-----
Software	ELEKTRA	94.60.0	-----	-----	-----

Test Period: Dec 21, 2022

Testing Engineer: David hsu

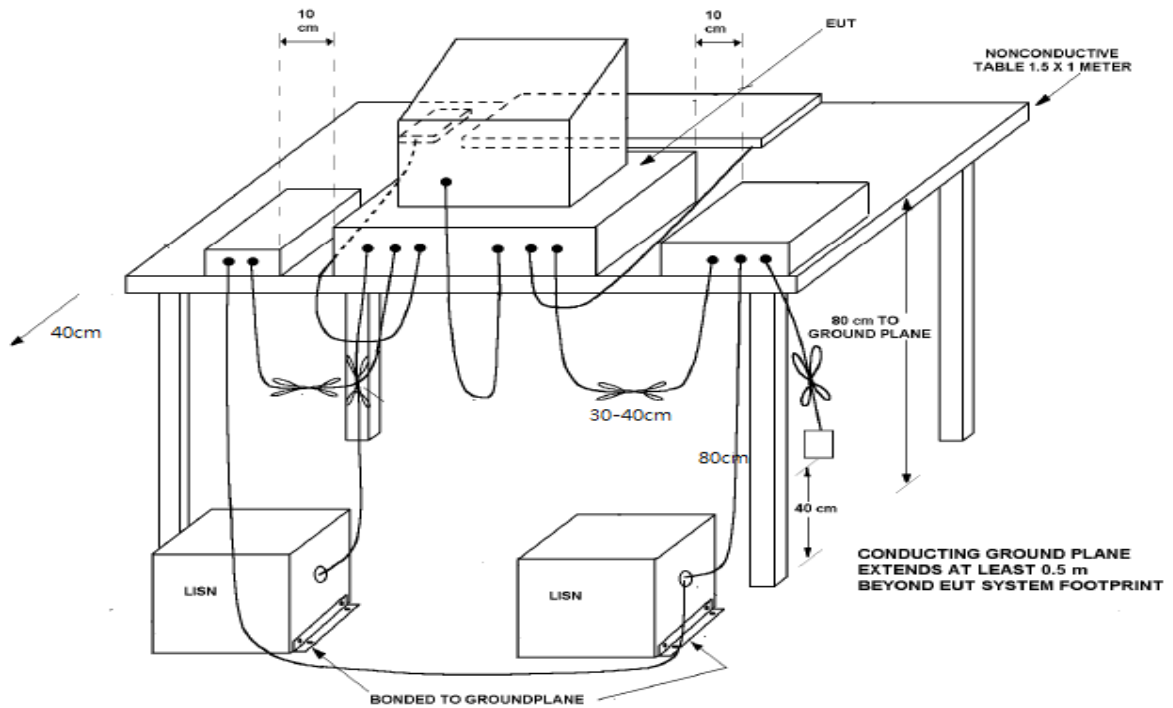
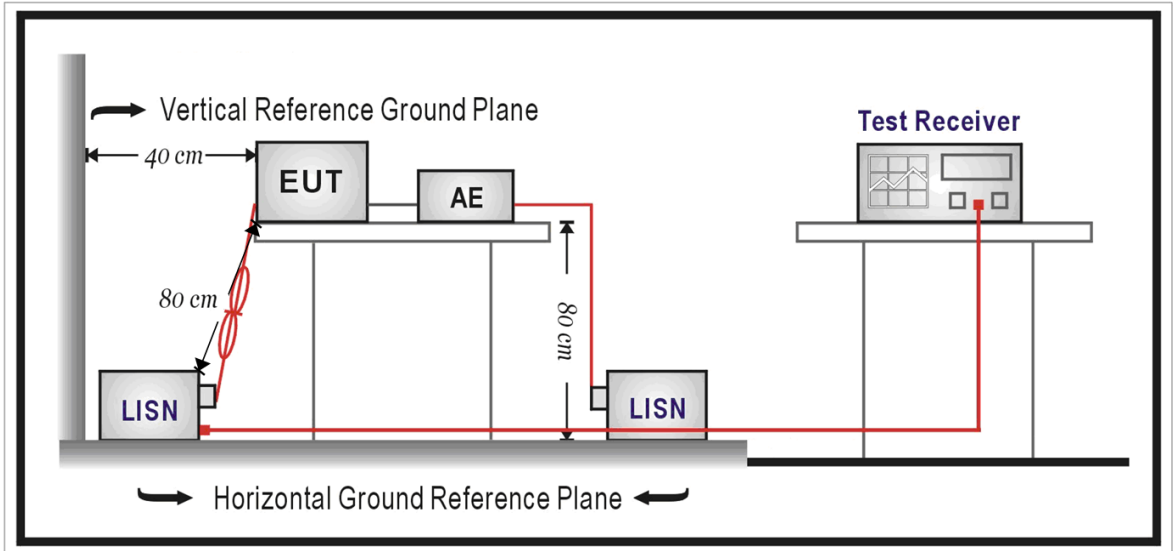
3 Meter Chamber					
Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Receiver	R & S	ESR26	101775	Nov. 22, 2022	1 year
Amplifier (30-1000 MHz)	EMCI	EMC001330	980721	Dec. 01, 2022	1 year
Broadband Antenna (30-1000 MHz)	Schwarzbeck	VULB9168	01276	Jan. 24, 2022	1 year
Cable (30-1000 MHz)	EMCI	EMCCFD400-NM-NM-2000	211005	Apr. 07, 2022	1 year
Cable (30-1000 MHz)	EMCI	EMCCFD400-NM-NM-2000	211013	Apr. 07, 2022	1 year
Cable (30-1000 MHz)	EMCI	EMCCFD400-NM-NM-6000	211016	Apr. 07, 2022	1 year
Software	EZ EMC	1.1.4.4	-----	-----	-----
Test Site(NSA)	Eurofins	96601-WG	96601-WG	Jan 12, 2022	1 year

Note: N.C.R. = No Calibration Request.

4 Measurement Procedure

4.1. Conducted Emission

■ Test Setup



■ Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a $50 \Omega // 50 \mu\text{H}$ coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a $50 \Omega // 50 \mu\text{H}$ coupling impedance with 50ohm termination.

Tabletop device shall be placed on a non-conducting platform, of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The wall of screened room shall be located 40cm to the rear of the EUT. Other surfaces of tabletop or floor standing EUT shall be at least 80cm from any other ground conducting surface including one or more LISNs. For floor-standing device shall be placed under the EUT with a 12 mm insulating material.

Conducted emissions were investigated over the frequency range from 0.15 MHz to 30 MHz using a resolution bandwidth of 9 kHz. The equipment under test (EUT) shall be meet the limits in section 4.1.1, as applicable, including the average limit and the quasi-peak limit when using respectively, an average detector and quasi-peak detector measured in accordance with the methods described of related standard. When all of peak value were complied with quasi-peak and average limit from 150 kHz to 30 MHz then quasi-peak and average measurement was unnecessary.

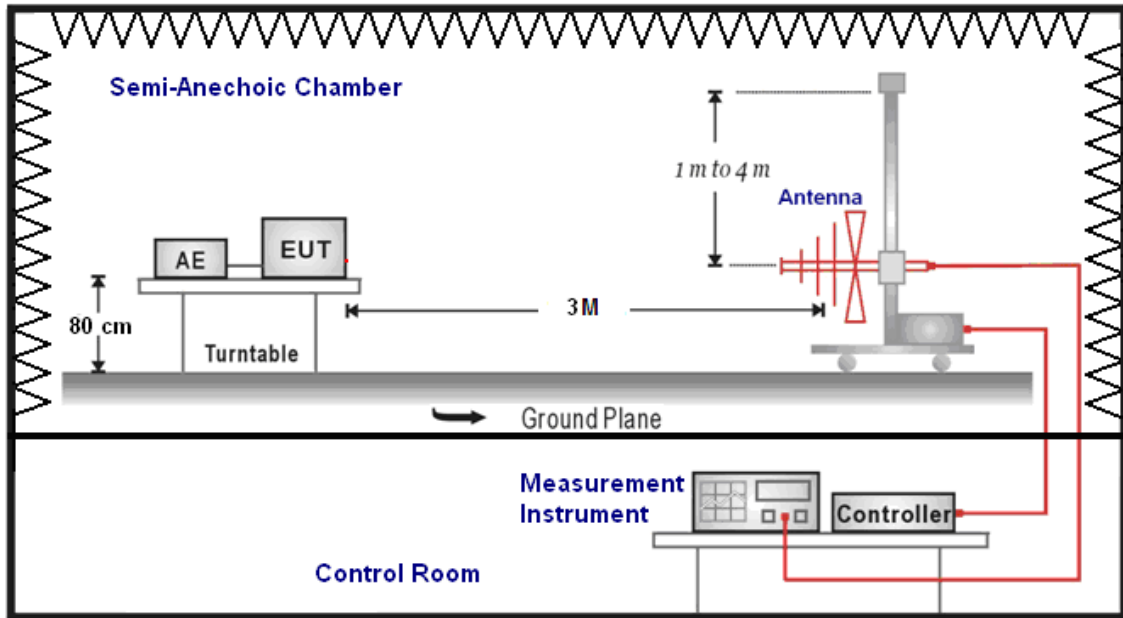
The AMN shall be placed 0,8 m from the boundary of the unit under test and bonded to a ground reference plane for AMNs mounted on top of the ground reference plane. This distance is between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment shall be at least 0,8 m from the AMN. If the mains power cable is longer than 1m then the cable shall be folded back and forth at the centre of the lead to form a bundle no longer than 0.4 m. All of interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 cm to 40 cm long. All of EUT and AE shall be separate place more than 0.1 m. All 50Ω ports of the LISN shall be resistively terminated into 50Ω loads when not connected to the measuring instrument.

If the reading of the measuring receiver shows fluctuations close to the limit, the reading shall be observed for at least 15 s at each measurement frequency; the higher reading shall be recorded with the exception of any brief isolated high reading which shall be ignored.

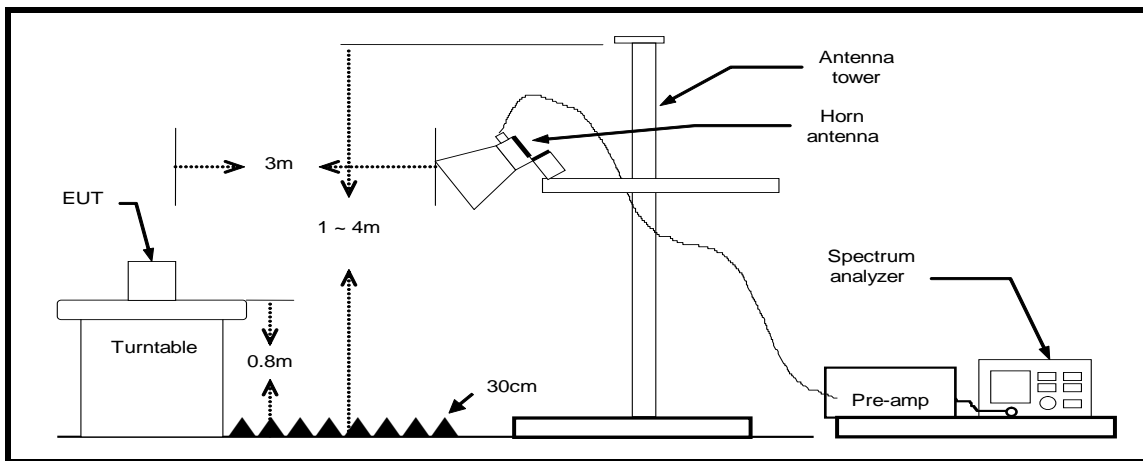
4.2. Radiated Emission

■ Test Setup

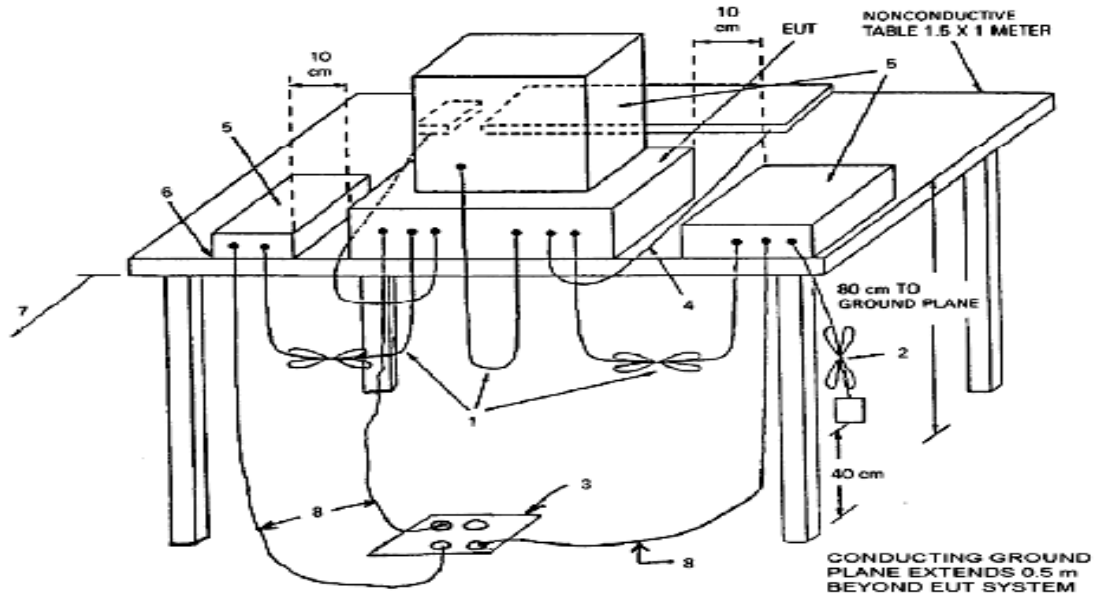
Below 1 GHz



Above 1 GHz



Test arrangement for radiated emissions of tabletop equipment.



■ **Test Procedure**

Below 1 GHz

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. When the EUT is floor-standing equipment, it is placed on the ground plane which has a 12 mm non-conductive covering to insulate the EUT from the ground plane.

The turn table is 0.8 m height and 2.0 m wide x 1.0 m deep size. It can rotate 360 degrees to determine the position of the maximum emission level. The spacing between the each equipment was 10 cm. The mains cables are dropped to floor and are round to receptacle. Interconnecting cables of table top equipment that hang closer than 0.4 m to the ground plane are folded back and forth forming a bundle 0.3 m to 0.4 m long, hanging approximately in the middle between ground plane and table. The EUT was positioned such that the distance from antenna to the EUT was 10 meters and the receive antenna was moved from 1 m to 4 m to investigate maximum highest emission at least 6 points over the frequency range from 30 MHz to 1 GHz using a resolution bandwidth of 120 kHz and measured by the quasi-peak detector.

According to this standard paragraph 15.109, as an alternative to the radiated emission limits, digital devices may be shown to comply with the standards contained in Third Edition of the International Special Committee on Radio Interference (CISPR), Pub. 22, "Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement".

Above 1 GHz

The Setup is same as Below 1 GHz placement. The turn table is 0.8 m height and 1.8 m wide x 1.0 m deep size. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meter for above 1 GHz, the highest frequency performed according to internal source frequency of the EUT, the specification was below:

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705 - 108	1000
108 - 500	2000
500 - 1000	5000
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower

Absorber shall be spread between floor of a turn table and a receive antenna shown in 4.2.3. The antenna used boresight antenna master from 1 meter and 4 meters to find out the maximum emission level and find the highest emission at least 6 points. Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated on radiated measurement.

Radiated emissions were applied to above 1 GHz using a resolution bandwidth of 1 MHz and measured by the peak and average detector which antenna to the EUT distance was 3 meters. If the EUT was meet both limits and measurement with the average detector receiver is unnecessary.

5 Requirements and Performance Criteria

5.1. Conducted Emission

■ Limit

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

Note: (1) The lower limit shall apply at the transition frequencies.

(2) The limit decreases in line with the logarithm of the frequency in the range 0.15 to 0.50 MHz.

5.2. Radiated Emission

■ Limit

Under 1 GHz test shall not exceed following value

FCC 47 CFR PART 15 SUBPART B								
Frequency range (MHz)	Class A				Class B			
	Distance (m)	dBuV/m	Distance (m)	dBuV/m	Distance (m)	dBuV/m	Distance (m)	dBuV/m
30 to 88	10	39	3	49.5	10	29.5	3	40
88 to 216	10	43.5	3	54	10	33.1	3	43.5
216 to 960	10	46.4	3	56.9	10	35.6	3	46
Above 960	10	49.5	3	60	10	43.5	3	54

CISPR 22				
Frequency range (MHz)	Class A		Class B	
	Distance (m)	dBuV/m	Distance (m)	dBuV/m
30 to 230	10	40	10	30
230 to 1000	10	47	10	37

Above 1 GHz test shall not exceed following value

Frequency (MHz)	dBuV/m (Distance 3 m)			
	Class A		Class B	
	Average	Peak	Average	Peak
1000 ~ 40000	60	80	54	74

- Remark:
1. The tighter limit shall apply at the edge between two frequency bands.
 2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
 3. RF Voltage (dBuV/m) = 20 log RF Voltage (uV/m)
 4. Peak detector limit is corresponding to 20 dB above the maximum permitted average limit.

According to FCC Part 15.33 (b), for an unintentional radiator, including a digital device, the spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a radiated emission limit is specified, up to the frequency shown in the following table:

Highest frequency generated or used in the device or in which the device operated or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705-108	1000
108-500	2000
500-1000	5000
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower

6 Test Result

6.1. Conducted Emission

■ Test Result

Test Standard:	FCC Part 15B	Power Line:	L1
Test Mode:	Mode 1	Test Power:	AC 120 V / 60 Hz
Description:			

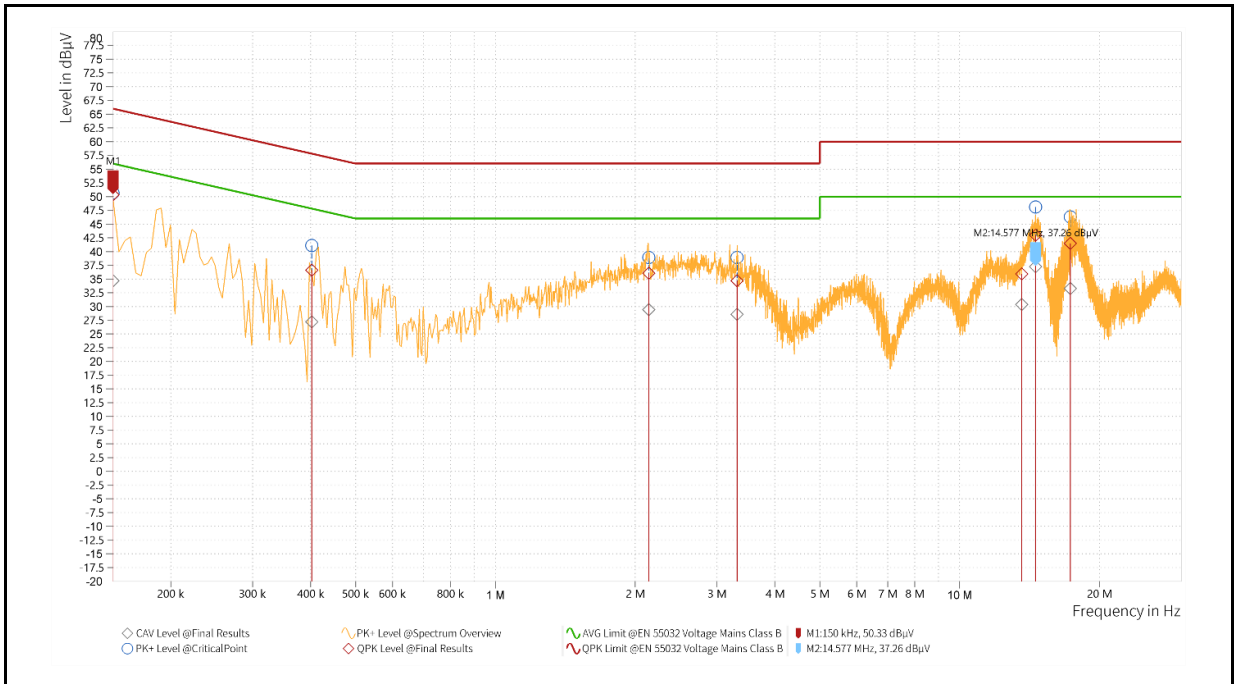


No.	Frequency (MHz)	QP reading (dBuV)	AVG reading (dBuV)	Correction factor (dB)	QP result (dBuV)	AVG result (dBuV)	QP limit (dBuV)	AVG limit (dBuV)	QP margin (dB)	AVG margin (dB)	Remark
1	0.150	41.49	29.00	9.65	51.13	38.64	66.00	56.00	-14.87	-17.36	Pass
2	0.285	29.12	19.61	9.65	38.78	29.26	60.67	50.67	-21.89	-21.41	Pass
3	0.501	25.01	15.78	9.66	34.67	25.44	56.00	46.00	-21.33	-20.56	Pass
4	3.696	25.03	17.21	9.75	34.78	26.97	56.00	46.00	-21.22	-19.03	Pass
5	13.542	26.45	20.86	9.91	36.36	30.77	60.00	50.00	-23.64	-19.23	Pass
6	14.649	34.07	28.40	9.92	44.00	38.33	60.00	50.00	-16.00	-11.67	Pass
7	17.813	30.66	23.75	9.96	40.62	33.71	60.00	50.00	-19.38	-16.29	Pass

Note: 1. Result (dBuV) = Correction factor (dB) + Reading(dBuV).

2. Correction factor (dB) = Cable loss (dB) + L.I.S.N. factor (dB).

Test Standard:	FCC Part 15B	Power Line:	N
Test Mode:	Mode 1	Test Power:	AC 120 V / 60 Hz
Description:			



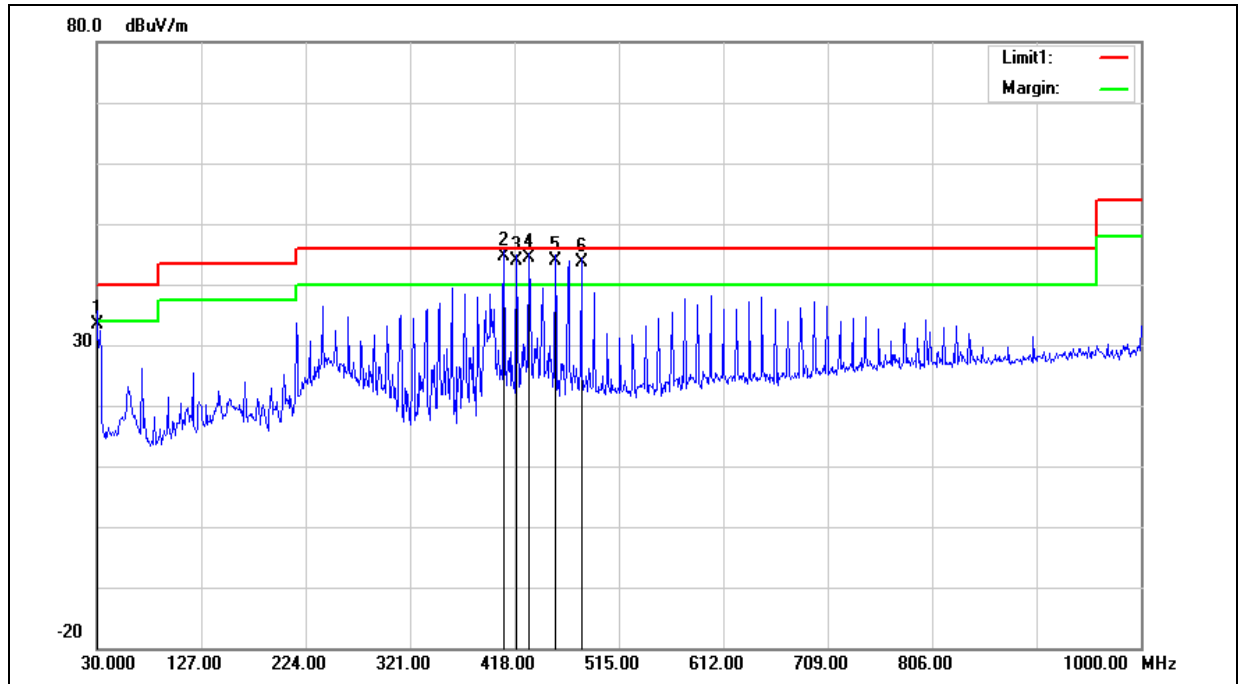
No.	Frequency (MHz)	QP reading (dBuV)	AVG reading (dBuV)	Correction factor (dB)	QP result (dBuV)	AVG result (dBuV)	QP limit (dBuV)	AVG limit (dBuV)	QP margin (dB)	AVG margin (dB)	Remark
1	0.150	40.68	25.03	9.65	50.33	34.67	66.00	56.00	-15.67	-21.33	Pass
2	0.402	26.93	17.52	9.66	36.59	27.18	57.81	47.81	-21.22	-20.63	Pass
3	2.139	26.33	19.70	9.72	36.05	29.42	56.00	46.00	-19.95	-16.58	Pass
4	3.314	24.93	18.83	9.75	34.68	28.58	56.00	46.00	-21.32	-17.42	Pass
5	13.605	26.00	20.45	9.92	35.92	30.37	60.00	50.00	-24.08	-19.63	Pass
6	14.577	33.04	27.32	9.94	42.98	37.26	60.00	50.00	-17.02	-12.74	Pass
7	17.313	31.52	23.29	9.98	41.50	33.27	60.00	50.00	-18.50	-16.73	Pass

Note: 1. Result (dBuV) = Correction factor (dB) + Reading(dBuV).
2. Correction factor (dB) = Cable loss (dB) + L.I.S.N. factor (dB).

6.2. Radiated Emission

■ Test Result

Test Standard:	FCC Part 15B	Test Distance:	3 m
Test Mode:	Mode 1	Test Power:	DC 5 V
Measurement Range:	30 MHz~1 GHz	Ant.Polar.:	Horizontal

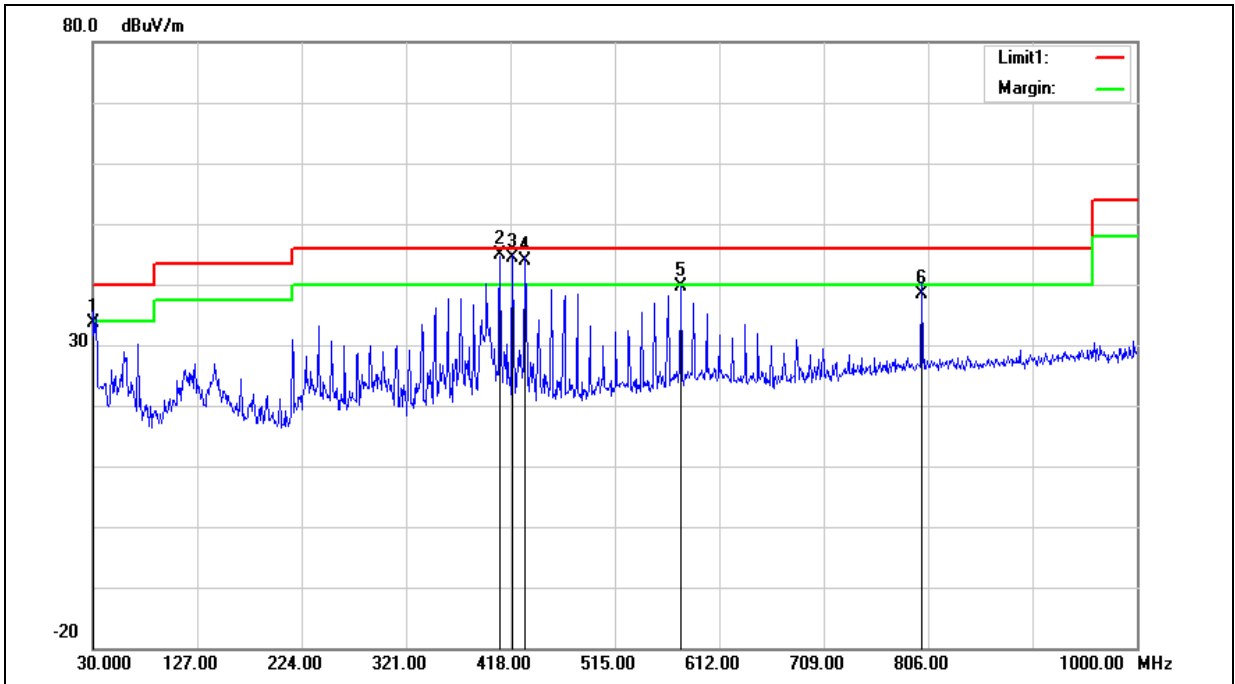


No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	30.0000	46.62	-13.36	33.26	40.00	-6.74	112	200	QP
2	408.3000	53.10	-8.50	44.60	46.00	-1.40	315	200	QP
3	419.9400	52.13	-8.13	44.00	46.00	-2.00	308	200	QP
4	431.5800	52.19	-7.89	44.30	46.00	-1.70	321	200	QP
5	455.8300	51.20	-7.40	43.80	46.00	-2.20	292	200	QP
6	480.0800	50.72	-7.12	43.60	46.00	-2.40	301	200	QP

Note: 1. Result (dBuV/m) = Correction factor (dB/m) + Reading(dBuV).

2. Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

Test Standard:	FCC Part 15B	Test Distance:	3 m
Test Mode:	Mode 1	Test Power:	DC 5 V
Measurement Range:	30 MHz~1 GHz	Ant.Polar.:	Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
1	30.0000	46.99	-13.36	33.63	40.00	-6.37	360	100	QP
2	408.3000	53.30	-8.50	44.80	46.00	-1.20	315	100	QP
3	419.9400	52.53	-8.13	44.40	46.00	-1.60	314	100	QP
4	431.5800	51.69	-7.89	43.80	46.00	-2.20	306	100	QP
5	576.1100	44.90	-5.31	39.59	46.00	-6.41	360	100	QP
6	800.1800	40.00	-1.74	38.26	46.00	-7.74	255	100	QP

Note: 1. Result (dBuV/m) = Correction factor (dB/m) + Reading(dBuV).

2. Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

--- END ---