

RF Test Report

Applicant : Ring LLC

Product Type : Video Doorbell 3 Plus (for model : 5UM6E5)
Video Doorbell 3 (for model : 5AT3S9)

Trade Name : Ring

Model Number : 5UM6E5, 5AT3S9

Applicable Standard : FCC 47 CFR PART 15 SUBPART E
ANSI C63.10:2013

Received Date : Mar. 02, 2020

Test Period : Mar. 03 ~ Mar. 04, 2020

Issued Date : Mar. 16, 2020

Issued by

A Test Lab Techno Corp.
No. 140-1, Changan Street, Bade District,
Taoyuan City 33465, Taiwan (R.O.C.)
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Taiwan Accreditation Foundation accreditation number: 1330
Test Firm MRA designation number: TW0010

Note:

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Revision History

Rev.	Issued Date	Revisions	Revised By
00	Mar. 10, 2020	Initial Issue	Tobey Cheng
01	Mar. 16, 2020	Page 8 Revised EUT Modify Description. Page 24~25 Revised Radiated Emission Measurement.	Tobey Cheng

Verification of Compliance

Issued Date: Mar. 16, 2020

Applicant : Ring LLC

Product Type : Video Doorbell 3 Plus (for model : 5UM6E5)
Video Doorbell 3 (for model : 5AT3S9)

Trade Name : Ring

Model Number : 5UM6E5, 5AT3S9

FCC ID : 2AEUPBHARG051

EUT Rated Voltage : AC 8-24 V, 50/60 Hz, 200 mA

Test Voltage : AC 24 V, 60 Hz

Applicable Standard : FCC 47 CFR PART 15 SUBPART E
ANSI C63.10:2013

Test Result : Complied

Performing Lab. : A Test Lab Techno Corp.

No. 140-1, Changan Street, Bade District,
Taoyuan City 33465, Taiwan (R.O.C.)
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Taiwan Accreditation Foundation accreditation number: 1330
<http://www.atl-lab.com.tw/e-index.htm>

A Test Lab Techno Corp. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by A Test Lab Techno Corp. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Approved By



(Manager)

(Fly Lu)

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1 General Information

1.1. Summary of Test Result

Standard	Item	Result	Remark
15.407(b)(6) 15.207	AC Power Conducted Emission	PASS	---
15.407(b) 15.205 / 15.209	Transmitter Radiated Emissions	PASS	---
15.407(a)	Maximum Conducted Output Power	PASS	Refer report number : 1909FR13
15.407(a)	26 dB RF Bandwidth	PASS	Refer report number : 1909FR13
15.407(e)	6 dB RF Bandwidth	PASS	Refer report number : 1909FR13
15.407(a)	Maximum Power Spectral Density	PASS	Refer report number : 1909FR13
15.407(c)	Automatically discontinue transmission	PASS	Refer report number : 1909FR13
15.407(a) 15.203	Antenna Requirement	PASS	Refer report number : 1909FR13

Standard	Description
CFR47, Part 15, Subpart C	Intentional Radiators
CFR47, Part 15, Subpart E	Unlicensed National Information Infrastructure Devices
ANSI C63. 10: 2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
KDB789033: D02	Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices Part 15, Subpart E
KDB 662911 D01 v02r01	Emissions Testing of Transmitters with Multiple Outputs in the Same Band (e.g., MIMO, Smart Antenna, etc)

1.2. Measurement Uncertainty

Test Item	Frequency Range	Uncertainty (dB)
Conducted Emission	150 kHz ~ 30 MHz	2.68
Radiated Emission	9 kHz ~ 30 MHz	2.14
	30 MHz ~ 1000 MHz	4.99
	1000 MHz ~ 18000 MHz	4.99
	18000 MHz ~ 26500 MHz	4.23
	26500 MHz ~ 40000 MHz	4.39

Decision Rule

- Uncertainty is not included.
- Uncertainty is included.



2 EUT Description

Applicant	Ring LLC 1523 26th Street, Santa Monica CA 90404, United States			
Manufacturer	Ring Inc. 1523 26th Street, Santa Monica CA 90404, United States			
Product Type	Video Doorbell 3 Plus (for model : 5UM6E5) Video Doorbell 3 (for model : 5AT3S9)			
Trade Name	Ring			
Model No.	5UM6E5, 5AT3S9			
Difference description of product type/model number	5UM6E5 : With glance 5AT3S9 : Without glance			
FCC ID	2AEUPBHARG051			
Operate Frequency	Frequency Band		Frequency Range (MHz)	Number of Channels
	IEEE 802.11a	U-NII Band I	5180 – 5240	3
		U-NII Band II-A	5260 – 5320	3
		U-NII Band II-C	5500 – 5700	4
		U-NII Band III	5745 – 5825	4
	IEEE 802.11n 5 GHz 20 MHz	U-NII Band I	5180 – 5240	3
		U-NII Band II-A	5260 – 5320	3
		U-NII Band II-C	5500 – 5700	4
		U-NII Band III	5745 – 5825	4
	IEEE 802.11n 5 GHz 40 MHz	U-NII Band I	5190 – 5230	2
		U-NII Band II-A	5270 – 5310	2
		U-NII Band II-C	5510 – 5670	4
		U-NII Band III	5755 – 5795	3
Modulation Type	OFDM			
Equipment Type	Client without radar detection			
Antenna information	ANT	Model Number	Type	Max. Gain (dBi)
	ANT-0	RFPCA491914EMLB301	PCB Antenna	5.22
	ANT-1	RFPCA491914EMLB303	PCB Antenna	5.26
Antenna Delivery	Reference section 3.1			
Operate Temp. Range	-20 ~ 50 °C			



Frequency Band		RF Output Power (W)
IEEE 802.11a	U-NII Band I	0.023
	U-NII Band II-A	0.022
	U-NII Band II-C	0.025
	U-NII Band III	0.025
IEEE 802.11n 5 GHz 20 MHz	U-NII Band I	0.022
	U-NII Band II-A	0.021
	U-NII Band II-C	0.024
	U-NII Band III	0.024
IEEE 802.11n 5 GHz 40 MHz	U-NII Band I	0.018
	U-NII Band II-A	0.017
	U-NII Band II-C	0.022
	U-NII Band III	0.020

EUT Modify Description :

<p>Modification Description: Product Type :</p> <p>1) Video Doorbell 3 with model number 5UM6E5 adds one more model number : 5AT3S9 that removes glance, but the layout remains the same.</p> <p>2) The product name of model name 5UM6E5 changes its name from Video Doorbell 3 to Video Doorbell 3 Plus. The product name of model 5AT3S9 remains the same.</p> <p>After the evaluation, Conducted Emission & Radiated Emissions (Below 1 GHz) Mode 3 - 5500 MHz of Model: 5AT3S9 need to be re-evaluated. The other test data refer to the original report.</p> <p>Original Report : 1909FR13 Modify: 2003FR17 Rev.01</p>
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Equipment Type		
Outdoor access point	point-to-point	---
	point-to-multipoint	---
Indoor access point		---
Fixed point-to-point access points		---
Client devices		V

3 Test Methodology

3.1. Mode of Operation

Decision of Test ATL has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

Test Mode
Mode 1: Transmit mode
Mode 2: IEEE 802.11a Continuous TX mode
Mode 3: IEEE 802.11ac 20 MHz Continuous TX mode
Mode 4: IEEE 802.11ac 40 MHz Continuous TX mode

Software used to control the EUT for staying in continuous transmitting mode was programmed.

After verification, all tests were carried out with the worst case test modes.

Note: ANT-1 is the worst case in Mode 2 / Mode 3 / Mode 4.

Test Mode	ANT-0	ANT-1	ANT-0+1
Mode 2	V	V	---
Mode 3	V	V	---
Mode 4	V	V	---

Test Mode	Antenna Delivery	Data Rate (Mbps)	Band	Test Channel
Mode 2	1TX (Diversity)	6	U-NII Band I	36, 40, 48
			U-NII Band II-A	52, 56, 64
			U-NII Band II-C	100, 112, 140, 144
			U-NII Band III	144, 149, 157, 165
Mode 3	1TX (Diversity)	6.5	U-NII Band I	36, 40, 48
			U-NII Band II-A	52, 56, 64
			U-NII Band II-C	100, 112, 140, 144
			U-NII Band III	144, 149, 157, 165
Mode 4	1TX (Diversity)	13.5	U-NII Band I	38, 46
			U-NII Band II-A	54, 62
			U-NII Band II-C	102, 110, 134, 142
			U-NII Band III	142, 151, 159



3.2. EUT Test Step

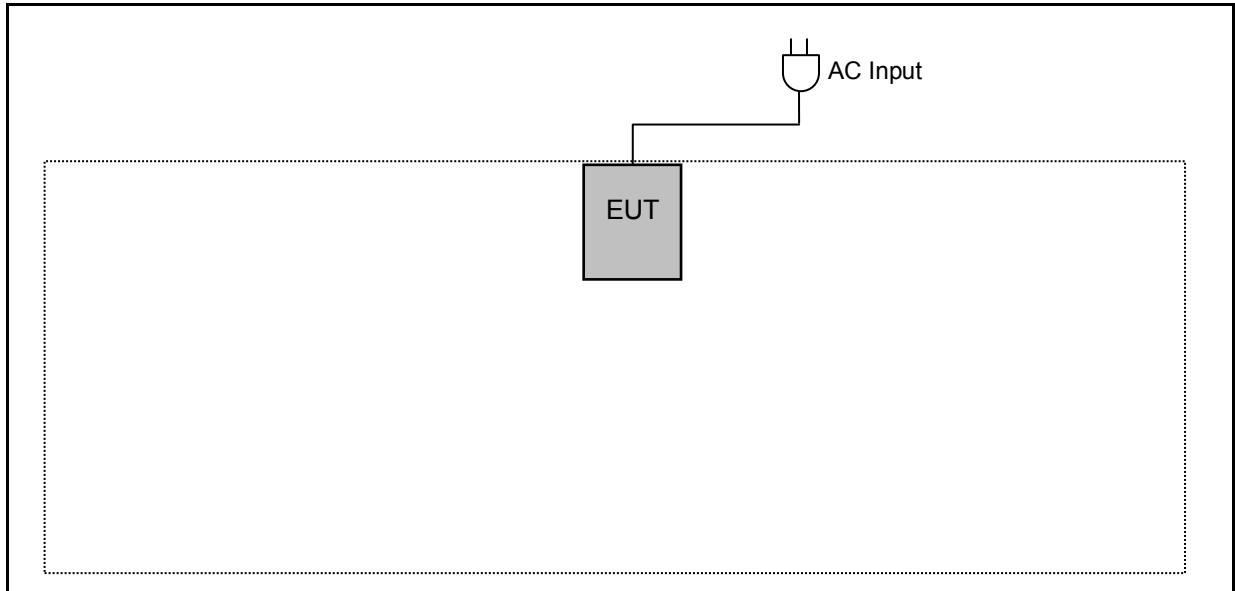
The EUT is operated in the engineering mode to fix the TX frequency for the purposes of measurement. According to its specifications, the EUT must comply with the requirements of Section 15.407 under the FCC Rules Part 15 Subpart E.

1.	Setup the EUT shown on "Configuration of Test System Details".
2.	Turn on the power of all equipment.
3.	Turn on TX function.
4.	EUT run test program.

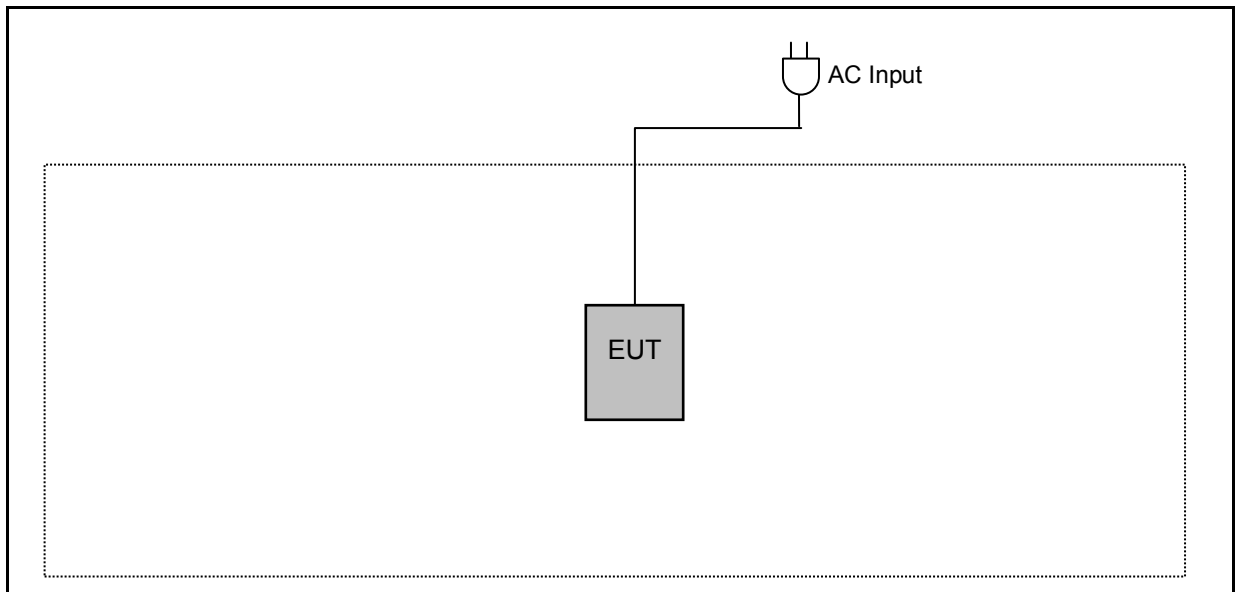
Measurement Software			
No.	Description	Software	Version
1	Conducted Emission	EZ EMC	1.1.4.3
2	Radiated Emission	EZ EMC	1.1.4.4

3.3. Configuration of Test System Details

Conducted Emissions



Radiated Emission



Devices Description				
Product	Manufacturer	Model Number	Serial Number	Power Cord
---	---	---	---	---



3.4. Test Instruments

For Conducted Emission

Test Period: Mar. 03, 2020

Testing Engineer: Louis Shen

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Test Receiver	R&S	ESCI	100367	05/23/2019	1 year
LISN	R&S	ENV216	101040	04/03/2019	1 year
LISN	R&S	ENV216	101041	03/28/2019	1 year
RF Cable	Woken	00100D1380194M	TE-02-03	05/23/2019	1 year

For Radiated Emissions

Test Period: Mar. 04, 2020

Testing Engineer: Ricky Liu

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Spectrum Analyzer (10 Hz~44 GHz)	Keysight	N9010A	MY52221312	01/13/2020	1 year
Pre Amplifier (100 kHz~1.3 GHz)	Agilent	8447D	2944A11119	01/15/2020	1 year
Broadband Antenna	Schwarzbeck	VULB9168	416	10/23/2019	1 year
Loop Antenna	COM-POWER CORPORATION	AL-130	121014	03/29/2019	1 year
RF Cable	EMCI	EMC104-N-N-6000	TE01-1	02/20/2020	1 year
Microwave Cable	EMCI	EMC104-SM -SM-13000	170814	10/29/2019	1 year
Microwave Cable	EMCI	EMC102-KM -KM-14000	151001	02/20/2020	1 year

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

3.5. Test Site Environment

Items	Required (IEC 60068-1)	Actual
Temperature (°C)	15-35	20-30
Humidity (%RH)	25-75	45-75
Barometric pressure (mbar)	860-1060	990-1005

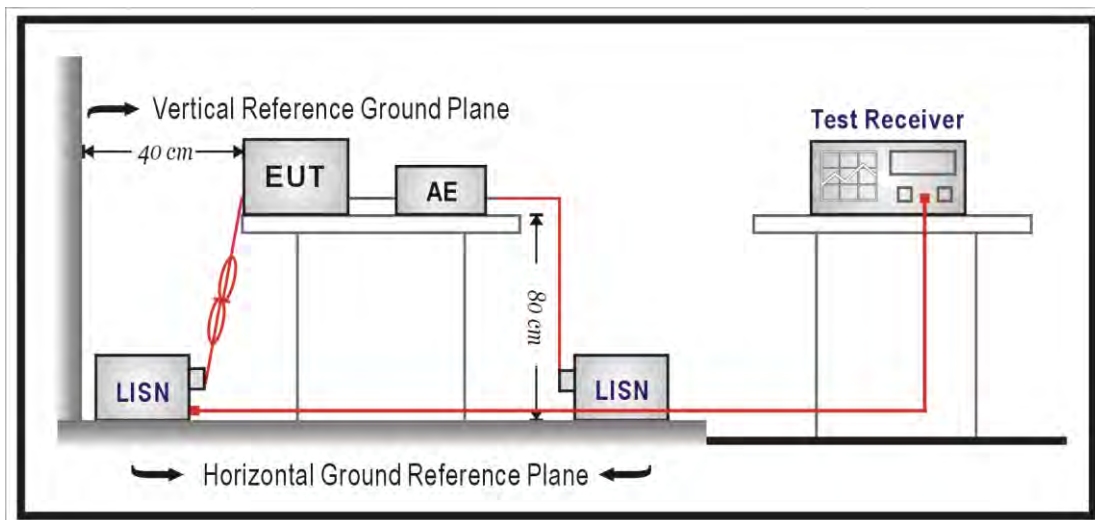
4 Measurement Procedure

4.1. AC Power Conducted Emission Measurement

■ Limit

Frequency (MHz)	Quasi-peak	Average
0.15 - 0.5	66 to 56	56 to 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

■ 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 50 ohm 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 40 cm to the rear of the EUT. Other surfaces of tabletop or floor standing EUT shall be at least 80 cm 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, 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 1 m 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. Transmitter Radiated Emissions Measurement

■ Limit

(1) Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(a) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

(b) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

(c) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

(d) For transmitters operating in the 5.725-5.85 GHz band:

(i) All emissions shall be limited to a level of -27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

(2) Limits of Radiated Emission Measurement

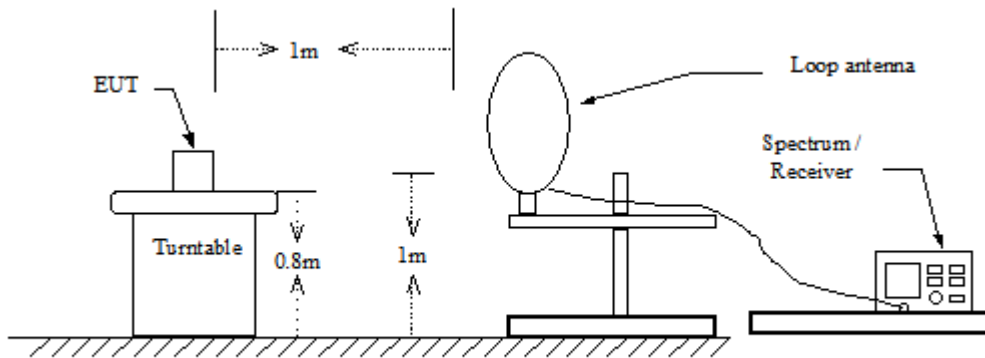
Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

Frequency Range (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	10	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

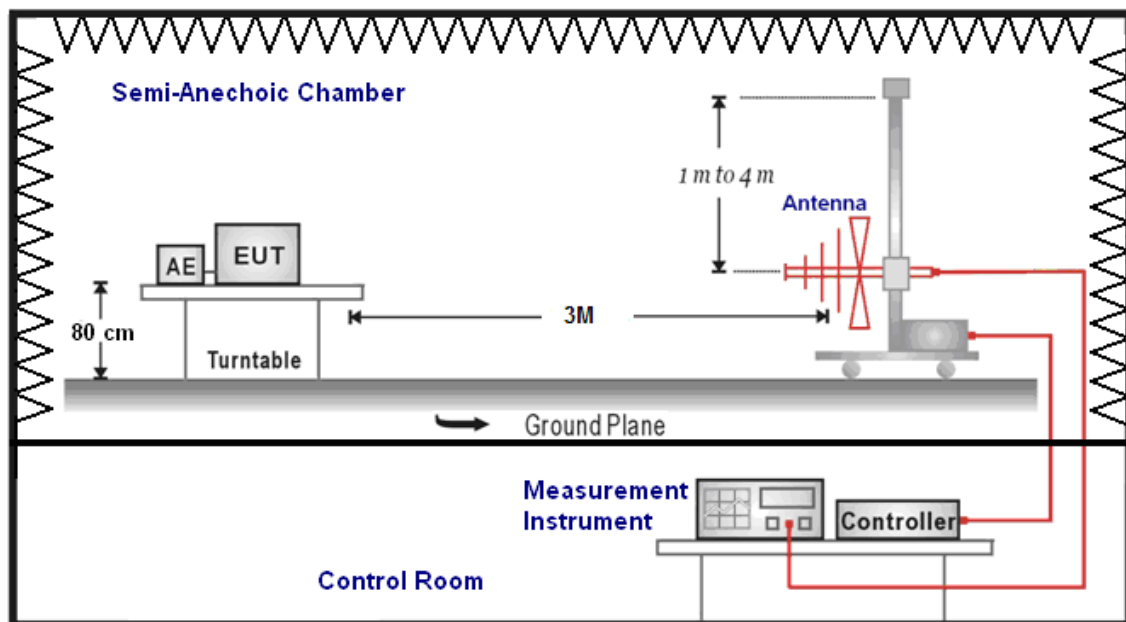
- Note:
1. The lower limit shall apply at the transition frequencies.
 2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
 3. As shown in 15.35(b), for frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

■ Setup

9 kHz ~ 30 MHz



30 MHz ~ 1 GHz



■ Test Procedure

Final radiation measurements were made on a three-meter, Semi Anechoic Chamber. The EUT system was placed on a nonconductive turntable which is 0.8 or 1.5 meters height (below 1 GHz use 0.8 m turntable / above 1 GHz use 1.5 m turntable), top surface 1.0 x 1.5 meter. The spectrum was examined from 250 MHz to 2.5 GHz in order to cover the whole spectrum below 10th harmonic which could generate from the EUT. During the test, EUT was set to transmit continuously & Measurements spectrum range from 9 kHz to 40 GHz is investigated.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For restricted measurements above 1 GHz the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 3 MHz for peak measurements and 10 Hz for average measurements when Duty cycle > 0.98 / 1/T for average measurements when Duty cycle < 0.98.

For out of band measurements above 1 GHz the resolution bandwidth is set to 1 MHz, and then the video bandwidth is set to 3 MHz for peak measurements.

A nonconductive material surrounded the EUT to supporting the EUT for standing on three orthogonal planes. At each condition, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters to find the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarization.

SCHWARZBECK MESS-ELEKTRONIK Trilog-Broadband Antenna at 3 Meter and the ETS-Lindgren Double-Ridged Waveguide Horn antenna Schwarzbeck Mess-Elektronik Broadband Horn Antenna was used in frequencies 1 – 40 GHz at a distance of 3 meter. The antenna at an angle toward the source of the emission. All test results were extrapolated to equivalent signal at 3 meters utilizing an inverse linear distance extrapolation Factor (20 dB/decade).

For testing above 1 GHz, the emission level of the EUT in peak mode was 20 dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

Appropriate preamplifiers were used for improving sensitivity and precautions were taken to avoid overloading or desensitizing the spectrum analyzer. No post – detector video filters were used in the test.

The spectrum analyzer's 6 dB bandwidth was set to 1 MHz, and the analyzer was operated in the peak detection mode, for frequencies both below and up 1 GHz. The average levels were obtained by subtracting the duty cycle correction factor from the peak readings.

The following procedures were used to convert the emission levels measured in decibels referenced to 1 microvolt (dBuV) into field intensity in micro volts per meter (uV/m).

The actual field intensity in decibels referenced to 1 microvolt in to field intensity in micro volts per meter (dBuV/m).

The actual field is intensity in referenced to 1 microvolt per meter (dBuV/m) is determined by algebraically adding the measured reading in dBuV, the antenna factor (dB), and cable loss (dB) and Subtracting the gain of preamplifier (dB) is auto calculate in spectrum analyzer.

(1) $\text{Amplitude (dBuV/m)} = \text{FI (dBuV)} + \text{AF (dBuV)} + \text{CL (dBuV)} - \text{Gain (dB)}$

FI= Reading of the field intensity.

AF= Antenna factor.

CL= Cable loss.

P.S Amplitude is auto calculate in spectrum analyzer.

(2) $\text{Actual Amplitude (dBuV/m)} = \text{Amplitude (dBuV)} - \text{Dis(dB)}$

The FCC specified emission limits were calculated according the EUT operating frequency and by following linear interpolation equations:

(a) For fundamental frequency : Transmitter Output < +30 dBm

(b) For spurious frequency : Spurious emission limits = fundamental emission limit /10

Measuring Instruments and setting

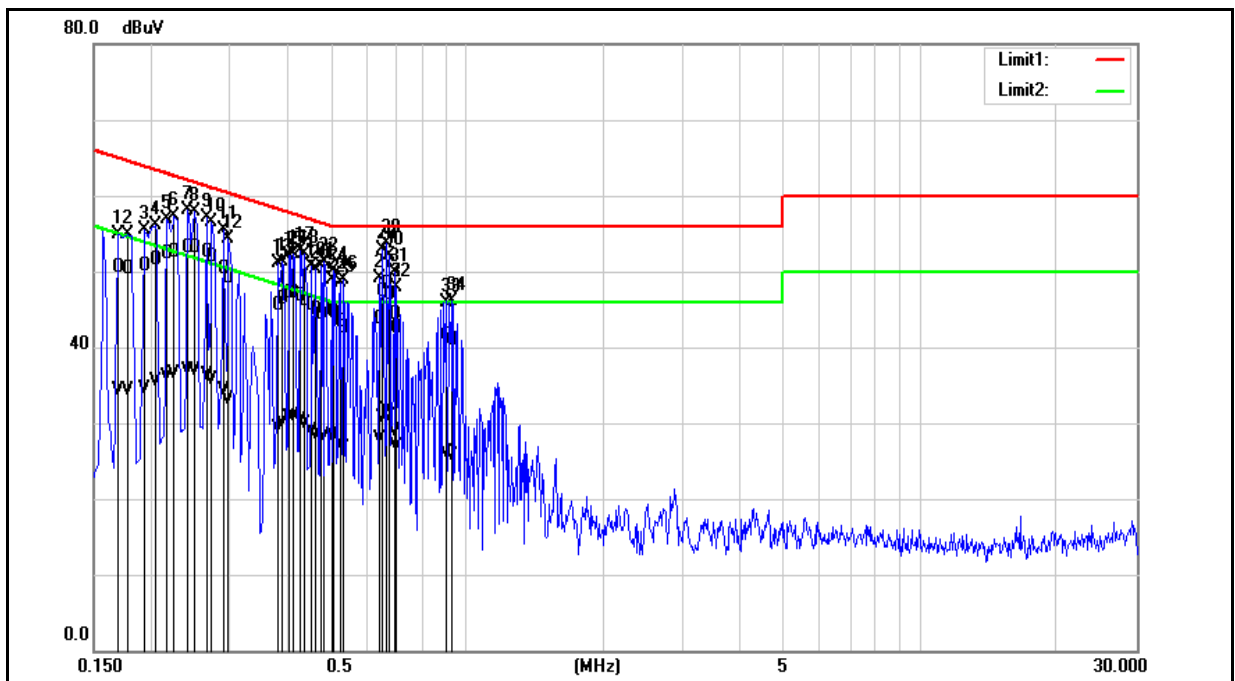
The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	40 GHz
RBW/VBW(Emission in restricted band)	1 MHz / 3 MHz for Peak 1 MHz / (1/T) for Average
RBW/VBW(Emission in non-restricted band)	1 MHz / 3 MHz for Peak

5 Test Results

Annex A. Conducted Emission

Standard:	FCC Part 15.407	Line:	L1
Test item:	Conducted Emission	Power:	AC 24 V/60 Hz
Mode:	Mode 1	Temp.(°C)/Hum.(%RH):	26(°C)/60 %RH
Description:			





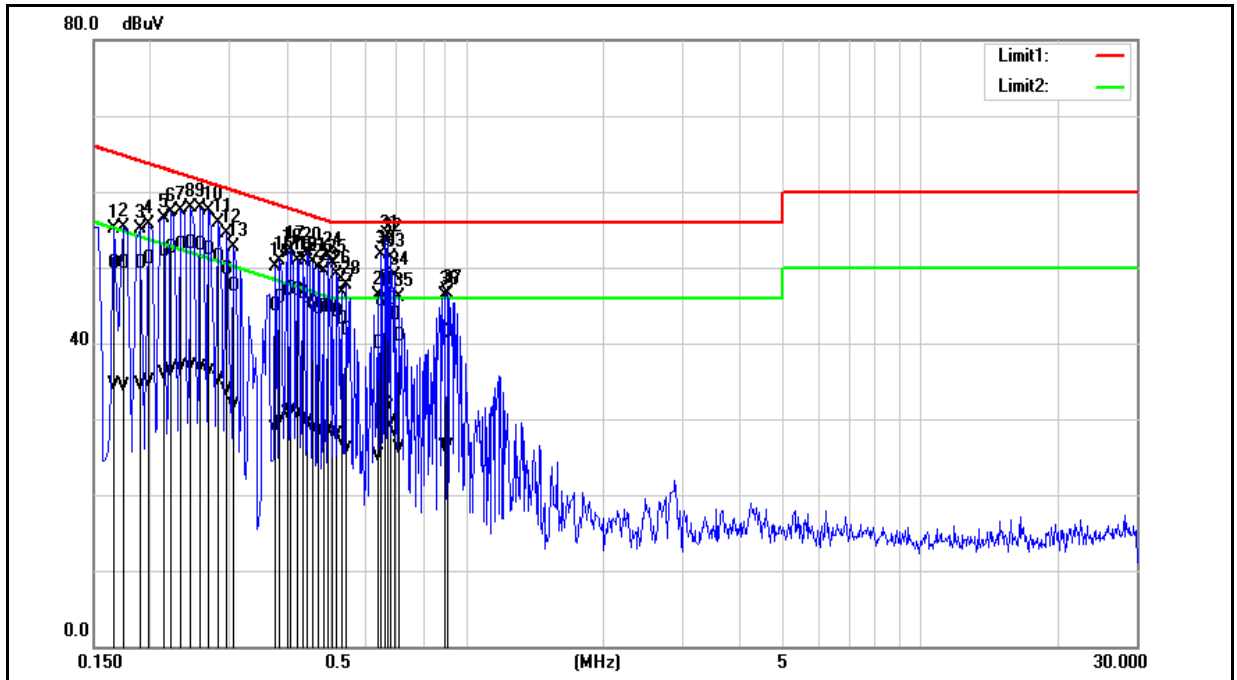
Standard:	FCC Part 15.407	Line:	L1
Test item:	Conducted Emission	Power:	AC 24 V/60 Hz
Mode:	Mode 1	Temp.(°C)/Hum.(%RH):	26(°C)/60 %RH
Description:			

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
11	0.2900	40.66	24.57	9.65	50.31	34.22	60.52	50.52	-10.21	-16.30	Pass
12	0.2980	39.41	23.43	9.65	49.06	33.08	60.30	50.30	-11.24	-17.22	Pass
13	0.3820	35.79	19.61	9.65	45.44	29.26	58.24	48.24	-12.80	-18.98	Pass
14	0.3900	36.59	20.38	9.65	46.24	30.03	58.06	48.06	-11.82	-18.03	Pass
15	0.4060	37.38	21.13	9.65	47.03	30.78	57.73	47.73	-10.70	-16.95	Pass
16	0.4140	37.41	21.17	9.65	47.06	30.82	57.57	47.57	-10.51	-16.75	Pass
17	0.4300	36.96	20.65	9.66	46.62	30.31	57.25	47.25	-10.63	-16.94	Pass
18	0.4380	36.54	20.21	9.66	46.20	29.87	57.10	47.10	-10.90	-17.23	Pass
19	0.4540	35.76	19.33	9.66	45.42	28.99	56.80	46.80	-11.38	-17.81	Pass
20	0.4620	35.23	18.80	9.66	44.89	28.46	56.66	46.66	-11.77	-18.20	Pass
21	0.4780	34.72	18.21	9.66	44.38	27.87	56.37	46.37	-11.99	-18.50	Pass
22	0.4860	35.22	18.70	9.66	44.88	28.36	56.24	46.24	-11.36	-17.88	Pass
23	0.5020	35.07	18.64	9.66	44.73	28.30	56.00	46.00	-11.27	-17.70	Pass
24	0.5100	34.78	18.46	9.66	44.44	28.12	56.00	46.00	-11.56	-17.88	Pass
25	0.5260	33.67	17.65	9.66	43.33	27.31	56.00	46.00	-12.67	-18.69	Pass
26	0.5340	32.83	16.99	9.66	42.49	26.65	56.00	46.00	-13.51	-19.35	Pass
27	0.6420	34.11	18.32	9.66	43.77	27.98	56.00	46.00	-12.23	-18.02	Pass
28	0.6500	37.60	21.11	9.66	47.26	30.77	56.00	46.00	-8.74	-15.23	Pass
29	0.6660	38.71	22.14	9.66	48.37	31.80	56.00	46.00	-7.63	-14.20	Pass
30	0.6740	37.27	21.19	9.66	46.93	30.85	56.00	46.00	-9.07	-15.15	Pass
31	0.6900	34.72	19.30	9.66	44.38	28.96	56.00	46.00	-11.62	-17.04	Pass
32	0.6980	32.85	17.33	9.66	42.51	26.99	56.00	46.00	-13.49	-19.01	Pass
33	0.9020	31.74	16.34	9.68	41.42	26.02	56.00	46.00	-14.58	-19.98	Pass
34	0.9260	31.22	16.08	9.68	40.90	25.76	56.00	46.00	-15.10	-20.24	Pass

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

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

Standard:	FCC Part 15.407	Line:	N
Test item:	Conducted Emission	Power:	AC 24 V/60 Hz
Mode:	Mode 1	Temp.(°C)/Hum.(%RH):	26(°C)/60 %RH
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	0.1660	40.92	24.88	9.68	50.60	34.56	65.16	55.16	-14.56	-20.60	Pass
2	0.1740	40.76	24.67	9.68	50.44	34.35	64.77	54.77	-14.33	-20.42	Pass
3	0.1900	40.91	24.86	9.67	50.58	34.53	64.04	54.04	-13.46	-19.51	Pass
4	0.1980	41.37	25.30	9.67	51.04	34.97	63.69	53.69	-12.65	-18.72	Pass
5	0.2140	42.42	26.29	9.67	52.09	35.96	63.05	53.05	-10.96	-17.09	Pass
6	0.2220	42.79	26.64	9.67	52.46	36.31	62.74	52.74	-10.28	-16.43	Pass
7	0.2340	43.21	27.02	9.67	52.88	36.69	62.31	52.31	-9.43	-15.62	Pass
8	0.2460	43.46	27.24	9.67	53.13	36.91	61.89	51.89	-8.76	-14.98	Pass
9	0.2580	43.23	26.99	9.67	52.90	36.66	61.50	51.50	-8.60	-14.84	Pass
10	0.2700	42.63	26.44	9.67	52.30	36.11	61.12	51.12	-8.82	-15.01	Pass

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

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



Standard:	FCC Part 15.407	Line:	N
Test item:	Conducted Emission	Power:	AC 24 V/60 Hz
Mode:	Mode 1	Temp.(°C)/Hum.(%RH):	26(°C)/60 %RH
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
11	0.2820	41.59	25.46	9.68	51.27	35.14	60.76	50.76	-9.49	-15.62	Pass
12	0.2940	40.11	24.09	9.68	49.79	33.77	60.41	50.41	-10.62	-16.64	Pass
13	0.3060	37.86	21.98	9.68	47.54	31.66	60.08	50.08	-12.54	-18.42	Pass
14	0.3780	35.22	19.04	9.68	44.90	28.72	58.32	48.32	-13.42	-19.60	Pass
15	0.3860	36.22	20.05	9.68	45.90	29.73	58.15	48.15	-12.25	-18.42	Pass
16	0.4020	37.29	21.07	9.68	46.97	30.75	57.81	47.81	-10.84	-17.06	Pass
17	0.4100	37.43	21.20	9.68	47.11	30.88	57.65	47.65	-10.54	-16.77	Pass
18	0.4220	37.29	21.03	9.68	46.97	30.71	57.41	47.41	-10.44	-16.70	Pass
19	0.4340	36.76	20.47	9.69	46.45	30.16	57.18	47.18	-10.73	-17.02	Pass
20	0.4460	36.24	19.91	9.69	45.93	29.60	56.95	46.95	-11.02	-17.35	Pass
21	0.4580	35.51	19.10	9.69	45.20	28.79	56.73	46.73	-11.53	-17.94	Pass
22	0.4700	34.87	18.45	9.69	44.56	28.14	56.51	46.51	-11.95	-18.37	Pass
23	0.4820	34.97	18.48	9.69	44.66	28.17	56.30	46.30	-11.64	-18.13	Pass
24	0.4940	35.28	18.82	9.69	44.97	28.51	56.10	46.10	-11.13	-17.59	Pass
25	0.5060	35.05	18.70	9.69	44.74	28.39	56.00	46.00	-11.26	-17.61	Pass
26	0.5180	34.38	18.20	9.69	44.07	27.89	56.00	46.00	-11.93	-18.11	Pass
27	0.5300	33.37	17.48	9.69	43.06	27.17	56.00	46.00	-12.94	-18.83	Pass
28	0.5420	31.97	16.28	9.69	41.66	25.97	56.00	46.00	-14.34	-20.03	Pass
29	0.6340	30.28	15.41	9.69	39.97	25.10	56.00	46.00	-16.03	-20.90	Pass
30	0.6460	35.91	19.90	9.69	45.60	29.59	56.00	46.00	-10.40	-16.41	Pass
31	0.6580	38.89	22.24	9.69	48.58	31.93	56.00	46.00	-7.42	-14.07	Pass
32	0.6700	38.25	21.80	9.69	47.94	31.49	56.00	46.00	-8.06	-14.51	Pass
33	0.6820	35.99	19.86	9.69	45.68	29.55	56.00	46.00	-10.32	-16.45	Pass
34	0.6940	33.95	18.59	9.69	43.64	28.28	56.00	46.00	-12.36	-17.72	Pass
35	0.7060	31.22	16.46	9.69	40.91	26.15	56.00	46.00	-15.09	-19.85	Pass

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

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



Standard:	FCC Part 15.407	Line:	N
Test item:	Conducted Emission	Power:	AC 24 V/60 Hz
Mode:	Mode 1	Temp.(°C)/Hum.(%RH):	26(°C)/60 %RH
Description:			

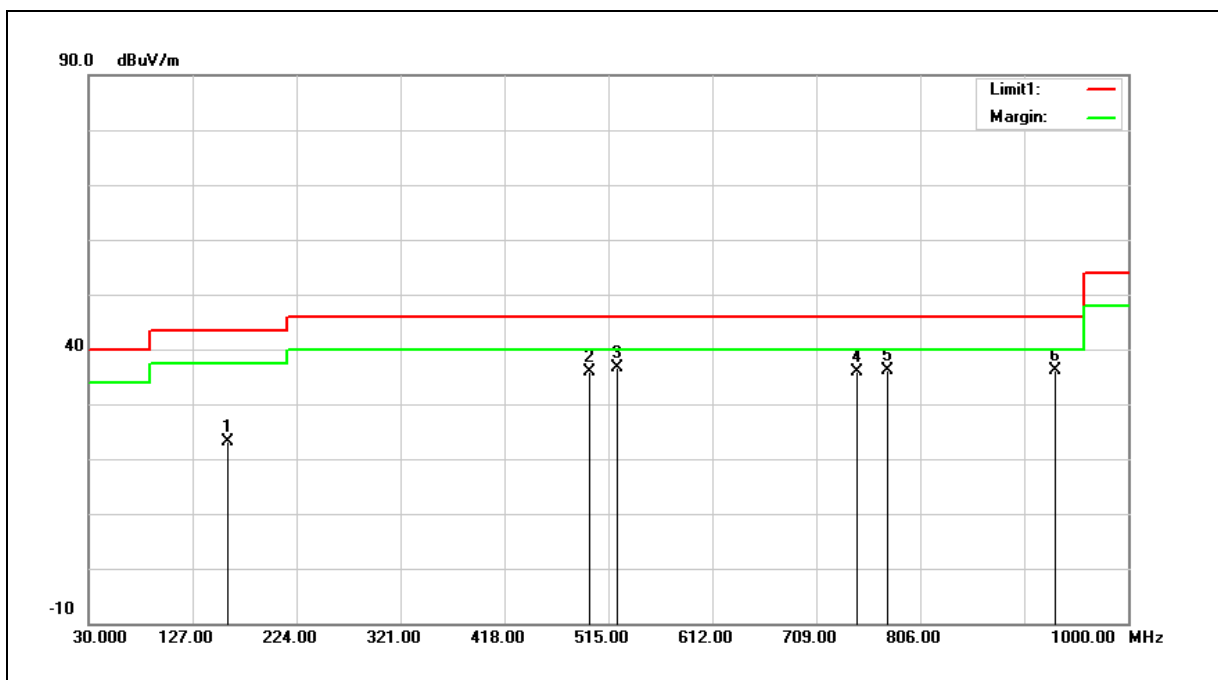
No.	Frequency (MHz)	QP reading (dBuV)	AVG reading (dBuV)	Correction factor (dB)	QP result (dBuV)	AVG result (dBuV)	QP limit (dBuV)	AVG limit (dBuV)	QP margin (dB)	AVG margin (dB)	Remark
36	0.8940	31.67	16.52	9.70	41.37	26.22	56.00	46.00	-14.63	-19.78	Pass
37	0.9060	31.78	16.60	9.70	41.48	26.30	56.00	46.00	-14.52	-19.70	Pass

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

Annex B. Radiated Emission Measurement

Below 1 GHz

Standard:	FCC Part 15.407	Test Distance:	3 m
Test item:	Harmonic	Power:	AC 24 V/60 Hz
Frequency:	5500 MHz	Temp.(°C)/Hum.(%RH):	26(°C)/60 %RH
Mode:	Mode 3		
Ant.Polar.:	Horizontal		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	159.9800	28.50	-5.41	23.09	43.50	-20.41	QP
2	497.5400	36.04	-0.17	35.87	46.00	-10.13	QP
3	522.7600	36.21	0.40	36.61	46.00	-9.39	QP
4	746.8300	30.63	5.13	35.76	46.00	-10.24	QP
5	775.9300	30.50	5.53	36.03	46.00	-9.97	QP
6	932.1000	27.66	8.54	36.20	46.00	-9.80	QP

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading (dBuV).

Example: $23.09 = -5.41 + 28.50$

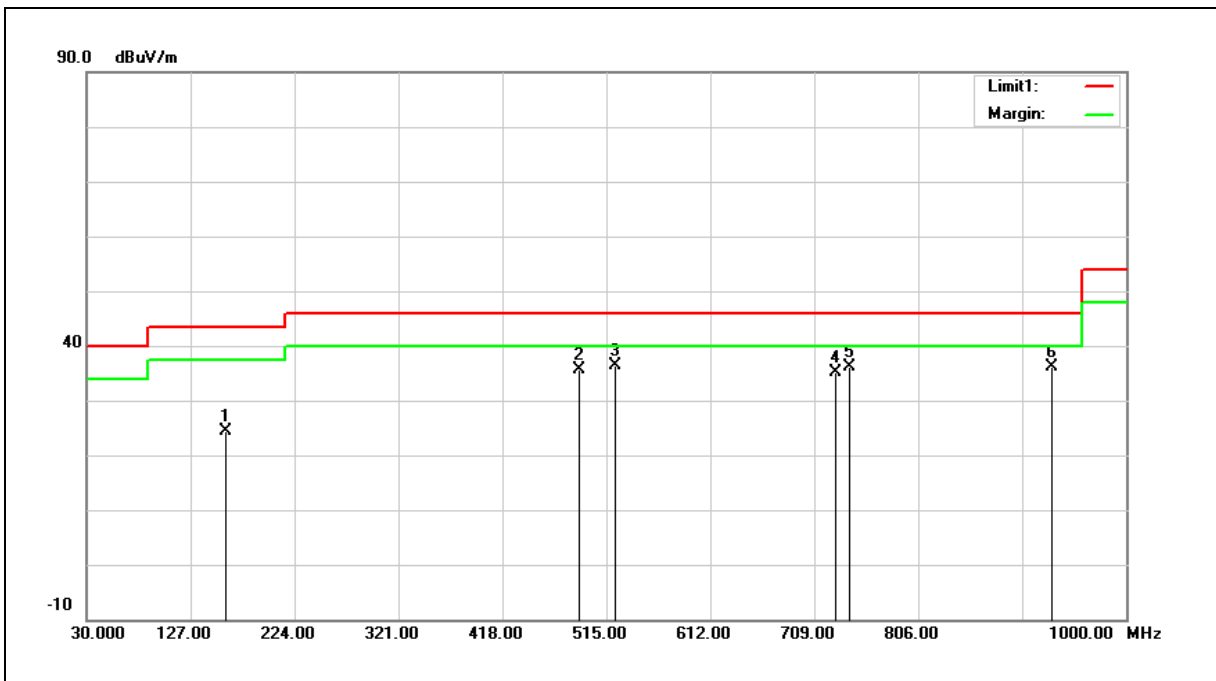
2.Correction factor (dB/m) = Antenna Factor (dB/m) + Cable loss (dB) – Pre-Amplifier gain (dB).

3.When the peak results are less than average limit, so not need to evaluate the average.

4.All amplitude of spurious emissions that are attenuated by more than 20 dB on below 30 MHz.



Standard:	FCC Part 15.407	Test Distance:	3 m
Test item:	Harmonic	Power:	AC 24 V/60 Hz
Frequency:	5500 MHz	Temp.(°C)/Hum.(%RH):	26(°C)/60 %RH
Mode:	Mode 3		
Ant.Polar.:	Vertical		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	159.9800	29.85	-5.41	24.44	43.50	-19.06	QP
2	489.7800	35.92	-0.25	35.67	46.00	-10.33	QP
3	522.7600	36.02	0.40	36.42	46.00	-9.58	QP
4	729.3700	30.55	4.68	35.23	46.00	-10.77	QP
5	741.9800	31.23	5.01	36.24	46.00	-9.76	QP
6	931.1300	27.67	8.50	36.17	46.00	-9.83	QP

Note:1.Result (dBuV/m) = Correct Factor (dB/m) + Reading (dBuV).

Example: 24.44 = -5.41 + 29.85

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

3.When the peak results are less than average limit, so not need to evaluate the average.

4.All amplitude of spurious emissions that are attenuated by more than 20 dB on below 30 MHz.

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