
FCC Test Report

Report No: WD-RF-R-230052-A0

Product Name : Dual Frequency RFID Multi-ISO Protocol Modules
Model Name : QD60
FCC ID : WXAQD60
Applicant : GIGA-TMS INC.
Received Date : Dec. 06, 2022
Tested Date : Feb. 22, 2023 ~ Mar. 13, 2023
Applicable Standard : 47 CFR FCC Part 15, Subpart C (Section 15.225)
ANSI C63.10 : 2013



Wendell Industrial Co., Ltd
Wendell EMC & RF Laboratory

Caution:

This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted.

The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment.

Please note that the measurement uncertainty are provided for informational purpose only and are not used in determining the Pass/Fail results.

This report must not be used to claim product endorsement by TAF or any agency of the government.

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Test Report

Issued Date: March 14, 2023

Project No.: 22Q120603

Product Name	Dual Frequency RFID Multi-ISO Protocol Modules
Trade Name	PROMAG
Model Name	QD60
FCC ID	WXAQD60
Applicant	GIGA-TMS INC.
Manufacturer	GIGA-TMS INC.
EUT Rated Voltage	DC 5V
EUT Test Voltage	AC 120V / 60Hz
EUT Supports Radios Application	RFID 13.56 MHz RFID 125kHz
Applicable Standard	47 CFR FCC Part 15, Subpart C (Section 15.225) ANSI C63.10 : 2013
Test Result	Complied

Documented :



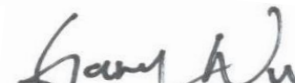
(Specialist / Emma Lu)

Technical Engineer :



(Section Manager / Jack Chang)

Approved :



(Project Manager / Gary Wu)

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Attachment 2: EUT Detailed Photographs	

Document Revision History

Report No.	Issue date	Description
WD-RF-R-230052-A0	March 14, 2023	Initial report

Summary of Test Result

Ref. Std. Clause	Test Items	Result
15.203	Antenna Requirement	Pass
15.215(c)	20dB Spectrum Bandwidth	Pass
15.225(e)	Frequency Stability	Pass
15.225 (a)(b)(c)	Field Strength of Fundamental Emissions	Pass
15.225(d)	Radiated Spurious Emissions	Pass
15.207	AC Conducted Emission	Pass

1 Generation Information

1.1 Applicant

GIGA-TMS INC.
8F, NO.31, LANE 169, KANG-NING ST.,HSI-CHIH, NEW TAIPEI CITY, Taiwan

1.2 Manufacturer

GIGA-TMS INC.
8F, NO.31, LANE 169, KANG-NING ST.,HSI-CHIH, NEW TAIPEI CITY, Taiwan

1.3 Description of Equipment under Test

Product Name	Dual Frequency RFID Multi-ISO Protocol Modules
Model No.	QD60
FCC ID	WXAQD60
Frequency Range	13.56 MHz
Type of Modulation	ASK
Antenna Information	Refer to the table “Antenna List”
EUT Supports Radios Application	RFID 13.56 MHz RFID 125kHz
EUT Rated Voltage	DC 5V
EUT Test Voltage	AC 120V / 60Hz

Antenna List

No.	Manufacturer	Model No.	Antenna Type	Peak Gain	Remark
1	N/A	N/A	Loop Antenna	N/A	For 13.56MHz

Channel List

Channel	Frequency (MHz)
01	13.56

Test Frequencies in each operating band

Frequency range over which the device operates in each operating band (Note 1)	Number of test frequencies required	Location of test frequencies inside the operating frequency range (Note 1,2)
≤ 1 MHz	1	near centre
> 1 MHz and ≤ 10 MHz	2	1 near high end, 1 near low end
> 10 MHz	3	1 near high end, 1 near centre, and 1 near low end

Note 1: The frequency range over which the device operates in a given operating band is the difference between the highest and lowest frequencies on which the device can be tuned within that given operating band. The frequency range can be smaller than or equal to the operating band, but cannot be greater than the operating band.

Note 2: In the third column of table 1, “near” means as close as possible to or at the centre / low end / high end of the frequency range over which the device operates.

Firmware / Software Version

1	Product Name	Dual Frequency RFID Multi-ISO Protocol Modules
2	Model No.	QD60
3	Test SW Version	PROMAG Multi-Protocol Studio_Ver:7.8R0
4	RF power setting in TEST SW	<input checked="" type="checkbox"/> RF power setting was not able to alter during testing. <input type="checkbox"/> RF power setting was able to alter during testing. (See the following table)

Parameters of test software setting

Type of Modulation	Channel	Frequency (MHz)	Set Value
ASK	01	13.56	Default

Test Mode

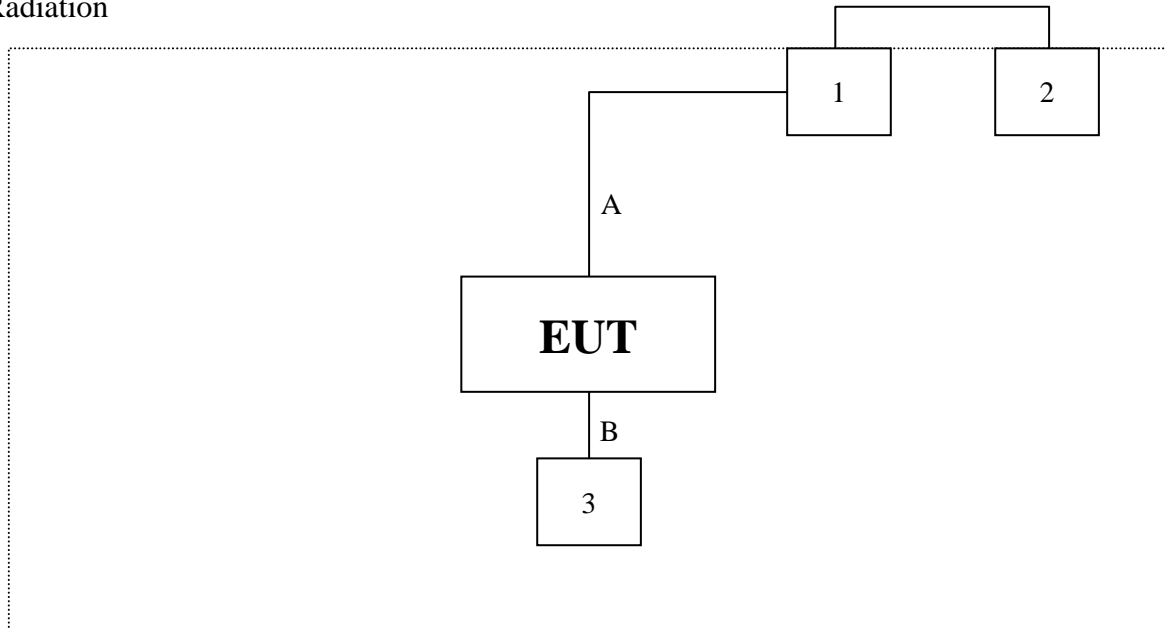
Mode 1	Transmit
Mode 2	Standby

Note:

1. This device is a Dual Frequency RFID Multi-ISO Protocol Modules with a built-in RFID ransceiver.
2. These tests were performed on a sample of equipment to demonstrate compliance with 47 CFR FCC Part 15, Subpart C (Section 15.225).
3. The radiation measurements are performed in X, Y, Z axis positioning. Only the X axis worst case is shown in the report.

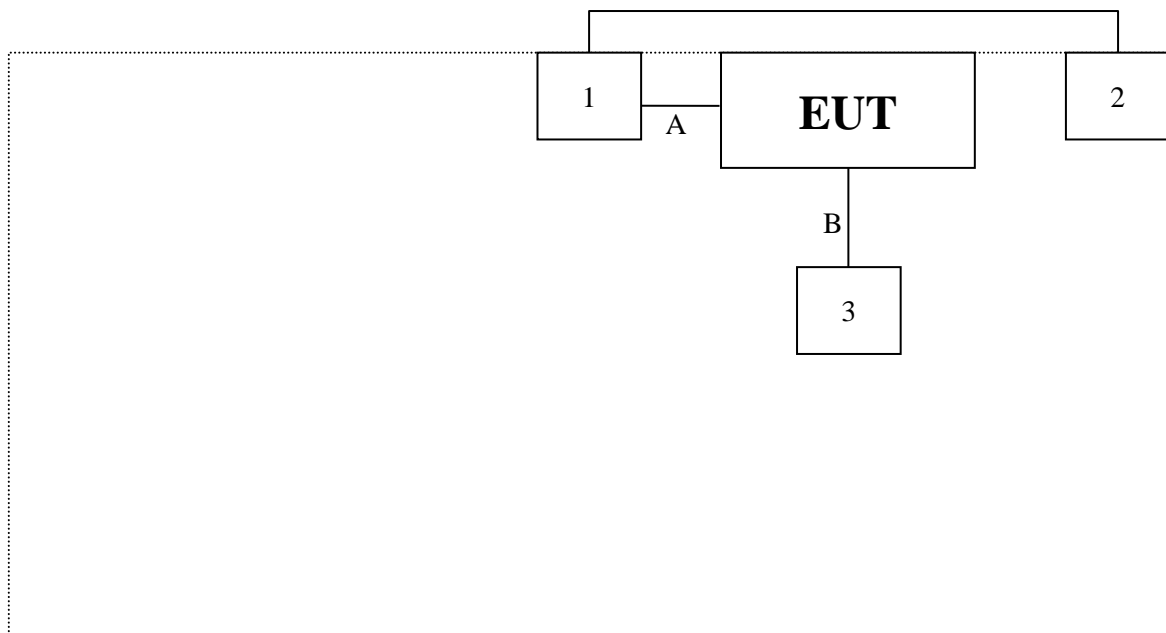
1.4 Configuration of Tested System

Radiation



Test Table

AC Conduction



Test Table

1.5 EUT Exercise Software

1. Setup the EUT as shown in Section 1.4
2. Turn on the power of all equipment.
3. Using tag to trigger RFID continuous transmission.
4. Verify that the EUT works properly.

1.6 Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

No.	Product	Manufacturer	Model No.	Serial No.	Power Cord
1	Notebook PC	acer	N17W3	NXVJ7TA00302301D496600	N/A
2	Adapter	Acer	W15-045N4A	KP045H00694601969PH05	Non-shielded, 1 Core, 1.6m
3	13.56 MHz Antenna	N/A	N/A	N/A	N/A
	125 kHz Antenna	Shenzhen Xinlifeng Technology Co., Ltd	ANT-T044	N/A	N/A

No.	Signal Cable Type	Signal cable Description
A	USB Cable	Non-shielded, Non-Core, 0.35m
B	Data Cable	Non-shielded, Non-Core, 0.16m

1.7 Test Facility

Items	Required (IEC 60068-1)
Temperature (°C)	15-35
Humidity (% RH)	25-75
Barometric pressure (mbar)	860-1060

Description: Accredited by TAF
Accredited Number: 2965

Issued by: Wendell Industrial Co., Ltd

Lab Address: 6F/6F-1, No.188, Baoqiao Rd., Xindian Dist.,
New Taipei City 23145, Taiwan R.O.C

Test Lab: Wendell EMC & RF Laboratory

Test Location: No. 119, Wugong 3rd Rd., Wugu Dist.,
New Taipei City 248, Taiwan (R.O.C.)

Designation Number: TW0025

Test Firm Registration Number: 665221

1.8 Measurement Uncertainty

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

Measurement Project	Condition	Expanded Uncertainty
AC Conducted Emission	0.150 ~ 30 MHz	± 2.64 dB
Radiated Emission	0.009 ~ 30 MHz	± 3.7 dB
	30 ~ 1000 MHz	± 3.9 dB
	1000 ~ 18000 MHz	± 4.5 dB
	18000 ~ 40000 MHz	± 4.3 dB
RF Power, Conducted	Conducted Measuring	± 0.75 dB
Occupied Bandwidth	Conducted Measuring	± 2.4 %
Power Density	Conducted Measuring	± 1.2 dB
Duty Cycle and Dwell Time	Conducted Measuring	± 0.9 %
Conducted Unwanted Emission Strength	Conducted Measuring	± 1.4 dB
DC Power Supply	--	± 2.0 %
Temperature	--	± 0.55 °C
Humidity	--	± 3.1 %

Note: Please note that the measurement uncertainty are provided for informational purpose only and are not used in determining the Pass/Fail results.

1.9 List of Test Equipment

For Conducted measurements / W08-Conducted Measurement

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
✓ Spectrum analyzer	Keysight	N9010A	SG50420005	2022/08/01	2023/07/31
Wideband Peak Power Meter	Anritsu	ML2495A	1733007	2022/09/06	2023/09/05
Pulse Power Sensor + Precision Adaptor	Anritsu	MA2411B	1726022	2022/09/06	2023/09/05
✓ Temperature Chamber	TAICHY	MHK-225LK	1061121	2022/04/22	2023/04/21
Wireless Connectivity Tester	R&S	CMW270	101307	2022/05/23	2023/05/22
Attenuator	MVE	MVE2211-10	CT-9-056	2022/08/10	2023/08/09
Attenuator	MVE	MVE2211-20	CT-9-057	2022/08/10	2023/08/09
Attenuator	MVE	MVE2211-30	CT-9-058	2022/08/10	2023/08/09
Power Divider	MVE	MVE8546	170826003	2022/08/10	2023/08/09
Power Splitter	MVE	MVE8547	170302047	2022/08/11	2023/08/10
DC Power Supply	GW INSTEK	GPC-3060D	GER817636	2022/08/09	2023/08/08

Remark:

1. All equipments are calibrated every one year.
2. The test instruments marked with “✓” are used to measure the final test results.

For AC Conduction measurements / W08-CE

	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
✓	EMI Test Receiver	R&S	ESR3	102309	2022/6/15	2023/6/14
✓	2-Line V-Network LISN	R&S	ENV216	101185	2022/6/20	2023/6/19
✓	LISN	SCHWARZBECK	NSLK 8127RC	05028	2022/6/20	2023/6/19
✓	Transient Limiter	EM Electronics Corporation	EM-7600	857	2022/6/20	2023/6/19
✓	50ohm Cable	EMCI	EMCCFD300-BM-BM-5000	170612	2022/6/17	2023/6/16
✓	50 ohm terminal impedance	HUBER+SUHNER	50 ohm terminal impedance	CT-1-109-1	2022/6/17	2023/6/16

Remark:

1. All equipments are calibrated every one year.
2. The test instruments marked with “✓” are used to measure the final test results.
3. Test Software version: FARAD EZ-EMC Ver.EMC-CON 3A1

For Radiated measurements / W08-996-2

Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
✓ EMI Receiver	Keysight	N9038A	MY51210173	2022/08/17	2023/08/16
✓ Spectrum Analyzer	Keysight	N9010A	MY52220228	2022/08/16	2023/08/15
✓ Loop Antenna	EMCI	LPA600	277	2022/08/22	2023/08/21
✓ TRILOG super broad Antenna	Schwarzbeck	VULB 9168	VULB 9168-700 & 20E03	2022/08/12	2023/08/11
Horn Antenna	Schwarzbeck	BBHA 9120D	01767	2022/08/24	2023/08/23
Horn Antenna	Schwarzbeck	BBHA 9170	703	2022/08/29	2023/08/28
✓ Pre-Amplifier	EMEC	EMC330	060774	2022/08/17	2023/08/16
Pre-Amplifier	EMEC	EM01G18G	060648	2022/08/18	2023/08/17
Pre-Amplifier	JPT	JPA0118-55-303K	1910001800055003	2022/08/18	2023/08/17
Pre-Amplifier	EMCI	EMC184045SE	980515	2022/08/18	2023/08/17
✓ Cable	EMEC	EM-CB400	105060103	2022/08/18	2023/08/17
✓ Cable	EMEC	EM-CB400	105060102	2022/08/18	2023/08/17
✓ Cable	EMEC	EM-CB400	105060101	2022/08/18	2023/08/17
RF Cable	HUBER+SUHNER	SF102	MY2752/2	2022/08/17	2023/08/16
RF Cable	MVE	280280.LL266.1200	B60028C	2022/08/17	2023/08/16
RF Cable	EMCI	EMC102-KM-KM-600	190646	2022/08/17	2023/08/16
RF Cable	MVE	140140.LL404.700	B90014C	2022/07/28	2023/07/27
RF Cable	MVE	140140.LL404.300	B90006C	2022/08/17	2023/08/16
RF Filter	EMEC	BRF-2400-2500	002	2022/08/17	2023/08/16
RF Filter	EMEC	BRF-5150-5350	104	2022/08/17	2023/08/16
RF Filter	EMEC	BRF-5470-5725	092	2022/08/17	2023/08/16
RF Filter	EMEC	BRF-5725-5875	091	2022/08/17	2023/08/16
RF Filter	EMEC	HPF-2800	002	2022/08/17	2023/08/16
RF Filter	EMEC	HPF-5850	059	2022/08/17	2023/08/16
SMA Notch Filter	MVE	MFN-902.928.S1	190604001	2022/08/17	2023/08/16

Remark:

1. All equipments are calibrated every one year.

2. The test instruments marked with “✓” are used to measure the final test results.
3. Test Software version: FARAD EZ-EMC Ver.WD-03A1-1

2 Test Result

2.1 Antenna Requirement

2.1.1 Applicable Standard

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

2.1.2 Antenna Connected Construction

Non-standard antenna connector is used.

2.2 20dB Spectrum Bandwidth Measurement

2.2.1 Limit

Intentional radiators must be designed to ensure that the 20dB emission bandwidth in the specific band 13.553~13.567MHz.

2.2.2 Test Setup

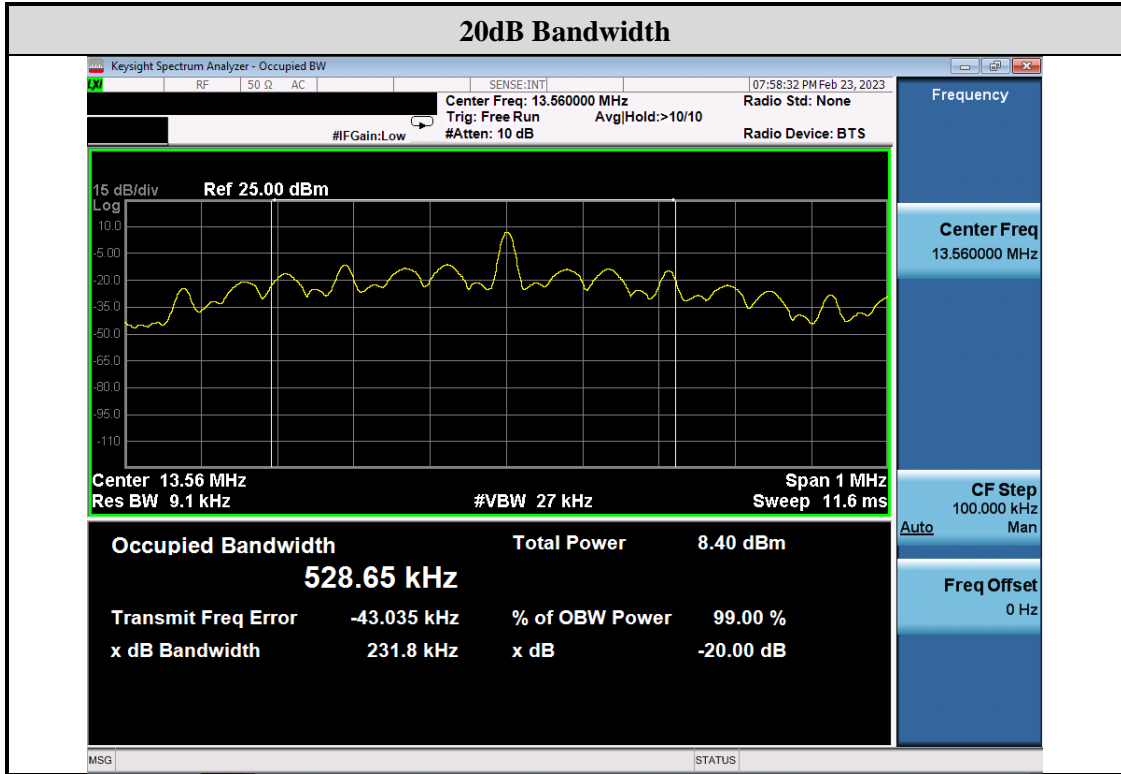


2.2.3 Test Procedure

Refer to ANSI C63.10 : 2013 clause 6.9

2.2.4 Test Result

Operating Frequency Band : 13.553~13.567 MHz

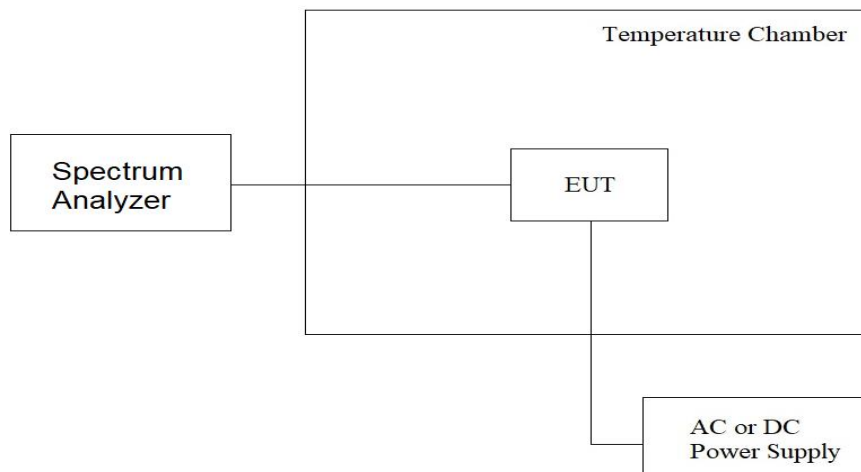


2.3 Frequency Stability Measurement

2.3.1 Limit

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ (100ppm) of the operating frequency over a temperature variation of -20°C to $+50^{\circ}\text{C}$ at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20°C .

2.3.2 Test Setup



2.3.3 Test Procedure

1. Set the spectrum analyzer span to view the entire emissions bandwidth.
2. The f_c is declaring of channel frequency. Then the frequency error formula is $(f_c - f) / f_c \times 10^6$ ppm and the limit is less than ± 100 ppm.
3. Extreme temperature rule is $-20^{\circ}\text{C} \sim 50^{\circ}\text{C}$.

2.3.4 Test Result

Temperature (°C)	Voltage	Observe Time	Frequency	Delta Frequency (Hz)	Delta Frequency (%)	Limit (%)	Result
20	Normal	start	13.560750	750	0.0055	±0.01%	Pass
		2 min	13.559740	-260	-0.0019	±0.01%	Pass
		5 min	13.560470	470	0.0035	±0.01%	Pass
		10 min	13.559790	-210	-0.0015	±0.01%	Pass
20	High(+15%)	start	13.560630	630	0.0046	±0.01%	Pass
		2 min	13.560290	290	0.0021	±0.01%	Pass
		5 min	13.559640	-360	-0.0027	±0.01%	Pass
		10 min	13.559450	-550	-0.0041	±0.01%	Pass
20	Low(-15%)	start	13.560480	480	0.0035	±0.01%	Pass
		2 min	13.559420	-580	-0.0043	±0.01%	Pass
		5 min	13.560860	860	0.0063	±0.01%	Pass
		10 min	13.559500	-500	-0.0037	±0.01%	Pass
50	Normal	start	13.559760	-240	-0.0018	±0.01%	Pass
		2 min	13.560170	170	0.0013	±0.01%	Pass
		5 min	13.559690	-310	-0.0023	±0.01%	Pass
		10 min	13.559440	-560	-0.0041	±0.01%	Pass
40	Normal	start	13.560750	750	0.0055	±0.01%	Pass
		2 min	13.559630	-370	-0.0027	±0.01%	Pass
		5 min	13.559720	-280	-0.0021	±0.01%	Pass
		10 min	13.560630	630	0.0046	±0.01%	Pass
30	Normal	Start	13.560990	990	0.0073	±0.01%	Pass
		2 min	13.559060	-940	-0.0069	±0.01%	Pass
		5 min	13.559520	-480	-0.0035	±0.01%	Pass
		10 min	13.559860	-140	-0.0010	±0.01%	Pass
10	Normal	Start	13.559700	-300	-0.0022	±0.01%	Pass
		2 min	13.559660	-340	-0.0025	±0.01%	Pass
		5 min	13.560530	530	0.0039	±0.01%	Pass
		10 min	13.559340	-660	-0.0049	±0.01%	Pass
0	Normal	start	13.559480	-520	-0.0038	±0.01%	Pass
		2 min	13.560630	630	0.0046	±0.01%	Pass
		5 min	13.559270	-730	-0.0054	±0.01%	Pass
		10 min	13.559330	-670	-0.0049	±0.01%	Pass

-10	Normal	start	13.559050	-950	-0.0070	±0.01%	Pass
		2 min	13.560310	310	0.0023	±0.01%	Pass
		5 min	13.559700	-300	-0.0022	±0.01%	Pass
		10 min	13.560380	380	0.0028	±0.01%	Pass
-20	Normal	star	13.559830	-170	-0.0013	±0.01%	Pass
		2 min	13.559410	-590	-0.0044	±0.01%	Pass
		5 min	13.559030	-970	-0.0072	±0.01%	Pass
		10 min	13.559660	-340	-0.0025	±0.01%	Pass

2.4 Field Strength of Fundamental Emissions Measurement

2.4.1 Limit

Rules and specifications	FCC Part 15 Subpart C Paragraph 15.225 Limits		
Freq. of Emission (MHz)	Field Strength ($\mu\text{V/m}$) at 30m	Field Strength ($\text{dB}\mu\text{V/m}$) at 30m	Field Strength ($\text{dB}\mu\text{V/m}$) at 3m
13.553~13.567	15848	84.0	124.0
13.410 – 13.553 and 13.567 – 13.710	334	50.5	90.5
13.110 – 13.410 and 13.710 – 14.010	106	40.5	80.5
Outside of the 13.110 – 14.010	See 15.209 Limits		

Remark:

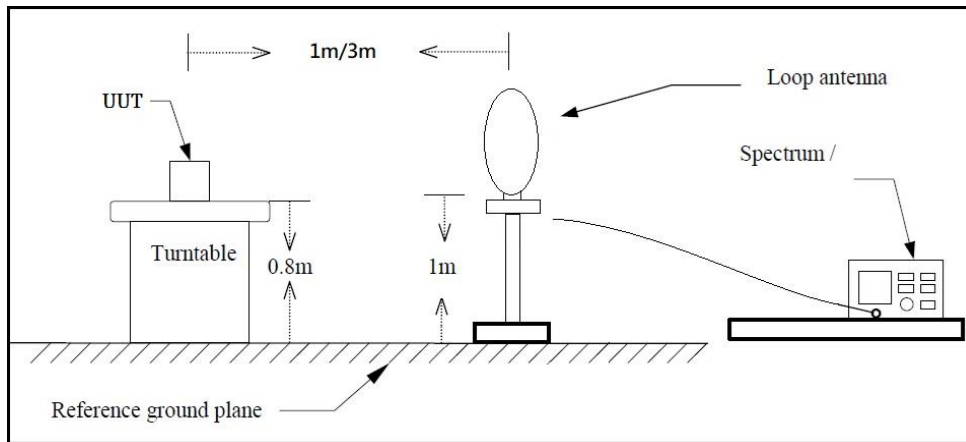
1. Emission level ($\text{dB}\mu\text{V/m}$) = 20 log Emission level ($\mu\text{V/m}$)
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
3. The emission limit in this paragraph is based on measurement instrumentation employing an quasi-peak detector.

FCC Part 15 Subpart C Paragraph 15.209 Limits		
Frequency (MHz)	Field Strength ($\mu\text{V/m}$)	Measurement Distance (m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3

Remark:

1. Emission level ($\text{dB}\mu\text{V/m}$) = 20 log Emission level ($\mu\text{V/m}$)
2. In the Above Table, the tighter limit applies at the band edges.
3. The emission limit in this paragraph is based on a measurement frequency below 1GHz instrumentation employing a quasi-peak detector.

2.4.2 Test Setup

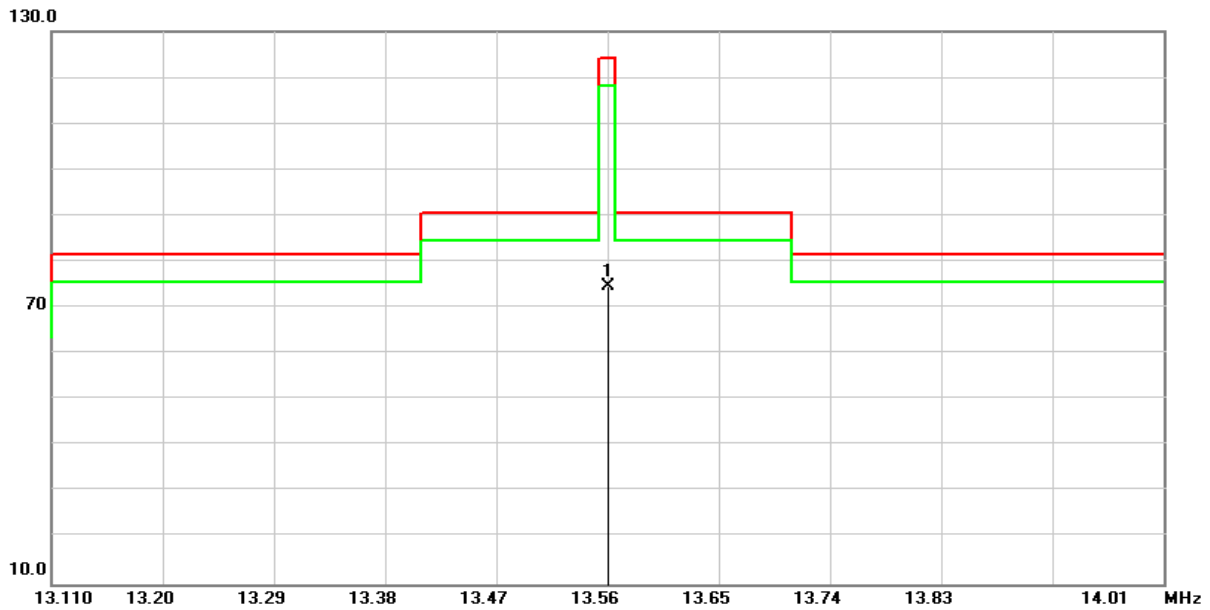


2.4.3 Test Procedure

1. For Fundamental emissions, use the receiver to measure QP reading.
2. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.
4. Compliance with the spectrum mask is tested with RBW = 9kHz.

2.4.4 Test Result

Test Mode :	Mode 1 ; Transmit	Test Date :	2023/02/22
Test Frequency :	13.56 MHz	Temperature :	20.1 °C
Polarization :	Horizontal ; X axis	Relative Humidity :	43.1 %

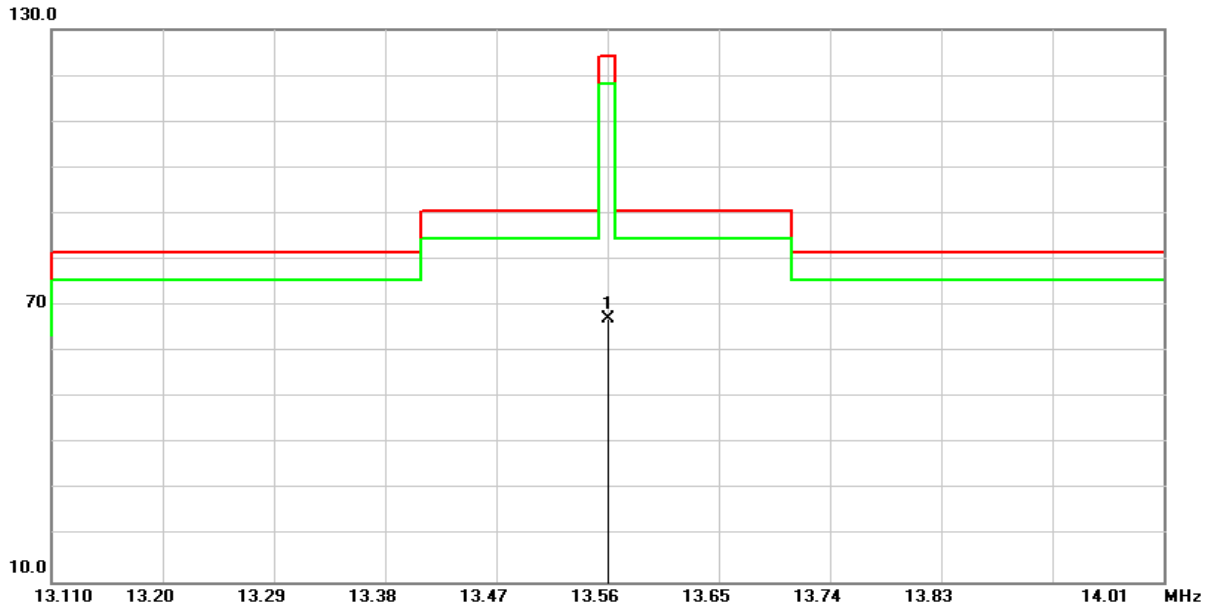


No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	13.5600	36.41	38.16	74.57	124.00	-49.43	peak

Remark :

- (1) Correction Factor = Antenna factor + Cable loss – Amplifier gain
- (2) Result Value = Reading Level + Correct Factor
- (3) Margin Level = Measurement Value – Limit Value

Test Mode :	Mode 1 ; Transmit	Test Date :	2023/02/22
Test Frequency :	13.56 MHz	Temperature :	20.1 °C
Polarization :	Vertical ; X axis	Relative Humidity :	43.1 %



No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	13.5600	28.98	38.16	67.14	124.00	-56.86	peak

Remark :

- (1) Correction Factor = Antenna factor + Cable loss – Amplifier gain
- (2) Result Value = Reading Level + Correct Factor
- (3) Margin Level = Measurement Value – Limit Value

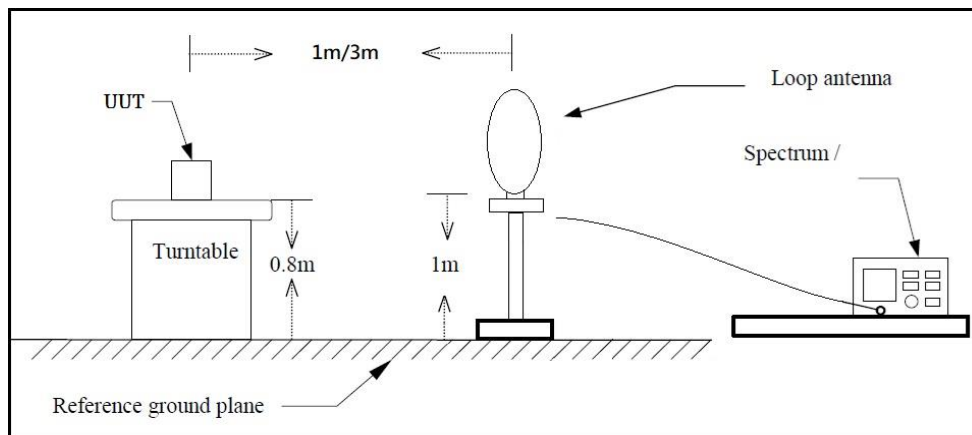
2.5 Radiated Emissions Measurement

2.5.1 Limit

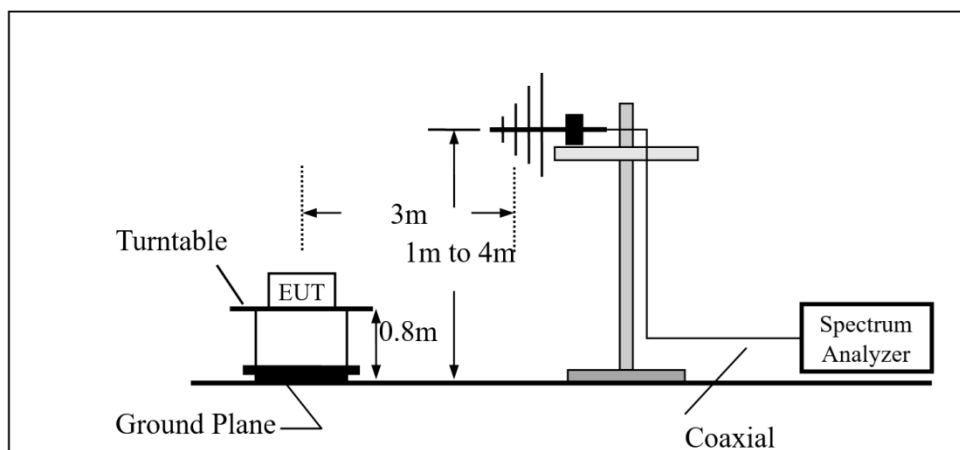
The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in Section 15.209. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified in Section 15.209

2.5.2 Test Setup

Below 30MHz



Above 30MHz



2.5.3 Test Procedure

The EUT was setup according to ANSI C63.10, 2013 for compliance to FCC 47CFR 15.225 requirements.

For Radiated emission below 30MHz

- (1) The EUT was placed on the top of a rotating table 0.8 meters above the ground in a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- (2) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- (3) Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- (4) For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- (5) The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

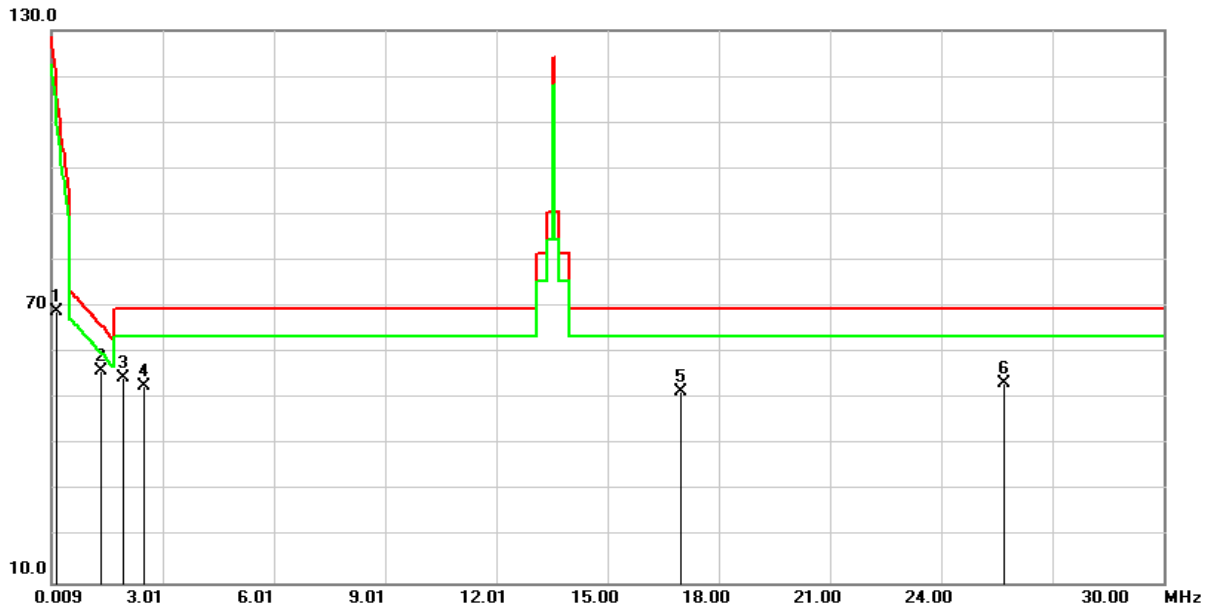
For Radiated emission Above 30MHz

- (1) The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meter chamber room for the test. The table was rotated 360 degrees to determine the position of the highest radiation.
- (2) The EUT was set 3 meters away from the interference-receiving antenna, the height of the antenna is varied from 1 meter to 4 meters above the ground to determine the maximum value of the field strength.
- (3) Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- (4) For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- (5) The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

2.5.4 Test Result

Below 30 MHz Data

Test Mode :	Mode 1 ; Transmit	Test Date :	2023/02/22
Test Frequency :	13.56 MHz	Temperature :	20.1 °C
Polarization :	Horizontal ; X axis	Relative Humidity :	43.1 %

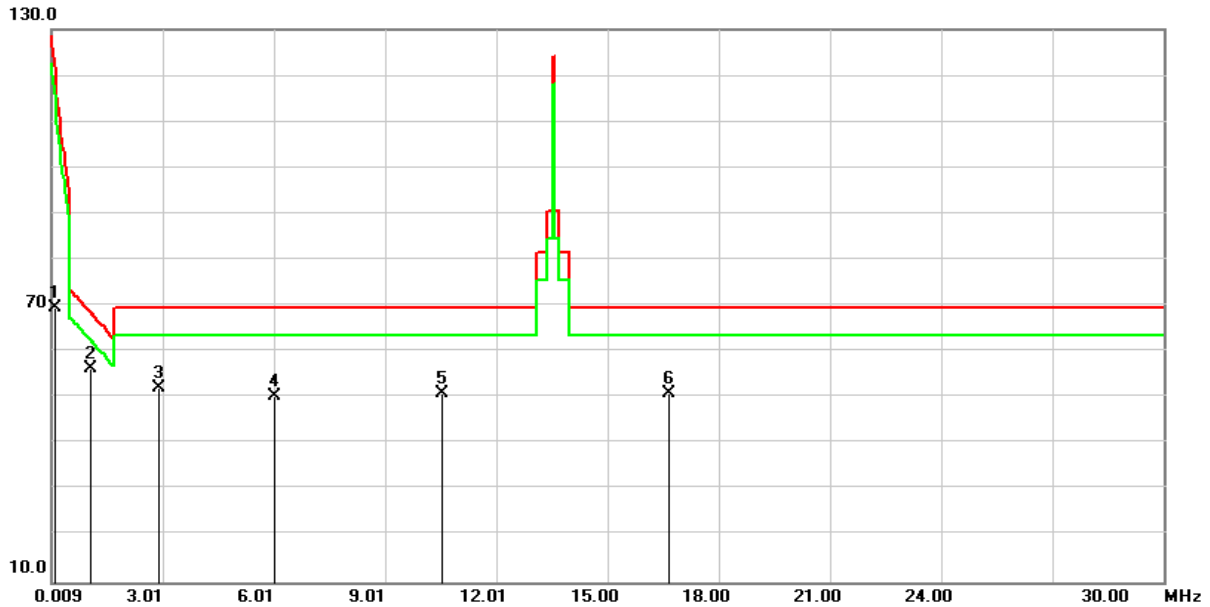


No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	0.1040	11.87	57.09	68.96	107.26	-38.30	QP
2	1.3141	15.27	40.75	56.02	65.23	-9.21	QP
3	1.9111	15.11	39.53	54.64	69.54	-14.90	QP
4	2.5082	14.48	38.29	52.77	69.54	-16.77	QP
5	16.9854	13.70	37.75	51.45	69.54	-18.09	QP
6	25.7010	13.89	39.35	53.24	69.54	-16.30	QP

Remark :

- (1) Correction Factor = Antenna factor + Cable loss – Amplifier gain
- (2) Result Value = Reading Level + Correct Factor
- (3) Margin Level = Measurement Value – Limit Value
- (4) The other emission levels were very low against the limit

Test Mode :	Mode 1 ; Transmit	Test Date :	2023/02/22
Test Frequency :	13.56 MHz	Temperature :	20.1 °C
Polarization :	Vertical ; X axis	Relative Humidity :	43.1 %



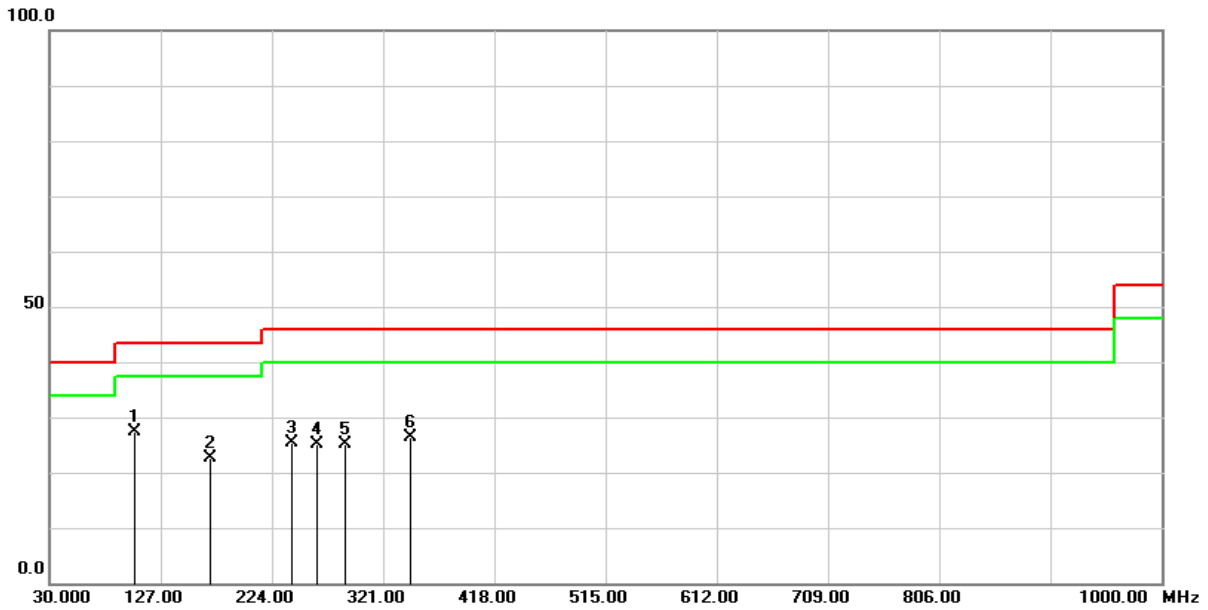
No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	0.0947	11.43	57.99	69.42	108.08	-38.66	QP
2	1.0754	15.26	41.24	56.50	66.97	-10.47	QP
3	2.8664	14.67	37.55	52.22	69.54	-17.32	QP
4	6.0006	13.28	37.04	50.32	69.54	-19.22	QP
5	10.5378	12.59	38.51	51.10	69.54	-18.44	QP
6	16.6570	13.03	37.79	50.82	69.54	-18.72	QP

Remark :

- (1) Correction Factor = Antenna factor + Cable loss – Amplifier gain
- (2) Result Value = Reading Level + Correct Factor
- (3) Margin Level = Measurement Value – Limit Value
- (4) The other emission levels were very low against the limit

Above 30MHz Data

Test Mode :	Mode 1 ; Transmit	Test Date :	2023/02/22
Test Frequency :	13.56 MHz	Temperature :	20.1 °C
Polarization :	Horizontal	Relative Humidity :	43.1 %

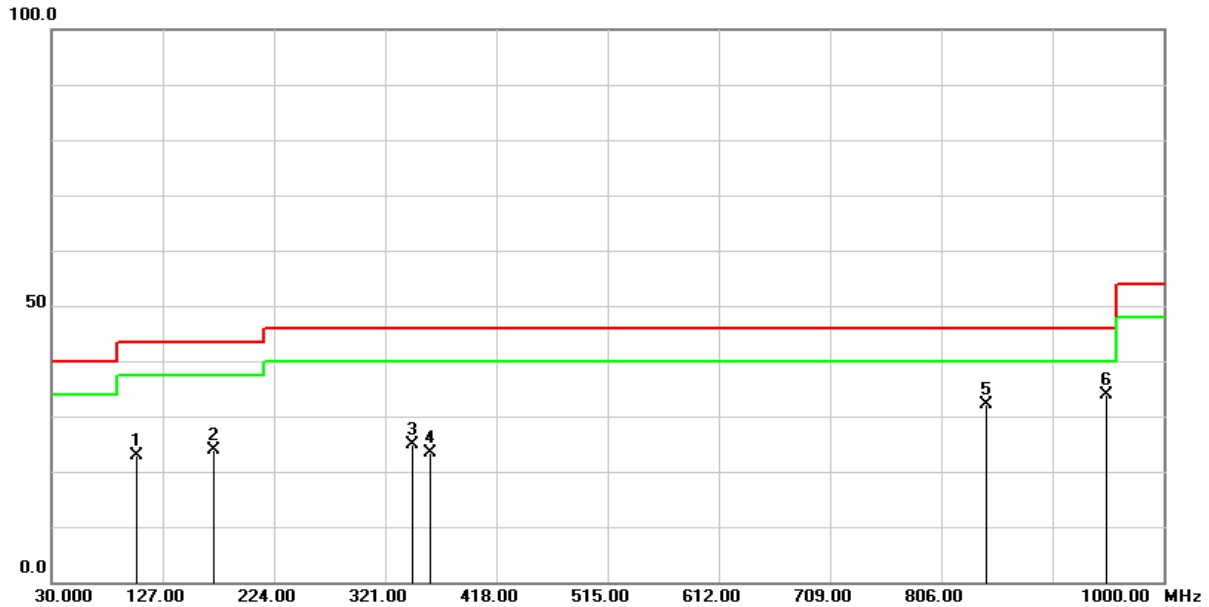


No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	103.7200	42.44	-15.15	27.29	43.50	-16.21	QP
2	169.6800	34.08	-11.55	22.53	43.50	-20.97	QP
3	241.4600	37.57	-12.25	25.32	46.00	-20.68	QP
4	263.7700	36.46	-11.26	25.20	46.00	-20.80	QP
5	288.0200	35.55	-10.39	25.16	46.00	-20.84	QP
6	345.2500	35.25	-8.82	26.43	46.00	-19.57	QP

Remark :

- (1) Correction Factor = Antenna factor + Cable loss – Amplifier gain
- (2) Result Value = Reading Level + Correct Factor
- (3) Margin Level = Measurement Value –Limit Value
- (4) The other emission levels were very low against the limit

Test Mode :	Mode 1 ; Transmit	Test Date :	2023/02/22
Test Frequency :	13.56 MHz	Temperature :	20.1 °C
Polarization :	Vertical	Relative Humidity :	43.1 %



No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	104.6900	37.90	-14.94	22.96	43.50	-20.54	QP
2	171.6200	35.33	-11.56	23.77	43.50	-19.73	QP
3	345.2500	33.65	-8.82	24.83	46.00	-21.17	QP
4	359.8000	32.22	-8.73	23.49	46.00	-22.51	QP
5	845.7700	29.73	2.45	32.18	46.00	-13.82	QP
6	949.5600	29.68	4.18	33.86	46.00	-12.14	QP

Remark :

- (1) Correction Factor = Antenna factor + Cable loss – Amplifier gain
- (2) Result Value = Reading Level + Correct Factor
- (3) Margin Level = Measurement Value – Limit Value
- (4) The other emission levels were very low against the limit

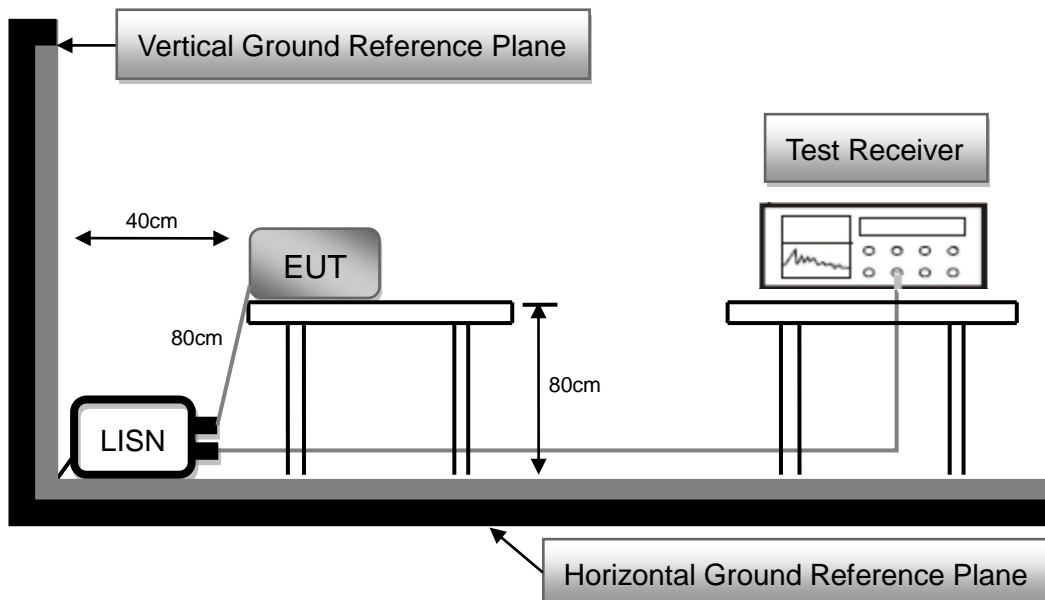
2.6 AC Conducted Emissions Measurement

2.6.1 Limit

Frequency (MHz)	FCC Part 15 Subpart C Paragraph 15.207 (dB μ V) Limit	
	Quasi-peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.50 to 5.0	56	46
5.0 to 30.0	60	50

*Decreases with the logarithm of the frequency

2.6.2 Test Setup



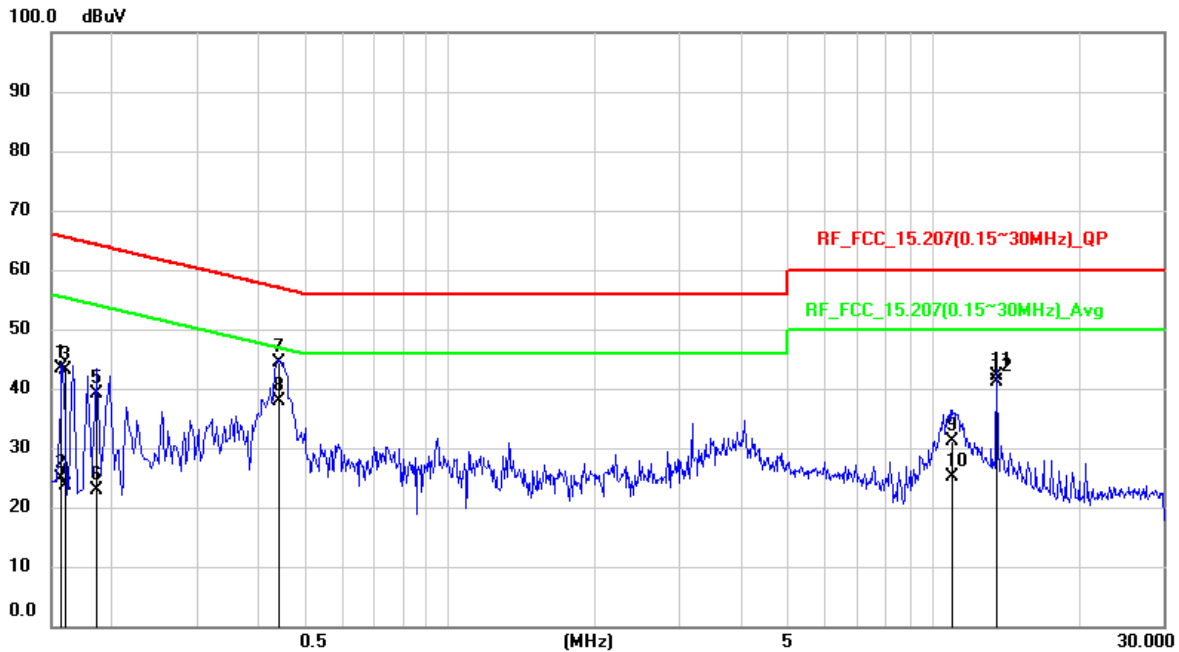
2.6.3 Test Procedure

1. The EUT was placed 0.8 meter height wooden table from the horizontal ground plane with EUT being connected to power source through a line impedance stabilization network (LISN). The LISN at least be 80 cm from nearest chassis of EUT.
2. The line impedance stabilization network (LISN) provides 50 ohm/50uH of coupling impedance for the measuring instrument. All other support equipments powered from additional LISN(s).
3. Interrelating cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle. All I/O cables were positioned to simulate typical usage.
4. All I/O cables that are not connected to a peripheral shall be bundle in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
5. The EMI test receiver connected to LISN powering the EUT. The actual test configuration, please refer to EUT test photos.
6. The receiver scanned from 150kHz to 30MHz for emissions in each of test modes. A scan was taken on both power lines, Line and Neutral, recording at least six highest emissions.
7. The EUT and cable configuration of the above highest emission levels were recorded. The Test Data of the worst case was recorded.

Note: For a device with a permanent or detachable antenna operating at or below 30 MHz, the FCC will accept measurements performed with a suitable dummy load in lieu of the antenna.

2.6.4 Test Result

Test Voltage :	110Vac, 60Hz	Frequency Range:	0.15-30 MHz
Test Mode :	Mode 1 ; Transmit	6dB Bandwidth :	9 kHz
Test Date :	2023/03/07	Phase :	L
Temperature :	22°C	Humidity :	45 %



No.	Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measurement (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1562	33.66	9.81	43.47	65.66	-22.19	QP
2	0.1562	15.01	9.81	24.82	55.66	-30.84	AVG
3	0.1619	33.34	9.81	43.15	65.37	-22.22	QP
4	0.1619	13.8	9.81	23.61	55.37	-31.76	AVG
5	0.1855	29.42	9.8	39.22	64.24	-25.02	QP
6	0.1855	13.01	9.8	22.81	54.24	-31.43	AVG
7	0.4422	34.62	9.81	44.43	57.02	-12.59	QP
8	0.4422	28.1	9.81	37.91	47.02	-9.11	AVG
9	10.9812	21.04	10.04	31.08	60	-28.92	QP
10	10.9812	15.16	10.04	25.2	50	-24.8	AVG
*11	13.5609	32.09	10.09	42.18	60	-17.82	QP
*12	13.5609	30.92	10.09	41.01	50	-8.99	AVG

Remark:

1. QP = Quasi Peak, AVG = Average
2. Correction Factor = Insertion loss of LISN + Cable loss
3. Measurement Value = Reading Level + Correct Factor
4. Margin Level = Measurement Value – Limit Value
5. * = The test frequency 13.56MHz is RF Tx

Test Voltage :	110Vac, 60Hz	Frequency Range:	0.15-30 MHz
Test Mode :	Mode 1 ; Transmit	6dB Bandwidth :	9 kHz
Test Date :	2023/03/07	Phase :	N
Temperature :	22°C	Humidity :	45 %



No.	Frequency (MHz)	Reading Level (dBuV)	Correct Factor (dB)	Measurement (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.16	33.12	9.81	42.93	65.46	-22.53	QP
2	0.16	14.92	9.81	24.73	55.46	-30.73	AVG
3	0.1751	30.31	9.8	40.11	64.71	-24.6	QP
4	0.1751	13.24	9.8	23.04	54.71	-31.67	AVG
5	0.1948	28.59	9.8	38.39	63.83	-25.44	QP
6	0.1948	12.61	9.8	22.41	53.83	-31.42	AVG
7	0.4462	32.02	9.81	41.83	56.95	-15.12	QP
8	0.4462	25.5	9.81	35.31	46.95	-11.64	AVG
9	12.283	22.9	10.06	32.96	60	-27.04	QP
10	12.283	15.78	10.06	25.84	50	-24.16	AVG
*11	13.5613	29.75	10.09	39.84	60	-20.16	QP
*12	13.5613	28.39	10.09	38.48	50	-11.52	AVG

Remark:

1. QP = Quasi Peak, AVG = Average
2. Correction Factor = Insertion loss of LISN + Cable loss
3. Measurement Value = Reading Level + Correct Factor
4. Margin Level = Measurement Value – Limit Value
5. * = The test frequency 13.56MHz is RF Tx

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