FCC Test Report

Product Name	：	Partial Discharge Handheld Surveyor
Brand Name	：	PDS Power Diagnostic Service
Model No.	：	PDH-P31
FCC ID	：	2A9OJPDH-P31
Applicant	：	POWER DIAGNOSTIC SERVICE CO., LTD.
Address	：	1 F., No. 10, Ln. 482, Sec. 4, Zhonghua Rd., Niupu Vil., Xiangshan Dist., Hsinchu City 300075, Taiwan (R.O.C.)
Date of Receipt	：	Oct. 26, 2022
Issued Date	：	Mar. 20, 2023
Report No.	：	22A0691R-RFUSOTHV03-A
Report Version	：	V1.0

ilac-MRA TAF Testing Laboratory 3024

The test results relate only to the samples tested.
The test results shown in the test report are traceable to the national/international standard through the calibration of the equipment and evaluated measurement uncertainty herein.
This report must not be used to claim product endorsement by TAF or any agency of the government.
Measurement uncertainties evaluated for each testing system and associated connections are given here to provide the system information for reference. Compliance determinations do not take into account measurement uncertainties for each testing system, but are based on the results of the compliance measurement.

Product Name	:	Partial Discharge Handheld Surveyor
Applicant	:	POWER DIAGNOSTIC SERVICE CO., LTD.
Address	:	1 F., No. 10, Ln. 482, Sec. 4, Zhonghua Rd., Niupu Vil., Xiangshan Dist., Hsinchu City 300075, Taiwan (R.O.C.)
Manufacturer	:	POWER DIAGNOSTIC SERVICE CO., LTD.
Address	:	1 F., No. 10, Ln. 482, Sec. 4, Zhonghua Rd., Niupu Vil., Xiangshan Dist., Hsinchu City 300075, Taiwan (R.O.C.)
Brand Name	:	PDS Power Diagnostic Service
Model No.	:	PDH-P31
FCC ID	:	2A9OJPDH-P31
EUT Voltage	:	DC 5V (host equipment) DC 3.7V for battery
Applicable Standard	:	FCC CFR Title 47 Part 15 Subpart C Section 15.225 ANSI C63.10: 2013
Laboratory Name	:	DEKRA Testing and Certification Co., Ltd. Hsin Chu Laboratory
Address	:	No.372-2, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County 310, Taiwan, R.O.C.
Test Result	:	Complied

Documented By : Amelia Wu

(Amelia Wu / Project Specialist)

Approved By : Rueyyan. Lin

(Rueyyan Lin / Supervisor)

The test results relate only to the samples tested.

The test report shall not be reproduced except in full without the written approval of DEKRA Testing and Certification Co., Ltd.

Revision History

Version	Description	Issued Date
V1.0	Initial issue of report	Mar. 20, 2023

TABLE OF CONTENTS

1. General Information

1.1. EUT Description

Product Name	Partial Discharge Handheld Surveyor
Brand Name	
Model No.	PDH-P31
Frequency	13.56 MHz
Channel Number	1 Channel
Type of Modulation	ASK

No.	Equipment Name	Brand Name	Model No.	Rating
1	Charger	itri	Probe cradle	INPUT: DC 4.5 ~ 5.5V, 1A OUTPUT: DC 5V, 1A

Antenna Information				
Ant.	Brand Name	Model No.	Type	Gain (dBi)
0	ELECHOUSE	NFC_EXT ANTENNA	Copper Loop	3

EUT Operational Condition			
Testing Voltage	Vnom (AC 120V/60Hz)	Vmax (AC 138V/60Hz)	Vmin (AC 102V/60Hz)

Working Frequency of Each Channel	
Channel	Frequency
01	13.56 MHz

Note: The above EUT information is declared by the manufacturer.

1.2. Test Mode

DEKRA has verified the construction and function in typical operation. All the test modes were carried out with the EUT in transmitting operation, which was shown in this test report and defined as follows:

Test Mode	Mode 1: Adapter Mode 2: Charger + Adapter

Test Items	Test Mode	Modulation	Result
AC Power Line Conducted Emission	Mode 1, Mode 2	ASK	Pass
20dB Bandwidth	Mode 1	ASK	Pass
Field Strength of Fundamental Emissions and Spectrum Mask	Mode 1	ASK	Pass
Radiated Emission	Mode 1, Mode 2	ASK	Pass
Frequency Tolerance	Mode 1	ASK	Pass

Note:

1. Determining compliance shall be based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
2. For Mode 1: The EUT was performed at X axis, Y axis and Z axis position for radiated emission test. The worst case was found at Z axis, so the measurement will follow this same test configuration.
3. For Mode 2: The EUT can only be used at Y axis position.

1.3. Comments and Remarks

The product specification and testing instructions for the EUT declared in the report are provided by the manufacturer who will take all responsibilities for the accuracy.

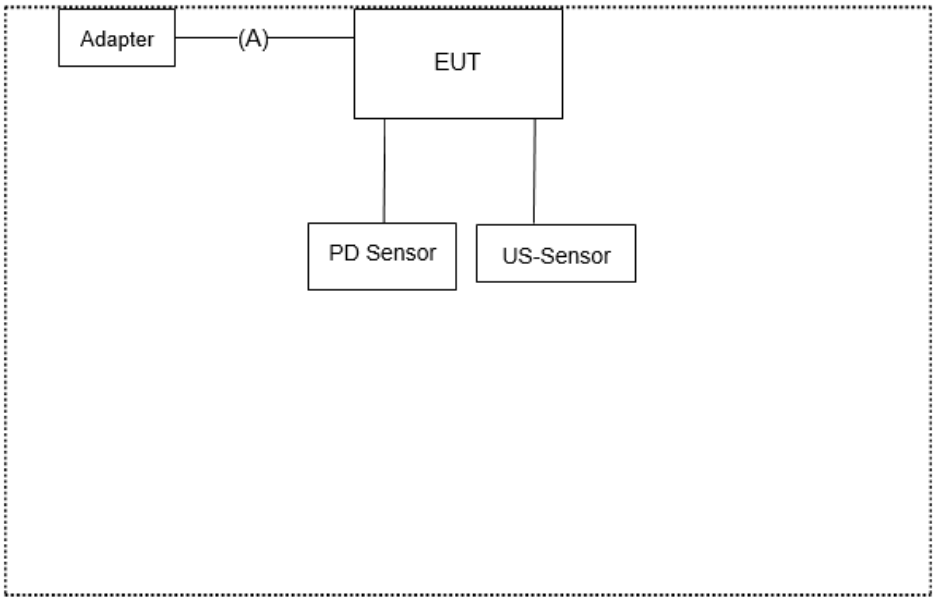
1.4. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system.

	Product	Manufacturer	Model No.	Serial No.
1	Adapter	GRENOPLUS	PD-65W	N/A
2	PD Sensor	PDS	PD Sensor	N/A
3	US-Sensor	L50	US Sensor	N/A

1.5. Configuration of tested System

Connection Diagram



	Signal Cable Type	Signal cable Description
A	USB Cable	Non-Shielded, 1m

1.6. EUT Operation of during Test

1	EUT power on.
2	Make the EUT to start the continuous transmitting.
3	Verify that device is working properly.

1.7. Test Facility

Ambient conditions in the laboratory:

Items	Test Item	Actually	Tested by	Test Date	Test Site
Temperature (°C)	AC Power Line Conducted Emission	23	Getaz Yang	2022/11/09	HC-SR02
Humidity (%RH)		61			
Temperature (°C)	Emission Bandwidth	21	Clemens Fang	2022/11/23	HC-SR12
Humidity (%RH)		67			
Temperature (°C)	Field Strength of Fundamental	23	Cyril Chen	2022/11/08	HC-CB02
Humidity (%RH)	Emissions and Spectrum Mask	59			
Temperature (°C)	Radiated Emission	23	Cyril Chen	2022/11/08	HC-CB02
Humidity (%RH)		59			
Temperature (°C)	Frequency Stability	21	Clemens Fang	2022/11/23	HC-SR12
Humidity (%RH)		67			

Note: Test site information refers to Laboratory Information.

Laboratory Information

USA	**:**	**FCC Registration Number: TW3024**
Canada	**:**	**CAB identifier : TW3024**

The address and introduction of DEKRA Testing and Certification Co., Ltd. laboratories can be founded in our Web site: http://www.dekra.com.tw

If you have any comments, please don't hesitate to contact us. Our test sites as below:

Test Laboratory	DEKRA Testing and Certification Co., Ltd.
Address	1. No.372-2, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County 31061, Taiwan, R.O.C. 2. No.372, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County 31061, Taiwan, R.O.C.
Phone number	1. +886-3-582-8001 2. +886-3-582-8001
Fax number	1. +886-3-582-8958 2. +886-3-582-8958
Email address	info.tw@dekra.com
Website	http://www.dekra.com.tw
Note: Test site number for address 1 includes HC-SR02. Test site number for address 2 includes HC-CB02, HC-CB03, HC-CB04, HC-SR10 and HC-SR12.	

1.8. List of Test Equipment

HC-SR02

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Artificial Mains Network	R&S	ENV4200	848411/010	2021/12/27	2022/12/26
EMI Test Receiver	R&S	ESR3	102608	2022/05/30	2023/05/29
LISN	R&S	ENV216	100092	2022/04/29	2023/04/28
Coaxial Cable(9 m)	Harbour	RG-400	HC-SR02	2022/08/15	2023/08/14
DEKRA Testing System	DEKRA	Version 2.0	HC-SR02	N/A	N/A

HC-SR12

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Temperature & Humidity Test Chamber	KSON	THS-B4T-150	A0401	2021/12/16	2022/12/15
Signal and Spectrum Analyzer	R&S	FSVA40	101435	2022/05/30	2023/05/29

HC-CB02

Instrument	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Date
Signal Analyzer	R&S	FSVA40	101455	2022/09/29	2023/09/28
Trilog Broadband Antenna	Schwarzbeck	VULB 9168	1272	2022/05/19	2023/05/18
Pre-Amplifier	EMCI	EMC01820I	980365	2022/04/15	2023/04/14
EMI Test Receiver	R&S	ESR7	102260	2021/12/22	2022/12/21
Magnetic Loop Antenna	Teseq	HLA 6121	44287	2022/10/21	2023/10/20
Coaxial Cable(13m)	Suhner	SF104	HC-CB02	2022/08/15	2023/08/14
Radiated Software	AUDIX	e3 V9	HC-CB02_1	N/A	N/A

Note: All equipment upon which need to calibrated are with calibration period of 1 year.

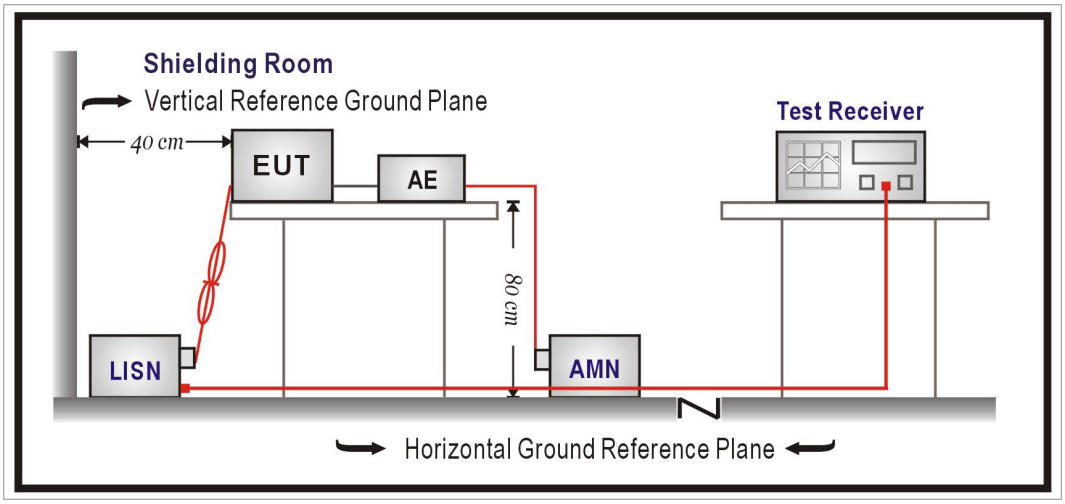
1.9. Measurement Uncertainty

Uncertainties have been calculated according to the DEKRA internal document 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).

Test item	Uncertainty
AC Power Line Conducted Emission	± 2.10 dB
Emission Bandwidth	± 282.55 Hz
Field Strength of Fundamental Emissions and Spectrum Mask	± 3.27 dB
Radiated Emission	± 3.25 dB
Frequency Stability	± 282.55 Hz

2. AC Power Line Conducted Emission

2.1. Test Setup



2.2. Test Limit

Frequency (MHz)	QP (dBuV)	AV (dBuV)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Remarks: In the above table, the tighter limit applies at the band edges.

2.3. 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 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50 ohm termination. (Please refer to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement.

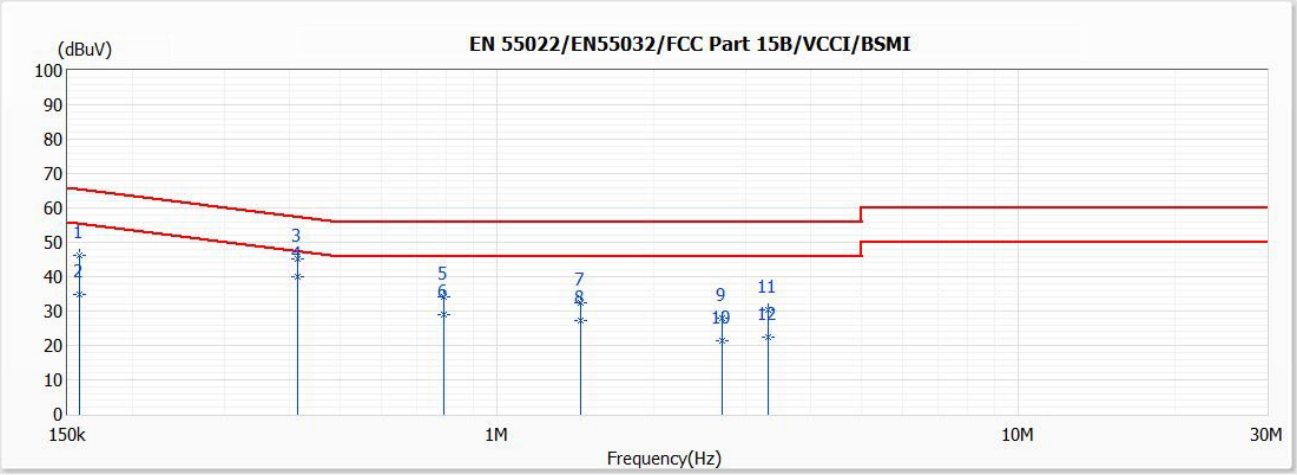
Conducted emissions were invested over the frequency range from 0.15 MHz to 30 MHz using a receiver bandwidth of 9 kHz.

2.4. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.207

2.5. Test Result of AC Power Line Conducted Emission

Test Mode	Mode 1: Adapter	Phase	Line
Test Condition	13.56 MHz		



No	Frequency (MHz)	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)	Reading Level (dBuV)	Correct Factor (dB)	Detector Type
1	0.158	46.04	65.55	-19.51	36.42	9.62	QP
2	0.158	34.95	55.55	-20.60	25.33	9.62	AV
3	0.415	45.30	57.56	-12.26	35.66	9.64	QP
*4	0.415	40.06	47.56	-7.50	30.42	9.64	AV
5	0.791	34.06	56.00	-21.94	24.38	9.68	QP
6	0.791	29.10	46.00	-16.90	19.42	9.68	AV
7	1.445	32.37	56.00	-23.63	22.65	9.72	QP
8	1.445	27.35	46.00	-18.65	17.63	9.72	AV
9	2.705	28.05	56.00	-27.95	18.26	9.79	QP
10	2.705	21.27	46.00	-24.73	11.48	9.79	AV
11	3.309	30.32	56.00	-25.68	20.51	9.81	QP
12	3.309	22.53	46.00	-23.47	12.72	9.81	AV

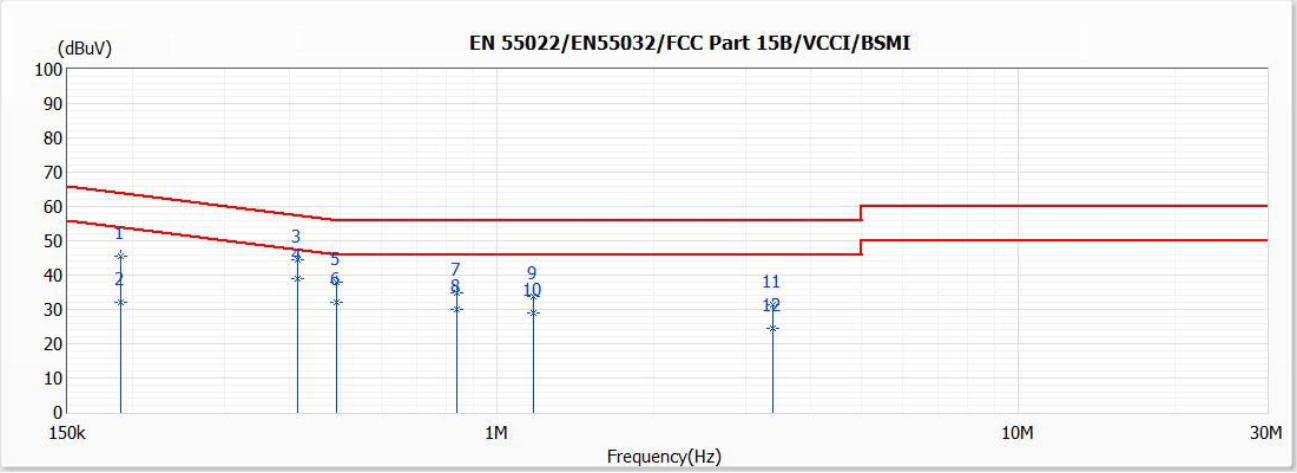
Remark:

1. "*" means this data is the worst emission level.

2. Emission Level = Reading Level + Correct Factor (Correct Factor = LISN Insertion Loss + Cable Loss).

3. Margin = Emission Level - Limit.

Test Mode	Mode 1: Adapter	Phase	Neutral
Test Condition	13.56 MHz		



No	Frequency (MHz)	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)	Reading Level (dBuV)	Correct Factor (dB)	Detector Type
1	0.190	45.63	64.04	-18.41	36.02	9.61	QP
2	0.190	32.05	54.04	-21.99	22.44	9.61	AV
3	0.415	44.51	57.55	-13.04	34.88	9.63	QP
*4	0.415	38.97	47.55	-8.58	29.34	9.63	AV
5	0.491	38.00	56.15	-18.15	28.36	9.64	QP
6	0.491	32.23	46.15	-13.92	22.59	9.64	AV
7	0.836	34.98	56.00	-21.02	25.30	9.68	QP
8	0.836	30.12	46.00	-15.88	20.44	9.68	AV
9	1.173	33.93	56.00	-22.07	24.22	9.71	QP
10	1.173	28.91	46.00	-17.09	19.20	9.71	AV
11	3.383	31.31	56.00	-24.69	21.49	9.82	QP
12	3.383	24.52	46.00	-21.48	14.70	9.82	AV

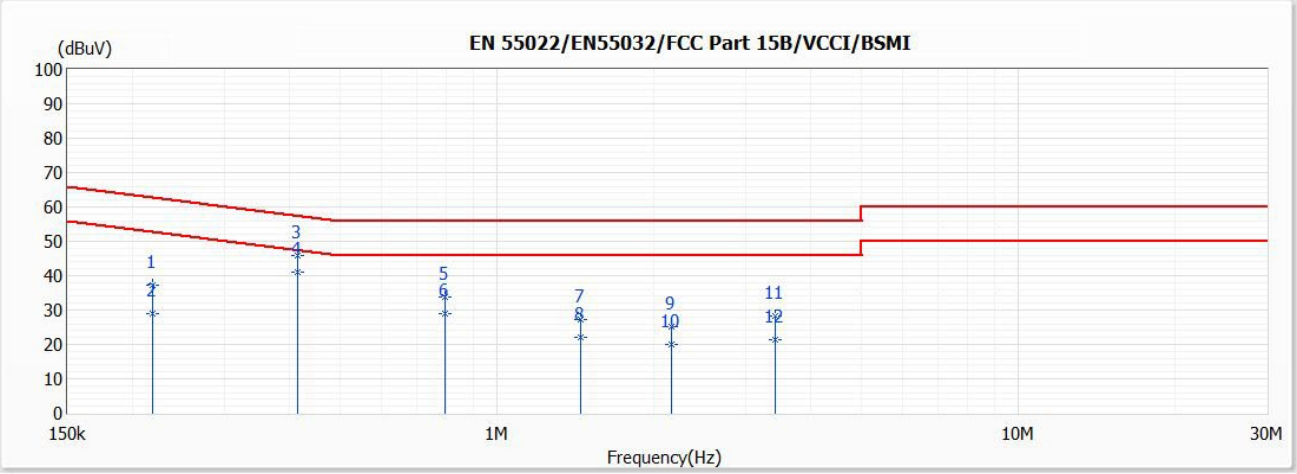
Remark:

1. "*" means this data is the worst emission level.

2. Emission Level = Reading Level + Correct Factor (Correct Factor = LISN Insertion Loss + Cable Loss).

3. Margin = Emission Level - Limit.

Test Mode	Mode 2: Charger + Adapter	Phase	Line
Test Condition	13.56 MHz		

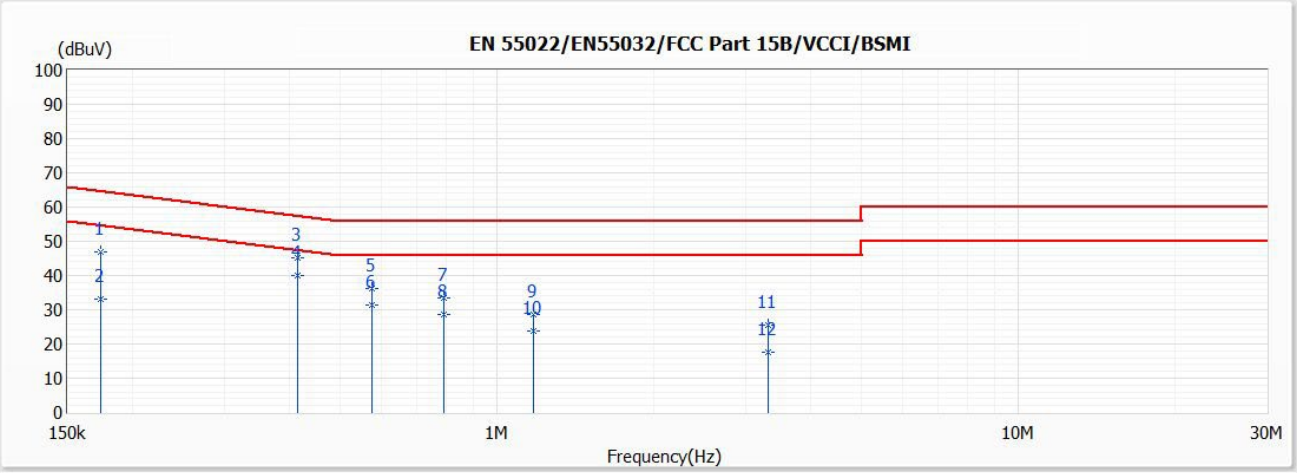


No	Frequency (MHz)	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)	Reading Level (dBuV)	Correct Factor (dB)	Detector Type
1	0.218	37.34	62.88	-25.54	27.72	9.62	QP
2	0.218	29.10	52.88	-23.78	19.48	9.62	AV
3	0.414	45.86	57.56	-11.70	36.22	9.64	QP
*4	0.414	41.02	47.56	-6.54	31.38	9.64	AV
5	0.792	33.71	56.00	-22.29	24.03	9.68	QP
6	0.792	28.82	46.00	-17.18	19.14	9.68	AV
7	1.449	27.08	56.00	-28.92	17.36	9.72	QP
8	1.449	22.21	46.00	-23.79	12.49	9.72	AV
9	2.156	25.08	56.00	-30.92	15.32	9.76	QP
10	2.156	20.03	46.00	-25.97	10.27	9.76	AV
11	3.411	28.23	56.00	-27.77	18.42	9.81	QP
12	3.411	21.37	46.00	-24.63	11.56	9.81	AV

Remark:

1. "*" means this data is the worst emission level.
2. Emission Level = Reading Level + Correct Factor (Correct Factor = LISN Insertion Loss + Cable Loss).
3. Margin = Emission Level - Limit.

Test Mode	Mode 2: Charger + Adapter	Phase	Neutral
Test Condition	13.56 MHz		



No	Frequency (MHz)	Emission Level (dBuV)	Limit (dBuV)	Margin (dB)	Reading Level (dBuV)	Correct Factor (dB)	Detector Type
1	0.174	46.76	64.77	-18.01	37.14	9.62	QP
2	0.174	33.09	54.77	-21.68	23.47	9.62	AV
3	0.415	45.07	57.55	-12.48	35.44	9.63	QP
*4	0.415	40.15	47.55	-7.40	30.52	9.63	AV
5	0.576	36.30	56.00	-19.70	26.64	9.66	QP
6	0.576	31.38	46.00	-14.62	21.72	9.66	AV
7	0.792	33.38	56.00	-22.62	23.71	9.67	QP
8	0.792	28.61	46.00	-17.39	18.94	9.67	AV
9	1.172	28.62	56.00	-27.38	18.91	9.71	QP
10	1.172	23.90	46.00	-22.10	14.19	9.71	AV
11	3.311	25.51	56.00	-30.49	15.69	9.82	QP
12	3.311	17.44	46.00	-28.56	7.62	9.82	AV

Remark:

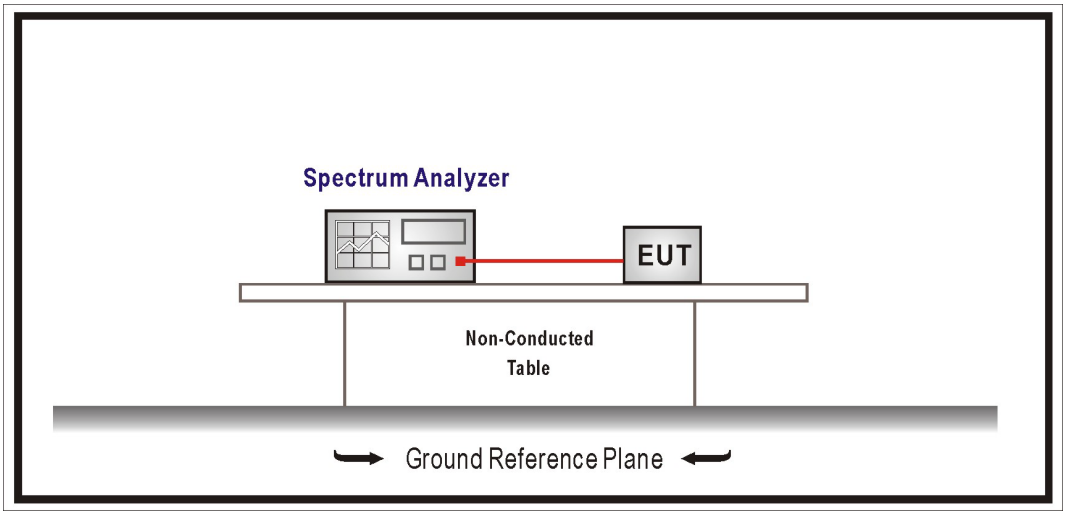
1. "*" means this data is the worst emission level.

2. Emission Level = Reading Level + Correct Factor (Correct Factor = LISN Insertion Loss + Cable Loss).

3. Margin = Emission Level - Limit.

3. Emission Bandwidth

3.1. Test Setup



3.2. Test Limit

Intentional radiators must be designed to ensure that the emission bandwidth of the emissions in the specific band. (13.553 ~ 13.567 MHz)

3.3. Test Procedures

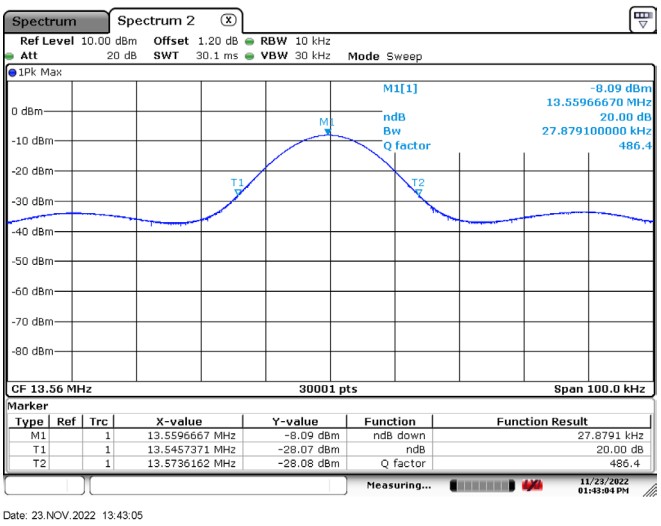
1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
2. The resolution bandwidth of 10 kHz and the video bandwidth of 30 kHz were used.

3.4. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.225.

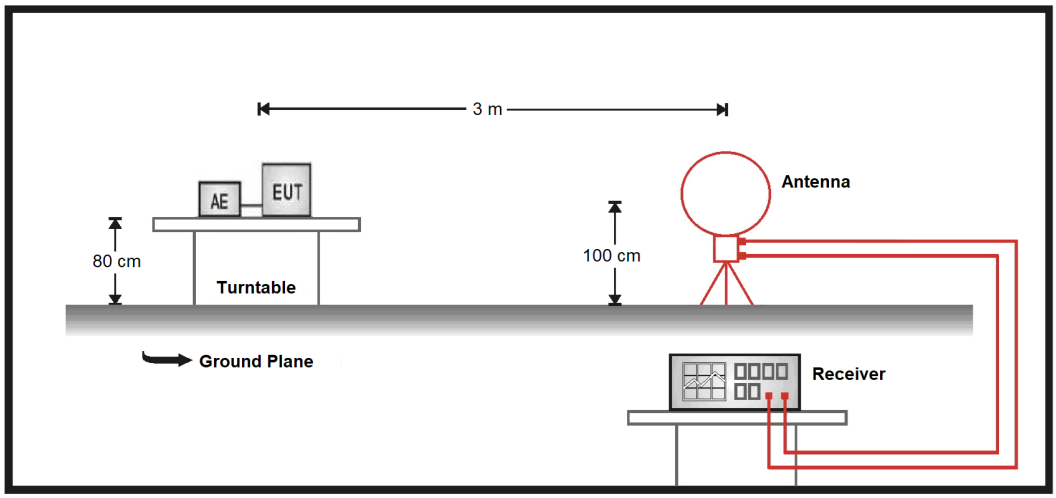
3.5. Test Result of Emission Bandwidth

Frequency (MHz)	Measurement (kHz)	Limit (kHz)
13.56	27.879	-



4. Field Strength of Fundamental Emissions and Spectrum Mask

4.1. Test Setup



4.2. Test Limit

Field Strength of Fundamental Emissions			
Frequencies (MHz)	Field Strength (microvolts/meter) at 30m	Field Strength (dBμV/m) at 10m	Field Strength (dBμV/m) at 3m
13.553 – 13.567 MHz	15848	103.08 (QP)	124 (QP)
Quasi peak measurement of the fundamental.			

Spectrum Mask					
Rules and specifications	CFR 47 Part 15 section 15.225(a)-(d)				
Description	Compliance with the spectrum mask is tested using a spectrum analyzer with RBW set to a 9kHz for the band 13.553 – 13.567 MHz.				
Limit	Freq. of Emission (MHz)	Field Strength			
		(uV/m)@30m	(dBuV/m)@30m	(dBuV/m)@10m	(dBuV/m)@3m
	1.705~13.110	30	29.5	48.6	69.5
	13.110~13.410	106	40.5	59.6	80.5
	13.410~13.553	334	50.5	69.6	90.5
	13.553~13.567	15848	84.0	103.1	124.0
	13.567~13.710	334	50.5	69.6	90.5
	13.710~14.010	106	40.5	59.6	80.5
	14.010~30.000	30	29.5	48.6	69.5

4.3. Test Procedure

1. Configure the EUT according to ANSI C63.10: 2013. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the loop receiving antenna mounted antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the receiving antenna was fixed at one meter above ground to find the maximum emissions field strength.
4. For Fundamental emissions, use the receiver to measure QP reading.
5. 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.
6. Compliance with the spectrum mask is tested using a spectrum analyzer with RBW set to a 9kHz for the band 13.553 – 13.567 MHz.

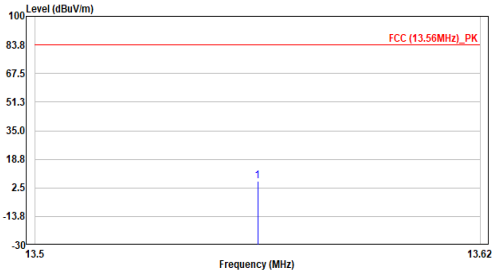
4.4. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.225.

4.5. Test Result of Field Strength of Fundamental Emissions

Mode 1: Adapter

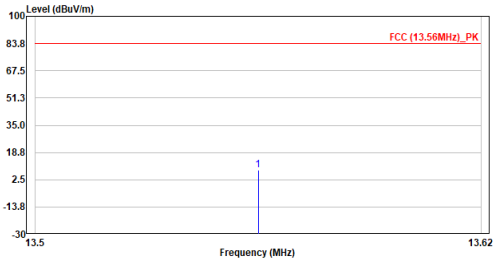
Site :HC-CB02
Condition :3m Loop
Mode :NFC_Fundamental_13.56MHz_Z-X
Test by :Cyril



No.	Frequency	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	13.560	6.44	84.00	-77.56	24.89	-18.45	Peak

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Aux Factor
3. Over Limit = Level - Limit Line
4. Aux Factor = Convert distance formula
= 40*log(3/300) = -80dB @300m
= 40*log(3/30) = -40dB @30m
5. The other emission levels were very low against the limit.

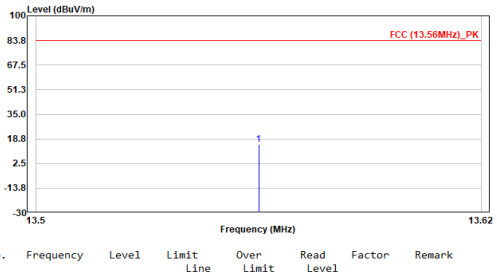
Site :HC-CB02
Condition :3m Loop
Mode :NFC_Fundamental_13.56MHz_Z-Y
Test by :Cyril



No.	Frequency	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	13.560	8.03	84.00	-75.97	26.48	-18.45	Peak

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Aux Factor
3. Over Limit = Level - Limit Line
4. Aux Factor = Convert distance formula
= 40*log(3/300) = -80dB @300m
= 40*log(3/30) = -40dB @30m
5. The other emission levels were very low against the limit.

Site :HC-CB02
Condition :3m Loop
Mode :NFC_Fundamental_13.56MHz_Z-Z
Test by :Cyril

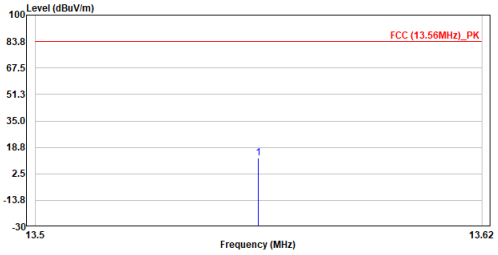


No.	Frequency	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	13.560	14.99	84.00	-69.01	33.44	-18.45	Peak

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Aux Factor
3. Over Limit = Level - Limit Line
4. Aux Factor = Convert distance formula
= 40*log(3/300) = -80dB @300m
= 40*log(3/30) = -40dB @30m
5. The other emission levels were very low against the limit.

Mode 2: Charger + Adapter

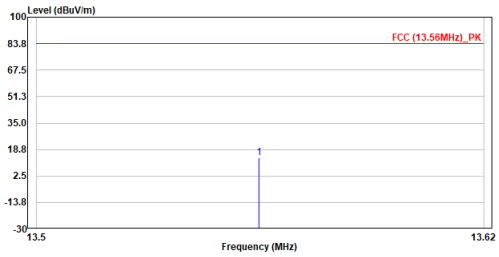
Site :HC-CB02
Condition :3m Loop
Mode :NFC_Fundamental_13.56MHz_X
Test by :Cyril



No.	Frequency	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	13.560	12.02	84.00	-71.98	30.47	-18.45	Peak

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Aux Factor
3. Over Limit = Level - Limit Line
4. Aux Factor = Convert distance formula
= 40*log(3/300) = -80dB @300m
= 40*log(3/30) = -40dB @30m
5. The other emission levels were very low against the limit.

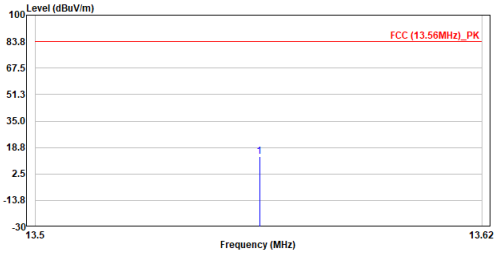
Site :HC-CB02
Condition :3m Loop
Mode :NFC_Fundamental_13.56MHz_Y
Test by :Cyril



No.	Frequency	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	13.560	13.66	84.00	-70.34	32.11	-18.45	Peak

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Aux Factor
3. Over Limit = Level - Limit Line
4. Aux Factor = Convert distance formula
= 40*log(3/300) = -80dB @300m
= 40*log(3/30) = -40dB @30m
5. The other emission levels were very low against the limit.

Site :HC-CB02
Condition :3m Loop
Mode :NFC_Fundamental_13.56MHz_Z
Test by :Cyril



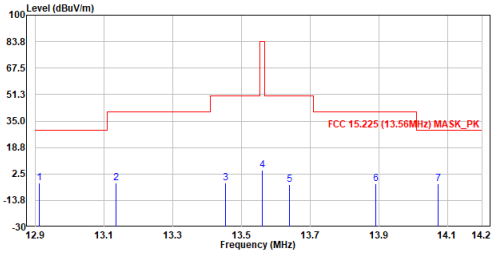
No.	Frequency	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	13.560	13.14	84.00	-70.86	31.59	-18.45	Peak

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Aux Factor
3. Over Limit = Level - Limit Line
4. Aux Factor = Convert distance formula
= 40*log(3/300) = -80dB @300m
= 40*log(3/30) = -40dB @30m
5. The other emission levels were very low against the limit.

4.6. Test Result of Spectrum Mask

Mode 1: Adapter

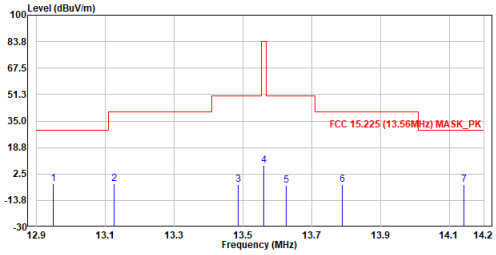
Site :HC-CB02
Condition :3m Loop
Mode :NFC_Mask_13.56MHz_Z-X
Test by :Cyril



No.	Frequency	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	12.912	-3.03	29.50	-32.53	15.47	-18.50	Peak
2	13.134	-3.23	40.50	-43.73	15.25	-18.48	Peak
3	13.454	-3.04	50.50	-53.54	15.42	-18.46	Peak
4	13.561	4.75	84.00	-79.25	23.20	-18.45	Peak
5	13.639	-3.98	50.50	-54.48	14.47	-18.45	Peak
6	13.891	-3.27	40.50	-43.77	15.16	-18.43	Peak
7	14.072	-3.47	29.50	-32.97	14.94	-18.41	Peak

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Aux Factor
3. Over Limit = Level - Limit Line
4. Aux Factor = Convert distance formula
= 40*log(3/300) = -80dB @300m
= 40*log(3/30) = -40dB @30m
5. The other emission levels were very low against the limit.

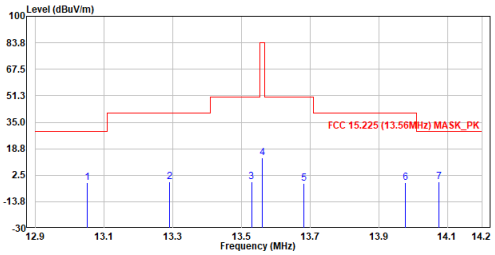
Site :HC-CB02
Condition :3m Loop
Mode :NFC_Mask_13.56MHz_Z-Y
Test by :Cyril



No.	Frequency	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	12.949	-3.63	29.50	-33.13	14.86	-18.49	Peak
2	13.126	-3.64	40.50	-44.14	14.84	-18.48	Peak
3	13.486	-4.01	50.50	-54.51	14.45	-18.46	Peak
4	13.560	7.75	84.00	-76.25	26.20	-18.45	Peak
5	13.626	-4.35	50.50	-54.85	14.10	-18.45	Peak
6	13.789	-3.83	40.50	-44.33	14.60	-18.43	Peak
7	14.143	-3.85	29.50	-33.35	14.56	-18.41	Peak

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Aux Factor
3. Over Limit = Level - Limit Line
4. Aux Factor = Convert distance formula
= 40*log(3/300) = -80dB @300m
= 40*log(3/30) = -40dB @30m
5. The other emission levels were very low against the limit.

Site :HC-CB02
Condition :3m Loop
Mode :NFC_Mask_13.56MHz_Z-Z
Test by :Cyril

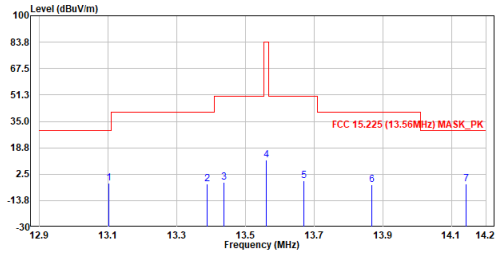


No.	Frequency	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	13.051	-1.85	29.50	-31.35	16.64	-18.49	Peak
2	13.292	-1.39	40.50	-41.89	17.08	-18.47	Peak
3	13.529	-1.36	50.50	-51.86	17.09	-18.45	Peak
4	13.560	13.29	84.00	-70.71	31.74	-18.45	Peak
5	13.681	-2.34	50.50	-52.84	16.10	-18.44	Peak
6	13.977	-1.98	40.50	-42.48	16.44	-18.42	Peak
7	14.075	-1.76	29.50	-31.26	16.65	-18.41	Peak

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Aux Factor
3. Over Limit = Level - Limit Line
4. Aux Factor = Convert distance formula
= 40*log(3/300) = -80dB @300m
= 40*log(3/30) = -40dB @30m
5. The other emission levels were very low against the limit.

Mode 2: Charger + Adapter

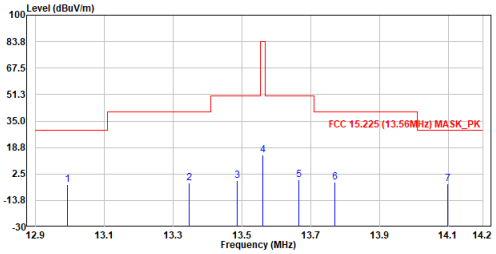
Site :HC-CB02
Condition :3m Loop
Mode :NFC_Mask_13.56MHz_X
Test by :Cyril



No.	Frequency	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	13.102	-3.25	29.50	-32.75	15.23	-18.48	Peak
2	13.389	-3.69	40.50	-44.19	14.77	-18.46	Peak
3	13.437	-2.40	50.50	-52.90	16.06	-18.46	Peak
4	13.560	11.25	84.00	-72.75	29.70	-18.45	Peak
5	13.669	-1.32	50.50	-51.82	17.12	-18.44	Peak
6	13.867	-3.95	40.50	-44.45	14.48	-18.43	Peak
7	14.142	-3.40	29.50	-32.90	15.01	-18.41	Peak

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Aux Factor
3. Over Limit = Level - Limit Line
4. Aux Factor = Convert distance formula
= 40*log(3/300) = -80dB @300m
= 40*log(3/30) = -40dB @30m
5. The other emission levels were very low against the limit.

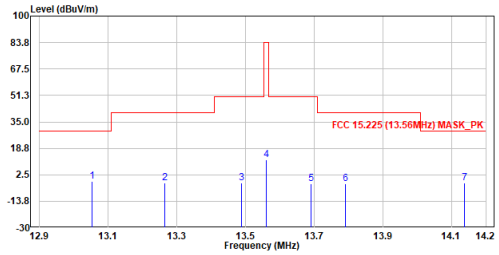
Site :HC-CB02
Condition :3m Loop
Mode :NFC_Mask_13.56MHz_Y
Test by :Cyril



No.	Frequency	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	12.993	-3.97	29.50	-33.47	14.52	-18.49	Peak
2	13.347	-3.02	40.50	-43.52	15.45	-18.47	Peak
3	13.487	-1.47	50.50	-51.97	16.99	-18.46	Peak
4	13.560	13.97	84.00	-70.03	32.42	-18.45	Peak
5	13.666	-0.82	50.50	-51.32	17.62	-18.44	Peak
6	13.769	-2.58	40.50	-43.08	15.86	-18.44	Peak
7	14.098	-3.60	29.50	-33.10	14.81	-18.41	Peak

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Aux Factor
3. Over Limit = Level - Limit Line
4. Aux Factor = Convert distance formula
= 40*log(3/300) = -80dB @300m
= 40*log(3/30) = -40dB @30m
5. The other emission levels were very low against the limit.

Site :HC-CB02
Condition :3m Loop
Mode :NFC_Mask_13.56MHz_Z
Test by :Cyril



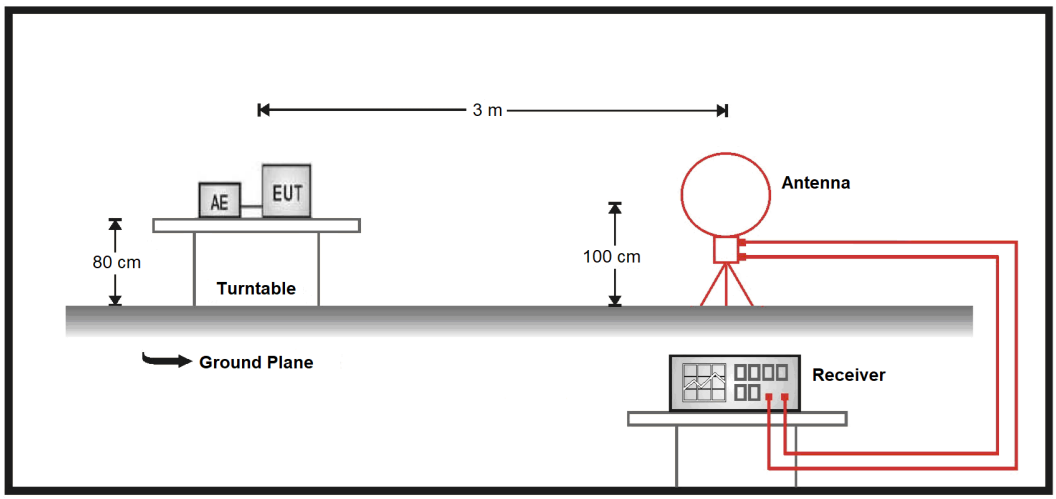
No.	Frequency	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	13.054	-1.74	29.50	-31.24	16.75	-18.49	Peak
2	13.266	-2.52	40.50	-43.02	15.95	-18.47	Peak
3	13.488	-2.33	50.50	-52.83	16.13	-18.46	Peak
4	13.560	11.50	84.00	-72.50	29.95	-18.45	Peak
5	13.691	-3.04	50.50	-53.54	15.40	-18.44	Peak
6	13.790	-3.12	40.50	-43.62	15.31	-18.43	Peak
7	14.137	-2.77	29.50	-32.27	15.64	-18.41	Peak

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Aux Factor
3. Over Limit = Level - Limit Line
4. Aux Factor = Convert distance formula
= 40*log(3/300) = -80dB @300m
= 40*log(3/30) = -40dB @30m
5. The other emission levels were very low against the limit.

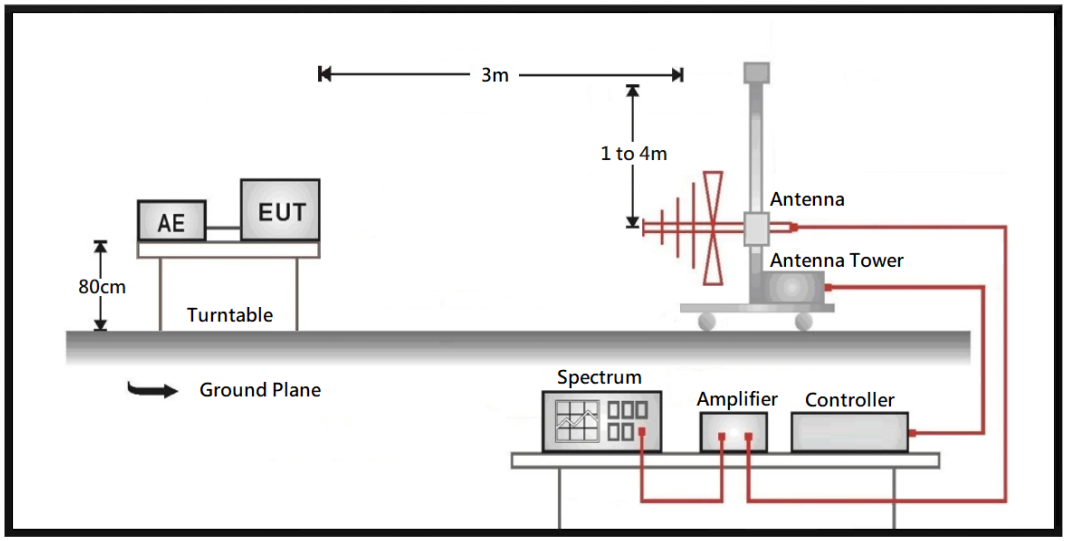
5. Radiated Emission

5.1. Test Setup

9 kHz ~ 30 MHz



30 MHz ~ 1 GHz



5.2. Test Limit

The field strength of any emissions which appear outside of 13.553 ~ 13.567MHz band shall not exceed the general radiated emissions limits.

Frequency (MHz)	Field strength (uV/m)	Field strength (dBuV/m)	Measurement distance (m)
0.009 – 0.490	2400/F(kHz)	20 log (2400/F(kHz))	300
0.490 – 1.705	24000/F(kHz)	20 log (24000/F(kHz))	30
1.705 - 30	30	29.5	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
Above 960	500	54	3

Remarks:

1. Field strength (dBuV/m) = 20 log Field strength (uV/m)
2. In the Above Table, the tighter limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

5.3. Test Procedure

1. Configure the EUT according to ANSI C63.10: 2013. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. 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.
7. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High – Low scan is not required in this case.

5.4. Test Specification

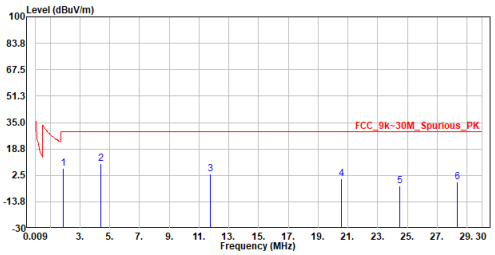
According to FCC Part 15 Subpart C Paragraph 15.225.

5.5. Test Result of Radiated Emission

9 kHz ~ 30 MHz

Mode 1: Adapter

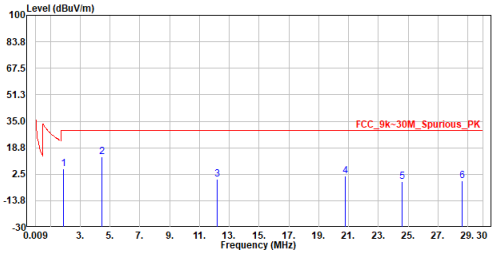
Site :HC-CB02
Condition :3m Loop
Mode :NFC_TX_13.56MHz_Z-X
Test by :Cyril



No.	Frequency	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	1.877	6.63	29.54	-22.91	27.16	-20.53	Peak
2	4.394	9.68	29.54	-19.86	30.17	-20.49	Peak
3	11.744	3.18	29.54	-26.36	21.76	-18.58	Peak
4	20.574	0.45	29.54	-29.09	18.46	-18.01	Peak
5	24.461	-3.83	29.54	-33.37	14.21	-18.04	Peak
6	28.333	-1.51	29.54	-31.05	16.57	-18.08	Peak

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Aux Factor
3. Over Limit = Level - Limit Line
4. Aux Factor = Convert distance formula
= 40*log(3/300) = -80dB @300m
= 40*log(3/30) = -40dB @30m
5. The other emission levels were very low against the limit.

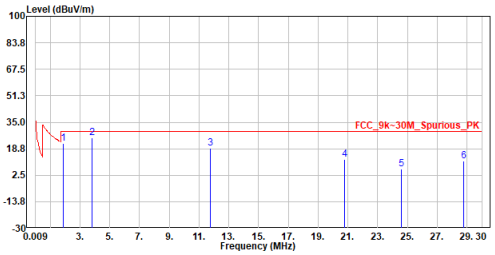
Site :HC-CB02
Condition :3m Loop
Mode :NFC_TX_13.56MHz_Z-Y
Test by :Cyril



No.	Frequency	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	1.856	5.75	29.54	-23.79	26.28	-20.53	Peak
2	4.475	12.96	29.54	-16.58	33.44	-20.48	Peak
3	12.179	-0.49	29.54	-30.03	18.06	-18.55	Peak
4	20.760	1.15	29.54	-28.39	19.16	-18.01	Peak
5	24.578	-1.85	29.54	-31.39	16.20	-18.05	Peak
6	28.605	-1.50	29.54	-31.04	16.59	-18.09	Peak

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Aux Factor
3. Over Limit = Level - Limit Line
4. Aux Factor = Convert distance formula
= 40*log(3/300) = -80dB @300m
= 40*log(3/30) = -40dB @30m
5. The other emission levels were very low against the limit.

Site :HC-CB02
Condition :3m Loop
Mode :NFC_TX_13.56MHz_Z-Z
Test by :Cyril

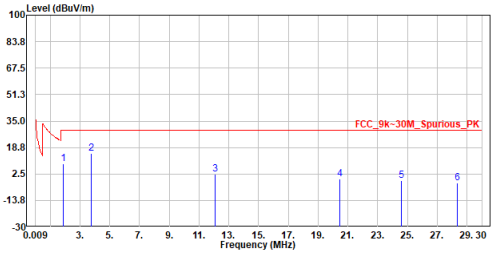


No.	Frequency	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	1.874	22.21	29.54	-7.33	42.74	-20.53	Peak
2	3.788	25.24	29.54	-4.30	45.82	-20.58	Peak
3	11.774	19.18	29.54	-10.36	37.76	-18.58	Peak
4	20.766	12.04	29.54	-17.50	30.05	-18.01	Peak
5	24.578	6.10	29.54	-23.44	24.15	-18.05	Peak
6	28.791	11.42	29.54	-18.12	29.51	-18.09	Peak

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Aux Factor
3. Over Limit = Level - Limit Line
4. Aux Factor = Convert distance formula
= 40*log(3/300) = -80dB @300m
= 40*log(3/30) = -40dB @30m
5. The other emission levels were very low against the limit.

Mode 2: Charger + Adapter

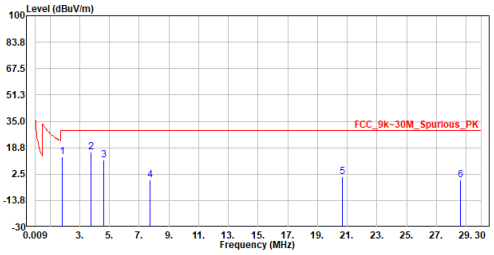
Site :HC-CB02
Condition :3m Loop
Mode :NFC_TX_13.56MHz_X
Test by :Cyril



No.	Frequency	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	1.862	8.90	29.54	-20.64	29.43	-20.53	Peak
2	3.746	15.25	29.54	-14.29	35.84	-20.59	Peak
3	12.080	2.45	29.54	-27.09	21.00	-18.55	Peak
4	20.463	-0.37	29.54	-29.91	17.63	-18.00	Peak
5	24.578	-1.75	29.54	-31.29	16.30	-18.05	Peak
6	28.324	-2.96	29.54	-32.50	15.12	-18.08	Peak

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Aux Factor
3. Over Limit = Level - Limit Line
4. Aux Factor = Convert distance formula
= 40*log(3/300) = -80dB @300m
= 40*log(3/30) = -40dB @30m
5. The other emission levels were very low against the limit.

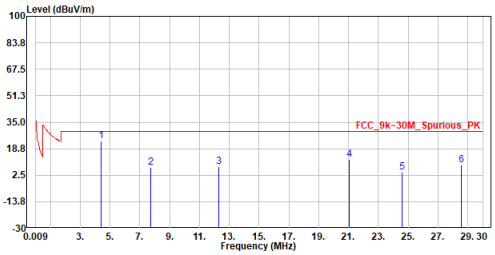
Site :HC-CB02
Condition :3m Loop
Mode :NFC_TX_13.56MHz_Y
Test by :Cyril



No.	Frequency	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	1.838	13.10	29.54	-16.44	33.63	-20.53	Peak
2	3.779	15.89	29.54	-13.65	36.47	-20.58	Peak
3	4.634	11.33	29.54	-18.21	31.78	-20.45	Peak
4	7.729	-0.98	29.54	-30.52	18.49	-19.47	Peak
5	20.658	0.68	29.54	-28.86	18.69	-18.01	Peak
6	28.614	-0.93	29.54	-30.47	17.16	-18.09	Peak

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Aux Factor
3. Over Limit = Level - Limit Line
4. Aux Factor = Convert distance formula
= 40*log(3/300) = -80dB @300m
= 40*log(3/30) = -40dB @30m
5. The other emission levels were very low against the limit.

Site :HC-CB02
Condition :3m Loop
Mode :NFC_TX_13.56MHz_Z
Test by :Cyril



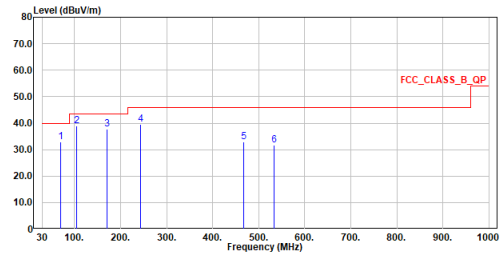
No.	Frequency	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	4.406	23.28	29.54	-6.26	43.77	-20.49	Peak
2	7.756	7.11	29.54	-22.43	26.57	-19.46	Peak
3	12.272	7.68	29.54	-21.86	26.22	-18.54	Peak
4	21.051	12.00	29.54	-17.54	30.01	-18.01	Peak
5	24.578	4.52	29.54	-25.02	22.57	-18.05	Peak
6	28.551	8.53	29.54	-21.01	26.62	-18.09	Peak

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Aux Factor
3. Over Limit = Level - Limit Line
4. Aux Factor = Convert distance formula
= 40*log(3/300) = -80dB @300m
= 40*log(3/30) = -40dB @30m
5. The other emission levels were very low against the limit.

30 MHz ~ 1 GHz

Mode 1: Adapter

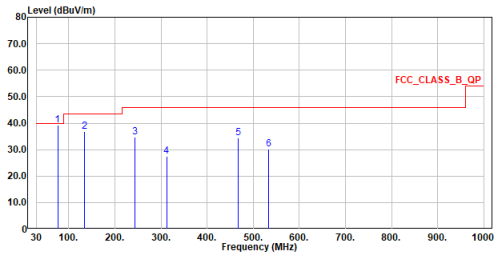
Site :HC-CB02
Condition :3m Horizontal
Mode :NFC_TX_13.56MHz
Test by :Cyril



No.	Frequency	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	69.382	32.78	40.00	-7.22	36.79	-4.01	QP
2	104.011	39.01	43.50	-4.49	45.70	-6.69	QP
3	171.135	37.76	43.50	-5.74	40.70	-2.94	QP
4	244.079	39.52	46.00	-6.48	43.36	-3.84	QP
5	466.694	33.04	46.00	-12.96	30.23	2.81	QP
6	533.333	31.64	46.00	-14.36	27.51	4.13	QP

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Cable Loss - Preamp Factor
3. Over Limit = Level - Limit Line
4. The emission under 30MHz was not included since the emission levels are very low against the limit.
5. The other emission levels were very low against the limit.

Site :HC-CB02
Condition :3m Vertical
Mode :NFC_TX_13.56MHz
Test by :Cyril

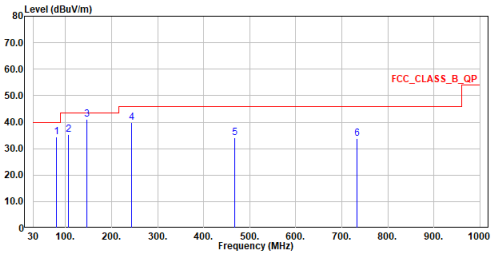


No.	Frequency	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	75.784	39.36	40.00	-0.64	44.84	-5.48	QP
2	134.275	36.74	43.50	-6.76	40.20	-3.46	QP
3	244.079	34.60	46.00	-11.40	38.44	-3.84	QP
4	311.882	27.41	46.00	-18.59	28.87	-1.46	QP
5	466.694	34.44	46.00	-11.56	31.63	2.81	QP
6	533.333	30.10	46.00	-15.90	25.97	4.13	QP

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Cable Loss - Preamp Factor
3. Over Limit = Level - Limit Line
4. The emission under 30MHz was not included since the emission levels are very low against the limit.
5. The other emission levels were very low against the limit.

Mode 2: Charger + Adapter

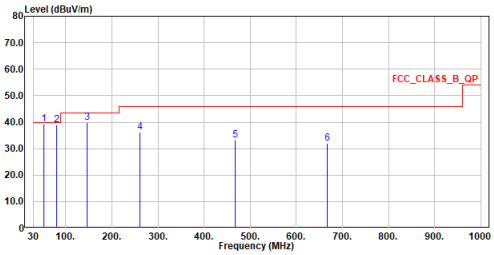
Site :HC-CB02
Condition :3m Horizontal
Mode :NFC_TX_13.56MHz
Test by :Cyril



No.	Frequency	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	80.343	34.43	40.00	-5.57	41.06	-6.63	QP
2	106.436	35.26	43.50	-8.24	41.44	-6.18	QP
3	145.527	41.00	43.50	-2.50	43.86	-2.86	QP
4	244.079	39.83	46.00	-6.17	43.67	-3.84	QP
5	466.694	34.17	46.00	-11.83	31.36	2.81	QP
6	732.765	33.93	46.00	-12.07	25.97	7.96	QP

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Cable Loss - Preamp Factor
3. Over Limit = Level - Limit Line
4. The emission under 30MHz was not included since the emission levels are very low against the limit.
5. The other emission levels were very low against the limit.

Site :HC-CB02
Condition :3m Vertical
Mode :NFC_TX_13.56MHz
Test by :Cyril

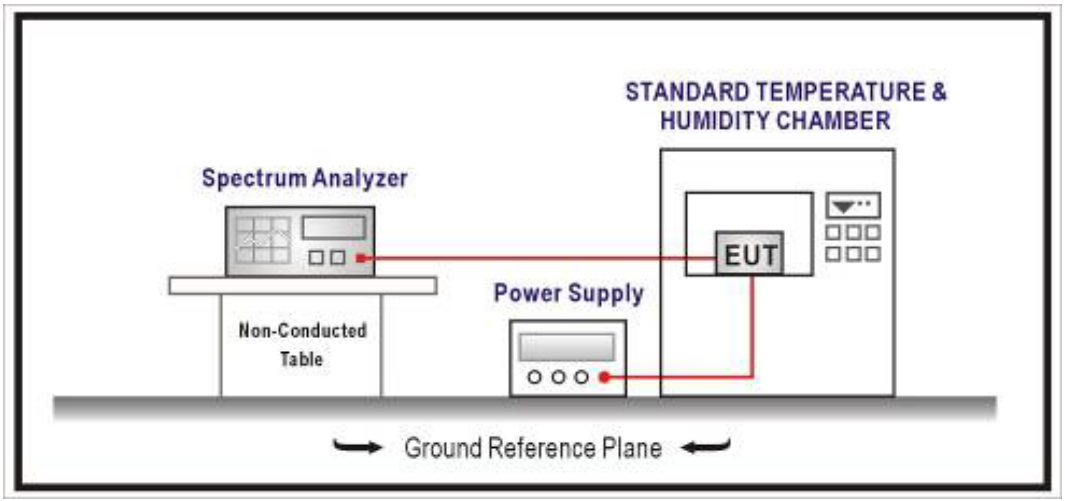


No.	Frequency	Level	Limit Line	Over Limit	Read Level	Factor	Remark
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	
1	52.019	39.32	40.00	-0.68	41.50	-2.18	QP
2	80.246	39.08	40.00	-0.92	45.68	-6.60	QP
3	145.527	39.98	43.50	-3.52	42.84	-2.86	QP
4	260.666	36.17	46.00	-9.83	39.57	-3.40	QP
5	466.694	33.28	46.00	-12.72	30.47	2.81	QP
6	666.708	31.99	46.00	-14.01	25.08	6.91	QP

Note:
1. Level = Read Level + Factor
2. Factor = Antenna Factor + Cable Loss - Preamp Factor
3. Over Limit = Level - Limit Line
4. The emission under 30MHz was not included since the emission levels are very low against the limit.
5. The other emission levels were very low against the limit.

6. Frequency Stability

6.1. Test Setup



6.2. Test Limit

Carrier frequency stability shall be maintained to ±0.01% (±100 ppm).

6.3. Test Procedures

The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency over a temperature variation of −20 degrees to 50 degrees 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 degrees C.

For battery operated equipment, the equipment tests shall be performed using a new battery.

6.4. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.225.

6.5. Test Result of Frequency Stability

Test Conditions		Frequency (MHz)	Frequency Tolerance (%)	Limit (%)
20℃	102V	13.55970	-0.00225	± 0.01
20℃	120V	13.55967	-0.00243	± 0.01
20℃	138V	13.55971	-0.00214	± 0.01

Test Conditions		Frequency (MHz)	Frequency Tolerance (%)	Limit (%)
-20℃	120V	13.55987	-0.00100	± 0.01
-10℃	120V	13.55978	-0.00166	± 0.01
0℃	120V	13.55979	-0.00159	± 0.01
10℃	120V	13.55972	-0.00206	± 0.01
20℃	120V	13.55970	-0.00221	± 0.01
30℃	120V	13.55976	-0.00177	± 0.01
40℃	120V	13.55974	-0.00192	± 0.01
50℃	120V	13.55973	-0.00203	± 0.01
55℃	120V	13.55980	-0.00147	± 0.01