FCC Test Report

Report No.:	RFBFPJ-WTW-P22060392-5
FCC ID:	SWX-UCEVS
Test Model:	UC-EV-Station
Received Date:	2022/3/21
Test Date:	2022/7/21 ~ 2022/8/18
Issued Date:	2022/9/2
Applicant:	Ubiquiti Inc.
Address:	685 Third Avenue, New York, New York 10017 USA
Issued By:	Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Lin Kou Laboratories
Lab Address:	No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan
Test Location (1):	No.19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, Taiwan
Test Location (2):	No. 70, Wenming Rd., Guishan Dist., Taoyuan City 333, Taiwan
FCC Registration / Designation Number (1):	788550 / TW0003
FCC Registration / Designation Number (2):	281270 / TW0032

Testing Laboratory
2021

Table of Contents

Release Control Record

Issue No.	Description	Date Issued
RFBFPJ-WTW-P22060392-5	Original Release	2022/9/2

1 Certificate of Conformity

Product:	UniFi Connect EV Station
Brand:	
Test Model:	UC-EV-Station
Sample Status:	Engineering Sample
Applicant:	Ubiquiti Inc.
Test Date:	2022/7/21 ~ 2022/8/18
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.225) 47 CFR FCC Part 15, Subpart C (Section 15.215) ANSI C63.10:2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

Prepared by : Gina Liu , **Date:** 2022/9/2

Gina Liu / Specialist

Approved by : Jeremy Lin , **Date:** 2022/9/2

Jeremy Lin / Project Engineer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.225, 15.215)			
FCC Clause	**Test Item**	**Result**	**Remarks**
15.207	Conducted emission test	Pass	Meet the requirement of limit. Minimum passing margin is -2.13 dB at 0.64471 MHz.
15.225 (a)	The field strength of any emissions within the band 13.553-13.567 MHz	Pass	Meet the requirement of limit. Minimum passing margin is -42.7 dB at 13.56 MHz.
15.225 (b)	The field strength of any emissions within the bands 13.410-13.553 MHz and 13.567-13.710 MHz	Pass	Meet the requirement of limit.
15.225 (c)	The field strength of any emissions within the bands 13.110-13.410 MHz and 13.710-14.010 MHz	Pass	Meet the requirement of limit.
15.225 (d)	The field strength of any emissions appearing outside of the 13.110-14.010 MHz band	Pass	Meet the requirement of limit. Minimum passing margin is -1.1 dB at 80.40 MHz.
15.225 (e)	The frequency tolerance	Pass	Meet the requirement of limit.
15.215 (c)	20 dB Bandwidth	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	No antenna connector is used.

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Measurement Uncertainty

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

Measurement	Specification	Expanded Uncertainty (k=2) (±)
AC Power Conducted Emissions	-	2.94 dB
Unwanted Emissions below 1 GHz	9 kHz ~ 30 MHz	3 dB
	30 MHz ~ 1 GHz	2.93 dB
Unwanted Emissions above 1 GHz	1 GHz ~ 18 GHz	1.76 dB
	18 GHz ~ 40 GHz	1.77 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	UniFi Connect EV Station
Brand	
Test Model	UC-EV-Station
Status of EUT	Engineering Sample
Power Supply Rating	200-240 Vac
Modulation Type	ASK
Data Rate	Type A: 106 kbit/s Type B: 106 kbit/s Type V: 26.48 kbit/s
Operating Frequency	13.56 MHz
Field Strength (Maximum)	14.90 dBuV/m (30m)
Antenna Type	Loop Antenna
Accessory Device	N/A
Data Cable Supplied	N/A

Note: The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.

3.2 Description of Test Modes

One channel was provided to this EUT:

Channel	Frequency (MHz)
1	13.56

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To				Description
	RE	PLC	FS	EB	
-	√	√	√	√	-

Where **RE:** Radiated Emission **PLC:** Power Line Conducted Emission
FS: Frequency Stability **EB:** 20 dB Bandwidth measurement

NOTE: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Z-plane**.

NOTE: The EUT had been pre-tested on Type A, Type B and Type V. The worst case was found when data rate was Type A and chosen for final test.

Radiated Emission Test:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Axis
-	1	1	ASK	Z

Power Line Conducted Emission Test:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Axis
-	1	1	ASK	Z

Frequency Stability:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Axis
-	1	1	ASK	Z

20 dB Bandwidth:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Available Channel	Tested Channel	Modulation Type	Axis
-	1	1	ASK	Z

Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested By
RE	27 deg. C, 80 % RH	220 Vac, 60 Hz	Tim Chen
FS	25 deg. C, 60 % RH	220 Vac, 60 Hz	Randy Wu
PLC	25 deg. C, 75 % RH	220 Vac, 60 Hz	James Chang
EB	27 deg. C, 80 % RH	220 Vac, 60 Hz	Tim Chen

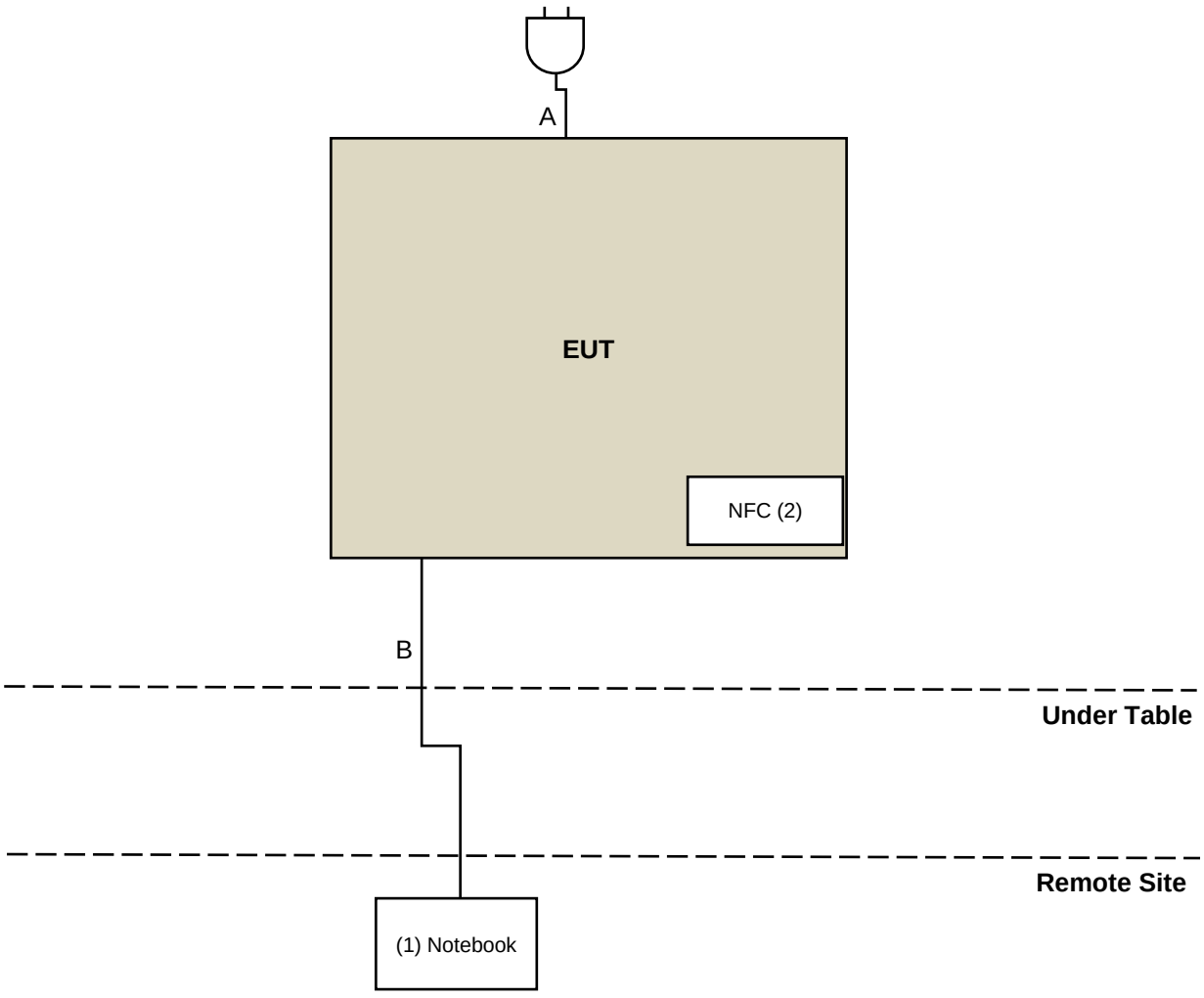
3.3 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
1	Notebook	DELL	E5410	1HC2XM1	N/A	Provided by Lab
2	NFC Type A, B, V	N/A	N/A	N/A	N/A	Provided by Lab

ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
A	Power Cable	1	1M	NO	N/A	Provided by client
B	LAN	1	3M	NO	N/A	Provided by Lab

3.3.1 Configuration of System under Test



3.4 General Description of Applied Standards and references

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards and references:

FCC Part 15, Subpart C (15.225)
FCC Part 15, Subpart C (15.215)
ANSI C63.10-2013

All test items have been performed and recorded as per the above standards.

References Test Guidance :

KDB 414788 D01 Radiated Test Site v01r01

All test items have been performed as a reference to the above KDB test guidance.

4 Test Types and Results

4.1 Radiated Emission Measurement

4.1.1 Limits of Radiated Emission Measurement

a. The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
b. Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
c. Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.
d. 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 §15.209 as below table:

Frequencies (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	100	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. 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.

4.1.2 Test Instruments

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Antenna Tower Max-Full	MFA-515BSN	N/A	N/A	N/A
Bi-log Broadband Antenna Schwarzbeck	VULB9168	9168-1214	2021/10/27	2022/10/26
Loop Antenna EMCI	EM-6879	269	2021/9/16	2022/9/15
MXA Signal Analyzer KEYSIGHT	N9020B	MY60110513	2021/12/24	2022/12/23
MXE EMI Receiver KEYSIGHT	N9038B	MY60180018	2022/2/18	2023/2/17
Pre-amplifier EMCI	EMC001340	980201	2021/9/15	2022/9/14
Pre_Amplifier EMCI	EMC330N	980798	2022/1/17	2023/1/16
RF Coaxial Cable EMCI	5D-NM-BM	140903+140902	2022/1/15	2023/1/14
	EMCCFD400-NM-NM-500	201248	2022/1/17	2023/1/16
	EMCCFD400-NM-NM-3000	201249	2022/1/17	2023/1/16
	EMCCFD400-NM-NM-9000	201251	2022/1/17	2023/1/16
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	N/A	N/A	N/A
Turn Table Max-Full	MFT-201SS	N/A	N/A	N/A
Turn Table Controller Max-Full	MF-7802BS	MF780208676	N/A	N/A
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Temperature & Humidity Chamber	GTH-120-40-CP-AR	MAA1306-019	2021/9/10	2022/9/9
DC Power Supply Topward	33010D	807748	NA	NA
Digital Multimeter Fluke	87-III	70360742	2022/6/23	2023/6/22

Notes:

1. The test was performed in WM - 966 chamber 9.
2. Tested Date: 2022/7/21-7/22

4.1.3 Test Procedures

For Radiated Emission below 30 MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
d. 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.
e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode, except for the frequency band (9kHz-90kHz, 110Hz-490kHz) set to average detect function.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9 kHz at frequency below 30 MHz.
2. There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

For Radiated Emission above 30 MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. 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.
f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

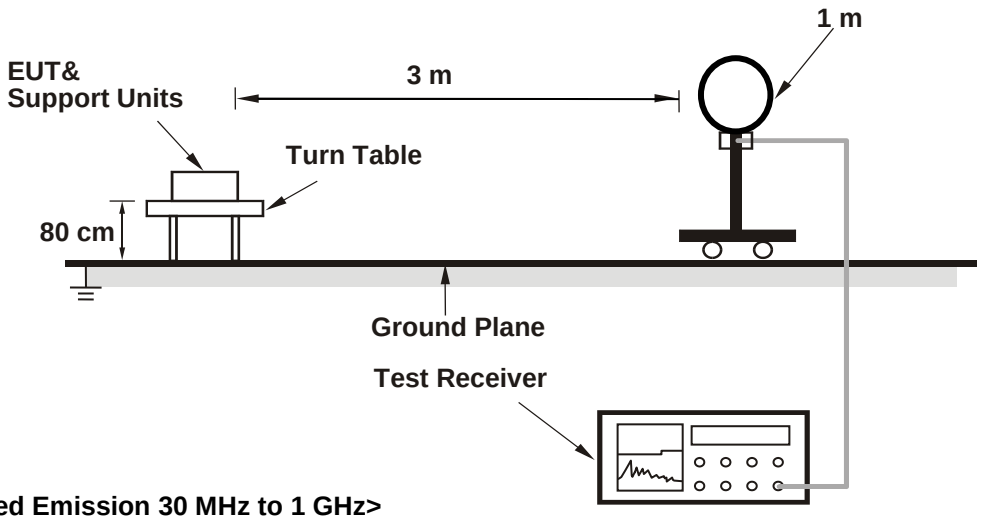
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection (QP) or Peak detection (PK) at frequency below 1 GHz.
2. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

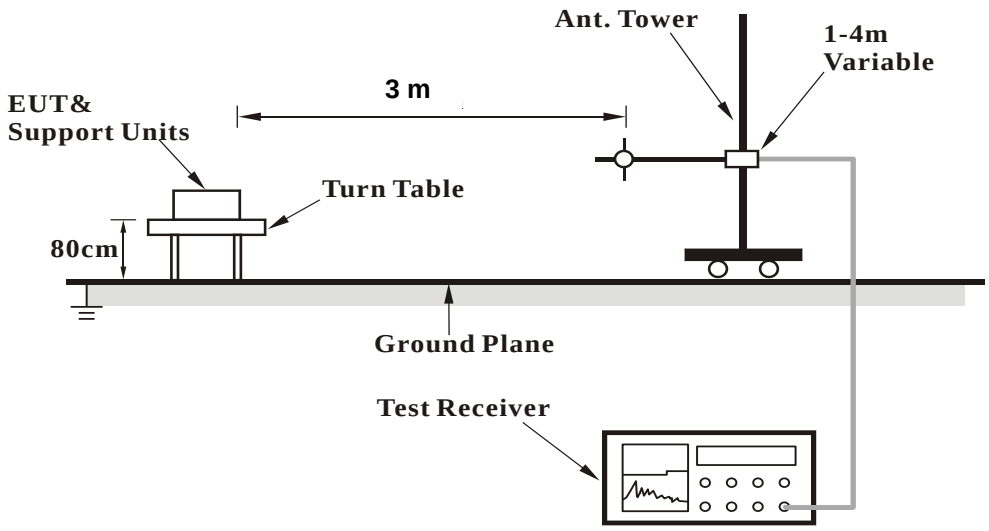
No deviation.

4.1.5 Test Set Up

<Radiated Emission below 30 MHz>



<Radiated Emission 30 MHz to 1 GHz>



For the actual test configuration, please refer to the attached file (Test Setup Photo).

KDB 414788 OFS and Chamber Correlation Justification

- Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

- Open-field site and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

4.1.6 EUT Operating Conditions

a. Placed the EUT on the testing table.
b. Set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Type A

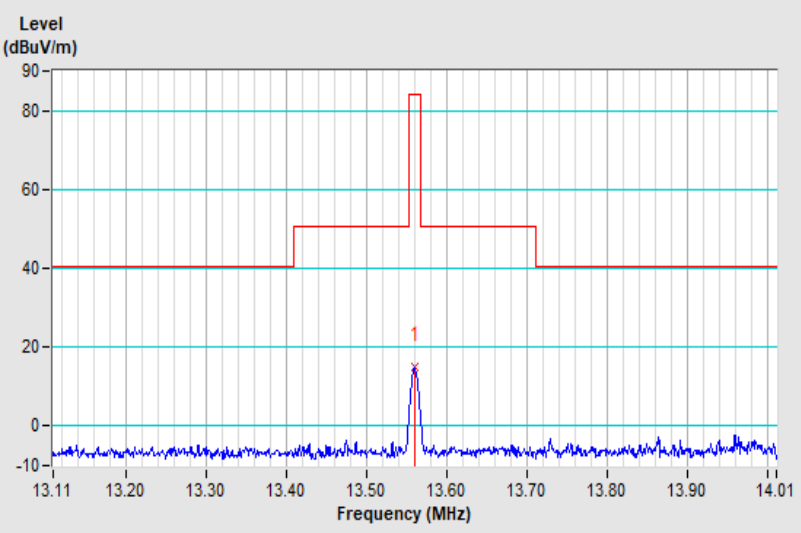
Test Mode	Tx		
RF Mode	NFC-13.56MHz	**Channel**	CH 1：13.56 MHz
Frequency Range	13.11 MHz ~ 14.01 MHz	**Detector Function & Bandwidth**	Quasi-Peak (QP), 9 kHz
Input Power	220 Vac, 60 Hz	**Environmental Conditions**	24°C, 74% RH
Test Date	Thomas Cheng	**Tested By**	2022/8/18

Antenna Polarity : Parallel								
No	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	***13.56**	**14.90 QP**	**84.00**	**-69.10**	**1.00**	**245**	**59.00**	**-44.10**

Remarks:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Factor (dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor
3. " * ": Fundamental frequency.
4. Margin value = Emission level – Limit value.
5. Above limits have been translated by the formula

The measured field strength was extrapolated to distance 30 meters distance factor@3m = 40* log(3/30) = -40dB, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)



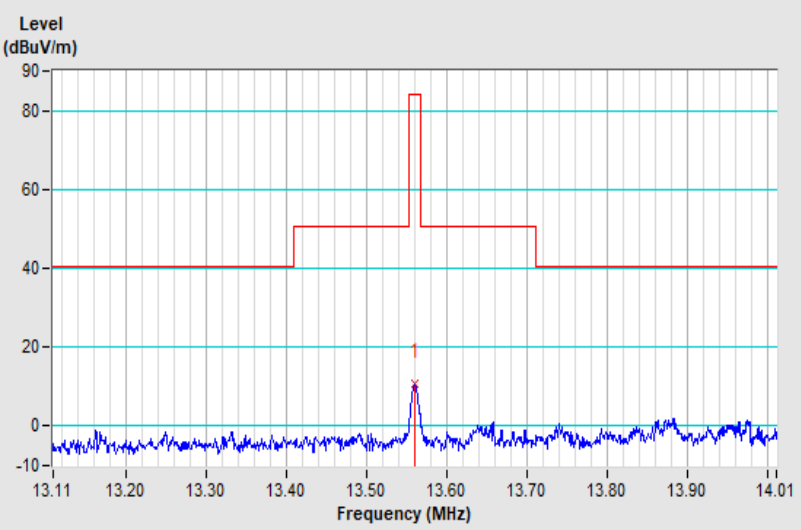
Test Mode	Tx		
RF Mode	NFC-13.56MHz	**Channel**	CH 1：13.56 MHz
Frequency Range	13.11 MHz ~ 14.01 MHz	**Detector Function & Bandwidth**	Quasi-Peak (QP), 9 kHz
Input Power	220 Vac, 60 Hz	**Environmental Conditions**	24°C, 74% RH
Test Date	Thomas Cheng	**Tested By**	2022/8/18

Antenna Polarity : Perpendicular								
No	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	*13.56	10.70 QP	84.00	-73.30	1.00	212	54.80	-44.10

Remarks:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Factor (dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor
3. " * ": Fundamental frequency.
4. Margin value = Emission level – Limit value.
5. Above limits have been translated by the formula

The measured field strength was extrapolated to distance 30 meters distance factor@3m = 40* log(3/30) = -40dB, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)



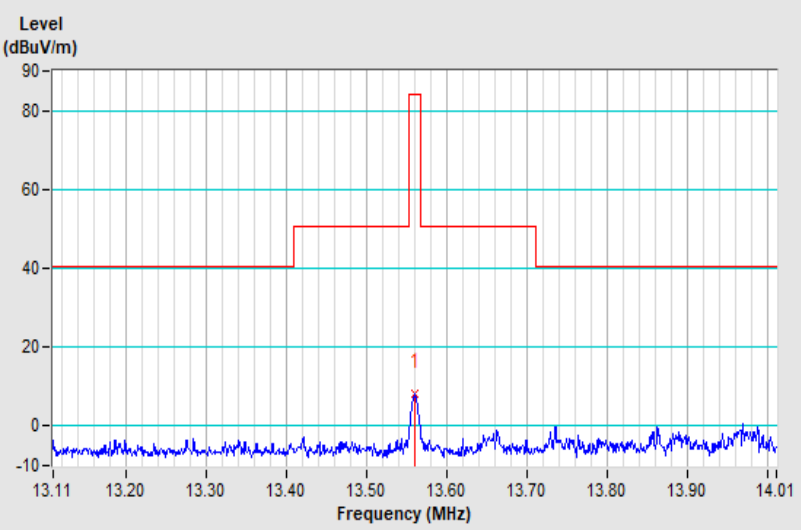
Test Mode	Tx		
RF Mode	NFC-13.56MHz	Channel	CH 1：13.56 MHz
Frequency Range	13.11 MHz ~ 14.01 MHz	Detector Function & Bandwidth	Quasi-Peak (QP), 9 kHz
Input Power	220 Vac, 60 Hz	Environmental Conditions	24°C, 74% RH
Test Date	Thomas Cheng	Tested By	2022/8/18

Antenna Polarity : Ground-parallel								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*13.56	8.20 QP	84.00	-75.80	1.00	227	52.30	-44.10

Remarks:

1. Emission level (dBuV/m) = Raw Value (dBuV) + Factor (dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor
3. " * ": Fundamental frequency.
4. Margin value = Emission level – Limit value.
5. Above limits have been translated by the formula

The measured field strength was extrapolated to distance 30 meters distance factor@3m = 40* log(3/30) = -40dB, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)



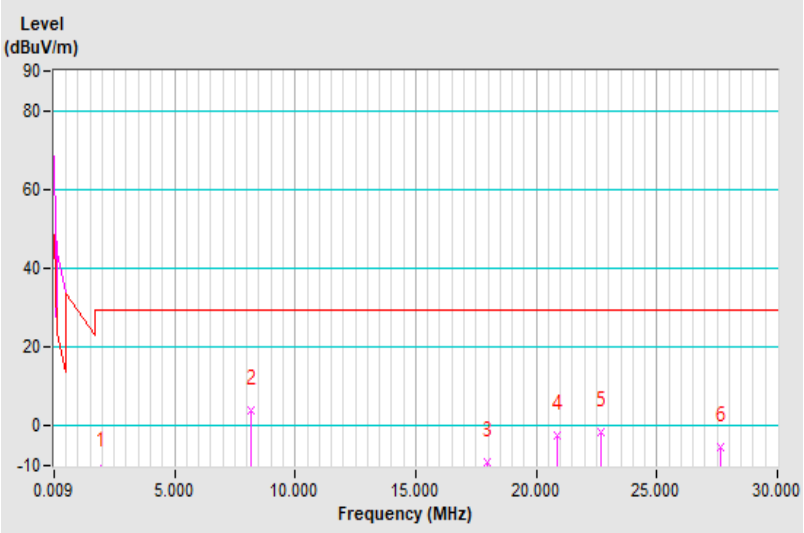
Below 30MHz

Test Mode	Tx		
RF Mode	NFC-13.56MHz	**Channel**	CH 1：13.56 MHz
Frequency Range	9 kHz ~ 30 MHz	**Detector Function & Bandwidth**	Quasi-Peak (QP), 9 kHz
Input Power	220 Vac, 60 Hz	**Environmental Conditions**	27°C, 80% RH
Test Date	Tim Chen	**Tested By**	2022/7/22

Antenna Polarity : Parallel								
No	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	1.93	-11.9 QP	29.5	-41.4	1.00	152	30.0	-41.9
2	8.17	3.9 QP	29.5	-25.6	1.00	166	47.8	-43.9
3	17.97	-9.2 QP	29.5	-38.7	1.00	150	35.7	-44.9
4	20.85	-2.2 QP	29.5	-31.7	1.00	133	42.9	-45.1
5	22.68	-1.5 QP	29.5	-31.0	1.00	164	43.2	-44.7
6	27.63	-5.2 QP	29.5	-34.7	1.00	144	38.3	-43.5

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. The measured field strength was extrapolated to distance 30 meters distance factor@3m = 40* log(3/30) = -40dB, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

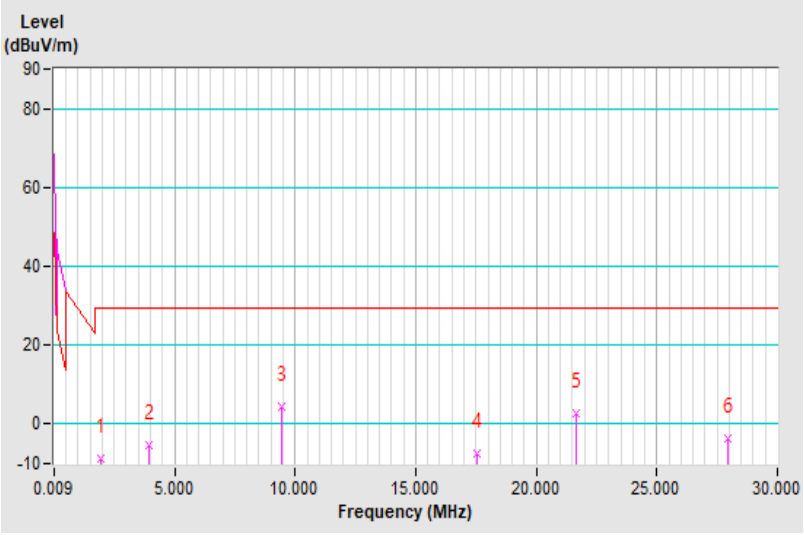


Test Mode	Tx		
RF Mode	NFC-13.56MHz	Channel	CH 1：13.56 MHz
Frequency Range	9 kHz ~ 30 MHz	Detector Function & Bandwidth	Quasi-Peak (QP), 9 kHz
Input Power	220 Vac, 60 Hz	Environmental Conditions	27°C, 80% RH
Test Date	Tim Chen	Tested By	2022/7/22

Antenna Polarity : Perpendicular								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1.96	-8.8 QP	29.5	-38.3	1.00	134	33.1	-41.9
2	3.91	-5.5 QP	29.5	-35.0	1.00	166	38.9	-44.4
3	9.43	4.5 QP	29.5	-25.0	1.00	233	48.0	-43.5
4	17.52	-7.4 QP	29.5	-36.9	1.00	136	37.4	-44.8
5	21.63	2.9 QP	29.5	-26.6	1.00	32	47.8	-44.9
6	27.96	-3.6 QP	29.5	-33.1	1.00	155	39.8	-43.4

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. The measured field strength was extrapolated to distance 30 meters distance factor@3m = 40* log(3/30) = -40dB, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

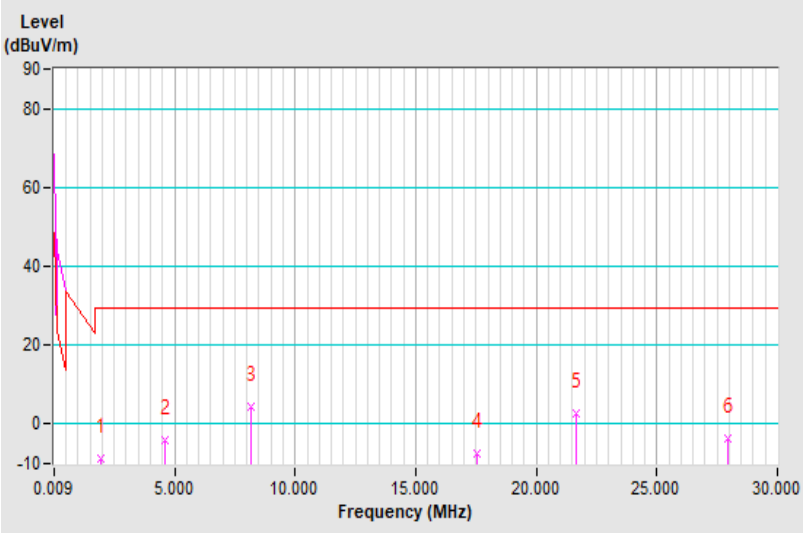


Test Mode	Tx		
RF Mode	NFC-13.56MHz	Channel	CH 1：13.56 MHz
Frequency Range	9 kHz ~ 30 MHz	Detector Function & Bandwidth	Quasi-Peak (QP), 9 kHz
Input Power	220 Vac, 60 Hz	Environmental Conditions	27°C, 80% RH
Test Date	Tim Chen	Tested By	2022/7/22

Antenna Polarity : Ground-parallel								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1.96	-8.8 QP	29.5	-38.3	1.00	155	33.1	-41.9
2	4.63	-4.0 QP	29.5	-33.5	1.00	131	40.7	-44.7
3	8.17	4.2 QP	29.5	-25.3	1.00	221	48.1	-43.9
4	17.52	-7.4 QP	29.5	-36.9	1.00	133	37.4	-44.8
5	21.63	2.9 QP	29.5	-26.6	1.00	152	47.8	-44.9
6	27.96	-3.6 QP	29.5	-33.1	1.00	136	39.8	-43.4

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB) + Distance Factor
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. The measured field strength was extrapolated to distance 30 meters distance factor@3m = 40* log(3/30) = -40dB, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)



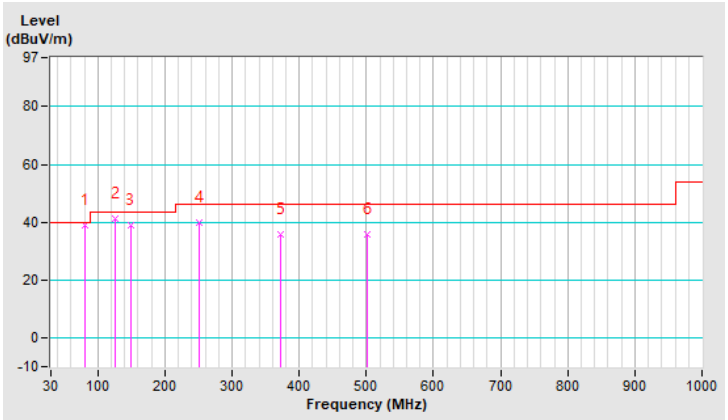
Below 1GHz

RF Mode	TX NFC-13.56MHz	**Channel**	CH 1：13.56 MHz
Frequency Range	30 MHz ~ 1 GHz	**Detector Function & Bandwidth**	(QP) RB = 120kHz
Input Power	220 Vac, 60 Hz	**Environmental Conditions**	28°C, 76% RH
Tested By	Randy Wu	**Test Date**	2022/7/21

Antenna Polarity & Test Distance : Horizontal at 3 m								
No	**Frequency (MHz)**	**Emission Level (dBuV/m)**	**Limit (dBuV/m)**	**Margin (dB)**	**Antenna Height (m)**	**Table Angle (Degree)**	**Raw Value (dBuV)**	**Correction Factor (dB/m)**
1	**80.40**	**38.9 QP**	**40.0**	**-1.1**	**1.99 H**	**81**	**57.0**	**-18.1**
2	125.10	41.2 QP	43.5	-2.3	1.99 H	74	56.0	-14.8
3	148.30	39.0 QP	43.5	-4.5	1.99 H	42	52.2	-13.2
4	250.20	40.0 QP	46.0	-6.0	1.49 H	235	54.2	-14.2
5	371.40	35.6 QP	46.0	-10.4	1.99 H	78	46.2	-10.6
6	500.40	35.6 QP	46.0	-10.4	1.49 H	2	43.5	-7.9

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30 MHz ~ 1 GHz.
5. The emission levels were very low against the limit of frequency range 9 kHz ~ 30 MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

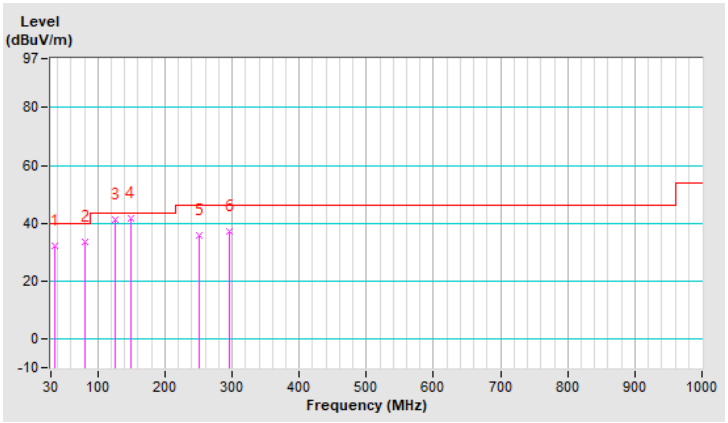


RF Mode	TX NFC-13.56MHz	Channel	CH 1：13.56 MHz
Frequency Range	30 MHz ~ 1 GHz	Detector Function & Bandwidth	(QP) RB = 120kHz
Input Power	220 Vac, 60 Hz	Environmental Conditions	28°C, 76% RH
Tested By	Randy Wu	Test Date	2022/7/21

Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	35.80	32.2 QP	40.0	-7.8	1.51 V	223	46.4	-14.2
2	80.40	33.6 QP	40.0	-6.4	1.01 V	6	51.7	-18.1
3	125.10	41.2 QP	43.5	-2.3	1.01 V	140	56.0	-14.8
4	148.30	41.8 QP	43.5	-1.7	1.01 V	83	55.0	-13.2
5	250.20	35.9 QP	46.0	-10.1	1.99 V	142	50.1	-14.2
6	296.80	37.2 QP	46.0	-8.8	1.99 V	65	49.7	-12.5

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30 MHz ~ 1 GHz.
5. The emission levels were very low against the limit of frequency range 9 kHz ~ 30 MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

4.2.2 Test Instruments

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
50 ohm terminal LYNICS	0900510	E1-011285	2021/10/1	2022/9/30
		E1-011286	2021/10/1	2022/9/30
		E1-011484	2022/6/26	2023/6/25
Attenuator STI	STI02-2200-10	NO.1	2021/9/15	2022/9/14
DC LISN Schwarzbeck	NNLK 8121	8121-808	2022/4/29	2023/4/28
Isolation Transformer Erika Fiedler	D-65396	017	2021/9/9	2022/9/8
LISN R&S	ENV216	101196	2022/5/24	2023/5/23
		101197	2022/7/5	2023/7/4
LISN Schwarzbeck	NNLK 8121	8121-731	2022/5/26	2023/5/25
	NNLK8129	8129229	2022/6/8	2023/6/7
RF Coaxial Cable Commate	5D-FB	Cable-CO10-01	2022/2/9	2023/2/8
Software BVADT	Cond_V7.3.7.4	N/A	N/A	N/A
Test Receiver R&S	ESR3	102414	2021/12/20	2022/12/19

Notes:

1. The test was performed in Linkou Conduction 10.
2. Tested Date: 2022/8/4

4.2.3 Test Procedures

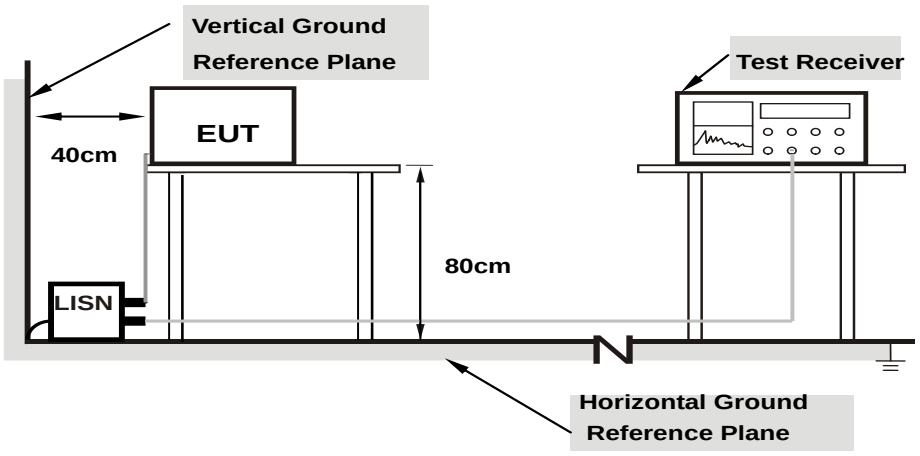
a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/50 uH of coupling impedance for the measuring instrument.
b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
c. The frequency range from 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) was not recorded.

Note: The resolution bandwidth and video bandwidth of test receiver is 9 kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15 MHz - 30 MHz.

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.2.6 EUT Operating Conditions

a. Placed the EUT on the testing table.
b. Set the EUT under transmission condition continuously at specific channel frequency.

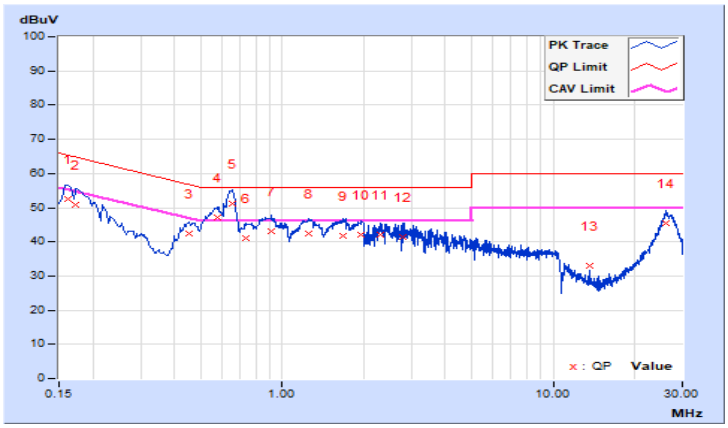
4.2.7 Test Results

Frequency Range	150 kHz ~ 30 MHz	**Detector Function & Resolution Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	220 Vac, 60 Hz	**Environmental Conditions**	25°C, 75% RH
Tested by	James Chang	**Test Date**	2022/8/4

Phase Of Power : Line (L)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.16173	9.61	42.83	32.26	52.44	41.87	65.37	55.37	-12.93	-13.50
2	0.17329	9.61	41.23	28.52	50.84	38.13	64.80	54.80	-13.96	-16.67
3	0.45455	9.62	32.70	24.42	42.32	34.04	56.79	46.79	-14.47	-12.75
4	0.57772	9.63	37.44	25.86	47.07	35.49	56.00	46.00	-8.93	-10.51
5	0.65644	9.64	41.54	32.31	51.18	41.95	56.00	46.00	-4.82	-4.05
6	0.73040	9.64	31.48	23.11	41.12	32.75	56.00	46.00	-14.88	-13.25
7	0.91065	9.65	33.36	24.75	43.01	34.40	56.00	46.00	-12.99	-11.60
8	1.25873	9.67	32.76	25.11	42.43	34.78	56.00	46.00	-13.57	-11.22
9	1.67721	9.68	32.21	24.07	41.89	33.75	56.00	46.00	-14.11	-12.25
10	1.95098	9.69	32.44	25.58	42.13	35.27	56.00	46.00	-13.87	-10.73
11	2.30897	9.70	32.42	25.40	42.12	35.10	56.00	46.00	-13.88	-10.90
12	2.77438	9.71	31.86	23.97	41.57	33.68	56.00	46.00	-14.43	-12.32
13	13.56000	9.87	22.97	16.42	32.84	26.29	60.00	50.00	-27.16	-23.71
14	26.06074	9.91	35.53	30.10	45.44	40.01	60.00	50.00	-14.56	-9.99

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

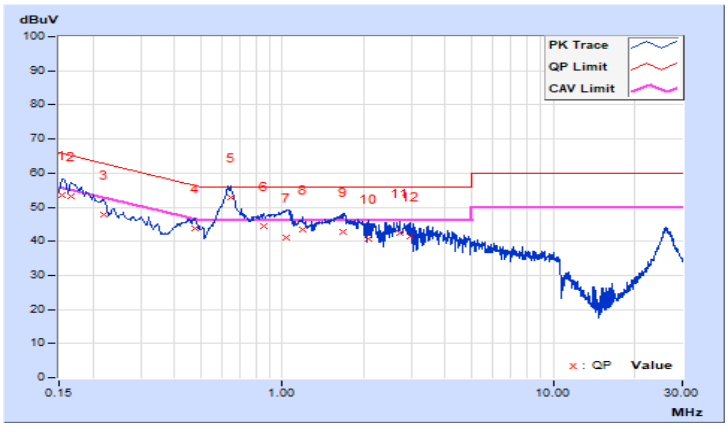


Frequency Range	150 kHz ~ 30 MHz	**Detector Function & Resolution Bandwidth**	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	220 Vac, 60 Hz	**Environmental Conditions**	25°C, 75% RH
Tested by	James Chang	**Test Date**	2022/8/4

Phase Of Power : Neutral (N)										
No	**Frequency (MHz)**	**Correction Factor (dB)**	**Reading Value (dBuV)**		**Emission Level (dBuV)**		**Limit (dBuV)**		**Margin (dB)**	
			Q.P.	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**	**Q.P.**	**AV.**
1	0.15391	9.63	43.74	32.37	53.37	42.00	65.79	55.79	-12.42	-13.79
2	0.16564	9.63	43.48	32.92	53.11	42.55	65.18	55.18	-12.07	-12.63
3	0.22040	9.63	38.23	28.38	47.86	38.01	62.80	52.80	-14.94	-14.79
4	0.47461	9.64	34.24	25.03	43.88	34.67	56.43	46.43	-12.55	-11.76
5	**0.64471**	**9.66**	**43.07**	**34.21**	**52.73**	**43.87**	**56.00**	**46.00**	**-3.27**	**-2.13**
6	0.85101	9.67	34.87	26.50	44.54	36.17	56.00	46.00	-11.46	-9.83
7	1.03150	9.68	31.43	17.93	41.11	27.61	56.00	46.00	-14.89	-18.39
8	1.19225	9.69	33.70	25.99	43.39	35.68	56.00	46.00	-12.61	-10.32
9	1.67721	9.70	33.03	24.43	42.73	34.13	56.00	46.00	-13.27	-11.87
10	2.07040	9.71	31.00	22.33	40.71	32.04	56.00	46.00	-15.29	-13.96
11	2.72354	9.72	32.70	24.94	42.42	34.66	56.00	46.00	-13.58	-11.34
12	2.96211	9.73	31.64	24.60	41.37	34.33	56.00	46.00	-14.63	-11.67

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

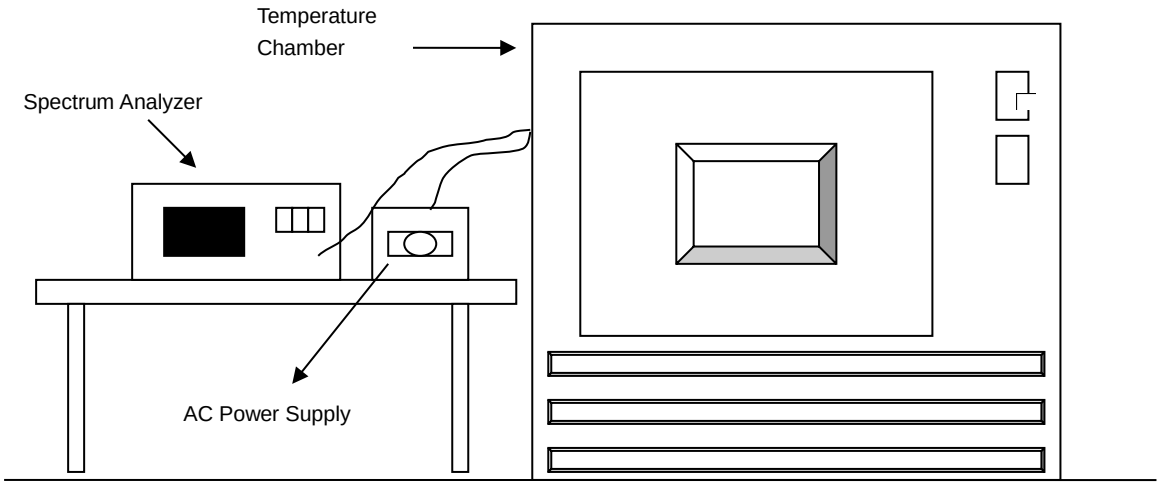


4.3 Frequency Stability

4.3.1 Limits of Frequency Stability Measurement

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.

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedure

a. The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.
b. Turned the EUT on and coupled its output to a spectrum analyzer.
c. Turned the EUT off and set the chamber to the highest temperature specified.
d. Allowed sufficient time (approximately 30 min) for the temperature of the chamber to stabilize then turned the EUT on and measured the operating frequency after 2, 5, and 10 minutes.
e. Repeated step c and d with the every 10 degrees reduction until the lowest temperature achieved.
f. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85 % to 115 % and the frequency record.

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

a. Placed the EUT on the testing table.
b. Set the EUT under transmission condition continuously at specific channel frequency.

4.3.7 Test Results

Frequency Stability Versus Temperature									
Temp. (℃)	Power Supply (Vac)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift
		(MHz)	%	(MHz)	%	(MHz)	%	(MHz)	%
50	220	13.56002	0.00015	13.56002	0.00015	13.56002	0.00015	13.56001	0.00007
40	220	13.56003	0.00022	13.56004	0.00029	13.56003	0.00022	13.56003	0.00022
30	220	13.56006	0.00044	13.56005	0.00037	13.56005	0.00037	13.56005	0.00037
20	220	13.55994	-0.00044	13.55993	-0.00052	13.55993	-0.00052	13.55992	-0.00059
10	220	13.55993	-0.00052	13.55994	-0.00044	13.55993	-0.00052	13.55994	-0.00044
0	220	13.55996	-0.00029	13.55997	-0.00022	13.55997	-0.00022	13.55997	-0.00022
-10	220	13.55998	-0.00015	13.55998	-0.00015	13.55998	-0.00015	13.55997	-0.00022
-20	220	13.55997	-0.00022	13.55998	-0.00015	13.55998	-0.00015	13.55998	-0.00015
-30	220	13.56003	0.00022	13.56003	0.00022	13.56003	0.00022	13.56003	0.00022
-40	220	13.56005	0.00037	13.56005	0.00037	13.56005	0.00037	13.56005	0.00037

Frequency Stability Versus Voltage									
Temp. (℃)	Power Supply (Vdc)	0 Minute		2 Minute		5 Minute		10 Minute	
		Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift
		(MHz)	%	(MHz)	%	(MHz)	%	(MHz)	%
20	253	13.55994	-0.00044	13.55993	-0.00052	13.55993	-0.00052	13.55992	-0.00059
	220	13.55994	-0.00044	13.55993	-0.00052	13.55993	-0.00052	13.55992	-0.00059
	187	13.55994	-0.00044	13.55993	-0.00052	13.55993	-0.00052	13.55992	-0.00059

4.4 20 dB Bandwidth

4.4.1 Limits of 20 dB Bandwidth Measurement

The 20 dB bandwidth shall be specified in operating frequency band.

4.4.2 Test Setup

Refer to section 4.1.5.

4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedures

The bandwidth of the fundamental frequency was measured by spectrum analyzer with 1 kHz RBW and 3 kHz VBW. The 20 dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20 dB.

4.4.5 Deviation from Test Standard

No deviation.

4.4.6 EUT Operating Conditions

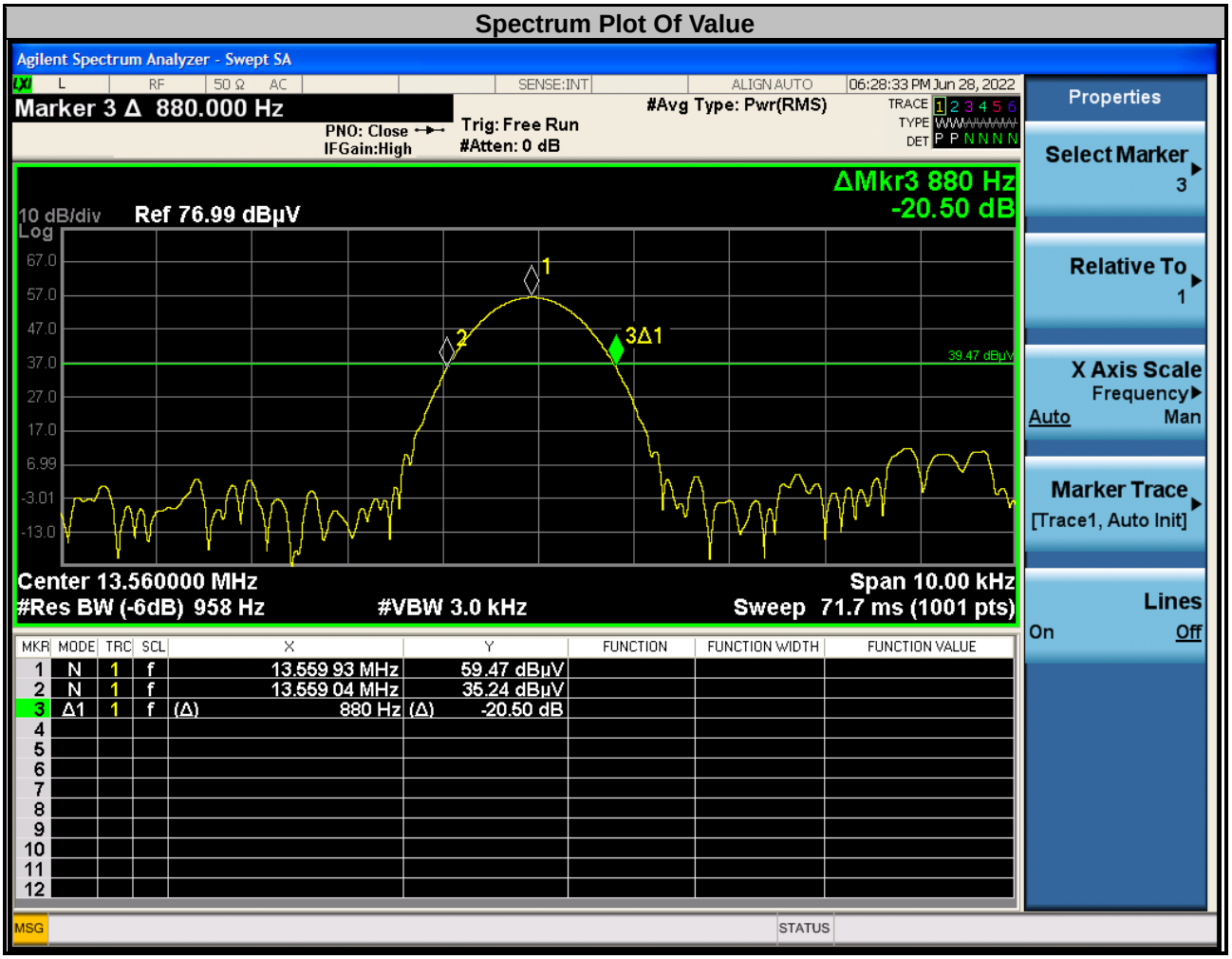
a. Placed the EUT on the testing table.
b. Set the EUT under transmission condition continuously at specific channel frequency.

4.4.7 Test Results

20 dBc Point (Low)	20 dBc Point (High)	Operating Frequency Band (MHz)	Pass / Fail
13.559904 MHz	13.56081 MHz	13.553~13.567	Pass

***20 dBc Point (High) = Marker 1 + Delta 1**

Spectrum Plot Of Value



Note: The signal look like CW signal, so RBW can't be match 1~5 % OBW.

5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

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

Lin Kou EMC/RF Lab
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab
Tel: 886-3-6668565
Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab
Tel: 886-3-3183232
Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com
Web Site: www.bureauveritas-adt.com

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

--- END ---