

FCC Test Report

Report No.: RFBDBO-WTW-P21100529

FCC ID: G7H-SPRFTR002

Test Model: PARARFTRDR002

Received Date: 2021/10/16

Test Date: 2022/4/7 ~ 2022/4/13

Issued Date: 2022/5/4

Applicant: Semnox Solutions Private Limited

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
Lin Kou Laboratories

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**FCC Registration /
Designation Number:** 198487 / TW2021



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Release Control Record

Issue No.	Description	Date Issued
RFBDDBO-WTW-P21100529	Original release	2022/5/4

1 Certificate of Conformity

Product: Parafait RF Tag Reader 2

Brand: Parafait

Test Model: PARARFTRDR002

Sample Status: Engineering sample

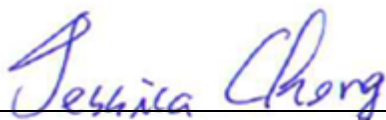
Applicant: Semnox Solutions Private Limited

Test Date: 2022/4/7 ~ 2022/4/13

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 :



Jessica Cheng / Senior Specialist

Date:

2022/5/4

Approved by :



Jeremy Lin / Project Engineer

Date:

2022/5/4

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 -3.48dB at 13.55469MHz
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 -61.9dB at 13.56MHz.
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 -3.6dB at 40.68MHz
15.225 (e)	The frequency tolerance	Pass	Meet the requirement of limit.
15.215 (c)	20dB Bandwidth	Pass	Meet the requirement of limit.

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	Frequency	Expanded Uncertainty (k=2) ($\pm$)
Conducted Emissions at mains ports	150kHz ~ 30MHz	3.00 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	2.38 dB
	30MHz ~ 1GHz	5.70 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Parafait RF Tag Reader 2
Brand	Parafait
Test Model	PARARFTRDR002
Sample Status	Engineering sample
Power Supply Rating	5Vdc from host equipment
Modulation Type	ASK
Operating Frequency	13.56MHz
Antenna Type	coil antenna
Field Strength	22.1dBuV/m @30m
Accessory Device	N/A
Data Cable Supplied	N/A

Note:

1. The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.
2. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.2 Description of Test Modes

1 channel is provided to EUT:

Channel	Frequency (MHz)
1	13.56

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To				Description
	RE<1G	PLC	FS	EB	
A	√	√	√	√	Operating Mode
B	√	√	-	√	Standby Mode

Where **RE<1G**: Radiated Emission below 1GHz
PLC: Power Line Conducted Emission

FS: Frequency Stability
EB: 20dB Bandwidth measurement

Radiated Emission Test (Below 1GHz):

- ☒ 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	Frequency (MHz)	Modulation Type
A & B	1	13.56	ASK

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	Operating Frequency (kHz)	Tested Frequency (kHz)	Modulation Type
A & B	1	13.56	ASK

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	Operating Frequency (kHz)	Tested Frequency (kHz)	Modulation Type
A	1	13.56	ASK

20dB 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	Operating Frequency (kHz)	Tested Frequency (kHz)	Modulation Type
A & B	1	13.56	ASK

Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested by
RE<1G	22 deg. C, 67% RH	120Vac, 60Hz (system)	Ian Chang
PLC	25 deg. C, 75% RH	120Vac, 60Hz (system)	Pirar Hsieh
FS	25 deg. C, 76% RH	120Vac, 60Hz (system)	Pirar Hsieh
EB	25 deg. C, 76% RH	5Vdc	Dalen Dai

3.3 Description of Support Units

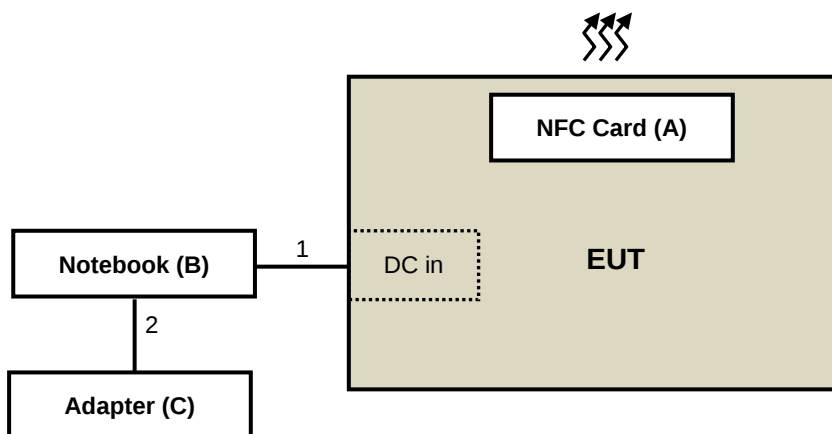
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No./lot no.	FCC ID	Remarks
A.	NFC Card	NA	NA	NA	NA	Supplied by applicant
B.	Notebook	Lenovo	81A4	YD02TWDP	NA	Provided by Lab
C.	Aadpter	Lenovo	ADLX65CCGU2A	WX61A45JRXLF	NA	Provided by Lab

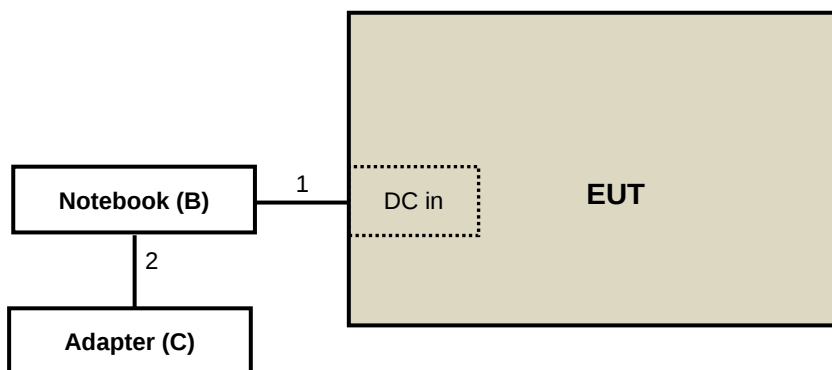
ID	Cable Descriptions	Qty.	Length (m)	Shielding (Yes/ No)	Cores (Qty.)	Remarks
1.	USB Cable	1	1.5	Y	0	Supplied by applicant
2.	DC Cable	1	1.9	Y	0	Provided by Lab

3.3.1 Configuration Of System Under Test

Operating Mode



Standby Mode



3.4 General Description of Applied Standards

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

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.

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

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.

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.

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.

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 1000MHz, 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 20dB under any condition of modulation.

4.1.2 Test Instruments

For Radiated Emission below 1GHz Test:

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
Bi_Log Antenna Schwarzbeck	VULB 9168	137	2021/10/27	2022/10/26
Coupling/Dcoupling Network Schwarzbeck	CDNE-M2	00097	2021/5/6	2022/5/5
	CDNE-M3	00091	2021/5/6	2022/5/5
Pre_Amplifier HP	8447D	2432A03504	2022/2/17	2023/2/16
RF Coaxial Cable Pacific	8D-FB	Cable-CH6-02	2021/7/13	2022/7/12
Software BVADT	Radiated_V8.7.08	N/A	N/A	N/A
Spectrum Analyzer R&S	FSV40	101544	2021/5/24	2022/5/23
Test Receiver Agilent	N9038A	MY51210137	2021/6/16	2022/6/15
Tower ADT	AT100	0306	N/A	N/A
Turn Table ADT	TT100	0306	N/A	N/A

- NOTE:** 1. The calibration interval of the above test instruments is 12 months. And the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Linkou 966 Chamber 6 (CH 6) , The test site validated date: 2021/11/4 (NSA)
3. Tested Date: 2022/4/7

For Frequency Stability & 20dB Bandwidth Test:

Description Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until
MIMO Powermeasurement Test set (4X4) KEYSIGHT	U2021XA	U2021XA_001	2021/6/16	2022/6/15
MXG Vector Signal Generator KEYSIGHT	N5182B	MY53052658	2021/5/19	2022/5/18
Peak Power meter Anritsu	ML2495A	0842014	2021/4/15	2022/4/14
Pulse Power Sensor Anritsu	MA2411B	0738404	2021/4/15	2022/4/14
Spectrum Analyzer R&S	FSV40	101544	2021/5/24	2022/5/23
		101042	2021/9/9	2022/9/8
Spectrum Analyzer KEYSIGHT	N9030A	MY54490260	2021/7/23	2022/7/22
Temperature & Humidity Chamber TERCHY	MHU-225AU	920409	2021/7/2	2022/7/1
True RMS Clamp Meter Fluke	325	31130711WS	2021/6/2	2022/6/1
Programmable DC Power Supply (IDRC)	DSP80-180WE	701217	2022/3/3	2023/3/2

- NOTE:** 1. The calibration interval of the above test instruments is 12 months. And the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in LK - Oven
3. Tested Date: 2022/4/12

4.1.3 Test Procedures

For Radiated emission below 30MHz

- 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, 110kHz-490kHz) set to average detect function and peak detect function.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 200Hz at frequency band (9kHz-150kHz) and 9kHz at frequency below 30MHz (except 9kHz-150kHz).
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 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for below 1GHz) 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.

Note:

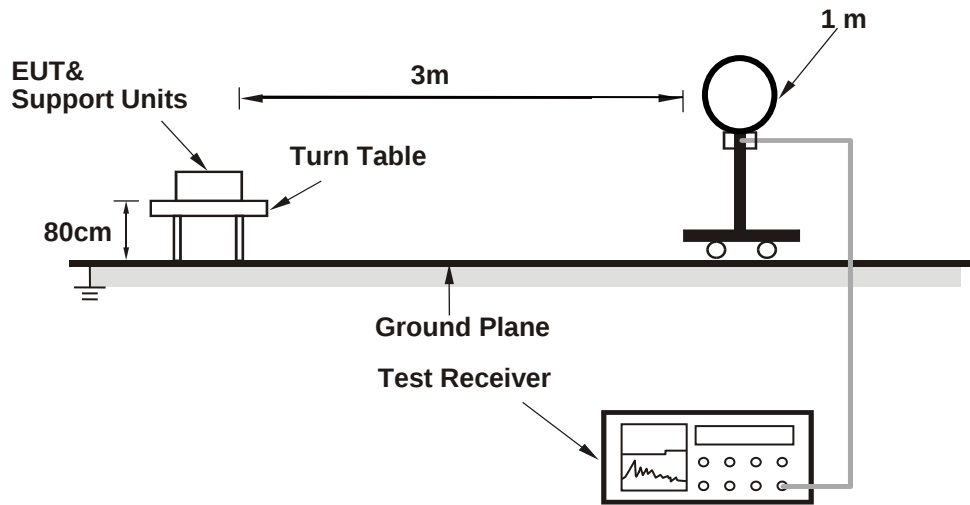
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

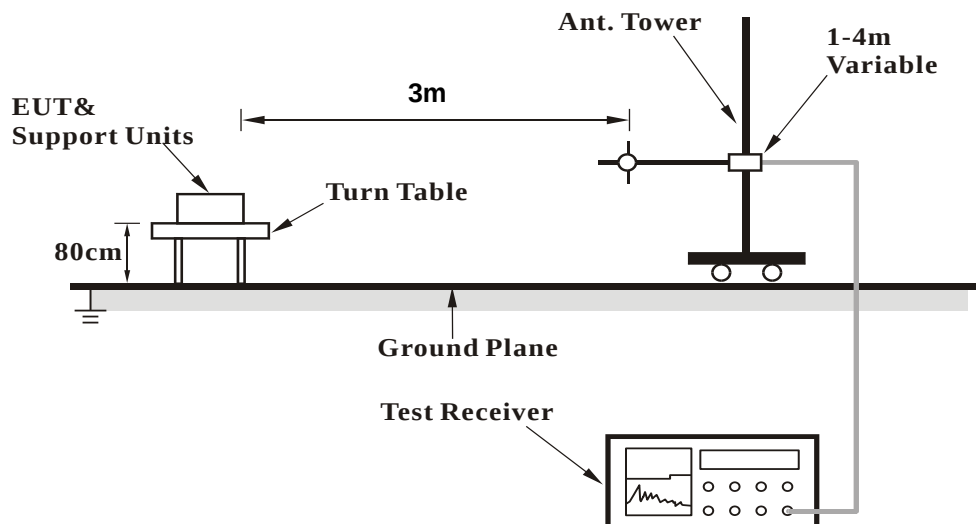
No deviation.

4.1.5 Test Set Up

For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



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

KDB 414788 OFS and Chamber Correlation Justification

- Based on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in 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. Connected the EUT to Notebook..
- b. Put the NFC card on the EUT.
- c. Set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Mode A

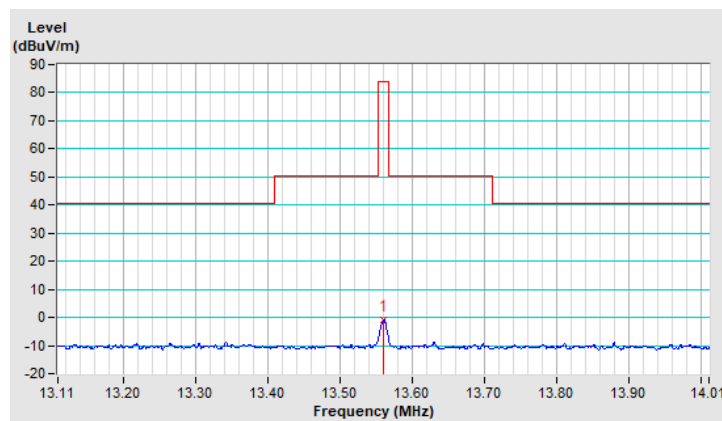
Test Frequency	13.56MHz	Detector Function	Quasi-Peak (QP)
Frequency Range	13.553 ~ 13.567MHz		

Antenna Polarity : Parallel								
No	Freq. (MHz)	Emission Level (dBuV/m) (30m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV) (3m)	Correction Factor (dB/m)
1	*13.56	-0.9 QP	84.0	-84.9	1.00	150	37.2	-38.1

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. “ * “ : Fundamental frequency
6. Above limits have been translated by the formula

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)



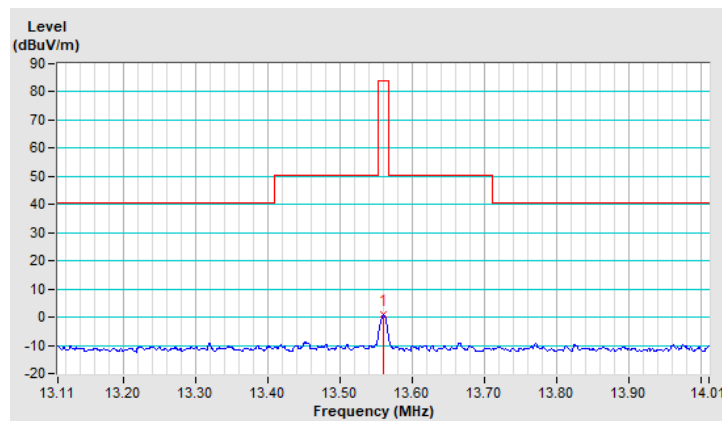
Test Frequency	13.56MHz	Detector Function	Quasi-Peak (QP)
Frequency Range	13.553 ~ 13.567MHz		

Antenna Polarity : Perpendicular								
No	Freq. (MHz)	Emission Level (dBuV/m) (30m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV) (3m)	Correction Factor (dB/m)
1	*13.56	0.9 QP	84.0	-83.1	1.00	289	39.0	-38.1

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. “ * “ : Fundamental frequency
6. Above limits have been translated by the formula

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)



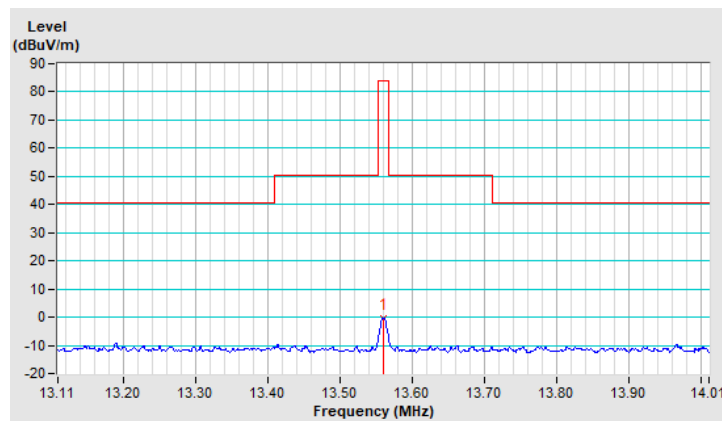
Test Frequency	13.56MHz	Detector Function	Quasi-Peak (QP)
Frequency Range	13.553 ~ 13.567MHz		

Antenna Polarity : Ground-parallel								
No	Freq. (MHz)	Emission Level (dBuV/m) (30m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV) (3m)	Correction Factor (dB/m)
1	*13.56	-0.2 QP	84.0	-84.2	1.00	189	37.9	-38.1

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. “ * “ : Fundamental frequency
6. Above limits have been translated by the formula

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)



Mode B

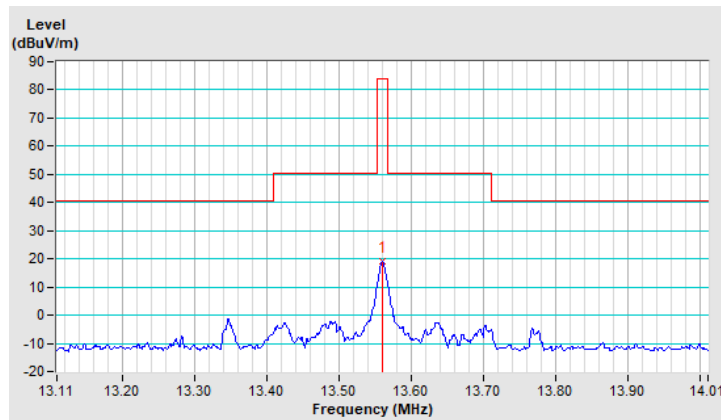
Test Frequency	13.56MHz	Detector Function	Quasi-Peak (QP)
Frequency Range	13.553 ~ 13.567MHz		

Antenna Polarity : Parallel								
No	Freq. (MHz)	Emission Level (dBuV/m) (30m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV) (3m)	Correction Factor (dB/m)
1	*13.56	19.1 QP	84.0	-64.9	1.00	183	57.2	-38.1

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. “ * ” : Fundamental frequency
6. Above limits have been translated by the formula

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)



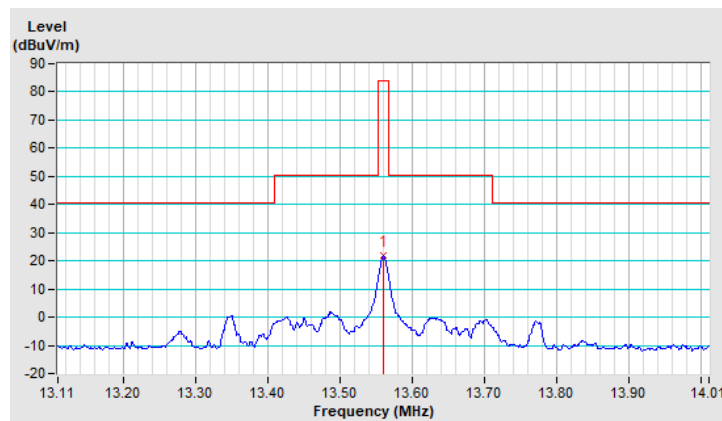
Test Frequency	13.56MHz	Detector Function	Quasi-Peak (QP)
Frequency Range	13.553 ~ 13.567MHz		

Antenna Polarity : Perpendicular								
No	Freq. (MHz)	Emission Level (dBuV/m) (30m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV) (3m)	Correction Factor (dB/m)
1	*13.56	22.1 QP	84.0	-61.9	1.00	219	60.2	-38.1

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. “ * “ : Fundamental frequency
6. Above limits have been translated by the formula

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)



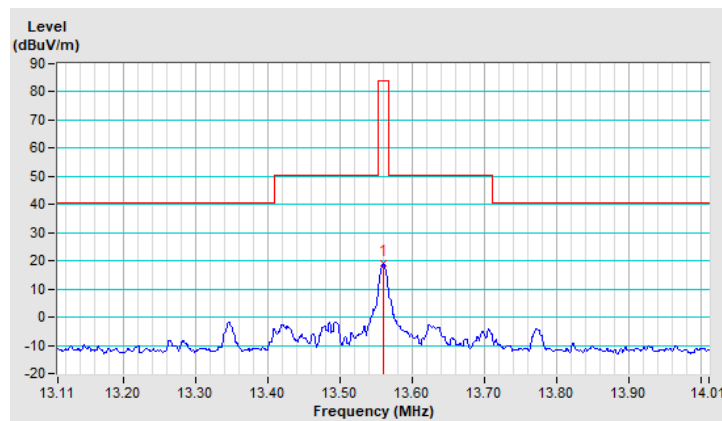
Test Frequency	13.56MHz	Detector Function	Quasi-Peak (QP)
Frequency Range	13.553 ~ 13.567MHz		

Antenna Polarity : Ground-parallel								
No	Freq. (MHz)	Emission Level (dBuV/m) (30m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV) (3m)	Correction Factor (dB/m)
1	*13.56	19.0 QP	84.0	-65.0	1.00	163	57.1	-38.1

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. “ * “ : Fundamental frequency
6. Above limits have been translated by the formula

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)



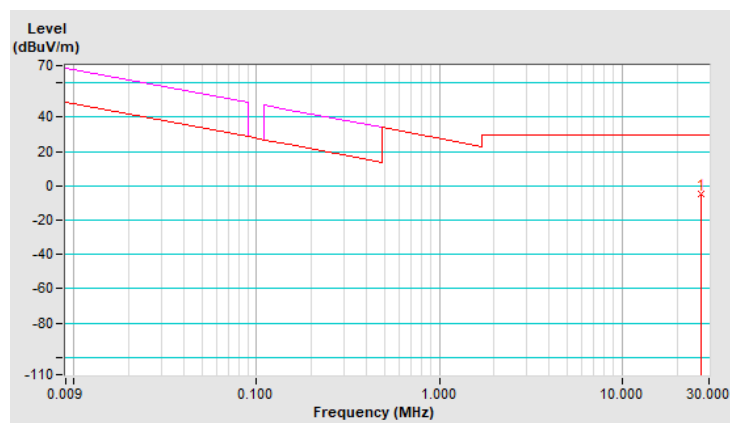
Mode A

Test Frequency	13.56MHz	Detector Function	Quasi-Peak (QP)
Frequency Range	Below 30MHz		

Antenna Polarity : Parallel								
No	Freq. (MHz)	Emission Level (dBuV/m) (30m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV) (3m)	Correction Factor (dB/m)
1	27.12	-4.7 QP	29.5	-34.2	1.00	164	31.7	-36.4

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, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

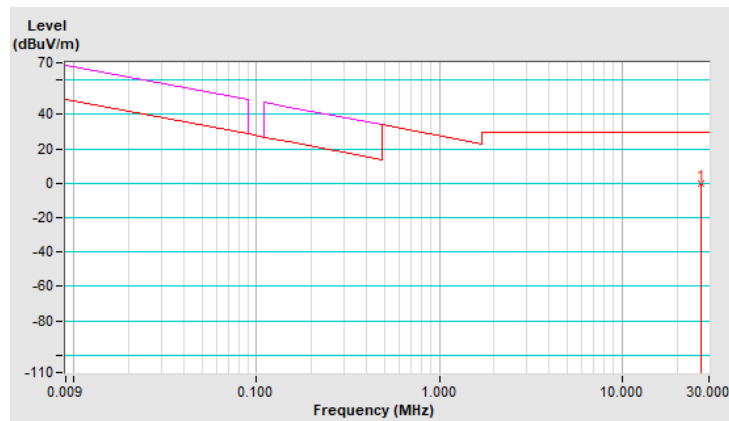


Test Frequency	13.56MHz	Detector Function	Quasi-Peak (QP)
Frequency Range	Below 30MHz		

Antenna Polarity : Perpendicular								
No	Freq. (MHz)	Emission Level (dBuV/m) (30m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV) (3m)	Correction Factor (dB/m)
1	27.12	-0.3 QP	29.5	-29.8	1.00	214	36.1	-36.4

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, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

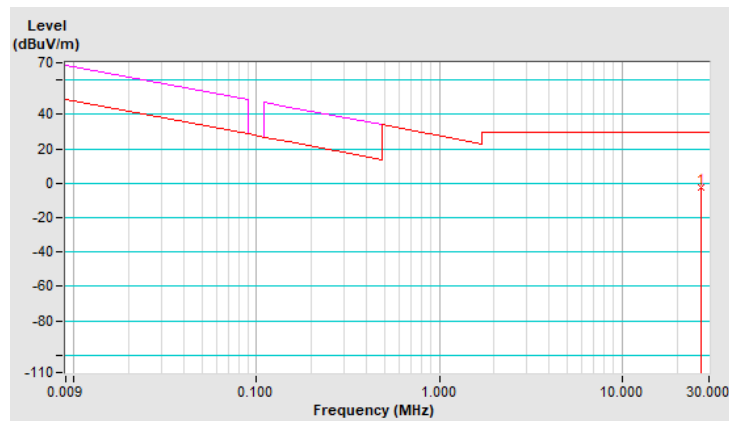


Test Frequency	13.56MHz	Detector Function	Quasi-Peak (QP)
Frequency Range	Below 30MHz		

Antenna Polarity : Ground-parallel								
No	Freq. (MHz)	Emission Level (dBuV/m) (30m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV) (3m)	Correction Factor (dB/m)
1	27.12	-2.7 QP	29.5	-32.2	1.00	188	33.7	-36.4

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, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)



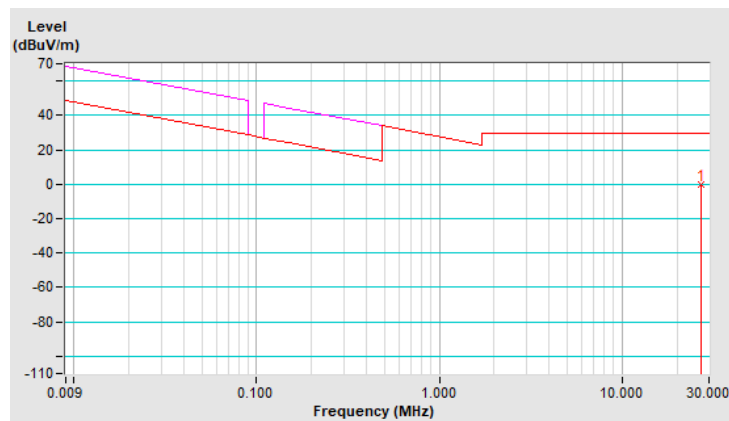
Mode B

Test Frequency	13.56MHz	Detector Function	Quasi-Peak (QP)
Frequency Range	Below 30MHz		

Antenna Polarity : Parallel								
No	Freq. (MHz)	Emission Level (dBuV/m) (30m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV) (3m)	Correction Factor (dB/m)
1	27.12	-0.2 QP	29.5	-29.7	1.00	185	36.2	-36.4

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, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

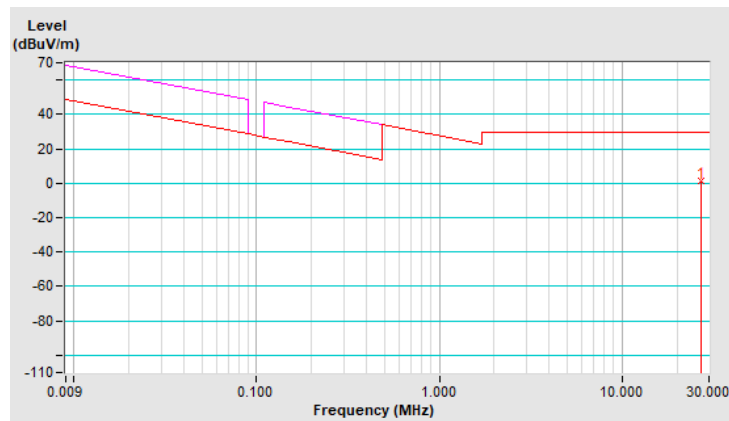


Test Frequency	13.56MHz	Detector Function	Quasi-Peak (QP)
Frequency Range	Below 30MHz		

Antenna Polarity : Perpendicular								
No	Freq. (MHz)	Emission Level (dBuV/m) (30m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV) (3m)	Correction Factor (dB/m)
1	27.12	1.2 QP	29.5	-28.3	1.00	181	37.6	-36.4

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, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

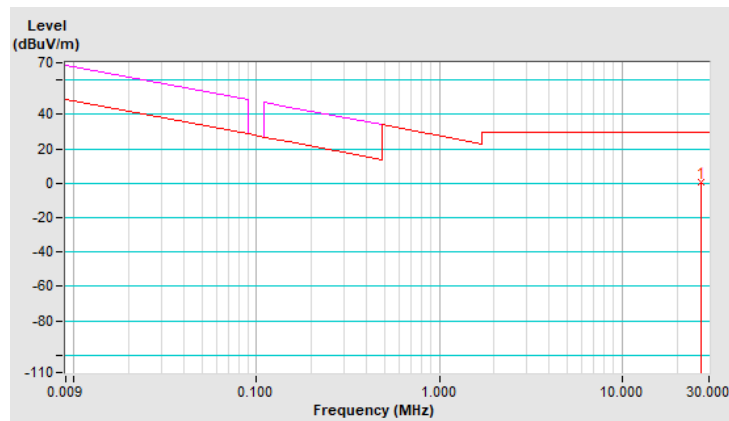


Test Frequency	13.56MHz	Detector Function	Quasi-Peak (QP)
Frequency Range	Below 30MHz		

Antenna Polarity : Ground-parallel								
No	Freq. (MHz)	Emission Level (dBuV/m) (30m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV) (3m)	Correction Factor (dB/m)
1	27.12	0.7 QP	29.5	-28.8	1.00	164	37.1	-36.4

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, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)



Mode A

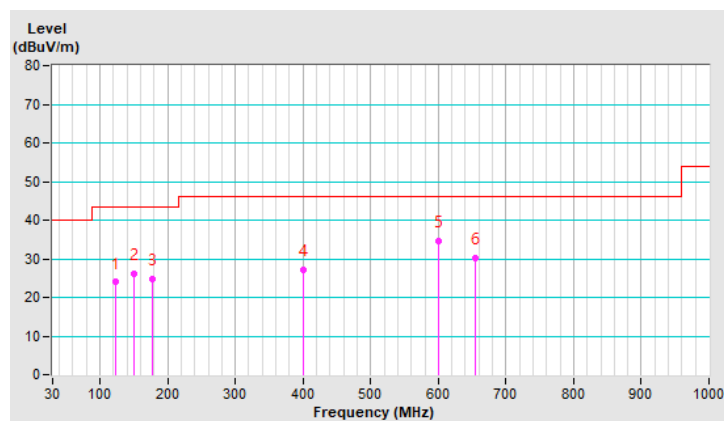
30MHz ~ 1GHz Data:

Test Frequency	13.56MHz	Detector Function	Quasi-Peak (QP)
Frequency Range	30MHz ~ 1GHz		

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	122.16	23.9 QP	43.5	-19.6	1.32 H	111	34.2	-10.3
2	149.32	26.3 QP	43.5	-17.2	1.80 H	159	34.3	-8.0
3	176.48	24.7 QP	43.5	-18.8	1.51 H	130	33.4	-8.7
4	399.58	27.2 QP	46.0	-18.8	1.00 H	10	30.8	-3.6
5	600.37	34.7 QP	46.0	-11.3	2.35 H	212	33.8	0.9
6	653.72	30.1 QP	46.0	-15.9	2.81 H	258	28.0	2.1

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 30MHz~1000MHz.

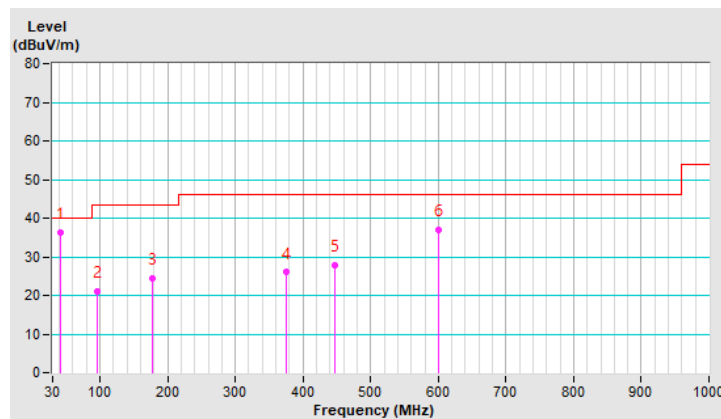


Test Frequency	13.56MHz	Detector Function	Quasi-Peak (QP)
Frequency Range	30MHz ~ 1GHz		

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	40.68	36.4 QP	40.0	-3.6	1.00 V	197	45.5	-9.1
2	95.00	21.1 QP	43.5	-22.4	1.12 V	29	34.7	-13.6
3	176.48	24.4 QP	43.5	-19.1	1.48 V	65	33.1	-8.7
4	375.33	26.0 QP	46.0	-20.0	2.12 V	128	30.0	-4.0
5	446.14	27.9 QP	46.0	-18.1	2.44 V	159	30.1	-2.2
6	600.37	37.1 QP	46.0	-8.9	2.94 V	208	36.2	0.9

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 30MHz~1000MHz.



Mode B

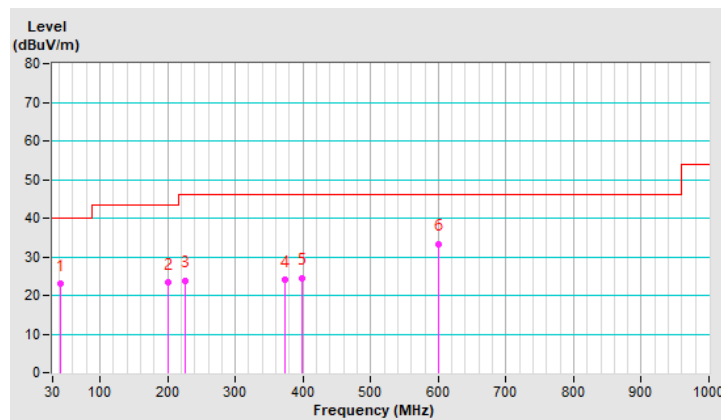
30MHz ~ 1GHz Data:

Test Frequency	13.56MHz	Detector Function	Quasi-Peak (QP)
Frequency Range	30MHz ~ 1GHz		

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	40.67	22.9 QP	40.0	-17.1	1.00 H	360	32.0	-9.1
2	199.75	23.3 QP	43.5	-20.2	1.06 H	360	33.8	-10.5
3	224.97	23.8 QP	46.0	-22.2	1.00 H	360	34.1	-10.3
4	372.41	23.9 QP	46.0	-22.1	1.00 H	360	28.1	-4.2
5	398.60	24.6 QP	46.0	-21.4	2.43 H	360	28.2	-3.6
6	600.36	33.2 QP	46.0	-12.8	2.91 H	360	32.3	0.9

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 30MHz~1000MHz.

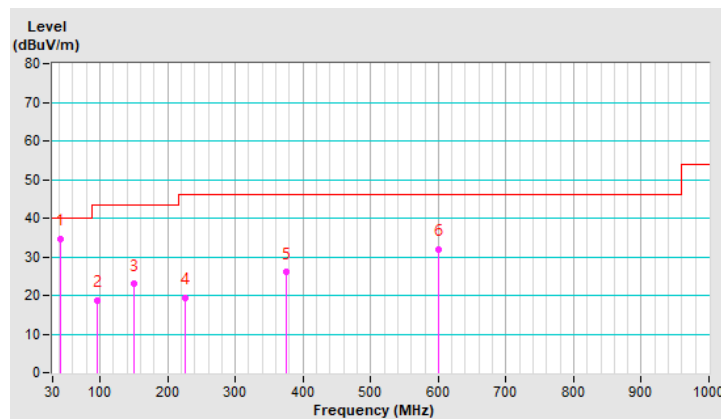


Test Frequency	13.56MHz	Detector Function	Quasi-Peak (QP)
Frequency Range	30MHz ~ 1GHz		

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	40.68	34.5 QP	40.0	-5.5	1.10 V	146	43.6	-9.1
2	94.99	18.7 QP	43.5	-24.8	2.88 V	325	32.3	-13.6
3	149.31	22.9 QP	43.5	-20.6	1.69 V	208	30.9	-8.0
4	224.97	19.5 QP	46.0	-26.5	3.66 V	360	29.8	-10.3
5	375.32	26.0 QP	46.0	-20.0	2.10 V	249	30.0	-4.0
6	600.36	32.0 QP	46.0	-14.0	2.40 V	278	31.1	0.9

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 30MHz~1000MHz.



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 0.50MHz.

4.2.2 Test Instruments

Description & Manufacturer	Model no.	Serial No.	Calibrated Date	Calibrated Until
Test Receiver R&S	ESR3	102412	2022/1/22	2023/1/21
LISN Schwarzbeck	NSLK 8128	8128-244	2021/11/11	2022/11/10
LISN Schwarzbeck	NNLK8129	8129229	2021/5/20	2022/5/19
DC LISN Schwarzbeck	NNLK 8121	8121-808	2021/4/18	2022/4/17
LISN Schwarzbeck	NNLK 8121	8121-731	2021/4/28	2022/4/27
LISN R&S	ENV216	101196	2021/4/26	2022/4/25
LISN R&S	ESH3-Z5	100220	2021/11/25	2022/11/24
LISN R&S	ESH3-Z6	844950/018	2021/7/25	2022/7/24
DC LISN R&S	ESH3-Z6	100219	2021/7/25	2022/7/24
High Voltage Probe Schwarzbeck	TK9420	00982	2021/12/24	2022/12/23
RF Coaxial Cable Commate	5D-FB	Cable-CO5-01	2022/1/28	2023/1/27
Attenuator STI	STI02-2200-10	NO.4	2021/9/3	2022/9/2
50 Ohms Terminator LYNICS	0900510	E1-01-305	2022/2/9	2023/2/8
Isolation Transformer Erika Fiedler	D-65396	017	2021/9/9	2022/9/8
Software BVADT	Cond_V7.3.7.4	NA	NA	NA

Note: 1. The test was performed in Linkou Conduction 05.

2. The VCCI Site Registration No. C-11093.

3. Tested Date: 2022/4/13

4.2.3 Test Procedures

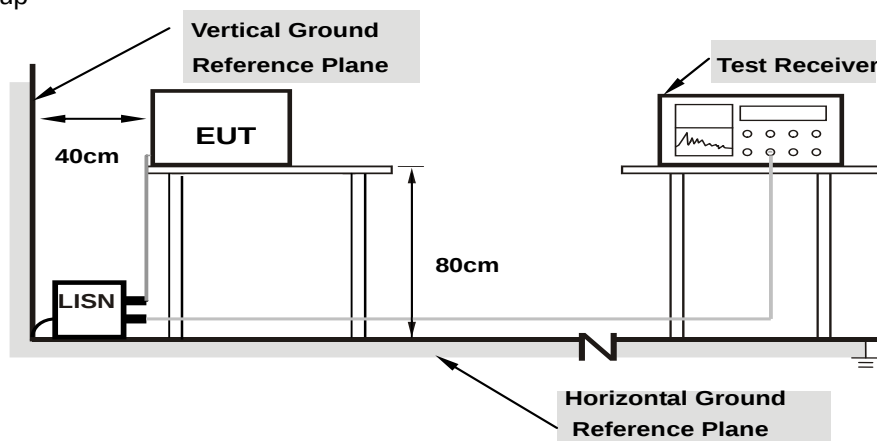
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

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

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

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

4.2.6 EUT Operating Conditions

Same as item 4.1.6.

4.2.7 Test Results

Mode A

Frequency Range	150kHz ~ 30MHz	Detector Function	Quasi-Peak (QP) / Average (AV)
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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	0.15391	9.88	44.85	24.48	54.73	34.36	65.79	55.79	-11.06	-21.43
2	0.22031	9.89	27.05	17.78	36.94	27.67	62.81	52.81	-25.87	-25.14
3	0.53281	9.92	32.28	24.14	42.20	34.06	56.00	46.00	-13.80	-11.94
4	3.63672	10.10	16.81	5.97	26.91	16.07	56.00	46.00	-29.09	-29.93
5	8.33984	10.32	11.52	4.95	21.84	15.27	60.00	50.00	-38.16	-34.73
6	13.55859	10.52	30.41	27.12	40.93	37.64	60.00	50.00	-19.07	-12.36

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

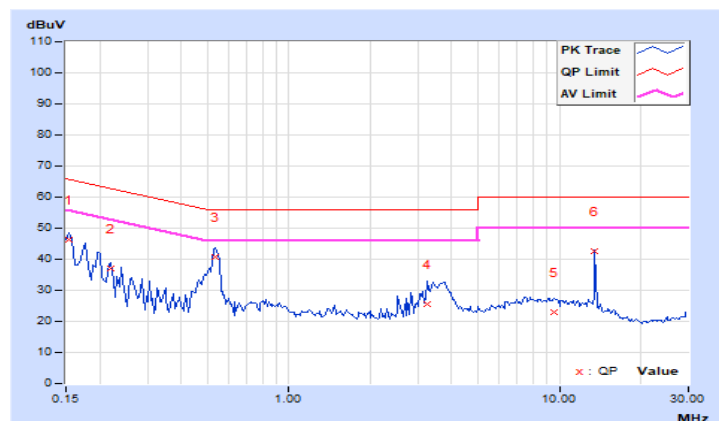


Frequency Range	150kHz ~ 30MHz	Detector Function	Quasi-Peak (QP) / Average (AV)
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Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	9.89	36.25	21.49	46.14	31.38	65.79	55.79	-19.65	-24.41
2	0.22031	9.90	27.27	15.49	37.17	25.39	62.81	52.81	-25.64	-27.42
3	0.53672	9.95	30.71	21.37	40.66	31.32	56.00	46.00	-15.34	-14.68
4	3.25391	10.10	15.38	2.70	25.48	12.80	56.00	46.00	-30.52	-33.20
5	9.52344	10.37	12.62	6.27	22.99	16.64	60.00	50.00	-37.01	-33.36
6	13.55859	10.51	32.07	28.89	42.58	39.40	60.00	50.00	-17.42	-10.60

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



Mode B

Frequency Range	150kHz ~ 30MHz	Detector Function	Quasi-Peak (QP) / Average (AV)
-----------------	----------------	-------------------	--------------------------------

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	0.15391	9.88	37.10	25.52	46.98	35.40	65.79	55.79	-18.81	-20.39
2	0.22031	9.89	27.53	18.03	37.42	27.92	62.81	52.81	-25.39	-24.89
3	0.54063	9.92	30.95	25.10	40.87	35.02	56.00	46.00	-15.13	-10.98
4	1.47656	9.99	14.37	8.26	24.36	18.25	56.00	46.00	-31.64	-27.75
5	3.53125	10.10	16.95	5.99	27.05	16.09	56.00	46.00	-28.95	-29.91
6	13.55469	10.52	41.35	34.46	51.87	44.98	60.00	50.00	-8.13	-5.02

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

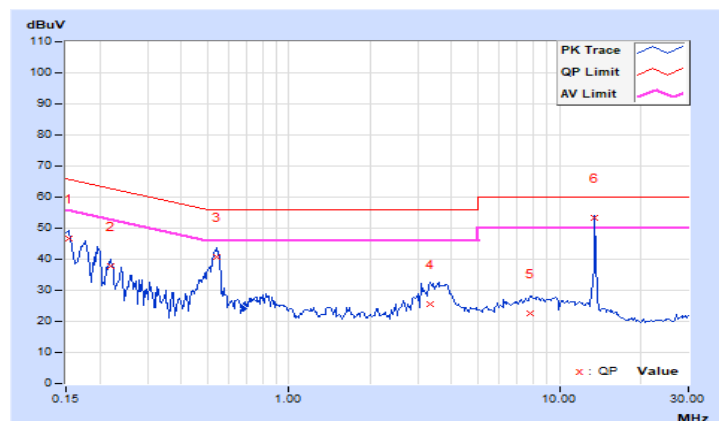


Frequency Range	150kHz ~ 30MHz	Detector Function	Quasi-Peak (QP) / Average (AV)
-----------------	----------------	-------------------	--------------------------------

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	9.89	36.96	21.43	46.85	31.32	65.79	55.79	-18.94	-24.47
2	0.22031	9.90	27.72	15.32	37.62	25.22	62.81	52.81	-25.19	-27.59
3	0.54063	9.95	30.83	24.71	40.78	34.66	56.00	46.00	-15.22	-11.34
4	3.33594	10.10	15.46	3.56	25.56	13.66	56.00	46.00	-30.44	-32.34
5	7.79297	10.29	12.25	5.39	22.54	15.68	60.00	50.00	-37.46	-34.32
6	13.55469	10.51	42.91	36.01	53.42	46.52	60.00	50.00	-6.58	-3.48

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

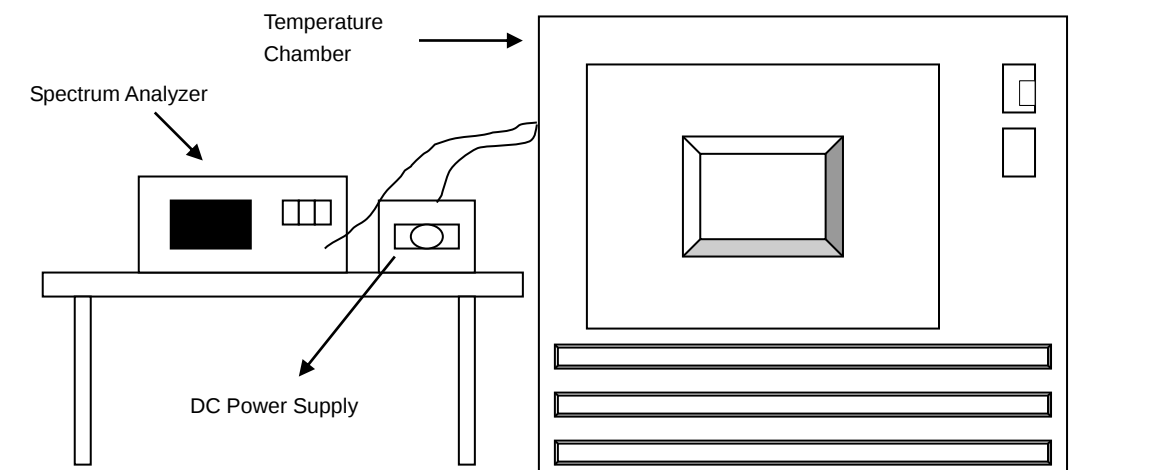


4.3 Frequency Stability

4.3.1 Limits of Frequency Stability Measurement

The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ 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

- The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.
- Turned the EUT on and coupled its output to a spectrum analyzer.
- Turned the EUT off and set the chamber to the highest temperature specified.
- Allowed sufficient time (approximately 30 min) for the temperature of the chamber to stabilize then turned the EUT on and measured the operating frequency.
- Repeated step c and d with the temperature chamber set to the lowest temperature.
- The test chamber was allowed to stabilize at $+25$ 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

Same as Item 4.1.6.

4.3.7 Test Result

Mode A

Frequency Stability Versus Temp.									
Temp. (°C)	Power Supply (Vdc)	0 Minute		2 Minute		5 Minute		10 Minute	
		Reading (MHz)	Drift (%)	Reading (MHz)	Drift (%)	Reading (MHz)	Drift (%)	Reading (MHz)	Drift (%)
50	5	13.56	0.00000	13.55999	-0.00007	13.55999	-0.00007	13.55999	-0.00007
40	5	13.56	0.00000	13.56001	0.00007	13.56001	0.00007	13.56001	0.00007
30	5	13.56004	0.00029	13.56004	0.00029	13.56004	0.00029	13.56005	0.00037
20	5	13.55996	-0.00029	13.55997	-0.00022	13.55996	-0.00029	13.55996	-0.00029
10	5	13.56006	0.00044	13.56006	0.00044	13.56007	0.00052	13.56006	0.00044
0	5	13.55997	-0.00022	13.55996	-0.00029	13.55996	-0.00029	13.55997	-0.00022
-10	5	13.55999	-0.00007	13.56	0.00000	13.56	0.00000	13.56001	0.00007
-20	5	13.55998	-0.00015	13.55997	-0.00022	13.55996	-0.00029	13.55997	-0.00022

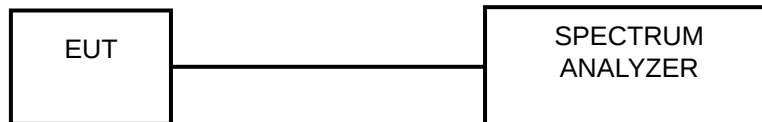
Frequency Stability Versus Voltage									
Temp. (°C)	Power Supply (Vdc)	0 Minute		2 Minute		5 Minute		10 Minute	
		Reading (MHz)	Drift (%)	Reading (MHz)	Drift (%)	Reading (MHz)	Drift (%)	Reading (MHz)	Drift (%)
20	5.75	13.55994	-0.00044	13.55999	-0.00007	13.56005	0.00037	13.55999	-0.00007
	5	13.55996	-0.00029	13.55997	-0.00022	13.55996	-0.00029	13.55996	-0.00029
	4.25	13.55991	-0.00066	13.56001	0.00007	13.55997	-0.00022	13.56006	0.00044

4.4 20dB Bandwidth

4.4.1 Limits Of 20dB Bandwidth Measurement

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

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedures

RBW=approximately 1~5% of the emission bandwidth and VBW $\geq$ 3 RBW.

4.4.5 Deviation from Test Standard

No deviation.

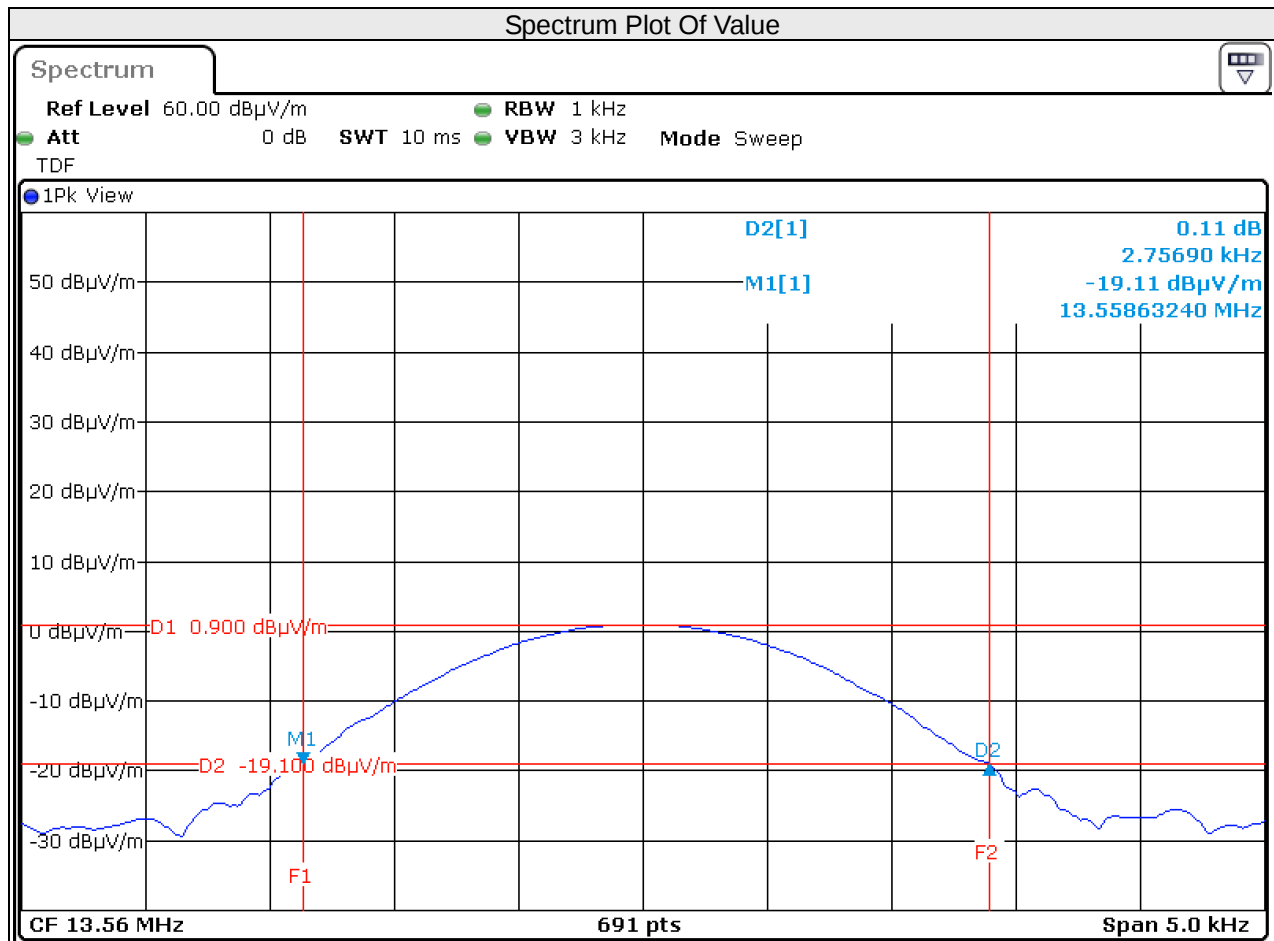
4.4.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.4.7 Test Results

Mode A

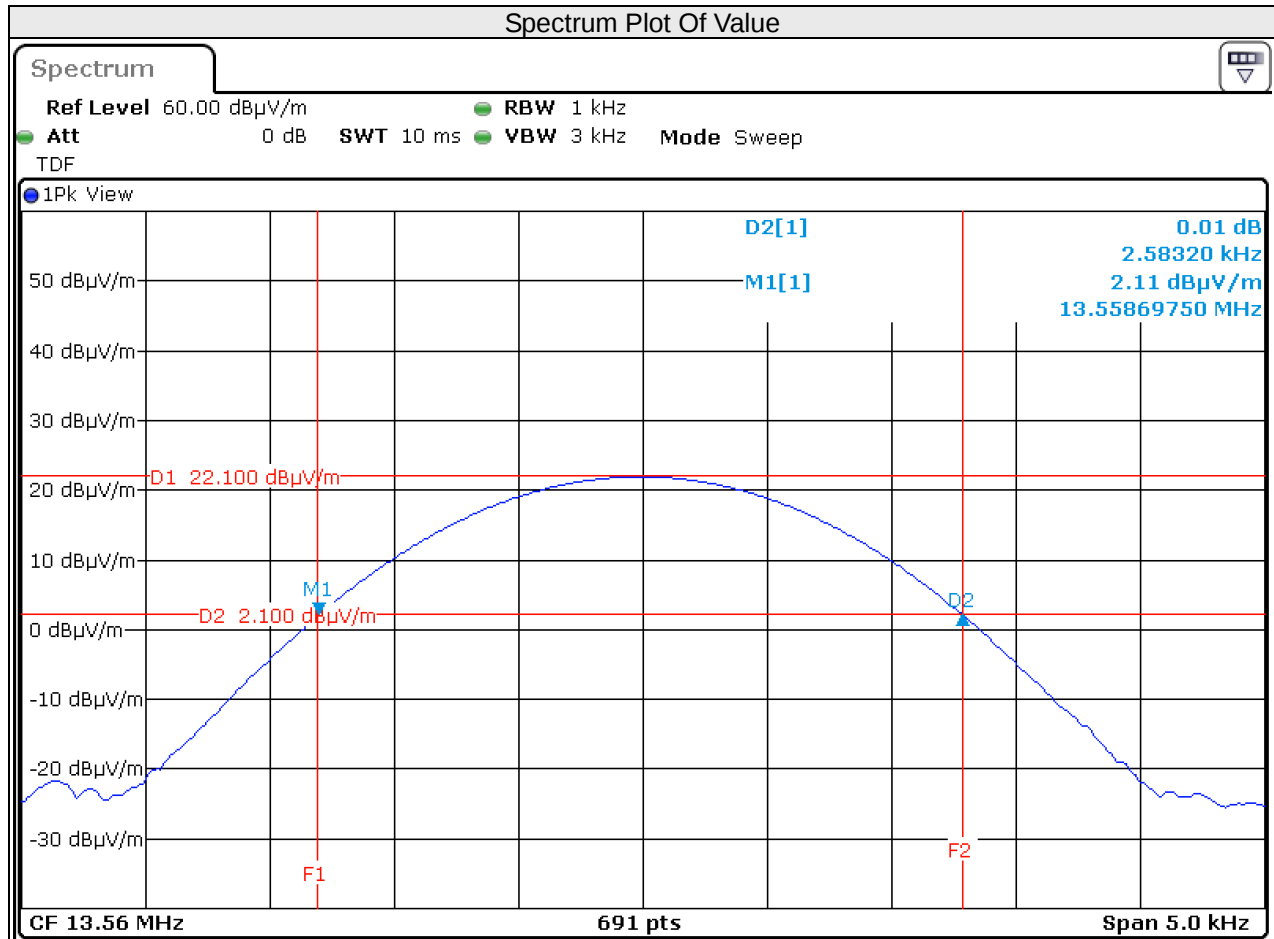
20dBc Point (Low)	20dBc Point (High)	Operating Frequency Band (MHz)	Pass/Fail
13.5586327MHz	13.5613893 MHz	13.553~13.567	Pass



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

Mode B

20dBc Point (Low)	20dBc Point (High)	Operating Frequency Band (MHz)	Pass/Fail
13.5586975MHz	13.5612807 MHz	13.553~13.567	Pass



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 and approved according to ISO/IEC 17025.

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

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

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