FCC RADIO TEST REPORT

FCC ID	:	**APYHRO00331**
Equipment	:	**Smart phone**
Brand Name	:	**SHARP**
Model Name	:	**APYHRO00331**
Applicant	:	**SHARP CORPORATION** **1 Takumi-cho, Sakai-ku, Sakai City, Osaka 590-8522, Japan**
Manufacturer	:	**SHARP CORPORATION** **1 Takumi-cho, Sakai-ku, Sakai City, Osaka 590-8522, Japan**
Standard	:	**FCC Part 15 Subpart C §15.225**

The product was received on Mar. 20, 2024 and testing was performed from Mar. 28, 2024 to Apr. 12, 2024. We, Sporton International Inc. Wensan Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval from Sporton International Inc. Wensan Laboratory, the test report shall not be reproduced except in full.

Louis Wu

Approved by: Louis Wu

Sporton International Inc. Wensan Laboratory
No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)

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History of this test report

Report No.	Version	Description	Issue Date
FR3D2225D	01	Initial issue of report	May 09, 2024

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.1	15.207	AC Power Line Conducted Emissions	Pass	14.75 dB under the limit at 1.48MHz
3.2	15.215(c)	20dB Spectrum Bandwidth	Pass	-
	2.1049	99% OBW Spectrum Bandwidth	Reporting only	-
3.3	15.225(e)	Frequency Stability	Pass	-
3.4	15.225(a)(b)(c)	Field Strength of Fundamental Emissions	Pass	Max level 18.48 dBμV/m at 13.56 MHz
3.5	15.225(d) 15.209	Radiated Spurious Emissions	Pass	9.30 dB under the limit at 108.03MHz
3.6	15.203	Antenna Requirements	Pass	-

Conformity Assessment Condition:

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacturer who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2. The measurement uncertainty please refer to each test result in the section “Measurement Uncertainty”.

Disclaimer:

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Keven Cheng

Report Producer: Clio Lo

1. General Description

1.1 Product Feature of Equipment Under Test

Product Feature
General Specs GSM/WCDMA/LTE, Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n/ac, Wi-Fi 5GHz 802.11a/n/ac, NFC, and GNSS. **Antenna Type** WWAN: <Ant. 0>: Monopole Antenna <Ant. 1>: PIFA Antenna <Ant. 2>: Monopole Antenna WLAN: Loop Antenna Bluetooth: Loop Antenna GPS / Glonass / BDS / Galileo: PIFA Antenna NFC: Loop Antenna

Remark: The EUT's information above is declared by manufacturer. Please refer to Disclaimer in report summary.

Item	Main		2nd Source			
	Main Sample		Sample 2		Sample 3	
	Vendor	Model Number	Vendor	Model Number	Vendor	Model Number
Memory	SAMSUNG	SA05P91D010	Hynix	SA0QG9G5010	Micron	SA0D81SF010
PA	QORVO	SA07048B020 (QM77048B)	QORVO	SA077048020 (QM77048)	QORVO	SA077048020 (QM77048)
FPC_USB	PBH	MESX314004A	SUNFLEX	MESX114012A	SUNFLEX	MESX114012A
FPC_AJ	PBH	MESX314003A	SUNFLEX	MESX114013A	SUNFLEX	MESX114013A
FPC_Main	PBH	MESX414001A	SUNFLEX	MESX414011A	SUNFLEX	MESX414011A
FPC_SPK	AKM	MESX414004A	SUNFLEX	MESX114015A	SUNFLEX	MESX114015A
FPC_Side_Key	PBH	MESX414002A	AKM	MESX414012A	AKM	MESX414012A
FPC_flashlight	PBH	MESX414003A	SUNFLEX	MESX414013A	SUNFLEX	MESX414013A
rear housing	DY	MESX461130A	COXON	MESX461131A	COXON	MESX461131A
Battery	SCUD	BPSX400001S (SX4)	EVE	BPSX400002S (X4)	EVE	BPSX400002S (X4)
Display	DJN	SLX1462BX00	CPT	SLX65WM2X00	CPT	SLX65WM2X00
Camera 50M	Shinetech	S0CNN72B000	Union Image	S0C50A350A0	Union Image	S0C50A350A0
Camera 8M	Shinetech	S0CF891B060	Union Image	S0C8F357060	Union Image	S0C8F357060
E-compass	MEMSIC	SA0C56030A0	QST	SA0C6308130	QST	SA0C6308130
DPDT	MAXSCEND	SA08546C020	CANAANTEK	SA01122N080	CANAANTEK	SA01122N080
Switch	MAXSCEND	SA08621E080	Richwave	SA086102080	Richwave	SA086102080
P-sensor	EMINENT	SA0MN789080	Sensortek	SA033562020	Sensortek	SA033562020
G- sensor	TDK	SA042670020	Bosch	SA0MI320020	Bosch	SA0MI320020

1.2 Modification of EUT

No modifications made to the EUT during the testing.

1.3 Testing Location

Test Site	Sporton International Inc. EMC & Wireless Communications Laboratory
Test Site Location	No.52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.) TEL: +886-3-327-3456 FAX: +886-3-328-4978
Test Site No.	**Sporton Site No.**
	TH03-HY (TAF Code: 1190)
Test Engineer	Eric Wu
Temperature	20.8~22.8℃
Relative Humidity	46.6~48.6%
Remark	The Near Field test item subcontracted to Sporton International Inc. EMC & Wireless Communications Laboratory.

Test Site	Sporton International Inc. Wensan Laboratory	
Test Site Location	No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.) TEL: +886-3-327-0868 FAX: +886-3-327-0855	
Test Site No.	**Sporton Site No.**	
	CO07-HY	03CH11-HY
Test Engineer	Louis Chung	Sam Chou and Troye Hsieh
Temperature	20.2~26.3℃	19.8~20.6℃
Relative Humidity	44.4~74.8%	53.5~63.8%

Note: The test site complies with ANSI C63.4 2014 requirement.

FCC designation No.: TW1190 and TW3786

1.4 Applicable Standards

According to the specifications declared by the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.225
- FCC KDB 414788 D01 Radiated Test Site v01r01
- ANSI C63.10-2013

Remark:

1. All the test items were validated and recorded in accordance with the standards without any modification during the testing.
2. The TAF code is not including all the FCC KDB listed without accreditation.
3. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

2. Test Configuration of Equipment Under Test

2.1 Descriptions of Test Mode

Investigation has been done on all the possible configurations.

The following table is a list of the test modes shown in this test report.

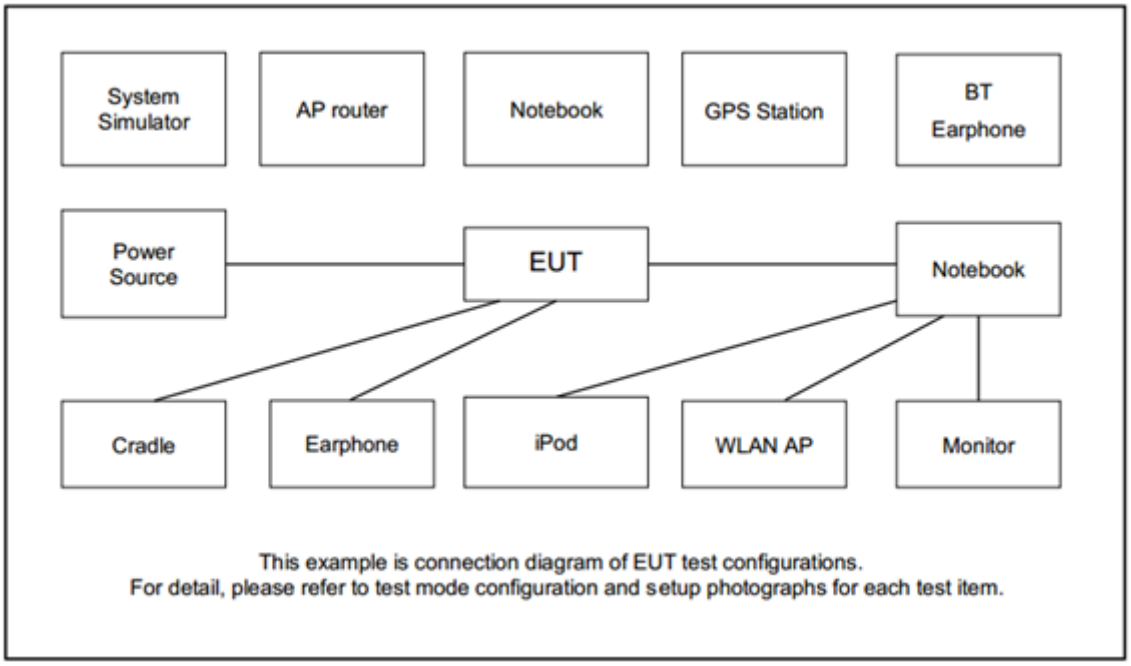
Test Items	
AC Power Line Conducted Emissions	Field Strength of Fundamental Emissions
20dB Spectrum Bandwidth	Frequency Stability
Radiated Emissions 9kHz~30MHz	Radiated Emissions 30MHz~1GHz

The EUT pre-scanned in reader mode with NFC tag (four NFC type A, B, F, V) and without reading tag. Based on the highest field strength of fundamental and spurious emissions, the worst case type (type F) was recorded in this report.

The measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and three receiving antenna orientations (parallel, perpendicular, and ground-parallel) for Loop Antenna and adjusting the measurement antenna orientation and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and only the worst case emissions were reported in this report.

Test Cases	
AC Conducted Emission	Mode 1 : NFC Link + Earphone + USB Cable (Charging from AC Adapter) + Battery 1 for Main Sample
Remark: For Radiated Test Cases, the tests were performed with Battery 1 and Main Sample.	

2.2 Connection Diagram of Test System



2.3 Table for Supporting Units

Item	Equipment	Brand Name	Model Name	FCC ID	Data Cable	Power Cord
1.	NFC Card	NFC Card F	NFCF-14	N/A	N/A	N/A
2.	Earphone	NOKIA	WH-108	N/A	Unshielded, 1.5 m	N/A

2.4 EUT Operation Test Setup

The EUT is programmed to be in continuously transmitting mode.

The ancillary equipment, NFC card, is used to make the EUT (NFC) continuously transmitting signal (Power Level: Default) at 13.56MHz.

3. Test Results

3.1 AC Power Line Conducted Emissions Measurement

3.1.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

For terminal test result, the testing follows FCC KDB 174176.

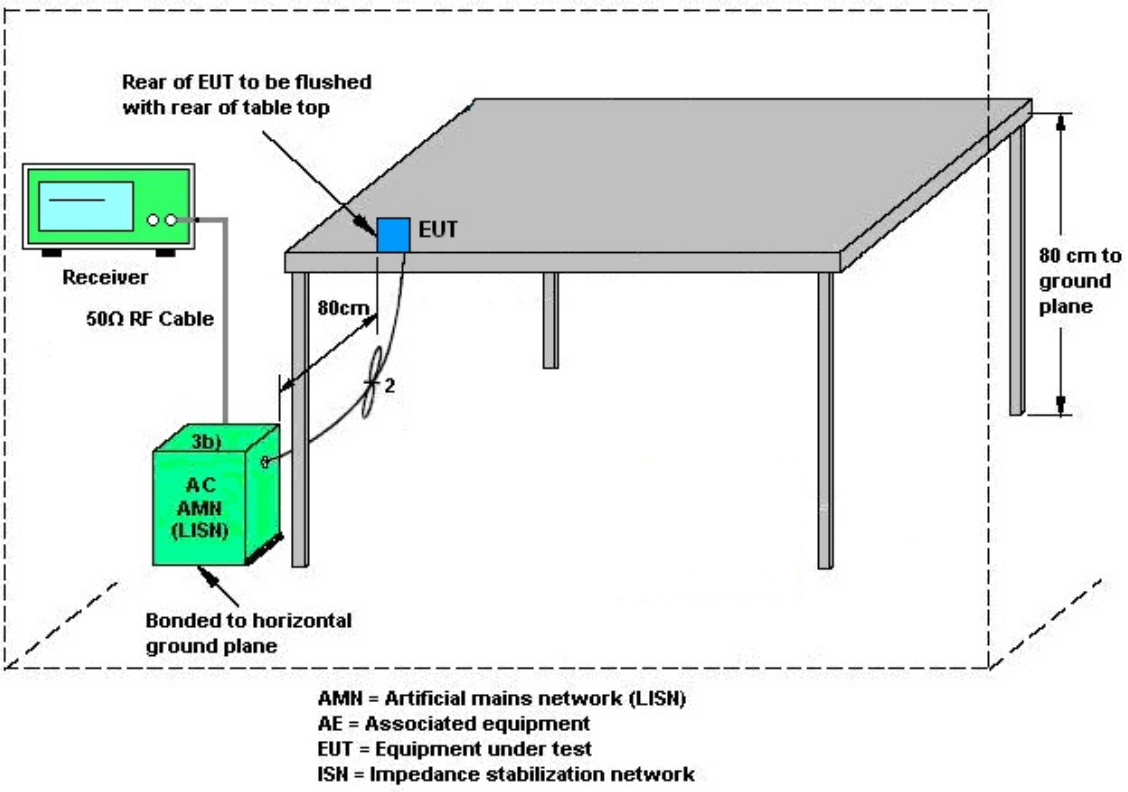
3.1.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.1.3 Test Procedures

1. The EUT is placed 0.4 meter away from the conducting wall of the shielding room, and is kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN shall be used.
6. Both Line and Neutral shall be tested in order to find out the maximum conducted emission.
7. The frequency range from 150 kHz to 30 MHz is scanned.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9 kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

3.1.4 Test setup



AMN = Artificial mains network (LISN)
AE = Associated equipment
EUT = Equipment under test
ISN = Impedance stabilization network

3.1.5 Test Result of AC Conducted Emission

Please refer to Appendix A.

Note:

(1) with antenna

Remark: 13.560MHz is the NFC RF fundamental signal.

(2) with dummy load

Remark: Only the fundamental NFC signal needs to be retested per C63.4.

3.2 20dB and 99% OBW Spectrum Bandwidth Measurement

3.2.1 Limit

Intentional radiators must be designed to ensure that the 20 dB and 99% emission bandwidth in the specific band 13.553~13.567 MHz.

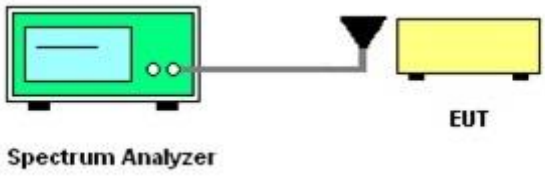
3.2.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.2.3 Test Procedures

1. The spectrum analyzer connected via a receive antenna placed near the EUT in peak Max Hold Mode.
2. The resolution bandwidth of 1 kHz and the video bandwidth of 3 kHz were used.
3. Measured the spectrum width with power higher than 20 dB below carrier.
4. Measured the 99% OBW.

3.2.4 Test Setup



3.2.5 Test Result of Near Field Test Items

Please refer to Appendix B.

3.3 Frequency Stability Measurement

3.3.1 Limit

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% (100ppm) 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 by using a new battery.

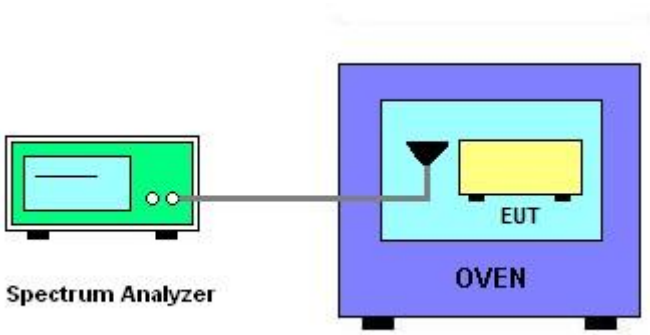
3.3.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.3.3 Test Procedures

1. The spectrum analyzer connected via a receive antenna placed near the EUT.
2. EUT has transmitted signal and fixed channelize.
3. Set the spectrum analyzer span to view the entire emissions bandwidth.
4. Set RBW = 1 kHz, VBW = 3 kHz with peak detector and maxhold settings.
5. The fc is declaring of channel frequency. Then the frequency error formula is (fc-f)/fc × 10^6 ppm and the limit is less than ±100ppm.
6. Extreme temperature rule is -20°C~50°C.

3.3.4 Test Setup



3.3.5 Test Result of Near Field Test Items

Please refer to Appendix B.

3.4 Field Strength of Fundamental Emissions and Mask Measurement

3.4.1 Limit

Rules and specifications	FCC CFR 47 Part 15 section 15.225			
Description	Compliance with the spectrum mask is tested with RBW set to 9kHz.			
Freq. of Emission (MHz)	Field Strength (μV/m) at 30m	Field Strength (dBμV/m) at 30m	Field Strength (dBμV/m) at 10m	Field Strength (dBμV/m) at 3m
1.705~13.110	30	29.5	48.58	69.5
13.110~13.410	106	40.5	59.58	80.5
13.410~13.553	334	50.5	69.58	90.5
13.553~13.567	15848	84.0	103.08	124.0
13.567~13.710	334	50.5	69.58	90.5
13.710~14.010	106	40.5	59.58	80.5
14.010~30.000	30	29.5	48.58	69.5

Remark:

1. The field strength test result is in 3m test distance, follow test rules the test data use distance extrapolation factor and reported in this report at 30m test result.
2. Distance extrapolation factor = 40 log (specific distance / test distance) (dB)

3.4.2 Measuring Instruments

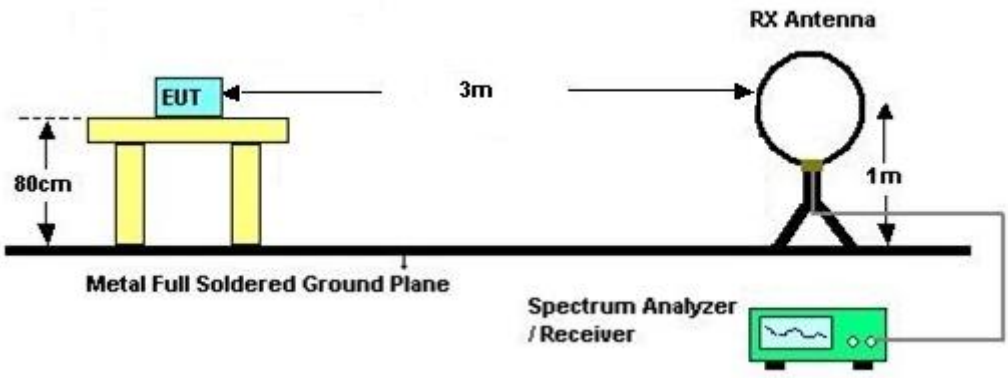
Please refer to the measuring equipment list in this test report.

3.4.3 Test Procedures

1. Configure the EUT according to ANSI C63.10. The EUT is placed on the top of the turntable 0.8 meter above ground. The phase center of the loop receiving antenna mounted antenna tower is placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable is rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the receiving antenna is 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 with RBW set to 9 kHz.
   Note: Emission level (dBμV/m) = 20 log Emission level (μV/m).

3.4.4 Test Setup

For radiated test below 30MHz



3.4.5 Test Result of Field Strength of Fundamental Emissions and Mask

Please refer to Appendix C.

3.5 Radiated Emissions Measurement

3.5.1 Limit

The field strength of any emissions which appear outside of 13.110 ~14.010MHz band shall not exceed the general radiated emissions limits.

Frequencies (MHz)	Field Strength (μV/m)	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

3.5.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

3.5.3 Measuring Instrument Setting

The following table is the setting of receiver:

Receiver Parameter	Setting
Attenuation	Auto
Frequency Range: 9kHz~150kHz	RBW 200Hz for QP
Frequency Range: 150kHz~30MHz	RBW 9kHz for QP
Frequency Range: 30MHz~1000MHz	RBW 120kHz for Peak

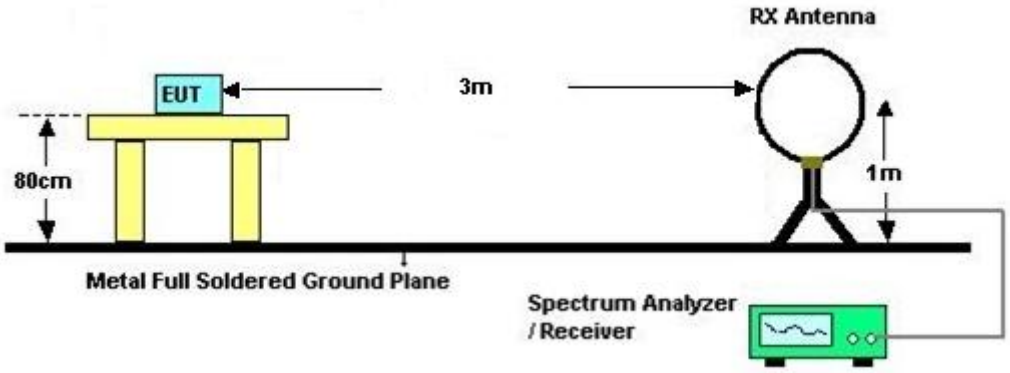
Note: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz and 110-490 kHz. Radiated emission limits in these two bands are based on measurements employing an average detector.

3.5.4 Test Procedures

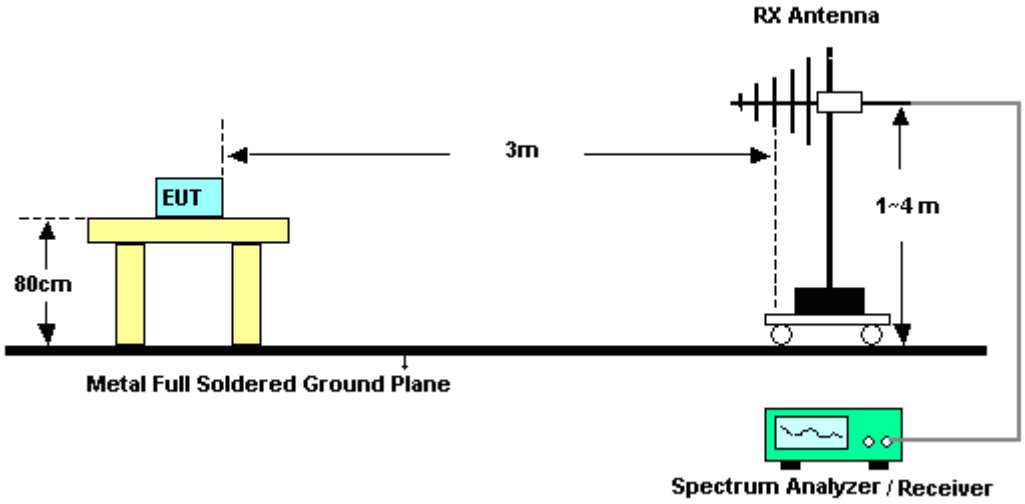
1. Configure the EUT according to ANSI C63.10. The EUT is placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower is placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable is rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna is 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 is scanned (from 1 M to 4 M) and then the turntable is 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 30 MHz, loop antenna has to be used for measurement and the recorded data shall be QP measured by receiver.
8. Radiated testing below 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading. When there is no suspected emission found and the emission level is with at least 6 dB margin against QP limit line, the position is marked as “-“.

3.5.5 Test Setup

For radiated test below 30MHz



For radiated test above 30MHz



3.5.6 Test Result of Radiated Emissions Measurement

Please refer to Appendix C.

Remark:

1. There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.
2. According to C63.10 radiated test, the EUT pre-scanned horizontal, vertical, and ground-parallel three polarization's, the worst case is horizontal & vertical polarization, test data of two modes was reported.

3.6 Antenna Requirements

3.6.1 Standard Applicable

Except for special regulations, the Low-power Radio-frequency Devices must not be equipped with any jacket for installing an antenna with extension cable. An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited.

The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

3.6.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

4. List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Bilog Antenna	TESEQ	CBL 6111D & N-6-06	35414 & AT-N0602	30MHz~1GHz	Oct. 07, 2023	Mar. 28, 2024~ Mar. 29, 2024	Oct. 06, 2024	Radiation (03CH11-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Sep. 12, 2023	Mar. 28, 2024~ Mar. 29, 2024	Sep. 11, 2024	Radiation (03CH11-HY)
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Dec. 08, 2023	Mar. 28, 2024~ Mar. 29, 2024	Dec. 07, 2024	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz~44GHz	Oct. 05, 2023	Mar. 28, 2024~ Mar. 29, 2024	Oct. 04, 2024	Radiation (03CH11-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY53290045	20MHz~8.4GHz	Apr. 25, 2023	Mar. 28, 2024~ Mar. 29, 2024	Apr. 24, 2024	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	MY2859/2	30MHz~40GHz	Mar. 06, 2024	Mar. 28, 2024~ Mar. 29, 2024	Mar. 05, 2025	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	803951/2	9K~30M	Mar. 06, 2024	Mar. 28, 2024~ Mar. 29, 2024	Mar. 05, 2025	Radiation (03CH11-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 102	803951/2	30M~40G	Mar. 06, 2024	Mar. 28, 2024~ Mar. 29, 2024	Mar. 05, 2025	Radiation (03CH11-HY)
Filter	Wainwright	WHK20/1000C7 /40SS	SN2	20M High Pass	Sep. 11, 2023	Mar. 28, 2024~ Mar. 29, 2024	Sep. 10, 2024	Radiation (03CH11-HY)
Controller	EMEC	EM 1000	N/A	Control Turn table & Ant Mast	N/A	Mar. 28, 2024~ Mar. 29, 2024	N/A	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	Mar. 28, 2024~ Mar. 29, 2024	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	N/A	Mar. 28, 2024~ Mar. 29, 2024	N/A	Radiation (03CH11-HY)
Software	Audix	E3 6.2009-8-24	RK-001053	N/A	N/A	Mar. 28, 2024~ Mar. 29, 2024	N/A	Radiation (03CH11-HY)
Hygrometer	TECPEL	DTM-303A	TP201996	N/A	Nov. 07, 2023	Apr. 12, 2024	Nov. 06, 2024	Near Field (TH03-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP30	101329	9kHz~30GHz	Sep. 20, 2023	Apr. 12, 2024	Sep. 19, 2024	Near Field (TH03-HY)
Thermal Chamber	ESPEC	SU-241	92003713	-30℃ ~95℃	May 17, 2023	Apr. 12, 2024	May 16, 2024	Near Field (TH03-HY)
Programmable Power Supply	GW Instek	PSS-2005	EL890001	1V~20V 0.5A~4A	Sep. 12, 2023	Apr. 12, 2024	Sep. 11, 2024	Near Field (TH03-HY)
AC Power Source	ACPOWER	AFC-11003G	F317040033	N/A	N/A	Apr. 08, 2024~ Apr. 11, 2024	N/A	Conduction (CO07-HY)
Software	Rohde & Schwarz	EMC32 V10.30	N/A	N/A	N/A	Apr. 08, 2024~ Apr. 11, 2024	N/A	Conduction (CO07-HY)
Pulse Limiter	SCHWARZBECK	VTSD 9561-F N	9561-F N00373	9kHz-200MHz	Oct. 20, 2023	Apr. 08, 2024~ Apr. 11, 2024	Oct. 19, 2024	Conduction (CO07-HY)
RF Cable	HUBER + SUHNER	RG 214/U	1358175	9kHz~30MHz	Mar. 14, 2024	Apr. 08, 2024~ Apr. 11, 2024	Mar. 13, 2025	Conduction (CO07-HY)
Two-Line V-Network	TESEQ	NNB 51	45051	N/A	Mar. 10, 2024	Apr. 08, 2024~ Apr. 11, 2024	Mar. 09, 2025	Conduction (CO07-HY)
Four-Line V-Network	TESEQ	NNB 52	36122	N/A	Mar. 07, 2024	Apr. 08, 2024~ Apr. 11, 2024	Mar. 06, 2025	Conduction (CO07-HY)
EMI Test Receiver	Rohde & Schwarz	ESR3	102317	9kHz~3.6GHz	Sep. 20, 2023	Apr. 08, 2024~ Apr. 11, 2024	Sep. 19, 2024	Conduction (CO07-HY)

5. Measurement Uncertainty

Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.44 dB**

Uncertainty of Radiated Emission Measurement (9 kHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**3.8 dB**

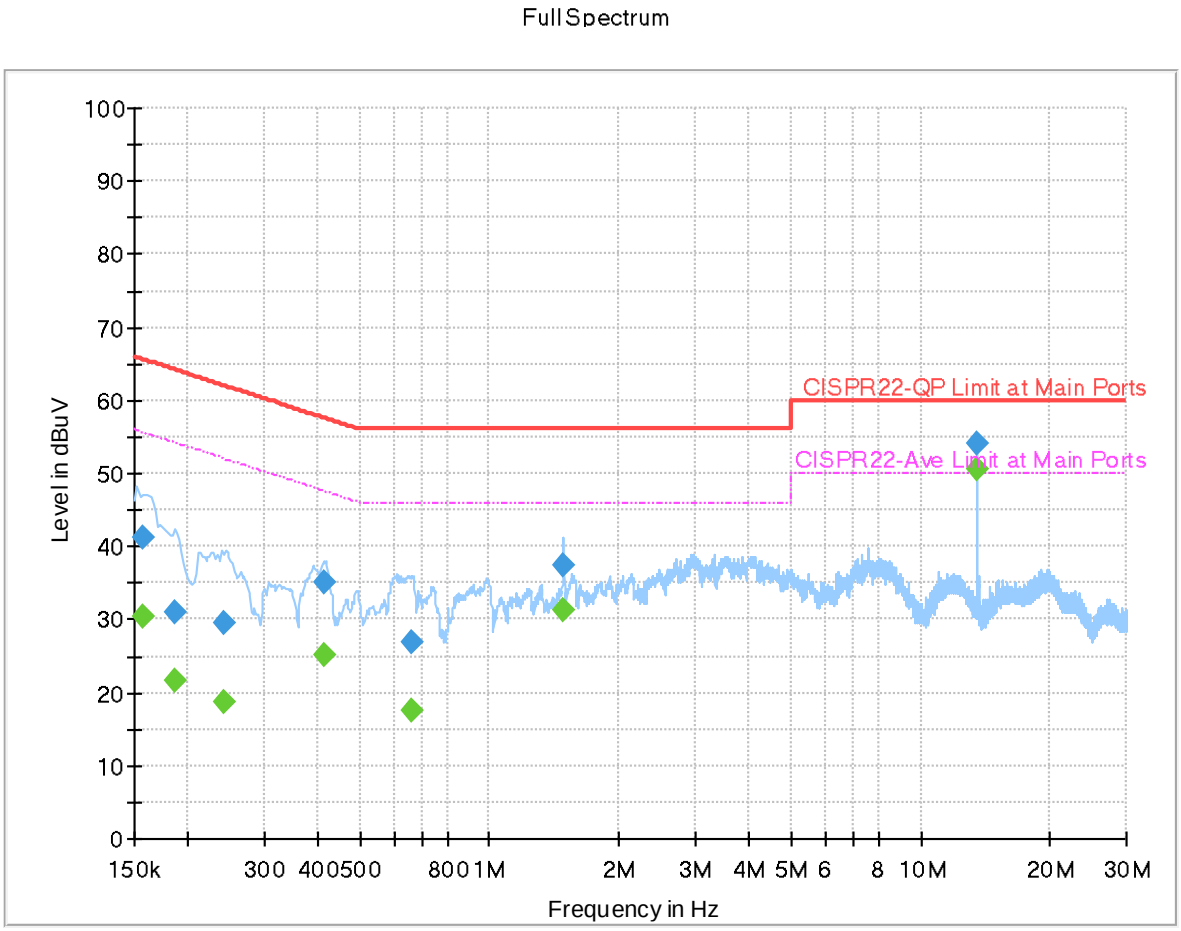
Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	**6.1 dB**

Appendix A. Test Results of Conducted Emission Test

Original

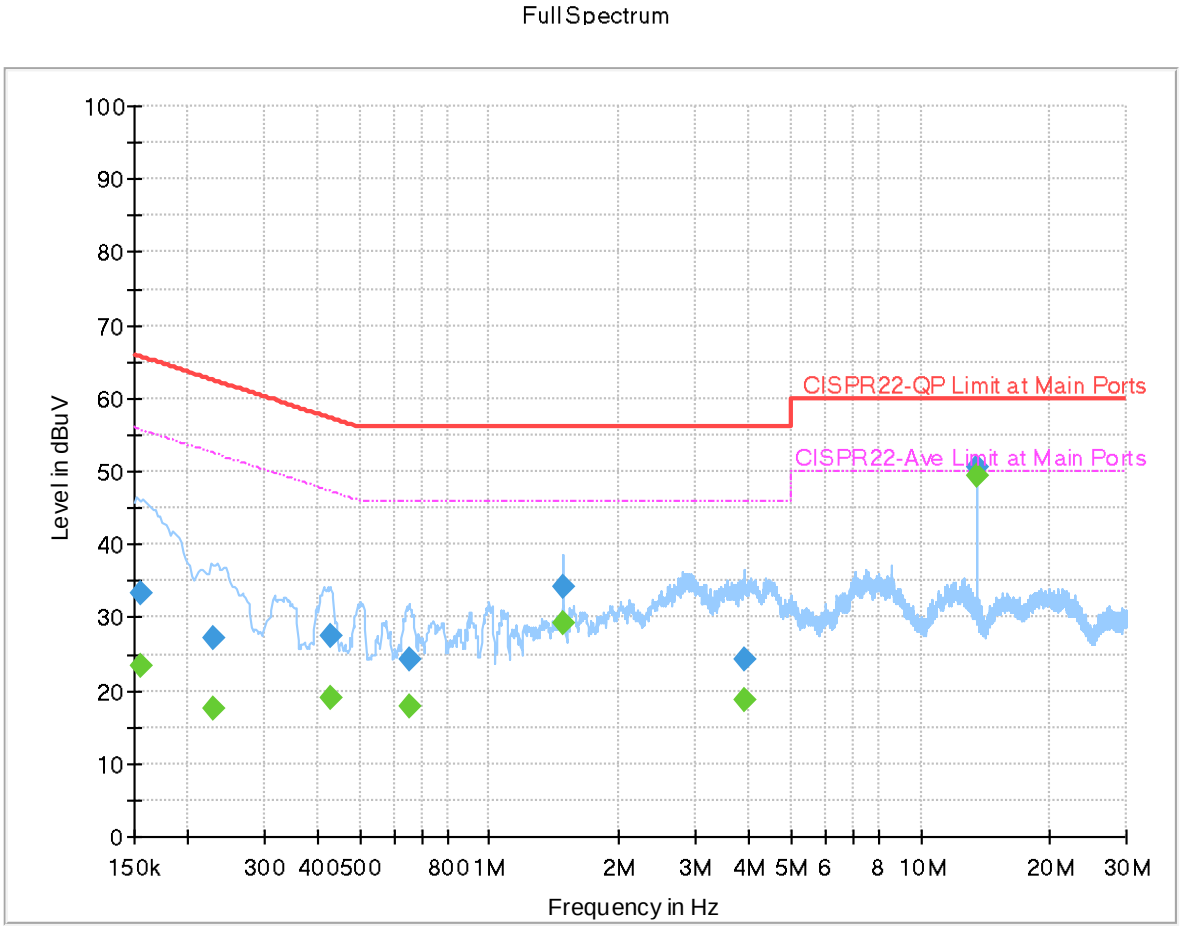
Report NO :	3D2225
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Line



Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.156750	---	30.51	55.63	25.12	L1	OFF	19.9
0.156750	41.17	---	65.63	24.46	L1	OFF	19.9
0.186990	---	21.74	54.17	32.43	L1	OFF	19.9
0.186990	30.91	---	64.17	33.26	L1	OFF	19.9
0.242340	---	18.69	52.02	33.33	L1	OFF	19.9
0.242340	29.41	---	62.02	32.61	L1	OFF	19.9
0.415500	---	25.19	47.54	22.35	L1	OFF	19.9
0.415500	35.02	---	57.54	22.52	L1	OFF	19.9
0.661830	---	17.56	46.00	28.44	L1	OFF	19.9
0.661830	26.98	---	56.00	29.02	L1	OFF	19.9
1.482990	---	31.25	46.00	14.75	L1	OFF	19.9
1.482990	37.56	---	56.00	18.44	L1	OFF	19.9
13.560360	---	50.58	50.00	-0.58	L1	OFF	20.1
13.560360	54.03	---	60.00	5.97	L1	OFF	20.1

Report NO :	3D2225
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Neutral

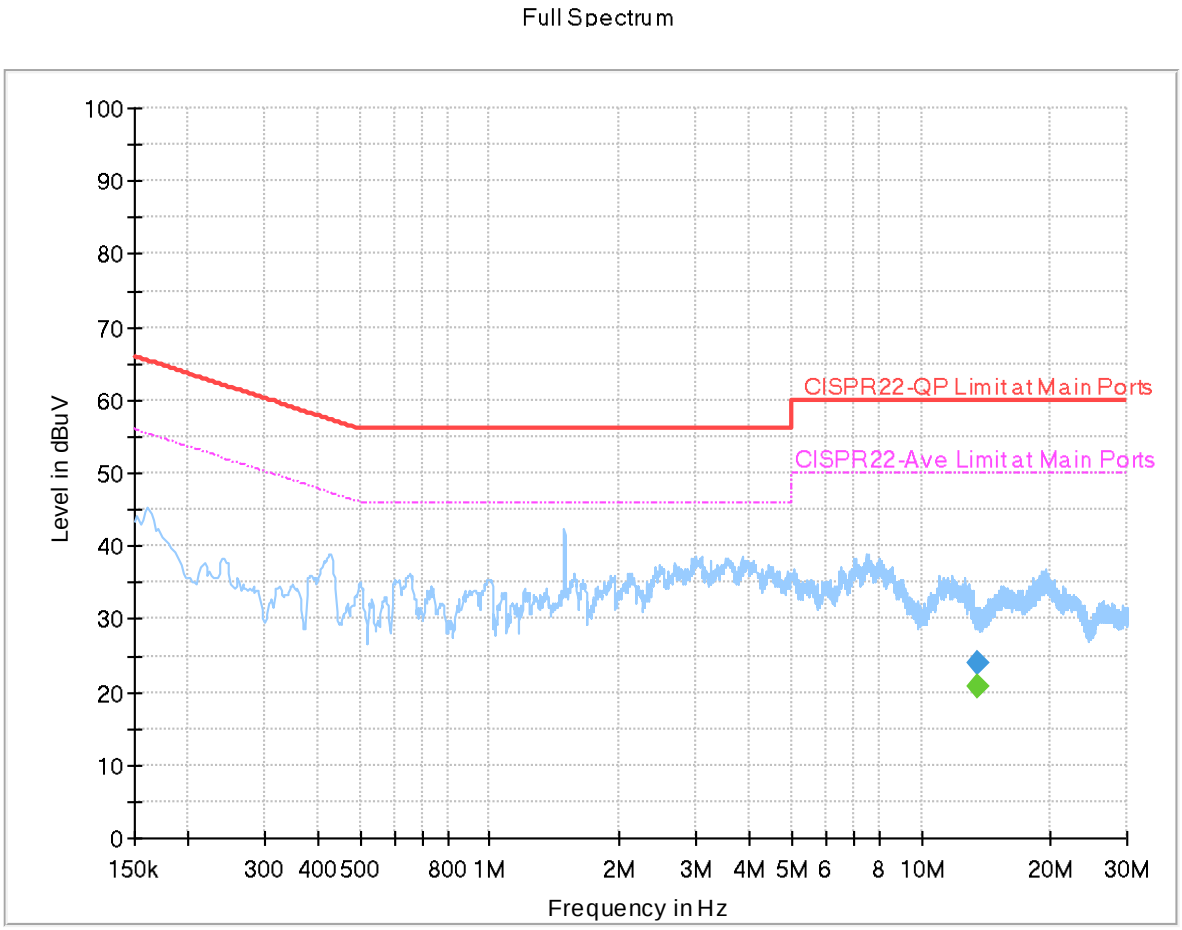


Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
0.154500	---	23.28	55.75	32.47	N	OFF	19.9
0.154500	33.47	---	65.75	32.28	N	OFF	19.9
0.228750	---	17.69	52.50	34.81	N	OFF	19.9
0.228750	27.34	---	62.50	35.16	N	OFF	19.9
0.426750	---	19.12	47.32	28.20	N	OFF	19.9
0.426750	27.59	---	57.32	29.73	N	OFF	19.9
0.653460	---	17.74	46.00	28.26	N	OFF	19.9
0.653460	24.36	---	56.00	31.64	N	OFF	19.9
1.482450	---	29.17	46.00	16.83	N	OFF	19.9
1.482450	34.16	---	56.00	21.84	N	OFF	19.9
3.898770	---	18.78	46.00	27.22	N	OFF	20.0
3.898770	24.26	---	56.00	31.74	N	OFF	20.0
13.560540	---	49.44	50.00	0.56	N	OFF	20.1
13.560540	50.61	---	60.00	9.39	N	OFF	20.1

Terminal

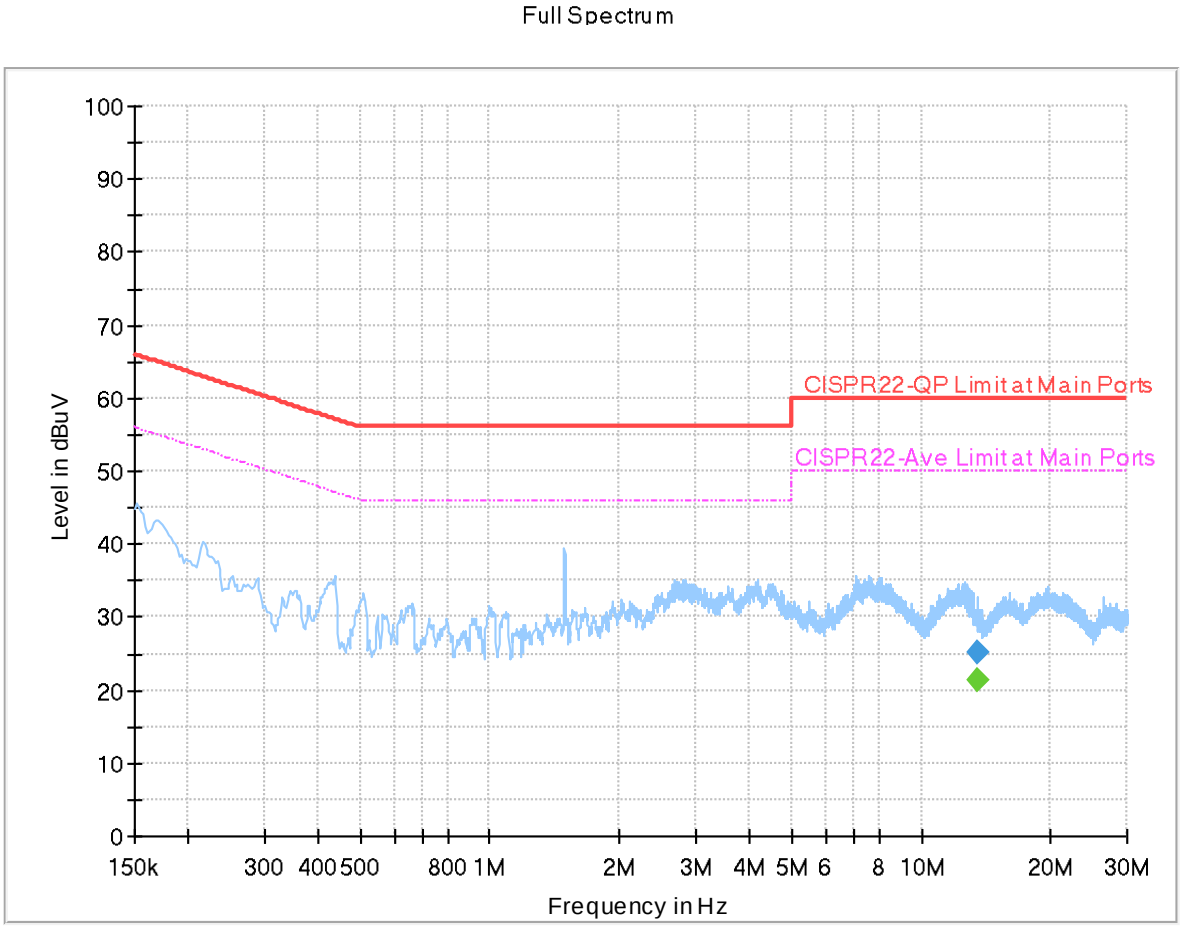
Report NO :	3D2225
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Line



Final_Result

Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
13.558830	---	20.79	50.00	29.21	L1	OFF	20.1
13.558830	24.09	---	60.00	35.91	L1	OFF	20.1

Report NO :	3D2225
Test Mode :	Mode 1
Test Voltage :	120Vac/60Hz
Phase :	Neutral



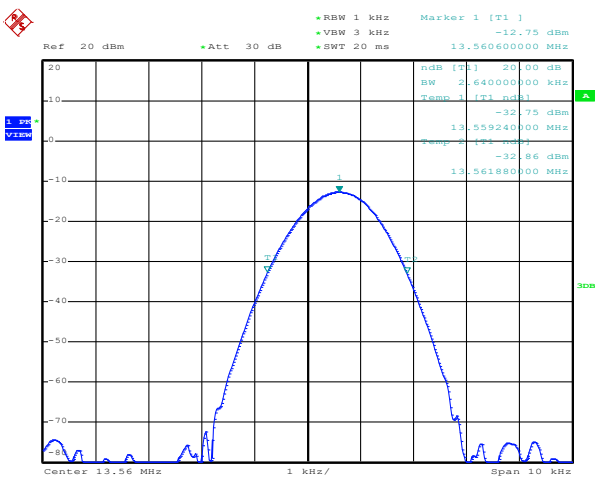
Final_Result

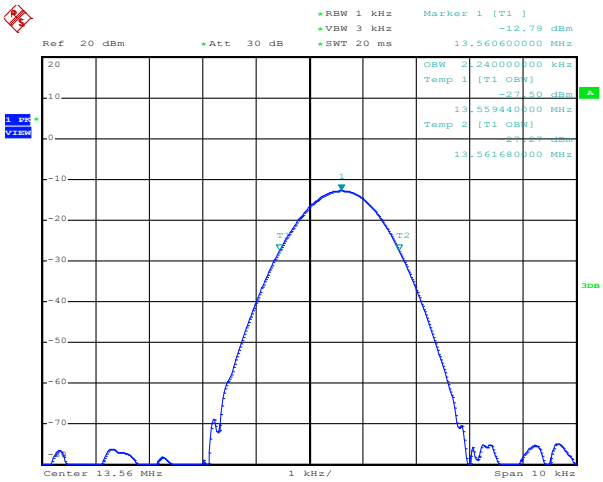
Frequency (MHz)	QuasiPeak (dBuV)	CAverage (dBuV)	Limit (dBuV)	Margin (dB)	Line	Filter	Corr. (dB)
13.558650	---	21.49	50.00	28.51	N	OFF	20.1
13.558650	25.06	---	60.00	34.94	N	OFF	20.1

Appendix B. Test Results of Near Field Test Items

B1. Test Result of 20dB Spectrum Bandwidth

Test mode	NFC Tx	Test Frequency (MHz)	13.56





20dB Bandwidth (kHz)	2.640	99% OccupiedBW(kHz)	2.240
Frequency range (MHz)	**f_L > 13.553**	13.55924	**Test Result**
	f_H < 13.567	13.56188	**Complies**

Remark: Because the measured signal is CW adjusting the RBW per C63.10 would not be practical since measured bandwidth will always follow the RBW and the result will be approximately twice the RBW.

B2. Test Result of Frequency Stability

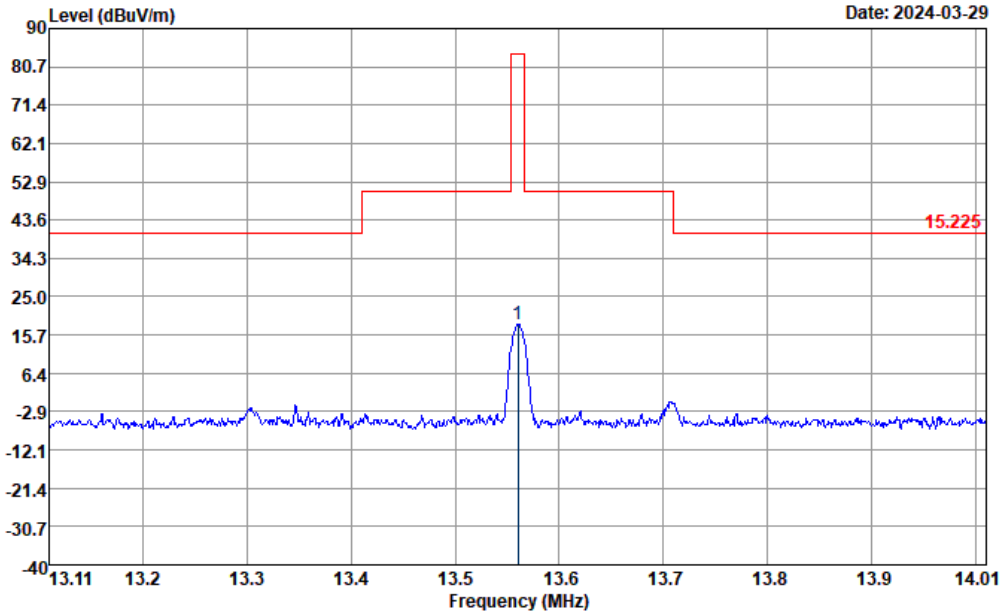
Voltage vs. Frequency Stability		Temperature vs. Frequency Stability		
Voltage (Vdc)	Measurement Frequency (MHz)	Temperature (℃)	Time	Measurement Frequency (MHz)
3.87	13.560560	**-20**	**0**	13.560680
3.6	13.560560		**2**	13.560680
4.2	13.560560		**5**	13.560680
			10	13.560680
		-10	**0**	13.560680
			2	13.560680
			5	13.560680
			10	13.560680
		0	**0**	13.560680
			2	13.560680
			5	13.560680
			10	13.560680
		10	**0**	13.560650
			2	13.560650
			5	13.560660
			10	13.560660
		20	**0**	13.560640
			2	13.560640
			5	13.560640
			10	13.560630
		30	**0**	13.560600
			2	13.560600
			5	13.560600
			10	13.560600
		40	**0**	13.560580
			2	13.560580
			5	13.560580
			10	13.560560

Voltage vs. Frequency Stability		Temperature vs. Frequency Stability		
Voltage (Vdc)	**Measurement Frequency (MHz)**	**Temperature (℃)**	**Time**	**Measurement Frequency (MHz)**
		50	**0**	13.560560
			2	13.560550
			5	13.560550
			10	13.560540
Max.Deviation (MHz)	0.000560	**Max.Deviation (MHz)**		0.000680
Max.Deviation (ppm)	41.2979	**Max.Deviation (ppm)**		50.1475
Limit	**FS < ±100 ppm**	**Limit**		**FS < ±100 ppm**
Test Result	**PASS**	**Test Result**		**PASS**

Appendix C. Test Results of Radiated Test Items

C1. Test Result of Field Strength of Fundamental Emissions

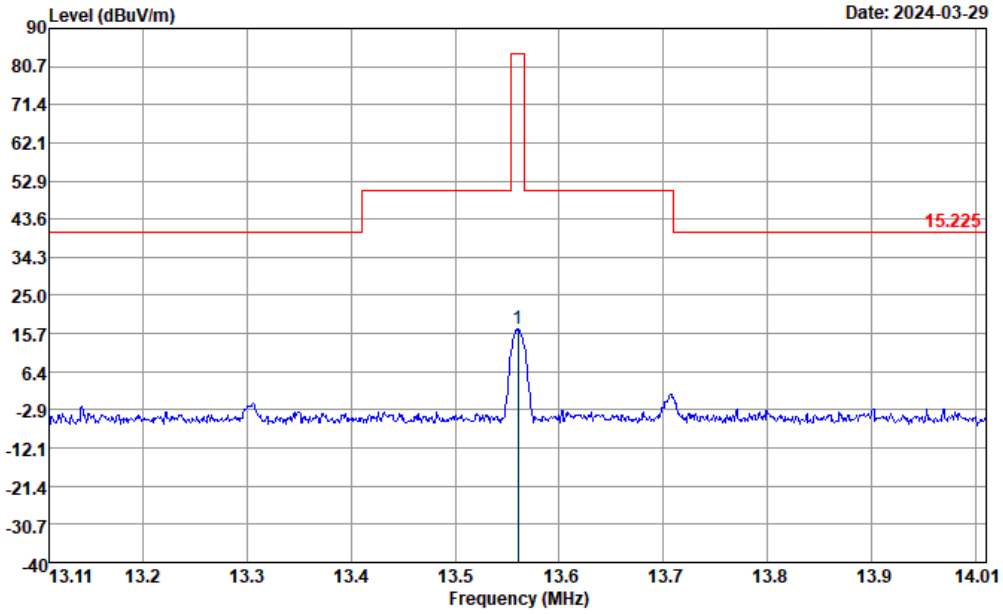
Test Mode :	NFC Tx	Test Frequency (MHz)	13.56



Site : 03CH11-HY
Condition : 15.225 3m LOOP_100488_230912 HORIZONTAL
: RBW:9.000KHz VBW:9.000KHz SWT:Auto

Frequency (MHz)	Level (dBµV/m)	Distance extrapolation Factor (dB)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB)	Cable Loss (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
13.56	18.48	40	-65.52	84	37.71	20.64	0.13	100	352	QP

Test Mode :	NFC Tx	Test Frequency (MHz)	13.56



Site : 03CH11-HY
Condition : 15.225 3m LOOP_100488_230912 VERTICAL
: RBW:9.000KHz VBW:9.000KHz SWT:Auto

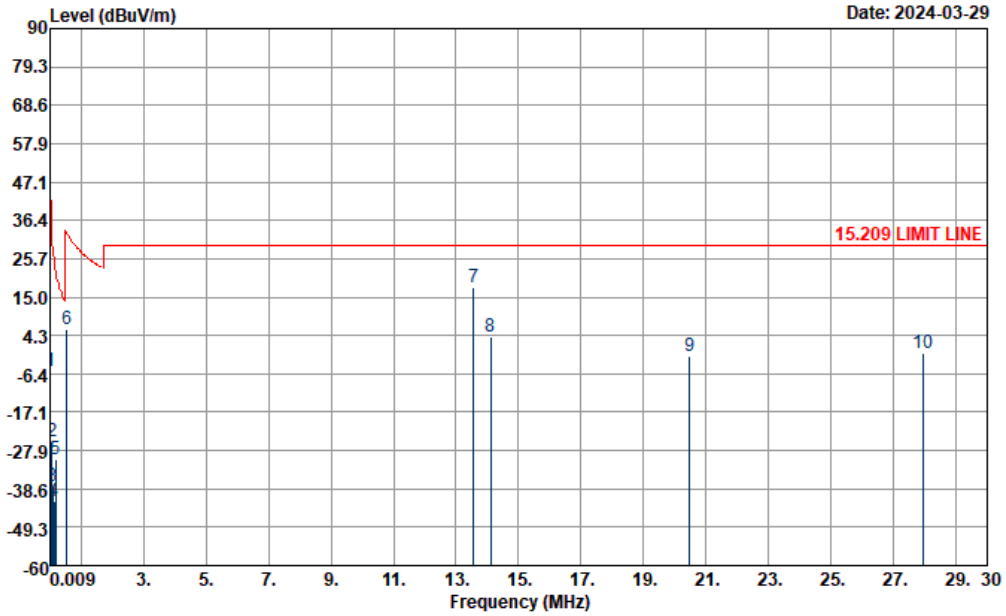
Frequency (MHz)	Level (dBµV/m)	Distance extrapolation Factor (dB)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB)	Cable Loss (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
13.56	16.72	40	-67.28	84	35.95	20.64	0.13	100	84	QP

Note :

1. Distance extrapolation factor = 40 log (specific distance / test distance) (dB)
2. Level = Antenna Factor + Cable Loss + Read Level - Distance extrapolation factor.

C2. Results of Radiated Spurious Emissions (9 kHz~30MHz)

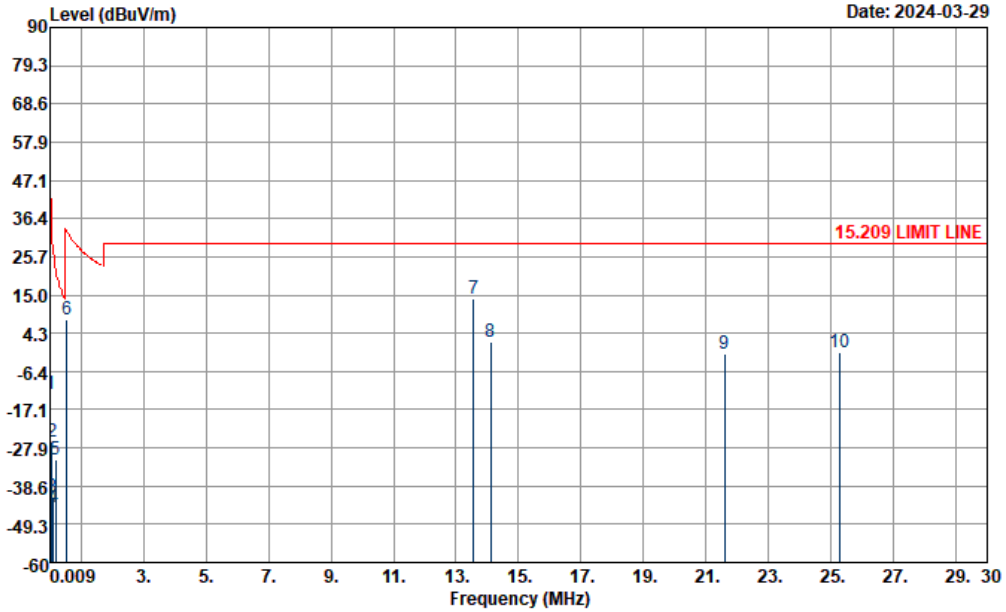
Test Mode :	NFC Tx	Polarization :	Horizontal



Site : 03CH11-HY
Condition : 15.209 LIMIT LINE 3m LOOP_100488_230912 HORIZONTAL

Frequency (MHz)	Level (dBµV/m)	Distance extrapolation Factor (dB)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB)	Cable Loss (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
0.0193	-5.7	80	-47.59	41.89	54.92	19.32	0.06	-	-	Average
0.06648	-25.27	80	-56.42	31.15	36.47	18.19	0.07	-	-	Average
0.10358	-37.71	80	-65.01	27.3	24.11	18.11	0.07	-	-	QP
0.135	-41.97	80	-66.97	25	19.72	18.24	0.07	-	-	Average
0.18978	-30.34	80	-52.38	22.04	31.13	18.46	0.07	-	-	Average
0.55008	6.18	40	-26.62	32.8	27.27	18.85	0.06	-	-	QP
13.56	17.9	40	-11.6	29.5	37.13	20.64	0.13	-	-	QP
14.112	3.99	40	-25.51	29.5	23.25	20.61	0.13	-	-	QP
20.473	-1.39	40	-30.89	29.5	16.7	21.81	0.1	-	-	QP
27.94	-0.57	40	-30.07	29.5	16.46	22.8	0.17	-	-	QP

Test Mode :	NFC Tx	Polarization :	Vertical



Site : 03CH11-HY
Condition : 15.209 LIMIT LINE 3m LOOP_100488_230912 VERTICAL

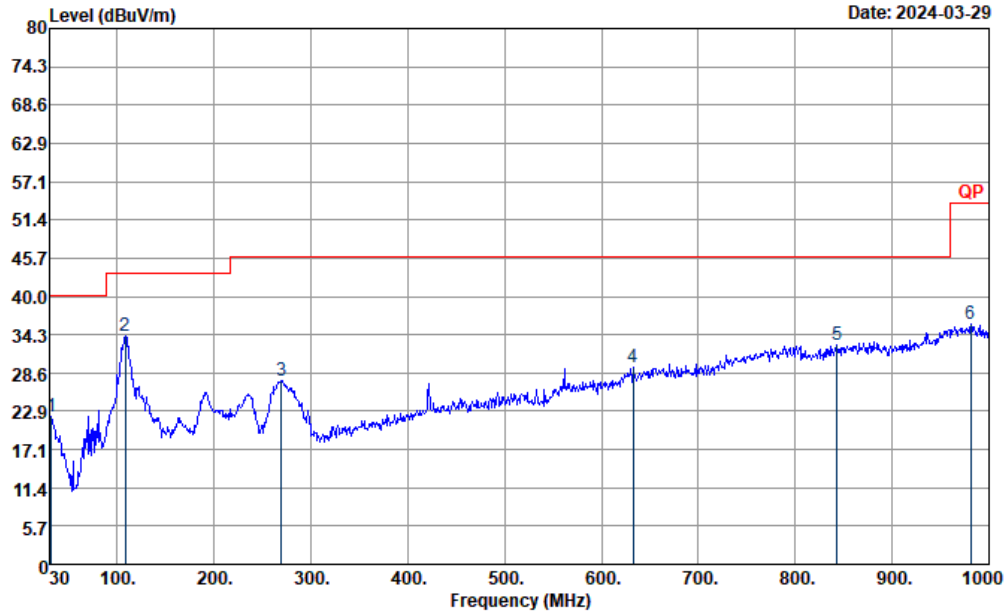
Frequency (MHz)	Level (dBµV/m)	Distance extrapolation Factor (dB)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB)	Cable Loss (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
0.0193	-12.73	80	-54.62	41.89	47.89	19.32	0.06	-	-	Average
0.06645	-26.05	80	-57.2	31.15	35.69	18.19	0.07	-	-	Average
0.09088	-41.74	80	-70.17	28.43	20.18	18.01	0.07	-	-	QP
0.11852	-44.35	80	-70.48	26.13	17.41	18.17	0.07	-	-	Average
0.18876	-31.15	80	-53.24	22.09	30.32	18.46	0.07	-	-	Average
0.55008	8.04	40	-24.76	32.8	29.13	18.85	0.06	-	-	QP
13.56	13.93	40	-15.57	29.5	33.16	20.64	0.13	-	-	QP
14.112	1.66	40	-27.84	29.5	20.92	20.61	0.13	-	-	QP
21.598	-1.46	40	-30.96	29.5	16.8	21.64	0.1	-	-	QP
25.26	-0.9	40	-30.4	29.5	16.19	22.8	0.11	-	-	QP

Note :

1. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
2. Distance extrapolation factor = 40 log (specific distance / test distance) (dB)
3. Level = Antenna Factor + Cable Loss + Read Level - Distance extrapolation factor.
4. 13.56 MHz is fundamental signal which can be ignored

C3. Results of Radiated Spurious Emissions (30MHz~1GHz)

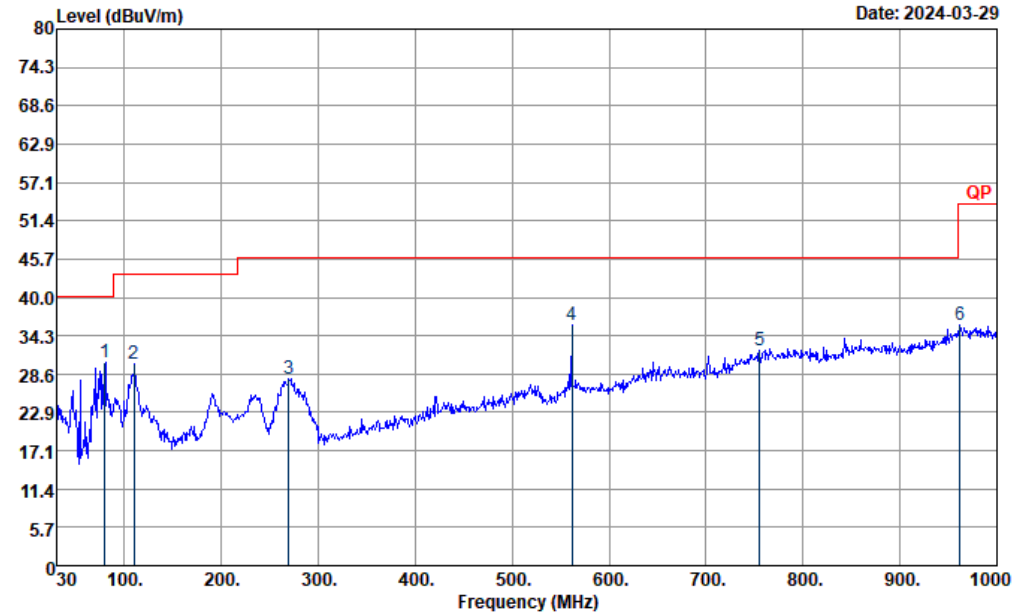
Test Mode :	NFC Tx	Polarization :	Horizontal



Site : 03CH11-HY
Condition : QP 3m 2_BILOG_35414_231007 HORIZONTAL

Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
31.62	22.12	-17.88	40	30.44	23.37	0.75	32.44	-	-	Peak
108.03	34.2	-9.3	43.5	48.43	16.71	1.29	32.23	-	-	Peak
269.76	27.49	-18.51	46	38.43	18.89	2.19	32.02	-	-	Peak
632.5	29.5	-16.5	46	31.16	26.29	4.11	32.06	-	-	Peak
843.2	32.69	-13.31	46	30.48	28.74	5.09	31.62	-	-	Peak
981.1	35.96	-18.04	54	29.98	30.9	5.7	30.62	-	-	Peak

Test Mode :	NFC Tx	Polarization :	Vertical



Site : 03CH11-HY
Condition : QP 3m 2_BILOG_35414_231007 VERTICAL

Frequency (MHz)	Level (dBµV/m)	Over Limit (dB)	Limit Line (dBµV/m)	Read Level (dBµV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
79.95	30.33	-9.67	40	48.39	13.18	1.08	32.32	-	-	Peak
109.92	30.05	-13.45	43.5	44.18	16.78	1.29	32.2	-	-	Peak
269.49	27.85	-18.15	46	38.76	18.92	2.19	32.02	-	-	Peak
561.8	35.78	-10.22	46	38.73	26.13	3.48	32.56	-	-	Peak
755	32.1	-13.9	46	31.23	28.04	4.36	31.53	-	-	Peak
962.2	35.91	-18.09	54	30.35	31.05	5.36	30.85	-	-	Peak

Note:

1. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
2. Emission level (dBµV/m) = 20 log Emission level (µV/m).
3. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor= Level.
4. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only.