



# FCC RF Test Report

**APPLICANT** : HMD Global Oy  
**EQUIPMENT** : Smart Phone  
**BRAND NAME** : NOKIA  
**MODEL NAME** : TA-1044  
**FCC ID** : 2AJOTTA-1044  
**STANDARD** : FCC Part 15 Subpart C §15.225  
**CLASSIFICATION** : (DXX) Low Power Communication Device Transmitter

The testing was completed on Feb. 09, 2017. We, SPORTON INTERNATIONAL INC., 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 of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

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Reviewed by: Joseph Lin / Supervisor

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Approved by: Jones Tsai / Manager



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FCC ID : 2AJOTTA-1044

Page Number : 1 of 19

Report Issued Date : Mar. 24, 2017

Report Version : Rev. 01

Report Template No.: BU5-FR15CNFC Version 2.0



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## REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR712016E	Rev. 01	Initial issue of report	Mar. 24, 2017

## SUMMARY OF THE TEST RESULT

Applied Standard: 47 CFR FCC Part 15 Subpart C				
Part	FCC Rule	Description of Test	Result	Under Limit
3.1	15.207	AC Power Line Conducted Emissions	Complies	0.70 dB at 13.558MHz
3.2	15.215(c)	20dB Spectrum Bandwidth	Complies	-
	-	99% OBW Spectrum Bandwidth	Complies	-
3.3	15.225(e)	Frequency Stability	Complies	-
3.4	15.225(a)(b)(c)	Field Strength of Fundamental Emissions	Complies	68.370 dB at 13.560 MHz
3.5	15.225(d) 15.209	Radiated Emissions	Complies	11.39 dB at 30.000 MHz for Peak
3.6	15.203	Antenna Requirements	Complies	-

Test Items	Uncertainty	Remark
AC Power Line Conducted Emissions	$\pm 2.70\text{dB}$	Confidence levels of 95%
Radiated Emissions (30MHz~1000MHz)	$\pm 5.70\text{dB}$	Confidence levels of 95%



## 1. GENERAL INFORMATION

### 1.1 Applicant

**HMD Global Oy**

Karaportti 2, 02610 Espoo, Finland

### 1.2 Manufacturer

**HMD Global Oy**

Karaportti 2, 02610 Espoo, Finland

### 1.3 Product Feature of Equipment Under Test

GSM/WCDMA/LTE, Bluetooth, Wi-Fi 2.4GHz 802.11b/g/n, Wi-Fi 5GHz 802.11a/n, Ant.+, FM Receiver, NFC, and GPS.

Product Specification subjective to this standard	
Antenna Type	WWAN: PIFA Antenna WLAN: PIFA Antenna Bluetooth: PIFA Antenna Ant.+ : PIFA Antenna GPS/Glonass/Beidou : Monopole Antenna NFC : Loop Antenna

### 1.4 Modification of EUT

No modifications are made to the EUT during all test items.

## 1.5 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW1190 under the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

<b>Test Site</b>	SPORTON INTERNATIONAL INC.		
<b>Test Site Location</b>	No. 52, Hwa Ya 1 <sup>st</sup> Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C. TEL: +886-3-3273456 / FAX: +886-3-3284978		
<b>Test Site No.</b>	<b>Sporton Site No.</b>		
	TH02-HY/ TH03-HY	CO05-HY	03CH07-HY
<b>Test Engineer</b>	William Liao	Arthur Hsieh	Daniel Lee
<b>Temperature</b>	22~24°C	21~22°C	23~24°C
<b>Relative Humidity</b>	53~55%	58~60%	49~51%

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

## 1.6 Applicable Standards

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

- ♦ FCC Part 15 Subpart C §15.225
- ♦ ANSI C63.10-2013



## 2. TEST CONFIGURATION OF EQUIPMENT UNDER TEST

### 2.1 Descriptions of Test Mode

Investigation has been done on all the possible configurations for searching the worst cases.

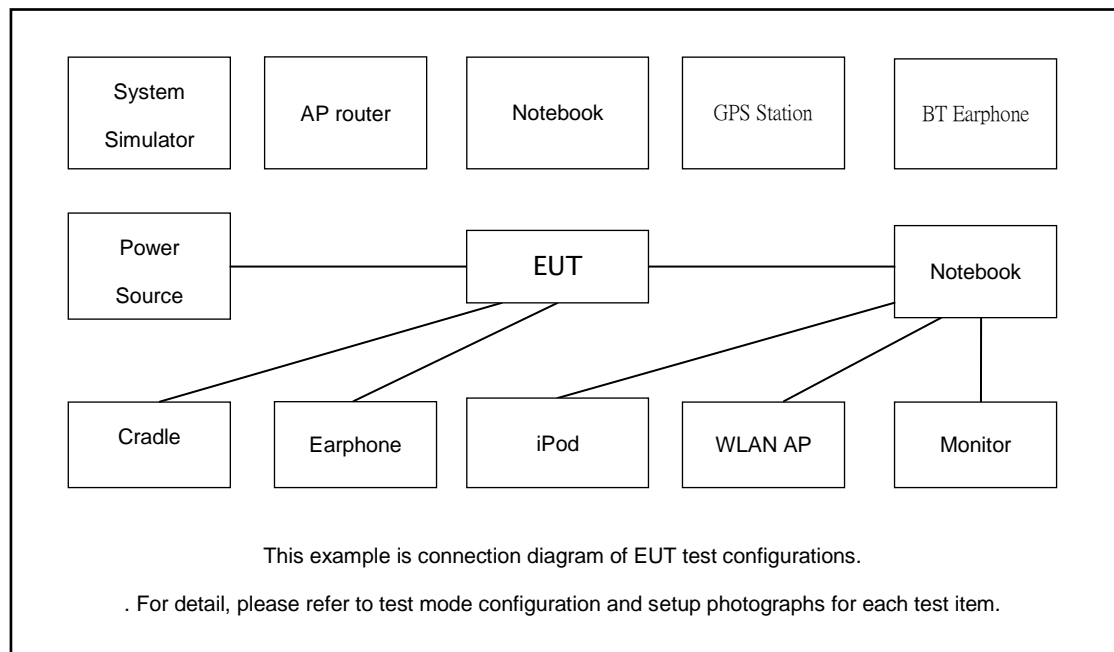
The following table is a list of the test modes shown in this test report.

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 four NFC type, A, B, F, V. The worst type (type A) was recorded in this report. Pre-scanned tests, X, Y, Z in three orthogonal panels to determine the final configuration (X plane as worst plane) from all possible combinations.

Test Cases	
<b>AC Conducted Emission</b>	Mode 1: GSM850 Idle + NFC Tx + Bluetooth Idle + WLAN (2.4GHz) Idle + Earphone + USB Cable (Charging from Adapter)

## 2.2 Connection Diagram of Test System



## 2.3 Table for Supporting Units

Support Unit	Manufacturer	Model	FCC ID
System Simulator	Anritsu	MT8820C	N/A
Bluetooth Earphone	Sony Ericsson	MW600	PY7DDA-2029
WLAN AP	ASUS	RT-AC66U	MSQ-RTAC66U
SD Card	SanDisk	MicroSD HC	FCC DoC
NFC Card	Metro Taipei	Easy Card	N/A

## 2.4 EUT Operation Test Setup

The EUT was programmed to be in continuously transmitting mode.

The ancillary equipment, NFC card, is used to make the EUT (NFC) continuously transmit at 13.56MHz and is placed around 3 cm gap to the EUT.



### 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 (dB $\mu$ V)	
	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.

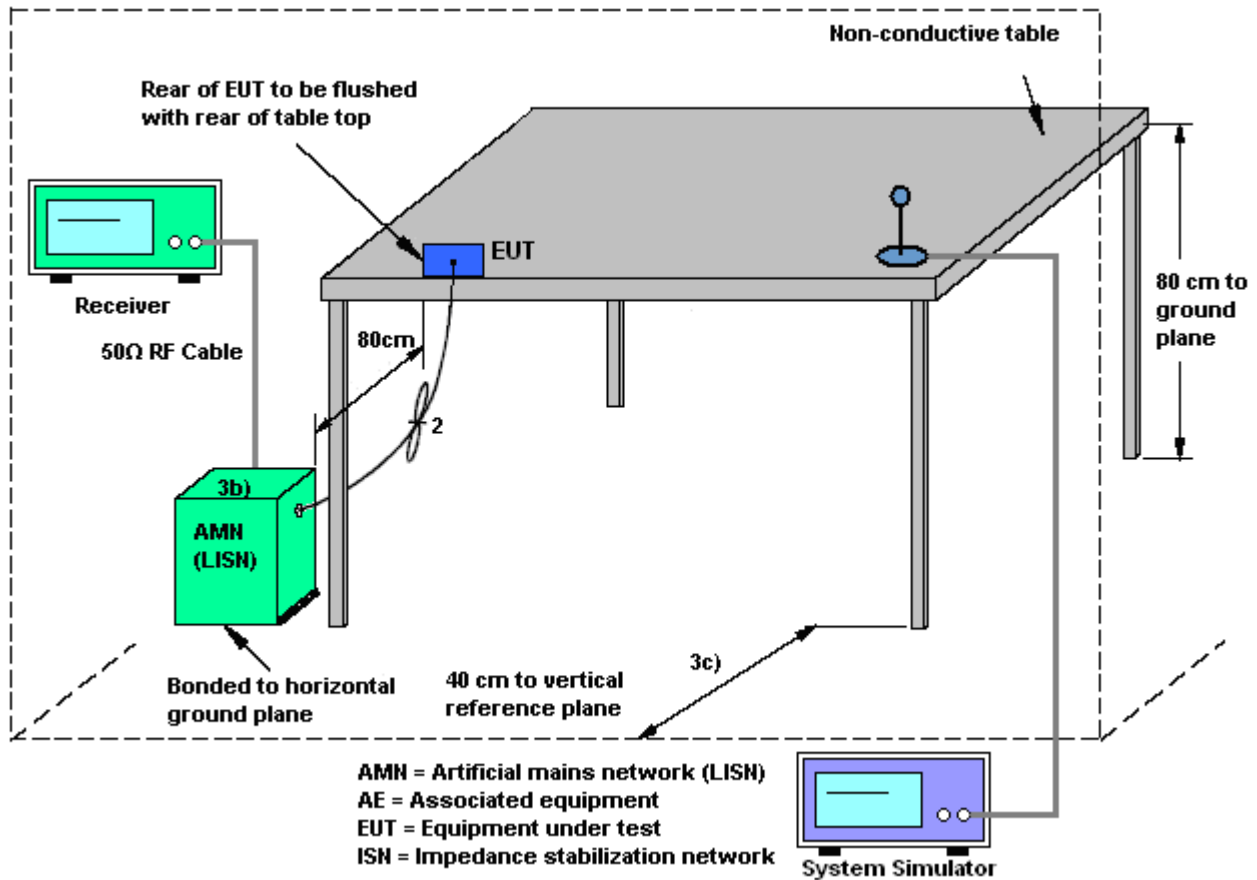
##### 3.1.2 Measuring Instruments

See list of measuring instruments of this test report.

##### 3.1.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room, and it was 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 should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

### 3.1.4 Test setup



### 3.1.5 Test Result of AC Conducted Emission

Please refer to Appendix A.

**Note:**

(1) with antenna

Remark: 13.558MHz 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 20dB and 99% emission bandwidth in the specific band 13.553~13.567MHz.

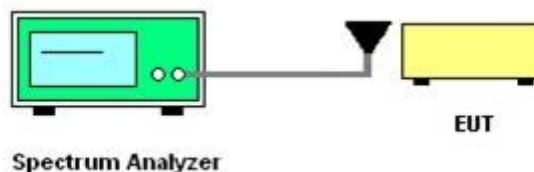
### 3.2.2 Measuring Instruments

See list of measuring instruments of 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 20dB below carrier.
4. Measured the 99% OBW.

### 3.2.4 Test Setup



### 3.2.5 Test Result of Conducted 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 using a new battery.

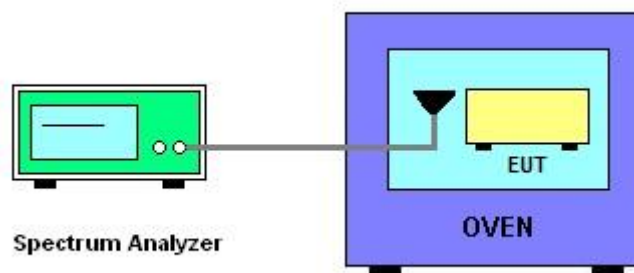
#### 3.3.2 Measuring Instruments

See list of measuring instruments of this test report.

#### 3.3.3 Test Procedures

1. The spectrum analyzer connected via a receive antenna placed near the EUT.
2. EUT have 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  $(f_c - f)/f_c \times 10^6$  ppm and the limit is less than  $\pm 100$ ppm.
6. Extreme temperature rule is -20°C~50°C.

#### 3.3.4 Test Setup



#### 3.3.5 Test Result of Conducted 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			
	IC RSS-210 B.6			
Description	Compliance with the spectrum mask is tested with RBW set to 9kHz.			
Freq. of Emission (MHz)	Field Strength ( $\mu$ V/m) at 30m	Field Strength (dB $\mu$ V/m) at 30m	Field Strength (dB $\mu$ V/m) at 10m	Field Strength (dB $\mu$ V/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

#### 3.4.2 Measuring Instruments

See list of measuring instruments of this test report.

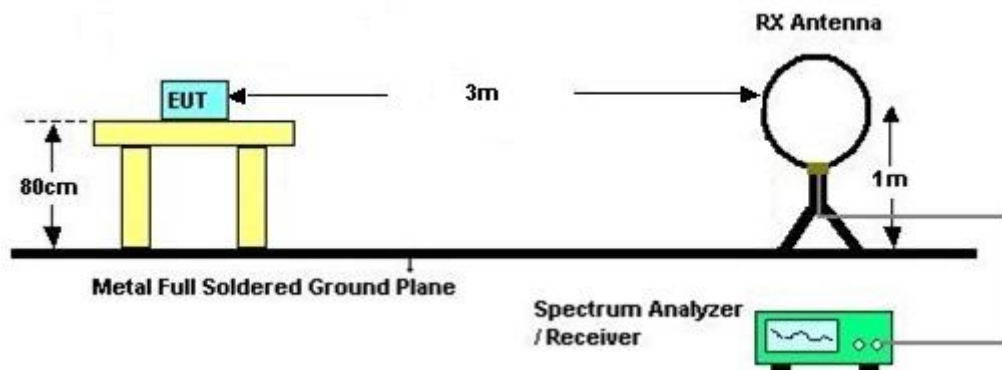
#### 3.4.3 Test Procedures

1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the loop receiving antenna mounted antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the receiving antenna was fixed at one meter above ground to find the maximum emissions field strength.
4. For Fundamental emissions, use the receiver to measure QP reading.

5. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.
6. Compliance with the spectrum mask is tested with RBW set to 9kHz.  
Note: Emission level (dB $\mu$ V/m) = 20 log Emission level ( $\mu$ V/m).

### 3.4.4 Test Setup

For radiated emissions 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 ( $\mu$ V/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

See list of measuring instruments of 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, 110-490 kHz. Radiated emission limits in these two bands are based on measurements employing an average detector.



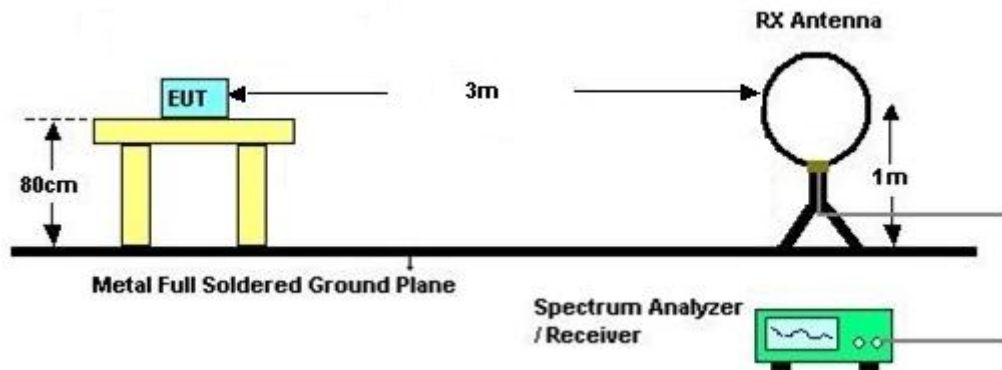
### 3.5.4 Test Procedures

1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
1. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
2. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
3. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
4. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
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. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. Antenna Requirements

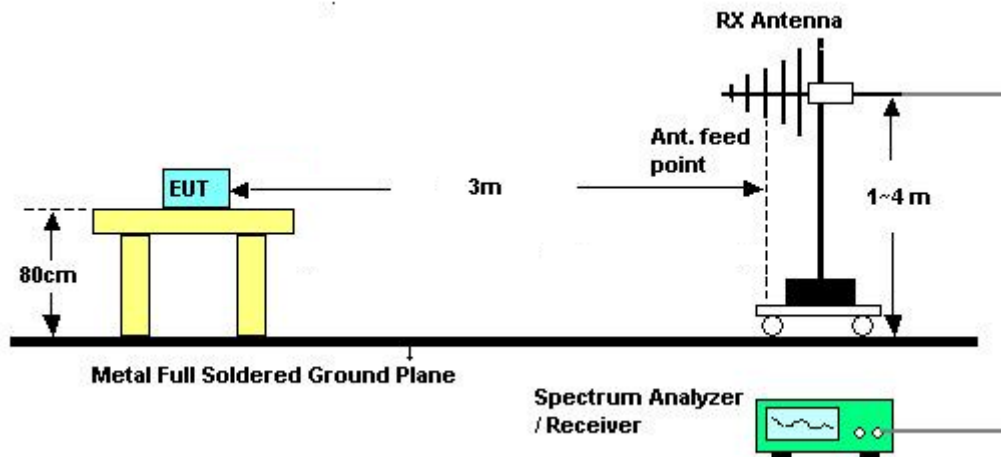


### 3.5.5 Test Setup

For radiated emissions below 30MHz



For radiated emissions above 30MHz



### 3.5.6 Test Result of Radiated Emissions Measurement

Please refer to Appendix C.

## **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 FCC rule.

### **3.6.2 Antenna Anti-Replacement Construction**

An embedded-in antenna design is used.



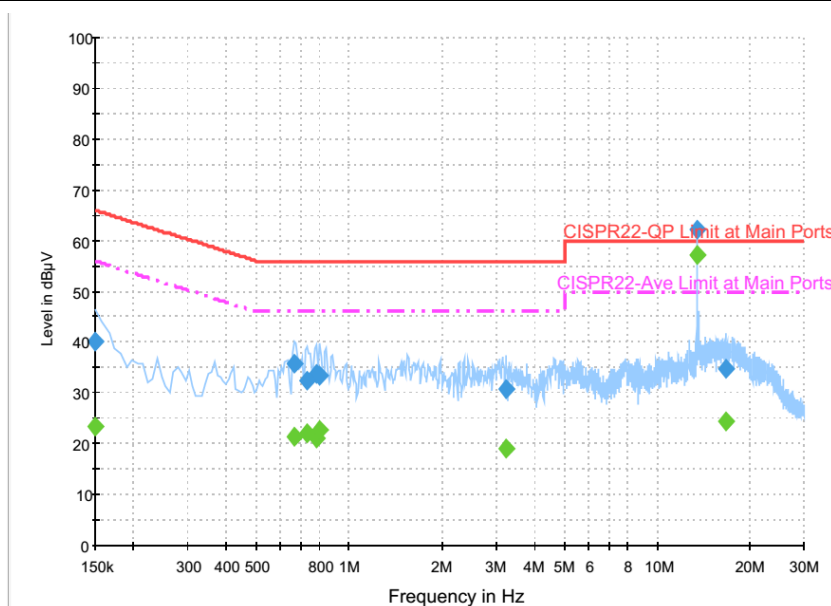
## 4. LIST OF MEASURING EQUIPMENT

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
AC Power Source	AC POWER	AFC-500W	F104070011	50Hz~60Hz	Dec. 01, 2016	Feb. 08, 2017	Nov. 30, 2017	Conducted (TH02-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP30	101329	9kHz~30GHz	Jun. 27, 2016	Feb. 08, 2017	Jun. 26, 2017	Conducted (TH03-HY)
Temperature Chamber	ESPEC	SU-641	92013721	-30℃ ~70℃	Nov. 16, 2016	Feb. 08, 2017	Nov. 15, 2017	Conducted (TH03-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	Feb. 09, 2017	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESCI 7	100724	9kHz~7GHz	Aug. 30, 2016	Feb. 09, 2017	Aug. 29, 2017	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Nov. 29, 2016	Feb. 09, 2017	Nov. 28, 2017	Conduction (CO05-HY)
LF Cable	HUBER + SUHNER	RG-214/U	LF01	N/A	Jan. 05, 2017	Feb. 09, 2017	Jan. 04, 2018	Conduction (CO05-HY)
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100851	N/A	Jan. 05, 2017	Feb. 09, 2017	Jan. 04, 2018	Conduction (CO05-HY)
Bilog Antenna	TESEQ	CBL 6111D&0080 0N1D01N-06	35419&03	30MHz to 1GHz	Jan. 07, 2017	Feb. 08, 2017	Jan. 06, 2018	Radiation (03CH07-HY)
EMI Test Receiver	Keysight	N9038A(MXE)	MY54130085	20Hz ~ 8.4GHz	Oct. 26, 2016	Feb. 08, 2017	Oct. 25, 2017	Radiation (03CH07-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100315	9 kHz~30 MHz	Sep. 02, 2015	Feb. 08, 2017	Sep. 01, 2017	Radiation (03CH07-HY)
Preamplifier	COM-POWER	PA-103A	161241	10MHz-1GHz	Mar. 18, 2016	Feb. 08, 2017	Mar. 17, 2017	Radiation (03CH07-HY)
Spectrum Analyzer	Agilent	N9010A	MY53470118	10Hz~44GHz	Feb. 27, 2016	Feb. 08, 2017	Feb. 26, 2017	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	Y84209521+ MY84209521	9KHz~30MHz	Jan. 03, 2017	Feb. 08, 2017	Jan. 02, 2018	Radiation (03CH07-HY)
RF Cable	HUBER + SUHNER	SUCOFLEX 104	MY84209521	30MHz~1GHz	Jan. 03, 2017	Feb. 08, 2017	Jan. 02, 2018	Radiation (03CH07-HY)
Antenna Mast	Max-Full	MFA520BS	N/A	1m~4m	N/A	Feb. 08, 2017	N/A	Radiation (03CH07-HY)
Turn Table	ChainTek	Chaintek 3000	N/A	0~360 Degree	N/A	Feb. 08, 2017	N/A	Radiation (03CH07-HY)

## Appendix A. Test Results of Conducted Emission Test

<Original Test Result with NFC Antenna>

<b>Test Engineer :</b>	Arthur Hsieh	<b>Temperature :</b>	21~22°C
		<b>Relative Humidity :</b>	58~60%
<b>Test Voltage :</b>	120Vac / 60Hz	<b>Phase :</b>	Line



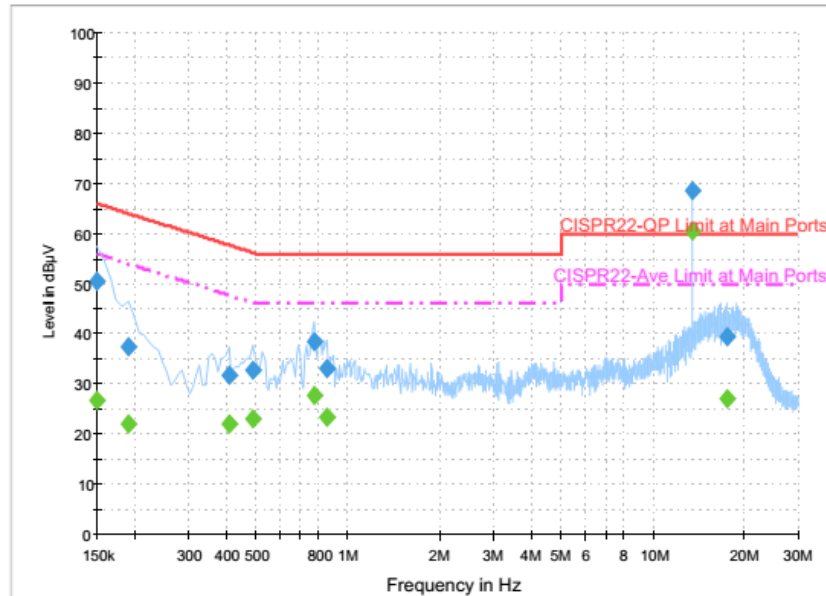
### Final Result : Quasi-Peak

Frequency (MHz)	Quasi-Peak (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	40.0	Off	L1	19.6	26.0	66.0
0.662000	35.7	Off	L1	19.6	20.3	56.0
0.734000	32.5	Off	L1	19.6	23.5	56.0
0.782000	33.8	Off	L1	19.6	22.2	56.0
0.806000	33.4	Off	L1	19.6	22.6	56.0
3.246000	30.8	Off	L1	19.6	25.2	56.0
13.558000	62.1	Off	L1	20.2	-2.1	60.0
16.694000	34.7	Off	L1	20.4	25.3	60.0

### Final Result : Average

Frequency (MHz)	Average (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	23.3	Off	L1	19.6	32.7	56.0
0.662000	21.4	Off	L1	19.6	24.6	46.0
0.734000	22.0	Off	L1	19.6	24.0	46.0
0.782000	21.2	Off	L1	19.6	24.8	46.0
0.806000	22.6	Off	L1	19.6	23.4	46.0
3.246000	19.0	Off	L1	19.6	27.0	46.0
13.558000	57.1	Off	L1	20.2	-7.1	50.0
16.694000	24.3	Off	L1	20.4	25.7	50.0

<b>Test Engineer :</b>	Arthur Hsieh	<b>Temperature :</b>	21~22°C
		<b>Relative Humidity :</b>	58~60%
<b>Test Voltage :</b>	120Vac / 60Hz	<b>Phase :</b>	Neutral


**Final Result : Quasi-Peak**

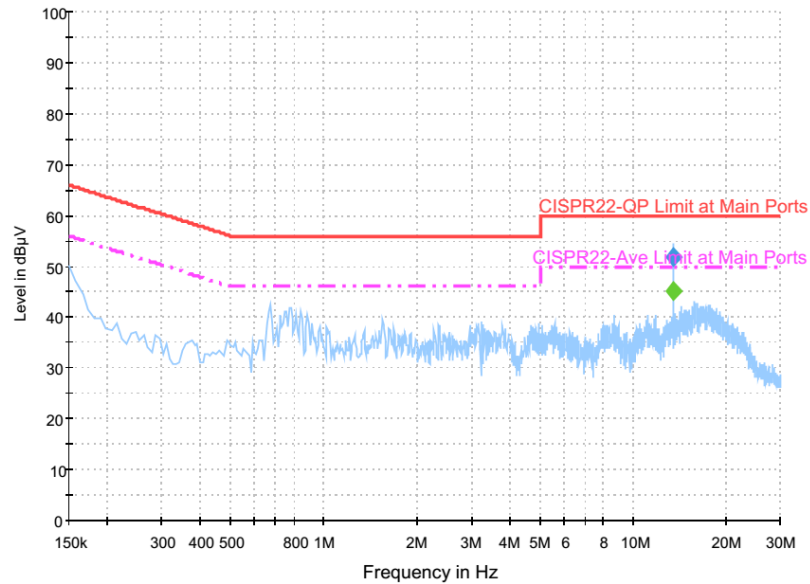
Frequency (MHz)	Quasi-Peak (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	50.4	Off	N	19.6	15.6	66.0
0.190000	37.6	Off	N	19.6	26.4	64.0
0.406000	31.8	Off	N	19.6	25.9	57.7
0.486000	32.7	Off	N	19.6	23.5	56.2
0.774000	38.3	Off	N	19.6	17.7	56.0
0.854000	33.2	Off	N	19.6	22.8	56.0
13.558000	68.4	Off	N	20.3	-8.4	60.0
17.574000	39.6	Off	N	20.5	20.4	60.0

**Final Result : Average**

Frequency (MHz)	Average (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	26.7	Off	N	19.6	29.3	56.0
0.190000	22.1	Off	N	19.6	31.9	54.0
0.406000	22.0	Off	N	19.6	25.7	47.7
0.486000	22.9	Off	N	19.6	23.3	46.2
0.774000	27.7	Off	N	19.6	18.3	46.0
0.854000	23.3	Off	N	19.6	22.7	46.0
13.558000	60.6	Off	N	20.3	-10.6	50.0
17.574000	27.2	Off	N	20.5	22.8	50.0

**<Terminal Test Result with Dummy Load>**

<b>Test Engineer :</b>	Arthur Hsieh	<b>Temperature :</b>	21~22°C
		<b>Relative Humidity :</b>	58~60%
<b>Test Voltage :</b>	120Vac / 60Hz	<b>Phase :</b>	Line

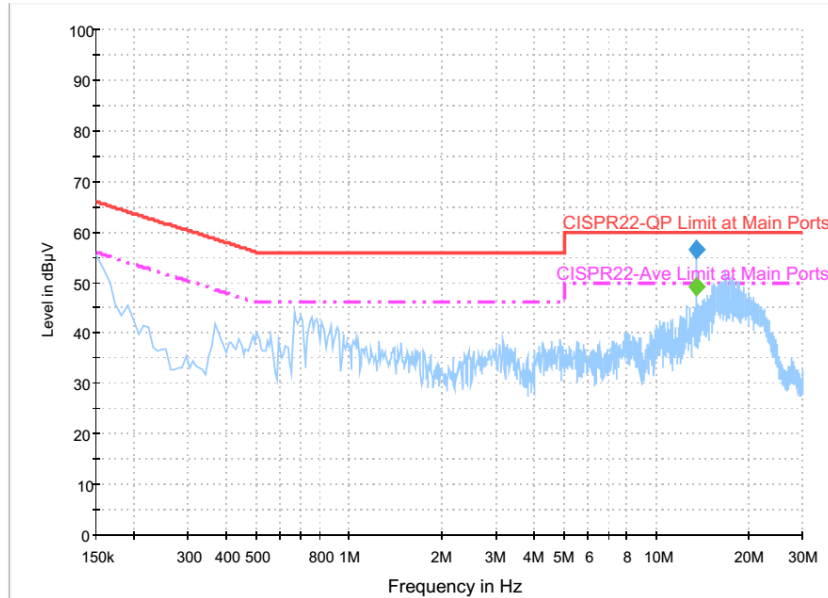

**Final Result : Quasi-Peak**

Frequency (MHz)	Quasi-Peak (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
13.558000	51.7	Off	L1	20.2	8.3	60.0

**Final Result : Average**

Frequency (MHz)	Average (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
13.558000	45.1	Off	L1	20.2	4.9	50.0

<b>Test Engineer :</b>	Arthur Hsieh	<b>Temperature :</b>	21~22°C
		<b>Relative Humidity :</b>	58~60%
<b>Test Voltage :</b>	120Vac / 60Hz	<b>Phase :</b>	Neutral


**Final Result : Quasi-Peak**

Frequency (MHz)	Quasi-Peak (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
13.558000	56.6	Off	N	20.3	3.4	60.0

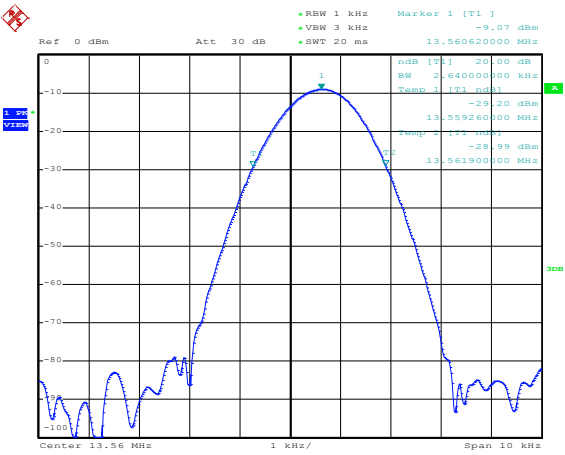
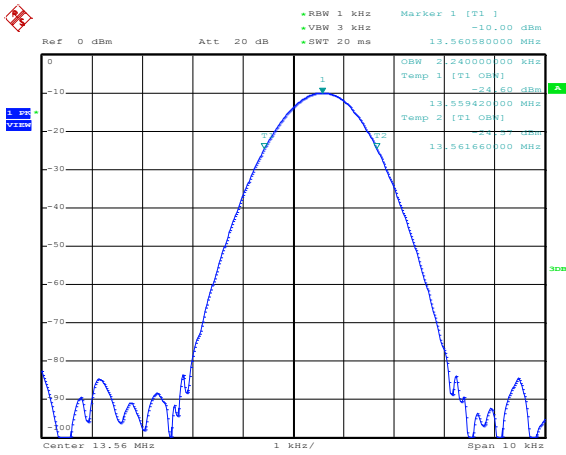
**Final Result : Average**

Frequency (MHz)	Average (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
13.558000	49.3	Off	N	20.3	0.7	50.0



## Appendix B. Test Results of Conducted Test Items

### B1. Test Result of 20dB Spectrum Bandwidth

Test mode		Test Frequency (MHz)	
NFC Tx		13.56	
			
20dB Bandwidth (kHz)		99% OccupiedBW(kHz)	
Frequency range (MHz)		$f_L > 13.553$	Test Result
		$f_H < 13.567$	Complies



**B2. Test Result of Frequency Stability**

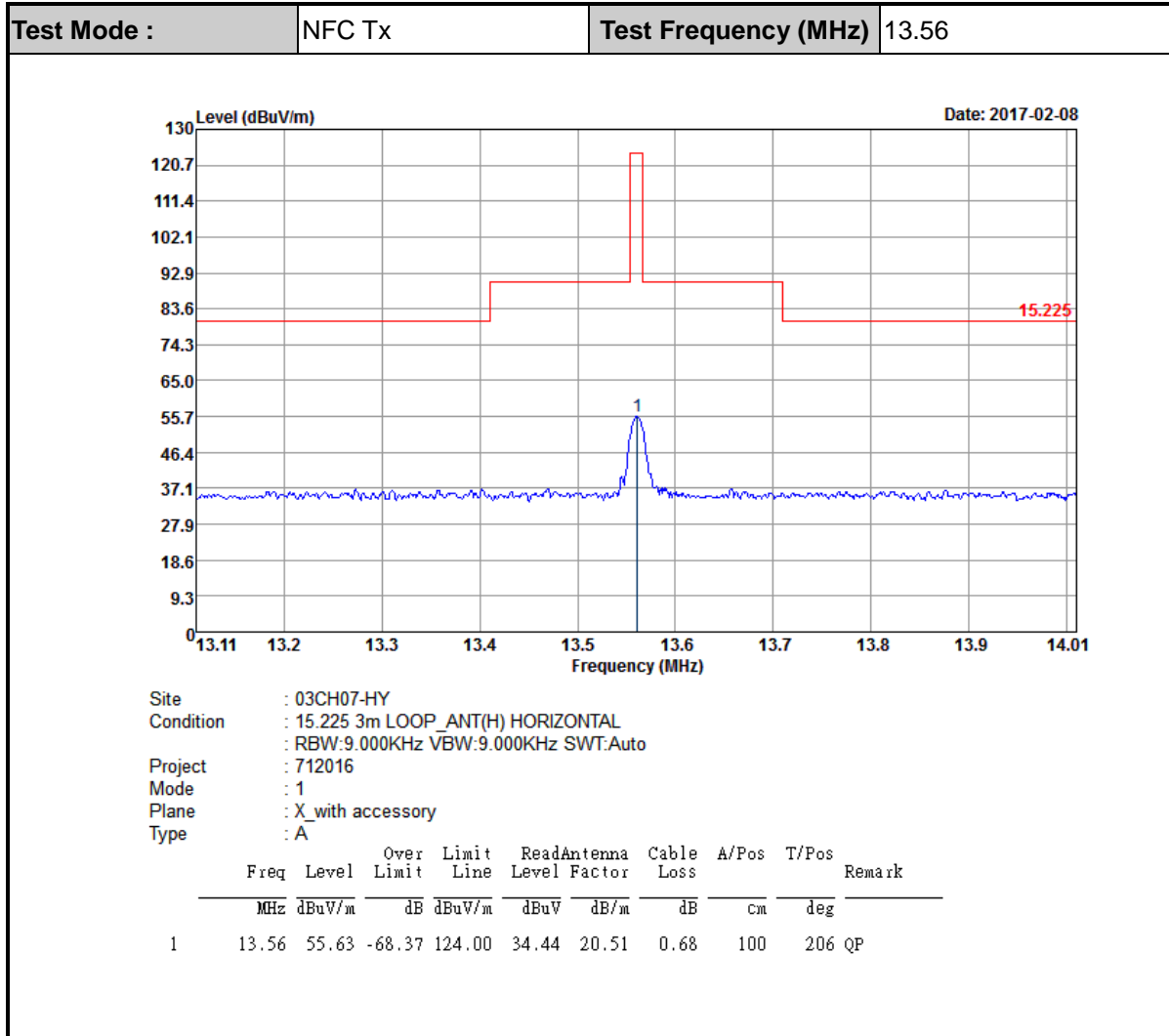
<b>B3. Voltage vs. Frequency Stability</b>		<b>Temperature vs. Frequency Stability</b>		
<b>Voltage (Vac)</b>	<b>Measurement Frequency (MHz)</b>	<b>Temperature (°C)</b>	<b>Time</b>	<b>Measurement Frequency (MHz)</b>
<b>120</b>	13.560540	<b>-20</b>	<b>0</b>	13.560560
<b>102</b>	13.560540		<b>2</b>	13.560560
<b>138</b>	13.560540		<b>5</b>	13.560560
			<b>10</b>	13.560560
		<b>-10</b>	<b>0</b>	13.560560
			<b>2</b>	13.560560
			<b>5</b>	13.560560
			<b>10</b>	13.560560
		<b>0</b>	<b>0</b>	13.560560
			<b>2</b>	13.560560
			<b>5</b>	13.560560
			<b>10</b>	13.560560
		<b>10</b>	<b>0</b>	13.560560
			<b>2</b>	13.560540
			<b>5</b>	13.560540
			<b>10</b>	13.560560
		<b>20</b>	<b>0</b>	13.560560
			<b>2</b>	13.560560
			<b>5</b>	13.560560
			<b>10</b>	13.560560
		<b>30</b>	<b>0</b>	13.560550
			<b>2</b>	13.560540
			<b>5</b>	13.560540
			<b>10</b>	13.560540
		<b>40</b>	<b>0</b>	13.560540
			<b>2</b>	13.560540
			<b>5</b>	13.560540
			<b>10</b>	13.560540

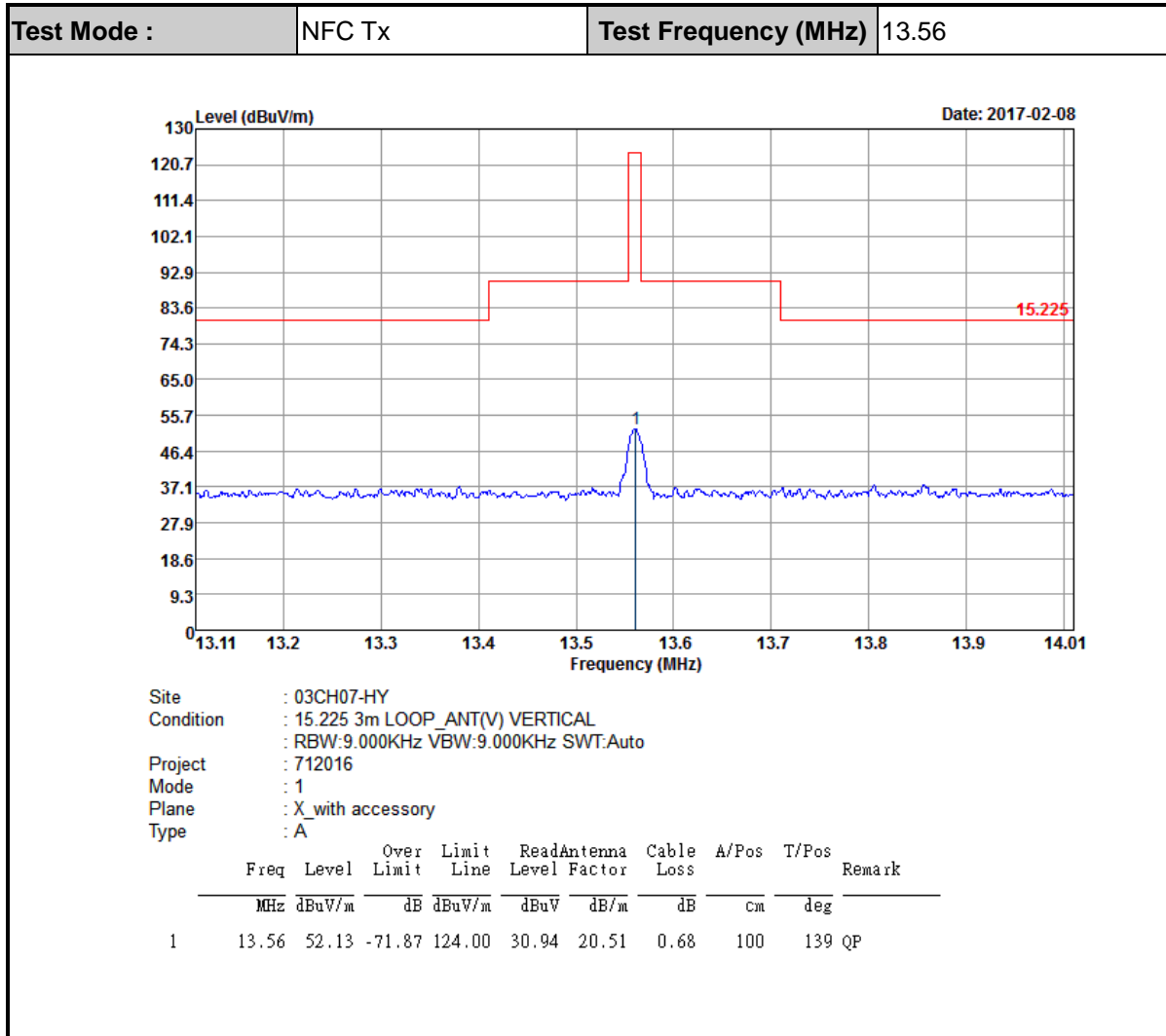


Voltage vs. Frequency Stability		Temperature vs. Frequency Stability		
Voltage (Vac)	Measurement Frequency (MHz)	Temperature (°C)	Time	Measurement Frequency (MHz)
		50	0	13.560540
			2	13.560540
			5	13.560540
			10	13.560540
Max.Deviation (MHz)	0.000540	Max.Deviation (MHz)		0.000560
Max.Deviation (ppm)	39.8230	Max.Deviation (ppm)		41.2979
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





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

<b>Test Mode :</b>	NFC Tx	<b>Polarization :</b>	Horizontal
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Frequency ( MHz )	Level ( dBμV/m )	Over Limit ( dB )	Limit Line ( dBμV/m )	Read Level (dBμV)	Antenna Factor ( dB )	Cable Loss ( dB )	Ant Pos ( cm )	Table Pos ( deg )	Remark
0.03435	48.29	-68.6	116.89	28.41	19.2	0.68	-	-	Average
0.06315	45.26	-66.34	111.6	25.58	19	0.68	-	-	Average
0.09062	47.52	-60.94	108.46	28.04	18.8	0.68	-	-	QP
0.12248	49.33	-56.51	105.84	29.86	18.79	0.68	-	-	Average
0.15102	51.79	-52.23	104.02	32.34	18.77	0.68	-	-	Average
0.49751	40.35	-33.32	73.67	21.07	18.6	0.68	-	-	QP
13.56	54.1	-15.4	69.5	32.91	20.51	0.68	-	-	QP
15.528	37.35	-32.15	69.5	15.77	20.9	0.68	-	-	QP
19.483	39.28	-30.22	69.5	16.91	21.69	0.68	-	-	QP
25.13	39.62	-29.88	69.5	16.44	22.11	1.07	100	60	QP

<b>Test Mode :</b>	NFC Tx	<b>Polarization :</b>	Vertical
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Frequency ( MHz )	Level ( dBμV/m )	Over Limit ( dB )	Limit Line ( dBμV/m )	Read Level (dBμV)	Antenna Factor ( dB )	Cable Loss ( dB )	Ant Pos ( cm )	Table Pos ( deg )	Remark
0.01334	48.31	-76.79	125.1	24.73	22.9	0.68	-	-	Average
0.07545	46.86	-63.19	110.05	27.18	19	0.68	-	-	Average
0.09066	41.98	-66.48	108.46	22.5	18.8	0.68	-	-	QP
0.11092	41.06	-65.64	106.7	21.58	18.8	0.68	-	-	Average
0.15	48.87	-55.21	104.08	29.42	18.77	0.68	-	-	Average
0.61016	38.12	-33.78	71.9	18.77	18.67	0.68	-	-	QP
13.56	50.66	-18.84	69.5	29.47	20.51	0.68	-	-	QP
15.896	38.53	-30.97	69.5	16.87	20.98	0.68	-	-	QP
24.982	39.39	-30.11	69.5	16.22	22.1	1.07	-	-	QP
29.49	39.44	-30.06	69.5	16	22.37	1.07	100	109	QP

**Note:**

- 13.56 MHz is fundamental signal which can be ignored.
- The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
- Distance extrapolation factor =  $40 \log (\text{specific distance} / \text{test distance})$  (dB);
- Limit line = specific limits (dBμV) + distance extrapolation factor.

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

<b>Test Mode :</b>	NFC Tx	<b>Polarization :</b>	Horizontal
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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
30.27	28.08	-11.92	40	32.36	26	1.07	31.35	100	0	Peak
210.36	26.59	-16.91	43.5	39.88	16.3	1.87	31.46	-	-	Peak
238.44	26.03	-19.97	46	37.44	17.92	2.07	31.4	-	-	Peak
796.3	31.78	-14.22	46	30.82	27.66	3.9	30.6	-	-	Peak
871.9	32.45	-13.55	46	30	28.83	4.17	30.55	-	-	Peak
947.5	33.26	-12.74	46	29.57	30.15	4.07	30.53	-	-	Peak

<b>Test Mode :</b>	NFC Tx	<b>Polarization :</b>	Vertical
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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
30	28.61	-11.39	40	32.89	26	1.07	31.35	100	0	Peak
40.53	26.69	-13.31	40	37.27	19.84	1.07	31.49	-	-	Peak
54.3	26.37	-13.63	40	43.03	13.86	1.07	31.59	-	-	Peak
802.6	31.59	-14.41	46	30.54	27.74	3.9	30.59	-	-	Peak
863.5	32.67	-13.33	46	30.28	28.78	4.17	30.56	-	-	Peak
947.5	33.81	-12.19	46	30.12	30.15	4.07	30.53	-	-	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.