



# FCC RF Test Report

**APPLICANT** : SHARP CORPORATION  
**EQUIPMENT** : Smart Phone  
**BRAND NAME** : SHARP  
**MODEL NAME** : X1  
**FCC ID** : APYHRO00247  
**STANDARD** : FCC Part 15 Subpart C §15.225  
**CLASSIFICATION** : (DXX) Low Power Communication Device Transmitter

The testing was completed on May 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.

Reviewed by: Joseph Lin / Supervisor

Approved by: Jones Tsai / Manager



**SPORTON INTERNATIONAL INC.**

No. 52, Hwa Ya 1<sup>st</sup> Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C.



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### SUMMARY OF THE TEST RESULT

Applied Standard: 47 CFR FCC Part 15 Subpart C				
Part	FCC Rule	Description of Test	Result	Remark
3.1	15.207	AC Power Line Conducted Emissions	Complies	Under limit 6.40 dB at 0.782MHz
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	Max level 61.24 dB $\mu$ V/m at 13.560 MHz
3.5	15.225(d) 15.209	Radiated Spurious Emissions	Complies	Under limit 10.90 dB at 40.800MHz
3.6	15.203	Antenna Requirements	Complies	-

Test Items	Uncertainty	Remark
AC Power Line Conducted Emissions	$\pm 2.70$ dB	Confidence levels of 95%
Radiated Emissions (30MHz~1000MHz)	$\pm 5.20$ dB	Confidence levels of 95%



# 1. GENERAL INFORMATION

## 1.1 Applicant

SHARP CORPORATION

Takumi-Cho, Sakai-Ku, Sakai-Shi, 2, Osaka 590-852, Japan

## 1.2 Manufacturer

SHARP CORPORATION

Takumi-Cho, Sakai-Ku, Sakai-Shi, 2, Osaka 590-852, Japan

## 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/ac, NFC, and GPS.

Product Specification subjective to this standard	
Sample 1	EUT with Memory 1
Sample 2	EUT with Memory 2
Antenna Type	WWAN: ILA Antenna WLAN: ILA Antenna Bluetooth: ILA Antenna GPS / Glonass : ILA Antenna NFC: Loop Antenna

Remark: All tests were performed with sample 1.

## 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. TW0007 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>	
	TH03-HY	CO05-HY
<b>Test Engineer</b>	William Liao	Marlowe Ho
<b>Temperature</b>	22~24°C	23~25°C
<b>Relative Humidity</b>	53~55%	52~54%

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

<b>Test Site</b>	SPORTON INTERNATIONAL INC.	
<b>Test Site Location</b>	No.58, Aly. 75, Ln. 564, Wenhua 3rd Rd. Guishan Dist, Taoyuan City, Taiwan (R.O.C.) TEL: +886-3-327-0868 / FAX: +886-3-327-0855	
<b>Test Site No.</b>	<b>Sporton Site No.</b>	
	03CH11-HY	
<b>Test Engineer</b>	Jacky Hung	
<b>Temperature</b>	21~24°C	
<b>Relative Humidity</b>	53~58%	

## 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.

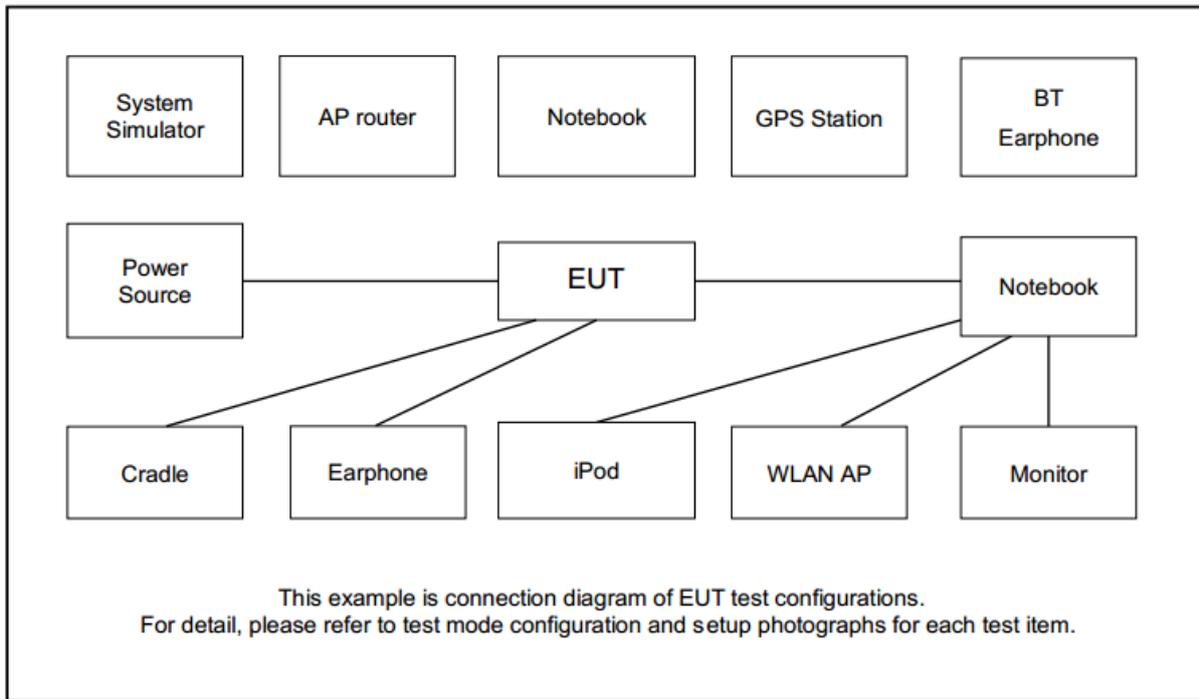
The following table is a list of the test modes shown in this test report.

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

Test Cases	
<b>AC Conducted Emission</b>	Mode 1: GSM850 Idle + NFC Tx + Bluetooth Link + WLAN (2.4GHz) Link + 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
Notebook	DELL	Latitude E6320	FCC DoC/ Contains FCC ID: QDS-BRCM1054

## 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 1 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 (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.

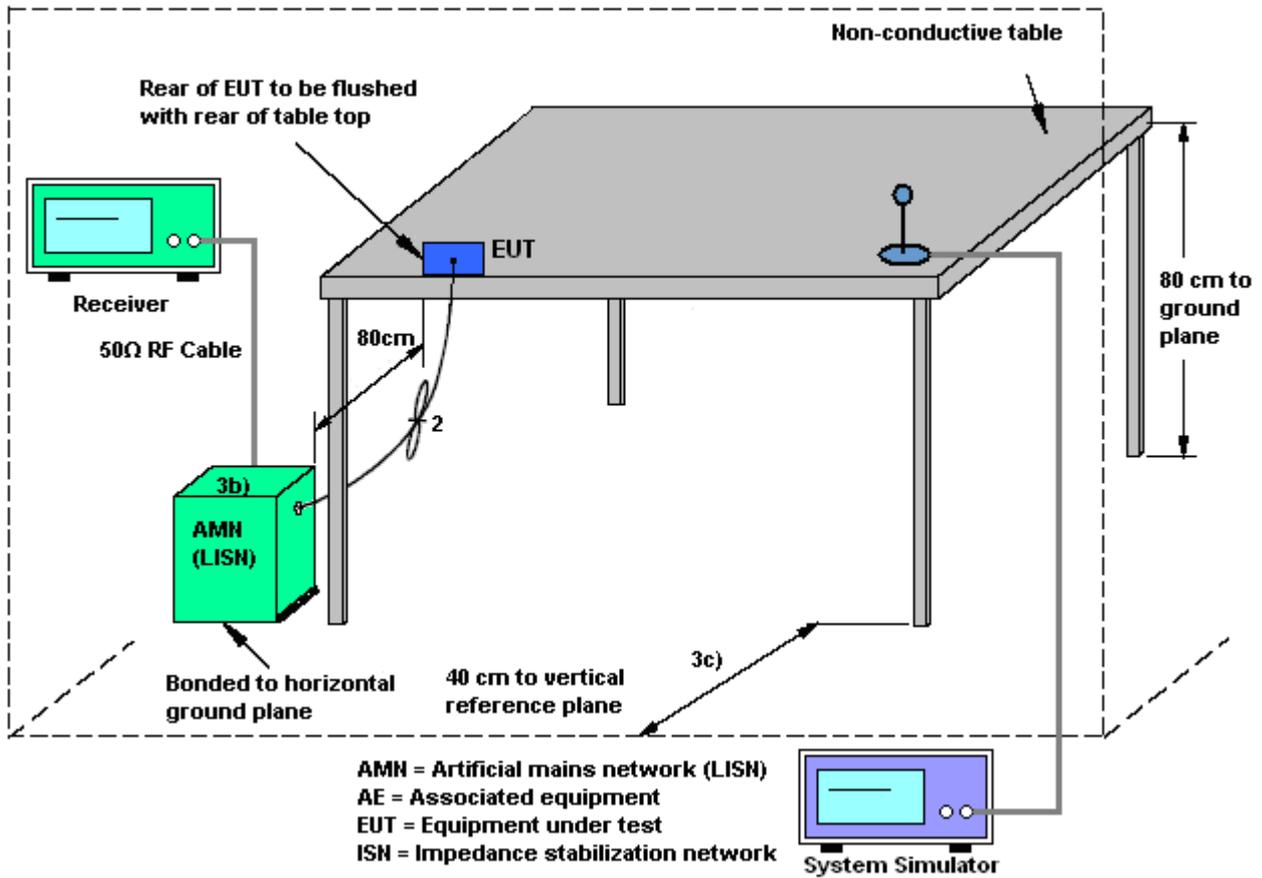
##### 3.1.2 Measuring Instruments

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.

## 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.

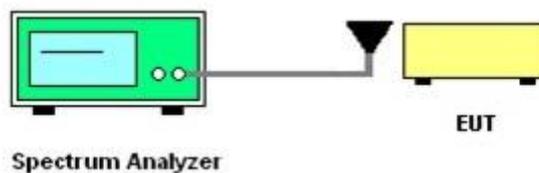
### 3.2.2 Measuring Instruments

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.

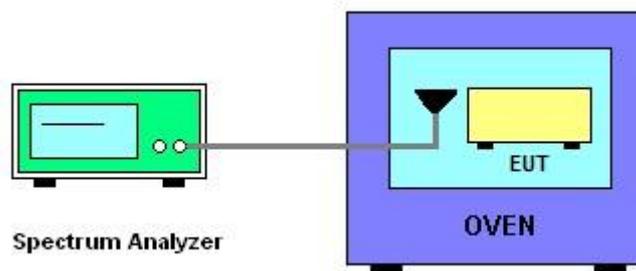
#### 3.3.2 Measuring Instruments

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  $f_c$  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			
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

#### 3.4.2 Measuring Instruments

See list of measuring instruments of this test report.

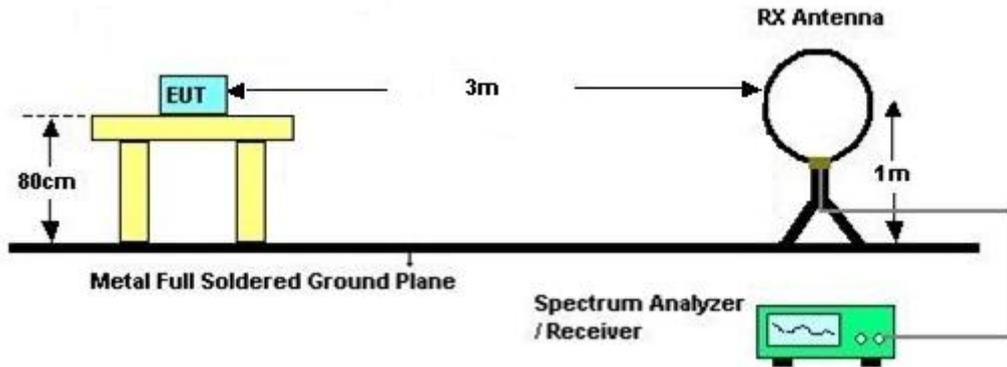
#### 3.4.3 Test Procedures

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 (dBμV/m) = 20 log Emission level (μV/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 (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

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.

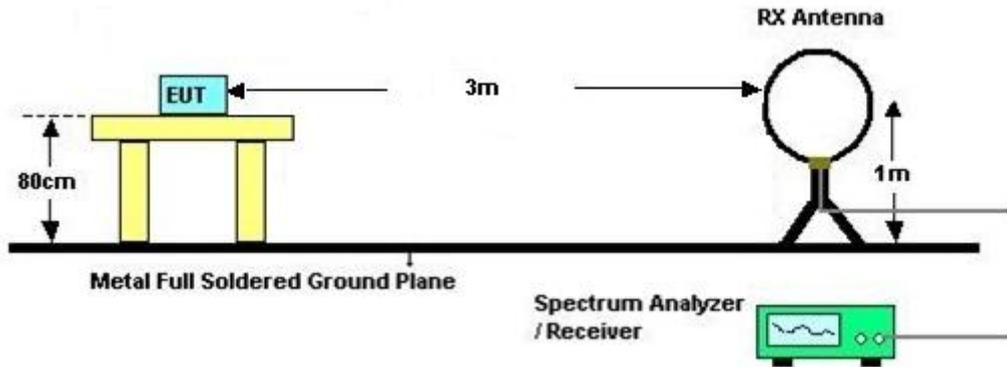


### **3.5.4 Test Procedures**

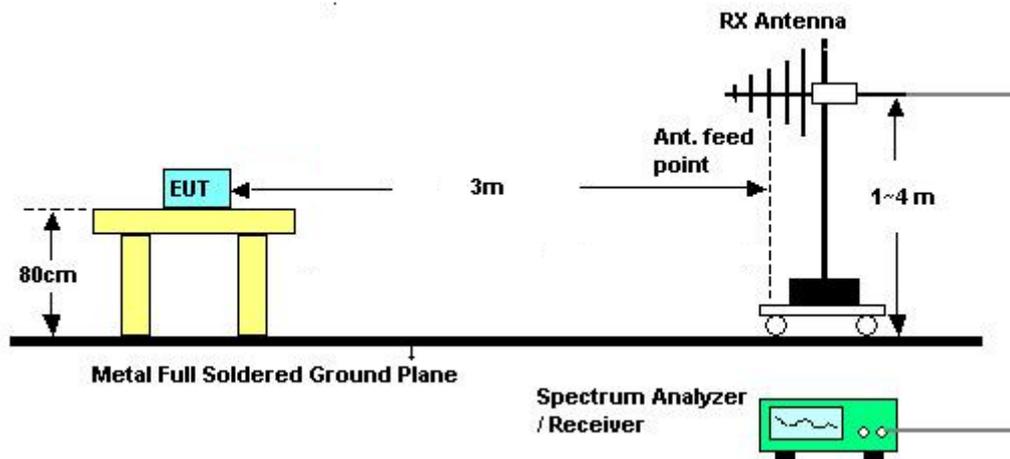
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.
7. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. 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	Apr. 28, 2017	Nov. 30, 2017	Conducted (TH03-HY)
Spectrum Analyzer	Rohde & Schwarz	FSP30	101329	9kHz~30GHz	Jun. 27, 2016	Apr. 28, 2017	Jun. 26, 2017	Conducted (TH03-HY)
Temperature Chamber	ESPEC	SU-641	92013721	-30°C ~70°C	Nov. 16, 2016	Apr. 28, 2017	Nov. 15, 2017	Conducted (TH03-HY)
AC Power Source	ChainTek	APC-1000W	N/A	N/A	N/A	May 09, 2017	N/A	Conduction (CO05-HY)
EMI Test Receiver	Rohde & Schwarz	ESCI 7	100724	9kHz~7GHz	Aug. 30, 2016	May 09, 2017	Aug. 29, 2017	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100080	9kHz~30MHz	Nov. 29, 2016	May 09, 2017	Nov. 28, 2017	Conduction (CO05-HY)
LISN	Rohde & Schwarz	ENV216	100081	9kHz~30MHz	Dec. 06, 2016	May 09, 2017	Dec. 05, 2017	Conduction (CO05-HY)
Amplifier	SONOMA	310N	187312	9kHz~1GHz	Nov. 10, 2016	Apr. 29, 2017	Nov. 09, 2017	Radiation (03CH11-HY)
Bilog Antenna	TESEQ	CBL 6111D&N-6-06	35414&AT-N0602	30MHz~1GHz	Oct. 15, 2016	Apr. 29, 2017	Oct. 14, 2017	Radiation (03CH11-HY)
Loop Antenna	Rohde & Schwarz	HFH2-Z2	100488	9 kHz~30 MHz	Oct. 20, 2016	Apr. 29, 2017	Oct. 19, 2018	Radiation (03CH11-HY)
Spectrum Analyzer	Keysight	N9010A	MY54200486	10Hz ~ 44GHz	Oct. 12, 2016	Apr. 29, 2017	Oct. 11, 2017	Radiation (03CH11-HY)
Antenna Mast	EMEC	AM-BS-4500-B	N/A	1~4m	N/A	Apr. 29, 2017	N/A	Radiation (03CH11-HY)
Turn Table	EMEC	TT 2000	N/A	0~360 Degree	N/A	Apr. 29, 2017	N/A	Radiation (03CH11-HY)
EMI Test Receiver	Agilent	N9038A(MXE)	MY53290053	20Hz to 26.5GHz	Jan. 12, 2017	Apr. 29, 2017	Jan. 11, 2018	Radiation (03CH11-HY)

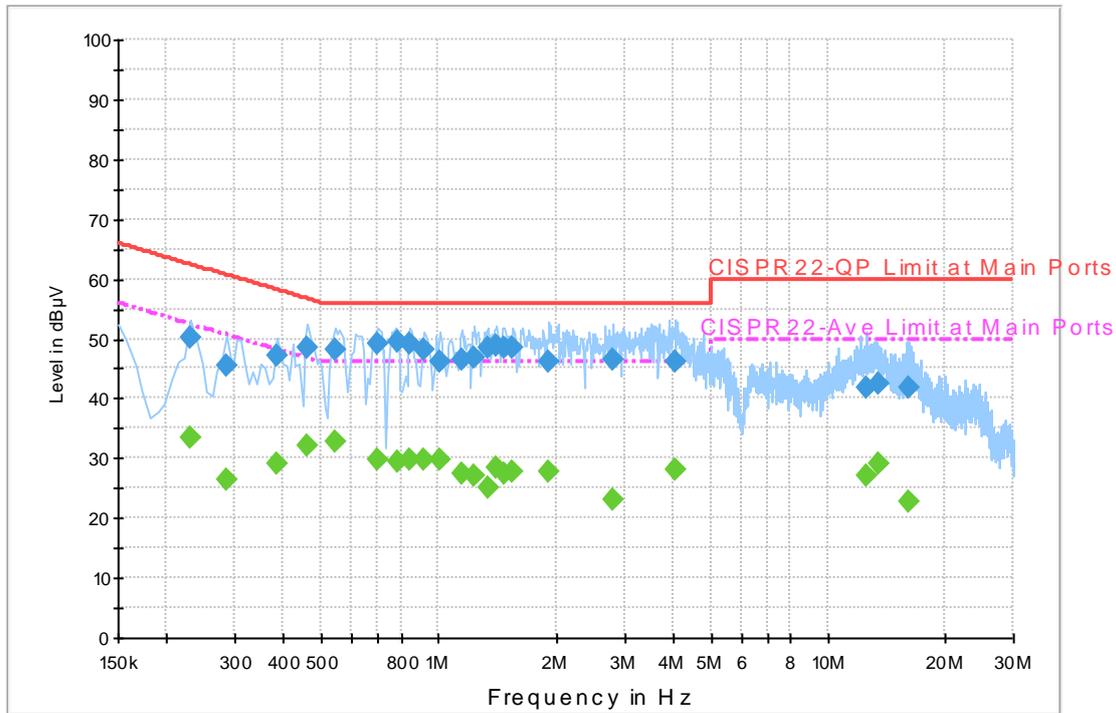


## **Appendix A. Test Results of Conducted Emission Test**

# EUT Information

Report NO : 740122  
 Test Mode : Mode 1  
 Test Voltage : 120Vac/60Hz  
 Phase : Line

ENV216 Auto Test FCC Power Bar - L



## Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.230000	50.0	Off	L1	19.6	12.4	62.4
0.286000	45.5	Off	L1	19.6	15.1	60.6
0.382000	47.1	Off	L1	19.6	11.1	58.2
0.462000	48.4	Off	L1	19.6	8.3	56.7
0.542000	48.1	Off	L1	19.6	7.9	56.0
0.694000	49.2	Off	L1	19.6	6.8	56.0
0.782000	49.6	Off	L1	19.6	6.4	56.0
0.846000	49.1	Off	L1	19.6	6.9	56.0
0.918000	48.3	Off	L1	19.6	7.7	56.0
1.006000	46.0	Off	L1	19.6	10.0	56.0
1.150000	46.6	Off	L1	19.6	9.4	56.0
1.238000	46.9	Off	L1	19.6	9.1	56.0
1.334000	48.3	Off	L1	19.6	7.7	56.0
1.414000	48.7	Off	L1	19.6	7.3	56.0
1.478000	48.6	Off	L1	19.6	7.4	56.0
1.550000	48.6	Off	L1	19.6	7.4	56.0
1.926000	46.2	Off	L1	19.6	9.8	56.0
2.798000	46.5	Off	L1	19.5	9.5	56.0
4.062000	46.2	Off	L1	19.7	9.8	56.0
12.566000	41.9	Off	L1	20.2	18.1	60.0
13.558000	42.3	Off	L1	20.2	17.7	60.0
16.150000	41.8	Off	L1	20.4	18.2	60.0

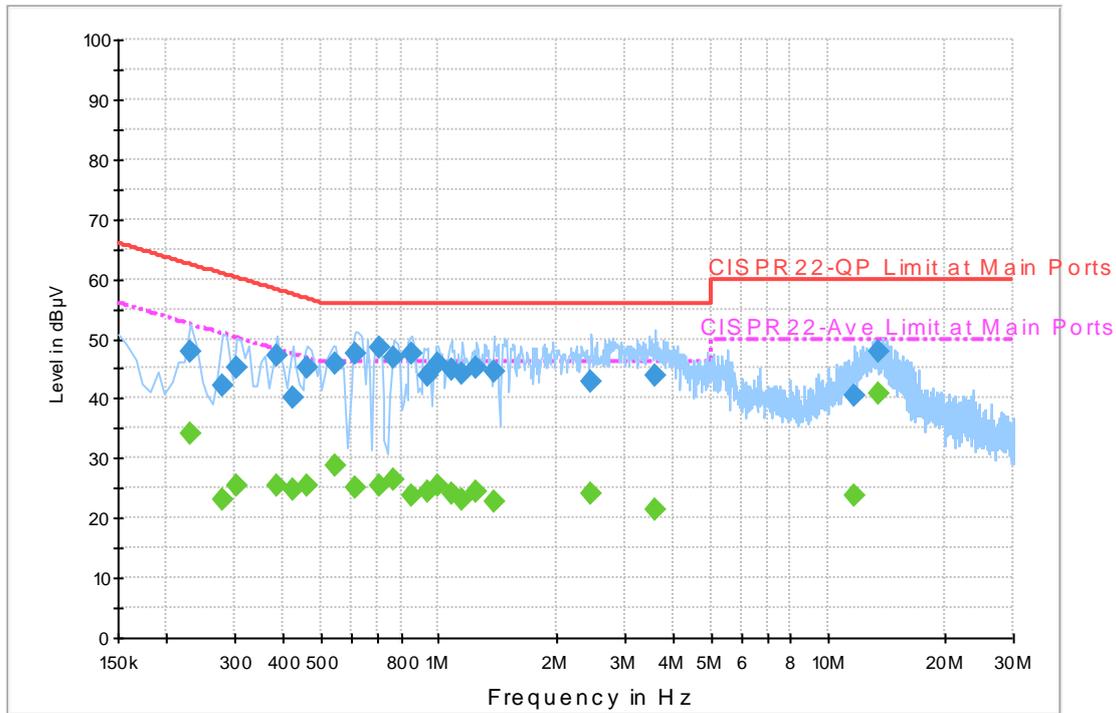
## Final Result 2

Frequency (MHz)	Average (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.230000	33.4	Off	L1	19.6	19.0	52.4
0.286000	26.6	Off	L1	19.6	24.0	50.6
0.382000	29.3	Off	L1	19.6	18.9	48.2
0.462000	32.0	Off	L1	19.6	14.7	46.7
0.542000	32.8	Off	L1	19.6	13.2	46.0
0.694000	29.8	Off	L1	19.6	16.2	46.0
0.782000	29.4	Off	L1	19.6	16.6	46.0
0.846000	29.8	Off	L1	19.6	16.2	46.0
0.918000	29.8	Off	L1	19.6	16.2	46.0
1.006000	29.7	Off	L1	19.6	16.3	46.0
1.150000	27.6	Off	L1	19.6	18.4	46.0
1.238000	27.2	Off	L1	19.6	18.8	46.0
1.334000	25.1	Off	L1	19.6	20.9	46.0
1.414000	28.3	Off	L1	19.6	17.7	46.0
1.478000	27.5	Off	L1	19.6	18.5	46.0
1.550000	27.9	Off	L1	19.6	18.1	46.0
1.926000	27.9	Off	L1	19.6	18.1	46.0
2.798000	23.0	Off	L1	19.5	23.0	46.0
4.062000	28.2	Off	L1	19.7	17.8	46.0
12.566000	27.0	Off	L1	20.2	23.0	50.0
13.558000	28.9	Off	L1	20.2	21.1	50.0
16.150000	22.8	Off	L1	20.4	27.2	50.0

# EUT Information

Report NO : 740122  
 Test Mode : Mode 1  
 Test Voltage : 120Vac/60Hz  
 Phase : Neutral

ENV216 Auto Test FCC Power Bar - N



## Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.230000	47.8	Off	N	19.5	14.6	62.4
0.278000	42.2	Off	N	19.5	18.7	60.9
0.302000	45.2	Off	N	19.5	15.0	60.2
0.382000	47.1	Off	N	19.5	11.1	58.2
0.422000	40.1	Off	N	19.5	17.3	57.4
0.462000	45.3	Off	N	19.5	11.4	56.7
0.542000	45.9	Off	N	19.5	10.1	56.0
0.614000	47.3	Off	N	19.5	8.7	56.0
0.702000	48.4	Off	N	19.5	7.6	56.0
0.766000	46.9	Off	N	19.5	9.1	56.0
0.854000	47.6	Off	N	19.6	8.4	56.0
0.934000	44.0	Off	N	19.5	12.0	56.0
0.998000	45.8	Off	N	19.6	10.2	56.0
1.078000	44.9	Off	N	19.6	11.1	56.0
1.150000	44.3	Off	N	19.6	11.7	56.0
1.254000	45.0	Off	N	19.6	11.0	56.0
1.382000	44.3	Off	N	19.6	11.7	56.0
2.470000	43.0	Off	N	19.2	13.0	56.0
3.606000	43.9	Off	N	19.7	12.1	56.0
11.742000	40.3	Off	N	20.2	19.7	60.0
13.558000	48.0	Off	N	20.3	12.0	60.0

## Final Result 2

Frequency (MHz)	Average (dB $\mu$ V)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)
0.230000	34.0	Off	N	19.5	18.4	52.4
0.278000	23.0	Off	N	19.5	27.9	50.9
0.302000	25.5	Off	N	19.5	24.7	50.2
0.382000	25.5	Off	N	19.5	22.7	48.2
0.422000	24.6	Off	N	19.5	22.8	47.4
0.462000	25.4	Off	N	19.5	21.3	46.7
0.542000	28.8	Off	N	19.5	17.2	46.0
0.614000	25.2	Off	N	19.5	20.8	46.0
0.702000	25.5	Off	N	19.5	20.5	46.0
0.766000	26.5	Off	N	19.5	19.5	46.0
0.854000	23.9	Off	N	19.6	22.1	46.0
0.934000	24.5	Off	N	19.5	21.5	46.0
0.998000	25.5	Off	N	19.6	20.5	46.0
1.078000	24.1	Off	N	19.6	21.9	46.0
1.150000	23.2	Off	N	19.6	22.8	46.0
1.254000	24.4	Off	N	19.6	21.6	46.0
1.382000	22.8	Off	N	19.6	23.2	46.0
2.470000	24.0	Off	N	19.2	22.0	46.0
3.606000	21.4	Off	N	19.7	24.6	46.0
11.742000	23.7	Off	N	20.2	26.3	50.0
13.558000	40.9	Off	N	20.3	9.1	50.0



# Appendix B. Test Results of Conducted Test Items

## B1. Test Result of 20dB Spectrum Bandwidth

Test mode	NFC Tx	Test Frequency (MHz)	13.56
<b>20dB Bandwidth (kHz)</b>	2.620	<b>99% OccupiedBW(kHz)</b>	2.240
<b>Frequency range (MHz)</b>	$f_L > 13.553$	13.55870	<b>Test Result</b>
	$f_H < 13.567$	13.56132	<b>Complies</b>



B2. Test Result of Frequency Stability

Voltage vs. Frequency Stability		Temperature vs. Frequency Stability		
Voltage (Vac)	Measurement Frequency (MHz)	Temperature (°C)	Time	Measurement Frequency (MHz)
120	13.560040	-20	0	13.560040
			2	13.560040
			5	13.560040
			10	13.560040
102	13.560020	-10	0	13.560040
			2	13.560040
			5	13.560040
			10	13.560040
138	13.560020	0	0	13.560040
			2	13.560040
			5	13.560000
			10	13.560020
		10	0	13.560020
			2	13.560020
			5	13.560020
			10	13.560020
		20	0	13.559880
			2	13.559880
			5	13.559880
			10	13.559880
		30	0	13.559880
			2	13.559880
			5	13.559880
			10	13.559880
		40	0	13.559880
			2	13.559880
			5	13.559880
			10	13.559880



Voltage vs. Frequency Stability		Temperature vs. Frequency Stability		
Voltage (Vac)	Measurement Frequency (MHz)	Temperature (°C)	Time	Measurement Frequency (MHz)
		50	0	13.559880
			2	13.559880
			5	13.559880
			10	13.559880
Max.Deviation (MHz)	0.000040	Max.Deviation (MHz)		-0.000120
Max.Deviation (ppm)	2.9499	Max.Deviation (ppm)		-8.8496
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

<b>Test Mode :</b>	NFC Tx	<b>Test Frequency (MHz)</b>	13.56	
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Date: 2017-04-29

Site : 03CH11-HY  
 Condition : 15.225 3m LOOP\_ANT(H) HORIZONTAL  
 : RBW:9.000KHz VBW:9.000KHz SWT:Auto  
 Project : 740122  
 Mode : 1

Freq	Level	Over	Limit	ReadAntenna	Cable	A/Pos	T/Pos	Remark	
MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	cm	deg	
1	13.56	61.24	-62.76	124.00	40.42	20.14	0.68	100	186 OP

Date: 2017-04-29

Site : 03CH11-HY  
 Condition : 15.225 3m LOOP\_ANT(V) VERTICAL  
 : RBW:9.000KHz VBW:9.000KHz SWT:Auto  
 Project : 740122  
 Mode : 1

Freq	Level	Over	Limit	ReadAntenna	Cable	A/Pos	T/Pos	Remark	
MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	cm	deg	
1	13.56	58.03	-65.97	124.00	37.21	20.14	0.68	100	80 QP



**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
0.0192	44.95	-76.99	121.94	24.9	20.05	0	-	-	Average
0.0624	35.72	-75.98	111.7	15.65	20.06	0.01	-	-	Average
0.09174	32.69	-75.66	108.35	12.67	20.01	0.01	-	-	QP
0.11856	33.78	-72.35	106.13	13.77	20	0.01	-	-	Average
0.17754	48.11	-54.51	102.62	28.11	19.99	0.01	-	-	Average
1.654	47.71	-15.52	63.23	27.56	20.02	0.13	100	0	QP
13.56	60.69	-8.81	69.5	40.29	20.14	0.26	-	-	QP
13.832	36.97	-32.53	69.5	16.57	20.14	0.26	-	-	QP
24.496	36.69	-32.81	69.5	15.89	20.53	0.27	-	-	QP
25.58	37.34	-32.16	69.5	16.58	20.5	0.26	-	-	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
0.01925	45.84	-76.08	121.92	25.79	20.05	0	-	-	Average
0.06105	35.37	-76.52	111.89	15.3	20.06	0.01	-	-	Average
0.10314	32.09	-75.25	107.34	12.07	20.01	0.01	-	-	QP
0.14068	33.2	-71.44	104.64	13.19	20	0.01	-	-	Average
0.37372	45.82	-50.33	96.15	25.83	19.97	0.02	-	-	Average
1.662	43.2	-19.99	63.19	23.05	20.02	0.13	100	0	QP
9.48	34.93	-34.57	69.5	14.64	20.12	0.17	-	-	QP
13.56	57.52	-11.98	69.5	37.12	20.14	0.26	-	-	QP
22.948	34.78	-34.72	69.5	13.99	20.52	0.27	-	-	QP
25.625	35.85	-33.65	69.5	15.09	20.5	0.26	-	-	QP

**Note:**

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



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

Test Mode :	NFC Tx	Polarization :	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
40.8	22.44	-17.56	40	35.15	18.83	0.94	32.49	-	-	Peak
141.78	17.88	-25.62	43.5	31.37	17.38	1.51	32.44	-	-	Peak
288.12	20.84	-25.16	46	32.07	18.92	2.13	32.37	-	-	Peak
519.8	24.74	-21.26	46	30.02	24.16	2.89	32.4	-	-	Peak
764.8	30.77	-15.23	46	31.18	28.26	3.47	32.28	-	-	Peak
958.7	33.37	-12.63	46	29.3	31.14	3.87	31.12	100	0	Peak

Test Mode :	NFC Tx	Polarization :	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
40.8	29.1	-10.9	40	41.81	18.83	0.94	32.49	100	82	Peak
67.8	22.38	-17.62	40	41.67	12.12	1.06	32.49	-	-	Peak
81.84	21.13	-18.87	40	38.96	13.42	1.22	32.48	-	-	Peak
552.7	26.21	-19.79	46	29.95	25.61	2.98	32.42	-	-	Peak
743.1	30.01	-15.99	46	30.73	28.06	3.44	32.35	-	-	Peak
951	33.13	-12.87	46	29.51	30.82	3.82	31.19	-	-	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.