

# FCC Test Report

Product Name	NFC Antenna Module
Model No.	MAB03
FCC ID	2AAYI-MAB03NFCAM

Applicant	Smart Approach Co.,Ltd.
Address	4F, No.669, Sec.4, Chung Hsing Rd., Chutung, HsinChu 310, Taiwan, R.O.C.

Date of Receipt	Jan. 08, 2014
Issued Date	Feb. 12, 2014
Report No.	1410208R-RFUSP17V00
Report Version	V1.0



The test results relate only to the samples tested.

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This report must not be used to claim product endorsement by TAF or any agency of the U.S. Government

# Test Report Certification

Issued Date: Feb. 12, 2014

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Product Name	NFC Antenna Module
Applicant	Smart Approach Co.,Ltd.
Address	4F, No.669, Sec.4, Chung Hsing Rd., Chutung, HsinChu 310, Taiwan,
Manufacturer	Smart Approach Co.,Ltd.
Model No.	MAB03
FCC ID.	2AAIYI-MAB03NFCAM
EUT Rated Voltage	DC 3.3V
EUT Test Voltage	DC 3.3V
Trade Name	Smart Approach Co.,Ltd.
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2012 ANSI C63.10: 2009
Test Result	Complied

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Documented By :

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( Senior Adm. Specialist / Rita Huang )

Tested By :

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( Engineer / Andy Lin )

Approved By :

A handwritten signature in blue ink that appears to read "Vincent Lin".

( Director / Vincent Lin )

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Attachment 1: EUT Test Photographs

Attachment 2: EUT Detailed Photographs

## 1. GENERAL INFORMATION

### 1.1. EUT Description

Product Name	NFC Antenna Module
Trade Name	Smart Approach Co.,Ltd.
Model No.	MAB03
FCC ID	2AAYI-MAB03NFCAM
Frequency Range	13.56MHz
Modulation	ASK
Antenna Type	Loop Antenna
Signal Cable (10pin)	Non-Shielded, 0.1m
Signal Cable (8pin)	Non-Shielded, 0.15m

Frequency of Each Channel:

Channel	Frequency
Channel 1:	13.56 MHz

Note:

1. This device is a NFC Antenna Module with a built-in 13.56MHz transceiver.
2. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15 Subpart C Paragraph 15.225
3. There are two kinds of EUT connection cables (10pin cable and 8pin cable), fundamental value is no difference through the prescan, only conducted emission and 9kHz - 1GHz radiated emission are tested and recorded in this report.
4. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.

Test Mode	Mode 1: Transmit mode
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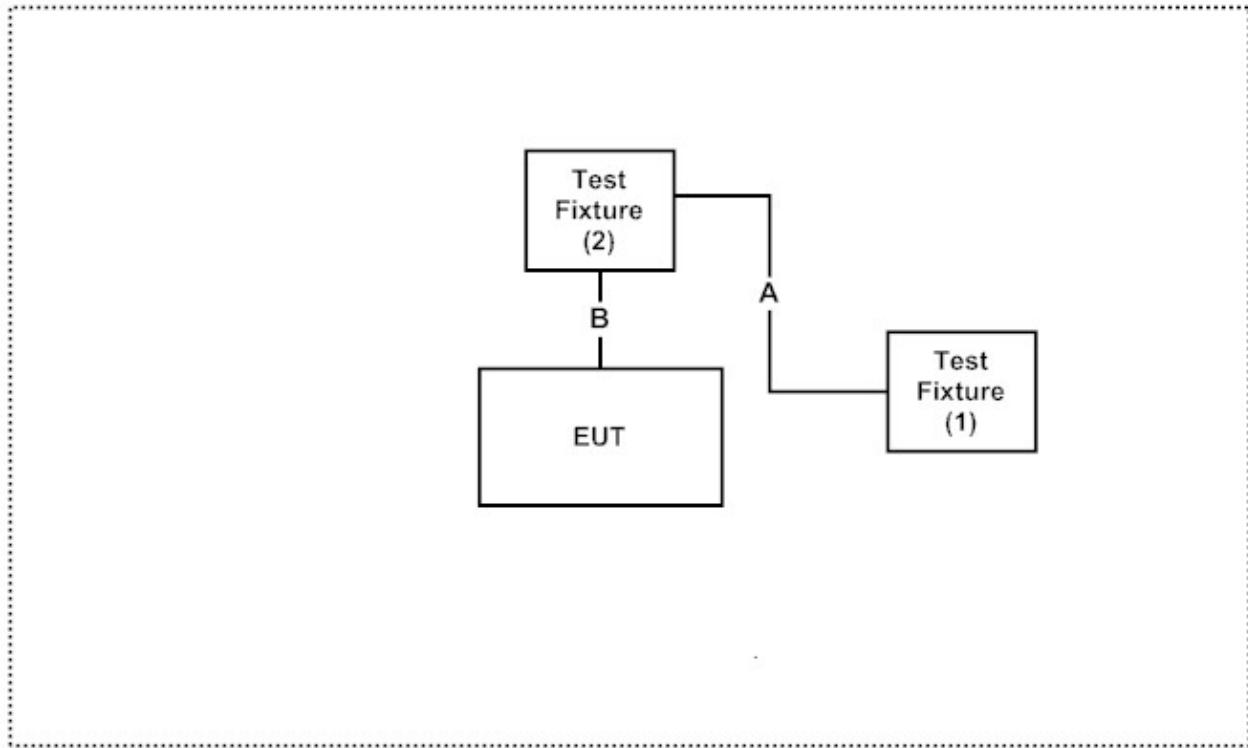
### 1.3. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

	Product	Manufacturer	Model No.	Serial No.	Power Cord
1	Test Fixture	Smart Approach Co.,Ltd.	N/A	N/A	N/A
2	Test Fixture	Smart Approach Co.,Ltd.	N/A	N/A	N/A

Signal Cable Type	Signal cable Description
A Signal Cable	Non Shielded, 0.7m
B Signal Cable	Non Shielded, 0.1m or 0.15m

### 1.4. Configuration of tested System



### 1.5. EUT Exercise Software

- (1) Setup the EUT as shown in section 1.4
- (2) Provides the power source, start continuous receiver
- (3) Verify that the EUT works correctly.

## 1.6. Test Facility

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (% RH)	25-75	50-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from QuieTek Corporation's Web Site: <http://www.quietek.com/tw/ctg/cts/accreditations.htm>

The address and introduction of QuieTek Corporation's laboratories can be founded in our Web site:  
<http://www.quietek.com/>

Site Description: File on  
Federal Communications Commission  
FCC Engineering Laboratory  
7435 Oakland Mills Road  
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Registration Number: 92195

Site Name: Quietek Corporation  
Site Address: No.5-22, Ruishukeng,  
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Taiwan, R.O.C.  
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E-Mail : [service@quietek.com](mailto:service@quietek.com)

FCC Accreditation Number: TW1014

## 2. Conducted Emission

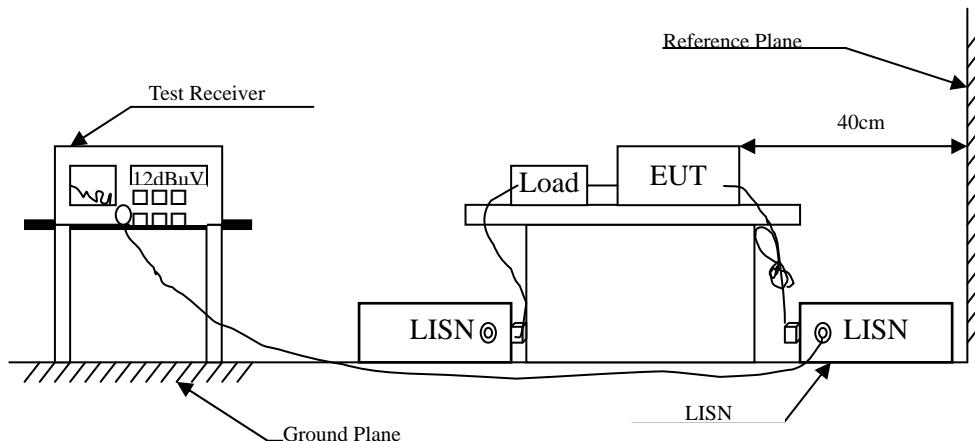
### 2.1. Test Equipment

Equipment	Manufacturer	Model No. / Serial No.	Last Cal.	Remark
X Test Receiver	R & S	ESCS 30 / 825442/018	Sep., 2013	
X Artificial Mains Network	R & S	ENV4200 / 848411/10	Feb., 2014	Peripherals
X LISN	R & S	ESH3-Z5 / 825562/002	Feb., 2014	EUT
DC LISN	Schwarzbeck	8226 / 176	Mar, 2013	EUT
X Pulse Limiter	R & S	ESH3-Z2 / 357.8810.52	Feb., 2014	
No.1 Shielded Room				

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked by “X” are used to measure the final test results.

### 2.2. Test Setup



## 2.3. Limits

<b>FCC Part 15 Subpart C Paragraph 15.207 (dBuV) Limit</b>		
Frequency MHz	Limits	
	QP	AV
0.15 - 0.50	66-56 <sub>(±)</sub>	56-46 <sub>(±)</sub>
0.50-5.0	56	46
5.0 - 30	60	50

## 2.4. Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm Cableination. (Please refers to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2009 on conducted measurement.

Conducted emissions were invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

## 2.5. Uncertainty

± 2.26 dB

## 2.6. Test Result of Conducted Emission

Product : NFC Antenna Module  
 Test Item : Conducted Emission Test  
 Power Line : Line 1  
 Test Mode : Mode 1: Transmit mode (10pin)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV	dB	dBuV
<b>LINE 1</b>					
<b>Quasi-Peak</b>					
0.177	9.742	36.370	46.112	-19.117	65.229
0.240	9.740	29.210	38.950	-24.479	63.429
0.298	9.743	24.810	34.553	-27.218	61.771
0.365	9.746	12.770	22.516	-37.341	59.857
0.541	9.754	16.000	25.754	-30.246	56.000
1.189	9.784	8.030	17.814	-38.186	56.000
<b>Average</b>					
0.177	9.742	31.300	41.042	-14.187	55.229
0.240	9.740	18.920	28.660	-24.769	53.429
0.298	9.743	10.910	20.653	-31.118	51.771
0.365	9.746	1.060	10.806	-39.051	49.857
0.541	9.754	8.240	17.994	-28.006	46.000
1.189	9.784	6.760	16.544	-29.456	46.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. " █ " means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : NFC Antenna Module  
 Test Item : Conducted Emission Test  
 Power Line : Line 2  
 Test Mode : Mode 1: Transmit mode (10pin)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV	dB	dBuV
<b>LINE 2</b>					
<b>Quasi-Peak</b>					
0.177	9.748	36.230	45.978	-19.251	65.229
0.240	9.750	29.030	38.780	-24.649	63.429
0.298	9.746	23.620	33.367	-28.404	61.771
0.541	9.754	13.800	23.554	-32.446	56.000
9.759	9.950	16.520	26.470	-33.530	60.000
13.209	9.990	18.890	28.880	-31.120	60.000
<b>Average</b>					
0.177	9.748	31.610	41.358	-13.871	55.229
0.240	9.750	22.410	32.160	-21.269	53.429
0.298	9.746	16.870	26.617	-25.154	51.771
0.541	9.754	7.420	17.174	-28.826	46.000
9.759	9.950	11.090	21.040	-28.960	50.000
13.209	9.990	6.880	16.870	-33.130	50.000

**Note:**

1. All Reading Levels are Quasi-Peak and average value.
2. "  " means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : NFC Antenna Module  
 Test Item : Conducted Emission Test  
 Power Line : Line 1  
 Test Mode : Mode 1: Transmit mode (8pin)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV	dB	dBuV
<b>LINE 1</b>					
<b>Quasi-Peak</b>					
0.181	9.698	34.510	44.208	-20.906	65.114
0.306	9.704	37.930	47.634	-13.909	61.543
0.369	9.706	29.790	39.496	-20.247	59.743
0.595	9.717	22.040	31.757	-24.243	56.000
10.068	9.880	24.070	33.950	-26.050	60.000
13.545	9.890	13.810	23.700	-36.300	60.000
<b>Average</b>					
0.181	9.698	26.690	36.388	-18.726	55.114
0.306	9.704	27.510	37.214	-14.329	51.543
0.369	9.706	23.310	33.016	-16.727	49.743
0.595	9.717	8.710	18.427	-27.573	46.000
10.068	9.880	18.240	28.120	-21.880	50.000
13.545	9.890	7.580	17.470	-32.530	50.000

**Note:**

1. All Reading Levels are Quasi-Peak and average value.
2. "  " means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : NFC Antenna Module  
 Test Item : Conducted Emission Test  
 Power Line : Line 2  
 Test Mode : Mode 1: Transmit mode (8pin)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV	dB	dBuV
<b>LINE 2</b>					
<b>Quasi-Peak</b>					
0.306	9.684	37.890	47.574	-13.969	61.543
0.392	9.687	29.620	39.307	-19.779	59.086
1.091	9.729	18.200	27.929	-28.071	56.000
2.482	9.790	13.850	23.640	-32.360	56.000
10.068	9.890	14.320	24.210	-35.790	60.000
13.545	9.940	13.650	23.590	-36.410	60.000
<b>Average</b>					
0.306	9.684	23.630	33.314	-18.229	51.543
0.392	9.687	21.370	31.057	-18.029	49.086
1.091	9.729	7.270	16.999	-29.001	46.000
2.482	9.790	2.710	12.500	-33.500	46.000
10.068	9.890	14.310	24.200	-25.800	50.000
13.545	9.940	7.920	17.860	-32.140	50.000

**Note:**

1. All Reading Levels are Quasi-Peak and average value.
2. " █ " means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

### 3. Radiated Emission

#### 3.1. Test Equipment

The following test equipment are used during the radiated emission test:

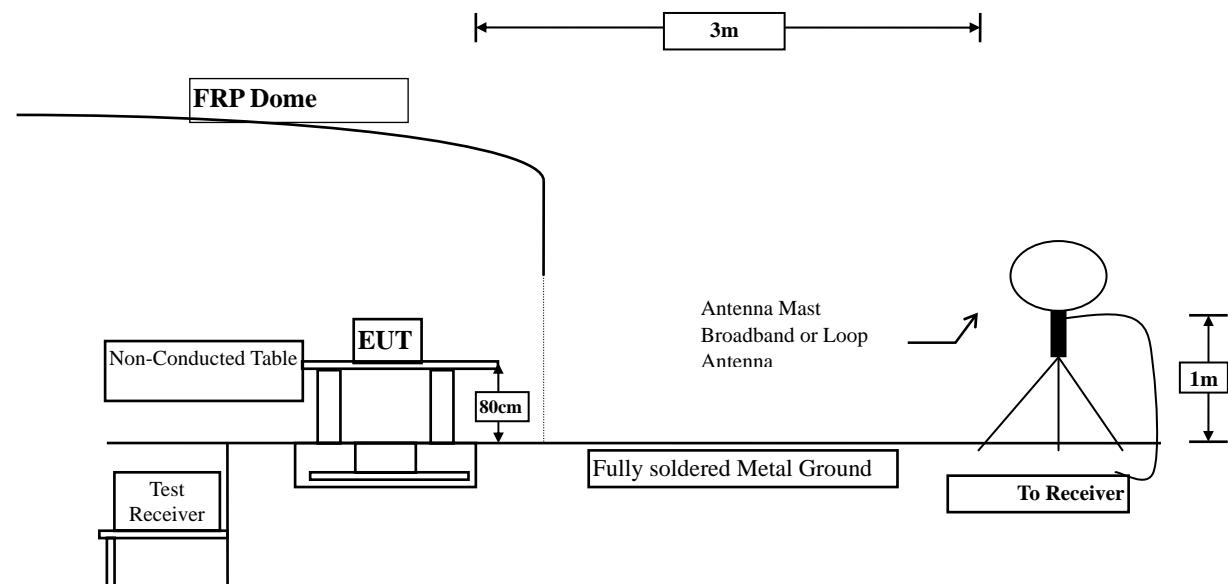
Test Site	Equipment		Manufacturer	Model No./Serial No.	Last Cal.
☒ Site # 3	X	Loop Antenna	Teseq	HLA6120 / 26739	Jul., 2013
	X	Bilog Antenna	Schaffner Chase	CBL6112B/2673	Sep., 2013
	X	Horn Antenna	Schwarzbeck	BBHA9120D/D305	Sep., 2013
		Horn Antenna	Schwarzbeck	BBHA9170/208	Jul., 2013
	X	Pre-Amplifier	Agilent	8447D/2944A09549	Sep., 2013
	X	Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2013
	X	Test Receiver	R & S	ESCS 30/ 825442/018	Sep., 2013
	X	Coaxial Cable	QuieTek	QTK-CABLE/ CAB5	Feb., 2014
	X	Controller	QuieTek	QTK-CONTROLLER/ CTRL3	N/A
	X	Coaxial Switch	Anritsu	MP59B/6200265729	N/A

Note: 1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

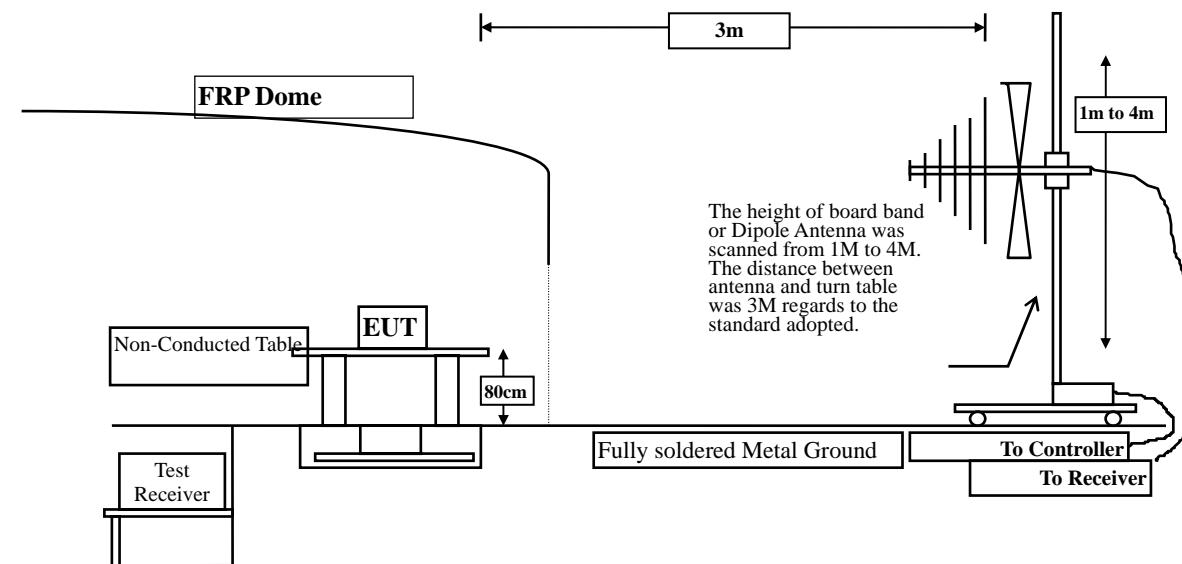
2. The test instruments marked with “X” are used to measure the final test results.

#### 3.2. Test Setup

9kHz~30MHz



30MHz~1GHz



### 3.3. Limits

#### ► Fundamental electric field strength Limit

FCC Part 15 Subpart C Paragraph 15.225 Limits				
Fundamental Frequency MHz	Field strength of fundamental			
	uV/m	Distance (meter)	dBuV/m	Distance (meter)
13.553 – 13.567	15848	30	124	3
13.410 – 13.553 and 13.567 – 13.710	334	30	90.47	3
13.110 – 13.410 and 13.710 – 14.010	106	30	80.50	3
Outside of the 13.110 – 14.010	See 15.209 Limits			

Remarks : 1. RF Voltage (dBuV) =  $20 \log \text{RF Voltage (uV)}$

2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
3. The emission limit in this paragraph is based on measurement instrumentation employing an average detector.

## ➤ Spurious electric field strength Limit

FCC Part 15 Subpart C Paragraph 15.209 Limits			
Frequency MHz	uV/m	dBuV/m	Measurement distance (meter)
0.009-0.490	2400/F(kHz)	See Remark <sup>1</sup>	300
0.490-1.705	24000/F(kHz)	See Remark <sup>1</sup>	30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

Remarks : 1. RF Voltage (dBuV) =  $20 \log \text{RF Voltage (uV)}$

2. In the Above Table, the tighter limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

### **3.4. Test Procedure**

#### **Fundamental electric field strength:**

The EUT and its simulators are placed on a turn table which is 1 meter above ground. The turn

table can rotate 360 degrees to determine the position of the maximum electric field strength.

The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna which is 1 meter above ground. All X-axis, Y-axis and Z-axis polarization of the antenna are set on measurement.

#### **Spurious electric field strength:**

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10 on radiated measurement.

On any frequency the radiated limits shown are based upon the use of measurement instrumentation employing an average detector function. When average radiated emission measurement are included emission measurement below 1000 MHz, there also is a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.

The bandwidth below 30MHz setting on the field strength meter is 9kHz and above 30MHz is 120kHz.

The frequency range from 9kHz to 10th harmonics is checked.

### **3.5. Uncertainty**

± 2.6 dB below 30MHz

± 3.8 dB above 30MHz

### 3.6. Test Result of Radiated Emission

Product : NFC Antenna Module  
 Test Item : Fundamental Radiated Emission  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit mode

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
<b>X-axis</b>					
<b>Quasi-Peak</b>					
<b>Horizontal</b>					
13.560	21.158	27.400	48.558	-75.442	124.000
<b>Vertical</b>					
13.560	21.158	28.900	50.058	-73.942	124.000
<b>Y-axis</b>					
<b>Quasi-Peak</b>					
<b>Horizontal</b>					
13.560	21.158	36.700	57.858	-66.142	124.000
<b>Vertical</b>					
13.560	21.158	36.800	57.958	-66.042	124.000
<b>Z-axis</b>					
<b>Quasi-Peak</b>					
<b>Horizontal</b>					
13.560	21.158	35.600	56.758	-67.242	124.000
<b>Vertical</b>					
13.560	21.158	35.500	56.658	-67.342	124.000

Note:

1. Limit=84dBuV/m + 40\*Log (30(m)/3(m))=124dBuV/m
2. Quasi-Peak detector was used for each measurement level.
3. Measurement Level = Reading Level + Correct Factor.
4. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

Product : NFC Antenna Module  
 Test Item : General Radiated Emission Data (below 30MHz)  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit mode (10pin)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
<b>Quasi-Peak</b>					
<b>Horizontal</b>					
27.120	20.560	7.200	27.760	-41.780	69.540
<b>Vertical</b>					
27.120	20.560	13.700	34.260	-35.280	69.540

Note:

1. Limit=29.54dBuV/m + 40\*Log (30(m)/3(m))=69.54dBuV/m
2. Quasi-Peak detector was used for each measurement level.
3. “” means the worst emission level.
4. Measurement Level = Reading Level + Correct Factor.

Product : NFC Antenna Module  
 Test Item : General Radiated Emission Data (below 30MHz)  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit mode (8pin)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
<b>Quasi-Peak</b>					
<b>Horizontal</b>					
27.120	20.560	7.000	27.560	-41.980	69.540
<b>Vertical</b>					
27.120	20.560	13.700	34.260	-35.280	69.540

Note:

1. Limit=29.54dBuV/m + 40\*Log (30(m)/3(m))=69.54dBuV/m
2. Quasi-Peak detector was used for each measurement level.
3. “” means the worst emission level.
4. Measurement Level = Reading Level + Correct Factor.

Product : NFC Antenna Module  
 Test Item : General Radiated Emission Data (above 30MHz)  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit mode (10pin)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m

### Horizontal

#### QP Detector

90.625	-19.834	49.365	29.531	-13.969	43.500
311.362	-16.661	50.102	33.440	-12.560	46.000
479.247	-10.439	41.061	30.622	-15.378	46.000
552.308	-7.809	31.091	23.282	-22.718	46.000
672.003	-6.470	35.879	29.409	-16.591	46.000
888.077	-5.757	30.834	25.077	-20.923	46.000

### Vertical

#### QP Detector

294.263	-17.882	46.074	28.192	-17.808	46.000
392.196	-12.135	45.322	33.187	-12.813	46.000
479.247	-11.590	39.833	28.243	-17.757	46.000
586.506	-9.343	32.811	23.469	-22.531	46.000
793.253	-7.374	29.242	21.869	-24.131	46.000
942.484	-4.768	30.147	25.379	-20.621	46.000

### Note:

1. Quasi-Peak detector was used for each measurement level.
2. “ ” means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : NFC Antenna Module  
 Test Item : General Radiated Emission Data (above 30MHz)  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit mode (8pin)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m

### Horizontal

#### QP Detector

121.715	-21.369	54.297	32.928	-10.572	43.500
284.936	-17.388	52.543	35.155	-10.845	46.000
393.750	-11.212	44.178	32.966	-13.034	46.000
501.010	-10.061	46.394	36.333	-9.667	46.000
637.804	-5.935	38.816	32.881	-13.119	46.000
855.433	-5.821	35.775	29.954	-16.046	46.000

### Vertical

#### QP Detector

179.231	-14.611	42.586	27.975	-15.525	43.500
365.769	-13.973	44.237	30.263	-15.737	46.000
501.010	-11.342	46.327	34.985	-11.015	46.000
637.804	-8.657	38.733	30.076	-15.924	46.000
827.452	-6.559	34.812	28.254	-17.746	46.000
909.840	-4.917	33.803	28.885	-17.115	46.000

Note:

1. Quasi-Peak detector was used for each measurement level.
2. “ ” means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

## 4. Band Edge

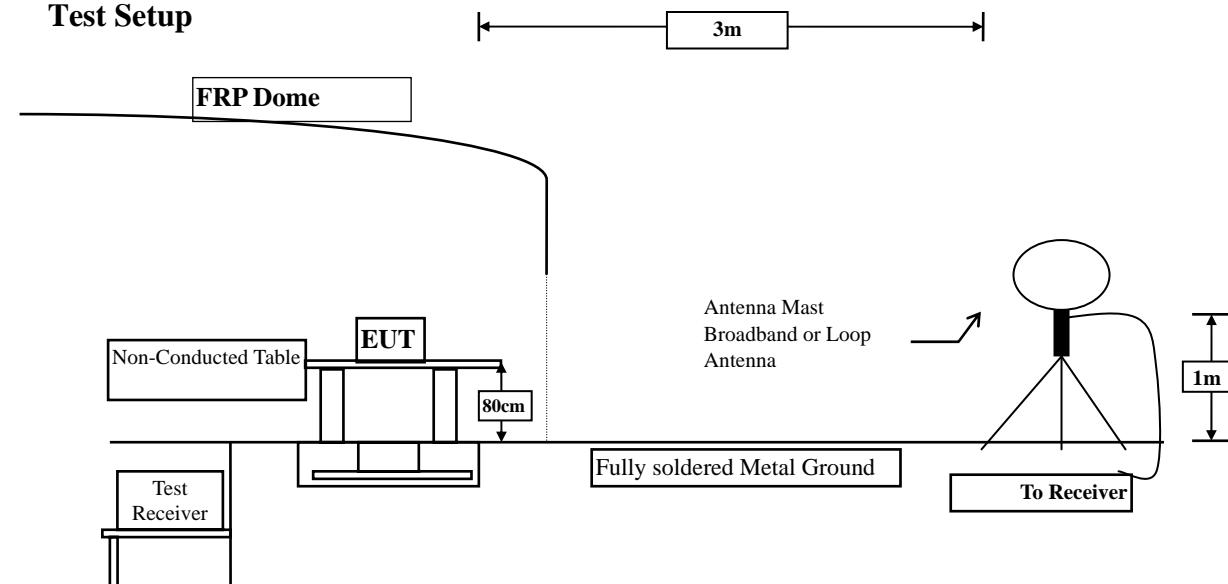
### 4.1. Test Equipment

The following test equipments are used during the band edge tests:

Test Site	Equipment		Manufacturer	Model No./Serial No.	Last Cal.
☒Site # 3	X	Loop Antenna	Teseq	HLA6120 / 26739	Jul., 2013
		Bilog Antenna	Schaffner Chase	CBL6112B/2673	Sep., 2013
		Horn Antenna	Schwarzbeck	BBHA9120D/D305	Sep., 2013
		Horn Antenna	Schwarzbeck	BBHA9170/208	Jul., 2013
		Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2013
		Pre-Amplifier	QTK	AP-180C / CHM_0906076	Sep., 2013
		Pre-Amplifier	MITEQ	AMF-4D-180400-45-6P/925975	Mar, 2013
	X	Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2013
	X	Test Receiver	R & S	ESCS 30/ 825442/018	Sep., 2013
	X	Coaxial Cable	QuiTek	QTK-CABLE/ CAB5	Feb., 2014
	X	Controller	QuiTek	QTK-CONTROLLER/ CTRL3	N/A
	X	Coaxial Switch	Anritsu	MP59B/6200265729	N/A

Note: 1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.  
2. The test instruments marked with "X" are used to measure the final test results.

### 4.2. Test Setup



#### **4.3. Limits**

In any 9 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 50 dB below that in the 9 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

#### **4.4. Test Procedure**

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10 on radiated measurement.

The bandwidth below 30MHz setting on the field strength meter is 9kHz and above 30MHz is 120kHz.

#### **4.5. Uncertainty**

Radiated is  $\pm$  2.6 dB

#### 4.6. Test Result of Band Edge

Product : NFC Antenna Module  
 Test Item : Band Edge Data  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit mode

#### RF Radiated Measurement

##### (Horizontal)- Quasi-Peak

Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	QP Limit (dBuV/m)	Result
13.110	21.110	14.300	35.410	69.540	Pass
13.360	21.140	8.500	29.640	69.540	Pass
13.410	21.140	7.500	28.640	69.540	Pass
14.010	21.200	10.000	31.200	69.540	Pass

Note:

1. Quasi-Peak detector was used for each measurement level.
2. “ ” means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

##### (Vertical)- Quasi-Peak

Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	QP Limit (dBuV/m)	Result
13.110	21.110	10.700	31.810	69.540	Pass
13.360	21.140	6.400	27.540	69.540	Pass
13.410	21.140	7.300	28.440	69.540	Pass
14.010	21.200	7.900	29.100	69.540	Pass

Note:

1. Quasi-Peak detector was used for each measurement level.
2. “ ” means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

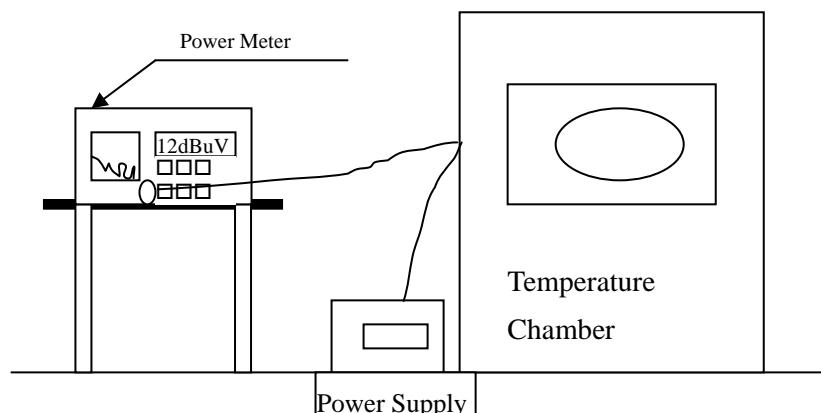
## 5. Frequency Tolerance

### 5.1. Test Equipment

Equipment	Manufacturer	Model No./Serial No.	Last Cal.
Spectrum Analyzer	R&S	FSP40 / 100170	Jun, 2013
Spectrum Analyzer	Agilent	E4407B / US39440758	Jun, 2013
X Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2013
X Temperature Chamber	TDE	CHM 150CT	March, 2013

Note: All equipments are calibrated every one year.

### 5.2. Test Setup



### 5.3. Limits

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

### 5.4. Test Procedure

The over 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.

### 5.5. Uncertainty

$\pm 150$  Hz

## 5.6. Test Result of Frequency Stability

Product : NFC Antenna Module  
 Test Item : Frequency Tolerance  
 Test Site : Temperature Chamber  
 Test Mode : Mode 1: Transmit mode

Temperature (°C)	Voltage (V)	Observe Time	Declared Frequency (MHz)	Read Frequency (MHz)	Tolerance (%)	Limit (%)
20	3.3	start	13.56	13.56014	0.001018	± 0.01 %
		2mins	13.56	13.56014	0.001018	
		5mins	13.56	13.56016	0.001143	
		10mins	13.56	13.56014	0.001047	
20	3.795	start	13.56	13.56017	0.001283	± 0.01 %
		2mins	13.56	13.56017	0.001283	
		5mins	13.56	13.56018	0.001291	
		10mins	13.56	13.56017	0.001276	
20	2.805	start	13.56	13.56022	0.001622	± 0.01 %
		2mins	13.56	13.56021	0.001563	
		5mins	13.56	13.56022	0.001630	
		10mins	13.56	13.56021	0.001571	
50	3.3	start	13.56	13.56014	0.001062	± 0.01 %
		2mins	13.56	13.56014	0.001062	
		5mins	13.56	13.56015	0.001069	
		10mins	13.56	13.56015	0.001091	
40	3.3	start	13.56	13.56017	0.001232	± 0.01 %
		2mins	13.56	13.56017	0.001268	
		5mins	13.56	13.56017	0.001261	
		10mins	13.56	13.56017	0.001254	
30	3.3	start	13.56	13.56016	0.001158	± 0.01 %
		2mins	13.56	13.56016	0.001165	
		5mins	13.56	13.56016	0.001165	
		10mins	13.56	13.56016	0.001165	

10	3.3	start	13.56	13.56016	0.001143	± 0.01 %
		2mins	13.56	13.56016	0.001143	
		5mins	13.56	13.56016	0.001143	
		10mins	13.56	13.56016	0.001143	
0	3.3	start	13.56	13.56022	0.001637	± 0.01 %
		2mins	13.56	13.56022	0.001637	
		5mins	13.56	13.56022	0.001637	
		10mins	13.56	13.56022	0.001637	
-10	3.3	start	13.56	13.56019	0.001379	± 0.01 %
		2mins	13.56	13.56019	0.001394	
		5mins	13.56	13.56019	0.001386	
		10mins	13.56	13.56019	0.001379	
-20	3.3	start	13.56	13.56021	0.001556	± 0.01 %
		2mins	13.56	13.56021	0.001571	
		5mins	13.56	13.56021	0.001578	
		10mins	13.56	13.56022	0.001600	

## **6. EMI Reduction Method During Compliance Testing**

No modification was made during testing.

## Attachment 1: EUT Test Photographs

## Attachment 2: EUT Detailed Photographs