FCC Test Report

Product Name	NFC Antenna Module
Model No.	MAN02
FCC ID	2AAYI-MAN02NFCAM

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

Date of Receipt	June. 14, 2013
Issued Date	Sep. 02, 2013
Report No.	136264R-RFUSP39V01
Report Version	V1.0

Testing Laboratory
0914

Test Report Certification

Issued Date: Sep. 02, 2013
Report No.: 136264R-RFUSP39V01

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.	MAN02
FCC ID.	2AAYI-MAN02NFCAM
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 C63.4: 2003, ANSI C63.10: 2009
Test Result	Complied

Test results relate only to the samples tested.
The test report shall not be reproduced except in full without the written approval of QuieTek Corporation.
This report must not be used to claim product endorsement by TAF or any agency of the U.S. Government

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(Senior Adm. Specialist / Rita Huang)

Tested By : Andy Lin
(Engineer / Andy Lin)

Approved By :
(Manager / Vincent Lin)

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1. GENERAL INFORMATION

1.1. EUT Description

Product Name	NFC Antenna Module
Trade Name	Smart Approach Co.,Ltd.
Model No.	MAN02
FCC ID	2AAYI-MAN02NFCAM
Frequency Range	13.56MHz
Modulation	ASK
Antenna Type	Loop Antenna

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. The EUT with 2 kinds of connection cable. (Long cable and short cable)
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

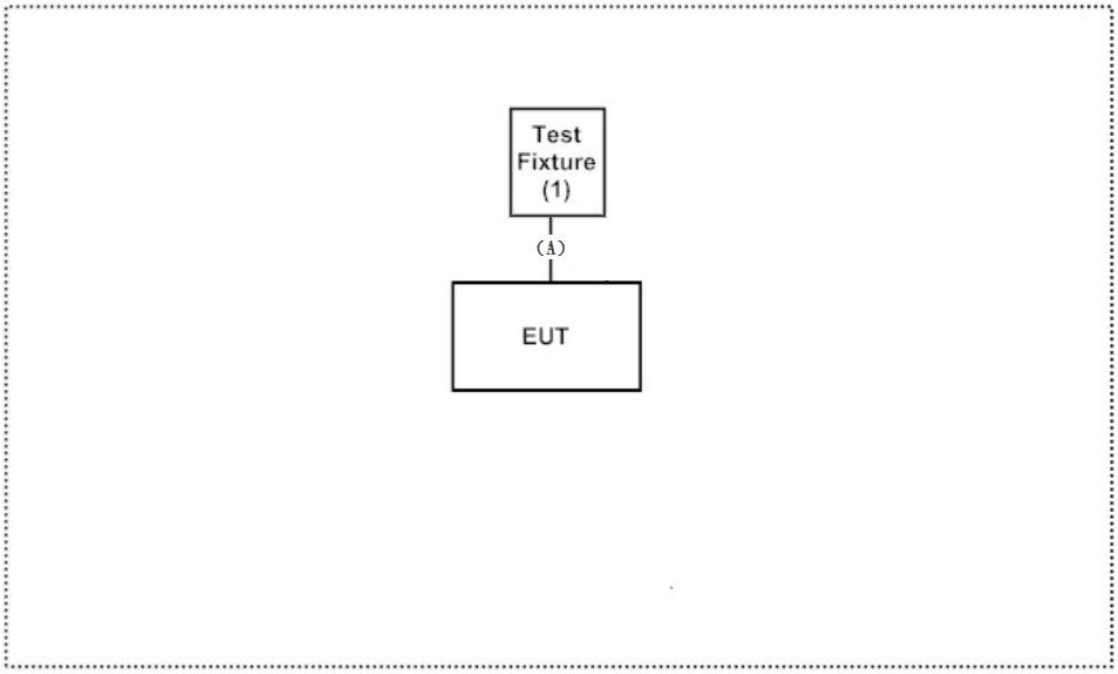
1.3. Tested System Datails

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

Signal Cable Type		Signal cable Description
A	Signal Cable (For Long cable)	Non Shielded, 0.06m
A	Signal Cable (For Short cable)	Non Shielded, 0.6m

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
Columbia, MD 21046
Registration Number: 92195

Site Name: Quietek Corporation
Site Address: No.5-22, Ruishukeng,
Linkou Dist. New Taipei City 24451,
Taiwan, R.O.C.
TEL: 886-2-8601-3788 / FAX : 886-2-8601-3789
E-Mail : service@quietek.com

FCC Accreditation Number: TW1014

2. Conducted Emission

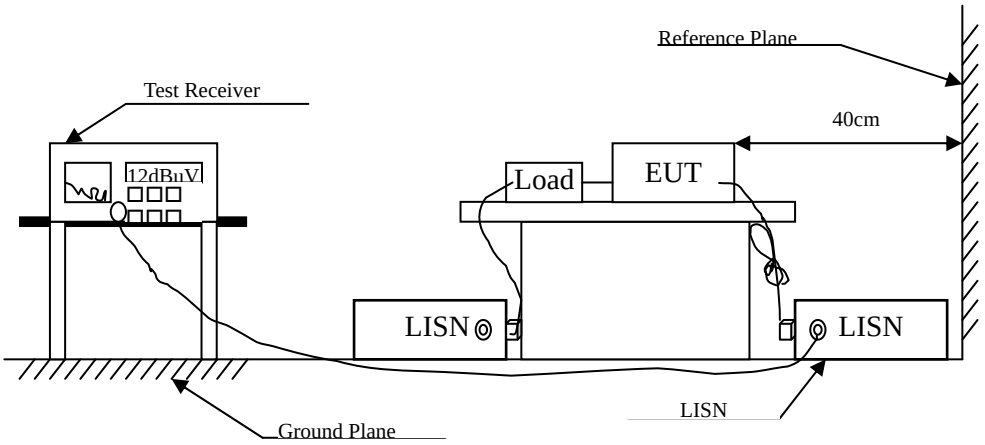
2.1. Test Equipment

	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., 2013	Peripherals
X	LISN	R & S	ESH3-Z5 / 825562/002	Feb., 2013	EUT
	DC LISN	Schwarzbeck	8226 / 176	Mar, 2013	EUT
X	Pulse Limiter	R & S	ESH3-Z2 / 357.8810.52	Feb., 2013	
	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

FCC Part 15 Subpart C Paragraph 15.207 (dBuV) Limit		
Frequency MHz	Limits	
	QP	AV
0.15 - 0.50	66-56(※)	56-46(※)
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 (Short-Cable)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV	dB	dBuV
LINE 1					
Quasi-Peak					
0.240	9.900	37.900	47.800	-15.629	63.429
0.326	9.870	40.880	50.750	-10.221	60.971
0.478	9.856	40.470	50.326	-6.303	56.629
0.650	9.790	40.580	50.370	-5.630	56.000
0.974	9.780	38.890	48.670	-7.330	56.000
1.427	9.750	37.660	47.410	-8.590	56.000
Average					
0.240	9.900	29.590	39.490	-13.939	53.429
0.326	9.870	32.170	42.040	-8.931	50.971
0.478	9.856	33.600	43.456	-3.173	46.629
0.650	9.790	31.470	41.260	-4.740	46.000
0.974	9.780	30.860	40.640	-5.360	46.000
1.427	9.750	27.090	36.840	-9.160	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 (Short-Cable)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV	dB	dBuV
LINE 2					
Quasi-Peak					
0.240	9.757	39.930	49.687	-13.742	63.429
0.970	9.790	38.280	48.070	-7.930	56.000
1.427	9.800	36.680	46.480	-9.520	56.000
1.662	9.800	35.080	44.880	-11.120	56.000
3.091	9.880	30.040	39.920	-16.080	56.000
4.283	9.950	28.210	38.160	-17.840	56.000
Average					
0.240	9.757	31.250	41.007	-12.422	53.429
0.970	9.790	30.610	40.400	-5.600	46.000
1.427	9.800	27.470	37.270	-8.730	46.000
1.662	9.800	27.530	37.330	-8.670	46.000
3.091	9.880	20.190	30.070	-15.930	46.000
4.283	9.950	15.100	25.050	-20.950	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 1
Test Mode : Mode 1: Transmit mode (Long-Cable)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV	dB	dBuV
LINE 1					
Quasi-Peak					
0.236	9.900	38.740	48.640	-14.903	63.543
0.474	9.855	39.590	49.445	-7.298	56.743
0.646	9.790	41.210	51.000	-5.000	56.000
1.189	9.767	33.110	42.877	-13.123	56.000
1.642	9.745	28.630	38.375	-17.625	56.000
2.615	9.750	29.370	39.120	-16.880	56.000
Average					
0.236	9.900	30.680	40.580	-12.963	53.543
0.474	9.855	30.120	39.975	-6.768	46.743
0.646	9.790	32.280	42.070	-3.930	46.000
1.189	9.767	23.770	33.537	-12.463	46.000
1.642	9.745	2.240	11.985	-34.015	46.000
2.615	9.750	11.800	21.550	-24.450	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 (Long-Cable)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV	dB	dBuV
LINE 2					
Quasi-Peak					
0.322	9.754	42.760	52.514	-8.572	61.086
0.478	9.766	40.660	50.426	-6.203	56.629
0.642	9.751	38.430	48.181	-7.819	56.000
0.951	9.784	32.960	42.744	-13.256	56.000
1.670	9.800	35.630	45.430	-10.570	56.000
2.627	9.850	31.000	40.850	-15.150	56.000
Average					
0.322	9.754	33.680	43.434	-7.652	51.086
0.478	9.766	31.000	40.766	-5.863	46.629
0.642	9.751	26.560	36.311	-9.689	46.000
0.951	9.784	24.440	34.224	-11.776	46.000
1.670	9.800	27.280	37.080	-8.920	46.000
2.627	9.850	18.210	28.060	-17.940	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

3. Radiated Emission

3.1. Test Equipment

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

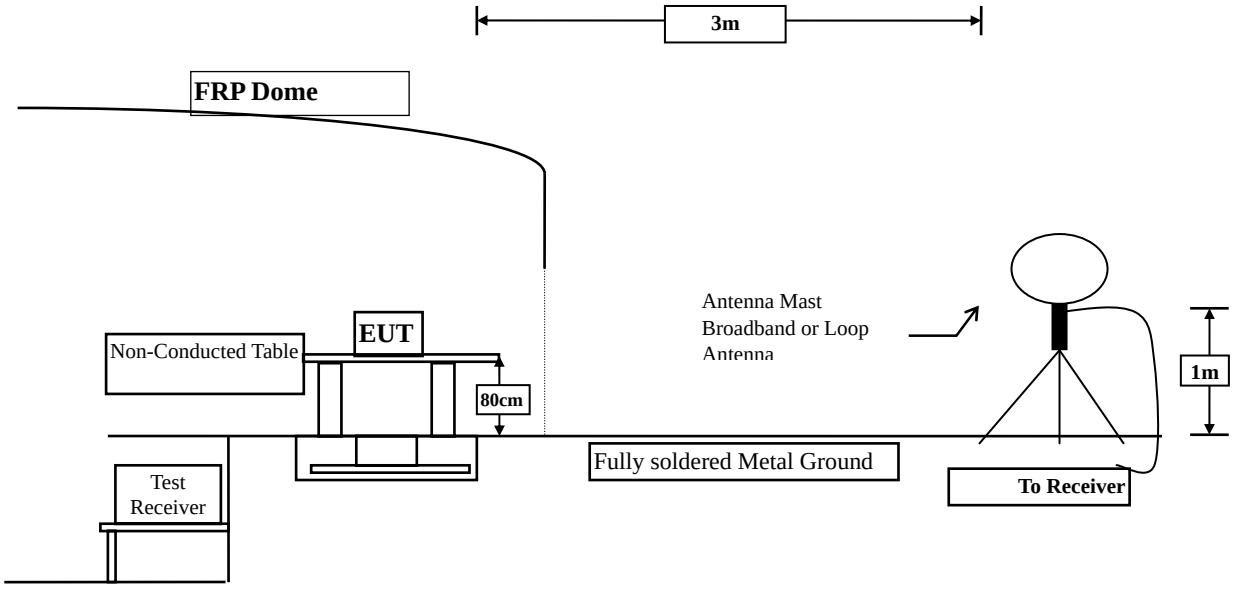
Test Site		Equipment	Manufacturer	Model No./Serial No.	Last Cal.
☒Site # 3	X	Loop Antenna	Teseq	HLA6120 / 26739	Jul., 2013
	X	Bilog Antenna	Schaffner Chase	CBL6112B/2673	Sep., 2013
	X	Horn Antenna	Schwarzbeck	BBHA9120D/D305	Sep., 2013
		Horn Antenna	Schwarzbeck	BBHA9170/208	Jul., 2013
	X	Pre-Amplifier	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., 2013
	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.

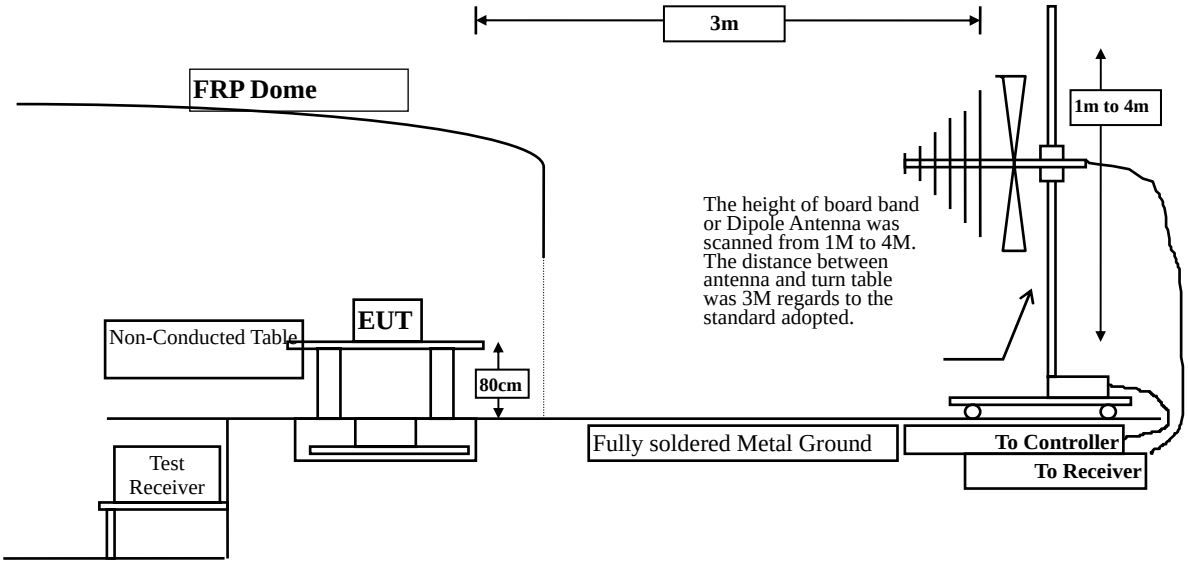
2. The test instruments marked with "X" are used to measure the final test results.

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 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[1]	300
0.490-1.705	24000/F(kHz)	See Remark[1]	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 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 deCableine 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 deCableine 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
X-axis					
Quasi-Peak					
Horizontal					
13.560	21.158	27.700	48.858	-75.142	124.000
Vertical					
13.560	21.158	34.900	56.058	-67.942	124.000
Y-axis					
Quasi-Peak					
Horizontal					
13.560	21.158	38.500	59.658	-64.342	124.000
Vertical					
13.560	21.158	40.300	61.458	-62.542	124.000
Z-axis					
Quasi-Peak					
Horizontal					
13.560	21.158	36.600	57.758	-66.242	124.000
Vertical					
13.560	21.158	38.300	59.458	-64.542	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 (Short-Cable)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Quasi-Peak					
Horizontal					
27.120	20.560	0.100	20.660	-48.880	69.540
Vertical					
27.120	20.560	2.200	22.760	-46.780	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 (Long-Cable)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Quasi-Peak					
Horizontal					
27.120	20.560	2.100	22.660	-46.880	69.540
Vertical					
27.120	20.560	3.700	24.260	-45.280	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 (Short-Cable)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
QP Detector					
121.180	-9.834	30.744	20.910	-22.590	43.500
379.200	-1.005	30.115	29.109	-16.891	46.000
433.520	-1.972	33.010	31.038	-14.962	46.000
460.680	1.589	32.298	33.887	-12.113	46.000
615.880	3.215	27.592	30.807	-15.193	46.000
868.080	5.401	26.482	31.883	-14.117	46.000
Vertical					
QP Detector					
39.700	-1.056	31.636	30.580	-9.420	40.000
99.840	-0.021	25.642	25.621	-17.879	43.500
344.280	-3.171	26.811	23.641	-22.359	46.000
511.120	-0.261	24.485	24.224	-21.776	46.000
689.600	2.538	23.736	26.274	-19.726	46.000
970.900	7.302	22.885	30.187	-23.813	54.000

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 (Long-Cable)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
QP Detector					
45.545	-16.107	46.346	30.239	-9.761	40.000
244.519	-18.479	40.054	21.575	-24.425	46.000
460.593	-11.041	39.687	28.646	-17.354	46.000
623.814	-6.360	29.160	22.800	-23.200	46.000
729.519	-6.767	29.179	22.412	-23.588	46.000
895.849	-6.110	40.094	33.984	-12.016	46.000
922.276	-5.912	37.308	31.395	-14.605	46.000
Vertical					
QP Detector					
39.320	-8.649	35.800	27.151	-12.849	40.000
176.122	-16.027	37.762	21.735	-21.765	43.500
435.721	-12.133	27.697	15.564	-30.436	46.000
706.202	-8.818	27.654	18.836	-27.164	46.000
892.740	-5.147	27.968	22.821	-23.179	46.000
953.365	-4.829	28.272	23.443	-22.557	46.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above are average value.
2. “ ” means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

4. Band Edge

4.1. Test Equipment

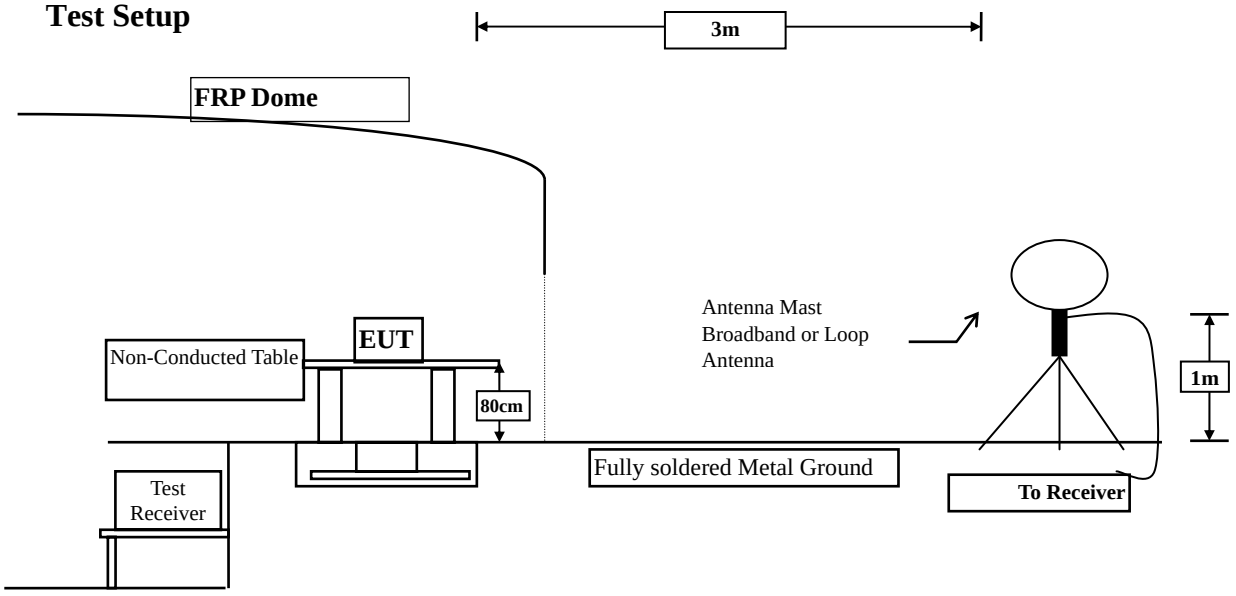
The following test equipments are used during the band edge tests:

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., 2012
	X	Coaxial Cable	QuieTek	QTK-CABLE/ CAB5	Feb., 2013
	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.

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 deCableine 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 ± 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	14.800	35.910	69.540	Pass
13.360	21.140	9.900	31.040	69.540	Pass
13.410	21.140	10.600	31.740	69.540	Pass
14.010	21.200	5.800	27.000	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	18.100	39.210	69.540	Pass
13.360	21.140	11.000	32.140	69.540	Pass
13.410	21.140	11.300	32.440	69.540	Pass
14.010	21.200	5.600	26.800	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

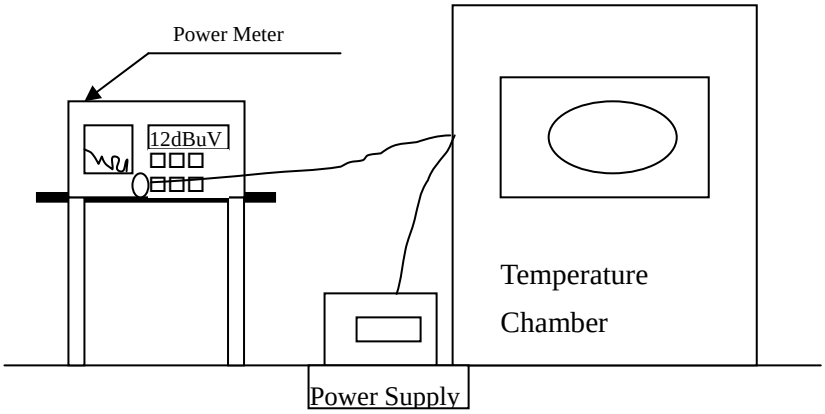
5. Frequency Tolerance

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 ±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

± 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 (℃)	Voltage (V)	Observe Time	Declared Frequency (MHz)	Read Frequency (MHz)	Tolerance (%)	Limit (%)
20	3.3	start	13.56	13.56021	0.001549	± 0.01 %
		2mins	13.56	13.56021	0.001549	
		5mins	13.56	13.56021	0.001549	
		10mins	13.56	13.56021	0.001549	
20	3.975	start	13.56	13.56021	0.001549	± 0.01 %
		2mins	13.56	13.56021	0.001549	
		5mins	13.56	13.56021	0.001549	
		10mins	13.56	13.56021	0.001549	
20	2.805	start	13.56	13.56019	0.001386	± 0.01 %
		2mins	13.56	13.56019	0.001386	
		5mins	13.56	13.56019	0.001386	
		10mins	13.56	13.56019	0.001386	
50	3.3	start	13.56	13.56024	0.001770	± 0.01 %
		2mins	13.56	13.56024	0.001770	
		5mins	13.56	13.56024	0.001770	
		10mins	13.56	13.56024	0.001770	
40	3.3	start	13.56	13.56019	0.001401	± 0.01 %
		2mins	13.56	13.56019	0.001401	
		5mins	13.56	13.56019	0.001401	
		10mins	13.56	13.56019	0.001401	
30	3.3	start	13.56	13.56018	0.001327	± 0.01 %
		2mins	13.56	13.56018	0.001327	
		5mins	13.56	13.56018	0.001327	
		10mins	13.56	13.56018	0.001327	

10	3.3	start	13.56	13.56017	0.001246	±	0.01	%
		2mins	13.56	13.56017	0.001246			
		5mins	13.56	13.56017	0.001246			
		10mins	13.56	13.56017	0.001246			
0	3.3	start	13.56	13.56023	0.001696	±	0.01	%
		2mins	13.56	13.56023	0.001696			
		5mins	13.56	13.56023	0.001696			
		10mins	13.56	13.56023	0.001696			
-10	3.3	start	13.56	13.56023	0.001696	±	0.01	%
		2mins	13.56	13.56023	0.001696			
		5mins	13.56	13.56023	0.001696			
		10mins	13.56	13.56023	0.001696			
-20	3.3	start	13.56	13.56021	0.001549	±	0.01	%
		2mins	13.56	13.56021	0.001549			
		5mins	13.56	13.56021	0.001549			
		10mins	13.56	13.56021	0.001549			

6. EMI Reduction Method During Compliance Testing

No modification was made during testing.

Attachment 1: EUT Test Photographs

Attachment 2: EUT Detailed Photographs