

## FCC Test Report

Product Name	NFC Controller Module with Integrated Antenna
Model No.	SM-MSN09-C01
FCC ID	JCK-MSN09C01

Applicant	GIGA-BYTE TECHNOLOGY CO., LTD
Address	No.6, Bao Chiang Road, Hsin-Tien Dist., New Taipei City 231,Taiwan

Date of Receipt	Jan. 05, 2015
Issued Date	Jan. 20, 2015
Report No.	1510123R-RFUSP17V00
Report Version	V1.0



The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration of the equipment and evaluated measurement uncertainty herein.

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# Test Report

Issued Date: Jan. 20, 2015

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Product Name	NFC Controller Module with Integrated Antenna
Applicant	GIGA-BYTE TECHNOLOGY CO., LTD
Address	No.6, Bao Chiang Road, Hsin-Tien Dist., New Taipei City 231,Taiwan
Manufacturer	Smart Approach Co., Ltd.
Model No.	SM-MSN09-C01
FCC ID.	JCK-MSN09C01
EUT Rated Voltage	DC 3.3V
EUT Test Voltage	DC 3.3V
Trade Name	Smart Approach
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2013 ANSI C63.10: 2009
Test Result	Complied

Documented By :

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( Senior Adm. Specialist / Rita Huang )

Tested By :

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( Engineer / Jack Hsu )

Approved By :

*Vincent Lin*

( Director / Vincent Lin )

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**1. GENERAL INFORMATION**

**1.1. EUT Description**

Product Name	NFC Controller Module with Integrated Antenna
Trade Name	Smart Approach
Model No.	SM-MSN09-C01
FCC ID	JCK-MSN09C01
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 Controller Module with Integrated Antenna 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 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

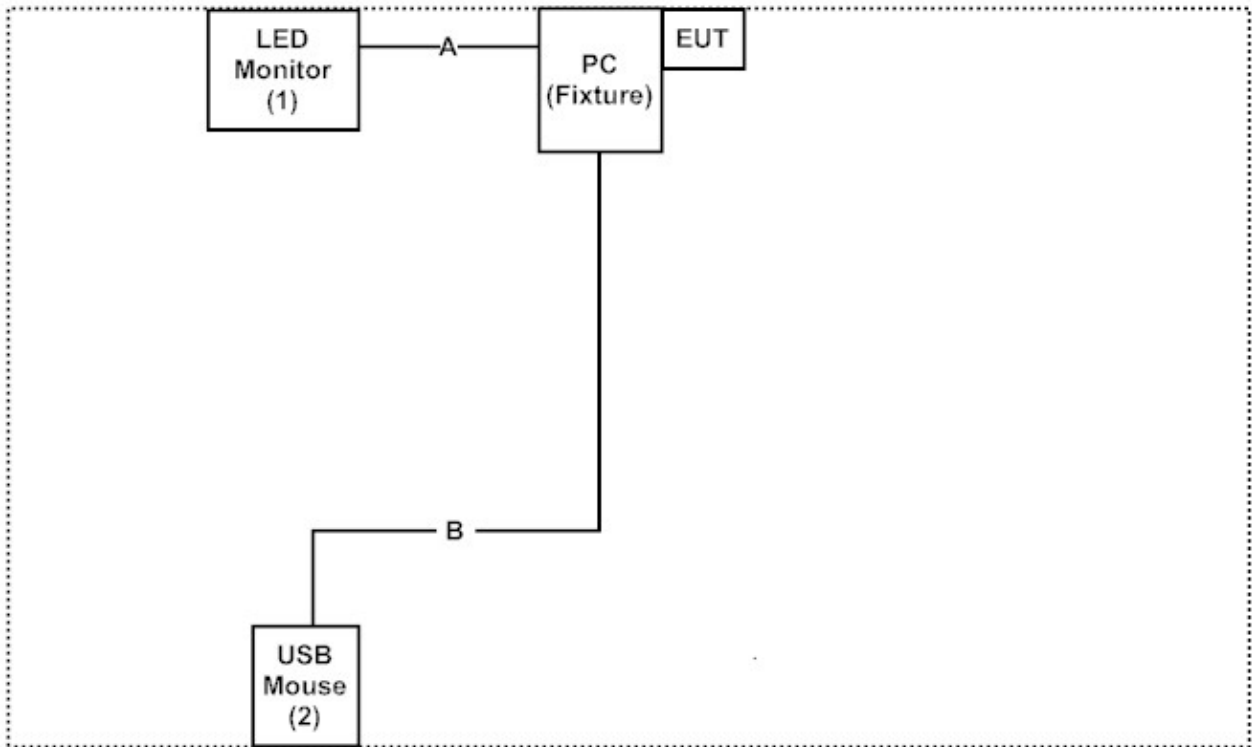
The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

	Product	Manufacturer	Model No.	Serial No.	Power Cord
1	LED Monitor	DELL	ST2402Lb	CN-0X0K27-74261-27E-0M6U T	Non-Shielded, 1.8m
2	USB Mouse	Logitech	M-U0003	LZ024HR	N/A

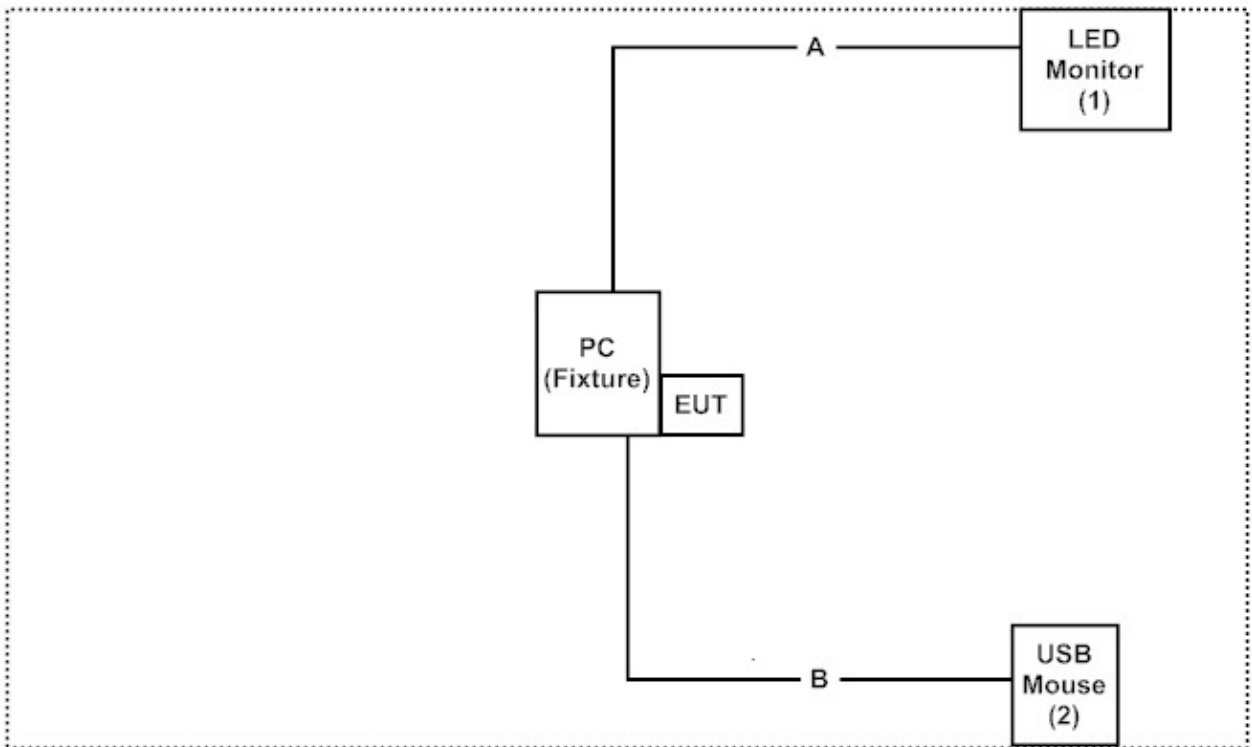
	Signal Cable Type	Signal cable Description
A	HDMI Cable	Non-Shielded, 1.8m
B	USB Cable	Non-Shielded, 1.8m

1.4. Configuration of tested System

Conduction



Radiation



**1.5. EUT Exercise Software**

- (1) Setup the EUT as shown in section 1.4
- (2) Execute software “Proxy TAP v1.6.6” on the Notebook PC and start continuous transceiver.
- (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  
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 Linkou Dist. New Taipei City 24451,  
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FCC Accreditation Number: TW1014



2. Conducted Emission

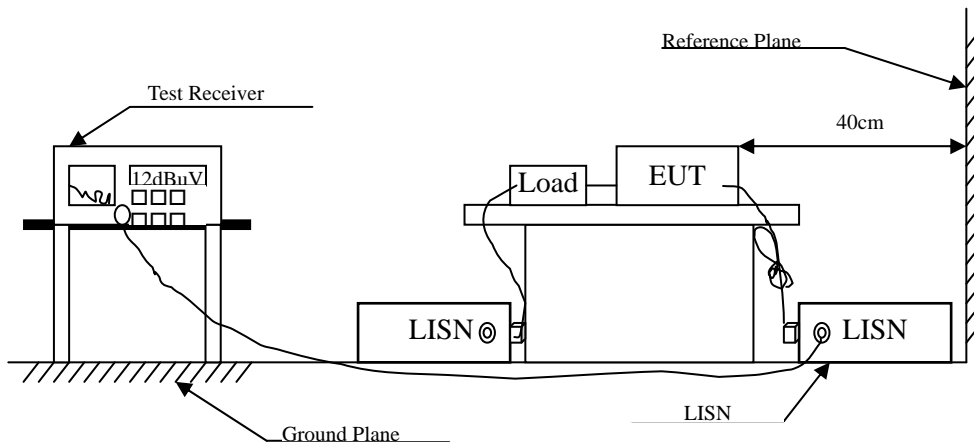
2.1. Test Equipment

	Equipment	Manufacturer	Model No. / Serial No.	Last Cal.	Remark
X	Test Receiver	R & S	ESCS 30 / 825442/018	Sep., 2014	
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, 2014	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>(註)</sub>	56-46 <sub>(註)</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 Controller Module with Integrated Antenna  
 Test Item : Conducted Emission Test  
 Power Line : Line 1  
 Test Mode : Mode 1: Transmit mode

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV	Margin dB	Limit dBuV
<b>LINE 1</b>					
<b>Quasi-Peak</b>					
0.162	9.667	37.660	47.327	-18.330	65.657
0.193	9.660	36.660	46.320	-18.451	64.771
0.216	9.661	29.810	39.471	-24.643	64.114
0.298	9.666	22.070	31.736	-30.035	61.771
0.650	9.685	23.170	32.855	-23.145	56.000
12.759	9.986	15.550	25.536	-34.464	60.000
<b>Average</b>					
0.162	9.667	28.940	38.607	-17.050	55.657
0.193	9.660	28.890	38.550	-16.221	54.771
0.216	9.661	24.550	34.211	-19.903	54.114
0.298	9.666	14.930	24.596	-27.175	51.771
0.650	9.685	22.150	31.835	-14.165	46.000
12.759	9.986	9.330	19.316	-30.684	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 Controller Module with Integrated Antenna  
 Test Item : Conducted Emission Test  
 Power Line : Line 2  
 Test Mode : Mode 1: Transmit mode

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV	Margin dB	Limit dBuV
<b>LINE 2</b>					
<b>Quasi-Peak</b>					
0.162	9.667	40.540	50.207	-15.450	65.657
0.189	9.660	36.880	46.540	-18.346	64.886
0.216	9.661	33.590	43.251	-20.863	64.114
0.244	9.663	30.460	40.123	-23.191	63.314
0.646	9.685	17.800	27.485	-28.515	56.000
3.595	9.822	11.640	21.462	-34.538	56.000
<b>Average</b>					
0.162	9.667	25.910	35.577	-20.080	55.657
0.189	9.660	28.460	38.120	-16.766	54.886
0.216	9.661	14.100	23.761	-30.353	54.114
0.244	9.663	23.350	33.013	-20.301	53.314
0.646	9.685	-2.390	7.295	-38.705	46.000
3.595	9.822	10.880	20.702	-25.298	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**

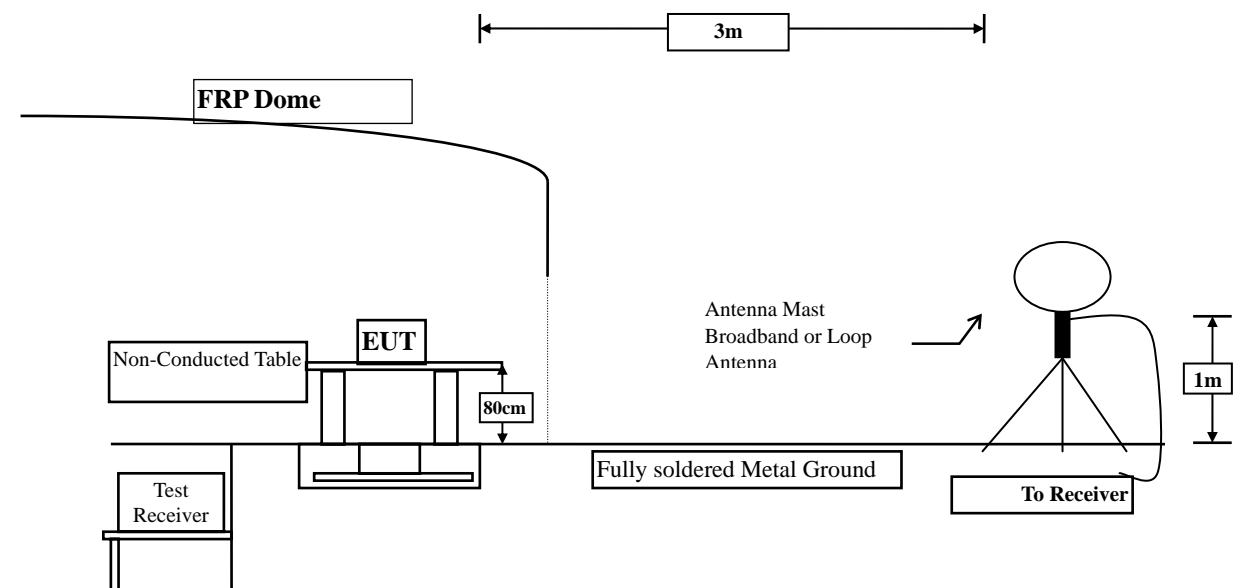
The following test equipment are used during the radiated emission test:

Test Site	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
☒ Site # 3	X Loop Antenna	Teseq	HLA6120 / 26739	Jul., 2014
	X Bilog Antenna	Schaffner Chase	CBL6112B/2673	Sep., 2014
	X Horn Antenna	Schwarzbeck	BBHA9120D/D305	Sep., 2014
	Horn Antenna	Schwarzbeck	BBHA9170/208	Jul., 2014
	X Pre-Amplifier	Agilent	8447D/2944A09549	Sep., 2014
	X Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2014
	X Test Receiver	R & S	ESCS 30/ 825442/018	Sep., 2014
	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

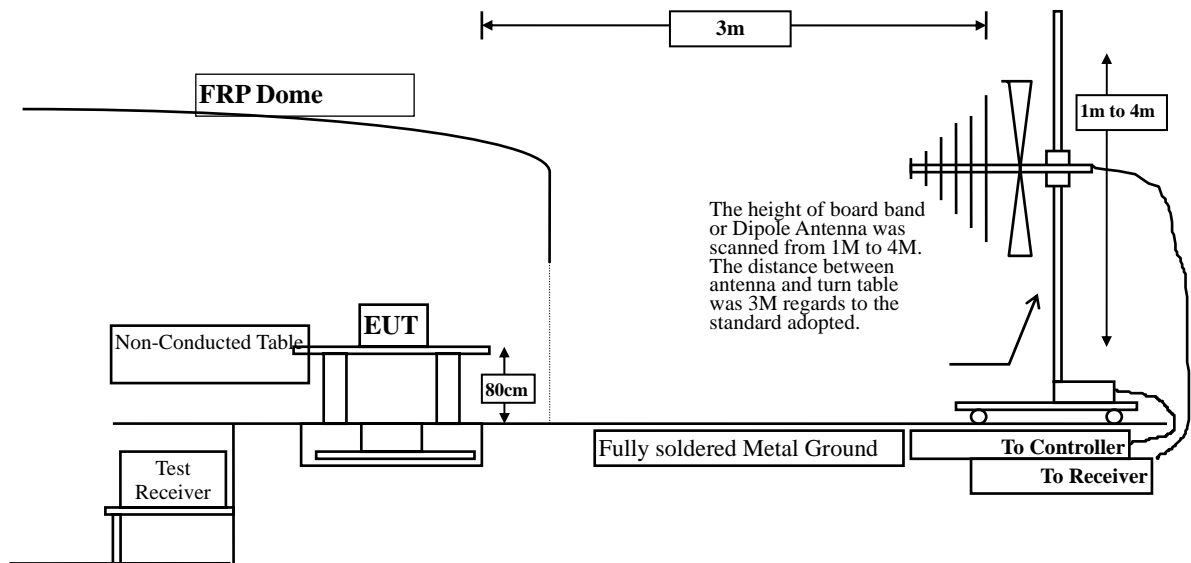
- Note: 1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.  
 2. The test instruments marked with “X” are used to measure the final test results.

**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 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 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 Controller Module with Integrated Antenna  
 Test Item : Fundamental Radiated Emission  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit mode

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
<b>X-axis</b>					
<b>Quasi-Peak</b>					
<b>Horizontal</b>					
13.560	20.410	17.880	38.290	-85.710	124.000
<b>Vertical</b>					
13.560	20.410	18.220	38.630	-85.370	124.000
<b>Y-axis</b>					
<b>Quasi-Peak</b>					
<b>Horizontal</b>					
13.560	20.410	21.560	41.970	-82.030	124.000
<b>Vertical</b>					
13.560	20.410	20.510	40.920	-83.080	124.000
<b>Z-axis</b>					
<b>Quasi-Peak</b>					
<b>Horizontal</b>					
13.560	20.410	18.190	38.600	-85.400	124.000
<b>Vertical</b>					
13.560	20.410	19.260	39.670	-84.330	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 Controller Module with Integrated Antenna  
 Test Item : General Radiated Emission Data (below 30MHz)  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit mode

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level	dB	dBuV/m
	dB	dBuV	dBuV/m		
<b>Quasi-Peak</b>					
<b>Horizontal</b>					
27.120	19.950	9.880	29.830	-39.710	69.540
<b>Vertical</b>					
27.120	19.950	10.220	30.170	-39.370	69.540

Note:

1.  $Limit = 29.54 \text{ dBuV/m} + 40 * \text{Log} (30 \text{ (m)} / 3 \text{ (m)}) = 69.54 \text{ dBuV/m}$
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 Controller Module with Integrated Antenna  
 Test Item : General Radiated Emission Data (above 30MHz)  
 Test Site : No.3 OATS  
 Test Mode : Mode 1: Transmit mode

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
<b>Horizontal</b>					
<b>QP Detector</b>					
119.240	-7.291	38.650	31.360	-12.140	43.500
247.280	-6.359	34.778	28.419	-17.581	46.000
437.400	0.819	38.400	39.219	-6.781	46.000
631.400	1.266	35.979	37.245	-8.755	46.000
796.300	6.389	28.732	35.121	-10.879	46.000
885.540	6.542	33.111	39.653	-6.347	46.000

<b>Vertical</b>					
<b>QP Detector</b>					
119.240	-3.571	32.050	28.480	-15.020	43.500
245.340	-5.908	33.224	27.316	-18.684	46.000
388.900	-0.726	30.440	29.714	-16.286	46.000
625.580	0.299	40.917	41.217	-4.783	46.000
800.180	2.637	33.037	35.674	-10.326	46.000
963.140	3.581	29.551	33.132	-20.868	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

4. Band Edge

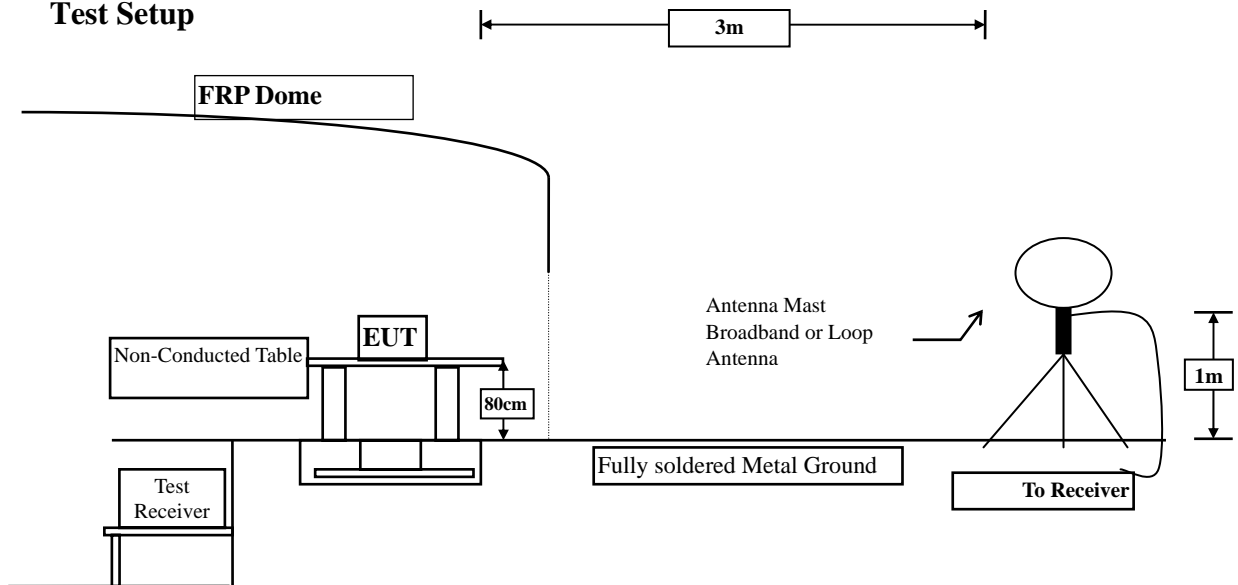
4.1. Test Equipment

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., 2014
	Bilog Antenna	Schaffner Chase	CBL6112B/2673	Sep., 2014
	Horn Antenna	Schwarzbeck	BBHA9120D/D305	Sep., 2014
	Horn Antenna	Schwarzbeck	BBHA9170/208	Jul., 2014
	Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2014
	Pre-Amplifier	QTK	AP-180C / CHM_0906076	Sep., 2014
	Pre-Amplifier	MITEQ	AMF-4D-180400-45-6P/ 925975	Mar, 2014
	X Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2014
	X Test Receiver	R & S	ESCS 30/ 825442/018	Sep., 2014
	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.

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 Controller Module with Integrated Antenna  
 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	20.430	14.020	34.450	69.540	Pass
13.360	20.420	14.120	34.540	69.540	Pass
13.410	20.420	13.960	34.380	69.540	Pass
14.010	20.400	14.190	34.590	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	20.430	14.180	34.610	69.540	Pass
13.360	20.420	13.100	33.520	69.540	Pass
13.410	20.420	13.910	34.330	69.540	Pass
14.010	20.400	14.020	34.420	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

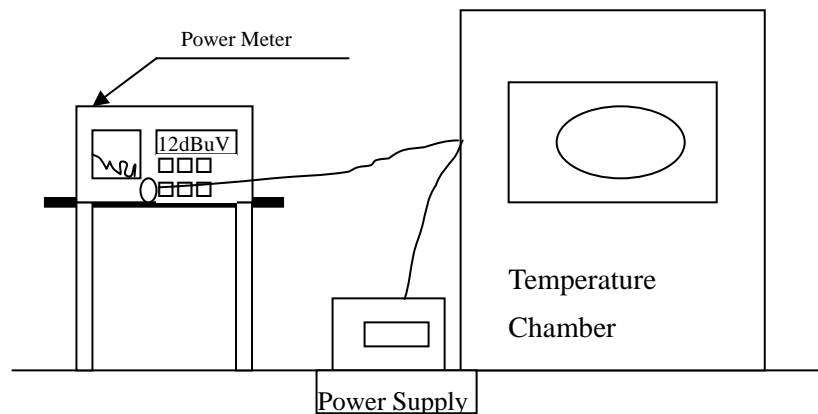
**5. Frequency Tolerance**

**5.1. Test Equipment**

	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
	Spectrum Analyzer	R&S	FSP40 / 100170	Jun, 2014
	Spectrum Analyzer	Agilent	E4407B / US39440758	Jun, 2014
X	Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2014
X	Temperature Chamber	TDE	CHM 150CT	March, 2014

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 Controller Module with Integrated Antenna  
 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	120	start	13.56	13.56075	0.005531	± 0.01 %
		2mins	13.56	13.56075	0.005531	
		5mins	13.56	13.56075	0.005531	
		10mins	13.56	13.56075	0.005531	
20	138	start	13.56	13.56075	0.005531	± 0.01 %
		2mins	13.56	13.56075	0.005531	
		5mins	13.56	13.56075	0.005531	
		10mins	13.56	13.56075	0.005531	
20	102	start	13.56	13.56075	0.005531	± 0.01 %
		2mins	13.56	13.56075	0.005531	
		5mins	13.56	13.56075	0.005531	
		10mins	13.56	13.56075	0.005531	
50	120	start	13.56	13.56031	0.002286	± 0.01 %
		2mins	13.56	13.56031	0.002286	
		5mins	13.56	13.56031	0.002286	
		10mins	13.56	13.56031	0.002286	
40	120	start	13.56	13.56047	0.003466	± 0.01 %
		2mins	13.56	13.56047	0.003466	
		5mins	13.56	13.56047	0.003466	
		10mins	13.56	13.56047	0.003466	
30	120	start	13.56	13.56022	0.001622	± 0.01 %
		2mins	13.56	13.56022	0.001622	
		5mins	13.56	13.56022	0.001622	
		10mins	13.56	13.56022	0.001622	



10	120	start	13.56	13.56004	0.000295	± 0.01 %
		2mins	13.56	13.56004	0.000295	
		5mins	13.56	13.56004	0.000295	
		10mins	13.56	13.56004	0.000295	
0	120	start	13.56	13.56004	0.000295	± 0.01 %
		2mins	13.56	13.56004	0.000295	
		5mins	13.56	13.56004	0.000295	
		10mins	13.56	13.56004	0.000295	
-10	120	start	13.56	13.56092	0.006785	± 0.01 %
		2mins	13.56	13.56092	0.006785	
		5mins	13.56	13.56092	0.006785	
		10mins	13.56	13.56092	0.006785	
-20	120	start	13.56	13.56092	0.006785	± 0.01 %
		2mins	13.56	13.56092	0.006785	
		5mins	13.56	13.56092	0.006785	
		10mins	13.56	13.56092	0.006785	

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

No modification was made during testing.

Attachment 1: EUT Test Photographs

Attachment 2: EUT Detailed Photographs