



## FCC Test Report

**Issued Date** : Jun. 23, 2011  
**Project No.** : R1012007  
**Equipment** : Active RFID Wireless Receiver  
**Model Name** : nuRF 2401AP  
  
**Applicant** : Free Alliance Sdn Bhd  
**Address** : Suite B-3-2 Block B, Plaza Damas, Sri  
Hartamas, 50480 Kuala Lumpur,  
MALAYSIA

**Tested by:** Neutron Engineering Inc. EMC Laboratory  
**Date of Receipt:** Dec. 30, 2010  
**Date of Test:** Dec. 30, 2010 ~ Jun. 13, 2011

**Testing Engineer:** Peter Li  
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C-2918 G-91 R-2669  
R-2829 T-1666 T-1667



### **Declaration**

**Neutron** represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with the standards traceable to National Measurement Laboratory (**NML**) of **R.O.C.**, or National Institute of Standards and Technology (**NIST**) of **U.S.A.**

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### **Limitation**

For the use of the authority's logo is limited unless the Test Standard(s)/Scope(s)/Item(s) mentioned in this test report is (are) included in the conformity assessment authorities acceptance respective.



<b>Table of Contents</b>	<b>Page</b>
<b>1 . CERTIFICATION</b>	<b>4</b>
<b>2 . SUMMARY OF TEST RESULTS</b>	<b>5</b>
2.1 TEST FACILITY	6
2.2 MEASUREMENT UNCERTAINTY	6
<b>3 . GENERAL INFORMATION</b>	<b>7</b>
3.1 GENERAL DESCRIPTION OF EUT	7
3.2 DESCRIPTION OF TEST MODES	8
3.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED	9
3.4 DESCRIPTION OF SUPPORT UNITS	10
<b>4 . EMC EMISSION TEST</b>	<b>11</b>
4.1 CONDUCTED EMISSION MEASUREMENT	11
4.1.1 POWER LINE CONDUCTED EMISSION	11
4.1.2 MEASUREMENT INSTRUMENTS LIST	11
4.1.3 TEST PROCEDURE	12
4.1.4 DEVIATION FROM TEST STANDARD	12
4.1.5 TEST SETUP	12
4.1.6 EUT OPERATING CONDITIONS	12
4.1.7 TEST RESULTS	13
4.2 RADIATED EMISSION MEASUREMENT	15
4.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT	15
4.2.2 MEASUREMENT INSTRUMENTS LIST	16
4.2.3 TEST PROCEDURE	16
4.2.4 DEVIATION FROM TEST STANDARD	16
4.2.5 TEST SETUP	17
4.2.6 EUT OPERATING CONDITIONS	17
4.2.7 TEST RESULTS-BETWEEN 30MHZ AND 1000MHZ	18
<b>5 . EUT TEST PHOTO</b>	<b>20</b>



## 1. CERTIFICATION

Equipment : Active RFID Wireless Receiver  
Brand Name : nuRF  
Model Name : nuRF 2401AP  
Applicant : Free Alliance Sdn Bhd  
Date of Test : Dec. 30, 2010 ~ Jun. 13, 2011  
Standards : FCC Part 15, Subpart B Class A  
CISPR 22: 2005 +A1: 2005 Class A  
ICES-003: 2004 Class A  
ANSI C63.4 (2003)

The above equipment has been tested and found compliance with the requirement of the relative standards by Neutron Engineering Inc. EMC Laboratory.

The test data, data evaluation, and equipment configuration contained in our test report (Ref No. NEI-FCCE-1-R1012007) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of NVLAP and TAF according to the ISO-17025 quality assessment standard and technical standard(s).

**2. SUMMARY OF TEST RESULTS**

Test procedures according to the technical standards:

Emission				
Standard	Test Item	Limit	Judgment	Remark
FCC Part 15, Subpart B CISPR 22: 2005 +A1: 2005 ICES-003: 2004	Conducted Emission	Class A	PASS	
	Radiated Emission	Class A	PASS	

**NOTE:**

(1) " N/A" denotes test is not applicable in this Test Report.



## 2.1 TEST FACILITY

The test facilities used to collect the test data in this report:

**OS02:** (VCCI RN: R-2829; FCC RN: 95335; FCC DN: TW1010)

No.132-1, Lane 329, Sec. 2, Palian Road, Shijr City, Taipei, Taiwan.

## 2.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement  $y \pm U$ , where expended uncertainty  $U$  is based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95%.

The measurement instrumentation uncertainty considerations contained in CISPR 16-4-2.

A. Radiated Measurement :

Test Site	Method	Measurement Frequency Range	Ant. H / V	U , (dB)	NOTE
OS-01	ANSI	30 MHz ~ 200 MHz	V	2.86	
		30 MHz ~ 200 MHz	H	2.56	
		200 MHz ~ 1, 000 MHz	V	2.88	
		200 MHz ~ 1, 000 MHz	H	2.98	

Test Site	Item	Measurement Frequency Range	Uncertainty	NOTE
CB08	Radiated Emission at 3m	Horizontal Polarization	30 - 200MHz	3.35 dB
			200 - 1000MHz	3.11 dB
			1 - 18GHz	3.97 dB
			18 - 40GHz	4.01 dB
		Vertical Polarization	30 - 200MHz	3.22 dB
			200 - 1000MHz	3.24 dB
			1 - 18GHz	4.05 dB
			18 - 40GHz	4.04 dB

Our calculated Measurement Instrumentation Uncertainty is shown in the tables above. These are our  $U_{lab}$  values in CISPR 16-4-2 terminology.

Since Table 1 of CISPR 16-4-2 has values of measurement instrumentation uncertainty, called  $U_{CISPR}$ , as follows:

Conducted Disturbance (mains port) – 150 kHz – 30 MHz : 3.6 dB

Radiated Disturbance (electric field strength on an open area test site or alternative test site) – 30 MHz – 1000 MHz : 5.2 dB

It can be seen that our  $U_{lab}$  values are smaller than  $U_{CISPR}$ .



### 3. GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

Equipment	Active RFID Wireless Receiver
Brand Name	nuRF
Model Name	nuRF 2401AP
OEM Brand/Model Name	N/A
Model Difference	N/A
Product Description	The EUT is a Active RFID Wireless Receiver. Based on the application, features, or specification exhibited in User's Manual, the EUT is considered as an ITE/Computing Device. More details of EUT technical specification, please refer to the User's Manual.
Power Source	Please refer to the User's Manual
Power Rating	Please refer to the User's Manual
Connecting I/O Port(s)	Please refer to the User's Manual
Products Covered	N/A
EUT Modification(s)	N/A

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.
2. For the test and this report **ONLY** covers EUT receiver function. Its transmitter function testing is not covered in this test report.



### 3.2 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generated from EUT, the test system was pre-scanning tested based on the consideration of following EUT operation mode or test configuration mode which possibly have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Pretest Test Mode	Description
Mode 1	Normal Operation

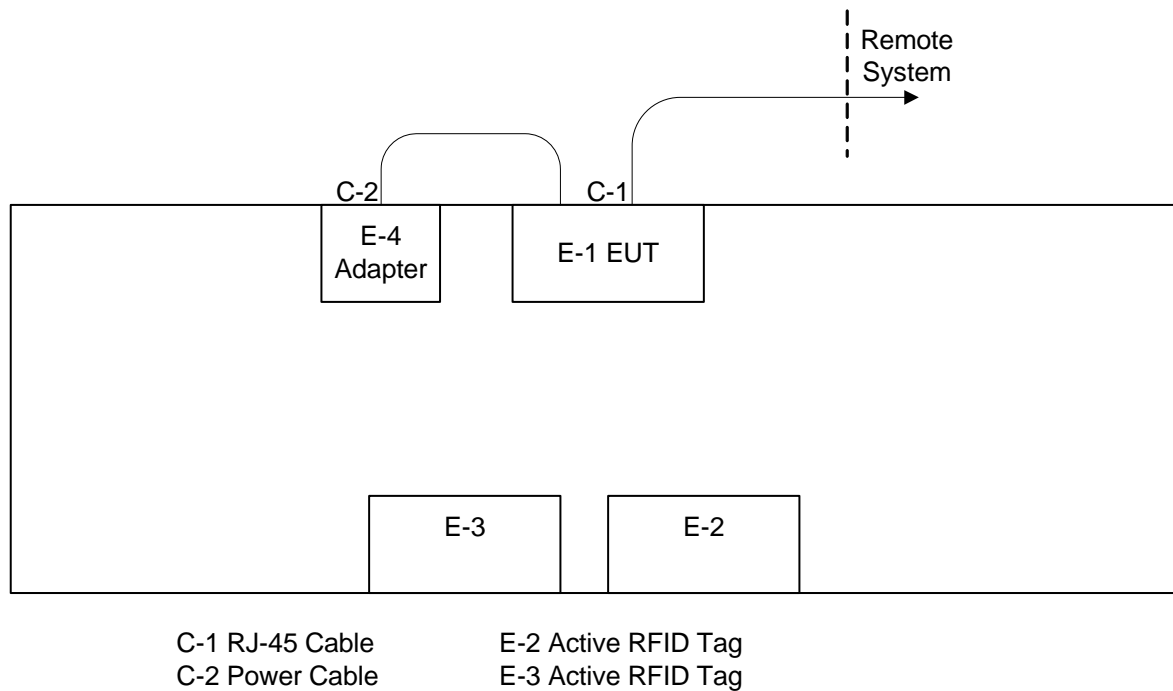
For Conducted Test	
Final Test Mode	Description
Mode 1	Normal Operation

For Radiated Test	
Final Test Mode	Description
Mode 1	Normal Operation





### 3.3 BLOCK DIAGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED





### 3.4 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Series No.	Note
E-1	Active RFID Wireless Receiver	nuRF	nuRF 2401AP	N/A	N/A	EUT
E-2	Active RFID Tag	nuRF	nuRF 2401T-A	N/A	N/A	
E-3	Active RFID Tag	nuRF	nuRF 2401T-P	N/A	N/A	
E-4	Adapter	PHIHONG	PSA05F-050Q	N/A	N/A	

Item	Shielded Type	Ferrite Core	Length	Note
C-1	NO	NO	10.0M	
C-2	YES	NO	1.0M	

Note:

- (1) For detachable type I/O cable should be specified the length in cm in 『Length』 column



## 4. EMC EMISSION TEST

### 4.1 CONDUCTED EMISSION MEASUREMENT

#### 4.1.1 POWER LINE CONDUCTED EMISSION (FREQUENCY RANGE 150 KHZ-30MHZ)

FREQUENCY ( MHz)	Class A (dBuV)		Class B (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 -0.5	79.00	66.00	66 - 56 *	56 - 46 *
0.50 -5.0	73.00	60.00	56.00	46.00
5.0 -30.0	73.00	60.00	60.00	50.00

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of " \* " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

#### 4.1.2 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	LISN	EMCO	3816/2	00042991	Feb. 16, 2012
2	Test Cable	TIMES	LMR-400	SR03_C_01&02	Aug. 20, 2011
3	Pulse Limiter	Electro-Metrics	EM-7600	112647	Dec. 13, 2011
4	EMI Test Receiver	R&S	ESCI	100082	Mar. 15, 2012
5	ISN	FCC	FCC-TLISN-T4-02	20431	Jul. 14, 2011

Remark: " N/A" denotes No Model Name , Serial No. or No Calibration specified.

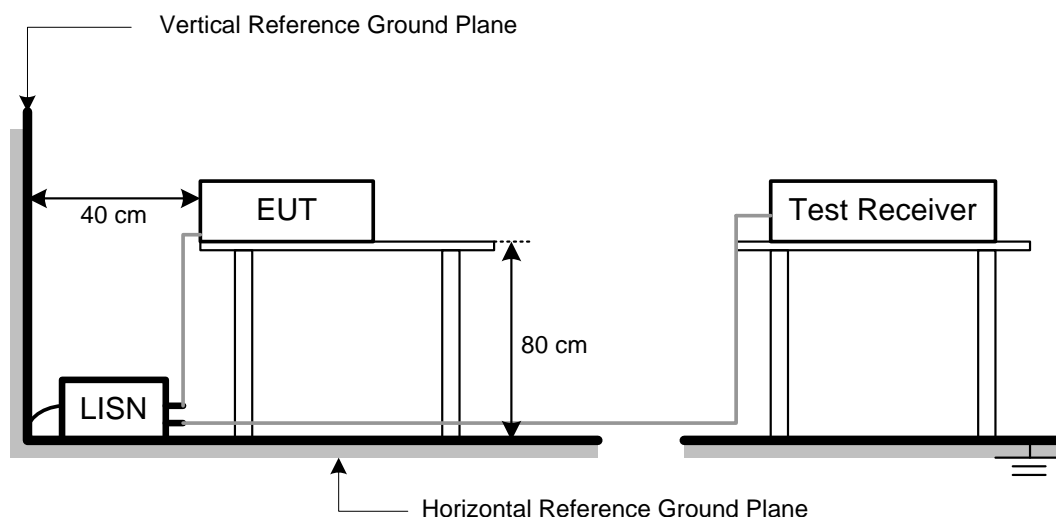
#### 4.1.3 TEST PROCEDURE

- The EUT was placed 0.8 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- LISN at least 80 cm from nearest part of EUT chassis.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

#### 4.1.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.1.5 TEST SETUP



#### 4.1.6 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously receive during test. This operating condition was tested and used to collect the included data.

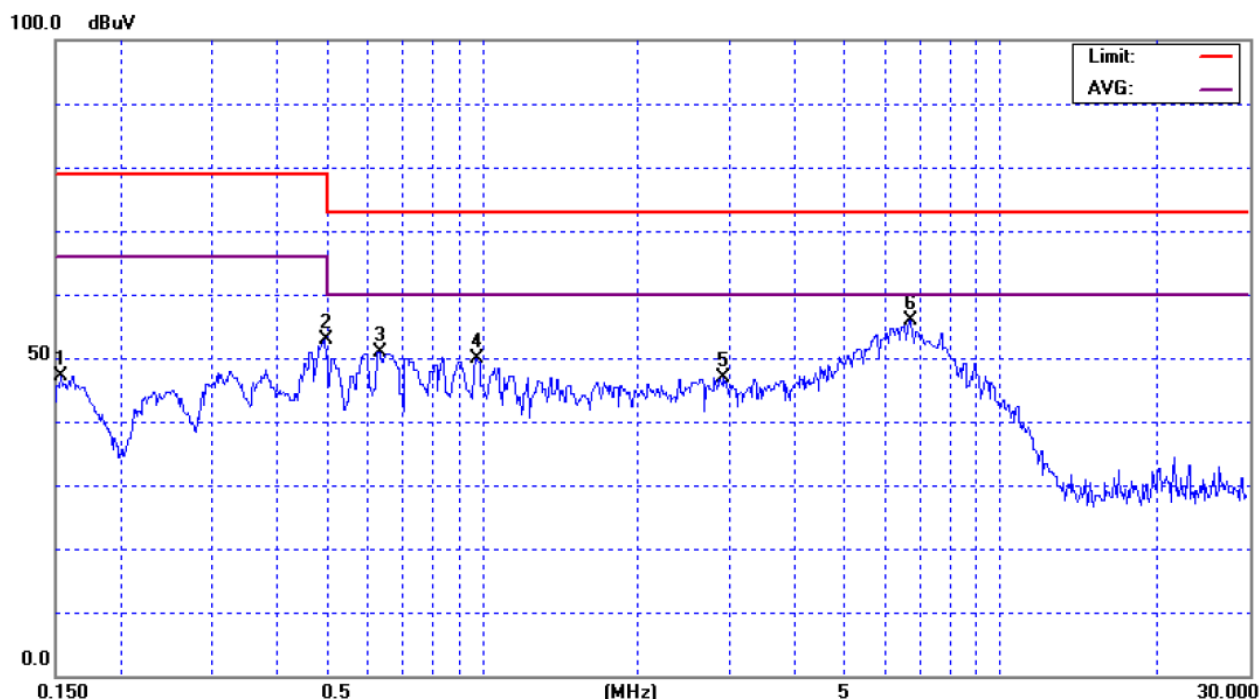
**4.1.7 TEST RESULTS**

E.U.T :	Active RFID Wireless Receiver	Model Name :	nuRF 2401AP
Temperature :	24 °C	Relative Humidity :	48%
Test Voltage :	AC 120V/60Hz		
Test Mode :	Normal Operation		

Freq. (MHz)	Terminal L/N	Reading Level(dBuV)		Correct Factor(dB)	Measurement(dBuV)		Limit(dBuV)		Margin (dB)	Note
		QP-Mode	AV-Mode		QP-Mode	AV-Mode	QP-Mode	AV-Mode		
0.1535	Line	37.11	*	10.13	47.24	*	79.00	66.00	-31.76	(QP)
0.4972	Line	43.24	*	9.56	52.80	*	79.00	66.00	-26.20	(QP)
0.6350	Line	41.51	*	9.36	50.87	*	73.00	60.00	-22.13	(QP)
0.9770	Line	41.15	*	8.84	49.99	*	73.00	60.00	-23.01	(QP)
2.9300	Line	38.07	*	8.87	46.94	*	73.00	60.00	-26.06	(QP)
6.7000	Line	46.87	*	9.01	55.88	*	73.00	60.00	-17.12	(QP)

**Remark:**

- (1) Reading in which marked as QP means measurements by using are Quasi-Peak Mode with Detector BW=9 kHz; SPA setting in RBW=10 kHz, VBW =10 kHz, Swp. Time = 0.2 sec./ MHz. Reading in which marked as AV means measurements by using are Average Mode with instrument setting in RBW=10 kHz, VBW=10 kHz, Swp. Time =0.2 sec./ MHz.
- (2) All readings are QP Mode value unless otherwise stated AVG in column of Note. If the QP Mode Measured value compliance with the QP Limits and lower than AVG Limits, the EUT shall be deemed to meet both QP & AVG Limits and then only QP Mode was measured, but AVG Mode didn't perform. In this case, a " \*" marked in AVG Mode column of Interference Voltage Measured.
- (3) In the "Note" column, QP means the margin value of QP is higher than Average and the "Margin" column shows the margin value of QP; AV means the margin value of Average is higher than QP and the "Margin" column shows the margin value of Average.



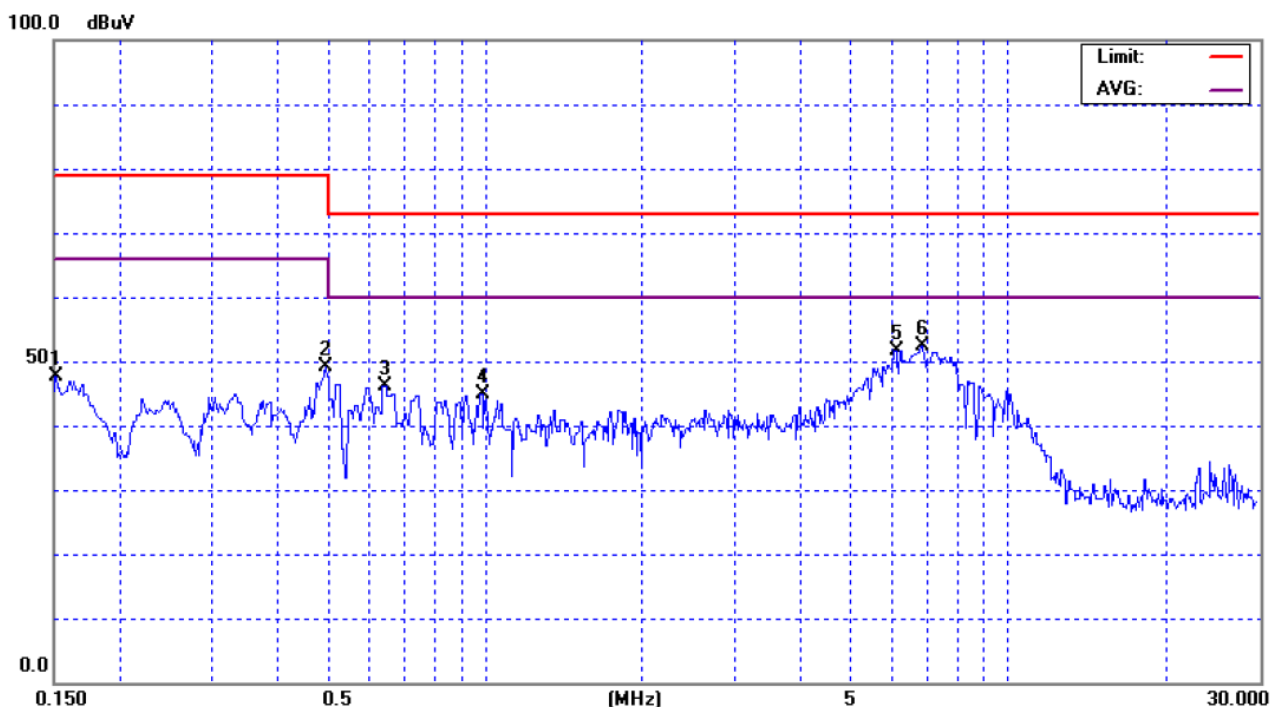


E.U.T :	Active RFID Wireless Receiver	Model Name :	nuRF 2401AP
Temperature :	24 °C	Relative Humidity :	48%
Test Voltage :	AC 120V/60Hz		
Test Mode :	Normal Operation		

Freq. (MHz)	Terminal L/N	Reading Level(dBuV)		Correct Factor(dB)	Measurement(dBuV)		Limit(dBuV)		Margin (dB)	Note
		QP-Mode	AV-Mode		QP-Mode	AV-Mode	QP-Mode	AV-Mode		
0.1514	Neutral	37.69	*	9.93	47.62	*	79.00	66.00	-31.38	(QP)
0.4965	Neutral	39.71	*	9.45	49.16	*	79.00	66.00	-29.84	(QP)
0.6440	Neutral	36.90	*	9.24	46.14	*	73.00	60.00	-26.86	(QP)
0.9860	Neutral	36.09	*	8.72	44.81	*	73.00	60.00	-28.19	(QP)
6.1000	Neutral	42.96	*	8.75	51.71	*	73.00	60.00	-21.29	(QP)
6.8500	Neutral	43.55	*	8.76	52.31	*	73.00	60.00	-20.69	(QP)

Remark:

- (1) Reading in which marked as QP means measurements by using are Quasi-Peak Mode with Detector BW=9 kHz; SPA setting in RBW=10 kHz, VBW =10 kHz, Swp. Time = 0.2 sec./ MHz. Reading in which marked as AV means measurements by using are Average Mode with instrument setting in RBW=10 kHz, VBW=10 kHz, Swp. Time =0.2 sec./ MHz.
- (2) All readings are QP Mode value unless otherwise stated AVG in column of Note. If the QP Mode Measured value compliance with the QP Limits and lower than AVG Limits, the EUT shall be deemed to meet both QP & AVG Limits and then only QP Mode was measured, but AVG Mode didn't perform. In this case, a " \*" marked in AVG Mode column of Interference Voltage Measured.
- (3) In the "Note" column, QP means the margin value of QP is higher than Average and the "Margin" column shows the margin value of QP; AV means the margin value of Average is higher than QP and the "Margin" column shows the margin value of Average.





## 4.2 RADIATED EMISSION MEASUREMENT

### 4.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT (BELOW 1000MHZ)

FREQUENCY (MHz)	Class A (at 10m)	Class B (at 10m)
	dBuV/m	dBuV/m
30 – 230	40	30
230 – 1000	47	37

Notes:

- (1) The limit for radiated test was performed according to as following:  
CISPR 22/ FCC PART 15B /ICES-003.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).
- (4) The test result calculated as following:  
Measurement Value = Reading Level + Correct Factor  
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain(if use)  
Margin Level = Measurement Value – Limit Value

### LIMITS OF RADIATED EMISSION MEASUREMENT (ABOVE 1000MHZ)

FREQUENCY (MHz)	Class A (dBuV/m) (at 3m)		Class B (dBuV/m) (at 3m)	
	PEAK	AVERAGE	PEAK	AVERAGE
Above 1000	80	60	74	54

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15B.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).
- (4) The test result calculated as following:  
Measurement Value = Reading Level + Correct Factor  
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain(if use)  
Margin Level = Measurement Value – Limit Value

### FREQUENCY RANGE OF RADIATED MEASUREMENT (FOR UNINTENTIONAL RADIATORS)

Highest frequency generated or Upper frequency of measurement used in the device or on which the device operates or tunes (MHz)	Range (MHz)
Below 1.705	30
1.705 – 108	1000
108 – 500	2000
500 – 1000	5000
Above 1000	5 <sup>th</sup> harmonic of the highest frequency or 40 GHz, whichever is lower

**4.2.2 MEASUREMENT INSTRUMENTS LIST**

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Log-Bicon Antenna	Schwarzbeck	VULB 9160	3173	Nov. 04, 2011
2	Pre-Amplifier	Anritsu	MH648A	M98457	Dec. 13, 2011
3	Test Cable	TIMES	LMR-400	10M-OS01	Jun. 17, 2011
4	Test Cable	TIMES	LMR-400	OS02	Jun. 17, 2011
5	EMI Test Receiver	R&S	ESCI	100082	Mar. 15, 2012
6	System Controller (OS02)	CT	SC100	N/A	N/A
7	Turn Table	Chance Most	CMTB-1.5	N/A	N/A

Remark: " N/A" denotes No Model Name / Serial No. and No Calibration specified.

**4.2.3 TEST PROCEDURE**

- The measuring distance of at 10 m shall be used for measurements at frequency up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
- The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3m or 10 meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- The height of the equipment or of the substitution antenna shall be 0.8 m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- The initial step in collecting radiated emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

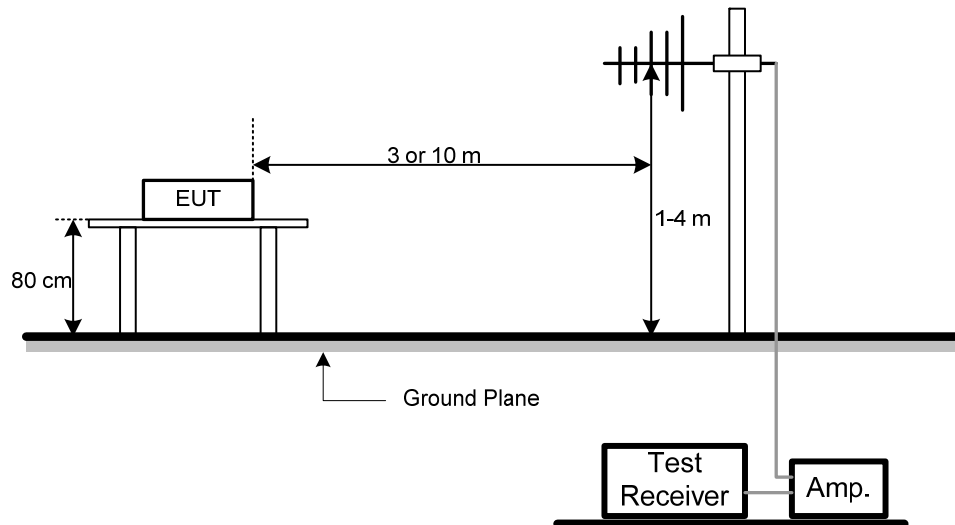
**4.2.4 DEVIATION FROM TEST STANDARD**

No deviation

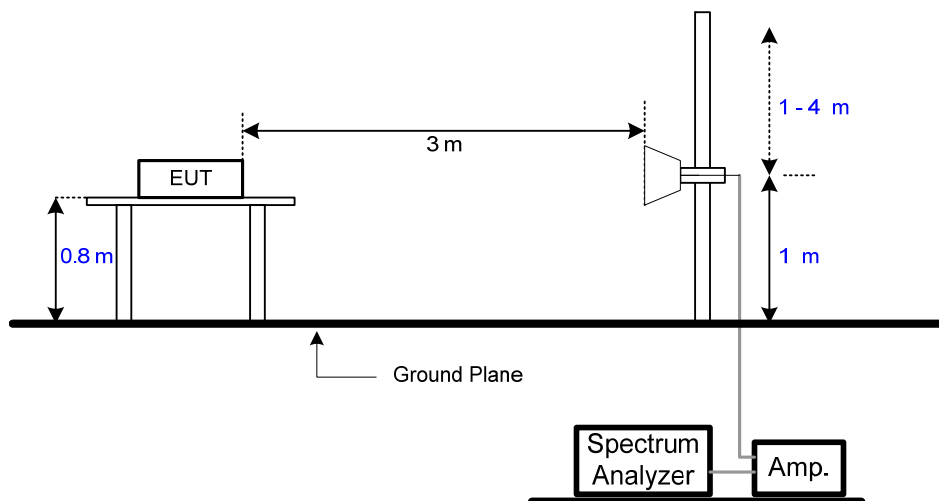


#### 4.2.5 TEST SETUP

##### Radiated Emission Test Set-Up Frequency 30 - 1000MHz



##### Radiated Emission Test Set-Up Frequency Above 1 GHz



#### 4.2.6 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 4.1.6 Unless otherwise a special operating condition is specified in the follows during the testing.

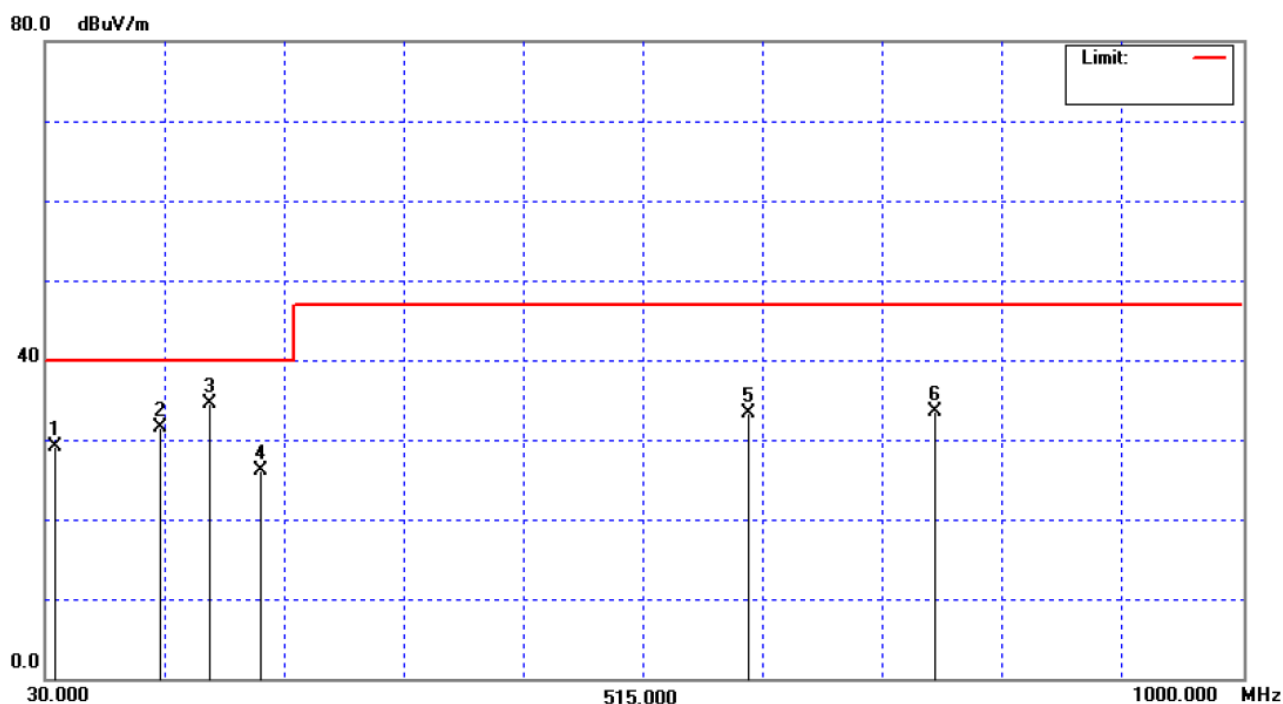
**4.2.7 TEST RESULTS-BETWEEN 30MHZ AND 1000MHZ**

E.U.T :	Active RFID Wireless Receiver	Model Name :	nuRF 2401AP
Temperature :	32 °C	Relative Humidity :	56%
Test Voltage :	AC 120V/60Hz		
Test Mode :	Normal Operation		

Freq. (MHz)	Polarization H/V	Reading Level (dBuV)	Correct Factor(dB)	Measurement (dBuV/m)	Limit(Quasi-Peak) (dBuV/m)	Margin (dB)	Note
37.6560	V	35.89	-6.83	29.06	40.00	- 10.94	
122.8000	V	37.28	-5.84	31.44	40.00	- 8.56	
162.0000	V	38.83	-4.33	34.50	40.00	- 5.50	
204.0000	V	33.83	-7.79	26.04	40.00	- 13.96	
600.0400	V	29.90	3.48	33.38	47.00	- 13.62	
750.0800	V	28.15	5.43	33.58	47.00	- 13.42	

**Remark :**

- (1) Reading in which marked as QP or Peak means measurements by using are Quasi-Peak Mode or Peak Mode with Detector BW=120 kHz; SPA setting in RBW=120 kHz, VBW =120 kHz, Swp. Time = 0.3 sec./ MHz.
- (2) All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform.
- (3) Measuring frequency range from 30 MHz to 1000 MHz.
- (4) If the peak scan value is under the limit for more than 20dB, the signal will not show in table.



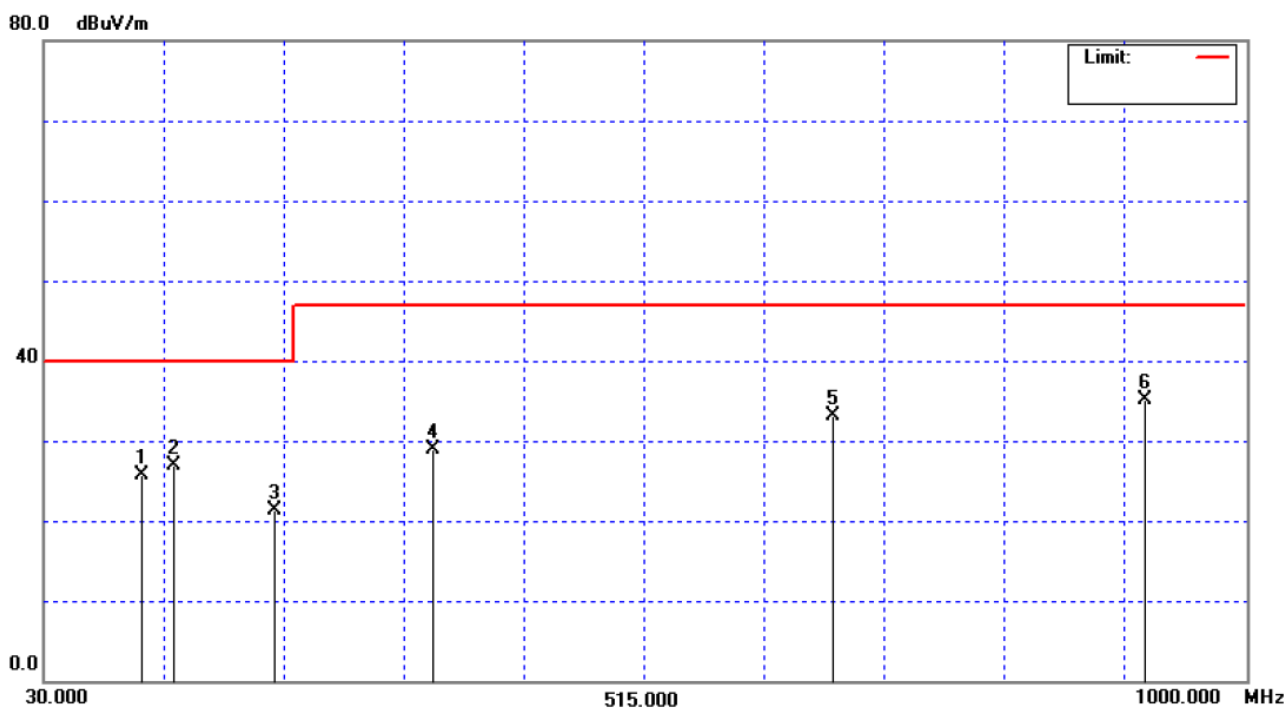


E.U.T :	Active RFID Wireless Receiver	Model Name :	nuRF 2401AP
Temperature :	32 °C	Relative Humidity :	56%
Test Voltage :	AC 120V/60Hz		
Test Mode :	Normal Operation		

Freq. (MHz)	Polarization H/V	Reading Level (dBuV)	Correct Factor(dB)	Measurement (dBuV/m)	Limit(Quasi-Peak) (dBuV/m)	Margin (dB)	Note
108.4000	H	33.01	-7.25	25.76	40.00	- 14.24	
133.6000	H	32.05	-5.18	26.87	40.00	- 13.13	
216.1600	H	28.55	-7.23	21.32	40.00	- 18.68	
344.1200	H	31.52	-2.65	28.87	47.00	- 18.13	
666.6600	H	28.95	4.19	33.14	47.00	- 13.86	
920.4600	H	26.73	8.28	35.01	47.00	- 11.99	

**Remark :**

- (1) Reading in which marked as QP or Peak means measurements by using are Quasi-Peak Mode or Peak Mode with Detector BW=120 kHz; SPA setting in RBW=120 kHz, VBW =120 kHz, Swp. Time = 0.3 sec./ MHz.
- (2) All readings are Peak unless otherwise stated QP in column of Note. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform.
- (3) Measuring frequency range from 30 MHz to 1000 MHz.
- (4) If the peak scan value is under the limit for more than 20dB, the signal will not show in table.



## 5. EUT TEST PHOTO

### Conducted Measurement Photos



**Radiated Measurement Photos  
BETWEEN 30MHZ AND 1000MHZ**

