



# FCC TEST REPORT (RFID)

**REPORT NO.:** RF130412E08

**MODEL NO.:** T77H446

**FCC ID:** MCLT77H446

**RECEIVED:** Apr. 12, 2013

**TESTED:** Apr. 18 to May 02, 2013

**ISSUED:** May 10, 2013

**APPLICANT:** Hon Hai PRECISION IND.CO.,LTD

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**ISSUED BY:** Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch Hsin Chu Laboratory

**LAB ADDRESS :** No. 81-1, Lu Liao Keng, 9th Ling,Wu Lung Tsuen, Chiung Lin Hsiang, Hsin Chu Hsien 307, Taiwan, R.O.C.

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## RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF130412E08	Original release	May 10, 2013



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## 1 CERTIFICATION

**PRODUCT :** NFC 13.56MHz RFID transceiver module

**BRAND NAME :** FOXCONN

**MODEL NO. :** T77H446

**TEST SAMPLE :** ENGINEERING SAMPLE

**APPLICANT :** Hon Hai PRECISION IND.CO.,LTD

**TESTED :** Apr. 18 to May 02, 2013

**STANDARDS:** FCC Part 15, Subpart C (Section 15.225)

FCC Part 15, Subpart C (Section 15.215)

ANSI C63.10-2009

The above equipment (Model: T77H446) has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

**PREPARED BY** : Phoenix Huang, DATE: May 10, 2013  
(Phoenix Huang, Specialist)

**APPROVED BY** : May Chen, DATE: May 10, 2013  
( May Chen, Manager )



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## 2 SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.225, 15.215)			
STANDARD SECTION	TEST TYPE AND LIMIT	RESULT	REMARK
15.207	Conducted emission test	PASS	Meet the requirement of limit. Minimum passing margin is -17.62dB at 3.14453MHz.
15.225 (a)	The field strength of any emissions within the band 13.553-13.567 MHz	PASS	Meet the requirement of limit. Minimum passing margin is -62.67dB at 13.56MHz
15.225 (d)	The field strength of any emissions appearing outside of the 13.110-14.010 MHz band	PASS	Meet the requirement of limit. Minimum passing margin is -7.86dB at 1.44MHz
15.225 (e)	The frequency tolerance	PASS	Meet the requirement of limit.
15.215 (c)	20dB Bandwidth	PASS	Meet the requirement of limit.

## 2.1 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Measurement	Value
Conducted Emission	2.98 dB
Radiated Emission-Chamber F	4.12 dB
Radiated Emission-Chamber G	5.59 dB



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### 3 GENERAL INFORMATION

#### 3.1 GENERAL DESCRIPTION OF EUT

<b>PRODUCT</b>	NFC 13.56MHz RFID transceiver module
<b>MODEL NO.</b>	T77H446
<b>POWER SUPPLY</b>	DC 3.3V±10% from host equipment
<b>MODULATION TYPE</b>	ASK
<b>OPERATING FREQUENCY</b>	13.56MHz
<b>NUMBER OF CHANNEL</b>	1
<b>ANTENNA TYPE</b>	Please see note
<b>DATA CABLE</b>	NA
<b>I/O PORTS</b>	NA
<b>ASSOCIATED DEVICES</b>	NA

#### NOTE:

1. There is antenna provided to this EUT, please refer to the following table:

Brand	Model	Antenna Type	Gain(dBi)	Frequency Range (MHz to MHz)	Antenna Connector	Cable Length
WNC	81.EKH15.G25	PCB antenna	N/A	13.56	NA	6.5cm

2. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

### 3.2 DESCRIPTION OF TEST MODES

The EUT only has 1 channel.

CHANNEL	FREQUENCY (MHz)
1	13.56

#### 3.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

EUT CONFIGURE MODE	APPLICABLE TO					DESCRIPTION
	PLC	RE (Below 30MHz)	RE (Above 30MHz)	FS	BW	
-	√	√	√	√	√	-

Where RE: Radiated Emission  
**PLC:** Power Line Conducted Emission  
**FS:** Frequency Stability  
**BW:** 20dB Bandwidth

**NOTE:** The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Y-plane**.

#### POWER LINE CONDUCTED EMISSION TEST:

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
-	1	1	ASK

#### RADIATED EMISSION TEST(BELOW 30MHz):

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
-	1	1	ASK



#### RADIATED EMISSION TEST(ABOVE 30MHz):

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
-	1	1	ASK

#### FREQUENCY STABILITY:

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
-	1	1	ASK

#### 20dB BANDWIDTH:

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
-	1	1	ASK

#### TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
PLC	27deg. C, 68%RH	120Vac, 60Hz	Anderson Chen
RE	22deg. C, 68%RH	120Vac, 60Hz	Robert Cheng
	22deg. C, 64%RH	120Vac, 60Hz	Chilin Lee
BW	25deg. C, 60%RH	120Vac, 60Hz	Robert Cheng
FS	25deg. C, 60%RH	120Vac, 60Hz	Robert Cheng



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### 3.3 GENERAL DESCRIPTION OF APPLIED STANDARDS

The EUT is a RF product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**FCC Part 15, Subpart C (15.225)**

**FCC Part 15, Subpart C (15.215)**

ANSI C63.10-2009

All test items have been performed and recorded as per the above standards.



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### 3.4 DESCRIPTION OF SUPPORT UNITS

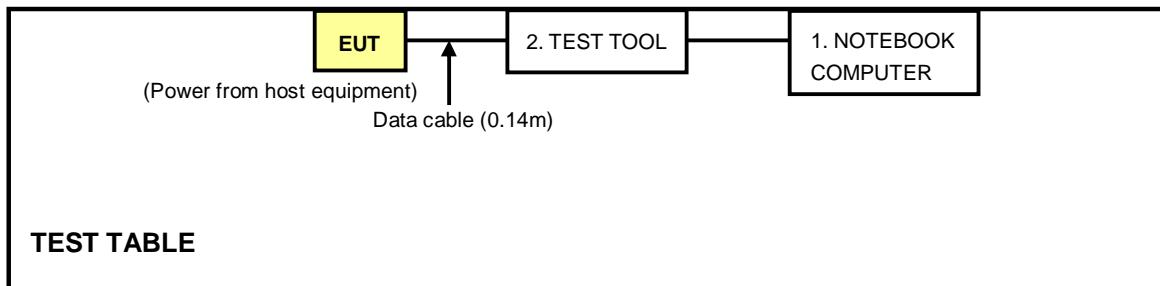
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	NOTEBOOK COMPUTER (for conducted test)	DELL	E5420	CHHYLQ1	FCC DoC
	NOTEBOOK COMPUTER (for radiated test)	DELL	PP32LA	FSLB32S	FCC DoC
2	TEST TOOL	Hon Hai	NA	NA	NA

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	USB cable, 0.7m
2	Data cable, 0.3m

**NOTE:** All power cords of the above support units are non shielded (1.8m).

### 3.5 CONFIGURATION OF SYSTEM UNDER TEST



## 4 TEST PROCEDURES AND RESULTS

### 4.1 CONDUCTED EMISSION MEASUREMENT

#### 4.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB $\mu$ V)	
0.15-0.5 0.5-5 5-30	Quasi-peak	Average
	66 to 56	56 to 46
	56	46
	60	50

**NOTE:**

1. The lower limit shall apply at the transition frequencies.
2. All emanations from a class B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

#### 4.1.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver ROHDE & SCHWARZ	ESCS 30	100287	Feb. 28, 2013	Feb. 27, 2014
Line-Impedance Stabilization Network (for EUT) SCHWARZBECK	NSLK 8127	8127-523	Sep. 19, 2012	Sep. 20, 2013
Line-Impedance Stabilization Network (for Peripheral) ROHDE & SCHWARZ	ESH3-Z5	848773/004	Oct. 29, 2012	Oct. 28, 2013
RF Cable (JYEBAO)	5DFB	COACAB-002	Aug. 05, 2012	Aug. 04, 2013
50 ohms Terminator	50	3	Oct. 23, 2012	Oct. 22, 2013
Software ADT	BV ADT_Cond_V7.3.7 .3	NA	NA	NA

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Shielded Room No. A.
3. The VCCI Con A Registration No. is C-817.
4. Tested Date: Apr. 29, 2013

#### 4.1.3 TEST PROCEDURES

- a. The EUT/HOST was placed 0.4 meters from the conducting wall of the shielded room with EUT/HOST being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN.
- b. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- c. Both lines of the power mains connected to the EUT/HOST were checked for maximum conducted interference.
- d. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

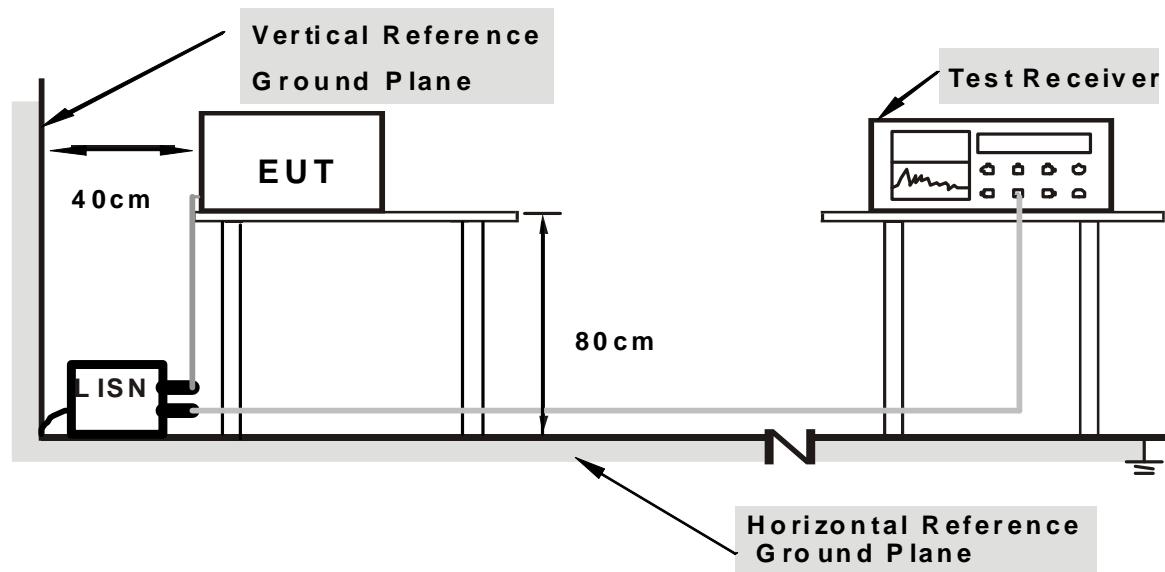
**NOTE:**

1. The resolution bandwidth of test receiver is 9kHz for Quasi-peak detection (QP) & Average detection (AV).

#### 4.1.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.1.5 TEST SETUP



**Note: 1. Support units were connected to second LISN.**

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.



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#### 4.1.6 EUT OPERATING CONDITIONS

1. Turn on the power of all equipment.
2. The support unit 1 (NB) runs a test program “NFCTestTool.exe” to link EUT under transmission condition continuously.

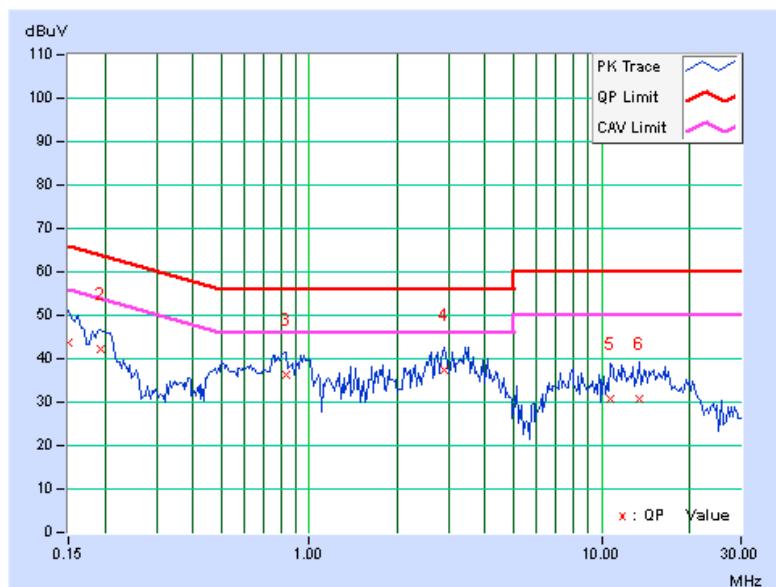
#### 4.1.7 TEST RESULTS

PHASE	Line (L)		6dB BANDWIDTH		Quasi-Peak (QP) / Average (AV)	
-------	----------	--	---------------	--	--------------------------------	--

No	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin	
	[MHz]	Factor (dB)	Q.P. [dB (uV)]	AV. [dB (uV)]	Q.P. [dB (uV)]	AV. [dB (uV)]	Q.P. [dB (uV)]	AV. [dB (uV)]	Q.P. (dB)	AV. (dB)
	[MHz]	(dB)	Q.P. [dB (uV)]	AV. [dB (uV)]	Q.P. [dB (uV)]	AV. [dB (uV)]	Q.P. [dB (uV)]	AV. [dB (uV)]	Q.P. (dB)	AV. (dB)
1	0.15000	0.10	43.45	24.91	43.55	25.01	66.00	56.00	-22.45	-30.99
2	0.19297	0.11	41.95	24.73	42.06	24.84	63.91	53.91	-21.85	-29.07
3	0.83359	0.17	36.25	18.25	36.42	18.42	56.00	46.00	-19.58	-27.58
4	2.91016	0.27	37.14	27.70	37.41	27.97	56.00	46.00	-18.59	-18.03
5	10.72656	0.60	30.28	24.01	30.88	24.61	60.00	50.00	-29.12	-25.39
6	13.51563	0.72	30.18	24.02	30.90	24.74	60.00	50.00	-29.10	-25.26

#### REMARKS:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value

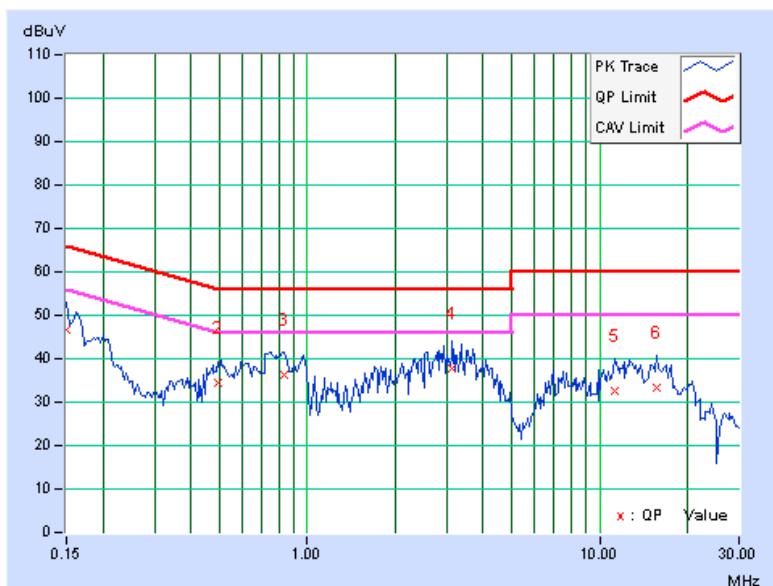


PHASE	Neutral (N)		6dB BANDWIDTH		Quasi-Peak (QP) / Average (AV)	
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No	Freq.	Corr.	Reading Value	Emission Level	Limit		Margin	
	Factor	[dB]	[dB (uV)]	[dB (uV)]	[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	0.14	46.59	26.61	46.73	26.75	66.00	56.00
2	0.49375	0.19	34.28	23.15	34.47	23.34	56.10	46.10
3	0.83359	0.21	36.16	20.29	36.37	20.50	56.00	46.00
<b>4</b>	<b>3.14453</b>	<b>0.32</b>	<b>37.43</b>	<b>28.06</b>	<b>37.75</b>	<b>28.38</b>	<b>56.00</b>	<b>46.00</b>
5	11.31250	0.58	31.94	25.56	32.52	26.14	60.00	50.00
6	15.74609	0.69	32.79	26.29	33.48	26.98	60.00	50.00

**REMARKS:**

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level – Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value





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## 4.2 RADIATED EMISSION & OCCUPIED BANDWIDTH EASUREMENT

### 4.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

FREQUENCIES (MHz)	FIELD STRENGTH (microvolts/meter)	MEASUREMENT DISTANCE (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dB<sub>u</sub>V/m) = 20 log Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.



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#### 4.2.2 TEST INSTRUMENTS

For below 30MHz:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer Agilent	E9038A	MY50010125	Feb. 01, 2013	Jan. 31, 2014
	E9038A	MY50010132	Dec. 27, 2012	Dec. 26, 2013
Pre-Amplifier Mini-Circuits	ZFL-1000VH2B	AMP-ZFL-01	Nov. 14, 2012	Nov. 13, 2013
	ZFL-1000VH2B	AMP-ZFL-02	Nov. 14, 2012	Nov. 13, 2013
Spectrum Analyzer Agilent	E4446A	MY48250253	Aug. 28, 2012	Aug. 27, 2013
Loop Antenna <sup>(*)</sup> Electro-Metrics	EM-6879	264	Jan. 08, 2013	Jan. 07, 2015
RF Cable	NA	RF104-110 RF104-206 RF104-209	Dec. 21, 2012	Dec.20, 2013
RF Cable	8DFB	CHFCAB-001 CHFCAB-002 CHFCAB-003	Nov. 14, 2012	Nov. 13, 2013
Software	ADT_Radiated_V8.7.06	NA	NA	NA
Antenna Tower & Turn Table CT	NA	NA	NA	NA

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The horn antenna, preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
- 3 \* = The calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
- 4 The test was performed in 10m Chamber No. F.
- 5 The FCC Site Registration No. is 928149.
- 6 The VCCI Site Registration No. is R-3252 & G-136.
- 7 The CANADA Site Registration No. is IC 7450H-1.
- 8 Loop antenna was used for all emissions below 30MHz.
- 9 Tested Date: Apr. 25, 2013



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**For above 30MHz:**

<b>DESCRIPTION &amp; MANUFACTURER</b>	<b>MODEL NO.</b>	<b>SERIAL NO.</b>	<b>CALIBRATED DATE</b>	<b>CALIBRATED UNTIL</b>
Spectrum Analyzer Agilent	E4446A	MY48250253	Sep. 03, 2012	Sep. 02, 2013
MXE EMI Receiver Agilent	N9038A	MY50010156	Jan. 16, 2013	Jan. 15, 2014
Pre-Amplifier Mini-Circuits	ZFL-1000VH2 B	AMP-ZFL-04	Nov. 14, 2012	Nov. 13, 2013
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Mar. 25, 2013	Mar. 24, 2014
RF Cable	NA	RF104-205 RF104-207 RF104-202	Dec. 26, 2012	Dec. 25, 2013
RF Cable	NA	CHHCAB_001	Oct. 07, 2012	Oct. 06, 2013
Software	ADT_Radiated _V8.7.05	NA	NA	NA
Antenna Tower & Turn Table CT	NA	NA	NA	NA

**Note:**

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The horn antenna, preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
3. The test was performed in 966 Chamber No. H.
4. The FCC Site Registration No. is 797305.
5. The CANADA Site Registration No. is IC 7450H-3.
6. Tested Date: Apr. 18, 2013

#### 4.2.3 TEST PROCEDURES

##### For Radiated emission below 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Both X and Y axes of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

##### NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

##### For Radiated emission 30~1000MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

##### NOTE:

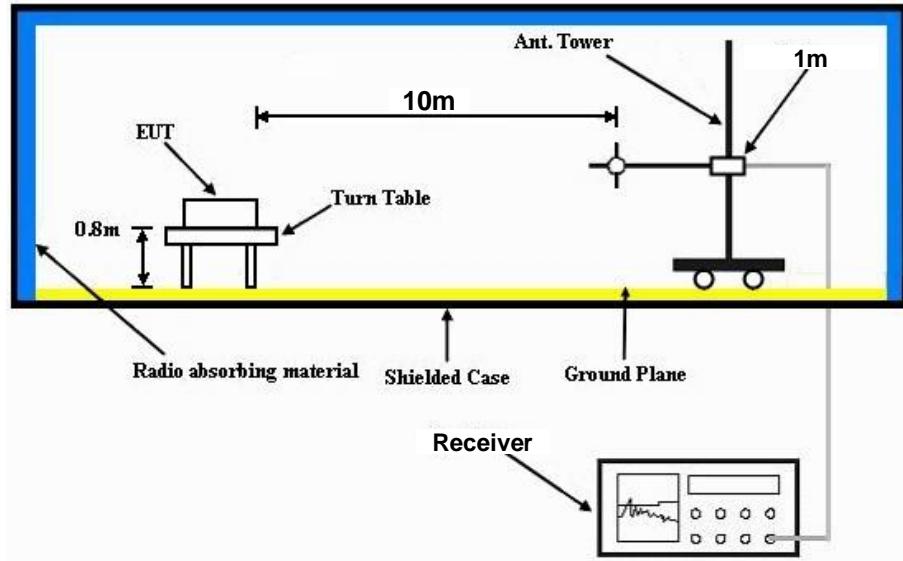
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency 30MHz ~ 1GHz.

#### 4.2.4 DEVIATION FROM TEST STANDARD

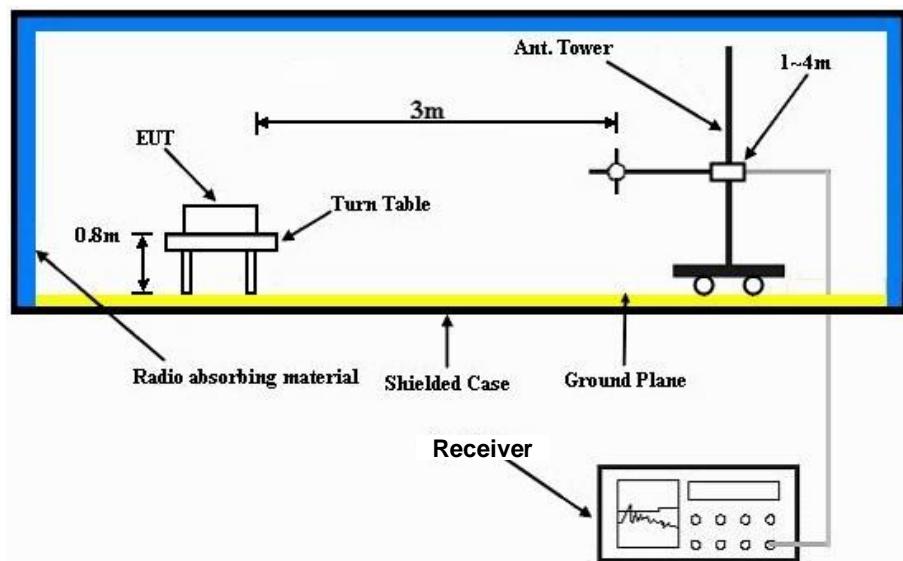
No deviation

#### 4.2.5 TEST SETUP

##### For Radiated emission below 30MHz



##### For Radiated emission 30~1000MHz



For the actual test configuration, please refer to the related item in this test report - Photographs of the Test Configuration.

#### 4.2.6 EUT OPERATING CONDITIONS

Set the transmitter part of EUT under transmission condition continuously at specific channel frequency.



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#### 4.2.7 TEST RESULTS

EUT TEST CONDITION		MEASUREMENT DETAIL			
INPUT POWER (SYSTEM)		120Vac, 60Hz		FREQUENCY RANGE 13.553 ~ 13.567MHz	
ENVIRONMENTAL CONDITIONS		22deg. C, 68%RH		DETECTOR FUNCTION Quasi-Peak (QP)	
TESTED BY		Robert Cheng			

LOOP ANTENNA TEST DISTANCE: AT 10 M (X AXIS)								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*13.56	36.77 QP	103.1	-66.33	1.00	12	40.41	-3.64

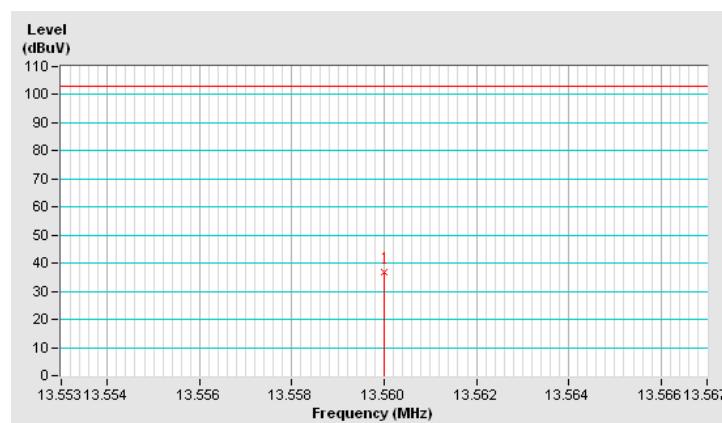
**REMARKS:**

1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value
5. “\*”: Fundamental frequency.

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

$$\begin{aligned}13.56\text{MHz} &= 15848\text{uV/m} & 30\text{m} \\ &= 84\text{dBuV/m} & 30\text{m} \\ &= 84+20\log(30/10)^2 & 10\text{m} \\ &= 103.1\text{dBuV/m}\end{aligned}$$





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EUT TEST CONDITION		MEASUREMENT DETAIL		
INPUT POWER (SYSTEM)		120Vac, 60Hz		FREQUENCY RANGE 13.553 ~ 13.567MHz
ENVIRONMENTAL CONDITIONS		22deg. C, 68%RH		DETECTOR FUNCTION Quasi-Peak (QP)
TESTED BY		Robert Cheng		

LOOP ANTENNA TEST DISTANCE: AT 10 M (Y AXIS)								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*13.56	40.43 QP	103.1	-62.67	1.00	329	44.07	-3.64

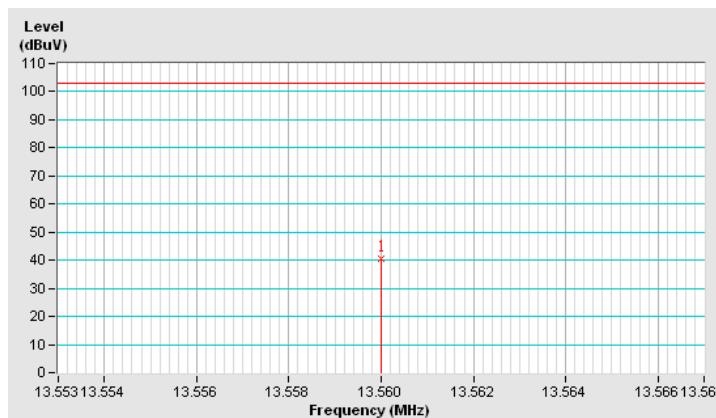
**REMARKS:**

1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value
5. “\*”: Fundamental frequency.

The measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

$$\begin{aligned}13.56\text{MHz} &= 15848\text{uV/m} & 30\text{m} \\ &= 84\text{dBuV/m} & 30\text{m} \\ &= 84+20\log(30/10)^2 & 10\text{m} \\ &= 103.1\text{dBuV/m}\end{aligned}$$





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EUT TEST CONDITION		MEASUREMENT DETAIL		
INPUT POWER (SYSTEM)		120Vac, 60Hz		FREQUENCY RANGE Below 30MHz
ENVIRONMENTAL CONDITIONS		22deg. C, 68%RH		DETECTOR FUNCTION Quasi-Peak (QP)
TESTED BY		Robert Cheng		

LOOP ANTENNA TEST DISTANCE: AT 10 M (X AXIS)								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	0.03	49.55 QP	97.15	-47.6	1.00	215	21.14	28.41
2	0.13	37.65 QP	84.42	-46.77	1.00	112	22.52	15.13
3	1.43	26.72 QP	43.62	-16.9	1.00	258	27.18	-0.46
4	6.55	14.75 QP	48.6	-33.85	1.00	27	17.93	-3.18
5	23.13	16.44 QP	48.6	-32.16	1.00	24	23.22	-6.78
6	29.24	17.04 QP	48.6	-31.56	1.00	116	20.14	-3.1
LOOP ANTENNA TEST DISTANCE: AT 10 M (Y AXIS)								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	0.03	48.07 QP	97.15	-49.08	1.00	49	19.66	28.41
2	0.13	43.22 QP	84.42	-41.2	1.00	318	28.09	15.13
3	1.44	35.7 QP	43.56	-7.86	1.00	84	36.18	-0.48
4	2	31.13 QP	48.6	-17.47	1.00	338	33.04	-1.91
5	23.13	20.95 QP	48.6	-27.65	1.00	354	27.73	-6.78
6	24.04	19.22 QP	48.6	-29.38	1.00	6	26.54	-7.32

**REMARKS:**

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value



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EUT TEST CONDITION		MEASUREMENT DETAIL			
INPUT POWER (SYSTEM)		120Vac, 60Hz		FREQUENCY RANGE 30~1000MHz	
ENVIRONMENTAL CONDITIONS		22deg. C, 64%RH		DETECTOR FUNCTION Quasi-Peak (QP)	
TESTED BY		Chilin Lee			

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	120.02	35.2 QP	43.5	-8.3	1.50 H	237	50.35	-15.18
2	240.00	25.4 QP	46.0	-20.6	1.00 H	292	39.94	-14.52
3	398.31	25.4 QP	46.0	-20.6	1.50 H	255	35.36	-9.98
4	479.98	25.0 QP	46.0	-21.0	2.00 H	122	33.05	-8.07
5	940.59	29.9 QP	46.0	-16.1	2.00 H	287	29.48	0.46
6	959.99	30.5 QP	46.0	-15.5	1.00 H	144	29.50	1.00

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	120.02	26.8 QP	43.5	-16.7	1.50 V	299	42.01	-15.18
2	286.32	30.3 QP	46.0	-15.7	2.00 V	237	43.03	-12.71
3	395.98	25.1 QP	46.0	-20.9	1.00 V	4	35.14	-10.06
4	433.37	25.9 QP	46.0	-20.1	1.50 V	338	34.68	-8.78
5	621.60	31.9 QP	46.0	-14.1	1.00 V	250	36.89	-4.95
6	940.68	32.4 QP	46.0	-13.6	1.00 V	316	31.95	0.46

**REMARKS:**

1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB/m).
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB).
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.



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## 4.3 20dB BANDWIDTH

### 4.3.1 LIMITS OF 20dB BANDWIDTH MEASUREMENT

The 20dB bandwidth shall be specified in operating frequency band.

### 4.3.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
R&S SPECTRUM ANALYZER	FSP40	100037	Nov. 01, 2012	Oct. 31, 2013

Note:

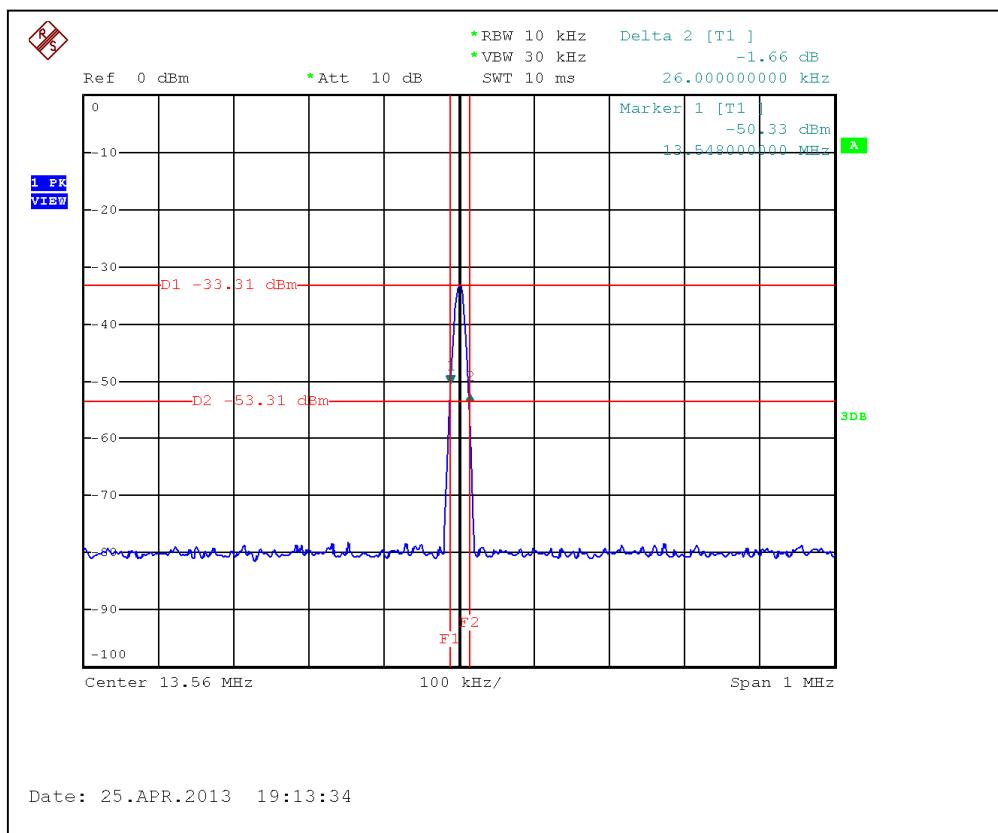
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. Tested date : May 02, 2013

### 4.3.3 EUT OPERATING CONDITION

The bandwidth of the fundamental frequency was measured by spectrum analyzer with 10kHz RBW and 30kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

## 4.3.4 TEST RESULTS

20dBc point (Low)	20dBc point (High)	Operating frequency band (MHz)	PASS/FAIL
13.55 MHz	13.57 MHz	13.11 – 14.01	PASS



## 4.4 FREQUENCY STABILITY

### 4.4.1 LIMITS OF FREQUENCY STABILITY MEASUREMENT

The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\% (\pm 100\text{ppm})$  of the operating frequency over a temperature variation of -20 degrees to 50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

### 4.4.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
R&S SPECTRUM ANALYZER	FSP40	100037	Nov. 01, 2012	Oct. 31, 2013
Temperature & Humidity Chamber GIANTFORCE	GTH-150-40-S P-AR	MAA0812-008	Jan. 17, 2013	Jan. 16, 2014

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. Tested date : Apr. 25, 2013

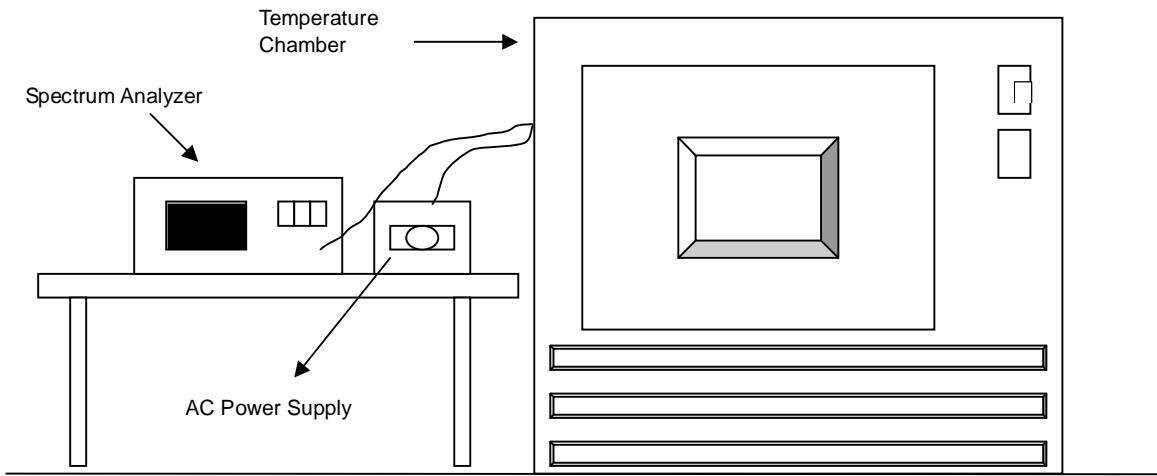
### 4.4.3 TEST PROCEDURE

1. The EUT was placed inside the environmental test chamber and powered by nominal AC voltage.
2. Turn the EUT on and couple its output to a spectrum analyzer.
3. Turn the EUT off and set the chamber to the highest temperature specified.
4. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 minutes.
5. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
6. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

#### 4.4.4 DEVIATION FROM TEST STANDARD

No deviation

#### 4.4.5 TEST SETUP



#### 4.4.6 EUT OPERATING CONDITION

The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.



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#### 4.4.7 TEST RESULTS

FREQUEMCY STABILITY VERSUS TEMP.									
TEMP. (°C)	POWER SUPPLY (Vac)	0 MINUTE		2 MINUTE		5 MINUTE		10 MINUTE	
		Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift
		(MHz)	%	(MHz)	%	(MHz)	%	(MHz)	%
50	120	13.56	0.00000	13.55999	-0.00007	13.56	0.00000	13.56001	0.00007
40	120	13.56001	0.00007	13.56	0.00000	13.56001	0.00007	13.55999	-0.00007
30	120	13.55996	-0.00029	13.55995	-0.00037	13.55995	-0.00037	13.55996	-0.00029
20	120	13.55998	-0.00015	13.56	0.00000	13.56	0.00000	13.56	0.00000
10	120	13.55999	-0.00007	13.55998	-0.00015	13.55999	-0.00007	13.55999	-0.00007
0	120	13.56001	0.00007	13.56	0.00000	13.55999	-0.00007	13.56001	0.00007
-10	120	13.56006	0.00044	13.56004	0.00029	13.56004	0.00029	13.56006	0.00044
-20	120	13.55996	-0.00029	13.55995	-0.00037	13.55995	-0.00037	13.55994	-0.00044
-30	120	13.56003	0.00022	13.56004	0.00029	13.56003	0.00022	13.56002	0.00015

FREQUEMCY STABILITY VERSUS VOLTAGE									
TEMP. (°C)	POWER SUPPLY (Vac)	0 MINUTE		2 MINUTE		5 MINUTE		10 MINUTE	
		Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift	Measured Frequency	Frequency Drift
		(MHz)	%	(MHz)	%	(MHz)	%	(MHz)	%
20	138	13.55998	-0.00015	13.56	0.00000	13.56	0.00000	13.56	0.00000
	120	13.55998	-0.00015	13.56	0.00000	13.56	0.00000	13.56	0.00000
	102	13.55998	-0.00015	13.56	0.00000	13.56	0.00000	13.56	0.00000



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## 5 INFORMATION ON THE TESTING LABORATORIES

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

**Linko EMC/RF Lab:**

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**Hsin Chu EMC/RF Lab:**

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**Web Site:** [www.bureauveritas-adt.com](http://www.bureauveritas-adt.com)

The address and road map of all our labs can be found in our web site also.



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## 6 APPENDIX-A- MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No any modifications are made to the EUT by the lab during the test.

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