

MEASUREMENT REPORT

of

RFID MODULE

Applicant : Elo Touch Solutions, Inc.
EUT : RFID MODULE
FCC ID : RBWE031451
Model : E031451

Test by :

Training Research Co., Ltd.

TEL : 886-2-26935155 **FAX : 886-2-26934440**
No. 255, Nan-yang Street, Shijr, Taipei Hsien 221, Taiwan


CERTIFICATION


We here by verify that:

The test data, data evaluation, test procedures and equipment configurations shown in this report were made mainly in accordance with the procedures given in ANSI C63.4 (2003) as a reference. All tests were conducted by *Training Research Co., Ltd.*, No. 255, Nan-yang Street, Shijr, Taipei Hsien 221, Taiwan. Also, we attest to the accuracy of each.

We further submit that the energy emitted by the sample EUT tested as described in the report is **in compliance with** the technical requirements set forth in the FCC Rules Part 15 Subpart C Section 15.225.

Applicant : Elo Touch Solutions, Inc.
Applicant address : 301 Constitution Drive, Menlo Park,
California, U.S.A., 94025
Report No. : J2215120130
Test Date : December 20, 2012

Prepared by: 
Jack Tsai

Approved by: 
Frank Tsai

Conditions of issue :

- (1) **This test report shall not be reproduced except in full, without written approval of TRC. And the test result contained within this report only relate to the sample submitted for testing.**

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Chapter 1 General

1.1 Introduction

The following measurement report is submitted on behalf of Applicant in support of a RF mouse certification in accordance with Part 2 Subpart J and Part 15 Subpart C of the Commission's Rules and Regulations.

1.2 Description of EUT

FCC ID	: RBWE031451
Product Name	: RFID MODULE
Model	: E031451
Frequency Range	: 13.553MHz ~ 13.567MHz
Operating Frequency	: 13.56MHz
Modulation Skill	: ASK
Power Type	: By AC/DC Adapter

1.3 Test method

All measurements contained in this report were performed according to the techniques described in Measurement procedure ANSI C63.4 – 2003.

Pretest was found that the emission of operating mode is worse than standby mode. So, the final test is made at the operating mode (transmitted). The EUT set in 13.56MHz continuously transmitting mode, which transmitted the maximum emission.

The test placement as the photographs showed is the worst case emission placed. (If the emission is close to the ambient, the resolution BW and view resolution will be reduced and the data will be recorded by detection of maximum hold peak mode.)

1.4 Description of Support Equipment

AC/DC Adapter	:	L.T.E
Model No.	:	LTE05W-S1
Power type	:	I/P: 100-240 Vac / 47-63Hz, 1A O/P: 5 Vdc / 1A
Power cord	:	1.76m length, non-shielded, without ferrite core

1.5 Test Procedure

All measurements contained in this report were performed mainly according to the techniques described in Measurement procedure ANSI C63.4 (2003).

1.6 Location of the Test Site

The radiated emissions measurements required by the rules were performed on the **three-meter, Anechoic Chamber (FCC Registration Number: 93906)** maintained by *Training Research Co., Ltd.* 1F, No. 255, Nan-yang Street, Shijr, Taipei Hsien 221, Taiwan, R.O.C. Complete description and measurement data have been placed on file with the commission. The conducted power line emissions tests and other test items were performed in an anechoic chamber also located at Training Research Co., Ltd. 1F, No. 255, Nan-yang Street, Shijr, Taipei Hsien 221, Taiwan, R.O.C. *Training Research Co., Ltd.* is listed by the FCC as a facility available to do measurement work for others on a contract basis.

1.7 General Test Condition

The conditions under which the EUT operates were varied to determine their effect on the equipment's emission characteristics. The final configuration of the test system and the mode of operation used during these tests were chosen as that which produced the highest emission levels. However, only those conditions which the EUT was considered likely to encounter in normal use were investigated.

In test, they were set in high power and continuously transmitting mode. The setting up procedure is recorded on 1.3 Test Method.

Chapter 2 Conducted Emissions Measurements

2.1 Test Condition & Setup

The power line conducted emission measurements were performed in an semi-anechoic chamber. The EUT was assembled on a wooden table, which is 80 centimeters high, was placed 40 centimeters from the backwall and at least 1 meter from the sidewall.

Power was fed to the EUT from the public utility power grid through a line filter and Line Impedance Stabilization Networks (LISNs). The LISN housing, measuring instrumentation case, ground plane, etc., were electrically bonded together at the same RF potential. The Spectrum analyzer (or EMI receiver) was connected to the AC line through an isolation transformer. The 50-ohm output of the LISN was connected to the spectrum analyzer directly. Conducted emission levels were in the CISPR quasi-peak and average detection mode. The analyzer's 6 dB bandwidth was set to 9 KHz. No post-detector video filter was used.

The spectrum was scanned from 150 KHz to 30 MHz. The physical arrangement of the test system and associated cabling was varied (within the scope of arrangements likely to be encountered in actual use) to determine the effect on the unit's emanations in amplitude and frequency. All spurious emission frequencies were observed. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in paragraph 2.3

There is a test condition apply in this test item, the test procedure description as <1.3>. Three channels were tested, one in the top, one in the middle and the other in bottom.

2.2 List of Test Instruments

				<u>Calibration Date</u>
Instrument Name	Model	Brand	Serial No.	Next time
EMI Receiver	8546A	HP	3520A00242	08/16/13
RF Filter Section	85460A	HP	3448A00217	08/16/13
LISN (EUT)	3816/2	EMCO	00042976	08/10/13
LISN (Support E.)	3816/2	EMCO	00042989	08/15/13
Coaxial Cable (2.0 meter)	A30A30-0058-50FS-2M	Jyebao	SMA-08	04/11/13
Coaxial Cable (1.1 meter)	A30A30-0058-50FS-1M	Jyebao	SMA-09	04/11/13
Coaxial Cable (20 meter)	RG-214/U	Jyebao	NP-01	04/11/13
Coaxial Cable (20 meter)	RG-214/U	Jyebao	NP-02	04/11/13
Auto Switch Box (< 30MHz)	ASB-01	TRC	9904-01	04/11/13

2.3 Test Result of Conducted Emissions

The following table shows a summary of the highest emissions of power line conducted emissions on the LIVE and NETURAL conductors of the EUT power cord. Show as follows.

Test Conditions: Temperature : 25 °C Humidity : 73 % RH

Test mode:

Power Connected Emissions					Class B		
Conductor	Frequency (KHz)	Peak (dBµV)	QP (dBµV)	Average (dBµV)	QP-limit (dBµV)	AVG-limit (dBµV)	Margin (dB)
Line 1	243.000	47.57	---	---	63.34	53.34	-5.77
	259.000	47.21	---	---	62.89	52.89	-5.68
	317.000	44.59	---	---	61.23	51.23	-6.64
	494.000	43.15	---	---	56.17	46.17	-3.02
	3189.000	38.27	---	---	56.00	46.00	-7.73
	13500.000	45.77	---	---	60.00	50.00	-4.23
Line 2	240.000	43.19	---	---	63.43	53.43	-10.24
	257.000	42.99	---	---	62.94	52.94	-9.95
	288.000	40.40	---	---	62.06	52.06	-11.66
	490.000	37.46	---	---	56.29	46.29	-8.83
	3158.000	34.09	---	---	56.00	46.00	-11.91
	13500.000	38.97	---	---	60.00	50.00	-11.03

NOTE:

- (1)Margin = Peak Amplitude – Limit, *The reading amplitudes are all under limit.*
- (2)A "+" sign in the margin column means the emission is OVER the Class B Limit and "-" sign of means UNDER the Class B limit

Chapter 3 Radiated Emission Measurements

3.1 Harmonic and Spurious Emission

3.1.1 Test Condition and Setup

Pretest:

Prior to the final test ,the EUT is placed in an anechoic chamber, and scan from 26MHz to 1GHz. The devices to determine which attitude and configuration produces the highest emission relative to the limit. This is done to ensure the radiation exactly emits form the EUT.

Final test:

Final radiation measurements is made on a **3-meter** anechoic chamber. The EUT's maximum emission of radiation is placed on a nonconductive table, which is 0.8m height, the top surface is 1.0 x 1.5 meter. All placement is according to ANSI C63.4 - 2003.

The spectrum is examined from 30MHz to 1000MHz measured by HP spectrum. The whole range antenna is used to measure frequency from 30MHz to 1GHz.

The final test is used the spectrum analyzer. Measure more than six top marked frequencies generated form pretest by computer step by step at each frequency. The EUT is three orthogonal planes and rotated 360 degrees, and antenna is raised and lowered from 1 to 4 meters to find the maximum emission levels. The antenna is used with both horizontal and vertical polarization.

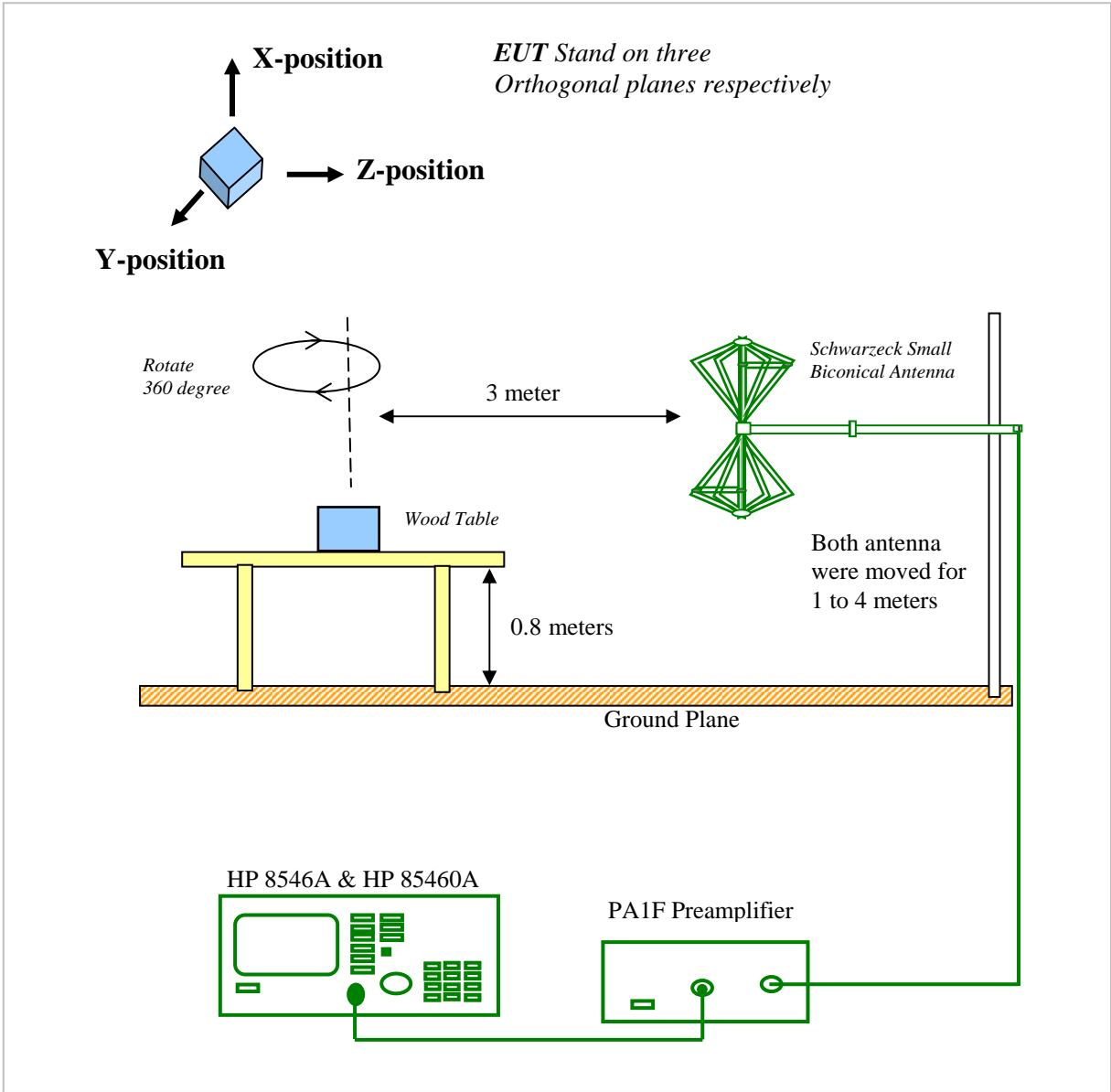
Appropriated preamplifier, which is made by TRC is used for improving sensitivity and precautions is taken to avoid overloading. The spectrum analyzer's 6dB bandwidth is set to 120 kHz, and the EUT is measured at quasi-peak mode. (30MHz to 1GHz)

If the emission is close to the frequency band of ambient, the tester will recheck the data and the corrected data will be written in the test data sheet. If the emission is just within the ambient, the data from shield room will be taken as the final data.

3.1.2 List of Test Instruments

Instrument Name	Model	Brand	Serial No.	Calibration Date
				Next time
EMI Receiver	8546A	HP	3520A00242	08/16/13
RF Filter Section	85460A	HP	3448A00217	08/16/13
Small Biconical Antenna	UBAA9114 & BBVU9135	Schwarzeck	127	07/20/13
Pre-amplifier	PA1F	TRC	1FAC	04/06/13
Coaxial Cable (Double shielded, 15 meter)	A30A30-0058-50FS-15 M	JYEBAO	SMA-01	04/06/13
Coaxial Cable (1.1 meter)	A30A30-0058-50FS-1M	JYEBAO	SMA-02	04/06/13

3.1.3 Configuration of System Under Test



3.1.4 Test Result of Harmonic and Spurious Emission

The highest peak values of radiated emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following.

Testing room : Temperature : 25 ° C Humidity : 73 % RH

Test Result of Harmonic and Spurious Emission for Horizontal

Frequency	Reading Amplitude	Ant. Height	Table	Correction Factors	Corrected Amplitude	Class B Limit	Margin
MHz	dBµV	m	degree	dB/m	dBµV/m	dBµV/m	dB
32.42	23.29	1.00	48	7.15	30.44	40.00	-9.56
179.14	35.78	1.00	182	-3.71	32.07	43.50	-11.43
205.81	33.00	1.00	171	-3.15	29.85	43.50	-13.65
233.70	32.96	1.00	185	-3.12	29.84	46.00	-16.16
247.04	35.68	1.00	171	-3.28	32.40	46.00	-13.60
260.37	41.38	1.00	185	-3.58	37.80	46.00	-8.20
301.60	39.97	1.00	326	-2.99	36.98	46.00	-9.02
314.94	40.11	1.00	185	-2.75	37.36	46.00	-8.64
328.27	39.73	1.00	315	-2.52	37.21	46.00	-8.79
356.16	40.30	1.00	305	-1.98	38.32	46.00	-7.68
489.54	36.36	1.00	305	2.35	38.71	46.00	-7.29

Note:

1. Margin = Amplitude – limit, if margin is minus means under limit.
2. Corrected Amplitude = Reading Amplitude + Correction Factors
3. Correction factor = Antenna factor + (Cable Loss – Amplitude gain) + Switching Box Loss

Test Result of Harmonic and Spurious Emission for Vertical

Frequency	Reading Amplitude	Ant. Height	Table	Correction Factors	Corrected Amplitude	Class B Limit	Margin
MHz	dB μ V	m	degree	dB/m	dB μ V/m	dB μ V/m	dB
38.83	28.20	1.00	245	4.13	32.33	40.00	-7.67
179.14	38.67	1.00	211	-3.71	34.96	43.50	-8.54
205.81	35.83	1.00	262	-3.15	32.68	43.50	-10.82
233.70	34.69	1.00	68	-3.12	31.57	46.00	-14.43
247.04	34.60	1.00	319	-3.28	31.32	46.00	-14.68
261.59	34.27	1.00	92	-3.57	30.70	46.00	-15.30
287.05	33.68	1.00	319	-3.20	30.48	46.00	-15.52
300.39	33.79	1.00	153	-3.01	30.78	46.00	-15.22
327.06	32.09	1.00	105	-2.54	29.55	46.00	-16.45
354.95	34.25	1.00	251	-2.01	32.24	46.00	-13.76
392.54	30.52	1.00	241	-1.12	29.40	46.00	-16.60
487.11	31.52	1.00	109	2.25	33.77	46.00	-12.23
582.90	25.98	1.00	266	6.09	32.07	46.00	-13.93

3.2 Peak Power of Fundamental Frequency, Harmonic and Spurious Measurement

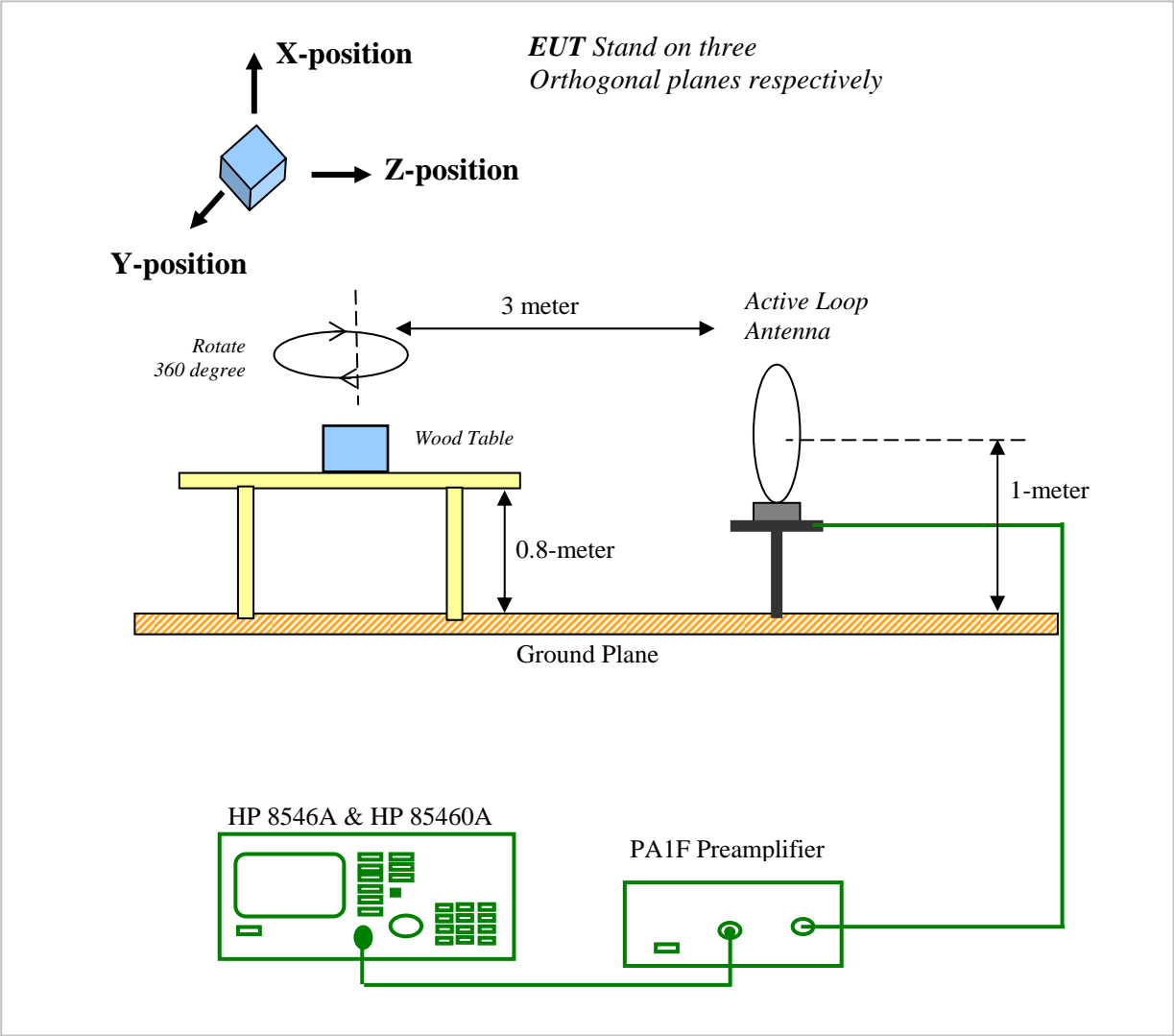
3.2.1 Test Condition and Setup

- A) The EUT was setup in the anechoic chamber
- B) Set the Loop Antenna height 1m, Vertical and rotate the antenna to find the azimuth of the highest emission and record the reading.
- C) Keep the antenna azimuth and turn the EUT 360 degree and record the highest emission.
- D) Raise the antenna to 2 meters and repeat set (B) and (C).
- E) Change the antenna Horizontal and repeat (B) to (D).
- F) Record the highest reading in test report.

3.2.2 List of Test Instruments

Instrument Name	Model	Brand	Serial No.	Calibration Date
				Next time
EMI Receiver	8546A	HP	3520A00242	08/16/13
RF Filter Section	85460A	HP	3448A00217	08/16/13
Pre-amplifier	PA1F	TRC	1FAC	04/06/13
Active Loop Antenna	6507	EMCO	1493	11/09/13

3.2.3 Configuration of System Under Test

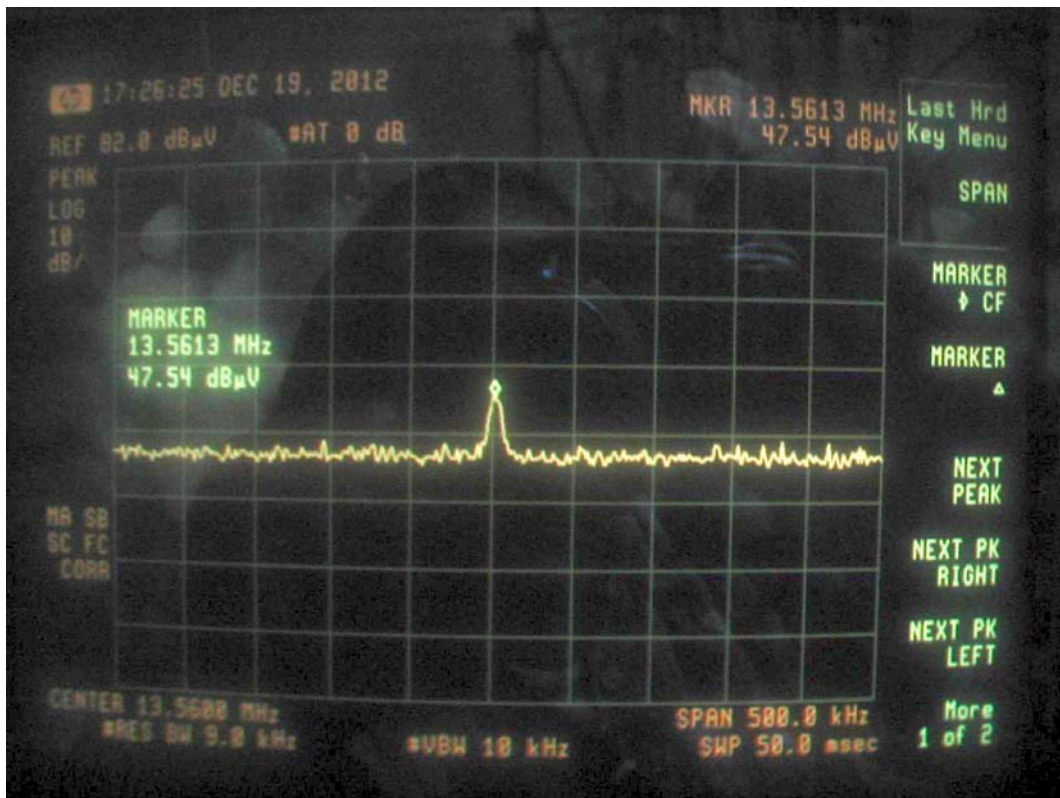


3.2.4 Test Result of Fundamental Emission

Testing room : Temperature : 25 ° C Humidity : 73 % RH

Test Result of Fundamental Emission for Horizontal

Frequency	Reading Amplitude	Ant. Height	Table	Correction Factors	Corrected Amplitude	Class B Limit	Margin
MHz	dB μ V	m	degree	dB/m	dB μ V/m	dB μ V/m	dB
13.5600	47.54	1.00	281	-14.99	32.55	124.00	-91.45

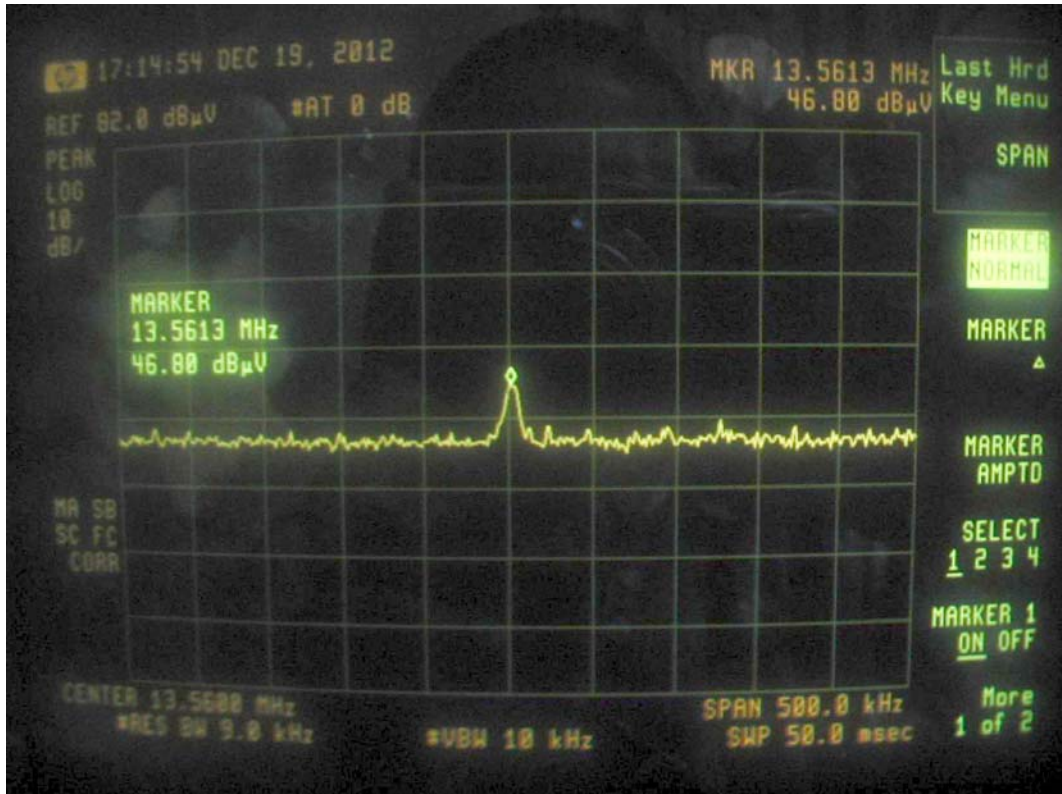


Note:

1. Correction Factor (dB/m) = Cable Loss + Antenna Factor
2. Corrected Amplitude (dB μ V/m) = Reading Data + Correction Factor
3. The limit is 15848 (uV/m) = 84 dB μ V/m @ 30 m, for main frequency < 30 MHz, the formula transfers the limit to 30 m to 3 m is $L_{30}(\text{dB}\mu\text{V/m}) + 40 = 124 \text{ dB}\mu\text{V/m}$
4. Margin (dB) = Limit – Corrected Amplitude

Test Result of Fundamental Emission for Vertical

Frequency	Reading Amplitude	Ant. Height	Table	Correction Factors	Corrected Amplitude	Class B Limit	Margin
MHz	dB μ V	m	degree	dB/m	dB μ V/m	dB μ V/m	dB
13.5600	46.80	1.00	150	-14.99	31.81	124.00	-92.19



3.2.5 Test Result of Harmonic and Spurious Emission

Testing room : Temperature : 25 ° C Humidity : 73 % RH

Test Result of Harmonic and Spurious Emission for Horizontal

Frequency	Reading Amplitude	Ant. Height	Table	Correction Factors	Corrected Amplitude	Class B Limit	Margin
MHz	dBμV	m	degree	dB/m	dBμV/m	dBμV/m	dB
27.1200	***	***	***	-15.43	***	69.54	***

Test Result of Harmonic and Spurious Emission for Vertical

Frequency	Reading Amplitude	Ant. Height	Table	Correction Factors	Corrected Amplitude	Class B Limit	Margin
MHz	dBμV	m	degree	dB/m	dBμV/m	dBμV/m	dB
27.1200	***	***	***	-15.43	***	69.54	***

Note:

1. Correction Factor (dB/m) = Cable Loss + Antenna Factor
2. Corrected Amplitude (dBuV/m) = Reading Data + Correction Factor
3. For main frequency < 30 MHz, the formula transfers the limit to 30 m to 3 m is
 $L_{30}(\text{dBuV/m}) + 40$
4. Margin (dB) = Limit – Corrected Amplitude
5. *** - It is not found for spurious emission of horizontal & vertical.

3.3 Test Result of the Bandedge

The following show our observations referring to the single channel respectively. Test Condition & Setup same as 3.2.1 to 3.2.2.

Antenna polarity: Horizontal & Vertical, Frequency Band: 13.110MHz ~ 14.040MHz

Frequency	Reading Amplitude	Ant. Height	Table	Correction Factors	Corrected Amplitude	Class B Limit	Margin
MHz	dBμV	m	degree	dB/m	dBμV/m	dBμV/m	dB
***	***	***	***	***	***	***	***

Note:

1. Correction Factor (dB/m) = Cable Loss + Antenna Factor
2. Corrected Amplitude (dBμV/m) = Reading Data + Correction Factor
3. For main frequency < 30 MHz, the formula transfers the limit to 30 m to 3 m is $L_{30}(\text{dB}\mu\text{V}/\text{m}) + 40$
4. Margin (dB) = Limit –Corrected Amplitude
5. *** - Fundamental emission is less than limit of bandedge above 20dB in horizontal & vertical.

Chapter 4 Frequency Stability (Part 2.1055, 15.225 (e))

4.1 Test procedure: (Temperature)

(1) Frequency shift vs. temperature:

The nominal room temperature 20°C, and the reference frequency is 13.560000MHz.

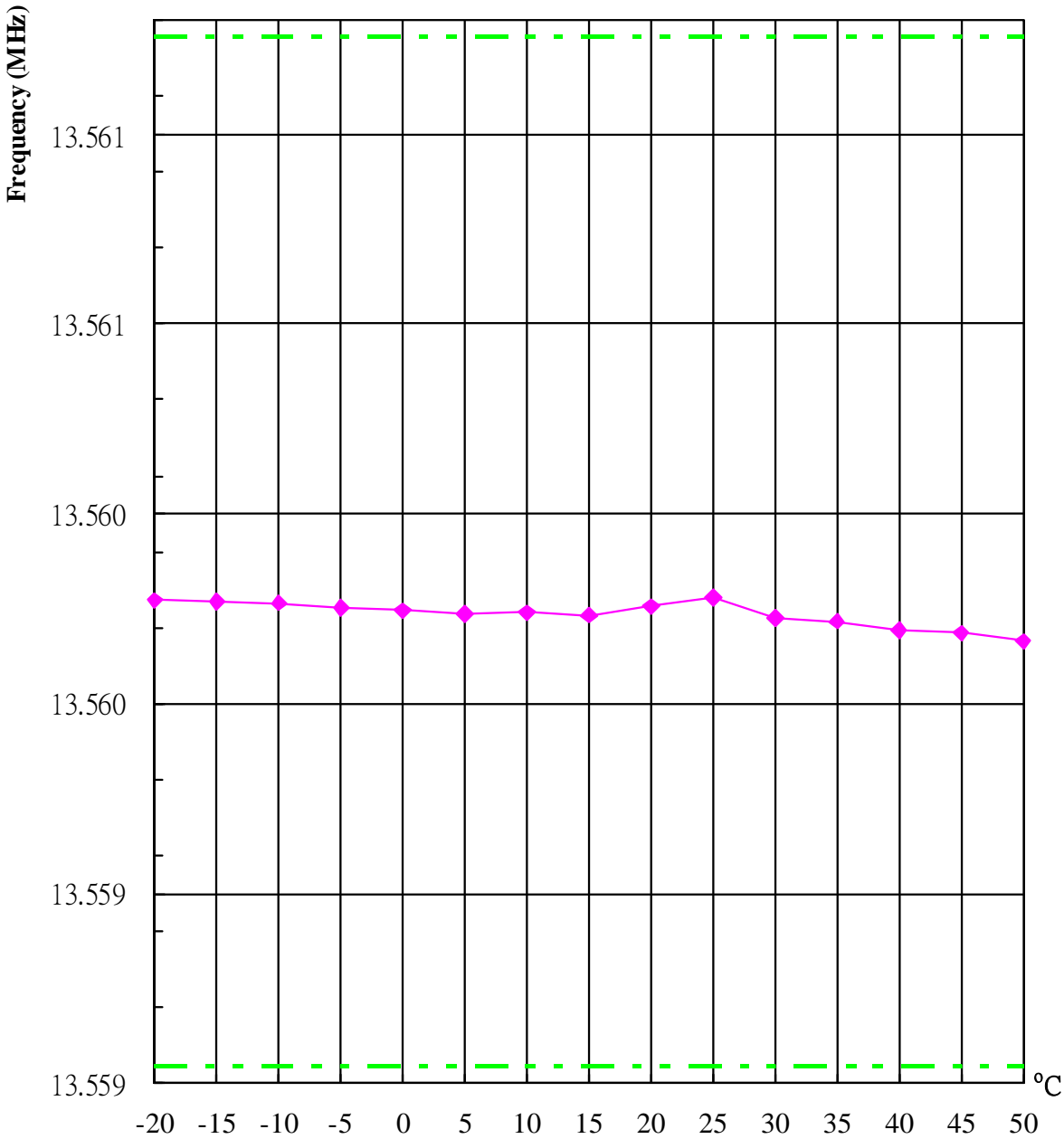
(2) The EUT was put in an environmental chamber and set up the temperature of this chamber from -20°C to +50°C and recorded the frequency has been shift at ± 0.01%

4.2 Test Result:

Temperature Variation Table

<i>Temperature (Centigrade)</i>	<i>Frequency (MHz)</i>	<i>Frequency Stability (± 0.01%)</i>
-20	13.559872	13.558644 ~ 13.561356
-15	13.559868	
-10	13.559864	
-5	13.559852	
0	13.559844	
5	13.559836	
10	13.559840	
15	13.559832	
20	13.559856	
25	13.559880	
30	13.559824	
35	13.559816	
40	13.559792	
45	13.559784	
50	13.559764	

Chart 4.1 Temperatuer Variation Vs. Frequency



4.3 Test Equipment:

Instrument Name	Model No.	Brand	Serial No.	Next time
Spectrum Analyzer	MS2665C	Anritsu	6200175476	02/15/13
Digital Multimeter	GDM-8055	GW	8080365	09/20/13
Temperature & Humidity Chamber	THS-ML1	King Son	240	02/21/13

4.4 Test procedure:(voltage)

(1) Frequency shift vs. voltage:

Nominal power is 4.8Vdc and the reference Frequency is 13.560000MHz

(2) The EUT was powered at 85% and 115% of nominal.

4.5 Test Result:

Frequency Stability of Voltage Variation Measurement Table

<i>Supply Voltage (Volt)</i>	<i>Frequency (MHz)</i>	<i>Frequency Stability (± 0.01%)</i>
102 (85%)	13.559872	13.558644
120 (100%)	13.559880	~
138 (115%)	13.559868	13.561356

Chart 4.2 Voltage Variation Vs. Frequency

