FCC Part 15
EMI TEST REPORT

of

E.U.T. : ELECTRONIC LEVERSET
FCC ID. : YLKPT2C
Model : PT2C
Working Frequency : 13.56 MHz

for

APPLICANT : Tong Lung Metal Industry Co., Ltd
ADDRESS : 62, Chung-Hsiao 1st Street, Hou-Hu-Li, Chia-Yi 600, Taiwan, R.O.C.

Test Performed by

ELECTRONICS TESTING CENTER, TAIWAN
NO. 34, LIN 5, DING FU TSUN, LINKOU HSIANG
TAIPEI HSIEN, TAIWAN, R.O.C.
Tel : (02)26023052 Fax : (02)26010910
http://www.etc.org.tw ; e-mail**: r00@etc.org.tw**

Report Number : 13-01-RBF-018-01

TEST REPORT CERTIFICATION

Applicant : Tong Lung Metal Industry Co., Ltd
62, Chung-Hsiao 1st Street, Hou-Hu-Li, Chia-Yi 600, Taiwan, R.O.C.

Manufacture : Tong Lung Metal Industry Co., Ltd
62, Chung-Hsiao 1st Street, Hou-Hu-Li, Chia-Yi 600, Taiwan, R.O.C.

Description of EUT :

a) Type of EUT	: ELECTRONIC LEVERSET
b) Trade Name	: EZSET,EZSET,KWIKSET
c) Model No.	: PT2C
d) FCC ID	: YLKPT2C
e) Working Frequency	: 13.56 MHz
f) Power Supply	: DC 1.5V Battery * 4

Regulation Applied : FCC Rules and Regulations Part 15 Subpart C

I HEREBY CERTIFY THAT; The data shown in this report were made in accordance with the procedures given in ANSI C63.4 and the energy emitted by the device was founded to be within the limits applicable. I assume full responsibility for accuracy and completeness of these data.

Note : 1. The results of the testing report relate only to the items tested.
2. The testing report shall not be reproduced except in full, without the written approval of ETC

Issued Date : Apr. 03, 2013

Test Engineer : Vincent Chang
(Vincent Chang)

Approve & Authorized Signer : S. S. Liou
S. S. Liou, Section Manager
EMC Dept. II of ELECTRONICS
TESTING CENTER, TAIWAN

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1. GENERAL INFORMATION

1.1 Product Description

a) Type of EUT	: ELECTRONIC LEVERSET
b) Trade Name	: EZSET,EZSET,KWIKSET
c) Model No.	: PT2C
d) FCC ID	: YLKPT2C
e) Working Frequency	: 13.56 MHz
f) Power Supply	: DC 1.5V Battery * 4

1.2 Characteristics of Device:

The EUT is an electric door lock with 13.56MHz RFID.

1.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures in chapter 13 of ANSI C63.4.
The Transmitter under test was operated continuously in its normal operating mode for the purpose of the measurements. In order to secure the continuous operation of the device under test, rewiring in the circuit was done by the manufacturer so as to affect its intended operation.
The receiving antenna polarized horizontally was varied from 1 to 4 meters and the wooden turntable was rotated through 360 degrees to obtain the highest reading on the field strength meter or on the display of the spectrum analyzer. And also, each emission was to be maximized by changing the orientation of the Transmitter under test.
In order to determining the average value during one pulse train of the radiated power generated from the Transmitter under test, the encoded wave form in the time domain was used.

1.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the roof top of Building at NO. 34. LIN 5, DINGFU VIL., LINKOU DIST.,NEW TAIPEI CITY, TAIWAN, 24442, R.O.C.
This site has been fully described in a report submitted to your office, and accepted in a letter dated Jan. 11, 2011.

2. DEFINITION AND LIMITS

2.1 Definition

Intentional radiator:
A device that intentionally generates and emits radio frequency energy by radiation or induction.

2.2 Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42-16.423	399.9-410	4.5-5.15
0.495 - 0.505 **	16.69475 - 16.69525	608-614	5.35-5.46
2.1735 - 2.1905	16.80425 - 16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475 - 156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3360-4400	Above 38.6
13.36-13.41			

Remark "**" : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

2.3 Limitation

(1) Conducted Emission Limits:

Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency MHz	**Quasi Peak dB μ V**	**Average dB μ V**
0.15 - 0.5	66-56*	56-46*
0.5 - 5.0	56	46
5.0 - 30.0	60	50

- Decreases with the logarithm of the frequency

(2) Radiated Emission Limits:

According to 15.225, the requirement of radiated emission is:

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

(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) 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.

According to § 15.209 Radiated emission limits, general requirements.
(a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

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

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

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 20 dB under any condition of modulation.

(3) Frequency Stability Limit:

According to 15.225, the requirement of frequency stability is:

(e) The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% 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. For battery operated equipment, the equipment tests shall be performe using a new battery.

2.4 Labeling Requirement

The device shall bear the following statement in a conspicuous location on the device :

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

2.5 User Information

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

3 SYSTEM TEST CONFIGURATION

3.1 Justification

All measurement were intentional to maximum the emissions from EUT by varying the connection cables, therefore, the test result is sure to meet the applicable requirement.

3.2 Devices for Tested System

Device	Manufacture	Model / FCC ID.	Description
ELECTRONIC LEVERSET*	Tong Lung Metal Industry Co., Ltd	PT2C / YLKPT2C	----

Remark "*" means equipment under test.

4. RADIATED EMISSION MEASUREMENT

4.1 Applicable Standard

According to 15.225, the requirement of radiated emission is:

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

(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) 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.

4.2 Measurement Procedure

1. Setup the configuration per figure 1 and 2 for frequencies measured below and above 30 MHz respectively.
2. For emission frequencies measured below 1 GHz, a pre-scan is performed in a shielded chamber to determine the accurate frequencies of higher emissions will be checked on an open test site.
3. For emission frequencies measured below 1 GHz, set the spectrum analyzer on a 100 kHz resolution bandwidth for each frequency measured in step 2.
4. For emission frequencies measured above 30 MHz, the search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0° to 360° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.
5. Repeat step 4 until all frequencies need to be measured were complete.
6. Repeat step 5 with search antenna in vertical polarized orientations.
7. Check the three frequencies of highest emission with varying the placement of cables associated with EUT to obtain the worse case and record the result.
8. For emission frequencies measured below 30 MHz, the search antenna is to be set in horizontal and vertical polarized orientation respectively. Rotate the loop antenna when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0° to 360° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna rotation again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.

Figure 1 : Frequencies measured below 30 MHz configuration

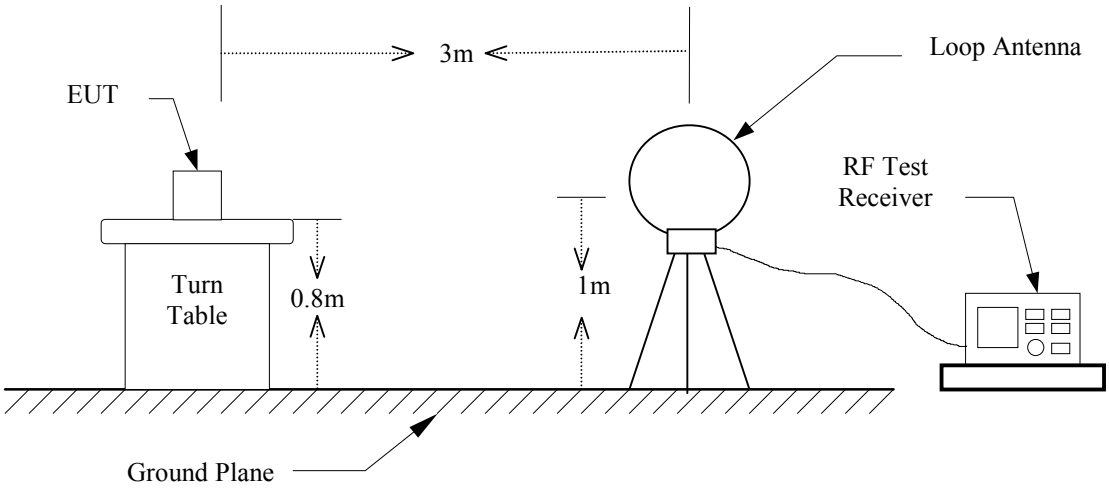
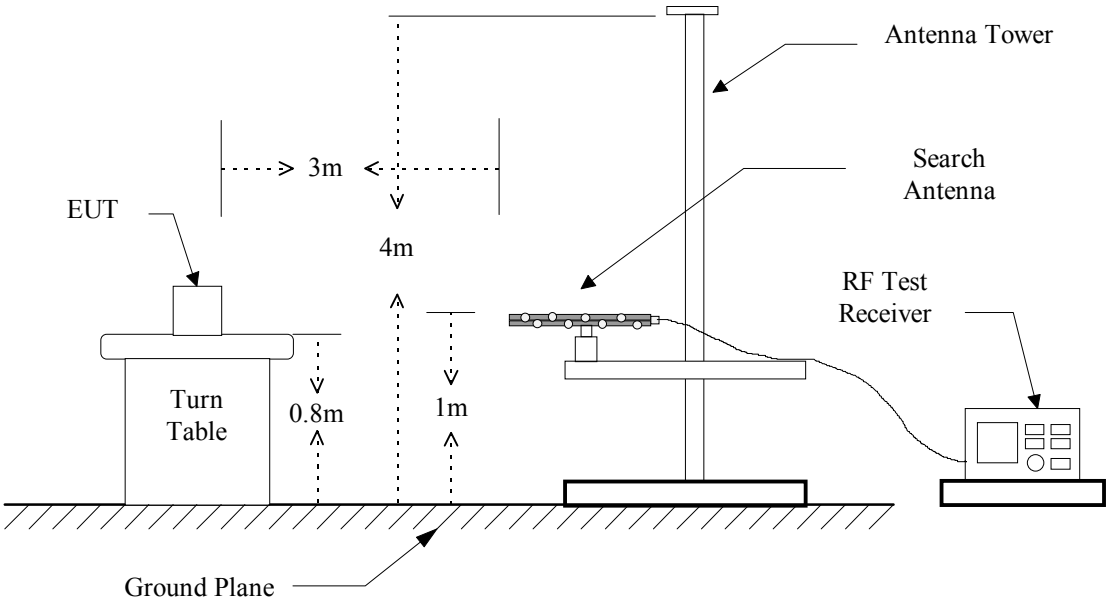


Figure 2 : Frequencies measured above 30 MHz configuration



4.3 Test Data

4.3.1 Below 30MHz

Operation Mode : Transmitting

Test Date : Mar. 06, 2013 Temperature : 20 °C Humidity : 60 %

Frequency (MHz)	Meter Reading (dBuV)	Corrected Factor (dB)	Amplifier (dB)	Result @3m (dBuV/m)	Result @30m (dBuV/m)	Limit @30m (dBuV/m)
13.560	49.6	34.6	28.1	43.3	3.3	84.0
27.120	---	---	---	---	---	29.5

Frequency (MHz)	Meter Reading (dBuV)	Corrected Factor (dB)	Amplifier (dB)	Result @3m (dBuV/m)	Result @30m (dBuV/m)	Limit @30m (dBuV/m)
13.410 ~ 13.553	---	---	---	---	---	50.5
13.567 ~ 13.710	---	---	---	---	---	50.5
13.110 ~ 13.410	---	---	---	---	---	40.5
13.710 ~ 14.010	---	---	---	---	---	40.5

Note :

1. *Result = Reading + C. Factor*
2. *If the result of peak value is under the limit of Quasi-Peak, the Quasi-Peak value doesn't need to be measured.*
3. *Remark "---" means that the emissions level is too low to be measured.*
4. *With a distant extrapolation of 40log(30m/3m) on the offset level of receiver during the test.*

Limit Calculation:

Fundamental (§15.225(a)) : 20 log (15848) = 84.0 dBuV/m @30m

Harmonic < 30MHz (§15.225(d)) : 20 log (30) = 29.5 dBuV/m @30m

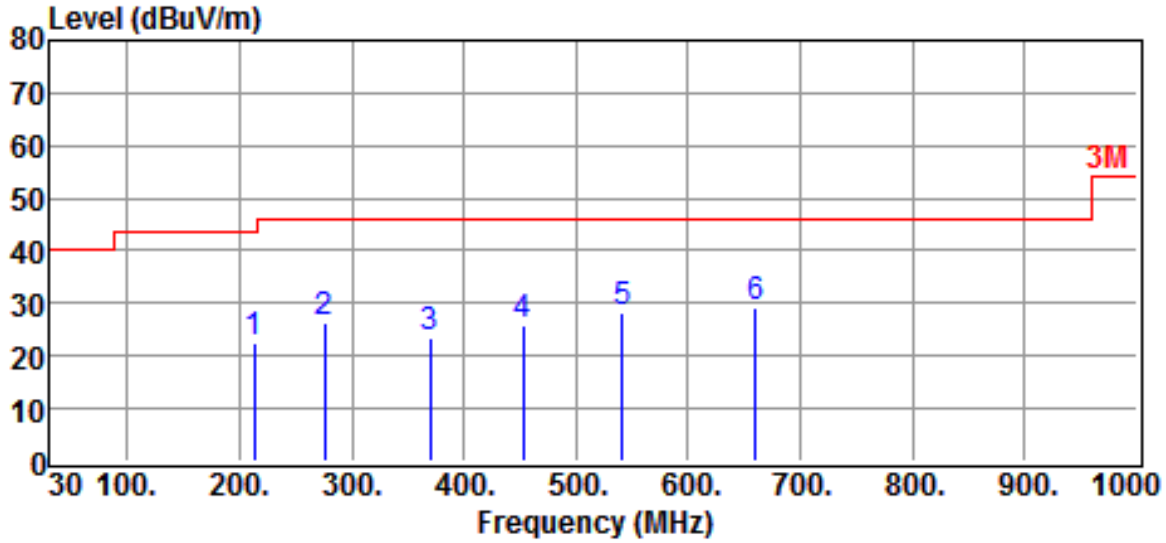
Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz:

20 log (334) = 50.5 dBuV/m @30m

Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz:

20 log (106) = 40.5 dBuV/m @30m

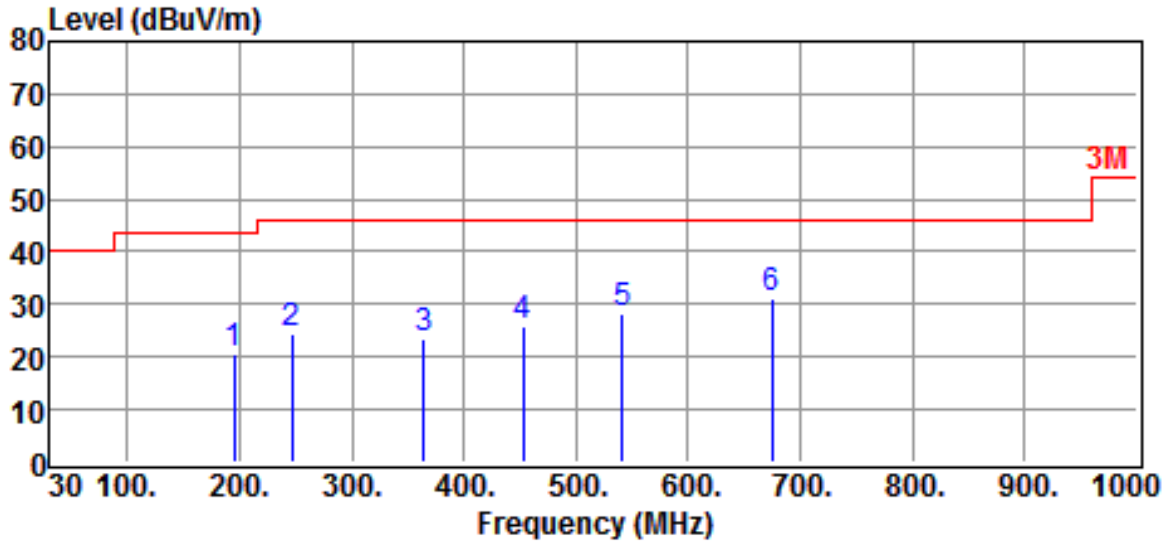
4.3.2 30MHz – 1GHz



Site	:OPEN SITE	Date	:2013-03-06
Limit	:3M	Ant. Pol.	:HORIZONTAL
EUT	:ELECTRONIC LEVERSET	Temp.	:20°C
Power Rating	:DC 6V	Humi.	:65%
Model	:PT2C	Engineer.	:VC
Test Mode	:RFID OPERATION MODE		

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
213.3300	4.3	18.2	22.5	43.5	-21.0	QP
275.4100	3.8	22.5	26.3	46.0	-19.7	QP
370.4700	4.9	18.4	23.3	46.0	-22.7	QP
452.9200	5.4	20.5	25.9	46.0	-20.1	QP
541.1900	6.0	22.1	28.1	46.0	-17.9	QP
659.5300	4.9	24.5	29.4	46.0	-16.6	QP

Note :
1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss
3. The margin value=Limit - Result



Site	:OPEN SITE	Date	:2013-03-06
Limit	:3M	Ant. Pol.	:VERTICAL
EUT	:ELECTRONIC LEVERSET	Temp.	:20°C
Power Rating	:DC 6V	Humi.	:65%
Model	:PT2C	Engineer.	:VC
Test Mode	:RFID OPERATION MODE		

Freq MHz	Reading dBuV	Correction Factor dB	Result dBuV/m	Limits dBuV/m	Over limit dB	Detector
194.9000	4.1	16.6	20.7	43.5	-22.8	QP
246.3100	4.5	19.8	24.3	46.0	-21.7	QP
364.6500	5.2	18.2	23.4	46.0	-22.6	QP
452.9200	5.4	20.5	25.9	46.0	-20.1	QP
541.1900	6.0	22.1	28.1	46.0	-17.9	QP
675.0500	6.2	24.8	31.0	46.0	-15.0	QP

Note :
1. Result = Reading + Corrected Factor
2. Corrected Factor = Antenna Factor + Cable Loss
3. The margin value=Limit - Result

4.4 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. For the limit is employed average value, therefore the peak value can be transferred to average value by subtracting the duty factor. The basic equation with a sample calculation is as follows:

Result = Reading + Corrected Factor

where

Corr. Factor = Antenna Factor + Cable Factor - Amplifier Gain (if any)

4.5 Radiated Test Equipment

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Test Receiver	Rohde & Schwarz	ESVS30	2012/05/07	2013/05/07
Bi-Log Antenna	Schaffner	MCTD 2756	2013/01/17	2014/01/17
Log-periodic Antenna	EMCO	3146	2012/10/17	2013/10/17
Biconical Antenna	EMCO	3110	2012/10/17	2013/10/17
Spectrum	R&S	FSP3	2012/04/06	2013/04/06
Amplifier	HP	8447D	2012/05/16	2013/05/16
EMI Test Receiver	Rohde & Schwarz	ESU 40	2012/09/17	2013/09/17
Double Ridged Antenna	EMCO	3115	2012/05/18	2013/05/18
LOOP Antenna	EMCO	6512	2012/09/18	2013/09/18

4.8 Measuring Instrument Setup

Explanation of measuring instrument setup in frequency band measured is as following :

Frequency Band (MHz)	Instrument	Function	Resolution bandwidth	Video Bandwidth
0.009 to 30	RF Test Receiver	Quasi-Peak	10 kHz	N/A
	Spectrum Analyzer	Peak	10 kHz	30 kHz
30 to 1000	RF Test Receiver	Quasi-Peak	120 kHz	N/A
	Spectrum Analyzer	Peak	100 kHz	100 kHz

4.9 Radiated Measurement Photos

5 FREQUENCY STABILITY MEASUREMENT

5.1 Provisions Applicable

According to sec. 15.225(e) the frequency tolerance of the carrier signal shall be maintained within +/- 0.01% 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. For battery operated equipment, the equipment tests shall be performed using a new battery.

5.2 Measurement Procedure

A) Frequency stability versus environmental temperature

1. Setup the configuration per figure 3 for frequencies measured at an environmental chamber set for a temperature of 20°C.

2. Turn on EUT and set SA center frequency to the right frequency needs to be measured. Then set SA RBW to 30 kHz, VBW to 100kHz and frequency span to 500 kHz. Record this frequency to be a reference.

3. Set the temperature of chamber to 50°C. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the chamber, turn the EUT on and measure the EUT operating frequency.

4. Repeat step 2 with a 10°C decreased per stage until the lowest temperature -20°C is measured, record all measurement frequencies.

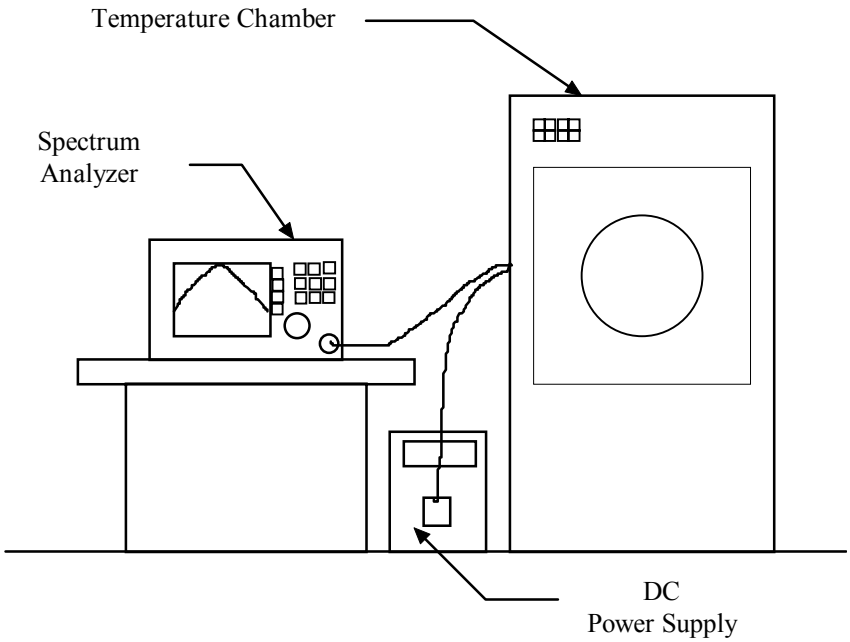
B) Frequency stability versus input voltage

1. Setup the configuration per figure 3 for frequencies measured at an environmental chamber set for a temperature of 20°C.

2. Set SA center frequency to the right frequency needs to be measured. Then set SA RBW to 30 kHz, VBW to 100kHz and frequency span to 500 kHz. Record this frequency to be a reference.

3. The EUT is powered with the DC Power Supply, supplied it with 85% and 115% voltage, and measured the EUT operating frequency.

Figure 3 : Frequency stability measurement configuration



5.3 Measurement Instrument

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Spectrum Analyzer	HP	8564E	2012/05/22	2013/05/22
Temperature Chamber	MALLIER	MCT-2X-M	2012/05/03	2013/05/03

5.4 Measurement Data

A1. Frequency stability versus enviroment tempture

Reference Frequency : 13.56 MHz		Limit：0.01%					
Enviroment Tempture (°C)	Power Supplied (Vdc)	Frequency measured with time elapsed					
		2 minute		5 minute		10 minute	
		(MHz)	(%)	(MHz)	(%)	(MHz)	(%)
50	6.0	13.5598	-0.00155	13.5610	0.00746	13.5597	-0.00216
40		13.5590	-0.00739	13.5602	0.00115	13.5595	-0.00363
30		13.5593	-0.00499	13.5598	-0.00162	13.5608	0.00613
20		13.5596	-0.00281	13.5608	0.00624	13.5598	-0.00174
10		13.5596	-0.00316	13.5608	0.00562	13.5592	-0.00609
0		13.5599	-0.00074	13.5595	-0.00375	13.5594	-0.00469
-10		13.5609	0.00644	13.5596	-0.00309	13.5597	-0.00223
-20		13.5591	-0.00647	13.5590	-0.00754	13.5609	0.00700

A2. Frequency stability versus input voltage (±15%)

Reference Frequency : 13.56 MHz		Limit：0.01%					
Enviroment Tempture (°C)	Power Supplied (Vdc)	Frequency measured with time elapsed					
		2 minute		5 minute		10 minute	
		(MHz)	(%)	(MHz)	(%)	(MHz)	(%)
20	5.1	13.5601	0.00106	13.5603	0.00206	13.5600	-0.00021
20	6.9	13.5601	0.00106	13.5603	0.00206	13.5600	-0.00021

6. CONDUCTED EMISSION MEASUREMENT

6.1 Description

This EUT is excused from investigation of conducted emission, for it is powered by DC battery only. According to §15.207 (d), measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines.

7 ANTENNA REQUIREMENT

7.1 Standard Applicable

According to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

7.2 Antenna Construction

The antenna is permanently intergated on the main PCB, no consideration of replacement.

Please see photos submitted in Exhibit B.