TEST REPORT

Part 15 Subpart C 15.225

1. Applicant

Name	: HONG International Corp.
Address	: 3F, JnK Digital Tower 222-3, Guro-3Dong, Guro-Gu, Seoul, Republic of Korea
FCC ID	: 2ABCF-VSPHOENIXS

2. Products

Name	: Electronic Dart System
Model/Type	: VSPHOENIXS / Electronic Dart System
Manufacturer	: SHENZHEN HAX TECHNOLOGY CO., LTD.
3. Test Standard	: 47 CFR FCC Part 15 Subpart C:2011 section 15.225
4. Test Method	: ANSI C63.10:2009
5. Test Result	: Positive
6.Dates of Test	: November 14, 2013 to November 18, 2013
7. Date of Issue	: November 19, 2013
8. Test Laboratory	: Korea Standard Quality Laboratories FCC Designation Number : 100384

Tested by

Soon Ho, Kim

Test Engineer:

Approved by

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Compliance Engineer:

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Revision History

Issue Report No.	Issued Date	Revisions	Effect Section
KSQ-FCC131116	November 19, 2013	Initial Release	All

1. VERIFICATION OF COMPLIANCE

-. APPLICANT : HONG International Corp.

-. ADDRESS : 3F, JnK Digital Tower 222-3, Guro-3Dong, Guro-Gu, Seoul, Republic of Korea

-. CONTACT PERSON : Byung Chang, Oh / Team Manager

-. TELEPHONE NO : +82-2-6124-6731

-. FCC ID : 2ABCF-VSPHOENIXS

DEVICE TYPE	FCC: DXX - Low Power Communication Device Transmitter
E.U.T. DESCRIPTION	Electronic Dart System
THIS REPORT CONCERNS	Original Grant
MEASUREMENT PROCEDURES	FCC: ANSI C63.10: 2009
TYPE OF EQUIPMENT TESTED	Pre-Production
KIND OF EQUIPMENT AUTHORIZATION REQUESTED	Certification
EQUIPMENT WILL BE OPERATED UNDER FCC RULES PART(S)	FCC PART 15 SUBPART C:2011, Section 15.225
MODIFICATIONS ON THE EQUIPMENT TO ACHIEVE COMPLIANCE	N/A
FINAL TEST WAS CONDUCTED ON	3 m open area test site

2. GENERAL INFORMATION

2.1 Product Description

The HONG International Corp., Model VSPHOENIXS (referred to as the EUT in this report) is a Electronic Dart System that is included a RF card reader. The product specification described herein was obtained from product data sheet or user 's manual.

CHASSIS TYPE	Non-Metal
TX FREQUENCY	13.559 MHz
MODULATION	ASK
LIST OF EACH OSC. OR CRY. FREQ.(FREQ.>=1 MHz)	Main Board: 14.3MHz, Connector Board: 4MHz, Audio Board: 28.63636 MHz, Audio Control Board: 10MHz RF Board: 13.56MHz, RF LED Board: 20MHz
ANTENNA TYPE	Inserted into the main board (Pattern Antenna)
RATED SUPPLY VOLTAGE	120 V~, 60 Hz, 200 W
NUMBER OF PCB LAYERS	8 Layers: Main Board 4 Layers: Connector Board, Audio Board, Audio Control Board, RF Board and RF LED Board

2.2 Model Differences:

-. None

2.3 Related Submittal(s) / Grant(s)

-. Original

2.4 Purpose of the test

To determine whether the equipment under test fulfills the requirements of the regulation stated in section 15.225

2.5 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2009 Radiated testing was performed at a distance of 3 m from EUT to the antenna.

3. SYSTEM TEST CONFIGURATION

3.1 Justification

This device was configured for testing in a typical way as a normal customer is supposed to be used. During the test, the following components were installed inside of the EUT.

DEVICE TYPE	MANUFACTURER	MODEL/PART NUMBER	FCC ID
Main Board	GIGABYTE	GA-G31M-ES2L	DoC
Connector Board	HONG International Corp.	REV 1.61	N/A
Audio Board	HONG International Corp.	1.1	N/A
Audio Control Board	HONG International Corp.	1.1	N/A
RF Board	HONG International Corp.	N/A	N/A
RF LED Board	HONG International Corp.	LED_MD	N/A
LED Interface Board	HONG International Corp.	HONG-LED-INTERFACE VER1.2	N/A
Power Board	Open Digital Power	RS-75-24	N/A

3.2 Peripheral equipment

Defined as equipment needed for correct operation of the EUT, but not considered as tested:

Model	Manufacturer	FCC ID	Description	Connected to
VSPHOENIXS	HONG International Corp.	2ABCF-VSPHOENIXS	Electronic Dart System (EUT)	-
VOSTRO 3350	DELL	-	NOTE BOOK	

3.3 Mode of operation during the test

-. To get a maximum radiated emission from the EUT, the EUT was continuously transmitted RF carrier and the card shall be used with the EUT and tested with together. And the ping testing mode was performed at the same time during the test.

3.4 Cable Description for the EUT

Ports Name	Shielded	Ferrite Bead	Metal Shell	Length (m)	Connected to
LAN	N	N	N	3.0	Notebook PC

3.5 Equipment Modifications

N/A

3.6 Configuration of Test System

Line Conducted Test: The power of EUT was connected to LISN. All supporting equipments were connected to another LISN. Preliminary Power line Conducted Emission tests were performed by using the procedure in ANSI C63.10: 2009 7.3.3 to determine the worse operating conditions.

Radiated Emission Test: Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2009 8.3.1.1 and 13.1.4.1 to determine the worse operating conditions. The radiated emissions measurements were performed on the 3 m, EMI chamber and open-field test site. The EUT was placed on the ground plane as typical applications. For frequencies from 150 kHz to 30 MHz measurements were made of the magnetic H field. The measuring antenna is an electrically screened loop antenna. The frequency spectrum from 30 MHz to 1 000 MHz was scanned and maximum emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

3.7 Antenna Requirement

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

Antenna Construction:

The transmitter antenna of the EUT is a PCB pattern antenna in the EUT, so there is no consideration of replacement by the user.

4. PRELIMINARY TEST

4.1 AC Power line Conducted Emissions Tests

During Preliminary Tests, the following operating mode was investigated

Operation Mode	The Worse operating condition (Please check one only)
Standby Mode	-
TX mode	X

4.2 Radiated Emissions Tests

During Preliminary Tests, the following operating modes were investigated

Operation Mode	The Worse operating condition (Please check one only)
Standby Mode	-
TX mode	X

5. FINAL RESULT OF MEASURMENT

5.1 Conducted Emission Test

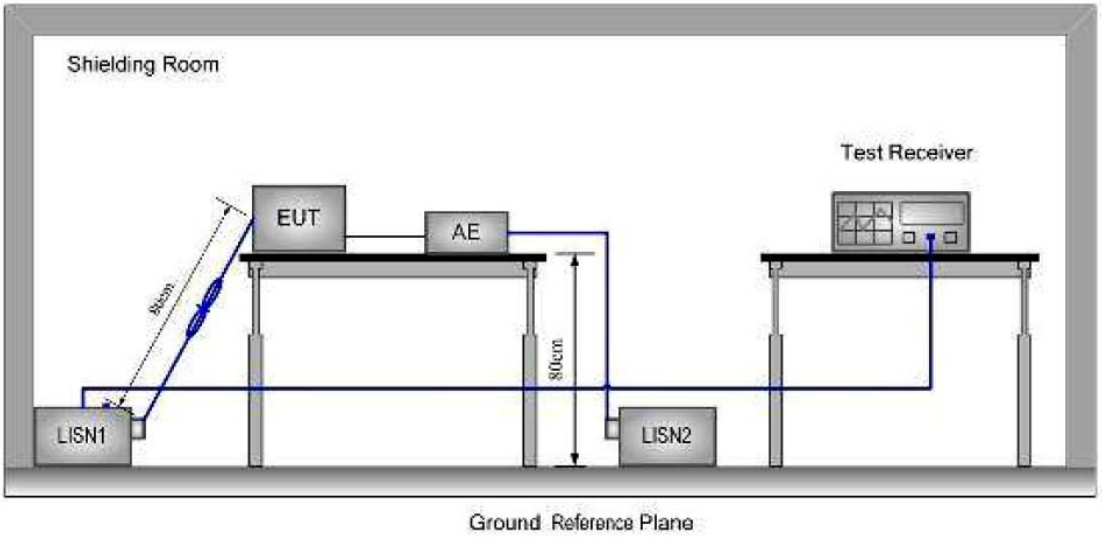
Humidity Level : 48 % R.H. Temperature: 22°C
Limits apply to : FCC CFR 47, PART 15 Section 15.207
Result : PASS

EUT Operating : Electronic Dart System Date: November 13, 2013
Condition : Transmitting Mode
Detector : CISPR Quasi-Peak (6 dB Bandwidth: 9 kHz)

Limits for conducted disturbance at the mains ports of class B

Frequency Range (MHz)	Class B Limit dB(μV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
NOTE 1 The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz.		

Test Configuration:



Test procedure:
1. The mains terminal disturbance voltage test was conducted in a shielded room.
2. The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50/50μH + 5linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
3. The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation.

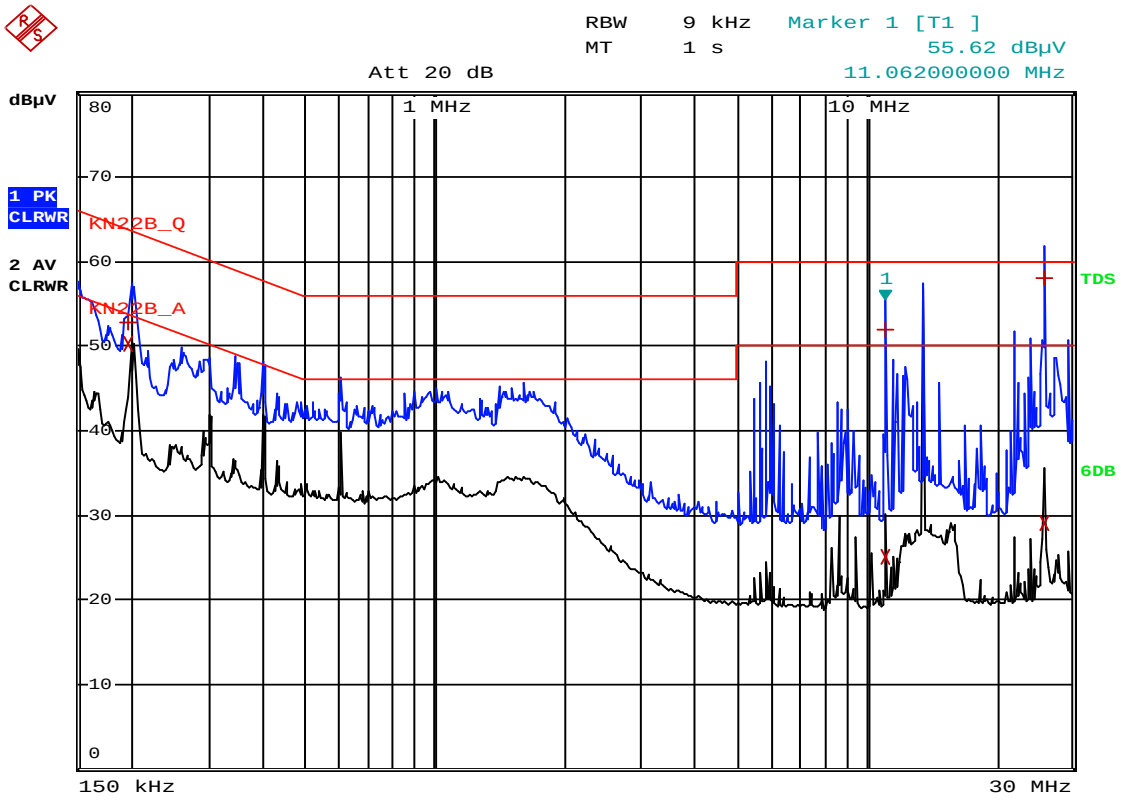
4. The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0,4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0,8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane.
This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0,8 m from the LISN 2.

Measured values of the Conducted Emissions									
Frequency (MHz)	Correction Factor		Line	Quasi-Peak			Average		
	LISN	Cable		Limit [dBuV]	Reading [dBuV]	Result [dBuV]	Limit [dBuV]	Reading [dBuV]	Result [dBuV]
0.19	0.21	0.06	H	64.04	52.56	52.83	54.04	50.08	50.35
0.20	0.33	0.06	N	63.61	49.15	49.54	53.61	39.50	39.89
11.05	1.07	0.40	N	60.00	50.05	51.52	50.00	23.43	24.90
11.06	0.94	0.40	H	60.00	50.65	51.99	50.00	23.78	25.12
25.80	1.40	0.67	N	60.00	53.25	55.32	50.00	25.51	27.58
25.81	1.27	0.67	H	60.00	54.18	56.12	50.00	27.08	29.02

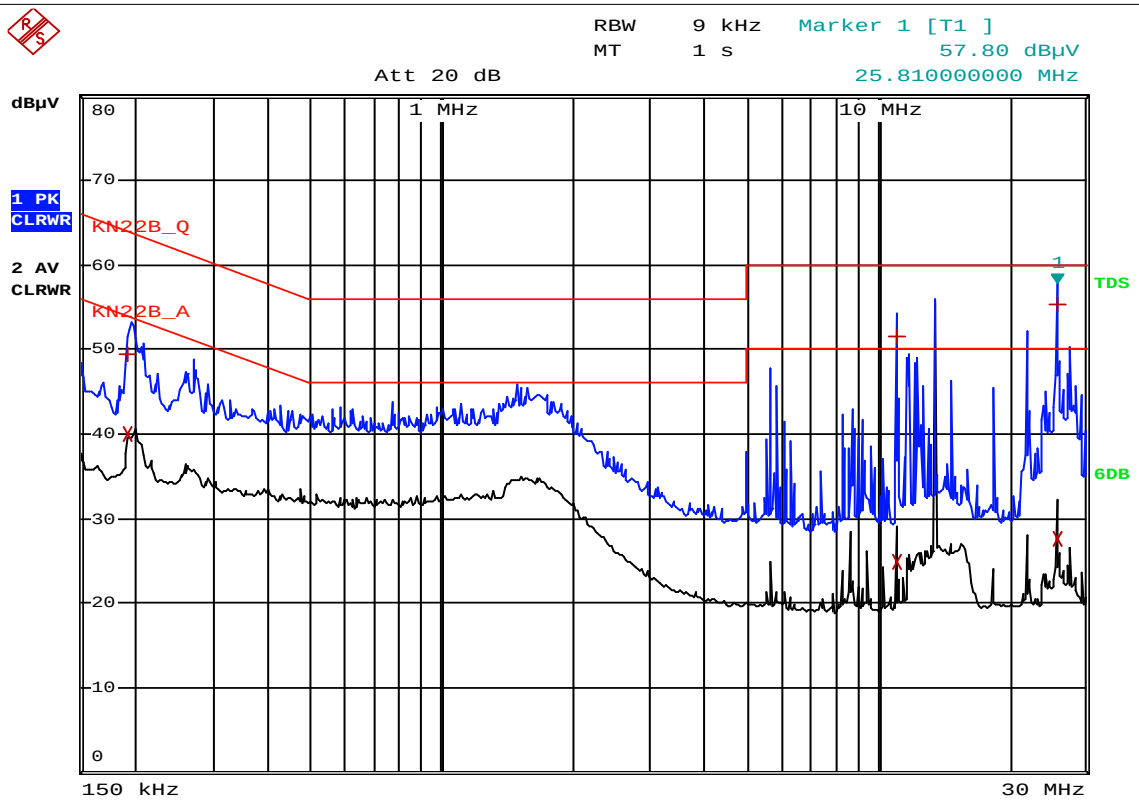
Line Conducted Emission Tabulated Data

Remark : "H": Hot Line, "N": Neutral Line.

See next page for an overview sweep performed with peak and average detector.



HOT LINE



NEUTRAL LINE

5.2 Emission Test

5.2.1 Radiated Emissions

5.2.1.1 Regulation

the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:
15.225(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.i.e. 124.0dBμV/m @ 3 m.
15.225(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. i.e. 90.5dBμV/m @ 3 m.
15.225l: 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. i.e. 80.5dBμV/m @ 3 m.
15.225(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

Out of band emissions shall not exceed:

Frequency (MHz)	Quasi-peak limits (dBμV/m)
1.705 - 30.0	69.5
30 - 88	40
88 - 216	43.5
216 - 960	46
Above 960	54
At transitional frequencies the lower limit applies.	

5.2.1.2 Measurement Procedure

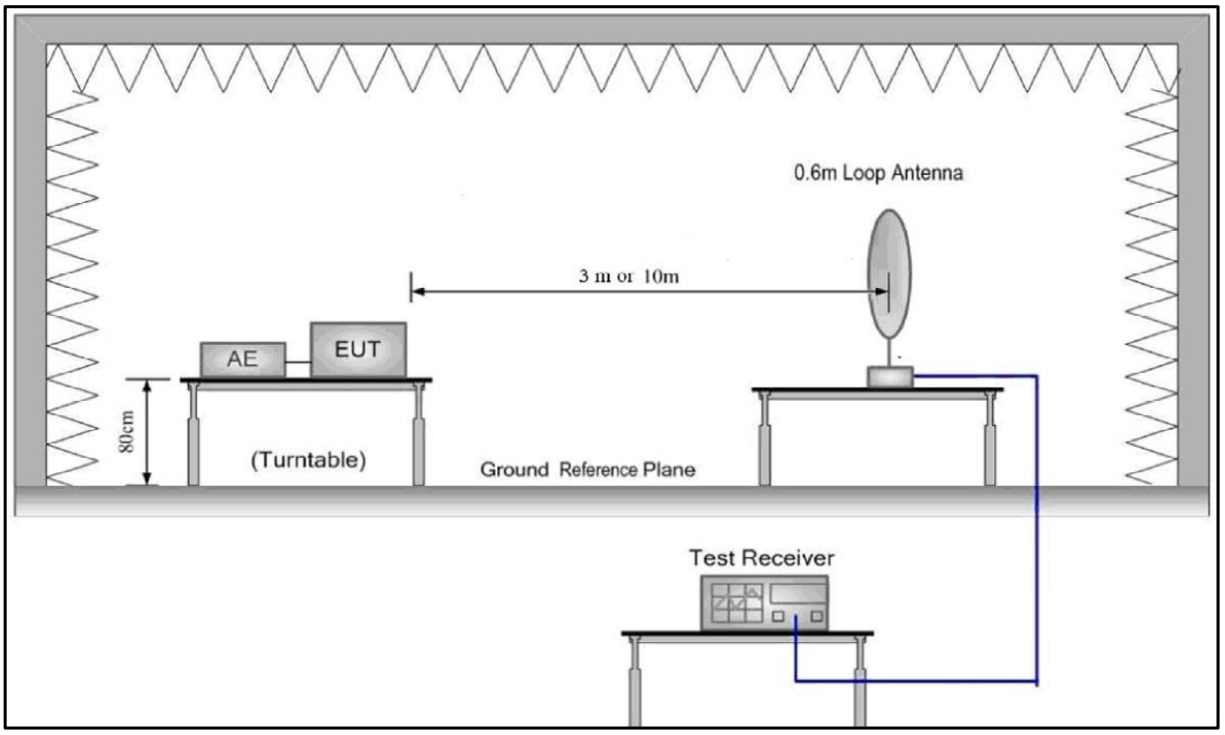
1) 9 kHz to 30 MHz emissions:
For testing performed with the loop antenna. The center of the loop was positioned 1 m above the ground and positioned with its plane vertical at the specied distance from the EUT. During testing the loop was rotated about its vertical axis for maximum response at each azimuth and also investigated with the loop positioned in the horizontal plane.
2) 30 MHz to 1 GHz emissions:
For testing perfomed with the bi-log type antenna. The measurement is performed with the EUT rotated 360º, the antenna height scaned between 1m and 4m, and the antenna rotated to repeat the measurement for both the horizontal and vertical antenna polarizations.

Detector Peak for pre-scan

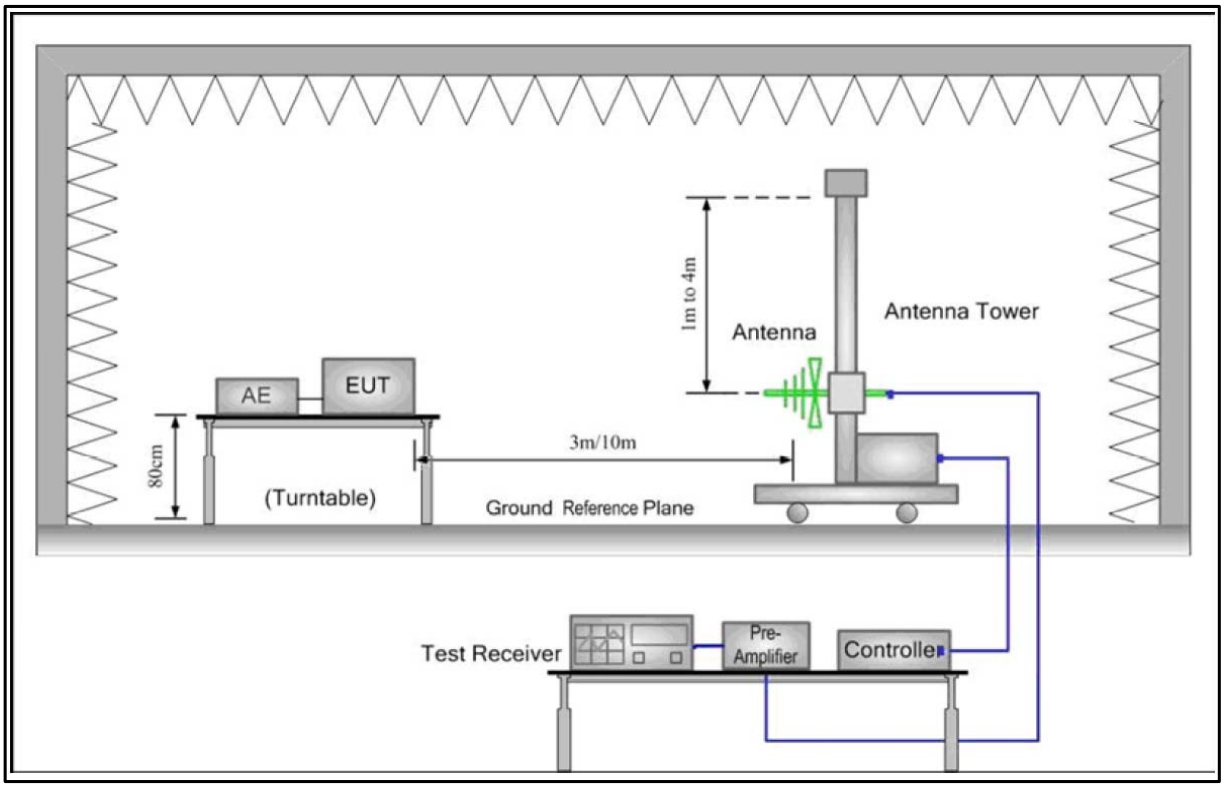
Test Receiver test setup	Detector		
	9 kHz-150 kHz	150 kHz-30 MHz	30 MHz-1000 MHz
RBW	200 Hz	9 kHz	120 kHz
VBW	³ RBW	³ RBW	³ RBW
Sweep	auto	auto	auto
Detector function	QP	QP	AV
Trace	max hold	max hold	max hold

5.2.1.3 Test Configuration

1) 9 kHz to 30 MHz emissions:



2) 30 MHz to 1 GHz emissions:



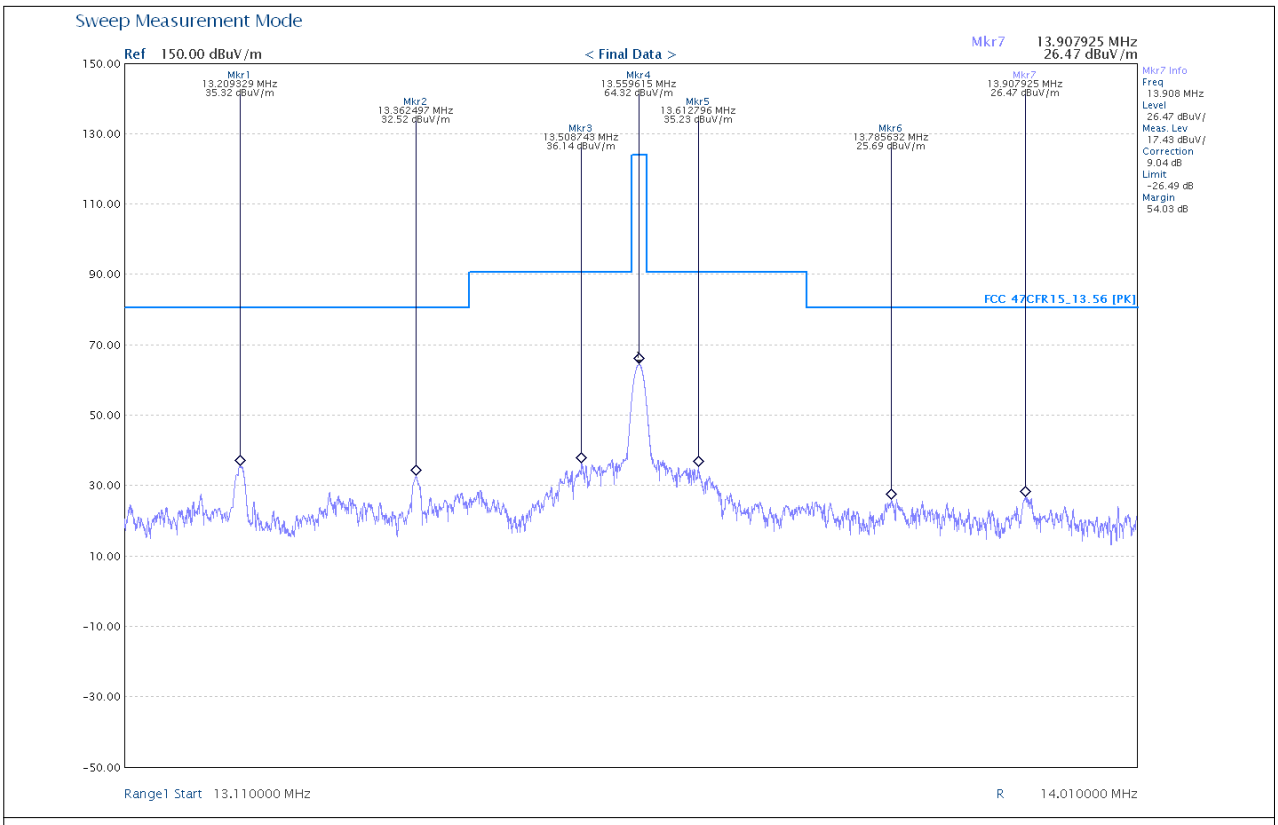
5.2.1.4 Test Configuration

1) Intentional Emission and Spectrum Mask

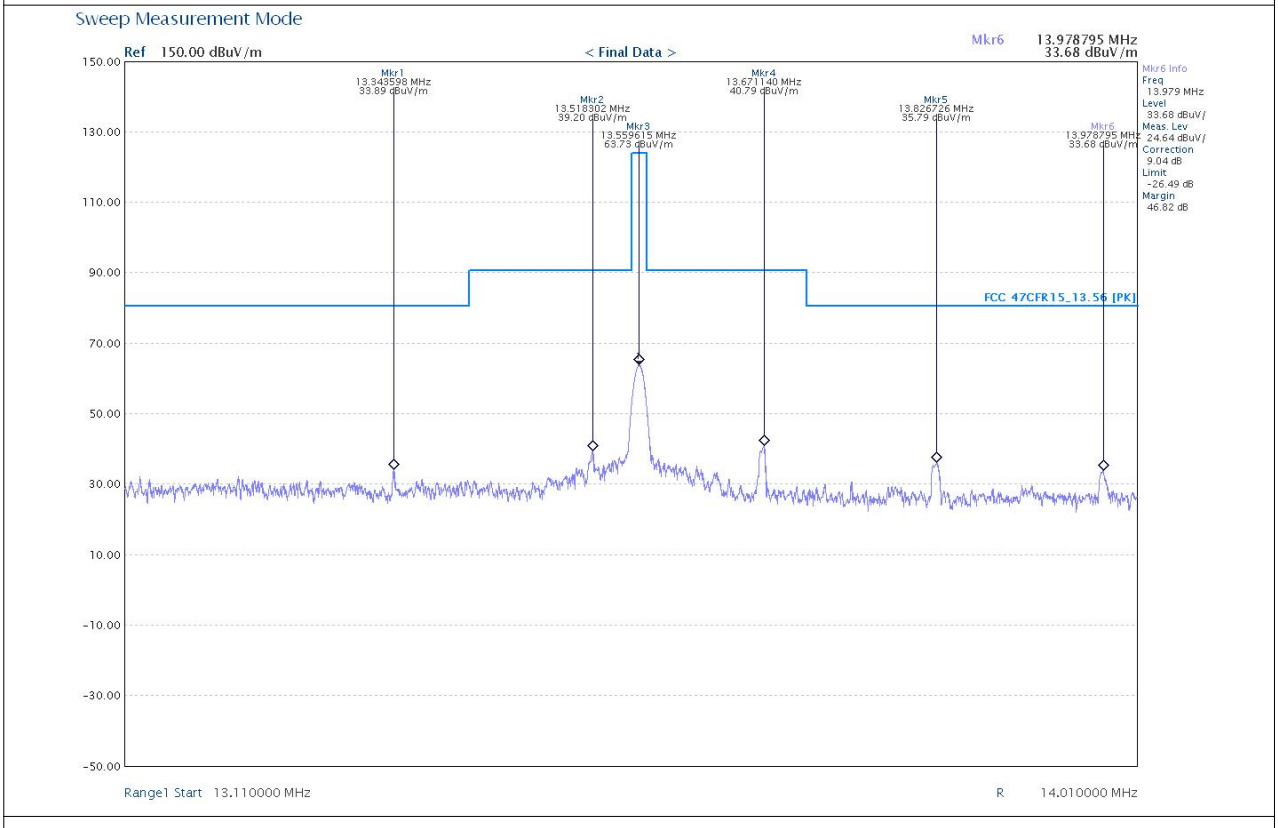
Test Frequency (MHz)	Detect Mode	Quasi-Peak (dBμV/m)	Limits (dBμV/m)	Margin (dB)
13.209	H	35.32	80.5	45.18
13.343	V	33.89	80.5	46.61
13.362	H	32.52	80.5	47.98
13.508	H	36.14	90.5	54.36
13.518	V	39.20	90.5	51.3
13.559	H	64.32	124	59.68
13.559	V	63.73	124	60.27
13.612	H	35.23	90.5	55.27
13.671	V	40.79	90.5	49.71
13.785	H	25.69	80.5	54.81
13.826	V	35.79	80.5	44.71
13.907	H	26.47	80.5	54.03
13.978	V	33.68	80.5	46.82

2) Spurious Emission: below 30 MHz

Test Frequency (MHz)	Detect Mode	Quasi-Peak (dBμV/m)	Limits (dBμV/m)	Margin (dB)
1.463	H	50.49	69.5	19.01
1.457	V	51.31	69.5	18.19
2.214	H	46.23	69.5	23.27
2.237	V	42.74	69.5	26.76
9.746	H	52.16	69.5	17.34
10.593	V	50.44	69.5	19.06
27.527	H	49.58	69.5	19.92
27.622	V	50.74	69.5	18.76

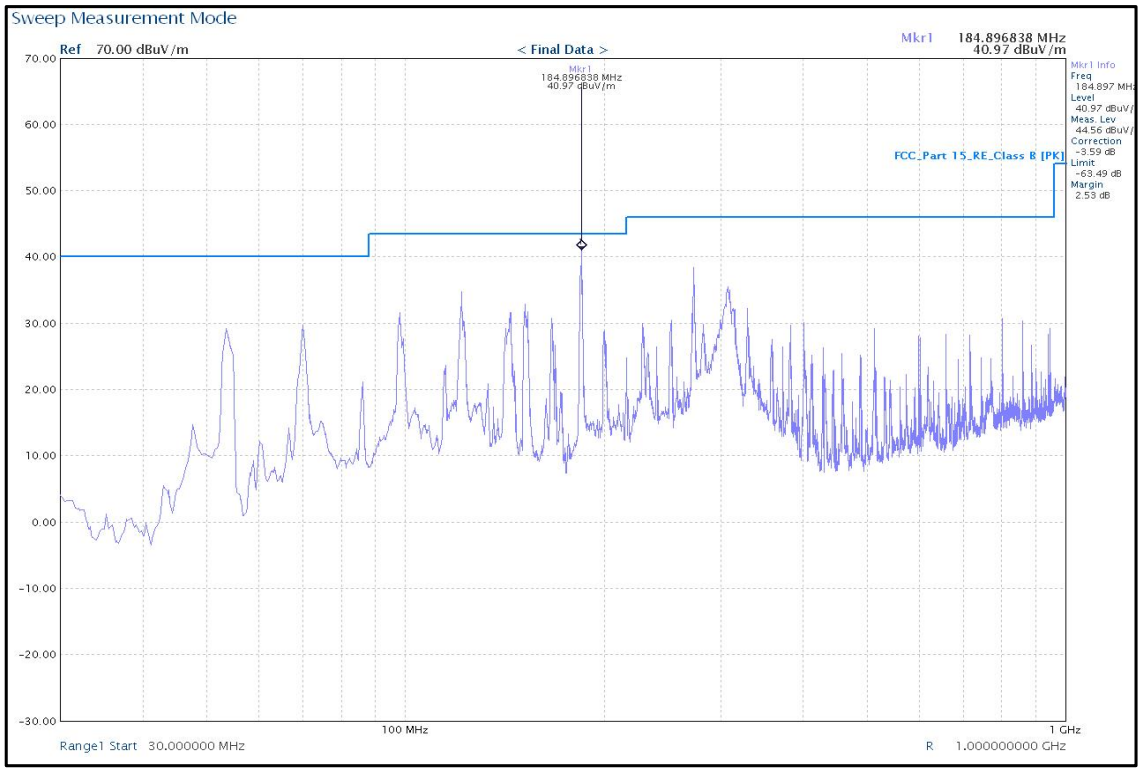


Horizontal



Vertical

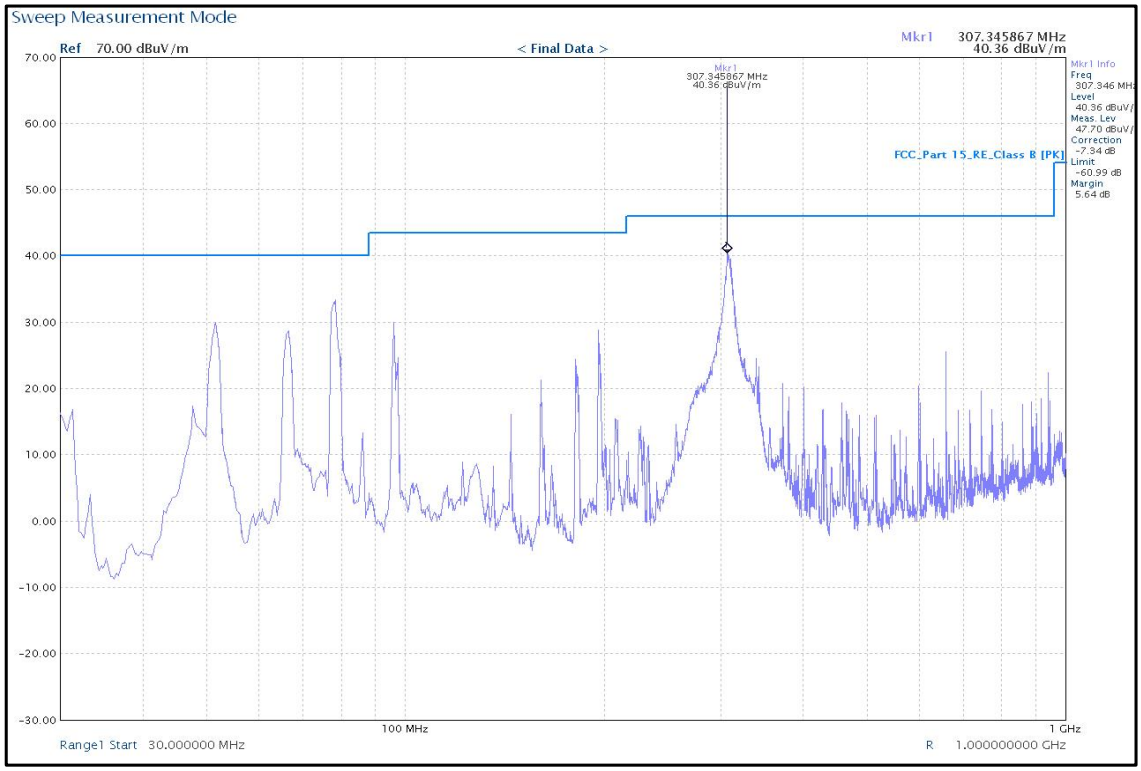
3) Spurious Emssion: above 30 MHz
The following test results were performed on the EUT.
Horizontal:
Peak scan
Level (dBμV/m)



REDUCTION TABLE

Freq (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Reference
53.566	29.14	40.00	10.86	QK
69.908	29.68	40.00	10.32	QK
97.974	31.59	43.50	11.91	QK
121.540	34.80	43.50	8.70	QK
144.396	31.62	43.50	11.88	QK
151.620	32.81	43.50	10.69	QK
184.896	40.97	43.50	2.53	QK
273.358	38.45	46.00	7.55	QK
307.937	35.55	46.00	10.45	QK
401.018	30.05	46.00	15.95	QK
513.638	29.15	46.00	16.85	QK
802.115	30.68	46.00	15.32	QK

Vertical:
Peak scan
Level (dBμV/m)



REDUCTION TABLE

Freq (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Reference
51.552	29.98	40.00	10.02	QK
66.592	28.72	40.00	11.28	QK
78.316	33.35	40.00	6.65	QK
96.079	29.99	43.50	13.51	QK
196.028	28.81	43.50	14.69	QK
307.345	40.36	46.00	5.64	QK

5.3 Occupied bandwidth

5.3.1 Regulation

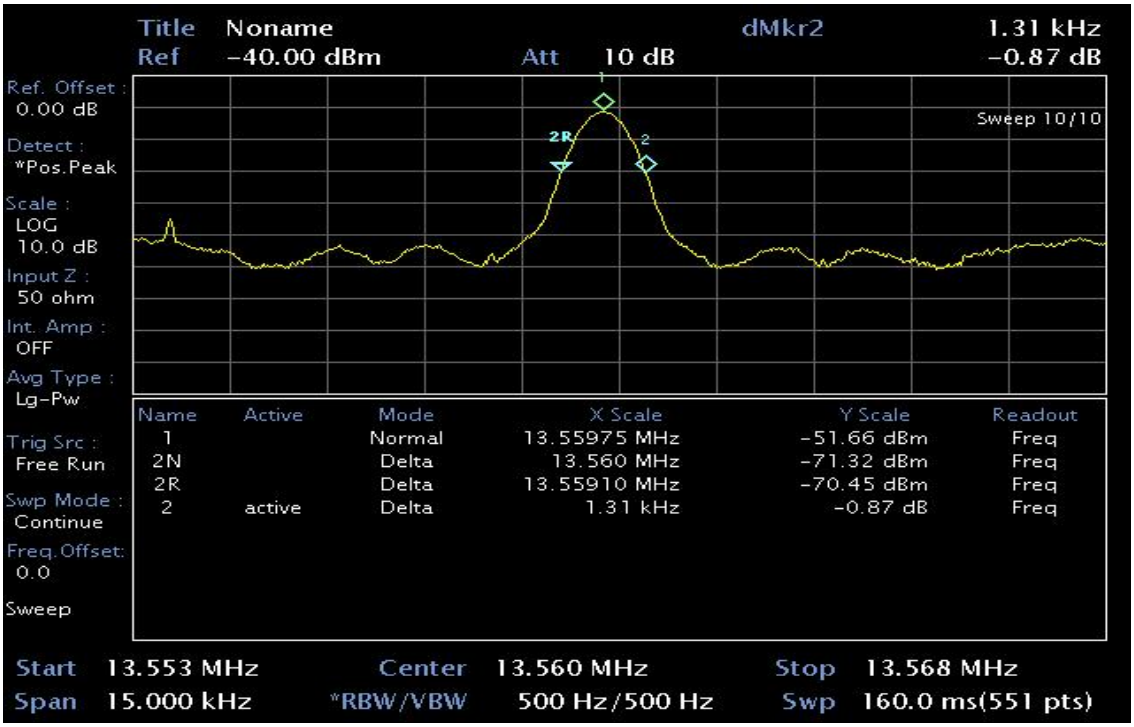
FCC 47CFR15 - 15.225

15.215(c), Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the 20 dB bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

5.3.2 Measurement Procedure

The useful radiated emission from the EUT was detected by the spectrum analyzer with peak detector. Record the 20 dB bandwidth of the carrier.
The useful radiated emission from the EUT was detected by the spectrum analyser with peak detector. The vertical Scale is set to 10dB per division. The horizontal scale is set to 20 kHz per division. Read the down 20dB bandwidth of the carrier.
Set the spectrum analyzer: Span = 15 kHz
Set the spectrum analyzer: RBW = 500 Hz, VBW = 500 Hz
Sweep = auto; Detector Function = Peak. Trace = Max Hold.
Mark the peak frequency and -20dB points bandwidth.

5.3.3 Test Results



5.4 Frequency Stability

5.4.1 Regulation

FCC 47CFR15 - 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.

5.4.2 Measurement Procedure

Frequency stability versus environmental temperature

1. Supply the EUT with nominal AC voltage.

2. Turn the EUT off, and place it inside an environmental temperature chamber. For devices that are normally operated continuously, the EUT may be energized while inside the test chamber. For devices that have oscillator heaters, energize only the heater circuit while the EUT is inside the chamber.

3. RF output was connected to a frequency counter or other frequency-measuring instrument via feed through attenuators.

4. Set the temperature control on the chamber to the highest specified EUT operating temperature, and allow the temperature inside the chamber to stabilize at the set temperature before starting frequency measurements.

5. While maintaining a constant temperature inside the environmental chamber, turn the EUT on and record the operating frequency at startup and two, five, and ten minutes after the EUT is energized.

6. After all measurements have been made at the highest specified temperature turn the EUT off.

7. Repeat the above measurement process for the EUT with the test chamber set at the appropriate temperature.

Frequency Stability versus Input Voltage

1. At temperature (20 ± 5°C), supply the EUT with nominal AC voltage

2. Couple RF output to a frequency counter or other frequency-measuring instrument.

3. Turn the EUT on, and measure the EUT operating frequency at startup and two, five, and ten minutes after startup
4. Supply it with 85% of the nominal AC voltage and repeat above procedure.

5. Supply it with 115% of the nominal AC voltage and repeat above procedure.

5.4.3 Test Results: PASS

TEST MODE : TX on

Table 6: Test Data, Frequency Tolerance of carrier signal									
Operating Frequency : 13.5596 MHz, LIMIT : within 1.35596 KHz (+/- 0.01% of the operating frequency)									
Environment Temperature [C]	Power Supplied [AC]	Carrier Frequency Measured with Time Elapsed							
		STARTUP		2 minutes		5 minutes		10 minutes	
		[MHz]	Err[KHz]	[MHz]	Err[KHz]	[MHz]	Err[KHz]	[MHz]	Err[KHz]
+50	120	13.5597	+0.0001	13.5597	+0.0001	13.5597	+0.0001	13.5597	+0.0001
+40	120	13.5598	+0.0002	13.5598	+0.0002	13.5598	+0.0002	13.5597	+0.0001
+30	120	13.5598	+0.0002	13.5598	+0.0002	13.5598	+0.0002	13.5597	+0.0001
+20	120	13.5597	+0.0001	13.5597	+0.0001	13.5597	+0.0001	13.5597	+0.0001
+10	120	13.5599	+0.0003	13.5599	+0.0003	13.5598	+0.0002	13.5598	+0.0002
0	120	13.5594	-0.0002	13.5594	-0.0002	13.5594	-0.0002	13.5594	-0.0002
-10	120	13.5593	-0.0003	13.5593	-0.0003	13.5593	-0.0003	13.5594	-0.0003
-20	120	13.5592	-0.0004	13.5591	-0.0004	13.5591	-0.0004	13.5591	-0.0004

Operating Frequency : 13.5596 MHz, LIMIT : within 1.35596 KHz (+/- 0.01% of the operating frequency)								
Power Supplied [AC]	Carrier Frequency Measured with Time Elapsed							
	STARTUP		2 minutes		5 minutes		10 minutes	
	[MHz]	Err[KHz]	[MHz]	Err[Hz]	[MHz]	Err[Hz]	[MHz]	Err[Hz]
85 %	13.5597	+0.0001	13.5597	+0.0001	13.5597	+0.0001	13.5597	+0.0001
100 %	13.5599	+0.0003	13.5599	+0.0003	13.5599	+0.0003	13.5599	+0.0003
115 %	13.5600	+0.0004	13.5600	+0.0004	13.5600	+0.0004	13.5600	+0.0004

Err[Hz] = Measured carrier frequency (MHz) – Reference Frequency (13.5596MHz)

6. LIST OF TEST EQUIPMENT

No.	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Next Cal. Data	Used equipment
1	EMI Test Receiver	LIG Nex1	LSA-265	L07098033	2012.12.24	2013.12.24	■
2	Bi-log Antenna	Schwarzbeck	VULB9160	3311	2013.10.16	2015.10.16	■
3	Turn Table	KEI	KEI-TURN	9210	N/A	N/A	■
4	Turn Table	KEI	KEI-TURN	N/A	N/A	N/A	■
5	Loop ANT.	EMCO	6502/1	9801-3191	2012.02.02	2014.02.02	■
6	Spectrum Analyzer	Agilent	E4440A	MY45304715	2013.02.21	2014.02.21	■
7	Function Generator	Agilent	33120A	US36026465	2013.06.08	2014.06.08	□
8	Frequency Counter	HP	5350B	3049A05530	2013.06.08	2014.06.08	■
9	Modulation Analyzer	Agilent	8901B	3438A05099	2013.06.08	2014.06.08	□
10	Audio Analyaer	Agilent	8903B	3729A18576	2013.06.08	2014.06.08	□
11	Attenuator	Agilent	8494B	MY41110204	2013.06.08	2014.06.08	□
12	Attenuator	Agilent	8496B	US40152183	2013.06.08	2014.06.08	□
13	Attenuator	Agilent	8495B	3308A17660	2013.06.08	2014.06.08	□
14	Attenuator	TAE SUNG	SMA-2	N/A	2013.06.08	2014.06.08	□
15	Power Meter	Agilent	E4418B	GB43312894	2013.06.08	2014.06.08	□
16	Power Sensor	HP	8485A	3316A14708	2013.06.08	2014.06.08	□
17	Vibration Tester	Gana	GNV-400		2013.06.21	2014.06.21	□
18	RF Cable	Gigalane	SMS-LL280-SMS-1.5M	SMS105-LL280-SMS105-1.5M	N/A	N/A	■
19	Temp & Humidity Chamber	Seoksan Tech	SE-CT-02	S7400JD5340618	2013.06.08	2014.06.08	■
20	Signal Generator	Leader Electronics	3220	0137231	2013.06.08	2014.06.08	■
21	Oscilloscope	Tektronix	TDS-350	B031902	2013.06.08	2014.06.08	□
22	Drop Tester	Self-made	KSQ-01	N/A	2013.06.08	2014.06.08	□
23	Pre Amplifier	GTC	GA-1825A	GT0929/003	2013.06.08	2014.06.08	■
24	Continuous operation tester	GTC	CT-100	GT0929/001	N/A	N/A	□
25	CW Generator	HP	83711B	US34490158	2013.06.08	2014.06.08	□
26	POWER DIVIDER	Agilent	11636B	54381	2013.06.08	2014.06.08	□
27	Power Sensor	Agilent	8482B	N/A	2013.06.08	2014.06.08	□
28	Attenuator	Winswell	53-30-33	N/A	2013.06.08	2014.06.08	□
29	DC Power Supply	Hanil	HPS-505A	0606123	2013.06.08	2014.06.08	□
30	Slidacs	Hanchang	5KV	N/A	2013.06.08	2014.06.08	■

31	Termination	Kwang Yeok	KYTE-NJ-150W	2040004	2013.06.08	2014.06.08	□
32	Band-limited filter	MITECH	KSQ-02	N/A	2013.06.08	2014.06.08	□
33	Horn ANT.	SCHWARZBECK	BBHA 9120D	9120D-679	2012.07.12	2014.07.12	□
34	Horn ANT.	A.H. SYSTEMS	SAS-572	100284	2013.09.07	2015.09.07	□
35	DC Power Supply	ALINCO	DM-340MW	F001015	2013.06.08	2014.06.08	□
36	LISN	Electro Metrics	ANS-25/2	2535	2013.04.25	2014.04.25	■
37	LISN	Kyoritsu	KNW-407	8-1010-14	2013.06.08	2014.06.08	□
38	Pulse Limiter	LIG Nex1	EPL-30	N/A	2013.06.08	2014.06.08	■

APPENDIX

1. EUT photo