



FCC 47 CFR PART 15 SUBPART C

ANSI C63.4: 2003

TEST REPORT

For

Industrial Radio Remote Controller

MODEL: SAGA1-P40

BRAND: SAGA

Issued to

GAIN ELECTRONIC CO., LTD

4F-1, NO.288-5, HSIN YA RD, CHIEN CHEN ZONE (806), KAOHSIUNG,
TAIWAN, ROC

Issued by

Compliance Certification Services Inc.

Tainan Lab.

No.8,Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)

TEL: (06) 580-2201

FAX: (06) 580-2202

Issued Date: January 28, 2013



Note: This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc. This document may be altered or revised by Compliance Certification Services Inc. personnel only, and shall be noted in the revision section of the document.

**REVISION HISTORY**

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	January 28, 2013	Initial Issue	ALL	Sunny.Chang



TABLE OF CONTENTS

1. TEST RESULT CERTIFICATION	4
2. EUT DESCRIPTION.....	5
3. TEST METHODOLOGY.....	7
3.1 EUT CONFIGURATION	7
3.2 EUT EXERCISE	7
3.3 GENERAL TEST PROCEDURES.....	7
3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS	8
3.5 DESCRIPTION OF TEST MODES.....	8
4. INSTRUMENT CALIBRATION	9
4.1 MEASURING INSTRUMENT CALIBRATION	9
4.2 MEASUREMENT EQUIPMENT USED	9
4.3 MEASUREMENT UNCERTAINTY.....	10
5. FACILITIES AND ACCREDITATIONS.....	11
5.1 FACILITIES	11
5.2 EQUIPMENT	11
5.3 LABORATORY ACCREDITATIONS LISTING	11
5.4 TABLE OF ACCREDITATIONS AND LISTINGS.....	12
6. SETUP OF EQUIPMENT UNDER TEST	13
6.1 SETUP CONFIGURATION OF EUT	13
6.2 SUPPORT EQUIPMENT.....	13
6.3 EUT OPERATING CONDITION	13
6.4 CENTER FREQUENCY CHECK.....	14
7. FCC PART 15.249 REQUIREMENTS	16
7.1 20 DB BANDWIDTH.....	16
7.2 BAND EDGES MEASUREMENT	19
7.3 DUTY CYCLE.....	20
7.4 SPURIOUS EMISSION	22
7.5 POWERLINE CONDUCTED EMISSIONS	38
APPENDIX I - PHOTOGRAPHS OF TEST SETUP	39
APPENDIX II - PHOTOGRAPHS OF EUT	A1



1. TEST RESULT CERTIFICATION

Product: Industrial Radio Remote Controller

Model: SAGA1-P40

Brand Name: SAGA

Applicant: GAIN ELECTRONIC CO., LTD

4F-1, NO.288-5, HSIN YA RD, CHIEN CHEN ZONE (806),
KAOHSIUNG, TAIWAN, ROC

Manufacturer: GAIN ELECTRONIC CO., LTD

4F-1, NO.288-5, HSIN YA RD, CHIEN CHEN ZONE (806),
KAOHSIUNG, TAIWAN, ROC

Tested: January 08, 2013 ~ January 22, 2013

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 15 Subpart C ANSI C63.4 : 2009	No non-compliance noted

We hereby certify that:

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4: 2003 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements emission limits of FCC Rules Part 15.107, 15.109, 15.207, 15.209 and 15.249.

The test results of this report relate only to the tested sample identified in this report.

Approved by:

Jeter Wu
Assistant Manager

Reviewed by:

Eric Huang
Assistant Section Manager



2. EUT DESCRIPTION

Product	Industrial Radio Remote Controller
Model Number	SAGA1-P40
Brand Name	SAGA
Received Date	December 22, 2012
Frequency Range	904.033MHz to 925.873MHz
Transmit Peak Power	86.24 dB μ V/m
Data Rate	4.8kbps
Number of Channels	256 Channel
Type of Modulation	FSK
Power Supply	6Vdc
Antenna Type	Whip antenna Gain: 0 dBi
Temperature Range	-15°C ~ +60°C

Remark:

1. Client consigns only one model sample to test (Model Number: **SAGA1-P40**).
Therefore, the testing Lab. just guarantees the unit, which has been tested.
2. This submittal(s) (test report) is intended for FCC ID: **NCT12CP40** filing to comply with Section 15.107 & 15.109 (FCC Part 15, Subpart B) and Section 15.207, 15.209, 15.249.
3. For more details, please refer to the User's manual of the EUT.



SAGA1-P40 Frequency Listed													
Frequency Range : 904.033MHz ~ 925.873 MHz													
Number of Channels : 256 Channels													
Type of Modulation : FSK (Frequency Shift Key)													
No	MHz	No	MHz	No	MHz	No	MHz	No	MHz	No	MHz	No	MHz
1	904.033	35	907.233	75	910.433	115	913.633	149	916.833	189	920.033	223	923.233
2	904.113	36	907.313	76	910.513	116	913.713	150	916.913	190	920.113	224	923.313
3	904.193	37	907.393	77	910.593	117	913.793	151	916.993	191	920.193	225	923.393
4	904.273	38	907.473	78	910.673	118	913.873	152	917.073	192	920.273	226	923.473
5	904.353	39	907.553	79	910.753	119	913.953	153	917.153	193	920.353	227	923.553
6	904.433	40	907.633	80	910.833		914.033	154	917.233	194	920.433	228	923.633
7	904.513	41	907.713	81	910.913		914.113	155	917.313	195	920.513	229	923.713
8	904.593	42	907.793	82	910.993		914.193	156	917.393	196	920.593	230	923.793
9	904.673	43	907.873	83	911.073		914.273	157	917.473	197	920.673	231	923.873
10	904.753	44	907.953	84	911.153		914.353	158	917.553	198	920.753	232	923.953
11	904.833	45	908.033	85	911.233		914.433	159	917.633	199	920.833	233	924.033
12	904.913	46	908.113	86	911.313	120	914.513	160	917.713	200	920.913	234	924.113
13	904.993	47	908.193	87	911.393	121	914.593	161	917.793	201	920.993	235	924.193
14	905.073	48	908.273	88	911.473	122	914.673	162	917.873	202	921.073	236	924.273
15	905.153	49	908.353	89	911.553	123	914.753	163	917.953	203	921.153	237	924.353
16	905.233	50	908.433	90	911.633	124	914.833	164	918.033	204	921.233	238	924.433
17	905.313	51	908.513	91	911.713	125	914.913	165	918.113	205	921.313	239	924.513
18	905.393	52	908.593	92	911.793	126	914.993	166	918.193		921.393	240	924.593
19	905.473	53	908.673	93	911.873	127	915.073	167	918.273		921.473	241	924.673
20	905.553	54	908.753	94	911.953	128	915.153	168	918.353		921.553	242	924.753
21	905.633	55	908.833	95	912.033	129	915.233	169	918.433		921.633	243	924.833
22	905.713	56	908.913	96	912.113	130	915.313	170	918.513		921.713	244	924.913
23	905.793	57	908.993	97	912.193	131	915.393	171	918.593		921.793	245	924.993
24	905.873	58	909.073	98	912.273	132	915.473	172	918.673	206	921.873	246	925.073
25	905.953	59	909.153	99	912.353	133	915.553	173	918.753	207	921.953	247	925.153
26	906.033	60	909.233	100	912.433	134	915.633	174	918.833	208	922.033	248	925.233
27	906.113	61	909.313	101	912.513	135	915.713	175	918.913	209	922.113	249	925.313
28	906.193	62	909.393	102	912.593	136	915.793	176	918.993	210	922.193	250	925.393
29	906.273	63	909.473	103	912.673	137	915.873	177	919.073	211	922.273	251	925.473
30	906.353	64	909.553	104	912.753	138	915.953	178	919.153	212	922.353	252	925.553
31	906.433	65	909.633	105	912.833	139	916.033	179	919.233	213	922.433	253	925.633
32	906.513	66	909.713	106	912.913	140	916.113	180	919.313	214	922.513	254	925.713
33	906.593	67	909.793	107	912.993	141	916.193	181	919.393	215	922.593	255	925.793
	906.673	68	909.873	108	913.073	142	916.273	182	919.473	216	922.673	256	925.873
	906.753	69	909.953	109	913.153	143	916.353	183	919.553	217	922.753		
	906.833	70	910.033	110	913.233	144	916.433	184	919.633	218	922.833		
	906.913	71	910.113	111	913.313	145	916.513	185	919.713	219	922.913		
	906.993	72	910.193	112	913.393	146	916.593	186	919.793	220	922.993		
	907.073	73	910.273	113	913.473	147	916.673	187	919.873	221	923.073		
34	907.153	74	910.353	114	913.553	148	916.753	188	919.953	222	923.153		



3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, 15.207, 15.209 and 15.249.

3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.107 and 15.109 under the FCC Rules Part 15 Subpart B and Section 15.207, 15.209, 15.249 under the FCC Rules Part 15 Subpart C.

3.3 GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.4.



3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

(a) Except as shown in paragraph (d) of this section, 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
¹ 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 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	(²)
13.36 - 13.41	322 - 335.4		

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

3.5 DESCRIPTION OF TEST MODES

The EUT(**Model: SAGA1-P40**) had been tested under engineering test mode condition and the EUT staying in continuous transmitting mode.

Note :

The field strength of spurious emission was measured in the following position: EUT have three test modes(X, Y, Z axis). The worst emission was found in Y axis and the worst case was recorded.



4. INSTRUMENT CALIBRATION

4.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

4.2 MEASUREMENT EQUIPMENT USED

Equipment Used for Emissions Measurement

Open Area Test Site # 6				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
TYPE N COAXIAL CABLE	SUHNER	CHA9513	6	NOV. 15, 2013
BI-LOG Antenna	Sunol	JB1	A070506-2	SEP. 26, 2013
LOOP ANTENNA	EMCO	6502	8905-2356	JUN. 10, 2013
Pre-Amplifier	HP	8447F	NCR	N.C.R
EMI Receiver	R&S	ESVS10	833206/012	JUN. 26, 2013
Horn Antenna	Com-Power	AH-118	071032	DEC. 05, 2013
Spectrum Analyzer	R&S	FSEK 30	835253/002	SEP. 29, 2013
Spectrum Analyzer	R&S	FSU	200789	SEP. 29, 2013
3116 Double Ridge Antenna (40G)	ETS-LINDGREN	EMCO-003	00078	NOV. 14, 2013
Turn Table	Yo Chen	001	-----	N.C.R.
Antenna Tower	AR	TP1000A	309874	N.C.R.
Controller	CT	SC101	-----	N.C.R.
RF Swicth	E-INSTRUMENT TELH LTD	ERS-180A	EC1204141	N.C.R
Power Meter	Anritsu	ML2487A	6K00003888	MAY. 20, 2013
Power Sensor	Anritsu	MA2491A	33265	MAY. 20, 2013
Temp./Humidity Chamber	K.SON	THS-M1	242	AUG. 08, 2013
DC Power Source	LOKO	DSP-5050	L1507009282	N.C.R

Remark: Each piece of equipment is scheduled for calibration once a year.



4.3 MEASUREMENT UNCERTAINTY

Parameter	Uncertainty
Radiated Emission, 30 to 200 MHz Test Site : OATS-6	±3.3456dB
Radiated Emission, 200 to 1000 MHz Test Site : OATS-6	±2.6828dB
Radiated Emission, 1 to 8 GHz	± 2.6485dB
Radiated Emission, 8 to 18 GHz	± 2.6852dB
Radiated Emission, 18 to 26.5 GHz	± 2.6485dB
Radiated Emission, 26 to 40 GHz	± 3.0295dB
Power Line Conducted Emission	±1.91dB
Band Width	136.49kHz
Peak Output Power MU	±1.904dB
Band Edge MU	±0.302dBuV
Channel Separation MU	361.69Hz
Duty Cycle MU	0.064ms
Frequency Stability MU	0.223kHz

Uncertainty figures are valid to a confidence level of 95%, k=2



5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

No.8, Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)

The sites are constructed in conformance with the requirements of ANSI C63.7:1992, ANSI C63.4 : 2003 and CISPR Publication 22.

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

5.3 LABORATORY ACCREDITATIONS LISTING

The test facilities used to perform radiated and conducted emissions tests are accredited by Taiwan Accreditation Foundation for the specific scope of accreditation under Lab Code: 1109 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by TAF or any agency of the Government. In addition, the test facilities are listed with Federal Communications Commission (registration no: TW-1037).



5.4 TABLE OF ACCREDITATIONS AND LISTINGS

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

Taiwan TAF

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

Canada	Industry Canada
Germany	TUV NORD
Taiwan	BSMI
USA	FCC

Copies of granted accreditation certificates are available for downloading from our web site, <http://www.ccsrf.com>

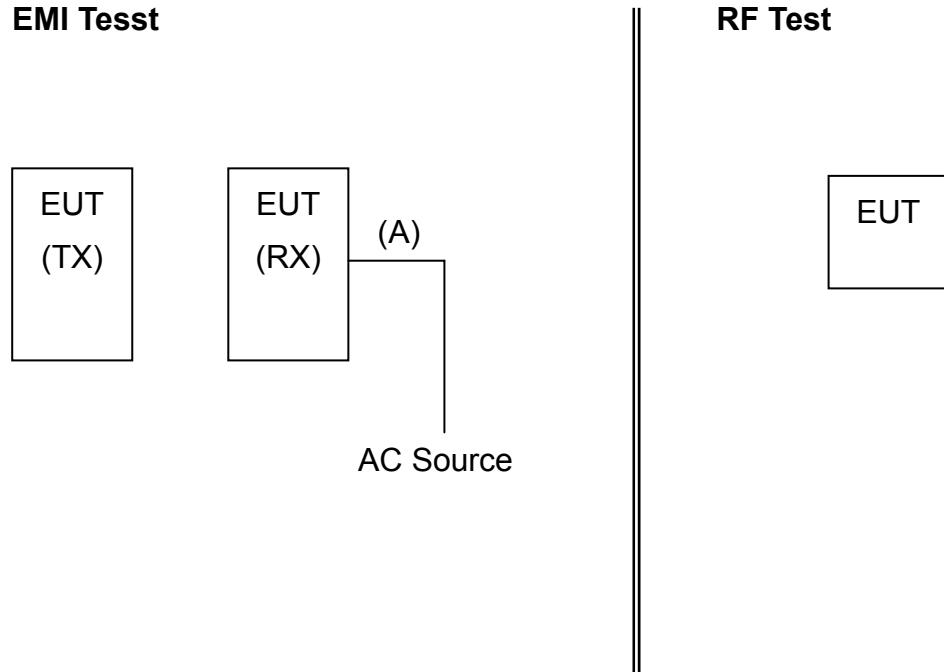


6. SETUP OF EQUIPMENT UNDER TEST

6.1 SETUP CONFIGURATION OF EUT

EMI Test

RF Test



6.2 SUPPORT EQUIPMENT

No.	Product	Manufacturer	Model No.	Certify No.	Signal cable
1	N/A	---	---	---	---

No.	Signal cable description	
A	AC Power	Unshielded, 1.8m, 1pcs.

Remark:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

6.3 EUT OPERATING CONDITION

RF Setup

1. Setup a whole system as the setup diagram.
2. Turn on power.
3. Press the button "start" and press the other button.



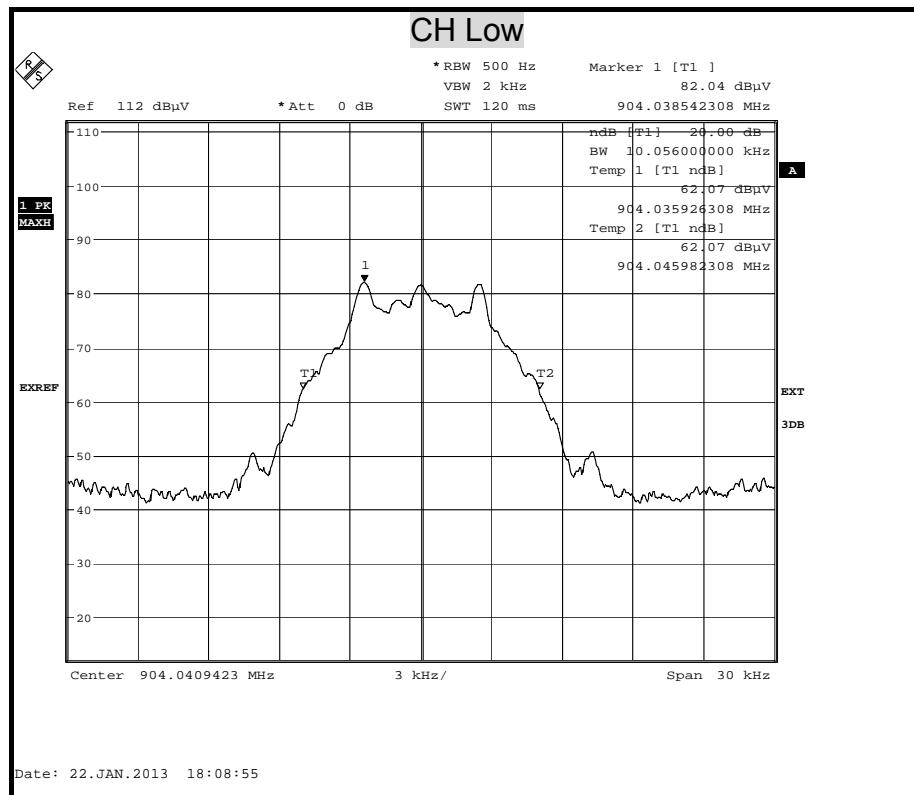
6.4 CENTER FREQUENCY CHECK

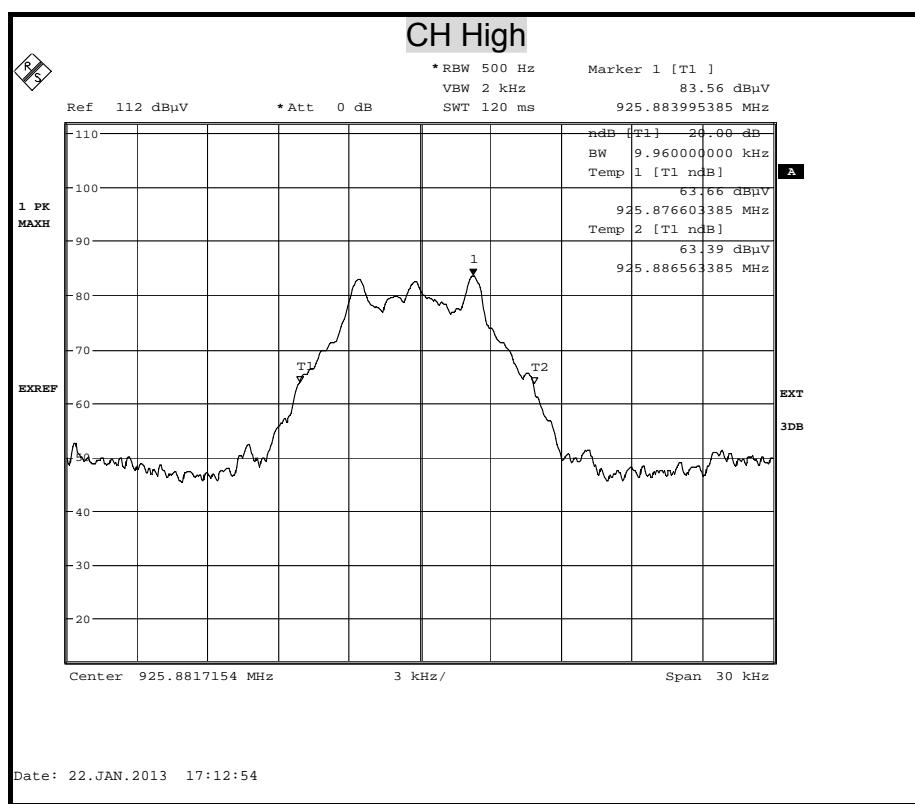
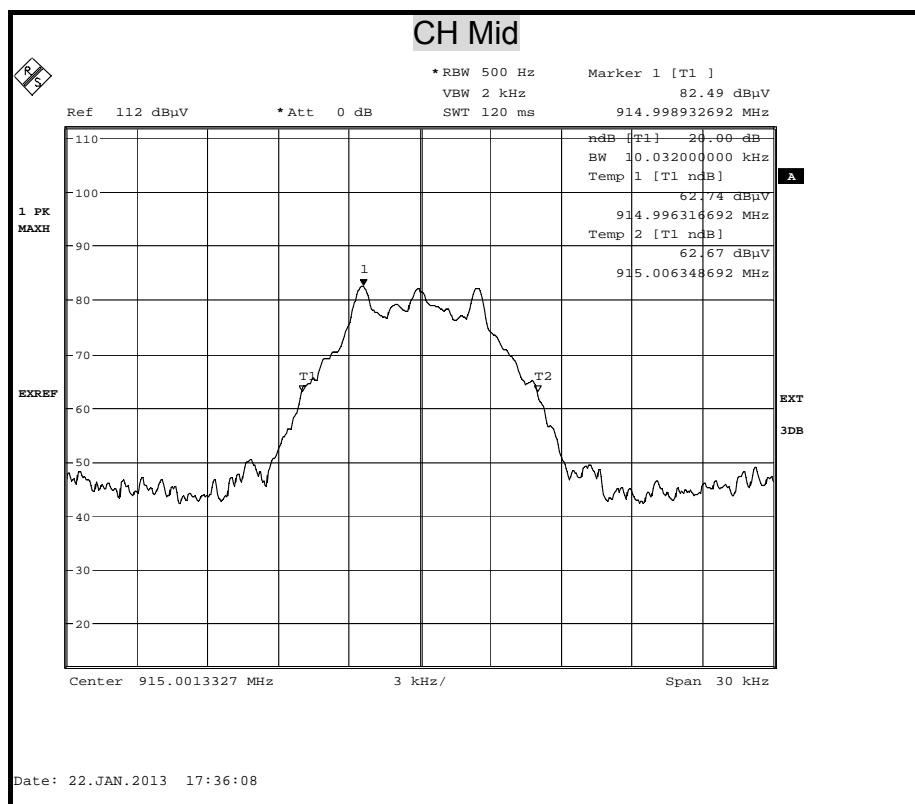
Manufacturer is define frequency error of EUT at 904.033~925.873MHz $\pm 10\text{kHz}$, and after verify the worst frequency error range is 925.882MHz (+8.583kHz).

Channel	Frequency f1 (MHz)	Frequency f2 (MHz)	Centre Frequency (MHz)
Low	904.036	904.046	904.041
Middle	914.996	915.006	915.001
High	925.877	925.887	925.882

Channel	Frequency (MHz)	Centre Frequency (MHz)	Frequency Error (kHz)
Low	904.033	904.041	7.954
Middle	914.993	915.001	8.333
High	925.873	925.882	8.583

Test Plot







7. FCC PART 15.249 REQUIREMENTS

7.1 20 DB BANDWIDTH

LIMIT

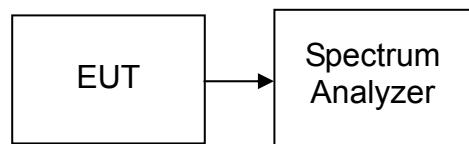
None; for reporting purposes only.

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
SPECTRUM ANALYZER	R&S	FSU	200789	SEP. 29 , 2013

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST PROCEDURE

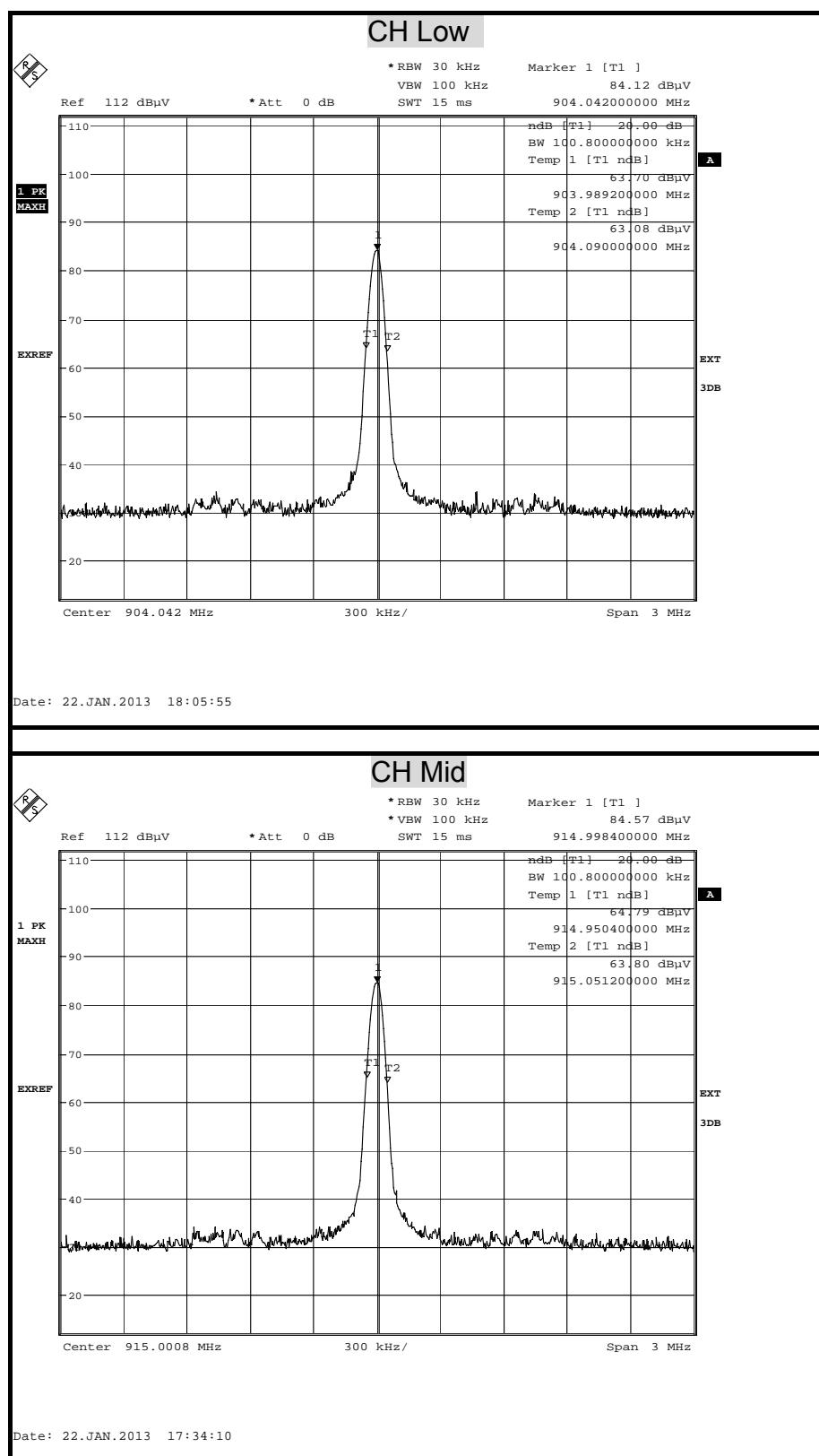
The transmitter output is connected to the spectrum analyzer. The spectrum analyzer center frequency is set to the transmitter frequency. The RBW is set to 30 kHz and VBW is set 100kHz..

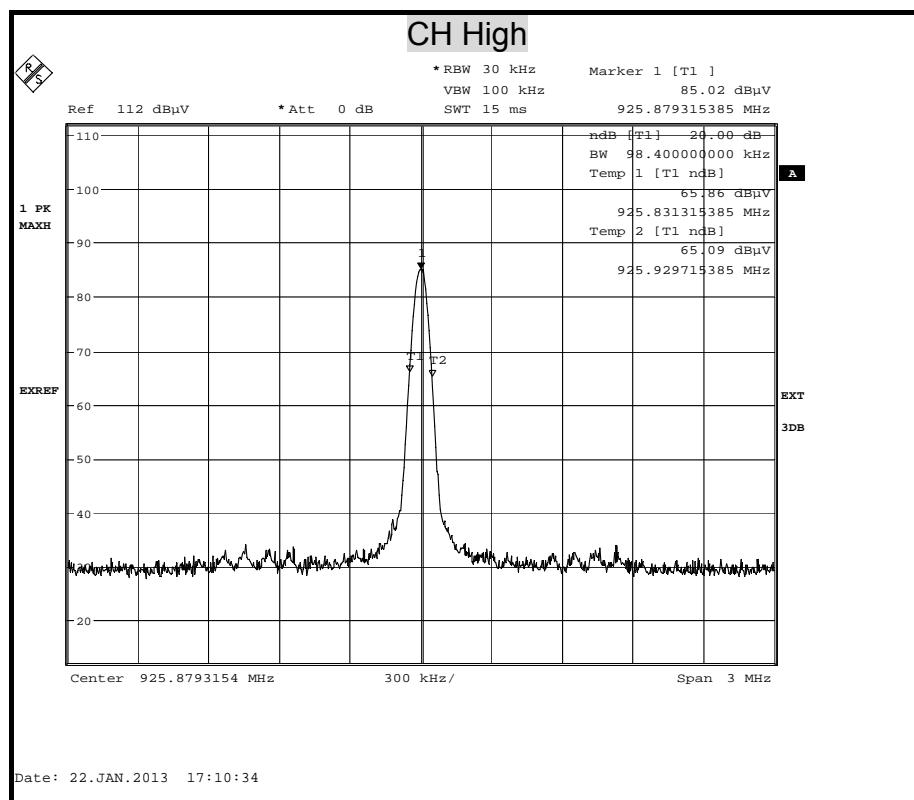
TEST RESULTS

No non-compliance noted.

Test Data

Channel	Frequency (MHz)	20dB Bandwidth (KHz)
Low	904.04	100.800
Middle	915.00	100.800
High	925.88	98.400

**Test Plot**





7.2 BAND EDGES MEASUREMENT

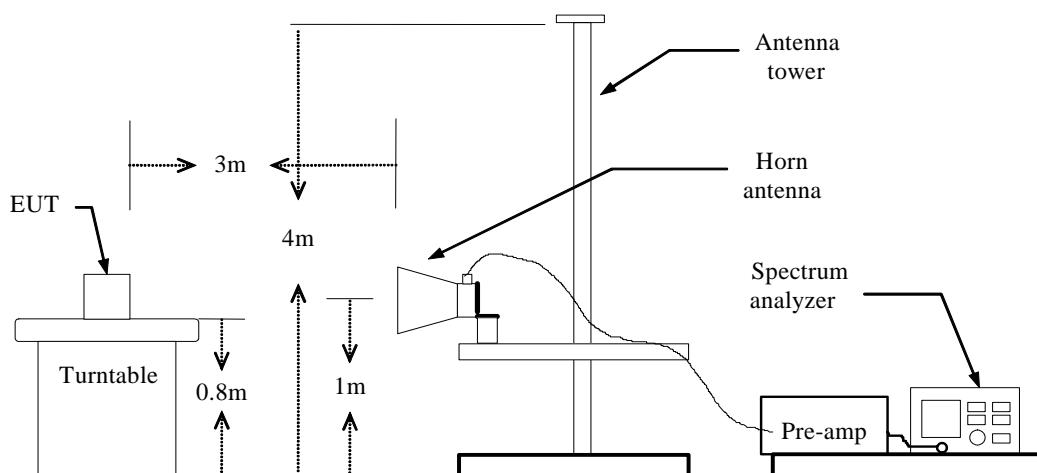
LIMIT

1. In the above emission table, the tighter limit applies at the band edges.

Frequency (MHz)	Field Strength ($\mu\text{V/m}$ at 3-meter)	Field Strength ($\text{dB}\mu\text{V/m}$ at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

2. As shown in Section 15.35(b), for frequencies above 1000 MHz, the above field strength limits in paragraphs (a) and (b) of this section are based on average limits. 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. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.

Test Configuration



TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
 - (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
 - (b) AVERAGE: Peak Level + Duty Factor
5. Repeat the procedures until all the PEAK and AVERAGE versus polarization are measured.

TEST RESULTS

After estimate 20dB bandwidth of 1st and last channel ,the declared frequency will not invade restrict band. There is no requirement for this test.



7.3 DUTY CYCLE

LIMIT

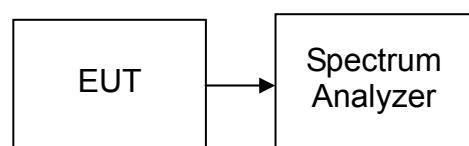
Nil (No dedicated limit specified in the Rules)

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
SPECTRUM ANALYZER	R&S	FSEK 30	835253/002	SEP, 29, 2013

Remark: Each piece of equipment is scheduled for calibration once a year.

TEST CONFIGURATION



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=100KHz, Span = 0Hz, a suitable Sweep Time.
5. Repeat above procedures until all frequency measured were complete.

TEST RESULTS

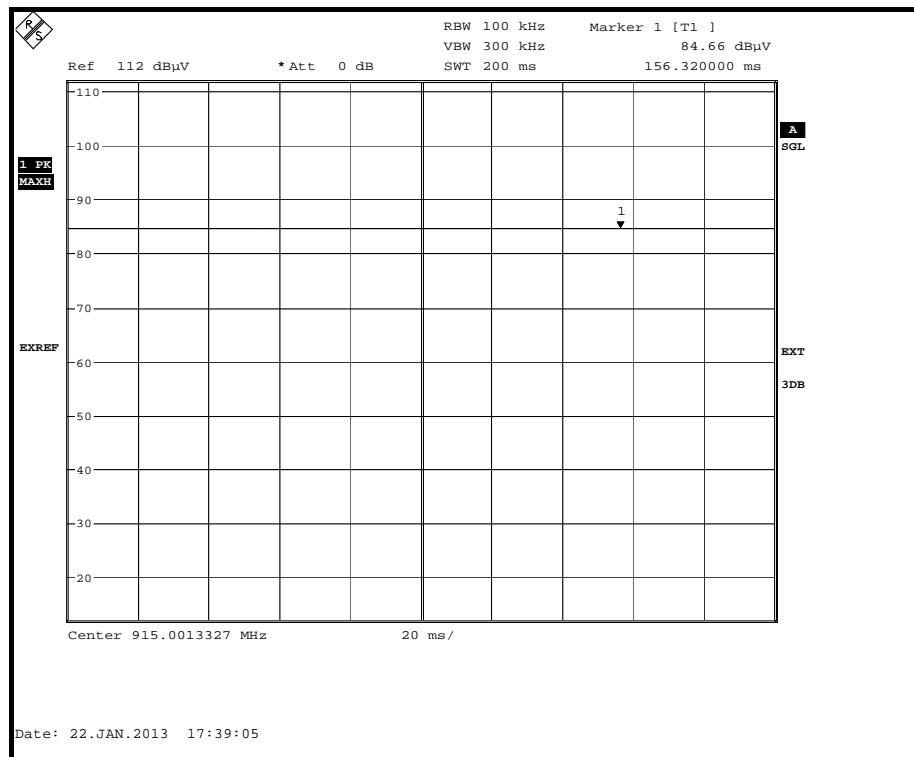
No non-compliance noted.

TEST DATA

	us	Times	Ton	Total Ton time(ms)
Ton1	100000.000	1	100000.000	100.000
Ton2		0	0.000	
Ton3		0	0.000	
Tp				100.000

Ton	100.000
Tp(Ton+Toff)	100.000
Duty Cycle	1.000
Duty Factor	0.000

100 %

Test PlotTon



7.4 SPURIOUS EMISSION

LIMIT

1. In the section 15.249(a):

Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental Field Strength (mV/m)	Field Strength of Harmonics (μV/m)
902-928 MHz	50	500
2400 - 2483.5 MHz	50	500
5725 - 5875 MHz	50	500
24.0 - 24.25 GHz	250	2500

2. 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:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
30-88	100*	3
88-216	150*	3
216-960	200*	3
Above 960	500	3

Remark: 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.

3. In the above emission table, the tighter limit applies at the band edges.

Frequency (MHz)	Field Strength (μV/m at 3-meter)	Field Strength (dBμV/m at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

**MEASUREMENT EQUIPMENT USED**

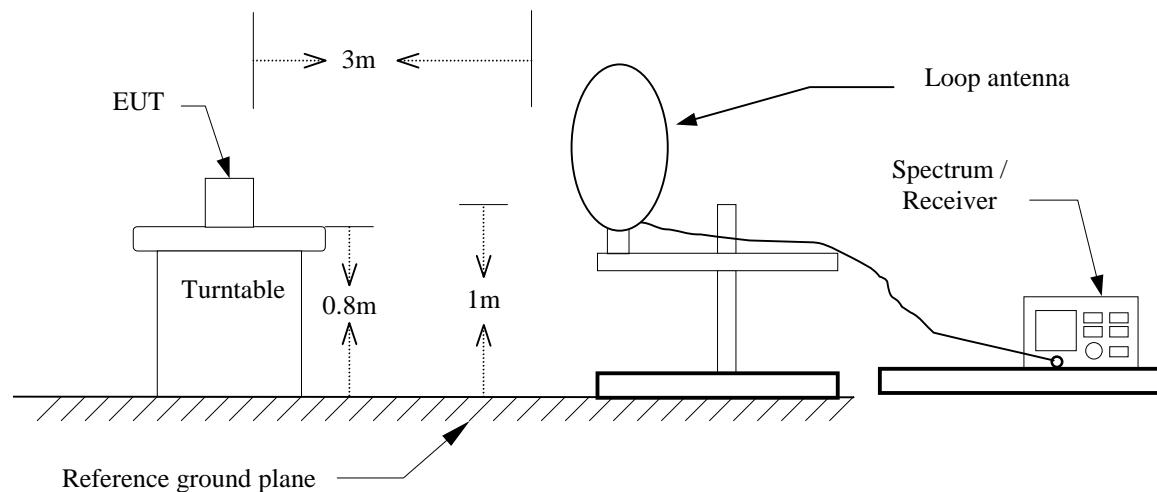
Open Area Test Site # 6				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
TYPE N COAXIAL CABLE	SUHNER	CHA9513	6	NOV. 15, 2013
BI-LOG Antenna	Sunol	JB1	A070506-2	SEP. 26, 2013
LOOP ANTENNA	EMCO	6502	8905-2356	JUN. 10, 2013
Pre-Amplifier	HP	8447F	NCR	N.C.R
EMI Receiver	R&S	ESVS10	833206/012	JUN. 26, 2013
Horn Antenna	Com-Power	AH-118	071032	DEC. 05, 2013
Spectrum Analyzer	R&S	FSEK 30	835253/002	SEP. 29, 2013
Spectrum Analyzer	R&S	FSU	200789	SEP. 29, 2013
3116 Double Ridge Antenna (40G)	ETS-LINDGREN	EMCO-003	00078	NOV. 14, 2013
Turn Table	Yo Chen	001	-----	N.C.R.
Antenna Tower	AR	TP1000A	309874	N.C.R.
Controller	CT	SC101	-----	N.C.R.
RF Switch	E-INSTRUMENT TELH LTD	ERS-180A	EC1204141	N.C.R
Power Meter	Anritsu	ML2487A	6K00003888	MAY. 20, 2013
Power Sensor	Anritsu	MA2491A	33265	MAY. 20, 2013
Temp./Humidity Chamber	K.SON	THS-M1	242	AUG. 08, 2013
DC Power Source	LOKO	DSP-5050	L1507009282	N.C.R

Remark: Each piece of equipment is scheduled for calibration once a year.

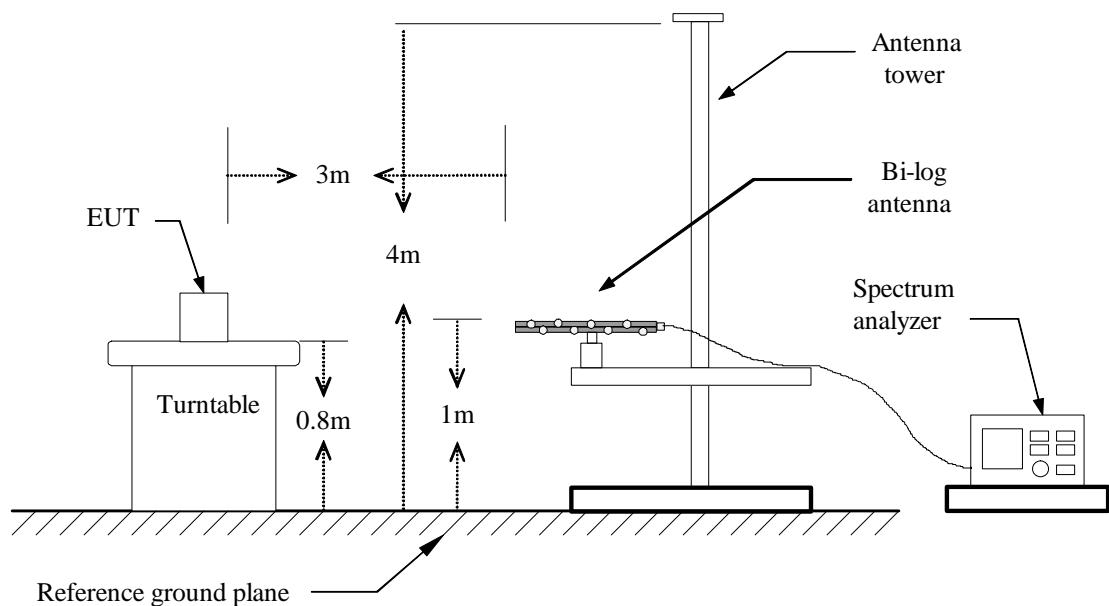


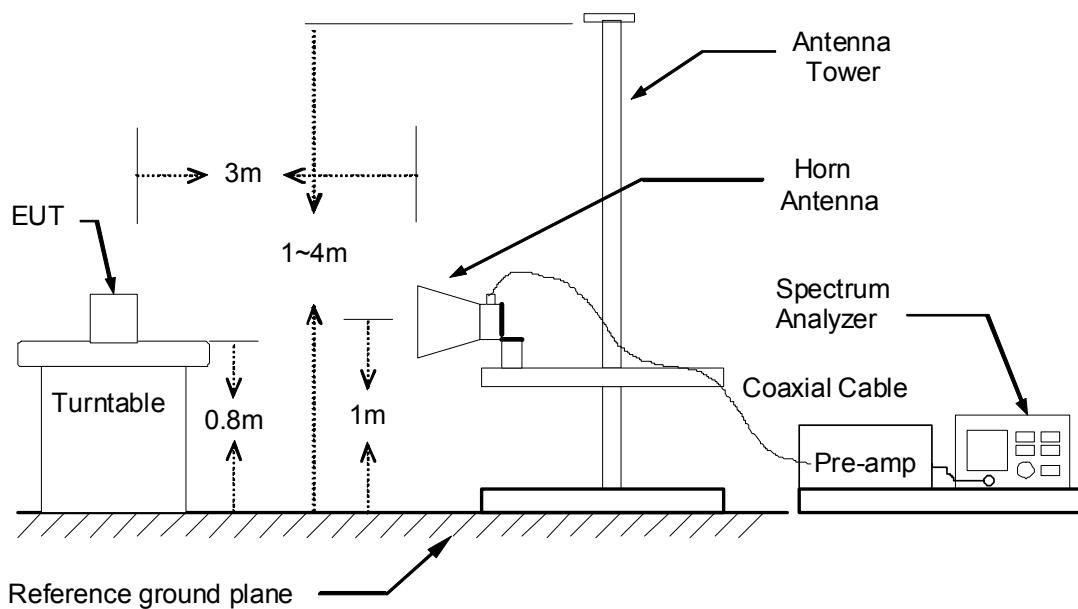
TEST CONFIGURATION

9kHz ~ 30MHz



30MHz ~ 1GHz



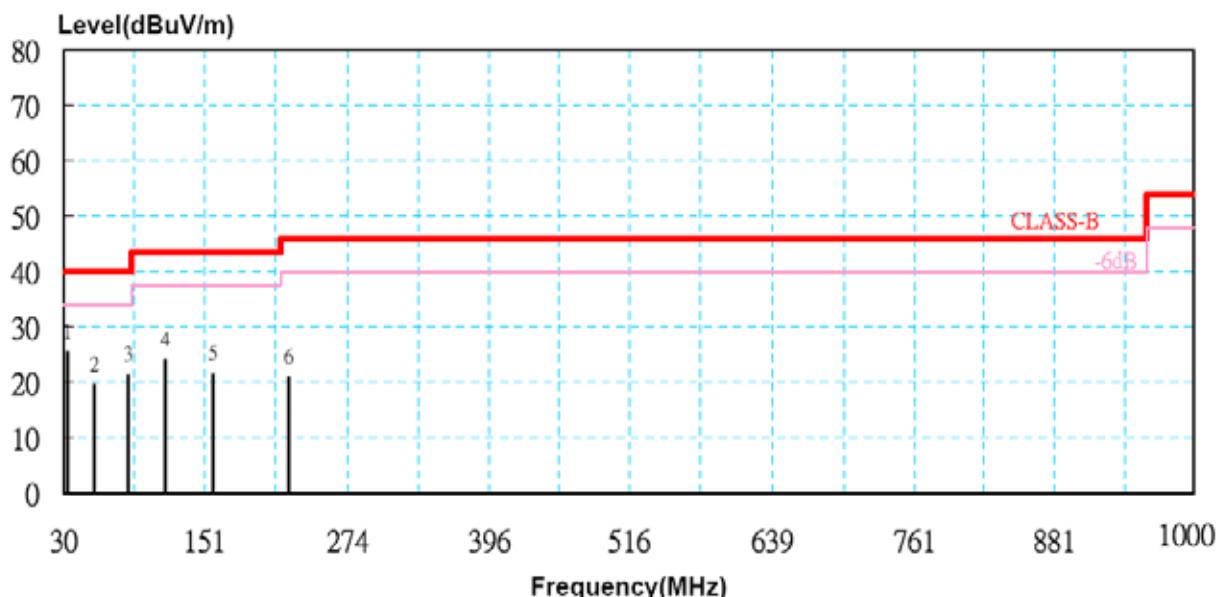
**Above 1 GHz**

**TEST PROCEDURE**

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:
Below 1GHz:
RBW=100kHz / VBW=300kHz / Sweep=AUTO
Above 1GHz:
(a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
(b) AVERAGE: Peak Level + Duty Factor
7. Repeat above procedures until the measurements for all frequencies are complete.

**Below 1GHz**

Operation Mode: TX CH MIDDLE (WORST CASE) **Test Date:** 2013/01/08
Temperature: 22.6°C **Tested by:** John Chen
Humidity: 61% RH **Polarity:** Ver. / Hor.

Vertical

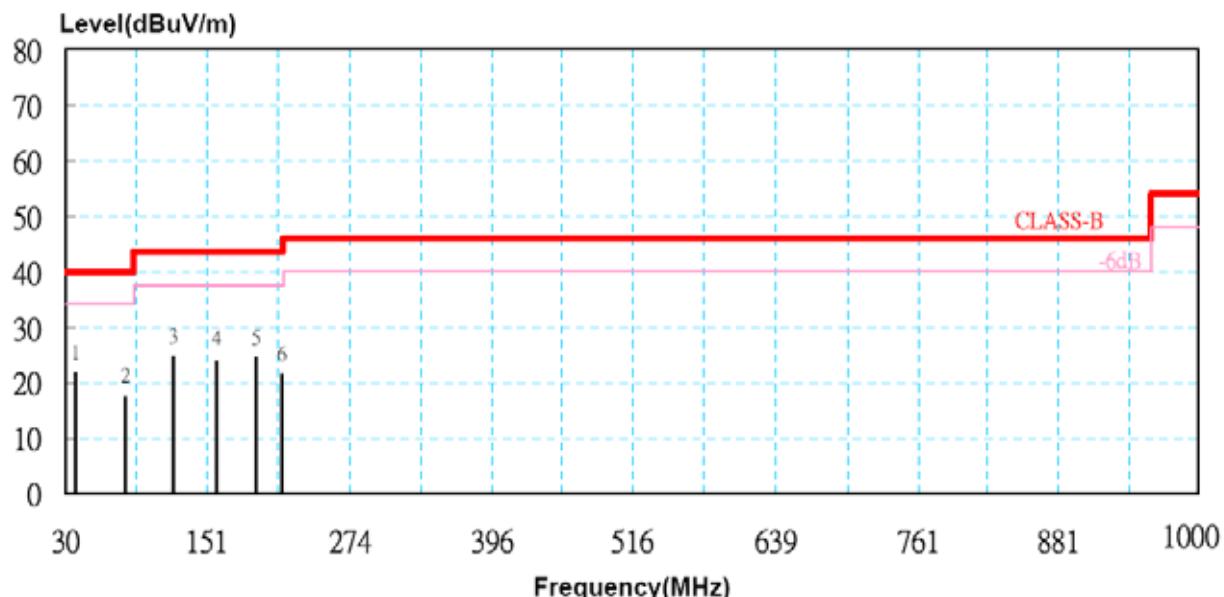
No.	Freq-Uency (MHz)	Meter Reading at 3 m Level (dB μ V)	Antenna Factor (dB/m)	Cable Loss (dB)	Emission at 3 m Level (dB μ V/m)	Limits (dB μ V/m)	Margin (dB)	Detector Mode
1	33.82	4.20	19.39	1.85	25.44	40.00	-14.56	QP
2	56.72	9.60	7.91	2.06	19.57	40.00	-20.43	QP
3	85.29	10.80	7.98	2.53	21.31	40.00	-18.69	QP
4	117.66	7.10	13.85	3.07	24.02	43.50	-19.48	QP
5	158.04	5.30	12.83	3.36	21.48	43.50	-22.02	QP
6	223.78	3.80	13.29	3.75	20.84	46.00	-25.16	QP

Remark:

1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).
2. Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.
3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with "N/A" remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. Margin (dB) = Remark result (dB μ V/m) – Quasi-peak limit (dB μ V/m).
6. That the limit for signals below 1GHz is a QP limit and peak readings are below the QP limit.
7. The fundamental signal is not shown in the test data because measurements at fundamental frequency are shown separately and were ignored during the 30 – 1000 MHz scan.



Operation Mode: TX CH MIDDLE (WORST CASE) **Test Date:** 2013/01/08
Temperature: 22.6°C **Tested by:** John Chen
Humidity: 61% RH **Polarity:** Ver. / Hor.

Horizontal

No.	Freq- Uency	Meter Reading at 3 m Level	Antenna Factor	Cable Loss	Emission at 3 m Level	Limits	Margin	Detector Mode
	(MHz)	(dB μ V)	(dB/m)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)	PK/QP
1	38.63	4.10	15.72	1.87	21.70	40.00	-18.30	QP
2	81.57	6.90	8.11	2.41	17.42	40.00	-22.58	QP
3	122.62	7.30	14.20	3.11	24.61	43.50	-18.89	QP
4	159.49	7.50	12.76	3.37	23.64	43.50	-19.86	QP
5	193.52	7.70	13.17	3.55	24.42	43.50	-19.08	QP
6	215.81	4.30	13.44	3.69	21.42	43.50	-22.08	QP

Remark:

1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).
2. Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak detector mode.
3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. Margin (dB) = Remark result (dB μ V/m) – Quasi-peak limit (dB μ V/m).
6. That the limit for signals below 1GHz is a QP limit and peak readings are below the QP limit.
7. The fundamental signal is not shown in the test data because measurements at fundamental frequency are shown separately and were ignored during the 30 – 1000 MHz scan.

**The fundamental signal****Operation Mode:** TX / Y Mode Low**Test Date:** 2013/01/22**Temperature:** 19.6°C**Tested by:** John Chen**Humidity:** 61% RH**Polarity:** Ver. / Hor.**Horizontal**

Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
(MHz)	(dB μ V)	(dB/m)	(dB)	(dB)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)	(P/Q/A)
904.04	84.15	22.96	4.52	27.05	0.00	84.57	114.00	-29.43	P
904.04	84.15	22.96	4.52	27.05	0.00	84.57	94.00	-9.43	Q

Vertical

Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
(MHz)	(dB μ V)	(dB/m)	(dB)	(dB)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)	(P/Q/A)
904.04	75.94	22.96	4.52	27.05	0.00	76.36	114.00	-37.64	P
904.04	75.94	22.96	4.52	27.05	0.00	76.36	94.00	-17.64	Q

Remark:*Margin (dB) = Remark result (dB μ V/m) – Quasi-peak limit (dB μ V/m).*

**The fundamental signal****Operation Mode:** TX / Y Mode Mid**Test Date:** 2013/01/22**Temperature:** 26.6°C**Tested by:** John Chen**Humidity:** 61% RH**Polarity:** Ver. / Hor.**Horizontal**

Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
(MHz)	(dB μ V)	(dB/m)	(dB)	(dB)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)	(P/Q/A)
915.00	84.67	23.13	4.53	26.85	0.00	85.48	114.00	-28.52	P
915.00	84.67	23.13	4.53	26.85	0.00	85.48	94.00	-8.52	Q

Vertical

Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
(MHz)	(dB μ V)	(dB/m)	(dB)	(dB)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)	(P/Q/A)
915.00	76.74	23.13	4.53	26.85	0.00	77.55	114.00	-36.45	P
915.00	76.74	23.13	4.53	26.85	0.00	77.55	94.00	-16.45	Q

Remark:*Margin (dB) = Remark result (dB μ V/m) – Quasi-peak limit (dB μ V/m).*

**The fundamental signal****Operation Mode:** TX / Y Mode High**Test Date:** 2013/01/22**Temperature:** 26.6°C**Tested by:** John Chen**Humidity:** 61% RH**Polarity:** Ver. / Hor.**Horizontal**

Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
(MHz)	(dB μ V)	(dB/m)	(dB)	(dB)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)	(P/Q/A)
925.88	85.03	23.31	4.54	26.64	0.00	86.24	114.00	-27.76	P
925.88	85.03	23.31	4.54	26.64	0.00	86.24	94.00	-7.76	Q

Vertical

Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
(MHz)	(dB μ V)	(dB/m)	(dB)	(dB)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)	(P/Q/A)
925.88	76.03	23.31	4.54	26.64	0.00	77.24	114.00	-36.76	P
925.88	76.03	23.31	4.54	26.64	0.00	77.24	94.00	-16.76	Q

Remark:*Margin (dB) = Remark result (dB μ V/m) – Quasi-peak limit (dB μ V/m).*

**Above 1GHz****Operation Mode:** TX / Y Mode Low**Test Date:** 2013/01/22**Temperature:** 26.6°C**Tested by:** John Chen**Humidity:** 61% RH**Polarity:** Ver. / Hor.

Horizontal

Freq. (MHz)	Reading (dB μ V)	AF (dB/m)	Cable Loss (dB)	Pre-amp (dB)	Filter (dB)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Mark	
1808.08	61.63	28.94	2.33	41.30	0.94	52.54	74.00	-21.46	P	
1808.08	61.63	28.94	2.33	41.30	0.94	52.54	54.00	-1.46	A	
*	2712.10	59.37	29.87	2.73	41.11	1.40	52.26	74.00	-21.74	P
*	2712.10	59.37	29.87	2.73	41.11	1.40	52.26	54.00	-1.74	A
*	3616.18	53.27	30.39	3.27	41.35	0.82	46.40	74.00	-27.60	P
*	3616.18	53.27	30.39	3.27	41.35	0.82	46.40	54.00	-7.60	A
	N/A	---	---	---	---	---	---	---	---	

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dB μ V/m) – Average limit (dB μ V/m). Peak detector mode and average detector mode of the emission shown in Result column.

**Operation Mode:** TX / Y Mode Low**Test Date:** 2013/01/22**Temperature:** 26.6°C**Tested by:** John Chen**Humidity:** 61% RH**Polarity:** Ver. / Hor.

Vertical

Freq. (MHz)	Reading (dB μ V)	AF (dB/m)	Cable Loss (dB)	Pre-amp (dB)	Filter (dB)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Mark	
1808.07	59.76	28.94	2.33	41.30	0.94	50.67	74.00	-23.33	P	
1808.07	59.76	28.94	2.33	41.30	0.94	50.67	54.00	-3.33	A	
*	2712.20	57.50	29.87	2.73	41.11	1.40	50.39	74.00	-23.61	P
*	2712.20	57.50	29.87	2.73	41.11	1.40	50.39	54.00	-3.61	A
*	3616.24	52.27	30.39	3.27	41.35	0.82	45.40	74.00	-28.60	P
*	3616.24	52.27	30.39	3.27	41.35	0.82	45.40	54.00	-8.60	A
	N/A	---	---	---	---	---	---	---	---	

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dB μ V/m) – Average limit (dB μ V/m). Peak detector mode and average detector mode of the emission shown in Result column.

**Operation Mode:** TX / Y Mode Mid**Test Date:** 2013/01/22**Temperature:** 26.6°C**Tested by:** John Chen**Humidity:** 61% RH**Polarity:** Ver. / Hor.

Horizontal

Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark	
(MHz)	(dB μ V)	(dB/m)	(dB)	(dB)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)	(P/Q/A)	
1829.96	61.35	29.11	2.34	41.27	0.95	52.48	74.00	-21.52	P	
1829.96	61.35	29.11	2.34	41.27	0.95	52.48	54.00	-1.52	A	
*	2745.08	59.31	29.90	2.74	41.11	1.41	52.25	74.00	-21.75	P
*	2745.08	59.31	29.90	2.74	41.11	1.41	52.25	54.00	-1.75	A
*	3659.93	53.57	30.46	3.28	41.37	0.80	46.74	74.00	-27.26	P
*	3659.93	53.57	30.46	3.28	41.37	0.80	46.74	54.00	-7.26	A
	N/A	---	---	---	---	---	---	---	---	

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dB μ V/m) – Average limit (dB μ V/m). Peak detector mode and average detector mode of the emission shown in Result column.

**Operation Mode:** TX / Y Mode Mid**Test Date:** 2013/01/22**Temperature:** 26.6°C**Tested by:** John Chen**Humidity:** 61% RH**Polarity:** Ver. / Hor.

Vertical

Freq. (MHz)	Reading (dB μ V)	AF (dB/m)	Cable Loss (dB)	Pre-amp (dB)	Filter (dB)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Mark	
1829.99	59.67	29.11	2.34	41.27	0.95	50.80	74.00	-23.20	P	
1829.99	59.67	29.11	2.34	41.27	0.95	50.80	54.00	-3.20	A	
*	2745.01	57.61	29.90	2.74	41.11	1.41	50.55	74.00	-23.45	P
*	2745.01	57.61	29.90	2.74	41.11	1.41	50.55	54.00	-3.45	A
*	3659.97	52.02	30.46	3.28	41.37	0.80	45.19	74.00	-28.81	P
*	3659.97	52.02	30.46	3.28	41.37	0.80	45.19	54.00	-8.81	A
	N/A	---	---	---	---	---	---	---	---	

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dB μ V/m) – Average limit (dB μ V/m). Peak detector mode and average detector mode of the emission shown in Result column.

**Operation Mode:** TX / Y Mode High**Test Date:** 2013/01/22**Temperature:** 26.6°C**Tested by:** John Chen**Humidity:** 61% RH**Polarity:** Ver. / Hor.

Horizontal

Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark	
(MHz)	(dB μ V)	(dB/m)	(dB)	(dB)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)	(P/Q/A)	
1851.64	60.24	29.27	2.35	41.25	0.97	51.59	74.00	-22.41	P	
1851.64	60.24	29.27	2.35	41.25	0.97	51.59	54.00	-2.41	A	
*	2777.65	58.40	29.92	2.75	41.11	1.43	51.40	74.00	-22.60	P
*	2777.65	58.40	29.92	2.75	41.11	1.43	51.40	54.00	-2.60	A
*	3703.74	53.11	30.53	3.30	41.39	0.78	46.33	74.00	-27.67	P
*	3703.74	53.11	30.53	3.30	41.39	0.78	46.33	54.00	-7.67	A
	N/A	---	---	---	---	---	---	---	---	

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dB μ V/m) – Average limit (dB μ V/m). Peak detector mode and average detector mode of the emission shown in Result column.

**Operation Mode:** TX / Y Mode High**Test Date:** 2013/01/22**Temperature:** 26.6°C**Tested by:** John Chen**Humidity:** 61% RH**Polarity:** Ver. / Hor.

Vertical

Freq. (MHz)	Reading (dB μ V)	AF (dB/m)	Cable Loss (dB)	Pre-amp (dB)	Filter (dB)	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Mark (P/Q/A)	
1851.53	59.57	29.27	2.35	41.25	0.97	50.91	74.00	-23.09	P	
1851.53	59.57	29.27	2.35	41.25	0.97	50.91	54.00	-3.09	A	
*	2777.58	59.52	29.92	2.75	41.11	1.43	52.52	74.00	-21.48	P
*	2777.58	59.52	29.92	2.75	41.11	1.43	52.52	54.00	-1.48	A
*	3703.68	52.42	30.53	3.30	41.39	0.78	45.64	74.00	-28.36	P
*	3703.68	52.42	30.53	3.30	41.39	0.78	45.64	54.00	-8.36	A
	N/A	---	---	---	---	---	---	---	---	

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown “ --- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with “ N/A ” remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dB μ V/m) – Average limit (dB μ V/m). Peak detector mode and average detector mode of the emission shown in Result column



7.5 POWERLINE CONDUCTED EMISSIONS

LIMIT

According to §15.207(a), 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 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/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 Range (MHz)	Limits (dB μ V)	
	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

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

MEASUREMENT EQUIPMENT USED

Conducted Emission room #1				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
L.I.S.N.	SCHWARZBECK	NNLK 8130	8130124	SEP. 30, 2013
	Rohde & Schwarz	ESH 3-Z5	840062/021	JUL. 31, 2013
TEST RECEIVER	Rohde & Schwarz	ESCS 30	100348	JUL. 23, 2013
BNC COAXIAL CABLE	CCS	BNC50	11	OCT. 30, 2013
Test S/W	e-3 (5.04211c) R&S (2.27)			

Remark: Each piece of equipment is scheduled for calibration once a year.

TEST RESULTS

This EUT is not connected to AC Source directly. Not applicability for this test.