

TEST REPORT

of

FCC Part 15 Subpart C

☒ New Application; ☐ Class I PC; ☐ Class II PC

Product : E-Tool
Brand: E-LEAD
Model: EL-400D
Model Difference: N/A
FCC ID: QYK-EL400D
FCC Rule Part: §15.209
Applicant: E-LEAD ELECTRONIC CO., LTD.
Address: NO. 37 Gungdung 1ST RD., Shengang
Shiang, Changhua, 509, TAIWAN, R.O.C.
(Chuan-Hsin Industrial Park)

Test Performed by:

International Standards Laboratory

<Lung-Tan LAB>

*Site Registration No.

BSMI: SL2-IN-E-0013; MRA TW1036; TAF: 0997; IC: IC4067B-3;

*Address:

No. 120, Lane 180, Hsin Ho Rd.

Lung-Tan Dist., Tao Yuan City 325, Taiwan

*Tel : 886-3-407-1718; Fax: 886-3-407-1738

Report No.: **ISL-15LR057FC**

Issue Date : **2015/03/25**



Test results given in this report apply only to the specific sample(s) tested and are traceable to national or international standard through calibration of the equipment and evaluating measurement uncertainty herein.

This report MUST not be used to claim product endorsement by TAF, NVLAP or any agency of the Government.

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VERIFICATION OF COMPLIANCE

Applicant: E-LEAD ELECTRONIC CO., LTD.
Product Description: E-Tool
Brand Name: E-LEAD
FCC ID: QYK-EL400D
FCC Rule Part: §15.209
Model No.: EL-400D
Model Difference: N/A
Date of test: 2015/03/17 ~ 2015/03/24
Date of EUT Received: 2015/03/17

We hereby certify that:

All the tests in this report have been performed and recorded in accordance with the standards described above and performed by an independent electromagnetic compatibility consultant, International Standards Laboratory.

The test results contained in this report accurately represent the measurements of the characteristics and the energy generated by sample equipment under test at the time of the test. The sample equipment tested as described in this report is in compliance with the limits of above standards.

Test By:	 _____ Dion Chang / Engineer	Date:	2015/03/25 _____
Prepared By:	 _____ Gigi Yeh / Specialist	Date:	2015/03/25 _____
Approved By:	 _____ Vincent Su / Technical Manager	Date:	2015/03/25 _____

Version

Version No.	Date	Description
00	2015/03/25	Initial creation of document

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1. GENERAL INFORMATION

1.1 Product Description

Product Name	E-Tool	
Brand Name	E-LEAD	
Model Name	EL-400D	
Model Difference	N/A	
USB port	One provided for data link	
RS232	One provided for data link	
Power Supply	16Vdc from AC/DC adapter or 11.1V Li-ion Battery	
	Adapter	Model: ZPP301400000/ZPC251601000
	Battery	Model No.: 334561

Bluetooth:

Bluetooth Version	V2.1 + EDR (GFSK + $\pi/4$ DQPSK + 8DPSK)
Frequency Range	2402 – 2480MHz
Channel number	79 channels
Modulation type	Frequency Hopping Spread Spectrum
Max Measured Transmit Power	2.97 dBm (Peak)
Dwell Time	$\leq 0.4s$
Antenna Designation	Chip Antenna, 1.5dBi

The EUT is compliance with Bluetooth EDR V2.1 Standard.

Rule: 15.209 (TX)

Frequency Range:	125KHz
Modulation type:	ASK
Antenna Designation:	Loop Antenna

1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: QYK-EL400D filing to comply with Section 15.209 of the FCC Part 15, Subpart C Rules.

1.3 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2009. Radiated testing was performed at an antenna to EUT distance 3 meters.

1.4 Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of **International Standards Laboratory** <Lung-Tan LAB> No. 120, Lane 180, Hsin Ho Rd., Lung-Tan Dist., Tao Yuan City 325, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2009. FCC Registration Number is: TW1036, Canada Registration Number: 4067B-3.

1.5 Special Accessories

Not available for this EUT intended for grant.

1.6 Equipment Modifications

Not available for this EUT intended for grant.

2. SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

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

2.2 EUT Exercise

The EUT (Transmitter) was tested with a test program to fix the Tx frequency that was for the purpose of the measurements. For more information please see test data and APPENDIX 1 for set-up photographs.

2.3 Test Procedure

2.3.1 Conducted Emissions (Not apply in the report)

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the requirements in Section 7, 13 of ANSI C63.4-2009 and RSS-Gen:2014. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and Average detector mode.

2.3.2 Radiated Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. The turn table 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 max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna. according to the requirements in Section 8 and 13 of ANSI C63.4-2009.

2.4 Limitation

(1) Conducted Emission

According to section 15.207(a) Conducted Emission Limits is as following.

Frequency range MHz	Limits dB (uV)	
	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 lower limit shall apply at the transition frequencies 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

(2) Radiated Emission

- (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:
- (b) In the emission table above, the tighter limit applies at the band edges.
- (c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other Sections within this Part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

Frequency (MHz)	Field strength $\mu\text{V/m}$	Distance (m)	Field strength at 3m $\text{dB}\mu\text{V/m}$
0.009-0.490	2400/F(KHz)	300	
0.490-1.705	24000/F(KHz)	30	
1.705-30	30	30	69.54
30-88	100	3	40
88-216	150	3	43.5
216-960	200	3	46
Above 960	500	3	54

Limit Table:

number of Harmonic	Frequency (KHz)	Distance m	Limit at 300m (uV/m)	Limit at 30m (uV/m)	Distance Factor dB	Limit at 3im (uV/m)
1	125	300	25.67	--	80	105.67
2	250	300	19.65	--	80	99.65
3	375	300	16.12	--	80	96.12
4	500	30	--	33.62	40	73.62
5	625	30	--	31.69	40	71.69
6	750	30	--	30.10	40	70.10
7	875	30	--	28.76	40	68.76
8	1000	30	--	27.60	40	67.60
9	1125	30	--	26.58	40	66.58
10	1250	30	--	25.67	40	65.67

Limit Calculation and transfer to 1m test distance:

If the frequency between 9 – 490KHz,
 $\text{Limit} = 20\log(2400/f(\text{KHz})) + 40\log(300/1)$

If the frequency between 490 KHz – 1.705MHz
 $\text{Limit} = 20\log(24000/f(\text{KHz})) + 40\log(30/1)$

2.5 Configuration of Tested System

Fig. 2-1 Configuration of Tested System



Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.	Data Cable	Power Cord
1	NB	IBM	X40i	N/A	No-Shielded	No-Shielded
2	JIG	NA	NA	NA	No-Shielded	No-Shielded

3. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207	Conducted Emission	Compliant
§15.209	Radiated Emission	Compliant

4. Description of test modes

The EUT has been tested under continuous operating condition with a Test Kit. The Frequency 125KHz was chosen for testing.

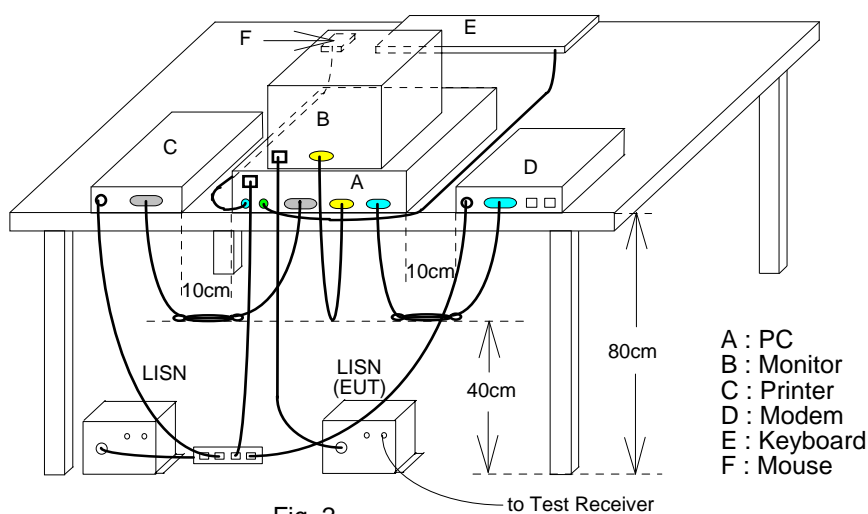
The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1,E2 mode) three axis modes. Worse case E1 mode.

5. CONDUCTED EMISSIONS TEST (NOT APPLY IN THE REPORT)

5.1 Measurement Procedure:

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

5.2 Test SET-UP (Block Diagram of Configuration)



5.3 Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Conduction 04-3 Cable	WOKEN	CFD 300-NL	Conduction 04 -3	07/24/2014	07/23/2015
EMI Receiver 17	Rohde & Schwarz	ESCI 7	100887	09/03/2014	09/02/2015
LISN 18	ROHDE & SCHWARZ	ENV216	101424	03/13/2015	03/12/2016
LISN 19	ROHDE & SCHWARZ	ENV216	101425	03/13/2015	03/12/2016

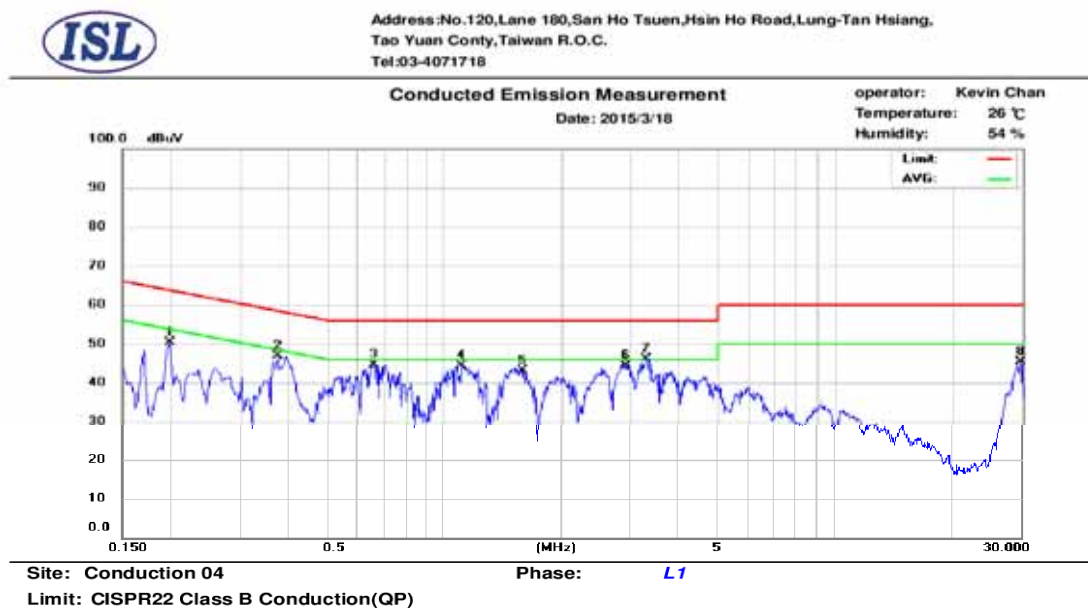
5.4 Measurement Result:

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

Note: Refer to next page for measurement data and plots.

AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation Mode	Test Date:	2015/03/18
Test By:	Dino		



No.	Frequency (MHz)	Correct Factor (dB)	QP Emission (dBuV)	QP Limit (dBuV)	QP Margin (dB)	AVG Emission (dBuV)	AVG Limit (dBuV)	AVG Margin (dB)	Note
1	0.198	9.60	46.05	63.69	-17.64	34.19	53.69	-19.50	
2	0.376	9.61	45.85	58.36	-12.51	38.69	48.36	-9.67	
3	0.665	9.62	42.60	56.00	-13.40	33.59	46.00	-12.41	
4	1.125	9.64	41.68	56.00	-14.32	31.89	46.00	-14.11	
5	1.604	9.67	40.88	56.00	-15.12	31.07	46.00	-14.93	
6	2.903	9.70	39.64	56.00	-16.36	29.63	46.00	-16.37	
7	3.246	9.71	39.04	56.00	-16.96	27.78	46.00	-18.22	
8	29.826	10.20	45.27	60.00	-14.73	45.27	50.00	-4.73	



Address: No.120, Lane 180, San Ho Tsuen, Hsin Ho Road, Lung-Tan Hsiang,
Tao Yuan Conty, Taiwan R.O.C.
Tel: 03-4071718

Conducted Emission Measurement

Date: 2015/3/18

operator: Kevin Chan

Temperature: 26 °C

Humidity: 54 %



Site: Conduction 04

Phase: **N**

Limit: CISPR22 Class B Conduction(QP)

No.	Frequency (MHz)	Correct Factor (dB)	QP Emission (dBuV)	QP Limit (dBuV)	QP Margin (dB)	AVG Emission (dBuV)	AVG Limit (dBuV)	AVG Margin (dB)	Note
1	0.186	9.62	43.28	64.21	-20.93	29.70	54.21	-24.51	
2	0.242	9.62	41.30	62.03	-20.73	31.74	52.03	-20.29	
3	0.394	9.62	47.74	57.98	-10.24	38.83	47.98	-9.15	
4	0.410	9.62	47.22	57.65	-10.43	36.93	47.65	-10.72	
5	0.742	9.64	41.78	56.00	-14.22	31.64	46.00	-14.36	
6	1.226	9.66	42.65	56.00	-13.35	32.58	46.00	-13.42	
7	1.750	9.68	40.26	56.00	-15.74	30.79	46.00	-15.21	
8	2.774	9.71	41.20	56.00	-14.80	31.20	46.00	-14.80	
9	3.162	9.72	38.29	56.00	-17.71	29.69	46.00	-16.31	
10	29.474	10.23	38.16	60.00	-21.84	29.28	50.00	-20.72	

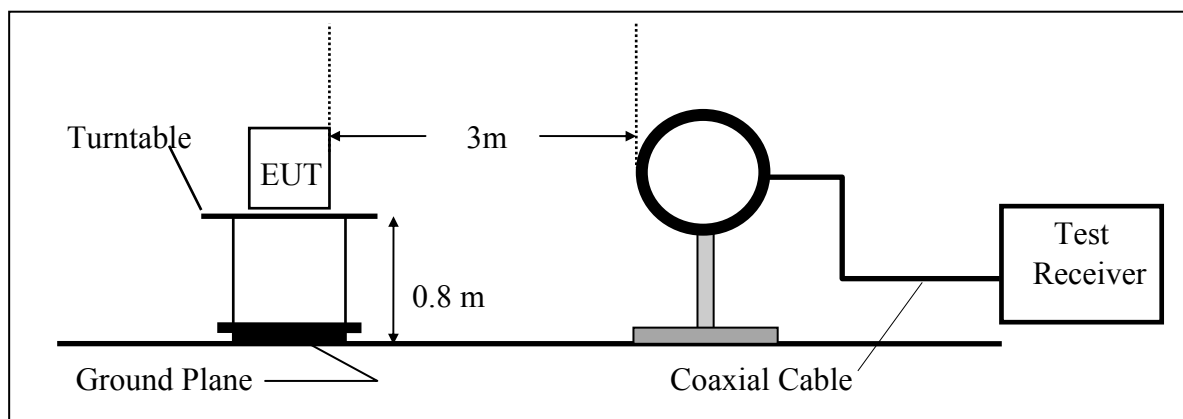
6. RADIATED EMISSION TEST

6.1 Measurement Procedure

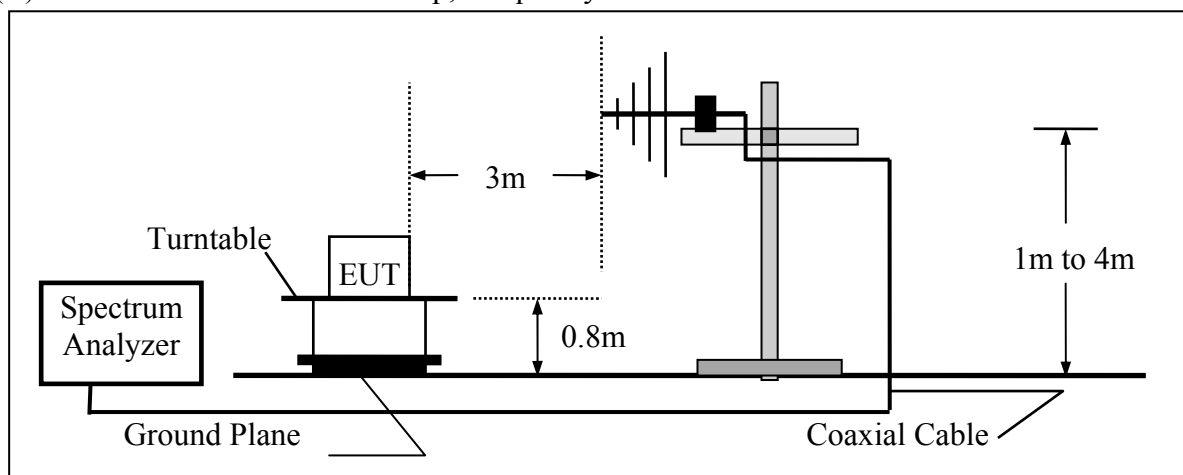
1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measured were complete.

6.2 Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency Below 1000MHz



6.3 Measurement Equipment Used:

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer 21(26.5GHz)	Agilent	N9010A	MY49060537	07/29/2014	07/28/2015
Spectrum Analyzer 20(6.5GHz)	Agilent	E4443A	MY48250315	05/26/2014	05/25/2015
Spectrum Analyzer 22(43GHz)	R&S	FSU43	100143	05/07/2014	05/06/2015
Loop Antenna9K-30M	A.H.SYSTEM	SAS-564	294	03/07/2015	03/06/2017
Bilog Antenna30-1G	Schaffner	CBL 6112B	2756	12/30/2014	12/29/2015
Horn antenna1-18G	ETS	3117	00066665	11/27/2014	11/26/2015
Preamplifier9-1000M	HP	8447D	NA	02/20/2015	02/19/2016
Preamplifier1-18G	MITEQ	AFS44-001018 00-25-10P-44	1329256	07/30/2014	07/29/2015
Cable UP to 1G	HUBER SUHNER	RG 214/U	NA	10/17/2014	10/16/2015

6.4 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Average Value = Peak Value + 20 Log (Ton/Tp) Pulse Modulation

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

6.5 Measurement Result

Fundamental Measurement Result

Operation Mode	: TX CH	Test Date	: 2015/03/18
Fundamental Frequency	: 125KHz	Test By	: Dino
Temp	: 25	Hum.	: 60%

Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
0.13	49.02	48.54	97.56	125.00	-27.44	Peak	VERTICAL
0.12	47.34	48.71	96.05	125.00	-28.95	Peak	HORIZONTAL

Remark:

- 1 Measurement distance is 1 m.
- 2 The IF bandwidth of SPA was 10KHz, VBW=30KHz.

Radiated Spurious Emission Measurement Result (9K~30M)

Operation Mode: Transmitting Mode

Test Date: 2015/03/18

Fundamental Frequency: 125KHz

Test By: Dino

Temperature : 25

Humidity : 65 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	5.83	30.94	14.74	45.68	69.54	-23.86	Peak	VERTICAL
2	8.59	39.28	12.10	51.38	69.54	-18.16	Peak	VERTICAL
3	10.00	47.70	11.62	59.32	69.54	-10.22	Peak	VERTICAL
4	13.96	32.88	11.78	44.66	69.54	-24.88	Peak	VERTICAL
5	21.21	41.89	11.03	52.92	69.54	-16.62	Peak	VERTICAL
6	28.59	34.81	5.92	40.73	69.54	-28.81	Peak	VERTICAL
1	5.80	29.69	14.75	44.44	69.54	-25.10	Peak	HORIZONTAL
2	8.71	37.77	12.05	49.82	69.54	-19.72	Peak	HORIZONTAL
3	10.12	43.44	11.60	55.04	69.54	-14.50	Peak	HORIZONTAL
4	13.87	31.83	11.75	43.58	69.54	-25.96	Peak	HORIZONTAL
5	20.88	40.89	11.26	52.15	69.54	-17.39	Peak	HORIZONTAL
6	22.74	37.54	9.98	47.52	69.54	-22.02	Peak	HORIZONTAL

Remark:

- 1 Measurement distance is 3 m.
- 2 The IF bandwidth of SPA was 10KHz, VBW=30KHz.

Radiated Spurious Emission Measurement Result (30M - 1GHz)

Operation Mode: Transmitting Mode

Test Date: 2015/03/18

Fundamental Frequency: 125KHz

Test By: Dino

Temperature : 25

Humidity : 65 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	31.94	40.27	-13.13	27.14	40.00	-12.86	Peak	VERTICAL
2	95.96	43.31	-17.93	25.38	43.50	-18.12	Peak	VERTICAL
3	119.24	48.65	-15.12	33.53	43.50	-9.97	Peak	VERTICAL
4	178.41	38.92	-13.39	25.53	43.50	-17.97	Peak	VERTICAL
5	208.48	38.45	-15.09	23.36	43.50	-20.14	Peak	VERTICAL
6	866.14	26.36	-1.13	25.23	46.00	-20.77	Peak	VERTICAL
1	51.34	38.75	-12.15	26.60	40.00	-13.40	Peak	HORIZONTAL
2	92.08	43.13	-18.48	24.65	43.50	-18.85	Peak	HORIZONTAL
3	118.27	48.93	-15.23	33.70	43.50	-9.80	Peak	HORIZONTAL
4	168.71	37.74	-12.53	25.21	43.50	-18.29	Peak	HORIZONTAL
5	448.07	28.78	-7.83	20.95	46.00	-25.05	Peak	HORIZONTAL
6	883.60	24.85	-0.80	24.05	46.00	-21.95	Peak	HORIZONTAL

Remark:

- 1 Measuring frequencies from the lowest internal frequency to the 1GHz.
- 2 Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak / QP detector mode.
- 3 The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz, VBW=300KHz.