EMC
TEST REPORT

Report No.: TS13070042-EME
Model No.: K110
Issued Date: Jul. 25, 2013

Applicant:	**Kobo Inc** **135 Liberty Street, Suite 101, Toronto, Ontario, M6K1A7** **Canada**
Test Method/ Standard:	**FCC Part 15 Subpart C Section §15.205, §15.207, §15.209, §15.247, KDB558074 and ANSI C63.4/2003**
Test By:	**Intertek Testing Services Taiwan Ltd.** **No. 11, Lane 275, Ko-Nan 1 Street, Chia-Tung Li,** **Shiang-Shan District, Hsinchu City, Taiwan**

Testing Laboratory
0597

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Summary of Tests

Test Item	Reference	Results
Maximum 6 dB Bandwidth	15.247 (a)(2)	Pass
Power Spectral Density	15.247(e)	Pass
Maximum Output Power test	15.247(b)	Pass
RF Antenna Conducted Spurious test	15.247(d)	Pass
Radiated Spurious Emission test	15.205, 15.209	Pass
Emission on the Band Edge test	15.247(d)	Pass
AC Power Line Conducted Emission test	15.207	Pass

1. General information

1.1 Identification of the EUT

Product:	Tablet
Model No.:	K110
FCC ID.:	ZJLKOBOK110
Frequency Range:	2402MHz~2480MHz
Total Hopping Channel No:	40 channels
Frequency of Each Channel:	2402+2k, k＝0~39
Type of Modulation:	GFSK
Rated Power:	1. DC 5.35 V from adapter 2. DC 3.7 V from battery
Power Cord:	N/A
Data Cable:	USB shielded cable 1 meter × 1
Sample Received:	Jul. 04, 2013
Test Date(s):	Jun. 11, 2013~Jul. 22, 2013
Note 1:	This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to permit copying or distribution of this report and then only in its entirety. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results in this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.
Note 2:	When determining the test conclusion, the Measurement Uncertainty of test has been considered.

1.2 Additional information about the EUT

The EUT is Tablet, and was defined as information technology equipment.

For more detail features, please refer to User's manual as file name “Installation guide.pdf”

1.3 Antenna description

Chain 0: AUX Antenna

The antenna is affixed to the EUT using a unique connector, which allows for replacement of a broken antenna, but DOES NOT use a standard antenna jack or electrical connector.

Antenna Gain	: 3.24dBi
Antenna Type	: PIFA Antenna
Connector Type	: I-PEX

1.4 Adapter information

The EUT will be supplied with a power supply from below list:

No.	Brand	Model no.	Specification
Adapter	kobo	PSAI10R-050Q	I/P: 100-240V~, 0.3A, 50-60Hz O/P: 5.35V, 2.0A

2. Test specifications

2.1 Test standard

The EUT was performed according to the procedures in FCC Part 15 Subpart C Section §15.205, §15.207, §15.209, §15.247, KDB558074 and ANSI C63.4/2003.

The test of radiated measurements according to FCC Part15 Section 15.33(a) had been conducted and the field strength of this frequency band was all meet limit requirement, thus we evaluate the EUT pass the specified test.

2.2 Operation mode

The EUT is supplied with DC 3.7 V from battery for all test items except for conducted emission test.

The EUT is supplied with DC 5.35 V from adapter (Test voltage: 120VAC, 60Hz) for conducted emission test.

The EUT executes test by "MS-DOS" and key-in commands provided by Wistron.

The signal is maximized through rotation and placement in the three orthogonal axes (The EUT configuration refers to the "Spurious set-up photo.pdf").
After verifying three axes, we found the maximum electromagnetic field was occurred at X axis. The final test data was executed under this configuration.

2.3 Measurement Uncertainty

Measurement uncertainty was calculated in accordance with TR 100 028-1

Parameter	Uncertainty		
Radiated Emission	Below 1 GHz	Vertical	3.90 dB
		Horizontal	3.86 dB
	Above 1 GHz	Vertical	5.74 dB
		Horizontal	5.55 dB
Conducted Emission	2.08 dB		

This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of k=2.

2.4 Test equipment

Equipment	Brand	Model No.	Serial No.	Calibration Date	Next Calibration Date
EMI Test Receiver	Rohde & Schwarz	ESCI	100018	2012/11/30	2013/11/29
Spectrum Analyzer	Rohde&schwarz	FSP30	100137	2013/06/21	2014/06/21
Spectrum Analyzer	Rohde&schwarz	FSEK30	100186	2013/01/23	2014/01/23
Horn Antenna (1-18G)	Schwarzbeck	BBHA 9120 D	9120D-456	2012/09/03	2014/09/03
Horn Antenna (14-42G)	SHWARZBECK	BBHA 9170	BBHA9170159	2012/09/05	2014/09/05
Broadband Antenna	SCHWARZBECK	VULB 9168	9168-172	2011/07/26	2013/07/25
Loop Antenna	RolfHeine	LA-285	02/10033	2012/03/20	2014/03/20
Pre-Amplifier	MITEQ	AFS44-00102650--42-10P-44	1495287	2011/10/27	2013/10/26
Pre-Amplifier	MITEQ	JS4-26004000--27-8A	828825	2012/09/18	2014/09/18
Power Meter	Anritsu	ML2495A	0844001	2012/10/09	2013/10/09
Power Senor	Anritsu	MA2411B	0738452	2012/10/09	2013/10/09
WiMAX PSA Spectrum Analyzer	Agilent	E4440A	MY46186191	2013/06/05	2014/06/05
Two-Line V-Network	Rohde&schwarz	ESH3-Z5	838979/014	2012/10/29	2013/10/29

Note: The above equipments are within the valid calibration period.

3. - 6dB Bandwidth

3.1 Operating environment

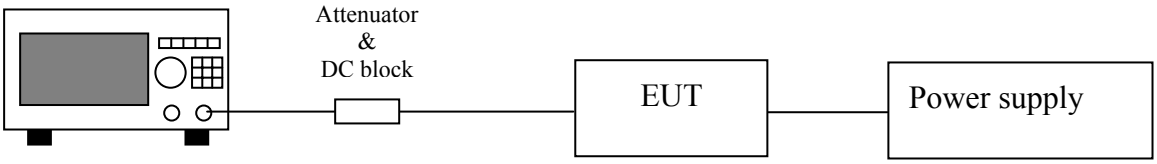
Temperature:	23	℃
Relative Humidity:	55	%
Atmospheric Pressure:	1008	hPa
Test Date:	Jul. 22, 2013	

3.2 Test setup & procedure

Method of Measurement:

Reference FCC document: KDB558074
A portion of the transmitted signal is coupled to a Spectrum Analyzer with a resolution bandwidth of 1~5 % of the bandwidth of the transmitted signal. The resolution bandwidth is chosen so as not to reduce the peak level of the measured waveform. The appropriate bandwidth mask is applied to the output waveform to verify compliance.

Test Diagram:



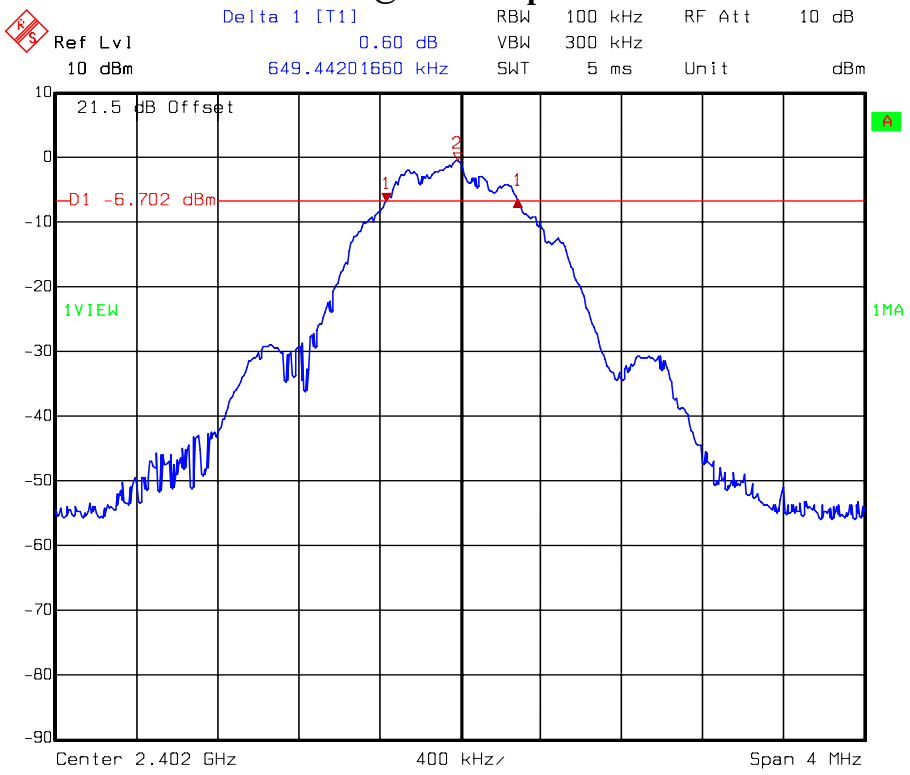
Note: The EUT was tested while in a continuous transmit mode and the data rates are 1 Mbps for GFSK. The EUT was tuned to a low, middle and high channel.

3.3 Measured data of - 6dB Bandwidth test results

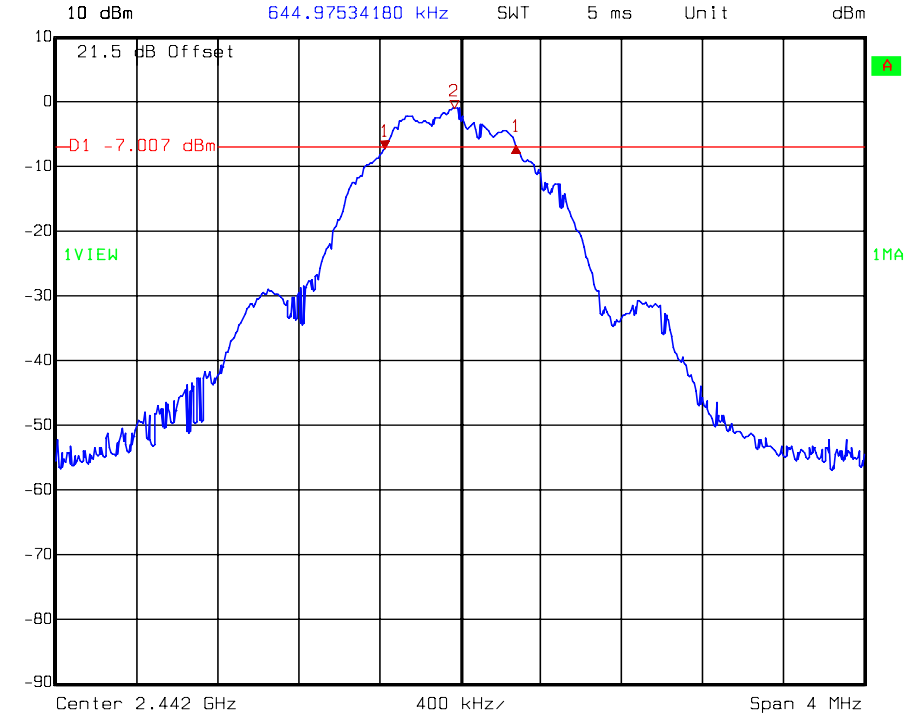
1TX Mode	Channel	Frequency (MHz)	- 6dB Bandwidth (MHz)	Min. Limit (MHz)	Pass/Fail
			Chain 0		
LE-1Mbps	0	2402	0.6494	0.5	Pass
	20	2442	0.6449	0.5	Pass
	39	2480	0.6457	0.5	Pass

Please see the plot below.

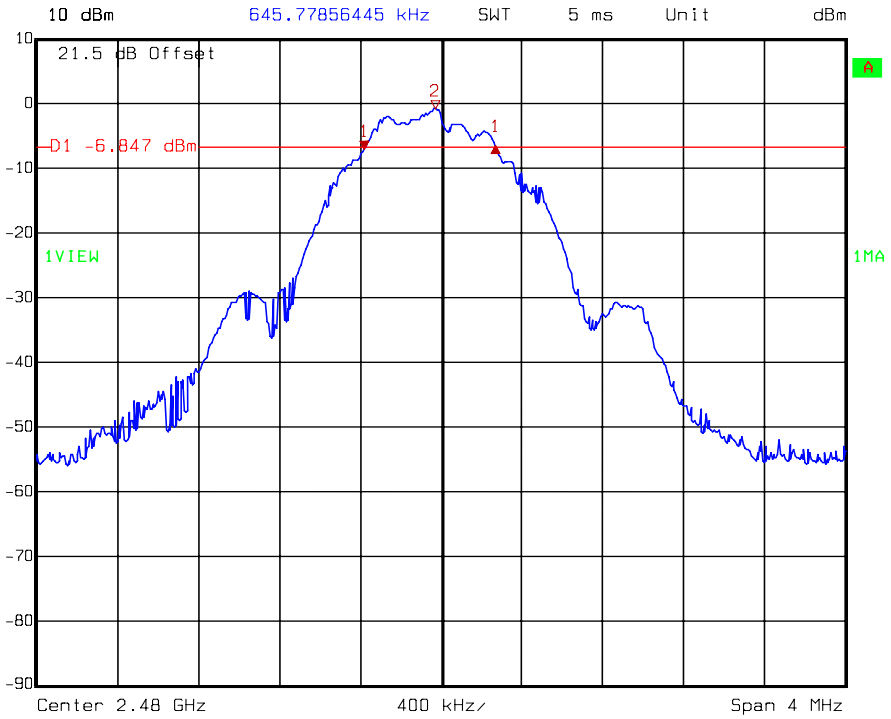
- 6dB Bandwidth @ LE-1Mbps mode Channel 0



- 6dB Bandwidth @ LE-1Mbps mode Channel 20



- 6dB Bandwidth @ LE-1Mbps mode Channel 39



4. Power Spectral Density

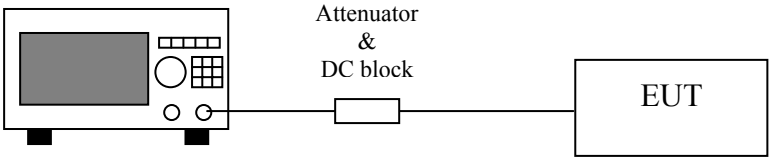
4.1 Operating environment

Temperature:	23	℃
Relative Humidity:	55	%
Atmospheric Pressure:	1008	hPa
Test Date:	Jul. 22, 2013	

4.2 Test setup & procedure

Method of Measurement:
Reference FCC document: KDB558074
The power spectrum density was measured from the antenna port of the EUT using a 50 ohm spectrum analyzer. Locate and zoom in on emission peak(s) within the pass band. Set RBW ≥ 3 kHz, VBW ≥ 3×RBW, sweep time = auto couple. The peak level measured must be no greater than + 8 dBm. Power spectrum density was read directly and cable loss (1 dB)/external attenuator (20 dB) correction was added to the reading to obtain power at the EUT antenna terminals.

Test Diagram:



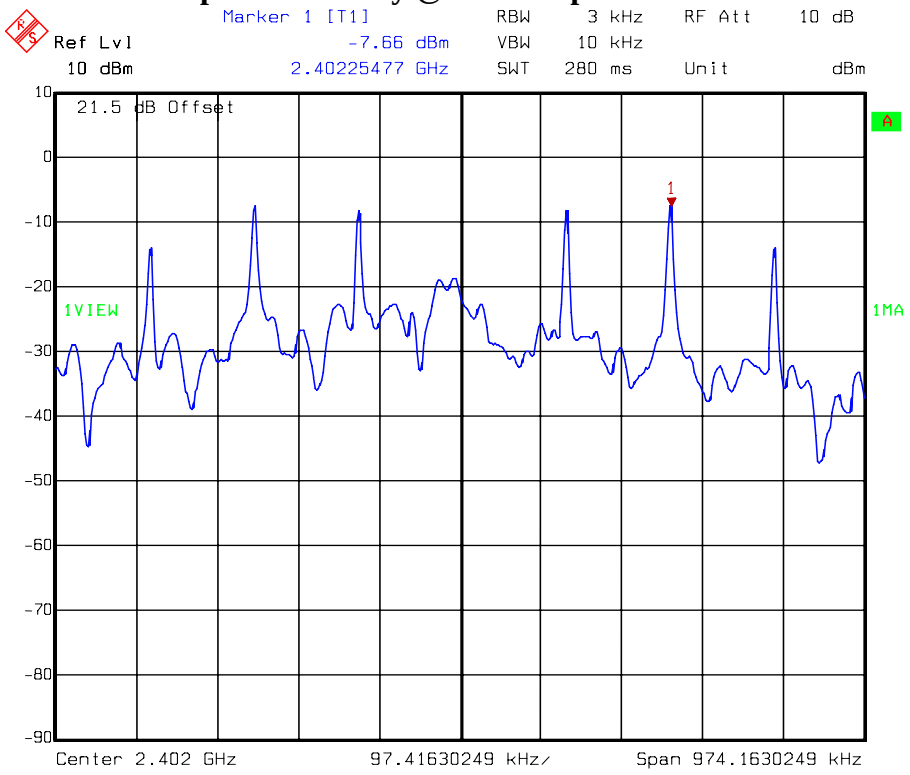
Spectrum Analyzer

4.3 Measured data of Power Spectral Density test results

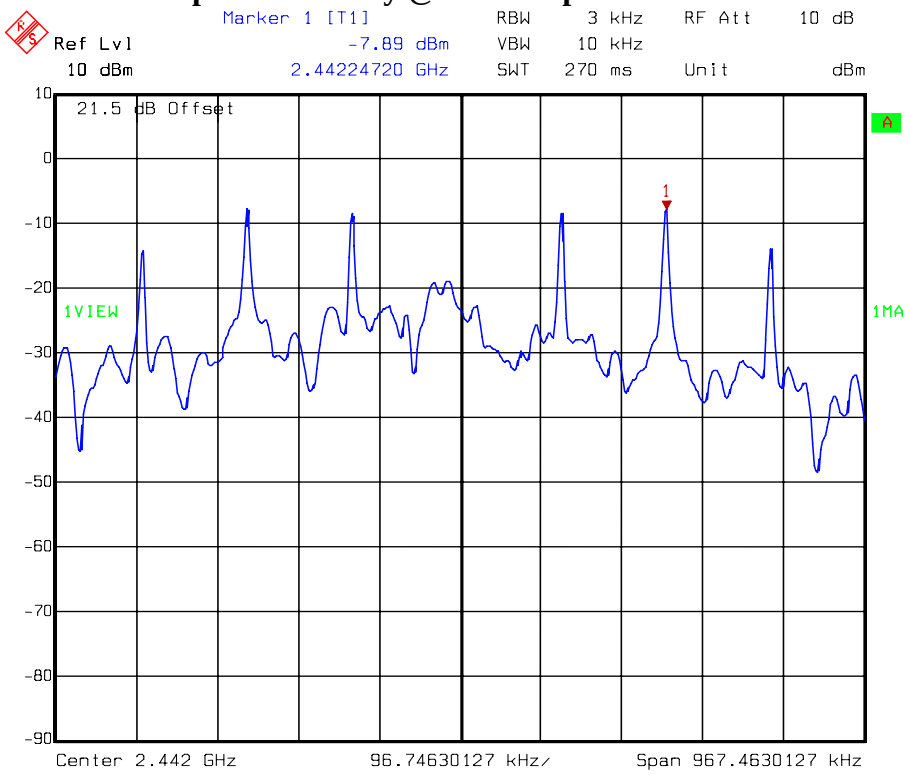
1TX Mode	Channel	Frequency (MHz)	PSD (dBm) Chain 0	PSD (mW)	Limit (dBm)	Margin (dB)
LE-1Mbps	0	2402	-7.66	0.17	8	-15.66
	20	2442	-7.89	0.16	8	-15.89
	39	2480	-7.89	0.16	8	-15.89

Please see the plot below.

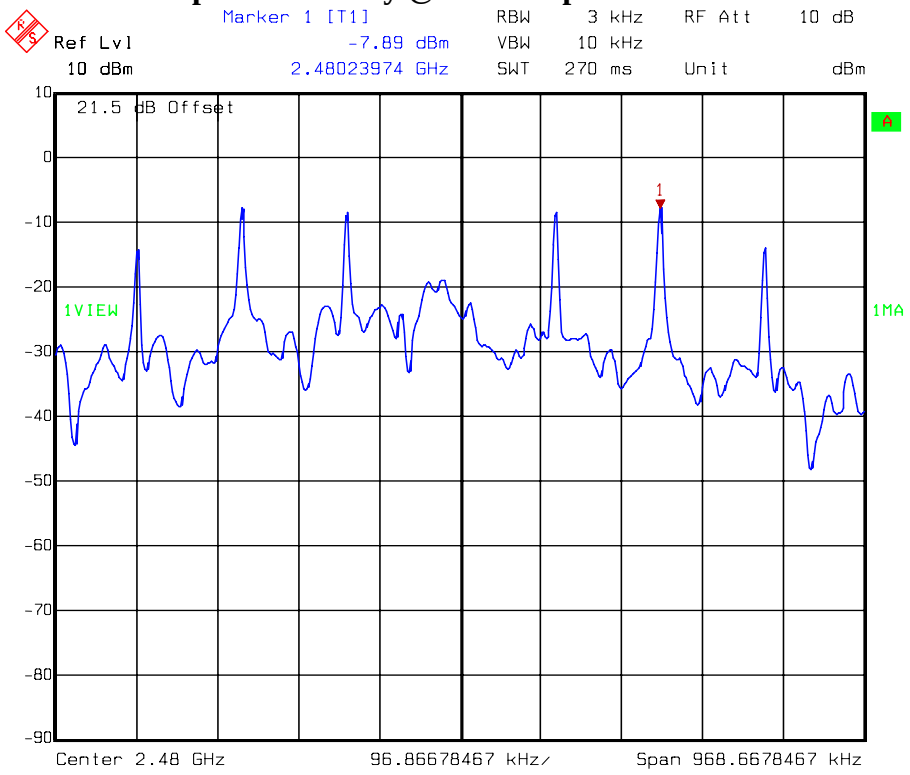
Power Spectral Density @ LE-1Mbps mode Channel 0



Power Spectral Density @ LE-1Mbps mode Channel 20



Power Spectral Density @ LE-1Mbps mode Channel 39



5. Maximum Output Power test

5.1 Operating environment

Temperature: 23 ℃
Relative Humidity: 55 %
Atmospheric Pressure: 1008 hPa
Test Date: Jul. 16, 2013

5.2 Test setup & procedure

The test procedure was according to FCC measurement guidelines KDB558074.
The power output per FCC §15.247(b) was measured on the EUT using a 50 ohm SMA cable connected to peak power meter via power sensor. Power was read directly and cable loss correction (1 dB) was added to the reading to obtain power at the EUT antenna terminals. The test was performed at 3 channels (lowest, middle and highest channel).

5.3 Measured data of Maximum Output Power test results

Mode	Channel	Frequency (MHz)	Output Power (dBm) (PK) Chain 0	Total Power (mW) (PK)	Limit (dBm)	Margin (dB)
LE-1Mbps	0	2402	1	1.26	30	-29.00
	20	2442	1.15	1.30	30	-28.85
	39	2480	1.06	1.28	30	-28.94

6. RF Antenna Conducted Spurious test

6.1 Operating environment

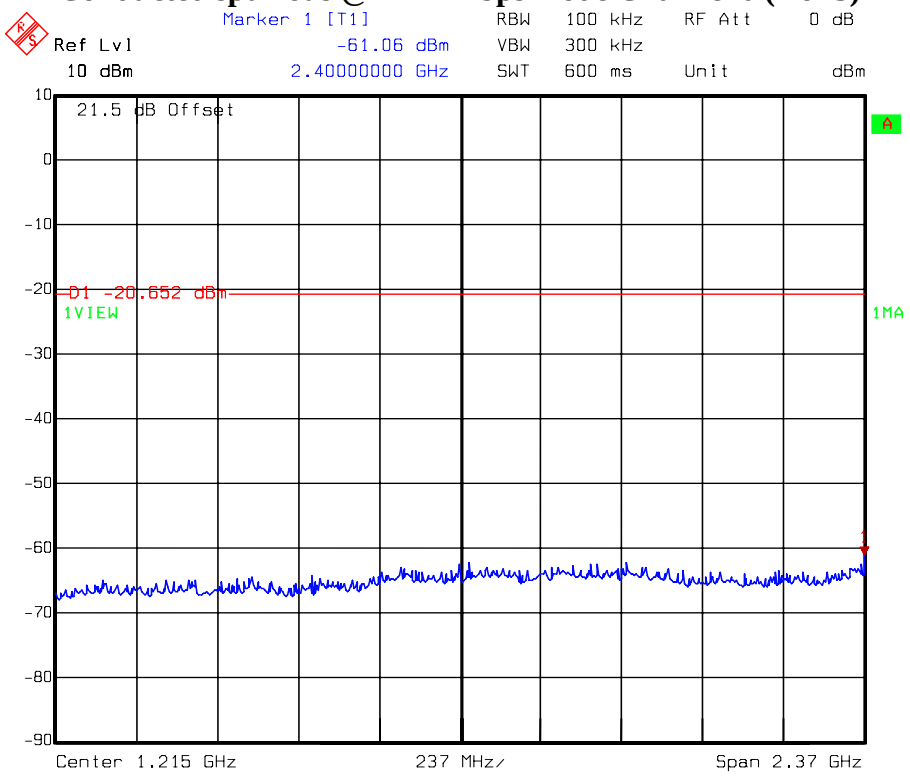
Temperature:	23	℃
Relative Humidity:	55	%
Atmospheric Pressure:	1008	hPa
Test Date:	Jul. 22, 2013	

6.2 Test setup & procedure

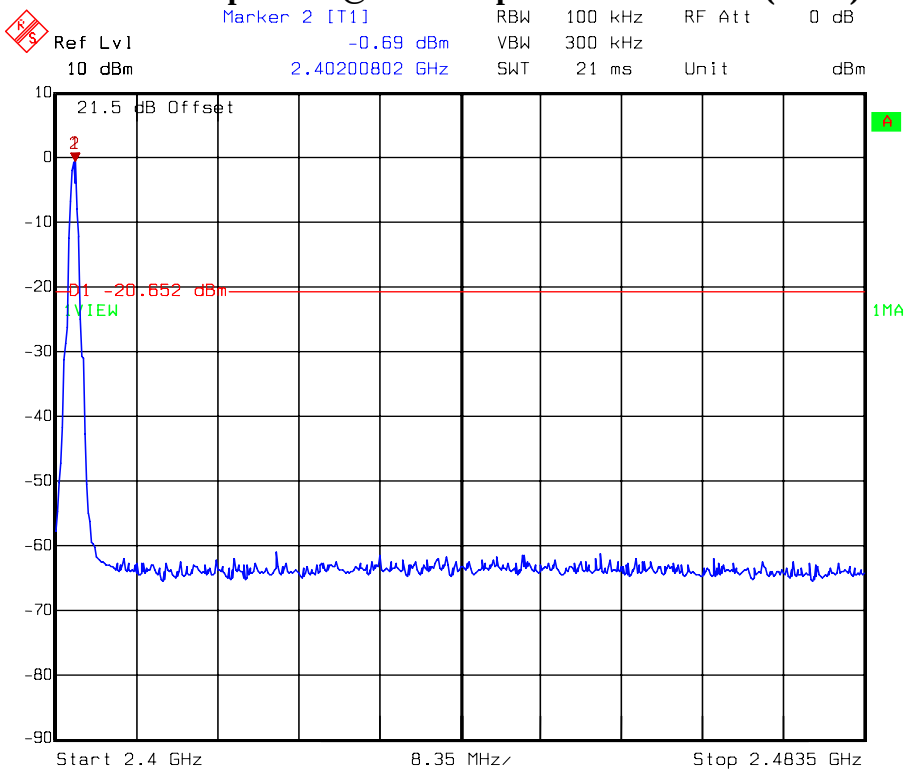
The test procedure was according to FCC measurement guidelines KDB558074.
The measurements were performed from lowest generated frequency to 10th fundamental frequency RF antenna conducted per FCC 15.247 (c) was measured from the EUT antenna port using a 50ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 300 kHz.
Harmonics and spurious noise must be at least 20dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW. The table below is the results from the highest emission for each channel within the authorized band. This table was used to determine the spurious limits for each channel.

6.3 Measured data of the highest RF Antenna Conducted Spurious test result

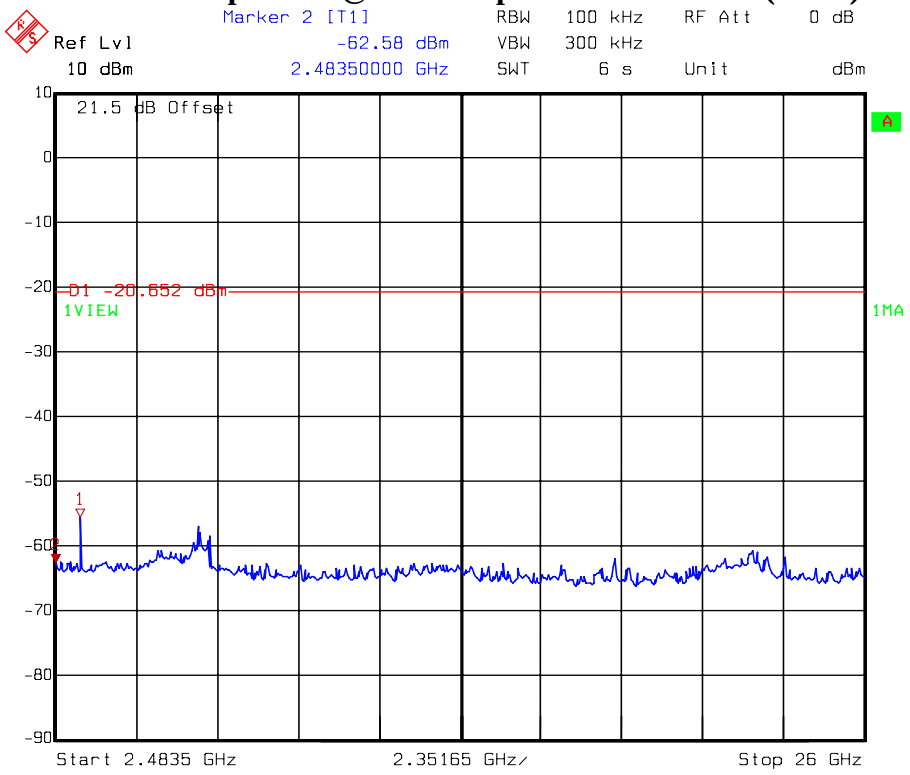
Conducted spurious @ LE-1Mbps mode Channel 0 (1 of 3)



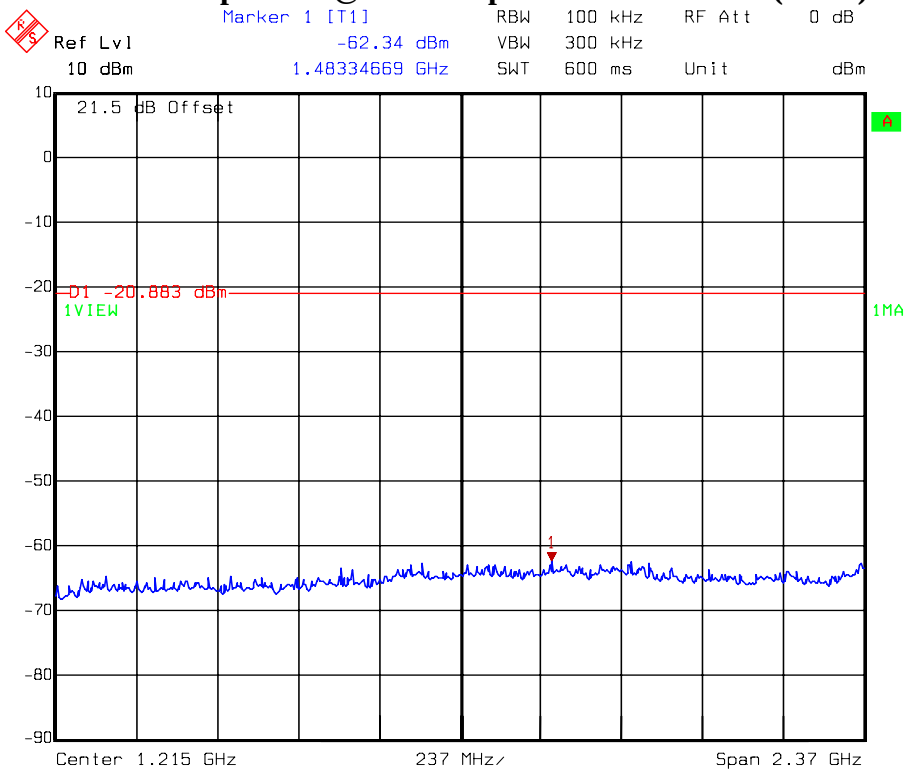
Conducted spurious @ LE-1Mbps mode Channel 0 (2 of 3)



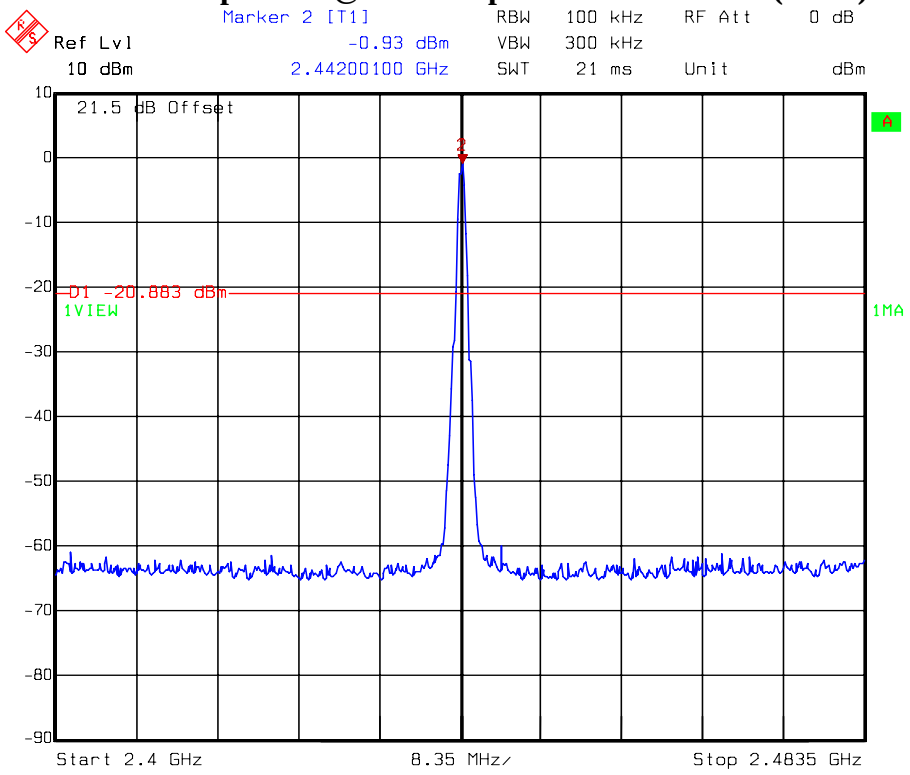
Conducted spurious @ LE-1Mbps mode Channel 0 (3 of 3)



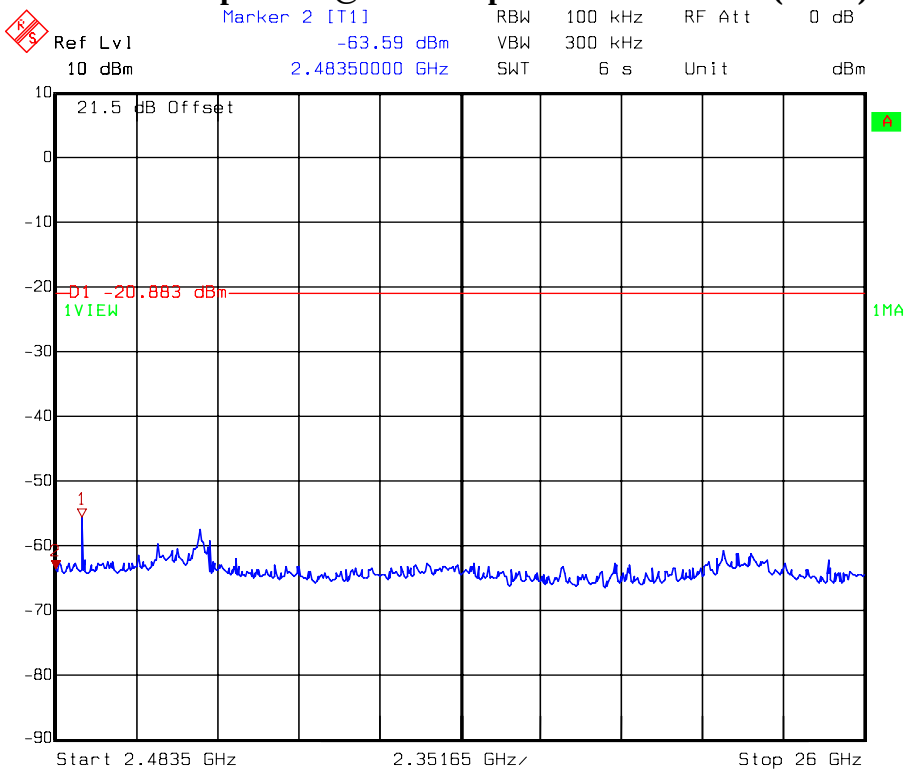
Conducted spurious @ LE-1Mbps mode Channel 20 (1 of 3)



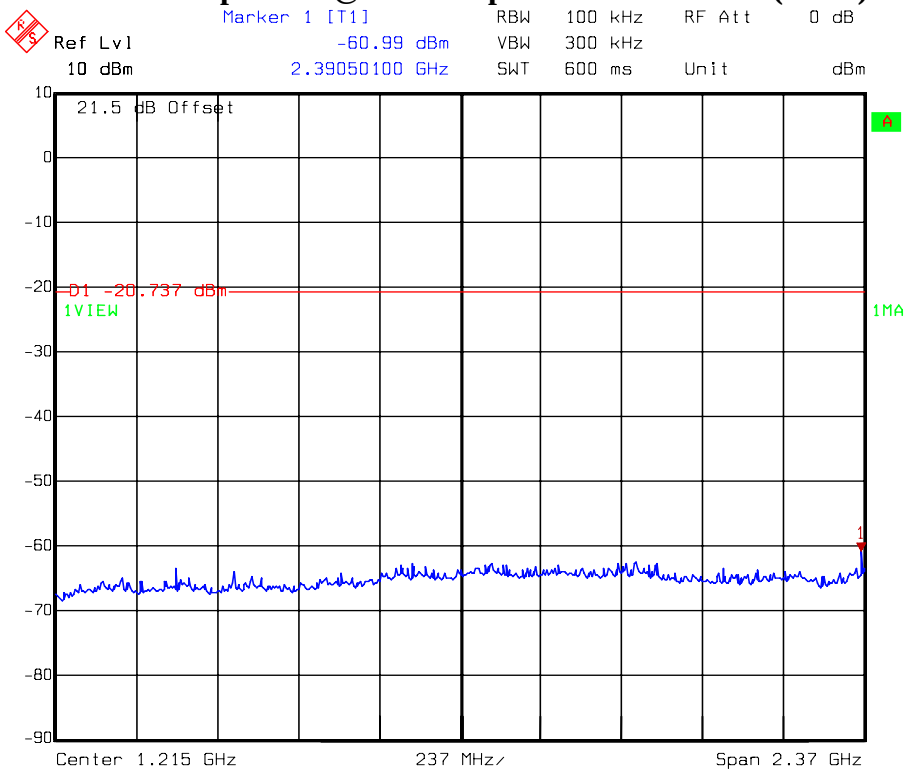
Conducted spurious @ LE-1Mbps mode Channel 20 (2 of 3)



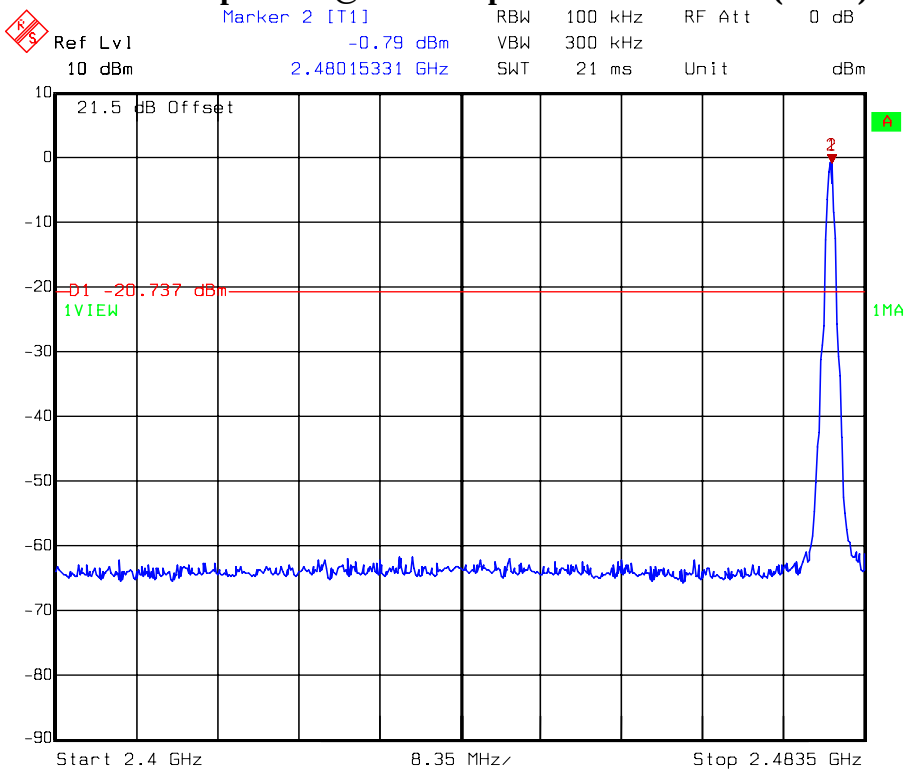
Conducted spurious @ LE-1Mbps mode Channel 20 (3 of 3)



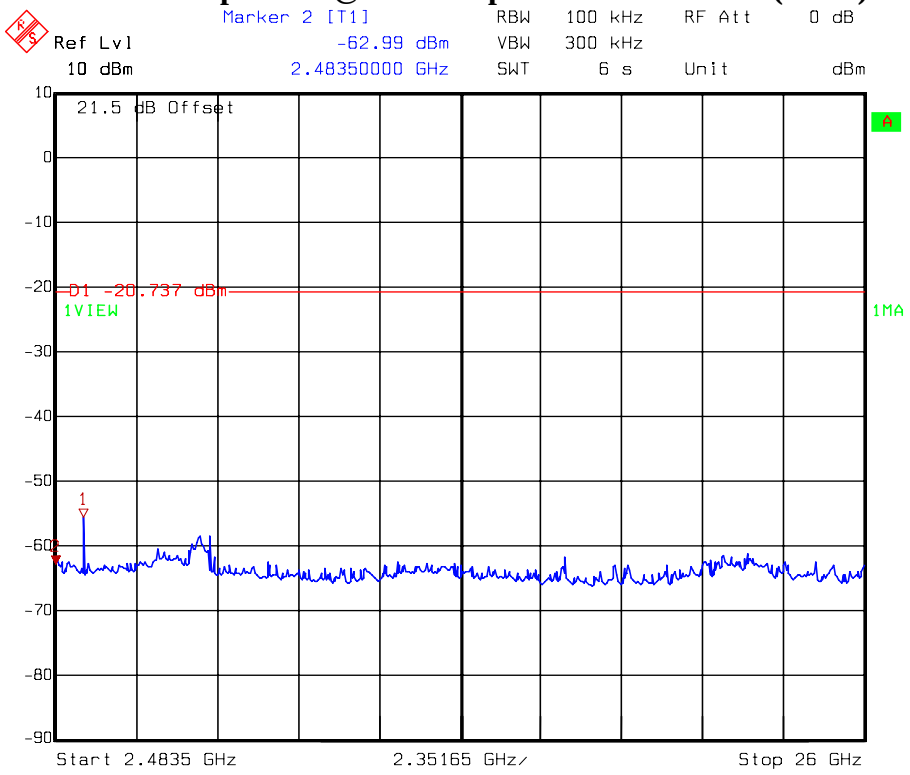
Conducted spurious @ LE-1Mbps mode Channel 39 (1 of 3)



Conducted spurious @ LE-1Mbps mode Channel 39 (2 of 3)



Conducted spurious @ LE-1Mbps mode Channel 39 (2 of 3)



7. Radiated Emission test

7.1 Operating environment

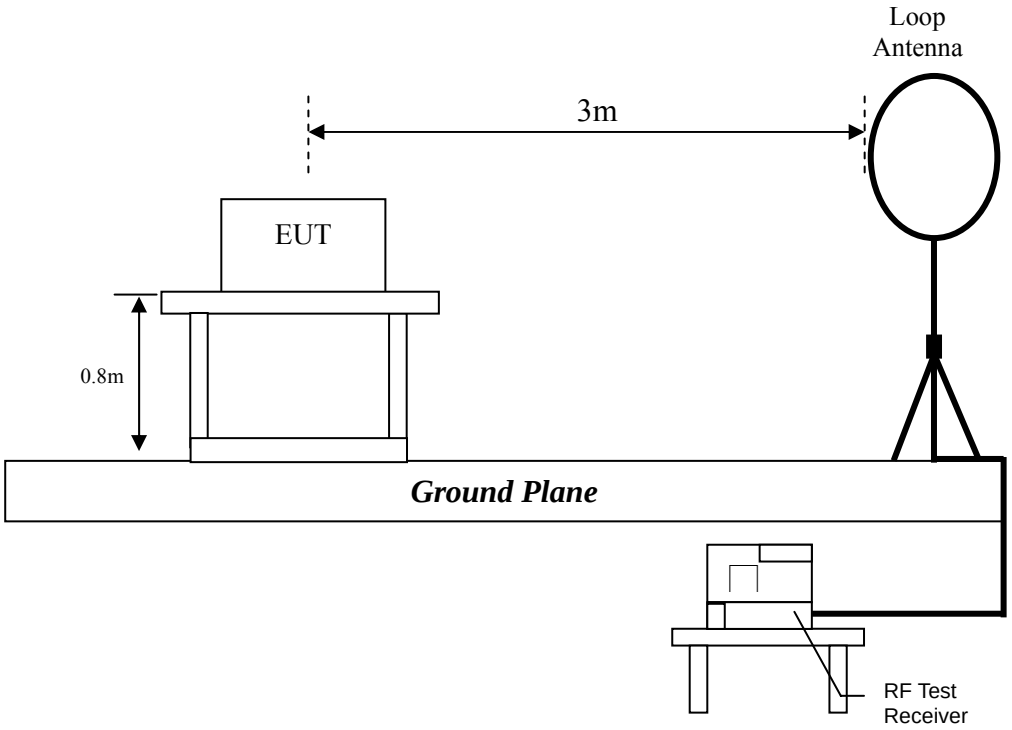
Temperature:	24	℃
Relative Humidity:	55	%
Atmospheric Pressure:	1008	hPa
Test Date:	Jul. 12, 2013~Jul. 16, 2013	

7.2 Test setup & procedure

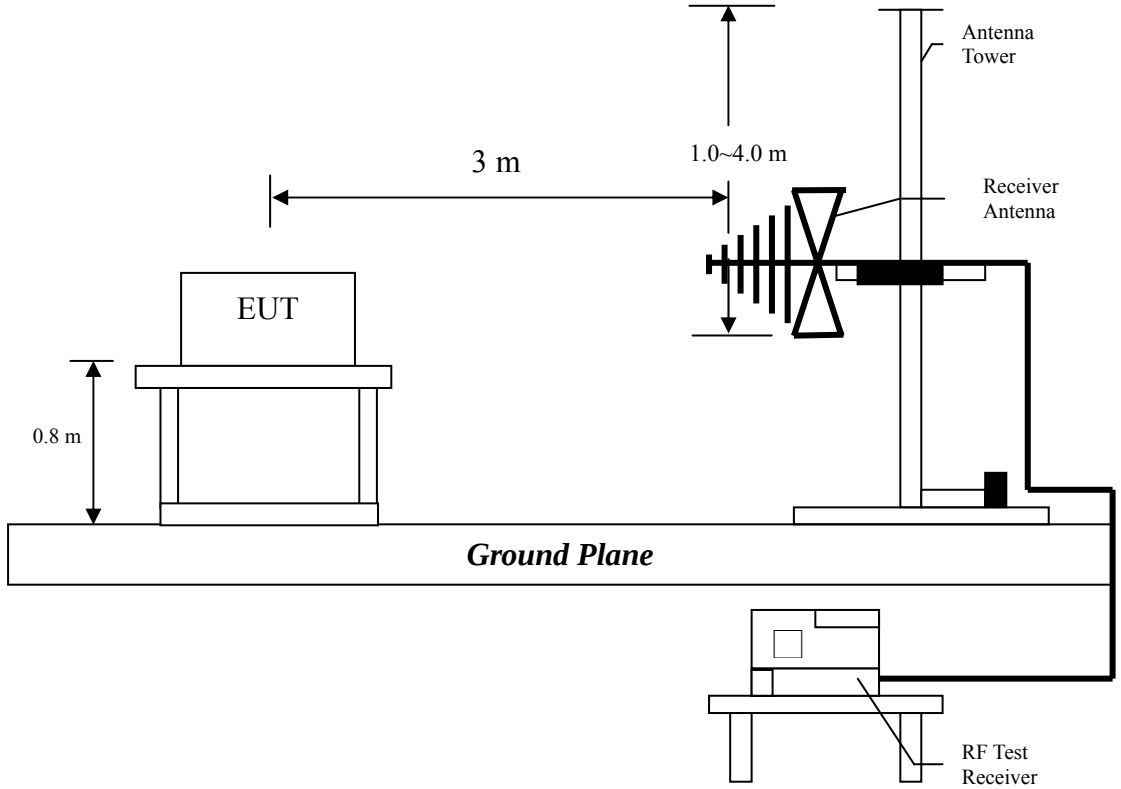
The test procedure was according to FCC measurement guidelines KDB558074 and ANSI C63.4/2003.

The Diagram below shows the test setup, which is utilized to make these measurements.

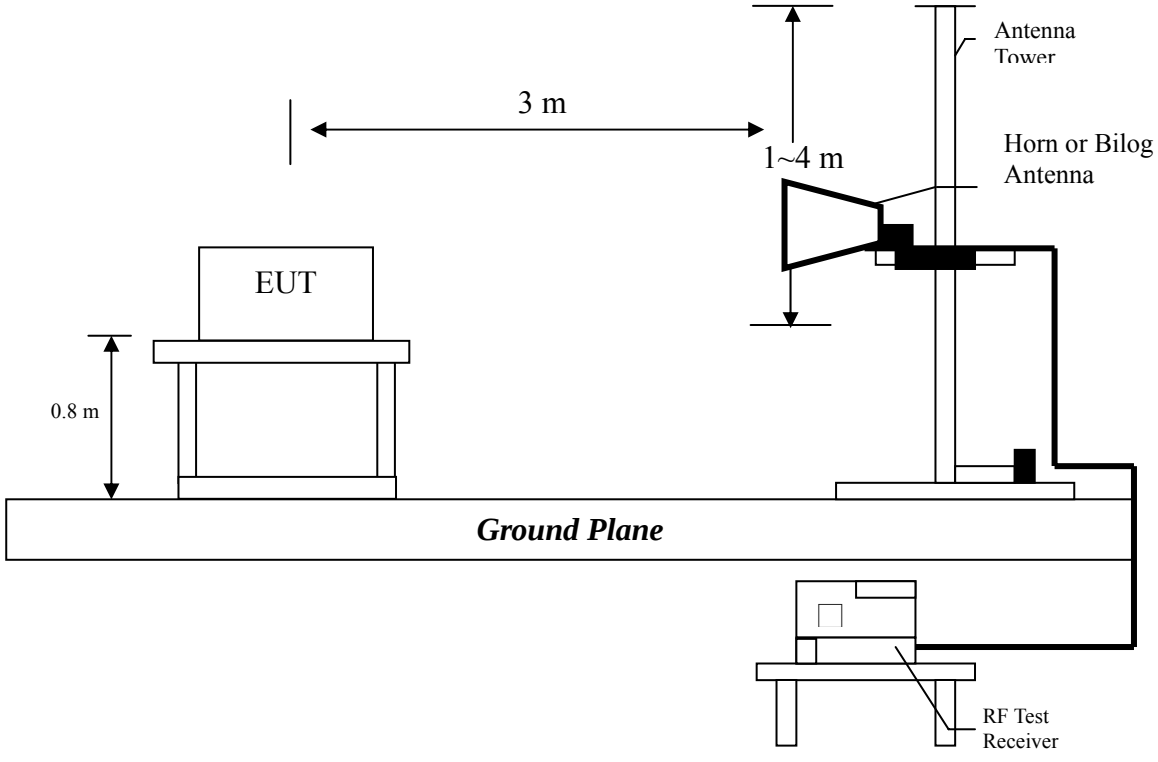
Radiated emission from 9kHz to 30MHz uses Loop Antenna:



Radiated emission from 30MHz to 1GHz uses Bilog Antenna:



Radiated emission above 1GHz uses Horn Antenna:



The signal is maximized through rotation and placement in the three orthogonal axes. According to §15.33(a), the spectrum shall be investigated from the lowest radio frequency signal generated in the device, to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower. Spectrum Analyzer Resolution Bandwidth is 100kHz or greater for frequencies 30MHz to 1GHz, 1MHz – for frequencies above 1GHz.

The EUT for testing is arranged on a fiberglass turntable. If some peripherals apply to the EUT, the peripherals will be connected to EUT and the whole system. During the test, all cables were arranged to produce worst-case emissions. The signal is maximized through rotation. The height of antenna and polarization is changing constantly for exploring for maximum signal level. The height of antenna can be up to 4 meters and down to 1 meter.

The measurement for radiated emission will be done at the distance of three meters unless the signal level is too low to measure at that distance. In the case of the reading under noise floor, a pre-amplifier is used and/or the test is conducted at a closer distance. And then all readings are extrapolated back to the equivalent 3 meter reading using inverse scaling with distance.

The EUT configuration refers to the "Spurious set-up photo.pdf".

7.3 Emission limits

The spurious Emission shall test through the 10th harmonic. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

Frequency (MHz)	Field Strength (microvolts/meter)
0.009~0.490	2400/F(kHz)
0.490~1.705	2400/F(kHz)
1.705~30	30
30-88	100
88-216	150
216-960	200
Above 960	500

Remark:
1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

7.4 Radiated spurious emission test data

7.4.1 Measurement results: frequencies equal to or less than 1 GHz

The test was performed on EUT under Channel 0, 20 and 39. The worst case occurred at Channel 20.

EUT : K110
Worst Case : LE-1Mbps mode at Channel 20

Antenna Polariz. (V/H)	Freq. (MHz)	Receiver Detector	Corr. Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
V	51.34	QP	12.90	22.25	35.14	40.00	-4.86
V	239.52	QP	12.18	26.19	38.37	46.00	-7.63
V	421.88	QP	16.47	21.02	37.49	46.00	-8.51
V	491.72	QP	18.43	24.77	43.19	46.00	-2.81
V	516.94	QP	18.56	23.74	42.29	46.00	-3.71
V	718.70	QP	22.29	21.77	44.05	46.00	-1.95
H	41.64	QP	14.20	12.07	26.27	40.00	-13.73
H	142.52	QP	13.24	11.19	24.42	43.50	-19.08
H	338.46	QP	14.40	11.53	25.92	46.00	-20.08
H	493.66	QP	18.64	23.91	42.55	46.00	-3.45
H	513.06	QP	18.77	22.16	40.93	46.00	-5.07
H	631.40	QP	21.55	10.92	32.46	46.00	-13.54

Remark:1. Corr. Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Corr. Factor
Note: The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.

7.4.2 Measurement results: frequency above 1GHz

EUT : K110
Test Condition : LE-1Mbps mode at Channel 0

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
4804	PK	V	35.1	38.54	37.3	40.74	54	-13.26
4804	PK	H	35.1	38.54	38.25	41.69	54	-12.31

Remark:
1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1GHz to 25GHz.The data value listed above which is higher than the noise floor, the others please refer to noise floor level.

EUT : K110
Test Condition : LE-1Mbps mode at Channel 20

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
4884	PK	V	35.1	38.54	37.82	41.26	54	-12.74
4884	PK	H	35.1	38.54	38.02	41.46	54	-12.54

Remark:
1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1GHz to 25GHz.The data value listed above which is higher than the noise floor, the others please refer to noise floor level.

EUT : K110
Test Condition : LE-1Mbps mode at Channel 39

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Preamp Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
4960	PK	H	35.1	38.54	37.95	41.39	54	-12.61
4960	PK	V	35.1	38.54	37.22	40.66	54	-13.34

Remark:
1. Correction Factor = Antenna Factor + Cable Loss
2. Corrected Level = Reading + Correction Factor – Preamp. Gain
3. The frequency measured ranges from 1GHz to 25GHz.The data value listed above which is higher than the noise floor, the others please refer to noise floor level.

8. Emission on the band edge §FCC 15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

8.1 Operating environment

Temperature: 24 ℃
Relative Humidity: 55 %
Atmospheric Pressure: 1008 hPa
Test Date: Jul. 16, 2013

8.2 Test setup & procedure

Please refer to the section 9.2 of this report.

8.3 Test Result

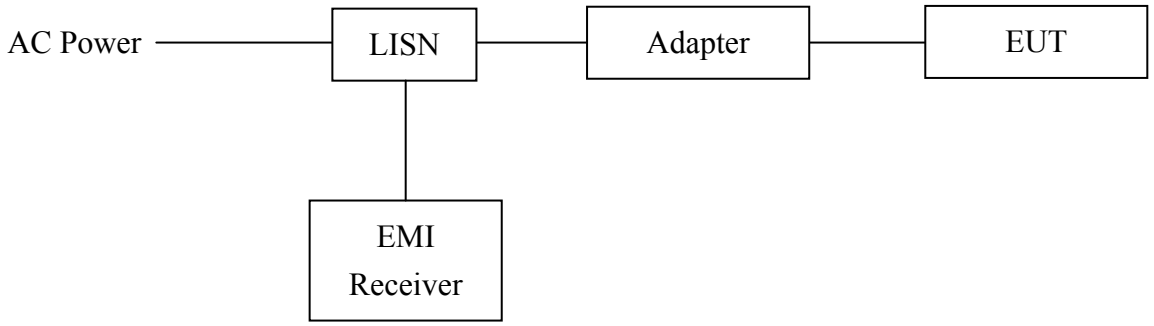
Mode	Restricted Band (MHz)	Freq. (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Preamp. Gain (dB)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV/m)	Limit @ 3 m (dBuV/m)	Margin (dB)
GFSK	2310~2390	2339.60	PK	H	38.008	31.611	64.508	58.11	74	-15.89
		2339.60	AV	H	38.008	31.611	51.568	45.17	54	-8.83
	-	2402.00	PK	H	38.025	31.907	98.427	92.31	-	92.31
		2402.00	AV	H	38.025	31.907	98.177	92.06	-	92.06
	-	2480.00	PK	H	38.045	32.278	98.387	92.62	-	92.62
		2480.00	AV	H	38.045	32.278	98.177	92.41	-	92.41
	2483.5~2500	2483.50	PK	H	38.046	32.294	64.211	58.46	74	-15.54
		2483.50	AV	H	38.046	32.294	56.781	51.03	54	-2.97

9. Power Line Conducted Emission test §FCC 15.207

9.1 Operating environment

Temperature:	23	℃
Relative Humidity:	52	%
Atmospheric Pressure	1008	hPa
Test Date:	Jun. 11, 2013	

9.2 Test setup & procedure



The test procedure was according to ANSI C63.4/2003.

The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a 50 ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50 ohm/50uH coupling impedance with 50 ohm termination.
Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4/2003 on conducted measurement. The bandwidth of the field strength meter (R & S Test Receiver ESCS 30) is set at 9 kHz.

The EUT configuration refers to the "Conducted set-up photo.pdf".

9.3 Emission limit

Freq. (MHz)	Conducted Limit (dBuV)	
	Q.P.	Ave.
0.15~0.50	66 – 56*	56 – 46*
0.50~5.00	56	46
5.00~30.0	60	50

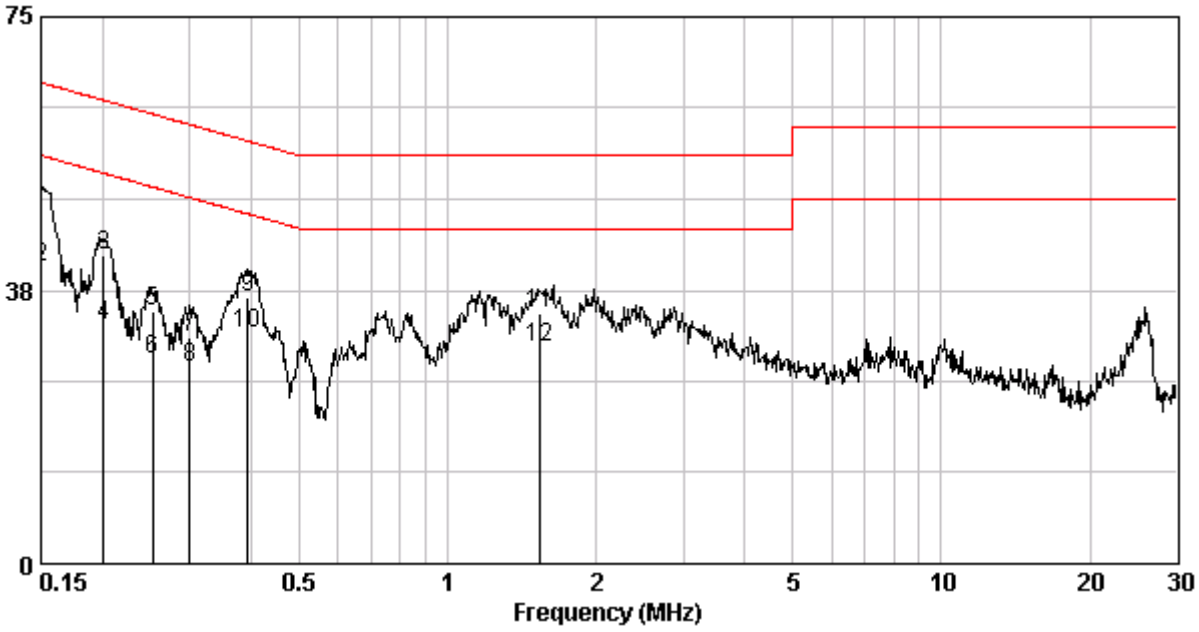
*Decreases with the logarithm of the frequency.

9.4 Power Line Conducted Emission test data

Phase: Line
Model No.: K110
Operating mode: TX mode

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level Av (dBuV)	Limit Av (dBuV)	Margin (dB) Qp	Margin (dB) Av
0.150	0.13	49.48	66.00	40.70	56.00	-16.52	-15.30
0.201	0.14	42.20	63.58	32.59	53.58	-21.38	-20.99
0.252	0.14	34.66	61.69	27.94	51.69	-27.02	-23.74
0.300	0.15	31.17	60.24	27.03	50.24	-29.06	-23.20
0.393	0.16	36.53	57.99	31.53	47.99	-21.46	-16.46
1.544	0.24	34.32	56.00	29.64	46.00	-21.68	-16.36

Remark:
1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)



Phase: Neutral
Model No.: K110
Operating mode: TX mode

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level Av (dBuV)	Limit Av (dBuV)	Margin (dB) Qp	Margin (dB) Av
0.151	0.10	50.41	65.96	43.47	55.96	-15.55	-12.49
0.202	0.11	43.73	63.54	37.09	53.54	-19.81	-16.45
0.253	0.11	39.81	61.64	33.36	51.64	-21.83	-18.28
0.299	0.11	38.11	60.28	33.62	50.28	-22.16	-16.65
0.354	0.12	35.29	58.87	31.33	48.87	-23.58	-17.54
0.417	0.12	37.88	57.51	32.71	47.51	-19.62	-14.79

Remark:
1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)