TEST REPORT

of

FCC Part 15 Subpart C

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

Product Name:	**Exquisite Bluetooth Keyboard**
Brand Name:	**GIGABYTE**
Model Name:	**GK-AIRE K15**
Model Different:	**N/A**
FCC ID:	**JCK28703AIREK15**
FCC Rule Part:	**§15.247, Cat: DSS**
Applicant:	**GIGA-BYTE Technology Co., Ltd.**
Address:	**No.6, Bao Chiang Road, Hsin-Tien Dist., New Taipei City 231, Taiwan**

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, San Ho suen, Hsin Ho Rd.
Lung-Tan Hsiang, Tao Yuan County 325, Taiwan
*Tel : 886-3-407-1718; Fax: 886-3-407-1738

Report No.: **ISL-13LR113FC**

Issue Date : **2013/07/02**

VERIFICATION OF COMPLIANCE

Applicant:	GIGA-BYTE Technology Co., Ltd.
Product Description:	Exquisite Bluetooth Keyboard
Brand Name:	GIGABYTE
Model Name:	GK-AIRE K15
Model Different:	N/A
FCC ID:	JCK28703AIREK15
FCC Rule Part:	§15.247
Date of test:	2013/06/26 ~ 2013/07/01
Date of EUT Received:	2013/06/26

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 Chen	***Date:***	2013/07/02
	Dion Chang / Engineer		
Prepared By:	Gigi yeh	***Date:***	2013/07/02
	Gigi Yeh / Specialist		
Approved By:	Vincent Su	***Date:***	2013/07/02
	Vincent Su / Technical Manager		

Version

Version No.	Date	Description
00	2013/07/02	Initial creation of document

Table of Contents

1. GENERAL INFORMATION 6
1.1. Product Description 6
1.2. Related Submittal(s) / Grant (s) 7
1.3. Test Methodology 7
1.4. Test Facility 7
1.5. Special Accessories 7
1.6. Equipment Modifications 7
2. SYSTEM TEST CONFIGURATION 8
2.1. EUT Configuration 8
2.2. EUT Exercise 8
2.3. Test Procedure 8
2.4. Configuration of Tested System 9
3. SUMMARY OF TEST RESULTS 10
4. DESCRIPTION OF TEST MODES 10
5. AC POWER LINE CONDUCTED EMISSION TEST 11
5.1. Standard Applicable: 11
5.2. Measurement Equipment Used: 11
5.3. EUT Setup: 11
5.4. Measurement Procedure: 11
5.5. Measurement Result: 11
6. PEAK OUTPUT POWER MEASUREMENT 12
6.1. Standard Applicable: 12
6.2. Measurement Equipment Used: 12
6.3. .Test Set-up: 12
6.4. Measurement Procedure: 12
6.5. Measurement Result: 13
7. 100KHz BANDWIDTH OF BAND EDGES MEASUREMENT 14
7.1. Standard Applicable: 14
7.2. Measurement Equipment Used: 14
7.3. Test SET-UP: 15
7.4. Measurement Procedure: 16
7.5. Field Strength Calculation 16
7.6. Measurement Result: 16

8. SPURIOUS EMISSION TEST 19
8.1. Standard Applicable: 19
8.2. Measurement Equipment Used: 19
8.3. Test SET-UP: 19
8.4. Measurement Procedure: 19
8.5. Field Strength Calculation 20
8.6. Measurement Result: 20
9. FREQUENCY SEPARATION 30
9.1. Standard Applicable: 30
9.2. Measurement Equipment Used: 30
9.3. Test Set-up: 30
9.4. Measurement Procedure: 30
9.5. Measurement Result: 30
10. NUMBER OF HOPPING FREQUENCY 32
10.1. Standard Applicable: 32
10.2. Measurement Equipment Used: 32
10.3. Test Set-up: 32
10.4. Measurement Procedure: 32
10.5. Measurement Result: 32
11. TIME OF OCCUPANCY (DWELL TIME) 34
11.1. Standard Applicable: 34
11.2. Measurement Equipment Used: 34
11.3. Test Set-up: 34
11.4. Measurement Procedure: 34
11.5. Measurement Result: 34
12. 20dB Bandwidth 40
12.1. Standard Applicable: 40
12.2. Measurement Equipment Used: 40
12.3. Test Set-up: 40
12.4. Measurement Procedure: 40
12.5. Measurement Result: 41
13. ANTENNA REQUIREMENT 44
13.1. Standard Applicable: 44
13.2. Antenna Connected Construction: 44
14. RF EXPOSURE 45
14.1. Standard Applicable 45
14.2. Measurement Result: 45

1. GENERAL INFORMATION

1.1. Product Description

General:

Product Name:	Exquisite Bluetooth Keyboard
Brand Name:	GIGABYTE
Model Name:	GK-AIRE K15
Model Different:	N/A
Power Supply:	3V DC from AAA battery *2

Bluetooth:

Frequency Range:	2402 – 2480MHz
Bluetooth Version:	Bluetooth V2.0 (GFSK)
Channel number:	79 channels
Modulation type:	Frequency Hopping Spread Spectrum
Transmit Power:	-0.46 dBm
Dwell Time:	<= 0.4s
Operating Mode:	Point-to-Point
Antenna Designation:	Printed Antenna: 1.87 dBi.

The EUT is compliance with Bluetooth 2.0 Standard.

1.2. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: JCK28703AIREK15** filing to comply with Section 15.247 of the FCC Part 15C, Subpart C Rules.

1.3. Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 (2003). Radiated testing was performed at an antenna to EUT distance 3 meters.

Tested in accordance with FCC Public Notice DA 00-705

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, San Ho Tsuen, Hsin Ho Rd., Lung-Tan Hsiang, Tao Yuan County 325, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2003. 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/RX 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

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 C63.4-2003. 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 C63.4-2003 and DA 00-705.

2.4. Configuration of Tested System

Fig. 2-1 Configuration of Tested System (Fixed channel)

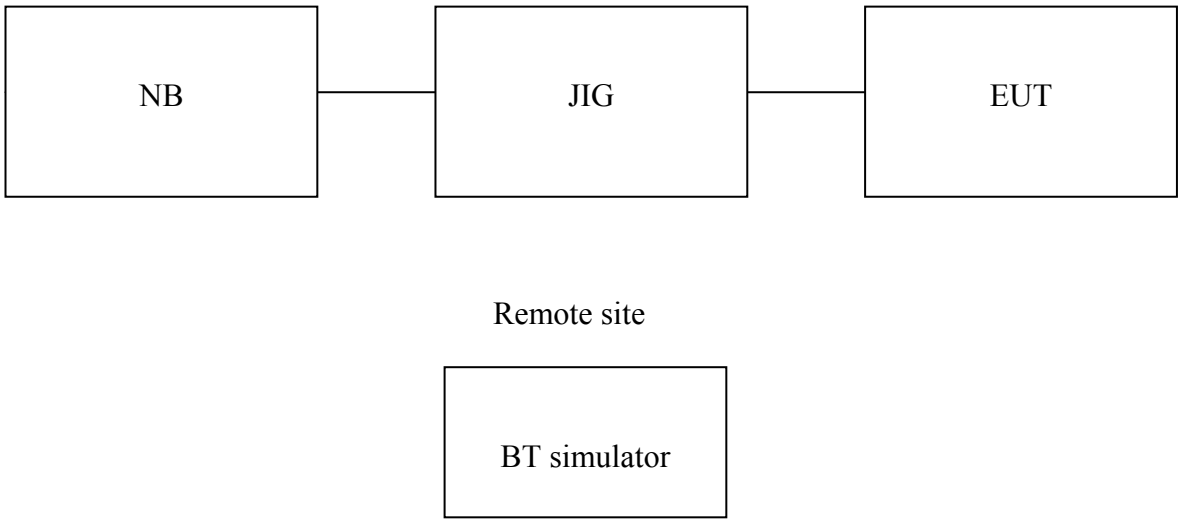


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mrf/Brand	Model name	Series No	Data Cable	Power Cable
1	JIG	NA	NA	NA	N/A	N/A
2	NB	Lenovo	X220i	N/A	RS232 /shield	Non-shield
3	BT simulator	Agilent	N4010A	N/A	N/A	Non-shield

3. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	AC Power line Conducted Emission	N/A
§15.247(b)(1)	Peak Output Power	Compliant
§15.247(d)	100 KHz Bandwidth Of Frequency Band Edges	Compliant
§15.247(c)	Spurious Emission	Compliant
§15.247(a)(1)	Frequency Separation	Compliant
§15.247(a)(1)(iii)	Number of hopping frequency	Compliant
§15.247(a)(1)(ii)	Time of Occupancy	Compliant
§15.247	Peak Power Density	Compliant
§15.247(a)(1)	20dB Bandwidth	Compliant
§15.203, §15.247(c)	Antenna Requirement	Compliant
§2.1091	RF EXPOSURE	Compliant

4. DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition.

Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Channel low (2402MHz)、mid (2441MHz) and high (2480MHz) with each data rate are chosen for full testing.

5. AC POWER LINE CONDUCTED EMISSION TEST

5.1. Standard Applicable:

According to §15.207, frequency range within 150KHz to 30MHz shall not exceed the Limit table as below.

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.		

5.2. Measurement Equipment Used:

AC Power Line Test Site					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
Conduction 03 -1 Cable	WOKEN	CFD 300-NL	Conduction 0-1	06/28/2013	06/28/2014
EMI Receiver 12	ROHDE & SCHWARZ	ESCI	100804	07/16/2012	07/15/2013
LISN 07	FCC Inc.	FCC-LISN-50-100-4-02	07040	07/23/2012	07/22/2013
LISN 08	FCC	FCC-LISN50-25-2-01	07039	07/23/2012	07/22/2013

5.3. EUT Setup:

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4-2003.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

5.4. 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.

5.5. Measurement Result: N/A

6. PEAK OUTPUT POWER MEASUREMENT

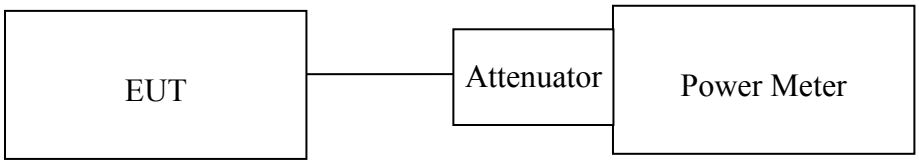
6.1. Standard Applicable:

According to §15.247(b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1Watt. For all other frequency hopping systems in the 2400 – 2483.5MHz band: 0.125 Watts.

6.2. Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
Power Meter 05	Anritsu	ML2495A	1116010	04/19/2013	04/18/2014
Power Sensor 05	Anritsu	MA2411B	34NKF50	04/19/2013	04/18/2014
Temperature Chamber	KSON	THS-B4H100	2287	03/15/2013	03/14/2014
DC Power supply	ABM	51850	N/A	06/17/2013	06/16/2014
AC Power supply	EXTECH	CFC105W	NA	12/19/2012	12/18/2013
Splitter	MCLI	PS4-199	12465	07/18/2012	07/17/2013

6.3. .Test Set-up:



6.4. Measurement 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 power meter or spectrum. (Channel power function, RBW, VBW = 1MHz)
3. Record the max. reading.
4. Repeat above procedures until all frequency measured were complete.

6.5. Measurement Result:

BDR Mode

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	-0.51	0.00	-0.51	0.00089	1
2441.00	-0.46	0.00	-0.46	0.00090	1
2480.00	-0.63	0.00	-0.63	0.00086	1

offset: 1dB

Note: Refer to next page for plots.

7. 100KHz BANDWIDTH OF BAND EDGES MEASUREMENT

7.1. Standard Applicable:

According to §15.247(d), in any 100 KHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100KHz bandwidth within the band that contains the highest level of the desired power, 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 in15.209(a).

7.2. Measurement Equipment Used:

7.2.1. Conducted Emission at antenna port:

Refer to section 6.2 for details.

7.2.2. Radiated emission:

Chamber (1166)					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
Spectrum Analyzer 21(26.5GHz)	Agilent	N9010A	MY52100117	04/10/2013	04/09/2014
Dipole antenna	SCHWARZBECK	VHAP,30-300	919	11/16/2011	11/15/2013
Dipole antenna	SCHWARZBECK	UHAP,300-1000	1195	10/25/2011	10/24/2013
Loop Antenna	A.H.SYSTEM	SAS-564	294	03/07/2013	03/06/2015
Bilog Antenna	Schaffner	9168	9168-495	06/19/2013	06/18/2014
Horn antenna1-18G	EM	EM-AH-10180	2011071401	08/22/2012	08/21/2013
Horn antenna18-26G	Com-power	AH-826	081001	05/15/2013	05/14/2015
Horn antenna26-40G	Com-power	AH-640	100A	01/09/2013	01/08/2015
Preamplifier9-1.3G	HP	8447F	NA	08/21/2012	08/20/2013
Preamplifier1-26G	EM	EM01M26G	NA	02/26/2013	02/25/2014
Preamplifier26-40G	MITEQ	JS-26004000-27-5A	818471	05/08/2013	05/07/2015
Cable	HUBER SUHNER	SUCOF-LEX104A	1166 cable	10/03/2012	10/02/2013
Cable	HUBER SUHNER	SUCOF-LEX104A	1166 cable 001	02/26/2013	02/25/2014
Cable	HUBER SUHNER	SUCOF-LEX104A	1166 cable 002	02/26/2013	02/25/2014
SUCOFLEX 1GHz~40GHz cable	HUBER SUHNER	Sucoflex 102	27963/2&37421/2	09/21/2011	09/20/2013
Signal Generator	R&S	SMU200A	102330	02/19/2013	02/18/2014
Signal Generator	Anritsu	MG3692A	20311	09/18/2012	09/17/2013
2.4G Filter	Micro-Tronics	Brm50702	76	12/27/2012	12/26/2013

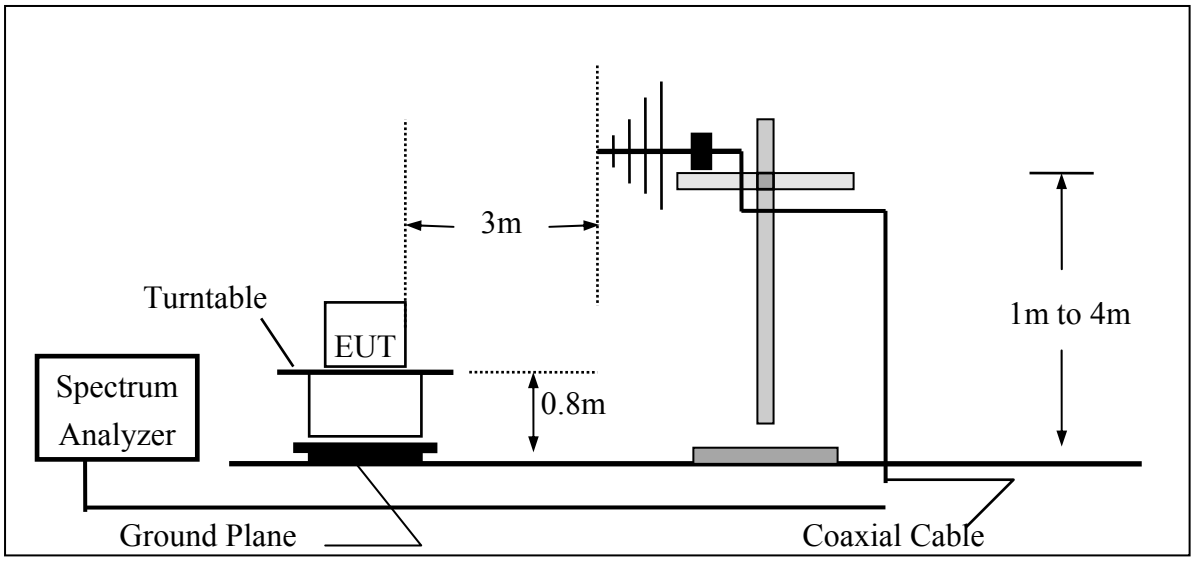
7.3. Test SET-UP:

7.3.1. Conducted Emission at antenna port:

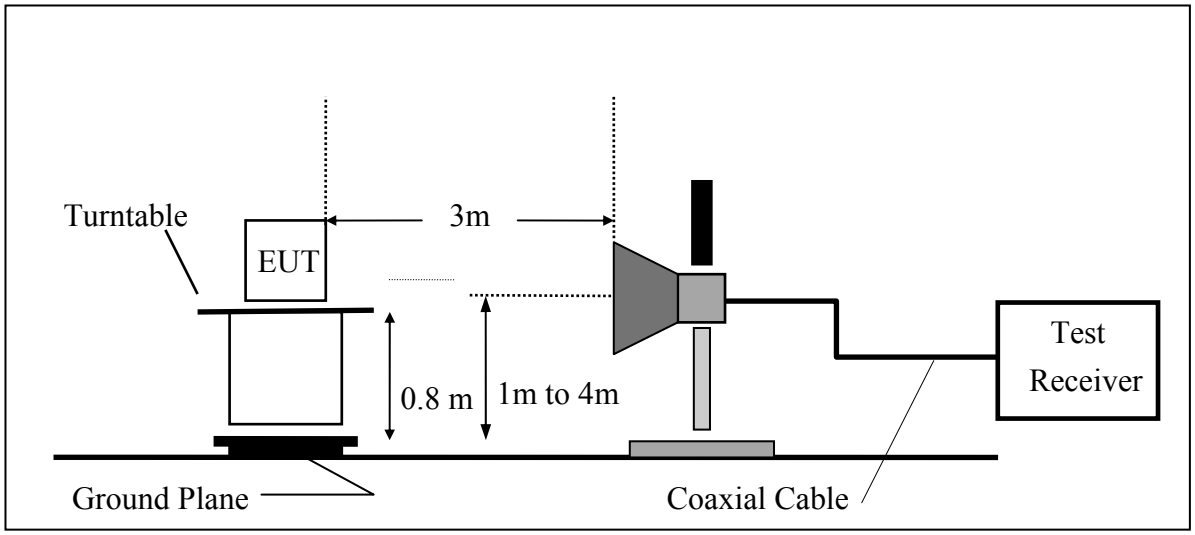
Refer to section 6.3 for details.

7.3.2. Radiated emission:

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



(B) Radiated Emission Test Set-UP Frequency Over 1 GHz



7.4. Measurement 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=25MHz, Sweep = auto
5. Mark Peak, 2.390GHz and 2.4835GHz and record the max. level.
6. Repeat above procedures until all frequency measured were complete.

7.5. 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

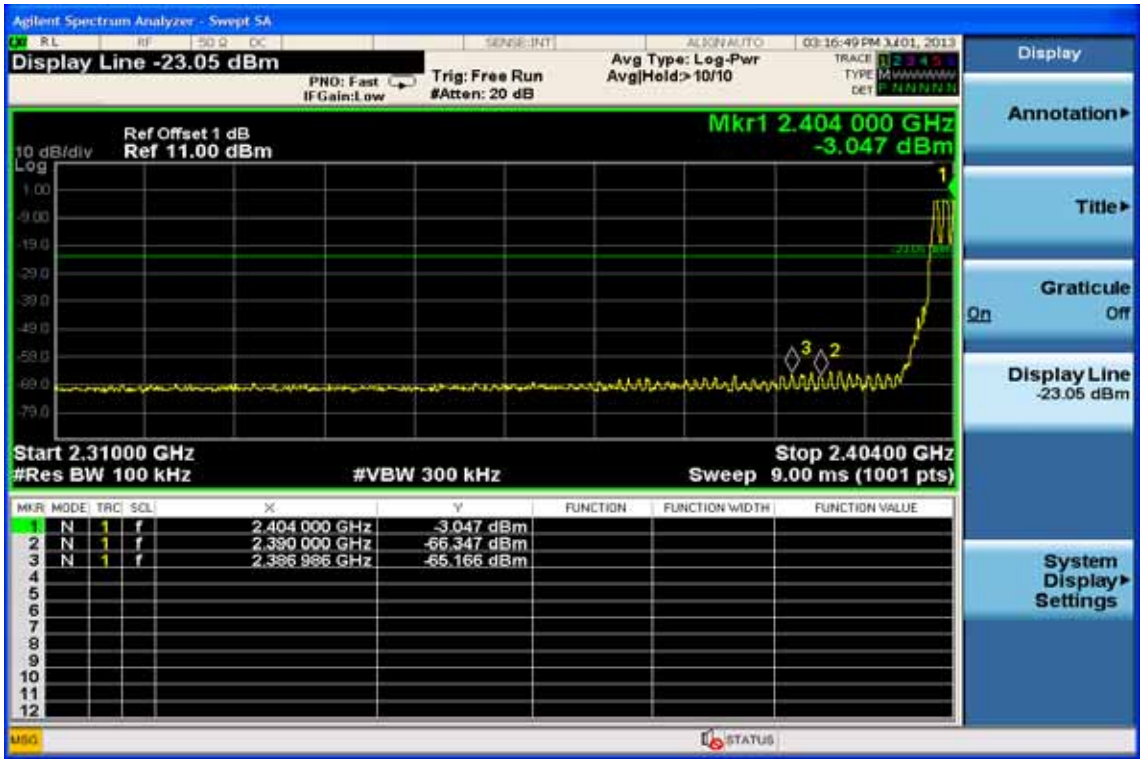
Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

7.6. Measurement Result:

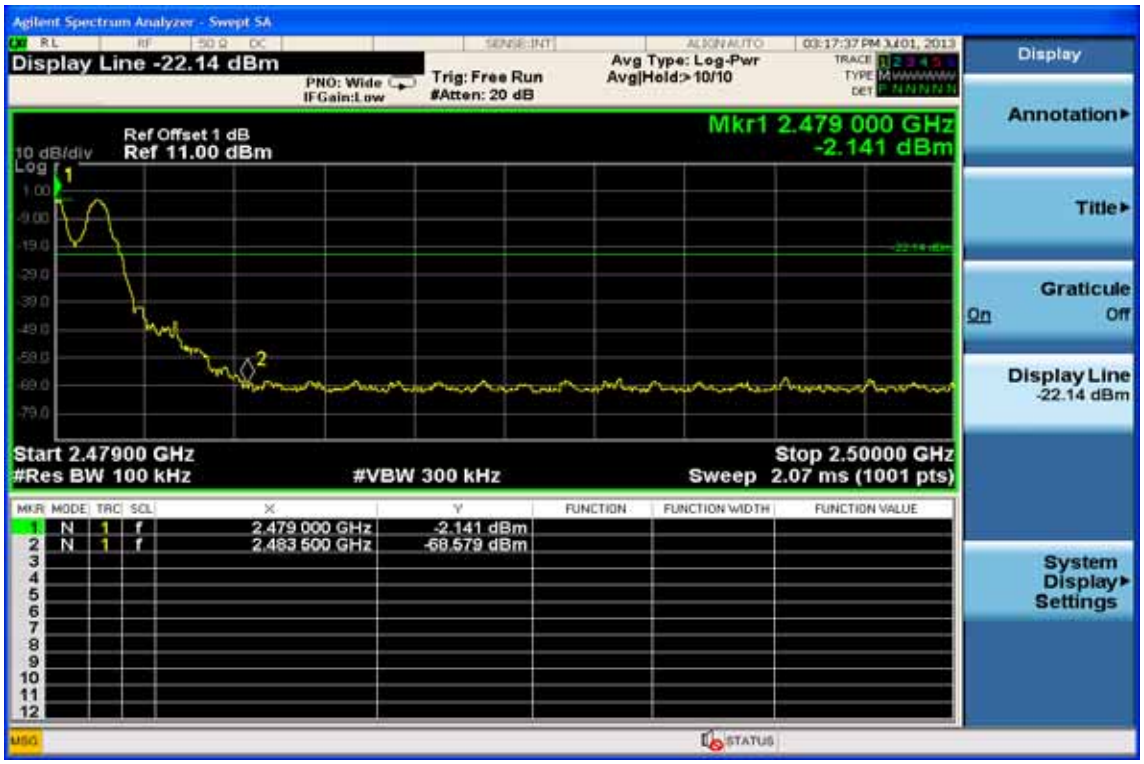
Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

BDR Mode

Band Edges Test Data CH-Low



Band Edges Test Data CH-High



Radiated Emission: (BDR mode)

Operation Mode	TX CH Low	Test Date	2013/06/26
Fundamental Frequency	2402 MHz	Test By	Dino
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	2313.76	51.93	-7.18	44.75	74.00	-29.25	Peak	VERTICAL
2	2390.00	46.61	-7.01	39.60	74.00	-34.40	Peak	VERTICAL
1	2355.97	55.85	-7.08	48.77	74.00	-25.23	Peak	HORIZONTAL
2	2390.00	53.28	-7.01	46.27	74.00	-27.73	Peak	HORIZONTAL

Operation Mode	TX CH High	Test Date	2013/06/26
Fundamental Frequency	2480 MHz	Test By	Dino
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	2483.50	45.66	-6.81	38.85	74.00	-35.15	Peak	VERTICAL
2	2485.44	49.58	-6.79	42.79	74.00	-31.21	Peak	VERTICAL
1	2483.50	51.43	-6.81	44.62	74.00	-29.38	Peak	HORIZONTAL
2	2493.97	54.62	-6.79	47.83	74.00	-26.17	Peak	HORIZONTAL

Remark:

1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency

2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

3 “F” denotes fundamental frequency; “H” denotes harmonics frequency. “S” denotes spurious frequency.

4 Measurement of data 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 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

6 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

8. SPURIOUS EMISSION TEST

8.1. Standard Applicable:

According to §15.247(c), all other emissions outside these bands shall not exceed the general radiated emission limits specified in §15.209(a). And according to §15.33(a)(1), for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

8.2. Measurement Equipment Used:

8.2.1. Conducted Emission at antenna port:

Refer to section 6.2 for details.

8.2.2. Radiated emission:

Refer to section 7.2 for details.

8.3. Test SET-UP:

8.3.1. Conducted Emission at antenna port:

Refer to section 6.3 for details.

8.3.2. Radiated emission:

Refer to section 7.3 for details.

8.4. Measurement Procedure:

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
4. When 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.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. Repeat above procedures until all frequency measured were complete.

8.5. 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

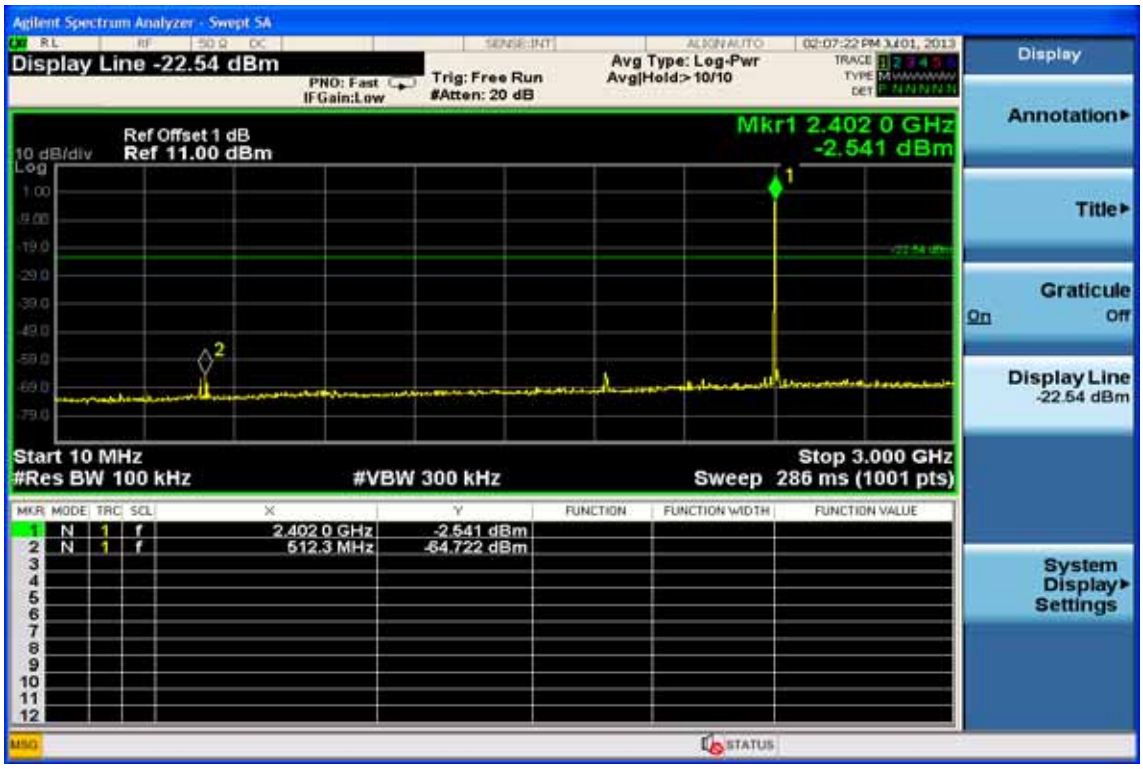
Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

8.6. Measurement Result:

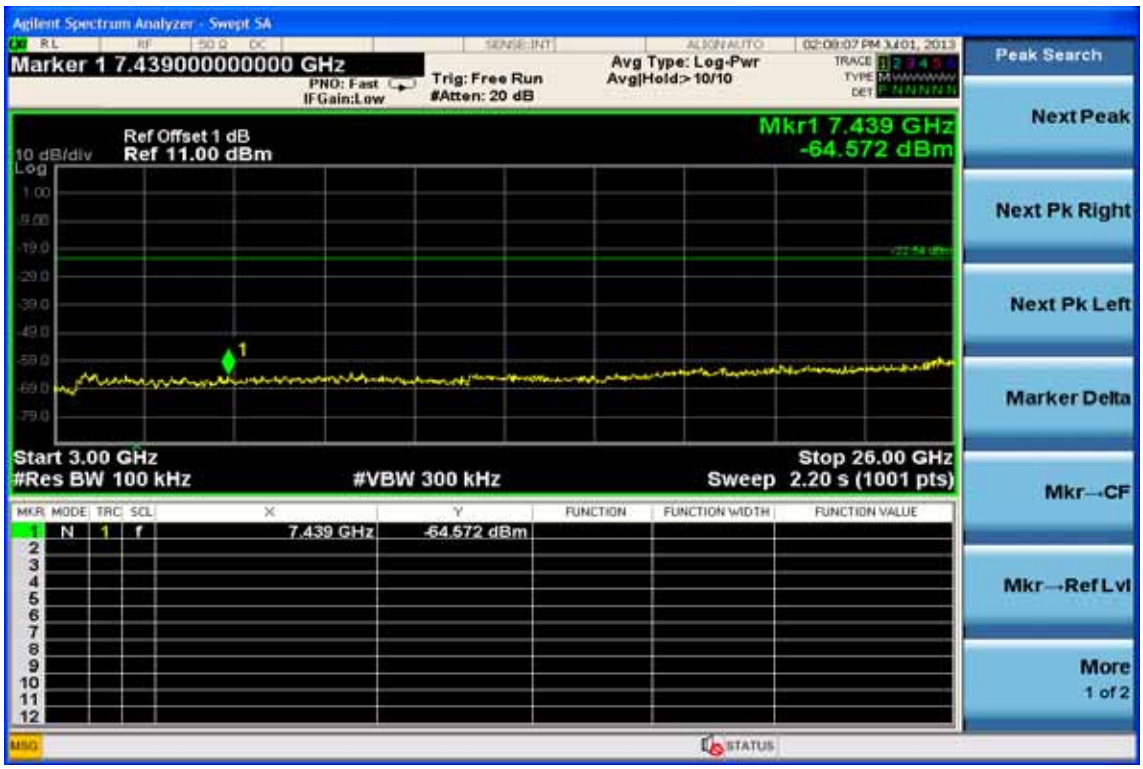
Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

Conducted Spurious Emission Measurement Result (worst case: BDR Mode)

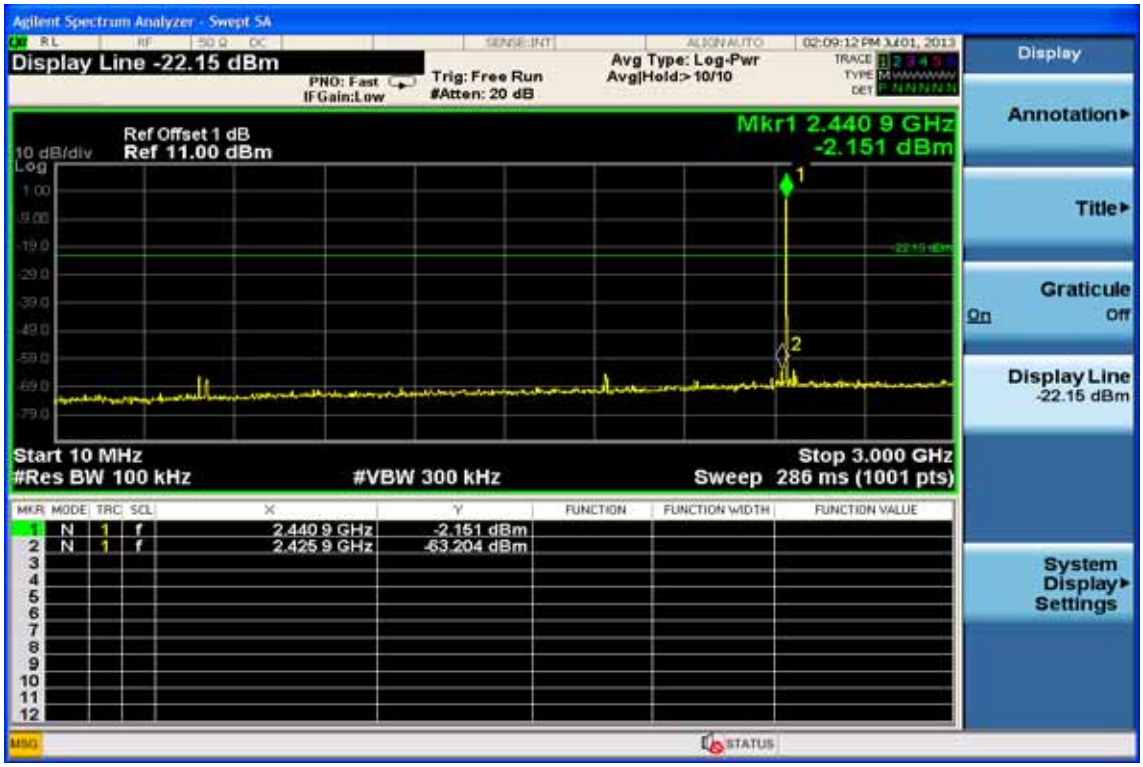
Ch Low 30MHz – 3GHz



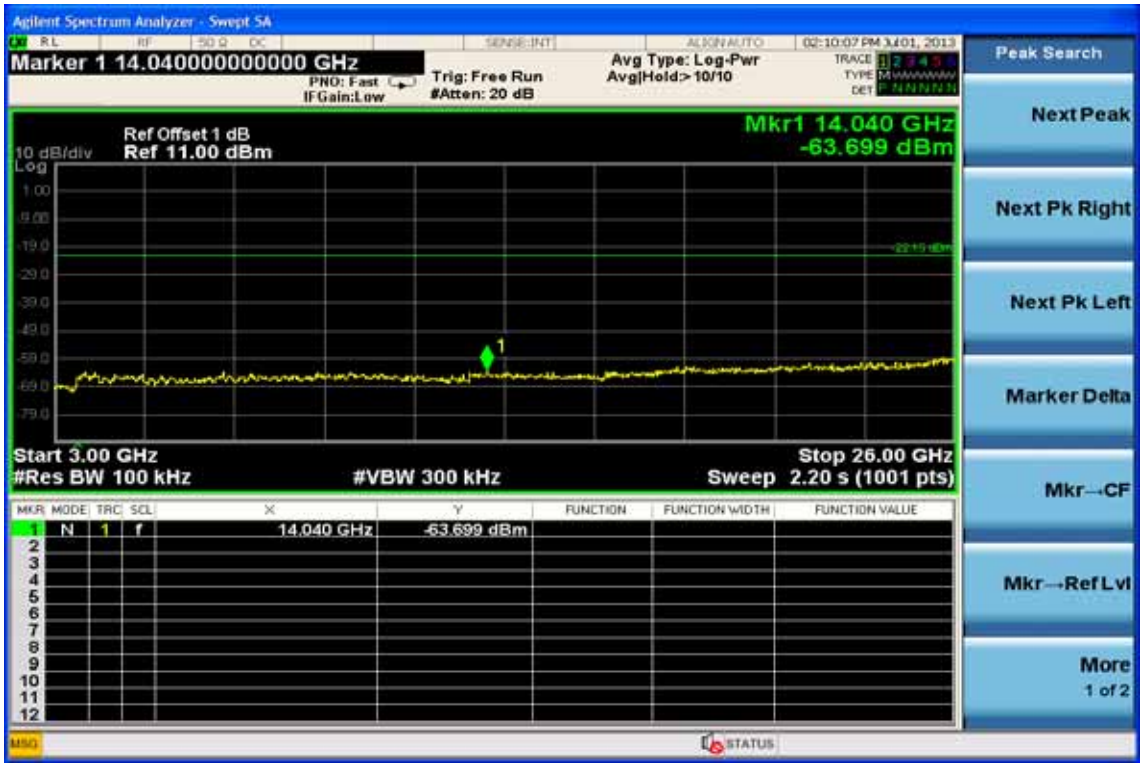
Ch Low 3GHz – 26.5GHz



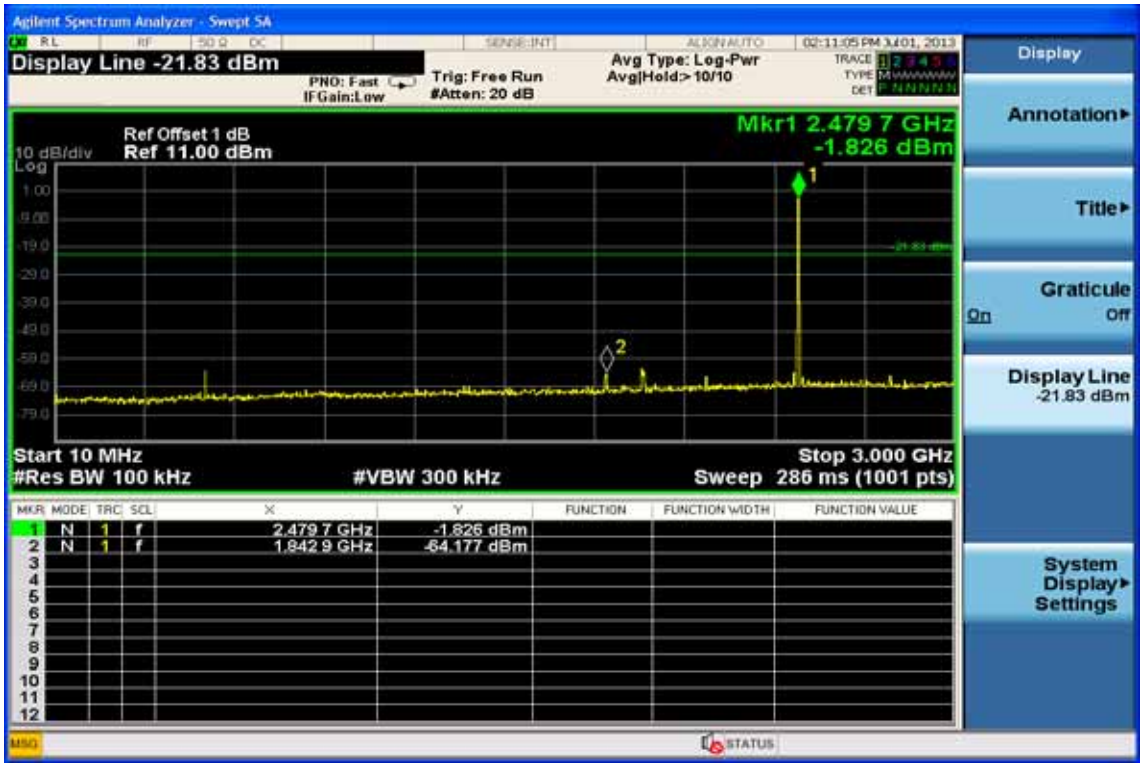
Ch Mid 30MHz – 3GHz



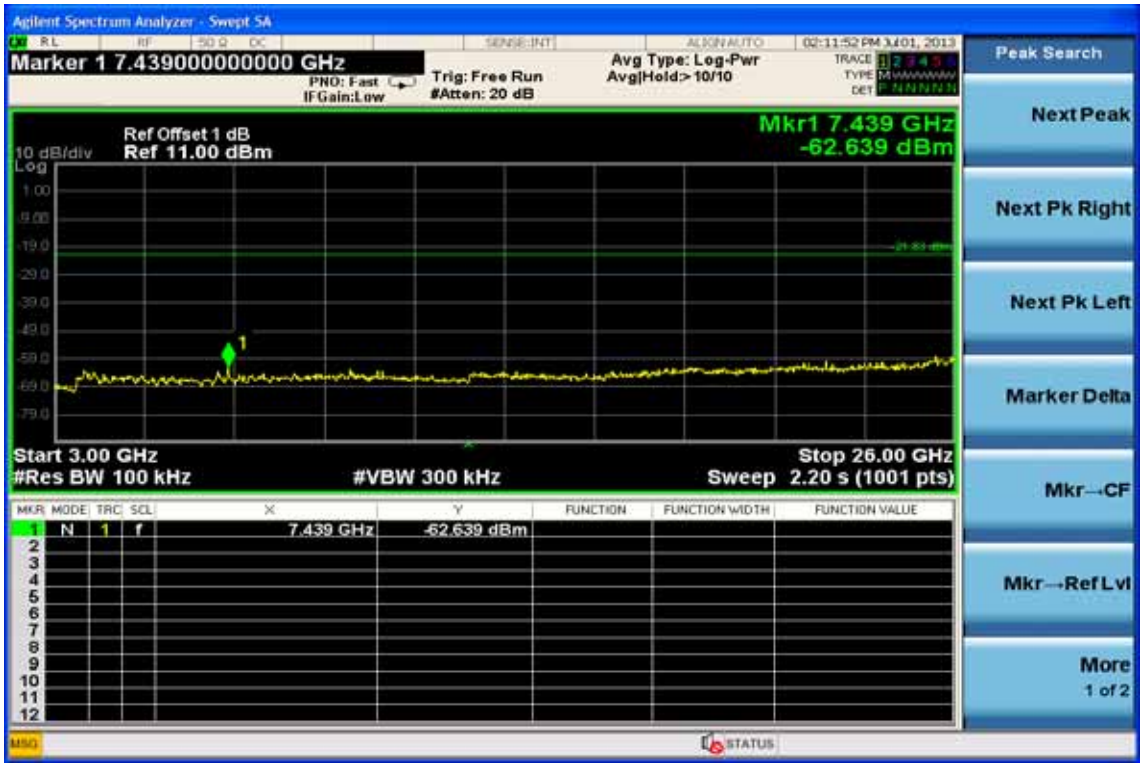
Ch Mid 3GHz – 26.5GHz



Ch High 30MHz – 3GHz



Ch High 3GHz – 26.5GHz



Radiated Spurious Emission Measurement Result (below 1GHz)

Operation Mode	TX CH Low	Test Date	2013/06/26
Fundamental Frequency	2402MHz	Test By	Dino
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	48.43	48.60	-13.62	34.98	40.00	-5.02	Peak	VERTICAL
2	135.73	48.60	-14.33	34.27	43.50	-9.23	Peak	VERTICAL
3	380.17	40.83	-10.40	30.43	46.00	-15.57	Peak	VERTICAL
4	599.39	35.67	-6.12	29.55	46.00	-16.45	Peak	VERTICAL
5	757.50	35.61	-3.00	32.61	46.00	-13.39	Peak	VERTICAL
6	944.71	29.76	-0.38	29.38	46.00	-16.62	Peak	VERTICAL
1	107.60	51.57	-16.61	34.96	43.50	-8.54	Peak	HORIZONTAL
2	191.99	53.42	-15.94	37.48	43.50	-6.02	Peak	HORIZONTAL
3	408.30	41.95	-9.95	32.00	46.00	-14.00	Peak	HORIZONTAL
4	600.36	31.71	-6.10	25.61	46.00	-20.39	Peak	HORIZONTAL
5	755.56	34.18	-3.02	31.16	46.00	-14.84	Peak	HORIZONTAL
6	944.71	30.22	-0.38	29.84	46.00	-16.16	Peak	HORIZONTAL

Remark:

1 No further spurious emissions detected from the lowest internal frequency and 30MHz.

2 Measuring frequencies from the lowest internal frequency to the 1GHz.

3 Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak / QP detector mode.

4 Measurement result 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 The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz, VBW=300KHz.

Radiated Spurious Emission Measurement Result (below 1GHz)

Operation Mode	TX CH Mid	Test Date	2013/06/26
Fundamental Frequency	2441MHz	Test By	Dino
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	48.43	47.59	-13.62	33.97	40.00	-6.03	Peak	VERTICAL
2	134.76	49.67	-14.47	35.20	43.50	-8.30	Peak	VERTICAL
3	379.20	40.69	-10.41	30.28	46.00	-15.72	Peak	VERTICAL
4	599.39	35.37	-6.12	29.25	46.00	-16.75	Peak	VERTICAL
5	759.44	42.21	-2.99	39.22	46.00	-6.78	Peak	VERTICAL
6	868.08	32.60	-1.70	30.90	46.00	-15.10	Peak	VERTICAL
1	68.80	47.36	-15.72	31.64	40.00	-8.36	Peak	HORIZONTAL
2	191.99	53.54	-15.94	37.60	43.50	-5.90	Peak	HORIZONTAL
3	408.30	42.32	-9.95	32.37	46.00	-13.63	Peak	HORIZONTAL
4	599.39	31.60	-6.12	25.48	46.00	-20.52	Peak	HORIZONTAL
5	756.53	34.27	-3.00	31.27	46.00	-14.73	Peak	HORIZONTAL
6	944.71	29.77	-0.38	29.39	46.00	-16.61	Peak	HORIZONTAL

Remark:

1 No further spurious emissions detected from the lowest internal frequency and 30MHz.

2 Measuring frequencies from the lowest internal frequency to the 1GHz.

3 Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak / QP detector mode.

4 Measurement result 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 The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz, VBW=300KHz.

Radiated Spurious Emission Measurement Result (below 1GHz)

Operation Mode	TX CH High	Test Date	2013/06/26
Fundamental Frequency	2480MHz	Test By	Dino
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	48.43	47.04	-13.62	33.42	40.00	-6.58	Peak	VERTICAL
2	134.76	50.14	-14.47	35.67	43.50	-7.83	Peak	VERTICAL
3	379.20	39.00	-10.41	28.59	46.00	-17.41	Peak	VERTICAL
4	504.33	37.87	-8.42	29.45	46.00	-16.55	Peak	VERTICAL
5	759.44	39.03	-2.99	36.04	46.00	-9.96	Peak	VERTICAL
6	944.71	29.49	-0.38	29.11	46.00	-16.89	Peak	VERTICAL
1	108.57	51.21	-16.51	34.70	43.50	-8.80	Peak	HORIZONTAL
2	191.99	53.36	-15.94	37.42	43.50	-6.08	Peak	HORIZONTAL
3	408.30	42.02	-9.95	32.07	46.00	-13.93	Peak	HORIZONTAL
4	599.39	33.35	-6.12	27.23	46.00	-18.77	Peak	HORIZONTAL
5	755.56	36.68	-3.02	33.66	46.00	-12.34	Peak	HORIZONTAL
6	944.71	28.68	-0.38	28.30	46.00	-17.70	Peak	HORIZONTAL

Remark:

1 No further spurious emissions detected from the lowest internal frequency and 30MHz.

2 Measuring frequencies from the lowest internal frequency to the 1GHz.

3 Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak / QP detector mode.

4 Measurement result 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 The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz, VBW=300KHz.

Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode	TX CH Low	Test Date	2013/06/26
Fundamental Frequency	2402 MHz	Test By	Dino
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	4804.00	35.71	1.25	36.96	74.00	-37.04	Peak	VERTICAL
2	7206.00	37.61	7.91	45.52	74.00	-28.48	Peak	VERTICAL
1	4804.00	35.38	1.25	36.63	74.00	-37.37	Peak	HORIZONTAL
2	7206.00	37.30	7.91	45.21	74.00	-28.79	Peak	HORIZONTAL

Remark:

1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency

2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

3 “F” denotes fundamental frequency; “H” denotes harmonics frequency. “S” denotes spurious frequency.

4 Measurement of data 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 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

6 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode	TX CH Mid	Test Date	2013/06/26
Fundamental Frequency	2441 MHz	Test By	Dino
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	4882.00	36.50	1.48	37.98	74.00	-36.02	Peak	VERTICAL
2	7323.00	36.54	8.03	44.57	74.00	-29.43	Peak	VERTICAL
1	4882.00	35.52	1.48	37.00	74.00	-37.00	Peak	HORIZONTAL
2	7323.00	39.15	8.03	47.18	74.00	-26.82	Peak	HORIZONTAL

Remark:

1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency

2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

3 “F” denotes fundamental frequency; “H” denotes harmonics frequency. “S” denotes spurious frequency.

4 Measurement of data 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 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

6 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode	TX CH High	Test Date	2013/06/26
Fundamental Frequency	2480 MHz	Test By	Dino
Temperature	25 ℃	Humidity	60 %

No	Freq MHz	Reading dBuV	Factor dB	Level dBuV/m	Limit dBuV/m	Over Limit dB	Remark	Pol V/H
1	4960.00	39.36	1.72	41.08	74.00	-32.92	Peak	VERTICAL
2	7440.00	38.15	8.15	46.30	74.00	-27.70	Peak	VERTICAL
1	4960.00	37.13	1.72	38.85	74.00	-35.15	Peak	HORIZONTAL
2	7440.00	36.20	8.15	44.35	74.00	-29.65	Peak	HORIZONTAL

Remark:

1 Measuring frequencies from the lowest internal frequency to the 10th of fundamental frequency

2 Field strength limits for frequency above 1000MHz are based on average limits. However, Peak mode field strength shall not exceed the average limits specified plus 20dB.

3 “F” denotes fundamental frequency; “H” denotes harmonics frequency. “S” denotes spurious frequency.

4 Measurement of data 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 Spectrum Peak mode IF bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, Sweep time= 200 ms., the VBW setting was 3 MHz.

6 Spectrum AV mode if bandwidth Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

9. FREQUENCY SEPARATION

9.1. Standard Applicable:

According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the 20dB bandwidth of the hopping channel, whichever is greater.

9.2. Measurement Equipment Used:

Refer to section 6.2 for details.

9.3. Test Set-up:

Refer to section 6.3 for details.

9.4. Measurement 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 = middle of hopping channel .
4. Set the spectrum analyzer as RBW,VBW=100KHz, Adjust Span to 3.0 MHz, Sweep = auto.
5. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

9.5. Measurement Result:

Channel separation (MHz)	Limit	Result
1	>=25KHz or 2/3 times 20dB bandwidth	PASS

Note: Refer to next page for plots.

Frequency Separation Test Data

10. NUMBER OF HOPPING FREQUENCY

10.1. Standard Applicable:

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

10.2. Measurement Equipment Used:

Refer to section 6.2 for details.

10.3. Test Set-up:

Refer to section 6.3 for details.

10.4. Measurement 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 spectrum analyzer Start=2400MHz, Stop = 2441MHz and Start=2441MHz, Stop = 2483.5MHz, Sweep = auto.
4. Set the spectrum analyzer as RBW=300KHz, VBW=1MHz
5. Max hold, view and count how many channel in the band.

10.5. Measurement Result:

Note: Refer to next page for plots.

Channel Number
2.4 GHz – 2.441GHz

2.441 GHz – 2.4835GHz

11. TIME OF OCCUPANCY (DWELL TIME)

11.1. Standard Applicable:

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 seconds multiplied by the number of hopping channel employed.

11.2. Measurement Equipment Used:

Refer to section 6.2 for details.

11.3. Test Set-up:

Refer to section 6.3 for details.

11.4. Measurement 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 =1MHz, Span = 0Hz , Adjust Sweep = 2.5ms.
5. Repeat above procedures until all frequency measured were complete.

11.5. Measurement Result:

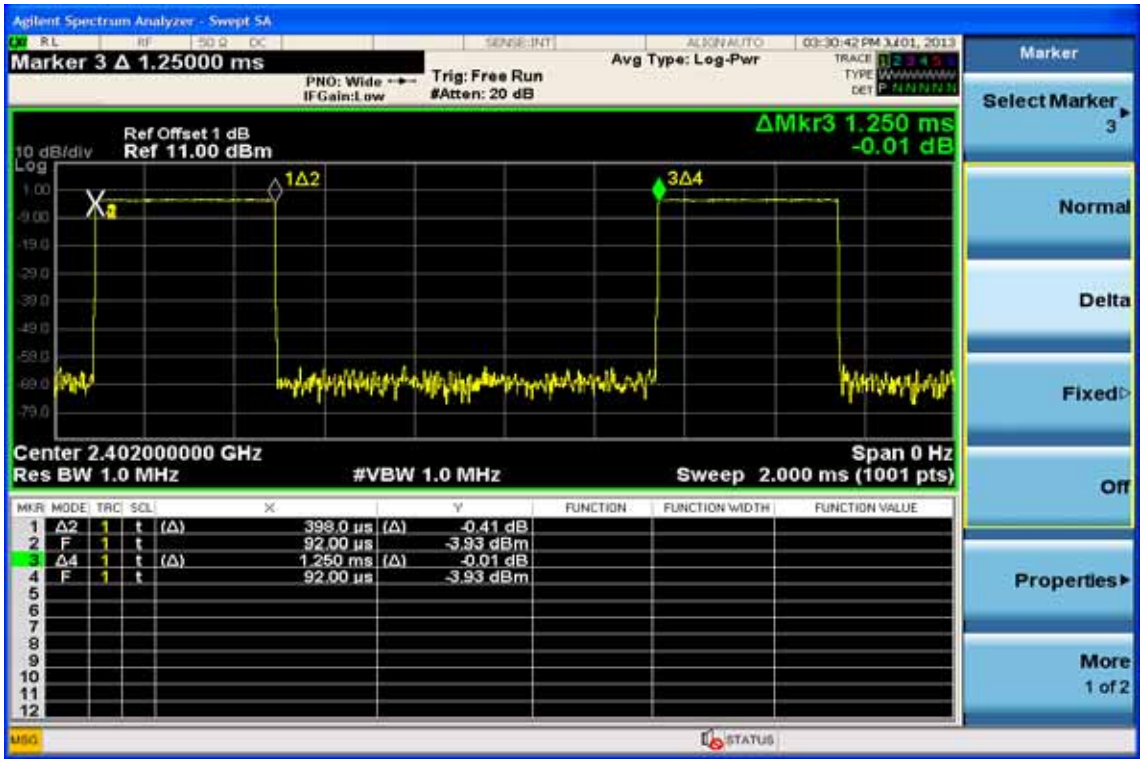
A period time = 0.4 (ms) * 79 = 31.6 (s)

CH Low	DH1 time slot	= 0.398	(ms)	* (1600/2/79)	* 31.6 =	127.36	(ms)
	DH3 time slot	= 1.650	(ms)	* (1600/4/79)	* 31.6 =	264.00	(ms)
	DH5 time slot	= 2.900	(ms)	* (1600/6/79)	* 31.6 =	309.33	(ms)
CH Mid	DH1 time slot	= 0.396	(ms)	* (1600/2/79)	* 31.6 =	126.72	(ms)
	DH3 time slot	= 1.650	(ms)	* (1600/4/79)	* 31.6 =	264.00	(ms)
	DH5 time slot	= 2.910	(ms)	* (1600/6/79)	* 31.6 =	310.40	(ms)
CH High	DH1 time slot	= 0.398	(ms)	* (1600/2/79)	* 31.6 =	127.36	(ms)
	DH3 time slot	= 1.655	(ms)	* (1600/4/79)	* 31.6 =	264.80	(ms)
	DH5 time slot	= 2.900	(ms)	* (1600/6/79)	* 31.6 =	309.33	(ms)

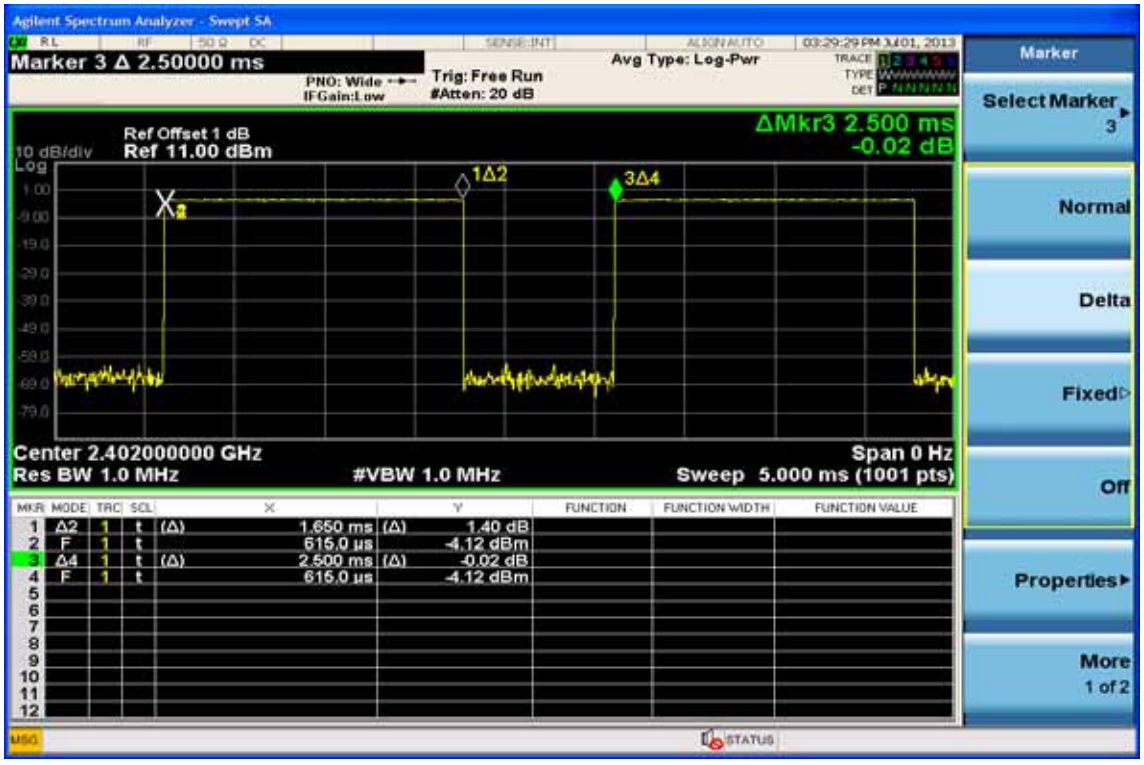
Note: Refer to next page for plots.

CH-Low

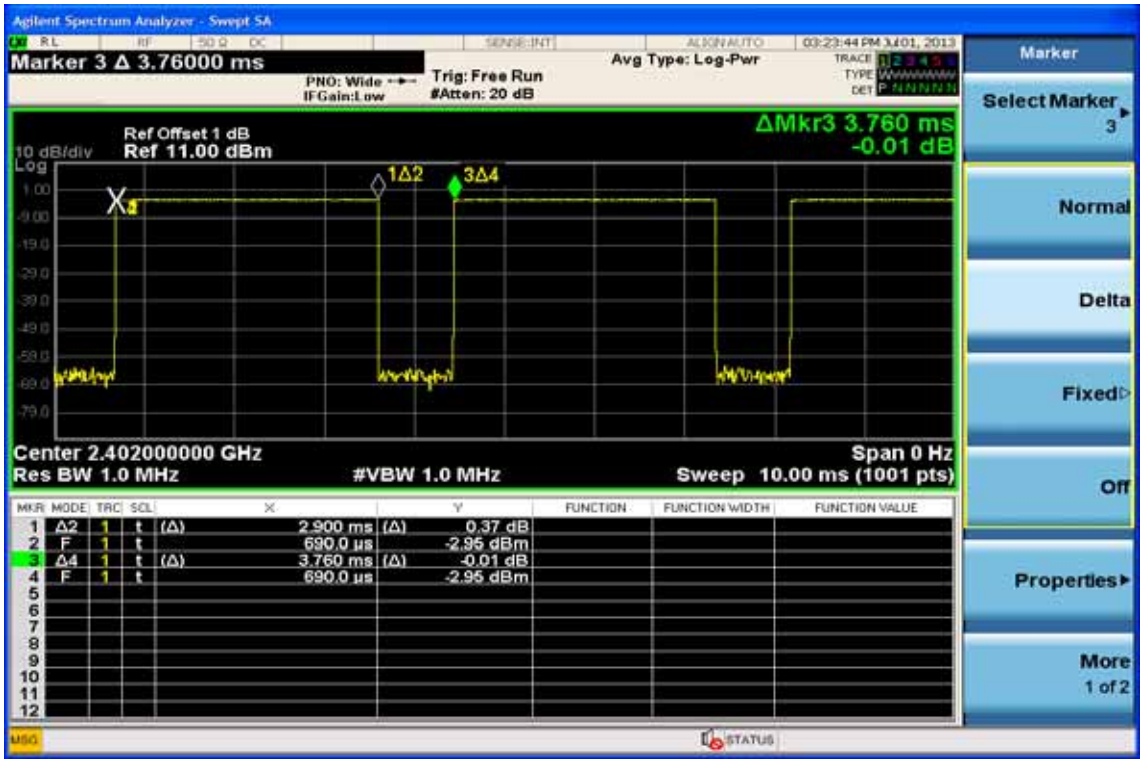
DH1



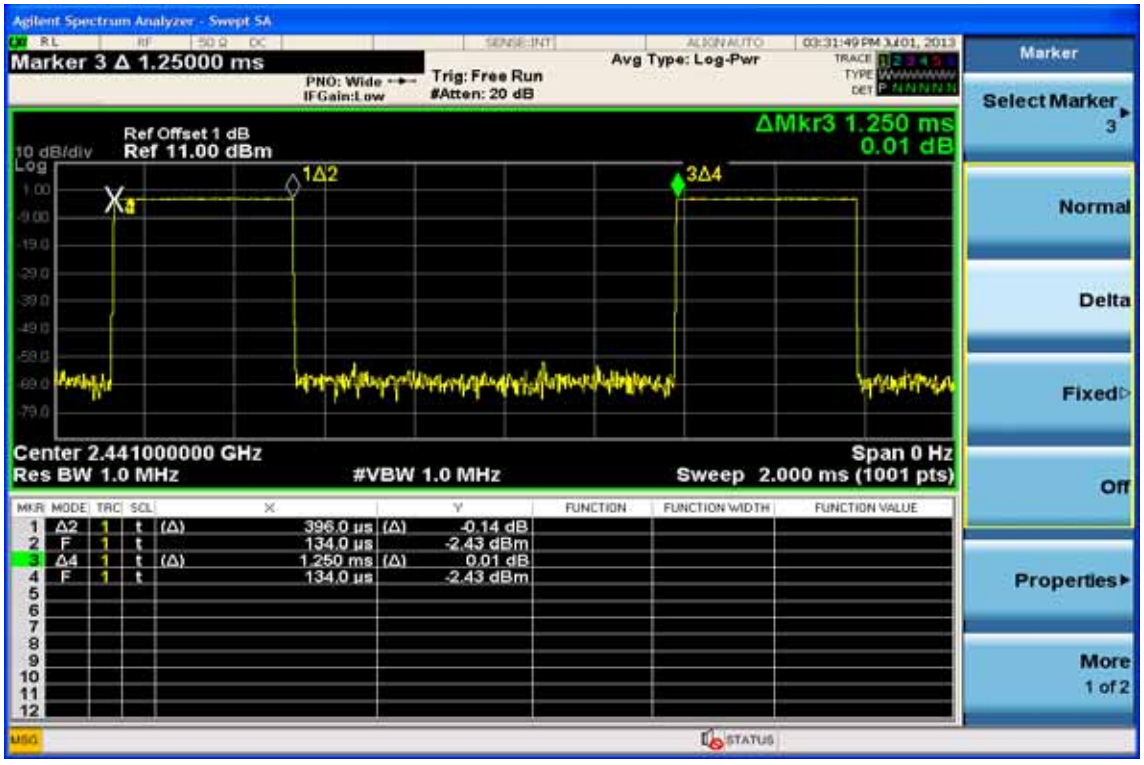
DH3



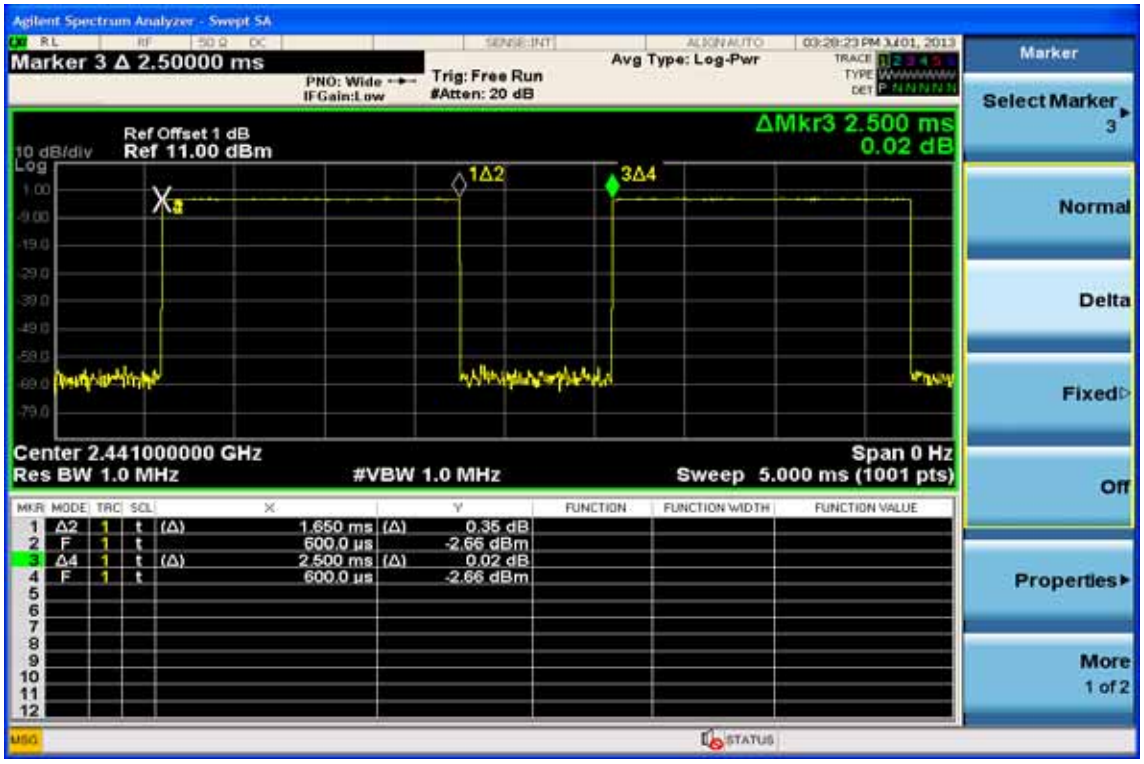
DH5



CH-Mid
DH1



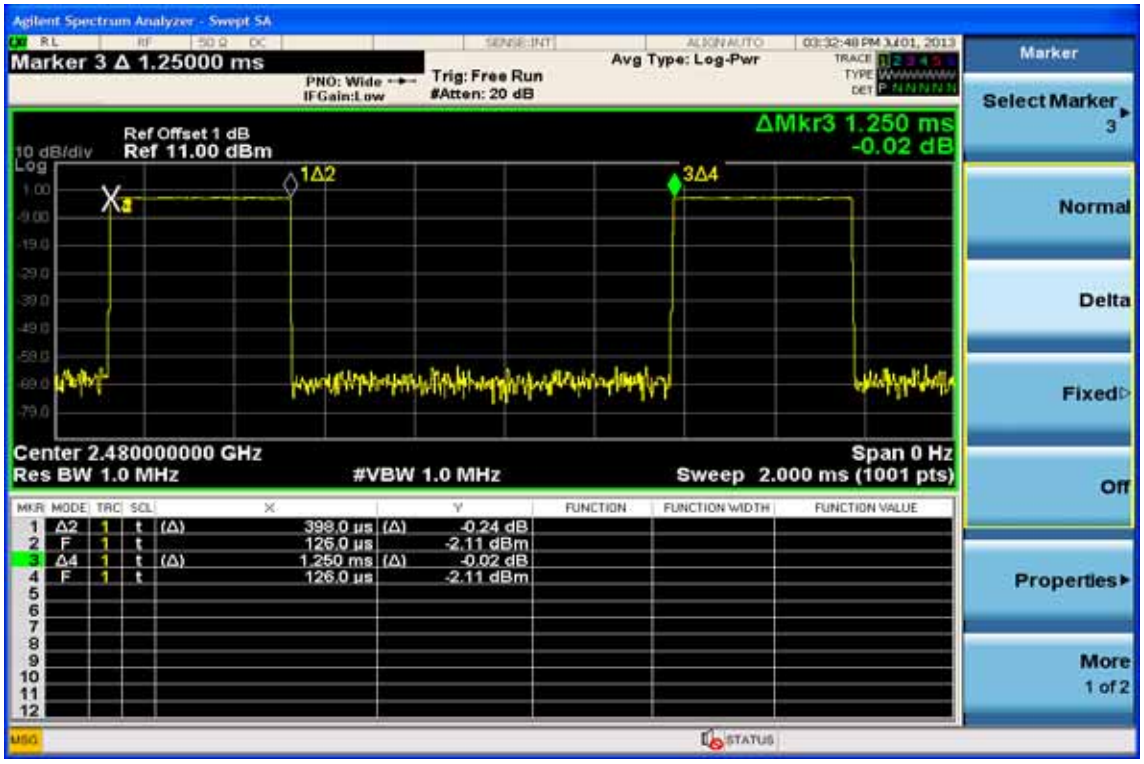
DH3


Agilent Spectrum Analyzer - Swept SA
Marker 3 Δ 2.50000 ms
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Ref Offset 1 dB
10 dB/div
Ref 11.00 dBm
ΔMkr3 2.500 ms
0.02 dB
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 5.000 ms (1001 pts)
1 Δ2 1.650 ms (Δ) 0.35 dB
2 F 600.0 µs -2.66 dBm
3 Δ4 2.500 ms (Δ) 0.02 dB
4 F 600.0 µs -2.66 dBm
Marker
Select Marker 3
Normal
Delta
Fixed
Off
Properties
More 1 of 2

DH5

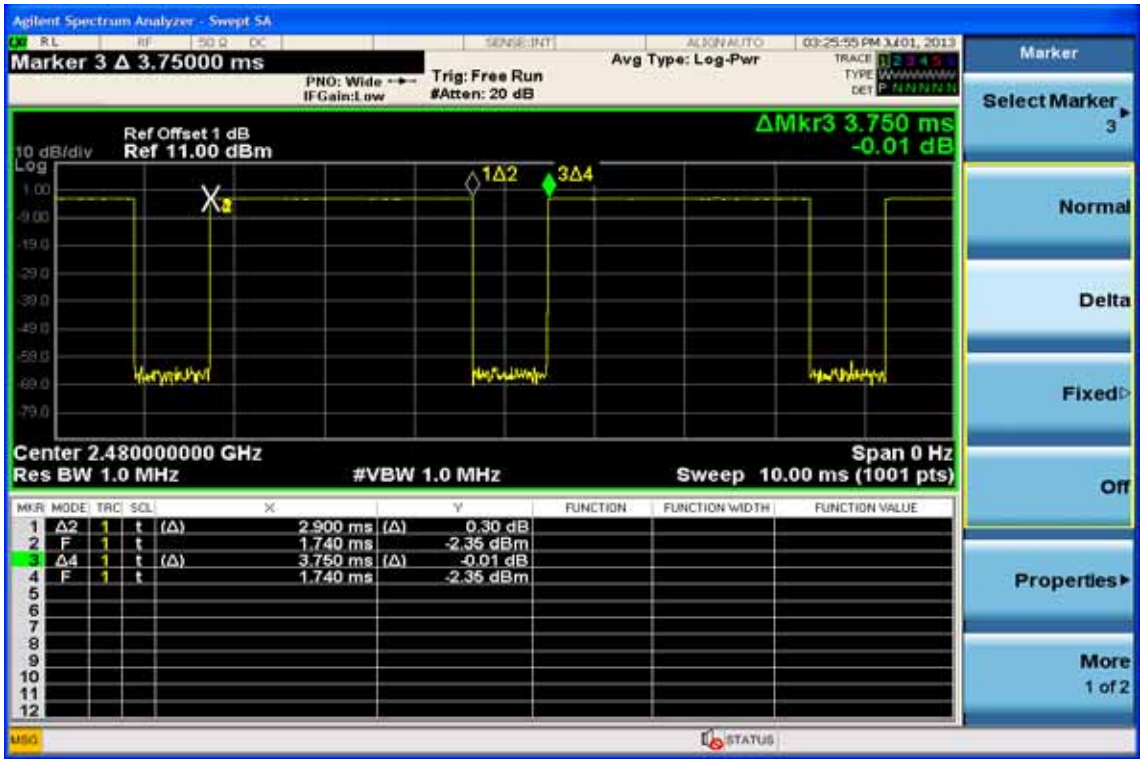

Agilent Spectrum Analyzer - Swept SA
Marker 3 Δ 3.75000 ms
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Ref Offset 1 dB
10 dB/div
Ref 11.00 dBm
ΔMkr3 3.750 ms
-0.03 dB
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 10.00 ms (1001 pts)
1 Δ2 2.910 ms (Δ) 0.10 dB
2 F 1.440 ms -2.92 dBm
3 Δ4 3.750 ms (Δ) -0.03 dB
4 F 1.440 ms -2.92 dBm
Marker
Select Marker 3
Normal
Delta
Fixed
Off
Properties
More 1 of 2

CH-High
DH1



DH3

DH5


Agilent Spectrum Analyzer - Swept SA
Marker 3 Δ 3.75000 ms
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Ref Offset 1 dB
10 dB/div
Ref 11.00 dBm
ΔMkr3 3.750 ms
-0.01 dB
Center 2.480000000 GHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 10.00 ms (1001 pts)
1 Δ2 2.900 ms (Δ) 0.30 dB
2 F 1 1.740 ms -2.35 dBm
3 Δ4 1 3.750 ms (Δ) -0.01 dB
4 F 1 1.740 ms -2.35 dBm
Marker
Select Marker 3
Normal
Delta
Fixed
Off
Properties
More 1 of 2

12. 20dB Bandwidth

12.1. Standard Applicable:

According to §15.247(a)(1) for frequency hopping systems operating in the 2400MHz-2483.5 MHz no limit for 20dB bandwidth.

12.2. Measurement Equipment Used:

Refer to section 6.2 for details.

12.3. Test Set-up:

Refer to section 6.3 for details.

12.4. Measurement 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 the spectrum analyzer as RBW=10KHz (1 % of Bandwidth.), Span= 3MHz, Sweep=auto
4. Mark the peak frequency and –20dB (upper and lower) frequency.
5. Repeat above procedures until all frequency measured were complete.

12.5. Measurement Result:

20dB Bandwidth

BDR Mode

CH	Bandwidth (MHz)
Lower	0.8236
Mid	0.8634
Higher	0.8247

Note: Refer to next page for plots.

BDR Mode

20dB Bandwidth Test Data CH-Low

20dB Bandwidth Test Data CH-Mid

20dB Bandwidth Test Data CH-High

13. ANTENNA REQUIREMENT

13.1. Standard Applicable:

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

And according to §15.246(1), if transmitting antennas of directional gain greater than 6dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

13.2. Antenna Connected Construction:

The directional gains of antenna used for transmitting is 1.87dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Please see EUT photo for details.

14. RF EXPOSURE

14.1. Standard Applicable

According to§2.1093 this is a Portable device.

According toKDB 447498 D01 V5, Appendix A SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≤ 50 mm, the power level 10mW at 5 mm.

14.2. Measurement Result:

This is a portable device and the Max. peak output power is -0.46dBm (0.9 mW) lower than low threshold 10 mW (24.48mW), d at 5mm in general population category；

The SAR measurement is not necessary.