TEST REPORT

of

FCC Part 15 Subpart C AND CANADA RSS-210

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

Full Modular Approval

Product :	**BT 4.0 Dual Mode Module**
Brand:	**BlueRadios**
Model:	**BR-LE4.0-D2A**
Model Difference:	**N/A**
FCC ID:	**XDULE40-D2**
IC:	**8456A-LE4D2**
FCC Rule Part:	**§15.247, Cat: DSS**
IC Rule Part:	**RSS-210 issue 8:2010, Annex 8**
Applicant:	**BlueRadios, Inc.**
Address:	**7173 S. Hanava Street, Suite 600, Englewood, CO/USA**

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 Tsuen, Hsin Ho Rd.
Lung-Tan Hsiang, Tao Yuan County 325, Taiwan
*Tel : 886-3-407-1718; Fax: 886-3-407-1738
Report No.: **ISL-12LR100FCB**
Issue Date : **2012/08/07**

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:	BlueRadios, Inc.
Product Description:	BT 4.0 Dual Mode Module
Brand Name:	BlueRadios
Model No.:	BR-LE4.0-D2A
Model Difference:	N/A
FCC ID:	XDULE40-D2
IC:	8456A-LE4D2
FCC Rule Part:	§15.247
IC Rule Part:	RSS-210 issue 8:2010, Annex 8
Date of test:	2012/06/19 ~ 2012/07/24
Date of EUT Received:	2012/06/19

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:***	2012/08/07
	Dion Chang / Engineer		
Prepared By:	Eva Kao	***Date:***	2012/08/07
	Eva Kao / Technical Supervisor		
Approved By:	Vincent Su	***Date:***	2012/08/07
	Vincent Su / Technical Manager		

Version

Version No.	Date	Description
00	2012/08/07	Initial creation of document

Table of Contents

1. GENERAL INFORMATION

1.1. Product Description

General:

Product Name	BT 4.0 Dual Mode Module
Brand Name	BlueRadios
Model Name	BR-LE4.0-D2A
Model Difference	N/A
Power Supply	3.0Vdc from host

Bluetooth:

Bluetooth Version	V2.1 + EDR (GFSK + π /4 DQPSK + 8DPSK)	V4.0(GFSK)
Frequency Range:	2402 – 2480MHz	2402 – 2480MHz
Channel number:	79 channels	
Modulation type:	Frequency Hopping Spread Spectrum (FHSS)	
Transmit Power:	11.01dBm Peak	
Dwell Time:	<= 0.4s	
Operating Mode:	Point-to-Point	
Antenna Designation:	Type: Chip Antenna, 2dBi max. P/N:ANT8030-2R4-01A	
Type of Emission:	1M20FXD	

Remark: The above DUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

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

This submittal(s) (test report) is intended for **FCC ID: XDULE40-D2** filing to comply with Section 15.247 of the FCC Part 15C, Subpart C Rules. And I**C: 8456A-LE4D2** filing to comply with Industry Canada RSS-210 issue 8: 2010 Annex 8.

1.3. Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 (2003) and RSS-Gen: 2010. 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 and RSS-Gen:2010. 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)

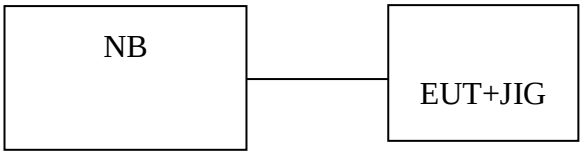


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mrf/Brand	Model name	Series No	Data Cable	Power Cable
1	NB	Dell	P19G	6LCQCT1	Shield	No- Shielding
2	JIG	N/A	N/A	N/A	N/A	N/A

3. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)/ RSS-Gen §7.2.2	AC Power line Conducted Emission	Compliant
§15.247(b)(1)/ RSS-210 issue 8,§A8.4(2)	Peak Output Power	Compliant
§15.247(d) RSS-210 issue 8,§A8.5	100 KHz Bandwidth Of Frequency Band Edges	Compliant
§15.247(c) RSS-Gen §7.2.3 RSS-210 issue 8,§A2.9	TX/RX Spurious Emission	Compliant
§15.247(a)(1)/ RSS-210 issue 8,§A8.1(b)	Frequency Separation	Compliant
§15.247(a)(1)(iii)/ RSS-210 issue 8,§A8.1(d)	Number of hopping frequency	Compliant
§15.247(a)(1)(ii)/ RSS-210 issue 8,§A8.1(d)	Time of Occupancy	Compliant
§15.247/ RSS-210 issue 8,§A8.2(b)	Peak Power Density	Compliant
§15.247(a)(1) RSS210 issue ,§A8.1(b)	20dB Bandwidth & 99% Power Bandwidth	Compliant
§15.203, §15.247(c)/ RSS-GEN 7.1.4, RSS-210 issue 8,§A8.4	Antenna Requirement	Compliant
§15.212, RSS-GEN issue 3,§3.2.2	Modular Transmitter	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 modulation were chosen for full testing.

5. AC POWER LINE CONDUCTED EMISSION TEST

5.1. Standard Applicable:

According to §15.207 and RSS-Gen §7.2.2, 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	06/27/2012	06/27/2013
EMI Receiver 12	ROHDE & SCHWARZ	ESCI	100804	07/12/2012	07/12/2013
LISN 07	FCC Inc.	FCC-LISN-50-100-4-02	07040	07/13/2012	07/13/2013
LISN 08	FCC	FCC-LISN50-25-2-01	07039	07/13/2012	07/13/2013

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:

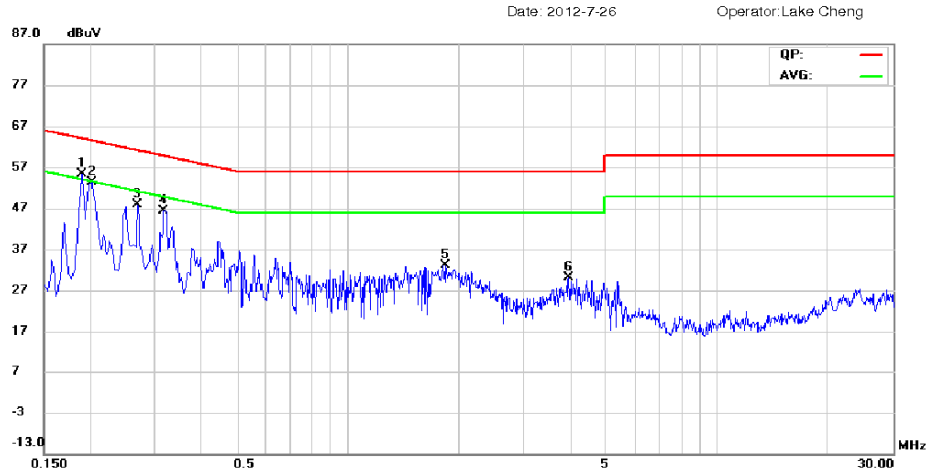
The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

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

AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation Mode	Test Date:	2012/07/26
Test By:	Lake		

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

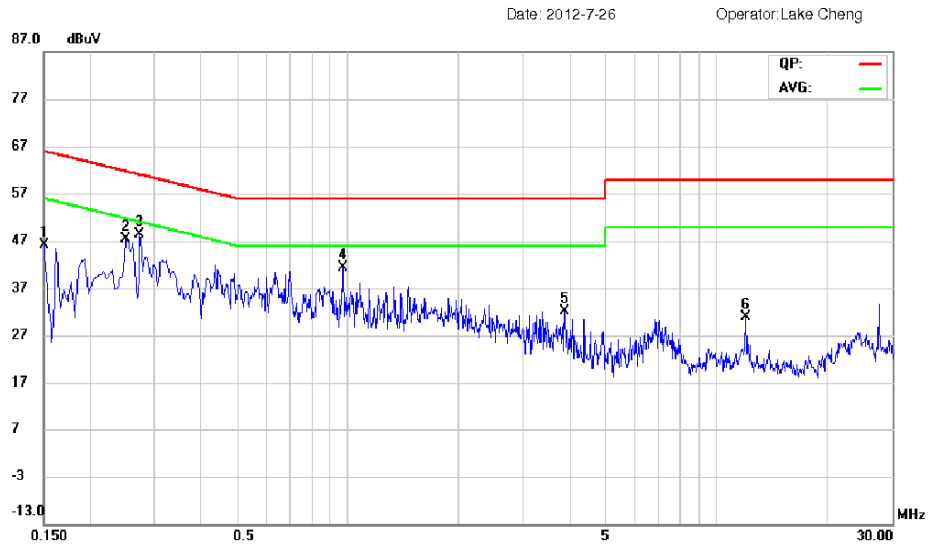


Site Conduction 04 Phase: *L1* Temperature: 26 ℃
Condition : CISPR13 Class B Conduction Humidity: 54 %

No.		Freq.	Reading_Level (dBuV)			Correct Factor	Measurement (dBuV)			Limit (dBuV)		Margin (dB)		
		MHz	Peak	QP	AVG	dB	peak	QP	AVG	P/Q	AVG	P/Q	AVG	P/F Comment
1	*	0.1900	45.90	44.21	31.24	9.60	55.50	53.81	40.84	64.04	54.04	-10.23	-13.20	
2		0.2020	43.73	42.64	27.09	9.60	53.33	52.24	36.69	63.53	53.53	-11.29	-16.84	
3		0.2700	38.32	34.33	21.19	9.60	47.92	43.93	30.79	61.12	51.12	-17.19	-20.33	
4		0.3180	36.74	33.13	24.89	9.60	46.34	42.73	34.49	59.76	49.76	-17.03	-15.27	
5		1.8460	23.57	20.11	9.19	9.65	33.22	29.76	18.84	56.00	46.00	-26.24	-27.16	
6		3.9780	20.53	14.51	3.44	9.68	30.21	24.19	13.12	56.00	46.00	-31.81	-32.88	

*:Maximum data x:Over limit !:over margin

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



Site Conduction 04 Phase: *N* Temperature: 26 ℃
Condition : CISPR13 Class B Conduction Humidity: 54 %

No.	Freq.	Reading_Level (dBuV)			Correct Factor	Measurement (dBuV)			Limit (dBuV)		Margin (dB)		
	MHz	Peak	QP	AVG	dB	peak	QP	AVG	P/Q	AVG	P/Q	AVG	P/F Comment
1	0.1500	36.52	31.61	12.44	9.60	46.12	41.21	22.04	66.00	56.00	-24.79	-33.96	
2	0.2500	37.66	35.87	26.87	9.60	47.26	45.47	36.47	61.76	51.76	-16.29	-15.29	
3	0.2740	38.75	30.78	23.03	9.60	48.35	40.38	32.63	61.00	51.00	-20.62	-18.37	
4 *	0.9740	31.67	28.94	27.62	9.63	41.30	38.57	37.25	56.00	46.00	-17.43	-8.75	
5	3.8860	22.35	16.33	9.81	9.68	32.03	26.01	19.49	56.00	46.00	-29.99	-26.51	
6	12.0020	20.97	20.40	19.50	9.80	30.77	30.20	29.30	60.00	50.00	-29.80	-20.70	

*:Maximum data x:Over limit !:over margin

6. PEAK OUTPUT POWER MEASUREMENT

6.1. Standard Applicable:

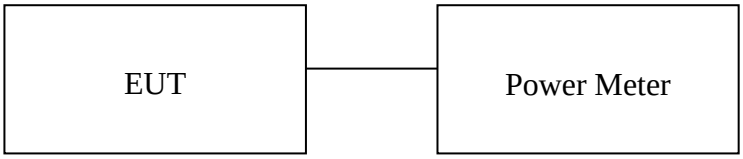
According to §15.247(b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1Watt. For all other frequency hopping systems in the 2400 – 2483.5MHz band: 0.125 Watts.

According to RSS-210 issue 8,§A8.4(2), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, the maximum conducted output power shall not exceed 1 W. For all other frequency hopping systems, the maximum peak conducted output power shall not exceed 0.125 W.

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	04/17/2012	04/16/2013
Power Sensor 05	Anritsu	MA2411B	34NKF50	04/16/2012	04/15/2013
Temperature Chamber	KSON	THS-B4H100	2287	03/03/2012	03/02/2013
DC Power supply	ABM	51850	N/A	06/17/2012	06/16/2013
AC Power supply	EXTECH	CFC105W	NA	12/19/2011	12/18/2012
Splitter	MCLI	PS4-199	12465	07/18/2012	07/17/2013
Spectrum analyzer	Agilent	N9030A	MY51360021	03/11/2012	03/10/2013

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.
3. Record the max. reading.
4. Repeat above procedures until all frequency measured were complete.

6.5. Measurement Result:

GFSK Mode

Frequency (MHz)	Peak Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	8.06	0.00	8.06	0.00640	1
2441.00	8.12	0.00	8.12	0.00649	1
2480.00	8.07	0.00	8.07	0.00641	1

II /4 DQPSK Mode

Frequency (MHz)	Peak Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	10.53	0.00	10.53	0.01130	1
2441.00	10.41	0.00	10.41	0.01099	1
2480.00	10.30	0.00	10.30	0.01072	1

8DPSK Mode

Frequency (MHz)	Peak Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	11.01	0.00	11.01	0.01262	1
2441.00	10.77	0.00	10.77	0.01194	1
2480.00	10.55	0.00	10.55	0.01135	1

offset: 18dB

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).

According to RSS-210 issue 8,§A8.5, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required. In addition, radiated emissions which fall in the restricted bands of Table 1 must also comply with the radiated emission limits specified in Tables 2 and 3.

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 14(966)					
EQUIPMENT TYPE	**MFR**	**MODEL NUMBER**	**SERIAL NUMBER**	**LAST CAL.**	**CAL DUE.**
Spectrum Analyzer 21	Agilent	N9010A	MY49060537	07/18/2011	07/17/2012
Spectrum Analyzer 20	Agilent	E4443A	MY48250315	05/12/2011	05/11/2012
Loop Antenna9K-30M	A.H.SYSTEM	SAS-564	294	02/28/2011	02/27/2013
Bilog Antenna30-1G	Schaffner	CBL 6111B	2756	12/27/2011	12/26/2012
Horn antenna1-18G	COM-POWER	AH118	2011071401	03/01/2012	02/29/2013
Horn antenna1-18G(06)	EMCO	3117	0006665	09/21/2011	09/20/2012
Horn antenna26-40G(05)	Com-power	AH-640	100A	01/11/2011	01/10/2013
Horn antenna18-26G(04)	Com-power	AH-826	081001	05/04/2011	05/03/2013
Preamplifier9-1000M	HP	8447D	NA	02/10/2012	02/09/2013
Preamplifier1-18G	MITEQ	AFS44-00101800-25-10P-44	1329256	07/19/2012	07/18/2013
Preamplifier1-26G	EM	EM01M26G	NA	02/21/2012	02/20/2013
Preamplifier26-40G	MITEQ	JS-26004000-27-5A	818471	05/21/2011	05/20/2013
Cable1-18G	HUBER SUHNER	Sucoflex 106	NA	02/10/2012	02/09/2013
Cable UP to 1G	HUBER SUHNER	RG 214/U	NA	12/14/2011	12/13/2012
SUCOFLEX 1GHz~40GHz cable	HUBER SUHNER	Sucoflex 102	27963/2&37421/2	09/21/2011	09/20/2012
2.4G Filter	Micro-Tronics	Brm50702	76	10/22/2011	10/21/2012
5G Filter	Micro-Tronics	Brm50716	005	10/22/2011	10/21/2012

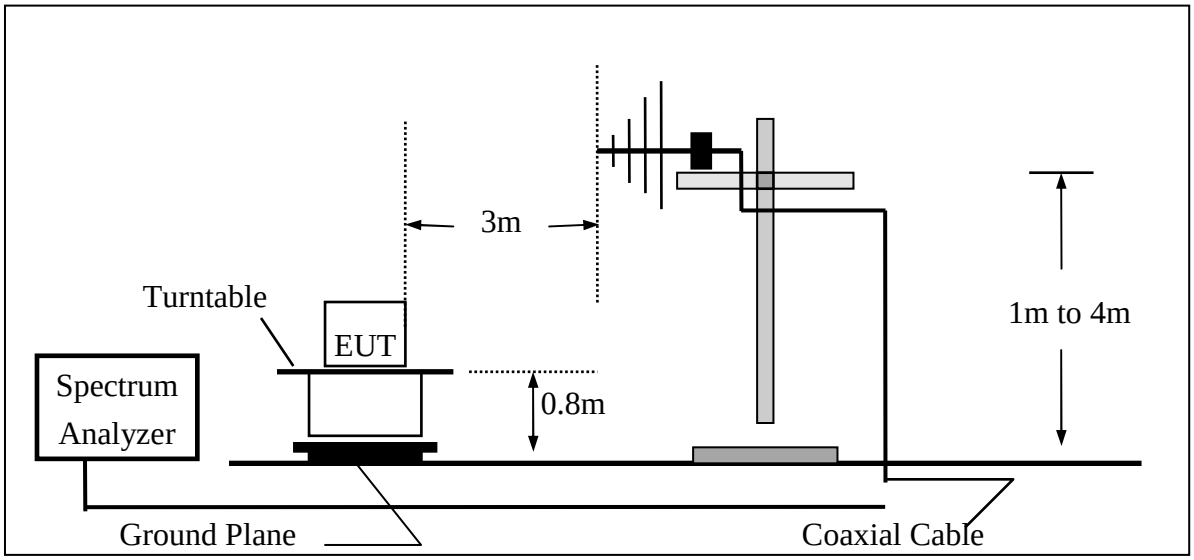
7.3. Test SET-UP:

7.3.1. Conducted Emission at antenna port:

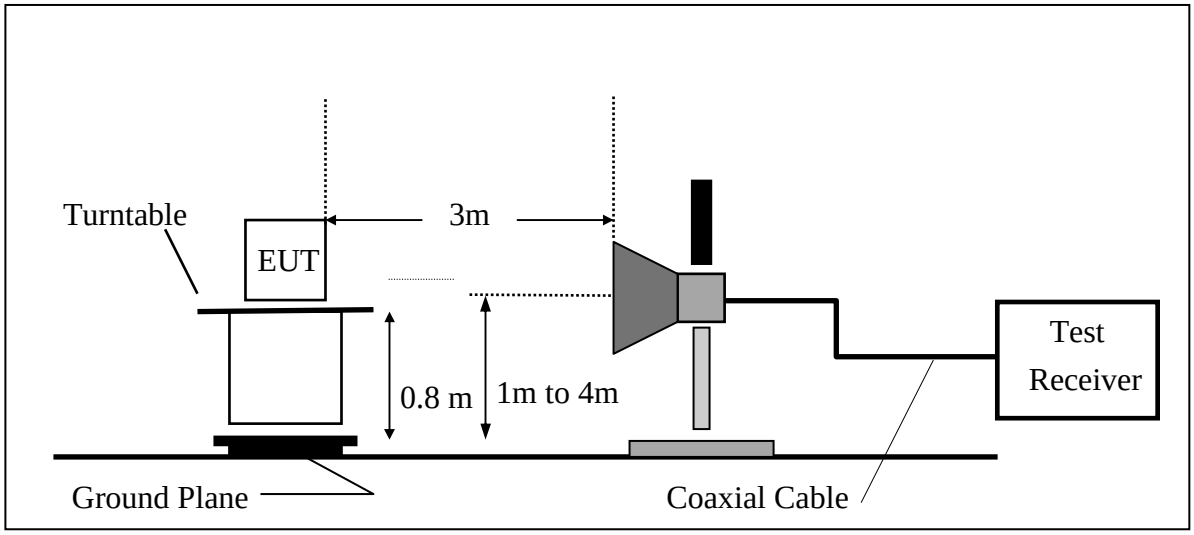
Refer to section 6.3 for details.

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

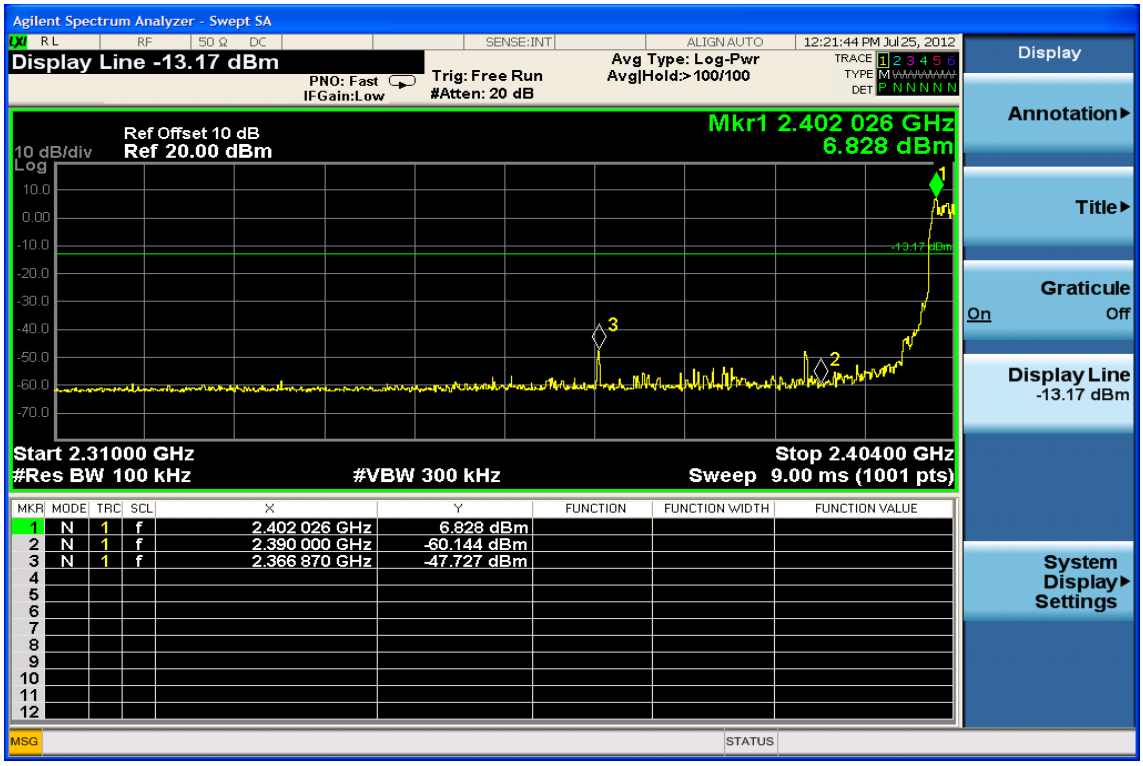
Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

7.6. Measurement Result:

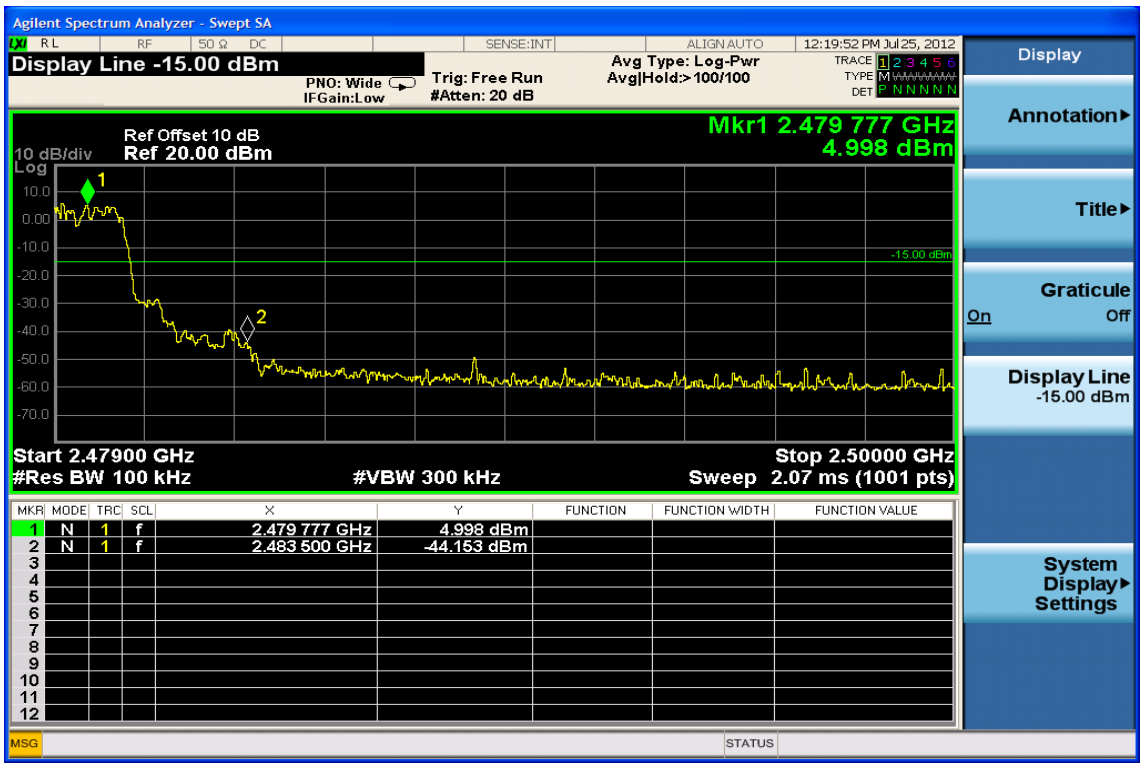
Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

8DPSK Mode (Worst case)

Band Edges Test Data CH-Low



Band Edges Test Data CH-High



Radiated Emission (8DPSK mode):

Operation Mode	TX CH Low	Test Date	2012/07/24
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	2358.21	61.30	-11.57	49.73	74.00	-24.27	Peak	VERTICAL
2	2390.00	59.78	-11.48	48.30	74.00	-25.70	Peak	VERTICAL
1	2359.68	54.73	-11.57	43.16	54.00	-10.84	Average	HORIZONTAL
2	2359.68	66.64	-11.57	55.07	74.00	-18.93	Peak	HORIZONTAL
3	2390.00	60.10	-11.48	48.62	74.00	-25.38	Peak	HORIZONTAL

Operation Mode	TX CH High	Test Date	2012/07/24
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	61.12	-11.25	49.87	74.00	-24.13	Peak	VERTICAL
2								
1	2483.50	48.51	-11.25	37.26	54.00	-16.74	Average	HORIZONTAL
2	2483.50	65.85	-11.25	54.60	74.00	-19.40	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.

According to RSS-Gen §7.2.3 and RSS-210 issue 8,§A2.9, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required. In addition, radiated emissions which fall in the restricted bands of Table 1 must also comply with the radiated emission limits specified in Tables 2 and 3.

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

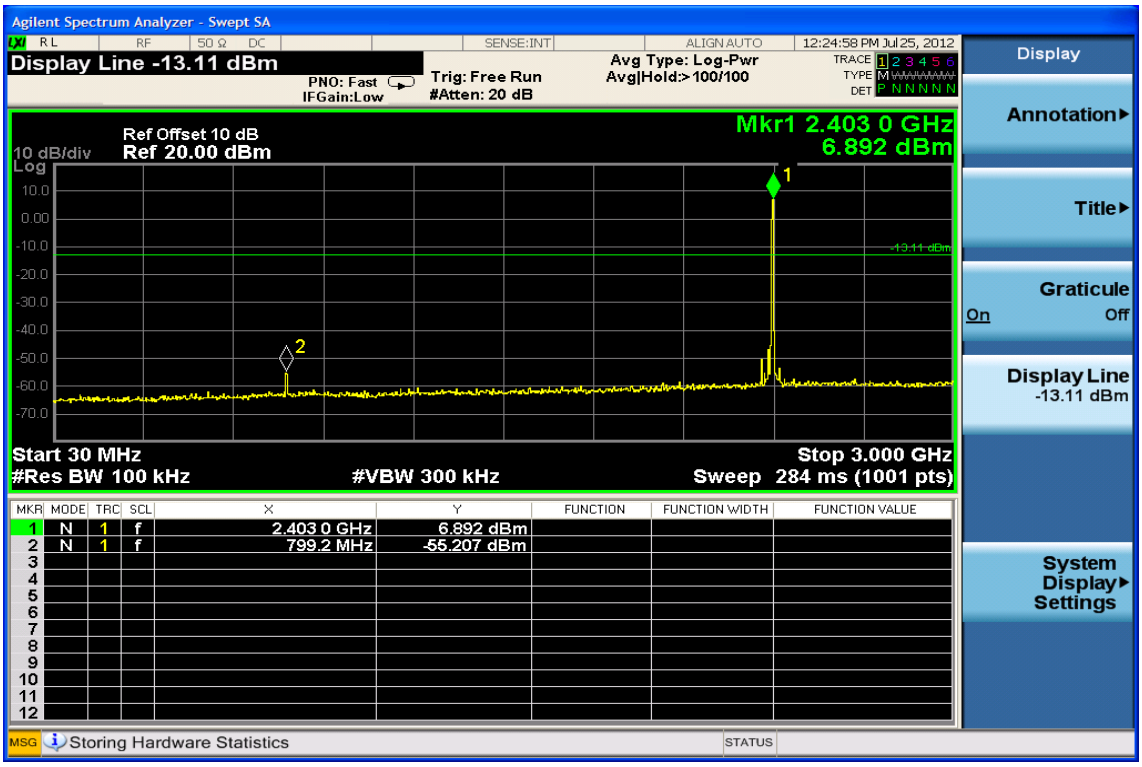
Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

8.6. Measurement Result:

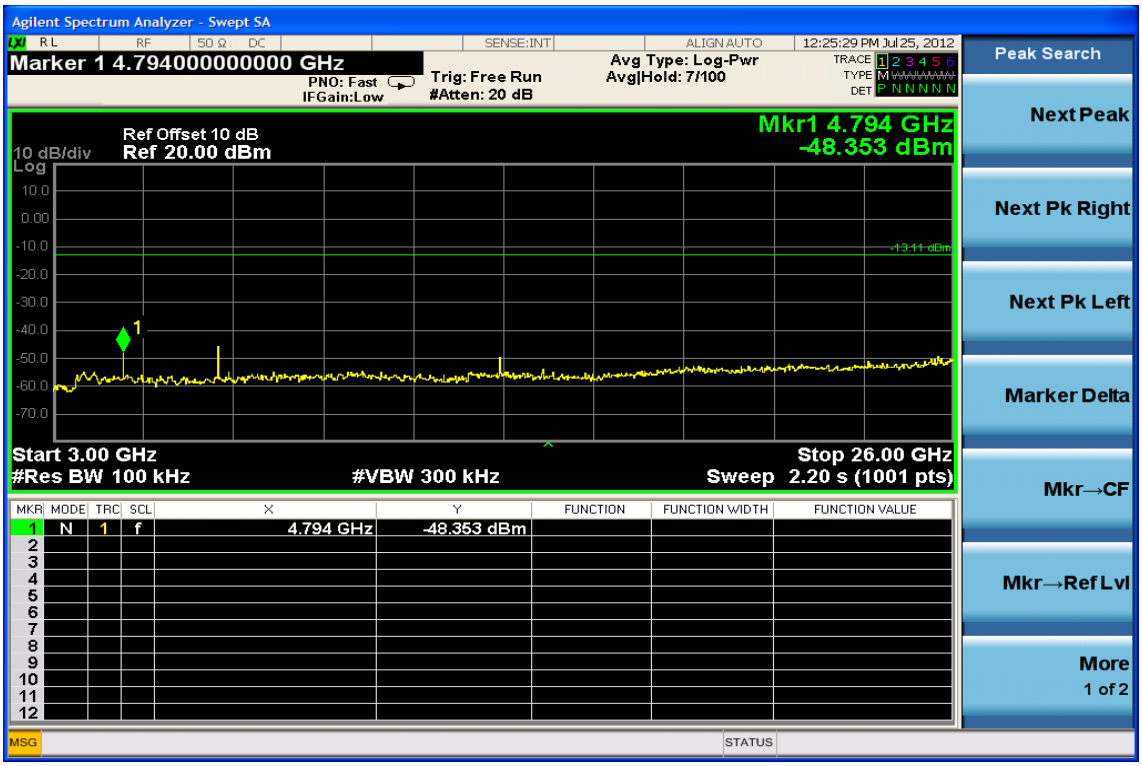
Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

Conducted Spurious Emission Measurement Result (worst case: 8DPSK Mode)

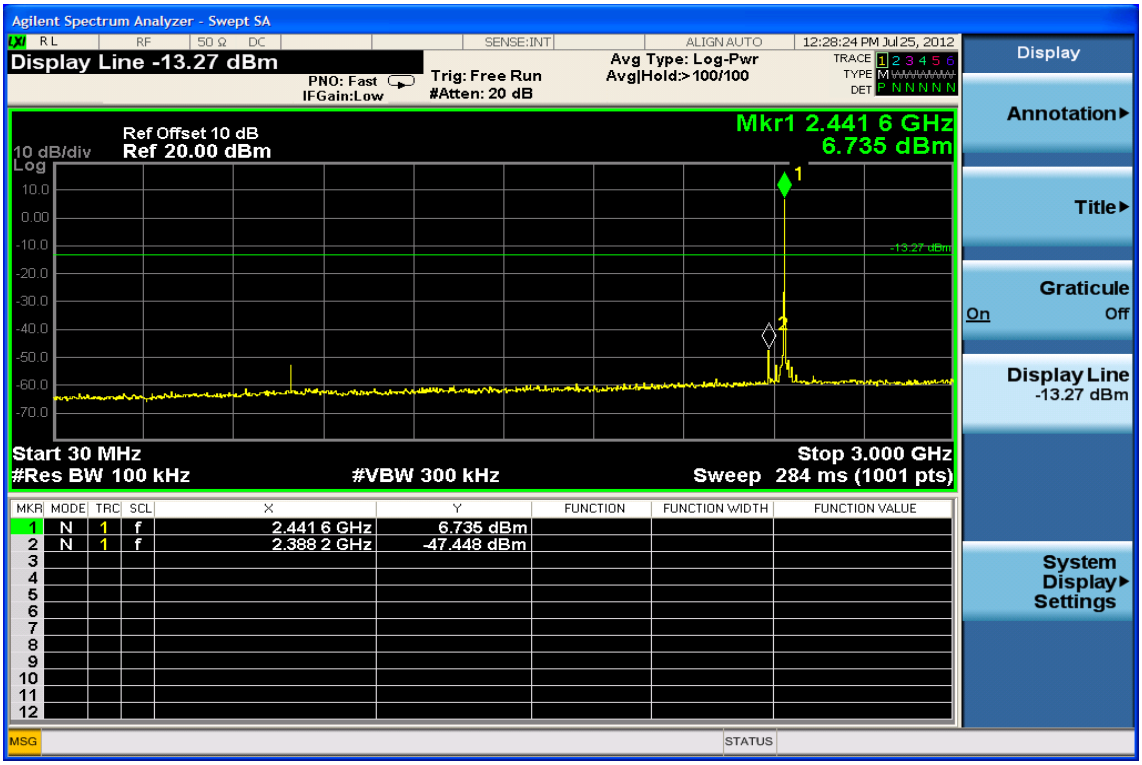
Ch Low 30MHz – 3GHz



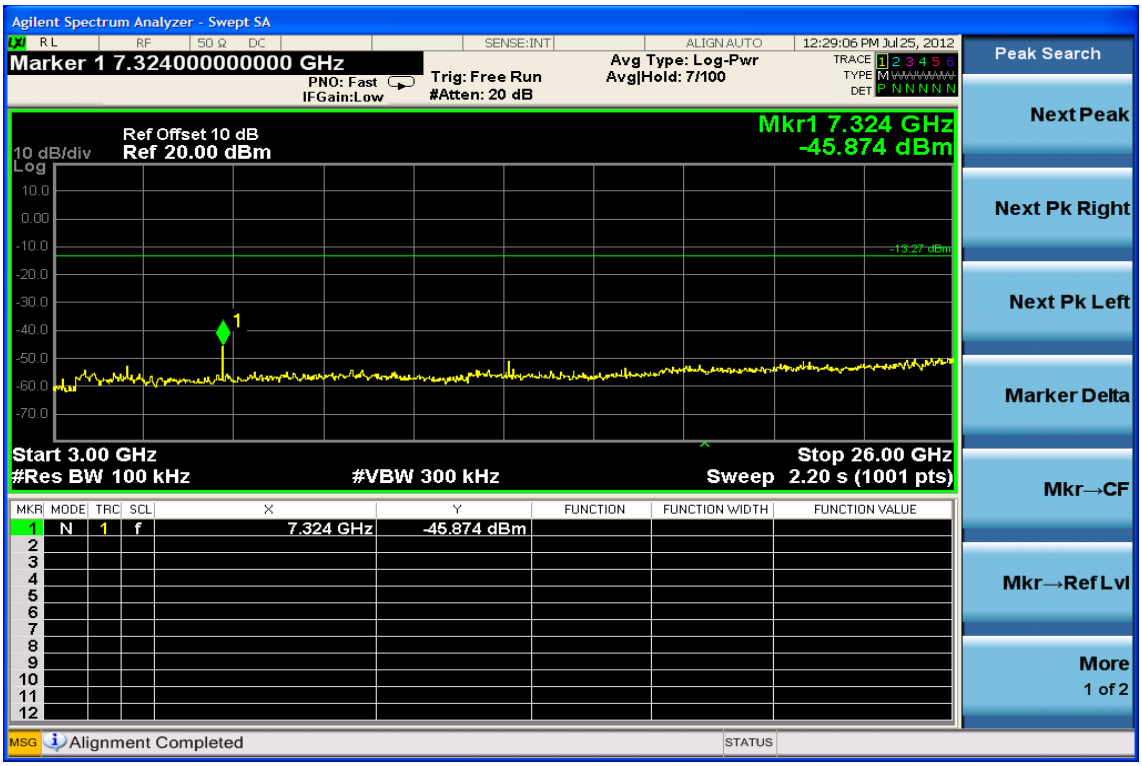
Ch Low 3GHz – 26.5GHz



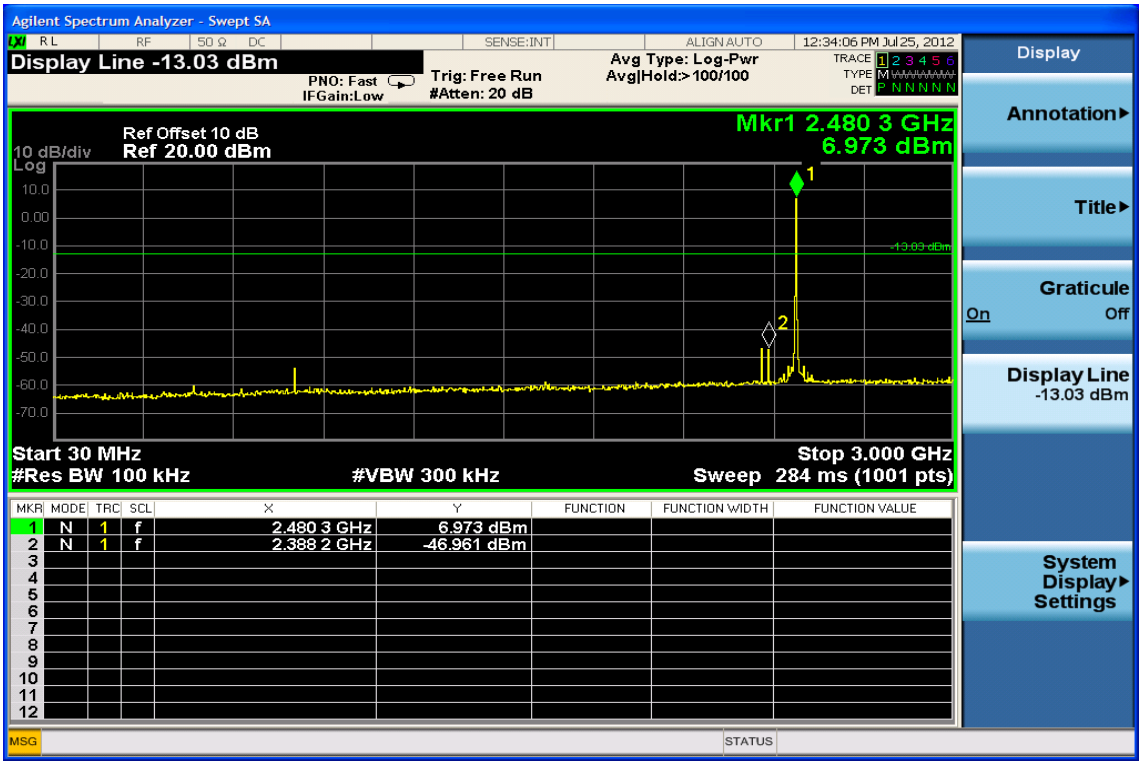
Ch Mid 30MHz – 3GHz



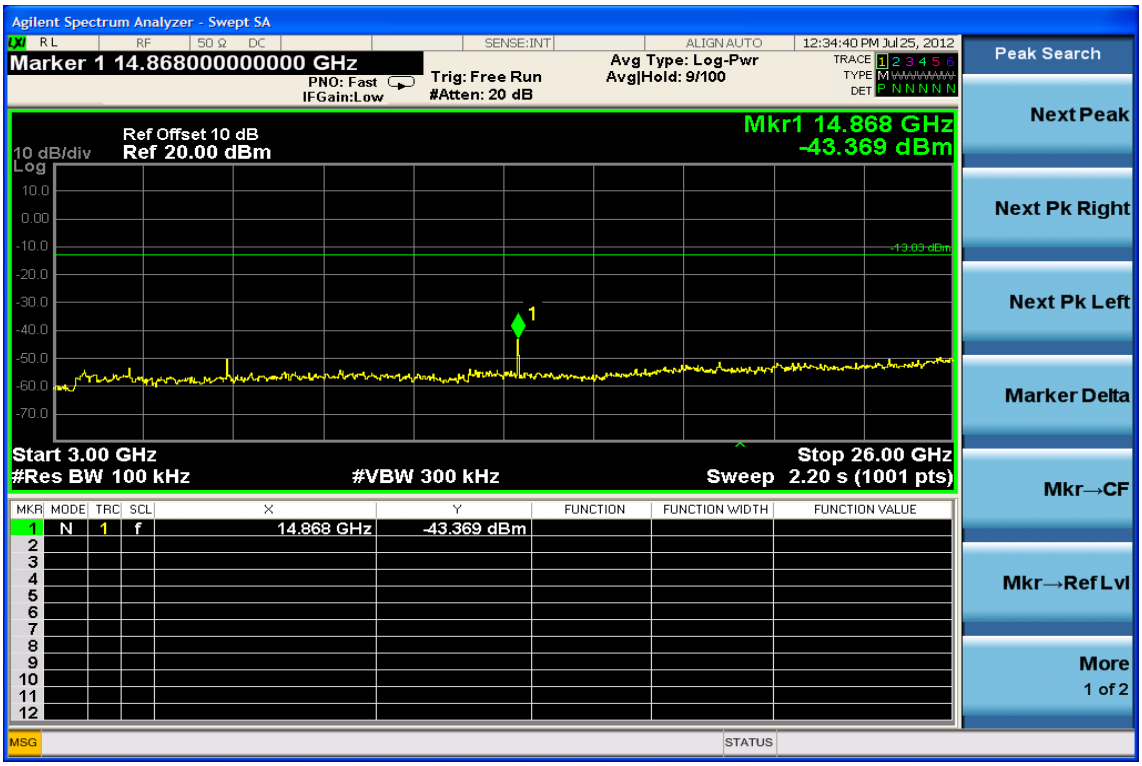
Ch Mid 3GHz – 26.5GHz



Ch High 30MHz – 3GHz



Ch High 3GHz – 26.5GHz



Radiated Spurious Emission Measurement Result: (8DPSK mode, Worst mode)

Radiated Spurious Emission Measurement Result: (below 1GHz)

Operation Mode	TX CH Low	Test Date	2012/07/24
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	91.11	48.10	-17.24	30.86	43.50	-12.64	Peak	VERTICAL
2	240.49	35.87	-13.74	22.13	46.00	-23.87	Peak	VERTICAL
3	283.17	37.22	-12.08	25.14	46.00	-20.86	Peak	VERTICAL
4	352.04	36.01	-10.50	25.51	46.00	-20.49	Peak	VERTICAL
5	844.80	28.14	-4.76	23.38	46.00	-22.62	Peak	VERTICAL
6	940.83	28.95	-3.70	25.25	46.00	-20.75	Peak	VERTICAL
1	54.25	46.92	-18.80	28.12	40.00	-11.88	Peak	HORIZONTAL
2	91.11	47.00	-17.24	29.76	43.50	-13.74	Peak	HORIZONTAL
3	282.20	38.44	-12.09	26.35	46.00	-19.65	Peak	HORIZONTAL
4	398.60	34.80	-9.61	25.19	46.00	-20.81	Peak	HORIZONTAL
5	593.57	31.54	-7.48	24.06	46.00	-21.94	Peak	HORIZONTAL
6	940.83	29.45	-3.70	25.75	46.00	-20.25	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	2012/07/24
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	54.25	46.73	-18.80	27.93	40.00	-12.07	Peak	VERTICAL
2	106.63	44.45	-14.56	29.89	43.50	-13.61	Peak	VERTICAL
3	138.64	46.40	-14.42	31.98	43.50	-11.52	Peak	VERTICAL
4	269.59	38.94	-12.15	26.79	46.00	-19.21	Peak	VERTICAL
5	398.60	35.22	-9.61	25.61	46.00	-20.39	Peak	VERTICAL
6	593.57	30.42	-7.48	22.94	46.00	-23.06	Peak	VERTICAL
1	89.17	48.28	-17.61	30.67	43.50	-12.83	Peak	HORIZONTAL
2	139.61	47.37	-14.48	32.89	43.50	-10.61	Peak	HORIZONTAL
3	269.59	39.97	-12.15	27.82	46.00	-18.18	Peak	HORIZONTAL
4	353.01	38.58	-10.48	28.10	46.00	-17.90	Peak	HORIZONTAL
5	426.73	35.77	-9.40	26.37	46.00	-19.63	Peak	HORIZONTAL
6	950.53	31.37	-3.55	27.82	46.00	-18.18	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	2012/07/24
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	106.63	44.23	-14.56	29.67	43.50	-13.83	Peak	VERTICAL
2	140.58	46.77	-14.54	32.23	43.50	-11.27	Peak	VERTICAL
3	266.68	36.93	-12.10	24.83	46.00	-21.17	Peak	VERTICAL
4	398.60	33.71	-9.61	24.10	46.00	-21.90	Peak	VERTICAL
5	593.57	29.77	-7.48	22.29	46.00	-23.71	Peak	VERTICAL
6	940.83	29.55	-3.70	25.85	46.00	-20.15	Peak	VERTICAL
1	89.17	46.80	-17.61	29.19	43.50	-14.31	Peak	HORIZONTAL
2	147.37	45.87	-14.97	30.90	43.50	-12.60	Peak	HORIZONTAL
3	268.62	36.16	-12.13	24.03	46.00	-21.97	Peak	HORIZONTAL
4	353.01	33.98	-10.48	23.50	46.00	-22.50	Peak	HORIZONTAL
5	450.98	31.31	-9.22	22.09	46.00	-23.91	Peak	HORIZONTAL
6	948.59	30.39	-3.58	26.81	46.00	-19.19	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	2012/07/24
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	43.35	-2.65	40.70	54.00	-13.30	Average	VERTICAL
2	4804.00	66.33	-2.65	63.68	74.00	-10.32	Peak	VERTICAL
1	4804.00	43.43	-2.65	40.78	54.00	-13.22	Average	HORIZONTAL
2	4804.00	67.26	-2.65	64.61	74.00	-9.39	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	2012/07/24
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	42.90	-2.40	40.50	54.00	-13.50	Average	VERTICAL
2	4882.00	67.06	-2.40	64.66	74.00	-9.34	Peak	VERTICAL
1	4882.00	42.75	-2.40	40.35	54.00	-13.65	Average	HORIZONTAL
2	4882.00	66.46	-2.40	64.06	74.00	-9.94	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	2012/07/24
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	41.51	-2.13	39.38	54.00	-14.62	Average	VERTICAL
2	4960.00	63.75	-2.13	61.62	74.00	-12.38	Peak	VERTICAL
1	4960.00	43.64	-2.13	41.51	54.00	-12.49	Average	HORIZONTAL
2	4960.00	64.99	-2.13	62.86	74.00	-11.14	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 (below 1GHz)

Operation Mode	RX CH Low	Test Date	2012/07/24
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	89.17	48.29	-17.61	30.68	43.50	-12.82	Peak	VERTICAL
2	148.34	38.97	-15.03	23.94	43.50	-19.56	Peak	VERTICAL
3	282.20	35.15	-12.09	23.06	46.00	-22.94	Peak	VERTICAL
4	353.01	34.50	-10.48	24.02	46.00	-21.98	Peak	VERTICAL
5	494.63	31.61	-8.81	22.80	46.00	-23.20	Peak	VERTICAL
6	846.74	27.73	-4.74	22.99	46.00	-23.01	Peak	VERTICAL
1	91.11	46.83	-17.24	29.59	43.50	-13.91	Peak	HORIZONTAL
2	148.34	46.28	-15.03	31.25	43.50	-12.25	Peak	HORIZONTAL
3	270.56	37.66	-12.16	25.50	46.00	-20.50	Peak	HORIZONTAL
4	494.63	32.69	-8.81	23.88	46.00	-22.12	Peak	HORIZONTAL
5	593.57	28.86	-7.48	21.38	46.00	-24.62	Peak	HORIZONTAL
6	845.77	28.81	-4.75	24.06	46.00	-21.94	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	RX CH Mid	Test Date	2012/07/24
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	53.28	45.99	-18.61	27.38	40.00	-12.62	Peak	VERTICAL
2	106.63	44.20	-14.56	29.64	43.50	-13.86	Peak	VERTICAL
3	139.61	45.99	-14.48	31.51	43.50	-11.99	Peak	VERTICAL
4	259.89	38.42	-12.01	26.41	46.00	-19.59	Peak	VERTICAL
5	460.68	32.99	-9.13	23.86	46.00	-22.14	Peak	VERTICAL
6	593.57	31.15	-7.48	23.67	46.00	-22.33	Peak	VERTICAL
1	53.28	46.54	-18.61	27.93	40.00	-12.07	Peak	HORIZONTAL
2	90.14	45.96	-17.43	28.53	43.50	-14.97	Peak	HORIZONTAL
3	106.63	43.57	-14.56	29.01	43.50	-14.49	Peak	HORIZONTAL
4	139.61	46.06	-14.48	31.58	43.50	-11.92	Peak	HORIZONTAL
5	398.60	36.10	-9.61	26.49	46.00	-19.51	Peak	HORIZONTAL
6	516.94	37.34	-8.41	28.93	46.00	-17.07	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	RX CH High	Test Date	2012/07/24
Fundamental Frequency	2480MHz	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	53.28	45.91	-18.61	27.30	40.00	-12.70	Peak	VERTICAL
2	106.63	44.32	-14.56	29.76	43.50	-13.74	Peak	VERTICAL
3	147.37	48.76	-14.97	33.79	43.50	-9.71	Peak	VERTICAL
4	269.59	37.77	-12.15	25.62	46.00	-20.38	Peak	VERTICAL
5	496.57	41.68	-8.78	32.90	46.00	-13.10	Peak	VERTICAL
6	593.57	31.05	-7.48	23.57	46.00	-22.43	Peak	VERTICAL
1	54.25	45.80	-18.80	27.00	40.00	-13.00	Peak	HORIZONTAL
2	91.11	46.26	-17.24	29.02	43.50	-14.48	Peak	HORIZONTAL
3	106.63	43.61	-14.56	29.05	43.50	-14.45	Peak	HORIZONTAL
4	140.58	46.82	-14.54	32.28	43.50	-11.22	Peak	HORIZONTAL
5	493.66	35.33	-8.81	26.52	46.00	-19.48	Peak	HORIZONTAL
6	593.57	30.03	-7.48	22.55	46.00	-23.45	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	RX CH Low	Test Date	2012/07/24
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	1847.00	48.78	-13.46	35.32	74.00	-38.68	Peak	VERTICAL
2	4724.00	39.98	-2.92	37.06	74.00	-36.94	Peak	VERTICAL
1	1847.00	46.50	-13.46	33.04	74.00	-40.96	Peak	HORIZONTAL
2	4759.00	37.54	-2.80	34.74	74.00	-39.26	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	RX CH Mid	Test Date	2012/07/24
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	1840.00	45.03	-13.51	31.52	74.00	-42.48	Peak	VERTICAL
2	4605.00	40.12	-3.32	36.80	74.00	-37.20	Peak	VERTICAL
1	1847.00	48.91	-13.46	35.45	74.00	-38.55	Peak	HORIZONTAL
2	5410.00	38.16	-0.93	37.23	74.00	-36.77	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	RX CH High	Test Date	2012/07/24
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	1847.00	50.23	-13.46	36.77	74.00	-37.23	Peak	VERTICAL
2	4941.00	39.54	-2.19	37.35	74.00	-36.65	Peak	VERTICAL
1	1840.00	44.35	-13.51	30.84	74.00	-43.16	Peak	HORIZONTAL
2	4766.00	39.39	-2.78	36.61	74.00	-37.39	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.

According to RSS 210 issue 6, A8.1(b), frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB 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:

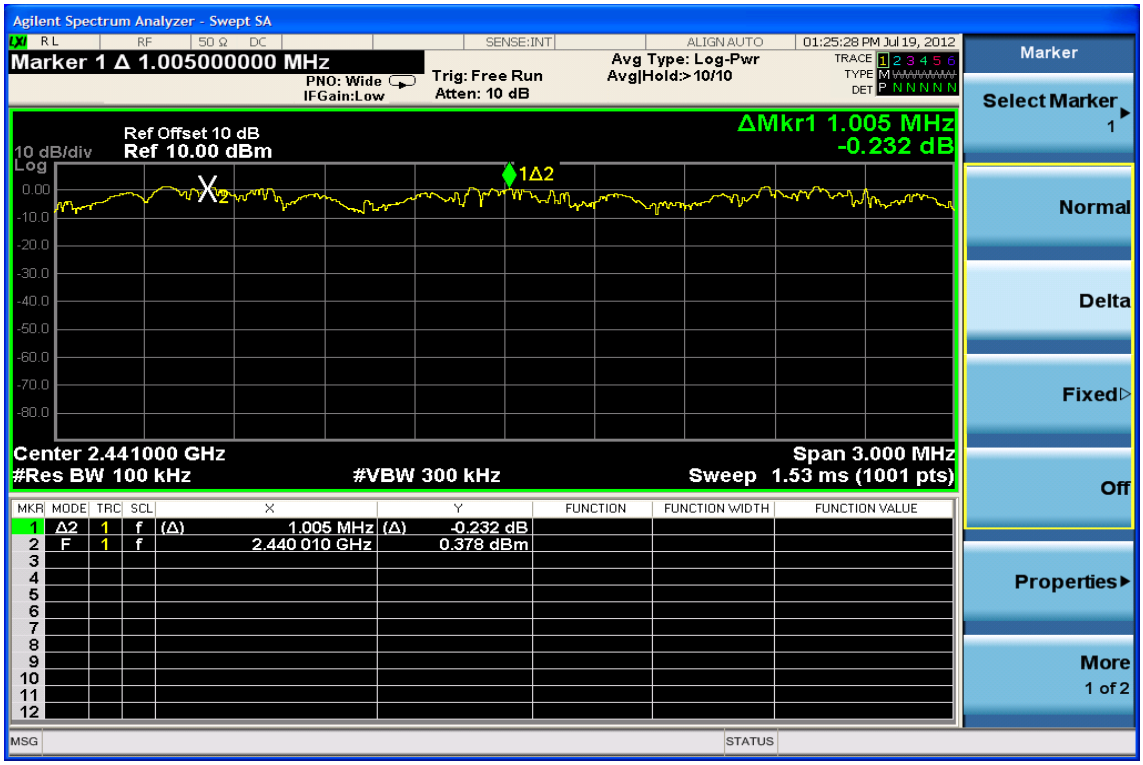
1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = middle of hopping channel .
4. Set the spectrum analyzer as RBW,VBW=100KHz, 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.

According to RSS-210 issue 8,§A8.1(d), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, the maximum conducted output power shall not exceed 1 W. For all other frequency hopping systems, the maximum peak conducted output power shall not exceed 0.125 W.

10.2. Measurement Equipment Used:

Refer to section 6.2 for details.

10.3. Test Set-up:

Refer to section 6.3 for details.

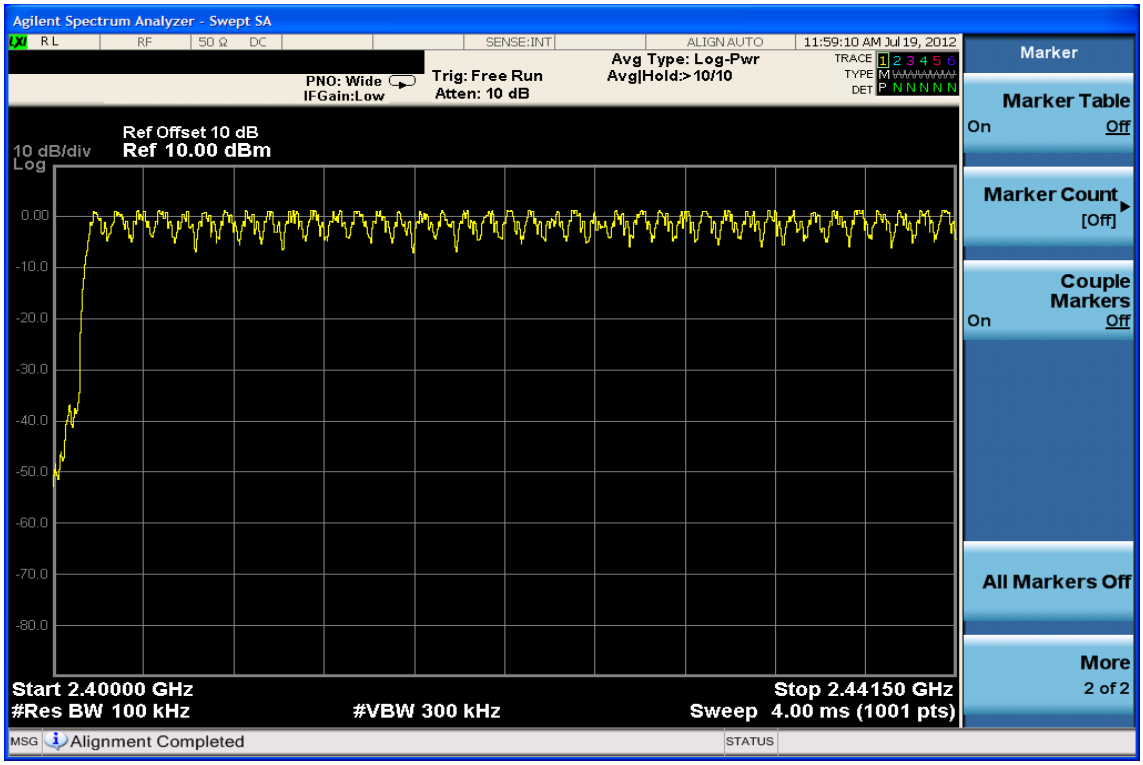
10.4. Measurement Procedure:

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.

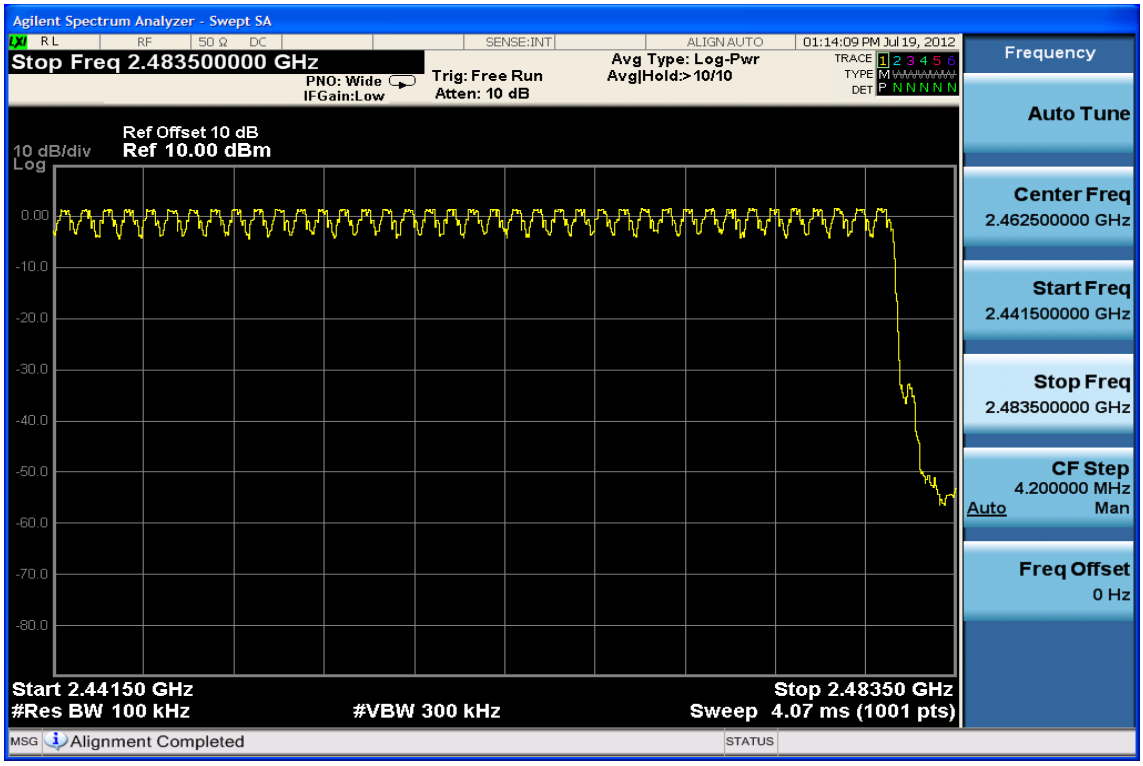
10.5. Measurement Result:

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.

According to RSS-210 issue 8,§A8.1(d), Frequency hopping systems operating in the 2400-2483.5 MHz band shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.

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:

GFSK Mode:

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

CH Low	DH1 time slot	= 0.384 (ms) * (1600/2/79) * 31.6 =	122.88	(ms)
	DH3 time slot	= 1.642 (ms) * (1600/4/79) * 31.6 =	262.72	(ms)
	DH5 time slot	= 2.880 (ms) * (1600/6/79) * 31.6 =	307.20	(ms)
CH Mid	DH1 time slot	= 0.384 (ms) * (1600/2/79) * 31.6 =	122.88	(ms)
	DH3 time slot	= 1.635 (ms) * (1600/4/79) * 31.6 =	261.60	(ms)
	DH5 time slot	= 2.860 (ms) * (1600/6/79) * 31.6 =	305.07	(ms)
CH High	DH1 time slot	= 0.381 (ms) * (1600/2/79) * 31.6 =	121.92	(ms)
	DH3 time slot	= 1.627 (ms) * (1600/4/79) * 31.6 =	260.32	(ms)
	DH5 time slot	= 2.870 (ms) * (1600/6/79) * 31.6 =	306.13	(ms)

π /4 DQPSK Mode:

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

CH Low	DH1 time slot	= 0.282 (ms) * (1600/2/79)	= * 31.6	90.24	(ms)
	DH3 time slot	= 0.900 (ms) * (1600/4/79)	= * 31.6	144.00	(ms)
	DH5 time slot	= 1.522 (ms) * (1600/6/79)	= * 31.6	162.35	(ms)
CH Mid	DH1 time slot	= 0.284 (ms) * (1600/2/79)	= * 31.6	90.88	(ms)
	DH3 time slot	= 0.900 (ms) * (1600/4/79)	= * 31.6	144.00	(ms)
	DH5 time slot	= 1.514 (ms) * (1600/6/79)	= * 31.6	161.49	(ms)
CH High	DH1 time slot	= 0.282 (ms) * (1600/2/79)	= * 31.6	90.24	(ms)
	DH3 time slot	= 0.905 (ms) * (1600/4/79)	= * 31.6	144.80	(ms)
	DH5 time slot	= 1.529 (ms) * (1600/6/79)	= * 31.6	163.09	(ms)

8DPSK mode:

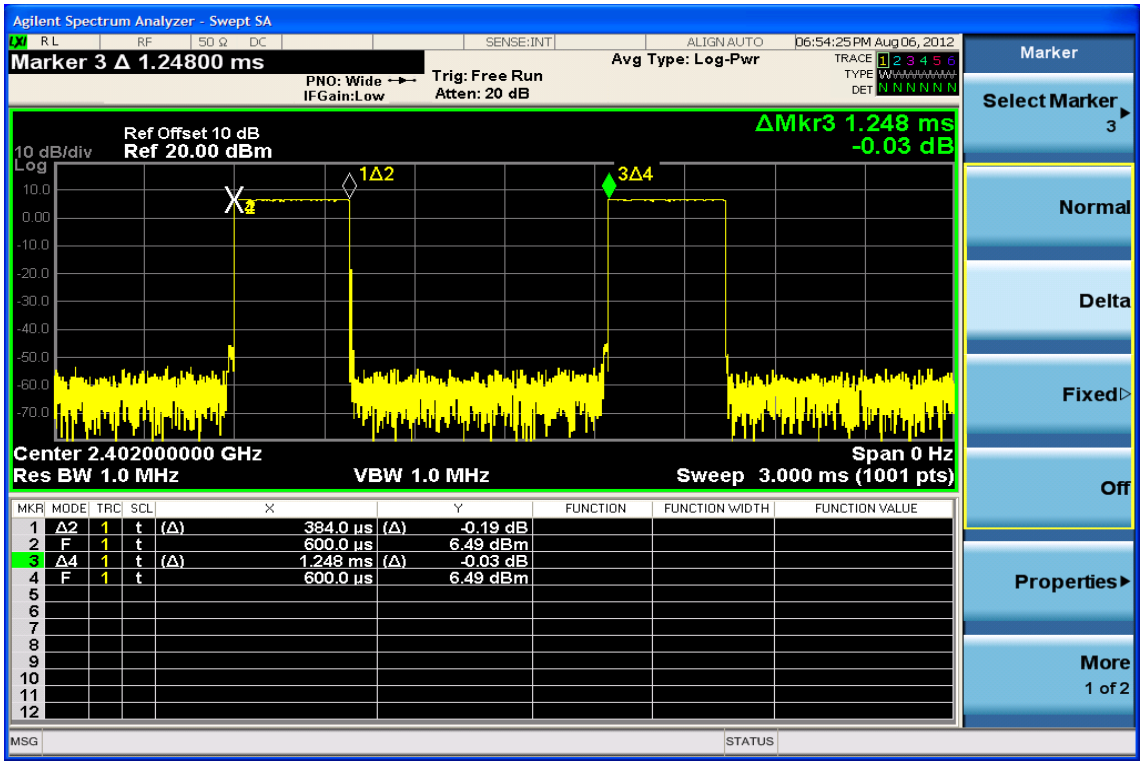
A period time = 0.4 (ms) * 79 = 31.6 (s)

CH Low	DH1 time slot	= 0.242 (ms) * (1600/2/79)	= * 31.6	77.44	(ms)
	DH3 time slot	= 0.655 (ms) * (1600/4/79)	= * 31.6	104.80	(ms)
	DH5 time slot	= 1.060 (ms) * (1600/6/79)	= * 31.6	113.07	(ms)
CH Mid	DH1 time slot	= 0.236 (ms) * (1600/2/79)	= * 31.6	75.52	(ms)
	DH3 time slot	= 0.660 (ms) * (1600/4/79)	= * 31.6	105.60	(ms)
	DH5 time slot	= 1.060 (ms) * (1600/6/79)	= * 31.6	113.07	(ms)
CH High	DH1 time slot	= 0.242 (ms) * (1600/2/79)	= * 31.6	77.44	(ms)
	DH3 time slot	= 0.655 (ms) * (1600/4/79)	= * 31.6	104.80	(ms)
	DH5 time slot	= 1.070 (ms) * (1600/6/79)	= * 31.6	114.13	(ms)

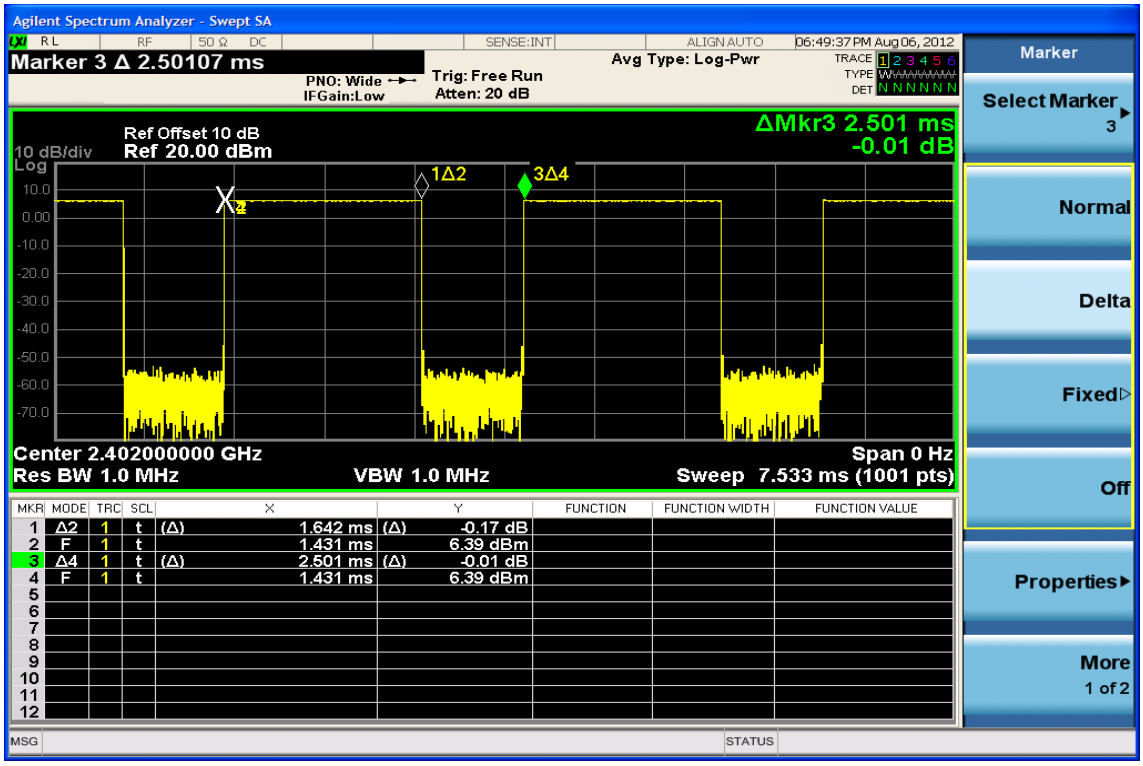
Note: Refer to next page for plots. The worst case was rported.

GFSK Mode: Low Channel

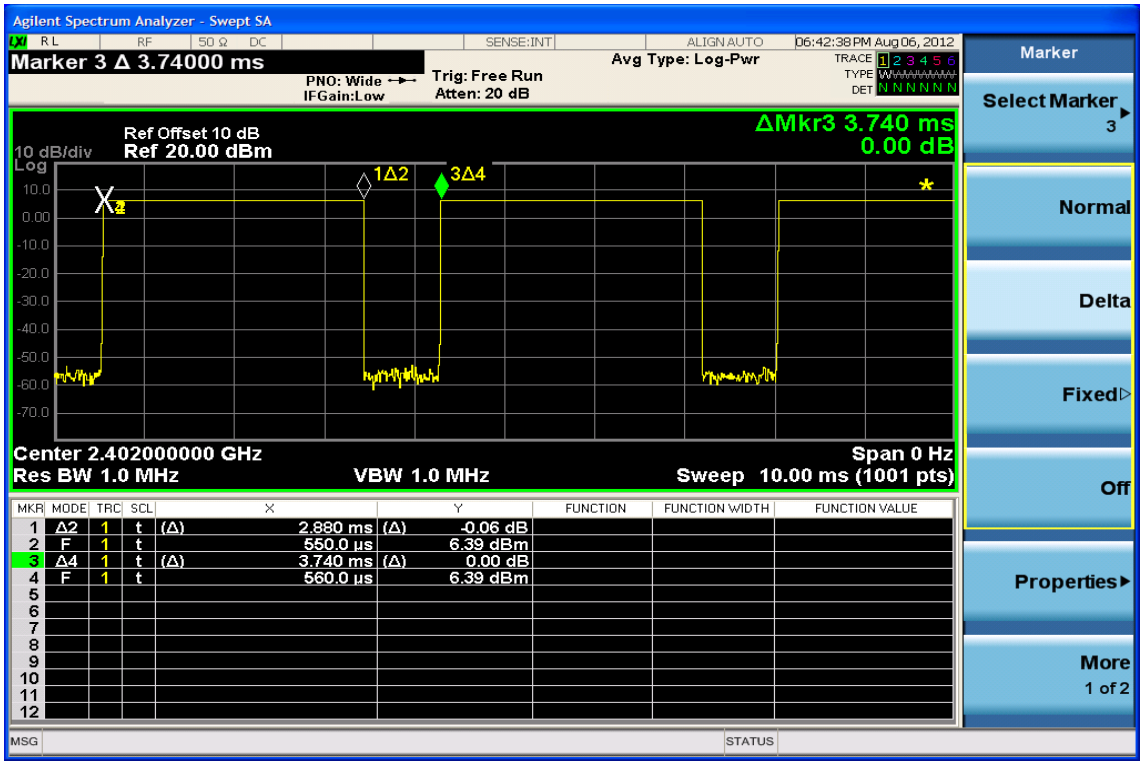
DH1



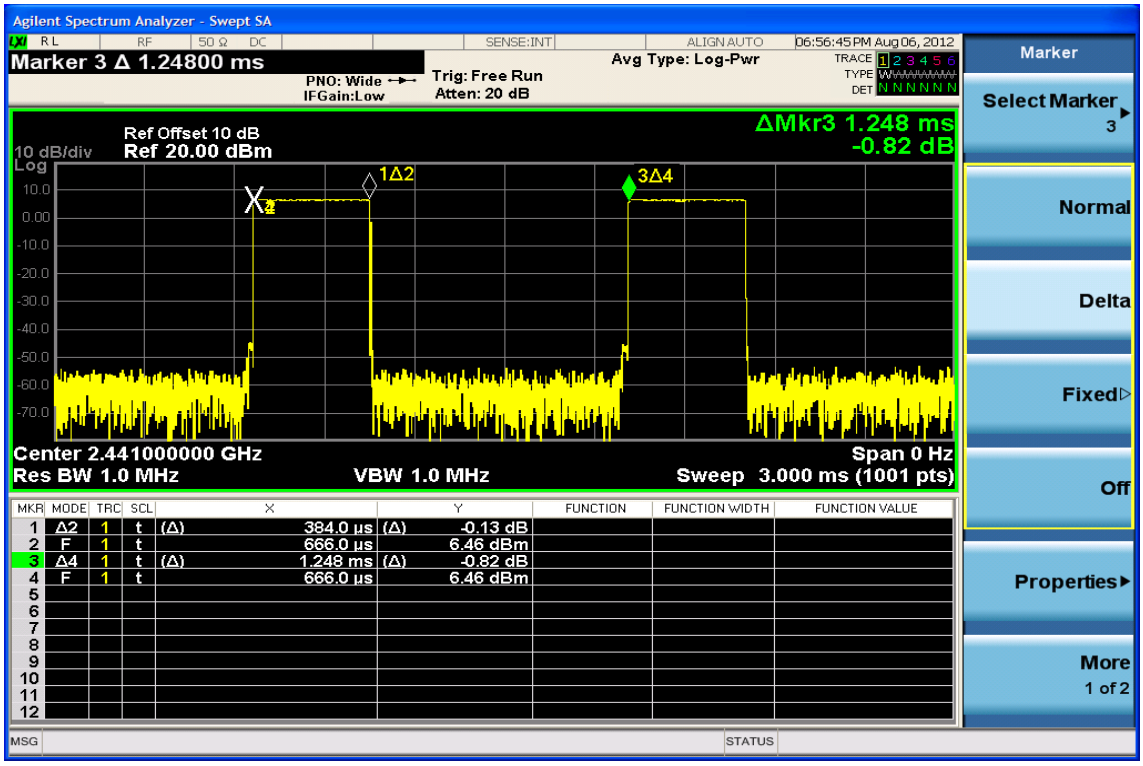
DH3



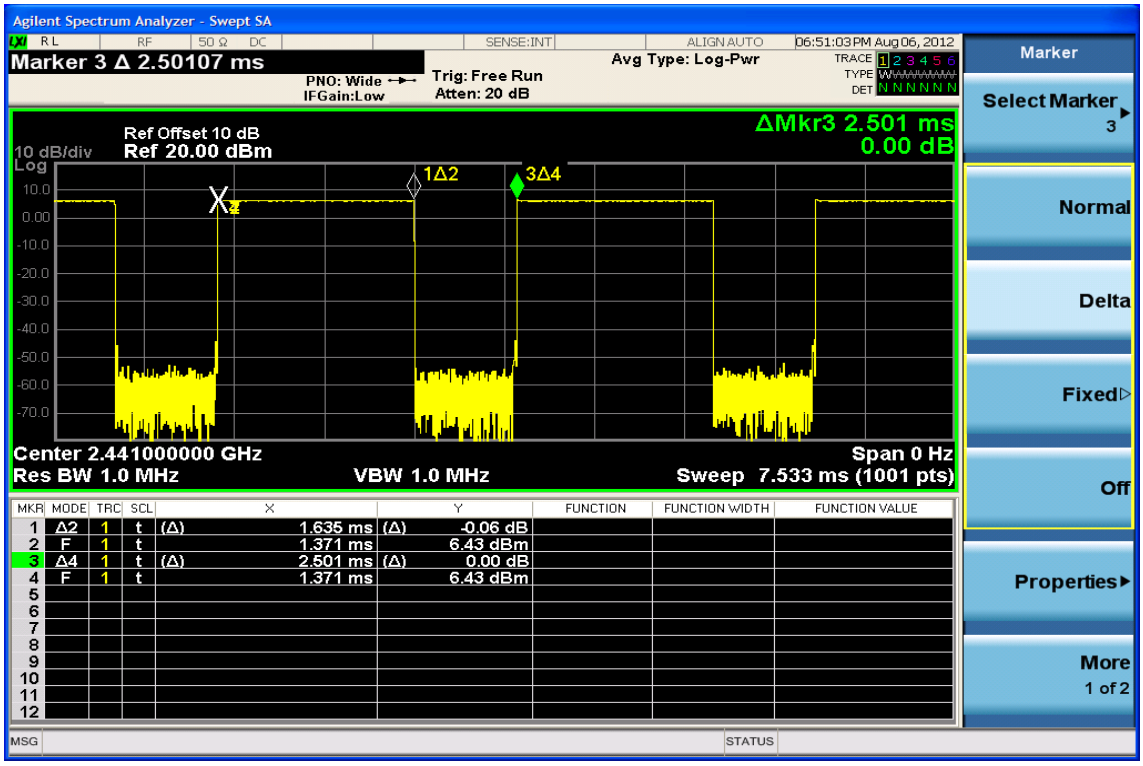
DH5



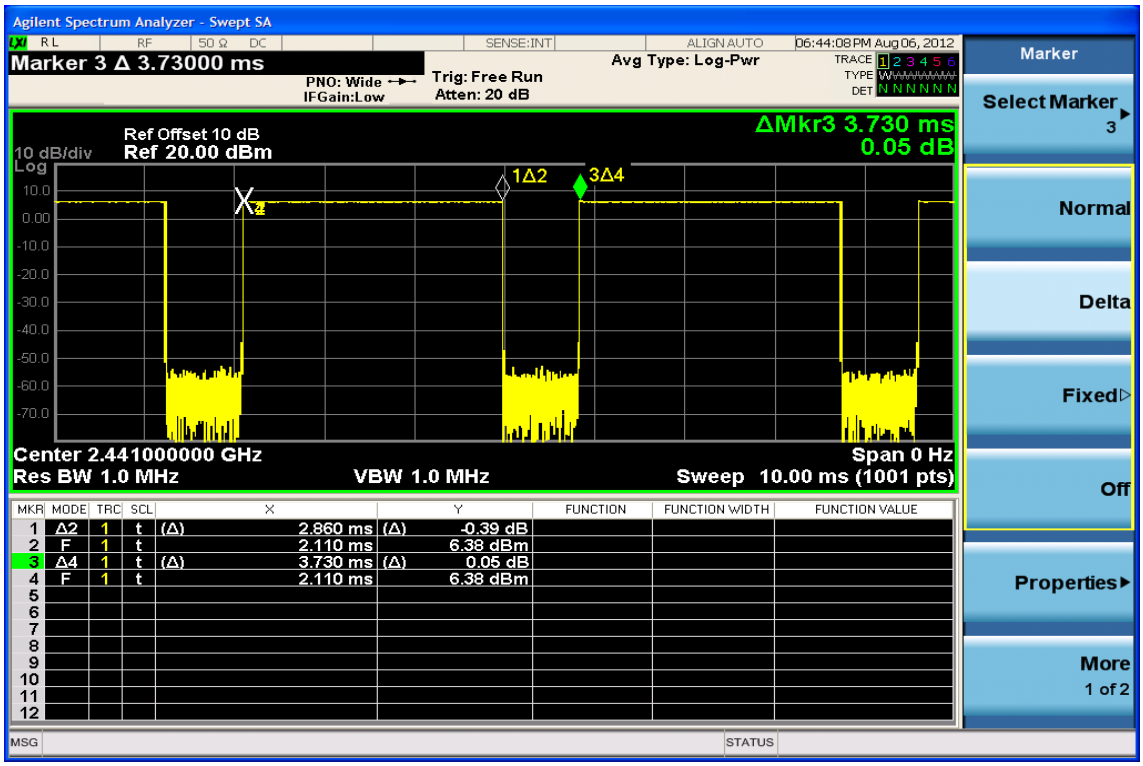
GFSK Mode: Mid Channel
DH1



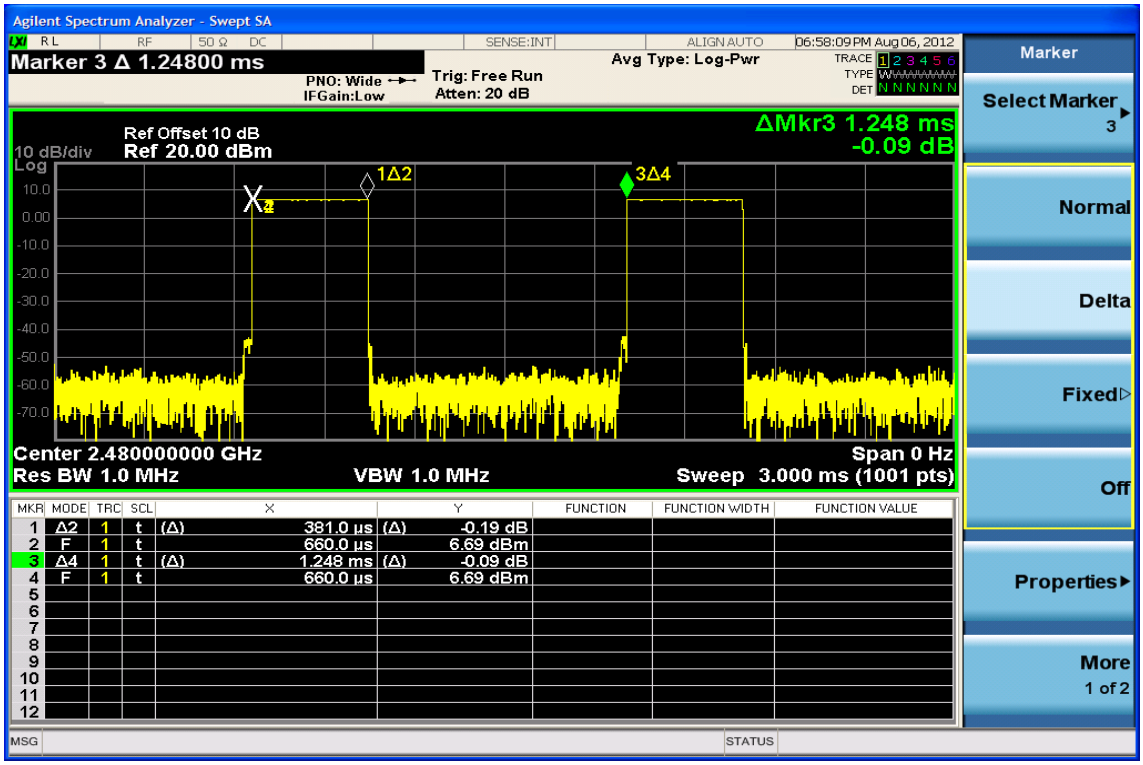
DH3


Agilent Spectrum Analyzer - Swept SA
Marker 3 Δ 2.50107 ms
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
06:51:03 PM Aug 06, 2012
Ref Offset 10 dB
10 dB/div
Ref 20.00 dBm
ΔMkr3 2.501 ms
0.00 dB
Center 2.441000000 GHz
Res BW 1.0 MHz
VBW 1.0 MHz
Span 0 Hz
Sweep 7.533 ms (1001 pts)
1 Δ2 1.635 ms -0.06 dB
2 F 1 1.371 ms 6.43 dBm
3 Δ4 1 2.501 ms 0.00 dB
4 F 1 1.371 ms 6.43 dBm
Marker
Select Marker 3
Normal
Delta
Fixed
Off
Properties
More 1 of 2

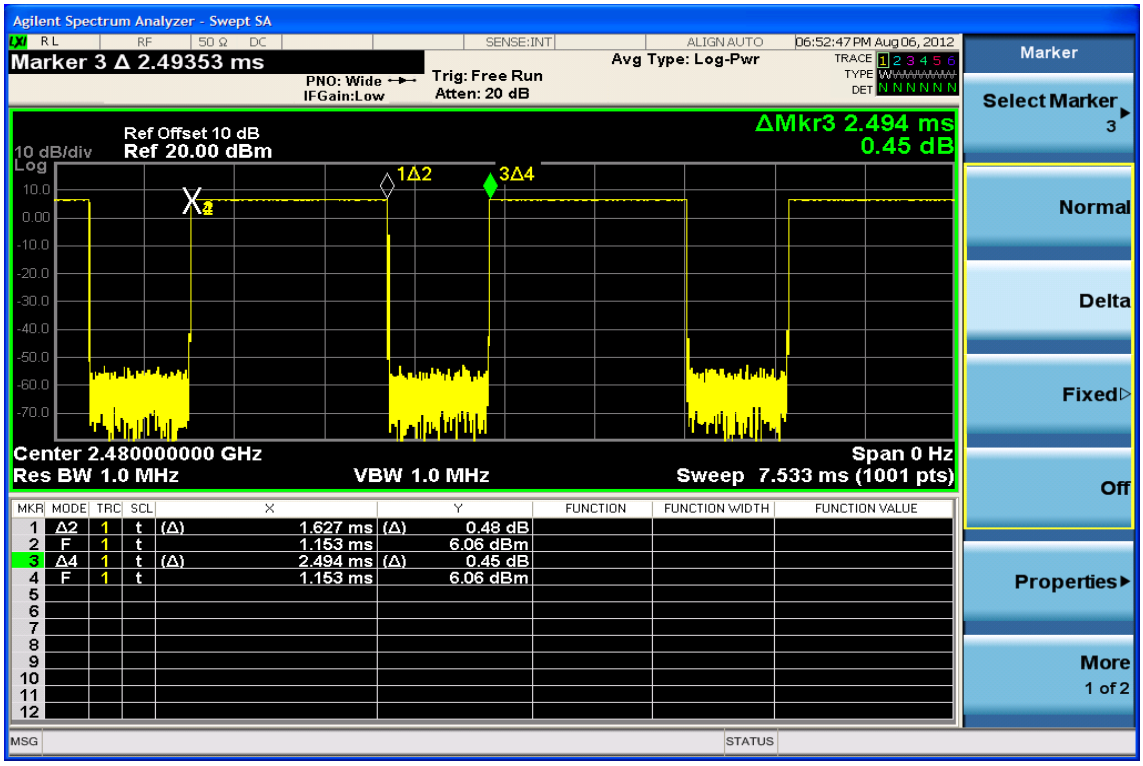
DH5


Agilent Spectrum Analyzer - Swept SA
Marker 3 Δ 3.73000 ms
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
06:44:08 PM Aug 06, 2012
Ref Offset 10 dB
10 dB/div
Ref 20.00 dBm
ΔMkr3 3.730 ms
0.05 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 2.860 ms -0.39 dB
2 F 1 2.110 ms 6.38 dBm
3 Δ4 1 3.730 ms 0.05 dB
4 F 1 2.110 ms 6.38 dBm
Marker
Select Marker 3
Normal
Delta
Fixed
Off
Properties
More 1 of 2

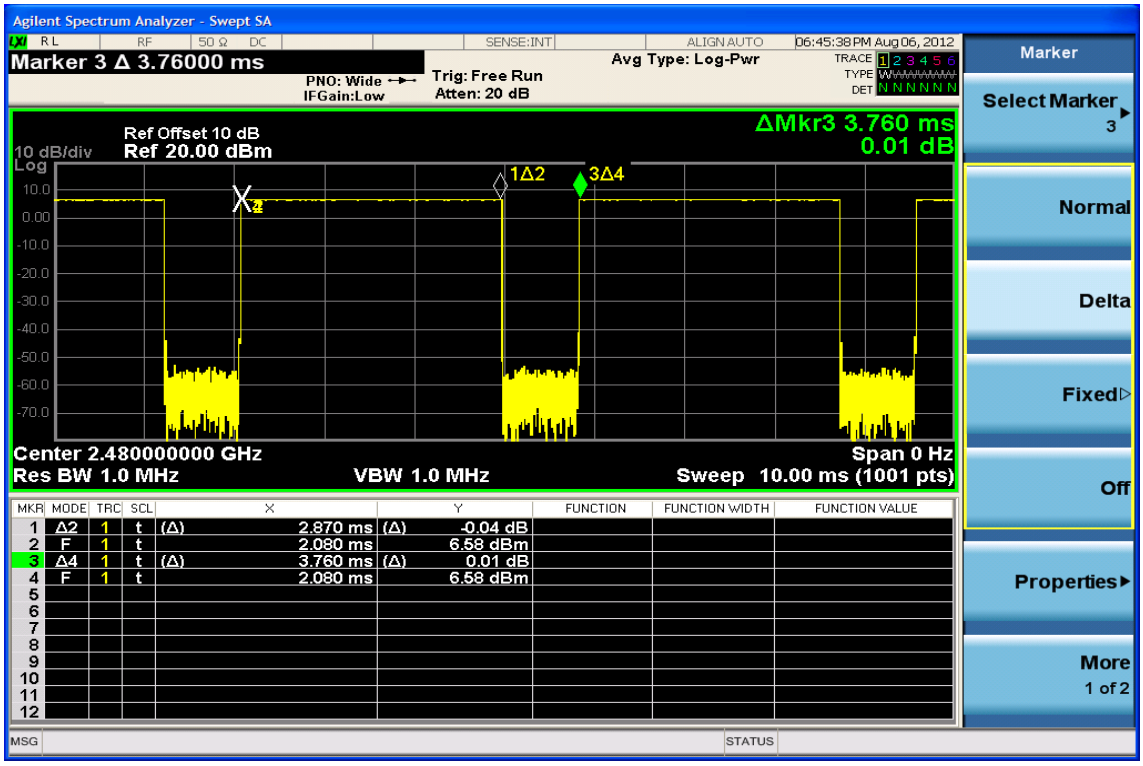
GFSK Mode: High Channel
DH1



DH3



DH5


Agilent Spectrum Analyzer - Swept SA
RL
RF
50 Ω DC
SENSE:INT
ALIGN AUTO
06:45:38 PM Aug 06, 2012
Marker 3 Δ 3.76000 ms
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 20 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE W
DET N N N N N
Ref Offset 10 dB
10 dB/div
Log
Ref 20.00 dBm
ΔMkr3 3.760 ms
0.01 dB
1Δ2
3Δ4
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
Center 2.480000000 GHz
Res BW 1.0 MHz
VBW 1.0 MHz
Span 0 Hz
Sweep 10.00 ms (1001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 Δ2 1 t (Δ) 2.870 ms (Δ) -0.04 dB
2 F 1 t 2.080 ms 6.58 dBm
3 Δ4 1 t (Δ) 3.760 ms (Δ) 0.01 dB
4 F 1 t 2.080 ms 6.58 dBm
5
6
7
8
9
10
11
12
MSG
STATUS
Marker
Select Marker 3
Normal
Delta
Fixed
Off
Properties
More 1 of 2

12. 20dB Bandwidth & 99% Bandwidth

12.1. Standard Applicable:

According to §15.247(a)(1),and RSS210 A8.1(b) 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:

GFSK Mode

CH	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
Lower	891.7	798.35
Mid	882.0	811.72
Higher	886.4	827.93

II /4 DQPSK Mode

CH	20dB Bandwidth (MHz)	2/3 20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Lower	1.282	0.855	1.163
Mid	1.26	0.840	1.159
Higher	1.276	0.851	1.165

8DPSK Mode

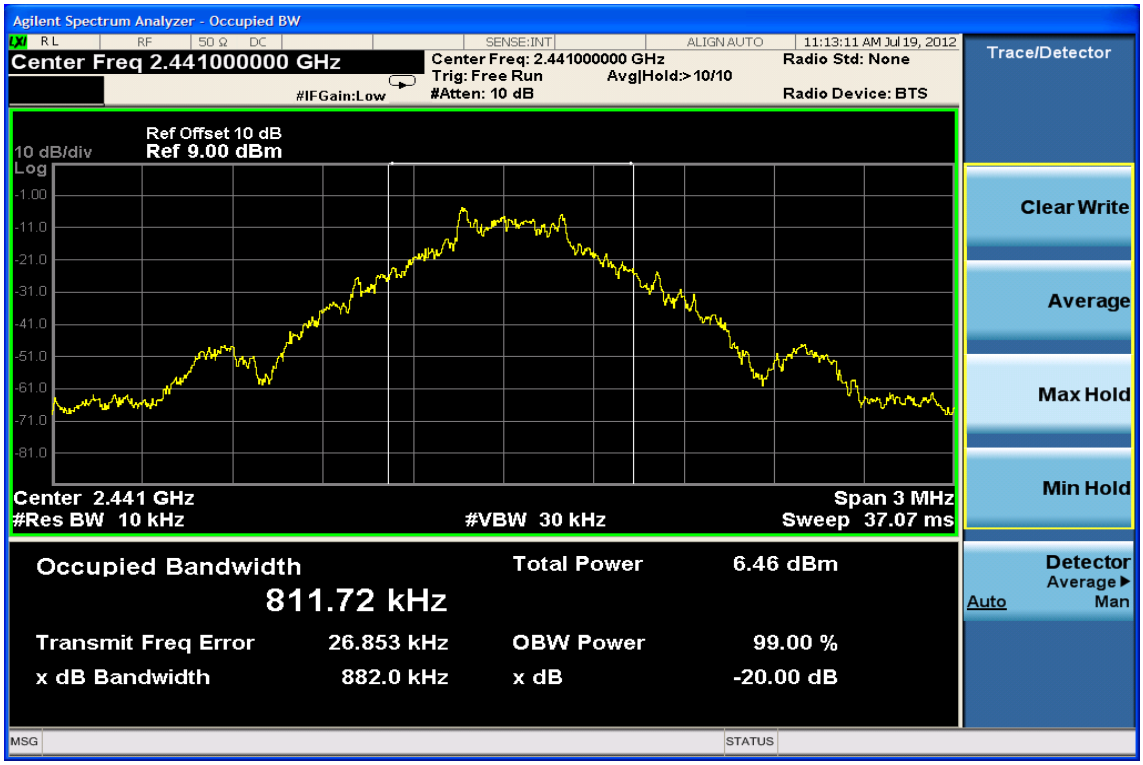
CH	20dB Bandwidth (MHz)	2/3 20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Lower	1.293	0.862	1.191
Mid	1.282	0.855	1.194
Higher	1.294	0.863	1.199

Note: Refer to next page for plots.

GFSK Mode

99% & 20dB Bandwidth Test Data CH-Low

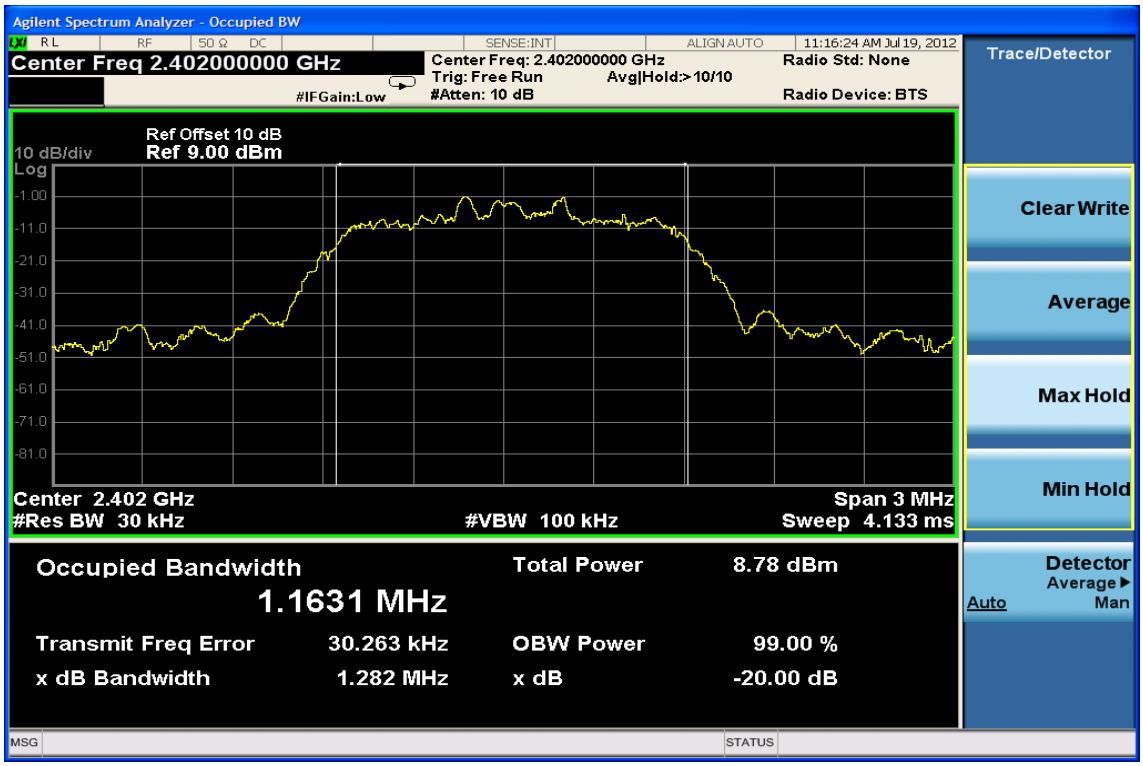
99% & 20dB Bandwidth Test Data CH-Mid



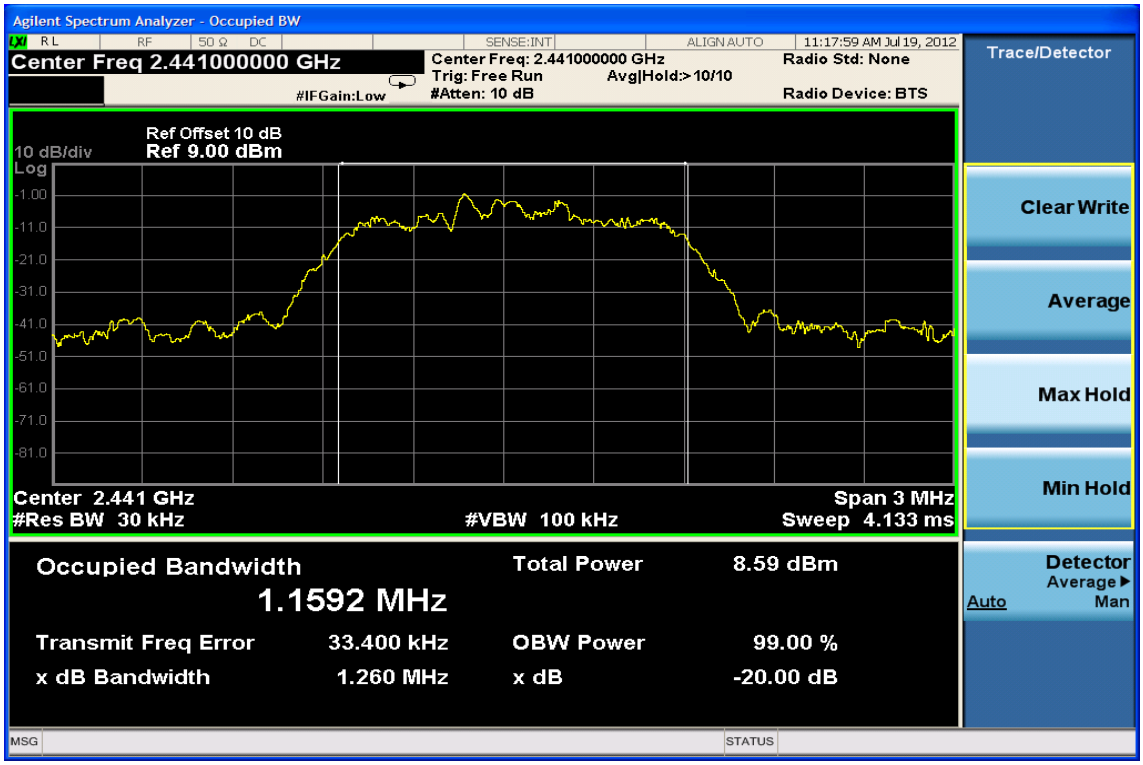
99% & 20dB Bandwidth Test Data CH-High

II /4 DQPSK *Mode*

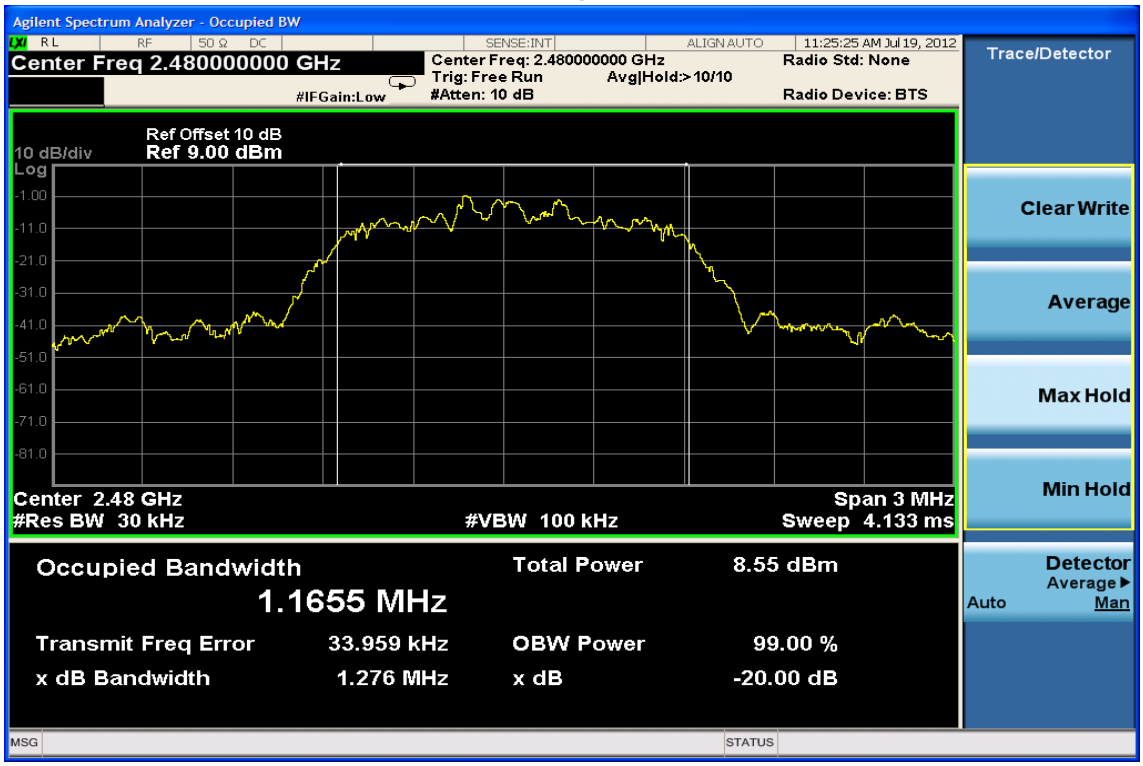
99% & 20dB Bandwidth Test Data CH-Low



99% & 20dB Bandwidth Test Data CH-Mid

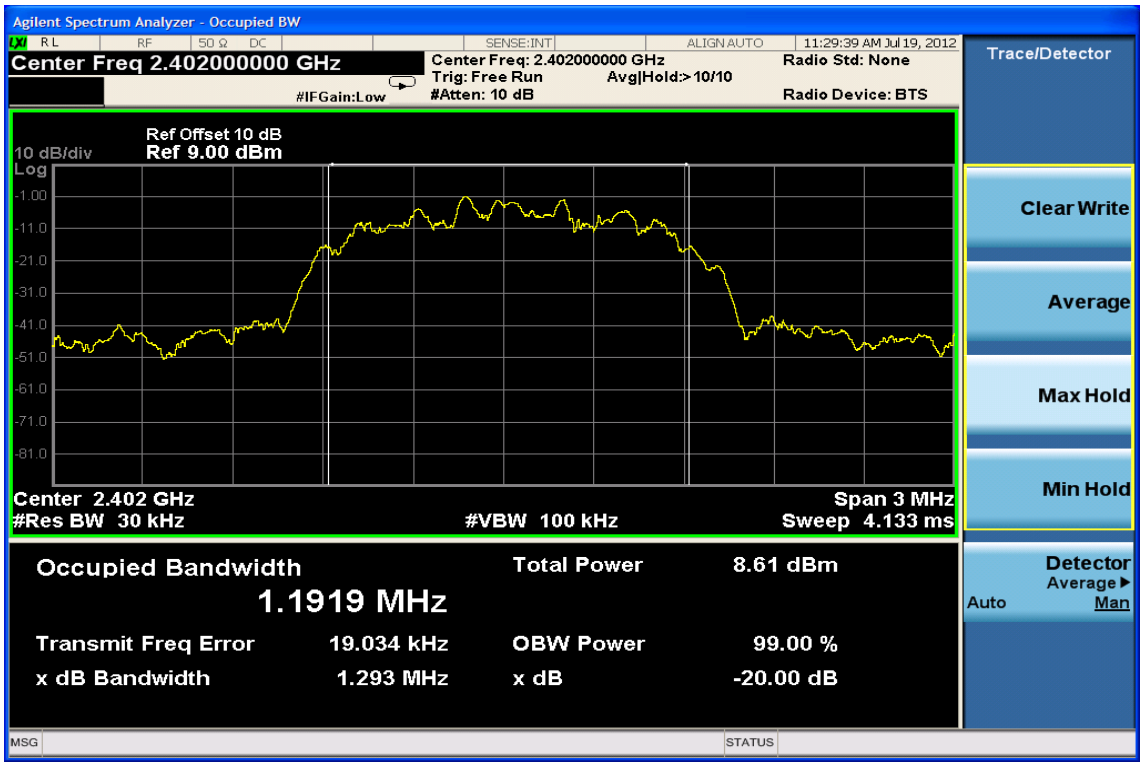


99% & 20dB Bandwidth Test Data CH-High

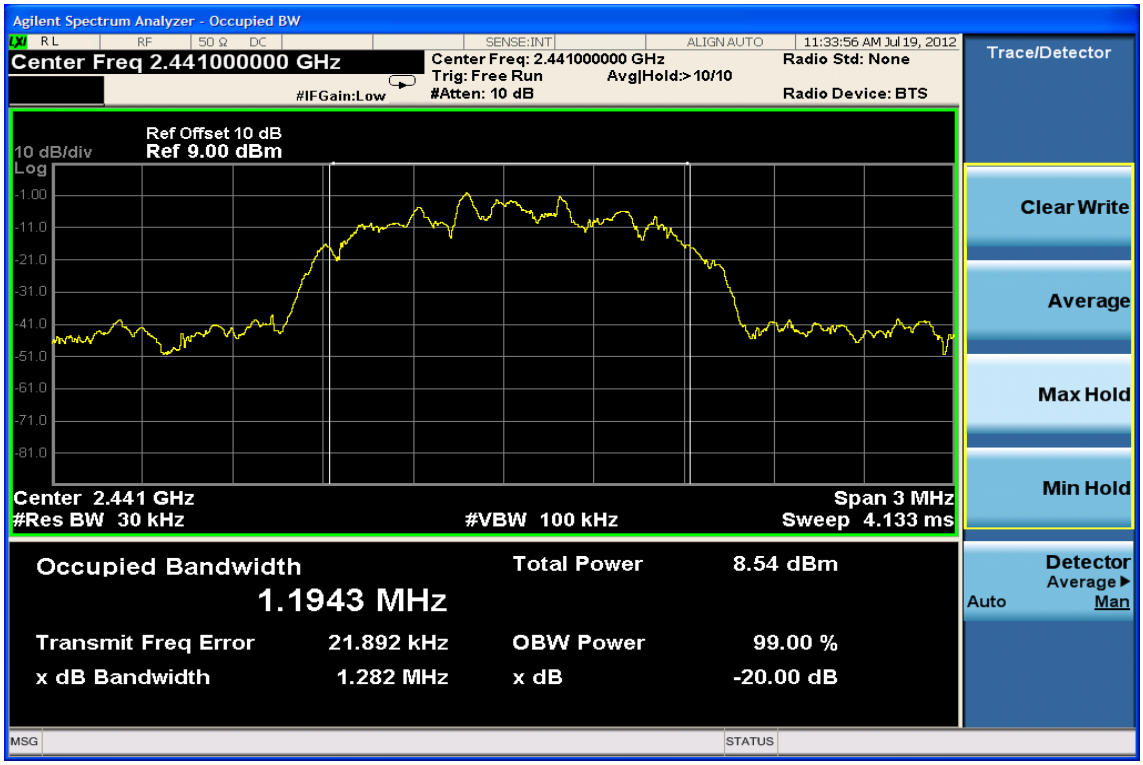


8DPSK Mode

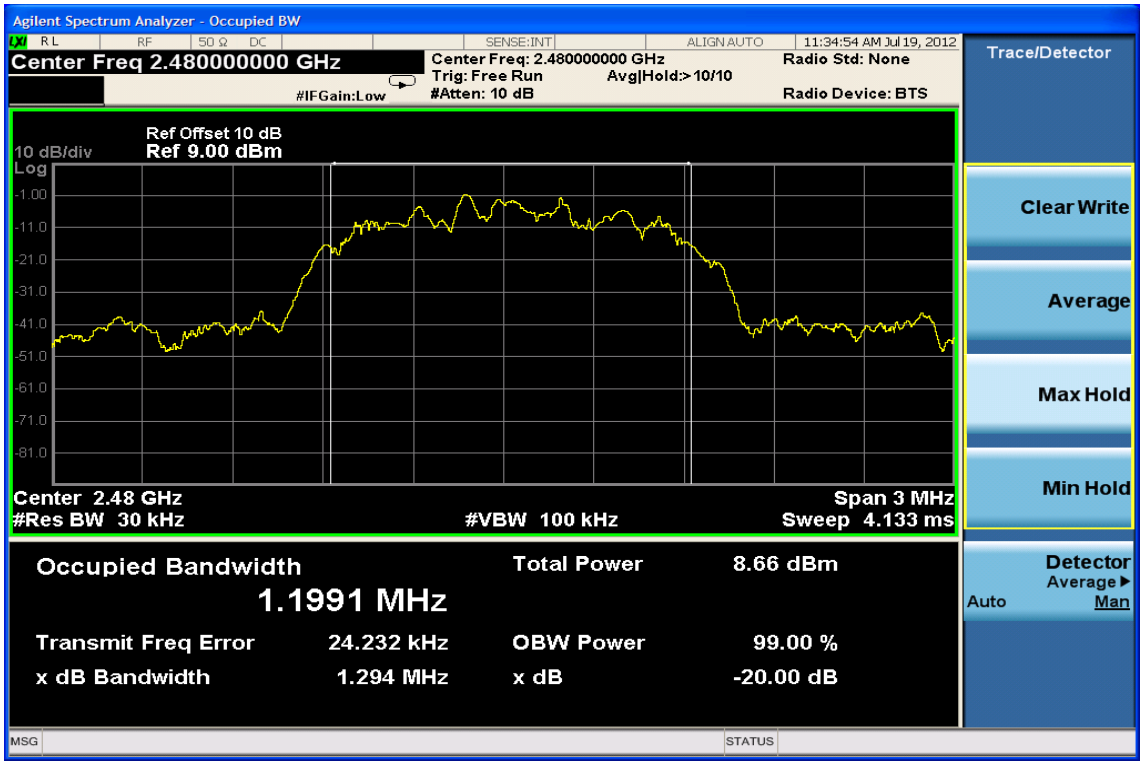
99% & 20dB Bandwidth Test Data CH-Low



99% & 20dB Bandwidth Test Data CH-Mid



99% & 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.

According to RSS-GEN 7.1.4, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest-gain antenna of each combination of transmitter and antenna type for which certification is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type and having equal or lesser gain as an antenna that had been successfully tested for certification with the transmitter, will also be considered certified with the transmitter, and may be used and marketed with the transmitter. The manufacturer shall include with the application for certification a list of acceptable antenna types to be used with the transmitter.

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer. Any antenna gain in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power before using the power limits specified in RSS-210 or RSS-310 for devices of RF output powers of 10 milliwatts or less. For devices of output powers greater than 10 milliwatts, except devices subject to RSS-210 Annex 8 (Frequency Hopping and Digital Modulation Systems Operating in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz Bands) or RSS-210 Annex 9 (Local Area Network Devices), the total antenna gain shall be added to the measured RF output power before using the specified power limits. For devices subject to RSS-210 Annex 8 or Annex 9, the antenna gain shall not be added.

13.2. Antenna Connected Construction:

The directional gains of antenna used for transmitting is 2dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Please see EUT photo for details.

14. RF EXPOSURE (MPE)

14.1. Standard Applicable

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

This is a Mobile device, the MPE is required.

FCC RF Exposure: §1.1310 and §2.1091

Limits for Maximum Permissive Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	F/1500	30
1500-15000	/	/	1.0	30

F = frequency in MHz

* = Plane-wave equipment power density

IC Exemption from Routine Evaluation Limits – RF Exposure Evaluation: RSS 102 Issue 4, section2.5.2

RF exposure evaluation is required if the separation distance between the user and the device's radiating element is greater than 20 cm, except when the device operates as follows:

above 1.5 GHz and the maximum e.i.r.p. of the device is equal to or less than 5 W.

14.2. Result:

The Measured Max. peak output power is 10.08dBm (10.185mW) refer to section 6.5.

MPE Prediction

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S=PG/4\pi R^2$

Where: S = Power density

P = Power input to antenna

G = Power gain of the antenna in the direction of interest relative to an isotropic radiator

R = Distance to the center of radiation of the antenna

Maximum Peak output power at antenna input terminal:	11.01	(dBm)
Maximum Peak output power at antenna input terminal:	12.61827535	(mW)
Duty cycle:	100	(%)
Maximum Pav :	12.61827535	(mW)
Antenna gain (typical):	2	(dBi)
Maximum antenna gain:	1.584893192	(numeric)
Prediction distance:	20	(cm)
Prediction frequency:	2402	(MHz)
MPE limit for uncontrolled exposure at prediction	1	(mW/cm2)
Power density at predication frequency at 20 (cm)	0.0039806	(mW/cm^2)

The predicted power density level at 20 cm is 0.00398 mW/cm^2. This is below the uncontrolled exposure limit of 1 mW/cm^2 at 2402MHz.