

FCC 47 CFR PART 15 SUBPART C

TEST REPORT

For

Bluetooth Module

Model: AB5C1

Trade Name: AIRcable SMD

Issued to

**Wireless Cables Inc.
3410 Bowman Ct., Santa Cruz, CA 95065, USA**

Issued by

**Telecom Technology Center
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1. TEST RESULT CERTIFICATION

Applicant: Wireless Cables Inc.
3410 Bowman Ct., Santa Cruz, CA 95065, United States

Equipment Under Test: Bluetooth Module

Trade Name: AIRcable SMD

Model: AB5C1

Date of Test: February 08 ~ 26, 2010

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 15 Subpart C	No non-compliance noted

We hereby certify that:

The above equipment was tested by Telecom Technology Center. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4: 2003 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.247.

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

Approved by:

Reviewed by:




Jerry Tsai
Associate Researcher
Telecom Technology Center.

Robert Huang
Engineer
Telecom Technology Center.

2. EUT DESCRIPTION

Product	Bluetooth Module
Trade Name	AIRcable SMD
Model Number	AB5C1
Model Discrepancy	N/A
Frequency Range	2402 ~ 2480 MHz
Transmit Power	18.91 dBm
Modulation Technique	GFSK for 1Mbps; $\pi/4$ -DQPSK for 2Mbps; 8DPSK for 3Mbps
Transmit Data Rate	1Mbps
Number of Channels	79 Channels
Antenna Specification	ANT2400Q9P:Dipole Antenna / Gain:9dBi ANT2400D18W:Directional Patch Antenna / Gain:18dBi

Remark:

1. *The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.*
2. *This submittal(s) (test report) is intended for FCC ID: SQCAB5C1 filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.*

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, 15.207, 15.209 and 15.247.

3.1 EUT CONFIGURATION

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

3.2 EUT EXERCISE

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

According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

3.3 GENERAL TEST PROCEDURES

Conducted Emissions

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

Radiated Emissions

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

3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

- (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	(²)
13.36 - 13.41	322 - 335.4		

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

² Above 38.6

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

3.5 DESCRIPTION OF TEST MODES

The EUT (model: AB5C1) had been tested under operating condition.

Test program used to control the EUT for staying in continuous transmitting mode was programmed.

During the preliminary test, GFSK, $\pi/4$ -QPSK & 8DPSK with DH1 were pre-tested and found that 8DPSK emits the highest output power. Then the tests were carried on with DH1 compare to DH3 & DH5 and found that 8DPSK with DH5 emit the highest output power, and therefore had been tested under operating condition.

Following channels were selected for the for radiated emission testing only as listed below:

Tested Channel	Modulation Type	Packet Type	Date Rate
Low, Mid, High	GFSK	DH 5	1
Low, Mid, High	8DPSK	DH 5	3

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz, which worst case was in normal link mode only.

Channel Low (2402MHz) 、 Mid (2441MHz) and High (2480MHz) with 1Mbps data rate were chosen for full testing.

4. INSTRUMENT CALIBRATION

4.1 MEASURING INSTRUMENT CALIBRATION

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

4.2 MEASUREMENT EQUIPMENT USED

Equipment Used for Emissions Measurement

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

Conducted Emissions Test Site				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
PSA Series Spectrum Analyzer	Agilent	E4446A	MY46180362	09/01/2010

Open Area test Site				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
PSA Series Spectrum Analyzer	Agilent	E4446A	MY46180362	09/01/2010
EMI Test Receiver	R&S	ESCI	100649	08/28/2010
Horn Antenna	Schwarz beck	9120D	609	07/29/2010
Horn Antenna	Schwarz beck	BBHA 9170	BBHA 9170353	07/29/2010
Bilog Antenna	Schaffner Chase	CBL6112B	2930	07/16/2010
Pre-Amplifier	Agilent	8449B	3008A02349	07/03/2010
Pre-Amplifier	Agilent	8447D	944A11029	12/30/2010
Pre-Amplifier	QTK	AP-025C0	71919	07/29/2010
CABLE	SUHNER	SUCOFLEX 106	32051-2-29080-15M	02/12/2010
CABLE	SUHNER	SUCOFLEX 104	63984/6/6	02/12/2010
Test S/W	E3			

Remark: The measurement uncertainty is less than $\pm 2.0065\text{dB}$ (30MHz ~ 1GHz), $\pm 3.0958\text{dB}$ (Above 1GHz) which is evaluated as per the NAMAS NIS 81 and CISPR/A/291/CDV.

Power line Conducted Emissions Test Site				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
LISN	Narda S.T.S	PMM L3-32	0120J70103	05/12/2010
LISN	Narda S.T.S	PMM L3-32	0120X90110	07/15/2010
EMI Test Receiver	R&S	ESCI	100649	08/28/2010
Pulse Limiter	R&S	ESH3-Z2	100611	10/22/2010
Test S/W	E3			

Remark: The measurement uncertainty is less than $\pm 2.81\text{dB}$, which is evaluated as per the NAMAS NIS 81 and CISPR/A/291/CDV.

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

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

- 5FL., No.86, Luke 5th Rd., Lujhu Shiang, Kaohsiung County 821, Taiwan (R.O.C.)
Tel: 886-7-695-5001 / Fax: 886-7-695-5019
- 4FL., No.300, Yang Guang St., Neihu Dist., Taipei City 114, Taiwan (R.O.C.)
Tel: 886-2-2658-9958 / Fax: 886-2-2658-9766
- No.5-24, Rueishu Keng, Rueiping Tsuen, Linkou Shiang, Taipei County, Taiwan
(R.O.C.) (10m OATS)

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

5.2 EQUIPMENT

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

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

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

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

5.3 TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	FCC	3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements	 452746
Canada	Industry Canada	RSS212, Issue 1	 8387A
Taiwan	TAF	EN 300 328-1, EN 300 328-2, EN 300 220-1, EN 300 220-2, EN 300 220-3, 47 CFR FCC Part 15 Subpart C, EN 61000-3-2, EN 61000-3-3, CNS 13439, CNS 13783-1, CNS 14115, CNS 13438, AS/NZS CISPR 22, CNS 13022-1, IEC 61000-4-2/3/4/5/6/8/11, CNS 13022-2/3	
Taiwan	BSMI	CNS 13438, CNS 13783-1, CNS 13439, CNS 14115	 SL2-IN-E-0047 SL2-R1/R2-E-0047

6. SETUP OF EQUIPMENT UNDER TEST

6.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

6.2 SUPPORT EQUIPMENT

No.	Device Type	Brand	Model	Series No.	FCC ID	Data Cable	Power Cord
1.	Notebook PC	DELL	PP16S	WT908 A01	FCC DOC	LAN Cable: Unshielded 1.5m Line Cable: Unshielded 1.2m	AC I/P: Unshielded 1.8m DC O/P: Unshielded 1.8m With one core
2.	Mouse	DELL	MOABBO	H0A002AF	FCC DOC	Unshielded 1.8m	DC I/P : Unshielded 1.8m
3.	Multimedia Headset	Logitech	ClearChat	PN 981-000089	FCC DOC	Unshielded 1.8m	Unshielded 1.8m
4.	Printer	EPSON	EPL-6200L	FGQZ103882	FCC DOC	Unshielded 1.8m	AC I/P : Unshielded 1.8m

Remark:

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

7. FCC PART 15.247 REQUIREMENTS

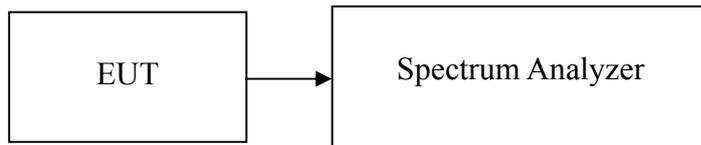
7.1 PEAK POWER

LIMIT

The maximum peak output power of the intentional radiator shall not exceed the following:

1. According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, 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, provided the systems operate with an output power no greater than 125 mW.
2. According to §15.247(b)(1), for frequency hopping systems operating in the 2400-2483.5MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1 Watt. For all other frequency hopping systems in the 2400-2483.5MHz band: 0.125 watts.
3. According to §15.247(c)(1)(i) Systems operating in the 2400-2483.5MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1dB for every 3 dB that the directional gain of the antenna exceeds 6dBi..

Test Configuration



TEST PROCEDURE

The transmitter output is connected to the Spectrum Analyzer. The Spectrum Analyzer is set to the peak power detection.

TEST RESULTS

No non-compliance noted

Test Data

GFSK

Test Data (ANT2400Q9P)

Channel	Frequency (MHz)	Output power (dBm)	Output power (W)	Limit (W)	Result
Low	2402	17.11	0.0514	0.79	PASS
Mid	2441	18.01	0.0632		PASS
High	2480	18.91	0.0778		PASS

9 dB – 6 dB=3 dB (Reduced by 1 dB for every 3 dB)

1W=30 dB

$(30 \text{ dB} - 1 \text{ dB}) / 10^{\wedge} \log = 0.79$

Test Data (ANT2400D18W)

Channel	Frequency (MHz)	Output power (dBm)	Output power (W)	Limit (W)	Result
Low	2402	17.11	0.0514	0.40	PASS
Mid	2441	18.01	0.0632		PASS
High	2480	18.91	0.0778		PASS

18 dB – 6 dB=12 dB (Reduced by 1 dB for every 3 dB)

1W=30 dB

$(30 \text{ dB} - 4 \text{ dB}) / 10^{\log} = 0.40$

8DPSK

Test Data (ANT2400O9P)

Channel	Frequency (MHz)	Output power (dBm)	Output power (W)	Limit (W)	Result
Low	2402	15.62	0.0365	0.79	PASS
Mid	2441	17.52	0.0565		PASS
High	2480	18.8	0.0759		PASS

9 dB – 6 dB=3 dB (Reduced by 1 dB for every 3 dB)

1W=30 dB

$(30 \text{ dB} - 1 \text{ dB}) / 10^{\log} = 0.79$

Test Data (ANT2400D18W)

Channel	Frequency (MHz)	Output power (dBm)	Output power (W)	Limit (W)	Result
Low	2402	15.62	0.0365	0.40	PASS
Mid	2441	17.52	0.0565		PASS
High	2480	18.8	0.0759		PASS

18 dB – 6 dB=12 dB (Reduced by 1 dB for every 3 dB)

1W=30 dB

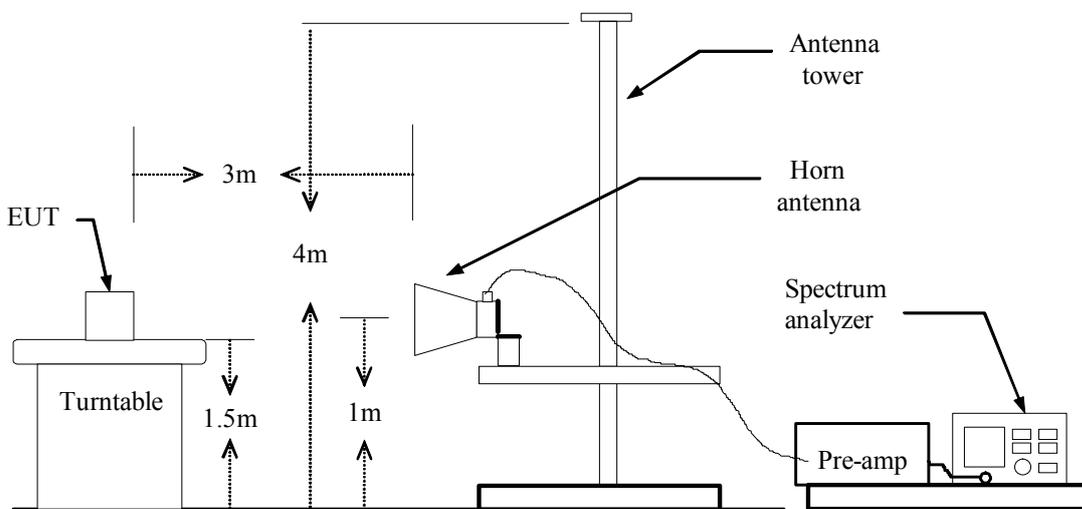
$(30 \text{ dB} - 4 \text{ dB}) / 10^{\log} = 0.40$

7.2 BAND EDGES MEASUREMENT

LIMIT

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)).

Test Configuration



TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
 - (a) PEAK: RBW=1MHz/VBW=1MHz/Sweep = auto
 - (b) AVERAGE: RBW=1MHz/VBW=10Hz/Sweep=auto
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

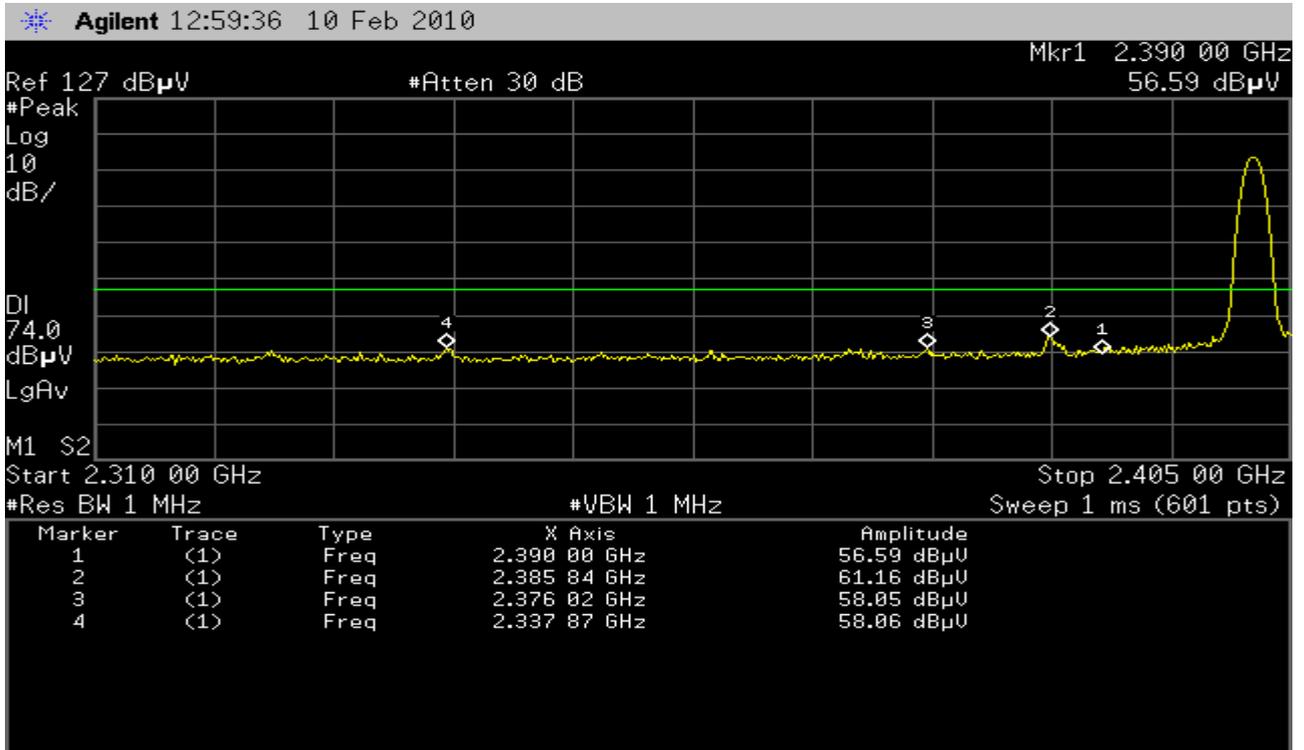
TEST RESULTS

Refer to attached spectrum analyzer data chart.

Band Edges (CH Low) --- ANT2400Q9P (GFSK)

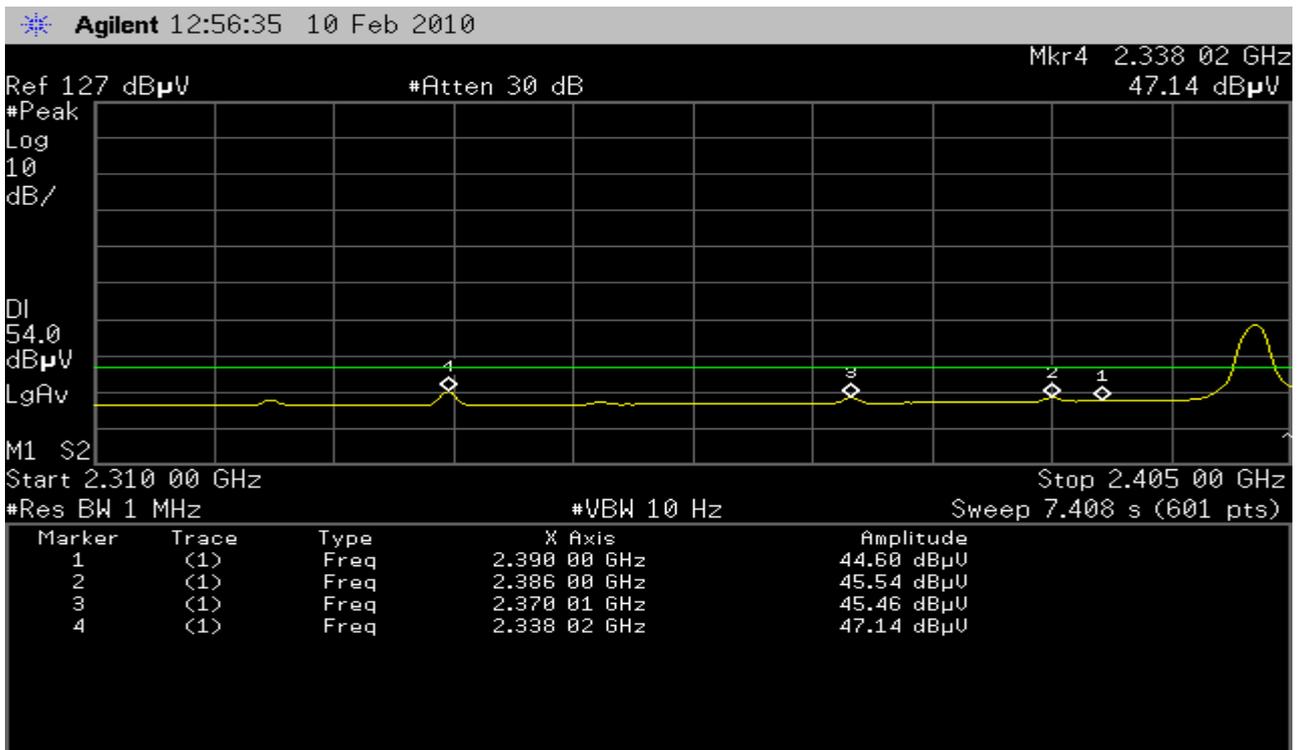
Detector mode: Peak

Polarity: Vertical



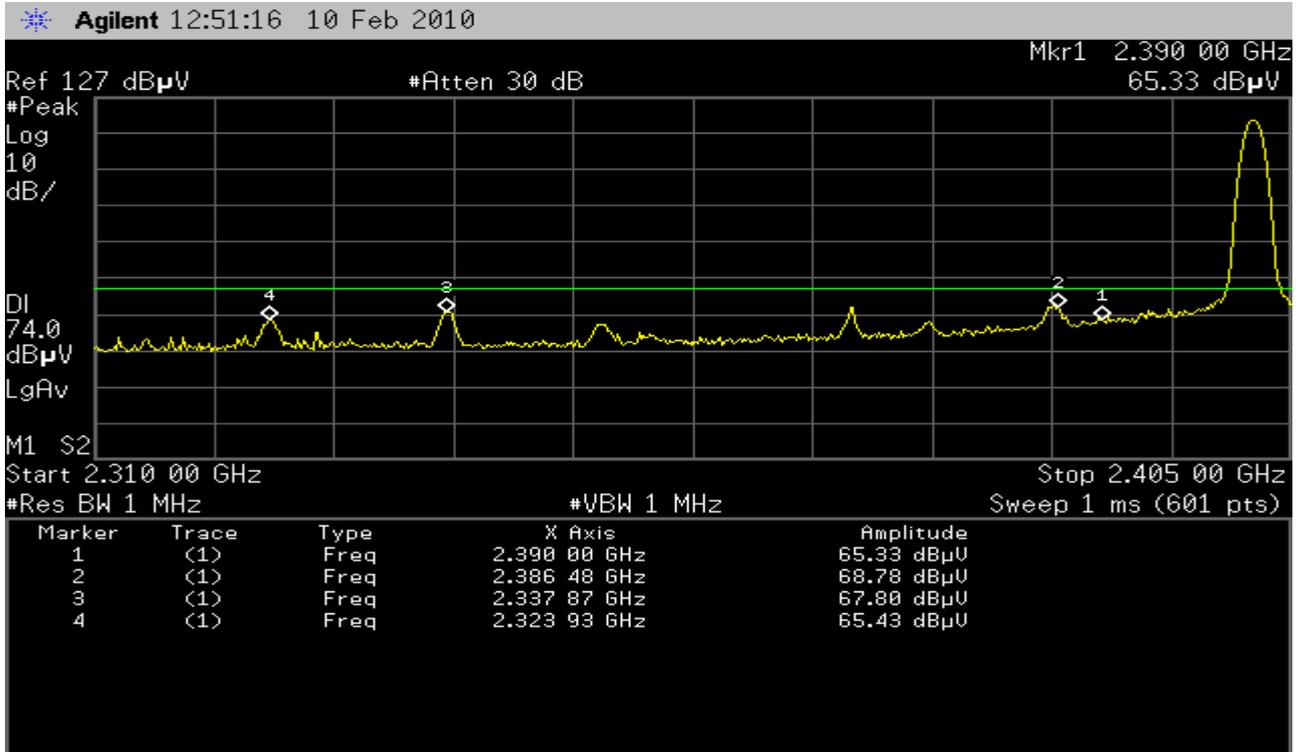
Detector mode: Average

Polarity: Vertical



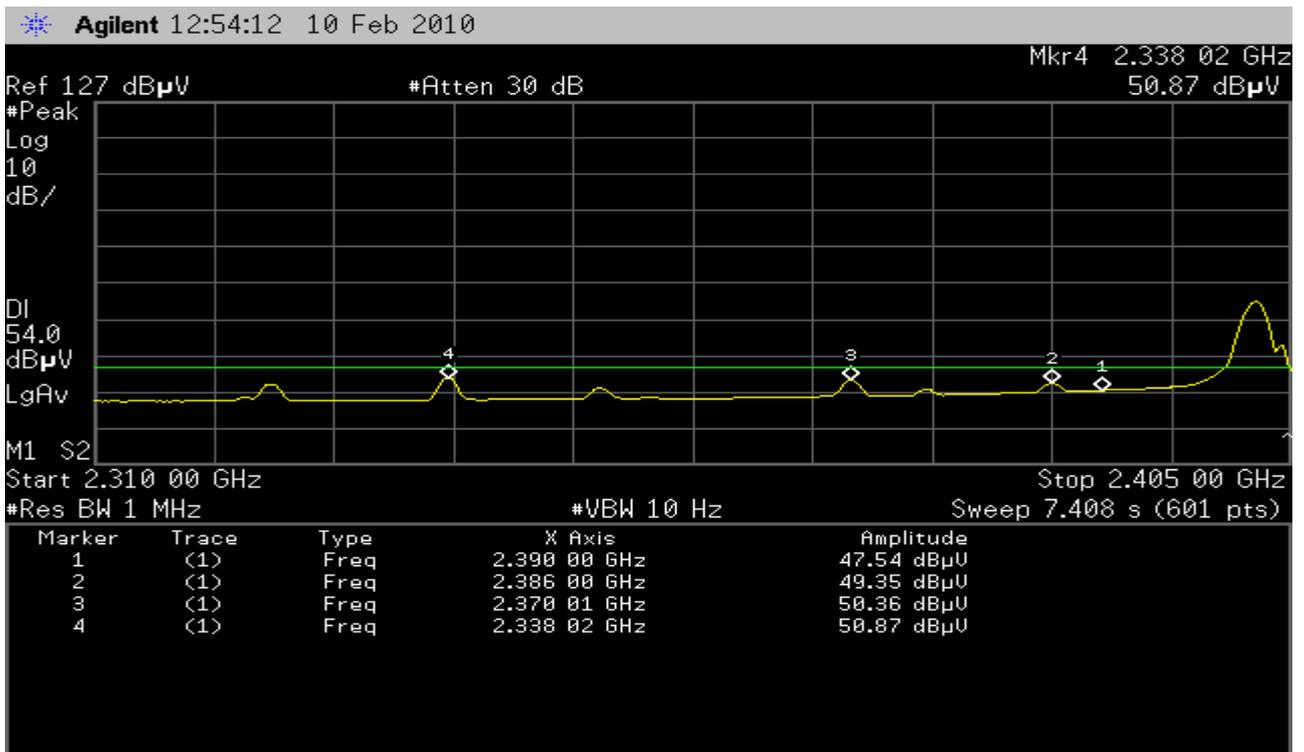
Detector mode: Peak

Polarity: Horizontal



Detector mode: Average

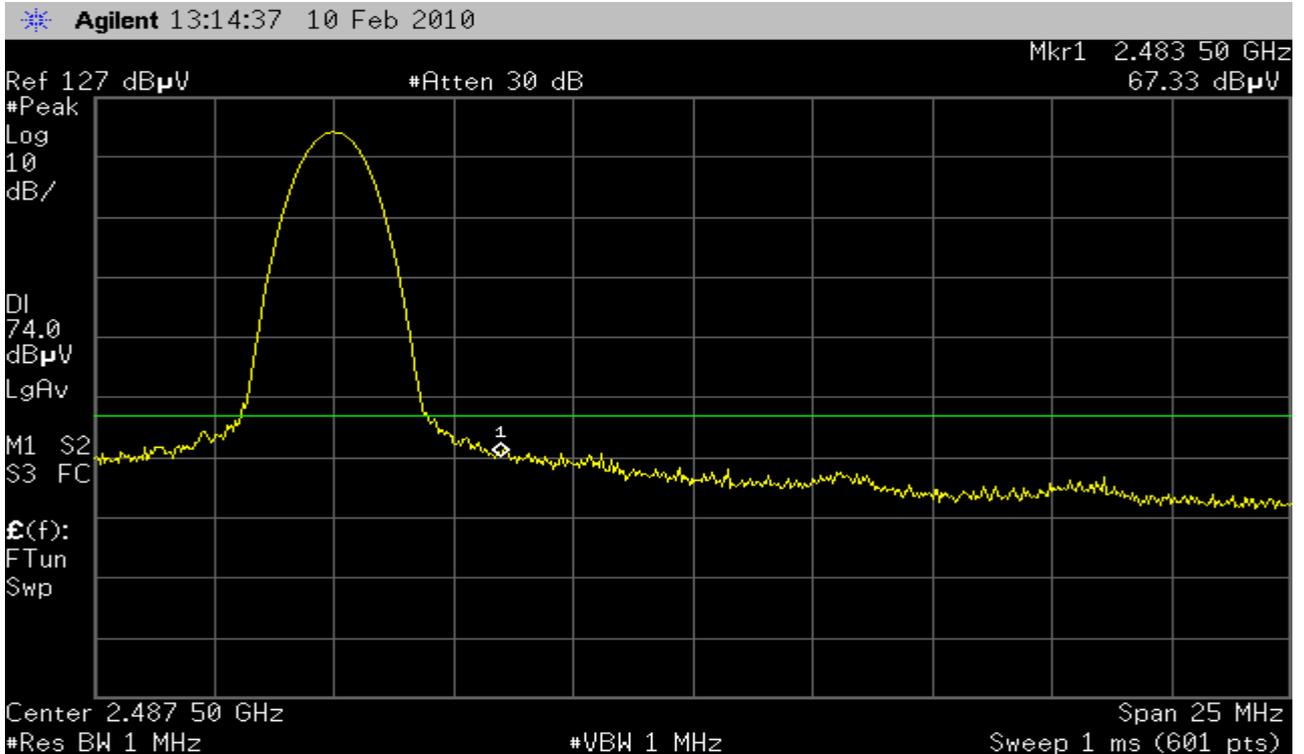
Polarity: Horizontal



Band Edges (CH High) --- ANT2400Q9P (GFSK)

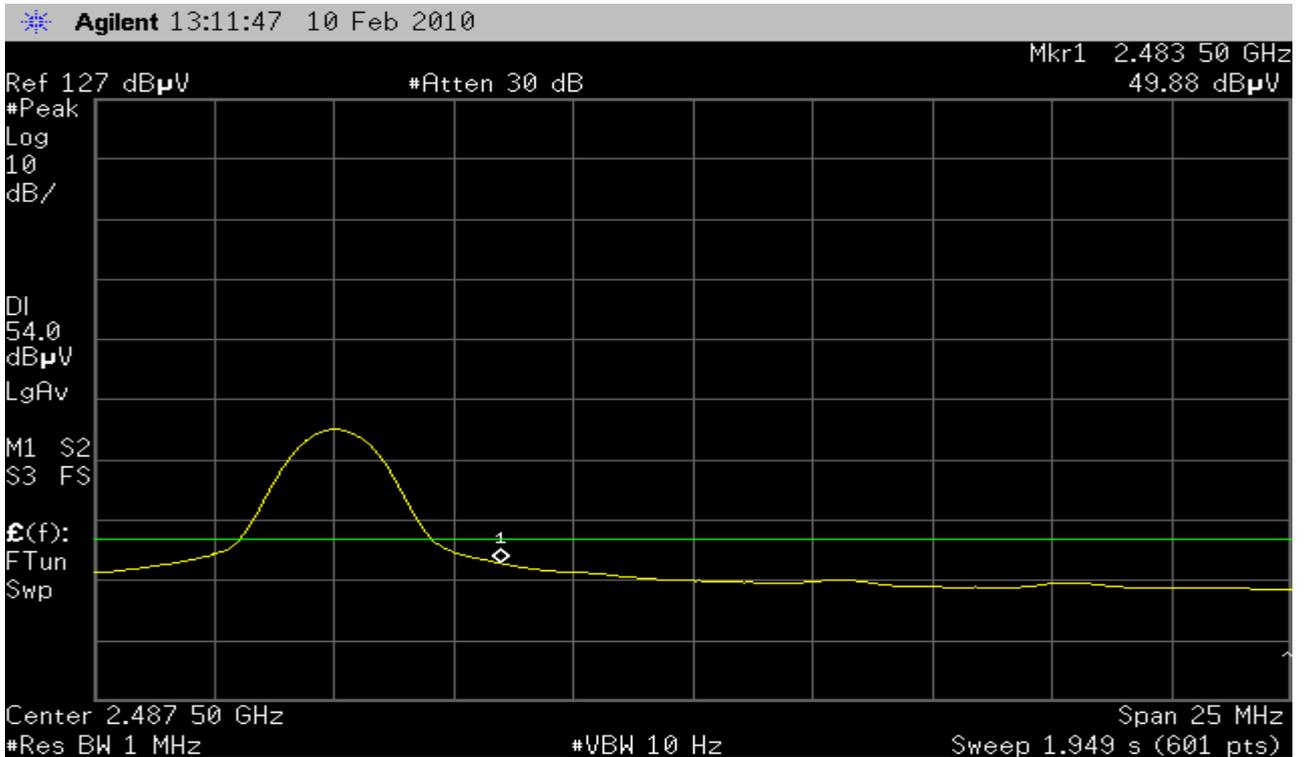
Detector mode: Peak

Polarity: Vertical



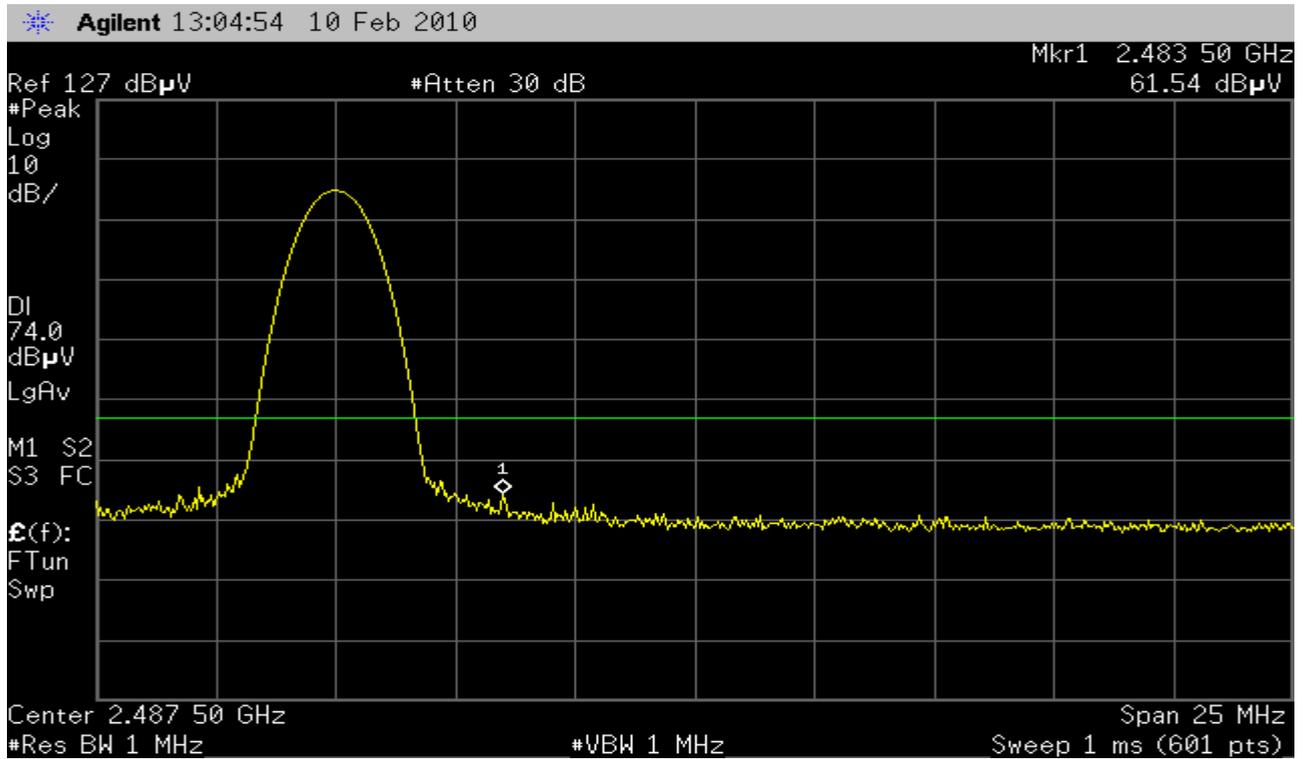
Detector mode: Average

Polarity: Vertical



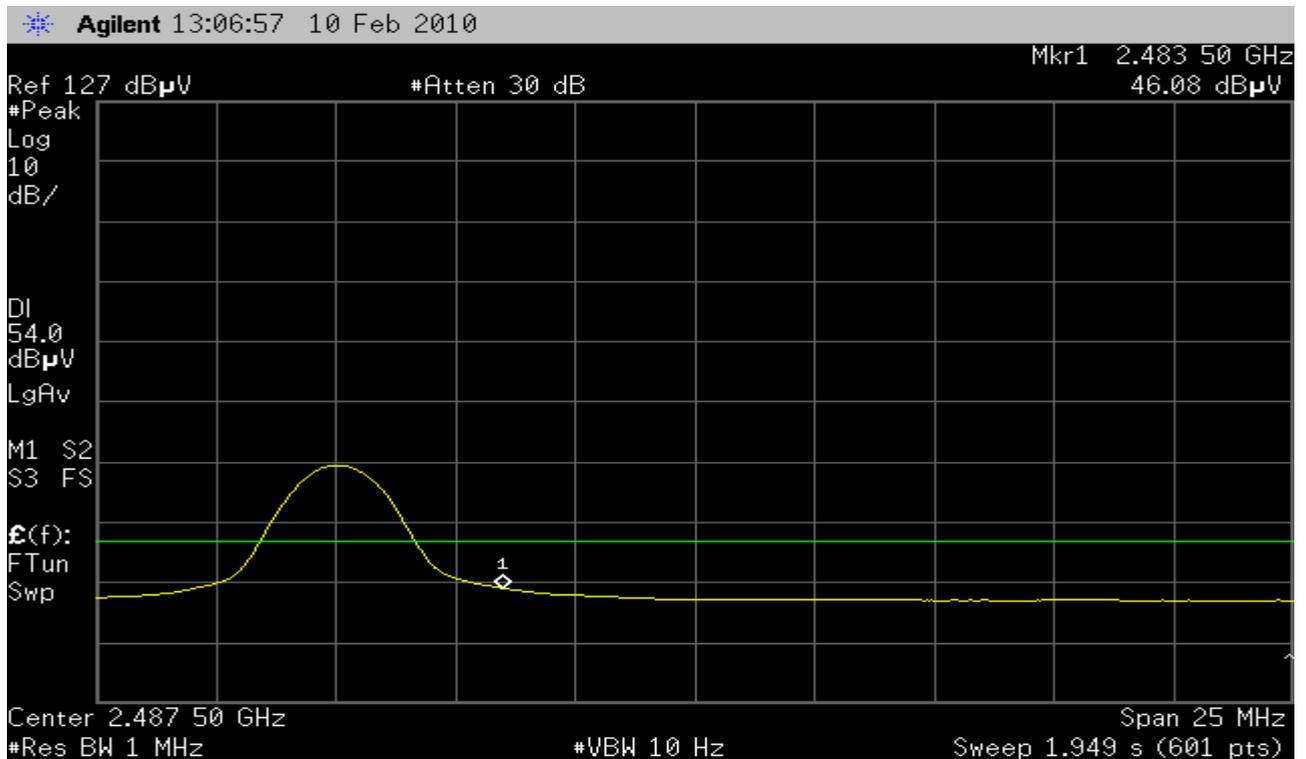
Detector mode: Peak

Polarity: Horizontal



Detector mode: Average

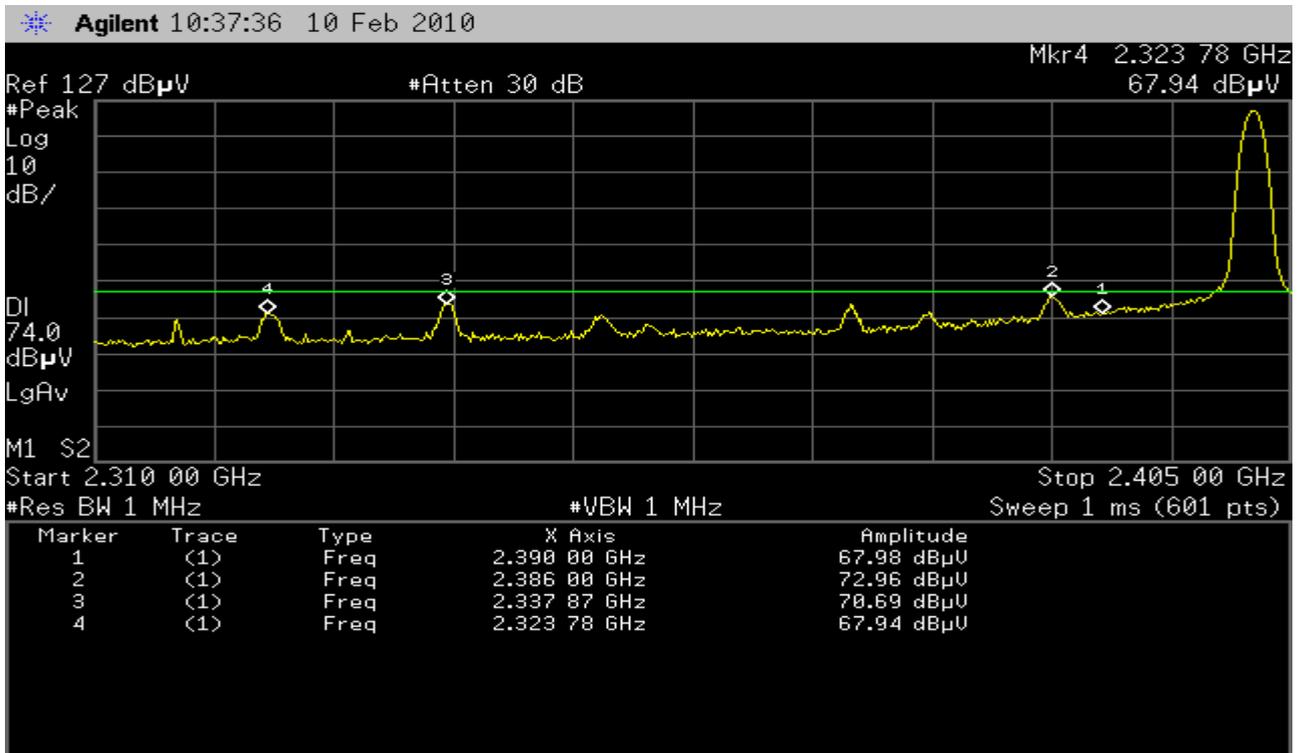
Polarity: Horizontal



Band Edges (CH Low) --- ANT2400D18W (GFSK)

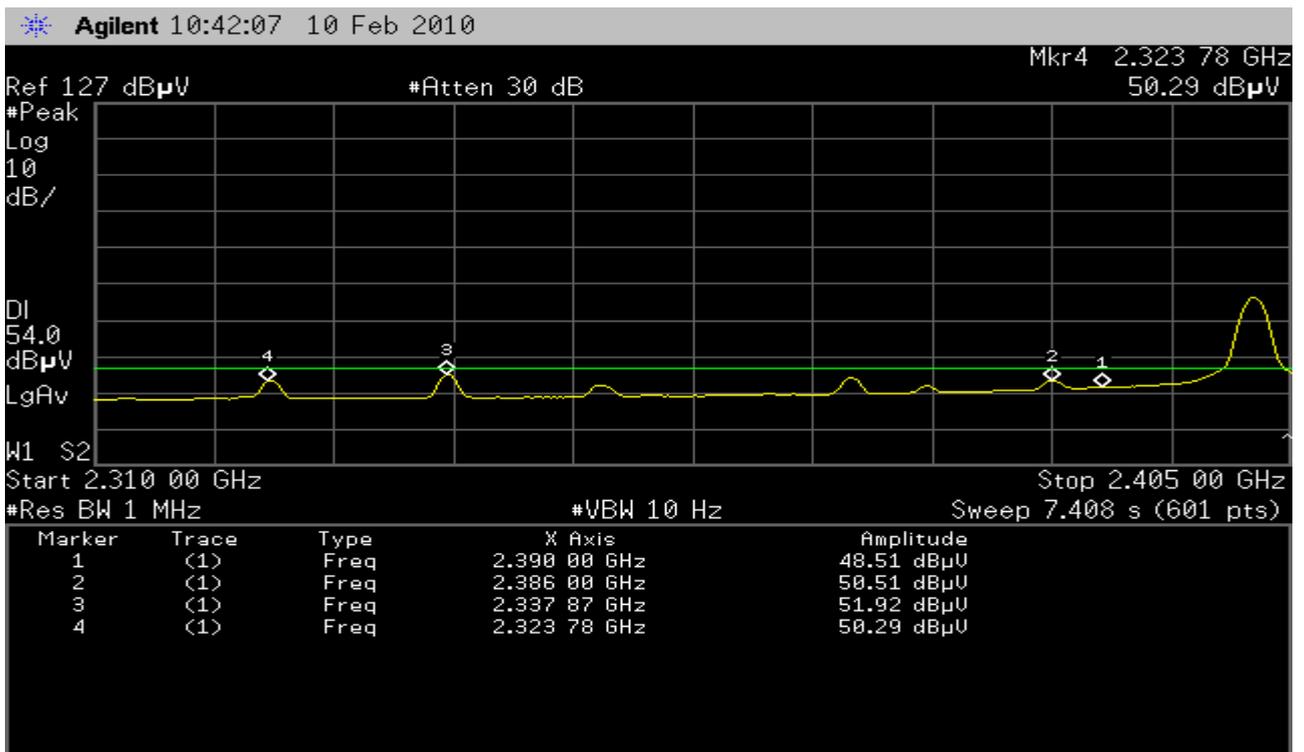
Detector mode: Peak

Polarity: Vertical



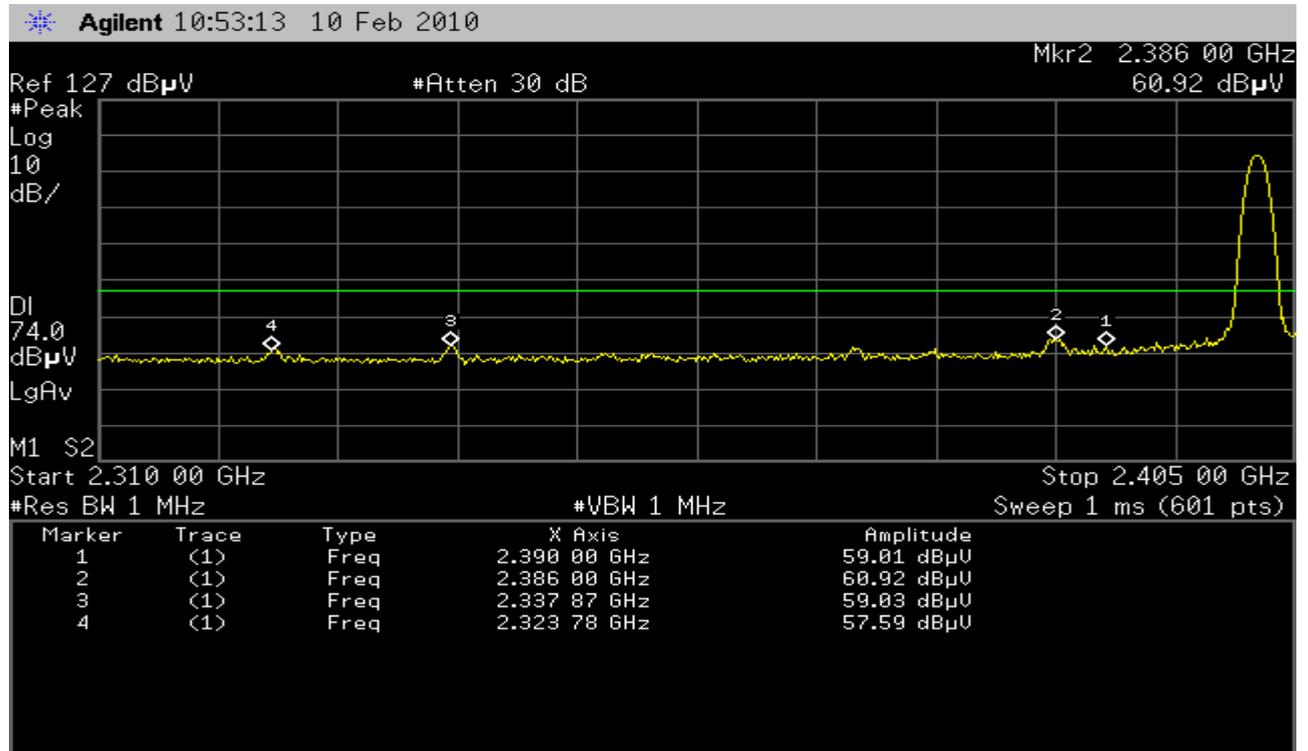
Detector mode: Average

Polarity: Vertical



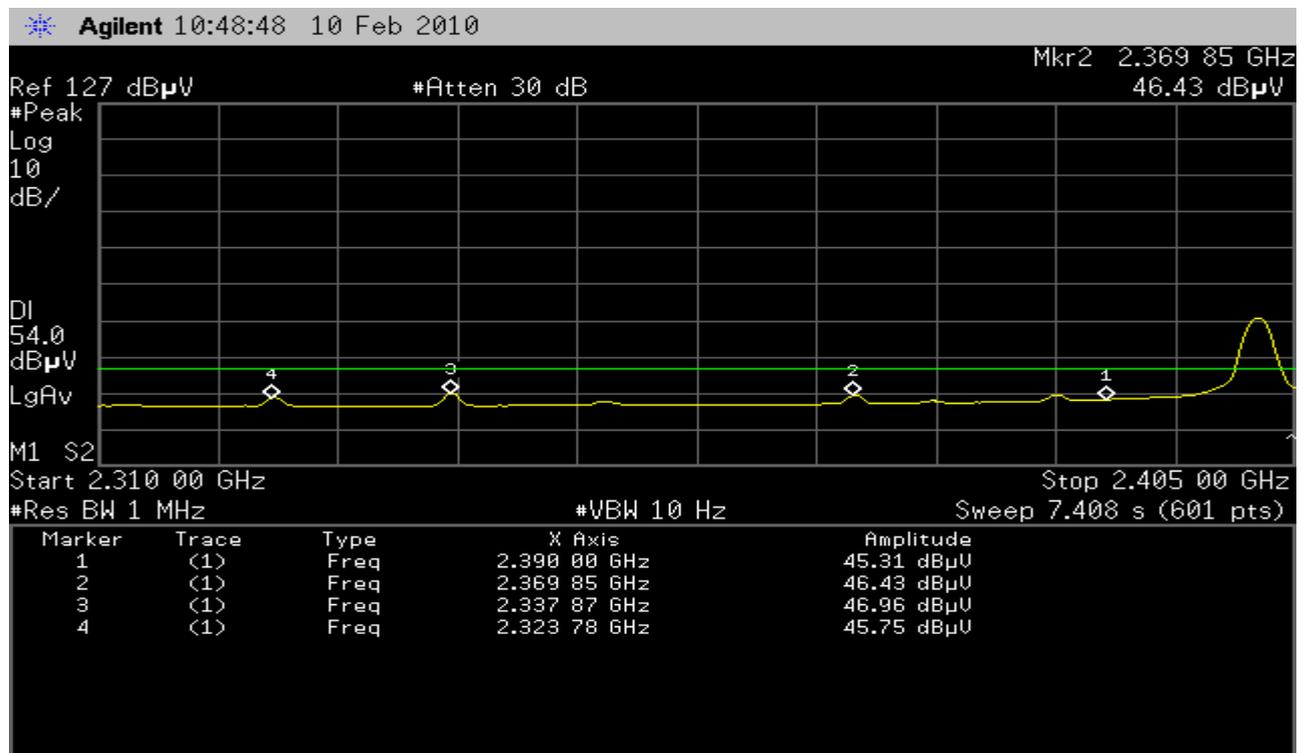
Detector mode: Peak

Polarity: Horizontal



Detector mode: Average

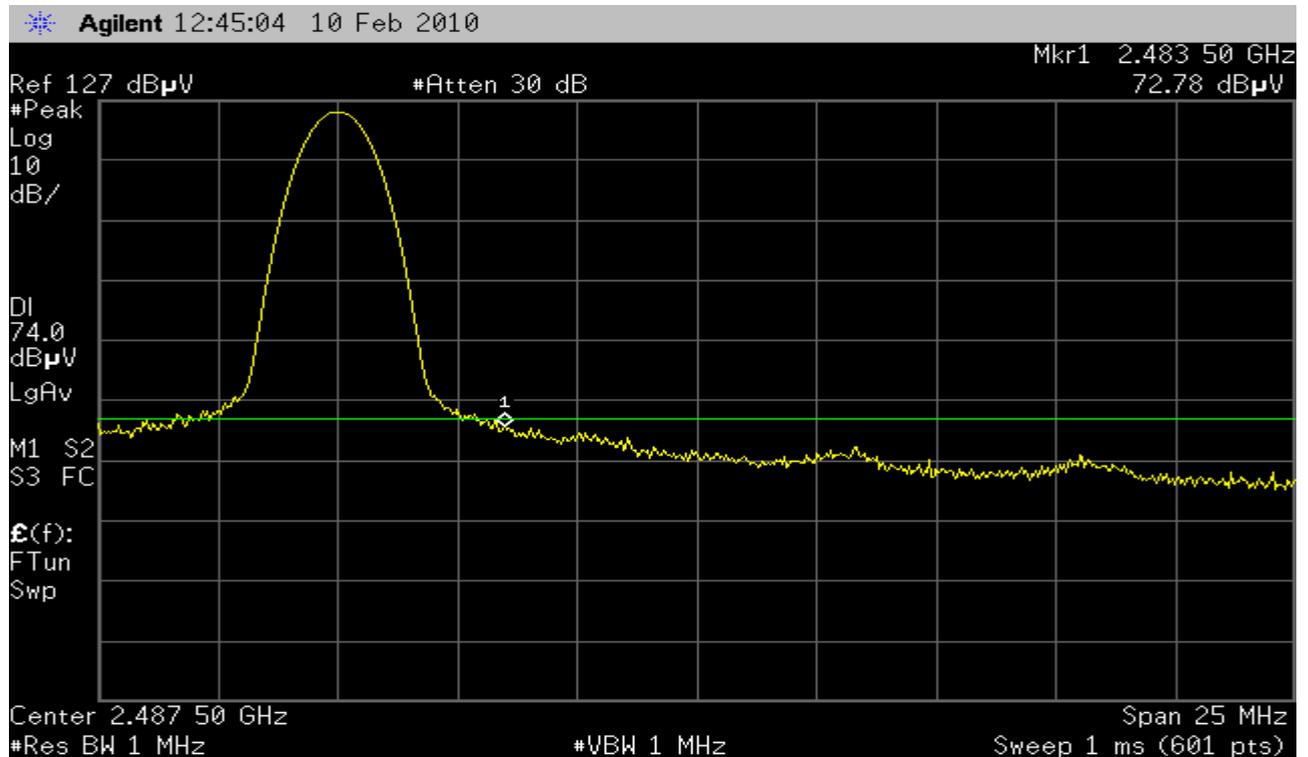
Polarity: Horizontal



Band Edges (CH High) --- ANT2400D18W (GFSK)

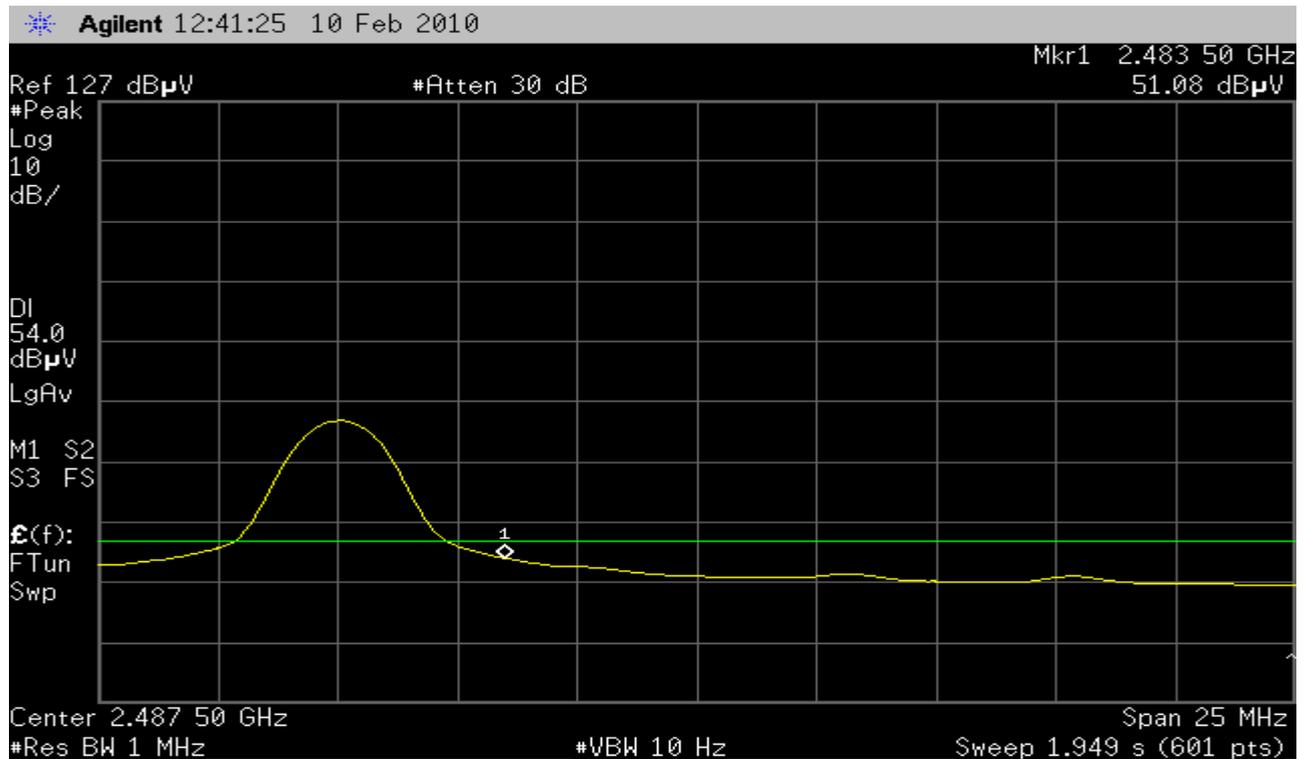
Detector mode: Peak

Polarity: Vertical



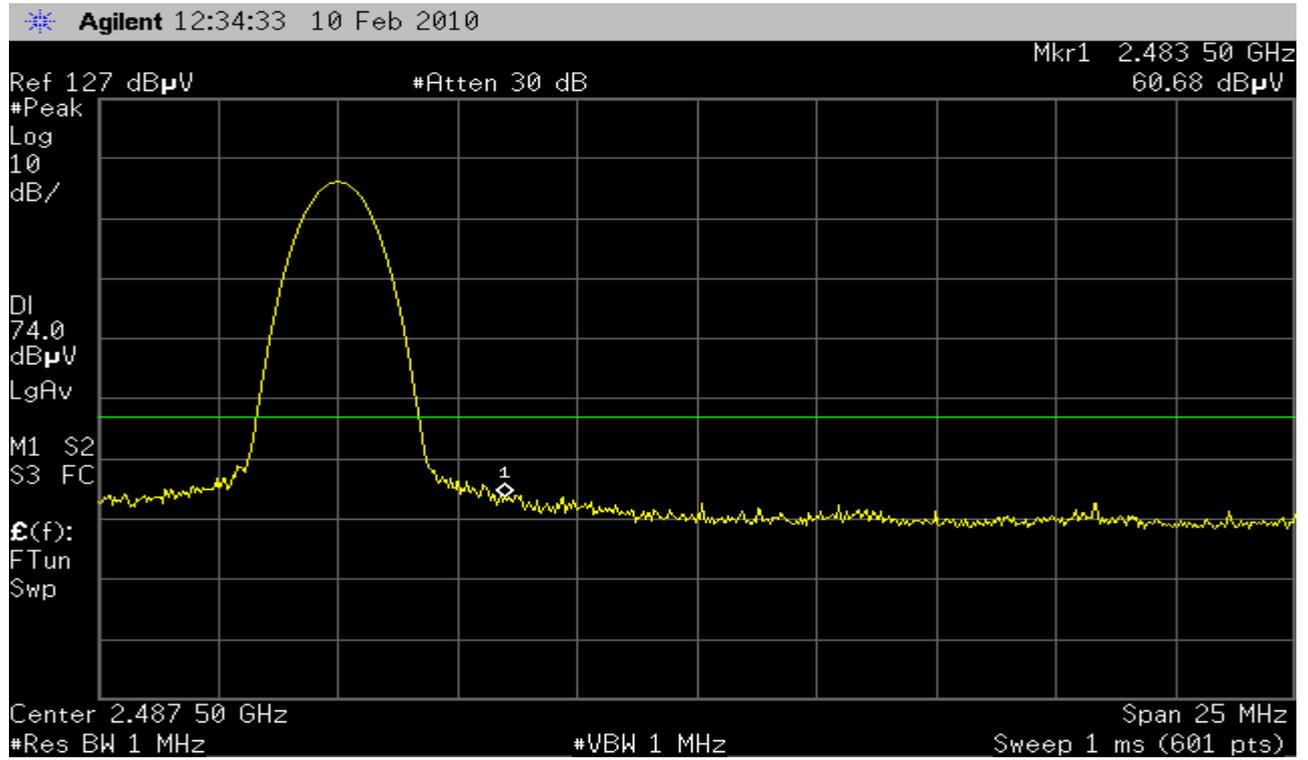
Detector mode: Average

Polarity: Vertical



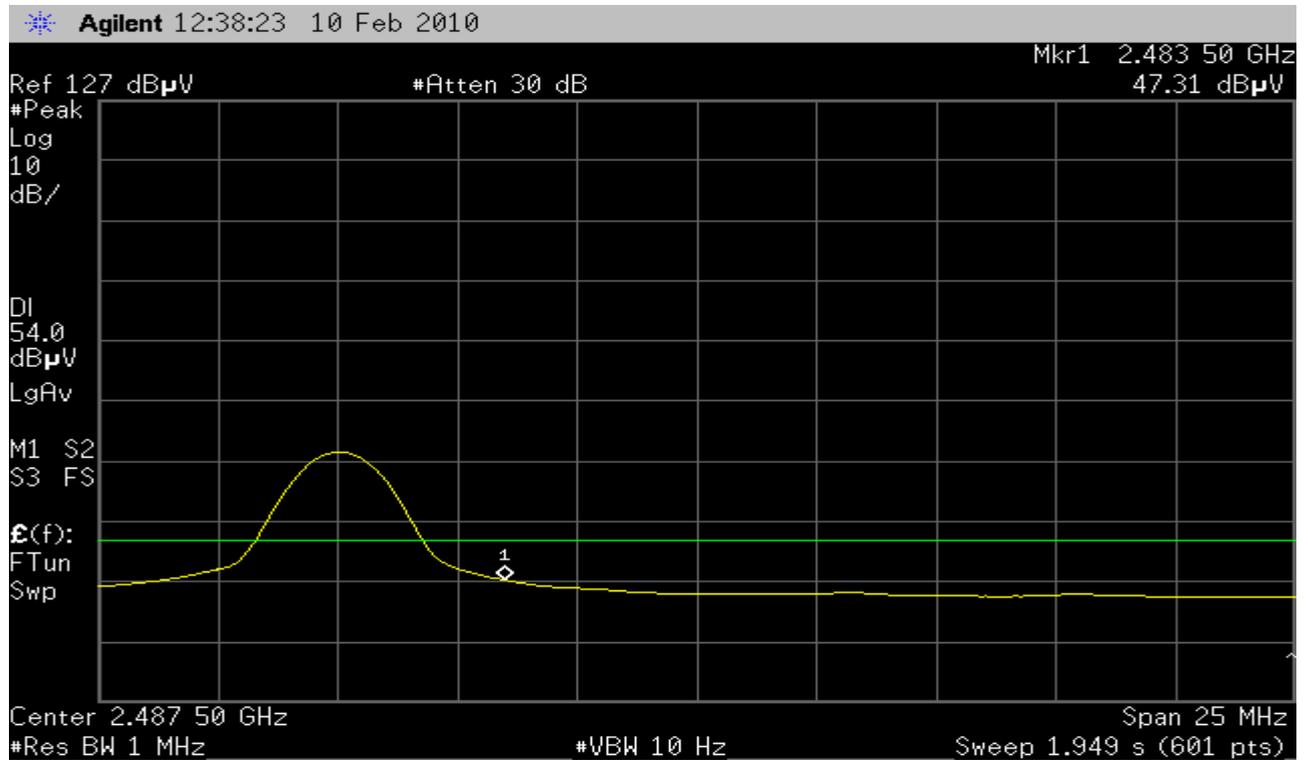
Detector mode: Peak

Polarity: Horizontal



Detector mode: Average

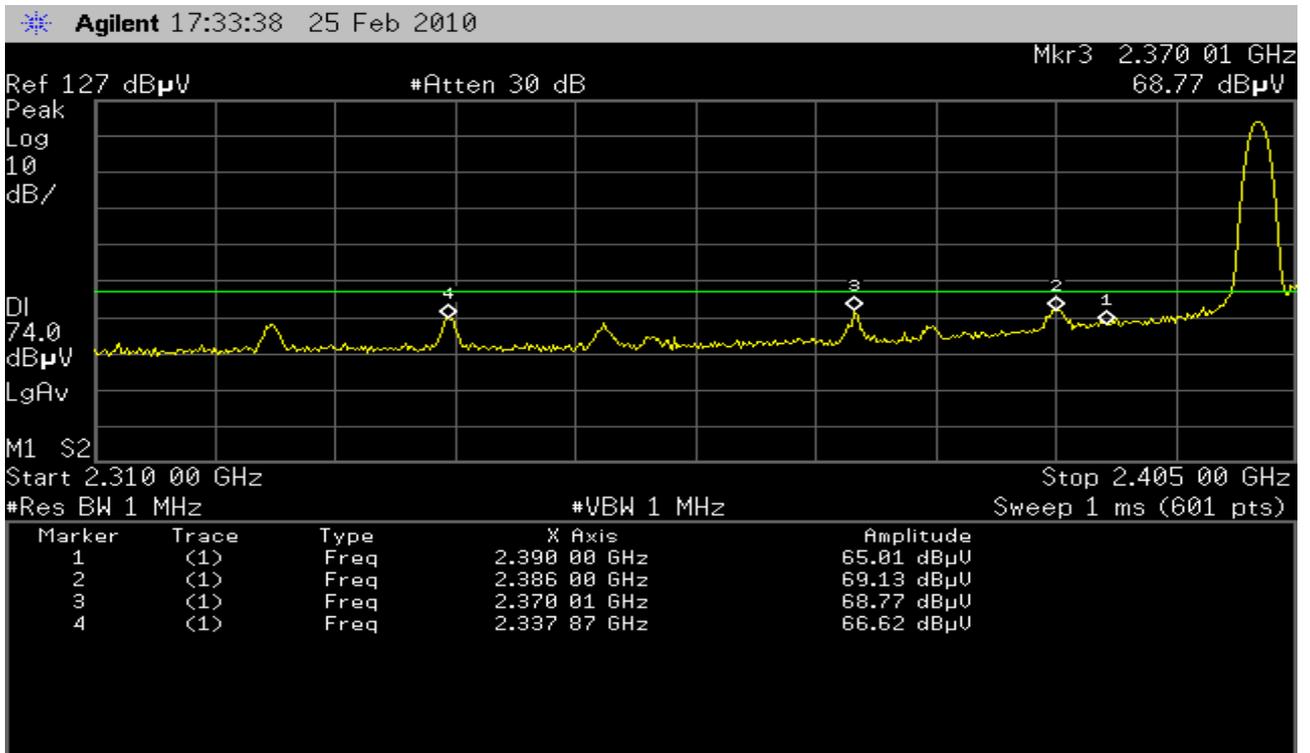
Polarity: Horizontal



Band Edges (CH Low) --- ANT2400Q9P (8DPSK)

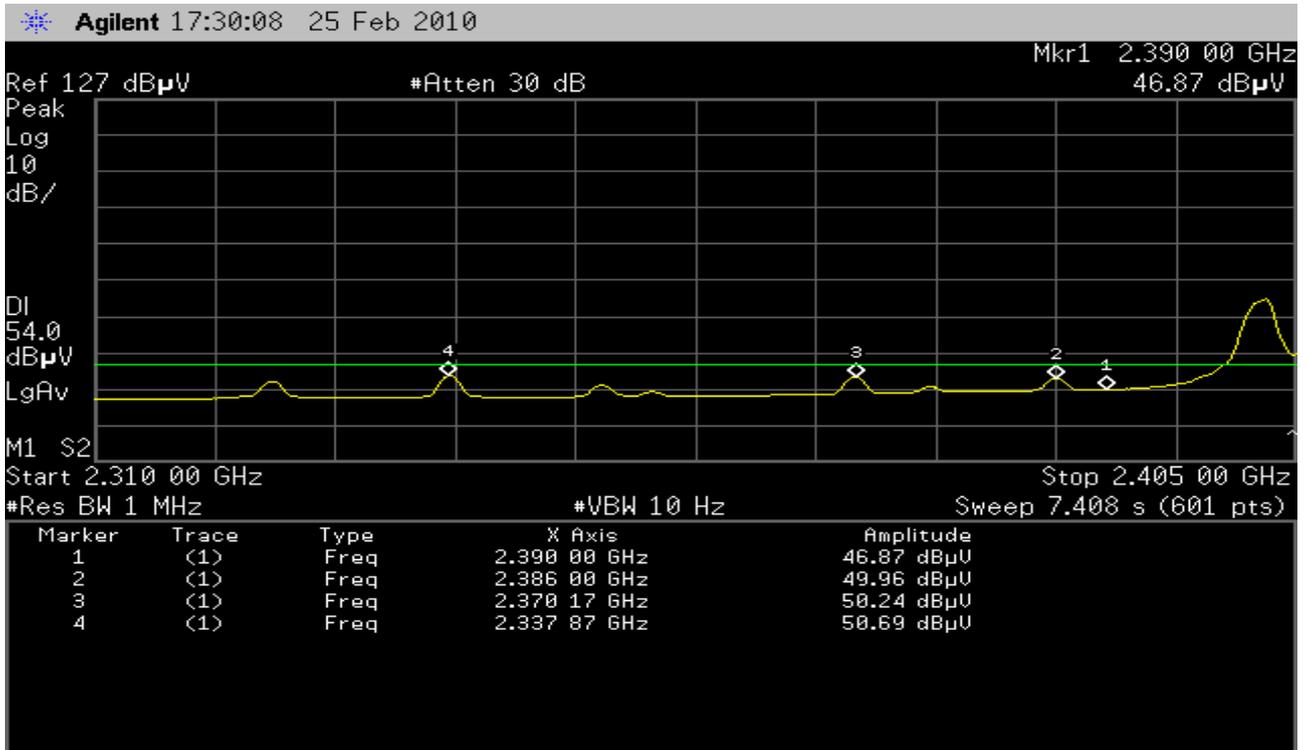
Detector mode: Peak

Polarity: Vertical



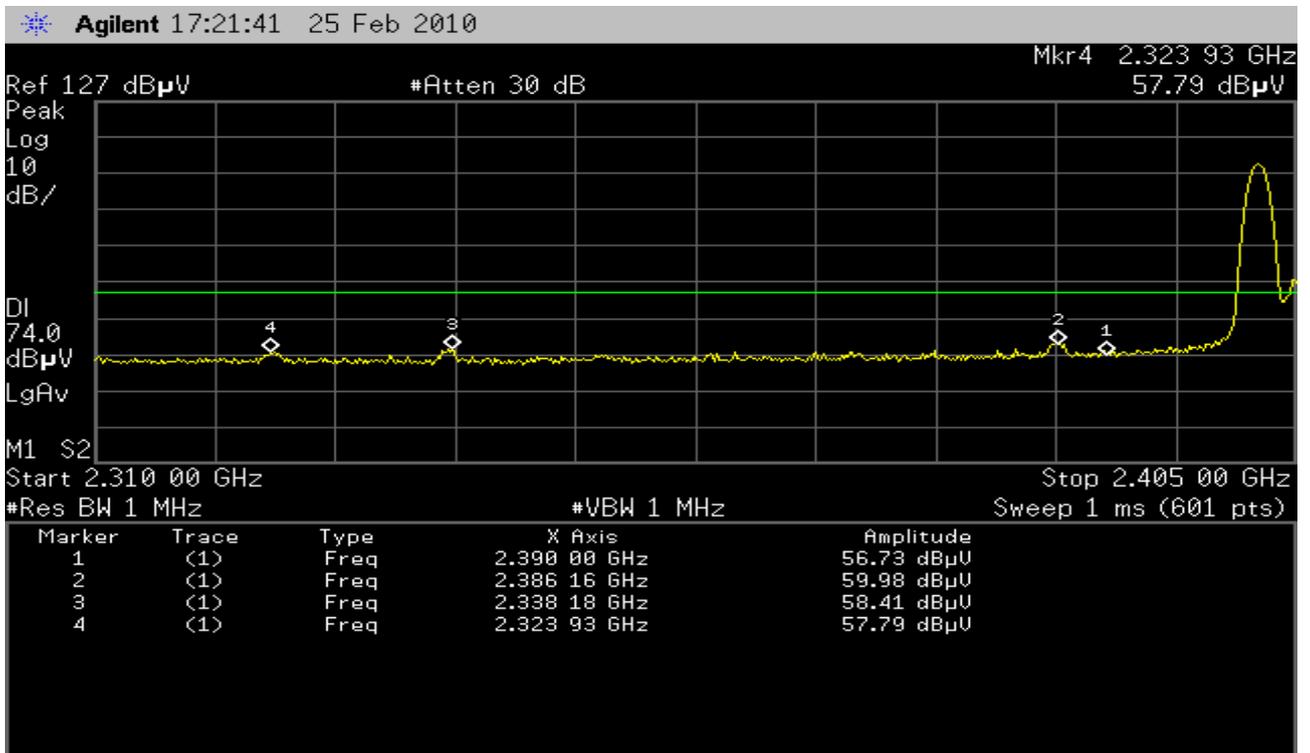
Detector mode: Average

Polarity: Vertical



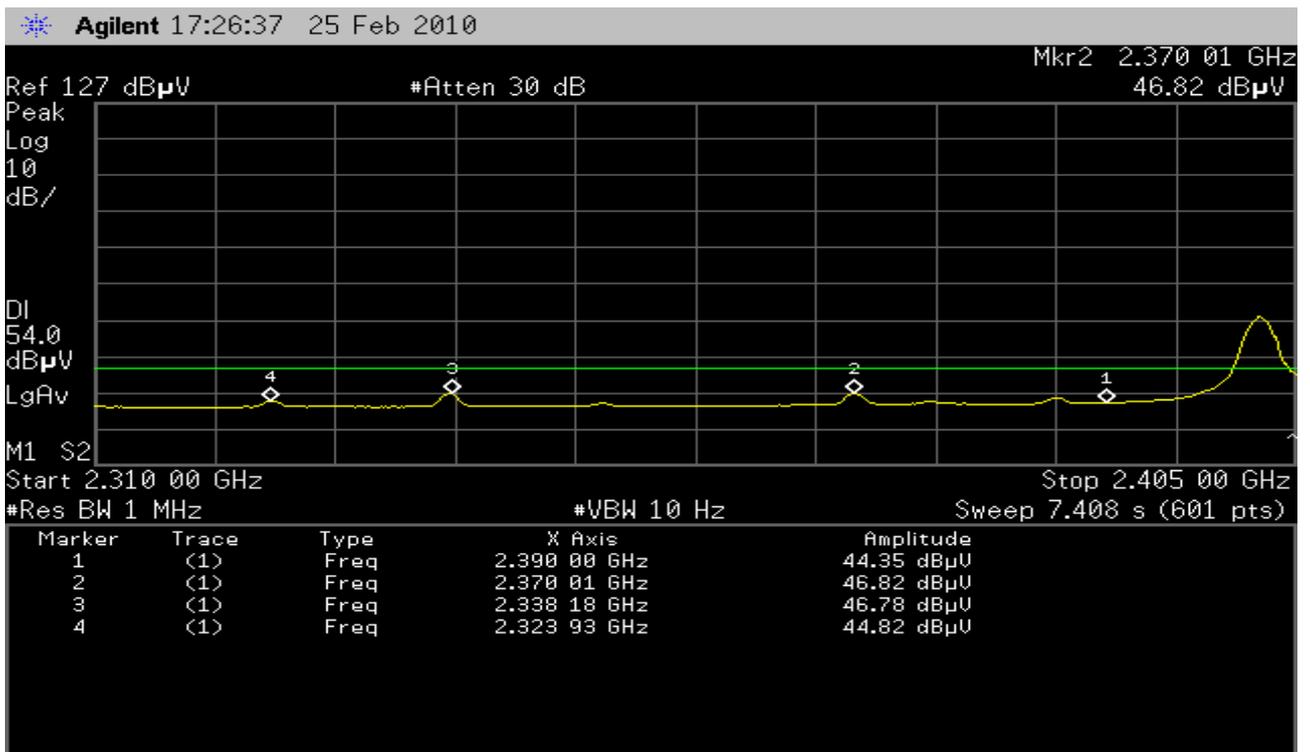
Detector mode: Peak

Polarity: Horizontal



Detector mode: Average

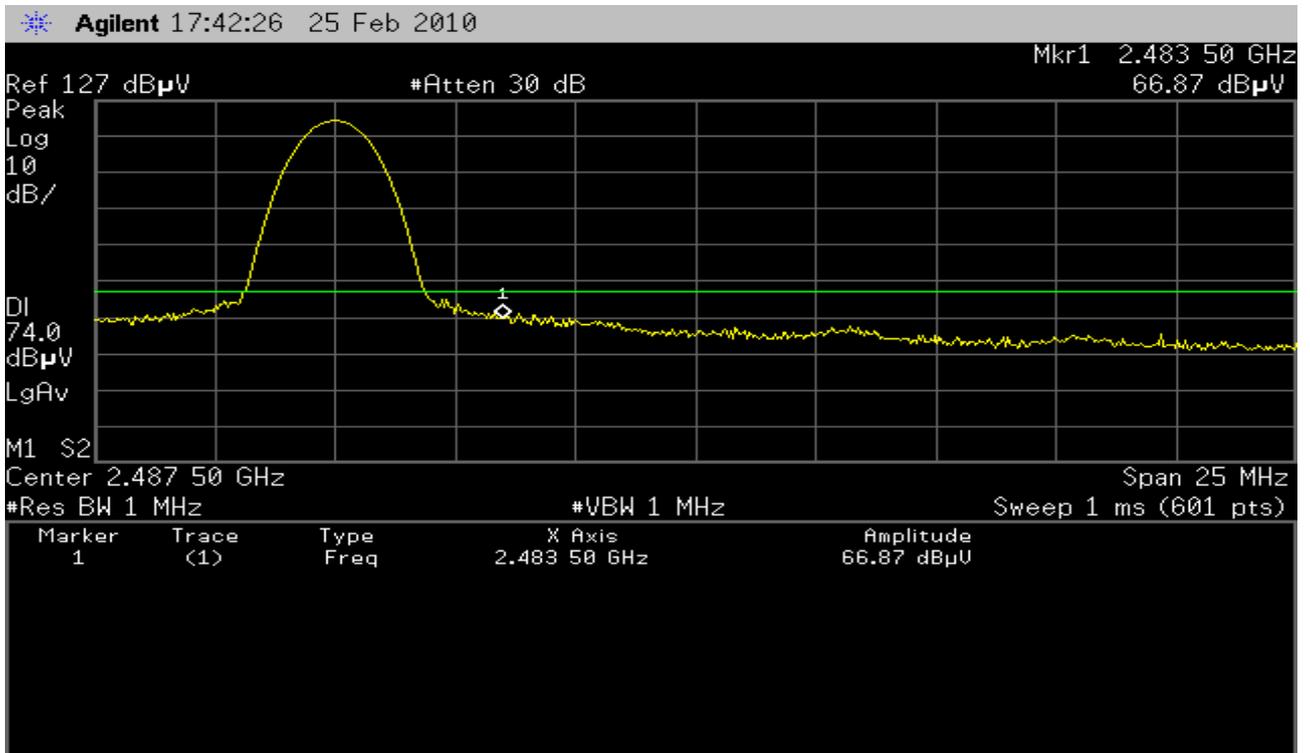
Polarity: Horizontal



Band Edges (CH High) --- ANT2400Q9P (8DPSK)

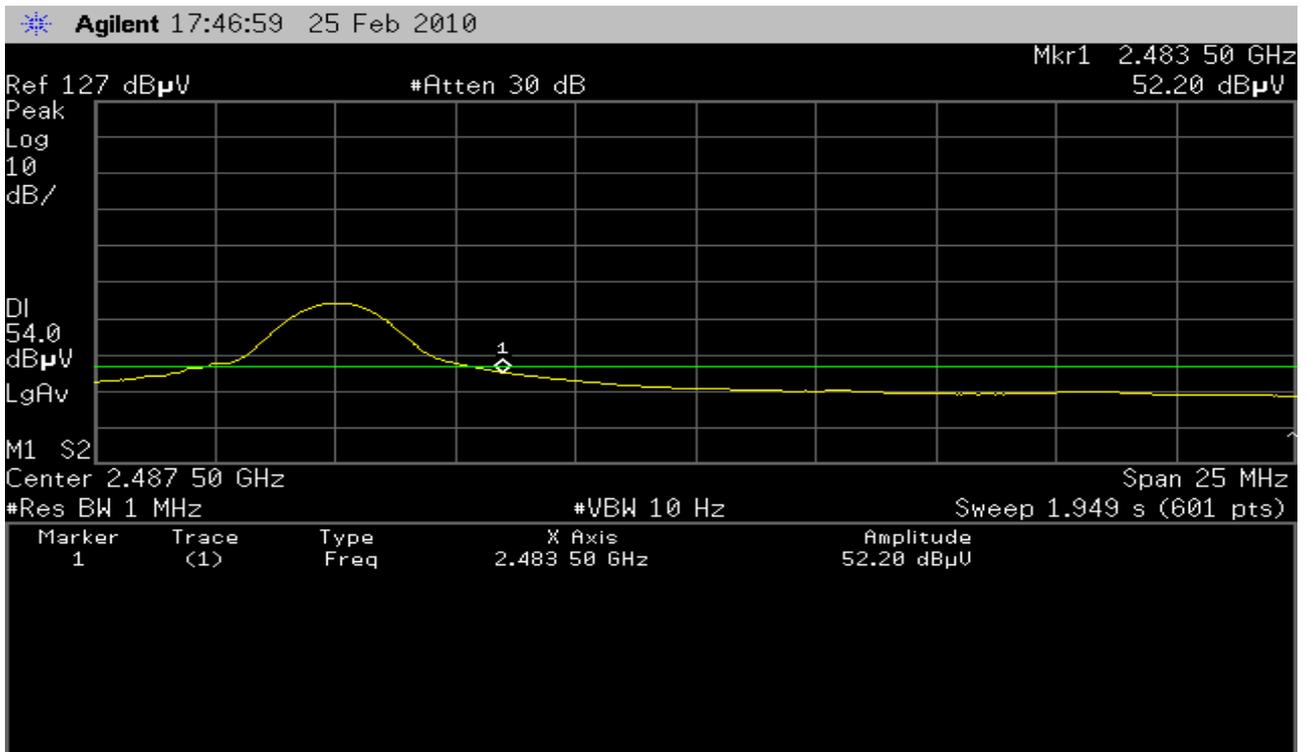
Detector mode: Peak

Polarity: Vertical



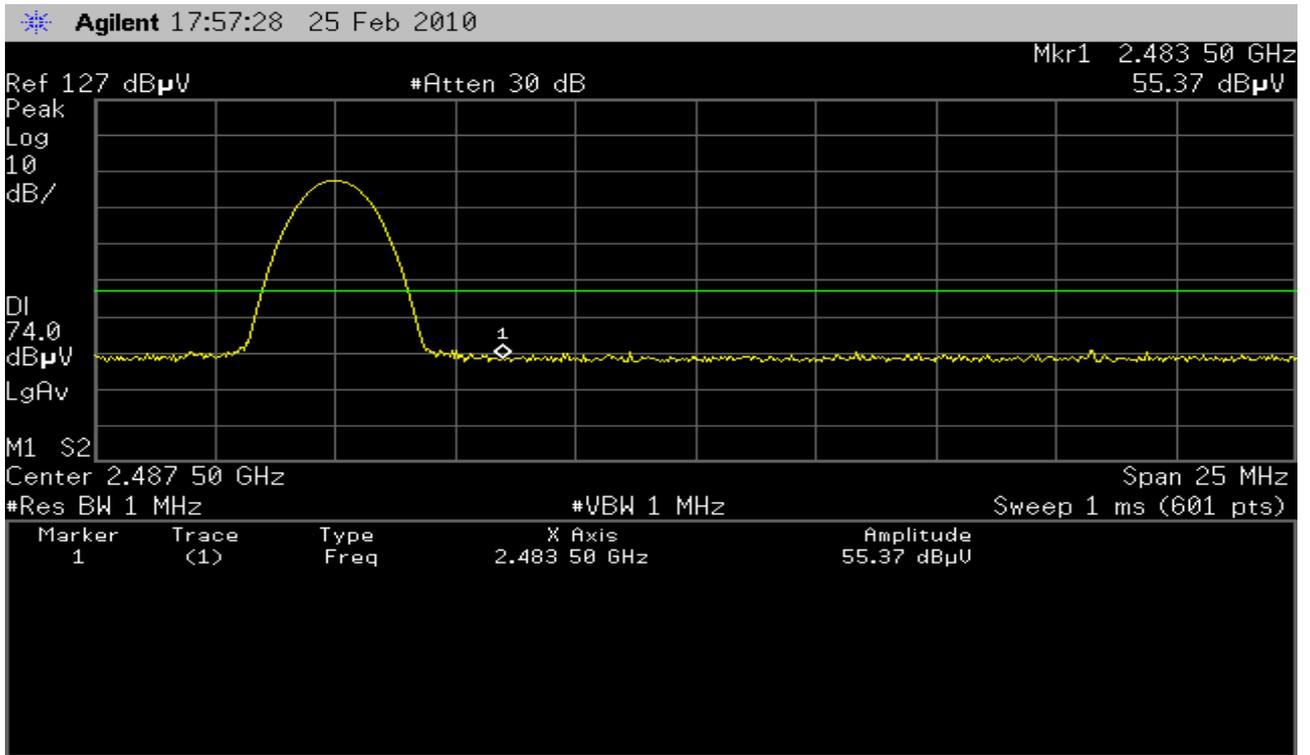
Detector mode: Average

Polarity: Vertical



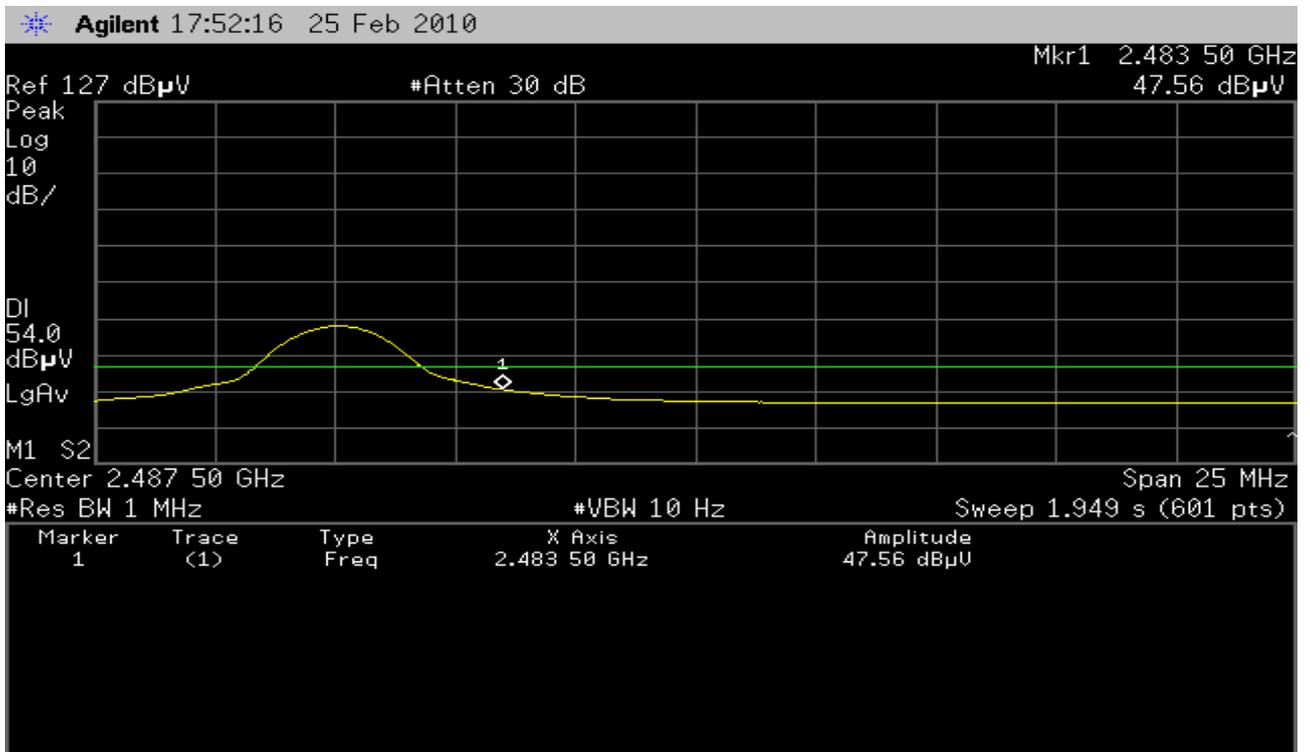
Detector mode: Peak

Polarity: Horizontal



Detector mode: Average

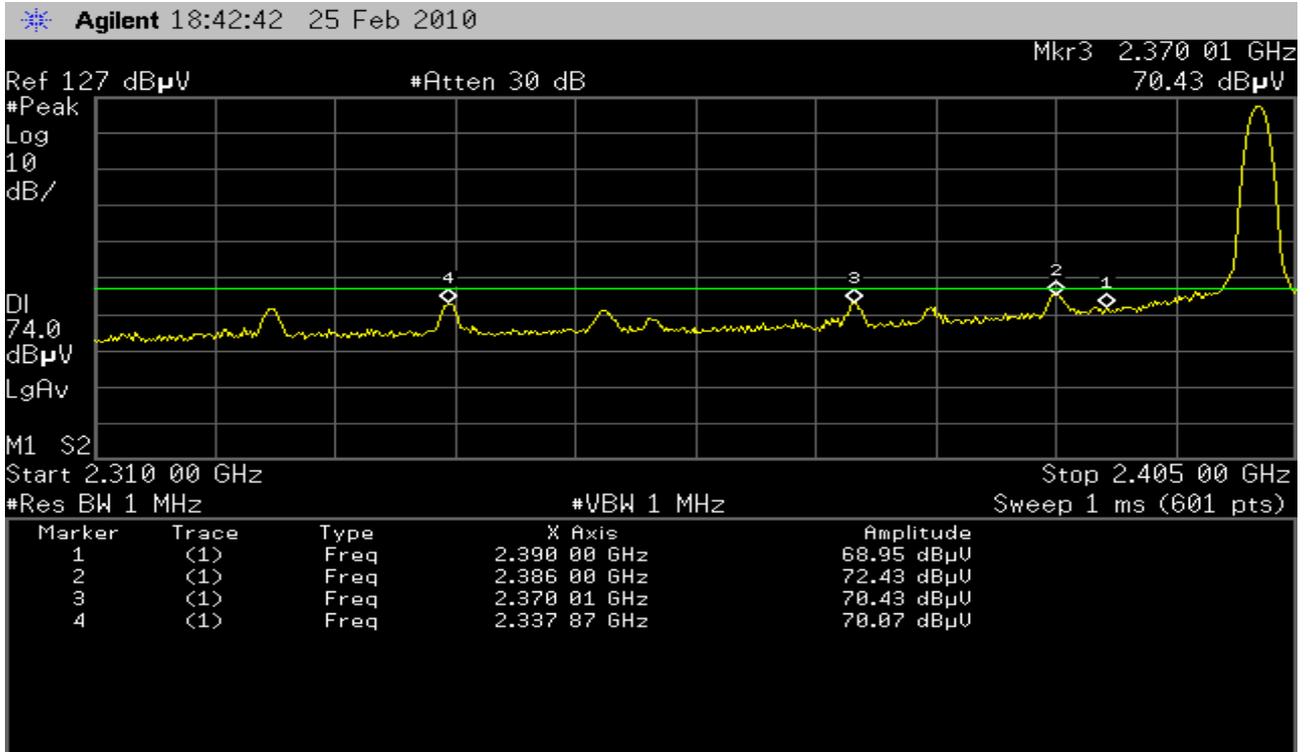
Polarity: Horizontal



Band Edges (CH Low) --- ANT2400D18W (8DPSK)

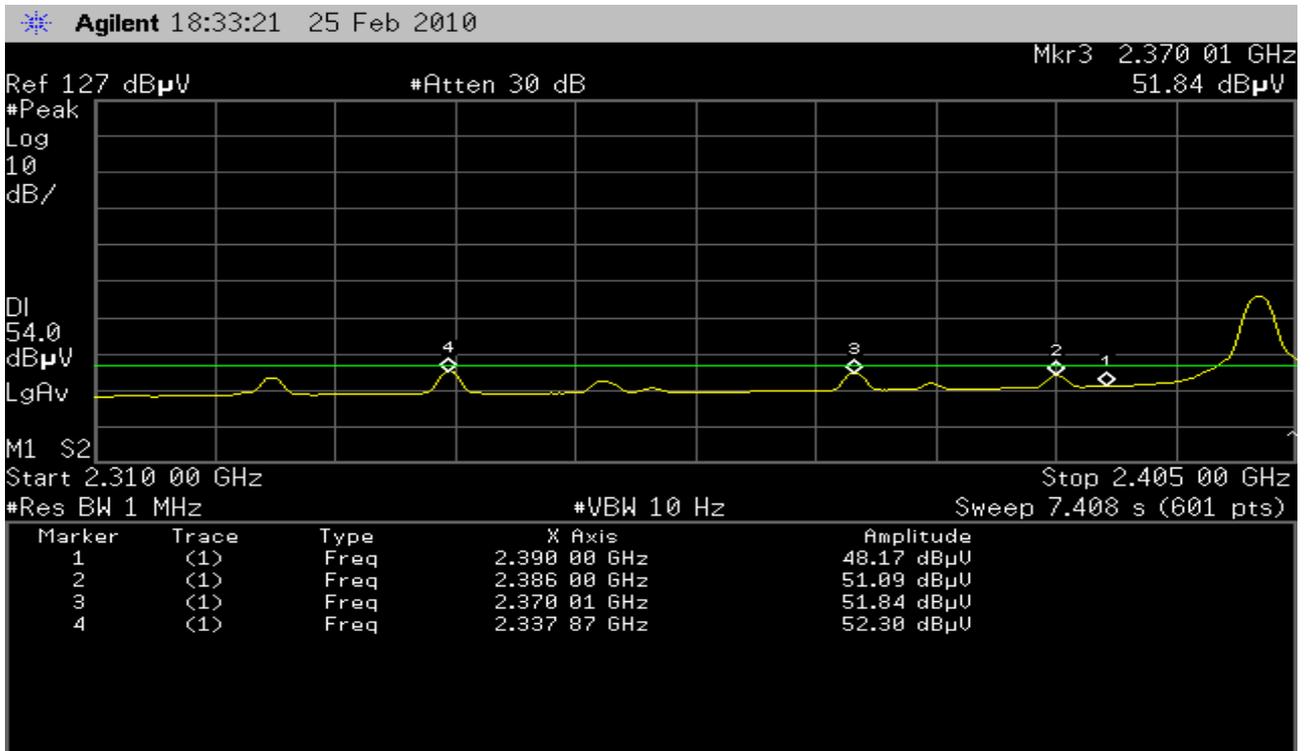
Detector mode: Peak

Polarity: Vertical



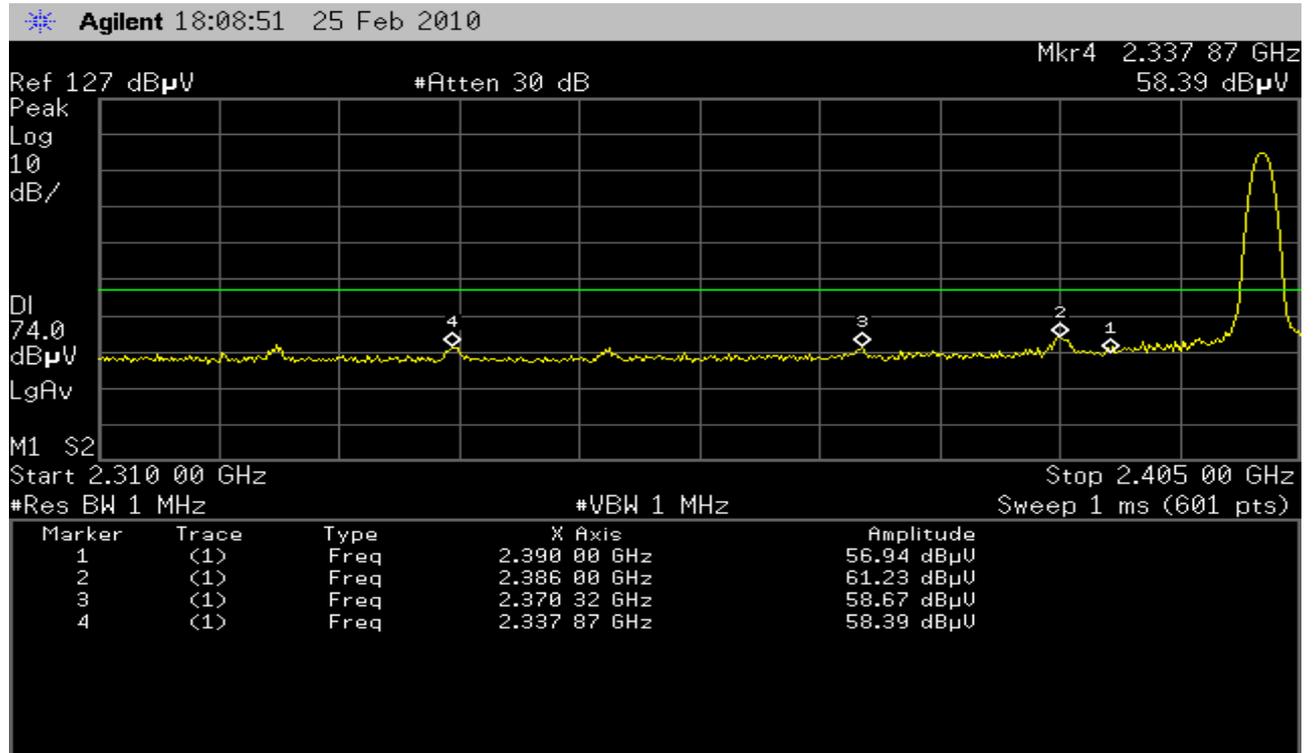
Detector mode: Average

Polarity: Vertical



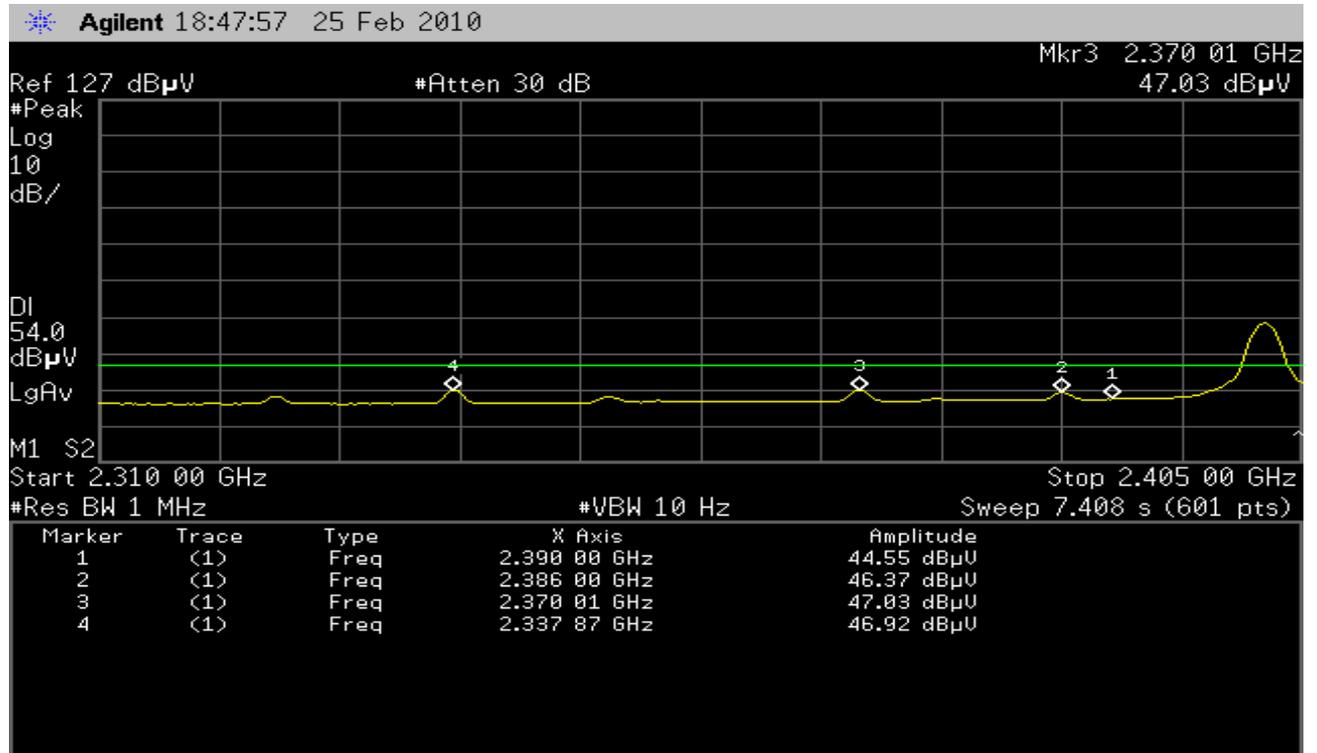
Detector mode: Peak

Polarity: Horizontal



Detector mode: Average

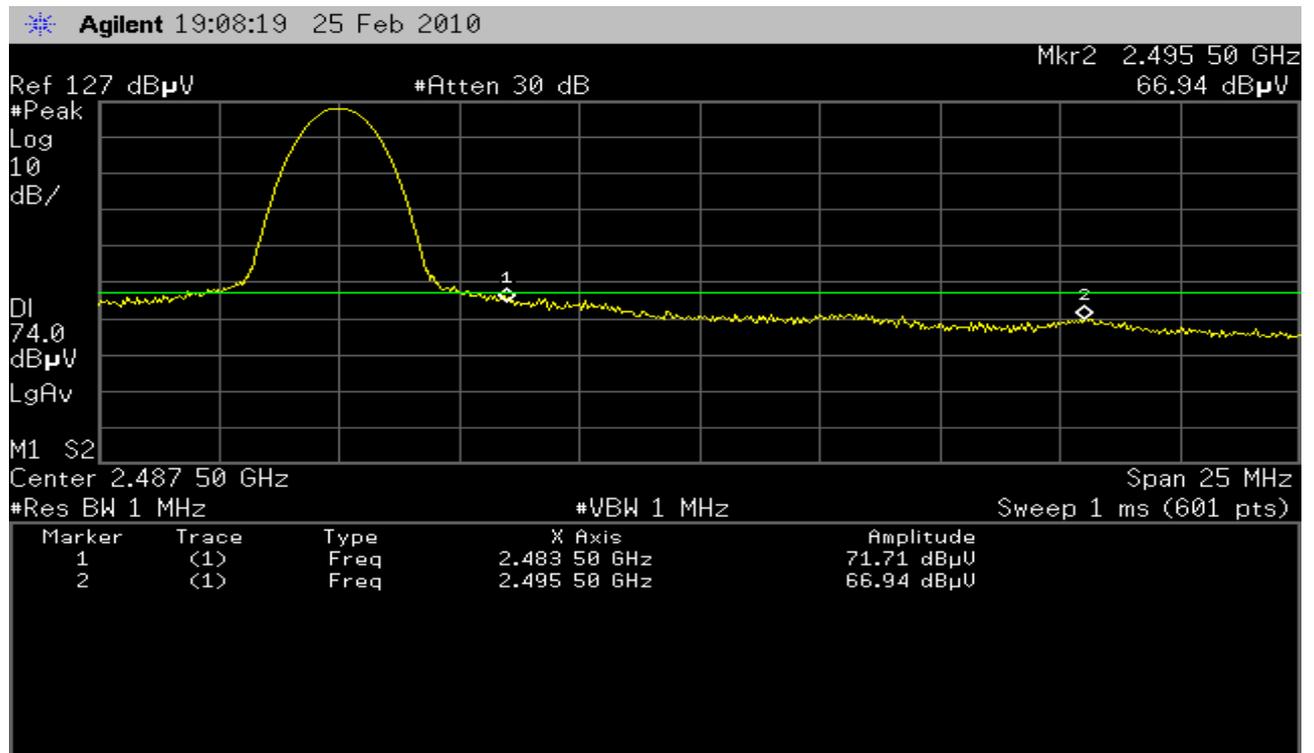
Polarity: Horizontal



Band Edges (CH High) --- ANT2400D18W (8DPSK)

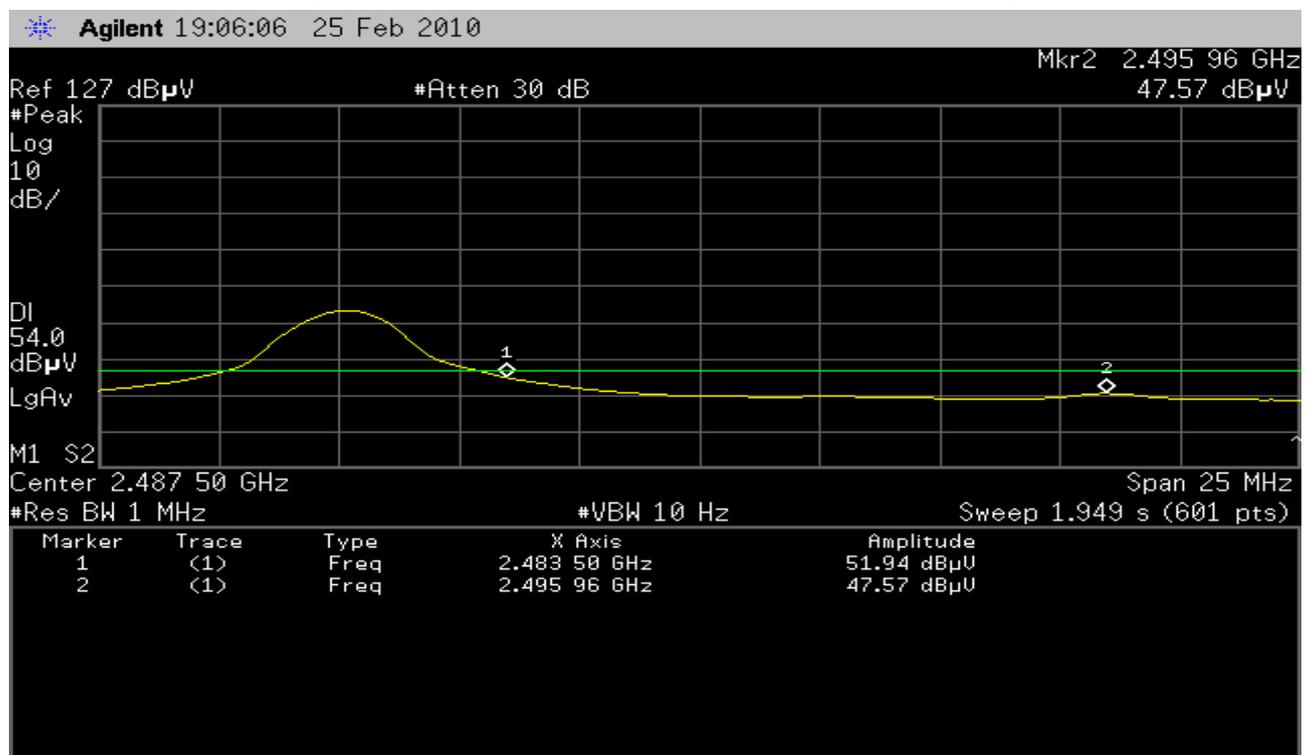
Detector mode: Peak

Polarity: Vertical



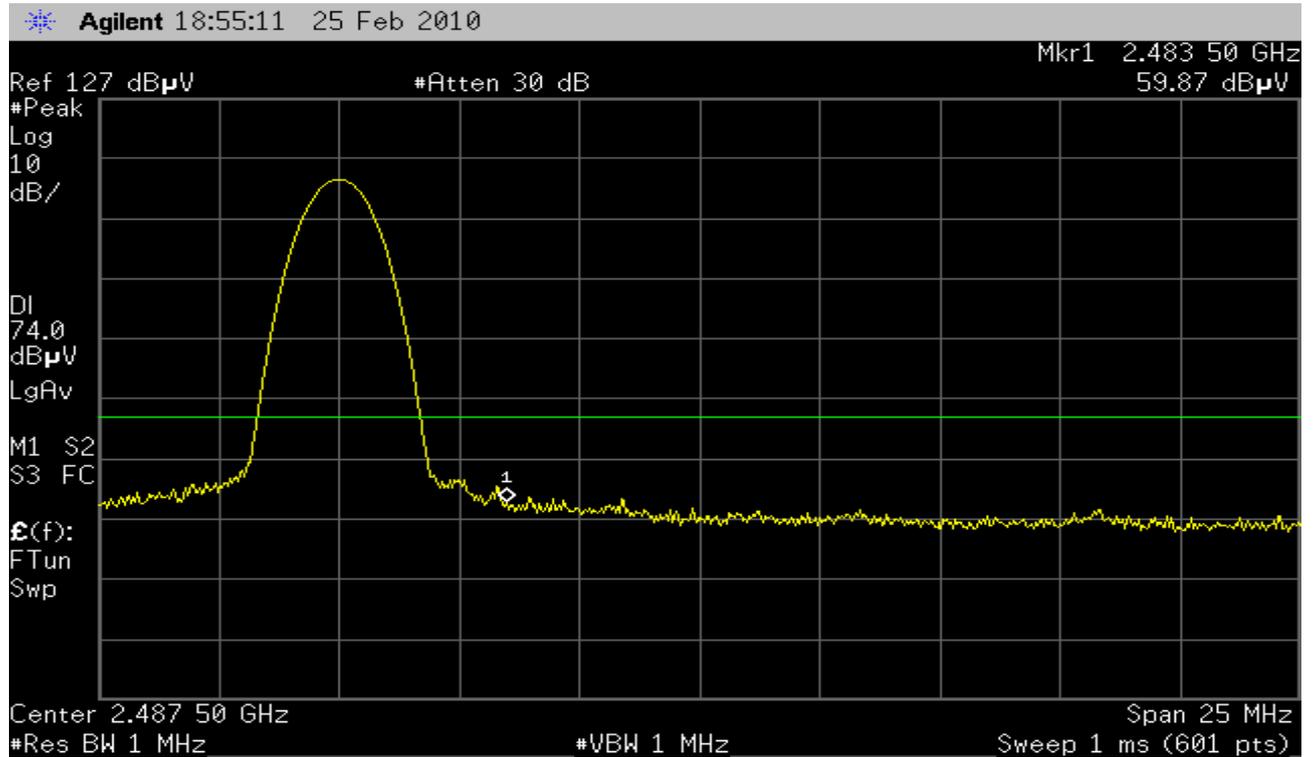
Detector mode: Average

Polarity: Vertical



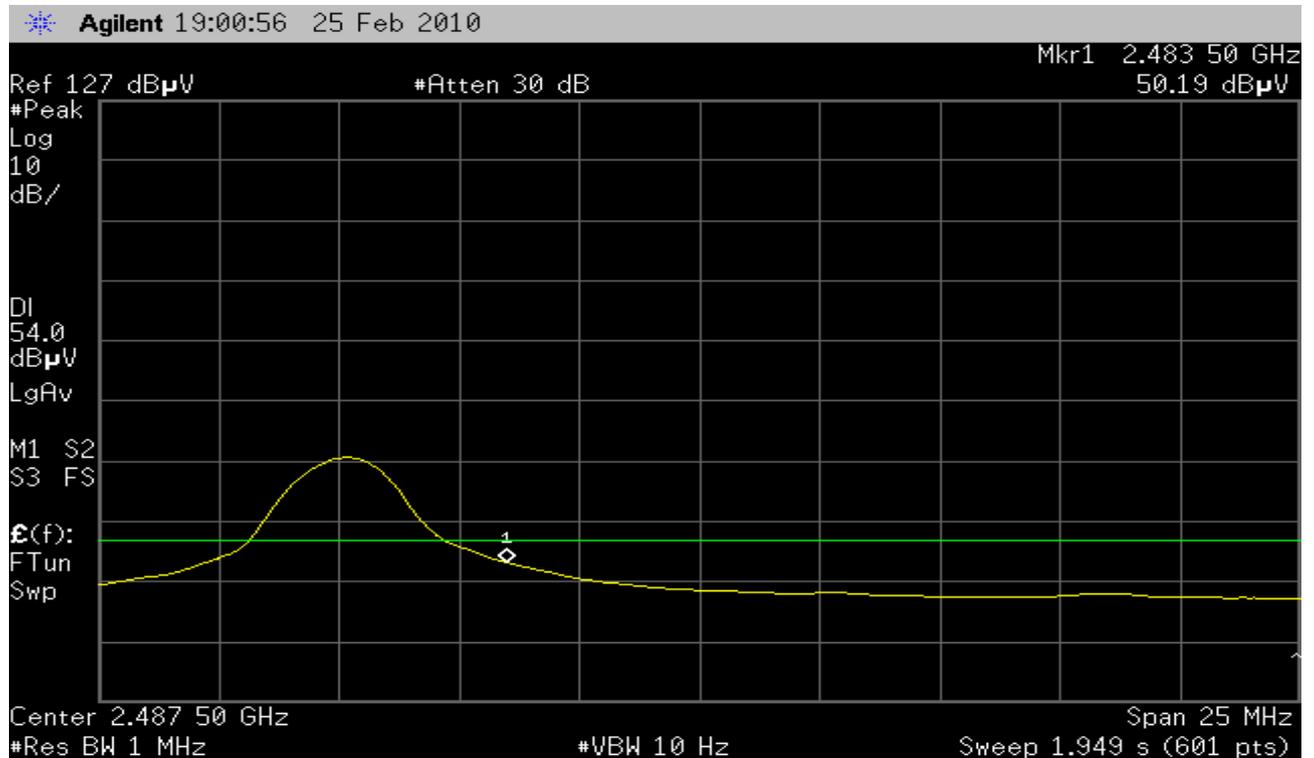
Detector mode: Peak

Polarity: Horizontal



Detector mode: Average

Polarity: Horizontal

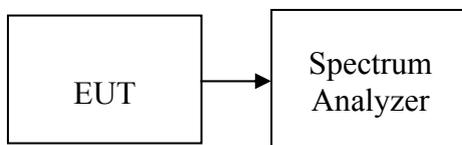


7.3 FREQUENCY SEPARATION

LIMIT

According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, 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, provided the systems operate with an output power no greater than 125 mW.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = middle of hopping channel.
4. Set the spectrum analyzer as RBW = 30kHz, VBW = 100kHz, Span = 3MHz, Sweep = auto.
5. Max hold, mark 3 peaks of hopping channel and record the 3 peaks frequency.

TEST RESULTS

No non-compliance noted

Test Data

GFSK

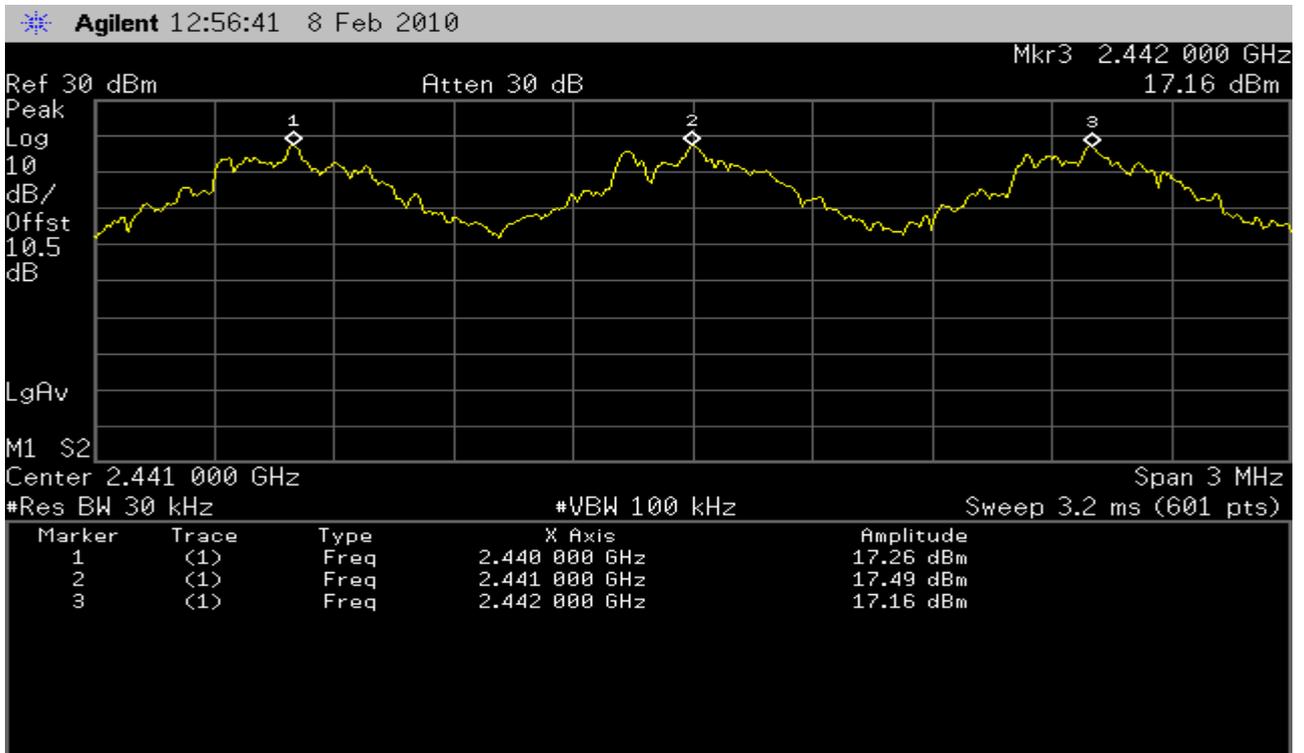
Channel Separation (MHz)	20dB Bandwidth (kHz)	Limit (kHz)	Result
1.00	905	>25	Pass

8DPSK

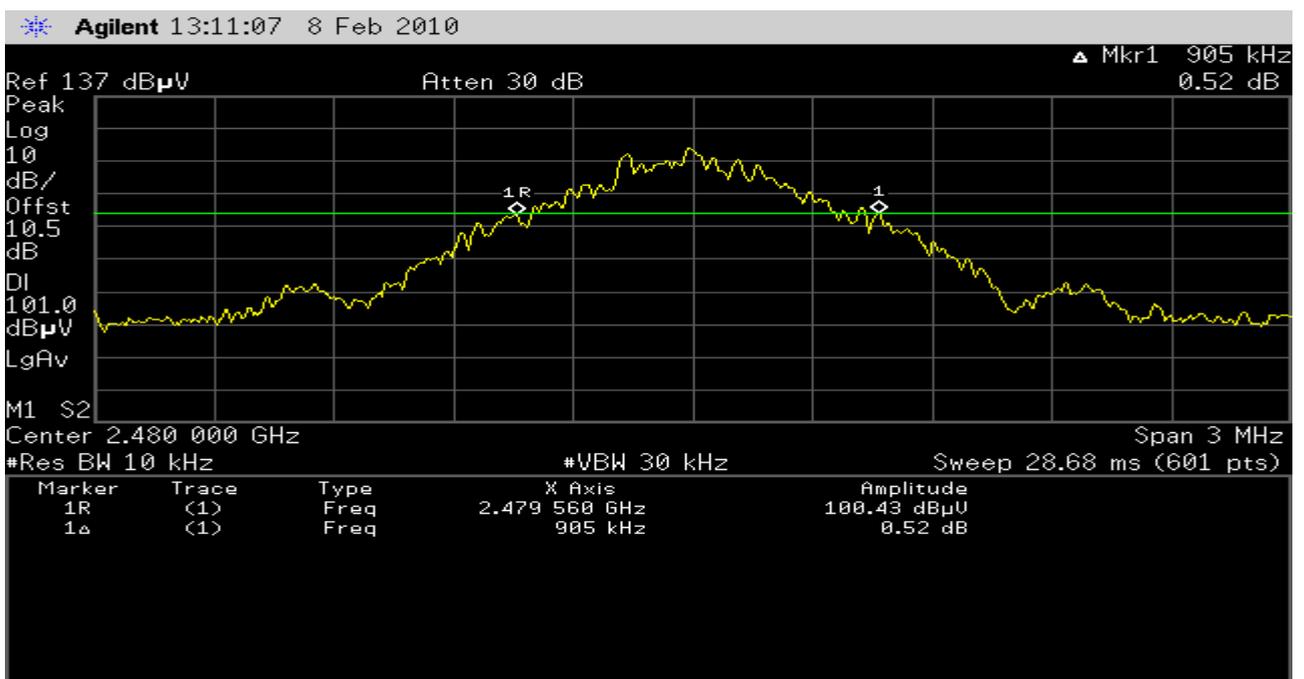
Channel Separation (MHz)	20dB Bandwidth (kHz)	Limit (kHz)	Result
1.00	1210	>25	Pass

Test Plot (GFSK)

Measurement of Channel Separation

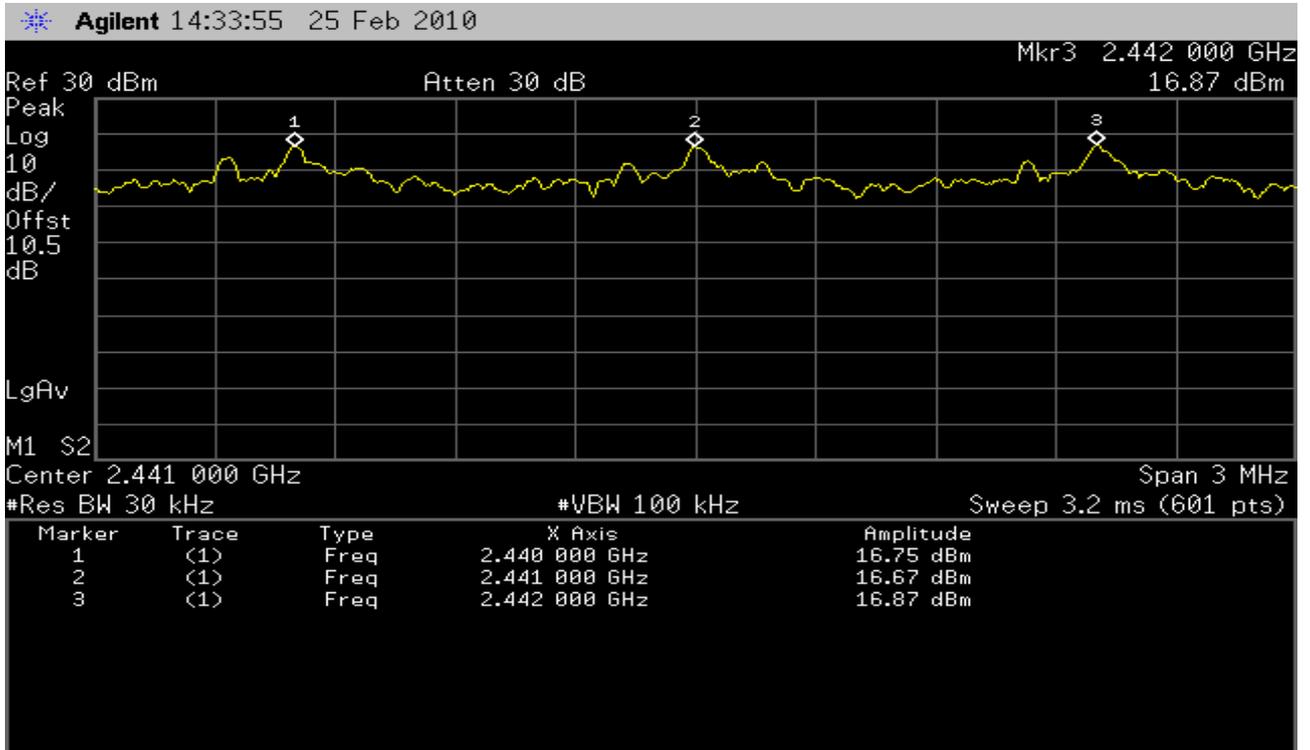


Measurement of 20dB Bandwidth

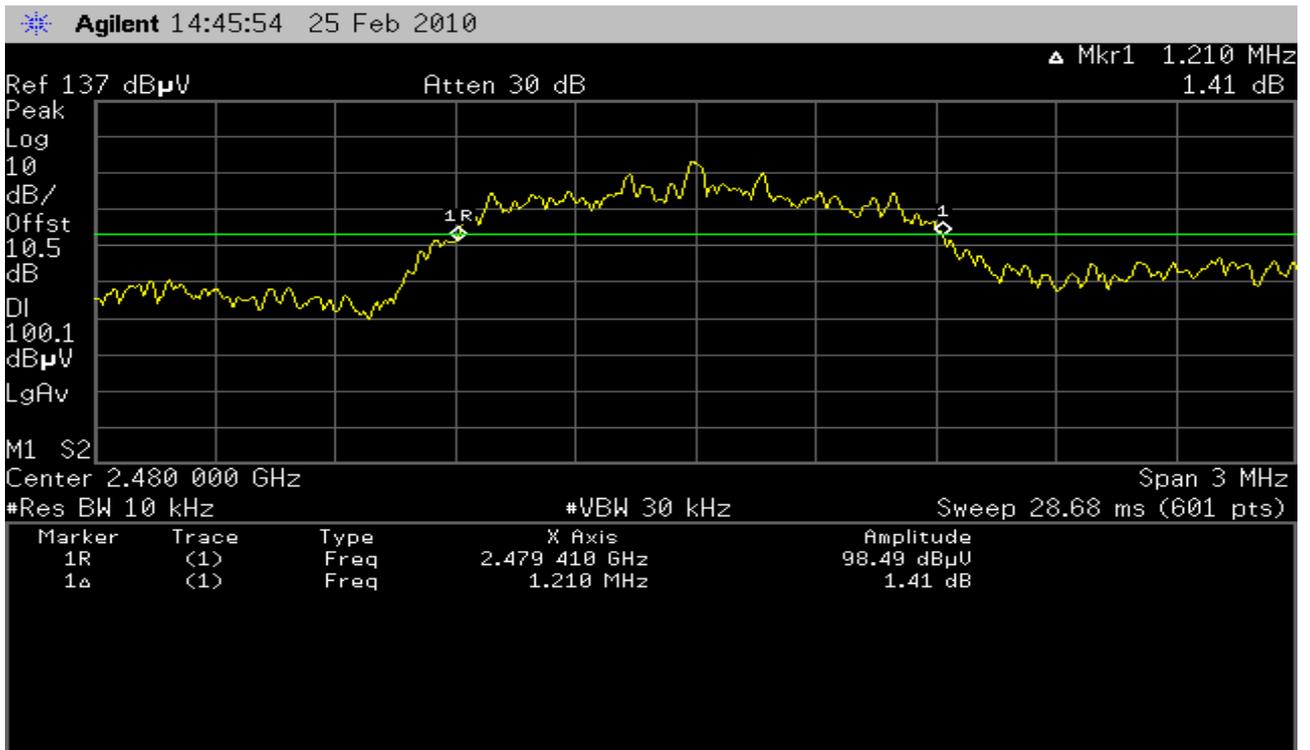


Test Plot (8DPSK)

Measurement of Channel Separation



Measurement of 20dB Bandwidth

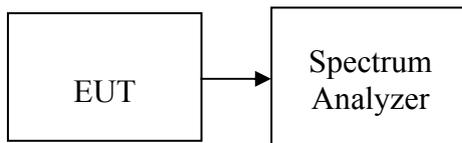


7.4 NUMBER OF HOPPING FREQUENCY

LIMIT

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

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set spectrum analyzer start=2400MHz, stop=2441.5MHz, sweep=auto and start=2441.5MHz stop=2483.5MHz, sweep=auto.
4. Set the spectrum analyzer as RBW, VBW=500kHz.
5. Max hold, view and count how many channel in the band.

TEST RESULTS

No non-compliance noted

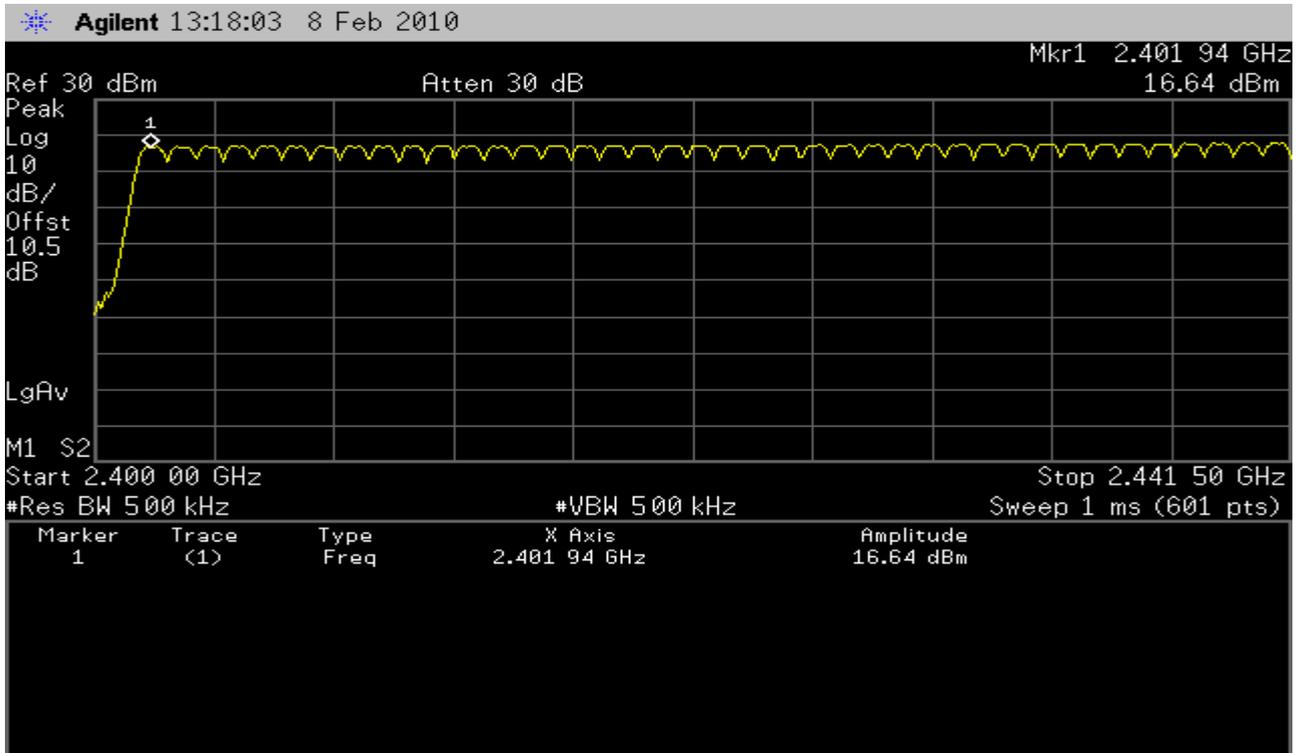
Test Data

Result (No. of CH)	Limit (No. of CH)	Result
79	>75	PASS

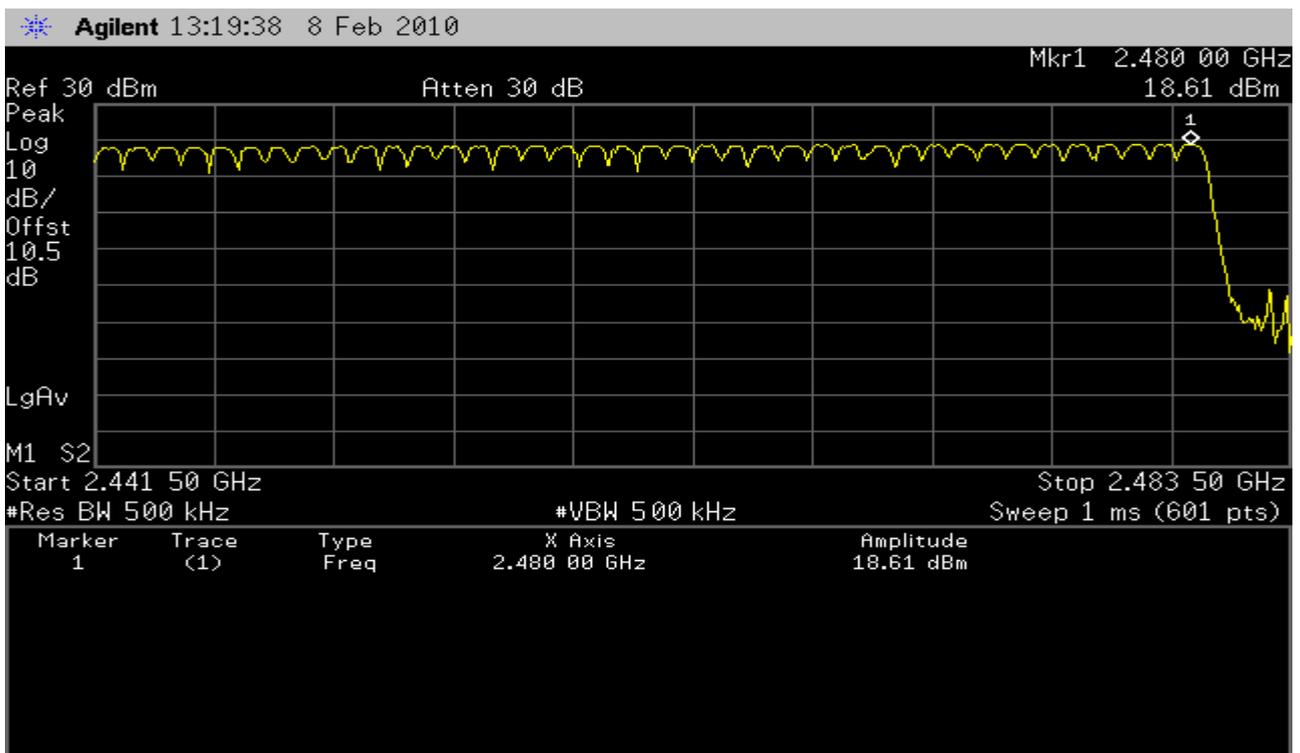
Test Plot(GFSK)

Channel Number

2.4 GHz – 2.4415 GHz



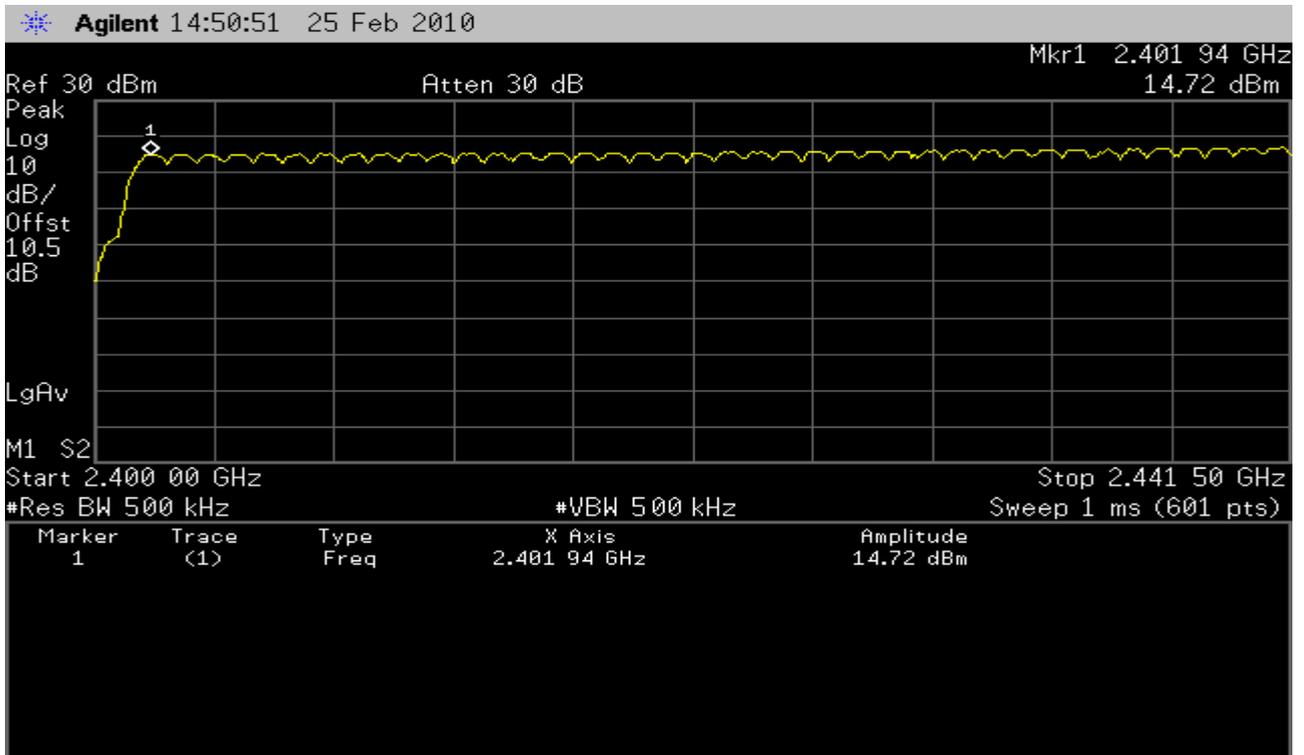
2.4415 GHz – 2.4835 GHz



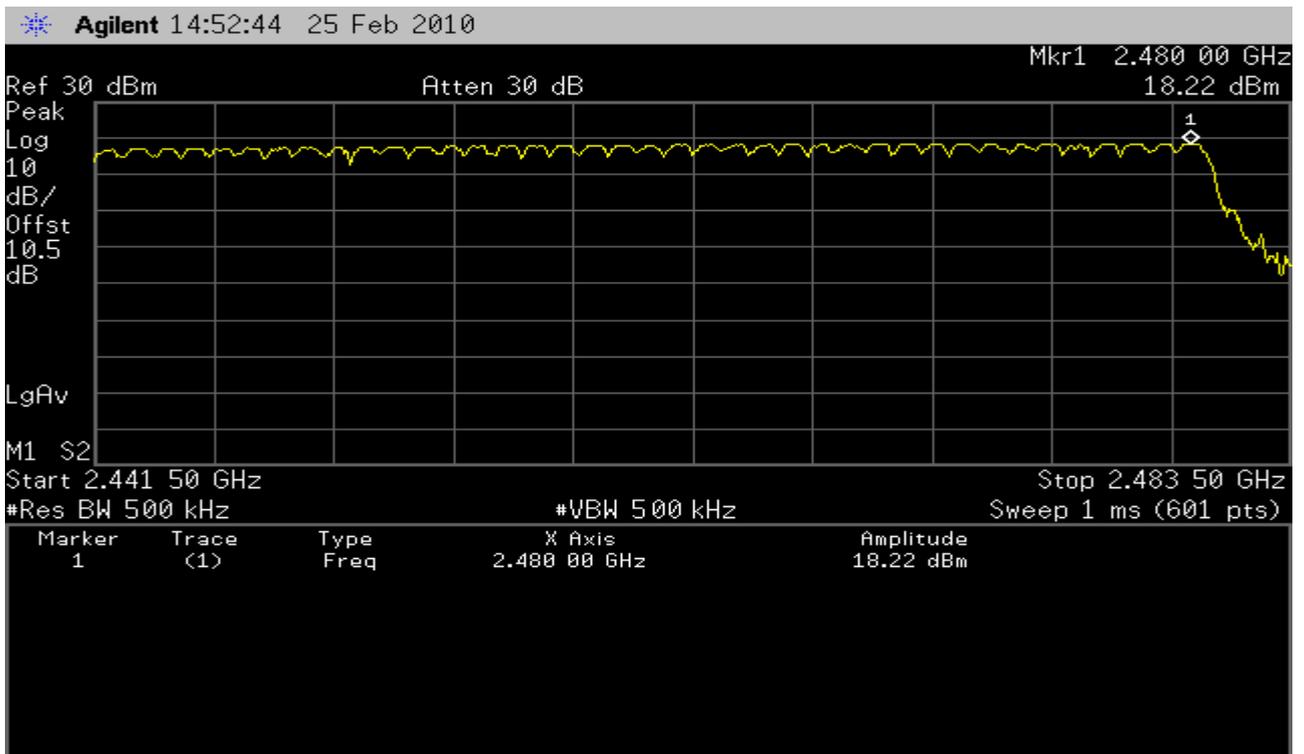
Test Plot(8DPSK)

Channel Number

2.4 GHz – 2.4415 GHz



2.4415 GHz – 2.4835 GHz

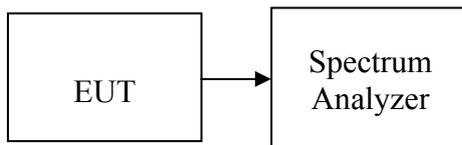


7.5 TIME OF OCCUPANCY (DWELL TIME)

LIMIT

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

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=1MHz, Span = 0Hz, Sweep = DH1,3,5=5,10 10ms.
5. Repeat above procedures until all frequency measured were complete.

TEST RESULTS

No non-compliance noted

Test Data (GFSK)

DH 1

CH Low: $0.40 * (1600/2)/79 * 31.6 = 128$ (ms)

CH Mid: $0.40 * (1600/2)/79 * 31.6 = 128$ (ms)

CH High: $0.40 * (1600/2)/79 * 31.6 = 128$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	0.40	128	31.60	400.00	PASS
Mid	0.40	128	31.60		PASS
High	0.40	128	31.60		PASS

DH 3

CH Low: $1.66 * (1600/4)/79 * 31.6 = 265.60$ (ms)

CH Mid: $1.63 * (1600/4)/79 * 31.6 = 260.80$ (ms)

CH High: $1.65 * (1600/4)/79 * 31.6 = 264.00$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	1.66	265.60	31.60	400.00	PASS
Mid	1.63	260.80	31.60		PASS
High	1.65	264.00	31.60		PASS

DH 5

CH Low: $2.90 * (1600/6)/79 * 31.6 = 309.33$ (ms)

CH Mid: $2.93 * (1600/6)/79 * 31.6 = 312.53$ (ms)

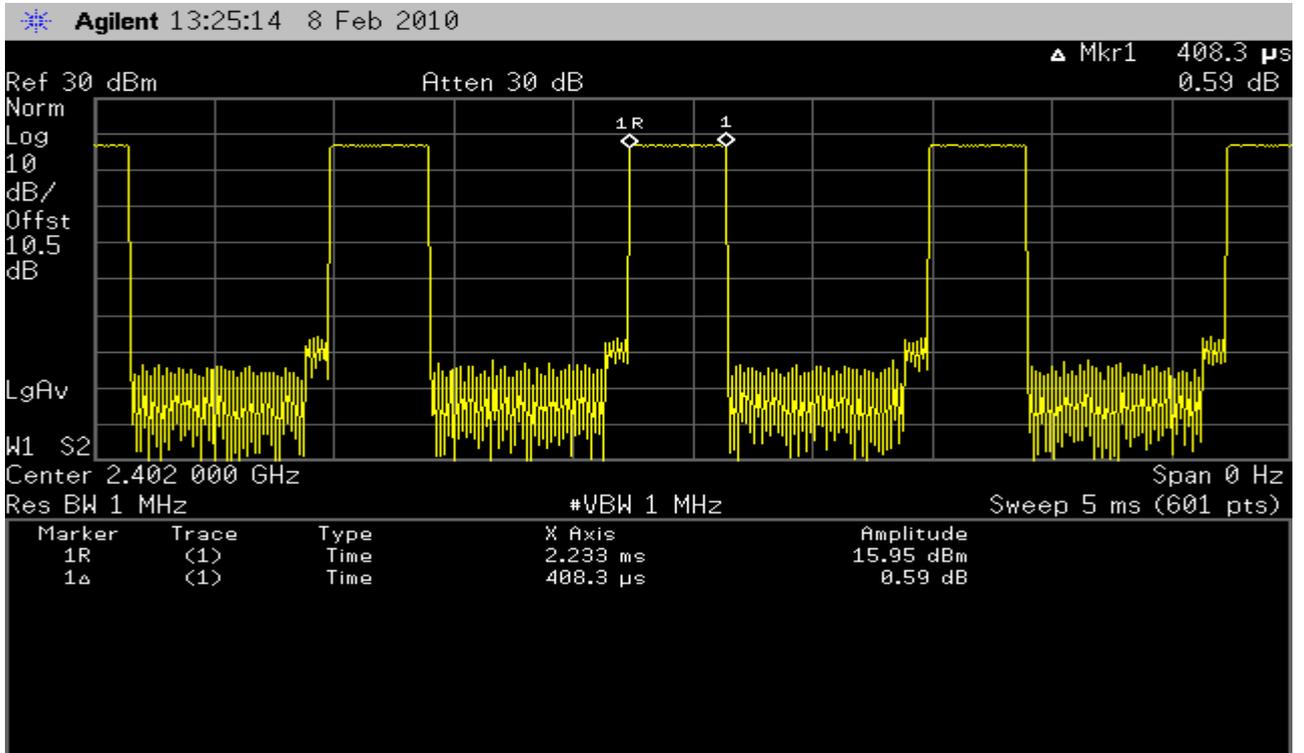
CH High: $2.90 * (1600/6)/79 * 31.6 = 309.33$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	2.9	309.33	31.60	400.00	PASS
Mid	2.93	312.53	31.60		PASS
High	2.9	309.33	31.60		PASS

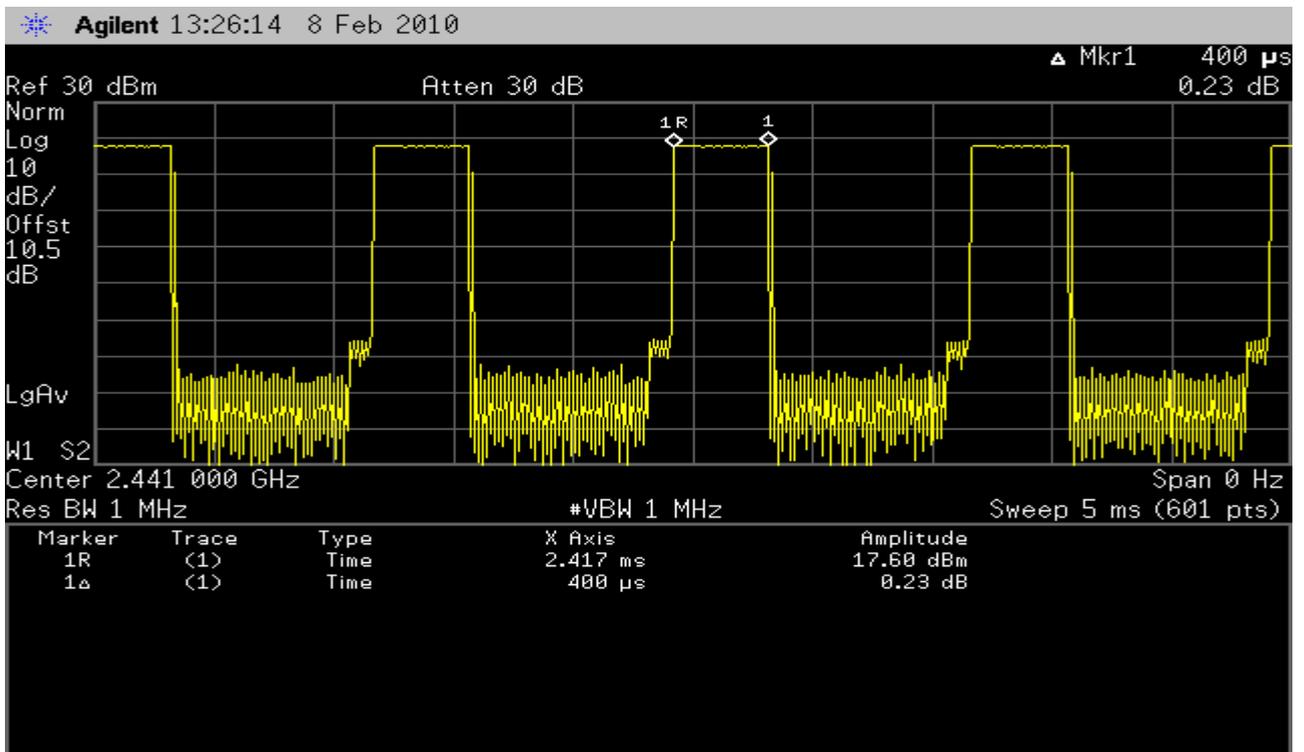
Test Plot

DH 1

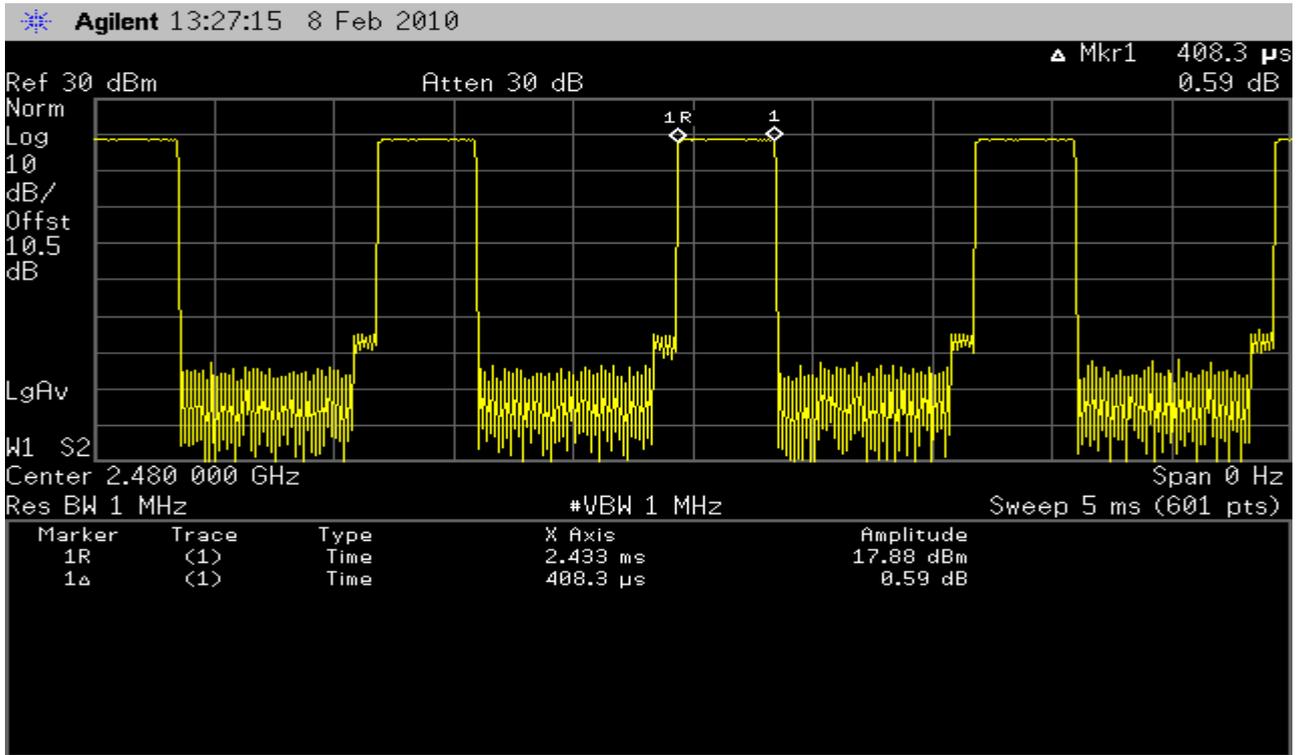
(CH Low)



(CH Mid)

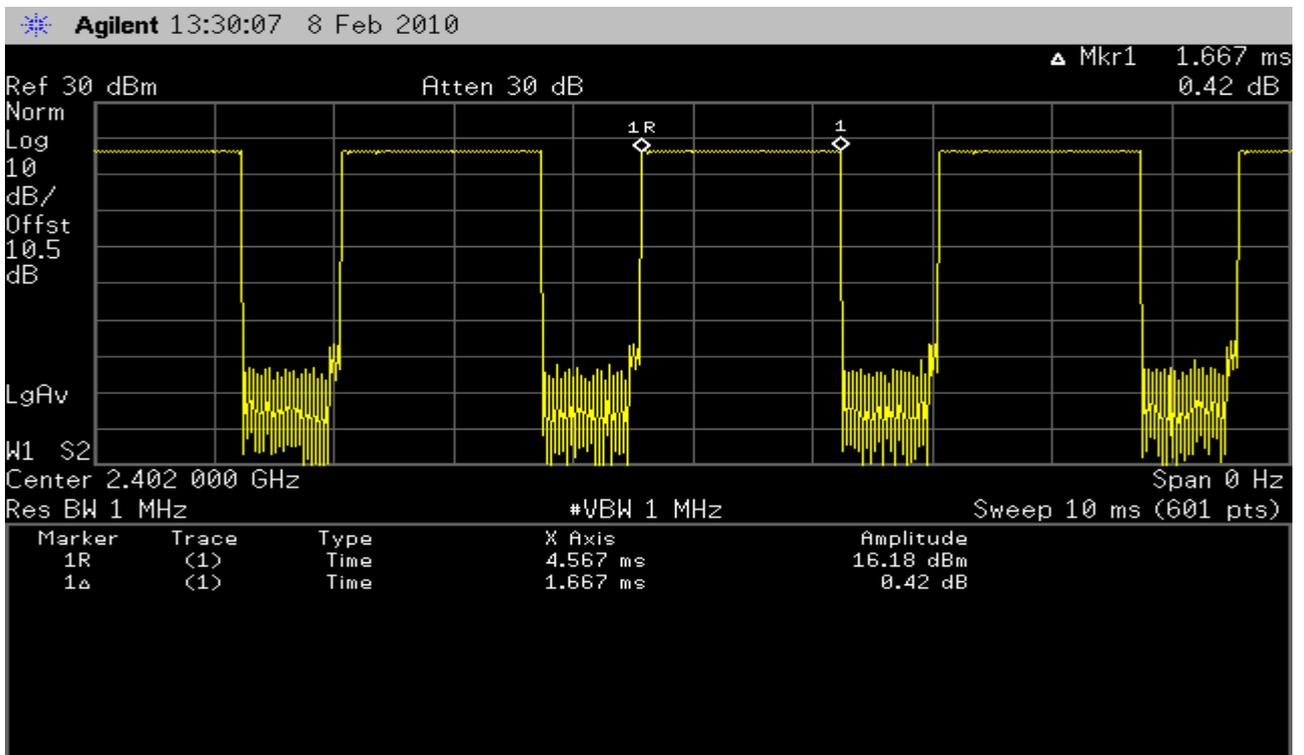


(CH High)

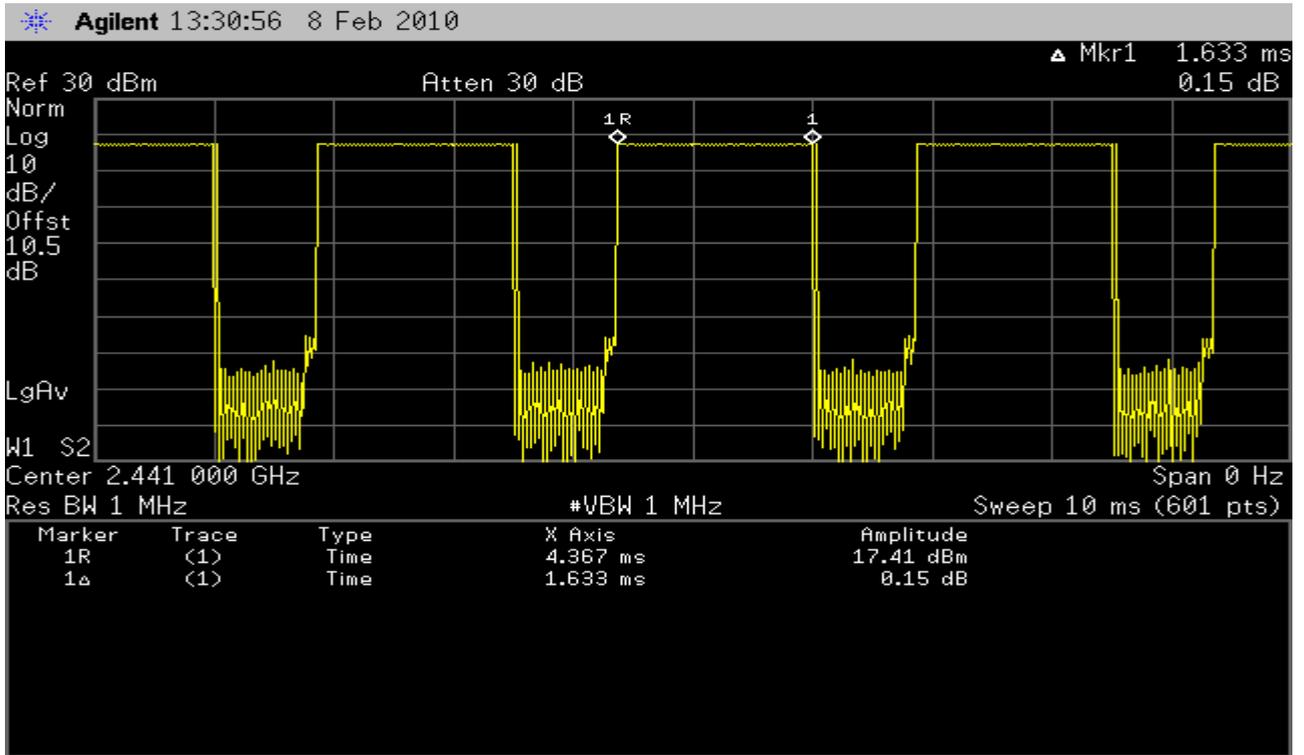


DH 3

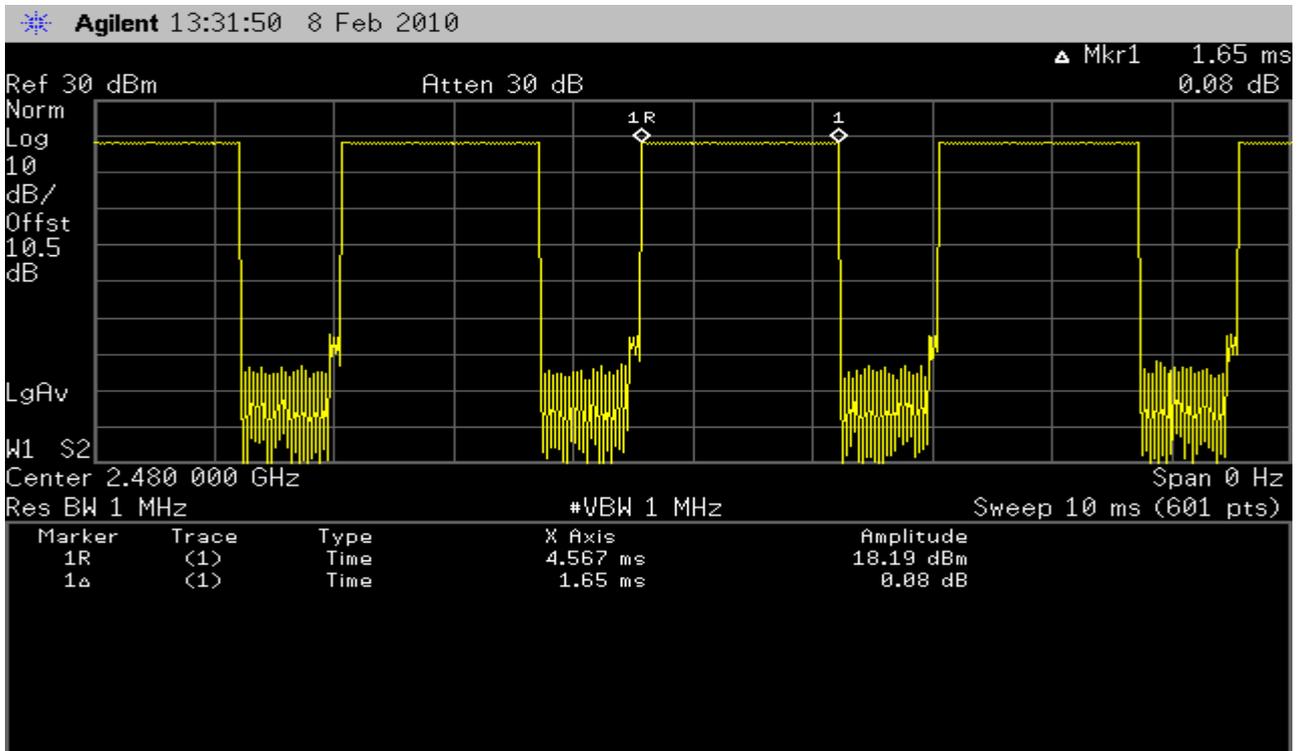
(CH Low)



(CH Mid)

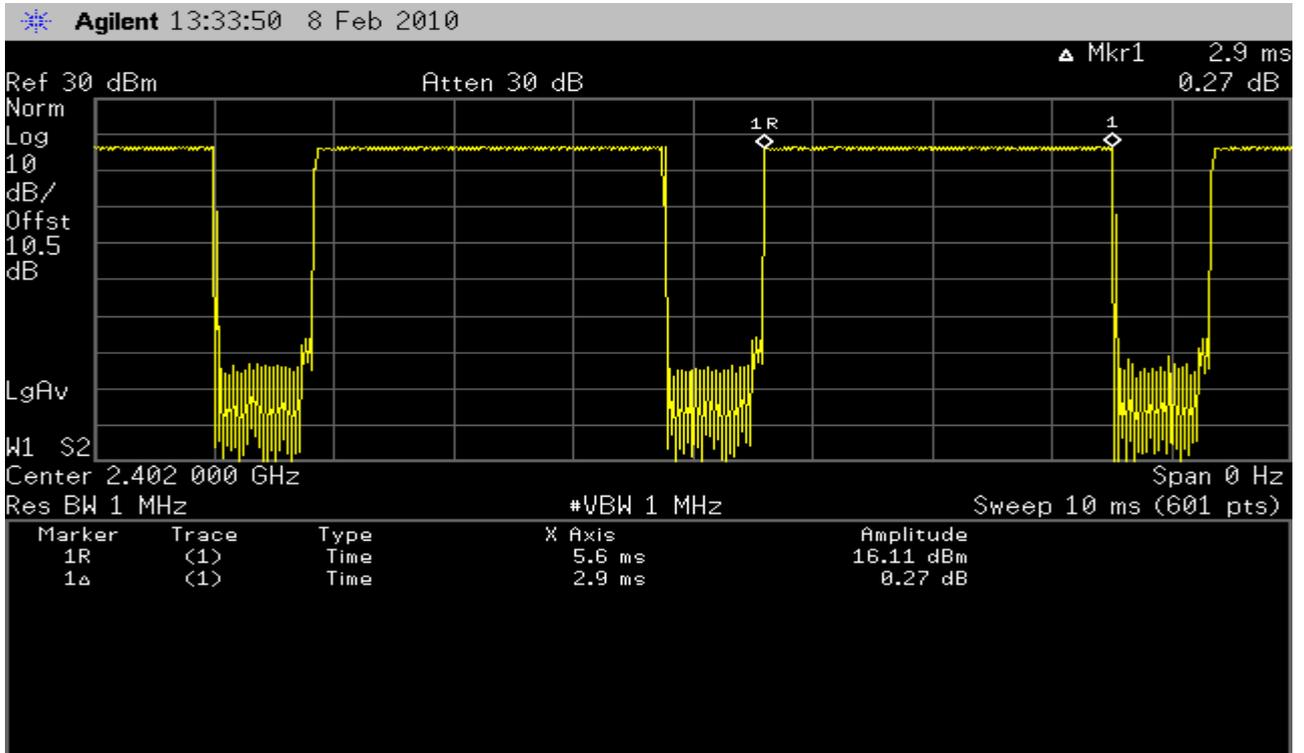


(CH High)

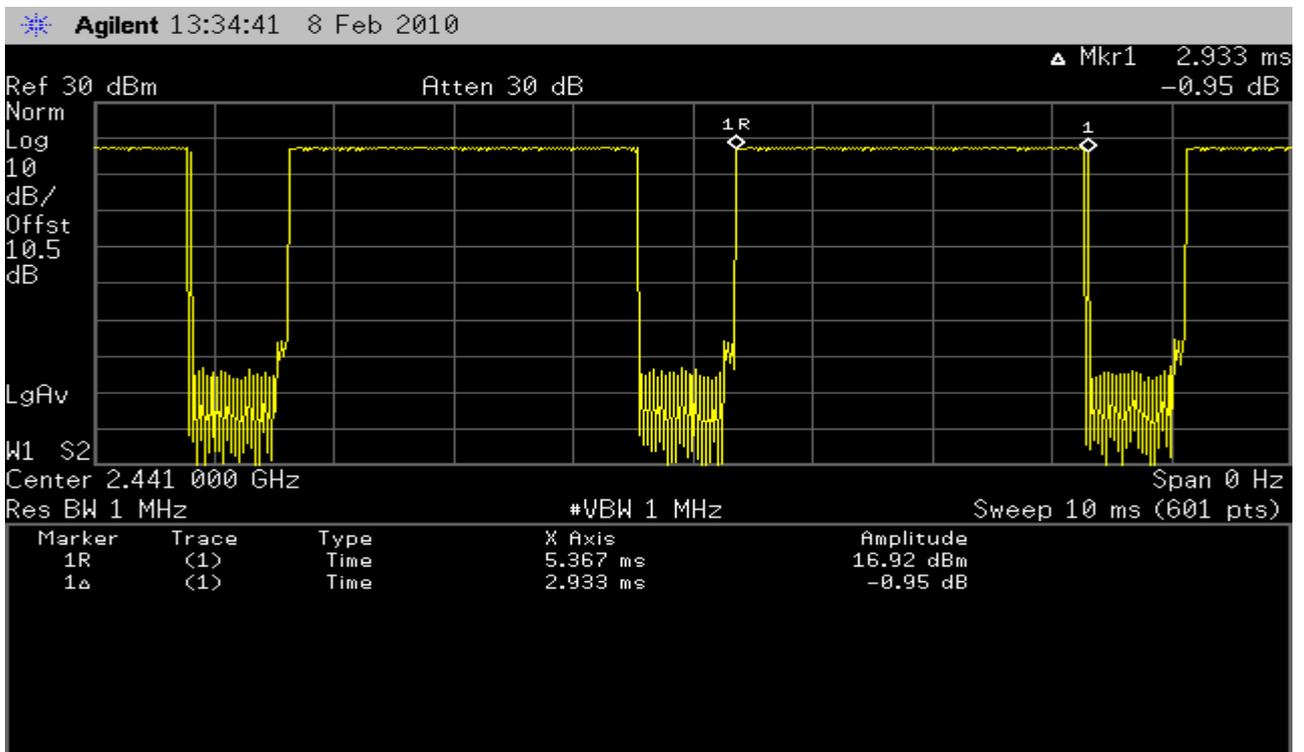


DH 5

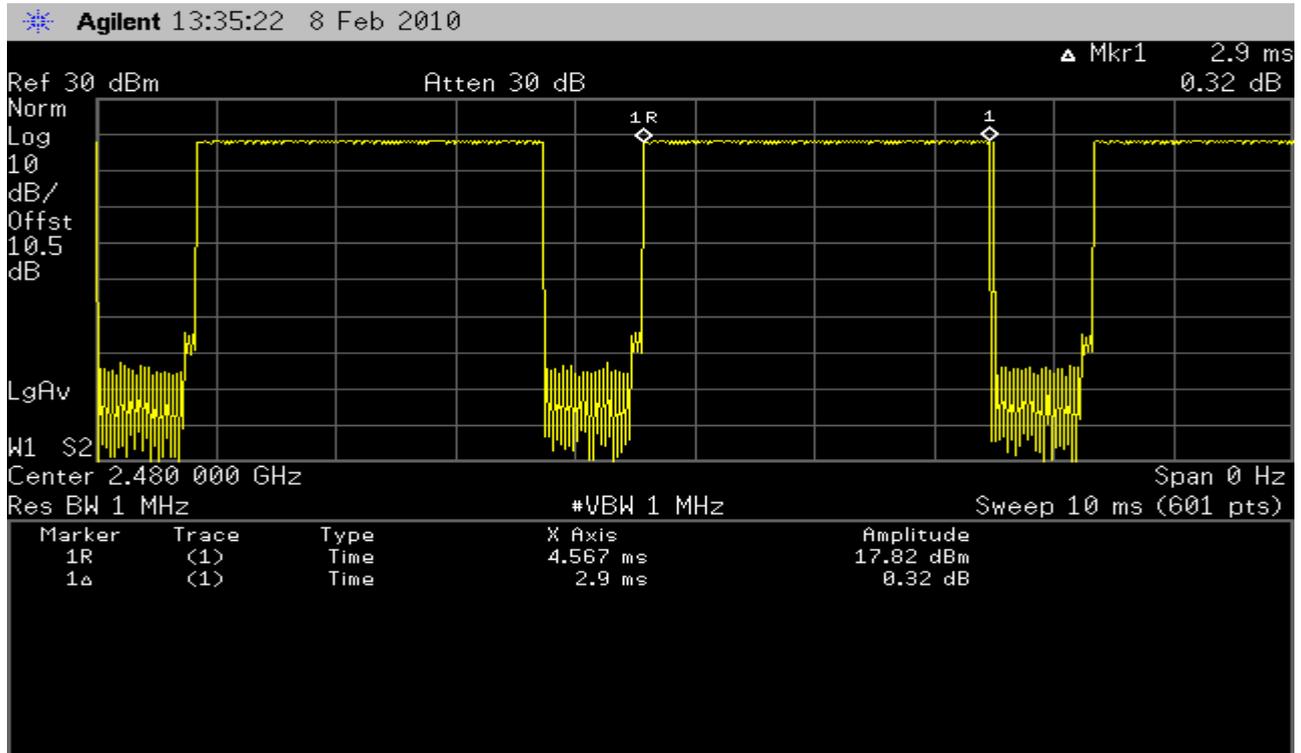
(CH Low)



(CH Mid)



(CH High)



Test Data (8DPSK)

DH 1

CH Low: $0.41 * (1600/2)/79 * 31.6 = 131.2$ (ms)

CH Mid: $0.41 * (1600/2)/79 * 31.6 = 131.2$ (ms)

CH High: $0.41 * (1600/2)/79 * 31.6 = 131.2$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	0.41	131.2	31.60	400.00	PASS
Mid	0.41	131.2	31.60		PASS
High	0.41	131.2	31.60		PASS

DH 3

CH Low: $1.66 * (1600/4)/79 * 31.6 = 265.60$ (ms)

CH Mid: $1.66 * (1600/4)/79 * 31.6 = 265.60$ (ms)

CH High: $1.66 * (1600/4)/79 * 31.6 = 265.60$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	1.66	265.60	31.60	400.00	PASS
Mid	1.66	265.60	31.60		PASS
High	1.66	265.60	31.60		PASS

DH 5

CH Low: $2.93 * (1600/6)/79 * 31.6 = 312.53$ (ms)

CH Mid: $2.90 * (1600/6)/79 * 31.6 = 309.33$ (ms)

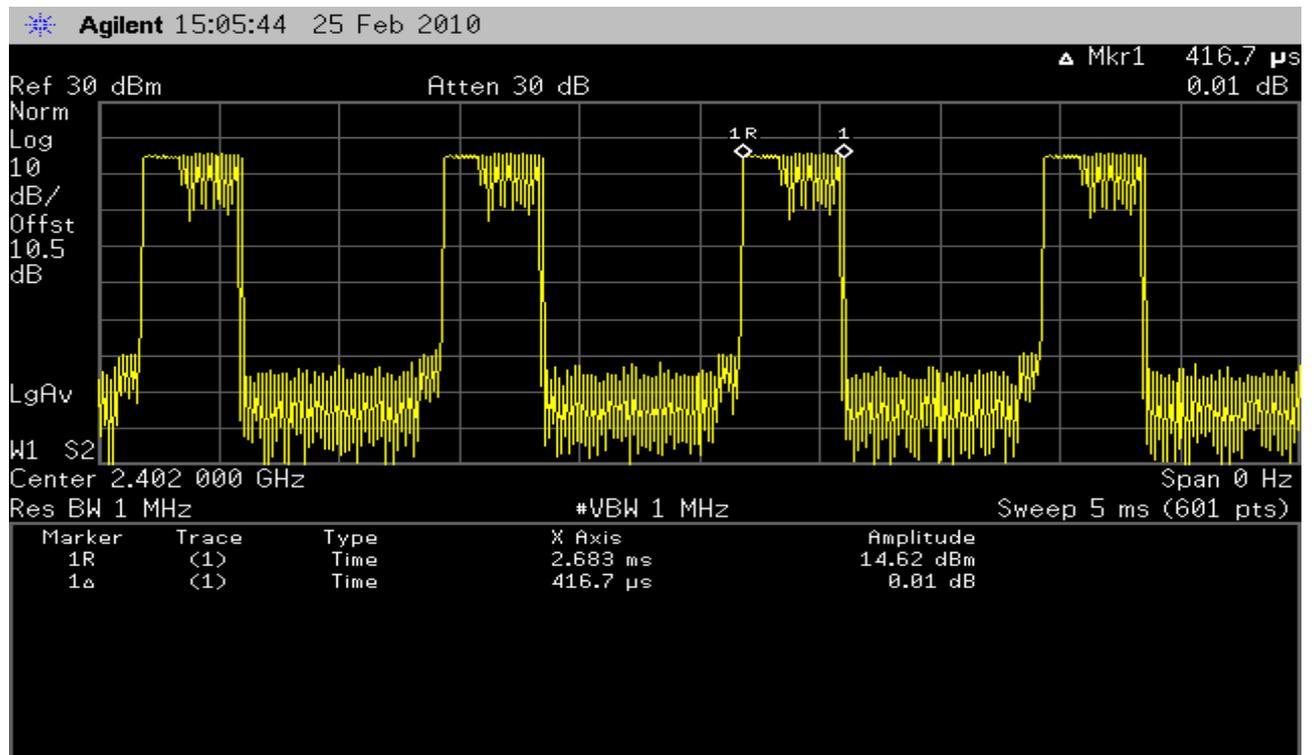
CH High: $2.90 * (1600/6)/79 * 31.6 = 309.33$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	2.93	312.53	31.60	400.00	PASS
Mid	2.9	309.33	31.60		PASS
High	2.9	309.33	31.60		PASS

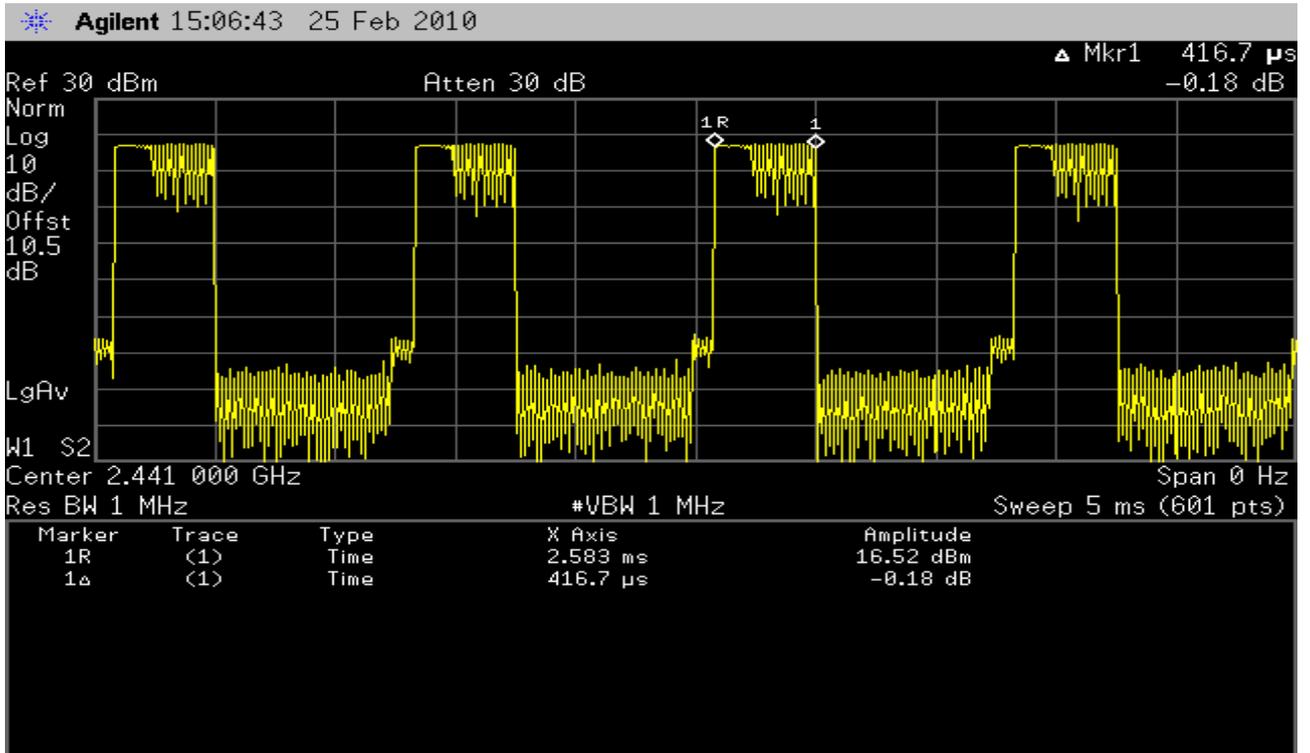
Test Plot

DH 1

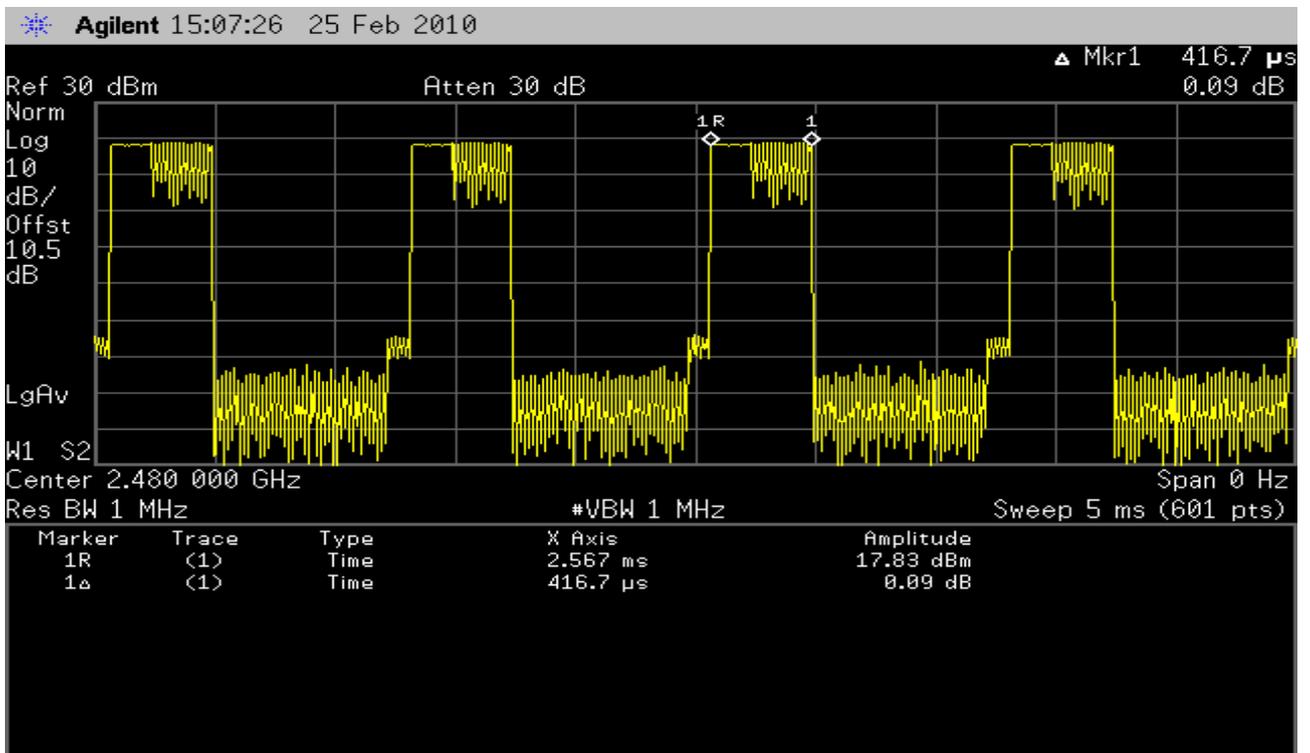
(CH Low)



(CH Mid)

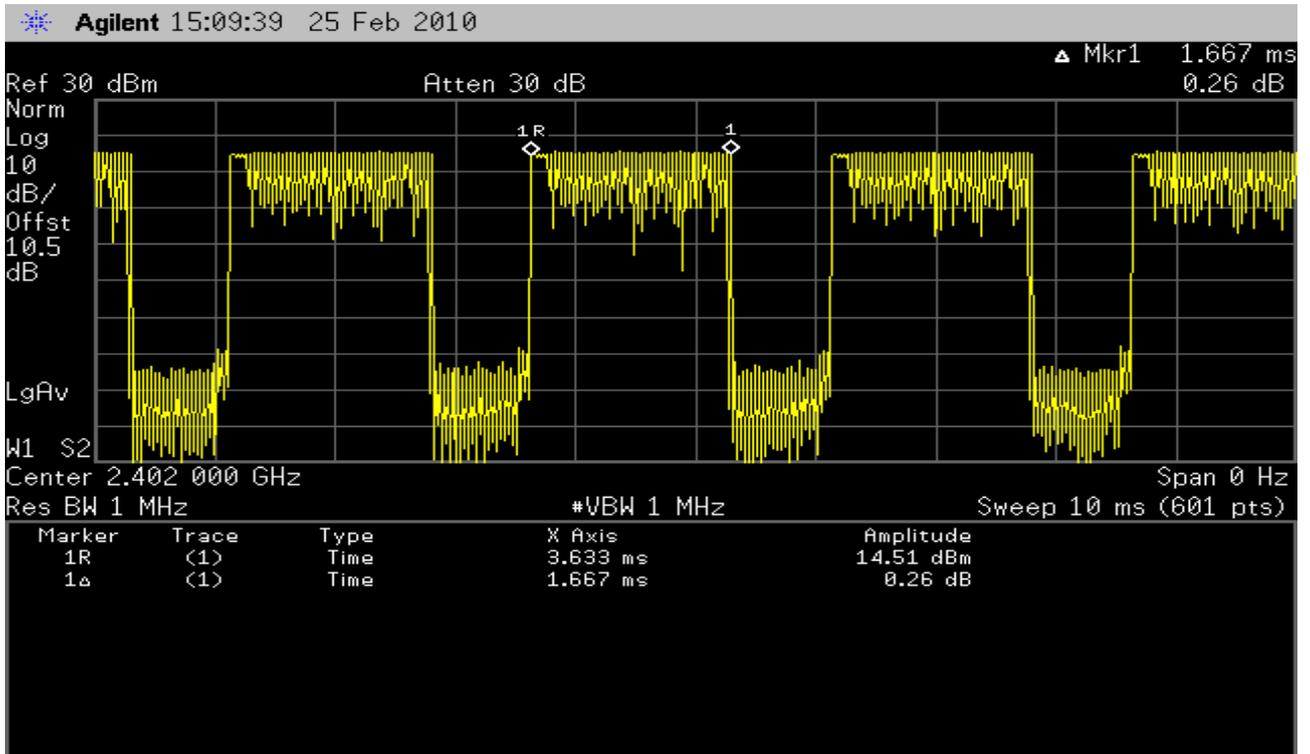


(CH High)

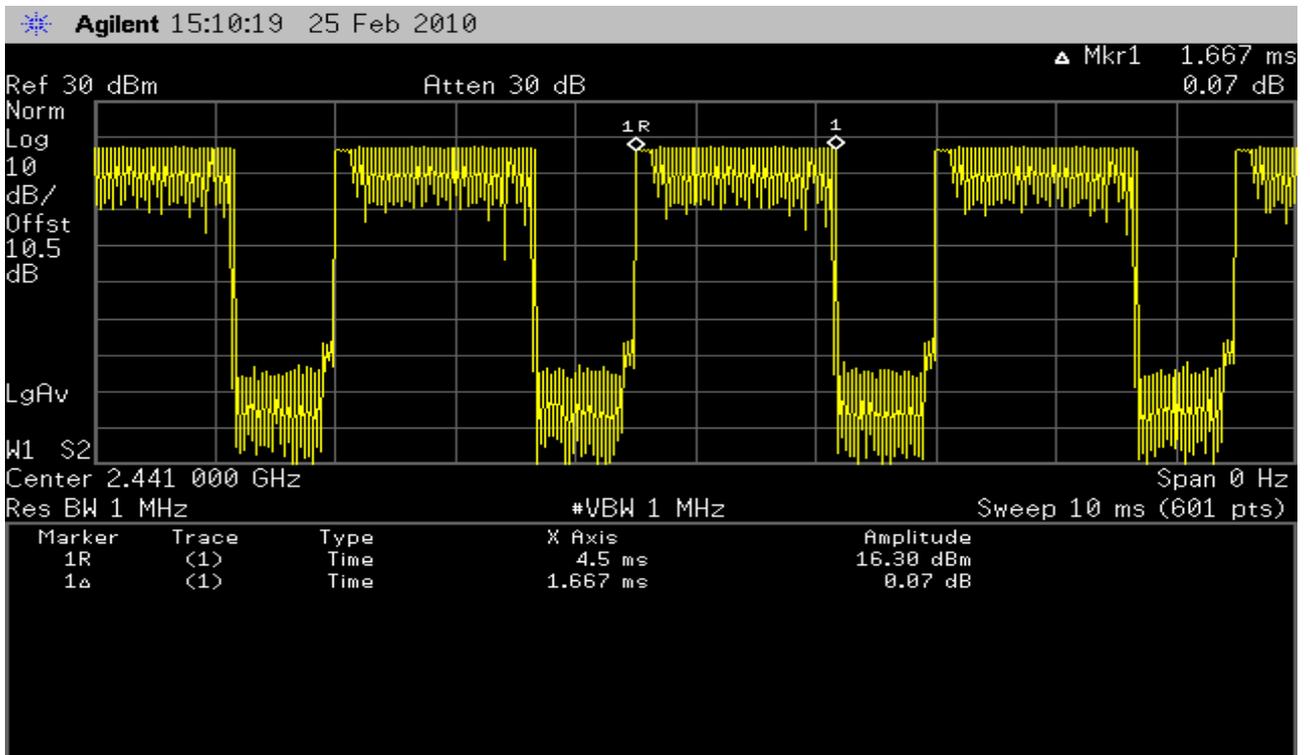


DH 3

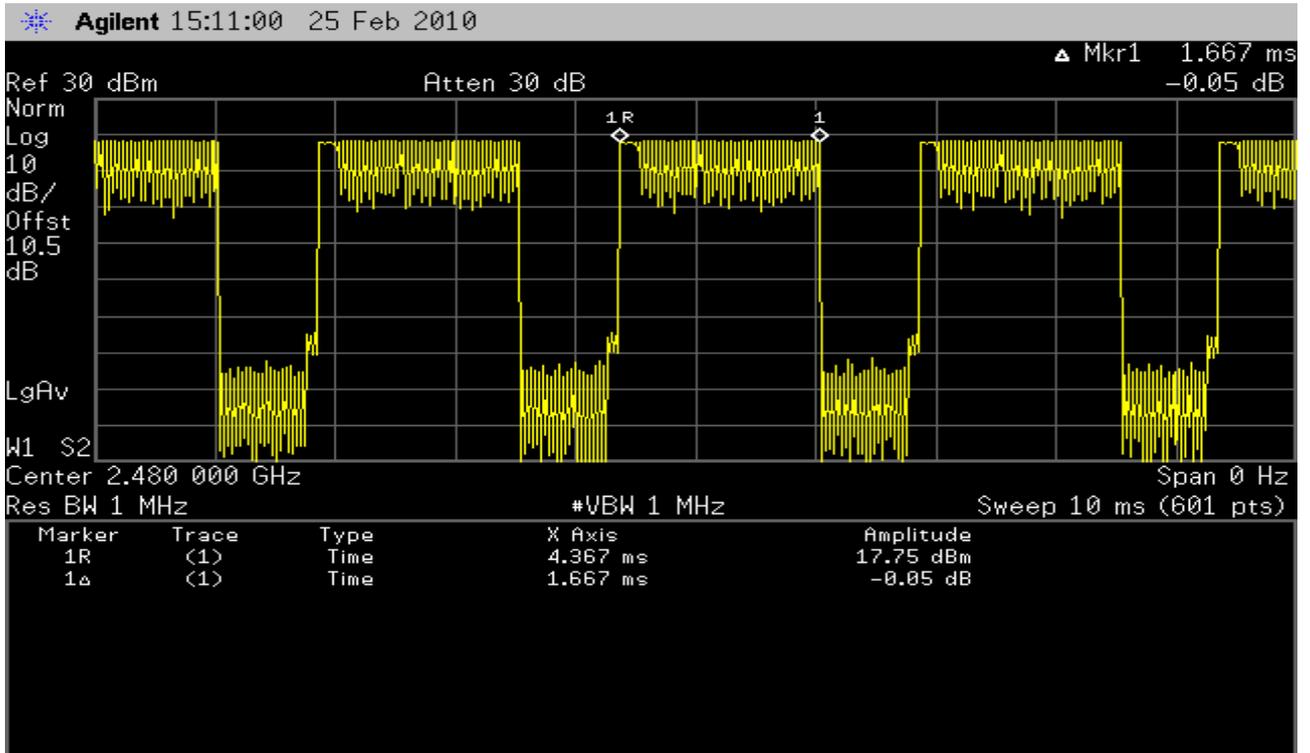
(CH Low)



(CH Mid)

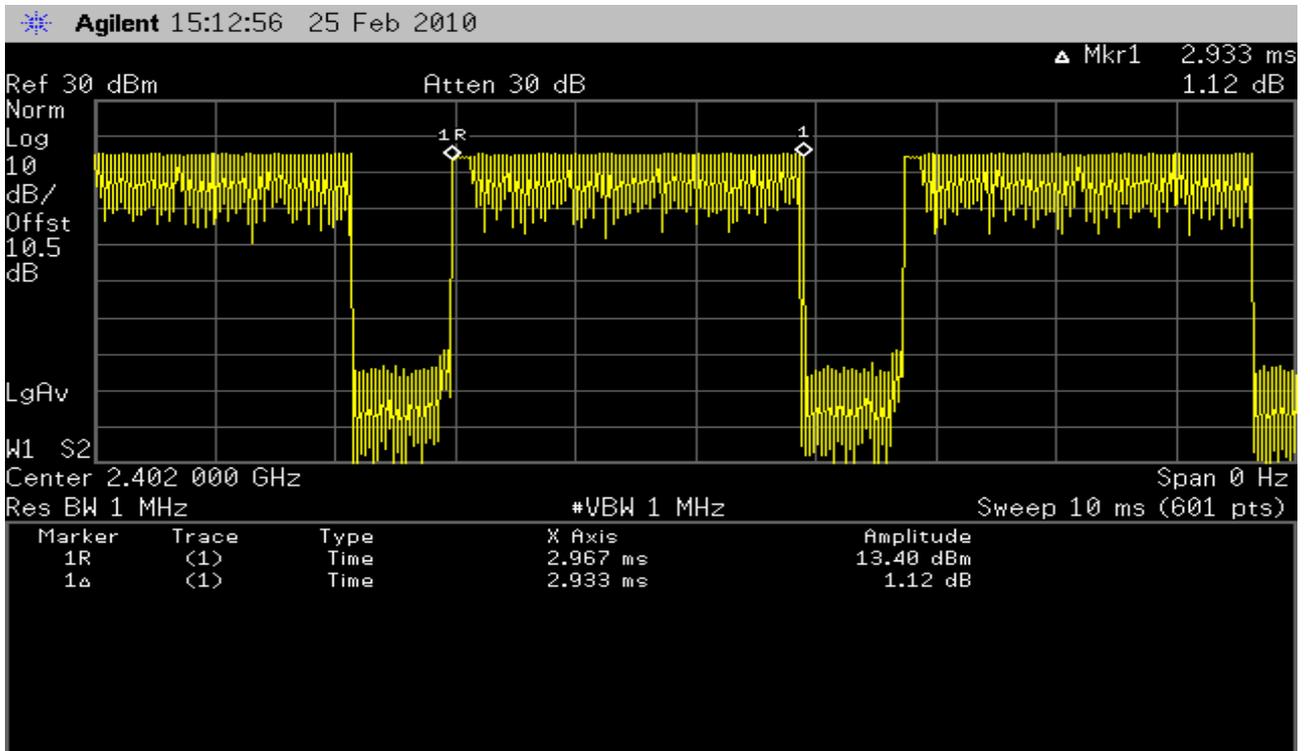


(CH High)

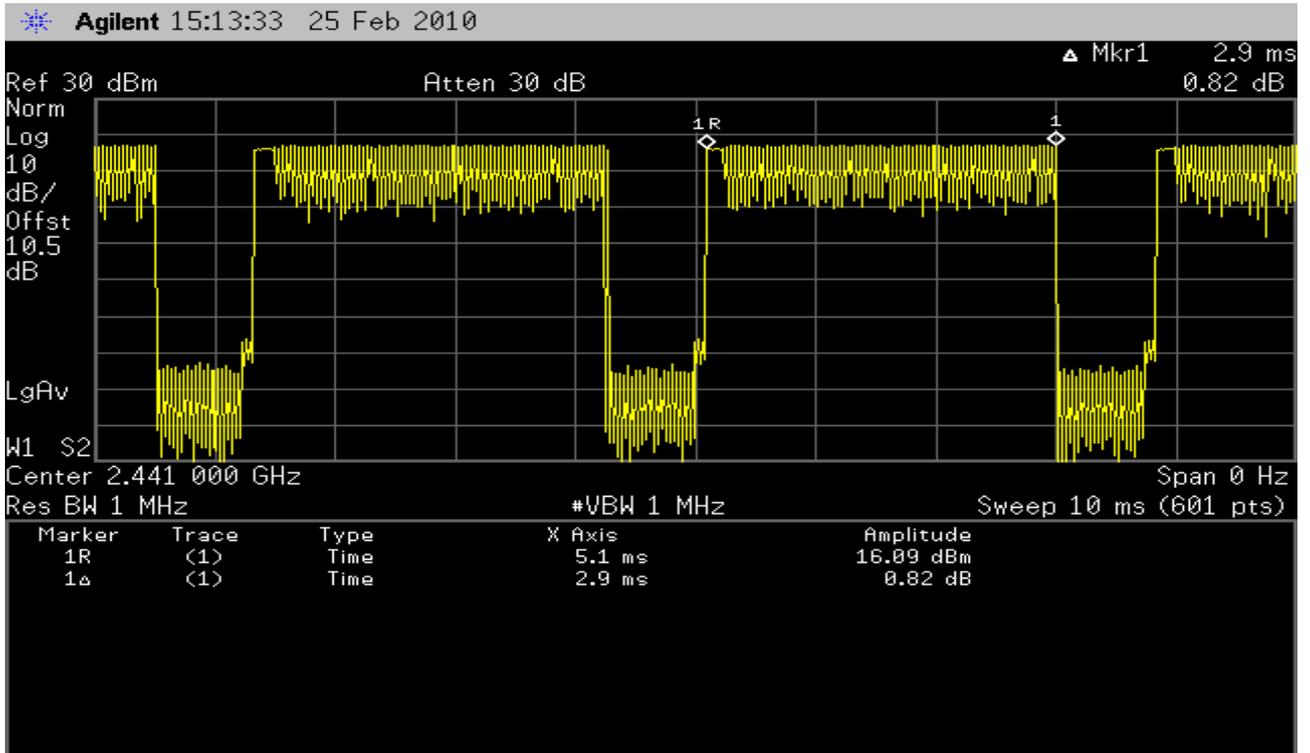


DH 5

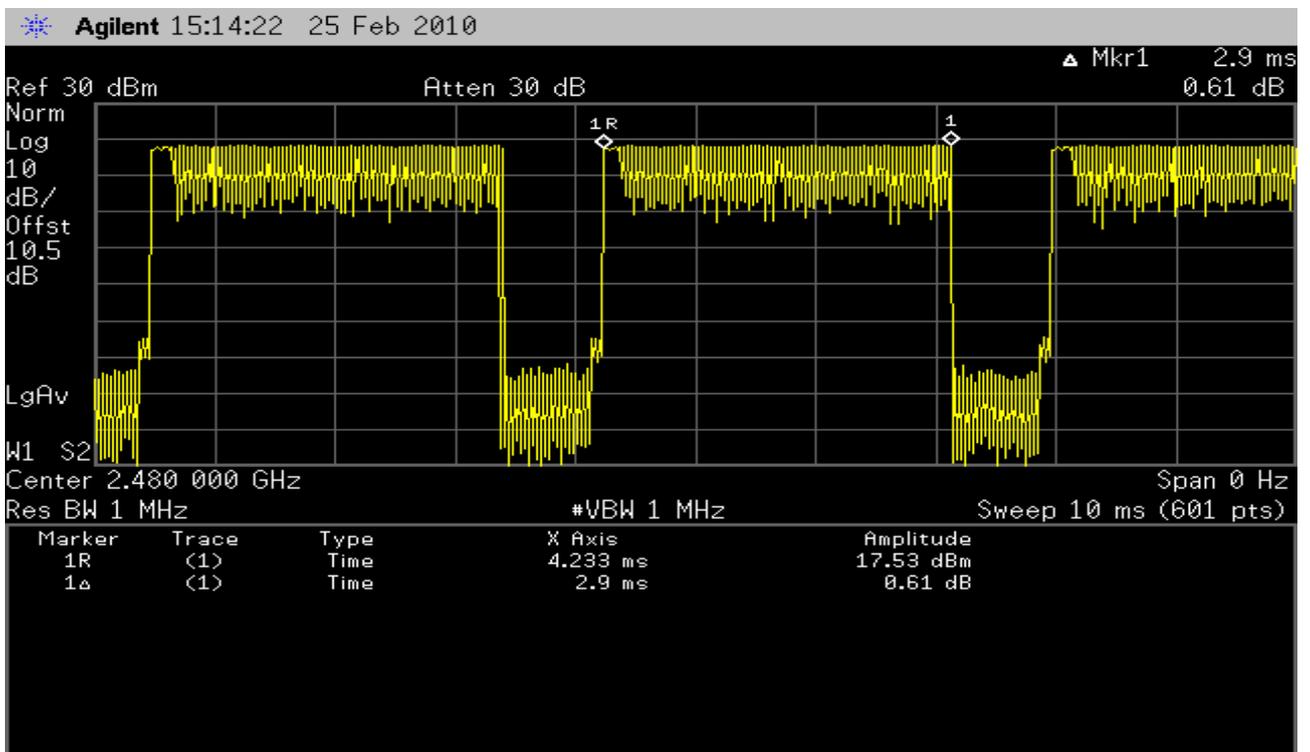
(CH Low)



(CH Mid)



(CH High)



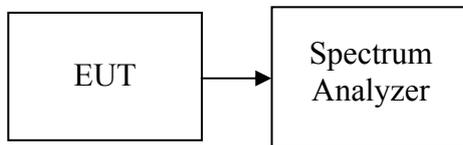
7.6 SPURIOUS EMISSIONS

7.6.1 Conducted Measurement

LIMIT

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a) (see Section 15.205(c)).

Test Configuration



TEST PROCEDURE

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 100 kHz.

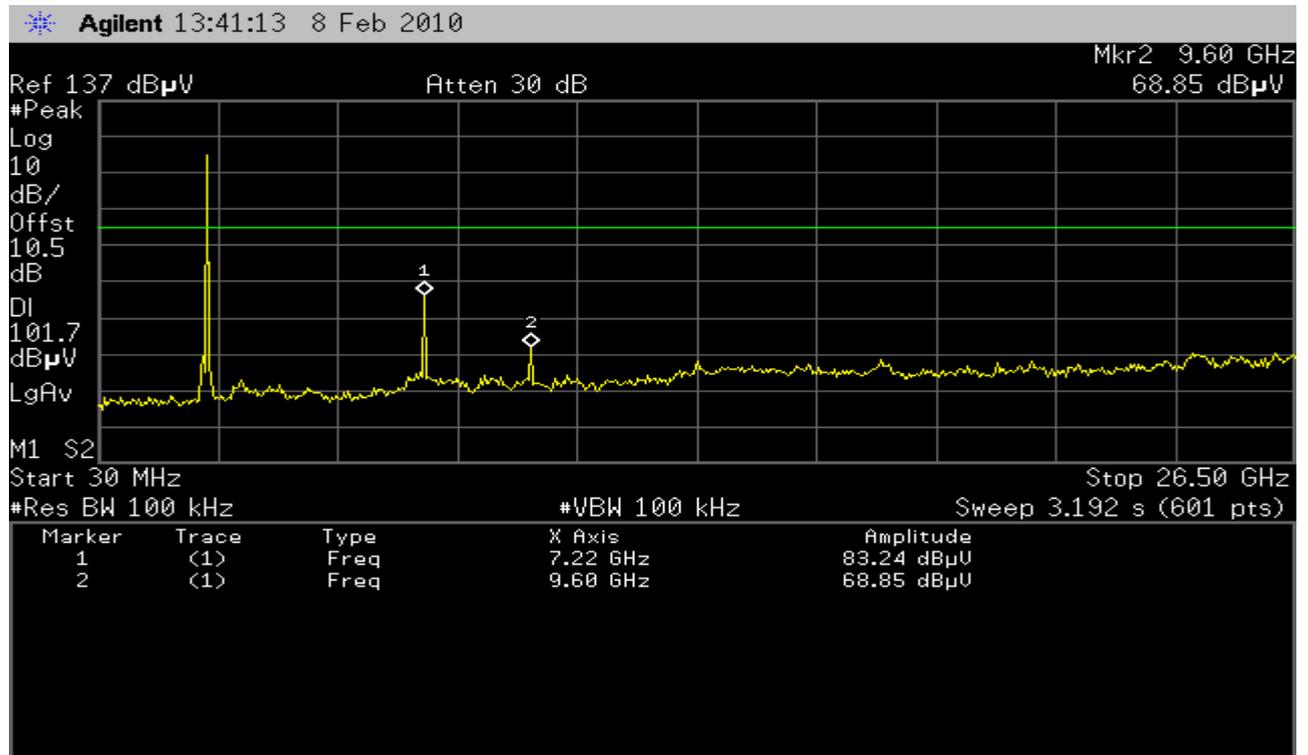
Measurements are made over the 30MHz to 26GHz range with the transmitter set to the lowest, middle, and highest channels.

TEST RESULTS

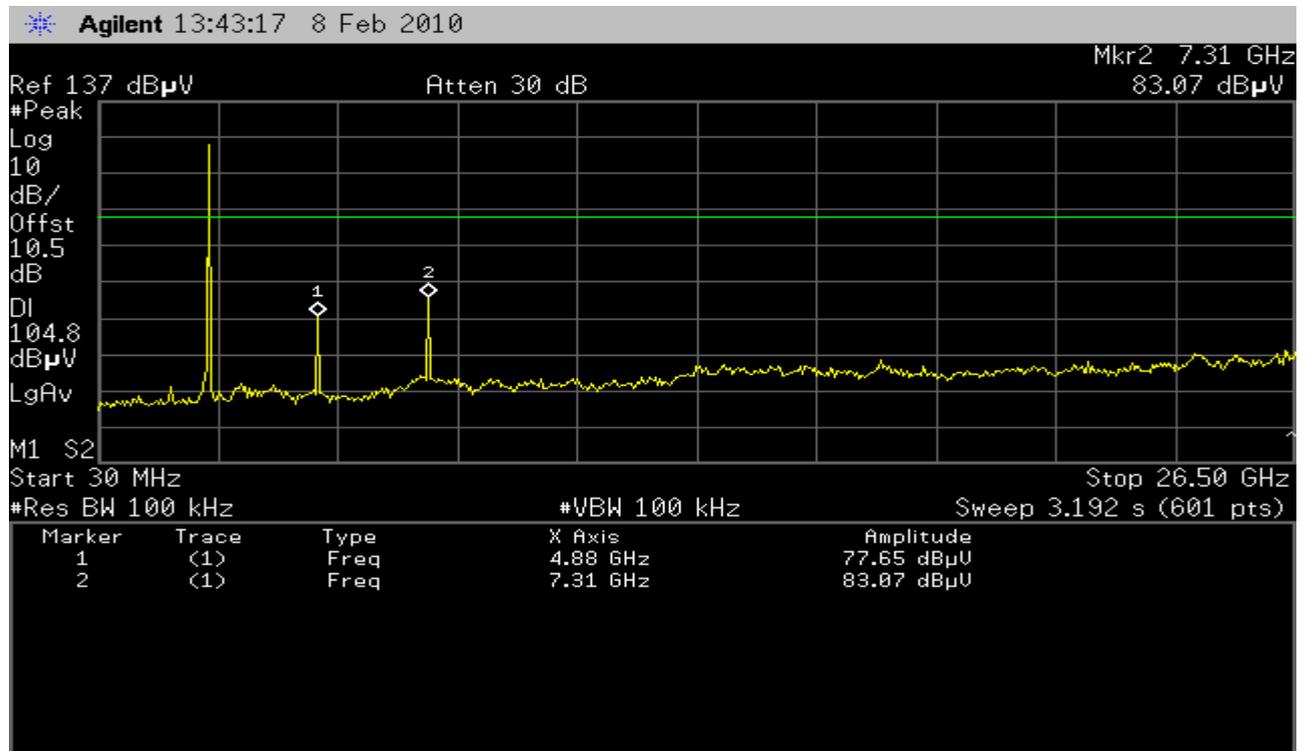
No non-compliance noted

Test Plot (GFSK)

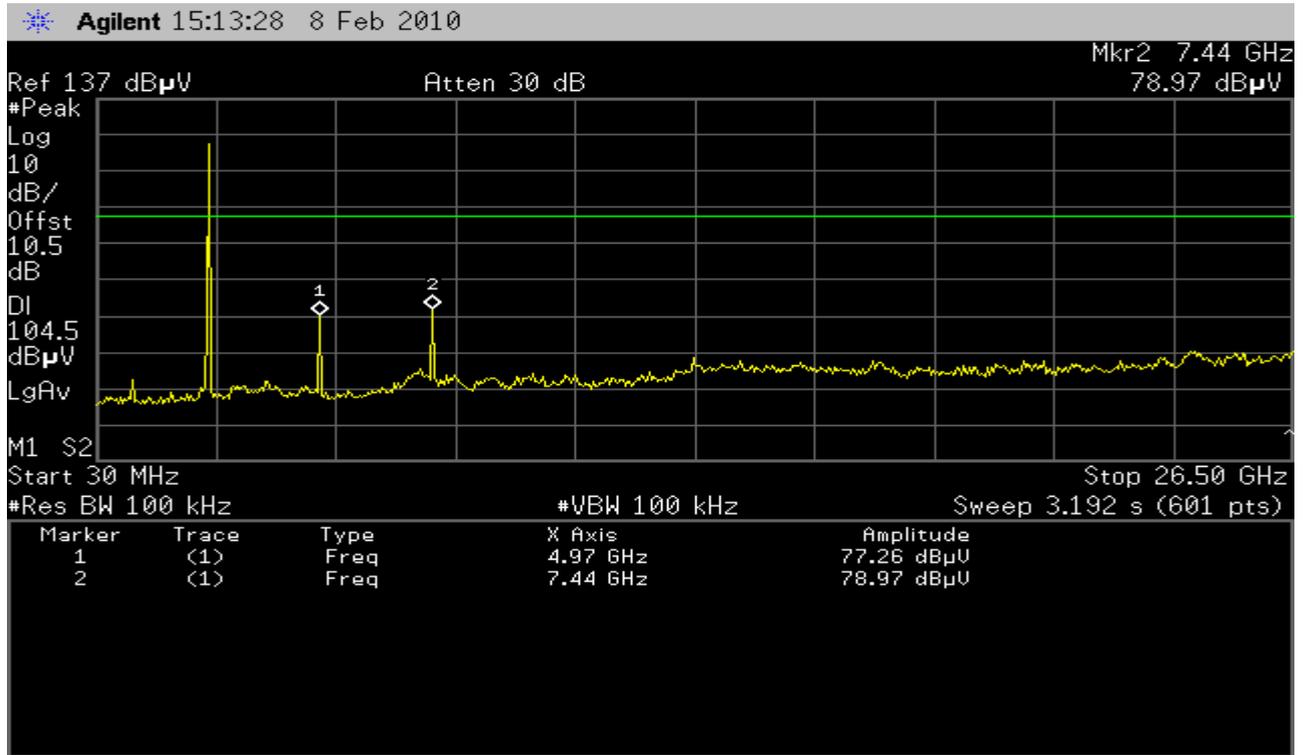
CH Low



CH Mid

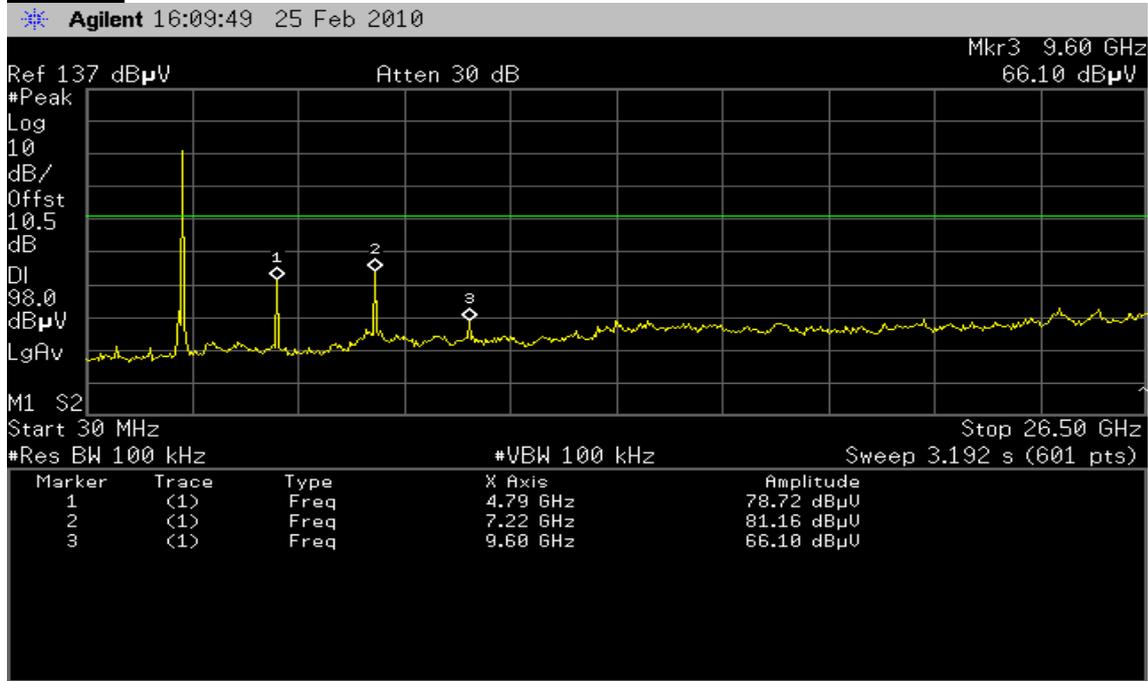


CH High

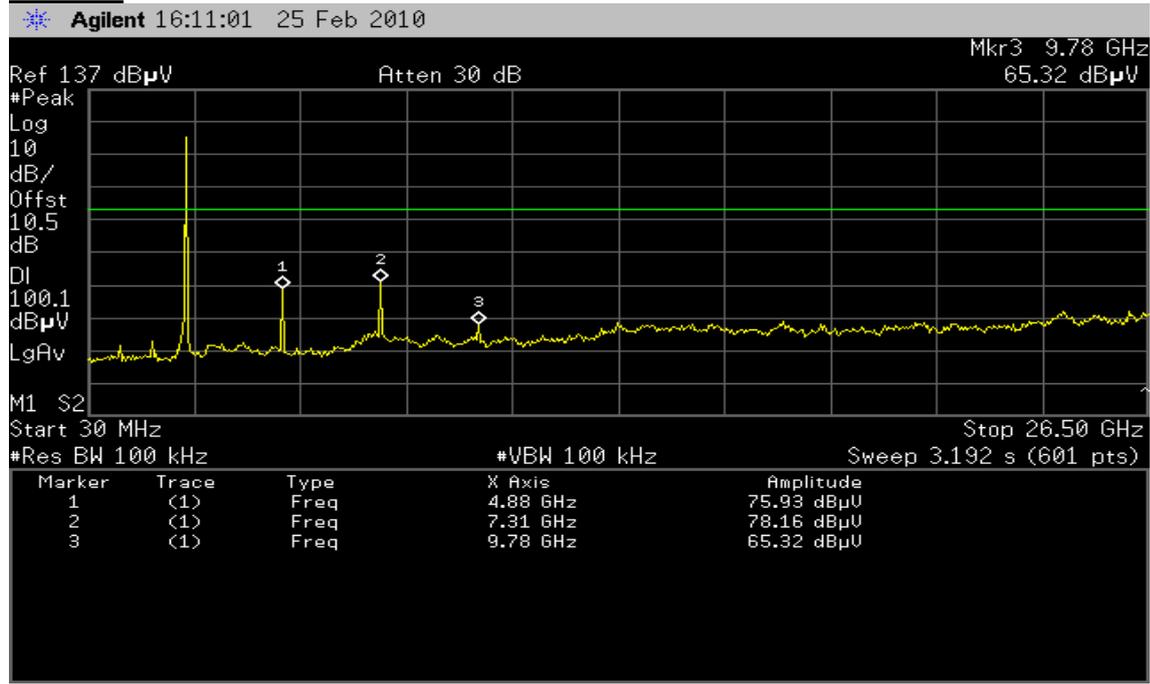


Test Plot (8DPSK)

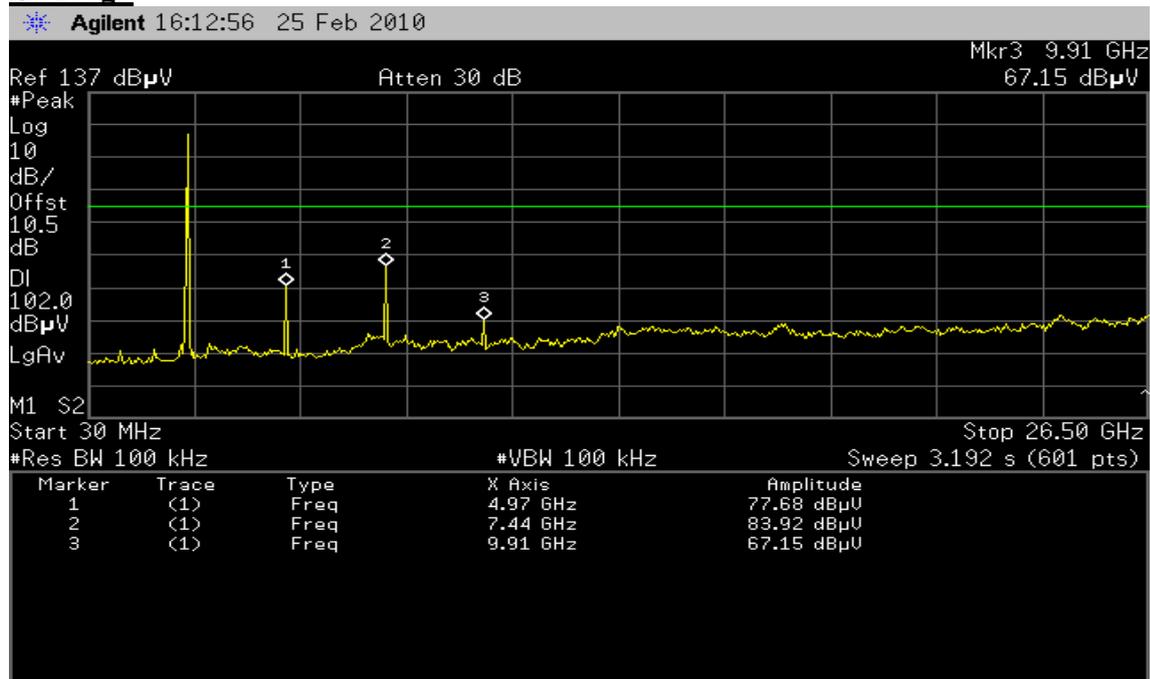
CH Low



CH Mid



CH High



7.6.2 Radiated Emissions

LIMIT

1. According to §15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength ($\mu\text{V}/\text{m}$)	Measurement Distance (m)
30-88	100*	3
88-216	150*	3
216-960	200*	3
Above 960	500	3

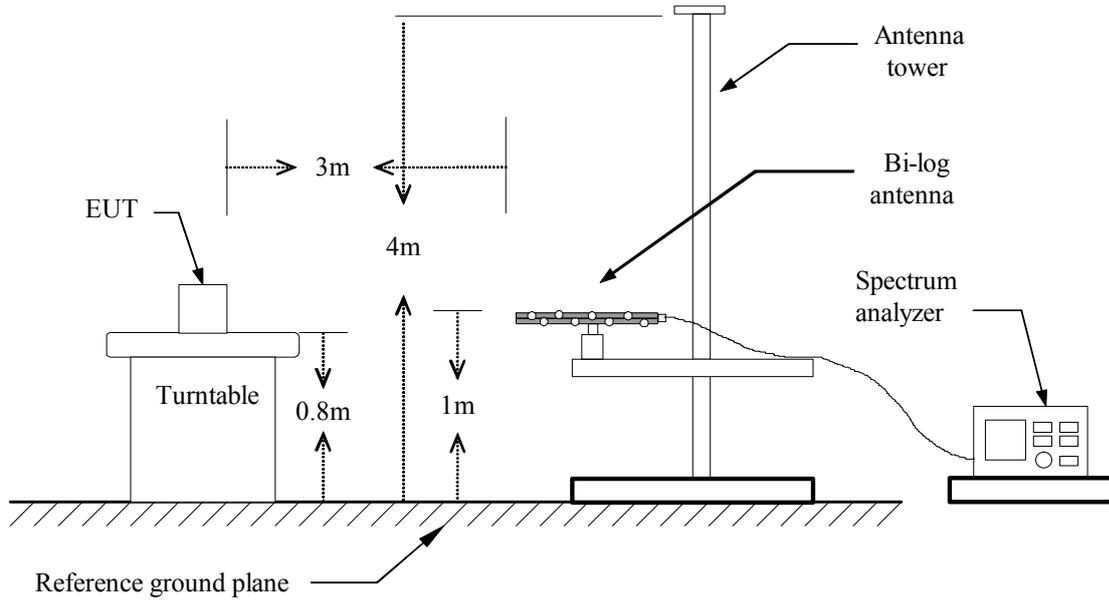
Remark: Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

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

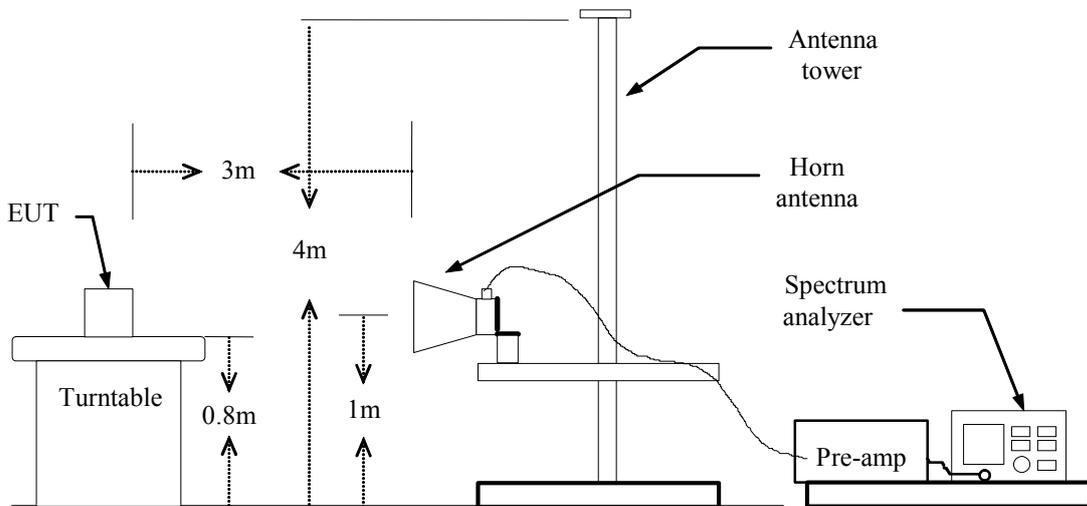
Frequency (MHz)	Field Strength ($\mu\text{V}/\text{m}$ at 3-meter)	Field Strength (dB $\mu\text{V}/\text{m}$ at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Test Configuration

Below 1 GHz



Above 1 GHz



TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Set the spectrum analyzer in the following setting as:
Below 1GHz:
RBW=100 kHz / VBW=300 kHz / Sweep=AUTO
Above 1GHz:
(a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
(b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
7. Repeat above procedures until the measurements for all frequencies are complete.

TEST RESULTS

Below 1 GHz

Operation Mode: Normal Link

Test Date: February 10, 2010

Temperature: 26°C

Tested by: Robert Huang

Humidity: 52 % RH

Polarity: Ver. / Hor.

RF Module: ANT2400Q9P

Freq. (MHz)	Ant.Pol. H/V	Detector (PK/QP)	Correct Factor (dBuV)	Reading Level (dBuV/m)	Measure (dBuV/m)	Margin (dB)	Limit (dBuV/m)
168.002	V	QP	14.077	11.723	25.800	-17.700	43.500
240.004	V	QP	17.135	11.160	28.295	-17.705	46.000
336.006	V	QP	20.224	11.473	31.697	-14.303	46.000
415.275	V	QP	22.374	9.662	32.035	-13.965	46.000
813.000	V	QP	29.232	9.688	38.921	-7.079	46.000
896.900	V	QP	30.374	1.600	31.974	-14.026	46.000
120.005	H	QP	16.752	8.005	24.757	-18.743	43.500
168.004	H	QP	13.779	9.064	22.843	-20.657	43.500
216.002	H	QP	14.746	14.866	29.611	-16.389	46.000
261.242	H	QP	17.519	15.238	32.757	-13.243	46.000
821.300	H	QP	29.346	10.102	39.447	-6.553	46.000
895.300	H	QP	30.351	4.711	35.061	-10.939	46.000

Remark:

1. Measuring frequencies from 30 MHz to the 1GHz.
2. Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak/Quasi-peak detector mode.
3. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
4. The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz.
5. Correct Factor(dBuV)=Antenna Factor +Cable Loss-Amplifier Gain
Measure (dBuV/m)=Reading level(dBuV/m)+ Correct Factor(dBuV)
Margin(dB)= Measure (dBuV/m)-limit(dBuV/m)

Above 1 GHz
Operation Mode: GFSK / TX / CH Low

Test Date: February 10, 2010

Temperature: 26°C

Tested by: Robert Huang

Humidity: 52 % RH

Polarity: Ver. / Hor.

RF Module: ANT2400Q9P

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV/m)	Reading (Average) (dBuV/m)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1600.000	V	49.210	28.010	-7.820	41.390	20.190	74	54	-32.610	Peak
1868.000	V	60.430	42.160	-6.290	54.140	35.870	74	54	-18.130	AVG
4800.000	V	49.230	28.320	1.810	51.040	30.130	74	54	-22.960	Peak
7210.000	V	62.350	33.690	6.350	68.700	40.040	74	54	-5.300	Peak
9610.000	V	50.560	29.110	7.770	58.330	36.880	74	54	-15.670	Peak
12010.000	V	55.690	31.780	10.770	66.460	42.550	74	54	-7.540	Peak
1600.000	H	49.540	28.130	-7.820	41.720	20.310	74	54	-32.280	Peak
3200.480	H	56.210	33.050	-3.362	52.848	29.688	74	54	-21.152	Peak
4800.000	H	51.510	32.330	1.810	53.320	34.140	74	54	-19.860	AVG
7210.000	H	61.160	38.880	6.350	67.510	45.230	74	54	-6.490	Peak
9610.000	H	45.330	31.270	7.770	53.100	39.040	74	54	-14.960	AVG
12010.00	H	58.380	34.620	10.770	69.150	45.390	74	54	-4.850	Peak

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. Correct Factor(dB/m)=Antenna Factor +Cable Loss-Amplifier Gain
 Result(dBuV/m)=Reading (dBuV/m)+ Correct Factor(dB/m)
 Margin(dB)= Remark Result(dBuV/m)-Remark limit(dBuV/m)

Operation Mode: GFSK /TX / CH Mid
Temperature: 26°C
Humidity: 52 % RH
RF Module: ANT2400Q9P

Test Date: February 10, 2010
Tested by: Robert Huang
Polarity: Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV/m)	Reading (Average) (dBuV/m)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1628.000	V	55.130	37.430	-7.66	47.470	29.770	74	54	-24.230	AVG
1924.000	V	52.790	36.510	-5.96	46.830	30.550	74	54	-23.450	AVG
4880.000	V	51.660	36.010	2.05	53.710	38.060	74	54	-15.940	AVG
7330.000	V	62.780	42.360	6.67	69.450	49.030	74	54	-4.550	Peak
9760.000	V	48.510	35.130	7.95	56.460	43.080	74	54	-10.920	AVG
1628.000	H	56.130	33.890	-7.66	48.470	26.230	74	54	-25.530	Peak
4880.000	H	55.170	33.560	2.05	57.220	35.610	74	54	-16.780	Peak
7330.000	H	63.240	40.580	6.67	69.910	47.250	74	54	-4.090	Peak
9760.000	H	48.190	36.970	7.95	56.140	44.920	74	54	-9.080	AVG
12210.00	H	46.180	32.320	10.87	57.050	43.190	74	54	-10.810	AVG

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. Correct Factor(dB/m)=Antenna Factor +Cable Loss-Amplifier Gain
 Result(dBuV/m)=Reading (dBuV/m)+ Correct Factor(dB/m)
 Margin(dB)= Remark Result(dBuV/m)- Remark limit(dBuV/m)

Operation Mode: GFSK /TX / CH High
Temperature: 26°C
Humidity: 52 % RH
RF Module: ANT2400Q9P

Test Date: February 10, 2010
Tested by: Robert Huang
Polarity: Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV/m)	Reading (Average) (dBuV/m)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1360.00	V	50.13	---	-9.04	41.09	---	74	54	-32.91	Peak
1656.00	V	56.87	---	-7.50	49.37	---	74	54	-24.63	Peak
1984.00	V	53.68	---	-5.62	48.06	---	74	54	-25.94	Peak
4960.00	V	68.83	49.14	0.849	69.679	49.989	74	54	-4.011	AVG
7440.00	V	55.69	43.16	6.568	62.258	49.728	74	54	-4.272	AVG
9760.00	V	53.21	33.87	7.95	61.16	41.82	74	54	-12.18	AVG
12210.00	V	44.98	32.17	10.87	55.85	43.04	74	54	-10.96	AVG
1656.00	H	52.66	---	-7.50	45.16	---	74	54	-28.84	Peak
1712.00	H	51.63	---	-7.18	44.45	---	74	54	-29.55	Peak
4960.00	H	51.99	---	0.85	52.84	---	74	54	-21.16	Peak
7440.00	H	49.45	38.20	6.568	56.018	44.768	74	54	-9.232	AVG
9760.00	H	50.03	32.18	7.95	57.98	40.13	74	54	-13.87	AVG
12210.00	H	44.99	29.48	10.87	55.86	40.35	74	54	-13.65	AVG

Remark:

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

Operation Mode: 8DPSK / TX / CH Low

Test Date: February 26, 2010

Temperature: 26°C

Tested by: Robert Huang

Humidity: 52 % RH

Polarity: Ver. / Hor.

RF Module: ANT2400Q9P

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV/m)	Reading (Average) (dBuV/m)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1809.996	V	63.66	43.68	-6.864	56.796	36.816	74	54	-17.204	Peak
4802.656	V	63.21	40.13	0.595	63.805	40.725	74	54	-8.895	Peak
7210.000	V	55.61	35.11	6.350	61.960	41.460	74	54	-12.010	Peak
9610.000	V	51.19	31.07	7.770	58.960	38.840	74	54	-15.040	Peak
12010.000	V	48.19	30.76	10.770	58.960	41.530	74	54	-12.470	AVG
1809.972	H	60.8	39.11	-6.864	53.936	32.246	74	54	-20.064	Peak
4809.956	H	49.32	---	0.606	49.926	---	74	54	-24.074	Peak
7210.000	H	44.87	---	6.350	51.220	---	74	54	-22.780	Peak
9610.000	H	48.62	30.11	7.770	56.390	37.880	74	54	-16.120	AVG
12010.000	H	50.11	33.65	10.770	60.880	44.420	74	54	-9.580	AVG

Remark:

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

Operation Mode: 8DPSK /TX / CH Mid
Temperature: 26°C
Humidity: 52 % RH
RF Module: ANT2400Q9P

Test Date: February 26, 2010
Tested by: Robert Huang
Polarity: Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV/m)	Reading (Average) (dBuV/m)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1809.968	V	65.480	42.469	-6.864	58.616	35.605	74	54	-15.384	Peak
4892.448	V	66.410	37.558	0.734	67.144	38.292	74	54	-6.856	Peak
7330.000	V	59.120	32.464	6.670	65.790	39.134	74	54	-8.210	Peak
9760.000	V	46.950	---	7.950	54.900	---	74	54	-19.100	Peak
1809.963	H	67.160	42.330	-6.864	60.296	35.466	74	54	-13.704	Peak
4892.480	H	52.130	---	0.734	52.864	---	74	54	-21.136	Peak
7330.000	H	56.170	36.110	6.670	62.840	42.780	74	54	-11.160	Peak
9760.000	H	43.970	---	7.950	51.920	---	74	54	-22.080	Peak
12210.00	H	48.160	31.990	10.870	59.030	42.860	74	54	-11.140	AVG

Remark:

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

Operation Mode: 8DPSK /TX / CH High
Temperature: 26°C
Humidity: 52 % RH
RF Module: ANT2400Q9P

Test Date: February 26, 2010
Tested by: Robert Huang
Polarity: Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV/m)	Reading (Average) (dBuV/m)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1809.963	V	63.190	41.330	-6.864	56.326	34.466	74	54	-17.674	Peak
4959.992	V	65.470	38.670	0.850	66.320	39.520	74	54	-7.680	Peak
7440.000	V	43.970	---	6.568	50.538	---	74	54	-23.462	Peak
9760.000	V	44.280	---	7.950	52.230	---	74	54	-21.770	Peak
12210.00	V	39.210	---	10.870	50.080	---	74	54	-23.920	Peak
1809.951	H	67.920	42.390	-6.864	61.056	35.526	74	54	-12.944	Peak
4959.974	H	50.880	---	0.850	51.730	---	74	54	-22.270	Peak
7440.000	H	40.130	---	6.568	46.698	---	74	54	-27.302	Peak
9760.000	H	42.830	---	7.950	50.780	---	74	54	-23.220	Peak
12210.00	H	39.170	---	10.870	50.040	---	74	54	-23.960	Peak

Remark:

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

TEST RESULTS

Below 1 GHz

Operation Mode: Normal Link

Test Date: February 10, 2010

Temperature: 26°C

Tested by: Robert Huang

Humidity: 52 % RH

Polarity: Ver. / Hor.

RF Module: ANT2400D18W

Freq. (MHz)	Ant.Pol. H/V	Detector Mode (PK/QP)	Correct Factor (dB) (dBuV)	Reading Level (dBuV) (dBuV/m)	Measure Level (dBuV/m) (dBuV/m)	Margin (dB)	Limit (dBuV/m)
120.002	V	QP	16.285	10.381	26.666	-16.834	43.500
144.002	V	QP	13.397	13.775	27.172	-16.328	43.500
213.302	V	QP	15.148	10.654	25.802	-17.698	43.500
336.006	V	QP	20.224	10.468	30.692	-15.308	46.000
415.600	V	QP	22.380	13.335	35.716	-10.284	46.000
899.500	V	QP	30.408	3.879	34.287	-11.713	46.000
168.001	H	QP	13.780	9.678	23.457	-20.043	43.500
216.001	H	QP	14.746	15.042	29.787	-16.213	46.000
277.175	H	QP	18.574	12.273	30.848	-15.152	46.000
415.575	H	QP	22.865	10.633	33.498	-12.502	46.000
768.005	H	QP	28.801	2.783	31.585	-14.415	46.000
897.550	H	QP	30.374	3.021	33.395	-12.605	46.000

Remark:

1. *Measuring frequencies from 30 MHz to the 1GHz.*
2. *Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak/Quasi-peak detector mode.*
3. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
4. *The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz.*
5. *Correct Factor(dBuV)=Antenna Factor +Cable Loss-Amplifier Gain
Measure (dBuV/m)=Reading level(dBuV/m)+ Correct Factor(dBuV)
Margin(dB)= Measure (dBuV/m)-limit(dBuV/m)*

Above 1 GHz
Operation Mode: GFSK /TX / CH Low

Test Date: February 10, 2010

Temperature: 26°C

Tested by: Robert Huang

Humidity: 52 % RH

Polarity: Ver. / Hor.

RF Module: ANT2400D18W

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV/m)	Reading (Average) (dBuV/m)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
4880.000	V	69.730	51.040	0.598	70.328	51.638	74	54	-2.362	AVG
7330.000	V	60.840	44.180	6.091	66.931	50.271	74	54	-3.729	AVG
9760.000	V	44.820	30.980	7.950	52.770	38.930	74	54	-15.070	AVG
12210.000	V	55.170	35.880	10.870	66.040	46.750	74	54	-7.250	AVG
4880.000	H	59.350	45.120	0.598	59.948	45.718	74	54	-8.282	AVG
7330.000	H	60.860	43.620	6.091	66.951	49.711	74	54	-4.289	AVG
9760.000	H	42.890	28.310	10.261	53.151	38.571	74	54	-15.429	AVG
12210.00	H	55.170	38.760	10.870	66.040	49.630	74	54	-4.370	AVG

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. Correct Factor(dBuV)=Antenna Factor + Cable Loss-Amplifier Gain
 Result(dBuV/m)=Reading (dBuV/m)+ Correct Factor(dB/m)
 Margin(dB)= Remark Result(dBuV/m)- Remark limit(dBuV/m)

Operation Mode: GFSK /TX / CH Mid
Temperature: 26°C
Humidity: 52 % RH
RF Module: ANT2400D18W

Test Date: February 10, 2010
Tested by: Robert Huang
Polarity: Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV/m)	Reading (Average) (dBuV/m)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
4882.200	V	69.620	50.840	0.715	70.335	51.555	74	54	-2.445	AVG
7323.312	V	61.550	43.900	6.302	67.852	50.202	74	54	-3.798	AVG
9760.000	V	43.420	29.870	7.950	51.370	37.820	74	54	-16.180	AVG
12210.00	V	51.110	35.160	10.870	61.980	46.030	74	54	-7.970	AVG
4959.975	H	53.150	36.610	0.850	54.000	37.460	74	54	-16.540	AVG
7439.975	H	47.430	32.540	6.568	53.998	39.108	74	54	-14.892	AVG
9760.000	H	46.780	33.780	7.950	54.730	41.730	74	54	-12.270	AVG
12210.00	H	51.990	37.630	10.870	62.860	48.500	74	54	-5.500	AVG

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. Correct Factor(dBuV)=Antenna Factor + Cable Loss-Amplifier Gain
 Result(dBuV/m)=Reading (dBuV/m)+ Correct Factor(dB/m)
 Margin(dB)= Remark Result(dBuV/m)- Remark limit(dBuV/m)

Operation Mode: GFSK /TX / CH High

Test Date: February 10, 2010

Temperature: 26°C

Tested by: Robert Huang

Humidity: 52 % RH

Polarity: Ver. / Hor.

RF Module: ANT2400D18W

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV/m)	Reading (Average) (dBuV/m)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
4960.150	V	68.67	49.06	0.849	69.519	49.909	74	54	-4.091	AVG
7440.225	V	58.82	41.93	6.568	65.388	48.498	74	54	-5.502	AVG
9920.000	V	49.17	35.49	8.140	57.310	43.630	74	54	-10.370	AVG
4959.975	H	53.15	31.29	0.850	54.000	32.140	74	54	-20.000	Peak
7439.975	H	47.43	38.56	6.568	53.998	45.128	74	54	-8.872	AVG
9920.000	H	48.37	33.59	8.140	56.510	41.730	74	54	-12.270	AVG

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. Correct Factor(dBuV)=Antenna Factor +Cable Loss-Amplifier Gain
 $Result(dBuV/m)=Reading(dBuV/m)+Correct\ Factor(dB/m)$
 $Margin(dB)=Remark\ Result(dBuV/m)-Remark\ limit(dBuV/m)$

Operation Mode: 8DPSK /TX / CH Low

Test Date: February 26, 2010

Temperature: 26°C

Tested by: Robert Huang

Humidity: 52 % RH

Polarity: Ver. / Hor.

RF Module: ANT2400D18W

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV/m)	Reading (Average) (dBuV/m)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1809.967	V	60.773	40.390	-6.740	54.033	33.65	74	54	-19.967	Peak
4802.700	V	55.021	37.187	0.595	55.616	37.782	74	54	-16.218	AVG
1854.963	H	59.790	39.117	-6.740	53.050	32.377	74	54	-20.950	Peak
4802.481	H	53.267	37.166	0.595	53.862	37.761	74	54	-16.239	AVG

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. Correct Factor(dBuV)=Antenna Factor +Cable Loss-Amplifier Gain
Result(dBuV/m)=Reading (dBuV/m)+ Correct Factor(dB/m)
6. Margin(dB)= Remark Result(dBuV/m)- Remark limit(dBuV/m)

Operation Mode: 8DPSK /TX / CH Mid
Temperature: 26°C
Humidity: 52 % RH
RF Module: ANT2400D18W

Test Date: February 26, 2010
Tested by: Robert Huang
Polarity: Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV/m)	Reading (Average) (dBuV/m)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
4892.453	V	72.19	39.33	0.734	72.924	40.064	74	54	-1.076	Peak
7322.483	V	66.18	40.21	6.301	72.481	46.511	74	54	-1.519	Peak
1809.974	H	60.18	38.142	-6.864	53.316	31.278	74	54	-20.684	Peak
4892.460	H	52.09	35.659	0.734	52.824	36.393	74	54	-17.607	AVG

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. Correct Factor(dBuV)=Antenna Factor + Cable Loss-Amplifier Gain
 Result(dBuV/m)=Reading (dBuV/m)+ Correct Factor(dB/m)
 Margin(dB)= Remark Result(dBuV/m)- Remark limit(dBuV/m)

Operation Mode: 8DPSK /TX / CH High
Temperature: 26°C
Humidity: 52 % RH
RF Module: ANT2400D18W

Test Date: February 26, 2010
Tested by: Robert Huang
Polarity: Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV/m)	Reading (Average) (dBuV/m)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
4959.96	V	70.98	38.36	0.850	71.830	39.210	74	54	-2.170	Peak
7434.962	V	66.19	39.66	6.554	72.744	46.214	74	54	-1.256	Peak
1809.941	H	68.35	41.06	-6.864	61.486	34.196	74	54	-12.514	Peak
4959.996	H	59.09	37.458	0.850	59.940	38.308	74	54	-14.060	Peak

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
5. Correct Factor(dBuV)=Antenna Factor + Cable Loss-Amplifier Gain
 Result(dBuV/m)=Reading (dBuV/m)+ Correct Factor(dB/m)
 Margin(dB)= Remark Result(dBuV/m)- Remark limit(dBuV/m)

7.7 POWERLINE CONDUCTED EMISSIONS

LIMIT

According to §15.207(a), except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

* Decreases with the logarithm of the frequency.

Test Configuration

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

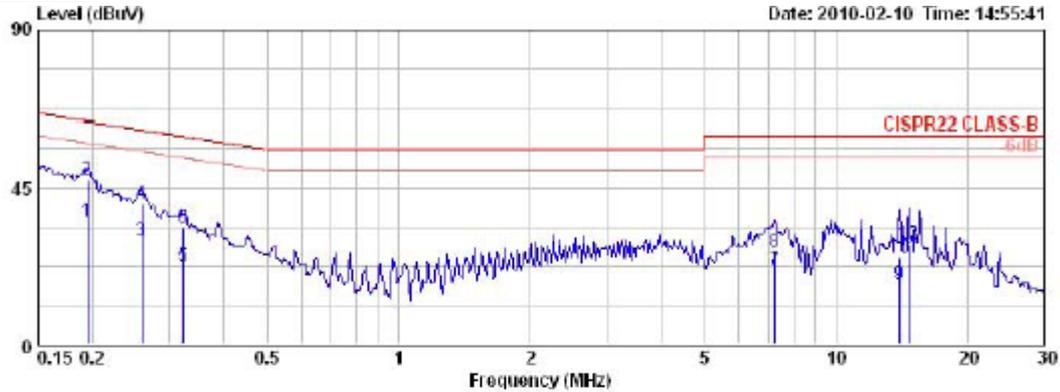
TEST PROCEDURE

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.

TEST RESULTS

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.

Test Data

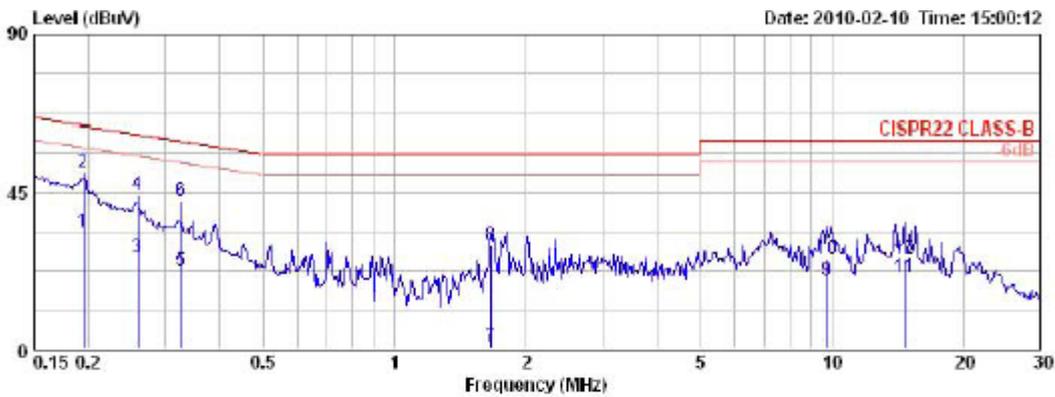


Site : CS/CE Chamber
Condition : CISPR22 CLASS-B LINE
RBW:10.000KHz VBW:120.000KHz
cut : Bluetooth Module
mode : Charge
memo :

	Freq	Read Level	Level	Limit Line	Over Limit	LISN Factor	Cable Loss	Aux Factor	Pol/Phase	Remark
	MHz	dBuV	dBuV	dBuV	dB	dB	dB	dB		
1 a	0.19	23.90	35.14	63.84	-28.70	1.23	0.01	10.00	LINE	Average
2 q	0.19	35.96	47.20	63.84	-16.64	1.23	0.01	10.00	LINE	QP
3	0.26	18.47	29.58	61.47	-31.89	1.03	0.08	10.00	LINE	Average
4	0.26	29.21	40.32	61.47	-21.15	1.03	0.08	10.00	LINE	QP
5	0.32	11.55	22.51	59.66	-37.15	0.88	0.08	10.00	LINE	Average
6	0.32	22.73	33.69	59.66	-25.97	0.88	0.08	10.00	LINE	QP
7	7.25	11.28	21.74	60.00	-38.26	0.20	0.26	10.00	LINE	Average
8	7.25	16.05	26.51	60.00	-33.49	0.20	0.26	10.00	LINE	QP
9	13.99	6.57	17.29	60.00	-42.71	0.30	0.42	10.00	LINE	Average
10	13.99	14.15	24.87	60.00	-35.13	0.30	0.42	10.00	LINE	QP
11	14.67	14.03	24.77	60.00	-35.23	0.31	0.43	10.00	LINE	Average
12	14.67	18.28	29.02	60.00	-30.98	0.31	0.43	10.00	LINE	QP

Remark:

1. Measuring frequencies from 0.15 MHz to 30MHz.
2. The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Quasi-peak detector and average detector.
3. The IF bandwidth of SPA between 0.15MHz and 30MHz was 10kHz; the IF bandwidth of Test Receiver between 0.15MHz and 30MHz was 9kHz;
4. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)



Site : CS/CE Chamber
Condition : CISPR22 CLASS-B NEUTRAL
 : RBW:10.000KHz VBW:120.000KHz
cut : Bluetooth Module
mode : Charge
memo :

	Read Freq	Read Level	Limit Level	Over Limit	LISS	Cable Loss	Aux Factor	Pol/Phase	Remark
	MHz	dBuV	dBuV	dB	dB	dB	dB		
1 a	0.19	22.57	33.80	63.84	-30.04	1.22	0.01	10.00	NEUTRAL Average
2 q	0.19	39.37	50.60	63.84	-13.24	1.22	0.01	10.00	NEUTRAL QP
3	0.26	15.17	26.28	61.47	-35.19	1.03	0.08	10.00	NEUTRAL Average
4	0.26	33.41	44.52	61.47	-16.95	1.03	0.08	10.00	NEUTRAL QP
5	0.33	11.37	22.32	59.57	-37.25	0.87	0.08	10.00	NEUTRAL Average
6	0.33	31.58	42.53	59.57	-17.04	0.87	0.08	10.00	NEUTRAL QP
7	1.66	-9.63	0.60	56.00	-55.40	0.12	0.11	10.00	NEUTRAL Average
8	1.66	19.29	29.52	56.00	-26.48	0.12	0.11	10.00	NEUTRAL QP
9	9.76	9.38	19.91	60.00	-40.09	0.19	0.34	10.00	NEUTRAL Average
10	9.76	15.21	25.74	60.00	-34.26	0.19	0.34	10.00	NEUTRAL QP
11	14.67	9.72	20.61	60.00	-39.39	0.46	0.43	10.00	NEUTRAL Average
12	14.67	15.01	25.90	60.00	-34.10	0.46	0.43	10.00	NEUTRAL QP

Remark:

1. Measuring frequencies from 0.15 MHz to 30MHz.
2. The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Quasi-peak detector and average detector.
3. The IF bandwidth of SPA between 0.15MHz and 30MHz was 10kHz; the IF bandwidth of Test Receiver between 0.15MHz and 30MHz was 9kHz;
4. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)

8. APPENDIX I

RADIO FREQUENCY EXPOSURE

LIMIT

According to §15.247(i), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See § 1.1307(b)(1) of this chapter.

EUT Specification

EUT	Bluetooth Module
Frequency band (Operating)	<input type="checkbox"/> WLAN: 2.412GHz ~ 2.462GHz <input type="checkbox"/> WLAN: 5.18GHz ~ 5.32GHz / 5.50GHz ~ 5.70GHz <input type="checkbox"/> WLAN: 5.745GHz ~ 5.825GHz <input checked="" type="checkbox"/> Others: <u>Bluetooth: 2.402GHz ~ 2.480GHz</u>
Device category	<input type="checkbox"/> Portable (<20cm separation) <input checked="" type="checkbox"/> Mobile (>20cm separation) <input type="checkbox"/> Others _____
Exposure classification	<input type="checkbox"/> Occupational/Controlled exposure ($S = 5mW/cm^2$) <input checked="" type="checkbox"/> General Population/Uncontrolled exposure ($S=1mW/cm^2$)
Antenna diversity	<input type="checkbox"/> Single antenna <input type="checkbox"/> Multiple antennas <input type="checkbox"/> Tx diversity <input type="checkbox"/> Rx diversity <input checked="" type="checkbox"/> Tx/Rx diversity
Max. output power	18.91dBm (0.0778mW)
Antenna gain (Max)	9 dBi (Numeric gain: 7.943) 18 dBi (Numeric gain: 63.096)
Evaluation applied	<input checked="" type="checkbox"/> MPE Evaluation <input type="checkbox"/> SAR Evaluation <input type="checkbox"/> N/A*

Remark:

1. The maximum output power is 18.91dBm (0.0778mW) at 2480MHz (with 7.943 and 63.096 numeric antenna gain.)
2. DTS device is not subject to routine RF evaluation; MPE estimate is used to justify the compliance.
3. For mobile or fixed location transmitters, no SAR consideration applied. The maximum power density is $1.0 mW/cm^2$ even if the calculation indicates that the power density would be larger.

TEST RESULTS

No non-compliance noted.

9. APPENDIX II PHOTOGRAPHS OF TEST SETUP

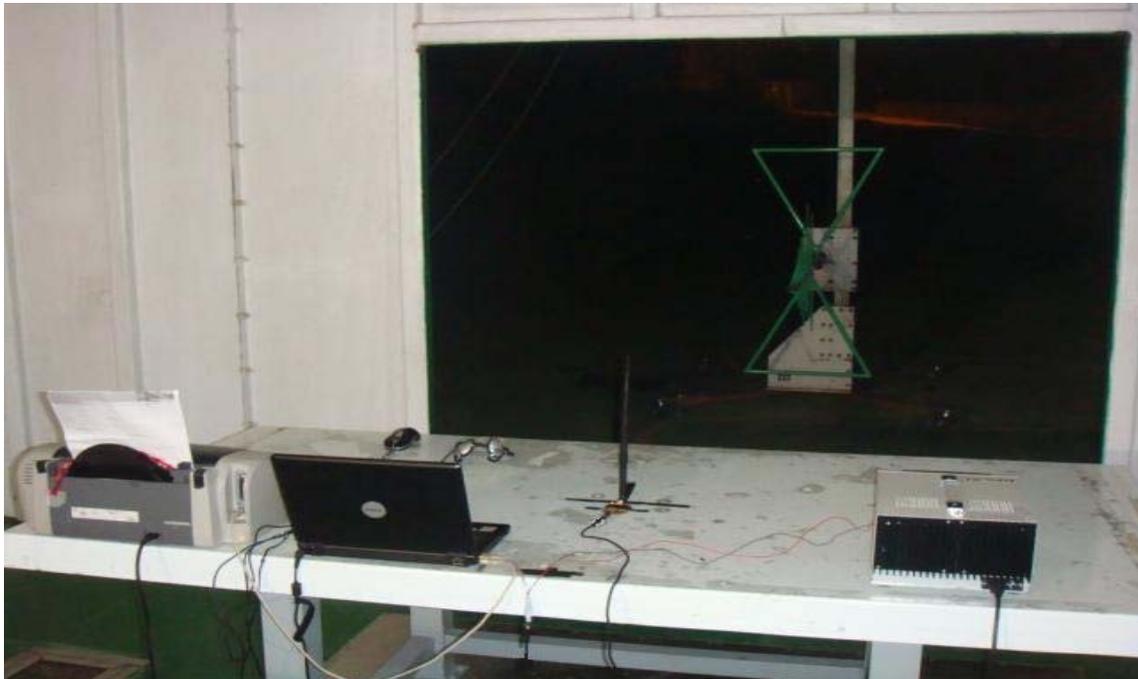
Conducted Emission Setup Photo



Radiated Emission Setup Photos

ANT2400Q9P

Below 1G

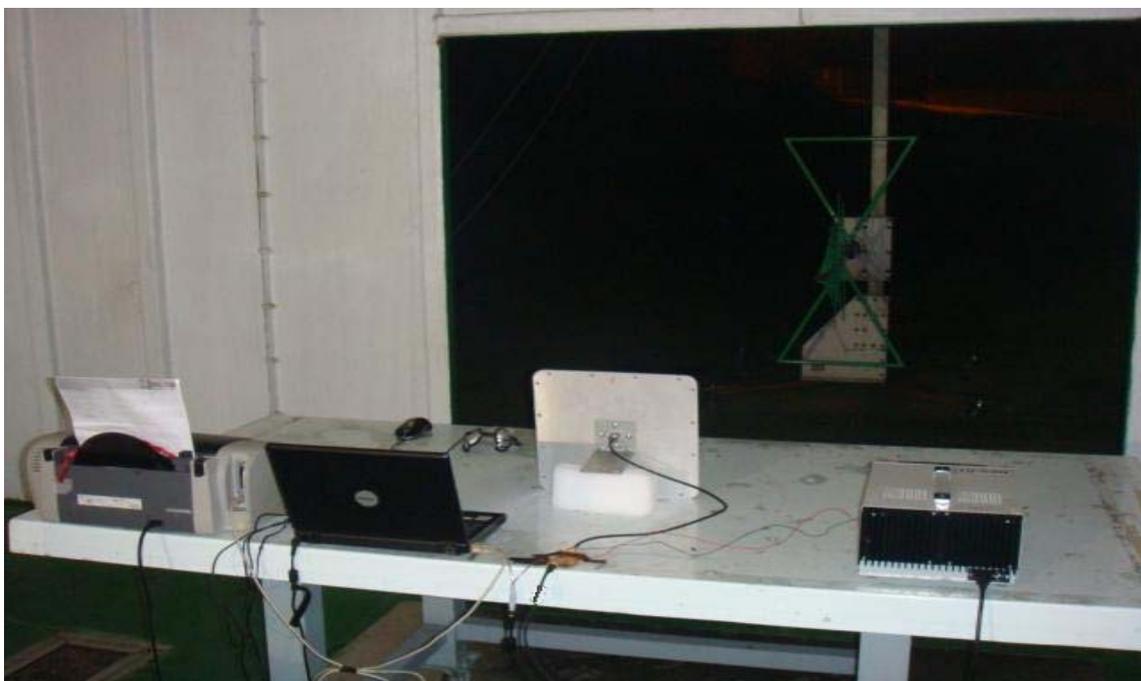
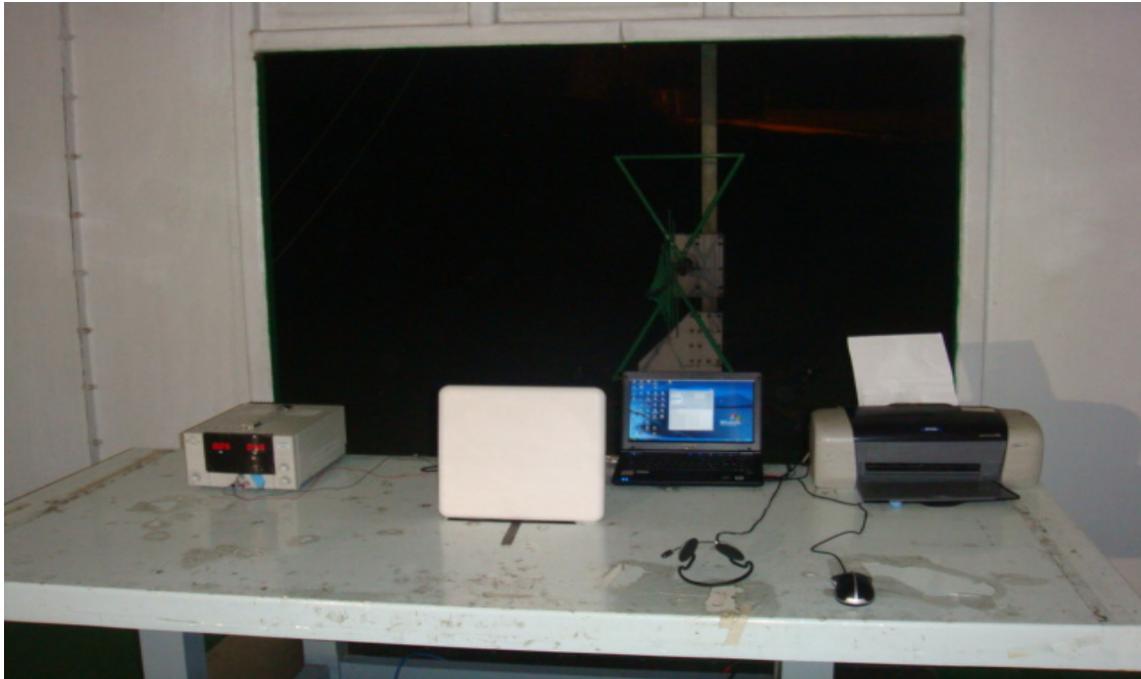


Above 1G

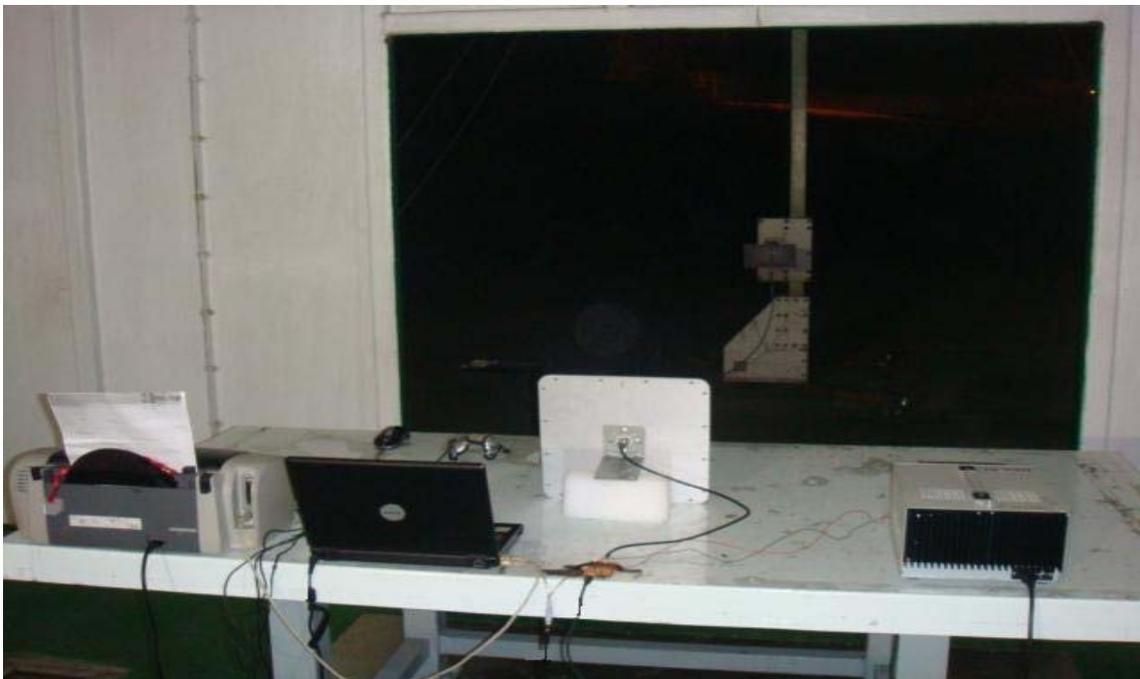


ANT2400D18W

Below 1G



Above 1G



Power line Conducted Emissions Setup Photos

