Test Report

Report Number: 3183595MPK-002A
Project Number: 3183595
February 26, 2010

Testing performed on the
Quantum 1000 Base Station
Model Number: QUANTUM 1000
FCC ID: XN3-Q1000-25-5

to

FCC Part 27 Subpart M

for

PUREWAVE NETWORKS

Test Performed by:	**Test Authorized by:**
Intertek Testing Services NA, Inc	PUREWAVE NETWORKS
1365 Adams Court	2660-C Marine Way
Menlo Park, CA 94025	Mountain View, CA 94043 USA

Prepared by: _____ **Date:** February 26, 2010
Krishna Vemuri, Senior EMC Engineer

Reviewed by: _____ **Date:** February 26, 2010
Ollie Moyrong, Engineering Manager

Report No. 3183595MPK-002A

Equipment Under Test:	Quantum 1000 Base Station
Trade Name:	PUREWAVE NETWORKS
Model No.:	QUANTUM 1000
Serial No.:	EMCProto1
FCC ID:	XN3-Q1000-25-5
Applicant:	PUREWAVE NETWORKS
Contact:	Mr. Jas Dhaliwal
Address:	2660-C Marine Way Mountain View, CA 94043
Country	USA
Tel. number:	650-528-5200
Fax number:	650-528-5222
Applicable Regulation:	FCC Part 27 Subpart M
Test Site Location:	1365 Adams Court Menlo Park, CA 94025
Date of Test:	February 10 –16, 2010

We attest to the accuracy of this report:

Krishna Vemuri	Ollie Moyrong
Senior EMC Engineer	Engineering Manager

TABLE OF CONTENTS

1.0 Introduction

1.1 Product Description

The Quantum 1000 employs an extremely flexible and versatile hardware architecture. The heart of the base station is a sophisticated and highly integrated ASIC that combines 6 DSP and general purpose processor cores along with specialized DSP hardware. A Linux based subsystem supports applications, SNMP and other management functions. Finally, the Quantum 1000 includes 2 RF transmitters and associated PAs, and 4 RF receivers.

Important characteristics of the Quantum 1000 Base Station Sector are:

- Board-to-board communications for scaling up to 6 antennas.
- 10 MHz profile
- WiMAX OFDMA compliance
- All layers implemented in software.
- 2.3 – 2.7 GHz and 3.3 – 3.8 GHz operations.

PureWave has implemented a scalable architecture that lets service providers upgrade their Base Stations by:

- Adding more Base Station Sector to a location
- Adding antennas (and corresponding RF module sets) within a sector
- Adding processing capability in order to process traffic within additional spectrum
- Upgrading software to allow for changes in features and standards.

Specification of the EUT	
Maximum Measured RF Output Power	33.4 dBm; 2.19 W
Frequency Ranges, MHz	2502.5 – 2687.5
Type of modulation	QPSK, 16QAM, 64QAM
Channel Bandwidth	5 MHz
Antenna Gain	Varies, refer to Report Section 1.4 for antenna details
Emission Designator	4M86W7D
Operating Temperature	From -30^0C to $+50^0$C

EUT receive date: February 10, 2009
EUT receive condition: The prototype version of the EUT was received in good condition with no apparent damage. As declared by the Applicant it is identical to the production units.
Test start date: February 10, 2010
Test completion date: February 16, 2010

1.2 Summary of Test Results

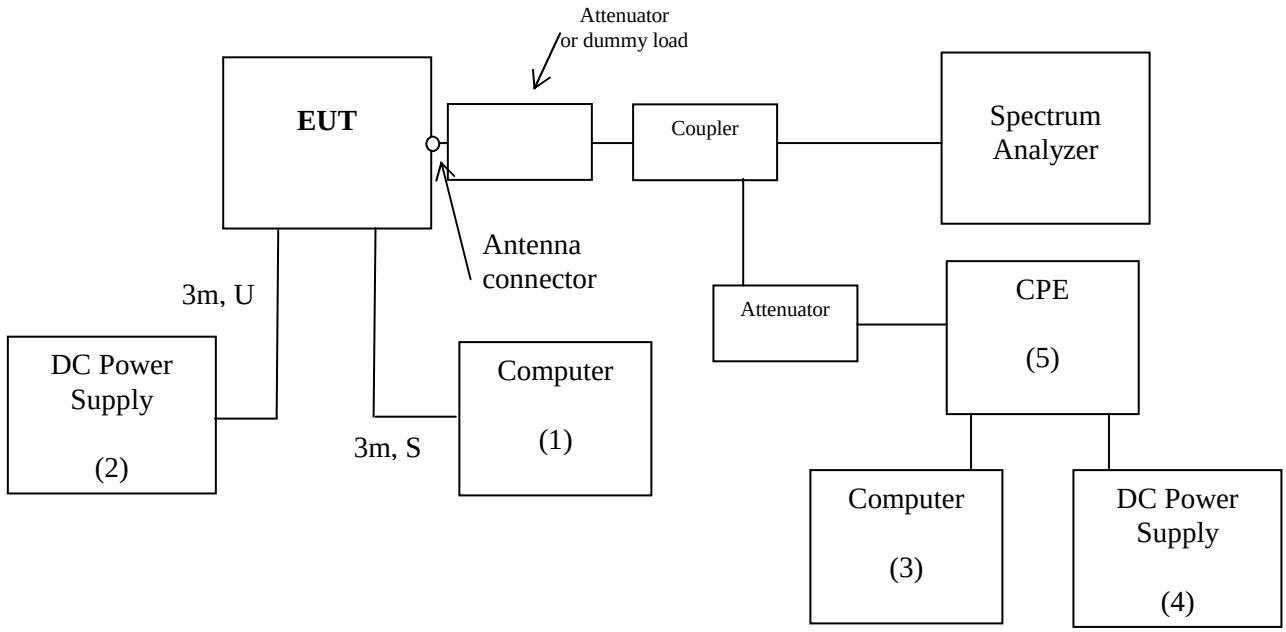
FCC Rule	Description of Test	Result
2.1046, 27.50	RF Power Output	Complies
2.1049	Occupied Bandwidth	Complies
2.1051, 27.53	Out of Band Emissions at Antenna Terminals	Complies
2.1053, 27.53	Spurious Radiation	Complies
2.1055, 27.54	Frequency Stability vs. Temperature and Voltage	Complies
15.109, 15.111	Emissions from Digital Parts, Receiver and Transmitter Spurious from 30 MHz to 1 GHz	Complies

1.3 Test Configuration

1.3.1 Support Equipment

Item #	Description	Model No.	S/N
1	Dell Personal Computer	Optiplex 320	9B32KC1
2	Agilent DC Power Supply	6644A	MY40001367
3	Dell Personal Computer	Optiplex 320	3RND5J1
4	Phihong DC Power Supply	PSUI6U-480	P72809868A1
5	Gemtek CPE	WIXS-177	002682124972

1.3.2 Block diagram of Test Setup



S = Shielded **U** = Unshielded	**F** = With Ferrite **m** = Length in Meters

1.4 Antenna Specifications

The Quantum 1000 2.5 GHz product line can be used with antennas supplied by PureWave Networks or any commercially available antenna. The table below lists antenna products that provide a representative sample of the range of antennas that may be used.

Description	Gain dBi	Az BW degrees	Manufacturer	Manufacturer P/N
4 element, vertical linear polarized array	14.5	120	Mars Antenna	MA-WE36-15PW4
4 element, vertical linear polarized array	15.5	90	Mars Antenna	MA-WD36-16PW4
2 element, dual polarized, +/- 45 degree slant	15	90	Mars Antenna	MA-WD35-DS15
2 element, dual polarized, +/- 45 degree slant	16.5	65	Mars Antenna	MA-WC35-DS17
Omni, vertical polarized	11	360	L-com	HG3511U-PRO
Omni, vertical polarized	8	360	Air802 LLC	ANOM3508
Omni, vertical polarized	12	360	Air802 LLC	ANOM3512

2.0 RF Power Output
FCC 2.1046, 27.50

2.1 Requirement

Main, booster and base stations. The maximum EIRP of a main, booster or base station shall not exceed 33 dBW + 10log(X/Y) dBW, where X is the actual channel width in MHz and Y is either 6 MHz if prior to transition or the station is in the MBS following transition or 5.5 MHz if the station is in the LBS and UBS following transition.

2.2 Test Procedure

The EUT RF output was connected as shown on the diagram in report section 1.3.2. The EUT was setup to transmit continuously the maximum power.

The spectrum analyzer was setup to measure a peak power using the Channel Power Function. The attenuation and cable loss were added to the spectrum analyzer reading by using OFFSET function.

The EUT was set to transmit at maximum power. Measurements were performed at three frequencies (low, middle, and high channels).

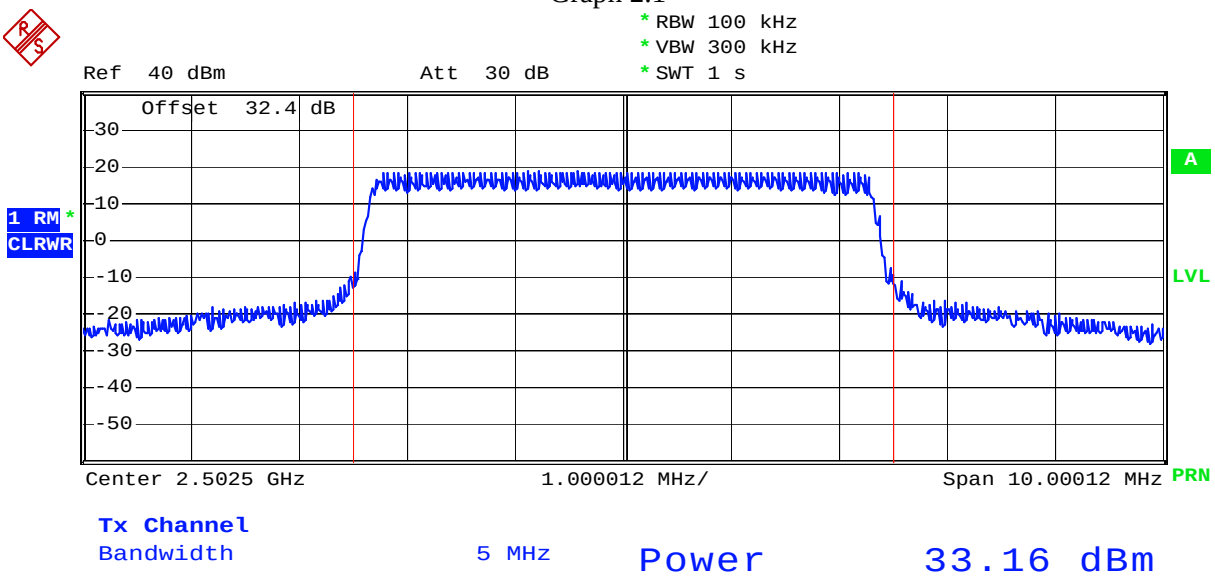
2.3 Test Equipment

Rohde & Schwarz FSP40 Spectrum Analyzer

2.4 Test Results

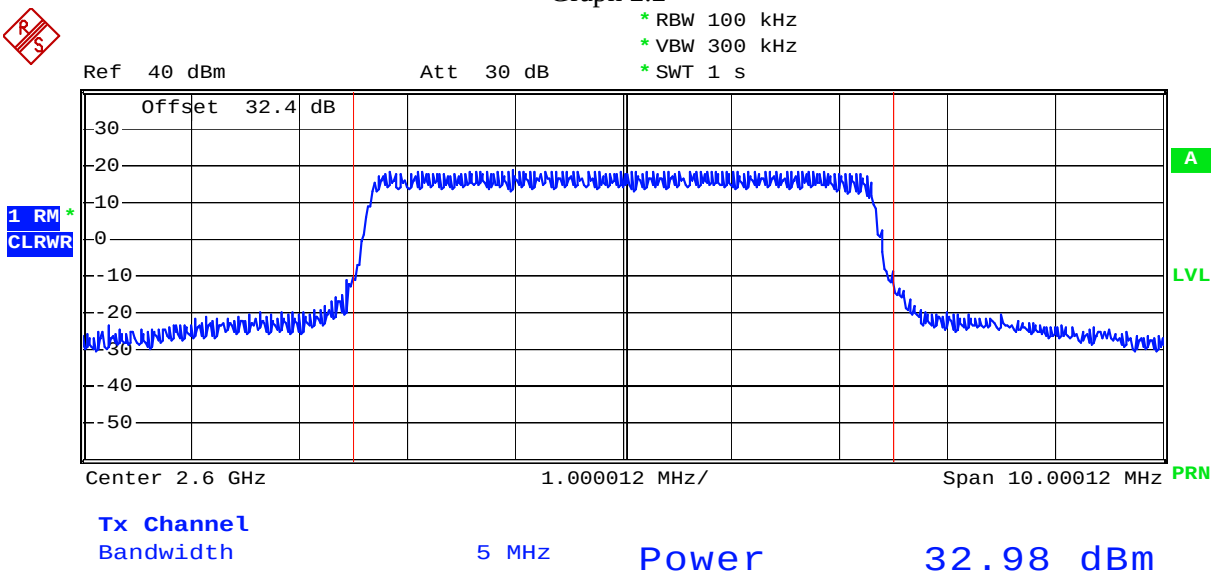
Frequency (MHz)	Measured Power (dBm)	Graph
Modulation: QPSK		
2502.5	33.16	2.1
2600.0	32.98	2.2
2687.5	33.4	2.3
Modulation: 16 QAM		
2502.5	33.15	2.4
2600.0	32.99	2.5
2687.5	33.39	2.6
Modulation: 64 QAM		
2502.5	33.16	2.7
2600.0	32.99	2.8
2687.5	33.39	2.9

Output Power
Graph 2.1



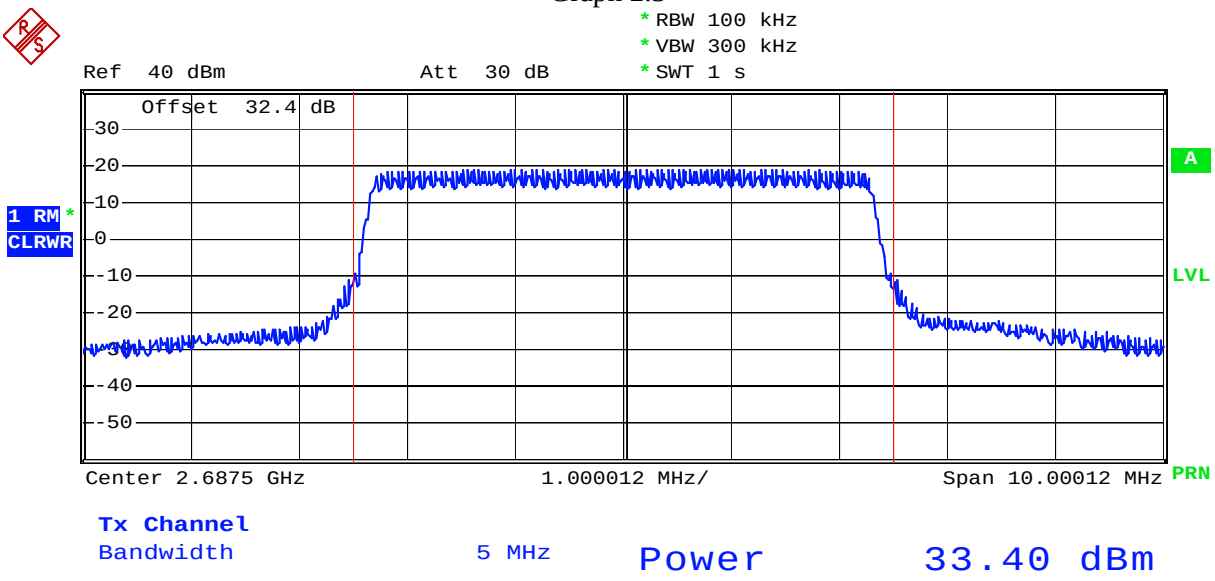
Comment: QPSK, LOW CHANNEL
Date: 10.FEB.2010 17:26:45

Graph 2.2



Comment: QPSK, MID CHANNEL
Date: 10.FEB.2010 17:34:58

Graph 2.3



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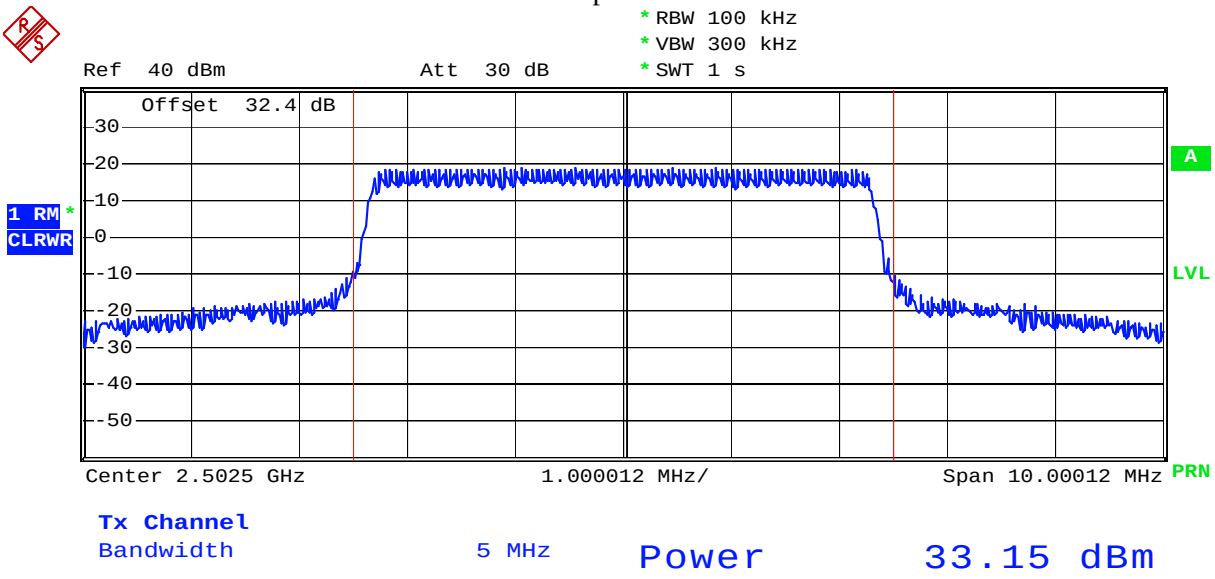
Graph 2.4



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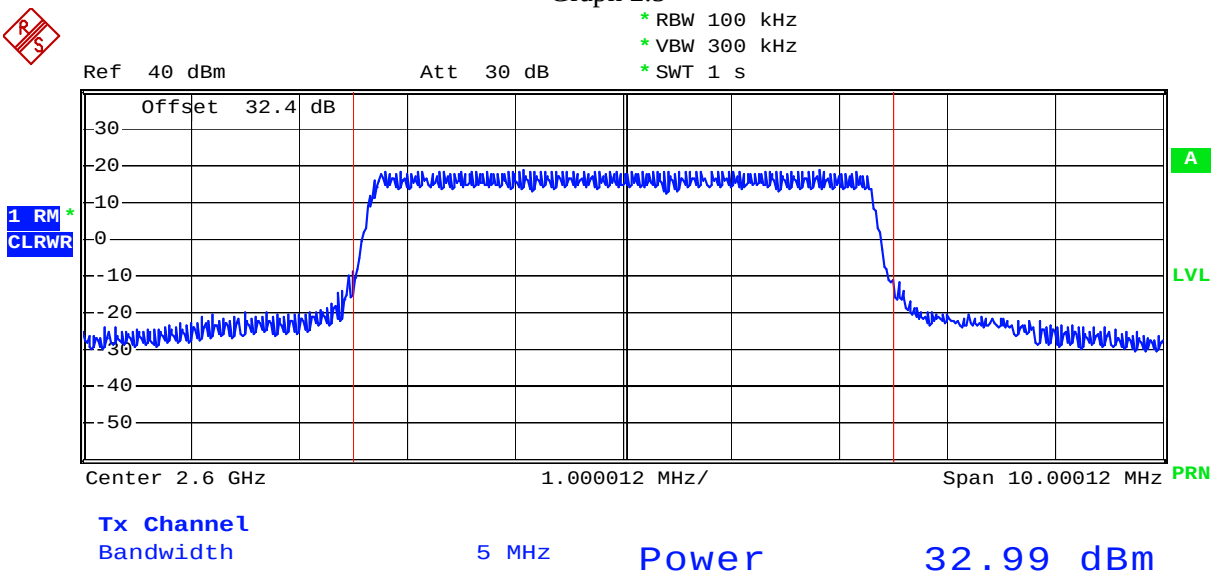
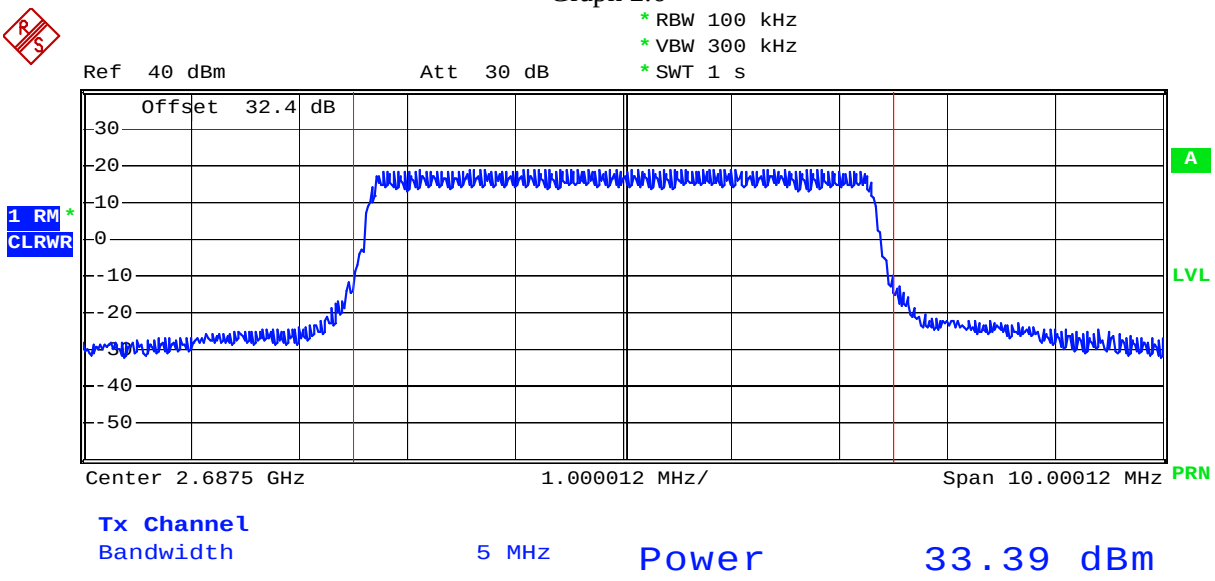
Date: 10.FEB.2010 17:28:51

Graph 2.5



Comment: 16QAM, MID CHANNEL
Date: 10.FEB.2010 17:33:26

Graph 2.6



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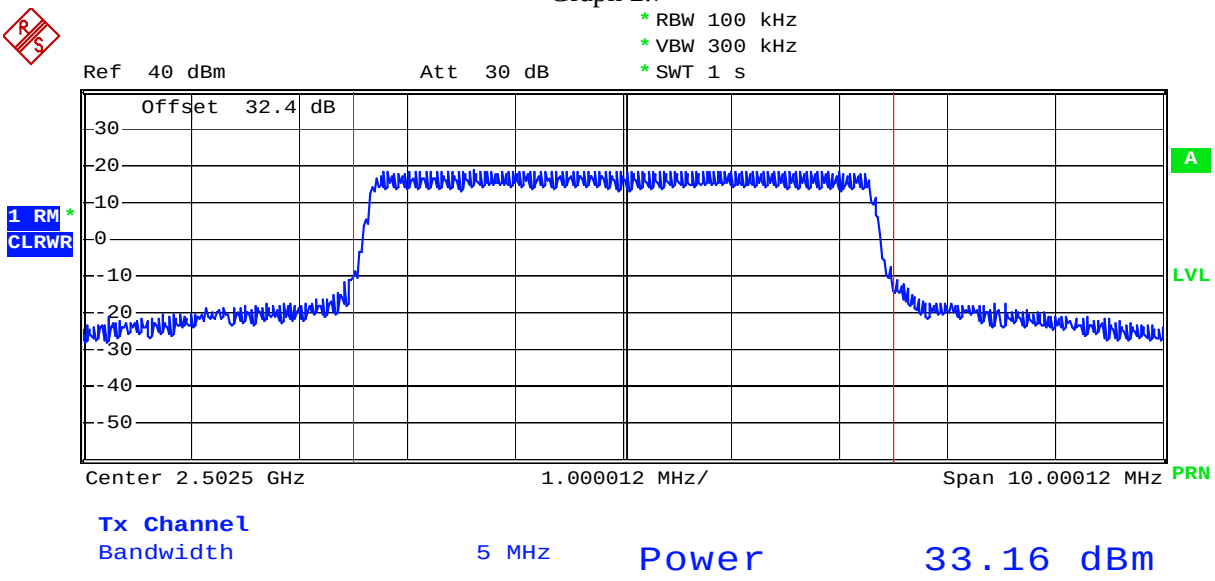
Graph 2.7



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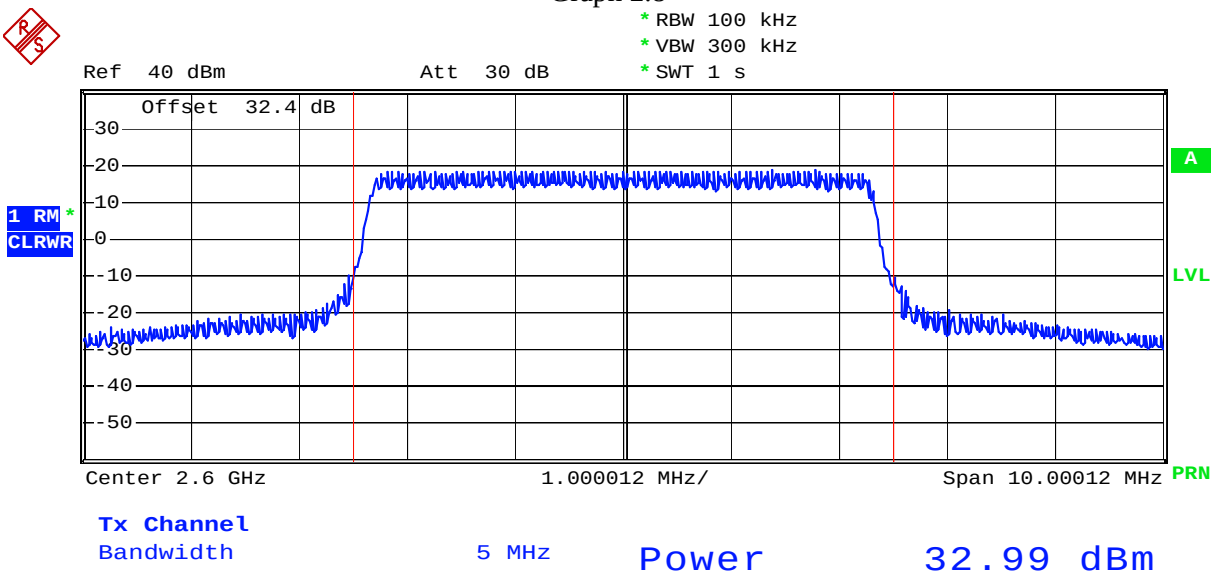
Date: 10.FEB.2010 17:30:07

Graph 2.8



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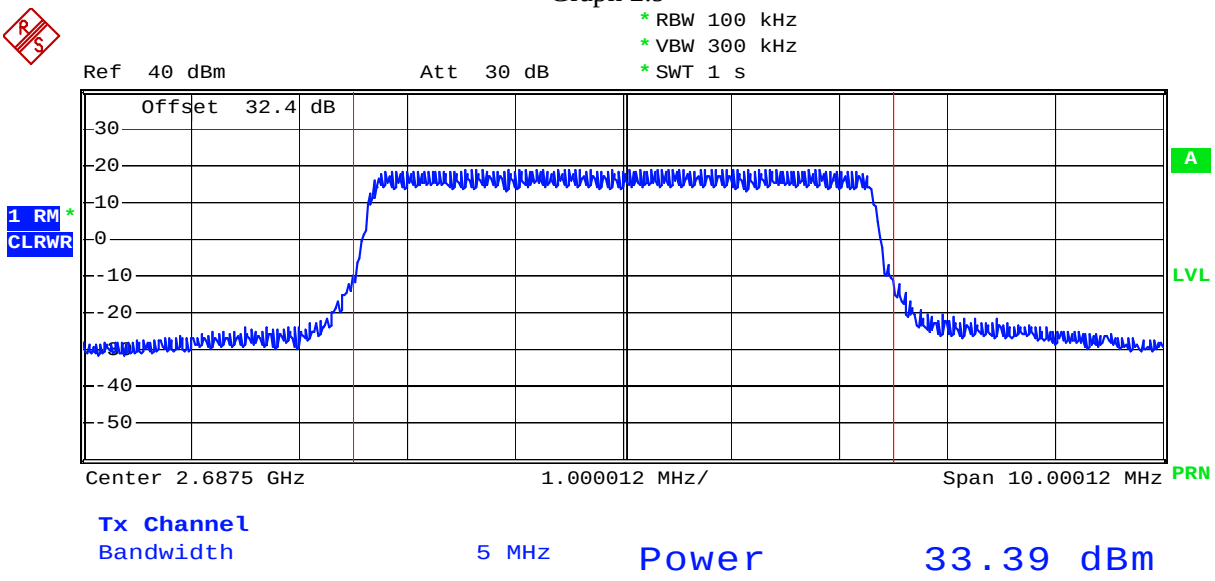
Date: 10.FEB.2010 17:31:40

Graph 2.9



Comment: 64QAM, HIGH CHANNEL
Date: 10.FEB.2010 17:40:57

3.0 Occupied Bandwidth

FCC 2.1049

3.1 Requirement

The 99% occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0.5% of the emitted power.

3.2 Test Procedure

The EUT RF output was connected as shown on the diagram in report section 1.3.2. The EUT was setup to transmit the maximum power.

The spectrum analyzed was setup to measure the Occupied Bandwidth (defined as the 99% Power Bandwidth). The Occupied Bandwidth was measured at the low, middle and high channels for all types of modulation and authorized bandwidths.

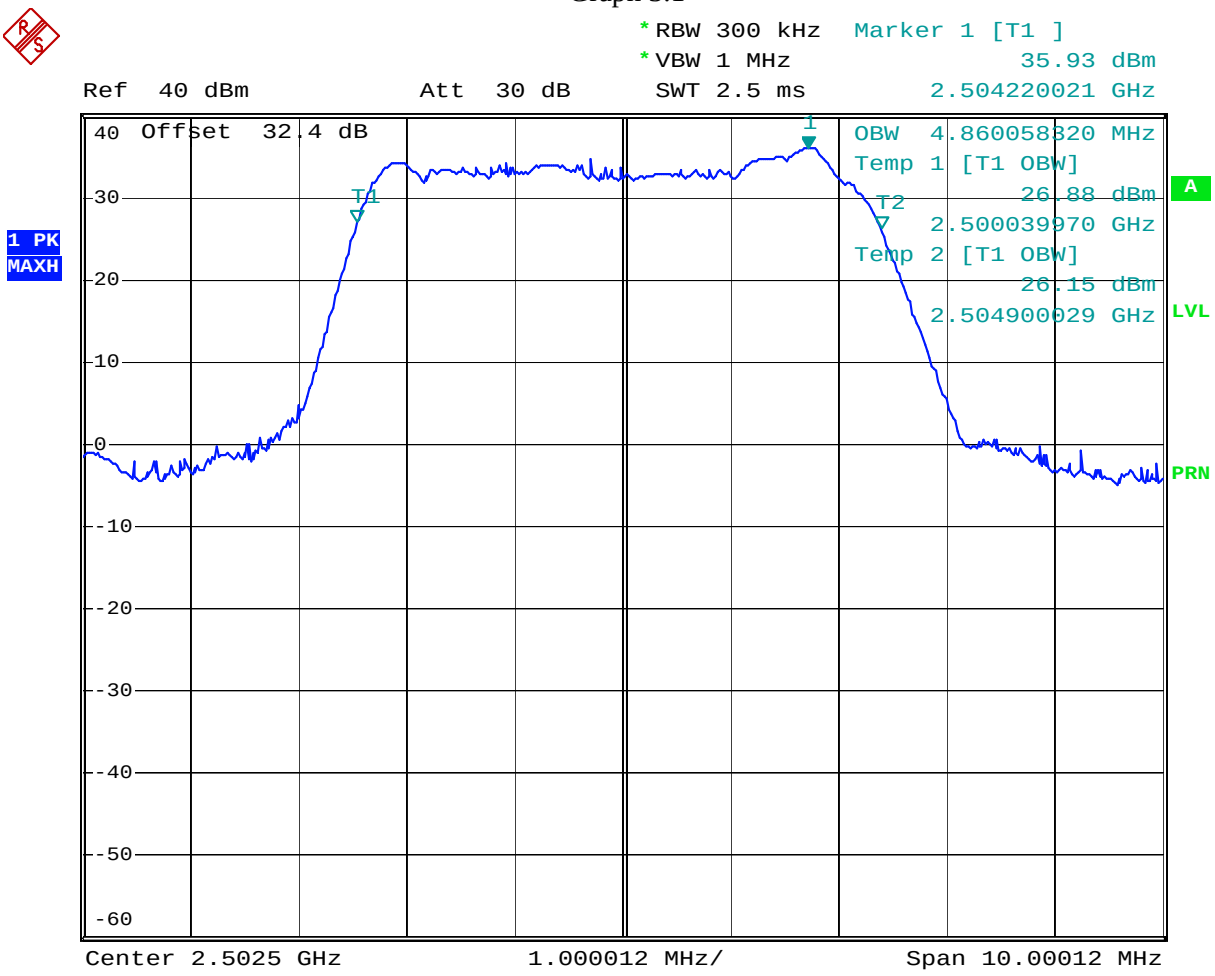
3.3 Test Equipment

Rohde & Schwarz FSP40 Spectrum Analyzer.

3.4 Test Results

Frequency (MHz)	Modulation	Channel Bandwidth (MHz)	Measured Occupied Bandwidth (MHz)	Graph
2502.5	QPSK	5	4.86	3.1
	16 QAM		4.86	3.2
	64 QAM		4.86	3.3
2600.0	QPSK	5	4.86	3.4
	16 QAM		4.84	3.5
	64 QAM		4.84	3.6
2687.5	QPSK	5	4.82	3.7
	16 QAM		4.86	3.8
	64 QAM		4.86	3.9

Graph 3.1



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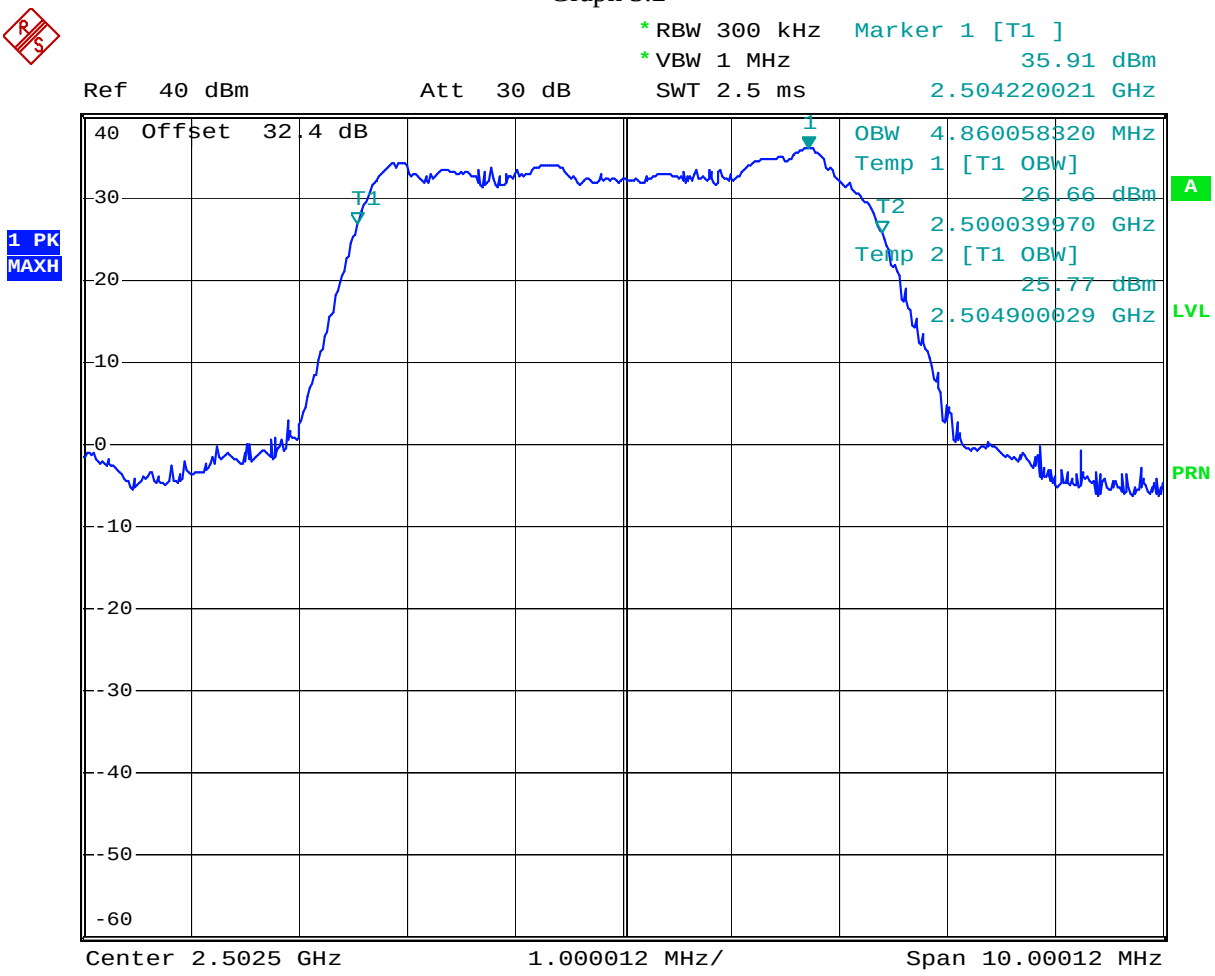
Graph 3.2



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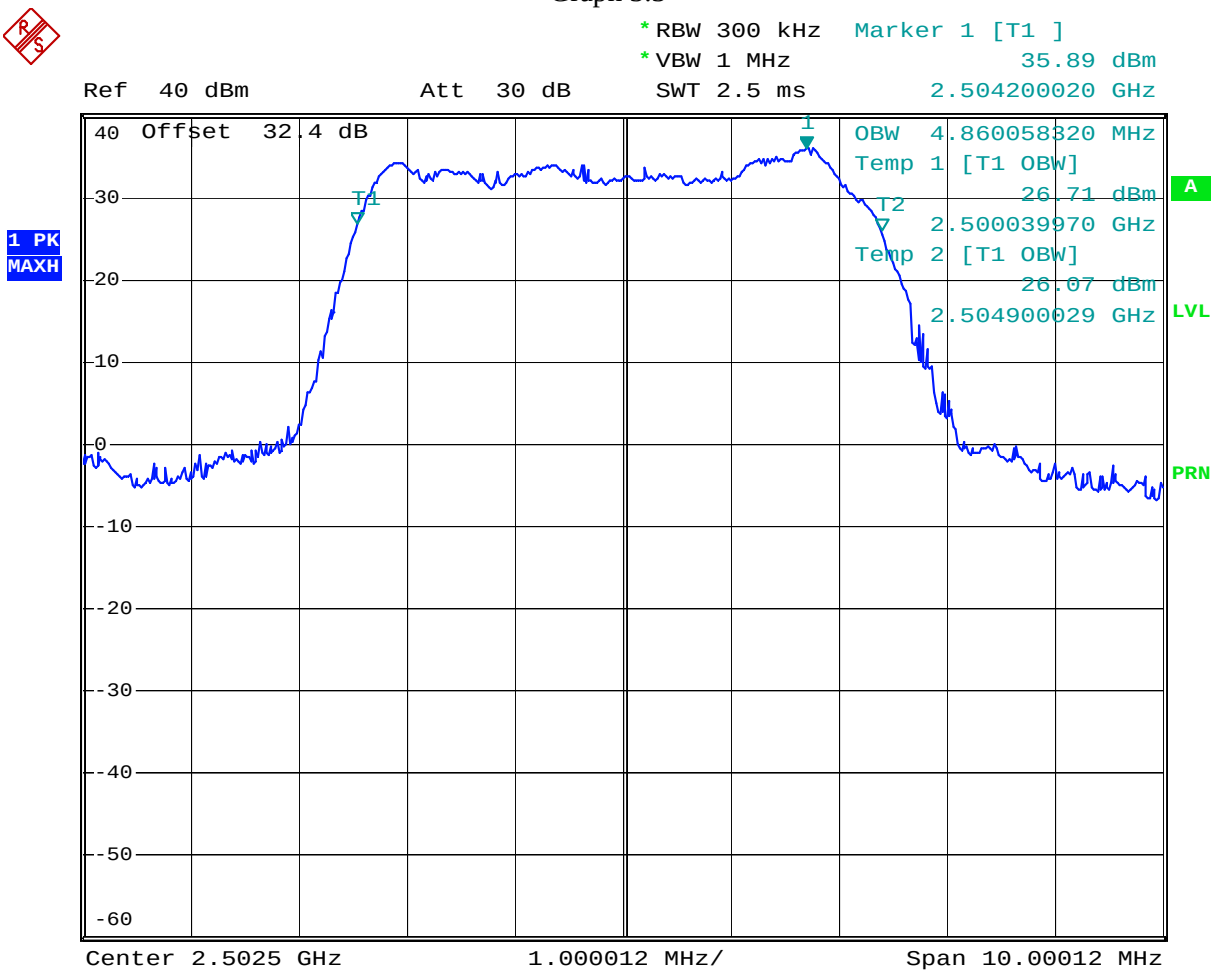
Date: 10.FEB.2010 17:57:54

Graph 3.3



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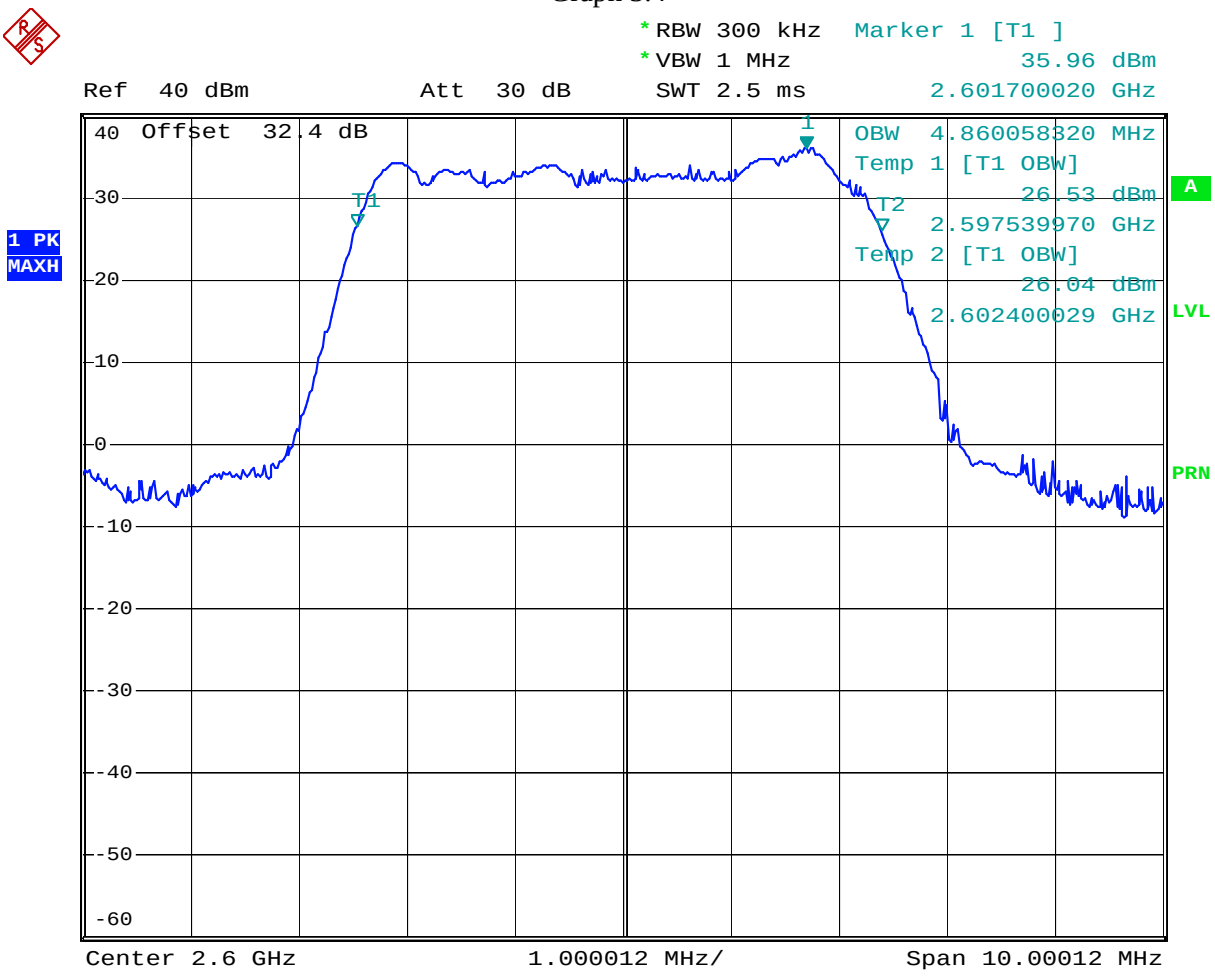
Graph 3.4



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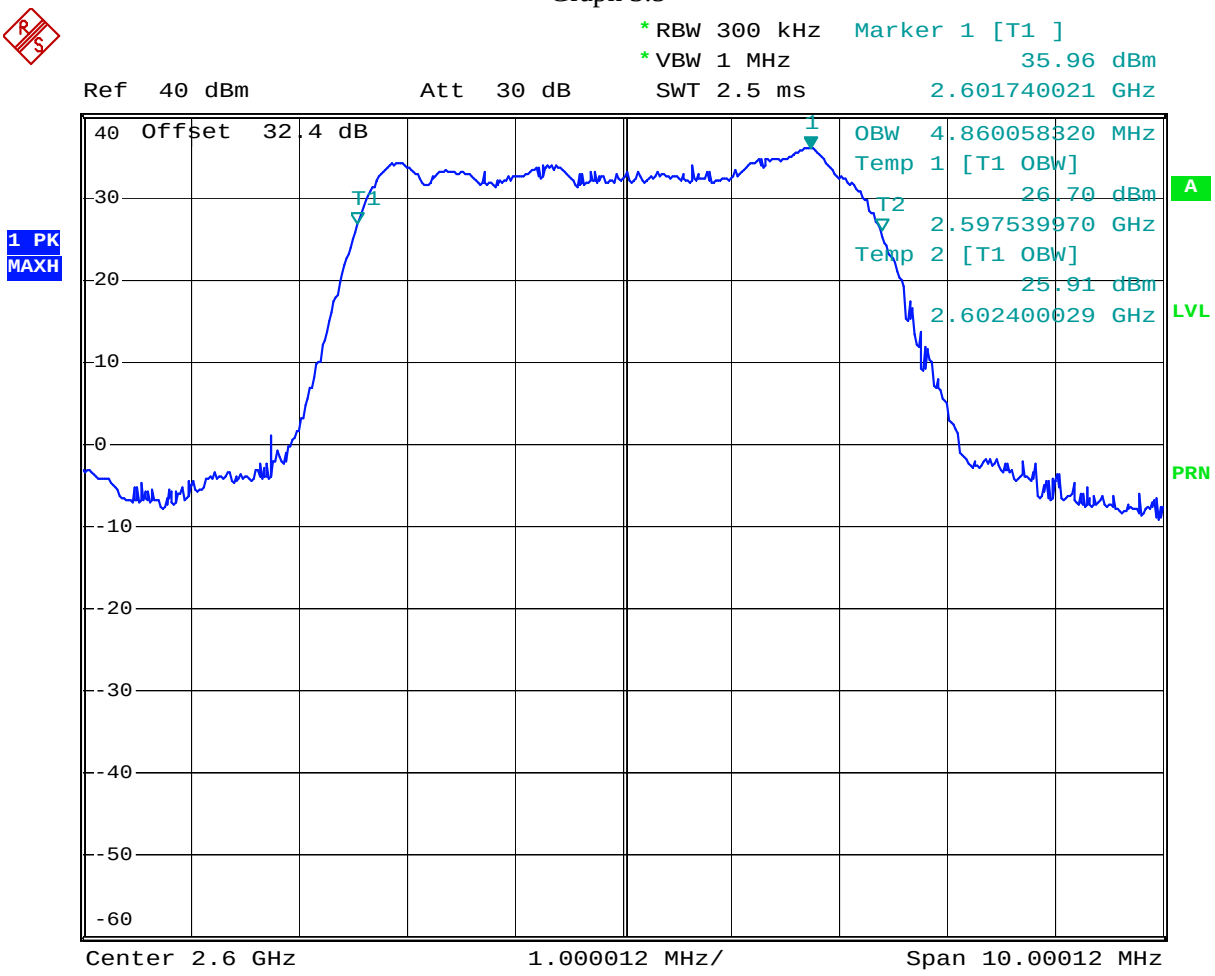
Date: 10.FEB.2010 17:52:02

Graph 3.5



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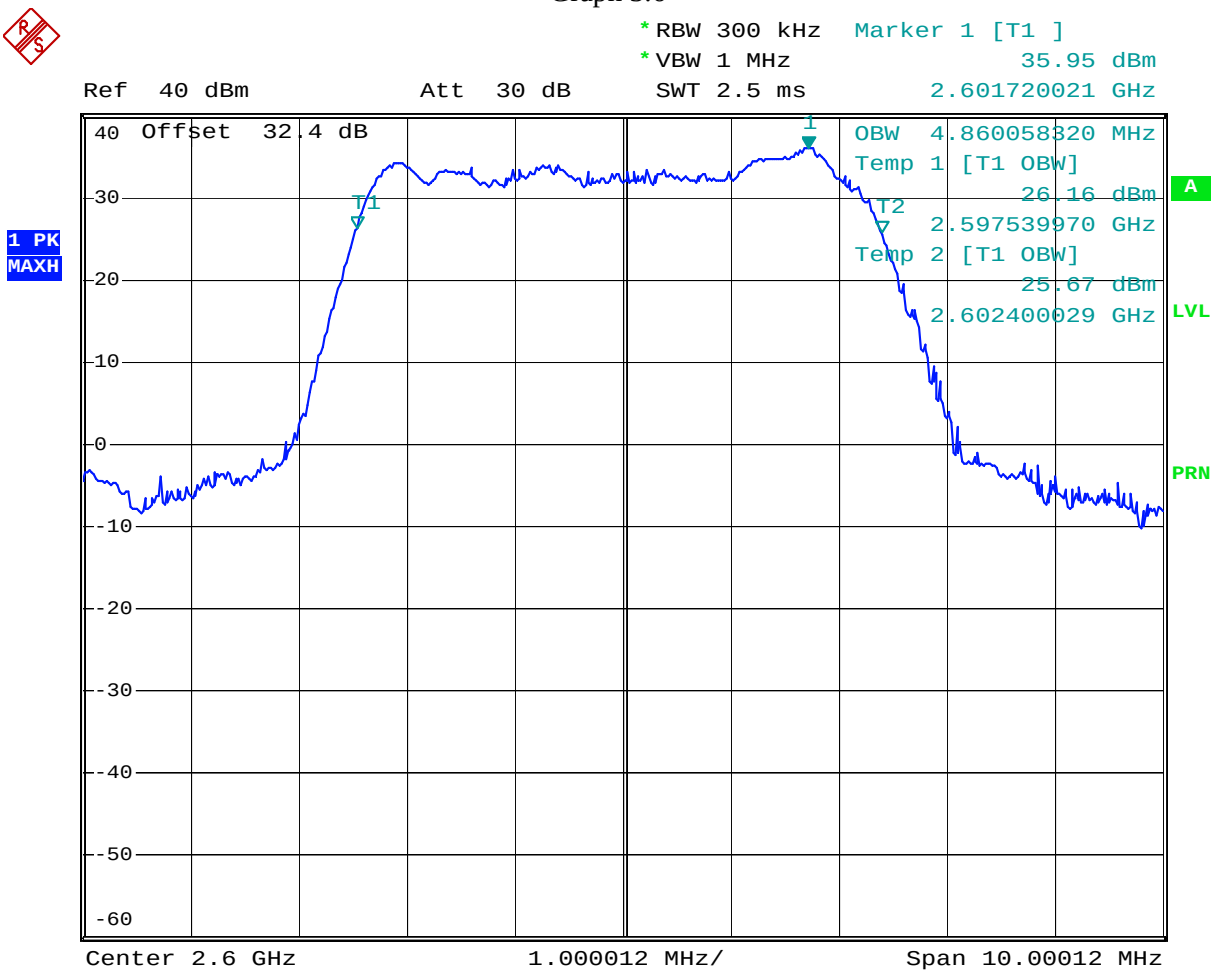
Graph 3.6



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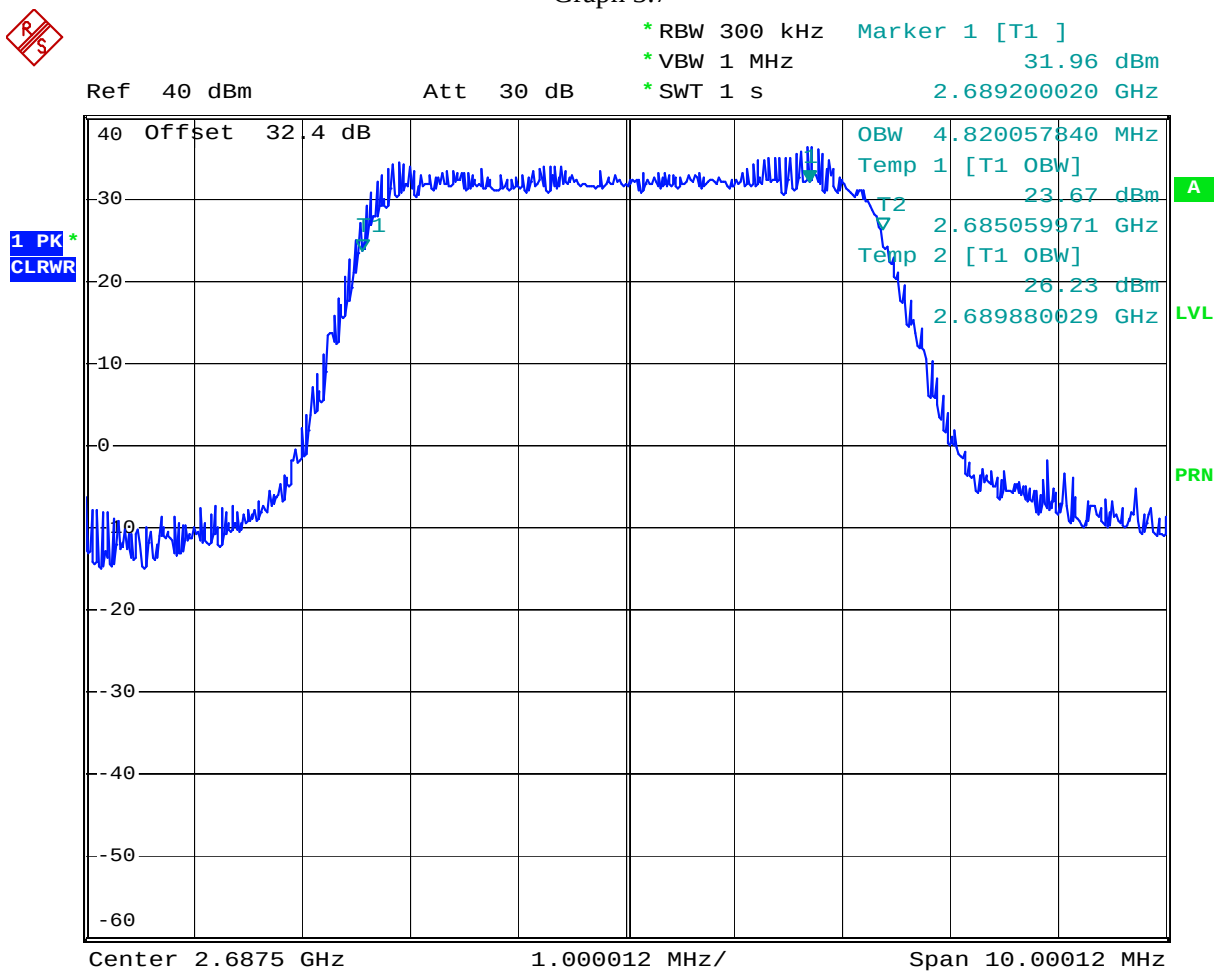
Graph 3.7



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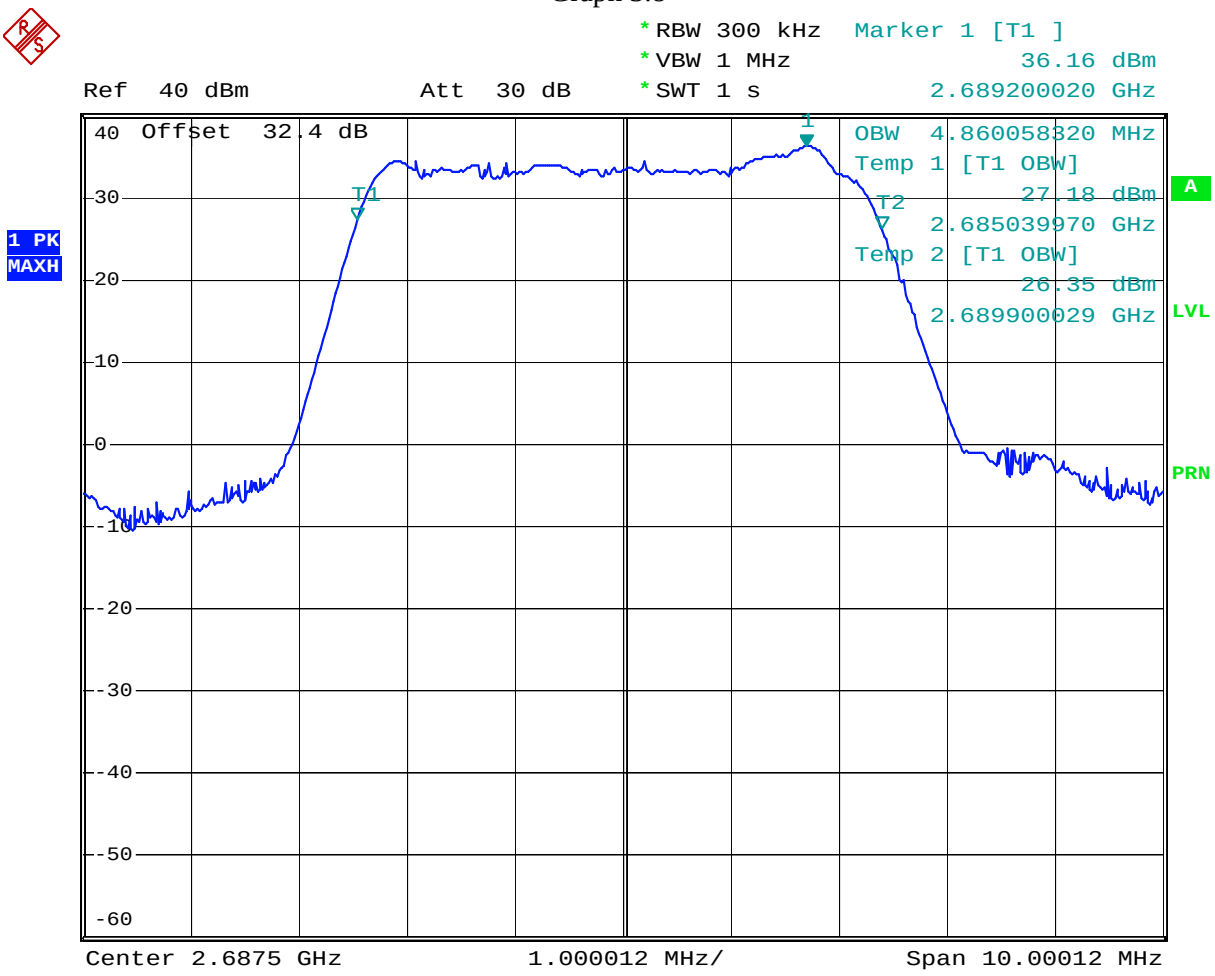
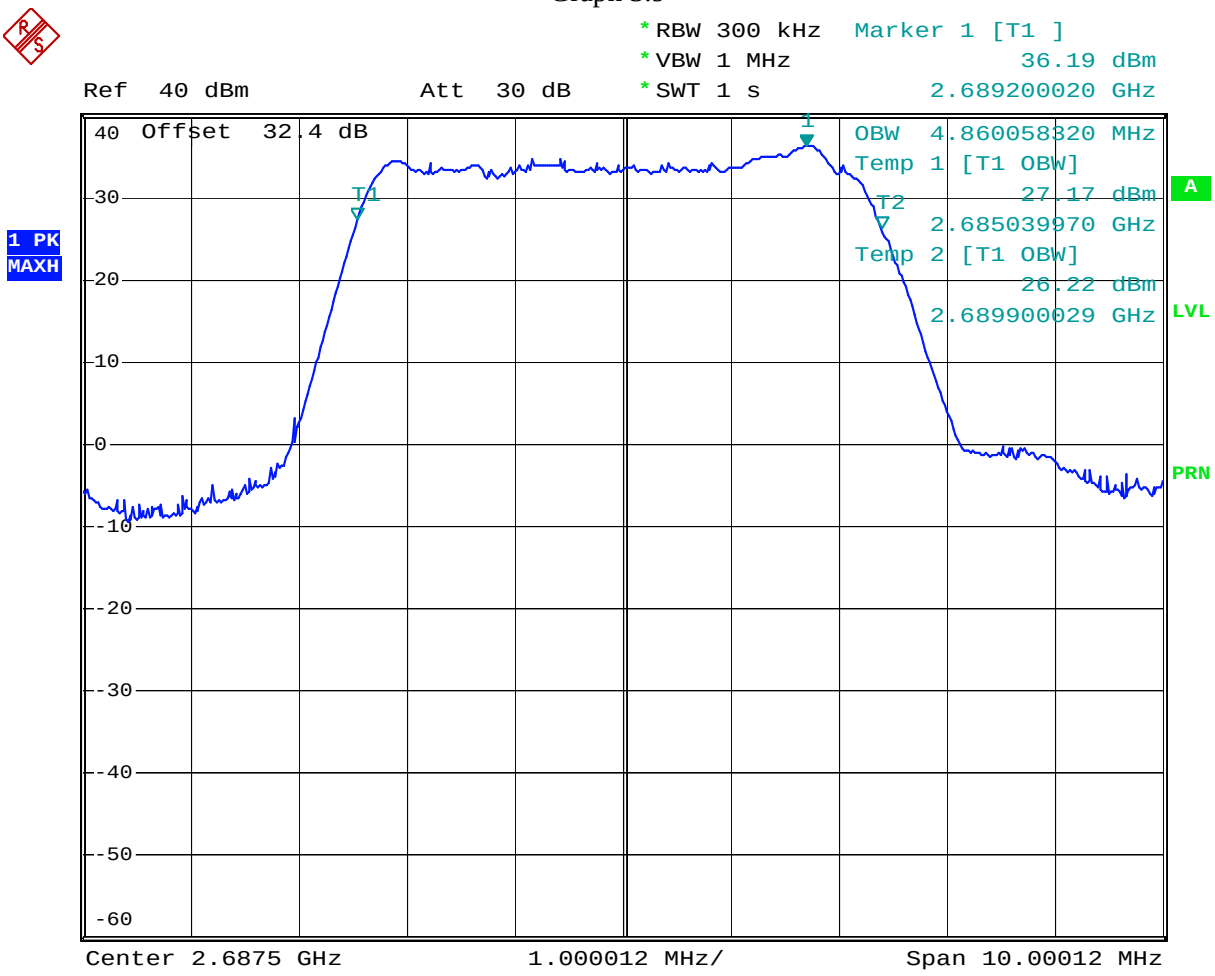
Date: 10.FEB.2010 17:49:47

Graph 3.8



Comment: 16QAM, HIGH CHANNEL
Date: 10.FEB.2010 17:48:26

Graph 3.9



Comment: 64QAM, HIGH CHANNEL
Date: 10.FEB.2010 17:45:06

4.0 Spurious Emissions at Antenna Terminals

FCC 2.1051, 27.53

4.1 Requirement

For digital base stations, the attenuation shall be not less than 43 + 10 log (P) dB
Note: That corresponds to the level of -13 dBm for any out-of-band and spurious emissions.

4.2 Test Procedure

The EUT RF output was connected as shown on the diagram in report section 1.3.2. The EUT was setup to transmit the maximum power.

For measurements at frequencies below 1 GHz, the spectrum analyzed resolution bandwidth was set to 100 kHz. For measurements at frequencies above 1 GHz, the spectrum analyzed resolution bandwidth was set to 1 MHz.

Sufficient scans were taken to show the spurious emissions up to 10th harmonic.

4.3 Test Equipment

Rohde & Schwarz FSP40 Spectrum Analyzer

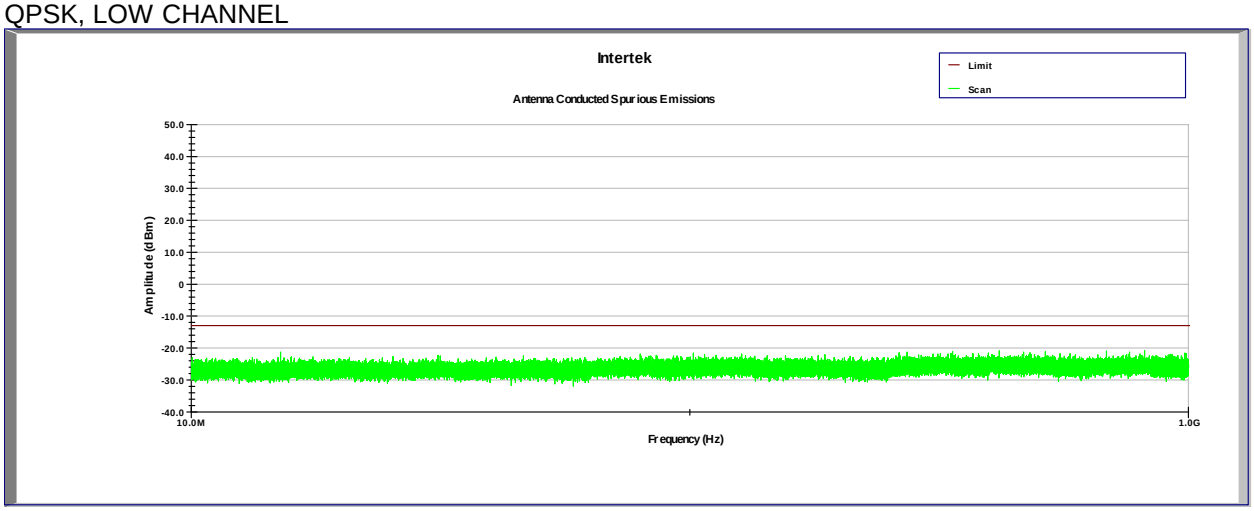
4.4 Test Results

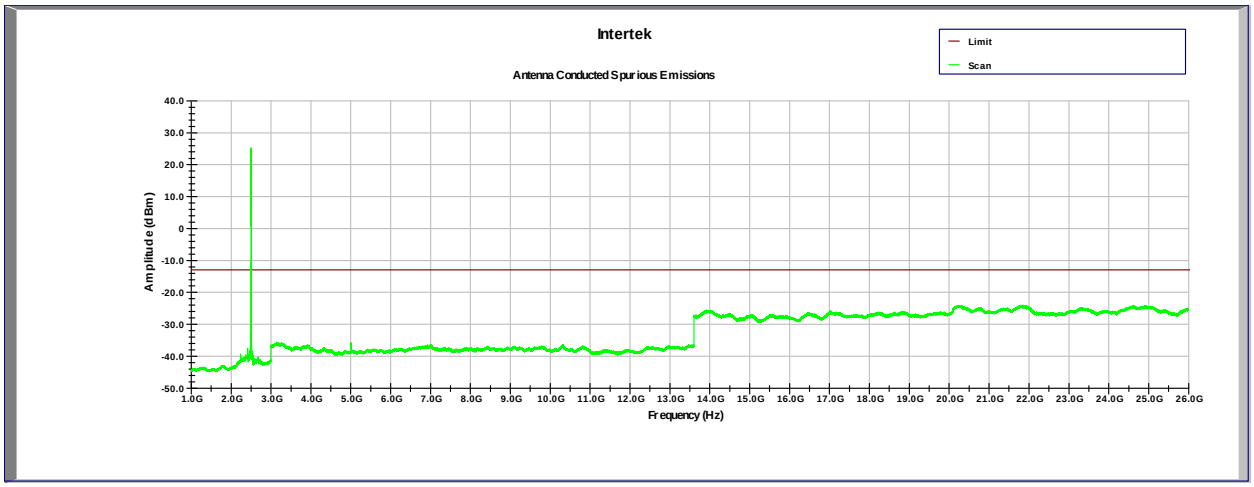
Complies	Refer to the following Graphs

Measurements were made on the low, middle and high channels for all modulations.

Graph 4.1

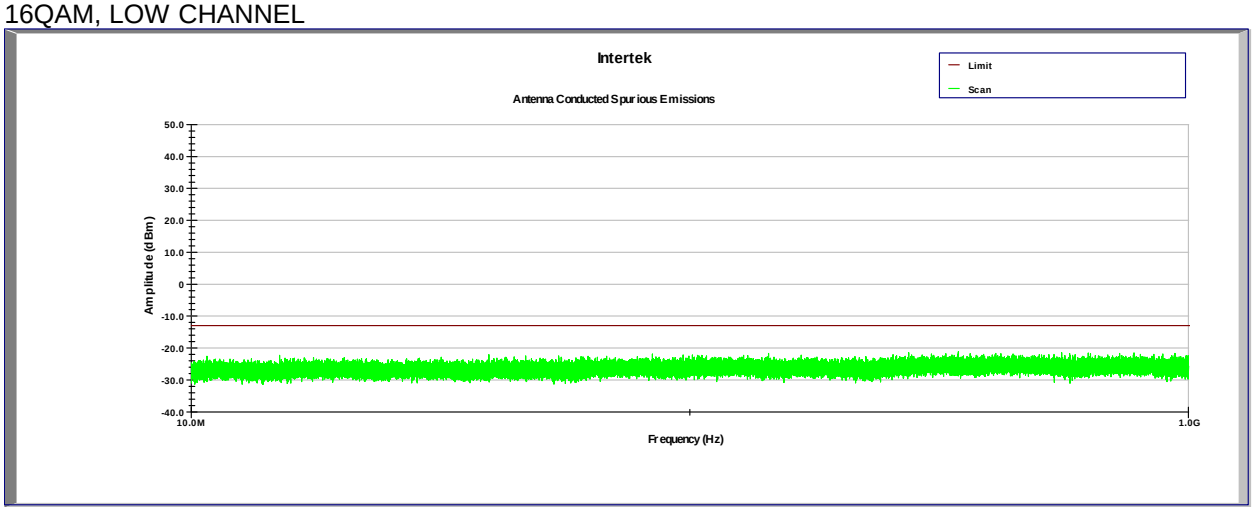
QPSK, LOW CHANNEL

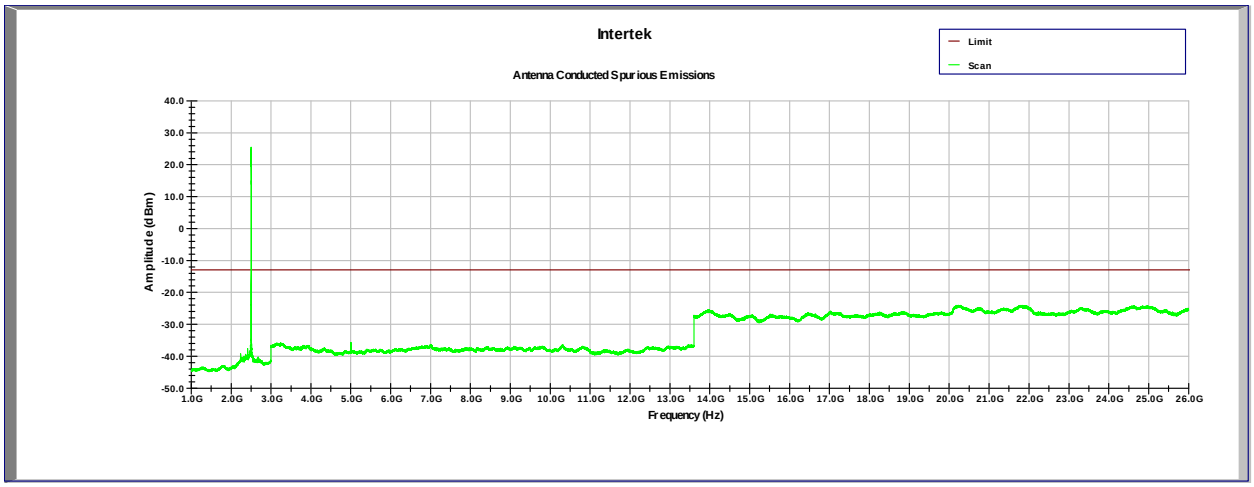




Graph 4.2

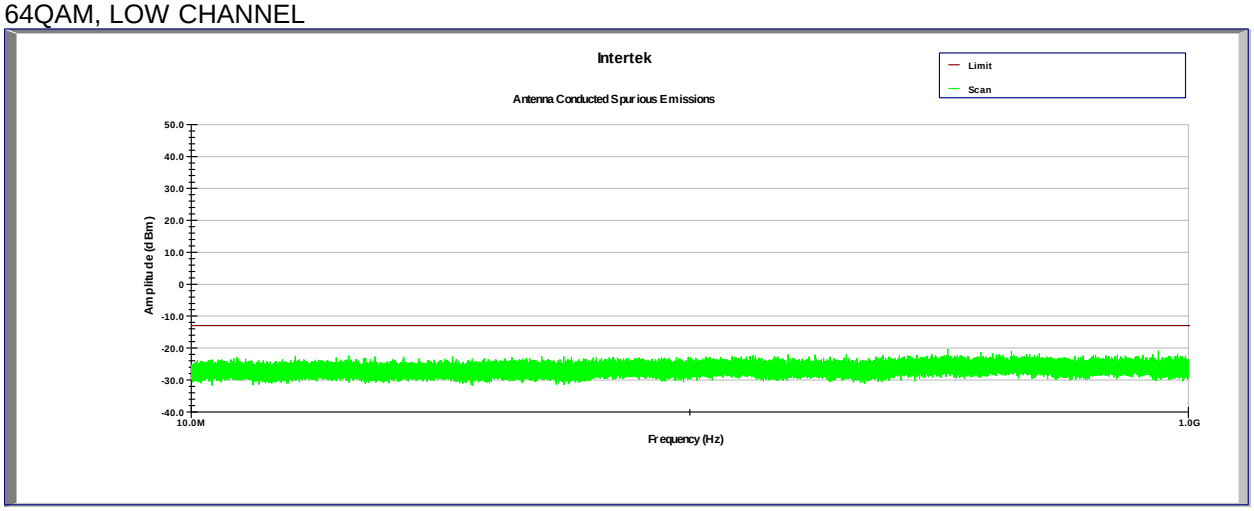
16QAM, LOW CHANNEL

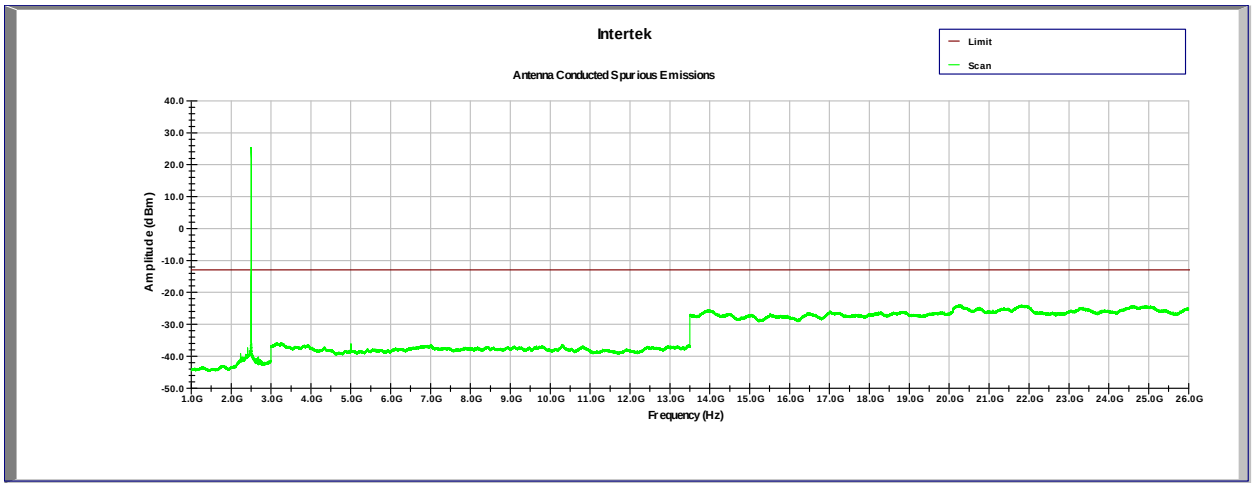




Graph 4.3

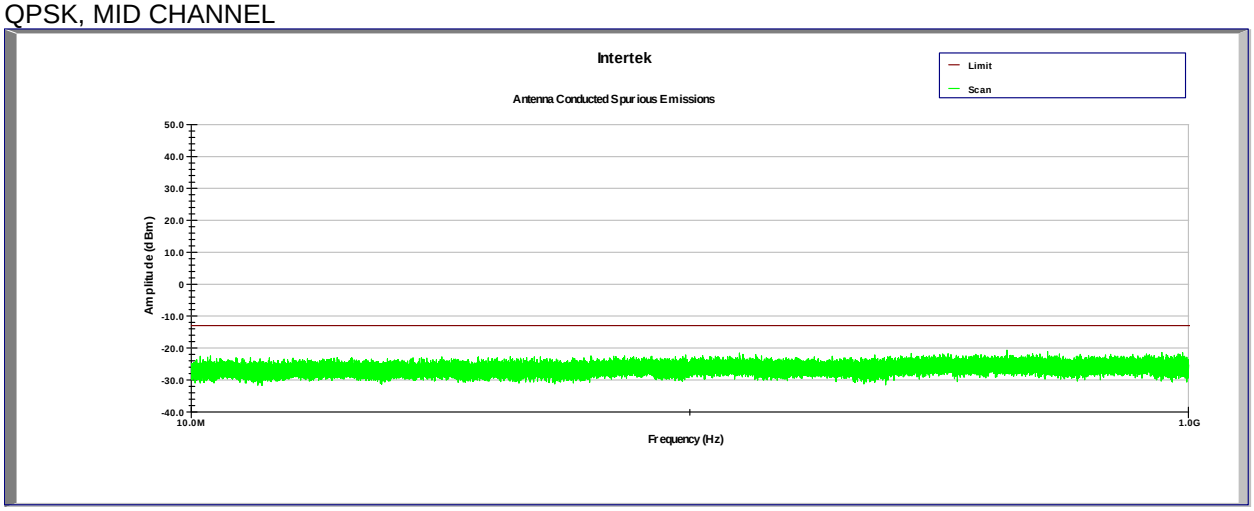
64QAM, LOW CHANNEL

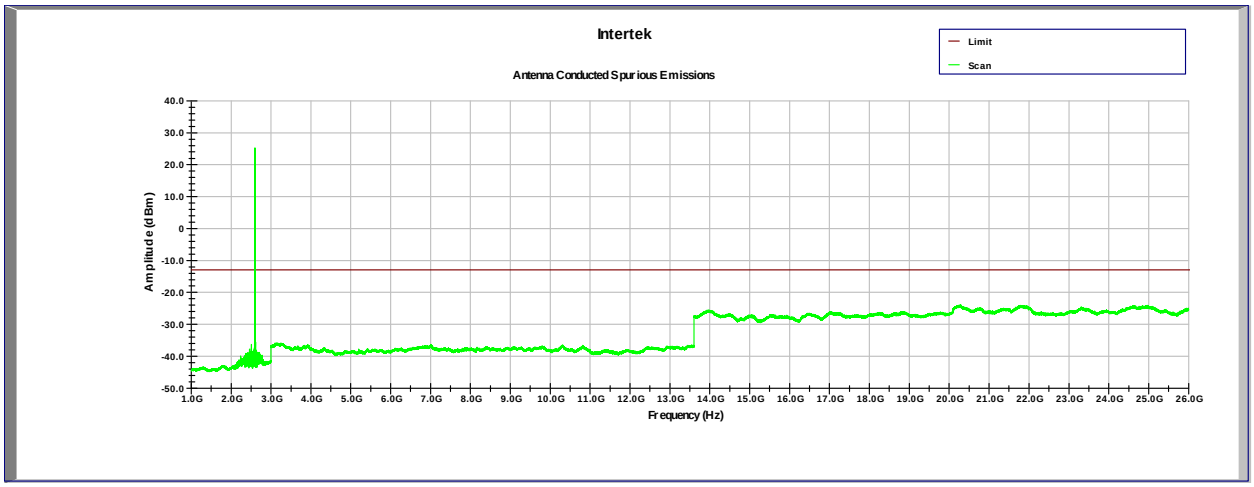




Graph 4.4

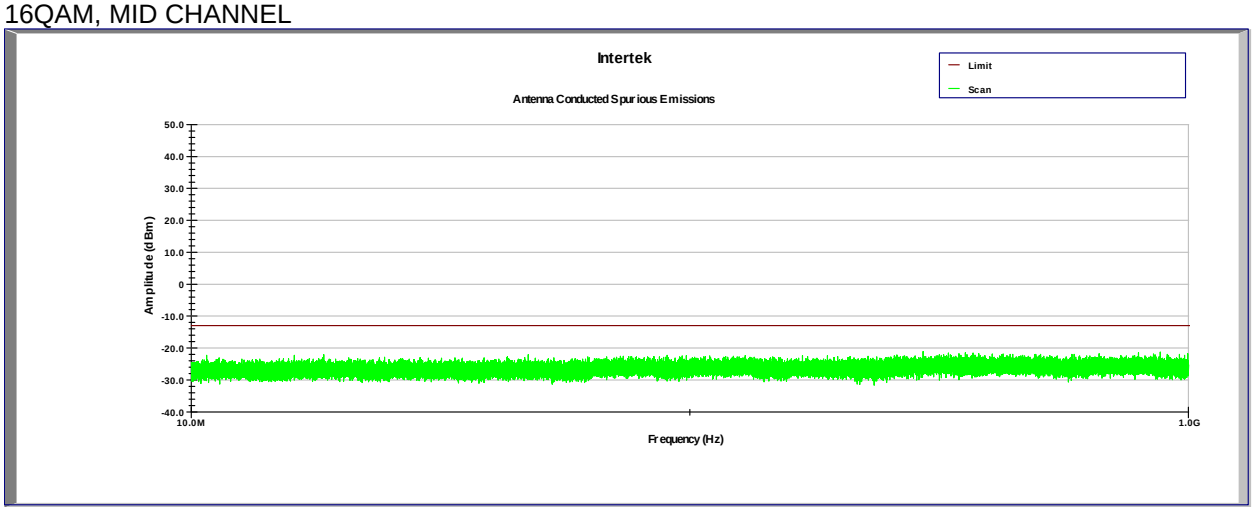
QPSK, MID CHANNEL

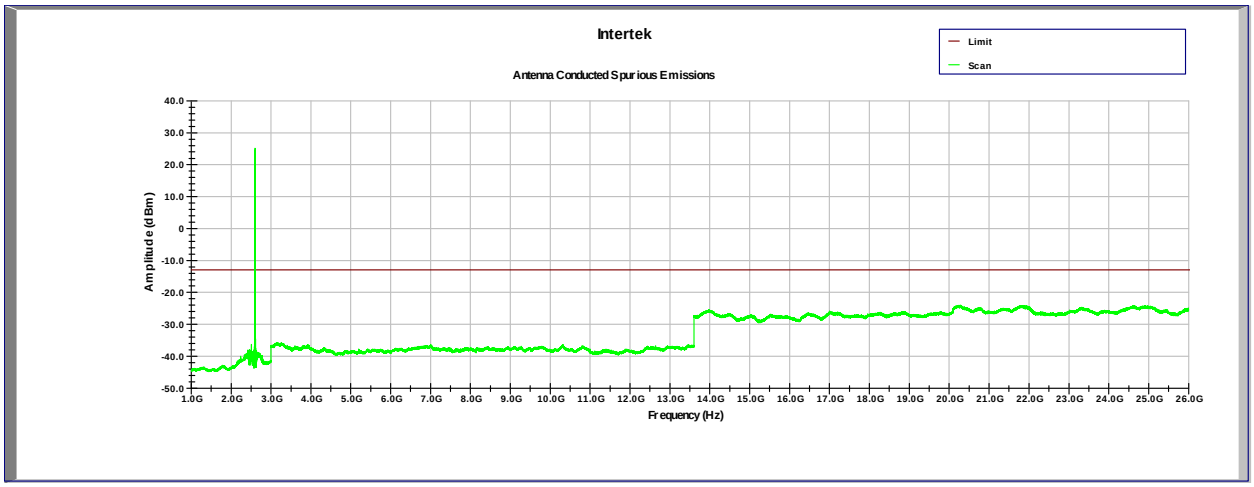




Graph 4.5

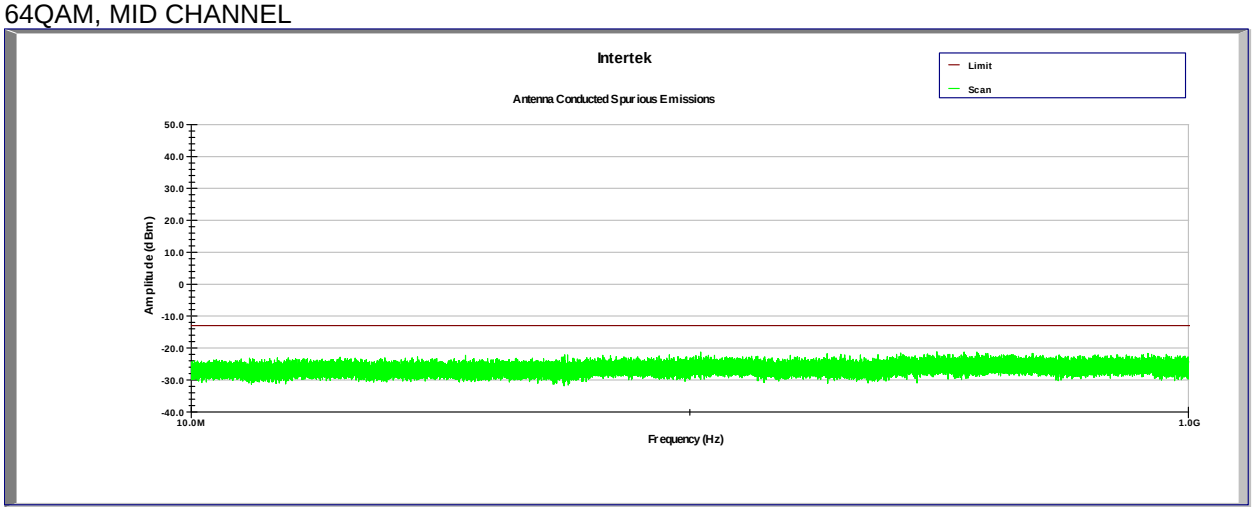
16QAM, MID CHANNEL

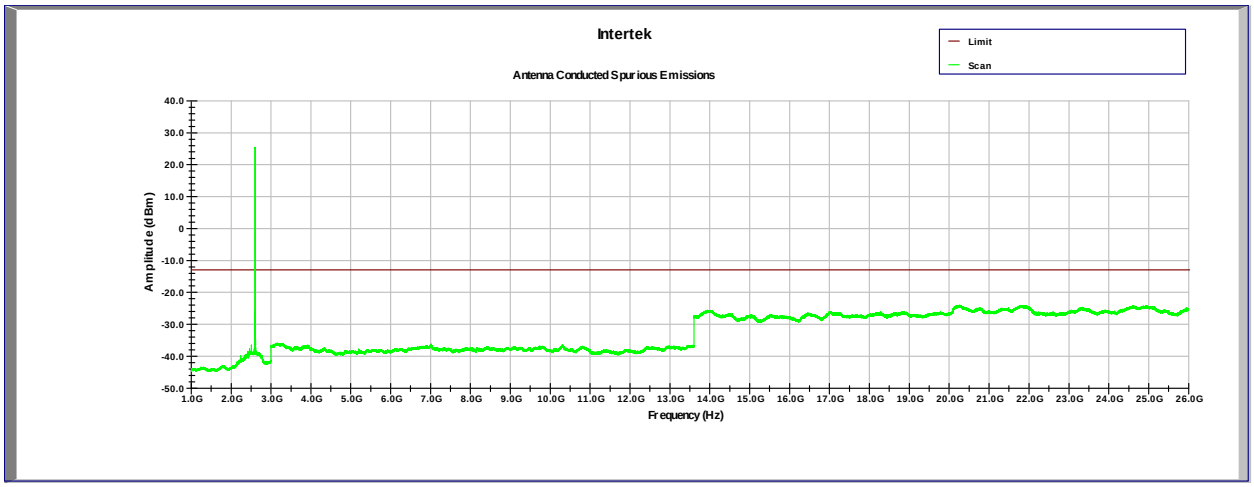




Graph 4.6

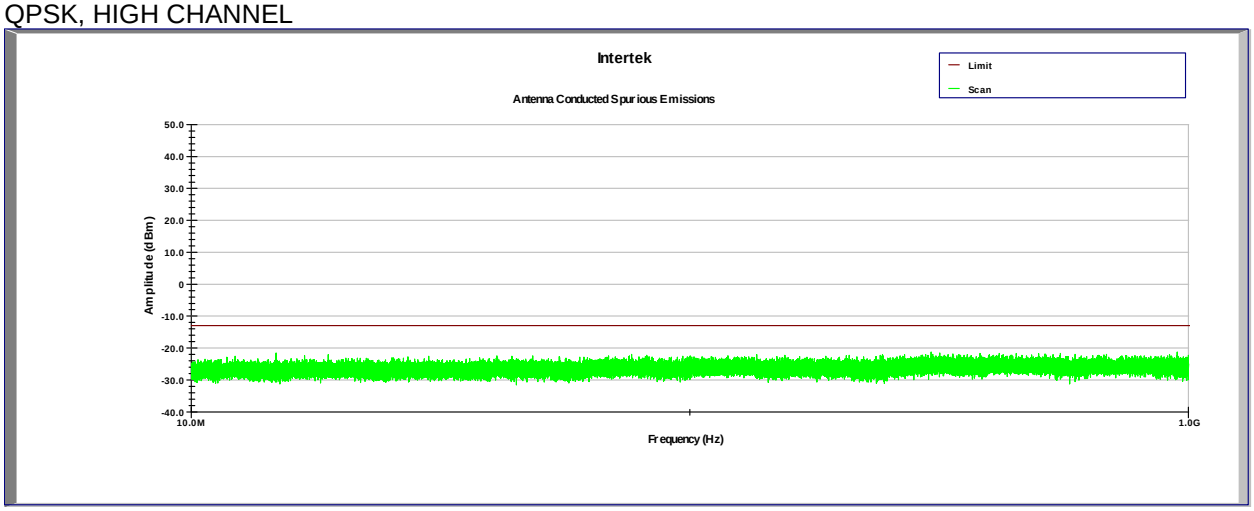
64QAM, MID CHANNEL

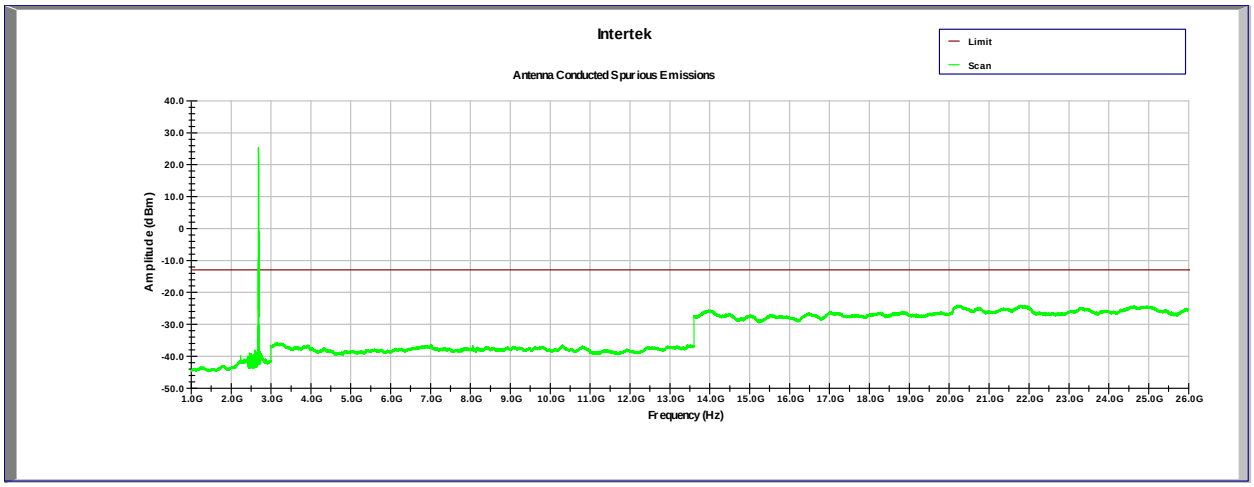




Graph 4.7

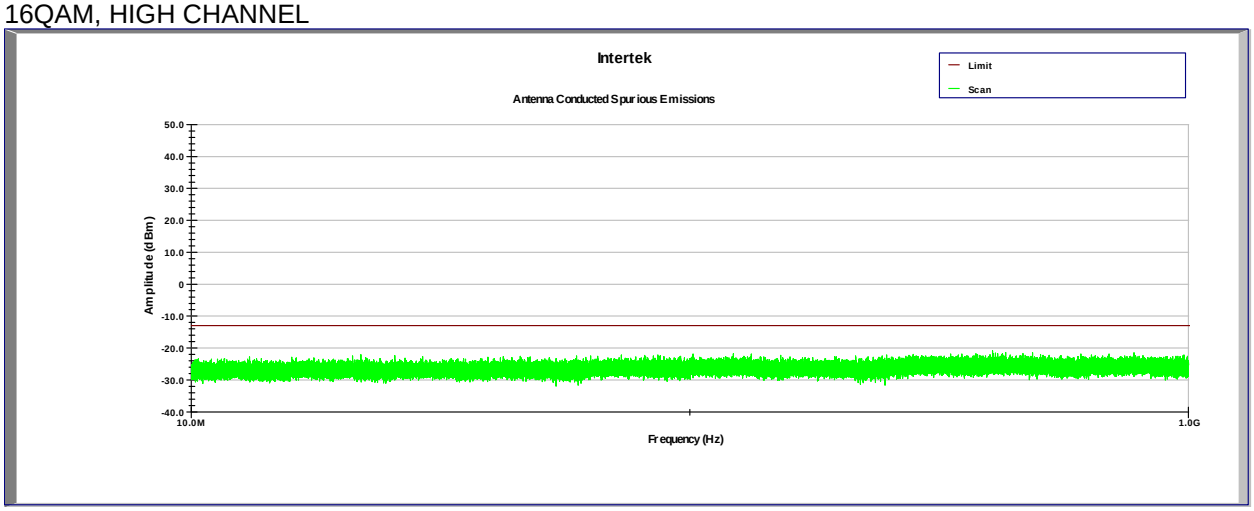
QPSK, HIGH CHANNEL

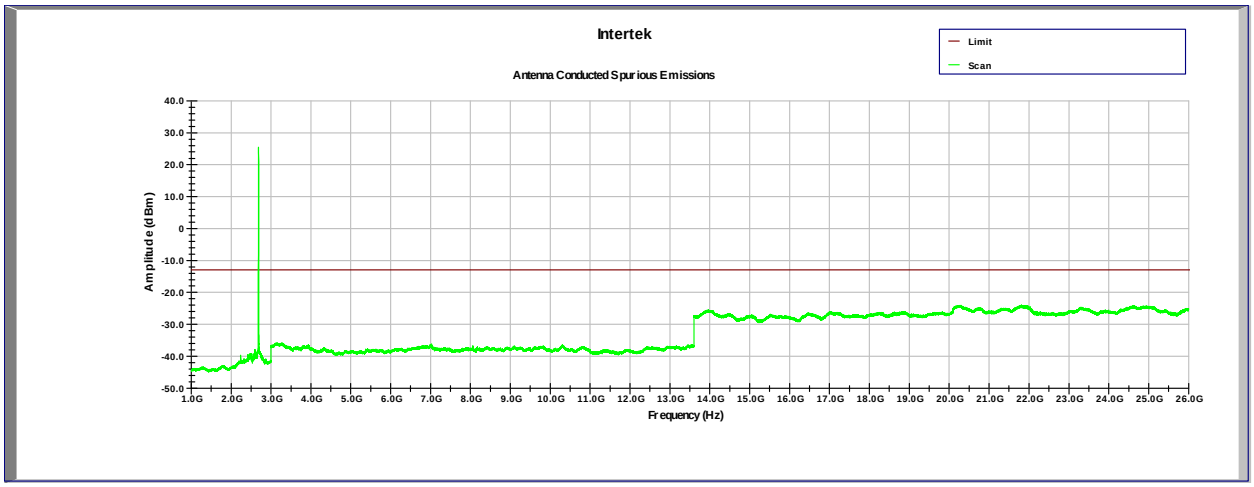




Graph 4.8

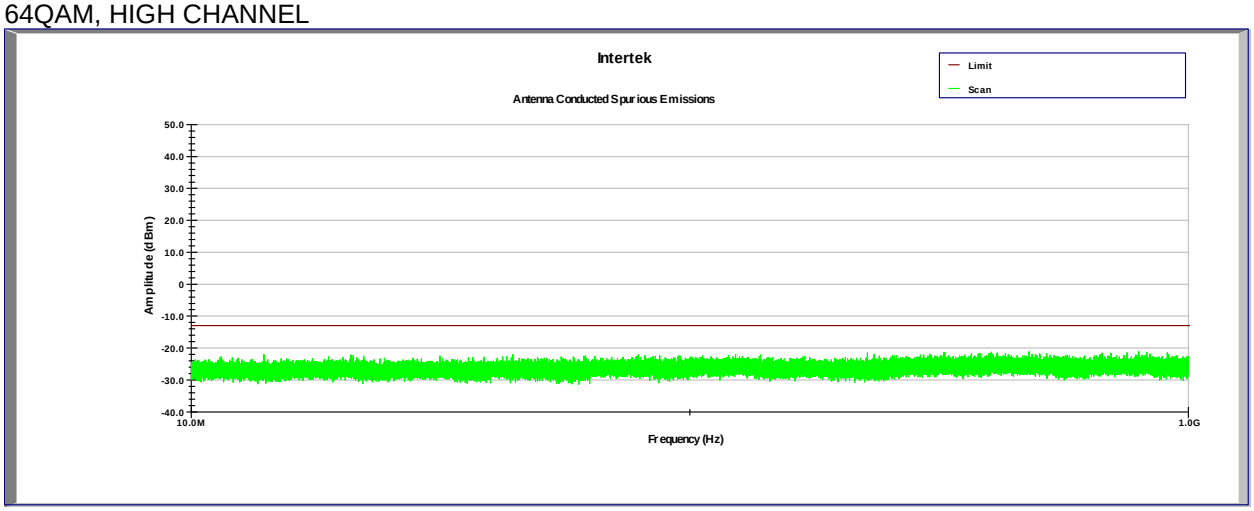
16QAM, HIGH CHANNEL

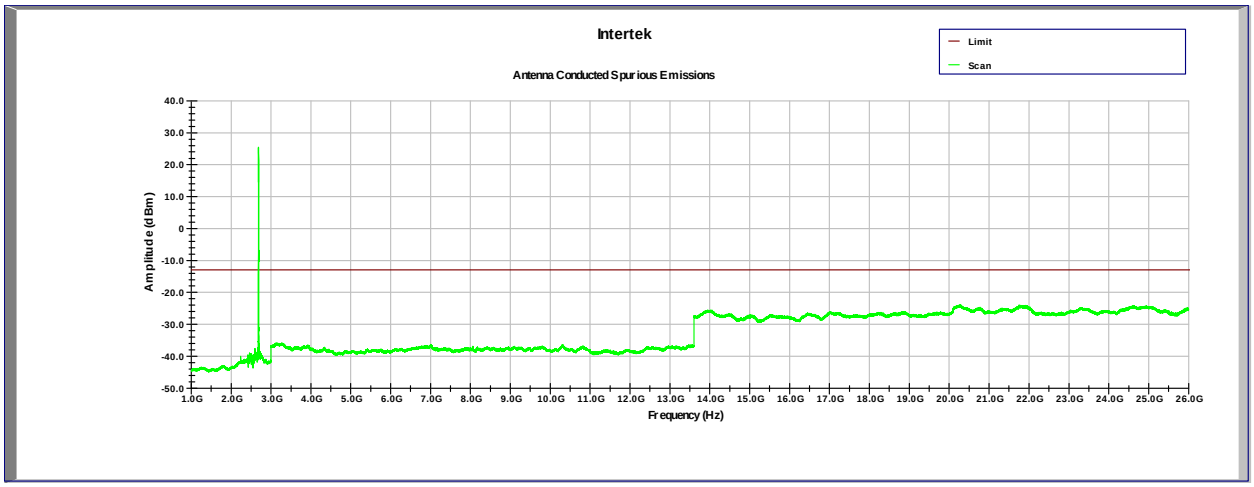




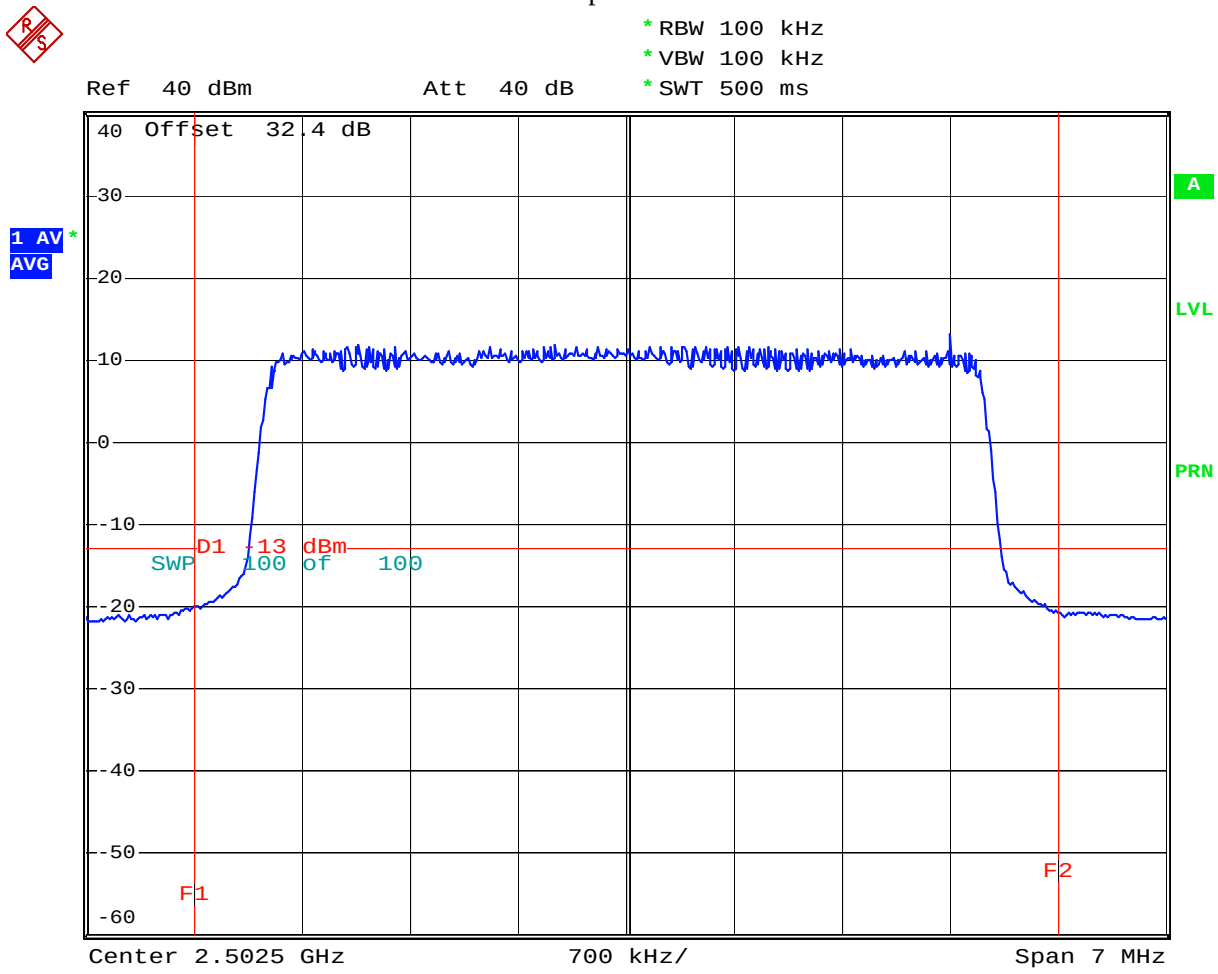
Graph 4.9

64QAM, HIGH CHANNEL



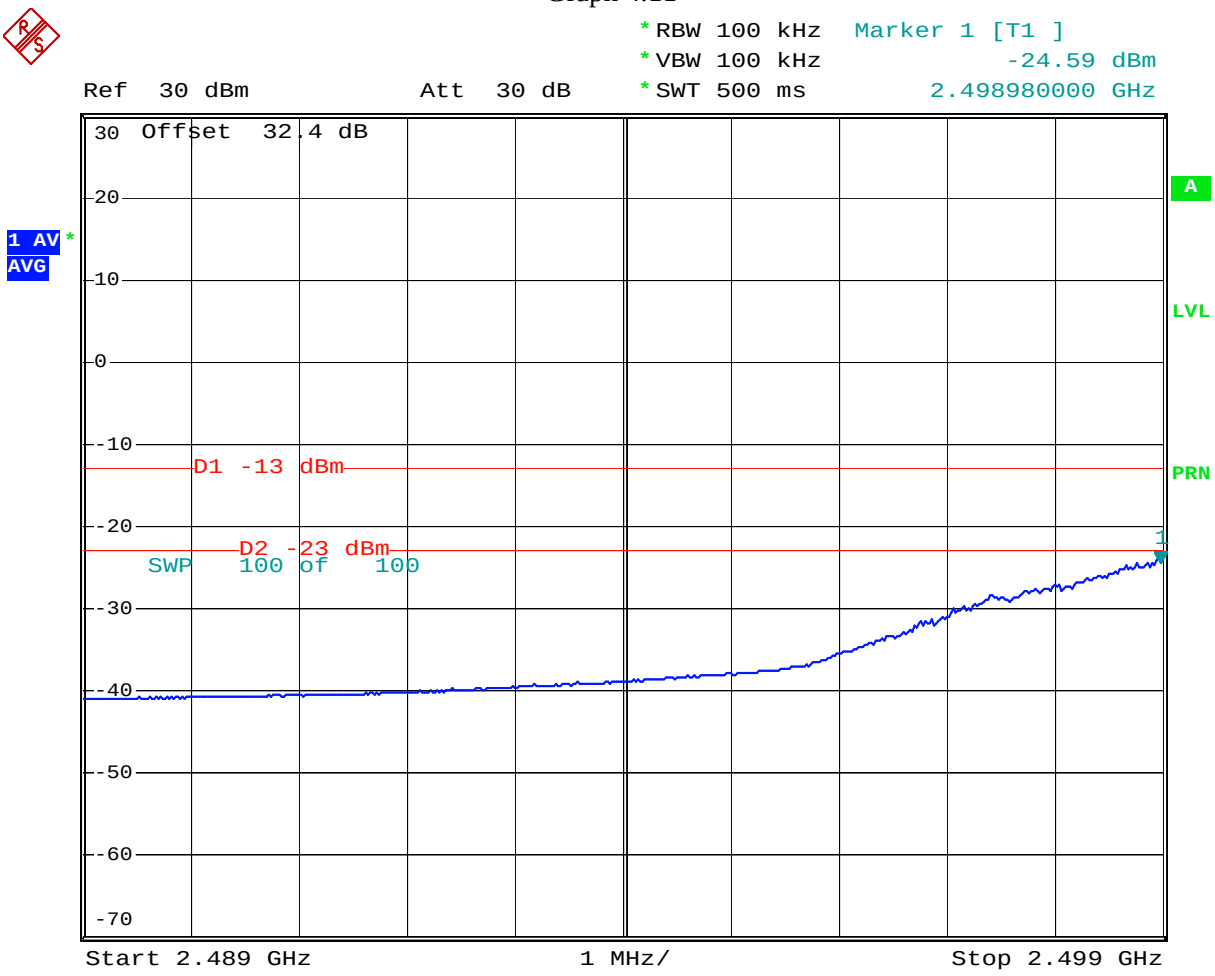


Graph 4.10



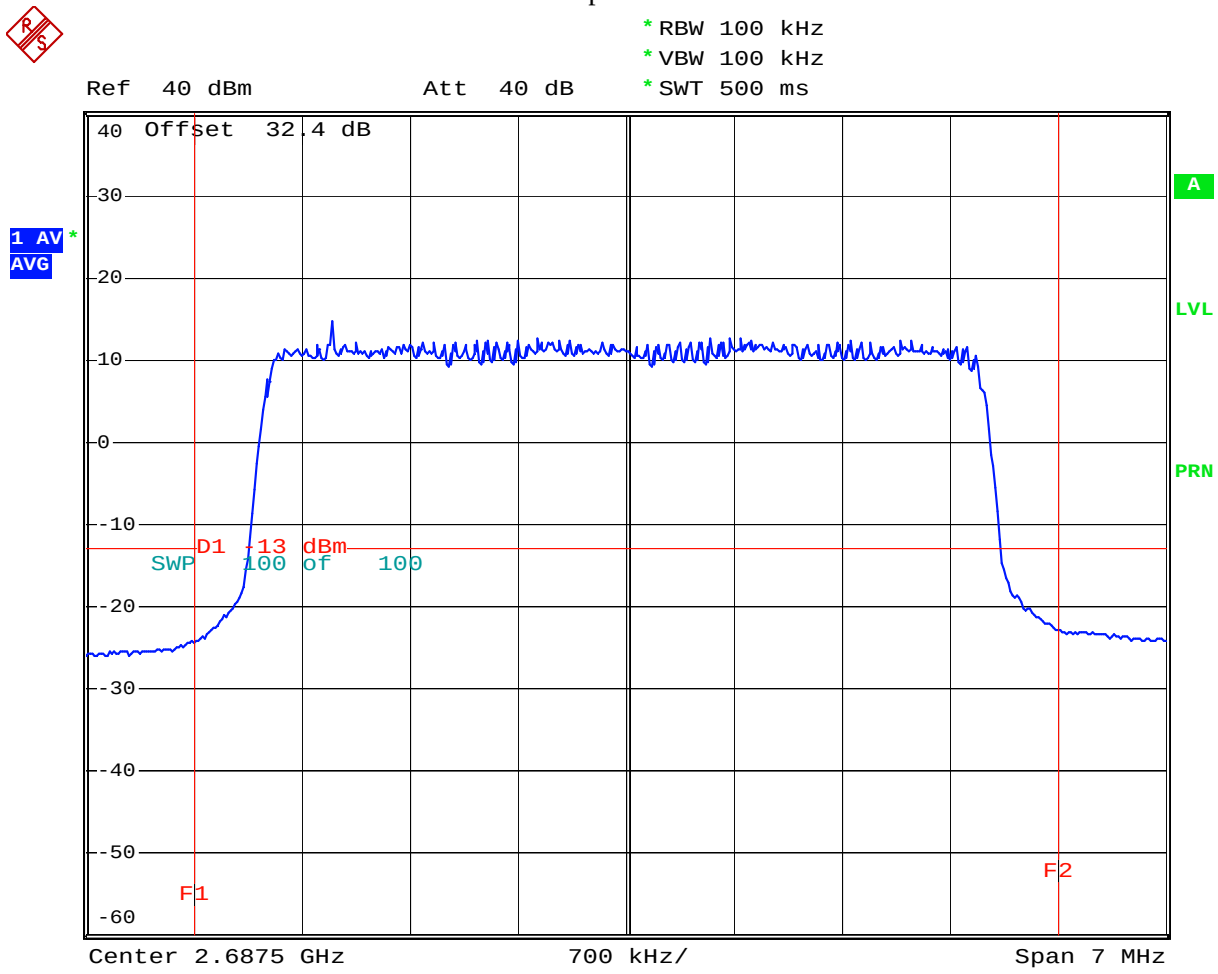
Comment: QPSK, LOW CHANNEL
Date: 11.FEB.2010 14:13:00

Graph 4.11



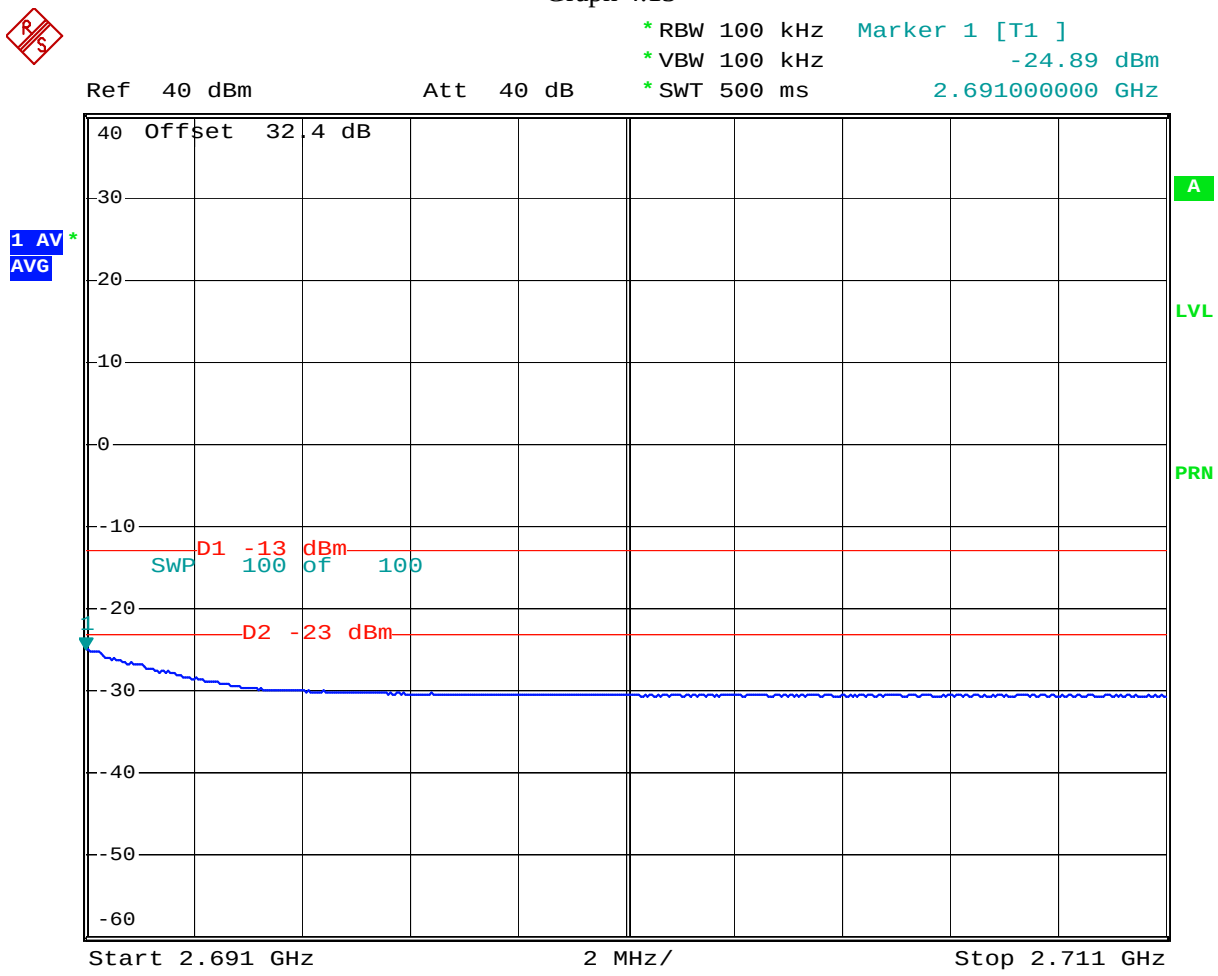
Comment: QPSK, LOW CHANNEL
Date: 11.FEB.2010 14:52:23

Graph 4.12



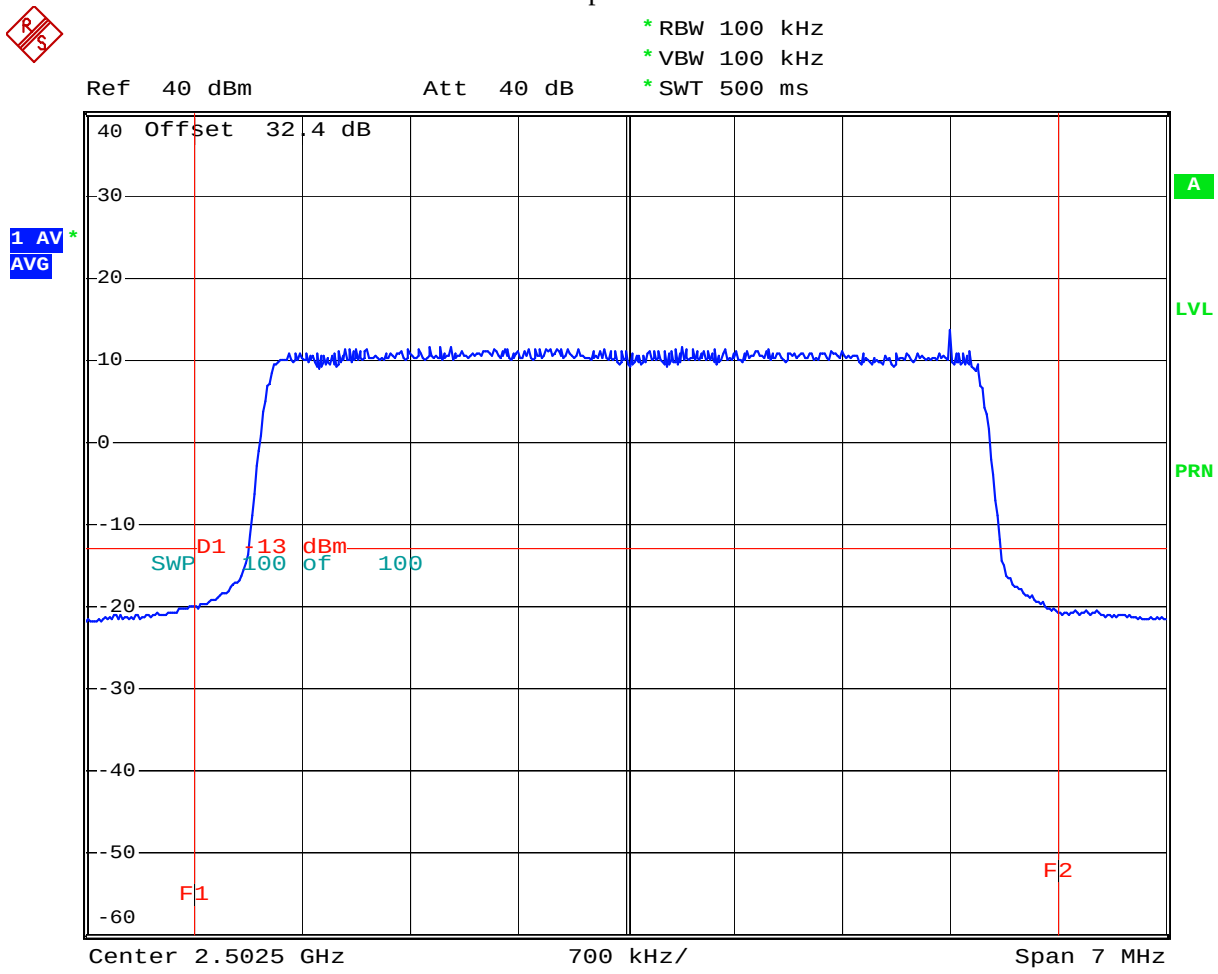
Comment: QPSK, HIGH CHANNEL
Date: 11.FEB.2010 14:15:19

Graph 4.13



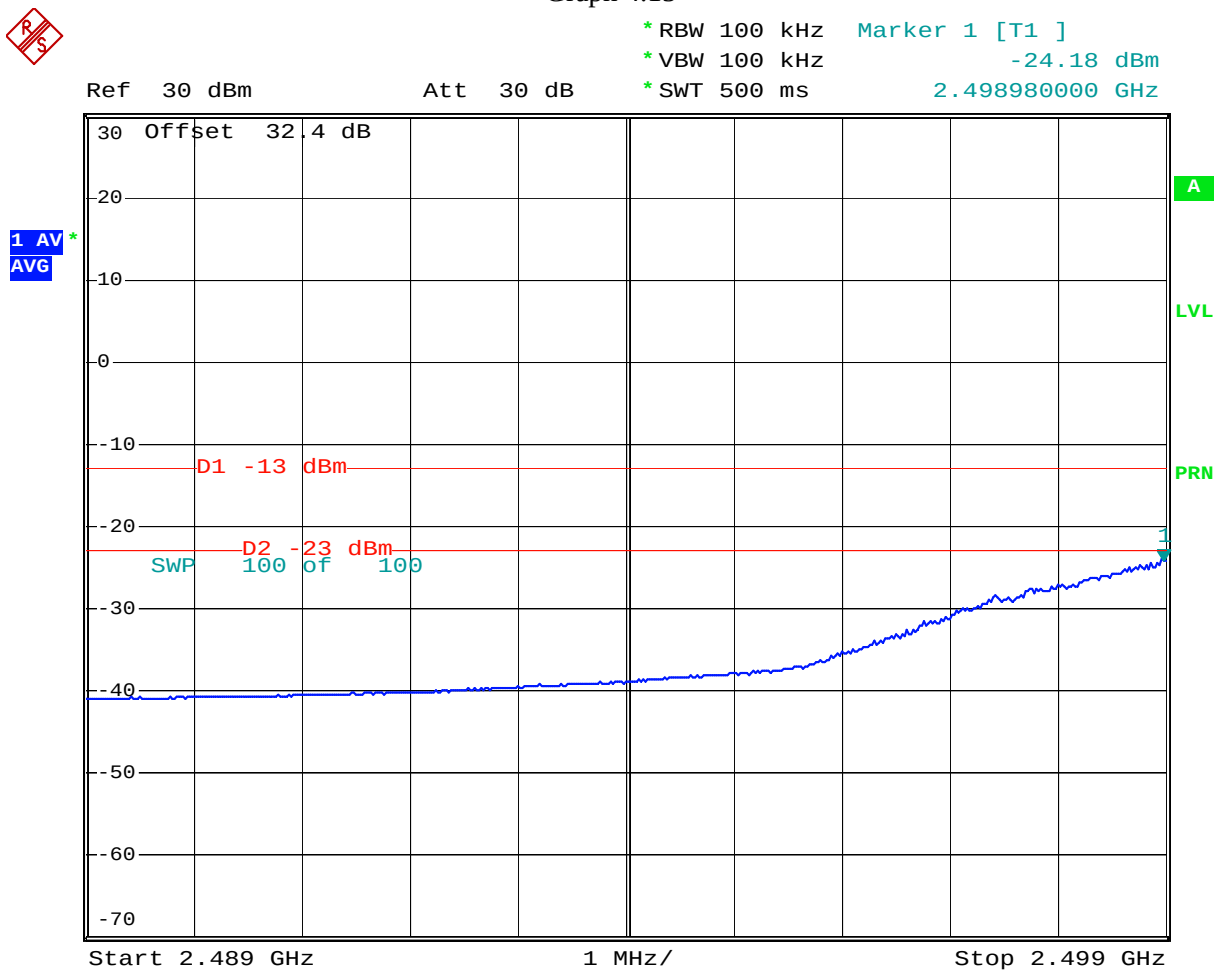
Comment: QPSK, HIGH CHANNEL
Date: 11.FEB.2010 14:44:23

Graph 4.14



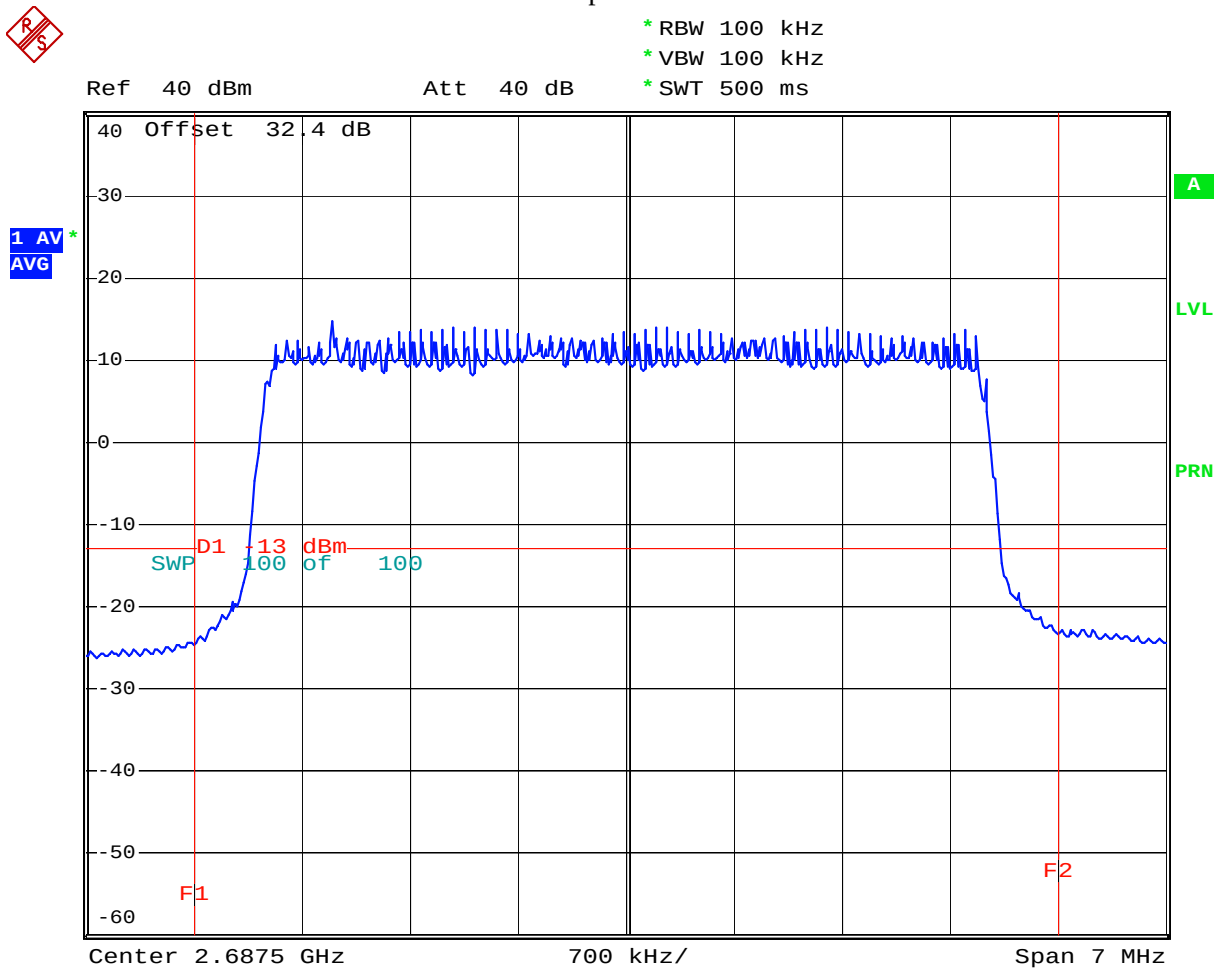
Comment: 16QAM, LOW CHANNEL
Date: 11.FEB.2010 14:10:52

Graph 4.15



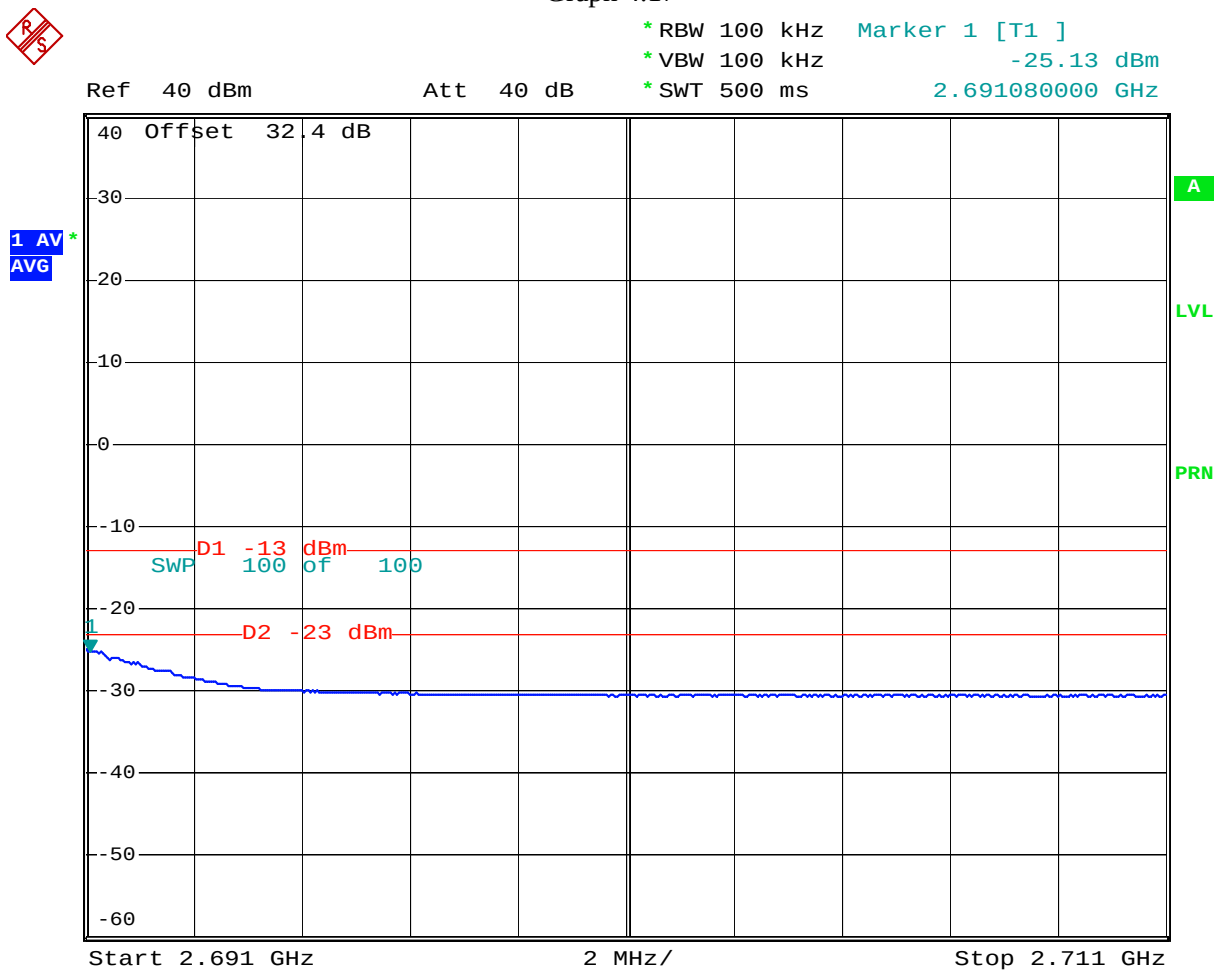
Comment: 16QAM, LOW CHANNEL
Date: 11.FEB.2010 14:54:05

Graph 4.16



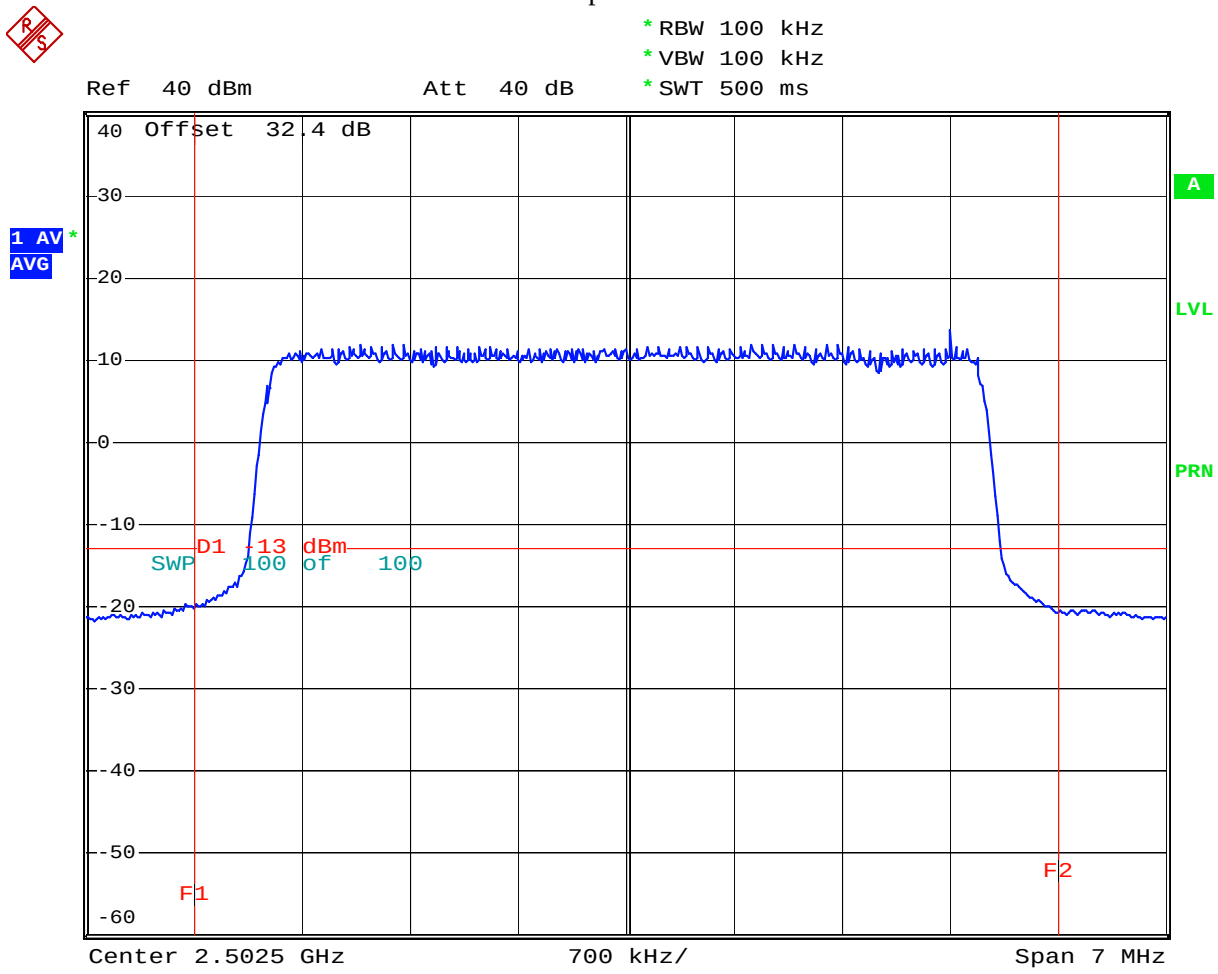
Comment: 16QAM, HIGH CHANNEL
Date: 11.FEB.2010 14:17:13

Graph 4.17



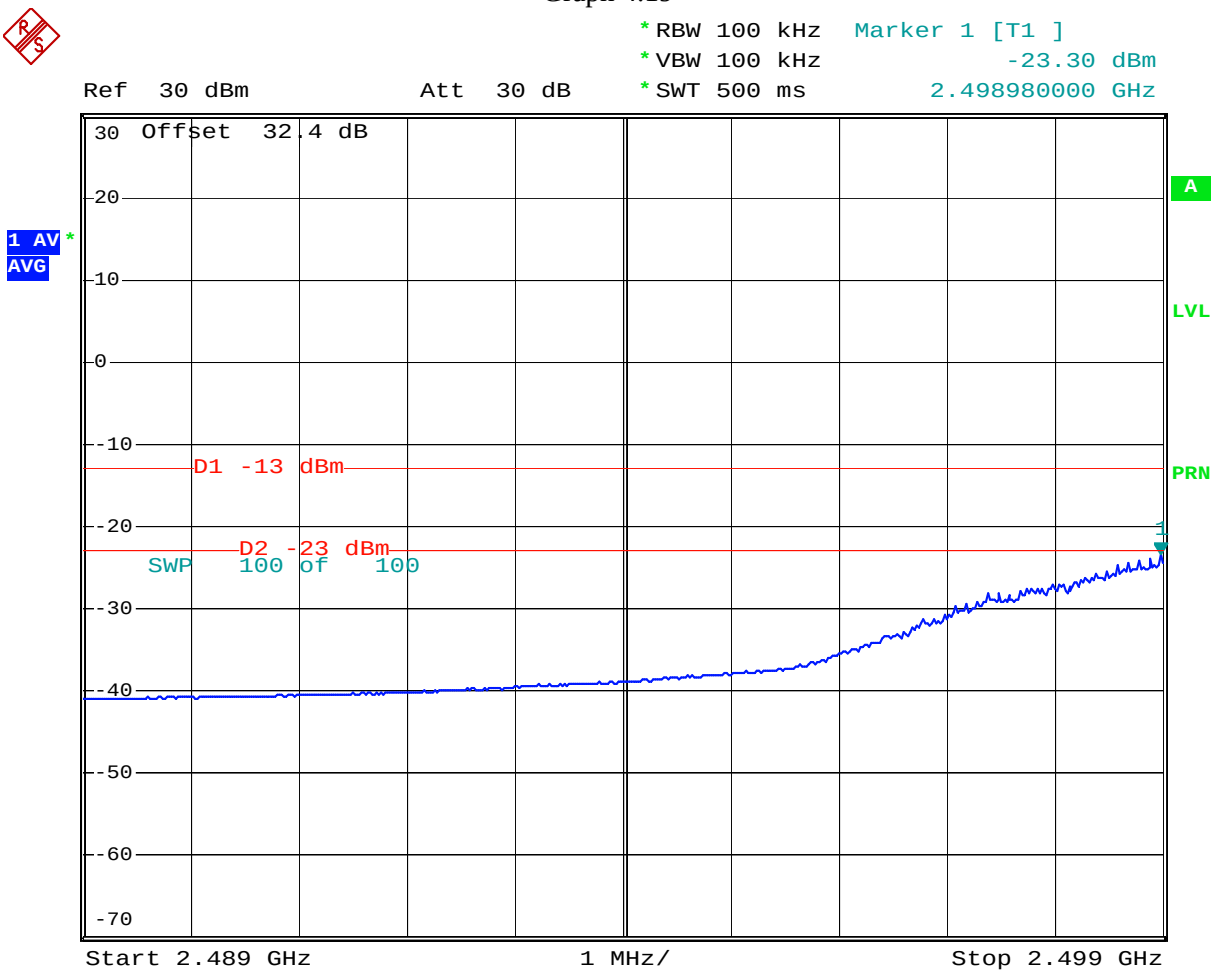
Comment: 16QAM, HIGH CHANNEL
Date: 11.FEB.2010 14:41:50

Graph 4.18



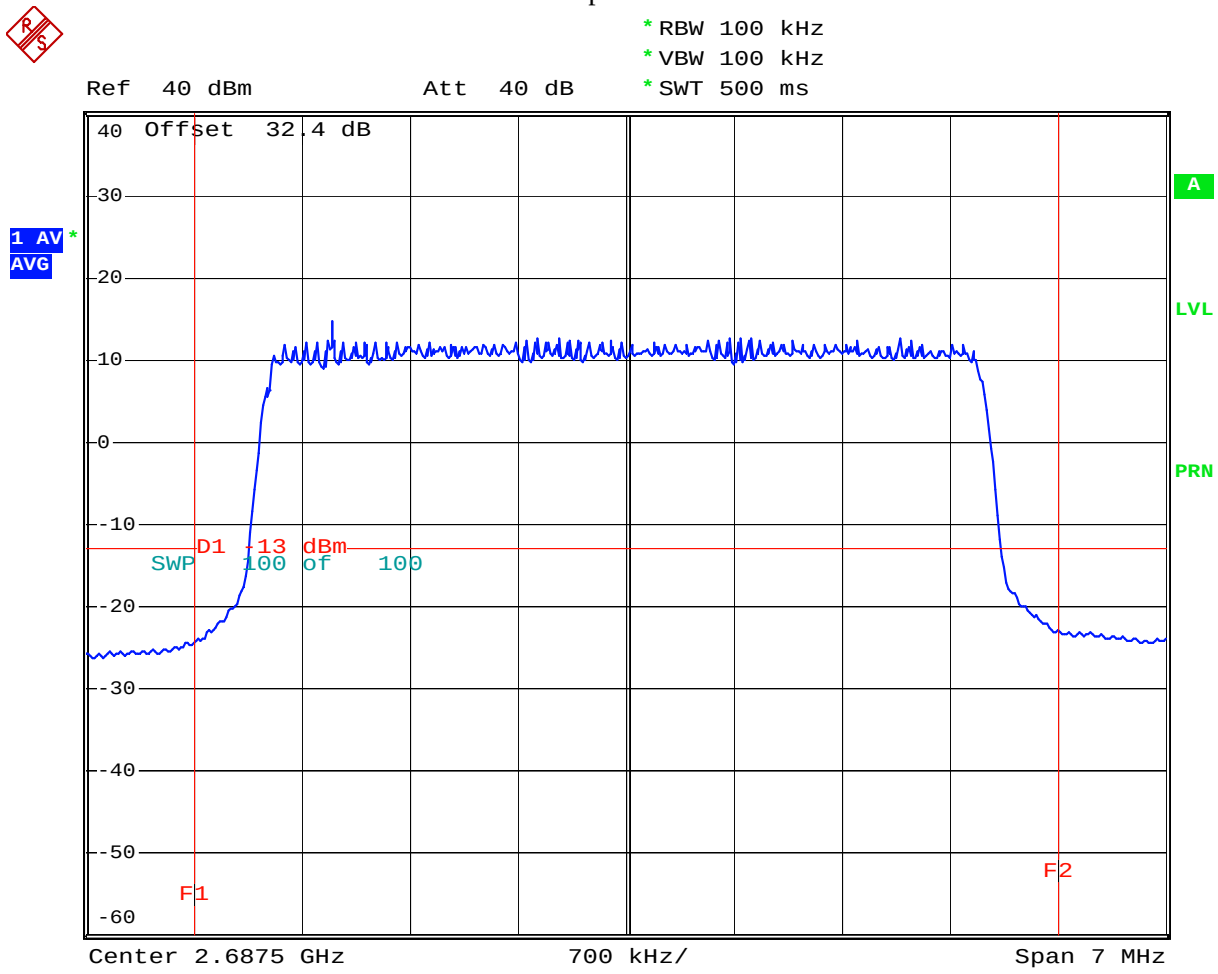
Comment: 64QAM, LOW CHANNEL
Date: 11.FEB.2010 14:07:37

Graph 4.19



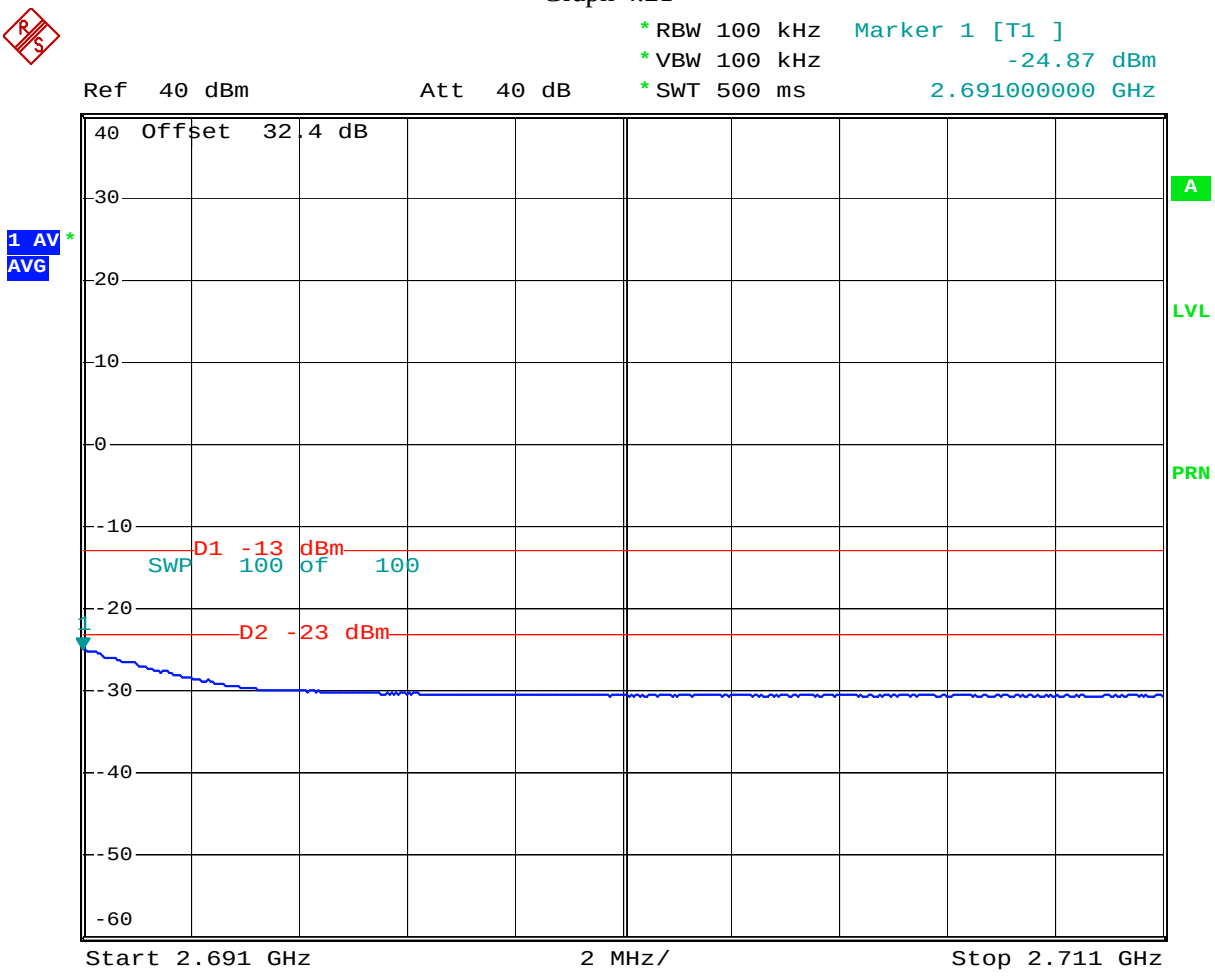
Comment: 64QAM, LOW CHANNEL
Date: 11.FEB.2010 14:57:38

Graph 4.20



Comment: 64QAM, HIGH CHANNEL
Date: 11.FEB.2010 14:20:11

Graph 4.21



Comment: 64QAM, HIGH CHANNEL
Date: 11.FEB.2010 14:39:18

5.0 Spurious Radiation

FCC 2.1053

5.1 Requirement

The power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB.

5.2 Test Procedure

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

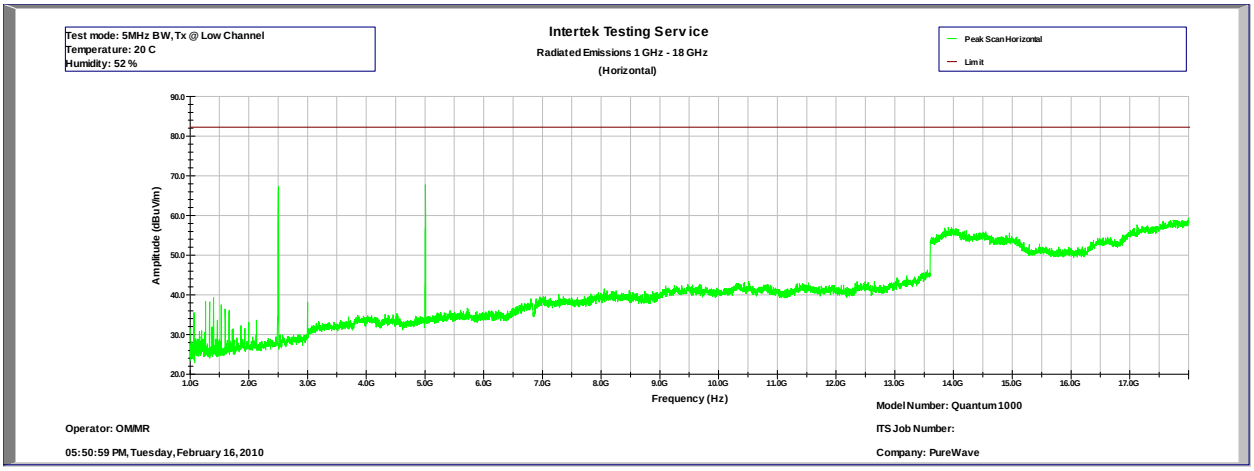
The frequency range up to 10th harmonic of each of the three fundamental frequency (low, middle, and high channels) was investigated. The worst case emissions are reported.

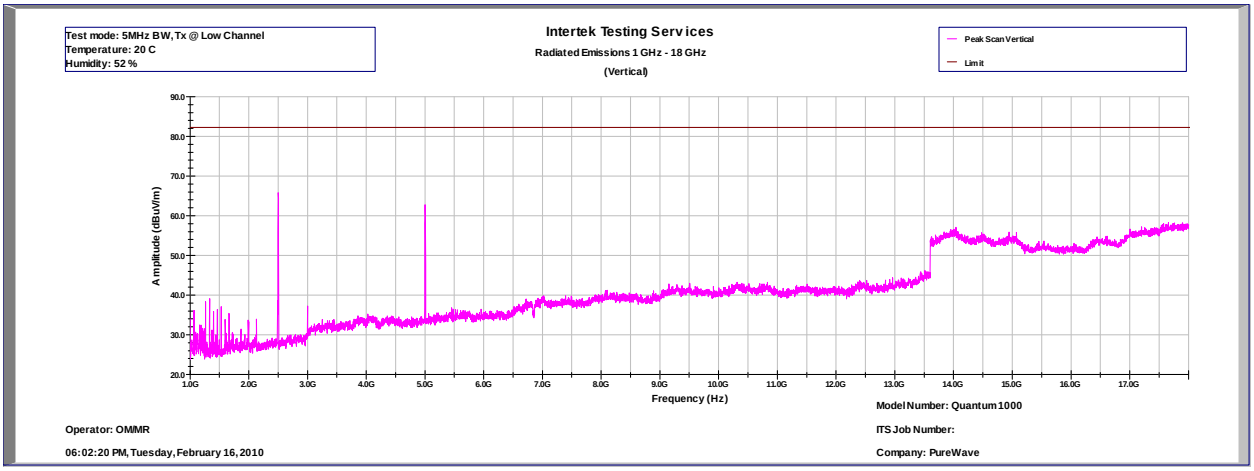
5.3 Test Equipment

EMCO 3115 Horn Antennas
Rohde & Schwarz FSU Spectrum Analyzer
Low Pass Filter
Preamplifiers

5.4 Test Results

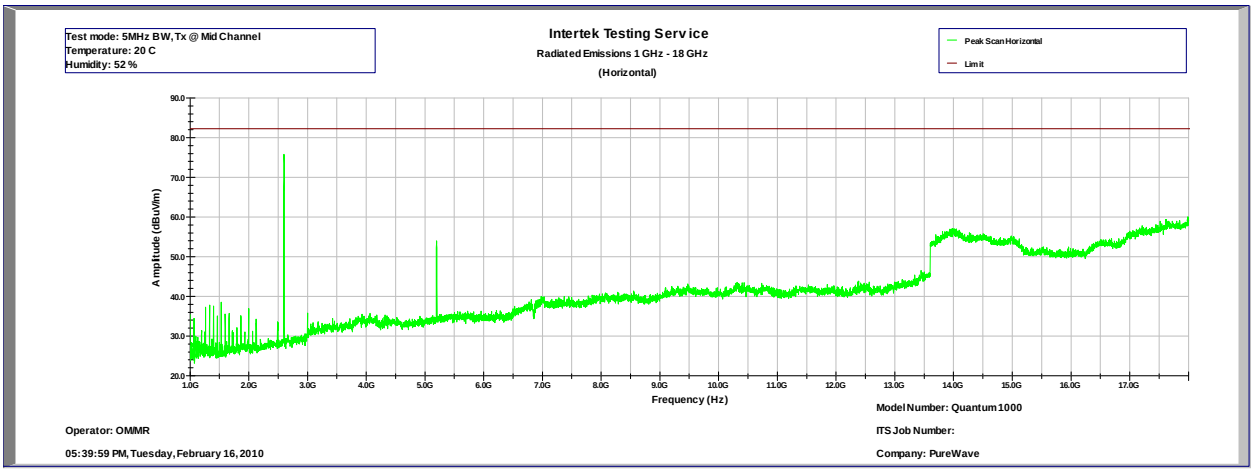
Spurious Radiated Emissions
Tx @ Low Channel

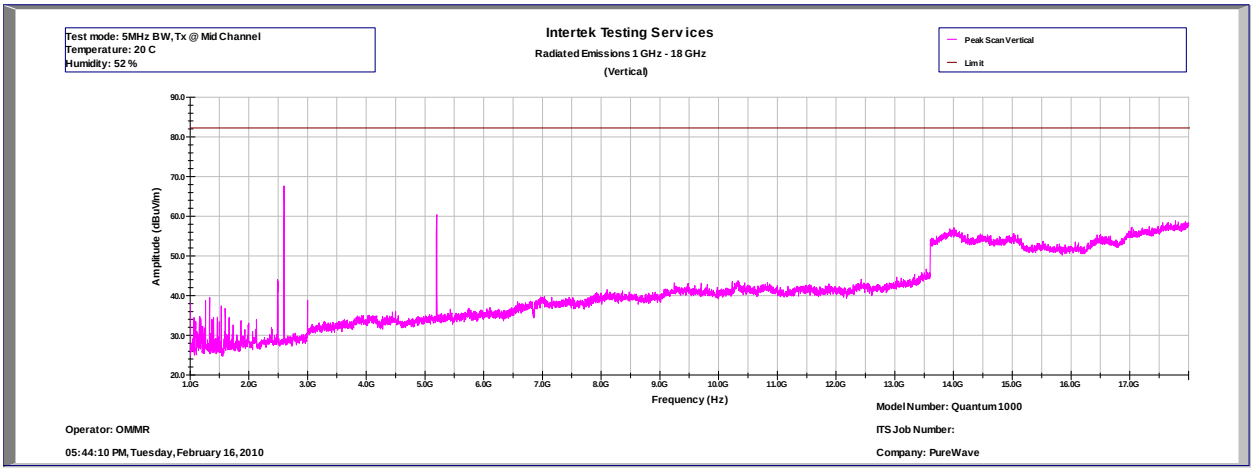




All other emissions are at least 20dB below the limit.

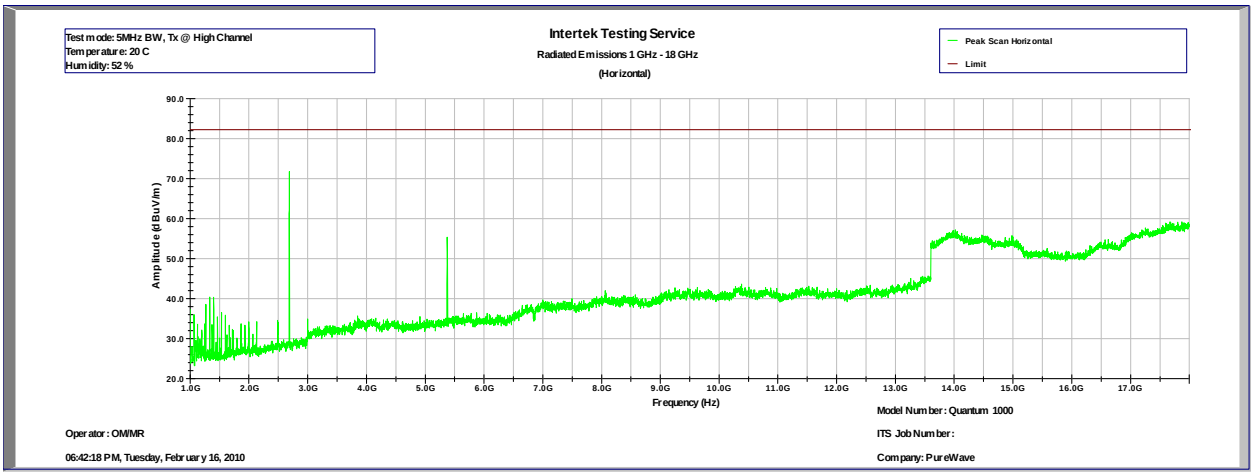
Spurious Radiated Emissions
Tx @ Mid Channel

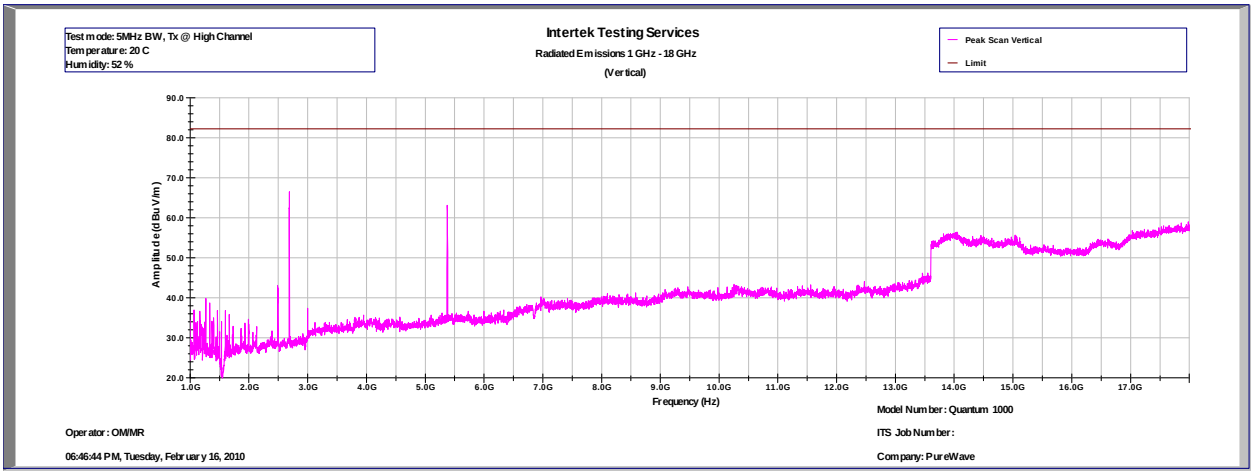




All other emissions are at least 20dB below the limit.

Spurious Radiated Emissions
Tx @ High Channel





All other emissions are at least 20dB below the limit.

Result	Complies

6.0 Frequency Stability vs Temperature and Voltage

FCC 2.1055

6.1 Requirement

The frequency stability shall be measured with variation of ambient temperature as follows:

From −30° to +50° centigrade. Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement.

The frequency stability shall be measured with variation of primary supply voltage as follows:

Vary primary supply voltage from 85 to 115 percent of the nominal value.

6.2 Test Procedure

The EUT was placed inside the temperature chamber. The RF power output was connected to frequency counter. The EUT was setup to transmit the maximum power.

After the temperature stabilized for approximately 20 minutes, the transmitting frequency was measured by the frequency counter and recorded.

At the room temperature, the frequency was measured when the EUT was powered with the nominal voltage and with 85% and 115% of the nominal voltage.

6.3 Test Equipment

Temperature Chamber
Rohde & Schwarz FSU Spectrum Analyzer

6.4 Test Results

Nominal frequency: 2,593,000,156 Hz

Temperature (°C)	**Measured Frequency** Hz	**Maximum deviation from nominal at 20°C Hz**
-30	2,593,000,130	-26
-20	2,593,000,179	+23
-10	2,593,000,192	+36
0	2,593,000,181	+25
10	2,593,000,190	+34
20	2,593,000,156	0
30	2,593,000,132	-24
40	2,593,000,178	+22
50	2,593,000,196	+40

DC Voltage	**Measured Frequency Hz**	**Maximum deviation from nominal at 20°C Hz**
-48V Nominal	2,593,000,156	-
85%	2,593,000,187	+31
115%	2,593,000,195	+39

Result	Complies

7.0 Emissions from Digital Parts, Receiver and Transmitter spurious from 30 MHz - 1GHz

7.1 Radiated emissions
FCC 15.109

7.1.1 Test Limit

Radiated Emission Limit for FCC Part 15 Subpart B

Radiated Emission Limits for Class A at 10 meters	
Frequency (MHz)	**Quasi-Peak limits, dB (µV/m)**
30 to 88	39.1
88 to 216	43.5
216 to 960	46.4
960 and up	49.5
Radiated Emission Limits for Class B at 3 meters	
Frequency (MHz)	**Quasi-Peak limits, dB (µV/m)**
30 to 88	40.0
88 to 216	43.5
216 to 960	46.0
960 and up	54.0

7.1.2 Test Procedure

Measurements are conducted with a quasi-peak detector instrument in the frequency range of 30 MHz to 1000 MHz and with the average detector instrument in the frequency range above 1000 MHz. The measuring receiver meets the requirements of Section One of CISPR 16 and the measuring antenna correlates to a balanced dipole.

Measurements of the radiated field are made with the antenna located at a distance of 10 meters from the EUT. If the field-strength measurements at 10m cannot be made because of high ambient noise level or for other reasons, measurements of Class B equipment may be made at a closer distance, for example 3m. An inverse proportionality factor of 20 dB per decade should be used to normalize the measured data to the specified distance for determining compliance.

The antenna is adjusted between 1m and 4m in height above the ground plane for maximum meter reading at each test frequency.

The antenna-to-EUT azimuth is varied during the measurement to find the maximum field-strength readings.

The antenna-to-EUT polarization (horizontal and vertical) is varied during the measurements to find the maximum field-strength readings.

The EUT, where intended for tabletop use, is placed on a table whose top is 0.8m above the ground plane. The table is constructed of non-conductive materials. Its dimensions are 1m by 1.5m, but may be extended for a larger EUT.

Floor standing EUTs are placed on a horizontal metal ground plane and isolated from the ground plane by 3 to 12 mm of insulating material.

Equipment setup for radiated emission tests followed the guidelines of ANSI C63.4 (2003).

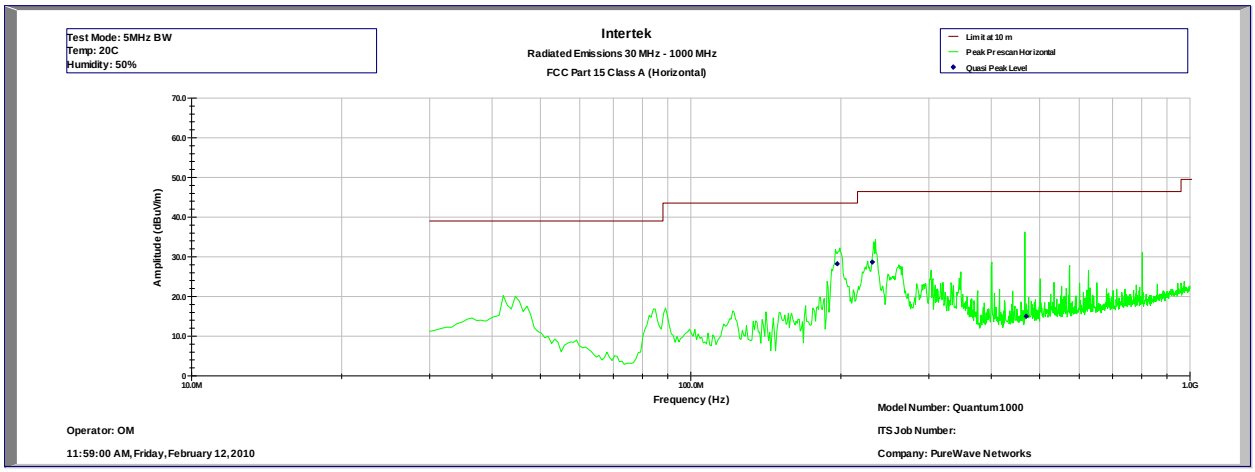
Field Strength Calculation

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

FS = RA + AF + CF - AG + DF

Where FS = Field Strength in dB(µV/m)
RA = Receiver Amplitude (including preamplifier) in dB(µV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB(1/m)
AG = Amplifier Gain in dB

7.1.3 Test Results

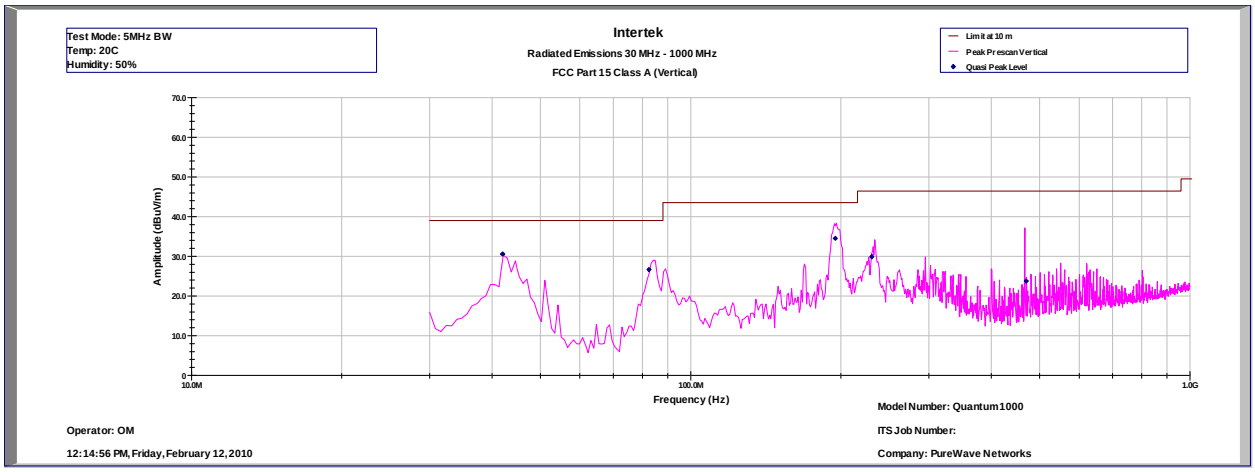


Intertek Testing Services
Radiated Emissions 30 MHz - 1000 MHz
FCC Part 15 Class A (QP-Horizontal)
Operator: OM — Model Number: Quantum 1000

11:58:59 AM, Friday, February 12, 2010 — Company: PureWave Networks

Frequency	Quasi Pk FS	Limit@10m	Margin	RA	CF	AG	AF
Hz	dB(uV/m)	dB(uV/m)	dB	dB(uV)	dB	dB	dB(1/m)
1.966E+08	28.2	43.5	-15.3	48.7	1.6	32.0	9.7
2.311E+08	28.7	46.4	-17.7	46.8	1.8	32.0	10.5
4.702E+08	15.0	46.4	-31.4	27.5	2.6	32.1	18.2

Test Mode: 5MHz BW
Temp: 20C
Humidity: 50%



Intertek Testing Services
Radiated Emissions 30 MHz - 1000 MHz
FCC Part 15 Class A (QP-Vertical)
Operator: OM

Model Number: Quantum 1000

12:14:54 PM, Friday, February 12, 2010

Company: PureWave Networks

Frequency	Quasi Pk FS	Limit@10m	Margin	RA	CF	AG	AF
Hz	dB(uV/m)	dB(uV/m)	dB	dB	dB	dB	dB(1/m)
4.201E+07	30.6	39.0	-8.4	45.4	0.8	32.1	5.3
8.251E+07	26.6	39.0	-12.4	49.4	1.0	32.0	7.4
1.950E+08	34.5	43.5	-9.0	54.8	1.6	32.0	11.0
2.307E+08	29.9	46.4	-16.5	48.4	1.8	32.0	12.3
4.702E+08	23.7	46.4	-22.7	35.9	2.6	32.1	18.2

Test Mode: 5MHz BW
Temp: 20C
Humidity: 50%

Result	Complies

8.0 List of Test Equipment

Measurement equipment used for compliance testing utilized the equipment on the following list:

Equipment	Manufacturer	Model/Type	Serial #	Cal Int	Cal Due
RF Filter Section	Hewlett Packard	85460A	3448A00267	12	12/04/10
EMI Receiver	Hewlett Packard	8546A	3710A00373	12	12/04/10
Spectrum Analyzer	Rohde&Schwarz	FSP40	036612004	12	10/16/10
BI-Log Antenna	Antenna Research	LPB-2513/A	1154	12	06/23/10
Pre-Amplifier	Sonoma	310N	185634	12	11/19/10
Pre-Amplifier	Miteq	AMF-4D-001180-24-10P	799159	12	07/28/10
Horn Antenna	EMCO	3115	9107-3712	12	11/03/10

9.0 Document History

Revision/ Job Number	Writer Initials	Date	Change
1.0 / 3183595	KV	February 26, 2010	Original document