FCC CFR47 PART 27 SUBPART M

Test Report

2.5 GHz BRS/EBR Fixed Wireless Base Station Transceiver

Model Number: Quantum 6600
FCC ID: XN3-QUANTUM6625
IC: 8974A-QUANTUM6625

Report Number: 10PRO011

Issue Date: 20 May 2010

Prepared for
PureWave Networks Inc.
2660-C Marine Way
Mountain View, CA 94043

Prepared by
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El Granada CA 94018

Report Revision History

Revision No.	Description	Revised by	Date
-	Original issue	T.N. Cokenias	11 May 2010
1	Add additional information justifying choice of worst-case test configuration. Minor editorial revisions	T. Cokenias	20 May 2010

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1. TEST AND TEST LOCATION INFORMATION

COMPANY NAME: PureWave Networks, Inc.
2660-C Marine Way
Mountain View, CA 94043

EUT DESCRIPTION: BRS/EBR 2.5 GHz Base Station Radio
Frequency Range: 2496-2690 MHz
WiMax 6x6 MIMO
Channel Bandwidths: 5 MHz, 10 MHz
Modulations: QPSK, 16QAM, 64QAM

FCC ID: XN3-QUANTUM6625
IC: 8974A-QUANTUM6625

MODEL: Quantum 6600

DATE TESTED: 14-16 April 2010

Radiated and antenna port conducted tests were performed by

Compliance Certification Services
47173 Benicia Street
Fremont, CA 94538

Frequency stability tests were performed at

PureWave Networks, Inc.
2660-C Marine Way
Mountain View, CA 94043

20 May 2010

T.N. Cokenias
Agent for PureWave Networks, Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with EIA/TIA 603, FCC CFR 47 Part 2 and FCC CFR 47 Part 27 Subpart M.

3. EQUIPMENT UNDER TEST

3.1. DESCRIPTION OF EUT

The EUT is a 6x6 MIMO WiMAX base station radio operating in the 2496-2690 MHz BRS/EBR frequency bands. Modulation is 802.16d/e in 5 MHz and 10 MHz channel bandwidths.

3.2. MAXIMUM OUTPUT POWER

5 MHz EBW		QPSK	16QAM	64QAM
	(MHz)	**(dBm)**	**(dBm)**	**(dBm)**
Low	2498.5	42.57	42.57	42.74
Low +1	2500	50.26	50.27	50.15
Middle	2600	50.76	50.5	50.56
High-1	2682.5	50.43	50.27	50.54
High	2687.5	42.91	42.8	42.83

10 MHz EBW		QPSK	16QAM	64QAM
	(MHz)	**(dBm)**	**(dBm)**	**(dBm)**
Low	2501	42.07	41.72	42.05
Low +1	2504	49.84	49.86	49.78
Middle	2600	50.04	49.98	49.86
High-1	2682.5	50.05	50.23	50.13
High	2685	42.23	42.38	42.28

3.3. ANTENNA SELECTION AND EIRP LIMITS

The licensee can select a variety of antenna types and gains from a variety of manufacturers in addition to PureWave Networks. It is the responsibility of the licensee to adjust transmitter output power such that the eirp limits specified in section 27.50(h) of the Rules are not exceeded:

5 MHz channels: 33 + 10 log (4.85/5.5) dBW = 32.5 dBW EIRP = 62.5 dBm EIRP
10 MHz channels: 33 + 10 log (9.67/5.5) dBw = 35.4 dBW EIRP = 65.4 dBm EIRP

The PureWave installation manual provides the installer guidance on how to calculate the maximum input power to the antenna so as to remain within the regulatory EIRP limits.

3.4. SOFTWARE AND FIRMWARE

The software controlling the EUT during testing was PureWave OS v1.1.1.

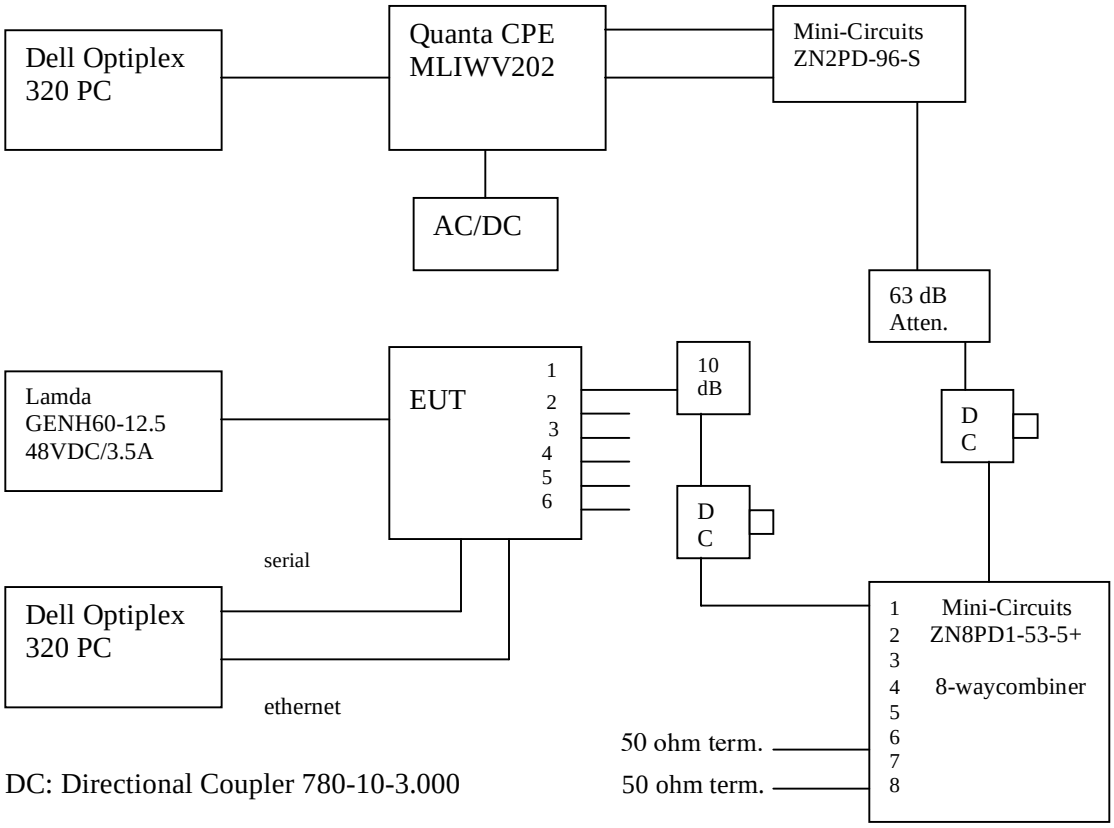
3.5. WORST-CASE CONFIGURATION AND MODE

Radiated and conducted emissions tests were performed for both 5 MHz and 10 MHz emission bandwidth channels. Testing was performed for all available modulations: QPSK, 16QAM and 64QAM. Worst-case emissions for both emissions bandwidths are reported.

For all operating modes, Part 27 peak eirp limits apply. The 6x6 CDD mode is considered the worst-case mode for emissions because all 6 transmitter chains are operating simultaneously at the maximum available output from each power amplifier, for each of the channel band widths and modulations tested. All six chains are carrying the same data, but delayed per the CDD protocol. The resultant combined signal is more complex, as shown in combiner output measurements, with nulls and peaks that would not be present with completely uncorrelated data streams. Other WiMAX modes have the same or fewer transmitter chains being activated.

3.6. DESCRIPTION OF TEST SETUP

SETUP DIAGRAM FOR TESTS



DC: Directional Coupler 780-10-3.000

3.7 Modifications to EUT

Shielded internal DC cable
FairRite 264350002 ferrite bead on internal DC cable (one turn)
Shielding added CAT5 cable connector to bond to chassis ground (metal tape)

TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report

Radiated Emissions

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Asset Number**	**Cal Due**
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01179	08/24/10
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01011	07/14/10
Antenna, Horn, 18 GHz	EMCO	3115	C00945	07/29/10
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	07/06/10
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	08/04/10

Antenna Port Conducted Emissions

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Asset Number**	**Cal Due**
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01069	01/05/11
Vector signal generator, 20GHz	Agilent / HP	E8267C	C01066	11/16/10
RF Power Meter	Boonton	4541	C01189	02/26/11
Peak Power Sensor	Boonton	57318	C01202	02/23/11

Frequency Stability Test Equipment

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Asset Number**	**Cal Due**
Wireless Networking Test Set	Agilent	N8300A	GB47350121	20Sept2010
Variable Voltage Source	Lambda	GENH60-12.5	27M4950F	N/A
Temperature Chamber	Associated Envoronmental Systems	ZBD-108	6381	N/A
Multi meter	GW Instek	GDM-8245	CH881834	N/A

LIMITS AND RESULTS

3.7. ANTENNA PORT CHANNEL TESTS

3.7.1. -26 dB and 99% OCCUPIED BANDWIDTH

REQUIREMENT

2.1049 Measurements required: Occupied bandwidth.

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured.

27.53(m)6 … The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 1% to 3% of the 99% bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled.

Test results were obtained for the following configurations:

a. 6 chain Combiner - Low, Mid, High channel for 5 MHz EBW: QPSK, 16QAM, 64QAM
b. 6 chain Combiner - Lo, Mid, High channel for 10 MHz EBW: QPSK, 16QAM, 64QAM
c. Individual chains 1-6: 64QAM, High channel only for 5 MHz and 10 MHz EBW
d. Chain 3 only – Low, Mid, High for 5 MHz and 10MHz EBW QPSK, 16QAM, 64QAM

TEST RESULTS

Tabular data and spectrum analyzer plots are located below. Worst-case readings were for the combiner measurements.

A. OCC BW 6 Chain Combiner

5MHz EBW QPSK

Channel	Frequency MHz	99% Occupied Bandwidth, MHz	-26 dB Bandwidth, MHz
Low	2498.5	4.6028	4.807
Middle	2600	4.6232	4.797
High	2687.5	4.561	4.783

5MHz EBW 16QAM

Channel	Frequency MHz	99% Occupied Bandwidth, MHz	-26 dB Bandwidth, MHz
Low	2498.5	4.643	4.829
Middle	2600	4.574	4.860
High	2687.5	4.545	4.794

5MHz EBW 64QAM

Channel	Frequency MHz	99% Occupied Bandwidth, MHz	-26 dB Bandwidth, MHz
Low	2498.5	4.574	4.796
Middle	2600	4.575	4.794
High	2687.5	4.567	4.851

B. OCC BW 6 Chain Combiner

10 MHz EBW QPSK

Channel	Frequency MHz	99% Occupied Bandwidth, MHz	-26 dB Bandwidth, MHz
Low	2501	9.197	9.523
Middle	2600	9.172	9.542
High	2685	9.104	9.553

10 MHz EBW 16QAM

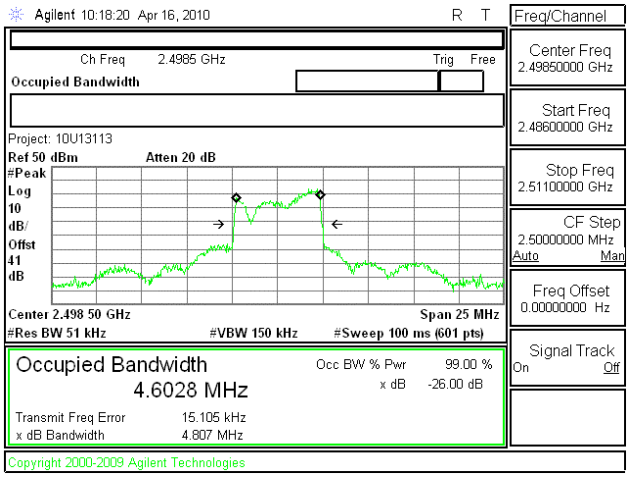
Channel	Frequency MHz	99% Occupied Bandwidth, MHz	-26 dB Bandwidth, MHz
Low	2501	9.177	9.648
Middle	2600	9.24	9.608
High	2685	9.114	9.598

10 MHz EBW 64QAM

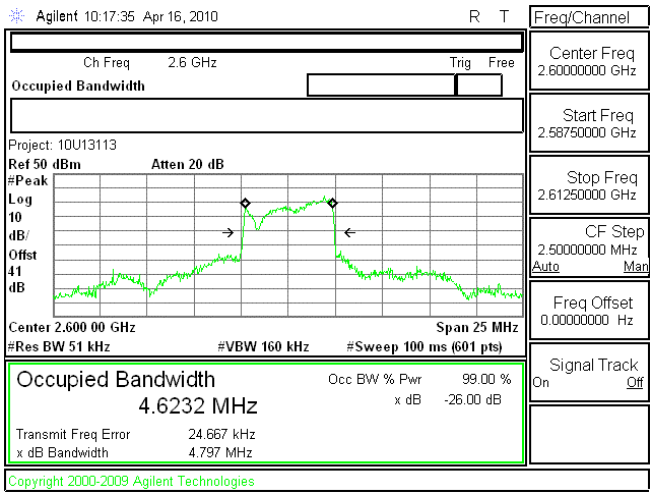
Channel	Frequency MHz	99% Occupied Bandwidth, MHz	-26 dB Bandwidth, MHz
Low	2501	9.247	9.506
Middle	2600	9.181	9.629
High	2685	9.158	9.668

A. COMBINER RESULTS: 5 MHz EBW

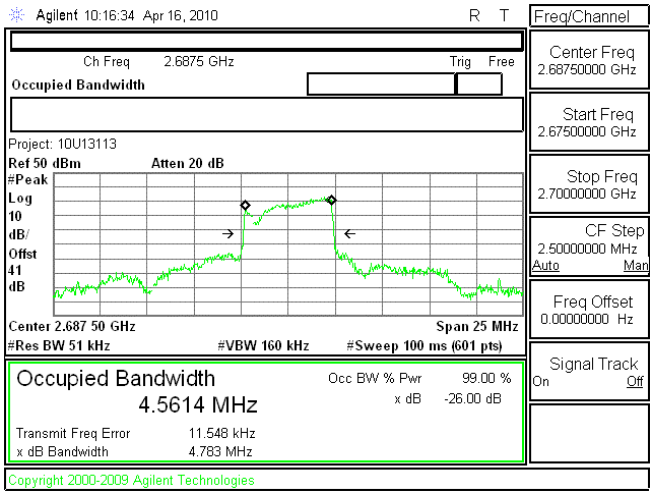
Combiner: 5 MHz QPSK Low Channel



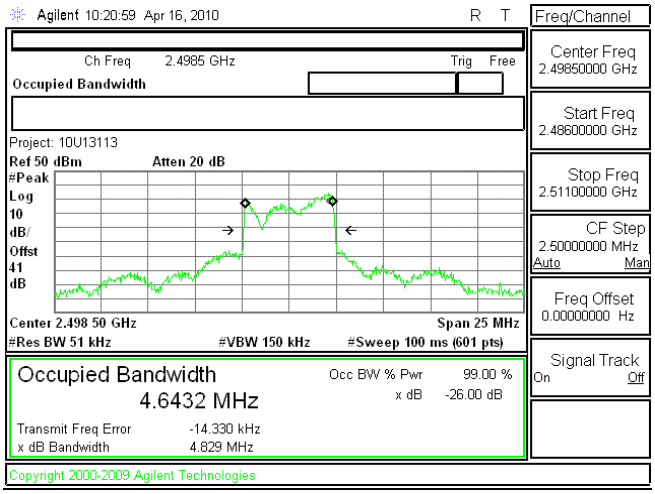
Combiner: 5 MHz QPSK Mid Channel



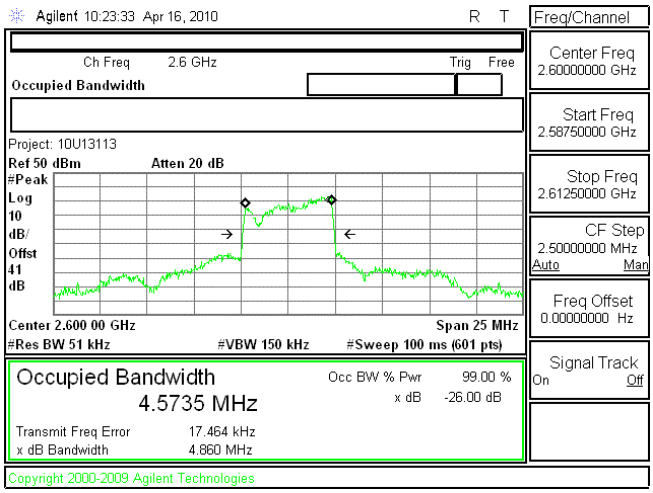
Combiner: 5 MHz QPSK High Channel



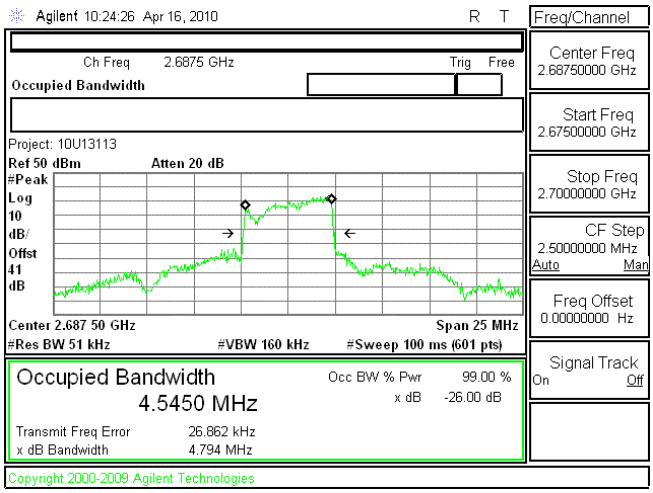
Combiner: 5 MHz 16QAM Low Channel



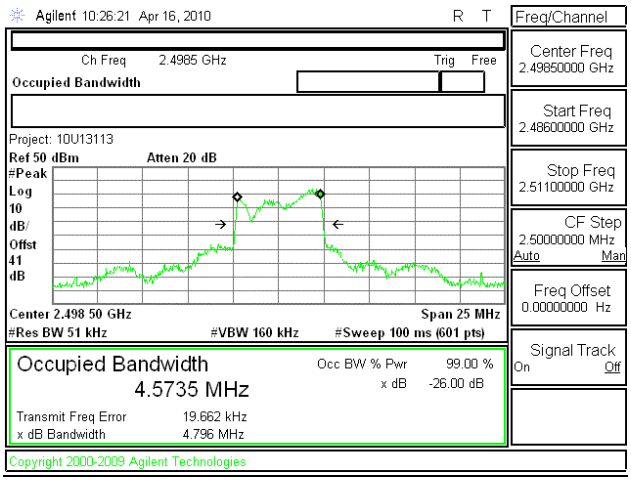
Combiner: 5 MHz 16QAM Mid Channel



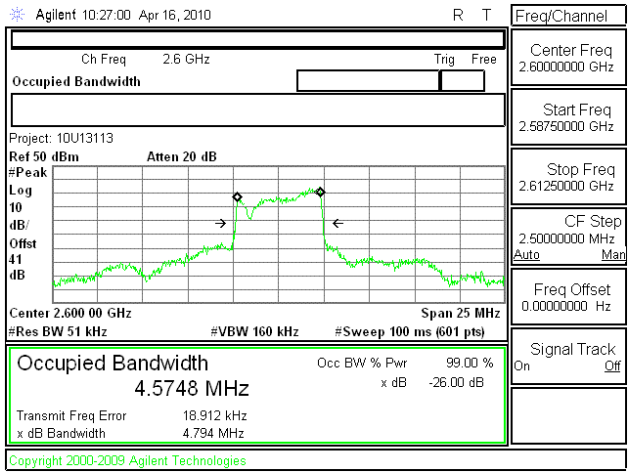
Combiner: 5 MHz 16QAM High Channel



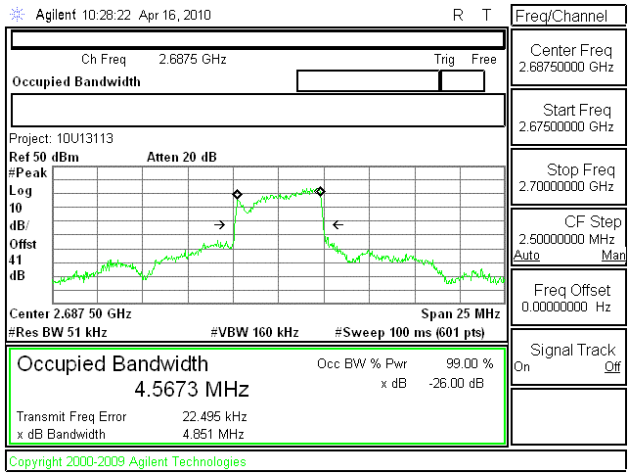
Combiner: 5 MHz 64QAM Low Channel



Combiner: 5 MHz 64QAM Mid Channel

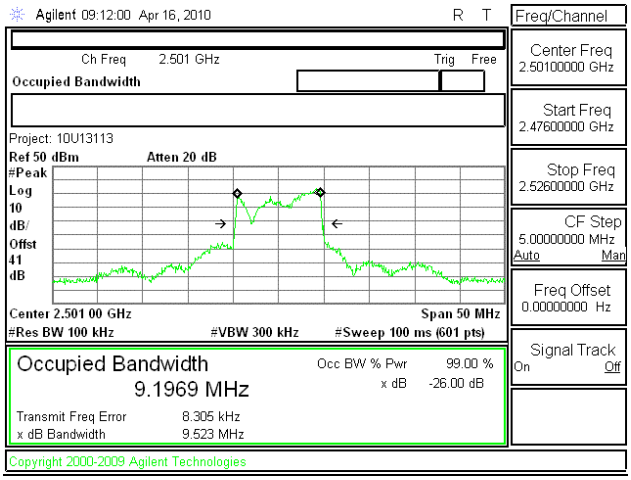


Combiner: 5 MHz 64QAM High Channel

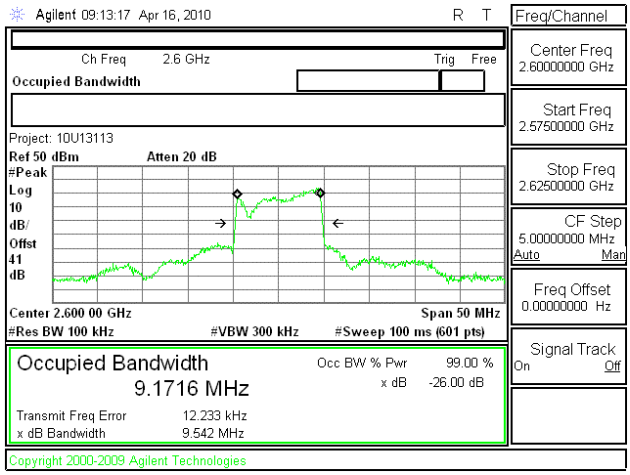


B. COMBINER RESULTS: 10 MHz EBW

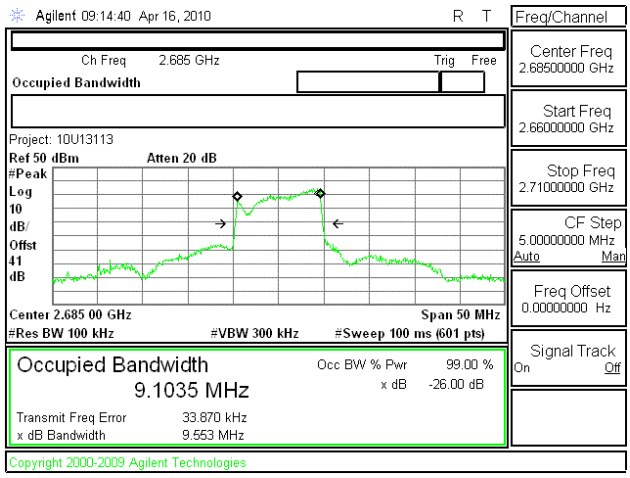
Combiner: 10 MHz QPSK Low Channel



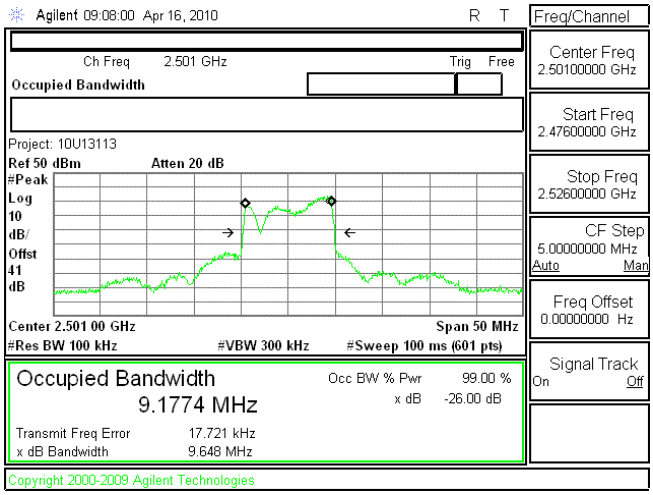
Combiner: 10 MHz QPSK Mid Channel



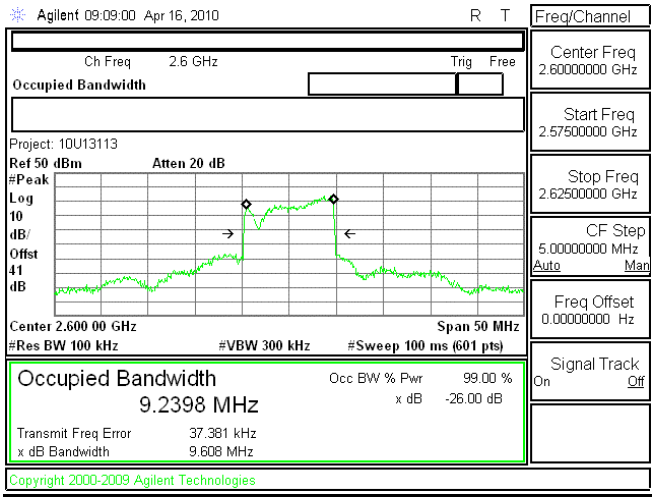
Combiner: 10 MHz QPSK High Channel



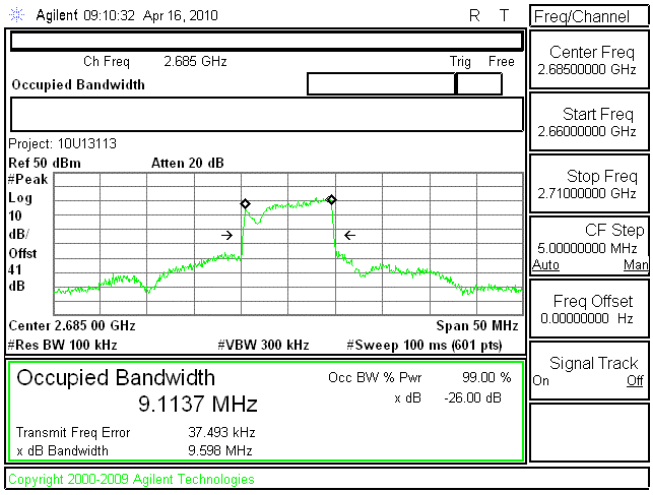
Combiner: 10 MHz 16QAM Low Channel



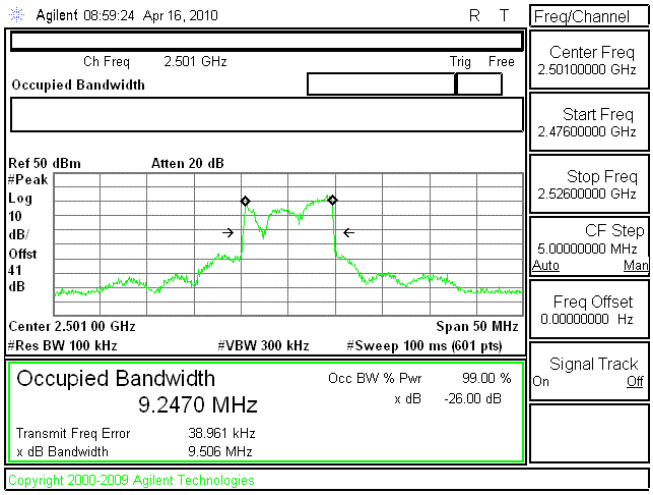
Combiner: 10 MHz 16QAM Mid Channel



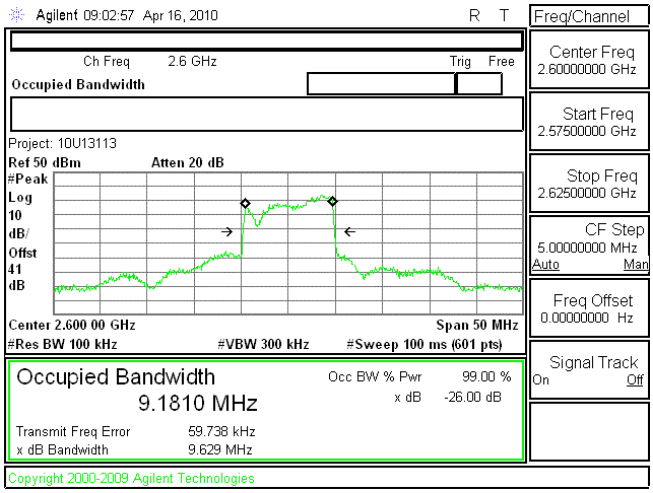
Combiner: 10 MHz 16QAM High Channel



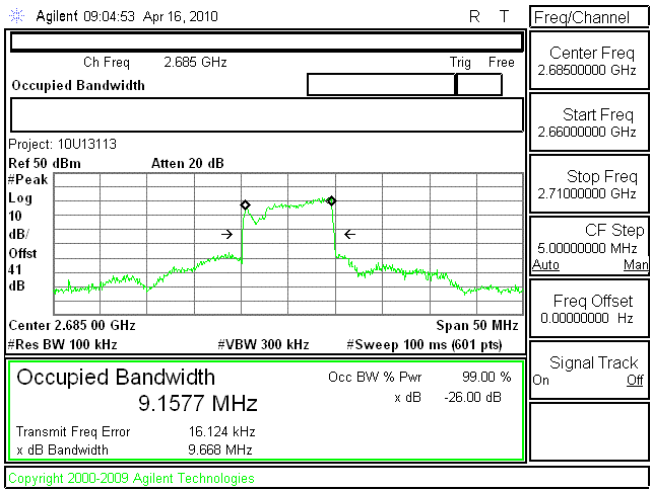
Combiner: 10 MHz 64 QAM Low Channel



Combiner: 10 MHz 64 QAM Mid Channel

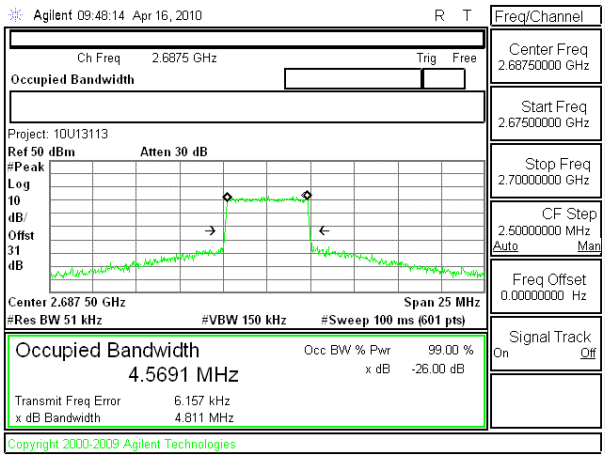


Combiner: 10 MHz 64 QAM High Channel

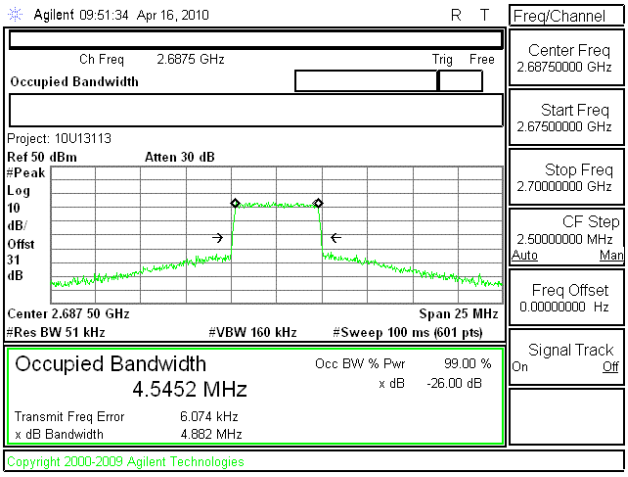


C. Chains 1-6, 5 MHz EBW, High Channel 64QAM

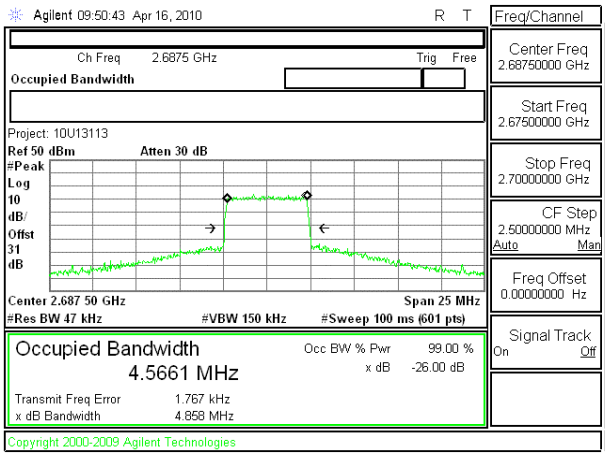
Chain 1



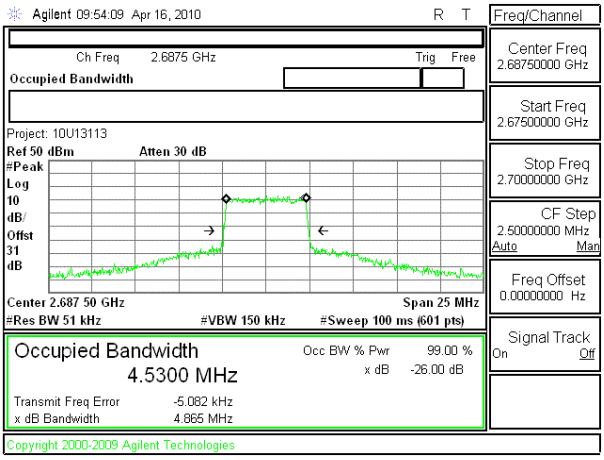
Chain 2



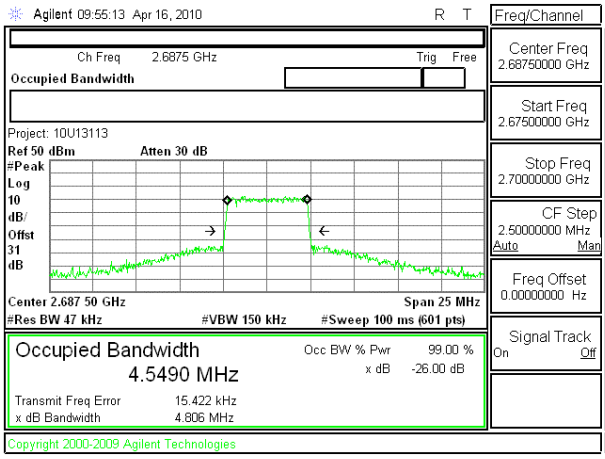
Chain 3



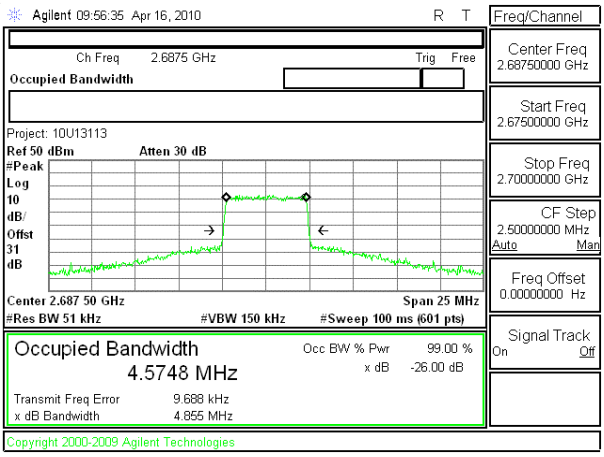
Chain 4



Chain 5

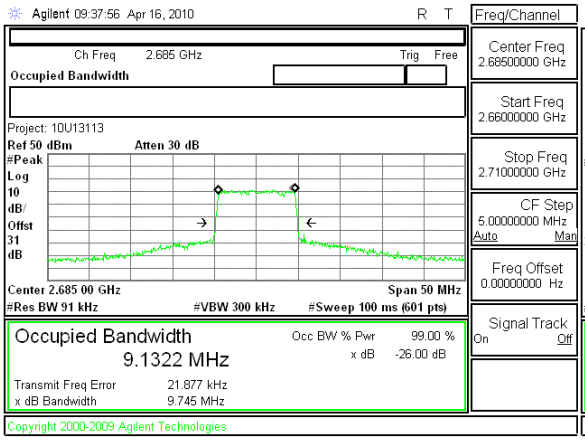


Chain 6

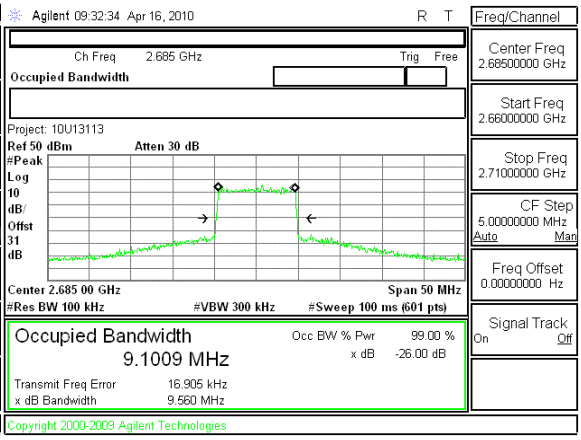


C. Chains 1-6, 10MHz EBW, High Channel 64QAM

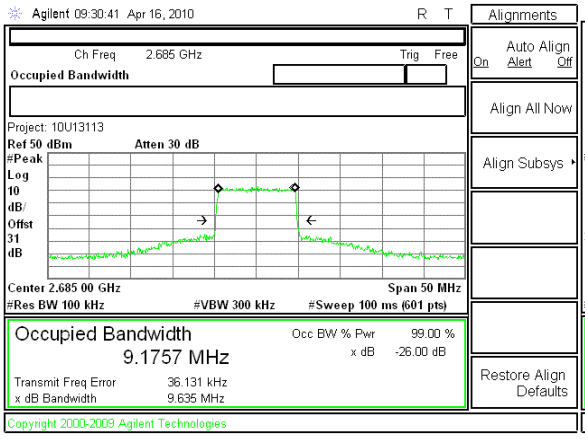
Chain 1



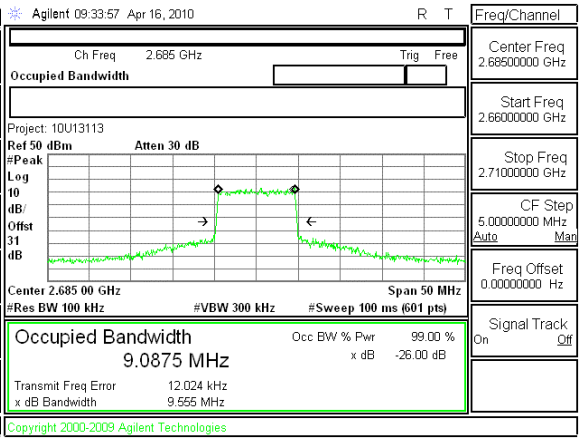
Chain 2



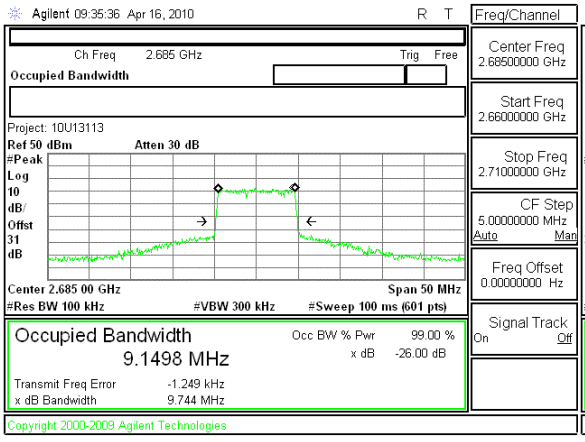
Chain 3



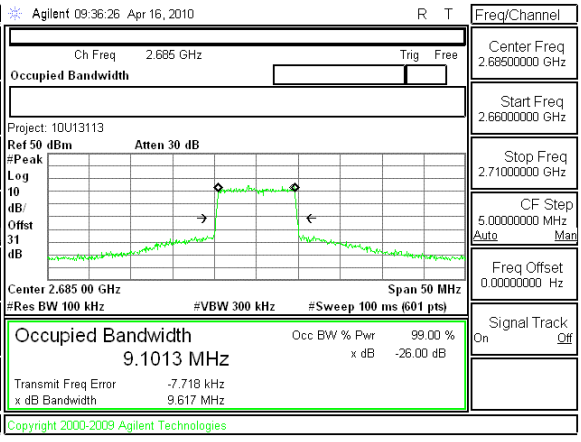
Chain 4



Chain 5



Chain 6



D. OCC BW Chain 3 Only

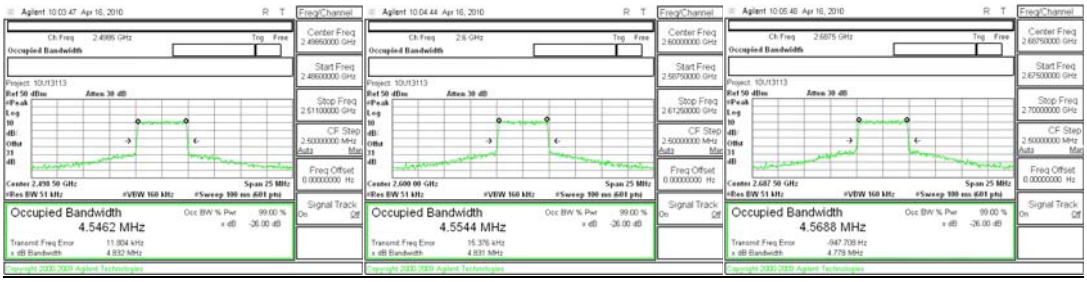
Occupied Bandwidth Chain 3 Only

5MHz QPSK

Low Channel Mid Channel High Channel

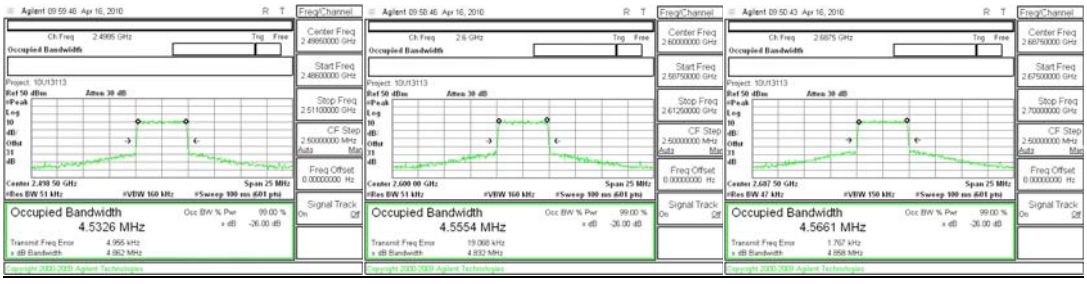
5MHz 16QAM

Low Channel Mid Channel High Channel



5MHz 64QAM

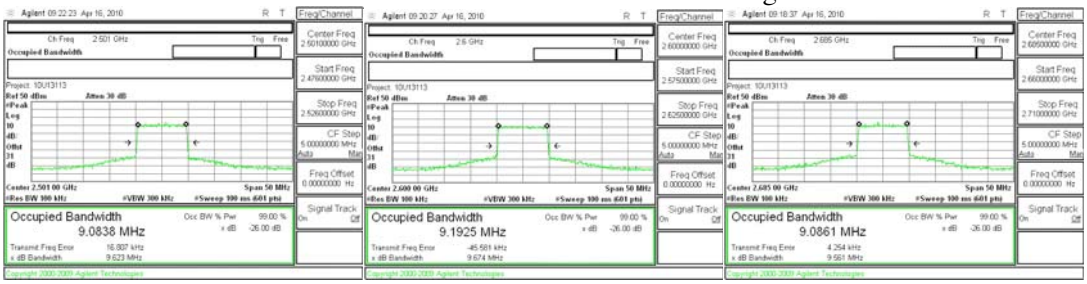
Low Channel Mid Channel High Channel



Occupied Bandwidth Chain 3 Only

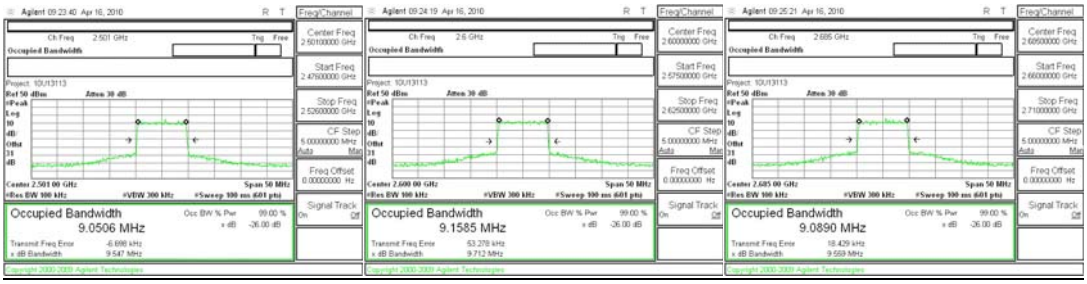
10MHz QPSK

Low Channel Mid Channel High Channel



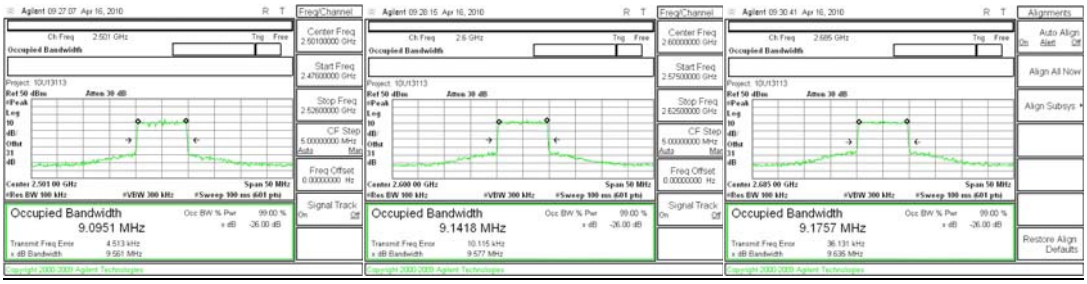
10MHz 16QAM

Low Channel Mid Channel High Channel



10MHz 64QAM

Low Channel Mid Channel High Channel



PEAK OUTPUT POWER

PEAK POWER LIMIT

27.50 Power and Antenna Height Limits

(h) The following power limits shall apply in the BRS and EBS:

(1) *Main, booster and base stations*. (i) 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, except as provided in paragraph (h)(1)(ii) of this section.

Based on occupied bandwidth measurements, EIRP limits are as follow:

5 MHz channels: 33 + 10 log (4.85/5.5) dBW = 32.5 dBW EIRP = 62.5 dBm EIRP
10 MHz channels: 33 + 10 log (9.67/5.5) dBw = 35.4 dBW EIRP = 65.4 dBm EIRP

TEST PROCEDURE

The transmitter output is connected to the Boonton power meter sensor head. The Boonton meter was set to measure both PEAK and AVERAGE power during the TX burst output only (gated).

Power was measured at Low channel, Mid channel and High channels. In addition, test were performed at the next to the lowest channel (Low +1) and the next to the highest channel (High -1).

The Low and High channel power settings were for lower output power than all other channels in order to keep out of band emissions within the specification limits (Software power setting = 28). All other channels meet all requirements at maximum power setting (Software power setting = 36).

Refer spread sheets below for maximum Peak and Average power measurements for 5 MHz and 10 MHz channels.

Power Output, 5 MHz channels

5 MHZ QPSK	F, MHz	Chain 1	Chain 2	Chain 3	Chain 4	Chain 5	Chain 6	Total, dBm	Total, Watts
Low Peak	2498.5	34.7	35.0	34.9	34.3	34.9	34.9	42.57	18.076
Low Average	2498.5	24.9	25.0	24.9	24.3	25.2	24.8	32.64	1.837
Low+1 Peak	2500	42.6	42.5	42.6	41.9	42.7	42.5	50.26	106.069
Low+1 Averag	2500	32.6	32.5	32.4	31.8	32.7	32.4	40.19	10.449
Mid Peak	2600	43.2	43.4	43.1	41.9	43.1	43.0	50.76	119.046
Mid Average	2600	32.9	33.4	32.8	32.1	33.2	32.5	40.62	11.532
High-1 Peak	2682.5	42.7	43.1	42.5	42.4	42.1	43.0	50.43	110.370
High-1 Averag	2682.5	32.6	33.5	32.7	32.4	32.7	32.9	40.60	11.470
High Peak	2687.5	35.2	36.0	35.2	34.2	34.9	35.1	42.91	19.560
High Average	2687.5	25.2	26.1	25.4	25.0	25.2	25.1	33.13	2.056

5 MHz 16QAM	F, MHz	Chain 1	Chain 2	Chain 3	Chain 4	Chain 5	Chain 6	Total, dBm	Total, Watts
Low Peak	2498.5	35.0	34.7	35.0	34.6	34.8	34.6	42.57	18.064
Low Average	2498.5	24.9	24.9	25.0	24.3	25.3	24.9	32.67	1.851
Low+1 Peak	2500	42.6	42.7	42.6	41.6	42.9	42.4	50.27	106.346
Low+1 Averag	2500	32.7	32.6	32.5	31.7	32.9	32.3	40.25	10.587
Mid Peak	2600	42.4	43.0	42.5	42.1	42.9	43.3	50.50	112.210
Mid Average	2600	32.6	33.3	32.7	32.1	33.0	32.5	40.50	11.215
High-1 Peak	2682.5	42.6	42.8	42.5	42.0	42.4	42.6	50.27	106.458
High-1 Averag	2682.5	32.6	33.5	32.7	32.4	32.8	32.9	40.61	11.514
High Peak	2687.5	35.0	35.2	35.0	34.9	35.0	35.0	42.80	19.051
High Average	2687.5	25.1	25.9	25.3	24.9	25.4	25.3	33.11	2.046

5MHz 64QAM	F, MHz	Chain 1	Chain 2	Chain 3	Chain 4	Chain 5	Chain 6	Total, dBm	Total, Watts
Low Peak	2498.5	35.8	34.7	35.0	34.1	35.0	35.0	42.74	18.810
Low Average	2498.5	25.0	24.8	25.1	24.3	25.3	24.9	32.69	1.859
Low+1 Peak	2500	42.9	42.1	42.4	41.5	42.5	42.7	50.15	103.624
Low+1 Averag	2500	32.4	32.4	32.5	31.8	32.9	32.6	40.23	10.537
Mid Peak	2600	42.8	43.1	43.0	42.1	43.0	42.6	50.56	113.792
Mid Average	2600	32.8	33.3	32.8	31.9	33.1	32.4	40.52	11.277
High-1 Peak	2682.5	42.6	43.1	42.8	42.3	42.6	43.1	50.54	113.266
High-1 Averag	2682.5	33.5	33.4	32.7	32.4	32.8	33.1	40.78	11.974
High Peak	2687.5	35.1	35.3	35.0	34.8	35.1	35.0	42.83	19.205
High Average	2687.5	25.2	25.9	25.2	24.9	25.2	25.3	33.08	2.030

Power Output, 10 MHz Channels

10 MHz QPSK	F, MHz	Chain 1	Chain 2	Chain 3	Chain 4	Chain 5	Chain 6	Total, dBm	Total, Watts
Low Peak	2501	34.1	34.3	34.2	34.0	34.9	34.2	42.07	16.125
Low Average	2501	24.3	24.3	24.5	23.7	24.8	24.4	32.13	1.632
Low+1 Peak	2504	42.3	42.0	42.1	41.6	42.2	42.1	49.84	96.318
Low+1 Averag	2504	32.1	31.9	31.9	31.3	32.2	31.8	39.66	9.242
Mid Peak	2600	42.2	42.4	42.3	41.9	42.5	42.2	50.04	100.823
Mid Average	2600	32.2	32.7	32.1	31.4	32.6	31.8	39.94	9.857
High-1 Peak	2682.5	42.3	43.0	42.1	41.9	42.0	42.2	50.05	101.086
High-1 Averag	2682.5	32.0	32.9	32.1	31.8	32.3	32.3	40.03	10.067
High Peak	2685	34.2	35.2	34.4	34.0	34.3	34.5	42.23	16.718
High Average	2685	24.4	25.3	24.7	24.3	24.6	24.7	32.46	1.762

10 MHz 16QA	F, MHz	Chain 1	Chain 2	Chain 3	Chain 4	Chain 5	Chain 6	Total, dBm	Total, Watts
Low Peak	2501	34.0	34.0	34.0	33.6	34.0	34.0	41.72	14.850
Low Average	2501	24.3	24.2	24.2	23.6	24.6	24.1	31.96	1.570
Low+1 Peak	2504	42.1	42.2	42.2	40.7	42.4	42.6	49.86	96.734
Low+1 Averag	2504	31.9	32.0	31.8	31.0	32.2	31.9	39.60	9.115
Mid Peak	2600	42.4	42.7	42.2	41.7	42.3	41.8	49.98	99.504
Mid Average	2600	32.3	32.7	32.1	31.6	32.5	31.8	39.96	9.919
High-1 Peak	2682.5	42.3	43.0	42.3	42.0	42.1	42.9	50.23	105.483
High-1 Averag	2682.5	31.9	32.9	32.1	32.0	32.4	32.6	40.11	10.263
High Peak	2685	34.1	35.2	34.3	34.2	34.7	35.0	42.38	17.317
High Average	2685	24.4	25.3	24.7	24.3	24.7	24.9	32.51	1.783

10MHz 64QA	F, MHz	Chain 1	Chain 2	Chain 3	Chain 4	Chain 5	Chain 6	Total, dBm	Total, Watts
Low Peak	2501	34.1	34.2	34.6	34.1	34.3	34.3	42.05	16.038
Low Average	2501	24.3	24.3	24.4	23.6	24.5	24.3	32.02	1.594
Low+1 Peak	2504	42.1	42.1	42.3	41.2	42.1	42.1	49.78	95.037
Low+1 Averag	2504	32.2	32.1	32.1	31.3	32.2	31.8	39.74	9.425
Mid Peak	2600	41.8	42.4	42.1	41.7	42.3	42.1	49.86	96.723
Mid Average	2600	32.1	32.7	32.1	31.5	32.5	31.8	39.92	9.810
High-1 Peak	2682.5	42.3	42.9	42.5	41.9	42.3	42.1	50.13	102.952
High-1 Averag	2682.5	32.0	32.9	32.1	31.8	32.4	32.4	40.06	10.146
High Peak	2685	34.2	35.5	33.9	34.3	34.1	34.8	42.28	16.915
High Average	2685	24.4	25.2	24.5	24.3	24.6	24.7	32.41	1.741

3.7.2. MAXIMUM PERMISSIBLE EXPOSURE

LIMITS

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

CALCULATIONS

Given

$E = \sqrt{(30 * P * G)} / d$

and

$S = E ^ 2 / 3770$

where

E = Field Strength in Volts/meter
P = Power in Watts
G = Numeric antenna gain
d = Distance in meters
S = Power Density in milliwatts/square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

$d = \sqrt{((30 * P * G) / (3770 * S))}$

Changing to units of Power to mW and Distance to cm, using:

P (mW) = P (W) / 1000 and
d (cm) =100 * d (m)

yields

$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$
$d = 0.282 * \sqrt{(P * G / S)}$

where

d = distance in cm
P = Power in mW
G = Numeric antenna gain
S = Power Density in mW/cm^2

Substituting the logarithmic form of power and gain using:

P (mW) = 10 ^ (P (dBm) / 10) and
G (numeric) = 10 ^ (G (dBi) / 10)

yields

$d = 0.282 * 10 ^ ((P + G) / 20) / \sqrt{S}$ Equation (1)

where

d = MPE distance in cm
P = Power in dBm
G = Antenna Gain in dBi
S = Power Density Limit in mW/cm^2

Equation (1) and the measured peak power is used to calculate the MPE distance.

LIMITS

From §1.1310 Table 1 (B), S = 1.0 mW/cm^2

RESULTS

RF exposure considerations will be addressed by the licensee at the time of installation. The maximum eirp allowed under Part 27 for this product is 65.4 dBm eirp (10 MHz channels). The MPE distance for 65.4 dBm eirp calculated below:

Power Density Limit (mW/cm^2)	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)
1.0	65.40	0.00	525.11

3.7.3. CONDUCTED SPURIOUS EMISSIONS

REQUIREMENT

27.53(m) Emission limits.

(2) For digital base stations, the attenuation shall be not less than 43 + 10 log (P) dB
(v) For all fixed digital user stations, the attenuation factor shall be not less than 43 + 10 log (P) dB at the channel edge.

(6) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (*i.e.* 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power. With respect to television operations, measurements must be made of the separate visual and aural operating powers at sufficiently frequent intervals to ensure compliance with the rules.

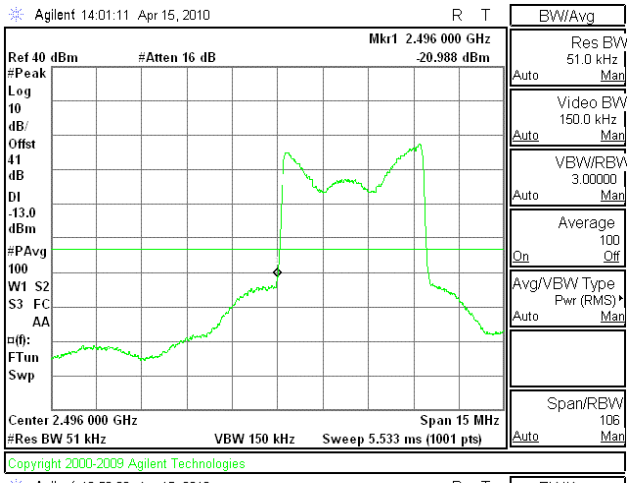
TEST PROCEDURE

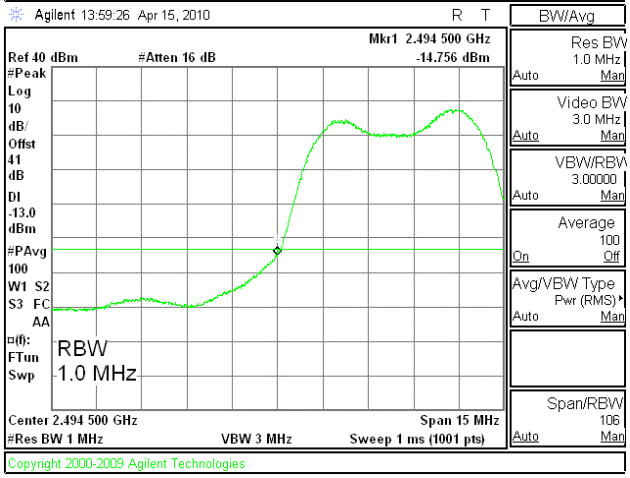
The transmitter output is connected to a spectrum analyzer. At the Low and High channels, in the 1 MHz band immediately adjacent to the band edge, RBW=1% EBW, VBW=3xRBW. Elsewhere RBW = 1 MHZ, VBW=3 MHz.

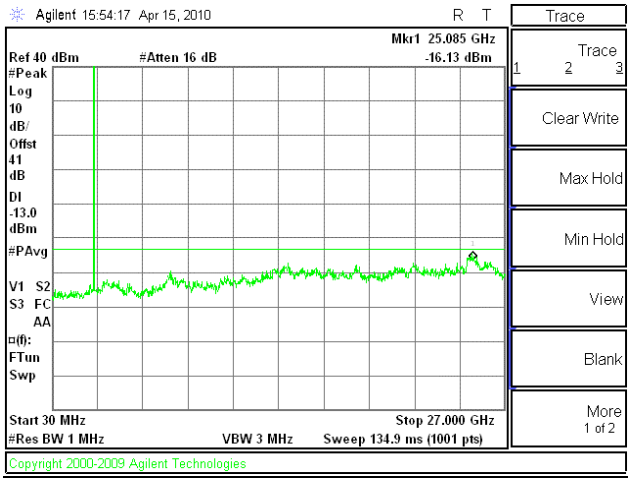
RESULTS

No non-compliance noted:

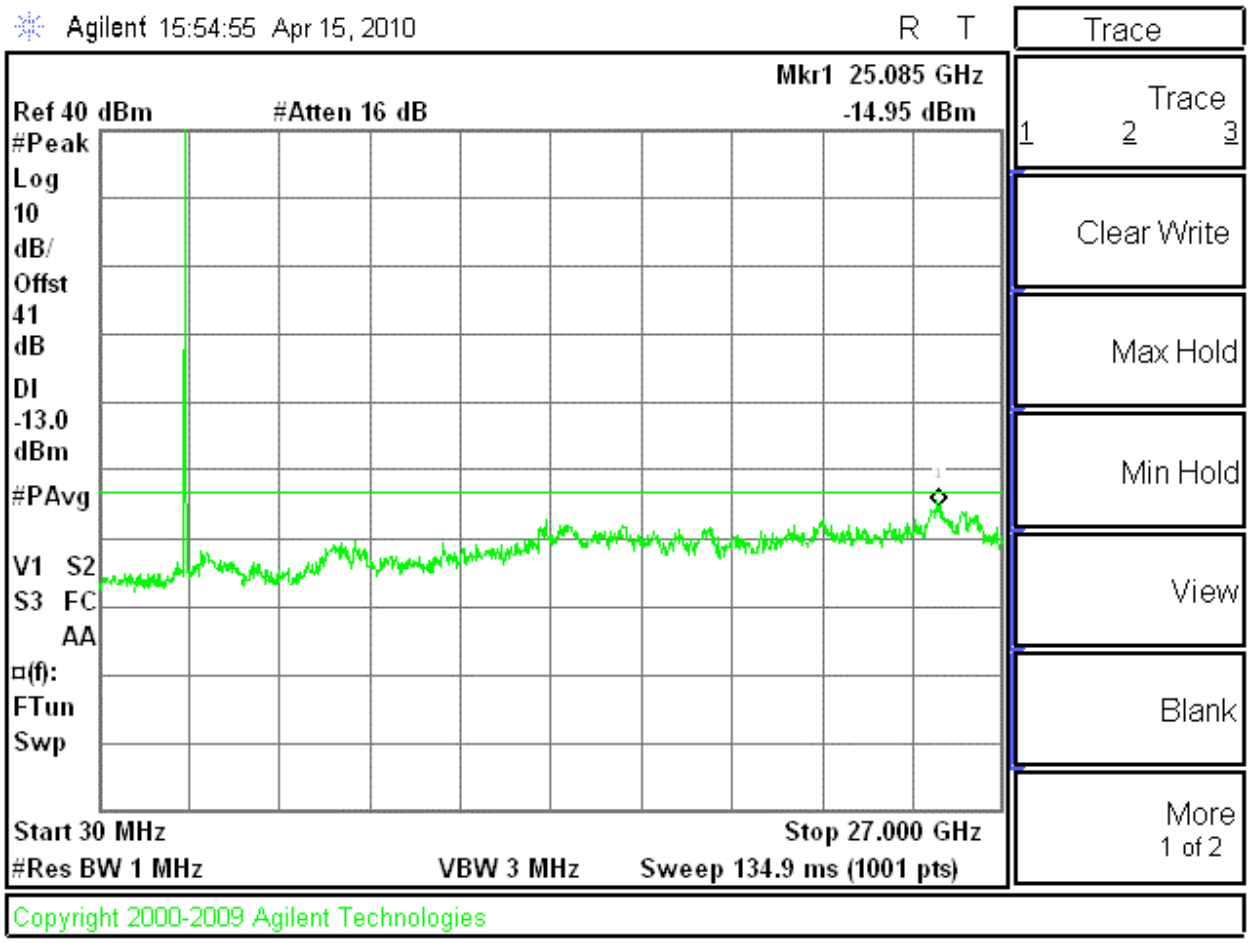
5 MHZ QPSK CONDUCTED SPURIOUS, LOW CHANNEL, P=28



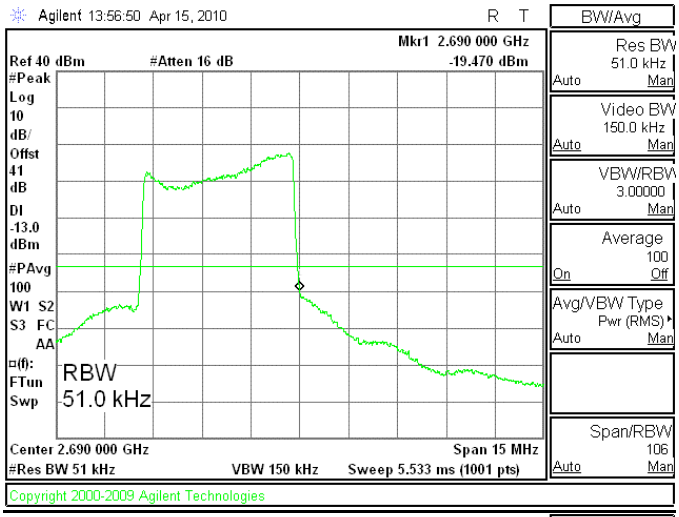


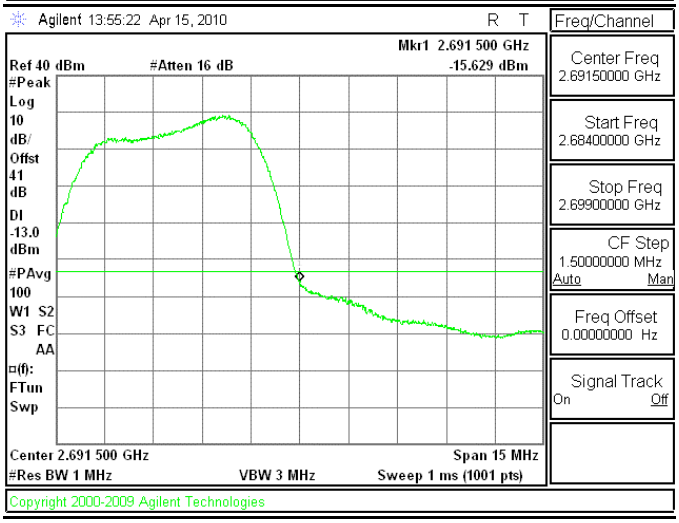


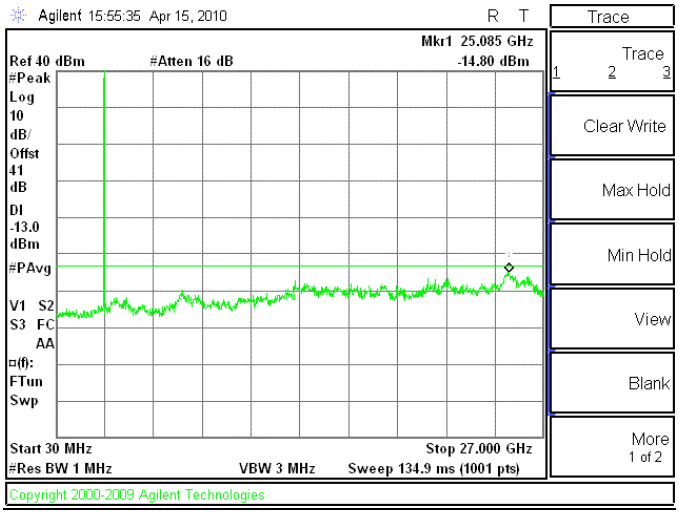
5 MHZ QPSK CONDUCTED SPURIOUS, MID CHANNEL, P=36



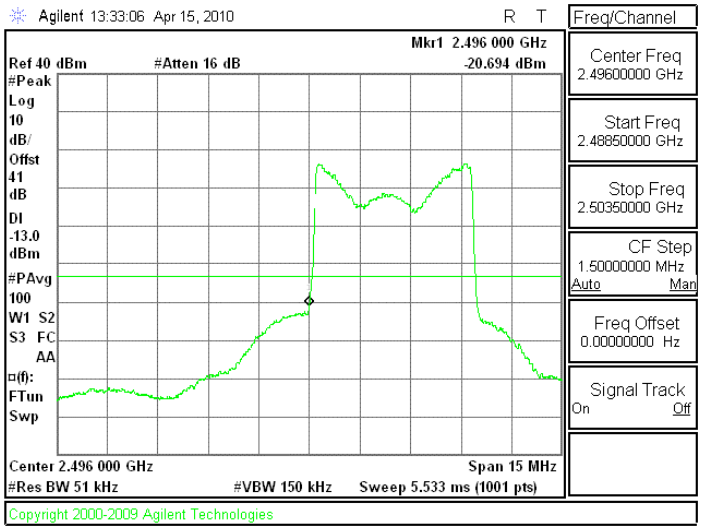
5 MHZ QPSK CONDUCTED SPURIOUS, HIGH CHANNEL, P=28

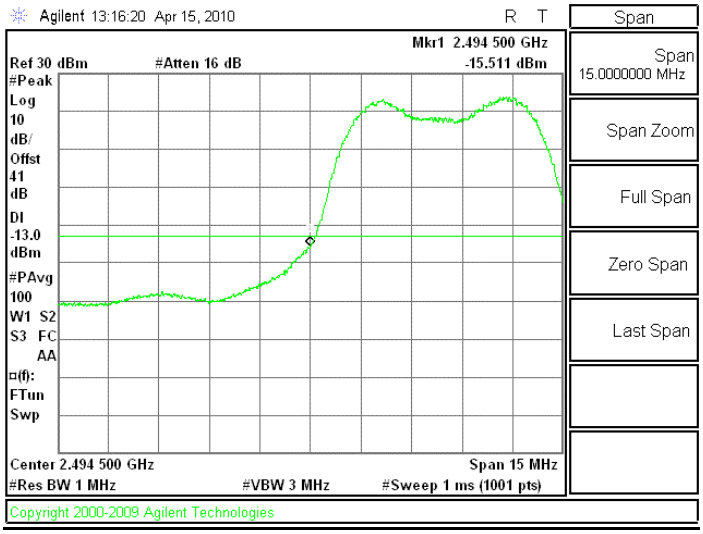


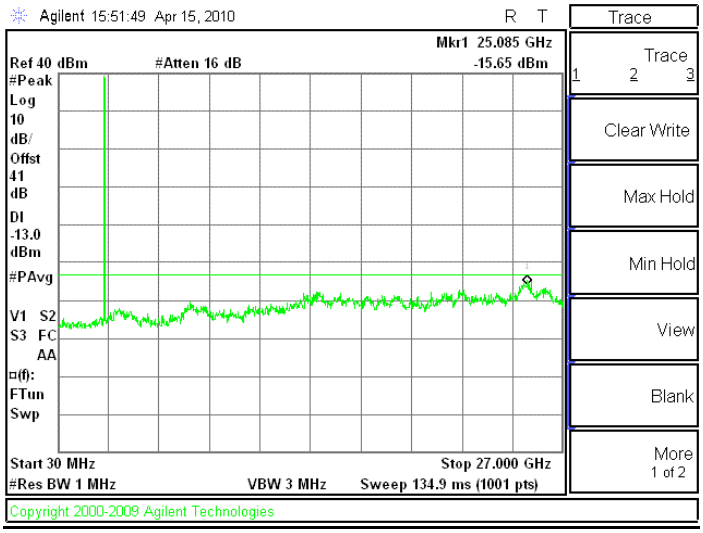




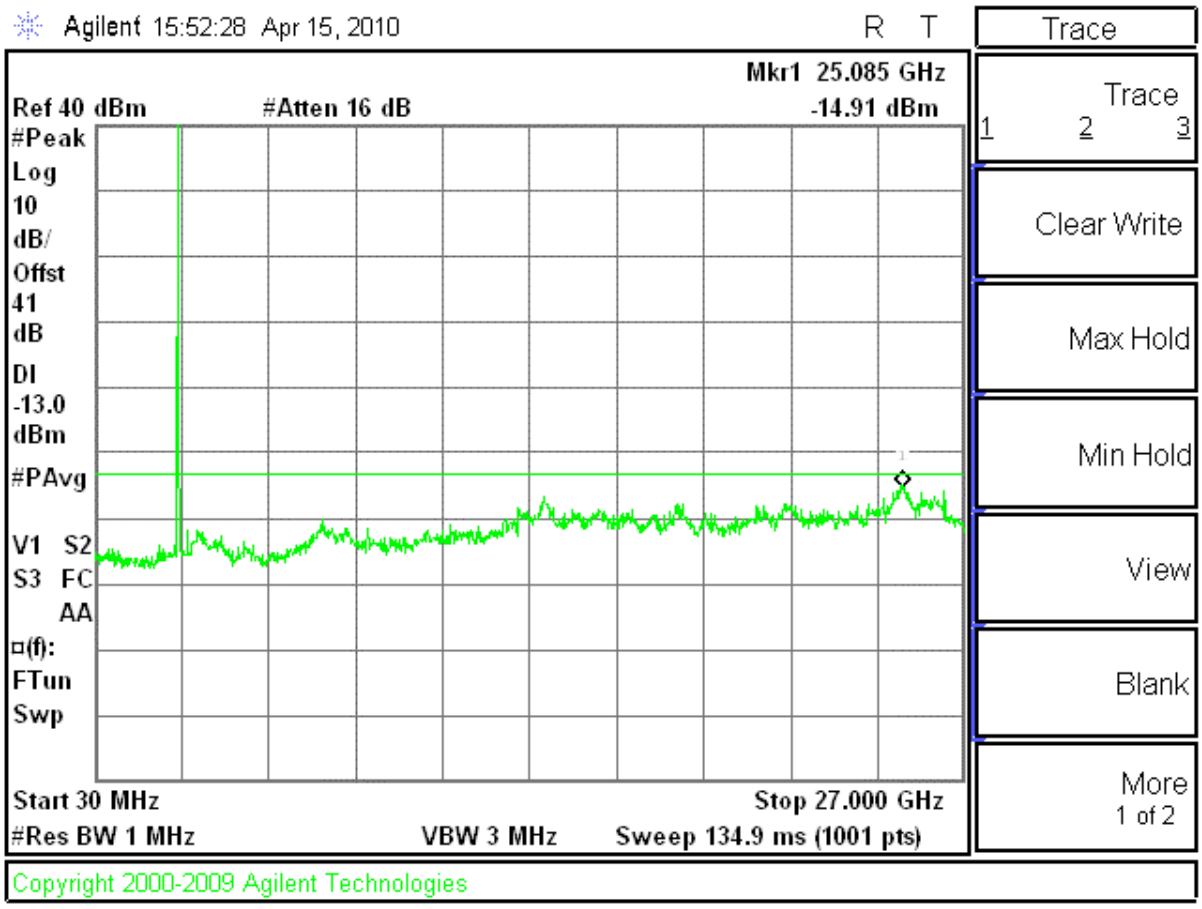
5 MHZ 16QAM CONDUCTED SPURIOUS, LOW CHANNEL, P=28



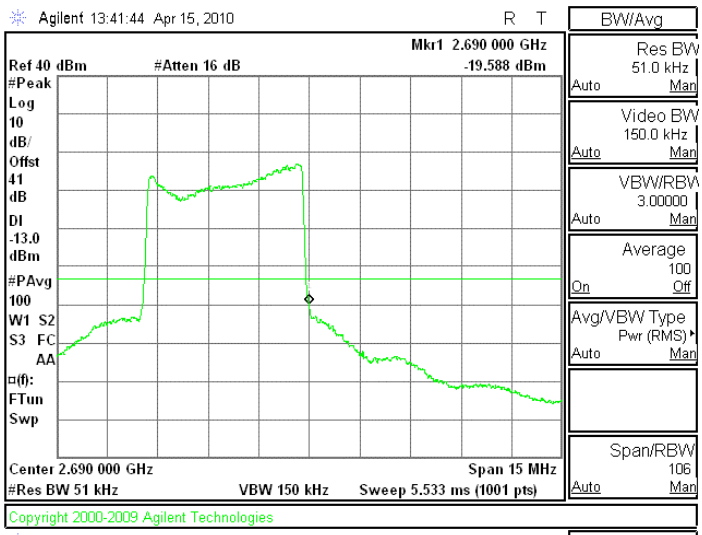


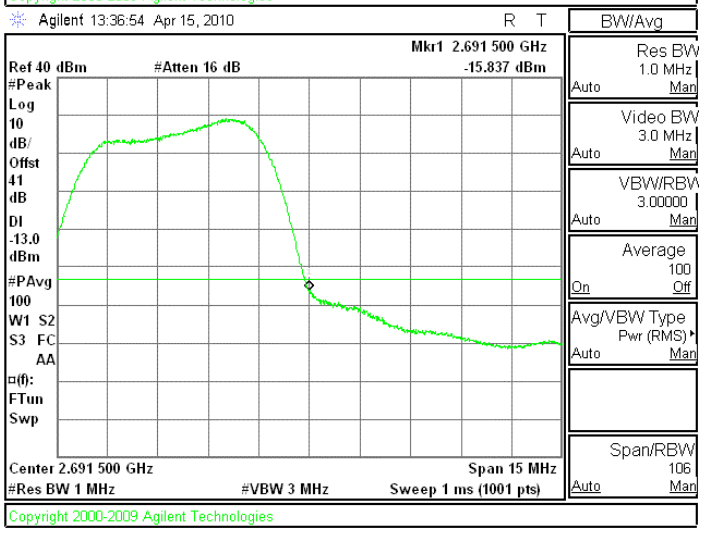


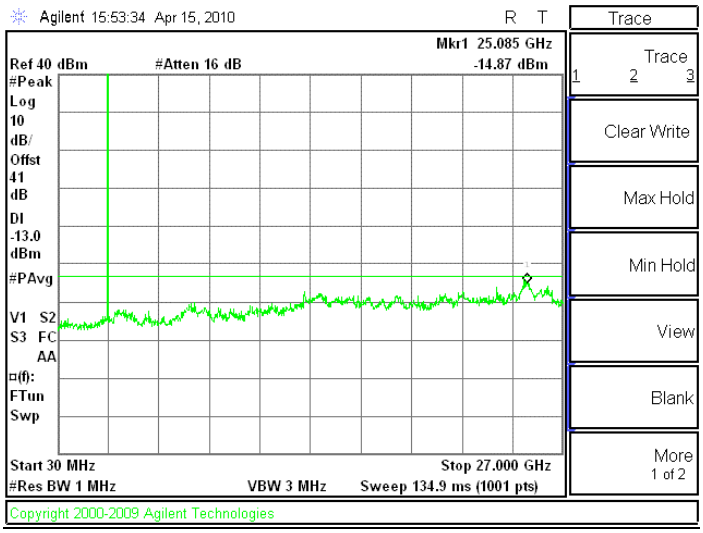
5 MHZ 16QAM CONDUCTED SPURIOUS, MID CHANNEL, P=36



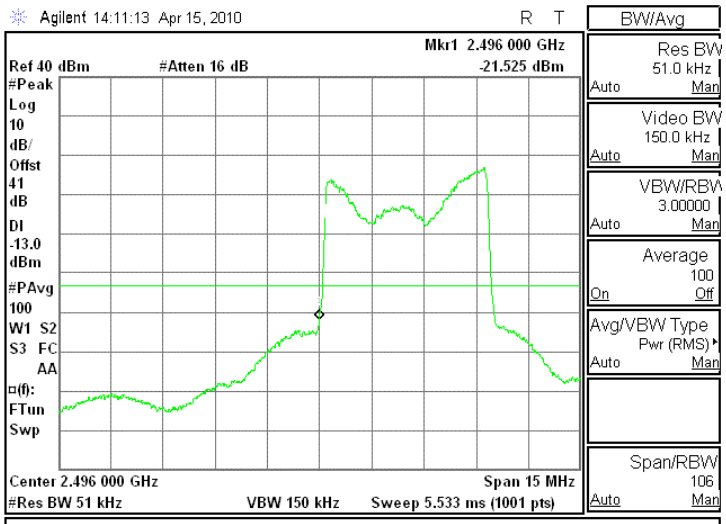
5 MHZ 16QAM CONDUCTED SPURIOUS, HIGH CHANNEL, P=28

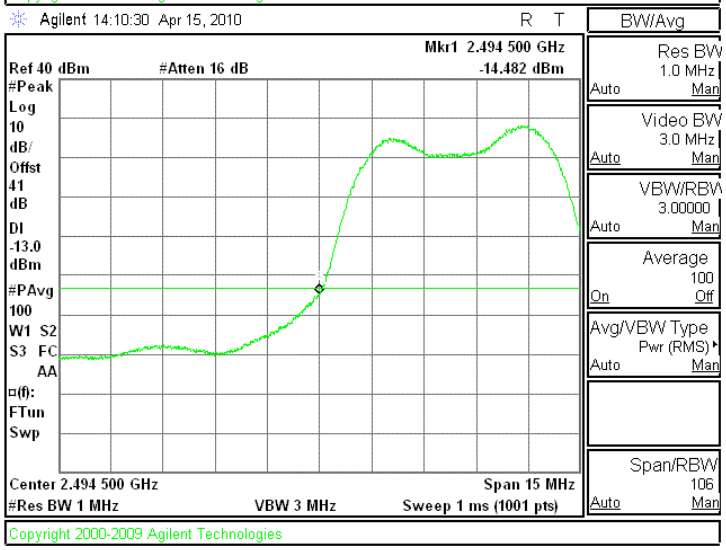


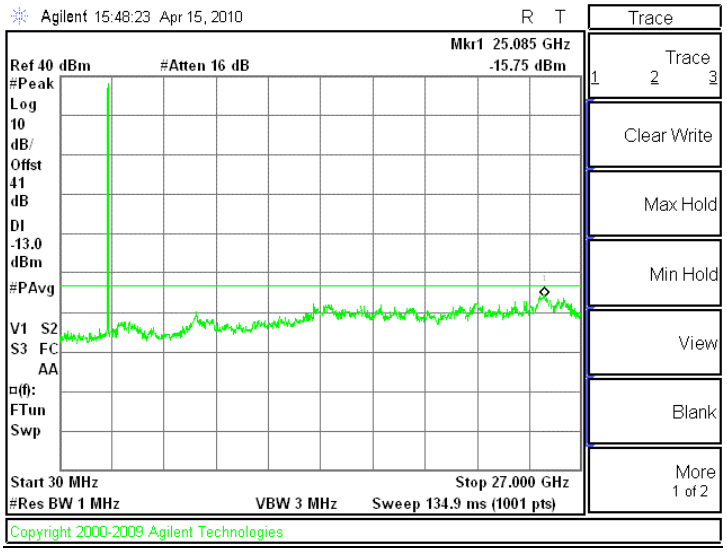




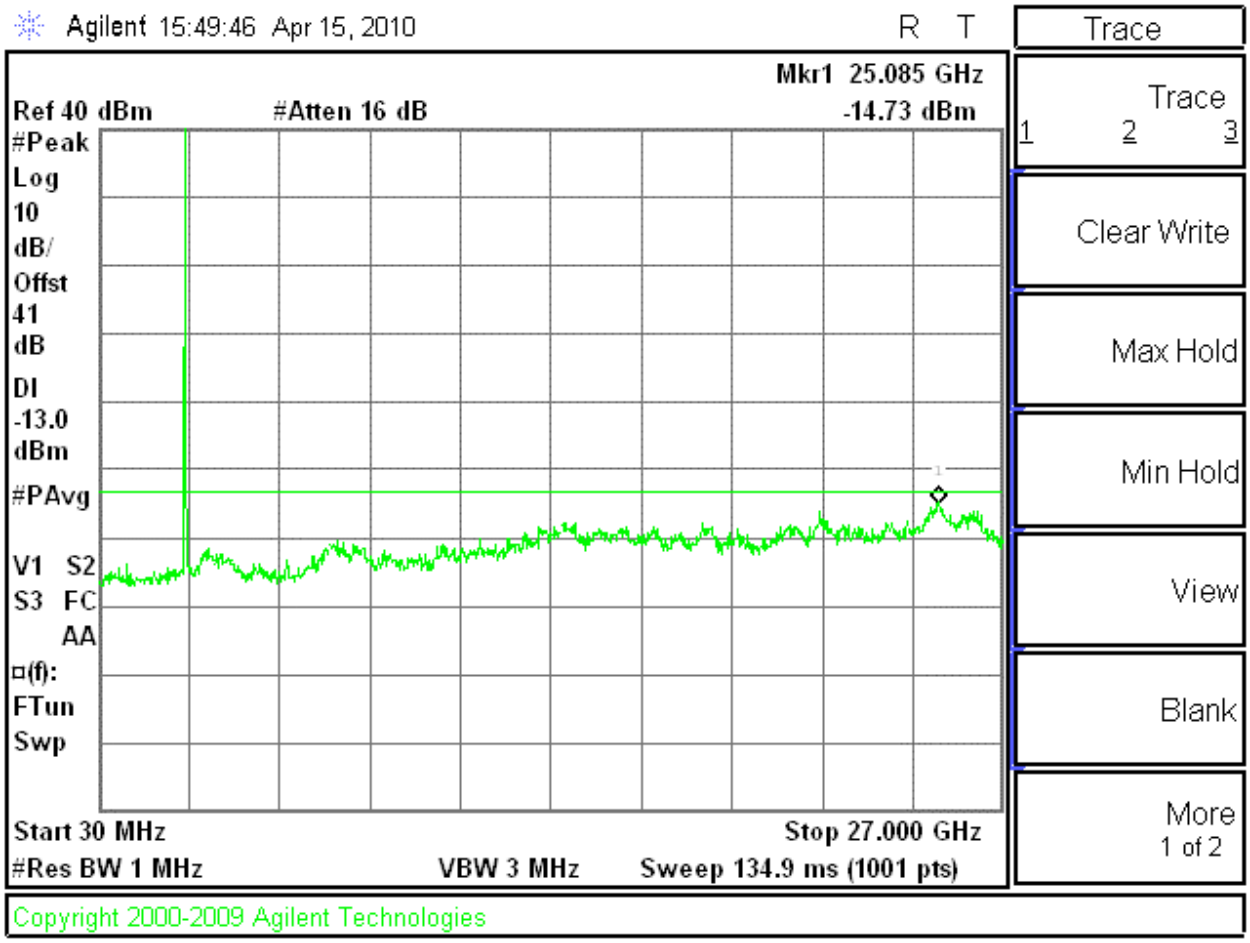
5 MHZ 64QAM CONDUCTED SPURIOUS, LOW CHANNEL, P=28



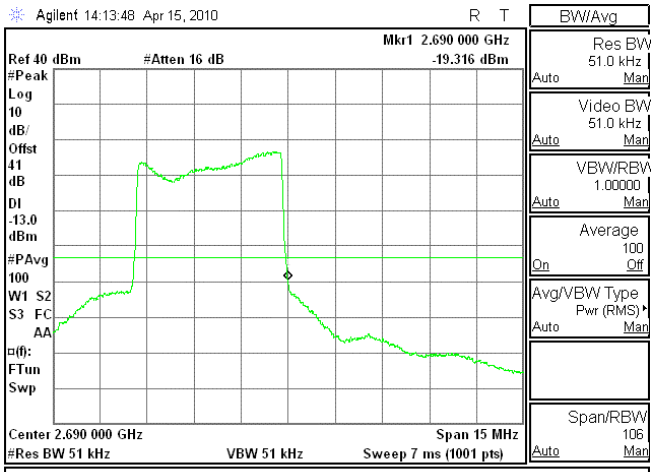


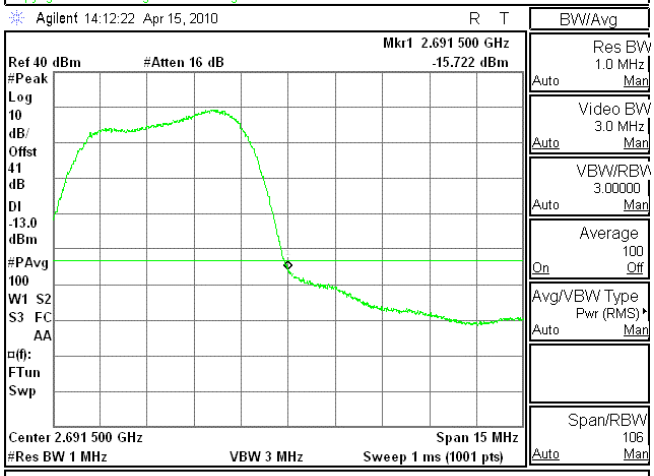


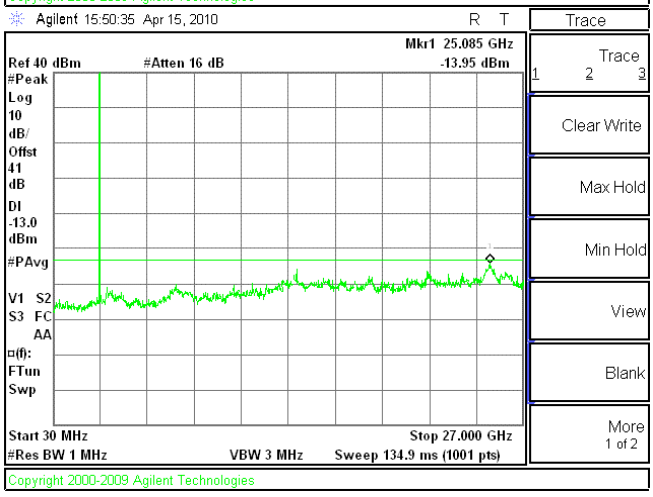
5 MHZ 64QAM CONDUCTED SPURIOUS, MID CHANNEL, P=36



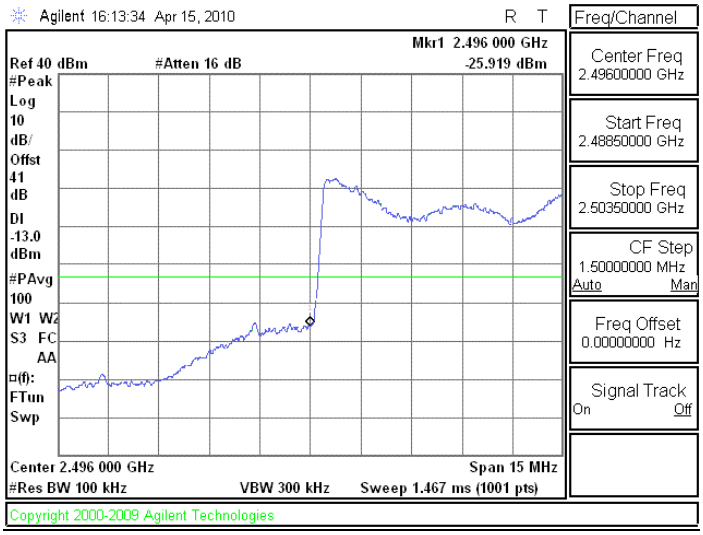
5 MHZ 64QAM CONDUCTED SPURIOUS, HIGH CHANNEL, P=28

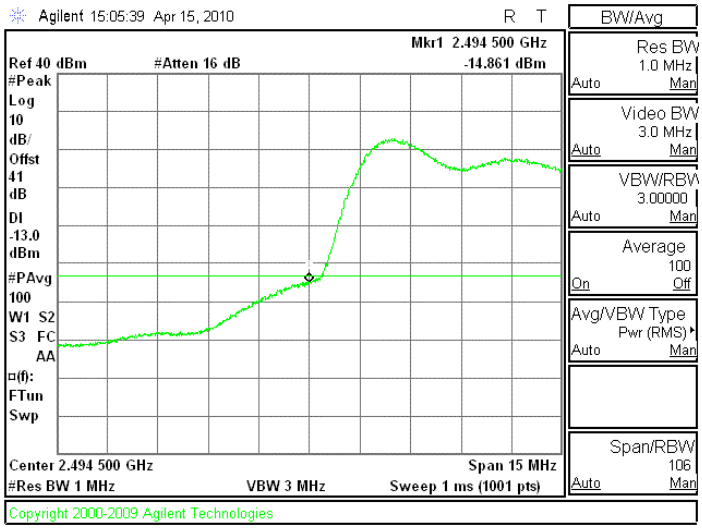


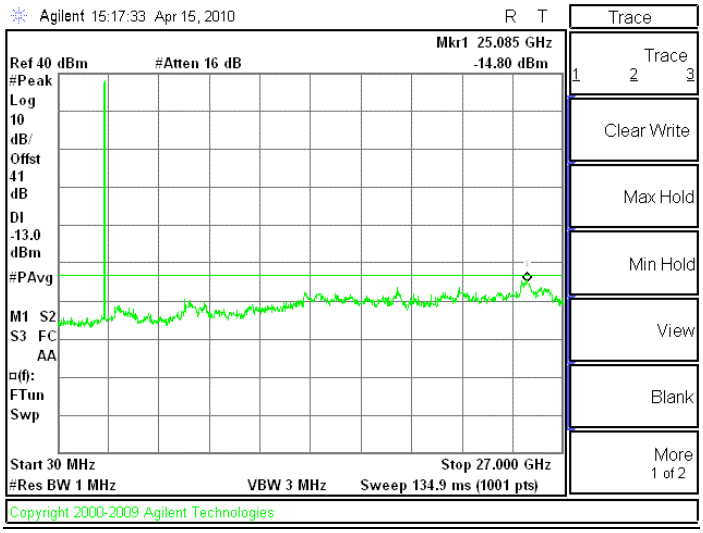




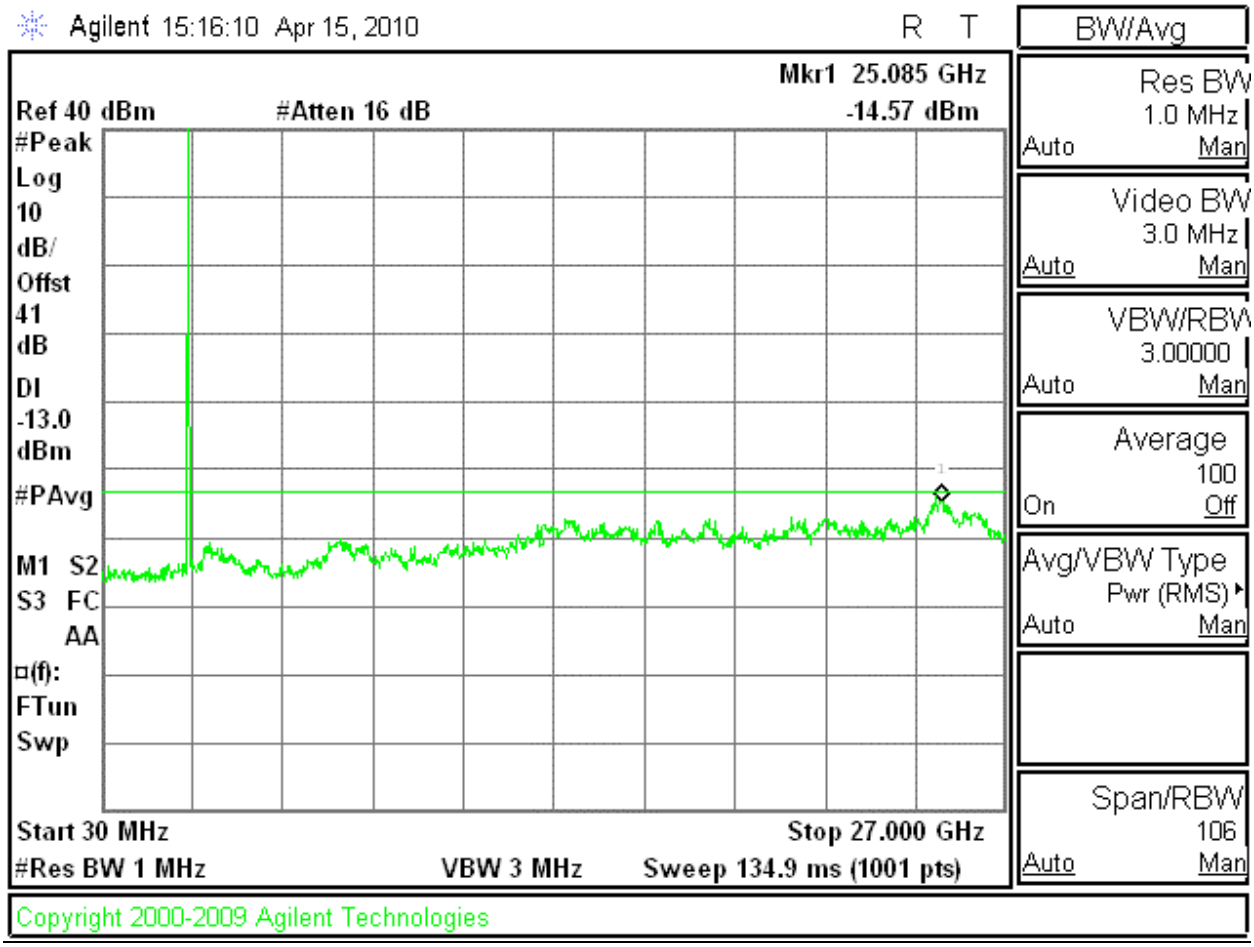
10 MHZ QPSK CONDUCTED SPURIOUS, LOW CHANNEL, P=28



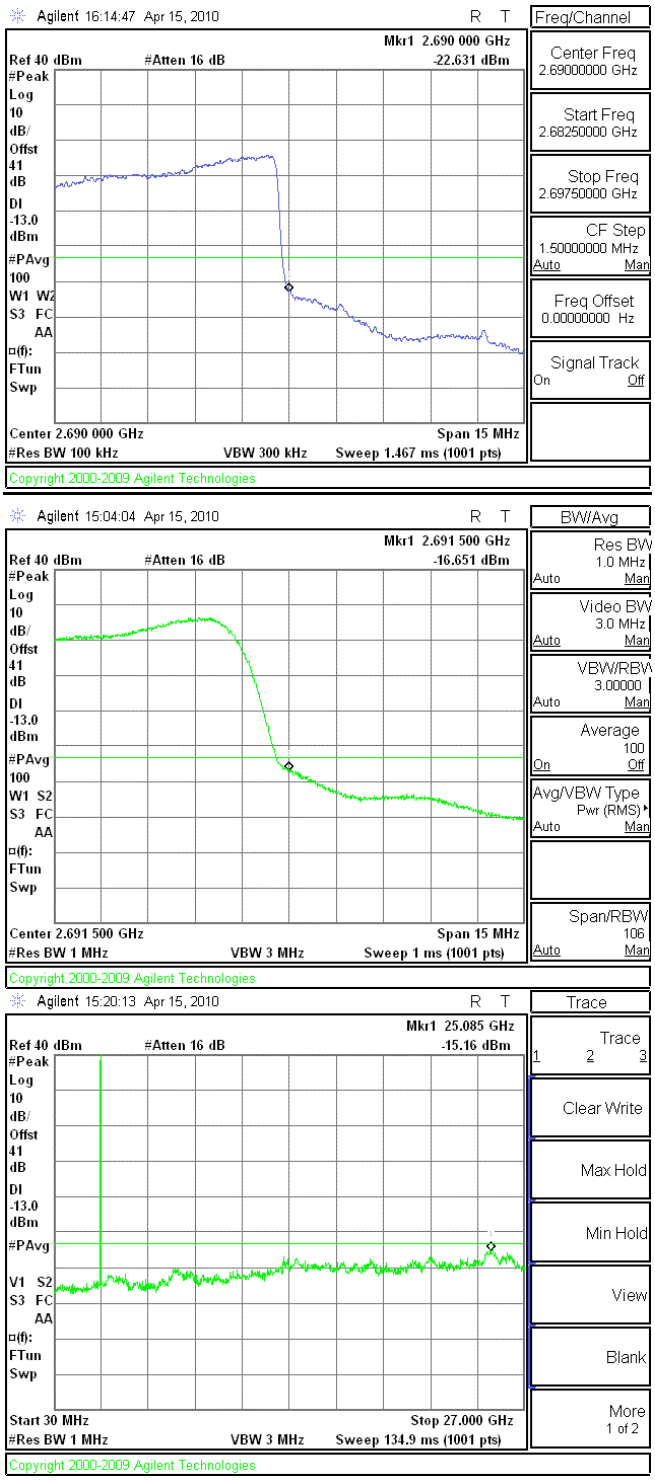




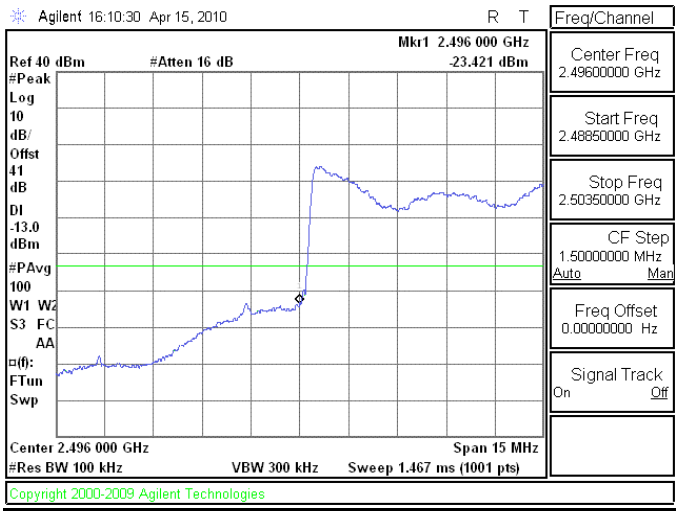
10 MHZ QPSK CONDUCTED SPURIOUS, MID CHANNEL, P=36

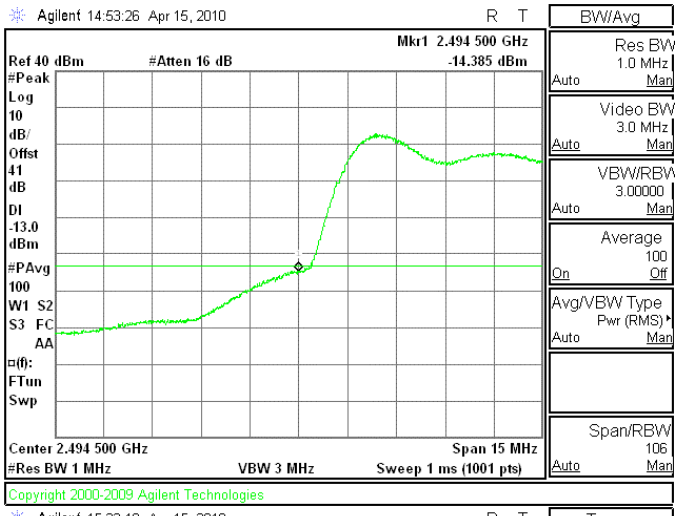


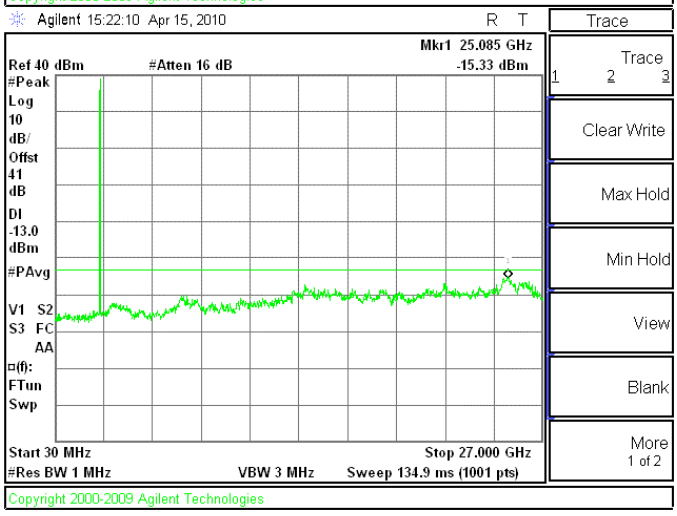
10 MHZ QPSK CONDUCTED SPURIOUS, HIGH CHANNEL, P=28



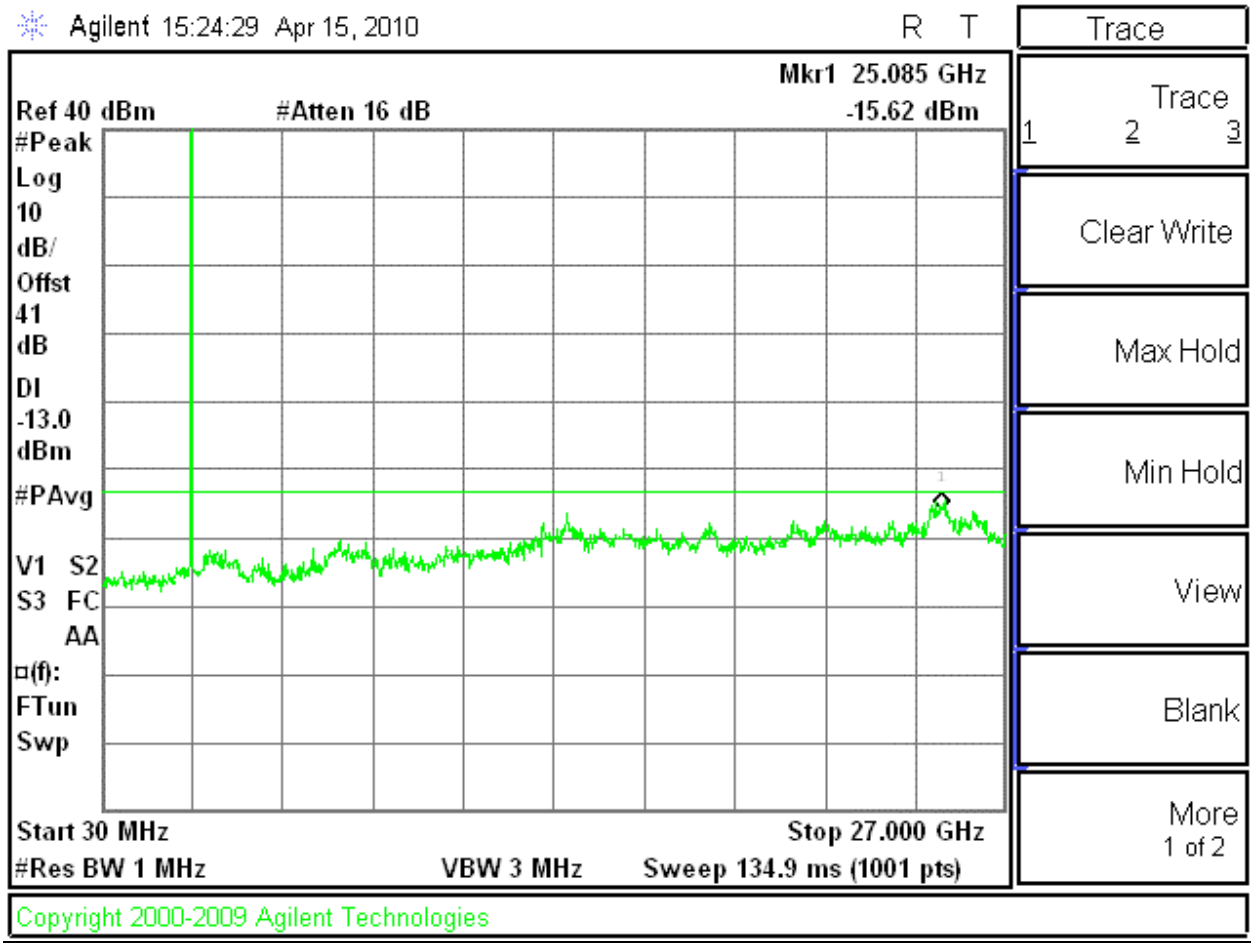
10 MHZ 16QAM CONDUCTED SPURIOUS, LOW CHANNEL, P=28



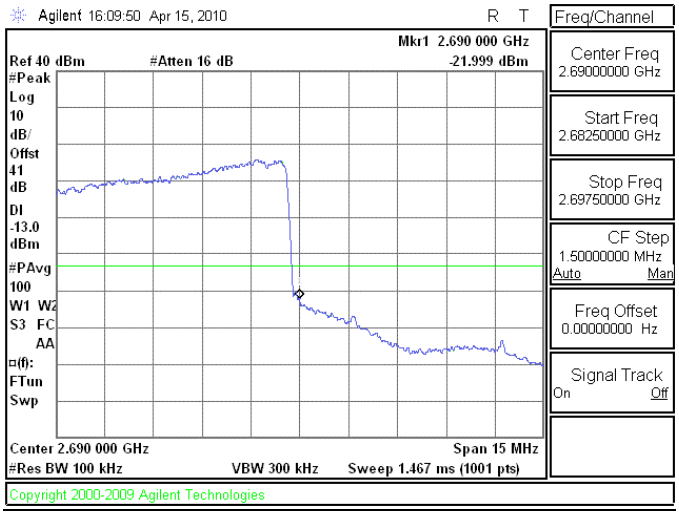


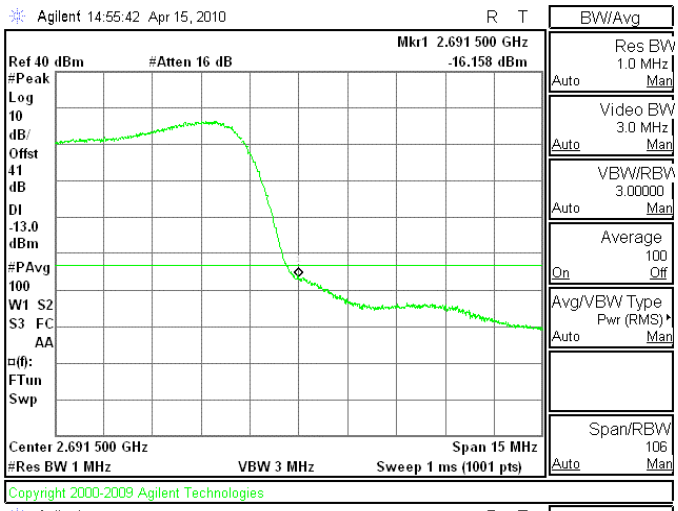


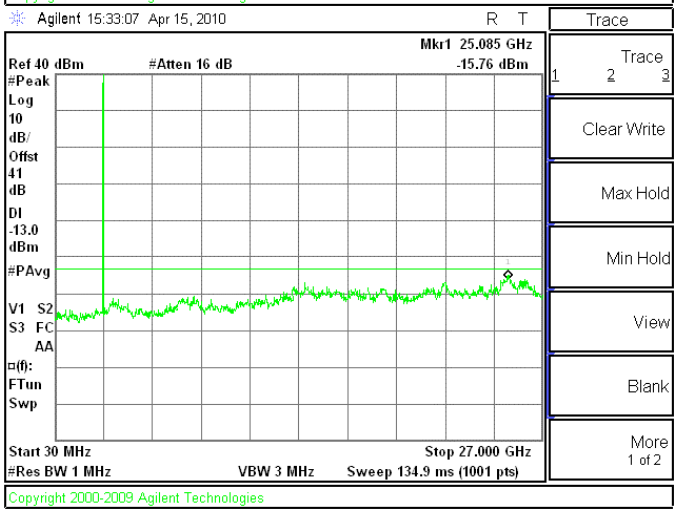
10 MHZ 16QAM CONDUCTED SPURIOUS, MID CHANNEL, P=36



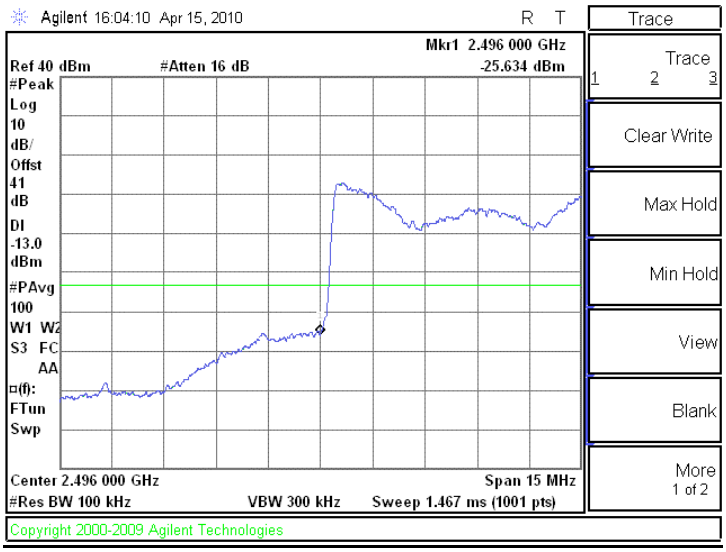
10 MHZ 16QAM CONDUCTED SPURIOUS, HIGH CHANNEL, P=28

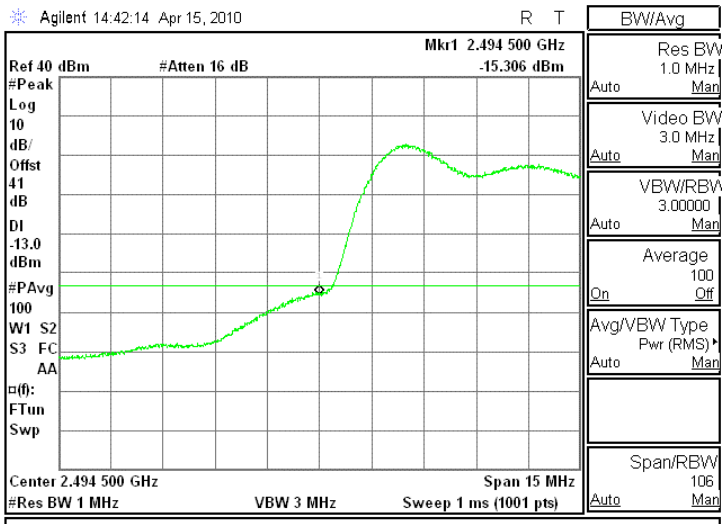


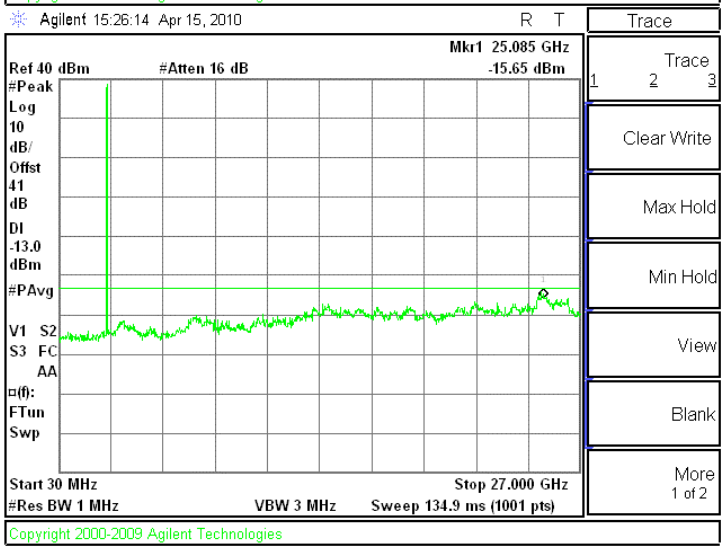




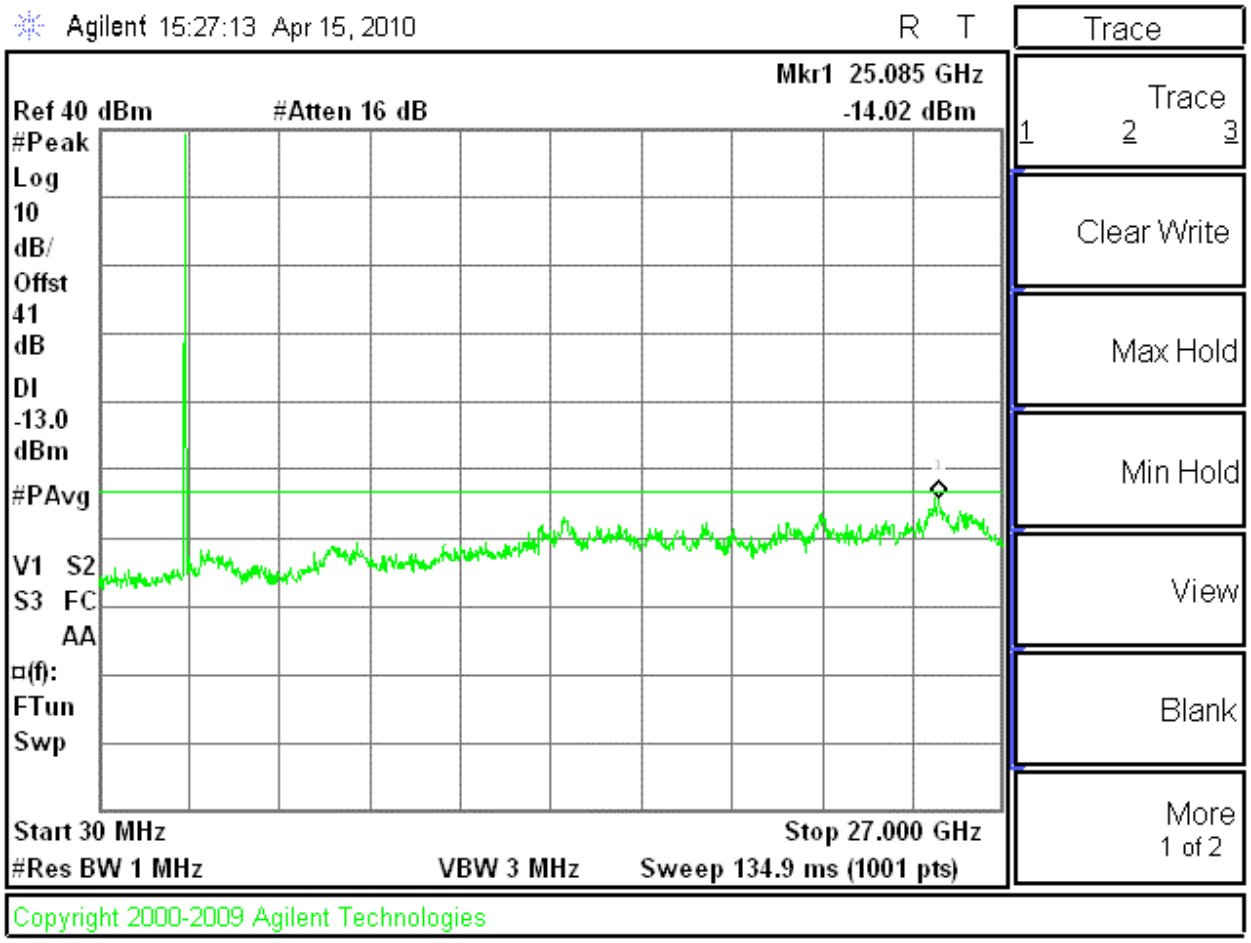
10 MHZ 64QAM CONDUCTED SPURIOUS, LOW CHANNEL, P=28



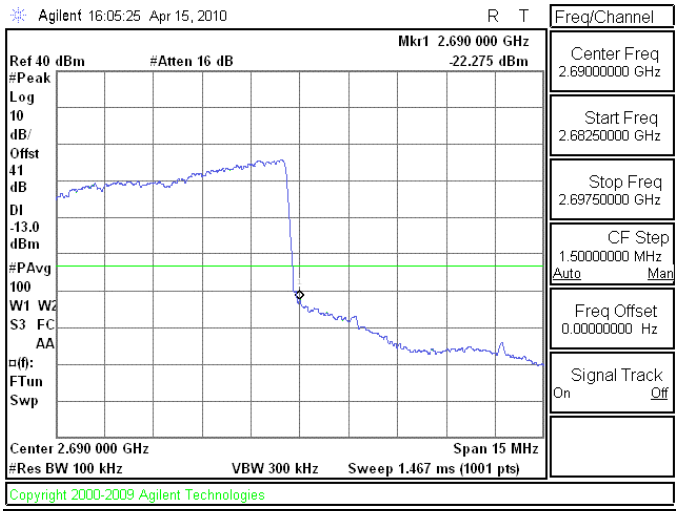


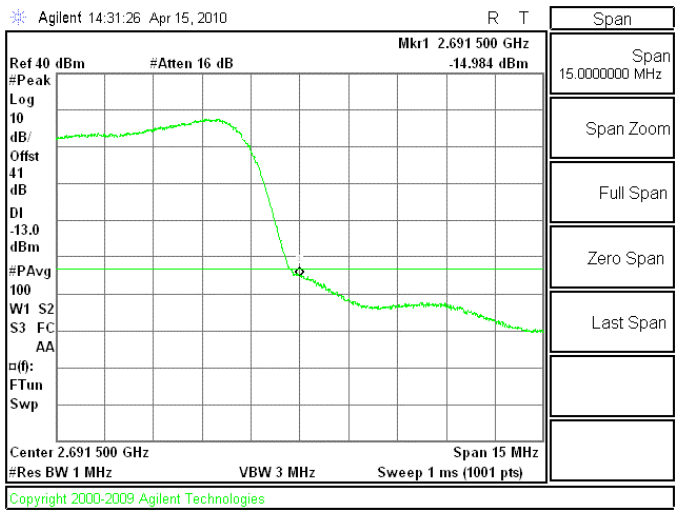


10 MHZ 64QAM CONDUCTED SPURIOUS, MID CHANNEL, P=36

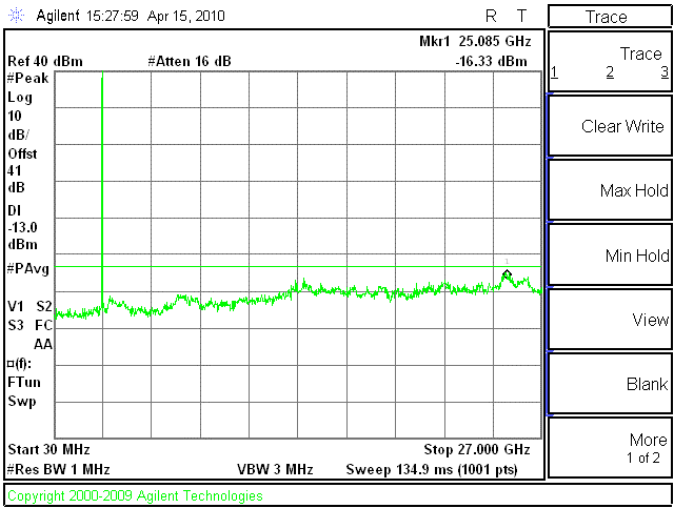


10 MHZ 64QAM CONDUCTED SPURIOUS, HIGH CHANNEL, P=28





3.8.



RADIATED EMISSIONS

3.8.1. TRANSMITTER RADIATED SPURIOUS EMISSIONS

REQUIREMENT

2.1053 Measurements required: Field strength of spurious radiation
Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from half wave dipole antennas.

27.53(m) Emission limits.
(2) For digital base stations, the attenuation shall be not less than 43 + 10 log (P) dB
(v) For all fixed digital user stations, the attenuation factor shall be not less than 43 + 10 log (P) dB at the channel edge.

TEST PROCEDURE
Testing was performed using the substitution method.

1. The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna port was terminated with a resistive non-radiating 50 ohm termination.
2. The spectrum from 30 MHz to 37 GHz was investigated with the transmitter set to the lowest, middle, and highest channels in each 5 GHz band.
3. The frequency range of interest was monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.
4. The EUT was replaced by a signal generator and antenna. The signal generator was set to produce field strengths matching the levels obtained in step 3 above. The equivalent eirp was calculated from the signal generator output and antenna gain with respect to isotropic.

Note: For emissions below 1 GHz, the field strength of the emission is also compared against the EN55022 class A limits for digital devices

TEST RESULTS

Refer to plots and tabulated data below. All emissions below 1 GHz were at least 20 dB below -13 dBm limit and were determined to be from the digital section of the product.

Worst-case emissions above 1 GHz are at least 8 dB below limits.

3.8.2. TRANSMITTER RADIATED EMISSIONS ABOVE 1 GHZ HARMONICS AND SPURIOUS EMISSIONS

5 MHz Channels

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Purewave Networks, Inc.
Project #: 10U13113
Date: 04/14/10
Test Engineer: Doug Anderson
Configuration: EUT and Support Equipment
Mode: Transmit 5MHz BW, Three Modulation Modes

Chamber	Pre-amplifer	Filter	Limit
5m Chamber A	T144 8449B		

f GHz	SA reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Path Loss (dB)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
16QAM:										
Low Channel 2498.5MHz										
5.00	-43.8	V	3.0	48.2	36.3		-31.9	-13.0	-18.9	
5.00	-39.8	H	3.0	48.8	36.3		-27.4	-13.0	-14.4	
Mid Channel 2600MHz										
5.20	-46.2	V	3.0	48.8	36.2		-33.7	-13.0	-20.7	
5.20	-38.9	H	3.0	49.3	36.2		-25.8	-13.0	-12.8	
High Channel 2.6875GHz										
5.38	-45.9	V	3.0	49.0	36.3		-33.2	-13.0	-20.2	
5.38	-37.9	H	3.0	49.6	36.3		-24.5	-13.0	-11.5	
64QAM:										
Low Channel 2498.5MHz										
5.00	-45.4	V	3.0	48.3	36.3		-33.5	-13.0	-20.5	
5.00	-36.2	H	3.0	48.8	36.3		-23.8	-13.0	-10.8	
Mid Channel 2600MHz										
5.20	-46.1	V	3.0	48.8	36.2		-33.5	-13.0	-20.5	
5.20	-35.0	H	3.0	49.3	36.2		-21.9	-13.0	-8.9	
High Channel 2.6875GHz										
5.37	-41.6	V	3.0	49.0	36.3		-28.9	-13.0	-15.9	
5.38	-38.4	H	3.0	49.6	36.3		-25.0	-13.0	-12.0	
QPSK:										
Low Channel 2498.5MHz										
5.00	-55.9	V	3.0	48.2	36.3		-44.0	-13.0	-31.0	
5.00	-36.7	H	3.0	48.8	36.3		-24.3	-13.0	-11.3	
Mid Channel 2600MHz										
5.20	-43.9	V	3.0	48.8	36.2		-31.3	-13.0	-18.3	
5.20	-34.1	H	3.0	49.3	36.2		-21.0	-13.0	-8.0	
High Channel 2.6875GHz										
5.36	-44.4	V	3.0	49.0	36.3		-31.6	-13.0	-18.6	
5.36	-39.0	H	3.0	49.6	36.3		-25.6	-13.0	-12.6	

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10 MHz Channels

Compliance Certification Services
Above 1GHz High Frequency Substitution Measurement

Company: Purewave Networks, Inc.
Project #: 10U13113
Date: 04/14/10
Test Engineer: Doug Anderson
Configuration: EUT and Support Equipment
Mode: Transmit 10MHz BW, Three Modulation Modes

Chamber	Pre-amplifer	Filter	Limit
5m Chamber A	T144 8449B		

f GHz	SA reading (dBm)	Ant. Pol. (H/V)	Distance (m)	Path Loss (dB)	Preamp (dB)	Filter (dB)	EIRP (dBm)	Limit (dBm)	Delta (dB)	Notes
16QAM:										
Low Channel 2501MHz										
5.00	-50.6	V	3.0	48.2	36.3		-38.7	-13.0	-25.7	
5.00	-47.3	H	3.0	48.7	36.3		-34.8	-13.0	-21.8	
Mid Channel 2600MHz										
5.21	-48.4	V	3.0	48.8	36.2		-35.8	-13.0	-22.8	
5.19	-40.5	H	3.0	49.3	36.2		-27.4	-13.0	-14.4	
High Channel 2.685GHz										
5.37	-50.0	V	3.0	49.0	36.3		-37.2	-13.0	-24.2	
5.36	-41.8	H	3.0	49.6	36.3		-28.4	-13.0	-15.4	
64QAM:										
Low Channel 2501MHz										
5.00	-56.3	V	3.0	48.2	36.3		-44.3	-13.0	-31.3	
5.00	-43.6	H	3.0	48.7	36.3		-31.1	-13.0	-18.1	
Mid Channel 2600MHz										
5.20	-49.8	V	3.0	48.8	36.2		-37.3	-13.0	-24.3	
5.20	-40.4	H	3.0	49.4	36.2		-27.3	-13.0	-14.3	
High Channel 2.685GHz										
5.37	-49.7	V	3.0	49.0	36.3		-36.9	-13.0	-23.9	
5.36	-44.5	H	3.0	49.6	36.3		-31.1	-13.0	-18.1	
1.27	-50.2	V	3.0	33.1	38.9		-56.0	-13.0	-43.0	
1.27	-52.6	H	3.0	33.5	38.9		-57.9	-13.0	-44.9	
QPSK:										
Low Channel: 2.501										
5.00	-53.8	V	3.0	48.2	36.3		-41.8	-13.0	-28.8	
5.00	-44.2	H	3.0	48.8	36.3		-31.8	-13.0	-18.8	
Mid Channel: 2.600										
5.20	-47.0	V	3.0	48.8	36.2		-34.4	-13.0	-21.4	
5.20	-41.4	H	3.0	49.3	36.2		-28.3	-13.0	-15.3	
High Channel: 2685										
5.37	-48.8	V	3.0	49.0	36.3		-36.0	-13.0	-23.0	
5.36	-42.9	H	3.0	49.6	36.3		-29.5	-13.0	-16.5	

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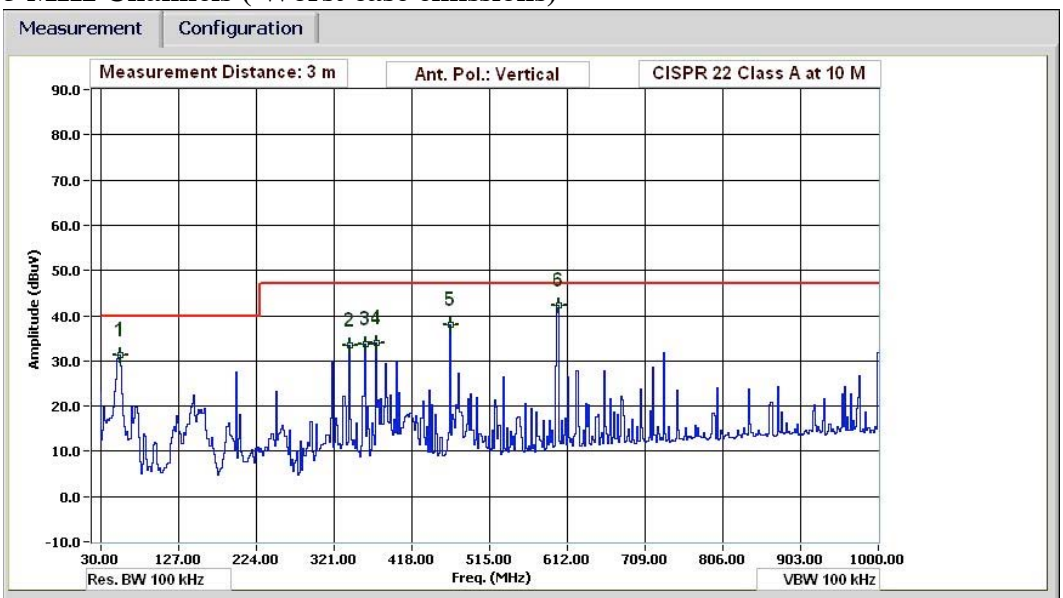
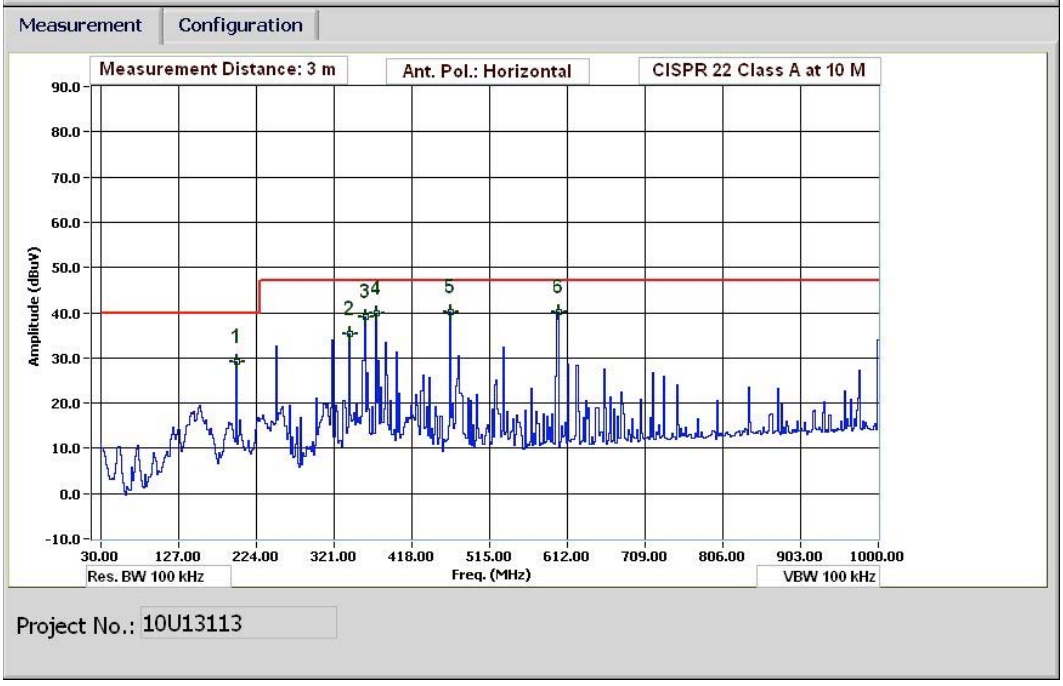
3.8.3. TRANSMITTER RADIATED EMISSIONS BELOW 1 GHZ SPURIOUS AND DIGITAL SECTION EMISSIONS

5 MHz Channels (Worst case emissions)





30-1000MHz Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Doug Anderson
Date: 04/14/10
Project #: 10U13113
Company: PureWave Networks, Inc.
EUT Description: 6x6 2.5GHz WiMax Base Station
EUT M/N: Quantum 6600
Test Target: EN55022 Class A
Mode Oper: Transmit 64 QAM / 5MHz BW/Low Channel (2498.5MHz)

f	Measurement Frequency	Amp	Preamp Gain	Margin	Margin vs. Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters		
Read	Analyzer Reading	Filter	Filter Insert Loss		
AF	Antenna Factor	Corr.	Calculated Field Strength		
CL	Cable Loss	Limit	Field Strength Limit		

f MHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filter dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Ant. High cm	Table Angle Degree
Vertical:														
54.250	3.0	61.4	8.2	0.7	28.4	-10.5	0.0	31.4	40.0	-8.6	V	P		
340.400	3.0	56.3	14.0	1.6	28.1	-10.5	0.0	33.4	47.0	-13.6	V	P		
359.800	3.0	56.3	14.3	1.7	28.1	-10.5	0.0	33.7	47.0	-13.3	V	P		
374.350	3.0	56.4	14.5	1.7	28.1	-10.5	0.0	34.1	47.0	-12.9	V	P		
466.500	3.0	58.4	16.1	2.0	27.9	-10.5	0.0	38.1	47.0	-8.9	V	P		
600.683	3.0	59.6	18.4	2.2	27.5	-10.5	0.0	42.3	47.0	-4.7	V	P		
Horizontal:														
199.750	3.0	54.5	12.0	1.3	28.2	-10.5	0.0	29.0	40.0	-11.0	H	P		
340.400	3.0	58.2	14.0	1.6	28.1	-10.5	0.0	35.3	47.0	-11.7	H	P		
359.800	3.0	61.5	14.3	1.7	28.1	-10.5	0.0	39.0	47.0	-8.0	H	P		
374.350	3.0	62.1	14.5	1.7	28.1	-10.5	0.0	39.8	47.0	-7.2	H	P		
466.500	3.0	60.4	16.1	2.0	27.9	-10.5	0.0	40.1	47.0	-6.9	H	P		
600.683	3.0	57.5	18.4	2.2	27.5	-10.5	0.0	40.2	47.0	-6.8	H	P		

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Note: No other emissions were detected above the system noise floor.

4. FREQUENCY STABILITY TEST

REQUIREMENT
2.1055 Measurements required: Frequency stability

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

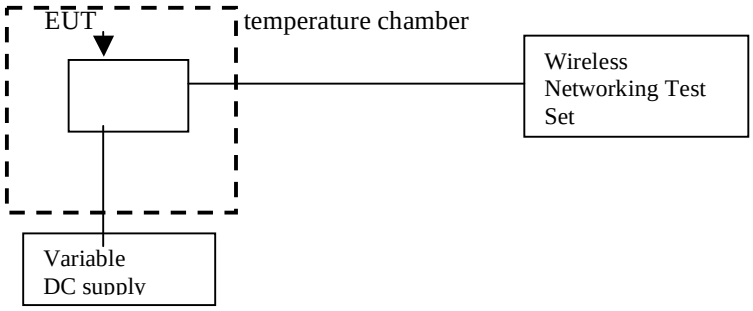
(1) From –30° to +50° centigrade

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

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

27.54 Frequency Stability
The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

Test Set-up



Test Procedures

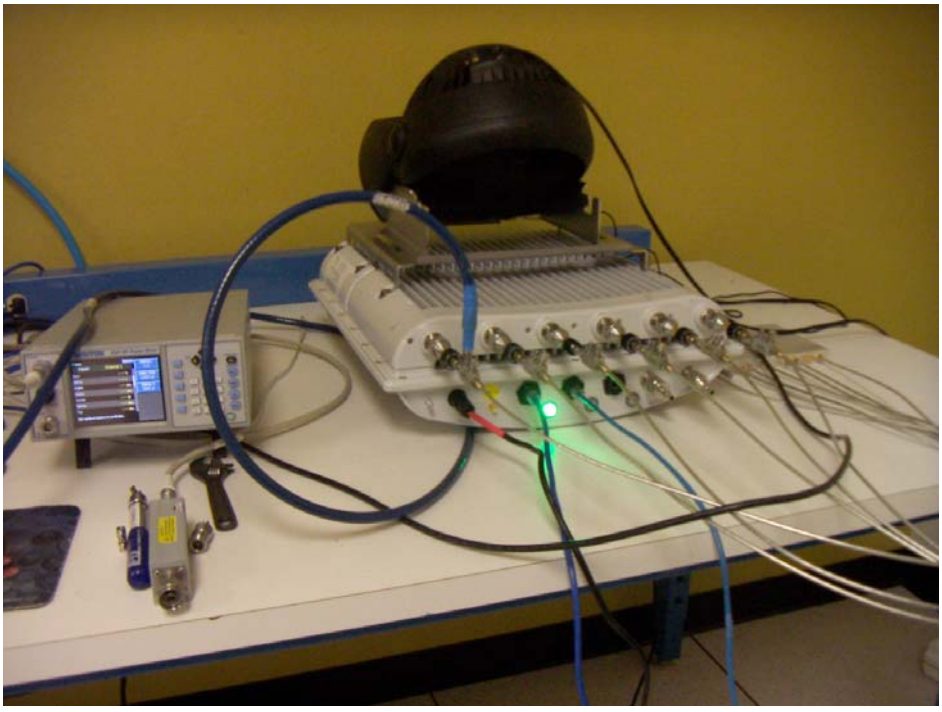
1. Wireless Networking Test Set center frequency was set to 2600 MHZ operating frequency. Frequency was measured at +20C using Wireless Test Set frequency error function.
2. The transmitter was allowed to stabilize at every 10 degrees C from –30C to +50C and measurements were recorded at each temperature.

Test Results
Refer to table below. Frequency remains within 7.95 kHz throughout all required temperature and supply voltage variations. The fundamental emissions of the transmitter remain within the authorized bands of operation under all conditions of temperature and operating voltage

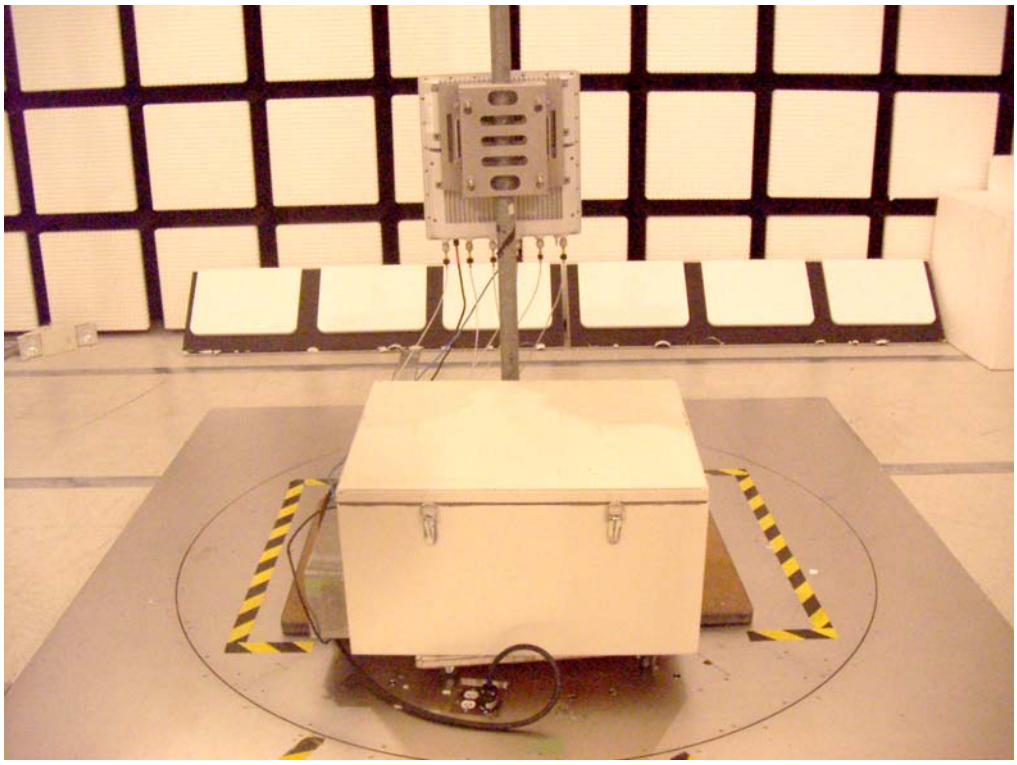
Quantum 6600 Frequency Accuracy Test Data				
Center frequency = 2.6GHz				
-30C to + 50C in 10C steps				
30 minute minimum soak time at each temperature between readings.				
Frequency measured using Agilent wireless networking test set analyzer to demodulate WiMAX signal.				
		Temperature C	Measured Center Frequency kHz	Deviation from nominal @ 20C kHz
		-30	2599993.77	-7.95
		-20	2599995.01	-6.71
		-10	2599996.97	-4.75
		0	2599999.04	-2.68
		10	2600000.66	-1.06
		20	2600001.72	0
		30	2600001.31	-0.41
		40	2600000.82	-0.9
		50	2600001.43	-0.29
	Frequency Variation with voltage @ 20C			
		Voltage	Measured Center Frequency kHz	Deviation from nominal @ -48VDC kH
		-40.8	2599998.22	-0.06
		-48	2599998.28	0
		-55.2	2599998.18	-0.1

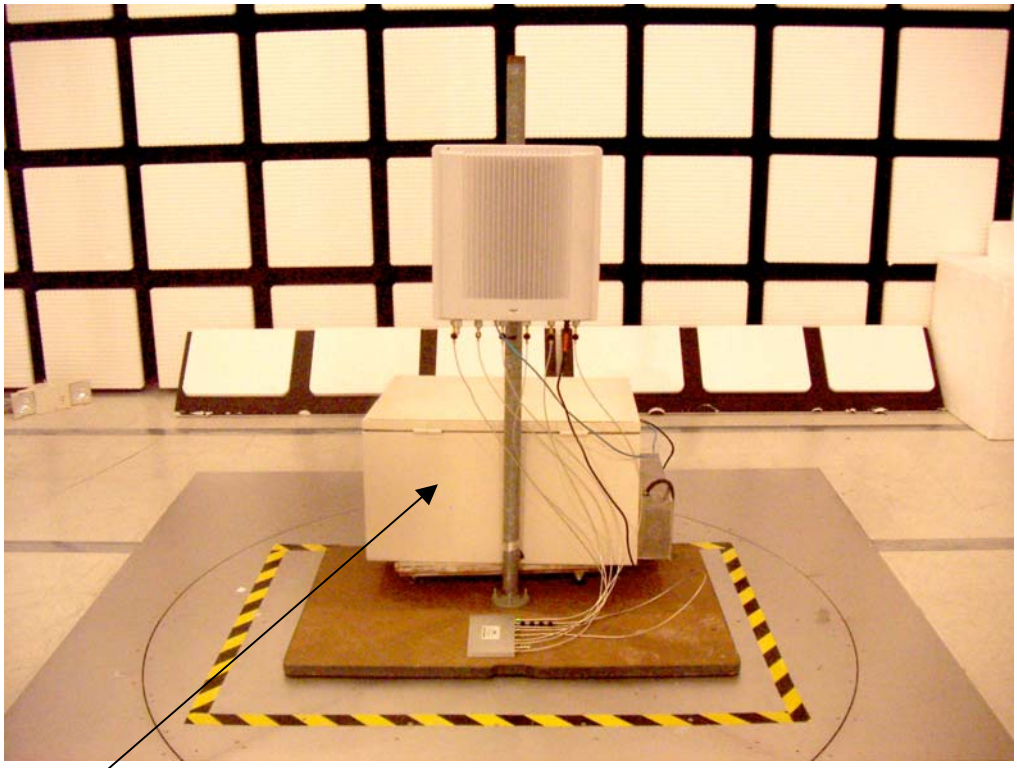
5. SETUP PHOTOS

ANTENNA PORT CONDUCTED RF MEASUREMENT SETUP



RADIATED RF MEASUREMENT SETUP





Note: Support equipment inside shielded box.

FREQUENCY STABILITY MEASUREMENT SETUP

END OF REPORT