



**FCC CFR47 PART 27 SUBPART M**

**CERTIFICATION TEST REPORT**

**FOR**

**WiMAX + WiFi Router**

**MODEL NUMBER: W801**

**FCC ID: N7N-MHS801**

**REPORT NUMBER: 09U12839-3, Revision B**

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*Prepared for*  
**SIERRA WIRELESS INC.  
2290 COSMOS COURT, CARLSBAD  
CALIFORNIA 92011, USA**

*Prepared by*  
**COMPLIANCE CERTIFICATION SERVICES  
47173 BENICIA STREET  
FREMONT, CA 94538, U.S.A.  
TEL: (510) 771-1000  
FAX: (510) 661-0888**



**NVLAP LAB CODE 200065-0**

Revision History

Rev.	Issue Date	Revisions	Revised By
---	10/19/09	Initial Issue	T. Chan
A	11/24/09	Addressed TCB Issue On Frequency Stability	T. Chan
B	11/24/09	Revised model number	A. Zaffar

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** SIERRA WIRELESS INC.  
2290 COSMOS COURT, CARLSBAD  
CALIFORNIA 92011, USA

**EUT DESCRIPTION:** WiMAX + WiFi Router

**MODEL:** W801

**SERIAL NUMBER:** H9H239901472014 AND H9H239901122014

**DATE TESTED:** OCTOBER 8 – 16, 2009

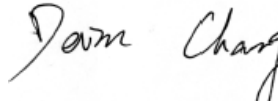
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC PART 27 SUBPART M	PASS

Compliance Certification Services, Inc. (CCS) tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For CCS By:

Tested By:



THU CHAN  
EMC MANAGER  
COMPLIANCE CERTIFICATION SERVICES

DEVIN CHANG  
EMC ENGINEER  
COMPLIANCE CERTIFICATION SERVICES

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with TIA/EIA 603C (2004), FCC CFR 47 Part 2, FCC CFR 47 Part 27M.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

### 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

Uncertainty figures are valid to a confidence level of 95%.

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is a WiMAX + WiFi Router.

The WiMAX radio module is manufactured by Sierra Wireless with the option to install a WAN radio module, FCC ID: N7N-MC5728, inside the EUT.

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum EIRP as follows:

Mode	Channel	Frequency (MHz)	EIRP (dBm)	EIRP (mW)
5MHz QPSK	Low	2498.5	23.40	218.78
5MHz 16QAM	Low	2498.5	22.80	190.55
10MHz QPSK	Low	2501	22.70	186.21
10MHz 16QAM	Low	2501	22.70	186.21

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA antenna, with a maximum gain of -0.5 dBi.

### 5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was Beceem Diagnostic Control Panel version 3.3.0.

### 5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power.

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop PC	DELL	PP18L	30216847141	DOC
AC Adapter	DELL	HS65NS1-00	662-47890-86B-C06B	DOC

### I/O CABLES

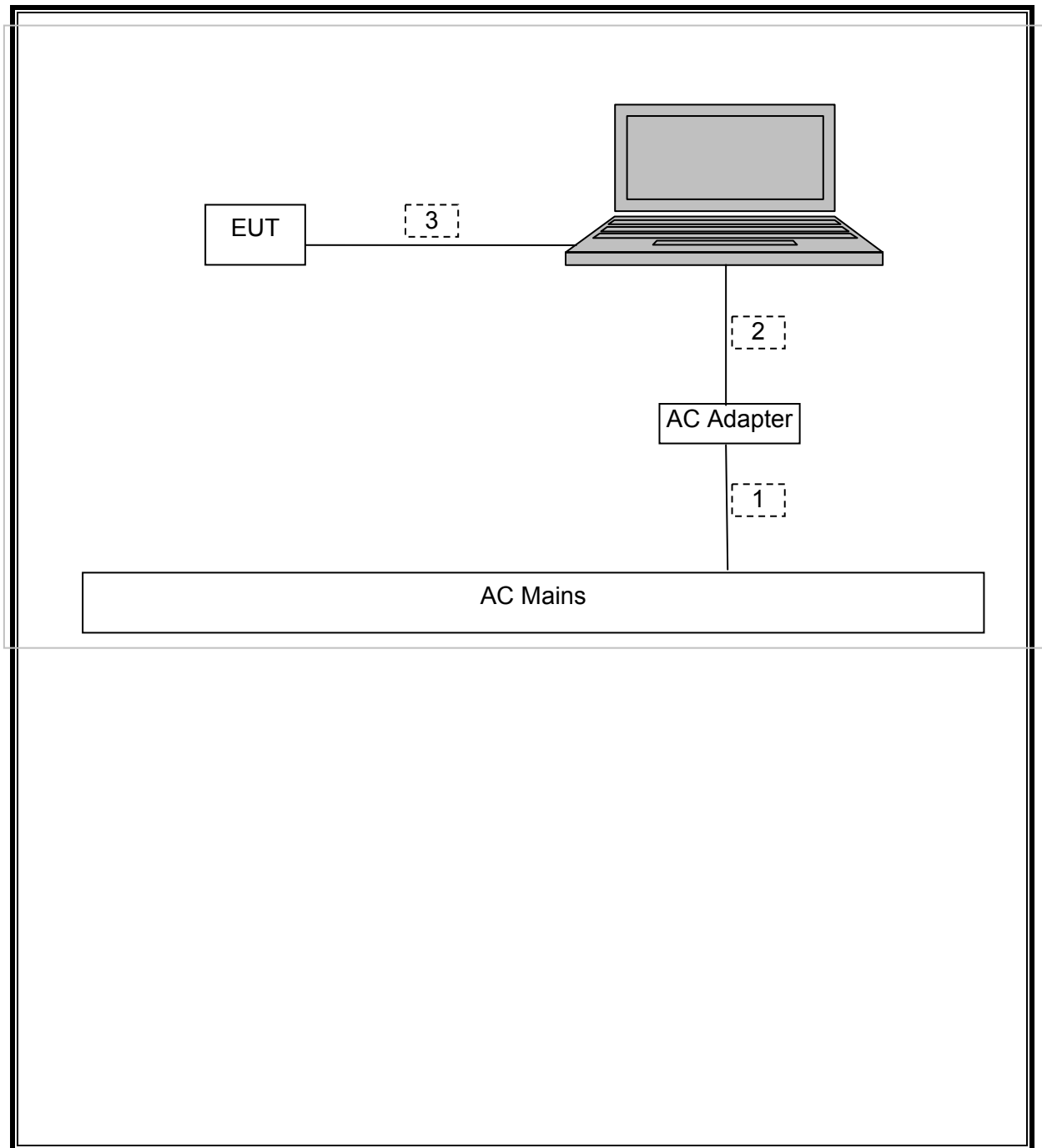
I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	AC	Unshielded	1.8 m	N/A
2	DC	1	DC	Unshielded	1.8 m	N/A
3	USB	1	USB	Unshielded	1.2 m	N/A

### TEST SETUP

The EUT is connected to the host laptop computer via USB cable during the tests. Test software exercised the radio card.



**SETUP DIAGRAM FOR TESTS**



## 6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	Manufacturer	Model	Asset	Cal Due
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C00749	02/04/10
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01171	01/14/10
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00580	12/16/09
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01012	04/20/10
Antenna, Horn, 18 GHz	EMCO	3115	C00872	04/22/10
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	05/06/11
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	11/06/10
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	N02481	11/06/10
Power Meter	Agilent / HP	437B	N02778	08/04/10
Power Sensor, 18 GHz	Agilent / HP	8481A	N02782	10/22/09
Highpass Filter, 4.0 GHz	Micro-Tronics	HPM13351	N02708	N/A
ESG Vector Generator	Agilent	E4438C	MY42080130	04/17/10

## 7. LIMITS AND RESULTS

### 7.1. ANTENNA PORT TEST RESULTS

#### 7.1.1. 26 dB and 99% BANDWIDTH

##### LIMITS

§2.1049 & §27.53 (m)(6)

##### TEST PROCEDURE

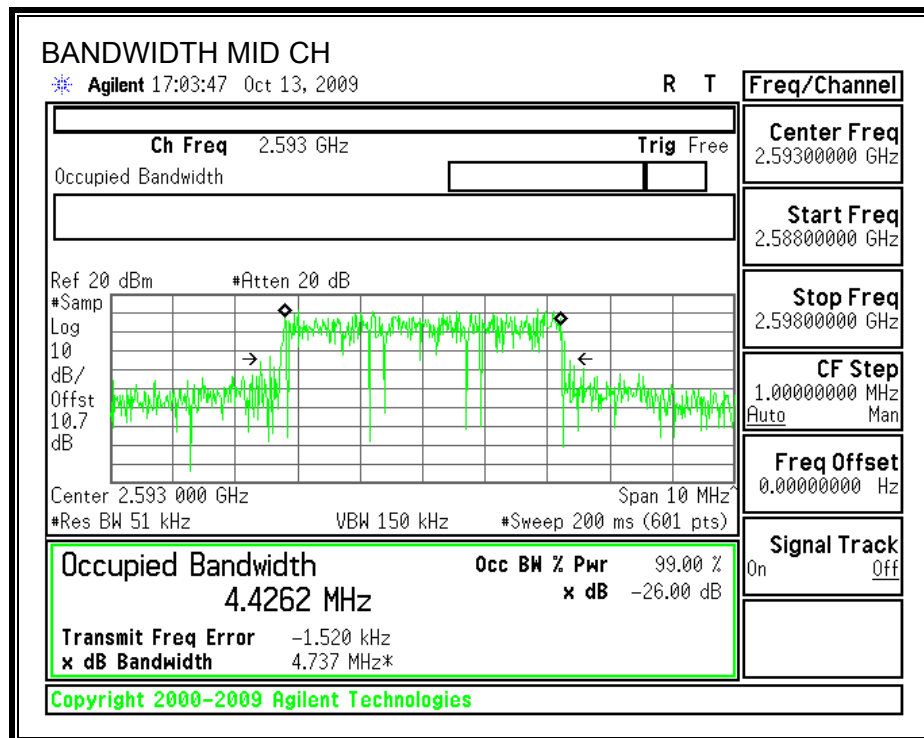
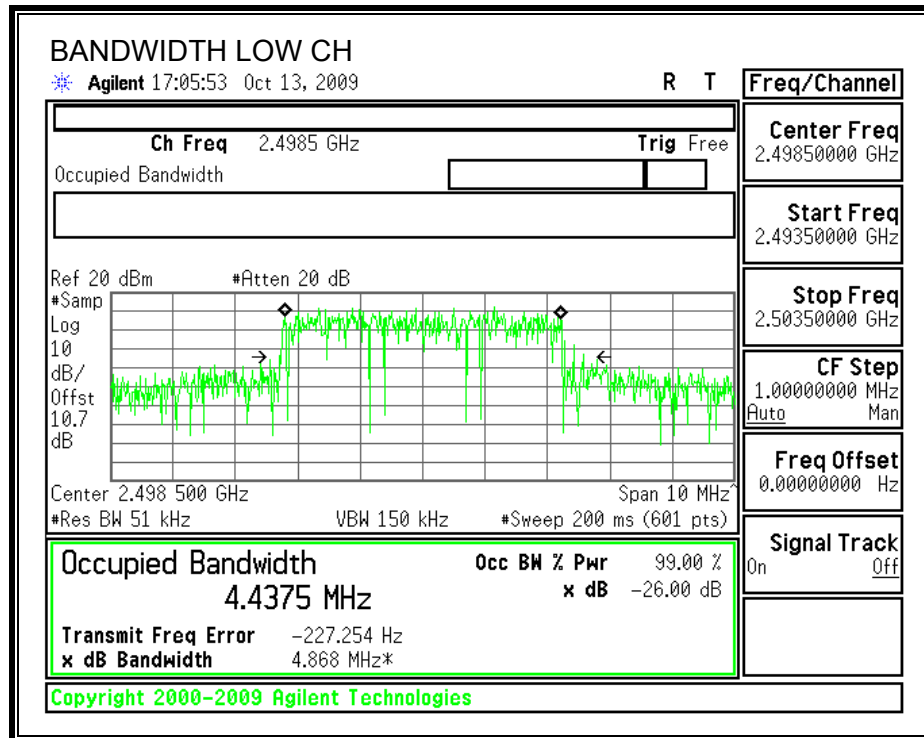
The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

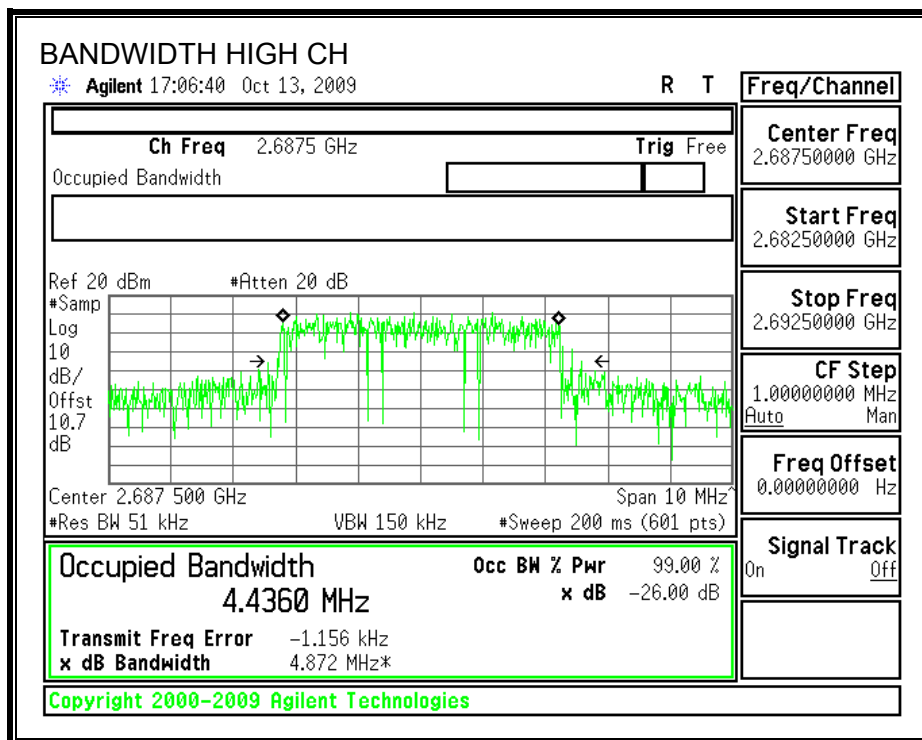
##### RESULTS

Mode	Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
5MHz QPSK	Low	2498.5	4.868	4.4375
	Middle	2593	4.737	4.4260
	High	2687.5	4.872	4.4360
5MHz 16QAM	Low	2498.5	4.868	4.4375
	Middle	2593	4.737	4.4262
	High	2687.5	4.872	4.4360
10MHz QPSK	Low	2501	9.387	9.0801
	Middle	2593	9.386	9.0751
	High	2685	9.386	9.0788
10MHz 16QAM	Low	2501	9.329	9.0250
	Middle	2593	9.392	9.0135
	High	2685	9.361	9.0406

## 5MHz\_QPSK

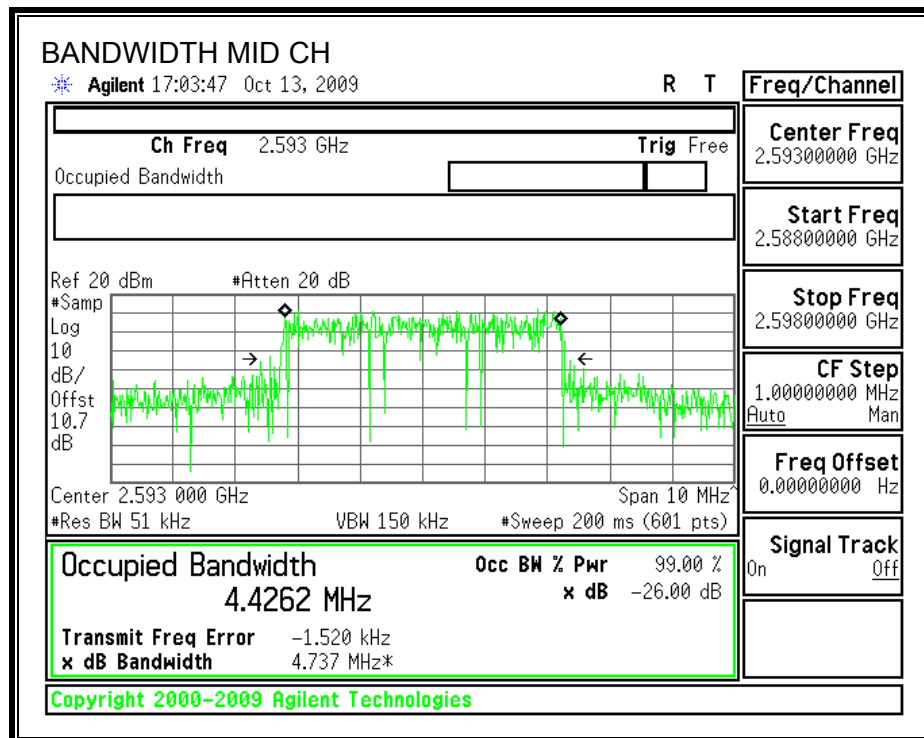
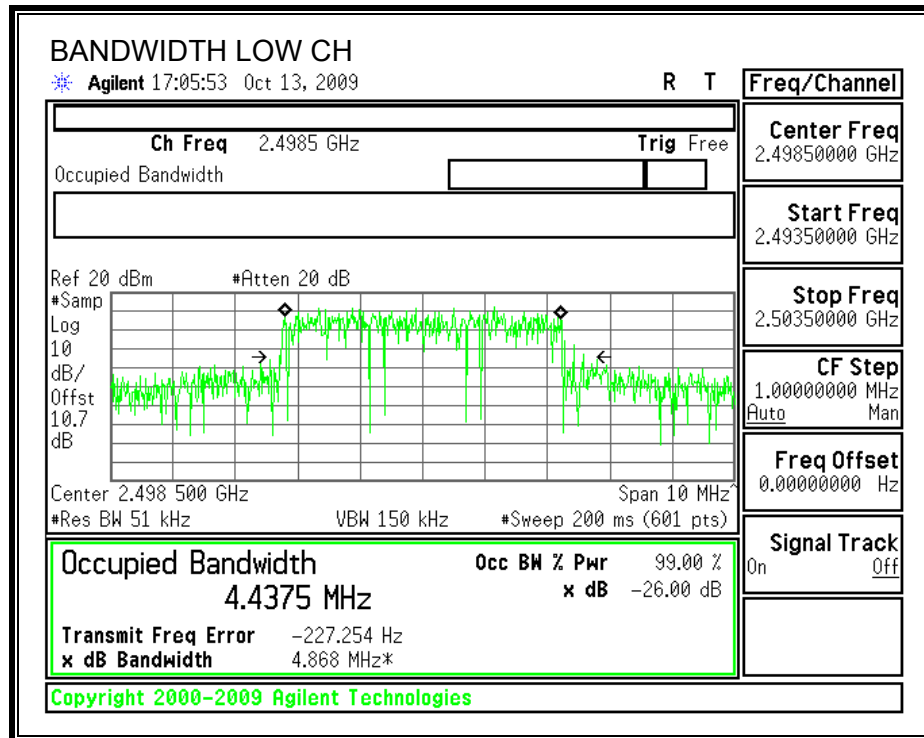
### 26 dB and 99% BANDWIDTH

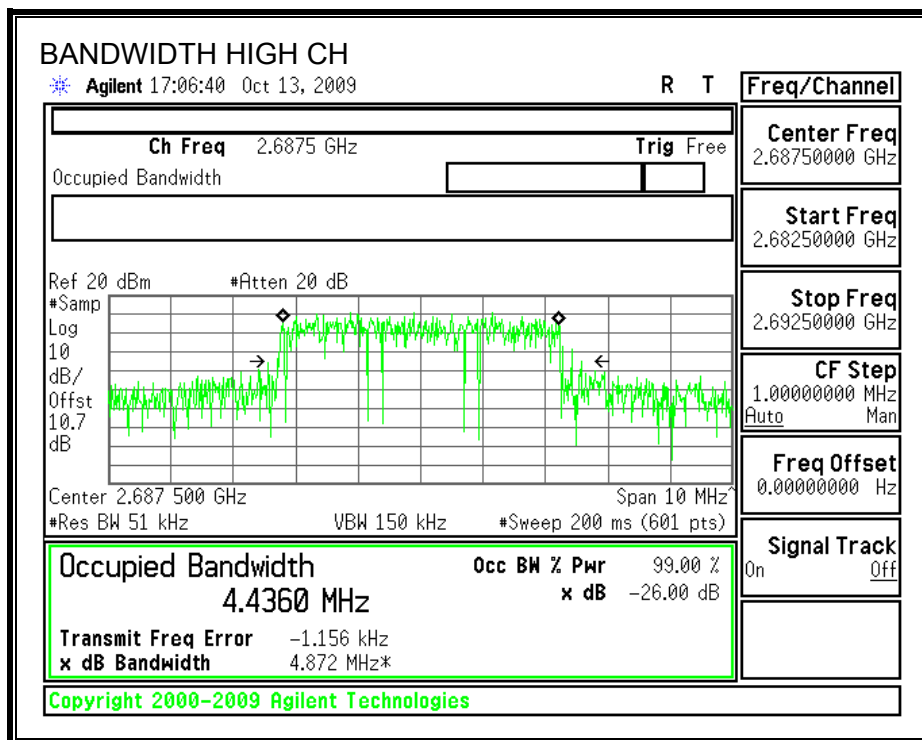




## 5MHz\_16QAM

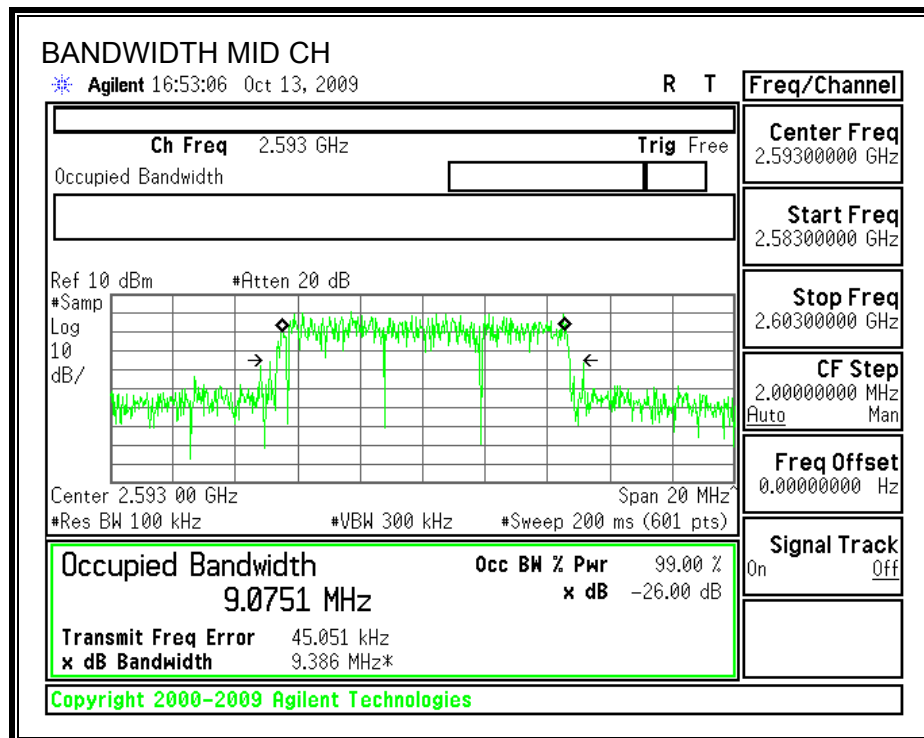
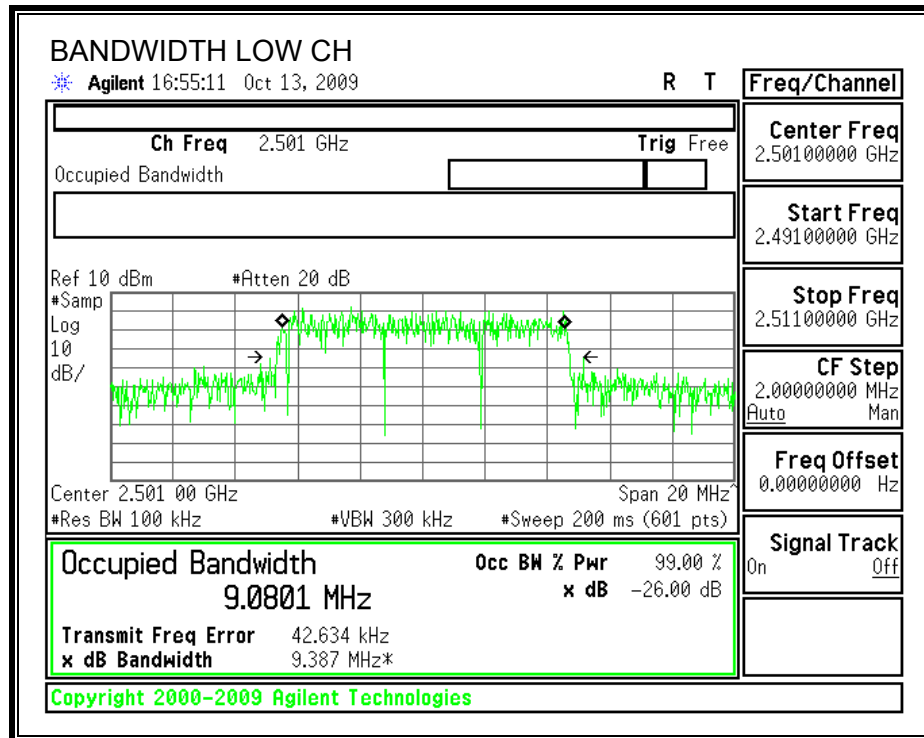
### 26 dB and 99% BANDWIDTH



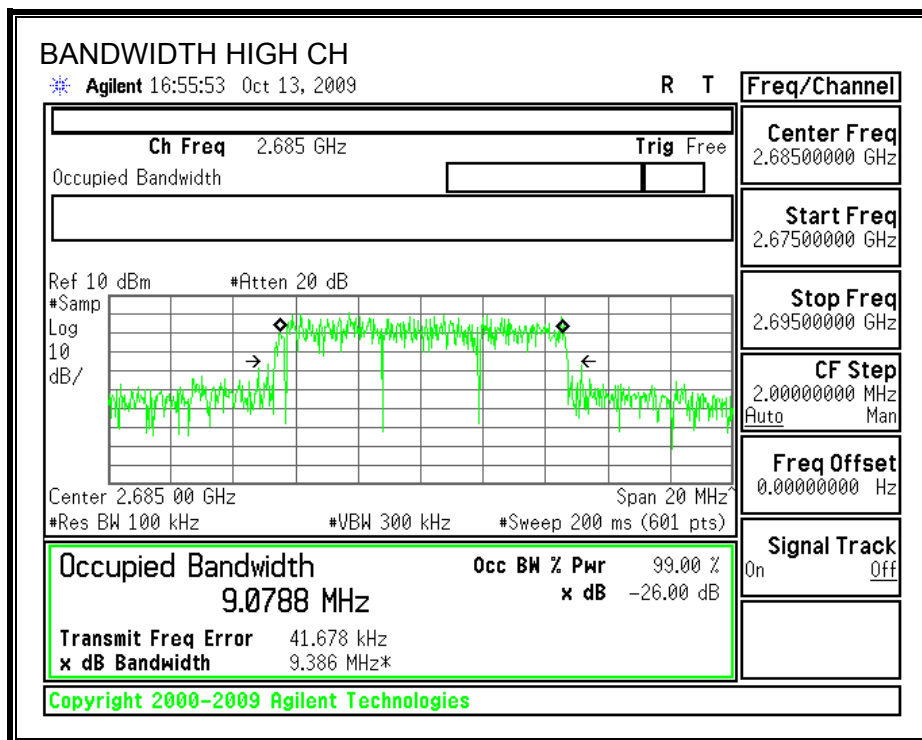


## 10MHz\_QPSK

### 26 dB and 99% BANDWIDTH

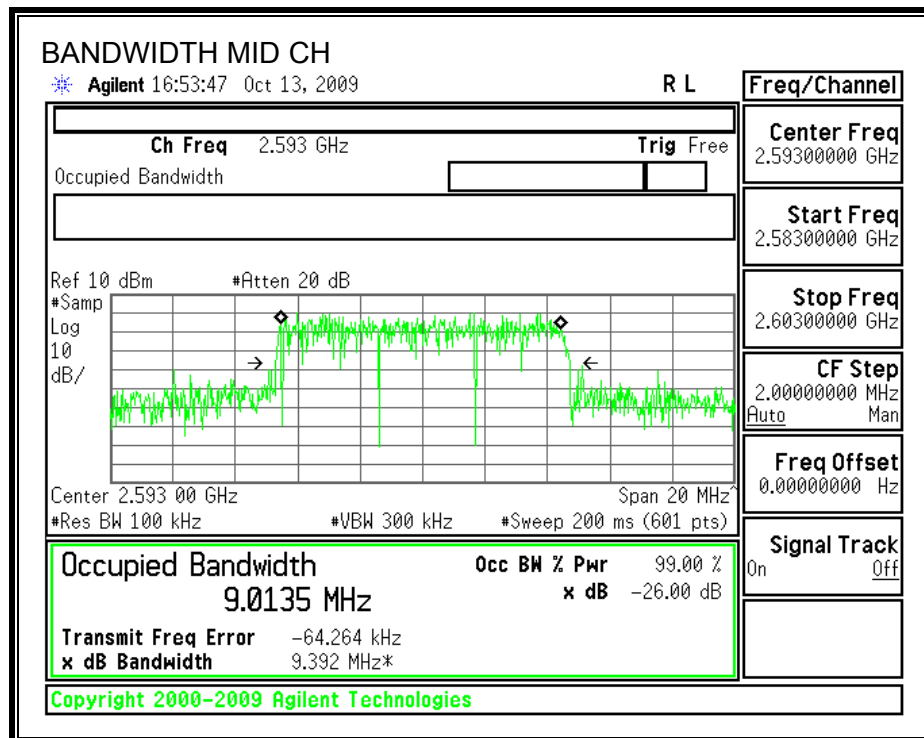
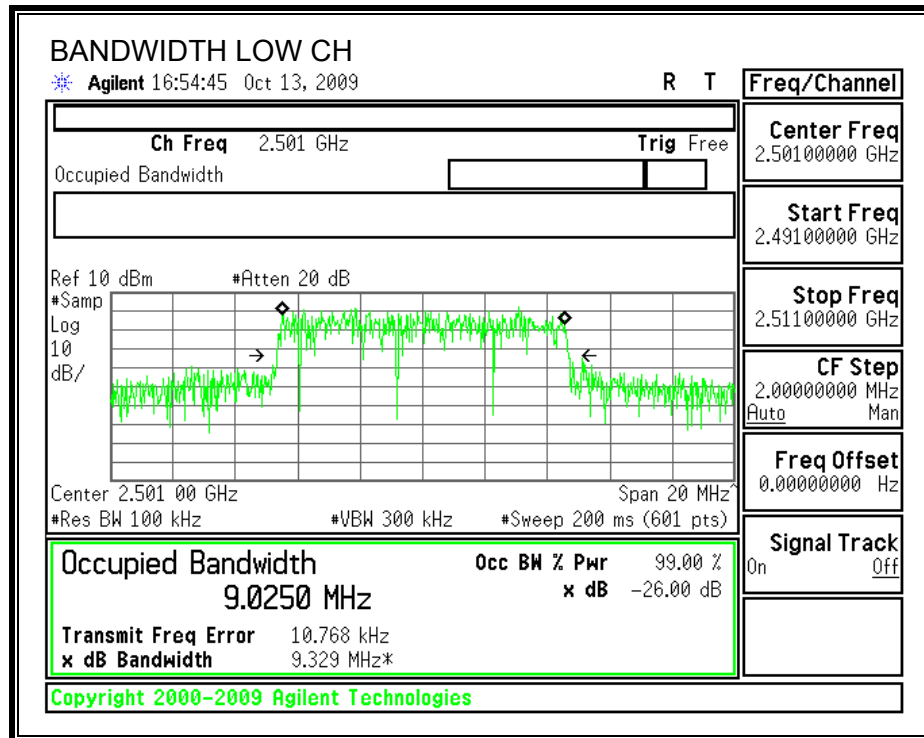


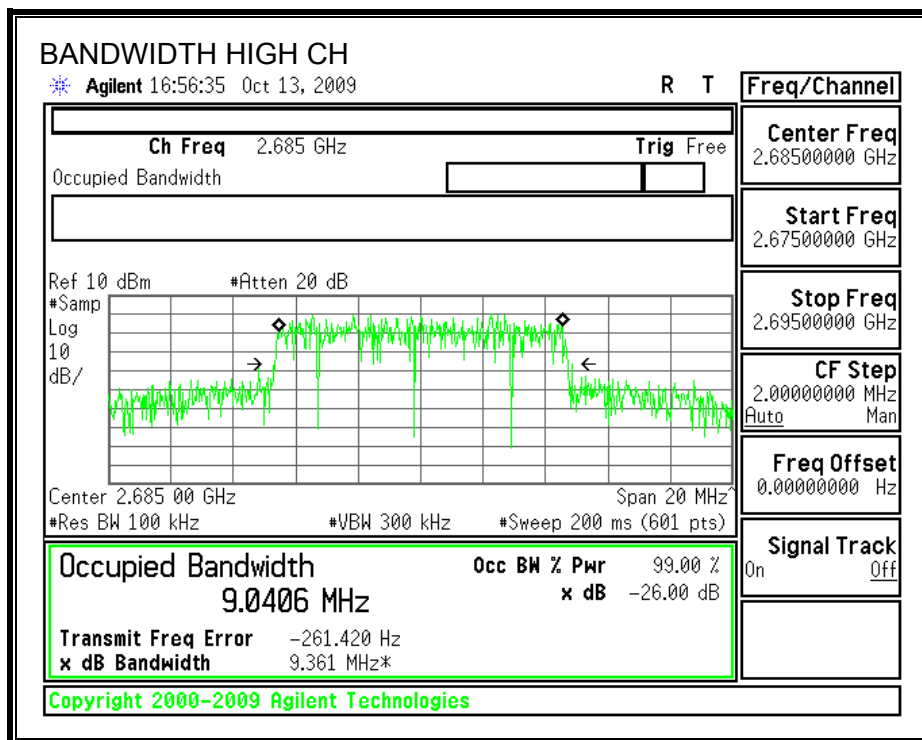




**10MHz\_16QAM**

**26 dB and 99% BANDWIDTH**





## 7.1.2. RF POWER OUTPUT AT THE ANTENNA TERMINALS

### LIMITS

§2.1046 & §27.50 (h)(2) Mobile and other user stations. Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.

### TEST PROCEDURE

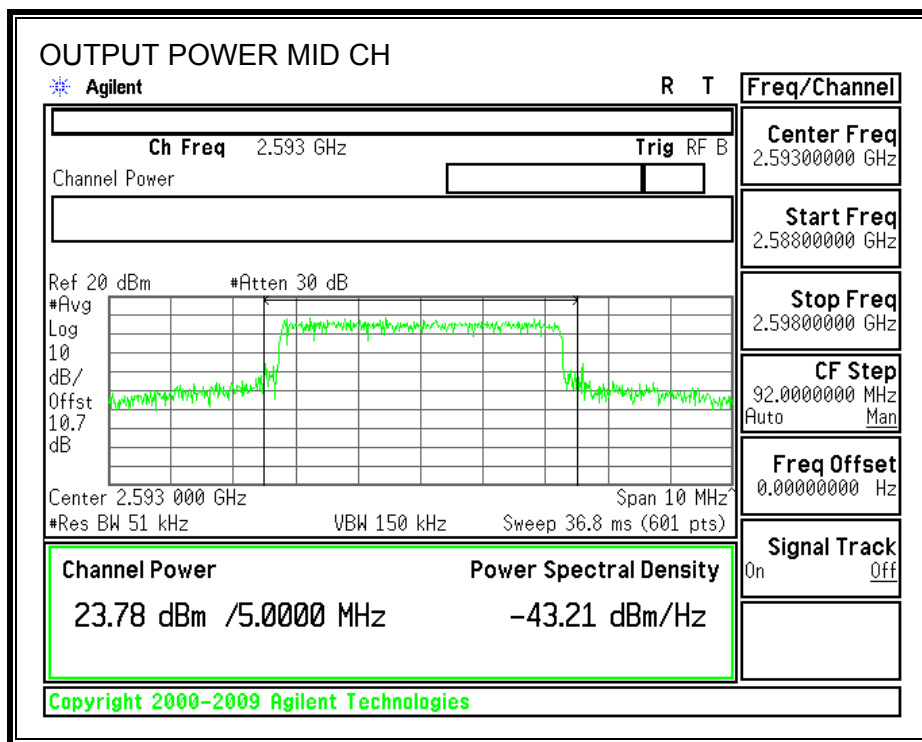
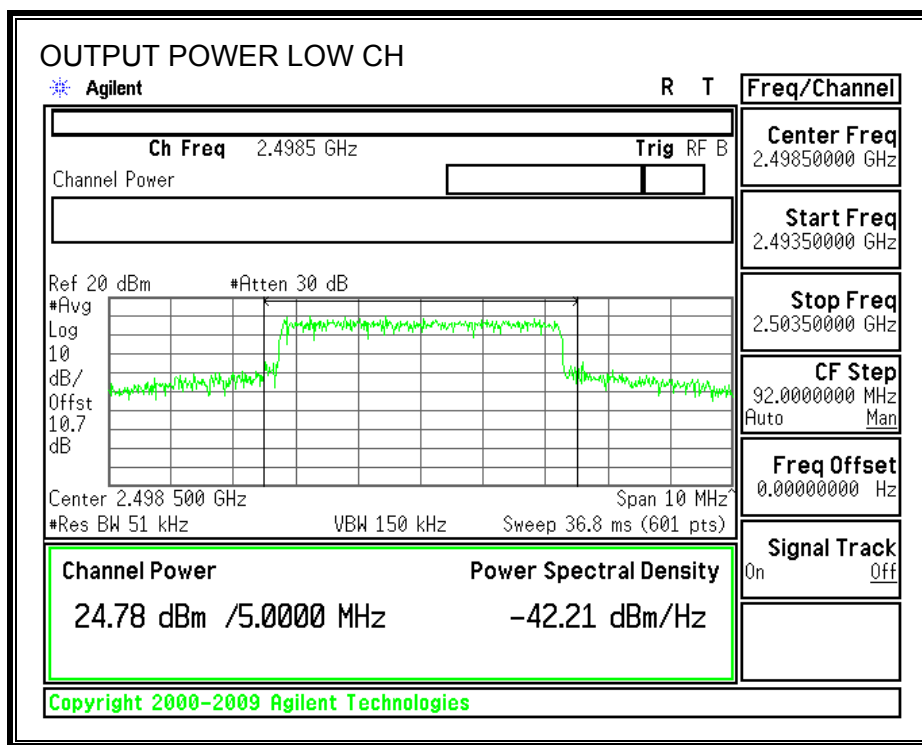
ANSI / TIA / EIA 603 Clause 2.2.17 and §27.50 (i)

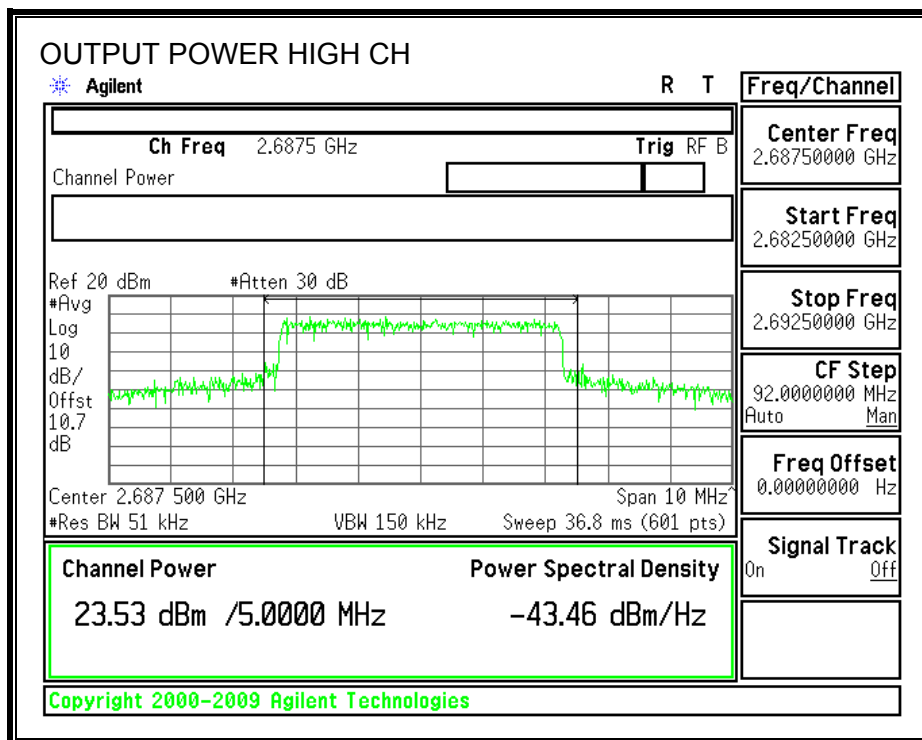
### RESULTS

Mode	Test Vector file name	Channel	Frequency (MHz)	Output powe (dBm)	Output powe (mW)
5MHz QPSK	T5D29U184Q12S85	Low	2498.5	24.78	300.61
		Middle	2593	23.78	238.78
		High	2687.5	23.53	225.42
5MHz 16QAM	T5D29U1816Q34S85	Low	2498.5	24.66	292.42
		Middle	2593	23.61	229.61
		High	2687.5	23.39	218.27
10MHz QPSK	T10D29U184Q12S175	Low	2501	24.61	289.07
		Middle	2593	23.65	231.74
		High	2685	23.31	214.29
10MHz 16QAM	T10D29U1816Q12S175	Low	2501	24.62	289.73
		Middle	2593	23.55	226.46
		High	2685	23.32	214.78

## 5MHz\_QPSK

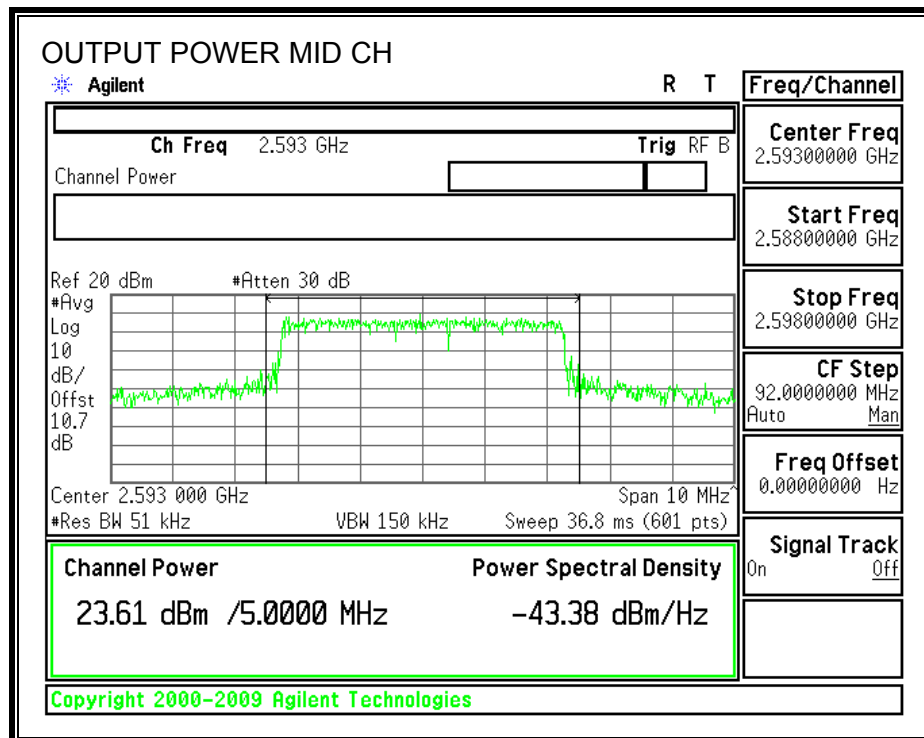
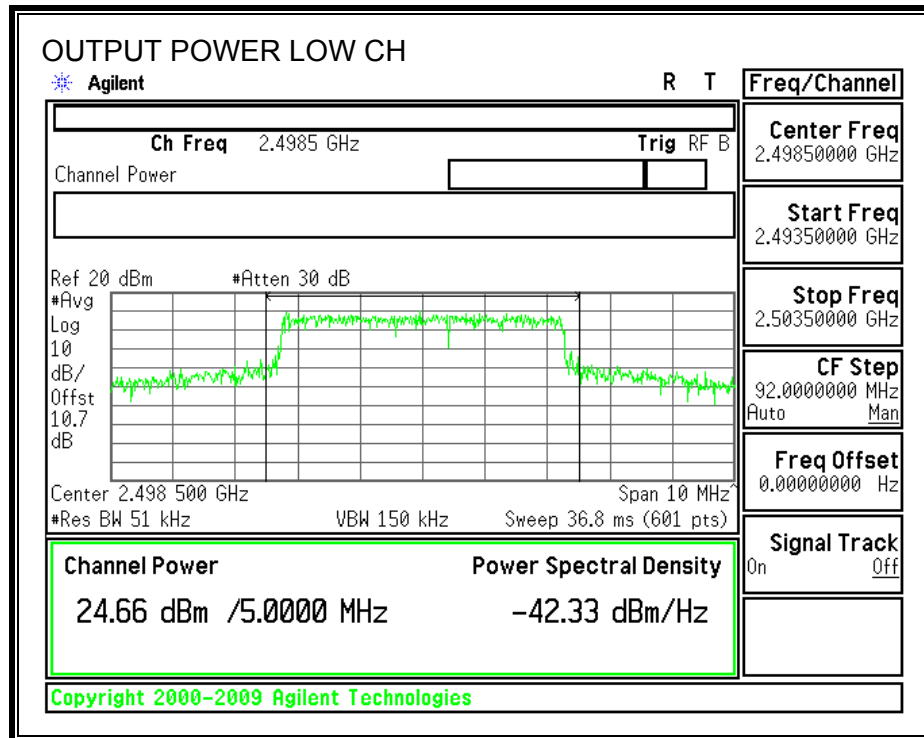
### OUTPUT POWER

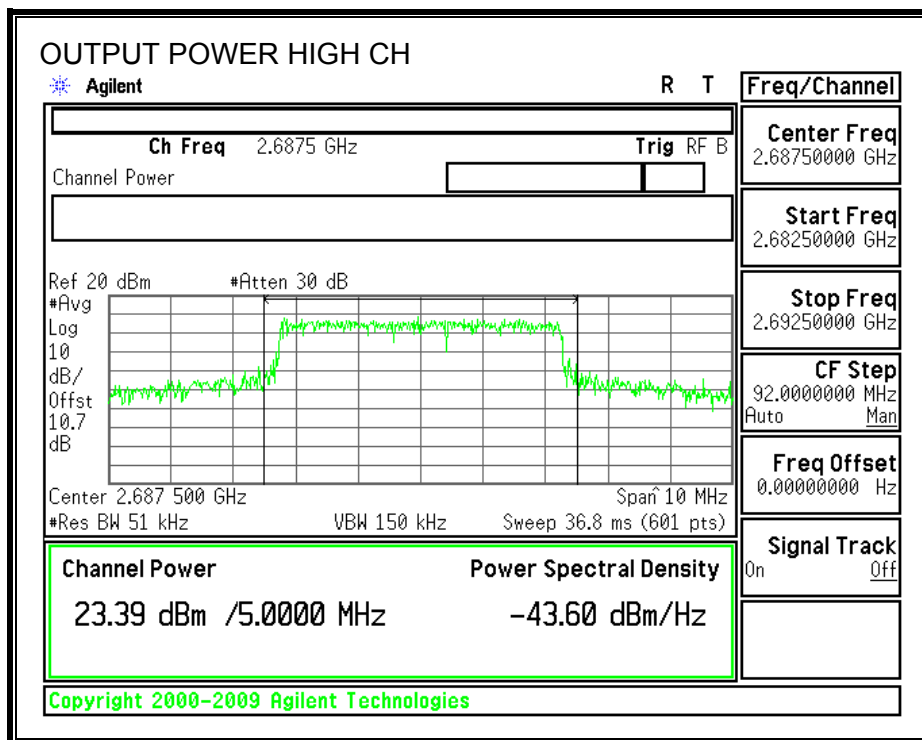




## 5MHz\_16QAM

### OUTPUT POWER

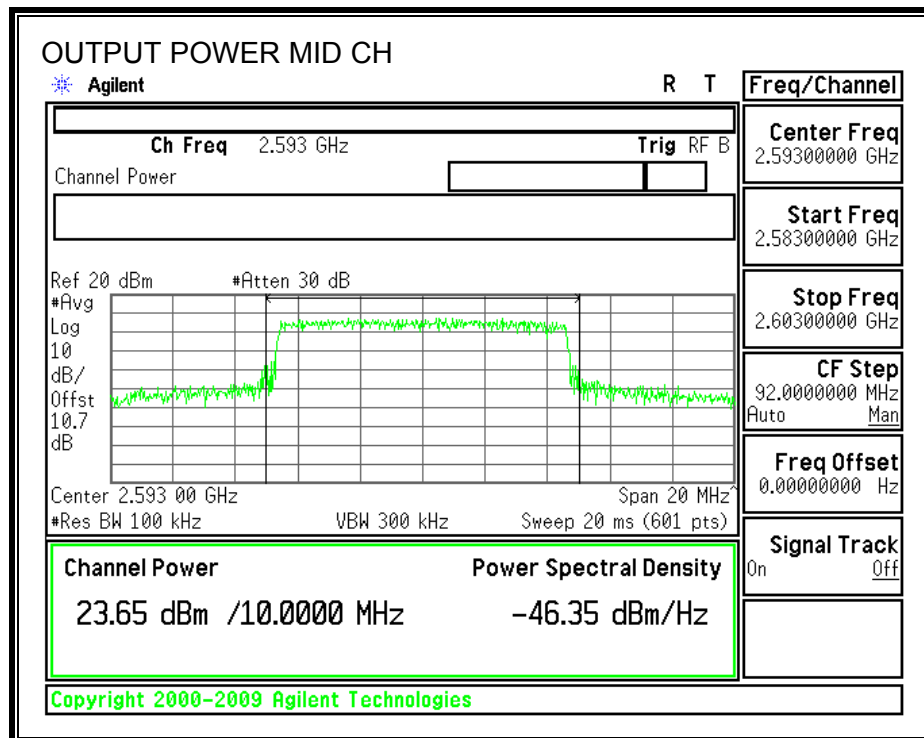
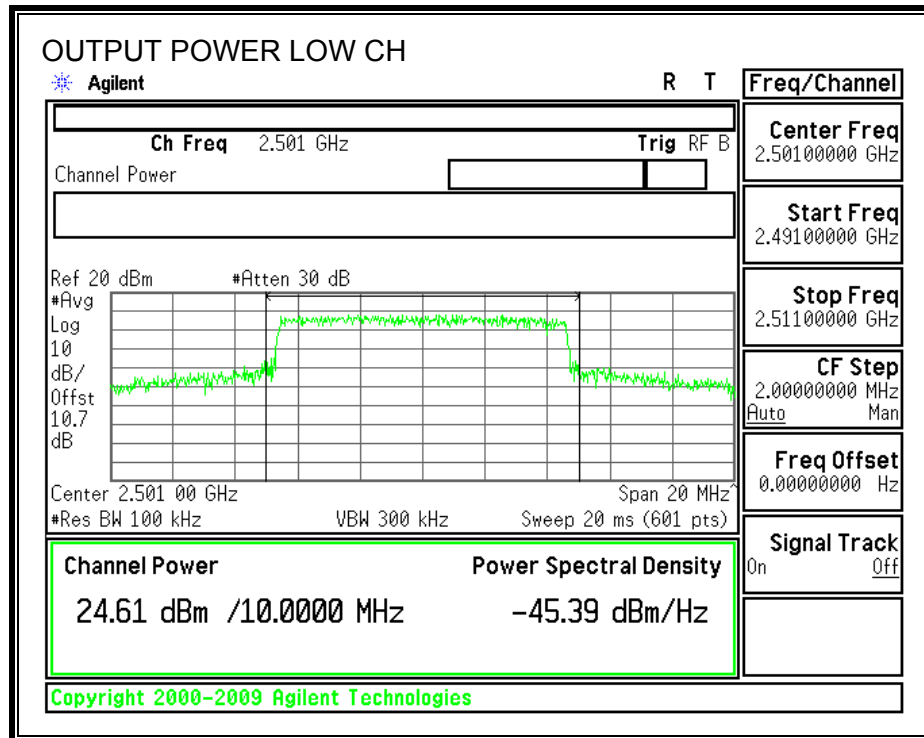


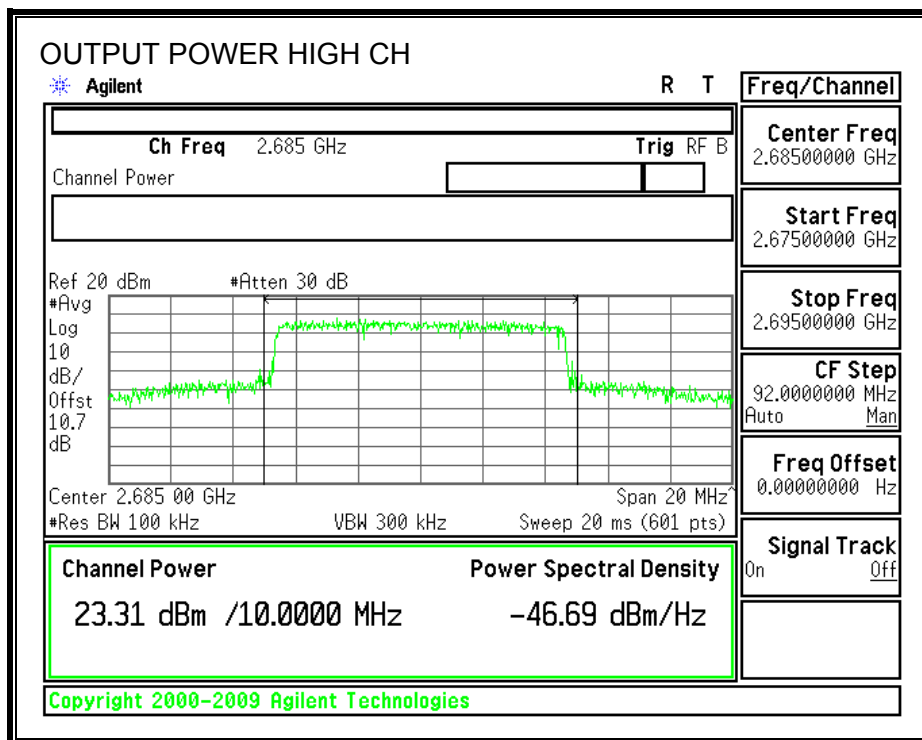




## 10MHz\_QPSK

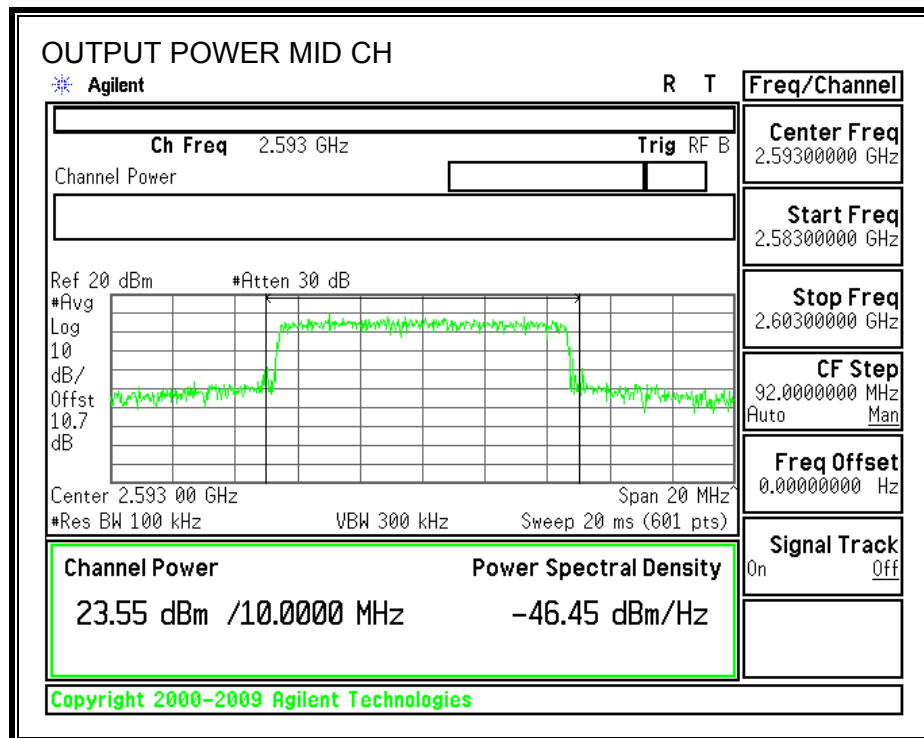
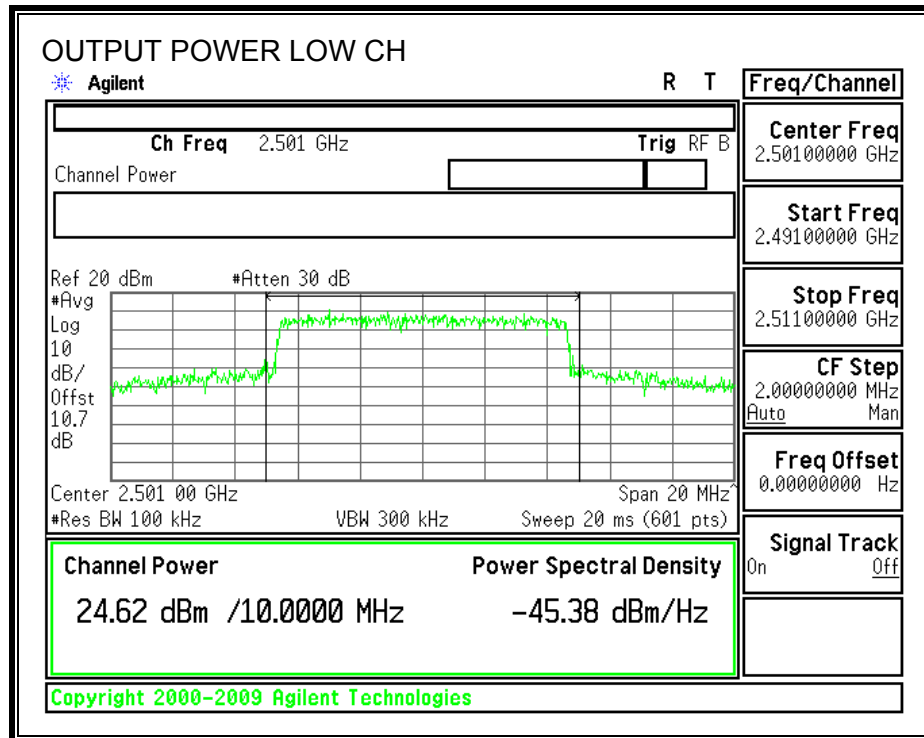
### OUTPUT POWER

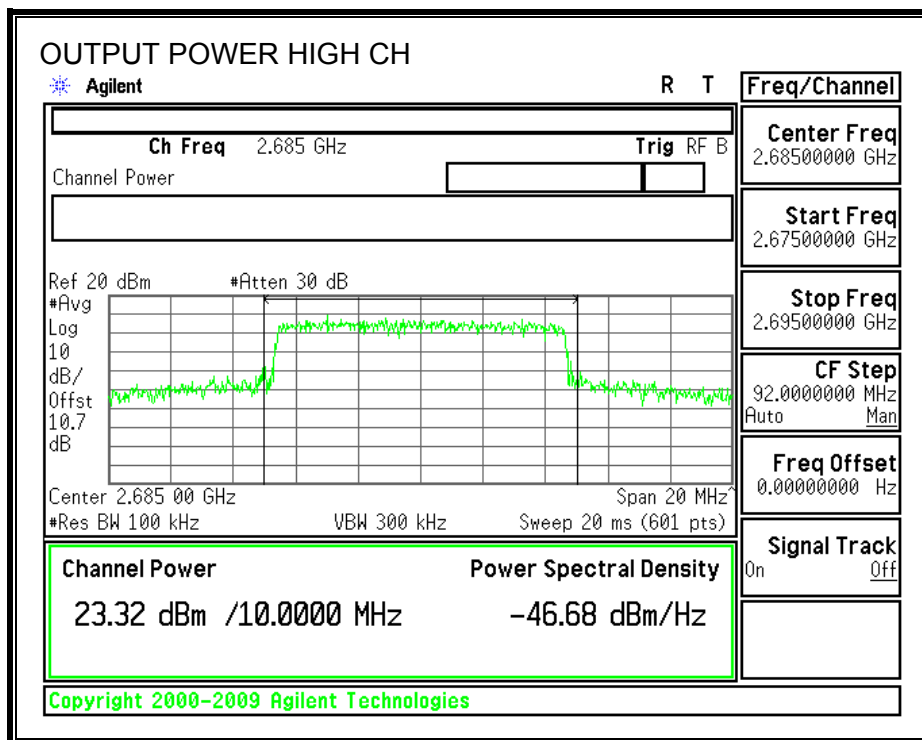




## 10MHz\_16QAM

### OUTPUT POWER





### **7.1.3. LIMITS OF CHANNEL EDGE**

#### **LIMITs**

§2.1051

§27.53 (m)(4)(6) For mobile digital stations, the attenuation factor shall be not less than  $43 + 10 \log (P)$  dB at the channel edge, the limit of emission equal to -13dBm, and  $55 + 10 \log (P)$  dB at 5.5 megahertz from the channel edges, the limit of emission equal to -25dBm.

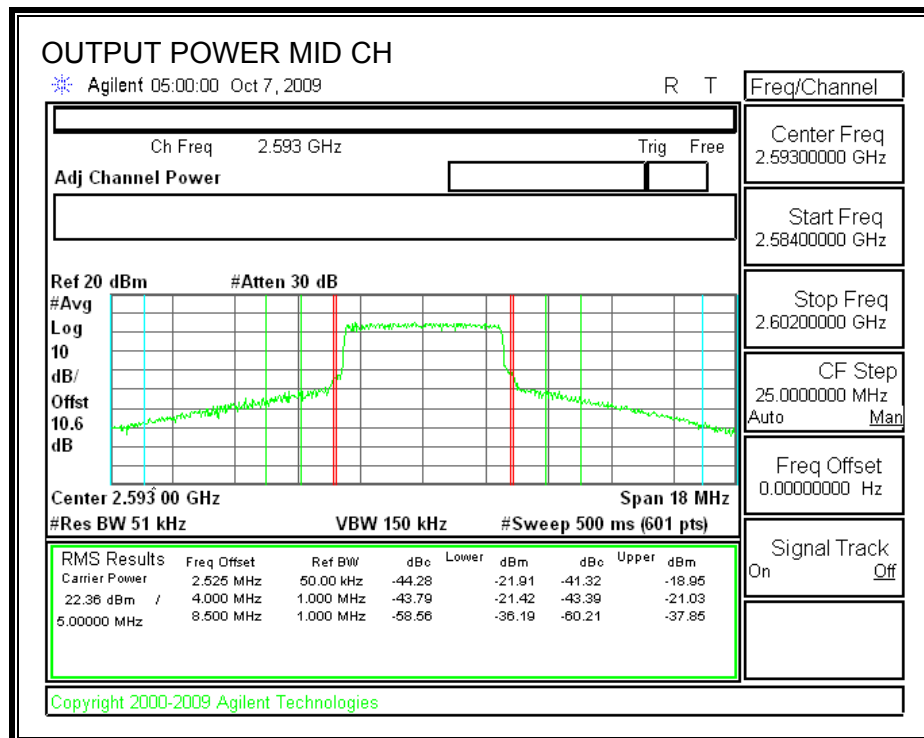
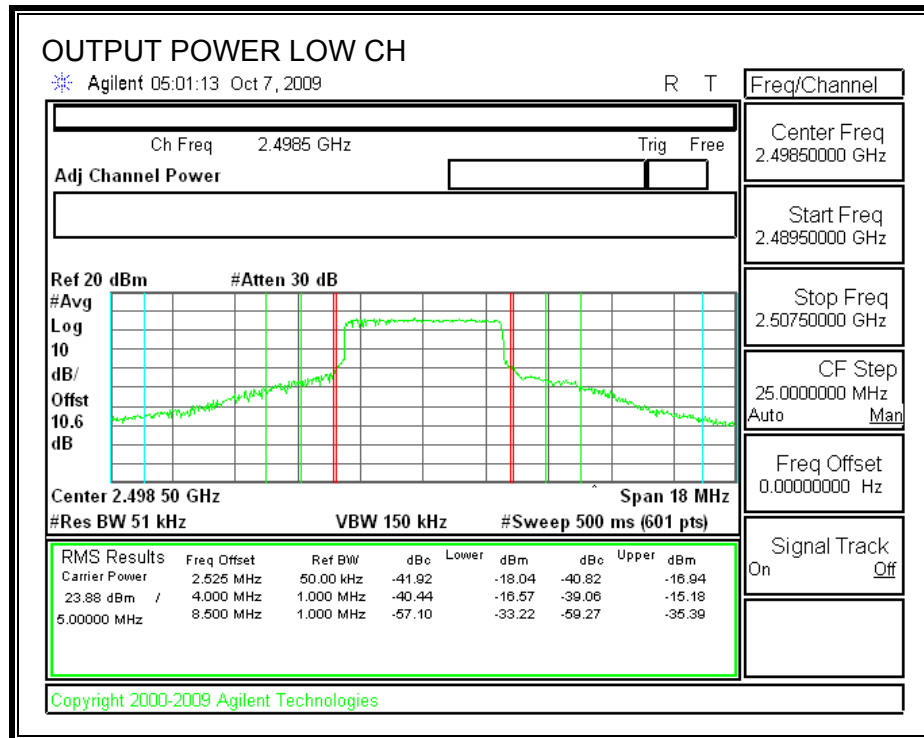
#### **TEST PROCEDURE**

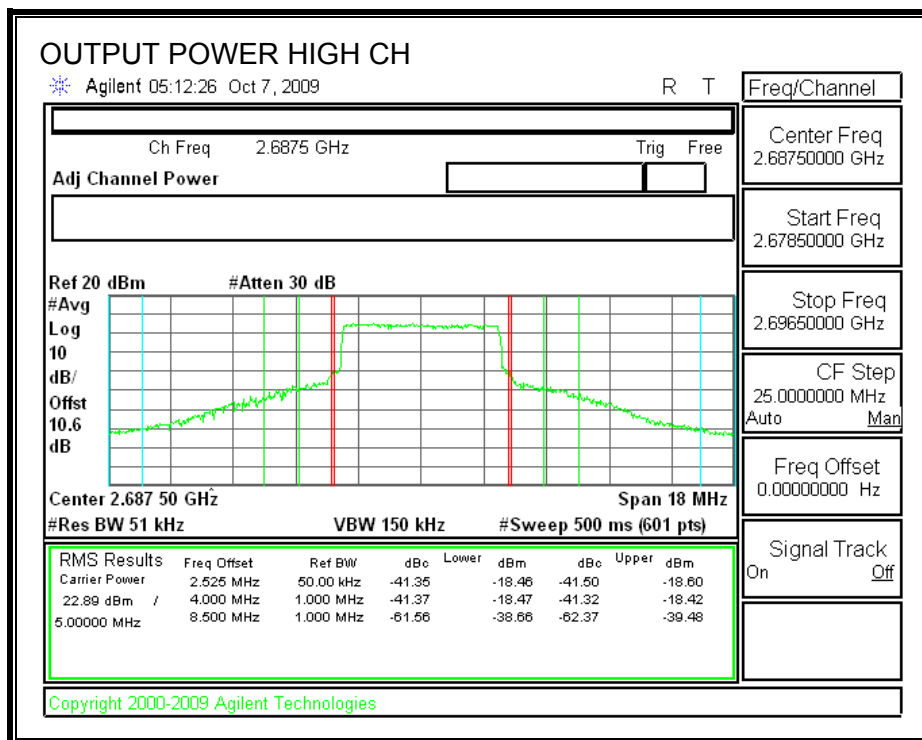
ANSI / TIA / EIA 603 Clause 3.2.12

#### **RESULTS**

## 5MHz\_QPSK

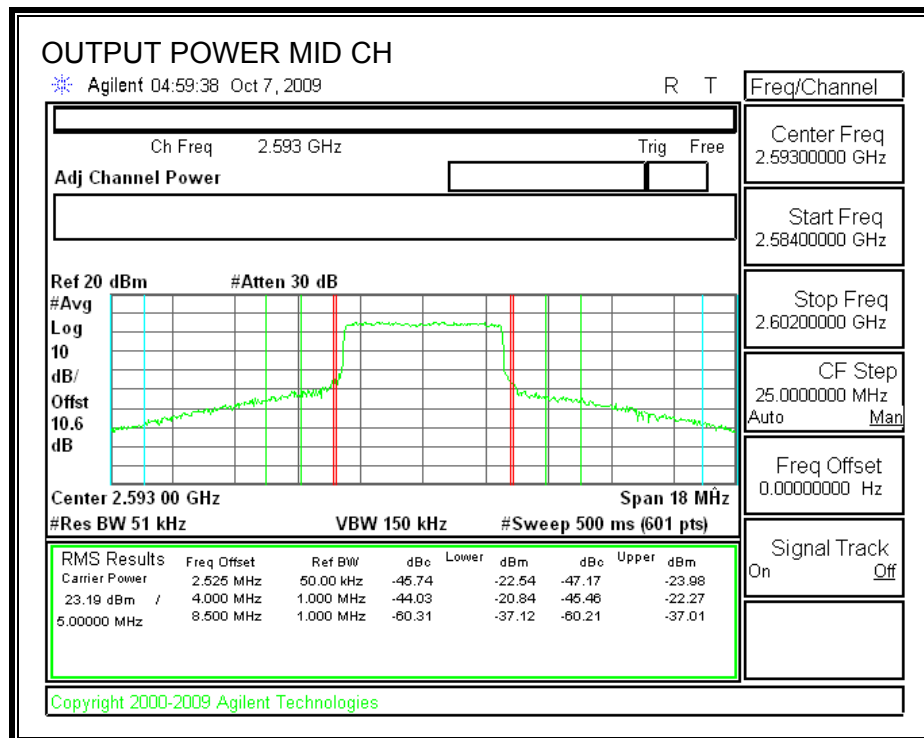
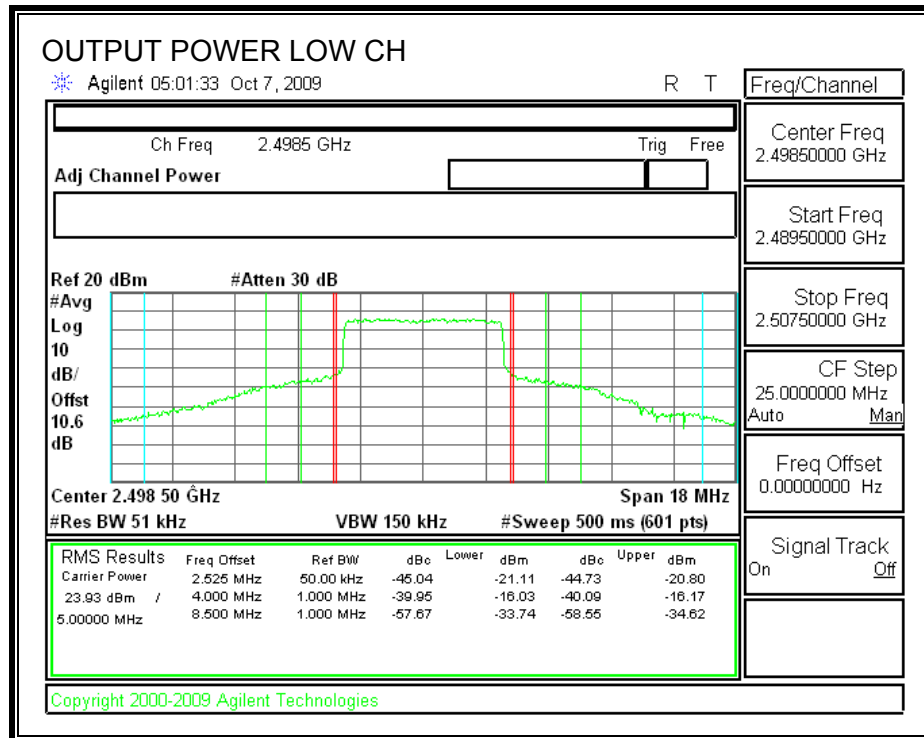
### OUTPUT POWER



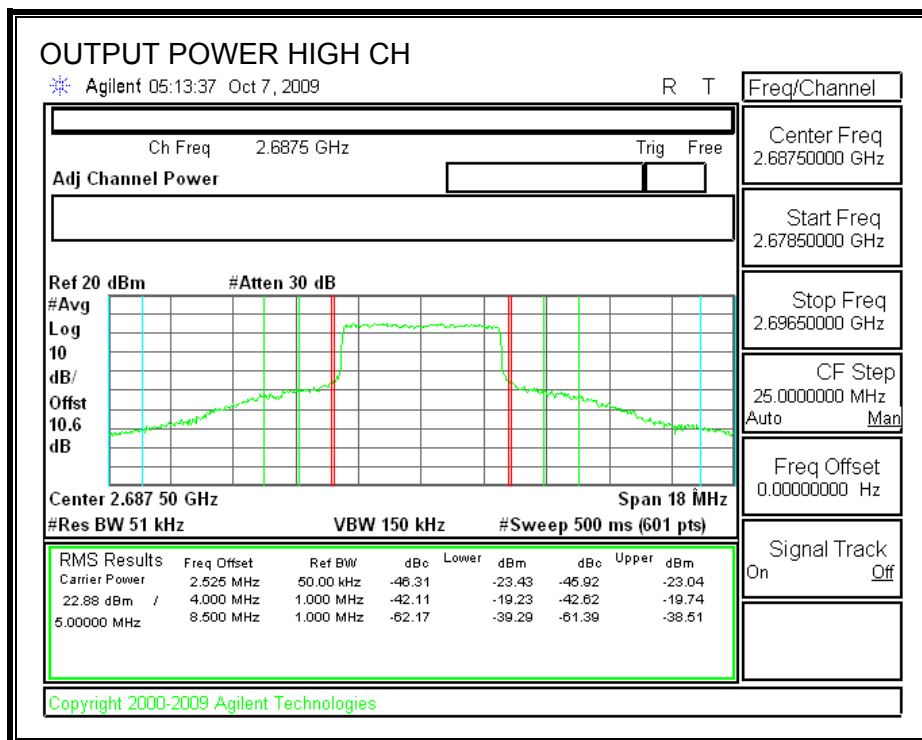


## 5MHz\_16QAM

### OUTPUT POWER

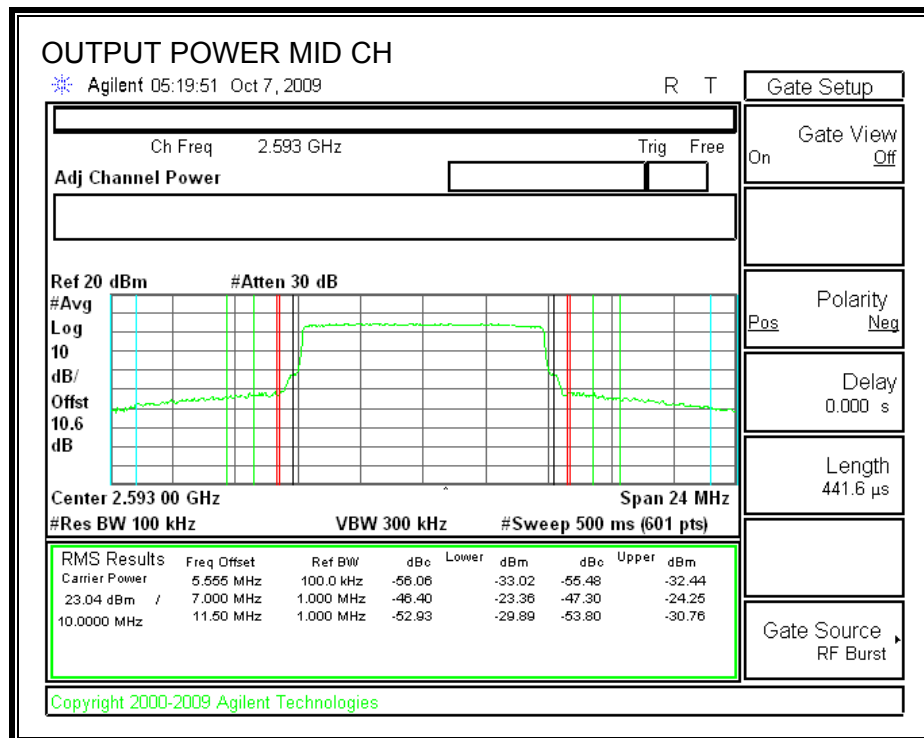
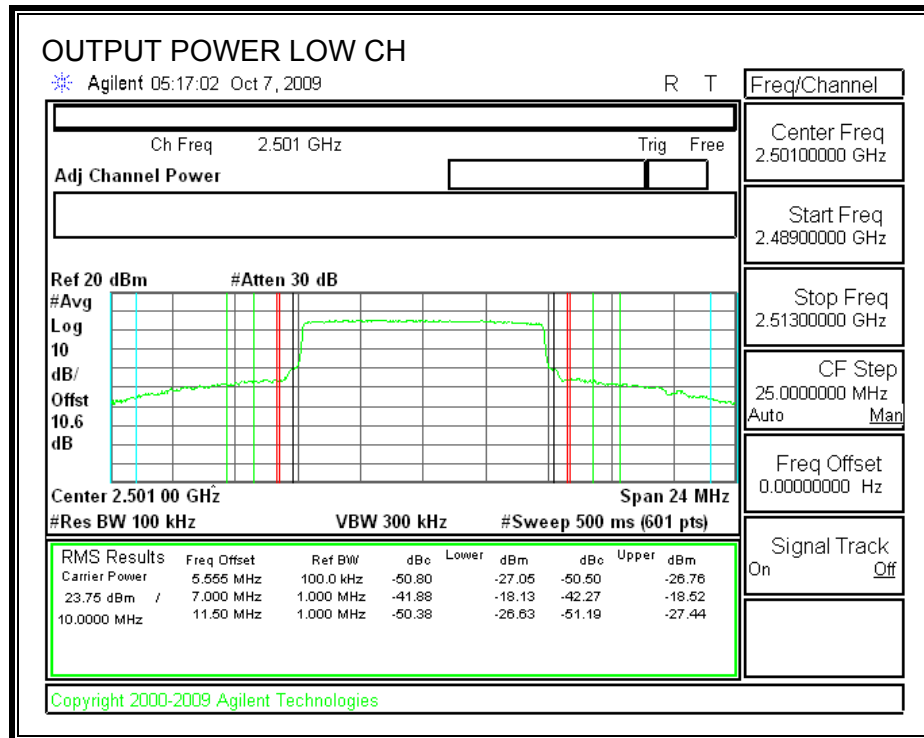


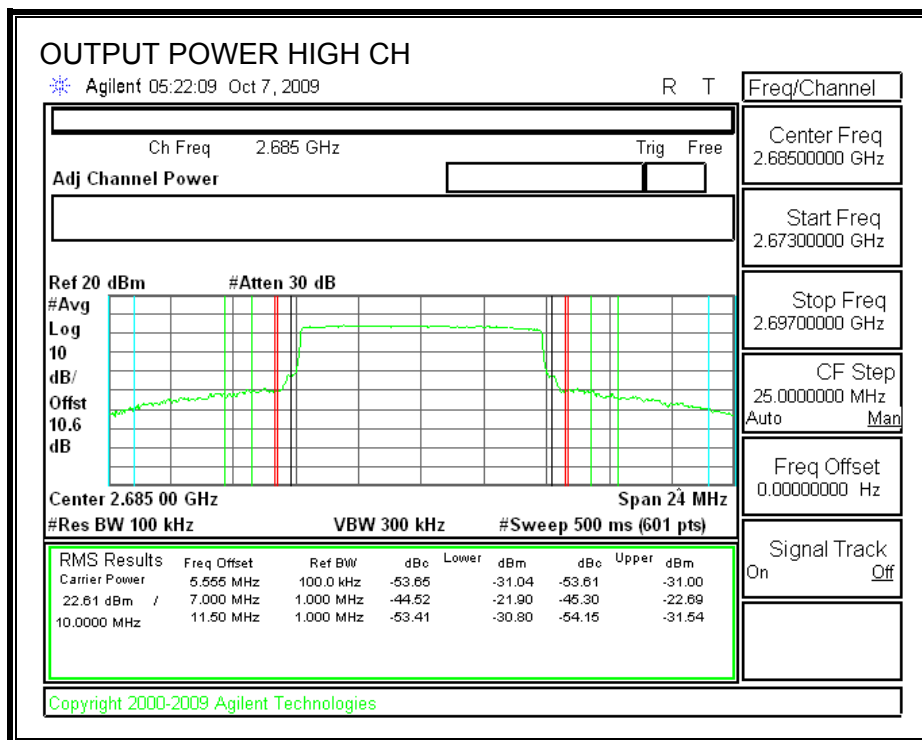




## 10MHz\_QPSK

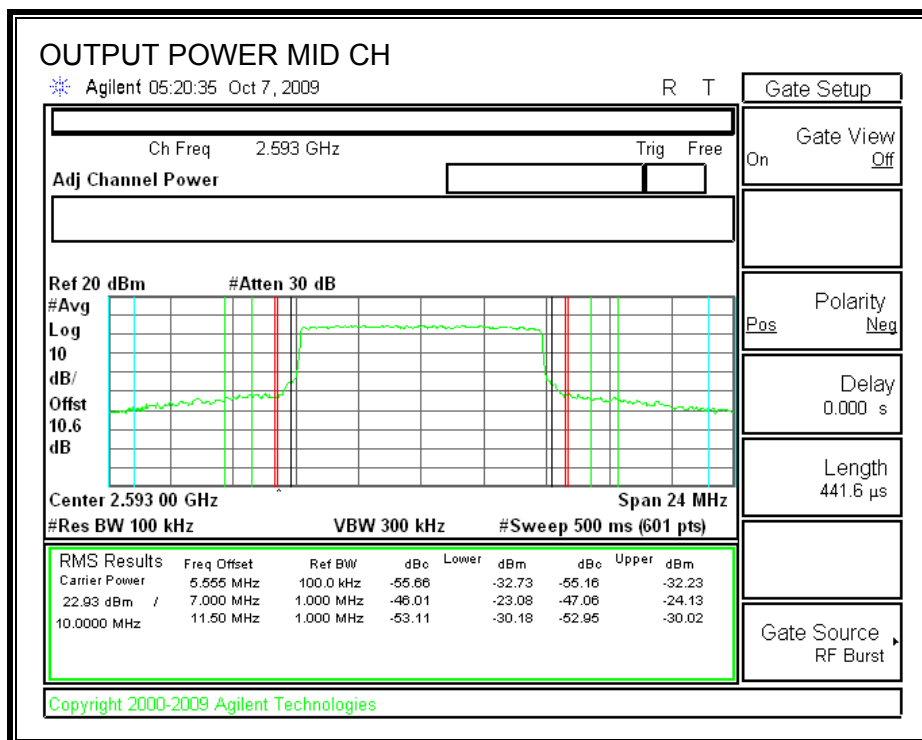
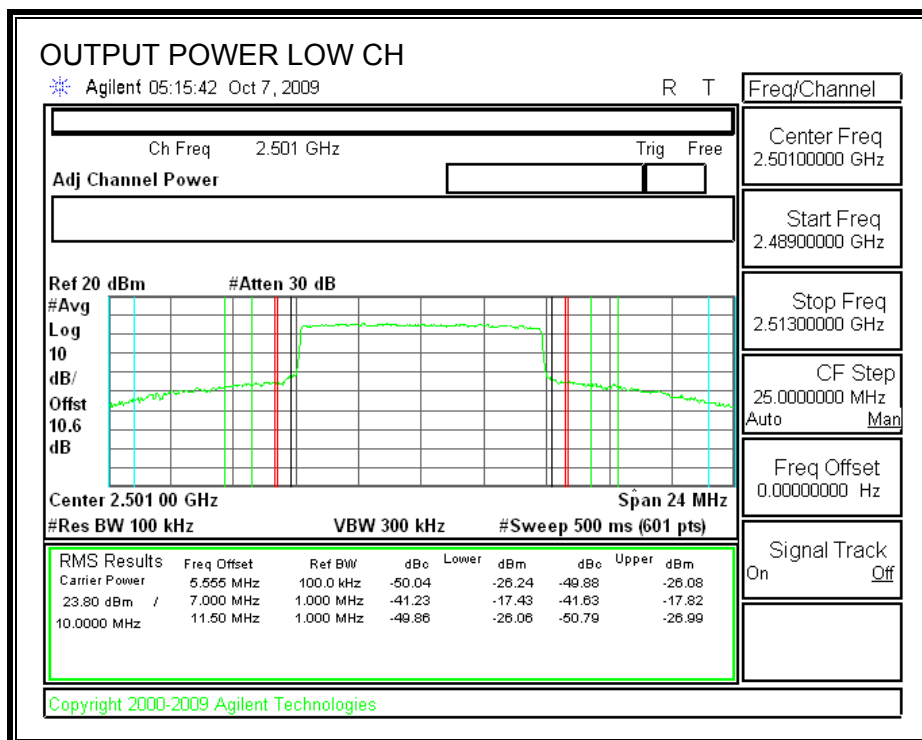
### OUTPUT POWER

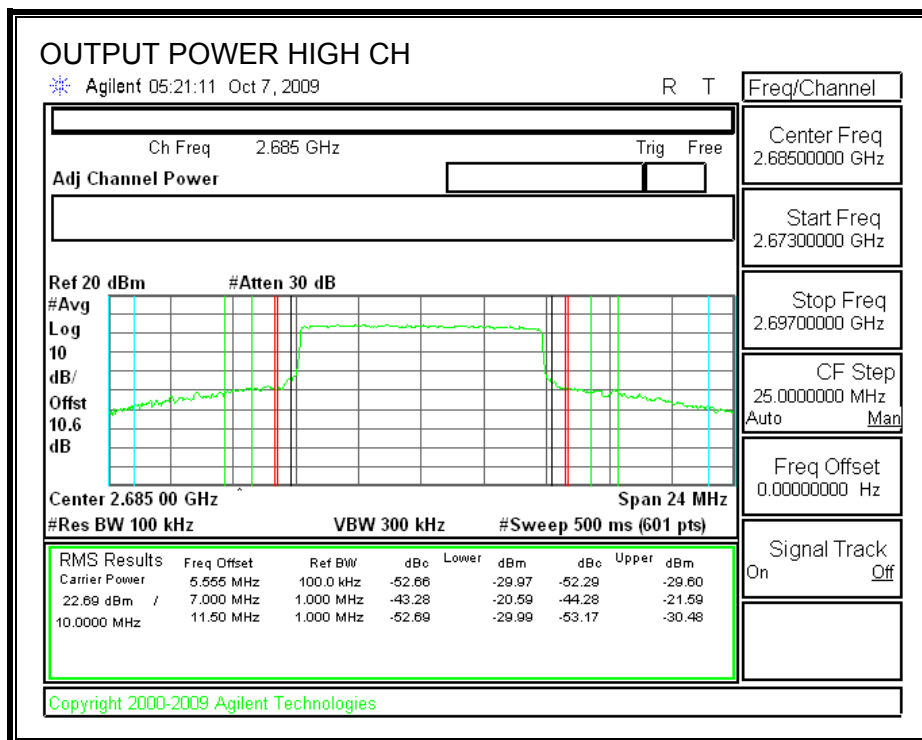




## 10MHz\_16QAM

### OUTPUT POWER





#### **7.1.4. CONDUCTED SPURIOUS EMISSIONS**

##### **LIMIT**

§2.1051

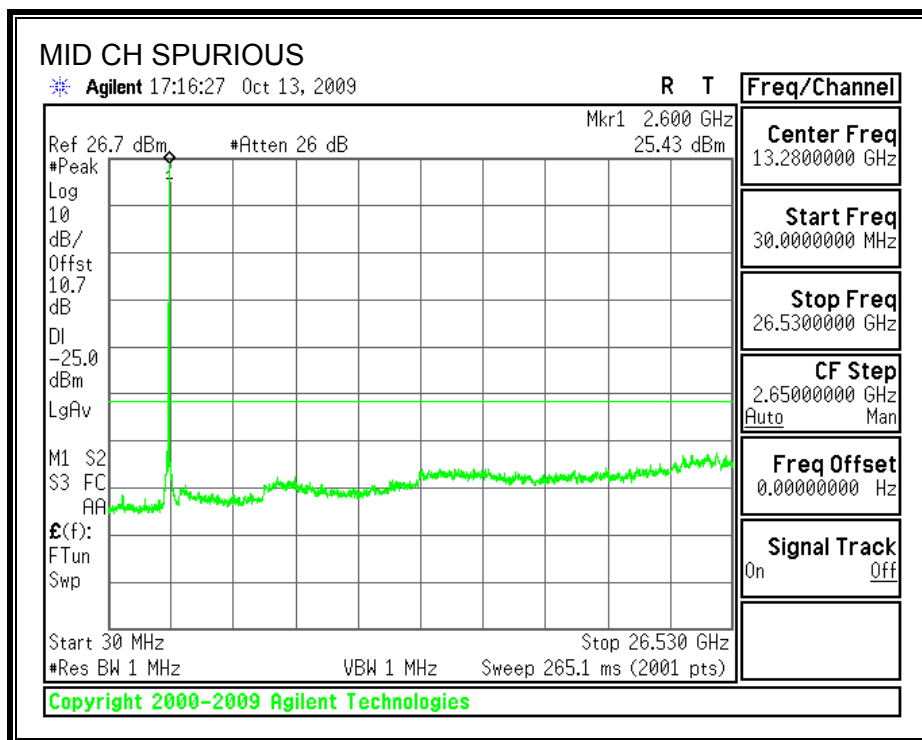
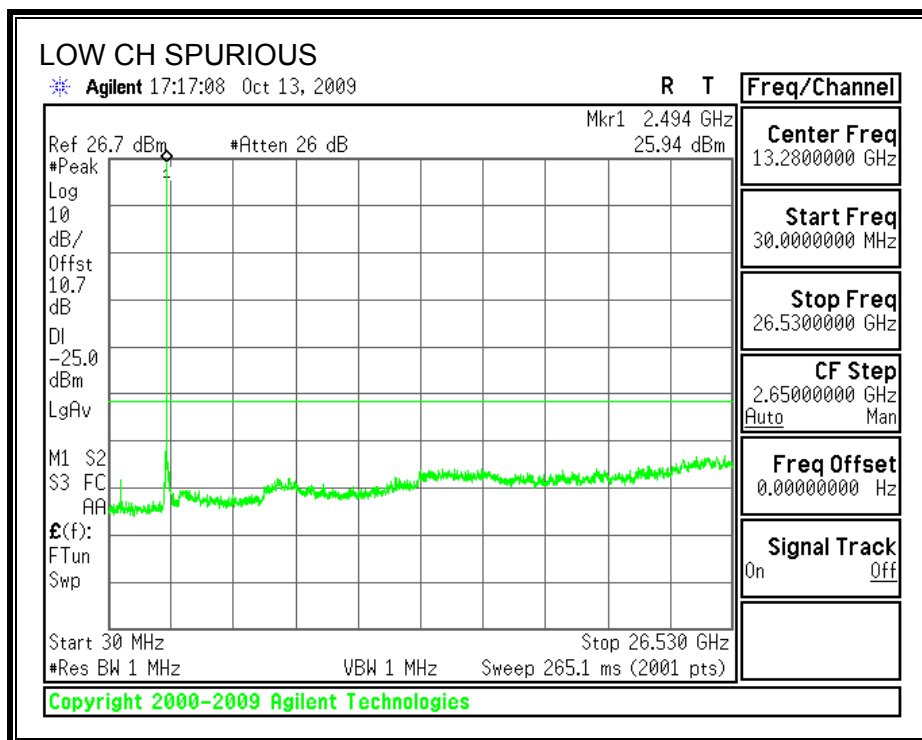
§27.53 (m)(4)(6) For mobile digital stations, the attenuation factor shall be not less than  $43 + 10 \log (P)$  dB at the channel edge and  $55 + 10 \log (P)$  dB at 5.5 megahertz from the channel edges.

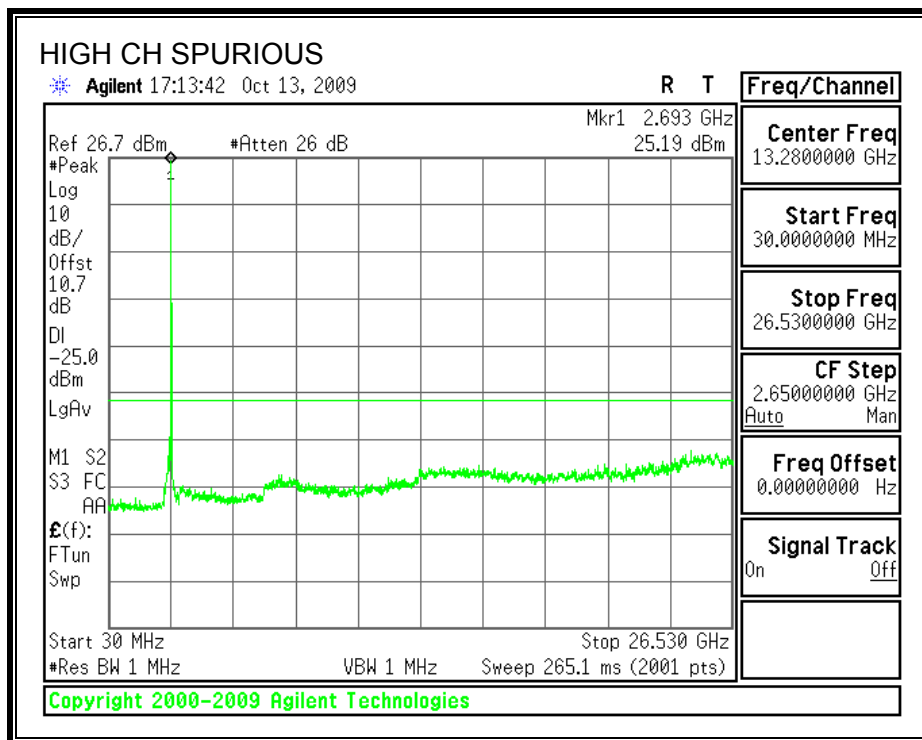
##### **TEST PROCEDURE**

ANSI / TIA / EIA 603 Clause 3.2.12 & FCC 27

## RESULTS

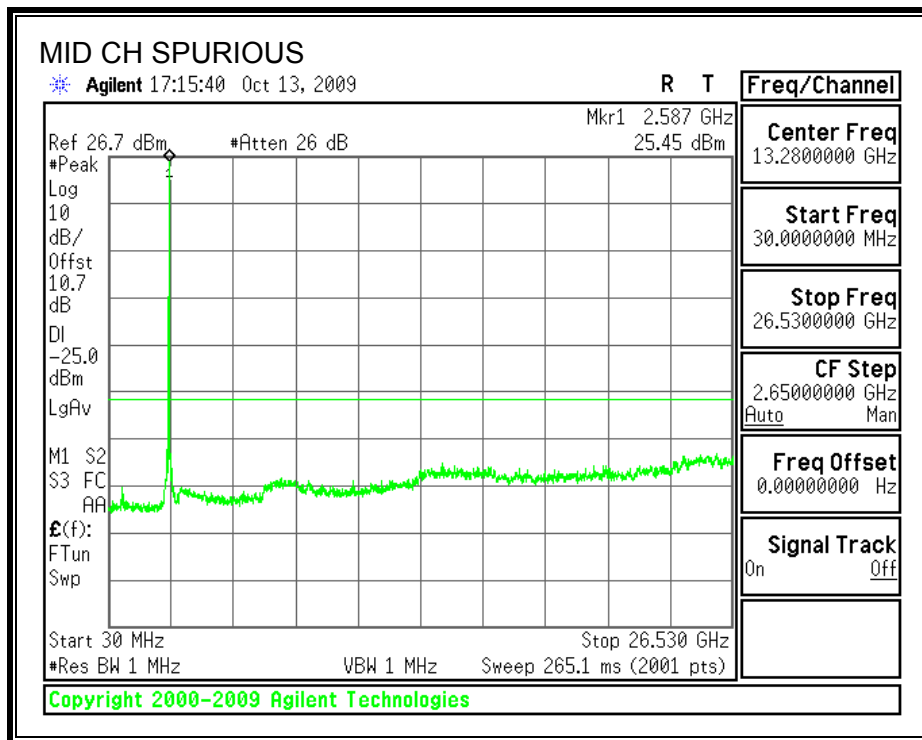
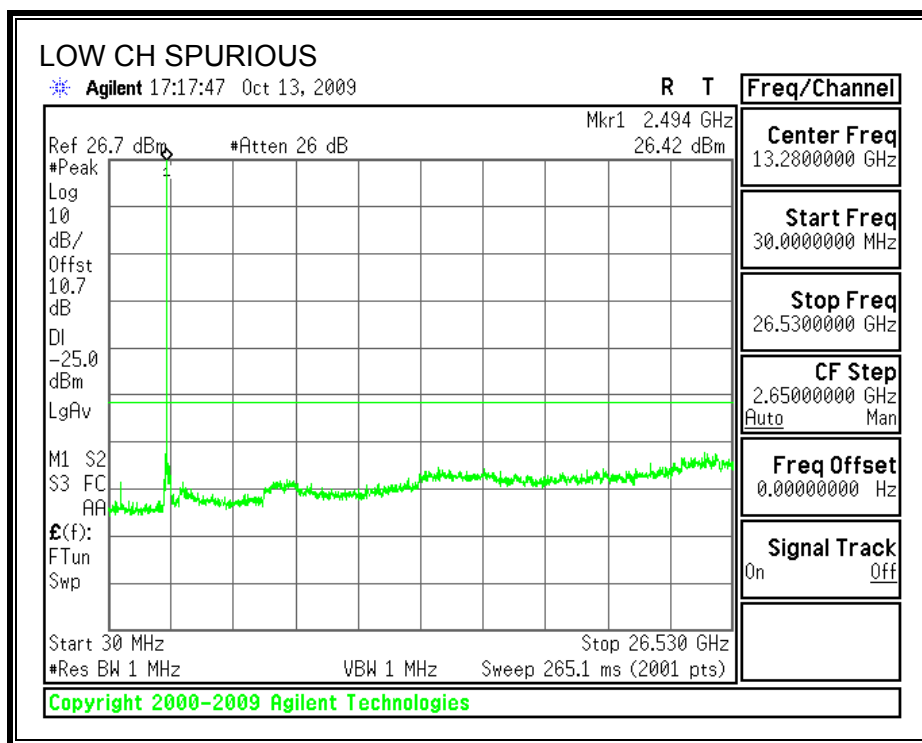
### 5MHz\_QPSK

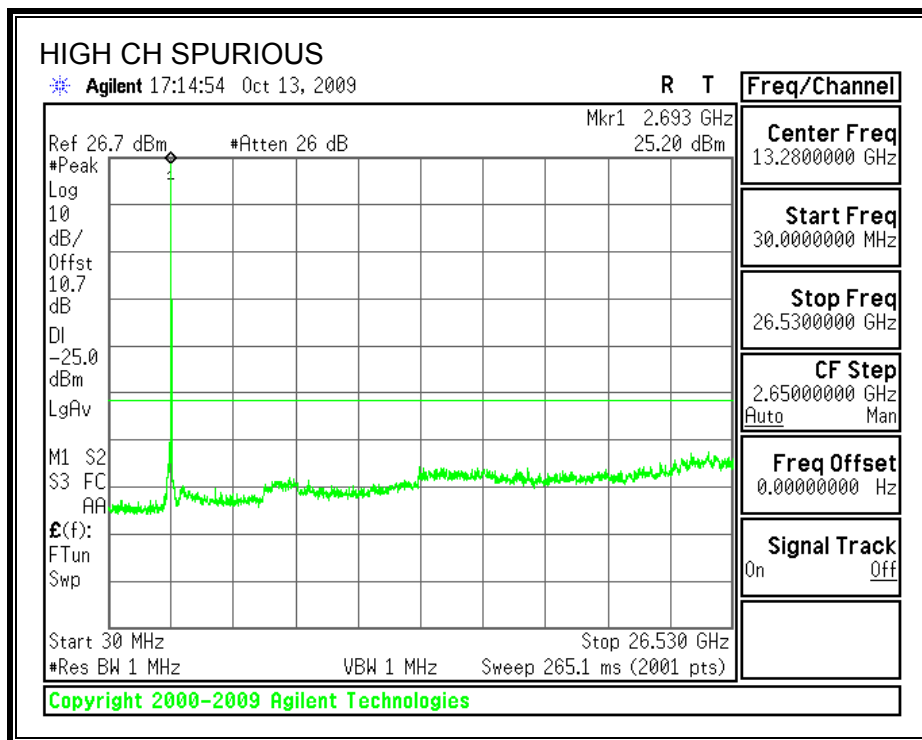




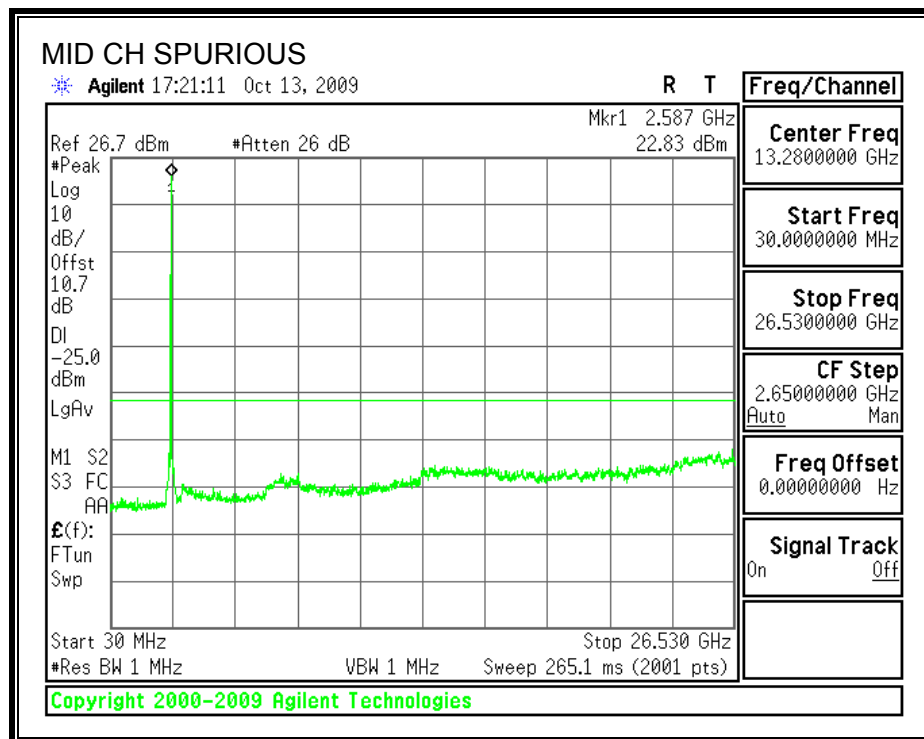
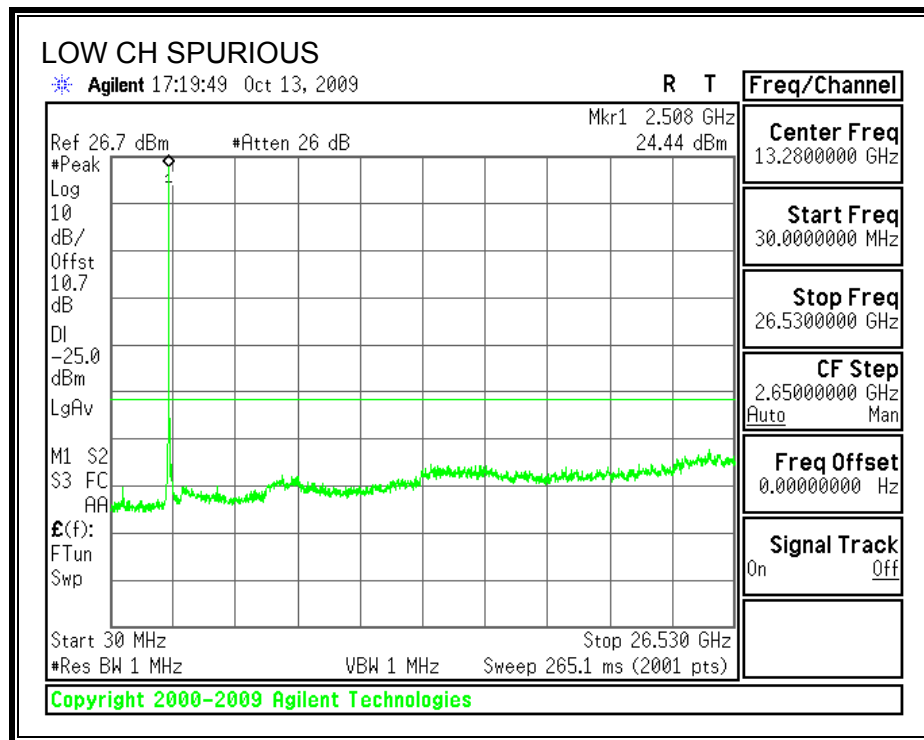


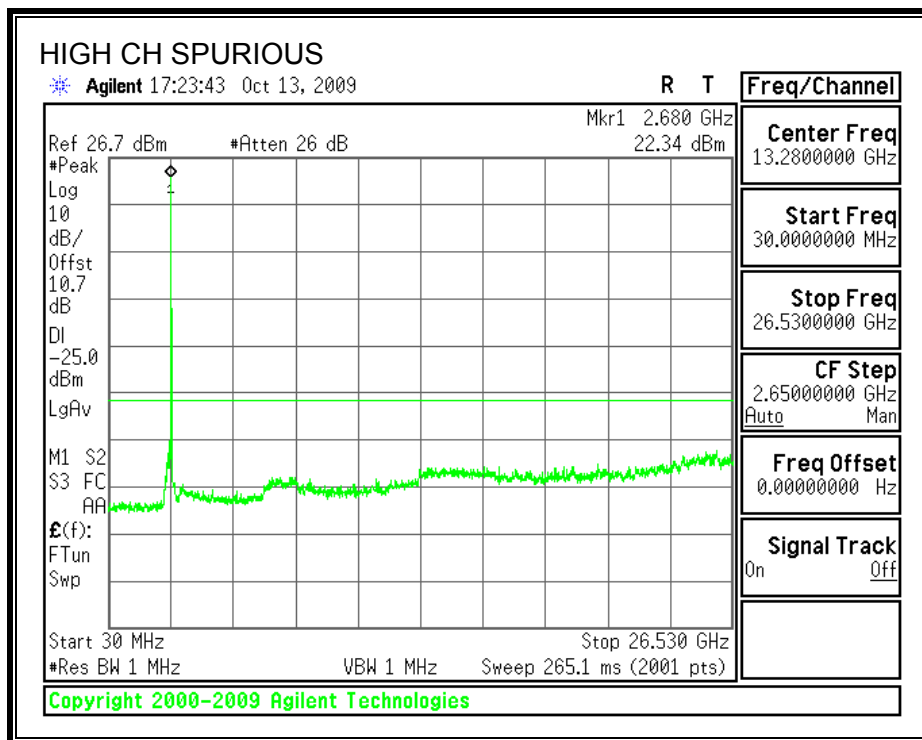
## 5MHz\_16QAM



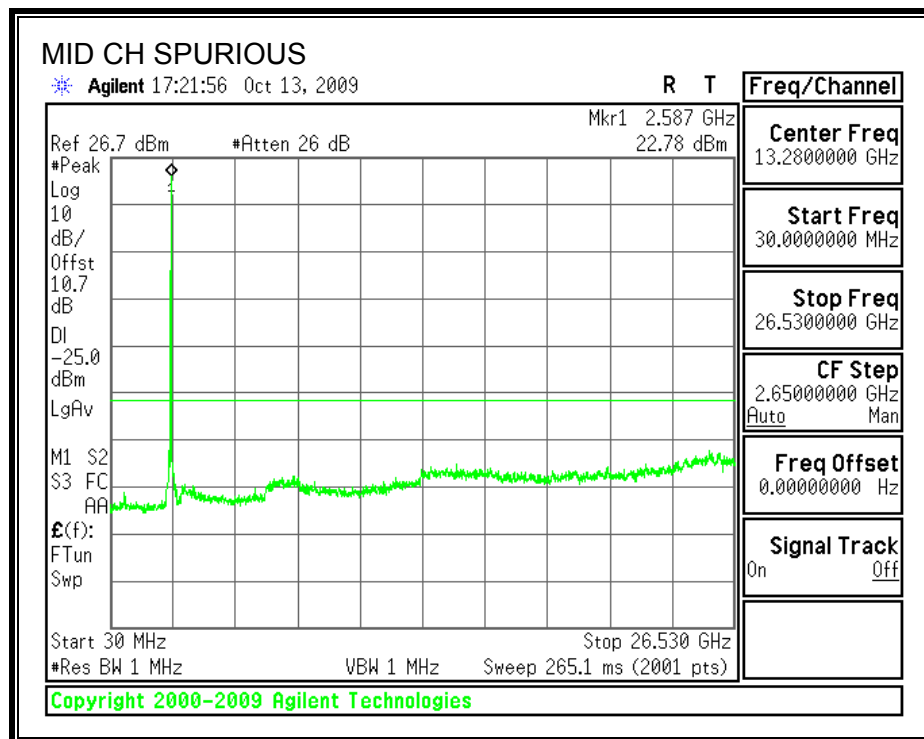
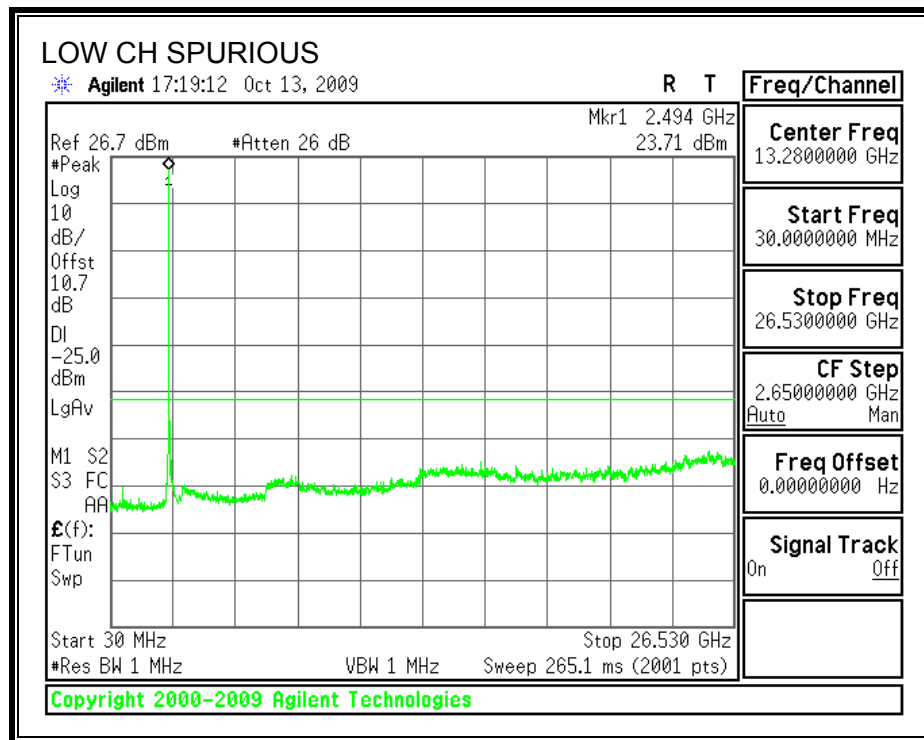


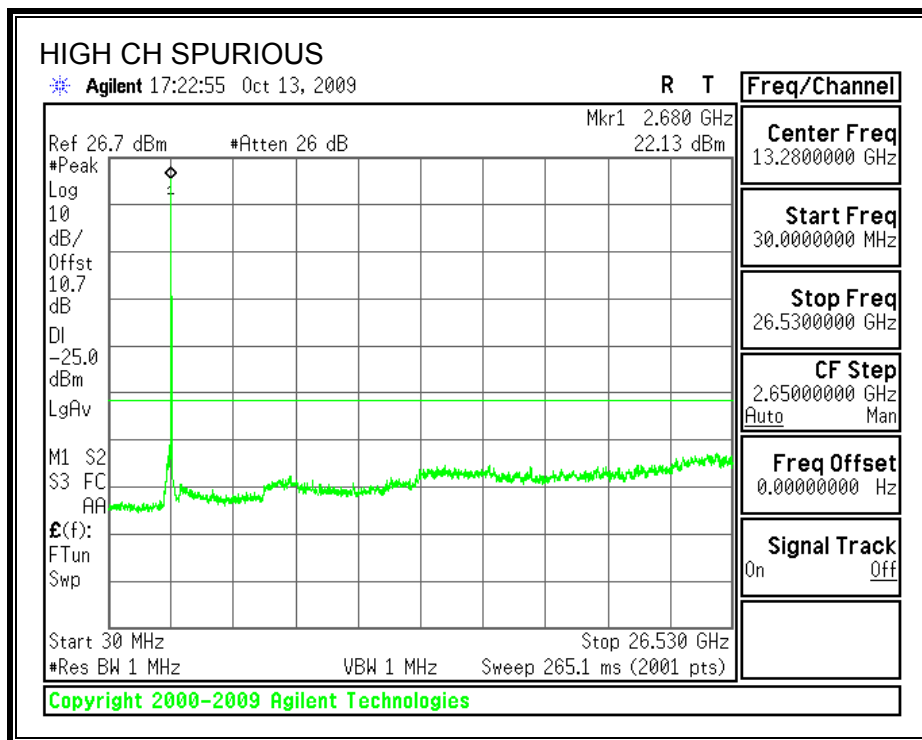
## 10MHz\_QPSK





10MHz\_16QAM





## 7.1.5. FREQUENCY STABILITY MEASUREMENT

### LIMIT

§27.54 & 2.1055 Frequency stability.

Manufacturers of wireless medical telemetry devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all of the manufacturer's specified conditions.

### TEST PROCEDURE

ANSI / TIA / EIA 603C Clause 2.3.1 and 2.3.2

### TEST RESULTS

Reference Frequency: 2593.0164 MHz @ 20°C				
Limit: ± 20 ppm = 51860 Hz				
Power Supply (VAC)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
115.00	50	2593.01235	1.571	Within the authorized frequency band
115.00	40	2593.01453	0.729	
115.00	30	2593.01582	0.231	
115.00	20	2593.01642	0.000	
115.00	10	2593.01778	-0.524	
115.00	0	2593.01911	-1.037	
115.00	-10	2593.02210	-2.190	
115.00	-20	2593.02421	-3.004	
115.00	-30	2593.02688	-4.034	
97.75	20	2593.01656	-0.054	Within the authorized frequency band
132.25	20	2593.01637	0.019	
Power Supply (VDC)	Environment Temperature (°C)	Frequency Deviation Measured with Time Elapse		
		(MHz)	Delta (ppm)	Limit (ppm)
4.1Vdc (100%)	20	2593.00771	3.361	Within the authorized frequency band
3.6Vdc (End Point)	20	2593.00798	3.256	

## 8. RADIATED TEST RESULTS

### 8.1.1. RADIATED OUTPUT POWER (EIRP)

#### LIMITS

§2.1046 & §27.50 (h)(2) Mobile and other user stations. Mobile stations are limited to 2.0 watts EIRP. All user stations are limited to 2.0 watts transmitter output power.

#### TEST PROCEDURE

ANSI / TIA / EIA 603 Clause 2.2.17& FCC 27

#### RESULTS

Mode	Channel	Frequency (MHz)	EIRP (dBm)	EIRP (mW)
5MHz QPSK	Low	2498.5	23.40	218.78
	Middle	2593	20.90	123.03
	High	2687.5	23.20	208.93
5MHz 16QAM	Low	2498.5	22.80	190.55
	Middle	2593	20.80	120.23
	High	2687.5	22.10	162.18
10MHz QPSK	Low	2501	22.70	186.21
	Middle	2593	20.30	107.15
	High	2685	22.30	169.82
10MHz 16QAM	Low	2501	22.70	186.21
	Middle	2593	20.20	104.71
	High	2685	22.10	162.18



## OUTPUT POWER (EIRP)

### 5MHz\_QPSK

**Compliance Certification Services**  
**Above 1GHz High Frequency Substitution Measurement**

Company: Sierra Wireless  
 Project #: 09U12839  
 Date: 10/7/2009  
 Test Engineer: Devin Chang  
 Configuration: EUT With Laptop PC  
 Mode: QPSK\_5MHz

**Chamber**  
 5m Chamber A

**Pre-amplifier**

**Filter**

**Limit**  
 Part 27

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
Low Ch										
2.4985	-18.5	V	3.0	41.8			23.4	33.0	-9.6	
2.4985	-18.9	H	3.0	40.1			21.2	33.0	-11.8	
Mid Ch										
2.5930	-21.2	V	3.0	42.1			20.9	33.0	-12.1	
2.5930	-22.4	H	3.0	40.6			18.2	33.0	-14.8	
High Ch										
2.6875	-19.2	V	3.0	42.4			23.2	33.0	-9.8	
2.6875	-21.8	H	3.0	41.2			19.4	33.0	-13.6	

Rev. 03.03.09

## 5MHz\_16QAM

### Compliance Certification Services Above 1GHz High Frequency Substitution Measurement

Company: Sierra Wireless  
Project #: 09U12839  
Date: 10/7/2009  
Test Engineer: Devin Chang  
Configuration: EUT With Laptop PC  
Mode: 16QAM\_5MHz

Chamber	Pre-amplifier	Filter	Limit
5m Chamber A			Part 27

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
Low Ch										
2.4985	-19.0	V	3.0	41.8			22.8	33.0	-10.2	
2.4985	-19.7	H	3.0	40.1			20.4	33.0	-12.6	
Mid Ch										
2.5930	-21.3	V	3.0	42.1			20.8	33.0	-12.2	
2.5930	-23.2	H	3.0	40.6			17.4	33.0	-15.6	
High Ch										
2.6875	-20.3	V	3.0	42.4			22.1	33.0	-10.9	
2.6875	-23.5	H	3.0	41.2			17.6	33.0	-15.4	

Rev. 03.03.09

# 10MHz\_QPSK

## Compliance Certification Services Above 1GHz High Frequency Substitution Measurement

Company: Sierra Wireless  
Project #: 09U12839  
Date: 10/7/2009  
Test Engineer: Devin Chang  
Configuration: EUT With Laptop PC  
Mode: QPSK\_10MHz

<b>Chamber</b>	<b>Pre-amplifier</b>	<b>Filter</b>	<b>Limit</b>
5m Chamber B			Part 27

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
Low Ch										
2.501	-19.2	V	3.0	41.8			22.7	33.0	-10.3	
2.501	-19.8	H	3.0	39.8			20.0	33.0	-13.0	
Mid Ch										
2.593	-21.8	V	3.0	42.1			20.3	33.0	-12.7	
2.593	-23.6	H	3.0	40.4			16.8	33.0	-16.2	
High Ch										
2.685	-20.1	V	3.0	42.4			22.3	33.0	-10.7	
2.685	-23.0	H	3.0	41.0			18.0	33.0	-15.0	

Rev. 03.03.09

# 10MHz\_16QAM

## Compliance Certification Services Above 1GHz High Frequency Substitution Measurement

Company: Sierra Wireless  
Project #: 09U12839  
Date: 10/7/2009  
Test Engineer: Devin Chang  
Configuration: EUT With Laptop PC  
Mode: 16QAM\_10MHz

Chamber	Pre-amplifier	Filter	Limit
5m Chamber B			Part 27

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
Low Ch										
2.501	-19.1	V	3.0	41.8			22.7	33.0	-10.3	
2.501	-19.4	H	3.0	39.8			20.4	33.0	-12.6	
Mid Ch										
2.593	-21.9	V	3.0	42.1			20.2	33.0	-12.8	
2.593	-23.5	H	3.0	40.4			16.9	33.0	-16.1	
High Ch										
2.685	-20.3	V	3.0	42.4			22.1	33.0	-10.9	
2.685	-23.1	H	3.0	41.0			17.9	33.0	-15.1	

Rev. 03.03.09



# Above 1GHz

## 5MHz\_16QAM

### Compliance Certification Services Above 1GHz High Frequency Substitution Measurement

Company: Sierra Wireless  
Project #: 09U12839  
Date: 10/9/2009  
Test Engineer: Devin Chang  
Configuration: EUT  
Mode: 16QAM\_5MHz (T5D29U1816Q34S85)

Chamber	Pre-amplifier	Filter	Limit
5m Chamber B	T145 8449B	Filter 1	Part 27

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
2498.5MHz										
4.997	-69.4	H	3.0	48.9	35.3	1.0	-54.9	-25.0	-29.9	
7.495	-69.6	H	3.0	53.1	35.7	1.0	-51.3	-25.0	-26.3	
4.997	-69.5	V	3.0	48.3	35.3	1.0	-55.6	-25.0	-30.6	
7.495	-68.8	V	3.0	51.4	35.7	1.0	-52.1	-25.0	-27.1	
2593MHz										
5.186	-68.9	H	3.0	49.4	35.3	1.0	-53.8	-25.0	-28.8	
7.779	-70.2	H	3.0	53.4	35.7	1.0	-51.5	-25.0	-26.5	
5.186	-69.0	V	3.0	48.8	35.3	1.0	-54.6	-25.0	-29.6	
7.779	-70.2	V	3.0	51.8	35.7	1.0	-53.1	-25.0	-28.1	
2687.5MHz										
5.375	-69.6	H	3.0	49.7	35.4	1.0	-54.3	-25.0	-29.3	
8.062	-69.9	H	3.0	53.7	35.7	1.0	-50.9	-25.0	-25.9	
5.375	-69.3	V	3.0	49.0	35.4	1.0	-54.7	-25.0	-29.7	
8.062	-70.0	V	3.0	52.1	35.7	1.0	-52.6	-25.0	-27.6	

Rev. 03.03.09

# 10MHz\_16QAM

## Compliance Certification Services Above 1GHz High Frequency Substitution Measurement

Company: Sierra Wireless  
Project #: 09U12839  
Date: 10/9/2009  
Test Engineer: Devin Chang  
Configuration: EUT  
Mode: 16QAM\_10MHz (T10D29U1816Q12S175)

Chamber  
5m Chamber B

Pre-amplifier  
T145 8449B

Filter  
Filter 1

Limit  
Part 27

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
2501MHz										
5.002	-69.2	H	3.0	48.9	35.3	1.0	-54.7	-25.0	-29.7	
7.503	-69.4	H	3.0	53.1	35.7	1.0	-51.0	-25.0	-26.0	
5.002	-68.2	V	3.0	48.3	35.3	1.0	-54.2	-25.0	-29.2	
7.503	-70.3	V	3.0	51.4	35.7	1.0	-53.5	-25.0	-28.5	
2593MHz										
5.186	-69.0	H	3.0	49.4	35.3	1.0	-53.9	-25.0	-28.9	
7.779	-70.2	H	3.0	53.4	35.7	1.0	-51.4	-25.0	-26.4	
5.186	-68.9	V	3.0	48.8	35.3	1.0	-54.5	-25.0	-29.5	
7.779	-70.5	V	3.0	51.8	35.7	1.0	-53.4	-25.0	-28.4	
2685MHz										
5.370	-69.3	H	3.0	49.7	35.4	1.0	-53.9	-25.0	-28.9	
8.055	-70.2	H	3.0	53.7	35.7	1.0	-51.1	-25.0	-26.1	
5.370	-69.3	V	3.0	49.0	35.4	1.0	-54.7	-25.0	-29.7	
8.055	-68.7	V	3.0	52.1	35.7	1.0	-51.3	-25.0	-26.3	

Rev. 03.03.09

## 9. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

FCC §15.207 (a)

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

\* Decreases with the logarithm of the frequency.

### TEST PROCEDURE

ANSI C63.4

### RESULTS

#### 6 WORST EMISSIONS

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	FCC_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.18	55.75	--	41.05	0.00	64.63	54.63	-8.88	-13.58	L1
4.38	36.25	--	25.54	0.00	56.00	46.00	-19.75	-20.46	L1
21.49	41.04	--	25.40	0.00	60.00	50.00	-18.96	-24.60	L1
0.18	54.23	--	40.35	0.00	64.63	54.63	-10.40	-14.28	L2
0.24	45.94	--	32.15	0.00	62.17	52.17	-16.23	-20.02	L2
4.38	39.49	--	27.20	0.00	56.00	46.00	-16.51	-18.80	L2
6 Worst Data									

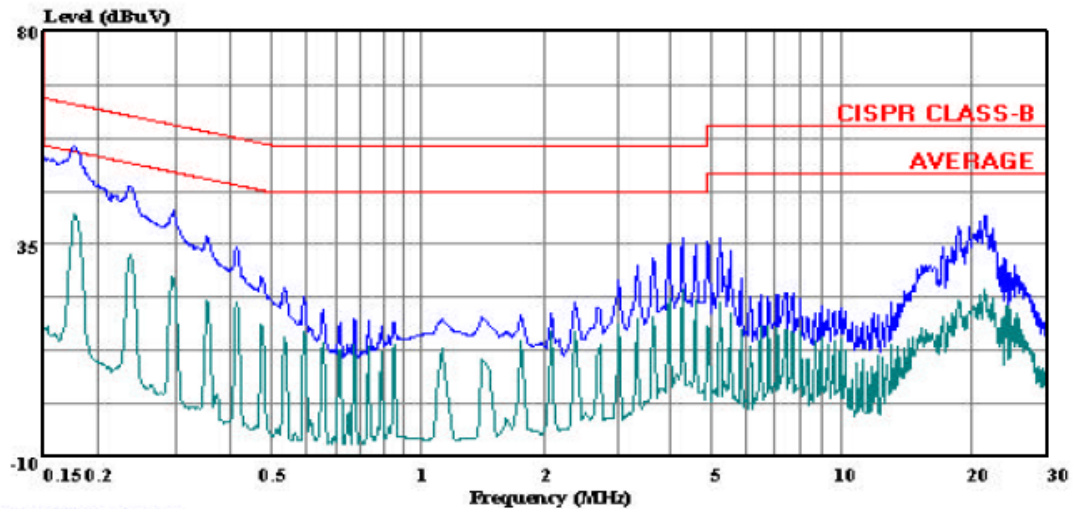


**LINE 1 RESULTS**



Compliance Certification Services  
47173 Benicia Street  
Fremont, CA 94538  
Tel: (510) 771-1000  
Fax: (510) 661-0888

Data#: 7 File#: 09u12839.EMI Date: 10-12-2009 Time: 14:27:02



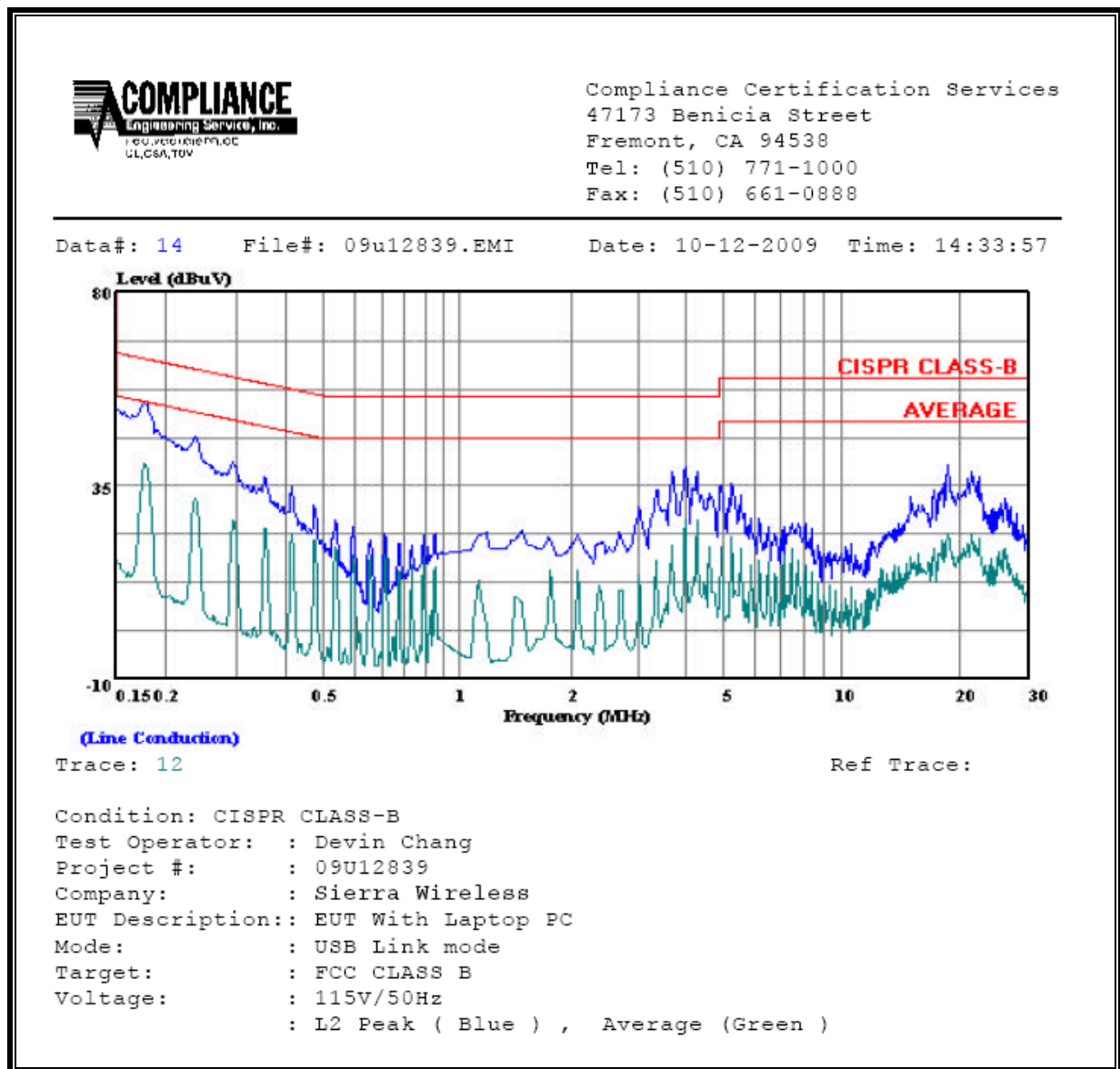
(Line Conduction)

Trace: 5

Ref Trace:

Condition: CISPR CLASS-B  
Test Operator: : Devin Chang  
Project #: : 09U12839  
Company: : Sierra Wireless  
EUT Description: : EUT With Laptop PC  
Mode: : USB Link mode  
Target: : FCC CLASS B  
Voltage: : 115V/50Hz  
: L1 Peak ( Blue ) , Average ( Green )

**LINE 2 RESULTS**



## 10. MAXIMUM PERMISSIBLE EXPOSURE

### 10.1. Limits

#### 10.1.1. FCC RULES

§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 <sup>2</sup> )	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 <sup>2</sup> )	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 <sup>2</sup> )	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 <sup>2</sup> )	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.

### 10.1.2. IC RULES

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

**Table 5**  
**Exposure Limits for Persons Not Classed As RF and Microwave Exposed Workers (Including the General Public)**

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m <sup>2</sup> )	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	280/ <i>f</i>	2.19/ <i>f</i>		6
10–30	28	2.19/ <i>f</i>		6
30–300	28	0.073	2*	6
300–1 500	1.585 <i>f</i> <sup>0.5</sup>	0.0042 <i>f</i> <sup>0.5</sup>	<i>f</i> /150	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	616 000 / <i>f</i> <sup>1.2</sup>
150 000–300 000	0.158 <i>f</i> <sup>0.5</sup>	4.21 x 10 <sup>-4</sup> <i>f</i> <sup>0.5</sup>	6.67 x 10 <sup>-5</sup> <i>f</i>	616 000 / <i>f</i> <sup>1.2</sup>

\* Power density limit is applicable at frequencies greater than 100 MHz.

**Notes:** 1. Frequency, *f*, is in MHz.  
2. A power density of 10 W/m<sup>2</sup> is equivalent to 1 mW/cm<sup>2</sup>.  
3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

### 10.1.3. LIMITS APPLICABLE TO THE EUT

For mobile radio equipment operating in the cellular phone band, the lowest power density limit is calculated using the lowest frequency, as 824 MHz / 1500 = 0.55 mW/cm<sup>2</sup> (FCC) and 824 MHz / 150 = 5.5 W/m<sup>2</sup> (IC).

For operation in the PCS band, the 2.4 GHz band and the 5 GHz bands, from FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm<sup>2</sup> and from IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m<sup>2</sup>.

## 10.2. EQUATIONS

Power density is given by:

$$S = \text{EIRP} / (4 * \pi * D^2)$$

where

S = Power density in W/m<sup>2</sup>

EIRP = Equivalent Isotropic Radiated Power in W

D = Separation distance in m

For multiple colocated transmitters operating simultaneously in frequency bands where the limit is identical, the total power density is calculated using the total EIRP obtained by summing the Power \* Gain product (in linear units) of each transmitter.

$$\text{Total EIRP} = (P_1 * G_1) + (P_2 * G_2) + \dots + (P_n * G_n)$$

where

P<sub>x</sub> = Power of transmitter x

G<sub>x</sub> = Numeric gain of antenna x

For multiple colocated transmitters operating simultaneously in frequency bands where different limits apply, either the lowest limit applicable to the operating frequency ranges of the co-located transmitters can be applied or a fraction of the exposure limit is established for each band, such that the sum of the fractions is less than or equal to one.

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

## 10.3. RESULTS

### 10.3.1. SINGLE TRANSMITTER (WiMAX OR WLAN)

Bandwidth Modulation	Mode	Separation Distance (m)	Output Power (dBm)	Antenna Gain (dBi)	IC Power Density (W/m <sup>2</sup> )	FCC Power Density (mW/cm <sup>2</sup> )
20 MHz 802.11b/g	WLAN	0.20	22.16	1.00	0.41	0.041
5MHz QPSK	WiMAX	0.20	24.78	-0.50	0.53	0.053
5MHz 16QAM	WiMAX	0.20	24.66	-0.50	0.52	0.052
10MHz QPSK	WiMAX	0.20	24.61	-0.50	0.51	0.051
10MHz 16QAM	WiMAX	0.20	24.62	-0.50	0.51	0.051

Each Power Density is less than 10 W/m<sup>2</sup> or 1 mW/cm<sup>2</sup>, which is the limit for these operating frequency ranges.

### 10.3.2. WiMAX AND CDMA 800/1900 TRANSMITTERS

These transmitters do not operate simultaneously, therefore they are not co-located.

### 10.3.3. CO-LOCATED TRANSMITTERS (WiMAX AND WLAN)

Band	Mode	Separation Distance (m)	Output Power (dBm)	Antenna Gain (dBi)	IC Power Density (W/m <sup>2</sup> )	FCC Power Density (mW/cm <sup>2</sup> )
2.4GHz g mode	WLAN		22.16	1.00		
5MHz 16QAM	WiMAX		24.78	-0.50		
Combined		0.20			0.95	0.095

The co-located Power Density is less than 10 W/m<sup>2</sup> or 1 mW/cm<sup>2</sup>, which is the limit for these operating frequency ranges.

### 10.3.4. CO-LOCATED TRANSMITTERS (WLAN and CDMA 800)

Band	Mode	Separation Distance (m)	Output Power (dBm)	Antenna Gain (dBi)	IC Power Density (W/m <sup>2</sup> )	FCC Power Density (mW/cm <sup>2</sup> )
2.4GHz g mode	WLAN		22.16	1.00		
800 MHz	CDMA		29.82	0.00		
Combined		0.20			2.32	0.232

The co-located Power Density is less than 5.5 W/m<sup>2</sup> or 0.55 mW/cm<sup>2</sup>, which is the most stringent of the limits for the above operating frequency ranges.

### 10.3.5. CO-LOCATED TRANSMITTERS (WLAN and CDMA 1900)

Band	Mode	Separation Distance (m)	Output Power (dBm)	Antenna Gain (dBi)	IC Power Density (W/m <sup>2</sup> )	FCC Power Density (mW/cm <sup>2</sup> )
2.4GHz g mode	WLAN		22.16	1.00		
1900 MHz	CDMA		29.11	0.00		
Combined		0.20			2.03	0.203

The co-located Power Density is less than 10 W/m<sup>2</sup> or 1 mW/cm<sup>2</sup>, which is the limit for these operating frequency ranges.