FCC CFR47 PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 7

CERTIFICATION TEST REPORT

FOR

BLUETOOTH LASER MOUSE

MODEL NUMBER: VGP- BMS80

FCC ID: GT3FC007

REPORT NUMBER: 09J12682-1

ISSUE DATE: AUGUST 24, 2009

Prepared for
SMK CORPORATION
5-5 TOGOSHI 6-CHOME
SHINAGAWA-KU, TOKYO
142-8511 JAPAN

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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	08/24/09	Initial Issue	T. Chan

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: SMK CORPORATION
5-5 TOGOSHI 6-CHOME
SHINAGAWA-KU, TOKYO
142-8511 JAPAN

EUT DESCRIPTION: BLUETOOTH LASER MOUSE

MODEL: VGP-BMS80

SERIAL NUMBER: F03DA5 (RADIATED UNIT), F03DAE (CONDUCTED UNIT)

DATE TESTED: AUGUST 11 - 23, 2009

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 7 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 2	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:

THU CHAN
EMC MANAGER
COMPLIANCE CERTIFICATION SERVICES

Tested By:

CHIN PANG
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 2, and RSS-210 Issue 7.

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:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

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 Bluetooth Laser Mouse operated at 2402-2480MHz

The radio module is manufactured by SMK Corporation.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	Basic GFSK	3.98	2.50
2402 - 2480	Enhanced 8PSK	2.79	1.90

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a Chip antenna, with a maximum gain of 0.14dBi.

5.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was RF Test Tool for Bluetooth Device, rev. 1.2.2.

5.5. WORST-CASE CONFIGURATION AND MODE

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

The EUT is a portable device that has three orientations; therefore X, Y and Z orientations have been investigated. The worst case was found to be X orientation.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
AC Adapter	HP	SU10095-1003	592C60EYMV40H	DoC
Laptop	HP	Presario F700	CNF7468G3Q	DoC

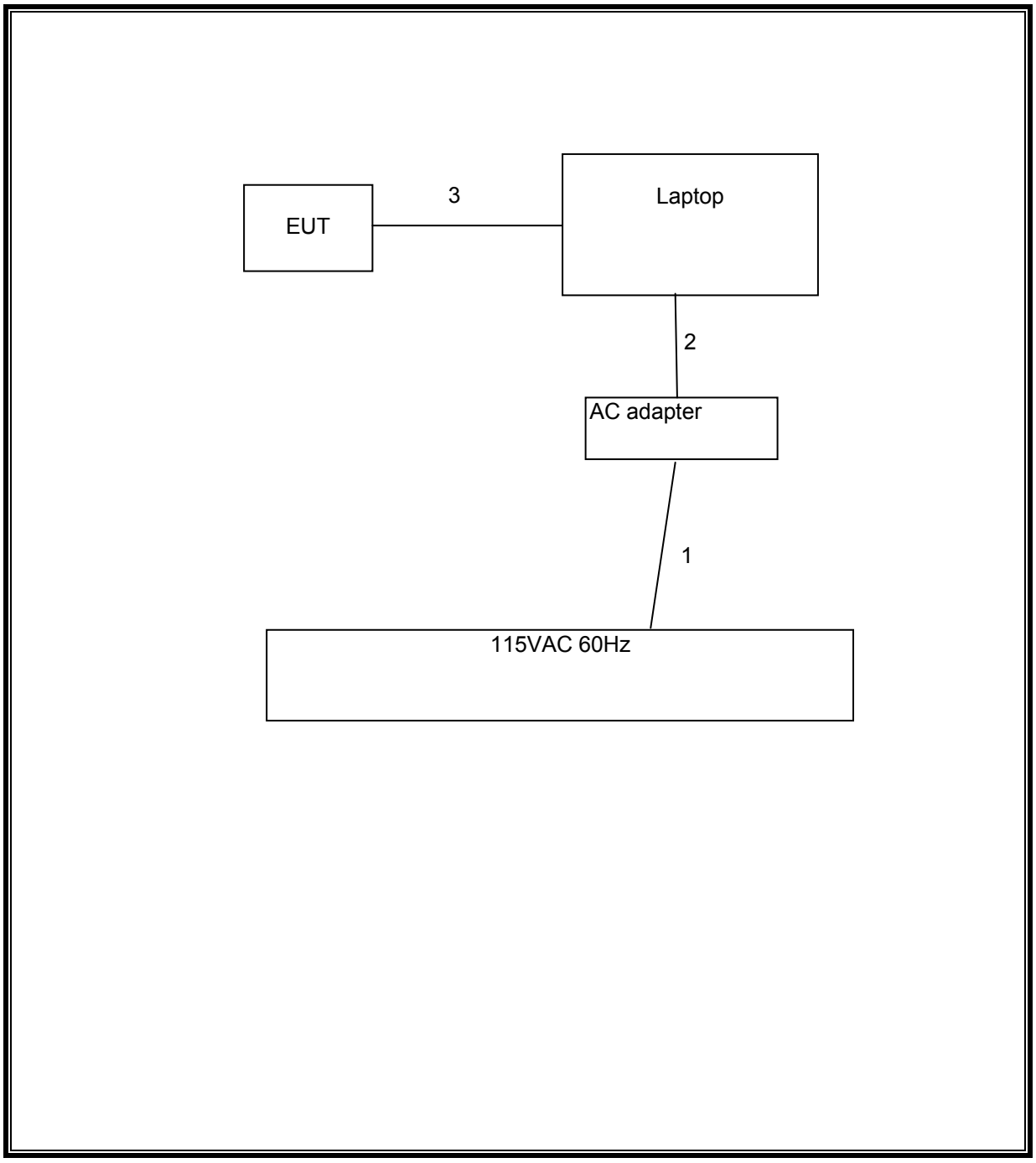
I/O CABLES

I/O CABLE LIST						
Cable No.	**Port**	**# of Identica Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	AC	1	US 115V	Un-shielded	2m	N/A
2	DC	1	DC	Un-shielded	2m	N/A
3	USB	1	USB	Un-shielded	1.0m	N/A

TEST SETUP

The EUT is a stand alone device. A laptop PC is connected via USB to exercise the device.

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**
Spectum Analyzer	Agilent	MXA	1176	10/23/09
Power Meter	HP	437B	2778	08/04/10
Power Sensor	Agilent	8481A	2781	11/02/09
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	08/06/10
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	10/29/09
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01012	06/01/10
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	02/04/10
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	12/16/09
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01016	01/14/10
Reject Filter, 2.4-2.5 GHz	Micro-Tronics	BRC13192	N02683	CNR

7. ANTENNA PORT TEST RESULTS

7.1. BASIC DATA RATE GFSK MODULATION

7.1.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

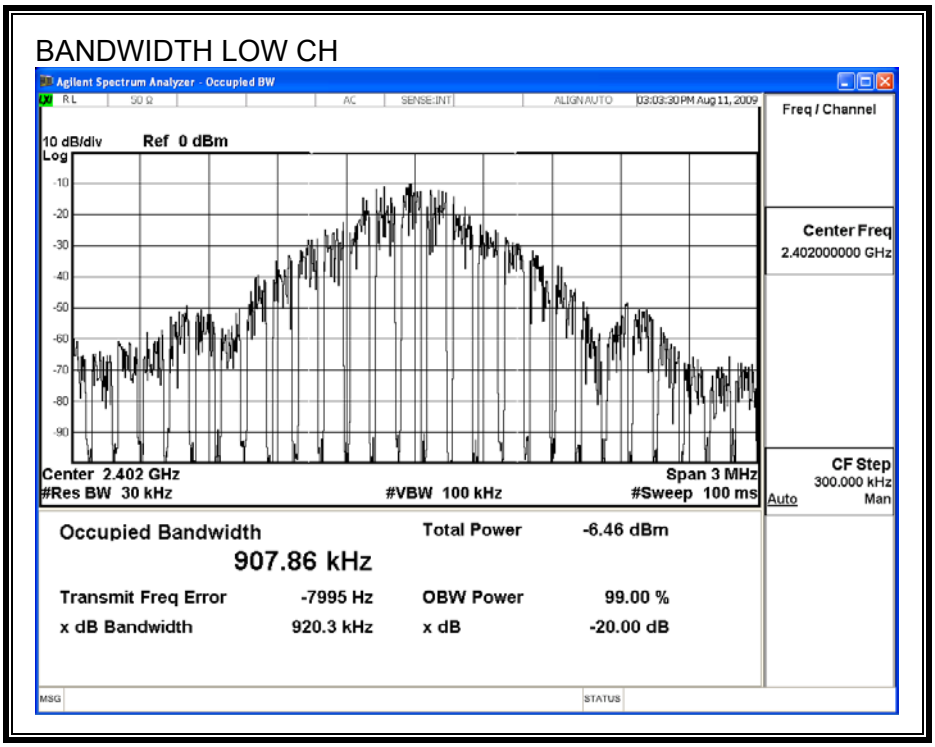
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

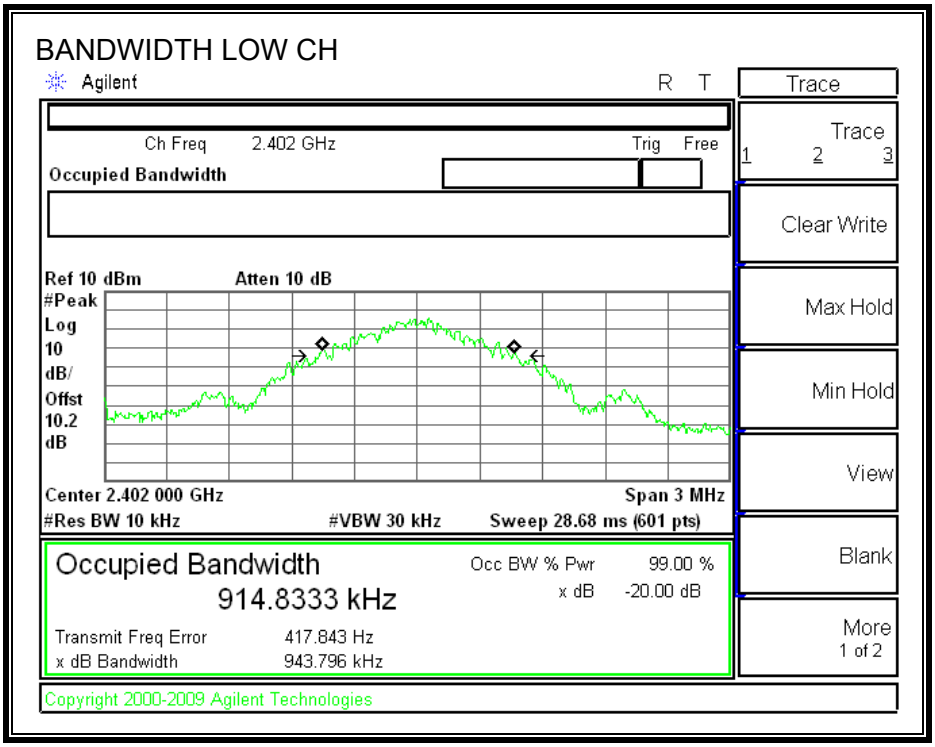
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	943.796	907.86
Middle	2441	921.159	929.8
High	2480	873.2	900.57

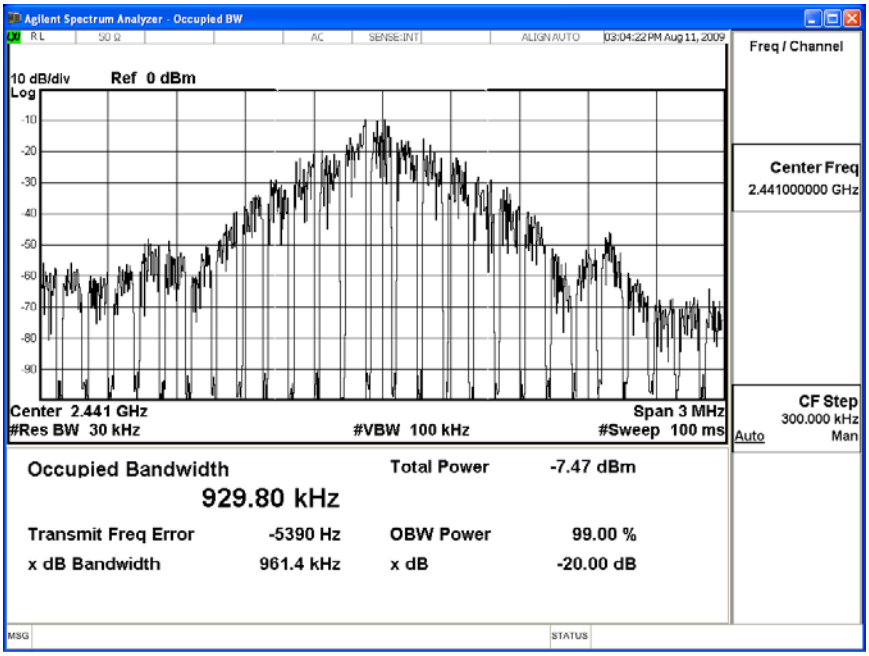
99% BANDWIDTH



20dB BANDWIDTH

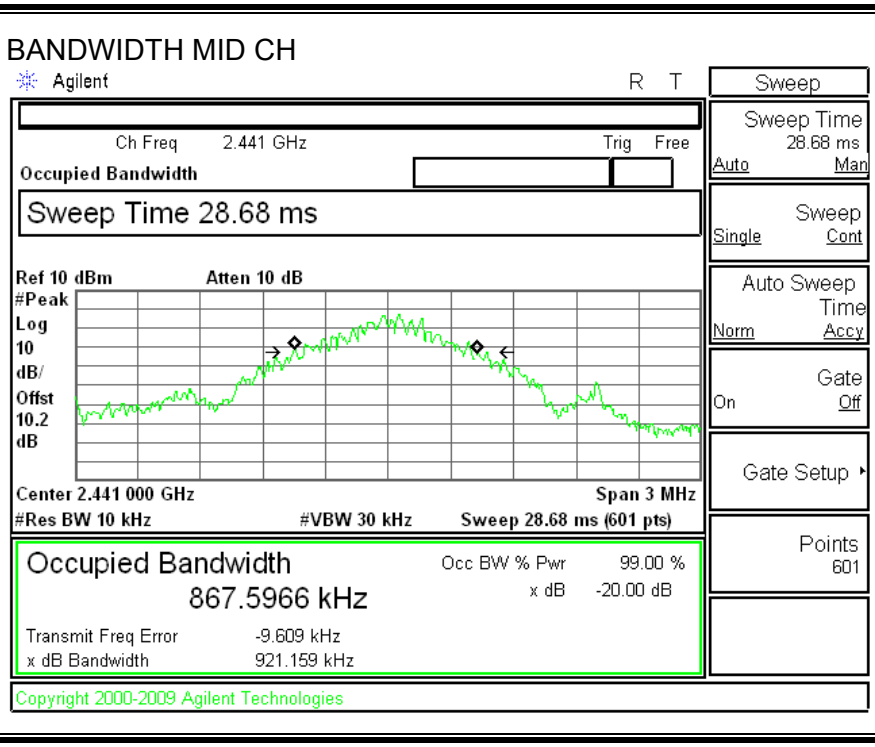


BANDWIDTH MID CH

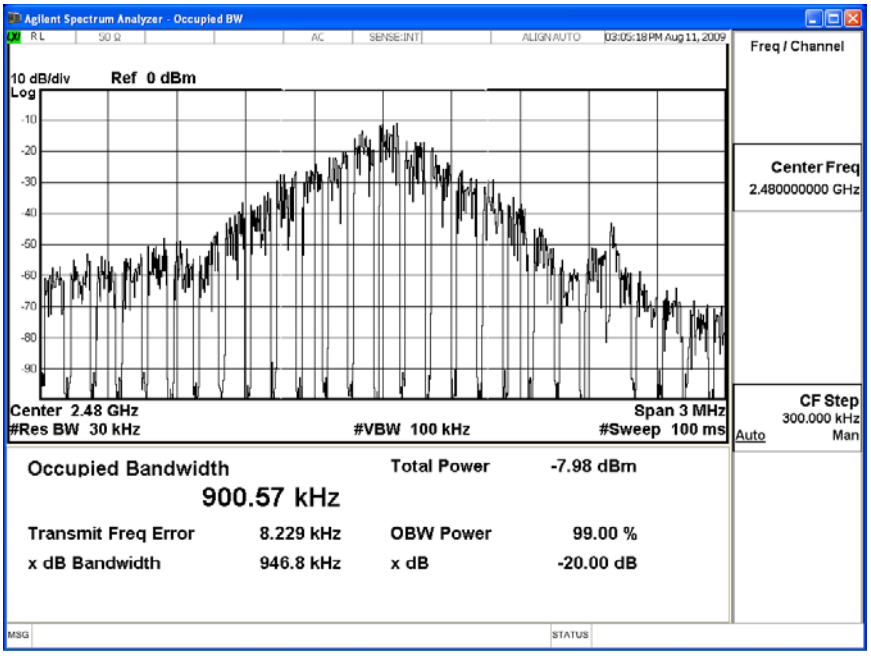


20dB BANDWIDTH

BANDWIDTH MID CH

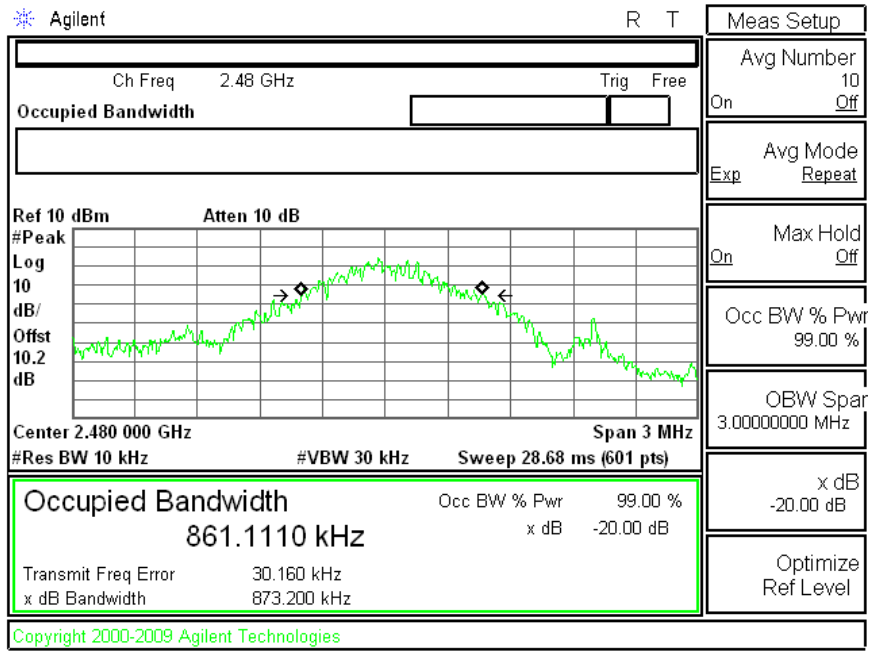


BANDWIDTH HIGH CH



20dB BANDWIDTH

BANDWIDTH HIGH CH



7.1.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

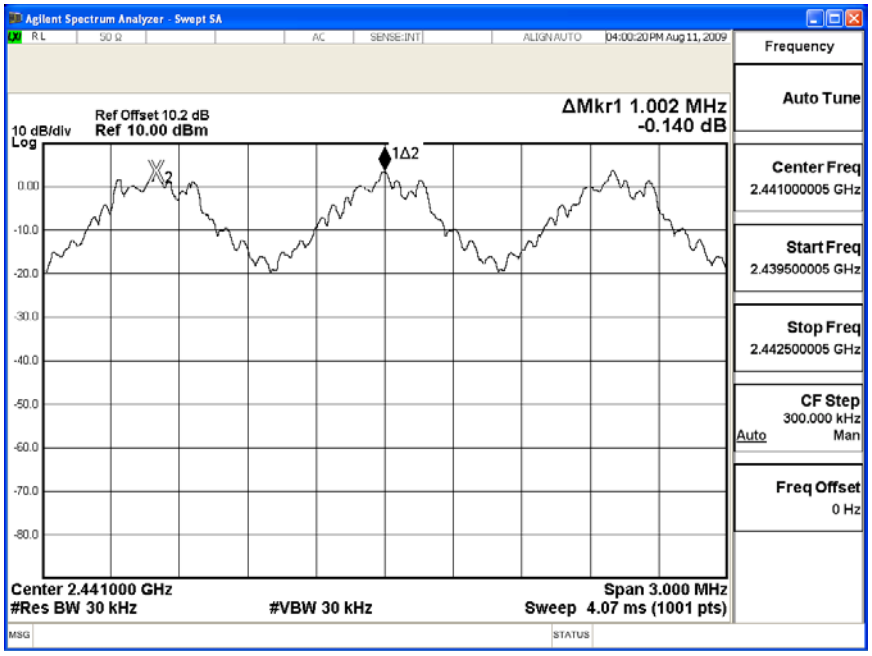
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

RESULTS

HOPPING FREQUENCY SEPARATION

HOPPING FREQUENCY SEPARATION



7.1.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

TEST PROCEDURE

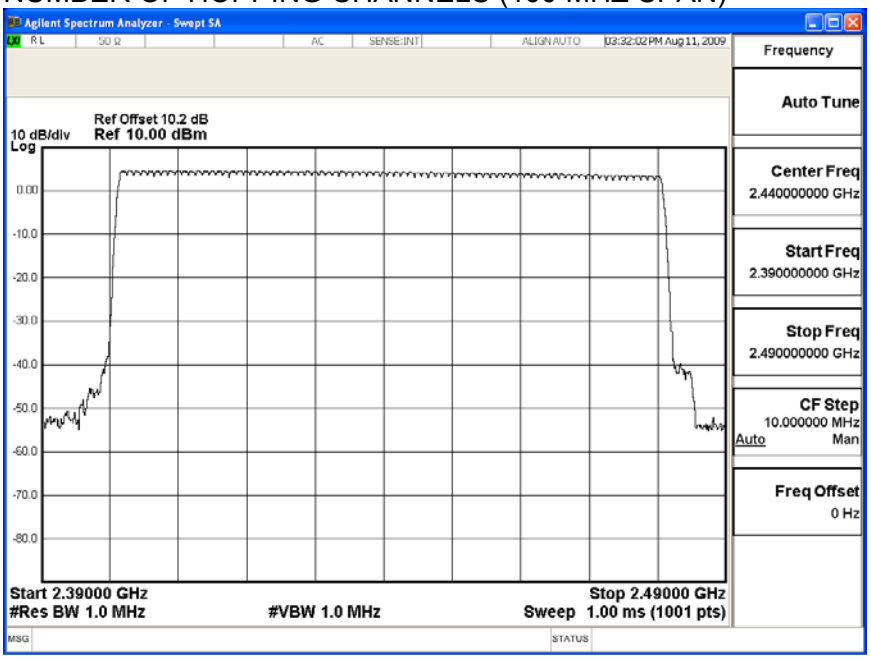
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

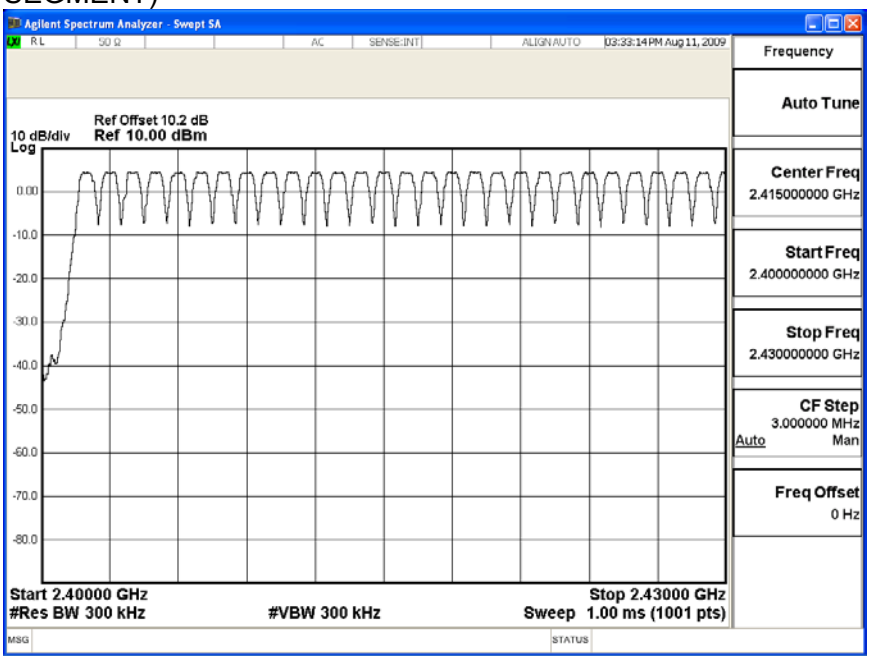
79 Channels observed.

NUMBER OF HOPPING CHANNELS

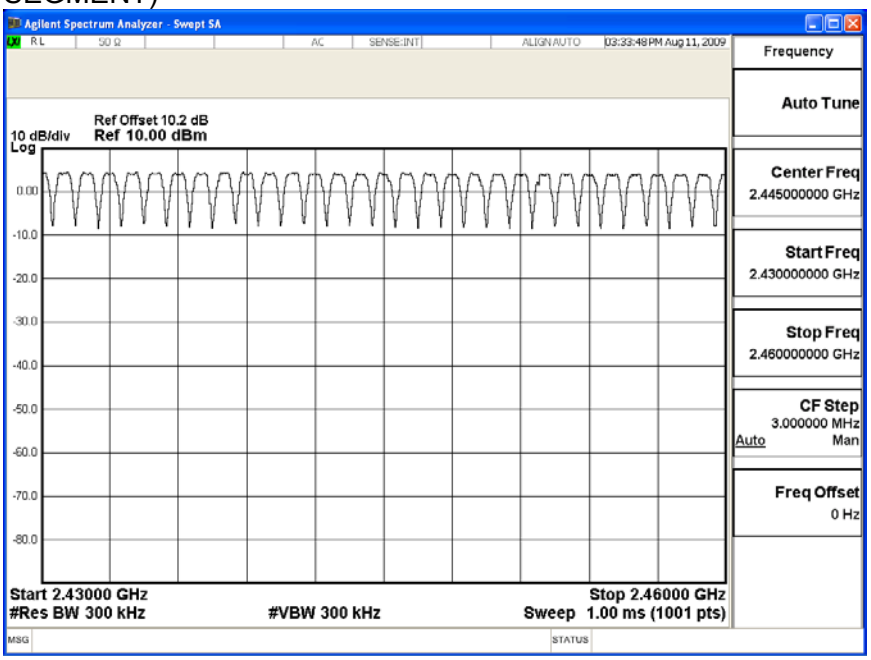
NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)



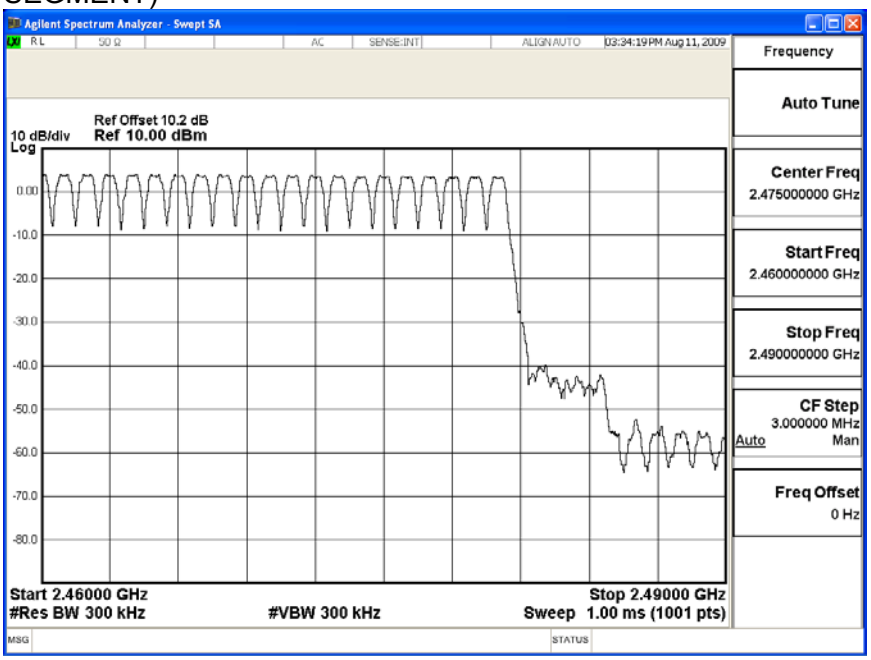
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, SECOND SEGMENT)



NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, THIRD SEGMENT)



7.1.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

RESULTS

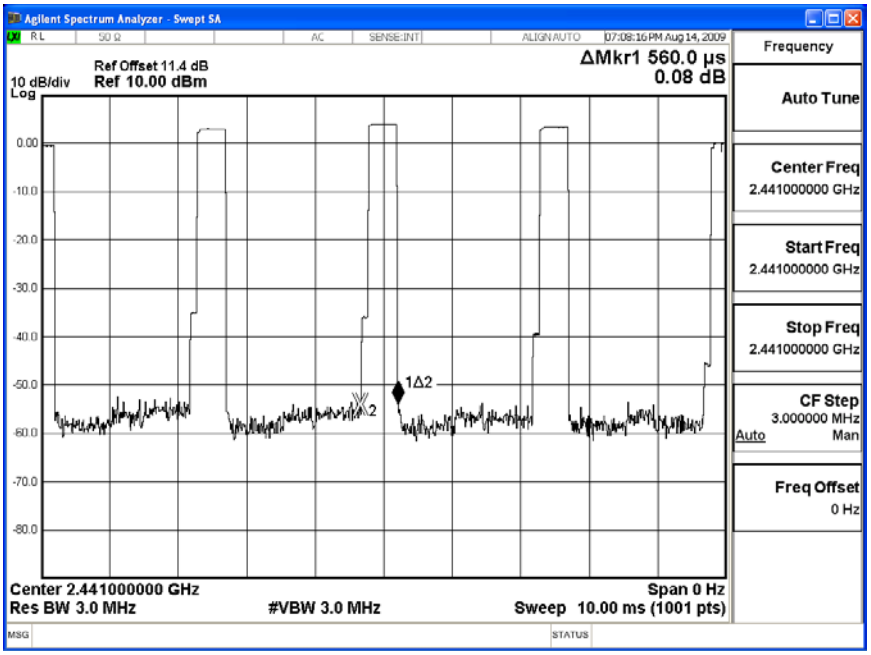
Time Of Occupancy = 10 * 11 pulses * 3.04 msec = 334 msec

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.56	32	0.179	0.4	0.221
DH3	1.79	16	0.286	0.4	0.114
DH5	3.04	11	0.334	0.4	0.066

DH1

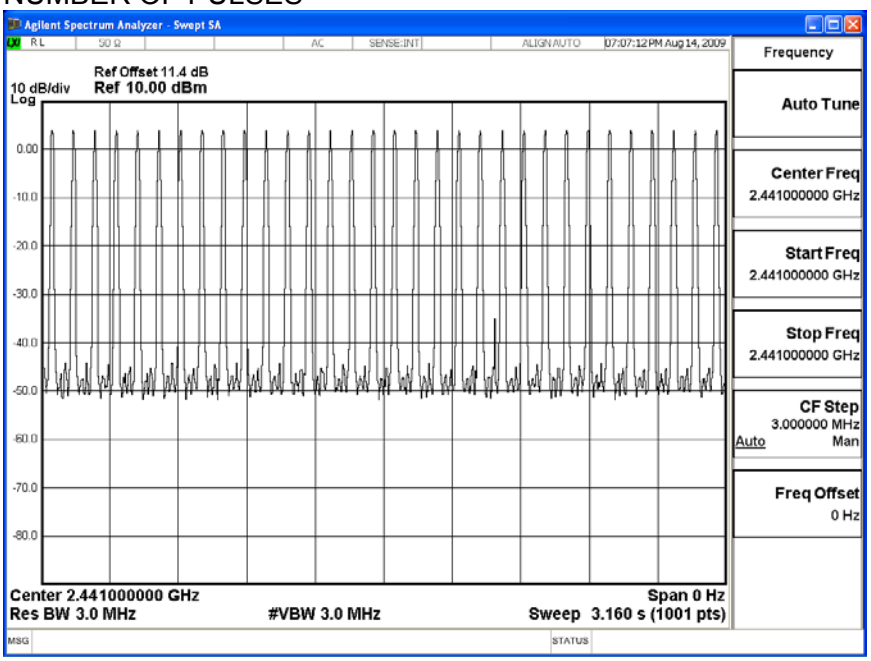
PULSE WIDTH

PULSE WIDTH



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD

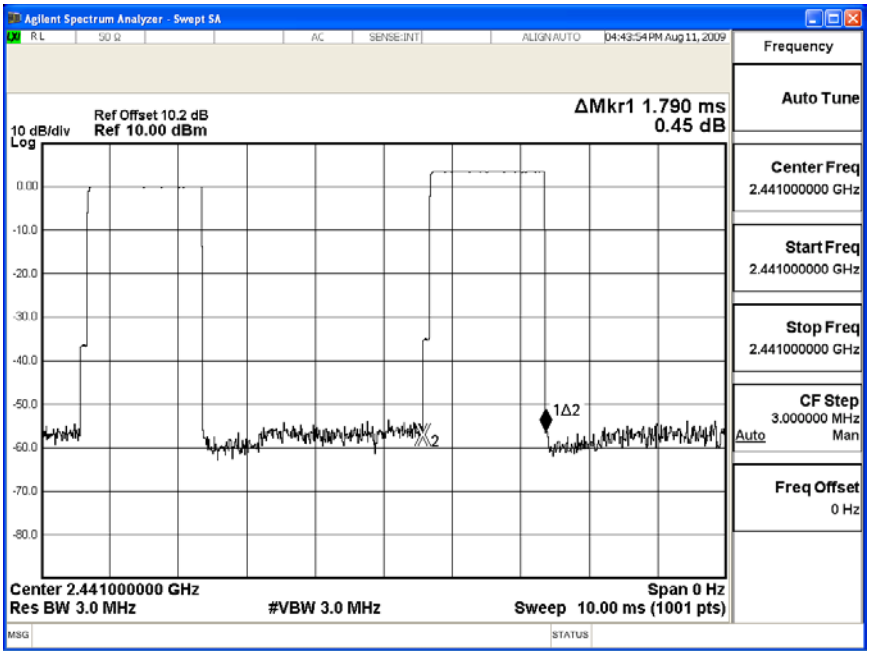
NUMBER OF PULSES



DH3

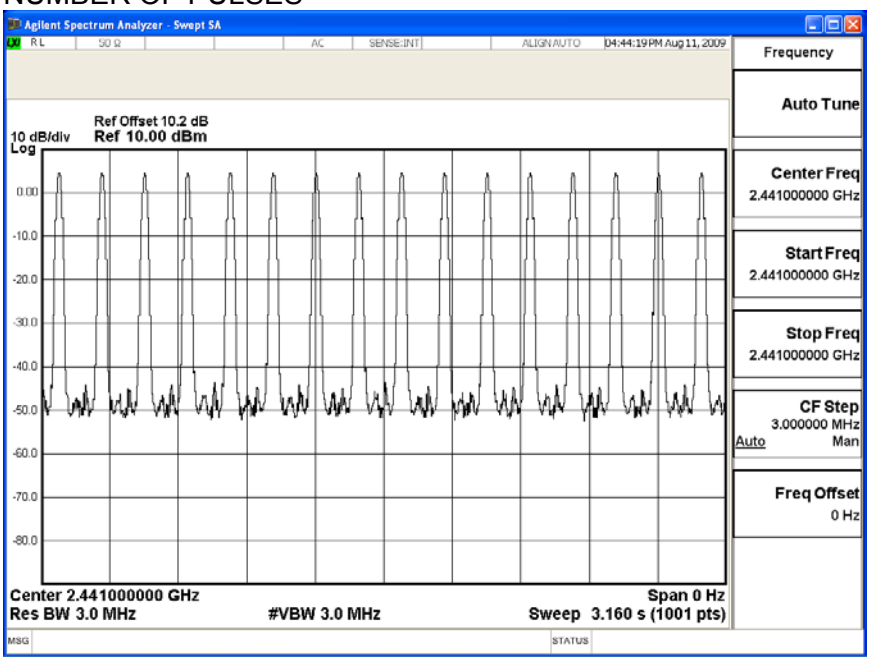
PULSE WIDTH

PULSE WIDTH



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD

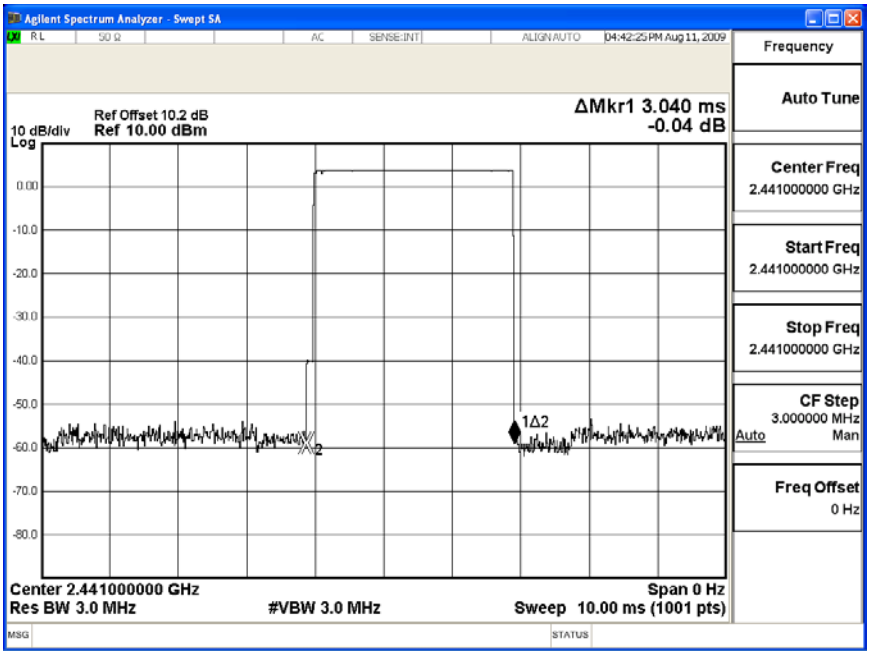
NUMBER OF PULSES



DH5

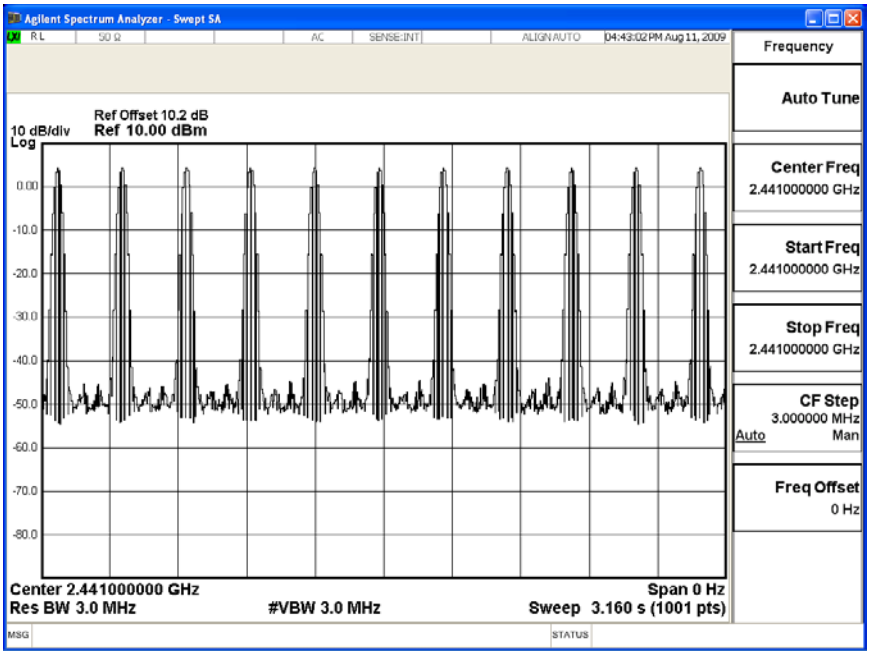
PULSE WIDTH

PULSE WIDTH



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD

NUMBER OF PULSES



7.1.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

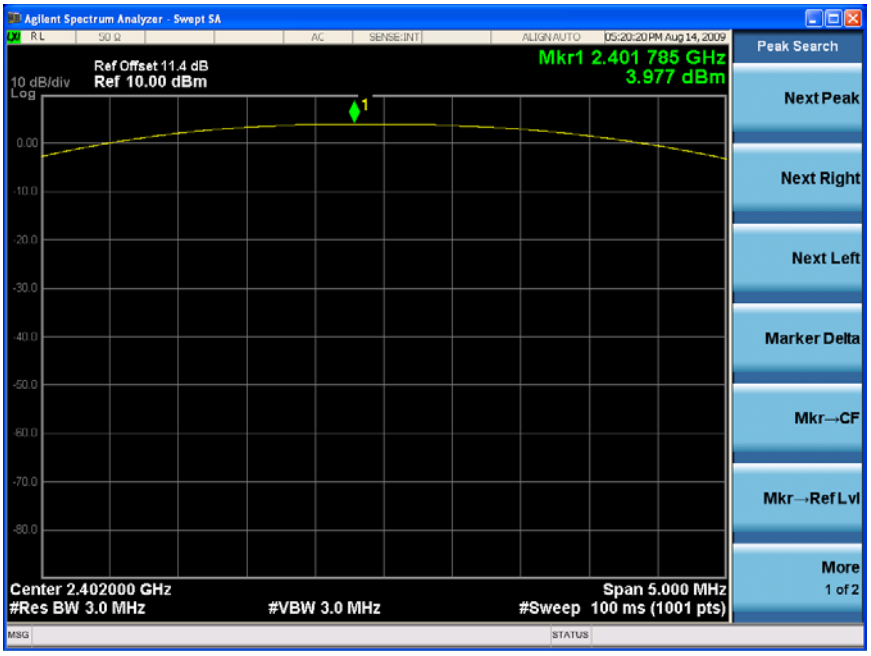
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

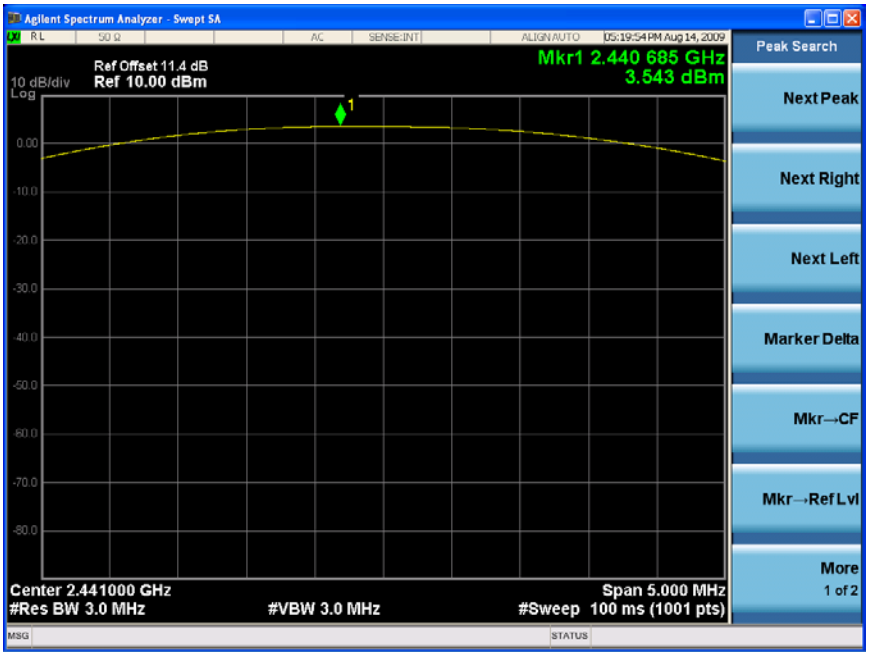
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	3.98	30	-26.02
Middle	2441	3.54	30	-26.46
High	2480	2.39	30	-27.61

OUTPUT POWER

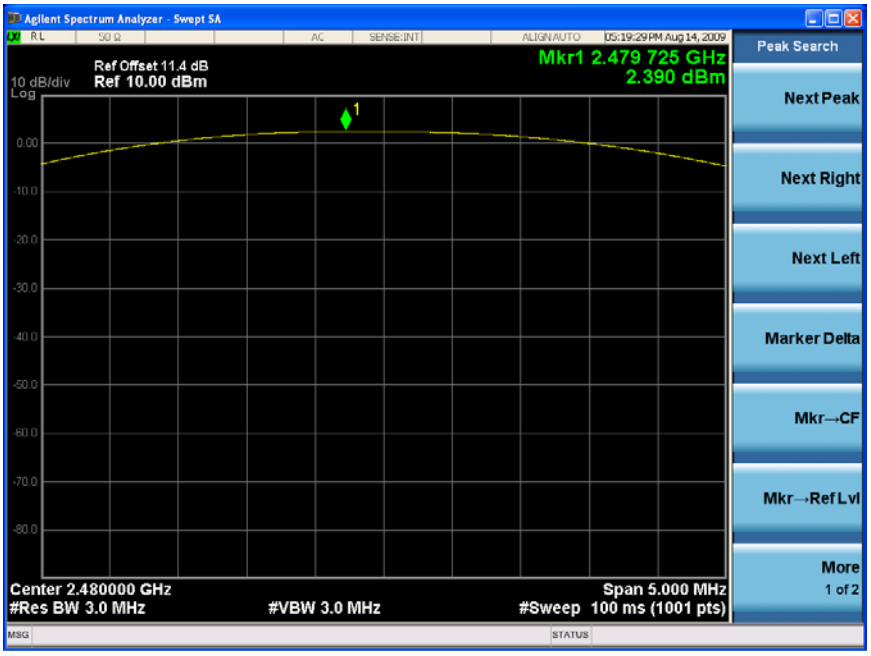
PEAK POWER LOW CH



PEAK POWER MID CH



PEAK POWER HIGH CH



7.1.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 11.2 dB (including 10 dB pad and 1.2dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	3.06
Middle	2441	2.61
High	2480	1.45

7.1.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

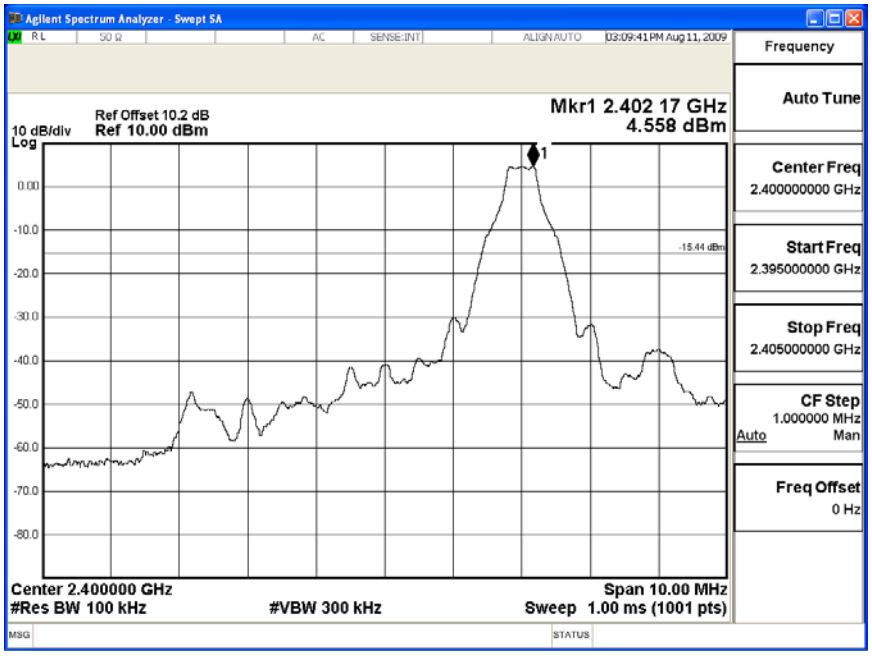
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

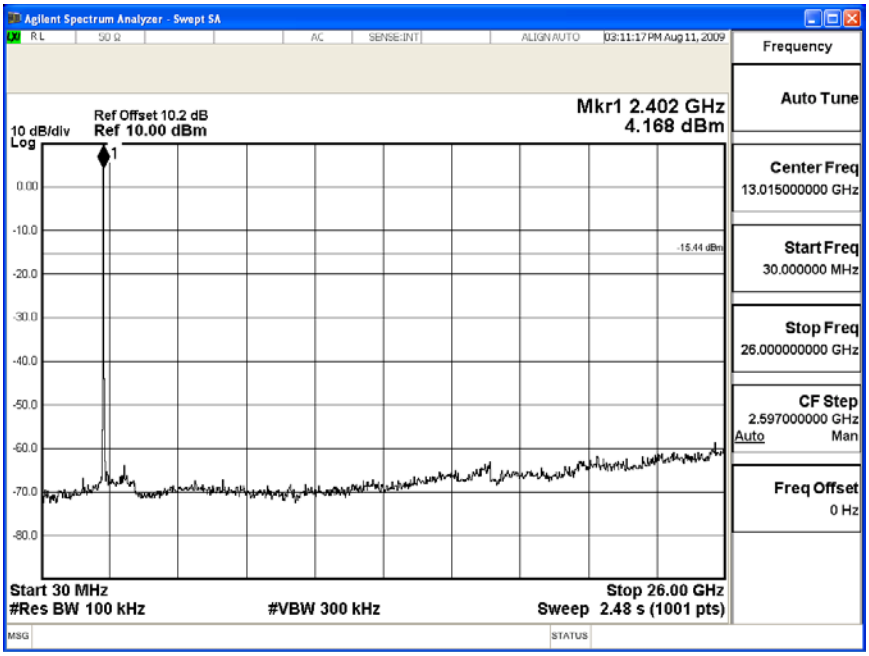
RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL

LOW CHANNEL BANDEDGE

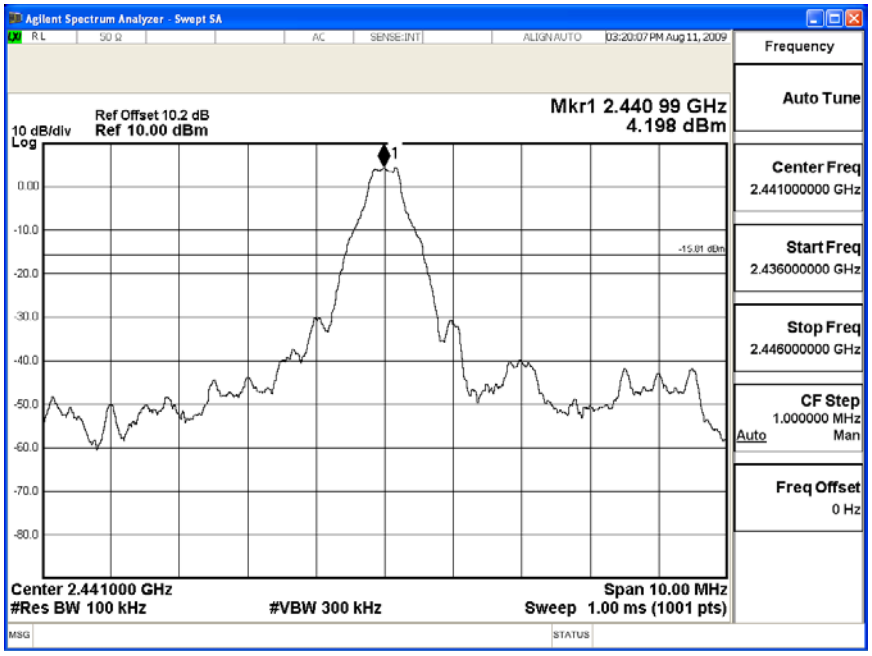


LOW CHANNEL SPURIOUS

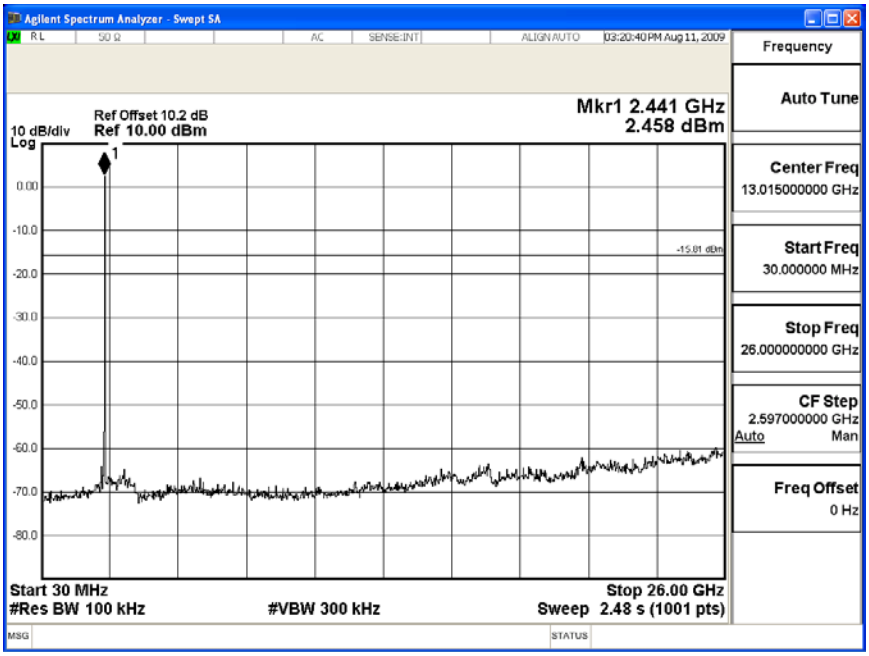


SPURIOUS EMISSIONS, MID CHANNEL

MID CHANNEL REFERENCE

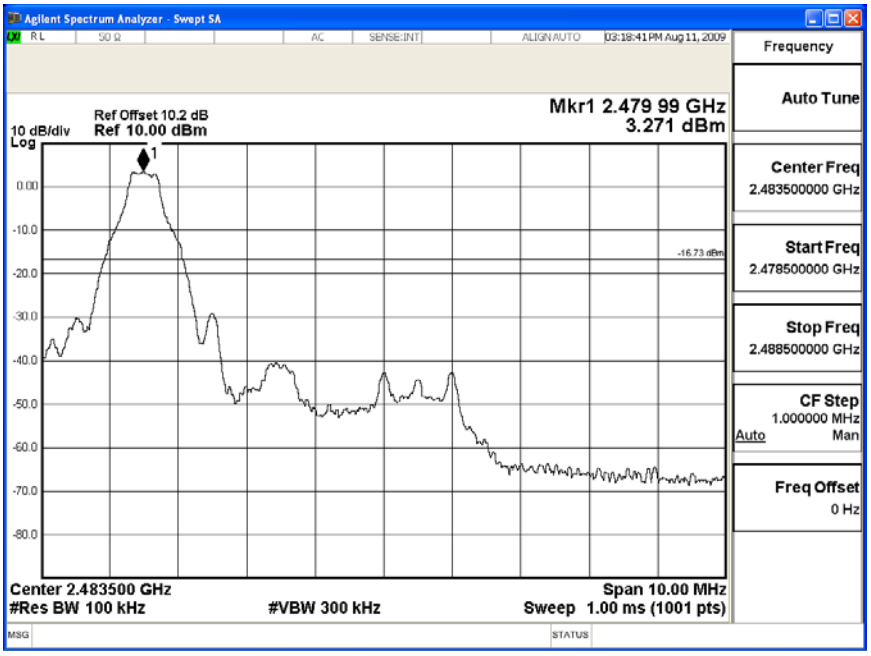


MID CHANNEL SPURIOUS

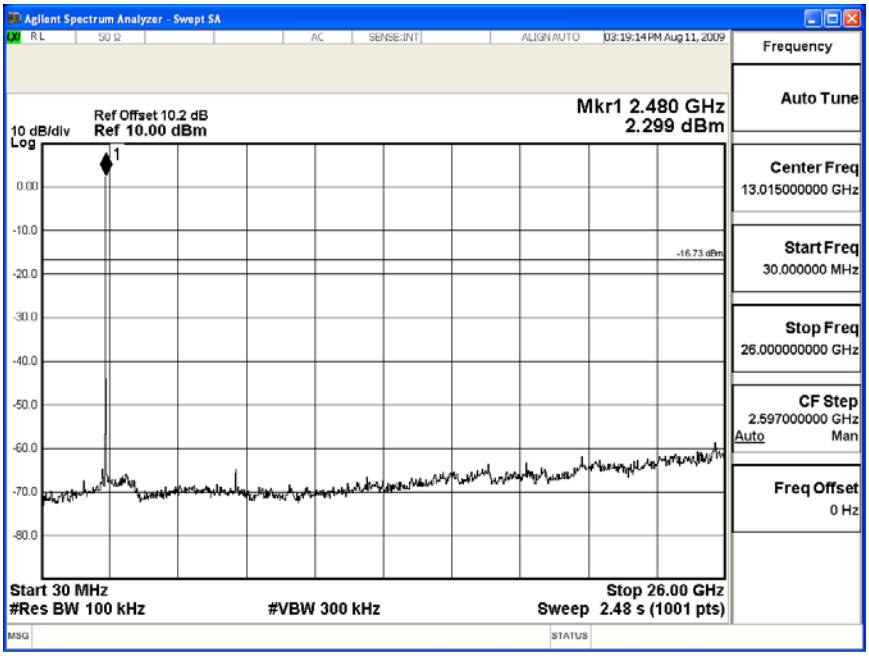


SPURIOUS EMISSIONS, HIGH CHANNEL

HIGH CHANNEL BANDEDGE

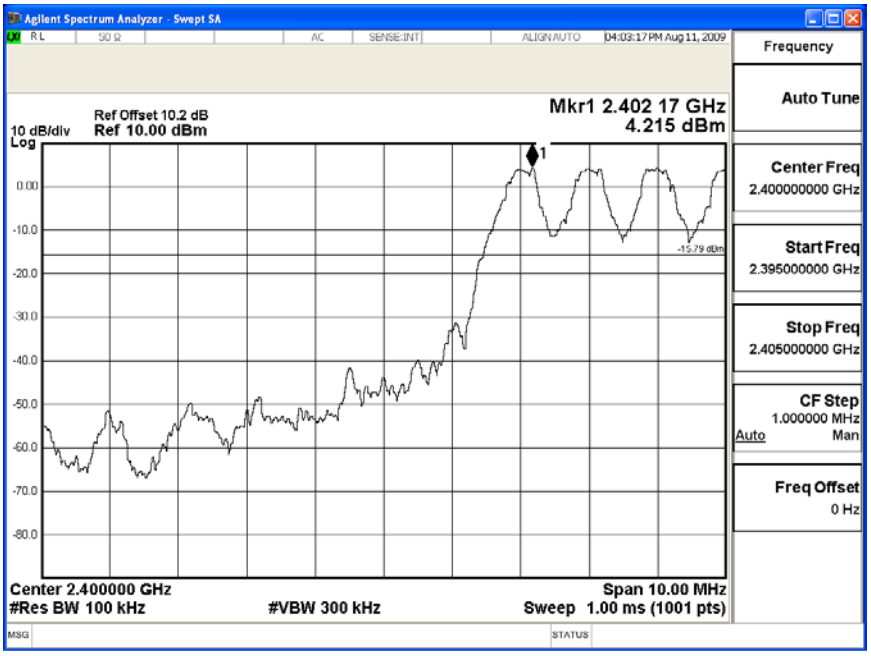


HIGH CHANNEL SPURIOUS

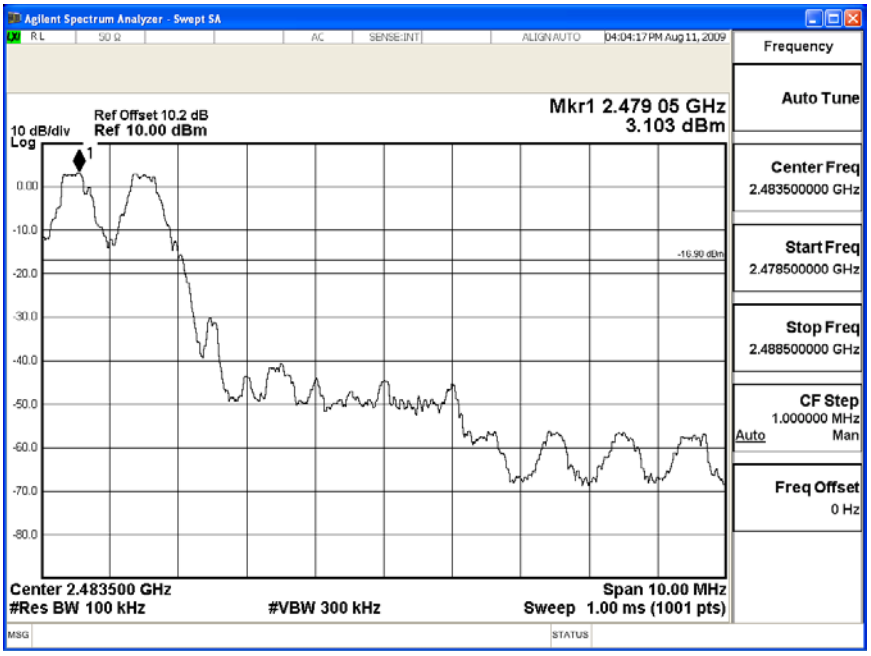


SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

LOW BANDEDGE WITH HOPPING ON



HIGH BANDEDGE WITH HOPPING ON



7.2. ENHANCED DATA RATE 8PSK MODULATION

7.2.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

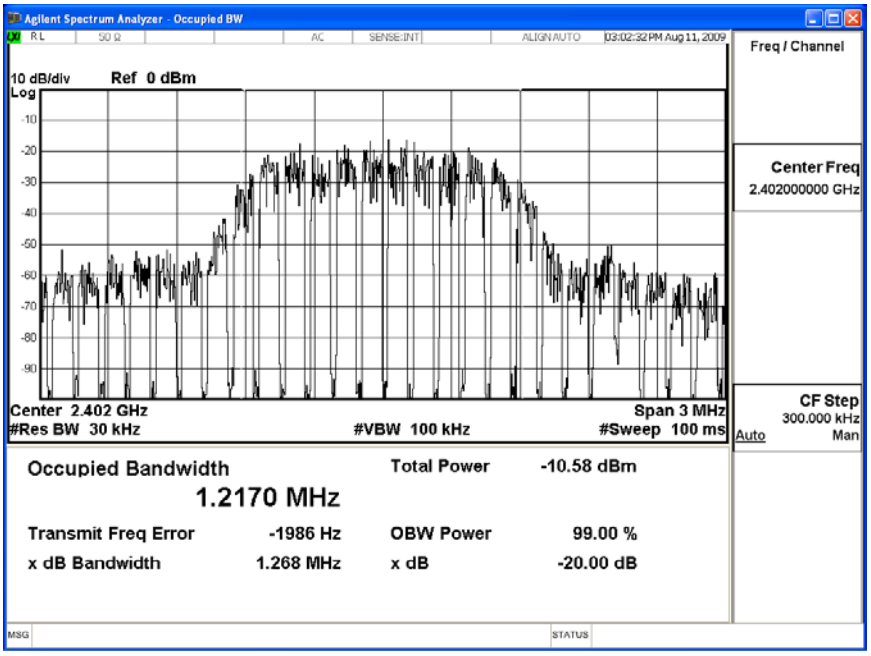
The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	1276	1217
Middle	2441	1237	1235.9
High	2480	1278	1224.5

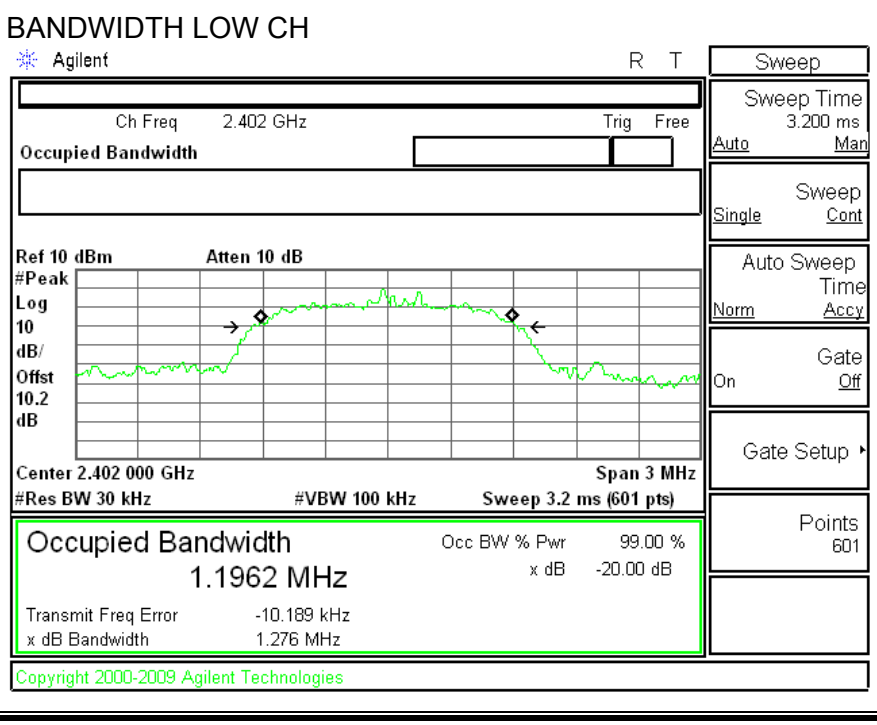
99% BANDWIDTH

BANDWIDTH LOW CH

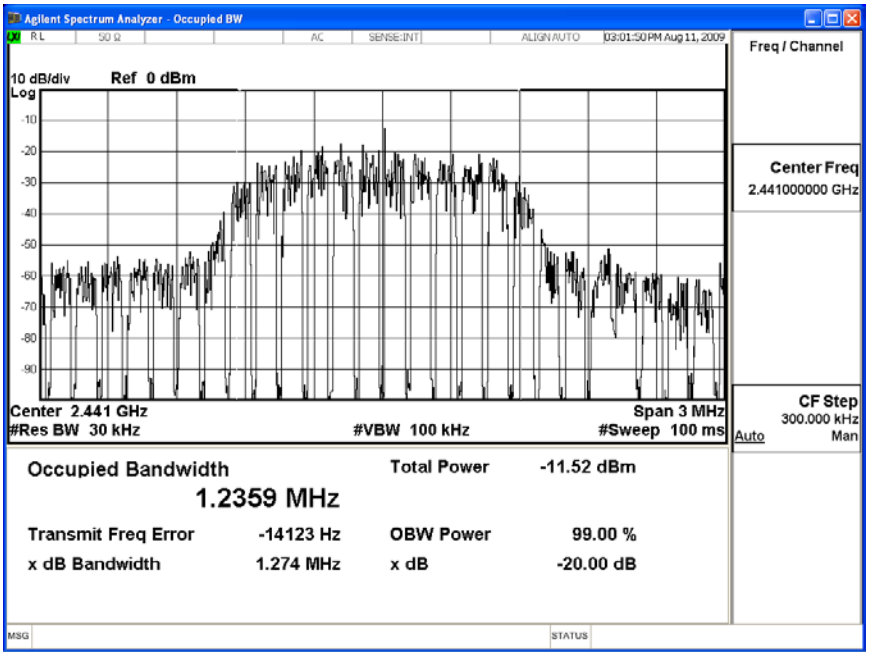


20dB BANDWIDTH

BANDWIDTH LOW CH

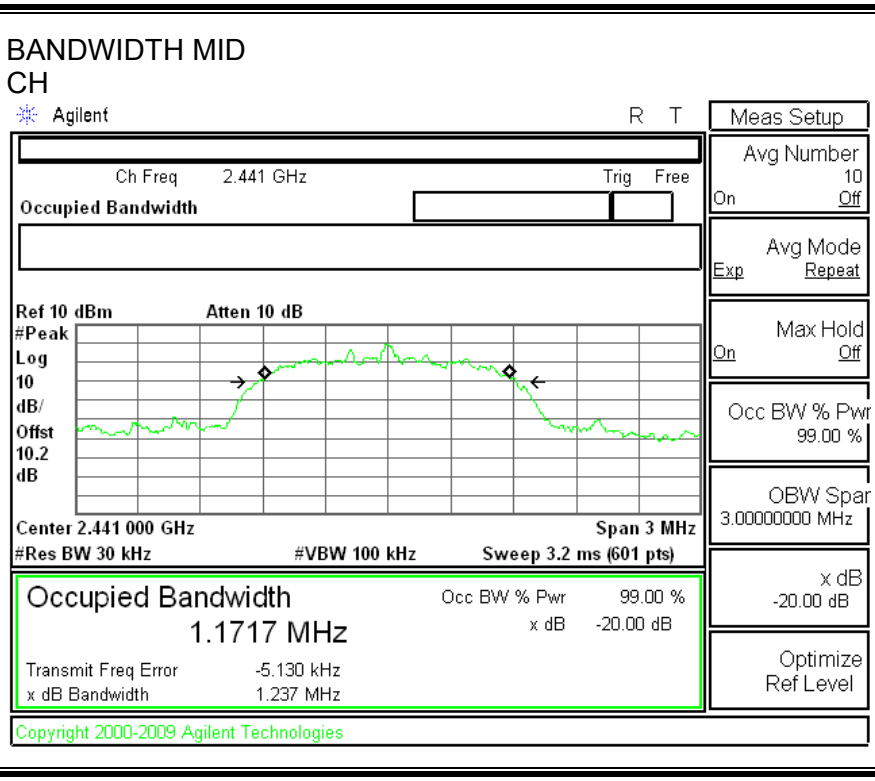


BANDWIDTH MID CH

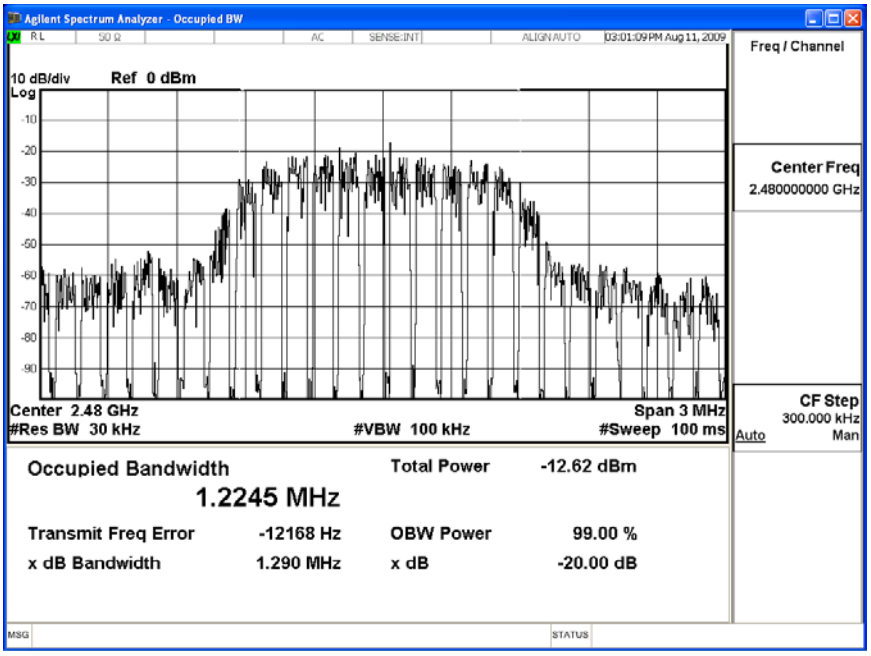


20dB BANDWIDTH

BANDWIDTH MID CH

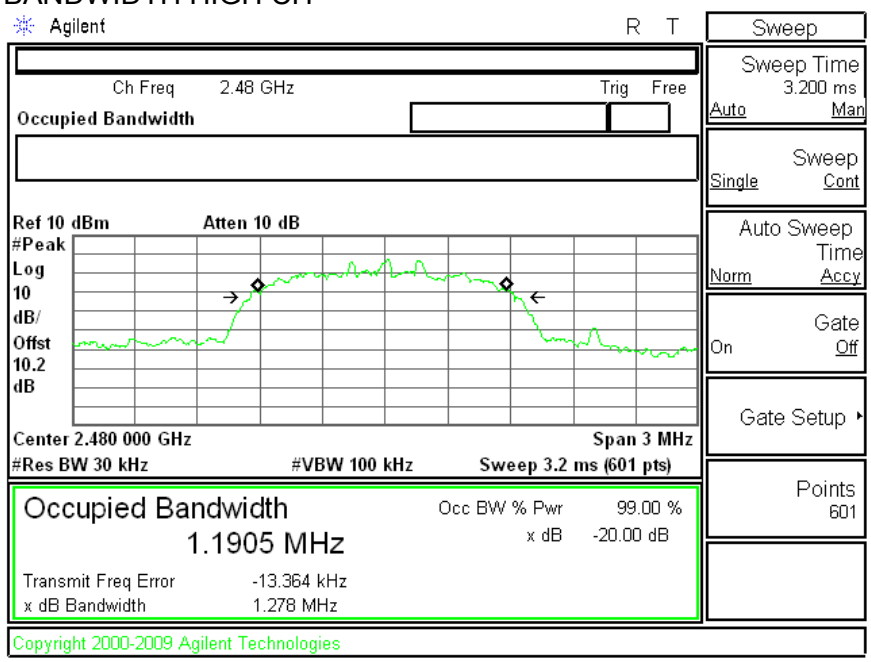


BANDWIDTH HIGH CH



20dB BANDWIDTH

BANDWIDTH HIGH CH



7.2.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

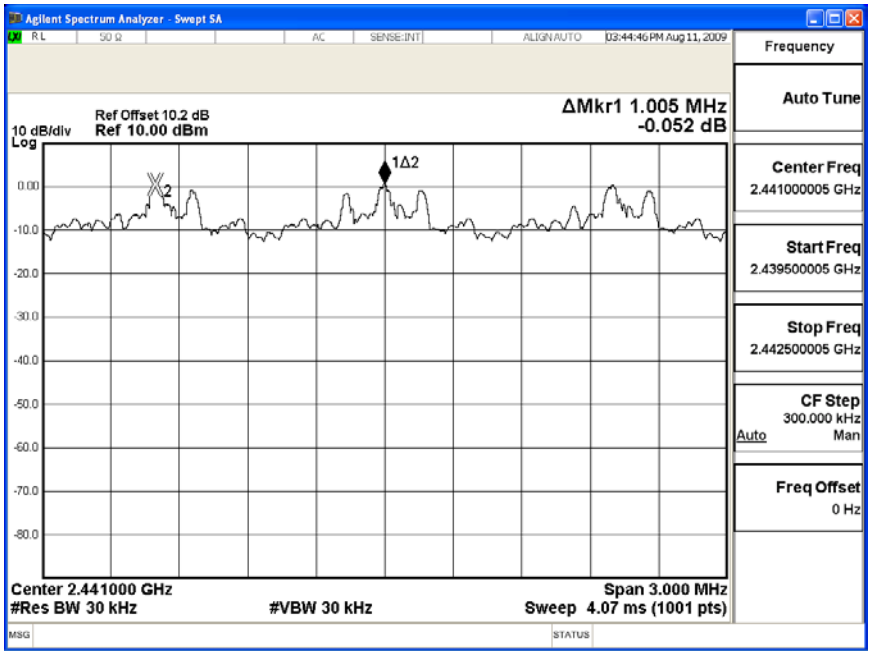
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

RESULTS

HOPPING FREQUENCY SEPARATION

HOPPING FREQUENCY SEPARATION



7.2.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

TEST PROCEDURE

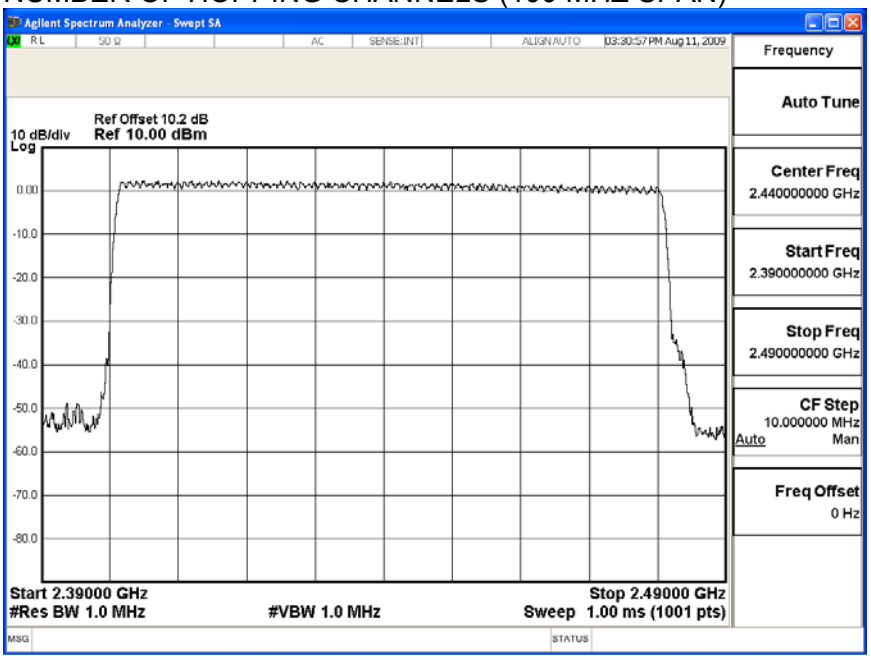
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

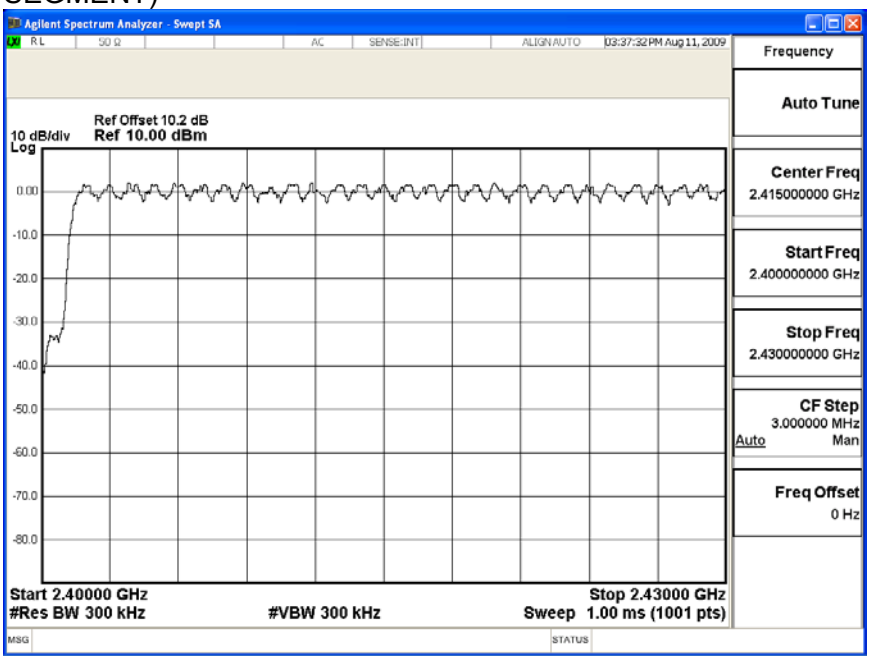
79 Channels observed.

NUMBER OF HOPPING CHANNELS

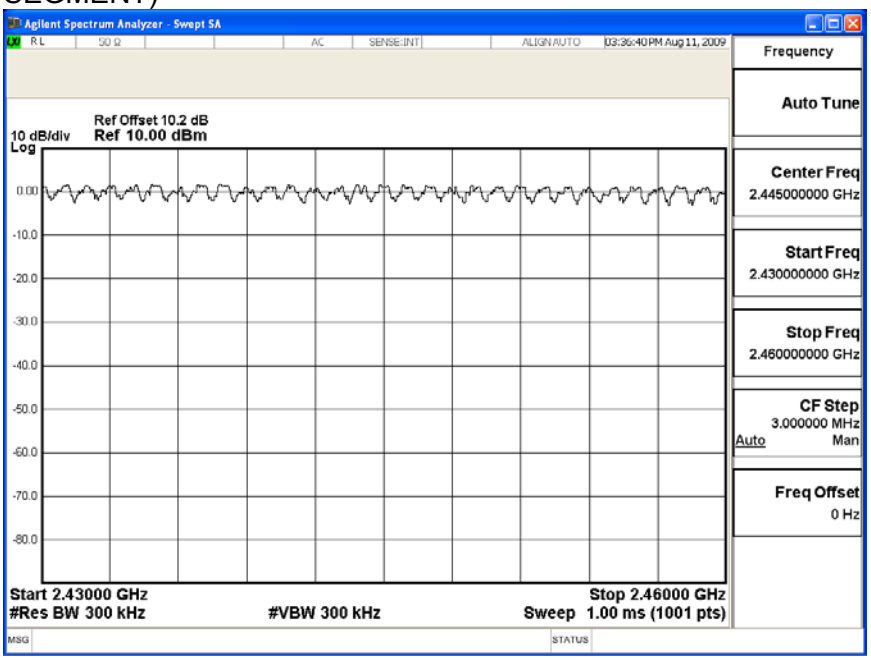
NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)



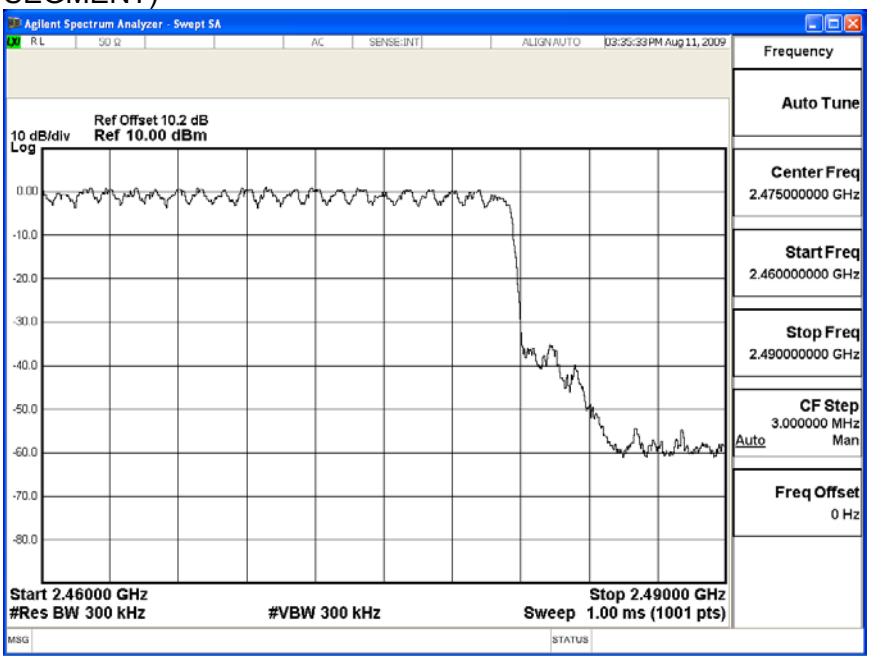
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, SECOND SEGMENT)



NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, THIRD SEGMENT)



7.2.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

RESULTS

Time Of Occupancy = 10 * 11 pulses *3.05msec = 335.5 msec

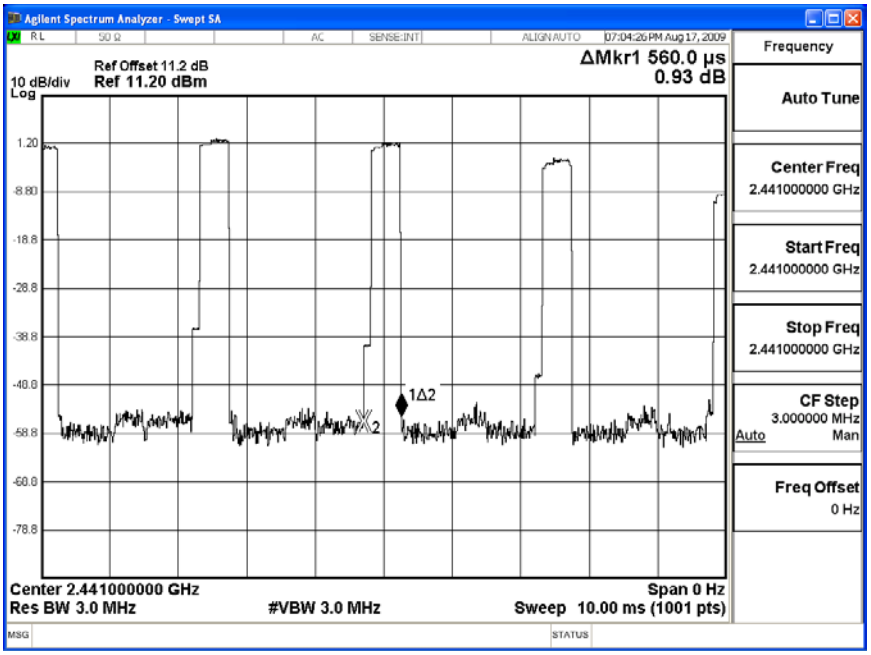
8PSK Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
DH1	0.56	32	0.179	0.4	0.221
DH3	1.8	16	0.288	0.4	0.112
DH5	3.05	11	0.336	0.4	0.065

DH1

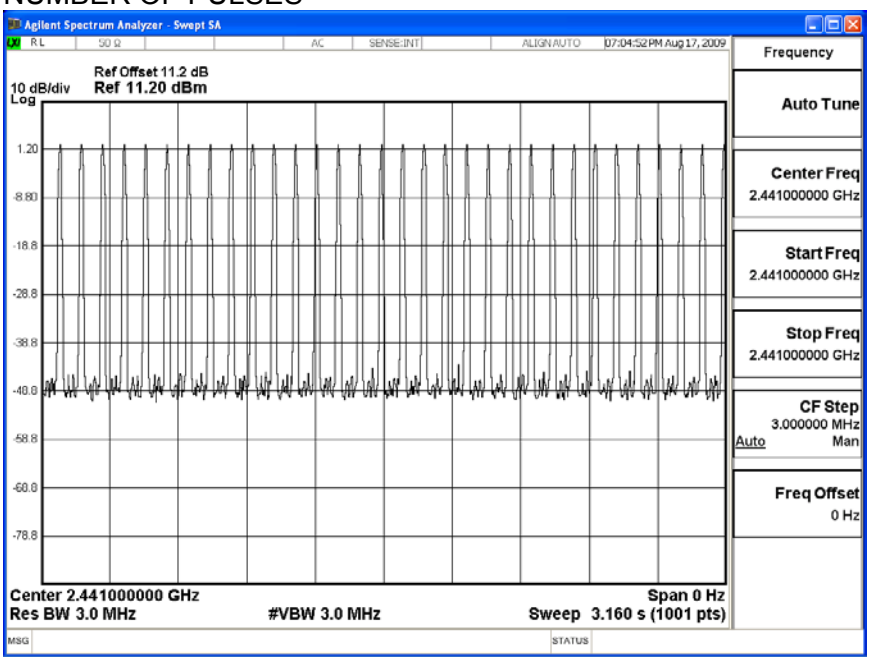
PULSE WIDTH

PULSE WIDTH



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD

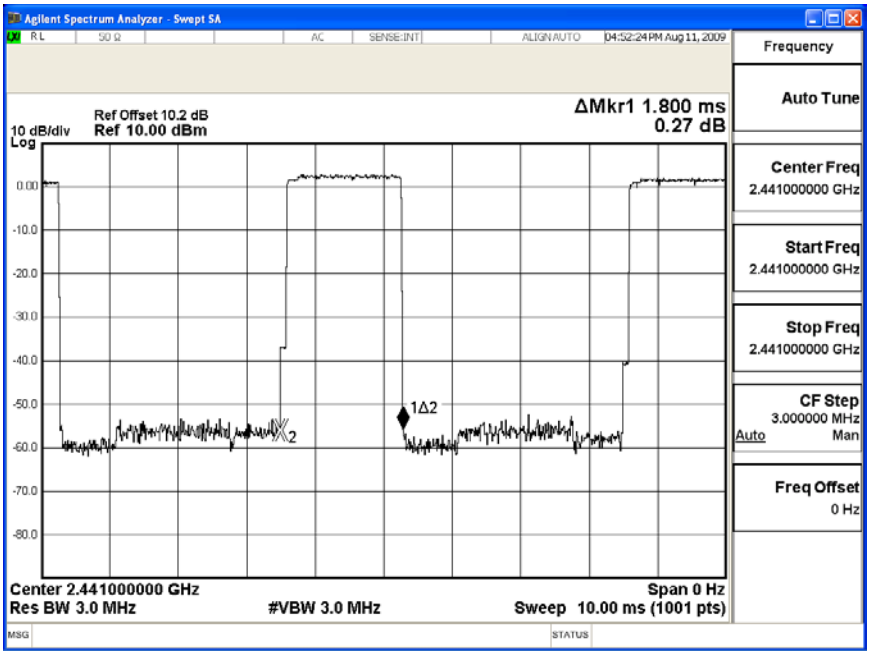
NUMBER OF PULSES



DH3

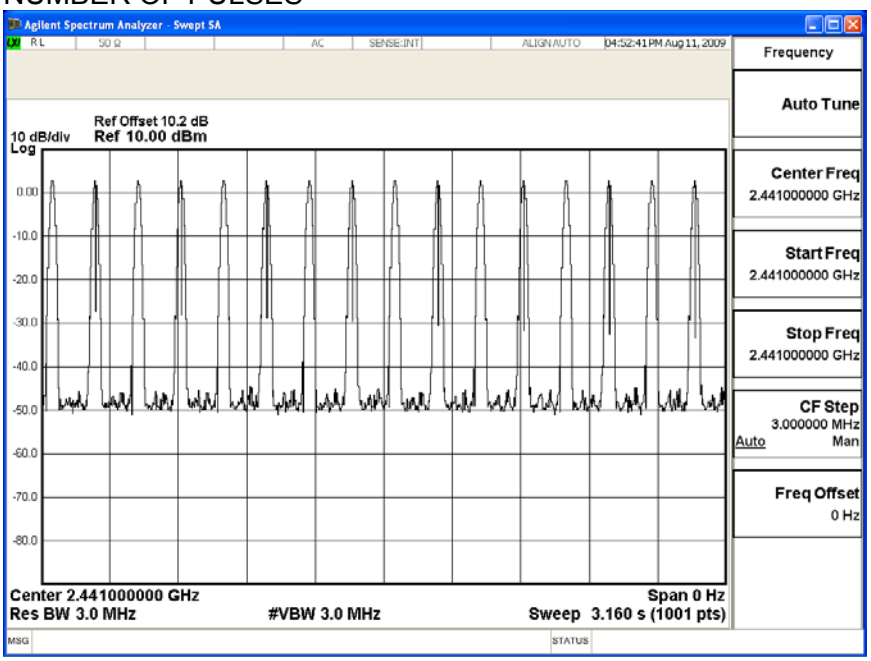
PULSE WIDTH

PULSE WIDTH



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD

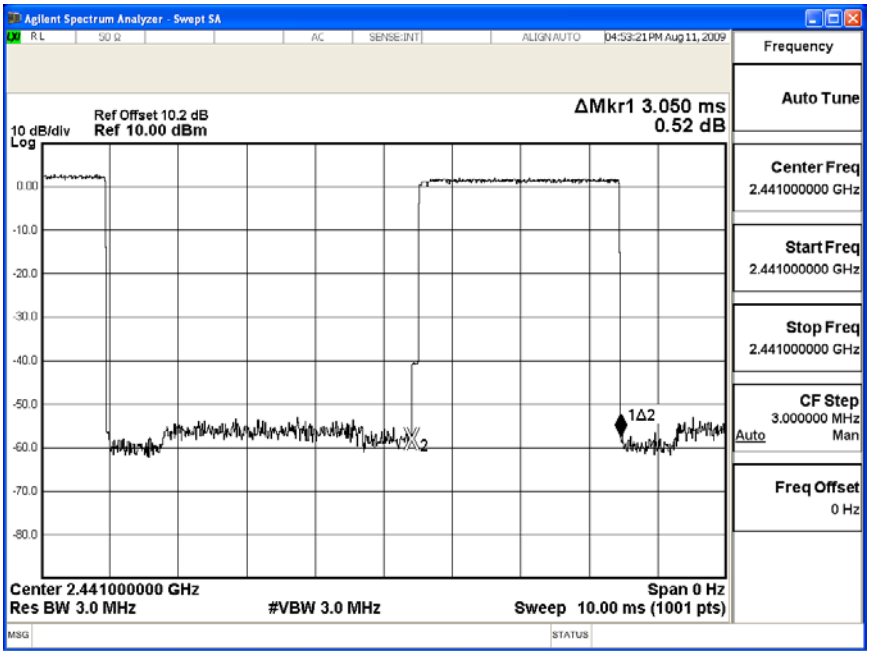
NUMBER OF PULSES



DH5

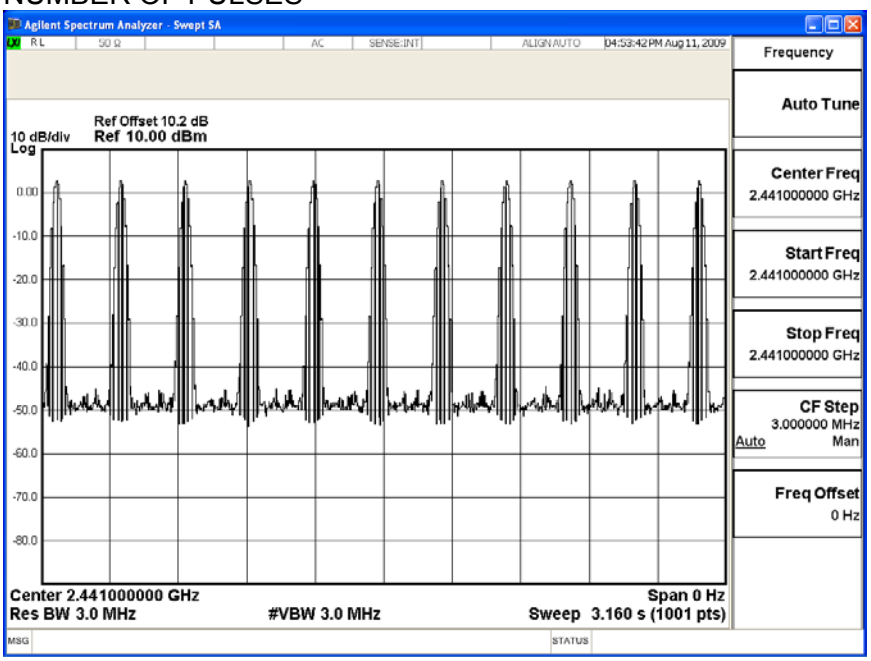
PULSE WIDTH

PULSE WIDTH



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD

NUMBER OF PULSES



7.2.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm.

Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

TEST PROCEDURE

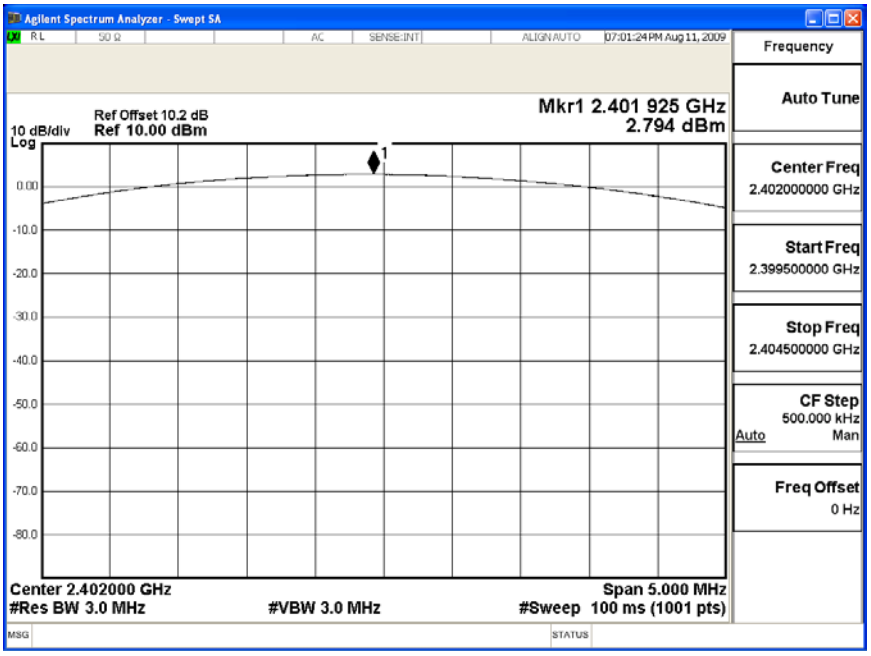
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

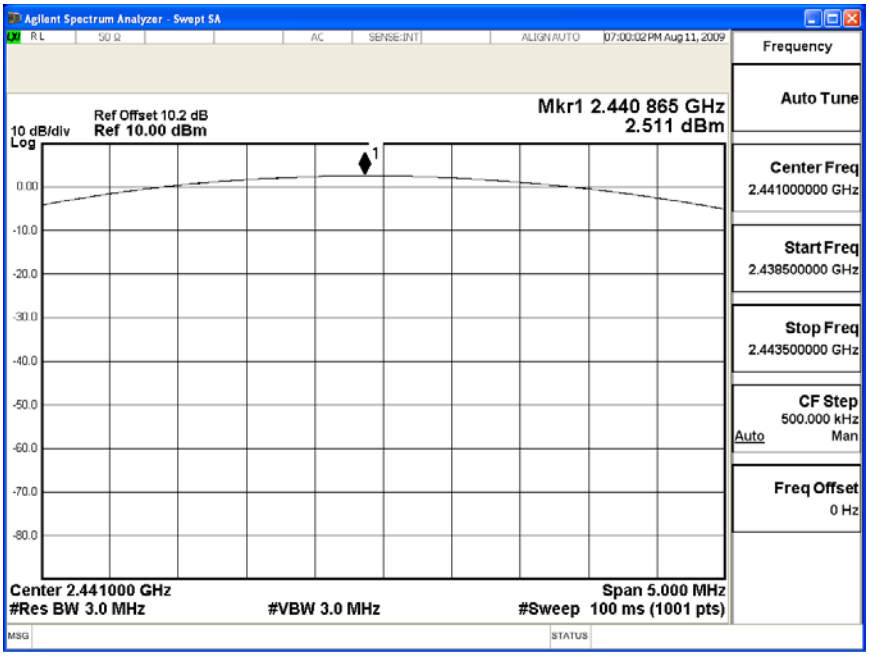
Channel	Frequency (MHz)	SA Output Power	Limit (dBm)	Margin (dB)
Low	2402	2.79	21	-18.44
Middle	2441	2.51	21	-18.59
High	2480	1.57	21	-19.23

OUTPUT POWER

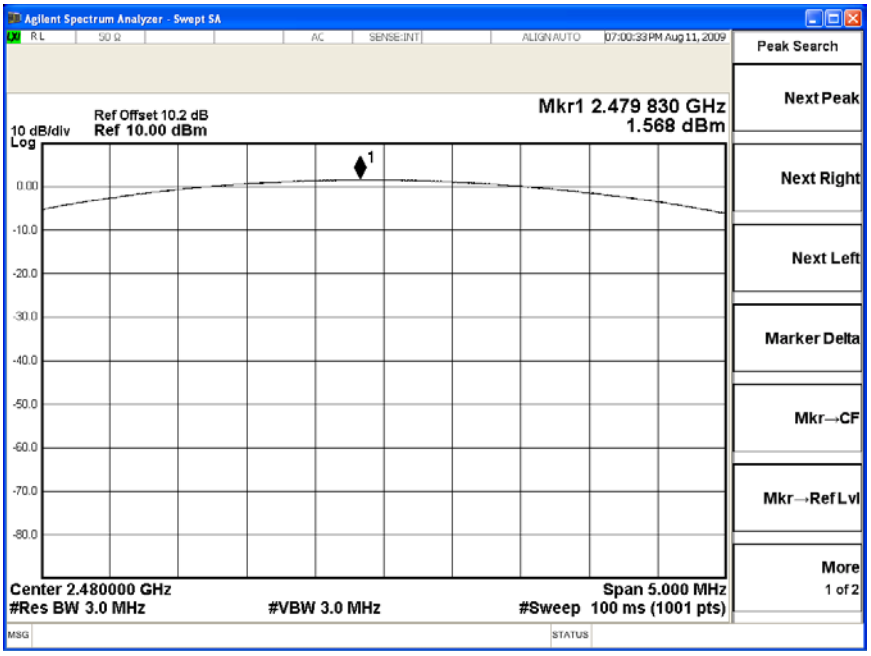
PEAK POWER LOW CH



PEAK POWER MID CH



PEAK POWER HIGH CH



7.2.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 11.2 dB (including 10 dB pad and 1.2dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	-0.77
Middle	2441	-0.99
High	2480	-2.43

7.2.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

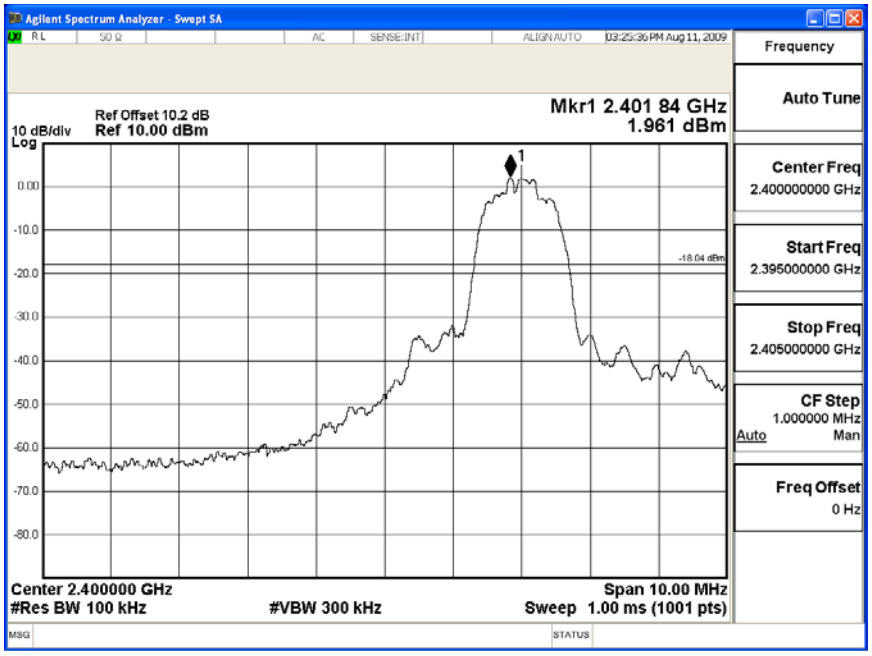
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

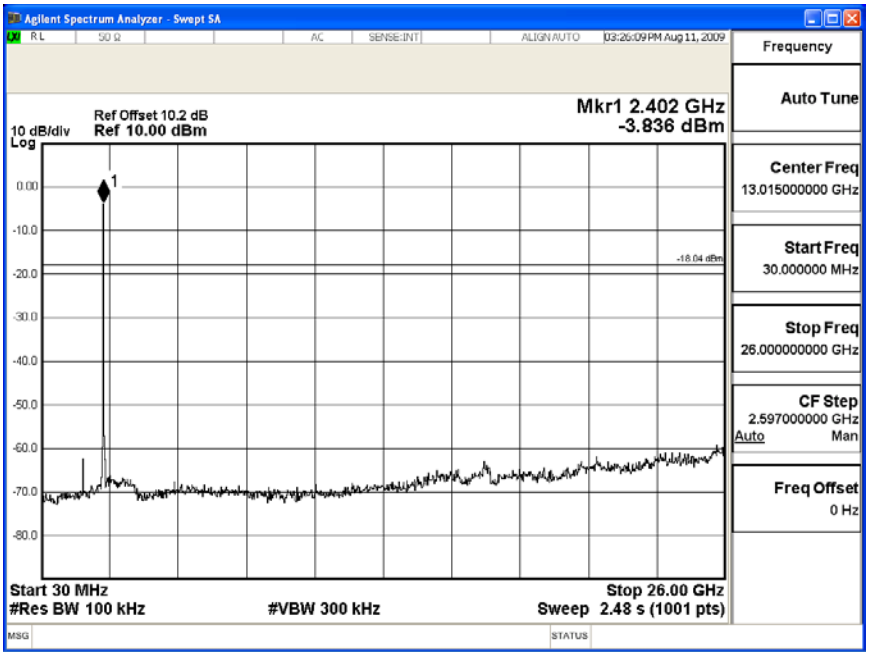
RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL

LOW CHANNEL BANDEDGE

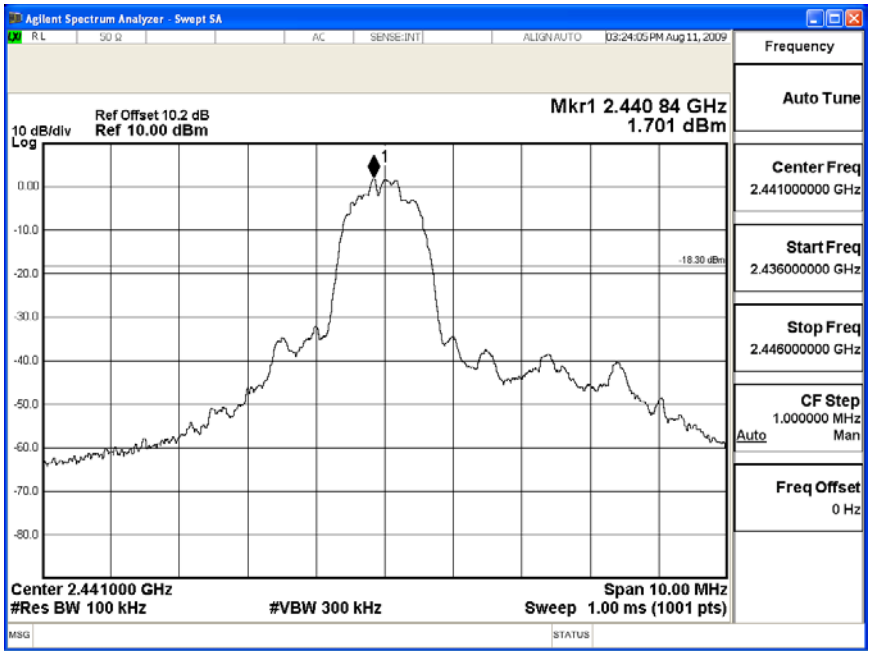


LOW CHANNEL SPURIOUS

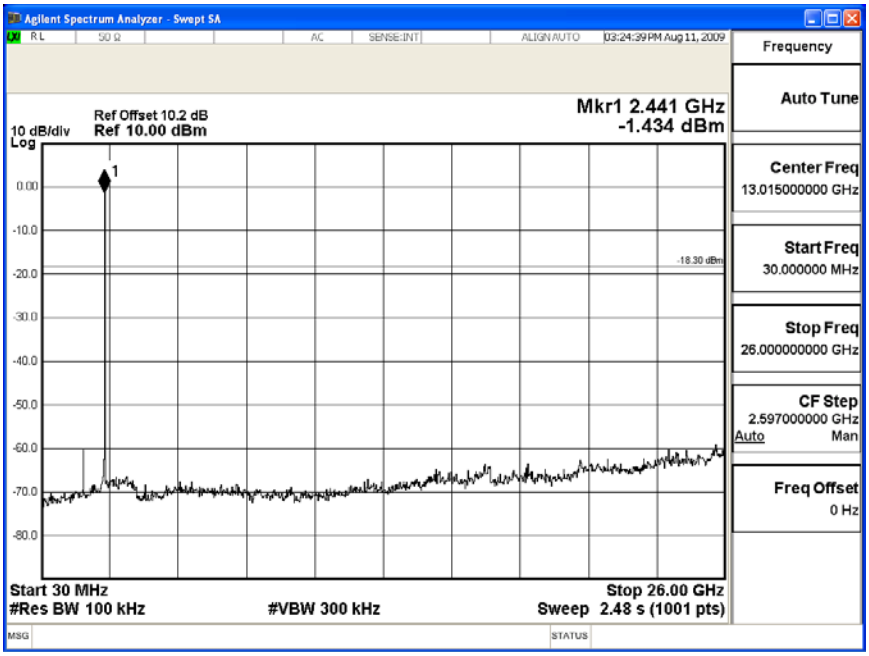


SPURIOUS EMISSIONS, MID CHANNEL

MID CHANNEL REFERENCE

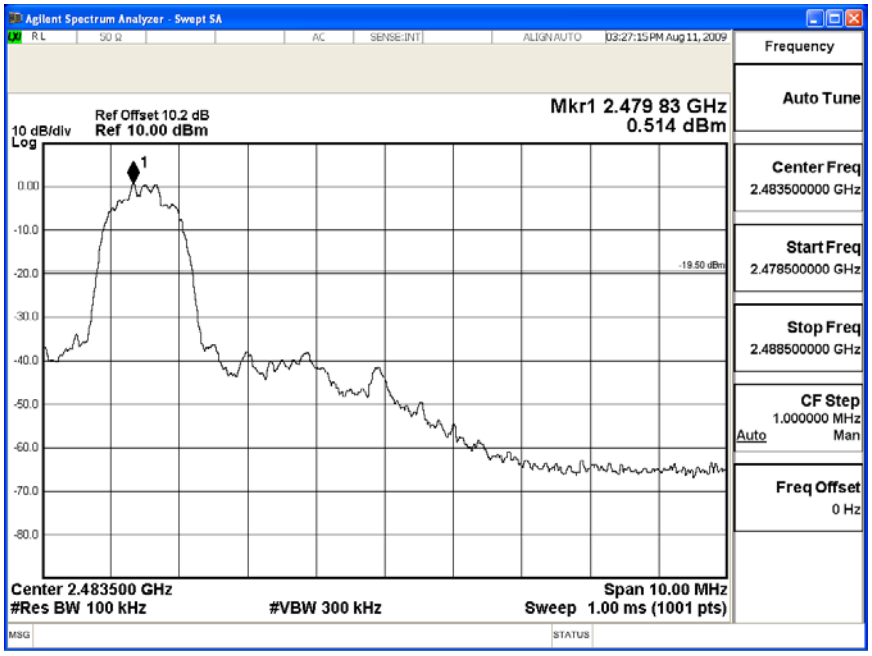


MID CHANNEL SPURIOUS

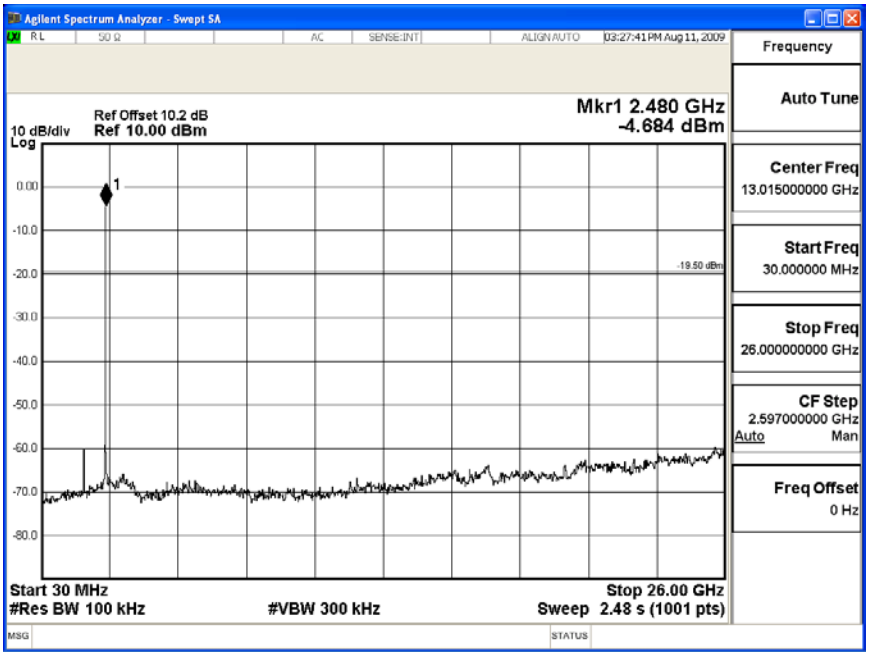


SPURIOUS EMISSIONS, HIGH CHANNEL

HIGH CHANNEL BANDEDGE

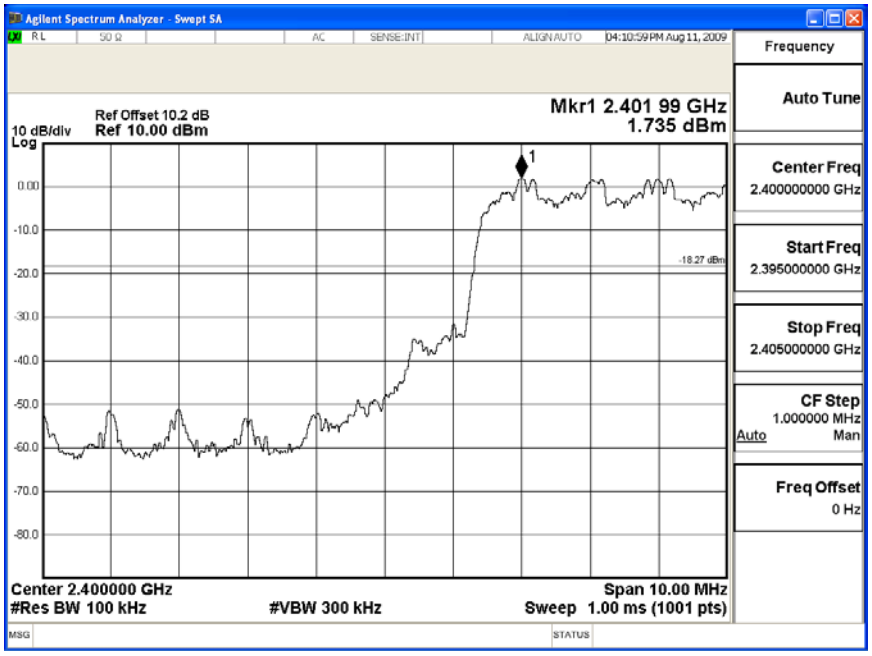


HIGH CHANNEL SPURIOUS

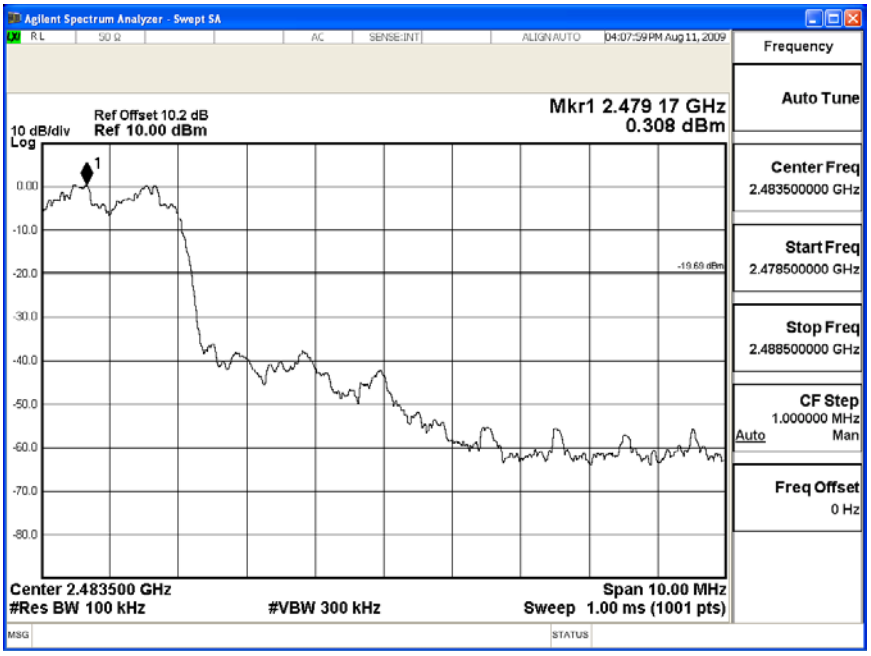


SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

LOW BANDEDGE WITH HOPPING ON



HIGH BANDEDGE WITH HOPPING ON



8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

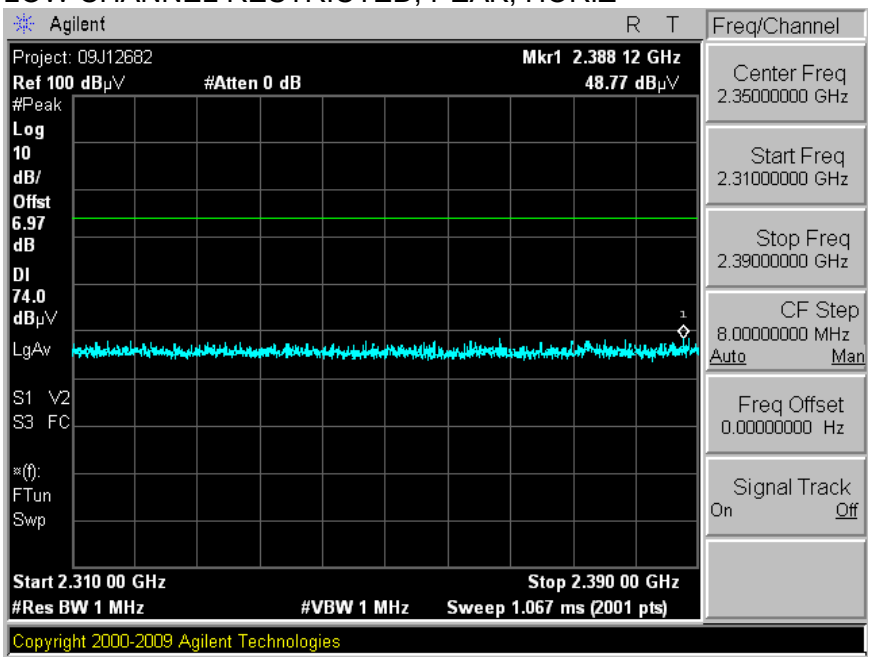
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

8.2. TRANSMITTER ABOVE 1 GHz

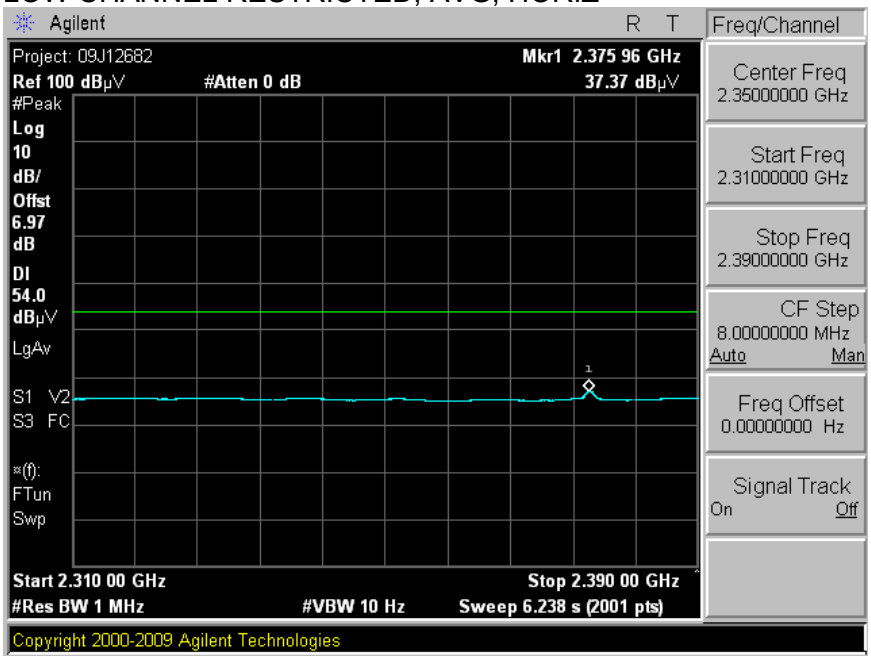
8.2.1. BASIC DATA RATE GFSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

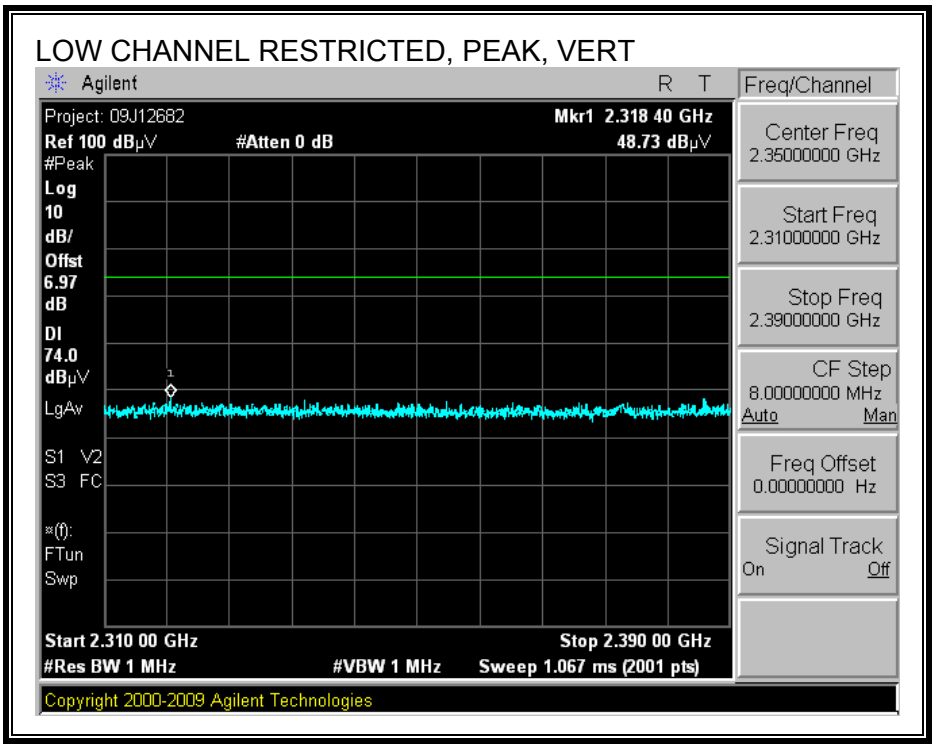
LOW CHANNEL RESTRICTED, PEAK, HORIZ



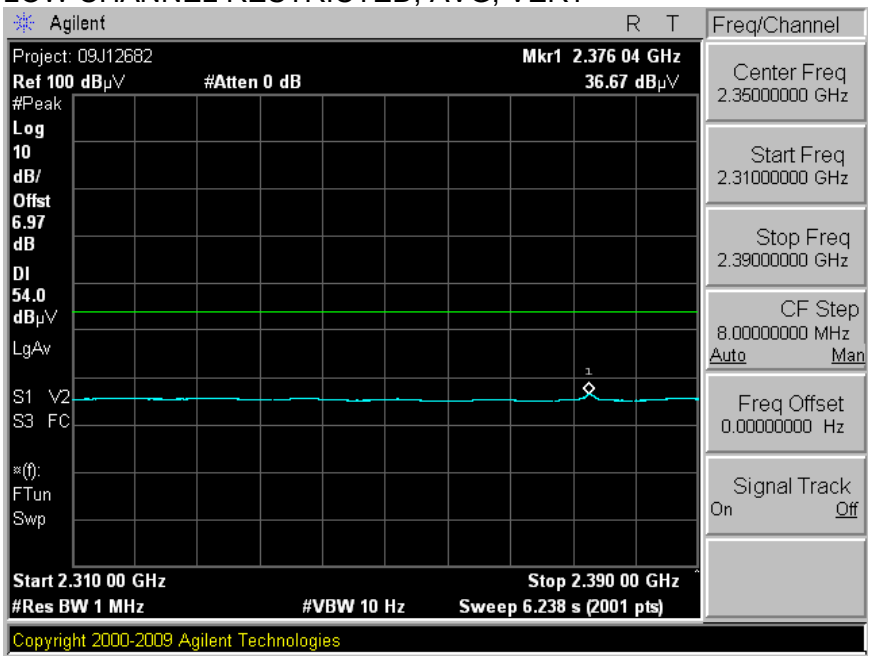
LOW CHANNEL RESTRICTED, AVG, HORIZ



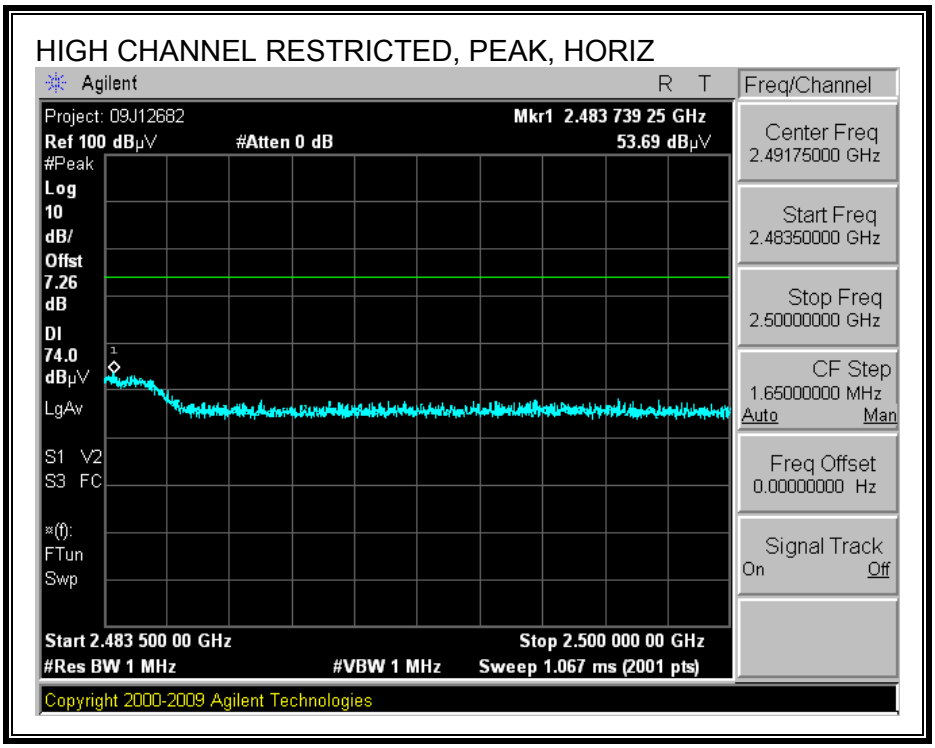
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



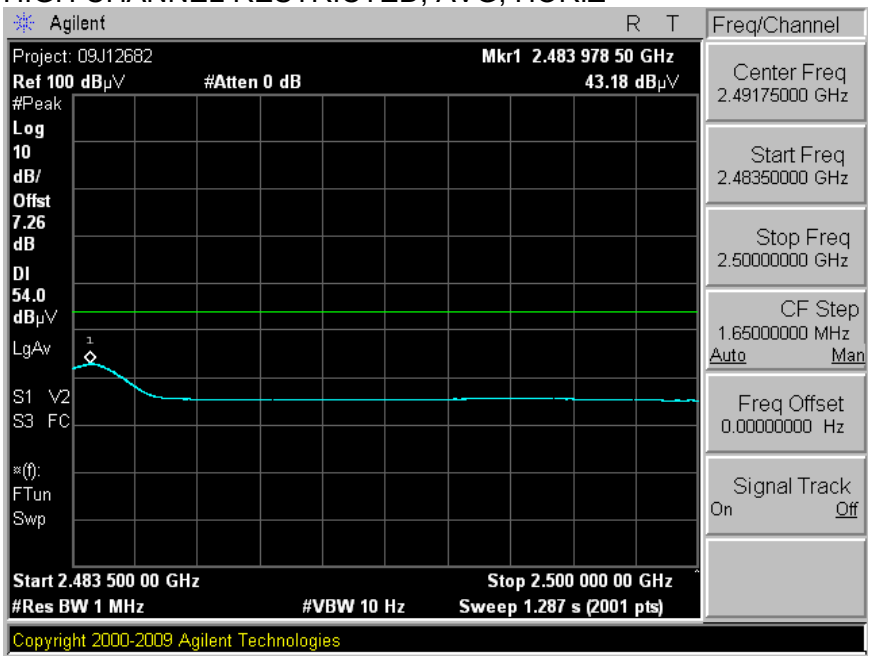
LOW CHANNEL RESTRICTED, AVG, VERT



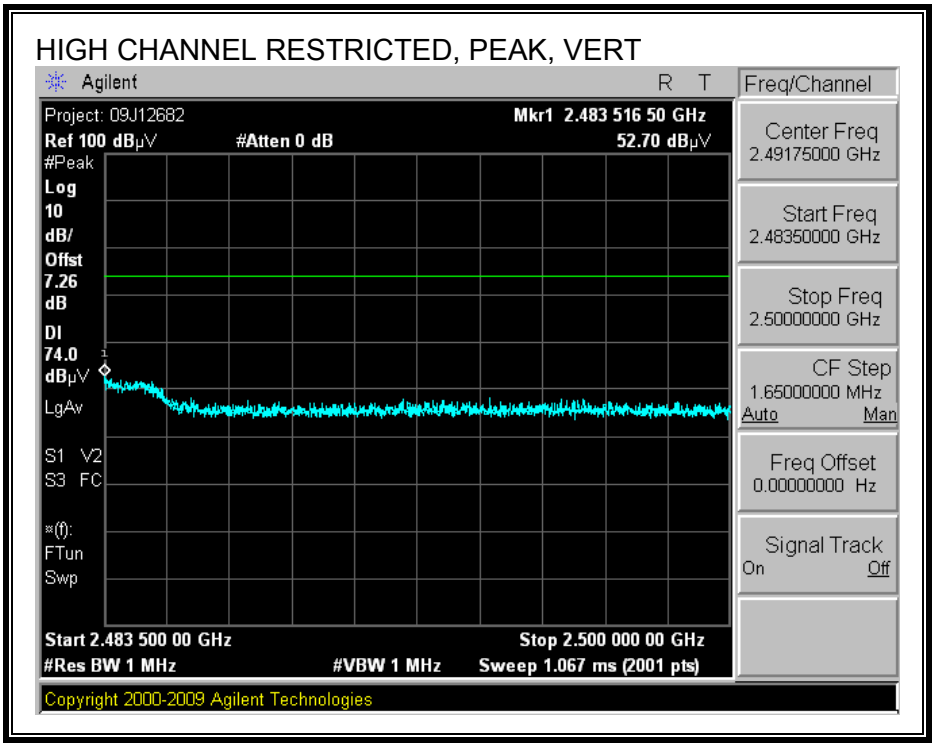
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



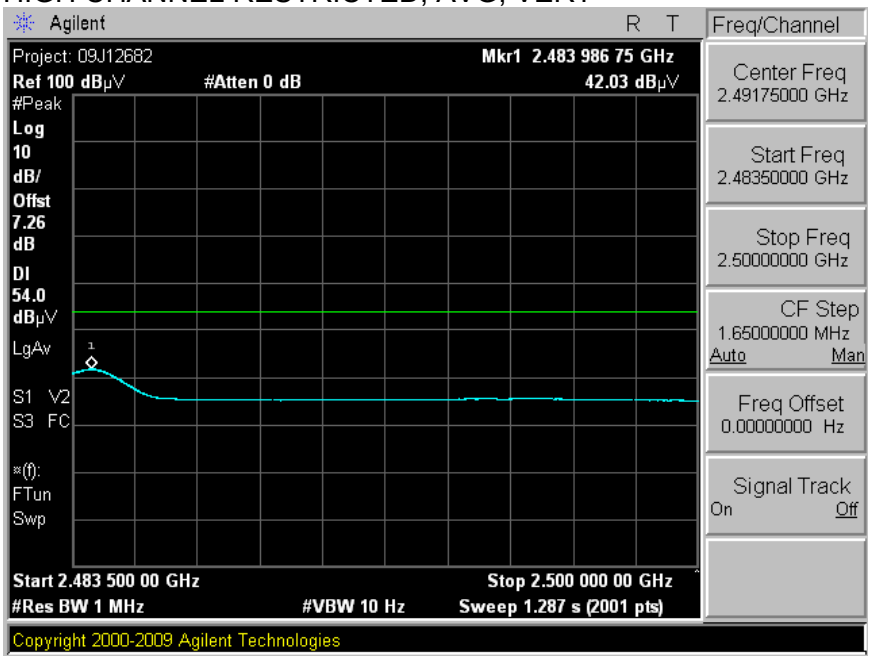
HIGH CHANNEL RESTRICTED, AVG, HORIZ



RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



HIGH CHANNEL RESTRICTED, AVG, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Monica Harrison
Date: 08/14/09
Project #: 09J12682
Company: SMK
Test Target: DUT
Mode Oper: Tx GFSK

f	Measurement Frequency	Amp	Preamp Gain	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter	

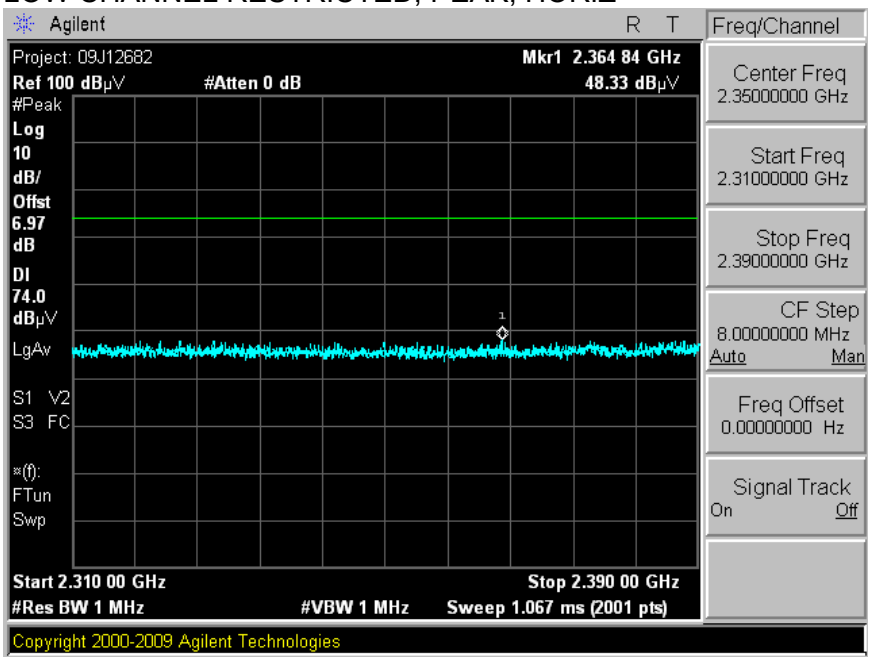
f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Ant.High cm	Table Angle Degree	Notes
2480															
4.960	3.0	41.6	32.9	5.9	-34.9	0.0	0.0	45.6	74.0	-28.4	V	P	100.7	312.4	
4.960	3.0	28.7	32.9	5.9	-34.9	0.0	0.0	32.6	54.0	-21.4	V	A	100.7	312.4	
7.440	3.0	37.8	35.4	7.3	-34.6	0.0	0.0	45.9	74.0	-28.1	V	P	160.0	181.4	
7.440	3.0	25.0	35.4	7.3	-34.6	0.0	0.0	33.1	54.0	-20.9	V	A	160.0	181.4	
9.920	3.0	36.8	37.2	8.7	-35.1	0.0	0.0	47.6	74.0	-26.4	V	P	139.3	360.0	
9.920	3.0	24.1	37.2	8.7	-35.1	0.0	0.0	35.0	54.0	-19.0	V	A	139.3	360.0	
4.960	3.0	44.7	32.9	5.9	-34.9	0.0	0.0	48.6	74.0	-25.4	H	P	181.6	164.7	
4.960	3.0	32.6	32.9	5.9	-34.9	0.0	0.0	36.5	54.0	-17.5	H	A	181.6	164.7	
7.440	3.0	37.7	35.4	7.3	-34.6	0.0	0.0	45.7	74.0	-28.3	H	P	136.8	38.6	
7.440	3.0	25.1	35.4	7.3	-34.6	0.0	0.0	33.2	54.0	-20.8	H	A	136.8	38.6	
9.920	3.0	37.9	37.2	8.7	-35.1	0.0	0.0	48.8	74.0	-25.2	H	P	154.1	173.9	
9.920	3.0	25.1	37.2	8.7	-35.1	0.0	0.0	35.9	54.0	-18.1	H	A	154.1	173.9	
2441															
4.882	3.0	42.9	32.8	5.8	-34.9	0.0	0.0	46.7	74.0	-27.3	H	P	199.8	62.9	
4.882	3.0	32.3	32.8	5.8	-34.9	0.0	0.0	36.1	54.0	-17.9	H	A	199.8	62.9	
7.323	3.0	37.2	35.2	7.3	-34.7	0.0	0.0	45.0	74.0	-29.0	H	P	123.8	298.7	
7.323	3.0	24.4	35.2	7.3	-34.7	0.0	0.0	32.2	54.0	-21.8	H	A	123.8	298.7	
9.764	3.0	36.9	37.2	8.6	-35.0	0.0	0.0	47.7	74.0	-26.3	H	P	164.8	328.0	
9.764	3.0	23.4	37.2	8.6	-35.0	0.0	0.0	34.2	54.0	-19.8	H	A	164.8	328.0	
4.882	3.0	41.6	32.8	5.8	-34.9	0.0	0.0	45.4	74.0	-28.6	V	P	135.2	356.6	
4.882	3.0	30.0	32.8	5.8	-34.9	0.0	0.0	33.8	54.0	-20.2	V	A	135.2	356.6	
7.323	3.0	37.7	35.2	7.3	-34.7	0.0	0.0	45.5	74.0	-28.5	V	P	153.3	171.0	
7.323	3.0	24.6	35.2	7.3	-34.7	0.0	0.0	32.4	54.0	-21.6	V	A	153.3	171.0	
9.764	3.0	36.4	37.2	8.6	-35.0	0.0	0.0	47.2	74.0	-26.8	V	P	106.8	22.2	
9.764	3.0	23.6	37.2	8.6	-35.0	0.0	0.0	34.3	54.0	-19.7	V	A	106.8	22.2	
2402															
4.804	3.0	41.1	32.8	5.8	-34.8	0.0	0.0	44.7	74.0	-29.3	V	P	101.4	164.0	
4.804	3.0	28.1	32.8	5.8	-34.8	0.0	0.0	31.8	54.0	-22.2	V	A	101.4	164.0	
7.206	3.0	37.8	35.0	7.2	-34.7	0.0	0.0	45.4	74.0	-28.6	V	P	182.3	212.9	
7.206	3.0	25.1	35.0	7.2	-34.7	0.0	0.0	32.7	54.0	-21.3	V	A	182.3	212.9	
9.608	3.0	36.3	37.1	8.5	-35.0	0.0	0.0	47.0	74.0	-27.0	V	P	139.7	281.7	
9.608	3.0	24.0	37.1	8.5	-35.0	0.0	0.0	34.6	54.0	-19.4	V	A	139.7	281.7	
4.804	3.0	41.1	32.8	5.8	-34.8	0.0	0.0	44.8	74.0	-29.2	H	P	196.6	6.8	
4.804	3.0	29.7	32.8	5.8	-34.8	0.0	0.0	33.4	54.0	-20.6	H	A	196.6	6.8	
7.206	3.0	37.4	35.0	7.2	-34.7	0.0	0.0	45.0	74.0	-29.0	H	P	107.5	51.4	
7.206	3.0	24.7	35.0	7.2	-34.7	0.0	0.0	32.3	54.0	-21.7	H	A	107.5	51.4	
9.608	3.0	37.3	37.1	8.5	-35.0	0.0	0.0	47.9	74.0	-26.1	H	P	199.7	162.4	
9.608	3.0	24.0	37.1	8.5	-35.0	0.0	0.0	34.6	54.0	-19.4	H	A	199.7	162.4	

Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

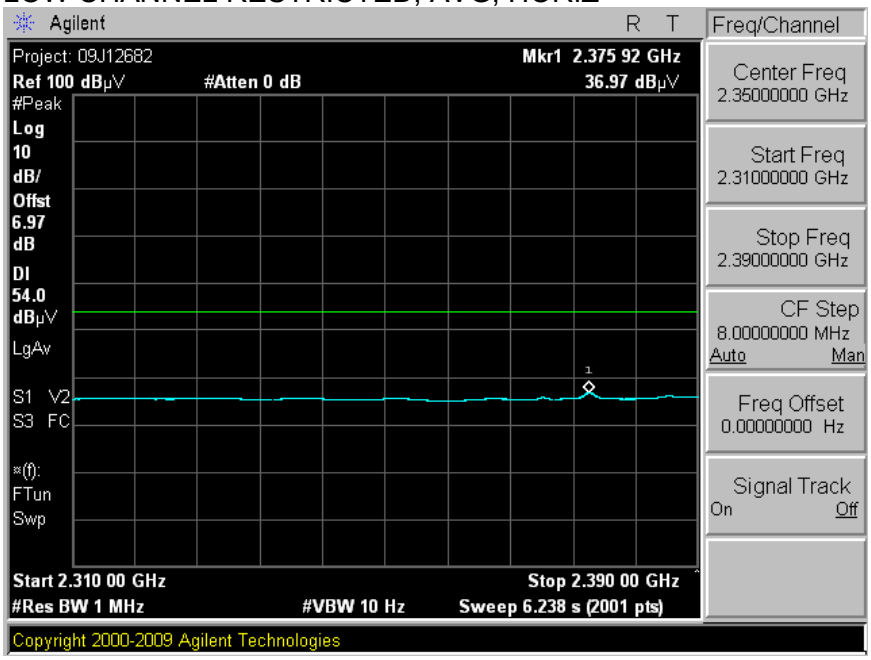
8.2.2. ENHANCED DATA RATE 8PSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

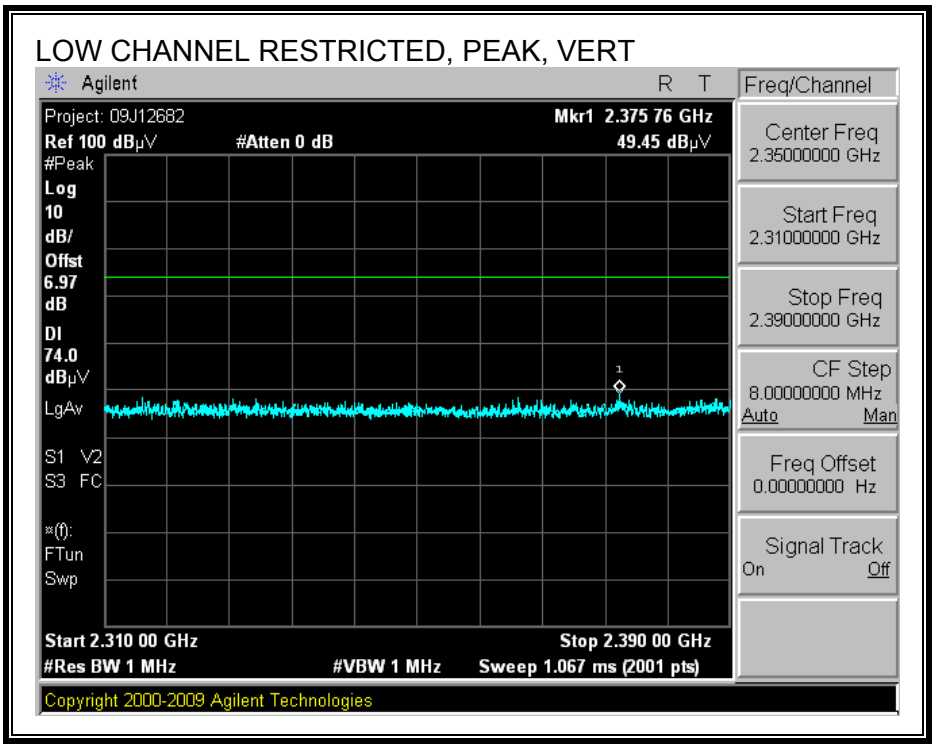
LOW CHANNEL RESTRICTED, PEAK, HORIZ



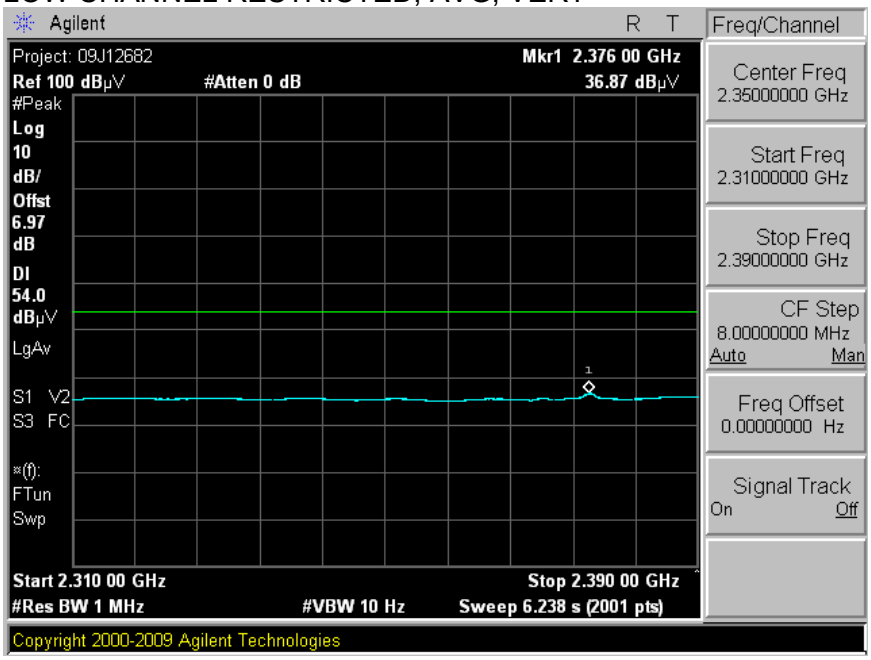
LOW CHANNEL RESTRICTED, AVG, HORIZ



RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

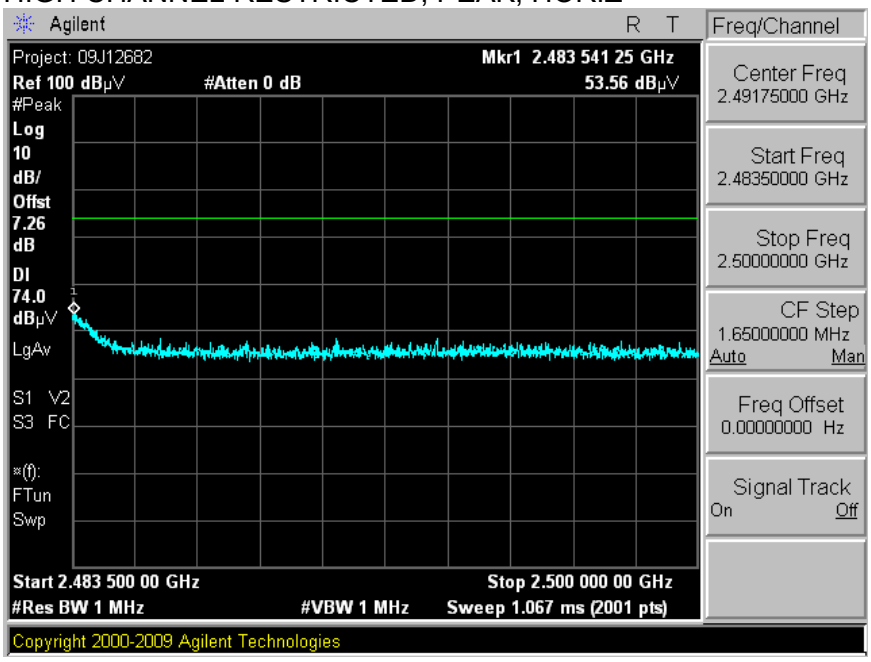


LOW CHANNEL RESTRICTED, AVG, VERT

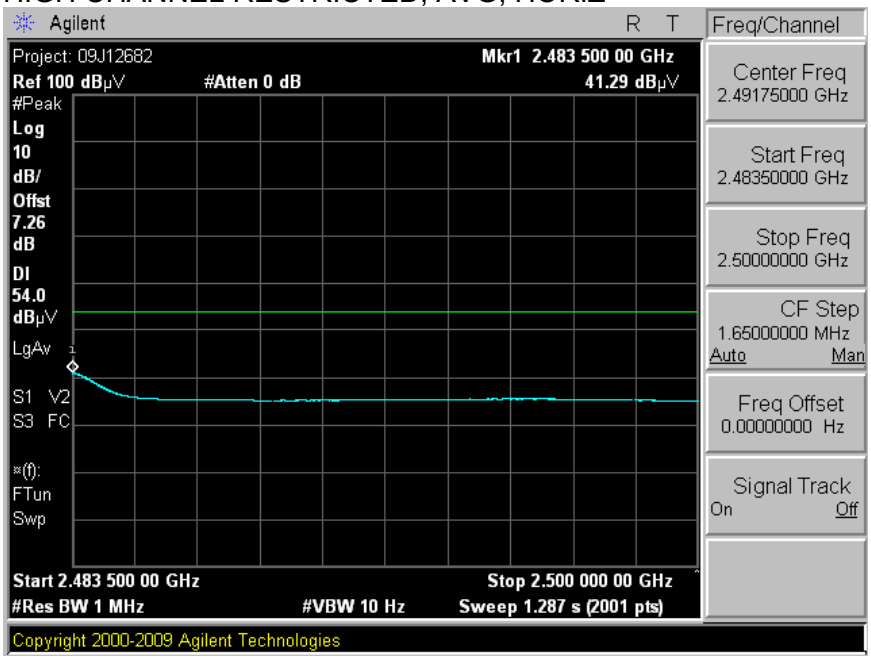


RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

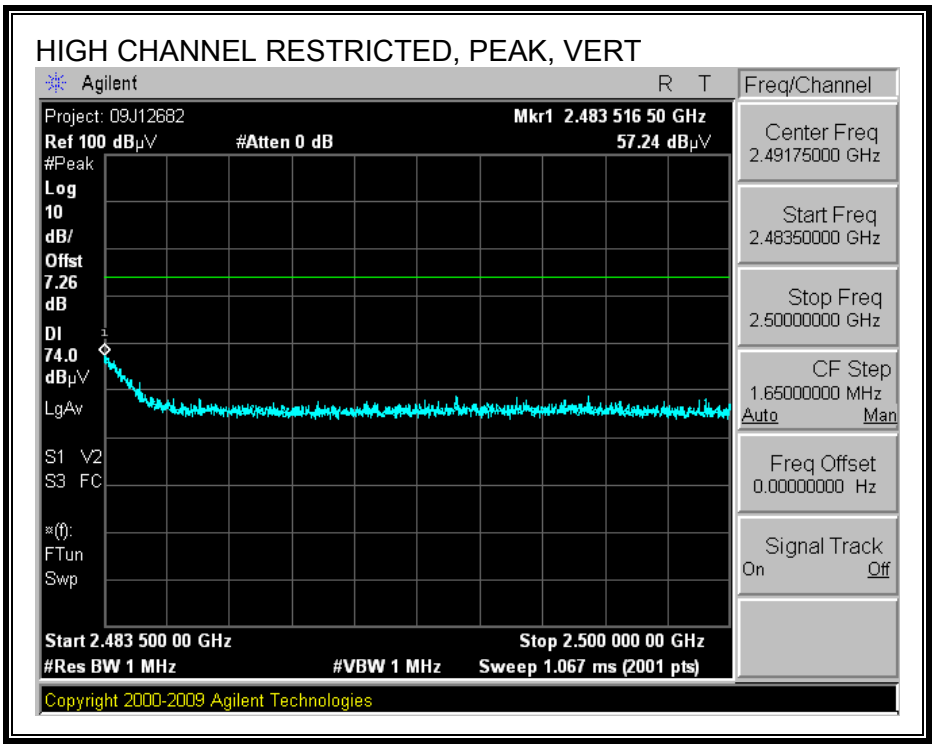
HIGH CHANNEL RESTRICTED, PEAK, HORIZ



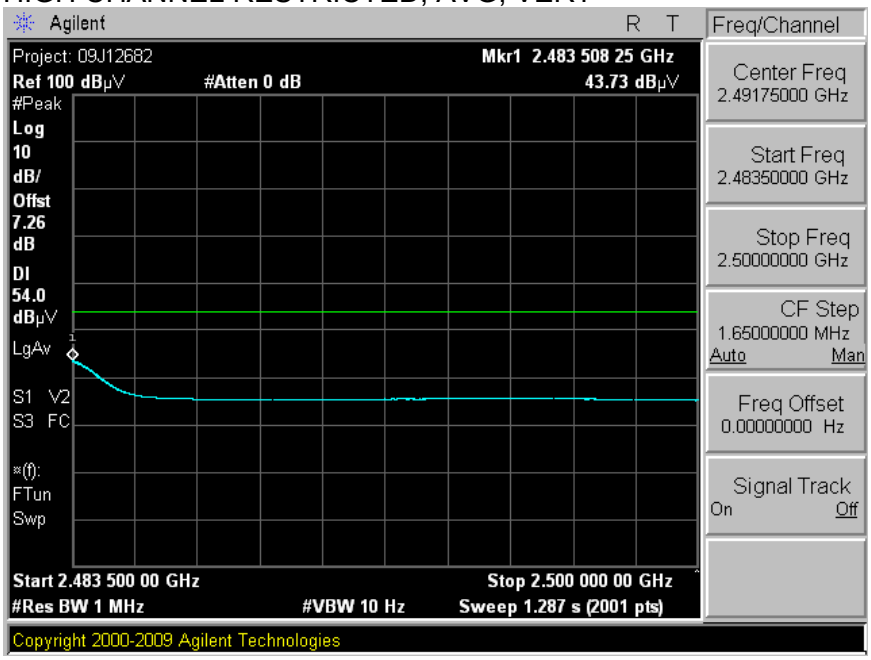
HIGH CHANNEL RESTRICTED, AVG, HORIZ



RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



HIGH CHANNEL RESTRICTED, AVG, VERT



HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Monica Harrison
Date: 08/16/09
Project #: 09J12682
Company: SMK
Test Target: DUT
Mode Oper: Tx 8PSK

f	Measurement Frequency	Amp	Preamp Gain	Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters	Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m	Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength	Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter	

f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Ant.High cm	Table Angle Degree	Notes
2480															
4.960	3.0	38.3	32.9	5.9	-34.9	0.0	0.0	42.2	74.0	-31.8	H	P	192.7	241.2	
4.960	3.0	25.2	32.9	5.9	-34.9	0.0	0.0	29.1	54.0	-24.9	H	A	192.7	241.2	
7.440	3.0	37.5	35.4	7.3	-34.6	0.0	0.0	45.5	74.0	-28.5	H	P	198.9	16.5	
7.440	3.0	25.0	35.4	7.3	-34.6	0.0	0.0	33.0	54.0	-21.0	H	A	198.9	16.5	
9.920	3.0	37.0	37.2	8.7	-35.1	0.0	0.0	47.9	74.0	-26.1	H	P	176.2	0.7	
9.920	3.0	24.0	37.2	8.7	-35.1	0.0	0.0	34.8	54.0	-19.2	H	A	176.2	0.7	
4.960	3.0	39.2	32.9	5.9	-34.9	0.0	0.0	43.1	74.0	-30.9	V	P	100.7	221.0	
4.960	3.0	25.4	32.9	5.9	-34.9	0.0	0.0	29.3	54.0	-24.7	V	A	100.7	221.0	
7.440	3.0	37.9	35.4	7.3	-34.6	0.0	0.0	46.0	74.0	-28.0	V	P	140.9	83.2	
7.440	3.0	25.0	35.4	7.3	-34.6	0.0	0.0	33.1	54.0	-20.9	V	A	140.9	83.2	
9.920	3.0	37.3	37.2	8.7	-35.1	0.0	0.0	48.2	74.0	-25.8	V	P	184.4	48.2	
9.920	3.0	23.9	37.2	8.7	-35.1	0.0	0.0	34.8	54.0	-19.2	V	A	184.4	48.2	
2441															
4.882	3.0	38.1	32.8	5.8	-34.9	0.0	0.0	41.9	74.0	-32.1	V	P	197.1	255.6	
4.882	3.0	25.3	32.8	5.8	-34.9	0.0	0.0	29.1	54.0	-24.9	V	A	197.1	255.6	
7.323	3.0	37.6	35.2	7.3	-34.7	0.0	0.0	45.4	74.0	-28.6	V	P	193.1	166.0	
7.323	3.0	24.6	35.2	7.3	-34.7	0.0	0.0	32.4	54.0	-21.6	V	A	193.1	166.0	
9.764	3.0	36.8	37.2	8.6	-35.0	0.0	0.0	47.5	74.0	-26.5	V	P	190.0	28.8	
9.764	3.0	23.7	37.2	8.6	-35.0	0.0	0.0	34.4	54.0	-19.6	V	A	190.0	28.8	
4.882	3.0	38.3	32.8	5.8	-34.9	0.0	0.0	42.1	74.0	-31.9	H	P	146.2	119.5	
4.882	3.0	25.4	32.8	5.8	-34.9	0.0	0.0	29.2	54.0	-24.8	H	A	146.2	119.5	
7.323	3.0	37.0	35.2	7.3	-34.7	0.0	0.0	44.8	74.0	-29.2	H	P	113.5	196.2	
7.323	3.0	24.4	35.2	7.3	-34.7	0.0	0.0	32.2	54.0	-21.8	H	A	113.5	196.2	
9.764	3.0	36.2	37.2	8.6	-35.0	0.0	0.0	46.9	74.0	-27.1	H	P	131.0	250.5	
9.764	3.0	23.3	37.2	8.6	-35.0	0.0	0.0	34.0	54.0	-20.0	H	A	131.0	250.5	
2402															
4.804	3.0	38.3	32.8	5.8	-34.8	0.0	0.0	42.0	74.0	-32.0	H	P	176.9	336.2	
4.804	3.0	26.1	32.8	5.8	-34.8	0.0	0.0	29.8	54.0	-24.2	H	A	176.9	336.2	
7.206	3.0	36.9	35.0	7.2	-34.7	0.0	0.0	44.5	74.0	-29.5	H	P	158.8	103.2	
7.206	3.0	24.5	35.0	7.2	-34.7	0.0	0.0	32.1	54.0	-21.9	H	A	158.8	103.2	
9.608	3.0	36.6	37.1	8.5	-35.0	0.0	0.0	47.2	74.0	-26.8	H	P	175.6	338.2	
9.608	3.0	23.7	37.1	8.5	-35.0	0.0	0.0	34.3	54.0	-19.7	H	A	175.6	338.2	
4.804	3.0	38.6	32.8	5.8	-34.8	0.0	0.0	42.3	74.0	-31.7	V	P	102.7	105.6	
4.804	3.0	26.1	32.8	5.8	-34.8	0.0	0.0	29.8	54.0	-24.2	V	A	102.7	105.6	
7.206	3.0	37.4	35.0	7.2	-34.7	0.0	0.0	45.0	74.0	-29.0	V	P	102.3	338.4	
7.206	3.0	24.4	35.0	7.2	-34.7	0.0	0.0	32.0	54.0	-22.0	V	A	102.3	338.4	
9.608	3.0	36.3	37.1	8.5	-35.0	0.0	0.0	46.9	74.0	-27.1	V	P	123.3	341.4	
9.608	3.0	23.7	37.1	8.5	-35.0	0.0	0.0	34.3	54.0	-19.7	V	A	123.3	341.4	

Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

8.3. RECEIVER ABOVE 1 GHz

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: Monica Harrison
Date: 08/16/09
Project #: 09J12682
Company: SMK
Test Target: RSS 210
Mode Oper: RX (Worst Case)

f	Measurement Frequency	Amp	Preamp Gain		Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters		Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m		Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength		Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
2.365	3.0	41.4	28.2	3.8	-35.1	0.0	10.0	48.3	74.0	-25.7	H	P	
2.376	3.0	30.0	28.2	3.8	-35.1	0.0	10.0	37.0	54.0	-17.0	H	A	
2.376	3.0	42.5	28.2	3.8	-35.1	0.0	10.0	49.5	74.0	-24.5	V	P	
2.376	3.0	29.9	28.2	3.8	-35.1	0.0	10.0	36.9	54.0	-17.1	V	A	
2.484	3.0	50.0	28.5	3.9	-35.1	0.0	10.0	57.2	74.0	-16.8	V	P	
2.484	3.0	36.5	28.5	3.9	-35.1	0.0	10.0	43.7	54.0	-10.3	V	A	
2.484	3.0	46.3	28.5	3.9	-35.1	0.0	10.0	53.6	74.0	-20.4	H	P	
2.483	3.0	34.0	28.5	3.9	-35.1	0.0	10.0	41.3	54.0	-12.7	H	A	

Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

8.4. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION))

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

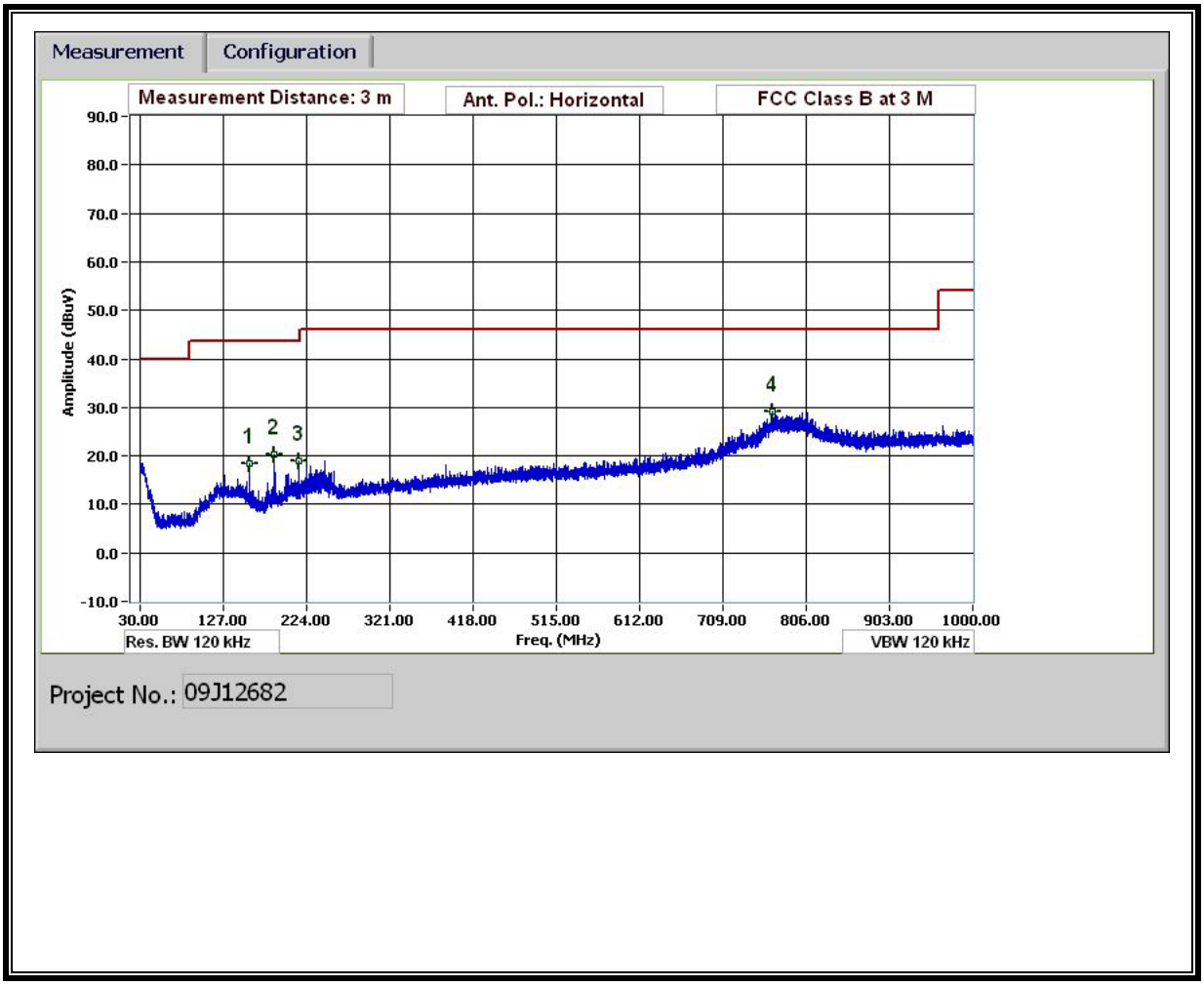
Test Engr: Chin Pang
Date: 08/15/09
Project #: 09J12682
Company: SMK
EUT Description: Bluetooth Laser Mouse
EUT M/N: VGP-BMS80
Test Target: FCC Class B
Mode Oper: TX (Worst Case)

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		

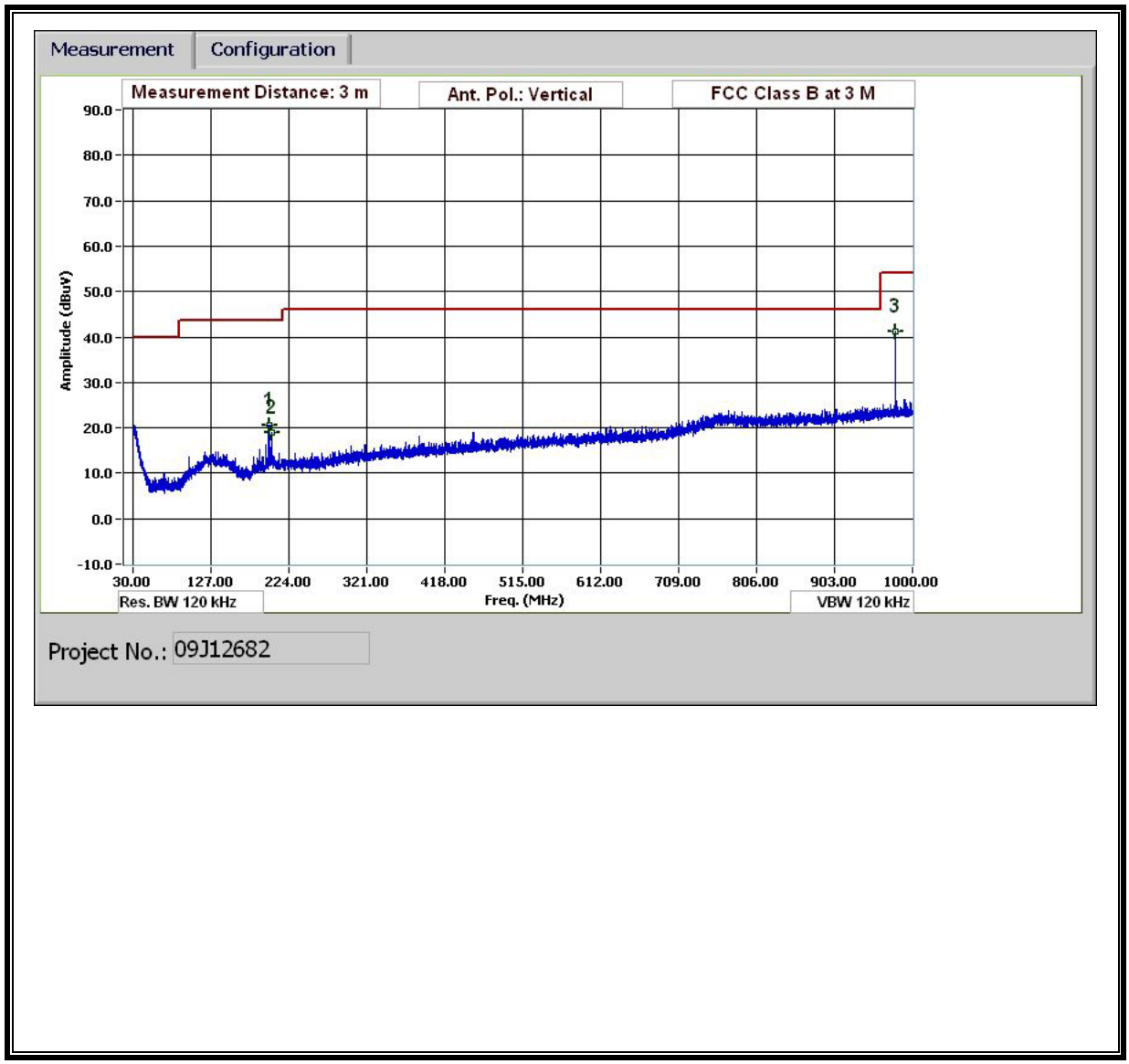
f MHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filter dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Notes
horiz													
157.445	3.0	35.2	11.3	1.1	29.3	0.0	0.0	18.3	43.5	-25.2	H	EP	
186.126	3.0	37.0	11.1	1.2	29.0	0.0	0.0	20.3	43.5	-23.2	H	EP	
214.808	3.0	34.6	11.9	1.3	28.9	0.0	0.0	19.0	43.5	-24.5	H	EP	
767.190	3.0	35.3	20.4	2.7	29.3	0.0	0.0	29.1	46.0	-16.9	H	EP	
199.087	3.0	36.1	11.9	1.3	28.9	0.0	0.0	20.4	43.5	-23.1	V	EP	
202.687	3.0	34.4	12.0	1.3	28.9	0.0	0.0	18.8	43.5	-24.7	V	EP	
979.479	3.0	44.1	22.4	3.2	28.4	0.0	0.0	41.2	54.0	-12.8	V	EP	

Rev. 1.27.09
Note: No other emissions were detected above the system noise floor.

HORIZONTAL PLOT



VERTICAL PLOT



9. MAXIMUM PERMISSIBLE EXPOSURE

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^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.

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^2)	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	$280/f$	$2.19/f$		6
10–30	28	$2.19/f$		6
30–300	28	0.073	2*	6
300–1 500	$1.585f^{0.5}$	$0.0042f^{0.5}$	$f/150$	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	$616\,000/f^{1.2}$
150 000–300 000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616\,000/f^{1.2}$

* 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^2 is equivalent to 1 mW/cm^2.
3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

EQUATIONS

Power density is given by:

S = EIRP / (4 * Pi * D^2)

where

S = Power density in W/m^2
EIRP = Equivalent Isotropic Radiated Power in W
D = Separation distance in m

Power density in units of W/m^2 is converted to units of mWc/m^2 by dividing by 10.

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.

LIMITS

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm^2

From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m^2

RESULTS

Band	Mode	Separation Distance (m)	Output Power (dBm)	Antenna Gain (dBi)	IC Power Density (W/m^2)	FCC Power Density (mW/cm^2)
2.4 GHz	Bluetooth	0.20	3.98	0.14	0.01	0.001