FCC CFR47 PART 15 SUBPART F

CLASS 2 PERMISSIVE CHANGE TEST REPORT

FOR

ZEROWIRE MINIPCI BOARD

NDS SURGICAL IMAGING PART NUMBER: 17C0016

FCC ID: UEZTZM7201

REPORT NUMBER: 09U12933-1, Revision A

ISSUE DATE: DECEMBER 10, 2009

Prepared for
NDS SURGICAL IMAGING
5750 HELLYER AVENUE
SAN JOSE, CA 95138, U.S.A.

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
--	12/10/09	Initial Issue	M. Heckrotte
A	12/10/09	Revised capitalization of EUT name in header	M. Heckrotte

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: NDS SURGICAL IMAGING
5750 HELLYER AVENUE
SAN JOSE, CA 95138, U.S.A.

EUT DESCRIPTION: UWB Module (MINI PCI)

MODEL: 17C0016

SERIAL NUMBER: NDS1 & NDS5

DATE TESTED: NOVEMBER 23 TO DECEMBER 7, 2009

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart F	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:

MICHAEL HECKROTTE
DIRECTOR OF ENGINEERING
COMPLIANCE CERTIFICATION SERVICES

Tested By:

THANH NGUYEN
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 and FCC CFR 47 Part 15.

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 UWB module in a mini PCI form factor intended for hand-held applications.

5.2. DESCRIPTION OF CLASS 2 PERMISSIVE CHANGE

Two additional antenna models are added, NDS part numbers 17Z0095 and 17Z0097.

5.3. OPERATING FREQUENCY RANGE

The UWB radio operates over a nominal frequency range of 3100 to 4800 MHz. The measured UWB bandwidths of all three channels lie within this range.

5.4. MAXIMUM OUTPUT POWER

The UWB transmitter has a maximum radiated output power for each antenna as follows:

Antenna Model	RMS Output Power (dBm/MHz EIRP)	RMS Output Power (uW/MHz EIRP)
17Z0095	-41.50	0.071
17Z0097	-42.20	0.060

5.5. SOFTWARE AND FIRMWARE

The board is run on core application software, 0.9.14. A script is used to force the TX to continuous transmission.

5.6. OPERATING MODE

The EUT was tested in its normal (hopping) operating mode in accordance with the waiver documented in ET Docket 04-352. Test results demonstrate that the EUT does not operate within the 5030 to 5650 MHz band.

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
AC/DC Adapter	SL POWER	MW172KB2403F01	9218	N/A

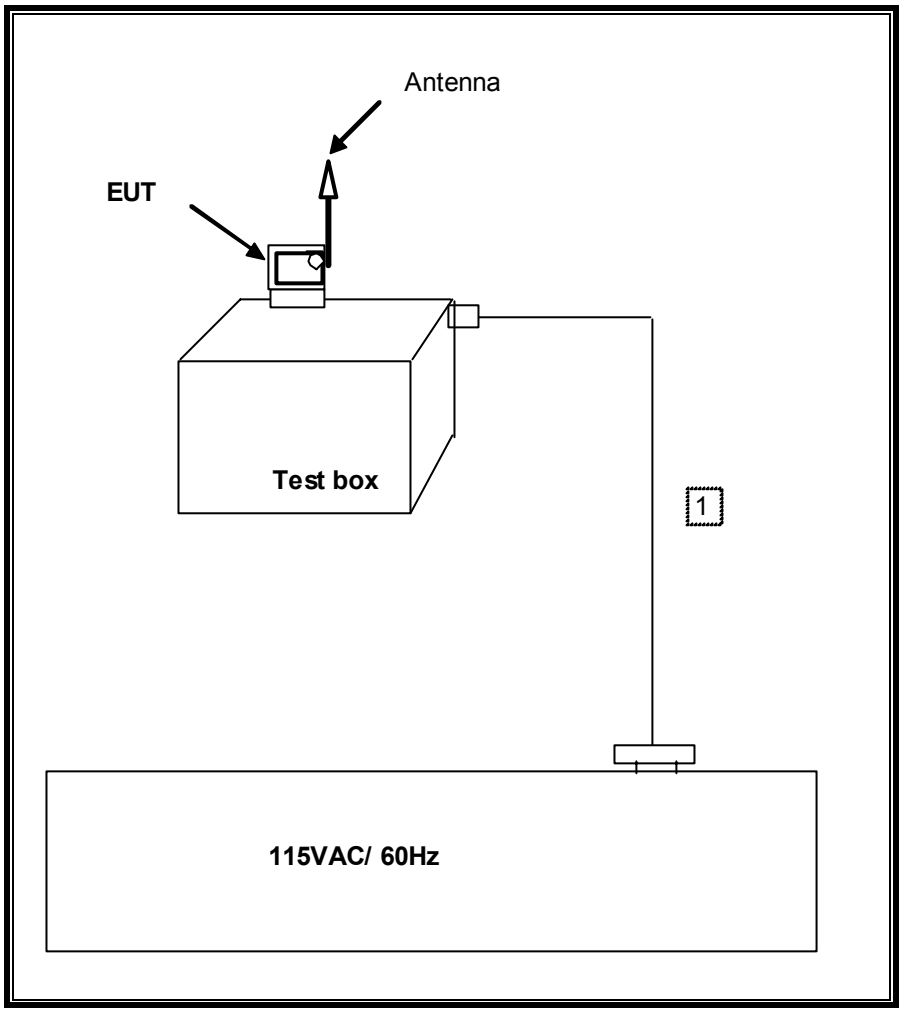
I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identica Ports	Connector Type	Cable Type	Cable Length	Remarks
1	DC	1	Plug in	Unshielded	1.5m	No

TEST SETUP

The script to force continuous transmission is run through a serial port / hyper-terminal session. After downloading the script, the laptop is disconnected and removed from the chamber during tests.

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**	**Serial Number**	**Cal Due**
Antenna, Bilog 30 MHz ~ 2 Ghz	Sunol Sciences	JB1	A0022704	1/14/2010
Antenna, Microwave Horn	ARA	AT4002A	322899	12/11/2009
Antenna, Horn 1 ~ 18 GHz	EMCO	3115	6717	1/29/2010
Antenna, Horn 18 ~ 26 GHz	ARA	SWH-28	1007	1/29/2010
Antenna, Horn 26 ~ 40 GHz	ARA	MWH-2640/B	1029	5/21/2010
Preamplifier, 1300 MHz	Agilent / HP	8447D	1937A02062	12/16/2009
Preamplifier, 1 ~ 2 GHz	Miteq	AFS3-01000200	1199462	12/11/2009
Preamplifier, 1 ~ 26.5 GHz	Agilent / HP	8449B	3008A00931	2/4/2010
Preamplifier, 26 ~ 40 GHz	Miteq	NSP4000-SP2	924343	2/3/2010
EMI Receiver, 9 kHz ~ 2.9 GHz	Agilent / HP	8542E	3942A00286	3/4/2011
RF Filter Section	Agilent / HP	85420E	3705A00256	3/4/2011
Spectrum Analyzer 3 Hz ~ 44 GHz	Agilent / HP	E4446A	US42510266	4/20/2010
LISN, 10 kHz ~ 30 MHz	FCC	LISN-50/250-25-2	2023	11/6/2010
EMI Test Receiver	R & S	ESHS 20	827129/006	5/6/2011

7. LIMITS AND RESULTS WITH ANTENNA MODEL 17Z0095

7.1. UWB BANDWIDTH, CENTER FREQUENCY, AND FRACTIONAL BANDWIDTH

DEFINITIONS AND LIMITS

§15.503 Definitions.
(a) UWB Bandwidth. For the purpose of this subpart, the UWB bandwidth is the frequency band bounded by the points that are 10 dB below the highest radiated emission, as based on the complete transmission system including the antenna. The upper boundary is designated f_H and the lower boundary is designated f_L. The frequency at which the highest radiated emission occurs is designated f_M.
(b) Center frequency. The center frequency, f_C, equals $(f_H + f_L)/2$.
(c) Fractional bandwidth. The fractional bandwidth equals $2(f_H - f_L)/ (f_H + f_L)$.
(d) Ultra-wideband (UWB) transmitter. An intentional radiator that, at any point in time, has a fractional bandwidth equal to or greater than 0.20 or has a UWB bandwidth equal to or greater than 500 MHz, regardless of the fractional bandwidth.

§15.519 (b) The UWB bandwidth of a device operating under the provisions of this section must be contained between 3100 MHz and 10,600 MHz.

TEST PROCEDURE

Radiated measurements are made using the procedures described above. The detection mode is set to peak detection, the sweep time is AUTO, and the Max Hold trace function is utilized. The frequency range from 3.1 to 10.6 GHz is measured, and corrected from raw values to Peak EIRP.

The frequency at which the maximum EIRP is measured is designated as f_M. A major graticule line of the plot is adjusted to exactly equal the peak EIRP at f_M. The spectral envelope at the major graticule line that is 10 dB below the reference graticule is examined to determine the frequency band bounded by the points that are 10 dB below the highest radiated emission. The upper boundary is designated f_H and the lower boundary is designated f_L.

The center frequency, f_C, is calculated as $(f_H + f_L)/2$.

The antenna polarization that yields the highest EIRP at f_M is used to calculate the above parameters.

Calculations are made independently for each of the three channels.

LOW CHANNEL RESULTS (WORST-CASE / VERTICAL POLARIZATION)

f Max (GHz)	Reference EIRP at f Max (dBm)	10 dB down from Reference EIRP (dBm)
3.634	-43.1	-53.1

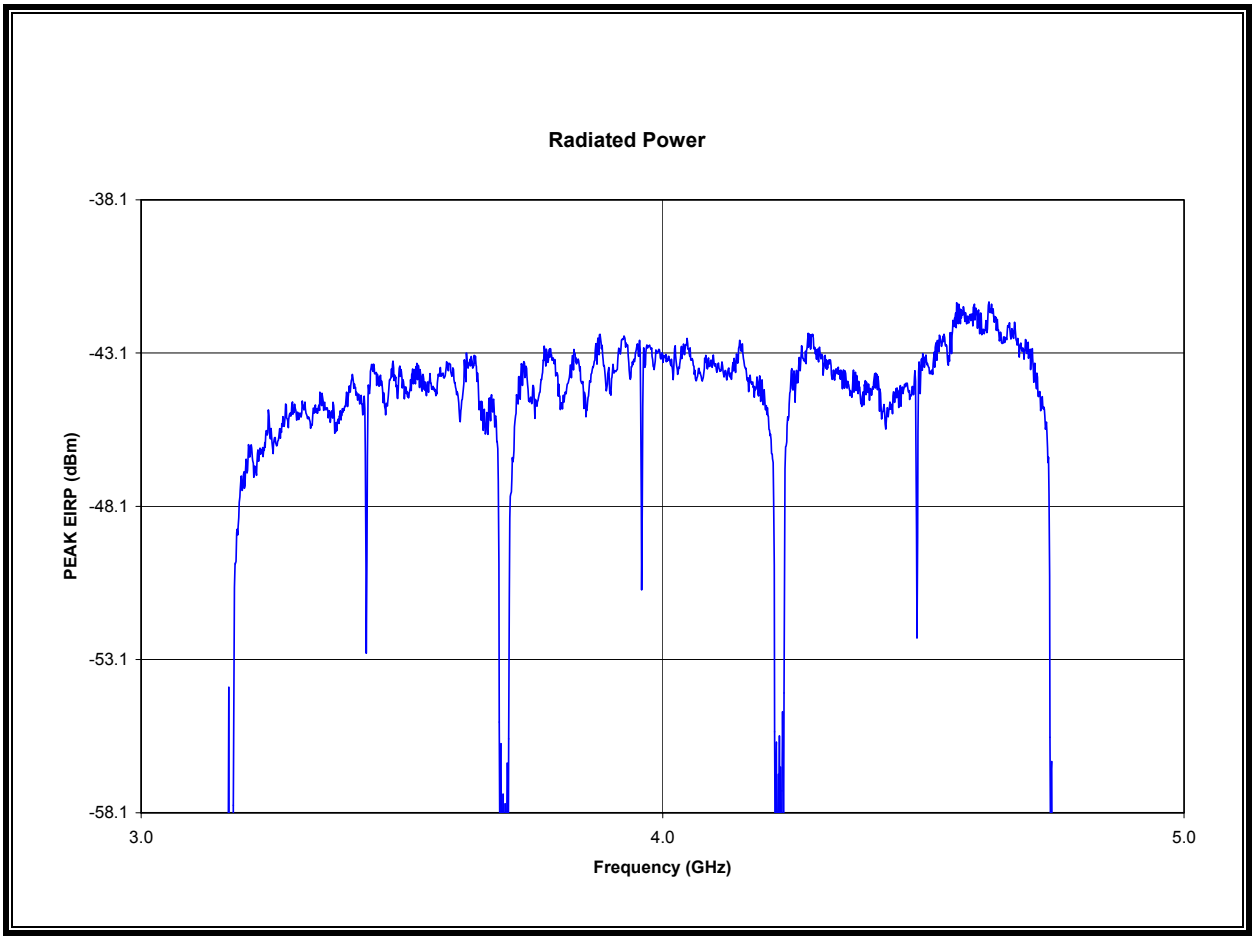
f Low (GHz)	Minimum f Low (GHz)
3.179	3.1

f High (GHz)	Maximum f High (GHz)
3.687	10.6

f Center (GHz)
3.433

UWB BW (GHz)	Minimum UWB BW (GHz)
0.508	0.500

PLOT OF PEAK EIRP WITH REFERENCE GRATICULE ADJUSTED FOR LOW CHANNEL F MAX



MID CHANNEL RESULTS (WORST-CASE / VERTICAL POLARIZATION)

f Max (GHz)	Reference EIRP at f Max (dBm)	10 dB down from Reference EIRP (dBm)
3.881	-42.6	-52.6

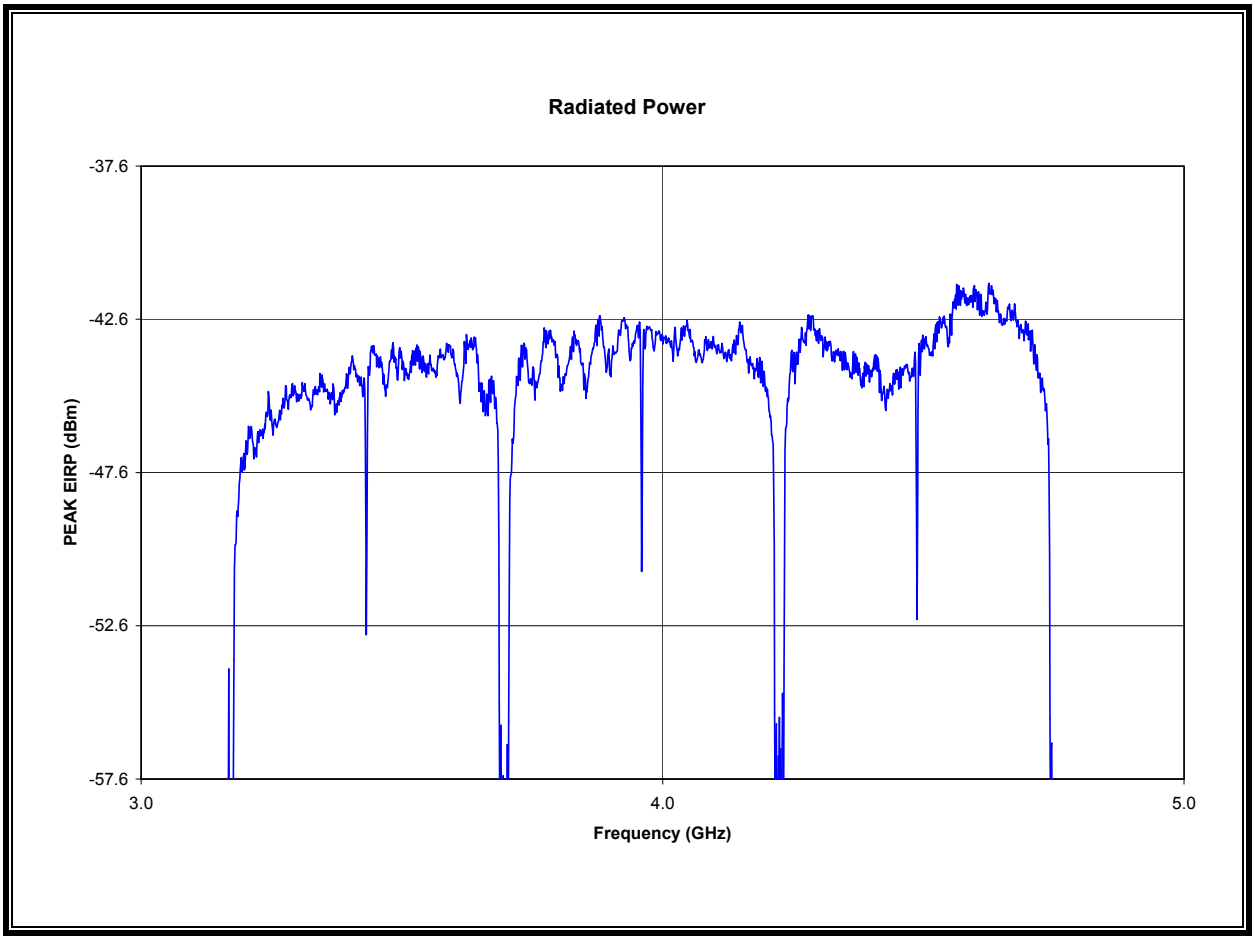
f Low (GHz)	Minimum f Low (GHz)
3.706	3.1

f High (GHz)	Maximum f High (GHz)
4.212	10.6

f Center (GHz)
3.959

UWB BW (GHz)	Minimum UWB BW (GHz)
0.506	0.500

PLOT OF PEAK EIRP WITH REFERENCE GRATICULE ADJUSTED FOR MID CHANNEL F MAX



HIGH CHANNEL RESULTS (WORST-CASE / VERTICAL POLARIZATION)

f Max (GHz)	Reference EIRP at f Max (dBm)	10 dB down from Reference EIRP (dBm)
4.626	-41.5	-51.5

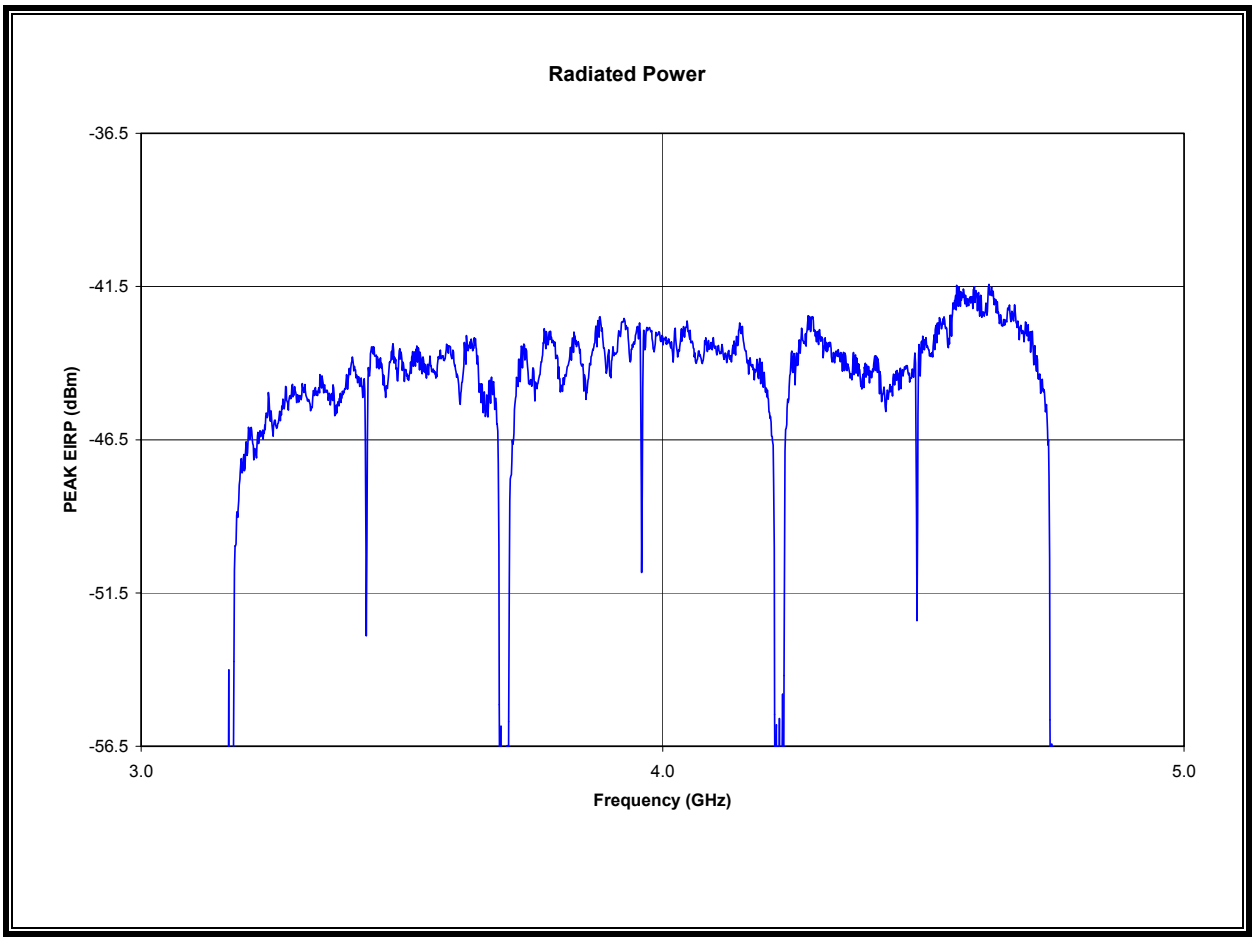
f Low (GHz)	Minimum f Low (GHz)
4.234	3.1

f High (GHz)	Maximum f High (GHz)
4.743	10.6

f Center (GHz)
4.489

UWB BW (GHz)	Minimum UWB BW (GHz)
0.509	0.500

PLOT OF PEAK EIRP WITH REFERENCE GRATICULE ADJUSTED FOR HIGH CHANNEL F MAX



7.2. PEAK POWER

LIMIT

§15.519 (e) There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, f_M. That limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described in §15.521.

§15.521 (g) When a peak measurement is required, it is acceptable to use a resolution bandwidth other than the 50 MHz specified in this subpart. This resolution bandwidth shall not be lower than 1 MHz or greater than 50 MHz, and the measurement shall be centered on the frequency at which the highest radiated emission occurs, f_M. If a resolution bandwidth other than 50 MHz is employed, the peak EIRP limit shall be 20 log (RBW/50) dBm where RBW is the resolution bandwidth in megahertz that is employed. This may be converted to a peak field strength level at 3 meters using E(dBuV/m) = P(dBm EIRP) + 95.2. If RBW is greater than 3 MHz, the application for certification filed with the Commission must contain a detailed description of the test procedure, calibration of the test setup, and the instrumentation employed in the testing.

§15.521 (e) The frequency at which the highest radiated emission occurs, f_M, must be contained within the UWB bandwidth.

TEST PROCEDURE

Radiated measurements are made using the procedures described above.

RESULTS

RBW =	3	Limit =	-24.44	Distance =	3.0

Low Channel

f Max (GHz)	Reading (dBuV)	Antenna Factor (dB/m)	Cable (dB)	Preamp (dB)	Distance Factor (dB)
3.634	67.46	32.10	4.90	-36.90	0.00

Field Strength at 3 meters (dBuV/m)	EIRP Conversion Factor	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
67.56	-95.20	-27.64	-24.44	-3.20

Mid Channel

f Max (GHz)	Reading (dBuV)	Antenna Factor (dB/m)	Cable (dB)	Preamp (dB)	Distance Factor (dB)
3.881	67.67	32.60	5.10	-36.70	0.00

Field Strength at 3 meters (dBuV/m)	EIRP Conversion Factor	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
68.67	-95.20	-26.53	-24.44	-2.09

High Channel

f Max (GHz)	Reading (dBuV)	Antenna Factor (dB/m)	Cable (dB)	Preamp (dB)	Distance Factor (dB)
4.626	67.05	33.60	5.60	-36.50	0.00

Field Strength at 3 meters (dBuV/m)	EIRP Conversion Factor	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
69.75	-95.20	-25.45	-24.44	-1.01

7.3. RADIATED EMISSIONS ABOVE 960 MHz

LIMITS

§15.519 (c) The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency in MHz	EIRP in dBm
960–1610	- 75.3
1610–1990	- 63.3
1990–3100	- 61.3
3100–10600	- 41.3
Above 10600	- 61.3

§15.519 (d) In addition to the radiated emission limits specified in the table in paragraph (c) of this section, UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz:

Frequency in MHz	EIRP in dBm
1164–1240	- 85.3
1559–1610	- 85.3

§15.521 (d) Within the tables in §§15.509, 15.511, 15.513, 15.515, 15.517, and 15.519, the tighter emission limit applies at the band edges. Radiated emission levels above 960 MHz are based on RMS average measurements over a 1 MHz resolution bandwidth. The RMS average measurement is based on the use of a spectrum analyzer with a resolution bandwidth of 1 MHz, an RMS detector, and a 1 millisecond or less averaging time.

§15.521 (e) The frequency at which the highest radiated emission occurs, f_M, must be contained within the UWB bandwidth.

TEST PROCEDURE

Radiated measurements are made using the procedures described above. The number of points on the horizontal axis of the spectrum analyzer is set to (frequency span in MHz + 1) and the sweep time is set to (frequency span in MHz) milliseconds, the RBW is set to 1 MHz and the detector function is set to RMS average.

For the requirements of §15.519 (d), an RBW of 10 kHz is utilized.

RESULTS

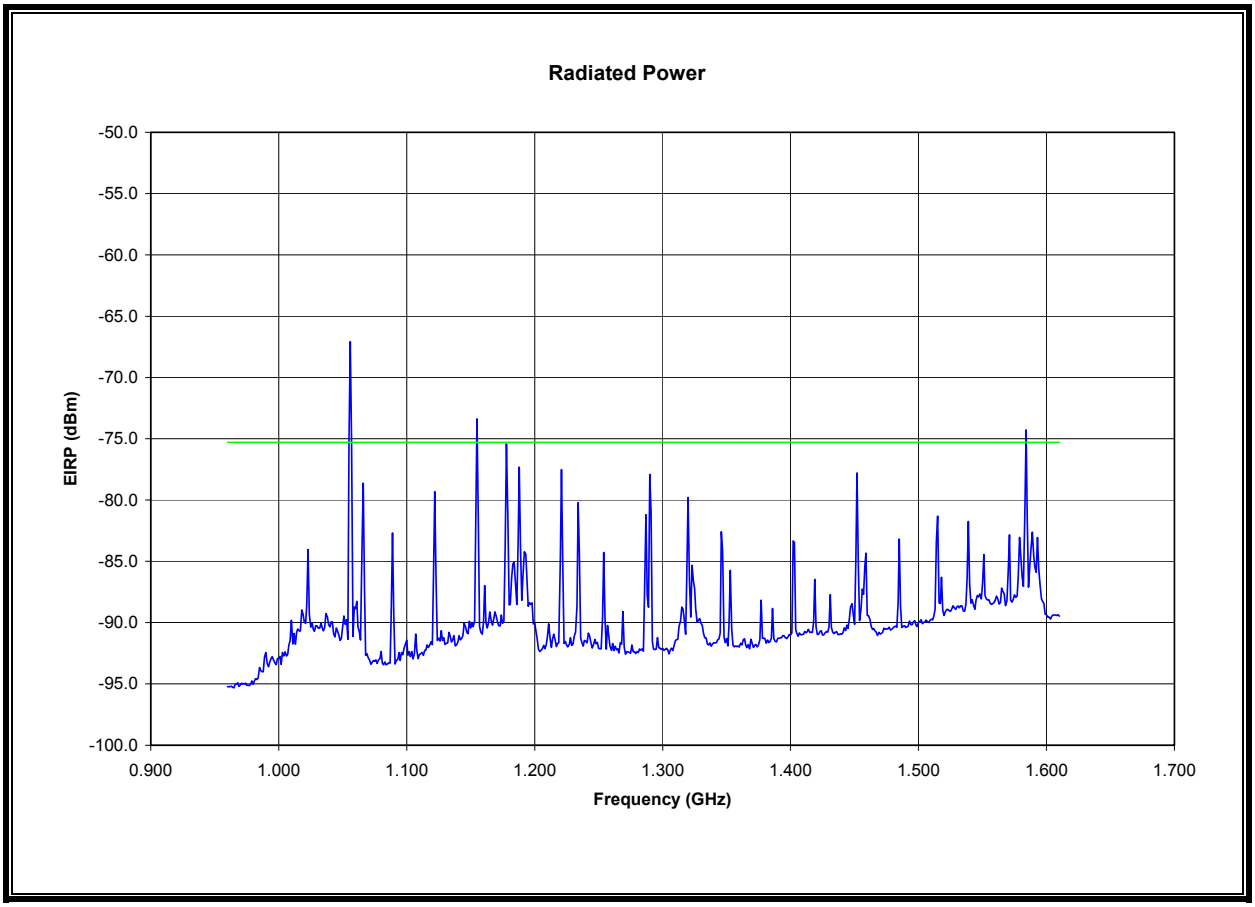
The highest radiated emission at f_M is as follows:

Polarization =	Vertical	Distance =	3.0

f Max (GHz)	Reading (dBuV)	Antenna Factor (dB/m)	Cable (dB)	Preamp (dB)	Distance Factor (dB)
4.626	51.0	33.5	5.6	-36.4	0.0

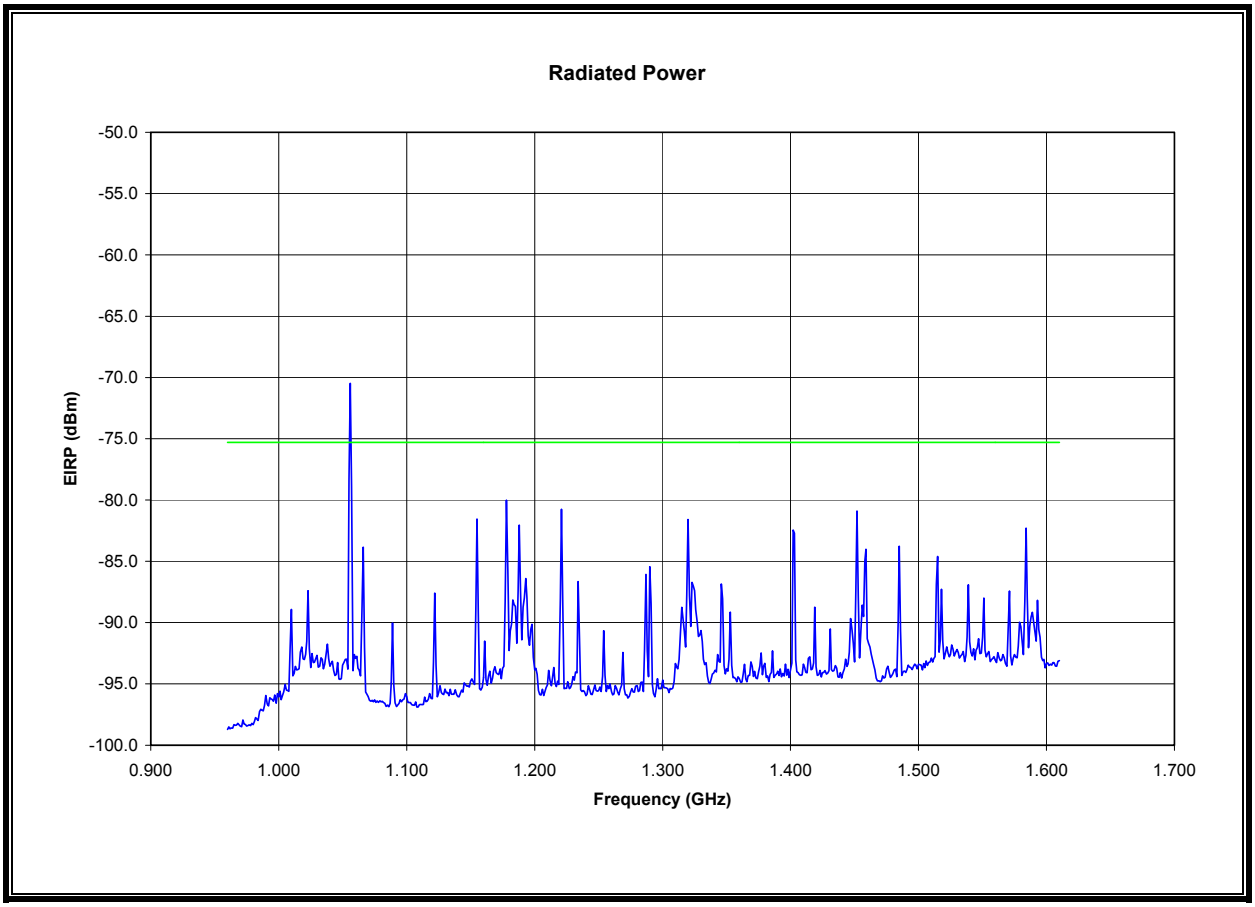
Field Strength at 3 meters (dBuV/m)	EIRP Conversion Factor	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
53.70	-95.20	-41.50	-41.30	-0.20

EIRP 0.960 TO 1.610 GHz, 1 MHz BW, HORIZONTAL



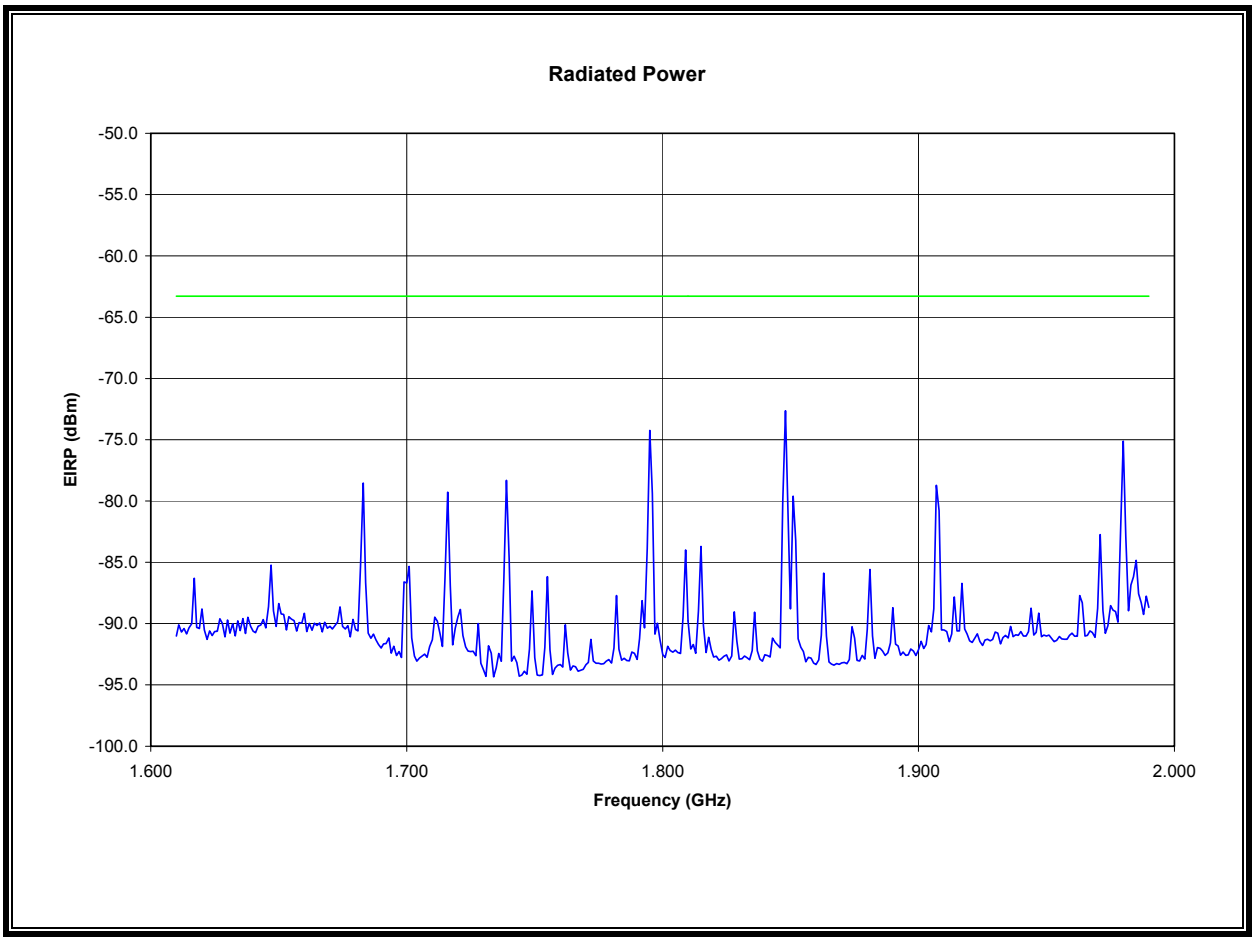
Note: The narrowband emissions over the UWB limit were identified as emissions from digital circuitry used to enable the operation of the UWB transmitter, and are not intended to be radiated from the transmitter's antenna.

EIRP 0.960 TO 1.610 GHz, 1 MHz BW, VERTICAL

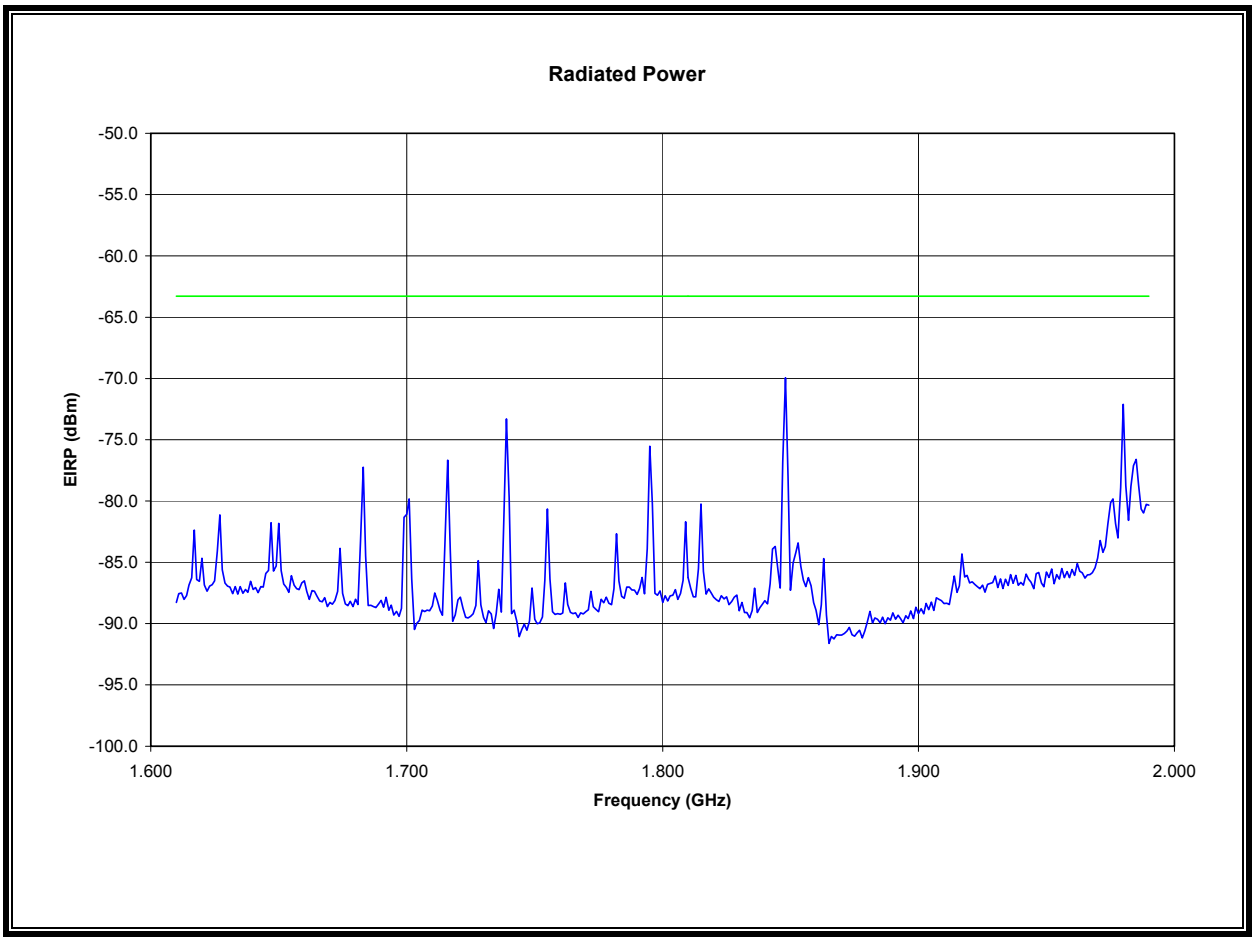


Note: The narrowband emission over the UWB limit was identified as an emission from digital circuitry used to enable the operation of the UWB transmitter, and is not intended to be radiated from the transmitter's antenna.

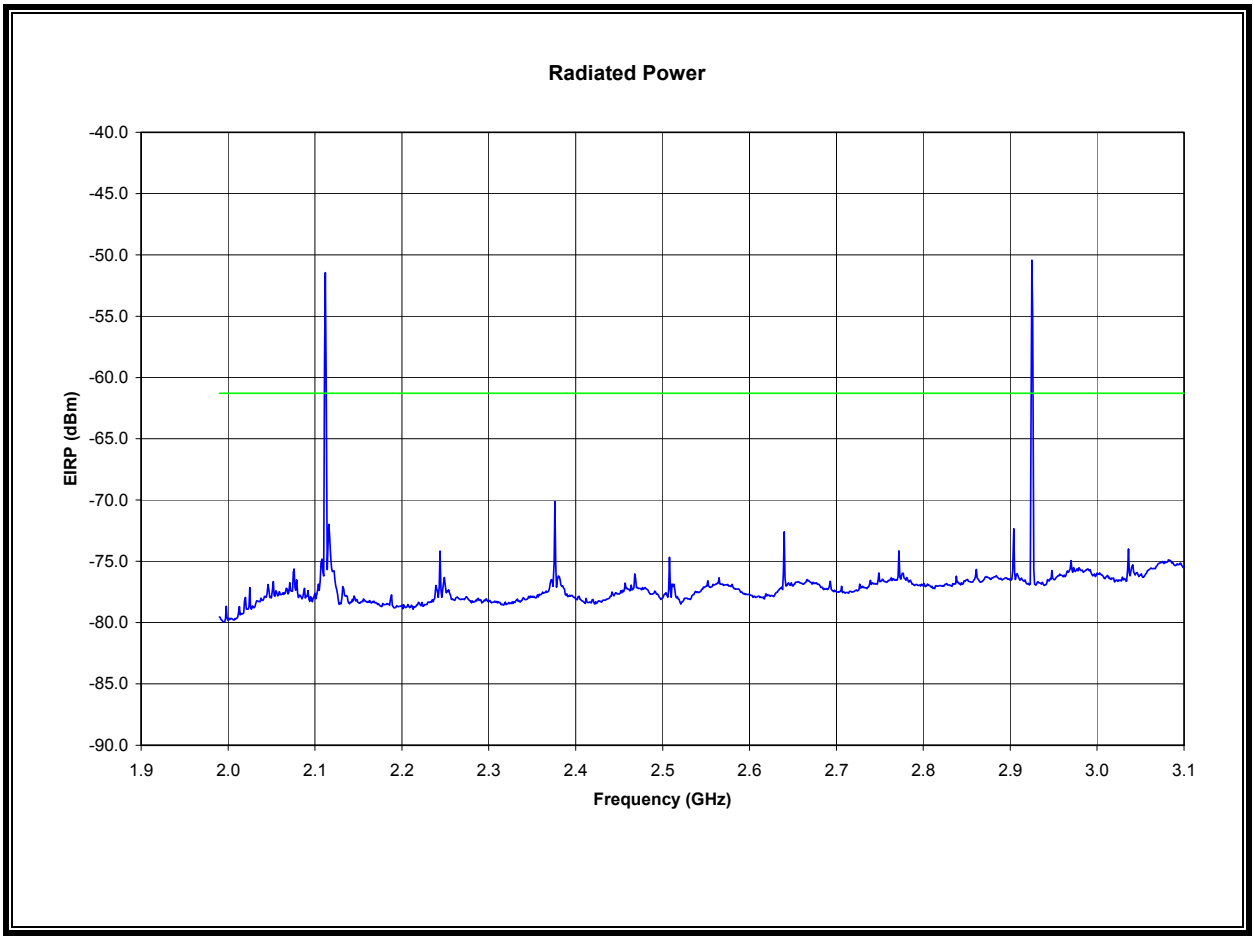
EIRP 1.610 TO 1.990 GHz, 1 MHz BW, HORIZONTAL



EIRP 1.610 TO 1.990 GHz, 1 MHz BW, VERTICAL

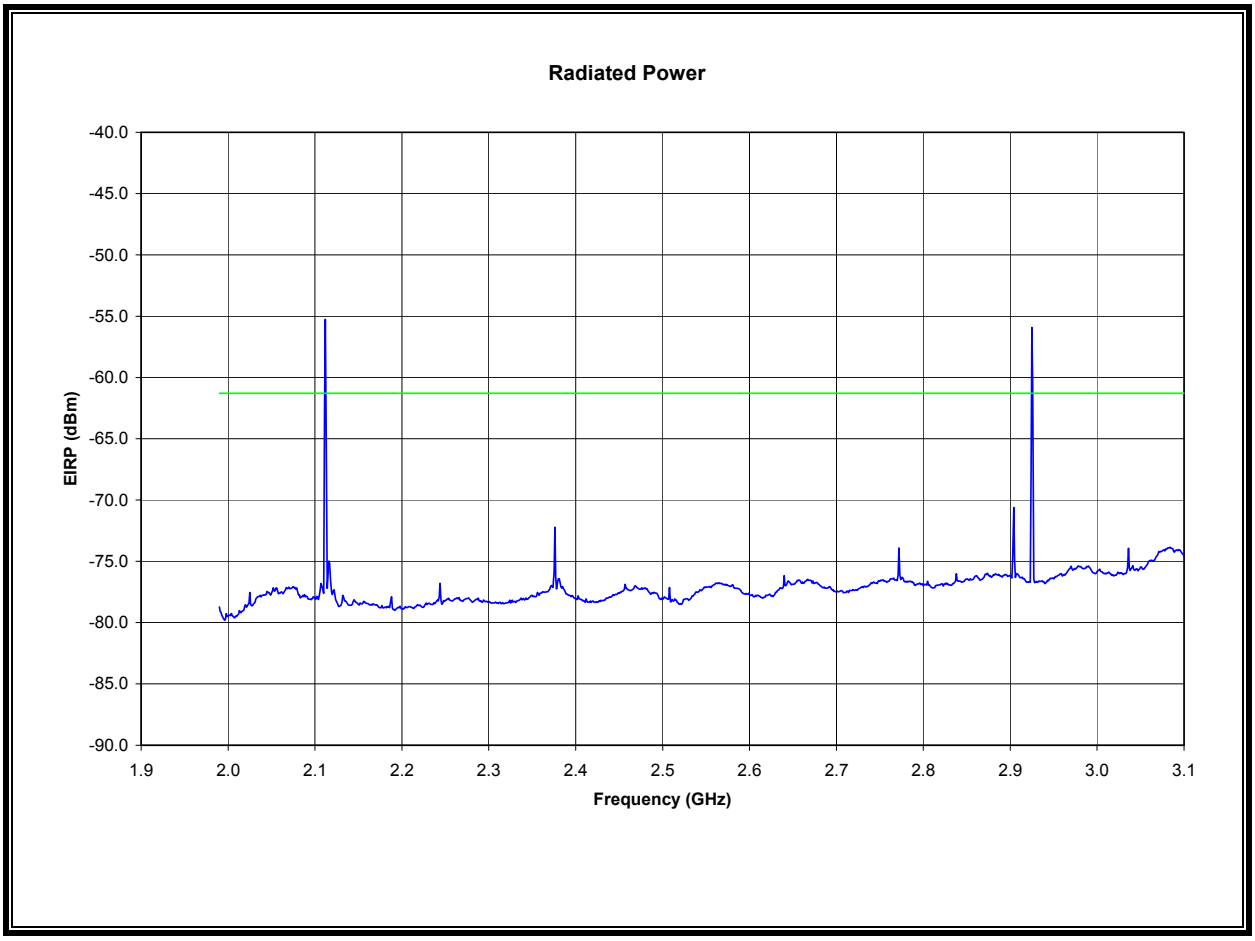


EIRP 1.990 TO 3.100 GHz, 1 MHz BW, HORIZONTAL



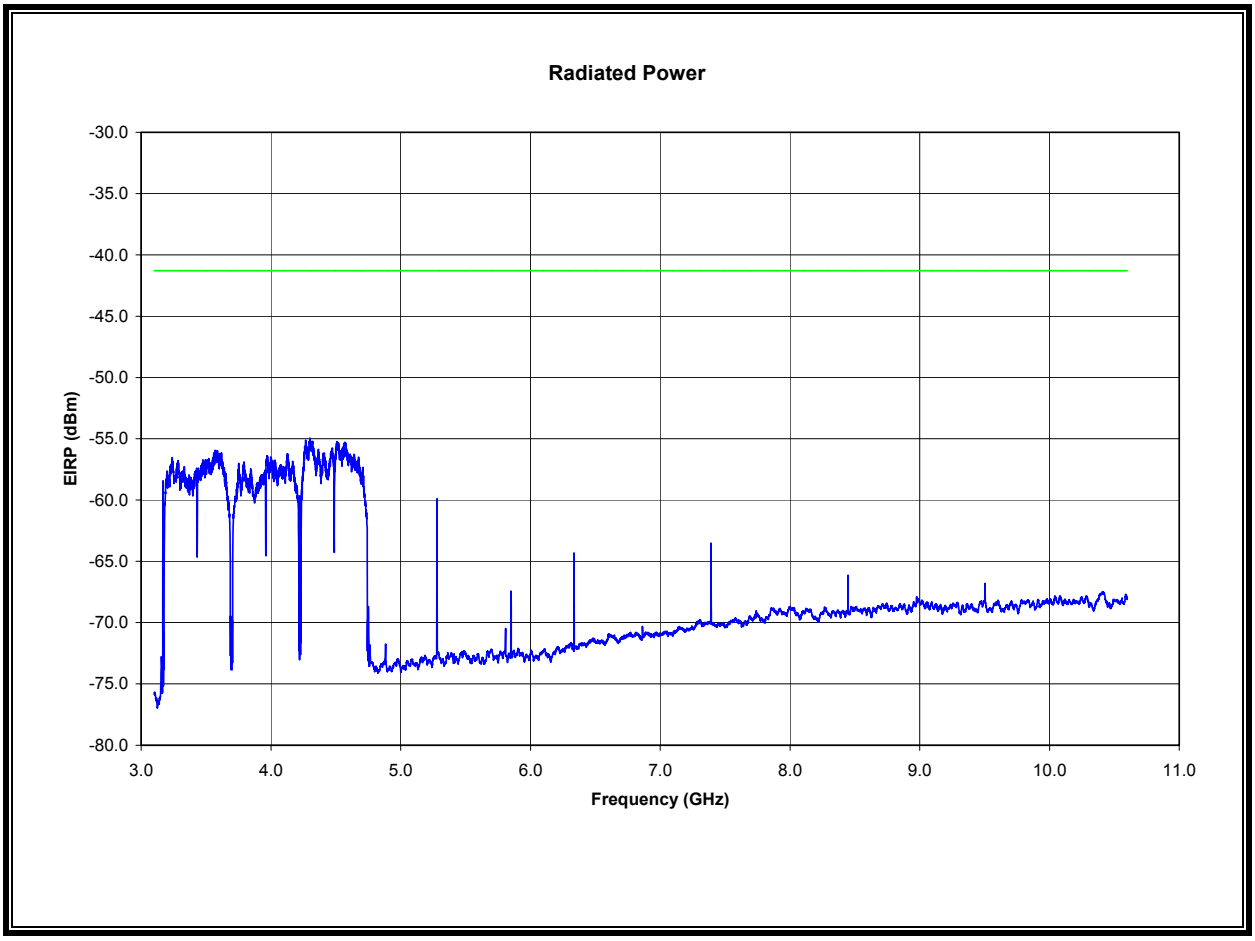
The narrowband emissions over the UWB limit were identified as emissions from digital circuitry used to enable the operation of the UWB transmitter, and are not intended to be radiated from the transmitter's antenna.

EIRP 1.990 TO 3.100 GHz, 1 MHz BW, VERTICAL

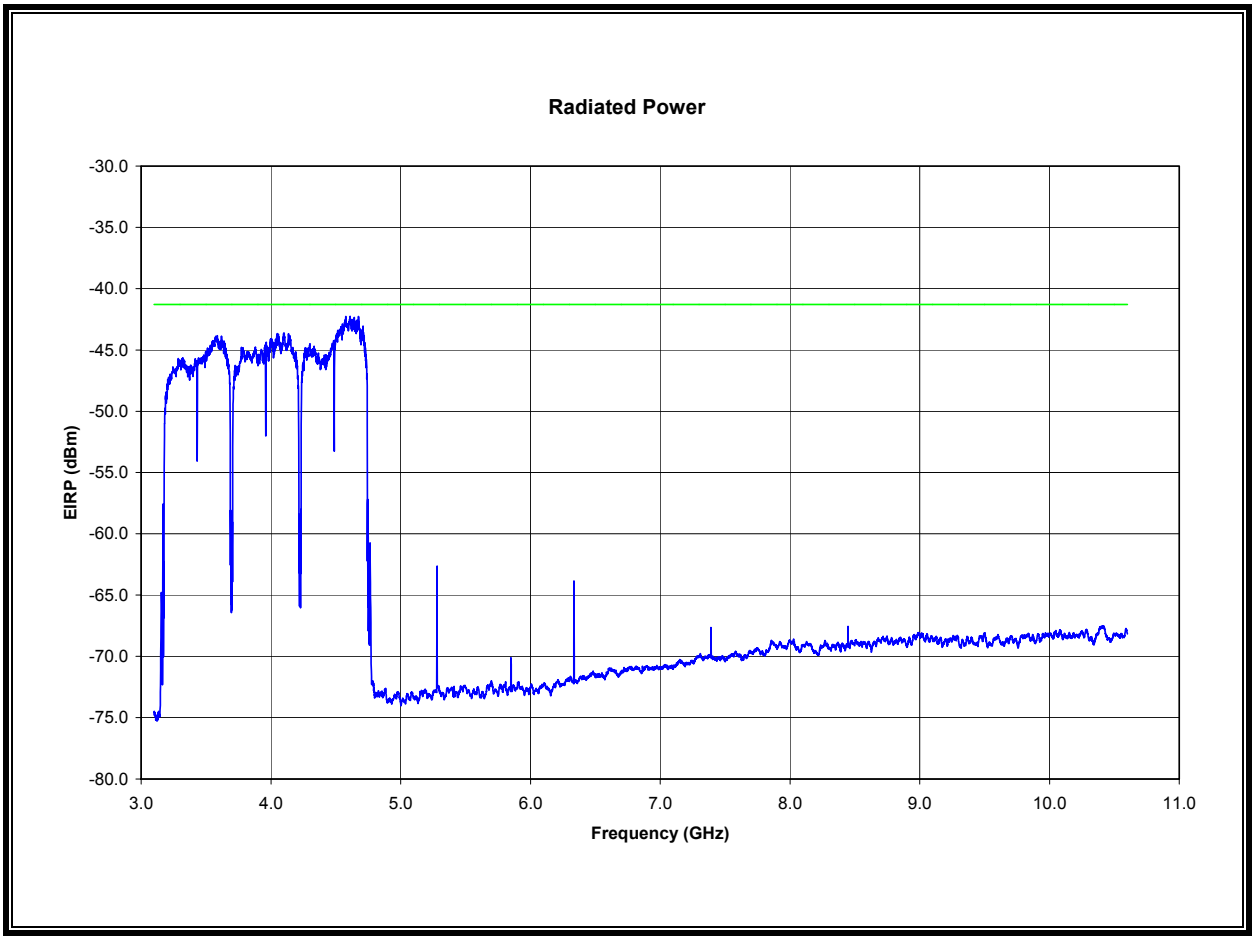


The narrowband emissions over the UWB limit were identified as emissions from digital circuitry used to enable the operation of the UWB transmitter, and are not intended to be radiated from the transmitter's antenna.

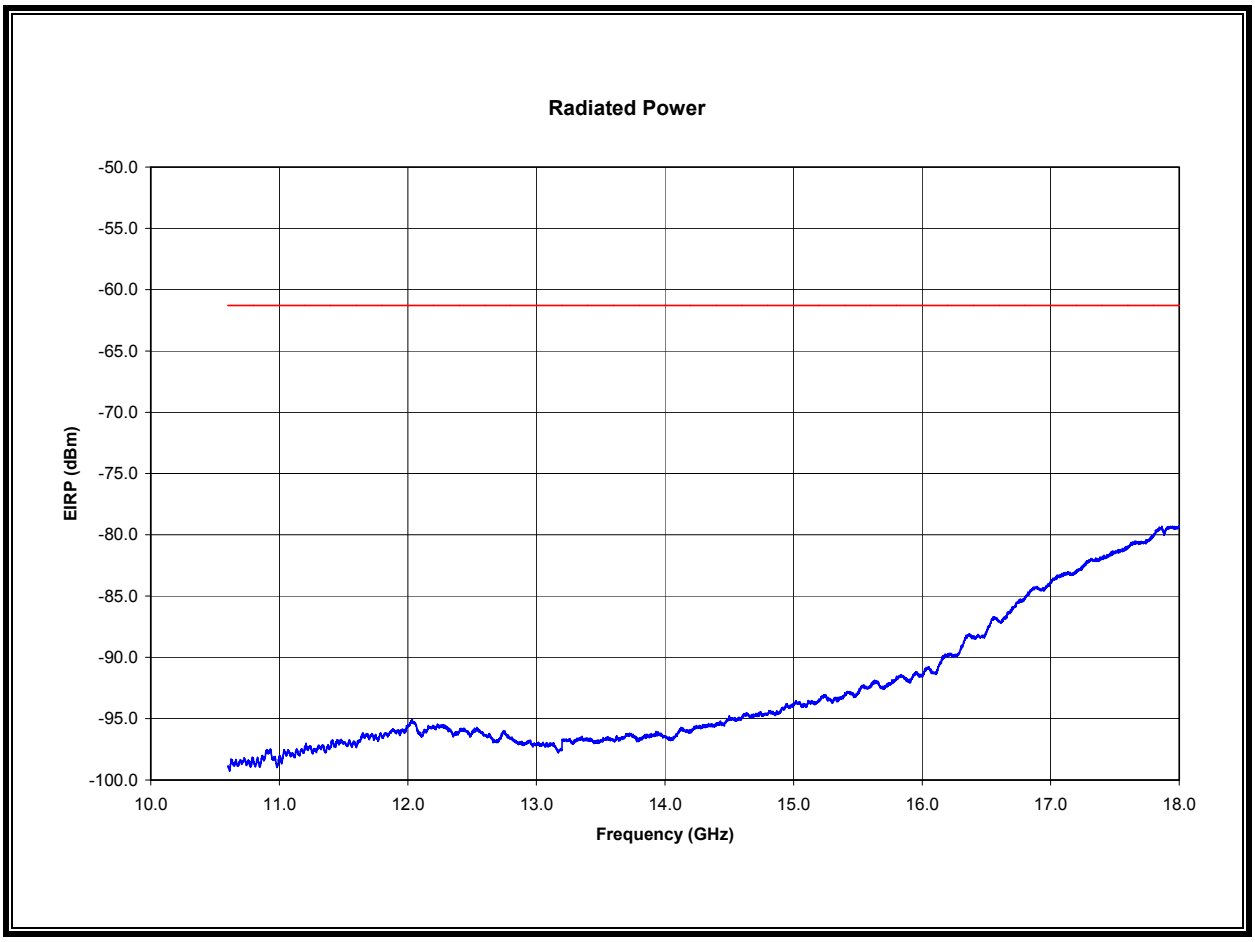
EIRP 3.1 TO 10.6 GHz, 1 MHz BW, HORIZONTAL



EIRP 3.1 TO 10.6 GHz, 1 MHz BW, VERTICAL

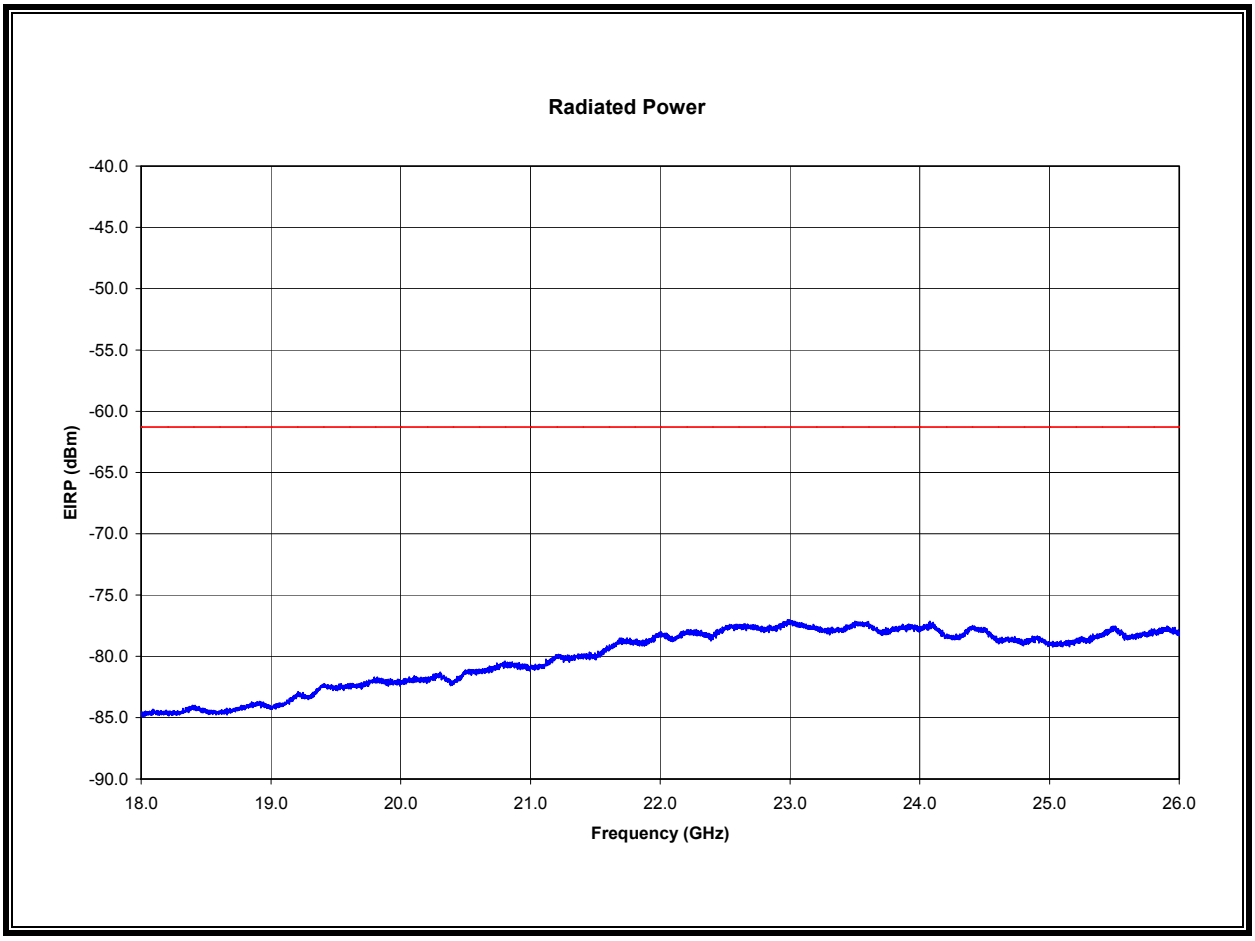


EIRP 10.6 TO 18 GHz, 1 MHz BW, HORIZONTAL AND VERTICAL



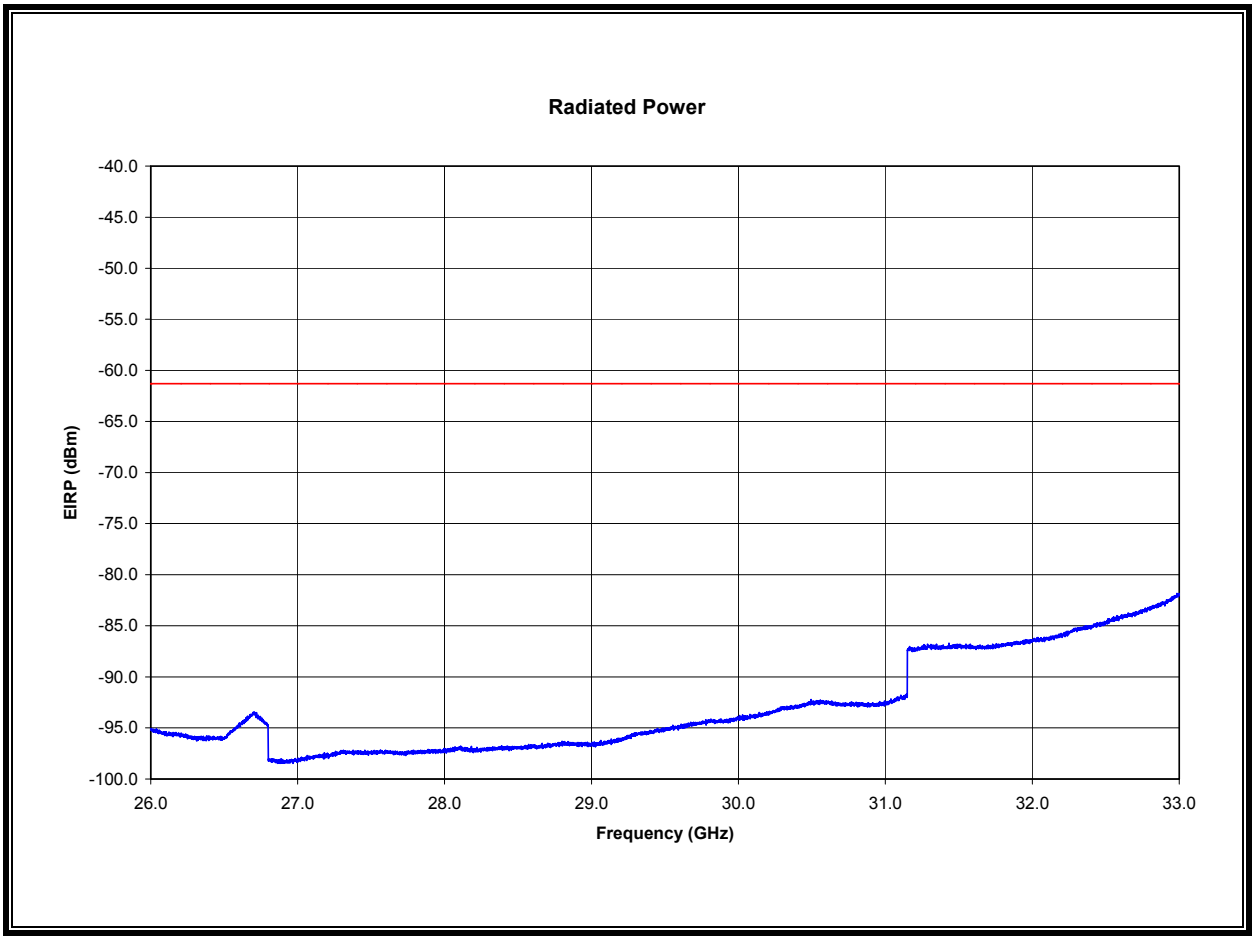
Note: No emissions above the system noise floor were observed.

EIRP 18 TO 26 GHz, 1 MHz BW, HORIZONTAL AND VERTICAL



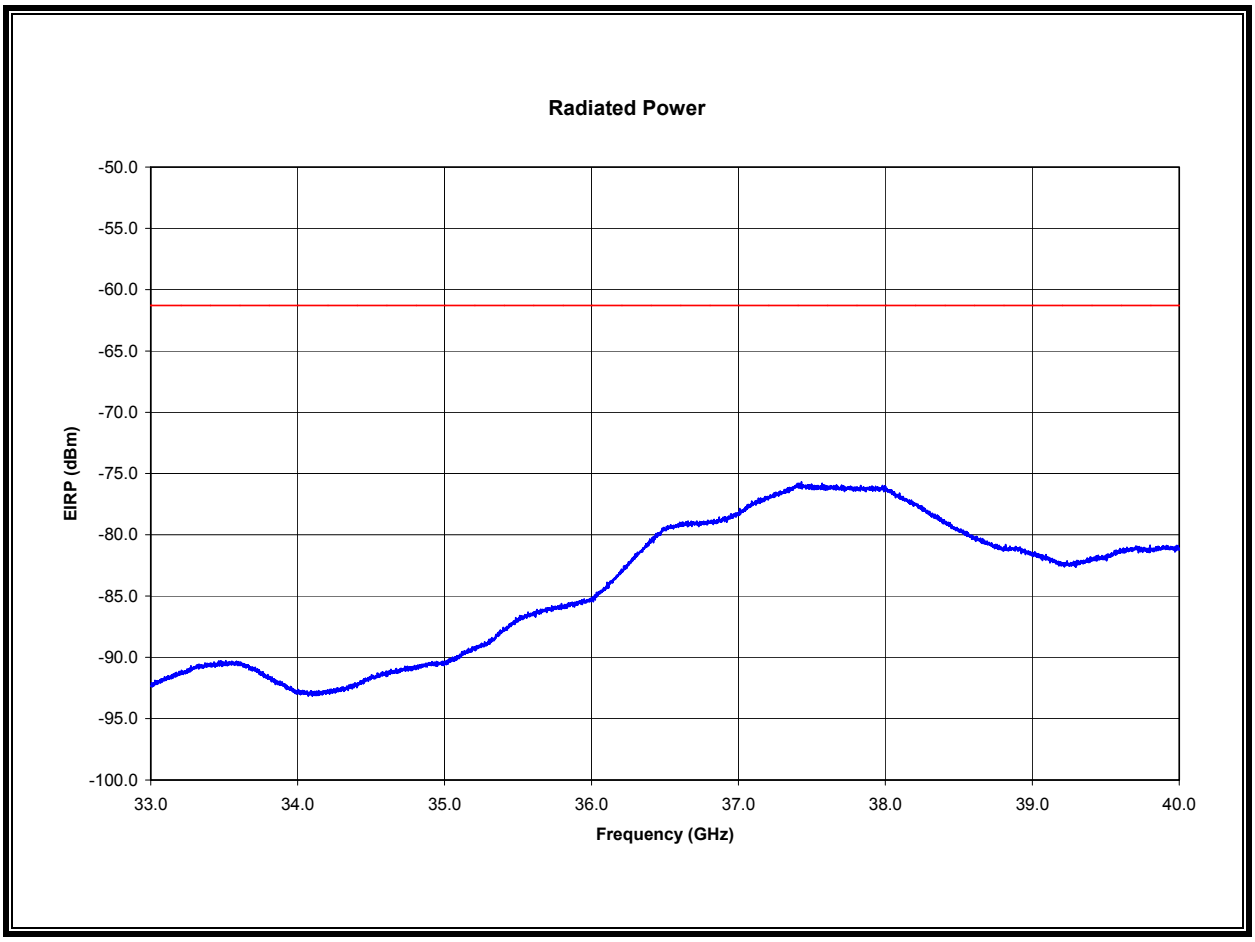
Note: No emissions above the system noise floor were observed.

EIRP 26 TO 33 GHz, 1 MHz BW, HORIZONTAL AND VERTICAL



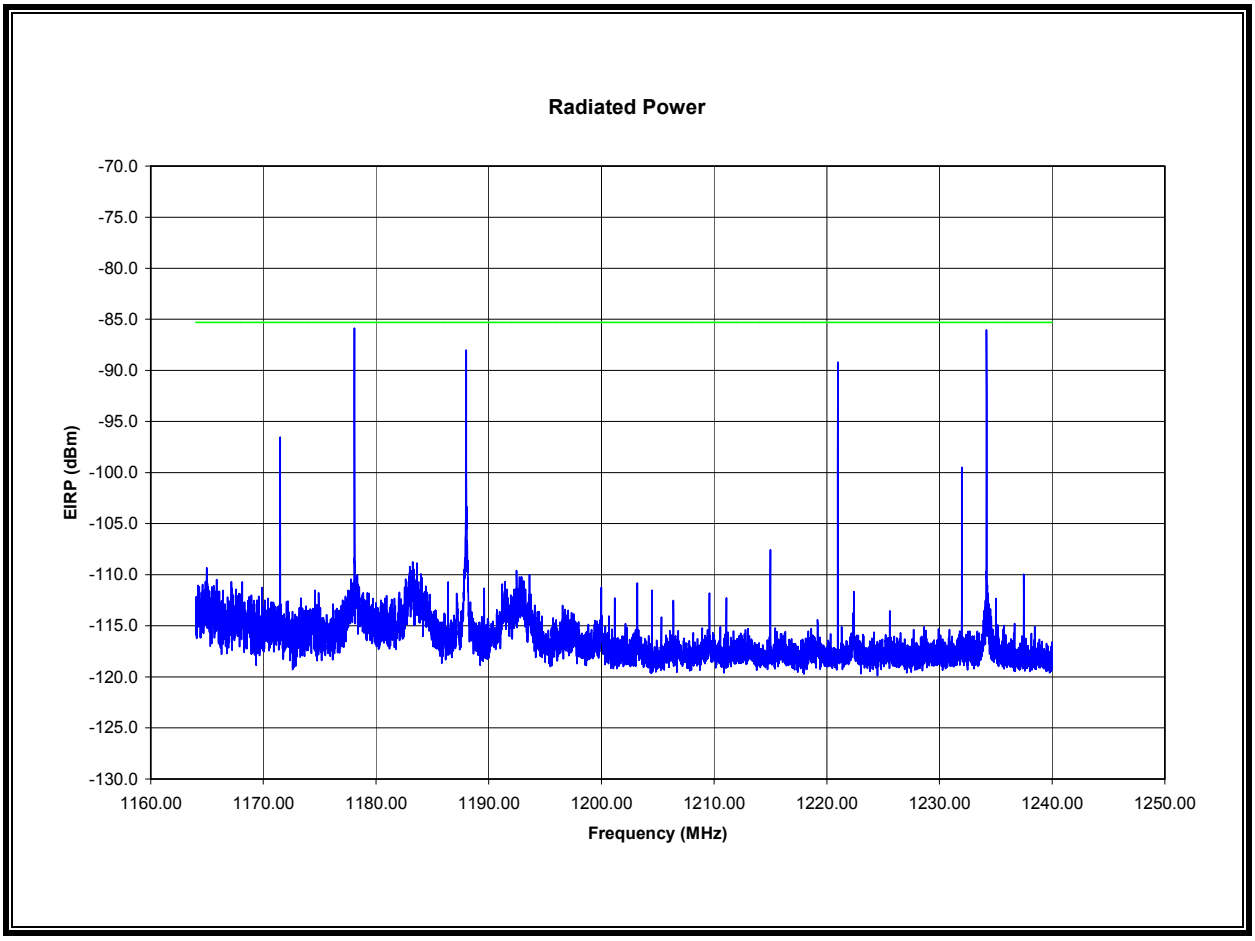
Note: No emissions above the system noise floor were observed.

EIRP 33 TO 40 GHz, 1 MHz BW, HORIZONTAL AND VERTICAL

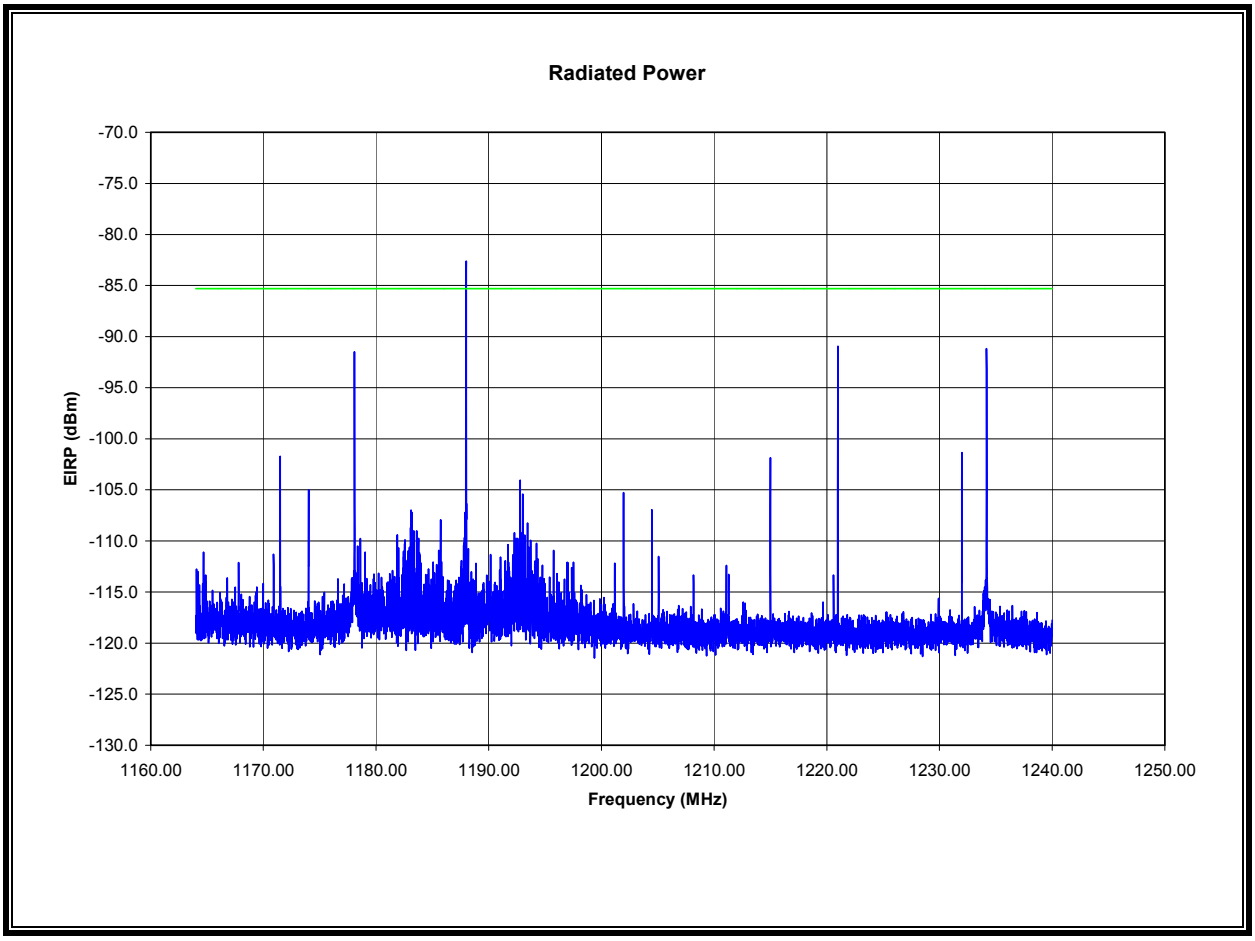


Note: No emissions above the system noise floor were observed.

EIRP 1.164 TO 1.240 GHz, 1 kHz BW, HORIZONTAL

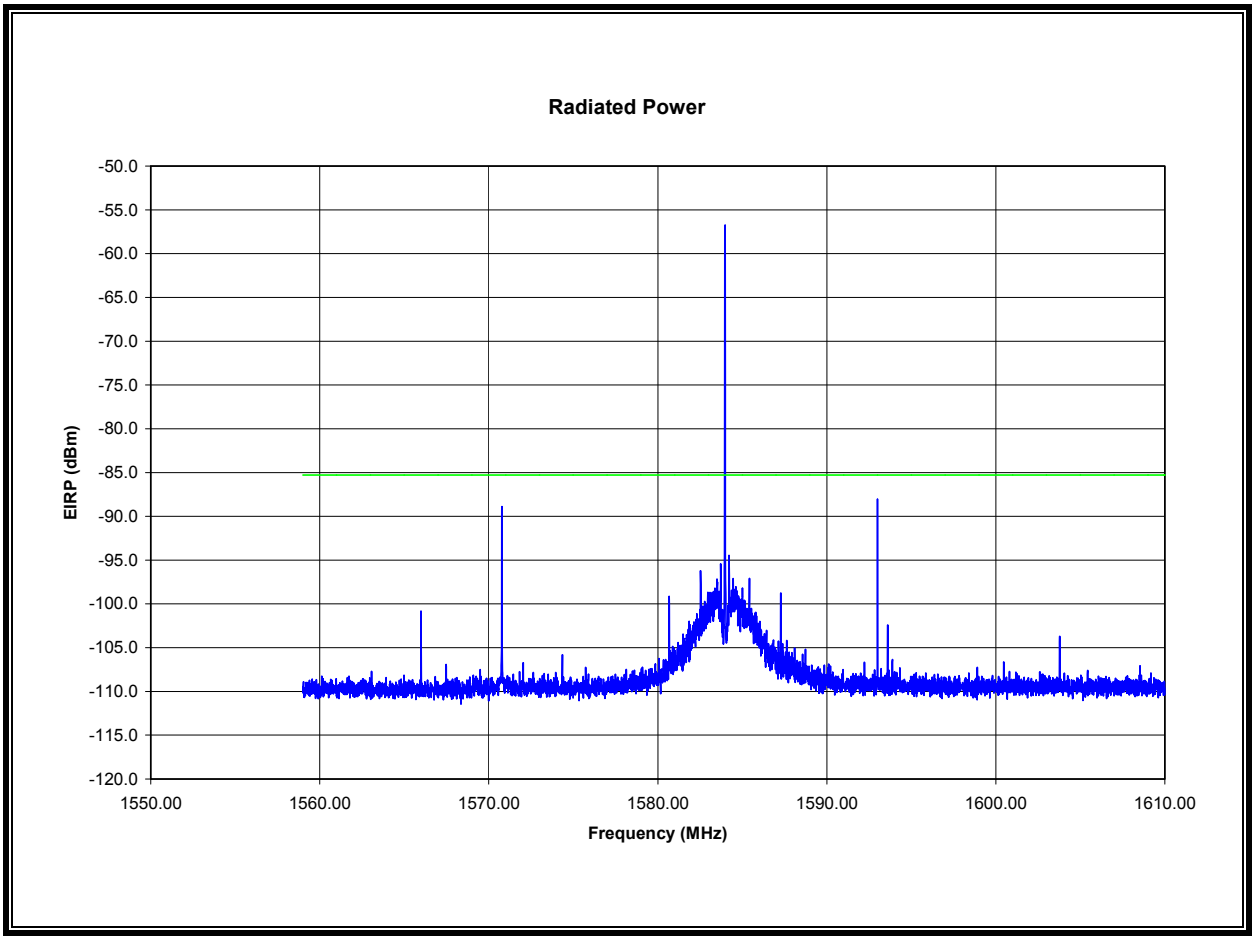


EIRP 1.164 TO 1.240 GHz, 1 kHz BW, VERTICAL



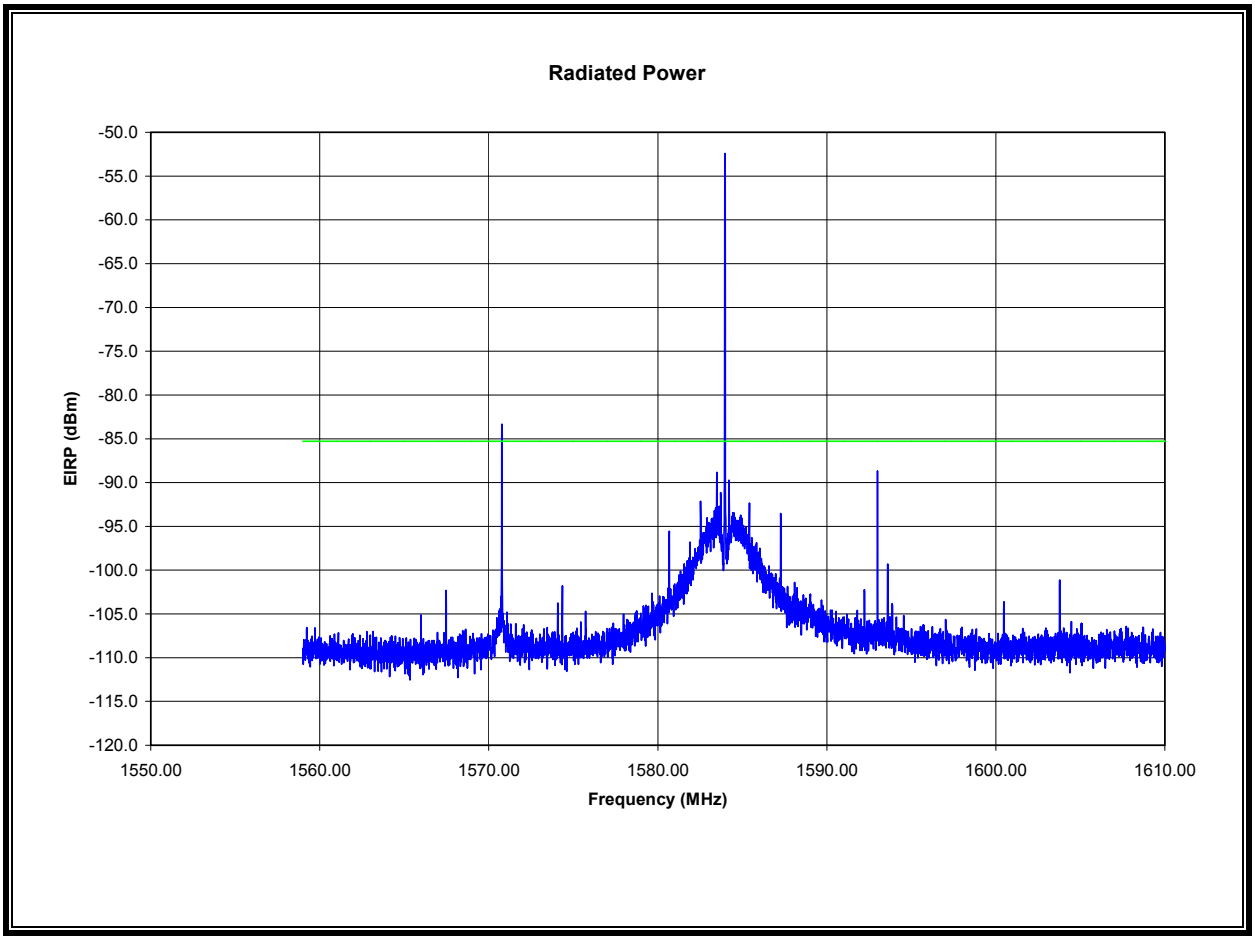
Note: The narrowband emission over the UWB limit was identified as an emission from digital circuitry used to enable the operation of the UWB transmitter, and is not intended to be radiated from the transmitter's antenna.

EIRP 1.559 TO 1.610 GHz, 1 kHz BW, HORIZONTAL



Note: The narrowband emission over the UWB limit was identified as an emission from digital circuitry used to enable the operation of the UWB transmitter, and is not intended to be radiated from the transmitter's antenna.

EIRP 1.559 TO 1.610 GHz, 1 kHz BW, VERTICAL



The narrowband emissions over the UWB limit were identified as emissions from digital circuitry used to enable the operation of the UWB transmitter, and are not intended to be radiated from the transmitter's antenna.

7.4. RADIATED EMISSIONS BELOW 960 MHz

§15.519 (c) The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in §15.209.

§15.521 (c) …Emissions from associated digital devices, as defined in §15.3(k), e.g., emissions from digitial circuitry used to control additional functions or capabilities other than the UWB transmission, are suject to the limits contained in Subpart B of this part.

RADIATED EMISSIONS 30 TO 960 MHz

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

Test Engr: Thanh Nguyen
Date: 12/07/09
Project #: 09U12933
Company: NDS Surgical Imaging
EUT Description: UWB indoor Product
Antenna: 17Z0095
Test Target: FCC 15.209 except 15.109 as noted
Mode Oper: Normal Tx

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
32.991	3.0	46.1	18.8	0.5	28.4	0.0	0.0	37.0	40.0	-3.0	V	P	
296.931	3.0	55.6	13.3	1.5	28.1	0.0	0.0	42.3	46.0	-3.7	V	P	
362.973	3.0	54.6	14.4	1.7	28.1	0.0	0.0	42.5	46.0	-3.5	V	P	
395.994	3.0	54.9	14.9	1.8	28.1	0.0	0.0	43.4	46.0	-2.6	V	P	
429.015	3.0	61.8	15.4	1.9	28.0	9.5	0.0	40.6	46.4	-5.8	V	P	Emission from associated Class A digital device used to control additional function other than the UWB transmission. 15.109 Class A limit is applied.
626.912	3.0	47.6	18.7	2.3	27.4	0.0	0.0	41.2	46.0	-4.8	V	P	
231.003	3.0	50.6	11.9	1.3	28.2	0.0	0.0	35.6	46.0	-10.4	H	P	
297.046	3.0	50.7	13.3	1.5	28.1	0.0	0.0	37.4	46.0	-8.6	H	P	
429.015	3.0	53.1	15.4	1.9	28.0	0.0	0.0	42.4	46.0	-3.6	H	P	
627.027	3.0	45.5	18.7	2.3	27.4	0.0	0.0	39.1	46.0	-6.9	H	P	

Rev. 1.27.09

8. LIMITS AND RESULTS WITH ANTENNA MODEL 17Z0097

8.1. UWB BANDWIDTH, CENTER FREQUENCY, AND FRACTIONAL BANDWIDTH

DEFINITIONS AND LIMITS

§15.503 Definitions.
(a) UWB Bandwidth. For the purpose of this subpart, the UWB bandwidth is the frequency band bounded by the points that are 10 dB below the highest radiated emission, as based on the complete transmission system including the antenna. The upper boundary is designated f_H and the lower boundary is designated f_L. The frequency at which the highest radiated emission occurs is designated f_M.
(b) Center frequency. The center frequency, f_C, equals $(f_H + f_L)/2$.
(c) Fractional bandwidth. The fractional bandwidth equals $2(f_H - f_L)/ (f_H + f_L)$.
(d) Ultra-wideband (UWB) transmitter. An intentional radiator that, at any point in time, has a fractional bandwidth equal to or greater than 0.20 or has a UWB bandwidth equal to or greater than 500 MHz, regardless of the fractional bandwidth.

§15.519 (b) The UWB bandwidth of a device operating under the provisions of this section must be contained between 3100 MHz and 10,600 MHz.

TEST PROCEDURE

Radiated measurements are made using the procedures described above. The detection mode is set to peak detection, the sweep time is AUTO, and the Max Hold trace function is utilized. The frequency range from 3.1 to 10.6 GHz is measured, and corrected from raw values to Peak EIRP.

The frequency at which the maximum EIRP is measured is designated as f_M. A major graticule line of the plot is adjusted to exactly equal the peak EIRP at f_M. The spectral envelope at the major graticule line that is 10 dB below the reference graticule is examined to determine the frequency band bounded by the points that are 10 dB below the highest radiated emission. The upper boundary is designated f_H and the lower boundary is designated f_L.

The center frequency, f_C, is calculated as $(f_H + f_L)/2$.

The antenna polarization that yields the highest EIRP at f_M is used to calculate the above parameters.

Calculations are made independently for each of the three channels.

LOW CHANNEL RESULTS (WORST-CASE / VERTICAL POLARIZATION)

f Max (GHz)	Reference EIRP at f Max (dBm)	10 dB down from Reference EIRP (dBm)
3.641	-42.9	-52.9

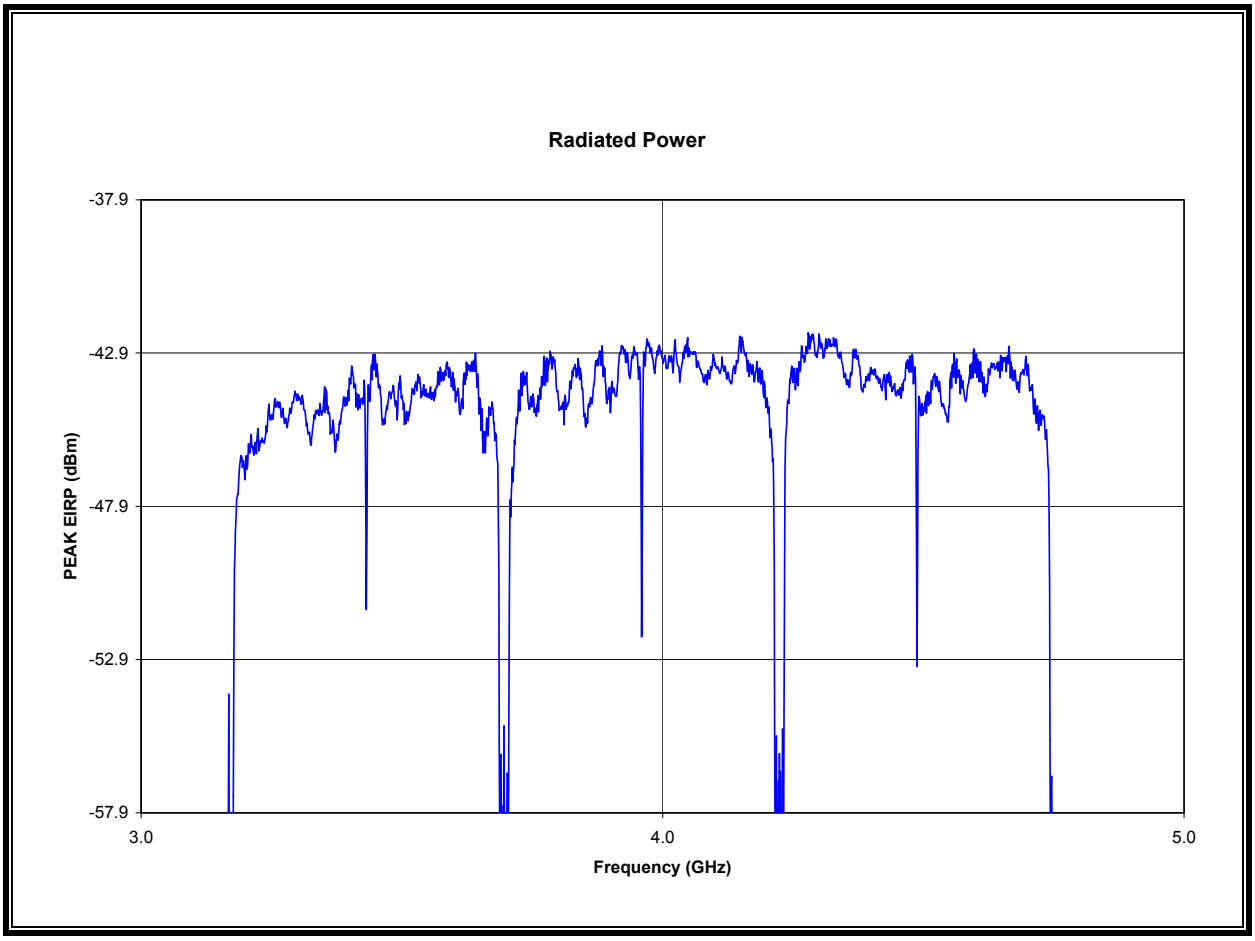
f Low (GHz)	Minimum f Low (GHz)
3.178	3.1

f High (GHz)	Maximum f High (GHz)
3.687	10.6

f Center (GHz)
3.433

UWB BW (GHz)	Minimum UWB BW (GHz)
0.509	0.500

PLOT OF PEAK EIRP WITH REFERENCE GRATICULE ADJUSTED FOR LOW CHANNEL F MAX



MID CHANNEL RESULTS (WORST-CASE / VERTICAL POLARIZATION)

f Max (GHz)	Reference EIRP at f Max (dBm)	10 dB down from Reference EIRP (dBm)
4.152	-42.4	-52.4

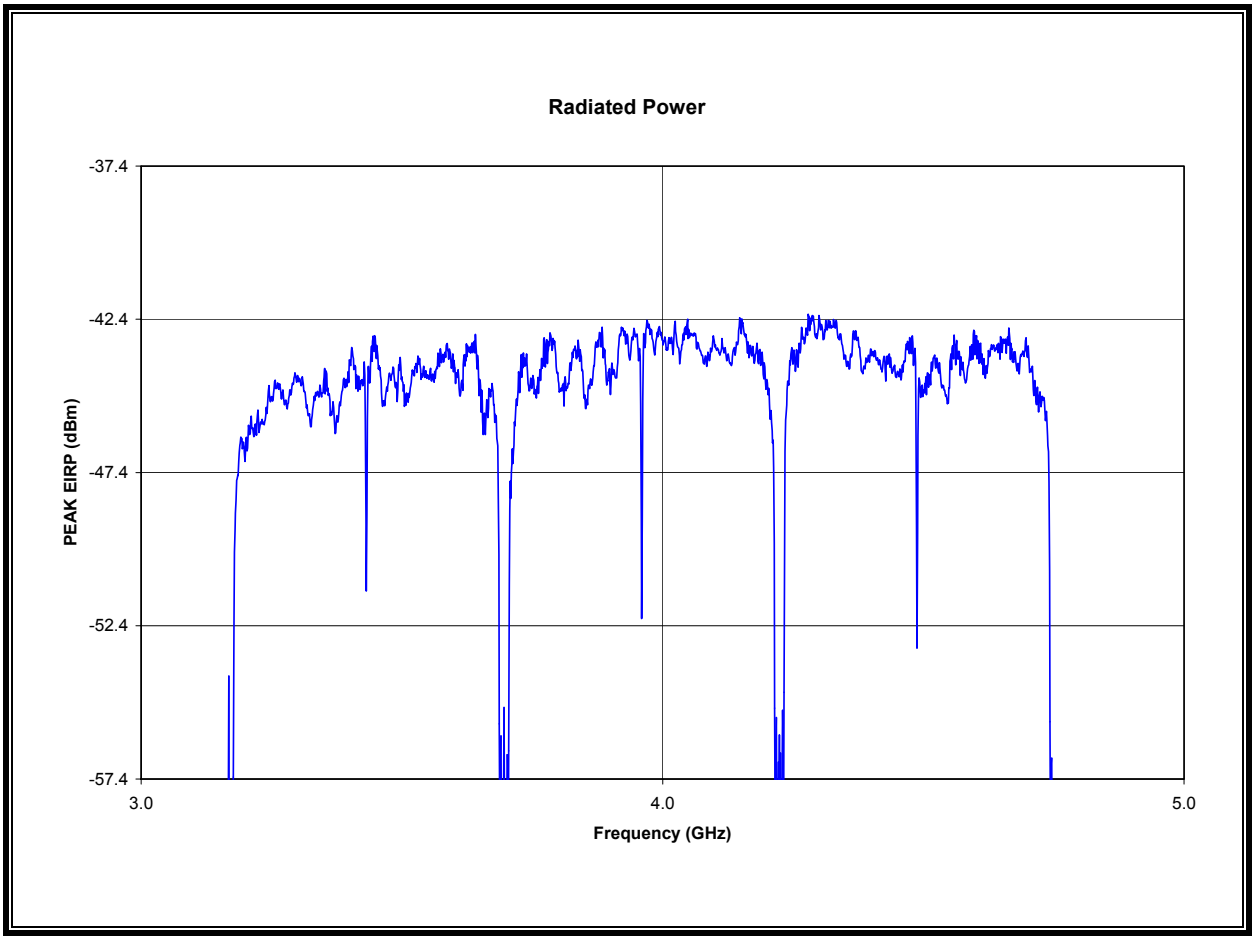
f Low (GHz)	Minimum f Low (GHz)
3.706	3.1

f High (GHz)	Maximum f High (GHz)
4.212	10.6

f Center (GHz)
3.959

UWB BW (GHz)	Minimum UWB BW (GHz)
0.506	0.500

PLOT OF PEAK EIRP WITH REFERENCE GRATICULE ADJUSTED FOR MID CHANNEL F MAX



HIGH CHANNEL RESULTS (WORST-CASE / VERTICAL POLARIZATION)

f Max (GHz)	Reference EIRP at f Max (dBm)	10 dB down from Reference EIRP (dBm)
4.287	-42.3	-52.3

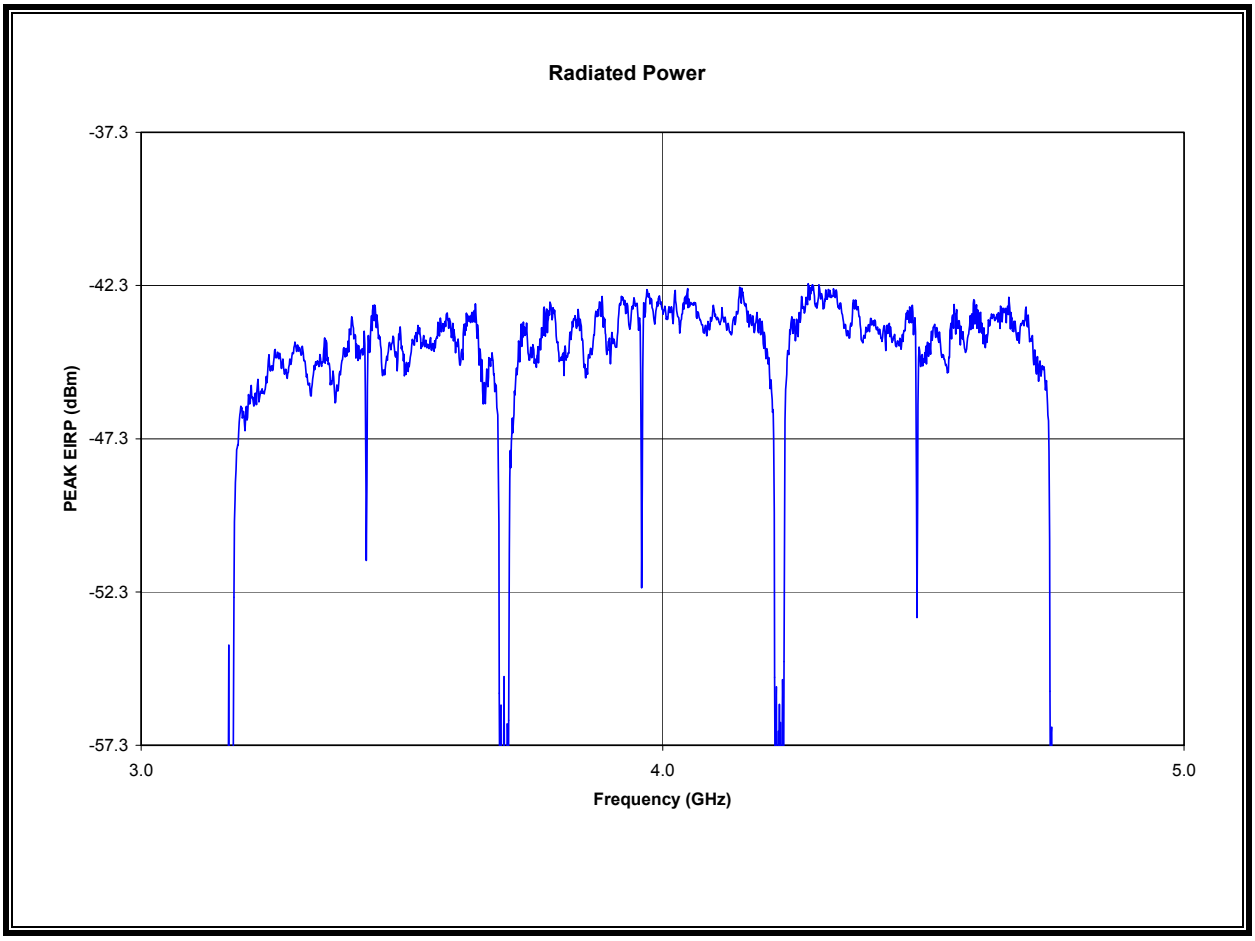
f Low (GHz)	Minimum f Low (GHz)
4.234	3.1

f High (GHz)	Maximum f High (GHz)
4.743	10.6

f Center (GHz)
4.489

UWB BW (GHz)	Minimum UWB BW (GHz)
0.509	0.500

PLOT OF PEAK EIRP WITH REFERENCE GRATICULE ADJUSTED FOR HIGH CHANNEL F MAX



8.2. PEAK POWER

LIMIT

§15.519 (e) There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, f_M. That limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described in §15.521.

§15.521 (g) When a peak measurement is required, it is acceptable to use a resolution bandwidth other than the 50 MHz specified in this subpart. This resolution bandwidth shall not be lower than 1 MHz or greater than 50 MHz, and the measurement shall be centered on the frequency at which the highest radiated emission occurs, f_M. If a resolution bandwidth other than 50 MHz is employed, the peak EIRP limit shall be 20 log (RBW/50) dBm where RBW is the resolution bandwidth in megahertz that is employed. This may be converted to a peak field strength level at 3 meters using E(dBuV/m) = P(dBm EIRP) + 95.2. If RBW is greater than 3 MHz, the application for certification filed with the Commission must contain a detailed description of the test procedure, calibration of the test setup, and the instrumentation employed in the testing.

§15.521 (e) The frequency at which the highest radiated emission occurs, f_M, must be contained within the UWB bandwidth.

TEST PROCEDURE

Radiated measurements are made using the procedures described above.

RESULTS

RBW =	3	Limit =	-24.44	Distance =	3.0

Low Channel					
f Max (GHz)	Reading (dBuV)	Antenna Factor (dB/m)	Cable (dB)	Preamp (dB)	Distance Factor (dB)
3.641	69.17	32.10	4.90	-36.90	0.00

Field Strength at 3 meters (dBuV/m)	EIRP Conversion Factor	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
69.27	-95.20	-25.93	-24.44	-1.49

Mid Channel					
f Max (GHz)	Reading (dBuV)	Antenna Factor (dB/m)	Cable (dB)	Preamp (dB)	Distance Factor (dB)
4.152	67.81	33.10	5.30	-36.50	0.00

Field Strength at 3 meters (dBuV/m)	EIRP Conversion Factor	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
69.71	-95.20	-25.49	-24.44	-1.05

High Channel					
f Max (GHz)	Reading (dBuV)	Antenna Factor (dB/m)	Cable (dB)	Preamp (dB)	Distance Factor (dB)
4.287	67.28	33.20	5.40	-36.50	0.00

Field Strength at 3 meters (dBuV/m)	EIRP Conversion Factor	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
69.38	-95.20	-25.82	-24.44	-1.38

8.3. RADIATED EMISSIONS ABOVE 960 MHz

LIMITS

§15.519 (c) The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency in MHz	EIRP in dBm
960–1610	- 75.3
1610–1990	- 63.3
1990–3100	- 61.3
3100–10600	- 41.3
Above 10600	- 61.3

§15.519 (d) In addition to the radiated emission limits specified in the table in paragraph (c) of this section, UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz:

Frequency in MHz	EIRP in dBm
1164–1240	- 85.3
1559–1610	- 85.3

§15.521 (d) Within the tables in §§15.509, 15.511, 15.513, 15.515, 15.517, and 15.519, the tighter emission limit applies at the band edges. Radiated emission levels above 960 MHz are based on RMS average measurements over a 1 MHz resolution bandwidth. The RMS average measurement is based on the use of a spectrum analyzer with a resolution bandwidth of 1 MHz, an RMS detector, and a 1 millisecond or less averaging time.

§15.521 (e) The frequency at which the highest radiated emission occurs, f_M, must be contained within the UWB bandwidth.

TEST PROCEDURE

Radiated measurements are made using the procedures described above. The number of points on the horizontal axis of the spectrum analyzer is set to (frequency span in MHz + 1) and the sweep time is set to (frequency span in MHz) milliseconds, the RBW is set to 1 MHz and the detector function is set to RMS average.

For the requirements of §15.519 (d), an RBW of 10 kHz is utilized.

RESULTS

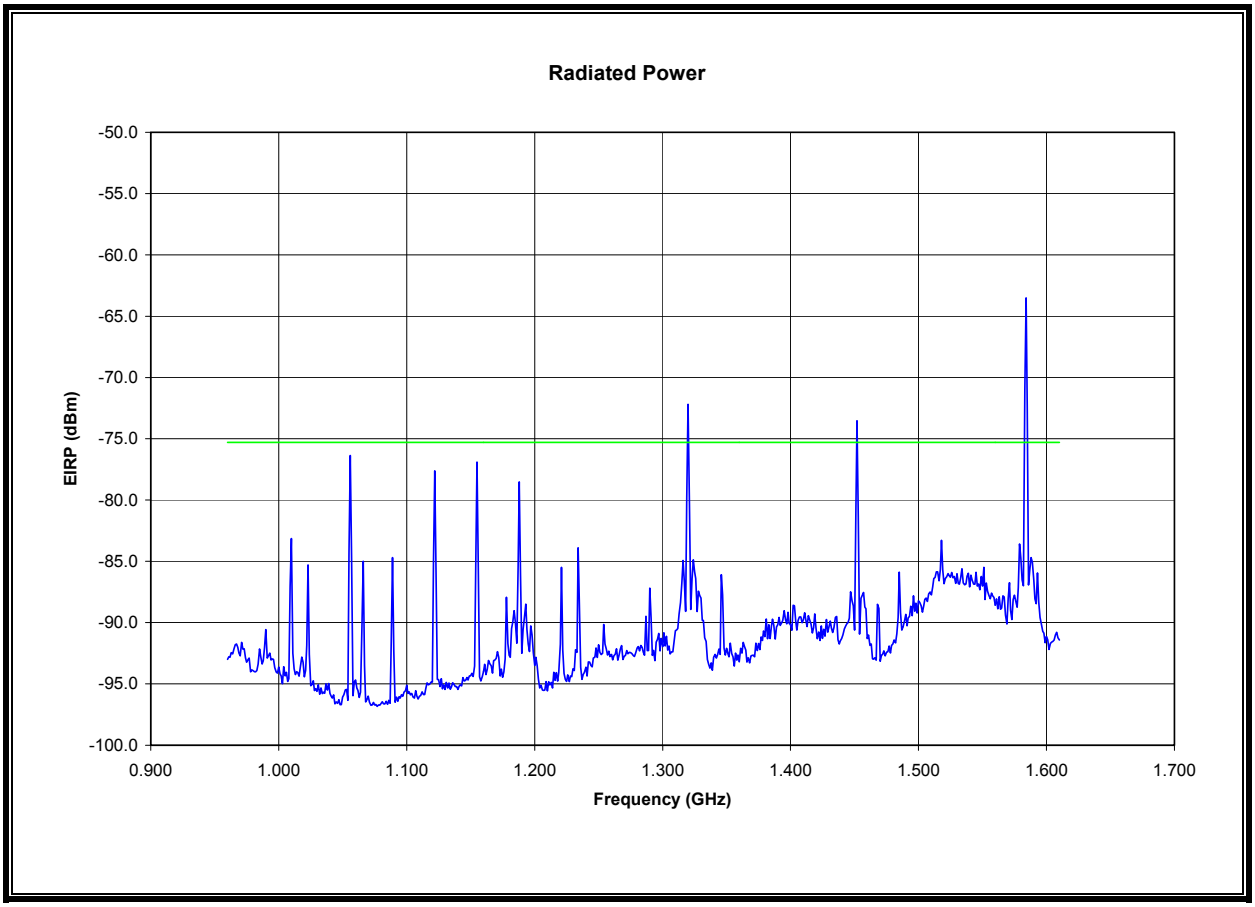
The highest radiated emission at f_M is as follows:

Polarization =	Vertical	Distance =	3.0

f Max (GHz)	Reading (dBuV)	Antenna Factor (dB/m)	Cable (dB)	Preamp (dB)	Distance Factor (dB)
4.279	50.9	33.2	5.4	-36.5	0.0

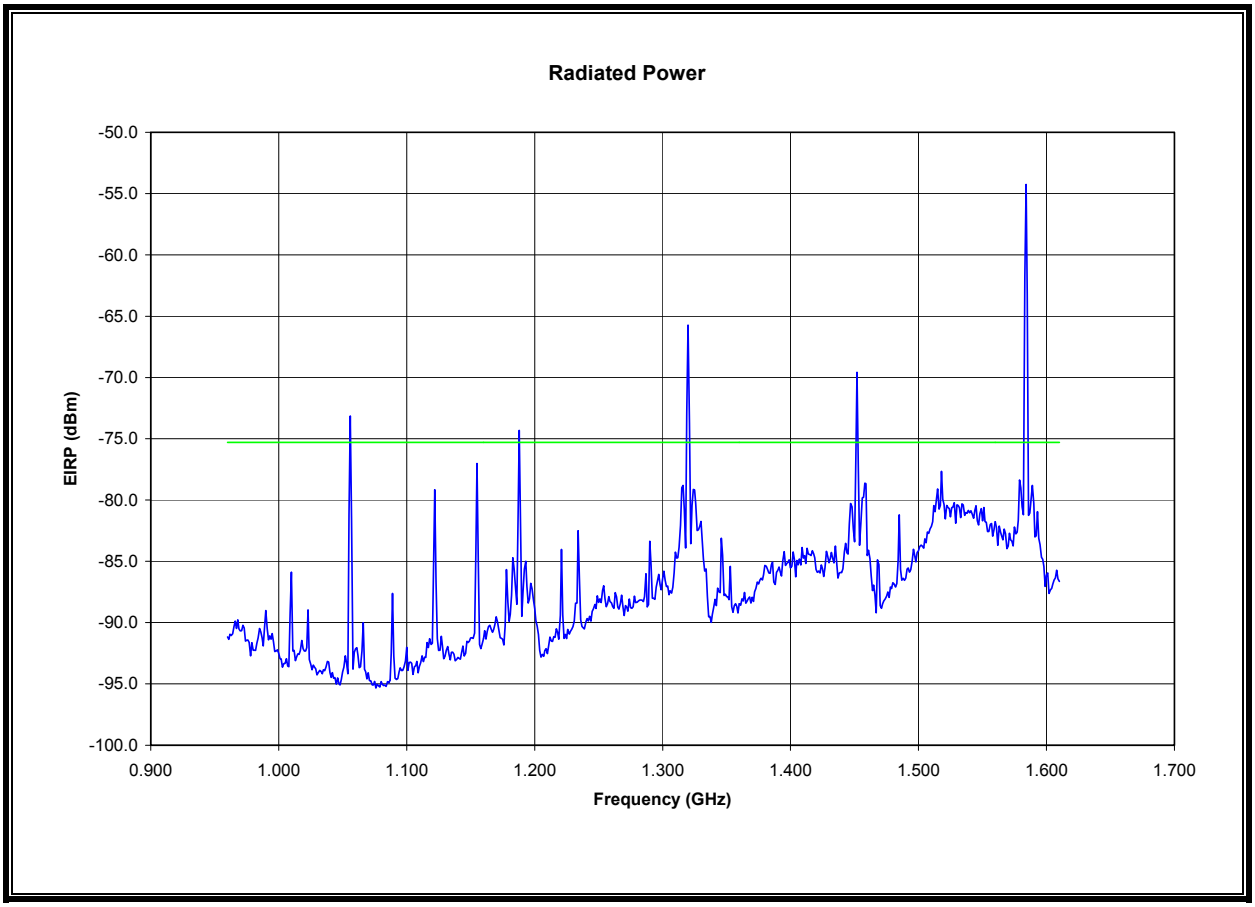
Field Strength at 3 meters (dBuV/m)	EIRP Conversion Factor	EIRP (dBm)	EIRP Limit (dBm)	Margin (dB)
53.00	-95.20	-42.20	-41.30	-0.90

EIRP 0.960 TO 1.610 GHz, 1 MHz BW, HORIZONTAL



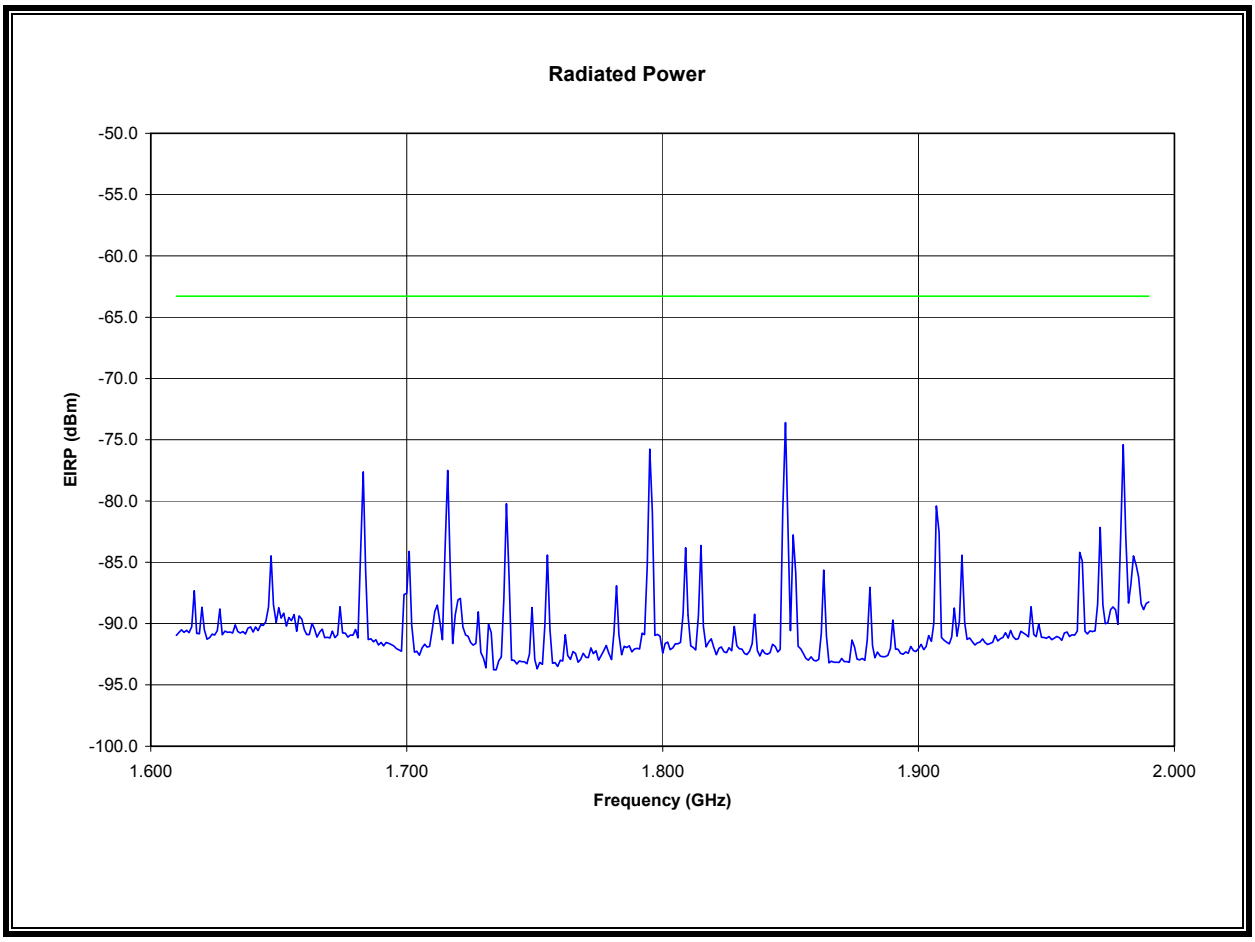
Note: The narrowband emissions over the UWB limit were identified as emissions from digital circuitry used to enable the operation of the UWB transmitter, and are not intended to be radiated from the transmitter's antenna.

EIRP 0.960 TO 1.610 GHz, 1 MHz BW, VERTICAL

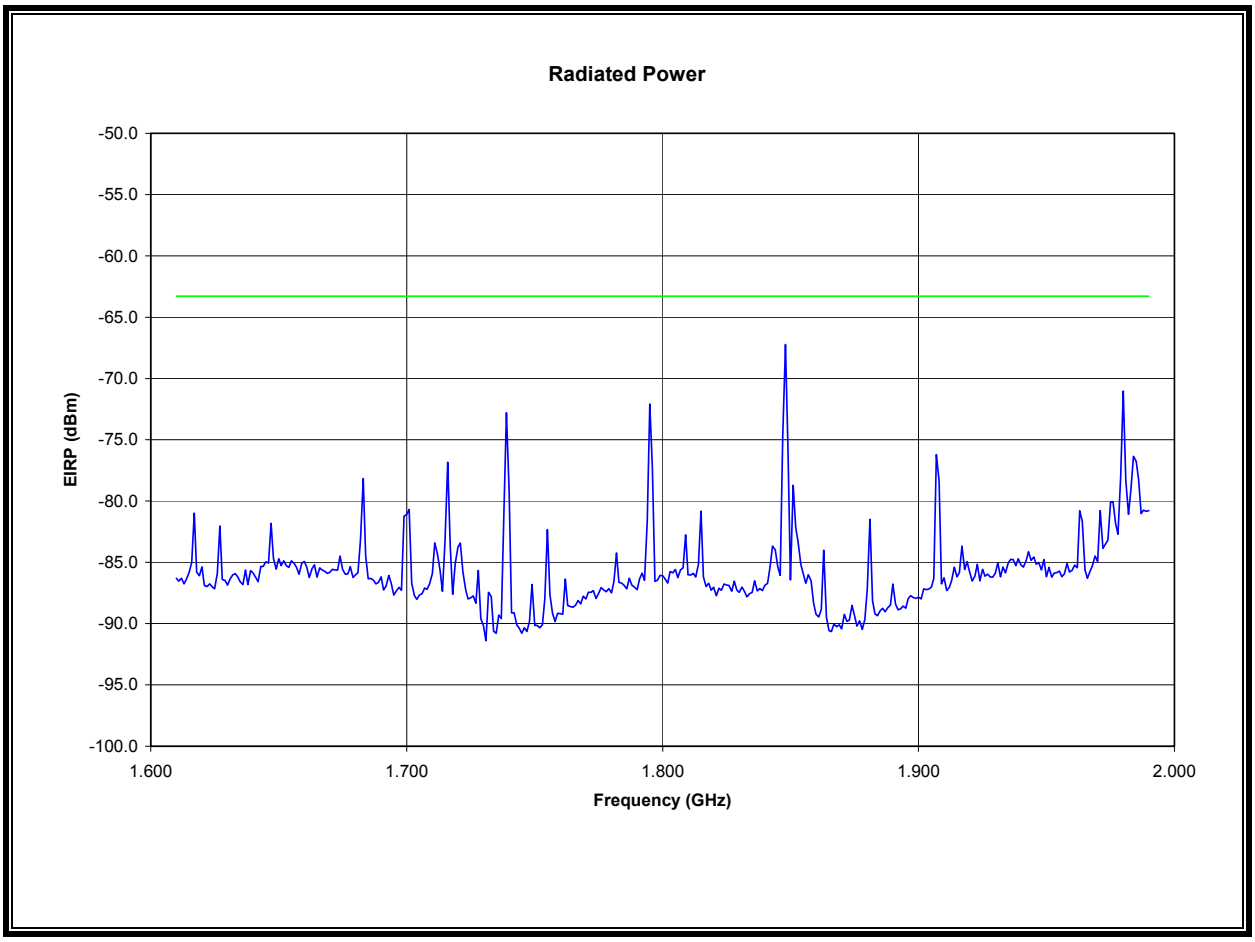


Note: The narrowband emissions over the UWB limit were identified as emissions from digital circuitry used to enable the operation of the UWB transmitter, and are not intended to be radiated from the transmitter's antenna.

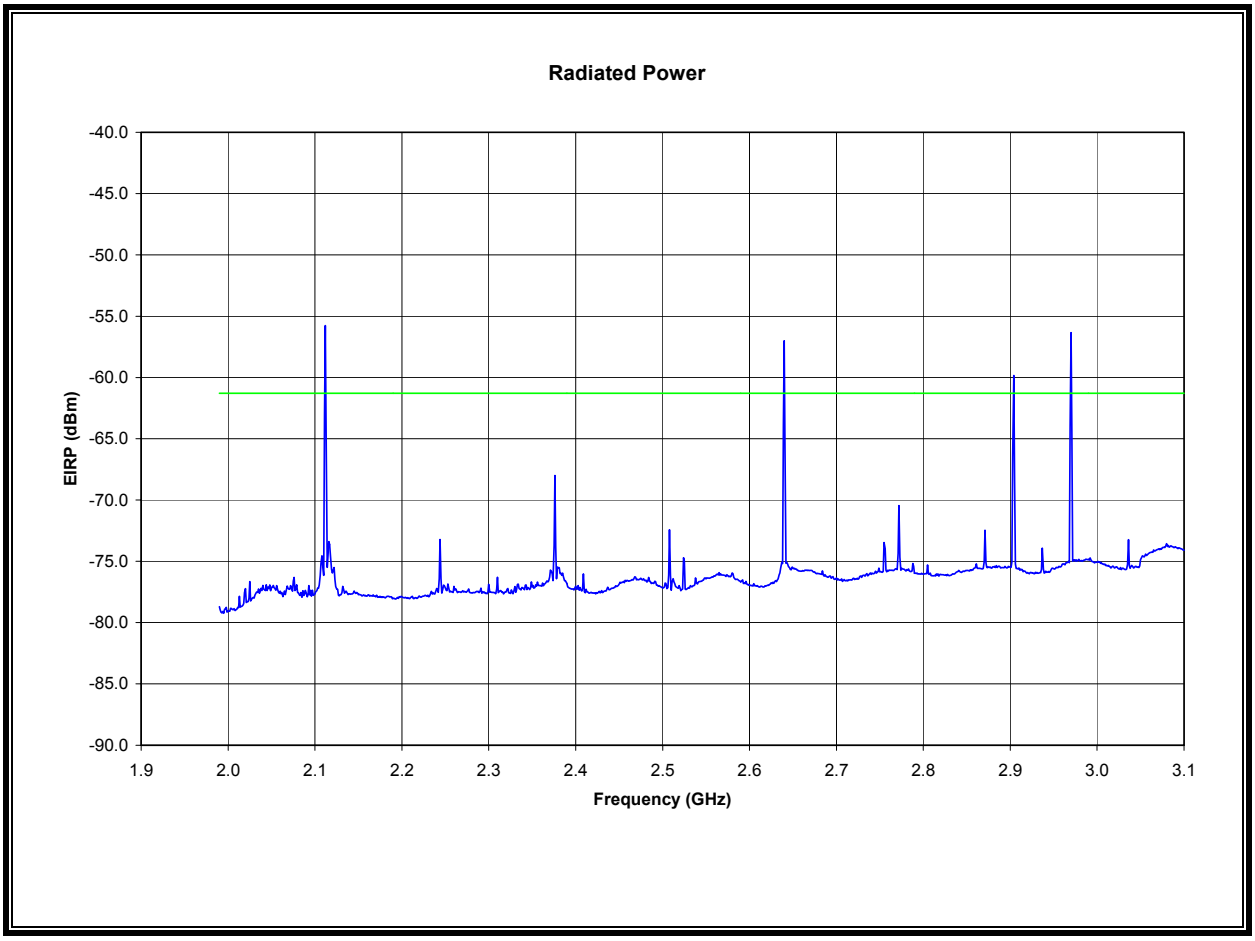
EIRP 1.610 TO 1.990 GHz, 1 MHz BW, HORIZONTAL



EIRP 1.610 TO 1.990 GHz, 1 MHz BW, VERTICAL

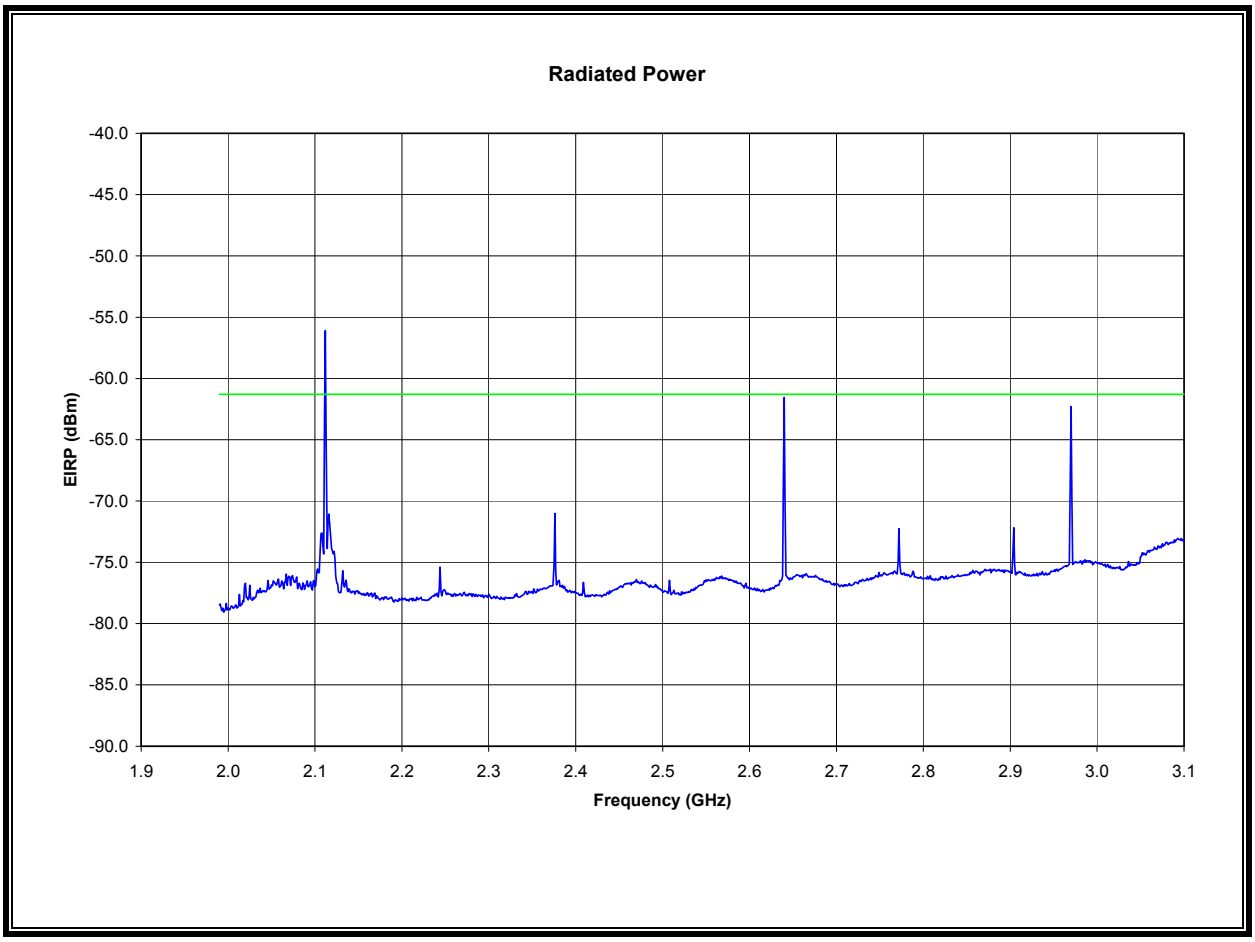


EIRP 1.990 TO 3.100 GHz, 1 MHz BW, HORIZONTAL



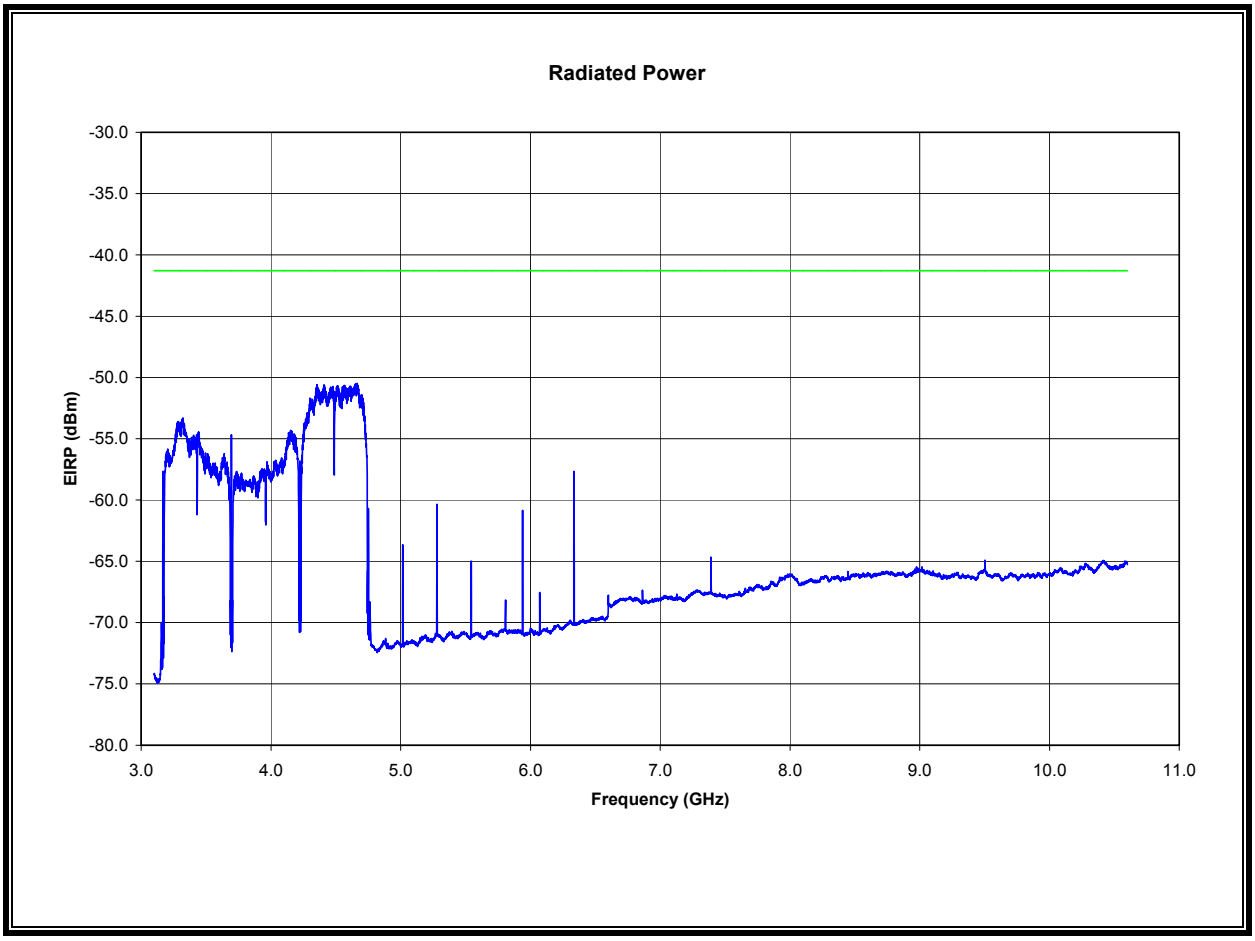
Note: The narrowband emissions over the UWB limit were identified as emissions from digital circuitry used to enable the operation of the UWB transmitter, and are not intended to be radiated from the transmitter's antenna.

EIRP 1.990 TO 3.100 GHz, 1 MHz BW, VERTICAL

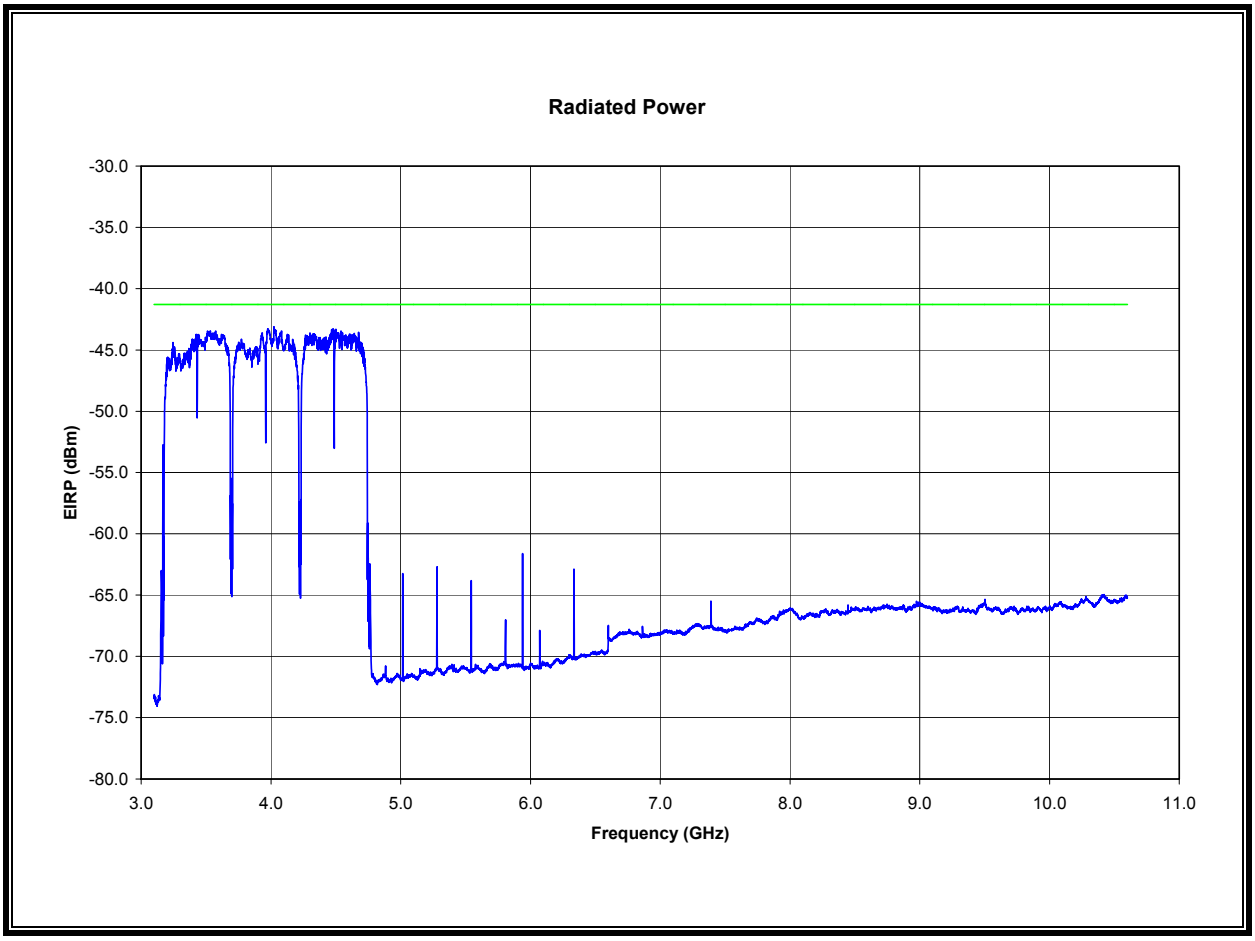


Note: The narrowband emission over the UWB limit was identified as an emission from digital circuitry used to enable the operation of the UWB transmitter, and is not intended to be radiated from the transmitter's antenna.

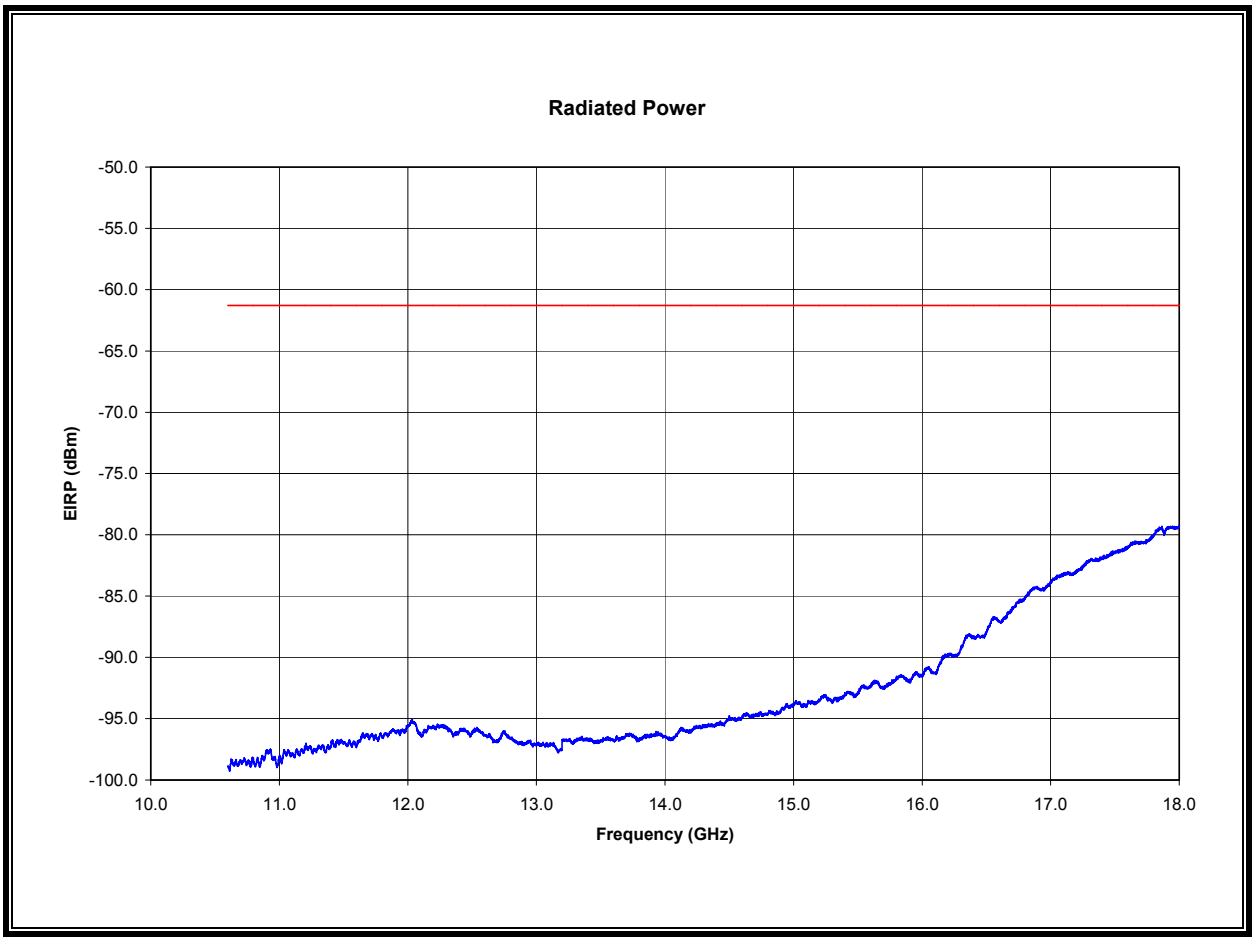
EIRP 3.1 TO 10.6 GHz, 1 MHz BW, HORIZONTAL



EIRP 3.1 TO 10.6 GHz, 1 MHz BW, VERTICAL

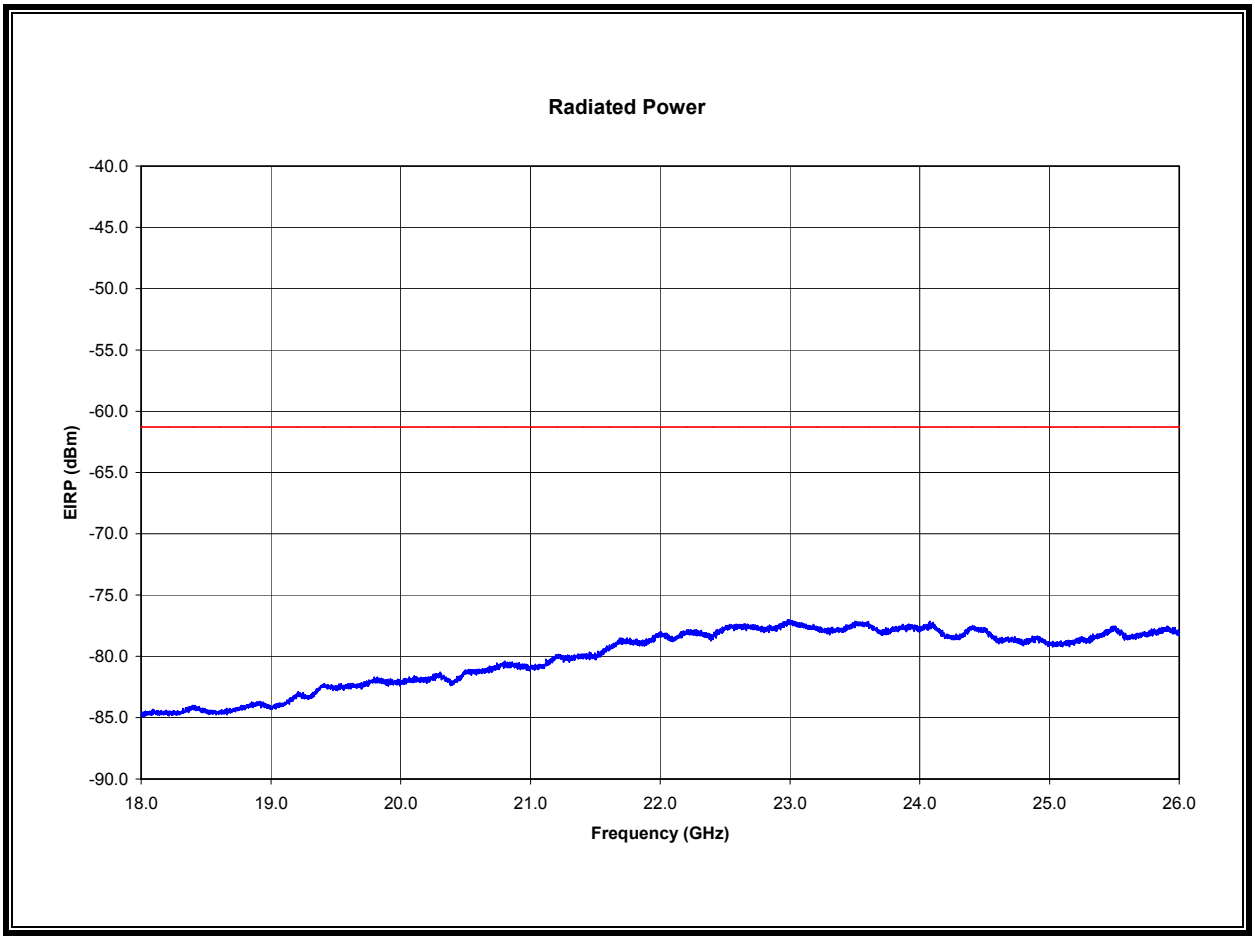


EIRP 10.6 TO 18 GHz, 1 MHz BW, HORIZONTAL AND VERTICAL



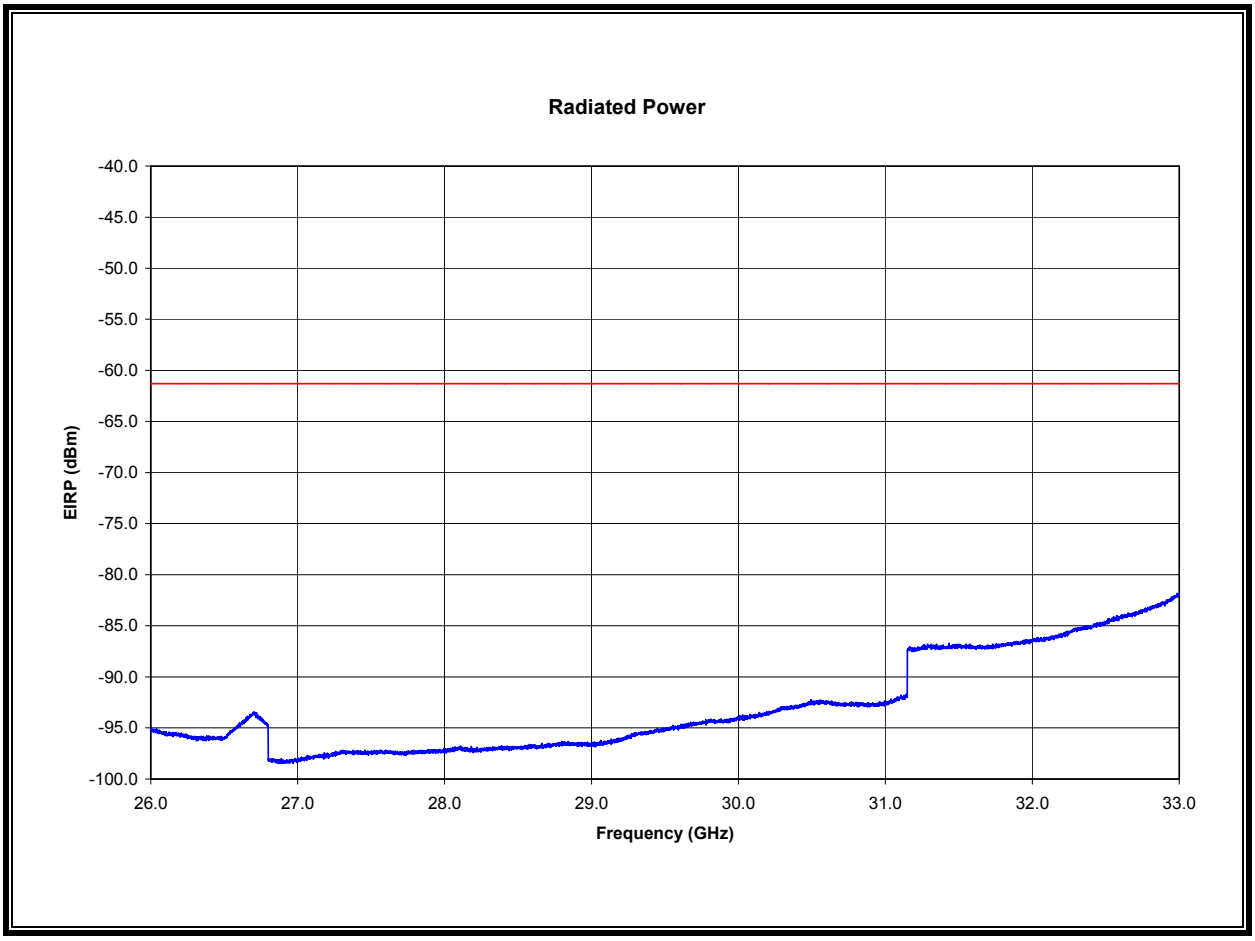
Note: No emissions above the system noise floor were observed.

EIRP 18 TO 26 GHz, 1 MHz BW, HORIZONTAL AND VERTICAL



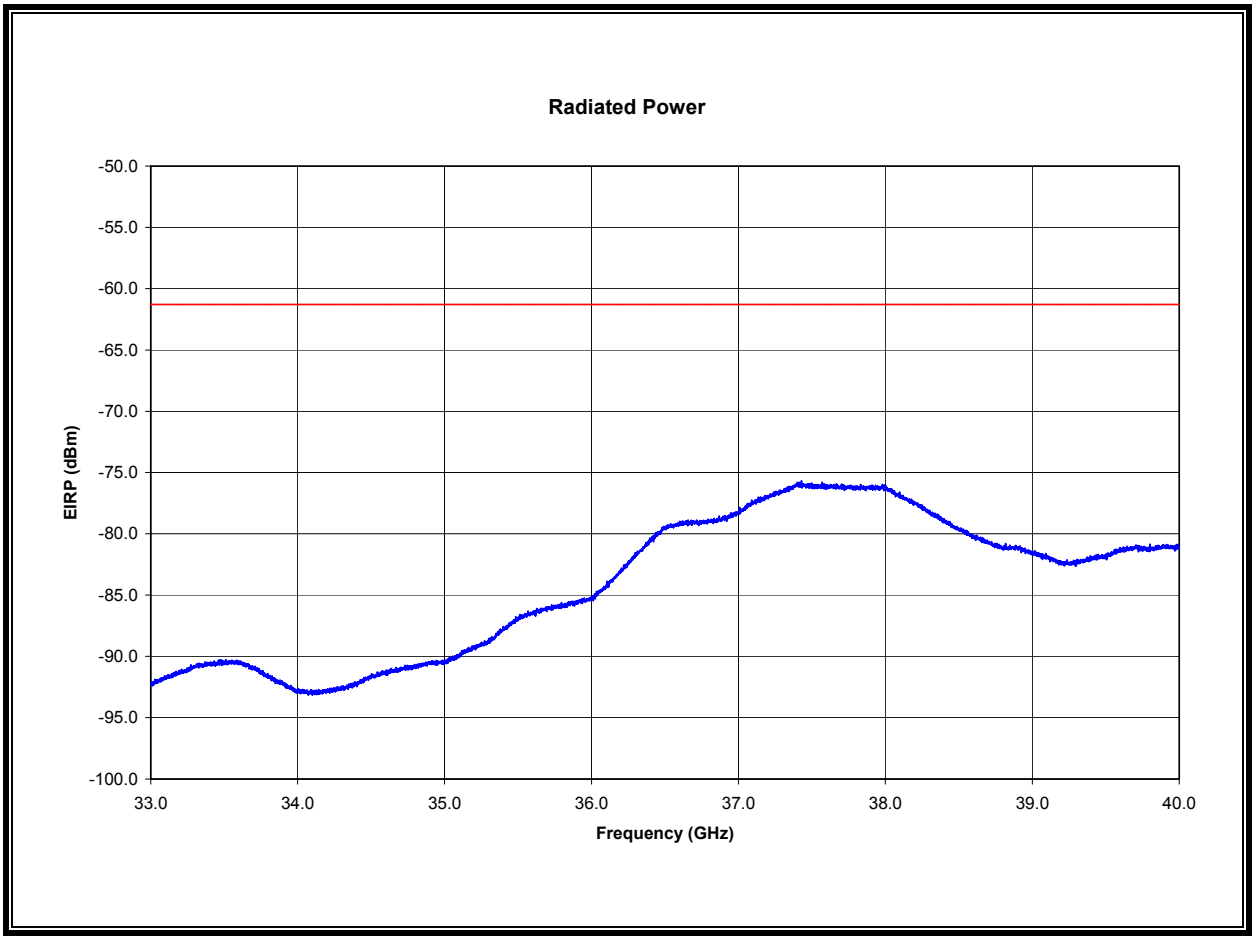
Note: No emissions above the system noise floor were observed.

EIRP 26 TO 33 GHz, 1 MHz BW, HORIZONTAL AND VERTICAL



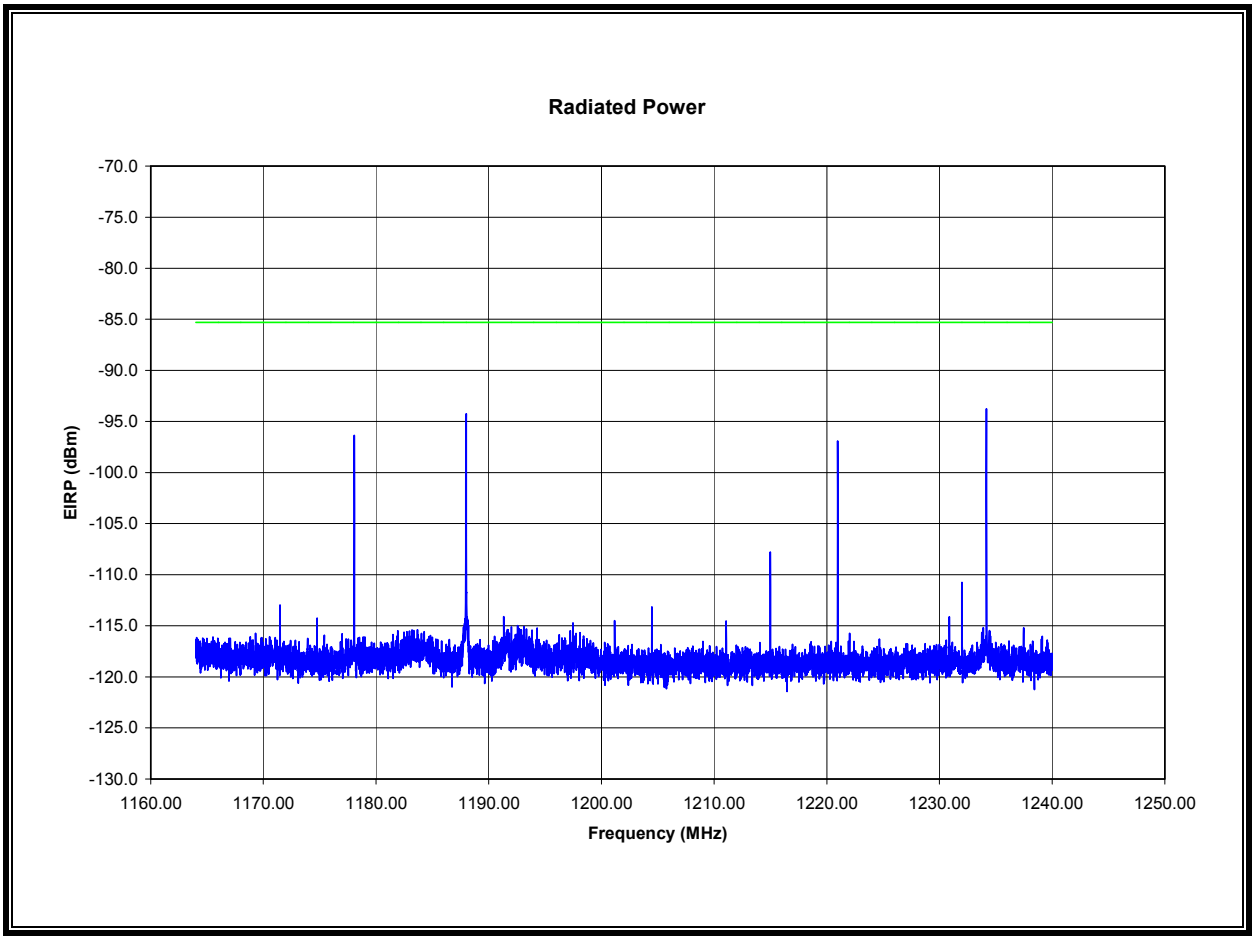
Note: No emissions above the system noise floor were observed.

EIRP 33 TO 40 GHz, 1 MHz BW, HORIZONTAL AND VERTICAL

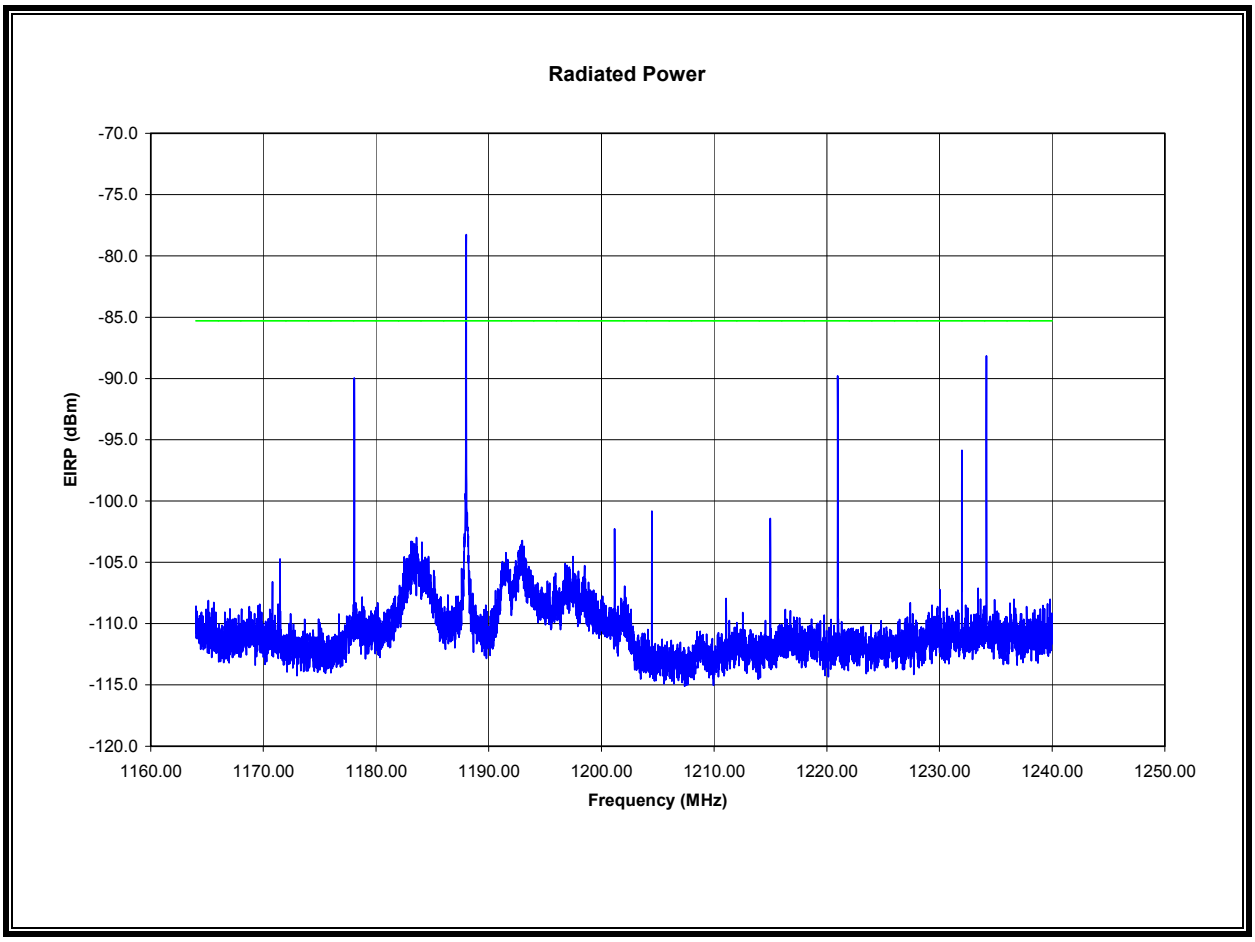


Note: No emissions above the system noise floor were observed.

EIRP 1.164 TO 1.240 GHz, 1 kHz BW, HORIZONTAL

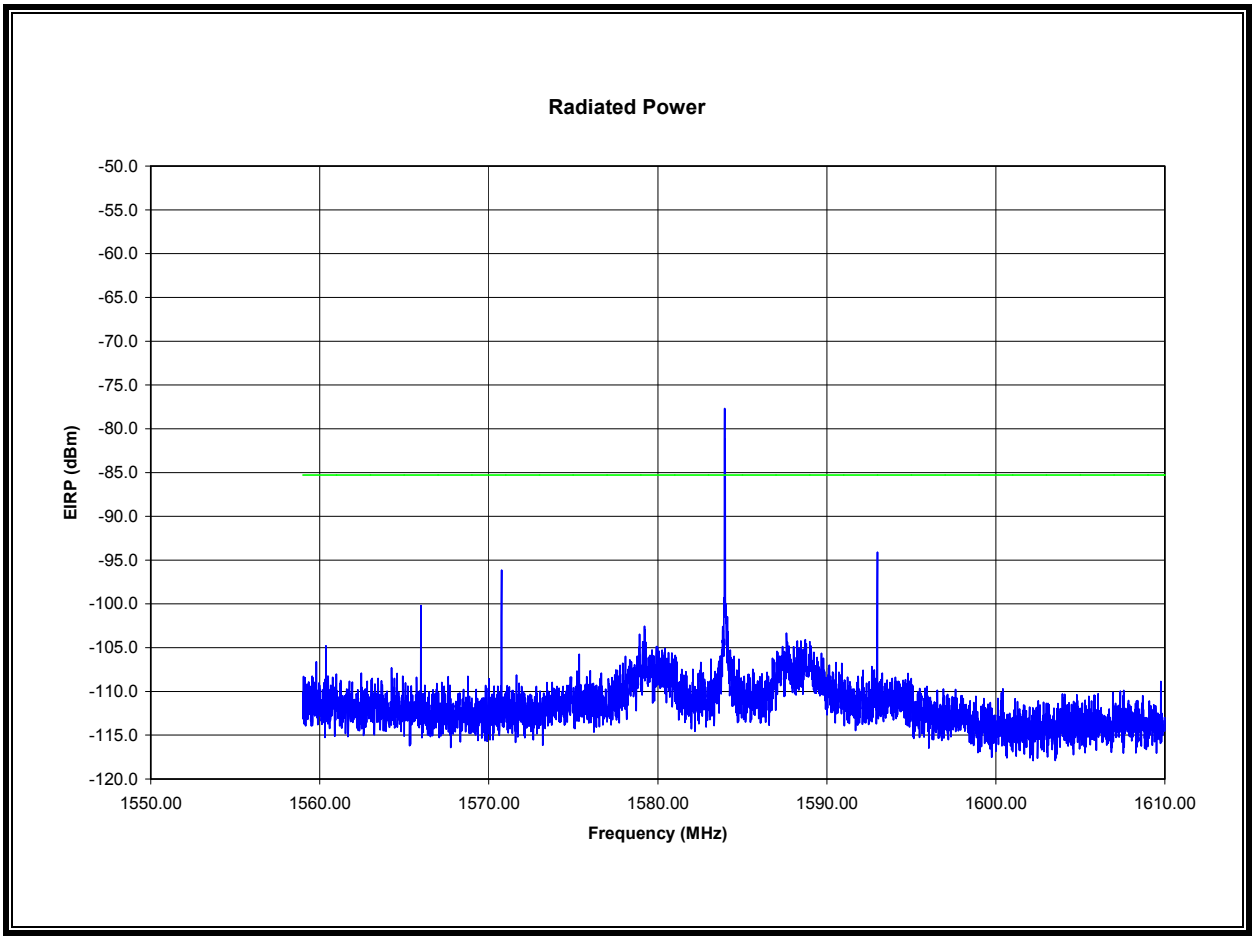


EIRP 1.164 TO 1.240 GHz, 1 kHz BW, VERTICAL



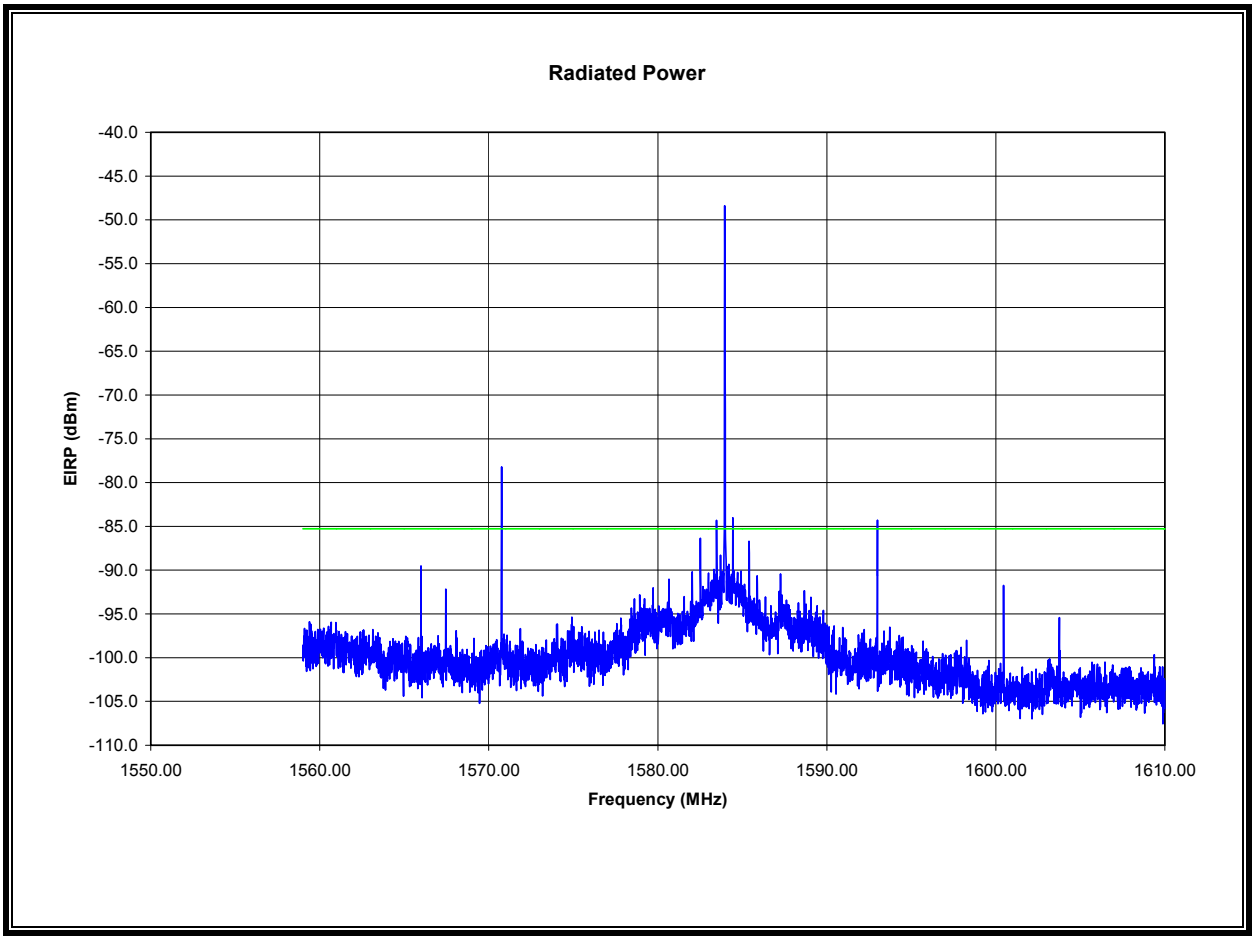
Note: The narrowband emission over the UWB limit was identified as an emission from digital circuitry used to enable the operation of the UWB transmitter, and is not intended to be radiated from the transmitter's antenna.

EIRP 1.559 TO 1.610 GHz, 1 kHz BW, HORIZONTAL



Note: The narrowband emission over the UWB limit was identified as an emission from digital circuitry used to enable the operation of the UWB transmitter, and is not intended to be radiated from the transmitter's antenna.

EIRP 1.559 TO 1.610 GHz, 1 kHz BW, VERTICAL



Note: The narrowband emissions over the UWB limit were identified as emissions from digital circuitry used to enable the operation of the UWB transmitter, and are not intended to be radiated from the transmitter's antenna.

8.4. RADIATED EMISSIONS BELOW 960 MHz

§15.519 (c) The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in §15.209.

§15.521 (c) …Emissions from associated digital devices, as defined in §15.3(k), e.g., emissions from digitial circuitry used to control additional functions or capabilities other than the UWB transmission, are suject to the limits contained in Subpart B of this part.

RADIATED EMISSIONS 30 TO 960 MHz

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

Test Engr: Thanh Nguyen
Date: 12/07/09
Project #: 09U12933
Company: NDS Surgical Imaging
EUT Description: UWB indoor Product
Antenna: 17Z0097
Test Target: FCC 15.209 except 15.109 as noted
Mode Oper: Normal Tx

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
32.991	3.0	44.8	18.8	0.5	28.4	0.0	0.0	35.7	40.0	-4.3	V	P	
99.034	3.0	52.4	9.7	0.9	28.3	0.0	0.0	34.7	43.5	-8.8	V	P	
297.046	3.0	55.9	13.3	1.5	28.1	0.0	0.0	42.6	46.0	-3.4	V	P	
362.973	3.0	54.9	14.4	1.7	28.1	0.0	0.0	42.9	46.0	-3.1	V	P	
395.994	3.0	52.9	14.9	1.8	28.1	0.0	0.0	41.5	46.0	-4.5	V	P	
429.015	3.0	62.0	15.4	1.9	28.0	9.5	0.0	40.8	46.4	-5.6	V	P	Emission from associated Class A digital device used to control additional function other than the UWB transmission. 15.109 Class A limit is applied.
627.027	3.0	48.4	18.7	2.3	27.4	0.0	0.0	42.0	46.0	-4.0	V	P	
99.034	3.0	47.0	9.7	0.9	28.3	0.0	0.0	29.3	43.5	-14.2	H	P	
231.003	3.0	51.3	11.9	1.3	28.2	0.0	0.0	36.2	46.0	-9.8	H	P	
297.046	3.0	50.6	13.3	1.5	28.1	0.0	0.0	37.3	46.0	-8.7	H	P	
560.985	3.0	42.0	17.8	2.2	27.6	0.0	0.0	34.3	46.0	-11.7	H	P	
429.015	3.0	53.0	15.4	1.9	28.0	0.0	0.0	42.3	46.0	-3.7	H	P	
627.027	3.0	44.5	18.7	2.3	27.4	0.0	0.0	38.1	46.0	-7.9	H	P	

Rev. 1.27.09