FCC Part 15, 25 Results

of the
Axonn, LLC
Satellite Personal Tracker Model: SPT

Issue Date: August 19, 2008
UST Project No: 08-0151

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Testing Tomorrow's Technology

I certify that I am authorized to sign for the test facility and that all of the statements in this report and in the Exhibits attached hereto are true and correct to the best of my knowledge and belief:

US TECH (AGENT RESPONSIBLE FOR TEST):

By: 

Name: John Livingston

Title: EMC And Product Safety Compliance Engineer

Date: August 19, 2008

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1. Test And Measurements

1.1 Configuration of Tested System and Test Methodology

Prepared in accordance with the requirements of the FCC Rules and Regulations Part 2 & 25. All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was off throughout the evaluation process. Interconnecting cables were manipulated as necessary to maximize emissions. A block diagram of the tested system is shown in Figure 1. Test configuration photographs for spurious emissions are shown in Figure 2.

The EUT was a modified Axonn SPT, which was previously tested at US Tech in 2007 (US Tech Project # 07-0197). The new product features a WiMax module installed into the existing circuitry of the SPT by means of a small transistor circuit that acts as a switch to control the operation of the two units. If the SPT is transmitting, the WiMax module remains off. The WiMax module features a USB port for connection to a computer, and if the module is connected to a computer through this port then the SPT shuts down and the WiMax module activates. By request, only the SPT functionality was tested.

The WiMax module was soldered into two modified SPT units, each in turn. The first was a sample set up to allow selection of various test modes for antenna conducted emissions measurements, and the second was set up to allow selection of various test modes for radiated emissions testing.

After the module was soldered into the SPT test unit and operation of the SPT unit verified, several of the antenna conducted measurements were checked against the old measurements, and it was determined that the previous antenna conducted data remained valid for the newly configured product. Radiated power and radiated spurious emissions were measured to account for any change in radiation patterns that may arise from the presence of the new WiMax board.

Emissions testing for the Part 25 portion of the test was performed with the EUT connected to a power supply at 3 VDC. Radiated emissions testing for the Part 15 portion was performed with the EUT powered by 2 new 1.5 VDC AA lithium batteries.

1.2 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA. This site has been fully described and registered with the FCC under designation Number US5115. Additionally, this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number 2982A-1.

1.3 Test Equipment

Table 2 describes test equipment used to evaluate this product.

1.4 Modifications

No modifications were made by US Tech to bring the EUT into compliance with FCC Part 25 limits for the transmitter portion of the EUT.

No modifications were made by US Tech to bring the EUT into compliance with the FCC Part 15 limits for the digital device portion of the EUT.

Figure 1

Test Configuration for Transmitter Radiated Emissions 1 – 16 GHz

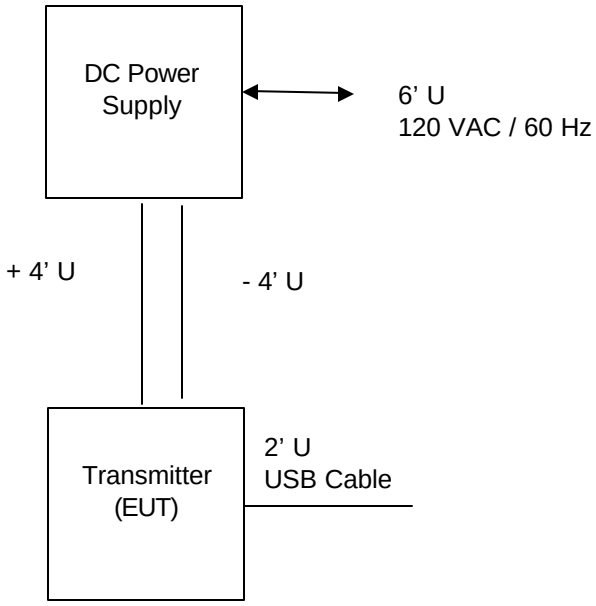


Figure 2

Test Configuration for Digital Emissions 30 MHz – 8.5 GHz

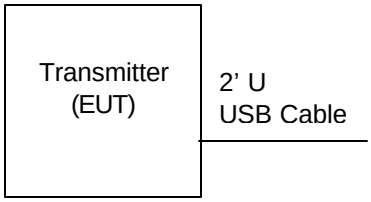


Table 1

EUT and Peripherals Transmitter Radiated Emissions 1 – 16 GHz

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
Satellite Personal Tracker Axonn LLC + WiMax module (EUT)	SPT	None	None	+ 4' U DC Lead - 4' U DC Lead
DC Power Supply	HY1803D	PS 1008 US Tech	N/A	6'U 120 VAC / 60 Hz Source

Table 2

EUT and Peripherals Digital Emissions 30 MHz – 8.5 GHz

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
Satellite Personal Tracker Axonn LLC + WiMax module (EUT)	SPT	None	None	None

Table 3 Test Instruments

EQUIPMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	DATE OF LAST CALIBRATION
SPECTRUM ANALYZER	8593E	HEWLETT-PACKARD	3205A00124	1/15/08
SIGNAL GENERATOR	8672A	HEWLETT-PACKARD	1733A00389	N/A
SPECTRUM ANALYZER	8566B	HEWLETT-PACKARD	2410A00109	10/1/2007
RF PREAMP	8447D	HEWLETT-PACKARD	2944A06291	10/30/07
RF PREAMP	8449B	HEWLETT-PACKARD	3008A00480	8/21/07
LOG PERIODIC ANTENNA	3146	EMCO	3236	11/21/07
LISN (x 2) 9247-50-TS-50-N	9247	SOLAR ELE.	910494 & 910495	4/2/08
HORN ANTENNA	SAS-571	A.H. SYSTEMS	605	12/06/07 2 Yr.
HORN ANTENNA	3115	EMCO	9107-3723	10/16/06 2 Yr.
CALCULATION PROGRAM	N/A	N/A	EMCCALC	N/A

Table 4

EUT and Peripherals Transmitter Radiated Emissions 1 – 16 GHz

Radiated Emissions									
Test By: D.A..	**Test:** FCC Part 15.109 Verification					**Client: Axonn LLC**			
	Project: 08-0151			**Class:** B		**Model:** Satellite Personal Tracker Model: SPT			
Frequency MHz	**Test Data dBm**	**Transducer Table**	**Test Data dBuV**	**AF+CA-AMP dB/m**	**Results uV/m**	**Limits uV/m**	**Distance / Polarity**	**Margin (dB)**	**Det**
1611.23	-18.1	1HN3mV	88.9	29.4	118.2		3m./VERT	**118.2**	**PK**
3225.8	-60.3	1HN3mV	46.7	-1.1	45.6	98.2	3m./VERT	**52.6**	**PK**
4834.05	-59.0	1HN1mH	48.0	4.7	52.7	74.0	1m./HORZ	**21.3**	**PK**
6444.78	-67.7	1HN1mV	39.3	7.0	46.4	98.2	1m./VERT	**51.8**	**PK**
1613.73	-18.5	1HN3mV	88.5	29.4	117.9		3m./VERT	**117.9**	**PK**
3227.18	-57.2	1HN3mV	49.8	-1.1	48.7	97.9	3m./VERT	**49.2**	**PK**
4841.15	-59.5	1HN1mH	47.5	4.7	52.2	74.0	1m./HORZ	**21.8**	**PK**
6454.85	-68.6	1HN1mH	38.4	7.0	45.4	97.9	1m./HORZ	**52.5**	**PK**
1618.7	-18.9	1HN3mV	88.2	29.4	117.5		3m./VERT	**117.5**	**PK**
3237.55	-59.9	1HN3mH	47.1	-1.0	46.1	84.4	3m./HORZ	**38.3**	**PK**
4856.15	-59.2	1HN1mH	47.8	4.8	52.6	84.4	1m./HORZ	**31.8**	**PK**
6474.98	-68.9	1HN1mV	38.2	7.1	45.2	84.4	1m./VERT	**39.2**	**PK**

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m
Antilog ((-60.3 + -1.1 + 107)/20) = 45.6
CONVERSION FROM dBm TO dBuV = 107 dB

Test Date: August 12, 2008

Tested by Signature: Daniel Aparaschivei **Name: Daniel Aparaschivei**

2.5 Antenna Description

The EUT will incorporate a Satellite transmit antenna: 25 mm ceramic patch, +4 dBi gain. GPS receive antenna: ceramic patch, passive.

2.6 RF Power Output (FCC Section 2.1046)

In bands shared coequally with terrestrial radio communications services, the equivalent isotropically radiated power transmitted in any direction towards the horizon by an earth station operating in frequency bands between 1 and 15 GHz, shall not exceed the limits below.

For angles of elevation of the horizon greater than 5 degrees there shall be no restriction as to the equivalent isotropically radiated power transmitted by an earth station towards the horizon.

FCC Minimum Standard (FCC Section 25.204 &)

EIRP < +40 dBW in any 4 kHz band for θ=0 degrees

The manufacturer has stated that the EUT has a maximum output power of +22.5 dBm.

Measurement Procedure

The peak radiated isotropic output power (EIRP) was measured using the Substitution Method as described in TIA/EIA-603:1992. First, the EUT was setup on an OATS, and electric field strength measurements were taken of the fundamental frequencies and harmonics/spurious emissions from the EUT following the measurement procedures of ANSI C63.4:2003. The EUT was placed on a non-conductive table 80 cm above the ground plane. The EUT was rotated through 360 degrees azimuth, and then the test antenna was raised to a height between 1 and 4 meters in order to maximize the field strength emissions. The RBW of the spectrum analyzer was set greater than the 20 dB bandwidth for measurements of the fundamental frequency, and the VBW was set equal to the RBW.

After obtaining the maximized field strength readings, the EUT was replaced by a substitution antenna who's center was placed at the same height as the center of the EUT. A signal generator was used to conduct a signal into the antenna at the same frequencies recorded in the previous process. The amplitude of the signal generator was adjusted so that, after maximizing the reading on the spectrum analyzer by adjusting the test antenna's height between 1 and 4 meters, the final result was approximately the same as measured from the EUT.

The cable connecting the signal generator to the substitution antenna was then disconnected from the substitution antenna and connected to the spectrum analyzer. This power level was recorded. The final EIRP was derived by adding the gain of the substitution antenna at each measurement to the power levels recorded, and adjusted by the difference between the original field strength measurement and the recreated field strength measurement, along with any distance extrapolation factors when necessary.

TABLE 5
EFFECTIVE ISOTROPICALLY RADIATED POWER (EIRP) OUTPUT

EUT Channel	Radiated P_{EUT} (dBm)	Radiated P_{subst} (dBm)	Conducted P_{subst} (dBm)	Antenna Gain (dBm	P_{EUT}- P_{subst}	Output Power (dBm)
1611.23	-18.1	-20.02	7.75	9.1	1.92	18.77
1613.73	-18.5	-19.90	7.89	9.1	1.4	18.39
1618.70	-18.9	-19.79	7.86	9.1	0.89	17.85

FCC Part 25 Limit = 40 dBW = 70 dBm

Sample calculation: At 1613.73 MHz: 7.89 + 9.1 +1.4 = 18.39 dBm

Test Date: August 13, 2008

Tester Signature: Daniel Aparaschivei **Name: Daniel Aparaschivei**

TABLE 6
RF CONDUCTED POWER OUTPUT
(For Reference Only)

Frequency of Fundamental (MHz)	Measurement (dBm)*	Measurement (Watt)
1611.160	21.95	.157
1613.640	22.77	.150
1618.730	21.25	.133

*Measurement includes 0.1 dB for cable loss

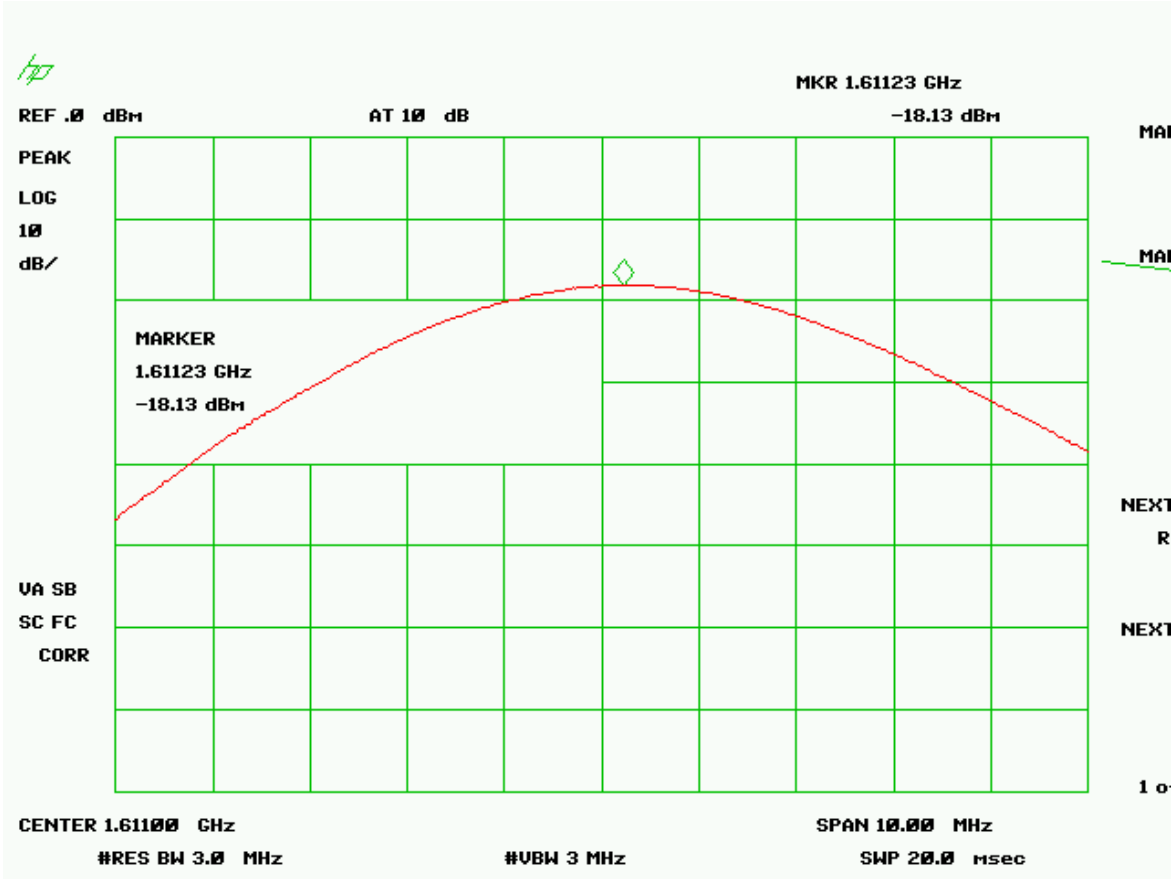
Note: Given the output power and antenna gain of +4 dBi, even the direct lobe of radiation meets the FCC's EIRP Requirement for $\theta = 0$ (+40 dBW)

Test Date: August 14, 2007

Daniel Aparaschivei

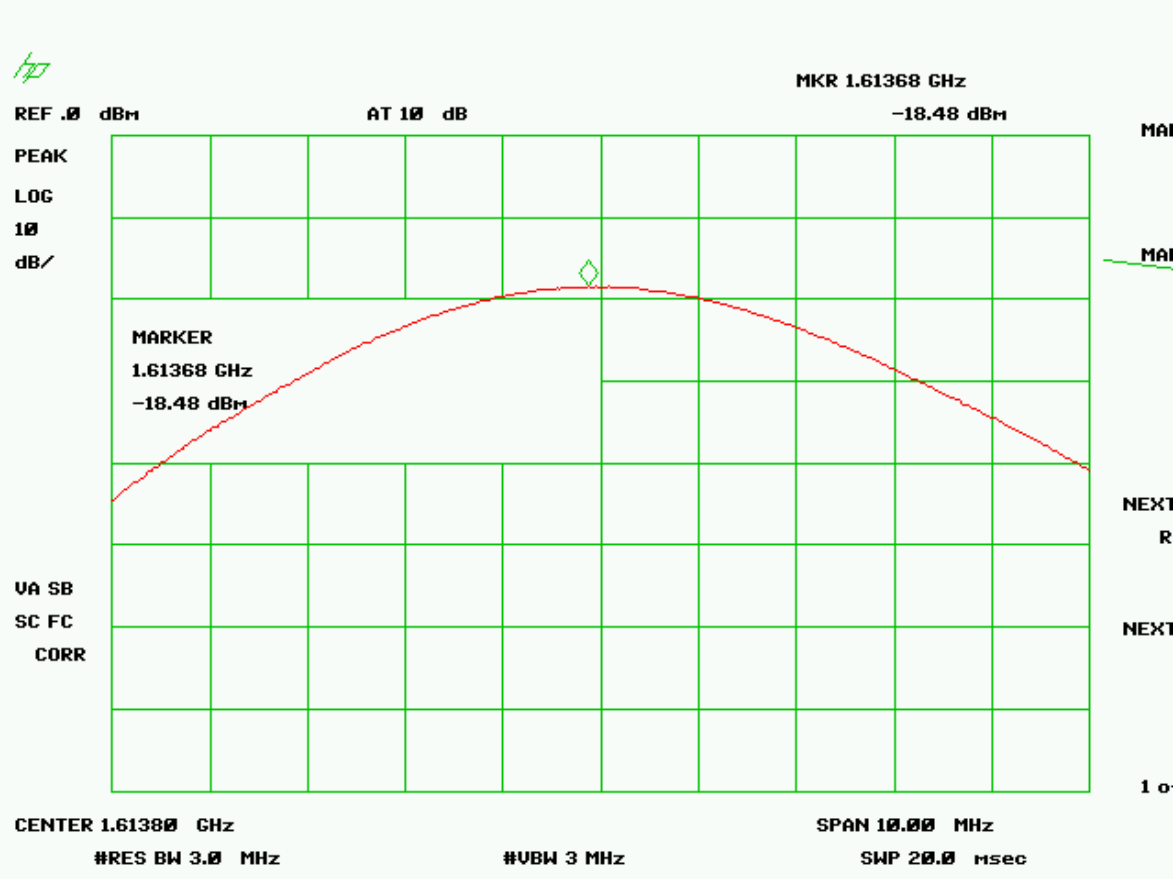
Tester
Signature: _____ Name: Daniel Aparaschivei

Figure 3a.
RF Radiated Power Output Low



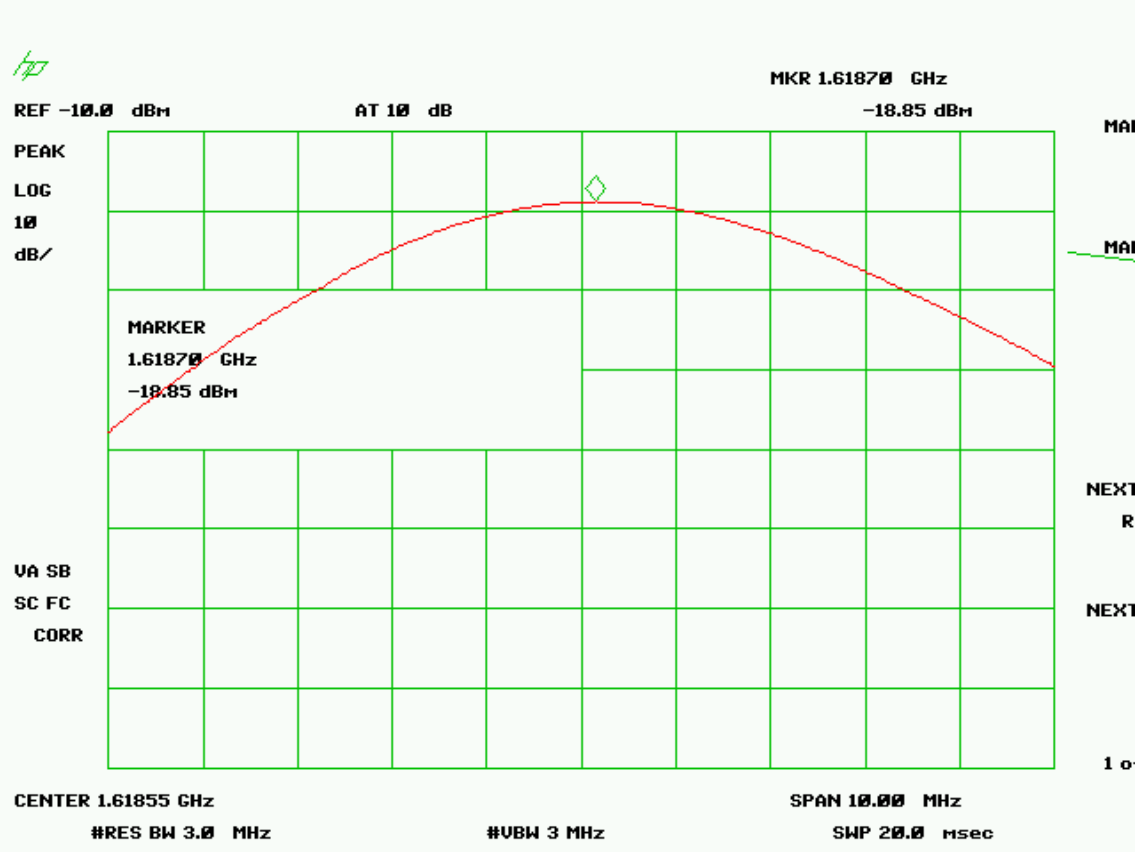
Note: -18.13 dBm => (-18.13 – 107) = 88.87 dBuV

Figure 3b.
RF Radiated Power Output Mid



Note: -18.48 dBm => (-18.48 – 107) = 88.52 dBuV

Figure 3c.
RF Radiated Power Output High



Note: -18.85 dBm => (-18.85 – 107) = 88.15 dBuV

2.7 Modulation Characteristics (FCC Section 2.1047)

Since the device incorporates digital modulation techniques, this information is not necessary.

Figure 4.
Modulation Characteristics

The EUT uses digital modulation techniques only which were employed during the tests for occupied bandwidth.

2.8 Occupied Bandwidth (FCC Section 2.1049)

EUT was modulated by its own internal sources. Low , First Mid, and High Channels were tested. The bandwidth of the fundamental was measured using a spectrum analyzer. The results are shown in Figure 5a through Figure 5d. Long sweep times were applied near to the fundamental to ensure a good signal was obtained.

FCC Minimum Standard (FCC Section 25.202(f))

For out-of-band emissions for frequencies removed from the midpoint of the assigned frequency by more than 50% up to and including 100% of the authorized bandwidth (2.5 MHz), at least 25 dB.

For out-of-band emissions for frequencies removed from the midpoint of the assigned frequency by more than 100% up to and including 250% of the authorized bandwidth (2.5 MHz), at least 35 dB.

For out-of-band emissions for frequencies removed from the midpoint of the assigned frequency segment by more than 250% of the authorized bandwidth (2.5 MHz), at least
43 + 10 log (P_{Watts}) attenuation below the mean power of the transmitter.

For Lowest Channel = 43 + 10 log (0.157) = 35 dBW = 65 dBm
For Highest Channel = 43 + 10 log (0.133) = 34.2 dBW = 64.2 dBm

Note:
A 30 kHz RBW was used instead. This was deemed to meet the 4 kHz RBW requirement.

Figure 5a.
99 % Occupied Bandwidth – Low

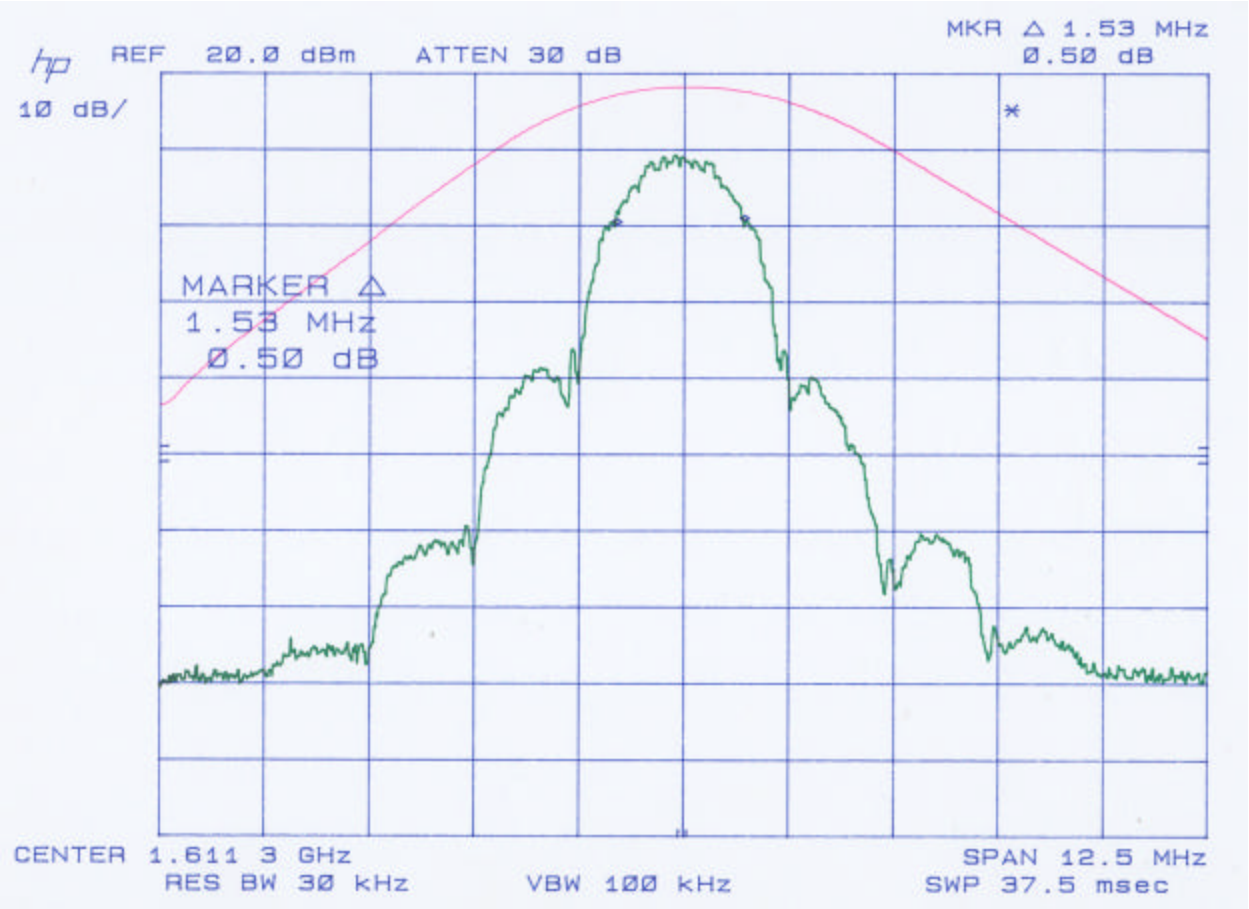


Figure 5b.
Occupied Bandwidth > 50% From Edge of Authorized Bandwidth – Low

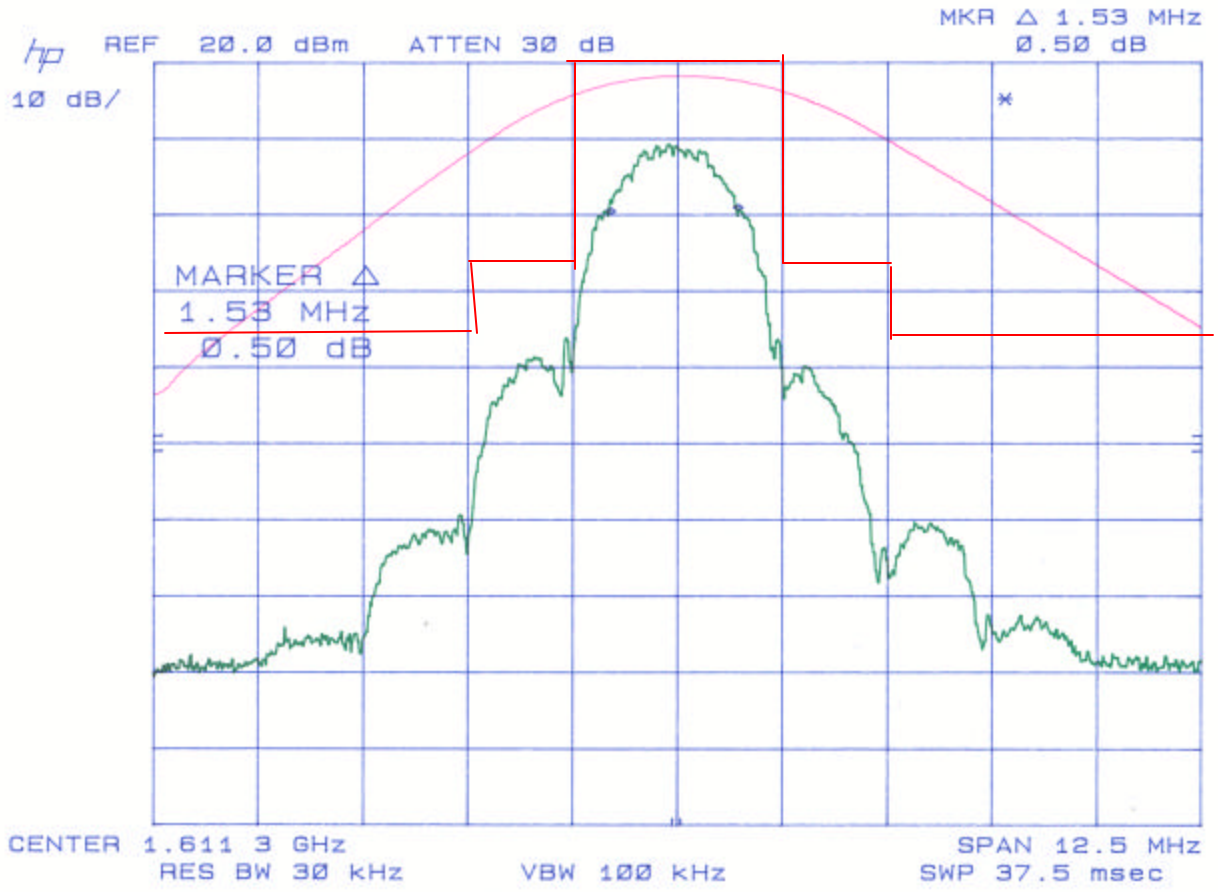


Figure 5c.
99% Occupied Bandwidth – High

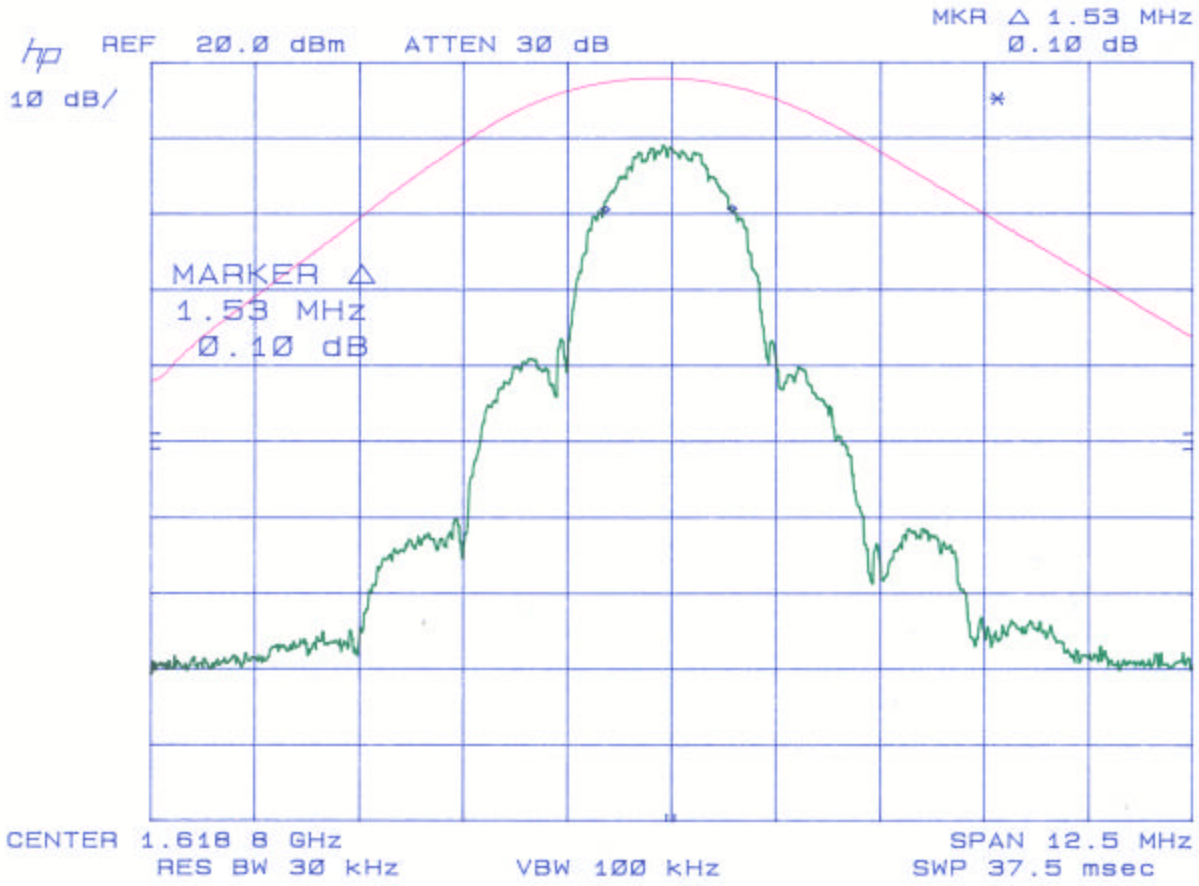


Figure 5d.
Occupied Bandwidth > 50% From Edge of Authorized Bandwidth – High