

Report Number: 08-0151
Customer: Axonn LLC
Model: Satellite Personal Tracker Model: SPT

Issue Date: August 19, 2008

2.9 Spurious Emissions at Antenna Terminals (FCC Section 2.1051)

Spurious emissions appearing at the antenna terminals were measured with a spectrum analyzer by connecting the spectrum analyzer directly via a short cable to the antenna output terminals or across the antenna leads on the PCB as specified by the manufacturer. Results are shown in Figures 6a – 6n.

Protection of the radio-navigation-satellite service. Mobile earth stations operating in the 1610-1626.5 MHz band shall limit out-of- band emissions in the 1574.397-1576.443 MHz band so as not to exceed an e.i.r.p. density level of -70 dB (W/MHz) averaged over any 20 ms period. The E.I.R.P. of any discrete spurious emission (i.e., bandwidth less than 600 Hz) in the 1574.397-1576.443 MHz band shall not exceed -80 dBW.

FCC Minimum Standard (FCC Section 25.202(f))

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

$43 + 10 \log (P_{\text{Watts}})$ attenuation below the mean power of the transmitter.

For Lowest Channel = $43 + 10 \log (0.157) \text{ dB} = 35 \text{ dB}$
 $10(\log(P_{\text{in}}=157 \text{ mW}) - 35 \text{ dB} = -13 \text{ dBm}$
For Highest Channel = $43 + 10 \log (0.133) \text{ dB} = 34.2 \text{ dB}$
 $10(\log(P_{\text{in}}=157 \text{ mW}) - 35 \text{ dB} = -13 \text{ dBm}$

Note:

A 10 kHz RBW was used instead. This was deemed to be comparable to 4 kHz RBW.

Additional requirement for 1574.397 - 1576.443 MHz

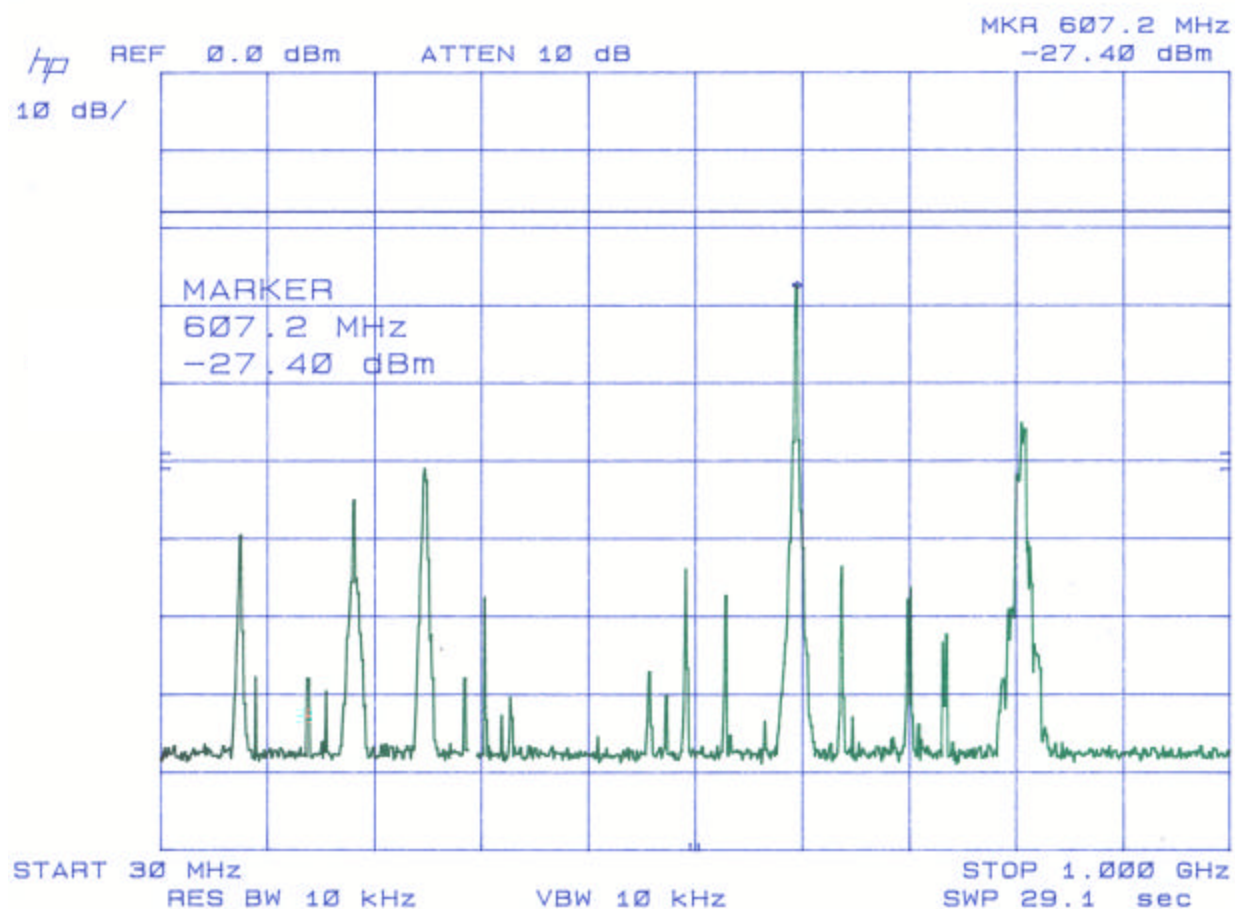
- 80 dBW (- 50 dBm)

See section 2.12

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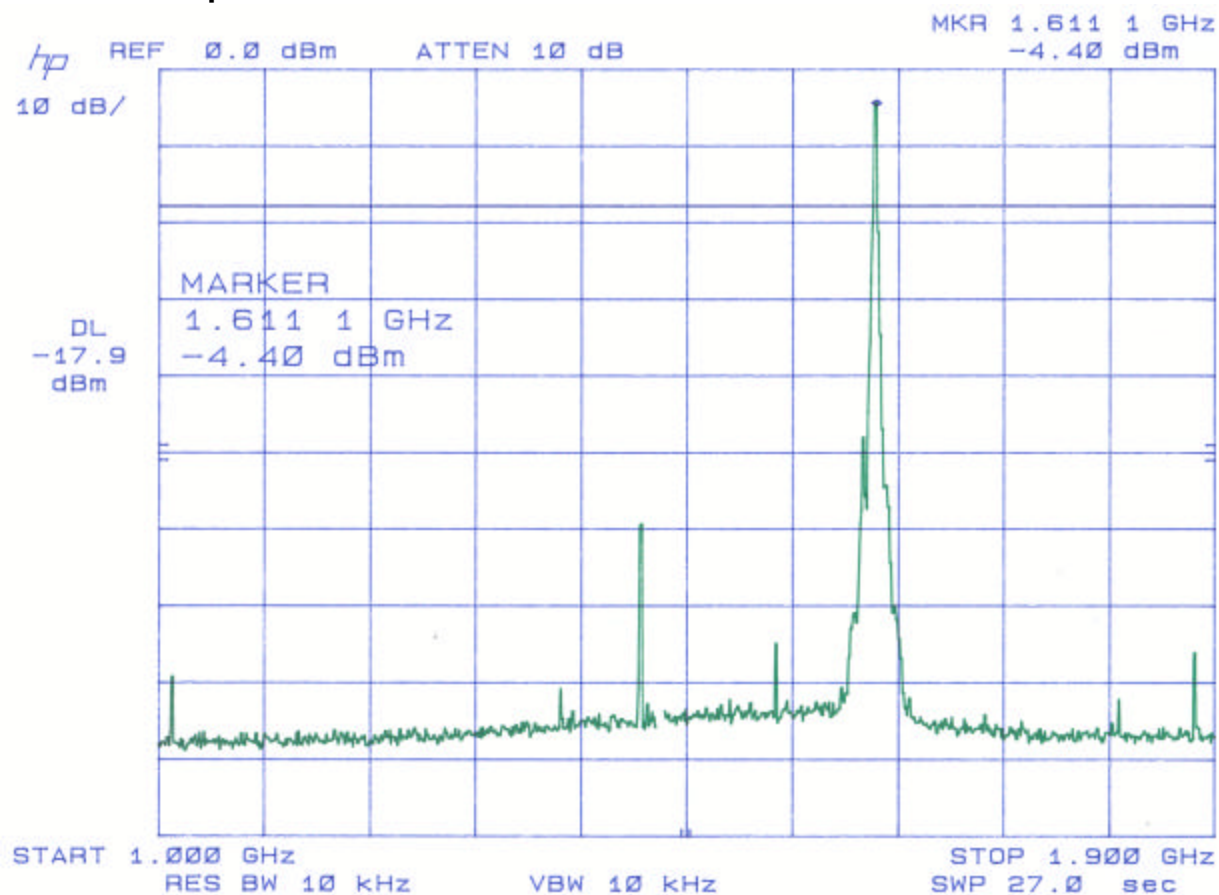
Figure 6a.
Spurious Emissions at Antenna Terminals – Low Channel



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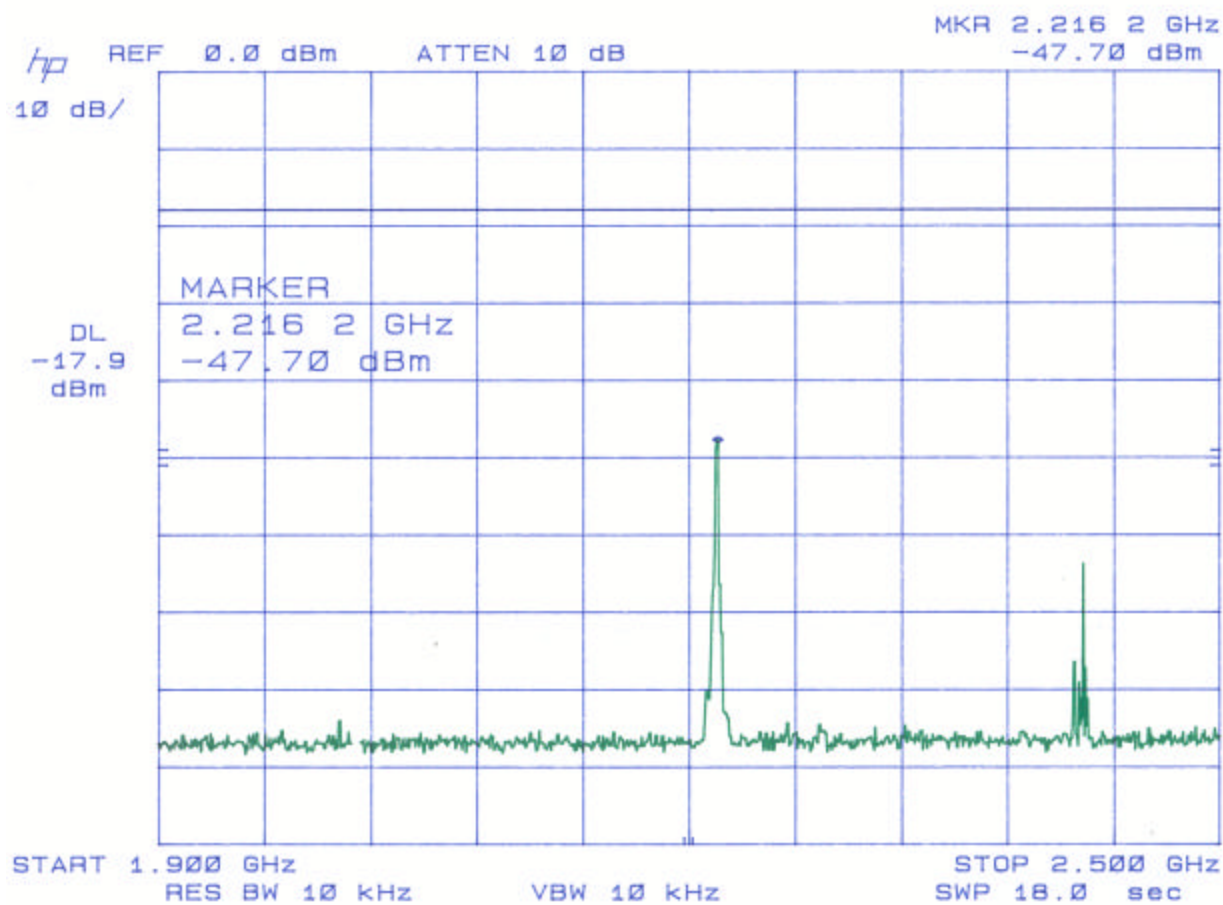
Figure 6b.
Spurious Emissions at Antenna Terminals – Low Channel



Report Number: 08-0151
Customer: Axonn LLC
Model: Satellite Personal Tracker Model: SPT

Issue Date: August 19, 2008

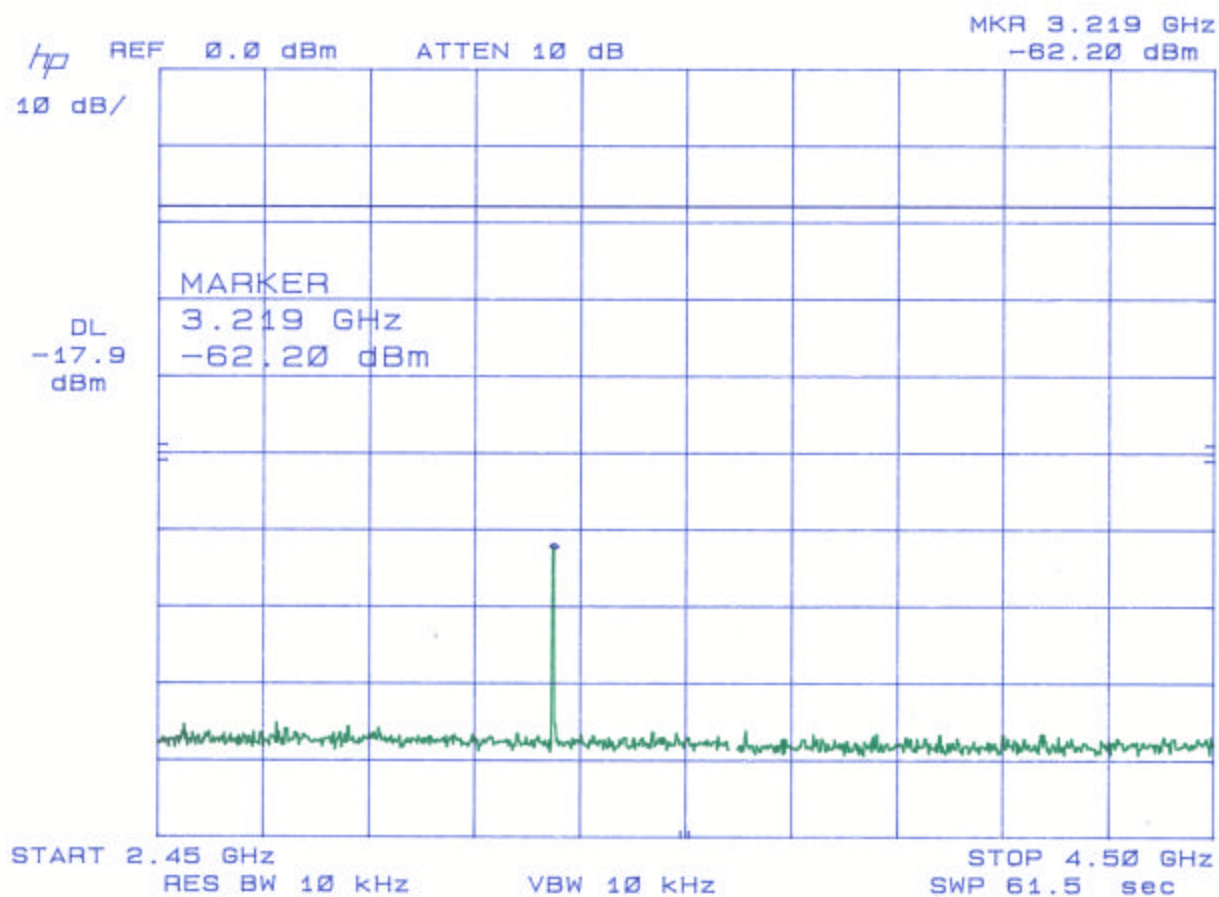
Figure 6c.
Spurious Emissions at Antenna Terminals – Low Channel



Report Number: 08-0151
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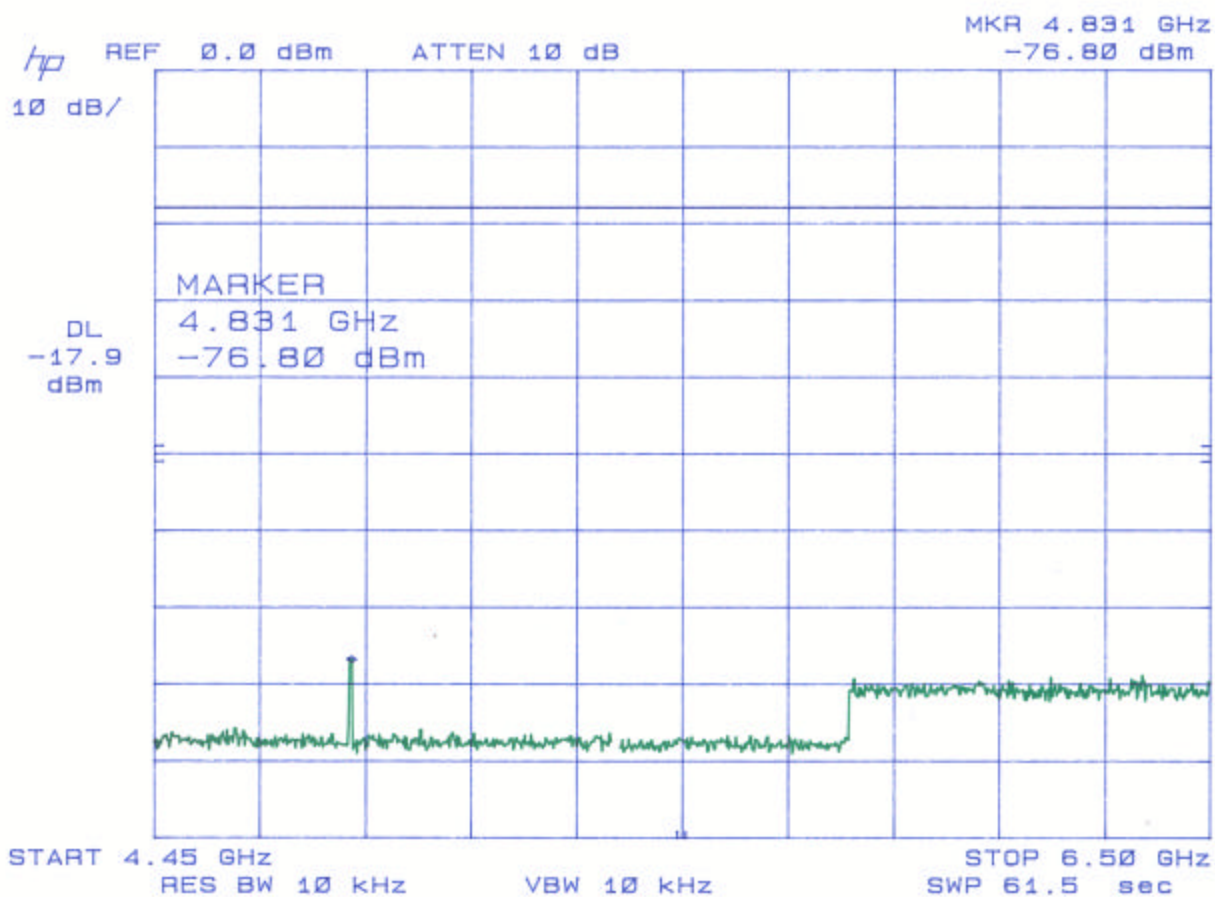
Figure 6d.
Spurious Emissions at Antenna Terminals – Low Channel



Report Number: 08-0151
Customer: Axonn LLC
Model: Satellite Personal Tracker Model: SPT

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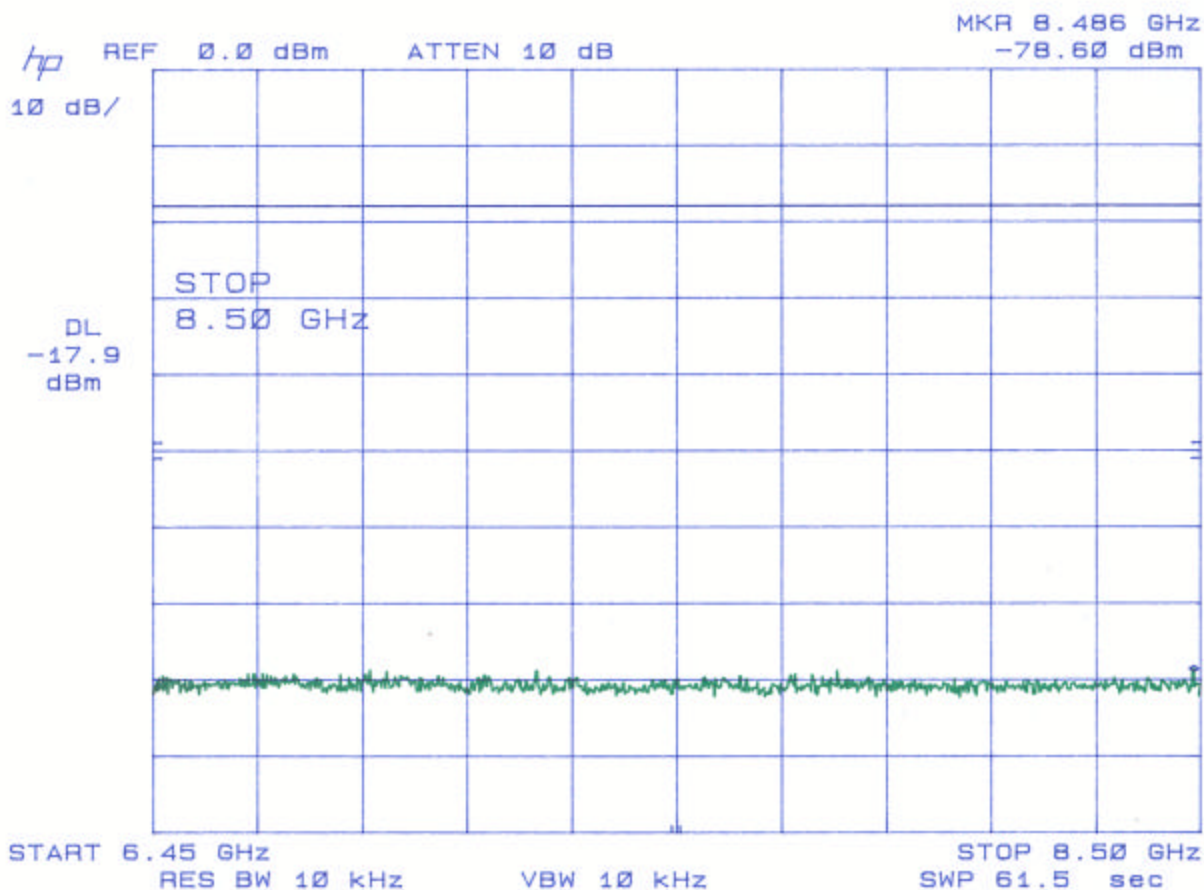
Figure 6e.
Spurious Emissions at Antenna Terminals – Low Channel



Report Number: 08-0151
Customer: Axonn LLC
Model: Satellite Personal Tracker Model: SPT

Issue Date: August 19, 2008

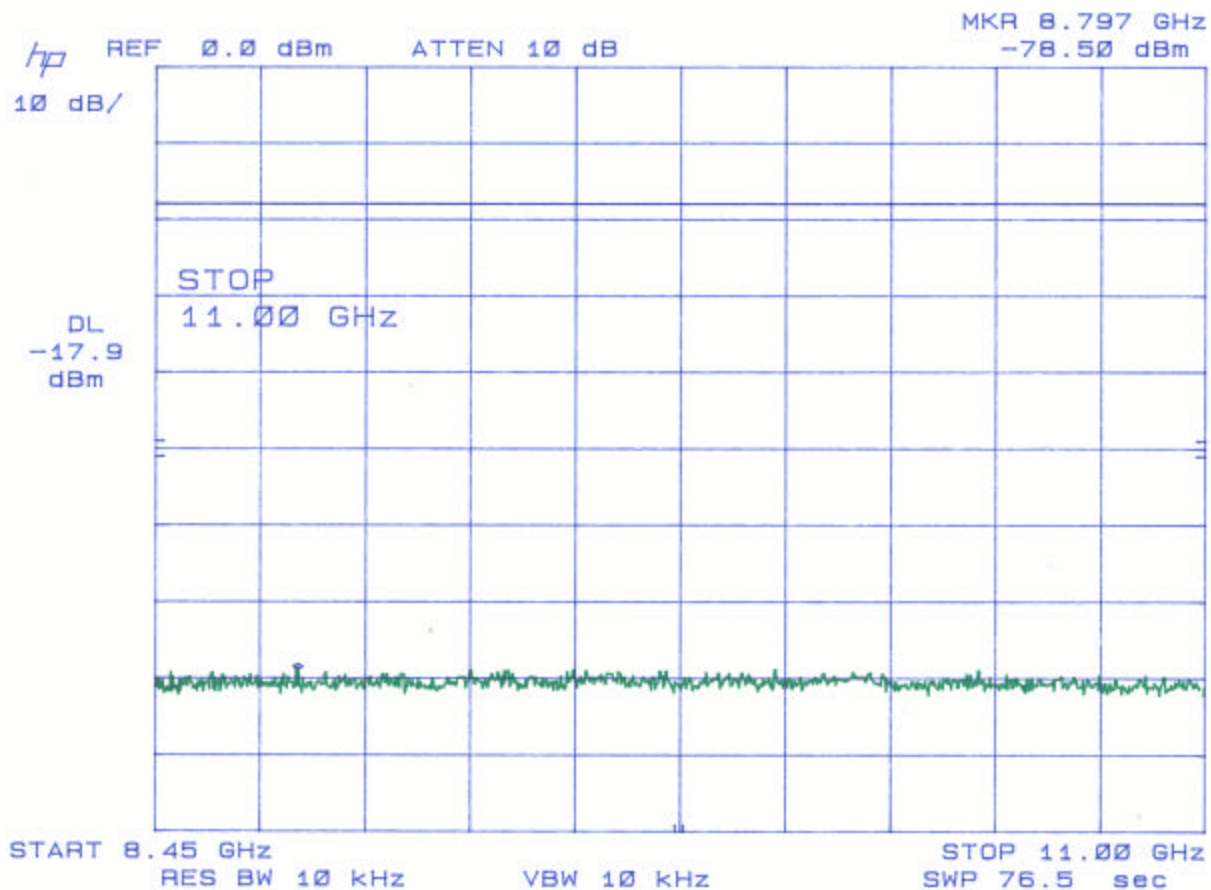
Figure 6f
Spurious Emissions at Antenna Terminals – Low Channel



Report Number: 08-0151
Customer: Axonn LLC
Model: Satellite Personal Tracker Model: SPT

Issue Date: August 19, 2008

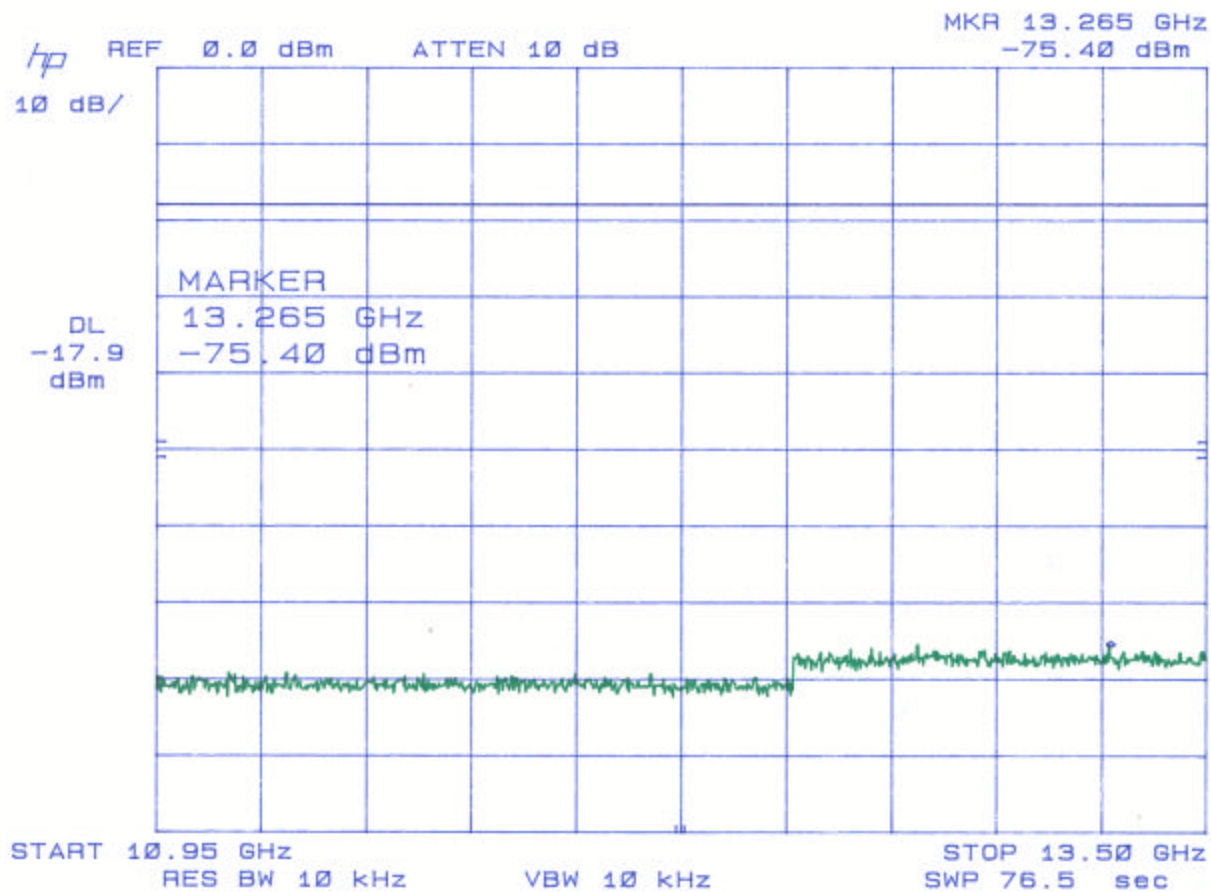
Figure 6g
Spurious Emissions at Antenna Terminals – Low Channel



Report Number: 08-0151
Customer: Axonn LLC
Model: Satellite Personal Tracker Model: SPT

Issue Date: August 19, 2008

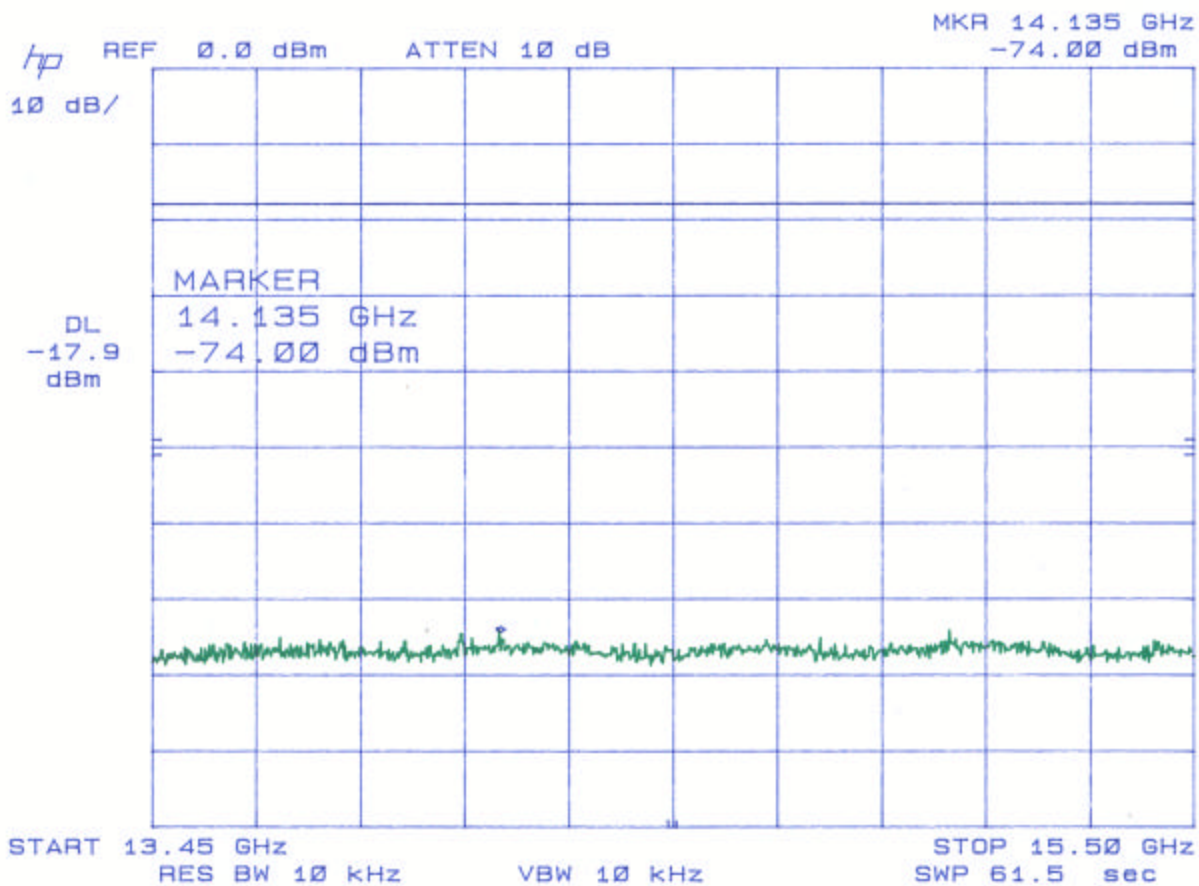
Figure 6h
Spurious Emissions at Antenna Terminals – Low Channel



Report Number: 08-0151
Customer: Axonn LLC
Model: Satellite Personal Tracker Model: SPT

Issue Date: August 19, 2008

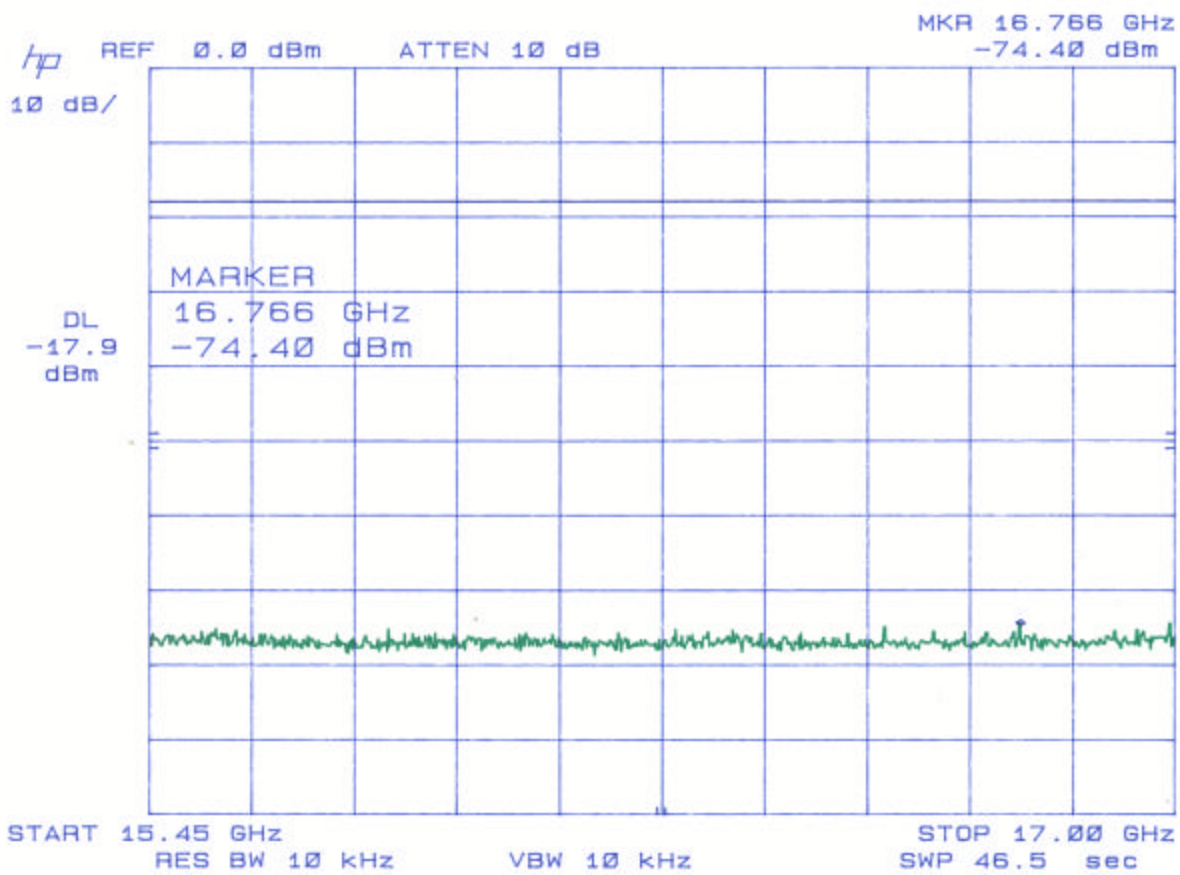
Figure 6i
Spurious Emissions at Antenna Terminals – Low Channel



Report Number: 08-0151
Customer: Axonn LLC
Model: Satellite Personal Tracker Model: SPT

Issue Date: August 19, 2008

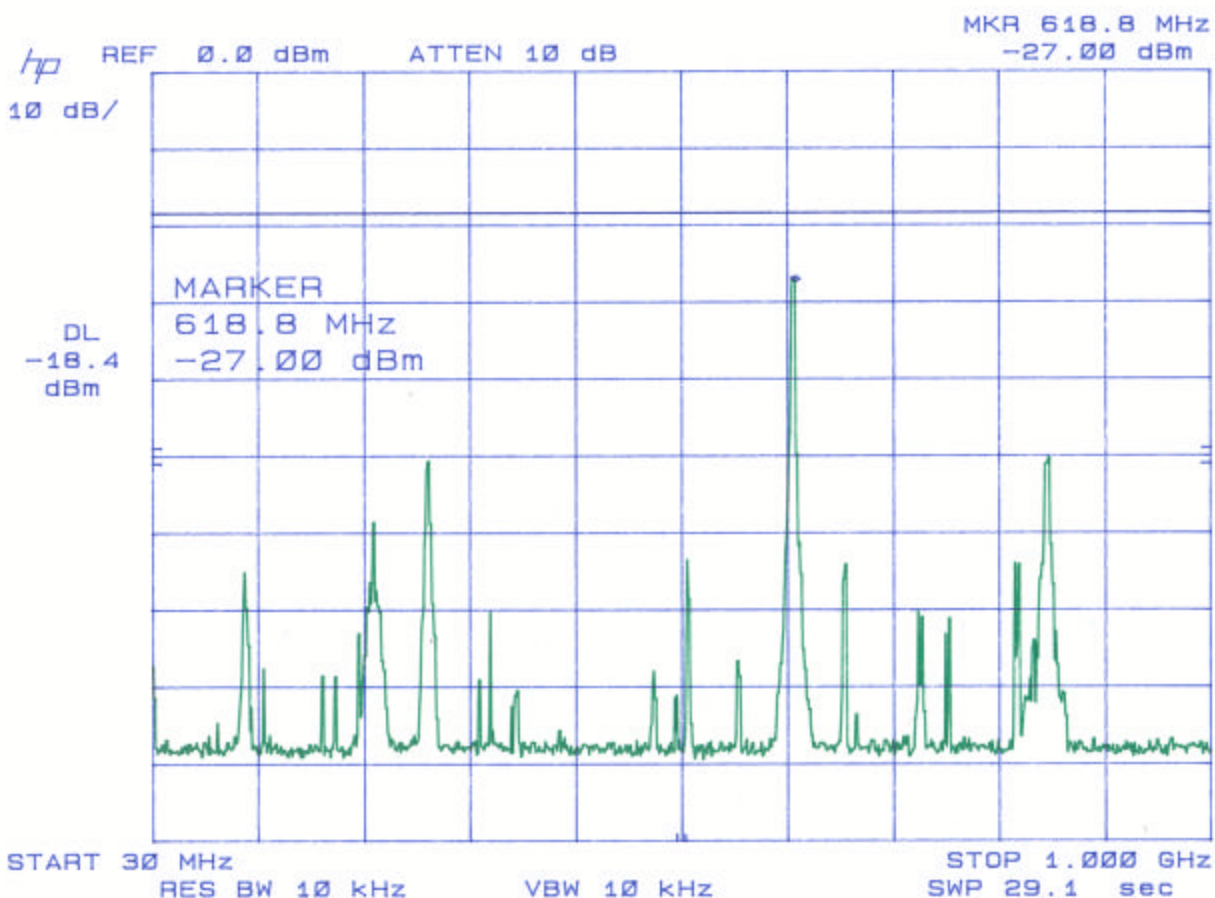
Figure 6j
Spurious Emissions at Antenna Terminals – Low Channel



Report Number: 08-0151
Customer: Axonn LLC
Model: Satellite Personal Tracker Model: SPT

Issue Date: August 19, 2008

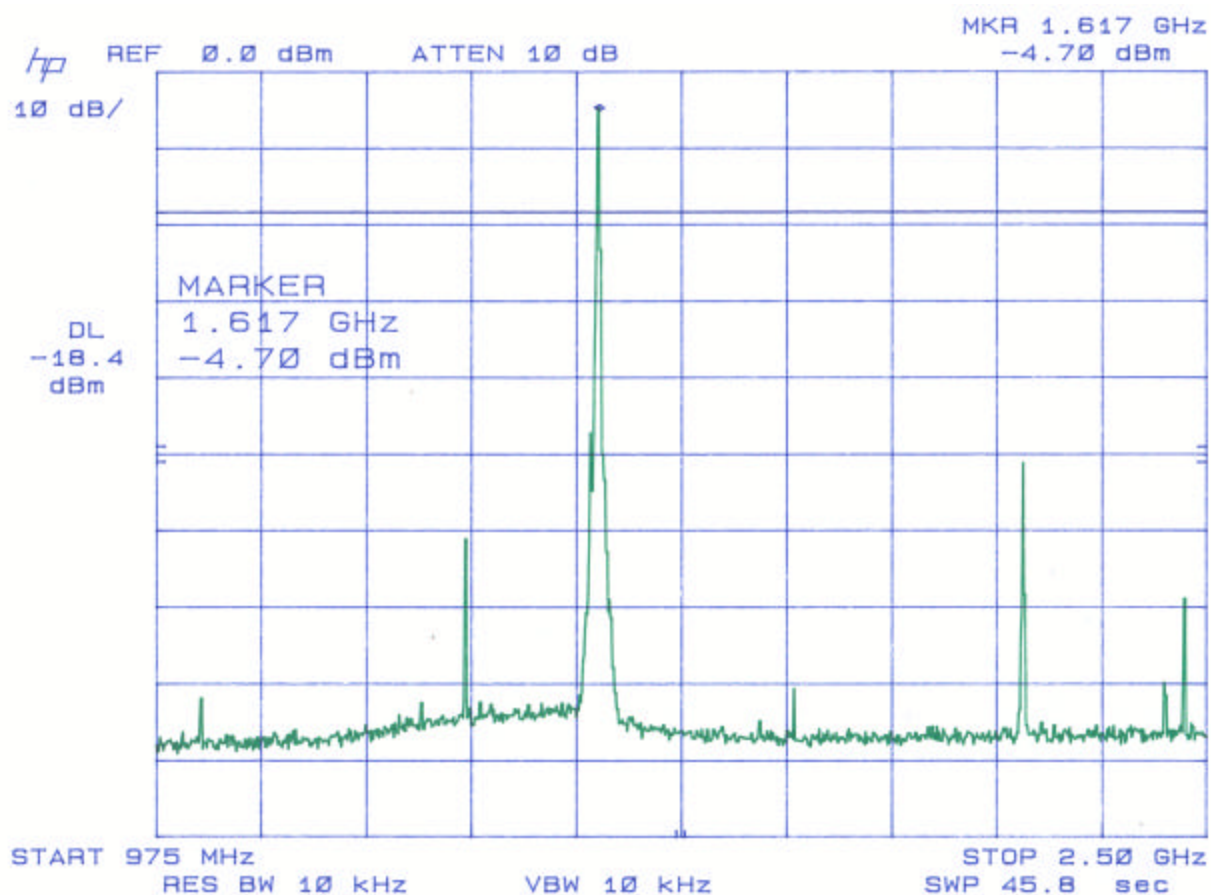
Figure 6k
Spurious Emissions at Antenna Terminals - High Channel



Report Number: 08-0151
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Figure 6I.
Spurious Emissions at Antenna Terminals

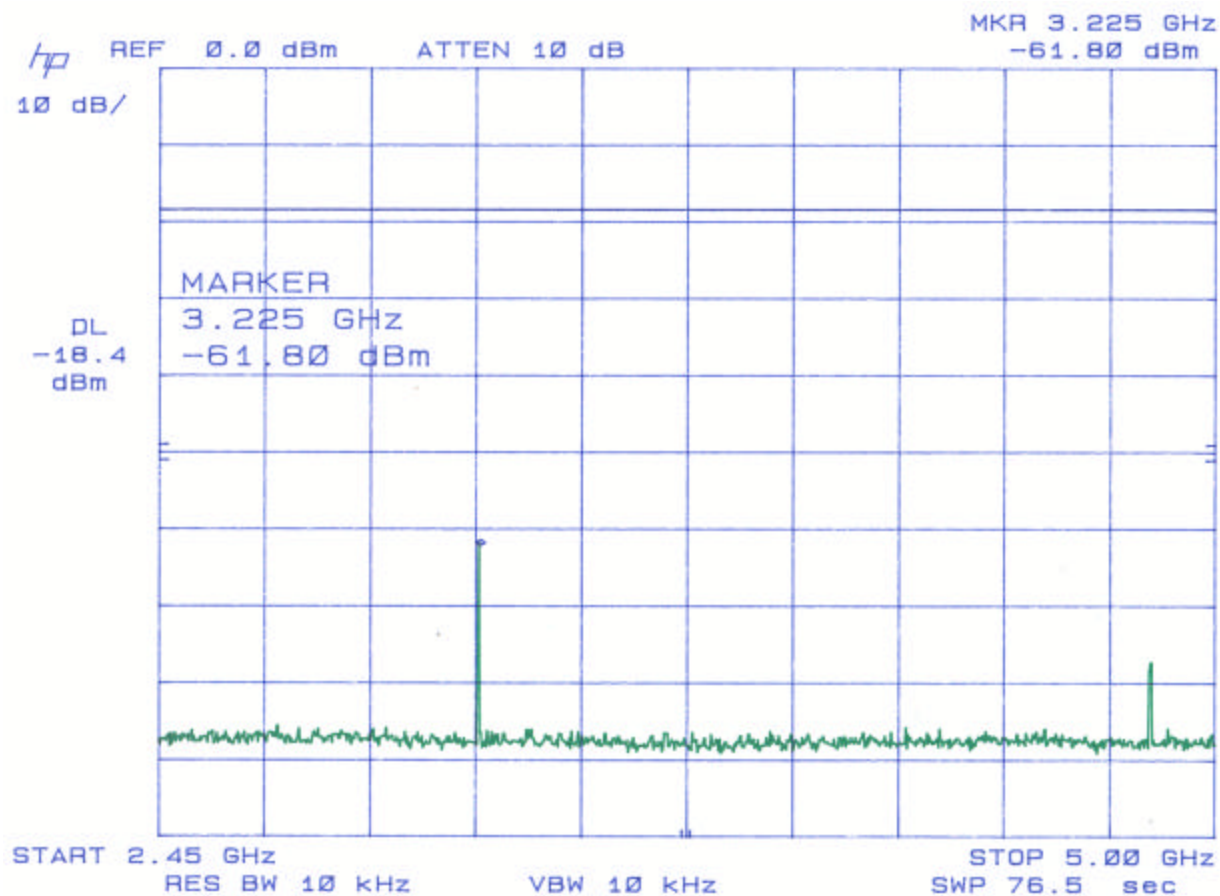


NOTE: Marker shows Fundamental Frequency

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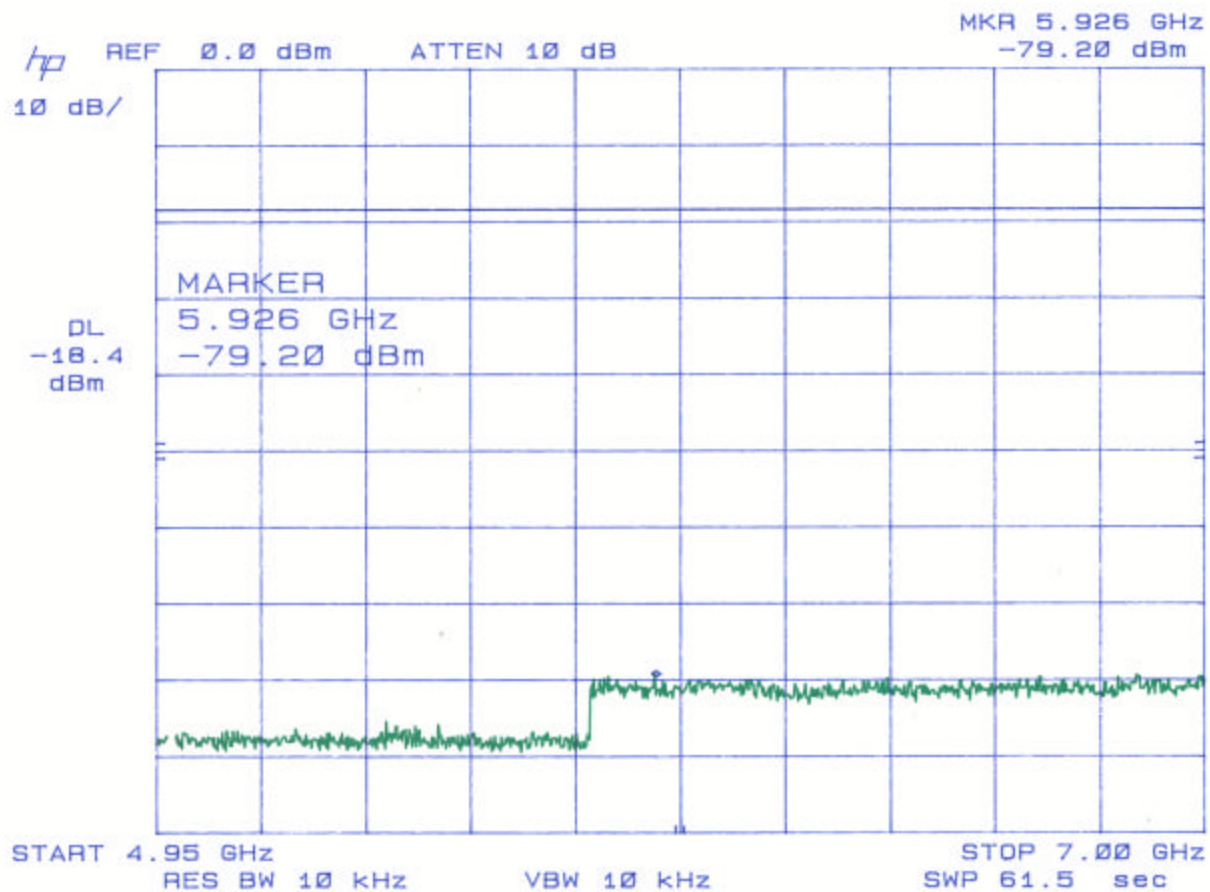
Figure 6m.
Spurious Emissions at Antenna Terminals – High Channel



Report Number: 08-0151
Customer: Axonn LLC
Model: Satellite Personal Tracker Model: SPT

Issue Date: August 19, 2008

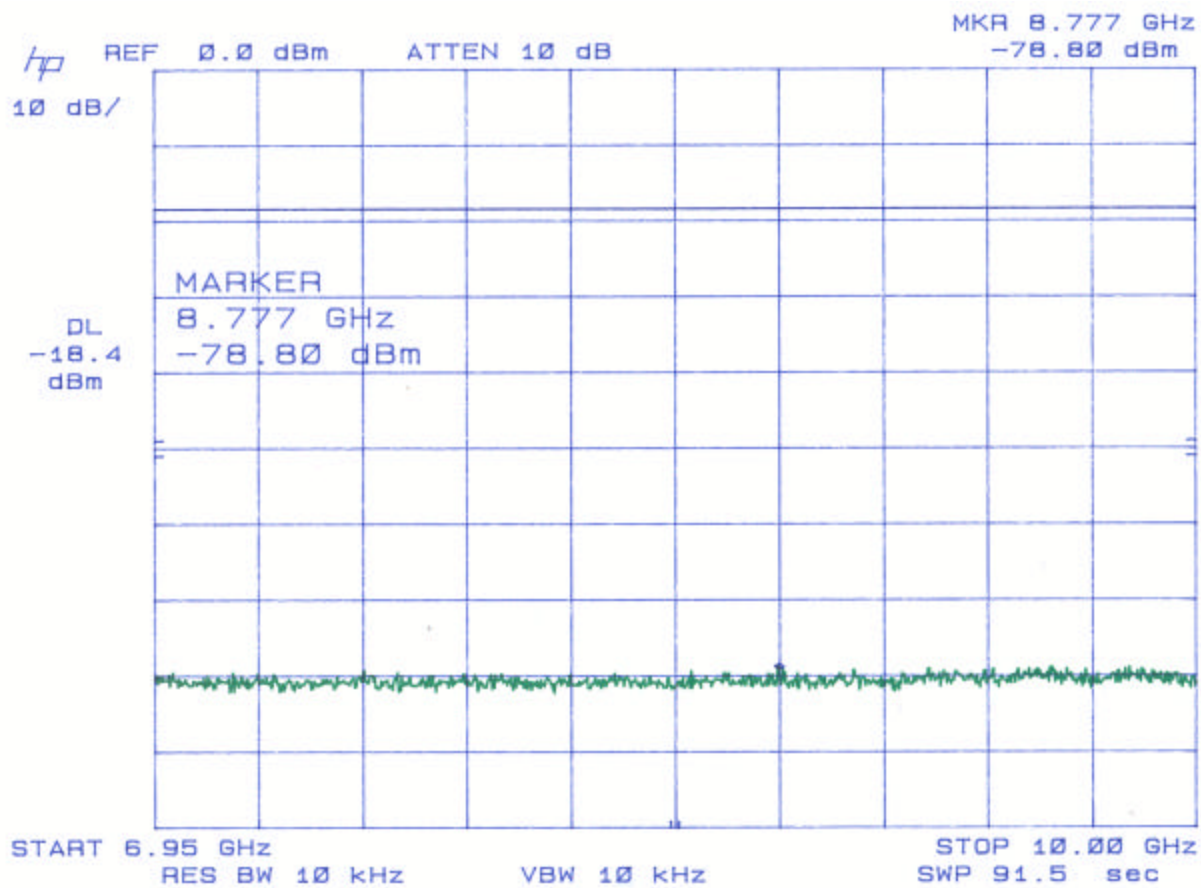
Figure 6n
Spurious Emissions at Antenna Terminals – High Channel



Report Number: 08-0151
Customer: Axonn LLC
Model: Satellite Personal Tracker Model: SPT

Issue Date: August 19, 2008

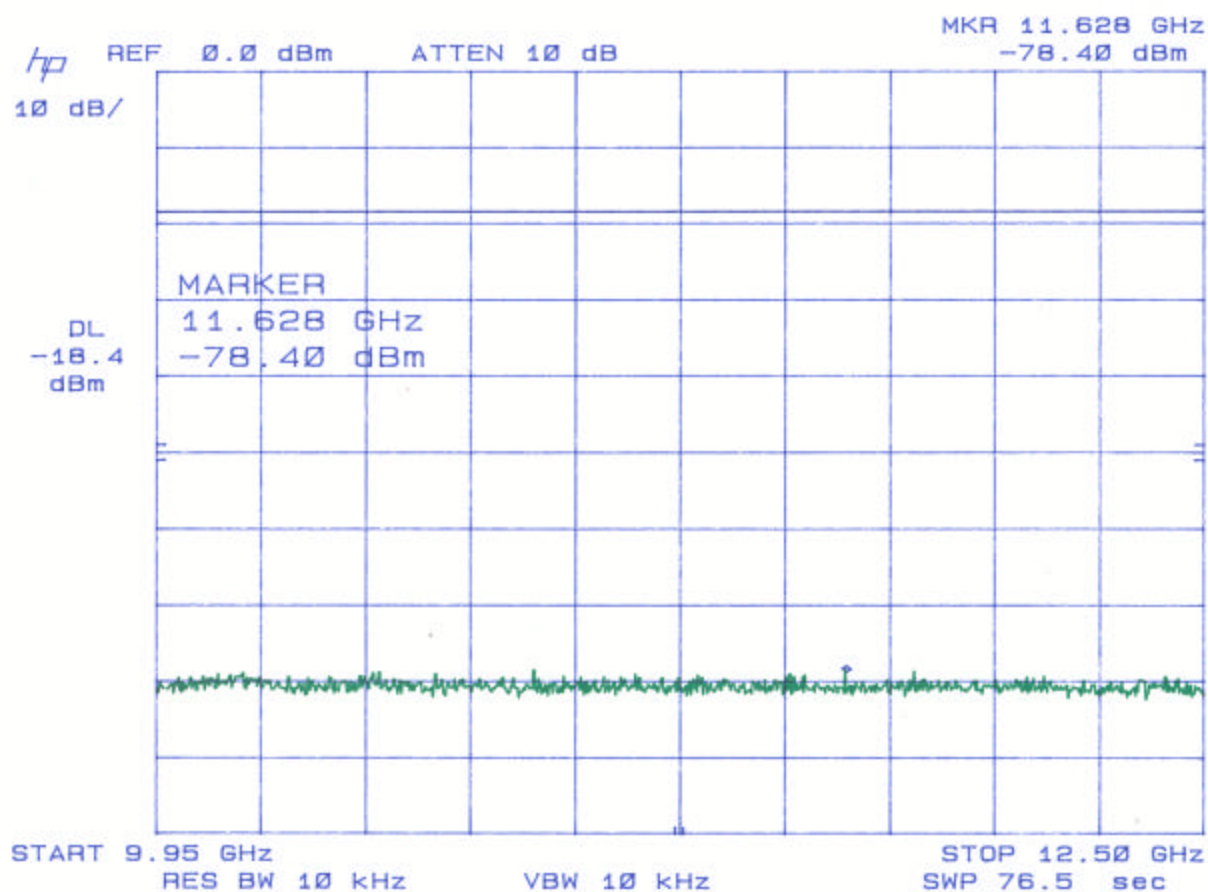
Figure 6o.
Spurious Emissions at Antenna Terminals – High Channel



Report Number: 08-0151
Customer: Axonn LLC
Model: Satellite Personal Tracker Model: SPT

Issue Date: August 19, 2008

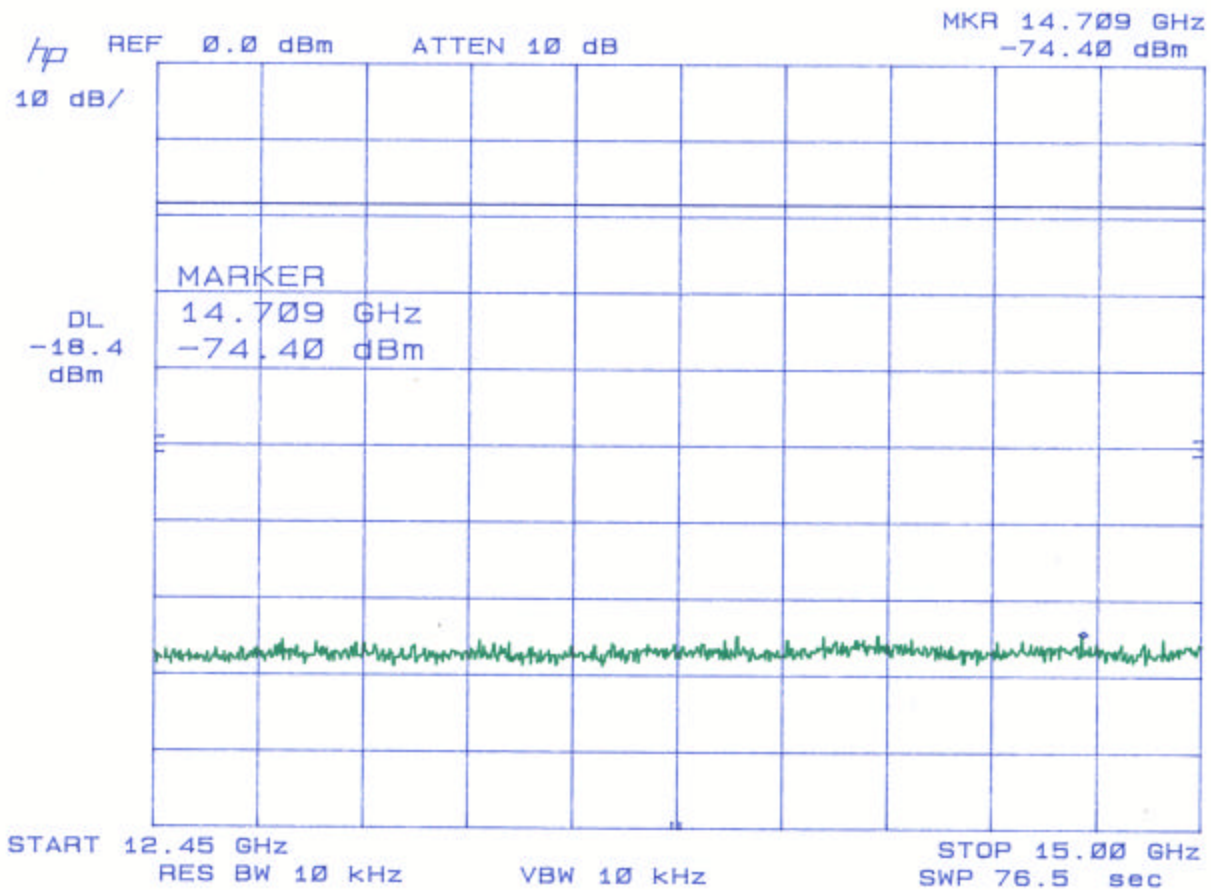
Figure 6p.
Spurious Emissions at Antenna Terminals – High Channel



Report Number: 08-0151
Customer: Axonn LLC
Model: Satellite Personal Tracker Model: SPT

Issue Date: August 19, 2008

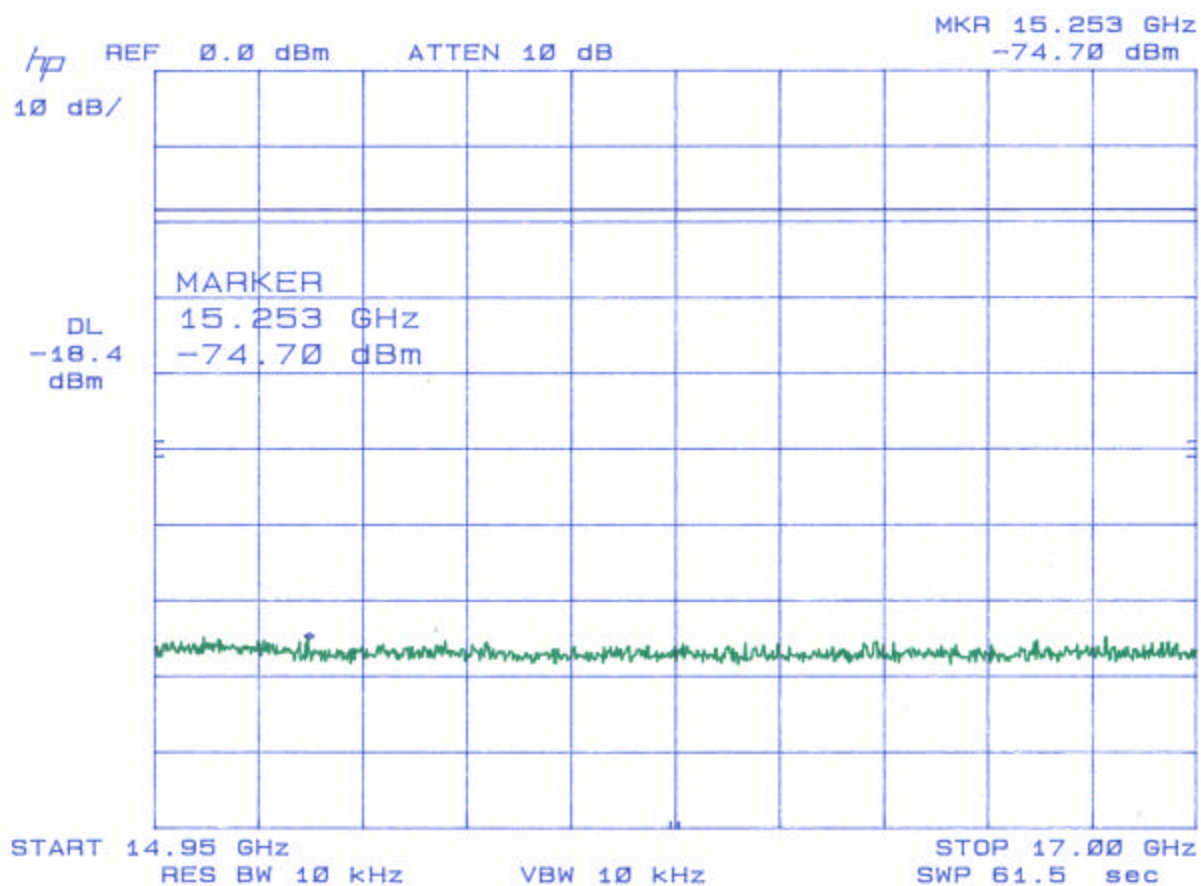
Figure 6q.
Spurious Emissions at Antenna Terminals – High Channel



Report Number: 08-0151
Customer: Axonn LLC
Model: Satellite Personal Tracker Model: SPT

Issue Date: August 19, 2008

Figure 6r.
Spurious Emissions at Antenna Terminals – High Channel



Report Number: 08-0151
Customer: Axonn LLC
Model: Satellite Personal Tracker Model: SPT

Issue Date: August 19, 2008

2.10 Field Strength of Spurious Radiation (FCC Section 2.1053)

Spurious emissions were evaluated from 30 MHz to 16.2 GHz at an EUT to antenna distance of 1 or 3 meters. The EUT was tested with an external power source and modulated by its own internal sources. Both a low and high channel were tested. The EUT was placed on an open area test site and the spurious emissions tested with the Substitution Method as stipulated by EIA/TIA-603: 1992 section 2.2.12. Measurements for 30 to 1000 MHz were made with the analyzer's bandwidth set to 120 kHz. Measurements above 1 GHz were made with the analyzer's bandwidth set to 1 MHz. The worse case results are shown in Table 4.

FCC Minimum Standard (FCC Section 25.202(f))

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

$43 + 10 \log (P_{\text{Watts}})$ attenuation below the mean power of the transmitter.

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**FIELD STRENGTH OF SPURIOUS RADIATION
TABLE 7**

EUT Channel	Radiated P_{EUT} (dBm)	Radiated P_{subst} (dBm)	Conducted P_{subst} (dBm)	Antenna Gain (dBi)	$P_{EUT} - P_{subst}$	Output Power (dBm)
3227.18	-57.2	-57.37	-28.36	9.0	0.17	-19.19
4834.05*	-49.44	-49.66	-20.58	9.6	0.22	-20.26
4841.15*	-49.95	-49.97	-21.31	9.7	0.02	-21.09
4856.15*	-49.68	-49.40	-20.68	9.7	-0.28	-20.76
6454.85*	-59.1	-59.21	-32.12	9.8	0.11	-31.71

*Note: Measurements above 4 GHz taken at 1 meter and adjusted to 3 meters by using a 9.5 dB inverse distance extrapolation factor.

Part 25 Attenuation Requirement For Spurious Emissions:

$$\begin{aligned}
 \text{Low Channel} &= 43 + 10 \cdot \log_{10}(P_{\text{Watts}}) = 43 + (18.77 - 30) = 31.77 \text{ dB} \\
 \text{Mid Channel} &= 43 + 10 \cdot \log_{10}(P_{\text{Watts}}) = 43 + (18.39 - 30) = 31.39 \text{ dB} \\
 \text{High Channel} &= 43 + 10 \cdot \log_{10}(P_{\text{Watts}}) = 43 + (17.85 - 30) = 30.85 \text{ dB}
 \end{aligned}$$

$$\text{Limit (Low Channel)} = 18.77 - 31.77 = -13.0 \text{ dBm}$$

$$\text{Limit (Mid Channel)} = 18.39 - 31.39 = -13.0 \text{ dBm}$$

$$\text{Limit (High Channel)} = 17.85 - 30.85 = -13.0 \text{ dBm}$$

Results

All spurious emissions meet the attenuation requirements set forth in Part 25 of the FCC's 47 CFR.

Sample Calculation:

$$\text{At 4856.15 MHz: Output Power (dBm)} = -20.68 + 9.7 + (-49.68 - (-49.40)) - 9.5 = -20.76$$

Test Date: August 13, 2008

Tester
 Signature: *Daniel Aparaschivei*

Name: Daniel Aparaschivei

Report Number: 08-0151
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Model: Satellite Personal Tracker Model: SPT

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2.11 Frequency Stability (FCC Section 2.1055 and 25.202(d))

The frequency tolerance of the carrier signal was measured by while ambient temperature was varied from -30 to 50 degrees centigrade. The frequency tolerance was verified at 10 degree increments. Additionally, the supply voltage was varied from 85% to 115% of the nominal value (except for hand carried, battery powered equipment which was additionally measured at battery endpoint).

FCC Minimum Standard

None

US Tech
Report Number: 08-0151
Customer: Axonn LLC
Model: Satellite Personal Tracker Model: SPT

FCC Part 15, 25 Test Data
Issue Date: August 19, 2008

(15.202 a) Maximum Deviation = 0.001% of Reference Frequency = $0.00001 \times 1611.001788 \text{ MHz}$
= 16110 Hz = 16. kHz

FCC

Certification

Axonn, LLC Model SPT

Frequency Stability vs. Temperature (At Startup)

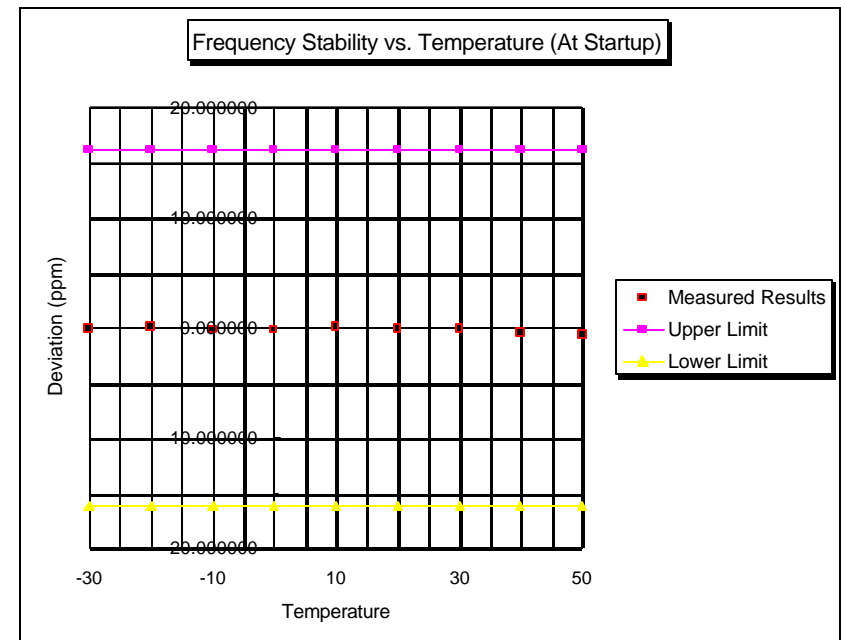
Test Results Reviewed
By:

Louis A.
Feudi

Temperature (degrees C)	Measured Frequency (MHz)	Deviation kHz
-30	1611.001750	-0.038000
-20	1611.001964	0.176000
-10	1611.001602	-0.186000
0	1611.001656	-0.132000
10	1611.001874	0.086000
20	1611.001788	0.000000
30	1611.001736	-0.052000
40	1611.001390	-0.398000
50	1611.001300	-0.488000

Actual TX Frequency was: 1611.001788 MHz

Reference Point from 20 degrees C:
1611.001788 MHz



US Tech
 Report Number: 08-0151
 Customer: Axonn LLC
 Model: Satellite Personal Tracker Model: SPT

FCC Part 15, 25 Test Data
 Issue Date: August 19, 2008

(15.202 a) Maximum Deviation = 0.001% of Reference Frequency = $0.00001 \times 1611.001340 \text{ MHz}$

= 16110 Hz = 16.1 kHz

FCC

Certification

Axonn, LLC Model SPT

Frequency Stability vs.
 Voltage

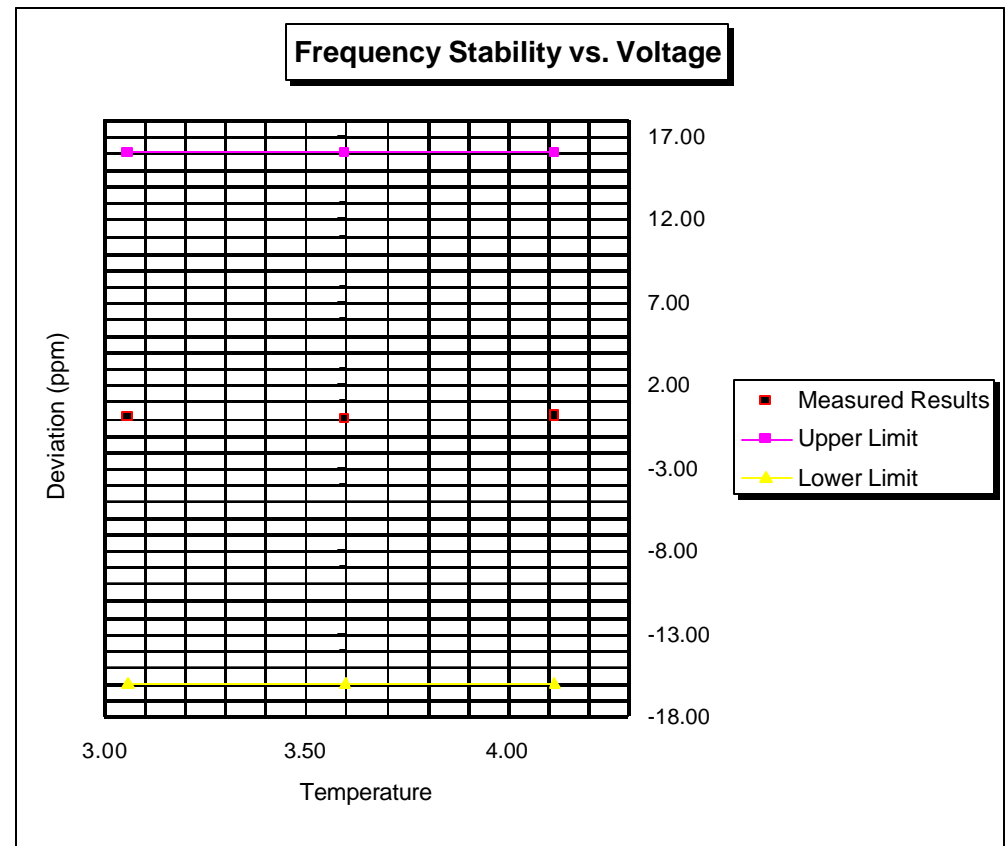
Test Results Reviewed
 By:

Louis A.
 Feudi

Voltage (V DC)	Measured Frequency (MHz)	Deviation kHz
3.06	1611.001364	0.024000
3.6	1611.001340	0.000000
4.12	1611.001508	0.168000

Actual TX Frequency was: 1611.001340 MHz

Maximum Deviation = 0.0001% or 16.1 kHz
 Reference Point From 20 degrees C:
 1611.001340 MHz



Report Number: 08-0151
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Model: Satellite Personal Tracker Model: SPT

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2.12 Emissions from Mobile Earth Stations for Protection of Aeronautical Radionavigation-Satellite Service. (FCC Section 25.216)

25.216c(1) Emissions from the EUT were evaluated from 1559 MHz – 1605 MHz and did not exceed the limit at -70dBW/MHz, averaged over 20 milliseconds.

25.216c(2) Emissions from the EUT were evaluated from 1559 MHz – 1605 MHz and did not exceed the limit at -80dBW/MHz, averaged over 20 milliseconds.

25.216g(1) Emissions from the EUT were evaluated from 1605 MHz – 1610 MHz and did not exceed the limits ranging from -70 dBW/MHz at 1605 MHz to -10dBW/MHz at 1610 MHz, averaged over 2 milliseconds.

25.216g(2) Emissions from the EUT were evaluated from 1605 MHz – 1610 MHz and did not exceed the limits ranging from -80 dBW/MHz at 1605 MHz to -20dBW/MHz at 1610 MHz, averaged over 2 milliseconds.

25.216(i) Emissions from the EUT were evaluated from 1559 MHz – 1605 MHz and did not exceed -80 dBW/MHz over any 2 millisecond active transmission interval. (carrier off)

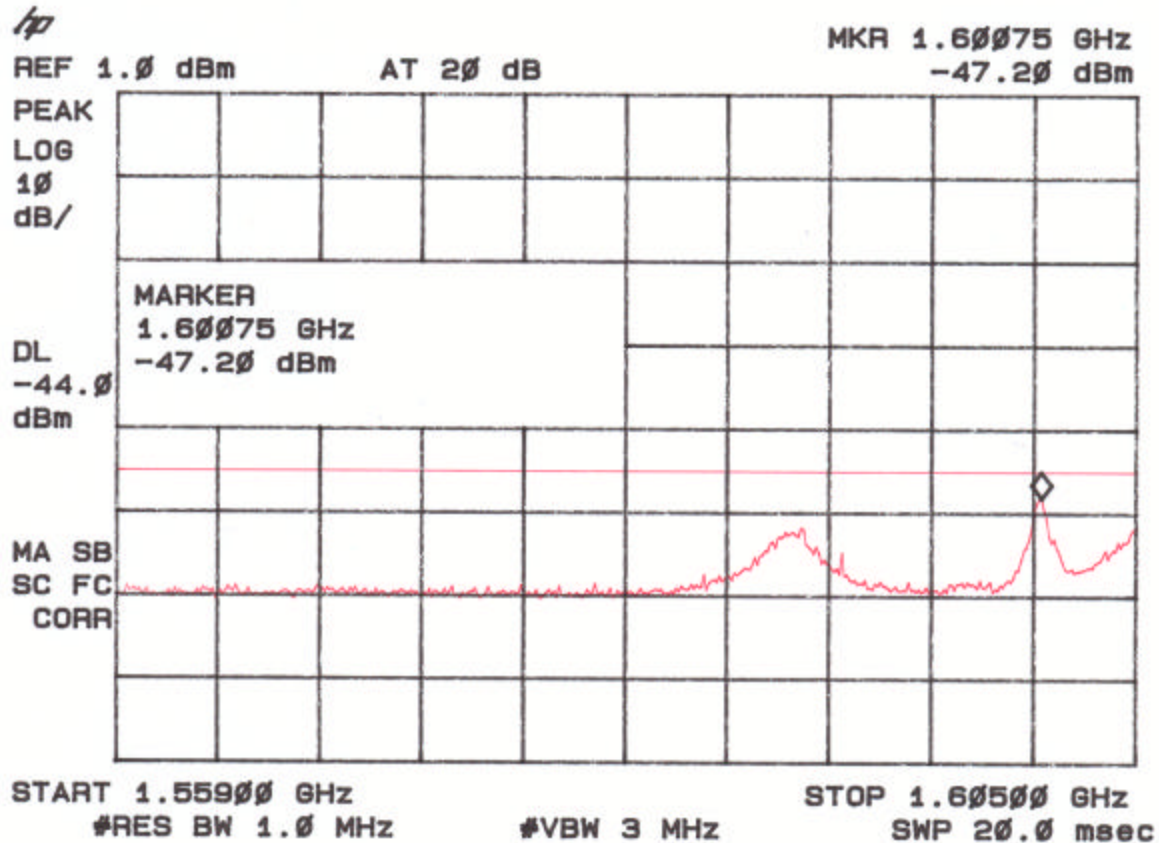
Emissions were measured with a spectrum analyzer by connecting the spectrum analyzer directly via a short cable to the antenna output terminal with the Resolution Bandwidth set to 1 MHz. Results are shown on Figures 8a -8c.

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Figure 8a.
Emissions from Mobile Earth Stations for Protection
of Aeronautical Radionavigation-Satellite Service (25.216(c)(1))

$$\text{Limit} = -70 \text{ dBW/MHz} + 4 \text{ dBi} (-44 \text{ dBm})$$



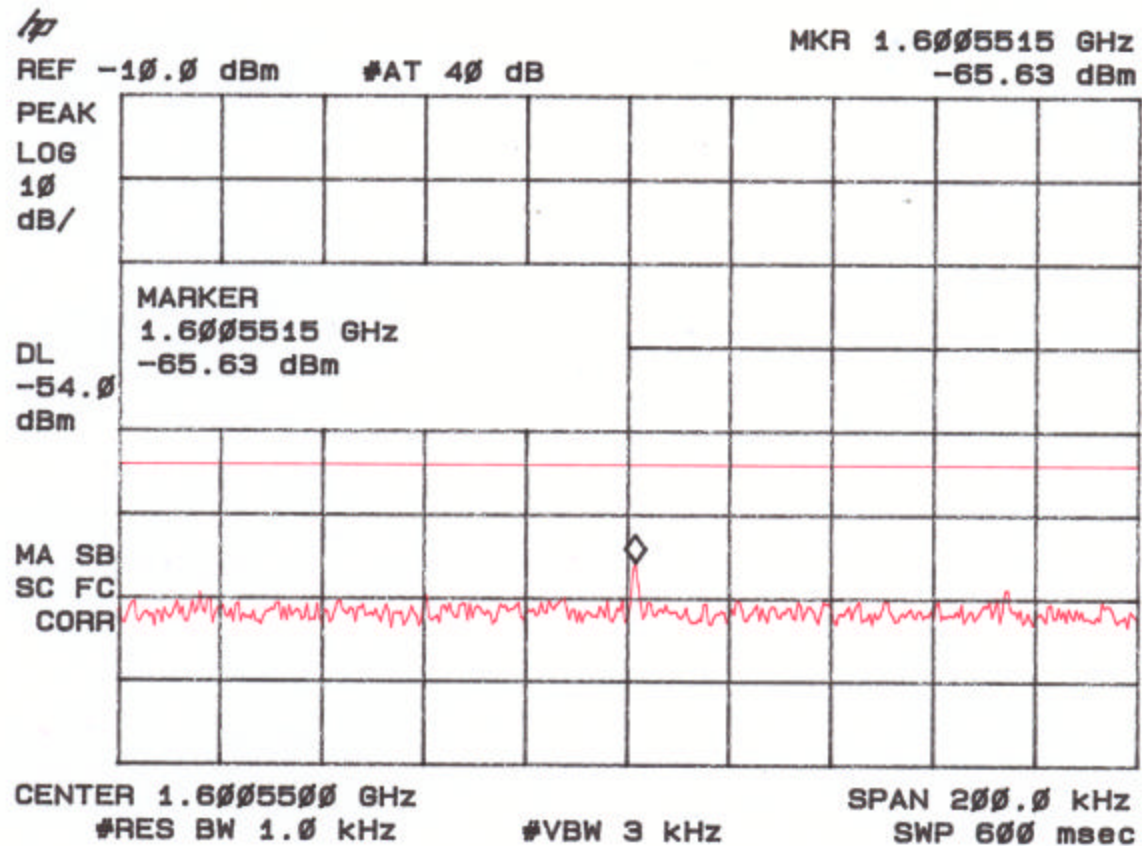
$$\text{Measured Value} = -47.20 + 0.25 = -46.95$$

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Figure 8b.
Emissions from Mobile Earth Stations for Protection
of Aeronautical Radionavigation-Satellite Service(25.216(c)(2))

$$\text{Limit} = -80 \text{ dBW} + 4 \text{ dBi} = -54 \text{ dBm}$$



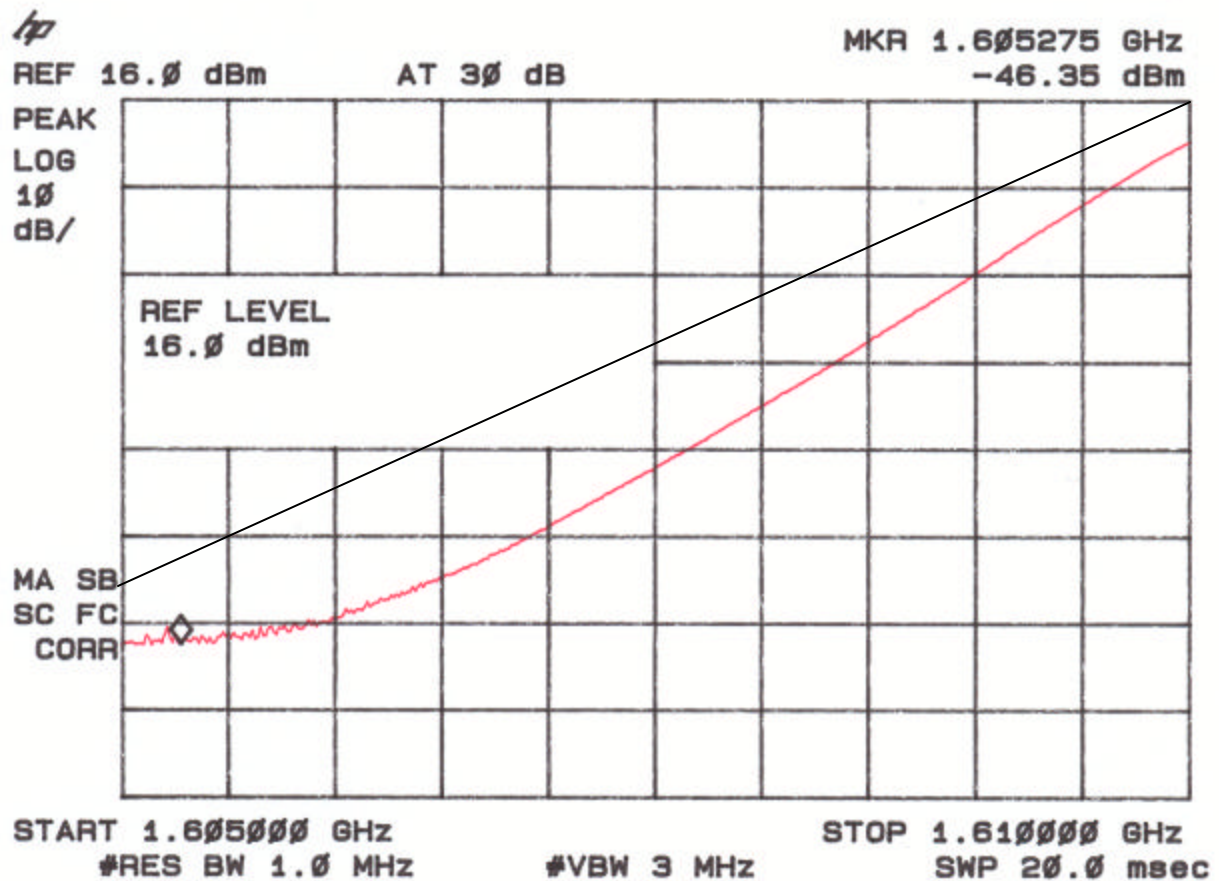
Measured Value is $-65.63 + 0.25$ (cable loss) = -65.38

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Figure 8c.
Emissions from Mobile Earth Stations for Protection
of Aeronautical Radionavigation-Satellite Service(25.216(g)(1))

Limit = -70 dBW/MHz at 1605 MHz to -10 dBW/MHz at 1610 (-44 dBm to 16 dBm)



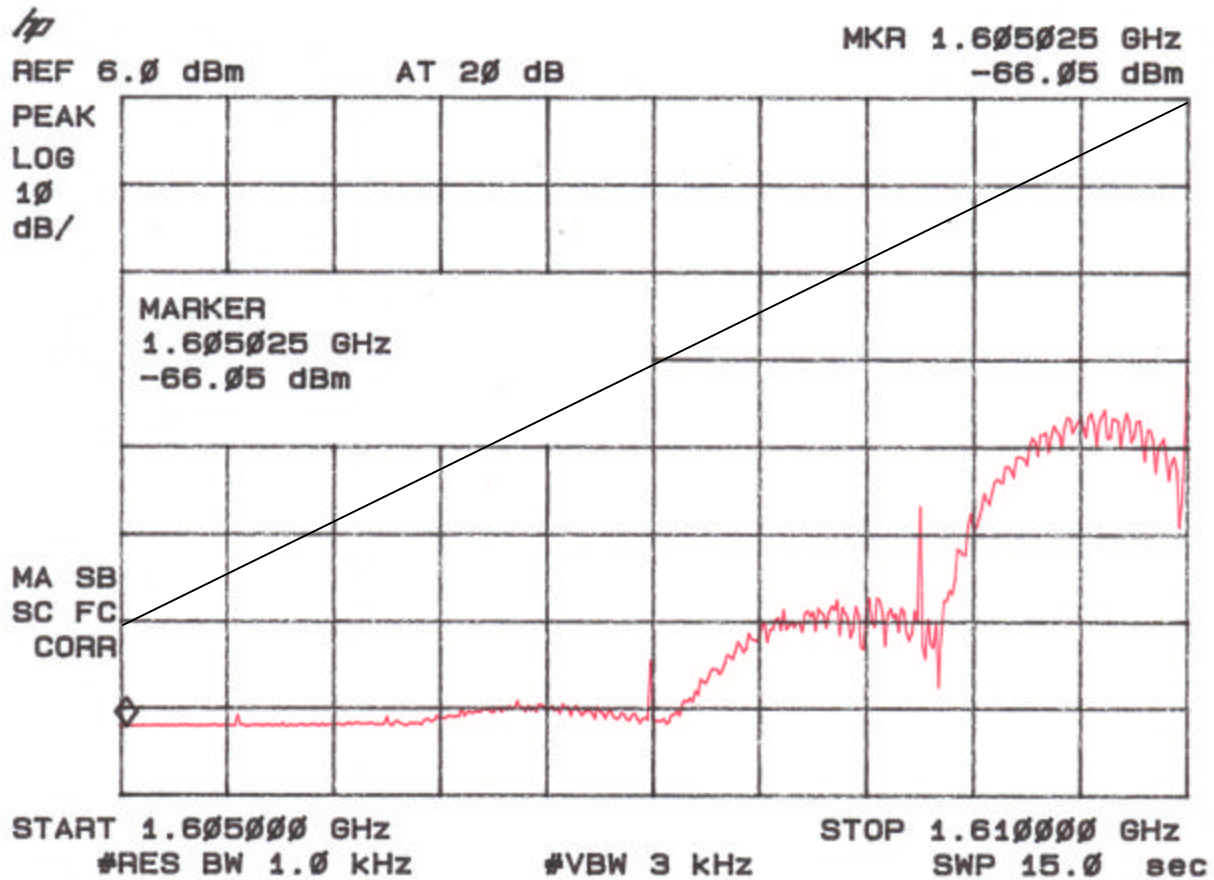
Measured Value is $-46.35 + 0.25$ (cable loss) = -46.10

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Customer: Axonn LLC
Model: Satellite Personal Tracker Model: SPT

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Figure 8d.
Emissions from Mobile Earth Stations for Protection
of Aeronautical Radionavigation-Satellite Service(25.216(g)(2))

Limit = -80 dBW/MHz at 1605 MHz to -20 dBW/MHz at 1610 (-54 dBm to 6 dBm)



Measured Value is -66.05 + 0.25 (cable loss) = -65.80 dBm

Report Number: 08-0151

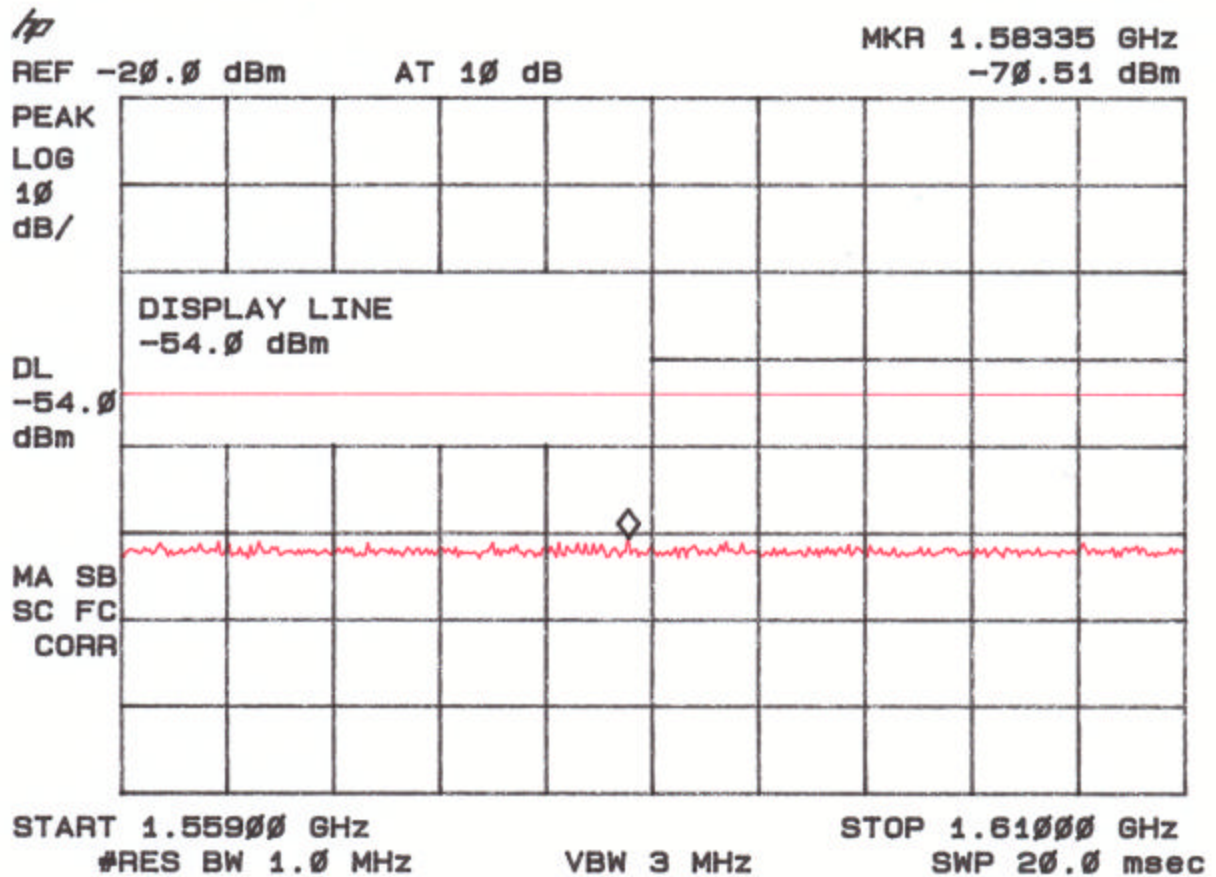
Issue Date: August 19, 2008

Customer: Axonn LLC

Model: Satellite Personal Tracker Model: SPT

Figure 8e.
Emissions from Mobile Earth Stations for Protection
of Aeronautical Radionavigation-Satellite Service(25.216(i)
(carrier off)

$$\text{Limit} = -80 \text{ dBW/MHz} + 4 \text{ dBi} (-54 \text{ dBm})$$



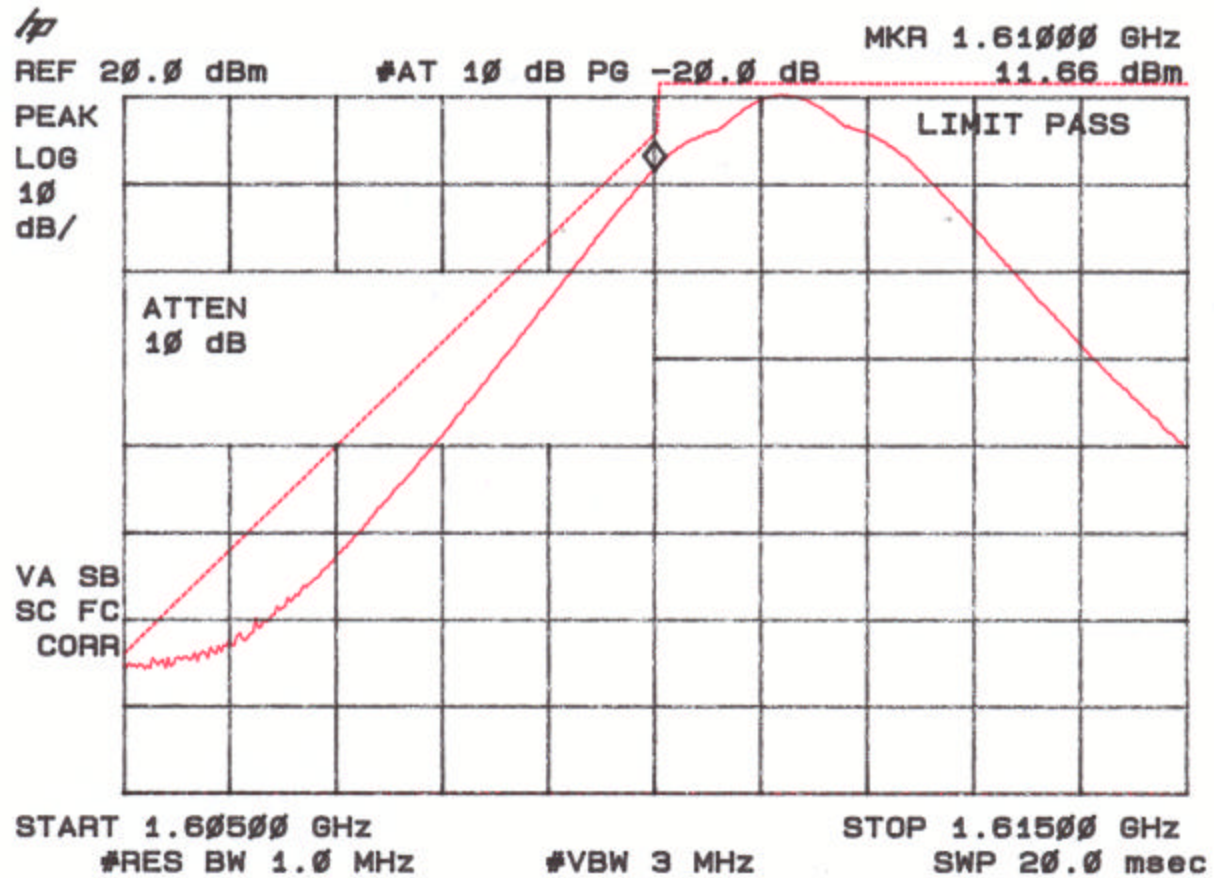
Measured Value is $-71.51 + 0.25$ (cable loss) = -71.26 dBm

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Customer: Axonn LLC
Model: Satellite Personal Tracker Model: SPT

Issue Date: August 19, 2008

Figure 8f.
Emissions from Mobile Earth Stations for Protection
of Aeronautical Radionavigation-Satellite Service(25.216(i)
(carrier off)

$$\text{Limit} = -80 \text{ dBW/MHz} + 4 \text{ dBi} (-54 \text{ dBm})$$



Measured Value is $11.66 + 0.25$ (cable loss) = 11.91 dBm

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 Customer: Axonn LLC
 Model: Satellite Personal Tracker Model: SPT

Issue Date: August 19, 2008

**TABLE 8. RADIATED EMISSIONS DATA
 (Digital Device & Receiver)**

CLASS B

EUT and Peripherals Transmitter Radiated Emissions 30 MHz – 8.5 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 dBuV/ m	Limits dBuV/ m	Distance / Polarity	Margin (dB)	Det
189.08	-94.6	1BI3mH	12.4	17.4	29.8	43.5	3m./HORZ	13.7	QP
236	-81.1	1LP3mH	25.9	15.0	40.9	46.0	3m./HORZ	5.1	QP
327.13	-91.9	1LP3mH	15.1	18.2	33.3	46.0	3m./HORZ	12.7	QP
363	-93.5	1LP3mH	13.6	18.6	32.1	46.0	3m./HORZ	13.9	QP
231.3	-91.6	1LP3mV	15.4	14.6	30.0	46.0	3m./VERT	16.0	QP

No other emissions detected within 20 dB of the FCC Part 15.109 Limits.

The EUT was set to the receive mode of operation for Class B 15.109 measurements.
 Measurement procedures were followed as specified in ANSI C63.4:2003.

SAMPLE CALCULATIONS:

RESULTS dBuV/m @ 3m

At 189.08 MHz: $(-94.6 + 107) + 17.4 = 29.8$ dBuV/m

CONVERSION FROM dBm TO dBuV = 107 dB

Test Date: August 13, 2008

Tested by
 Signature: _____



Name: Keyvan Muvahhid

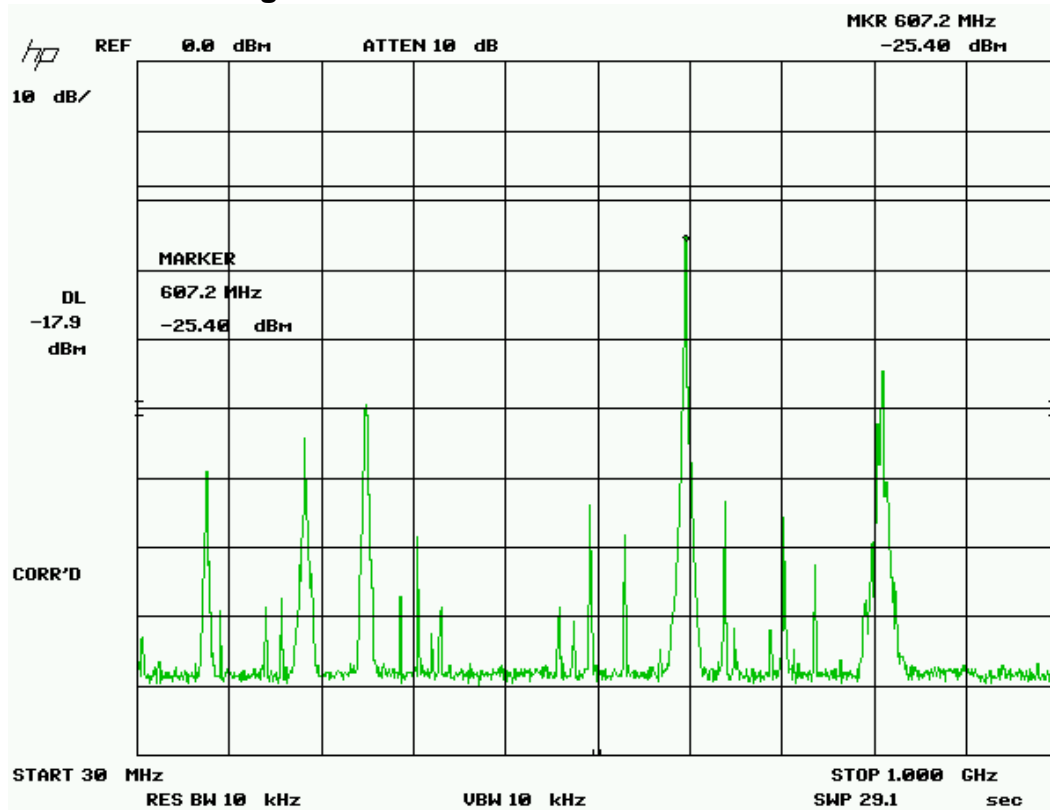
APPENDIX A

COMPARISON DATA BETWEEN ORIGINAL EUT AND MODIFIED EUT WITH WIMAX MODULE

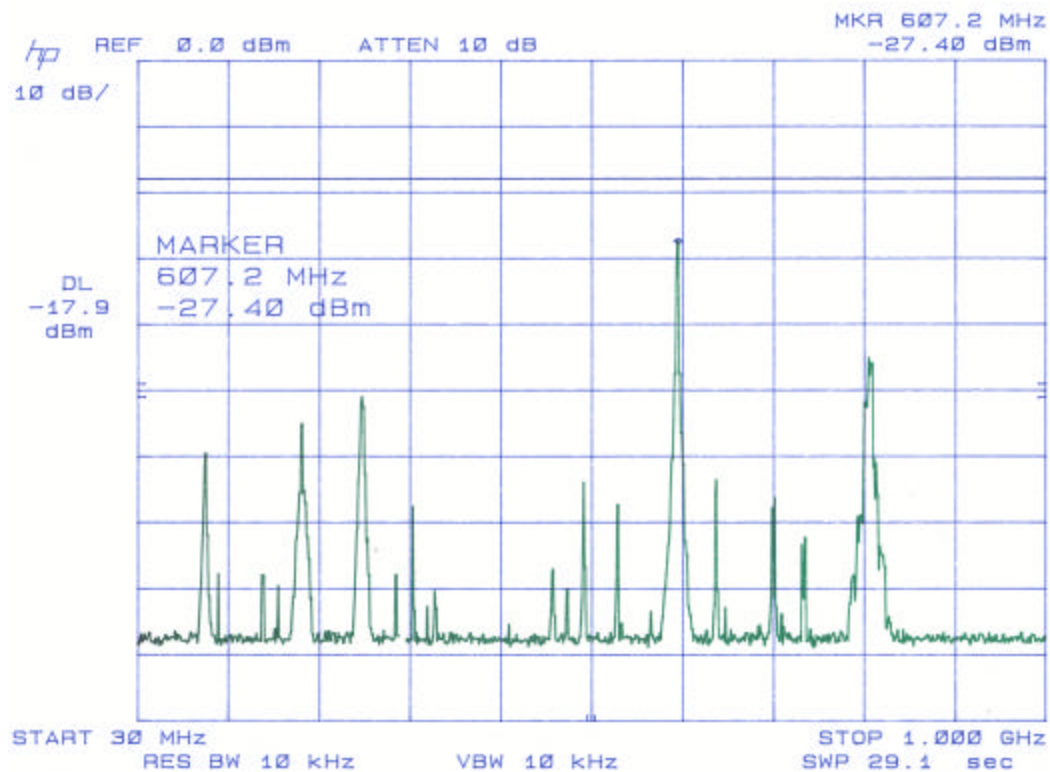
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Comparison Data – Original SPT Data vs. SPT + WiMax Module



Spurious Emissions at Antenna Terminals, Low Ch. – August 13, 2008

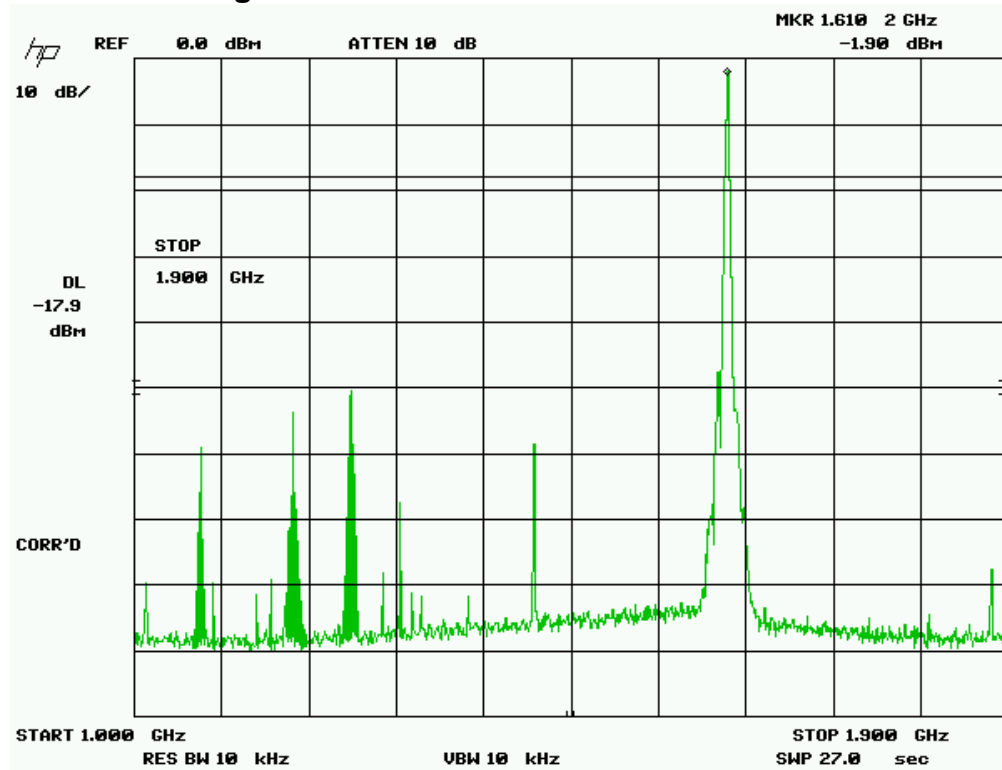


Spurious Emissions at Antenna Terminals, Low Ch. – Original Report

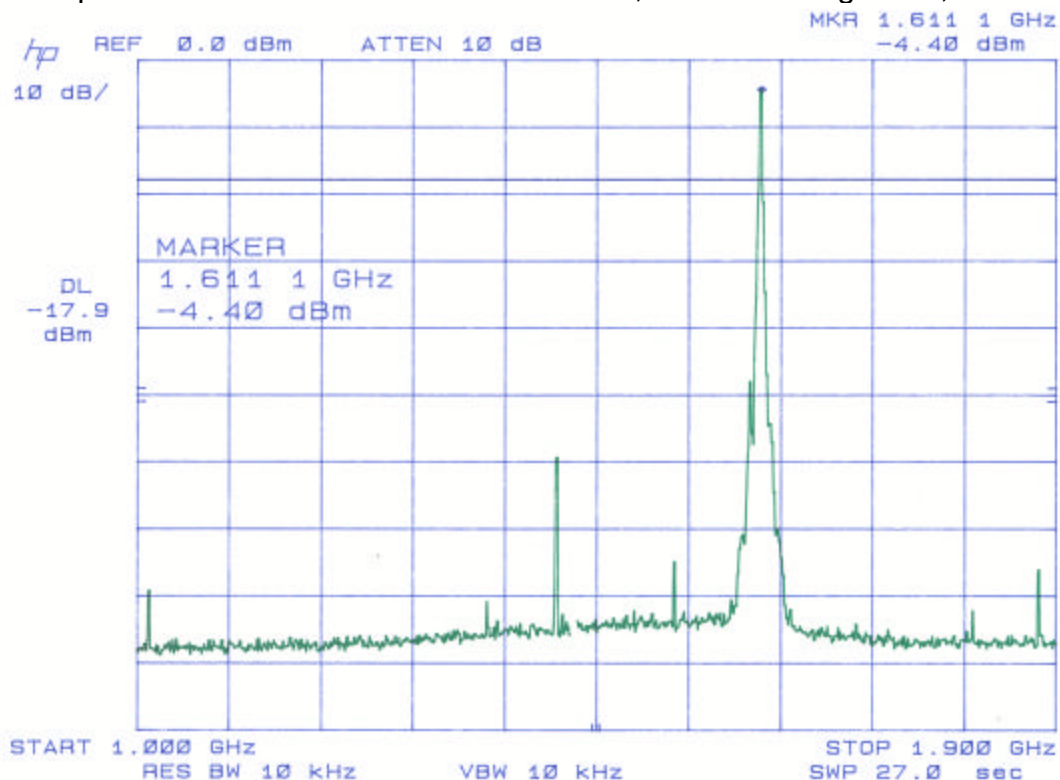
Report Number: 08-0151
Customer: Axonn LLC
Model: Satellite Personal Tracker Model: SPT

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Comparison Data – Original SPT Data vs. SPT + WiMax Module Cont.



Spurious Emissions at Antenna Terminals, Low Ch. – August 13, 2008

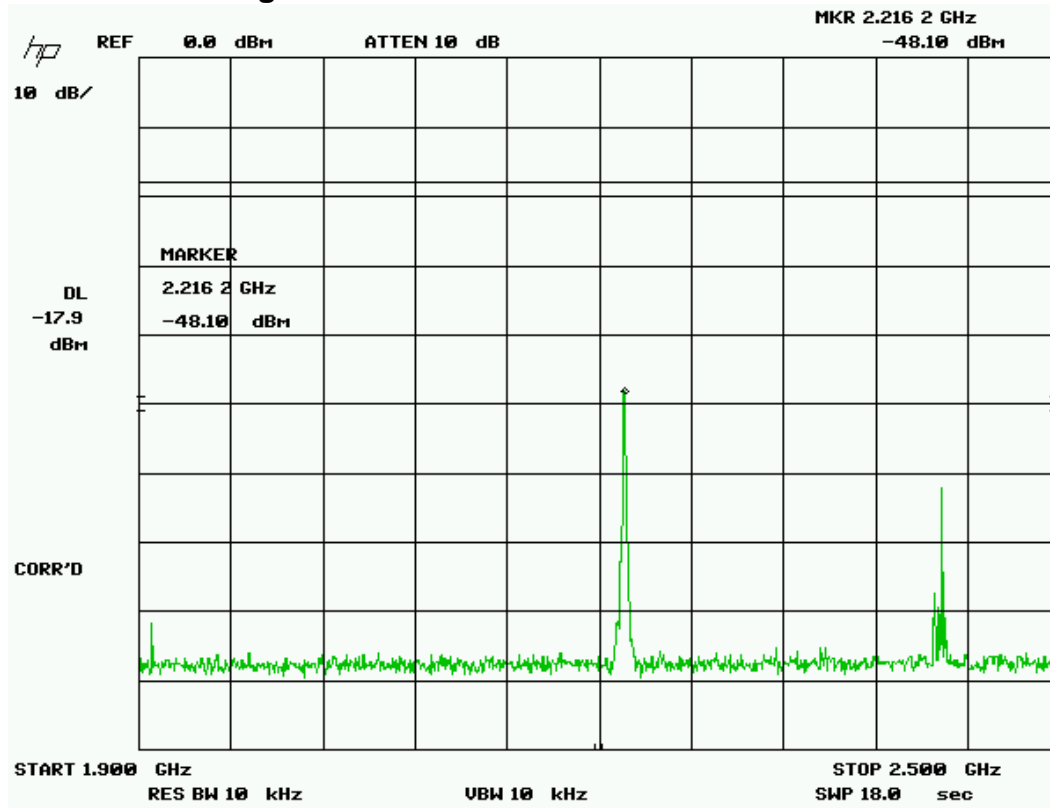


Spurious Emissions at Antenna Terminals, Low Ch. – Original Report

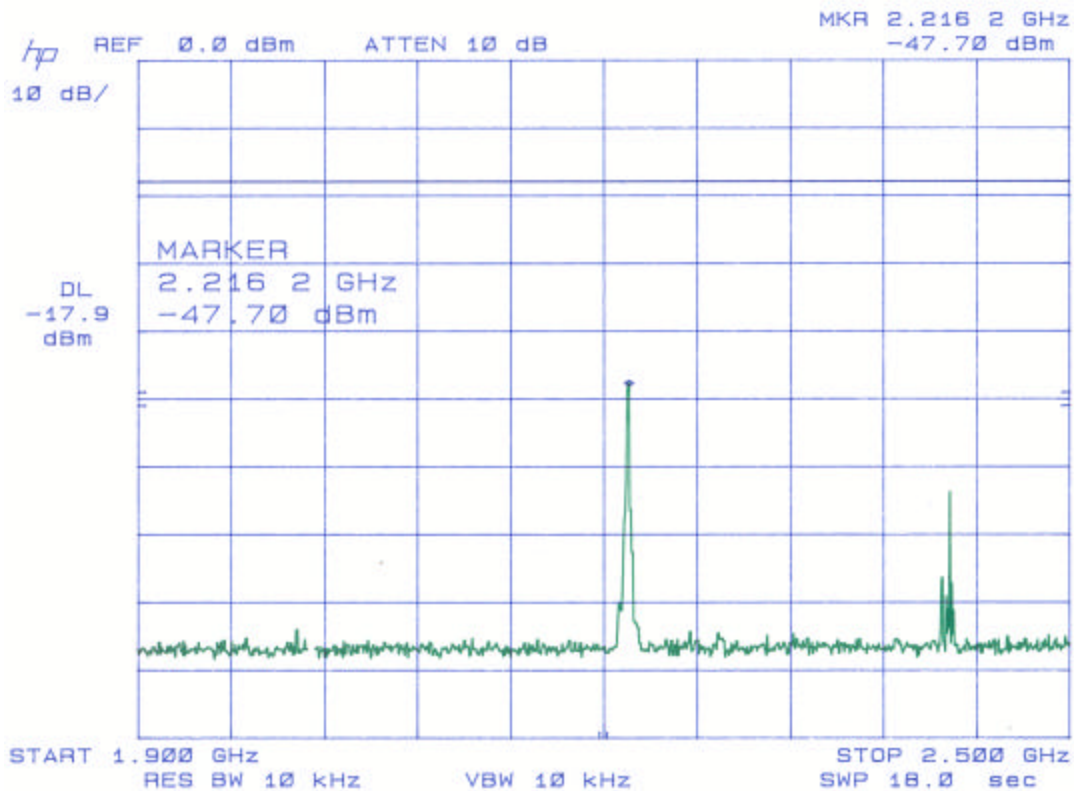
Report Number: 08-0151
Customer: Axonn LLC
Model: Satellite Personal Tracker Model: SPT

Issue Date: August 19, 2008

Comparison Data – Original SPT Data vs. SPT + WiMax Module Cont.



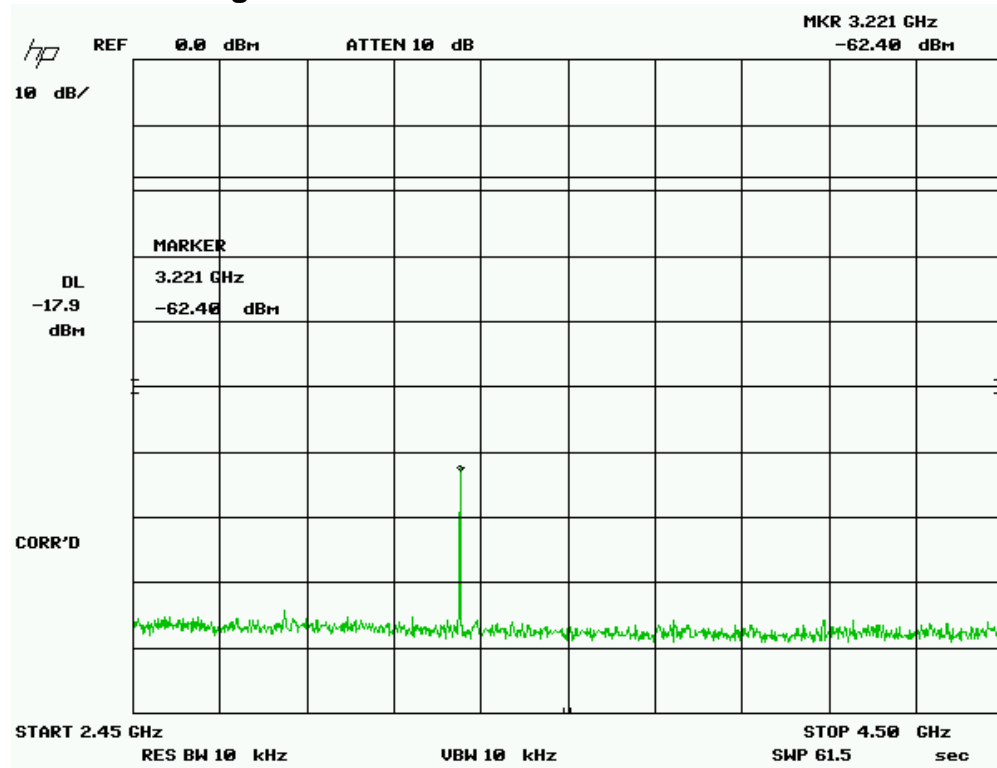
Spurious Emissions at Antenna Terminals, Low Ch. – August 13, 2008



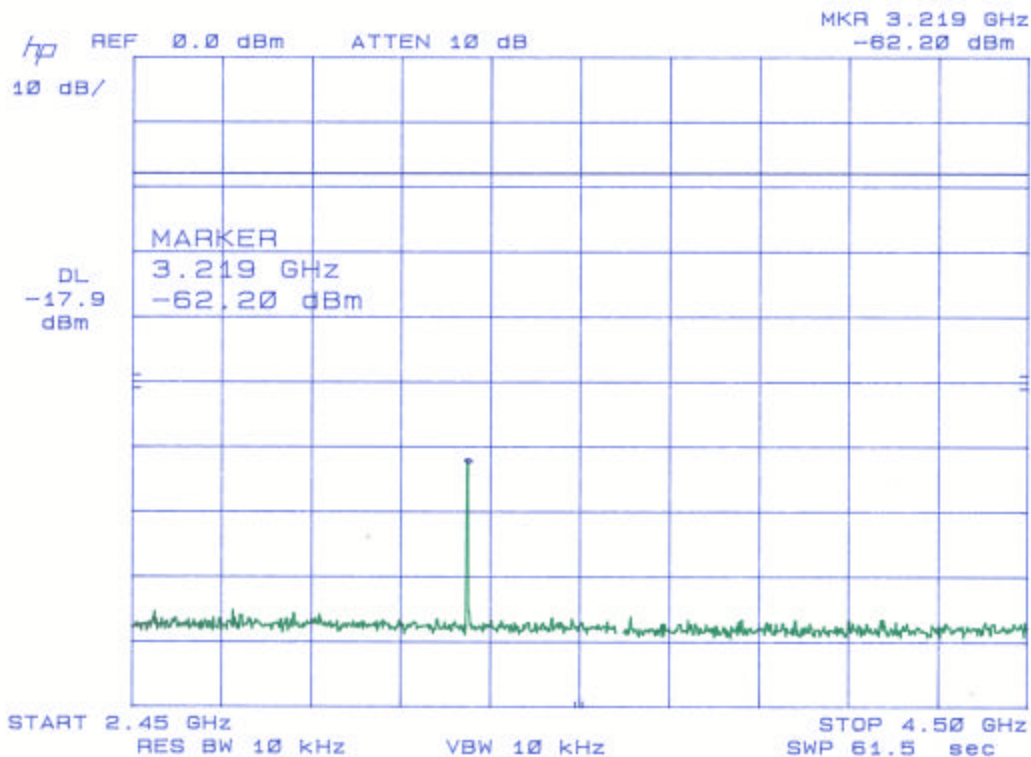
Report Number: 08-0151
Customer: Axonn LLC
Model: Satellite Personal Tracker Model: SPT

Issue Date: August 19, 2008

Spurious Emissions at Antenna Terminals, Low Ch. – Original Report
Comparison Data – Original SPT Data vs. SPT + WiMax Module Cont.



Spurious Emissions at Antenna Terminals, Low Ch. – August 13, 2008

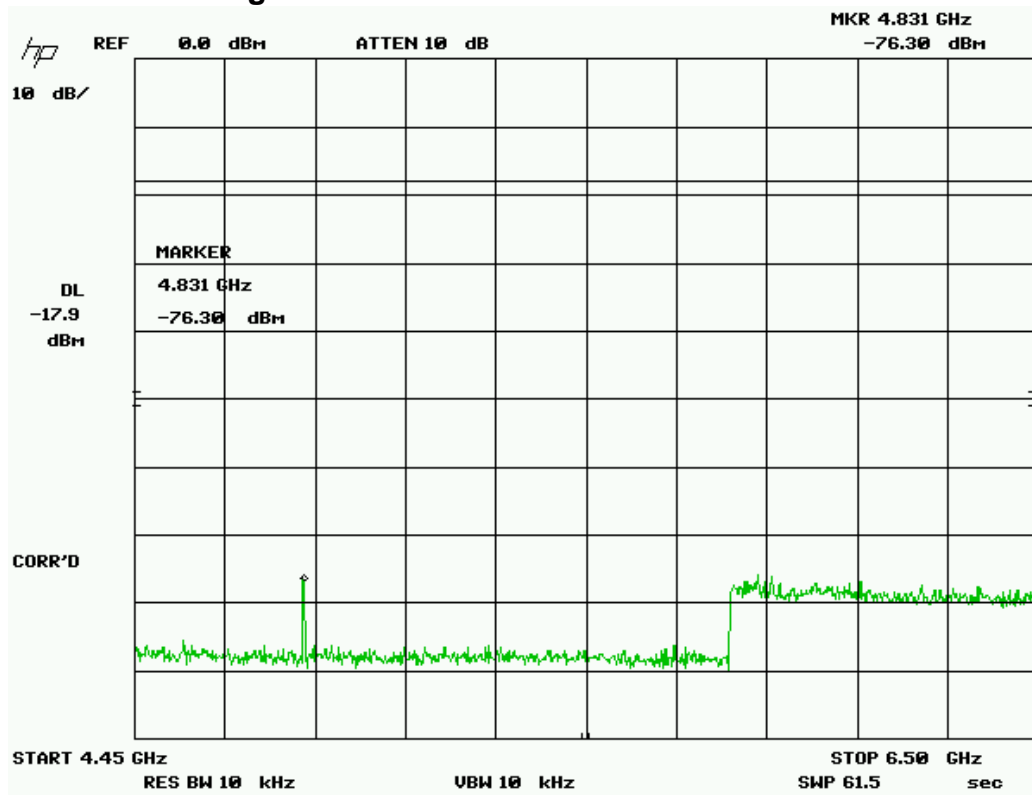


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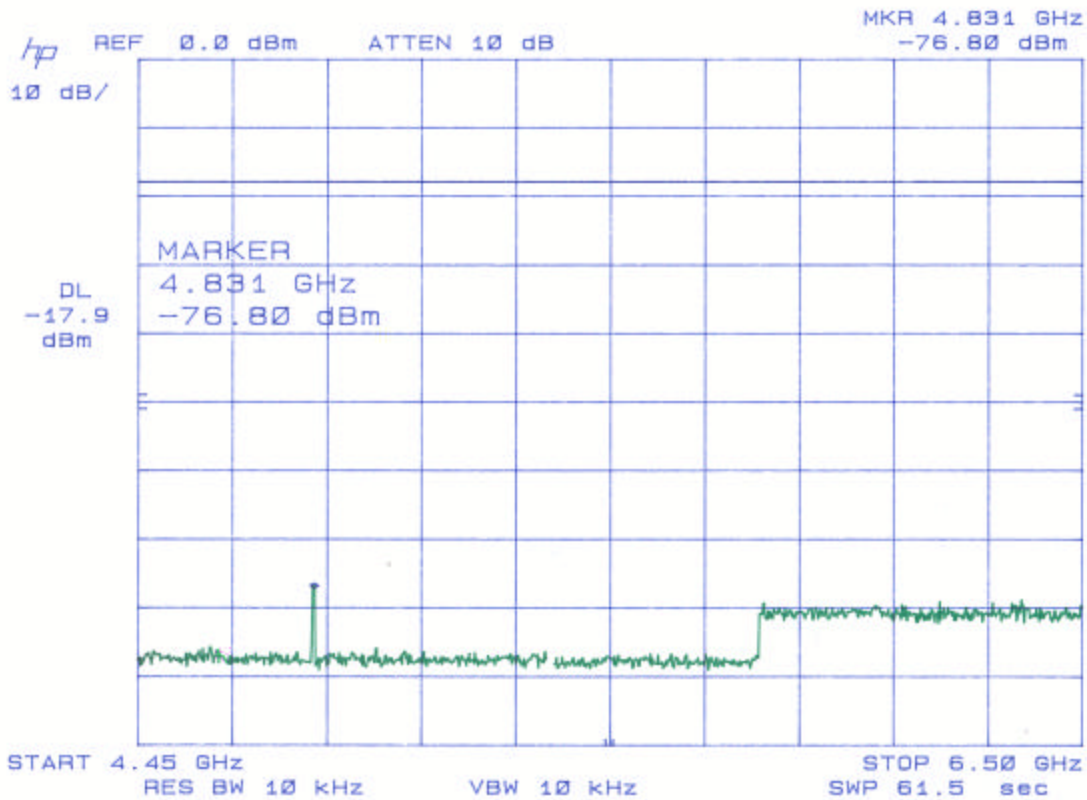
Comparison Data – Original SPT Data vs. SPT + WiMax Module Cont.



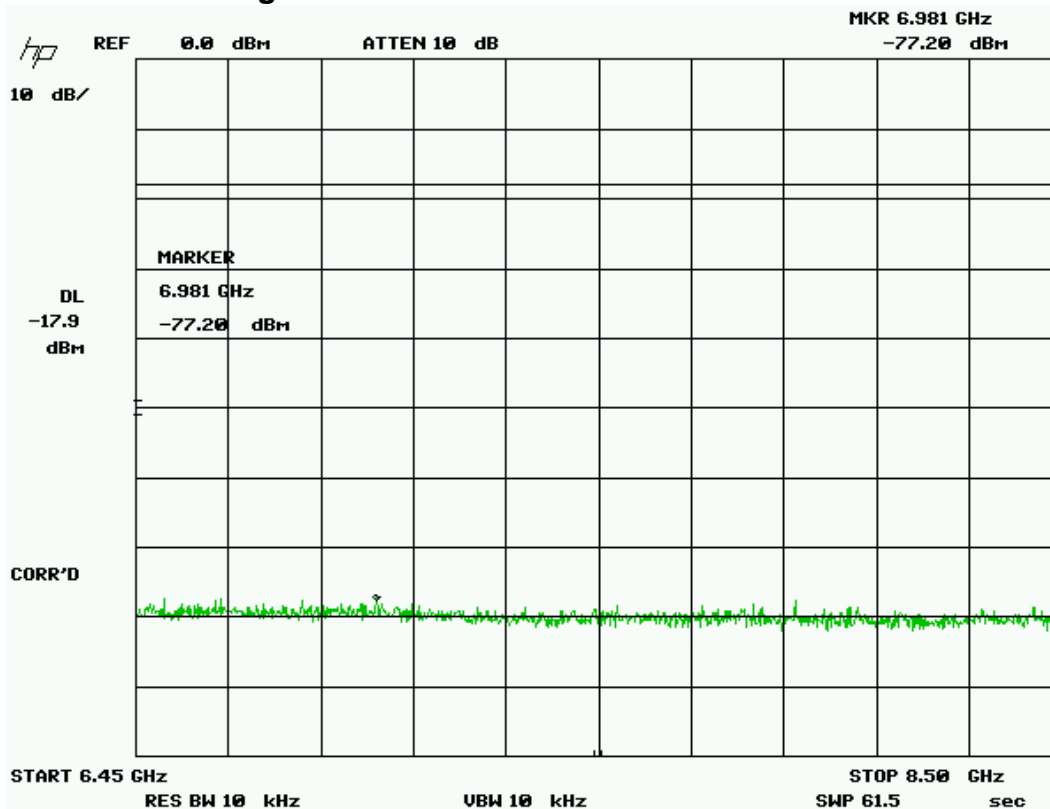
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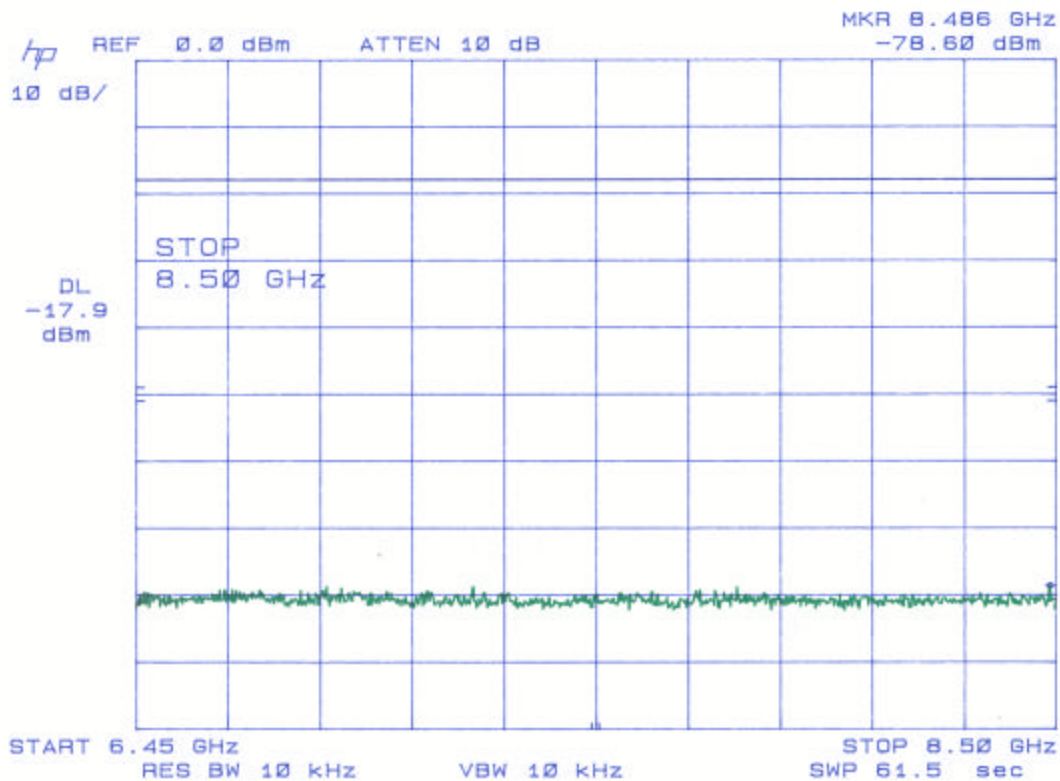
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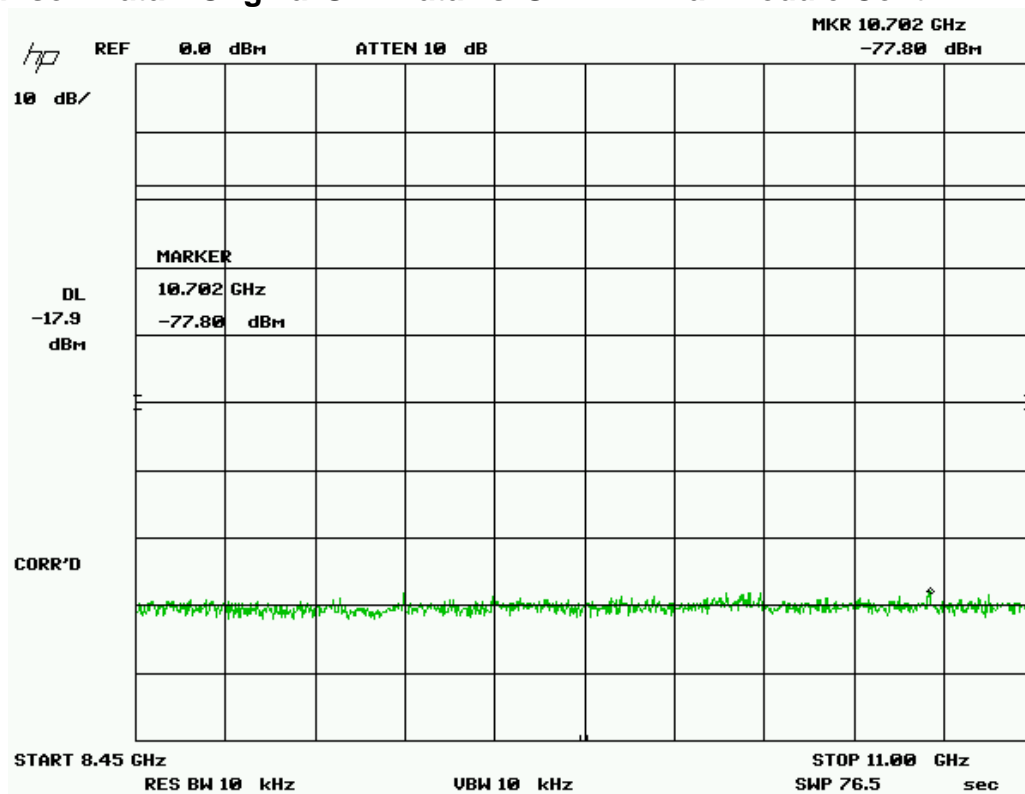
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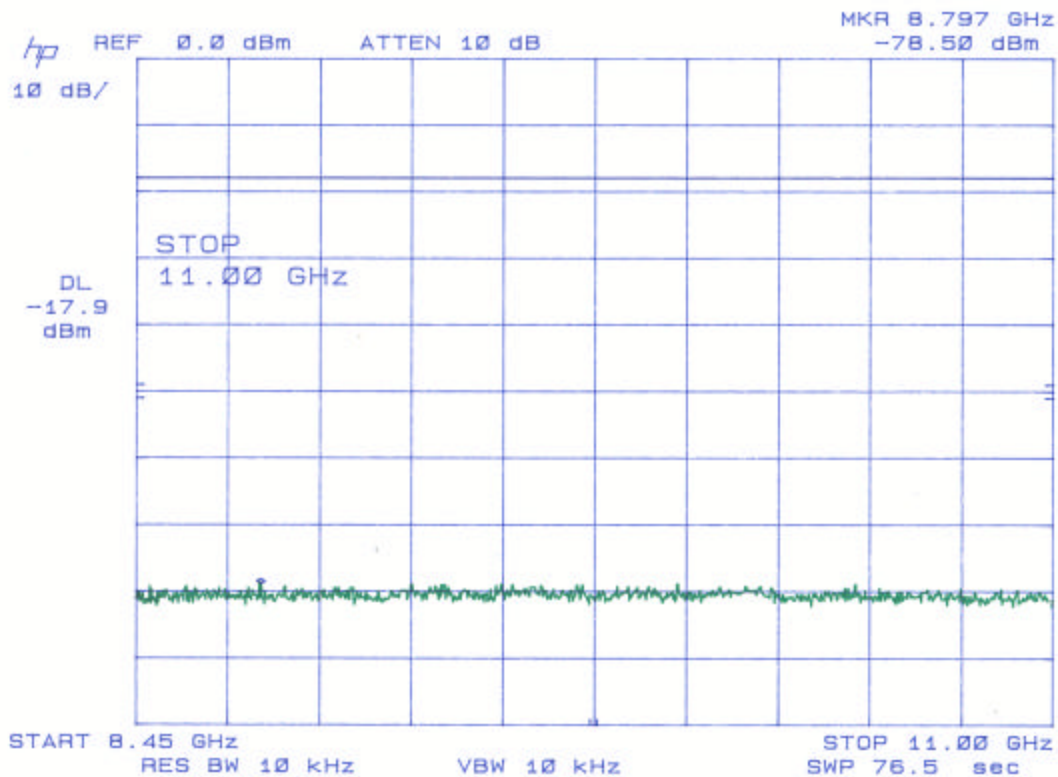
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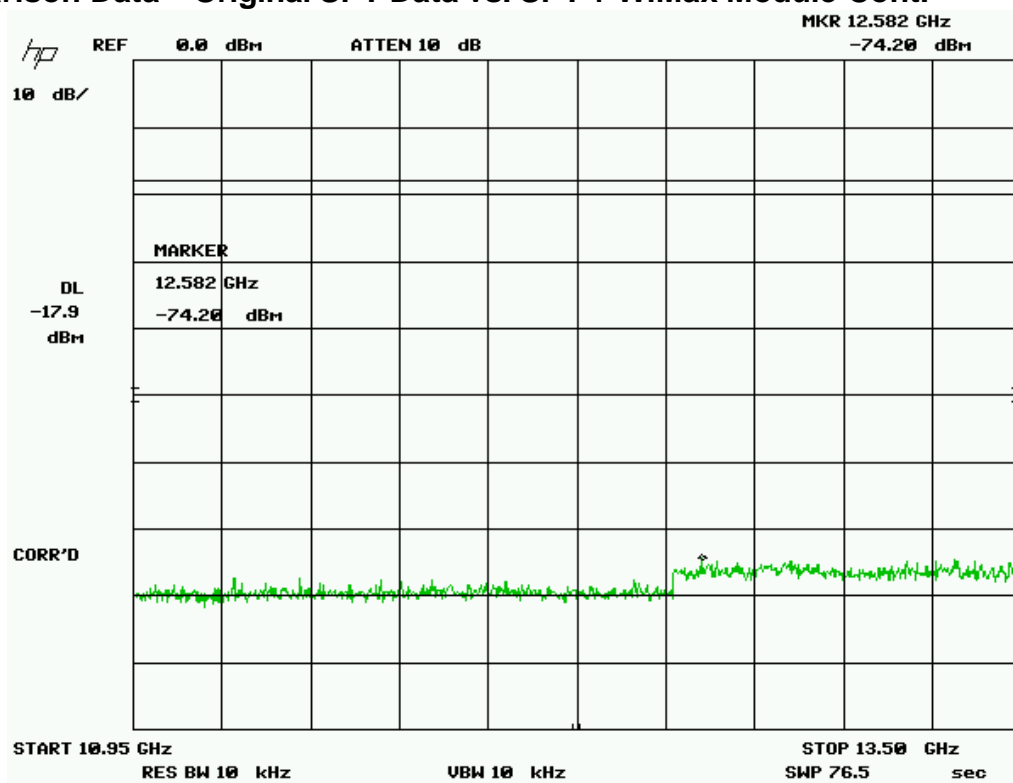
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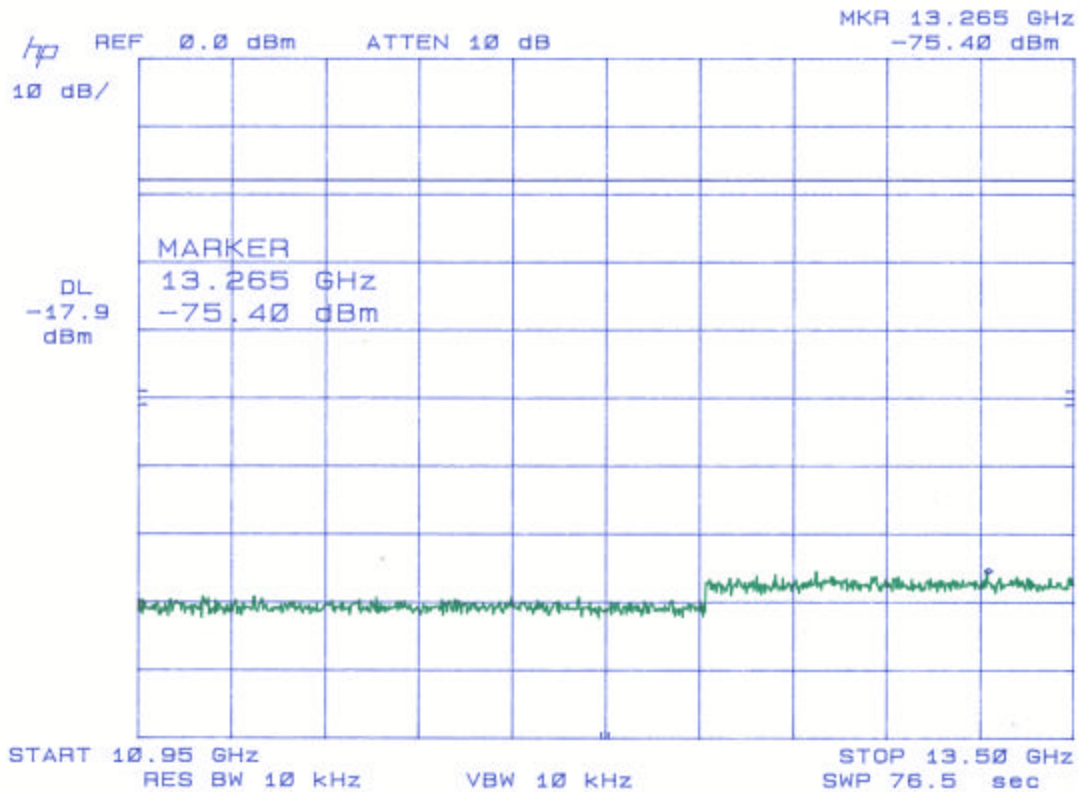
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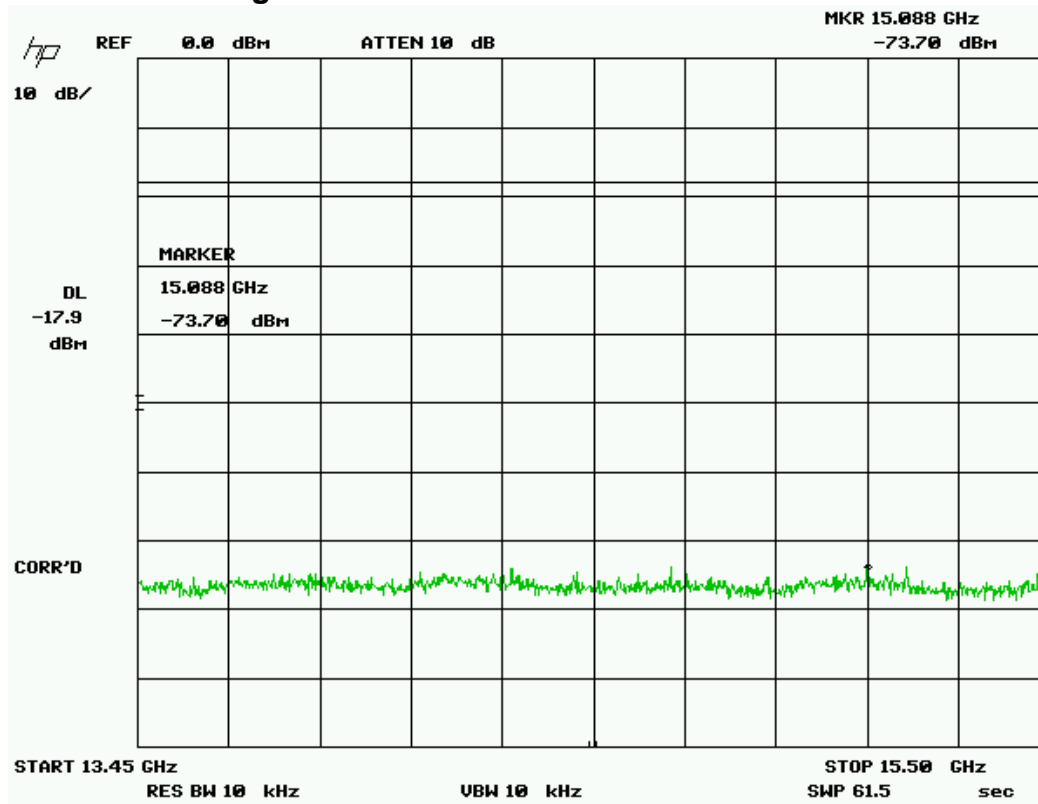
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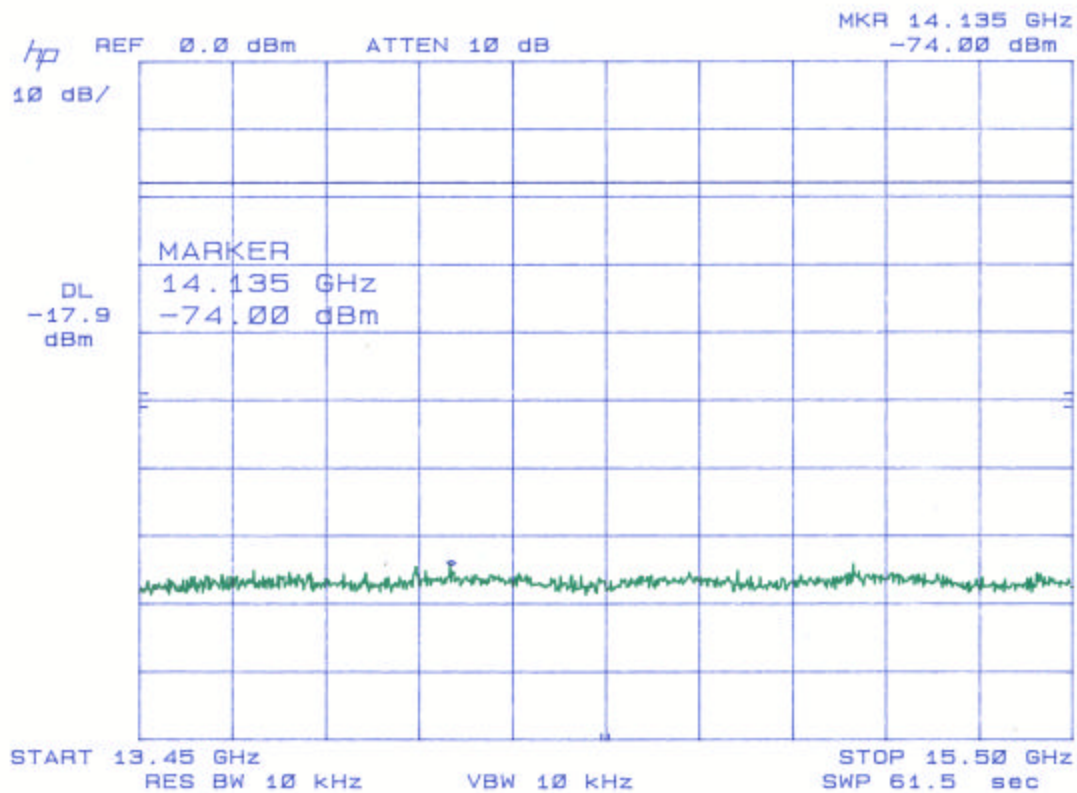
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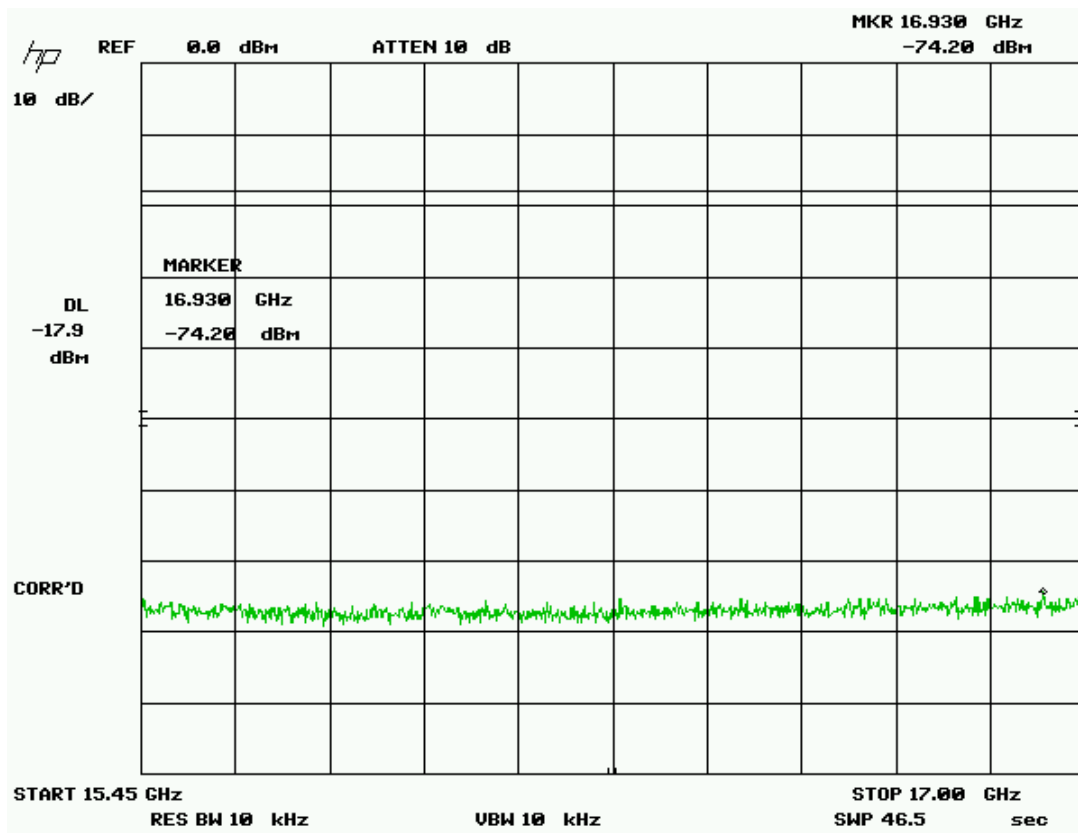
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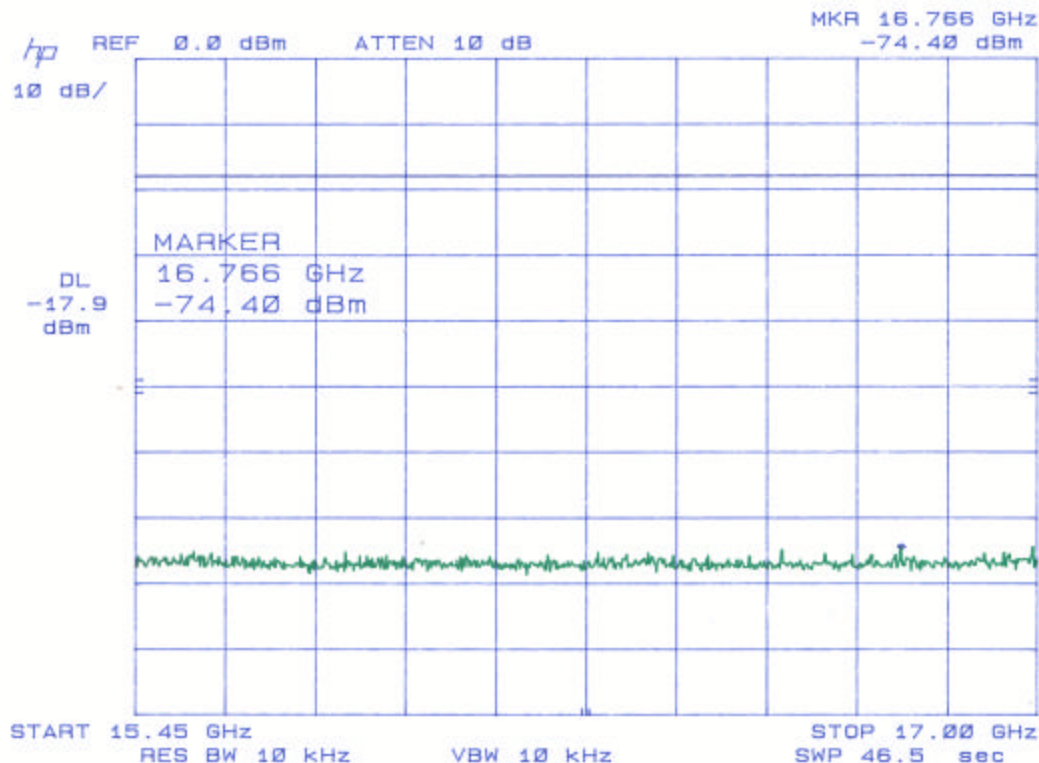
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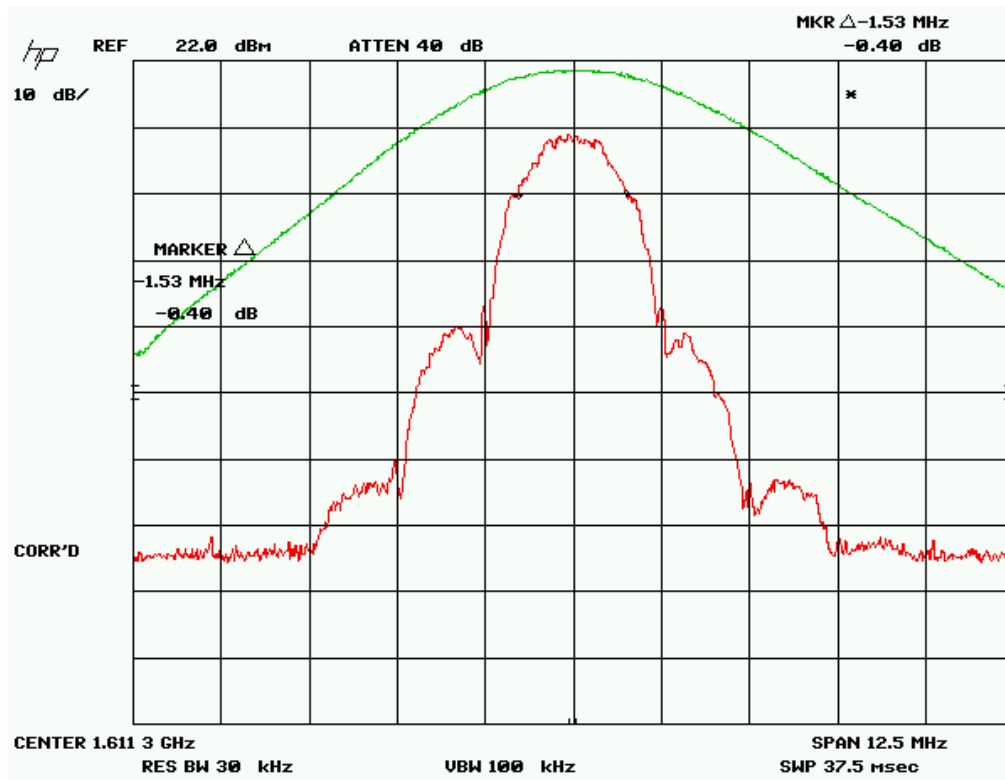
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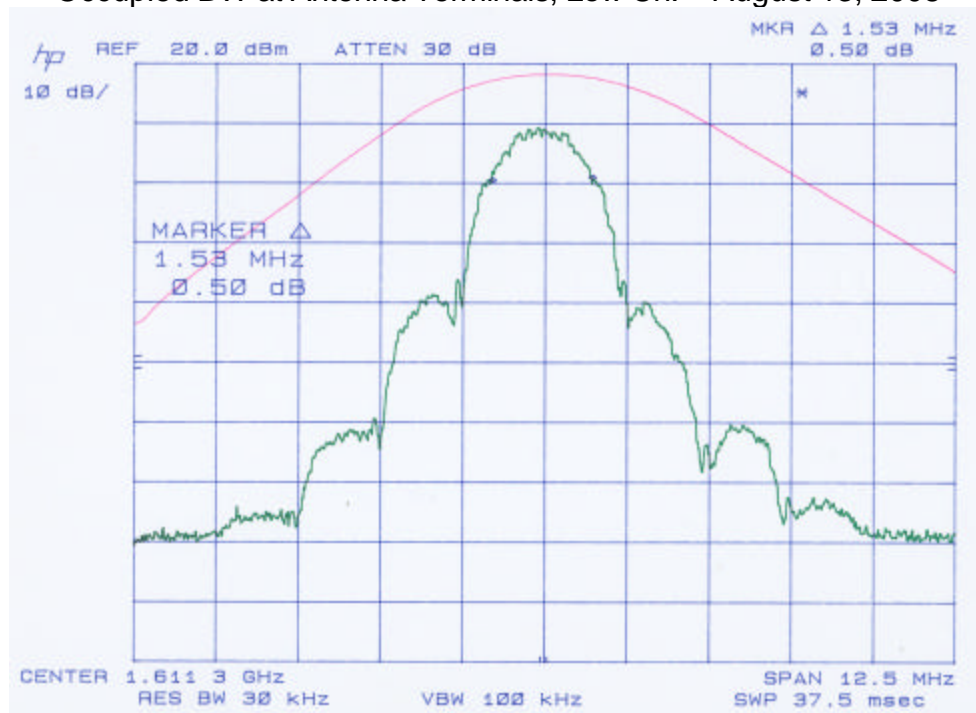
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Occupied BW at Antenna Terminals, Low Ch. – August 13, 2008

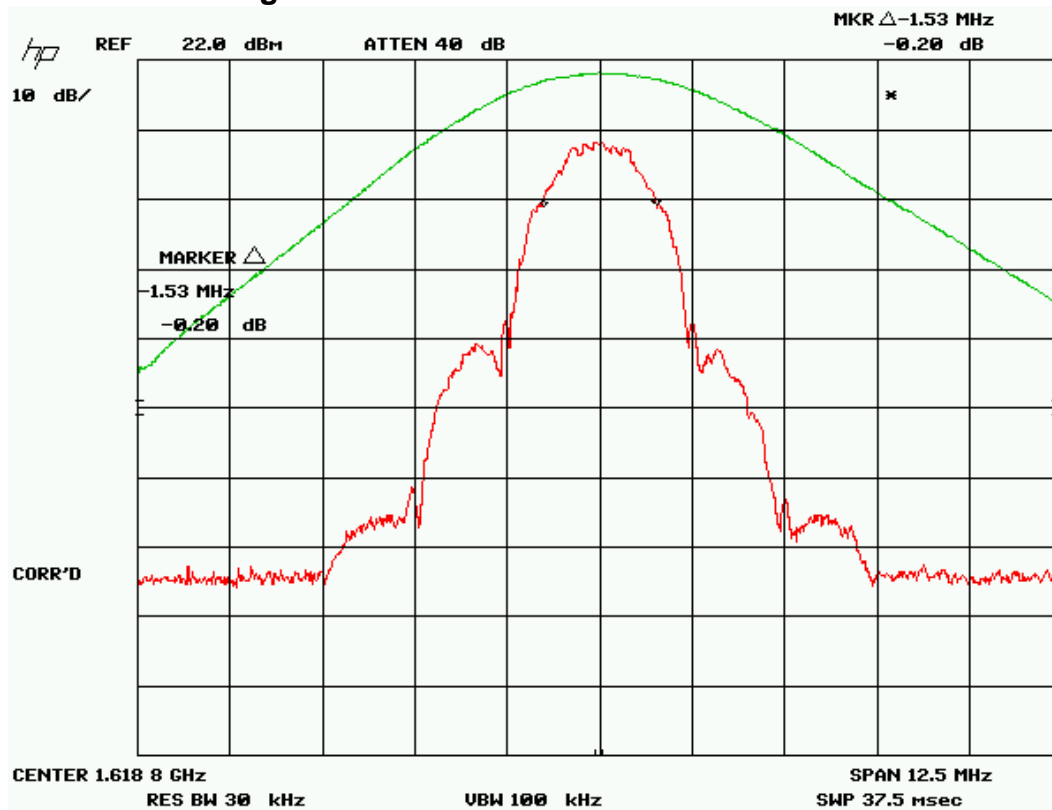


Occupied BW at Antenna Terminals, Low Ch. – Original Report

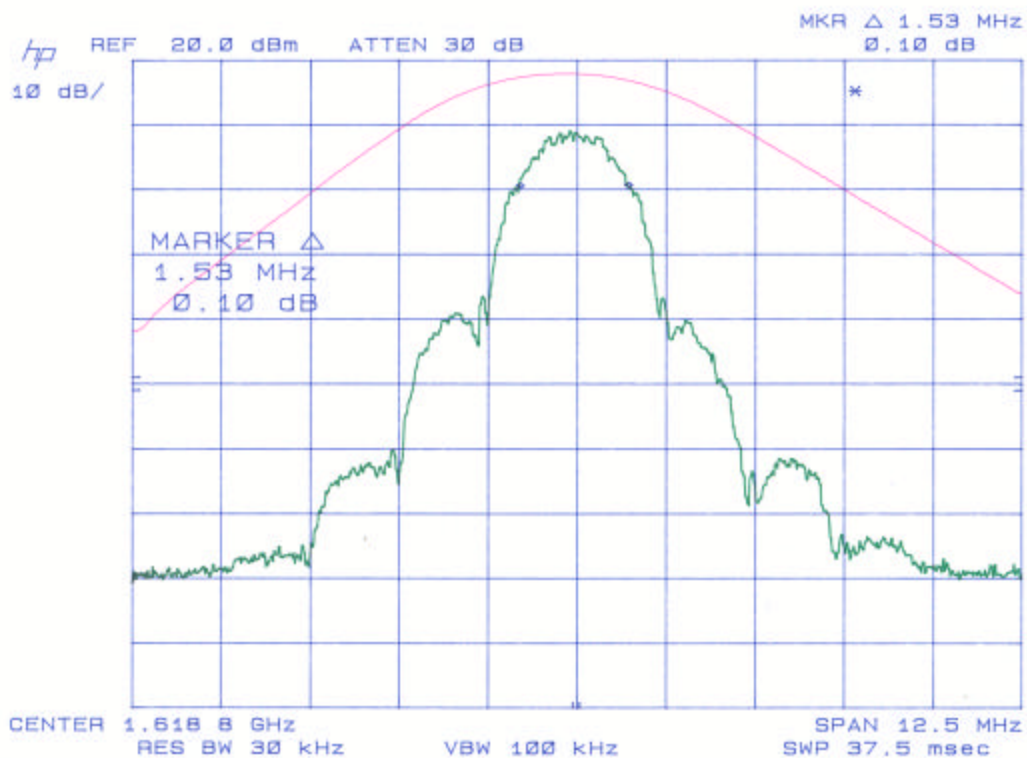
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Occupied BW at Antenna Terminals, High Ch. – August 13, 2008



Occupied BW at Antenna Terminals, High Ch. – Original Report