



## TEST REPORT

**Report Number: 3088423MIN-009**

**Project Number: 3088423**

**January 12, 2006**

**Evaluation of the  
Sky Tracker Propane Monitor System RF Link  
FCC ID:  
SOFSKYTRACKER**

**to  
FCC Part 2  
FCC Part 15, Subpart C, Section 15.249**

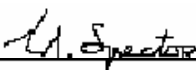
**For  
Applied Digital Inc.**

Test Performed by:  
Intertek  
7250 Hudson Blvd. Suite 100  
Oakdale, MN 55128

Test Authorized by:  
Applied Digital Inc.  
19315 North Highway 413  
Branson West, MO 65737

Prepared by:   
Norman Shpilsher

Date: January 12, 2006

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Date: January 12, 2006

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## 1.0 GENERAL DESCRIPTION

### 1.1 Related Submittals Grants

This is single application of the Applied Digital Inc. *Propane Monitor System (trademark Sky Tracker) RF Link* for Certification under FCC Part 15, Subpart C.

There are no other simultaneous applications.

The Receiver portion will be verified under Declaration of Conformity.

### 1.2 Product Description

The *Propane Monitor System* is a system to monitor propane tank levels providing the *RF Link* to other monitoring devices and also transmitting data via the satellite link.

The satellite link is previously certified by FCC (FCC ID: L2V2100-0149).

The *RF Link* transmitter operates at single channel in frequency range 902 to 928MHz with lowest frequency channel of 903MHz and highest frequency channel of 927MHz. The intended use of the *RF Link* transmitter is to generate and transmit a RF signal with propane tank status data to other monitoring device receiver. The *Propane Monitor System* is powered at 3VDC from internal batteries.

#### Antenna Description:

The antenna is a non-detachable (soldered to the PCB) 75mm wire as a monopole antenna.

The antenna is located under the device cover.

Sample Submitted: November 11, 2005

Test Work Started: December 9, 2005

Test Work Completed: January 11, 2006

### 1.3 Test Methodology

Emission measurements were performed according to the procedures in ANSI C63.4-2003. All field strength radiated emissions measurements were performed in the semi-anechoic chamber, and for each scan, the procedure for maximizing emissions in were followed. All field strength radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

### 1.4 Test Facility

The test site facility used to collect the radiated and conducted measurement data is located at 7250 Hudson Blvd., Suite 100, Oakdale, Minnesota. This test facility has been fully described in a report dated on March 2003 submitted to FCC. Please reference the site registration number: 90706, dated December 6, 2005.

## **2.0 SYSTEM TEST CONFIGURATION**

### **2.1 Justification**

N/A

### **2.2 EUT Setup**

For simplicity of testing, the transmitter was wired (using pre-programmed set of chip U3) to transmit continuously at single frequency of 903, 915, and 927MHz.

### **2.3 EUT Exercising Software**

N/A

### **2.4 Special Accessories**

There are no special accessories necessary for compliance of these products.

### **2.5 Equipment Modification**

No modifications were installed during the testing.

### **2.6 Support Equipment List and Description**

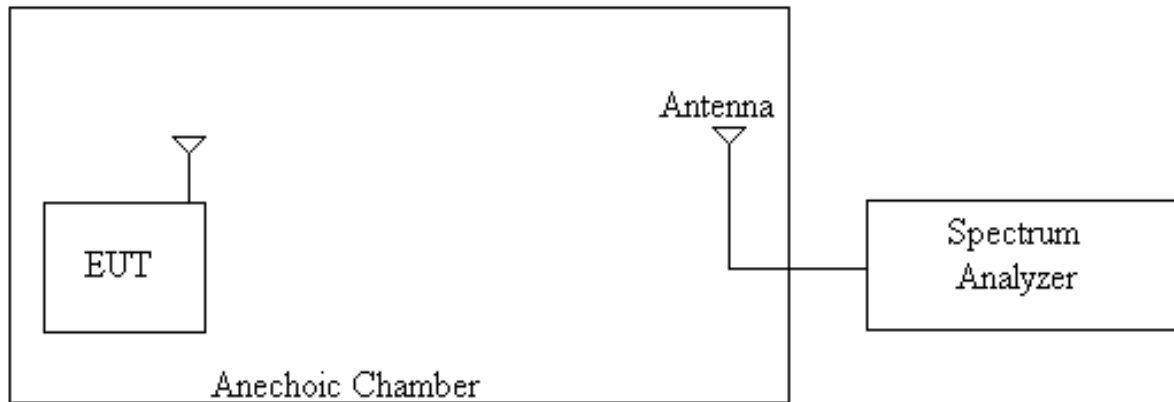
N/A

## 2.7 Test Configuration Block Diagrams

The EUT was setup as tabletop equipment.

The EUT was powered at 3VDC from four fresh 123A batteries connected in parallel as a battery pack.

### Field Strength Measurements



### 3.0 TEST RESULTS

Data is included for the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs, data tables and graphical representations of the emissions are included.

The EUT is intended for operation under the requirements of Part 15 Subpart C. Specific test requirements includes the following:

47 CFR 15.249(a)	Field Strength of Fundamental
47 CFR 15.249(a)(d), 15.205	Field Strength of Harmonics and Spurious Emissions
47 CFR 15.249(d), 15.209	Out of Band Spurious Emissions
47 CFR 15.215	Bandwidth of Emissions
47 CFR 15.109	Radiated Emissions

Note: A Conducted emissions testing was not performed as a internal battery operated device.

### 3.1 Field Strength of Fundamental, FCC 15.249(a)

The Field Strength of Fundamental was measured were made at the low, center, and high frequency channels (903, 915, and 927MHz).

The Field Strength of Fundamental was measured at continuously operated device using CISPR Quasi-Peak detector with 100kHz resolution bandwidth and 300kHz video bandwidth.

The EUT complies with the Standard requirements for Fundamental Emissions with the minimum margin 4.2dB below the limits.

The Table 3-1-1 shows the Field Strength of Fundamental.

#### Radiated Emissions at Fundamental

Date: 01-10-2006

**Company:** Applied Digital Inc.  
**Model:** Sky Tracker  
**Test Engineer:** Norman Shpilsher  
**Special Info:**  
**Standard:** FCC Part 15.249(a)  
**Test Site:** 3m Anechoic Chamber, 3m measurement distance  
**Note:** All measurements were taken using a CISPR Quasi-peak detector

Table # 3-1-1

Frequency MHz	Antenna			Readings dB $\mu$ V	Total at 3m dB $\mu$ V/m	QP Limit dB $\mu$ V/m	Margin dB	Comments
	Polarity	Hts(cm)	Factor (dB1/m)					
902.89	V	142	25.0	59.4	84.4	94.0	-9.6	
903.10	V	142	25.0	59.7	84.7	94.0	-9.3	
902.89	H	100	25.0	63.2	88.2	94.0	-5.8	
903.10	H	100	25.0	63.3	88.3	94.0	-5.7	
914.92	V	142	25.1	62.6	87.7	94.0	-6.3	
915.12	V	142	25.2	63.8	89.0	94.0	-5.0	
914.92	H	100	25.1	64.3	89.4	94.0	-4.6	
915.12	H	100	25.2	64.6	89.8	94.0	-4.2	
926.95	V	142	25.3	61.9	87.2	94.0	-6.8	
927.15	V	142	25.3	62.1	87.4	94.0	-6.6	
926.95	H	100	25.3	61.7	87.0	94.0	-7.0	
927.15	H	100	25.3	61.9	87.2	94.0	-6.8	

Comments:

### **3.2 Field Strength of Harmonics and Spurious Emissions, FCC 15.249(a)(d), 15.205**

Field Strength of Harmonics and Spurious Radiated Emissions measurements were made from 30MHz up to 9.3GHz (10<sup>th</sup>) harmonic at the low, center, and high frequency channels (903, 915, and 927MHz).

The EUT complies with the Standard requirements for Harmonics and Spurious Radiated Emissions with the minimum margin 5.0dB below the limits.

The Tables 3-2-1 to 3-2-3 and Graph 3-2-1 to 3-2-9 show the Field Strength Harmonics and Spurious Radiated Emissions.

No emissions above ambient was found at 4<sup>th</sup> and above harmonics.

**Note:** Emissions level shown on the Graphs include the Antenna Factor, Cable Loss, and Pre-amplifier gain.



# Harmonics and Spurious Radiated Emissions from 30MHz to 9.3GHz, 903MHz channel

**Date:** 01-11-2006

**Company:** Applied Digital Inc.

**Model:** Sky Tracker

**Test Engineer:** Norman Shpilsher

**Special Info:**

**Standard:** FCC Parts 15.249(a)(d), 15.209

**Test Site:** 3m Anechoic Chamber, 3m measurement distance

**Note:** The table shows the worst case radiated emissions  
All measurements were taken using a Peak detector

No emissions above floor noise were detected at 4th and higher harmonics.

**Table # 3-2-1**

Frequency	Ant. Polarity	Reading dB $\mu$ V	Ant. Factor dB1/m	Amp. Gain dB	Total at 3m dB $\mu$ V/m	15.209 Limit dB $\mu$ V/m	Margin dB
38.7 MHz	V	14.8	13.8	0.0	28.6	40.0	-11.4
62.625 MHz	V	18.6	6.8	0.0	25.4	40.0	-14.7
94.162 MHz	V	16.6	10.6	0.0	27.2	43.5	-16.3
106.67 MHz	V	14.6	12.8	0.0	27.4	43.5	-16.1
651.51 MHz	V	15.1	22.4	0.0	37.5	46.0	-8.6
31.343 MHz	H	14.2	18.1	0.0	32.3	40.0	-7.7
62.794 MHz	H	21.0	6.8	0.0	27.8	40.0	-12.3
75.458 MHz	H	16.2	7.6	0.0	23.8	40.0	-16.2
974.62 MHz	H	12.9	25.7	0.0	38.5	54.0	-15.5
2.7081 GHz	V	45.6	32.3	28.9	49.0	54.0	-5.0
4.6754 GHz	V	34.9	37.2	25.2	46.9	54.0	-7.1
2.7099 GHz	H	43.3	32.3	28.9	46.7	54.0	-7.3

# Harmonics and Spurious Radiated Emissions from 30MHz to 9.3GHz, 915MHz channel

**Date:** 01-11-2006

**Company:** Applied Digital Inc.

**Model:** Sky Tracker

**Test Engineer:** Norman Shpilsher

**Special Info:**

**Standard:** FCC Parts 15.249(a)(d), 15.209

**Test Site:** 3m Anechoic Chamber, 3m measurement distance

**Note:** The table shows the worst case radiated emissions  
All measurements were taken using a Peak detector

No emissions above floor noise were detected at 4th and higher harmonics.

**Table # 3-2-2**

Frequency	Ant. Polarity	Reading dB $\mu$ V	Ant. Factor dB1/m	Amp. Gain dB	Total at 3m dB $\mu$ V/m	15.209 Limit dB $\mu$ V/m	Margin dB
30.0 MHz	V	9.2	18.9	0.0	28.1	40.0	-11.9
62.625 MHz	V	18.6	6.8	0.0	25.4	40.0	-14.7
94.162 MHz	V	16.6	10.6	0.0	27.2	43.5	-16.3
106.67 MHz	V	14.6	12.8	0.0	27.4	43.5	-16.1
30.35 MHz	H	10.0	18.7	0.0	28.7	40.0	-11.4
62.794 MHz	H	21.0	6.8	0.0	27.8	40.0	-12.3
974.62 MHz	H	12.9	25.7	0.0	38.5	54.0	-15.5
2.7446 GHz	V	45.6	32.5	28.9	49.2	54.0	-4.7
4.6462 GHz	V	34.8	37.2	25.1	46.8	54.0	-7.2
2.7336 GHz	H	39.7	32.4	28.9	43.2	54.0	-10.7
2.7464 GHz	H	43.8	32.5	28.9	47.4	54.0	-6.6
4.8324 GHz	H	35.1	37.5	25.5	47.0	54.0	-6.9

# Harmonics and Spurious Radiated Emissions from 30MHz to 9.3GHz, 927MHz channel

**Date:** 01-11-2006

**Company:** Applied Digital Inc.

**Model:** Sky Tracker

**Test Engineer:** Norman Shpilsher

**Special Info:**

**Standard:** FCC Parts 15.249(a)(d), 15.209

**Test Site:** 3m Anechoic Chamber, 3m measurement distance

**Note:** The table shows the worst case radiated emissions  
All measurements were taken using a Peak detector

No emissions above floor noise were detected at 4th and higher harmonics.

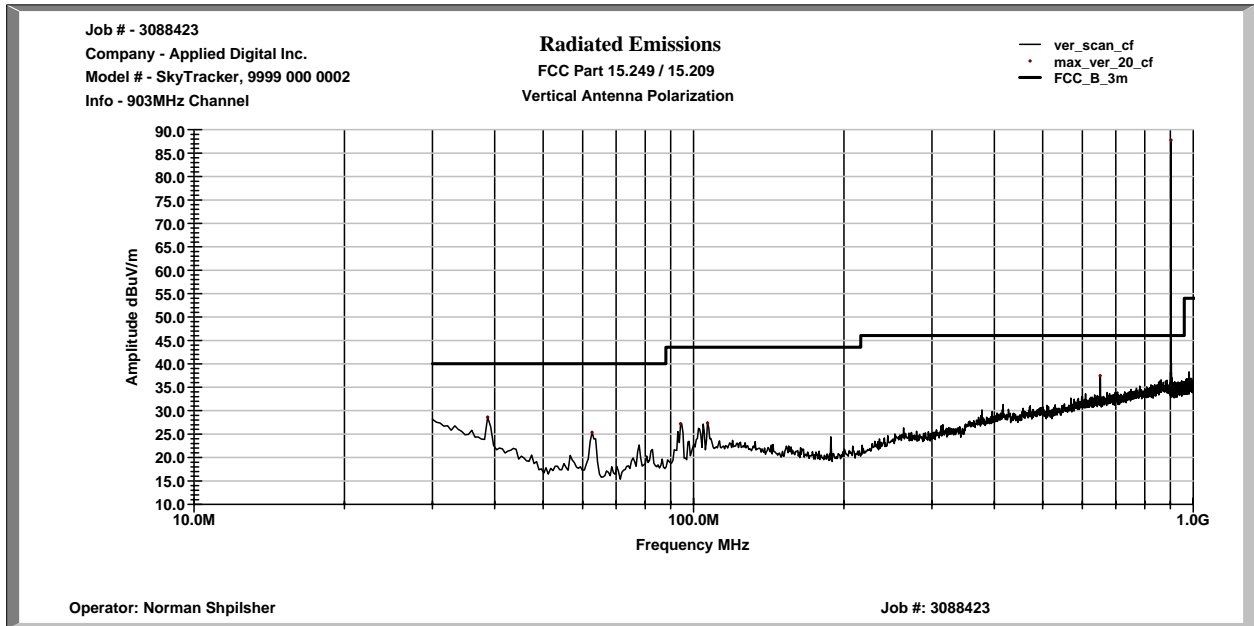
**Table # 3-2-3**

Frequency	Ant. Polarity	Reading dB $\mu$ V	Ant.Factor dB1/m	Amp.Gain dB	Total at 3m dB $\mu$ V/m	15.209 Limit dB $\mu$ V/m	Margin dB
30.0 MHz	V	9.2	18.9	0.0	28.1	40.0	-11.9
50.662 MHz	V	15.5	8.3	0.0	23.8	40.0	-16.2
62.625 MHz	V	18.6	6.8	0.0	25.4	40.0	-14.7
94.162 MHz	V	16.6	10.6	0.0	27.2	43.5	-16.3
106.67 MHz	V	14.6	12.8	0.0	27.4	43.5	-16.1
30.175 MHz	H	13.3	18.8	0.0	32.1	40.0	-7.9
62.794 MHz	H	21.0	6.8	0.0	27.8	40.0	-12.3
2.7826 GHz	V	44.7	32.6	28.8	48.6	54.0	-5.4
4.4265 GHz	V	35.4	36.9	25.1	47.2	54.0	-6.8
2.4643 GHz	H	38.9	31.4	29.5	40.9	54.0	-13.1
2.7796 GHz	H	44.4	32.6	28.8	48.2	54.0	-5.8

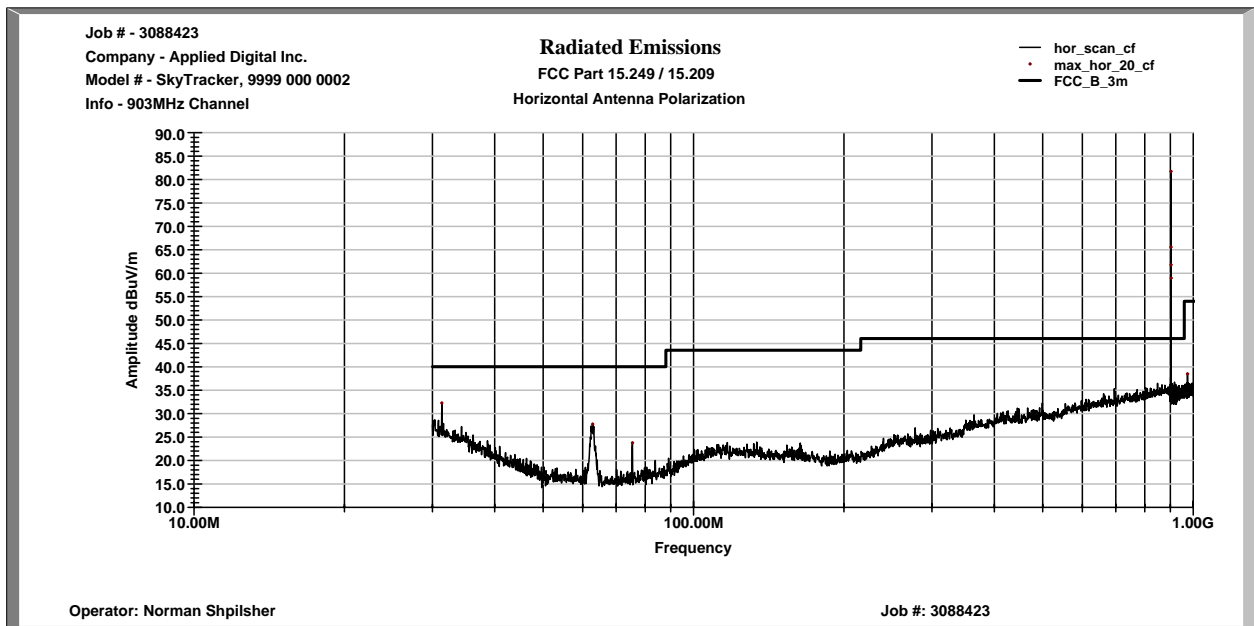
# Graph # 3-2-1

## 903MHz Channel, Radiated Emissions from 30MHz to 1GHz

### Vertical Antenna Polarization

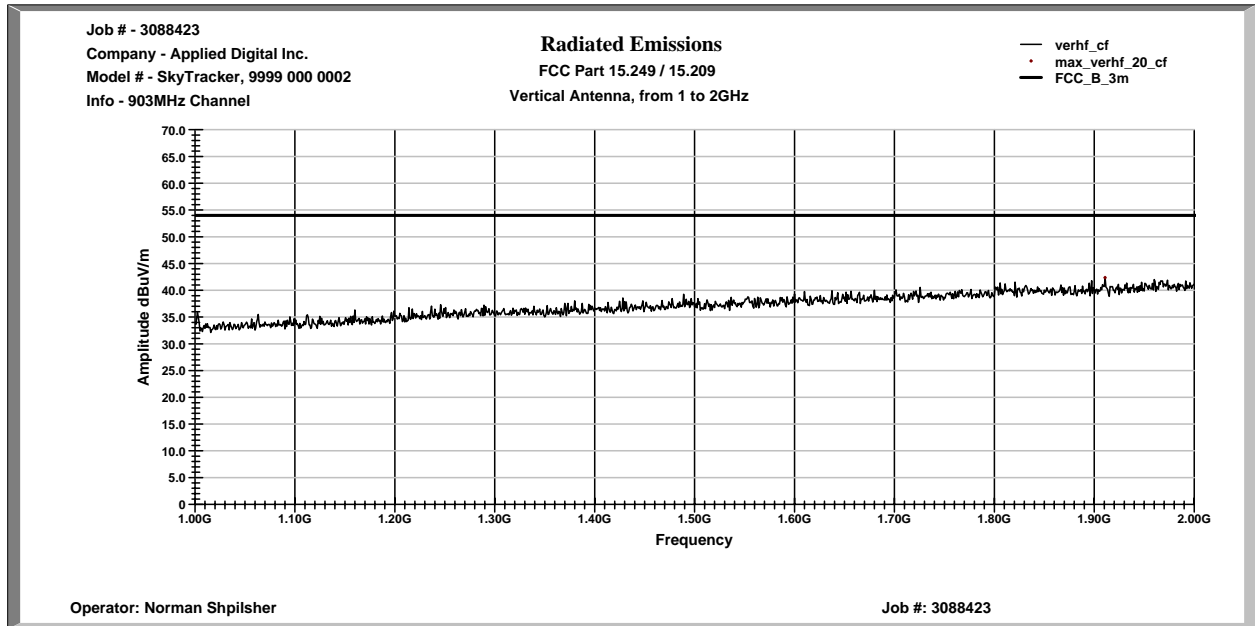


### Horizontal Antenna Polarization

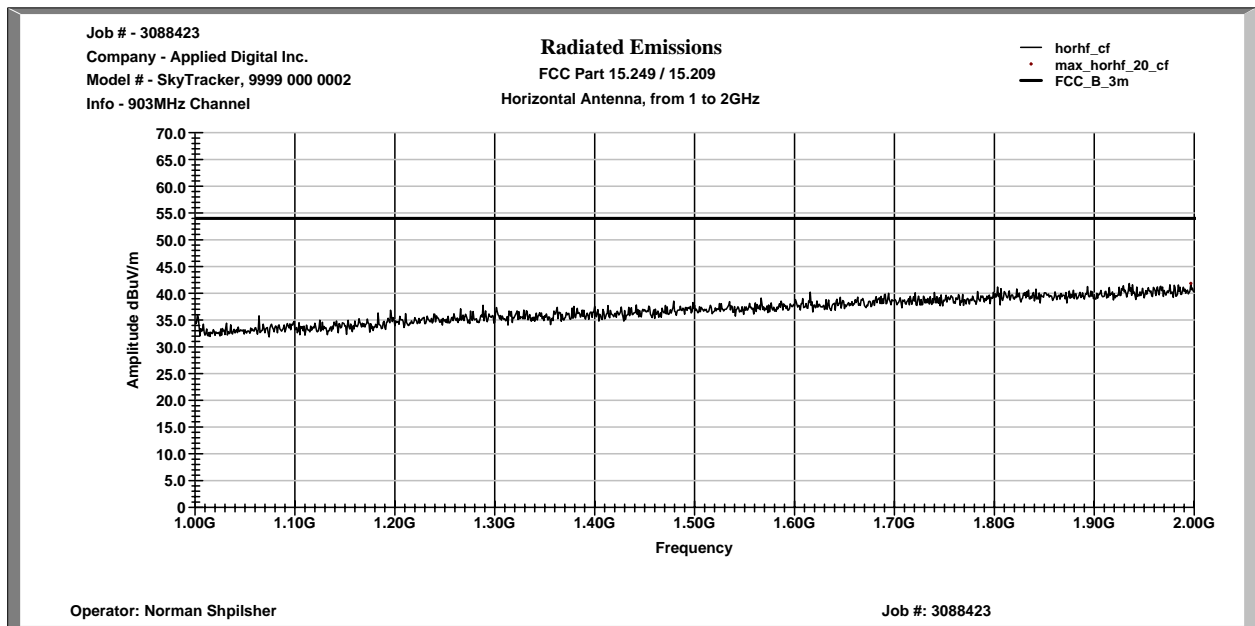


**Graph # 3-2-2**  
**903MHz Channel, Radiated Emissions from 1 to 2GHz**

**Vertical Antenna Polarization**

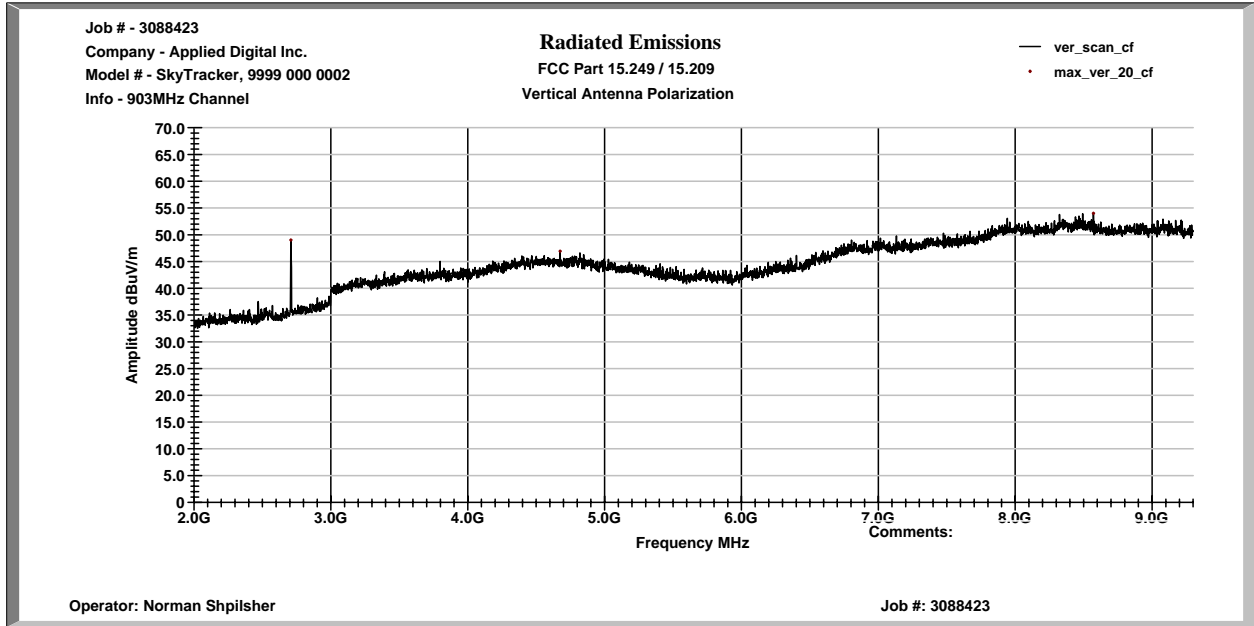


**Horizontal Antenna Polarization**

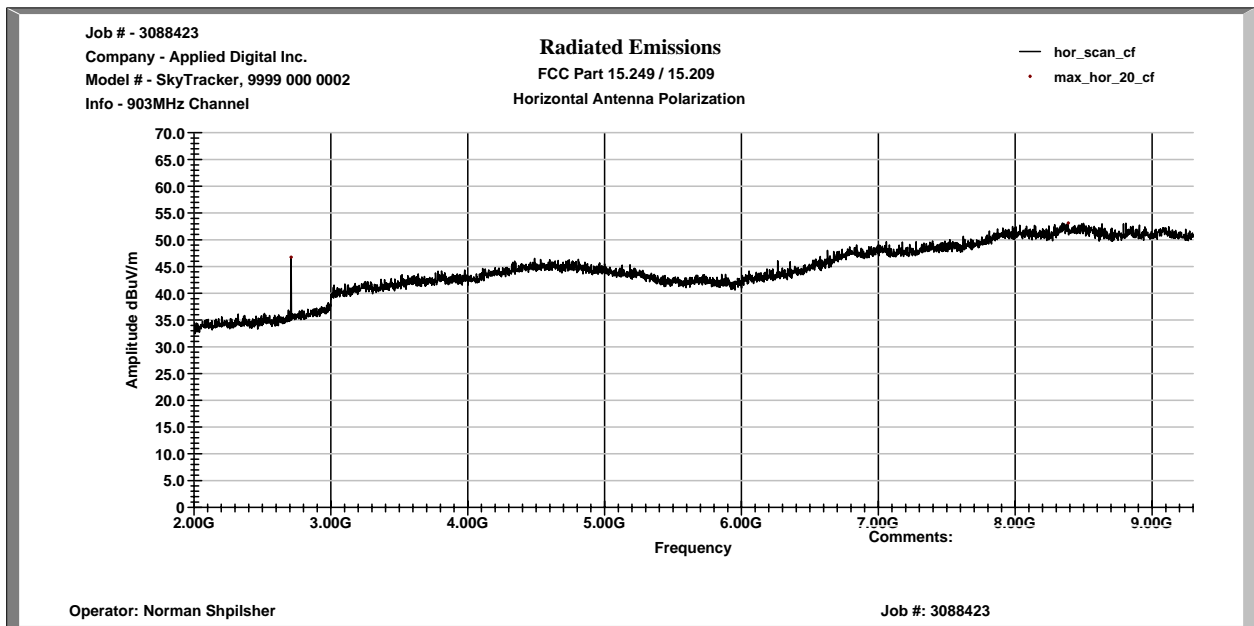


**Graph # 3-2-3**  
**903MHz Channel, Radiated Emissions from 2 to 9.3GHz**

**Vertical Antenna Polarization**



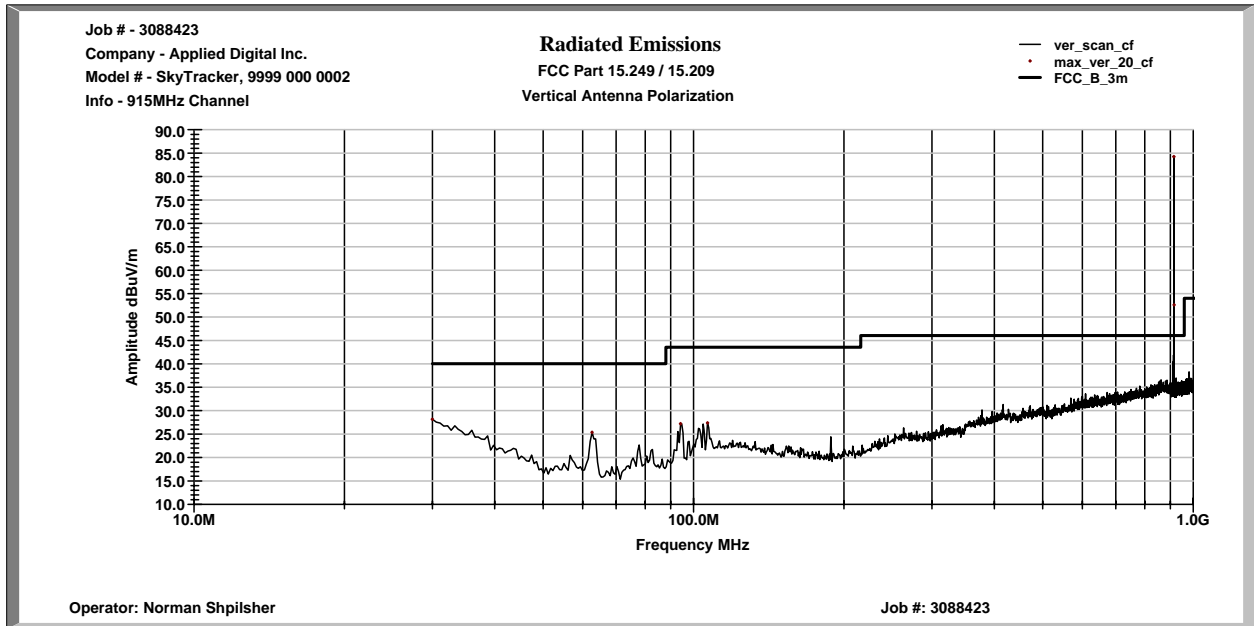
**Horizontal Antenna Polarization**



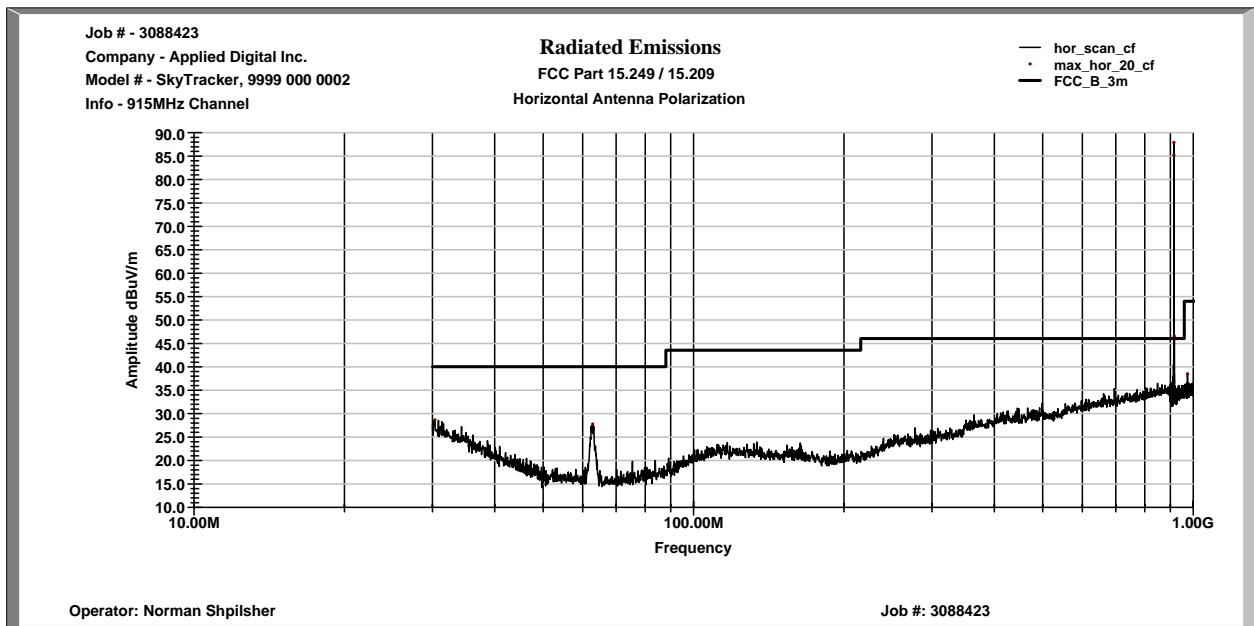
# Graph # 3-2-5

## 915MHz Channel, Radiated Emissions from 30MHz to 1GHz

### Vertical Antenna Polarization

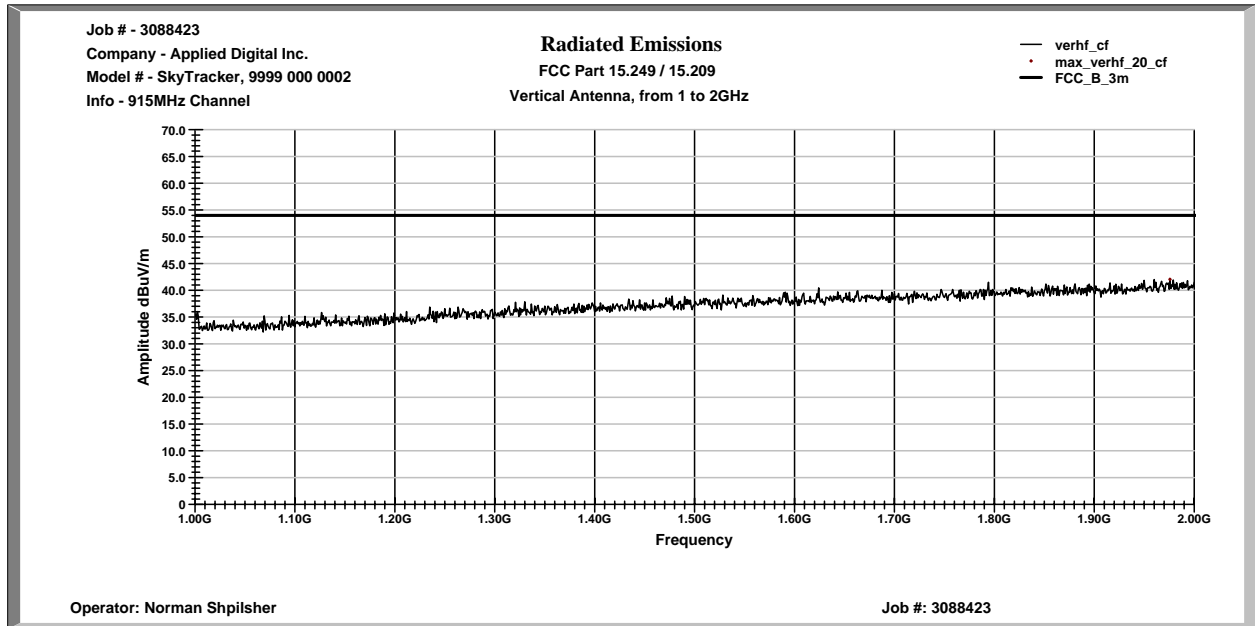


### Horizontal Antenna Polarization

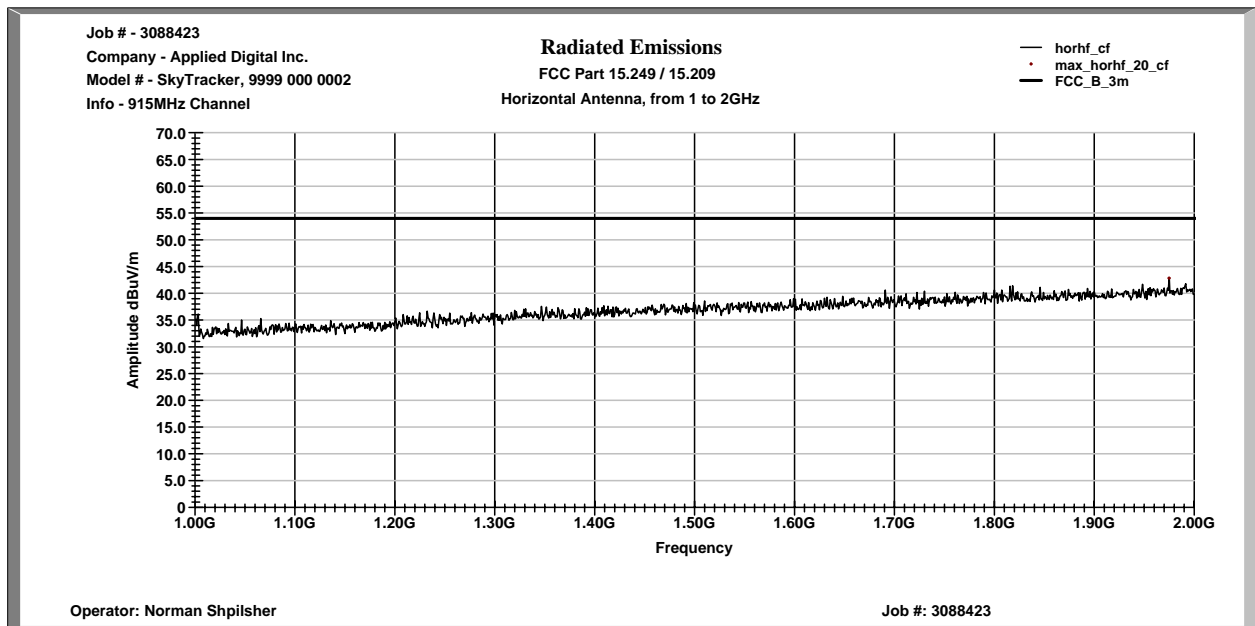


**Graph # 3-2-5**  
**915MHz Channel, Radiated Emissions from 1 to 2GHz**

**Vertical Antenna Polarization**



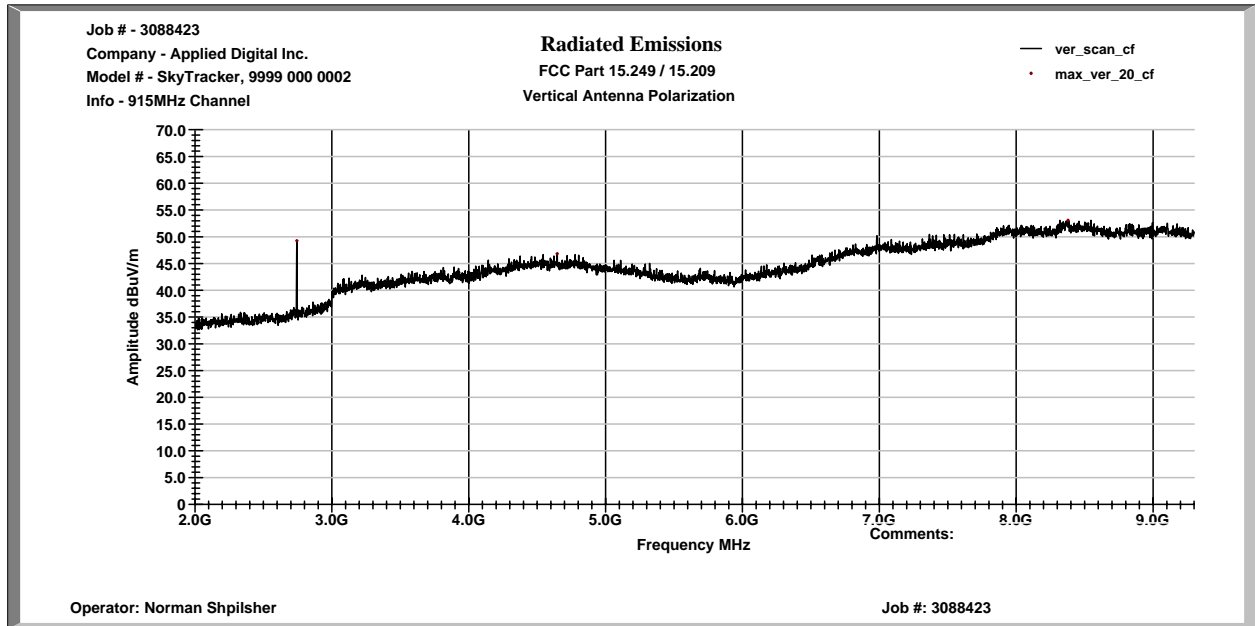
**Horizontal Antenna Polarization**



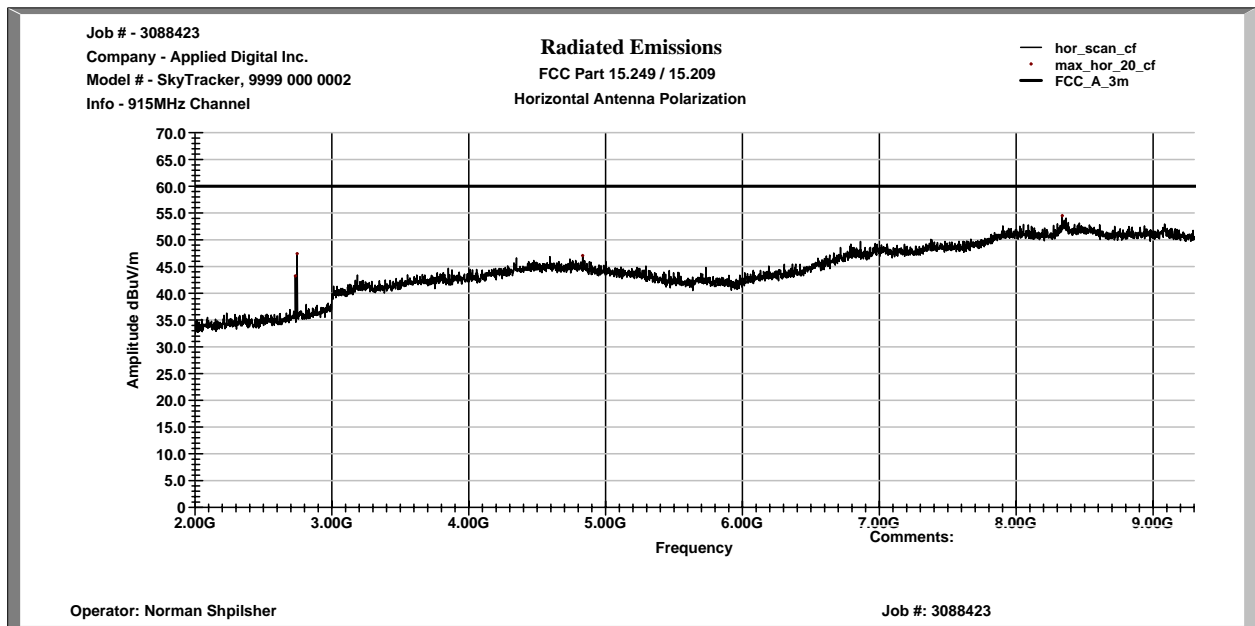


**Graph # 3-2-6**  
**915MHz Channel, Radiated Emissions from 2 to 9.3GHz**

**Vertical Antenna Polarization**



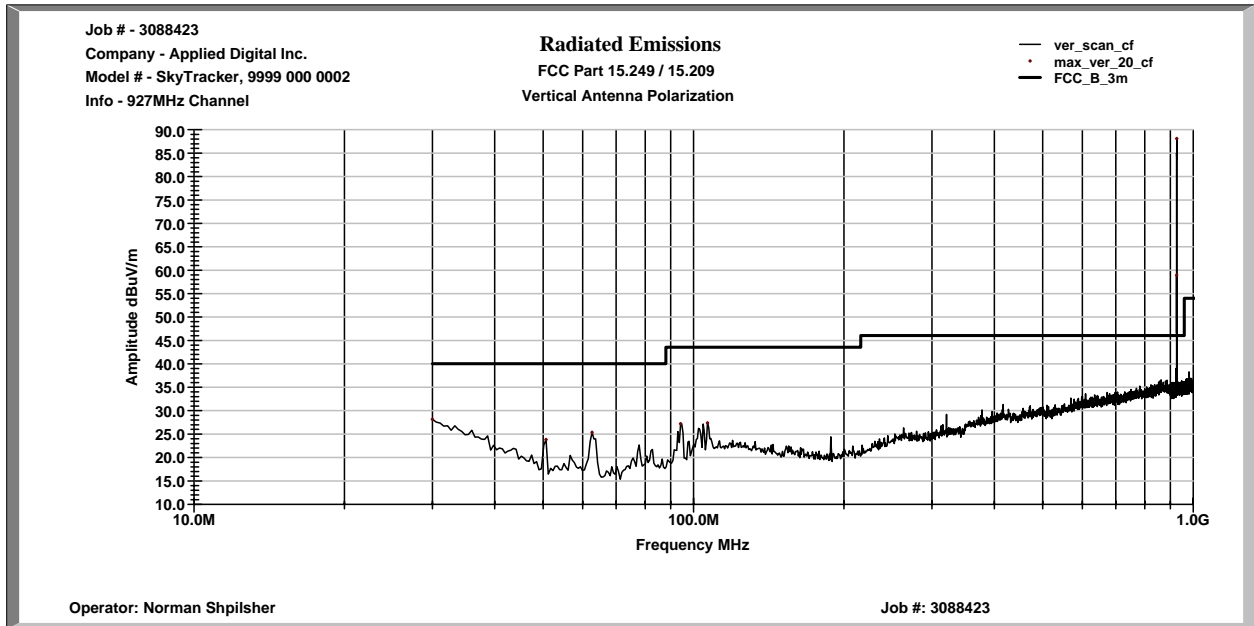
**Horizontal Antenna Polarization**



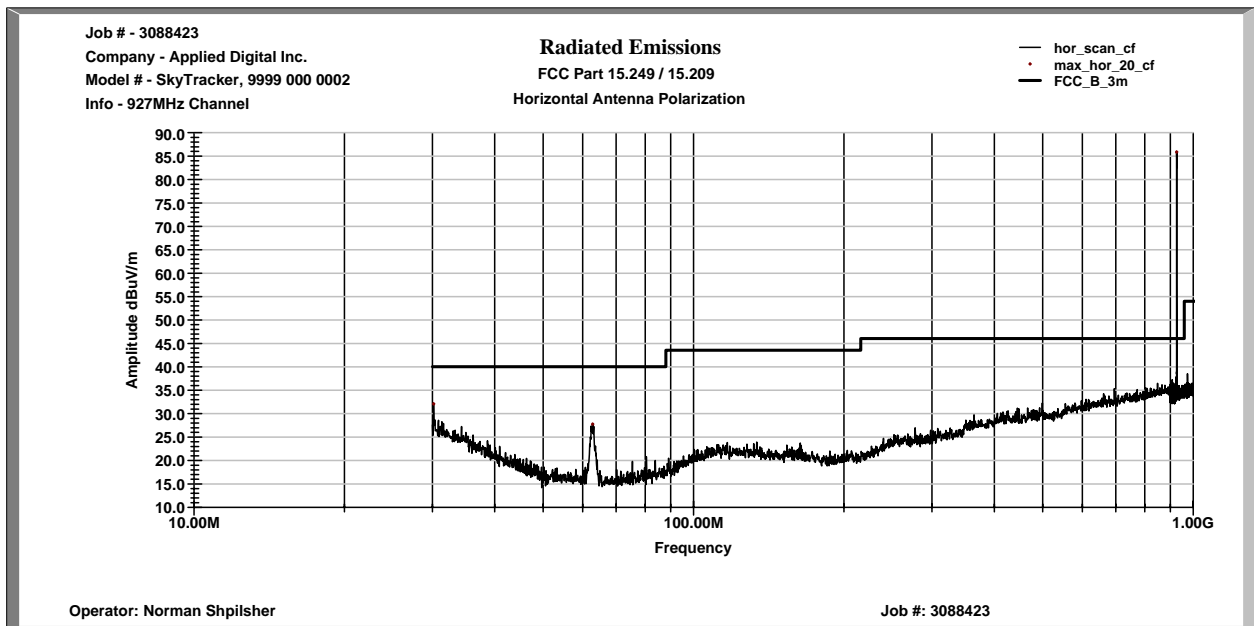
# Graph # 3-2-7

## 927MHz Channel, Radiated Emissions from 30MHz to 1GHz

### Vertical Antenna Polarization

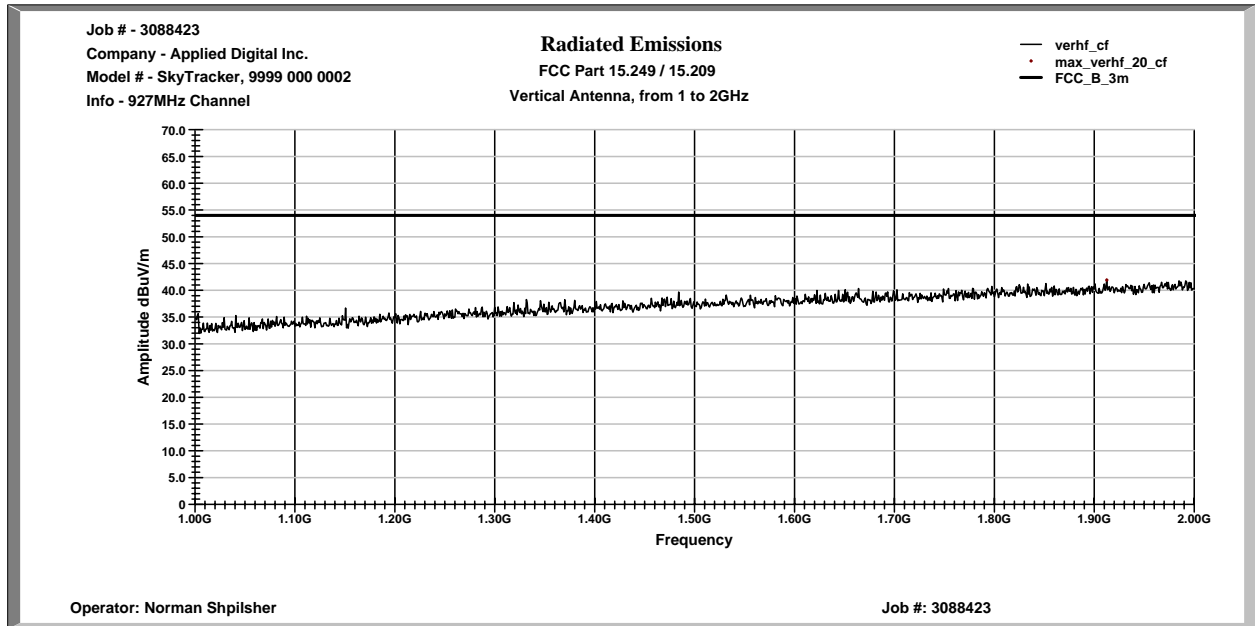


### Horizontal Antenna Polarization

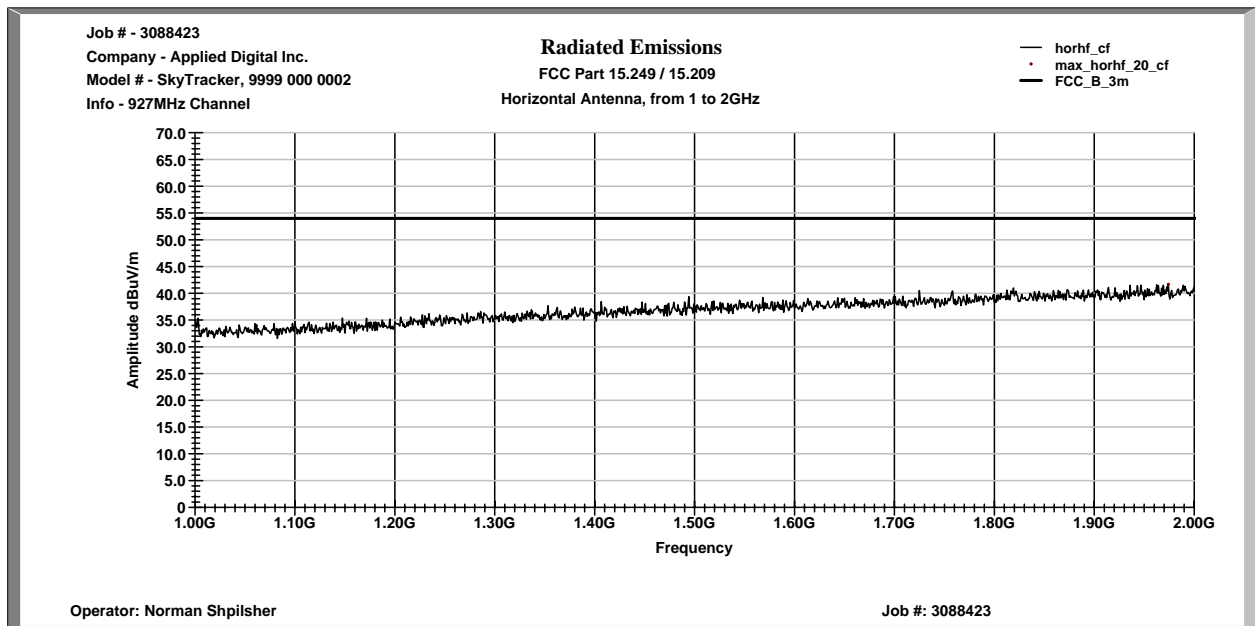


**Graph # 3-2-8**  
**927MHz Channel, Radiated Emissions from 1 to 2GHz**

**Vertical Antenna Polarization**

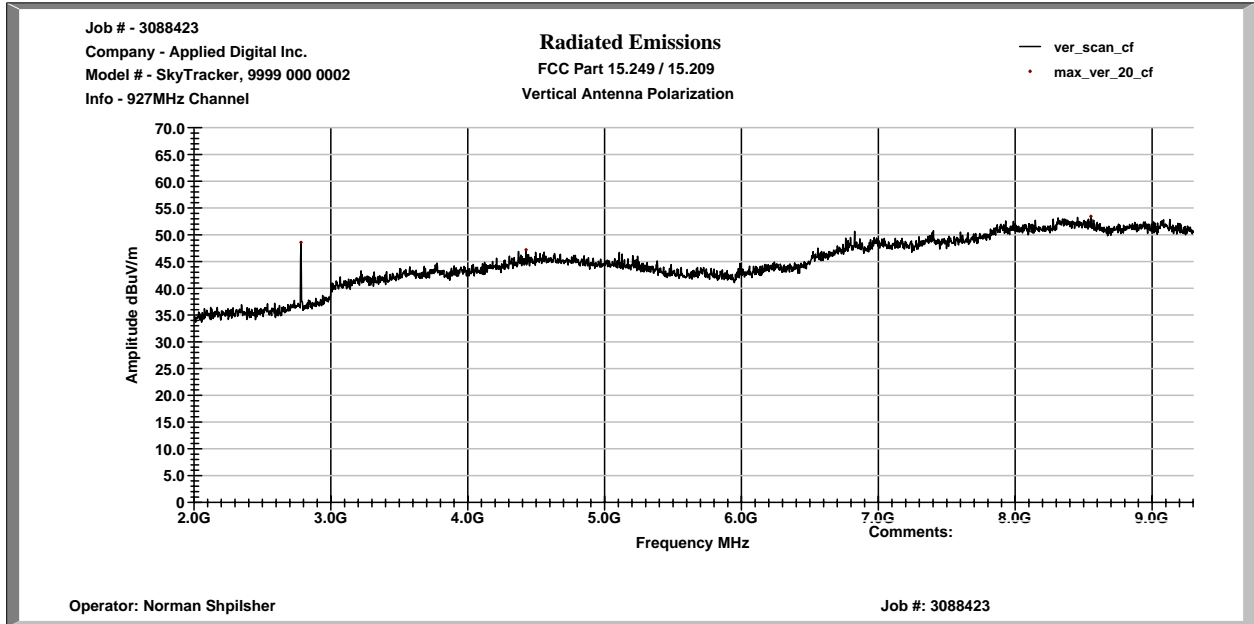


**Horizontal Antenna Polarization**

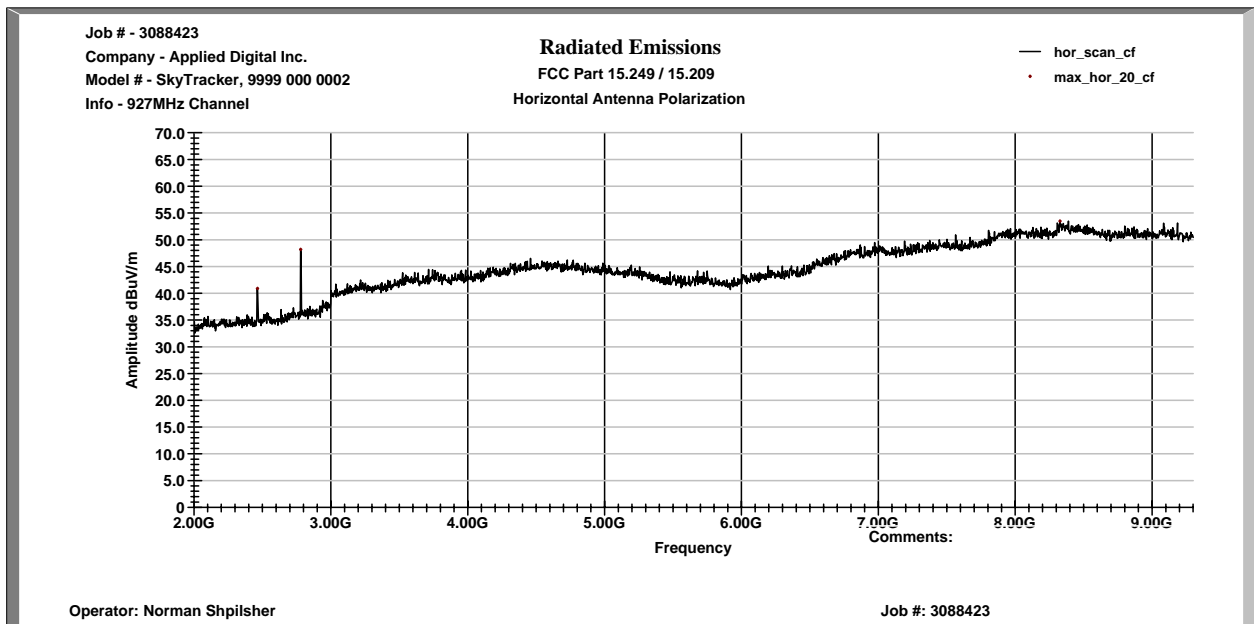


**Graph # 3-2-9**  
**927MHz Channel, Radiated Emissions from 2 to 9.3GHz**

**Vertical Antenna Polarization**



**Horizontal Antenna Polarization**



### 3.3 Out of Band Emissions, FCC 15.249(d), 15.209

Out-of-band measurements were made for frequencies:  
902MHz at low frequency channel of 903MHz, and  
928MHz high frequency channel of 927MHz

The EUT complies with the Standard requirements of Out of Band Spurious Emissions for Section 15.209.

The Table 3-3-1 and Graphs 3-3-1 and 3-3-2 show the Out of Band Spurious Emissions.

**Note:** Emissions level shown on the Graphs do not include the Antenna Factor, Cable Loss; no Pre-amplifier was used during measurements.

**Band Edge Radiated Emissions**                      **Date:**            01-12-2006

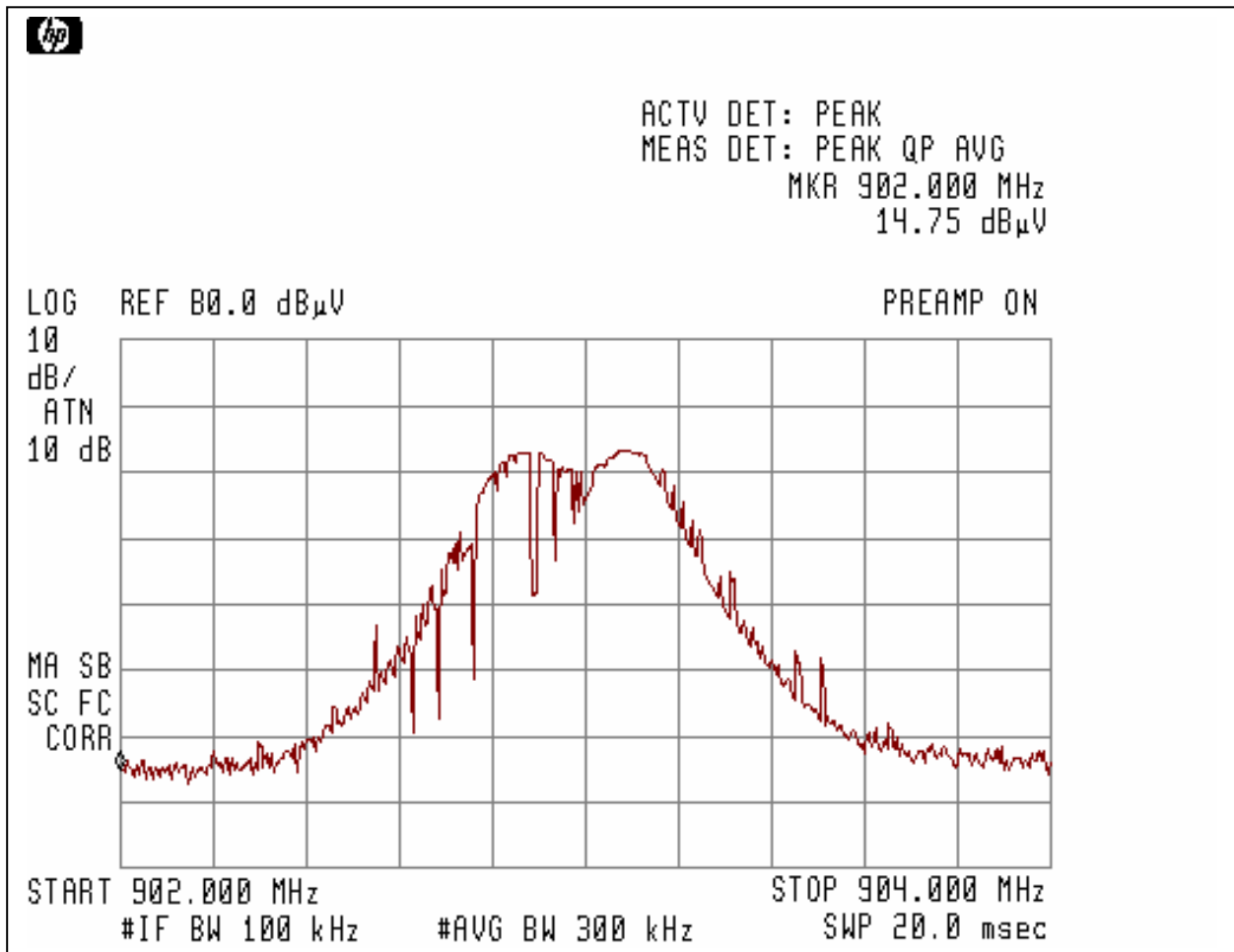
**Company:**            Applied Digital Inc.  
**Model:**                Sky Tracker  
**Test Engineer:**    Norman Shpilsher  
**Special Info:**  
**Standard:**            FCC Parts 15.249(d), 15.209  
**Test Site:**            3m Anechoic Chamber, 3m measurement distance  
**Note:**

**Table # 3-3-1**

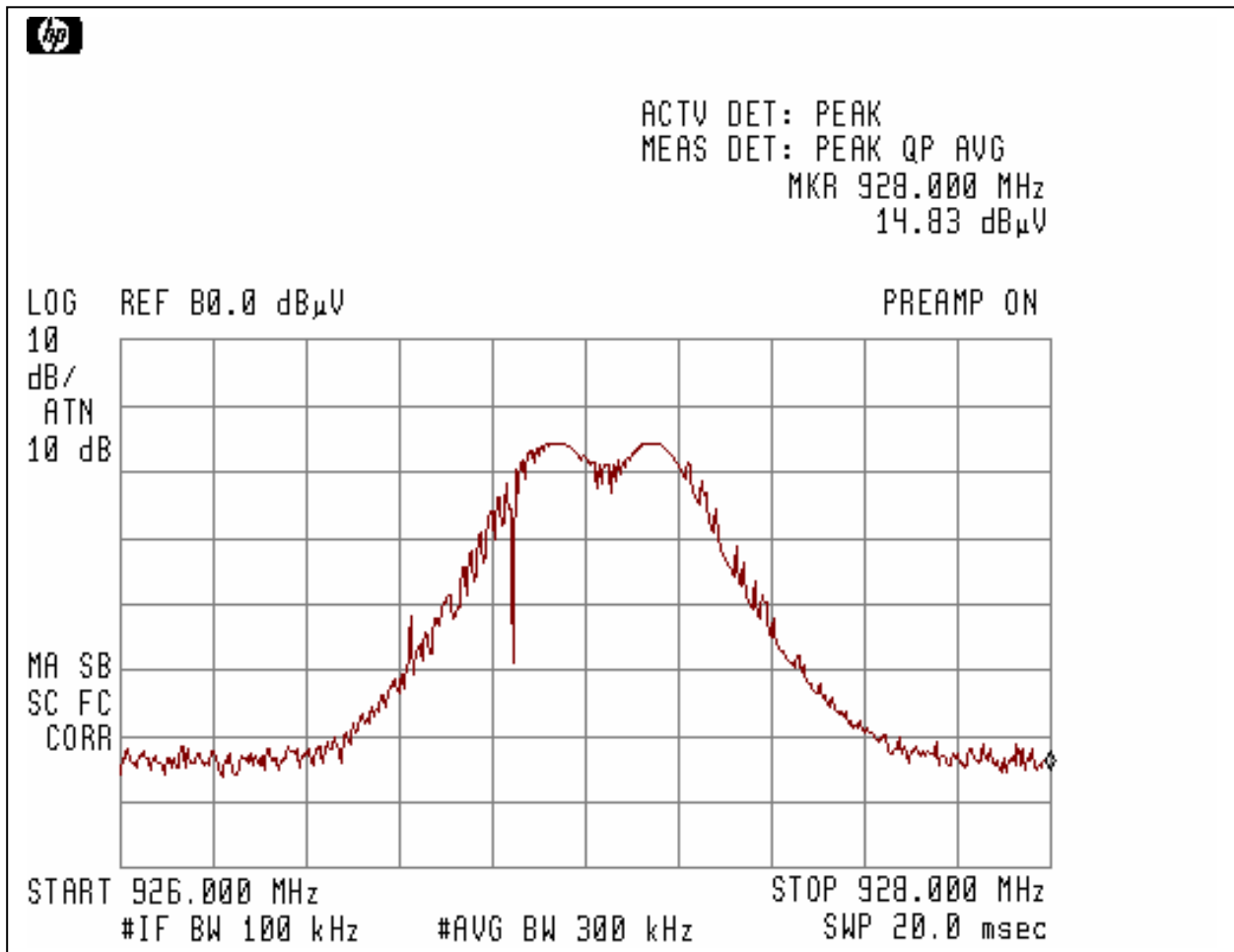
Frequency MHz	Antenna Factor (dB1/m)	Readings dBμV	Total at 3m dBμV/m	15.209 Limit dBμV/m	Margin dB	Comments
903MHz Channel						
902.00	25.0	14.8	39.8	54.0	-14.2	
927MHz Channel						
928.00	25.3	14.8	40.1	54.0	-13.9	

**Comments:**

**Graph # 3-3-1**  
**903MHz Channel, Out of Band Emissions at 902MHz**



Graph # 3-3-2  
927MHz Channel, Out of Band Emissions at 902MHz



### **3.4 Bandwidth of Emissions, FCC 15.215**

Bandwidth of Emissions measurements was made for frequency of 915MHz.

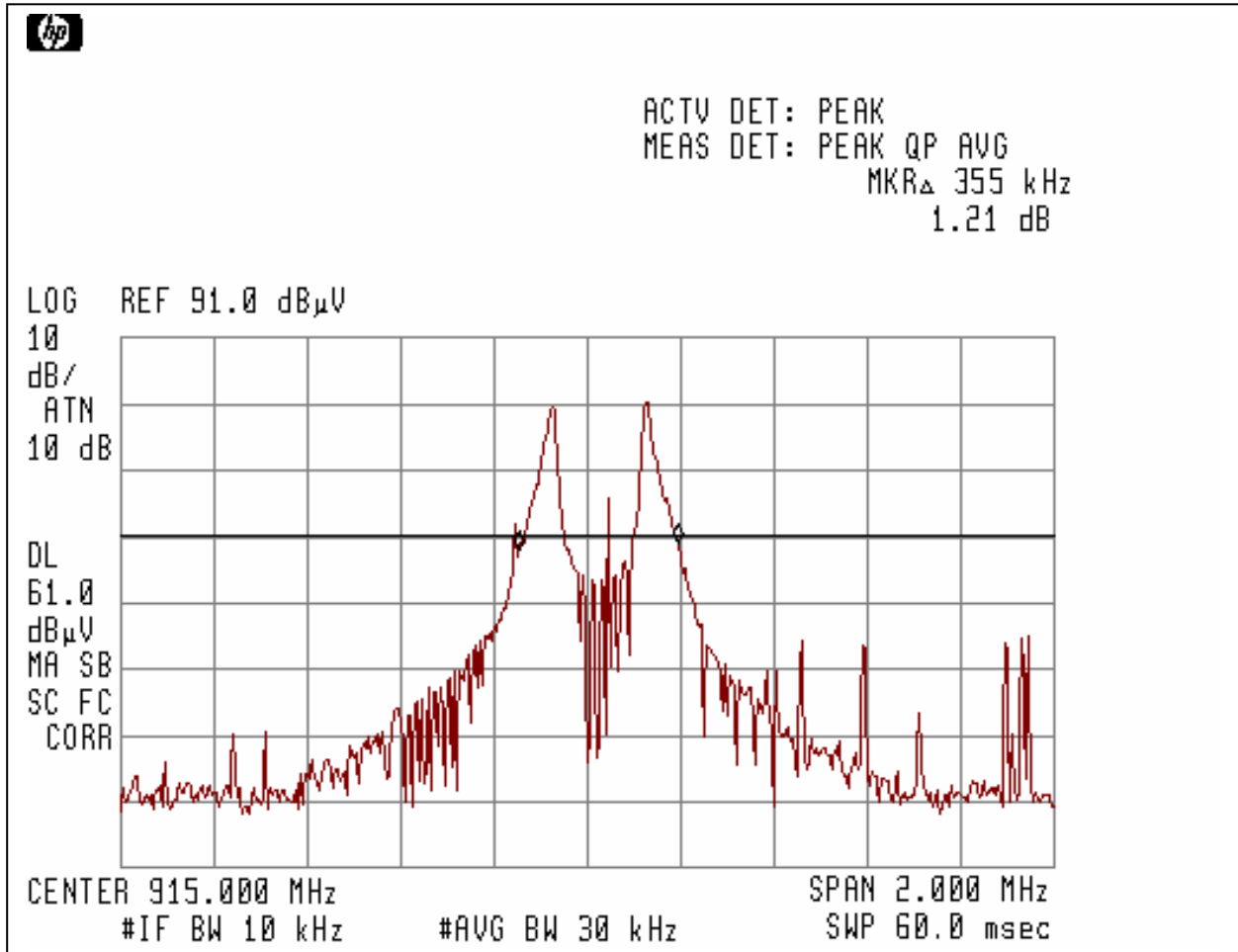
Bandwidth of Emissions at -20dB level was measured at 355kHz.

Bandwidth of Emissions at 99% power was measured at 325kHz.

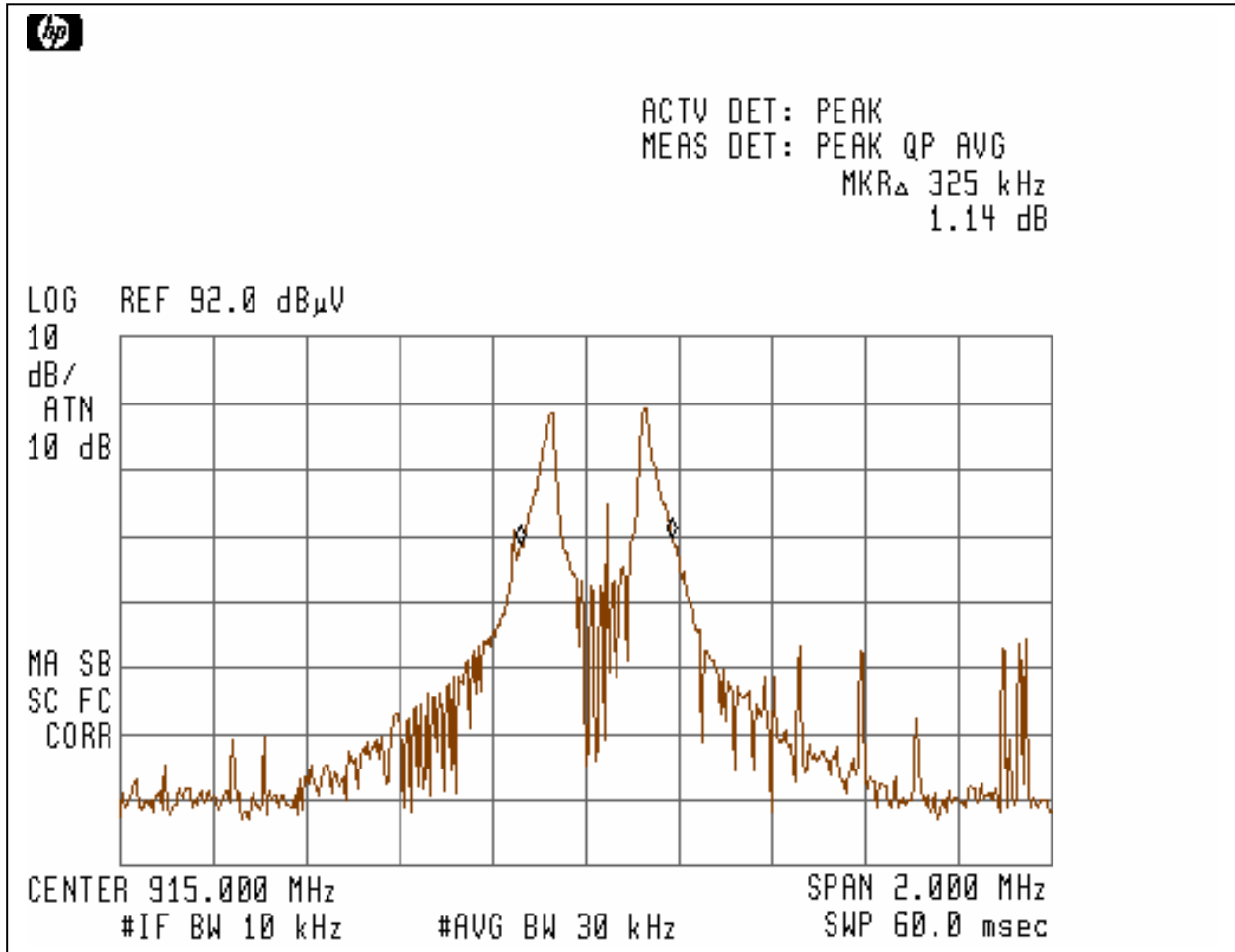
The Graphs 3-4-1 and 3-4-2 show the Bandwidth of Emissions.



**Graph # 3-4-1**  
**20dB Bandwidth of Emissions**



**Graph # 3-4-2**  
**99% Bandwidth of Emissions**



### 3.5 Radiated Emissions, FCC 15.109

The EUT as a digital device was tested according to FCC Part 15.109, Class B in frequency range from 30MHz to 1GHz.

The Table 3-5-1 and Graph 3-5-1 show the Field Strength of Radiated Emissions from 30MHz to 1GHz.

#### Radiated Emissions from 30MHz to 1GHz

Date: 01-11-2006

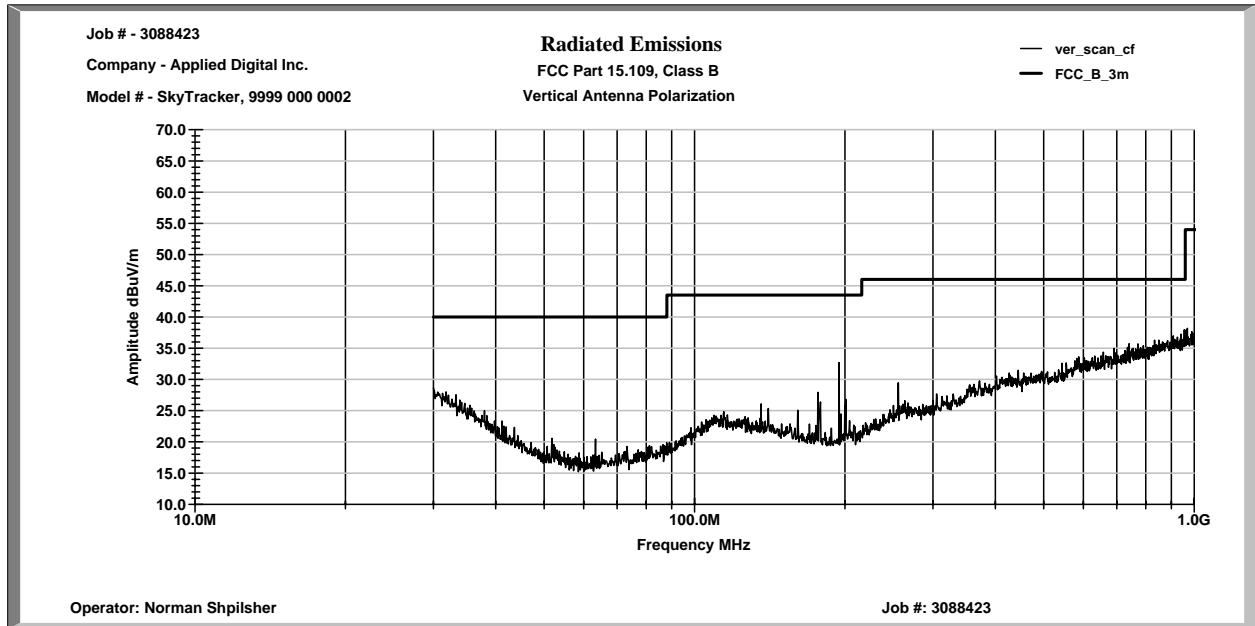
**Company:** Applied Digital Inc.  
**Model:** Sky Tracker  
**Test Engineer:** Norman Shpilsher  
**Special Info:**  
**Standard:** FCC Part 15.109, Class B  
**Test Site:** 3m Anechoic Chamber, 3m measurement distance  
**Note:** The table shows the worst case radiated emissions  
All measurements were taken using a Peak detector

**Table # 3-5-1**

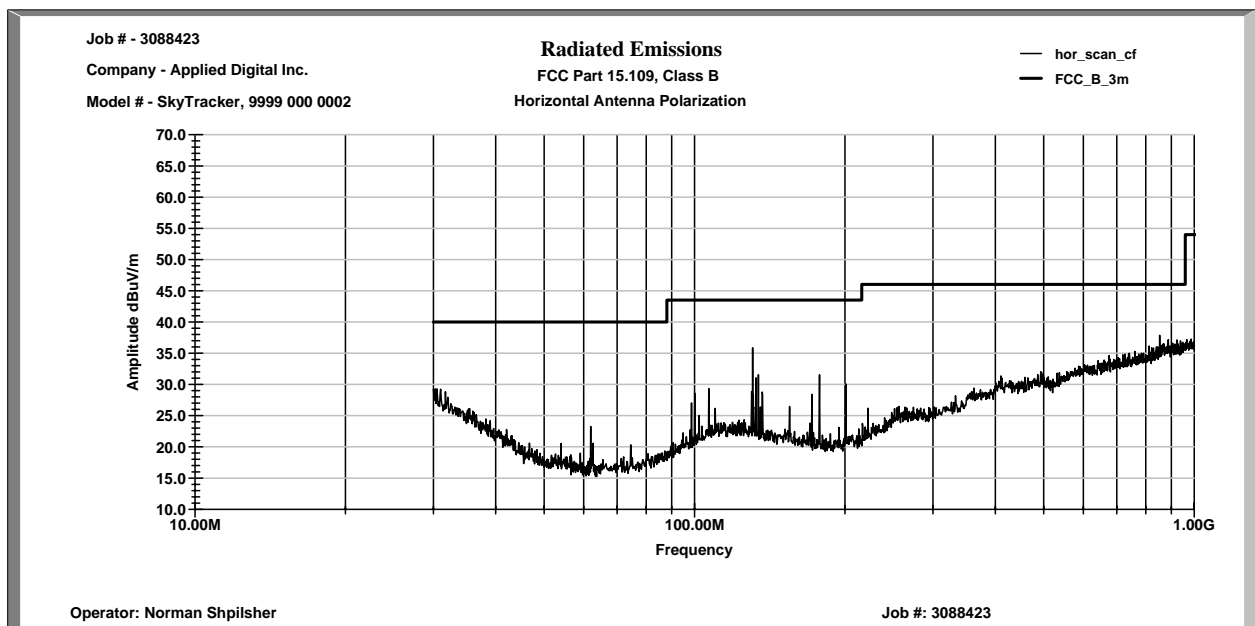
Frequency	Ant. Polarity	Reading dBμV	Ant. Factor dB1/m	Total at 3m dBμV/m	QP Limit dBμV/m	Margin dB
30.0 MHz	V	9.7	18.9	28.6	40.0	-11.4
176.62 MHz	V	17.1	10.8	27.9	43.5	-15.6
194.71 MHz	V	21.7	11.0	32.7	43.5	-10.8
200.74 MHz	V	15.2	11.6	26.8	43.5	-16.7
255.79 MHz	V	14.6	14.9	29.5	46.0	-16.6
30.519 MHz	H	10.7	18.6	29.3	40.0	-10.7
61.949 MHz	H	16.4	6.8	23.3	40.0	-16.8
130.67 MHz	H	16.9	13.0	29.9	43.5	-13.6
132.72 MHz	H	18.1	12.9	31.1	43.5	-12.5
134.21 MHz	H	18.7	12.8	31.5	43.5	-12.0
136.64 MHz	H	16.1	12.7	28.8	43.5	-14.8
154.92 MHz	H	14.8	11.7	26.5	43.5	-17.1
171.8 MHz	H	17.4	11.0	28.4	43.5	-15.1
177.83 MHz	H	20.7	10.8	31.5	43.5	-12.0
200.74 MHz	H	18.4	11.6	30.1	43.5	-13.5
853.23 MHz	H	13.4	22.5	37.9	46.0	-10.2

**Graph # 3-5-1**  
**FCC Part 15.109, Class B Radiated Emissions**

**Vertical Antenna Polarization**



**Horizontal Antenna Polarization**



### 3.6 Test Procedure

#### Field Strength Measurements

The EUT was placed on a non-conductive table 0.8m above the ground plane inside the Anechoic Chamber. The table was centered on a motorized turntable, which allows 360-degree rotation. The measurement antenna was positioned at 3m distance. The Bicono-Log antenna was used in frequency range from 30MHz to 1GHz, and the Horn antenna was used in frequency range above 1GHz. The radiated emissions were maximized by configuring the EUT through its placement in three orthogonal axes, by rotating the EUT, by changing antenna polarization, and by changing

### 3.7 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured emissions reading on the EMI Receiver.

The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where: FS = Field Strength in dB( $\mu$ V/m)

RA = Receiver Amplitude in dB( $\mu$ V)

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB( $m^{-1}$ )

AG = Amplifier Gain in dB

Assume a receiver reading of 48.1 dB( $\mu$ V) is obtained. The antenna factor of 7.4 dB( $m^{-1}$ ) and cable factor of 1.6 dB is added and amplifier gain of 16.0 dB is subtracted giving field strength of 41.1 dB( $\mu$ V/m).

$$RA = 48.1 \text{ dB}(\mu V)$$

$$AF = 7.4 \text{ dB}(m^{-1})$$

$$CF = 1.6 \text{ dB}$$

$$AG = 16.0 \text{ dB}$$

$$FS = RA + AF + CF - AG$$

$$FS = 48.1 + 7.4 + 1.6 - 16.0$$

$$FS = 41.1 \text{ dB}(\mu V/m)$$

In the tables the Cable correction factors are included to the Antenna Factors.

Tested by:

Norman Shpilsher  
EMC Engineer  
Intertek ETL SEMKO

Signature

Date: January 12, 2006

#### 4.0 TEST EQUIPMENT

##### Receivers/Spectrum Analyzers and Test Software

DESCRIPTION	SERIAL NO.	LAST CAL	CAL DUE	USED
HP85462A Receiver RF Section	3325A00106	10/05	10/06	
HP85460A RF Filter Section	3330A00109	10/05	10/06	
HP85462A Receiver RF Section	3549A00306	01/05	01/17/06	X
HP85460A RF Filter Section	3448A00276	01/05	01/17/06	X
Rohde & Schwarz FSP 40 Spectrum Analyzer	100024	08/05	08/06	X
Advantest R3271A Spectrum Analyzer	55050084	08/05	08/06	
Agilent E7402A Spectrum Analyzer	MY44212200	09/05	09/06	
TILE! Instrument Control System	Ver. 3.4 H.1	N/A	N/A	X

##### Antennas/ Pre-Amplifiers

DESCRIPTION	SERIAL NO.	LAST CAL	CAL DUE	USED
Schaffner-Chase Bicono-Log Antenna	2468	12/05	12/06	X
Schaffner-Chase Bicono-Log Antenna	2630	08/05	08/06	
EMCO Horn Antenna 3115	6579	01/05	01/26/06	X
CTT 66087 Pre-Amplifier	34511	12/05	12/06	
CompPower PA-122 Pre-Amplifier	02116	10/05	10/06	X
Reactel 7HS-1G-S12 Filter	0223	03/05	03/06	X

##### Artificial Mains Networks/Absorbing Clamps

DESCRIPTION	SERIAL NO.	LAST CAL	CAL DUE	USED
FCC LISN-2	316	04/05	04/06	
FCC-LISN-50-25-2	2014	05/05	05/06	

