

## **1.0 Introduction**

This application for Permissive change is submitted based on modifications to the original product certified under FCC ID: HDCTRACER2T1.

Modifications are being made to the device enclosure and the filter section of the transmitter.

The attached data measured at Intertek Testing Services indicates that the emissions performance is as good or better than those obtained for the original filing.

## **2.0 Product Modifications**

The following modifications were made to the transmitter section of the EUT.

The enclosure was modified. The enclosure maintains the same overall appearance of the original rack mount enclosure. Small modifications were made to the overall width to allow the device to accommodate various rack mount situations. The internal RF unit is contained in a sealed, milled aluminum housings that did not change.

The modifications to the RF filter section are as follows. The Circulator (Adtran PN 3216S245CCW) and Filter section (Adtran PN 321624212462) have been replaced with a Diplexer (Adtran PN 3354DIPLEX02A). The removal of the filter/circulator and replacement with a diplexer with additional poles improved the overall system performance reduced emissions even further in the FCC restricted bands.

### 3.0 Emissions Data

Conducted Spurious Emissions and Radiated Spurious emissions are provided in the attached plots. For Radiated Emissions data, the EUT was configured with a typical radiating antenna. Measurements in the restricted band were performed using a bandpass filter installed on the input of the measurement receiver to improve sensitivity and reduce overload conditions.

Figure 3.5-1	Conducted Spurious Emissions 2422 MHz Transmit Frequency
Figure 3.5-2	Conducted Spurious Emissions 2462 MHz Transmit Frequency
Table 3.5-2	Radiated Emissions (1-22 GHz) 2422 MHz Transmit Frequency Conifer 23 dBi, 3' Semi-Parabolic
Table 3.5-3	Radiated Emissions (30-1000 MHz) 2422 MHz Transmit Frequency Conifer 23 dBi 3' Semi-Parabolic
Table 3.5-4	Radiated Emissions (30-1000 MHz) 2462 MHz Transmit Frequency Conifer 23 dBi 3' Semi-Parabolic
Figure 3.5-3	Radiated Emissions, Peak Radiated Output Power, Conifer 23 dBi 3' Semi-Parabolic
Figure 3.5-4	Radiated Emissions, Average Radiated Output Power, Conifer 23 dBi 3' Semi-Parabolic
Figure 3.5-5	Radiated Emissions, 2.462 GHz TX, Restricted Band (24835-2500 MHz) Conifer 23 dBi 3' Semi-Parabolic, Vertical
Figure 3.5-6	Radiated Emissions, 2.462 GHz TX, Restricted Band (24835-2500 MHz) Conifer 23 dBi 3' Semi-Parabolic, Horizontal
Figure 3.5-7	Radiated Emissions, 2.422 GHz TX, Restricted Band (24835-2500 MHz) Conifer 23 dBi 3' Semi-Parabolic
Table 3.5-5	Radiated Spurious Emissions, (1 – 22 GHz) Comsat 27.5 dBi 4' Parabolic
Figure 3.5-8	Radiated Emissions, Peak Radiated Output Power, Comsat 27.5 dBi 4' Parabolic
Figure 3.5-9	Radiated Emissions, Average Radiated Output Power, Comsat 27.5 dBi 4' Parabolic
Figure 3.5-10	Radiated Emissions, 2.462 GHz TX, Restricted Band (24835-2500 MHz) Comsat 27.5 dBi 4' Parabolic, Vertical
Figure 3.5-11	Radiated Emissions, 2.462 GHz TX, Restricted Band (24835-2500 MHz) Comsat 27.5 dBi 4' Parabolic, Horizontal
Figure 3.5-12	Radiated Emissions, Peak Radiated Output Power, Cushcraft 13.9 dBi Yagi.
Figure 3.5-13	Radiated Emissions, Average Radiated Output Power, Cushcraft 13.9 dBi Yagi
Figure 3.5-14	Radiated Emissions, 2.462 GHz TX, Restricted Band (24835-2500 MHz) Cushcraft 13.9 dBi Yagi Vertical
Figure 3.5-15	Radiated Emissions, 2.462 GHz TX, Restricted Band (24835-2500 MHz) Cushcraft 13.9 dBi Yagi Horizontal
Table 3.5-7	Radiated Spurious Emission (1-22 GHz) Avitronics 16 dBi Flat Panel Array.
Figure 3.5-16	Radiated Emissions, Peak Radiated Power, Avitronics 16 dBi Flat Panel Array
Figure 3.5-17	Radiated Emissions, Average Radiated Power, Avitronics 16 dBi Flat Panel Array
Figure 3.5-18	Radiated Emissions, 2.462 GHz TX, Restricted Band (24835-2500 MHz) Avitronics 16 dBi Flat Panel Array, Vertical
Figure 3.5-19	Radiated Emissions, 2.462 GHz TX, Restricted Band (24835-2500 MHz) Avitronics 16 dBi Flat Panel Array, Horizontal

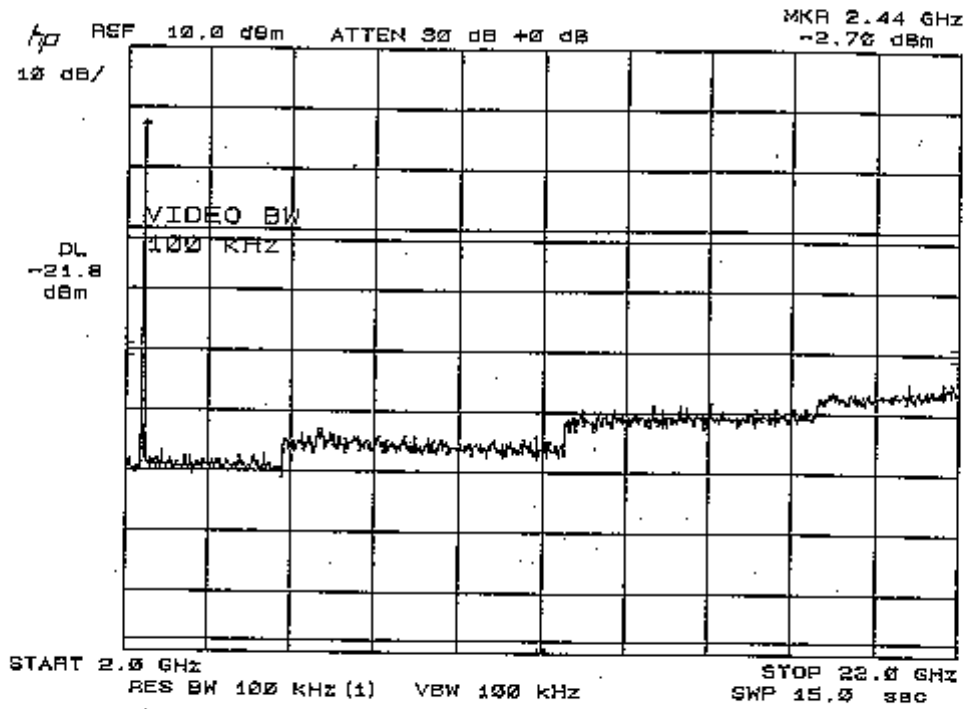


Figure 3.5 - 1: Conducted Spurious - Frequency Plan A

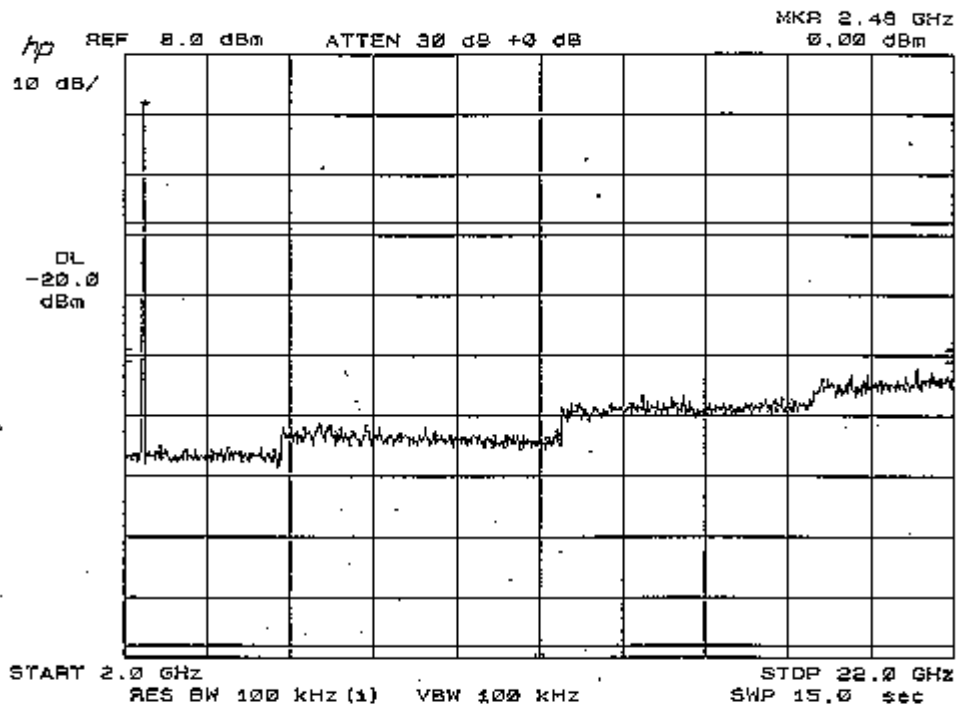


Figure 3.5 - 2: Conducted Spurious - Frequency Plan B

4280TRACERT1L1  
Adtran Inc.

# ITS Intertek Testing Services

## Semi Parabolic Reflector Antenna: Radiated Emission Test per

The data shown below lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

The antenna used during this test was a Conifer 26T-2400 with 23 dBi of gain. This was the highest gain of listed antennas of this type.

Table 3.5 - 2: Radiated Spurious Emissions, 1000 - 22000 MHz

Company: Adtran Inc.  
Model: 4280TRACERT1L1

Date: 03/17/98  
Tested by: Jeffrey D. Hiday  
Test Distance: 3  
Job Number: J96C02908


Notes: Initial Results

Standard: FCC Part 15  
Class B

Antenna Polarity	Frequency (MHz)	Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-amp Factor (dB)	External Attn (dB)	Net (dBuV/m)	Limit (dBuV/m)	Margin (dB)
h	7246.4	42.0	38.5	4.7	36.3	3.0	49.9	54.0	-4.1
v	7254.0	35.8	38.5	4.7	36.3	3.0	44.7	54.0	-9.3

Note: There were no other emissions detected within 10 dB of the limit.

### TEST PERSONNEL:

  
Tester Signature

Jeffrey D. Hiday / Project Engineer  
Typed/Printed Name

04-30-98  
Date



Semi Parabolic Reflector Antenna: Conifer 3' Semi-Parabolic Plots

- The following plot contains the peak radiated output of the Conifer 3' Semi-Parabolic dish antenna (Model Number: 26T-2400). This antenna has a 23 dBi gain. The plot shows average carrier data for the antenna in horizontal polarization. No pre-amplifier and no external attenuation were used for this plot. The measuring systems losses were 32.4 dB.

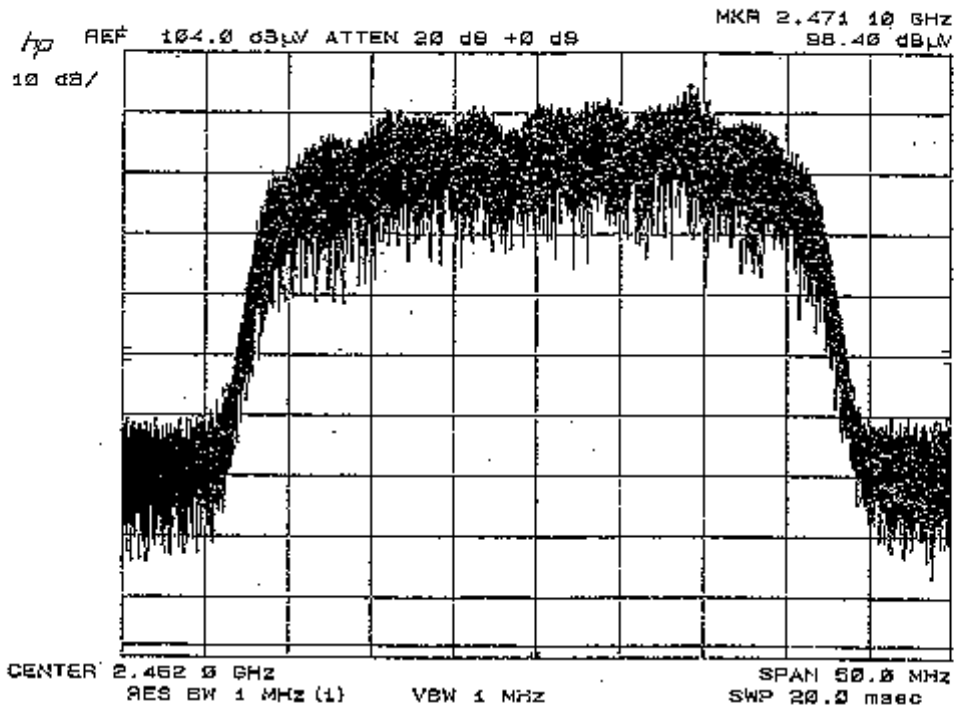


Figure 3.5 - 3: Conifer 3' Semi-Parabolic (26T-2400) 23 dBi - Peak Plot

Semi Parabolic Reflector Antenna: Conifer 3' Semi-Parabolic Plots

The following plot contains the average radiated output of the Conifer 3' Semi-Parabolic dish antenna (Model Number: 26T-2400). This antenna has a 23 dBi gain. The plot shows peak carrier data for the antenna in horizontal polarization. No pre-amplifier and no external attenuation were used for this plot. The measuring systems losses were 32.4 dB.

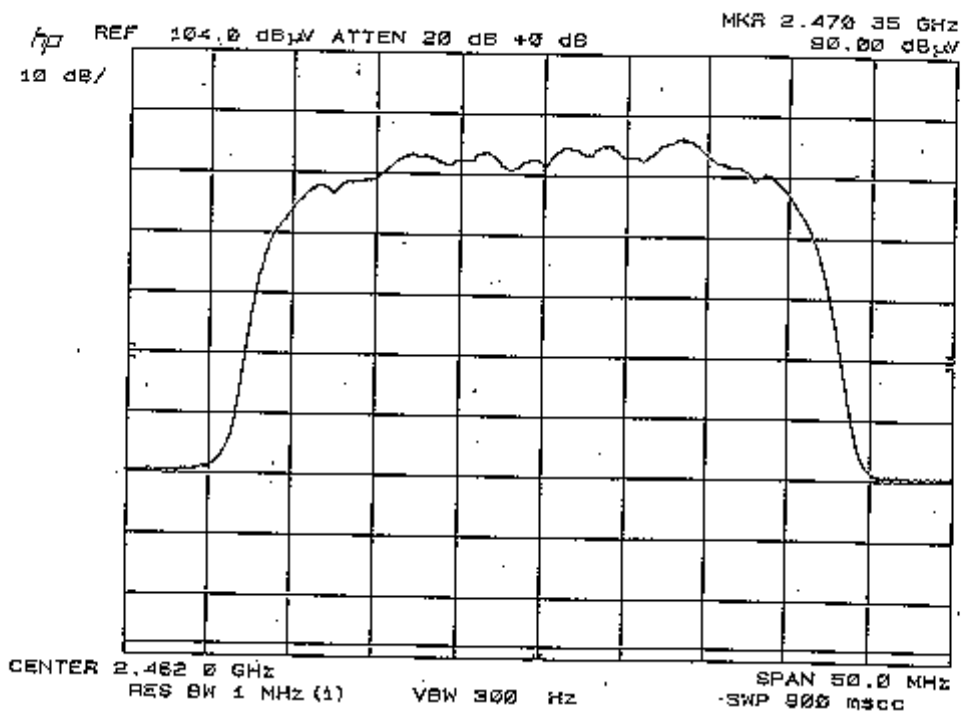


Figure 3.5 - 4: Conifer 3' Semi-Parabolic (26T-2400) 23 dBi - Average Plot



**Semi Parabolic Reflector Antenna: Conifer 3' Semi-Parabolic Plots**

The following two plots show the horizontal and vertical emissions of the EUT within the restricted band 2.4835 – 2.5 GHz. The EUT was set for frequency plan A. The analyzer was set for average detection. A bandpass filter was used to pass 2.48 – 2.6 GHz allowing the measurements to be made without overloading the analyzer. The insertion loss of this filter is approximately 3 dB. The antenna factor in the restricted band is approximately 30 dB/m. The cable loss in this band is approximately 2 dB. The pre-amplifier factor in this band is approximately 37 dB. This yields a margin of approximately 11 dB throughout this restricted band.

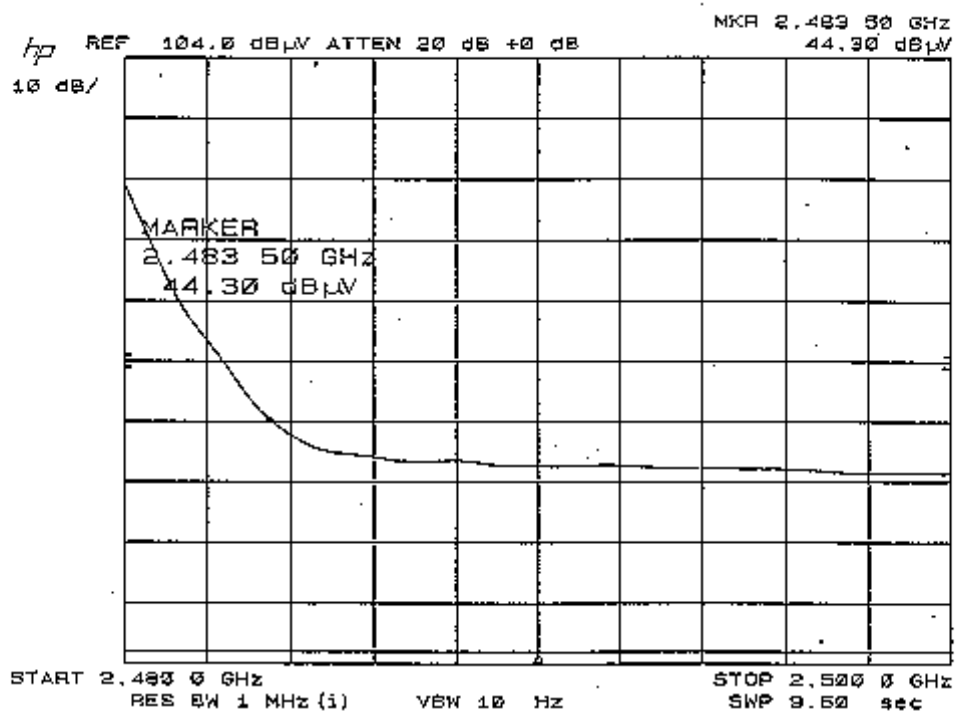


Figure 3.5 - 5: Conifer 3' Semi-Parabolic (26T-2400) 23 dBi - Restricted Band, Vertical

Semi Parabolic Reflector Antenna: Conifer 3' Semi-Parabolic Plots

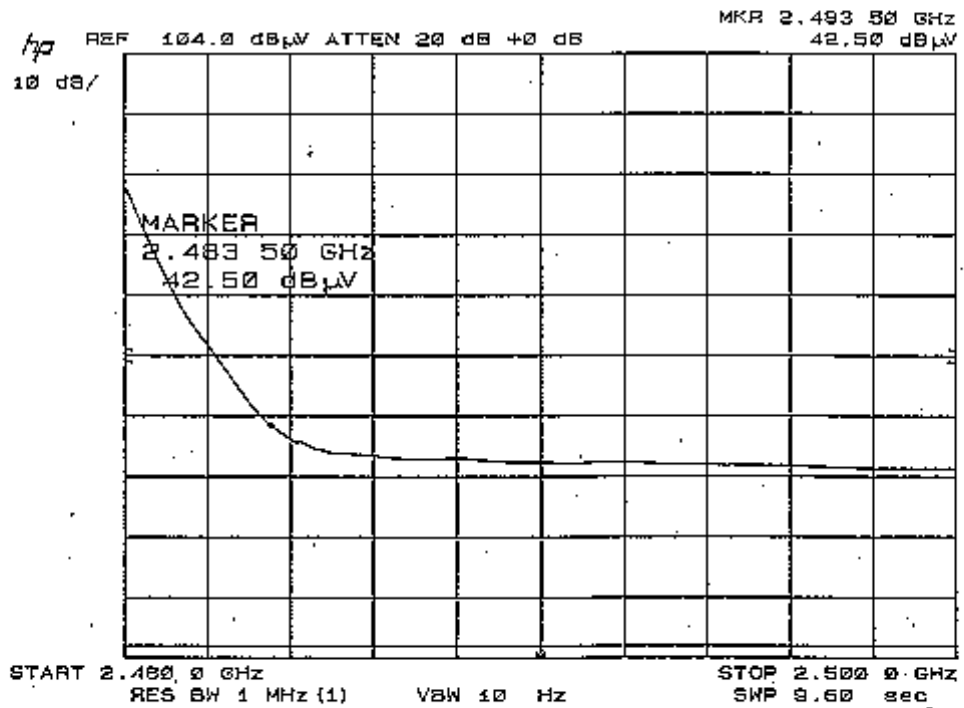


Figure 3.5 - 6: Conifer 3' Semi-Parabolic (26T-2400) 23 dBi - Restricted Band, Horizontal

Semi Parabolic Reflector Antenna: Conifer 3' Semi-Parabolic Plots

The following two plots show the horizontal and vertical emissions of the EUT within the restricted band 2.4835 – 2.5 GHz. The EUT was set for frequency plan B. The analyzer was set for average detection. A bandpass filter was used to pass 2.48 – 2.5 GHz allowing the measurements to be made without overloading the analyzer. The insertion loss of this filter is approximately 3 dB. The antenna factor in the restricted band is approximately 30 dB/m. The cable loss in this band is approximately 2 dB. The pre-amplifier factor in this band is approximately 37 dB. This yields a margin of approximately 11 dB throughout this restricted band.

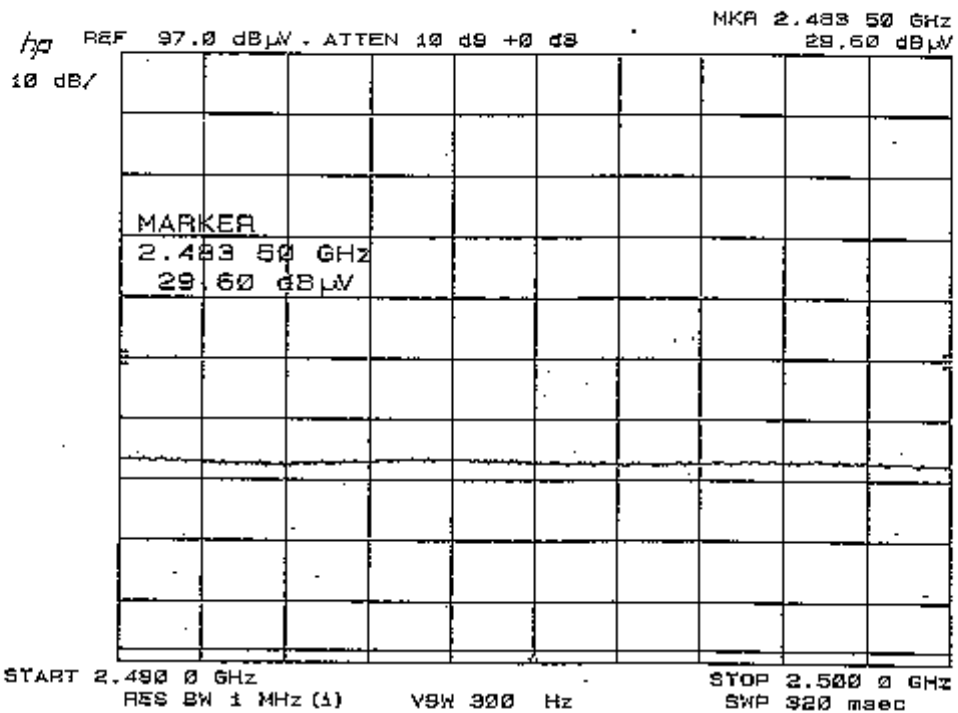


Figure 3.5 - 7: Conifer 3' Semi-Parabolic (26T-2400) 23 dBi - Restricted Band, Frequency Plan B

# ITS Intertek Testing Services

## Parabolic Dish Antenna: Radiated Emission Test per

The data shown below lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

The antenna used for this test was the Comstat P24A48GN-U. This antenna had 27.5 dBi of gain. The data indicates a margin of 10 dB from the FCC limits for all restricted bands. The largest antenna of the type listed for use with this device has a gain of 35.0 dBi.

Table 3.5 - 5: Radiated Spurious Emissions, 1000 - 22000 MHz

Company: Adtran Inc.  
Model: 4280TRACERT1L1  
Notes: Initial Results


Date: 02/18/98  
Tested by: Jeffrey D. Hiday  
Test Dist: 3  
Job Number: J98002308

Standard: FCC Part 15  
Class B

Antenna Polarity	Frequency (MHz)	Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-amp Factor (dB)	External Attn (dB)	Net (dBuV/m)	Limit (dBuV/m)	Margin (dB)
v	7261.0	33.1	36.5	4.7	36.3	3.0	41.0	54.0	-13.1

Note: There were no other emissions detected within 10 dB of the limit.

### TEST PERSONNEL:

  
Tester Signature

Jeffrey D. Hiday / Project Engineer  
Typed/Printed Name

04.30.98  
Date

Parabolic Dish Antenna: Radiated Emission Test

The following plot contains the peak radiated output of the Comstat 4' Parabolic dish antenna (Model Number: P24A48GN-U). This antenna has a 27.5 dBi gain. The plot shows peak carrier data for the antenna in vertical polarization. No pre-amplifier was used, however, 30 dB of external attenuation was used for this plot. The measuring systems losses were 32.4 dB.

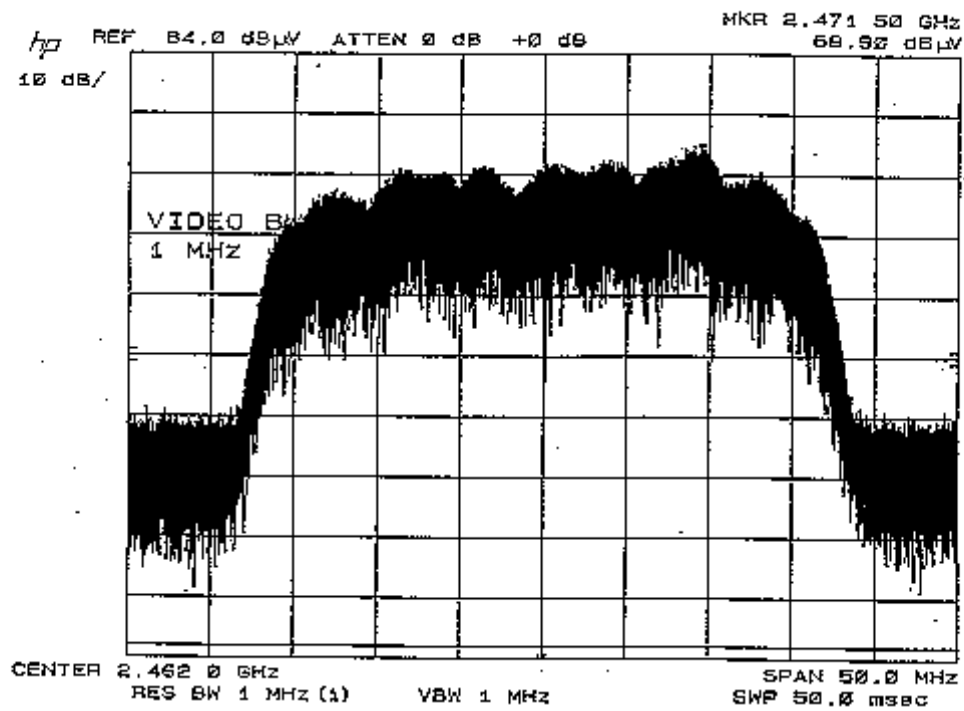


Figure 3.5 - 8: Comstat 4' Parabolic (24A48GN-U) 27.5 dBi - Peak Plot

# ITS Intertek Testing Services

## Parabolic Dish Antenna: Radiated Emission Test per

The following plot contains the average radiated output of the Comstat 4' Parabolic dish antenna (Model Number: P24A48GN-U). This antenna has a 27.5 dBi gain. The plot shows average carrier data for the antenna in vertical polarization. No pre-amplifier was used, however, 30 dB of external attenuation was used for this plot. The measuring systems losses were 32.4 dB.

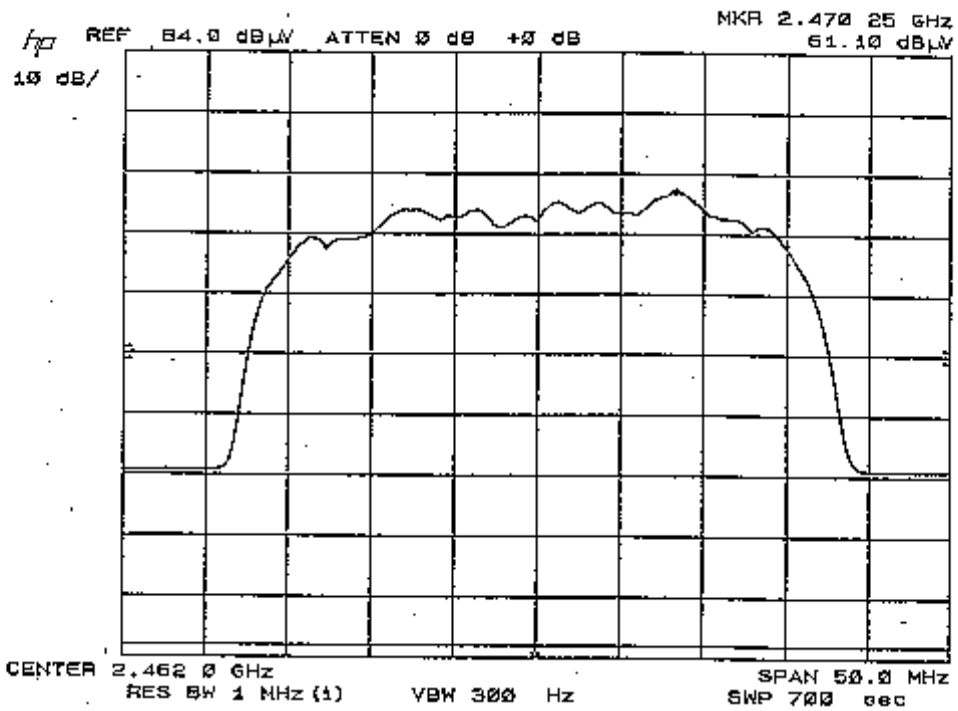


Figure 3.5 - 9: Comstat 4' Parabolic (24A48GN-U) 27.5 dBi - Average Plot

**Parabolic Dish Antenna: Radiated Emission Test**

The following two plots show the horizontal and vertical emissions of the EUT within the restricted band 2.4835 – 2.5 GHz. The EUT was set for frequency plan A. The analyzer was set for average detection. A bandpass filter was used to pass 2.48 – 2.6 GHz allowing the measurements to be made without overloading the analyzer. The insertion loss of this filter is approximately 3 dB. The antenna factor in the restricted band is approximately 30 dB/m. The cable loss in this band is approximately 2 dB. The pre-amplifier factor in this band is approximately 37 dB. This yields a margin of approximately 15 dB throughout this restricted band.

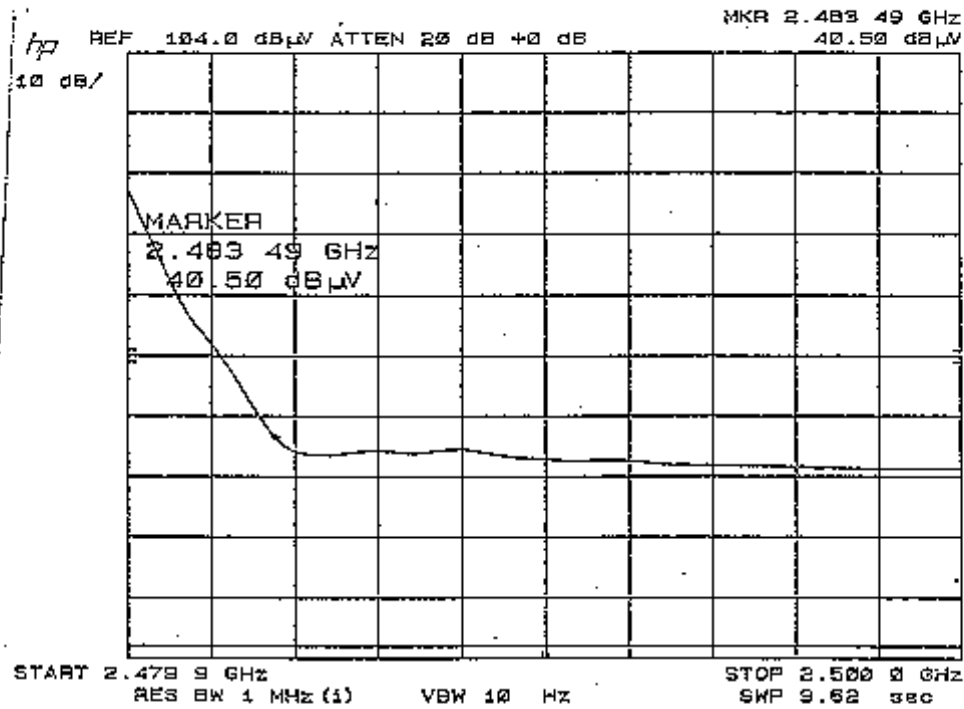


Figure 3.5 - 10: Comstat 4' Parabolic (24A48GN-U) 23 dBi – Restricted Band, Vertical

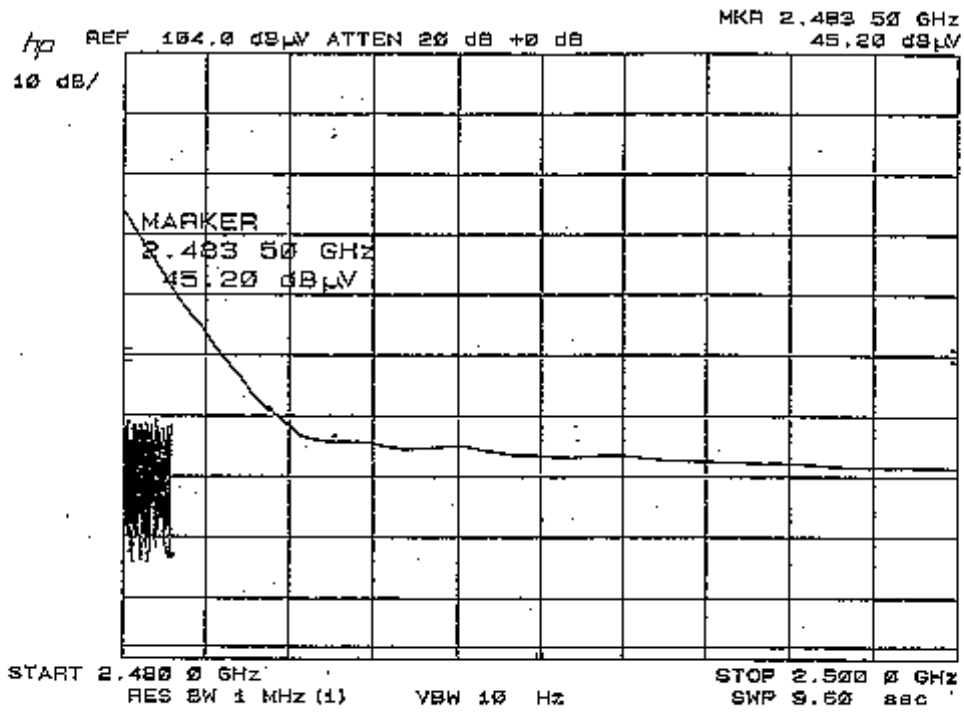


Figure 3.5 - 11: Comstat 4' Parabolic (24A48GN-U) 23 dBi - Restricted Band, Horizontal





Yagi Antenna: Radiated Emission Test

The following plot contains the peak radiated output of the Cushcraft Yagi antenna (Model Number: PC2415N). This antenna has a 13.9 dBi gain. The plot shows peak carrier data for the antenna in vertical polarization. No pre-amplifier was used and no external attenuation was used for this plot. The measuring systems losses were 32.4 dB.

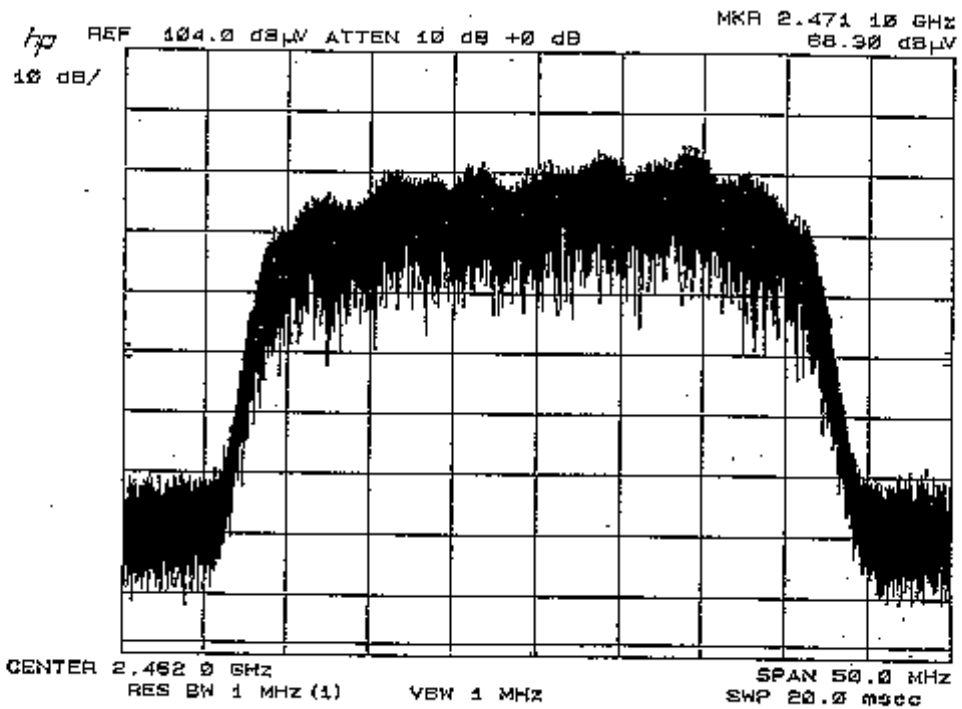
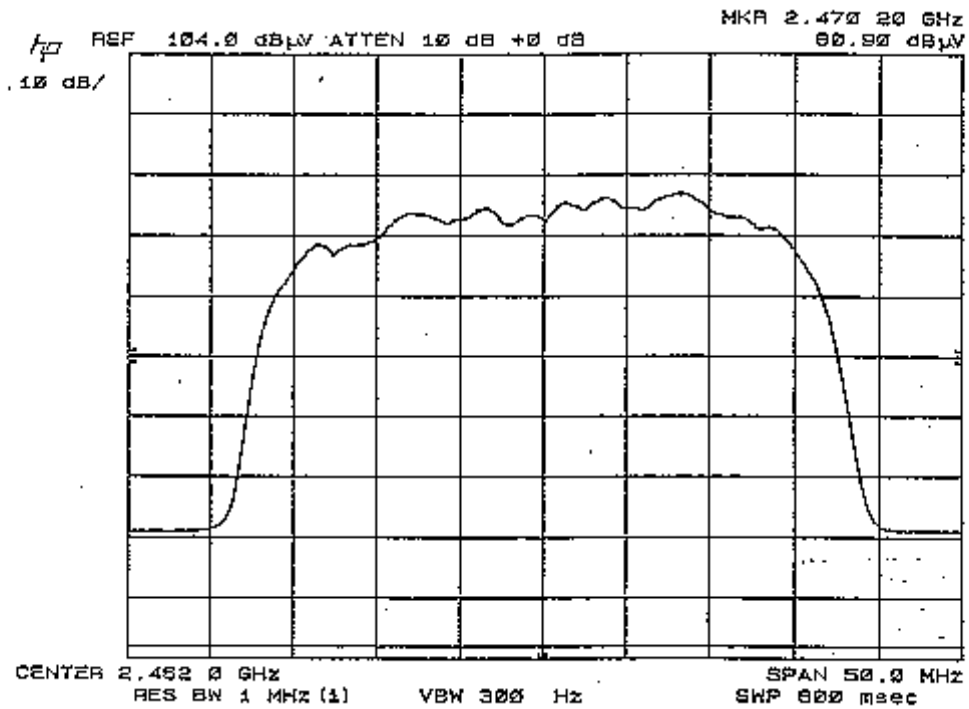


Figure 3.5 - 12: Cushcraft Yagi (PC-2415N) 13.9 dBi - Peak Plot

**Yagi Antenna: Radiated Emission Test**

The following plot contains the average radiated output of the Cushcraft Yagi antenna (Model Number: PC2415N). This antenna has a 13.9 dBi gain. The plot shows average carrier data for the antenna in vertical polarization. No pre-amplifier was used and no external attenuation was used for this plot. The measuring systems losses were 32.4 dB.



**Figure 3.5 - 13: Cushcraft Yagi (PC-2415N) 13.9 dBi - Average Plot**

Yagi Antenna: Radiated Emission Test

The following two plots show the horizontal and vertical emissions of the EUT within the restricted band 2.4835 – 2.5 GHz. The EUT was set for frequency plan A. The analyzer was set for average detection. A bandpass filter was used to pass 2.48 – 2.6 GHz allowing the measurements to be made without overloading the analyzer. The insertion loss of this filter is approximately 3 dB. The antenna factor in the restricted band is approximately 30 dB/m. The cable loss in this band is approximately 2 dB. The pre-amplifier factor in this band is approximately 37 dB. This yields a margin of approximately 25 dB throughout this restricted band.

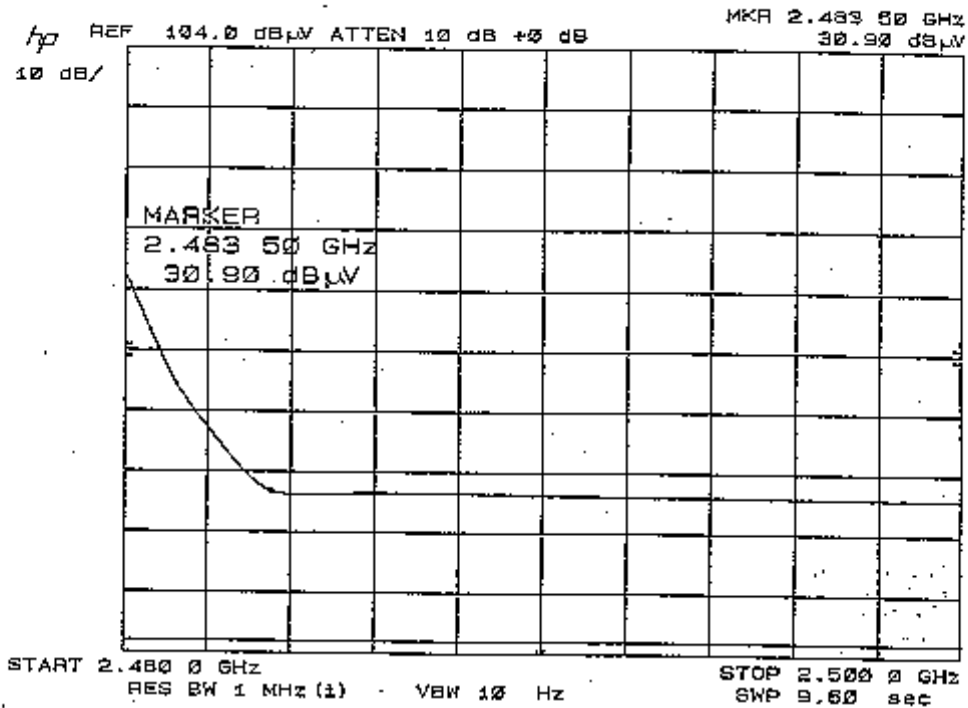


Figure 3.5 - 14: Cushcraft Yagi (PC-2415N) 13.9 dBi - Restricted Band, Vertical

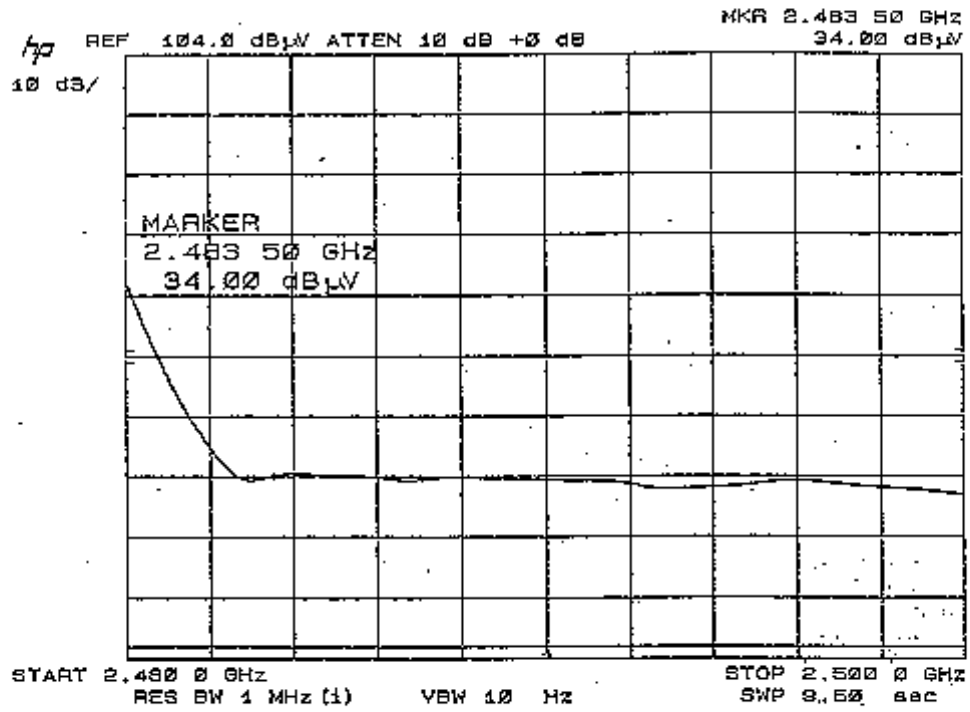


Figure 3.5 - 15: Cushcraft Yagi (PC-2415N) 13.9 dBi - Restricted Band, Horizontal

# ITS Intertek Testing Services

## Flat Panel Array: Radiated Emission Test

The data shown below lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

The antenna used during this test was the Avtronics AVFP-18 with 18 dBi of gain. The worst case restricted band was 6.7 dB below the FCC limit. The highest gain antenna of this type listed for the EUT is 21 dBi.

Table 3.5 - 7: Radiated Spurious Emissions, 1000 - 22000 MHz

Company: Adtran Inc.  
Model: 4280TRACERT1L1

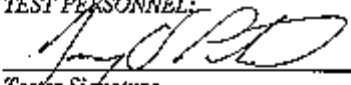
Date: 02/19/98  
Tested by: Jeremy Pickens  
Test Distance: 3  
Job Number: J98002308

Notes: Avtronics (AVFP-18) antenna

Standard: FCC Part 15  
Class B

Antenna Polarity	Frequency (MHz)	Reading (dBuV)	Antenna Factor (dB)	Cable Loss (dB)	Pre-amp Factor (dB)	External Attn (dB)	Net (dBuV/m)	Limit (dBuV/m)	Margin (dB)
h	7245.4	39.4	38.5	4.7	36.9	8.0	47.8	54.0	-6.7
v	7245.4	38.8	38.5	4.7	36.9	8.0	44.5	54.0	-9.5
h	7246.3	29.7	38.5	4.7	36.9	8.0	37.6	54.0	-16.5

TEST PERSONNEL:

  
Tester Signature

Jeremy Pickens / Project Engineer  
Typed/Printed Name

5/1/98  
Date

4280TRACERT1L1  
Adtran Inc.

**Flat Panel Antenna: Radiated Emission Test**

The following plot contains the peak radiated output of the Avitronics Flat Panel antenna (Model Number: AVFP-18). This antenna has a 18 dBi gain. The plot shows peak carrier data for the antenna in vertical polarization. No pre-amplifier was used and no external attenuation was used for this plot. The measuring systems losses were 32.4 dB.

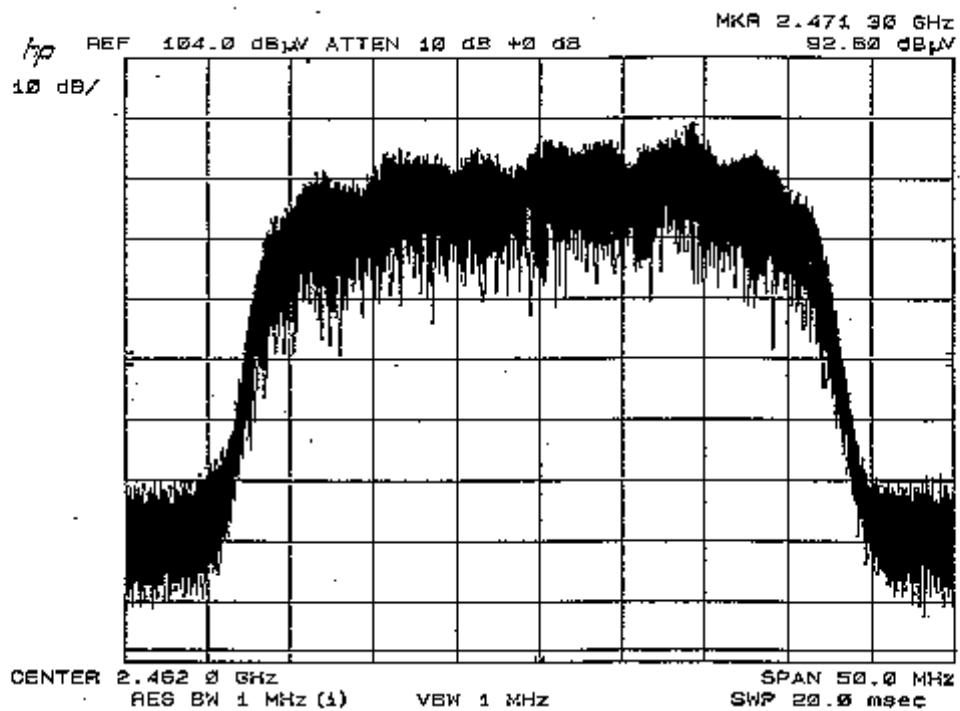


Figure 3.5 - 16: Avitronics Flat Panel (AVFP-18) 18 dBi - Peak Plot

**Flat Panel Antenna: Radiated Emission Test**

The following plot contains the average radiated output of the Avitronics Flat Panel antenna (Model Number: AVFP-18). This antenna has a 18 dBi gain. The plot shows average carrier data for the antenna in vertical polarization. No pre-amplifier was used and no external attenuation was used for this plot. The measuring systems losses were 32.4 dB.

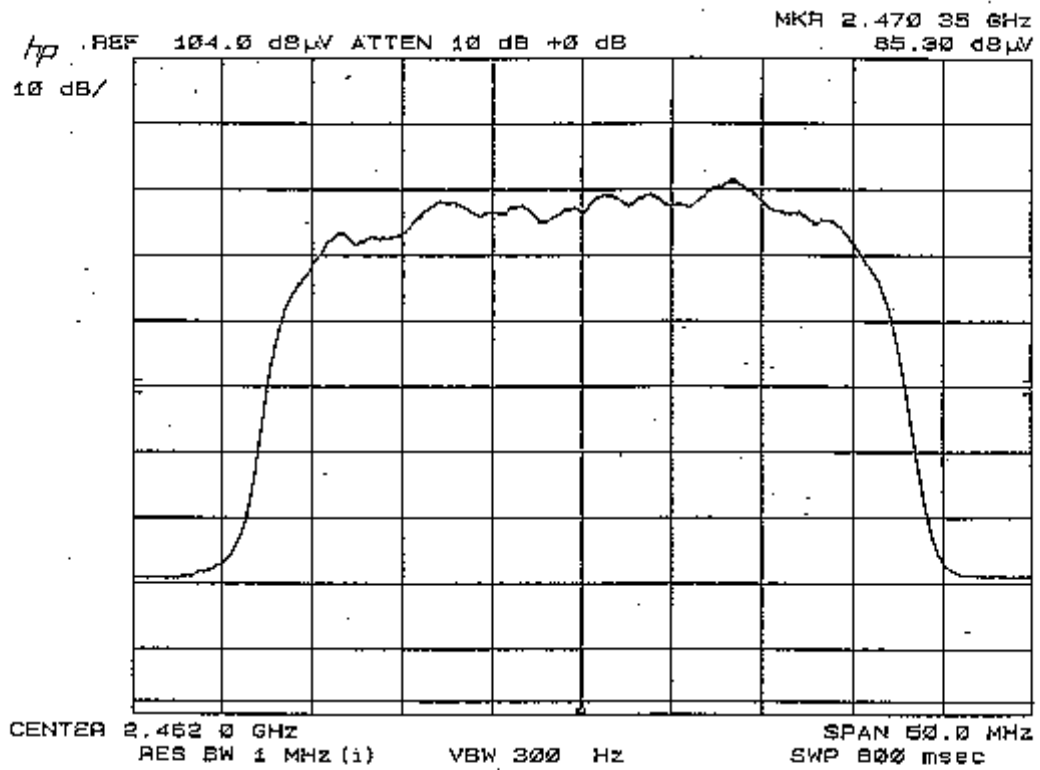


Figure 3.5 - 17: Avitronics Flat Panel (AVFP-18) 18 dBi - Average Plot



Flat Panel Antenna: Radiated Emission Test

The following two plots show the horizontal and vertical emissions of the EUT within the restricted band 2.4835 – 2.5 GHz. The EUT was set for frequency plan A. The analyzer was set for average detection. A bandpass filter was used to pass 2.48 – 2.6 GHz allowing the measurements to be made without overloading the analyzer. The insertion loss of this filter is approximately 3 dB. The antenna factor in the restricted band is approximately 30 dB/m. The cable loss in this band is approximately 2 dB. The pre-amplifier factor in this band is approximately 37 dB. This yields a margin of approximately 17 dB throughout this restricted band.

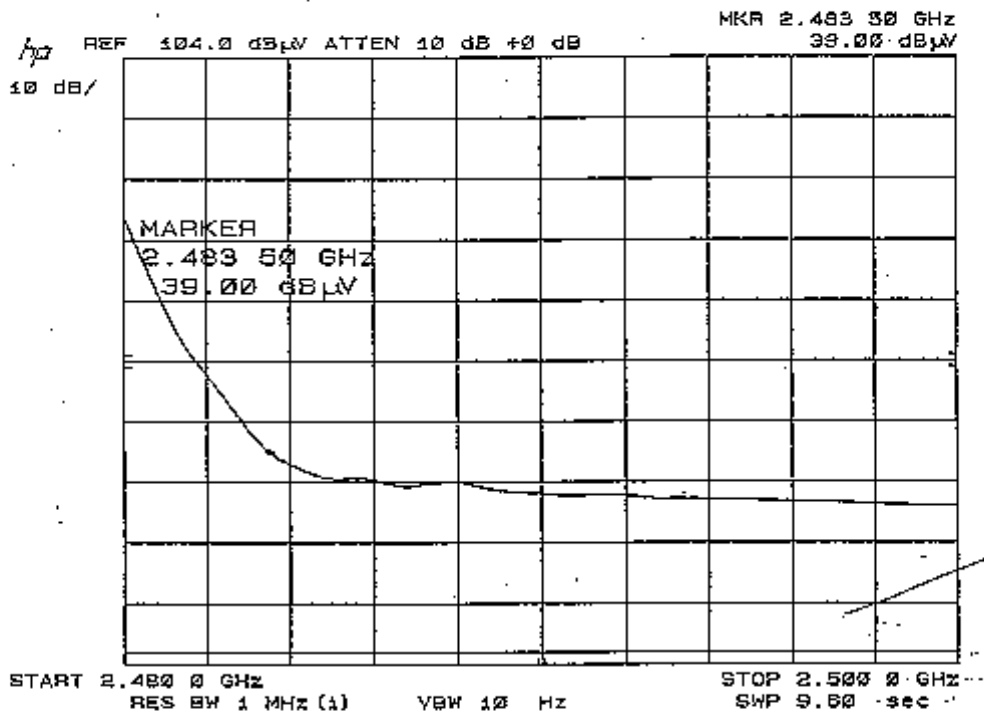


Figure 3.5 - 18: Avtronics Flat Panel (AVFP-18) Restricted Band - Horizontal

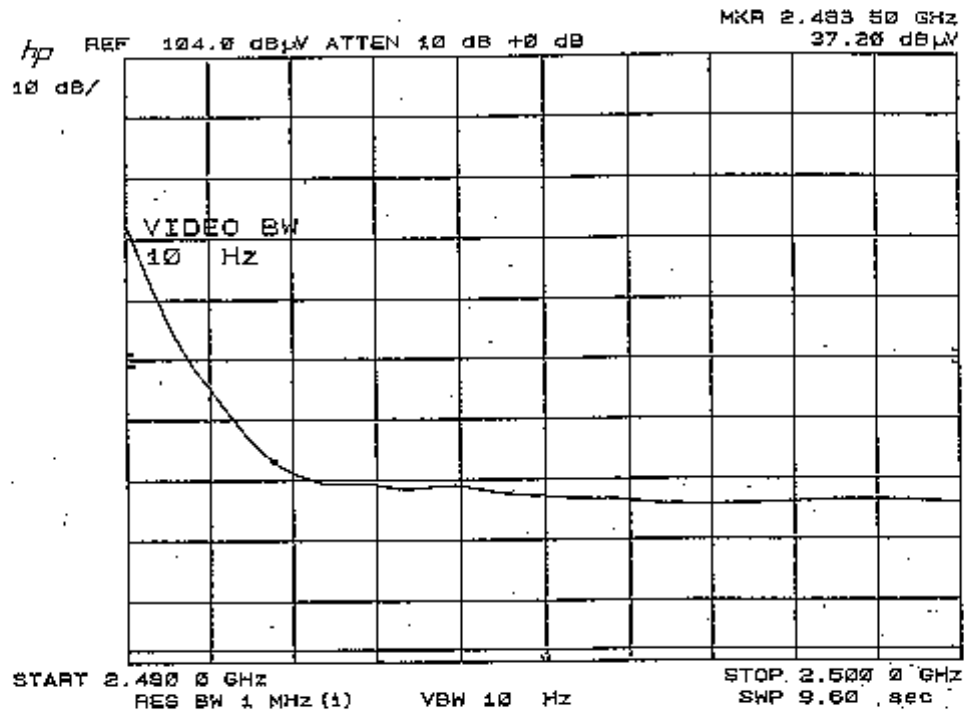


Figure 3.5 - 19: Avionics Flat Panel (AVFP-18) Restricted Band - Vertical

#### **4.0 Photographs**

Photographs are provided in JPEG format in a separate attachment. The photograph descriptions are below.

Frontvie.jpg	Front view of new chassis
Rearview.jpg	Rear view of new chassis
Topview.jpg	Top view, cover removed
Rearv1.jpg	Rear view, cover removed
Diplex.jpg	Diplexer, cover removed