



Washington Laboratories, Ltd.

**Summary Test Report
for the
Adtran, Inc.
Tracer 6410 System with 10 foot dish antenna**

**WLL JOB# 9361
August 28, 2006**

Prepared for:

**Adtran, Inc.
901 Explorer Boulevard
Huntsville, AL 35806**

Prepared By:

**Washington Laboratories, Ltd.
7560 Lindbergh Drive
Gaithersburg, Maryland 20879**

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Prepared by: Gregory M. Snyder
Chief EMC Engineer

Abstract

This summary report has been prepared on behalf of Adtran, Inc. to support an Application for Equipment Authorization under FCC Part 15.247 and Telecommunications Policy RSS-210 of Industry Canada. This report documents the test results for an Adtran, Inc. Tracer 4106 configured with a 10 foot dish antenna.

Testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The Industry Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

The Adtran, Inc. Tracer 4106 when configured with a 10 foot dish antenna complies with the limits for a Digitally Modulated Transceiver device under FCC Part 15.247 and Industry Canada RSS-210.

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1 Introduction

1.1 Compliance Statement

The Adtran, Inc. Tracer 4106 with 10 foot dish antenna complies with the limits for a Digitally Modulated Transmitter device under FCC Part 15.247 and Industry Canada RSS-210, Issue 6.

1.2 Test Scope

Tests for radiated emissions were performed. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.3 Contract Information

Customer:	Adtran, Inc. 901 Explorer Boulevard Huntsville, AL 35806
Quotation Number:	63122

1.4 Test Dates

Testing was performed on the following date(s): August 22 and 23, 2006

1.5 Test and Support Personnel

Washington Laboratories, LTD	James Ritter
Client Representative	Derek Foster

2 Equipment Under Test

2.1 EUT Identification & Description

The EUT tested was the Adtran Model 4106 Tracer configured with a 10 foot dish antenna.

Antenna Description of Tested Models:

Manufacturer	Model	Description	Gain
Andrew	PL10F-23-N7A	10' Dish Antenna with 2.4GHz Feed Horn	42.5dBi

2.2 Test Configuration

The Tracer 4106 was configured with an external power adapter to provide 48Vdc. Cables with terminations were connected to the 4 RJ-45 ports, unshielded wires were connected to the alarm I/O and a 50 Ohm coaxial cable was connected to the antenna port.

The EUT firmware was set up to provide continuous random data for Direct Sequence modulation to the output connector.

Two plans are available: "A" and "B". Changing between the plans is accomplished by switching the internal diplexer cables. The channels are then programmed within the plan.

A laptop PC was used to set up the EUT via Hyperterminal. The PC is only used for configuration and was removed during testing.

2.3 Test Location

All measurements herein were performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. The Industry Canada OATS numbers are 3035A-1 and 3035A-2 for Washington Laboratories, Ltd. Site 1 and Site 2, respectively. Washington Laboratories, Ltd. has been accepted by the FCC and approved by NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

2.4 Measurements

2.4.1 References

ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation

ANSI C63.4 American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

2.5 Measurement Uncertainty

All results reported herein relate only to the equipment tested. For the purposes of the measurements performed by Washington Laboratories, the measurement uncertainty is ± 2.3 dB. This has been

calculated for a *worst-case situation* (radiated emissions measurements performed on an open area test site).

The following measurement uncertainty calculation is provided:

$$\text{Total Uncertainty} = (A^2 + B^2 + C^2)^{1/2}/(n-1)$$

where:

A = Antenna calibration uncertainty, in dB = 2 dB

B = Spectrum Analyzer uncertainty, in dB = 1 dB

C = Site uncertainty, in dB = 4 dB

n = number of factors in uncertainty calculation = 3

Thus, Total Uncertainty = $0.5 (2^2 + 1^2 + 4^2)^{1/2} = \pm 2.3$ dB.

3 Test Equipment

Table 1 shows a list of the test equipment used for measurements along with the calibration information.

Table 1: Test Equipment List

WLL Asset #	Manufacturer Model/Type	Function	Cal. Due
0073	HP 8568B	SPECTRUM ANALYZER	6/23/2007
0007	ARA LPB-2520	BICONILOG ANTENNA	12/20/2006
0522	HEWLETT-PACKARD 8449B	MICROWAVE PREAMP	5/4/2007
0004	ARA DRG118/A	MICROWAVE HORN ANTENNA	2/2/2007
0210	NARDA V638	HORN ANTENNA	12/25/2008
0071	HP 85685A	RF PRESELECTOR	6/23/2007
0069	HP 85650A	QUASI-PEAK ADAPTER	6/23/2007
0074	HEWLETT-PACKARD 8593A	SPECTRUM ANALYZER	10/4/2006
0282	ITC WAVEGUIDE	21C-3A1	2/7/2007
0280	ITC WAVEGUIDE	21X-3A1	6/12/2008

4 Radiated Spurious Emissions: (FCC Part §15.247(c) and RSS-210 A8.5)

Radiated emissions that fall in the restricted bands must comply with the general emissions limits in 15.209(a) and RSS-210 Table 2.

The emissions were measured using the following resolution bandwidths:

Frequency Range	Resolution Bandwidth	Video Bandwidth
30MHz-1000 MHz	120kHz	>30 kHz
>1000 MHz	1 MHz	<30 Hz (Avg.) 1MHz (Peak)

Harmonic and Spurious emissions that were identified as coming from the EUT were checked in Peak and in Average Mode. It was verified that the peak-to-average ratio did not exceed 20dB.

Peak measurements and average measurements are made. All emissions were determined to have a peak-to-average ratio of less than 20 dB.

4.1.1 Test Procedure for 10' Dish Antenna

Guidance provided by the FCC on measurements of the 10' dish antenna was used for performing these measurements. A copy of the e-mail providing the guidance follows the test data.

A receive antenna was placed 10m from the EUT antenna. As the EUT antenna is very large it was determined that maximum emissions would be best detected by moving the receive antenna around the EUT antenna.

Maximum emissions were found at the bore sight of the antenna. Both the horizontal and vertical field components were measured. The restricted bands were scanned for spurious emissions. Additionally, the band edge emissions were measured although they do not fall within a restricted band.

All data collected was interpolated to 3m. The following is a sample calculation used in the data tables for calculating the final field strength of spurious emissions and comparing these levels to the specified limits.

Sample Calculation:

Spectrum Analyzer Voltage (SA Level):	V dBμV
Antenna Factor (Ant Corr):	AFdB/m
Cable Loss Correction (Cable Corr):	CCdB
Amplifier Gain:	GdB
Distance Correction Factor:	$20 \cdot \text{LOG}(10/3) = 10.45\text{dB}$
Electric Field (Corr Level):	$\text{EdB}\mu\text{V/m} = \text{VdB}\mu\text{V} + \text{AFdB/m} + \text{CCdB} - \text{GdB} + 10.45\text{dB}$
To convert to linear units:	$\text{E}\mu\text{V/m} = \text{antilog}(\text{EdB}\mu\text{V/m}/20)$

4.1.2 Test results

Data are supplied in the following table. Testing was performed to 25GHz. No emissions were detected above 12GHz. All detected emissions are reported in the following tables.

Table 2: Radiated Emissions; 10ft Dish Antenna – Plan A Band 1

Client: Adtran
Tester: James Ritter

Date: 8/22/2006
Job #: 9361

EUT Information:

EUT: Tracer 4106
Configuration: with 10ft antenna
Clocks:
S/N:

Plan A band 1

Test Requirements:

TEST STANDARD: FCC Part 15
DISTANCE: 3m
CLASS: B

Test Equipment (<1GHz):

ANTENNA: A_00007
CABLE: CSITE2_3m

Test Equipment (>1GHz):

ANTENNA: A_00004
CABLE: CSITE2_HF
AMPLIFIER: A_00066

LIMIT: LFCC_3m_Class_B

*Limit <30MHz normalized to 3m (40dB/decade)

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (m)	SA Level (dBμV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Amplifier Gain (dB)	Corr. Level (dBμV/m)	Corr. Level (μV/m)	Limit (μV/m)	Margin (dB)	Comments
				AVG.								
2390.000	V	0.0	2.5	48.0	28.9	1.6	32.0	46.4	209.8	500.0	-7.5	
2483.500	V	10.0	2.0	47.8	29.1	1.5	32.0	46.4	210.0	500.0	-7.5	
4832.000	V	0.0	2.0	36.3	34.0	3.5	31.8	42.0	126.2	500.0	-12.0	
12080.000	V	0.0	2.5	34.1	40.0	5.1	30.6	48.6	270.4	500.0	-5.3	amb
2390.000	H	0.0	2.5	45.8	28.9	1.6	32.0	44.2	162.8	500.0	-9.7	
2483.500	H	10.0	2.0	46.9	29.1	1.5	32.0	45.5	188.7	500.0	-8.5	
4832.000	H	0.0	2.0	38.0	34.0	3.5	31.8	43.7	153.0	500.0	-10.3	
12080.000	H	0.0	2.5	35.4	40.0	5.1	30.6	49.9	312.6	500.0	-4.1	amb
				PEAK								
2390.000	V	0.0	2.5	58.7	28.9	1.6	32.0	57.1	716.5	5000.0	-16.9	
2483.500	V	10.0	2.0	58.8	29.1	1.5	32.0	57.4	745.1	5000.0	-16.5	
4832.000	V	0.0	2.0	49.3	32.5	3.5	31.8	53.6	476.6	5000.0	-20.4	
12080.000	V	0.0	2.5	48.2	40.0	5.1	30.6	62.7	1359.8	5000.0	-11.3	amb
2390.000	H	0.0	2.5	55.1	28.9	1.6	32.0	53.5	475.1	5000.0	-20.4	
2483.500	H	10.0	2.0	56.1	29.1	1.5	32.0	54.7	544.2	5000.0	-19.3	
4832.000	H	0.0	2.0	50.1	32.5	3.5	31.8	54.3	520.7	5000.0	-19.6	
12080.000	H	0.0	2.5	48.9	40.0	5.1	30.6	63.4	1479.0	5000.0	-10.6	amb

Table 3: Radiated Emissions; 10ft Dish Antenna – Plan A Band 3

Client: Adtran
Tester: James Ritter

Date: 8/22/2006
Job #: 9361

EUT Information:

EUT: Tracer 4106
Configuration: with 10ft antenna Plan A Band 3

Test Requirements:

TEST STANDARD: FCC Part 15
DISTANCE: 3m
CLASS: B

Test Equipment (<1GHz):

ANTENNA: A_00007
CABLE: CSITE2_3m

Test Equipment (>1GHz):

ANTENNA: A_00004
CABLE: CSITE2_HF
AMPLIFIER: A_00066

LIMIT: LFCC_3m_Class_B

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (m)	SA Level (dBμV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Amplifier Gain (dB)	Corr. Level (dBμV/m)	Corr. Level (μV/m)	Limit (μV/m)	Margin (dB)	Comments
				AVG.								
2390.000	H	0.0	2.5	45.0	28.9	1.6	32.0	43.4	148.5	500.0	-10.5	
2483.500	H	10.0	2.0	45.0	29.1	1.5	32.0	43.6	151.6	500.0	-10.4	
4856.000	H	0.0	2.0	35.6	34.0	3.5	31.8	41.3	116.3	500.0	-12.7	
7284.000	H	0.0	2.0	37.2	37.1	4.4	31.4	47.3	232.1	500.0	-6.7	
12140.000	H	0.0	2.5	35.0	40.0	5.1	30.5	49.6	301.1	500.0	-4.4	amb
2390.000	V	0.0	2.5	45.2	28.9	1.6	32.0	43.6	152.0	500.0	-10.3	
2483.500	V	10.0	2.0	38.2	29.1	1.5	32.0	36.8	69.1	500.0	-17.2	
4856.000	V	0.0	2.0	34.0	34.0	3.5	31.8	39.7	96.7	500.0	-14.3	
7284.000	V	0.0	2.0	33.8	37.1	4.4	31.4	44.0	158.0	500.0	-10.0	amb
12140.000	V	0.0	2.5	34.7	40.0	5.1	30.5	49.2	289.9	500.0	-4.7	amb
				PEAK								
2390.000	H	0.0	2.5	54.2	28.9	1.6	32.0	52.6	426.8	5000.0	-21.4	
2483.500	H	10.0	2.0	55.5	29.1	1.5	32.0	54.1	507.8	5000.0	-19.9	
4856.000	H	0.0	2.0	50.1	32.6	3.5	31.8	54.4	523.9	5000.0	-19.6	
7284.000	H	0.0	2.0	49.5	37.1	4.4	31.4	59.6	959.7	5000.0	-14.3	amb
12140.000	H	0.0	2.5	46.5	40.0	5.1	30.5	61.1	1131.6	5000.0	-12.9	amb
2390.000	V	0.0	2.5	58.3	28.9	1.6	32.0	56.8	689.0	5000.0	-17.2	
2483.500	V	10.0	2.0	59.0	29.1	1.5	32.0	57.6	759.9	5000.0	-16.4	
4856.000	V	0.0	2.0	47.9	32.6	3.5	31.8	52.2	406.7	5000.0	-21.8	
7284.000	V	0.0	2.0	46.0	37.1	4.4	31.4	56.1	641.4	5000.0	-17.8	amb
12140.000	V	0.0	2.5	45.3	40.0	5.1	30.5	59.9	989.0	5000.0	-14.1	amb

Table 4: Radiated Emissions; 10ft Dish Antenna – Plan B Band 1

Client: Adtran
Tester: James Ritter

Date: 8/22/2006
Job #: 9361

EUT Information:

EUT: Tracer 4106
Configuration: with 10ft antenna Plan B band1

Test Requirements:

TEST STANDARD: FCC Part 15
DISTANCE: 3m
CLASS: B

Test Equipment (<1GHz):

ANTENNA: A_00007
CABLE: CSITE2_3m

Test Equipment (>1GHz):

ANTENNA: A_00004
CABLE: CSITE2_HF
AMPLIFIER: A_00522

LIMIT: LFCC_3m_Class_B

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (m)	SA Level (dBμV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Amplifier Gain (dB)	Corr. Level (dBμV/m)	Corr. Level (μV/m)	Limit (μV/m)	Margin (dB)	Comments
				AVG.								
2390.000	V	0.0	2.0	49.7	28.9	1.6	38.1	42.0	125.8	500.0	-12.0	
2483.500	V	10.0	2.0	49.3	29.1	1.5	38.1	41.8	123.5	500.0	-12.1	
4915.000	V	10.0	2.0	36.2	32.7	3.6	37.2	35.2	57.7	500.0	-18.8	
7372.500	V	0.0	2.0	38.1	37.1	4.6	37.6	42.3	130.3	500.0	-11.7	amb
12280.000	V	0.0	2.0	38.9	40.0	5.2	37.3	46.8	217.7	500.0	-7.2	amb
2390.000	H	0.0	2.0	49.7	28.9	1.6	38.1	42.0	125.5	500.0	-12.0	
2483.500	H	10.0	2.0	49.9	29.1	1.5	38.1	42.4	132.2	500.0	-11.6	
4915.000	H	10.0	2.0	37.0	32.7	3.6	37.2	36.0	62.9	500.0	-18.0	
7372.500	H	0.0	2.0	37.5	37.1	4.6	37.6	41.7	121.4	500.0	-12.3	amb
12287.500	H	0.0	2.0	38.2	40.0	5.2	37.3	46.1	202.7	500.0	-7.8	amb
				PEAK								
2390.000	V	0.0	2.0	59.6	28.9	1.6	38.1	51.9	394.6	5000.0	-22.1	
2483.500	V	10.0	2.0	60.7	29.1	1.5	38.1	53.2	458.7	5000.0	-20.7	
4915.000	V	10.0	2.0	46.7	32.7	3.6	37.2	45.7	193.3	5000.0	-28.3	
7372.500	V	0.0	2.0	48.7	37.1	4.6	37.6	52.9	439.4	5000.0	-21.1	amb
12287.500	V	0.0	2.0	48.4	40.0	5.2	37.3	56.3	654.5	5000.0	-17.7	amb
2390.000	H	0.0	2.0	61.4	28.9	1.6	38.1	53.7	486.6	5000.0	-20.2	
2483.500	H	10.0	2.0	61.5	29.1	1.5	38.1	54.0	502.4	5000.0	-20.0	
4915.000	H	0.0	2.0	47.4	32.7	3.6	37.2	46.5	210.2	5000.0	-27.5	
7372.500	H	0.0	2.0	49.5	37.1	4.6	37.6	53.7	484.0	5000.0	-20.3	amb
12287.500	H	0.0	2.0	50.6	40.0	5.2	37.3	58.5	842.2	5000.0	-15.5	amb

Table 5: Radiated Emissions; 10ft Dish Antenna – Plan B Band 3

Client: Adtran
Tester: James Ritter

Date: 8/22/2006
Job #: 9361

EUT Information:

EUT: Tracer 4106
Configuration: with 10ft antenna Plan B Band 3

Test Requirements:

TEST STANDARD: FCC Part 15
DISTANCE: 3m
CLASS: B

Test Equipment (<1GHz):

ANTENNA: A_00007
CABLE: CSITE2_3m

Test Equipment (>1GHz):

ANTENNA: A_00004
CABLE: CSITE2_HF
AMPLIFIER: A_00522

LIMIT: LFCC_3m_Class_B

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Height (m)	SA Level (dBμV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Amplifier Gain (dB)	Corr. Level (dBμV/m)	Corr. Level (μV/m)	Limit (μV/m)	Margin (dB)	Comments
				AVG.								
2390.000	V	0.0	2.0	49.1	28.9	1.6	38.1	41.4	117.8	500.0	-12.6	
2483.500	V	0.0	2.0	55.2	29.1	1.5	38.1	47.7	243.8	500.0	-6.2	
4936.000	V	10.0	2.0	35.9	32.7	3.6	37.2	35.0	56.2	500.0	-19.0	
7404.000	V	0.0	2.0	37.7	37.1	4.7	37.6	42.0	126.1	500.0	-12.0	amb
12340.000	V	0.0	2.0	38.2	40.0	5.3	37.2	46.3	206.0	500.0	-7.7	amb
2390.000	H	0.0	2.0	49.7	28.9	1.6	38.1	42.0	125.5	500.0	-12.0	
2483.500	H	0.0	2.0	49.2	29.1	1.5	38.1	41.8	122.5	500.0	-12.2	
4936.000	H	10.0	2.0	35.2	32.7	3.6	37.2	34.3	51.7	500.0	-19.7	
7404.000	H	0.0	2.0	37.3	37.1	4.7	37.6	41.6	119.9	500.0	-12.4	amb
12340.000	H	0.0	2.0	38.0	40.0	5.3	37.2	46.1	201.3	500.0	-7.9	amb
				PEAK								
2390.000	V	0.0	2.0	60.2	28.9	1.6	38.1	52.6	424.3	5000.0	-21.4	
2483.500	V	0.0	2.0	65.7	29.1	1.5	38.1	58.2	813.0	5000.0	-15.8	
4936.000	V	10.0	2.0	48.6	32.7	3.6	37.2	47.7	241.7	5000.0	-26.3	
7404.000	V	0.0	2.0	48.4	37.1	4.7	37.6	52.7	431.8	5000.0	-21.3	amb
12340.000	V	0.0	2.0	48.6	40.0	5.3	37.2	56.7	684.5	5000.0	-17.3	amb
2390.000	H	0.0	2.0	60.1	28.9	1.6	38.1	52.4	418.0	5000.0	-21.6	
2483.500	H	0.0	2.0	59.3	29.1	1.5	38.1	51.9	391.4	5000.0	-22.1	
4936.000	H	0.0	2.0	46.9	32.7	3.6	37.2	46.0	198.8	5000.0	-28.0	
7404.000	H	0.0	2.0	47.1	37.1	4.7	37.6	51.4	370.5	5000.0	-22.6	amb
12340.000	H	0.0	2.0	48.4	40.0	5.3	37.2	56.5	666.6	5000.0	-17.5	amb



Figure 4-1, Test Setup Photograph



Figure 4-2, Test Setup Photograph