FCC Certification Test Report

FCC & IC Certification Test Report Addendum

for

ADTRAN, Inc.

FCC ID: HDCTRC4206L1

IC: 2250A-TRC4206L1

April 26, 2005

Prepared for:

ADTRAN, Inc.
901 Explorer Blvd
Huntsville, AL 35806

Prepared By:

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

FCC & IC Certification Test Report Addendum
for the
ADTRAN, Inc.
TRACER
Transceiver 4206L1
FCC ID: HDCTRC4206L1

WLL JOB# 8028

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Chief EMC Engineer

Reviewed by: Steve Koster
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Abstract

This report has been prepared on behalf of ADTRAN, Inc. to supply emissions test data in support of large high gain antenna systems. The ADTRAN TRACER Model 4206 was originally tested with a 2' diameter dish antenna (28.5dBi). As this device is being sought for certification under §15.247 and operates as a fixed installation point-to-point system at 5.8GHz, the antenna gain can exceed 6dBi without any reduction in output power. The user manual specifies antennas up to 12' in diameter with gains up to 44.2dBi.

This test report presents emissions data for the 10' dish antenna (42.5dBi). It can be seen from the spurious emission data collected at the antenna terminal and the comparison of the radiated emissions data from the 2' to 10' dish antenna that the spurious emissions are not increased by the use of the high gain antenna.

Testing was performed at Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879.

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1 Introduction

1.1 Compliance Statement

The ADTRAN, Inc. TRACER 4206L1 Spread Spectrum System with dish antennas up to 44.2dBi gain complies with the limits for a Digitally Modulated intentional radiator device under FCC Part 15.247 and Industry Canada RSS-210.

1.2 Test Scope

Tests for radiated emissions of the TRACER 4206L1 with a 10' dish antenna were performed in accordance with guidance provided by the FCC Laboratory. Reference the e-mail included in 4.2.

The face of the antenna was scanned to determine the location of maximum field intensity. Both horizontal and vertical polarities were evaluated.

1.3 Contract Information

Customer:	ADTRAN, Inc. 901 Explorer Blvd Huntsville, AL 35806
Quotation Number:	62208

1.4 Test Dates

Testing was performed on March 7, 2005.

1.5 Test and Support Personnel

Washington Laboratories, LTD	Greg Snyder, Mike Violette

2 Equipment Under Test

2.1 EUT Identification & Description

ADTRAN Part #	Product Name/Description
12804206L1A	Tracer 4206L1 Plan A
12804206L1B	Tracer 4206L1 Plan B

Top Assembly #:	12804206L1A and B
Sub Assembly #(s):	2280003-20, 2280018-6
Circuit Board #(s):	5280003-20, 2280018-6

Antenna Description:

Manufacturer	Model	Description	Gain
Andrew	PL10F-23-N7A	10' Dish Antenna with 5.8GHz Feed Horn	42.5dBi

2.2 Test Configuration

The antenna and TRACER 4206L1 were placed in the parking lot of Washington Laboratories at a location that allowed a clear 10m path to the receive antenna. The EUT was configured with an external power adapter to provide 48Vdc. Cables with loopback connections were connected to the I/O ports. The RF output port was connected to the input of the dish antenna.

The EUT was setup for a continuous transmission at the maximum data rate and output power. Both Plan A lower frequency (5.734GHz) and Plan B upper frequency (5.833GHz) were evaluated.

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

Equipment	WLL Asset #	Calibration Due
Hewlett-Packard 8568B Spectrum Analyzer	0073	7/08/05
Hewlett-Packard 85650A Quasi-Peak Adapter	0069	7/08/05
Hewlett-Packard 8593A Spectrum Analyzer	0074	8/17/05
Hewlett-Packard 8449B Microwave Preamp	0312	9/29/05
Hewlett-Packard 8672A Signal Generator	0080	3/25/05
ARA LPB-2520 BiconiLog Antenna	0007	9/14/05
ARA DRG118/A Microwave Horn Antenna	0425	4/17/05
Narda V638 Horn Antenna	0210	12/25/08
Hewlett-Packard 85685A RF Preselector	0071	7/08/05
Hewlett-Packard 438A Power Meter	0394	3/10/05
Hewlett-Packard 8481B Power Head	0390	4/15/05

4 Test Results

4.1 Radiated Spurious Emissions: (FCC Part §15.247(c))

Radiated emissions that fall in the restricted bands must comply with the general emissions limits in 15.209(a).

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

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.

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*LOG(10/3) = 10.45dB
Electric Field (Corr Level):	EdBμV/m = VdBμV + AFdB/m + CCdB – GdB+10.45dB
To convert to linear units:	EμV/m = antilog (EdBμV/m/20)

4.1.2 Test results

Data are supplied in the following table. Testing was performed to 40GHz. No emissions were detected above 12GHz. All detected emissions are reported in the following tables. Note that bandedge tests were performed here for informational purposes only. These do not fall within the restricted bands. The measurements were made to show the 20dBc requirement is met although this was done at the antenna terminal.

Table 2: Radiated Emission Test Data - Plan A, Band 1

Restricted Band Spurious Emissions (§15.205)

CLIENT:	ADTRAN	DATE:	3/7/2005
TESTER:	Greg Snyder/Mike Violette	JOB #:	8028
EUT Information:		**Test Requirements:**	
EUT:	Tracer 4206L1 w/10'Dish	TEST STANDARD:	FCC Part 15
CONFIGURATION:	Transmitting on Plan A, Band 1, 5.741GHz		
DISTANCE:	3m	CLASS:	B
Test Equipment/Limit:			
ANTENNA:	00425	LIMIT:	LFCC_3m_Class_B
CABLE:	Assem#1	AMPLIFIER (dB)	A_00312

Plan B, Band 3: Tx = 5833MHz

Freq (MHz)	Pol H/V	Az Deg	Ant. Hght (m)	SA Level (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Distance Corr.	Amp Gain (dB)	Corr. Level dBµV/m	Corr. Level µV/m	Limit (µV/m)	Margin dB	Notes
				Avg.									
5833	H	0	1.5	84.0	35.0	1.3	10.5	0.0	130.8	3470468.4	N/A	**N/A**	Avg
5833	V	0	1.5	63.3	35.0	1.3	10.5	0.0	110.1	320175.5	N/A	**N/A**	Avg
11667	H	0	1.5	32.0	41.1	2.3	10.5	35.7	50.2	322.7	500.0	-3.8	NF
11667	V	0	1.5	32.0	41.1	2.3	10.5	35.7	50.2	322.7	500.0	-3.8	NF
				Peak									
5833	H	0	1.5	88.7	35.0	1.3	10.5	0.0	135.5	5961946.7	N/A	**N/A**	Peak
5833	V	0	1.5	68.7	35.0	1.3	10.5	0.0	115.5	596194.7	N/A	**N/A**	Peak
5850	H	0	1.5	47.7	35.0	1.3	10.5	0.0	94.5	53282.6	596194.7	-21.0	20dBc
5850	V	0	1.5	38.3	35.0	2.3	10.5	35.5	50.6	336.9	59619.5	-45.0	20dBc
11667	V	0	1.5	44.8	41.1	2.3	10.5	35.7	63.0	1408.7	5000.0	-11.0	NF
11667	H	0	1.5	45.0	41.1	2.3	10.5	35.7	63.2	1441.5	5000.0	-10.8	NF

NF = Noise Floor; No detectable signal

Plan A, Band 1: Tx = 5734MHz

Freq (MHz)	Pol H/V	Az Deg	Ant. Hight (m)	SA Level (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Distance Corr.	Amp Gain (dB)	Corr. Level dBµV/m	Corr. Level µV/m	Limit (µV/m)	Margin dB	Notes
				Avg.									
5734	H	0	1.5	83.3	34.8	1.3	10.5	0.0	130.0	3150259.8	N/A	N/A	Avg
5734	V	0	1.5	56.0	34.8	1.3	10.5	0.0	102.7	135939.7	N/A	N/A	Avg
11468	H	0	1.5	28.2	40.8	2.3	10.5	35.6	46.2	203.8	500.0	-7.8	NF
11468	V	0	1.5	28.4	40.8	2.3	10.5	35.6	46.4	208.6	500.0	-7.6	NF
				Peak									
5734	H	0	1.5	92.0	34.8	1.3	10.5	0.0	138.7	8577216.6	N/A	N/A	Peak
5734	V	0	1.5	71.8	34.8	1.3	10.5	0.0	118.5	838197.5	N/A	N/A	Peak
5725	H	0	1.5	56.2	34.8	1.3	10.5	0.0	102.9	138899.3	857721.7	-15.8	20dBc
5725	V	0	1.5	29.5	34.8	2.3	10.5	35.6	41.5	118.9	83819.8	-57.0	20dBc
11468	V	0	1.5	38.9	40.8	2.3	10.5	35.6	56.9	698.6	5000.0	-17.1	NF
11468	H	0	1.5	39.0	40.8	2.3	10.5	35.6	57.0	706.7	5000.0	-17.0	NF

NF = Noise Floor; No detectable signal

Figure 1. Test Setup Photograph

Figure 2. Test Setup Photograph

4.2 E-Mail From FCC Referencing Testing of Large Dish

From: Rich Fabina [Rich.Fabina@fcc.gov]
Sent: Friday, February 18, 2005 2:54 PM
To: mikev@wll.com
Subject: RE: Big old antenna

Mike,

Attached are the guidelines for testing a 10 foot dish with as Part 15, spread spectrum device.

Remember we are concerned about band edge compliance particularly in the 2.4 GHz band at 2.4835 MHz in the restricted band. If the device is a 2.4 GHz device, you will have to use the delta method (posted on our KDB) to determine the level of the emission at the band edge.

We are also concerned with the defacto EIRP limits in the 900 MHz and 2.4 GHz bands listed in the rules. Be careful with those.

For EMC/EMI Measurements:

Place the 10' parabolic antenna on a 10 meter OATS and bore-site the parabolic antenna to the receive antenna. To ensure measuring a maximized signal, with the transmission system transmitting rotate the EUT (left and right) slightly while monitoring the transmission - this is to ensure measuring in the center of the transmission beam. Then, with the transmission system still transmitting, raise and lower the receive antenna 1 to 4 meters to ensure that a maximized signal is being measured. Note: both horizontal and vertical polarities of the receiver antenna should be used to ensure a maximized signal will be measured. You will have to perform this for the fundamental to measure band edge compliance and for all the restricted band emissions. A look at the conducted emissions from this device should give you some guidance on where to look for spurious emissions from the system.

During all measurements, the measurement equipment requirements defined in Part 15, section 15.35 Measurement detector functions and bandwidths should be met.

These 10 meter measurements will then have to be extrapolated to 3 meters for comparison to the limits.

Let me know if we can be of further help.

Rich