FCC & IC Certification Test Report

FCC & Industry Canada Certification Test Report

for

ADTRAN, Inc.

FCC ID: HDCTRC4202L1

IC: 2250A-4202L1

August 27, 2004

Updated on May 24, 2005

Prepared for:

ADTRAN, Inc.
901 Explorer Blvd
Huntsville, AL 35806

Prepared By:

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

FCC & Industry Canada Certification Test Report
for the
ADTRAN, Inc.
TRACER
Transceiver 4202L1
FCC ID: HDCTRC4202L1
IC: 2250A-4202L1

WLL JOB# 8032

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Documentation Specialist

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Wireless/Telco Services Manager & Chief EMC Engineer

Abstract

This report has been prepared on behalf of ADTRAN, Inc. to support the attached Application for Equipment Authorization. The test report and application are submitted for a Digitally Modulated Transmitter under FCC Part 15.247 of the FCC Rules and Regulations and Spectrum Management and Telecommunications Policy RSS-210 of Industry Canada.. This Federal Communication Commission (FCC) Certification Test Report documents the test configuration and test results for an ADTRAN, Inc. TRACER 4202L1 Transceiver.

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 4202L1 Transceiver complies with the requirements for a Digitally Modulated Transmitter 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 4202L1 System complies with the requirements for a Digitally Modulated Transmitter device under Part 15.247 of the FCC Rules and Regulations and Industry Canada RSS-210.

1.2 Test Scope

Tests for radiated and conducted emissions were performed. All measurements were performed according to the 2003 version of ANSI C63.4. 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 Blvd Huntsville, AL 35806
Purchase Order Number:	416542
Quotation Number:	61468

1.4 Test Dates

Testing was performed from April 29 through May 18.

1.5 Test and Support Personnel

Washington Laboratories, LTD	Greg Snyder, James Ritter

1.6 Abbreviations

A	Ampere
Ac	alternating current
AM	Amplitude Modulation
Amps	Amperes
b/s	bits per second
BW	Bandwidth
CE	Conducted Emission
Cm	Centimeter
CW	Continuous Wave
DB	Decibel
Dc	direct current
EMI	Electromagnetic Interference
EUT	Equipment Under Test
FM	Frequency Modulation
G	giga – prefix for 10^9 multiplier
Hz	Hertz
IF	Intermediate Frequency
K	kilo – prefix for 10^3 multiplier
M	Mega – prefix for 10^6 multiplier
M	Meter
μ	micro – prefix for 10^{-6} multiplier
NB	Narrowband
LISN	Line Impedance Stabilization Network
RE	Radiated Emissions
RF	Radio Frequency
Rms	root-mean-square
SN	Serial Number
S/A	Spectrum Analyzer
V	Volt

2 Equipment Under Test

2.1 EUT Identification & Description

The Adtran 4202L1 radio is identical to the 4206L1 radio with the exception that the 4202L1 contains only two T1 ports. The remaining two T1 port connectors are not connected. Testing of the 4206L1 and 4202L1 was performed at the same time on a single unit.

ADTRAN Part #	Product Name/Description
12804202L1A	Tracer 4202L1 Plan A
12804202L1B	Tracer 4202L1 Plan B

Top Assembly #:	12804202L1A and B
Sub Assembly #(s):	2280003-20, 2280018-6
Circuit Board #(s):	5280003-20, 2280018-6

The 12804202L1 (Tracer 4202L1 Radio) is a digital radio device that accepts two 1.544 Mb/sec T1 signal and transports it over a wireless carrier. A pair of these radios forms a wireless transport for T1 digital services in the 5.8 GHz Industrial, Scientific and Medical (ISM) radio band. The 12804202L1 provides the network, antenna, and control/status interface to the customer. The T1 interfaces are network timed. No internal timing is available.

The Tracer 4202L1 operates in the 5734-5833 MHz band using direct sequence spread spectrum transmission. Two channels are available: “A” and “B”. The channels are determine`d by internal cable routing on the transmit module during manufacture.

I/O Ports and Cables available on the TRACER 4202L1 DS3 Radio:

#	Signal/ Port Name	Signal/ Port Type	Cable Type	NOTES
1	T1A	I/O	Unshielded	100 ohm impedance
2	T1B	I/O	Unshielded	100 ohm impedance
5	RS232	I/O	Shielded 25 wire	VT100
6	ALARM	Control	Unshielded TP	Alarm contacts, no active signals
7	ANTENNA	I/O	Shielded Coax	50 ohm impedance, 5.8 GHz signal only
8	TEST	Output	Unshielded TP	¼ inch stereo jack, X/Y Constellation plot
9	RSSI	Output	Unshielded wire	Mono jack, Receive Signal Strength
10	TX PWR	Output	Unshielded wire	Mono jack, Transmit Power

11	GND	Output	Unshielded wire	Mono jack, Circuit ground
EX :	HDSL Loop 1	Span Pwr-I/O	Twisted Pair	137V Span Voltage

Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	ADTRAN, Inc.
FCC ID Number	HDCTRC4202L1
IC:	2250A-4202L1
EUT Name:	Spread Spectrum Transceiver
Model:	4202L1
FCC Rule Parts:	§15.247
Industry Canada:	RSS-210
Frequency Range:	5734 MHz – 5833MHz
Maximum Output Power:	dBm (conducted)
Modulation:	Digital (QPSK)
Bandwidth:	7.7MHz
Keying:	Automatic
Type of Information:	Data
Number of Channels:	6
Power Output Level	Fixed
Antenna Type	Parabolic Dish
Frequency Tolerance:	N/A
Emission Type(s):	N/A
Power Source & Voltage:	48 Vdc

The TRACER DSSS 4202L1 contains the following sources:

Frequency (MHz)	Description
50.432	Master clock of digital transmit and receive. (XO 25ppm)
1.544	T1 rate clock for framer operation.
12.000	RF Reference XO
280.000	IF XO
5732.813	RF Center frequency for Channel A Bandplan 1
1398.203	RX LO Reference, Channel A Bandplan 1
1363.203	TX LO Reference, Channel A Bandplan 1
5748.438	RF Center frequency for Channel A Bandplan 2
1402.110	RX LO Reference, Channel A Bandplan 2
1367.110	TX LO Reference, Channel A Bandplan 2
5764.063	RF Center frequency for Channel A Bandplan 3
1406.016	RX LO Reference, Channel A Bandplan 3

Frequency (MHz)	Description
1371.016	TX LO Reference, Channel A Bandplan 3
5779.688	RF Center frequency for Channel A Bandplan 4
1409.922	RX LO Reference, Channel A Bandplan 4
1374.922	TX LO Reference, Channel A Bandplan 4
5795.313	RF Center frequency for Channel B Bandplan 1
1413.828	RX LO Reference, Channel B Bandplan 1
1378.828	TX LO Reference, Channel B Bandplan 1
5810.938	RF Center frequency for Channel B Bandplan 2
1417.735	RX LO Reference, Channel B Bandplan 2
1382.735	TX LO Reference, Channel B Bandplan 2
5826.563	RF Center frequency for Channel B Bandplan 3
1421.641	RX LO Reference, Channel B Bandplan 3
1386.641	TX LO Reference, Channel B Bandplan 3
5842.188	RF Center frequency for Channel B Bandplan 4
1425.547	RX LO Reference, Channel B Bandplan 4
1390.547	TX LO Reference, Channel B Bandplan 4

2.2 Test Configuration

The EUT was configured with an external power adapter, loopback connections on Channels A and B, unshielded wires connected to the alarm I/O, and a 50 Ohm coaxial cable 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”. Each “Plan” has three channels. Changing between the plans is accomplished by switching the internal cables. The channels are then programmed within the plan.

Testing was initially performed using the 2’ diameter, 28.5 dBi dish antenna. During testing all out-of-band radiated spurious emissions were detected from the enclosure of the equipment as opposed to the antenna structure.

Testing was also performed using a 10’ dish antenna (42.5dBi gain). Section 4.7 of this report includes an e-mail from the FCC concerning the testing method of the 10’ dish antenna. The antenna and TRACER 4202L1 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 10’ 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.

2.3 Testing Algorithm

The TRACER 4202L1 was operated continuously by firmware test sequence that provided a modulated RF data stream to the output port.

2.4 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.

2.5 Measurements

2.5.1 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

RSS-210 Issue 5, Amendment November 30, 2002

2.6 Measurement Uncertainty

All results reported herein relate only to the equipment tested. The measurement uncertainty of the data contained herein is ±2.3 dB.

For the purposes of the measurements performed by Washington Laboratories, the measurement uncertainty is ± 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:

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

Table 2: Test Equipment List

Manufacturer	Model/Type	Function	Identification	Cal. Due
HP	8568B	Spectrum Analyzer	2634A02888	7/07/04
HP	85650A	Quasi-Peak Adapter	3303A01786	7/08/04
HP	HP 8593A	Spectrum Analyzer	3009A00739	6/25/04
HP	8449B	Microwave Preamp	3008A00385	9/29/05
Solar	8012-50-R-24BNC	LISN	8379493	6/30/04
Narda	V638	Horn Antenna	210	7/22/04
ARA	LPB-2520	BiconiLog Antenna	1044	6/20/04
ARA	DRG118/A	Microwave Horn Antenna	1236	4/17/05
HP	85685A	RF Preselector	3221A01395	7/07/04
Tektronix	TDS 220	Oscilloscope	00333	8/18/04
HP	8672A	Generator	00080	3/25/05
Agilent	8474B	Diode Detector	00416	12/19/04
HP	438A	Power Meter	00394	3/10/05

Table 3: Test Equipment List for Testing 10’ Dish Antenna

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 RF Power Output (FCC Part 15.247(b) and RSS-210 6.2.2(o))

For devices within the scope of FCC §15.247 and RSS-210, the peak power conducted from the intentional radiator to the antenna shall not be greater than one watt (30 dBm).

The output from the transmitter was connected to a diode detector and oscilloscope. The peak deflection was measured on the oscilloscope and recorded. A signal generator was then substituted in place of EUT and set to the same frequency as the transmitter. The CW output of the signal generator was increased until the same deflection was noted on the oscilloscope. A power meter was then connected to the output of the signal generator to determine the output power of the signal generator. This level is then recorded as the output power of the EUT at the specified frequency.

This measurement method was chosen as the bandwidth of the EUT was much greater than the measurement bandwidth available on the spectrum analyzer.

The EUT carrier was modulated during this test.

Table 4. RF Power Output

Frequency	Level	Limit	Pass/Fail
Plan A			
Channel 1 5734.00 MHz	19.1	30 dBm	Pass
Channel 2 5743.80 MHz	19.3	30 dBm	Pass
Channel 3 5753.00 MHz	19.34	30 dBm	Pass
Plan B			
Channel 1 5814.70 MHz	19.5	30 dBm	Pass
Channel 2 5824.00 MHz	19.2	30 dBm	Pass
Channel 3 5833.10 MHz	19.3	30 dBm	Pass

RF Output Power Measurement
Diode Detector Method Test Setup Diagram

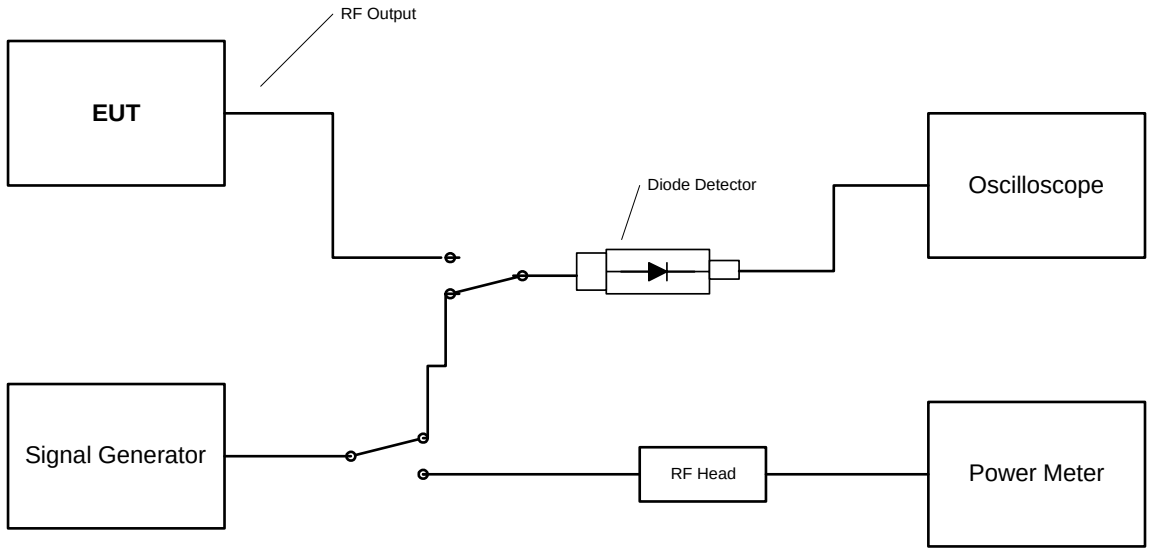

Figure 4-1: RF Power Measurement Test Setup Diagram

4.2 RF Peak Power Spectral Density (FCC Part 15.247(e) and RSS-210 Amendment 6.2.2(o)(iv))

For Digitally Modulated Devices and DSSS devices, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band.

The output from the transmitter was connected to an attenuator and then to the input of the RF Spectrum Analyzer. The analyzer offset was adjusted to compensate for the attenuator and other losses in the system. The entire bandwidth of the peak signal was scanned as the resolution bandwidth was reduced until a peak signal was identified. Once the peak was identified, the resolution bandwidth was reduced and the spectrum analyzer settings were adjusted to the following settings for making the measurement:

- 3 kHz RBW
- 10kHz VBW
- 300kHz span
- 100 second sweep time

The carrier was modulated internally via firmware that provided loop-back data to the rear-panel T1 connectors.

Table 5. Peak Power Spectral Density

Frequency	Level	Limit	Pass/Fail
Plan A			
Channel 1 5734.00 MHz	-2.01 dBm	8 dBm	Pass
Channel 2 5743.80 MHz	-1.81 dBm	8 dBm	Pass
Channel 3 5753.00 MHz	-2.4 dBm	8 dBm	Pass
Plan B			
Channel 1 5814.70 MHz	-4.12 dBm	8 dBm	Pass
Channel 2 5824.00 MHz	-2.02 dBm	8 dBm	Pass
Channel 3 5833.10 MHz	-2.62 dBm	8 dBm	Pass

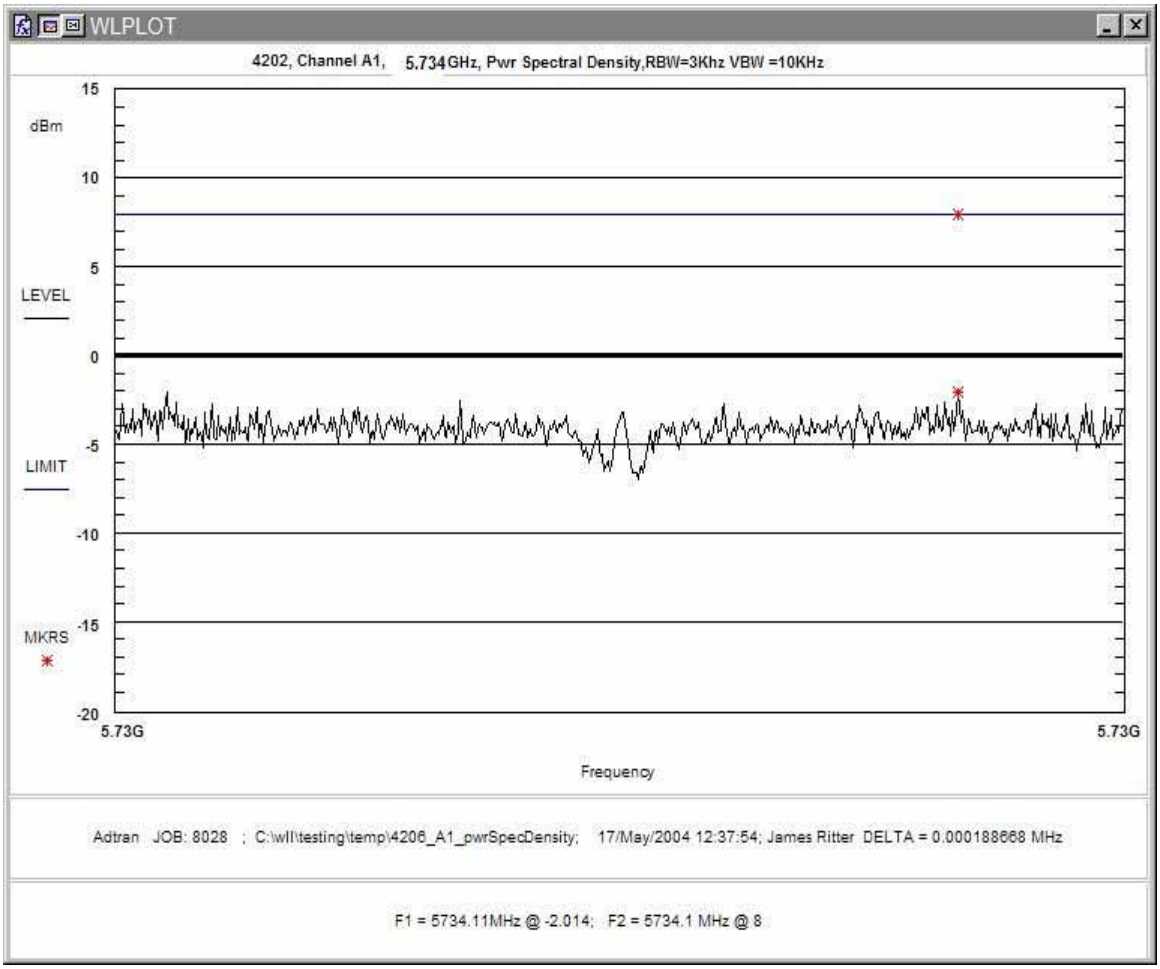

Figure 2. Power Spectral Density Plan A, Band 1

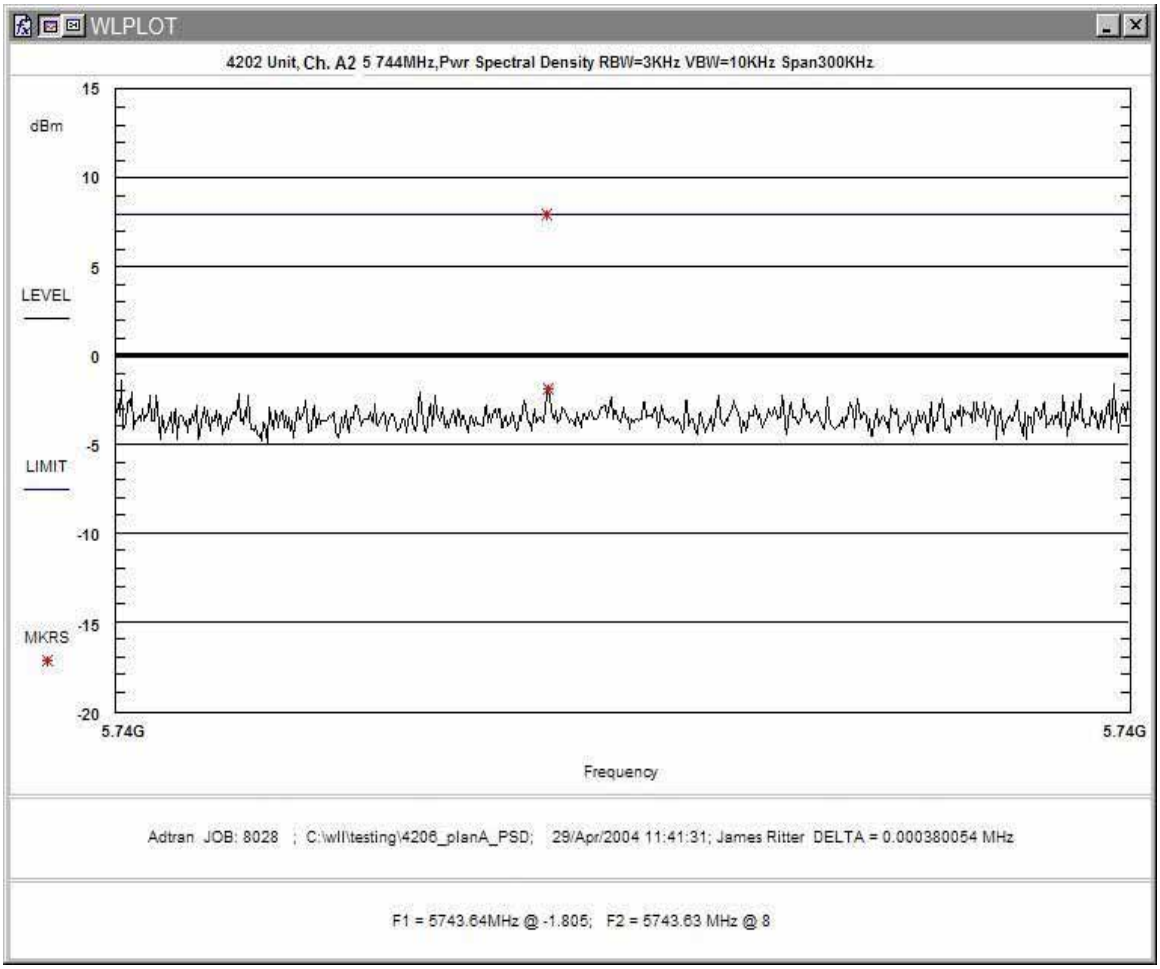

Figure 3. Power Spectral Density Plan A, Band 2

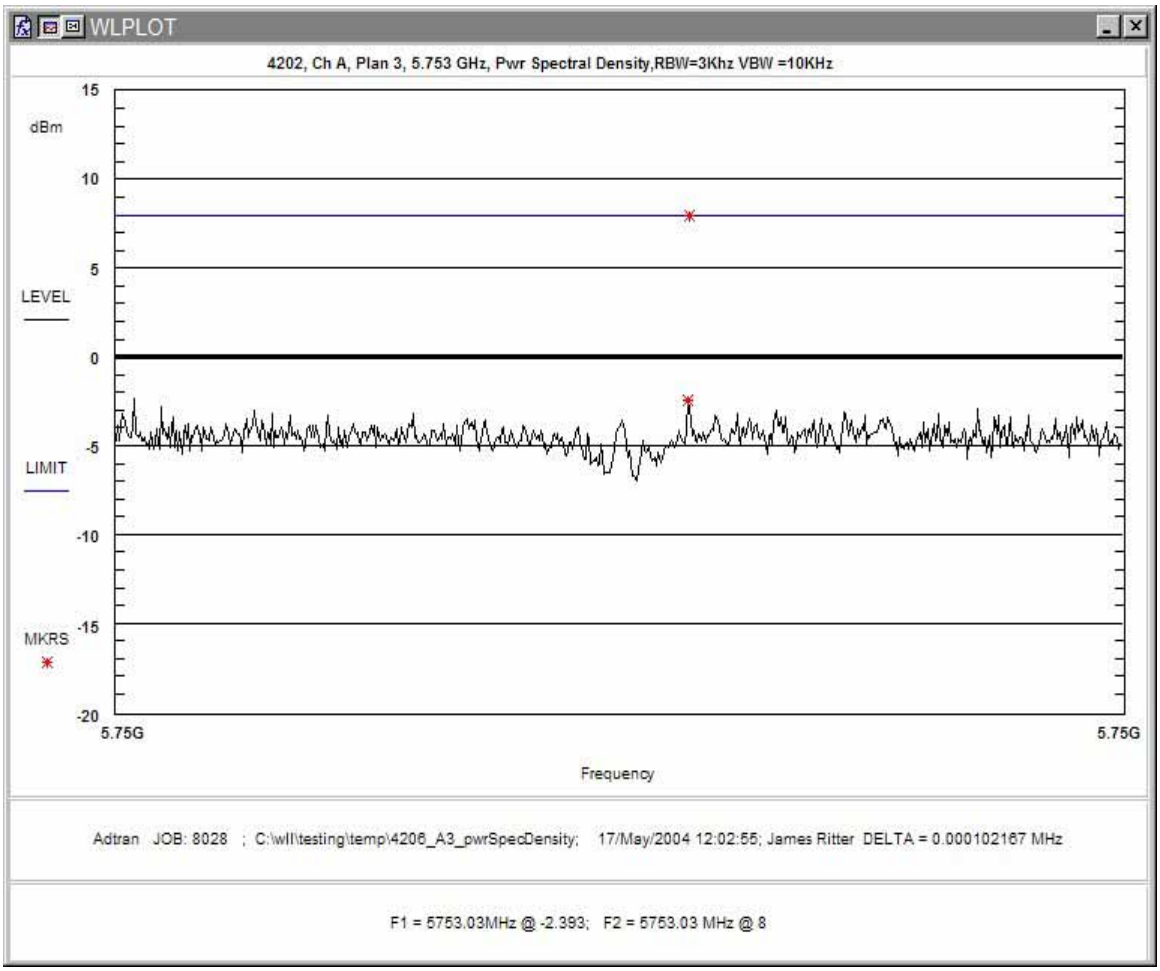

Figure 4. Power Spectral Density Plan A, Band 3

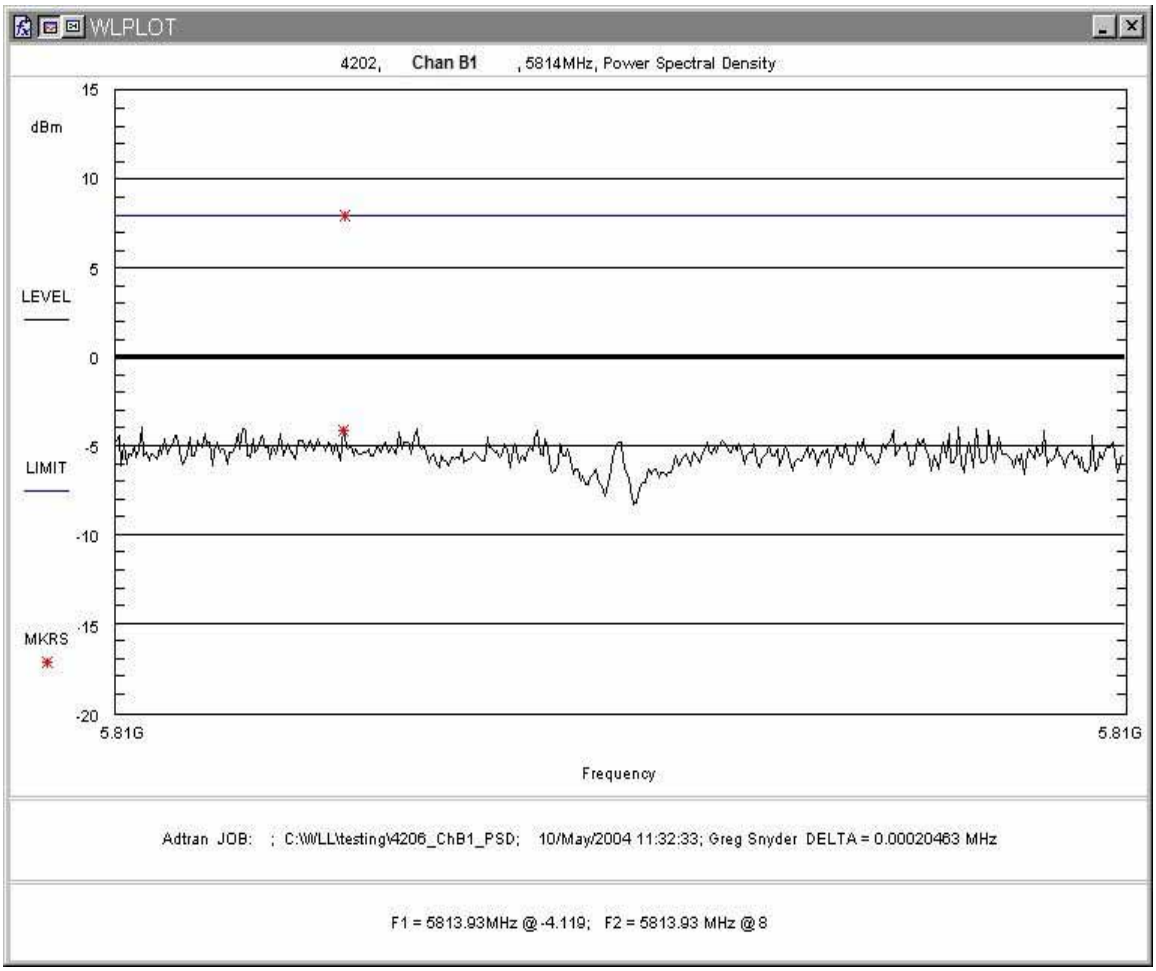

Figure 5. Power Spectral Density Plan B, Band 1

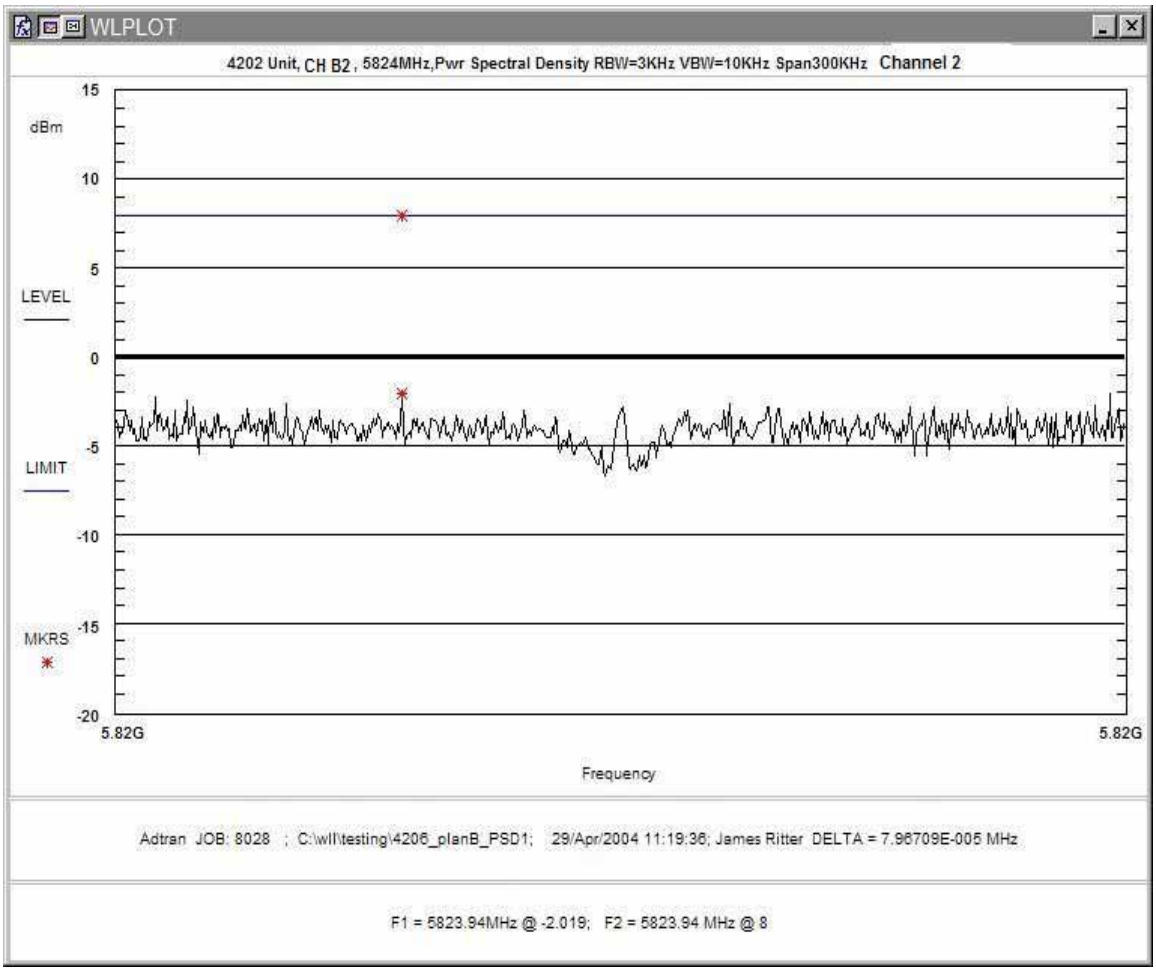

Figure 6. Power Spectral Density Plan B, Band 2

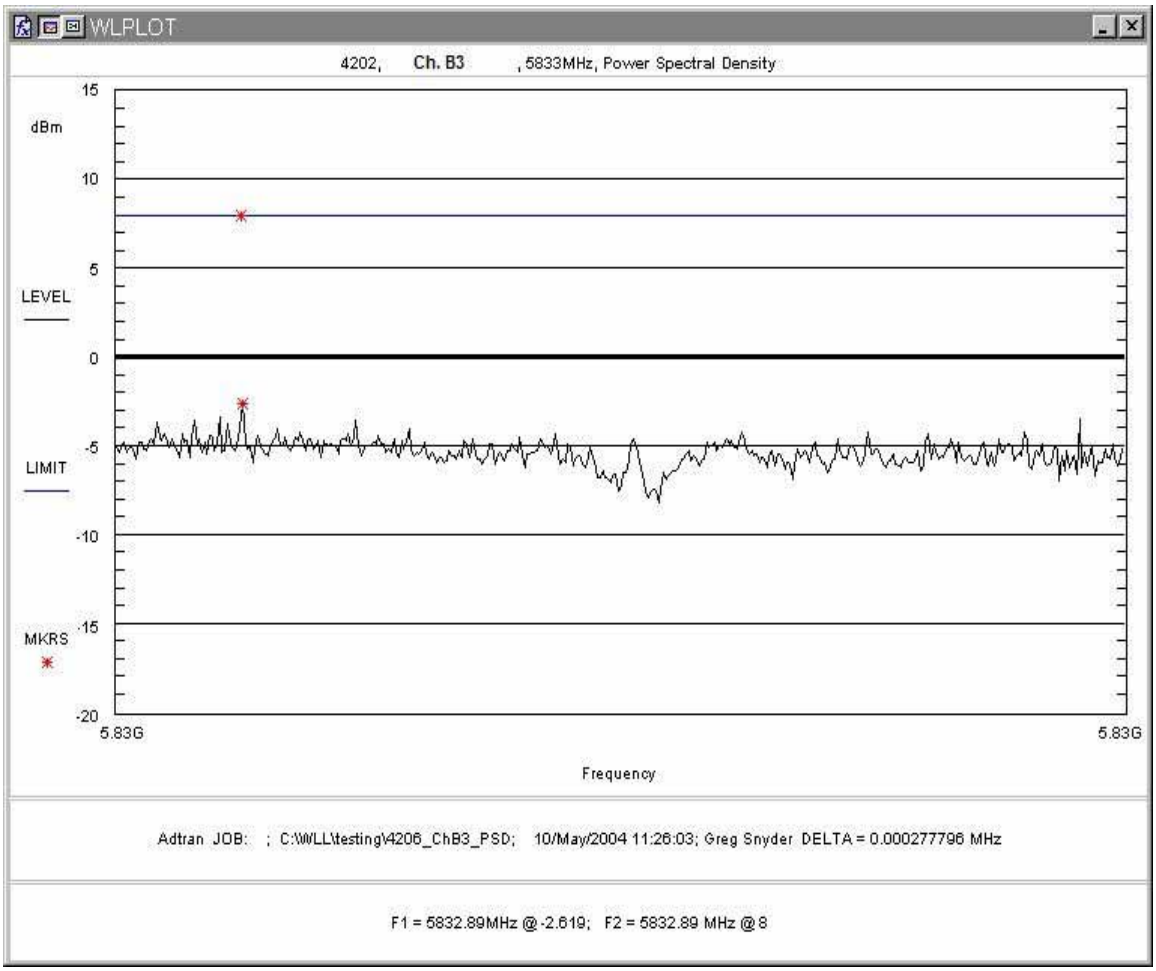

Figure 7. Power Spectral Density Plan B, Band 3

4.3 Occupied Bandwidth (FCC Part 15.247(a)(2) and RSS-210 Amendment 6.2.2(o)(iv))

Occupied bandwidth was performed by coupling the output of the EUT to the input of a spectrum analyzer.

For Direct Sequence Spread Spectrum Systems, FCC Part 15.247 and RSS-210 requires that the minimum 6 dB bandwidth be at least 500 kHz.

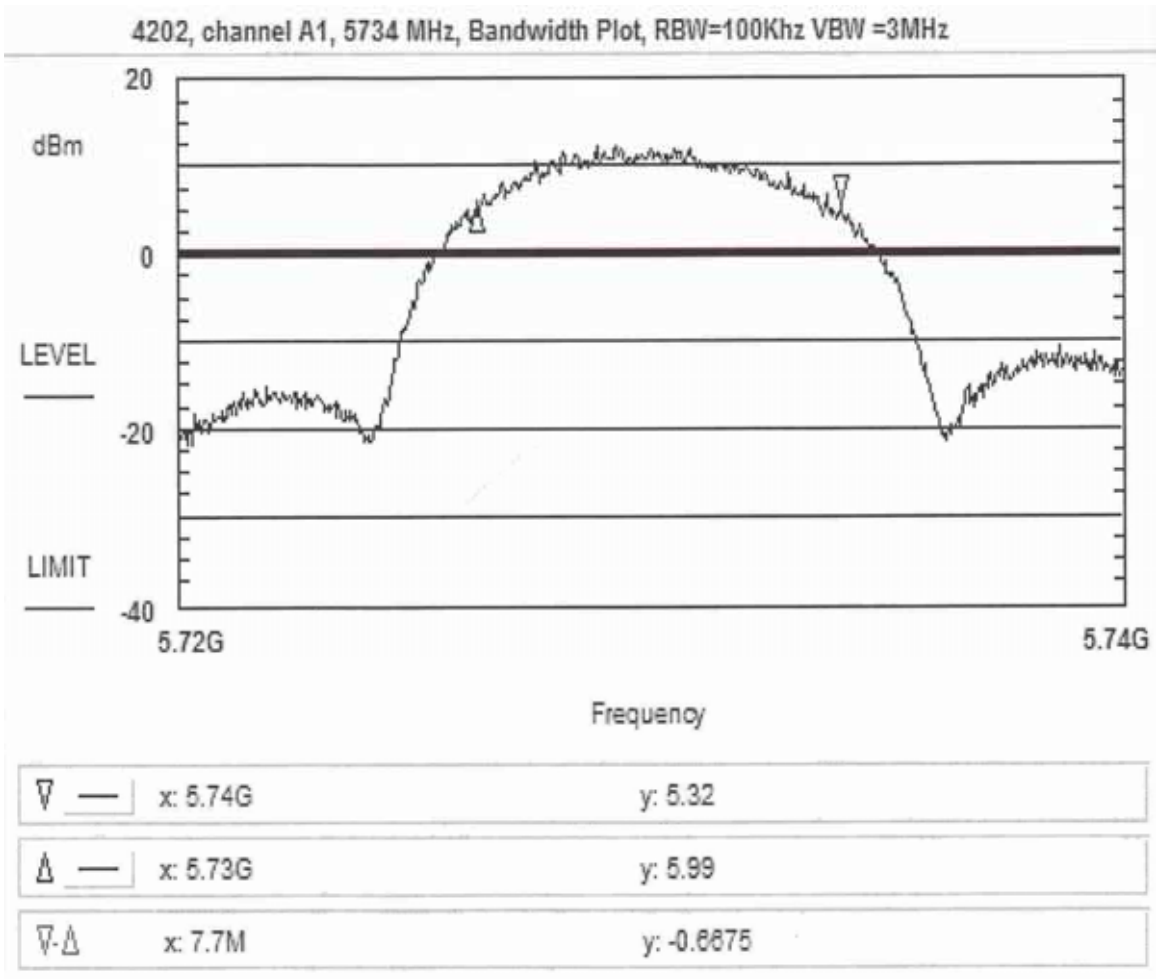

Figure 8. Occupied Bandwidth, Plan A, Channel 1

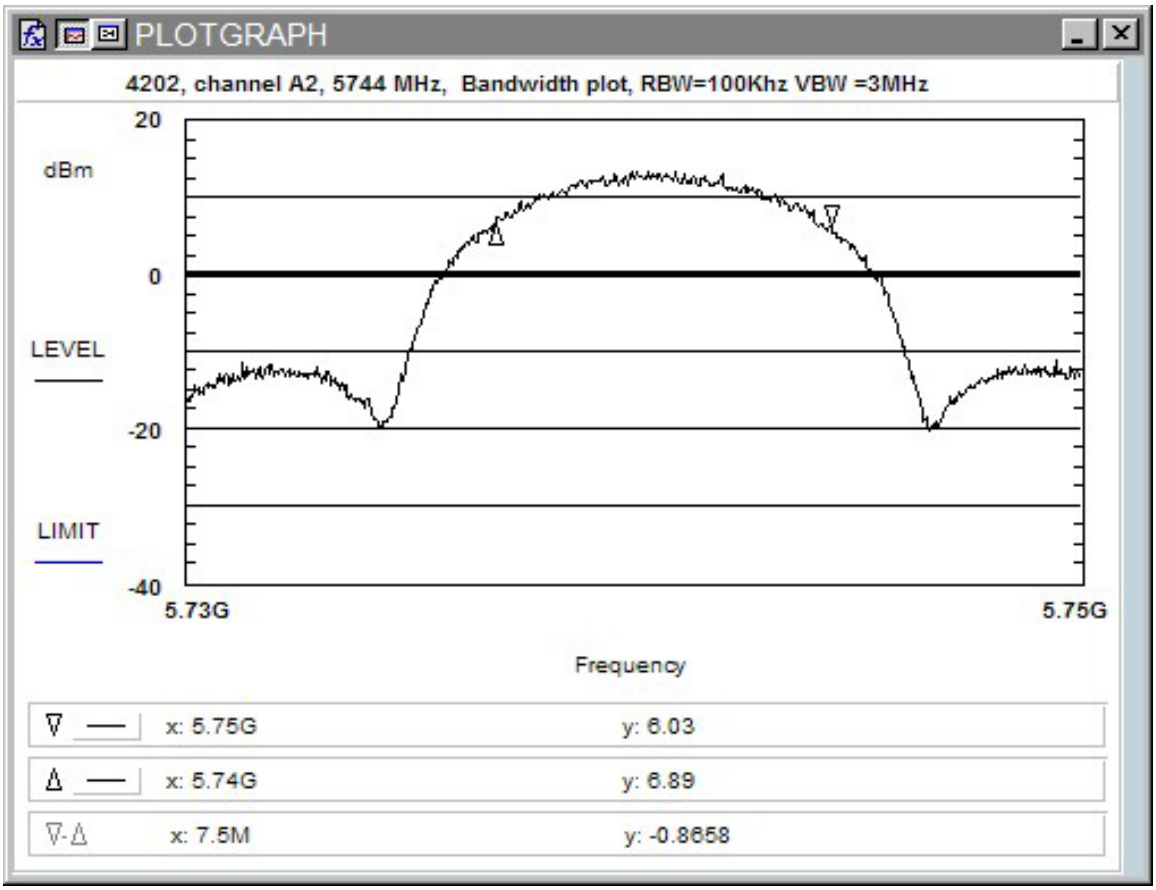

Figure 9. Occupied Bandwidth, Plan A, Channel 2

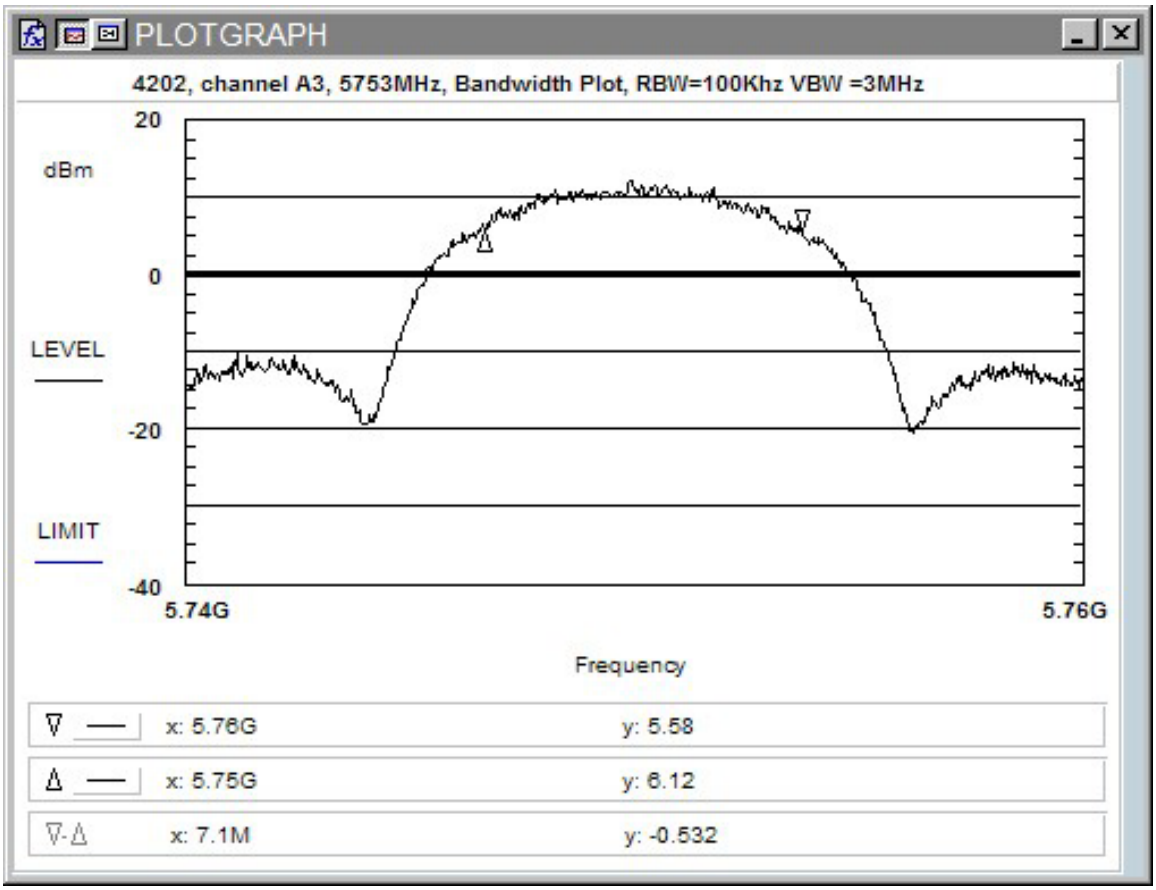

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Figure 10. Occupied Bandwidth, Plan A, Channel 3

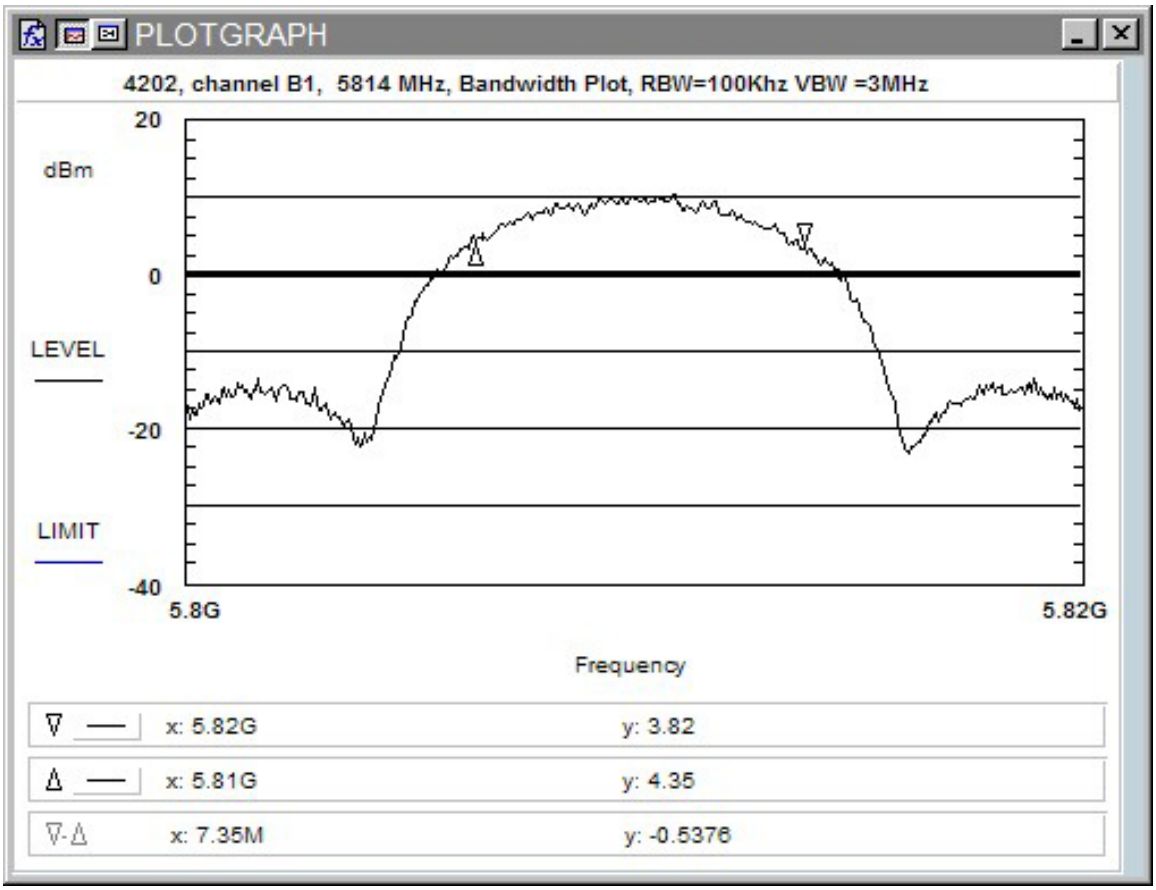

Figure 11. Occupied Bandwidth, Plan B, Channel 1

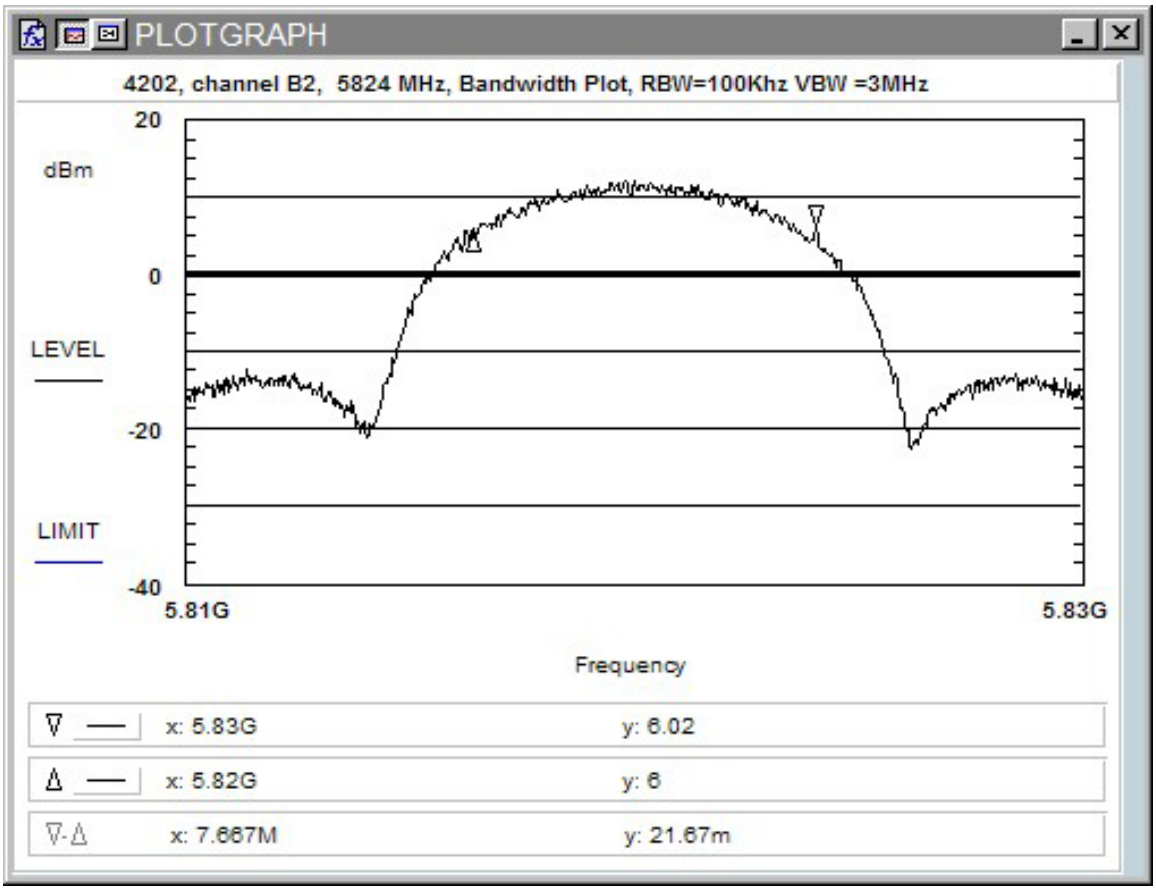

Figure 12. Occupied Bandwidth, Plan B, Channel 2

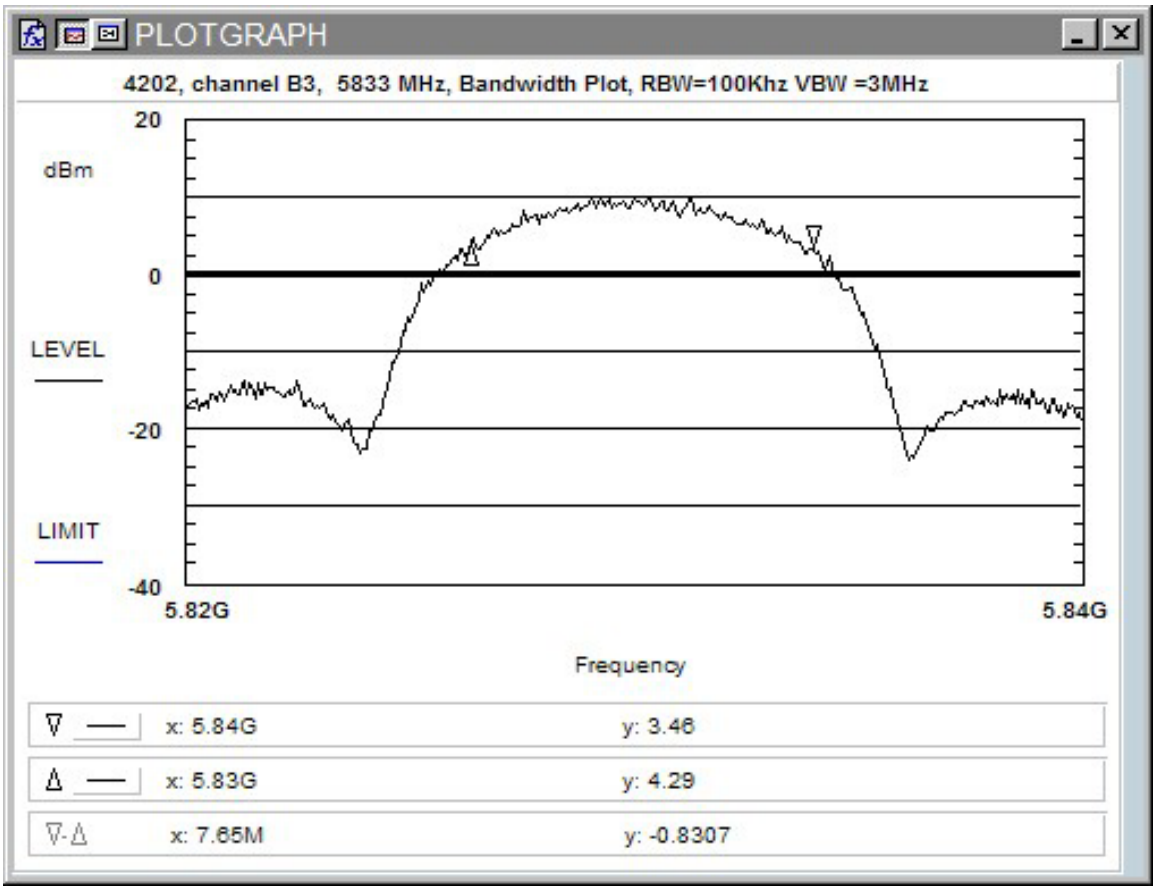

Figure 13. Occupied Bandwidth, Plan B, Channel 3

Table 6 provides a summary of the Occupied Bandwidth Results.

Table 6. Occupied Bandwidth Results

Frequency	Bandwidth	Limit	Pass/Fail
Plan A			
Channel 1 5734.00 MHz	7.7 MHz	> 500 kHz	Pass
Channel 2 5743.80 MHz	7.5 MHz	> 500 kHz	Pass
Channel 3 5753.00 MHz	7.1 MHz	> 500 kHz	Pass
Plan B			
Channel 1 5814.70 MHz	7.35 MHz	> 500 kHz	Pass
Channel 2 5824.00 MHz	7.67 MHz	> 500 kHz	Pass
Channel 3 5833.10 MHz	7.65 MHz	> 500 kHz	Pass

4.4 Spurious Emissions at Antenna Terminals (FCC Part §15.247(b) RSS-210 6.2.2(o)(e1))

In any 100 kHz band outside the frequency band in which the system is operating, the RF power shall be at least 20dB below that in the 100 kHz bandwidth that contain the highest level of the desired power.

4.4.1 Test Procedure

The RF output of the EUT was connected to the input of a spectrum analyzer. All calibration factors including attenuators and cable losses were included in the corrections for the measurements. The resolution bandwidth was set to 100kHz for the duration of the testing and the video bandwidth was set to 3MHz.

Initially the highest in-band signal was measured using the 100kHz measurement bandwidth. The limit for out-of-band spurious emissions was then set at 20dBc. Emissions were scanned to 40GHz.

4.4.2 Test Results

Conducted spurious emissions were scanned for all 6 channels. No above limit spurious emissions were detected. The following are plots of the conducted spurious emissions.

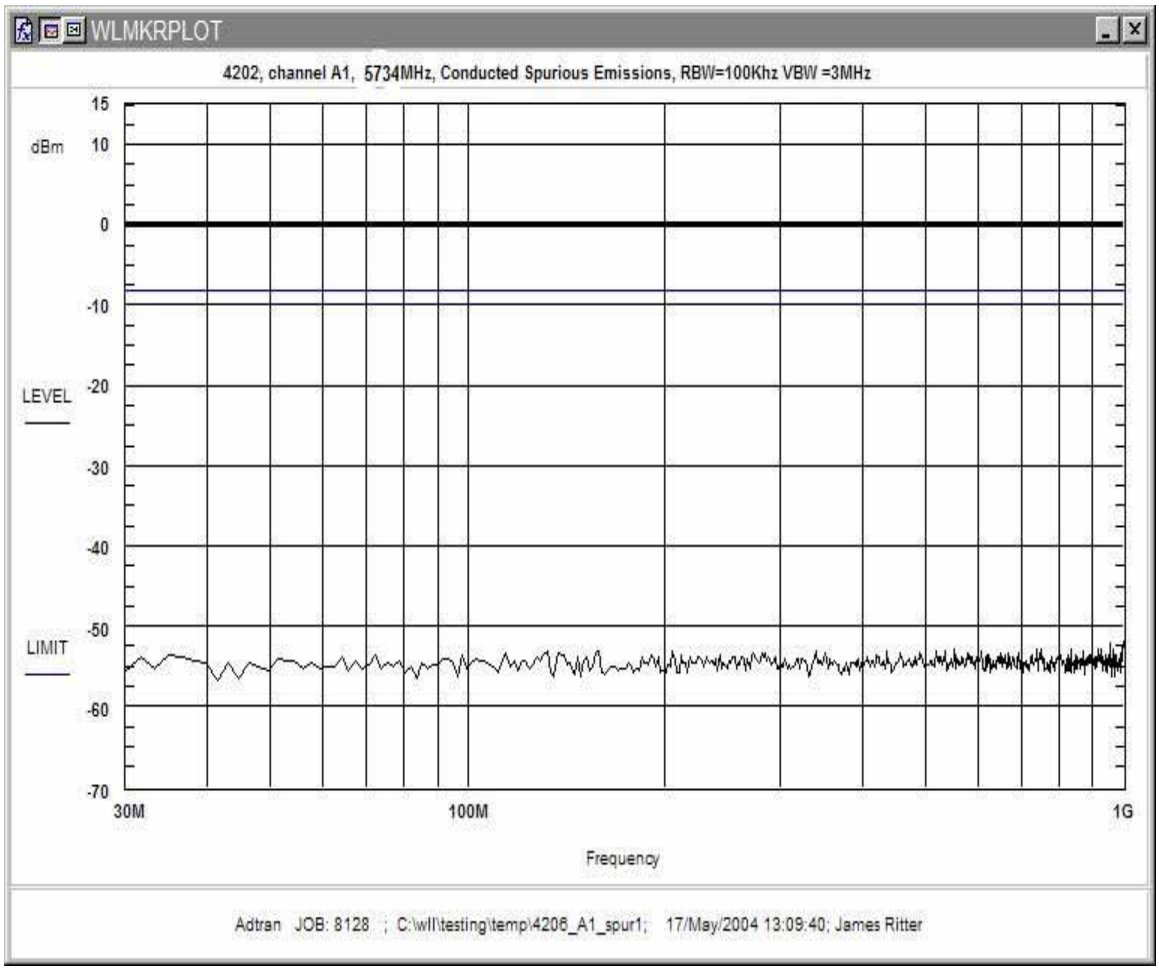

Figure 14. Conducted Spurious Emissions, Plan A - Channel 1, 30MHz-1GHz

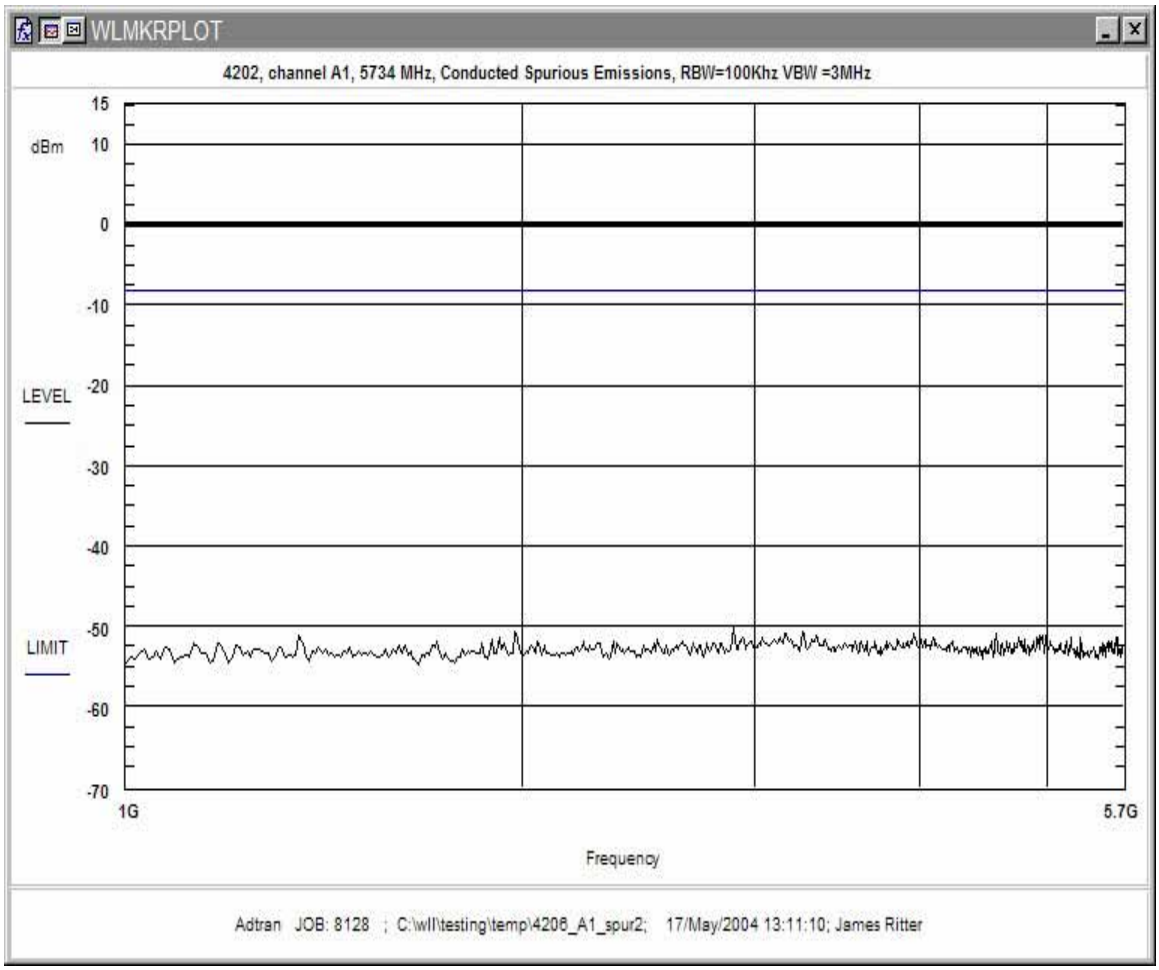

Figure 15. Conducted Spurious Emissions, Plan A - Channel 1, 1GHz-5.7GHz

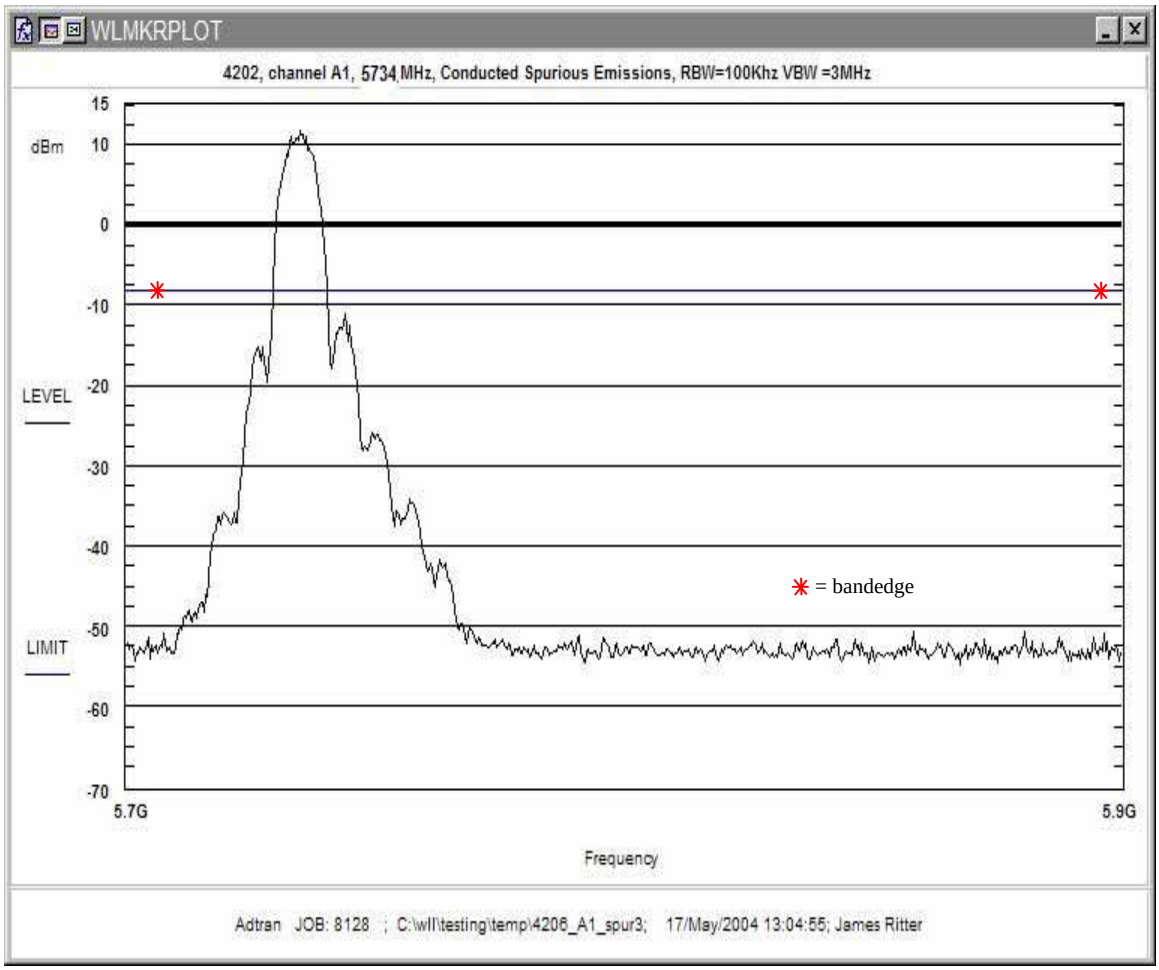

Figure 16. Conducted Spurious Emissions, Plan A - Channel 1, 5.7GHz-5.9GHz

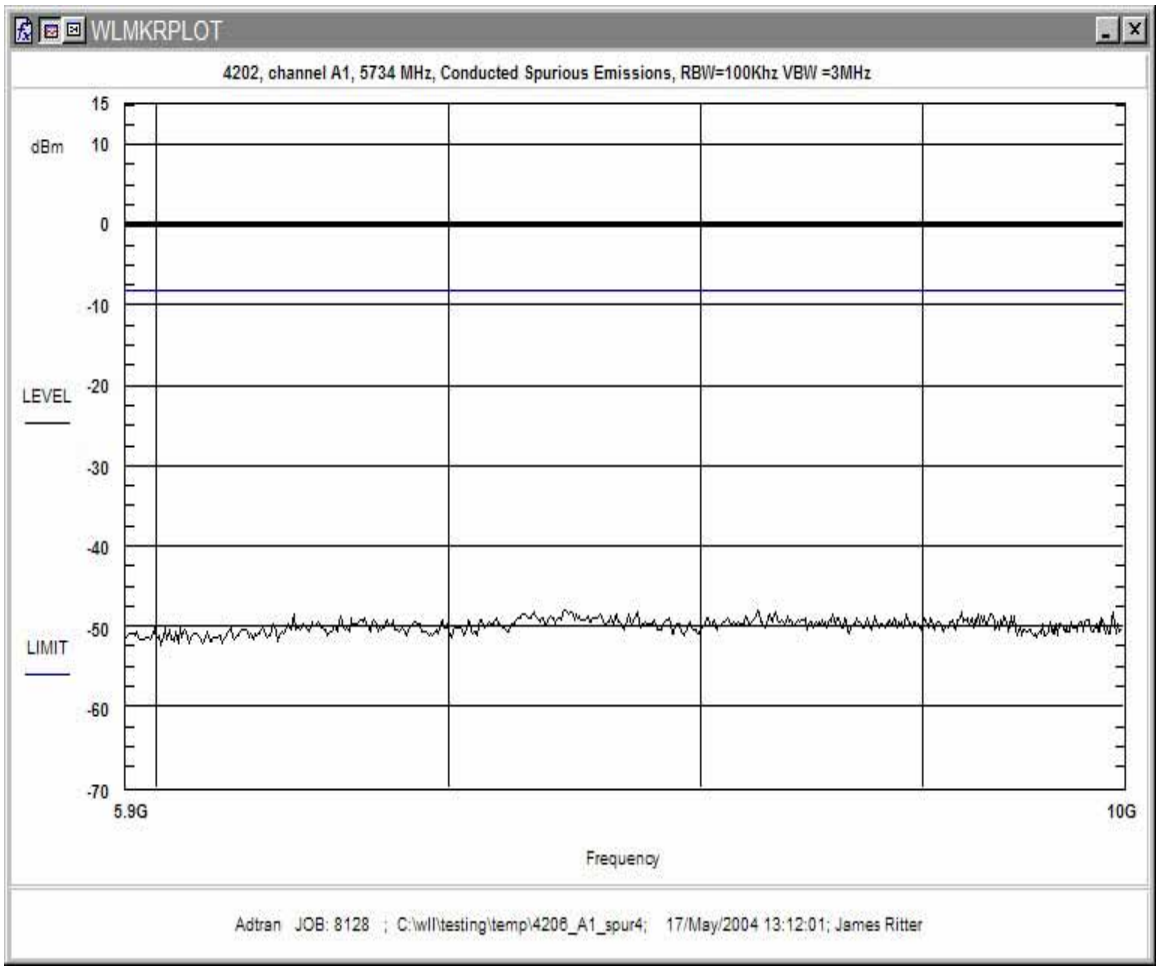

Figure 17. Conducted Spurious Emissions, Plan A - Channel 1, 5.9GHz-10GHz

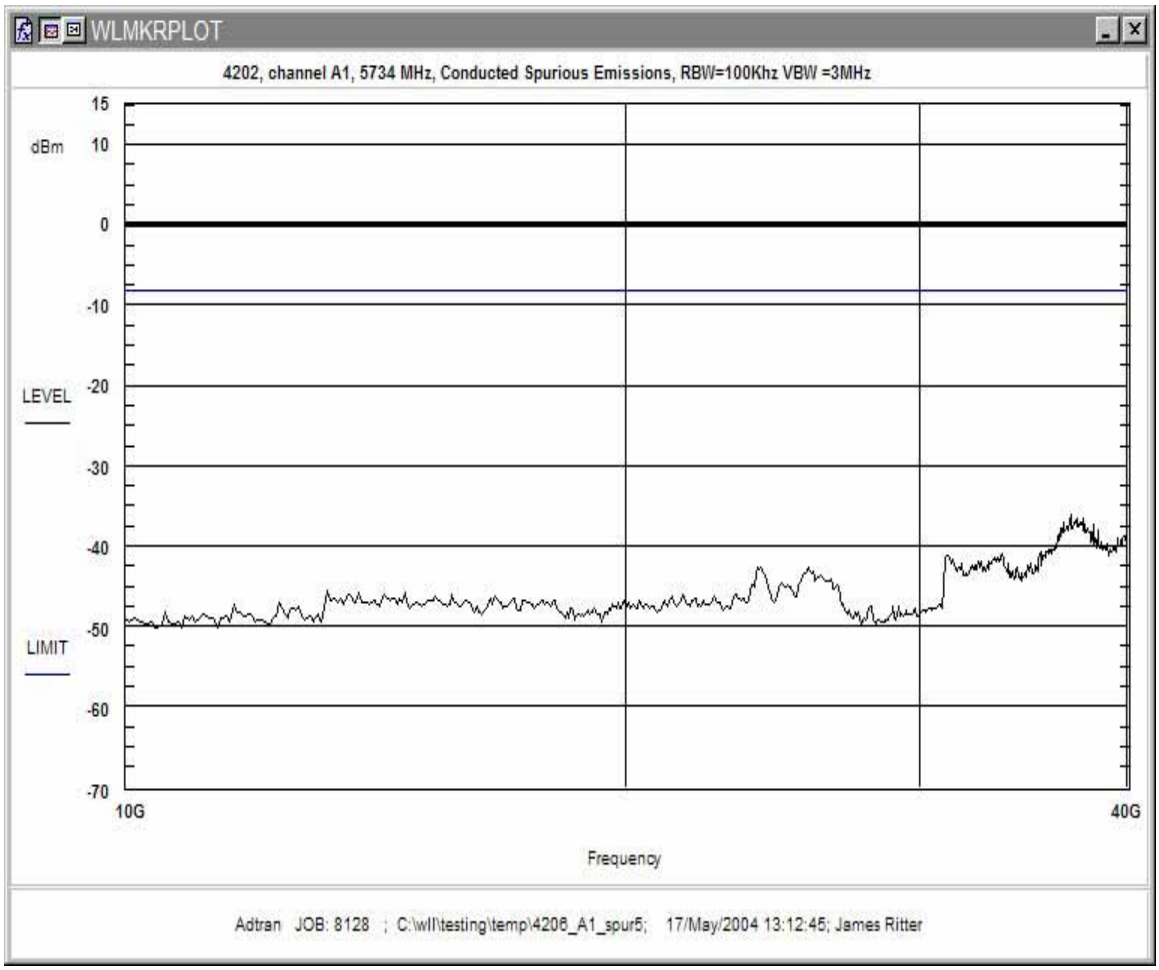

Figure 18. Conducted Spurious Emissions, Plan A - Channel 1, 10GHz-40GHz

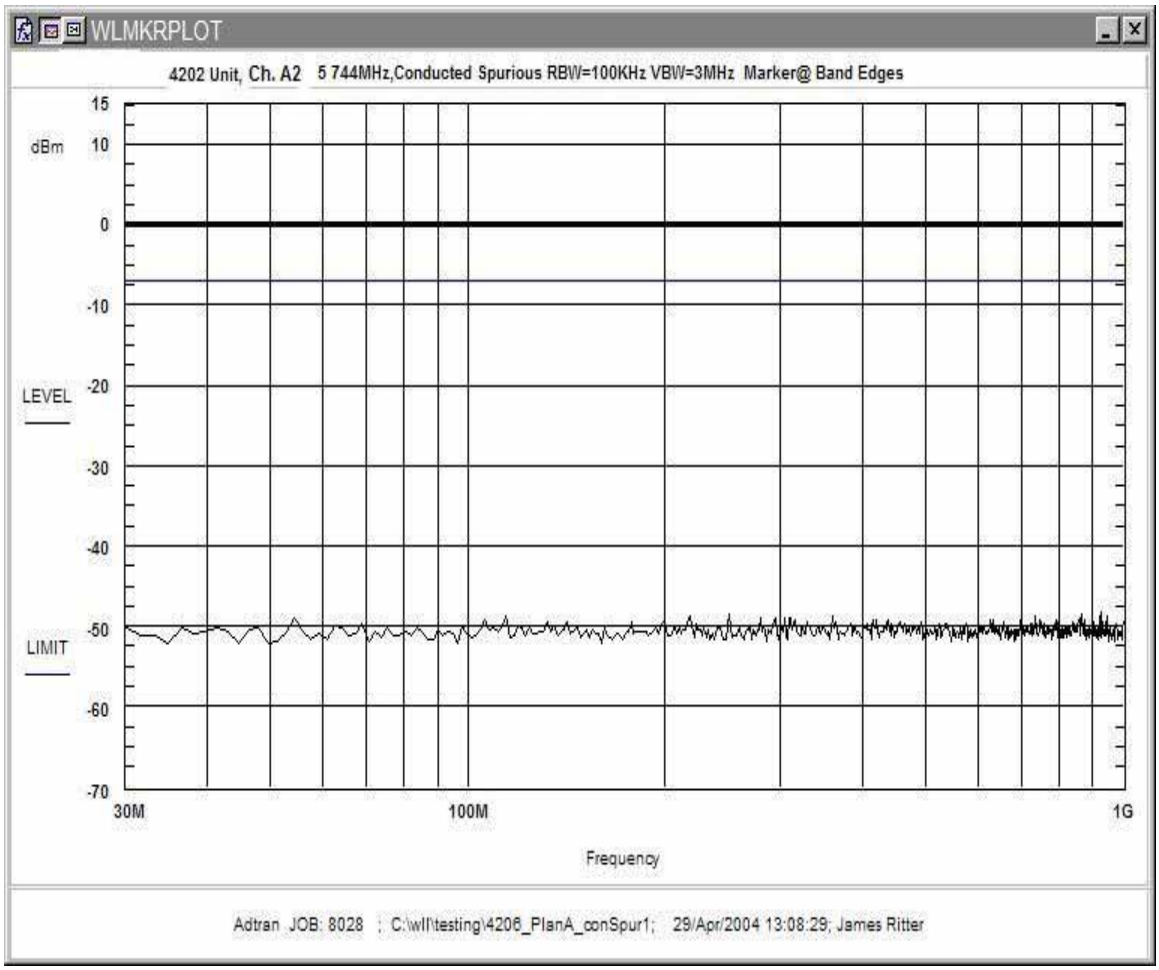

Figure 19. Conducted Spurious Emissions, Plan A - Channel 2, 30MHz-5.72GHz

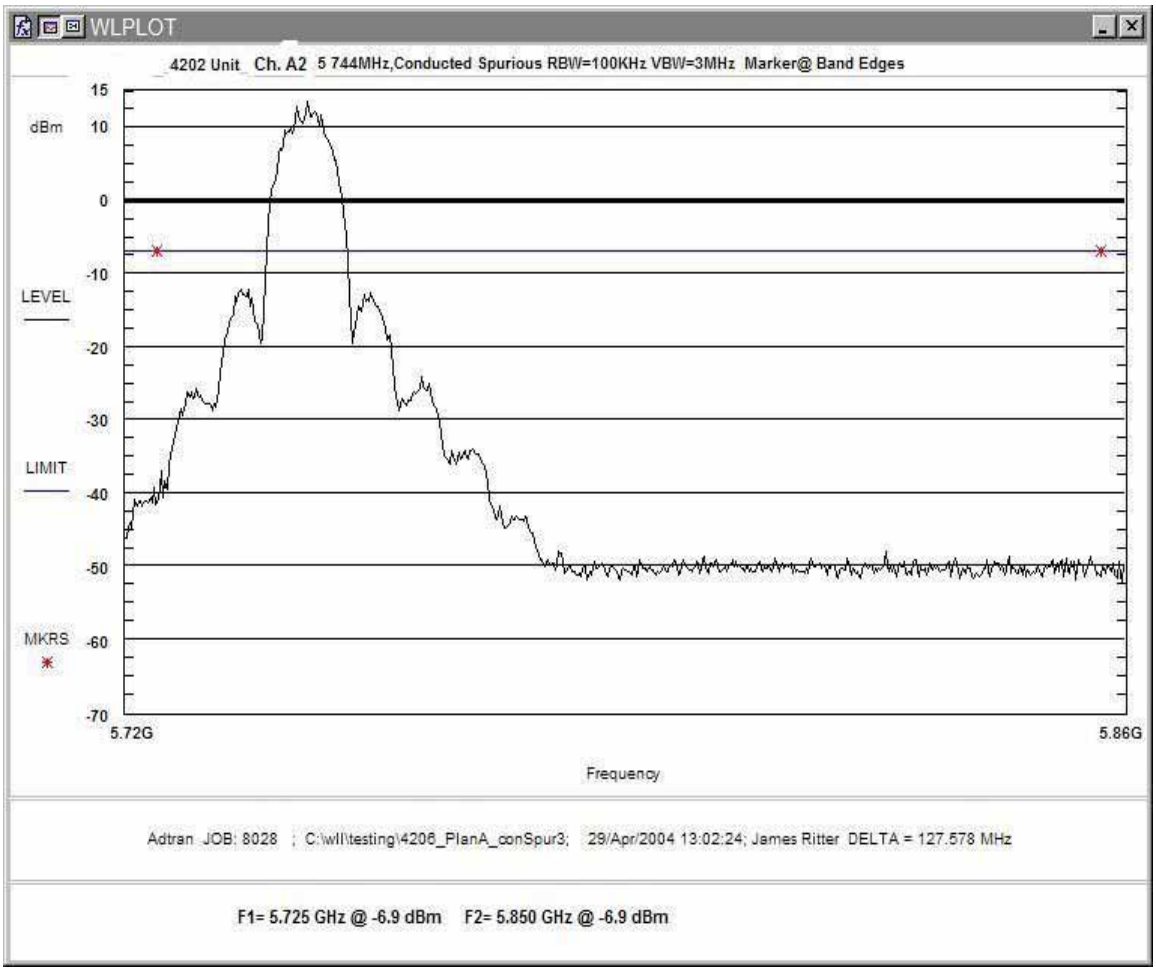

Figure 20. Conducted Spurious Emissions, Plan A - Channel 2, 5.72GHz-5.86GHz

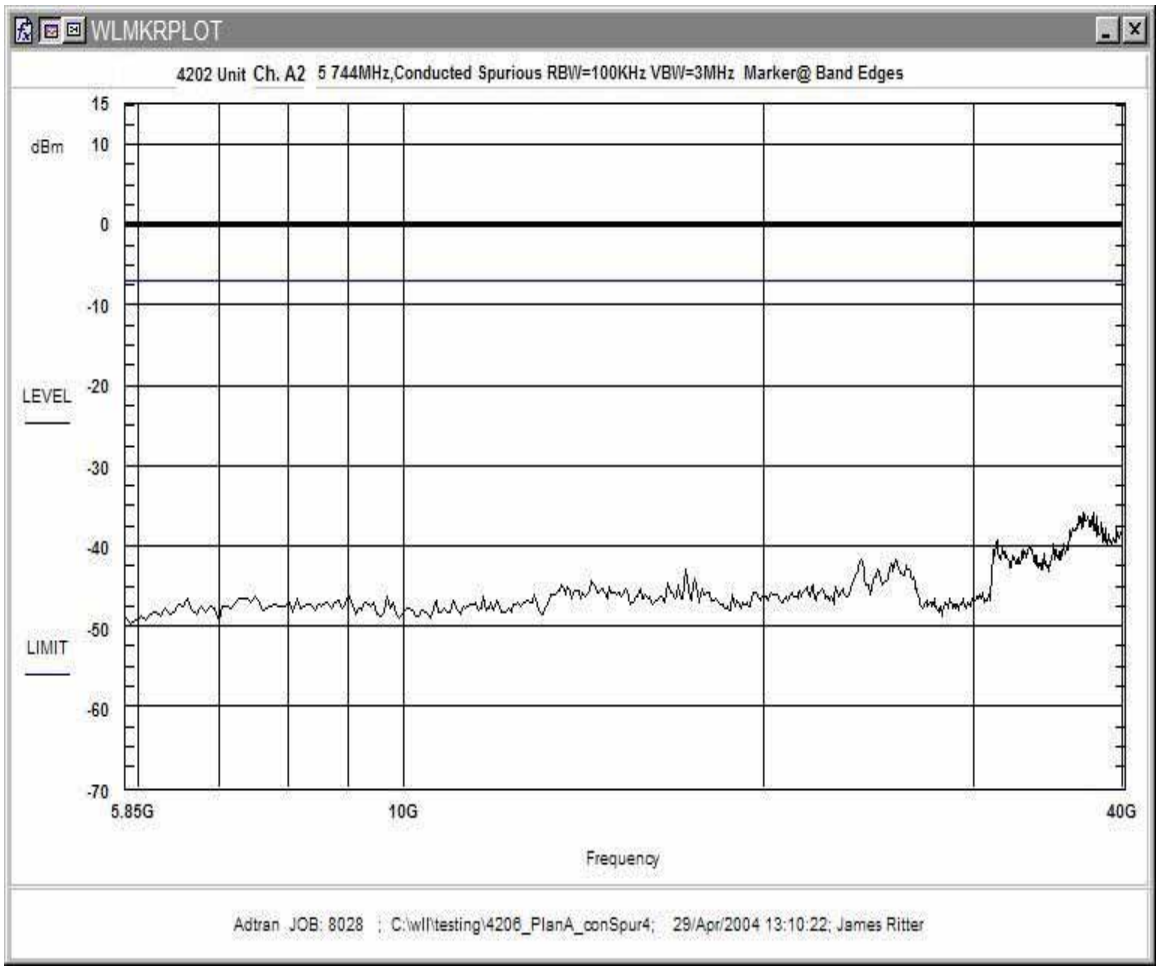

Figure 21. Conducted Spurious Emissions, Plan A - Channel 2, 5.85GHz-40GHz

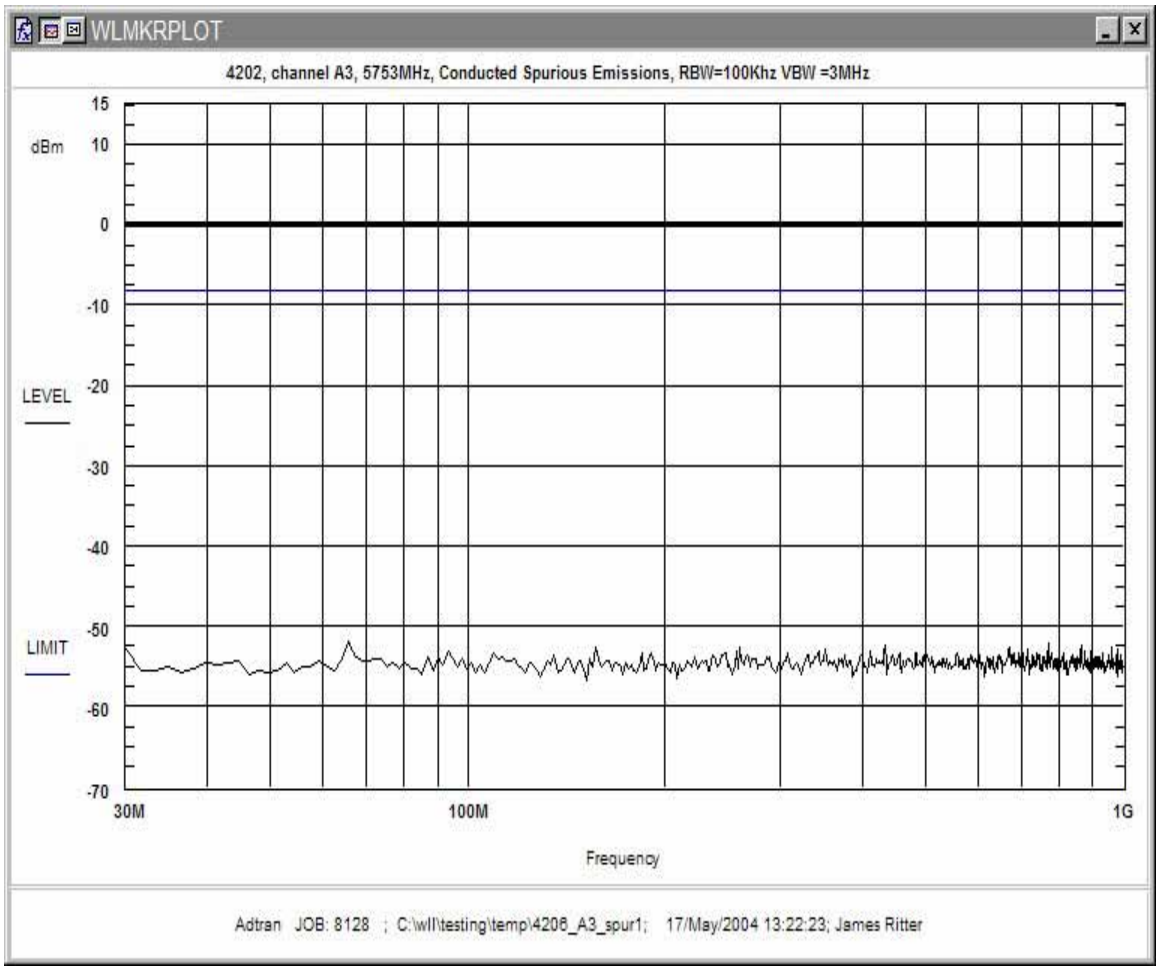

Figure 22. Conducted Spurious Emissions, Plan A - Channel 3, 30MHz-1GHz

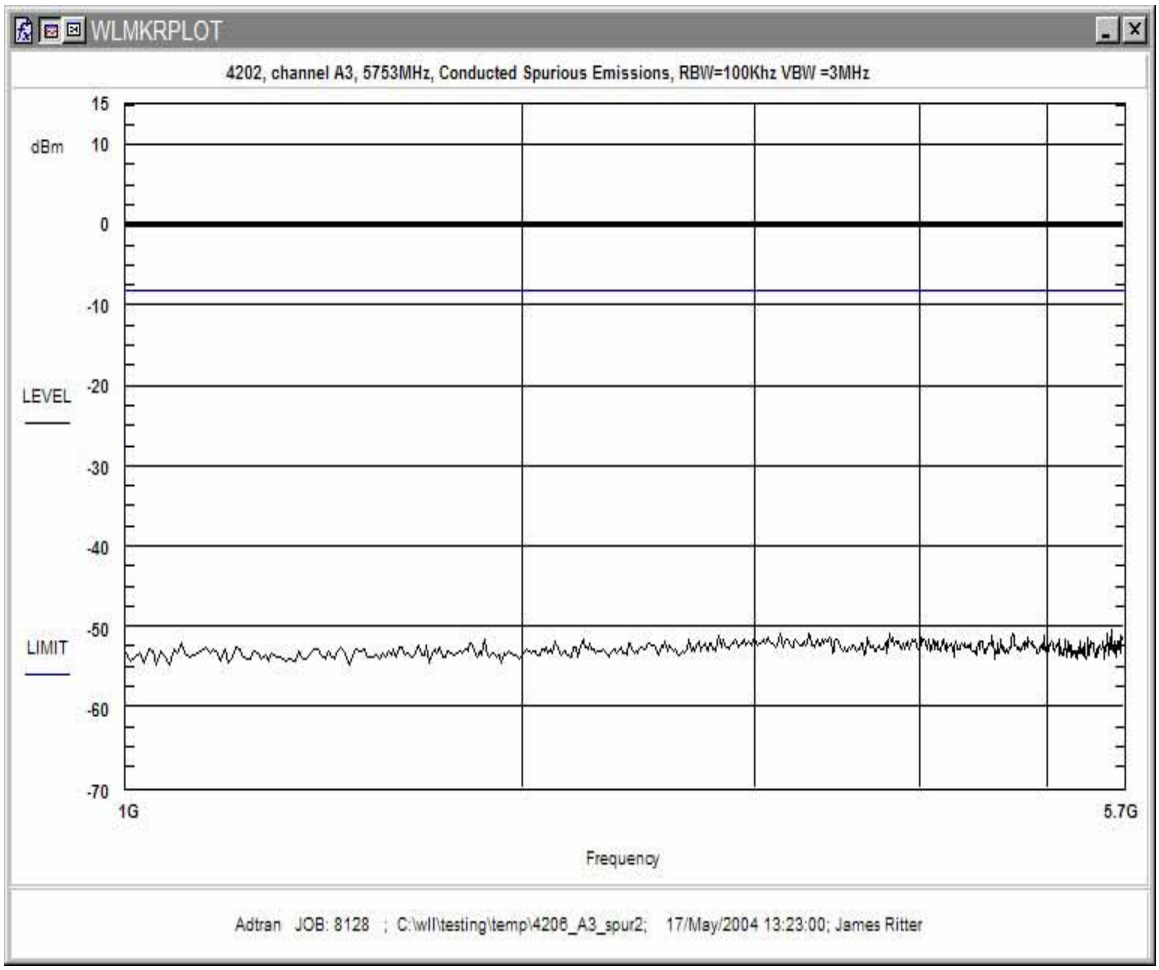

Figure 23. Conducted Spurious Emissions, Plan A - Channel 3, 1GHz-5.7GHz

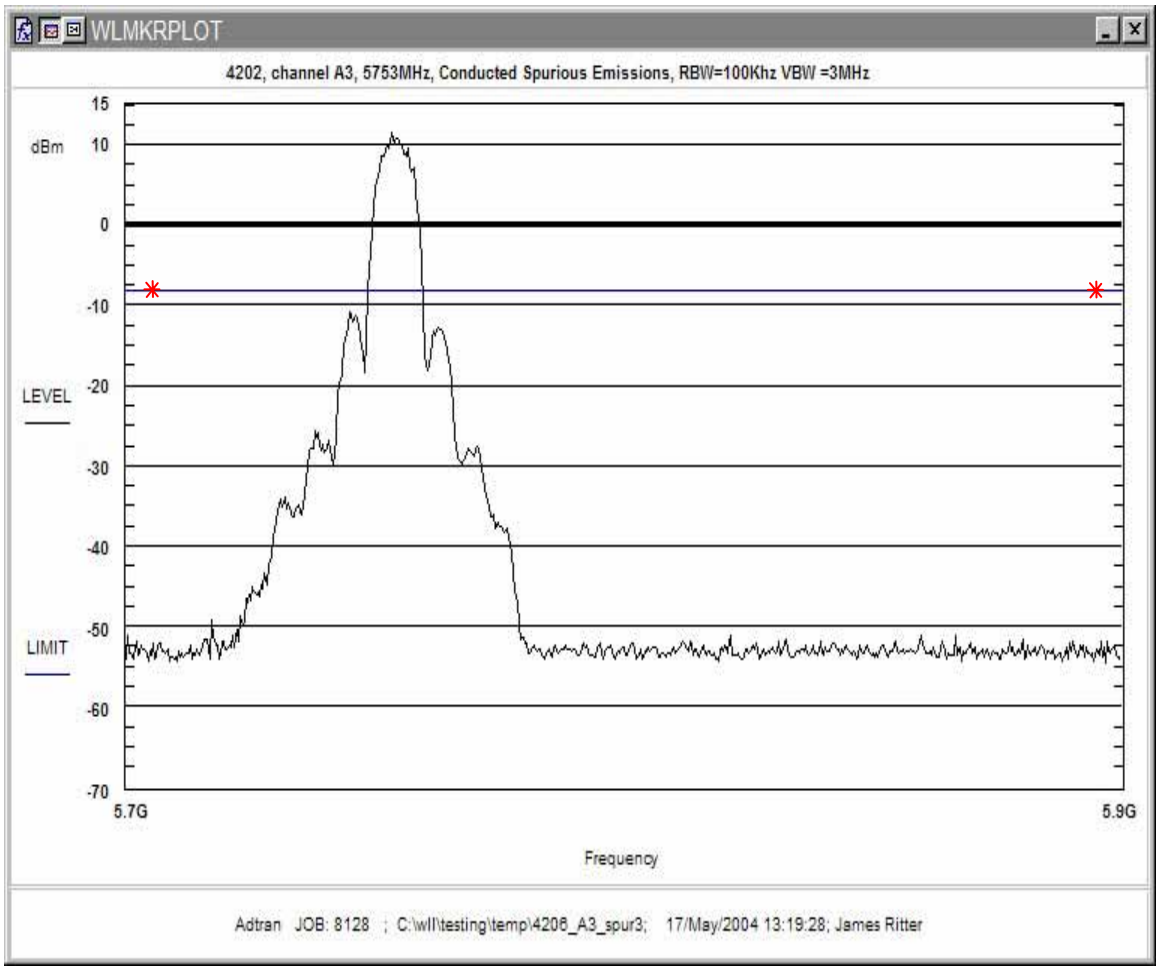

Figure 24. Conducted Spurious Emissions, Plan A - Channel 3, 5.7GHz-5.9GHz

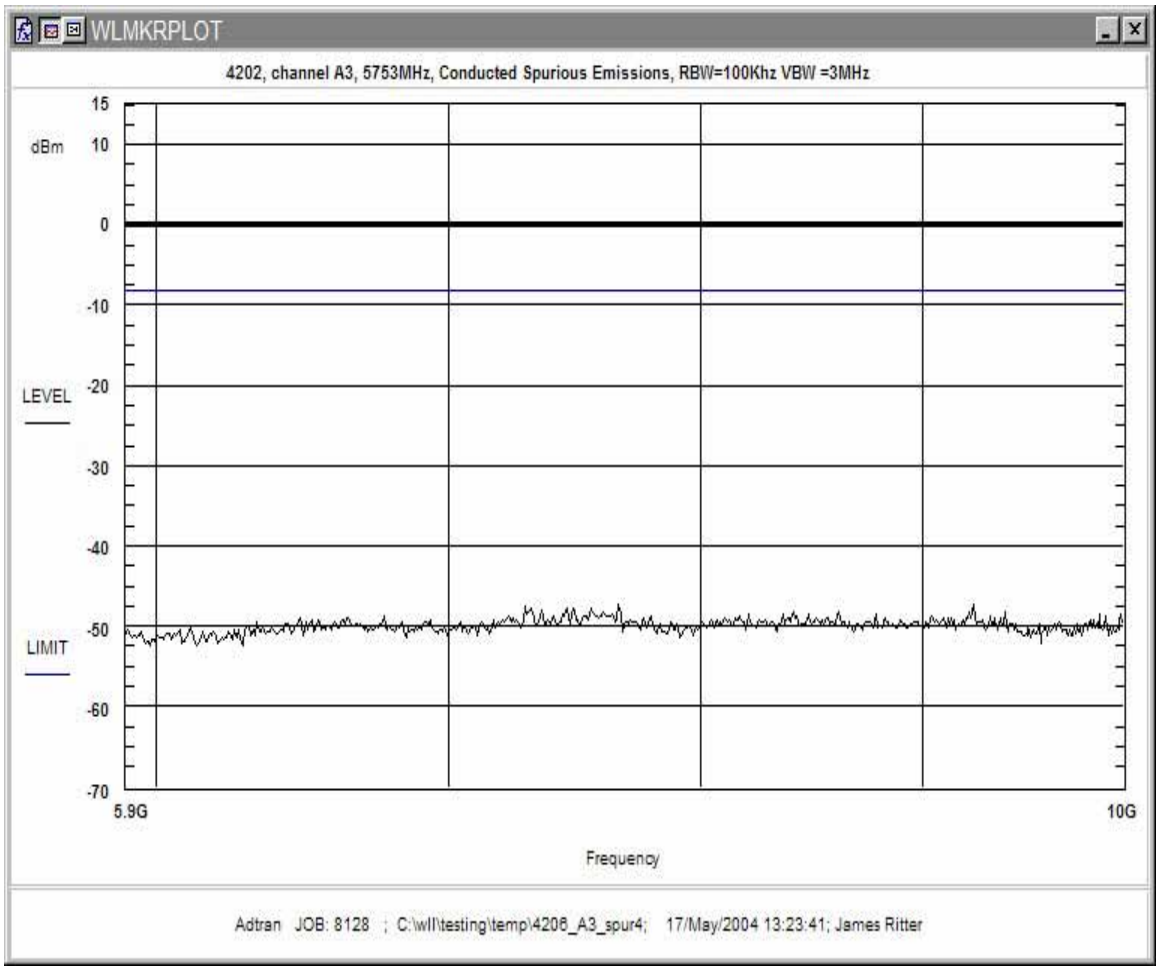

Figure 25. Conducted Spurious Emissions, Plan A - Channel 3, 5.9GHz-10GHz

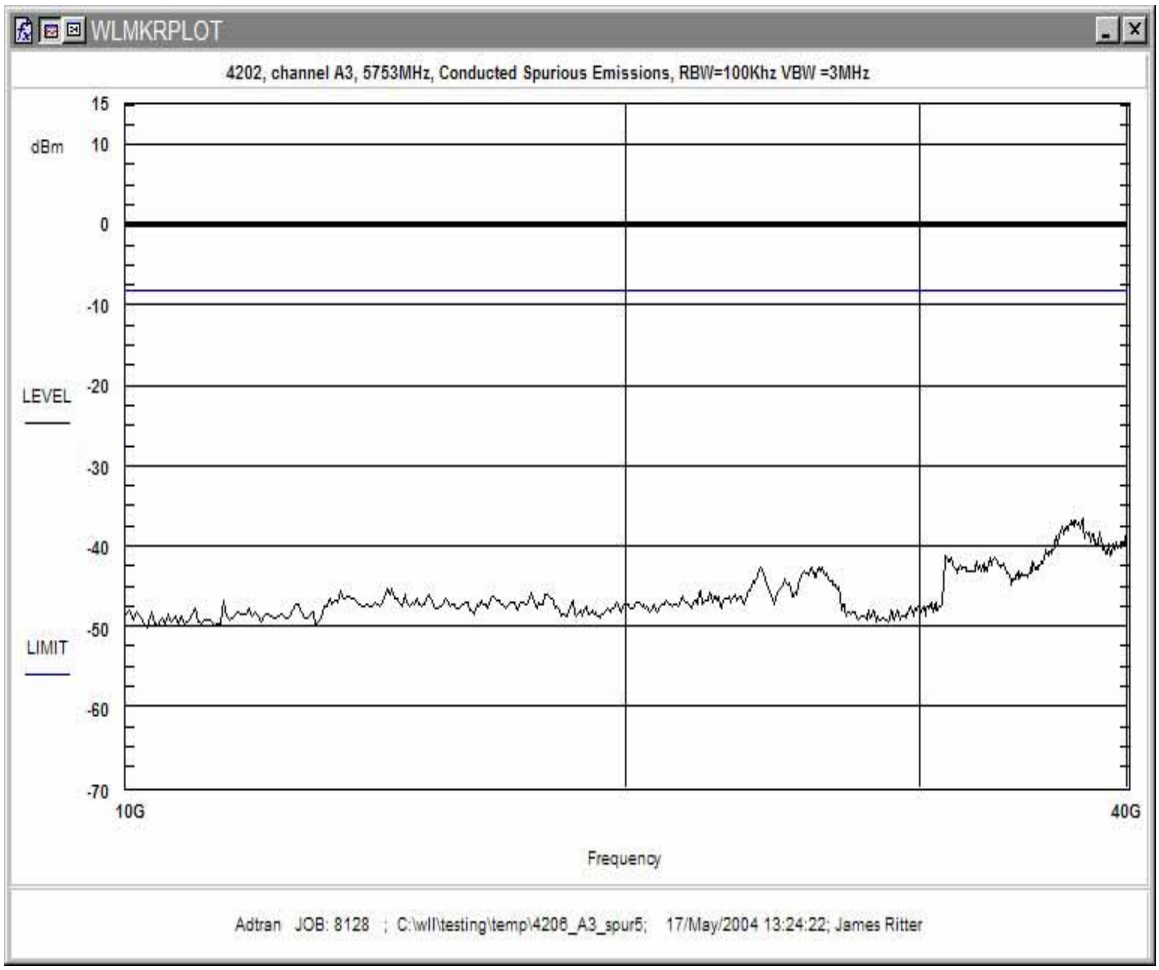

Figure 26. Conducted Spurious Emissions, Plan A - Channel 3, 10GHz-40GHz

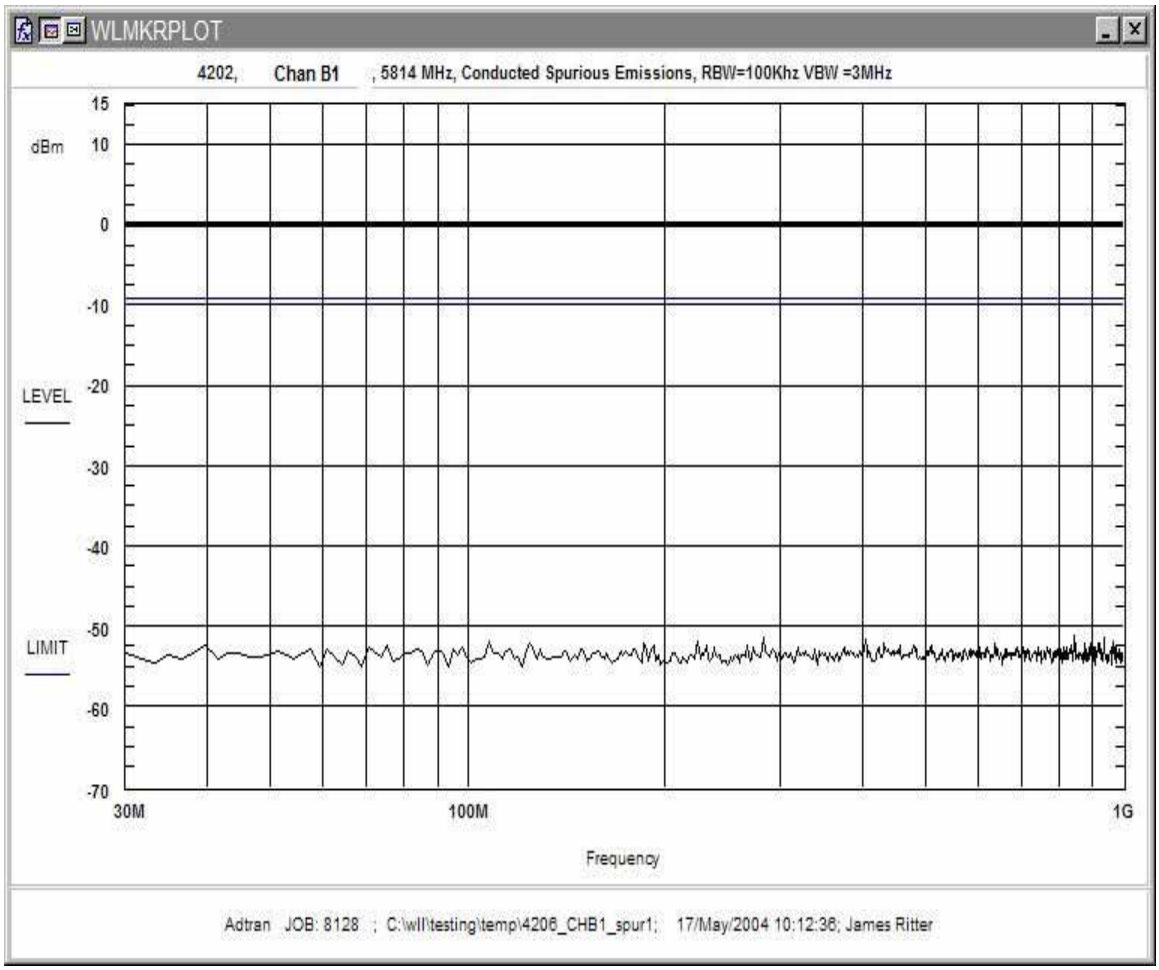

Figure 27. Conducted Spurious Emissions, Plan B - Channel 1, 30MHz-1GHz

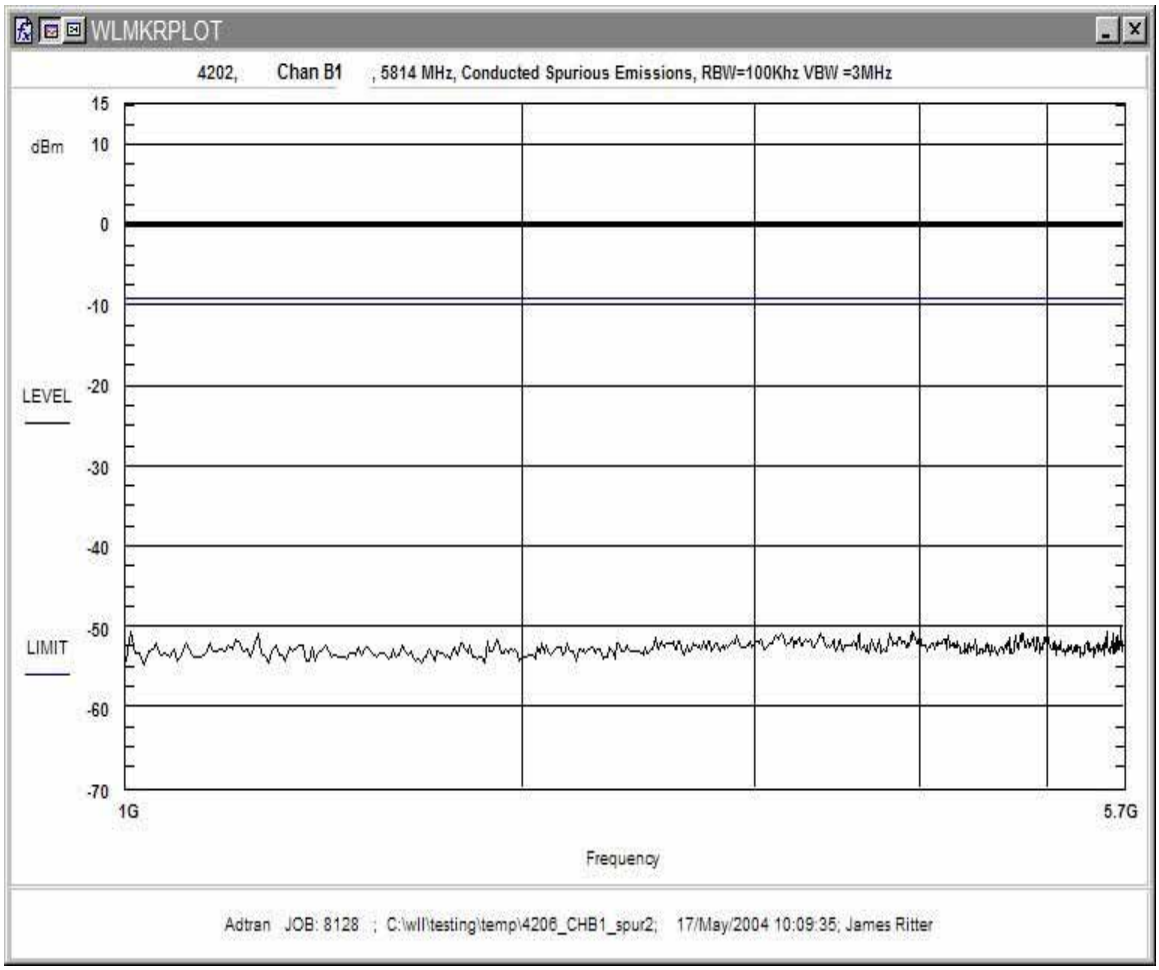

Figure 28. Conducted Spurious Emissions, Plan B - Channel 1, 1GHz-5.7GHz

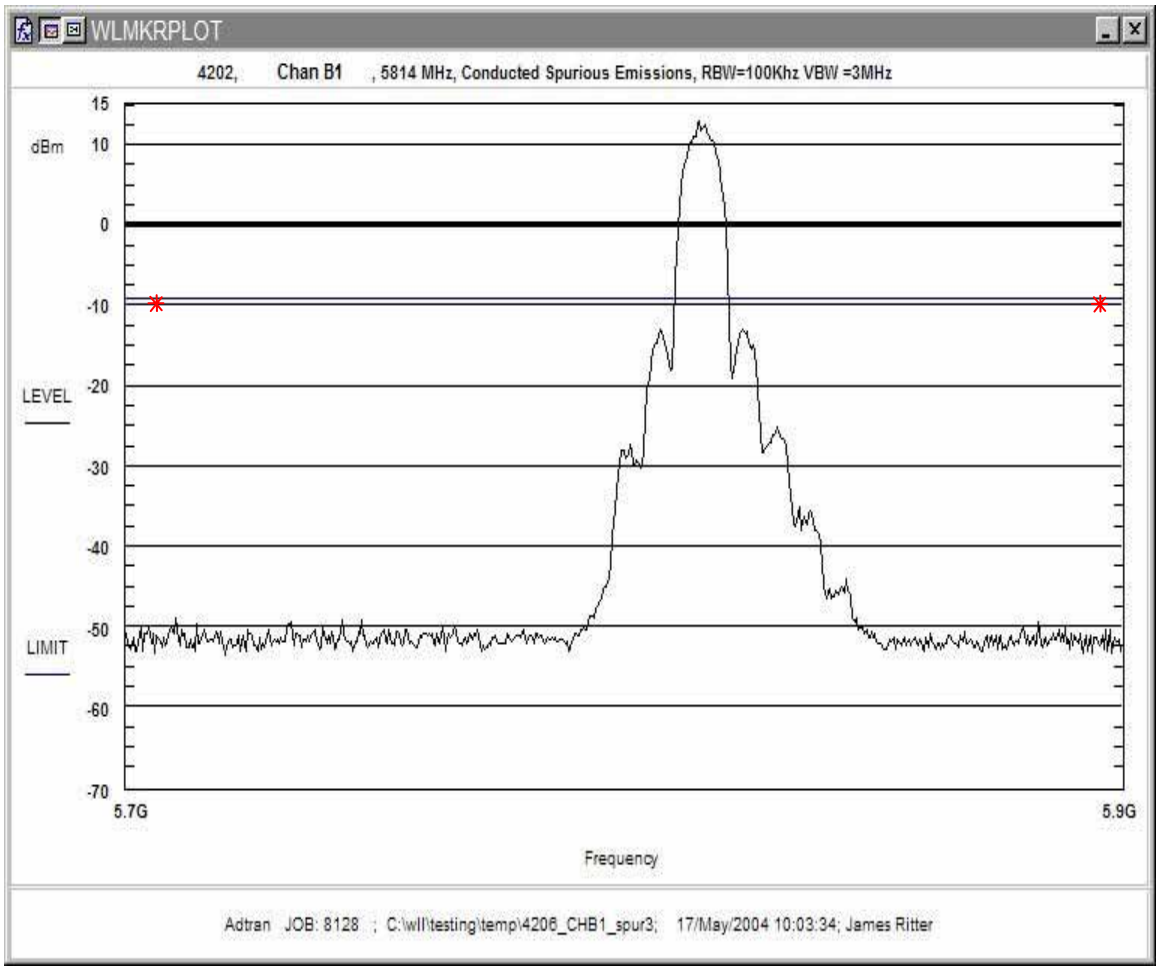

Figure 29. Conducted Spurious Emissions, Plan B - Channel 1, 5.7GHz-5.9GHz

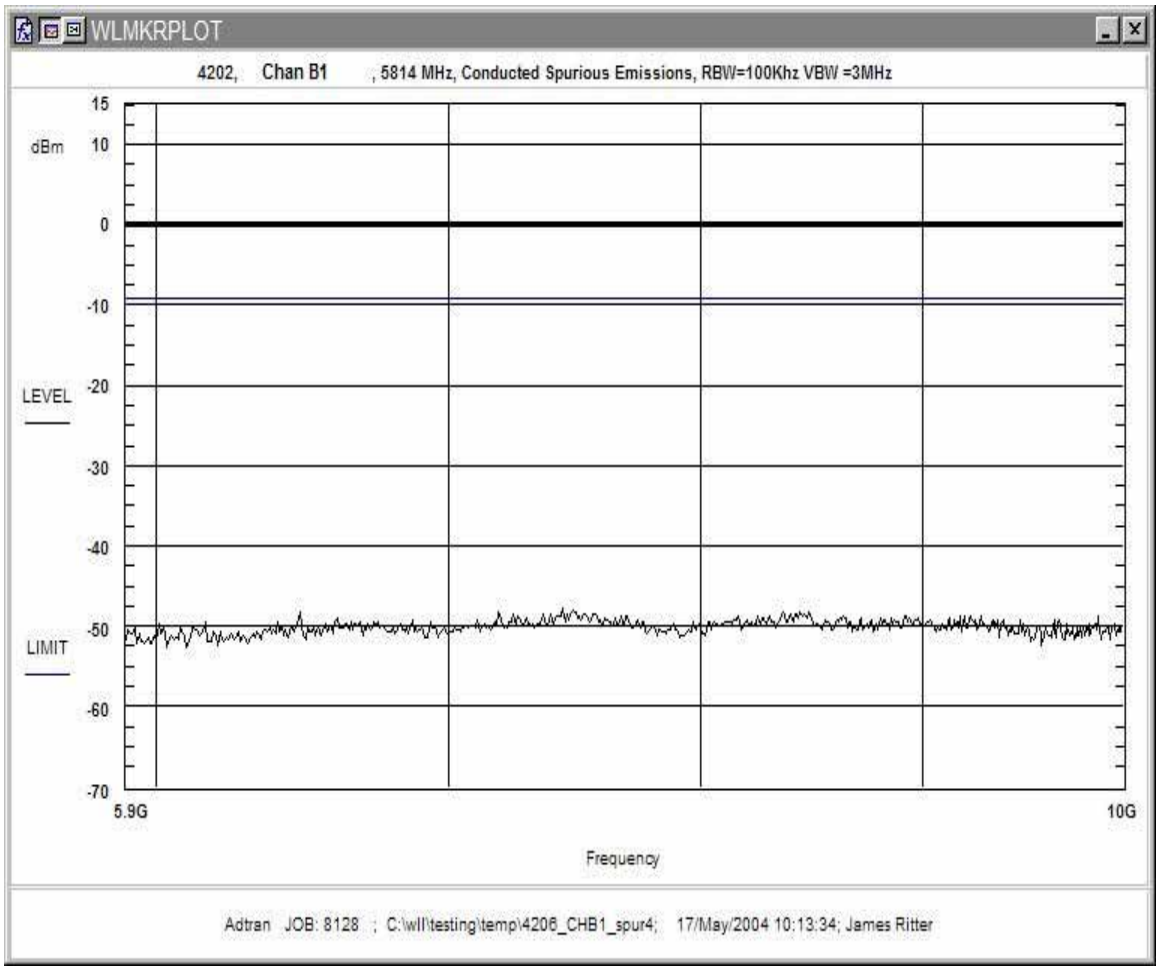

Figure 30. Conducted Spurious Emissions, Plan B - Channel 1, 5.9GHz-10GHz

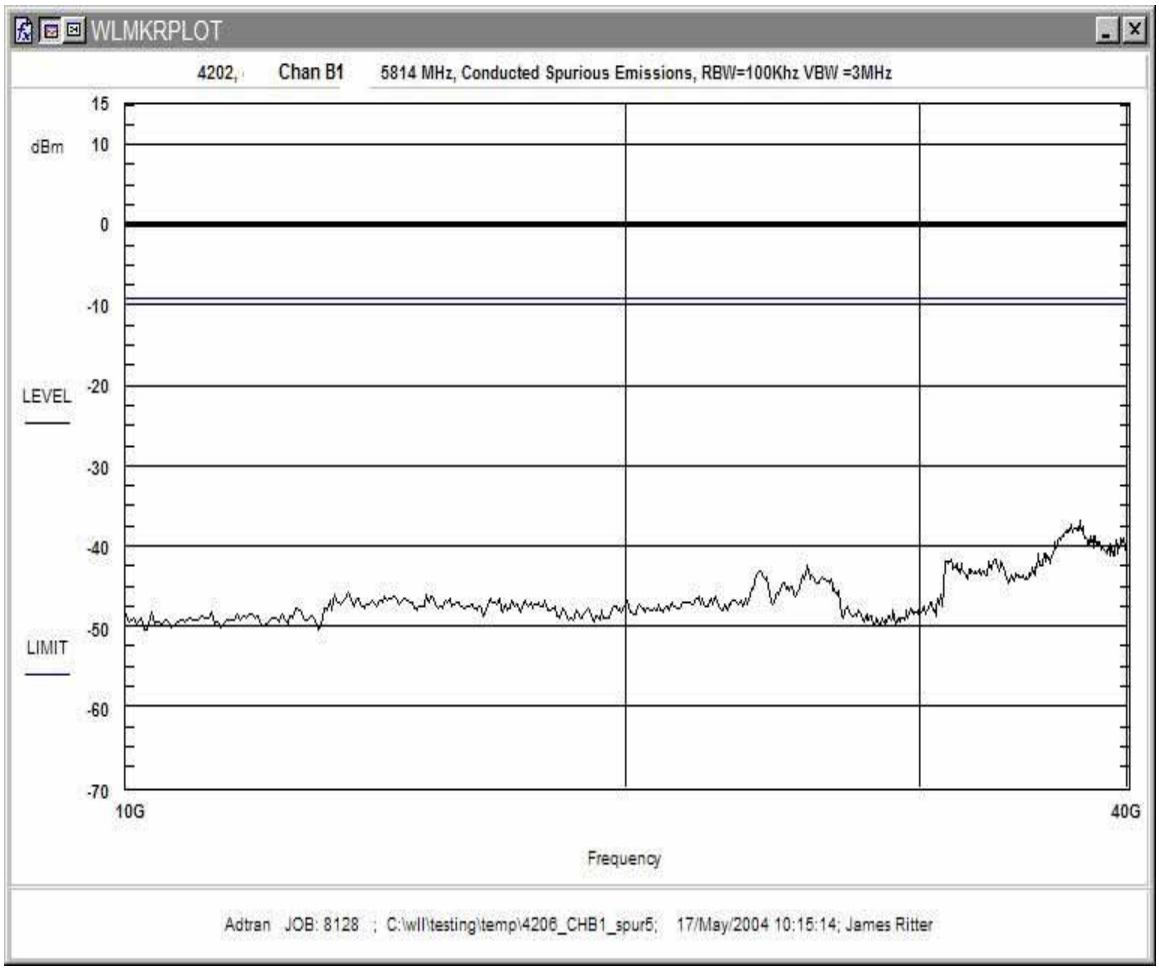

Figure 31. Conducted Spurious Emissions, Plan B - Channel 1, 10GHz-40GHz

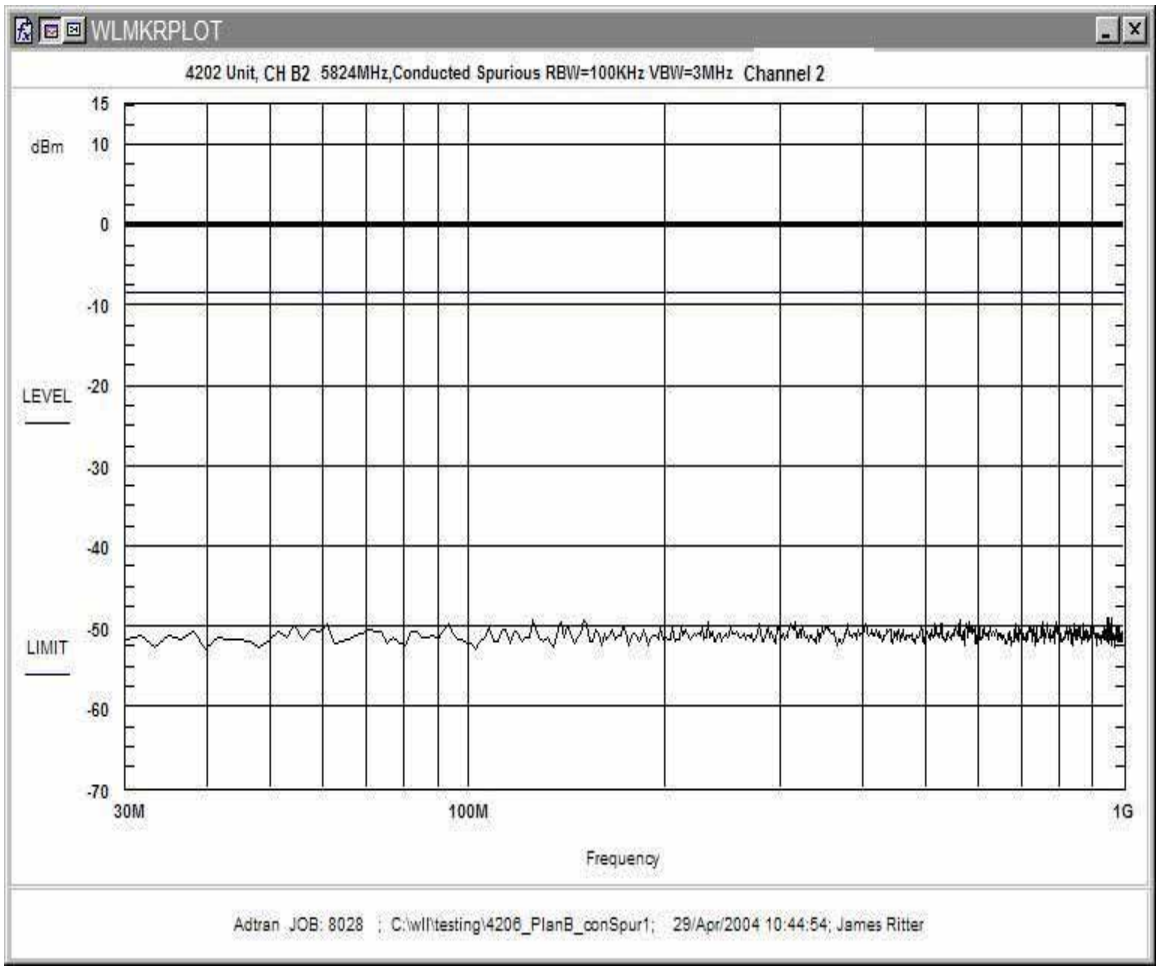

Figure 32. Conducted Spurious Emissions, Plan B - Channel 2, 30MHz-1GHz

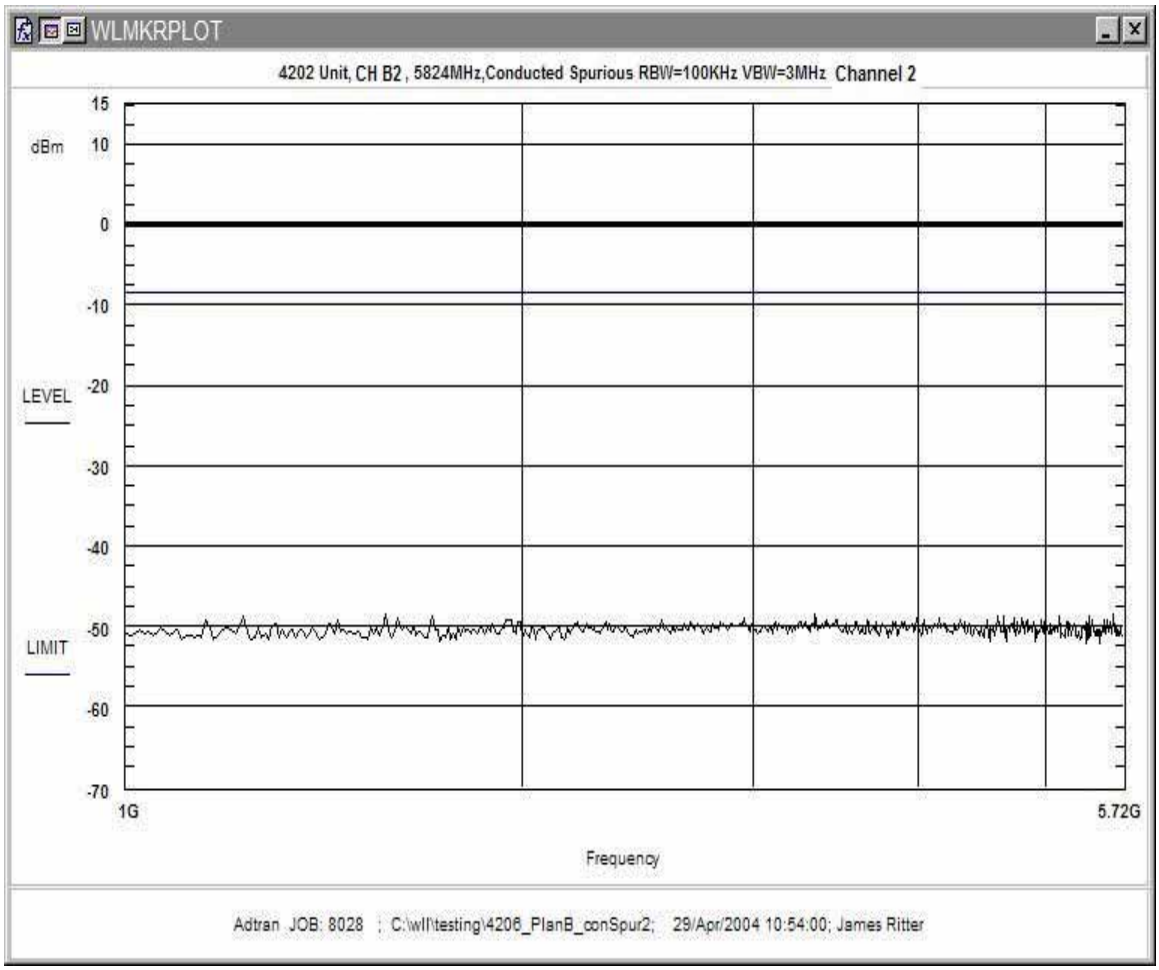

Figure 33. Conducted Spurious Emissions, Plan B - Channel 2, 1GHz-5.7GHz

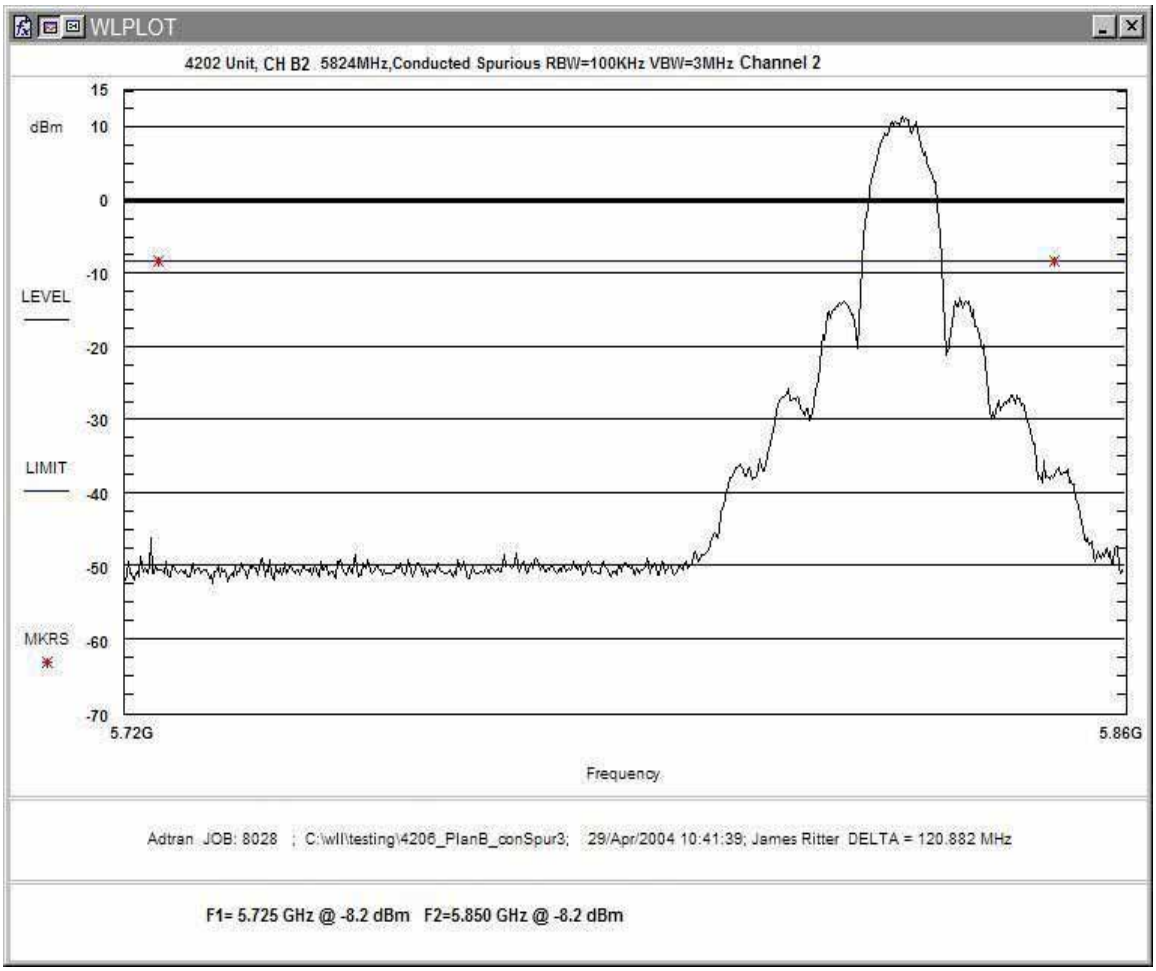

Figure 34. Conducted Spurious Emissions, Plan B - Channel 2, 5.72GHz-5.86GHz

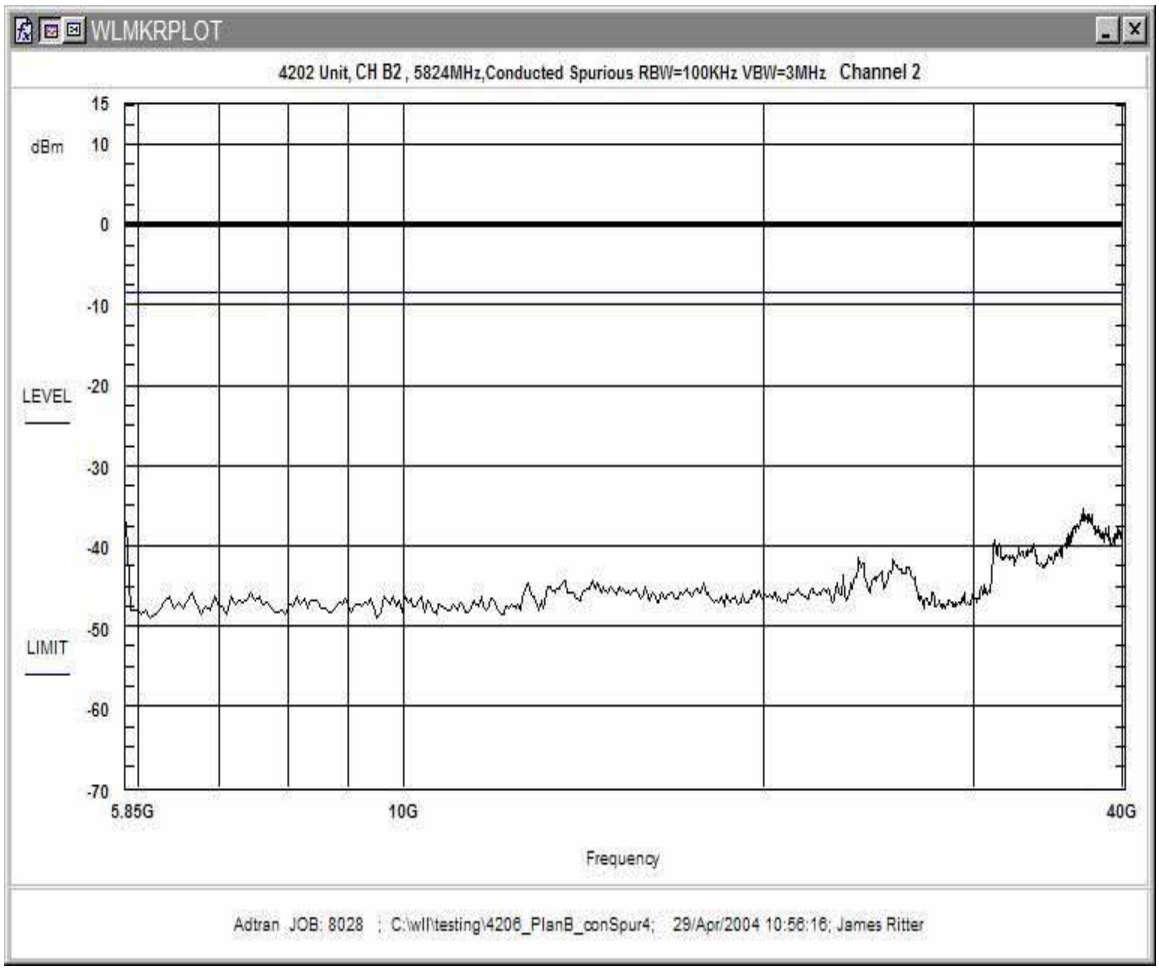

Figure 35. Conducted Spurious Emissions, Plan B - Channel 2, 5.85GHz-40GHz

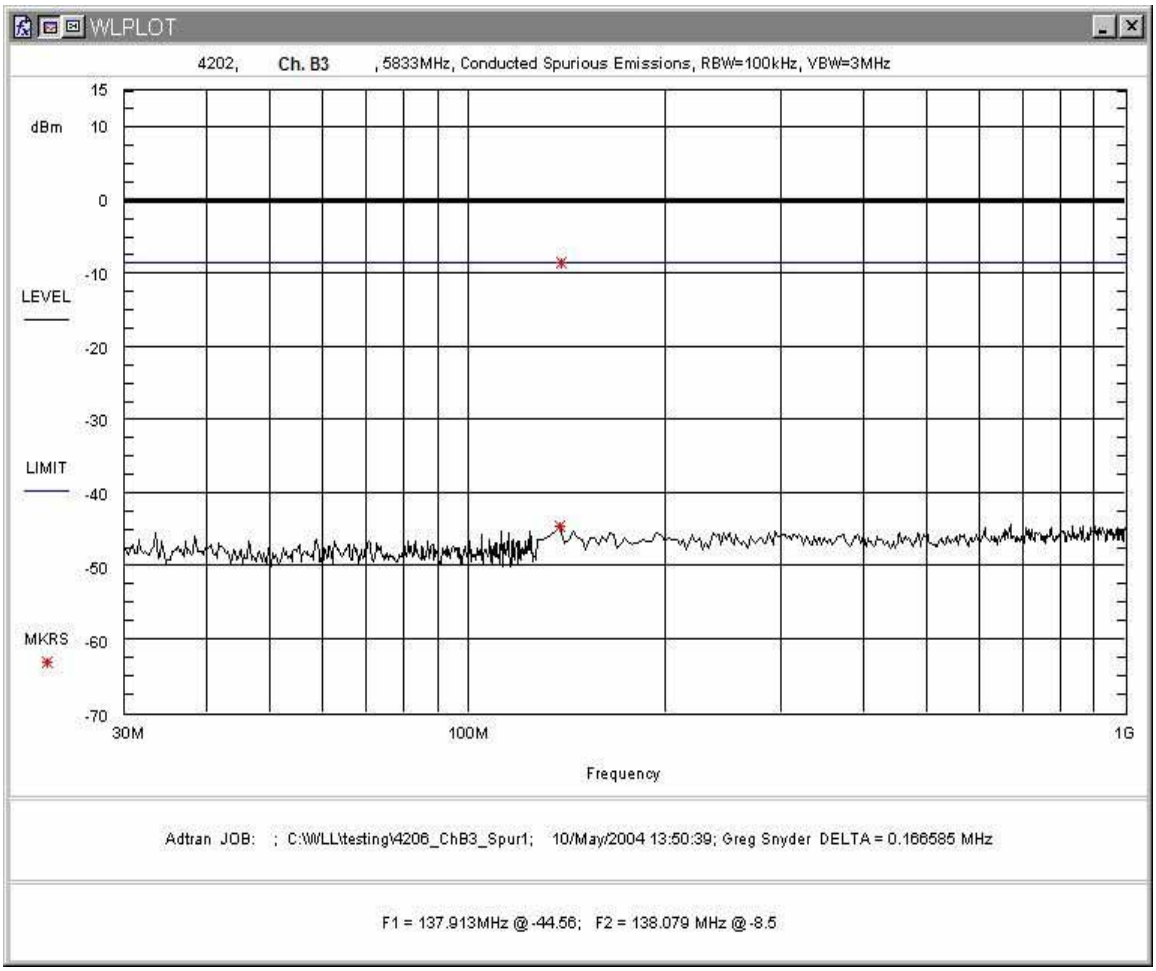

Figure 36. Conducted Spurious Emissions, Plan B - Channel 3, 30MHz-1GHz

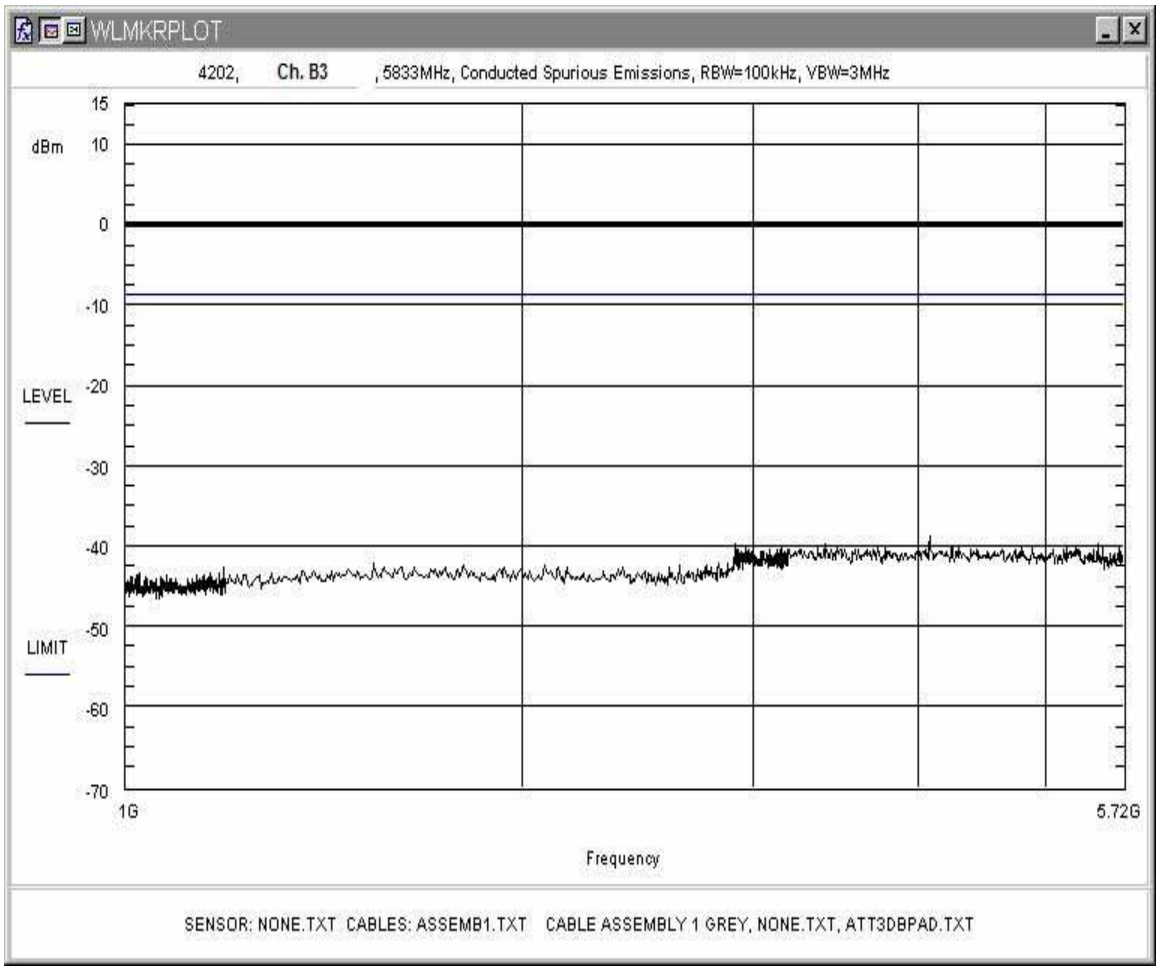

Figure 37. Conducted Spurious Emissions, Plan B - Channel 3, 1GHz-5.72GHz

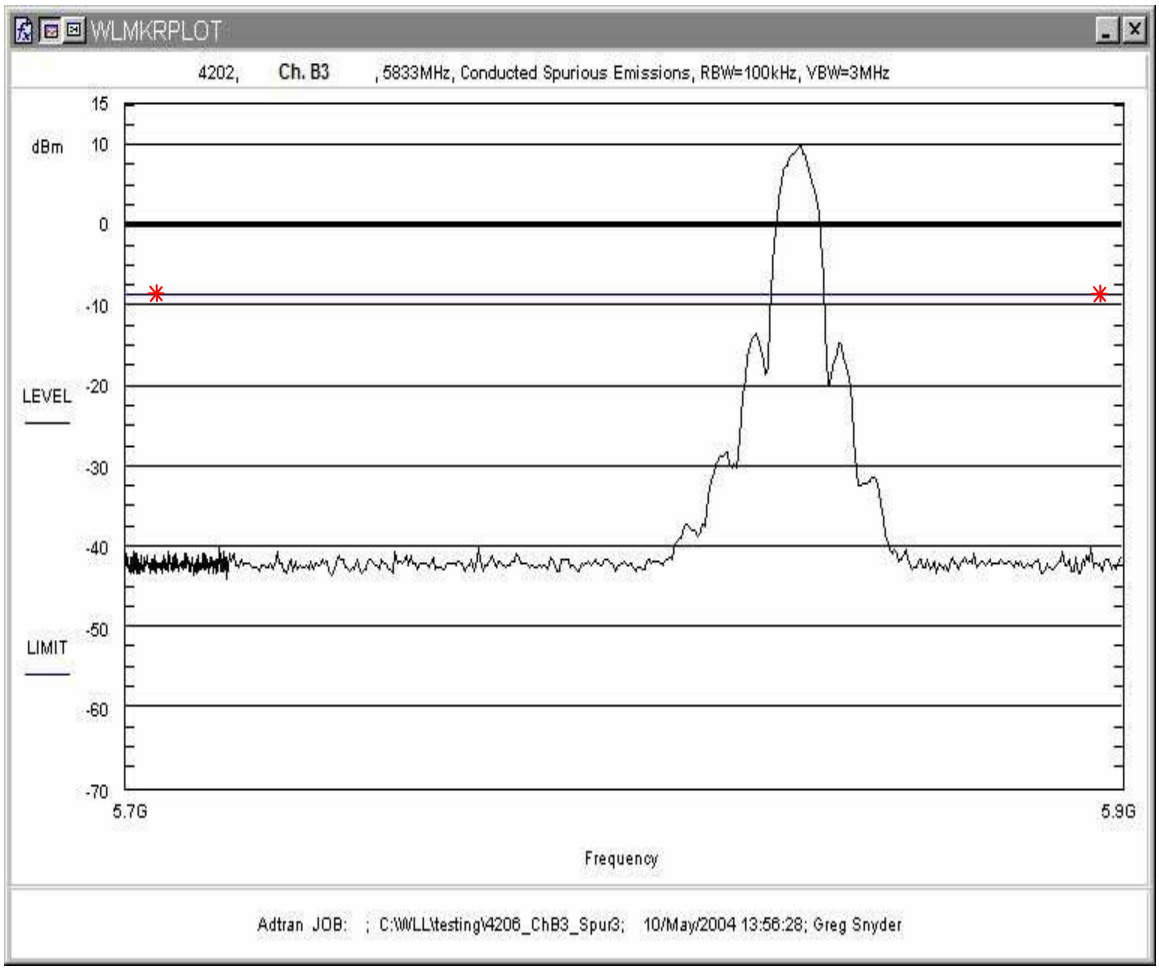

Figure 38. Conducted Spurious Emissions, Plan B - Channel 3, 5.7GHz-5.9GHz

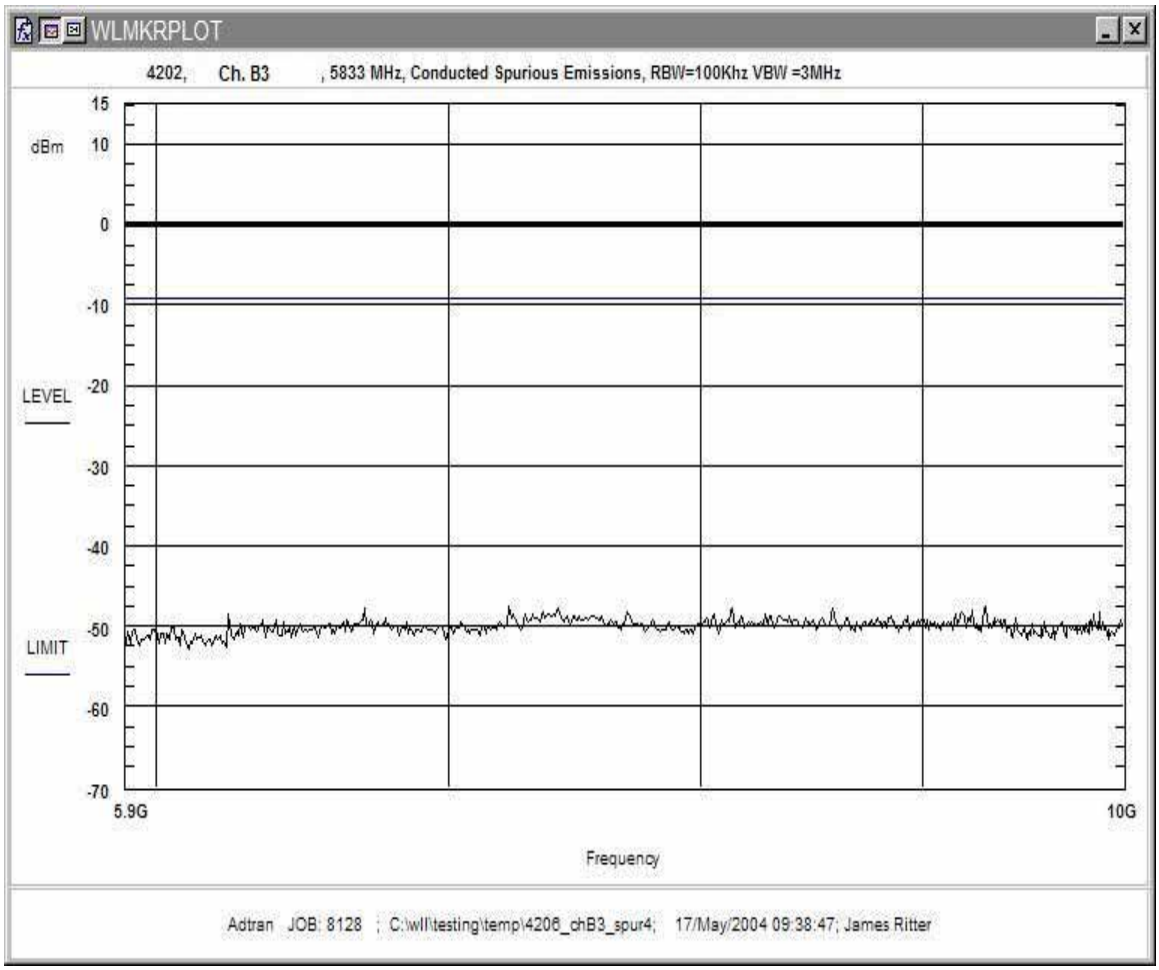

Figure 39. Conducted Spurious Emissions, Plan B - Channel 3, 5.9GHz-10GHz

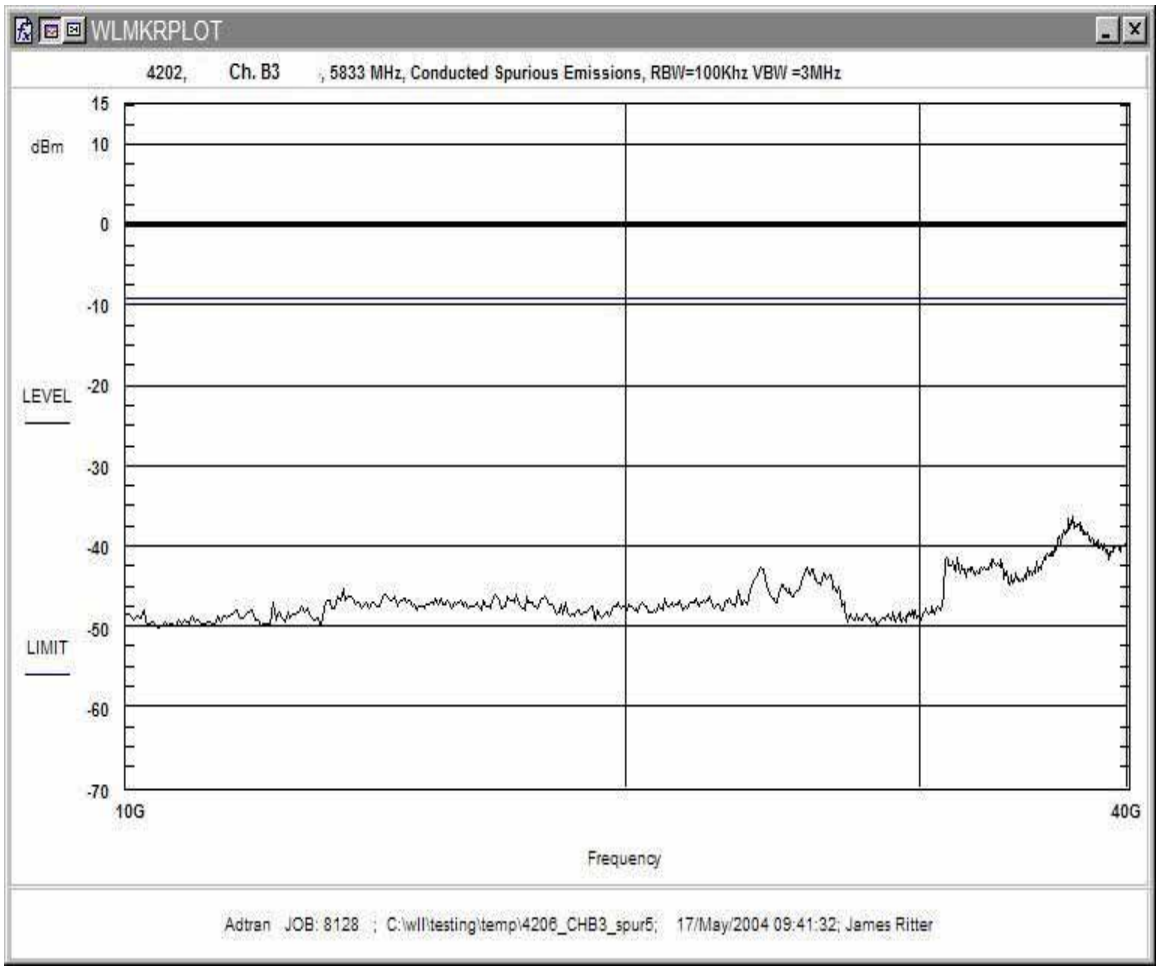

Figure 40. Conducted Spurious Emissions, Plan B - Channel 3, 10GHz-40GHz

4.5 Radiated Spurious Emissions: (FCC Part §15.247(c) and RSS-210 6.3)

Radiated emissions that fall in the restricted bands must comply with the general emissions limits in §15.209(a) and RSS-210 Table 3.

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.

4.5.1 Test Procedure (2' Dish Antenna)

The EUT was placed on motorized turntable for radiated testing on a 3-meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Receiving antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters. The peripherals were placed on the table in accordance with ANSI C63.4-2003. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured.

The EUT was tested in the following configurations and modes:

Antenna	**Channel**
Dish	A&B

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
Electric Field (Corr Level):	EdBμV/m = VdBμV + AFdB/m + CCdB - GdB
To convert to linear units:	EμV/m = antilog (EdBμV/m/20)

Data are supplied in the following tables. Testing was performed to 40GHz. No emissions were detected above 12GHz. All detected emissions are reported in the following tables. Both peak and average measurements are listed.

4.5.2 Test Procedure (10' Dish Antenna)

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)

4.5.3 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 for the 10' Dish Antenna 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 7: Radiated Emission Test Data - Plan A Channel 1

CLIENT:	Adtran	DATE:	5/18/2004
TESTER:	J. Ritter	JOB #:	8028
EUT:	Tracer 4202/4206	STANDARD:	FCC Part 15/RSS-210
CONFIGURATION:	Plan A Band 1	DISTANCE:	3m
CLOCKS:	Transmit at 5734Mhz (peak of signal)		
Test Equipment/Limit:			
ANTENNA:	A_00425	LIMIT:	LFCC_3m_Class_B
CABLE:	CSITE1_HF	AMPLIFIER (dB)	A_00066

Frequency (MHz)	Polarity H/V	Az Deg	Ant. Hght (m)	SA Level dBµV	Ant. Corr. dB/m	Cable Corr. dB	Amp Gain dB	Corr. Level dBµV/m	Corr. Level µV/m	Limit µV/m	Margin dB
Peak											
1700.67	H	180.0	1.0	45.4	28.2	2.4	35.7	40.3	103.8	5000.0	-33.7
2338.00	H	180.0	1.0	46.8	29.8	2.9	35.6	43.9	156.5	5000.0	-30.1
3785.13	H	10.0	1.0	47.5	31.1	3.8	35.4	46.9	222.3	5000.0	-27.0
8180.98	H	0.0	1.0	45.7	38.4	5.3	36.1	53.3	462.0	5000.0	-20.7 **a**
10907.99	H	0.0	1.0	45.3	40.2	6.1	35.6	56.1	635.1	5000.0	-17.9 **a**
11468.00	H	0.0	1.0	47.1	40.8	6.4	35.6	58.6	855.9	5000.0	-15.3 **a**
1700.67	V	180.0	1.0	48.6	28.2	2.4	35.7	43.5	149.4	5000.0	-30.5
2338.00	V	180.0	1.0	55.3	29.8	2.9	35.6	52.4	416.5	5000.0	-21.6
3785.13	V	40.0	1.0	57.3	31.1	3.8	35.4	56.7	685.3	5000.0	-17.3
8180.98	V	0.0	1.0	45.3	38.4	5.3	36.1	52.9	440.7	5000.0	-21.1 **a**
10907.99	V	0.0	1.0	45.1	40.2	6.1	35.6	55.9	620.6	5000.0	-18.1 **a**
11468.00	V	0.0	1.0	46.3	40.8	6.4	35.6	57.8	780.6	5000.0	-16.1 **a**
AVG											
1700.67	H	180.0	1.0	35.5	28.2	2.4	35.7	30.4	33.1	500.0	-23.6
2338.00	H	180.0	1.0	33.0	29.8	2.9	35.6	30.1	32.0	500.0	-23.9
3785.13	H	10.0	1.0	38.5	31.1	3.8	35.4	37.9	78.7	500.0	-16.1
8180.98	H	0.0	1.0	34.0	38.4	5.3	36.1	41.5	119.3	500.0	-12.4 **a**
10907.99	H	0.0	1.0	34.5	40.2	6.1	35.6	45.3	183.2	500.0	-8.7 **a**
11468.00	H	0.0	1.0	34.2	40.8	6.4	35.6	45.8	194.3	500.0	-8.2 **a**
1700.67	V	180.0	1.0	37.7	28.2	2.4	35.7	32.6	42.7	500.0	-21.4
2338.00	V	180.0	1.0	44.7	29.8	2.9	35.6	41.7	122.2	500.0	-12.2
3785.13	V	40.0	1.0	41.5	31.1	3.8	35.4	40.9	111.1	500.0	-13.1
8180.98	V	0.0	1.0	34.0	38.4	5.3	36.1	41.5	119.3	500.0	-12.4 **a**
10907.99	V	0.0	1.0	34.2	40.2	6.1	35.6	45.0	176.9	500.0	-9.0 **a**
11468.00	V	0.0	1.0	34.0	40.8	6.4	35.6	45.5	189.4	500.0	-8.4 **a**

a = ambient reading

Table 8: Radiated Emission Test Data - Plan A Channel 2

CLIENT:	Adtran	DATE:	5/18/2004
TESTER:	J. Ritter	JOB #:	8028
EUT:	Tracer 4202/4206	STANDARD:	FCC Part 15/RSS-210
CONFIGURATION:	Plan A Band 2	DISTANCE:	3m
CLOCKS:	Transmit at 5744Mhz (peak of signal)		
Test Equipment/Limit:			
ANTENNA:	A_00425	LIMIT:	LFCC_3m_Class_B
CABLE:	CSITE1_HF	AMPLIFIER (dB)	A_00066

Frequency (MHz)	Polarity H/V	Az Deg	Ant. Hght (m)	SA Level dBµV	Ant. Corr. dB/m	Cable Corr. dB	Amp Gain dB	Corr. Level dBµV/m	Corr. Level µV/m	Limit µV/m	Margin dB
PEAK											
1237.20	V	170.0	1.0	50.3	26.4	2.3	36.2	42.8	137.5	5000.0	-31.2
1339.92	V	270.0	1.0	45.6	26.8	2.3	36.0	38.7	85.9	5000.0	-35.3
1367.24	V	180.0	1.0	47.5	27.0	2.3	36.0	40.7	108.8	5000.0	-33.2
1676.00	V	179.0	1.0	47.8	28.2	2.4	35.7	42.6	134.9	5000.0	-31.4
1700.77	V	190.0	1.0	49.2	28.2	2.4	35.7	44.1	160.0	5000.0	-29.9
2732.00	V	0.0	1.0	40.5	30.4	3.2	35.6	38.3	82.6	5000.0	-35.6 **a**
11488.00	V	0.0	1.0	46.1	40.8	6.4	35.6	57.7	765.2	5000.0	-16.3 **a**
1237.20	H	170.0	1.0	48.1	26.4	2.3	36.2	40.6	106.7	5000.0	-33.4
1339.92	H	270.0	1.0	45.0	26.8	2.3	36.0	38.1	80.2	5000.0	-35.9
1367.24	H	180.0	1.0	46.0	27.0	2.3	36.0	39.2	91.6	5000.0	-34.7
1676.00	H	179.0	1.0	46.1	28.2	2.4	35.7	40.9	110.9	5000.0	-33.1
1700.77	H	190.0	1.0	50.1	28.2	2.4	35.7	45.0	178.1	5000.0	-29.0
2732.00	H	0.0	1.0	41.2	30.4	3.2	35.6	39.1	89.9	5000.0	-34.9 **a**
11488.00	H	0.0	1.0	45.1	40.8	6.4	35.6	56.7	682.0	5000.0	-17.3 **a**
AVG:											
1237.20	V	170.0	1.0	39.2	26.4	2.3	36.2	31.7	38.3	500.0	-22.3
1339.92	V	270.0	1.0	35.7	26.8	2.3	36.0	28.8	27.5	500.0	-25.2
1367.24	V	180.0	1.0	35.4	27.0	2.3	36.0	28.6	27.0	500.0	-25.3
1676.00	V	170.0	1.0	37.2	28.2	2.4	35.7	32.0	39.6	500.0	-22.0
1700.77	V	190.0	1.0	37.3	28.2	2.4	35.7	32.2	40.6	500.0	-21.8
2732.00	V	0.0	1.0	29.9	30.4	3.2	35.6	27.8	24.5	500.0	-26.2 **a**
11488.00	V	0.0	1.0	37.5	40.8	6.4	35.6	49.1	284.3	500.0	-4.9 **a**
1237.20	H	170.0	1.0	39.1	26.4	2.3	36.2	31.6	37.9	500.0	-22.4
1339.92	H	270.0	1.0	36.1	26.8	2.3	36.0	29.2	28.8	500.0	-24.8
1367.24	H	180.0	1.0	35.3	27.0	2.3	36.0	28.7	27.2	500.0	-25.3
1676.00	H	170.0	1.0	37.0	28.2	2.4	35.7	31.8	38.9	500.0	-22.2
1700.77	H	190.0	1.0	38.0	28.2	2.4	35.7	32.9	44.2	500.0	-21.1
2732.00	H	0.0	1.0	32.0	30.4	3.2	35.6	29.9	31.2	500.0	-24.1 **a**
11488.00	H	0.0	1.0	37.1	40.8	6.4	35.6	48.7	271.5	500.0	-5.3 **a**

a = ambient reading

Table 9: Radiated Emission Test Data - Plan A Channel 3

CLIENT:	Adtran	DATE:	5/18/2004
TESTER:	J. Ritter	JOB #:	8028
EUT:	Tracer 4202/4206	STANDARD:	FCC Part 15/RSS-210
CONFIGURATION:	Plan A Band 3	DISTANCE:	3m
CLOCKS:	Transmit at 5753Mhz (peak of signal)		
Test Equipment/Limit:			
ANTENNA:	A_00425	LIMIT:	LFCC_3m_Class_B
CABLE:	CSITE1_HF	AMPLIFIER (dB)	A_00066

Frequency (MHz)	Polarity H/V	Az Deg	Ant. Hght (m)	SA Level dBµV	Ant. Corr. dB/m	Cable Corr. dB	Amp Gain dB	Corr. Level dBµV/m	Corr. Level µV/m	Limit µV/m	Margin dB
PEAK											
1187.30	H	180.0	1.0	48.9	26.1	2.3	36.2	41.1	112.9	5000.0	-32.9
1236.80	H	180.0	1.0	48.3	26.4	2.3	36.2	40.8	109.2	5000.0	-33.2
1339.80	H	190.0	1.0	48.3	26.8	2.3	36.0	41.4	117.1	5000.0	-32.6
1700.77	H	290.0	1.0	47.7	28.2	2.4	35.7	42.6	135.1	5000.0	-31.4
2338.20	H	170.0	1.0	53.2	29.8	2.9	35.6	50.3	327.1	5000.0	-23.7
2736.50	H	180.0	1.0	46.4	30.4	3.2	35.6	44.3	163.7	5000.0	-29.7 **a**
11506.00	H	0.0	1.0	46.0	40.9	6.4	35.7	57.6	756.0	5000.0	-16.4 **a**
1187.30	V	180.0	1.0	48.1	26.1	2.3	36.2	40.3	102.9	5000.0	-33.7
1236.80	V	180.0	1.0	47.2	26.4	2.3	36.2	39.7	96.2	5000.0	-34.3
1339.80	V	190.0	1.0	48.9	26.8	2.3	36.0	42.0	125.6	5000.0	-32.0
1700.77	V	290.0	1.0	46.6	28.2	2.4	35.7	41.5	119.1	5000.0	-32.5
2338.20	V	170.0	1.0	47.7	29.8	2.9	35.6	44.8	173.6	5000.0	-29.2
2736.50	V	180.0	1.0	46.4	30.4	3.2	35.6	44.3	163.7	5000.0	-29.7 **a**
11506.00	V	0.0	1.0	46.1	40.9	6.4	35.7	57.7	767.4	5000.0	-16.3 **a**
AVG											
1187.30	H	180.0	1.0	38.1	26.1	2.3	36.2	30.3	32.5	500.0	-23.7
1236.80	H	180.0	1.0	40.5	26.4	2.3	36.2	33.0	44.7	500.0	-21.0
1339.80	H	190.0	1.0	36.4	26.8	2.3	36.0	29.5	29.8	500.0	-24.5
1700.77	H	290.0	1.0	36.3	28.2	2.4	35.7	31.2	36.3	500.0	-22.8
2338.20	H	170.0	1.0	42.6	29.8	2.9	35.6	39.7	96.5	500.0	-14.3
2736.50	H	180.0	1.0	34.0	30.4	3.2	35.6	31.9	39.5	500.0	-22.1 **a**
11506.00	H	0.0	1.0	34.9	40.9	6.4	35.7	46.5	211.4	500.0	-7.5 **a**
1187.30	V	180.0	1.0	36.0	26.1	2.3	36.2	28.2	25.6	500.0	-25.8
1236.80	V	180.0	1.0	40.2	26.4	2.3	36.2	32.7	43.0	500.0	-21.3
1339.80	V	190.0	1.0	34.2	26.8	2.3	36.0	27.3	23.1	500.0	-26.7
1700.77	V	290.0	1.0	34.1	28.2	2.4	35.7	29.0	28.2	500.0	-25.0
2338.20	V	170.0	1.0	42.3	29.8	2.9	35.6	39.4	93.3	500.0	-14.6
2736.50	V	180.0	1.0	35.1	30.4	3.2	35.6	33.0	44.6	500.0	-21.0 **a**
11506.00	V	0.0	1.0	34.1	40.9	6.4	35.7	45.7	192.8	500.0	-8.3 **a**

Table 10: Radiated Emission Test Data - Plan B Channel 1

CLIENT:	Adtran	DATE:	5/18/2004
TESTER:	J. Ritter	JOB #:	8028
EUT:	Tracer 4202/4206	STANDARD:	FCC Part 15/RSS-210
CONFIGURATION:	Plan B Band 1	DISTANCE:	3m
CLOCKS:	Transmit at 5814Mhz (peak of signal)		
Test Equipment/Limit:			
ANTENNA:	A_00425	LIMIT:	LFCC_3m_Class_B
CABLE:	CSITE1_HF	AMPLIFIER (dB)	A_00066

Frequency (MHz)	Polarity H/V	Az Deg	Ant. Hght (m)	SA Level dBµV	Ant. Corr. dB/m	Cable Corr. dB	Amp Gain dB	Corr. Level dBµV/m	Corr. Level µV/m	Limit µV/m	Margin dB
Peak											
1398.50	V	180.0	1.0	46.1	27.1	2.3	36.0	39.5	94.5	5000.0	-34.5
1597.62	V	190.0	1.0	57.3	27.9	2.4	35.8	51.8	387.4	5000.0	-22.2
1700.69	V	90.0	1.0	52.7	28.2	2.4	35.7	47.6	239.5	5000.0	-26.4
2767.00	V	0.0	1.0	48.8	30.4	3.2	35.7	46.8	218.0	5000.0	-27.2 **a**
4150.50	V	0.0	1.0	49.7	31.6	3.9	35.5	49.7	304.2	5000.0	-24.3 **a**
8301.00	V	0.0	1.0	45.2	38.5	5.3	36.1	52.9	439.7	5000.0	-21.1 **a**
11629.40	V	0.0	1.0	46.2	41.0	6.4	35.7	57.9	787.7	5000.0	-16.1 **a**
1398.50	H	180.0	1.0	47.8	27.1	2.3	36.0	41.2	114.9	5000.0	-32.8
1597.62	H	190.0	1.0	47.5	27.9	2.4	35.8	41.9	124.9	5000.0	-32.0
1700.69	H	90.0	1.0	47.7	28.2	2.4	35.7	42.6	134.7	5000.0	-31.4 **a**
2767.00	H	0.0	1.0	47.0	30.4	3.2	35.7	44.9	176.6	5000.0	-29.0 **a**
4150.50	H	0.0	1.0	48.1	31.6	3.9	35.5	48.1	253.9	5000.0	-25.9 **a**
8301.00	H	0.0	1.0	47.8	38.5	5.3	36.1	55.5	597.3	5000.0	-18.5 **a**
11629.40	H	0.0	1.0	45.2	41.0	6.4	35.7	56.9	702.9	5000.0	-17.0 **a**
AVG											
1398.50	V	180.0	1.0	38.5	27.1	2.3	36.0	31.9	39.4	500.0	-22.1
1597.62	V	190.0	1.0	40.8	27.9	2.4	35.8	35.3	58.0	500.0	-18.7
1700.69	V	90.0	1.0	38.3	28.2	2.4	35.7	33.2	45.8	500.0	-20.8
2767.00	V	0.0	1.0	37.2	30.4	3.2	35.7	35.1	57.1	500.0	-18.8 **a**
4150.50	V	0.0	1.0	38.2	31.6	3.9	35.5	38.2	80.9	500.0	-15.8 **a**
8301.00	V	0.0	1.0	35.2	38.5	5.3	36.1	42.9	139.1	500.0	-11.1 **a**
11629.40	V	0.0	1.0	36.2	41.0	6.4	35.7	47.9	249.4	500.0	-6.0 **a**
1398.50	H	180.0	1.0	36.2	27.1	2.3	36.0	29.6	30.1	500.0	-24.4
1597.62	H	190.0	1.0	38.6	27.9	2.4	35.8	33.0	44.8	500.0	-20.9
1700.69	H	90.0	1.0	37.5	28.2	2.4	35.7	32.4	41.8	500.0	-21.6 **a**
2767.00	H	0.0	1.0	37.1	30.4	3.2	35.7	35.0	56.5	500.0	-18.9 **a**
4150.50	H	0.0	1.0	36.8	31.6	3.9	35.5	36.8	69.1	500.0	-17.2 **a**
8301.00	H	0.0	1.0	34.8	38.5	5.3	36.1	42.5	133.3	500.0	-11.5 **a**
11629.40	H	0.0	1.0	35.5	41.0	6.4	35.7	47.3	230.9	500.0	-6.7 **a**

a = ambient reading

Table 11: Radiated Emission Test Data - Plan B Channel 2

CLIENT:	Adtran	DATE:	5/18/2004
TESTER:	J. Ritter	JOB #:	8028
EUT:	Tracer 4202/4206	STANDARD:	FCC Part 15/RSS-210
CONFIGURATION:	Plan A Band 1	DISTANCE:	3m
CLOCKS:	Transmit at 5824MHz (peak of signal)		
Test Equipment/Limit:			
ANTENNA:	A_00425	LIMIT:	LFCC_3m_Class_B
CABLE:	CSITE1_HF	AMPLIFIER (dB)	A_00066

Frequency (MHz)	Polarity H/V	Az Deg	Ant. Hght (m)	SA Level dBµV	Ant. Corr. dB/m	Cable Corr. dB	Amp Gain dB	Corr. Level dBµV/m	Corr. Level µV/m	Limit µV/m	Margin dB
Peak											
1236.53	H	180.0	1.0	52.1	26.4	2.3	36.2	44.6	169.1	5000.0	-29.4
1401.00	H	0.0	1.0	49.3	27.1	2.3	36.0	42.8	137.3	5000.0	-31.2
2802.00	H	0.0	1.0	48.0	30.4	3.2	35.7	46.0	199.6	5000.0	-28.0 **a**
3861.00	H	10.0	1.0	51.1	31.1	3.8	35.4	50.6	338.8	5000.0	-23.4 **a**
4158.00	H	0.0	1.0	47.7	31.6	3.9	35.5	47.7	242.1	5000.0	-26.3 **a**
8316.00	H	0.0	1.0	47.8	38.5	5.3	36.1	55.5	596.2	5000.0	-18.5 **a**
11648.00	H	0.0	1.0	45.0	41.1	6.4	35.7	56.8	691.3	5000.0	-17.2 **a**
1236.53	V	180.0	1.0	53.3	26.4	2.3	36.2	45.8	194.8	5000.0	-28.2
1401.00	V	190.0	1.0	43.7	27.1	2.3	36.0	37.1	71.6	5000.0	-36.9
2802.00	V	0.0	1.0	47.1	30.4	3.2	35.7	45.1	179.9	5000.0	-28.9 **a**
3861.00	V	10.0	1.0	53.6	31.1	3.8	35.4	53.1	451.8	5000.0	-20.9
4158.00	V	0.0	1.0	48.2	31.6	3.9	35.5	48.2	256.5	5000.0	-25.8 **a**
8316.00	V	0.0	1.0	45.4	38.5	5.3	36.1	53.1	452.3	5000.0	-20.9 **a**
11648.00	V	0.0	1.0	46.8	41.1	6.4	35.7	58.6	850.4	5000.0	-15.4 **a**
AVG											
1236.53	H	180.0	1.0	47.2	26.4	2.3	36.2	39.7	96.2	500.0	-14.3
1401.00	H	0.0	1.0	38.7	27.1	2.3	36.0	32.1	40.4	500.0	-21.9
2802.00	H	0.0	1.0	40.1	30.4	3.2	35.7	38.1	80.4	500.0	-15.9 **a**
3861.00	H	10.0	1.0	38.0	31.1	3.8	35.4	37.5	75.0	500.0	-16.5
4158.00	H	0.0	1.0	38.6	31.6	3.9	35.5	38.6	85.2	500.0	-15.4 **a**
8316.00	H	0.0	1.0	38.1	38.5	5.3	36.1	45.8	195.2	500.0	-8.2 **a**
11648.00	H	0.0	1.0	39.2	41.1	6.4	35.7	51.0	354.5	500.0	-3.0 **a**
1236.53	V	180.0	1.0	41.3	26.4	2.3	36.2	33.8	48.9	500.0	-20.2
1401.00	V	190.0	1.0	43.7	27.1	2.3	36.0	37.1	71.6	500.0	-16.9
2802.00	V	0.0	1.0	37.1	30.4	3.2	35.7	35.1	56.9	500.0	-18.9
3861.00	V	10.0	1.0	39.5	31.1	3.8	35.4	39.0	89.1	500.0	-15.0
4158.00	V	0.0	1.0	36.7	31.6	3.9	35.5	36.7	68.2	500.0	-17.3 **a**
8316.00	V	0.0	1.0	37.2	38.5	5.3	36.1	44.9	175.9	500.0	-9.1 **a**
11648.00	V	0.0	1.0	38.1	41.1	6.4	35.7	49.9	312.3	500.0	-4.1 **a**

a = ambient reading

Table 12: Radiated Emission Test Data - Plan B Channel 3

CLIENT:	Adtran	DATE:	5/18/2004
TESTER:	J. Ritter	JOB #:	8028
EUT:	Tracer 4202/4206	STANDARD:	FCC Part 15/RSS-210
CONFIGURATION:	Plan B Band 3	DISTANCE:	3m
CLOCKS:	Transmit at 5833Mhz (peak of signal)		
Test Equipment/Limit:			
ANTENNA:	A_00425	LIMIT:	LFCC_3m_Class_B
CABLE:	CSITE1_HF	AMPLIFIER (dB)	A_00066

Frequency (MHz)	Polarity H/V	Az Deg	Ant. Hght (m)	SA Level dBµV	Ant. Corr. dB/m	Cable Corr. dB	Amp Gain dB	Corr. Level dBµV/m	Corr. Level µV/m	Limit µV/m	Margin dB
Peak											
1237.70	H	170.0	1.0	51.9	26.4	2.3	36.2	44.4	165.0	5000.0	-29.6
1403.26	H	180.0	1.0	44.3	27.1	2.3	36.0	37.7	77.1	5000.0	-36.2 **a**
1494.54	H	190.0	1.0	49.4	27.5	2.3	35.9	43.4	147.2	5000.0	-30.6
1700.67	H	180.0	1.0	48.7	28.2	2.4	35.7	43.6	151.4	5000.0	-30.4
2337.35	H	180.0	1.0	55.0	29.8	2.9	35.6	52.1	402.3	5000.0	-21.9
8419.50	H	180.0	1.0	46.3	38.6	5.3	36.1	54.1	507.1	5000.0	-19.9 **a**
11667.00	H	180.0	1.0	47.3	41.1	6.4	35.7	59.1	900.4	5000.0	-14.9 **a**
1237.70	V	170.0	1.0	51.9	26.4	2.3	36.2	44.4	165.0	5000.0	-29.6
1403.26	V	180.0	1.0	43.3	27.1	2.3	36.0	36.7	68.7	5000.0	-37.2 **a**
1494.54	V	170.0	1.0	46.9	27.5	2.3	35.9	40.8	109.9	5000.0	-33.2
1700.67	V	180.0	1.0	48.5	28.2	2.4	35.7	43.4	148.2	5000.0	-30.6
2337.35	V	180.0	1.0	57.8	29.8	2.9	35.6	54.9	553.4	5000.0	-19.1
8419.50	V	90.0	1.0	45.3	38.6	5.3	36.1	53.1	454.1	5000.0	-20.8 **a**
11667.00	V	180.0	1.0	47.7	41.1	6.4	35.7	59.5	946.1	5000.0	-14.5 **a**
AVG											
1237.70	H	170.0	1.0	40.2	26.4	2.3	36.2	32.7	43.1	500.0	-21.3
1403.26	H	180.0	1.0	34.8	27.1	2.3	36.0	28.3	25.9	500.0	-25.7
1494.54	H	190.0	1.0	37.8	27.5	2.3	35.9	31.7	38.6	500.0	-22.3
1700.67	H	180.0	1.0	36.0	28.2	2.4	35.7	30.9	35.2	500.0	-23.0
2337.35	H	180.0	1.0	43.4	29.8	2.9	35.6	40.5	105.8	500.0	-13.5
8419.50	H	180.0	1.0	35.5	38.6	5.3	36.1	43.3	145.6	500.0	-10.7 **a**
11667.00	H	180.0	1.0	35.3	41.1	6.4	35.7	47.1	226.9	500.0	-6.9 **a**
1237.70	V	170.0	1.0	40.2	26.4	2.3	36.2	32.7	43.1	500.0	-21.3
1403.26	V	180.0	1.0	33.6	27.1	2.3	36.0	27.0	22.5	500.0	-26.9 **a**
1494.54	V	190.0	1.0	37.7	27.5	2.3	35.9	31.6	38.0	500.0	-22.4
1700.67	V	180.0	1.0	38.1	28.2	2.4	35.7	33.0	44.7	500.0	-21.0
2337.35	V	180.0	1.0	45.5	29.8	2.9	35.6	42.6	134.8	500.0	-11.4
8419.50	V	90.0	1.0	35.3	38.6	5.3	36.1	43.1	142.9	500.0	-10.9 **a**
11667.00	V	180.0	1.0	35.4	41.1	6.4	35.7	47.2	228.3	500.0	-6.8 **a**

a = ambient reading

Table 13: Radiated Emission Test Data 10' Dish Antenna - 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/RSS-210
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

4.6 AC Powerline Conducted Emissions: (FCC Part §15.207 and RSS-210 6.6)

The EUT was placed on an 80 cm high 1 x 1.5 m non-conductive table above a ground plane. Power to the EUT was provided through a Solar Corporation 50 Ω/50 μH Line Impedance Stabilization Network bonded to a 3 x 2 meter ground plane. The LISN has its AC input supplied from a filtered AC power source. Power and data cables were moved about to obtain maximum emissions.

The 50Ω output of the LISN was connected to the input of the spectrum analyzer and the emissions in the frequency range of 150 kHz to 30 MHz were measured. The detector function was set to quasi-peak, peak, or average as appropriate, and the resolution bandwidth during testing was at least 9 kHz, with all post-detector filtering no less than 10 times the resolution bandwidth for peak measurements.

Data is recorded in Table 12.

Table 14: Conducted Emissions Test Data; 15.207

CLIENT:	Adtran	EUT:	Tracer 4202L1/4206L1
JOB #:	8028	DATE:	5/7/04
TESTER:	G. Snyder	TEST STANDARD:	FCC Part 15/RSS-210
CLASS:	FCC_B	TEST VOLTAGE:	120 VAC

Frequency MHz	Level QP dBuV	Cable Loss dB	Limit QP dBuV	Margin QP dB	Level AVG dBuV	Cable Loss dB	Limit AVG dBuV	Margin AVG dB
0.26	19.3	10.7	61.4	-31.4	19.3	10.7	51.4	-21.4
0.30	37.6	10.7	60.1	-11.8	28.6	10.7	50.1	-10.8
0.48	21.4	10.7	56.3	-24.2	21.4	10.7	46.3	-14.2
1.04	34.6	11.0	56.0	-10.4	22.3	11.0	46.0	-12.7
3.49	34.2	11.4	56.0	-10.4	21.8	11.4	46.0	-12.8
9.95	29.6	11.9	60.0	-18.5	18.7	11.9	50.0	-19.4
13.10	35.1	12.2	60.0	-12.7	21.0	12.2	50.0	-16.8
16.13	30.4	12.3	60.0	-17.3	21.4	12.3	50.0	-16.3

LINE 2 - PHASE

Frequency MHz	Level QP dBuV	Cable Loss dB	Limit QP dBuV	Margin QP dB	Level AVG dBuV	Cable Loss dB	Limit AVG dBuV	Margin AVG dB
0.26	30.7	10.7	61.4	-20.0	30.7	10.7	51.4	-10.0
0.30	37.9	10.7	60.1	-11.5	27.4	10.7	50.1	-12.0
0.48	33.9	10.7	56.3	-11.7	20.3	10.7	46.3	-15.3
1.22	36.0	11.0	56.0	-9.0	24.1	11.0	46.0	-10.9
3.49	34.9	11.4	56.0	-9.7	22.8	11.4	46.0	-11.8
9.95	29.7	11.9	60.0	-18.4	20.0	11.9	50.0	-18.1
13.09	35.6	12.2	60.0	-12.2	25.1	12.2	50.0	-12.7
15.77	29.7	12.4	60.0	-17.9	19.7	12.4	50.0	-17.9

4.7 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