



FCC Certification Test Report
for
ADTRAN, Inc.
HDCTRC4208

March 31, 2003

Prepared for:

ADTRAN, Inc.
901 Explorer Blvd
Huntsville, AL 35806

Prepared By:

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



FCC Certification Test Report
for the
ADTRAN, Inc.
TRACER
Transceiver 4208
FCC ID: HDCTRC4208

WLL JOB# 7461

Prepared by: Brian J. Dettling
Documentation Specialist

Reviewed by: Michael F. Violette
President

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 Direct Spread Spectrum Transceiver under Part 15.247 of the FCC Rules and Regulations. This Federal Communication Commission (FCC) Certification Test Report documents the test configuration and test results for a ADTRAN, Inc. TRACER DSSS 4208.

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. 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 DSSS 4208 complies with the limits for a Direct Spread Spectrum Transceiver device under Part 15.247 of the FCC Rules and Regulations.

Table of Contents

| | |
|--|----|
| Abstract..... | ii |
| 1 Introduction..... | 1 |
| 1.1 Compliance Statement..... | 1 |
| 1.2 Test Scope..... | 1 |
| 1.3 Contract Information..... | 1 |
| 1.4 Test Dates..... | 1 |
| 1.5 Test and Support Personnel..... | 1 |
| 1.6 Abbreviations..... | 2 |
| 2 Equipment Under Test..... | 3 |
| 2.1 EUT Identification & Description..... | 3 |
| 2.2 Test Configuration..... | 4 |
| 2.3 Testing Algorithm..... | 5 |
| 2.4 Test Location..... | 5 |
| 2.5 Measurements..... | 5 |
| 2.5.1 References..... | 5 |
| 2.6 Measurement Uncertainty..... | 5 |
| 3 Test Equipment..... | 6 |
| 4 Test Results..... | 7 |
| 4.1 RF Power Output..... | 7 |
| 4.2 RF Peak Power Spectral Density..... | 7 |
| 4.3 Occupied Bandwidth..... | 10 |
| 4.4 Spurious Emissions at Antenna Terminals (FCC Part §15.247(b))..... | 13 |
| 4.5 Radiated Spurious Emissions: (FCC Part §15.247(c))..... | 28 |
| 4.5.1 Test Procedure..... | 28 |
| 4.6 AC Powerline Conducted Emissions: (FCC Part §15.207)..... | 35 |

List of Tables

| | |
|--|----|
| Table 1. Device Summary..... | 4 |
| Table 2: Test Equipment List..... | 6 |
| Table 3. RF Power Output..... | 7 |
| Table 4. RF Power Spectral Density..... | 10 |
| Table 5. Occupied Bandwidth Results..... | 13 |
| Table 6: Radiated Emission Test Data - Plan A, Band 1..... | 29 |
| Table 7: Radiated Emission Test Data - Plan A, Band 3..... | 31 |
| Table 8: Radiated Emission Test Data - Plan B, Band 1..... | 33 |
| Table 9: Radiated Emission Test Data - Plan B, Band 3..... | 34 |
| Table 10: Conducted Emissions Test Data; 15.207..... | 36 |

List of Figures

| | |
|--|----|
| Figure 1. Power Spectral Density Plan A, Band | 8 |
| Figure 2. Power Spectral Density Plan A, Band 3 | 8 |
| Figure 3. Power Spectral Density Plan B, Band 1 | 9 |
| Figure 4. Power Spectral Density Plan B, Band 3 | 9 |
| Figure 5. Occupied Bandwidth - Plan A , Band 1 | 10 |
| Figure 6. Occupied Bandwidth - Plan A , Band 2 | 11 |
| Figure 7. Occupied Bandwidth - Plan A, Band 3 | 11 |
| Figure 8. Occupied Bandwidth - Plan B, Band 1..... | 12 |
| Figure 9. Occupied Bandwidth - Plan B, Band 2..... | 12 |
| Figure 10. Occupied Bandwidth - Plan B, Band 3..... | 13 |
| Figure 11. Lower Band Edge Measurement..... | 14 |
| Figure 12. Upper Band Edge Measurement | 15 |
| Figure 13. Conducted Spurious Emissions, Plan A Band 1, 30MHz-1GHz..... | 16 |
| Figure 14. Conducted Spurious Emissions, Plan A Band 1, 1GHz-5.7GHz..... | 16 |
| Figure 15. Conducted Spurious Emissions, Plan A Band 1, 5.7GHz-5.9GHz..... | 17 |
| Figure 16. Conducted Spurious Emissions, Plan A Band 1, 5.9GHz-18GHz..... | 17 |
| Figure 17. Conducted Spurious Emissions, Plan A Band 1, 18GHz-26GHz..... | 18 |
| Figure 18. Conducted Spurious Emissions, Plan A Band 1, 26GHz-40GHz..... | 18 |
| Figure 19. Conducted Spurious Emissions, Plan A Band 3, 30MHz-1GHz..... | 19 |
| Figure 20. Conducted Spurious Emissions, Plan A Band 3, 1GHz-5.7GHz..... | 19 |
| Figure 21. Conducted Spurious Emissions, Plan A Band 3, 5.7GHz-5.9GHz..... | 20 |
| Figure 22. Conducted Spurious Emissions, Plan A Band 3, 5.9GHz-18GHz..... | 20 |
| Figure 23. Conducted Spurious Emissions, Plan A Band 3, 18GHz-26GHz..... | 21 |
| Figure 24. Conducted Spurious Emissions, Plan A Band 3, 26GHz-40GHz..... | 21 |
| Figure 25. Conducted Spurious Emissions, Plan B Band 1, 30MHz-1GHz..... | 22 |
| Figure 26. Conducted Spurious Emissions, Plan B Band 1, 1GHz-5.7GHz..... | 22 |
| Figure 27. Conducted Spurious Emissions, Plan B Band 1, 5.7GHz-5.9GHz..... | 23 |
| Figure 28. Conducted Spurious Emissions, Plan B Band 1, 5.9GHz-18GHz..... | 23 |
| Figure 29. Conducted Spurious Emissions, Plan B Band 1, 18GHz-26GHz..... | 24 |
| Figure 30. Conducted Spurious Emissions, Plan B Band 1, 26GHz-40GHz..... | 24 |
| Figure 31. Conducted Spurious Emissions, Plan B Band 3, 30MHz-1GHz..... | 25 |
| Figure 32. Conducted Spurious Emissions, Plan B Band 3, 1GHz-5.7GHz..... | 25 |
| Figure 33. Conducted Spurious Emissions, Plan B Band 3, 5.7GHz-5.9GHz..... | 26 |
| Figure 34. Conducted Spurious Emissions, Plan B Band 3, 5.9GHz-18GHz..... | 26 |
| Figure 35. Conducted Spurious Emissions, Plan B Band 3, 18GHz-26GHz..... | 27 |
| Figure 36. Conducted Spurious Emissions, Plan B Band 3, 26GHz-40GHz..... | 27 |

1 Introduction

1.1 Compliance Statement

The ADTRAN, Inc. TRACER DSSS 4208 Spread Spectrum System complies with the limits for a Spread Spectrum Transceiver device under Part 15.247 of the FCC Rules and Regulations.

1.2 Test Scope

Tests for radiated and conducted emissions were performed. All measurements were performed according to the 1992 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

Quotation Number: 60657

1.4 Test Dates

Testing was performed from March 3, 2003 to March 19, 2003

1.5 Test and Support Personnel

Washington Laboratories, LTD 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

| ADTRAN Part # | Product Name/Description |
|---------------|--------------------------|
| 12804208L1A | Tracer 4208 Plan A |
| 12804208L1B | Tracer 4208 Plan B |

| | |
|----------------------------|------------------------|
| Top Assembly #: | 12804208L1A / B |
| Sub Assembly #(s): | 2280003-28, 2280018-11 |
| Circuit Board #(s): | 5280003-28, 5280018-11 |

The 12804208L1 (Tracer 4208 Radio) is a digital radio device that accepts eight 1.544 Mb/sec T1 signals and transports them 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 12804208L1 provides the network, antenna, and control/status interface to the customer. The T1 interfaces are network timed. No internal timing is available.

The Tracer 4208 operates in the 5748-5823 MHz band using direct sequence spread spectrum transmission. Two Plans are available: "A" and "B". Each plan has three (3) channels. The channels are determined by internal cable routing on the transmit module during manufacture.

I/O Ports and Cables available on the TRACER 4208 Tracer:

| Signal/ Port Name | Signal/ Port Type | Cable Type | NOTES |
|-----------------------|----------------------|------------------|--|
| RS232 | I/O | Shielded 25 wire | VT100/Modem port |
| TEST | I/O | Unshielded TP | 1/4" stereo jack for I/Q constellation |
| T1A,B,C,D,E,F,G, H | I/O | Unshielded | 100 ohm impedance |
| ALARM | Control | Unshielded TP | Major and Minor alarm contacts |
| DC POWER | Power | Unshielded | DC Power input, 21-60 VDC |
| ANTENNA | I/O | Shielded Coax | Connection to 5.8GHz antenna, 50 ohm |
| RSSI | I/O | Unshielded wire | Mono jack, Received Signal Strength |
| TX PWR | I/O | Unshielded wire | Mono jack, Transmitter power level |
| GND | I/O | Unshielded wire | Mono jack, Circuit ground |

Table 1. Device Summary

| ITEM | DESCRIPTION |
|-------------------------|--|
| Manufacturer: | ADTRAN, Inc. |
| FCC ID Number | HDCTRC4208 |
| EUT Name: | Spread Spectrum Transceiver |
| Model: | 4208 |
| FCC Rule Parts: | §15.247 |
| Frequency Range: | 5742MHz – 5833MHz |
| Maximum Output Power: | 100 mW |
| Modulation: | Digital (QPSK) |
| Bandwidth: | >500kHz |
| Keying: | Automatic |
| Type of Information: | Data |
| Number of Channels: | 2 |
| Power Output Level | Fixed |
| Antenna Type | Parabolic Dish Radio Waves, Inc. SP2-5.8; 28.5 dBi |
| Frequency Tolerance: | N/A |
| Emission Type(s): | N/A |
| Interface Cables: | None |
| Power Source & Voltage: | 48 VDC |

The TRACER DSSS 4208 contains the following sources:

| Frequency (MHz) | Description |
|------------------------|---|
| 51.536 | Master clock of digital transmit and receive (XO) |
| 1.544 | T1 clock rate for framer (XO) |
| 12 | RF reference clock (XO) |
| 280 | IF frequency (XO) |
| 5748 | RF channel A frequency |
| 5823 | RF channel B frequency |
| 1402 | RF channel A RX IF |
| 1367 | RF channel A TX IF |
| 1422 | RF channel B RX IF |
| 1387 | RF channel B TX IF |

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". Changing between the plans is accomplished by switching the internal cables. The channels are then programmed within the plan.

An HP Pavilion Laptop PC, Model Number N3350, S/N: TW02810306 was used to set up the EUT. It was removed for the test.

2.3 Testing Algorithm

The EUT 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. 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

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 \pm 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 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 | Serial Number Asset Number | Calibration Due |
|---------------------|-------------------|--------------------|---------------------------------------|----------------------------|
| HP | 8568B | Spectrum Analyzer | 2634A02888 | 7/03/03 |
| HP | 85650A | Quasi-Peak Adapter | 3303A01786 | 7/05/03 |
| Solar | 8012-50-R-24BNC | LISN | 8379493 | 6/20/03 |
| ARA | LPB-2520 | BiconiLog Antenna | 1044 | 6/19/03 |
| HP | 85685A | RF Preselector | 3221A01395 | 5/17/03 |
| Tektronix | TDS 540 | Oscilloscope | 142 | 8/29/03 |
| HP | 8672 A | Signal Generator | 80 | 3/17/04 |
| HP | | Diode Detector | 416 | 12/03 |
| HP | 438 | Power Meter | 394 | 3/10/04 |

4 Test Results

4.1 RF Power Output

For devices within the scope of FCC §15.247, 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.

The EUT carrier was modulated during this test.

Table 3. RF Power Output

| Frequency | Level (dBm) | Level (mW) | Limit (W) | Pass/Fail |
|------------------|--------------------|-------------------|------------------|------------------|
| Plan A (1) | 19.68 | 92.9 | 1 | P |
| Plan A (3) | 20.2 | 104.7 | 1 | P |
| Plan B (1) | 20.17 | 104 | 1 | P |
| Plan B (3) | 19.8 | 95.5 | 1 | P |

4.2 RF Peak Power Spectral Density

For 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 carrier was modulated. Plots of the PSD were taken as shown in Figure 1 through Figure 4 below. Table 4 provides a summary of the data.

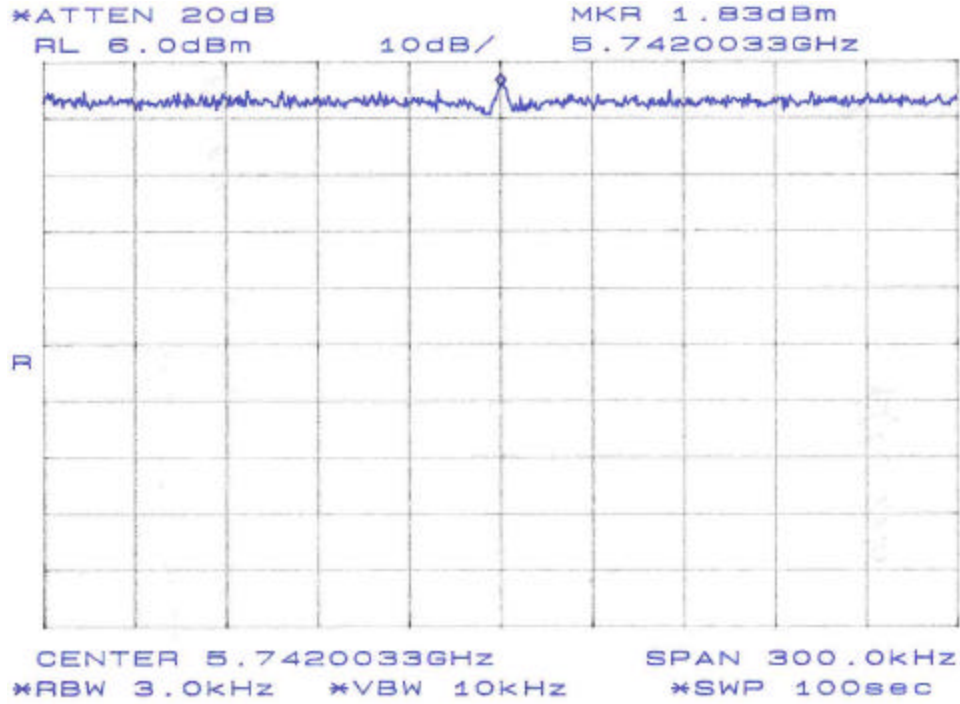
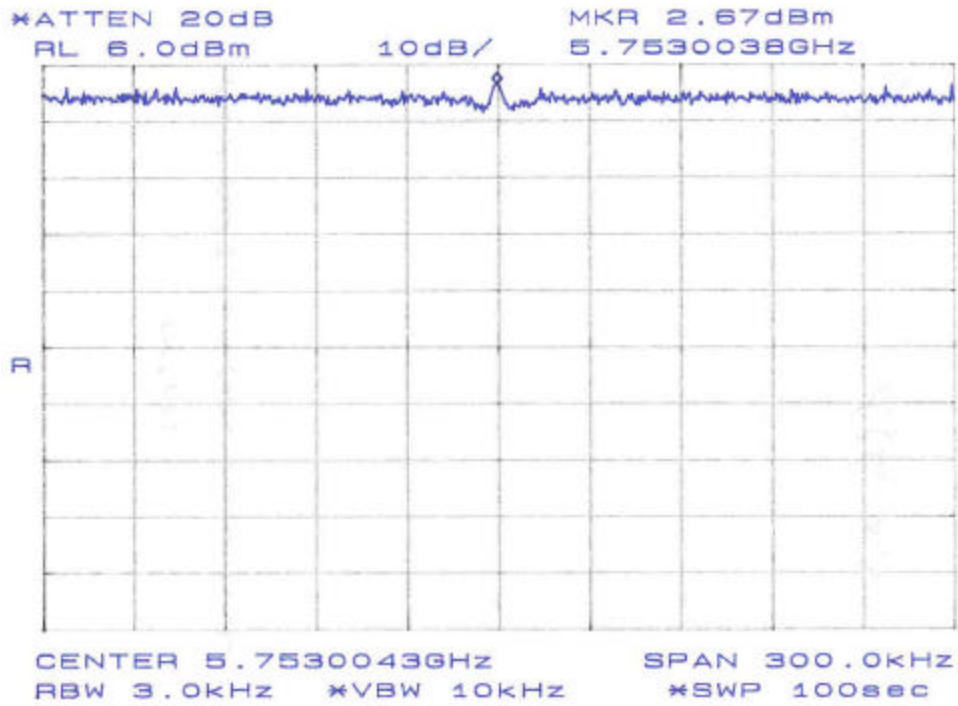


Figure 1. Power Spectral Density Plan A, Band



1

Figure 2. Power Spectral Density Plan A, Band 3

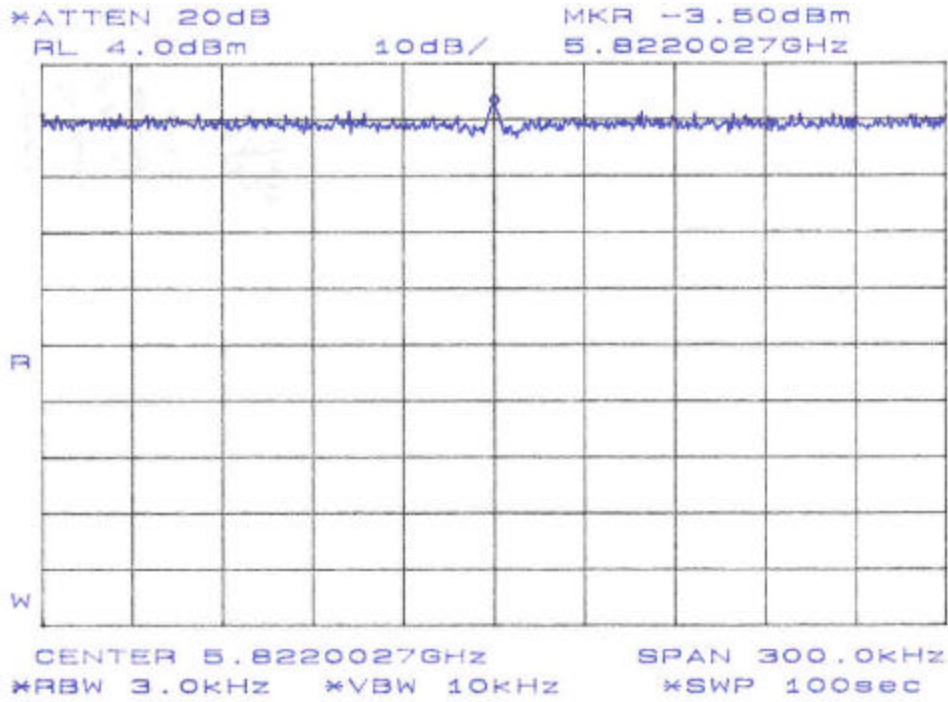


Figure 3. Power Spectral Density Plan B, Band 1

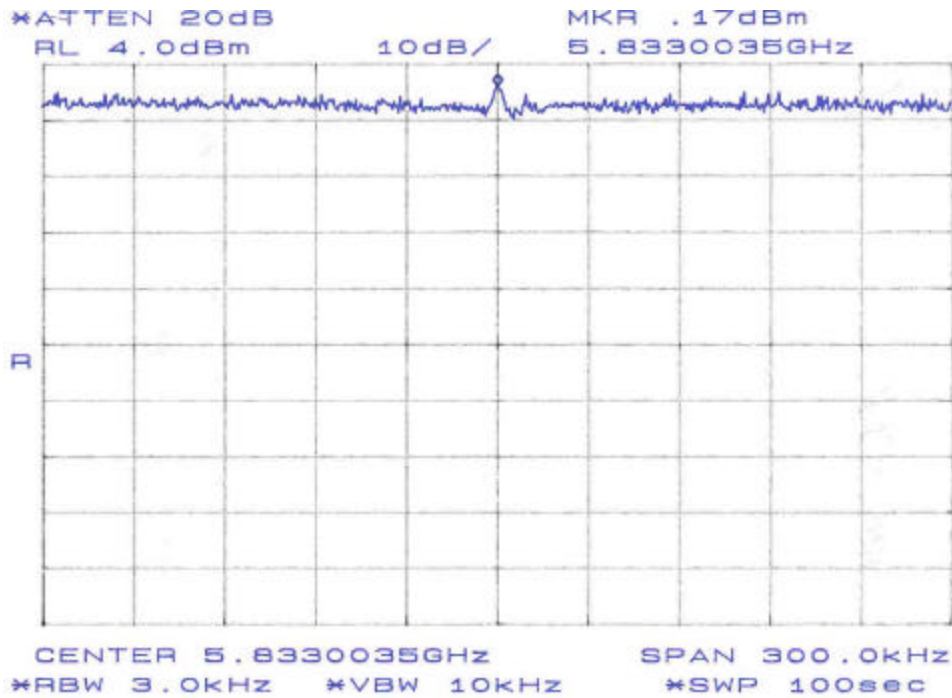


Figure 4. Power Spectral Density Plan B, Band 3

Table 4. RF Power Spectral Density

| Frequency | Level (dBm) | Limit (dBm) | Pass/Fail |
|------------|-------------|-------------|-----------|
| Plan A (1) | 1.83 | 8 | P |
| Plan A (3) | 2.67 | 8 | P |
| Plan B (1) | -3.5 | 8 | P |
| Plan B (3) | 0.17 | 8 | P |

4.3 Occupied Bandwidth

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 requires that the minimum 6dB bandwidth be at least 500 kHz.



Figure 5. Occupied Bandwidth - Plan A , Band 1



Figure 6. Occupied Bandwidth - Plan A , Band 2

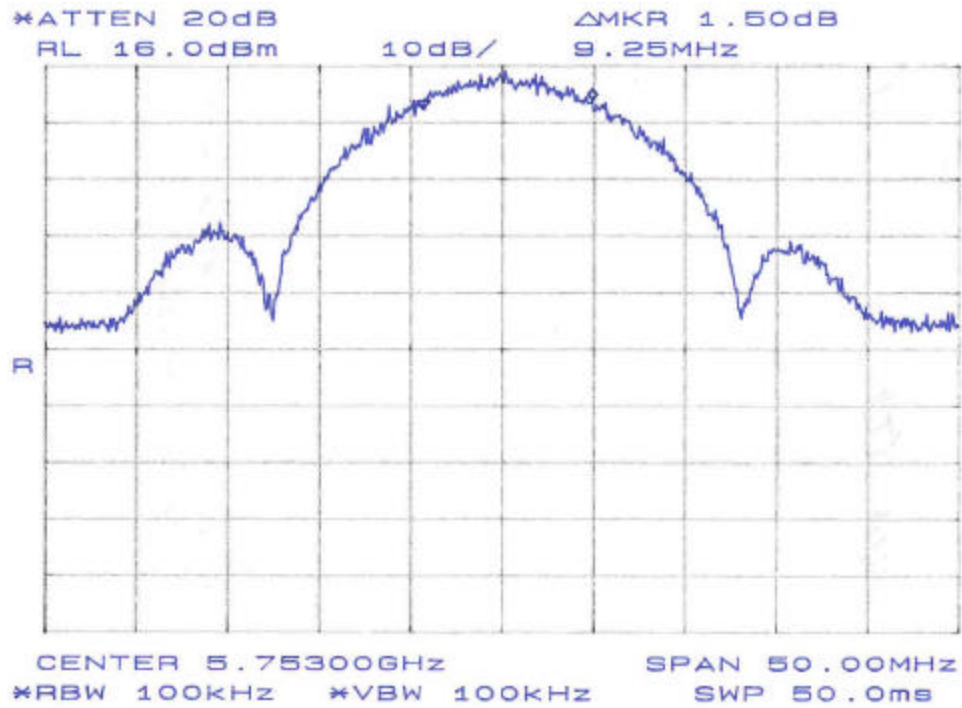


Figure 7. Occupied Bandwidth - Plan A, Band 3



Figure 8. Occupied Bandwidth - Plan B, Band 1

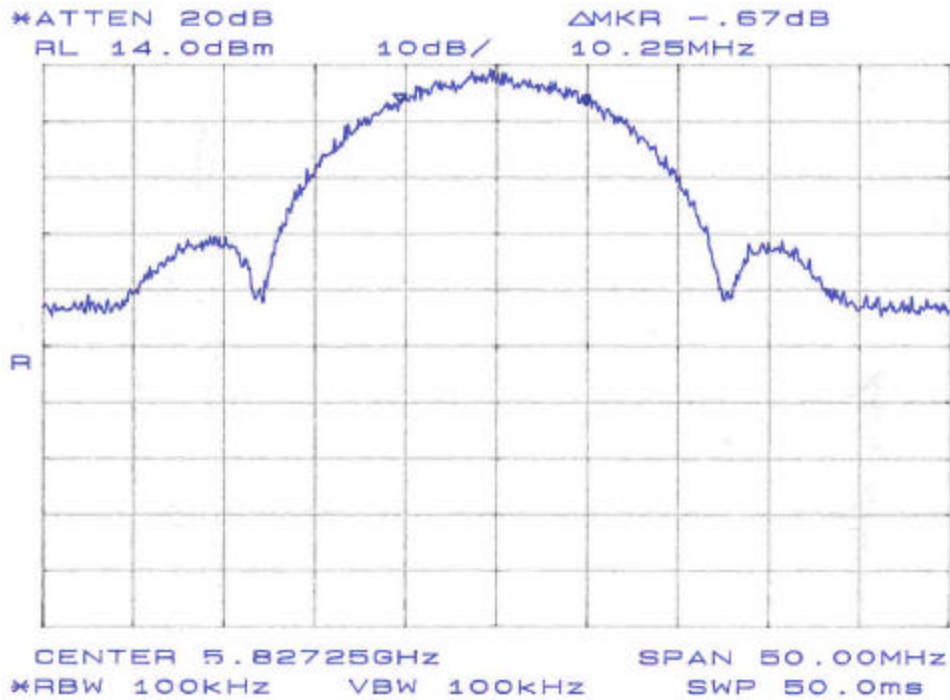


Figure 9. Occupied Bandwidth - Plan B, Band 2

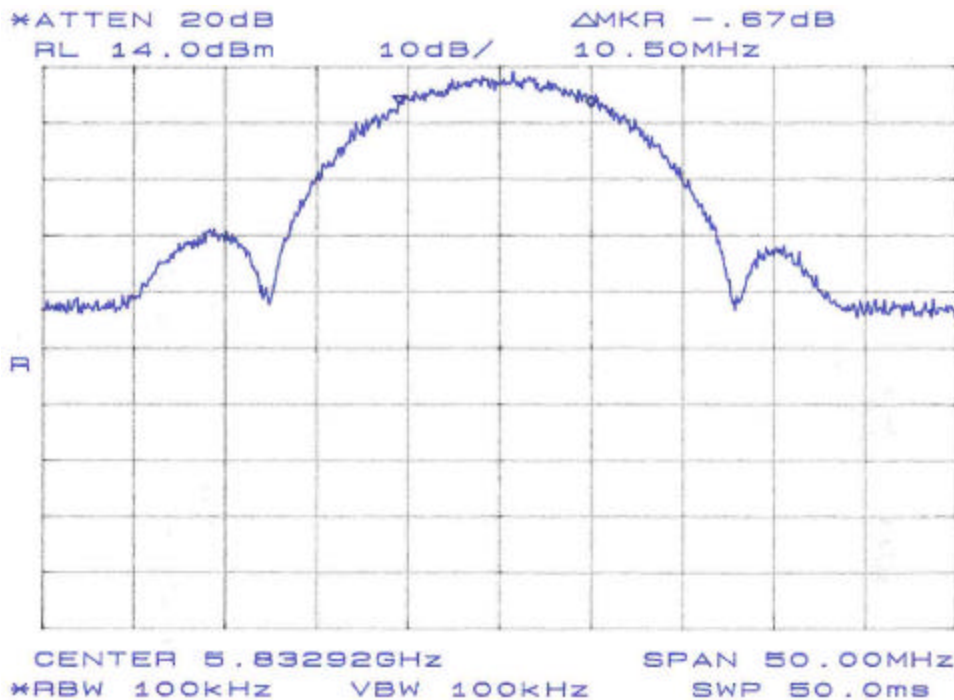


Figure 10. Occupied Bandwidth - Plan B, Band 3

Table 5 provides a summary of the Occupied Bandwidth Results.

Table 5. Occupied Bandwidth Results

| Frequency | Bandwidth (MHz) | Limit | Pass/Fail |
|------------|-----------------|-----------|-----------|
| Plan A (1) | 11.25 | > 500 kHz | Pass |
| Plan A (2) | 11.92 | > 500 kHz | Pass |
| Plan A (3) | 9.25 | > 500 kHz | Pass |
| Plan B (1) | 11.0 | > 500 kHz | Pass |
| Plan B (2) | 10.25 | > 500 kHz | Pass |
| Plan B (3) | 10.5 | > 500 kHz | Pass |

4.4 Spurious Emissions at Antenna Terminals (FCC Part §15.247(b))

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.

See the plots of conducted emissions plots below.

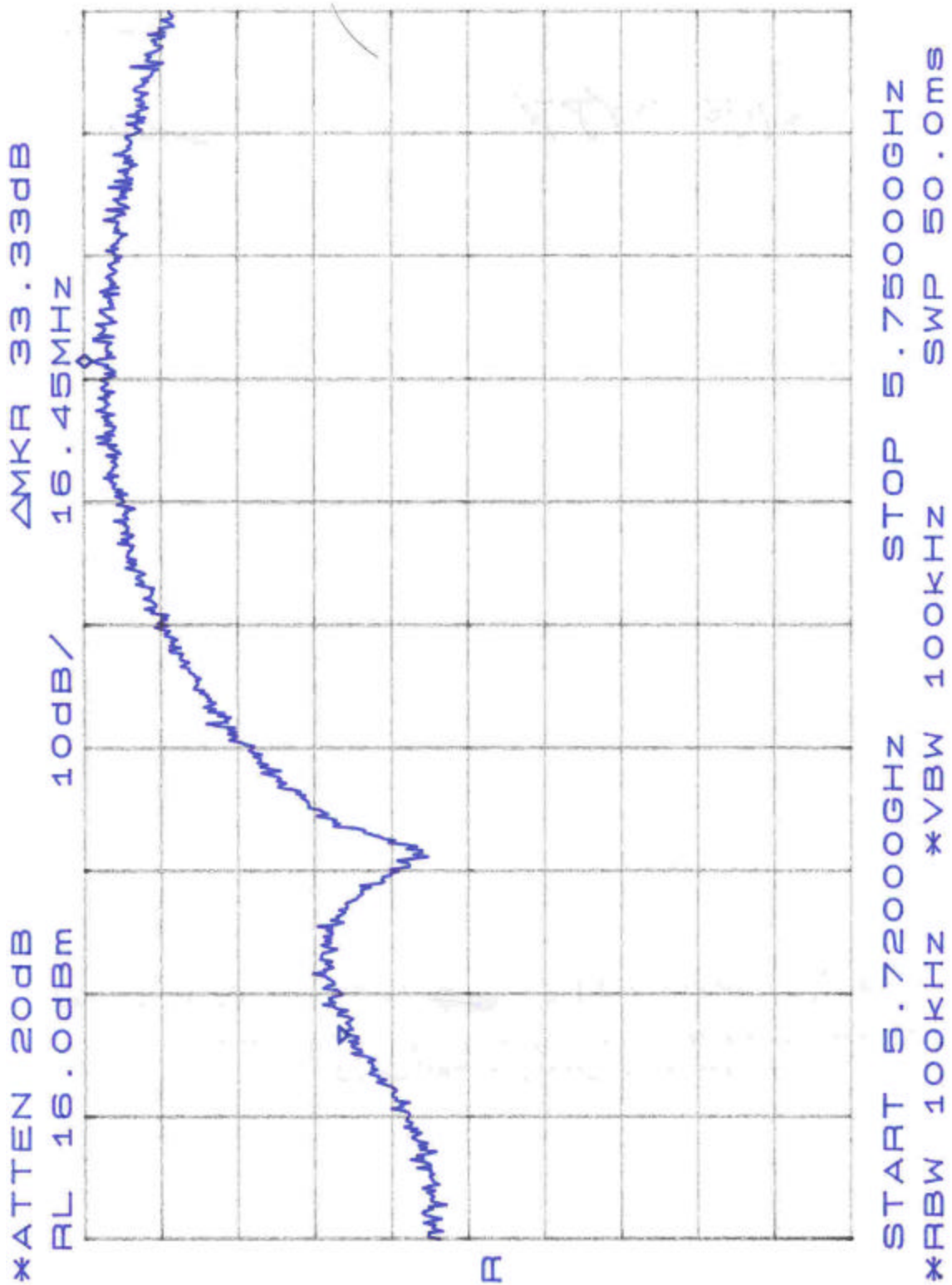


Figure 11. Lower Band Edge Measurement

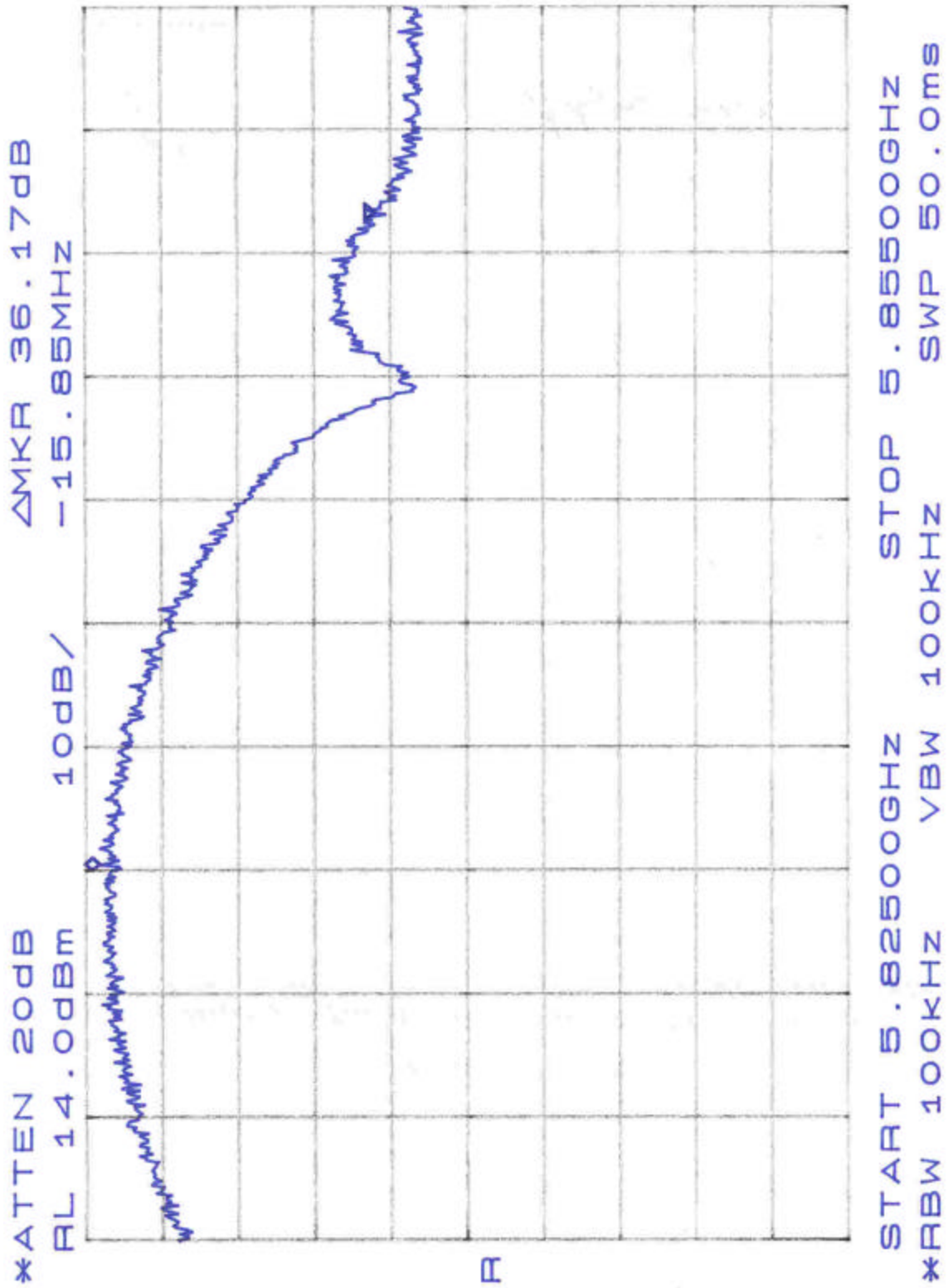


Figure 12. Upper Band Edge Measurement

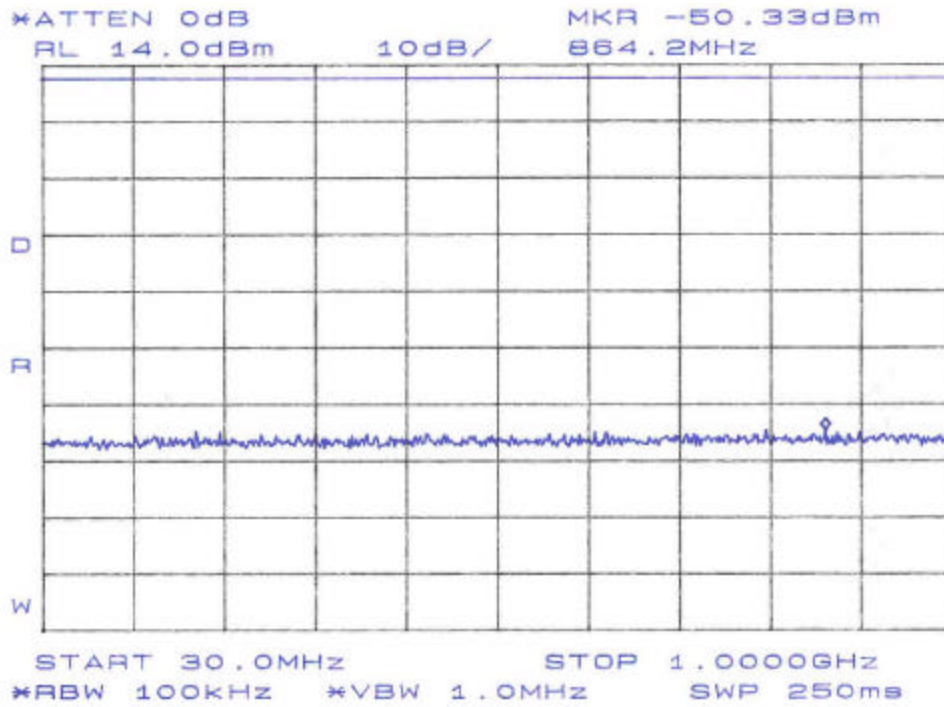


Figure 13. Conducted Spurious Emissions, Plan A Band 1, 30MHz-1GHz

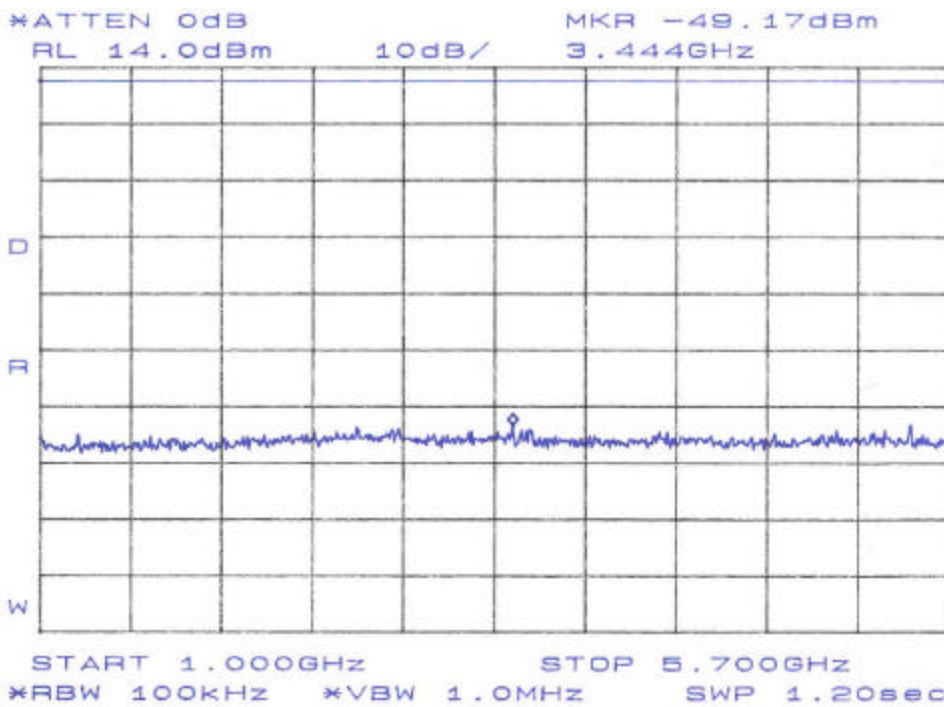


Figure 14. Conducted Spurious Emissions, Plan A Band 1, 1GHz-5.7GHz

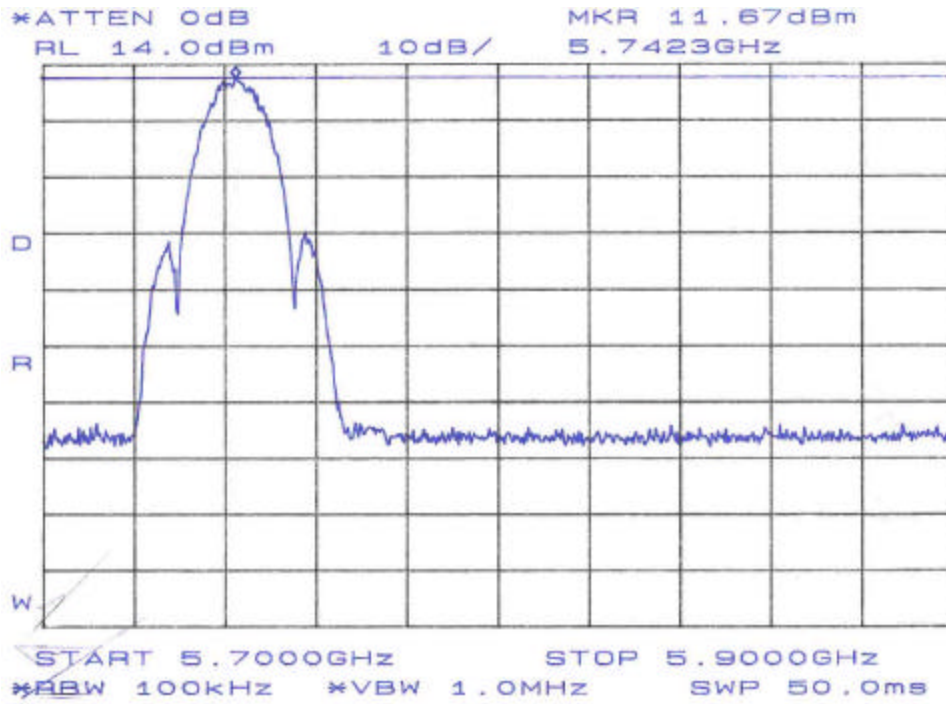


Figure 15. Conducted Spurious Emissions, Plan A Band 1, 5.7GHz-5.9GHz

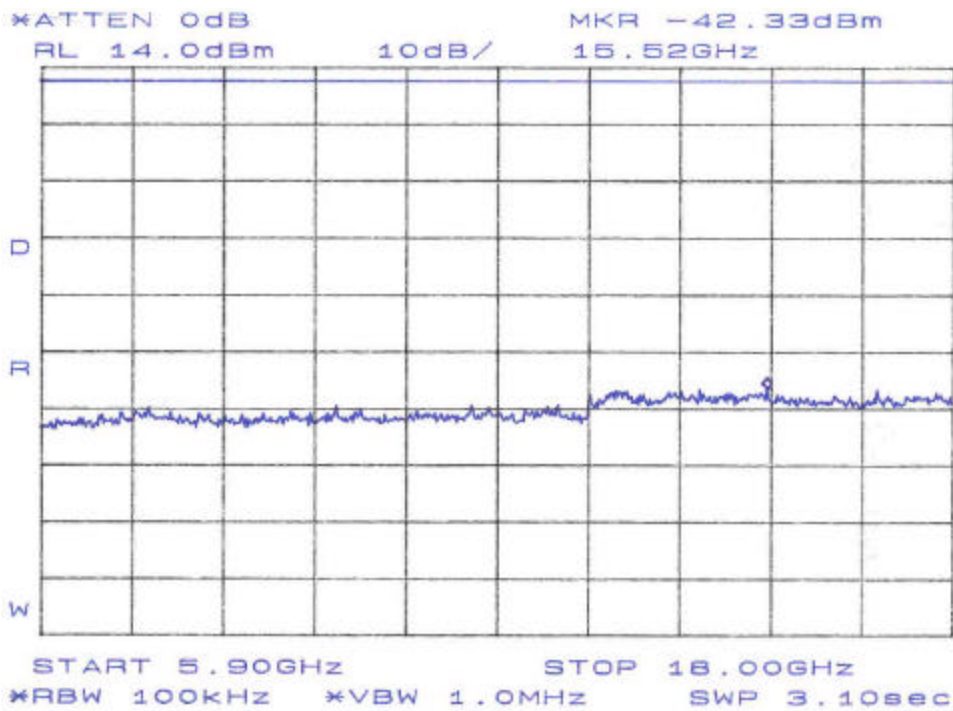


Figure 16. Conducted Spurious Emissions, Plan A Band 1, 5.9GHz-18GHz

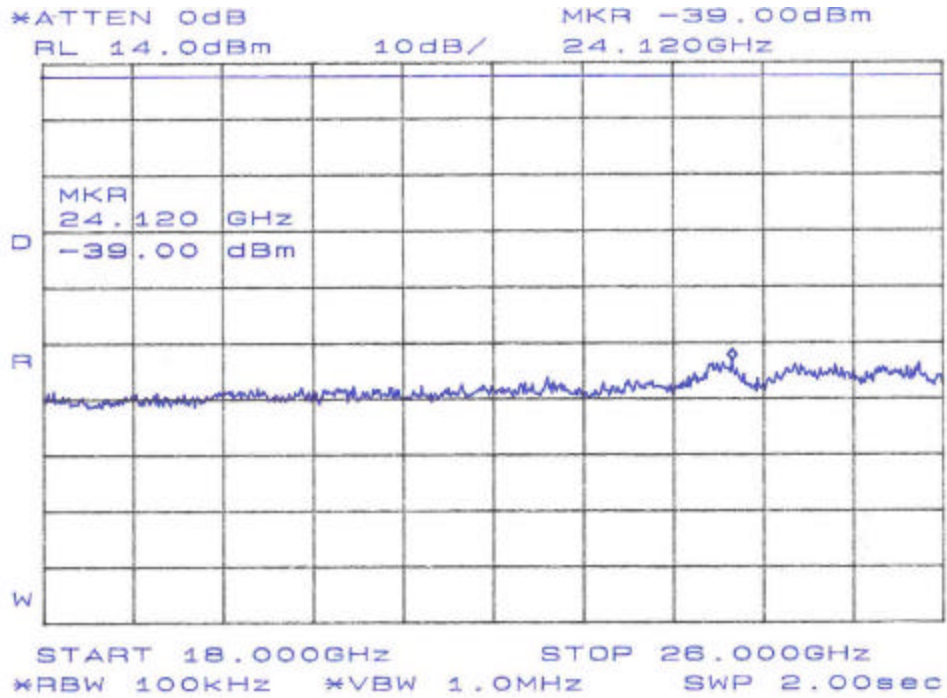


Figure 17. Conducted Spurious Emissions, Plan A Band 1, 18GHz-26GHz

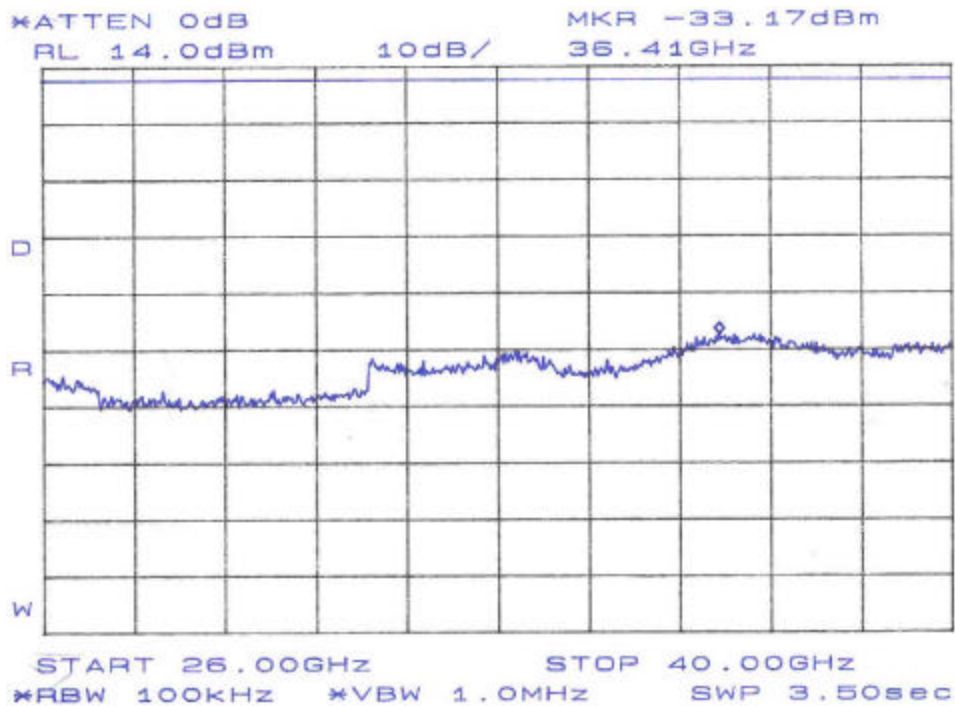


Figure 18. Conducted Spurious Emissions, Plan A Band 1, 26GHz-40GHz

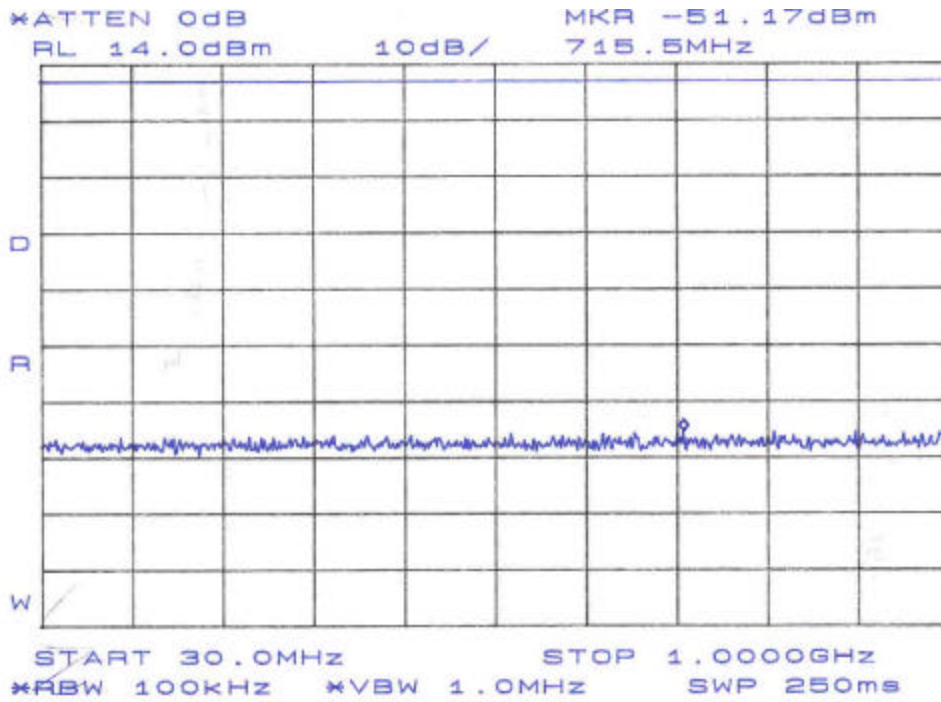


Figure 19. Conducted Spurious Emissions, Plan A Band 3, 30MHz-1GHz

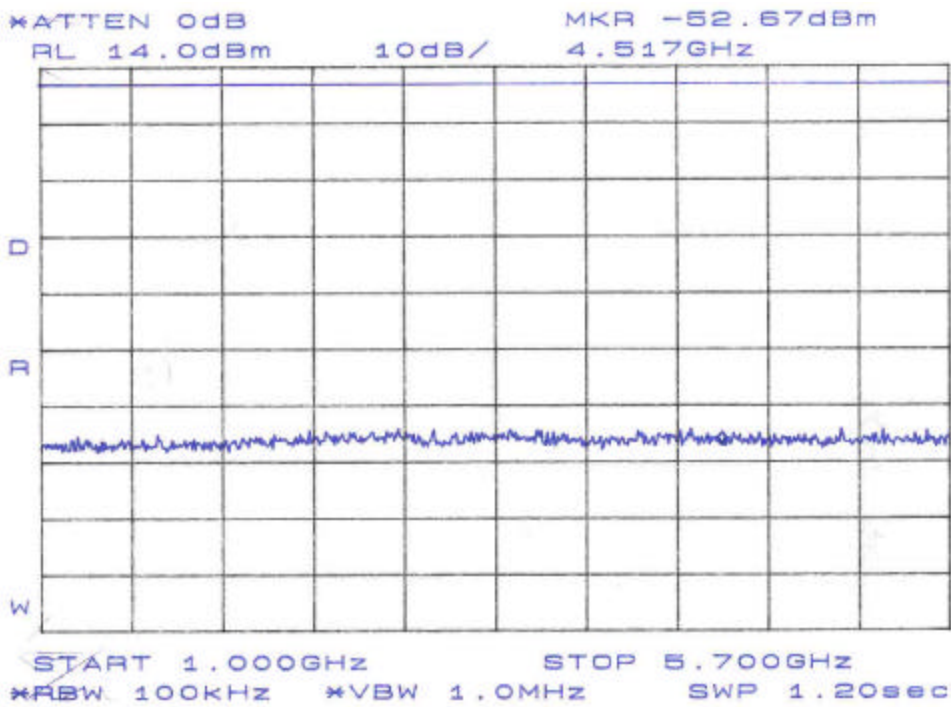


Figure 20. Conducted Spurious Emissions, Plan A Band 3, 1GHz-5.7GHz

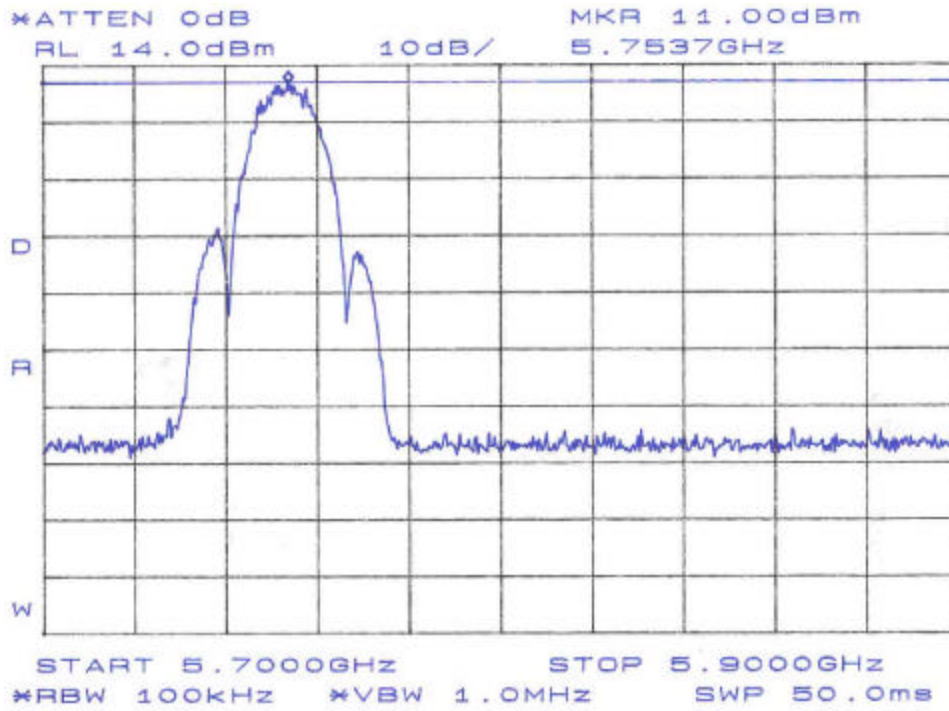


Figure 21. Conducted Spurious Emissions, Plan A Band 3, 5.7GHz-5.9GHz

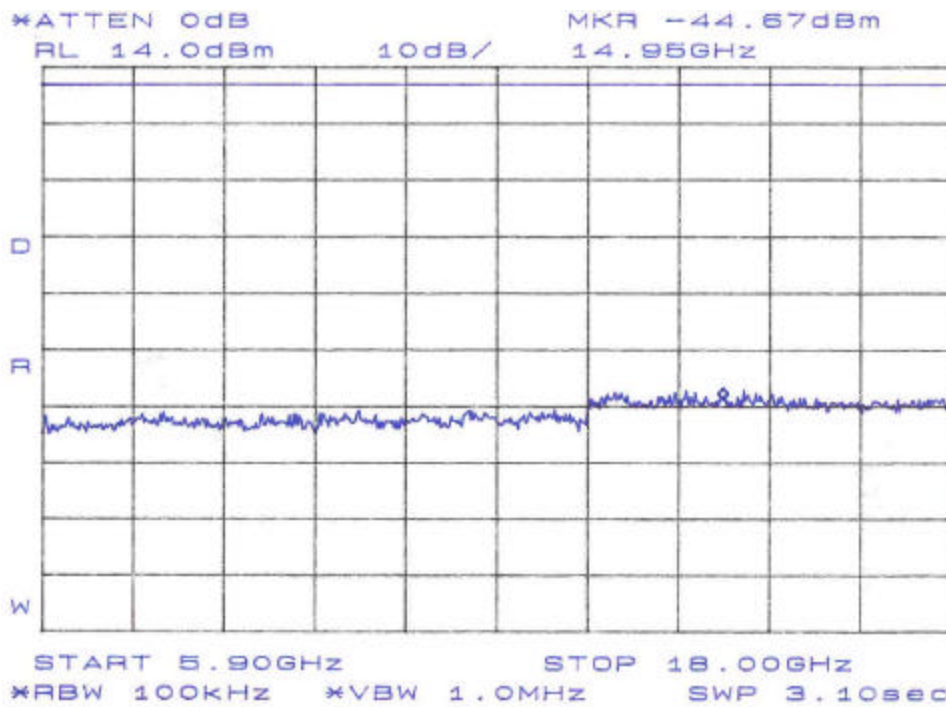


Figure 22. Conducted Spurious Emissions, Plan A Band 3, 5.9GHz-18GHz

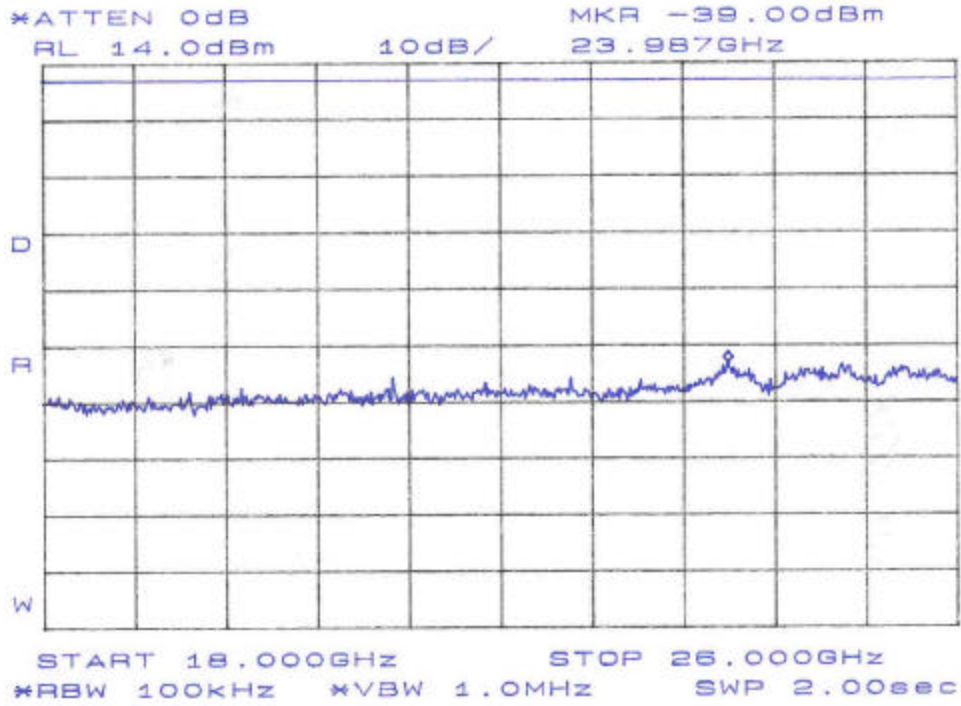


Figure 23. Conducted Spurious Emissions, Plan A Band 3, 18GHz-26GHz

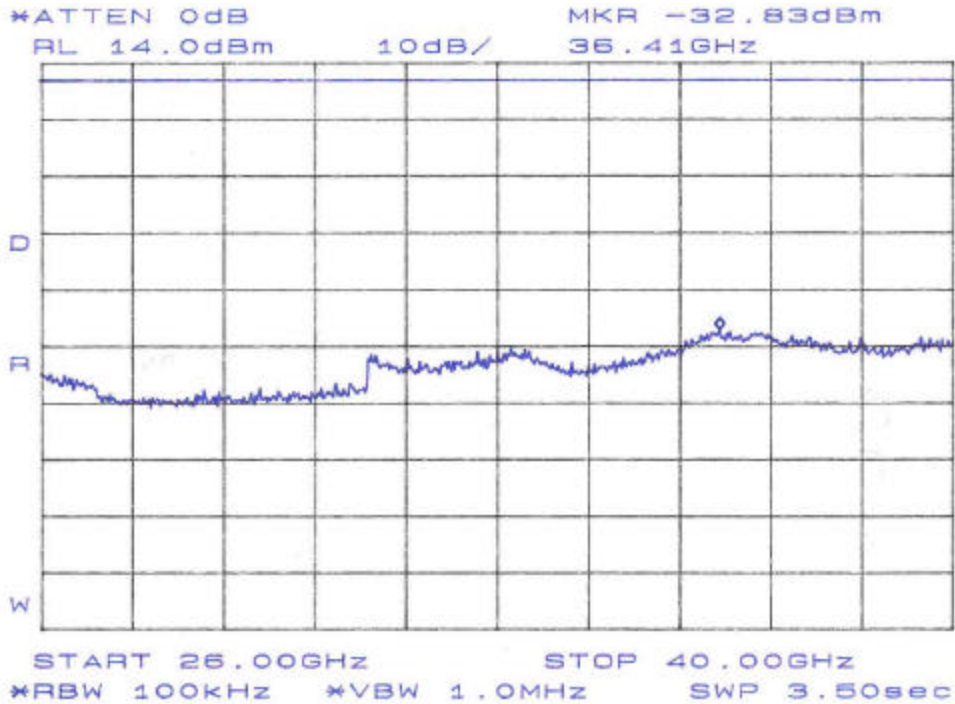


Figure 24. Conducted Spurious Emissions, Plan A Band 3, 26GHz-40GHz

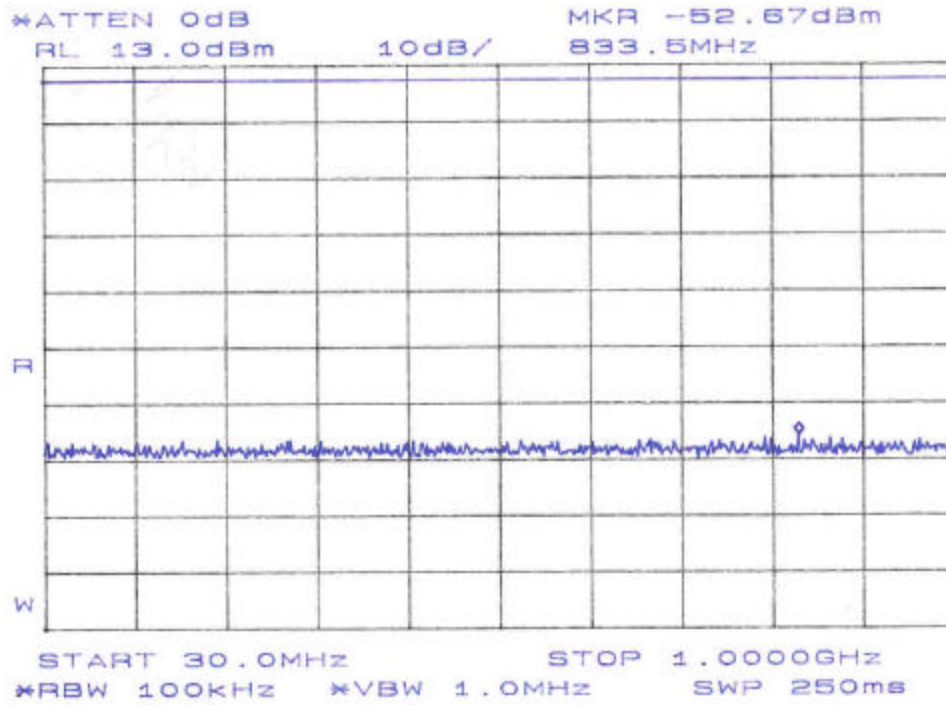


Figure 25. Conducted Spurious Emissions, Plan B Band 1, 30MHz-1GHz

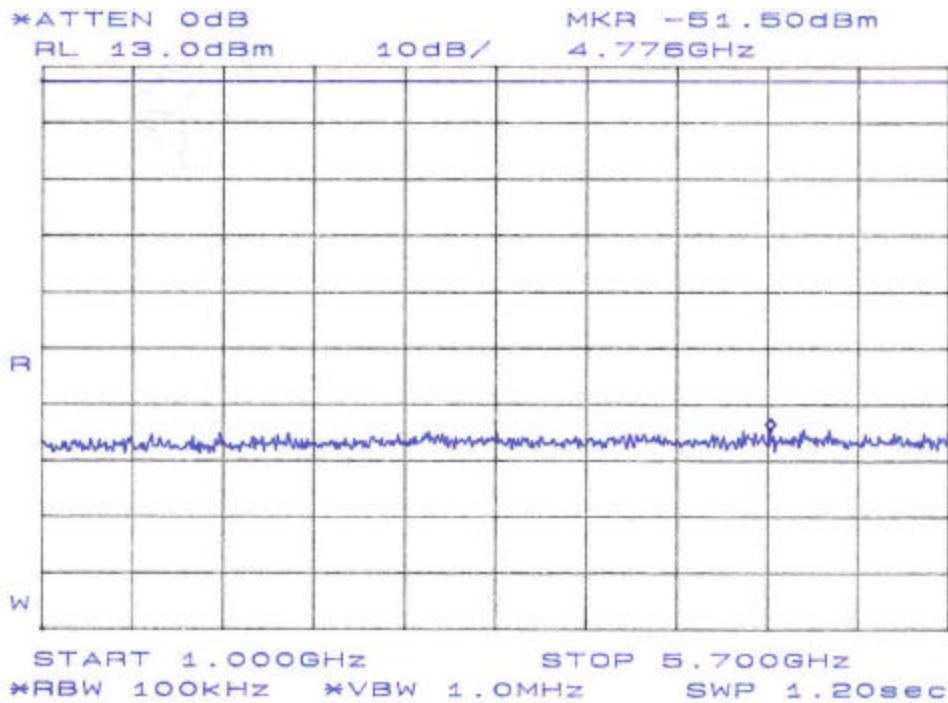


Figure 26. Conducted Spurious Emissions, Plan B Band 1, 1GHz-5.7GHz

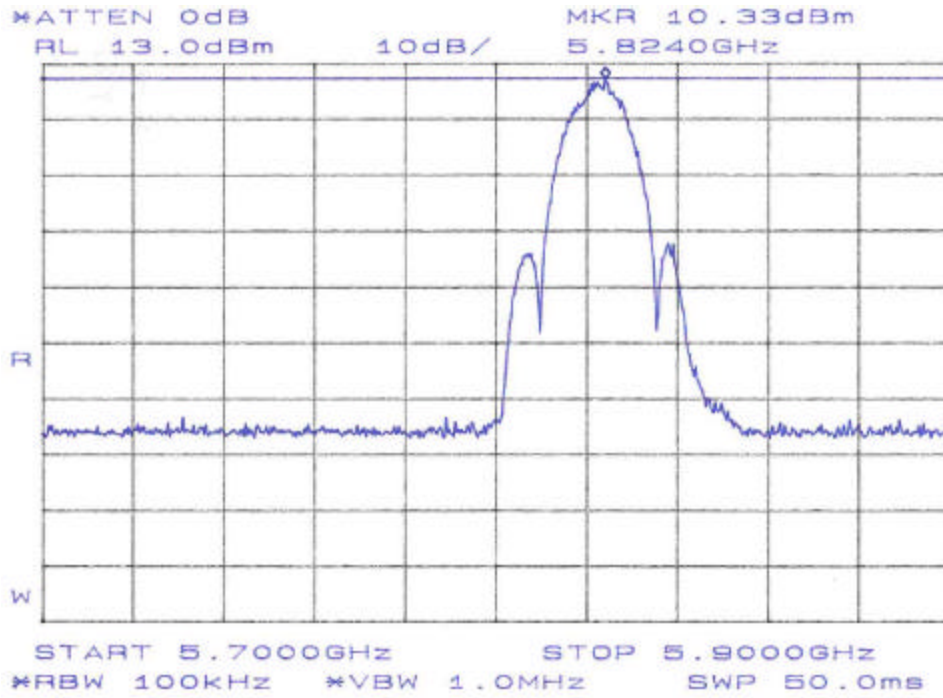


Figure 27. Conducted Spurious Emissions, Plan B Band 1, 5.7GHz-5.9GHz

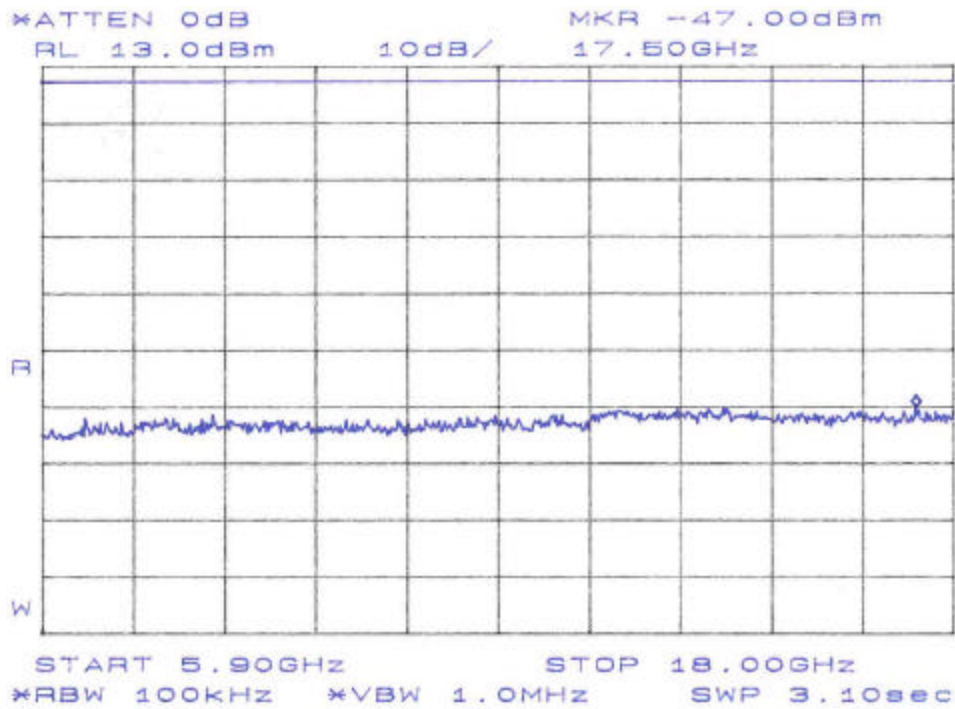


Figure 28. Conducted Spurious Emissions, Plan B Band 1, 5.9GHz-18GHz

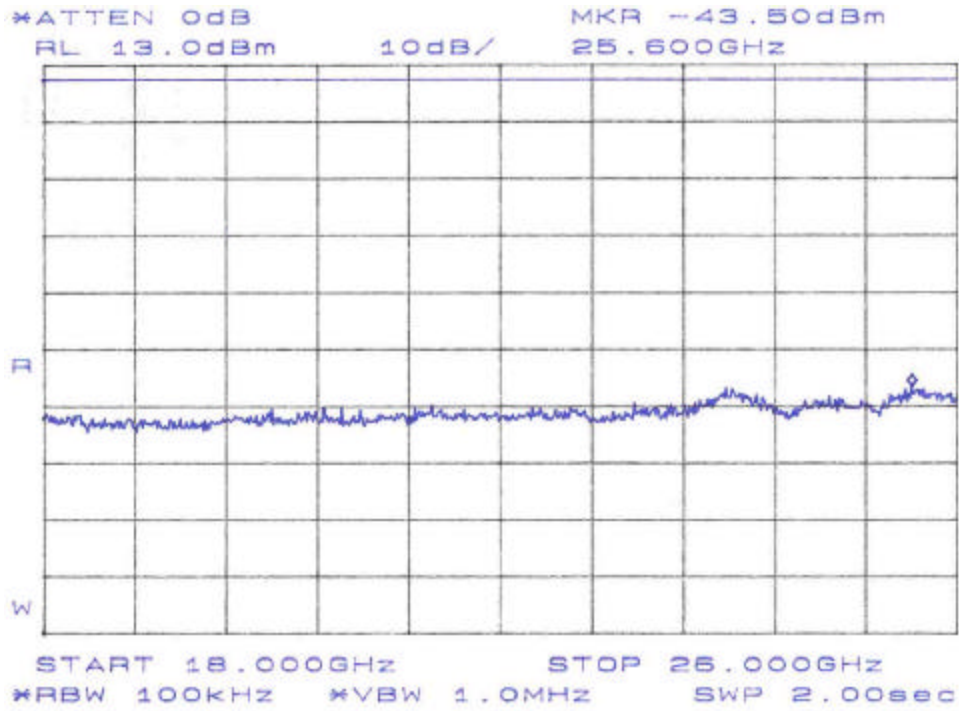


Figure 29. Conducted Spurious Emissions, Plan B Band 1, 18GHz-26GHz

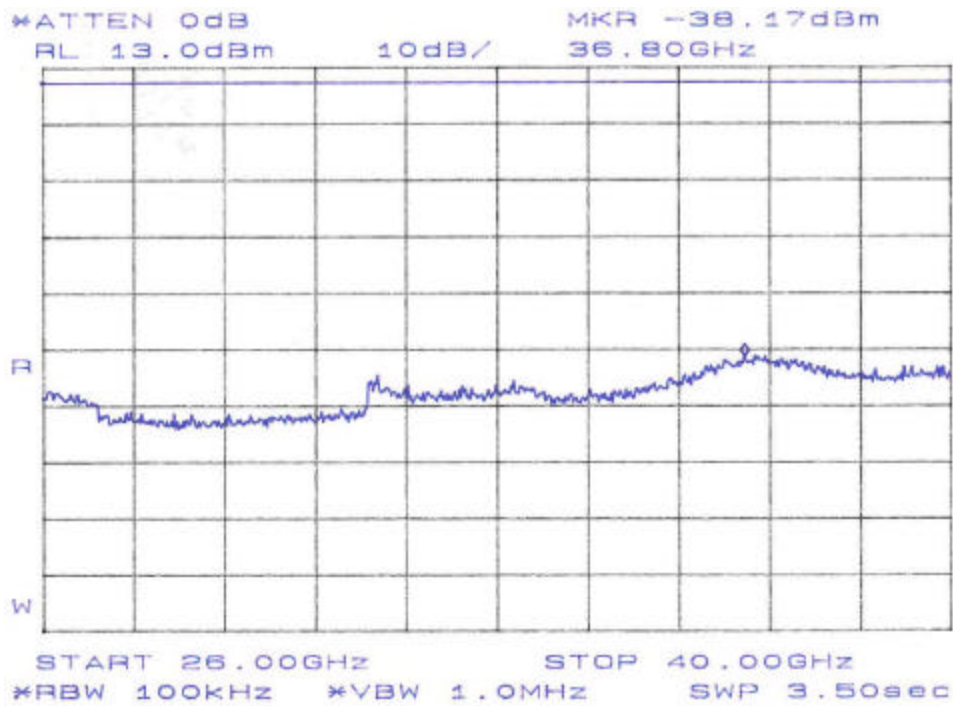


Figure 30. Conducted Spurious Emissions, Plan B Band 1, 26GHz-40GHz

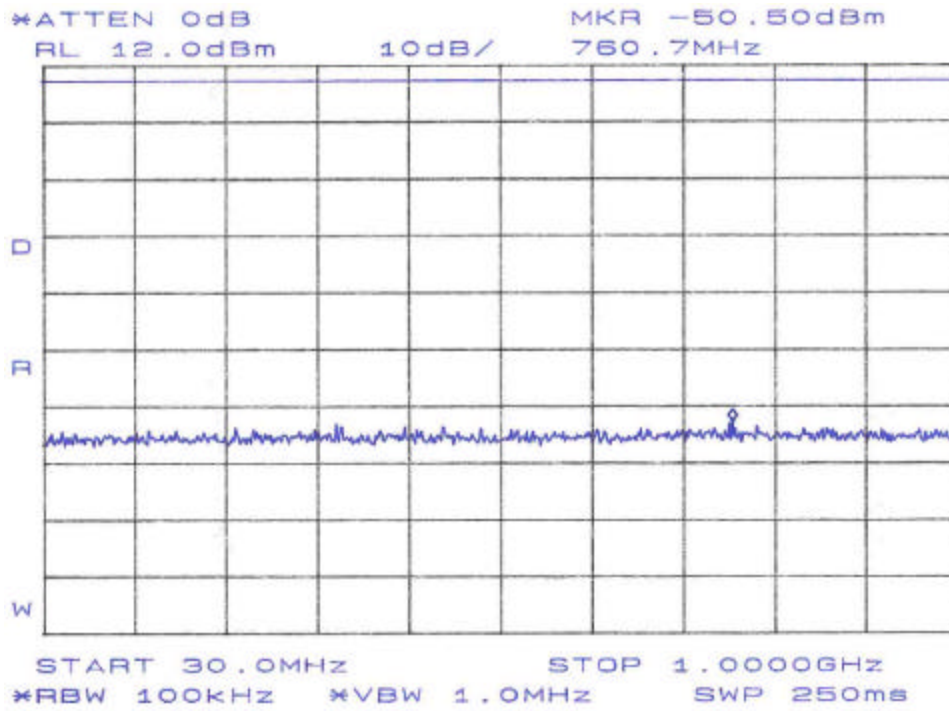


Figure 31. Conducted Spurious Emissions, Plan B Band 3, 30MHz-1GHz

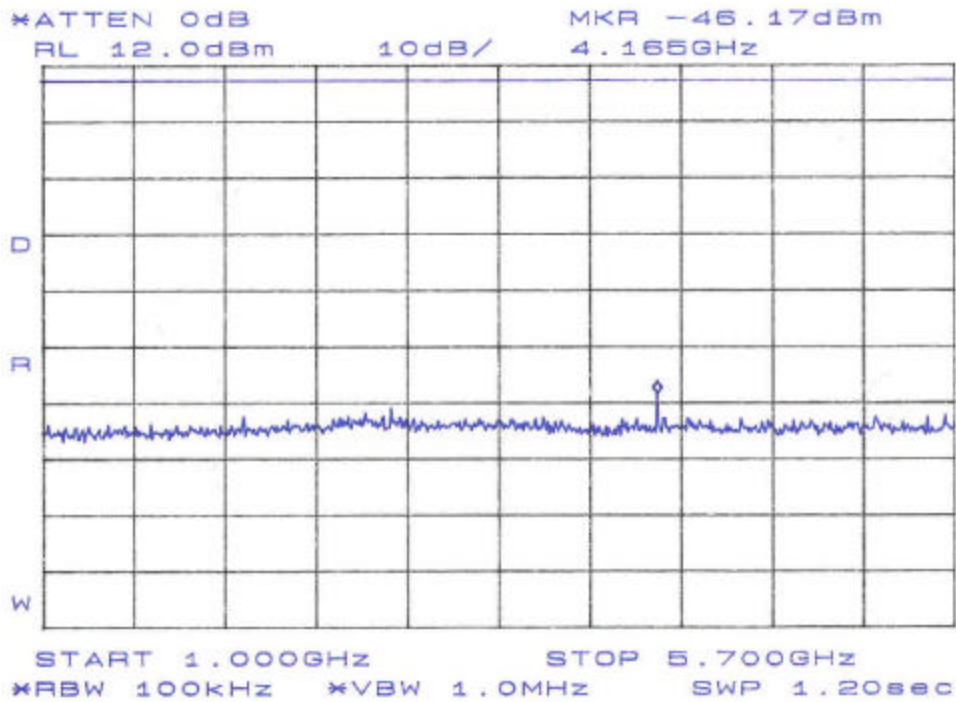


Figure 32. Conducted Spurious Emissions, Plan B Band 3, 1GHz-5.7GHz

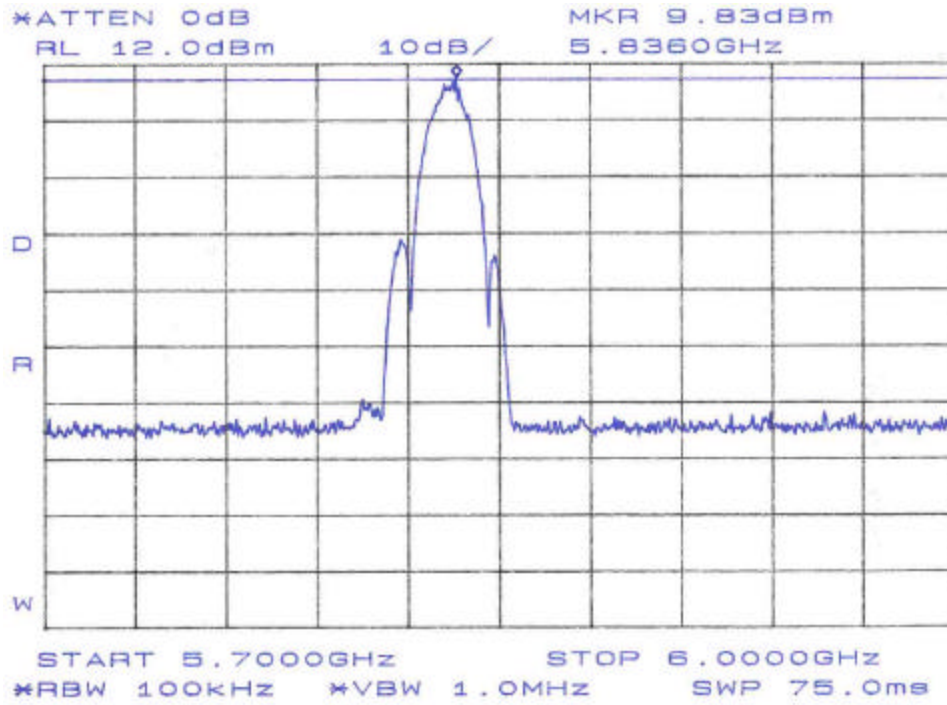


Figure 33. Conducted Spurious Emissions, Plan B Band 3, 5.7GHz-5.9GHz

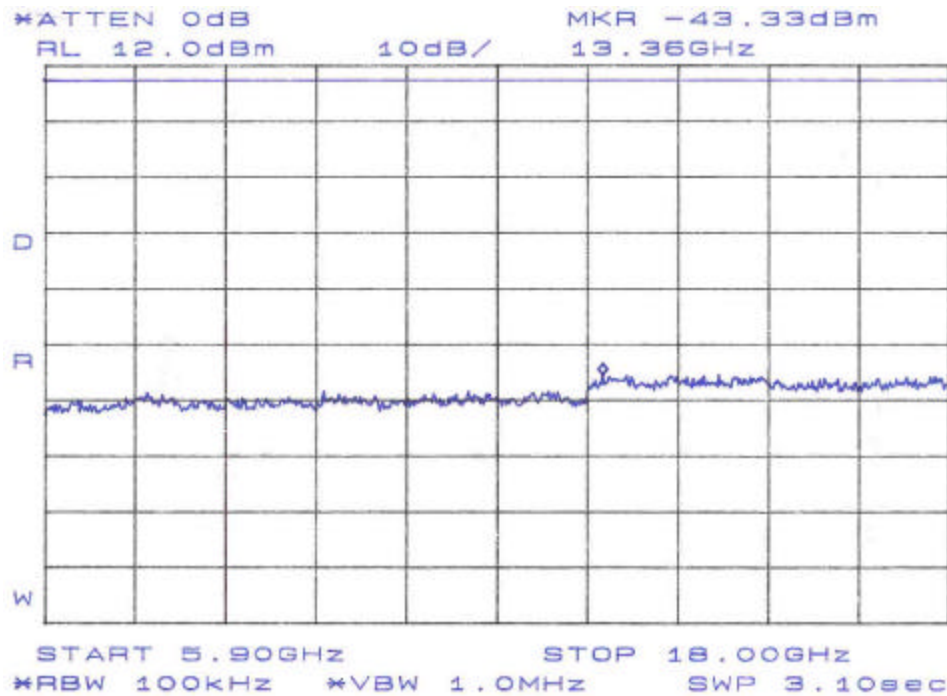


Figure 34. Conducted Spurious Emissions, Plan B Band 3, 5.9GHz-18GHz

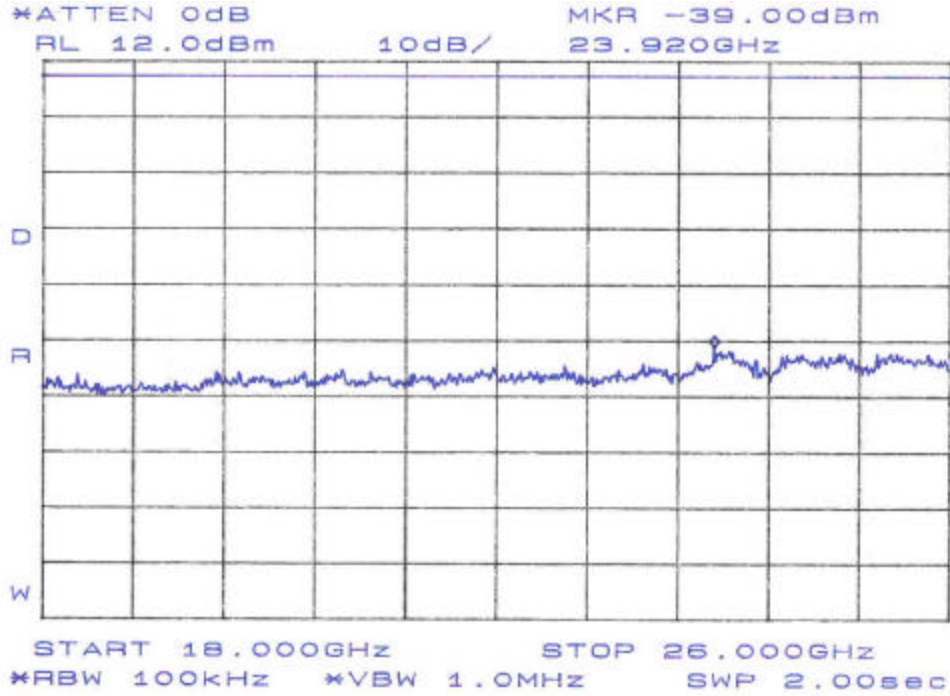


Figure 35. Conducted Spurious Emissions, Plan B Band 3, 18GHz-26GHz

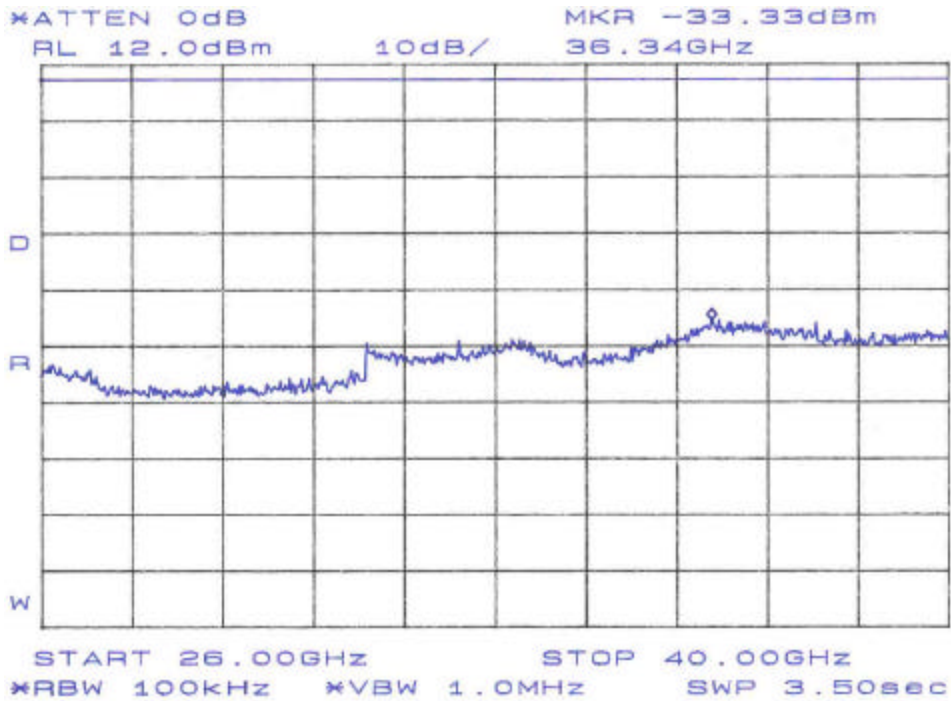


Figure 36. Conducted Spurious Emissions, Plan B Band 3, 26GHz-40GHz

4.5 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.

4.5.1 Test Procedure

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 C63.4-1992. 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 |

These data are supplied in the following tables.

Table 6: Radiated Emission Test Data - Plan A, Band 1

CLIENT: Adtran DATE: 3/5/03
 TESTER: James Ritter JOB #: 7461
 EUT: Tracer 4508 8T1 TEST STANDARD: FCC Part 15
 CONFIGURATION: Transmitter @ 5742 MHz Plan 1 Band A DISTANCE: 3m
 CLOCKS: 1.544, 12, 51.536, 280 MHz

| Frequency (MHz) | Polarity H/V | Azimuth Degree | Ant. Height (m) | SA Level (QP) 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 |
|--------------------|-----------------|-------------------|-----------------------|--------------------------|-------------------------|------------------------|---------------------------|-------------------------|--------------------------|-----------------|--------------|----------|
| PK | | | | | | | | | | | | |
| 1133.63 | H | 200.0 | 1.0 | 51.2 | 25.5 | 2.2 | 36.3 | 42.6 | 135.1 | 5000.0 | -31.4 | |
| 1365.48 | H | 220.0 | 1.0 | 52.3 | 26.6 | 2.3 | 36.0 | 45.1 | 180.7 | 5000.0 | -28.8 | |
| 1418.88 | H | 165.0 | 1.0 | 49.6 | 26.8 | 2.3 | 36.0 | 42.8 | 137.6 | 5000.0 | -31.2 | |
| 2837.60 | H | 180.0 | 1.0 | 50.5 | 30.5 | 3.2 | 35.7 | 48.5 | 266.2 | 5000.0 | -25.5 | |
| 4096.48 | H | 180.0 | 1.0 | 53.8 | 31.8 | 3.9 | 35.5 | 54.1 | 504.2 | 5000.0 | -19.9 | |
| 11484.00 | H | 0.0 | 1.0 | 48.0 | 40.8 | 6.4 | 35.6 | 59.6 | 951.9 | 5000.0 | -14.4 | amb |
| Avg | | | | | | | | | | | | |
| 1133.40 | H | 200.0 | 1.0 | 45.6 | 25.5 | 2.2 | 36.3 | 37.0 | 70.9 | 500.0 | -17.0 | |
| 1365.48 | H | 220.0 | 1.0 | 46.0 | 26.6 | 2.3 | 36.0 | 38.9 | 88.0 | 500.0 | -15.1 | |
| 1418.88 | H | 165.0 | 1.0 | 41.1 | 26.8 | 2.3 | 36.0 | 34.3 | 51.7 | 500.0 | -19.7 | |
| 2837.60 | H | 180.0 | 1.0 | 43.0 | 30.5 | 3.2 | 35.7 | 41.1 | 113.0 | 500.0 | -12.9 | |
| 4096.48 | H | 180.0 | 1.0 | 49.7 | 31.8 | 3.9 | 35.5 | 49.9 | 312.3 | 500.0 | -4.1 | |
| 11484.00 | H | 0.0 | 1.0 | 37.8 | 40.8 | 6.4 | 35.6 | 49.4 | 294.2 | 500.0 | -4.6 | amb |
| PK | | | | | | | | | | | | |
| 1133.63 | V | 190.0 | 1.0 | 51.2 | 25.5 | 2.2 | 36.3 | 42.6 | 134.8 | 5000.0 | -31.4 | |
| 1365.48 | V | 160.0 | 1.0 | 52.7 | 26.6 | 2.3 | 36.0 | 45.6 | 190.8 | 5000.0 | -28.4 | |
| 1418.88 | V | 190.0 | 1.0 | 51.2 | 26.8 | 2.3 | 36.0 | 44.4 | 165.4 | 5000.0 | -29.6 | |
| 2837.60 | V | 180.0 | 1.0 | 49.1 | 30.5 | 3.2 | 35.7 | 47.1 | 227.1 | 5000.0 | -26.9 | |
| 4096.48 | V | 180.0 | 1.0 | 54.7 | 31.8 | 3.9 | 35.5 | 55.0 | 560.5 | 5000.0 | -19.0 | |
| 11484.00 | V | 0.0 | 1.0 | 46.7 | 40.8 | 6.4 | 35.6 | 58.2 | 815.8 | 5000.0 | -15.7 | amb |
| Avg | | | | | | | | | | | | |
| 1133.63 | V | 190.0 | 1.0 | 45.6 | 25.5 | 2.2 | 36.3 | 37.0 | 70.5 | 500.0 | -17.0 | |
| 1365.48 | V | 160.0 | 1.0 | 48.3 | 26.6 | 2.3 | 36.0 | 41.2 | 114.4 | 500.0 | -12.8 | |
| 1418.88 | V | 190.0 | 1.0 | 41.8 | 26.8 | 2.3 | 36.0 | 35.0 | 56.1 | 500.0 | -19.0 | |
| 2837.60 | V | 180.0 | 1.0 | 42.1 | 30.5 | 3.2 | 35.7 | 40.1 | 100.9 | 500.0 | -13.9 | |
| 4096.48 | V | 180.0 | 1.0 | 50.8 | 31.8 | 3.9 | 35.5 | 51.0 | 356.5 | 500.0 | -2.9 | |
| 11484.00 | V | 0.0 | 1.0 | 37.8 | 40.8 | 6.4 | 35.6 | 49.4 | 294.2 | 500.0 | -4.6 | amb |

Table 8: Radiated Emission Test Data - Plan B, Band 1

CLIENT: Adtran DATE: 3/5/03
 TESTER: James Ritter JOB #: 7461
 EUT: Tracer 4508 8T1 TEST STANDARD: FCC Part 15
 CONFIGURATION: Transmitter @ 5742 MHz Plan 1 Band B DISTANCE: 3m
 CLOCKS: 1.544, 12, 51.536, 280 MHz

| Frequency (MHz) | Polarity H/V | Azimuth Degree | Ant. Height (m) | SA Level (QP) (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 |
|--------------------|-----------------|-------------------|-----------------------|----------------------------|-------------------------|------------------------|---------------------------|-------------------------|--------------------------|-----------------|--------------|----------|
| PK | | | | | | | | | | | | |
| 1133.93 | H | 145.0 | 1.0 | 49.2 | 25.5 | 2.2 | 36.3 | 40.7 | 107.8 | 5000.0 | -33.3 | |
| 1383.88 | H | 170.0 | 1.0 | 53.9 | 26.7 | 2.3 | 36.0 | 46.9 | 220.7 | 5000.0 | -27.1 | |
| 2801.10 | H | 180.0 | 1.0 | 47.2 | 30.4 | 3.2 | 35.7 | 45.1 | 180.9 | 5000.0 | -28.8 | |
| 4151.26 | H | 160.0 | 1.0 | 41.9 | 31.9 | 3.9 | 35.5 | 42.2 | 128.8 | 5000.0 | -31.8 | |
| 11644.00 | H | 0.0 | 1.0 | 36.0 | 41.0 | 6.4 | 35.7 | 47.7 | 243.4 | 5000.0 | -26.3 | amb |
| Avg | H | | | | | | | | | | | |
| 1133.93 | H | 145.0 | 1.0 | 43.1 | 25.5 | 2.2 | 36.3 | 34.6 | 53.4 | 500.0 | -19.4 | |
| 1383.88 | H | 170.0 | 1.0 | 50.3 | 26.7 | 2.3 | 36.0 | 43.2 | 145.3 | 500.0 | -10.7 | |
| 2801.10 | H | 180.0 | 1.0 | 43.0 | 30.4 | 3.2 | 35.7 | 41.0 | 111.8 | 500.0 | -13.0 | |
| 4151.26 | H | 160.0 | 1.0 | 37.4 | 31.9 | 3.9 | 35.5 | 37.7 | 76.7 | 500.0 | -16.3 | |
| 11644.00 | H | 0.0 | 1.0 | 26.0 | 41.0 | 6.4 | 35.7 | 37.7 | 77.0 | 500.0 | -16.3 | amb |
| PK | | | | | | | | | | | | |
| 1133.93 | V | 170.0 | 1.0 | 46.2 | 25.5 | 2.2 | 36.3 | 37.6 | 75.7 | 5000.0 | -36.4 | |
| 1383.88 | V | 190.0 | 1.0 | 47.5 | 26.7 | 2.3 | 36.0 | 40.5 | 105.6 | 5000.0 | -33.5 | |
| 2801.10 | V | 180.0 | 1.0 | 41.2 | 30.4 | 3.2 | 35.7 | 39.2 | 91.0 | 5000.0 | -34.8 | |
| 4151.26 | V | 180.0 | 1.0 | 43.9 | 31.9 | 3.9 | 35.5 | 44.2 | 162.1 | 5000.0 | -29.8 | |
| 11644.00 | V | 0.0 | 1.0 | 48.0 | 41.0 | 6.4 | 35.7 | 59.7 | 968.9 | 5000.0 | -14.3 | |
| Avg | V | | | | | | | | | | | |
| 1133.93 | V | 170.0 | 1.0 | 37.8 | 25.5 | 2.2 | 36.3 | 29.2 | 28.9 | 500.0 | -24.8 | |
| 1383.88 | V | 190.0 | 1.0 | 39.5 | 26.7 | 2.3 | 36.0 | 32.5 | 42.1 | 500.0 | -21.5 | |
| 2801.10 | V | 180.0 | 1.0 | 31.7 | 30.4 | 3.2 | 35.7 | 29.6 | 30.3 | 500.0 | -24.4 | |
| 4151.26 | V | 180.0 | 1.0 | 37.4 | 31.9 | 3.9 | 35.5 | 37.7 | 76.7 | 500.0 | -16.3 | |
| 11644.00 | V | 0.0 | 1.0 | 32.7 | 41.0 | 6.4 | 35.7 | 44.4 | 165.9 | 500.0 | -9.6 | |

Table 9: Radiated Emission Test Data - Plan B, Band 3

CLIENT: Adtran

DATE: 3/5/03

TESTER: James Ritter

JOB #: 7461

EUT: Tracer 4508 8T1

TEST STANDARD: FCC Part 15

CONFIGURATION: Transmitter @ 5742 MHz Plan 3 Band B

DISTANCE: 3m

CLOCKS: 1.544, 12, 51.536, 280 MHz

| Frequency (MHz) | Polarity H/V | Azimuth Degree | Ant. Height (m) | SA Level (QP) (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 |
|--------------------|-----------------|-------------------|-----------------------|----------------------------|-------------------------|------------------------|---------------------------|-------------------------|--------------------------|-----------------|--------------|----------|
| PK | | | | | | | | | | | | |
| 1133.87 | H | 170.0 | 1.0 | 45.8 | 25.5 | 2.2 | 36.3 | 37.2 | 72.8 | 5000.0 | -36.7 | |
| 1388.30 | H | 245.0 | 1.0 | 51.3 | 26.7 | 2.3 | 36.0 | 44.3 | 164.6 | 5000.0 | -29.6 | |
| 2806.97 | H | 270.0 | 1.0 | 49.1 | 30.4 | 3.2 | 35.7 | 47.1 | 225.5 | 5000.0 | -26.9 | |
| 4161.26 | H | 180.0 | 1.0 | 41.1 | 31.9 | 3.9 | 35.5 | 41.4 | 117.6 | 5000.0 | -32.6 | |
| 11666.00 | H | 0.0 | 1.0 | 42.0 | 41.0 | 6.4 | 35.7 | 53.7 | 486.8 | 5000.0 | -20.2 | amb |
| Avg | | | | | | | | | | | | |
| 1133.93 | H | 170.0 | 1.0 | 36.5 | 25.5 | 2.2 | 36.3 | 27.9 | 24.9 | 500.0 | -26.1 | |
| 1383.88 | H | 245.0 | 1.0 | 50.3 | 26.7 | 2.3 | 36.0 | 43.3 | 145.8 | 500.0 | -10.7 | |
| 2801.10 | H | 270.0 | 1.0 | 39.2 | 30.4 | 3.2 | 35.7 | 37.1 | 71.8 | 500.0 | -16.9 | |
| 4161.26 | H | 180.0 | 1.0 | 37.2 | 31.9 | 3.9 | 35.5 | 37.5 | 75.0 | 500.0 | -16.5 | |
| 11666.00 | H | 0.0 | 1.0 | 33.0 | 41.0 | 6.4 | 35.7 | 44.7 | 172.7 | 500.0 | -9.2 | amb |
| PK | | | | | | | | | | | | |
| 1133.87 | V | 170.0 | 1.0 | 44.9 | 25.5 | 2.2 | 36.3 | 36.3 | 65.4 | 5000.0 | -37.7 | |
| 1388.30 | V | 190.0 | 1.0 | 51.8 | 26.7 | 2.3 | 36.0 | 44.8 | 174.4 | 5000.0 | -29.1 | |
| 2806.97 | V | 270.0 | 1.0 | 45.2 | 30.4 | 3.2 | 35.7 | 43.2 | 143.9 | 5000.0 | -30.8 | |
| 4161.26 | V | 180.0 | 1.0 | 39.3 | 31.9 | 3.9 | 35.5 | 39.6 | 95.6 | 5000.0 | -34.4 | |
| 11666.00 | V | 0.0 | 1.0 | 45.7 | 41.0 | 6.4 | 35.7 | 57.4 | 745.3 | 5000.0 | -16.5 | |
| Avg | | | | | | | | | | | | |
| 1133.93 | V | 170.0 | 1.0 | 37.7 | 25.5 | 2.2 | 36.3 | 29.1 | 28.5 | 500.0 | -24.9 | |
| 1383.88 | V | 190.0 | 1.0 | 46.5 | 26.7 | 2.3 | 36.0 | 39.5 | 94.1 | 500.0 | -14.5 | |
| 2801.10 | V | 270.0 | 1.0 | 39.7 | 30.4 | 3.2 | 35.7 | 37.6 | 76.3 | 500.0 | -16.3 | |
| 4161.26 | V | 270.0 | 1.0 | 34.3 | 31.9 | 3.9 | 35.5 | 34.6 | 53.9 | 500.0 | -19.3 | |
| 11666.00 | V | 0.0 | 1.0 | 36.7 | 41.0 | 6.4 | 35.7 | 48.4 | 264.4 | 500.0 | -5.5 | |

4.6 AC Powerline Conducted Emissions: (FCC Part §15.207)

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 μ H 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 50 Ω output of the LISN was connected to the input of the spectrum analyzer and the emissions in the frequency range of 450 kHz to 30 MHz was measured. The detector function was set to quasi-peak or peak, 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.

Data is recorded in the following table.

Table 10: Conducted Emissions Test Data; 15.207

CLIENT: Adtran DATE: 3/4/03
 TESTER: James Ritter JOB #: 7461
 EUT: Tracer 4508 8T1
 CONFIGURATION: Transmitter @ 5833MHz Plan 3 Band B
 TEST STANDARD: For FCC class B (using harmonized standard)
 CLASS: CIS22_B VOLTAGE: 120VAC

LINE 1 - NEUTRAL

| Frequency | Level | Limit | Margin | Level | Limit | Margin |
|-----------|-------|-------|--------|-------|-------|--------|
| | QP | QP | QP | AVG | AVG | AVG |
| MHz | dBuV | dBuV | dB | dBuV | dBuV | dB |
| 0.220 | 38.6 | 62.8 | -24.2 | 38.6 | 52.8 | -14.2 |
| 0.307 | 37.6 | 60.1 | -22.5 | 37.6 | 50.1 | -12.5 |
| 1.010 | 36.4 | 56.0 | -19.6 | 36.4 | 46.0 | -9.6 |
| 12.717 | 46.4 | 60.0 | -13.6 | 40.8 | 50.0 | -9.2 |
| 13.390 | 48.1 | 60.0 | -11.9 | 42.6 | 50.0 | -7.4 |
| 13.476 | 51.6 | 60.0 | -8.4 | 46.4 | 50.0 | -3.6 |
| 16.425 | 44.2 | 60.0 | -15.8 | 39.4 | 50.0 | -10.6 |
| 28.469 | 29.8 | 60.0 | -30.2 | 29.8 | 50.0 | -20.2 |

LINE 2 - PHASE

| Frequency | Level | Limit | Margin | Level | Limit | Margin |
|-----------|-------|-------|--------|-------|-------|--------|
| | QP | QP | QP | AVG | AVG | AVG |
| MHz | dBuV | dBuV | dB | dBuV | dBuV | dB |
| 0.220 | 35.9 | 62.8 | -26.9 | 35.9 | 52.8 | -16.9 |
| 0.307 | 37.0 | 60.1 | -23.1 | 37.0 | 50.1 | -13.1 |
| 1.010 | 37.0 | 56.0 | -19.0 | 37.0 | 46.0 | -9.0 |
| 12.717 | 44.2 | 60.0 | -15.8 | 37.8 | 50.0 | -12.2 |
| 13.390 | 45.6 | 60.0 | -14.4 | 43.2 | 50.0 | -6.8 |
| 13.476 | 44.2 | 60.0 | -15.8 | 42.5 | 50.0 | -7.5 |
| 16.420 | 41.3 | 60.0 | -18.7 | 41.3 | 50.0 | -8.7 |
| 28.460 | 33.2 | 60.0 | -26.8 | 33.2 | 50.0 | -16.8 |