FCC Certification Test Report

FCC Certification Test Report for Mars Electronics, Inc. QP8-MEI915WLAN

September 30, 2003

REVISION 2 issued September 30, 2003

Prepared for:

Mars Electronics, Inc.
301 Wilson Drive
Westchester, PA 19380

Prepared By:

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

FCC Certification Test Program

FCC Certification Test Report
for the
Mars Electronics, Inc.
Easitrax Remote Data Port
QP8-MEI915WLAN

September 2, 2003

REVISION 1 issued September 19, 2003

WLL JOB# 7008

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Documentation Specialist

Reviewed by: Michael F. Violette, P.E.
President

Abstract

This report has been prepared on behalf of Mars Electronics, Inc. to support the attached Application for Equipment Authorization. The test report and application are submitted for a Frequency Hopping Spread Spectrum Transmitter 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 Mars Electronics, Inc. Easitrax Remote Data Port.

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 Mars Electronics, Inc. Easitrax Remote Data Port complies with the limits for a Frequency Hopping Spread Spectrum Transmitter device under Part 15.247 of the FCC Rules and Regulations.

Revision History:	Revision 1 issued September 19, 2003 to address comments received from AmericanTCB.

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1 Introduction

1.1 Compliance Statement

The Mars Electronics, Inc. Easitrax Remote Data Port complies with the limits for a Frequency Hopping Spread Spectrum Transmitter device under Part 15.247 of the FCC Rules and Regulations.

1.2 Test Scope

Tests for radiated and conducted (at antenna terminal) emissions were performed. All measurements were performed in accordance with FCC Public Notice DA 00-705 and the 2001 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:	Mars Electronics, Inc. 301 Wilson Drive Westchester, PA 19380
Purchase Order Number:	116932
Quotation Number:	59592

1.4 Testing Timeframe

Testing was completed on July 10, 2003.

1.5 Test and Support Personnel

Washington Laboratories, LTD	Greg Snyder, Steve Koster, Ken Gemmell
Client Representative	Robert Carney

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 Mars Electronics, Inc. Easitrax Remote Data Port is a DSP based, on-line monitoring device with configurable interfaces to capture transaction activities of bottling and full-service vending machines. This information can then be transmitted to a distant host through DEX/UCS protocol with a hand-held computer, WLAN, RF WAN, or PSTN connection. In order to monitor vend motor action, the remote data port can use one of two modules: the LMM or the MMM. The LMM and MMM interconnect between the remote data port and the vend motors to relay vend information back to the data port for later upload to the host. For payment system monitoring the data port monitors the coin and/or bill acceptor data lines for cash information. The remote data port uses 24VDC power.

Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	Mars Electronics, Inc.
FCC ID Number	QP8-MEI915WLAN
EUT Name:	Remote Data Port
Model:	Easitrax
FCC Rule Parts:	§15.247
Frequency Range:	902.4MHz – 927.75MHz
Maximum Output Power:	861mW (29.35dBm)
Modulation:	FSK
Occupied Bandwidth:	84kHz
Keying:	Automatic
Type of Information:	Data
Number of Channels:	50
Power Output Level	Fixed
Antenna Connector	SMB (Not changeable by user)
Antenna Type	UHF Whip
Interface Cables:	RX ANT, TX ANT, P3, P4
Power Source & Voltage:	24 Vdc

2.2 Test Configuration

The Easitrax was configured with an off-the-shelf 24 Vdc power supply. A TX & RX antenna was used in addition to two sets of interface cables. The EUT was controlled by a support PC (Dell Latitude) through the serial port.

2.3 Testing Algorithm

The Easitrax was programmed for FHSS operation via test software 1.02A. The software directed the EUT to operate in several modes including transmission at a single

discrete frequency either modulated or CW, or with the system hopping through 1 of 5 sets of 50 available channels.

Worst-case emission levels are provided in the test results data.

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

FCC Public Notice DA 00-705, Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

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. For the purposes of the measurements performed by Washington Laboratories, the measurement uncertainty is ±2.3 dB. This has been calculated for a *worst-case situation* (radiated emissions measurements performed on an open area test site).

The following measurement uncertainty calculation is provided:

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

where:

A = Antenna calibration uncertainty, in dB = 2 dB

B = Spectrum Analyzer uncertainty, in dB = 1 dB

C = Site uncertainty, in dB = 4 dB

n = number of factors in uncertainty calculation = 3

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

3 Test Equipment

Table 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	85685A	RF Preselector	3221A01395	7/07/04
HP	8564E	Spectrum Analyzer	3643A00657	5/22/04
ARA	DRG-118	Double Ridge Waveguide Antenna	1236	8/29/03
ARA	LPB-2520	BiconiLog Antenna	1044	6/20/04
HP	8449B	Pre-Amplifier	3008A00729	2/11/04
Tektronix	TDS-220	Oscilloscope	B025304	8/18/04
HP	438A	Power meter	3048U02786	3/10/04
HP	8481B	Power sensor	331BA04749	4/29/04
HP	8656B	Signal Generator	2926U07140	9/26/03
HP	8474B	Diode Detector	2905A04196	12/19/03

4 Test Results

4.1 Duty Cycle Correction

In accordance with the FCC Public Notice the spurious radiated emissions measurements may be adjusted if using a duty cycle correction factor if the dwell time per channel of the hopping signal is less than 100 ms.

The EUT uses a dwell time in excess of 400 ms, hence no duty cycle correction is made.

4.2 RF Power Output: (FCC Part §2.1046)

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. All attenuator and cable losses were taken into consideration during these measurements.

Table 3 lists the results of the RF output power measurements.

Table 3. RF Power Output

Frequency	Level		Limit	Pass/Fail
	(dBm)	(Watts)	(dBm)	
Low Channel 902.40MHz	29.35	0.861	30 dBm	Pass
Mid Channel 915.00MHz	29.0	0.794	30 dBm	Pass
High Channel 927.75MHz	28.7	0.741	30 dBm	Pass

4.3 Occupied Bandwidth: (FCC Part §2.1049)

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

For Frequency Hopping Spread Spectrum Systems, FCC Part 15.247 requires the maximum 20 dB bandwidth not exceed 1MHz.

Table 4 provides a summary of the Occupied Bandwidth Results.

Table 4. Occupied Bandwidth Results

Frequency	Bandwidth	Limit	Pass/Fail
Low Channel 902.51MHz	84.9kHz	1 MHz	Pass
Mid Channel 914.90MHz	86.4kHz	1 MHz	Pass
High Channel 927.40MHz	87.9kHz	1 MHz	Pass

At full modulation, the occupied bandwidth was measured as shown:

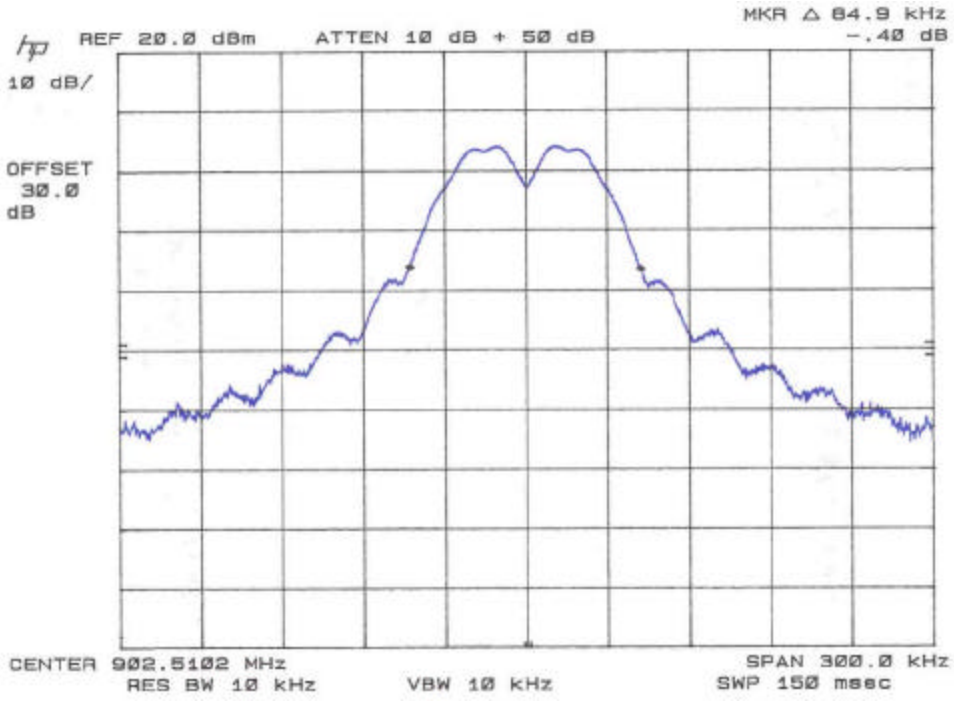

Figure 4-1. Occupied Bandwidth, Low Channel

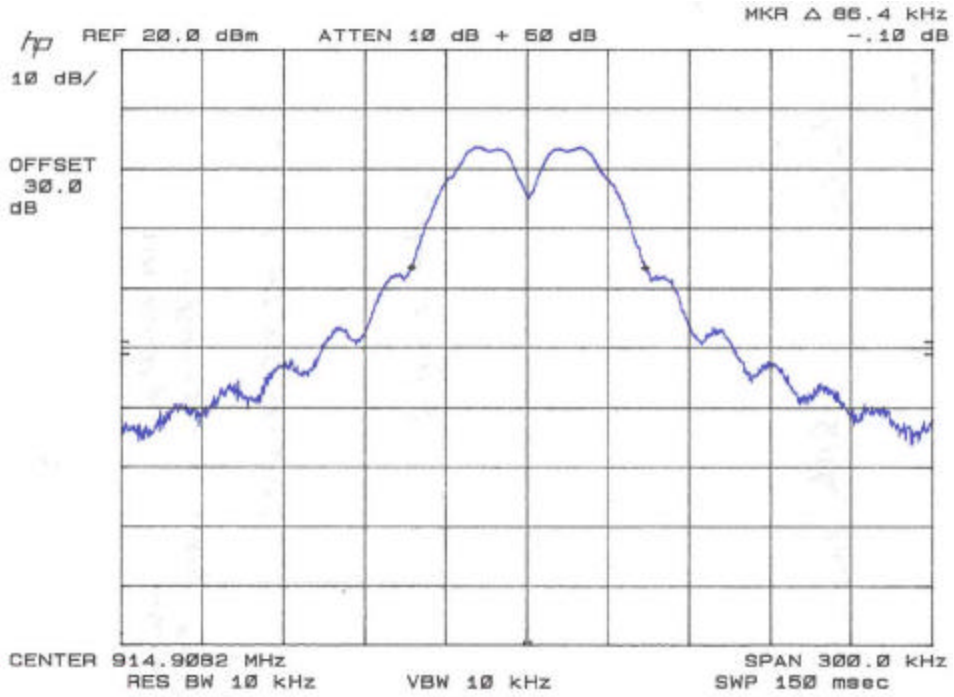

Figure 4-2. Occupied Bandwidth, Mid Channel

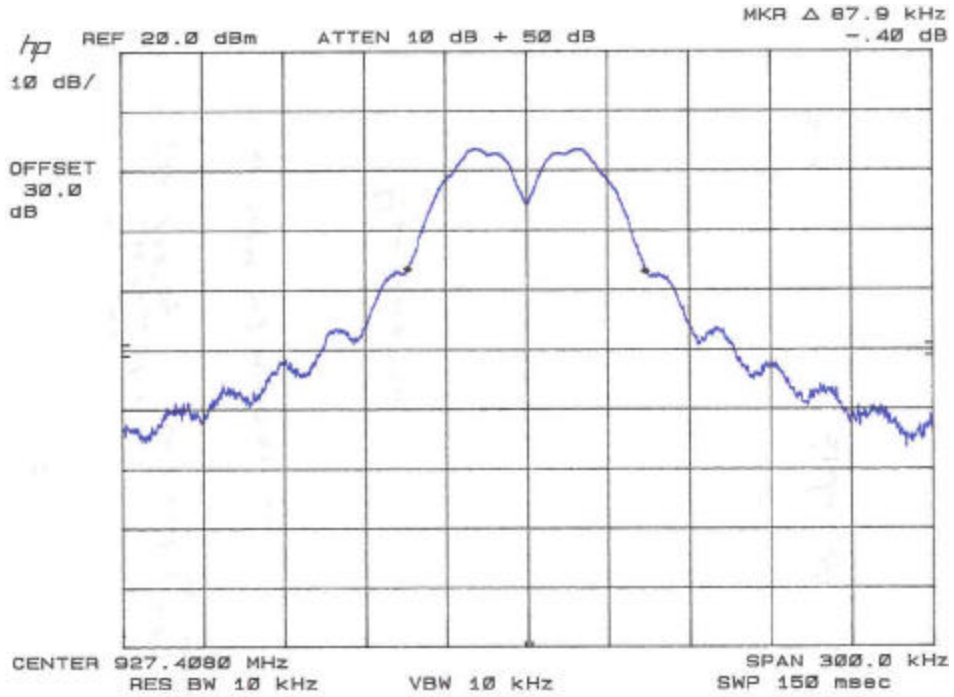

Figure 4-3. Occupied Bandwidth, High Channel

4.4 Channel Spacing and Number of Hop Channels (FCC Part §15247(a)(1)

Per the FCC requirements, frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20 dB bandwidth, whichever is greater. The maximum 20dB bandwidth measured is 84kHz.

The EUT antenna was removed and the cable was connected directly into a spectrum analyzer through a 10 dB attenuator. An offset was programmed into the spectrum analyzer to compensate for the loss of the external attenuator. The spectrum analyzer resolution bandwidth was set to 100 kHz and the video bandwidth was set to 100 kHz. The channel spacing of 2 adjacent channels was measured using a spectrum analyzer span setting of 2MHz and the number of hopping channels was measured.

The following are plots of the channel spacing and number of hopping channels data. The channel spacing was measured to be 500kHz and the number of channels used is 50.

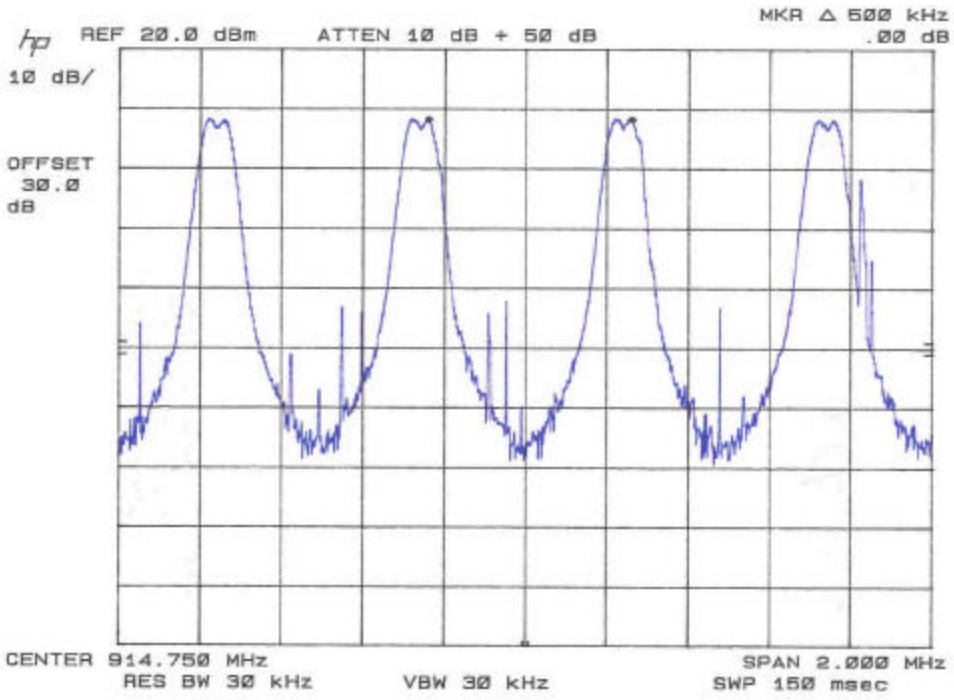

Figure 4-4, Channel Spacing, 500kHz

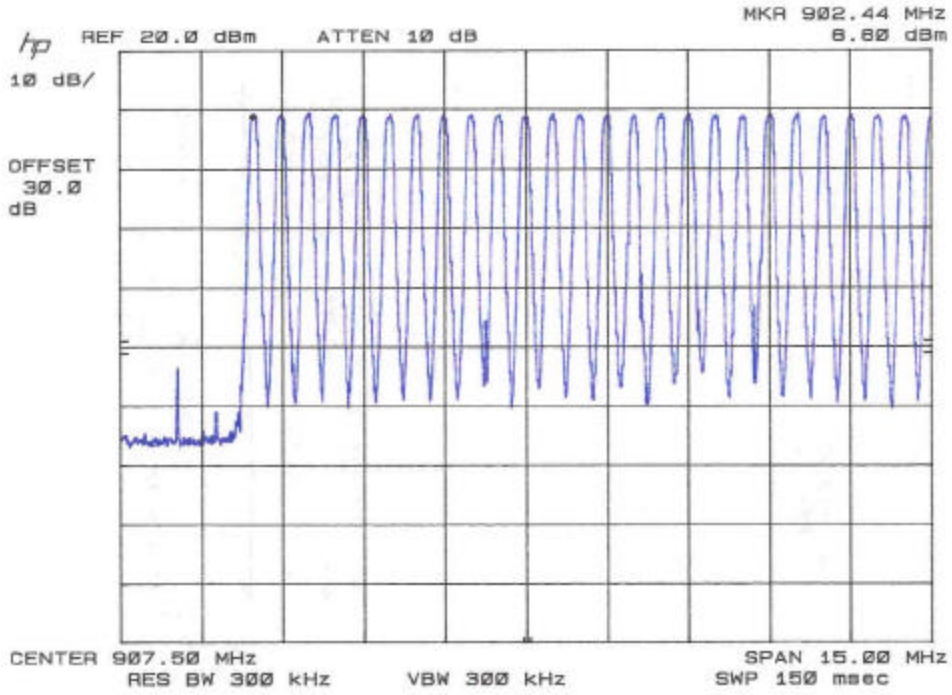

Figure 4-5, Number of Channels, Plot 1

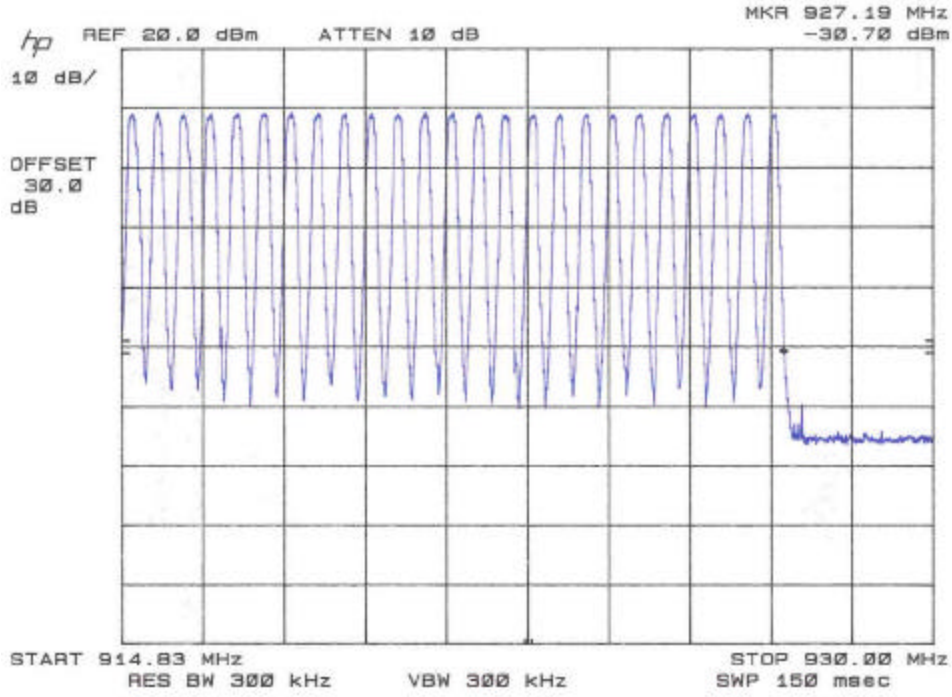

Figure 4-6, Number of Channels, Plot 2

4.5 Dwell Time

Per FCC requirements, the dwell time shall not exceed 400 ms. Following is a plot of the "on" time at a single frequency, which is indicative of the on dwell time of the hopping channel.

Table 5. Dwell Time

Frequency	Dwell Time	Limit	Pass/Fail
914.88MHz	129 ms	400 ms	Pass

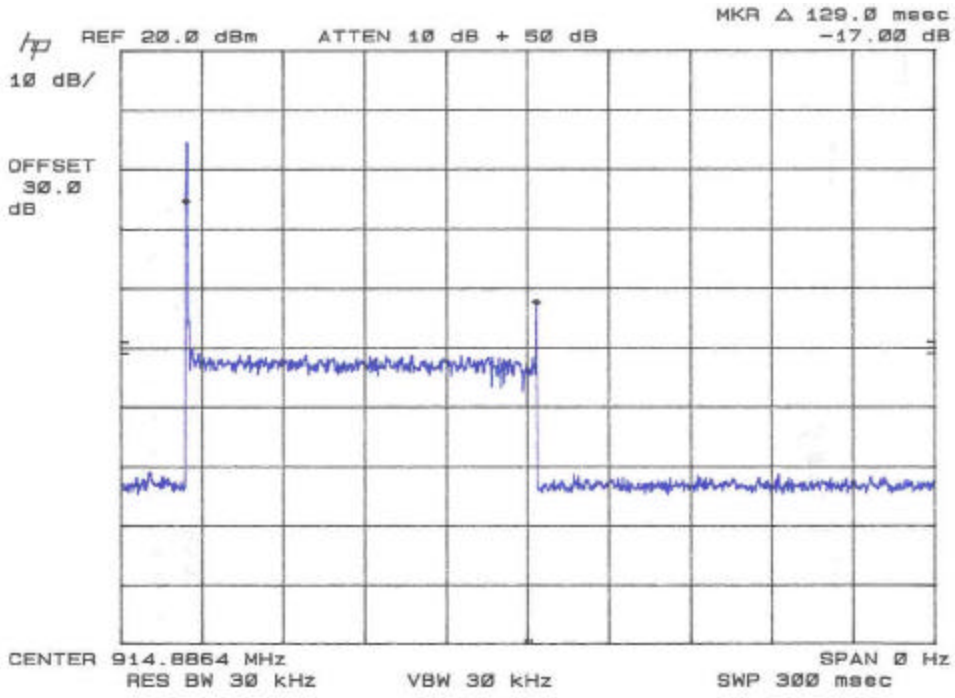

Figure 4-7. Dwell Time

4.6 Conducted Spurious Emissions at Antenna Terminals (FCC Part §2.1051)

The EUT must comply with requirements for spurious emissions at antenna terminals. Per §15.247(c) all spurious emissions in any 100 kHz bandwidth outside the frequency band in which the spread spectrum device is operating shall be attenuated 20 dB below the highest power level in a 100 kHz bandwidth within the band containing the highest level of the desired power.

The EUT antenna was removed and the cable was connected directly into a spectrum analyzer through a 10 dB attenuator. An offset was programmed into the spectrum analyzer to compensate for the loss of the external attenuator. The spectrum analyzer resolution bandwidth was set to 100 kHz and the video bandwidth was set to 100 kHz. The amplitude of the EUT carrier frequency was measured to determine the emissions

limit (20 dB below the carrier frequency amplitude). The emissions outside of the allocated frequency band were then scanned from 30 MHz up to the tenth harmonic of the carrier.

The following are plots of the conducted spurious emissions data.

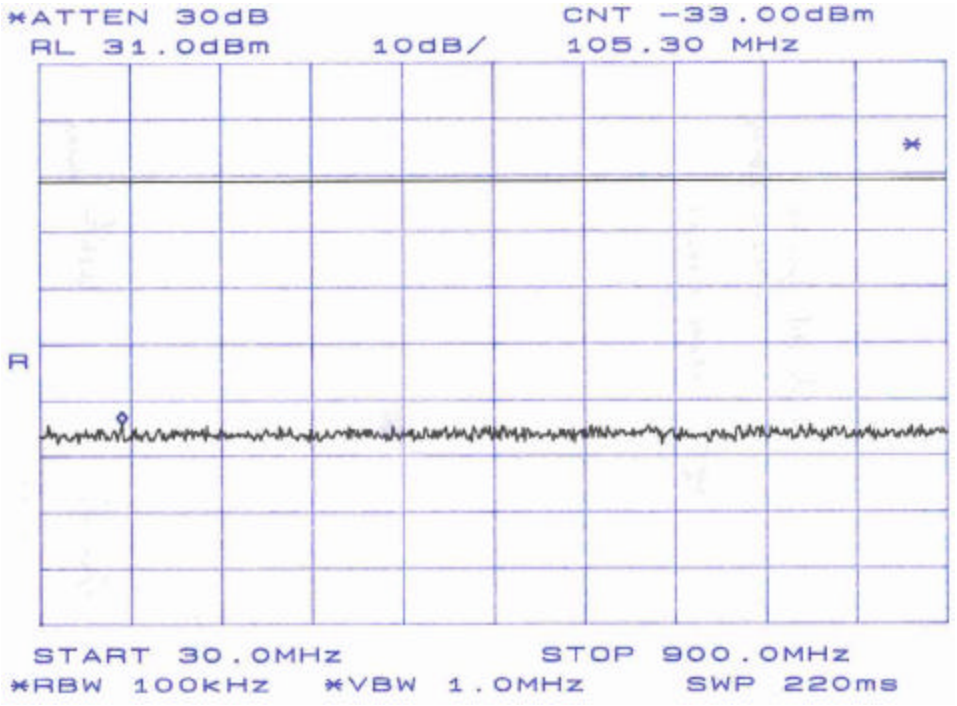

Figure 4-8. Conducted Spurious Emissions, Low Channel 30 - 900MHz

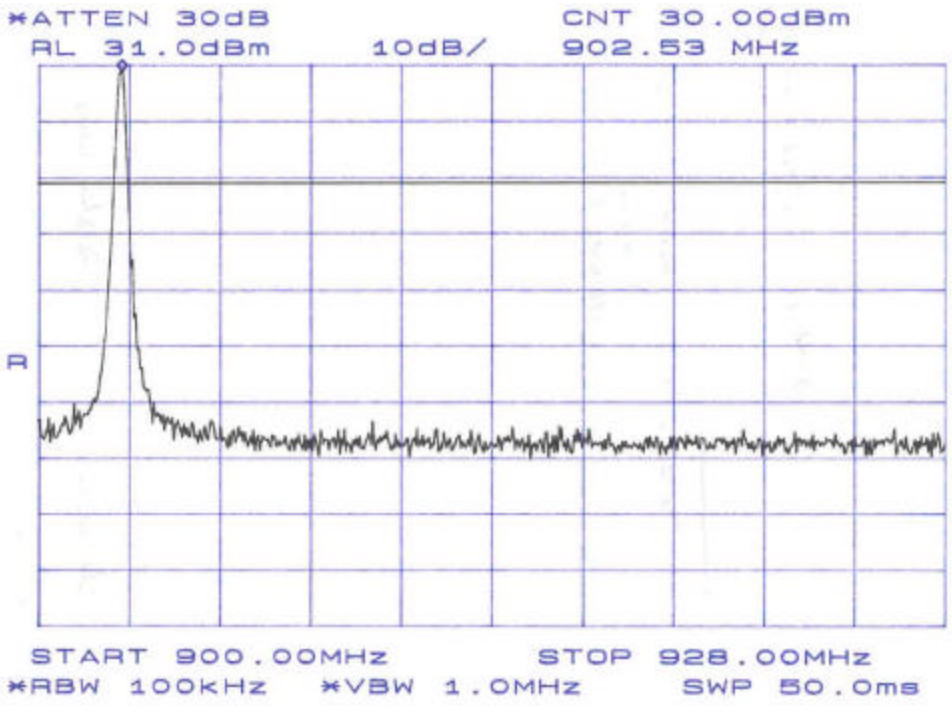

Figure 4-9. Conducted Spurious Emissions, Low Channel 900 - 928MHz

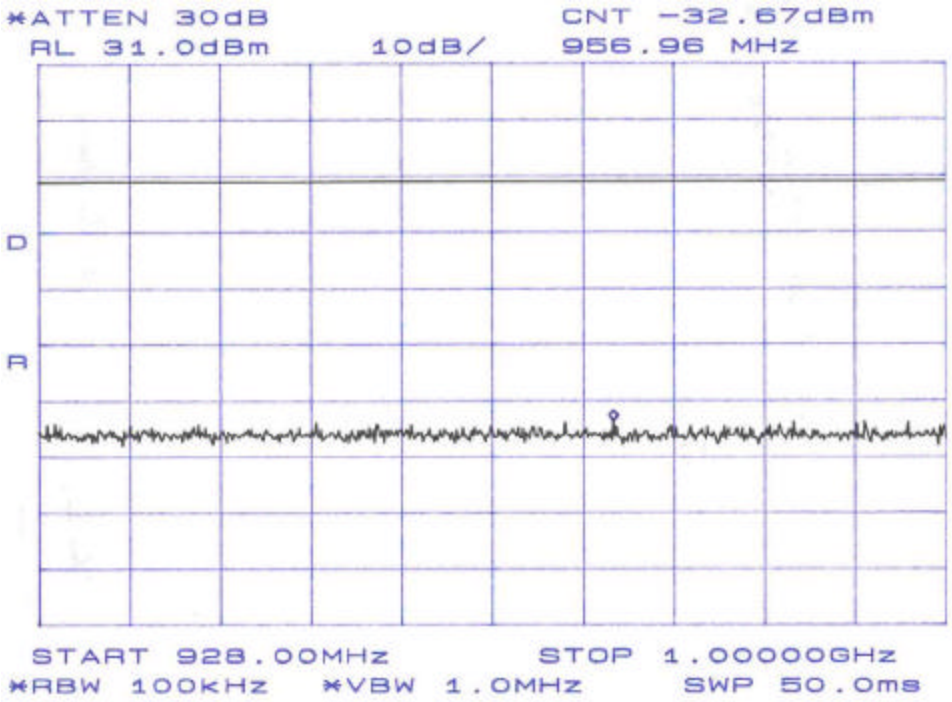

Figure 4-10. Conducted Spurious Emissions, Low Channel 928MHz – 1GHz

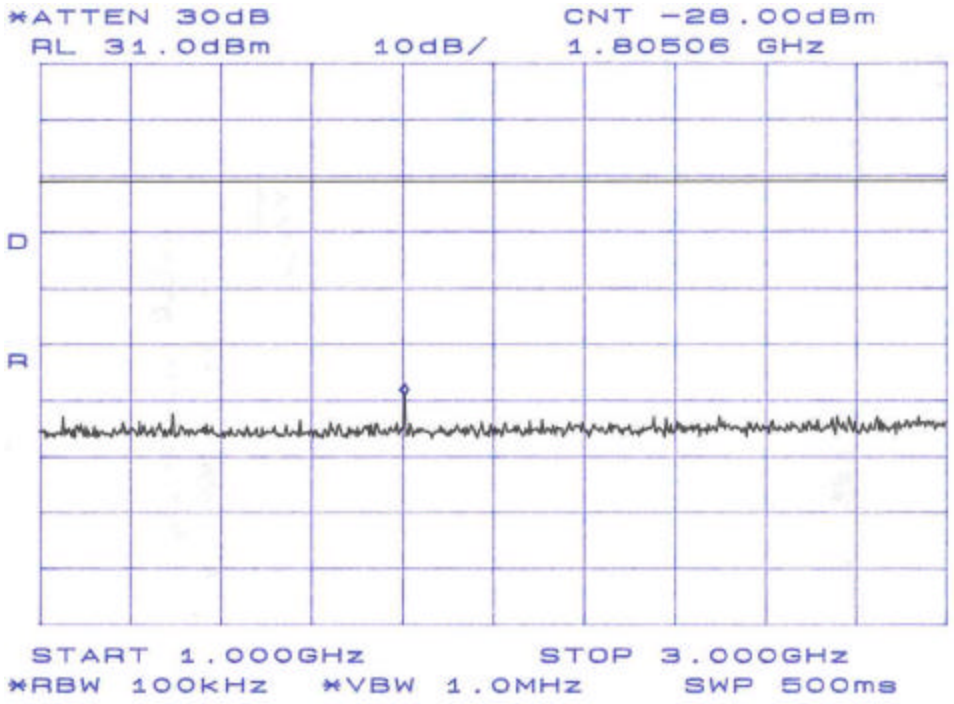

Figure 4-11. Conducted Spurious Emissions, Low Channel 1 – 3GHz

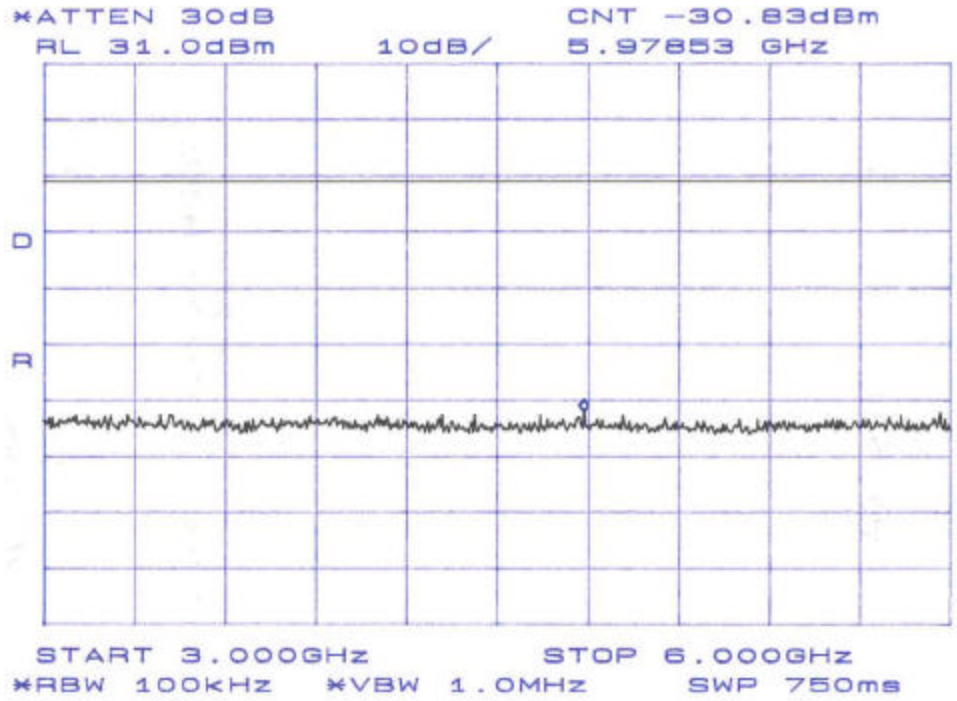

Figure 4-12. Conducted Spurious Emissions, Low Channel 3 - 6GHz

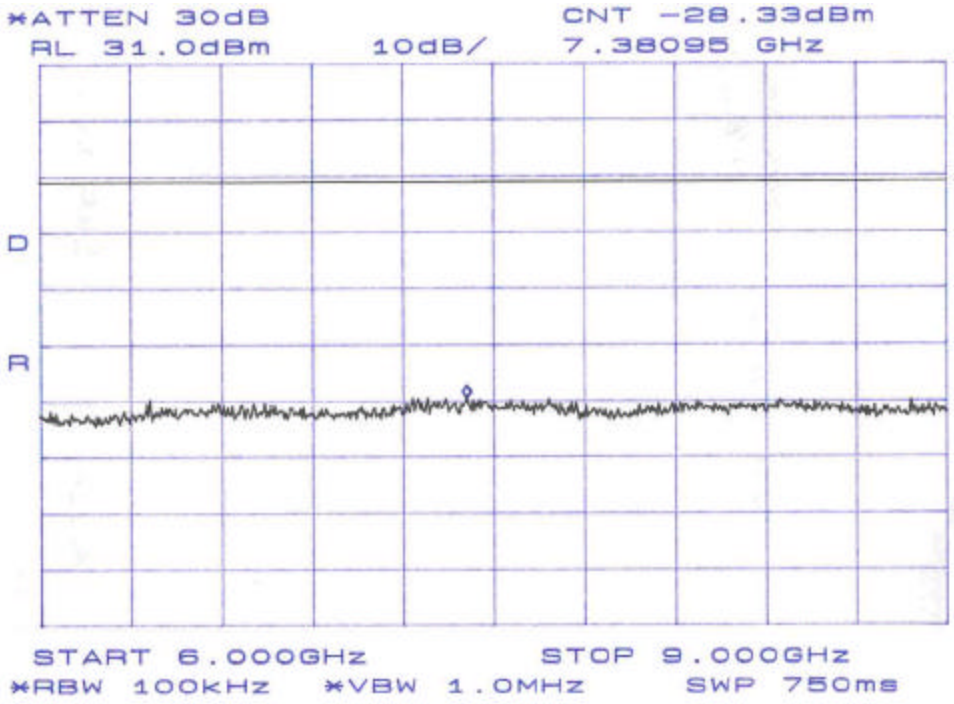

Figure 4-13. Conducted Spurious Emissions, Low Channel 6 - 9GHz

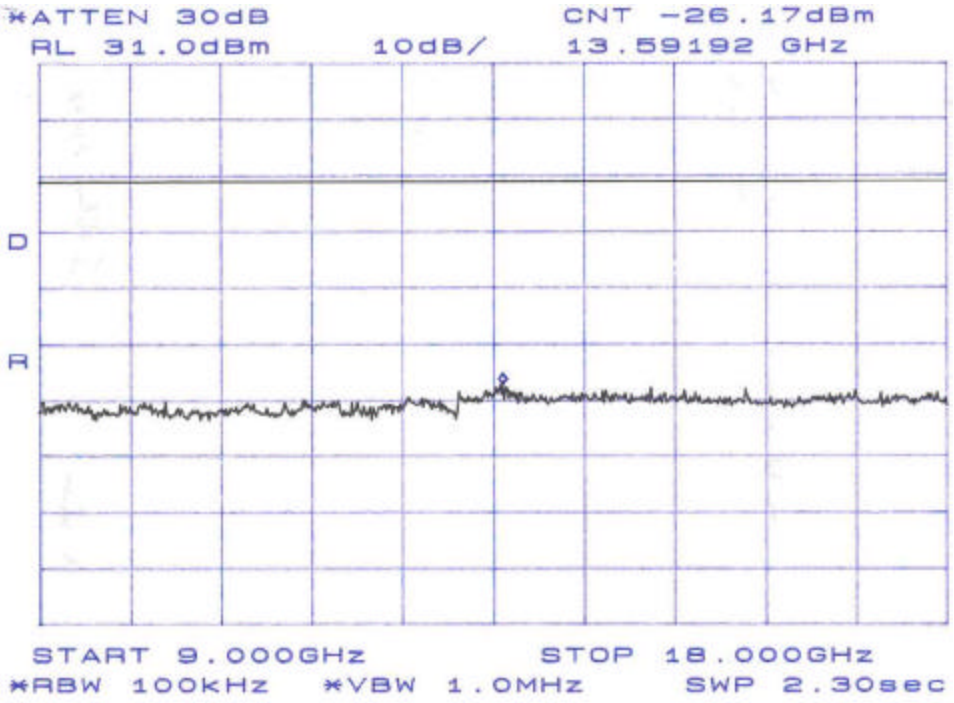

Figure 4-14. Conducted Spurious Emissions, Low Channel 9 - 18GHz

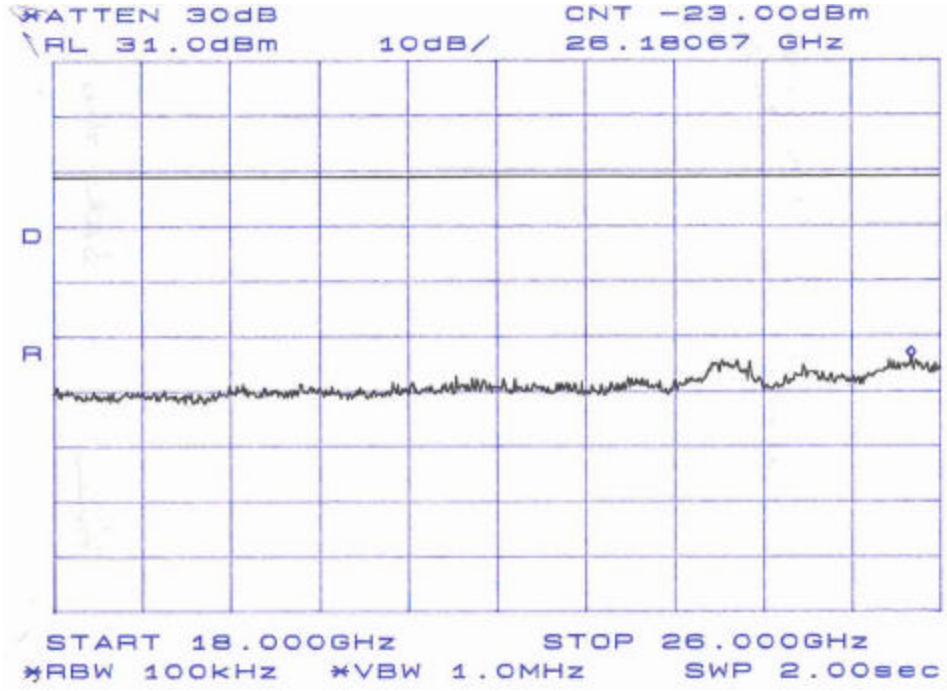

Figure 4-15. Conducted Spurious Emissions, Low Channel 18 - 26GHz

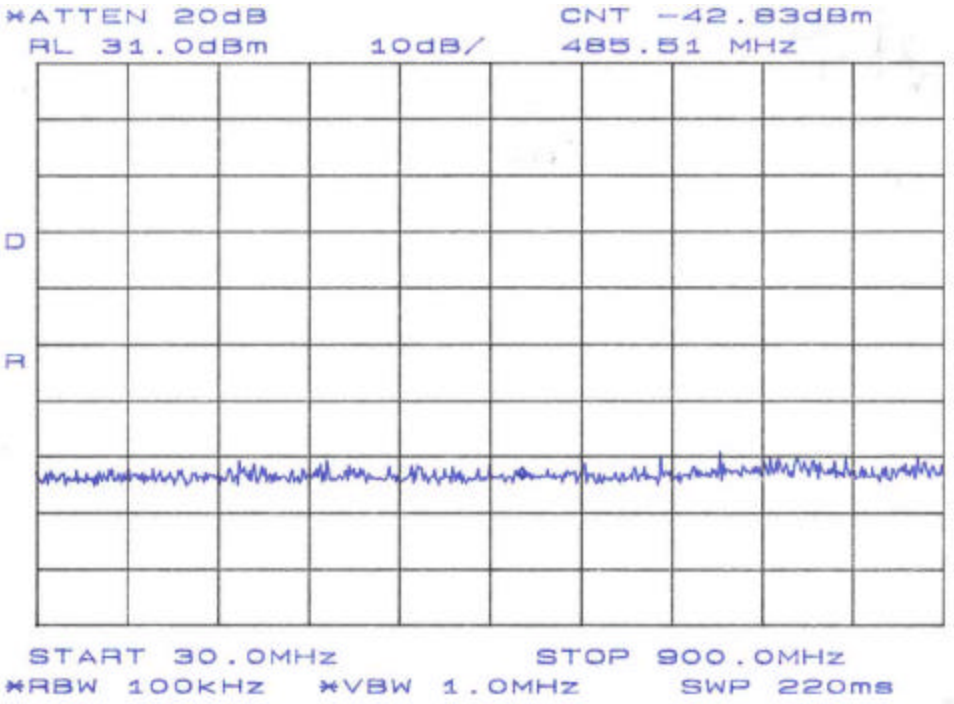

Figure 4-16. Conducted Spurious Emissions, Mid Channel 30 - 900MHz

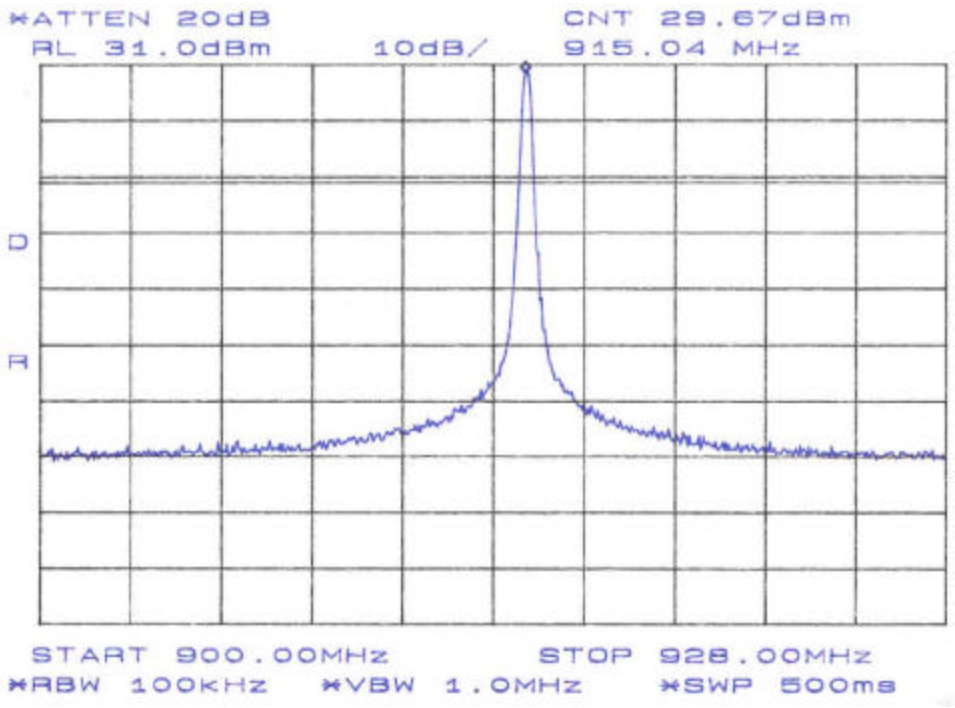

Figure 4-17. Conducted Spurious Emissions, Mid Channel 900 - 928MHz

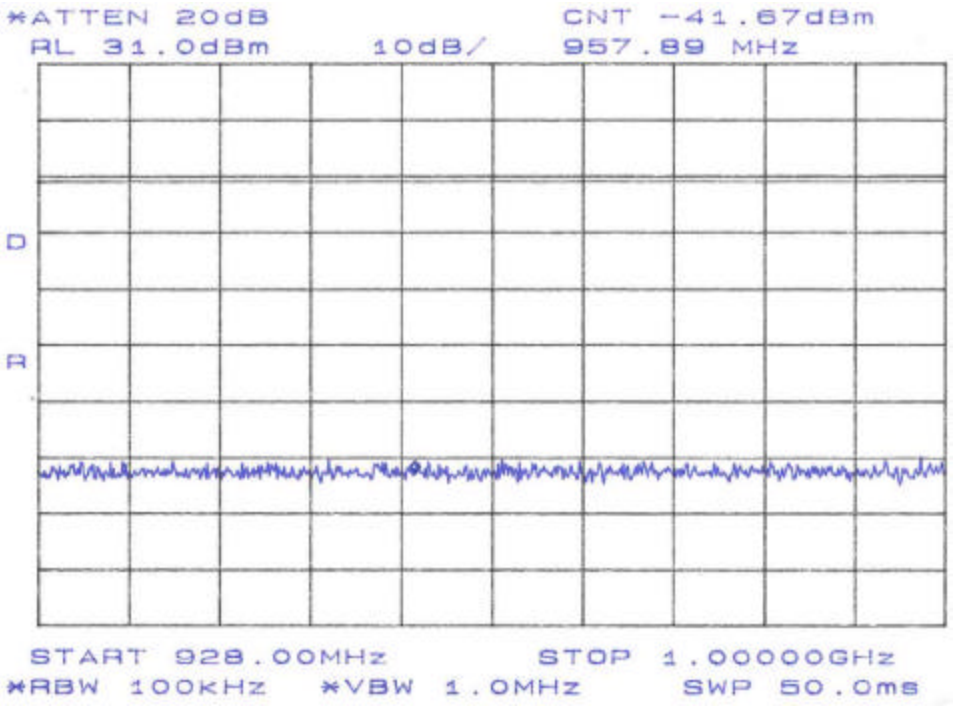

Figure 4-18. Conducted Spurious Emissions, Mid Channel 928MHz – 1GHz

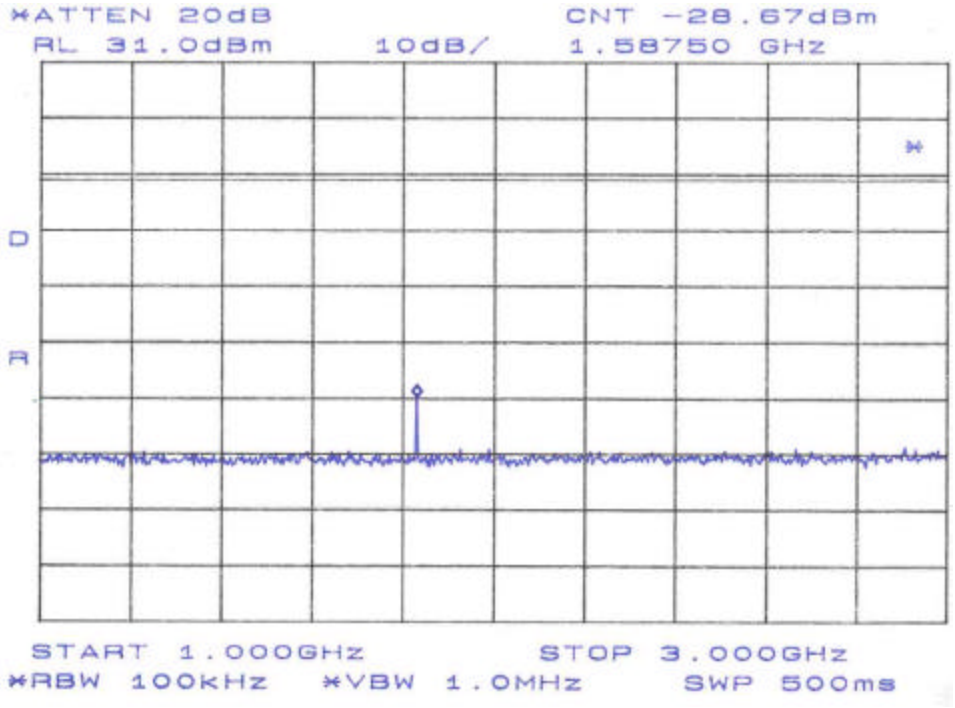

Figure 4-19. Conducted Spurious Emissions, Mid Channel 1 – 3GHz

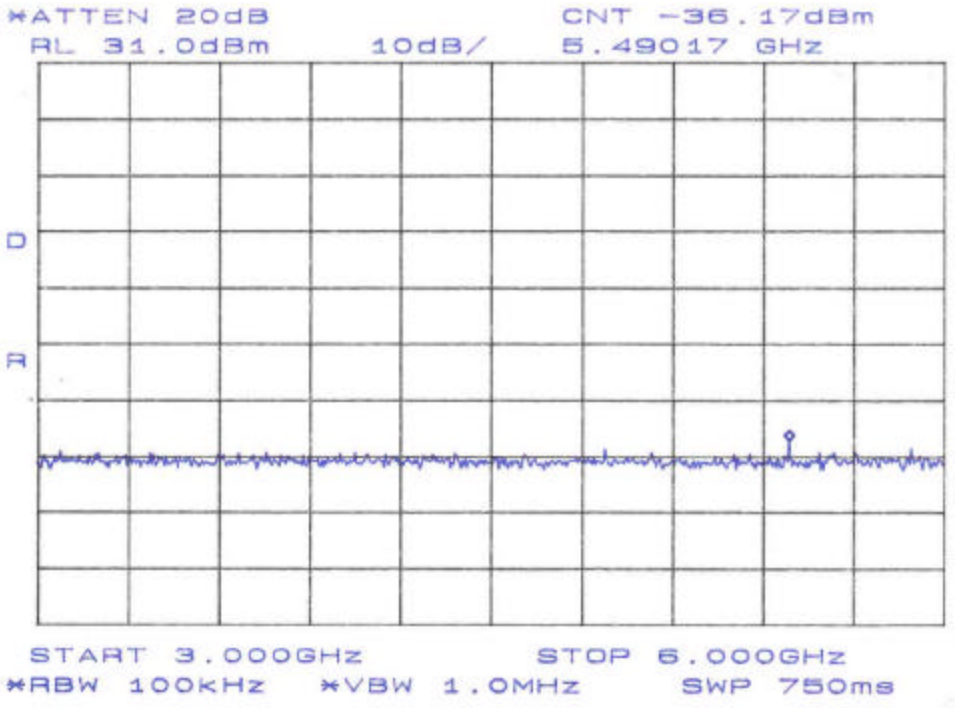

Figure 4-20. Conducted Spurious Emissions, Mid Channel 3 - 6GHz

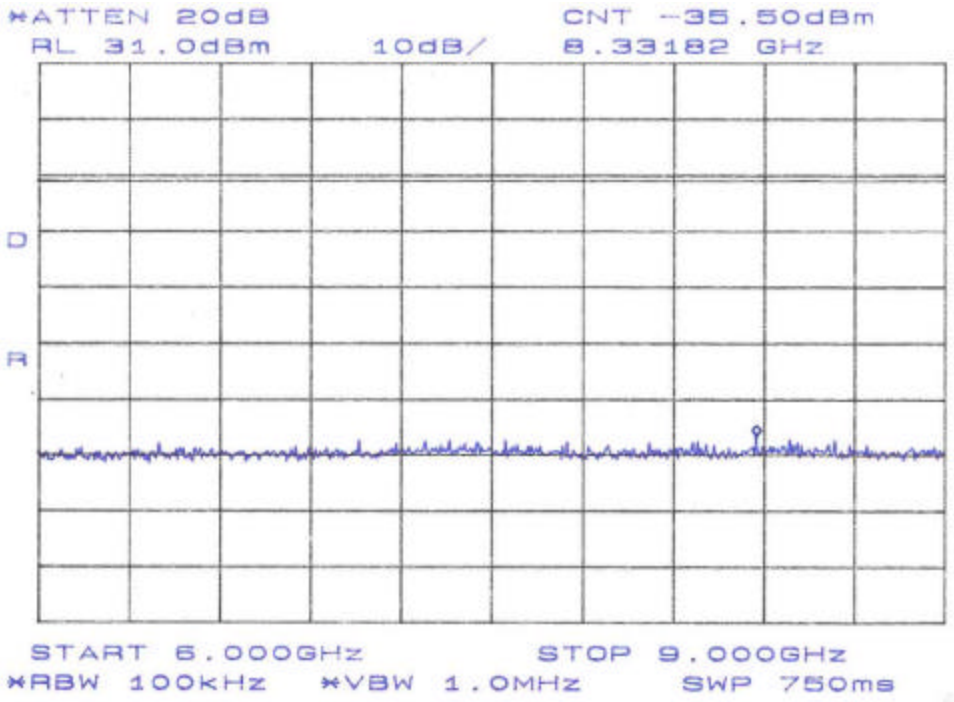

Figure 4-21. Conducted Spurious Emissions, Mid Channel 6 - 9GHz

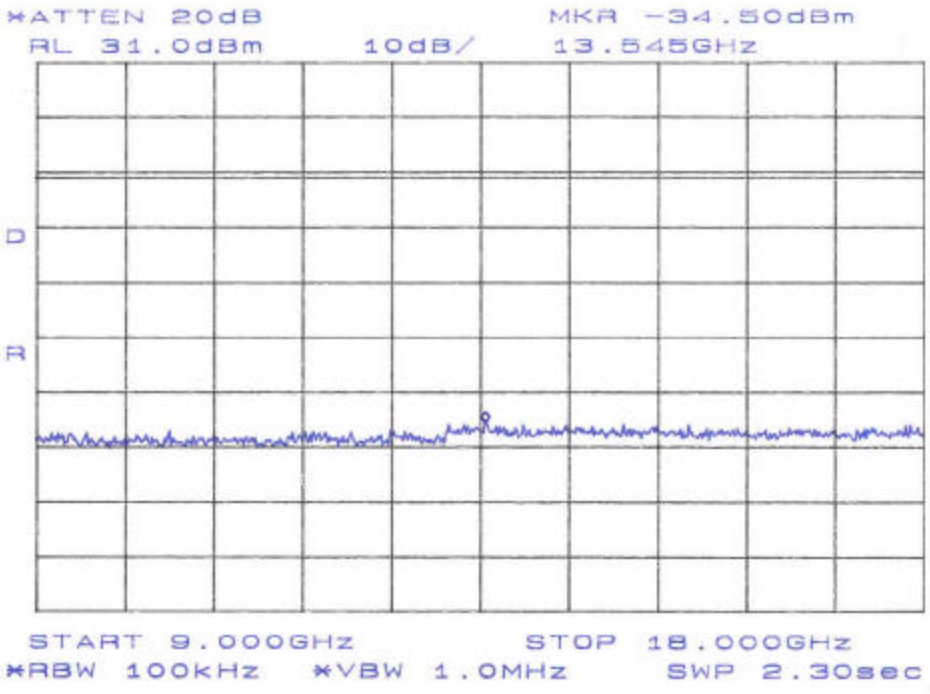

Figure 4-22. Conducted Spurious Emissions, Mid Channel 9 - 18GHz

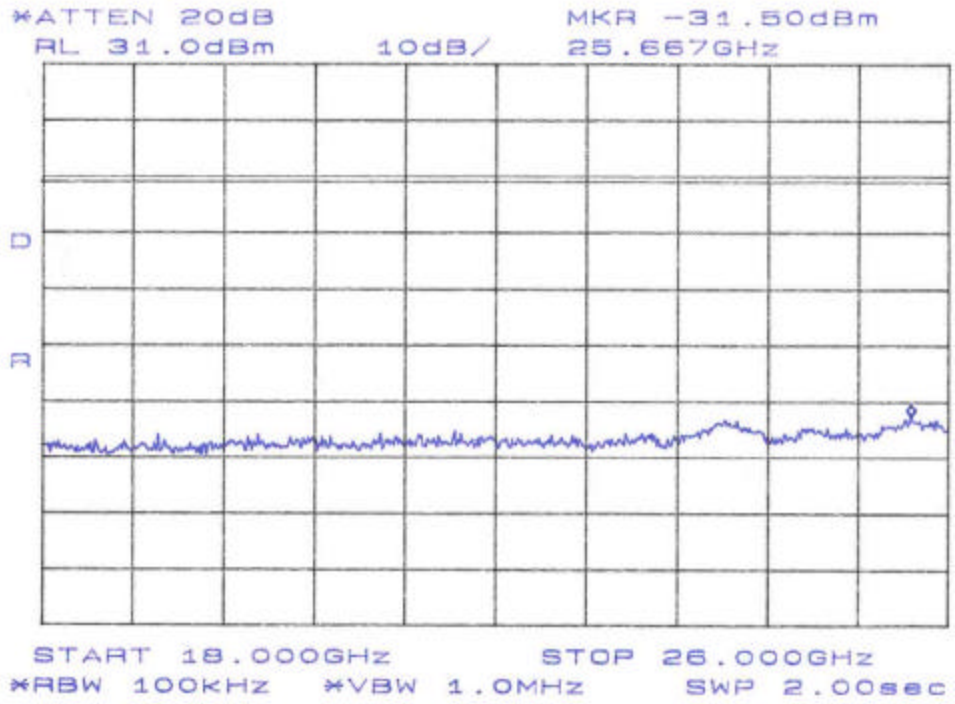

Figure 4-23. Conducted Spurious Emissions, Mid Channel 18 - 26GHz

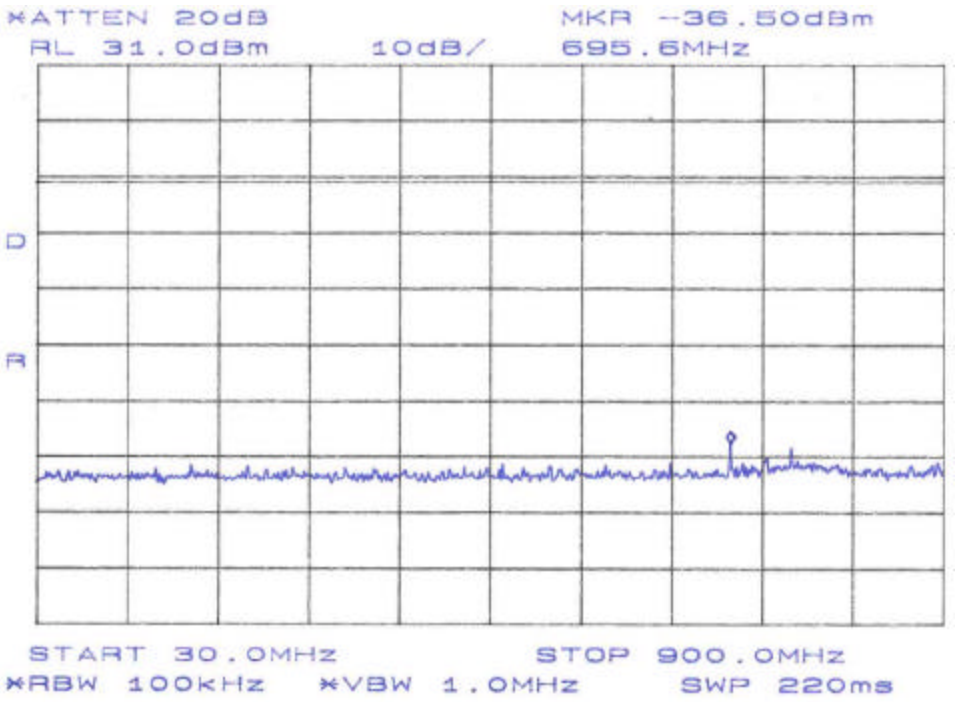

Figure 4-24. Conducted Spurious Emissions, High Channel 30 - 900MHz

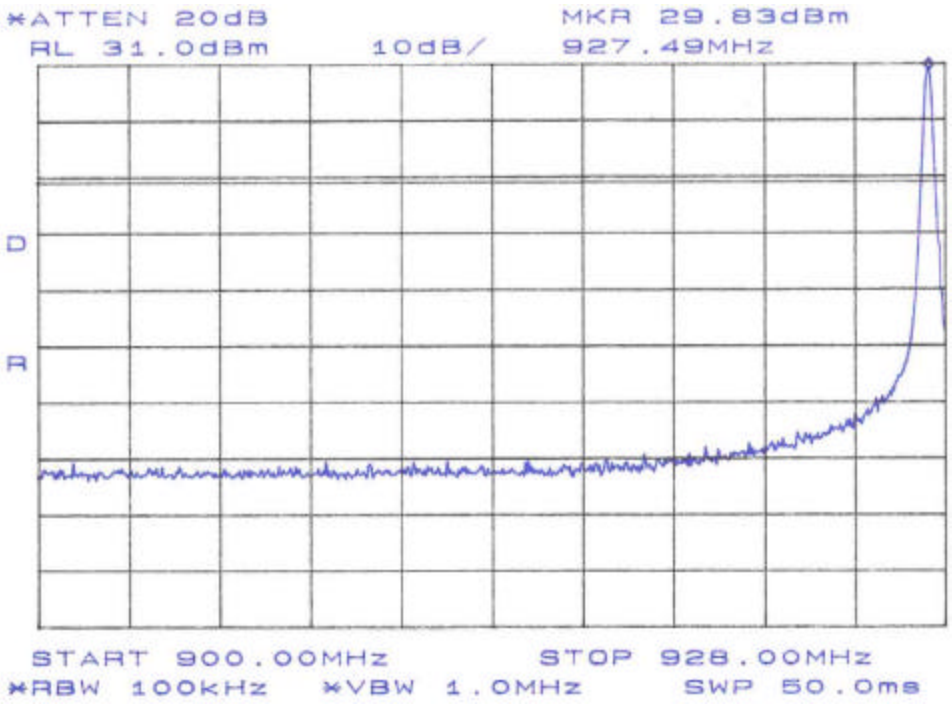

Figure 4-25. Conducted Spurious Emissions, High Channel 900 - 928MHz

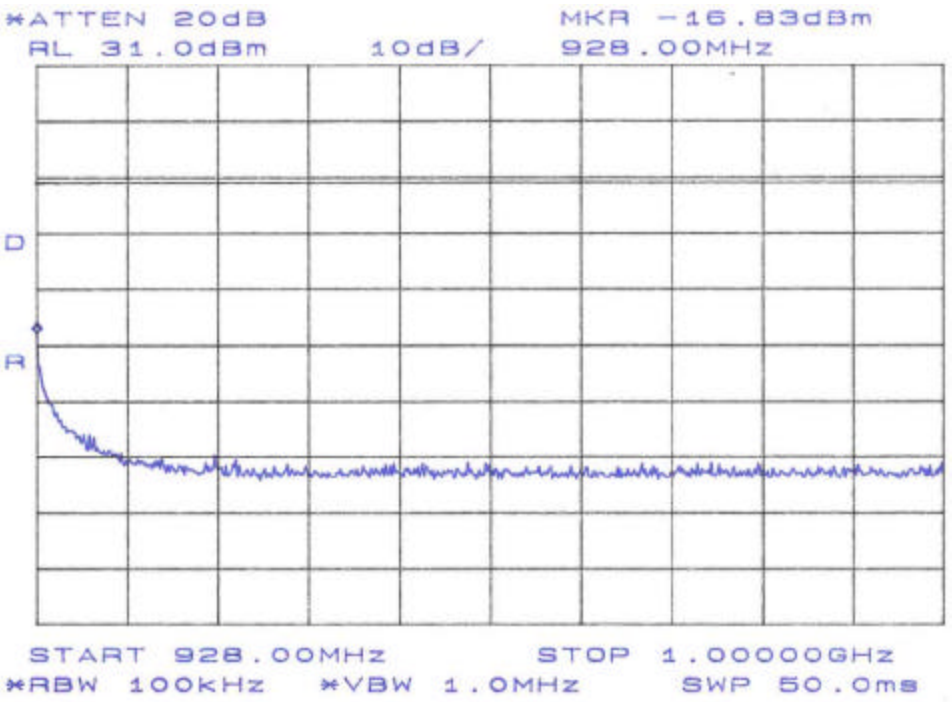

Figure 4-26. Conducted Spurious Emissions, High Channel 928MHz – 1GHz

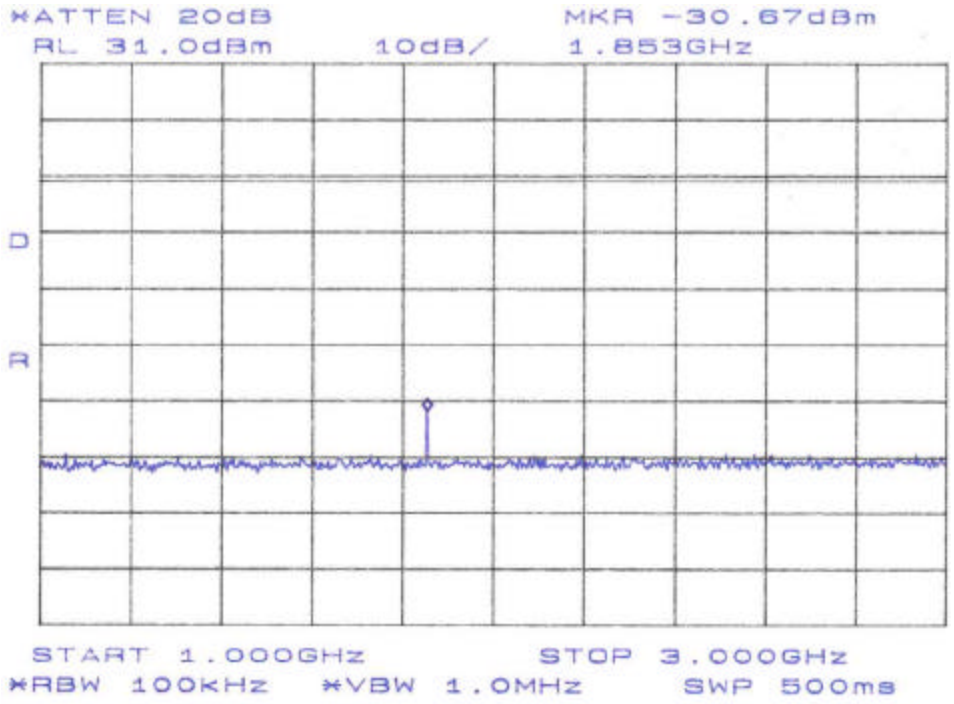

Figure 4-27. Conducted Spurious Emissions, High Channel 1 – 3GHz

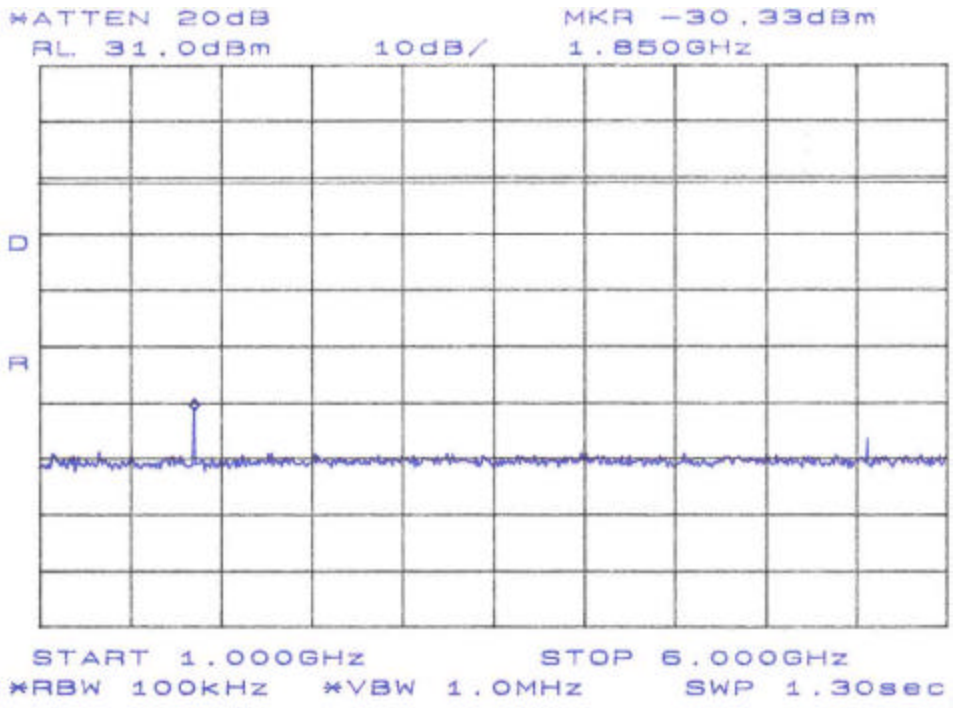

Figure 4-28. Conducted Spurious Emissions, High Channel 3 - 6GHz

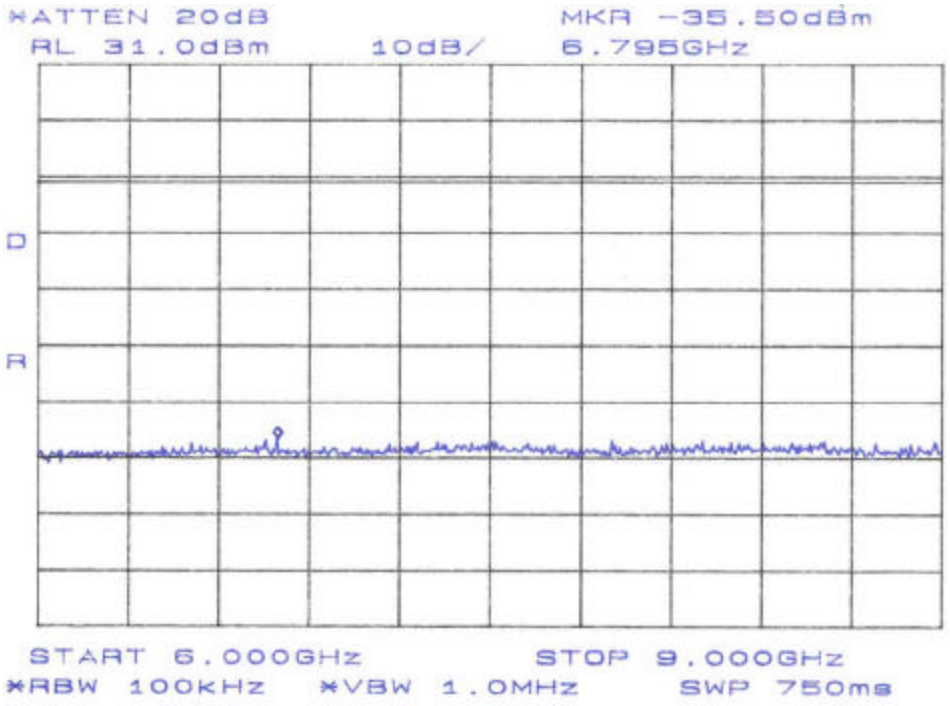

Figure 4-29. Conducted Spurious Emissions, High Channel 6 - 9GHz

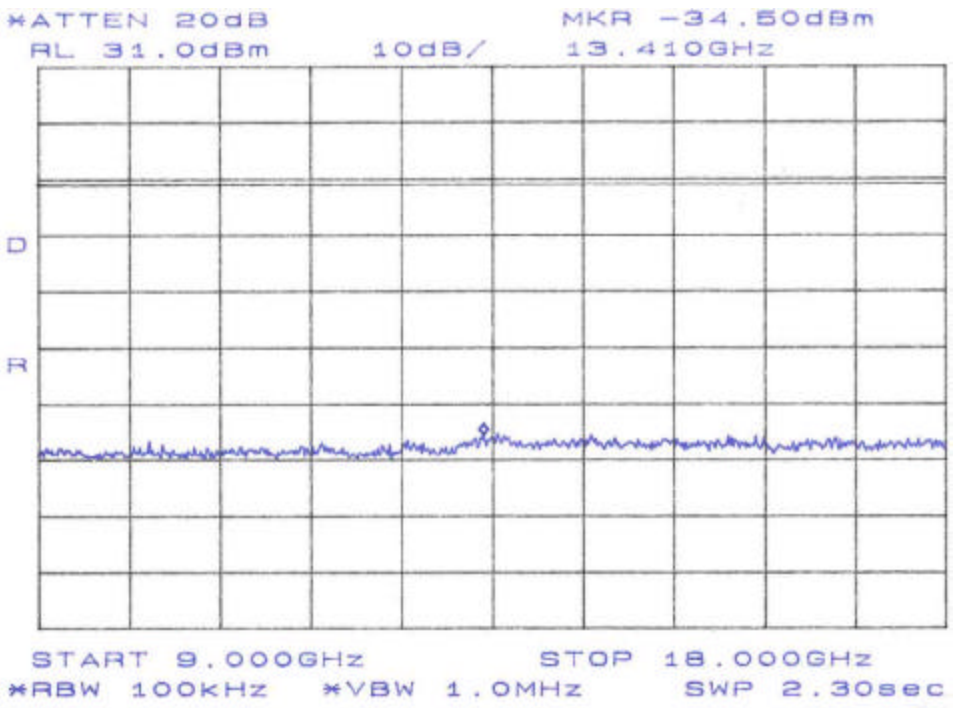

Figure 4-30. Conducted Spurious Emissions, High Channel 9 - 18GHz

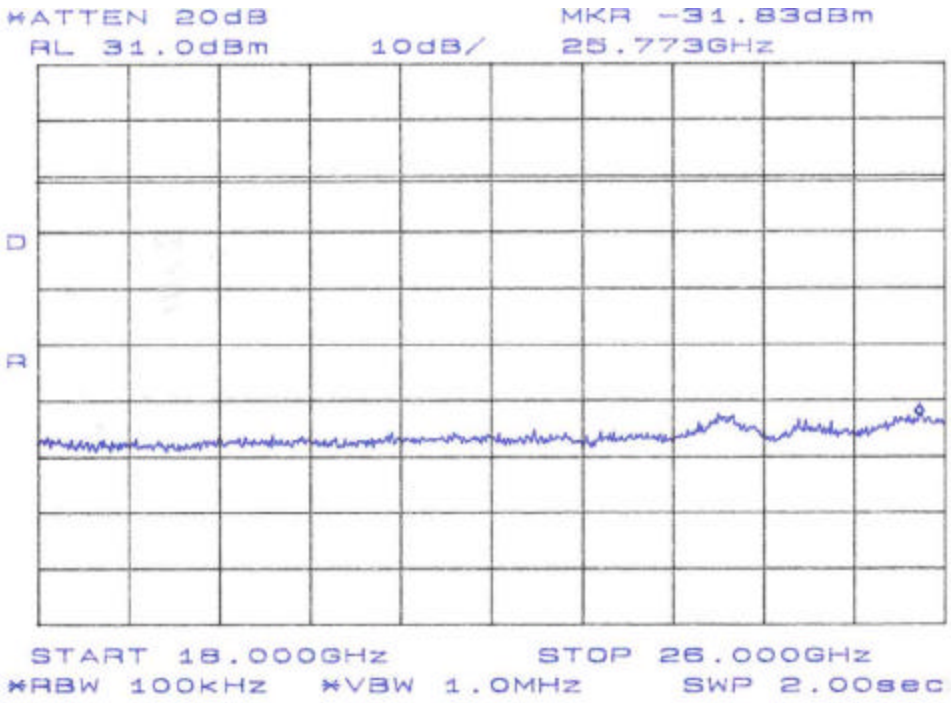

Figure 4-31. Conducted Spurious Emissions, High Channel 18 - 26GHz

4.7 Radiated Spurious Emissions: (FCC Part §2.1053)

The EUT must comply with the requirements for radiated spurious emissions that fall within the restricted bands. These emissions must meet the limits specified in §15.209 and §15.35(b) for peak measurements.

4.7.1 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 C63.4-2001. Cables were varied in position to produce maximum emissions. Both the horizontal and vertical field components were measured.

The emissions were measured using the following resolution bandwidths:

Frequency Range	Resolution Bandwidth	Video Bandwidth
30MHz-1000 MHz	120kHz	>100 kHz
>1000 MHz	1 MHz	<30 Hz (Avg.) 1MHz (Peak)

Table 6: Radiated Emission Test Data, Low Frequency Data (<1GHz)

CLIENT: Mar Electronics Inc DATE: 7/10/2003
TESTER: Ken Gemmell JOB #: 7008
EUT Information: **Test Requirements**
EUT: MEI EasyTrax Remote Data Port TEST STANDARD: FCC 15
CLOCKS: 10.7 MHz + Channel Freq (Highest 938 MHz)
DISTANCE: 3m CLASS: B
CABLE: CSITE2_3m AMPLIFIER (dB): None

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Hght (m)	SA Level (QP) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Amp Gain (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin dB
75.28	V	180.0	1.0	5.3	6.4	2.0	0.0	13.7	4.8	100.0	-26.3
150.35	V	270.0	1.0	7.2	8.7	2.7	0.0	18.6	8.5	150.0	-24.9
334.04	V	180.0	1.0	8.3	14.2	4.1	0.0	26.7	21.6	200.0	-19.3
467.68	V	135.0	1.0	10.1	17.4	5.0	0.0	32.5	42.3	200.0	-13.5
501.09	V	180.0	1.0	7.5	17.0	5.2	0.0	29.7	30.4	200.0	-16.4
601.13	V	315.0	1.0	11.6	18.4	5.7	0.0	35.6	60.5	200.0	-10.4
827.65	V	180.0	1.0	9.6	21.1	6.9	0.0	37.6	75.7	200.0	-8.4
888.31	V	180.0	1.0	4.8	21.3	7.5	0.0	33.7	48.3	200.0	-12.3
902.00	V	180.0	1.0	2.4	21.5	7.6	0.0	31.5	37.5	200.0	-14.5
988.00	V	180.0	1.0	5.6	22.7	7.8	0.0	36.1	63.7	500.0	-17.9
120.00	H	135.0	4.0	21.7	11.2	2.5	0.0	35.4	58.6	150.0	-8.2
150.35	H	180.0	3.0	7.3	8.7	2.7	0.0	18.7	8.6	150.0	-24.8
334.04	H	225.0	1.4	14.7	14.2	4.1	0.0	33.1	45.1	200.0	-12.9
467.68	H	180.0	1.4	9.6	17.4	5.0	0.0	32.0	40.0	200.0	-14.0
501.09	H	180.0	1.0	6.5	17.0	5.2	0.0	28.7	27.1	200.0	-17.4
601.13	H	45.0	1.0	8.9	18.4	5.7	0.0	32.9	44.3	200.0	-13.1
827.65	H	225.0	1.0	4.1	21.1	6.9	0.0	32.1	40.2	200.0	-13.9
888.31	H	180.0	1.0	2.7	21.3	7.5	0.0	31.6	37.9	200.0	-14.4
937.95	H	180.0	1.0	3.4	22.7	8.1	0.0	34.2	51.2	200.0	-11.8
942.45	H	135.0	1.0	4.8	22.8	7.8	0.0	35.5	59.4	200.0	-10.5

BB: Broadband

Table 7. Average Radiated Emission Test Data, High Frequency Data (>1GHz)

(Restricted Bands)

CLIENT: Mar Electronics Inc DATE: 7/9/03
TESTER: Ken Gemmell JOB #: 7008
EUT: MEI EasyTrax Remote Data Port CONFIG: Transceiver #7880 UUT1
TEST STANDARD: FCC Part 15 DISTANCE: 3m

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Hght (m)	SA Level (Ave.) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Amp Gain (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit (µV/m)	Margin dB
Chan 1											
1000.00	V	0.0	1.0	36.7	24.7	1.1	36.5	26.0	20.0	500.0	-27.9
1000.00	H	0.0	1.0	37.2	24.7	1.1	36.5	26.5	21.2	500.0	-27.4
1622.10	V	180.0	1.0	43.4	27.6	2.7	35.8	38.0	79.3	500.0	-16.0
1622.10	H	180.0	1.0	44.0	27.6	2.7	35.8	38.6	85.0	500.0	-15.4
1624.23	V	180.0	1.0	42.7	27.6	2.7	35.8	37.3	73.3	500.0	-16.7
1624.23	H	135.0	1.0	43.2	27.6	2.7	35.8	37.8	77.3	500.0	-16.2
2000.00	V	0.0	1.0	37.8	28.9	3.4	35.5	34.7	54.1	500.0	-19.3
2000.00	H	0.0	1.0	37.5	28.9	3.4	35.5	34.4	52.2	500.0	-19.6
2707.60	V	180.0	1.0	43.2	30.3	2.9	35.6	40.8	109.3	500.0	-13.2
2707.60	H	180.0	1.0	37.2	30.3	2.9	35.6	34.8	54.8	500.0	-19.2
3610.11	V	180.0	1.0	42.3	31.0	2.8	35.5	40.6	107.4	500.0	-13.4
3610.11	H	180.0	1.0	45.3	31.0	2.8	35.5	43.6	151.7	500.0	-10.4
4512.68	V	180.0	1.0	49.5	32.6	3.7	35.7	50.0	316.7	500.0	-4.0
4512.68	H	135.0	1.0	44.2	32.6	3.7	35.7	44.7	171.5	500.0	-9.3
5415.19	V	180.0	1.0	45.8	34.4	4.3	35.8	48.7	271.6	500.0	-5.3
5415.19	H	180.0	1.0	44.7	34.4	4.3	35.8	47.5	237.7	500.0	-6.5
8122.76	V	0.0	1.0	34.2	38.4	4.9	36.1	41.3	115.9	500.0	-12.7
8122.76	H	0.0	1.0	33.8	38.4	4.9	36.1	40.9	111.5	500.0	-13.0
9025.30	V	0.0	1.0	33.7	39.0	4.9	36.2	41.4	117.4	500.0	-12.6
9025.30	H	0.0	1.0	33.8	39.0	4.9	36.2	41.6	119.6	500.0	-12.4
Chan 25											
2744.81	V	205.0	1.0	46.5	30.4	2.9	35.6	44.1	160.7	500.0	-9.9
2744.81	H	180.0	1.0	47.2	30.4	2.9	35.6	44.8	173.6	500.0	-9.2
3659.72	V	180.0	1.0	48.2	31.0	2.8	35.5	46.5	211.4	500.0	-7.5
3659.72	H	225.0	1.0	47.3	31.0	2.8	35.5	45.7	191.9	500.0	-8.3
4574.67	V	225.0	1.0	32.7	32.7	3.8	35.8	33.4	46.8	500.0	-20.6
4574.67	H	225.0	1.0	32.2	32.7	3.8	35.8	32.9	44.2	500.0	-21.1
7319.45	V	0.0	1.0	33.5	37.7	4.6	35.9	39.9	98.4	500.0	-14.1

7319.45	H	0.0	1.0	33.5	37.7	4.6	35.9	39.9	98.4	500.0	-14.1
8234.38	V	0.0	1.0	33.0	38.5	4.9	36.1	40.2	102.2	500.0	-13.8
8234.38	H	0.0	1.0	33.0	38.5	4.9	36.1	40.2	102.2	500.0	-13.8
9149.31	V	0.0	1.0	34.2	39.2	5.0	36.2	42.1	126.8	500.0	-11.9
9149.31	H	0.0	1.0	33.7	39.2	5.0	36.2	41.6	119.7	500.0	-12.4
Chan 50											
2782.29	V	205.0	1.0	47.2	30.4	2.9	35.7	44.8	174.0	500.0	-9.2
2782.29	H	180.0	1.0	46.5	30.4	2.9	35.7	44.1	161.1	500.0	-9.8
3709.73	V	180.0	1.0	41.7	31.1	2.8	35.5	40.0	100.5	500.0	-13.9
3709.73	H	225.0	1.0	39.5	31.1	2.8	35.5	37.9	78.3	500.0	-16.1
4637.16	V	225.0	1.0	44.7	32.9	3.9	35.8	45.6	190.9	500.0	-8.4
4637.16	H	225.0	1.0	42.7	32.9	3.9	35.8	43.6	151.7	500.0	-10.4
7419.53	V	0.0	1.0	34.2	37.8	4.6	35.9	40.6	107.5	500.0	-13.3
7419.53	H	0.0	1.0	33.5	37.8	4.6	35.9	40.0	99.5	500.0	-14.0
8346.85	V	0.0	1.0	33.8	38.6	4.9	36.1	41.1	113.5	500.0	-12.9
8346.85	H	0.0	1.0	33.7	38.6	4.9	36.1	40.9	111.4	500.0	-13.0

Table 8: Peak Radiated Emission Test Data, High Frequency Data (>1GHz)

(Restricted Bands)

CLIENT: Mar Electronics Inc DATE: 7/9/03
TESTER: Ken Gemmell JOB #: 7008
EUT: MEI EasyTrax Remote Data Port TEST STANDARD: FCC Part 15
CONFIGURATION: Transceiver #7880 UUT1 DISTANCE: 3m

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Hght (m)	SA Level (Peak) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Amp Gain (dB)	Corr. Level (dBµV/m)	Corr. Level (µV/m)	Limit µV/m	Margin dB
Chan 1											
2707.60	V	180.0	1.0	50.0	30.3	2.9	35.6	47.6	109.3	5000	-26.4
2707.60	H	180.0	1.0	49.3	30.3	2.9	35.6	46.9	54.8	5000	-27.1
3610.11	V	180.0	1.0	49.7	31.0	2.8	35.5	48.0	107.4	5000	-26.0
3610.11	H	180.0	1.0	47.2	31.0	2.8	35.5	45.5	151.7	5000	-28.5
4512.68	V	180.0	1.0	55.5	32.6	3.7	35.7	56.0	316.7	5000	-18.0
4512.68	H	135.0	1.0	51.3	32.6	3.7	35.7	51.8	171.5	5000	-22.2
5415.19	V	180.0	1.0	48.5	34.4	4.3	35.8	51.4	271.6	5000	-22.6
5415.19	H	180.0	1.0	48.8	34.4	4.3	35.8	51.7	237.7	5000	-22.3
8122.76	V	0.0	1.0	44.8	38.4	4.9	36.1	51.9	115.9	5000	-22.1
8122.76	H	0.0	1.0	44.3	38.4	4.9	36.1	51.4	111.5	5000	-22.6
9025.30	V	0.0	1.0	44.3	39.0	4.9	36.2	52.1	117.4	5000	-21.9
9025.30	H	0.0	1.0	43.2	39.0	4.9	36.2	50.9	119.6	5000	-23.1
Chan 25											
2744.81	V	205.0	1.0	51.7	30.4	2.9	35.6	49.3	160.7	5000	-24.7
2744.81	H	180.0	1.0	51.0	30.4	2.9	35.6	48.6	173.6	5000	-25.4
3659.72	V	180.0	1.0	52.7	31.0	2.8	35.5	51.0	211.4	5000	-23.0
3659.72	H	225.0	1.0	51.7	31.0	2.8	35.5	50.0	191.9	5000	-24.0
4574.67	V	225.0	1.0	47.2	32.7	3.8	35.8	47.9	46.8	5000	-26.1
4574.67	H	225.0	1.0	47.8	32.7	3.8	35.8	48.6	44.2	5000	-25.4
7319.45	V	0.0	1.0	43.8	37.7	4.6	35.9	50.2	98.4	5000	-23.8
7319.45	H	0.0	1.0	44.5	37.7	4.6	35.9	50.9	98.4	5000	-23.1
8234.38	V	0.0	1.0	42.7	38.5	4.9	36.1	49.9	102.2	5000	-24.1
8234.38	H	0.0	1.0	44.2	38.5	4.9	36.1	51.4	102.2	5000	-22.6
9149.31	V	0.0	1.0	44.5	39.2	5.0	36.2	52.4	126.8	5000	-21.6
9149.31	H	0.0	1.0	44.2	39.2	5.0	36.2	52.1	119.7	5000	-21.9

Table 8: Peak Radiated Emission Test Data, High Frequency Data (>1GHz) continued

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Hght (m)	SA Level (Peak) (dBµV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Amp Gain (dB)	Corr. Level (dBµV/m)	Corr. Level µV/m	Limit µV/m	Margin dB
Chan 50											
2782.29	V	205.0	1.0	53.2	30.4	2.9	35.7	50.8	174.0	5000	-23.2
2782.29	H	180.0	1.0	53.8	30.4	2.9	35.7	51.5	161.1	5000	-22.5
3709.73	V	180.0	1.0	45.2	31.1	2.8	35.5	43.6	100.5	5000	-30.4
3709.73	H	225.0	1.0	47.3	31.1	2.8	35.5	45.7	78.3	5000	-28.3
4637.16	V	225.0	1.0	48.2	32.9	3.9	35.8	49.1	190.9	5000	-24.9
4637.16	H	225.0	1.0	47.2	32.9	3.9	35.8	48.1	151.7	5000	-25.9
7419.53	V	0.0	1.0	45.2	37.8	4.6	35.9	51.6	107.5	5000	-22.4
7419.53	H	0.0	1.0	42.8	37.8	4.6	35.9	49.3	99.5	5000	-24.7
8346.85	V	0.0	1.0	44.8	38.6	4.9	36.1	52.1	113.5	5000	-21.9
8346.85	H	0.0	1.0	43.0	38.6	4.9	36.1	50.3	111.4	5000	-23.7

4.8 Conducted Emissions

4.8.1 Requirements

Test Arrangement: Table Top

Compliance Standard: FCC Part 15.207 (8/2002)

Compliance Limits		
Frequency	Quasi-peak	Average
0.15-0.5MHz	66 to 56dBµV	56 to 46dBµV
0.5 to 5MHz	56dBµV	46dBµV
0.5-30MHz	60dBµV	50dBµV

4.8.2 Test Procedure

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 was supplied to the peripherals through a second LISN. The peripherals were placed on the table in accordance with ANSI C63.4-2001. 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 150 kHz to 30 MHz were 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.

4.8.3 Test Data

Table 10 provides the test results for phase and neutral line power line conducted emissions.

Table 9. Conducted Emissions Test Data Sheet

CLIENT:	Mar Electronics Inc	DATE:	7/10/03
MODEL:	MEI EasyTrax Remote Data Port	TESTER:	Ken Gemmell
JOB #:	7008	TEST VOLTAGE:	120 VAC
TEST STANDARD:	FCC Part 15.207	CLASS:	FCC_B

LINE 1 - NEUTRAL

Frequency MHz	Level QP dBuV	Limit QP dBuV	Margin QP dB	Level AVG dBuV	Limit AVG dBuV	Margin AVG dB
0.15	61.7	66.0	-4.3	9.8	56.0	-46.2
0.47	49.1	56.6	-7.5	11.7	46.6	-34.9
1.00	36.7	56.0	-19.3	16.5	46.0	-29.5
2.40	21.8	56.0	-34.2	21.8	46.0	-24.2
8.62	22.3	60.0	-37.7	22.3	50.0	-27.7
24.00	24.1	60.0	-35.9	24.1	50.0	-25.9

LINE 2 - PHASE

Frequency MHz	Level QP dBuV	Limit QP dBuV	Margin QP dB	Level AVG dBuV	Limit AVG dBuV	Margin AVG dB
0.15	60.6	66.0	-5.4	10.0	56.0	-46.0
0.47	47.7	56.6	-8.9	12.3	46.6	-34.3
1.00	36.5	56.0	-19.5	17.2	46.0	-28.8
2.40	22.0	56.0	-34.0	22.0	46.0	-24.0
8.62	21.7	60.0	-38.3	21.7	50.0	-28.3
24.00	21.3	60.0	-38.7	21.3	50.0	-28.7