FCC Certification Test Report

FCC Certification Test Report
for
Eka Systems, Inc.
BlueMeter Meter Module
FCC ID: P9X-EMS-MM-GE

August 21, 2002

Prepared for:

Eka Systems, Inc.
444 N. Frederick Avenue, Suite 315
Gaithersburg, MD 20877

Prepared By:

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7560 Lindbergh Drive
Gaithersburg, Maryland 20879

FCC Certification Test Program

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WLL JOB# 7044

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Documentation Specialist

Reviewed by: Gregory M. Snyder
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Abstract

This report has been prepared on behalf of Eka Systems, Inc. to support the attached Application for Equipment Authorization. The test report and application are submitted for a Frequency Hopping Spread Spectrum Transmitter Module 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 Eka Systems, Inc. BlueMeter Meter Module.

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 Eka Systems, Inc. BlueMeter Meter Module complies with the limits for a Frequency Hopping Spread Spectrum Transmitter device under Part 15.247 of the FCC Rules and Regulations.

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1 Introduction

1.1 Compliance Statement

The Eka Systems, Inc. BlueMeter Meter Module complies with the limits for a Frequency Hopping Spread Spectrum Transmitter Module 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:	Eka Systems, Inc. 444 N. Frederick Avenue, Suite 315 Gaithersburg, MD 20877
Purchase Order Number:	20099
Quotation Number:	59877

1.4 Test Dates

Testing was performed from March 26, 2002 to April 25, 2002.

1.5 Test and Support Personnel

Washington Laboratories, LTD	Santo Lavorata
Customer	Tzeta Tsau

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 BlueMeter Meter Module is a meter accessory board that is to be installed inside an electric meter; it is seated on the meter through a 30-pin connector. The board/module has four major components: microprocessor, memories, meter interface, and wireless unit. The microprocessor is an IC that controls the operations of the meter module. The memories are ICs that retains operation data. The meter interface is buffering circuitry for communication with the meter. The wireless unit uses a Bluetooth transceiver for wireless communication with other BlueMeter devices. In particular, the Bluetooth transceiver has a maximum transmit power of 20 dBm and is compliant with the Bluetooth Specifications, Version 1.1. Although the Bluetooth module has the capability of 20dBm, the transmit power is fixed to 10 dBm for this application and can not be changed by the user. The transceiver performs spectrum spreading by frequency hopping in 79 frequencies that are displaced by 1 MHz, between 2.402GHz and 2.480GHz. All 79 channels are equally used. The channel is divided into time slots, with a nominal slot length of 625µs, where each slot corresponds to different RF hop frequencies thus the dwell time on any one channel is 625us.

Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	Eka Systems, Inc.
FCC ID Number	P9X-EMS-MM-GE
Model:	BlueMeter Meter Module
FCC Rule Parts:	§15.247
Frequency Range:	2402MHz t 2480MHz
Maximum Output Power:	10mW
Modulation:	GFSK
Occupied Bandwidth:	837 kHz
Keying:	Automatic
Type of Information:	Data
Number of Channels:	79
Power Output Level	Fixed
Antenna Type	Integrated
Frequency Tolerance:	N/A
Interface Cables:	None
Power Source & Voltage:	120VAC

2.2 Test Configuration

The BlueMeter Meter Module was configured within a General Electric kV™ Vector electric service reading meter and powered via 120 VAC. This meter contains the appropriate interface to supply full functionality and realistic operation for the BlueMeter

Module. The Electric meter used for testing is constructed of plastic and contains no metals which could provide additional shielding of the module.

2.3 Testing Algorithm

The BlueMeter Meter Module was installed within a typical meter and set to continuously transmit on either the low, middle or high frequencies. The meter used for testing is constructed of plastic.

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

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

Land Mobile FM or PM Communications Equipment Measurement and Performance Standards (ANSI/TIA/EIA-603-93)

FCC Public Notice DA 00-705: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems; Released March 30, 2000

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	Description	Serial Number	Property Number	Date Calibrated	Calibration Due Date
Antenna Research Associates DRG-118/A	Horn Antenna	1010	00004	10/20/01	10/20/02
Antenna Research Associates LPB-2520	Biconilog Antenna Site 2	1118		5/15/01	5/15/02
Hewlett Packard 8449B	Pre-Amplifier	3008A00729	00066	1/31/02	1/31/03
Hewlett Packard 8449B	Pre-Amplifier	3008A00385	00312	9/24/01	9/24/02
Hewlett Packard 8564E	Spectrum Analyzer	3643A00657	00067	4/11/01	4/11/02
Hewlett Packard 85650A	Q.P. Adapter (Site 2)	2811A01283	00068	6/29/01	6/29/02
Hewlett Packard 85685A	RF Preselector (Site 2)	3221A01395	00071	6/28/01	6/28/02
Hewlett Packard 8568B	Spectrum Analyzer (Site 2)	2928A04750	00072	6/29/01	6/29/02
Hewlett Packard 8593A	Spectrum Analyzer	3009A00739	00074	5/10/01	5/10/02
Solar Electronics 8012-50-R-24-BNC	LISN	8379493	00124	8/15/01	8/15/02

4 Test Results

4.1 RF Power Output: (FCC Part §15.247(b)(1))

The output from the transmitter was fitted with a coaxial connector and connected to an attenuator and then to the input of the HP8564E RF Spectrum Analyzer. The analyzer offset was adjusted to compensate for the attenuator and other losses in the system. For the power measurement, the resolution bandwidth was set to 2MHz and the video bandwidth was set to 3MHz.

The transmitter was then set to the low, middle and high channels, individually, and the conducted transmitted power was measured. The following table lists the conducted power measurements.

Table 3: Conducted RF Power Output Results

Channel Frequency (MHz)	Measured Power (dBm)	Limit (dBm)	Pass/Fail
2402	9.47	30	Pass
2441	8.82	30	Pass
2480	9.82	30	Pass

4.2 Occupied Bandwidth: (FCC Part §15.247(a)(1)(ii))

The antenna was replaced with a coaxial. Occupied bandwidth measurement was performed by direct connection of 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 be no greater than 1 MHz.

At full modulation, the occupied bandwidth was measured for the low, middle and high channels. Figure 1 through Figure 3 are plots of the 20 dB bandwidth measurement results. Table 4 provides a summary of the Occupied Bandwidth Results.

Table 4. Occupied Bandwidth Results

Frequency	Bandwidth (MHz)	Limit (MHz)	Pass/Fail
Low Channel 2402 MHz	0.833	1	Pass
Mid Channel 2441 MHz	0.797	1	Pass
High Channel 2480 MHz	0.837	1	Pass

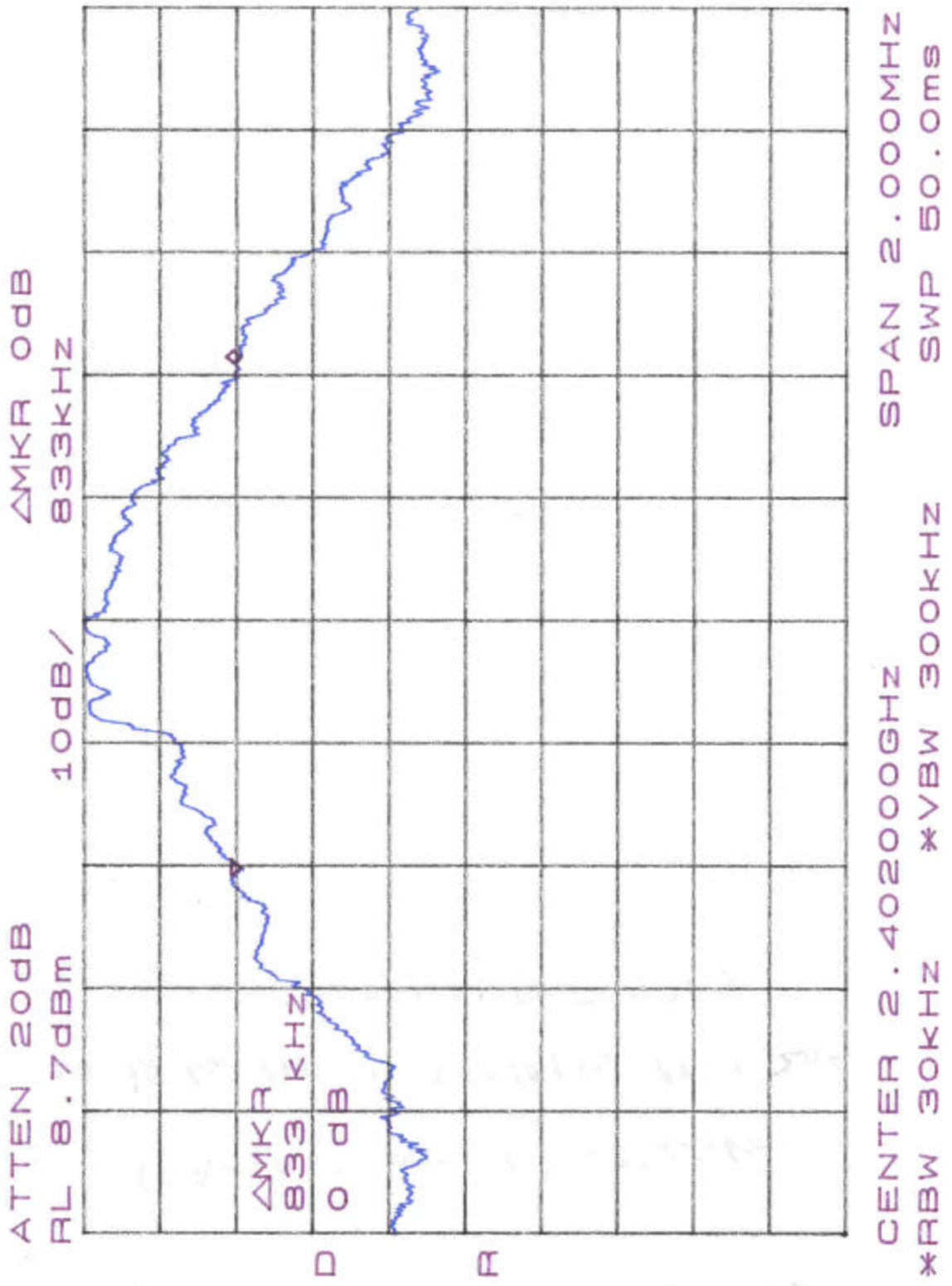

Figure 1. Occupied Bandwidth, Low Channel

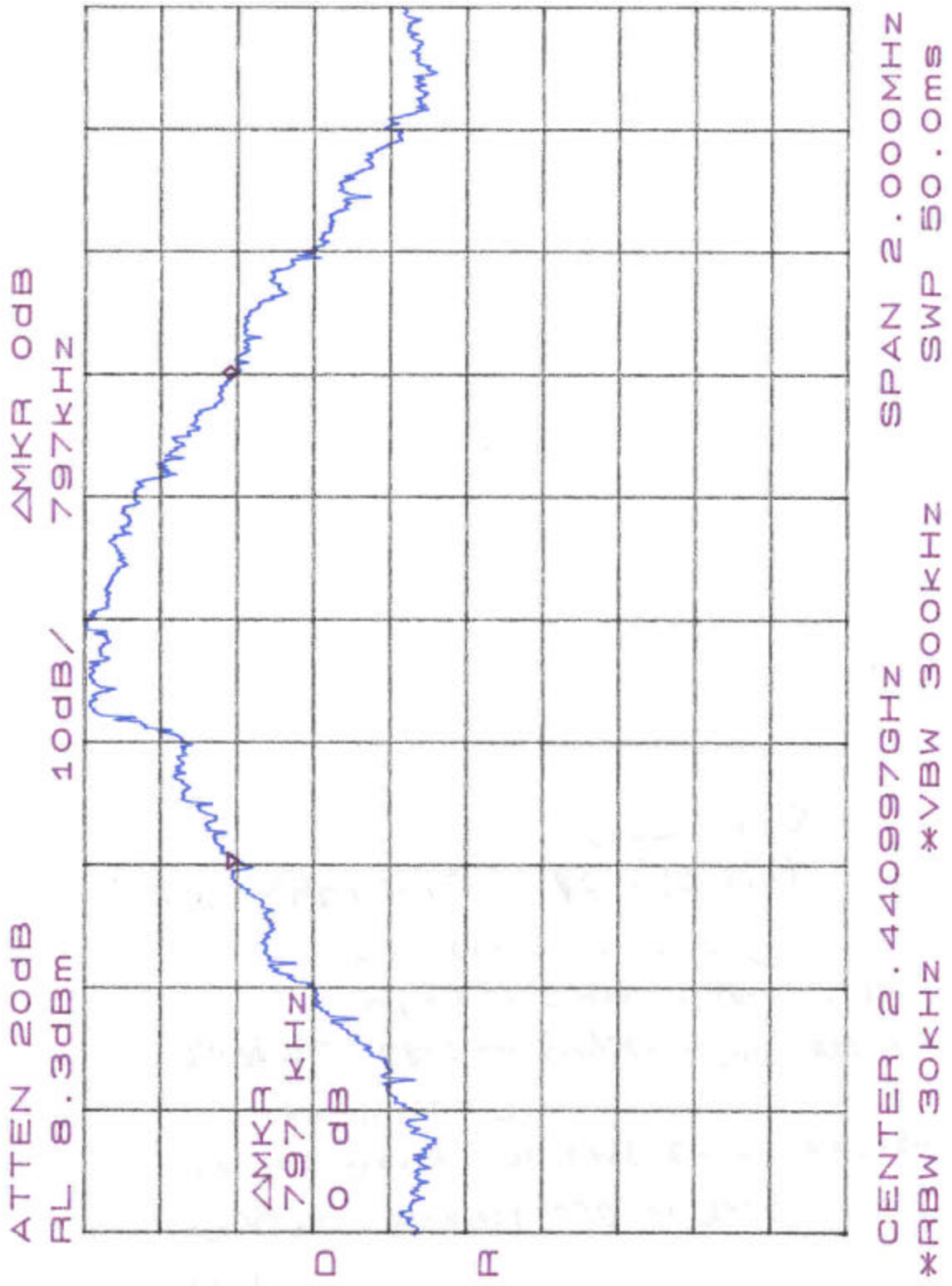

Figure 2. Occupied Bandwidth, Mid Channel

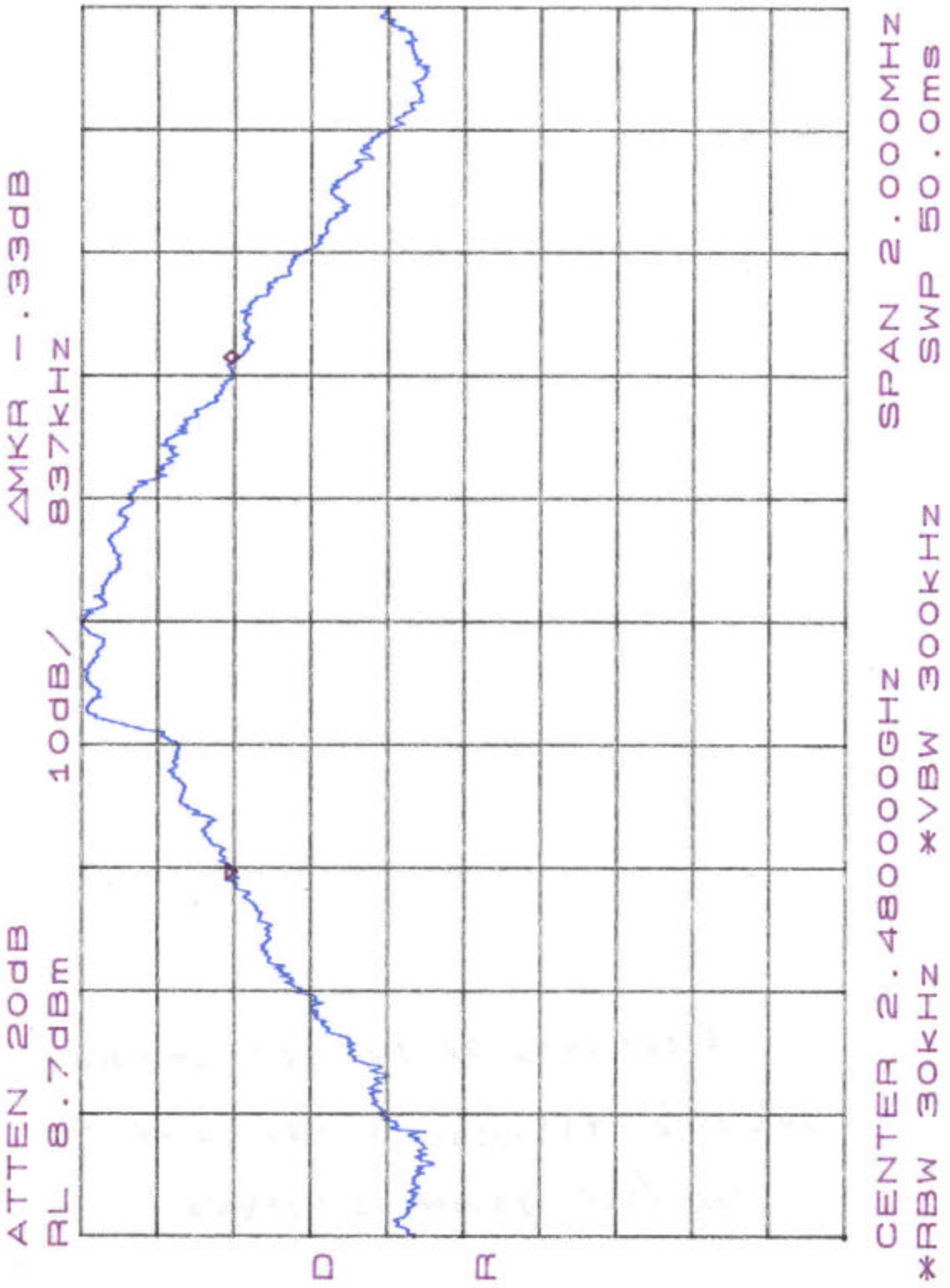

Figure 3. Occupied Bandwidth, High Channel

4.3 Power Spectral Density (FCC Part §15.247(d))

As the Bluetooth device is a hybrid type spread spectrum transmitter it is required to comply with the Power Spectral Density requirements while in the acquisition mode.

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 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 spectrum analyzer had the following settings:

- Resolution Bandwidth: 3 kHz
- Video Bandwidth: 10 kHz
- Sweep Time: 100 seconds
- Span: 300 kHz

The unit was then placed in the acquisition mode and the power spectral density was measured. Table 5 provides the worst case test results for the measured power spectral density while in the acquisition mode.

Table 5. Power Spectral Density

Frequency	Level	Limit	Pass/Fail
2402 MHz	-2.67 dBm	8 dBm	Pass

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

The EUT must comply with requirements for spurious emissions at antenna terminals. In any 100kHz band outside of the spread spectrum operating frequency all spurious emissions must be at least 20 dB below the highest emission level within the band as found with a 100kHz bandwidth.

Testing for spurious emissions was performed as a conducted test. Measurements of the peak levels in a 100kHz bandwidth for the low, middle and high channels and the limits for the conducted spurious emissions are listed in the following table.

For the purpose of this testing the hopping was stopped and the transmitter was set to continuously transmit.

Table 6. Conducted Spurious Emission Limits

Frequency (MHz)	100kHz Fundamental Level	Harmonic Limit (20 dBc)

	(dBm)	**(dBm)**
Low Channel (2402)		
Fundamental	9.50	
Harmonics		-10.5
Mid Channel (2441)		
Fundamental	9.0	
Harmonics		-11
High Channel (2480)		
Fundamental	9.8	
Harmonics		-10.2

Test results for the conducted spurious emissions for the low, middle and high channels are included in the plots contained in Figure 4 through Figure 17.

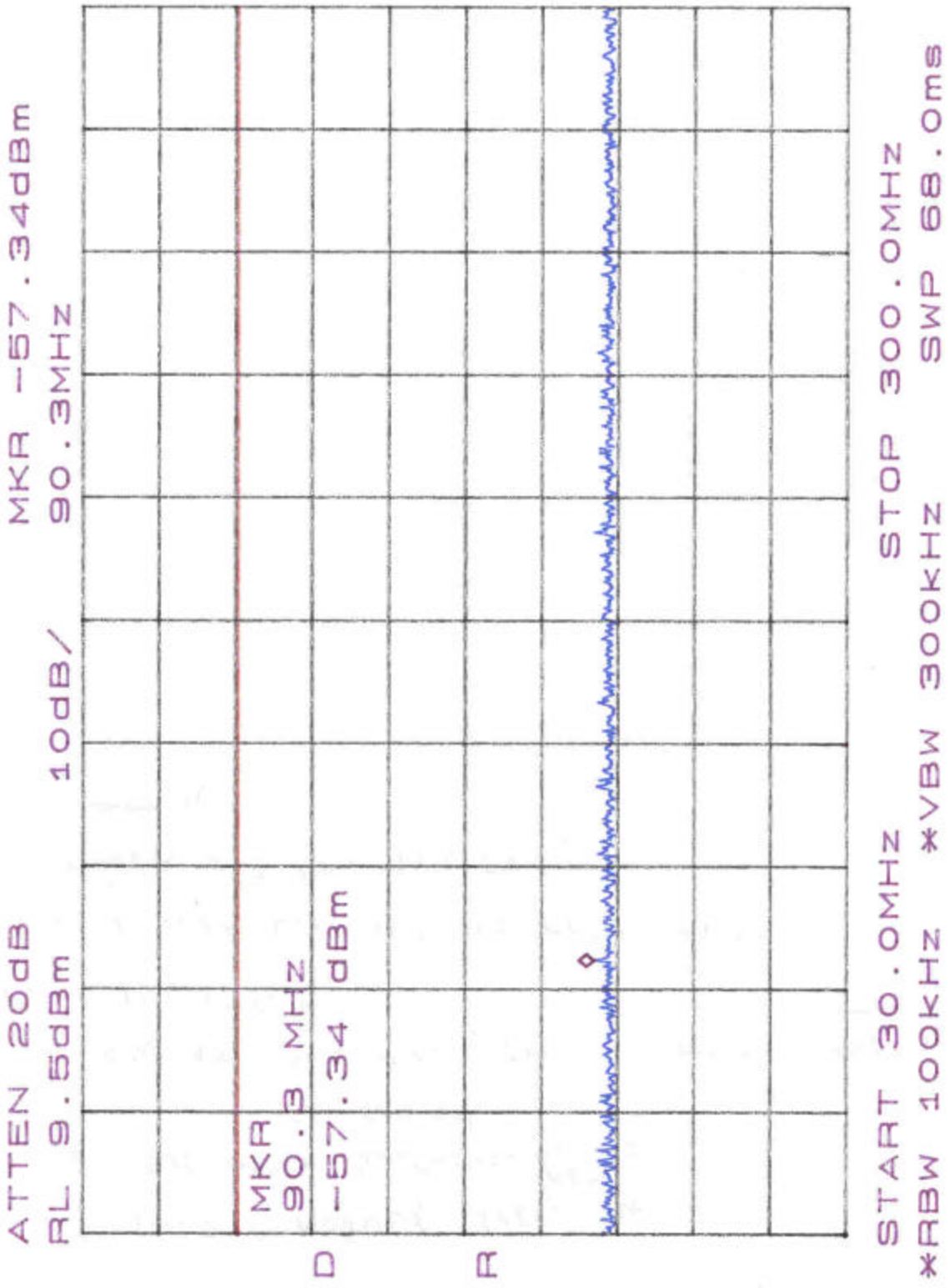

Figure 4. Conducted Spurious, Low Channel, Plot 1

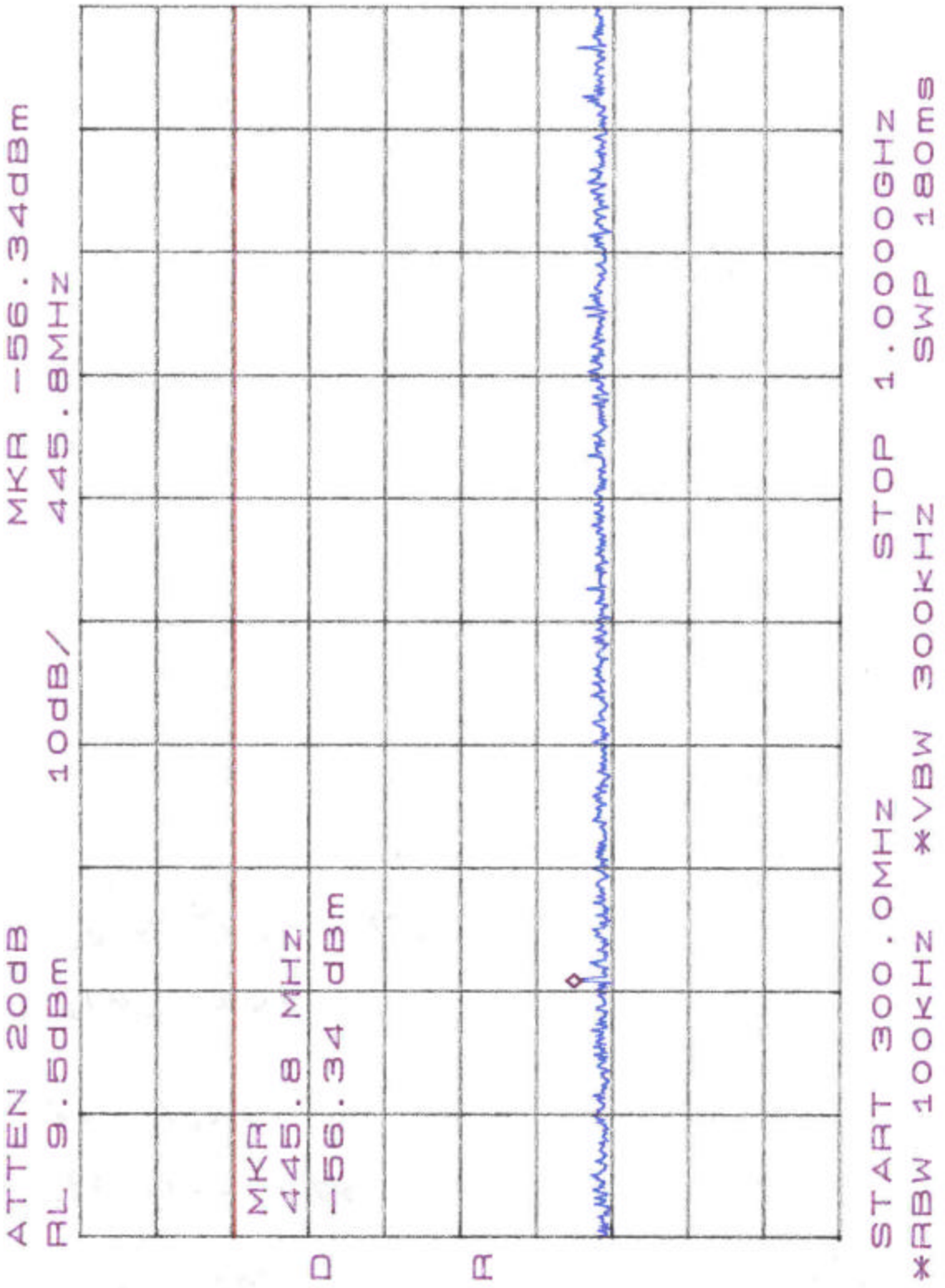

Figure 5. Conducted Spurious, Low Channel, Plot 2

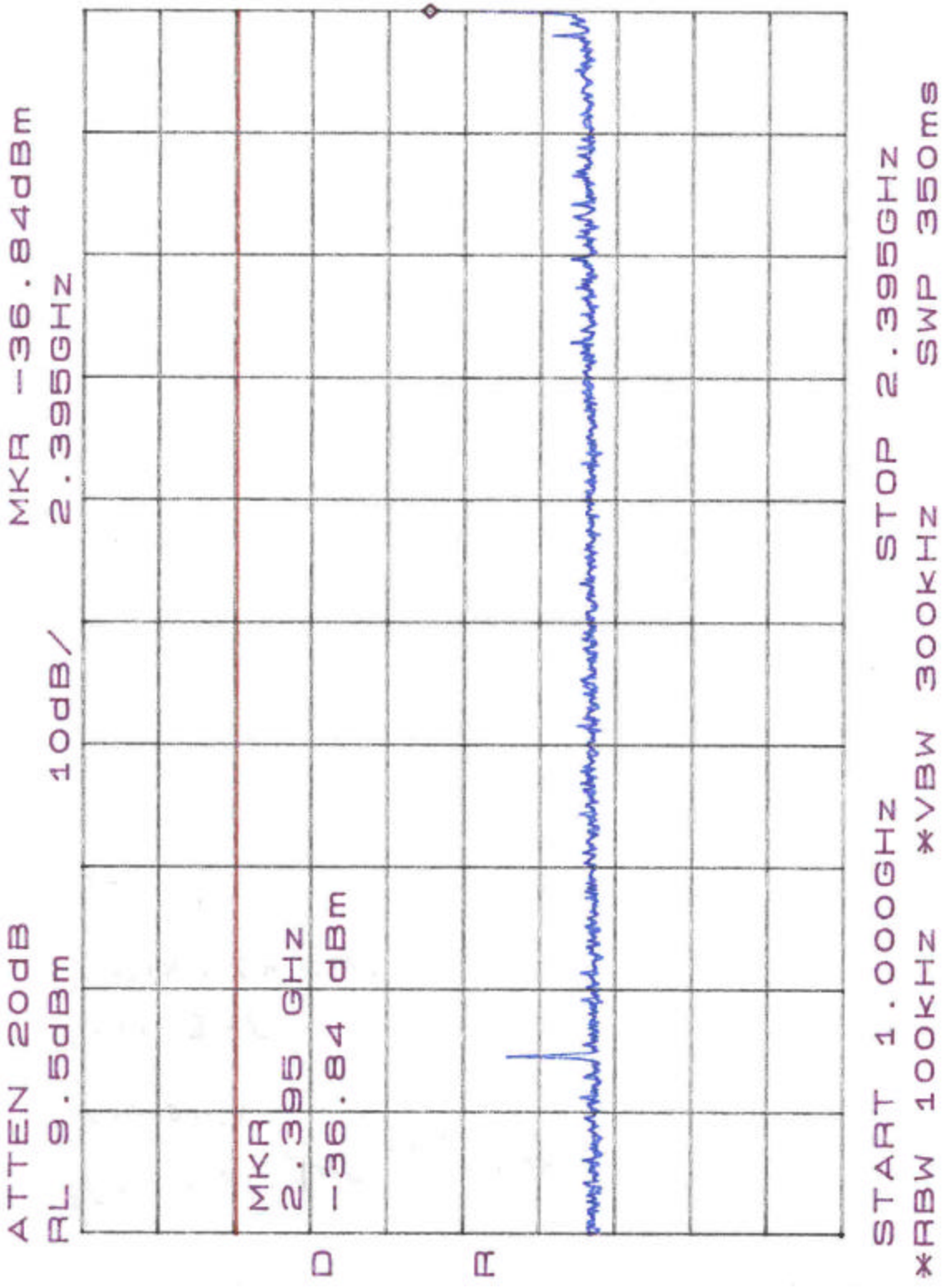

Figure 6. Conducted Spurious, Low Channel, Plot 3

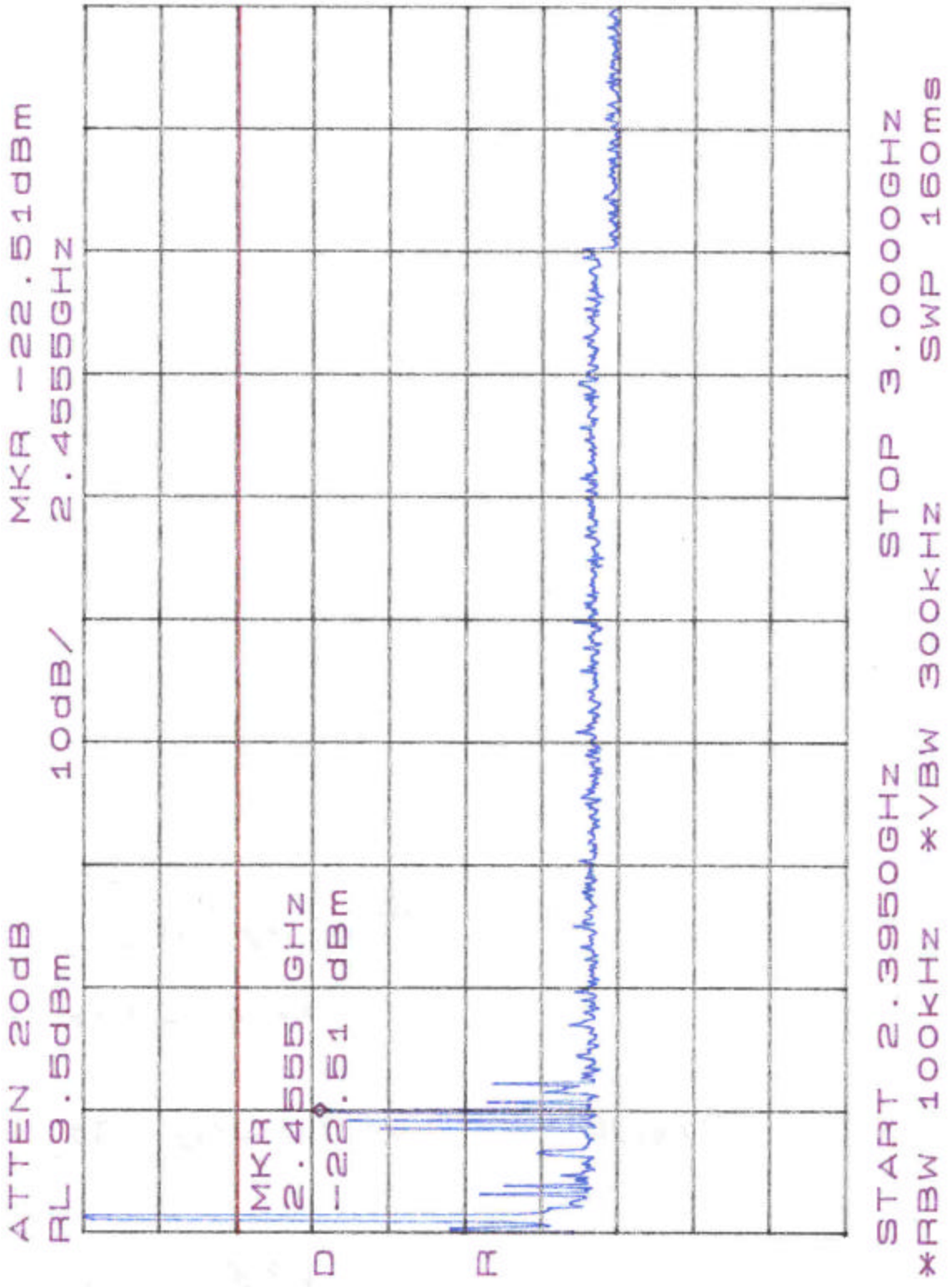

Figure 7. Conducted Spurious, Low Channel, Plot 4

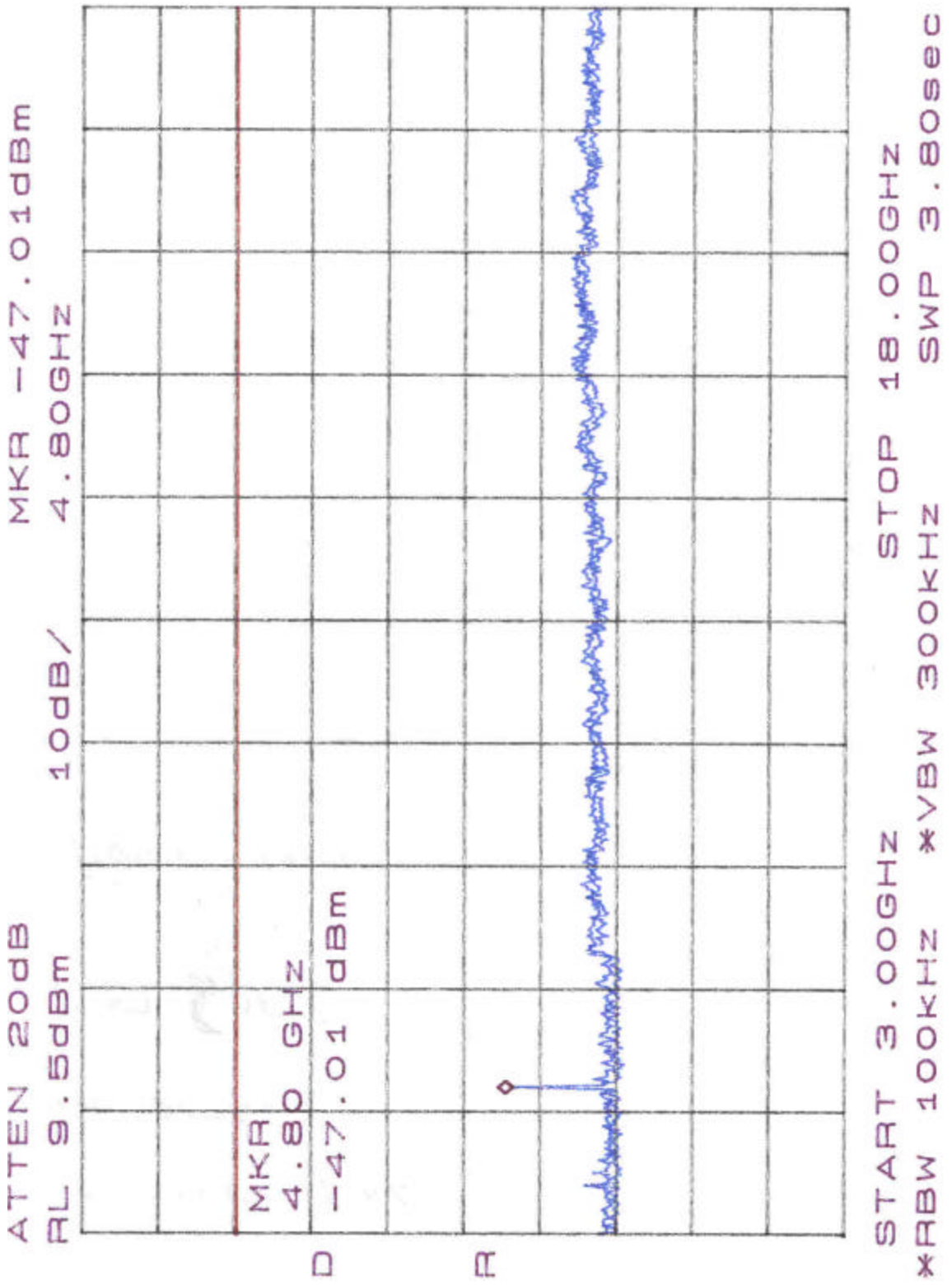

Figure 8. Conducted Spurious, Low Channel, Plot 5

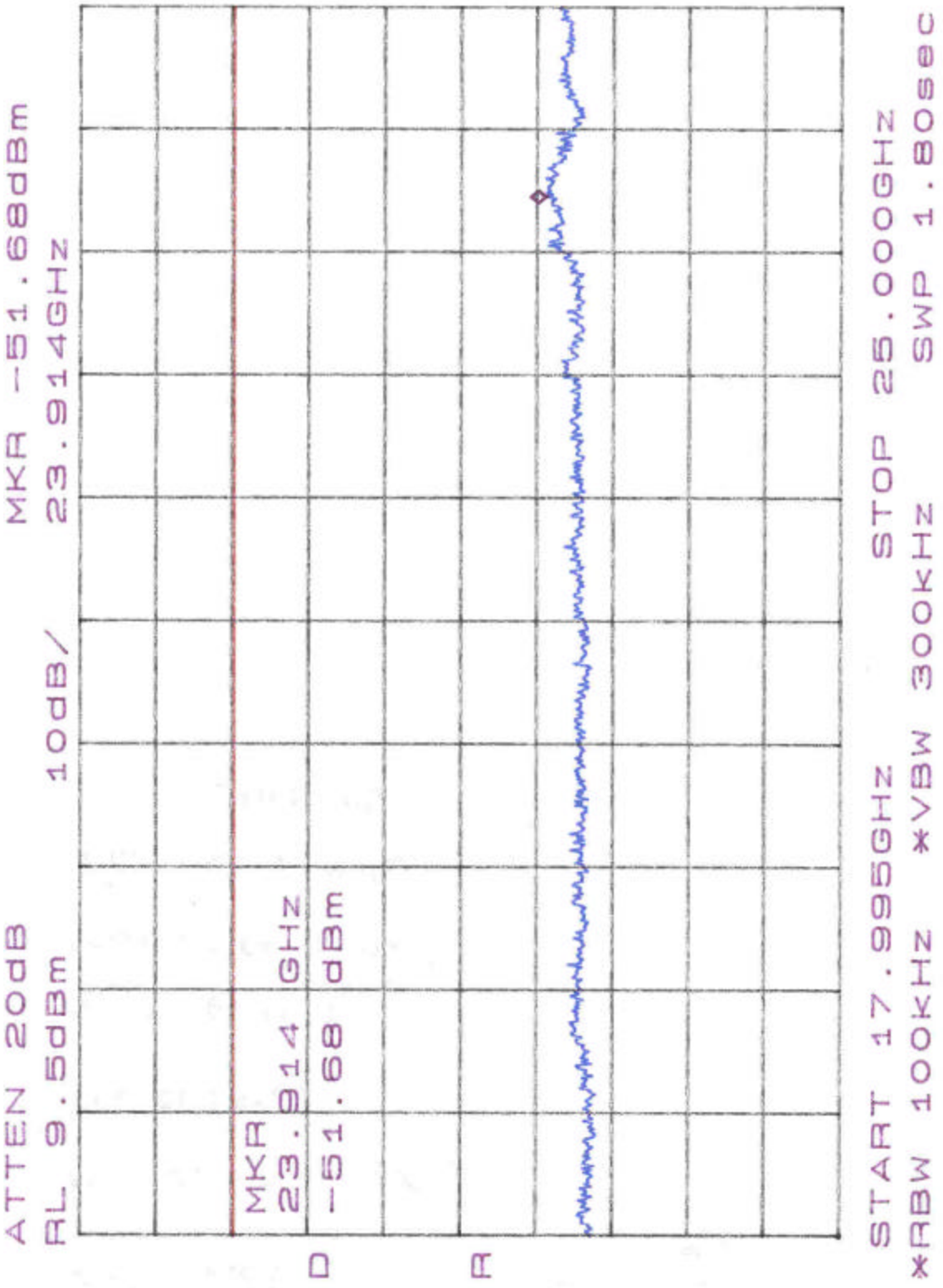

Figure 9. Conducted Spurious, Low Channel, Plot 6

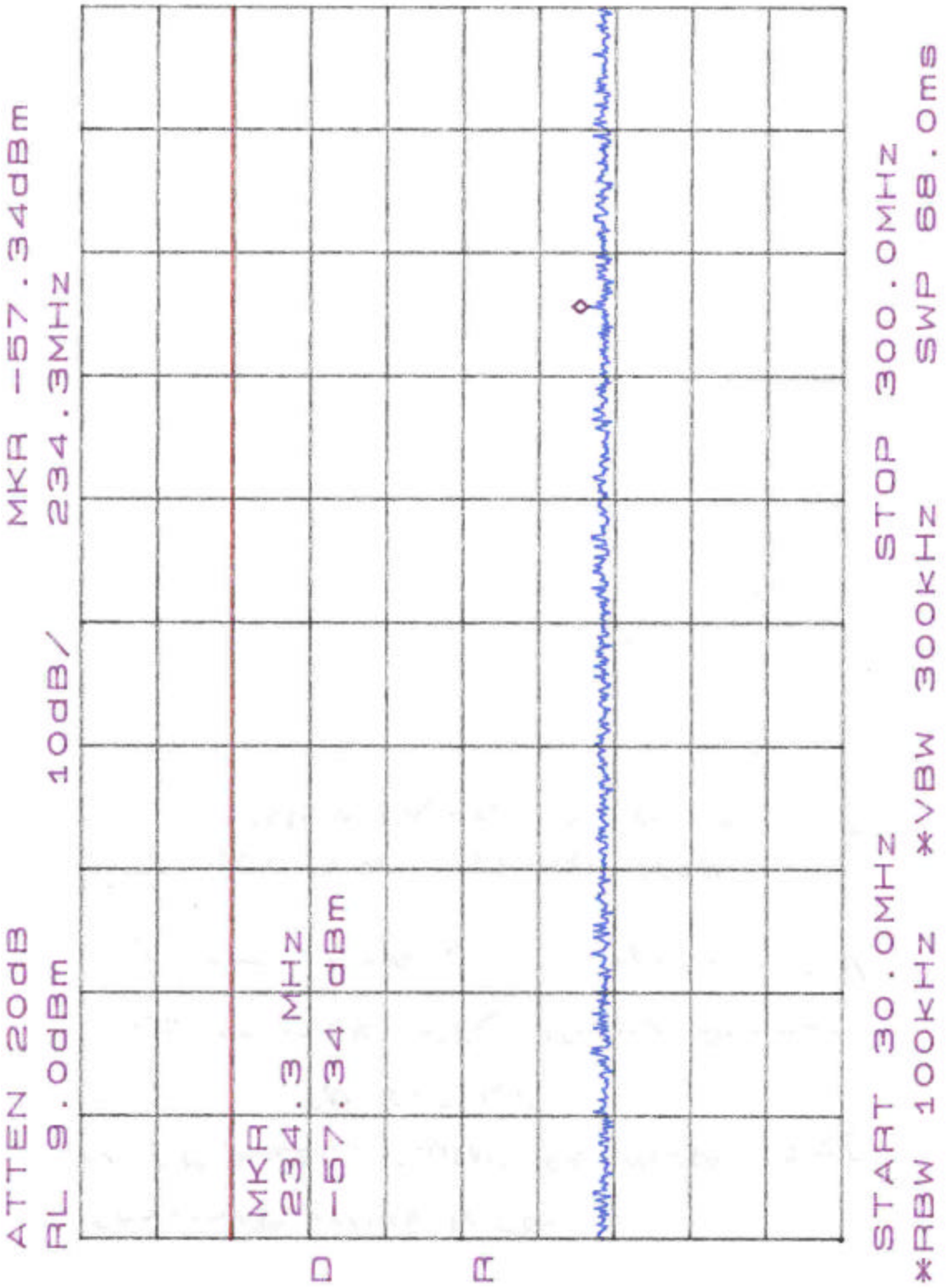

Figure 10. Conducted Spurious, Mid Channel, Plot 1

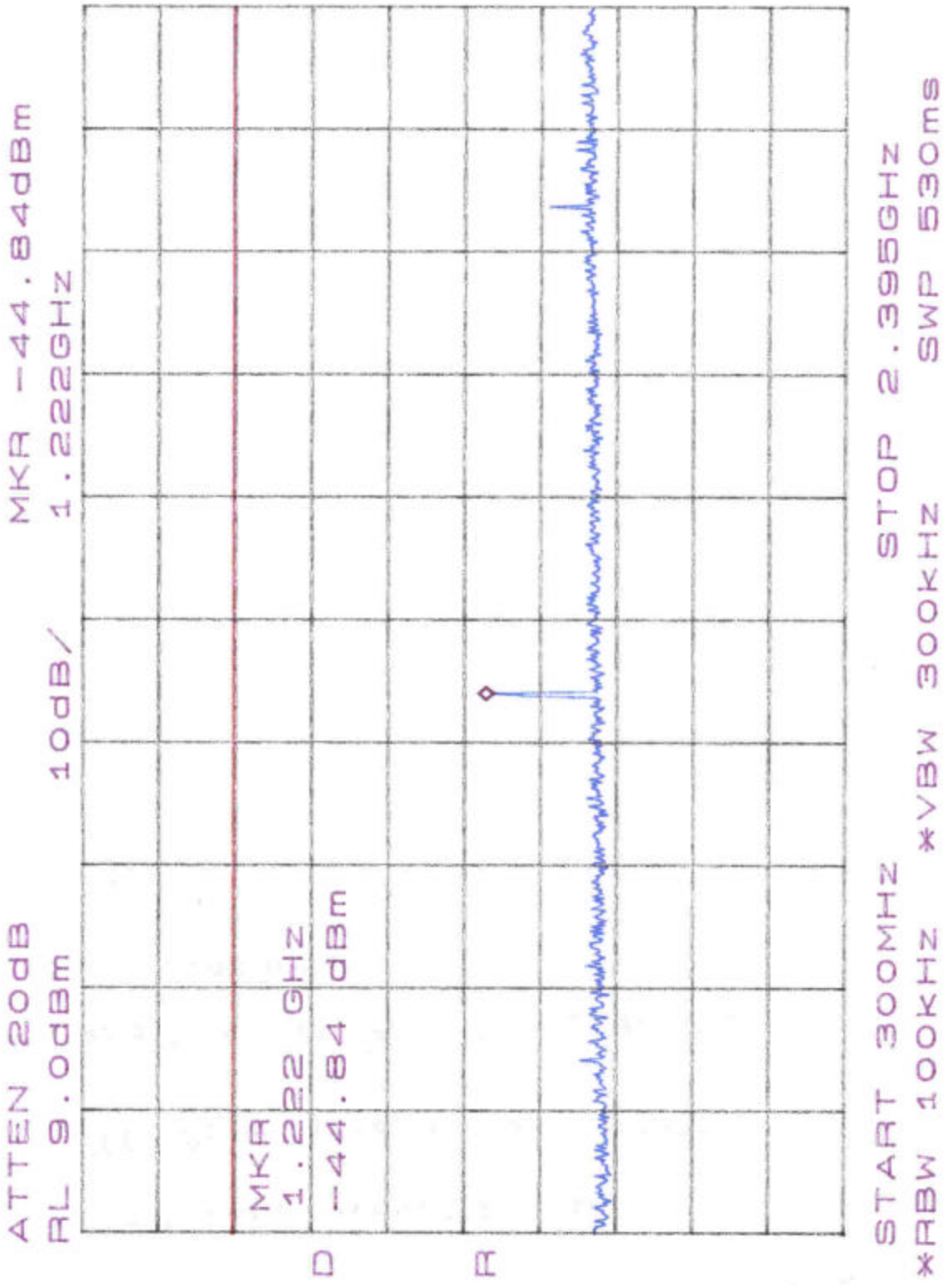

Figure 11. Conducted Spurious, Mid Channel, Plot 2

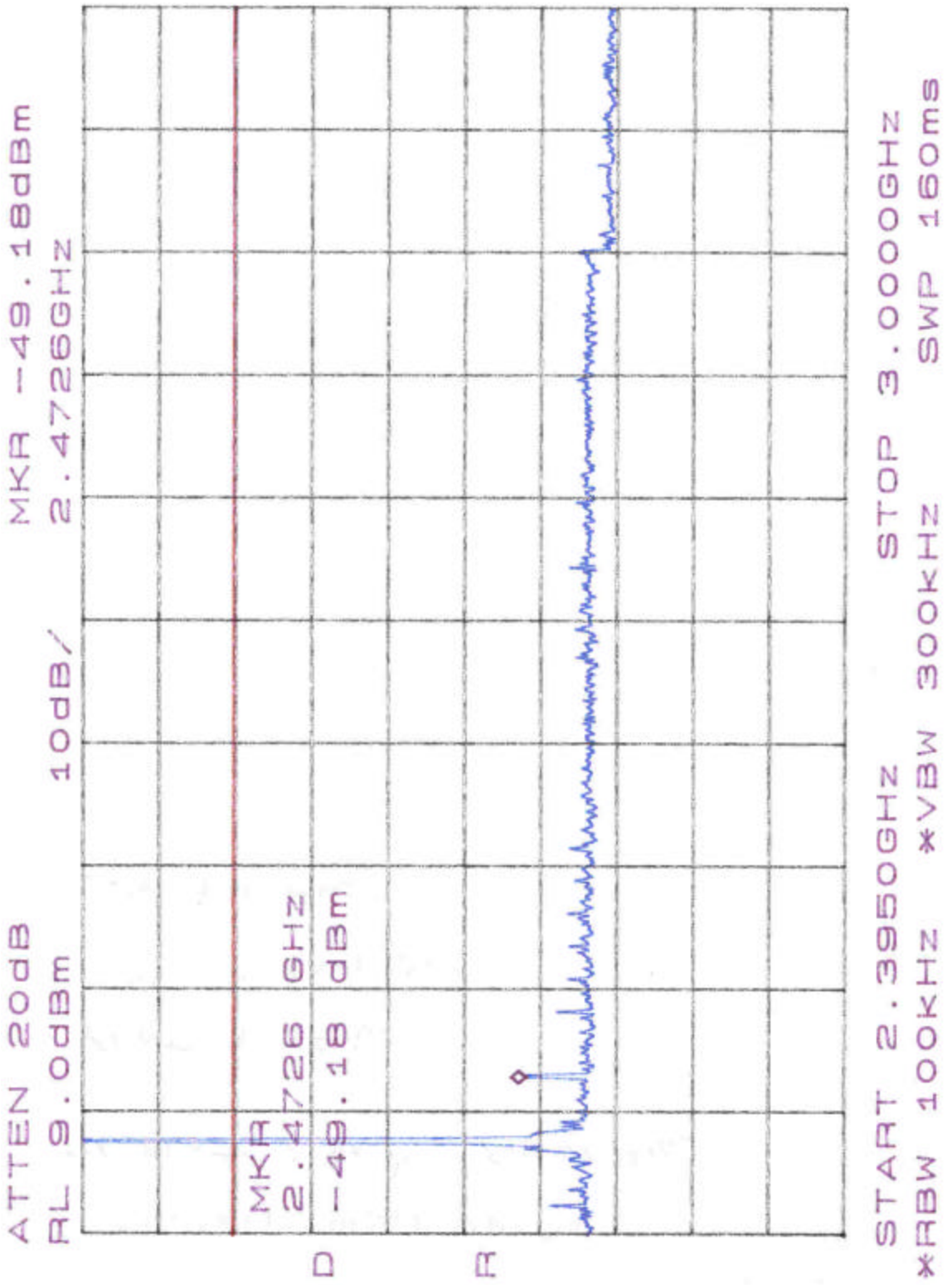

Figure 12. Conducted Spurious, Mid Channel, Plot 3

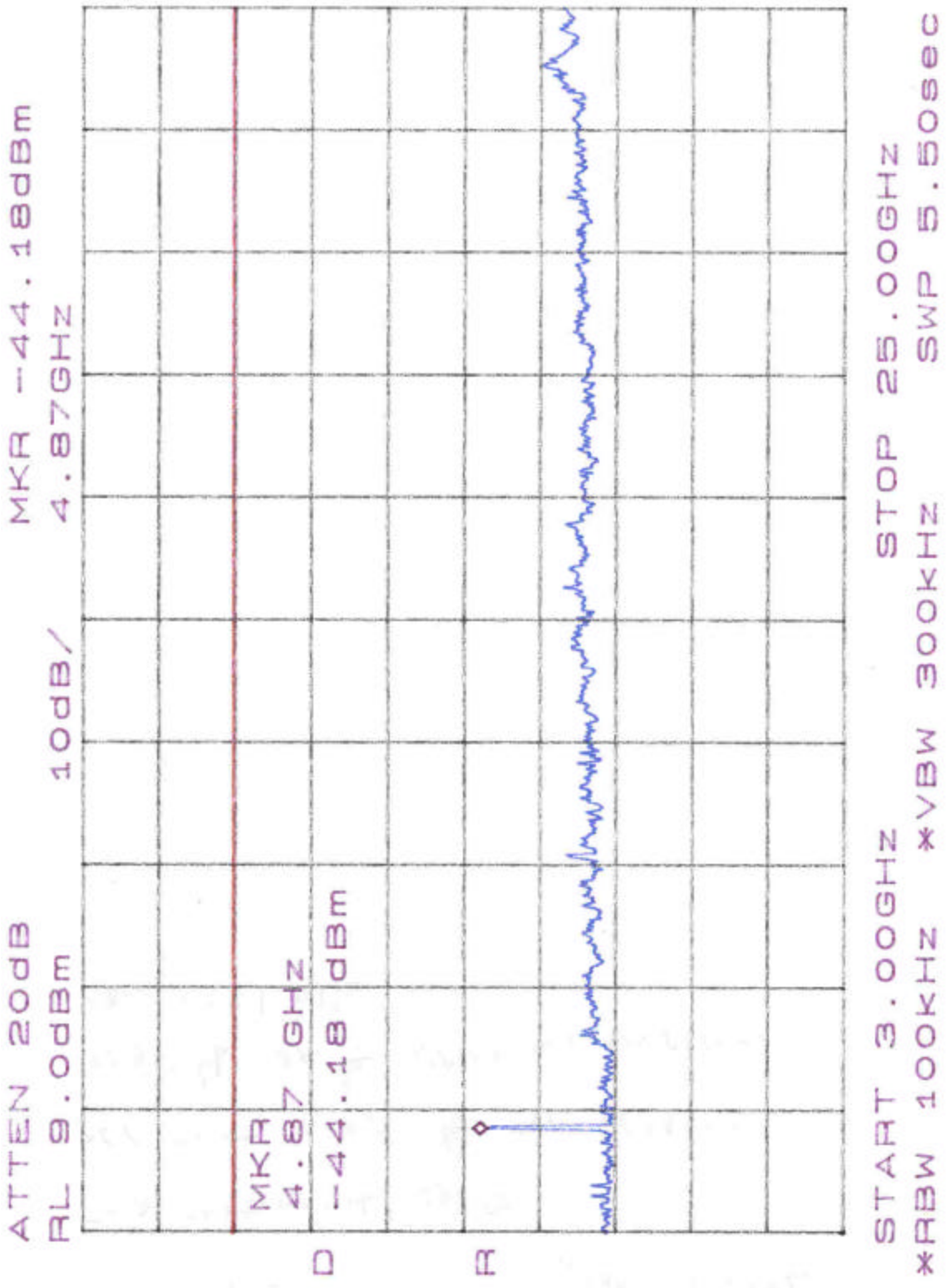

Figure 13. Conducted Spurious, Mid Channel, Plot 4

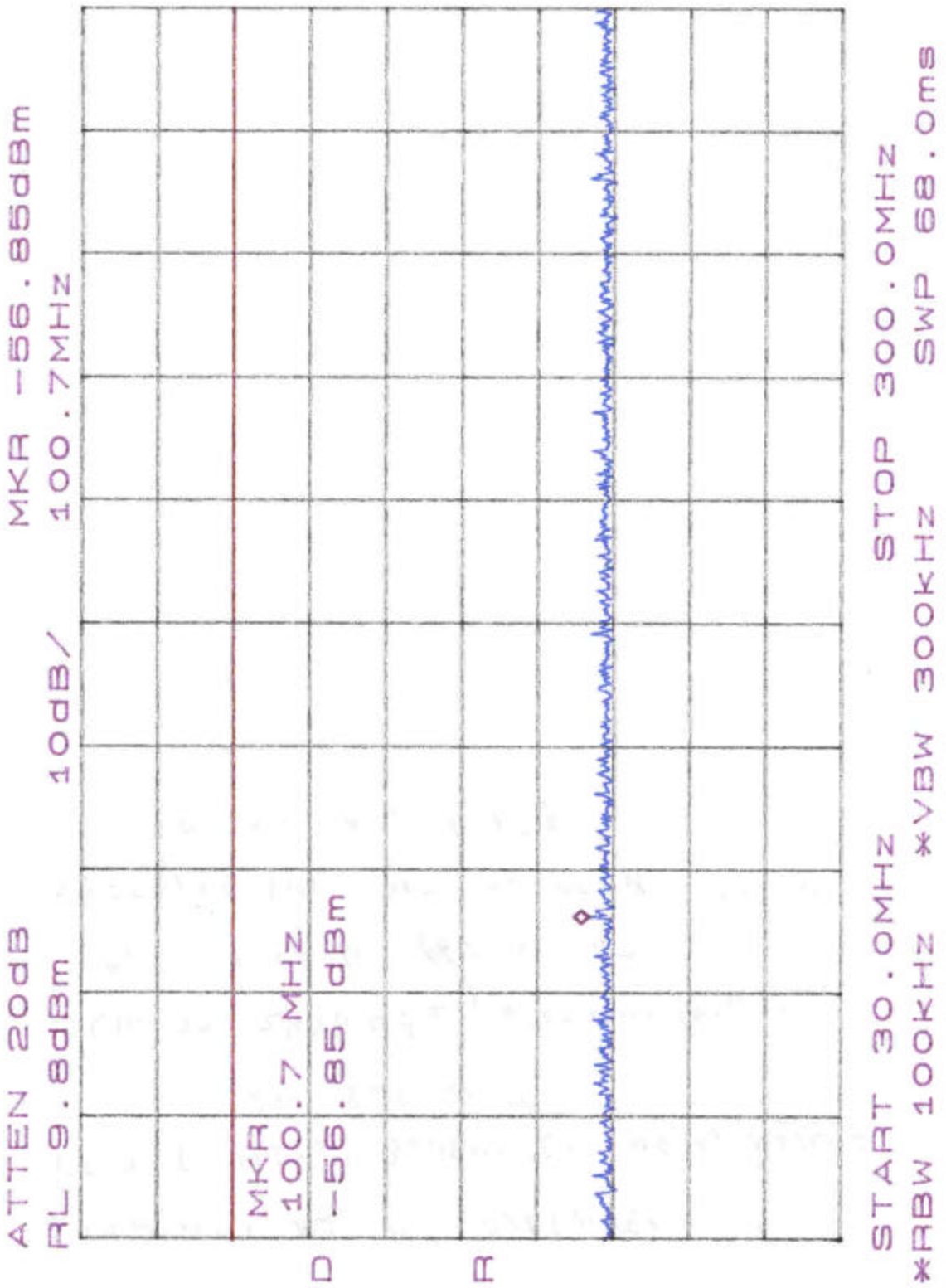

Figure 14. Conducted Spurious, High Channel, Plot 1

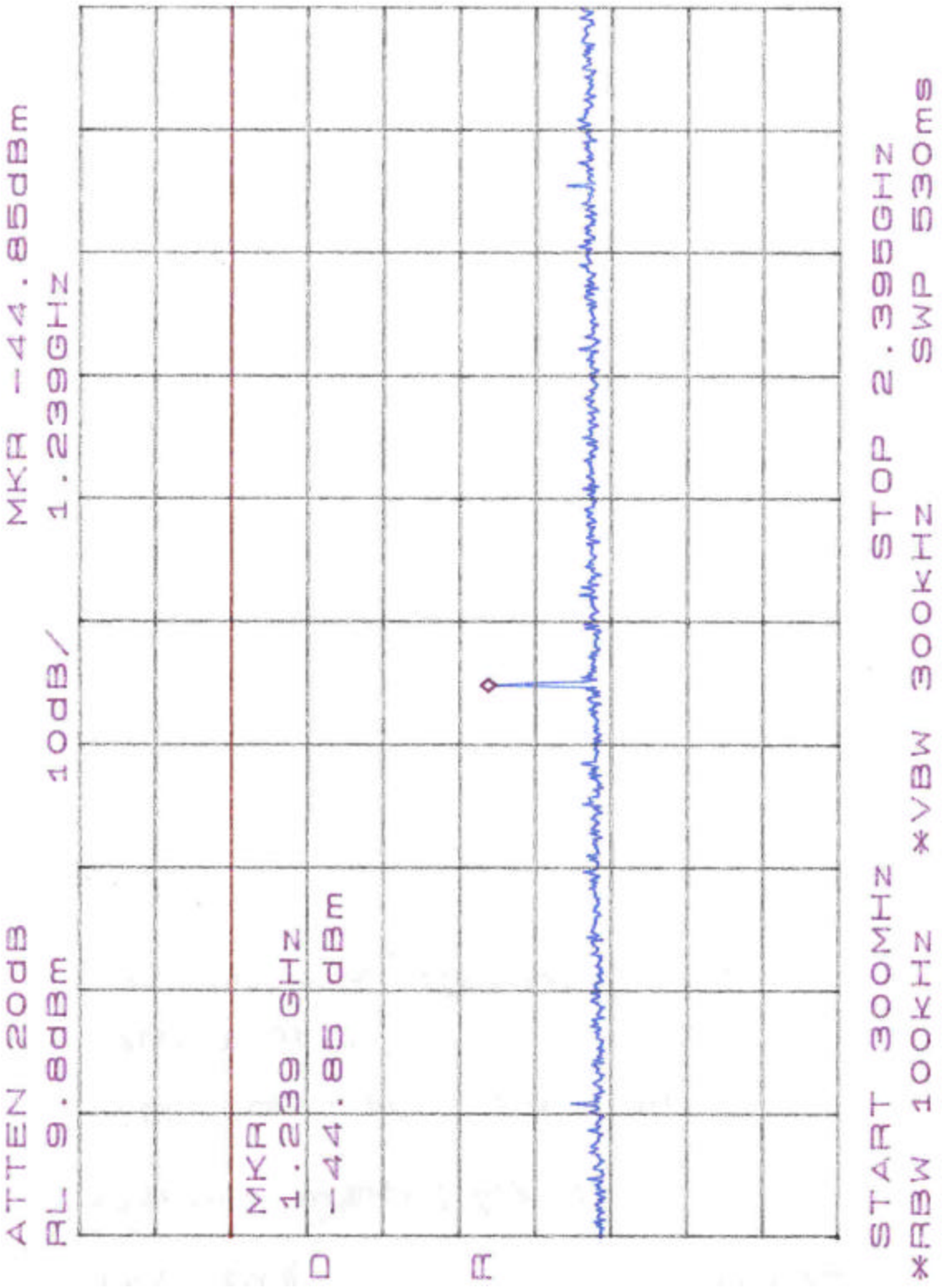

Figure 15. Conducted Spurious, High Channel, Plot 2

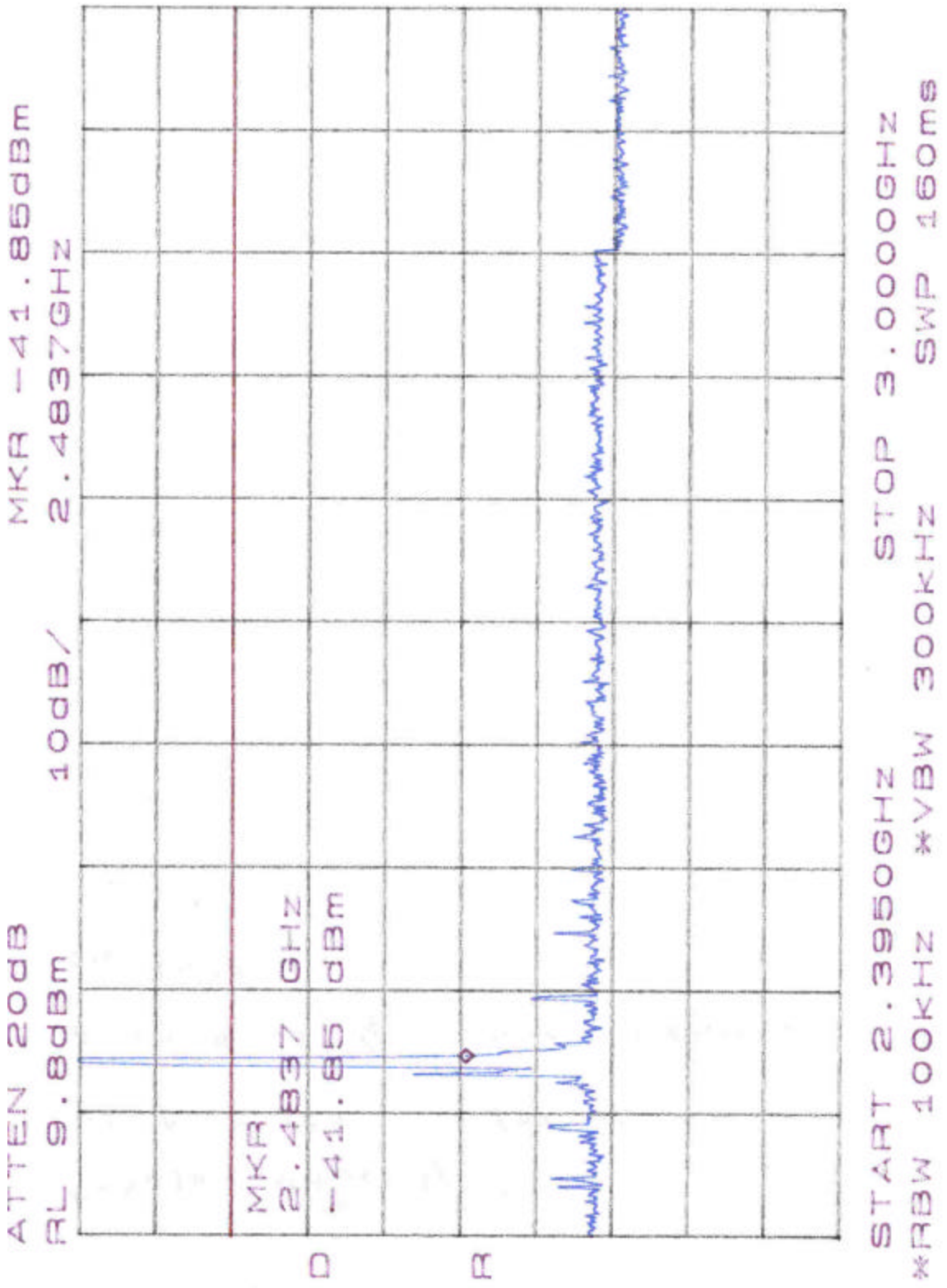

Figure 16. Conducted Spurious, High Channel, Plot 3

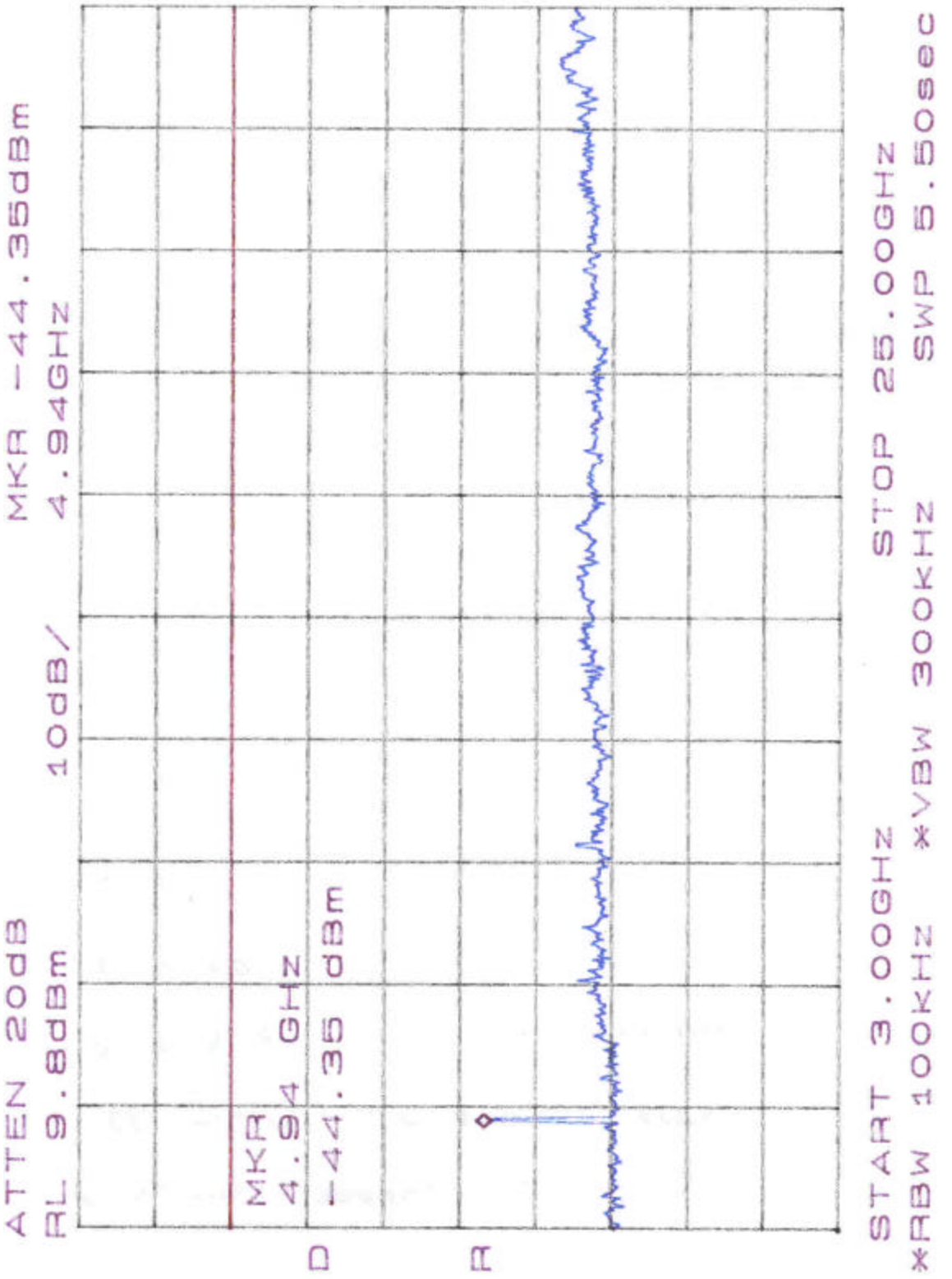

Figure 17. Conducted Spurious, High Channel, Plot 4

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

The EUT must comply with the radiated spurious emission limits of 15.209(a) for emissions that fall in the restricted bands as defined in Section 15.205(a). The limits are as shown in the following table.

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 emissions were measured using the following resolution bandwidths:

Frequency Range	Resolution Bandwidth	Video Bandwidth
30MHz-1000 MHz	100kHz	>100kHz
>1000 MHz	1 MHz	10Hz (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 for the restricted bands.

Emissions were measured to the 10^{th} harmonic of the transmit frequency.

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:	Eµ V/m = antilog (EdBµV/m/20)

*Note: In certain setups the amplifier gain is programmed into the spectrum analyzer and therefore already accounted for in the SA Level reading. In this situation the Amplifier Gain would be set to 0 dB in the table heading. Data is recorded in Table 7 through Table 9.

Table 7: Radiated Emission Test Data (§15.205 Restricted Bands)

CLIENT: EKA Systems DATE: 3/28/02
TESTER: S. Lavorata JOB #: 7044

EUT Information:
EUT: Bluemeter Meter Module, PN 3000107-001, Version/Rev:01, S/N: Eng. Unit
CONFIGURATION: EUT Installed in GE KV Kwatt meter

Test Equipment/Limit: **Test Requirements:**
ANTENNA: A_00004 TEST STANDARD: FCC Part 15.247
CABLE: CSITE2_HF DISTANCE: 3m
LIMIT: LFCC_3m_Class_B CLASS: B

Average emissions data (Tx = 2402MHz)
Pre-Amplifier Gain = 30dB (Entered into offset of Spectrum Analyzer)

Freq (MHz)	Pol H/V	Azimuth Degree	Ant. Height (m)	SA Level (Avg) (dBuV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Corr. Level (dBuV/m)	Corr. Level (uV/m)	Limit (uV/m)	Margin dB	Notes
4804.00	V	45.0	1.0	7.8	32.8	4.2	44.8	173.4	500.0	-9.2	
4804.00	H	270.0	1.0	8.5	32.8	4.2	45.4	187.3	500.0	-8.5	
12010.00	V	0.0	1.0	1.7	41.3	5.1	48.0	251.7	500.0	-6.0	amb
12010.00	H	0.0	1.0	1.7	41.3	5.1	48.0	252.5	500.0	-5.9	amb
19216.00	V	0.0	1.0	2.9	39.8	4.0	46.7	216.3	500.0	-7.3	amb
19216.00	H	0.0	1.0	2.9	39.8	4.0	46.7	216.3	500.0	-7.3	amb

Peak Data

Freq. (MHz)	Pol. H/V	Azimuth Degree	Ant. Height (m)	SA Level (Peak) (dBuV)	Pre-Amp Gain (dB)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Corr. Level (dBuV/m)	Corr. Level (uV/m)	Limit (uV/m)	Margin dB	Notes
4804.00	V	157.5	1.0	55.1	34	32.8	4.2	58.1	801.6	5000.0	-15.9	
12010.00	V	180.0	1.0	45.3	34	41.3	5.1	57.6	762.7	5000.0	-16.3	
19216.00	V	0.0	1.0	36.3	34	39.4	3.5	45.2	182.0	5000.0	-28.8	NF/Peak
4804.00	H	135.0	1.0	55.6	34	32.8	4.2	58.5	846.1	5000.0	-15.4	NF/Peak
12010.00	H	135.0	1.0	43.3	34	41.3	5.1	55.6	605.8	5000.0	-18.3	NF/Peak
19216.00	H	0.0	1.0	36.3	34	39.4	3.5	45.2	182.0	5000.0	-28.8	NF/Peak

NF = Noise Floor

Table 8: Radiated Emission Test Data (§15.205 Restricted Bands)

CLIENT:	EKA Systems	DATE:	4/17/02
TESTER:	S. Lavorata	JOB #:	7044

EUT Information:

EUT: Bluemeter Meter Module, PN 3000107-001, Version/Rev:01, S/N:Eng. Unit
CONFIGURATION: EUT Installed in GE KV Kwatt meter

Test Equipment/Limit:		**Test Requirements:**	
ANTENNA:	A_00004	TEST STANDARD:	FCC Part 15.247
CABLE:	CSITE2_HF	DISTANCE:	3m
LIMIT:	LFCC_3m_Class_B	CLASS:	B

Average emissions data (Tx = 2441MHz)
Pre-Amplifier Gain = 30dB (Entered into offset of Spectrum Analyzer)

Freq (MHz)	Pol H/V	Azimuth Degree	Ant. Height (m)	SA Level (Avg) (dBuV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Corr. Level (dBuV/m)	Corr. Level (uV/m)	Limit (uV/m)	Margin dB	Notes
4882.00	H	248.0	1.0	10.2	32.9	4.3	47.4	233.5	500.0	-6.6	
4882.00	V	225.0	1.0	10.3	32.9	4.3	47.5	237.0	500.0	-6.5	
7323.00	H	270.0	1.0	2.0	37.9	4.6	44.4	166.8	500.0	-9.5	
7323.00	V	45.0	1.0	3.0	37.9	4.6	45.4	187.1	500.0	-8.5	
12205.00	H	0.0	1.0	1.0	40.6	5.4	47.1	226.3	500.0	-6.9	amb
12205.00	V	0.0	1.0	0.9	40.6	5.4	47.0	223.7	500.0	-7.0	amb
19528.00	H	0.0	1.0	2.7	39.7	4.2	46.6	213.8	500.0	-7.4	amb
19528.00	V	0.0	1.0	2.7	39.7	4.2	46.6	213.8	500.0	-7.4	amb

Peak Data

Freq. (MHz)	Pol. H/V	Azimuth Degree	Ant. Height (m)	SA Level (Peak) (dBuV)	Pre-Amp Gain (dB)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Corr. Level (dBuV/m)	Corr. Level (uV/m)	Limit (uV/m)	Margin dB	Notes
4882.00	V	225.0	1.0	48.8	30	32.9	4.3	56.0	628.5	5000.0	-18.0	
4882.00	H	248.0	1.0	54.5	30	32.9	4.3	61.7	1211.5	5000.0	-12.3	
7323.00	V	45.0	1.0	42.5	30	37.9	4.6	54.9	558.6	5000.0	-19.0	
7323.00	H	270.0	1.0	45.2	30	37.9	4.6	57.6	762.3	5000.0	-16.3	
12205.00	V	0.0	1.0	43.0	30	40.6	5.4	59.1	900.9	5000.0	-14.9	amb
12205.00	H	0.0	1.0	43.8	30	40.6	5.4	59.9	987.8	5000.0	-14.1	amb
19528.00	V	0.0	1.0	12.0	0*	39.8	4.0	55.8	616.6	5000.0	-18.2	amb
19528.00	H	0.0	1.0	12.0	0*	39.8	4.0	55.8	616.6	5000.0	-18.2	amb

*Pre-amp gain of 30dB programmed into Spectrum Analyzer as an offset.

Table 9: Radiated Emission Test Data (§15.205 Restricted Bands)

CLIENT:	EKA Systems	DATE:	4/17/02
TESTER:	S. Lavorata	JOB #:	7044

EUT Information:

EUT: Bluemeter Meter Module, PN 3000107-001, Version/Rev:01, S/N:Eng. Unit
CONFIGURATION: EUT Installed in GE KV Kwatt meter

Test Equipment/Limit:		**Test Requirements:**	
ANTENNA:	A_00004	TEST STANDARD:	FCC Part 15.247
CABLE:	CSITE2_HF	DISTANCE:	3m
LIMIT:	LFCC_3m_Class_B	CLASS:	B

Average emissions data (TX = 2480MHz)
Pre-Amplifier Gain = 30dB (Entered into offset of Spectrum Analyzer)

Freq (MHz)	Pol H/V	Azimuth Degree	Ant. Height (m)	SA Level (Peak) (dBuV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Corr. Level (dBuV/m)	Corr. Level (uV/m)	Limit (uV/m)	Margin dB	Notes
4960.00	V	45.0	1.0	11.0	33.0	4.4	48.4	262.5	500.0	-5.6	
4960.00	H	45.0	1.0	13.5	33.0	4.4	48.4	262.5	500.0	-3.1	
7440.00	V	112.0	1.0	1.5	38.0	4.6	44.1	160.1	500.0	-9.9	amb
7440.00	H	112.0	1.0	1.5	38.0	4.6	44.1	160.1	500.0	-9.9	amb
12400.0	V	90.0	1.0	1.5	40.0	5.8	47.3	232.9	500.0	-6.6	
12400.0	H	90.0	1.0	3.0	40.0	5.8	47.3	232.9	500.0	-6.6	
19840.0	V	0.0	1.0	2.8	39.9	4.4	47.1	226.5	500.0	-6.9	amb
19840.0	H	0.0	1.0	2.8	39.9	4.4	47.1	226.5	500.0	-6.9	amb
22320.0	V	0.0	1.0	3.4	40.5	5.5	49.4	295.8	500.0	-4.6	amb
22320.0	H	0.0	1.0	3.4	40.5	5.5	49.4	295.8	500.0	-4.6	amb

Peak Data

Freq. (MHz)	Pol. H/V	Azimuth Degree	Ant. Height (m)	SA Level (Peak) (dBuV)	Pre-Amp Gain (dB)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Corr. Level (dBuV/m)	Corr. Level (uV/m)	Limit (uV/m)	Margin dB	Notes
4960.00	H	338.0	1.0	55.8	30	33.0	4.4	63.2	1442.3	5000.0	-10.8	
4960.00	V	45.0	1.0	56.7	30	33.0	4.4	64.1	1599.8	5000.0	-9.9	
7440.00	H	180.0	1.0	43.5	30	38.0	4.6	56.1	637.3	5000.0	-17.9	
7440.00	V	112.0	1.0	43.0	30	38.0	4.6	55.6	601.7	5000.0	-18.4	
12400.0	H	0.0	1.0	43.2	30	40.0	5.8	59.0	895.8	5000.0	-14.9	amb
12400.0	V	90.0	1.0	43.0	30	40.0	5.8	58.8	875.4	5000.0	-15.1	
19840.0	H	0.0	1.0	11.2	0*	39.6	4.0	54.8	550.2	5000.0	-19.2	amb
19840.0	V	0.0	1.0	11.2	0*	39.6	4.0	54.8	550.2	5000.0	-19.2	amb
22320.0	H	0.0	1.0	12.2	0*	40.5	6.0	58.7	861.0	5000.0	-15.3	amb
22320.0	V	0.0	1.0	12.2	0*	40.5	6.0	58.7	861.0	5000.0	-15.3	amb

*Pre-amp gain of 30dB programmed into Spectrum Analyzer as an offset.

4.6 Conducted Emissions (AC Powerline)

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 /50 mH 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 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.

AC Power Line conducted emissions test data are included in Table 10.

Table 10: Conducted Emissions Test Data Sheet

CLIENT:	EKA Systema	DATE:	3/27/2002
TESTER:	S. Lavorata	JOB #:	7044
TEST STANDARD:	FCC Part 15		
CLASS:	B		
TEST VOLTAGE:	120 VAC		

LINE 1 - NEUTRAL

Freq. MHz	Voltage (QP) dBuV	Voltage uV	FCC Limit uV	Margin dB
0.45	38.6	85.1	250.0	-9.4
0.53	37.3	73.3	250.0	-10.7
1.42	33.3	46.2	250.0	-14.7
3.42	33.4	46.8	250.0	-14.6
10.00	31.1	35.9	250.0	-16.9
16.03	32.2	40.7	250.0	-15.8
21.03	30.6	33.9	250.0	-17.4

LINE 2 - PHASE

Freq. MHz	Voltage (QP) dBuV	Voltage uV	FCC Limit uV	Margin dB
0.45	36.6	67.6	250.0	-11.4
0.53	38.5	84.1	250.0	-9.5
1.53	31.9	39.4	250.0	-16.1
3.20	34.0	50.1	250.0	-14.0
10.00	31.2	36.3	250.0	-16.8
16.03	31.0	35.5	250.0	-17.0
21.03	30.6	33.9	250.0	-17.4