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Radio Systems Corporation
FCC Part 15, Certification Report
Model IF-101 Transmitter

Test Date(s): April 1 & 6, 2005

UST Project: 05-0115

Issue Date: April 13, 2005

U.S. Technologies, Inc.		Test Report, Part 15 Rev: 040103
Report Number:	05-0115	Issue Date: April 13, 2005
Customer:	Radio Systems Corporation	
Model:	IF-101 Transmitter	

MEASUREMENT/TECHNICAL REPORT

This report concerns (check one): Original grant_X_
Class II change__

Equipment type: **Low Frequency, Low Power Transmitter**

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? yes_____ No_X_

If yes, defer until:_____
date

__N.A.__ agrees to notify the Commission by__NA___
date
of the intended date of announcement of the product so that the grant can be issued on that date.

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GENERAL INFORMATION

GENERAL INFORMATION

Product Description

The Equipment Under Test (EUT) is the IF-101 Transmitter. The EUT is part of a system that is used for pet containment to a specific area. The EUT transmits an Electro-magnetic signal circular in area that establishes the area for the pet to move about. The pet wears a receiver collar that detects the signal from the transmitter. When the pet is out of range of the transmitter, the pet will receive a static correction so that the pet will stay within the specified area.

Testing of the 18.7 kHz Electro-magnetic field was conducted with the EUT transmitting continuously at the max field condition.

Related Submittal(s) Grant(s)

The EUT is subject to the following authorization:

a) Certification as a low power transmitter (18.7 kHz)

The information contained in this report is presented for the Certification authorization for the transmitter portion of the EUT.

SECTION 2

TESTS AND MEASUREMENTS

TESTS AND MEASUREMENTS

Configuration of Tested System

The sample was tested per ANSI C63.4, Methods of Measurement from Low-Voltage Electrical and Electronic Equipment in the Range of 30 MHz -1 GHz (1992). Conducted and radiated emissions data were taken with the test receiver or spectrum analyzer's resolution bandwidth adjusted to 100 Hz (9 kHz – 150 kHz), 9kHz (150 kHz - 30 MHz), and 120 kHz (30 MHz - 1 GHz) respectively. All measurements are peak unless stated otherwise. The video filter associated with the spectrum analyzer was off throughout the evaluation process. Interconnecting cables were manipulated as necessary to maximize emissions. A block diagram of the tested system is shown in Figure 1. Test configuration photographs for spurious and fundamental emissions are shown in Figure 2.

Results below 100 kHz were corrected to 300 meters by the following 40 log (300/3) - 80 dB (which has been applied to other submittals and is allowed per previous discussions with Greg Czumak at the FCC).

Test Facility

Conducted and digital device testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA.

Test Equipment

Table 2 describes test equipment used to evaluate this product.

Modifications

No modifications were made to bring the EUT into compliance with FCC Part 15, Class B Requirements.

FIGURE 1

TEST CONFIGURATION

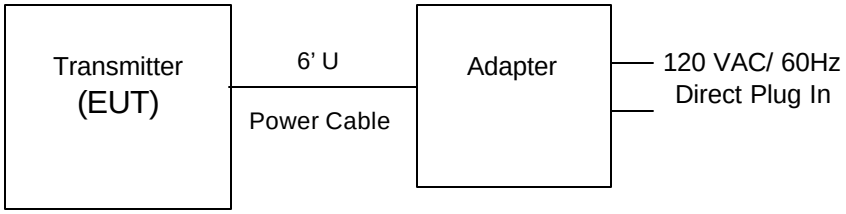
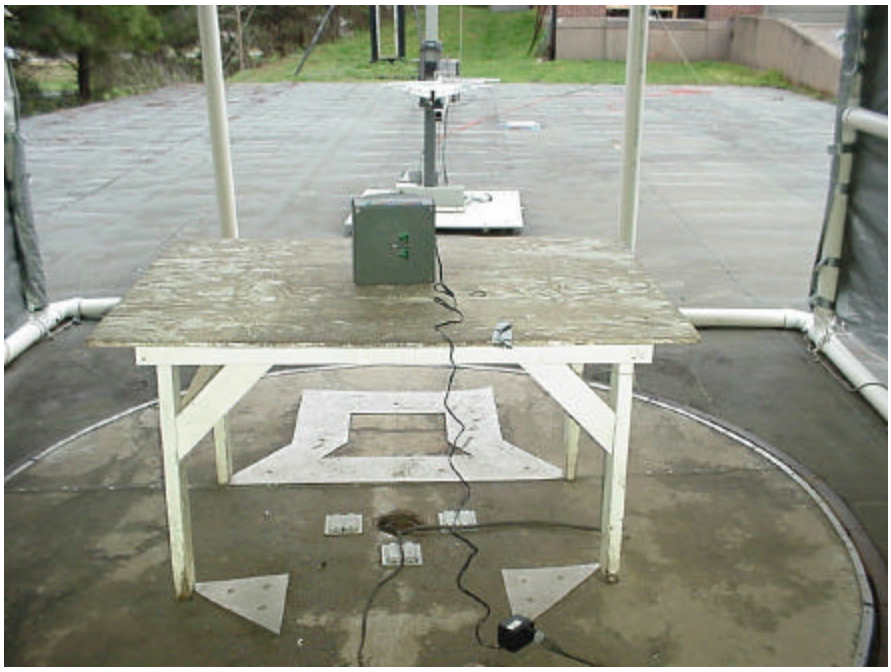


FIGURE 2a

Photograph(s) for Spurious and Fundamental Emissions

FIGURE 2b

Photograph(s) for Spurious and Fundamental Emissions



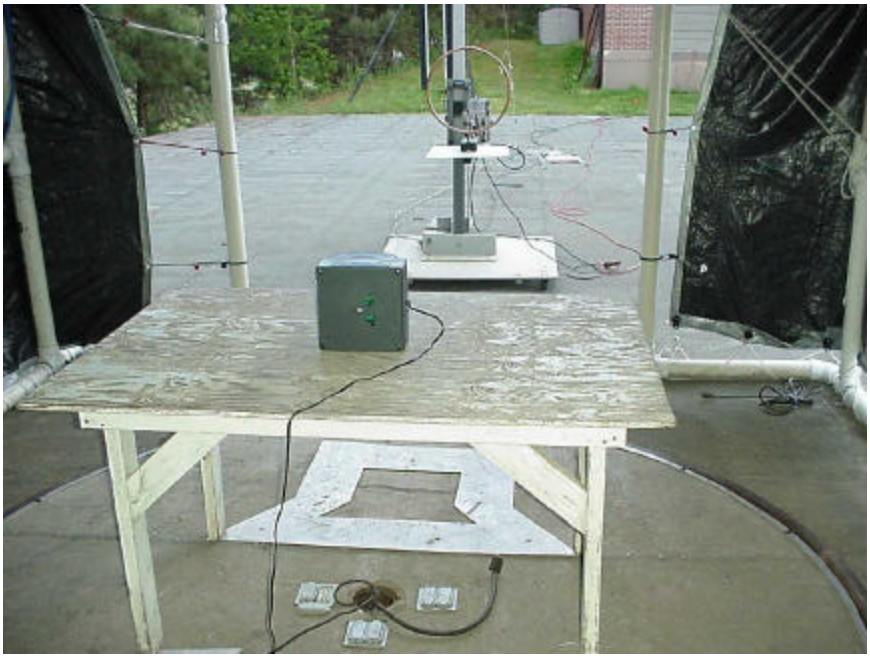


FIGURE 2c

Photograph(s) for Conducted Emissions

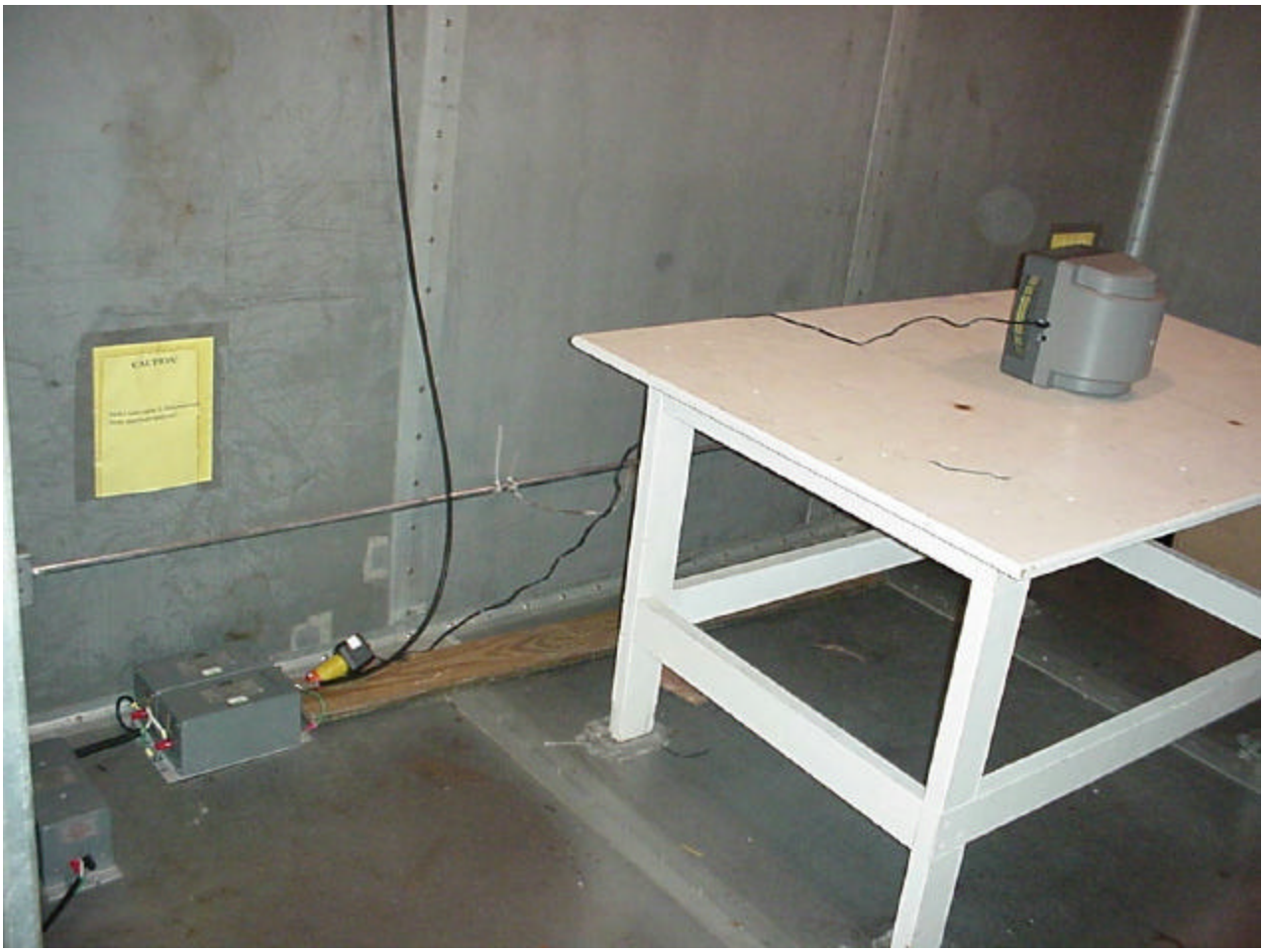


Table 1a

EUT and Peripherals

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
Transmitter (EUT)	IF-101	None	KE3IF101 (Pending)	6' U Power Cable
Adapter ENG Electric Co. Ltd.	57A-14-1800	None	N/A	120 VAC/ 60 Hz Direct Plug-in

Table 1b

Detail of I/O Cables Attached to EUT

DESCRIPTION OF CABLE	DETAILS OF CABLE			CABLE LENGTH
Power Cable	Manufacturer and Part Number			6’
	Shield Type	**Shield Termination**	**Type of Backshell**	
	N/A	N/A	N/A	

TABLE 2

TEST INSTRUMENTS

EQUIPMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	DATE OF LAST CALIBRATION
SPECTRUM ANALYZER	8558B	HEWLETT-PACKARD	2332A10055	2/25/05
SPECTRUM ANALYZER	8593E	HEWLETT-PACKARD	3205A00124	3/1/05
RF PREAMP	8447D	HEWLETT-PACKARD	2944A07436	4/29/04
BICONICAL ANTENNA	3110	EMCO	9307-1431	5/18/04
LOG PERIODIC ANTENNA	3146	EMCO	3236	6/30/05
LOOP ANTENNA	SAS/562	A.H. SYSTEMS	142	6/29/04
LISN (x 2) 8028-50-TS24-BNC	8028	SOLAR ELE.	910494 & 910495	1/27/05
CALCULATION PROGRAM	N/A	N/A	EMCCALC	N/A

Note: The calibration interval of the above test instruments is 12 months

Field Strength of Fundamental Emission (47 CFR 15.209)

Measurements were made using a peak detector. Field strength of the peak fundamental emission is shown in Figure 4.

For purposes of this test, the EUT was set to a maximum duty cycle, maximum TX power, and 18.7 kHz transmit frequency.

Duty Cycle Correction During 100 msec:

Although the Transmitter has a Duty Cycle associated with the output of the transmitter, Duty Cycle correction was not applied.

FIGURE 3

Duty Cycle Correction Not Applied
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TABLE 3

FIELD STRENGTH OF FUNDAMENTAL EMISSION

Peak Measurements, Average Limits

FREQ. (kHz)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	RESULTS (uV/m) @ 300m	FCC LIMITS (uV/m) @ 300m	Margin (dB)
18.7	-49.2	21.4	0.91	128.3	27.4

SAMPLE CALCULATIONS:

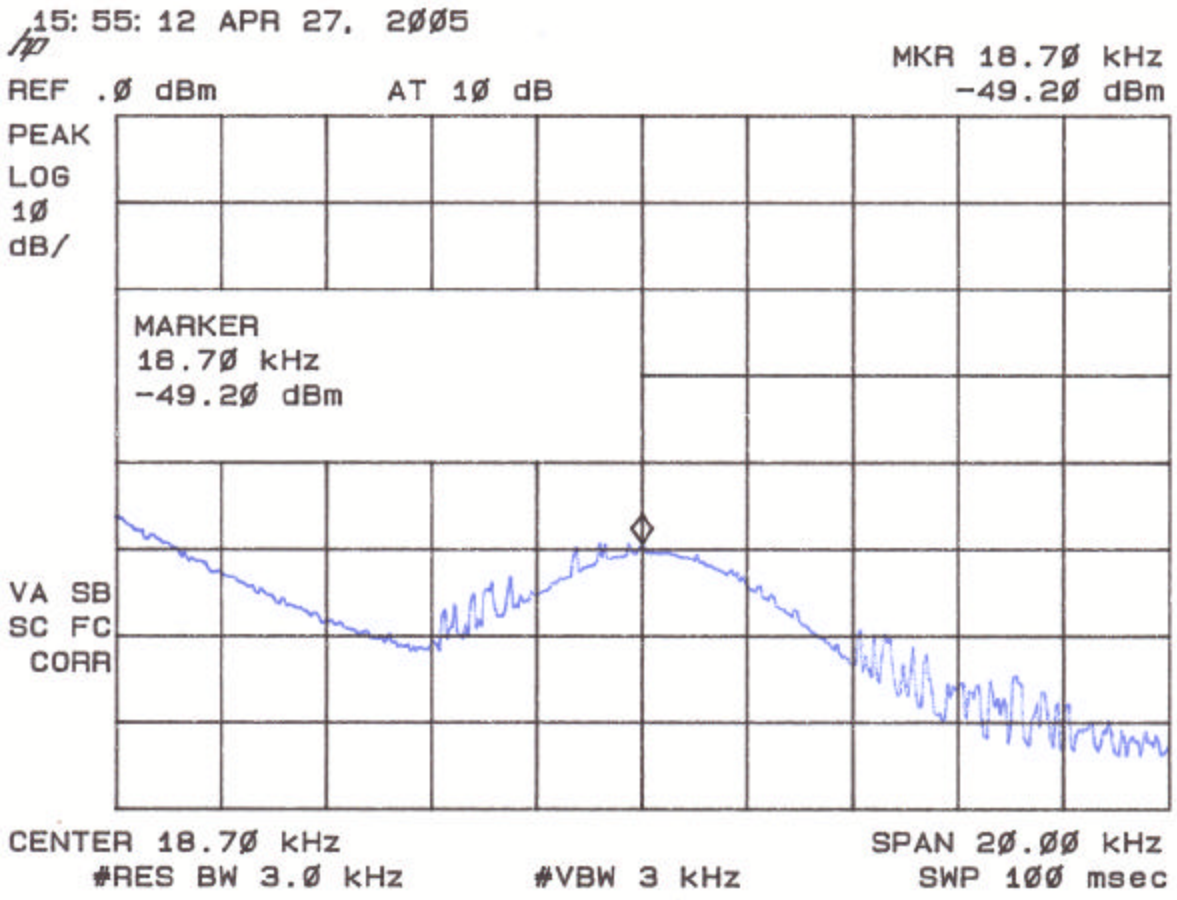
RESULTS uV/m @ 300m = Antilog ((-49.2 + 21.4 + 107 – 80)/20) = 0.91
CONVERSION FROM dBm TO dBuV = 107 dB
CORRECTION FROM 3m TO 300m =40 Log (3/300)= -80 dB

Test Date: April 1, 2005

Tested by
Signature:  **Name: David Blethen**

Figure 4

FIELD STRENGTH OF FUNDAMENTAL EMISSION (Peak)



Field Strength Of Spurious Emissions (47 CFR 15.209)

Measurements were made using a peak detector. Field strength of Spurious Emissions are shown in Figure 4. For all emission measurements made the limits given in 15.209 were applied.

For purposes of this test, the EUT was set to a maximum duty cycle, maximum TX power, and 18.7 kHz transmit frequency.

TABLE 4

FIELD STRENGTH OF SPURIOUS EMISSIONS

Peak/Quasi-Peak (< 30 MHz), Average Limits

FREQ. (kHz.)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	PEAK RESULTS (uV/m) @ 300m	AVERAGE FCC LIMITS (uV/m) @ 300m	MARGIN BELOW LIMIT (uV/m) @ 300m	Antenna Position
37.4	-74.1	15.5	0.03	64.2	64.2	Loop Facing
37.4	-74.2	15.5	0.03	64.2	64.2	Vertical Loop
37.4	-74.5	15.5	0.03	64.2	64.2	Horizontal Loop
56.1	-74.8	11.7	0.02	42.8	42.8	Loop Facing
56.1	-74.8	11.7	0.02	42.8	42.8	Vertical Loop
56.1	-74.8	11.7	0.02	42.8	42.8	Horizontal Loop

SAMPLE CALCULATIONS:

RESULTS uV/m @ 300m = Antilog ((-74.1 + 15.5 + 107 – 80)/20) = 0.03
CONVERSION FROM dBm TO dBuV = 107 dB
CORRECTION FROM 3m TO 300m =40 Log (3/300)= -80 dB

Test Date: April 1, 2005

Tested by
Signature: David B. Blethen **Name: David Blethen**

FIGURE 5a

FIELD STRENGTH OF SPURIOUS EMISSIONS

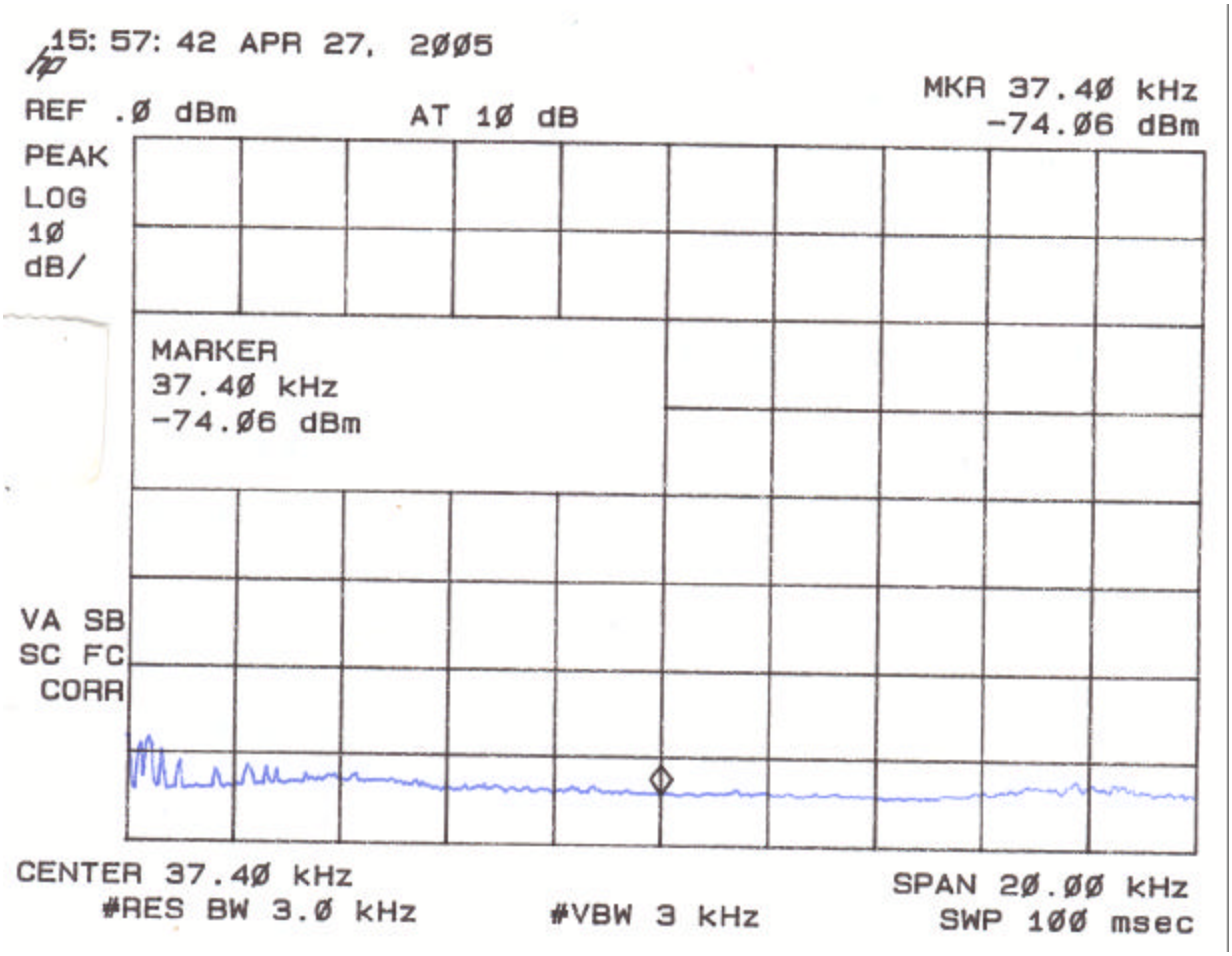


FIGURE 5b

FIELD STRENGTH OF SPURIOUS EMISSIONS

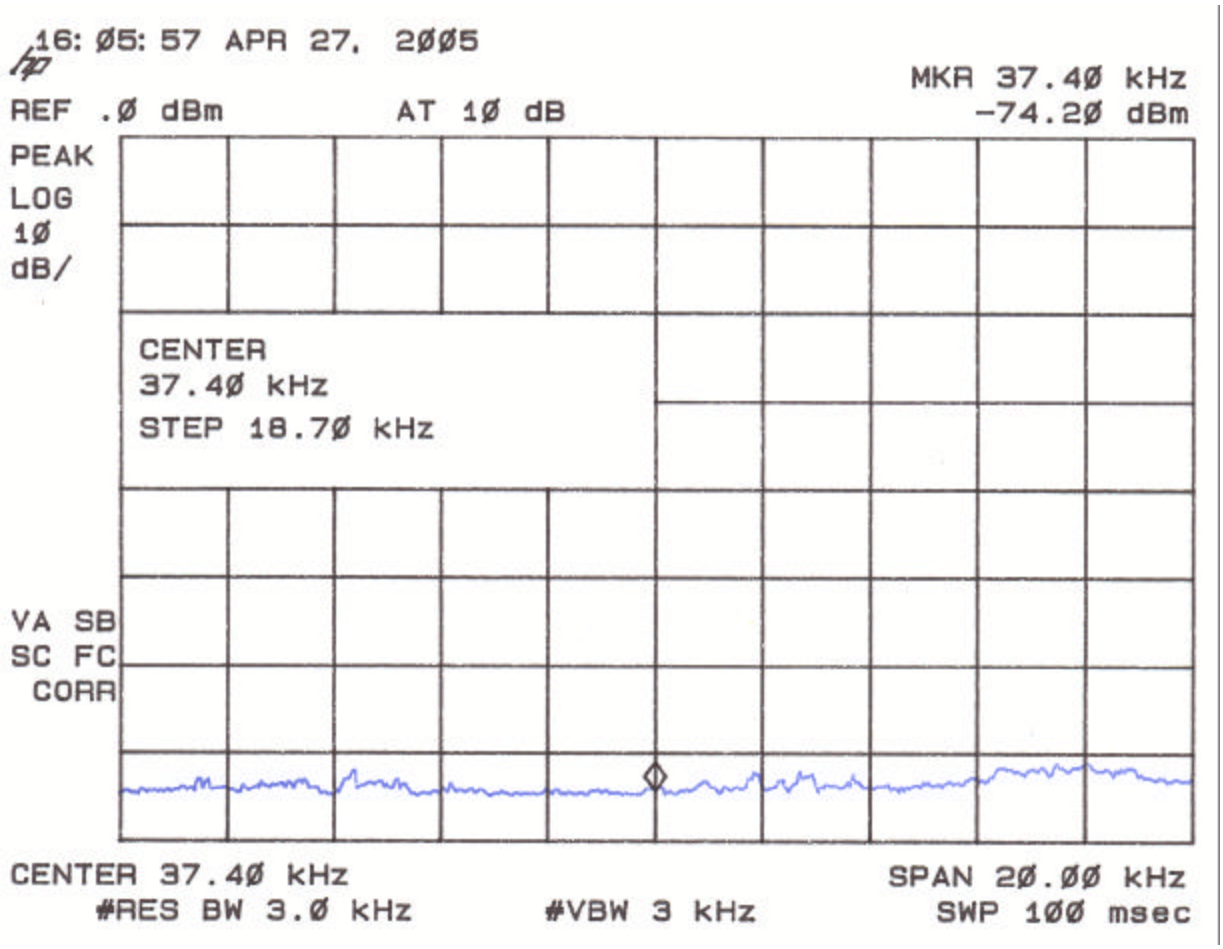


FIGURE 5c

FIELD STRENGTH OF SPURIOUS EMISSIONS

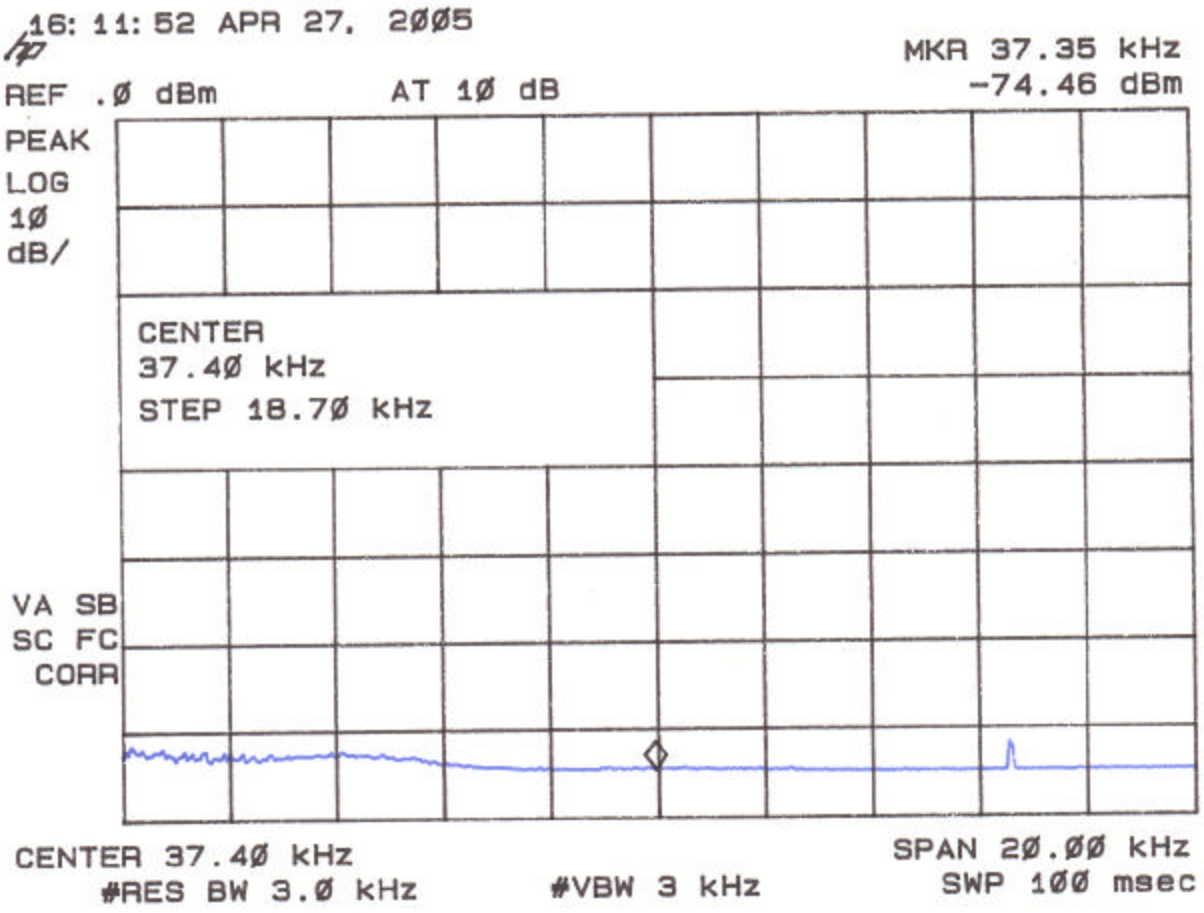


FIGURE 5d

FIELD STRENGTH OF SPURIOUS EMISSIONS

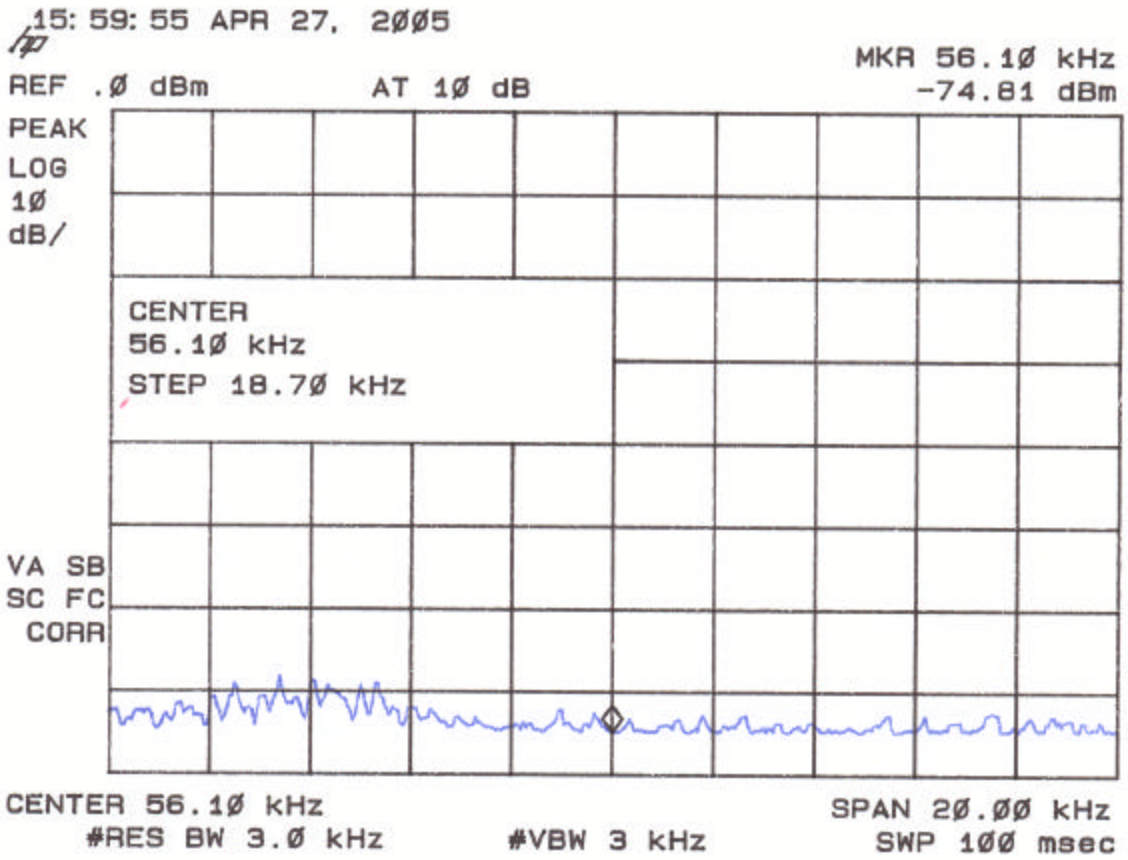


FIGURE 5e

FIELD STRENGTH OF SPURIOUS EMISSIONS

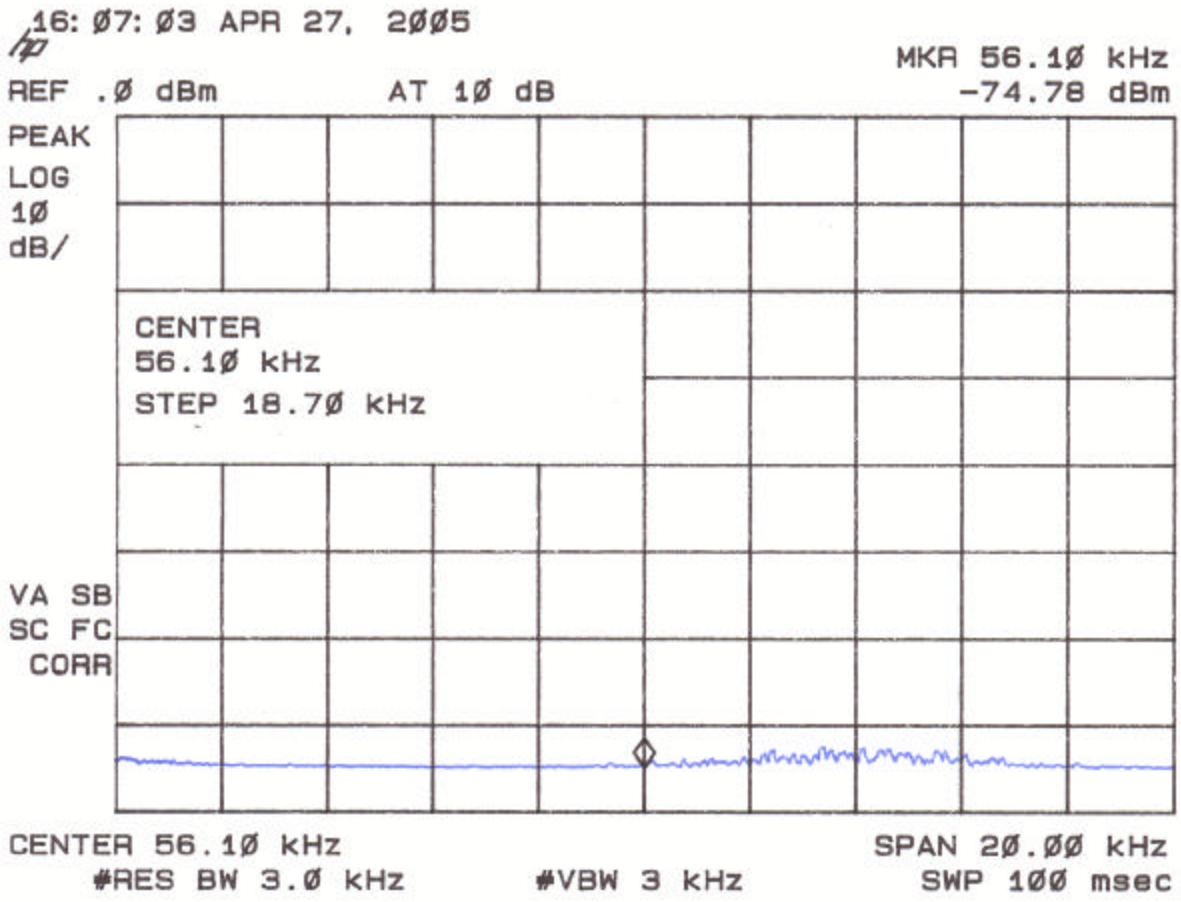
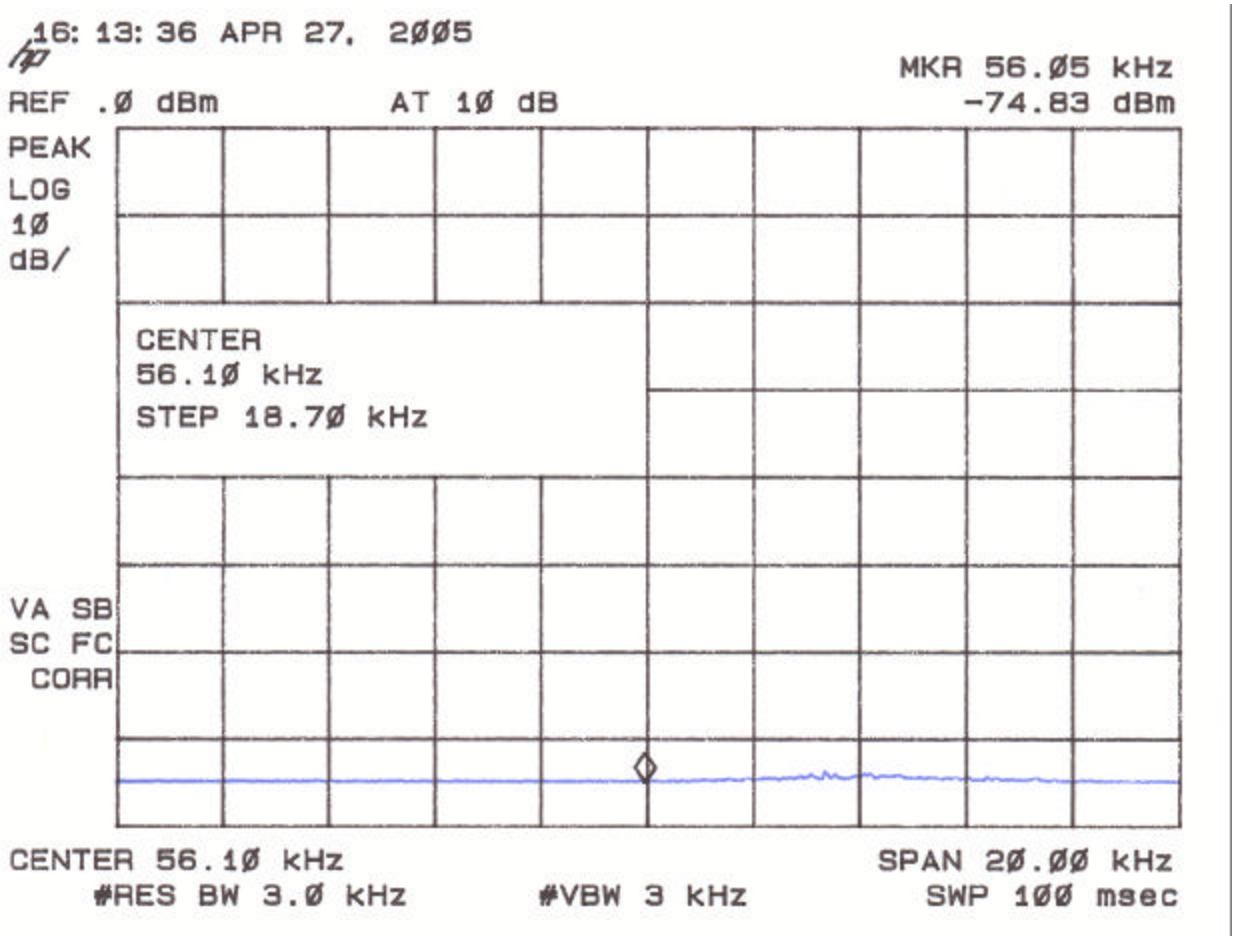


FIGURE 5f

FIELD STRENGTH OF SPURIOUS EMISSIONS



Radiated Emissions (47 CFR 15.109a)

Radiated emissions were evaluated from 30 to 1000 MHz. Measurements were made with the analyzer's bandwidth set to 120 kHz. These results are shown in Table 5.

Table 5
Radiated Emissions
Class B

Peak/Quasi-Peak (30 MHz – 1 GHz), Peak Limits

Radiated Emissions							
Test By:	Test: FCC Part 15 Digital Device				Client: Radio Systems		
DPB	Project: 05-0115				Model: IF-101		
Frequency (MHz)	**Test Data (dBm)**	**Test Data (dBuV)**	**AF+CA-AMP (dB)**	**Results (uV/m)**	**Limits (uV/m)**	**Margin (dB)**	**PK = n / QP**
53.50	-92.0	15.0	11.4	21.0	100.0	13.6	**PK**
68.3	-86.0	21.0	10.4	37.1	100.0	8.6	**PK**
84	-88.0	19.0	11.7	34.1	100.0	9.3	**PK**

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog ((-92.0 + 11.4 + 107/20) = 21.0
CONVERSION FROM dBm TO dBuV = 107 dB

Test Date: April 1, 2005

Tested by
Signature:  **Name: David Blethen**

Power Line Conducted Emissions (47 CFR 15.107a)

Conducted Emissions were evaluated from 150 kHz to 30 MHz. Measurements were made with the analyzer's bandwidth set to 9 kHz, emissions are shown in Tables 6a through 6d.

TABLE 6a CONDUCTED EMISSIONS DATA

CLASS B

(Peak / Quasi-Peak vs. Peak Limits)
0.15 MHz – 30 MHz

PHASE DATA

Line Conducted Emissions

Test By:	**Test:** Part 15 Phase vs. QP limits				**Client:** Radio Systems		
DPB	**Project:** 05-0115				**Model:** IF-101		
Frequency (MHz)	**Test Data (dBm)**	**Test Data (dBuV)**	**AF+CA-AMP (dB)**	**Results (dBuV)**	**Limits (dBuV)**	**Margin (dB)**	**PK = n / QP**
0.18	-45.7	61.3	0.2	61.5	65.1	**3.6**	**QP,PK=-41**
0.2	-47.2	59.8	0.3	60.1	64.6	**4.5**	**QP,PK=-43**
0.215	-48.3	58.7	0.3	59.0	64.1	**5.1**	**QP,PK=-45**
0.298	-61.5	45.5	0.2	45.7	61.8	**16.1**	**QP,PK=-55**
0.425	-64.0	43.0	0.2	43.2	58.1	**14.9**	**QP,PK=-57**
0.688	-71.8	35.2	0.2	35.4	56.0	**20.6**	**QP,PK=-63**

SAMPLE CALCULATIONS: RESULTS = 61.3 + 0.2 = 61.5 dBuV

Test Date: April 6, 2004

Tested by
Signature:  **Name: David Blethen**

TABLE 6b CONDUCTED EMISSIONS DATA

CLASS B

(Peak / Quasi-Peak vs. Peak Limits)
0.15 MHz – 30 MHz

NEUTRAL DATA

Line Conducted Emissions

Test By:	**Test:** Part 15 Neutral vs. QP limits				**Client:** Radio Systems		
DPB	**Project:** 05-0115				**Model:** IF-101		
Frequency (MHz)	**Test Data (dBm)**	**Test Data (dBuV)**	**AF+CA-AMP (dB)**	**Results (dBuV)**	**Limits (dBuV)**	**Margin (dB)**	**PK = n / QP**
0.18	-45.4	61.6	0.2	61.8	65.1	**3.3**	**QP,PK=-41**
0.2	-46.8	60.2	0.3	60.5	64.6	**4.1**	**QP,PK=-42**
0.215	-50.5	56.5	0.3	56.8	64.1	**7.3**	**QP,PK=-44**
0.298	-62.7	44.3	0.2	44.5	61.8	**17.3**	**QP,PK=-56**
0.425	-64.1	42.9	0.2	43.1	58.1	**15.0**	**QP,PK=-56**
0.688	-71.8	35.2	0.2	35.4	56.0	**20.6**	**QP,PK=-63**

SAMPLE CALCULATIONS: RESULTS = 61.6 + 0.2 = 61.8 dBuV

Test Date: April 6, 2004

Tested by
Signature:  **Name: David Blethen**

TABLE 6c CONDUCTED EMISSIONS DATA

CLASS B

(Average vs. Average Limits)
0.15 MHz – 30 MHz

PHASE DATA

Line Conducted Emissions							
Test By:	Test: Part 15 Phase vs. Average limits				Client: Radio Systems		
DPB	Project: 05-0115				Model: IF-101		
Frequency (MHz)	Test Data (dBm)	Test Data (dBuV)	AF+CA-AMP (dB)	Results (dBuV)	Limits (dBuV)	Margin (dB)	PK = n / QP
0.18	-94.1	12.9	0.2	13.1	55.1	42.0	**AVG**
0.2	-94.6	12.4	0.3	12.7	54.6	41.9	**AVG**
0.215	-96.2	10.8	0.3	11.1	54.1	43.0	**AVG**
0.298	-96.8	10.2	0.2	10.4	51.8	41.4	**AVG**
0.425	-97.7	9.3	0.2	9.5	48.1	38.6	**AVG**
0.688	-96.1	10.9	0.2	11.1	46.0	34.9	**AVG**

SAMPLE CALCULATIONS: RESULTS = 12.9 + 0.2 = 13.1 dBuV

Test Date: April 6, 2004

Tested by
Signature: David B. Blethen **Name: David Blethen**

TABLE 6d CONDUCTED EMISSIONS DATA

CLASS B

(Average vs. Average Limits)
0.15 MHz – 30 MHz

NEUTRAL DATA

Line Conducted Emissions

Test By:	Test: Part 15 Neutral vs. Average limits				Client: Radio Systems		
DPB	Project: 05-0115				Model: IF-101		
Frequency (MHz)	Test Data (dBm)	Test Data (dBuV)	AF+CA-AMP (dB)	Results (dBuV)	Limits (dBuV)	Margin (dB)	PK = n / QP
0.18	-100.7	6.3	0.2	6.5	55.1	48.6	**AVG**
0.2	-99.9	7.1	0.3	7.4	54.6	47.2	**AVG**
0.215	-101.5	5.5	0.3	5.8	54.1	48.3	**AVG**
0.298	-100.3	6.7	0.2	6.9	51.8	44.9	**AVG**
0.425	-101.1	5.9	0.2	6.1	48.1	42.0	**AVG**
0.688	-92.2	14.8	0.2	15.0	46.0	31.0	**AVG**

SAMPLE CALCULATIONS: RESULTS = 6.3 + 0.2 = 6.5 dBuV

Test Date: April 6, 2004

Tested by
Signature:  **Name: David Blethen**