



**Radio Systems Corporation
FCC Part 15, Certification Report
Model TC-101
Test Date(s): 2/20/04, 03/2/04, 05/24/04**

May 25, 2004

U.S. Technologies, Inc.

Test Report, Part 15

Rev: 040103

Issue Date: May 25, 2004

Report Number: 04-0020

Customer: Radio Systems Corporation

Model: TC-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.

Report prepared by:

United States Technologies, Inc.
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SECTION 1

GENERAL INFORMATION

U.S. Technologies, Inc.

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Customer: Radio Systems Corporation

Model: TC-101

GENERAL INFORMATION

Product Description

The Equipment Under Test (EUT) is the TC-101 Transmitter. The EUT is a Pet Training and Containment System. The EUT generates a 10.65 kHz magnetic field for containing pets wearing a receiver collar, at that frequency, which generates a discouragement pulse to the pet. The EUT receives a signal from a hand held transmitter operating at 303.825 MHz (rf), causing the EUT to generate an 8 second maximum magnetic field at 10.65 kHz.

Testing of the 10.65 kHz magnetic field was conducted with the EUT transmitting continuously at the max field condition (normally 8 seconds in duration).

A separate DOC report for the receiver portion has been issued under US Technologies Project Number: 04-0124.

Related Submittal(s) Grant(s)

The EUT is subject to the following authorization:

- a) Certification as a low power transmitter (10.65 kHz)

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

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SECTION 2

TESTS AND MEASUREMENTS

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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.

The 10.65 KHz channel was selected for test since the unit operates on less than a 1 MHz band of channels.

The EUT was set up with a 500' length of wire connected to it, to simulate a typical installation. The wire was not buried, as it would be in a typical installation (approximately 2 -3 inches). Measurements were taken at all three antenna polarities along one of the long edges (93.5') of the rectangle at a distance of 10 meters to characterize the emissions. Those results below 100 kHz were corrected to 300 meters by the following $60 \log (300/10) = 88.6 \text{ dB}$ (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.

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EUT and Peripherals

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
Dog Fence Transmitter TC-101 (EUT)	TC-101	None	KE3TC101 (Pending)	500' U 6' U 6' U Ground Wire
Adapter Globetek, Inc.	41A-12-830	None	N/A	120 VAC/ 60 Hz Direct Plug-in

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TABLE 2**TEST INSTRUMENTS**

EQUIPMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	DATE OF LAST CALIBRATION
SPECTRUM ANALYZER	8558B	HEWLETT-PACKARD	2332A10055	2/19/04
SPECTRUM ANALYZER	8593E	HEWLETT-PACKARD	3205A00124	2/19/04
RF PREAMP	8447D	HEWLETT-PACKARD	2944A07436	5/10/03
BICONICAL ANTENNA	3110	EMCO	9307-1431	5/06/03
LOG PERIODIC ANTENNA	3146	EMCO	3236	7/21/03
LOOP ANTENNA	SAS/562	A.H. SYSTEMS	142	6/24/03
LISN (x 2) 8028-50-TS24-BNC	8028	SOLAR ELE.	910494 & 910495	1/20/04
CALCULATION PROGRAM	N/A	N/A	Ver. 6.0	N/A

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

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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 Tables 3.

For purposes of this test, the EUT was set to a maximum duty cycle, maximum TX power, and 10.65 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.

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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
10.65	-67.29	76.7	24.57	220.18

SAMPLE CALCULATIONS:

RESULTS uV/m @ 3m = Antilog $((-67.29 + 76.7 + 107 - 88.6)/20)$ = 24.57

CONVERSION FROM dBm TO dBuV = 107 dB

CORRECTION FROM 3m TO 300m = -88.6 dB

Test Date: May 24, 2004

Tested by
Signature: 

Name: David Blethen

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Field Strength Of Spurious Emissions (47 CFR 15.209)

Measurements were made using a peak detector. Field strength of Spurious Emissions are shown in Table 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 10.65 kHz transmit frequency.

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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 (dB)
30.0	-85.93	68.4	1.10	79.92	-37.2
95.5	-61.65	39.2	0.63	25.13	-32.0
25.08	-85.35	70.0	1.42	95.69	-36.6
55.0	-78.91	63.8	1.46	43.64	-29.5
10.9*	-67.29	76.7	24.57	220.18	-19.0

* = Quasi-Peak

SAMPLE CALCULATIONS:**RESULTS uV/m @ 3m = Antilog ((-85.93 + 68.4 + 107 - 88.6)/20) = 1.10****CONVERSION FROM dBm TO dBuV = 107 dB****CORRECTION FROM 3m TO 300m = -88.6 dB****Test Date: May 24, 2004****Tested by****Signature:****Name: David Blethen**

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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 Table 5.

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TABLE 5**FIELD STRENGTH OF SPURIOUS EMISSIONS****Peak/Quasi-Peak versus Quasi- Peak Limits (30 MHz – 1 GHz), Average Limits****Digital Device Emissions actually tested while in TX Mode**

FREQ. (kHz.)	TEST DATA (dBm) @ 3m	ANTENNA FACTOR + CABLE ATTENUATION	PEAK RESULTS (uV/m) @ 300m	AVERAGE FCC LIMITS (uV/m) @ 300m	MARGIN BELOW LIMIT (dB)
33.3	-86.4*	14.8	58.7	100.0	-4.6
73.1	-86.0	11.5	42.3	100.0	-7.5

* = Quasi-Peak

SAMPLE CALCULATIONS:**RESULTS uV/m @ 3m = Antilog ((-86.4 + 14.8 + 107 – 88.6)/20) = 58.7****CONVERSION FROM dBm TO dBuV = 107 dB****CORRECTION FROM 3m TO 300m = -88.6 dB****Test Date: March 2, 2004****Tested by****Signature:****Name: David Blethen**

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Power Line Conducted Emissions (47 CFR 15.107a)

Conducted Emissions were evaluated from 450 kHz to 30 MHz. Measurements were made with the analyzer's bandwidth set to 9 kHz, emissions are shown in Table 6. The EUT was checked with a 500' fence length.

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TABLE 6a CONDUCTED EMISSIONS DATA**CLASS B****(Peak / Quasi-Peak vs. Average Limits)****PHASE MEASUREMENT**

FREQ. (MHz)	TEST DATA (dBuV) PHASE	LISN LOSS (dB) PHASE	CABLE FACTOR (dB)	RESULTS (dBuV) PHASE	EN55022 CLASS B LIMITS (dBuV)	MARGIN BELOW LIMIT (dB) PHASE
0.16	48.1	0.3	0.1	48.5	55.6	7.1
0.25	48.3	0.2	0.1	48.6	51.9	3.3
0.33	45.2	0.2	0.1	45.5	49.4	3.8
29.26	24.9	0.1	0.9	25.9	50.0	24.1
29.65	24.8	0.1	0.9	25.8	50.0	24.2
29.73	26.0	0.1	0.9	27.0	50.0	23.2

SAMPLE CALCULATIONS: RESULTS = 48.1 + 0.3 + 0.1 = 48.5**Test Date: April 15, 2004****Tested by****Signature:****Name: David Blethen**

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TABLE 6b CONDUCTED EMISSIONS DATA**CLASS B****(Peak / Quasi-Peak vs. Average Limits)****NEUTRAL DATA**

FREQ. (MHz)	TEST DATA (dBuV) NEUTRAL	LISN LOSS (dBuV) NEUTRAL	CABLE FACTOR (dB)	RESULTS (dBuV) NEUTRAL	EN55022 CLASS B LIMITS (dBuV)	MARGIN BELOW LIMIT (dB) NEUTRAL
0.16	46.1	0.3	0.1	46.5	55.6	9.1
0.19	45.0	0.2	0.1	45.3	54.1	8.8
0.20	44.9	0.2	0.1	45.2	53.5	8.3
29.26	24.7	0.1	0.9	25.7	50.0	24.3
29.65	24.5	0.1	0.9	25.5	50.0	24.5
29.73	25.8	0.1	0.9	26.8	50.0	23.2

SAMPLE CALCULATIONS: RESULTS = 46.1 + 0.3 + 0.1 = 46.5**Test Date: April 15, 2004****Tested by****Signature:****Name: David Blethen**

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SECTION 3

LABELING INFORMATION

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SECTION 4

SCHEMATICS

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SECTION 5

PHOTOGRAPHS

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PHOTOS OF THE TESTED EUT

- Photo 1. Front View of EUT
- Photo 2. Main Board of EUT, PCB Side
- Photo 3. Main Board of EUT, Solder Side
- Photo 4. Test In Progress Photo
- Photo 5. Test In Progress Photo
- Photo 6. Test In Progress Photo

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SECTION 6

USER'S MANUAL