Testing Tomorrow's Technology

Certification Application

BALOGH T.A.G. Corporation
RFID
Model ERC-71

Per Requirements of

Title 47 US Code, Part 15, Subpart C, Section 15.209

June 17, 2008

Number of Pages in this report: 36

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MEASUREMENT/TECHNICAL REPORT

COMPANY NAME: **BALOGH T. A. G. Corporation**

PRODUCT NAME AND MODEL: **RFID Transceiver**, **ERC-71**

FCC ID: **G863071X**

DATE: **June 17, 2008**

This report concerns (check one): Original grant X
Class II change_____

Equipment type: RFID Transceiver

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 N.A.
date
of the intended date of announcement of the product so that the grant can be issued on that date.

Report prepared by:

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1. General Information

The information contained in this report is presented for the FCC Equipment Authorization of Certification for the Balogh model ERC-71 RFID Transceiver.

1.1 Product Description

The Equipment under Test (EUT) is the BALOGH T.A.G. Corporation, Model ERC-71. The EUT is a Low Power RFID Transceiver operating at 1.5 MHz.

1.2 Related Submittal(s)/Grant(s)

The EUT will be used with part of a system to send/receive data. The transmitter presented in this report will be used with another transceiver which has been submitted for Certification.

1.2.1 The EUT is subject to the following authorizations:

a) Certification as a Transceiver
b) Verification as a Digital Device.

2 Tests and Measurements

2.1 Configuration of Tested EUT

The Test sample was tested per ANSI C63.4, Methods of Measurement from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (2003). A block diagram of the tested system is shown in Figure 1. Test configuration photographs for fundamental and harmonic emissions measurement are shown in Figures 2, 3 and 4.

The sample used for testing was received by US Tech on March 20, 2008 in good condition.

2.2 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA. This site has been fully described and registered with the FCC, under designation number US5117. Additionally this site has also been fully described and submitted to Industry Canada (IC), and has been approved under file number 2982A-1.

2.3 Test Equipment

Table 2 describes test equipment used to evaluate this product.

2.4 Modifications to Hardware

No modifications were necessary to be made by US Tech in order to bring the EUT into compliance with FCC Part 15, Subpart C limits for the transmitter portion of the EUT or the Class A Digital Device Requirements (Part 15, Subpart B).

2.5 Antenna Description (FCC Section 15.203)

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. See Figure 10, page 36, for antenna location inside of EUT.

The BALOGH T.A.G. Corporation Model ERC-71 incorporates a permanently attached antenna only.

Manufacturer: Balogh T.A.G. Corporation
7699 Kensington Court
Brighton, Michigan 48116-8561
Type: Internal Single Ferrite Antenna
Gain: 2 dBi
Connector: Permanently attached

2.6 Test Procedures

The EUT was configured as shown in the following block diagram(s) and Test Setup photograph(s). The sample was tested per ANSI C63.4, Methods of Measurement from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (1992) paragraph 7 for conducted disturbances and paragraph 8 for radiated disturbances. Conducted and radiated emissions data were taken with the test receiver or spectrum analyzer's resolution bandwidth adjusted to 9 kHz and 120 kHz, respectively, depending upon the frequency range. All measurements are peak unless stated otherwise. The video filter on the spectrum analyzer was OFF throughout the evaluation process. Interconnecting cables were manipulated as necessary to maximize emissions. The EUT was rotated about its Z axis in an attempt to maximize spurious emissions. The measurement antenna was raised and lowered through the height of 1 to 4 meters for emissions maximization. Test distances were chosen for measurement convenience. A distance correction factor was applied as either 20 dB/Decade or 40 dB/Decade depending upon frequency.

Figure 1. Test Configuration

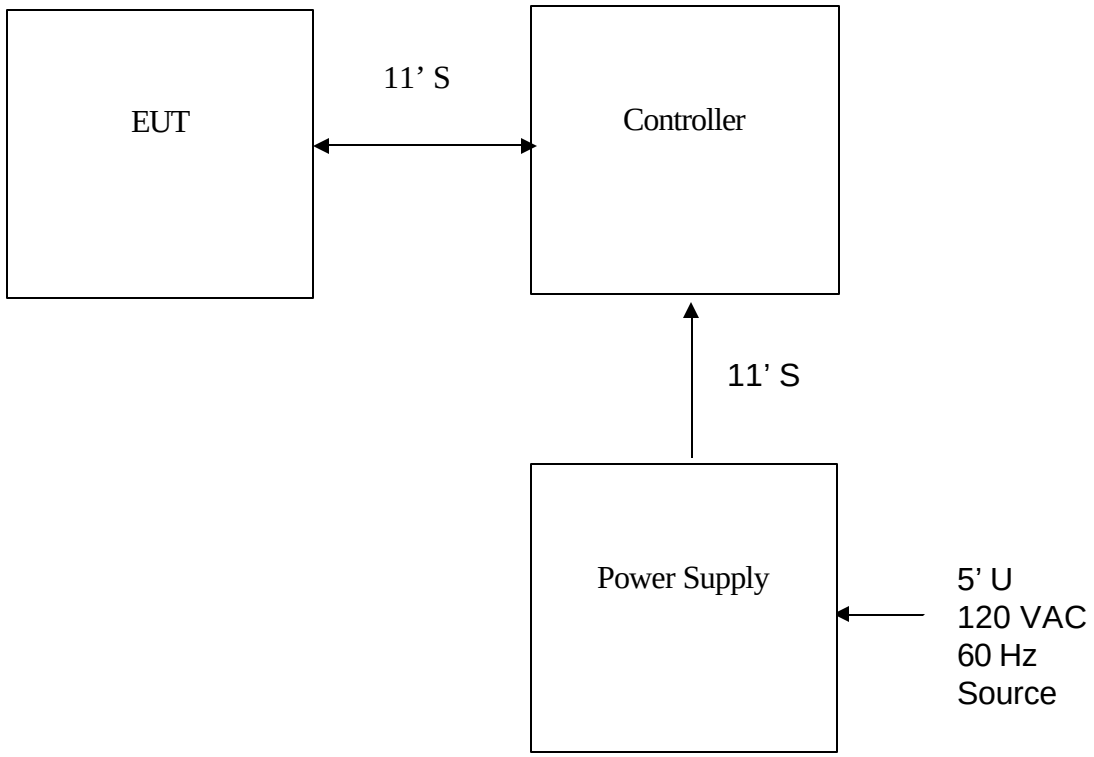


Table 1.

EUT and Peripherals

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID:	CABLES P/D
Transceiver BALOGH T.A.G. Corporation (EUT)	ERC-71	None	G863071X (Pending)	11' S
Controller BALOGH T.A.G. Corporation	BIET / XX	3090033	None	11' S
Power Supply Kenwood	PD56-6	None	None	5' U

P = Power D = data S = Shielded U = Unshielded

Table 2.

Test Instruments

TYPE	MANUFACTURER	MODEL	SN.	Cal Date.
SPECTRUM ANALYZER	HEWLETT-PACKARD	8593E	3205A00124	1/15/08
RF PREAMP 10 to 1000 MHz	HEWLETT-PACKARD	8447D	1937A03355	6/14/07
Loop Antenna 10 kHz to 30MHz	A. H. Systems	SAS-200/562	142	Due 10/16/08
BICONICAL ANTENNA 25 MHz to 200 MHz	EMCO	3110	9307-1431	11/15/07
LOG PERIODIC ANTENNA 100 MHz to 1 GHz	EMCO	3146	9110-3600	8/24/07
LISN	SOLAR Electronics.	8028	910495 & 910494	5/10/07

2.7 Field Strength of Fundamental

The results of the measurement for peak fundamental emissions are derived from the radiated emissions raw data of figure 5. The overall corrected value is given in Table 3. The EUT emissions were measured by setting up the loop antenna in the vertical orientation a distance of 3 meters from the EUT at a height of 1.0 meters above the ground. The EUT major axis was set to face the measuring antenna so that it intercepted the circular plane formed by the loop at right angles. When a signal was detected, the loop was slowly rotated about its axis in an attempt to maximize the emission. The antenna was left in the orientation where the emission was maximum and the signal was measured and recorded.

Table 3.

Peak Field Strength of Fundamental and Harmonics Emissions

Peak Radiated Emissions of Fundamental and Harmonics												
Test By: DA	**Test:** FCC Part 15.209							**Client:** BALOGH T.A.G. Corporation				
	Project: 08-0011		**Class:** N/A					**Model:** ERC-71				
Frequency	**Test Data**		**AF**	**CL- PA-DIST @30 m**			**Results @30 m**	**Limits @30 m**	**Actual Test Distance**	**Margin**	**DET PK/ QP**	
(MHz)	**(dBm)**	**(dBuV)**	**dB/m**	**(dB)**			**(uV/m)**	**(uV/m)**		**(dB)**		
1.50	-56.20	50.8	35.4	1.6	-26.7	-40	11.35	16	3m.	**2.9**	**PK**	
3.0	-86.09	18.91	28.7	0.3	-26.7	-40	0.11	29.54	3m	**29.4**	**PK**	
4.5	-95.10	11.9	25.0	0.3	-26.7	-40	0.033	29.54	3m	**29.5**	**PK**	
6.0	-90.27	16.73	21.8	0.3	-26.7	-40	0.04	29.54	3m	**29.5**	**PK**	
7.5	-89.34	17.66	19.4	0.4	-26.6	-40	0.035	29.54	3m	**29.5**	**PK**	
9.0	-93.39	13.61	17.1	0.4	-26.6	-40	0.016	29.54	3m	**29.5**	**PK**	
10.5	-93.62	13.38	16.5	0.5	-26.7	-40	0.015	29.54	3m	**29.5**	**PK**	

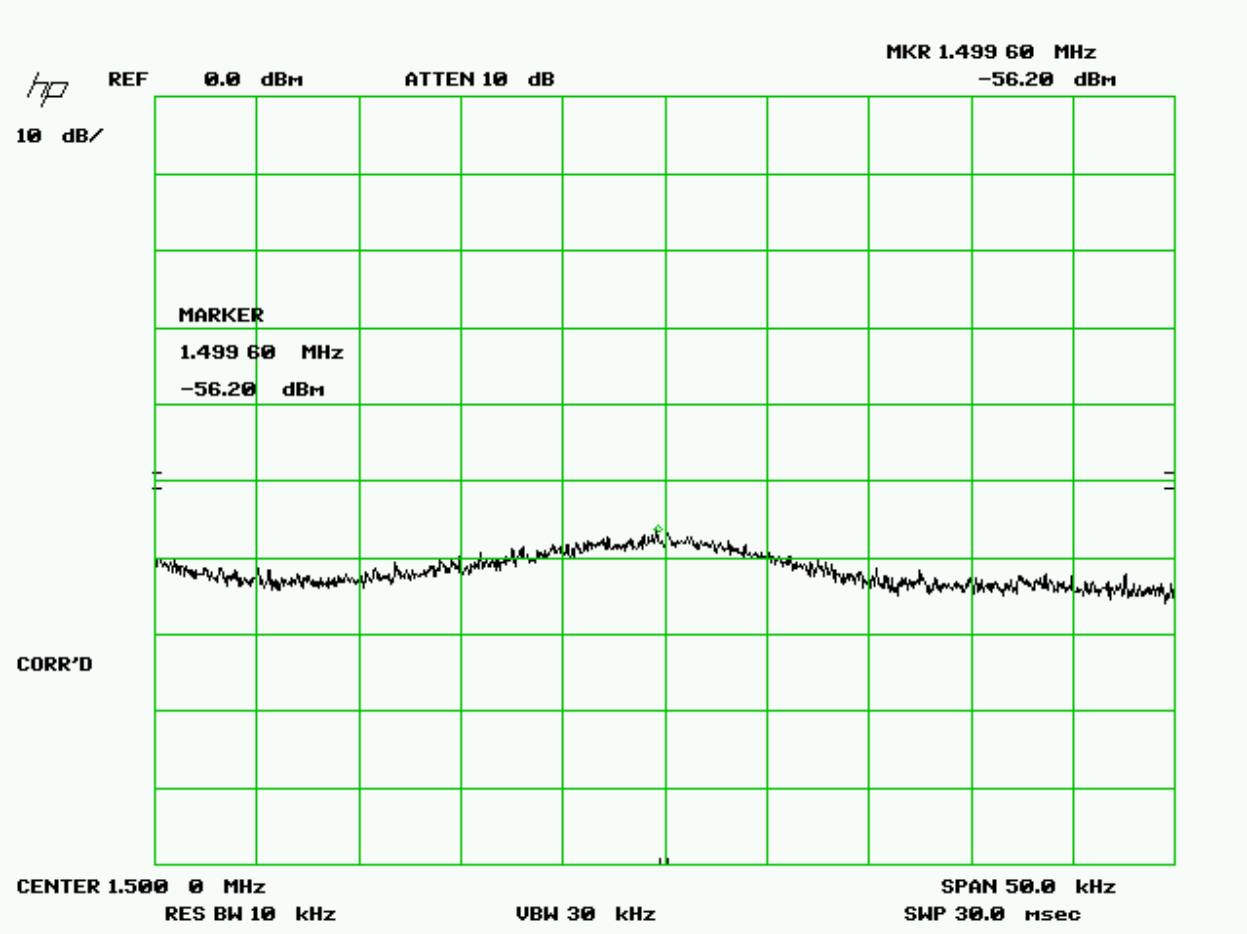
Measured from 1.5 MHz to 15 MHz.

SAMPLE CALCULATIONS:
Conversion from dBm to dBuv: dBuV = dBm+107
RESULTS = Antilog (50.8 + 37- 66.7) = $10^{(21.1/20)}$ = 11.35 uV/m @ 30 m

Test Results Reviewed By: Daniel Aparaschivei **Name: Daniel Aparaschivei**

Figure 5.

Peak Raw Data of Fundamental Emission per 15.209 (a)
(Spectrum Analyzer Reading from Receiving Antenna)



Used pre-amp: Gain = 26.7 dB, cable loss = 1.6 dB. For field strength, refer to Table 3.

2.8 Peak Radiated Spurious Emissions in the Frequency Range 30 MHz -1,000 MHz (FCC Section 15.205, 15.209 and)

A preliminary scan was performed on the EUT to determine spurious frequencies that were caused by the transmitter portion of the product. Significant emissions that fell within restricted bands were then measured on an OATS site. Radiated measurements below 1 GHz were tested with a RBW = 120 kHz. The results of all peak radiated spurious emissions including those falling in the restricted bands are given in Table 4.

Table 4. Peak Radiated Spurious Emissions

Test By:	**Client:** BALOGH T.A.G. Corporation	
DA	**15.209**	**Model:** ERC-71

Frequency	**Test Data**	**Test Data**	**AF+CA-Amp**	**Results**	**Limits**	**Distance/**	**Margin**	**PK / QP**
(MHz)	**(dBm)**	**(dBuV)**	**(dB)**	**(uV/m)**	**(uV/m)**	**Polarity**	**(dB)**	
30.0	-81.8	25.2	13.9	90.1	100	3m/Vert	**0.9**	**QP**
63.0	-87.8	19.2	10.4	30.2	100	3m/Vert	**10.4**	**QP**
85.49	-89.0	18.0	11.4	29.5	100	3m/Vert	**10.6**	**QP**
*110.99	-83.4	23.6	13.3	69.7	150	3m/Vert	**6.7**	**QP**
211.5	-95.7	11.3	14.1	18.6	150	3m/Vert	**18.1**	**QP**
366.0	-96.8	10.2	18.6	27.5	200	3m/Horiz	**17.2**	**QP**
477.74	-97.7	9.3	21.7	35.5	200	3m/Horiz	**15.0**	**QP**

*** Falls in Restricted Band.**
SAMPLE CALCULATIONS:

RESULTS @30 MHz = 10 $^{(25.2+13.9)/20}$ = 90.1 uV/m @ 3m

Test Results Reviewed By: Daniel Aparaschivei **Name: Daniel Aparaschivei**

2.9 Frequency Stability

The EUT temperature stability was measured over the temperature range of -20º C to 50º C as well as supply voltage variations of 85% to 115% at the temperature of 20º C. The results of this measurement are recorded in Figure 20 below.

Table 5. Frequency Variation with Temperature and Supply Voltage.

Voltage - Volts	**Temperature ºC**		
	-20	**20**	**50**
Frequency @ 20.4	NR	1.49988 MHz	NR
Frequency @ 24.0	1.50000 MHz	1.49988 MHz	1.50025 MHz
Frequency @ 27.6	NR	1.49975 MHz	NR
85 % of 24 VDC = 20.4 VDC			
115 % of 24 VDC= 27.6 VDC			

NR = Not Required

All of the measured values lie between the upper and lower 0.01% bounds.

Test Date: April 15, 2008

Tested by
Signature: Daniel Aparaschivei **Name: Daniel Aparaschivei**

Figure 7. Data Plot 24 VDC, +20º C

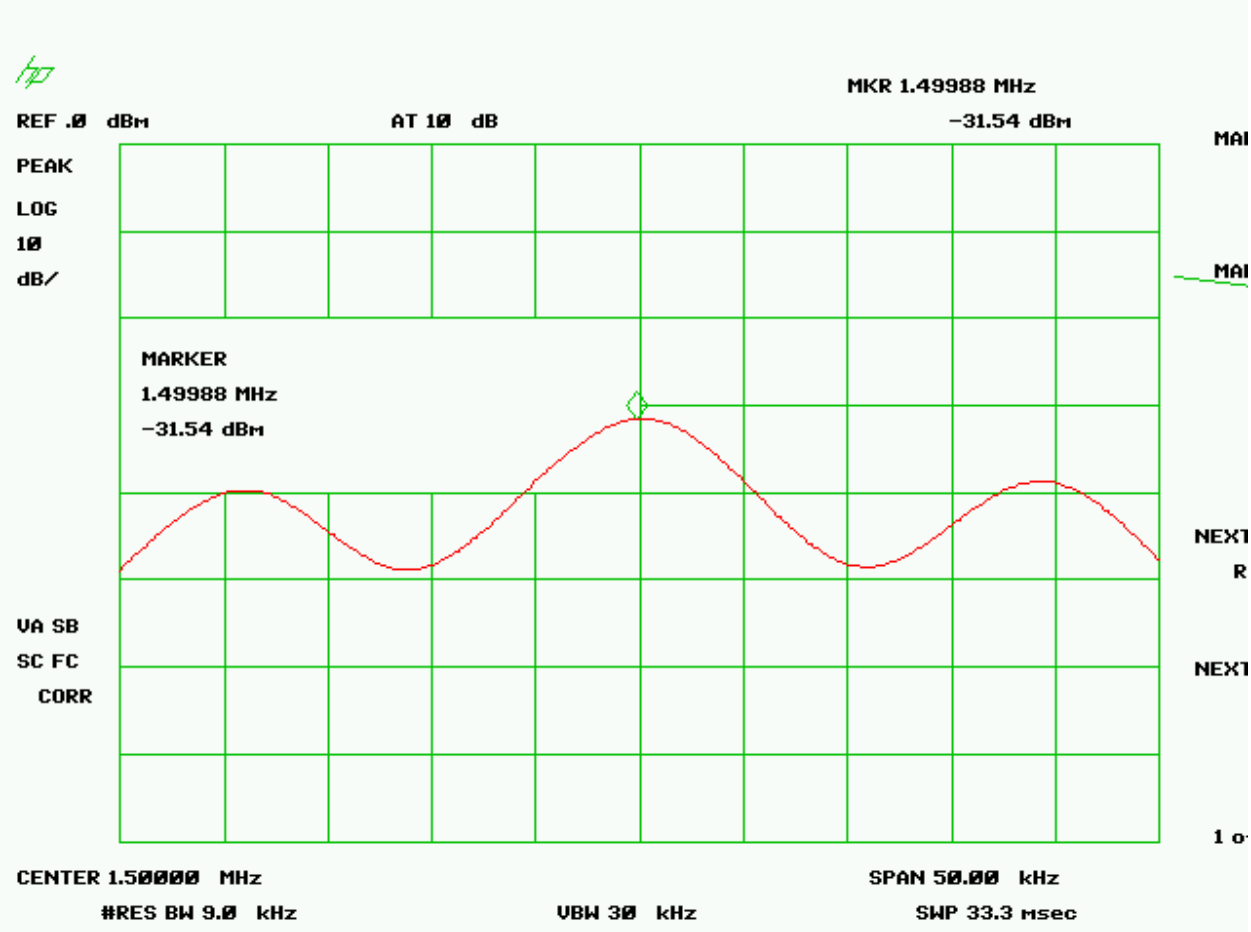


Figure 8. Data Plot, 24.0 VDC, -20 ºC.

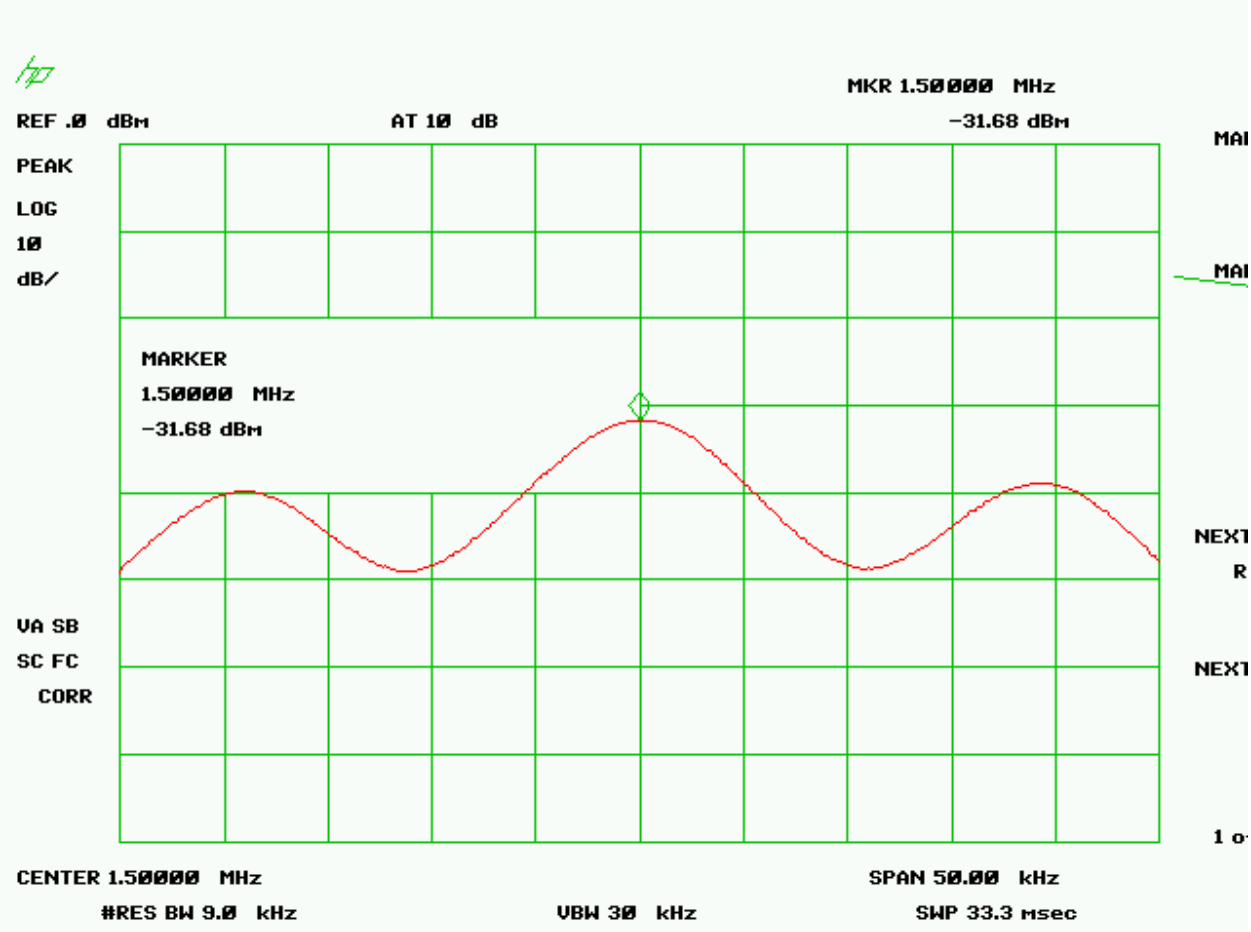
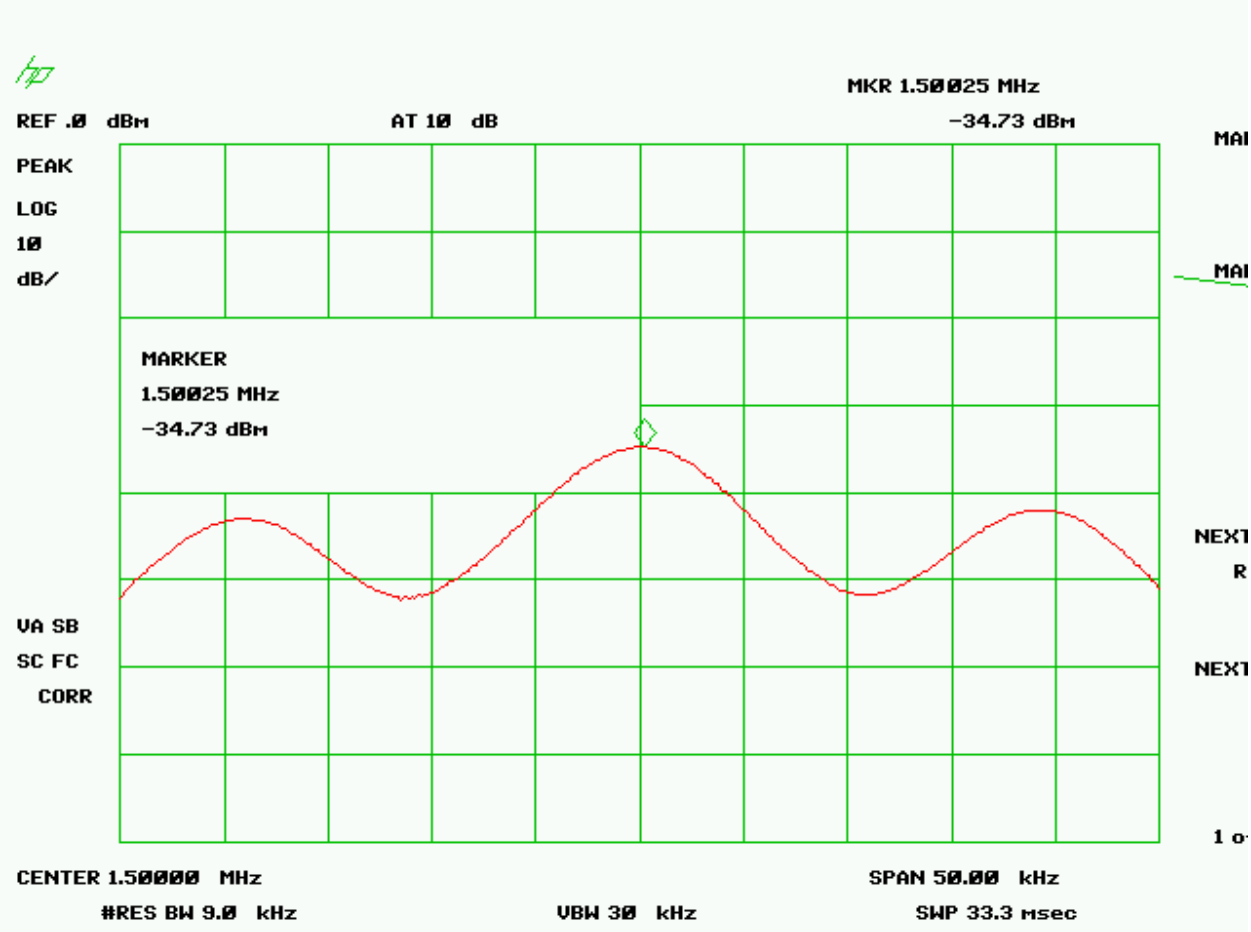


Figure 9. Data Plot 24 VDC, +50 ºC.



2.10 Powerline Conducted Emissions (EUT and Digital Device).

The conducted voltage measurements have been carried out in accordance with FCC Section 15.207, with a spectrum analyzer connected to an LISN and the EUT placed into a continuous mode of transmit. The results are given in Table 6.

Table 6. Conducted Emissions Test Data for Transmitter and Receiver/Digital Devices, Class B.

Conducted Emissions		
Test By: DA	**Test:** FCC Part 15.107 Class B and 15.207	**Client:** BALOGH T.A.G. Corporation
	Project: 08-0011	**Model:** ERC-71

Frequency (MHz)	Test Data (dBm)	AF Table	Test Data (dBuV)	AF+CA-AMP (dB)	Results (dBuV)	Limits (dBuV)	Distance / Polarity	Margin (dB)	PK = n / QP
3.00	-78.7	LISNP	28.3	0.2	28.5	46.0	PHASE	**17.5**	**PK**
7.5	-77.7	LISNP	29.3	0.4	29.7	50.0	PHASE	**20.3**	**PK**
9	-80.2	LISNP	26.8	0.4	27.2	50.0	PHASE	**22.8**	**PK**
13.5	-75.3	LISNP	31.7	0.4	32.1	50.0	PHASE	**17.9**	**PK**
15	-71.0	LISNP	36.0	0.6	36.6	50.0	PHASE	**13.4**	**PK**
18	-66.7	LISNP	40.3	0.7	41.0	50.0	PHASE	**9.0**	**PK**
28.5	-76.6	LISNP	30.4	0.7	31.1	50.0	PHASE	**18.9**	**PK**
3	-76.0	LISNN	31.0	0.2	31.2	46.0	NEUTRAL	**14.8**	**PK**
7.5	-76.2	LISNN	30.8	0.4	31.2	50.0	NEUTRAL	**18.8**	**PK**
9	-77.0	LISNN	30.0	0.4	30.4	50.0	NEUTRAL	**19.6**	**PK**
13.5	-71.8	LISNN	35.2	0.5	35.7	50.0	NEUTRAL	**14.3**	**PK**
15	-71.5	LISNN	35.5	0.6	36.1	50.0	NEUTRAL	**13.9**	**PK**
18	-67.4	LISNN	39.6	0.7	40.3	50.0	NEUTRAL	**9.7**	**PK**

Tested over the frequency range of 150 kHz to 30 MHz.

SAMPLE CALCULATIONS: At 3.00 MHz, level = 28.3 + 0.2 = 28.5 dBuV.

Test Results Reviewed By: Daniel Aparaschivei **Name: Daniel Aparaschivei**

2.11 Radiated Emissions from EUT (47 CFR 15.209)

Radiated emissions were evaluated from 30 MHz to 5000 MHz. Measurements were made with the analyzer's bandwidth set to 120 kHz for measurements made at less than 1 GHz and at 1 MHz for measurements made at 1 GHz and higher. Results are shown in Table 7 below.

Table 7. Radiated Emissions Data for EUT, Digital Device and Receiver, Class B.

Tested from 30 MHz – 5.0 GHz

Radiated Emissions for EUT, Digital Device and Receiver									
Test By:	**Test:** FCC Part 15					**Client:** BALOGH T.A.G. Corporation			
DA	**Project:** 08-0011		**15.109, Class: B**			**Model:** ERC-71			
Frequency (MHz)	**Test Data (dBm)**	**Test Data (dBuV)**	**Transducer Table**	**AF+CL-PA (dB)**	**Results (uV/m)**	**Limits (uV/m)**	**Distance / Polarity**	**Margin (dB)**	**DET**
30	-81.8	25.2	1B13mV	13.9	90.1	100.0	3m./VERT	**0.9**	**QP**
63.00	-87.8	19.2	1B13mV	10.4	30.2	100.0	3m./VERT	**10.4**	**QP**
85.49	-89.0	18.0	1B13mV	11.4	29.5	100.0	3m./VERT	**10.6**	**QP**
110.99	-83.4	23.6	1B13mV	13.3	69.7	150.0	3m./VERT	**6.7**	**QP**
211.5	-95.7	11.3	1LP3mV	14.1	18.6	150.0	3m./VERT	**18.1**	**QP**
366	-96.8	10.2	1LP3mV	18.6	27.5	200.0	3m./HORZ	**17.2**	**QP**
477.74	-97.7	9.3	1LP3mV	21.7	35.5	200.0	3m./HORZ	**15.0**	**QP**

AF = Antenna Factor; CL = Cable Loss; PA = Preamplifier Gain

SAMPLE CALCULATIONS:

RESULTS @30 MHz = Antilog ((-81.8 + 13.9 + 107)/20) = 90.1 uV/m @ 3m
CONVERSION FROM dBm TO dBuV = 107 dB

Test Results Reviewed By: Daniel Aparaschivei **Name: Daniel Aparaschivei**

2.12 Radiated Emissions for Digital Device and Receiver (47 CFR 15.109)

Radiated emissions were evaluated from 30 to 5000 MHz. Measurements were made with the analyzer's bandwidth set to 120 kHz for measurements made at less than 1 GHz and at 1 MHz for measurements made at 1 GHz and higher. Results are shown in Table 7 above along with the Transmitter part (15.209).

2.13 Occupied Bandwidth (CFR 2.1049)

A plot of the EUT signal showing its Occupied Bandwidth could not be made because the EUT has an integral antenna and radiated measurements would have had to be made. But the EUT radiated signal was so low in magnitude that an adequate dynamic range could not be attained even with pre-amplification. We cannot even measure its – 20 dB points where it is at 1 percent.

5 Photographs

Photos of The Tested EUT

5.1 EUT, Front View
5.2 EUT, Bottom View
5.3 EUT, Bottom View Cover Removed Transceiver board Solder Side
5.4 EUT, Transceiver board Component Side