Advanced
Compliance Laboratory

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ELECTROMAGNETIC EMISSION COMPLIANCE REPORT

of

Toro Systems Wireless Rain Sensor
MODEL: TWRS/TWRFS/TWRS-I/TWRFS-I

FCC ID: OF7TWRS

January 21, 2005

This report concerns (check one): Original grant ____ Class II change __X____
Equipment type: TRANSMITTER

Deferred grant requested per 47 CF 0.457(d)(1)(ii)? yes _____ no __x___
If yes, defer until: _____ (date)
Company agrees to notify the Commission by _____ (date)
of the intended date of announcement of the product so that the grant can be issued on that date.

Transition Rules Request per 15.37? yes _____ no __x___
If no, assumed Part 15, Subpart B for unintentional radiators - the new 47 CFR [10-1-90 Edition] provision.

Report prepared for:	THE TORO COMPANY
Report prepared by:	Advanced Compliance Lab
Report number:	0048-050117-01

NVLAP®

The test result in this report IS supported and covered by the NVLAP accreditation

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1. GENERAL INFORMATION

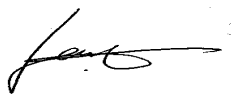
1.1 Verification of Compliance

EUT:	TRANSMITTER
Model:	TWRS/TWRFS/TWRS-I/TWRFS-I
Applicant:	THE TORO COMPANY
Test Type:	FCC Part 15C CERTIFICATION
Result:	PASS
Tested by:	ADVANCED COMPLIANCE LAB
Test Date:	January 21, 2005
Report Number:	0048-050117-01

The above equipment was tested by Advanced Compliance Laboratory for compliance with the requirement set forth in the FCC rules and regulations Part 15, subpart C. This said equipment in the configuration described in the report, shows the maximum emission levels emanating from equipment are within the compliance requirements.

The estimated uncertainty of the test result is given as following. The method of uncertainty calculation is provided in Advanced Compliance Lab. Doc. No. 0048-01-01.

	Prob. Dist.	Uncertainty(dB)	Uncertainty(dB)	Uncertainty(dB)
		30-1000MHz	1-6.5GHz	Conducted
Combined Std. Uncertainty u_c	norm.	±2.36	±2.99	±1.83



Wei Li
Lab Manager
Advanced Compliance Lab

Date: January 21, 2005

1.2 Equipment Modifications

N/A

1.3 Product Information

System Configuration

ITEM	DESCRIPTION	FCC ID	CABLE
Product	TRANSMITTER	OF7TWRS	
Housing	PLASTICS		
Power Supply	BATTERY 6VDC		
Clock/OSC Freq.	433.9 MHz		
Device Type	Periodic Operation		

(1) EUT submitted for grant.

1.4 Test Methodology

Radiated tests were performed according to the procedures in ANSI C63.4-2001 at an antenna to EUT distance of 3 meters.

1.5 Test Facility

The open area test site and conducted measurement facility used to collect the radiated and conducted data are located at Hillsborough, New Jersey. This site has been accepted by FCC to perform measurements under Part 15 or 18 in a letter dated May 19, 1997 (Refer to: 31040/PRV 1300F2). The NVLAP Lab code for accreditation of FCC EMC Test Method is: 200101-0.

1.6 Test Equipment

Manufacture	Model	Serial No.	Description	Last Cal dd/mm/yy	Cal Due dd/mm/yy
Hewlett-Packard	HP8546A	3448A00290	EMI Receiver	12/01/05	12/01/06
EMCO	3104C	9307-4396	20-300MHz Biconical Antenna	12/02/04	12/02/05
EMCO	3146	9008-2860	200-1000MHz Log-Periodic Antenna	09/02/04	09/02/05
Fischer Custom	LISN-2	900-4-0008	Line Impedance Stabilization Networks	23/08/04	23/08/05
Fischer Custom	LISN-2	900-4-0009	Line Impedance Stabilization Networks	23/08/04	23/08/05
EMCO	6502	2665	10KHz-30MHz Active Loop Antenna	27/02/04	27/02/05
EMCO	3115	4945	Double Ridge Guide Horn Antenna	11/08/04	11/08/05

All Test Equipment Used are Calibrated Traceable to NIST Standards.

1.7 Statement for the Document Use

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2. PRODUCT LABELING

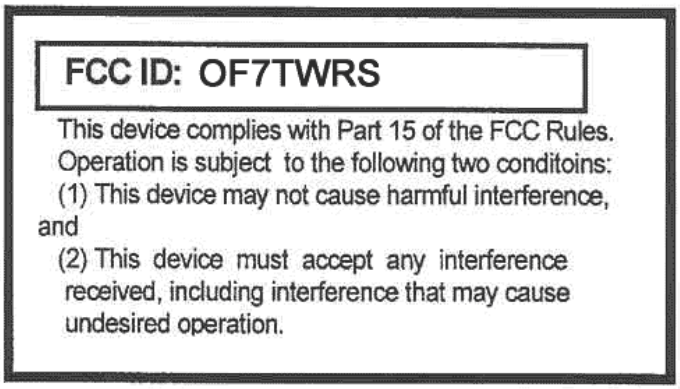


Fig 2.1 FCC Label

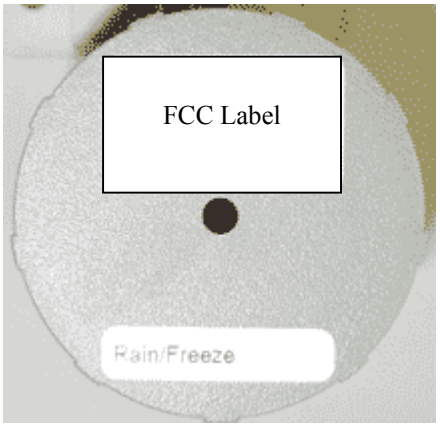


Fig 2.2 Location of the Label

3. SYSTEM TEST CONFIGURATION

3.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it).

TWRS, TWRFS, TWRS-I and TWRFS-I are identical except the name difference for marketing reason.

The unit should be mounted in a vertical orientation with the antenna wire protruding straight down from the housing. And its antenna was permanently attached to the EUT with fixed length, 6.5". Fresh batteries are used during the test in order to generate maximum emission from EUT.

This transmitter will deactivate within 5 seconds after activation.

3.2 Special Accessories

N/A

3.3 Configuration of Tested System

Figure 3.1 and Figure 3.2 illustrate this system, which is tested standing along.

Figure 3.1 Radiated Test Setup, Front

Figure 3.2 Radiated Test Setup, Rear

4. SYSTEM SCHEMATICS

See Attachment

Figure 4.1 System Schematics

5. RADIATED EMISSION DATA

5.1 Field Strength Calculation

The corrected field strength is automatically calculated by EMI Receiver using following:

$$FS = RA + AF + CF + AG$$

where FS: Corrected Field Strength in dBμV/m
RA: Amplitude of EMI Receiver before correction in dBμV
AF: Antenna Factor in dB/m
CF: Cable Attenuation Factor in dB
AG: Built-in Preamplifier Gain in dB (Stored in receiver as part of the calibration data)

The pulse train timing plots are showed in Figure 5.1.
The pulse train timing plots as follows (represent the worst case):
Each complete pulse train contains 12 wide and 13 narrow pulses. The narrow pulse is 0.395ms. The wide pulse is 0.79ms.

Coeff. =(12x0.79+13x0.395)/85.7= 17%

The maximum average field strength should be 0.17 of the peak field strength measured. So we use peak value minus 15.4dB as calculated maximum average field strength.

5.2 Test Methods and Conditions

The initial step in collecting radiated data is an EMI Receiver scan of the measurement range 30MHz - 5GHz using peak detector. IF bandwidth is 120KHz and video bandwidth is 300KHz for measuring 30MHz-1GHz. Both bandwidths are 1MHz for above 1GHz measurement.

5.3 Test Data

The following data lists the significant emission frequencies, polarity and position, peak reading of the EMI Receiver, calculated average reading, the FCC limit, and the difference between the peak reading and the limit. Explanation of the correction and calculation are given in section 5.1.

Test Personnel:

Tester Signature 

Typed/Printed Name: Edward Lee Date: January 21, 2005

Radiated Test Data

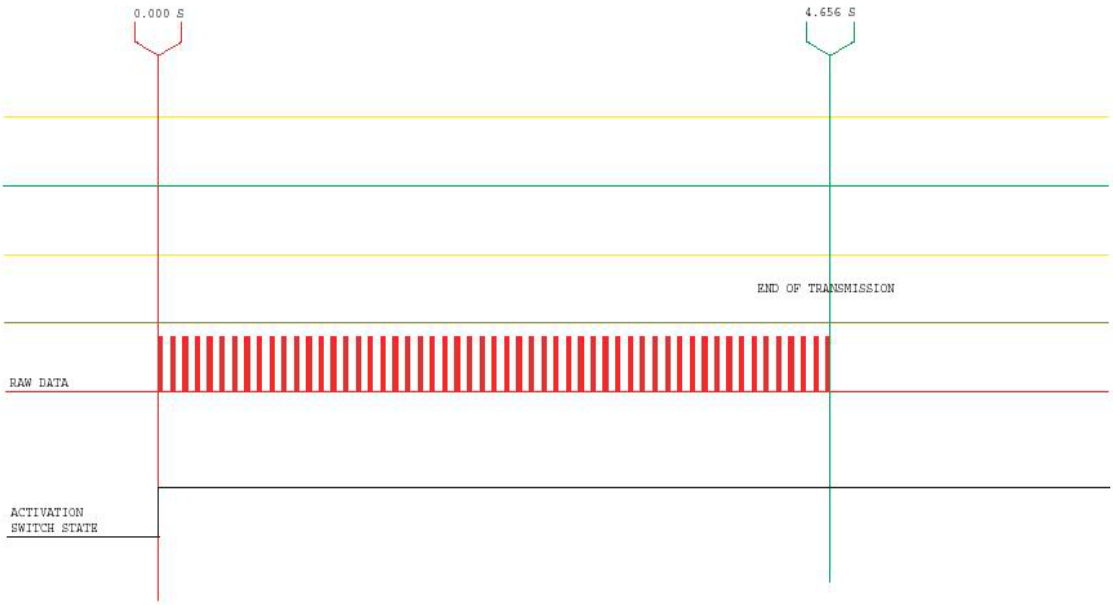
Frequency (MHz)	Polarity [H or V], Position (X,Y,Z)	Height (m)	Azimuth (Degree)	Peak Reading (dBμV/m)	Calculated Average Reading (dBμV/m)	FCC 3m Limit (dBμV/m)	Difference from limit (dB)
433.9	H	1.4	120	88.9	73.5	80.8(2)	-7.3
867.8	H	1.4	100	51.7	36.3	60.8(3)	-24.5
1301.7	H	1.3	120	54.3	38.9	54.0(1)	-15.1
1735.6	H	1.3	120	57.4	42	60.8	-18.8
2169.5	H	1.3	120	46.8	31.4	60.8	-29.4
2603.3	H	1.3	120	57.3	41.9	60.8	-18.9
3037.3	H	1.3	120	48.9	33.5	60.8	-27.3
3471.2	H	1.2	120	49.7	34.3	60.8	-26.5
3905.1	H	1.2	120	47.5	32.1	60.8	-28.7
433.9	V	1.2	200	95.1	79.7	80.8	-1.1
867.8	V	1.2	200	61.9	46.5	60.8	-14.3
1301.7	V	1.2	200	62.5	47.1	54.0	-6.9
1735.6	V	1.2	200	64.0	48.6	60.8	-12.2
2169.5	V	1.2	200	54.5	39.1	60.8	-21.7
2603.3	V	1.2	200	62.5	47.1	60.8	-13.7
3037.3	V	1.2	130	52.1	36.7	60.8	-24.1
3471.2	V	1.2	130	51.5	36.1	60.8	-24.7
3905.1	V	1.2	130	46.9	31.5	60.8	-29.3
4339.0	V	1.2	130	45.8	30.4	60.8	-30.4

(1) Restricted band.
(2) Fundamental limit is 3750-12500 microvolts/meter linear interpolations.
(3) Spurious limit is 375-1250 microvolts/meter linear interpolations.

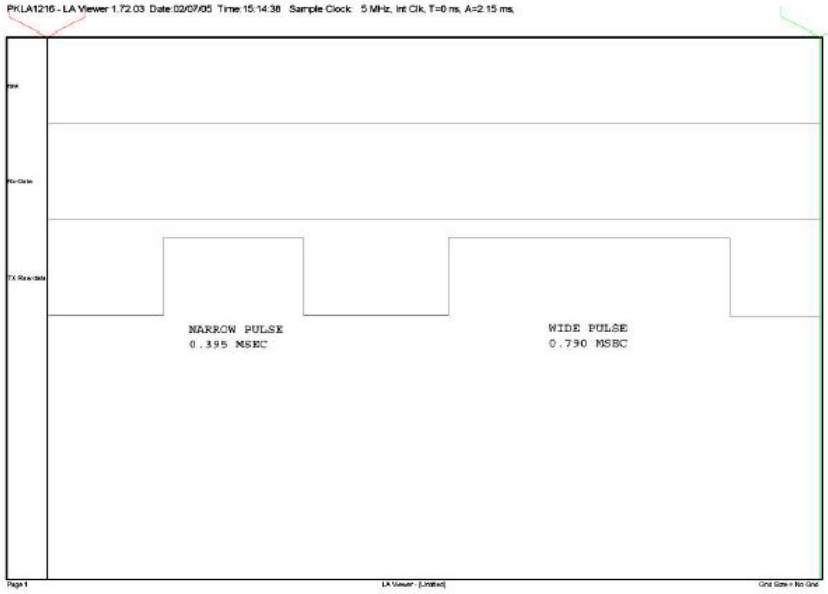
5.4 Occupied Bandwidth

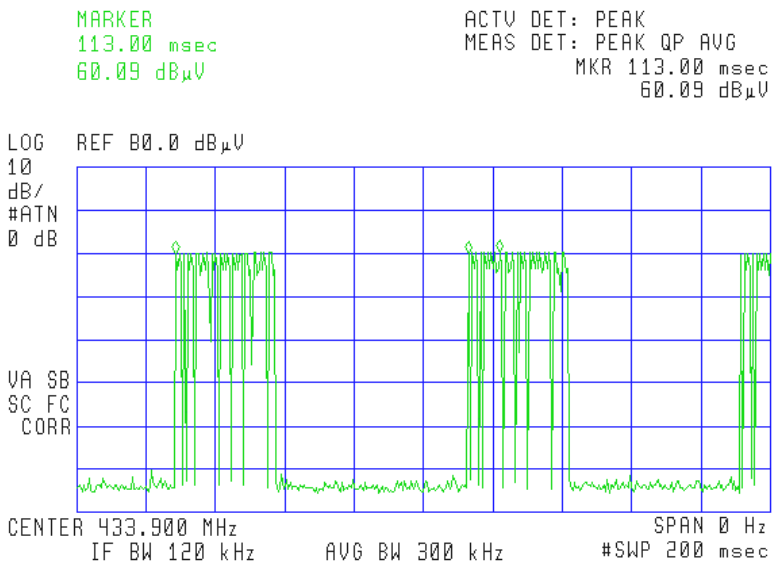
The bandwidth of the emission shall be no wider than 0.25% of the center frequency, in this case, 1.085MHz(433.9x0.25%). Bandwidth is determined at the points 20dB down from the modulated carrier. Figure 5.2 shows the occupied bandwidth plot.

TYPICAL TRANSMISSION UPON SWITCH STATE CHANGE (MODEL: TWRS SERIES)



TYPICAL PULSE WIDTH, NARROW AND WIDE PULSE SHOWN (MODEL: TWRS SERIES)





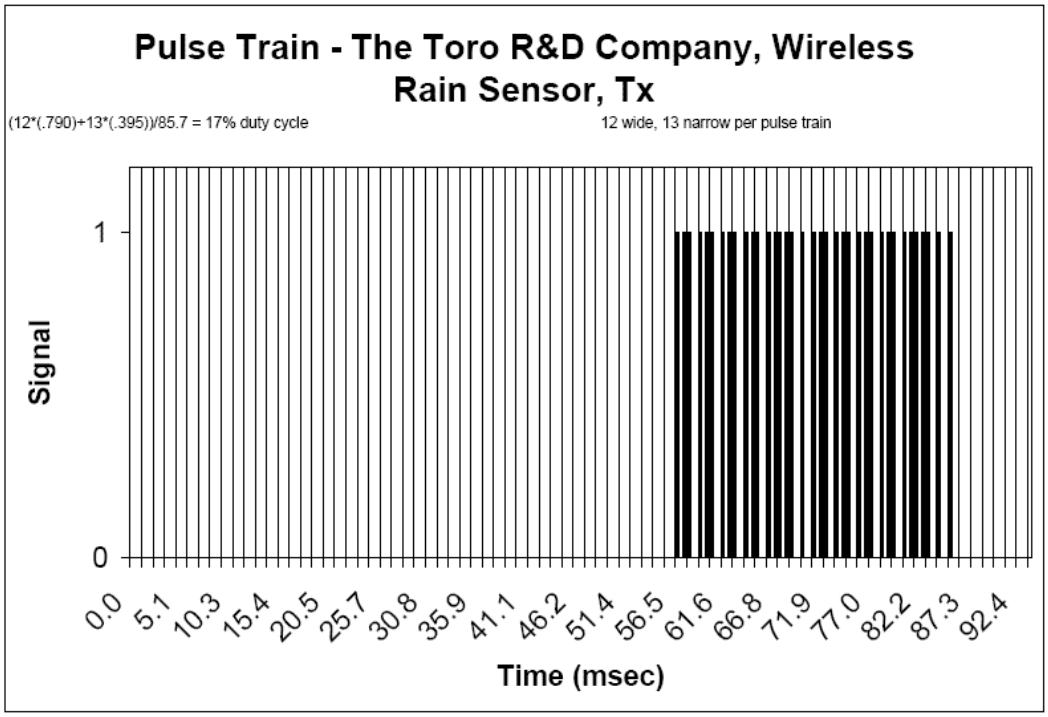


Figure 5.1 Pulse Train Timing

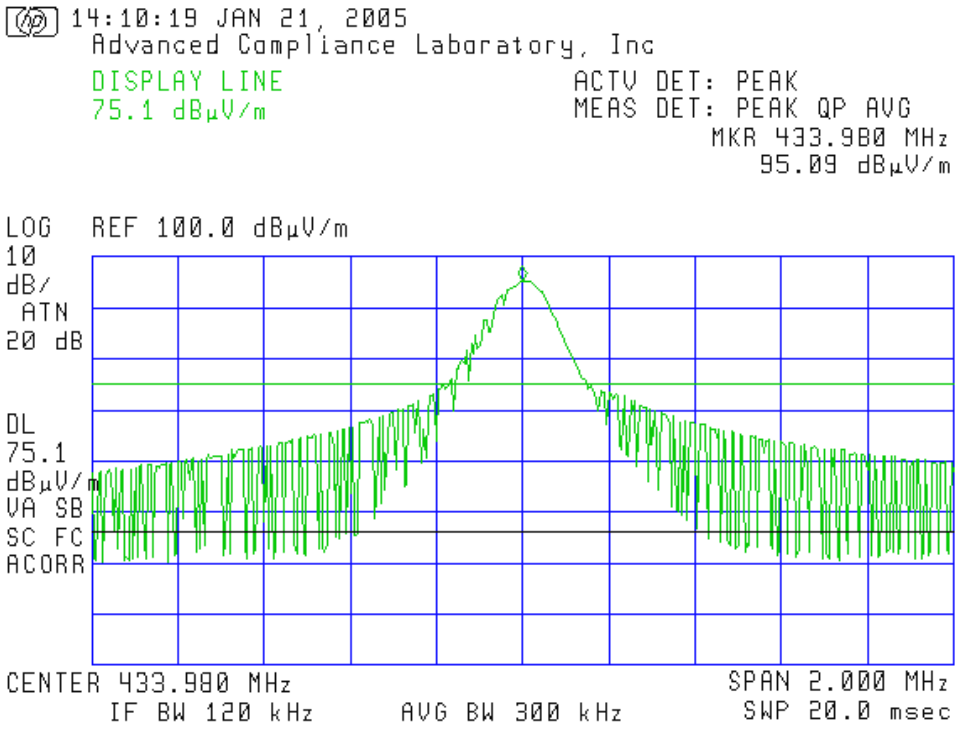


Figure 5.2 Occupied Bandwidth

6. PHOTOS OF TESTED EUT