TIMCO ENGINEERING, Inc.

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FCC PART 15.209 LOW POWER UNLICENSED INTENTIONAL RADIATOR TEST REPORT

Applicant	GuardRFID
Address	#8 – 1600 Derwent Way Delta, BC Canada V3M 6M5
FCC ID	VZKSP1
Model Number	Tag Exciter
Product Description	125 kHz RFID Transmitter
Date Sample Received	May 23, 2008
Date Tested	June 5, 2008
Tested By	Richard Block
Approved By	Mario de Aranzeta
Report Number	3754WUT7TestRepot.pdf
Test Results	☒ PASS ☐ FAIL

ACCREDITED
Certificate # 0955-01

TABLE OF CONTENT

ATTESTATION

Certificate #0955-01

This equipment has been tested in accordance with the standards identified in the referenced test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report and demonstrate that the equipment does comply with the appropriate standards.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025 requirements.

I attest that the necessary measurements were made by me or under my supervision, at TIMCO ENGINEERING, INC. located at 849 N.W. State Road 45, Newberry, Florida 32669 USA.

Authorized by: Mario de Aranzeta

Signature: On File

Function: Lab Supervisor / Test Engineer

Date: June 16, 2008

REPORT SUMMARY

Disclaimer	The test results only relate to the item tested.
Applicable Rule(s)	Pt 15.209, Pt 15.107, ANSI C63.4: 2003
Related Report	No related report

TEST ENVIRONMENT

Test Facility	Timco Engineering, Inc. 849 NW State Road 45 Newberry, FL 32669 USA.
Test Condition in the laboratory	Temperature: 26°C Relative humidity: 50%

TEST SETUP SUMMARY

Test Exercise/Software	The DUT was placed in continuous transmit mode of operation per applicant's instruction.
Supporting Equipment	N/A. The DUT is a stand-alone transmitter
Deviation from the standard/procedure	No deviation
Modification of DUT	No modification

GENERAL INFORMATION

DUT Description	125 kHz Transmitter		
FCC ID	VZKSP1		
IC Label	TBD		
Model Number	Tag Exciter		
Serial Number	N/A		
Trade Name	GuardRFID		
Operating Frequency	125 kHz		
No. of Channels	1		
Max. Output Power	N/A		
Modulation	None		
DUT Power Source	☒ 110–120Vac/50– 60Hz		
	☐ DC Power		
	☐ Battery Operated Exclusively		
Test Item	☐ Prototype	☒ Pre-Production	☐ Production
Type of Equipment	☐ Fixed	☒ Mobile	☐ Portable
Antenna Specification	N/A		

EMC EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
3/10-Meter OATS	TEI	N/A	N/A	Listed 3/27/07	3/26/10
3-Meter OATS	TEI	N/A	N/A	Listed 1/11/06	1/10/09
Antenna: Biconnical	Eaton	94455-1	1057	CAL 12/12/07	12/12/09
Antenna: Biconnical	Electro-Metrics	BIA-25	1171	CAL 4/29/07	4/29/09
Analyzer Blue Tower Quasi-Peak Adapter	HP	85650A	2811A01279	CAL 4/13/07	4/13/09
Analyzer Blue Tower RF Preselector	HP	85685A	2926A00983	CAL 9/5/07	9/5/09
Analyzer Blue Tower Spectrum Analyzer	HP	8568B	2928A04729 2848A18049	CAL 4/13/07	4/13/09
LISN	Electro-Metrics	ANS-25/2	2604	CAL 8/27/06	8/27/08
LISN	Electro-Metrics	EM-7820	2682	CAL 4/28/07	4/28/09
Antenna: Log-Periodic	Eaton	96005	1243	CAL 12/14/07	12/14/09
Antenna: Passive Loop	EMC Test Systems	EMCO 6512	9706-1211	CAL 4/27/08	4/27/10

TEST PROCEDURES

Power Line Conducted Interference: The procedure used was ANSI C63.4-2003 using a 50uH LISN. The spectrum was scanned from .15 to 30 MHz. The bandwidth of the spectrum analyzer was 10 kHz with an appropriate sweep speed.

Radiation Interference: The test procedure used was ANSI C63.4-2003 using an Agilent spectrum analyzer with preselector. In the frequency range 10 kHz to 30 MHz the RBW was 10 kHz and from 30-1000 MHz the RBW of the spectrum analyzer was 100 kHz with an appropriate sweep speed. The analyzer was calibrated in dB above a micro volt at the output of the antenna. The resolution bandwidth was 100 kHz and the video bandwidth was 300 kHz.

Occupied Bandwidth: The measurements were made with the spectrum analyzer's resolution bandwidth (RBW) = 100kHz and the video bandwidth (VBW) = 3 MHz and the span set as shown on plot.

Formula Of Conversion Factors: The Field Strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBµV) to the antenna correction factor supplied by the antenna manufacturer. The antenna correction factors are stated in terms of dB. The gain of the Pre-selector was accounted for in the Spectrum Analyzer Meter Reading.

Example:

Freq (MHz)	Meter Reading	+ ACF	+CL	= FS
33	20 dBµV	+ 10.36 dB/m	+0.40 dB	=30.76 dBµV/m @ 3m

ANSI C63.4-2003 Measurement Procedures: The DUT was placed on a non-conducting table 80 cm above the ground plane with the DUT located in the center of the table. With the antenna vertical a preliminary scan was done at 1 meters distance, the DUT was moved to a 10.0-meter distance and the antenna height varied and also placed in a horizontal position. The frequency was scanned from 9.0 kHz to 1.0 GHz. When an emission was found, the table was rotated to produce the maximum signal strength. The DUT was measured in three (3) orthogonal planes when necessary. When measurements are required below 30 MHz a loop antenna was employed.

RADIATION INTERFERENCE

Rules Part No.: 15.209

Requirements: Out-of-band emissions shall not exceed the level of the fundamental.

Frequency	Limits
9 to 490 kHz	2400/F (kHz) µV/m measured @ 300 meters
490 to 1705 kHz	24000/F (kHz) µV/m measured @ 30 meters
1705 kHz to 30 MHz	29.54 dBµV/m measured @ 30 meters
30 – 88 MHz	40.0 dBµV/m measured @ 3 meters
80 – 216 MHz	43.5 dBµV/m measured @ 3 meters
216 – 960 MHz	46.0 dBµV/m measured @ 3 meters
Above 960 MHz	54.0 dBµV/m measured @ 3 meters

Fundamental Limit:
2400/125= 19.2 uV/m @ 300 meters= 20 log(19.2) dBµV/m= 25.67
40 dB/decade correction factor on the distance
65.67 dBµV/m @ 30 meters
84.67 dBµV/m @ 10 meters

Test Data:

125 – 1250 kHz, measured at 10 meters

Tuned Frequency MHz	Emission Frequency MHz	Meter Reading dBµV	Ant. Polarity V/H	Coax Loss dB	Correction Factor dB/m	Duty Cycle dB	Field Strength dBµV/m	Margin dB
0.125	0.125	7.8	H	0.00	63.90	20	51.70	33.00
0.125	0.250	-2.8	H	0.01	58.25	20	35.46	49.24
0.125	0.375	-6.6	H	0.01	54.70	20	28.11	56.59
0.125	0.500	-4.0	H	0.01	52.10	20	28.11	>20
0.125	0.625	0.0	H	0.01	50.33	20	30.34	>20
0.125	0.750	4.5	H	0.02	48.90	20	33.42	>20
0.125	0.875	2.1	H	0.02	47.70	20	29.82	>20
0.125	1.000	8.7	H	0.02	46.50	20	35.22	>20
0.125	1.125	13.9	H	0.02	45.81	20	39.73	>20
0.125	1.250	6.5	H	0.03	45.13	20	31.66	>20

30-1000 MHz, Measured at 3 meters

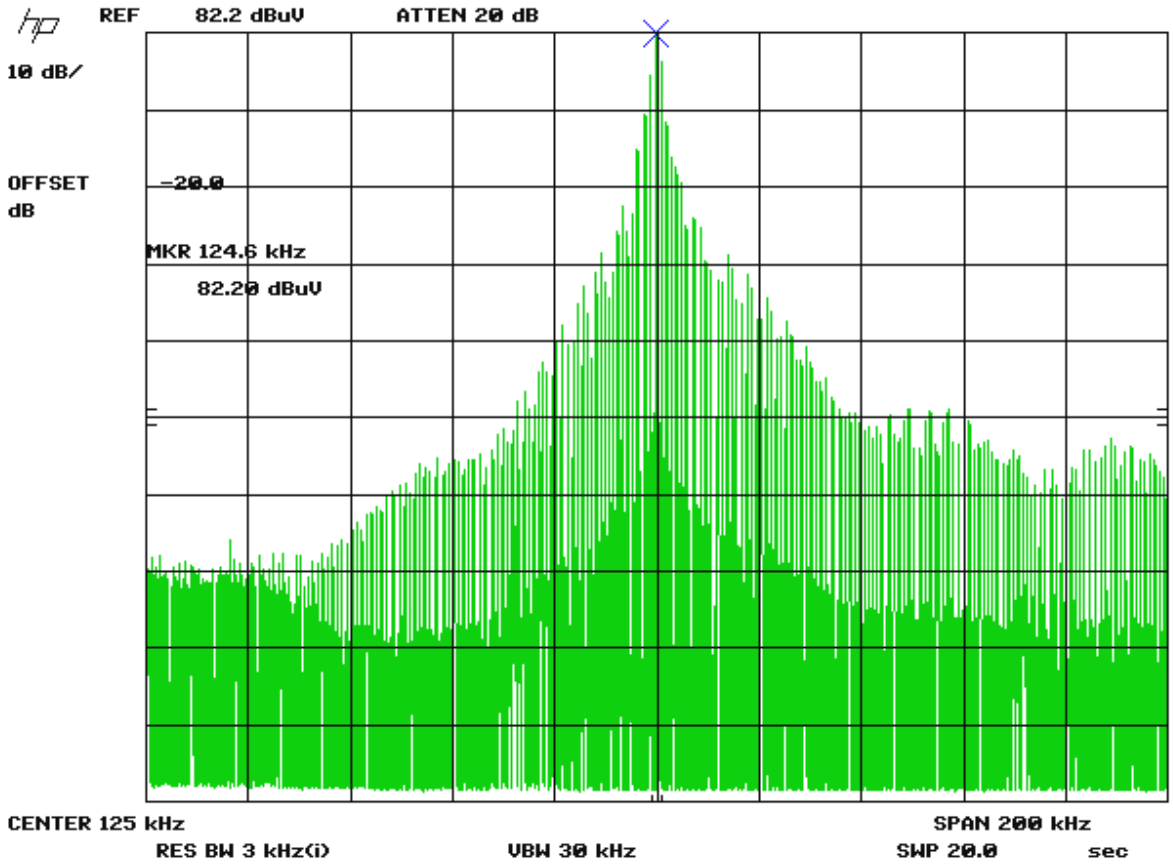
Emission Frequency MHz	Meter Reading dBµV	Ant. Polarity V/H	Coax Loss dB	Correction Factor dB/m	Field Strength dBµV/m	Margin dB
32.40	25.1	V	0.41	11.13	36.64	3.36
43.05	21.4	V	0.47	10.14	32.01	7.99
46.89	24.8	V	0.48	10.49	35.77	4.23
46.96	24.8	V	0.48	10.50	35.78	4.22
56.00	23.0	V	0.52	10.98	34.50	5.50
59.91	17.4	H	0.53	10.90	28.83	11.17
65.09	16.0	V	0.55	9.17	25.72	14.28
104.71	17.9	H	0.65	11.58	30.13	13.37
108.04	19.4	H	0.66	12.45	32.51	10.99
256.13	19.4	H	1.01	12.75	33.16	12.86
272.18	18.3	H	1.04	13.57	32.91	13.11

OCCUPIED BANDWIDTH

Rules Part No.: FCC Part 2.1049

Requirements: The field strength of any emissions appearing between the band edges below the level of the un-modulated carrier or to the general limits of 15.209, whichever permits the higher emission levels.

Test Data:



POWER LINE CONDUCTED INTERFERENCE

Rules Part No.: Part 15.207 Class B

Requirements:

Frequency (MHz)	Quasi Peak Limits (dBµV)	Average Limits (dBµV)
0.15 – 0.5	66 – 56	56 – 46
0.5 – 5.0	56	46
5.0 – 30	60	50

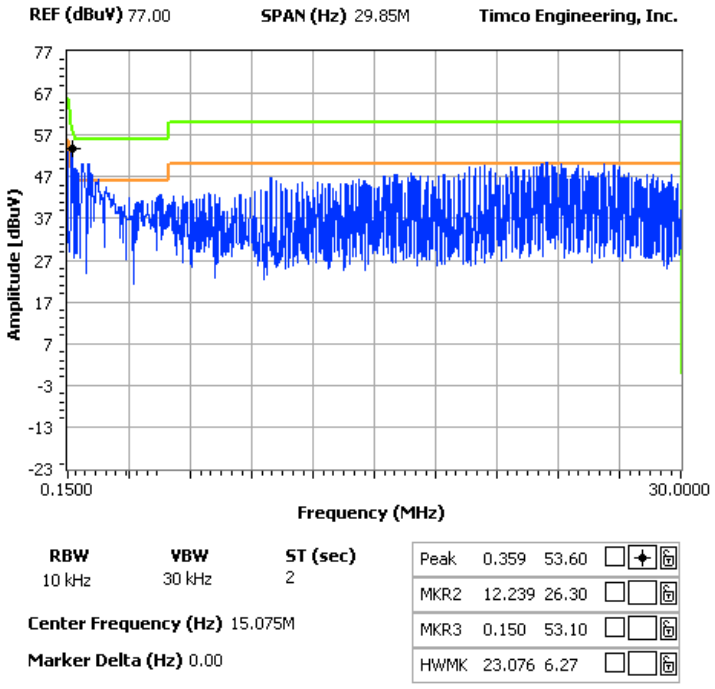
Test Data: The attached plots represent the power line conducted emissions. Both sides of the line were observed.

POWERLINE CONDUCTED EMISSIONS – LINE 1

QP/AVG	Frequency (kHz)	Emission (dBµV)	Limit (dBµV)
QP	163	49.94	65.31
QP	325	52.73	59.58
QP	486	48.07	56.24
QP	625	48.25	56.00
QP	810	49.23	56.00
QP	972	44.98	56.00
QP	1128	48.43	56.00
AVG	168	42.49	55.06
AVG	327	43.90	49.53
AVG	485	39.77	46.25
AVG	628	38.54	46.00
AVG	805	40.28	46.00
AVG	878	38.89	46.00
AVG	973	36.28	46.00
AVG	1128	39.51	46.00

NOTES:
POWERLINE CONDUCTED -- LINE 1
GuardRFID -- FCC ID: SIGN POST

FCC 15.107 Mask Class B

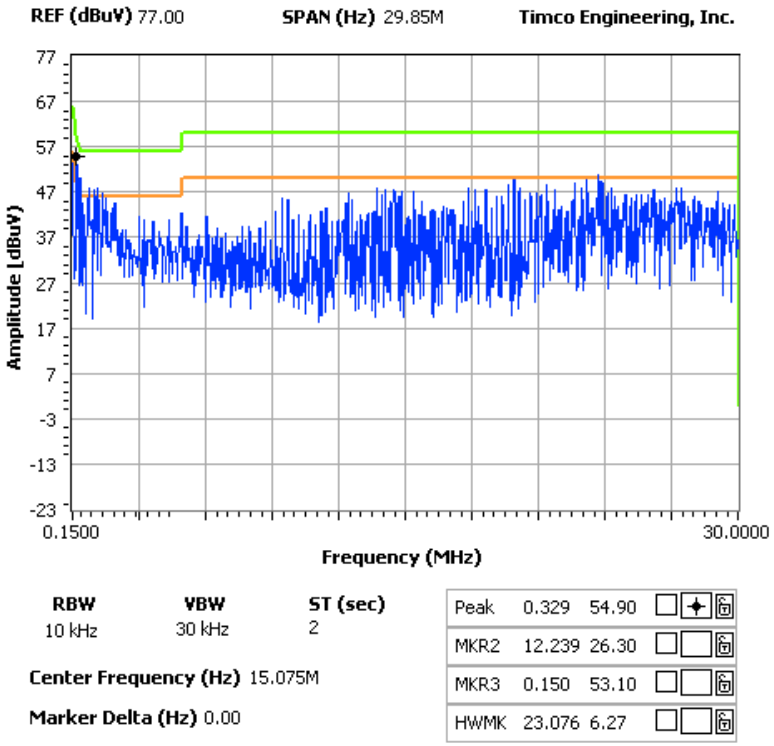


POWERLINE CONDUCTED EMISSIONS – LINE 2

QP/AVG	Frequency (kHz)	Emission (dBµV)	Limit (dBµV)
QP	169	47.94	65.01
QP	327	49.79	59.53
QP	489	43.59	56.18
QP	627	44.10	56.00
QP	812	44.43	56.00
QP	879	44.36	56.00
QP	975	39.17	56.00
QP	1138	43.26	56.00
AVG	162	40.47	55.36
AVG	326	39.67	49.55
AVG	486	34.40	46.24
AVG	624	33.48	46.00
AVG	810	34.23	46.00
AVG	874	34.02	46.00
AVG	973	30.34	46.00
AVG	1125	33.52	46.00

NOTES:
POWERLINE CONDUCTED -- LINE 2
GuardRFID -- FCC ID: SIGN POST

FCC 15.107 Mask Class B



CALCULATION OF DUTY CYCLE

The period of the pulse train is determined by observing it on an oscilloscope or a spectrum analyzer with zero (0) frequency span. A plot is then made of the pulse train with a sweep time of 100 milliseconds. This sweep determines the duration of the pulse train. This sweep allows the determination of the number of and type of pulses, i.e. long & short. Plots are then made showing the duration of each type of pulse and its duration. From the 100-millisecond plot, the number of a given type of pulse is then multiplied by the duration of that type pulse. This allows the calculation of the amount of time the DUT is on within 100 ms.

Long Pulse	
Short Pulse	
On Time	
Length of Pulse Train	
Total	

dB = 20*log(ON TIME)/PERIOD
dB = 20*log(0.1)
dB = 20*log(0.1)
dB = -20

From the manufacturer:

Based on the following plots.

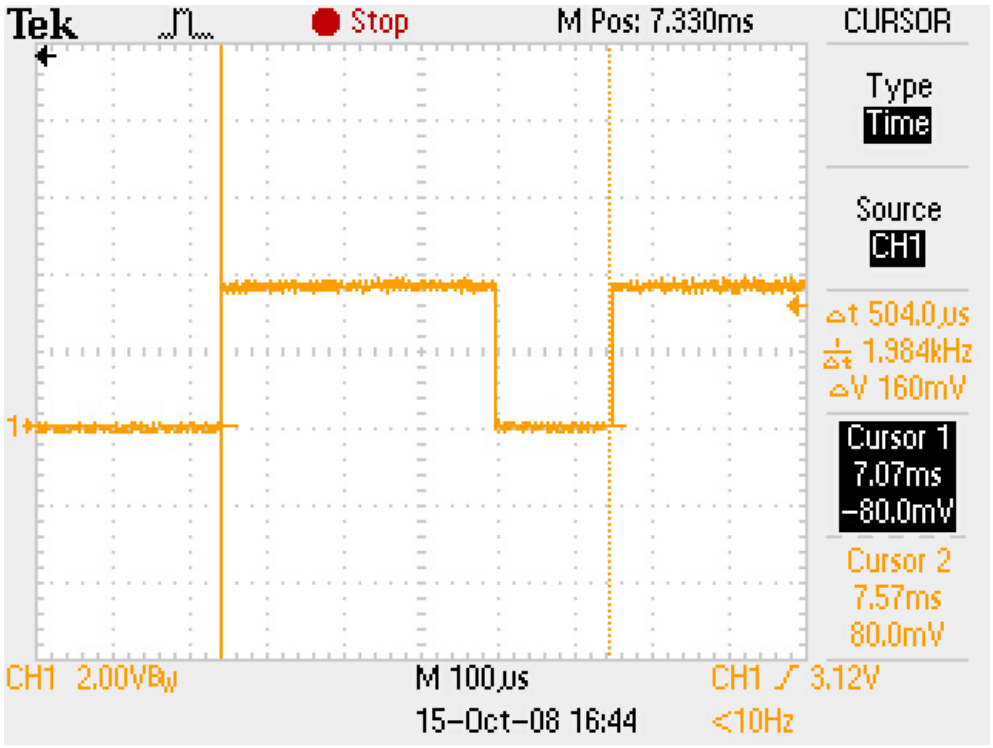
At the start of the TX cycle, there is 5.5ms Carrier Preamble (TX –on) followed by a guard gap of 1.5ms (TX-off); then followed by 26 bits (start (two bits), device ID (11 bits), data (6 bits) and CRC (7 bits).

Plot 1 shows the bit timing is 0.5ms.
Plot 2 shows the bit on time is 0.33ms
Plot 3 show the time between words.
Plot 4 shows a typical word length. The data in a word can't be all 1's

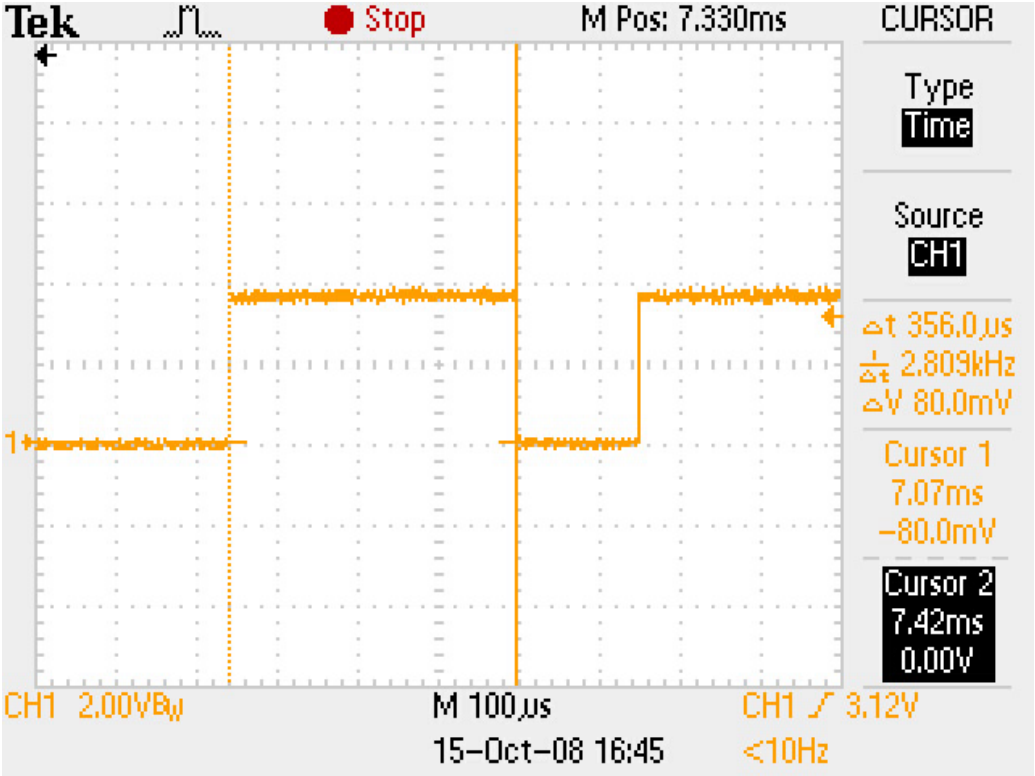
Hence the total on time per cycle is 5.5ms + 26 x 0.33ms = 14.08 ms

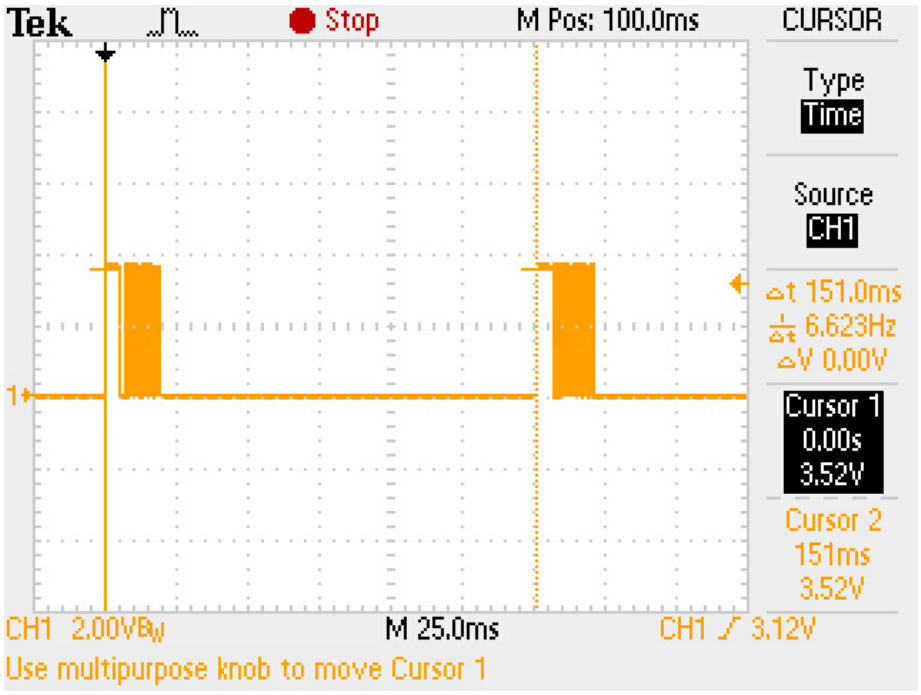
Therefore the duty cycle is (14.08 ms/150 ms) = 9.38%.

We estimate based on a worst case word in any 100ms time period that we will be on less than 10%.

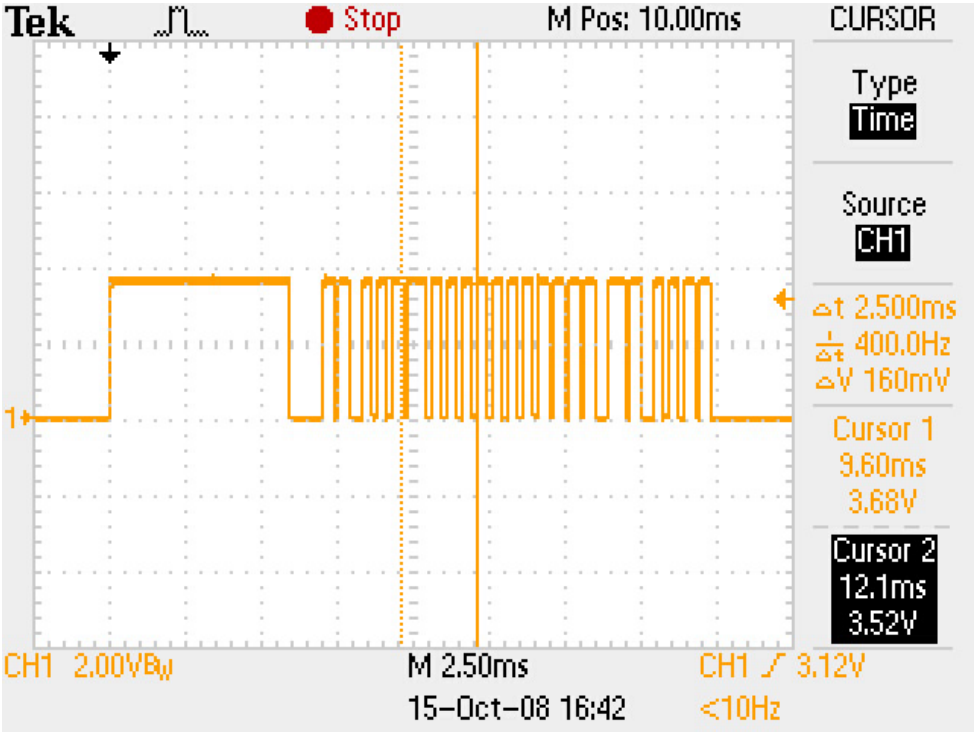

Tek
Stop
M Pos: 7.330ms
CURSOR
Type
Time
Source
CH1
Δt 504.0µs
1/Δt 1.984kHz
ΔV 160mV
Cursor 1
7.07ms
-80.0mV
Cursor 2
7.57ms
80.0mV
CH1 2.00V
M 100µs
CH1 3.12V
15-Oct-08 16:44
<10Hz

Plot 1


Tek
Stop
M Pos: 7.330ms
CURSOR
Type
Time
Source
CH1
Δt 356.0µs
1/Δt 2.809kHz
ΔV 80.0mV
Cursor 1
7.07ms
-80.0mV
Cursor 2
7.42ms
0.00V
CH1 2.00V
M 100µs
CH1 3.12V
15-Oct-08 16:45
<10Hz


Tek
Stop
M Pos: 100.0ms
CURSOR
Type
Time
Source
CH1
Δt 151.0ms
1/Δt 6.623Hz
ΔV 0.00V
Cursor 1
0.00s
3.52V
Cursor 2
151ms
3.52V
CH1 2.00V BW
M 25.0ms
CH1 3.12V
Use multipurpose knob to move Cursor 1

Plot 3


Tek
Stop
M Pos: 10.00ms
CURSOR
Type
Time
Source
CH1
Δt 2.500ms
1/Δt 400.0Hz
ΔV 160mV
Cursor 1
9.60ms
3.68V
Cursor 2
12.1ms
3.52V
CH1 2.00V BW
M 2.50ms
CH1 3.12V
15-Oct-08 16:42
<10Hz

Plot 4