

RETLIF TESTING LABORATORIES  
TEST REPORT R-4249N1  
April 19, 2004

FCC PART 15.231 COMPLIANCE TEST REPORT  
ON

MADGETECH, INC.  
WIRELESS DATA LOGGER  
FCC ID: RUYRFPHTMP

|                                                                        |                          |
|------------------------------------------------------------------------|--------------------------|
| APPLICANT<br>Madgetech, Inc.<br>201 Route 103 West<br>Warner, NH 03278 | MANUFACTURER<br><br>SAME |
|------------------------------------------------------------------------|--------------------------|

TEST SPECIFICATION: FCC Rules and Regulations Part 15, Subpart C, Para. 15.231

TEST PROCEDURE: ANSI C63.4:1992

### TEST SAMPLE DESCRIPTION

BRANDNAME: Madgetech MODEL: RFPHTEMP101

TYPE: Wireless Data Logger

POWER REQUIREMENTS: 3.5VDC via internal battery

FREQUENCY OF OPERATION: 418.0MHz

TYPE OF TRANSMISSION: Pulsed emission containing manchester encoded data bits

FCC ID: RUYRFPHTEMP

APPLICABLE RULE SECTION: Part 15, Subpart C, Section 15.231

### TESTS PERFORMED

- 15.231 (e) Spurious Emissions (30MHz to 4.2GHz)
- 15.231 (e) Field Strength of Fundamental
- 15.231 (c) Occupied Bandwidth, 0.25% of Fundamental Frequency
- Duty Cycle Determination

### TEST SAMPLE OPERATION

The EUT is powered by 3.5VDC, internal battery. The device is automatically operated and is intended to transmit variable environmental test data such as temperature, humidity or PH at a user defined interval (30 seconds to 12 hours). Operation of the EUT complies with the parameters required in Part 15, Subpart C, Section 15.231 (e) for devices which will transmit data and with the general requirements of 15.231 for automatically operated devices. For testing purposes the EUT was configured to continuously transmit at maximum duty cycle with new battery installed.

Test Report No. R-4249N1  
FCC ID: RUYRFPHTEMP

## TEST SAMPLE / TEST PROGRAM

- The transmitter ceases transmission within 5 seconds after activation per the requirements of 15.231 a (2).
- Operation is limited so that the duration of each transmission is less than one second (.937sec) and the minimum silent period between transmissions is 30 seconds which is more than 30 times the duration of the transmission and over ten seconds per the requirements of 15.231 (e) .
- The device is not employed for RC purposes involving fire, security and safety of life.
- The fundamental field strength at 418.0MHz did not exceed  $4133\mu\text{V/M}$  (Average) at a test distance of 3 meters.
- The peak value of fundamental emissions did not exceed a peak field strength limit corresponding to 20dB above the maximum permitted average limit.
- The field strength of harmonic and spurious emissions did not exceed  $413\mu\text{V/M}$  as specified in 15.231 (e) for a fundamental frequency of 418.0MHz.
- The device operates at a single frequency of 418.0MHz The bandwidth of emission did not exceed 0.25% of the operating frequency as specified in 15.231 (c) and was determined as follows:

|                           |   |                                         |
|---------------------------|---|-----------------------------------------|
| Fundamental Frequency     | = | 418.0MHz                                |
| 0.25% of Center Frequency | = | 1.045MHz                                |
| 1.045 divided by 2        | = | 0.5225MHz                               |
| Bandwidth Range           | = | Fundamental Frequency + and - 0.5225MHz |
| 418.0MHz - 0.5225MHz      | = | 417.4775MHz                             |
| 418.0MHz + 0.5225MHz      | = | 418.5225MHz                             |
| <b>Bandwidth Range</b>    | = | <b>417.4775MHz - 418.5225MHz</b>        |

- The device uses an external 1/4 wave whip antenna with a reverse SMA antenna connector which meets the unique antenna connector requirement of 15.203
- Radiated Emissions from the EUT were measured in all three axis. The attached Radiated Emissions test data is representative of the worst case orientation.

## DETERMINATION OF FIELD STRENGTH LIMITS

The field strength limits shown below were calculated as specified in Section 15.231 (e).

### **Fundamental Frequency: 418.0MHz**

Where F is the frequency in MHz, the formula for calculating the maximum permitted fundamental field strength for the band 260-470MHz,  $\mu\text{V/m}$  at 3 meters is as follows:

$$\begin{aligned} 16.6667(F) - 2833.3333 &= \text{Field Strength Limit } (\mu\text{V/m}) \\ 16.6667 \times 418.0 &= 6966.6806 \\ 6966.6806 - 2833.3333 &= 4133.35 \\ \text{Field Strength Limit} &= 4133.35\mu\text{V/m} = 72.33\text{dBuV/M} \end{aligned}$$

The maximum permitted unwanted emission level is 20dB below the maximum permitted fundamental level which equals  $413.33\mu\text{V/m} = 52.33\text{dBuV/M}$ .

## DETERMINATION OF DUTY CYCLE

The transmitter controls were adjusted to maximize the transmitted duty cycle. The analyzer was set for a frequency span of 0Hz. The sweep time was then adjusted in order to display one full pulse train. The transmitter on time was then summed and compared to the time for one full cycle in order to obtain the duty cycle. As the pulse train exceeded 100msec in duration the worst case duty cycle was determined by analyzing the 100msec period with the greatest on time. The “on time” within the pulse train was determined as follows:

The individual pulse widths within the pulse train were measured and summed in order to obtain the total “on time” within the train.

### **Fundamental Frequency: 418.0MHz**

$$\begin{aligned} \text{Transmitter On Time} &= 8.421 \text{ milliseconds} \\ \text{Transmitter Cycle Time} &= 100 \text{ milliseconds} \\ \text{Transmitter Duty Cycle} &= 8.421\% \\ \text{On Time divided by Cycle Time} &= \text{Duty Cycle Factor} \\ 8.421 \text{ divided by } 100 &= 0.08421 \\ 0.08421 \text{ converted to dB } (\text{LOG}_{10} .08421) \times 20 &= -21.49\text{dB} \\ \text{Duty Cycle Factor} &= \textbf{-21.49dB} \end{aligned}$$

Duty Cycle Factor Determination Plots are included with this application as a separate attachment.. The duty cycle factor was applied to the peak readings in order to determine the average value of the emissions.

## EQUIPMENT LISTS

### Spurious Emissions

| EN    | Type                  | Manufacturer    | Description     | Model No. | Cal Date  | Due       |
|-------|-----------------------|-----------------|-----------------|-----------|-----------|-----------|
| 4029B | Test Site Attenuation | Retlif          | 3 / 10 Meters   | RNH       | 7/30/2003 | 7/30/2004 |
| 4202  | Biconilog             | EMCO            | 26 MHz - 2 GHz  | 3142      | 8/29/2003 | 8/29/2004 |
| 4895  | Spectrum Analyzer     | Hewlett Packard | 9kHz - 22GHz    | 8593EM    | 3/22/2004 | 3/22/2005 |
| 4984A | High Gain Horn        | Microlab/FXR    | 1.0 - 1.7 GHz   | L638A     | 1/22/2004 | 1/22/2005 |
| 4984B | High Gain Horn        | Microlab/FXR    | 1.7 - 2.6 GHz   | R638A     | 1/22/2004 | 1/22/2005 |
| 4984C | High Gain Horn        | Microlab/FXR    | 2.6 - 3.95 GHz  | S638A     | 1/22/2004 | 1/22/2005 |
| 4984D | High Gain Horn        | Microlab/FXR    | 3.95 - 5.85 GHz | H638A     | 1/22/2004 | 1/22/2005 |

### Fundamental Field Strength

| EN    | Type                  | Manufacturer    | Description    | Model No. | Cal Date  | Due       |
|-------|-----------------------|-----------------|----------------|-----------|-----------|-----------|
| 4029B | Test Site Attenuation | Retlif          | 3 / 10 Meters  | RNH       | 7/30/2003 | 7/30/2004 |
| 4202  | Biconilog             | EMCO            | 26 MHz - 2 GHz | 3142      | 8/29/2003 | 8/29/2004 |
| 4895  | Spectrum Analyzer     | Hewlett Packard | 9kHz - 22GHz   | 8593EM    | 3/22/2004 | 3/22/2005 |

### Occupied Bandwidth/Duty Cycle

| EN  | Type              | Manufacturer    | Description      | Model No. | Cal Date | Due      |
|-----|-------------------|-----------------|------------------|-----------|----------|----------|
| 713 | EMI Test Receiver | Rohde & Schwarz | 20 Hz - 26.5 GHz | ESI26     | 9/5/2003 | 9/5/2004 |

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# RETLIF TESTING LABORATORIES

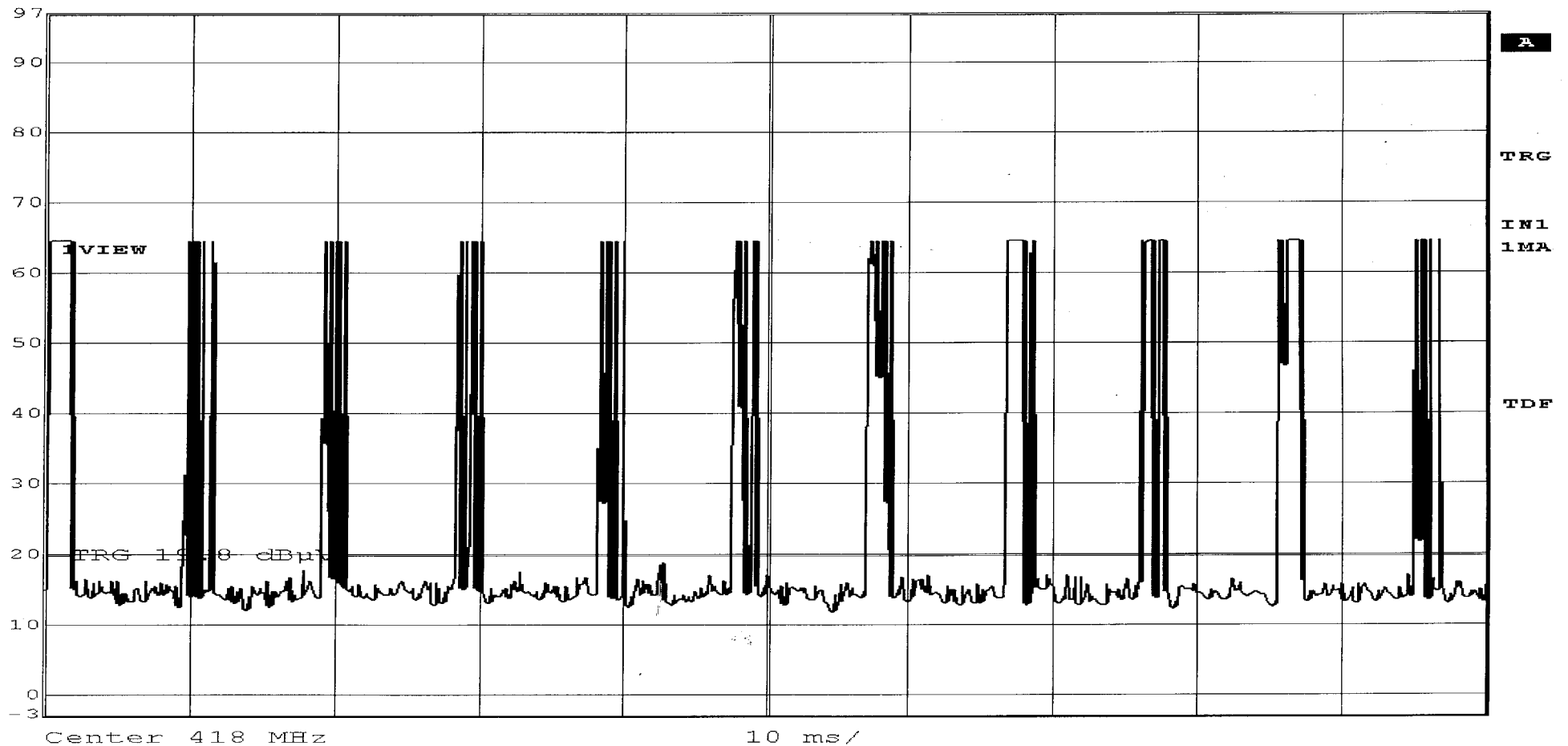
## EMISSIONS DATA SHEET

|                     |                               |              |              |
|---------------------|-------------------------------|--------------|--------------|
| Test Method:        | Duty Cycle                    |              |              |
| Customer:           | Madgetech, Inc.               | Test Sample: | Data Logger  |
| Model No:           | RFPHTEMP101                   | Serial No:   | n/a          |
| Test Specification: | FCC Part 15, Subpart C        | Paragraph:   | 15.231 ( e ) |
| Operating Mode:     | Transmitting Modulated Signal |              |              |
| Notes:              |                               |              |              |



Ref Lvl  
97 dBμV

RBW 100 kHz RF Att 0 dB  
VBW 300 kHz  
SWT 100 ms Unit dBμV

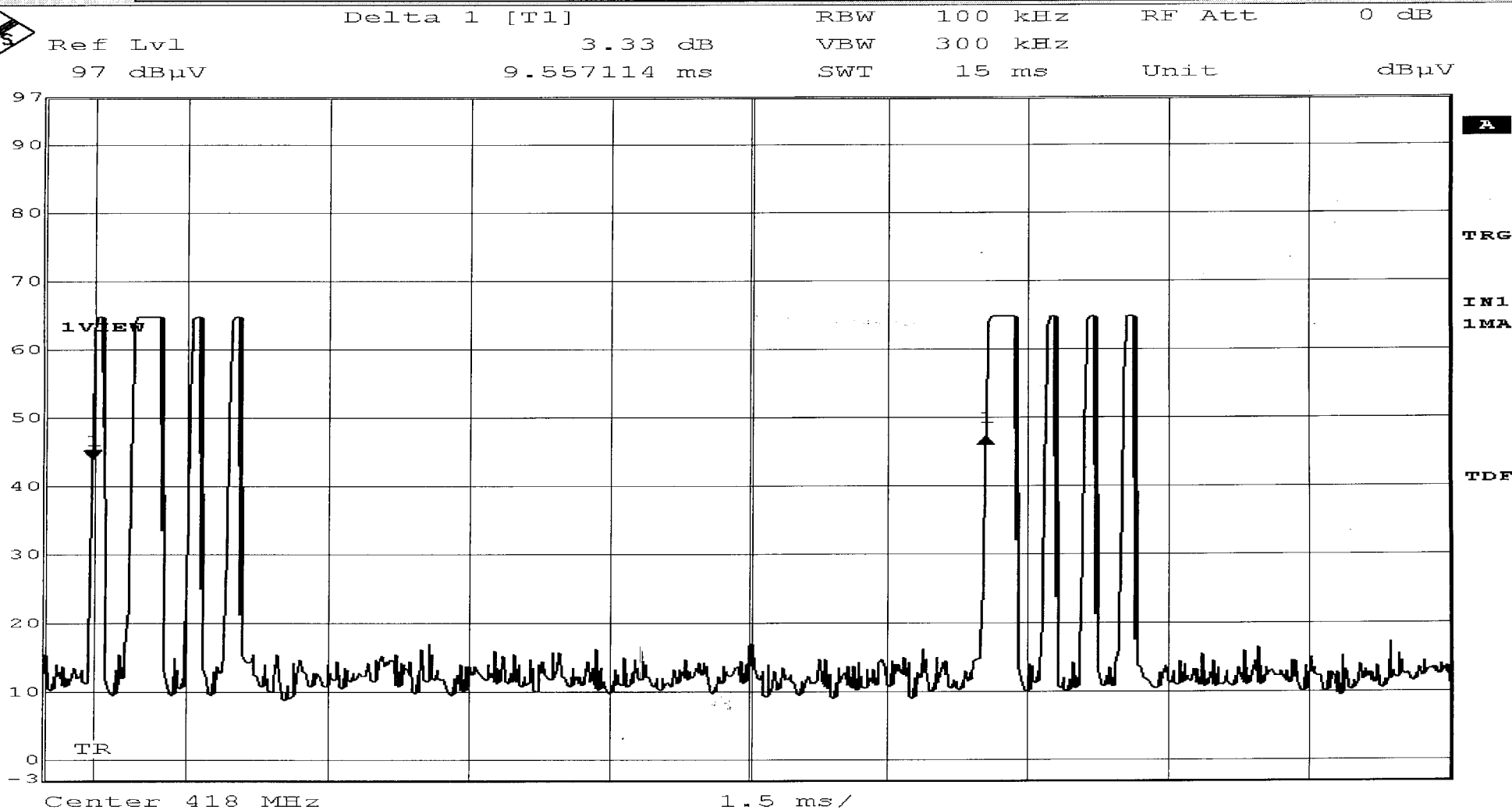


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# RETLIF TESTING LABORATORIES

## EMISSIONS DATA SHEET

|                     |                               |              |             |
|---------------------|-------------------------------|--------------|-------------|
| Test Method:        | Duty Cycle                    |              |             |
| Customer:           | Madgetech, Inc.               | Test Sample: | Data Logger |
| Model No:           | RFPHTEMP101                   | Serial No:   | n/a         |
| Test Specification: | FCC Part 15, Subpart C        | Paragraph:   | 15.231 (e)  |
| Operating Mode:     | Transmitting Modulated Signal |              |             |
| Notes:              |                               |              |             |

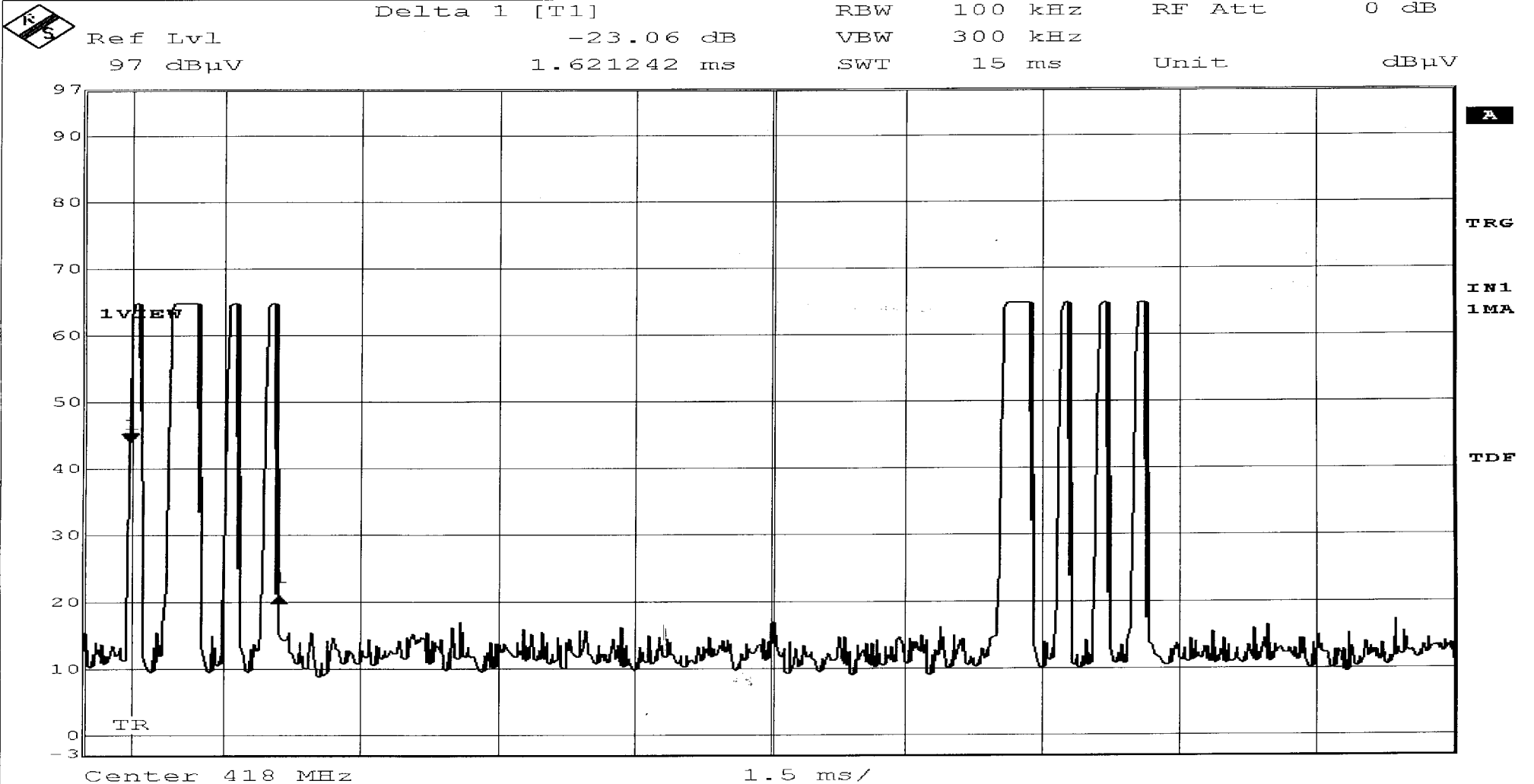


Date: 6.APR.2004 09:17:12

# RETLIF TESTING LABORATORIES

## EMISSIONS DATA SHEET

|                     |                               |              |             |
|---------------------|-------------------------------|--------------|-------------|
| Test Method:        | Duty Cycle                    |              |             |
| Customer:           | Madgetech, Inc.               | Test Sample: | Data Logger |
| Model No:           | RFPHTEMP101                   | Serial No:   | n/a         |
| Test Specification: | FCC Part 15, Subpart C        | Paragraph:   | 15.231 (e)  |
| Operating Mode:     | Transmitting Modulated Signal |              |             |
| Notes:              |                               |              |             |

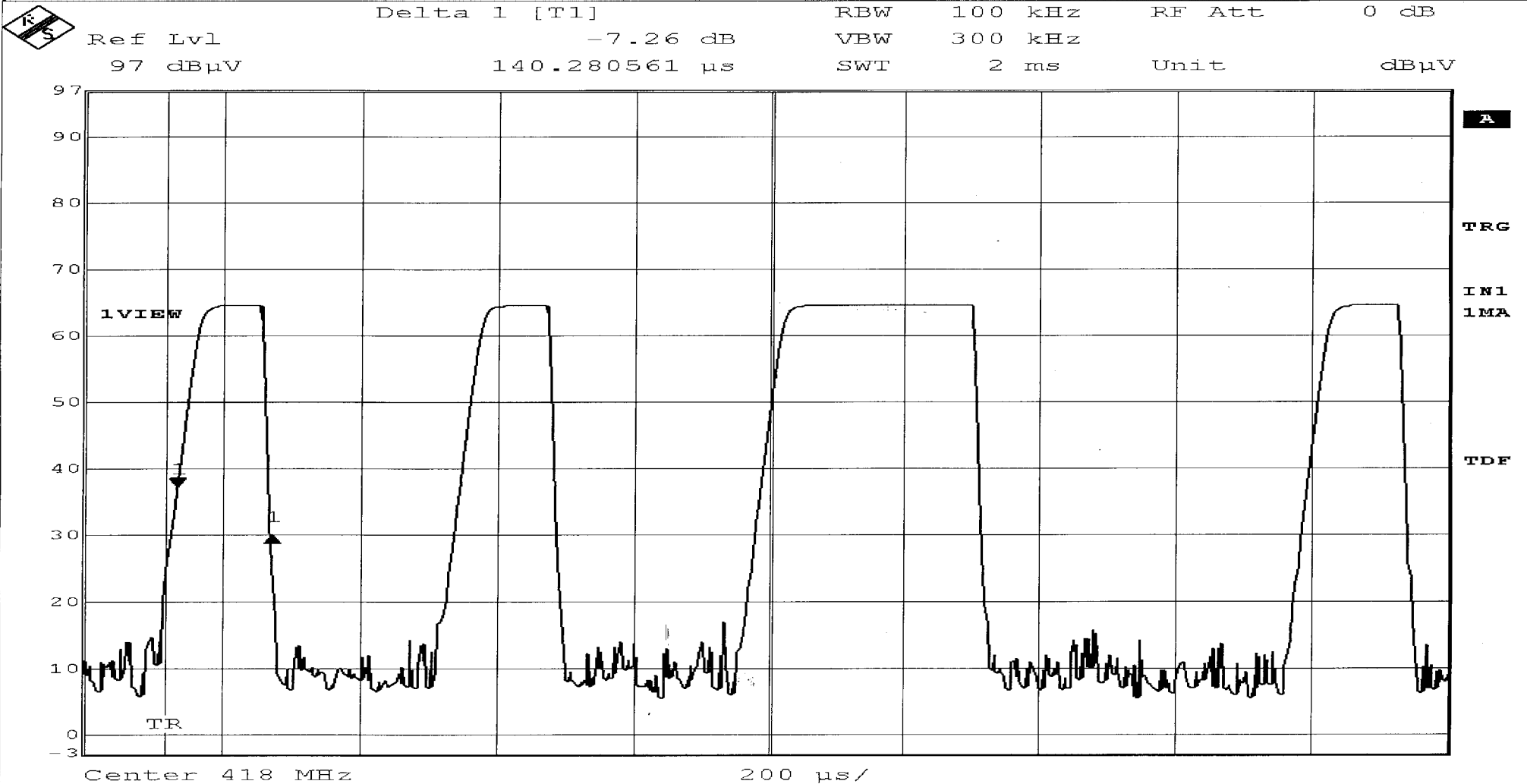


Date: 6.APR.2004 09:15:05

# RETLIF TESTING LABORATORIES

## EMISSIONS DATA SHEET

|                     |                               |              |             |
|---------------------|-------------------------------|--------------|-------------|
| Test Method:        | Duty Cycle                    |              |             |
| Customer:           | Madgetech, Inc.               | Test Sample: | Data Logger |
| Model No:           | RFPHTEMP101                   | Serial No:   | n/a         |
| Test Specification: | FCC Part 15, Subpart C        | Paragraph:   | 15.231 (e)  |
| Operating Mode:     | Transmitting Modulated Signal |              |             |
| Notes:              |                               |              |             |

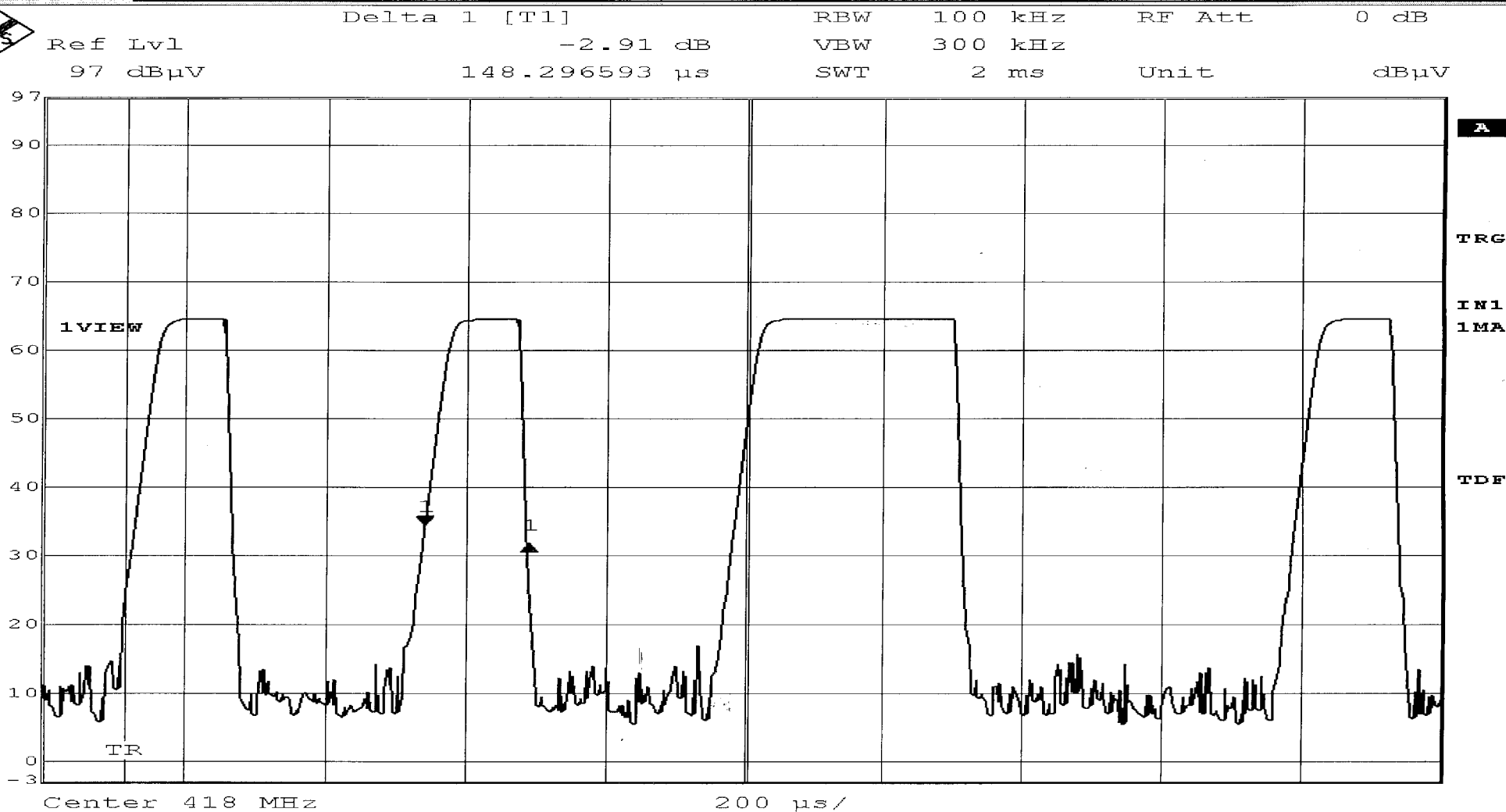


Date: 6.APR.2004 09:07:27

# RETLIF TESTING LABORATORIES

## EMISSIONS DATA SHEET

|                     |                               |              |             |
|---------------------|-------------------------------|--------------|-------------|
| Test Method:        | Duty Cycle                    |              |             |
| Customer:           | Madgetech, Inc.               | Test Sample: | Data Logger |
| Model No:           | RFPHTEMP101                   | Serial No:   | n/a         |
| Test Specification: | FCC Part 15, Subpart C        | Paragraph:   | 15.231 (e)  |
| Operating Mode:     | Transmitting Modulated Signal |              |             |
| Notes:              |                               |              |             |

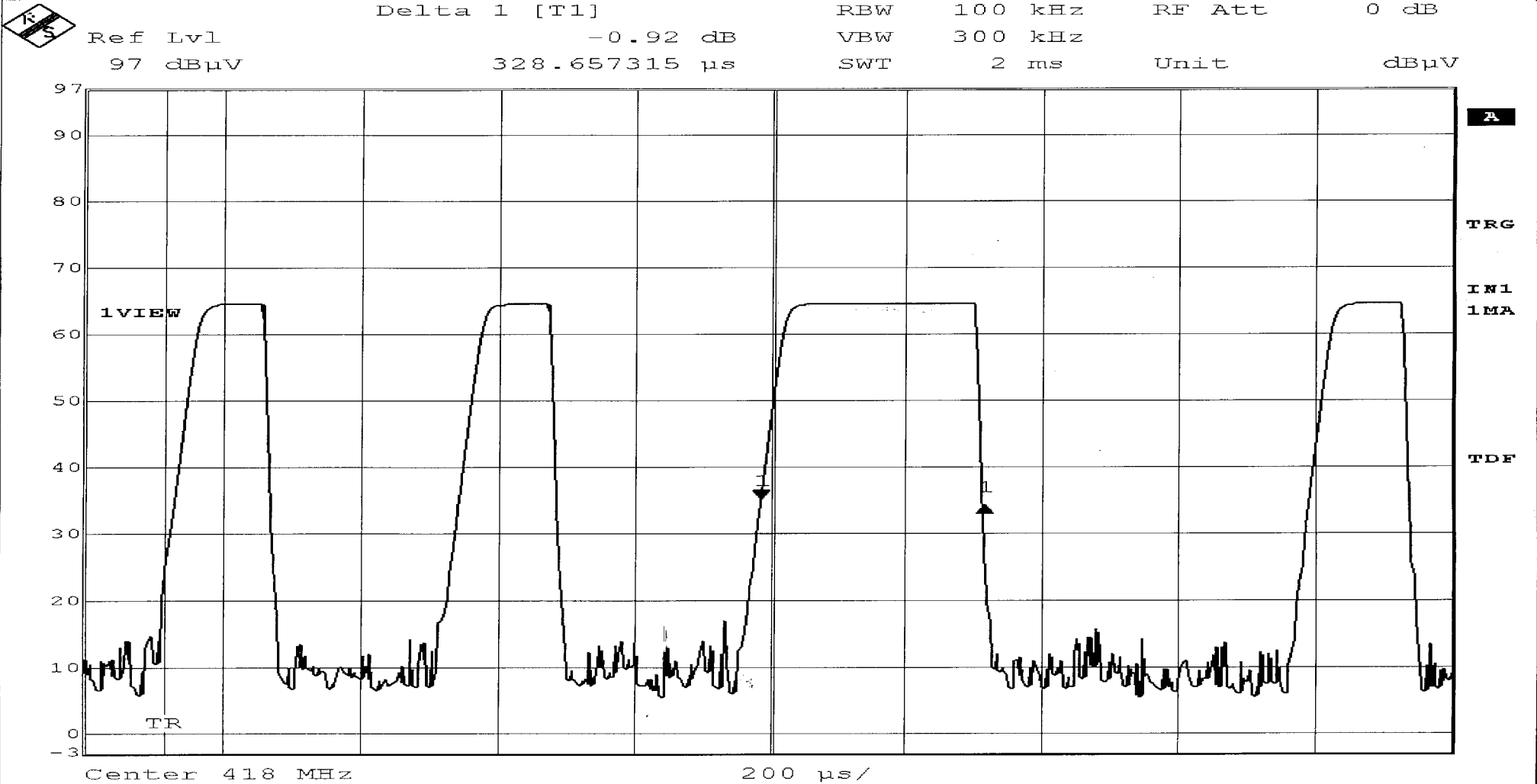


Date: 6.APR.2004 09:08:51

# RETLIF TESTING LABORATORIES

## EMISSIONS DATA SHEET

|                     |                               |              |             |
|---------------------|-------------------------------|--------------|-------------|
| Test Method:        | Duty Cycle                    |              |             |
| Customer:           | Madgetech, Inc.               | Test Sample: | Data Logger |
| Model No:           | RFPHTEMP101                   | Serial No:   | n/a         |
| Test Specification: | FCC Part 15, Subpart C        | Paragraph:   | 15.231 (e)  |
| Operating Mode:     | Transmitting Modulated Signal |              |             |
| Notes:              |                               |              |             |



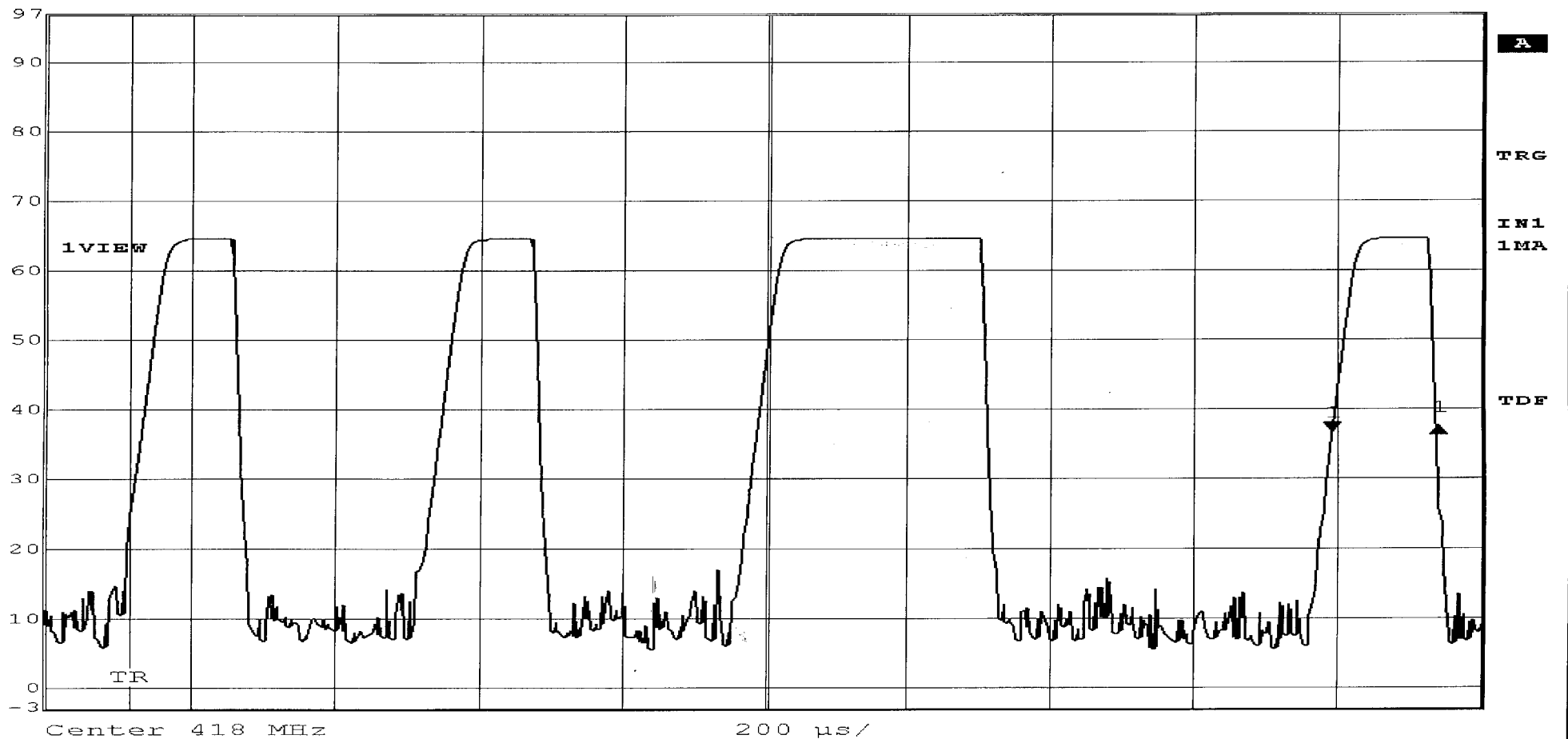
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# RETLIF TESTING LABORATORIES

## EMISSIONS DATA SHEET

|                     |                               |              |             |
|---------------------|-------------------------------|--------------|-------------|
| Test Method:        | Duty Cycle                    |              |             |
| Customer:           | Madgetech, Inc.               | Test Sample: | Data Logger |
| Model No:           | RFPHTEMP101                   | Serial No:   | n/a         |
| Test Specification: | FCC Part 15, Subpart C        | Paragraph:   | 15.231 (e)  |
| Operating Mode:     | Transmitting Modulated Signal |              |             |
| Notes:              |                               |              |             |

|                                                                                  |              |               |         |         |           |
|----------------------------------------------------------------------------------|--------------|---------------|---------|---------|-----------|
|  | Delta 1 [T1] | RBW           | 100 kHz | RF Att  | 0 dB      |
|                                                                                  | Ref Lvl      | 0.63 dB       | VBW     | 300 kHz |           |
|                                                                                  | 97 dBμV      | 148.296593 μs | SWT     | 2 ms    | Unit dBμV |



Date: 6.APR.2004 09:11:29

# RETLIF TESTING LABORATORIES

## TABULAR DATA SHEET

**Test Method:**

Fundamental Field Strength

**Customer:**

**Madgetech, Inc.**

Job No:

R-4249N1

**Test Sample:**

Data Logger

**Model No:**

RFPHTEMP101

**Serial No:**

n/a

### Test Specification:

FCC Part 15, Subpart C

Paragraph: 15.231 (e)

**Operating Mode:**

Transmitting Modulated Signal

**Technician:**

T. Firkowski

24

Date:

4/2/2004

**Notes:**

Test Distance: 3 Meters

Detector: Peak

[illegible]

# RETLIF TESTING LABORATORIES

## TABULAR DATA SHEET

**Test Method:**

Spurious Emissions 30MHz to 4.2GHz

**Customer:**

Madgetech, Inc.

**Job No:**

R-4249N1

**Test Sample:**

### Data Logger

**Model No:**

RFPHTEMP101

**Serial No:**

n/a

### Test Specification:

FCC Part 15, Subpart C

Paragraph: 15.231 (e)

**Operating Mode:**

Transmitting Modulated Signal

**Technician:**

T. Firkowski

7

**Date:**

04/05/2004

**Notes:**

Test Distance: 3 Meters

Detector: Peak

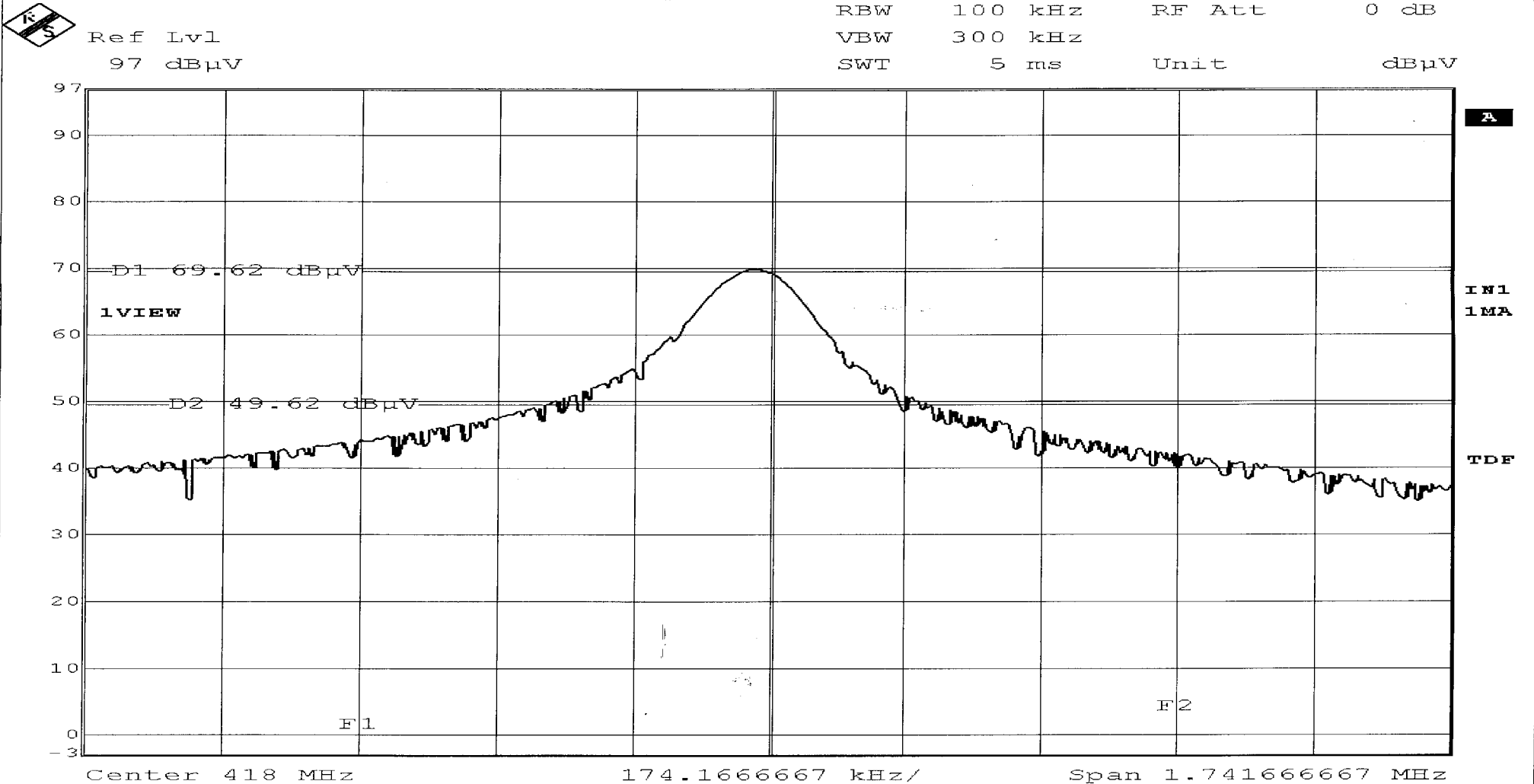
[illegible]

No EUT emissions were observed at the specified test distance, throughout the given frequency spectrum.

# RETLIF TESTING LABORATORIES

## EMISSIONS DATA SHEET

|                     |                               |              |             |
|---------------------|-------------------------------|--------------|-------------|
| Test Method:        | Occupied Bandwidth            |              |             |
| Customer:           | Madgetech, Inc.               | Test Sample: | Data Logger |
| Model No:           | RFPHTEMP101                   | Serial No:   | n/a         |
| Test Specification: | FCC Part 15, Subpart C        | Paragraph:   | 15.231 (c)  |
| Operating Mode:     | Transmitting Modulated Signal |              |             |
| Notes:              |                               |              |             |



Date: 6.APR.2004 08:59:33