RETLIF TESTING LABORATORIES
TEST REPORT R-4249N
April 16, 2004

FCC PART 15.231 COMPLIANCE TEST REPORT
ON

MADGETECH, INC.
WIRELESS DATA LOGGER
FCC ID: RUYBOARDRF

APPLICANT	MANUFACTURER
Madgetech, Inc. 201 Route 103 West Warner, NH 03278	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: RFTC4000

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: RUYBOARDRF

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 only the EUT was configured to continuously transmit at maximum duty cycle.

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 4133µV/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 413µV/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
Bandwidth Range	**=**	***417.4775MHz - 418.5225MHz***

- 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, µV/m at 3 meters is as follows:

16.6667(F) - 2833.3333	=	Field Strength Limit (µV/m)
16.6667 x 418.0	=	6966.6806
6966.6806 - 2833.3333	=	4133.35
Field Strength Limit	=	4133.35µV/m = 72.33dBuV/M

The maximum permitted unwanted emission level is 20dB below the maximum permitted fundamental level which equals 413.33µV/m = 52.33dBuV/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

Transmitter On Time	=	10.184milliseconds
Transmitter Cycle Time	=	100 milliseconds
Transmitter Duty Cycle	=	10.184%
On Time divided by Cycle Time	=	Duty Cycle Factor
10.1843672 divided by 100	=	0.10184
0.10184 converted to dB (LOG_{10} .10184)20	=	-19.84dB
Duty Cycle Factor	**=**	***-19.84dB***

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

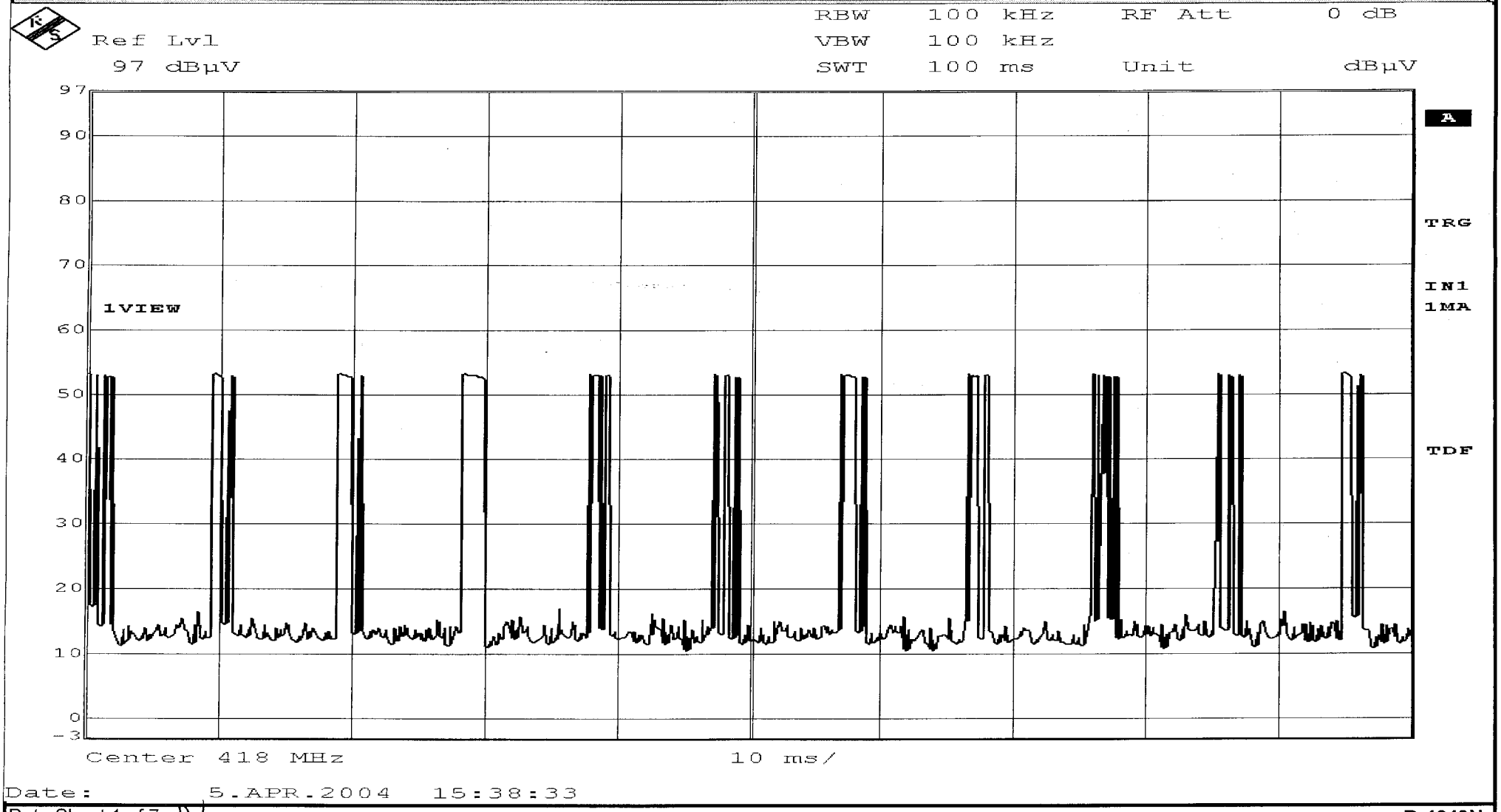
Occupied Bandwidth/Duty Cycle

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

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	Duty Cycle				
Customer:	Madgetech, Inc.	Test Sample:	Data Logger	Job No:	R-4249N
Model No:	RFTC4000	Serial No:	n/a	Technician:	T. Firkowski
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.231 (e)		Date:	April 5, 2004
Operating Mode:	Transmitting Modulated Signal				
Notes:					



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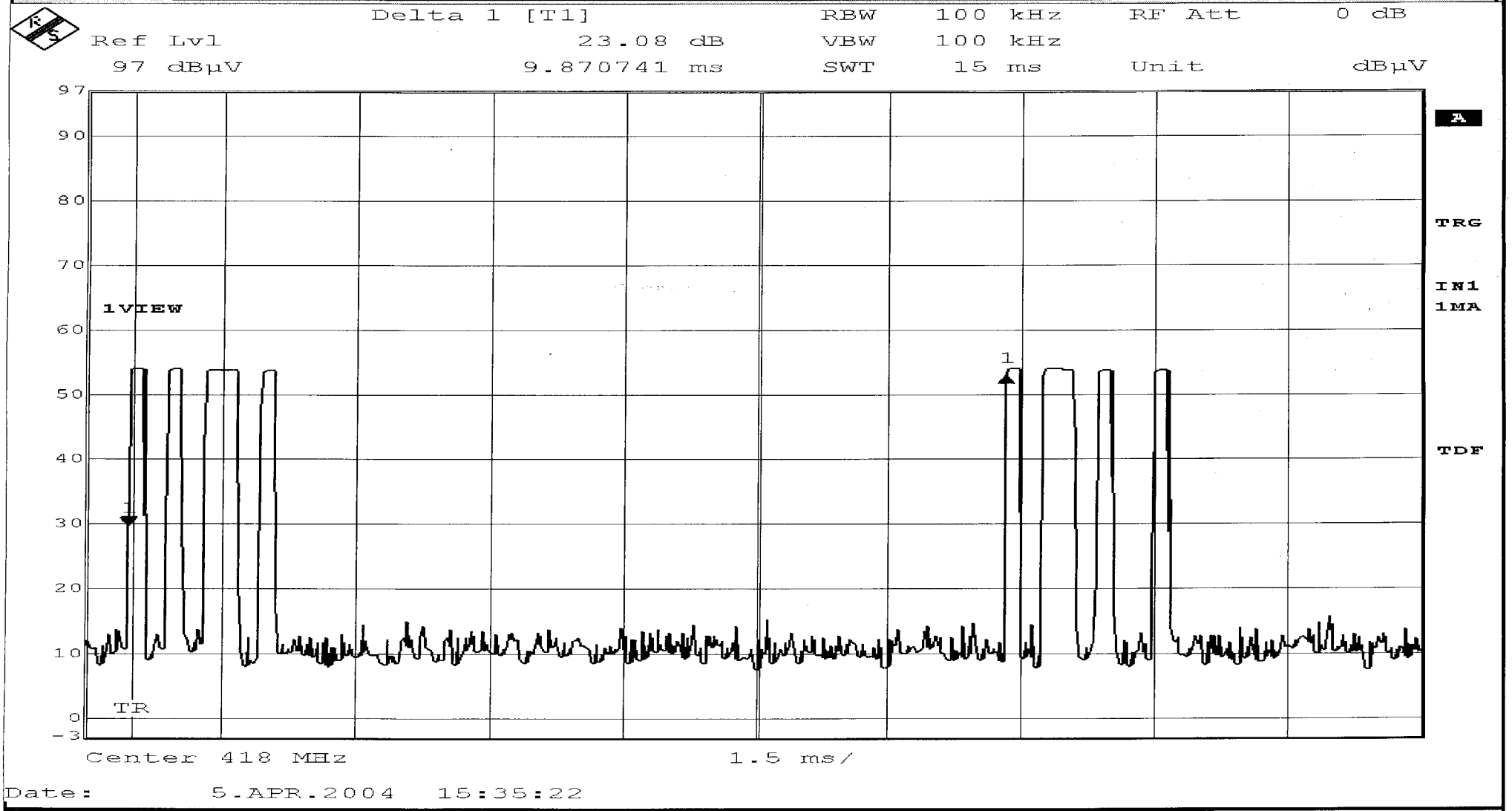
Model No:	RFTC4000	Serial No:	n/a	Technician:	T. Firkowski
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.231 (e)		Date:	April 5, 2004
Operating Mode:	Transmitting Modulated Signal				
Notes:					



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Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.231 (e)		**Date:**	April 5, 2004
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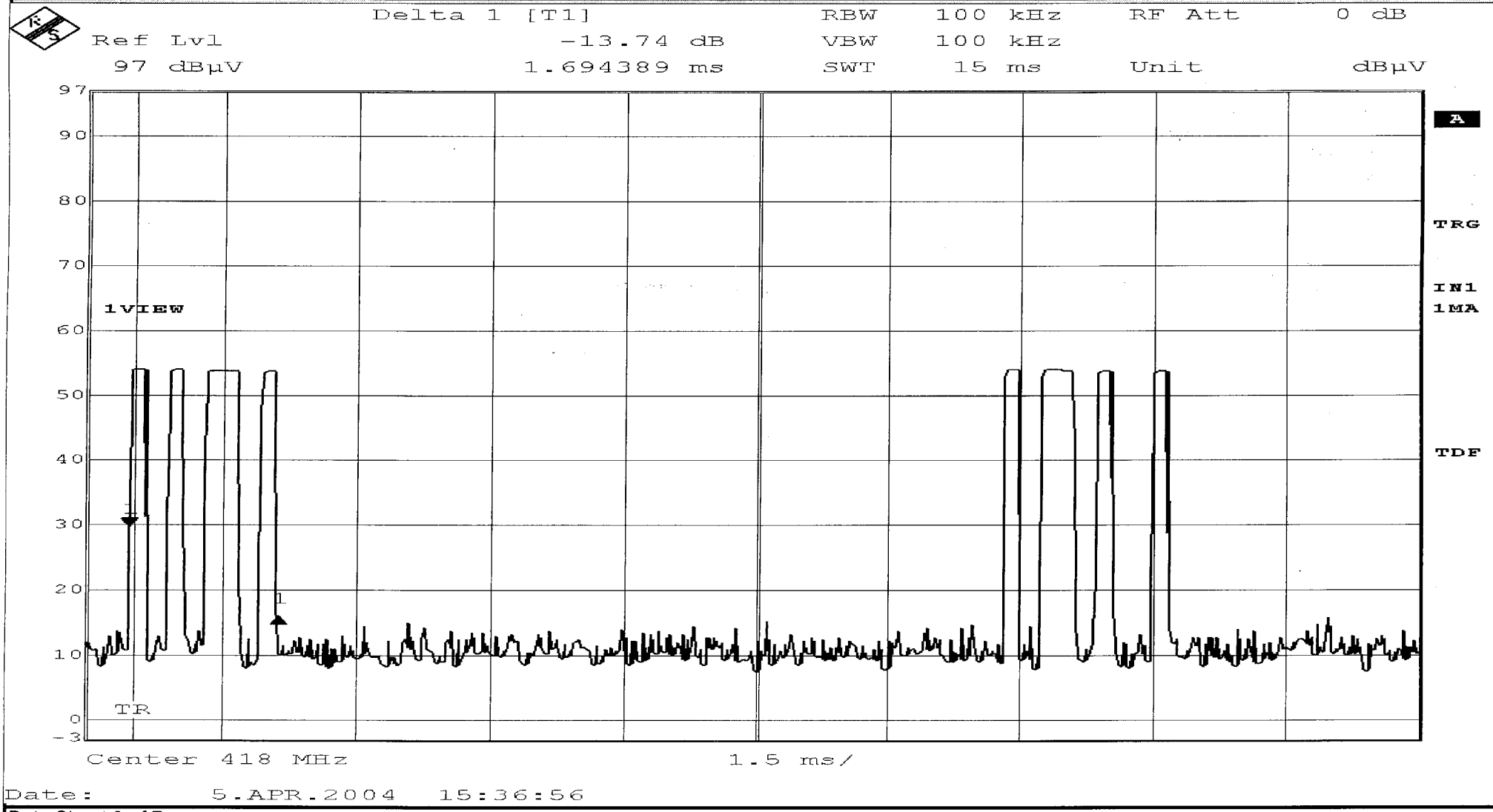

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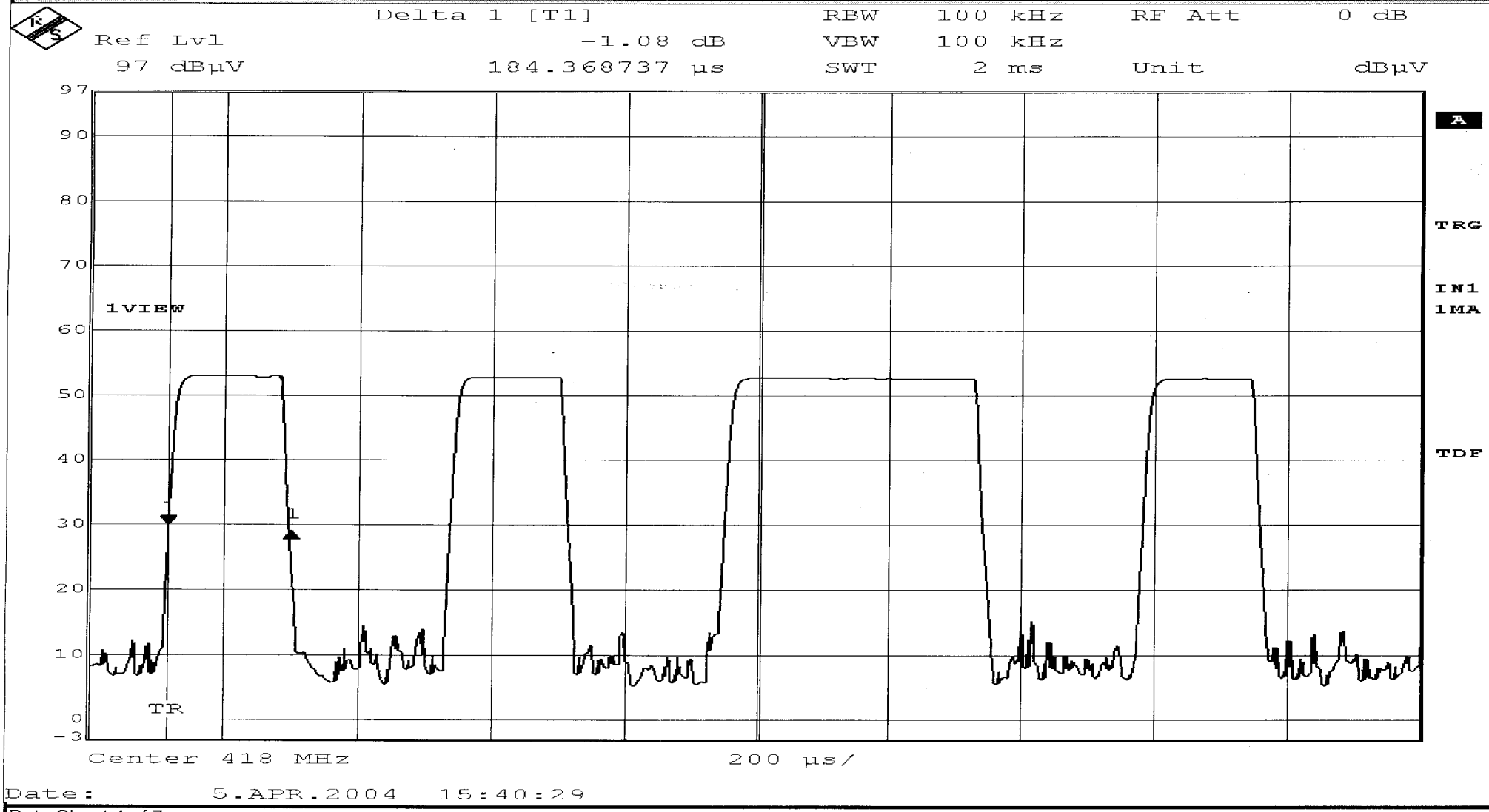

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EMISSIONS DATA SHEET

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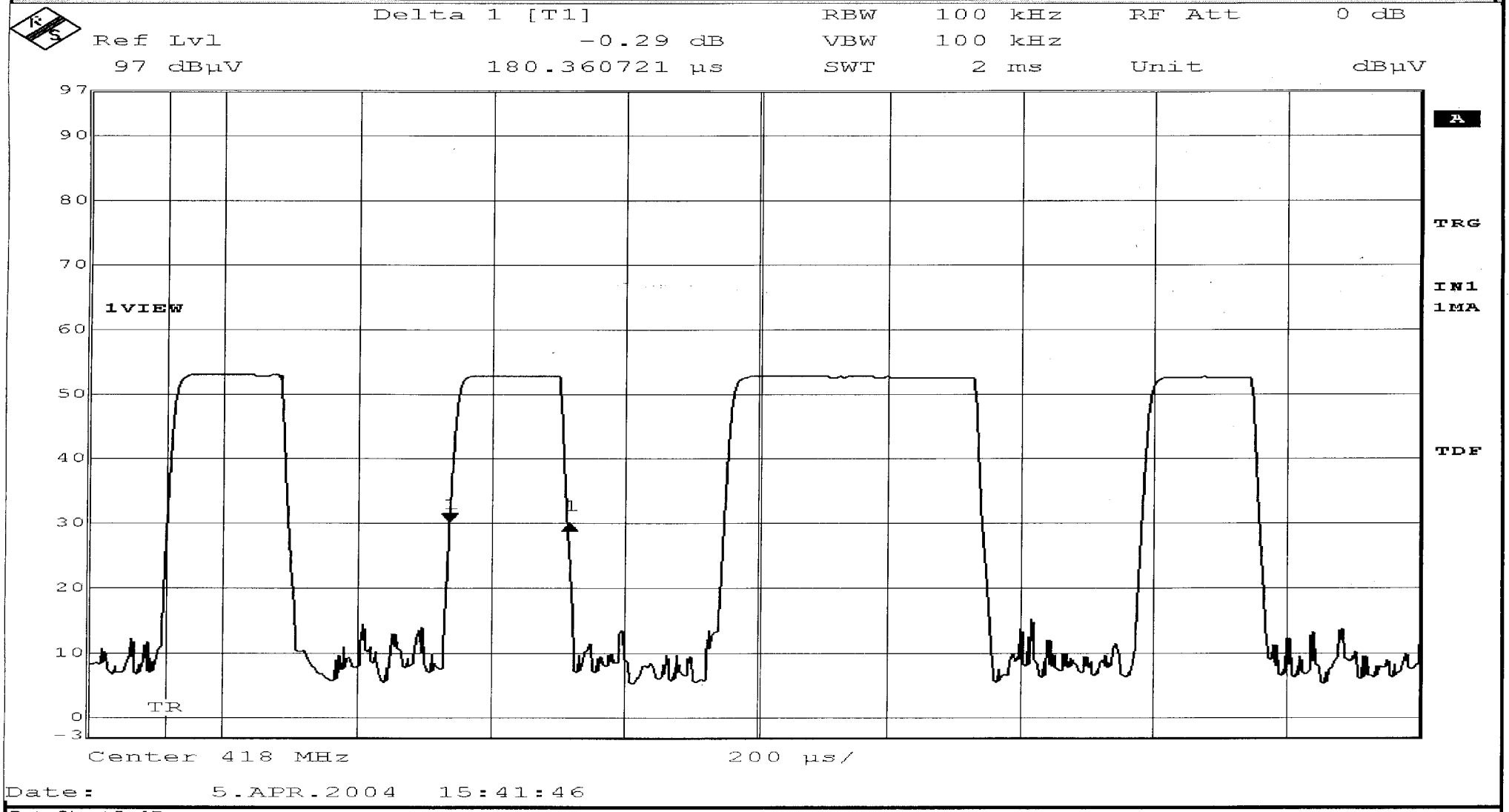
Customer:	Madgetech, Inc.	**Test Sample:**	Data Logger	**Job No:**	R-4249N
Model No:	RFTC4000	**Serial No:**	n/a	**Technician:**	T. Firkowski
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.231 (e)		**Date:**	April 5, 2004
Operating Mode:	Transmitting Modulated Signal				
Notes:					



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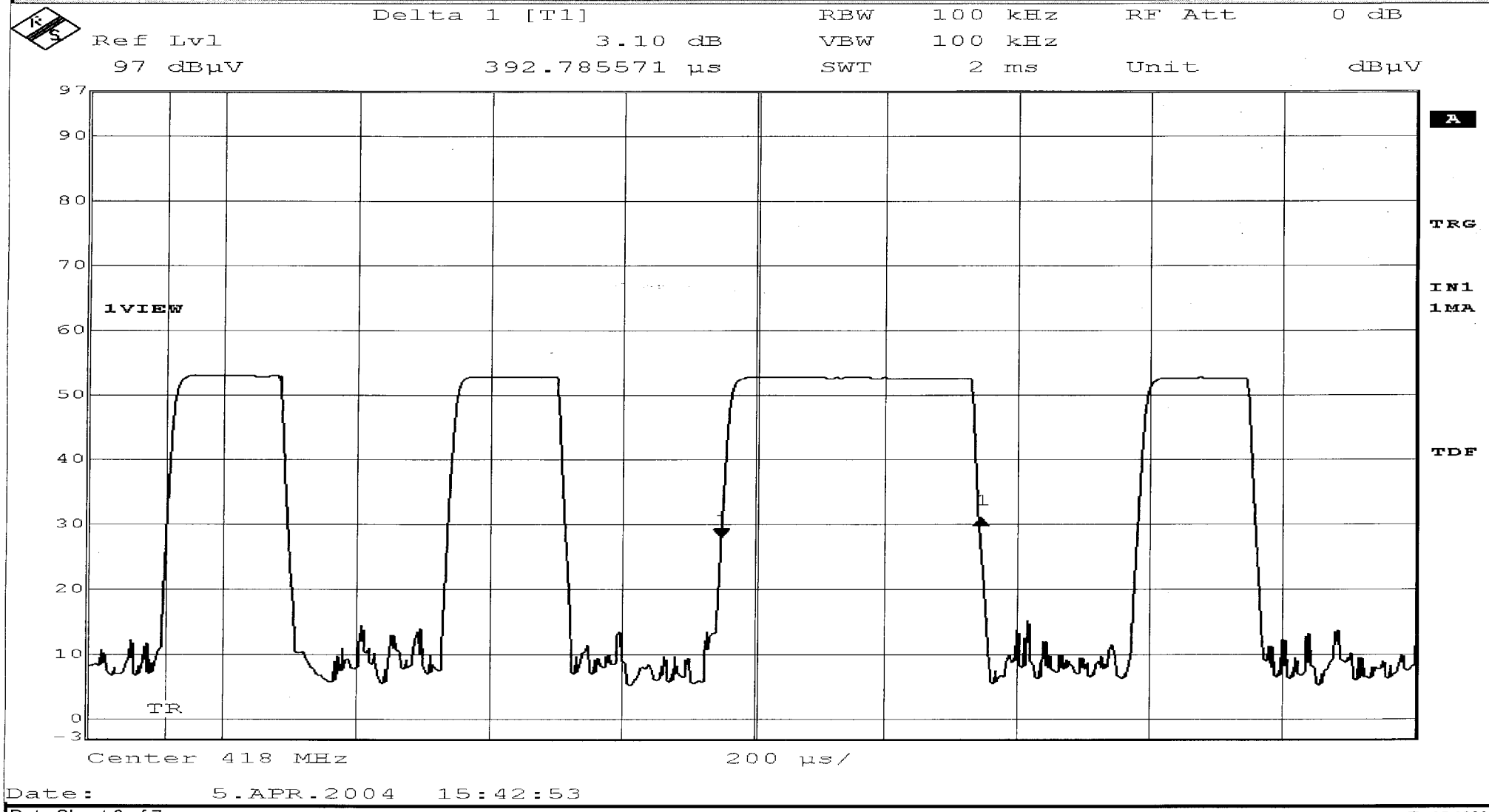
EMISSIONS DATA SHEET

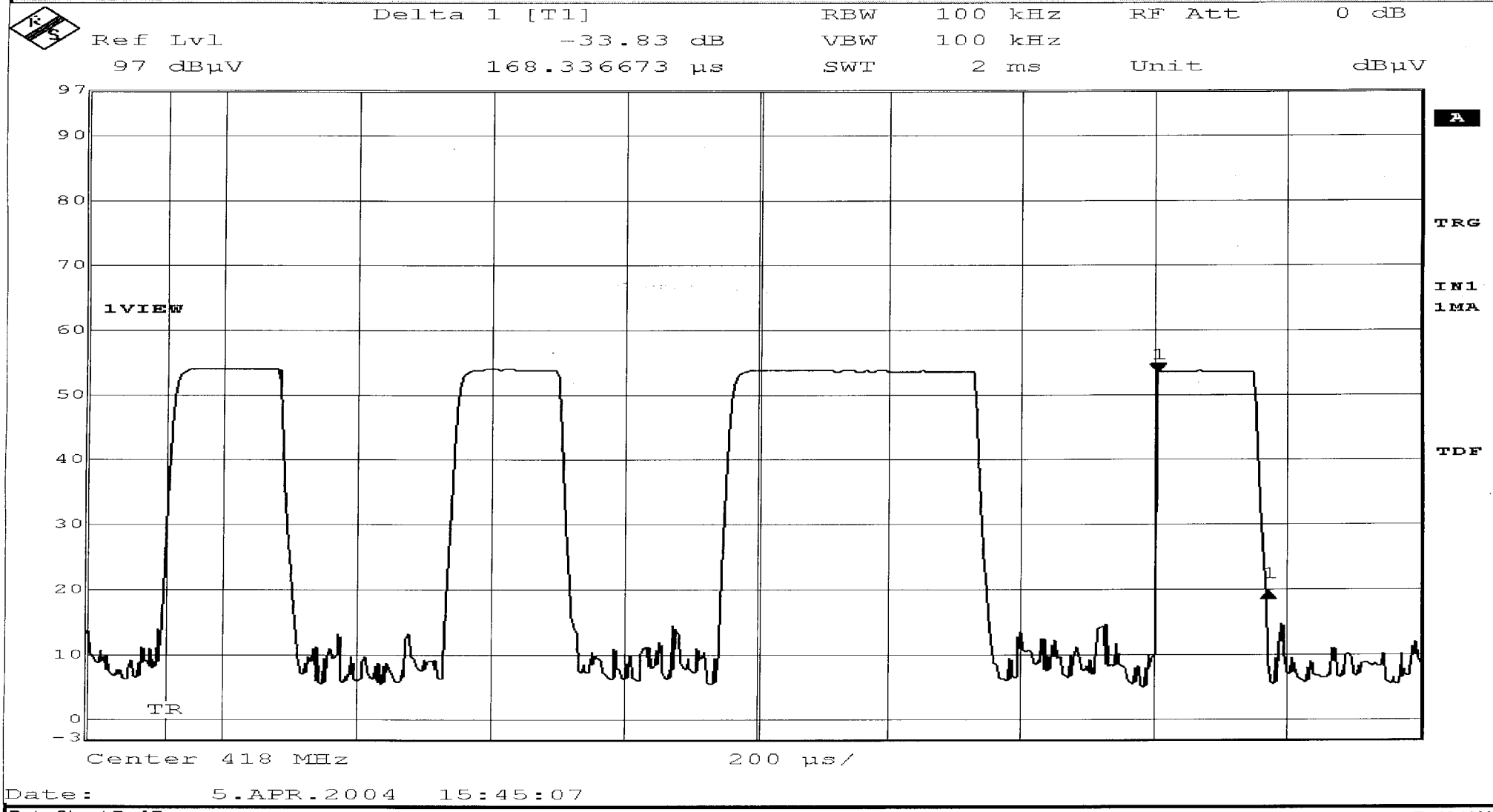
Test Method:	Duty Cycle				
Customer:	Madgetech, Inc.	Test Sample:	Data Logger	Job No:	R-4249N
Model No:	RFTC4000	Serial No:	n/a	Technician:	T. Firkowski
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.231 (e)		Date:	April 5, 2004
Operating Mode:	Transmitting Modulated Signal				
Notes:					



RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	Duty Cycle				
Customer:	Madgetech, Inc.	**Test Sample:**	Data Logger	**Job No:**	R-4249N
Model No:	RFTC4000	**Serial No:**	n/a	**Technician:**	T. Firkowski
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.231 (e)		**Date:**	April 5, 2004
Operating Mode:	Transmitting Modulated Signal				
Notes:					



RETLIF TESTING LABORATORIES

TABULAR DATA SHEET

Test Method: Fundamental Field Strength

Customer: Madgetech, Inc. **Job No:** R-4249N

Test Sample: Data Logger

Model No: RFTC4000 **Serial No:** n/a

Test Specification: FCC Part 15, Subpart C
Paragraph: 15.231 (e)

Operating Mode: Transmitting Modulated Signal

Technician: T. Firkowski **Date:** 4/2/2004

Notes: Test Distance: 3 Meters
Detector: Peak

Transmit Frequency	Test Frequency	Antenna/EUT Position	Meter Reading	Correction Factor	Corrected Peak Reading	Peak Limit	Duty Cycle Correction	Corrected Average Reading	Converted Reading	Limit at 3 Meters
MHz	MHz	Polarization/Axis	dBuV	dB	dBuV/m	dBuV/m	dB	dBuV/m	uV/m	uVm
418.00										
	418.0	V/Z	65.09	25.60	90.69	92.33	-19.84	70.85	3486.05	4133.35

RETLIF TESTING LABORATORIES

TABULAR DATA SHEET

Test Method: Spurious Emissions 30MHz to 4.2GHz

Customer: Madgetech, Inc. **Job No:** R-4249N

Test Sample: Data Logger

Model No: RFTC4000 **Serial No:** n/a

Test Specification: FCC Part 15, Subpart C
Paragraph: 15.231 (e)

Operating Mode: Transmitting Modulated Signal

Technician: T. Firkowski **Date:** 04/05/2004

Notes: Test Distance: 3 Meters
Detector: Peak

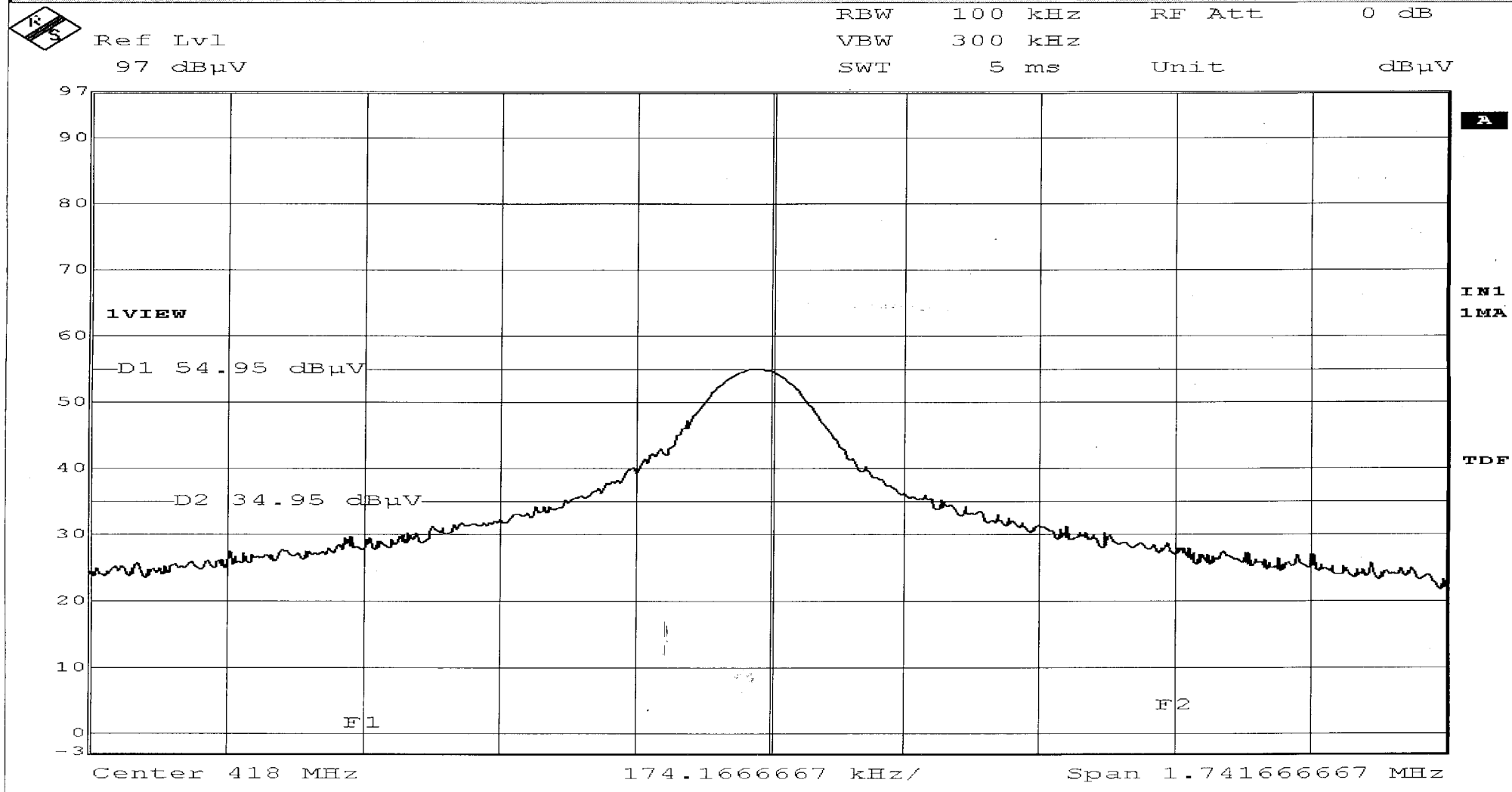
Transmit Frequency	Test Frequency	Antenna/EUT Position	Meter Reading	Correction Factor	Corrected Peak Reading	Peak Limit	Duty Cycle Correction	Corrected Average Reading	Converted Reading	Limit at 3 Meters
MHz	MHz	Polarization/Axis	dBuV	dB	dBuV/m	dBuV/m	dB	dBuV/m	uV/m	uVm
418.00										413.33
I	836.0	-	-	-	-	-	-	-	-	I
I	1254.0	V/Z	23.98	16.45	40.43	72.33	-19.84	20.59	10.70	I
I	1672.0	V/Z	22.12	17.34	39.46	72.33	-19.84	19.62	9.57	I
I	2090.0	V/Z	22.98	20.78	43.76	72.33	-19.84	23.92	15.70	I
I	2508.0	-	-	-	-	-	-	-	-	I
I	2926.0	-	-	-	-	-	-	-	-	I
I	3344.0	-	-	-	-	-	-	-	-	I
I	3762.0	-	-	-	-	-	-	-	-	I
I	4180.0	-	-	-	-	-	-	-	-	I
I										I
418.00										413.33

EUT emissions observed throughout the given frequency spectrum were recorded & evaluated. Emission levels closest to the limit are listed on this data sheet.

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	Occupied Bandwidth				
Customer:	Madgetech, Inc.	Test Sample:	Data Logger	Job No:	R-4249N
Model No:	RFTC4000	Serial No:	n/a	Technician:	T. Firkowski
Test Specification:	FCC Part 15, Subpart C	Paragraph: 15.231 (c)		Date:	April 5, 2004
Operating Mode:	Transmitting Modulated Signal				
Notes:					



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