RETLIF TESTING LABORATORIES
TEST REPORT R-4155N
September 24, 2003

FCC COMPLIANCE TEST REPORT
ON

RADIANSE, INC.
INDOOR POSITIONING TRANSMITTER
FCC ID: Q9V-100-A

APPLICANT	MANUFACTURER
Radianse, Inc. 439 South Union Street, Suite 401 Lawrence, MA 01843	SAME

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

TEST PROCEDURE: ANSI C63.4:1992

TEST SAMPLE DESCRIPTION

BRANDNAME: LightPak MODEL: 100A

TYPE: Indoor positioning/asset location tracking transmitter

POWER REQUIREMENTS: 3VDC via internal battery

FREQUENCY OF OPERATION: 433.92MHz

TYPE OF TRANSMISSION: Pulsed emission containing manchester encoded data bits

FCC ID: Q9V-100-A

APPLICABLE RULE SECTION: Part 15, Subpart C, Section 15.231 (e)

TESTS PERFORMED

Spurious Emissions (30MHz to 4.4GHz)

Field Strength of Fundamental

Occupied Bandwidth, 0.25% of Fundamental Frequency

Duty Cycle Determination

TEST SAMPLE OPERATION

The EUT is powered by 3VDC, internal battery. The device is normally automatically operated but can also be manually operated. The device transmits location data for personnel/asset tracking applications. 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 both automatic and manual operated devices. For testing purposes only the EUT was configured to continuously transmit.

TEST SAMPLE / TEST PROGRAM

- When manually activated the transmitter automatically ceases transmission within five seconds after activation per the requirements of 15.231 a (1).

- In automatic mode the transmitter ceases transmission within 5 seconds after activation per the requirements of 15.231 a (2).

- In automatic mode operation is limited so that the duration of each transmission is less than one second (8.016msec) and the silent period between transmissions 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 433.92MHz did not exceed 4398µV/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 439µV/M as specified in 15.231 (e) for a fundamental frequency of 433.92MHz.

- The device operates at a single frequency of 433.92MHz The bandwidth of emissions did not exceed 0.25% of the operating frequency as specified in 15.231 (c) and was determined as follows:

Fundamental Frequency	=	433.92MHz
0.25% of Center Frequency	=	1.0848MHz
1.0848 divided by 2	=	0.542MHz
Bandwidth Range	=	Fundamental Frequency + and - 0.542MHz
433.92MHz - 0.542MHz	=	433.378MHz
433.92MHz + 0.542MHz	=	434.462MHz
Bandwidth Range	**=**	***433.378MHz - 434.462MHz***

- The device uses an internal loop antenna

- 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 instructed in Section 15.231 (e).

Fundamental Frequency: 433.92MHz
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 433.92	=	7232
7232 - 2833.3333	=	4398
Field Strength Limit	=	4398 µV/m = 72.8dBuV/M

The maximum permitted unwanted emission level is 20dB below the maximum permitted fundamental level which equals 439.8 µV/m = 52.8dBuV/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 was less than 100msec in duration the worst case duty cycle was determined by measuring/calculating the duration of the pulse train and then the "on time" within the pulse train. The on times were 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: 433.92MHz

Transmitter On Time	=	4.0865 milliseconds
Transmitter Cycle Time	=	8.016 milliseconds
Transmitter Duty Cycle	=	50.98 %
On Time divided by Cycle Time	=	Duty Cycle Factor
4.0865 divided by 8.016	=	0.5096
0.5096 converted to dB (LOG_{10} .05096)20	=	-5.85dB
Duty Cycle Factor	**=**	***-5.85dB***

Duty Cycle Factor Determination Plots are included with this application as a separate attachment.

TEST SAMPLE / TEST PROGRAM (continued)

SPECTRUM ANALYZER

Due to the nature of the emissions being measured, care was taken to ensure that the resolution bandwidth of the spectrum analyzer was adequate to provide accurate measurements.

GENERAL NOTES

1. All readings were taken utilizing a peak detector function at a test distance of 3 meters.

2. The duty cycle factor was applied to the peak readings in order to determine the average value of the emissions.

EQUIPMENT LIST

Fundamental Field Strength & Spurious Emissions

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
3258	Double Ridge Guide	EMCO	1 - 18 GHz	3115	05/14/2003	05/14/2004
4029B	Test Site Attenuation	Retlif	3 / 10 Meters	RNH	07/30/2003	07/30/2004
4202	Biconilog	EMCO	26 MHz - 2 GHz	3142	07/25/2003	08/25/2003
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	03/18/2003	03/18/2004
713	EMI Test Receiver	Rohde & Schwarz	20 Hz - 26.5 GHz	ESI26	01/29/2003	01/29/2004

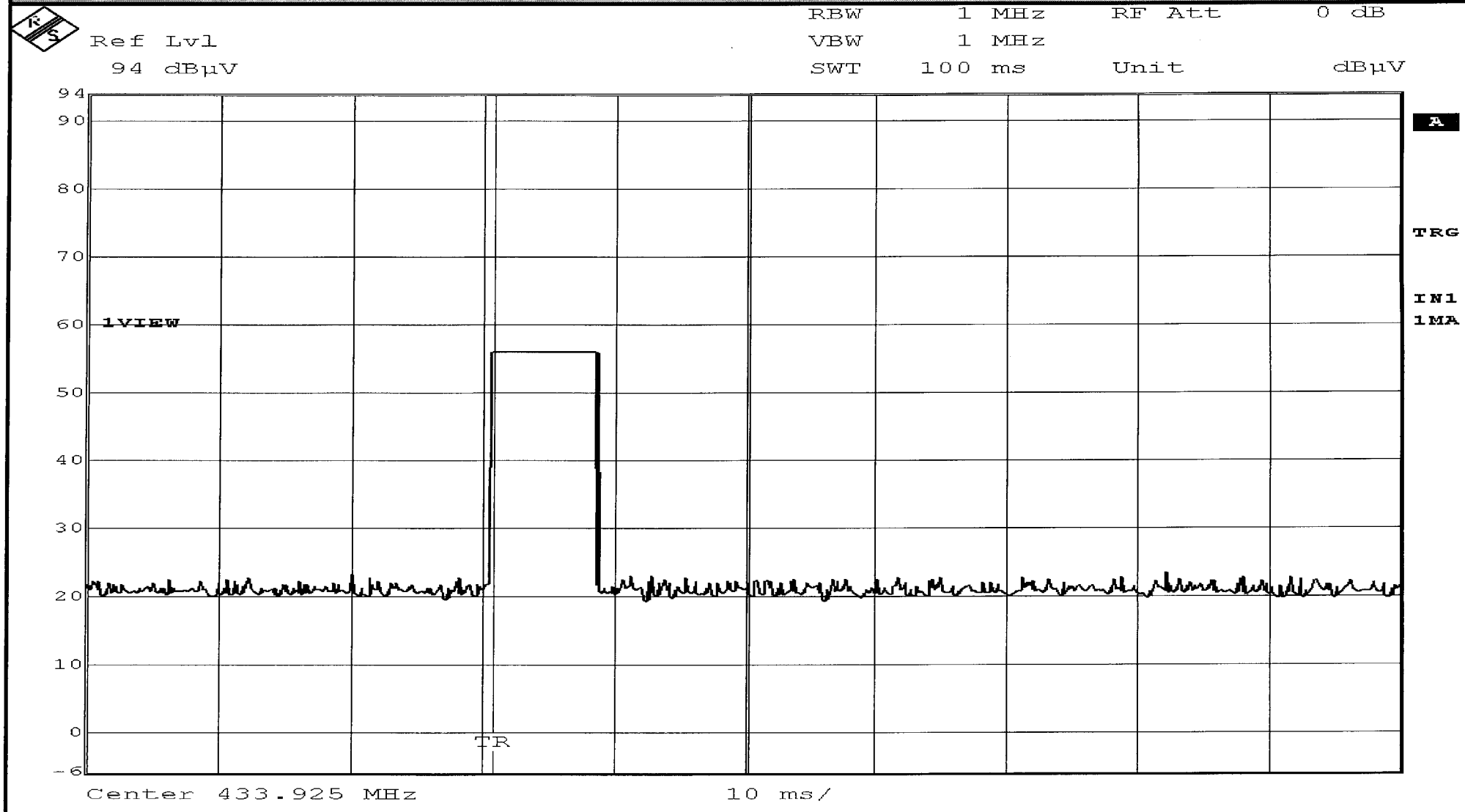
Occupied Bandwidth/Duty Cycle

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	03/18/2003	03/18/2004
713	EMI Test Receiver	Rohde & Schwarz	20 Hz - 26.5 GHz	ESI26	01/29/2003	01/29/2004

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	Duty Cycle Plots				
Customer:	Radianse, Inc.	Test Sample:	Transmitter	Job No:	R-4155N
Model No:	100A	Serial No:	n/a	Technician:	Tim Firkowski
Test Specification:	FCC Part 15	Paragraph: 15.231(e)		Date:	07/24/2003
Operating Mode:	Transmitting Data Bursts				
Notes:					



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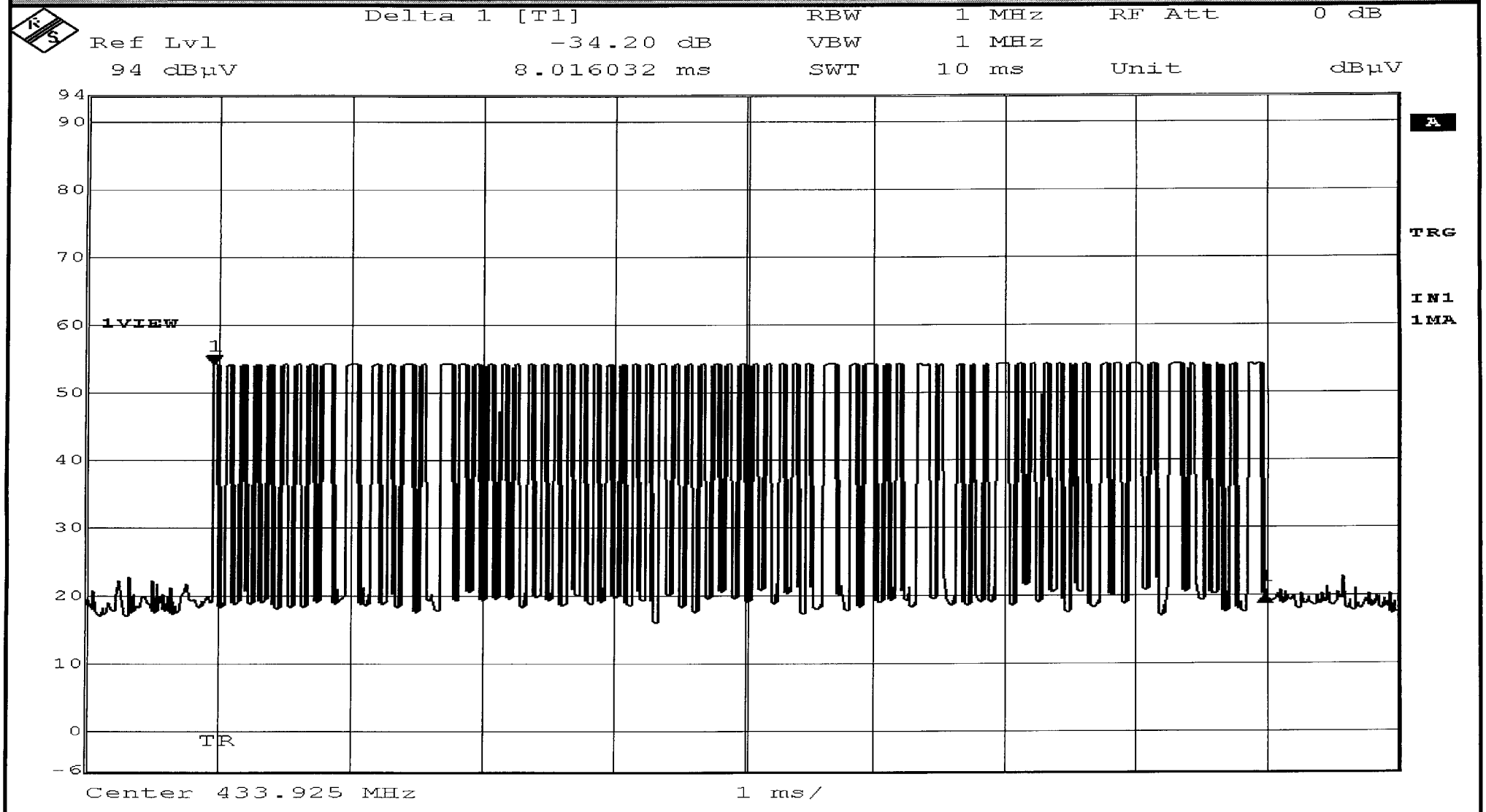
RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	Duty Cycle Plots				
Customer:	Radianse, Inc.	Test Sample:	Transmitter	Job No:	R-4155N
Model No:	100A	Serial No:	n/a	Technician:	Tim Firkowski
Test Specification:	FCC Part 15	Paragraph: 15.231(e)		Date:	07/24/2003
Operating Mode:	Transmitting Data Bursts				
Notes:					



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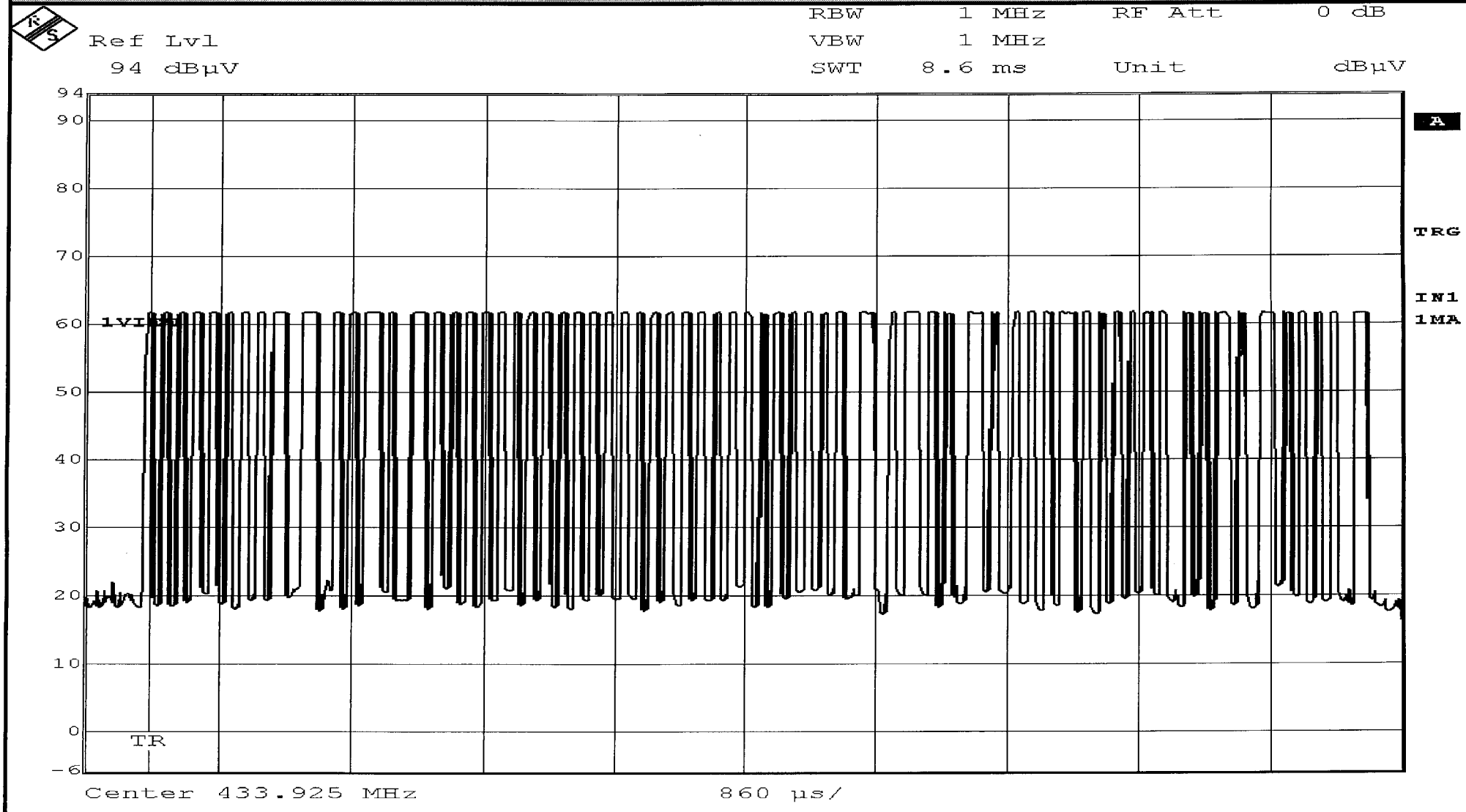
RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	Duty Cycle Plots				
Customer:	Radianse, Inc.	Test Sample:	Transmitter	Job No:	R-4155N
Model No:	100A	Serial No:	n/a	Technician:	Tim Firkowski
Test Specification:	FCC Part 15	Paragraph: 15.231(e)		Date:	07/24/2003
Operating Mode:	Transmitting Data Bursts				
Notes:					



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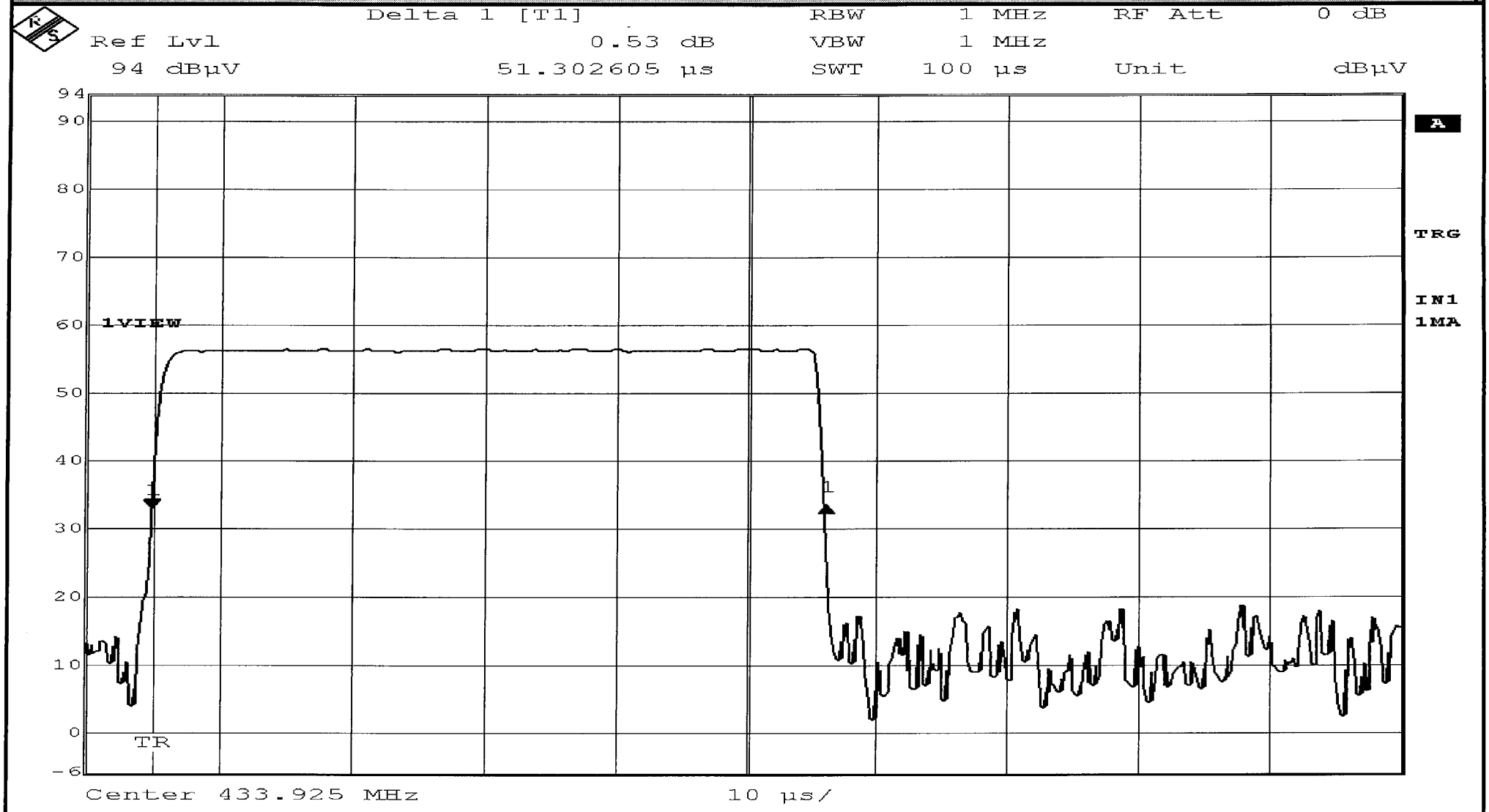
RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	Duty Cycle Plots				
Customer:	Radianse, Inc.	Test Sample:	Transmitter	Job No:	R-4155N
Model No:	100A	Serial No:	n/a	Technician:	Tim Firkowski
Test Specification:	FCC Part 15	Paragraph: 15.231(e)		Date:	07/24/2003
Operating Mode:	Transmitting Data Bursts				
Notes:					



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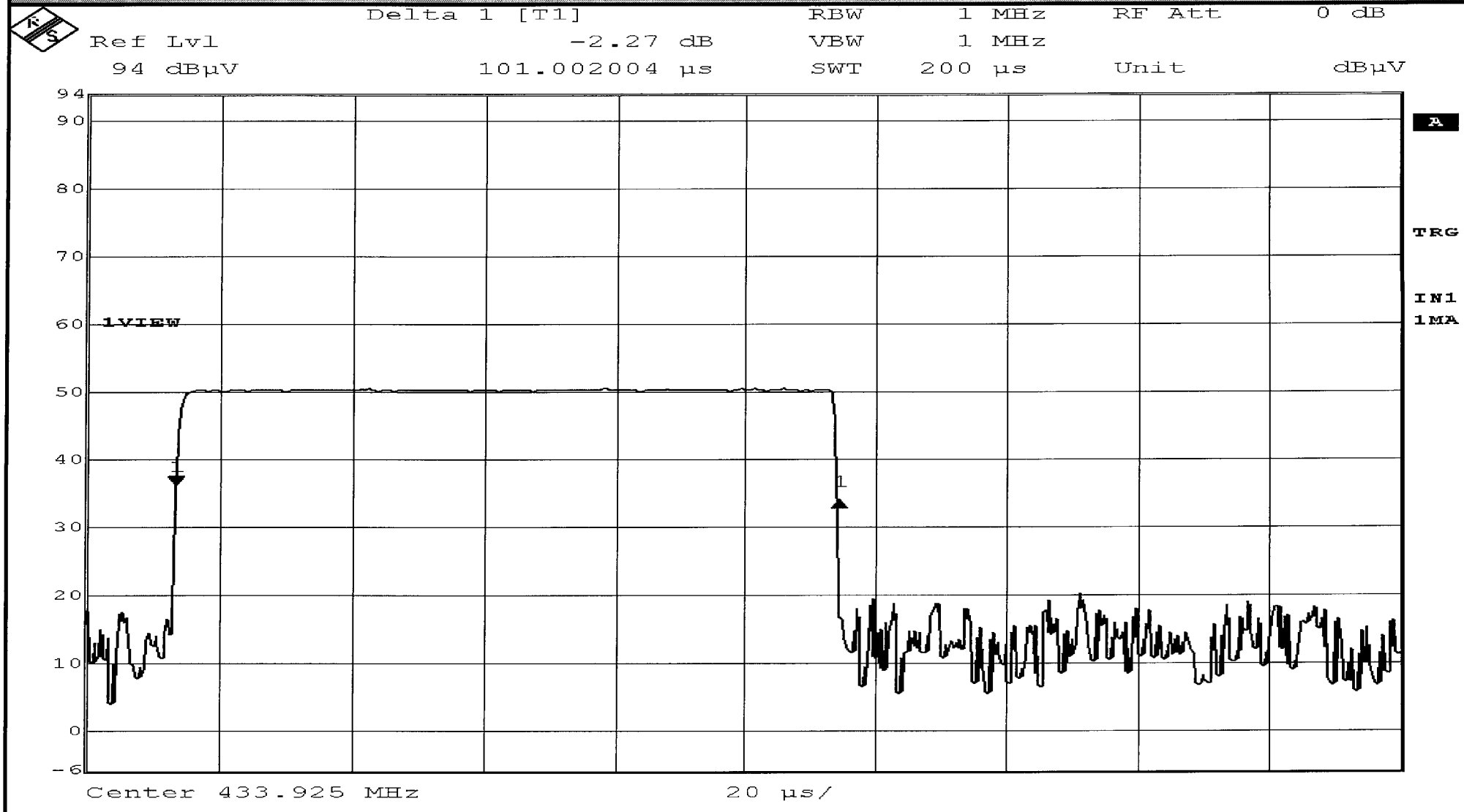
RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	Duty Cycle Plots				
Customer:	Radianse, Inc.	Test Sample:	Transmitter	Job No:	R-4155N
Model No:	100A	Serial No:	n/a	Technician:	Tim Firkowski
Test Specification:	FCC Part 15	Paragraph: 15.231(e)		Date:	07/24/2003
Operating Mode:	Transmitting Data Bursts				
Notes:					



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RETLIF TESTING LABORATORIES

TABULAR DATA SHEET

Test Method: Fundamental Field Strength & Spurious Emissions 30 MHz - 4.4 GHz

Customer: Radianse, Inc. **Job No:** R-4155N

Test Sample: Transmitter

Model No: 100A **Serial No:** n/a

Test Specification: FCC Part 15
Paragraph: 15.231 (e)

Operating Mode: Transmitting Data Bursts

Technician: T. Firkowski **Date:** 07/31/2003

Notes:

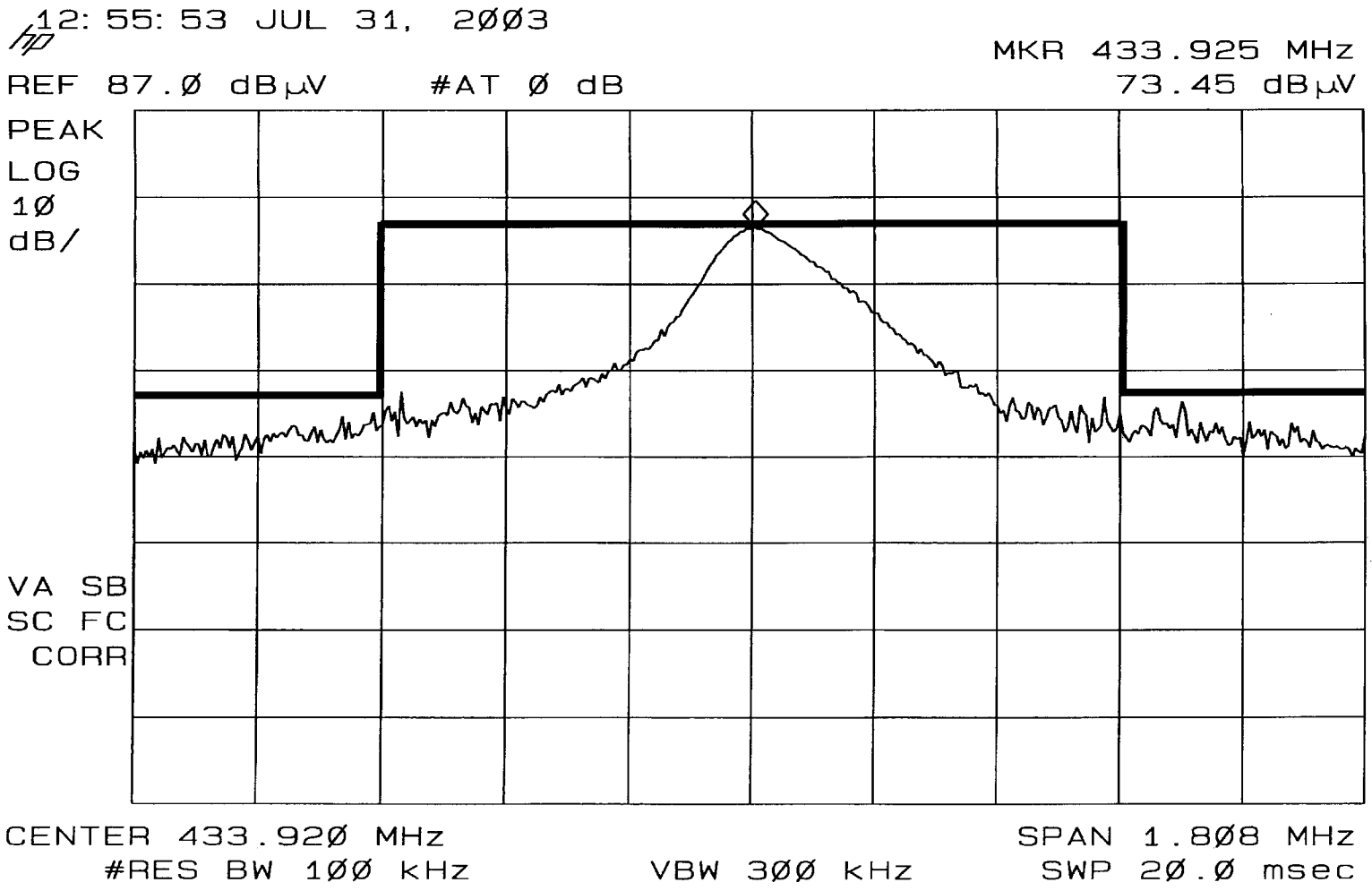
Transmit Frequency	Test Frequency	Antenna/EUT Position	Meter Reading	Correction Factor	Duty Cycle Correction	Corrected Reading			Converted Reading	Limit at 3 Meters
MHz	MHz	Polarization/Axis	dBuV	dB	dB	dBuV/m			uV/m	uVm
433.92	30.00	-	-	-	-	-			-	439.88
I	I	-	-	-	-	-			-	I
I	I	-	-	-	-	-			-	I
I	I	-	-	-	-	-			-	439.88
I	433.92	V/X	51.62	26.22	-5.85	71.99			3976.04	4398.76
I	I	-	-	-	-	-			-	439.88
I	I	-	-	-	-	-			-	I
I	867.84	-	-	-	-	-			-	I
I	1301.76	V/Z	27.76	25.23	-5.85	47.14			227.63	I
I	1735.68	-	-	-	-	-			-	I
I	2169.60	-	-	-	-	-			-	I
I	2603.52	-	-	-	-	-			-	I
I	3037.44	-	-	-	-	-			-	I
I	3471.36	-	-	-	-	-			-	I
I	3905.28	-	-	-	-	-			-	I
I	4339.20	-	-	-	-	-			-	I
I	I	-	-	-	-	-			-	I
I	I	-	-	-	-	-			-	I
I	I	-	-	-	-	-			-	I
I	I	-	-	-	-	-			-	I
433.92	4400.00	-	-	-	-	-			-	439.88

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

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:	Occupied Bandwidth				
Customer:	Radianse, Inc.	Test Sample:	Transmitter	Job No:	R-4155N
Model No:	100A	Serial No:	n/a	Technician:	Tim Firkowski
Test Specification:	FCC Part 15	Paragraph: 15.231		Date:	07/24/2003
Operating Mode:	Transmitting Data Bursts				
Notes:					



R-4155N