

RETLIF TESTING LABORATORIES
TEST REPORT R-3879N
January 2, 2002

FCC COMPLIANCE TEST REPORT
ON

LAB PARTNERS ASSOCIATES, INC.
DIGITAL CAMERA WITH D1 RF TRANSCEIVER
FCC ID: KDS-ND1-PWTRX-1

APPLICANT Lab Partners Associates, Inc. 1350 Shelburne Road, Suite 265 South Burlington, VT 05403	MANUFACTURER SAME
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TEST SPECIFICATION: FCC Rules and Regulations Part 15, Subpart C, Para. 15.231 (b)

TEST PROCEDURE: ANSI C63.4:1992

TEST SAMPLE DESCRIPTION

BRANDNAME: Nikon MODEL: D1

TYPE: Digital Camera with D1 RF Transceiver

POWER REQUIREMENTS: 3VDC via 120VAC, 60Hz AC/DC wall mount power supply

FREQUENCY BAND OF OPERATION: 344MHz to 354MHz (32 Discrete Channels) and 360MHz

MODULATION: Pulsed (On/Off Keying)

TYPE OF TRANSMISSION: Control Signal (Pulse Recognition Codes)

FREQUENCIES TESTED: 344.04MHz, 354.00MHz and 360.00MHz

FCC ID: KDS-ND1-PWTRX-1

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

TESTS PERFORMED

Spurious Emissions (30MHz to 3.6GHz)

Field Strength of Fundamental

Occupied Bandwidth, 0.25% of Fundamental Frequency

Duty Cycle Determination

Conducted Emissions (450kHz to 30MHz)

TEST SAMPLE OPERATION

The EUT is powered by 3VDC, either by internal battery or by an external wall mount 120VAC, 60Hz AC/DC power supply. All testing was performed utilizing the external power supply as this was considered to be the "worst case" configuration. The device is normally manually operated and transmits a control signal for remote triggering of a flashpack. Normal operation of the EUT complies with the parameters required in Part 15, Subpart C, Section 15.231. For testing purposes only the EUT was configured to continuously transmit.

TEST SAMPLE / TEST PROGRAM

- The transmitter is manually activated and automatically ceases transmission within five seconds after activation.
- The transmitter does not perform periodic transmissions at regularly predetermined intervals.
- The device can not be employed for RC purposes involving security.
- The fundamental field strength at 344.04MHz did not exceed 7251.68 μ V/M (Average) at a test distance of 3 meters.
The fundamental field strength at 354.00MHz did not exceed 7666.68 μ V/M (Average) at a test distance of 3 meters.
The fundamental field strength at 360.00MHz did not exceed 7916.68 μ 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 725.17 μ V/M or 500 μ V/M as applicable for a fundamental frequency of 344.04MHz.
The field strength of harmonic and spurious emissions did not exceed 766.67 μ V/M or 500 μ V/M as applicable for a fundamental frequency of 354.00MHz.
The field strength of harmonic and spurious emissions did not exceed 791.67 μ V/M or 500 μ V/M as applicable for a fundamental frequency of 360.00MHz. No harmonic or spurious emissions were observed within 20dB of the specified limit at test distances of 1 or 3 meters.
- The device can operate at 32 channels within the range of 344 to 354MHz and also at 360MHz. The device was tested at the frequencies of 344.04MHz, 354MHz and 360MHz. The bandwidth of emissions did not exceed 0.25% of the operating frequency and was determined as follows:

Fundamental Frequency	=	344.04MHz
0.25% of Center Frequency	=	0.860MHz
0.860 divided by 2	=	0.430MHz
Bandwidth Range	=	Fundamental Frequency + and - 0.430MHz
344.04MHz - 0.430MHz	=	343.61MHz
344.04MHz + 0.430MHz	=	344.47MHz
Bandwidth Range	=	343.61MHz - 344.47MHz

TEST SAMPLE / TEST PROGRAM (continued): (Bandwidth)

Fundamental Frequency	=	354.00MHz
0.25% of Center Frequency	=	0.885MHz
0.885 divided by 2	=	0.443MHz
Bandwidth Range	=	Fundamental Frequency + and - 0.443MHz
354.00MHz - 0.443MHz	=	353.557MHz
354.00MHz + 0.443MHz	=	354.443MHz
Bandwidth Range	=	353.557MHz - 354.443MHz

Fundamental Frequency	=	360.00MHz
0.25% of Center Frequency	=	0.900MHz
0.900 divided by 2	=	0.450MHz
Bandwidth Range	=	Fundamental Frequency + and - 0.450MHz
360.00MHz - 0.450MHz	=	359.550MHz
360.00MHz + 0.450MHz	=	360.450MHz
Bandwidth Range	=	359.550MHz - 360.450MHz

- The device uses an external detachable rubber coated copper spring antenna. This antenna plugs into the pc connector on the camera. The pc connector (no relation to IBM PC) referenced above is a photography industry unique connector normally used for a wired connection between a camera and flashpack. This connector type is unique to the photography industry. It has been verified with the FCC that this connector satisfies the requirements of 15.203 for a unique antenna connector. Attached as an exhibit with this application is a copy of e-mail correspondence from the FCC which confirms this fact.
- 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.

Fundamental Frequency: 344.04MHz

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:

$41.6667(F) - 7083.3333$	=	Field Strength Limit ($\mu\text{V/m}$)
41.6667×344.04	=	14335.01147
$14335.011 - 7083.3333$	=	7251.678
Field Strength Limit	=	7251.68 $\mu\text{V/m}$

The maximum permitted unwanted emission level is 20dB below the maximum permitted fundamental level which equals 725.17 $\mu\text{V/m}$.

TEST SAMPLE / TEST PROGRAM (continued)

Field Strength Limit Calculations continued:

Fundamental Frequency: 354.00MHz

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:

$$\begin{aligned} 41.6667(F) - 7083.3333 &= \text{Field Strength Limit } (\mu\text{V/m}) \\ 41.6667 \times 354.00 &= 14750.012 \\ 14750.012 - 7083.3333 &= 7666.679 \\ \text{Field Strength Limit} &= 7666.68 \mu\text{V/m} \end{aligned}$$

The maximum permitted unwanted emission level is 20dB below the maximum permitted fundamental level which equals 766.67 $\mu\text{V/m}$

Fundamental Frequency: 360.00MHz

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:

$$\begin{aligned} 41.6667(F) - 7083.3333 &= \text{Field Strength Limit } (\mu\text{V/m}) \\ 41.6667 \times 360.00 &= 15000.012 \\ 15000.012 - 7083.3333 &= 7916.678 \\ \text{Field Strength Limit} &= 7916.68 \mu\text{V/m} \end{aligned}$$

The maximum permitted unwanted emission level is 20dB below the maximum permitted fundamental level which equals 791.68 $\mu\text{V/m}$.

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 measuring/calculating the 100msec period with the greatest on time. The on times were determined as follows:

The worst case 100msec period contained 5 identical pulse bursts. The individual pulses within each burst were measured and summed in order to obtain the total "on time" within each burst. The total "on time" within each burst was then multiplied by five (as there were 5 pulse bursts within the 100msec period) to determine total "on time" within the 100msec period.

DETERMINATION OF DUTY CYCLE (continued)

Fundamental Frequency: 344.04MHz

Transmitter On Time	=	6.774 milliseconds (maximum)
Transmitter Cycle Time	=	100 milliseconds
Transmitter Duty Cycle	=	6.78 %
On Time divided by Cycle Time	=	Duty Cycle Factor
6.774 divided by 100	=	0.068
0.068 converted to dB ($\text{LOG}_{10} .068$)20	=	-23.349dB
<i>Duty Cycle Factor</i>	=	<i>-23.35dB</i>

Fundamental Frequency: 354.00MHz

Transmitter On Time	=	6.290 milliseconds (maximum)
Transmitter Cycle Time	=	100 milliseconds
Transmitter Duty Cycle	=	6.29 %
On Time divided by Cycle Time	=	Duty Cycle Factor
6.90 divided by 100	=	0.063
0.069 converted to dB ($\text{LOG}_{10} .069$)20	=	-24dB
<i>Duty Cycle Factor</i>	=	<i>-24B</i>

Fundamental Frequency: 360.00MHz

Transmitter On Time	=	6.704 milliseconds (maximum)
Transmitter Cycle Time	=	100 milliseconds
Transmitter Duty Cycle	=	6.7 %
On Time divided by Cycle Time	=	Duty Cycle Factor
6.704 divided by 100	=	0.0670
0.067 converted to dB ($\text{LOG}_{10} .067$)20	=	-23.478dB
<i>Duty Cycle Factor</i>	=	<i>-23.48dB</i>

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 LISTS

Field Strength of Fundamental

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
4202	Biconilog	EMCO	26 MHz - 2 GHz	3142	7/16/01	7/16/02
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	1/31/01	1/31/02
713	EMI Test Receiver	Rohde & Schwarz	20 Hz - 26.5 GHz	ESI26	6/9/01	6/9/02

Occupied Bandwidth

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
713	EMI Test Receiver	Rohde & Schwarz	20 Hz - 26.5 GHz	ESI26	6/9/01	6/9/02

Spurious Emissions

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
543	Pre-Amplifier	Hewlett Packard	1.0 GHz - 18 GHz	8449B	6/16/01	6/16/02
3258	Double Ridge Guide	EMCO	1GHz - 18 GHz	3115	5/6/01	5/6/02
4202	Biconilog	EMCO	26 MHz - 2 GHz	3142	7/16/01	7/16/02
4895	Spectrum Analyzer	Hewlett Packard	9kHz - 22GHz	8593EM	1/31/01	1/31/02
713	EMI Test Receiver	Rohde & Schwarz	20 Hz - 26.5 GHz	ESI26	6/9/01	6/9/02

Conducted Emissions

EN	Type	Manufacturer	Description	Model No.	Cal Date	Due Date
4027	LISN	Solar Electronics	10kHz - 30MHz	9252-50-R-24BNC	7/7/01	7/7/02
4028	Isolation Transformer	Acme	N/A	120x240	1/25/01	1/25/02
4050	Transient Limiter	Hewlett Packard	9kHz - 200MHz	11970K	1/8/01	1/8/02
713	EMI Test Receiver	Rohde & Schwarz	20 Hz - 26.5 GHz	ESI26	6/9/01	6/9/02

RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method: Occupied Bandwidth

Customer: LPA Design, Inc.

Test Sample:

Digital RF Transmitter

Job No:

R-3879N

Model No:

D1

Serial No:

5020634

Technician:

T. Firkowski

Test Specification:

FCC Part 15, Subpart C

Date:

11/16/01

Operating Mode:

Transmitting

Notes:



Marker 1 [T1]

Ref Lvl

97 dBμV

RBW

10 kHz

RF Att

0 dB

VBW

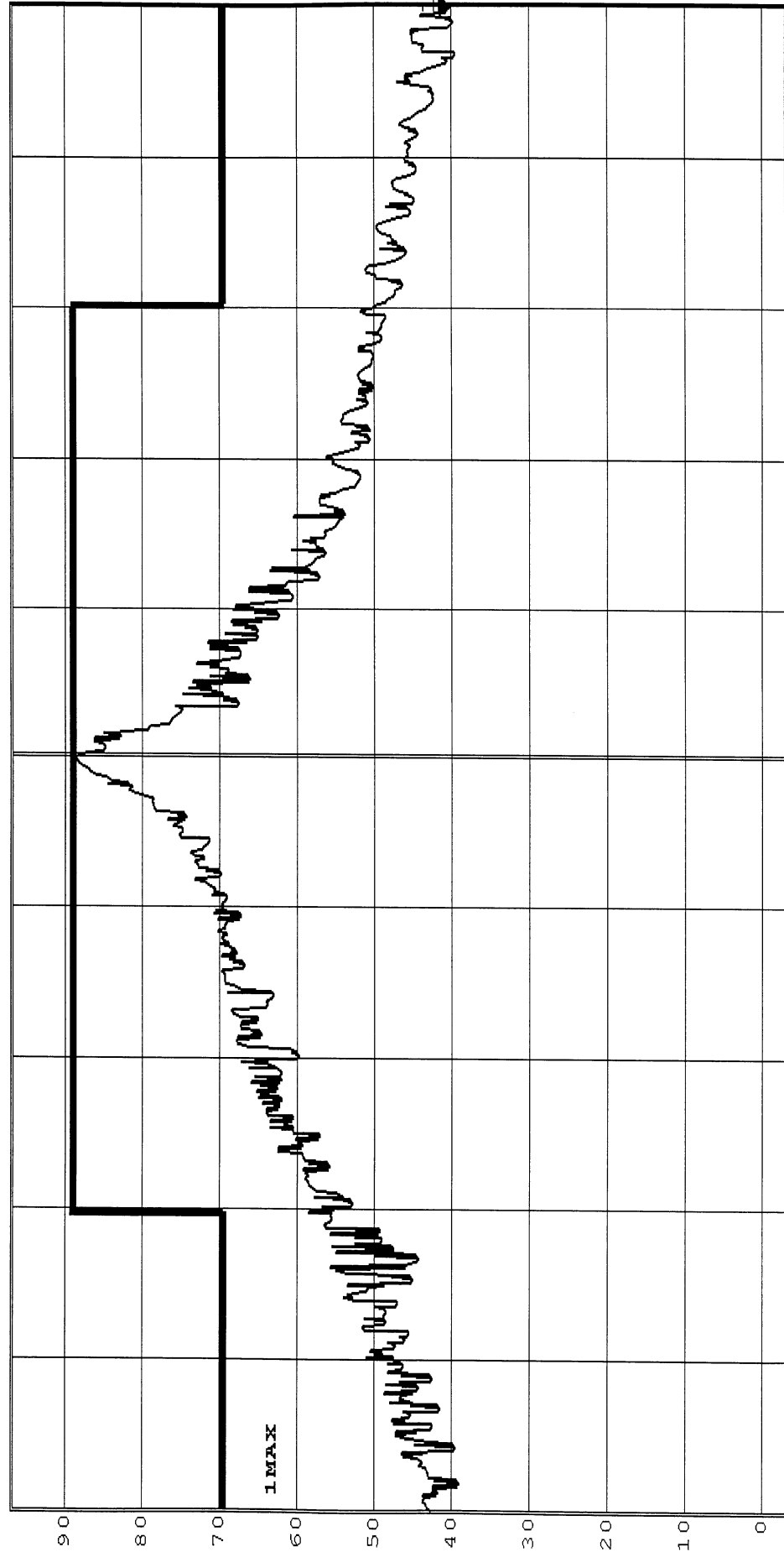
100 kHz

SWT

36 ms

Unit

dBμV



Center 344.04 MHz

143.35 kHz/

Span 1.4335 MHz

Date: 16.NOV.2001 08:34:03

Data Sheet 1 of 3

R-3879N

RETLLF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method: Occupied Bandwidth

Customer: LPA Design, Inc.

Model No:

D1

Test Sample:

Digital RF Transmitter

Job No:

R-3879N

Technician:

T. Firkowski

Test Specification:

FCC Part 15, Subpart C

Date:

11/16/01

Operating Mode:

Transmitting

Notes:



Marker 1 [T1]

Ref Lvl

97 dBμV

79.26 dBμV

354.01034569 MHz

RBW

10 kHz

VBW

100 kHz

SWT

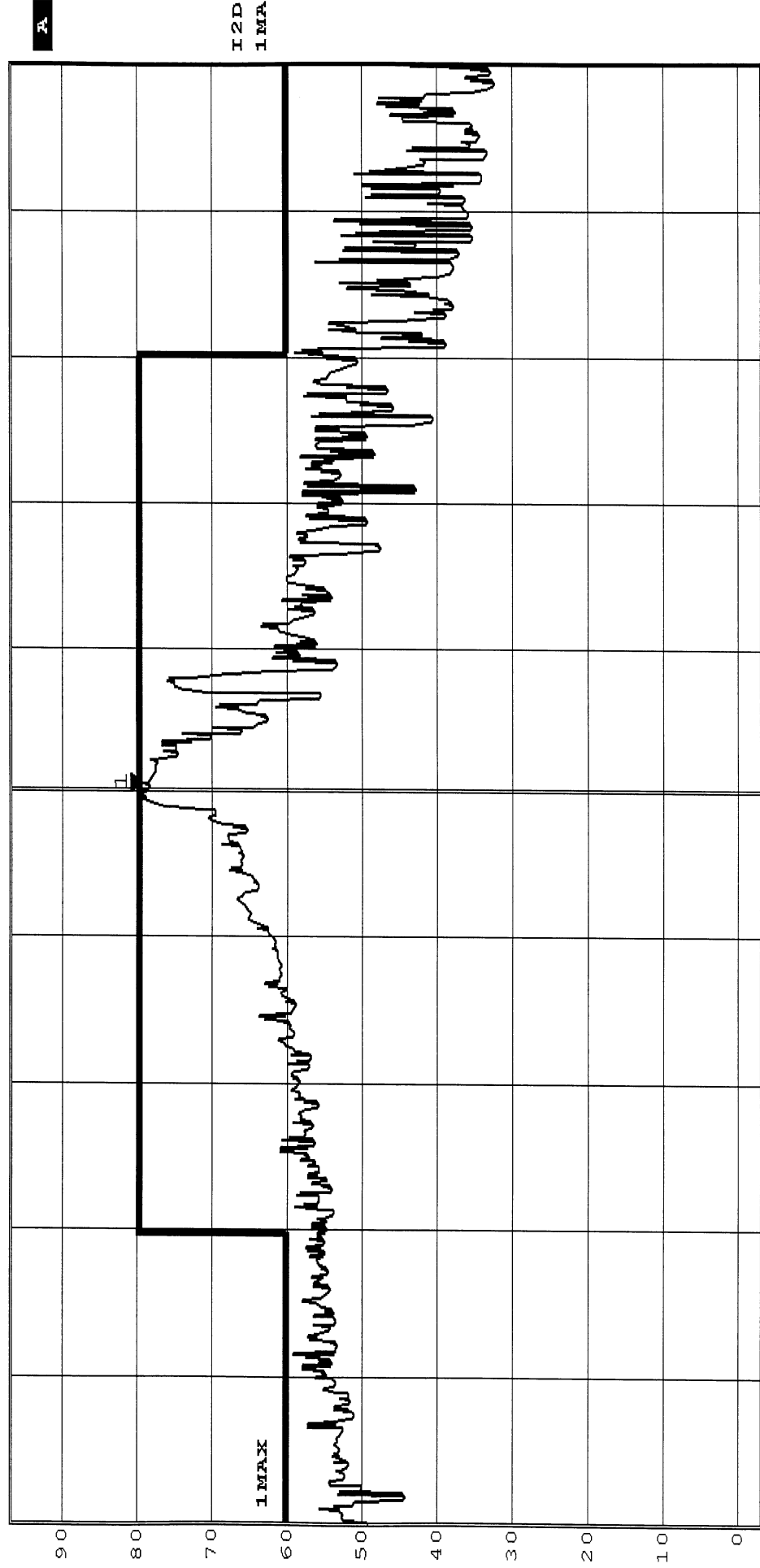
37 ms

RF Att

0 dB

Unit

dBμV



Center 354 MHz

147.5 kHz

Span 1.475 MHz

Date: 16.NOV.2001 08:29:26

Data Sheet 2 of 3

R-3879N

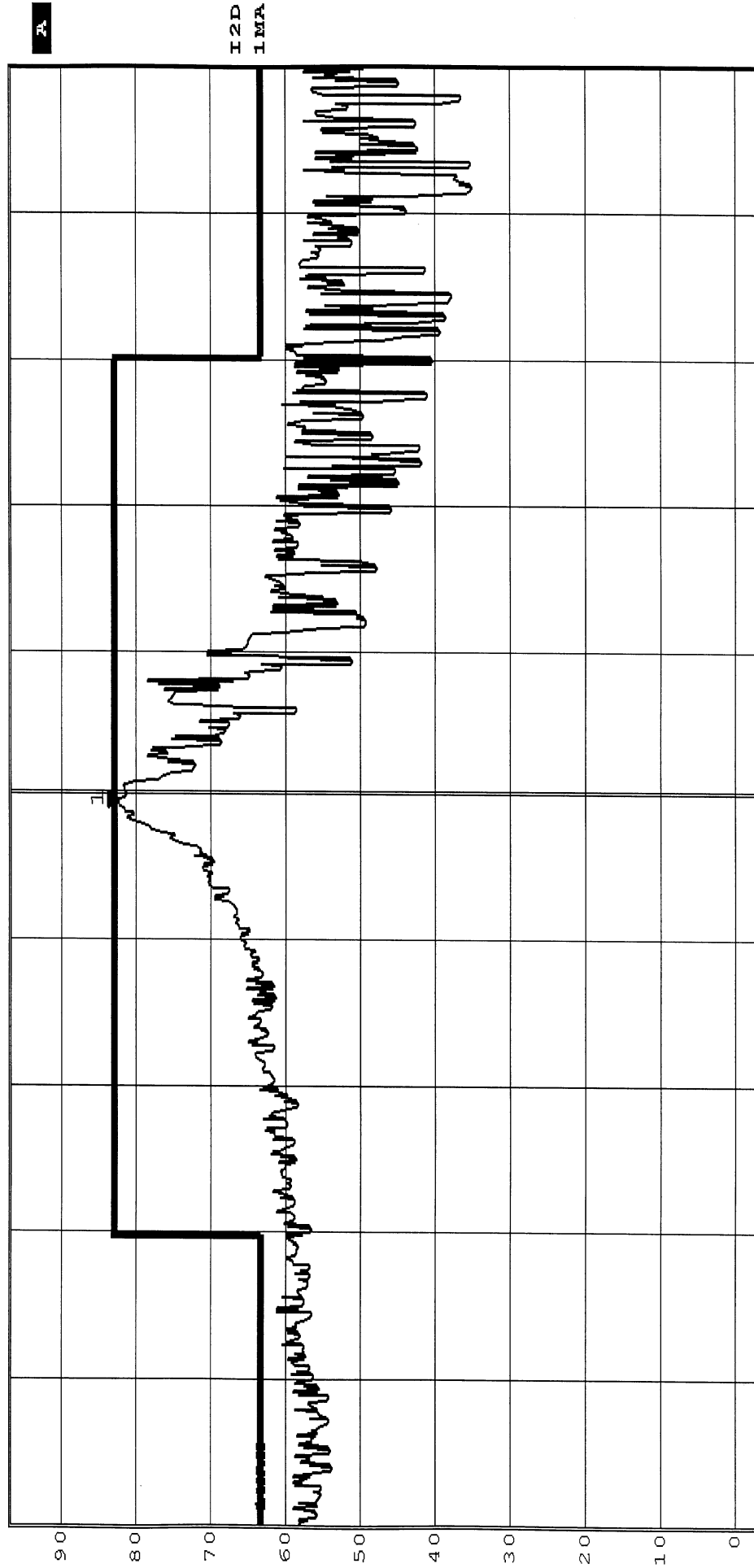
RETLIF TESTING LABORATORIES

EMISSIONS DATA SHEET

Test Method:		Occupied Bandwidth	
Customer:	LPA Design, Inc.	Test Sample:	Digital RF Transmitter
Model No:	D1	Serial No:	5020634
Test Specification:	FCC Part 15, Subpart C	Date:	11/16/01
Operating Mode:	Transmitting	Job No:	R-3879N
Notes:	Technician: T. Firkowski		



Marker 1 [T1] RBW 10 kHz RF Att 0 dB
 Ref Lvl 97 dBμV VBW 100 kHz
 360.00300597 MHz SWT 38 ms Unit dBμV



Center 360.007515 MHz 150 kHz/ Span 1.5 MHz

Date: 16.NOV.2001 10:24:19

RETLIF TESTING LABORATORIES

TABULAR DATA SHEET

Test Method:	Spurious Emissions 30MHz to 3.6GHz		
Customer:	LPA Design, Inc.	Job No:	R-3879N
Test Sample:	Digital RF Transmitter		
Model No:	D1	Serial No:	5020634
Test Specification:	FCC Part 15, Subpart C Paragraph: 15.231(b)		
Operating Mode:	Transmitting		
Technician:	T. Firkowski	Date:	11/26/01
Notes:	Fundamental Frequency: 344.04 MHz Tested at 1 and 3 meters		

[illegible]

RETLIF TESTING LABORATORIES

TABULAR DATA SHEET

Test Method:	Spurious Emissions 30MHz to 3.6GHz		
Customer:	LPA Design, Inc.	Job No:	R-3879N
Test Sample:	Digital RF Transmitter		
Model No:	D1	Serial No:	5020634
Test Specification:	FCC Part 15, Subpart C Paragraph: 15.231(b)		
Operating Mode:	Transmitting		
Technician:	T. Firkowski	Date:	11/26/01
Notes:	Fundamental Frequency: 360 MHz Tested at 1 and 3 meters		

[illegible]

RETLIF TESTING LABORATORIES

TABULAR DATA SHEET

Test Method:	Fundamental Field Strength		
Customer:	LPA Design, Inc.	Job No:	R-3879N
Test Sample:	Digital RF Transmitter		
Model No:	D1	Serial No:	5020634
Test Specification:	FCC Part 15, Subpart C Paragraph: 15.231(b)		
Operating Mode:	Transmitting		
Technician:	T. Firkowski	Date:	11/21/01
Notes:	Corrected peak readings meet peak limit (20dB above average limit) per 15.35		

[illegible]