

Retlif Testing Laboratories

795 Marconi Avenue, Ronkonkoma, N.Y. 11779 (516) 737-1500 - FAX 516-737-1497
(Branch Office)
101 New Boston Road, Goffstown, N.H. 03045 (603) 497-4600 - FAX (603) 497-5281

FCC COMPLIANCE TEST REPORT ON A

**418 MHz PULSED RF REMOTE
MODEL: NC97-418
FCC ID: MIKNUMETNC97A**

CUSTOMER NAME: Nu-Metrics

CUSTOMER P.O.: 7687

DATE OF REPORT: July 22, 1998

TEST REPORT NO.: R-7170

TEST START DATE: July 11, 1997

TEST FINISH DATE: July 14, 1998

TEST TECHNICIAN: D. Cortes

TEST ENGINEER: T. Schneider

SUPERVISOR: R.J. Reitz

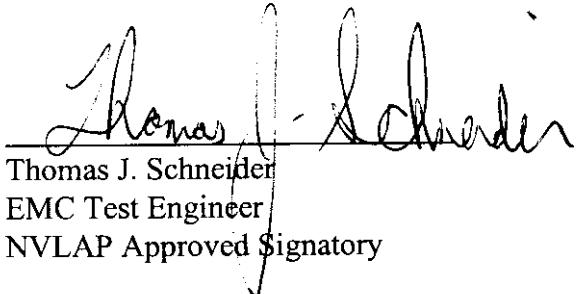
REPORT PREPARED BY: L. Anderson

GOVERNMENT SOURCE INSPECTION: Not Applicable

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CERTIFICATION AND SIGNATURES

We certify that this report is a true report of the results obtained from the tests of the equipment stated. We further certify that the measurements shown in this report were made in accordance with the procedures indicated and vouch for the qualifications of all Retlif Testing Laboratories personnel taking them.



Thomas J. Schneider
EMC Test Engineer
NVLAP Approved Signatory



Richard J. Reitz
Laboratory Manager
NVLAP Approved Signatory

NON-WARRANTY PROVISION

The testing services have been performed, findings obtained, and reports prepared in accordance with generally accepted testing laboratory principles and practices. This warranty is in lieu of all other warranties, either express or implied.

NON-ENDORSEMENT

This test report contains only findings and results arrived at after employing the specific test procedures and standards listed herein. It is not intended to constitute a recommendation endorsement, or certification of the product or material tested. This report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.



Retlif Testing Laboratories

Test Report No. R-7170
FCC ID: MIKNUMETNC97A

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EXHIBIT 2

Equipment Photographs

Para. 2.1033(b)(7)



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EXHIBIT 6

Report of Measurements

Para. 2.1033(b)(6)



Retlif Testing Laboratories

Test Report No. R-7170
FCC ID: MIKNUMETNC97A

APPLICANT	MANUFACTURER
Nu-Metrics University Drive Uniontown, PA 15401	SAME

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

TEST PROCEDURE: ANSI C63.4:1992

TEST SAMPLE DESCRIPTION

BRANDNAME: Nu-Metrics MODEL: NC97-418

TYPE: Pulsed RF Remote Transmitter

POWER REQUIREMENTS: 3.6 VDC via internal Ni-Cad batteries

FREQUENCY OF OPERATION: 418 MHz

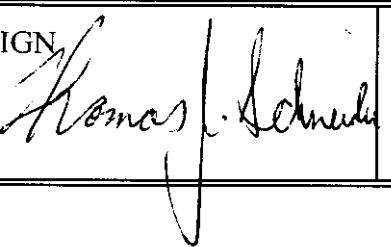
TESTS PERFORMED

Para. 15.231(e), Radiated Emissions

Para. 15.231(c), Occupied Bandwidth

I HEREBY CERTIFY THAT: The measurements shown here were in accordance with the procedure indicated and that the energy emitted by this equipment was found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements and vouch for the qualifications of all persons taking them.

I FURTHER CERTIFY THAT: On the basis of the measurements made, the device tested is capable of operation in compliance with the requirements of Part 15 of the FCC Rules under normal use and maintenance.

SIGN	PRINT	TITLE
	Thomas J. Schneider	EMC Test Engineer



Retlif Testing Laboratories

Test Report No. R-7170
FCC ID: MIKNUMETNC97A

REPORT OF MEASUREMENTS

Applicant: Nu-Metrics
Device: 418 MHz Pulsed RF Remote Transmitter
FCC ID: MIKNUMETNC97A
Power Requirements: 3.6 VDC via internal Ni-Cad batteries
Applicable Rule Section: Part 15, Subpart C, Section 15.231

TEST RESULTS

15.231 (a) - The device is used to transmit data for traffic /classifying purposes.

15.231 (c) - The device operates at 418 MHz. The bandwidth of emissions did not exceed 0.25% of the operating frequency (1.045 MHz).

15.231 (e) - The fundamental field strength did not exceed $4,130 \mu\text{V/M}$ (Average) at a test distance of 3 meters. In addition, the requirements of section 15.35 for averaging pulsed emissions and for limiting peak emissions were met.
The field strength of harmonic and spurious emissions did not exceed $413 \mu\text{V/M}$ (AVERAGE).

15.231 (e) - The device automatically ceases transmission within one second.

15.231 (e) - The minimum total time between transmissions was at least 30 times the transmission time but in no case was less than 10 seconds.



Retlif Testing Laboratories

Test Report No. R-7170
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REPORT OF MEASUREMENTS (continued)

DETERMINATION OF FIELD STRENGTH LIMITS

The field strength limits shown below are found in Section 15.231.

Frequency		Limit
F1	= 260	1500 = L1
Fo	= 418	Lo
F2	= 470	5000 = L2

The formula below was utilized to determine the limits:

$$\text{Limit} = L1 + [(Fo-F1)(L2-L1)/(F2-F1)]$$

Solving yields:

Fundamental Limit = 4,130 μ V/M (AVERAGE) @ 3 Meters

Harmonic Limit = 413 μ V/M (AVERAGE) @ 3 Meters

DETERMINATION OF DUTY CYCLE

The duty cycle for the transmitter was determined by Nu-Metrics as follows:

4 bits on + 1 stop bit = 5 bits

Message 9 bytes with 1 bit + 1 stop bit = 18 bits

Checksum = 4 bits + 1 stop bit = 5 bits

TOTAL = 28 bits

Data @ 2400 bps (0.42 ms/bit) = 11.7 ms on time

% On Time in 100 ms = 11.7%

SPECTRUM ANALYZER DESENSITIZATION CONSIDERATIONS

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. The following formula was utilized:

Setting pulse desensitization equal to zero and utilizing the minimum observed pulse width of 450 microseconds yields a minimum required bandwidth of 1481.5 Hz. FCC specified bandwidths of 100kHz and 1MHz were utilized below and above 1GHz, respectively.



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Test Report No. R-7170
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REPORT OF MEASUREMENTS (continued)

GENERAL NOTES

1. All readings were taken utilizing a peak detector function at a test distance of 3 meters.
2. The duty cycle was applied to the peak readings in order to determine the average value of the emissions.
3. All measurements were made with fully charged 3.6 VDC Ni-Cad batteries.
4. The frequency range was scanned from 30 MHz to 4.2 GHz . All emissions not reported were more than 20 dB below the specified limit.



Retlif Testing Laboratories

Test Report No. R-7170
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Exhibit 6
Report of Measurements
Radiated Emissions Data, Para. 15.231(e)



Retlif Testing Laboratories

Test Report No. R-7170
FCC ID: MIKNUMETNC97A

RETLIF TESTING LABORATORIES

TABULAR DATA SHEET

TEST METHOD:	FCC Part 15 Subpart C Radiated Emissions		
CUSTOMER:	Nu-Metrics	JOB No.:	R-7170
TEST SAMPLE:	Pulsed RF Remote		
MODEL No.:	NC97-418	SERIAL No.:	FCC ID: MIKNUMETNC97
TEST SPECIFICATION:	FCC Part 15 Subpart C		
OPERATING MODE:	Continuously transmitting 418 Mhz Signal		
TECHNICIAN:	Dennis Cortes	DATE:	7/13/98
NOTES:	Test Distance: 3 Meters Detector Function: Peak		

Test Frequency	Antenna Pol./Height	EUT Orientation	Meter Reading	Correction Factor	Test Distance/ Correction	Corrected Reading	Converted Reading	Peak Limit
MHz	(HV) / meters	X / Y / Z	dBuV	dB	(metrs / dB)	dBuV/m	uV/m	uV/m
418	H/1.3	X	73.4	-0.6	3.0/0.0	72.8	4365.2	41300
418	H/1.7	Y	89.8	-0.6	3.0/0.0	89.2	28840.3	41300
418	H/1.3	Z	70.6	-0.6	3.0/0.0	70.0	3162.3	41300
418	V/1.0	X	88.4	-0.6	3.0/0.0	87.8	24547.1	41300
418	V/1.9	Y	89.6	-0.6	3.0/0.0	89.0	28183.8	41300
418	V/1.8	Z	80.4	-0.6	3.0/0.0	79.8	9772.4	41300
836	H/1.7	X	30.1	6.5	3.0/0.0	36.6	67.6	4130
836	H/1.4	Y	40.5	6.5	3.0/0.0	46.5	211.3	4130
836	H/1.4	Z	25.2	6.5	3.0/0.0	31.7	38.5	4130
836	V/1.0	X	37.8	6.5	3.0/0.0	44.3	164.1	4130
836	V/1.7	Y	29.1	6.5	3.0/0.0	35.6	60.3	4130
836	V/2.0	Z	31.2	6.5	3.0/0.0	37.7	76.7	4130
1254	H/1.1	X	54.8	-5.0	1.5/6.0	43.8	154.9	4130
1254	H/1.5	Y	47.3	-5.0	1.5/6.0	36.3	65.3	4130
1254	H/2.2	Z	49.3	-5.0	1.5/6.0	38.3	82.2	4130
1254	V/1.4	X	48.9	-5.0	1.5/6.0	37.9	78.5	4130
1254	V/1.4	Y	51.0	-5.0	1.5/6.0	40.0	100.0	4130
1254	V/1.3	Z	46.0	-5.0	1.5/6.0	35.0	56.2	4130
1672	H/1.0	X	*39.8	-3.9	1.5/6.0	29.9	31.3	4130
1672	H/1.0	Y	*39.8	-3.9	1.5/6.0	29.9	31.3	4130
1672	H/1.0	Z	*39.8	-3.9	1.5/6.0	29.9	31.3	4130
1672	V/1.0	X	*39.8	-3.9	1.5/6.0	29.9	31.3	4130
1672	V/1.1	Y	46.3	-3.9	1.5/6.0	36.4	66.1	4130
1672	V/1.0	Z	*39.8	-3.9	1.5/6.0	29.9	31.3	4130
2090	H/1.0	X	*41.6	-1.4	1.5/6.0	34.2	51.3	4130
2090	H/1.0	Y	*41.6	-1.4	1.5/6.0	34.2	51.3	4130
2090	H/1.0	Z	*41.6	-1.4	1.5/6.0	34.2	51.3	4130
2090	V/1.0	X	*41.6	-1.4	1.5/6.0	34.2	51.3	4130
2090	V/1.0	Y	*41.6	-1.4	1.5/6.0	34.2	51.3	4130
2090	V/1.0	Z	*41.6	-1.4	1.5/6.0	34.2	51.3	4130

The frequency range was scanned from 30 MHz to 4.18 GHz. All emissions not recorded were more than 10dB below the specified limit. Emissions from the EUT do not exceed the specified limits.

*=Noise Floor Measurements (Minimum System Sensitivity)

RETLIF TESTING LABORATORIES

TABULAR DATA SHEET

TEST METHOD:	FCC Part 15 Subpart C Radiated Emissions		
CUSTOMER:	Nu-Metrics	JOB No.:	R-7170
TEST SAMPLE:	Pulsed RF Remote		
MODEL No.:	NC97-418	SERIAL No.:	FCC ID: MIKNUMETNC97
TEST SPECIFICATION:	FCC Part 15 Subpart C		
	PARAGRAPH: 15.231		
OPERATING MODE:	Continuously transmitting 418 Mhz Signal		
TECHNICIAN:	Dennis Cortes	DATE:	3/11/98
NOTES:	Test Distance: 3 Meters Detector Function: Peak		

Test Frequency	Antenna Pol./Height	EUT Orientation	Meter Reading	Correction Factor	Test distance/Correction	Corrected Reading	Converted Reading	Peak Limit
MHz	(H/V) / meters	X / Y / Z	dBuV	dB	meters/dB	dBuV/m	uV/m	uV/m
2508	H/1.0	X	*41.1	0.2	1.5/-6.0	35.3	58.2	4130
2508	H/1.0	Y	*41.1	0.2	1.5/-6.0	35.3	58.2	4130
2508	H/1.0	Z	*41.1	0.2	1.5/-6.0	35.3	58.2	4130
2508	V/1.0	X	*41.1	0.2	1.5/-6.0	35.3	58.2	4130
2508	V/1.0	Y	*41.1	0.2	1.5/-6.0	35.3	58.2	4130
2508	V/1.0	Z	*41.1	0.2	1.5/-6.0	35.3	58.2	4130
2926	H/1.0	X	*41.8	2.5	1.5/-6.0	38.3	82.2	4130
2926	H/1.0	Y	*41.8	2.5	1.5/-6.0	38.3	82.2	4130
2926	H/1.0	Z	*41.8	2.5	1.5/-6.0	38.3	82.2	4130
2926	V/1.0	X	*41.8	2.5	1.5/-6.0	38.3	82.2	4130
2926	V/1.0	Y	*41.8	2.5	1.5/-6.0	38.3	82.2	4130
2926	V/1.0	Z	*41.8	2.5	1.5/-6.0	38.3	82.2	4130
3344	H/1.0	X	*41.6	5.1	1.5/-6.0	40.7	108.4	4130
3344	H/1.0	Y	*41.6	5.1	1.5/-6.0	40.7	108.4	4130
3344	H/1.0	Z	*41.6	5.1	1.5/-6.0	40.7	108.4	4130
3344	V/1.0	X	*41.6	5.1	1.5/-6.0	40.7	108.4	4130
3344	V/1.0	Y	*41.6	5.1	1.5/-6.0	40.7	108.4	4130
3344	V/1.0	Z	*41.6	5.1	1.5/-6.0	40.7	108.4	4130
3762	H/1.0	X	*41.4	7.4	1.5/-6.0	42.8	138.0	4130
3762	H/1.0	Y	*41.4	7.4	1.5/-6.0	42.8	138.0	4130
3762	H/1.0	Z	*41.4	7.4	1.5/-6.0	42.8	138.0	4130
3762	V/1.0	X	*41.4	7.4	1.5/-6.0	42.8	138.0	4130
3762	V/1.0	Y	*41.4	7.4	1.5/-6.0	42.8	138.0	4130
3762	V/1.0	Z	*41.4	7.4	1.5/-6.0	42.8	138.0	4130
4180	H/1.0	X	*40.5	11.3	1.5/-6.0	45.8	195.0	4130
4180	H/1.0	Y	*40.5	11.3	1.5/-6.0	45.8	195.0	4130
4180	H/1.0	Z	*40.5	11.3	1.5/-6.0	45.8	195.0	4130
4180	V/1.0	X	*40.5	11.3	1.5/-6.0	45.8	195.0	4130
4180	V/1.0	Y	*40.5	11.3	1.5/-6.0	45.8	195.0	4130
4180	V/1.0	Z	*40.5	11.3	1.5/-6.0	45.8	195.0	4130

The frequency range was scanned from 30 MHz to 4.18 GHz. All emissions not recorded were more than 10dB below the specified limit. Emissions from the EUT do not exceed the specified limits.

*=Noise Floor Measurements (Minimum System Sensitivity)

RETLIF TESTING LABORATORIES

TABULAR DATA SHEET

TEST METHOD:	FCC Part 15 Subpart C Radiated Emissions		
CUSTOMER:	Nu-Metrics	JOB No.:	R-7170
TEST SAMPLE:	Pulsed RF Remote		
MODEL No.:	NC97-418	SERIAL No.:	FCC ID: MIKNUMETNC97
TEST SPECIFICATION:	FCC Part 15 Subpart C		
	PARAGRAPH: 15.231		
OPERATING MODE:	Continuously transmitting 418 Mhz Signal		
TECHNICIAN:	Dennis Cortes	DATE:	3/11/98
NOTES:	Test Distance: 3 Meters Worst case Duty Cycle: 11.7% (-18.6dB Duty Cycle Correction Factor)		

Test Frequency	Antenna Pol./Height	EUT Orientation	Peak Corrected Reading	Duty Cycle Corr. Factor	Corrected Average	Converted Average		Average Limit
MHz	(HV) / meters	X / Y / Z	dBuV/m	dB	dBuV/m	uV/m		uV/m
418	H/1.3	X	72.8	-18.6	54.2	512.9		4130
418	H/1.7	Y	89.2	-18.6	70.6	3388.4		4130
418	H/1.3	Z	70.0	-18.6	51.4	371.5		4130
418	V/1.0	X	87.8	-18.6	69.2	2884.0		4130
418	V/1.9	Y	89.0	-18.6	70.4	3311.3		4130
418	V/1.8	Z	79.8	-18.6	61.2	1148.2		4130
836	H/1.7	X	36.6	-18.6	18.0	7.9		413
836	H/1.4	Y	46.5	-18.6	27.9	24.8		413
836	H/1.4	Z	31.7	-18.6	13.1	4.5		413
836	V/1.0	X	44.3	-18.6	25.7	19.3		413
836	V/1.7	Y	35.6	-18.6	17.0	7.1		413
836	V/2.0	Z	37.7	-18.6	19.1	9.0		413
1254	H/1.1	X	43.8	-18.6	25.2	18.2		413
1254	H/1.5	Y	36.3	-18.6	17.7	7.7		413
1254	H/2.2	Z	38.3	-18.6	19.7	9.7		413
1254	V/1.4	X	37.9	-18.6	19.3	9.2		413
1254	V/1.4	Y	40.0	-18.6	21.4	11.7		413
1254	V/1.3	Z	35.0	-18.6	16.4	6.6		413
1672	H/1.0	X	*29.9	-18.6	11.3	3.7		413
1672	H/1.0	Y	*29.9	-18.6	11.3	3.7		413
1672	H/1.0	Z	*29.9	-18.6	11.3	3.7		413
1672	V/1.0	X	*29.9	-18.6	11.3	3.7		413
1672	V/1.1	Y	36.4	-18.6	17.8	7.8		413
1672	V/1.0	Z	*29.9	-18.6	11.3	3.7		413
2090	H/1.0	X	*34.2	-18.6	15.6	6.0		413
2090	H/1.0	Y	*34.2	-18.6	15.6	6.0		413
2090	H/1.0	Z	*34.2	-18.6	15.6	6.0		413
2090	V/1.0	X	*34.2	-18.6	15.6	6.0		413
2090	V/1.0	Y	*34.2	-18.6	15.6	6.0		413
2090	V/1.0	Z	*34.2	-18.6	15.6	6.0		413

The frequency range was scanned from 30 MHz to 4.18 GHz. All emissions not recorded were more than 10dB below the specified limit. Emissions from the EUT do not exceed the specified limits.

*=Noise Floor Measurements (Minimum System Sensitivity)

RETLIF TESTING LABORATORIES

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CUSTOMER:	Nu-Metrics	JOB No.:	R-7170
TEST SAMPLE:	Pulsed RF Remote		
MODEL No.:	NC97-418	SERIAL No.:	FCC ID: MIKNUMETNC97
TEST SPECIFICATION:	FCC Part 15 Subpart C		
	PARAGRAPH: 15.231		
OPERATING MODE:	Continuously transmitting 418 Mhz Signal		
TECHNICIAN:	Dennis Cortes	DATE:	7/13/98
NOTES:	Test Distance: 3 Meters Worst case Duty Cycle: 11.7% (-18.6dB Duty Cycle Correction Factor)		

Test Frequency	Antenna Pol./Height	EUT Orientation	Peak Corrected Reading	Duty Cycle Corr. Factor	Corrected Average	Converted Average		Average Limit
MHz	(H/V) / meters	X / Y / Z	dBuV/m	dB	dBuV/m	uV/m		uV/m
2508	H/1.0	X	*35.3	-18.6	16.7	6.8		413
2508	H/1.0	Y	*35.3	-18.6	16.7	6.8		413
2508	H/1.0	Z	*35.3	-18.6	16.7	6.8		413
2508	V/1.0	X	*35.3	-18.6	16.7	6.8		413
2508	V/1.0	Y	*35.3	-18.6	16.7	6.8		413
2508	V/1.0	Z	*35.3	-18.6	16.7	6.8		413
2926	H/1.0	X	*38.3	-18.6	19.7	9.7		413
2926	H/1.0	Y	*38.3	-18.6	19.7	9.7		413
2926	H/1.0	Z	*38.3	-18.6	19.7	9.7		413
2926	V/1.0	X	*38.3	-18.6	19.7	9.7		413
2926	V/1.0	Y	*38.3	-18.6	19.7	9.7		413
2926	V/1.0	Z	*38.3	-18.6	19.7	9.7		413
3344	H/1.0	X	*40.7	-18.6	22.1	12.7		413
3344	H/1.0	Y	*40.7	-18.6	22.1	12.7		413
3344	H/1.0	Z	*40.7	-18.6	22.1	12.7		413
3344	V/1.0	X	*40.7	-18.6	22.1	12.7		413
3344	V/1.0	Y	*40.7	-18.6	22.1	12.7		413
3344	V/1.0	Z	*40.7	-18.6	22.1	12.7		413
3762	H/1.0	X	*42.8	-18.6	24.2	16.2		413
3762	H/1.0	Y	*42.8	-18.6	24.2	16.2		413
3762	H/1.0	Z	*42.8	-18.6	24.2	16.2		413
3762	V/1.0	X	*42.8	-18.6	24.2	16.2		413
3762	V/1.0	Y	*42.8	-18.6	24.2	16.2		413
3762	V/1.0	Z	*42.8	-18.6	24.2	16.2		413
4180	H/1.0	X	*45.8	-18.6	27.2	22.9		413
4180	H/1.0	Y	*45.8	-18.6	27.2	22.9		413
4180	H/1.0	Z	*45.8	-18.6	27.2	22.9		413
4180	V/1.0	X	*45.8	-18.6	27.2	22.9		413
4180	V/1.0	Y	*45.8	-18.6	27.2	22.9		413
4180	V/1.0	Z	*45.8	-18.6	27.2	22.9		413

The frequency range was scanned from 30 MHz to 4.18 GHz. All emissions not recorded were more than 10dB below the specified limit. Emissions from the EUT do not exceed the specified limits.

*=Noise Floor Measurements (Minimum System Sensitivity)

Exhibit 6

Report of Measurements

Occupied Bandwidth, Para. 15.231(c)



Retlif Testing Laboratories

Test Report No. R-7170
FCC ID: MIKNUMETNC97A

11:30:52 JUL 11, 1997

R-7170

NC97 Occupied Bandwidth

N. D.

REF -14.5 dBm

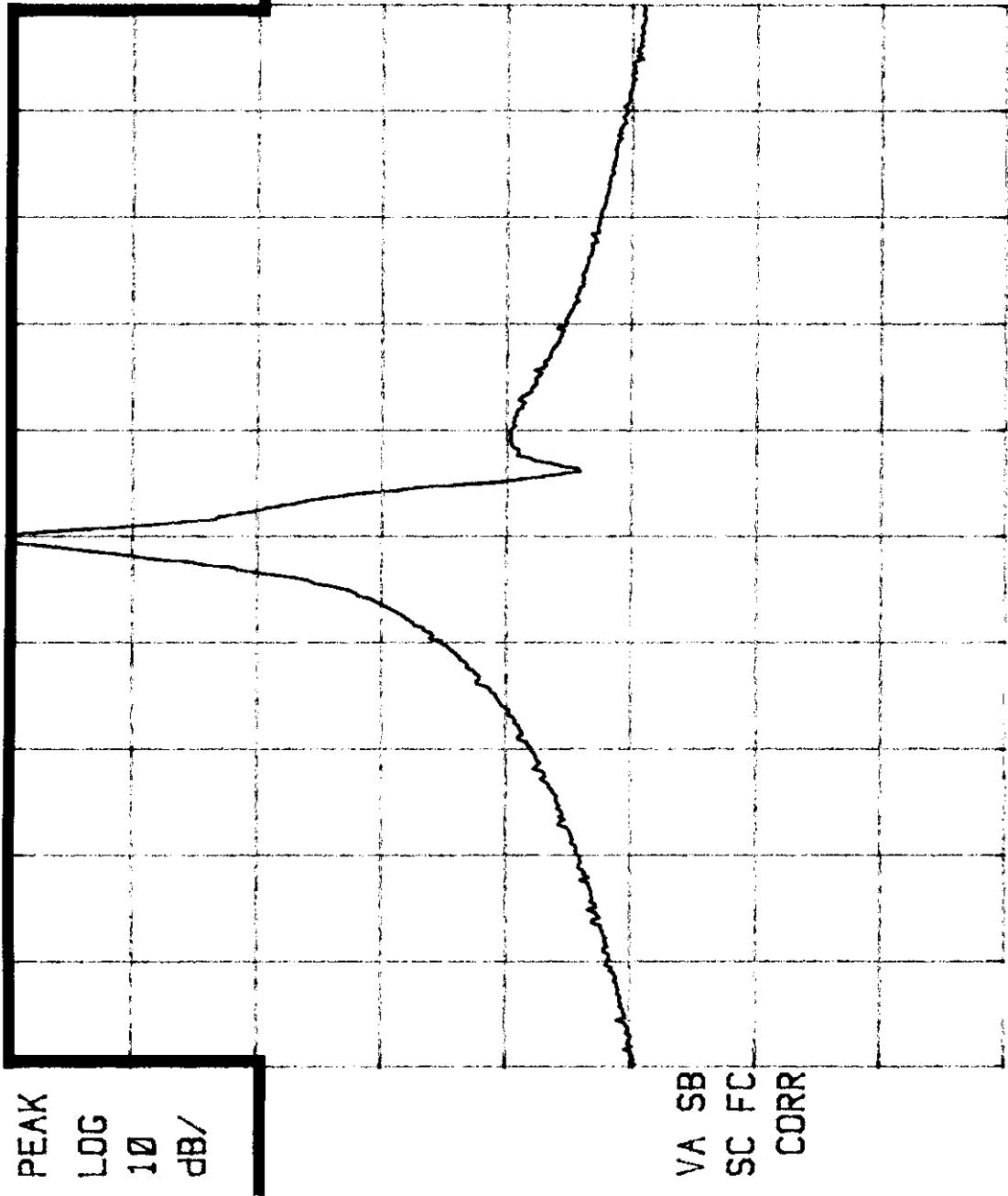
AT 10 dB

PEAK

LOG

10

dB/



Customer: Nu-Metrics
Test Sample: 418 MHz Pulsed RF Transmitter
Model No.: NC97-418
Test Method: FCC 15.231 (c) Occupied Bandwidth
Notes: 20 db bandwidth does not exceed 1.045 MHz

Date: 07/11/97

Techn: N. Dragotta

Sheet: 1 of 2

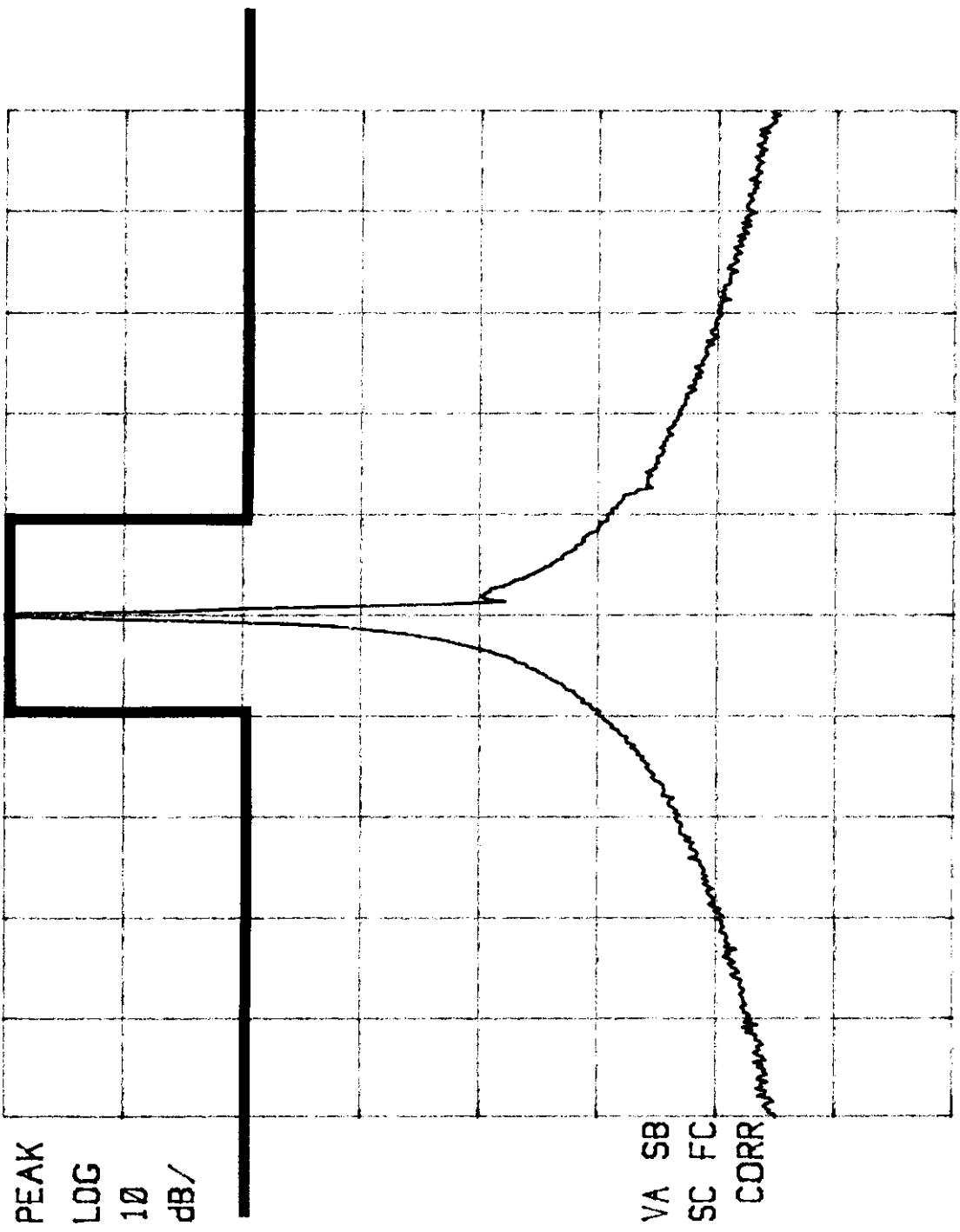


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11:33:32 JUL 11, 1997

R-7170 NC97 Occupied Bandwidth N.D.
REF -14.5 dBm AT 10 dB



CENTER 417.976 MHz
#RES BW 10 kHz

SPAN 5.225 MHz
SWP 157 msec
#VBW 30 kHz

VA SB
SC FC
CORR

Customer: Nu-Metrics
Test Sample: 418 MHz Pulsed RF Transmitter
Model No.: NC97-418
Test Method: FCC 15.231 (c) Occupied Bandwidth
Notes: 20 db bandwidth does not exceed 1.045 MHz

Date: 07/11/97

Techn: N. Dragotta

Sheet

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Exhibit 6

Report of Measurements

TEST EQUIPMENT LIST



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Test Report No. R-7170
FCC ID: MIKNUMETNC97A

Equipment List

EN	Type	Manufacturer	Frequency Range	Model No.	Serial No.	Cal Date	Due Date
067	Open Area Test Site	Retlif	3 Meter	RNY	001	8/30/97	8/30/99
128C	Double Ridge Guide	Eaton Corporation	1 GHz - 18 GHz	96001	2385	10/6/97	10/6/98
133	Broadband Pre-Amplifier	Electro-Metrics	10 kHz - 1 GHz, 26dB	BPA-1000	174	6/20/97	6/20/98
206B	6.0 dB Attenuator	Texscan	0 - 1.0 GHz	FP-50 - 6 dB	5785	6/20/97	6/20/98
523	Biconilog	Electro-Mechanics	26 MHz - 1100 MHz	3143	9602-1234	9/30/97	9/30/98
543	Preamplifier	Hewlett Packard	1.0 GHz - 26.5 GHz	8449B	3008A00829	8/12/97	8/12/98
544	EMC Analyzer	Hewlett Packard	9.0 kHz - 1.8 GHz	8591EM	3628A00844	8/11/97	8/11/98
R083	Spectrum Analyzer	Hewlett Packard	9 kHz - 22 GHz	8593E	3543A02183	11/20/97	11/20/98



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FCC ID: MIKNUMETNC97A