FCC Certification Test Report

FCC Certification Test Report for National Scientific Corporation FCC ID: Q79-703

July 23, 2003

Prepared for:

National Scientific Corporation
14455 North Hayden Road
Scottsdale, AZ 85260

Prepared By:

Washington Laboratories, Ltd.
7560 Lindbergh Drive
Gaithersburg, Maryland 20879

FCC Certification Test Program

FCC Certification Test Report
for the
National Scientific Corporation
Gotcha! Perimeter Safety Device
FCC ID: Q79-703

July 23, 2003

WLL JOB# 7623

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Abstract

This report has been prepared on behalf of National Scientific Corporation to support the attached Application for Equipment Authorization. The test report and application are submitted for a Periodic Intentional Radiator under Part 15.231 of the FCC Rules and Regulations. This Federal Communication Commission (FCC) Certification Test Report documents the test configuration and test results for a National Scientific Corporation Gotcha! Child Perimeter Safety Device.

Testing was performed on an Open Area Test Site (OATS) of Washington Laboratories, Ltd, 7560 Lindbergh Drive, Gaithersburg, MD 20879. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories, Ltd. has been accepted by the FCC and approved by NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

The National Scientific Corporation Gotcha! Perimeter Safety Device complies with the limits for a Periodic Intentional Radiator device under Part 15.231 of the FCC Rules and Regulations.

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1 Introduction

1.1 Compliance Statement

The National Scientific Corporation Gotcha! Child Perimeter Safety Device complies with the limits for a Periodic Intentional Radiator device under Part 15.231 of the FCC Rules and Regulations.

1.2 Test Scope

Tests for radiated emissions were performed. All measurements were performed according to the 1992 version of ANSI C63.4. The measurement equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

1.3 Contract Information

Customer:	National Scientific Corporation 14455 North Hayden Road Scottsdale, AZ 85260
Quotation Number:	60889

1.4 Test Dates

Testing was performed from June 18, 2003 to June 27, 2003.

1.5 Test and Support Personnel

Washington Laboratories, LTD	Ken Gemmell

1.6 Abbreviations

A	Ampere
Ac	alternating current
AM	Amplitude Modulation
Amps	Amperes
b/s	bits per second
BW	Bandwidth
CE	Conducted Emission
cm	centimeter
CW	Continuous Wave
dB	decibel
dc	direct current
EMI	Electromagnetic Interference
EUT	Equipment Under Test
FM	Frequency Modulation
G	giga - prefix for 10^9 multiplier
Hz	Hertz
IF	Intermediate Frequency
k	kilo - prefix for 10^3 multiplier
M	Mega - prefix for 10^6 multiplier
m	Meter
μ	micro - prefix for 10^{-6} multiplier
NB	Narrowband
LISN	Line Impedance Stabilization Network
RE	Radiated Emissions
RF	Radio Frequency
rms	root-mean-square
SN	Serial Number
S/A	Spectrum Analyzer
V	Volt

2 Equipment Under Test

2.1 EUT Identification & Description

The National Scientific Corporation Gotcha! Perimeter Safety Device is a small battery powered, portable low power RF based proximity alarm system. The system consists of two components: an RF transmitter and an RF receiver. When the units are operational and beyond a specified distance that can be set manually on the transmitter unit, the receiver unit will emit an audible warning until it comes back within range.

The device is used as a parent assist device for ensuring small children do not exceed a safe distance from the parent.

Table 1. Device Summary

ITEM	DESCRIPTION
Manufacturer:	National Scientific Corporation
FCC ID Number	Q79-703
EUT Name:	Child Perimeter Safety Device
Model:	Gotcha!
FCC Rule Parts:	§15.231(e)
Frequency Range:	434MHz
Maximum Output Power:	<1mW
Modulation:	Pulsed
Bandwidth:	172.5kHz
Keying:	Automatic every 10 seconds and Manual Locate/Cancel button
Type of Information:	Code
Number of Channels:	1
Power Output Level	3 settings for Close (Low power), Medium, and Far (High Power)
Antenna Type	Integral
Interface Cables:	None
Power Source & Voltage:	3Vdc from battery

2.2 Test Configuration

The Gotcha! was tested in an operational state with a receive unit located within the operating range.

2.3 Testing Algorithm

The Gotcha! transmitter was operated with the "Trigger Alarm" button continuously depressed to increase the rate transmitted signals. Also, the unit was set to the highest power setting (Far) during the testing.

Worst case emission levels are provided in the test results data.

2.4 Test Location

All measurements herein were performed at Washington Laboratories, Ltd. test center in Gaithersburg, MD. Site description and site attenuation data have been placed on file with the FCC's Sampling and Measurements Branch at the FCC laboratory in Columbia, MD. Washington Laboratories, Ltd. has been accepted by the FCC and approved by NIST NVLAP (NVLAP Lab Code: 200066-0) as an independent FCC test laboratory.

2.5 Measurements

2.5.1 References

ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation

ANSI C63.4 American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

Land Mobile FM or PM Communications Equipment Measurement and Performance Standards (ANSI/TIA/EIA-603-93)

2.6 Measurement Uncertainty

All results reported herein relate only to the equipment tested. For the purposes of the measurements performed by Washington Laboratories, the measurement uncertainty is ±2.3 dB. This has been calculated for a *worst-case situation* (radiated emissions measurements performed on an open area test site).

The following measurement uncertainty calculation is provided:

$$\text{Total Uncertainty} = (A^2 + B^2 + C^2)^{1/2}/(n-1)$$

where:

A = Antenna calibration uncertainty, in dB = 2 dB

B = Spectrum Analyzer uncertainty, in dB = 1 dB

C = Site uncertainty, in dB = 4 dB

n = number of factors in uncertainty calculation = 3

Thus, Total Uncertainty = $0.5\ (2^2 + 1^2 + 4^2)^{1/2} = \pm 2.3$ dB.

3 Test Equipment

Table 2 shows a list of the test equipment used for measurements along with the calibration information.

Table 2: Test Equipment List

Manufacturer	Model/Type	Function	Identification	Cal. Due
HP	8568B	Spectrum Analyzer	2634A02888	7/03/03
HP	85650A	Quasi-Peak Adapter	3303A01786	7/05/03
Solar	8116-50-TS-100-N	LISN	962509	10/16/03
ARA	LPB-2520	BiconiLog Antenna	1044	6/20/04
HP	85685A	RF Preselector	3221A01395	7/03/04

4 Test Results

4.1 Duty Cycle Correction

Measurements may be adjusted where pulsed RF is utilized to find the average level associated with a quantity. This calculation is applied to limits for pulsed licensed and unlicensed devices.

On time = $N_1L_1 + N_2L_2 + \ldots + N_{N-1}L_{N-1} + N_NL_N$, where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc.

- For Licensed Transmitters basic formula can be stated as 20log[Duty Cycle]
- For Unlicensed Intentional Radiators under 47CFR Part 15, all duty cycle measurements compared to a 100 millisecond period
- i.e. duty cycle = on time/100 milliseconds or period, whichever is less
- Restating the basic formula:
    - Duty cycle = $(N_1L_1 + N_2L_2 + \ldots + N_{N-1}L_{N-1} + N_NL_N)/100$ or T, whichever is less

Where T is the period of the pulse train.

The following Figures show the plots of the modulated carrier. The spectrum analyzer was set to Zero Span and the video triggered to collect the pulse train of the modulation. Calculations of the duty cycle correction factor were obtained from time data provided by the plots.

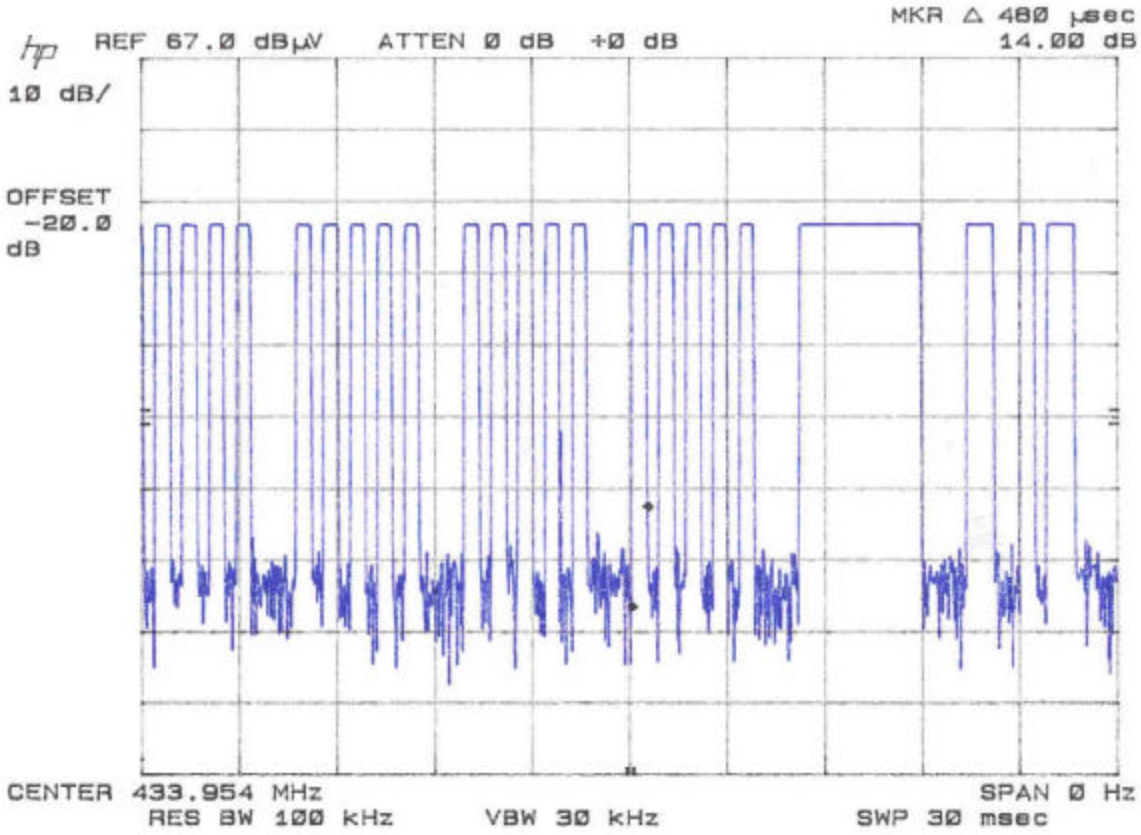

Figure 1. Duty Cycle; Narrow Pulse Width

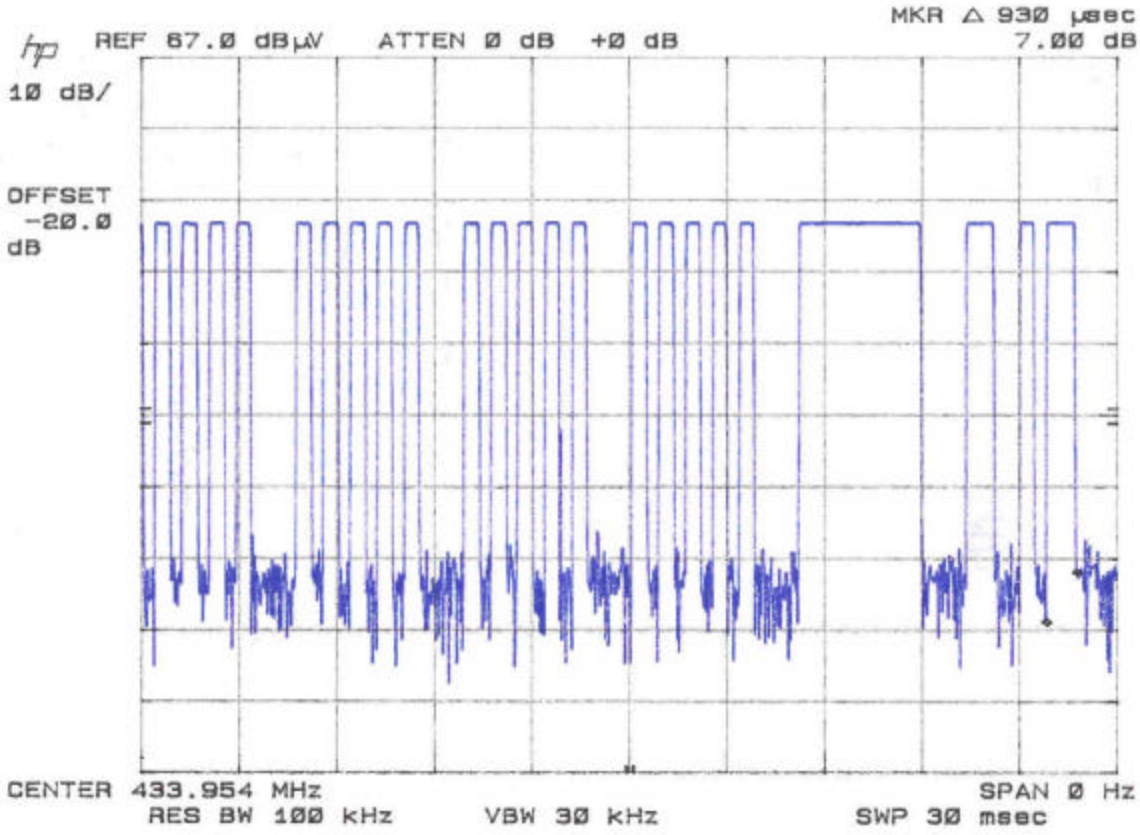

Figure 2. Duty Cycle; Medium Pulse Width

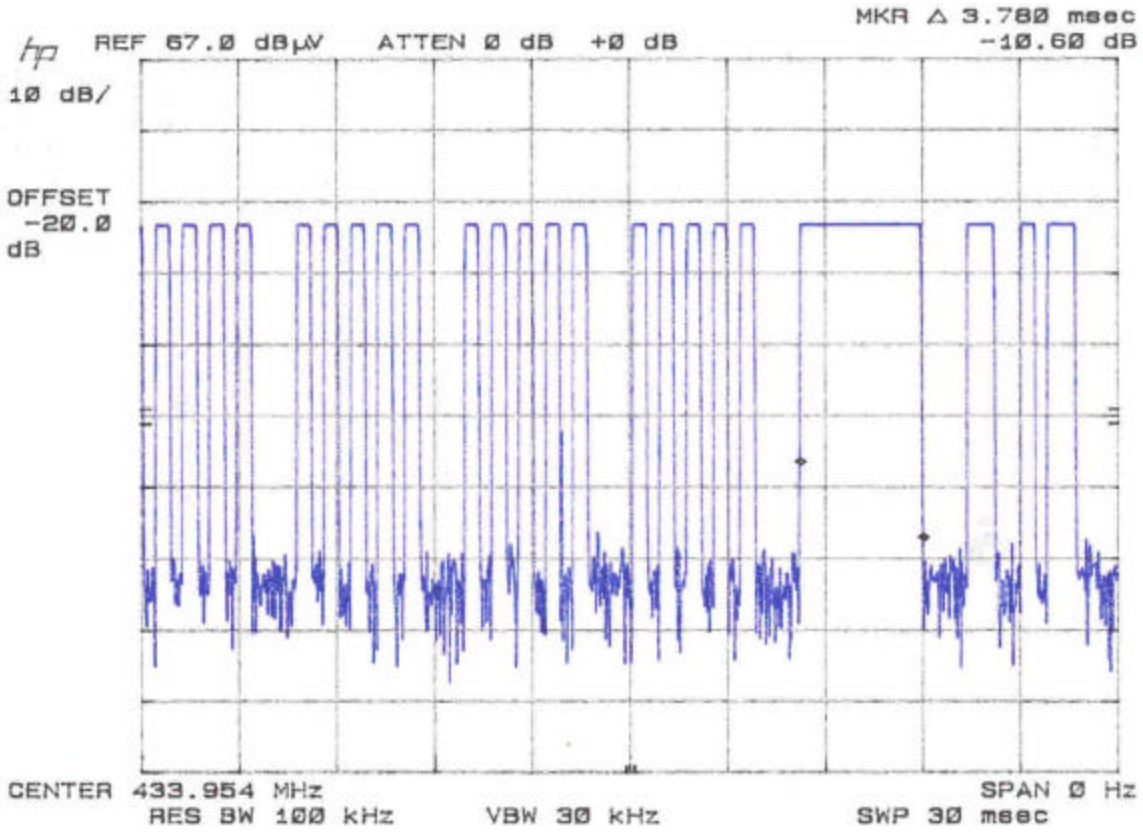

Figure 3. Duty Cycle; Wide Pulse Width

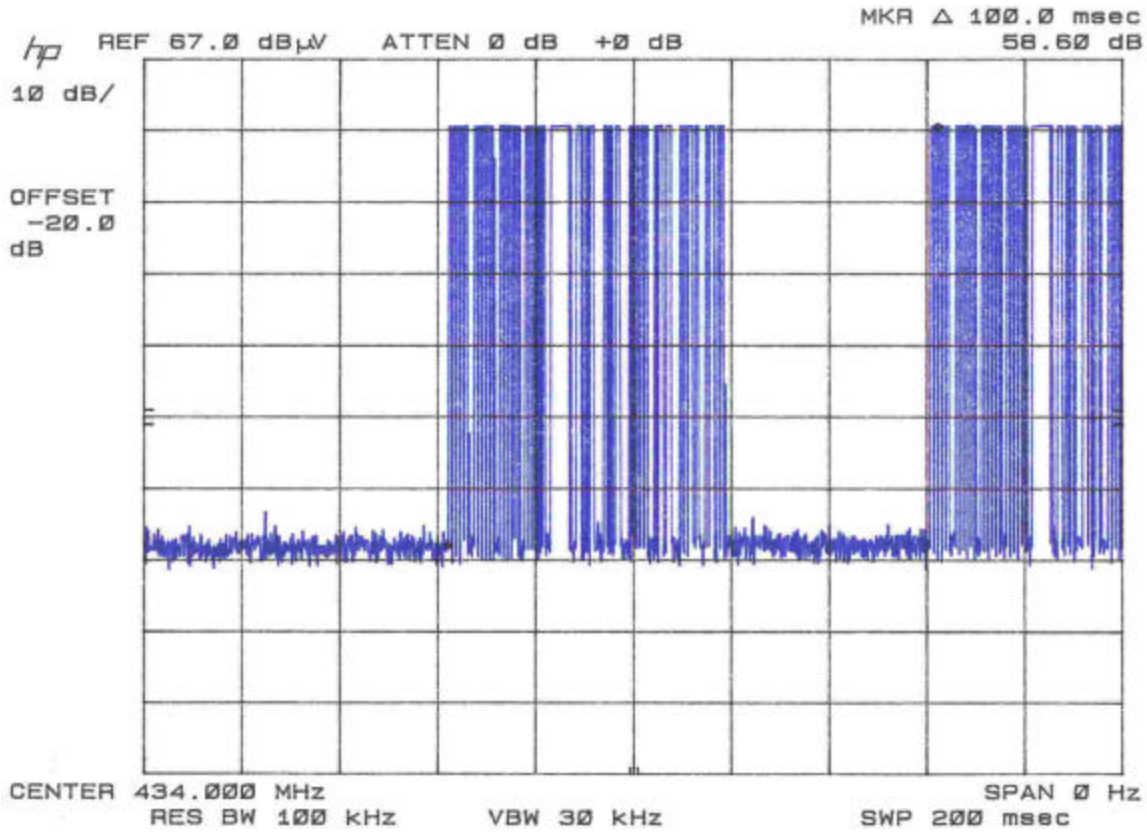

Figure 4. Duty Cycle Plot, Worst Case 100ms

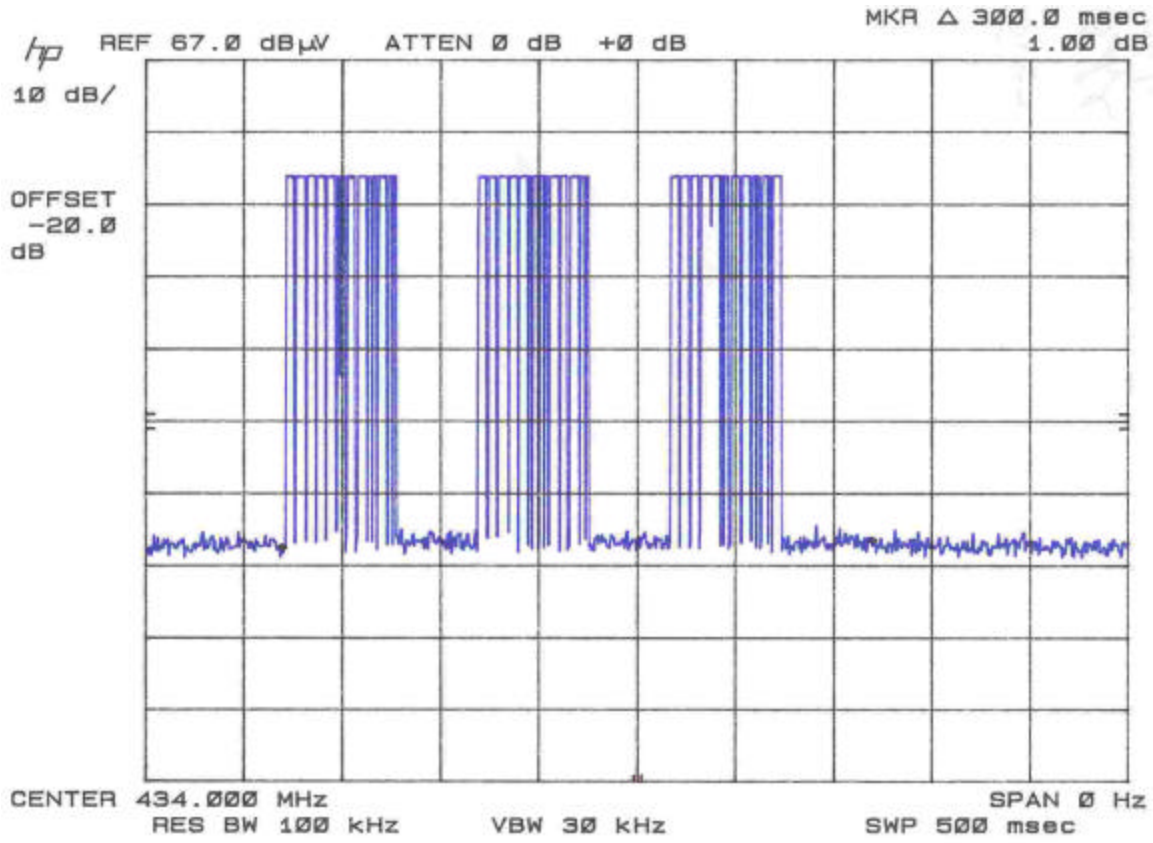

Figure 5. Complete Transmission

Table 3: Duty Cycle Correction

CLIENT:	National Scientific Corp.	DATE:	6/25/03
TESTER:	Ken Gemmell	JOB #:	7623
EUT:	Gotcha Transmitter		

	Pulse 1	Pulse 2	Pulse 3
Number of pulses	1	9	34
Pulse Width (microseconds)	3780	930	480
Total Time in (microseconds)	3780	8370	16320
Total Time in (ms)	3.78	8.37	16.32
Total time for both types Pulses			28.47
Worst Case Percent of 100 ms			28.47%
Duty Cycle Correction Factor			-10.91225 dB

4.2 Occupied Bandwidth: (FCC Part §2.1049)

Occupied bandwidth was performed by coupling the output of the EUT to the input of a spectrum analyzer.

FCC Part 15.231 states that the 20 dB bandwidth of the modulated carrier shall be as follows:

Frequency Range (MHz)	Occupied Bandwidth Limit
70-900 MHz	0.25%
> 900 MHz	0.5%

At full modulation, the occupied bandwidth was measured as shown:

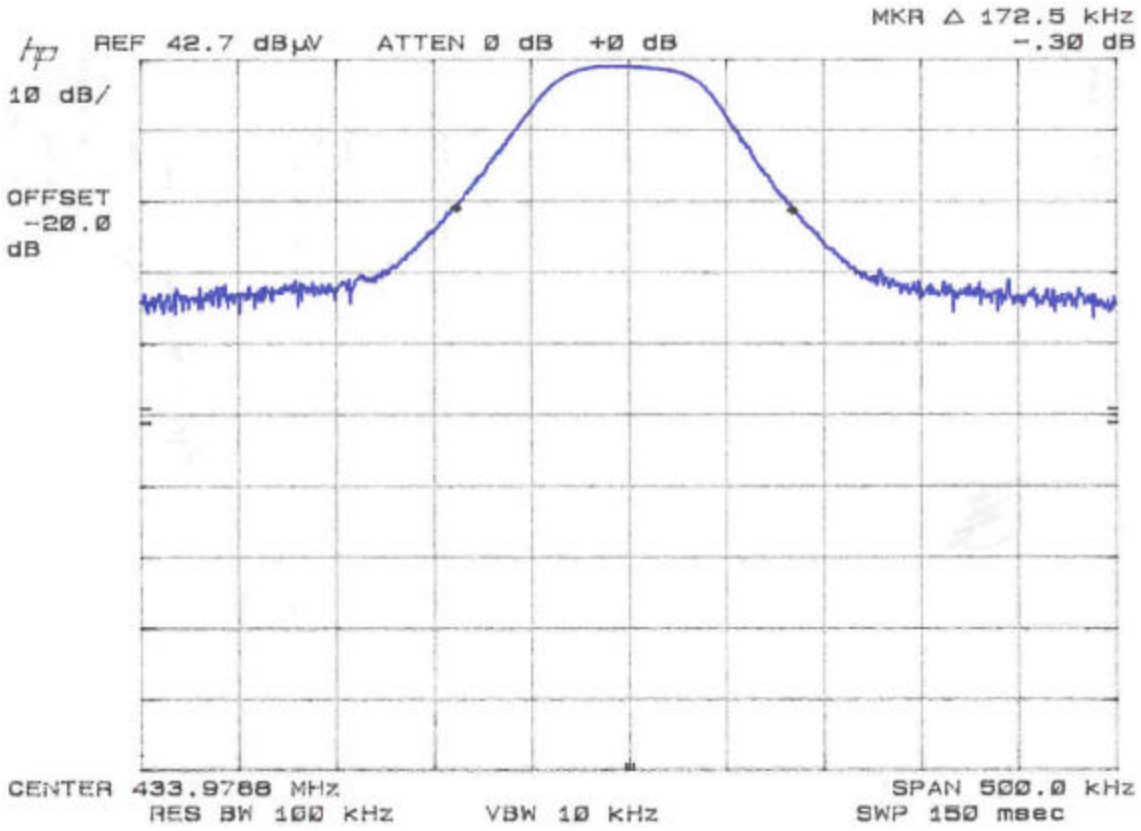

Figure 6. Occupied Bandwidth

Table 4 provides a summary of the Occupied Bandwidth Results.

Table 4. Occupied Bandwidth Results

Frequency	Bandwidth	Limit	Pass/Fail
434 MHz	172.5 kHz	1.085 MHz	Pass

4.3 Radiated Spurious Emissions: (FCC Part §2.1053)

The EUT must comply with requirements for radiated spurious emissions. The limits are as shown in the following table. These limits are based on §15.231(e).

Table 5. Radiated Spurious Emissions Limits

Frequency	Fundamental	Harmonic/Spurious Emission Level (-dBc or E-Field)
Fundamental	4400 µV/m	
Harmonics		440 µV/m

4.3.1 Test Procedure

The EUT was placed on motorized turntable for radiated testing on a 3-meter open field test site. The emissions from the EUT were measured continuously at every azimuth by rotating the turntable. Receiving antennas were mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna was varied between 1 and 4 meters.

The emissions were measured using the following spectrum analyzer bandwidths:

Frequency Range	Resolution Bandwidth	Video Bandwidth
30MHz-1000 MHz	100kHz	>100kHz
>1000 MHz	1 MHz	1MHz (peak)

Emissions were measured to the 10th harmonic of the transmit frequency. The EUT was tested in three orthogonal planes. Worst case emission levels are reported.

The following is a sample calculation used in the data tables for calculating the final field strength of spurious emissions and comparing these levels to the specified limits.

Sample Calculation:

Spectrum Analyzer Voltage (SA Level):	V dBµV
Antenna Factor (Ant Corr):	AFdB/m
Cable Loss Correction (Cable Corr):	CCdB
Duty Cycle Correction (Average)	DCCdB
Amplifier Gain:	GdB
Electric Field (Corr Level):	EdBµV/m = VdBµV + AFdB/m + CCdB + DCCdB - GdB

Table 6: Radiated Emission Test Data

CLIENT:	National Scientific Corp.	DATE:	6/27/03
TESTER:	Ken Gemmell	JOB #:	7623
EUT:	Gotcha Transmitter	**Test Requirements:**	
CONFIGURATION:	Transmitter	TEST STD:	FCC Part 15.231
CLOCKS:	13.68 MHz	DISTANCE:	3m
S/N:		CLASS:	B
Low FrequencyTest Equipment/Limit:		**High Frequency Test Equipment/Limit:**	
ANTENNA:	A_00382	ANTENNA:	A_00004
CABLE:	CSITE2_3m	CABLE:	CSITE1_HF
LIMIT:	LFCC_3m_Class_B	AMPLIFIER (dB)	A_00312

TX Frequency: 434 MHz **a = Ambient/Noise Floor**

Highest Power Setting X-Orientation Peak Data – Harmonics

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Hght (m)	SA Level (Peak) (dBuV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Duty Cycle Corr (dB)	Amp Gain (dB)	Corr. Level (dBuV/m)	Corr. Level (uV/m)	Limit (uV/m)	Margin dB
434.00	V	180.0	1.6	42.1	17.1	4.8	-10.9	0.0	53.1	453.5	4400.0	-19.7
868.00	V	180.0	1.0	18.5	23.6	7.5	-10.9	0.0	38.7	85.9	440.0	-14.2
1302.00	V	180.0	1.0	53.0	26.3	2.0	-10.9	34.2	36.1	64.0	440.0	-16.7
1736.00	V	180.0	1.0	57.4	28.0	3.0	-10.9	34.1	43.4	147.3	440.0	-9.5
2170.00	V	180.0	1.0	48.7	29.3	3.3	-10.9	34.1	36.2	64.6	440.0	-16.7
2604.00	V	180.0	1.0	51.7	30.1	3.0	-10.9	34.4	39.4	93.8	440.0	-13.4
3038.00	V	180.0	1.0	46.7	30.7	2.8	-10.9	34.6	34.7	54.3	440.0	-18.2
3472.00	V	180.0	1.0	46.8	31.2	2.8	-10.9	34.6	35.3	58.3	440.0	-17.6
3906.00	V	0.0	1.0	42.5	31.6	2.8	-10.9	34.6	31.4	37.1	440.0	-21.5a
4340.00	V	0.0	1.0	43.8	32.2	3.4	-10.9	34.6	33.9	49.7	440.0	-18.9a
434.00	H	180.0	1.0	58.5	17.1	4.8	-10.9	0.0	69.5	2996.5	4400.0	-3.3
868.00	H	180.0	1.0	26.5	23.6	7.5	-10.9	0.0	46.7	215.8	440.0	-6.2
1302.00	H	180.0	1.0	59.0	26.3	2.0	-10.9	34.2	42.1	127.7	440.0	-10.7
1736.00	H	180.0	1.0	61.0	28.0	3.0	-10.9	34.1	47.0	223.9	440.0	-5.9
2170.00	H	180.0	1.0	52.7	29.3	3.3	-10.9	34.1	40.2	102.3	440.0	-12.7
2604.00	H	180.0	1.0	55.5	30.1	3.0	-10.9	34.4	43.3	145.9	440.0	-9.6
3038.00	H	180.0	1.0	54.0	30.7	2.8	-10.9	34.6	42.0	126.2	440.0	-10.8
3472.00	H	0.0	1.0	45.8	31.2	2.8	-10.9	34.6	34.3	52.0	440.0	-18.6a
3906.00	H	0.0	1.0	42.8	31.6	2.8	-10.9	34.6	31.7	38.6	440.0	-21.1a
4340.00	H	0.0	1.0	43.8	32.2	3.4	-10.9	34.6	33.9	49.7	440.0	-18.9a

Y-Orientation Peak Data – Harmonics

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Hght (m)	SA Level (Peak) (dBuV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Duty Cycle Corr (dB)	Amp Gain (dB)	Corr. Level (dBuV/m)	Corr. Level (uV/m)	Limit (uV/m)	Margin dB
434.00	V	180.0	1.0	53.3	17.1	4.8	-10.9	0.0	64.3	1646.7	4400.0	-8.5
868.00	V	180.0	1.0	21.2	23.6	7.5	-10.9	0.0	41.4	117.2	440.0	-11.5
1302.00	V	180.0	1.0	58.8	26.3	2.0	-10.9	34.2	42.0	125.3	440.0	-10.9
1736.00	V	180.0	1.0	60.8	28.0	3.0	-10.9	34.1	46.8	219.6	440.0	-6.0
2170.00	V	180.0	1.0	57.0	29.3	3.3	-10.9	34.1	44.5	168.5	440.0	-8.3
2604.00	V	180.0	1.0	52.4	30.1	3.0	-10.9	34.4	40.2	102.1	440.0	-12.7
3038.00	V	180.0	1.0	49.2	30.7	2.8	-10.9	34.6	37.2	72.4	440.0	-15.7
3472.00	V	0.0	1.0	47.0	31.2	2.8	-10.9	34.6	35.5	59.5	440.0	-17.4a
3906.00	V	0.0	1.0	43.0	31.6	2.8	-10.9	34.6	31.9	39.3	440.0	-21.0a
4340.00	V	0.0	1.0	43.7	32.2	3.4	-10.9	34.6	33.8	48.8	440.0	-19.1a
434.00	H	180.0	1.0	51.4	17.1	4.8	-10.9	0.0	62.4	1323.1	4400.0	-10.4
868.00	H	180.0	1.0	20.7	23.6	7.5	-10.9	0.0	40.9	110.7	440.0	-12.0
1302.00	H	180.0	1.0	53.3	26.3	2.0	-10.9	34.2	36.5	66.5	440.0	-16.4
1736.00	H	180.0	1.0	60.2	28.0	3.0	-10.9	34.1	46.2	203.3	440.0	-6.7
2170.00	H	180.0	1.0	54.0	29.3	3.3	-10.9	34.1	41.5	119.3	440.0	-11.3
2604.00	H	160.0	1.0	51.3	30.1	3.0	-10.9	34.4	39.1	90.3	440.0	-13.8
3038.00	H	180.0	1.0	51.7	30.7	2.8	-10.9	34.6	39.7	96.5	440.0	-13.2
3472.00	H	0.0	1.0	45.2	31.2	2.8	-10.9	34.6	33.7	48.2	440.0	-19.2a
3906.00	H	0.0	1.0	43.0	31.6	2.8	-10.9	34.6	31.9	39.3	440.0	-21.0a
4340.00	H	0.0	1.0	43.3	32.2	3.4	-10.9	34.6	33.4	47.0	440.0	-19.4a

Z-Orientation Peak Data – Harmonics

Frequency (MHz)	Polarity H/V	Azimuth Degree	Ant. Hght (m)	SA Level (Peak) (dBuV)	Ant. Corr. (dB/m)	Cable Corr. (dB)	Duty Cycle Corr (dB)	Amp Gain (dB)	Corr. Level (dBuV/m)	Corr. Level (uV/m)	Limit (uV/m)	Margin dB
434.00	V	180.0	1.0	53.5	17.1	4.8	-10.9	0.0	64.5	1685.0	4400.0	-8.3
868.00	V	180.0	1.0	18.3	23.6	7.5	-10.9	0.0	38.5	83.9	440.0	-14.4
1302.00	V	180.0	1.0	57.8	26.3	2.3	-10.9	34.2	41.3	115.6	440.0	-11.6
1736.00	V	180.0	1.0	60.7	28.0	2.4	-10.9	34.1	46.1	201.9	440.0	-6.8
2170.00	V	180.0	1.0	59.5	29.3	2.7	-10.9	34.1	46.5	210.6	440.0	-6.4
2604.00	V	180.0	1.0	52.6	30.1	3.1	-10.9	34.4	40.4	105.0	440.0	-12.4
3038.00	V	180.0	1.0	57.2	30.7	3.4	-10.9	34.6	45.8	195.2	440.0	-7.1
3472.00	V	180.0	1.0	48.3	31.2	3.6	-10.9	34.6	37.6	76.3	440.0	-15.2
3906.00	V	0.0	1.0	42.8	31.6	3.8	-10.9	34.6	32.8	43.4	440.0	-20.1a
4340.00	V	0.0	1.0	43.8	32.2	3.9	-10.9	34.6	34.5	52.8	440.0	-18.4a
434.00	H	180.0	1.0	58.5	17.1	4.8	-10.9	0.0	69.5	2996.5	4400.0	-3.3
868.00	H	180.0	1.0	26.5	23.6	7.5	-10.9	0.0	46.7	215.8	440.0	-6.2
1302.00	H	180.0	1.0	59.3	26.3	2.0	-10.9	34.2	42.5	132.7	440.0	-10.4
1736.00	H	180.0	1.0	62.6	28.0	3.0	-10.9	34.1	48.6	269.2	440.0	-4.3
2170.00	H	180.0	1.0	53.5	29.3	3.3	-10.9	34.1	41.0	112.6	440.0	-11.8
2604.00	H	180.0	1.0	57.8	30.1	3.0	-10.9	34.4	45.6	189.5	440.0	-7.3
3038.00	H	180.0	1.0	49.7	30.7	2.8	-10.9	34.6	37.7	76.7	440.0	-15.2
3472.00	H	180.0	1.0	47.8	31.2	2.8	-10.9	34.6	36.3	65.4	440.0	-16.6
3906.00	H	180.0	1.0	47.7	31.6	2.8	-10.9	34.6	36.6	67.3	440.0	-16.3
4340.00	H	0.0	1.0	44.3	32.2	3.4	-10.9	34.6	34.4	52.7	440.0	-18.4a