

NATIONAL CERTIFICATION LABORATORY

**8370 Court Avenue, Suite B-1
Ellicot City, MD 21043**

(410) 461-5548

FCC REPORT OF RADIO INTERFERENCE

For

**OTEK Corporation
4016 E. Tennessee Street
Tucson, Arizona 85714-2130**

FS001 OTEK Transmitter

FCC ID: OYD-FS001TX

August 31, 2000



TABLE OF CONTENTS

- 1.0** Introduction
- 1.1** Summary
- 2.0** Description of Equipment Under Test (EUT)
- 3.0** Test Configuration
- 4.0** Conducted Emissions Scheme
- 5.0** Radiated Emissions Scheme

TABLES

- Table 1. Support Equipment
- Table 2. Interface Cables
- Table 3. Measurement Equipment

EXHIBITS

- Exhibit 1. EUT Photographs
- Exhibit 2. User Manual Statement
- Exhibit 3. Schematics

NCL PROJ.# OTEK-549TX



1.0 Introduction

This report has been prepared on behalf of OTEK CORPORATION, to support the attached application for FCC Certification of a Part 15 Intentional Radiator. The Equipment Under Test was the OTEK CORPORATION **FS001TX Transmitter**.

Radio-Noise Emissions tests were performed according to the ANSI C63.4- 1992, "**Method of Measurement of RFI from Low-Voltage Electronic Equipment in the Range of 9 KHz- 40 GHz**". The measuring equipment conforms to ANSI C63.2 Specifications for electromagnetic Noise and Field Strength-Instrumentation.

Test was performed at National Certification Laboratory in Ellicott City, MD. Site description and site attenuation data have been placed on file with the FCC's sampling and Measurements Branch. FCC acceptance was granted on May 26, 1993.

1.1 Summary

The OTEK Corporation **FX001TX Transmitter** complies with the Part 15.231(e) Radio Limits for periodic operation above 70 MHz of an Intentional Radiator.

2.0 Description of Equipment Under Test (EUT)

The EUT Features:

<u>FEATURES</u>	<u>FREQUENCY</u>
Internal PCB Antenna	433.92 MHz
Crystal Stable Osc.	
OOK Modulation	
Auto 0.3 sec. Transmission/60 sec. Off (meets 15.231(e))	
AC & Battery Operation	



3.0 Test Configuration

The EUT was setup on the test table in a manner which follows the general guidelines of ANSI C63.4, Section 6 “**General Operating Conditions and Configurations.**” Once the Start or Stop

buttons are pressed, the transmission is on for a 1 second period before automatically timed off. Tests were performed by repeated depressing of the buttons.

The EUT was configured in 3 orthogonal positions to determine the maximum RF level at each emission frequency. The data tables give the EUT position designation that produces worst-case field strength, in an X, Y, Z system. This is described below:

4.0 Conducted Emissions Scheme

The EUT is placed on an 80 cm high 1 X 1.5 meter non-conductive table. Power to the CPU is provided through a Solar Corporation 50 Ω /50 μ H line Impedance Stabilization Network bonded to a 2.2 X 2 meter horizontal ground plane, and a 2.2 X 2 meter vertical ground plane. The LISN has its AC input supplied from filtered AC power source. A separate LISN provides AC power to the peripheral equipment. I/O cables are moved about to obtain maximum emissions.

The 50 Ω output of the LISN is connected to the input of the spectrum analyzer and emissions in the frequency range of 450 kHz to 30 MHz are searched. The detector function is set to quasi-peak and the resolution bandwidth is set at 9 kHz, with all post-detector filtering no less than 10 times the resolution bandwidth for final measurements. All emissions within 20 dB of the limit are recorded in the data tables.



5.0 Radiated Emissions Scheme

The EUT was initially scanned in the frequency range 30 to 4340 MHz indoors, at a distance of one (1) meter to determine its emissions profile. The EUT was then placed on an 80 cm high 1 X 1.5 meter non-conductive motorized turntable for radiated testing on the 3-Meter open area test site. The emissions from the EUT are measured continuously at every azimuth by rotating the turntable. Waveguide horn and log periodic broadband antennas are mounted on an antenna mast to determine the height of maximum emissions. The height of the antenna is varied between one (1) and four (4) meters. Both the horizontal and vertical field components are measured. The output from the antenna is connected to the input of the spectrum analyzer. The detector function is set to Peak. All emissions within 20 dB of the limit are recorded in the data table.

Measurements from 30-1000 MHz: The output from the antenna is connected to the input of the spectrum analyzer. The detector function is set to Quasi-Peak. The resolution bandwidth of the spectrum analyzer system is set at 120 kHz for the range 30-1000 MHz with all post-detector filtering no less than 10 times the resolution bandwidth.

Measurements from 1-4 GHz: The output from the horn antenna is connected to the input of a 30 dB pre-Amp, which is in turn attached to the spectrum analyzer. The detector function is set to Quasi-Peak. The resolution bandwidth of the spectrum analyzer system is set at 1 MHz for the range 1-4 GHz.

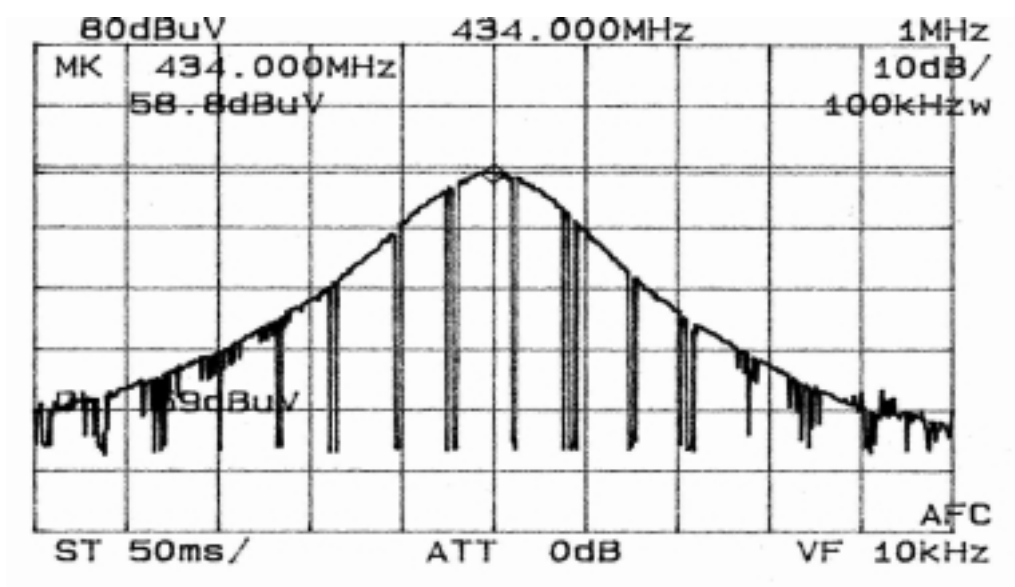
To convert the spectrum analyzer reading into a quantified E-field level to allow comparison with the FCC limits. It is necessary to account for various calibration factors. These factors include cable loss (CL) and antenna factors (AF). The AF/CL in dB/m is algebraically added to the Spectrum Analyzer voltage in dB μ V/m. This level is then compared with the FCC limit.

EXAMPLE:

Spectrum Analyzer Volt:	VdB μ V
Composite factor:	AF/CLdB/m
Electric Field:	EdB μ V/m= VdB μ V + AF/CLdB/m
Linear Conversion:	E μ V/m= Antilog (EdB μ V/m/20)

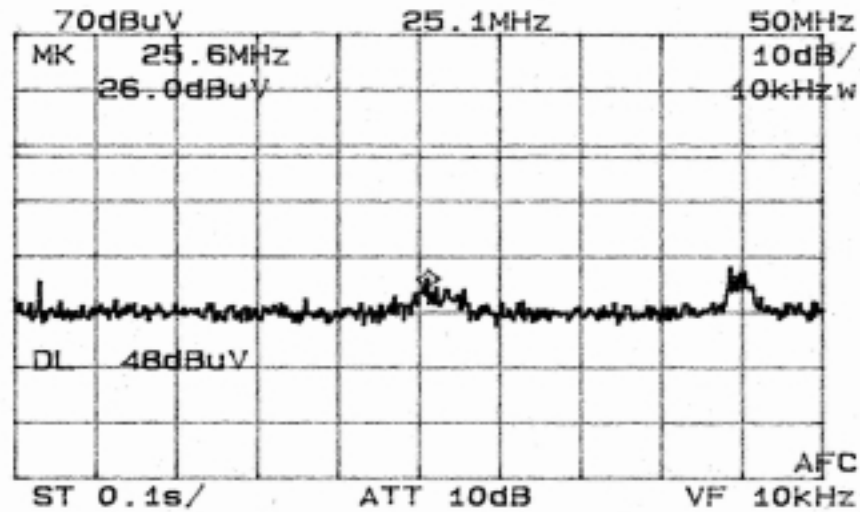


PEAK EMISSION PROFILE

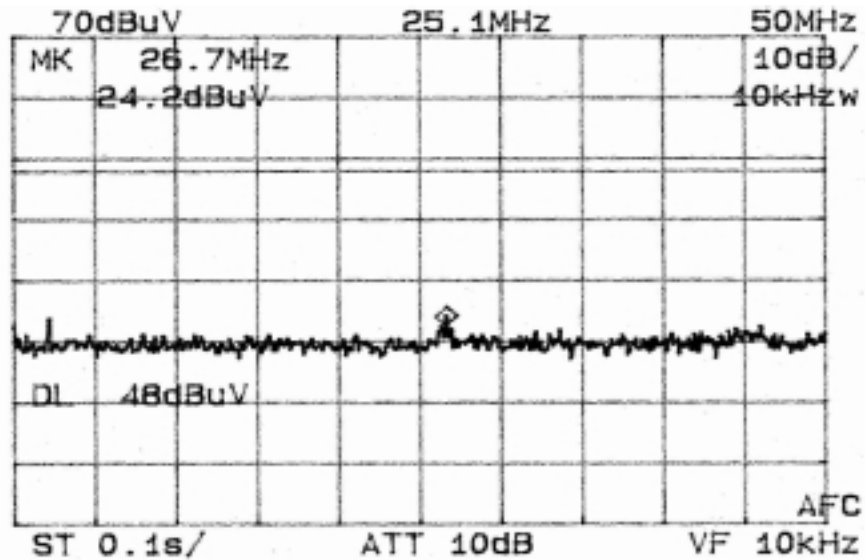


AC CONDUCTED EMISSIONS

Line 1



Line 2





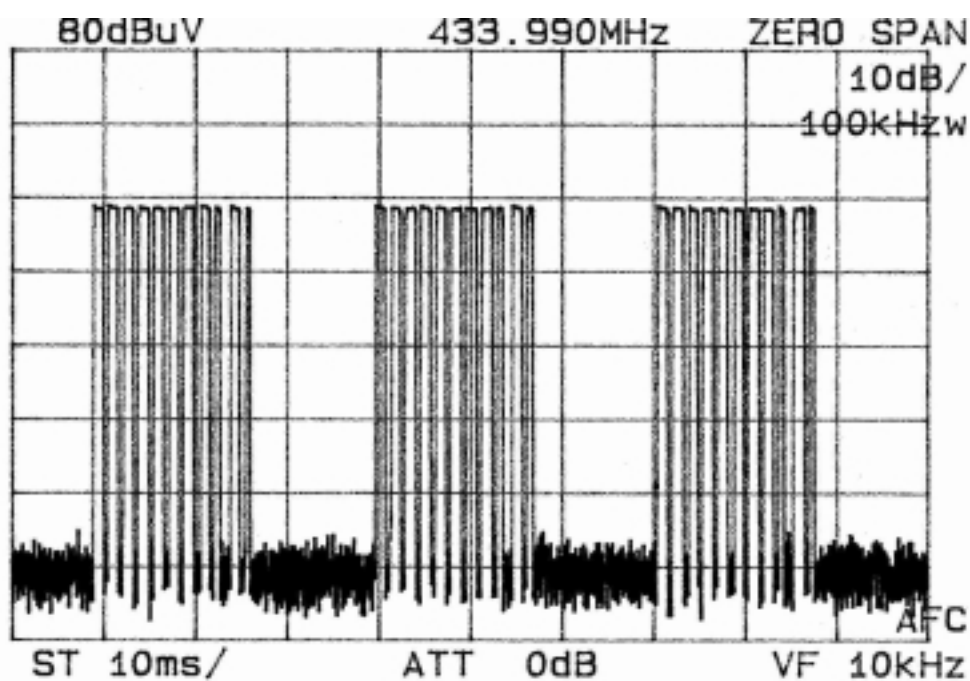
Average Field Strength Calculation:

Following spectrum analyzer plot reveals the maximum pulsed on/off duty cycle of the modulated carrier. A plot showing a 100 ms frame is given. The plot demonstrates clearly that the duty cycle is near 50 %. The average electric field level can thus be calculated as follows:

Linear: Avg. FS($\mu\text{V/m}$) = Peak FS($\mu\text{V/m}$) * 0.50

Logarithmic: Avg. FS(dB $\mu\text{V/m}$) = Peak FS(dB $\mu\text{V/m}$) - 6 dB

100 ms Frame – 10 ms/Div



Bandwidth Measurement:

The following plots include a graph of the modulated carrier that demonstrates the Bandwidth at a 20 dB point down from peak. Section 15.231(c) limits the Bandwidth to 0.25% of the center frequency:

$$\text{BW Limit} = .0025 * 434 \text{ MHz} = 1085 \text{ KHz}$$

$$\text{Measured BW} = 20 \text{ kHz}$$

Bandwidth Plot – Res BW: 3 kHz / Span: 1 MHz

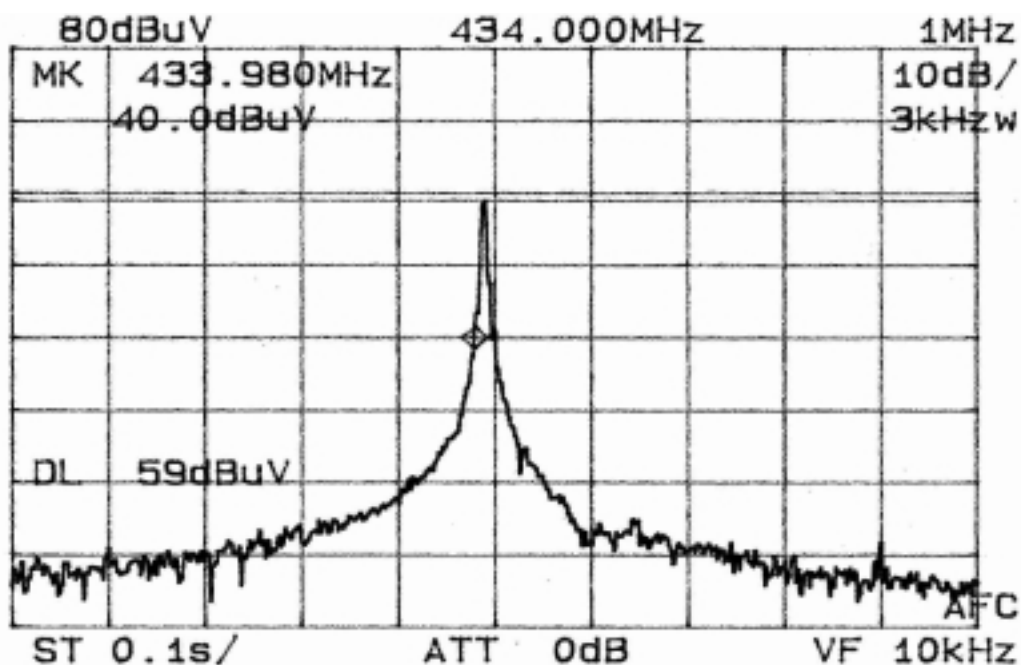




Table 1
Support Equipment

MANUFACTURER	FCC ID #	SERIAL #
NONE	N/A	



Table 2
Interface Cables Used

EUT to Printer	N/A
EUT to Modem	N/A
Modem (connected to telephone jack)	N/A
EUT Power	N/A
All other I/O cables such as monitor, keyboard, mouse are permanently attached to the peripherals - presume shielded.	
Note:	

Table 3

Measurement Equipment Used

The following equipment is used to perform measurements:

EQUIPMENT	SERIAL NUMBER
Wavetek 2410A 1100 MHz Signal Generator	1362016
EMCO Model 3110 Biconical Antenna	1619
EMCO Model 3146 Log Periodic Antenna	1222
Antenna Research LPD-3500 Log Antenna	1005
Advantest Model R4131D Spectrum Analyzer	54378A
Solar 8012-50-R-24-BNC LISN	927230
4 Meter Antenna Mast	None
Motorized Turntable	None
RG-233U 50 ohm coax Cable	None