

CONTROL CHIEF FCC INFORMATION

RF Measurement Report

Prepared by:

National Certification Laboratory

**8370 Court Avenue, Suite B-1
Ellicott City, Maryland 21043
(410) 461-5548**

In Support of:

FCC CERTIFICATION

For:

**Control Chief
200 Williams Street
Bradford, PA 16701**

Model: FLYMAX Remote Control Transmitter

FCCID: CBFFLYMT1-433

Demonstration of Compliance with FCC Rules Part 15.231

No part of this report may be reproduced without written approval of National Certification Laboratory

May 26, 2002

TABLE OF CONTENTS

1.0 General Information	4
1.1...Summary.....	4
1.2...Test Methodology	4
1.3...Test Facility.....	4
2.0 Description of Equipment Under Test (EUT)	5
2.1...EMI Countermeasure	6
3.0 Test Program	6
4.0 Test Configuration for Radiated and Conducted Emissions	6
4.1...Bandwidth Emission Test Result	7
4.1.1 Bandwidth Emission Plot.....	8
4.2.1 Peak Field Strength of Fundamental Plot.....	9
5.0 Conducted Emissions Scheme	10
6.0 Radiated Emissions Scheme	11
6.1...Radiated Emissions Data Table.....	13

TABLES

Table 1	EUT Accessories	14
Table 2	Support Equipment	15
Table 3	Measurement Equipment Used	16

EXHIBITS

Photographs

NCL PROJ.# Control-0725

1.0 General Information:

This report has been prepared on behalf of **Control Chief**, to support the FCC Certification of a Part 15 Intentional Radiator. The Equipment Under Test (EUT) was the **Model: FLYMAX Remote Control Transmitter**. The EUT configuration consisted of one Transmitter and one Receiver unit. The test results reported in this document relate only to the item that was tested.

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

1.1 Summary:

The **Control Chief, Model: FLYMAX Remote Control Transmitter**, complies with the Part 15.231 Radio Limits for periodic operation above 70 MHz for an Intentional Radiator..

1.2 Test Methodology:

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 1992. Radiated testing was performed at an antenna to EUT distance of three (3) meters.

1.3 Test Facility:

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of National Certification Laboratory 8370 Court Avenue, Suite B-1, Ellicott City, Maryland 21043. This site has been fully described in a report dated May 26, 1993, submitted to and approved by the Federal Communications Commission to perform AC line conducted and radiated emissions testing.

2.0 Description of Equipment Under Test (EUT):

The EUT features:

Internal PCB mount Antenna

433 MHz Frequency

Transmitter Chip Design

BSK Modulation

**Manual push “ON” with immediate
“OFF” upon release**

Battery Operation

2.1 EMI Countermeasure:

The following modifications were made to the EUT, by the project engineer to assure compliance to specifications:

None.

3.0 Test Program:

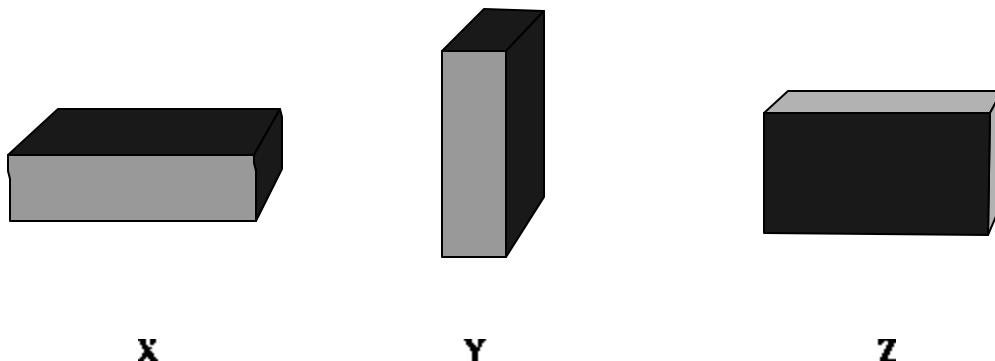
This report contains measurement charts and data as evidence for the following tests performed:

- 1- (15.231b) Field Strength of Fundamental and Harmonics.
- 2- (15.231c) Bandwidth Emission

4.0 Test Configuration for Radiated and Conducted Emissions:

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.**” Tests were performed by taping down one of the buttons to allow continuous operation.

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



4.1 Bandwidth Emission Test Results:

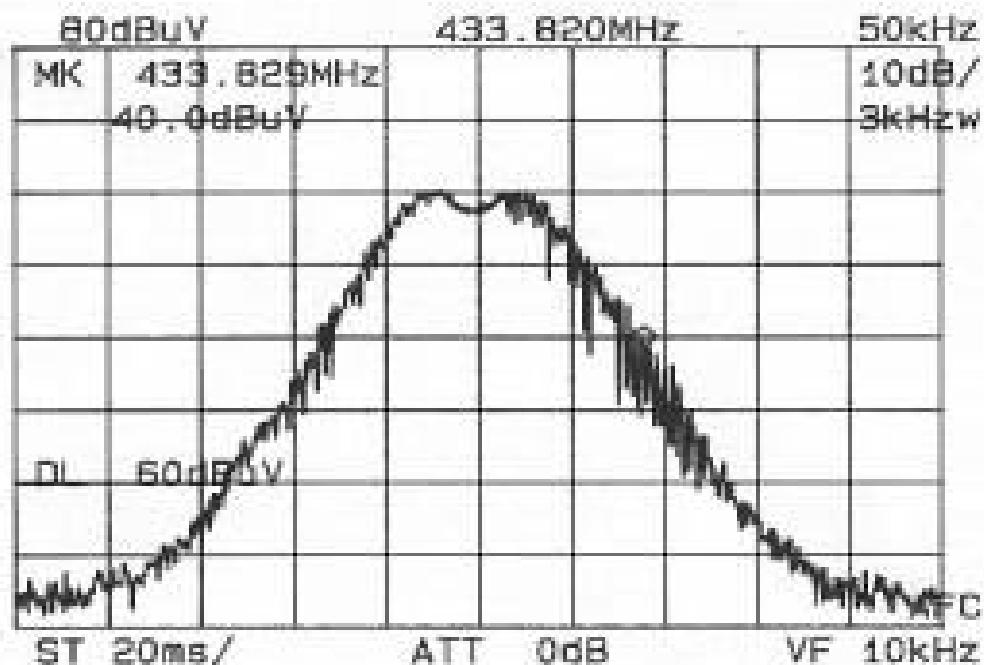
The following plot includes a graph of the modulated carrier that demonstrates the Bandwidth at a 20 dB point down from peak. Section 15.231(c) limits the Bandwidth to 0.25% of the center frequency:

BW Limit = .0025 * 433 MHz = 1083 KHz

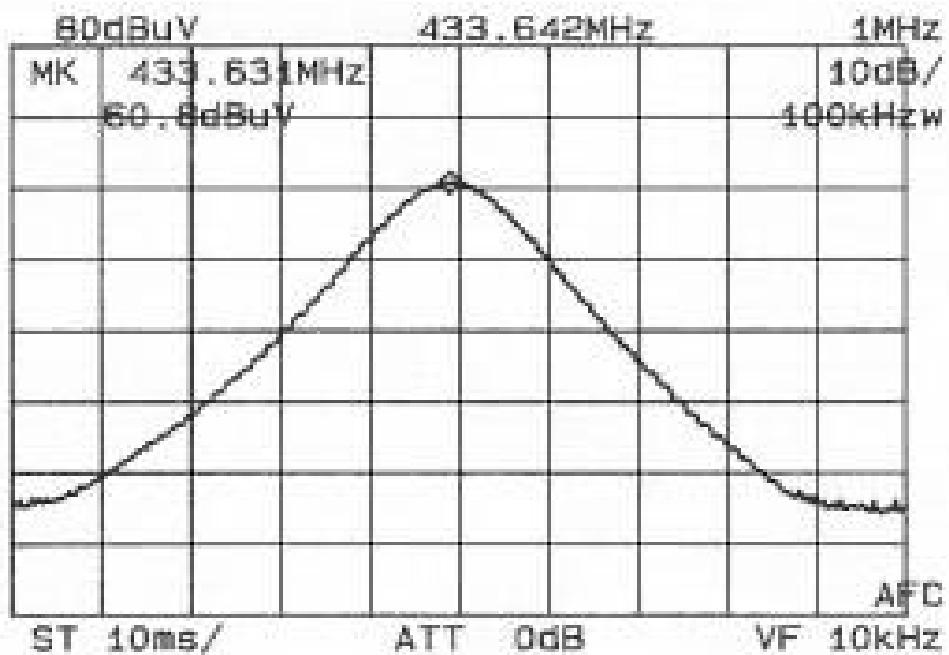
Measured BW = 18 kHz

4.1.1 Bandwidth Emission Plot:

Res BW: 3 kHz, Span: 50 kHz



4.2.1 Peak Field Strength of Fundamental Plot:



5.0 Conducted Emissions Scheme:

The EUT is powered by battery only.

6.0 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 Peak. The resolution bandwidth of the spectrum analyzer system is set at 100 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 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 to the FCC limit.

EXAMPLE

Spectrum Analyzer Voltage: V_{dBmV}

Composite Factor: $AF/CL \text{ dB/m}$

Electric Field: $E \text{ dBmV/m} = V \text{ dBmV} + AF/CL \text{ dB/m}$

Linear Conversion: $E \text{ mV/m} = \text{Antilog}(E \text{ dBmV/m} / 20)$

6.1 Radiated Emissions Data Table:

FCC RADIATED EMISSIONS DATA

CLIENT: CONTROL CHIEF
EUT: FLYMAX TX
CPU:
CLOCK 433.64 MHz
MODE: TRANSMIT

3 METER TEST Peak Level **DATE: 05/21/2002**

FREQUENCY MHz	POLARITY		SPEC A dBuV	AF/C dB/m	AMP Gain dB	Average Factor dB	PEAK E-Field dbuV/m	AVERAGE Limit dBuV/m	MARGIN dB	CONDITION
	Ant.	EUT								
433.64	V	Y	61.00	17.00	0.00	0.00	78.00	81.00	3.00	PASS
867.28	H	Z	59.00	24.00	30.00	0.00	53.00	61.00	8.00	PASS
1,300.92	V	Y	54.00	26.00	30.00	0.00	50.00	54.00	4.00	PASS
1,734.56	V	Y	52.00	29.00	30.00	0.00	51.00	61.00	10.00	PASS
2,168.20	H	X	50.00	32.00	30.00	0.00	52.00	61.00	9.00	PASS
2,601.80	H	Z	44.00	33.00	30.00	0.00	47.00	61.00	14.00	PASS
3,035.44	H	X	43.00	36.00	30.00	0.00	49.00	61.00	12.00	PASS
3,469.08	V	Y	40.00	36.00	30.00	0.00	46.00	61.00	15.00	PASS
3,902.72	H	X	35.00	37.00	30.00	0.00	42.00	54.00	12.00	PASS
4,336.40	V	Z	33.00	38.00	30.00	0.00	41.00	54.00	13.00	PASS

TABLE 1 – EUT ACCESSORIES

Type	Make	Model
None		

TABLE 2
SUPPORT EQUIPMENT

MANUFACTURER	FCC ID #	SERIAL #
None		

TABLE 3
MEASUREMENT EQUIPMENT USED

The following equipment is used to perform measurements:

EQUIPMENT	SERIAL #
Wavetek 2410A 1100 MHz Signal Generator	1362016
EMCO Model 3110 Biconical Antenna	1619
Antenna Research LPD-3500 Log Antenna	1005
EMCO Model 3146 Log Periodic Antenna	3007
HP 8348A Pre-Amplifier	197-2564A
Solar 8012-50-R-24-BNC LISN	924867
Bird 8306-300-N-30dB Attenuator	29198391515
Advantest Model R4131D Spectrum Analyzer	54378A
4 Meter Antenna Mast	
Motorized Turntable	
RG-233U 50 ohm coax Cable	
4 Meter Antenna Mast	

EUT PHOTOGRAPHS









