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: MDR-8410 / 8400 Transmitter

FCCID: CBFMDR-173

Demonstration of Compliance with FCC Rules Part 90.217

June 22, 2002

TABLE OF CONTENTS

TABLES

EXHIBITS

NCL PROJ.# CONTCHF-0723

1.0 General Information:

This report has been prepared on behalf of **Control Chief**, to support the FCC Certification of a Part 90 transmitter. The Equipment Under Test (EUT) was the **Model: MDR-8410 / 84100 Transmitter.** The EUT configuration consisted of one Transmitter 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: **MDR-8410 / 8400 Transmitter,** complies with the Part 90.217 Radio Limits for licensed transmitters under 120 mW RF power.

1.2 Test Methodology;

Both RF Antenna Conducted and Radiated out-of-band emissions testing were performed according to the procedures specified in the applicable sections of TIA/EIA- 603 documents. Radiated testing was performed at an antenna to EUT distance of three (3) meters. The Dipole Substitution Method based on Section 2.2.12 was used to measure out-of-band radiated emission levels.

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:

External Antenna
173 – 174 MHz Frequency
12.5 kHz Channel
F1D Emission Modulation
100 mW Peak RF Power
Battery Operation
2400 bps Data Rate
+/- 5 PPM Frequency Stability

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:

90.217 ---------- Power Rating

90.217 / 2.993 / 2.991 ---------- Harmonics & Out-of-Band Emissions

90.209 / 2.202 ---------- Frequency Segment/Channel Bandwidth

90.213 / 2.995 ----------Frequency Stability

4.0 Test Configuration for Radiated and Antenna Conducted RF Emissions:

For RF Antenna Conducted measurements of Power, Spurious/Harmonics, and Occupied Bandwidth, the RF antenna port was connected directly to the spectrum analyzer. Suitable attenuation was used to prevent overloading of the analyzer front end.

Radiated out-of-band emissions testing was performed according to the procedures specified in the applicable sections of **TIA/EIA- 603** documents. Radiated testing was performed at an antenna to EUT distance of three (3) meters. The Dipole Substitution Method based on Section 2.2.12 was used to measure out-of-band radiated emission levels. Once an emission level is found as maximum, the EUT is removed from the test table and replaced with a calibrated tuned dipole antenna in vertical polarity, which is driven by a signal generator. The generator level is adjusted to the duplicate the previous reading on the analyzer which will be the ERP.

5.0 FCC Part 2.202 / 90.209 - Calculation of Necessary Bandwidth:

Bn = 2M + 2DK

Where K= 1, M= Max Modulation, D= Peak Freq Deviation

Based on Designer's Specs.: M = 1.2 KHz (2400 bps), D = 2.5 KHz

Therefore: Bn = 2.4 KHz + 5.0 KHz = 7.4 KHz

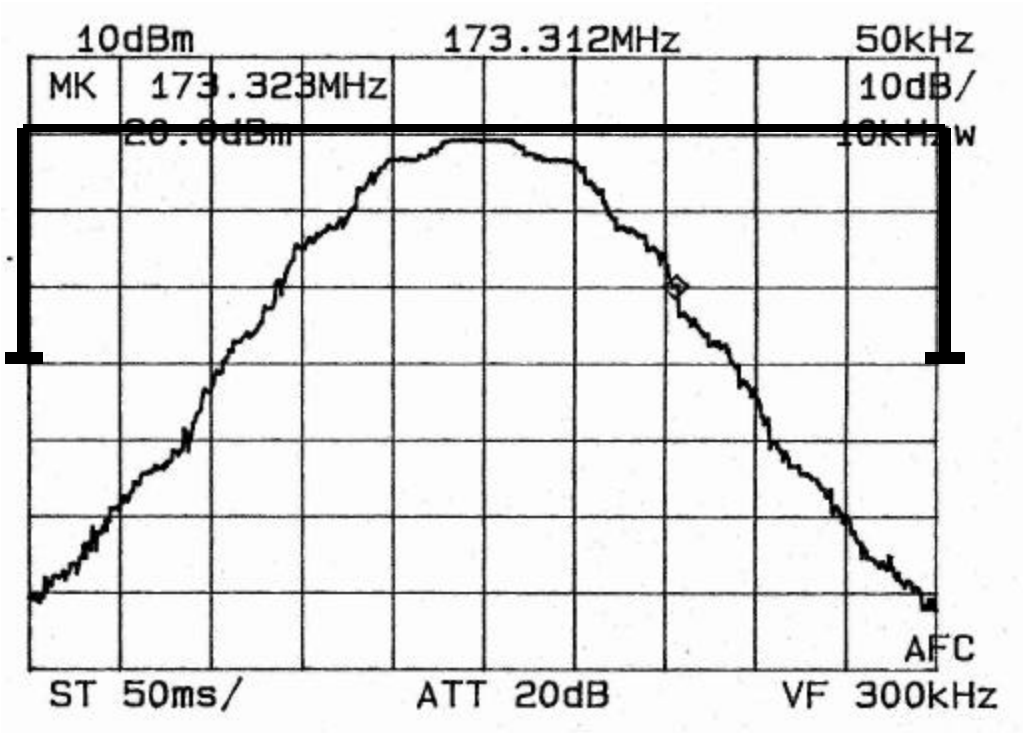
Emission Designator: 7K40F1D

6.0 FCC Part 90.217 – Out-of-Band Emission Limits for 12.5 kHz Channel:

Section 90.217 states:

For 12.5 kHz Channel: The sum of the Occupied Bandwidth and the Bandwidth for Stability shall be adjusted such that all emission levels 25 kHz or more from the center, are attenuated at least 30 dB below the unmodulated carrier. In this case the frequency stability is 5 PPM or +/- 868 Hz. The occupied bandwidth is 22.0 kHz.

SPAN: 5 kHz/DIV RES BW: 10 kHz 10 dB/DIV



FCC PART 2.993/90.217 - RADIATED SPURIOUS EMISSIONS

Frequency of Carrier = 173.3125 MHz
Limit = 30 dBc

TEST RESULTS

LIMIT: -30.0 dB FROM PEAK CARRIER

COMPONENT	FREQUENCY (MHZ)	RESULT (dB FROM PEAK)
HARMONIC	347.00	- 61
HARMONIC	520.50	- 65
HARMONIC	694.00	- 69
HARMONIC	867.50	- 72
HARMONIC	1041.00	- 75
HARMONIC	1214.50	- 77
HARMONIC	1388.00	- 76
HARMONIC	1561.50	- 80

FCC PART 2.991/90.217 - CONDUCTED SPURIOUS EMISSIONS

Frequency of Carrier = 173.3125 MHz
Limit = 30 dBc

TEST RESULTS

LIMIT: -30.0 dB FROM PEAK CARRIER

COMPONENT	FREQUENCY (MHZ)	RESULT (dB FROM PEAK)
HARMONIC	347.00	- 57
HARMONIC	520.50	- 60
HARMONIC	694.00	- 63
HARMONIC	867.50	- 67
HARMONIC	1041.00	- 70
HARMONIC	1214.50	- 73
HARMONIC	1388.00	- 77
HARMONIC	1561.50	- 79

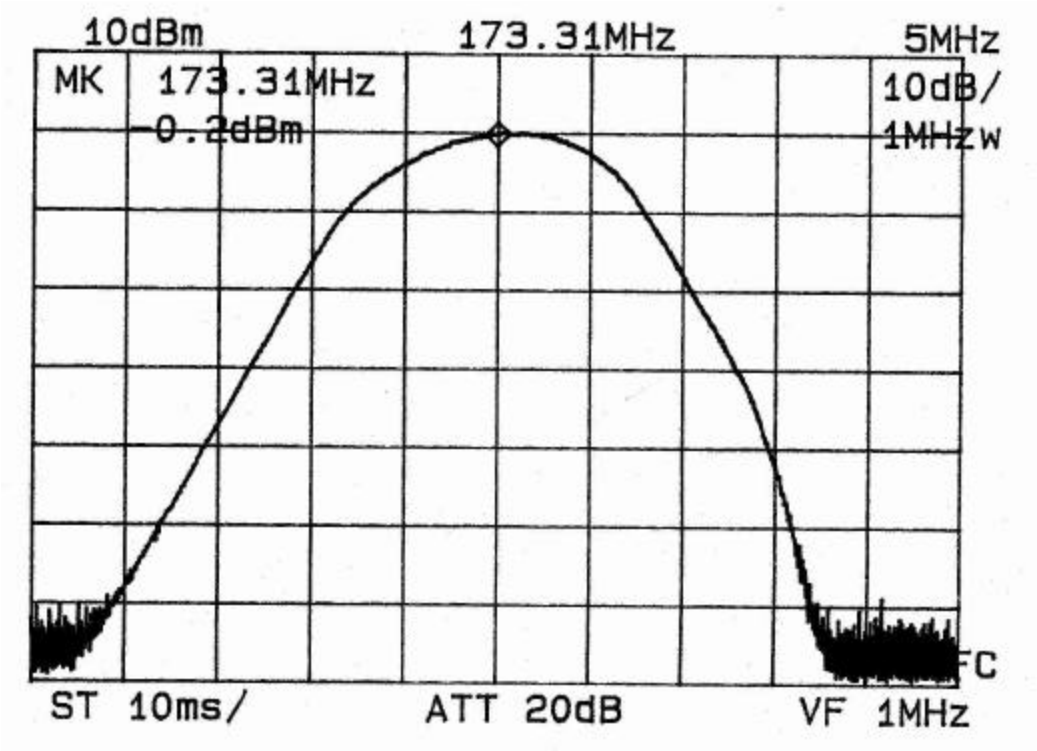
7.0 FCC Part 90.217 - RF Power Rating :

The RF power may not exceed 120 mW. RF power measurements were taken at the antenna port through an external 20 dB attenuator.

Results:

173.3125 MHz …… 20 dBm (100 mW)

Spectrum plots – Resolution BW = 1 MHz

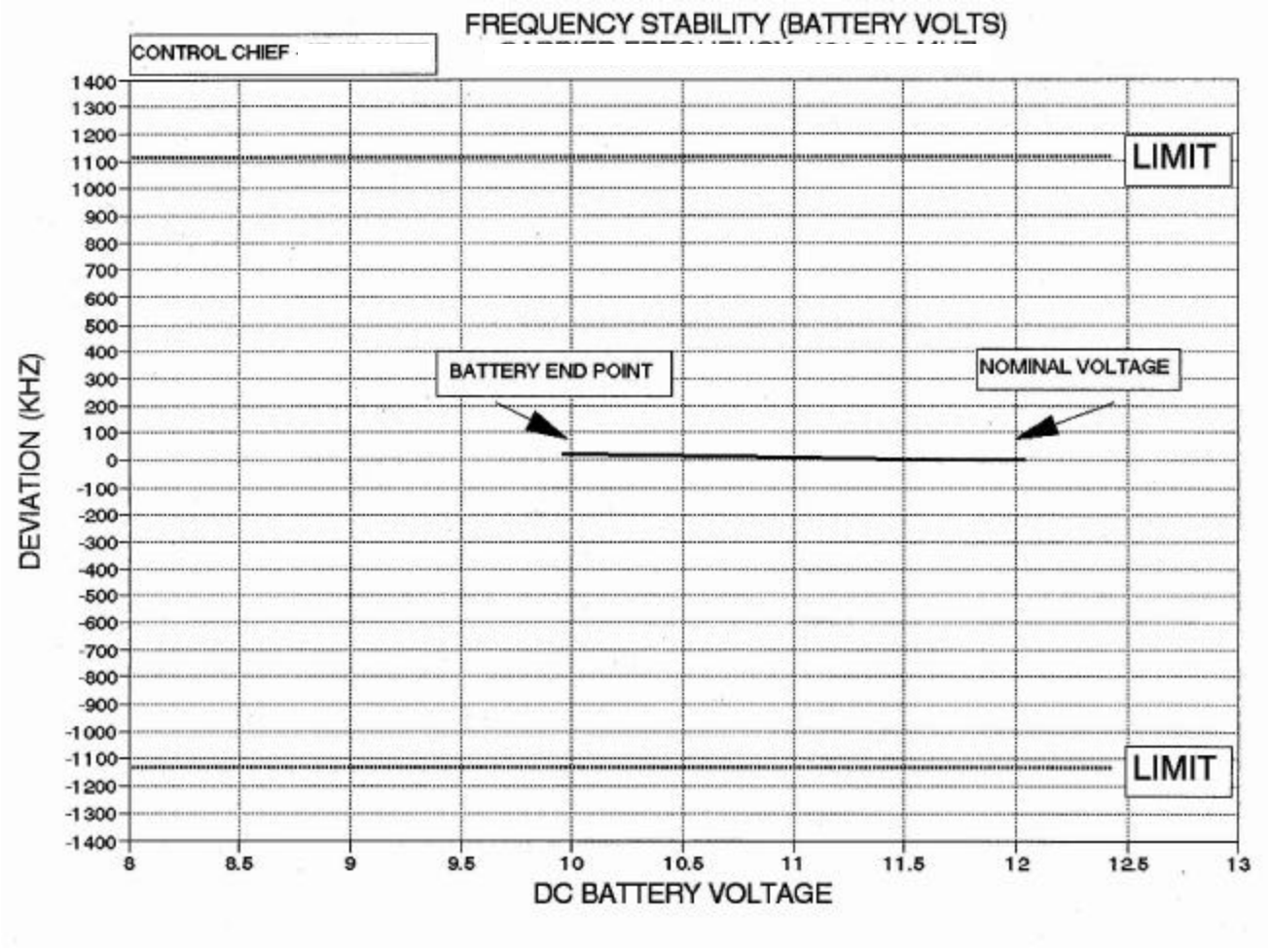


8.0 FCC Part 90.213 / 2.995 - Frequency Stability :

The following charts reveal the Frequency Tolerance of the transmitter carrier frequency as a function of Temperature and Supply Voltage. The charts confirm the rated tolerance of 5.0 ppm.

The transmitter was placed in the temperature chamber at 25 degrees C and allowed to stabilize for one hour. The transmitter was keyed on for one minute during which a frequency reading was taken. This was considered to be the reference frequnecy. The temp. was reduced to -30 degrees C and the transmitter allowed to stabilize for one hour. Frequency readings were taken and this procedure repeated in 10 degree increments up to 50 degrees C.

Frequency readings were also taken in increments down to the battery end-point voltage. Fc=173.3125 Mhz



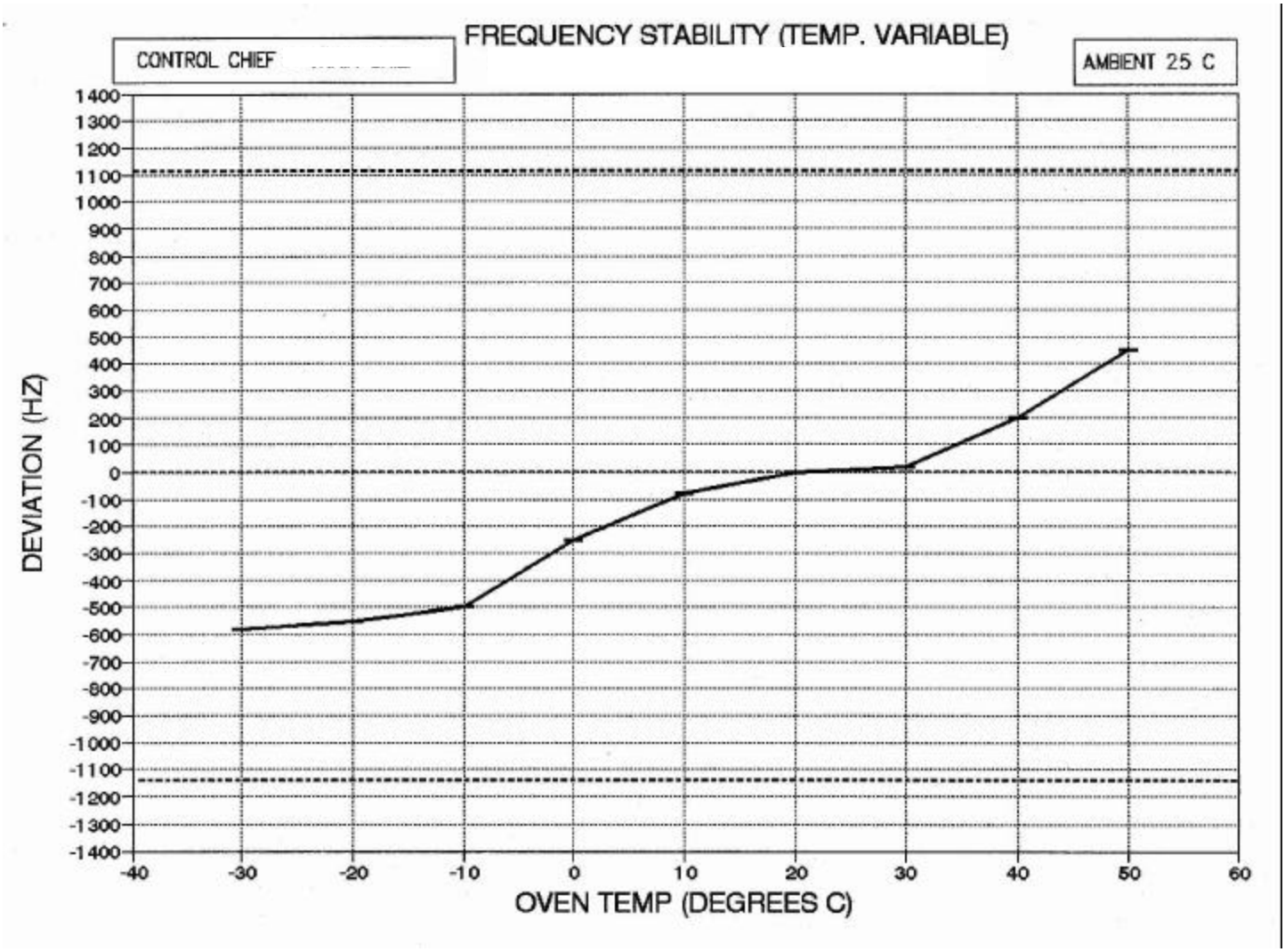

FREQUENCY STABILITY (TEMP. VARIABLE)
CONTROL CHIEF
AMBIENT 25 C
DEVIATION (HZ)
1400
1300
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
-700
-800
-900
-1000
-1100
-1200
-1300
-1400
-40
-30
-20
-10
0
10
20
30
40
50
60
OVEN TEMP (DEGREES C)

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	