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FCC REPORT OF TYPE ACCEPTANCE

for

Control Chief Corporation
P.O Box 141
Bradford, PA 16701

FCC ID: CBFTCT1-450

March 27, 1999

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1.0 Introduction

This report has been prepared on behalf of Control Chief Corp. to support the attached Application for Type Acceptance of a UHF Transceiver, for use under FCC Part 90, Subpart D, in the Industrial Radio Service. The Equipment Under Test was the Control Chief Corp. **Train Chief Radio Remote Transceiver**.

Radio-Noise Emissions tests were performed according to Part 2, Subpart J and 90.203-215 of the FCC Rules. The measuring equipment conforms to ANSI C63.2 Specifications for Electromagnetic Noise and Field Strength Instrumentation.

Testing 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 Control Chief Corp. **Train Chief Radio Remote Transceiver** complies with the technical standards for transmitters operating under FCC Rules Parts 90.203 - 90.215.

2.0 Description of Equipment Under Test (EUT)

The EUT Features:

- 450.0-470.0 MHz Operation
- 0.5 Watt Max RF Power Rating
- F1D Type Modulation
- 12.5 kHz Channel Spacing
- 50 Ohm RF Impedance
- 2400 bps Data Rate
- 12 VDC Operation from AC Adapter
- +/- 1.2 kHz Set Deviation

3.0 Test Program

Testing was performed on the EUT to demonstrate performance to the following FCC Rule Parts:

90.205 ----- Power Rating
90.210 ----- Harmonics & Out-of-Band Emissions
90.209 ----- Frequency Segment/Channel Bandwidth
90.213 ----- Frequency Stability
90.214 ----- Transient Freq. Behavior

The following Section 4.0 of this report provides Testing Configurations and Data.

FCC Part 2.202/90.209 - Calculation of Necessary Bandwidth

$$B_n = 2M + 2DK$$

Where $K = 1$, $M = \text{Max Modulation}$, $D = \text{Peak Freq Deviation}$

Based on Designer's Specs.: $M = 1.2 \text{ KHz}$, $D = 1.2 \text{ KHz}$

Therefore: $B_n = 2.4 \text{ KHz} + 2.4 \text{ KHz} = \underline{4.8 \text{ KHz}}$

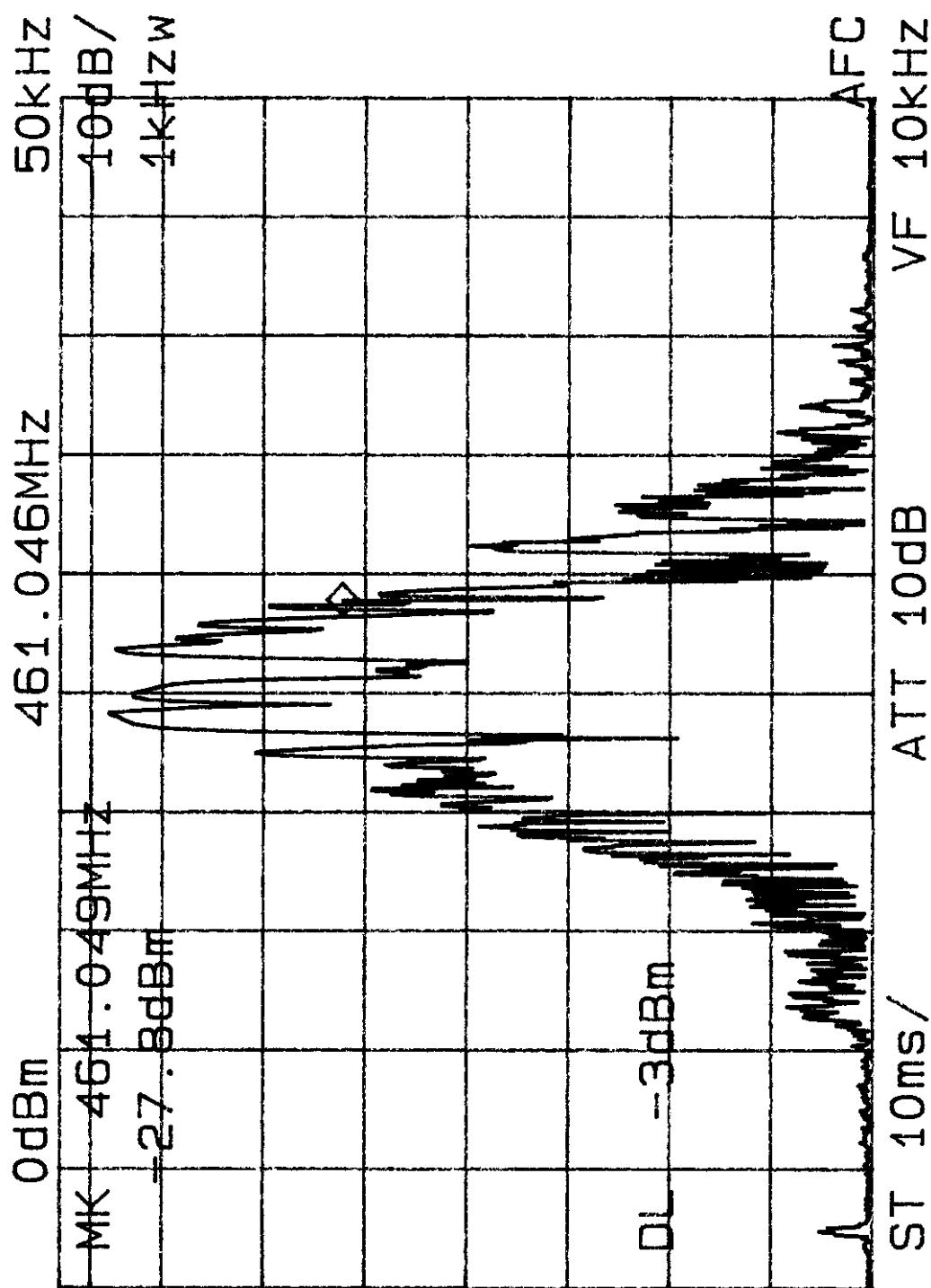
FCC Part 90.210(d) - Emission Limits

All spurious out-of-band emissions shall be attenuated by:

- 1) $7.27(F_d - 2.88 \text{ kHz}) \text{ dB}$ on any frequency removed from center of the authorized bandwidth by more than 5.625 kHz up to 12.5 kHz .
- 2) $50 + 10 \cdot \log \text{Power Out (dB)}$ on any frequency removed from center of the authorized bandwidth by more than 12.5 kHz .

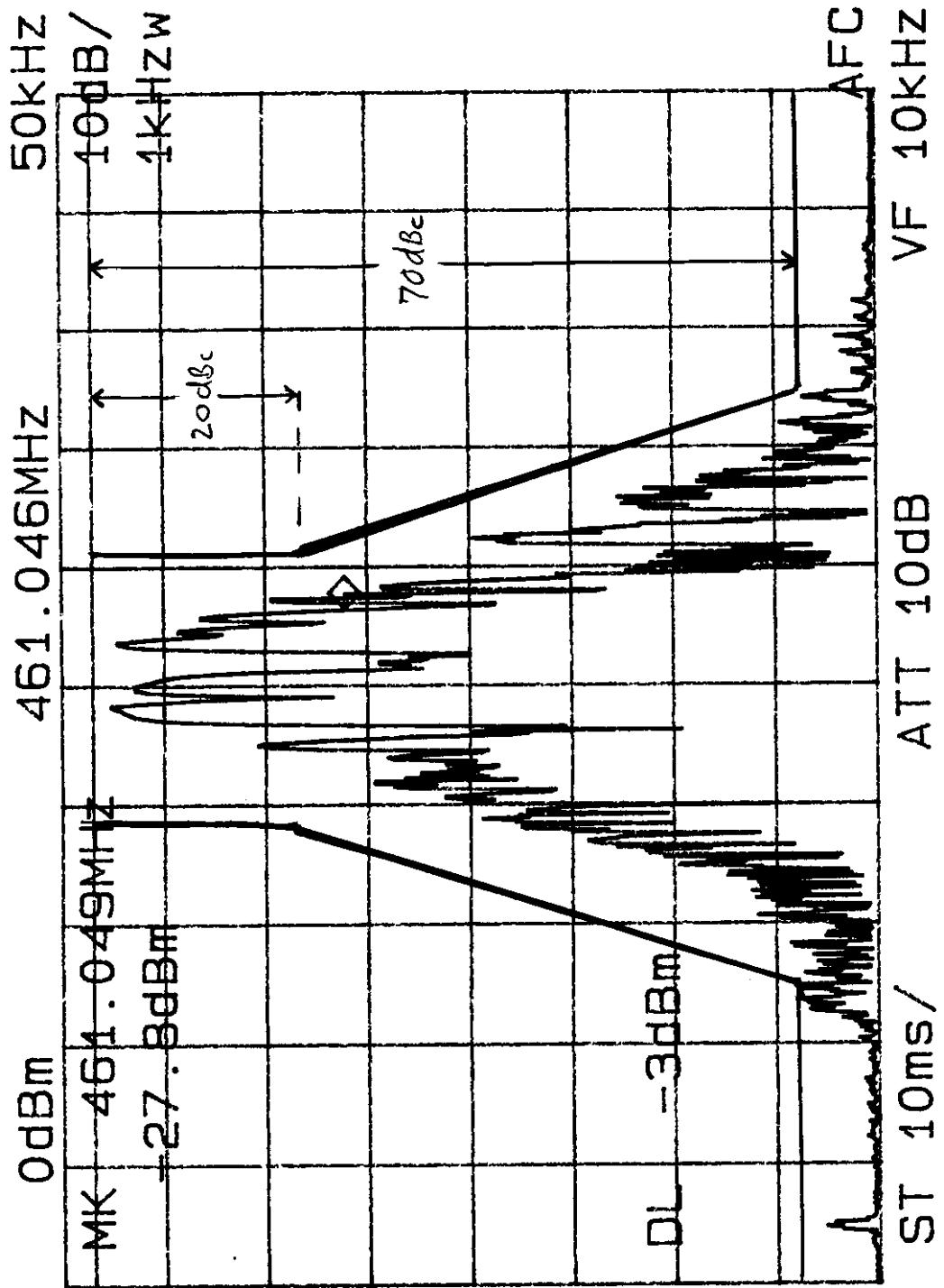
24 dB OCCUPIED BANDWIDTH = 6 KHZ

MODULATED 50 KHZ SPAN 1 KHZ RES. BW



OCCUPIED BANDWIDTH - EMISSION MASK D FOR 12.5 KHZ CHANNEL

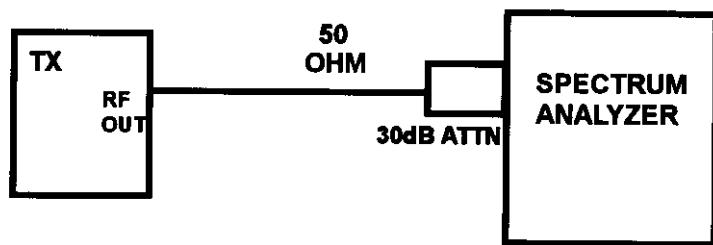
MODULATED 50 KHZ SPAN 1 KHZ RES. BW



NOTE: 30 dB
EXT. ATTN.

FCC Part 90.205 - Power Output Rating

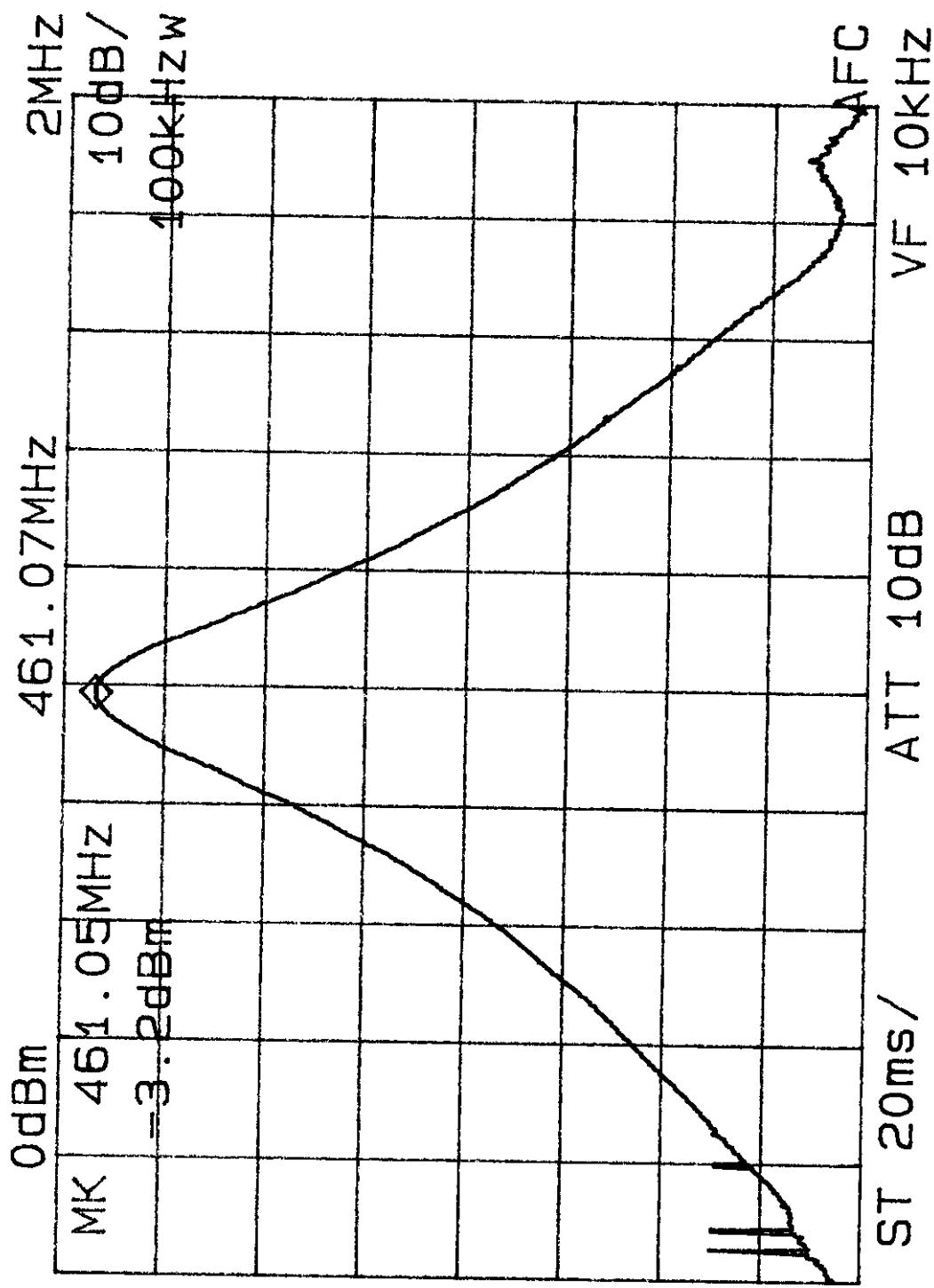
Test Configuration



RF Power Reading = 26.8 dBm

CONDUCTED PEAK RF POWER OUTPUT AT ANTENNA TERMINALS

MODULATED 2.0 MHZ SPAN 100 KHZ RES. BW

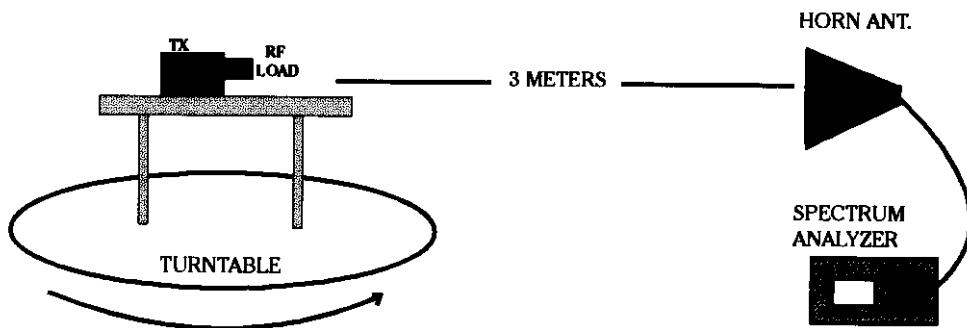


NOTE: 30 dB
EXT. ATTN.

RADIATED EMISSIONS MEASUREMENT

TEST CONFIGURATION

RADIATED EMISSIONS ARE TAKEN ON A 3-METER OUTDOOR SITE



**PEAK CARRIER FIELD STRENGTH
CALCULATION FOR HALF-WAVE DIPOLE @ 3 METERS**

$$\text{FS (V/m)} = \frac{\sqrt{(49.2 * 0.5 \text{ WATT})}}{3 \text{ METERS}} = 1.6 \text{ V/m @ 3 M}$$
$$= 124 \text{ dBuV/m @ 3M}$$

FCC PART 2.993/90.210 - RADIATED SPURIOUS EMISSIONS

Frequency of Carrier = 461.046 MHz
Limit = 50 + 10 (log 0.5 Watts) dB = 47.0 dBc

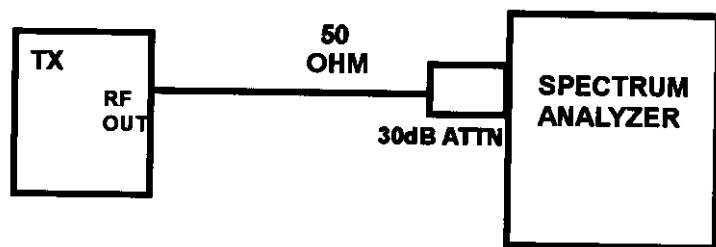
TEST RESULTS

LIMIT: -47.0 dB FROM PEAK CARRIER

<u>COMPONENT</u>	<u>FREQUENCY (MHZ)</u>	<u>RESULT (dB FROM PEAK)</u>
HARMONIC	922.092	- 69
HARMONIC	1383.14	- 72
HARMONIC	1844.18	- 74
HARMONIC	2305.23	- 75
HARMONIC	2766.28	- 79
HARMONIC	3227.32	- 77
HARMONIC	3688.37	- 76
HARMONIC	4149.41	- 80
HARMONIC	4610.46	- 82

CONDUCTED EMISSIONS MEASUREMENT

TEST CONFIGURATION



FCC PART 2.991/90.210 - CONDUCTED SPURIOUS EMISSIONS

Frequency of Carrier = 461.046 MHz
Limit = 50 + 10 (log 0.5 Watts) dB = 47.0 dBc

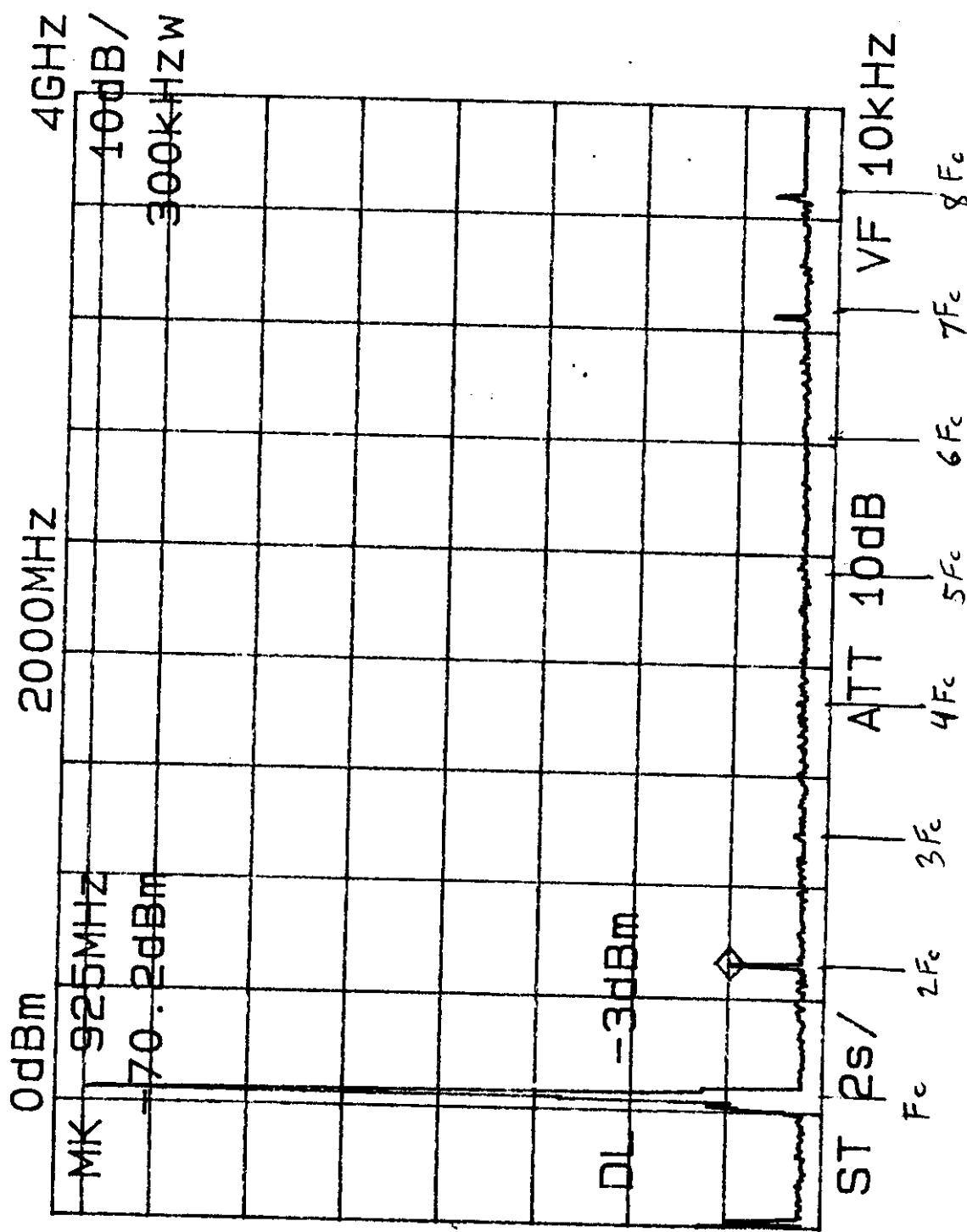
TEST RESULTS

LIMIT: -47.0 dB FROM PEAK CARRIER

<u>COMPONENT</u>	<u>FREQUENCY (MHZ)</u>	<u>RESULT (dB FROM PEAK)</u>
HARMONIC	922.092	- 67
HARMONIC	1383.14	- 75
HARMONIC	1844.18	- 75
HARMONIC	2305.23	- 76
HARMONIC	2766.28	- 76
HARMONIC	3227.32	- 71
HARMONIC	3688.37	- 71
HARMONIC	4149.41	- 75
HARMONIC	4610.46	- 76

CONDUCTED SPURIOUS/HARMONICS OUTPUT AT ANTENNA TERMINALS

MODULATED 4.0 GHZ SPAN 300 KHZ RES. BW



NOTE: 30 dB
EXT. ATTN.

FCC PART 2.995/90.213 - 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 2.5 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 frequency. 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.

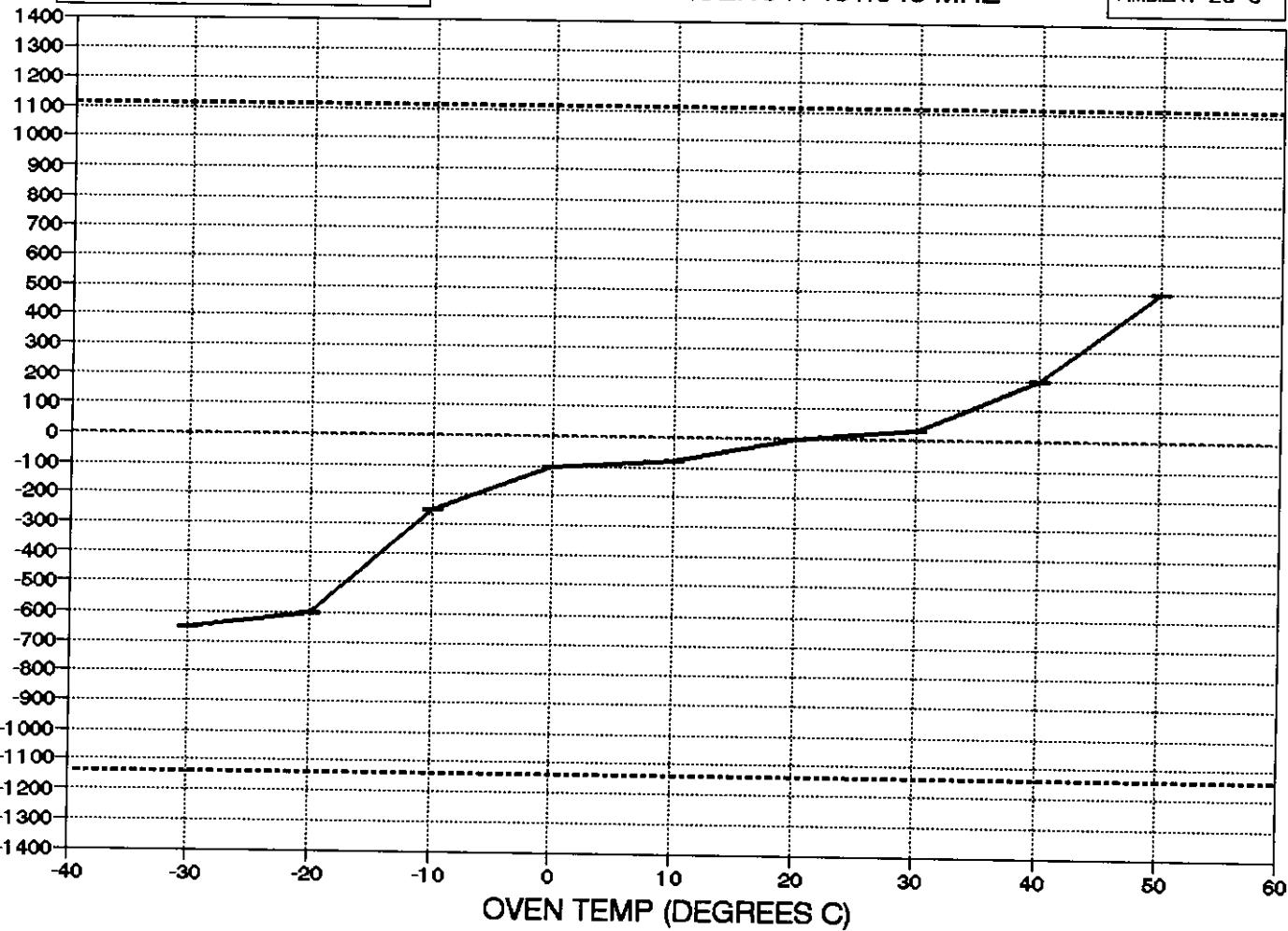
Frequency readings were also taken at the battery end-point voltage.

CONTROL CHIEF - TRAIN CHIEF

FREQUENCY STABILITY (TEMP. VARIABLE)
CARRIER FREQUENCY: 461.046 MHZ

AMBIENT 25 C

DEVIATION (HZ)



CONTROL CHIEF - TRAIN CHIEF

FREQUENCY STABILITY (BATTERY VOLTS)
CARRIER FREQUENCY: 461.046 MHZ

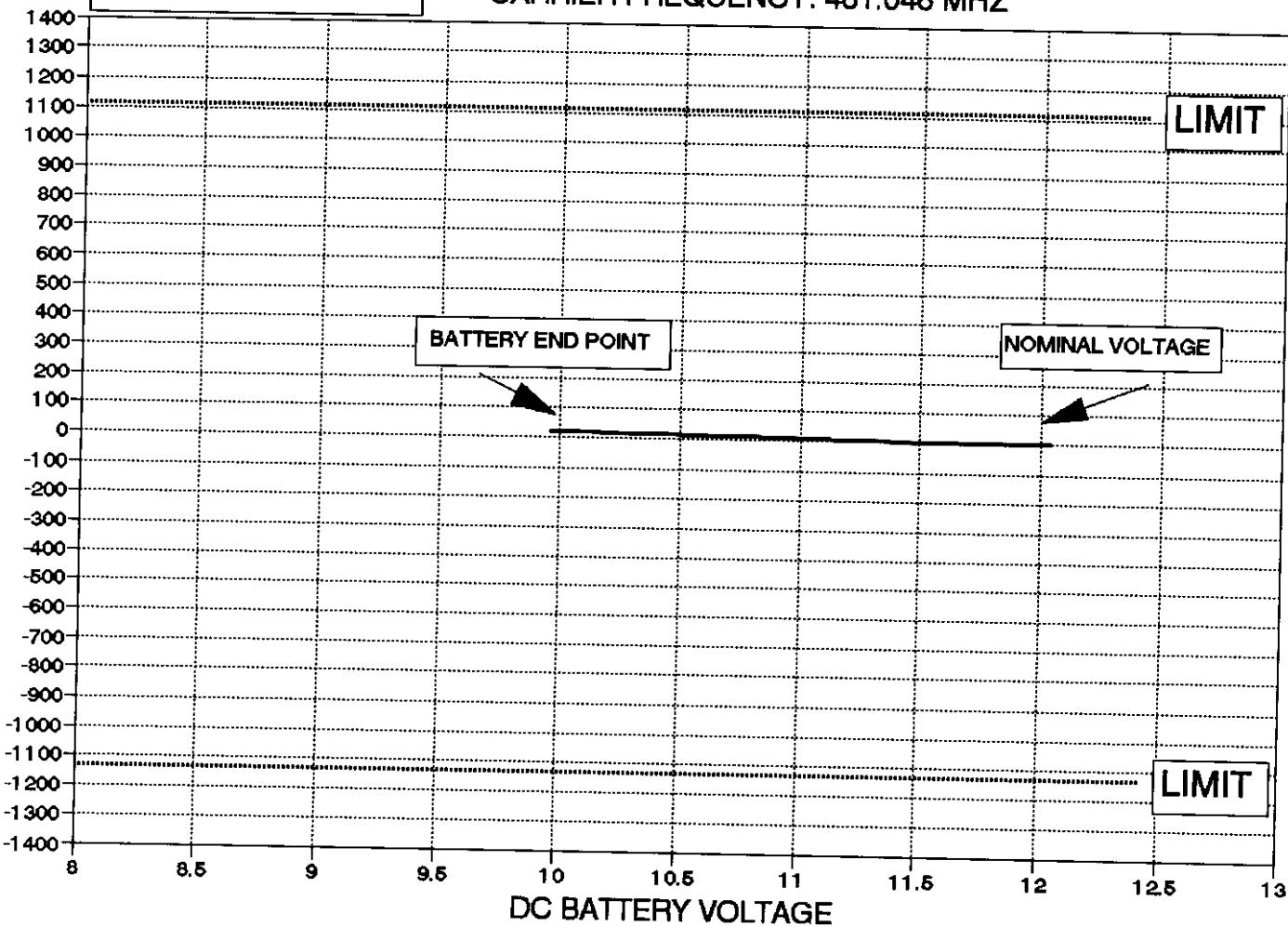


Table 1
Measurement Equipment Used

The following equipment is used to perform measurements:

EQUIPMENT	SERIAL NUMBER
EMCO Model 3115 Double Ridgeguide Horn Ant.	3807
EMCO Model 3110 Biconical Antenna	1619
EMCO Model 3146 Log Periodic Antenna	1222
HP 8482B Power Sensor	245-688PS
Advantest Model R4131D Spectrum Analyzer	54378A
HP 437B Power Meter	
HP 8498A 30dB Attenuator	924867
Thermotron S-16 Temperature Chamber	534-84
Decibel DB4303B 100 Watt/50 ohm RF Load	D34512-1