

ENGINEERING TEST REPORT

NPX 138 VHF TRANSCEIVER

IN ACCORDANCE WITH  
FCC PART 90, SUBPART I  
GENERAL TECHNICAL STANDARDS

PROJECT NO.: 5N0240-1H

TESTED FOR:

NORTHERN AIRBORNE TECHNOLOGY LTD.  
1925 KIRSCHER ROAD  
KELOWNA, BRITISH COLUMBIA  
V1Y 4N7

TESTED BY:

CERTELECOM LABORATORIES INC.  
3325 RIVER ROAD AT LIMEBANK ROAD  
RR#5 OTTAWA, ONTARIO  
K1G 3N3

DATE: MARCH 1995

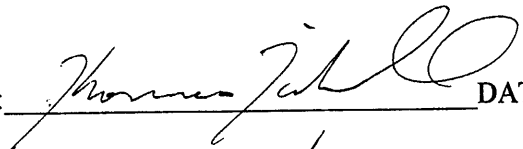
EQUIPMENT: NPX 138 VHF TRANSCEIVER SERIAL NO. 1001  
The E.U.T. is a 1W / 12W transceiver designed to operate in the 138-174 MHz band.

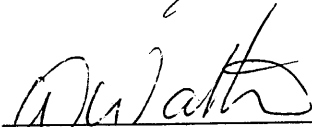
**GENERAL:**

These tests were conducted on a sample of the equipment for the purpose of compliance with FCC Part 90, Subpart I and Part 22, Subpart C.

**THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.**

**THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO OR EXCLUSIONS FROM THE TEST SPECIFICATION HAVE BEEN MADE. None.**

TESTED BY:  DATE: 22 March 1995

APPROVED BY:  DATE: 23rd March 1995

## ABSTRACT:

| TEST                                        | PARA. NO. | RESULTS  |
|---------------------------------------------|-----------|----------|
| RF Power Output                             | 2.985     | COMPLIES |
| Audio Frequency Response                    | 2.987(a)  | COMPLIES |
| Audio Low-Pass Filter<br>Frequency Response | 2.987(a)  | COMPLIES |
| Modulation Limiting                         | 2.987(b)  | COMPLIES |
| Occupied Bandwidth                          | 2.989     | COMPLIES |
| Spurious Emission at<br>Antenna Terminals   | 2.991     | COMPLIES |
| Field Strength of Spurious<br>Radiation     | 2.993     | COMPLIES |
| Frequency Stability                         | 2.995     | COMPLIES |

**NAME OF TEST**

RF Power Output

**PARA. NO.**

2.985

**TEST PERFORMED BY:** Tom Tidwell**DATE:** March 15, 1995**TEST CONDITIONS**

Standard Temperature & Humidity: +20°C, 50%  
Standard Test Voltage: 27.5 Vdc  
Unmodulated

**TEST EQUIPMENT**

As per block diagram and equipment list attached.

**MINIMUM STANDARD**

Para. No. 22.565 (a). The transmitter power output shall not exceed 150 watts.

**TESTS RESULTS**

The maximum RF power output is 12.9 watts.

**MEASUREMENT DATA**

| <u>Power Output</u><br>(Watts) |
|--------------------------------|
| 12.9                           |
|                                |
|                                |
|                                |

**NAME OF TEST**

Audio Frequency Response

**PARA. NO.**

2.987(a)

**TEST PERFORMED BY:** Tom Tidwell**DATE:** March 15, 1995**TEST CONDITIONS**

Standard Temperature & Humidity: +20°C, 50%  
Standard Test Voltage: 27.5 Vdc  
Modulated: 1 kHz tone, 3 kHz deviation

**TEST EQUIPMENT**

As per block diagram and equipment list attached.

**MINIMUM STANDARD**

E1A RS-152-B, Para. No. 7.2(a) from 300 Hz to 3000 Hz. The transmitter audio frequency response shall have a nominal 6 dB per octave pre-emphasis characteristic.

**TEST RESULTS**

COMPLIES. See attached graph.

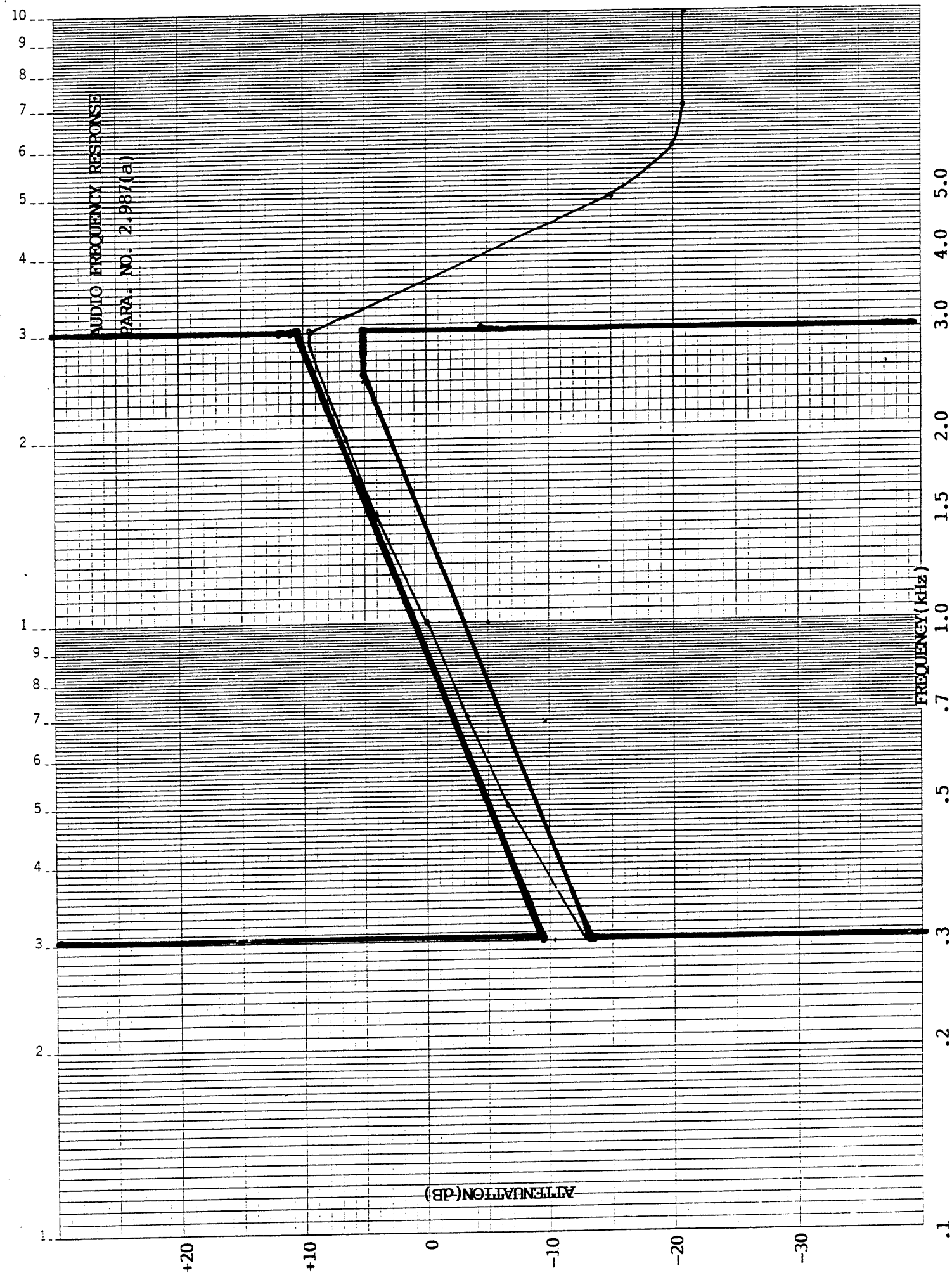
**MEASUREMENT DATA**

See attached graph.

46 4973

SEMI-LOGARITHMIC 2 CYCLES X 70 DIVISIONS  
KEUFFEL & ESSER CO. MADE IN U.S.A.

AUDIO FREQUENCY RESPONSE  
PARA. NO. 2.987(a)



**NAME OF TEST**

Audio Low-Pass Filter Frequency Response

**PARA. NO.**

2.987(a)

**TEST PERFORMED BY:** Tom Tidwell**DATE:** March 15, 1995**TEST CONDITIONS**

Standard Temperature & Humidity: +20°C, 50%  
Standard Test Voltage: 27.5 Vdc  
Modulated

**TEST EQUIPMENT**

As per block diagram and equipment list attached.

**MINIMUM STANDARD**

Para. No. 90.211(d)(1)(i). The attenuation of the audio low-pass filter between the frequencies 3 kHz and 20 kHz shall be greater than the attenuation at 1 kHz by at least:  $60 \log(f/3)$  decibels where  $f$  is the frequency in kHz. At frequencies above 20 kHz, attenuation shall be 50 dB greater than the attenuation at 1 kHz.

**TEST RESULTS**

COMPLIES. See attached graph.

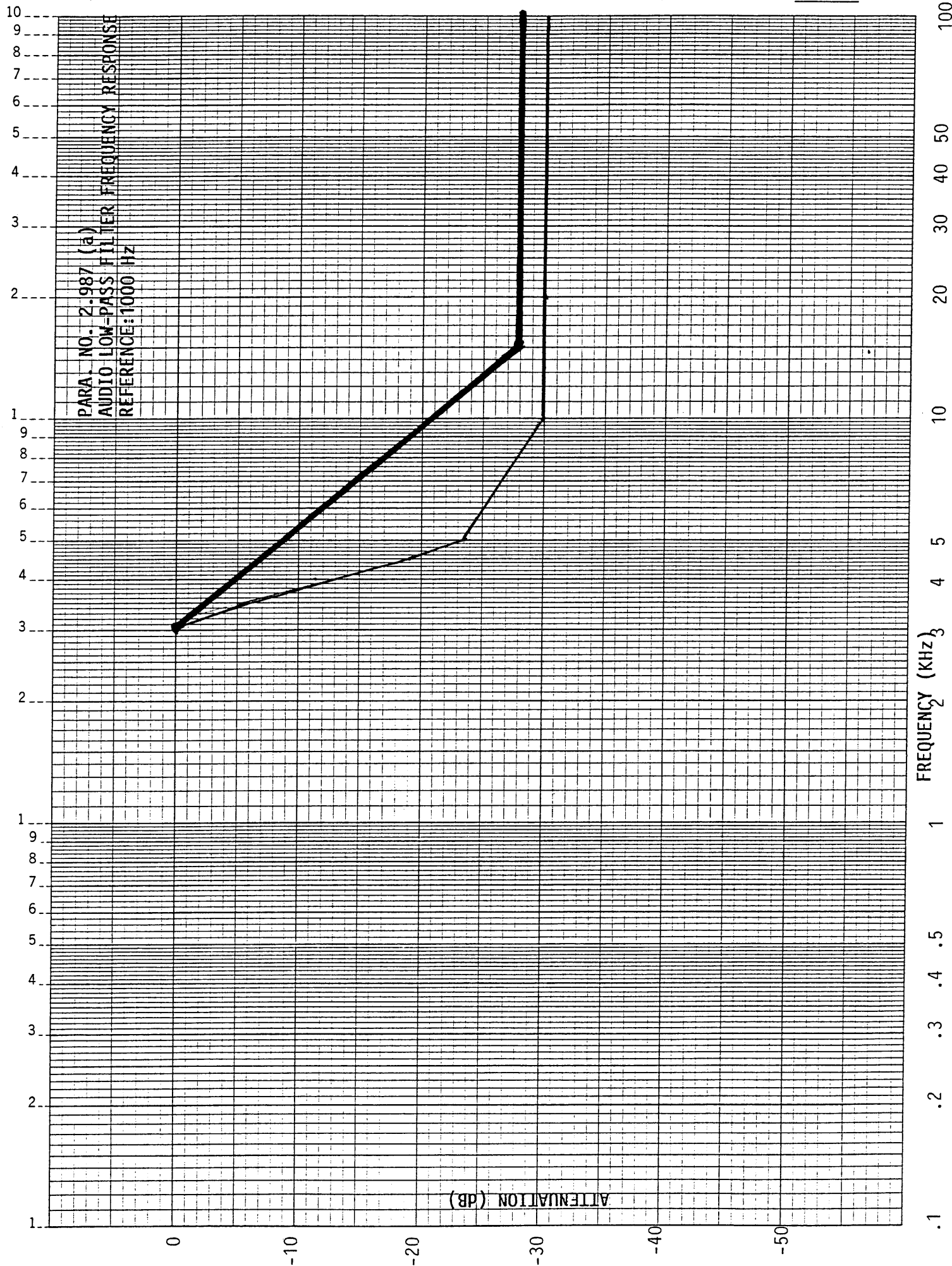
**MEASUREMENT DATA**

See attached graph.

46 5490

SEMI-LOGARITHMIC • 3 CYCLES X 70 DIVISIONS  
KEUFFEL & ESSER CO. MADE IN U.S.A.

PARA. NO. 2.987 (a)  
AUDIO LOW-PASS FILTER FREQUENCY RESPONSE  
REFERENCE: 1000 HZ



**NAME OF TEST**  
Modulation Limiting

**PARA. NO.**  
2.987(b)

**TEST PERFORMED BY:** Tom Tidwell

**DATE:** March 15, 1995

**TEST CONDITIONS**

Standard Temperature & Humidity: +20°C, 50%  
Standard Test Voltage: 27.5 Vdc

**TEST EQUIPMENT**

As per block diagram and equipment list attached.

**MINIMUM STANDARD**

Para. No. 90.209(b)(4). The maximum frequency deviation shall not exceed  $\pm 5.0$  kHz.

**TEST RESULTS**

COMPLIES. The maximum deviation is 4.2 kHz.

**MEASUREMENT DATA**

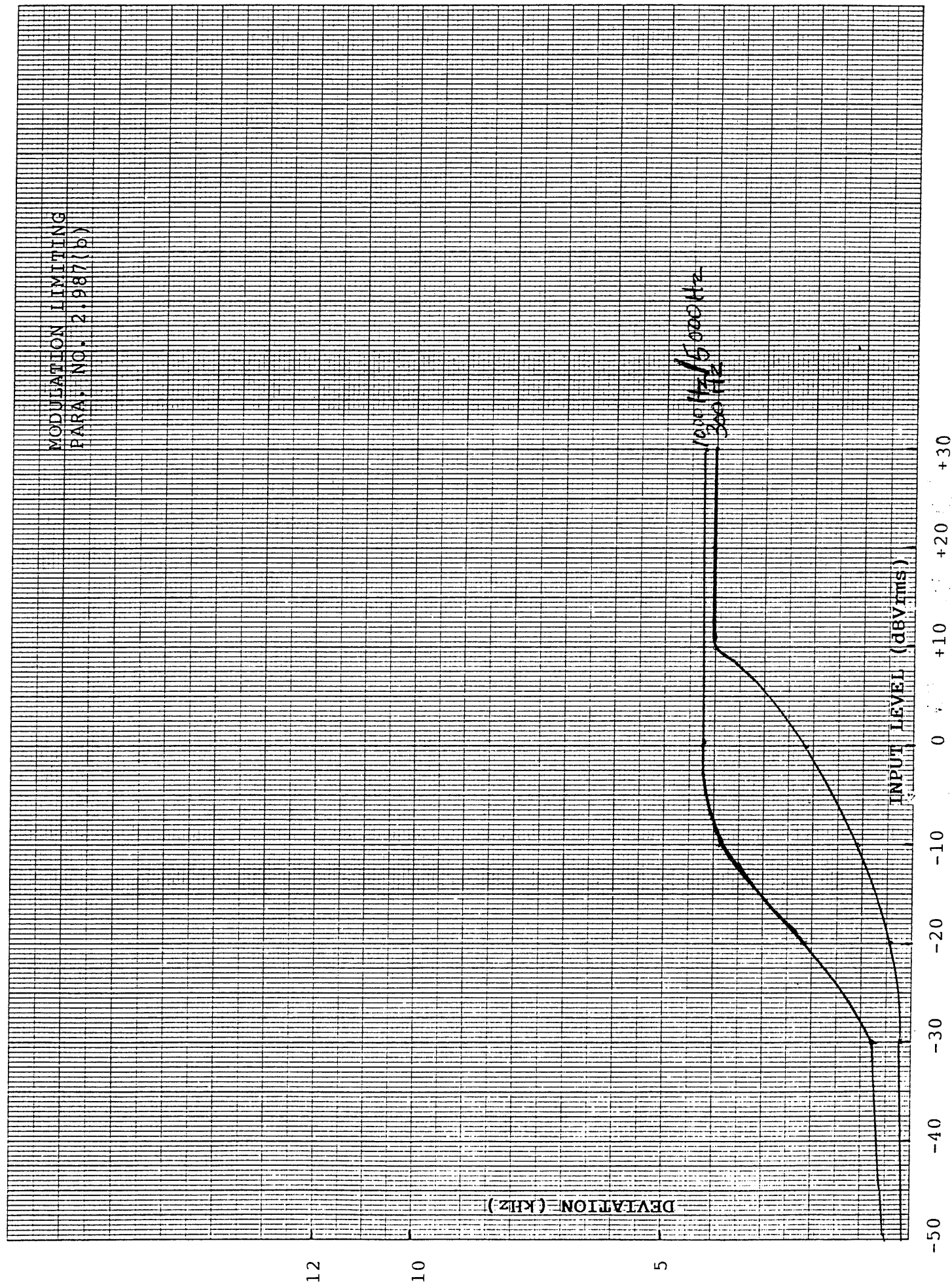
See attached graph.

46 1513

10 X 10 TO THE CENTIMETER 10 X 25 CM.  
KEUFFEL & ESSER CO. MADE IN U.S.A.

KE

MODULATION LIMITING  
PARA. NO. 2.987(b)



NAME OF TEST  
Occupied Bandwidth

PARA. NO.  
2.989

TEST PERFORMED BY: Tom Tidwell

DATE: March 15, 1995

**TEST CONDITIONS**

Standard Temperature & Humidity: +20°C, 50%  
Standard Test Voltage: 27.5 Vdc

**TEST EQUIPMENT**

As per block diagram and equipment list attached.

**MINIMUM STANDARD**

Para. No. 90.209(c). Emissions shall be attenuated as follows:  
Para. No. 22.359 (b) (1)

Frequency Range  
(kHz)

Attenuation  
(dB)

$f_c \pm 5$  to  $f_c \pm 10$

$83 \log(f_d/5)$

$f_c \pm 10$  to  $f_c \pm 25$

$29 \log(f_d^2/11)$

$<f_c - 25$  to  $>f_c + 25$

$43 + 10 \log P^*$  or 80 dB

\* P is the mean output power of the transmitter in watts.

**TEST RESULTS**

COMPLIES. See attached graphs.

**MEASUREMENT DATA**

See attached graphs.

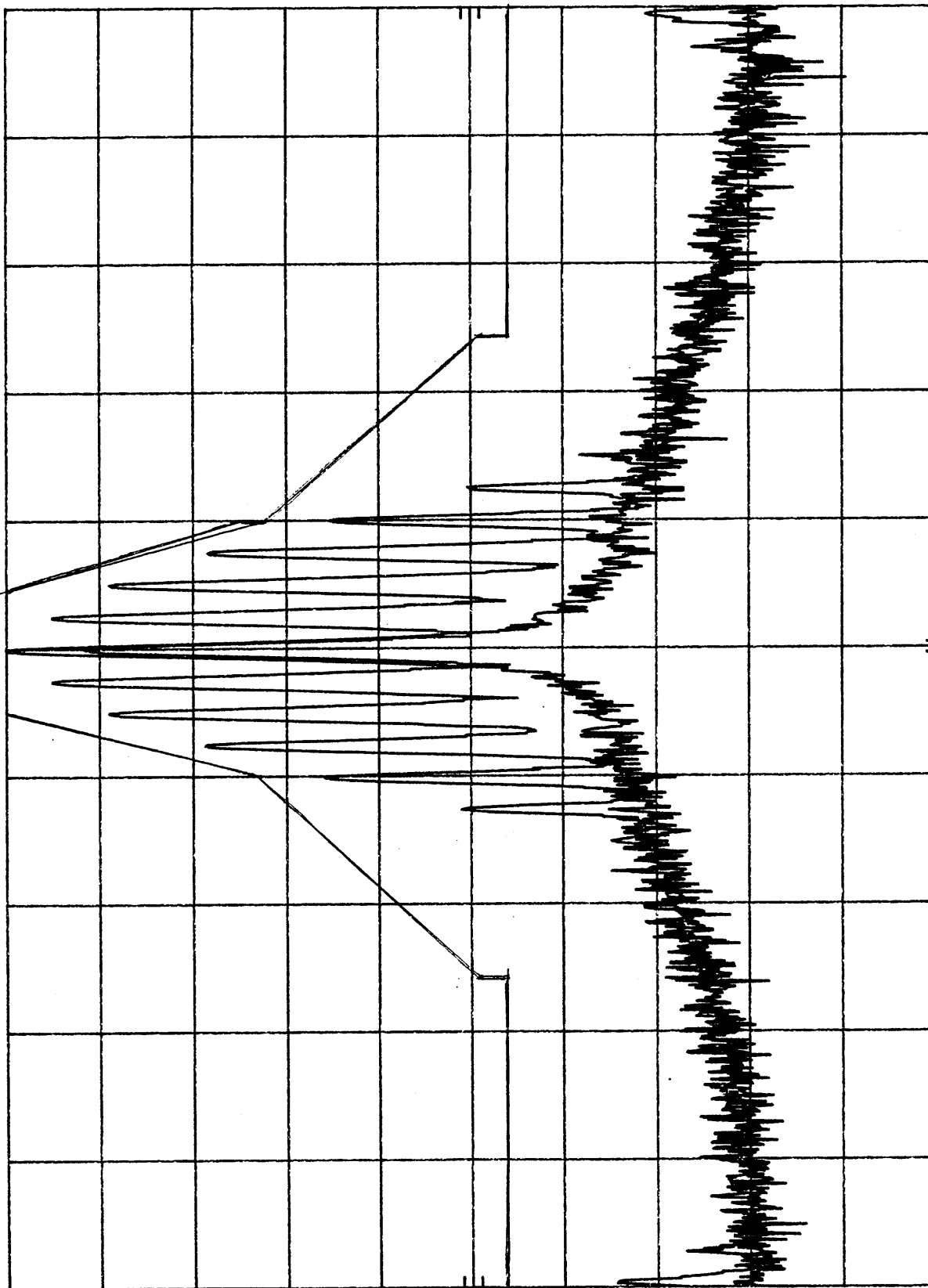
PROJECT NO. 5NO240-1H  
FCC PART 90, SUBPART I  
OCCUPIED BANDWIDTH  
POWER OUTPUT: 1W  
MODULATION: 2.5kHz SINE WAVE @ 16 dB OVERDRIVE

ATTEN 20 dB

REF 0.3 dBm

hp

10 dB/



CENTER 155.100 MHz  
RES BW 300 Hz

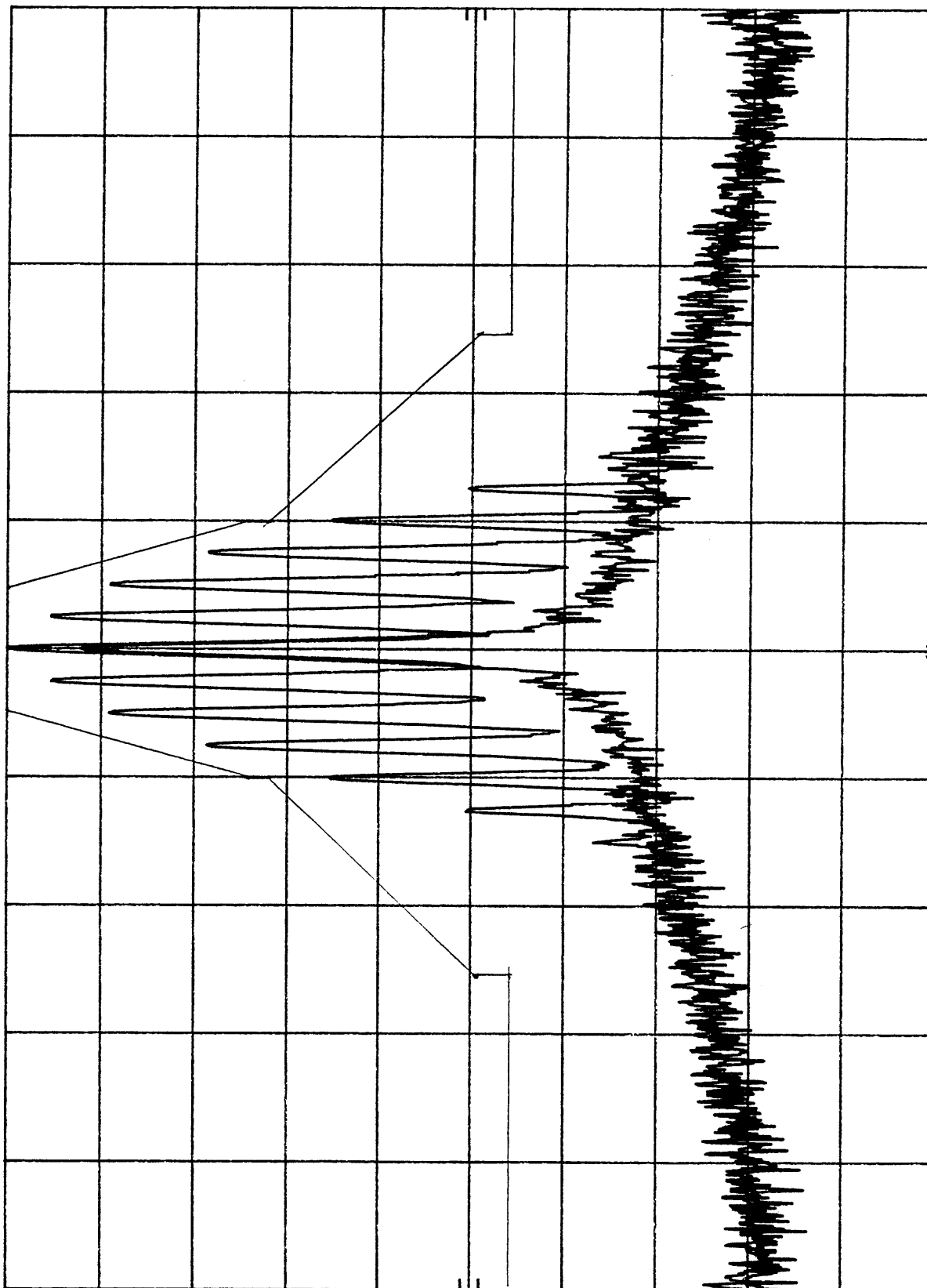
VBW 1 kHz

SPAN 100 kHz  
SWP 3.00 sec

PROJECT NO. 5NO240-1H  
FCC PART 90, SUBPART I  
OCCUPIED BANDWIDTH  
POWER OUTPUT: 12W  
MODULATION: 2.5kHz SINE WAVE @ 16 dB OVERDRIVE

h<sub>p</sub> REF 1.5 dBm ATTN 20 dB

10 dB/



CENTER 155.100 MHz  
RES BW 300 Hz  
SPAN 100 kHz  
SWP 3.00 sec  
VBW 1 kHz

**NAME OF TEST**

Spurious Emission at Antenna Terminals

**PARA. NO.**

2.991

**TEST PERFORMED BY:** Tom Tidwell**DATE:** March 16, 1995**TEST CONDITIONS**Standard Temperature & Humidity: +20°C, 50%  
Standard Test Voltage: 27.5 Vdc**TEST EQUIPMENT**

As per block diagram and equipment list attached.

**MINIMUM STANDARD**Para. No. 90.209(c). Spurious Emissions at the antenna terminals shall be attenuated below the mean output power of the transmitter by at least  $43 + 10\log$  (mean power output in watts) dB.**TEST RESULTS**

COMPLIES. The strongest emission is -24.5 dBm @ 310.212 MHz. This is 11.5 dB below the specification limit.

**MEASUREMENT DATA**

Mean Output Power of Transmitter +40 dBm.

| <u>Frequency</u><br>(MHz) | <u>Emission Level</u><br>(dBm) | <u>Attenuation</u><br>(dB) |
|---------------------------|--------------------------------|----------------------------|
| 310.212                   | -24.5                          | 64.5                       |
| 465.360                   | -34.0                          | 74.0                       |
| 620.410                   | -40.3                          | 80.3                       |
| 775.522                   | -40.7                          | 80.7                       |
| 1085.702                  | -39.5                          | 79.5                       |

**NAME OF TEST**

Field Strength of Spurious Radiation

**PARA. NO.**

2.993

**TEST PERFORMED BY:** Tom Tidwell**DATE:** March 15, 1995**TEST CONDITIONS**

Outdoor Range

Standard Test Voltage: 27.5 Vdc

Standard Temperature &amp; Humidity: +10°C, 50%

**TEST EQUIPMENT**

As per block diagram and equipment list attached.

**MINIMUM STANDARD**

Para. No. 22.359 (b) (1). The field strength of spurious radiation shall be attenuated below the mean output power of the transmitter by at least  $43 + 10\text{Log}$  (mean output power in watts) dB.

**TEST RESULTS**

COMPLIES. The strongest emission is 42.2 dB $\mu$ V/m @ 930.6 MHz. This is 42.1 dB below the specified limit.

**MEASUREMENT DATA**

See attached.



### CALCULATION OF RADIATED POWER

All emissions below 1000 MHz are expressed in terms of the equivalent power that would have to be fed into a dipole antenna in order to produce the same electric field strength. All emissions above 1000 MHz are expressed in terms of equivalent isotropic power. The equivalent power was determined by using the following formula:

$$P_t = E^2 R^2 / 30G$$

Example:      Electric field strength is  $E = 41.1 \text{ dB}\mu\text{V/m}$   
                  Measured at a distance of       $R = 3\text{m}$   
                  The gain of a dipole antenna is 1.64

$$P_t = [10^{(41.1/20)} \times 10^{-6}]^2 \times 3^2 / 30 \times 1.64 = 2.36 \times 10^{-9} \text{ watts} = -56.3 \text{ dBm}$$

When calculating equivalent isotropic radiated power for emissions above 1000 MHz the gain is  $G=1$ .

Example:      If the mean output power of the transmitter is 3 watts.

The minimum attenuation is  $43 + 10\text{Log } 3 = 47.8$  so the maximum power must not exceed  $3 \times 10^{-4.78} = 4.98 \times 10^{-5}\text{W}$ .

Using the above relation we have       $E = (30GP_t)^{0.5} / R$

For emissions which are less than or equal to 1000 MHz

$$G = 1.64 \text{ and } E = (30 \times 1.64 \times 4.98 \times 10^{-5})^{0.5} / 3 = 0.0165 \text{ v/m} \\ = 84.3 \text{ dB}\mu\text{V}$$

Therefore the electric field strength of emissions must not exceed  $84.3 \text{ dB}\mu\text{V/m @ } 3\text{m}$ .

Similarly for emissions which are greater than 1000 MHz  $G=1$  and the field strength must not exceed  $82.2 \text{ dB}\mu\text{V/m @ } 3\text{m}$ .

**NAME OF TEST**

Frequency Stability

**PARA. NO.**

2.995

**TEST PERFORMED BY:** Tom Tidwell**DATE:** March 15, 1995**TEST CONDITIONS**

As per measurement data.

**TEST EQUIPMENT**

As per block diagram and equipment list attached.

**MINIMUM STANDARD**Para No. 22.355. Para. No. 90.205(b). The transmitter carrier frequency shall remain within  $\pm 0.0005$  percent of the assigned frequency.**TEST RESULTS**

COMPLIES. The maximum frequency drift is 180 Hz, 0.000116% of the standard test frequency.

**MEASUREMENT DATA**

See attached.

| <u>Temperature</u><br>(°C) | <u>Frequency Drift</u><br>(Hz) |
|----------------------------|--------------------------------|
| -30                        | -55                            |
| -20                        | -64                            |
| -10                        | -58                            |
| 0                          | -63                            |
| +10                        | -88                            |
| +30                        | -135                           |
| +40                        | -180                           |
| +50                        | -172                           |
| <u>Voltage</u><br>(VDC)    | <u>Frequency Drift</u><br>(Hz) |
| 11.7                       | -174                           |
| 13.8                       | -168                           |
| 15.9                       | -173                           |

**MEASUREMENT DATA:**

Standard Test Frequency: 155.100000 MHz

Standard Test Voltage: 27.5 VDC

**FREQUENCY VERSUS SUPPLY VOLTAGE**

| TIME (Min) | 23.4 VDC    | 27.5 VDC    | 31.6 VDC    |
|------------|-------------|-------------|-------------|
| 0          | 155.099 827 | 155.099 836 | 155.099 829 |
| 0.5        | 155.099 826 | 155.099 836 | 155.099 830 |
| 1.0        | 155.099 828 | 155.099 835 | 155.099 830 |
| 1.5        | 155.099 827 | 155.099 834 | 155.099 829 |
| 2.0        | 155.099 831 | 155.099 833 | 155.099 828 |
| 2.5        | 155.099 832 | 155.099 833 | 155.099 828 |
| 3.0        | 155.099 831 | 155.099 832 | 155.099 827 |

**MEASUREMENT DATA**

Standard Test Frequency: 155.100000 MHz

Standard Test Voltage: 27.5 VDC

| <u>TIME</u> | <u>Frequency (MHz)</u> |             |             |             |
|-------------|------------------------|-------------|-------------|-------------|
| (Min)       | -30°C                  | -20°C       | -10°C       | 0°C         |
| 0           | 155.099 947            | 155.099 937 | 155.099 942 | 155.099 941 |
| 0.5         | 155.099 949            | 155.099 939 | 155.099 944 | 155.099 941 |
| 1.0         | 155.099 947            | 155.099 937 | 155.099 943 | 155.099 941 |
| 1.5         | 155.099 946            | 155.099 937 | 155.099 942 | 155.099 939 |
| 2.0         | 155.099 946            | 155.099 936 | 155.099 944 | 155.099 939 |
| 2.5         | 155.099 945            | 155.099 936 | 155.099 943 | 155.099 938 |
| 3.0         | 155.099 946            | 155.099 936 | 155.099 942 | 155.099 937 |

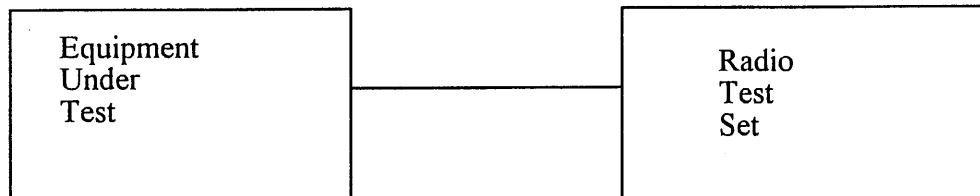
| <u>TIME</u> | <u>Frequency (MHz)</u> |             |             |             |
|-------------|------------------------|-------------|-------------|-------------|
| (Min)       | +10°C                  | +30°C       | +40°C       | +50°C       |
| 0           | 155.099 920            | 155.099 874 | 155.099 823 | 155.099 828 |
| 0.5         | 155.099 920            | 155.099 873 | 155.099 822 | 155.099 830 |
| 1.0         | 155.099 918            | 155.099 872 | 155.099 825 | 155.099 830 |
| 1.5         | 155.099 918            | 155.099 871 | 155.099 823 | 155.099 831 |
| 2.0         | 155.099 917            | 155.099 869 | 155.099 823 | 155.099 833 |
| 2.5         | 155.099 913            | 155.099 867 | 155.099 820 | 155.099 837 |
| 3.0         | 155.099 912            | 155.099 865 | 155.099 820 | 155.099 840 |

EQUIPMENT LIST

| <u>Equipment</u>    | <u>Manufacturer</u> | <u>Model</u> | <u>Serial No.</u> | <u>Last Cal.</u> | <u>Next Cal.</u> |
|---------------------|---------------------|--------------|-------------------|------------------|------------------|
| Attenuator          | Narda               | 776B-20      | -----             | Aug. 3/94        | Aug. 3/95        |
| Test Receiver       | Rohde & Schwarz     | ESVP         | 879962/021        | Jan. 6/95        | Jan. 6/96        |
| Antenna             | EMCO                | 3115         | 4336              | Aug. 1/94        | Feb. 1/96        |
| Antenna             | EMCO                | 3121C        | 1029              | May 21/94        | Nov. 21/95       |
| Power Supply        | Astron              | VS-50M       | 8606003           | -----            | -----            |
| Radio Test Set      | Rohde & Schwarz     | CMS 52       | 883832/018        | Sept. 9/94       | Sept. 9/95       |
| Spectrum Analyzer   | Hewlett Packard     | 8566B        | 2311A02238        | Jan. 5/95        | July 5/95        |
| Climate Chamber     | Conrad              | FH-27-3-3    | 4878              | -----            | -----            |
| Digital Thermometer | Fluke               | 2190A        | 01                | Dec. 5/94        | Dec. 5/95        |
| Power Supply        | Astron              | VS-50M       | 8606003           | -----            | -----            |
| Attenuator          | Stoddart            | 512          | 90506-27          | Aug. 3/94        | Aug. 3/95        |

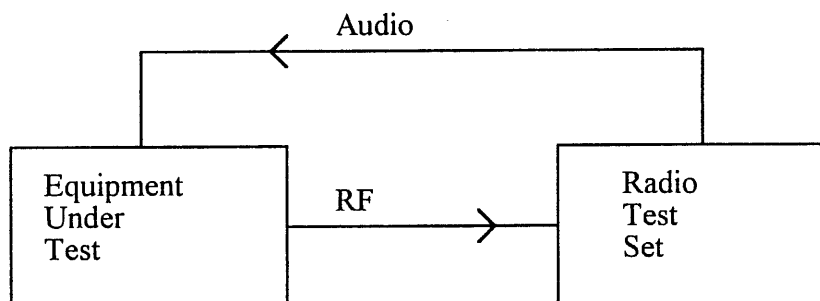
## MEASUREMENT PROCEDURE PARA. NO. 2.985

## RF POWER OUTPUT



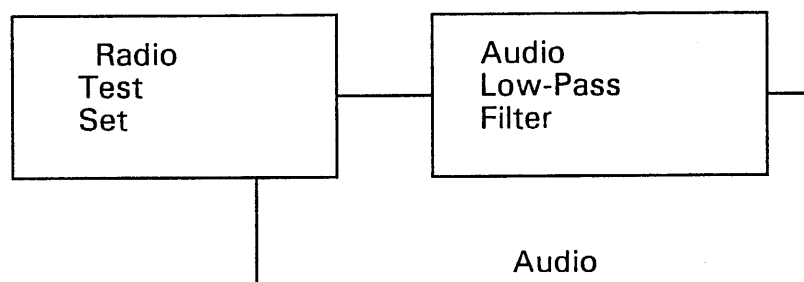
## MEASUREMENT PROCEDURE PARA. NO. 2.987(a)

## AUDIO FREQUENCY RESPONSE



## MEASUREMENT DATA PARA. NO. 2.987(a)

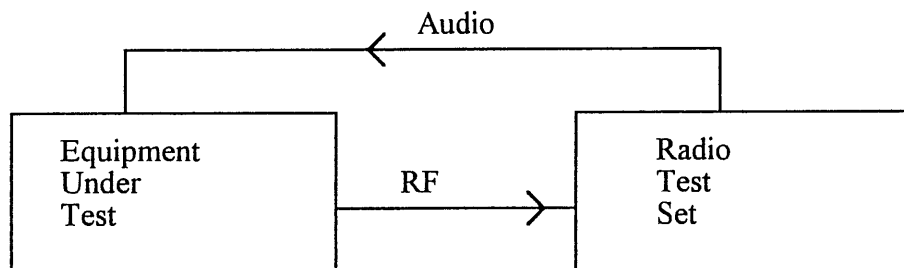
## AUDIO LOW-PASS FILTER FREQUENCY RESPONSE



MEASUREMENT DATA

PARA. NO. 2.987(b)

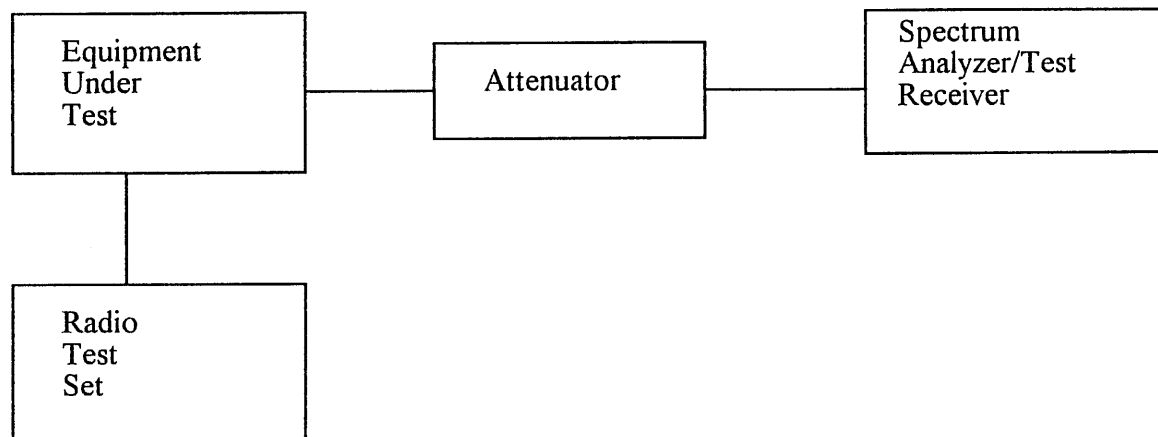
MODULATION LIMITING



## MEASUREMENT PROCEDURE

PARA. NO. 2.989

## OCCUPIED BANDWIDTH

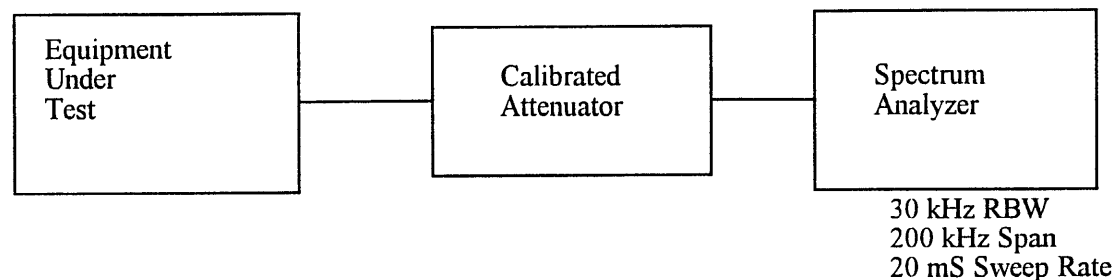


The transmitter was modulated with a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50% modulation.

Spectrum Analyzer settings as per measurement data.

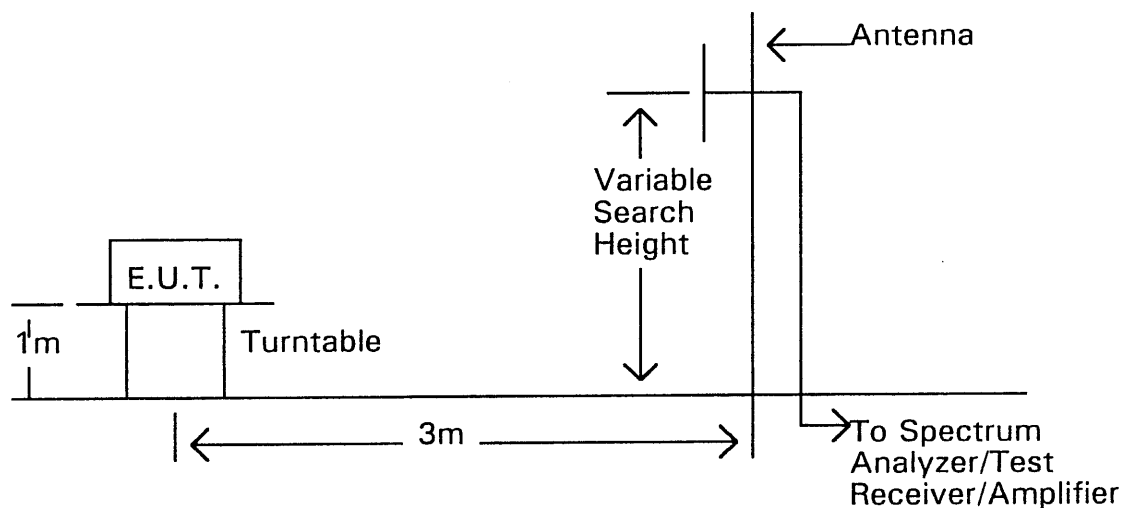
## MEASUREMENT DATA

PARA. NO. 2.991

SPURIOUS EMISSIONS AT  
ANTENNA TERMINALS

## MEASUREMENT DATA

PARA. NO. 2.993

FIELD STRENGTH OF SPURIOUS  
RADIATIONFrequency Range

&lt;1300 MHz

Test Receiver Settings

12 kHz BW

Average Detector

&gt;1300 MHz

Spectrum Analyzer Settings

30 kHz RBW

200 kHz Span

20 mS Sweep Rate

## MEASUREMENT PROCEDURE

PARA. NO. 2.995

## FREQUENCY STABILITY

