

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

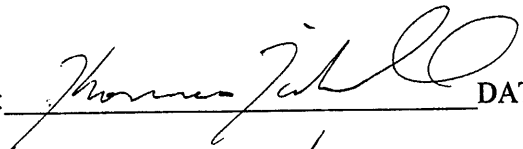
EQUIPMENT: NPX 138 VHF TRANSCEIVER SERIAL NO. 1001
The E.U.T. is a 1W / 12W transceiver designed to operate in the 138-174 MHz band.

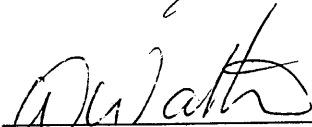
GENERAL:

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 Frequency Response	2.987(a)	COMPLIES
Modulation Limiting	2.987(b)	COMPLIES
Occupied Bandwidth	2.989	COMPLIES
Spurious Emission at Antenna Terminals	2.991	COMPLIES
Field Strength of Spurious 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> (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

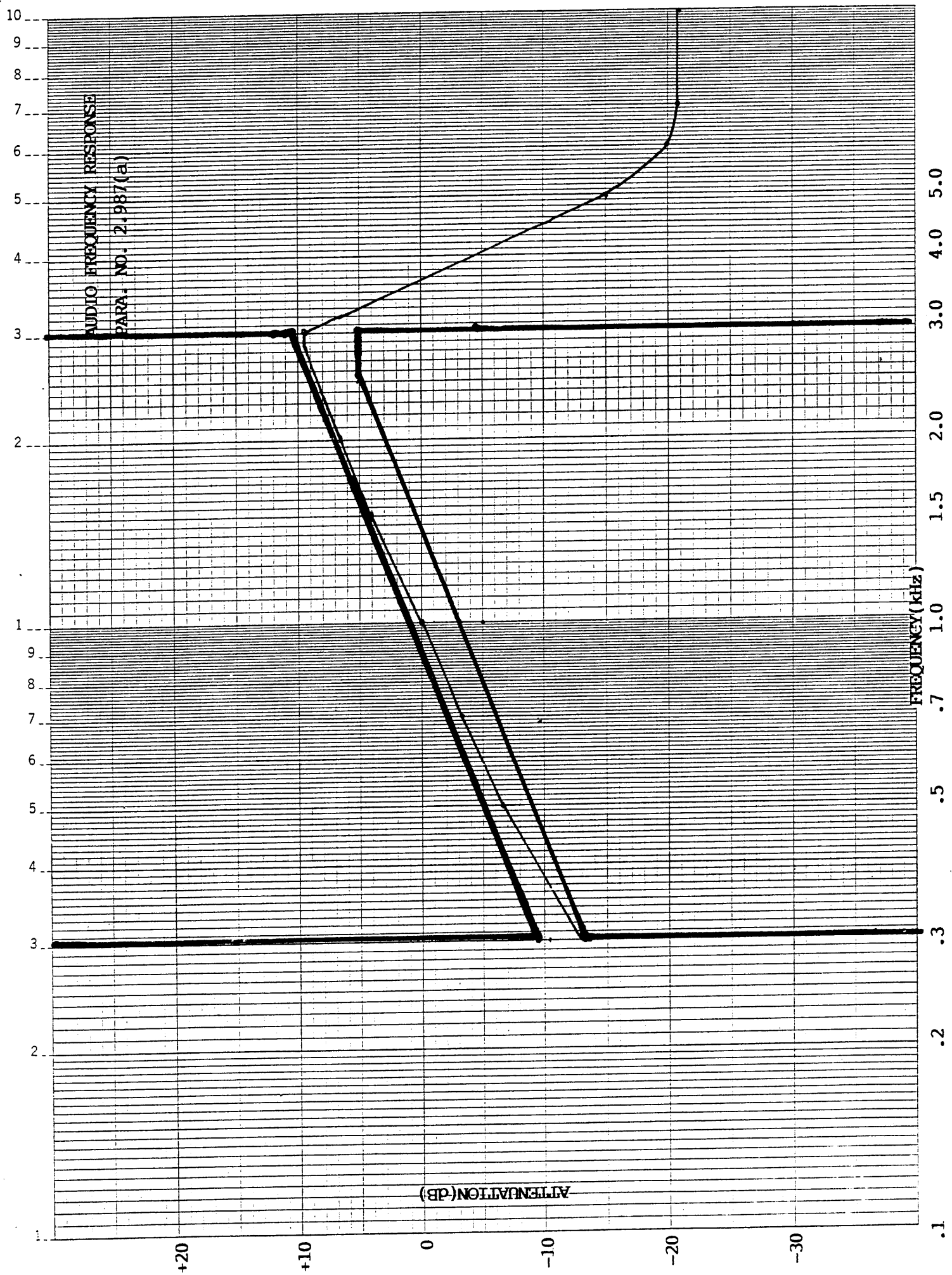
COMPLIES. See attached graph.

MEASUREMENT DATA

See attached graph.

46 4973

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



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.

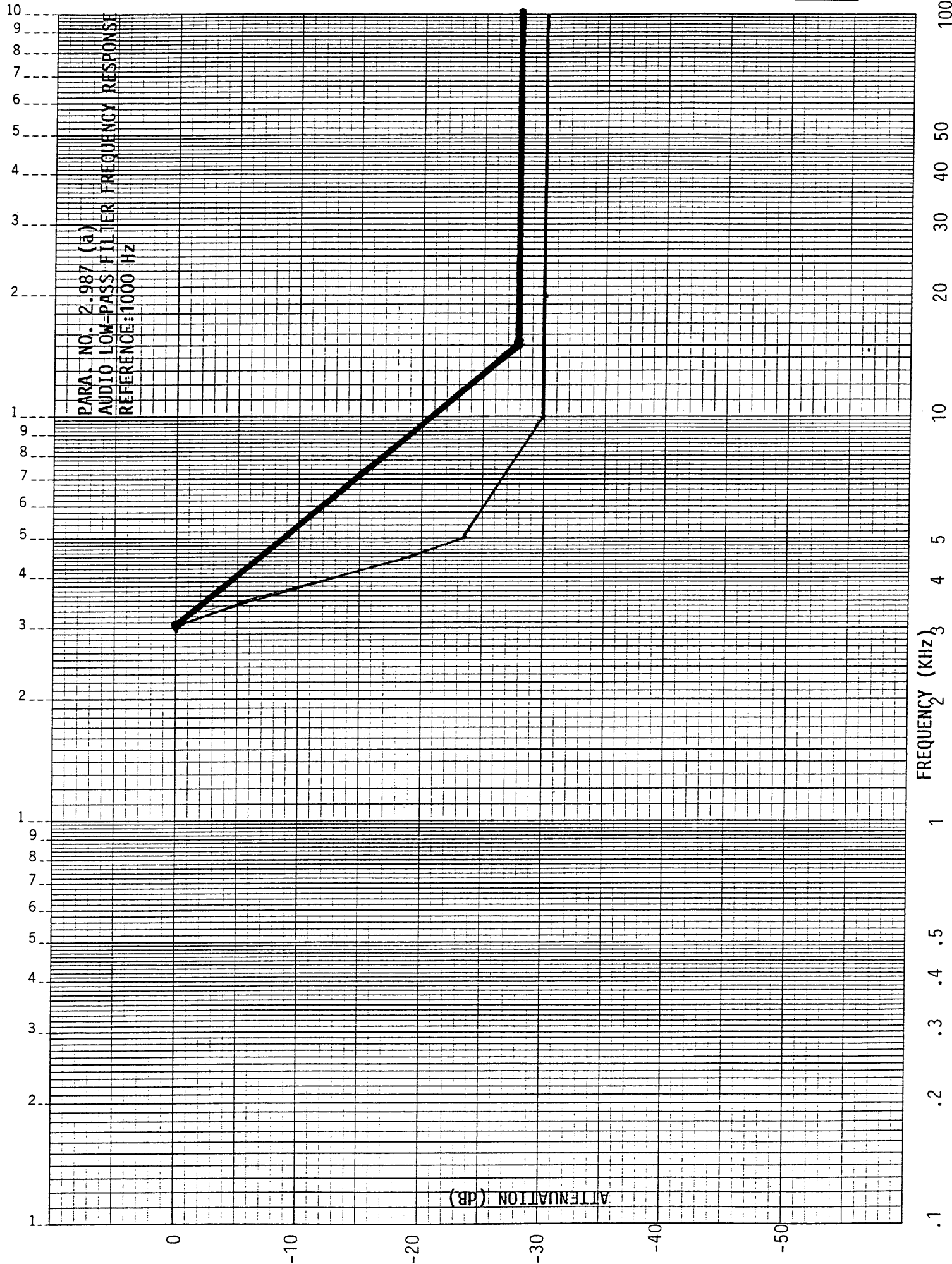
46 5490

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

ATTENUATION (dB)

FREQUENCY (KHz)



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 ± 5.0 kHz.

TEST RESULTS

COMPLIES. The maximum deviation is 4.2 kHz.

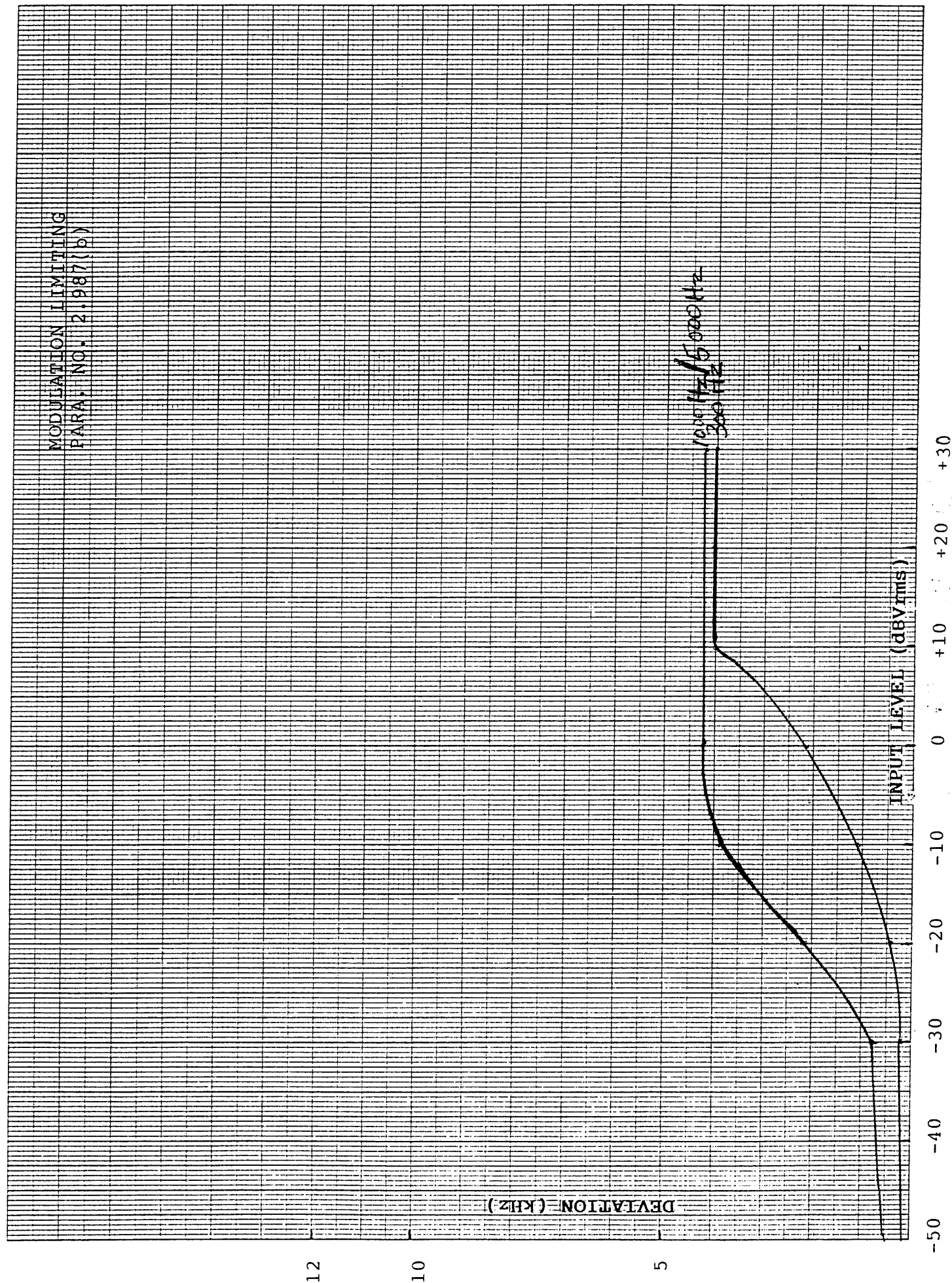
MEASUREMENT DATA

See attached graph.

46 1513

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

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.

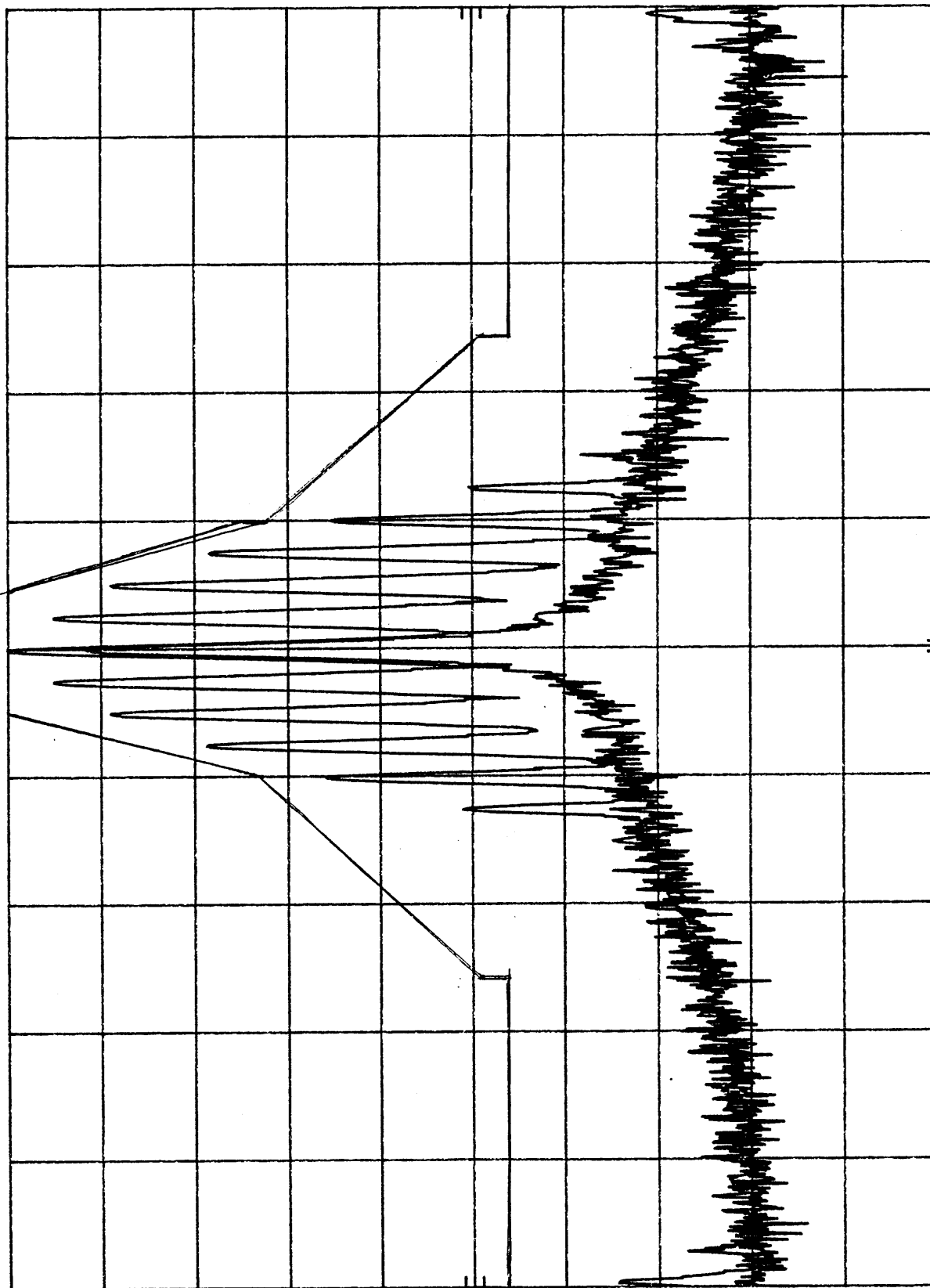
PROJECT NO. 5NO240-1H
FCC PART 90, SUBPART I
OCCUPIED BANDWIDTH
POWER OUTPUT: 1W
MODULATION: 2.5kHz SINE WAVE @ 16 dB OVERDRIVE

ATTEN 20 dB

REF 0.3 dBm

hp

10 dB/



CENTER 155.100 MHz
RES BW 300 Hz

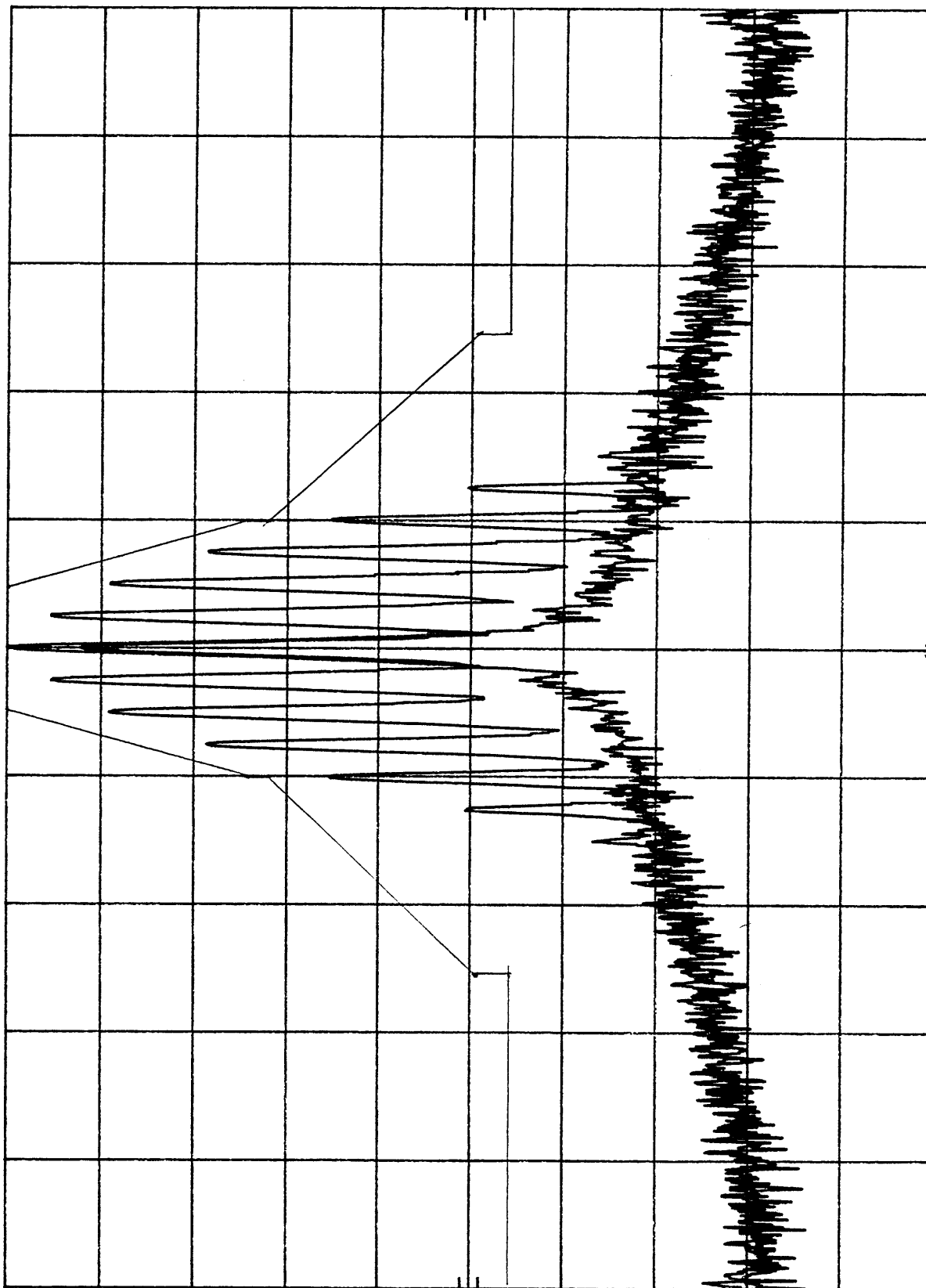
VBW 1 kHz

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_p REF 1.5 dBm ATTN 20 dB

10 dB/



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

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 STANDARDPara. 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> (MHz)	<u>Emission Level</u> (dBm)	<u>Attenuation</u> (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 & 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 μ 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 STANDARDPara No. 22.355. Para. No. 90.205(b). The transmitter carrier frequency shall remain within ± 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> (°C)	<u>Frequency Drift</u> (Hz)
-30	-55
-20	-64
-10	-58
0	-63
+10	-88
+30	-135
+40	-180
+50	-172
<u>Voltage</u> (VDC)	<u>Frequency Drift</u> (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

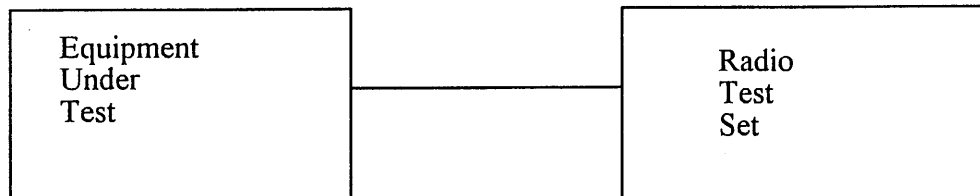
<u>TIME</u>	<u>Frequency (MHz)</u>			
(Min)	+10°C	+30°C	+40°C	+50°C
0	155.099 920	155.099 874	155.099 823	155.099 828
0.5	155.099 920	155.099 873	155.099 822	155.099 830
1.0	155.099 918	155.099 872	155.099 825	155.099 830
1.5	155.099 918	155.099 871	155.099 823	155.099 831
2.0	155.099 917	155.099 869	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

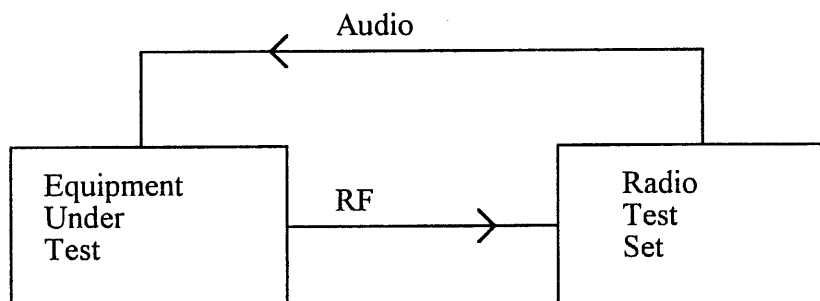
MEASUREMENT PROCEDURE PARA. NO. 2.985

RF POWER OUTPUT



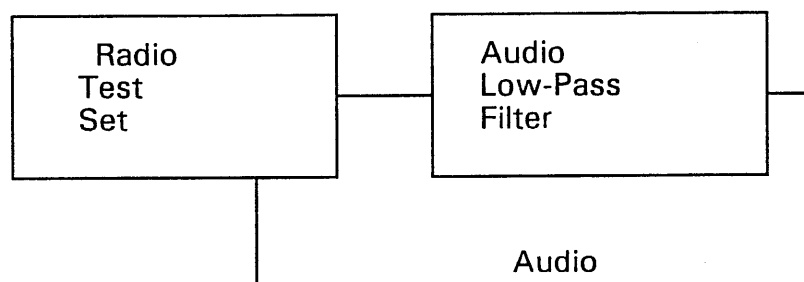
MEASUREMENT PROCEDURE PARA. NO. 2.987(a)

AUDIO FREQUENCY RESPONSE



MEASUREMENT DATA PARA. NO. 2.987(a)

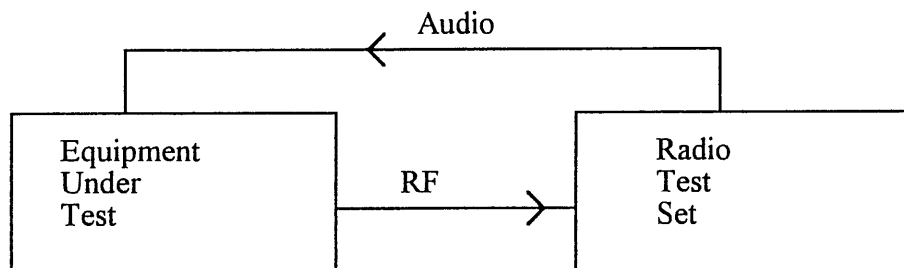
AUDIO LOW-PASS FILTER FREQUENCY RESPONSE



MEASUREMENT DATA

PARA. NO. 2.987(b)

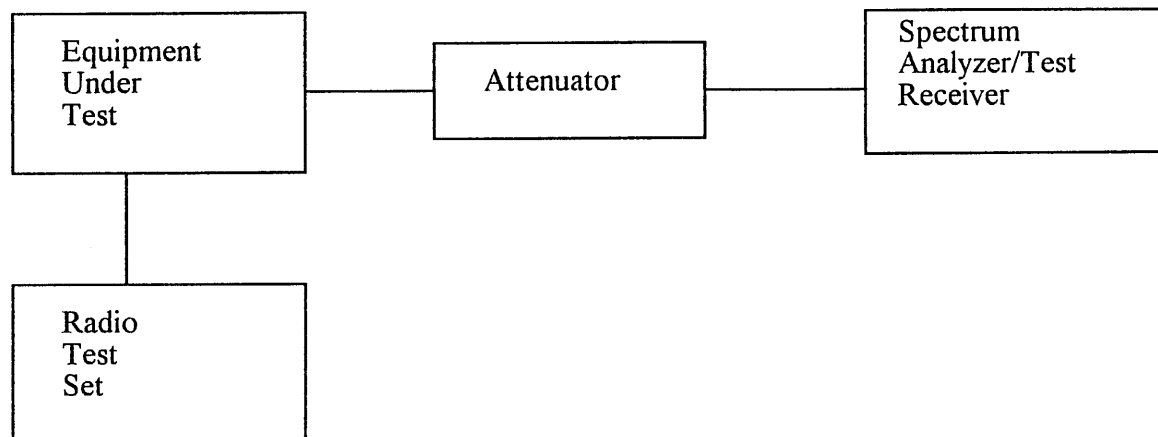
MODULATION LIMITING



MEASUREMENT PROCEDURE

PARA. NO. 2.989

OCCUPIED BANDWIDTH

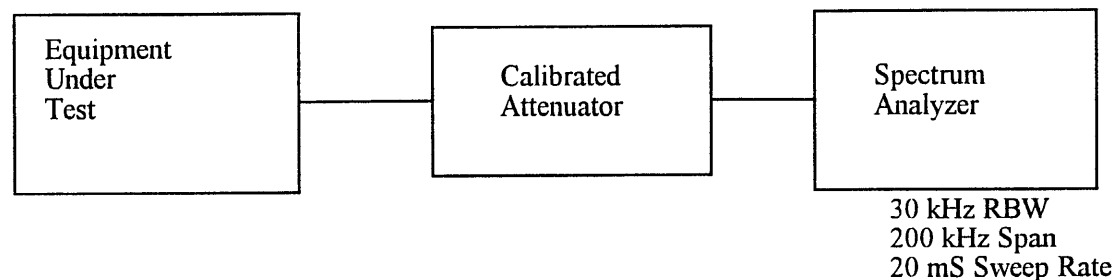


The transmitter was modulated with a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50% modulation.

Spectrum Analyzer settings as per measurement data.

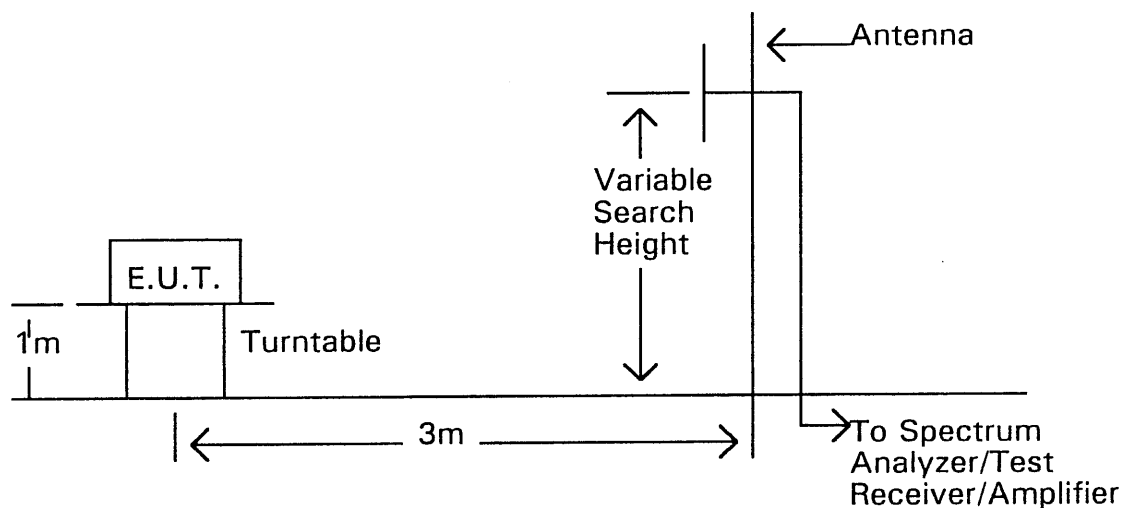
MEASUREMENT DATA

PARA. NO. 2.991

SPURIOUS EMISSIONS AT
ANTENNA TERMINALS

MEASUREMENT DATA

PARA. NO. 2.993

FIELD STRENGTH OF SPURIOUS
RADIATIONFrequency Range

<1300 MHz

Test Receiver Settings

12 kHz BW

Average Detector

>1300 MHz

Spectrum Analyzer Settings

30 kHz RBW

200 kHz Span

20 mS Sweep Rate

MEASUREMENT PROCEDURE

PARA. NO. 2.995

FREQUENCY STABILITY

