

ENGINEERING TEST REPORT

VT-3H040-S TRANSMITTER FAMILY

MODELS: VT-3H035-SWA3 and VT-3H045-SWA3

IN ACCORDANCE WITH:

FCC PART 90, SUBPART I
GENERAL TECHNICAL STANDARDS

INDUSTRY CANADA
RADIO STANDARDS SPECIFICATION RSS119 ISSUE 5

PROJECT NUMBER. 1290-9A

TESTED FOR:

DANIELS ELECTRONICS LTD.
43 ERIE STREET
VICTORIA, B.C. CANADA
V8V-1P8

TESTED BY:

DANIELS ELECTRONICS LTD.
43 ERIE STREET
VICTORIA, B.C. CANADA
V8V-1P8

May 1997

EQUIPMENT: VT-3H040-SW transmitter family. 29-50 MHz.
VT-3H035-SWA3 and VT-3H045-SWA3 family members.

GENERAL:

These tests were conducted on a production sample of the equipment for the purpose of compliance with FCC part 90 and IC RSS119 Issue 5.

This equipment is designed for land mobile NBFM 16K0F3E operation in the 29-50 MHz band with an output power of 3.0 watts. The two family members are essentially identical with only small component value changes applicable to local oscillator and output matching stages. The VT-3H035-SWA3 covers the lower frequency range of 29-38 MHz. The VT-3H045-SWA3 covers the frequency range of 38-50 MHz. Both models provide narrow band (20 kHz channel spacing) voice modulation only. All measurements were made with the transmitter (VT-3H045-SWA3) tuned to a mid band frequency of 39.5 MHz.

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

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

TESTED BY: Colin Dunn DATE: May 26 / 97

APPROVED BY: Raymond R. Biggs DATE: May 26 / 97

ABSTRACT:

<u>TEST</u>	<u>PARA. NO.</u> (FCC)	<u>PARA. NO.</u> (IC)	<u>RESULTS</u>
RF Power Output	2.985	6.2	CONFORMS
Audio Frequency Response	2.987(a)	NA	CONFORMS
Audio Low-Pass Filter Frequency Response	2.987(a)	6.6	CONFORMS
Modulation Limiting	2.987(b)	NA	CONFORMS
Occupied Bandwidth	2.989	6.4(b)	CONFORMS
Spurious Emissions at Antenna Terminals	2.991	6.3, 6.4(b)	CONFORMS
Field Strength of Spurious Radiation *	2.993	NA	CONFORMS
Frequency Stability	2.995	7.0	CONFORMS

* Note * Field Strength of Spurious Radiation tested by Acme Testing Ltd. With test report provided in this report.

EQUIPMENT: VT-3H045-SWA3 Transmitter

NAME OF TEST

PARA. NO.

RF Power Output

2.985 (FCC)
6.2 (IC)

TEST PERFORMED BY: Colin Gunn

DATE: May 5th, 1997

TEST CONDITIONS:

Standard Temperature & Humidity
Standard Test Voltage
Standard 50Ω load impedance.
Unmodulated (FCC)
Modulated at 2.5 kHz tone and +16 dB level (IC)

TEST EQUIPMENT:

As per block diagram and equipment list attached.

MINIMUM STANDARD:

Para. No. 90.205(b) The maximum transmitter output power is 300 watts (25 - 50 MHz).
Para. 6.2 (IC) The output power shall be within ±1.0 dB of the manufacturer's rated power.

TEST RESULTS:

CONFORMS. The measured RF power output is 3.1 watts. This is within ±1.0 dB of the manufacturer's rated power and below the 300 watt power limit.

There was no power level change between an unmodulated carrier (FCC) and a fully modulated carrier (IC).

MEASUREMENT DATA:

Power Output (Watts)

Unmodulated Fully Modulated

3.1	3.1
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EQUIPMENT: VT-3H045-SWA3 Transmitter

NAME OF TEST

PARA. NO.

Audio Frequency Response

2.987(a) (FCC)

TEST PERFORMED BY: Colin Gunn

DATE: May 9th, 1997

TEST CONDITIONS:

Standard Temperature & Humidity
Standard Test Voltage
Standard 50 Ω load impedance.
Modulated

TEST EQUIPMENT:

As per block diagram and equipment list attached.

MINIMUM STANDARD:

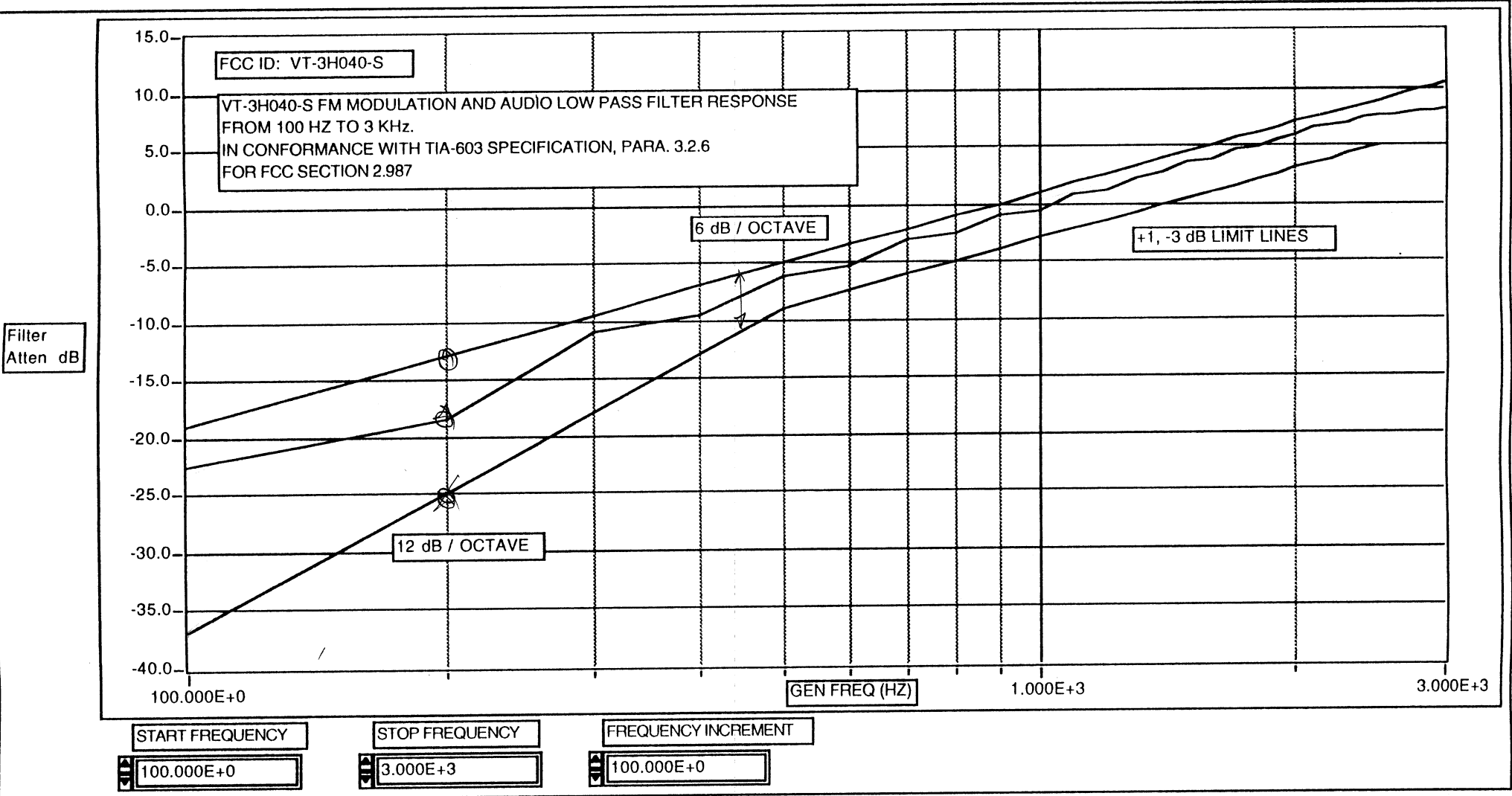
TIA-603, Para. 3.2.6 from 300 Hz to 3000 Hz. The transmitter audio frequency response shall have a nominal 6 dB per octave pre-emphasis characteristic.

TEST RESULTS:

CONFORMS. See attached graph.

MEASUREMENT DATA:

See attached graph (following page)



EQUIPMENT: VT-3H045-SWA3 Transmitter

<u>NAME OF TEST</u>	<u>PARA. NO.</u>
Audio Low-Pass Filter Frequency Response	2.987(a) (FCC) 6.6 (IC)

TEST PERFORMED BY: Colin Gunn **DATE:** May 9th, 1997

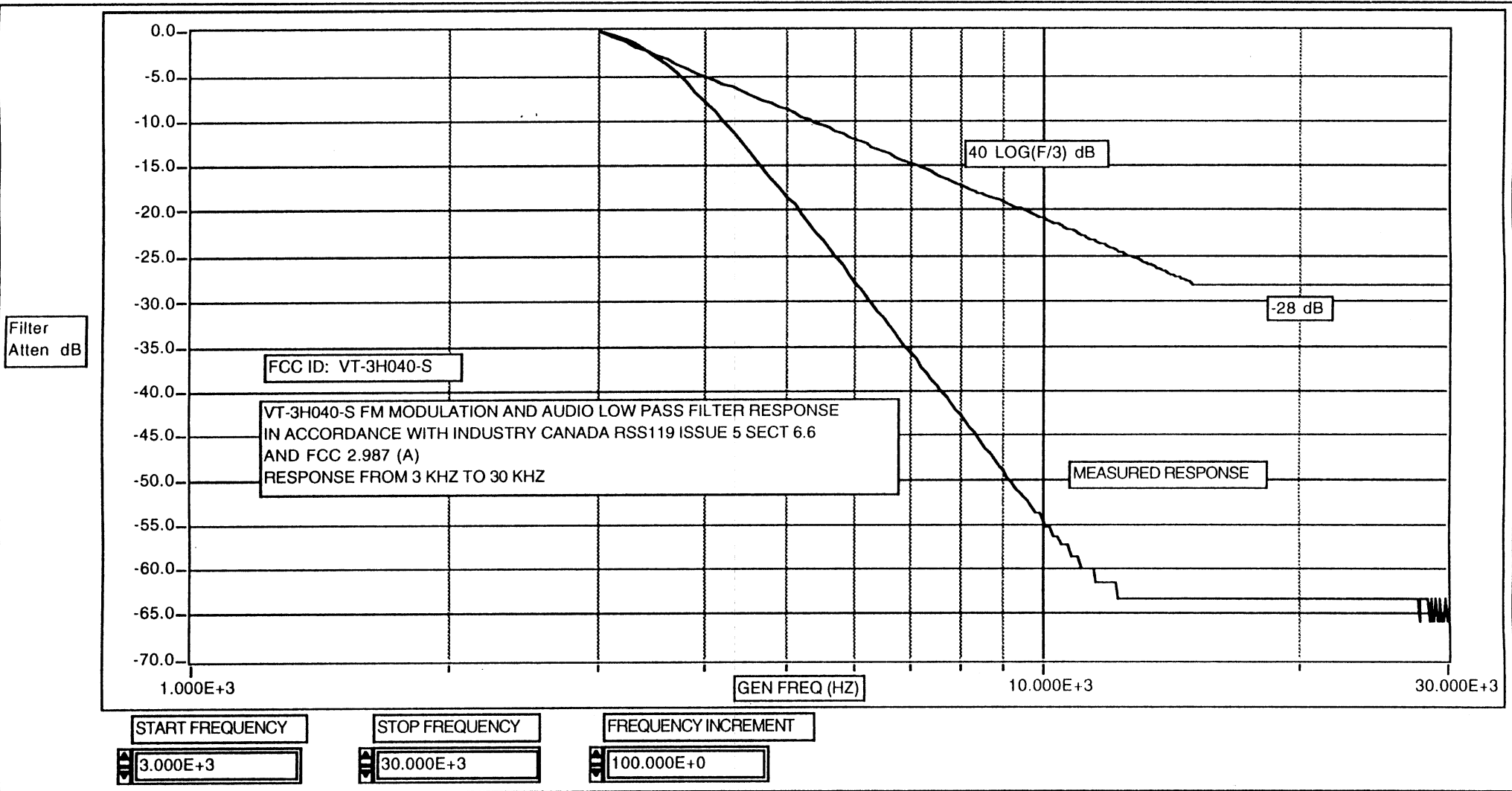
TEST CONDITIONS: Standard Temperature & Humidity
Standard Test Voltage
Modulated

TEST EQUIPMENT: As per block diagram and equipment list attached.

MINIMUM STANDARD: As per Table 3 of RSS119, Issue 5. Audio band 3-15 kHz the minimum attenuation rel. to 3 kHz attenuation shall be $40\text{Log}_{10}(f/3)$ dB. The audio band 15-30 kHz the minimum attenuation rel. to 3 kHz attenuation shall be 28dB.

TEST RESULTS: CONFORMS. See attached graph.

MEASUREMENT DATA: See attached graph (following page)



EQUIPMENT: VT-3H045-SWA3 Transmitter

NAME OF TEST

PARA. NO.

Modulation Limiting

2.987(b) (FCC)

TEST PERFORMED BY: Colin Gunn

DATE: May 9th, 1997

TEST CONDITIONS: Standard Temperature & Humidity
Standard Test Voltage
Standard 50Ω load impedance.

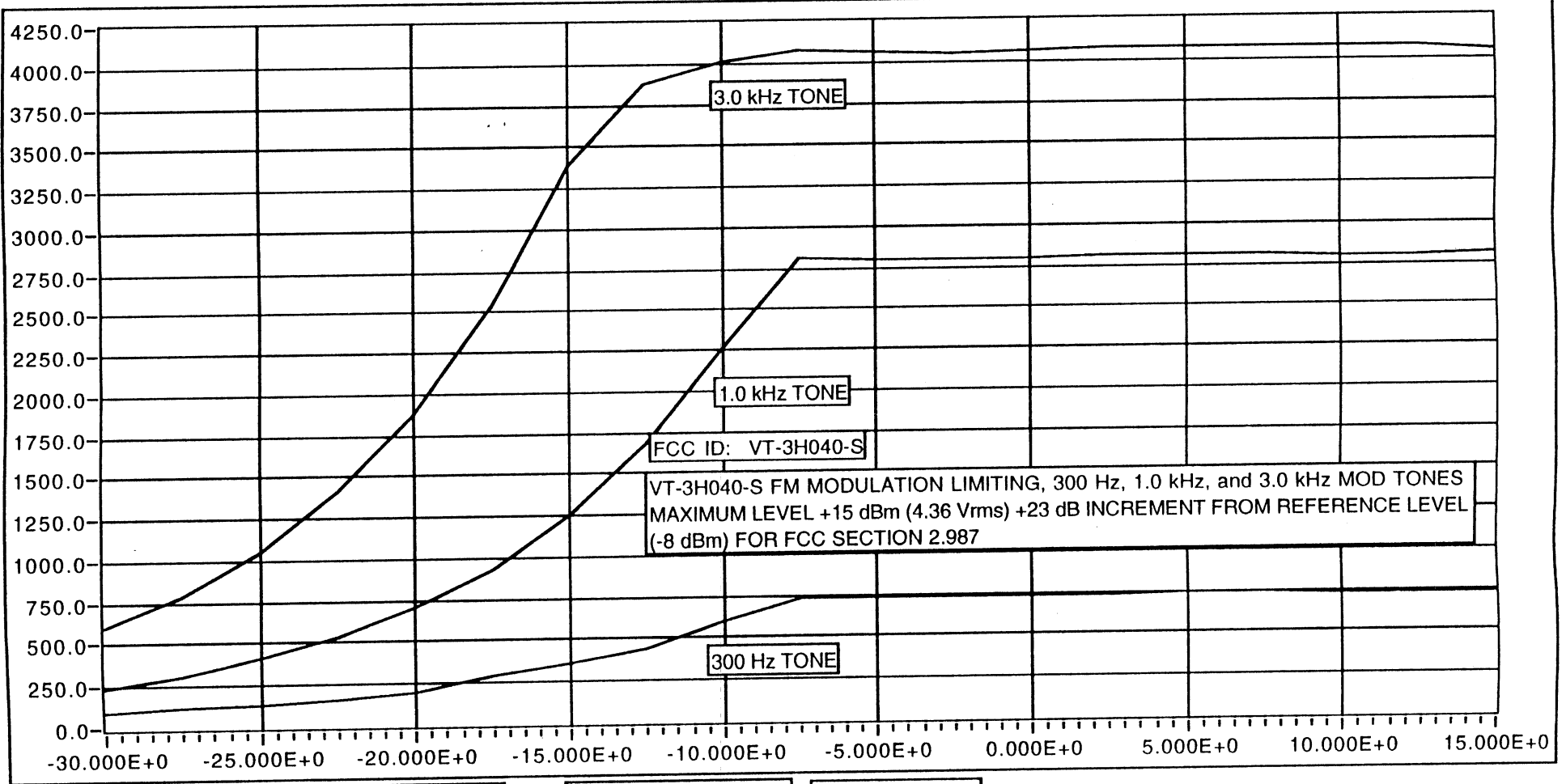
TEST EQUIPMENT: As per block diagram and equipment list attached.

MINIMUM STANDARD: Maximum frequency deviation shall not exceed ± 5 kHz.

TEST RESULTS: CONFORMS. The maximum deviation is ± 4100 Hz peak.

MEASUREMENT DATA: See attached graph (following page)

TX
Deviation



START LEVEL (dBm)

STOP LEVEL (dBm)

LEVEL INCREMENT (dB)

GEN LEVEL (dBm)

-30.000E+0

15.000E+0

2.500E+0

EQUIPMENT: VT-3H045-SWA3 Transmitter

<u>NAME OF TEST</u>	<u>PARA. NO.</u>
Occupied Bandwidth	2.989 (FCC) 6.4(b) (IC)

TEST PERFORMED BY: Colin Gunn **DATE:** May 7th, 1997

TEST CONDITIONS: Standard Temperature & Humidity
Standard Test Voltage
Standard 50Ω load impedance.
Modulated at 2.5 kHz tone at a level 16 dB higher than that required to produce 50% of the desired frequency deviation.

TEST EQUIPMENT: As per block diagram and equipment list attached.

MINIMUM STANDARD: Para. No. 90.210 (b) (FCC) and 6.4(b) (IC) Emissions shall be attenuated as follows:

<u>Frequency Range</u> (kHz)	<u>Attenuation</u> (dB)
$f_c \pm 10$ to $f_c \pm 20$	25
$f_c \pm 10$ to $f_c \pm 20$	35
$<f_c - 50$ to $>f_c + 50$	$43 + 10\log_{10} P^*$

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

TEST RESULTS: CONFORMS. See attached graph.

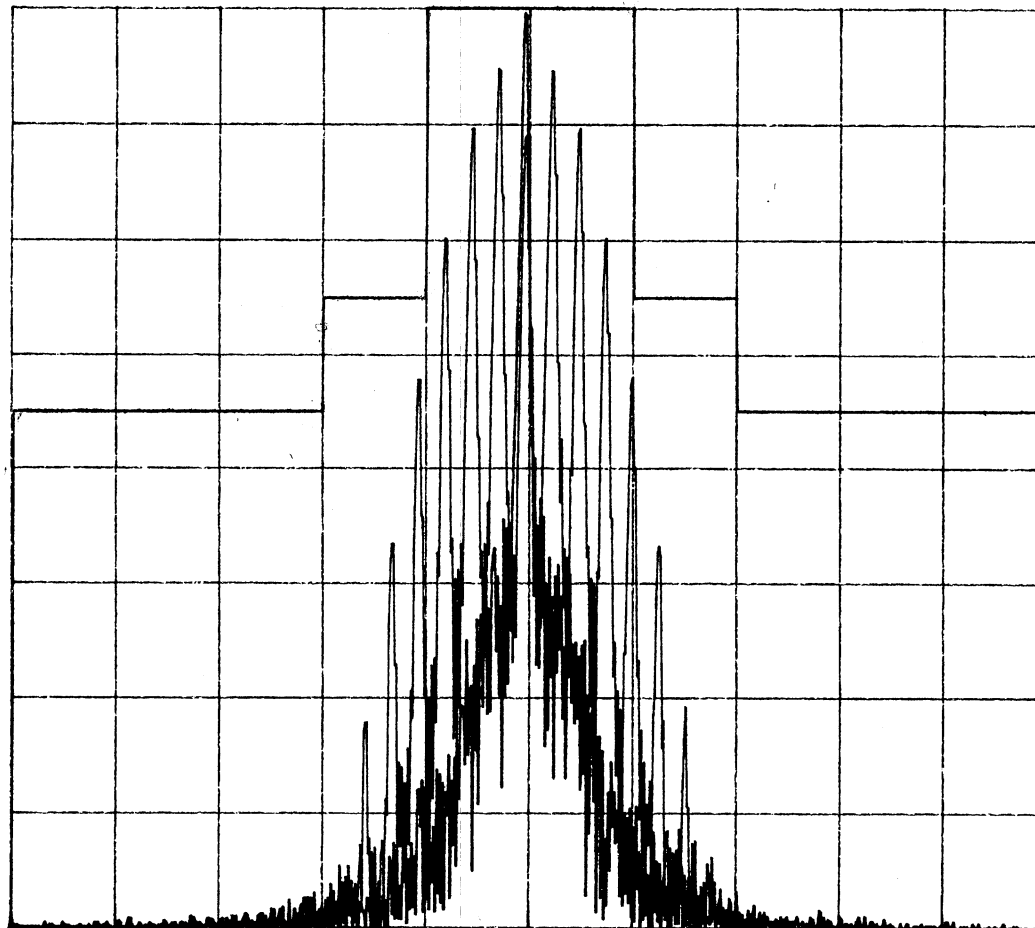
MEASUREMENT DATA: See attached graph (following page)

REF -10.0 dBm
10dB/

ATT 10 dB

A_write B_view

RBW
300 Hz
VBW
1 kHz
SWP
3 s



CENTER 39.5000 MHz

SPAN 100.0 kHz

EQUIPMENT: VT-3H045-SWA3 Transmitter

<u>NAME OF TEST</u>	<u>PARA. NO.</u>
Spurious Emission at Antenna Terminals	2.991 (FCC) 6.3, 6.4(b) (IC)

TEST PERFORMED BY: Colin Gunn **DATE:** May 7th, 1997

TEST CONDITIONS: Standard Temperature & Humidity
Standard Test Voltage

TEST EQUIPMENT: As per block diagram and equipment list attached.

MINIMUM STANDARD: Para. No. 90.210(b) (FCC) and 6.4(b) (IC). On any frequency removed from the carrier frequency by more than 250 percent of the authorized bandwidth:
At least $43 + 10\log_{10} P^* = 47.8$ dBc (3 watt mean power)

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

TEST RESULTS: CONFORMS. The strongest emission is -49 dBm @ 79 MHz. This is 36 dB below the specification limit.

MEASUREMENT DATA: Mean Output Power of Transmitter (3 Watt) 34.8 dBm.

<u>Frequency</u> (MHz)	<u>Emission Level</u> (dBm)	<u>Attenuation</u> (dBc)
79.0	-49.0	83.8
118.5	-63.0	97.8

* Spectrum searched to 2.6 GHz.

EQUIPMENT: VT-3H045-SWA3 Transmitter

<u>NAME OF TEST</u>	<u>PARA. NO.</u>
Field Strength of Spurious Radiation	2.993 (FCC)

TEST PERFORMED BY: Paul Slavens **DATE:** April 17th, 1997

Refer to Exhibit Q "Acme Testing Radiated Spurious Emission Report".
Document Report Number 970079

TEST CONDITIONS: As defined in Engineering Report Appendix A

TEST EQUIPMENT: As defined in Engineering Report Appendix A

MINIMUM STANDARD: As defined in Engineering Report Appendix A

TEST RESULTS: CONFORMS.

MEASUREMENT DATA: Refer to Acme Testing Report Number 970079
As defined in Engineering Report Appendix A

EQUIPMENT: VT-3H045-SWA3 Transmitter

NAME OF TEST

Frequency Stability

PARA. NO.

2.997 (FCC)

7.0 (IC)

TEST PERFORMED BY: Colin Gunn

DATE: May 9th, 1997

TEST CONDITIONS: As per measurement data.

TEST EQUIPMENT: As per block diagram and equipment list attached.

MINIMUM STANDARD: Para. No. 90.213 (FCC) and 7.0 (IC). Minimum standard is $< \pm 20$ ppm.

TEST RESULTS: CONFORMS. The maximum frequency drift is -26 Hz, corresponding to - 0.66 ppm.

MEASUREMENT DATA:

Standard Test Frequency: 39.5 MHz

Standard Temperature: 25°C

Standard Test Voltages (85%, 100%, 115%) 11.7 Vdc, 13.8 Vdc, 15.9 Vdc

FREQUENCY VS SUPPLY VOLTAGE

Time (Min)	11.7 Vdc	13.8 Vdc	15.9 Vdc
0	39.499995	39.499995	39.499996
0.5	39.499996	39.499996	39.499997
1.0	39.499997	39.499999	39.499998
1.5	39.499998	39.500000	39.500000
2.0	39.499998	39.500000	39.500001
2.5	39.499999	39.500001	39.500002
3.0	39.500000	39.500001	39.500002
Long Term (10 min)	39.500000	39.500002	39.500002

MEASUREMENT DATA:

Standard Test Frequency: 39.5 MHz

Temperature: -30°C to +50°C Environmental Chamber Controlled in 10°C steps.

Standard Test Voltage +13.8 Vdc

FREQUENCY VS TEMPERATURE

<u>Time</u>	<u>Frequency (MHz)</u>				
(Min)	-30°C	-20°C	-10°C	0°C	+10°C
0	39.499988	39.499979	39.499981	39.499989	39.499995
0.5	39.499987	39.499977	39.499979	39.499988	39.499996
1.0	39.499986	39.499975	39.499978	39.499989	39.499997
1.5	39.499986	39.499974	39.499979	39.499989	39.499997
2.0	39.499985	39.499975	39.499979	39.499990	39.499998
2.5	39.499984	39.499975	39.499980	39.499991	39.499998
3.0	39.499984	39.499975	39.499981	39.499991	39.499999

<u>Time</u>	<u>Frequency (MHz)</u>			
(Min)	+20°C	+30°C	+40°C	+50°C
0	39.499998	39.499997	39.499994	39.499991
0.5	39.499999	39.499998	39.499995	39.499991
1.0	39.500000	39.499999	39.499996	39.499993
1.5	39.500000	39.500000	39.499997	39.499994
2.0	39.500001	39.500000	39.499997	39.499994
2.5	39.500001	39.500001	39.499997	39.499993
3.0	39.500001	39.500001	39.499997	39.499993

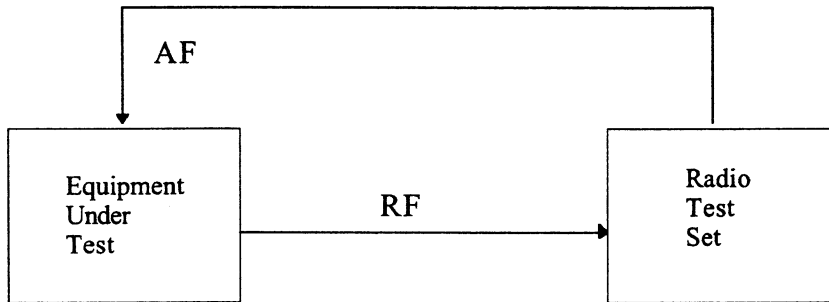
EQUIPMENT LIST

<u>Equipment</u>	<u>Manufacturer</u>	<u>Model</u>
Digital Multimeter	Fluke	45
Power Supply	Astron	VRM-50M
Radio Test Set	Marconi	2965A
Spectrum Analyzer	Advantest	R3361A
RF Signal Generator	Marconi	2040
WWVB Frequency Reference	Spectracomm	5120T
Environmental Chamber	Tenney	Tenney Jr.
High Power 50Ω Load	Bird	8166
RF Sampler (adjustable)	Bird	4275
VHF Notch Filter	AnnaMag	811A
IEEE-488 Control Software	National Instruments	Labview V4.1

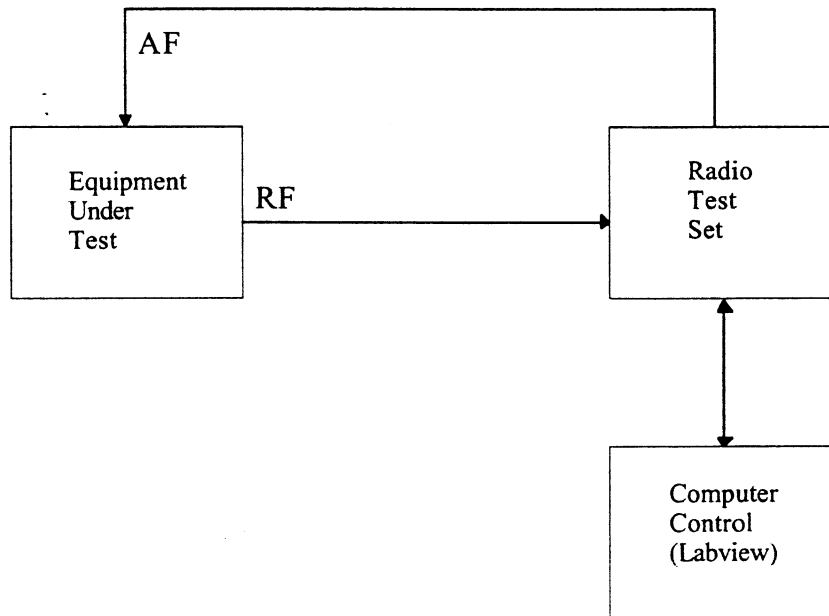
All test equipment calibrated to ISO-9002 certified levels.

MEASUREMENT PROCEDURE PARA. NO. 2.985 (FCC) and 6.2 (IC)

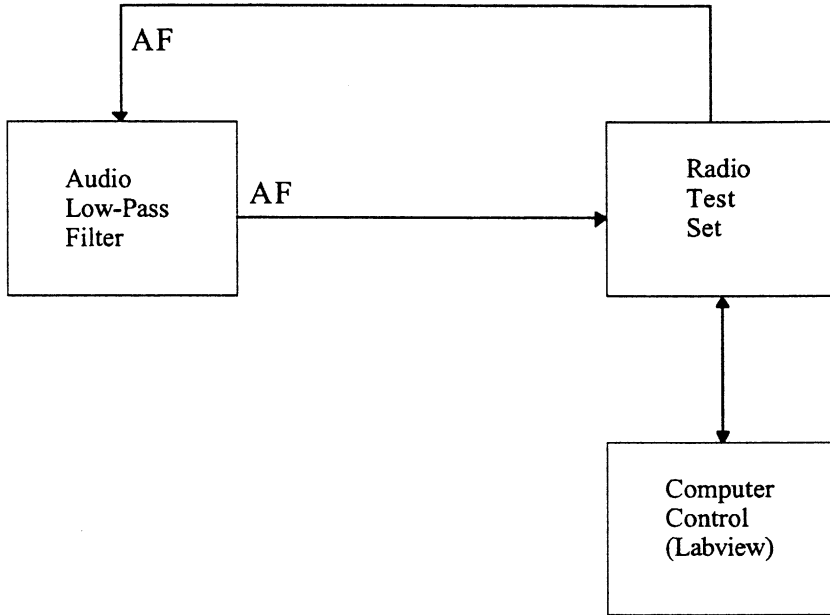
RF POWER OUTPUT



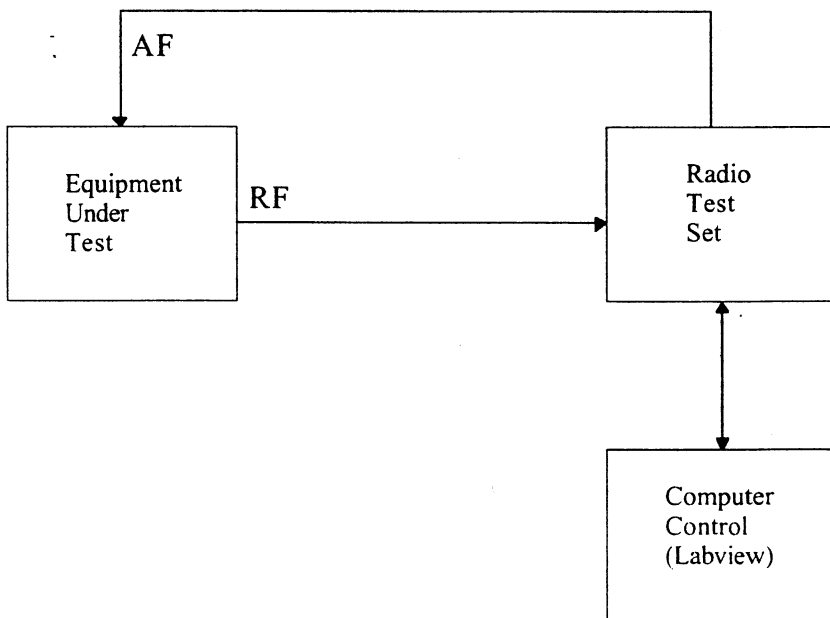
MEASUREMENT PROCEDURE PARA. NO. 2.987(a)
AUDIO FREQUENCY RESPONSE



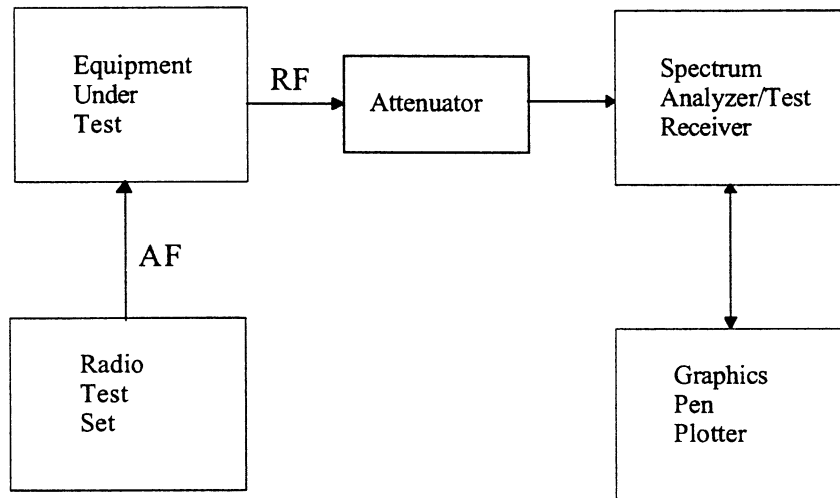
MEASUREMENT PROCEDURE PARA. NO. 2.987(a) (FCC), 6.6 (IC)
AUDIO LOW-PASS FILTER RESPONSE



MEASUREMENT PROCEDURE PARA. NO. 2.987(b) (FCC)
MODULATION LIMITING

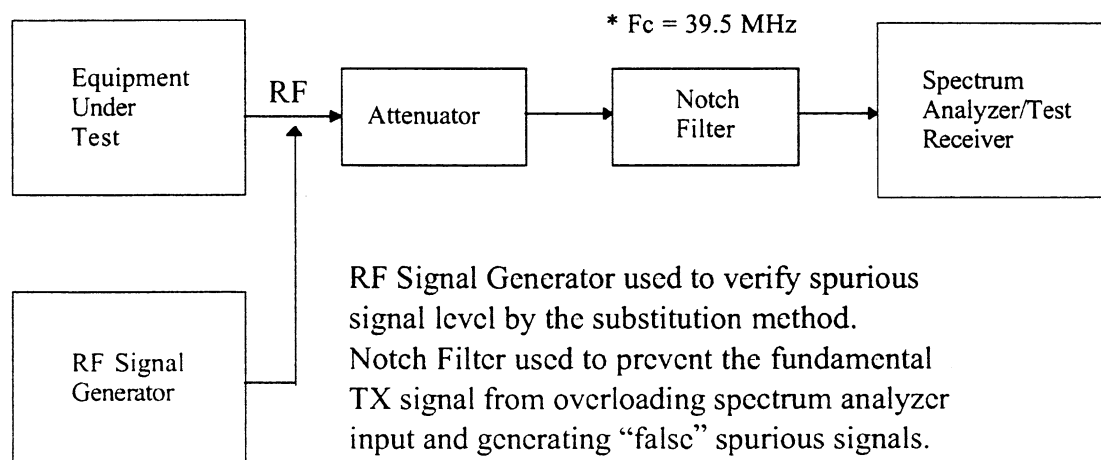


**MEASUREMENT PROCEDURE PARA. NO. 2.989 (FCC), 6.4(b) (IC)
OCCUPIED BANDWIDTH**



* 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 plot.

**MEASUREMENT PROCEDURE PARA. NO. 2.991(b) (FCC), 6.3, 6.4(b) (IC)
SPURIOUS EMISSIONS AT ANTENNA TERMINALS**



MEASUREMENT PROCEDURE PARA. NO. 2.993(b)
Field Strength of Spurious Radiation.

Refer to appendix A of this report for the test procedure.

MEASUREMENT PROCEDURE PARA. NO. 2.995 (FCC), 7.0 (IC)
Frequency Stability

