EMCEE

BROADCAST PRODUCTS, INC.

February 10, 2000

Federal Communications Commission
Equipment Approval Services
P.O. Box 358315
Pittsburgh, PA 15251-5315

Gentlemen:

EMCEE Broadcast Products requests certification of the Model TU1000F 1000 Watt UHF Translator in accordance with Part 74, Subpart G, of the Commission's Rules and Regulations.

Enclosed is a copy of the EMCEE engineering report describing the equipment and test procedures utilized to confirm compliance with the regulations applicable to Low Power Television, Television Translator and TV Booster Stations. Also included is the TU1000F Instruction Manual which contains the required circuit descriptions, alignment procedures, and technical specifications. Our check in the amount of $475 to cover the filing fee is also enclosed.

If any further information is required to expedite this application, please feel free to contact me at 570-443-9575 or bnash@emceebrd.com.

Sincerely,

Robert G. Nash
VP/Director of Engineering

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Certification Submission for the
Model TU1000F
Television Translator
per Part 74, Subpart G,
of the FCC Rules and Regulations

EMCEE Broadcast Products
PO Box 68
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SECTION I

1.0 INTRODUCTION

This report contains data required for certification of the EMCEE Model TU1000F Television Translator which EMCEE plans to manufacture in quantity. The translator is rated to provide 1000 watts peak visual and 50 watts average aural power on any FCC specified channel extending from 470MHz to 806MHz. The output frequency of the translator tested was UHF channel 69 (800 to 806MHz) with a VHF input of channel 6 (82 to 88MHz). The data contained in this report was obtained from tests made on an EMCEE production unit. A complete list of the test equipment utilized to obtain the certification data can be found in Section 1.3 of this report. Information relating to the description, operation and maintenance of the TU1000F Translator can be found in the EMCEE TU1000F Instruction Manual.

1.1 Equipment Description

The TU1000F Television Translator is composed of a Receiver drawer, a 20 Watt Exciter/ Upconverter assembly and two 500 Watt Amplifier drawers. The Receiver is made up of two sections: the Downconverter and the IF. The Downconverter accepts any VHF or UHF channel from the receive antenna and optional remote preamplifier and converts that signal to standard IF (45.75MHz visual and 41.25MHz aural). The IF section filters and amplifies the incoming signal while providing AGC and automatic on-off circuits which will place the unit in a nonradiating condition if the receiving portion of the translator fails or if the input signal is not of the correct frequency or amplitude. A 30-second time delay circuit is also included to prevent the translator from being turned off during momentary failures or fades of the incoming signal. Also contained in this drawer, to satisfy Section 74.750(c)(7) of the FCC Rules, is an optional Code Identification Unit capable of shifting the frequency of the transmitted carriers according to the station’s call sign. In the 20 Watt Exciter drawer, the IF carriers from the Receiver are shifted to any desired UHF TV frequency and amplified to the proper level to drive the four 300 watt solid-state amplifiers contained in two 500 Watt UHF Amplifier drawer assemblies. The outputs of these four amplifiers are then recombined and connected to a six-section UHF Bandpass Filter where unwanted products created by common amplification are reduced to appropriate levels. Other assemblies in the TU1000F Translator include a Front Panel Control Board for monitoring translator functions and a Power Panel to distribute AC power throughout the translator cabinet.

The Receiver, 20 Watt Exciter and Power Amplifier assemblies, in conjunction with the remote Preamplifier, are designated as the TU1000F Translator. The TU1000F Translator is designed for the express purpose of broadcasting as authorized by the Federal Communications Commission's Rules and Regulations, Part 74, Subpart G, Low Power TV, TV Translator and TV Booster Station service.

1.2 Personnel Qualifications

The type acceptance tests were conducted under the supervision of Robert Nash, EMCEE VP/Director of Engineering. Mr. Nash has more than twenty-four years of experience in the development and testing of television transmitters and translators.

1.3 <u>Test Equipment</u>

1. Antenna, Adjustable Dipole Set, 40-100MHz-1GHz, Model AS385/V, Stoddard
2. Antenna, Conical Helix, 1-11GHz, Model ALN108B, AEL
3. Attenuator, 10dB, 20W, Model 766-10, Narda
4. Attenuator, 20dB, 20W, Model 766-20, Narda
5. Attenuator, 30dB, 20W, Model 766-30, Narda
6. Distortion Measurement Set, Model 339A, Hewlett Packard
7. Demodulator, Model 1450, Tektronix
8. Directional Coupler, 30dB, Model 3001-30, Narda
9. Dummy Load, 50 ohm, 1000 watt, Model 8833, Bird Electronic Corporation
10. Environmental Chamber, Tenny Jr., Tenny Engineering
11. Frequency Counter, Model 5386A, Hewlett Packard
12. Mixer, Model ZAD-2, Mini-Circuits
13. Modulator, Model EM1, EMCEE
14. NTSC Video Generator, Type 149A, Tektronix
15. Power Meter, Model 435A, Hewlett Packard
16. Spectrum Analyzer, Model 8595E, Hewlett Packard
17. Variable Attenuator, Model 8494A/8495A, Hewlett Packard
18. Variable Voltage Transformer, Type 1226, Powerstat
19. Video Measurement Set, Model VM700A, Tektronix
20. Translator, Model TU1000F, EMCEE

1.4 Active Device List

The following is a complete listing of all the active devices used in the EMCEE Model TU1000F UHF Television Translator. The devices are grouped together as seen on each specific schematic or interconnection diagram. Given with each device is its schematic designator, part number and function.

DEVICE	PART #/DESIGNATOR	FUNCTION
VHF/UHF RECEIVER DRAWER INTERCONNECT DIAGRAMS 30383104/094		
Reference Oscillator Schematic Diagram 10368037		
Integrated Circuit	3B130/U1	RF Amplifier
TCXO	RTX0771AD/G1	Oscillator
VHF Synthesizer Schematic Diagram 30362003 (Band I)		
Integrated Circuit	3B160/U4	Reference Divider
Integrated Circuit	3B190/U2	Dual Prescaler
Integrated Circuit	3B161/U1	Synthesizer
Integrated Circuit	3B149/U3	Loop Filter
Integrated Circuit	3B181/U6	Feedback Amplifier
Integrated Circuit	3B151/U5	RF Amplifier
VCO	V220S015/G1	Oscillator
VHF Synthesizer Schematic Diagram 30362427 (Band III)		
Integrated Circuit	3B160/U4	Reference Divider
Integrated Circuit	MC12028AD/U2	Dual Prescaler
Integrated Circuit	3B161/U1	Synthesizer
Integrated Circuit	3B149/U3	Loop Filter
Integrated Circuit	3B181/U6	Feedback Amplifier
Integrated Circuit	SNA586/U5	RF Amplifier
VCO	V110SC01/G1	Oscillator

DEVICE	PART #/DESIGNATOR	FUNCTION
UHF Synthesizer Schematic Diagram 30367094		
Integrated Circuit	3B160/U4	Frequency Divider
Integrated Circuit	3B161/U1	Frequency Synthesizer
Integrated Circuit	3B190/U2	Dual Modulus Freq. Divider
Transistor	3B151/U5	RF Amplifier
Transistor	3B193/U6	RF Amplifier
X2 Multiplier (with Vectron Oscillator - Band I) Schematic Diagram B280-35		
Integrated Circuit	3B09/LL1	Voltage Regulator
Transistor	2B03/Q1	RF Amplifier
Transistor	2B06/Q2	RF Amplifier
X4 Multiplier (with Vectron Oscillator - Band III) Schematic Diagram C331-24		
Integrated Circuit	3B09/U1	Voltage Regulator
Transistor	2B03/Q1	RF Amplifier
Transistor	2B06/Q2, Q3	RF Amplifier
X16 Multiplier (with Vectron Oscillator - Band IV and V) Schematic Diagram 30367226		
Diode	SK-2/A1, A2, A3	Multiplier
Integrated Circuit	3B153/U1	RF Amplifier
Integrated Circuit	3B141/U2	RF Amplifier
Integrated Circuit	3B151/U3, U6	RF Amplifier
Integrated Circuit	3B238/U4	RF Amplifier
Integrated Circuit	2B130/U5	RF Amplifier
Downconverter/Preamplifier Schematic Diagram A331-29		
Diode	MCLSBL-1X/MX1	Mixer
Transistor	2B39/Q1	RF Amplifier

DEVICE	PART #/DESIGNATOR	FUNCTION
IF SAW Filter/Amplifier Schematic Diagram B331-21		
Transistor	2B110/Q1, Q3	RF Amplifier
Transistor	2B06/Q2	RF Amplifier
IF AGC Amplifier Schematic Diagram C331-37		
Diode	1B70/CR1, CR2, CR4, CR9	RF Attenuator
Diode	1B05/VR1	Voltage Regulator
Transistor	2B28/Q1	RF Amplifier
Transistor	2B06/Q2, Q3	RF Amplifier
TU20F 20 WATT EXCITER/UPCONVERTER **INTERCONNECT DIAGRAM 40383113**		
IF/Upconverter Schematic Diagram 30383013		
Diode	HSMS2812/CR1	RF Switch
Diode	HSMP3800/CR2, CR3, CR4	RF Attenuator
Diode	CMPZ52373/VR1	Voltage Regulator
Transistor	MAV-11SM/U1, U3, U7	RF Amplifier
Transistor	MAR-3SM/U6	RF Amplifier
Linearizer Schematic Diagram 30367078		
Diode	1B162/CR1-CR8	RF Switch
Transistor	2B08/Q2, Q4, Q5	RF Amplifier
Transistor	2B09/Q1, Q3	RF Amplifier
2W UHF Amplifier Schematic Diagram 30367002		
Transistor	3B141/U1	RF Amplifier
Transistor	3B151/U2	RF Amplifier
Transistor	3B152/U3	RF Amplifier
Transistor	2B158/Q1	RF Amplifier
Transistor	2B25/Q2	Current Regulator

DEVICE	PART #/DESIGNATOR	FUNCTION
20W UHF Amplifier Schematic Diagram 40383053		
Transistor	2B25/Q3, Q4	Current Regulator
Transistor	2B190/Q1, Q2	RF Amplifier
Metering Detector Schematic Diagram 30368024		
Diode	1B159/CR2, CR3, CR4	RF Detector
UHF Synthesizer Schematic Diagram 30367094		
Integrated Circuit	3B160/U4	Frequency Divider
Integrated Circuit	3B161/U1	Frequency Synthesizer
Integrated Circuit	3B190/U2	Dual Modulus Freq. Divider
Transistor	3B151/U5	RF Amplifier
Transistor	3B193/U6	RF Amplifier
Reference Oscillator Schematic Diagram 10368037		
Integrated Circuit	3B130/U1	RF Amplifier
TCXO	RTX0771AD	Oscillator
DUAL 300 WATT POWER AMPLIFIER DRAWER INTERCONNECT DIAGRAM 40386002		
300W UHF Amplifier Schematic Diagram 40386003		
Motorola Amplifier Pallet	XFA8090B/A1	RF Power Amplifier
Motorola Amplifier Pallet	XFA8180B/A2, A3	RF Power Amplifier

1.5 Certification of Data

Having supervised the tests and compilation of information in this report, I certify that all statements and test results submitted for certification of the EMCEE TU1000F are true and correct to the best of my knowledge.

Robert G. Nash
VP/Director of Engineering

SECTION II
TEST PROCEDURES AND DATA

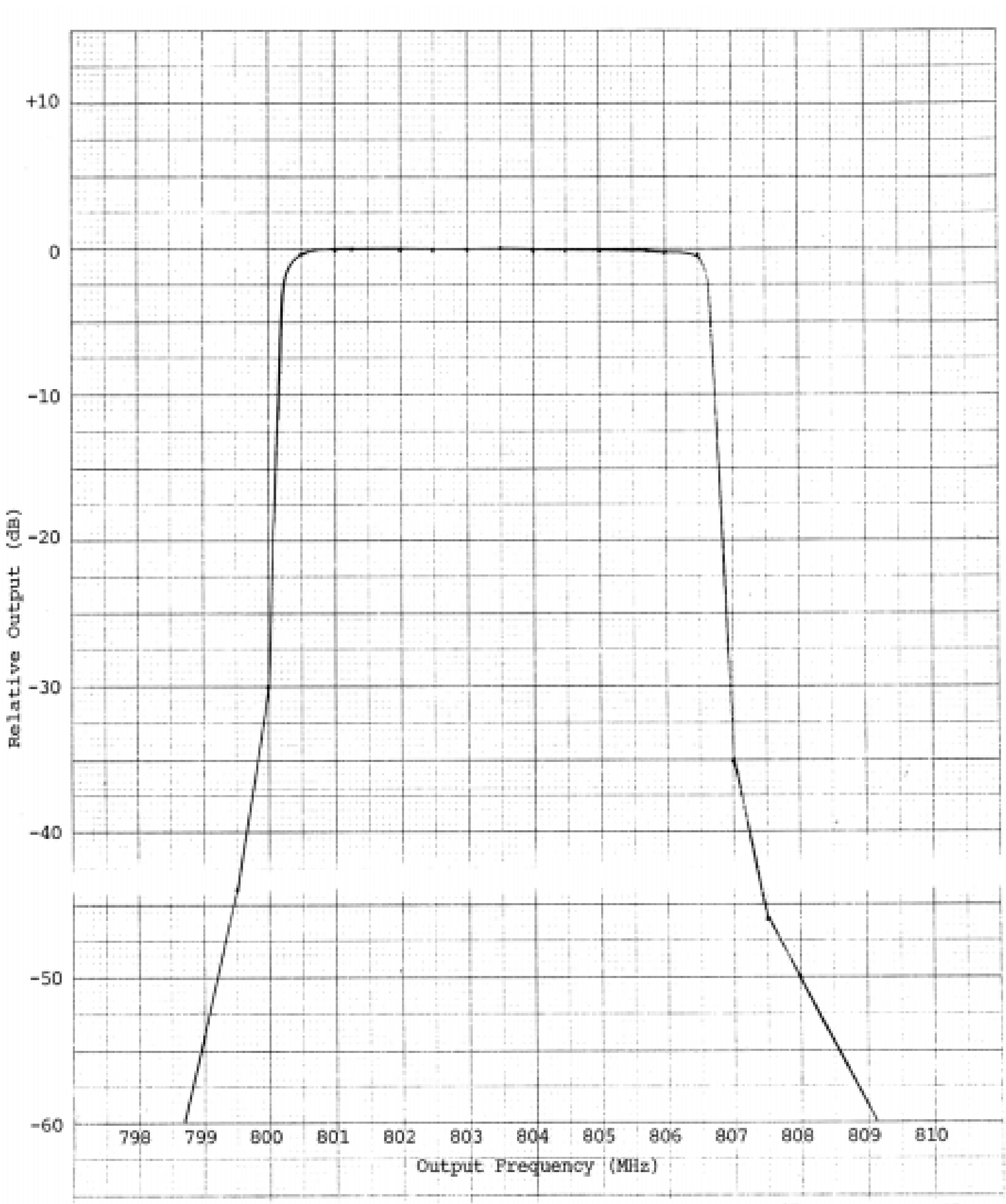
2.1 Frequency Response [73.687(a)(1)]

Test Equipment Setup	Figure 2–1A
Visual Output Power	1000 watts CW
% Video Modulation	0%
Aural Output Power	0 watts
Method of Measurement	The C.W. generator constant amplitude output was varied through the input channel frequency range. The data recorded was relative to the output visual carrier amplitude designated as 0dB.

Frequency Response Data

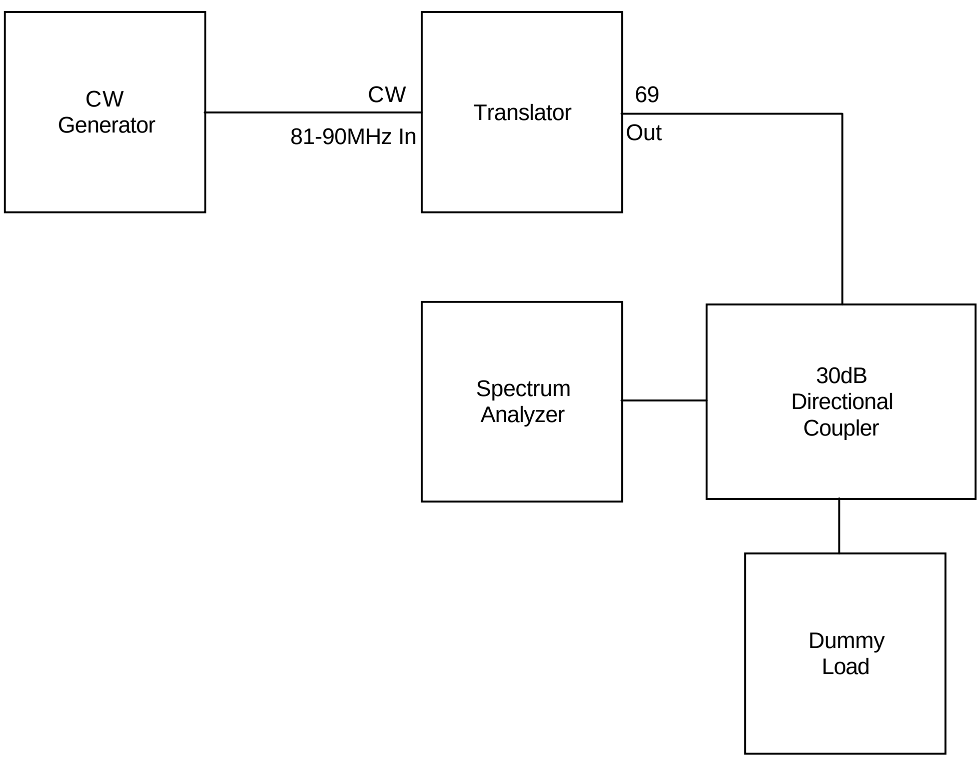
REFERENCE LEVEL: 0dB = 801.25MHz Visual Carrier amplitude

Output Freq. (MHz) Channel 69	Sidebands	Relative Output (dB) Channel 69
799.00		−54.0
799.50		−44.0
800.00		−30.0
800.50		−0.3
801.00		−0.1
801.25	VISUAL CARRIER	0.0
802.00		0.0
802.50		−0.1
803.00		0.0
803.50		+0.1
804.00		−0.1
804.50		−0.2
805.00		−0.2
805.75	AURAL CARRIER	−0.3
806.00		−0.3
806.50		−4.0
807.00		−35.0
807.50		−46.0
808.00		−50.0



AMPLITUDE VS. FREQUENCY CHARACTERISTICS

Figure 2–1



FREQUENCY RESPONSE TEST SETUP
Figure 2-1A

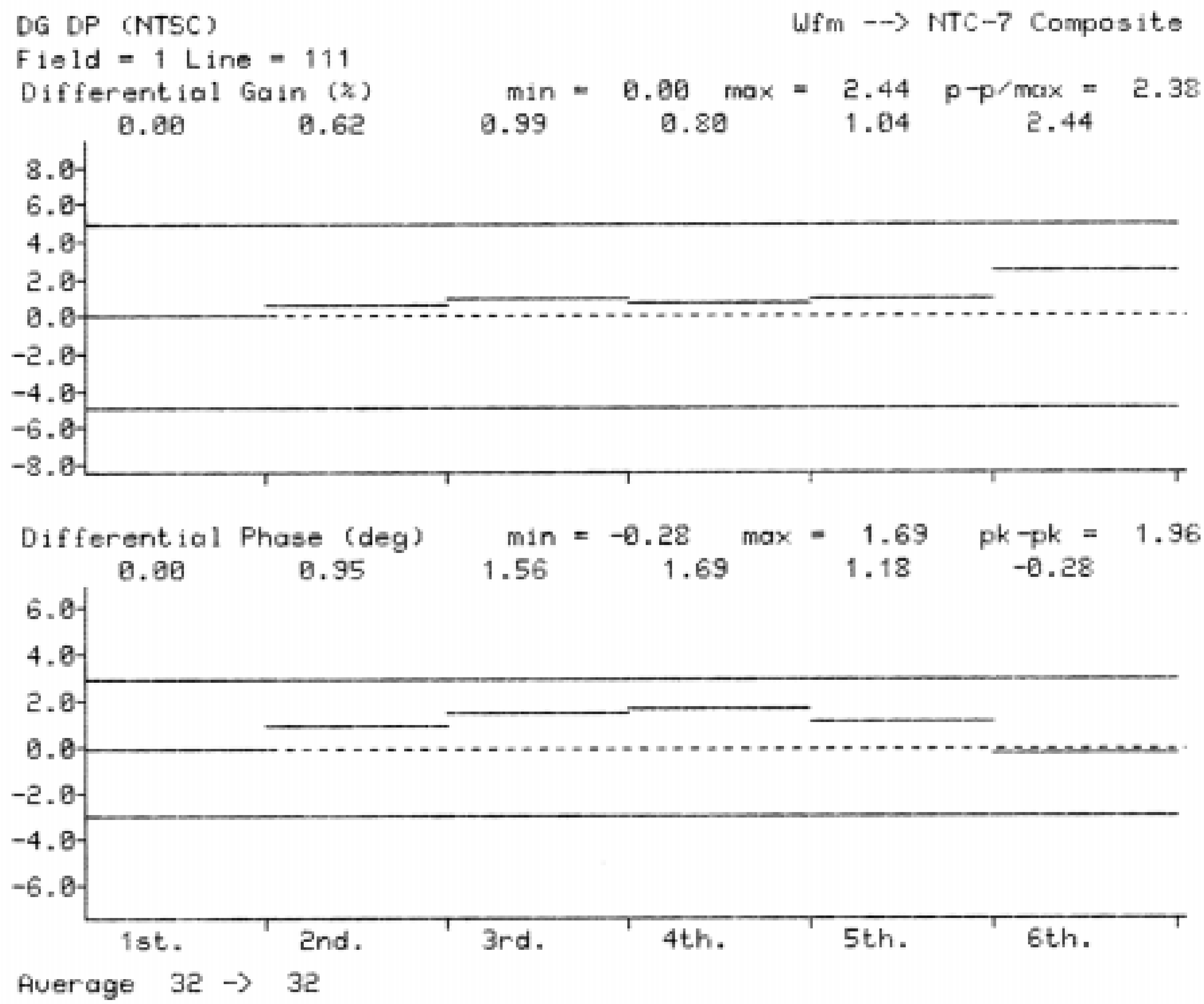
2.2 Differential Phase and Gain [74.750(c)(1)]

Test Equipment Setup	Figure 2–2A
Visual Output Power	1000 watts peak
% Video Modulation	87.5%
Type Video Modulation	Standard 5-riser stairstep modulated with 3.58MHz color subcarrier
Aural Output Power	50 watts average
% Aural Modulation	0%
Method of Measurement	Data was taken from the demodulated output viewed on a waveform monitor after passing through an internal chroma filter.

DIFFERENTIAL PHASE AND GAIN DATA

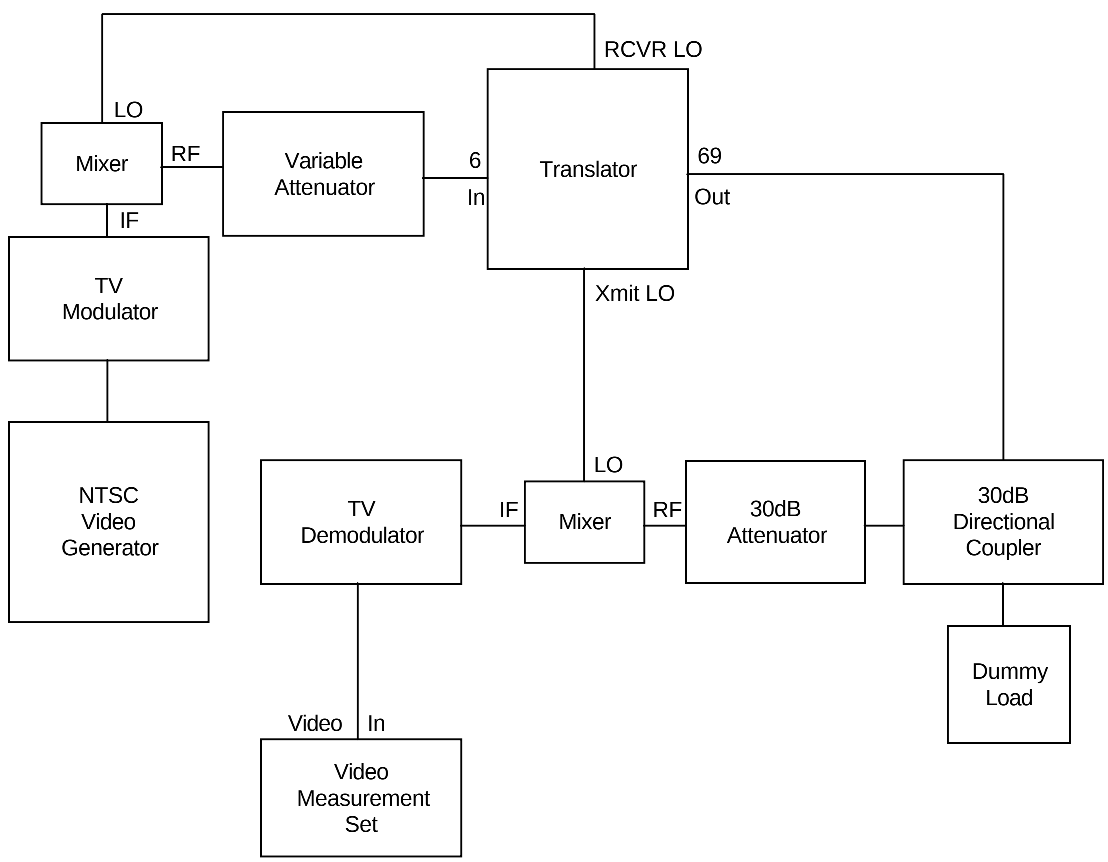
Differential Gain = 2.4%

Differential Phase = 1.7°



DIFFERENTIAL GAIN/DIFFERENTIAL PHASE

Figure 2–2



<u>DIFFERENTIAL PHASE AND GAIN TEST SETUP</u>
Figure 2-2A

2.3 Output Power Control [74.750(c)(4)&(5)]

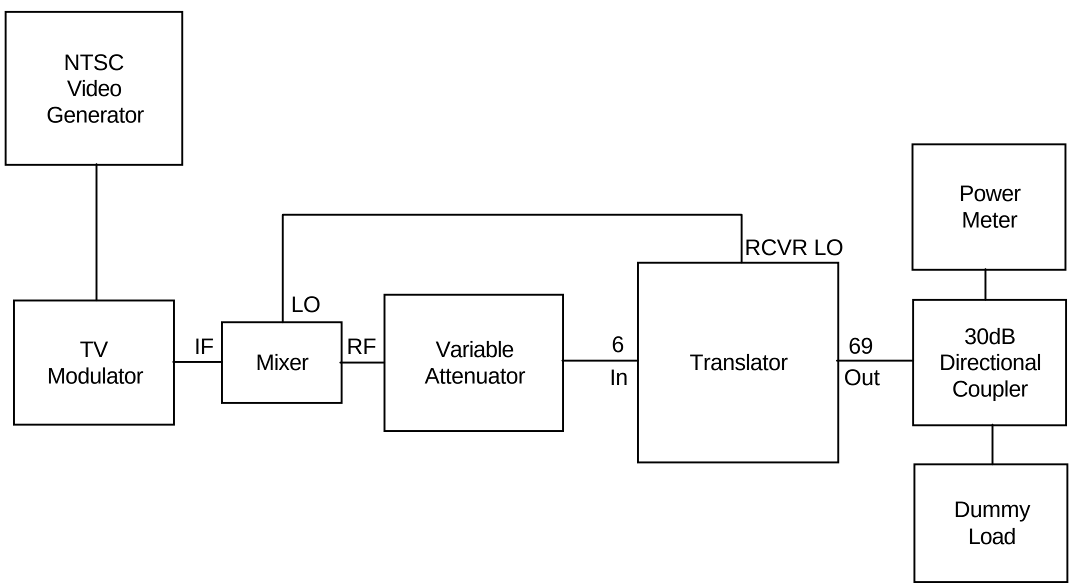
Test Equipment Setup	Figure 2–3A
Visual Output Power	1000 watts peak
% Video Modulation	87.5%
Type Video Modulation	Standard 10-riser stairstep
Aural Output Power	50 watts average
% Aural Modulation	0%
Method of Measurement	The input signal was varied over a 40dB range in 5dB increments using the variable attenuator. Variations in output power were noted using an external average power meter monitoring the translator output.

OUTPUT POWER CONTROL DATA

PEAK INPUT POWER (dBm)	PEAK OUTPUT POWER (dBm)
−25	+60.0
−30	+60.0
−35	+60.0
−40	+59.9
−45	+59.9
−50	+59.8
−55	+59.8
−60	+59.7
−65	+59.7
−70	+59.4

Automatic Operate/Standby

As the signal level into the Receiver approaches −70dBm, the Automatic-On circuit (PC2) will automatically place the TU1000F Translator in a nonradiating condition. Adjustment R4 of the Auto-On circuit allows this received signal operate/standby threshold to be variable from −50dBm to −70dBm.



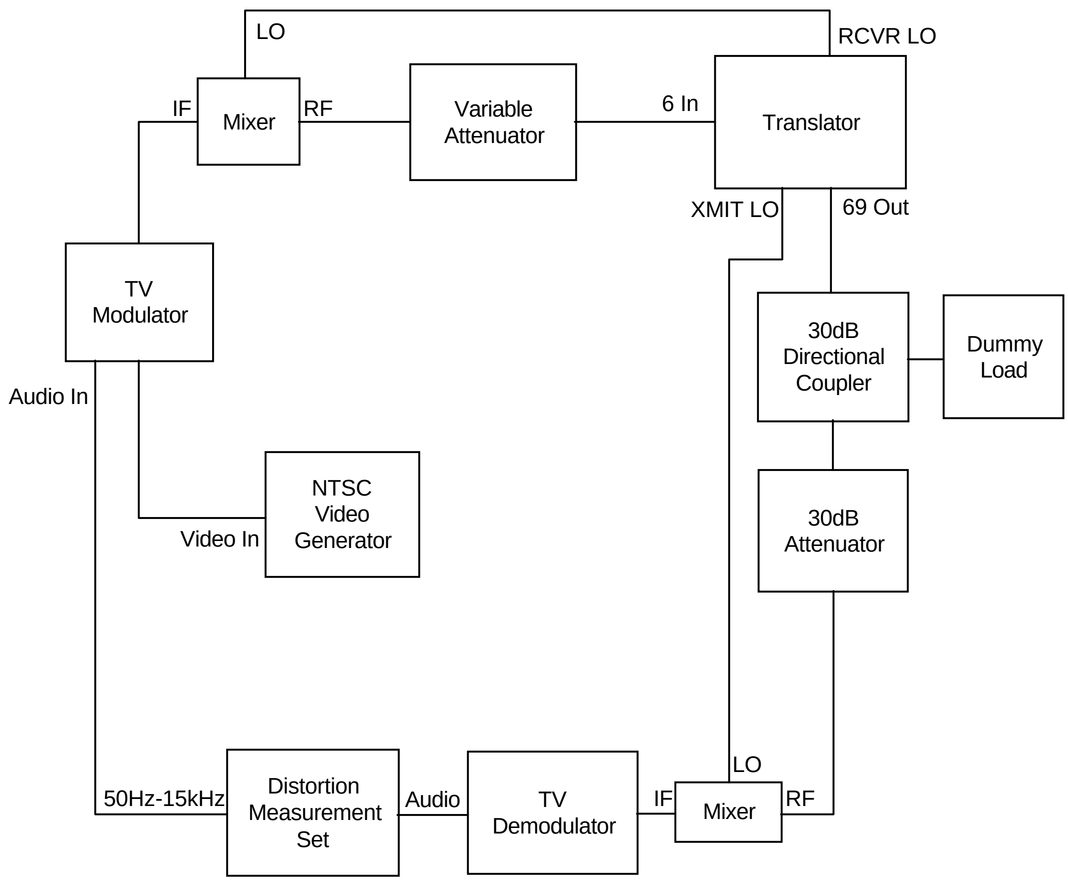
OUTPUT POWER CONTROL TEST SETUP
Figure 2-3A

2.4 Aural Distortion [73.687(b)(3)]

Test Equipment Setup	Figure 2–4A
Visual Output Power	1000 watts peak
% Video Modulation	87.5%
Type Video Modulation	Standard 10-riser stairstep
Aural Output Power	50 watts average
% Aural Modulation	100%
Aural Modulation Signal	Variable audio sine-wave from 50Hz to 15kHz
Method of Measurement	At 100% modulation, the aural modulation frequency was varied and an input/output distortion measurement was noted for each frequency.

AURAL DISTORTION DATA

FREQUENCY	% DISTORTION	
Hz	INPUT	OUTPUT
50	0.35	0.37
100	0.37	0.41
400	0.38	0.39
1000	0.30	0.35
5000	0.24	0.26
7500	0.21	0.23
10000	0.27	0.28
15000	0.32	0.33



AURAL DISTORTION TEST SETUP
Figure 2-4A

2.5 Frequency Modulation Noise [73.687(b)(4)]

Test Equipment Setup	Figure 2–5A
Visual Output Power	1000 watts peak
% Video Modulation	87.5%
Type Video Modulation	Standard 10-riser stairstep
Aural Output Power	50 watts average
% Aural Modulation	100% and 0%
Aural Modulation Signal	400Hz
Method of Measurement	With aural modulation applied, a reading was obtained from the Distortion Measurement Set RMS voltmeter. With modulation removed, a new reading was recorded. The signal to noise calculation was checked against the dB scale of the RMS voltmeter.

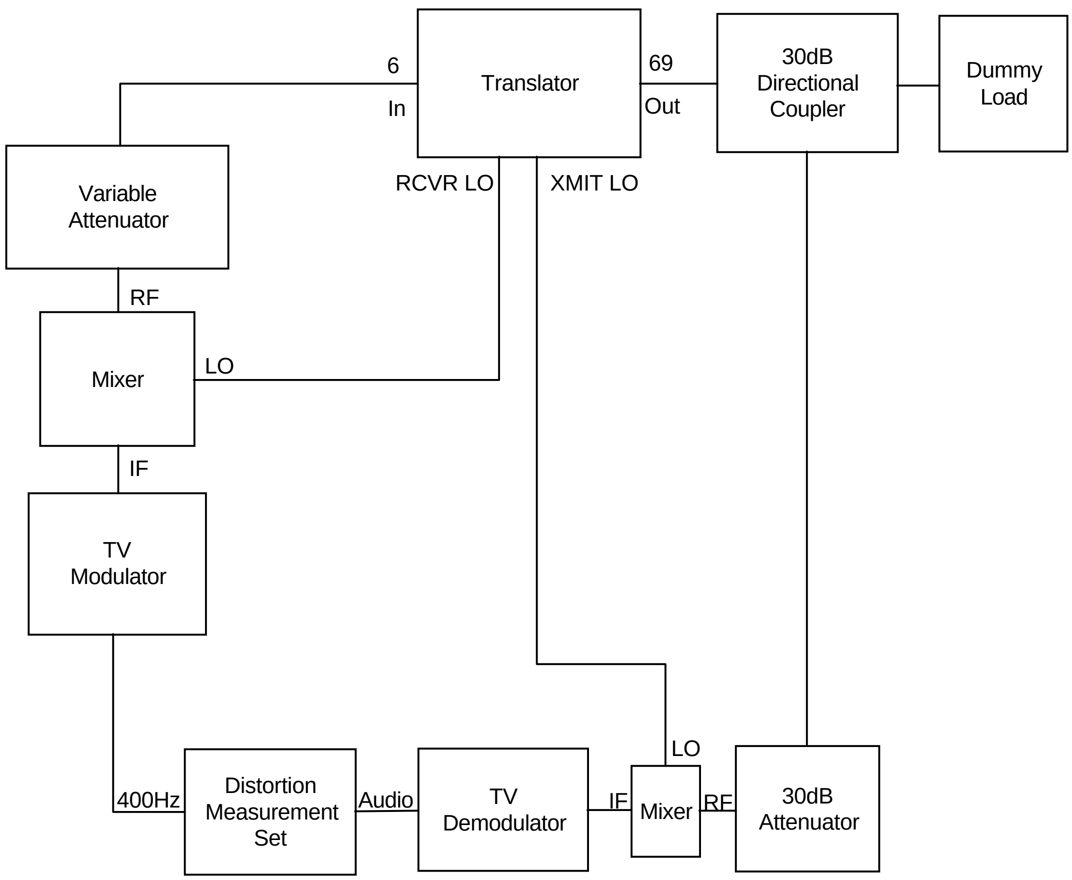
FM NOISE DATA

Detected Output w/o modulation = 2.4mV

Detected Output w/modulation = 2.7V

$$\text{FM Noise} = 20 \log \frac{\text{Output w/o modulation}}{\text{Output w/modulation}} = \frac{.0024\text{V}}{2.7\text{V}}$$

FM Noise = −61dB



<u>FM NOISE TEST SETUP</u>
Figure 2-5A

2.6 Antenna Terminal Radio Frequency Voltage [74.750(c)(2)]

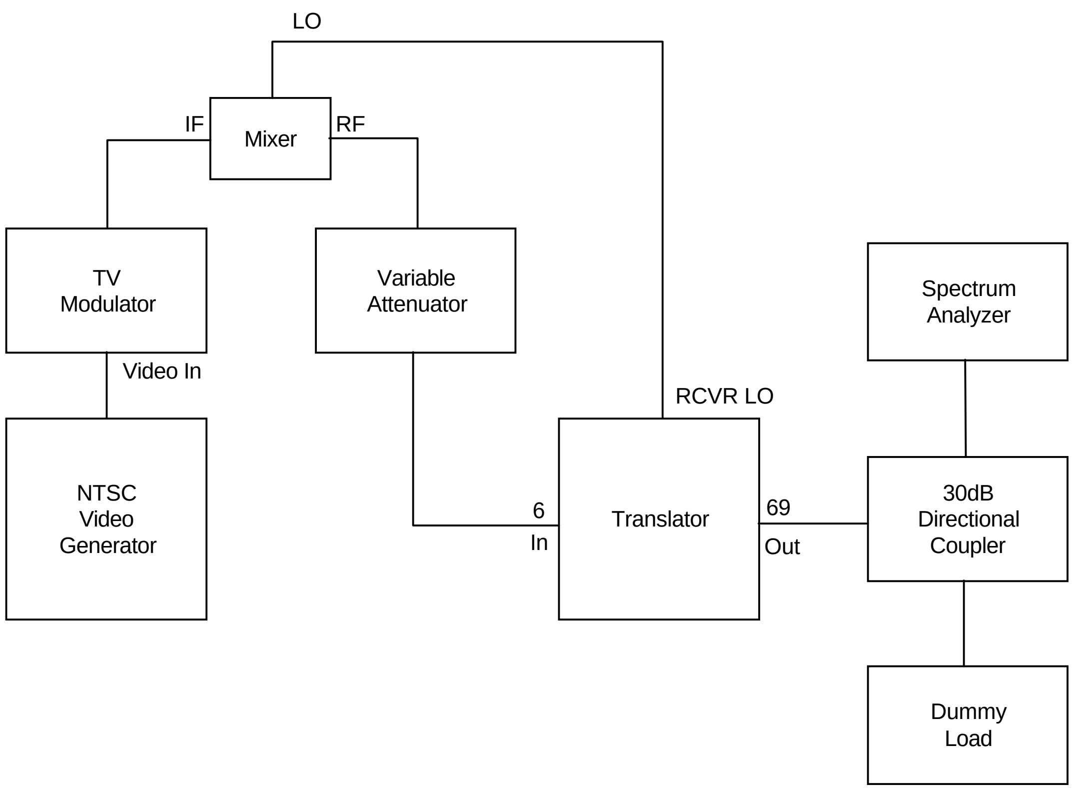
Test Equipment Setup	Figure 2–6A
Visual Output Power	1000 watts peak
% Video Modulation	87.5%
Type Video Modulation	Standard 10-riser stairstep
Aural Output Power	50 watts average
% Aural Modulation	0%
Method of Measurement	The spectrum analyzer display was adjusted for a zero reference level at the visual carrier using the following settings:

Frequency Span/Division	–	1MHz
Resolution Bandwidth	–	30kHz
Time/Division	–	10ms
Input Attenuation	–	30dB
Reference Level	–	−2dBm
Video Filter	–	Off

All emissions were checked relative to peak sync from 0 to 10.0GHz. Those emissions below −80dB were not noted.

ANTENNA TERMINAL RF VOLTAGE DATA

FREQUENCY (MHz)	LEVEL (dB relative to peak visual)	
801.25	0dB	Visual Carrier
805.75	−13dB	Aural Carrier
796.75	−62dB	Visual Carrier −4.5MHz
810.25	−65dB	Aural Carrier +4.5MHz
792.25	−65dB	Visual Carrier −9.0MHz
814.75	−70dB	Aural Carrier +9.0MHz
847.00	– – – –	Local Oscillator
1602.50	−65dB	Visual 2nd Harmonic
1611.50	−70dB	Aural 2nd Harmonic



ANTENNA TERMINAL RF TEST SETUP
Figure 2-6A

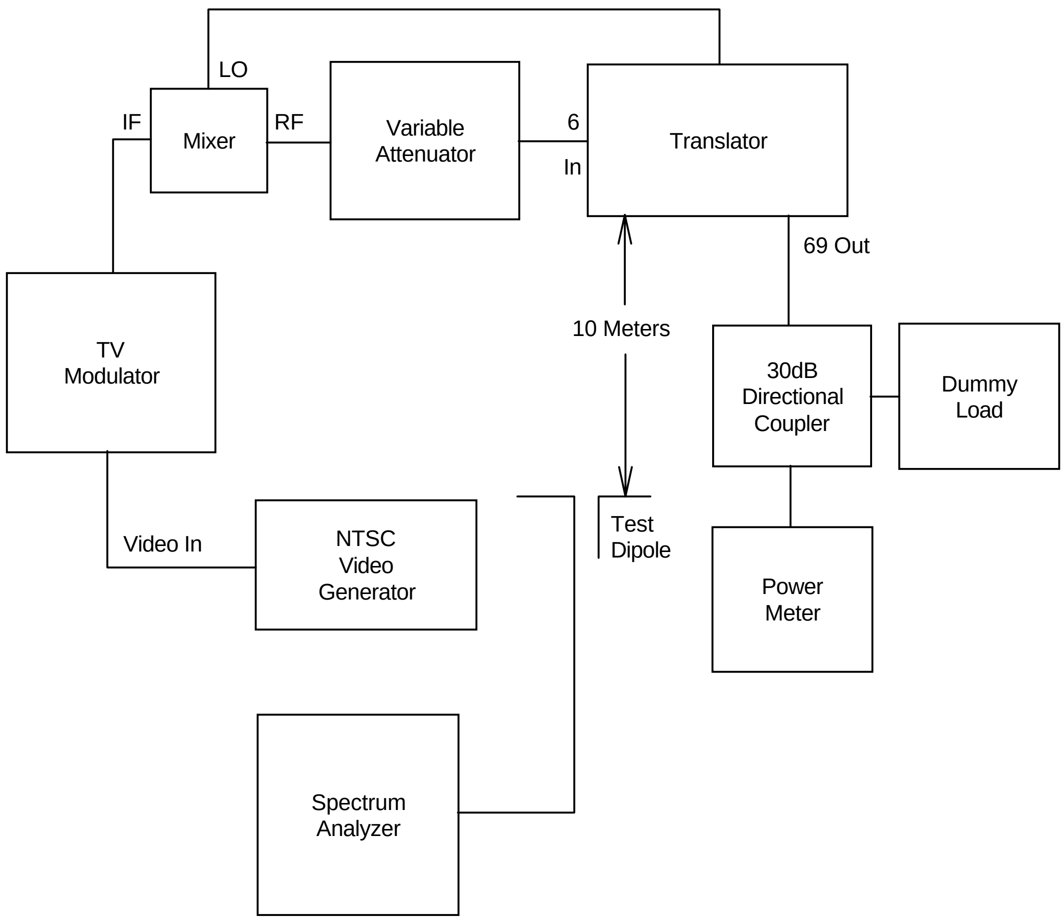
2.7 Spurious Radiation Field Strength [2.993]

Test Equipment Setup	Figure 2–7A
Visual Output Power	1000 watts peak
% Video Modulation	87.5%
Type Video Modulation	Standard 10-riser stairstep
Aural Output Power	50 watts average
% Aural Modulation	0%
Method of Measurement	The broadband receive antennas were moved horizontally and vertically around the unit to maximize receive level. Absolute power level of each spurious radiation was measured on a calibrated spectrum analyzer and converted to an equivalent field strength by finding the power density (absolute power divided by the antenna area). The relative field strength of the spurious radiation was then calculated with respect to the unit's rated output power. The field strength of the rated output was found using $\sqrt{49.2P}/R$ (P = rated output, R = distance). All emissions were assumed to be radiated from half-wave dipoles. Frequencies scanned extended from 20MHz to 10.0GHz.

SPURIOUS RADIATION FIELD STRENGTH DATA

$$E\ \text{Output} = \sqrt{49.2P}/R = \sqrt{(49.2)(1000)}/10 = 22.2\text{Volts/Meter}$$

FREQUENCY (MHz)		POWER MEASURED (dBm)	EQUIVALENT FIELD STRENGTH (VOLTS/METER)	RELATIVE FIELD STRENGTH (dB)
OUTPUT CHANNEL				
Visual	801.25	−46	2.28×10^{-2}	−59.8dB
Aural	805.75	−60	4.55×10^{-3}	−73.8dB
LO	847.00	Not Visible	– – – – – –	– – – –
2nd Harmonic	1602.50	Not Visible	– – – – – –	– – – –
INPUT CHANNEL				
Visual	83.25	Not Visible	– – – – – –	– – – –
Aural	87.75	Not Visible	– – – – – –	– – – –
LO	129.00	Not Visible	– – – – – –	– – – –



<u>SPURIOUS CABINET RADIATION TEST SETUP</u>
Figure 2-7A

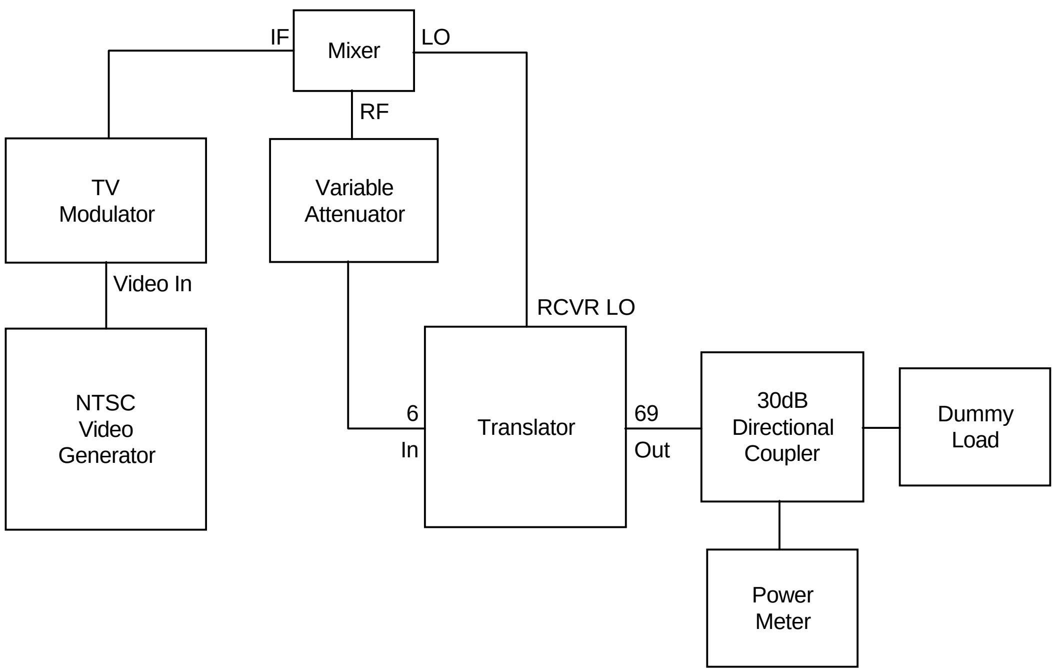
2.8 Power Output Meter Calibration [2.985]

Test Equipment Setup	Figure 2–8A
Visual Output Power	1000 watts peak
% Video Modulation	87.5%
Type Video Modulation	Standard sync with blanking level set at 75% of peak sync and maintained through the interval between pulses (0% APL).
Aural Output Power	50 watts average
% Aural Modulation	0%
Method of Measurement	The TU20F Translator/Driver was adjusted to obtain a 595mW average visual reading from the TU1000F Translator. This power level corresponds to 1000 watts peak power when using the factor of 1.68 and compensating for the output attenuation as shown:

$$\underset{\text{meter reading}}{[595\text{mW}]} \times \underset{\text{attenuation}}{[10^3]} \times \underset{\text{power factor}}{[1.68]} = 1000\text{W}$$

The test modulator's aural level was then adjusted to obtain a 645mW indication on the external power meter (595W average visual + 50W average aural –30dB = 645mW).

The FWD control of the Metering Detector, located behind an access hole on the translator Front Panel, was adjusted to provide a 100% indication on the % RF POWER meter with the meter switch set to FWD. The % POWER meter and meter switch are also located on the Front Panel.



POWER OUTPUT METER CALIBRATION SETUP
Figure 2-8A

2.9 Frequency Stability [74.750(c)(3)]

Test Equipment Setup — Figure 2–9A

Method of Measurement — The EMCEE Synthesizers used for the VHF Receiver and UHF Upconverter were removed from the translator and placed in an environmental chamber. The synthesizer's stabilities were first tested with ±15% variations in the AC line voltage. The chamber's internal temperature was then changed and the synthesizer frequencies were noted at every 10°C increments. The results of both tests are shown in the following tables.

AC LINE VOLTAGE	CH 6 RECEIVER SYNTHESIZER (MHz)	CHANNEL ERROR (Hz)
95	129.000006	+6
115	129.000007	+7
135	129.000006	+6

TEMP C°	CH 6 RECEIVER SYNTHESIZER (MHz)	CHANNEL ERROR (Hz)
+50	128.999964	−36
+40	128.999976	−24
+30	128.999988	−12
+20	129.000004	+4
+10	129.000015	+15
0	129.000035	+35
−10	129.000053	+53
−20	129.000040	+40
−30	129.000023	+23

AC LINE VOLTAGE	CH 69 UPCONVERTER SYNTHESIZER (MHz)	CHANNEL ERROR (Hz)
95	847.000124	+124
115	847.000122	+122
135	847.000123	+123

TEMP C°	CH 69 UPCONVERTER SYNTHESIZER (MHz)	CHANNEL ERROR (Hz)
+50	847.000176	+176
+40	847.000202	+202
+30	847.000156	+156
+20	847.000125	+125
+10	847.000098	+98
0	847.000053	+53
−10	847.000015	+15
−20	847.000047	+47
−30	847.000088	+88

Combining the worst instances of frequency variation for the Receiver and Upconverter synthesizers, the TU1000F carrier frequencies are well within the .002% specification for television translators. The measured stability also complies with the ±1kHz requirement necessary for zero offset carrier frequency operation. (These synthesizers are not capable of 10kHz offset.)

Test Equipment Setup — Figure 2–9A

Method of Measurement — To provide the customer with ±10kHz precision offset, the Vectron CO-254D57 high stability oscillator with multiplier will be used as a direct replacement for the EMCEE synthesizers in the TU1000F Translator. The Vectron CO-254D57 oscillator has a stability of ±5 x 10^{-7} and can be used in either or both the Receiver and Upconverter sections of the translator.

AC LINE VOLTAGE	CH 6 RECEIVER OSCILLATOR (MHz)	X2 MULTIPLIER (MHz)	CHANNEL ERROR (Hz)
95	64.500006	129.000012	+12
115	64.500007	129.000014	+14
135	64.500007	129.000014	+14

TEMP C°	CH 6 RECEIVER OSCILLATOR (MHz)	X2 MULTIPLIER (MHz)	CHANNEL ERROR (Hz)
+50	64.499976	128.999952	−48
+40	64.499991	128.999982	−18
+30	64.500001	129.000002	+2
+20	64.500007	129.000014	+14
+10	64.500018	129.000036	+36
0	64.500031	129.000062	+62
−10	64.500022	129.000044	+44
−20	64.500009	129.000018	+18
−30	64.499996	128.999992	−8

AC LINE VOLTAGE	CH 69 UPCONVERTER OSCILLATOR (MHz)	X16 MULTIPLIER (MHz)	CHANNEL ERROR (Hz)
95	52.937502	847.000032	+32
115	52.937502	847.000032	+32
135	52.937503	847.000048	+48

TEMP C°	CH 69 UPCONVERTER OSCILLATOR (MHz)	X16 MULTIPLIER (MHz)	CHANNEL ERROR (Hz)
+50	52.937481	846.999696	−304
+40	52.937488	846.999808	−192
+30	52.937494	846.999904	−96
+20	52.937500	847.000000	0
+10	52.937504	847.000064	+64
0	52.937511	847.000176	+176
−10	52.937518	847.000288	+288
−20	52.937522	847.000352	+352
−30	52.937527	847.000432	+432

Combining the worst instances of frequency variations for the EMCEE Synthesizers, the TU1000F carrier frequencies are well within the .002% FCC specifications for Low Power Television Translators and within the ±1kHz requirement for zero frequency offset. When using the Vectron high stability CO254D57 oscillator and X2, X4 or X16 Multiplier, the translator's frequency stability also falls within the ±1000Hz necessary for ±10kHz precision offset. (EMCEE synthesizers are not capable of 10kHz step resolution.)

TCXOs *(50 kHz to 140 MHz)*

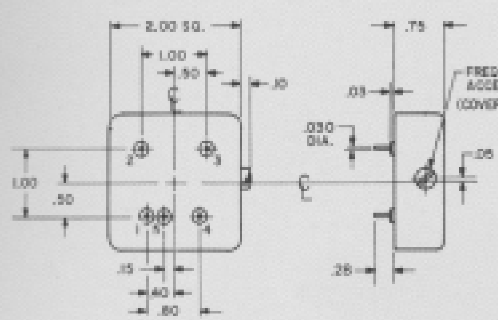
Series CO-252 and CO-254 offer the highest stability alternatives and broadest range of options within Vectron's line of TCXOs. The TCXOs on the adjacent pages are more limited in input/output alternatives and other options, but are smaller in size.

	50 kHz to 20 MHz CO-252 SERIES	20.1 MHz to 140 MHz CO-254 SERIES
FREQUENCY	Sine: 1 MHz to 20 MHz TTL: 200 kHz to 20 MHz CMOS: 50 kHz to 15 MHz HCMOS: 50 kHz to 20 MHz	Sine: 20.01 MHz to 140 MHz TTL: 20.01 MHz to 100 MHz CMOS: 20.01 MHz to 15 MHz HCMOS: 20.01 MHz to 50 MHz ECL: 20.01 MHz to 140 MHz
STABILITY Temperature (Temp. Range **A**) +15°C to +35°C:	**CO-252A17:** $\pm 1 \times 10^{-7}$ **CO-252A58:** $\pm 5 \times 10^{-8}$	**CO-254A57:** $\pm 5 \times 10^{-7}$ **CO-254A17:** $\pm 1 \times 10^{-7}$
(Temp. Range **B**) 0°C to +50°C:	**CO-252B57:** $\pm 5 \times 10^{-7}$ **CO-252B27:** $\pm 2 \times 10^{-7}$ **CO-252B17:** $\pm 1 \times 10^{-7}$	**CO-254B16:** $\pm 1 \times 10^{-6}$ **CO-254B57:** $\pm 5 \times 10^{-7}$ **CO-254B27:** $\pm 2 \times 10^{-7}$
(Temp. Range **C**) 0°C to +70°C:	**CO-252C16:** $\pm 1 \times 10^{-6}$ **CO-252C57:** $\pm 5 \times 10^{-7}$ **CO-252C37:** $\pm 3 \times 10^{-7}$	**CO-254C36:** $\pm 3 \times 10^{-6}$ **CO-254C16:** $\pm 1 \times 10^{-6}$ **CO-254C37:** $\pm 3 \times 10^{-7}$
(Temp. Range **D**) −20°C to +70°C:	**CO-252D16:** $\pm 1 \times 10^{-6}$ **CO-252D57:** $\pm 5 \times 10^{-7}$	**CO-254D56:** $\pm 5 \times 10^{-6}$ **CO-254D16:** $\pm 1 \times 10^{-6}$ **CO-254D57:** $\pm 5 \times 10^{-7}$
(Temp. Range **E**) −40°C to +75°C:	**CO-252E56:** $\pm 5 \times 10^{-6}$ **CO-252E26:** $\pm 2 \times 10^{-6}$ **CO-252E16:** $\pm 1 \times 10^{-6}$	**CO-254E56:** $\pm 5 \times 10^{-6}$ **CO-254E26:** $\pm 2 \times 10^{-6}$ **CO-254E16:** $\pm 1 \times 10^{-6}$
(Temp. Range **F**) −55°C to +85°C:	**CO-252F56:** $\pm 5 \times 10^{-6}$ **CO-252F26:** $\pm 2 \times 10^{-6}$ **CO-252F16:** $\pm 1 \times 10^{-6}$	**CO-254F56:** $\pm 5 \times 10^{-6}$ **CO-254F26:** $\pm 2 \times 10^{-6}$ **CO-254F16:** $\pm 1 \times 10^{-6}$
(Temp. Range **G**) −55°C to +105°C:	**CO-252G56:** $\pm 5 \times 10^{-6}$	**CO-254G56:** $\pm 5 \times 10^{-6}$
(Temp. Range **H**) −55°C to +125°C:	**CO-252H15:** $\pm 1 \times 10^{-5}$	**CO-254H15:** $\pm 1 \times 10^{-5}$
Aging Rate	≤5 MHz: 5×10^{-7}/year (3×10^{-9}/day avg) >5 MHz: 1×10^{-6}/year (5×10^{-9}/day avg)	
Short Term (Allan Variance)	1×10^{-9}/second under constant conditions	
Frequency vs Supply	2×10^{-8} per percent in supply with 10 to 28 Vdc input; 1×10^{-7} per percent change in supply for 5 to 9 Vdc input	

OUTLINE/INSTALLATION DRAWINGS

CO-252, CO-254 SERIES

PCB mount (standard)



Pin	WITH SINGLE SUPPLY No "V" Option	WITH SINGLE SUPPLY "V" Option	WITH SEPARATE TTL SUPPLY No "V" Option	WITH SEPARATE TTL SUPPLY "V" Option
1	Output	Output	Output	Output
2	Supply (+)	Supply (+)	Supply (+)	Supply (+)
3	0 Volt/case	0 Volt/case	*0 Volt/case	*0 Volt/case
4	0 Volt/case	VCXO in	+5V	VCXO in
5	*rf return	*rf return	*rf return	+5 Vdc

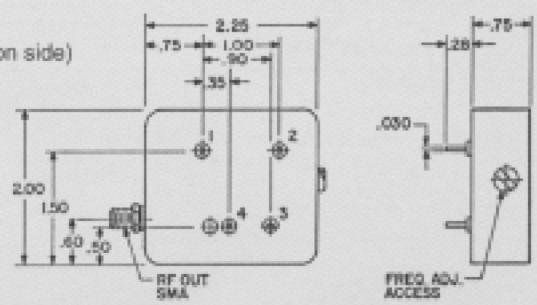
*Internally connected (except pin 5 is not internally connected with sine output in CO-252 series)

RF Connector options

Option **SW** (SMA connector on side)

Pin	Function
1	Supply (+)
2	0 volts, case
*3	Case
4	Case

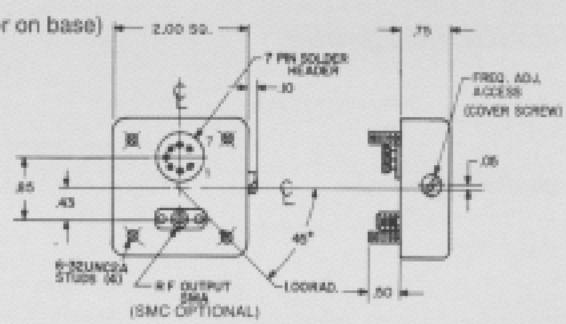
*In units with electronic tuning ("V" option), control voltage is applied from pin 3 to pin 2.

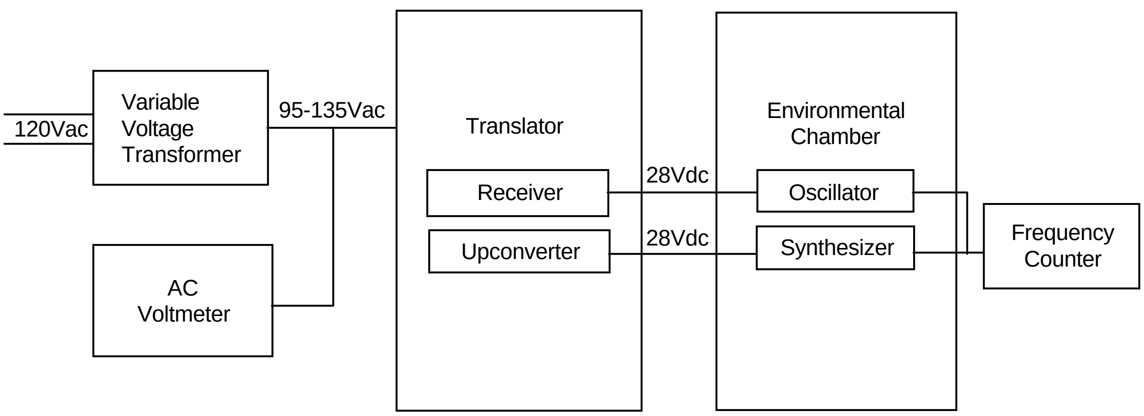


Option **W** (SMA connector on base)

Pin	Function
1	Supply (+)
2	N/C
3	0 volts, case
4	N/C
5	Case
6	N/C
*7	N/C

* In units with electronic tuning ("V" option), control voltage is applied from pin 7 to pin 3.





FREQUENCY STABILITY TEST SETUP
Figure 2-9A

2.10 Certification Identification Label [2.1003]

The certification identification label for the aforementioned translator model is shown below. This label shall be displayed conspicuously on the rear panel of the appropriate unit.

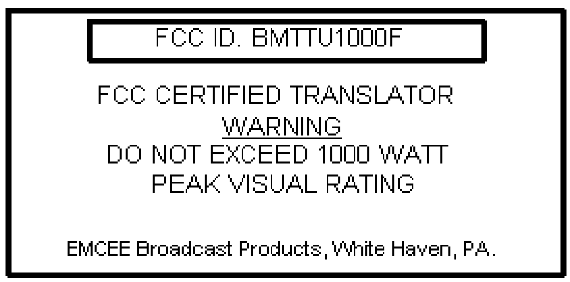


Figure 2–10

2.11 Photographs [2.983(g)]

The following photographs will be used as part of the TU1000F Instruction Manual.