Certification Submission for the Model TV1E 1 Watt VHF Translator per Part 74, Subpart G of the FCC Rules and Regulations

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SECTION I

1.0 INTRODUCTION

1.1 General

This report contains data required for certification of the EMCEE Model TV1E Television Translator which EMCEE plans to manufacture in quantity. The Translator is rated to provide 1 watt peak visual and 0.1 watt average aural on any FCC specified channel extending from 54 to 216MHz. The output frequency of the translator tested was VHF channel 6 (82 to 88MHz) with an input of channel 36 (602 to 608MHz). The data contained in this report was obtained from tests performed 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 TV1E Translator can be found in the EMCEE TV1E V/U Instruction Manual.

The TV1E Television Translator is composed of a Translator assembly and a 1 Watt Final Amplifier assembly. The Translator assembly is made up of three sections: the Downconverter, the IF and the Upconverter. 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 a momentary fade of the incoming signal. In the Upconverter, the carriers from the IF are shifted to any desired VHF TV frequency and amplified to the proper level to drive the Power Amplifier drawer. A complete explanation of these circuits can be found in the TV1E V/U Translator Instruction Manual.

The Translator and Final Amplifier assemblies are all contained in the same cabinet and, in conjunction with the remote Preamplifier, are designated as the TV1E Translator. The TV1E 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 certification tests were conducted by Robert Nash, EMCEE VP/Director of Engineering. Mr. Nash has more than 23 years of experience in the development and testing of television transmitters and translators.

1.3 Test Equipment

1. Antenna, Adjustable Dipole Set, 30MHz to 1GHz, Model 3121, EMCO
2. Antenna, Conical Helix, 1-11GHz, Model ALN108B, AEL
3. Attenuator, 10dB, Model 766-10, Narda
4. Attenuator, 20dB, Model 766-20, Narda
5. Attenuator, 30dB, Model 766-30, Narda
6. Distortion Measurement Set, Model 339A, Hewlett Packard
7. Demodulator, Model 1450, Tektronix
8. Diode Detector, 50 ohm, Model 423A, Hewlett Packard
9. Envelope Delay Measuring Set, Model 201/1, Shibasoku
10. Environmental Chamber, Tenny Jr., Tenny Engineering
11. Frequency Counter, Model 5386A, Hewlett Packard
12. Mixer, Model ZAD-2, 37023, Mini Circuits
13. Modulator, Model EM1, EMCEE
14. Multimeter, Digital, Model E2378A, Hewlett Packard
15. NTSC Vectorscope, Model 520, Tektronix
16. Power Meter, Model 435A, Hewlett Packard
17. NTSC Video Generator, Type 149A, Tektronix
18. Spectrum Analyzer, Model 8595E, Hewlett Packard
19. Waveform Monitor, Model 1485R, Tektronix
20. 1 Watt VHF Television Translator, Model TV1E, EMCEE

1.4 Active Device List

The following is a complete listing of all the active devices used in the EMCEE Model TV1E VHF Television Translator. The devices are grouped together as seen on each specific schematic or interconnection diagram. Given with each device is its schematic designator, EMCEE part number and function.

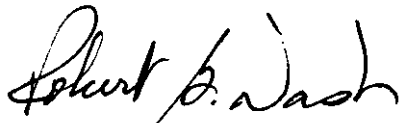
DEVICE	PART #/DESIGNATOR	FUNCTION
REFERENCE OSCILLATOR Schematic Diagram 10368037		
TCXO	RTX0771AD/G1	Oscillator
Integrated Circuit	3B130/U1	RF Amplifier
VHF SYNTHESIZER Schematic Diagram 30362427 (Band I)		
Integrated Circuit	3B160/U4	Reference Divider
Integrated Circuit	MC12028AD/U2	Dual Prescaler
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
VHF SYNTHESIZER Schematic Diagram 30362003 (Band III)		
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
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

DEVICE	PART #/DESIGNATOR	FUNCTION
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**		
Transistor	2B39/Q1	RF Amplifier
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

DEVICE	PART #/DESIGNATOR	FUNCTION
PRECORRECTOR Schematic Diagram A274-36		
Diode	1B36/CR1, CR2	RF Switch
Transistor	2B06/Q2	RF Amplifier
UPCONVERTER AMPLIFIER Schematic Diagram 20331117		
Transistor	2B129/Q1	RF Amplifier
Transistor	2B130/Q2	RF Amplifier
Transistor	2B131/Q3	RF Amplifier
1W VHF LOW BAND AMPLIFIER Schematic Diagram 20331081		
Transistor	2B26/Q1	Current Regulator
Transistor	2B109/Q2	RF Amplifier
1W VHF HIGH BAND AMPLIFIER Schematic Diagram B331-12		
Transistor	2B26/Q3, Q4	Current Regulator
Transistor	2B109/Q1, Q2	RF 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 TV1E Television Translator are true and correct to the best of my knowledge.



Robert G. Nash
VP/Director of Engineering

SECTION II
TEST PROCEDURES AND DATA

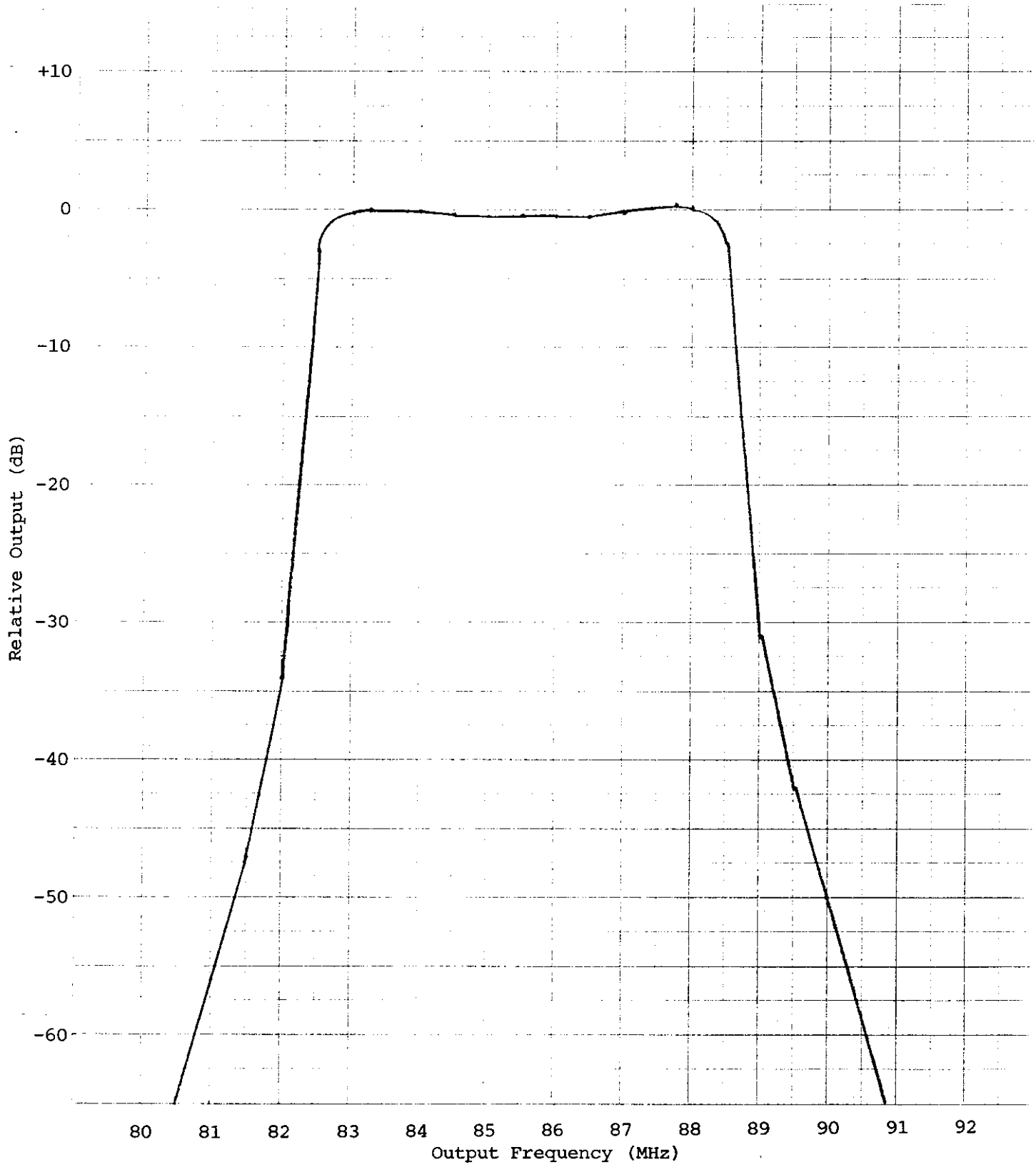
2.1 Frequency Response [73.687(a)(3)]

Test Equipment Setup	Figure 2–1A
Visual Output Power	1 watt C.W.
% 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.

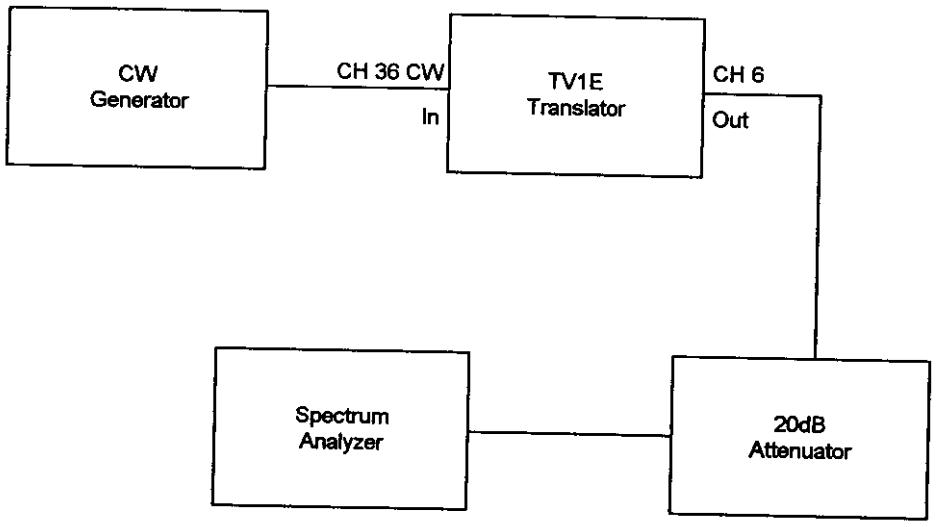
FREQUENCY RESPONSE DATA

REFERENCE LEVEL: 0dB = 83.25MHz Visual Carrier Amplitude

OUTPUT FREQ. (MHz) CHANNEL 6		RELATIVE OUTPUT (dB) CHANNEL 10
81.00		-56.0
81.50		-47.0
82.00		-34.0
82.50		-3.0
83.00		-0.2
83.25	Reference (Visual Carrier)	0
84.00		-0.1
84.50		-0.3
85.00		-0.4
85.50		-0.3
86.00		-0.4
86.50		-0.5
87.00		-0.2
87.75	(Aural Carrier)	+0.4
88.00		+0.2
88.50		-2.5
89.00		-31.0
89.50		-44.0
90.00		-50.0



AMPLITUDE VS. FREQUENCY CHARACTERISTICS
Figure 2–1



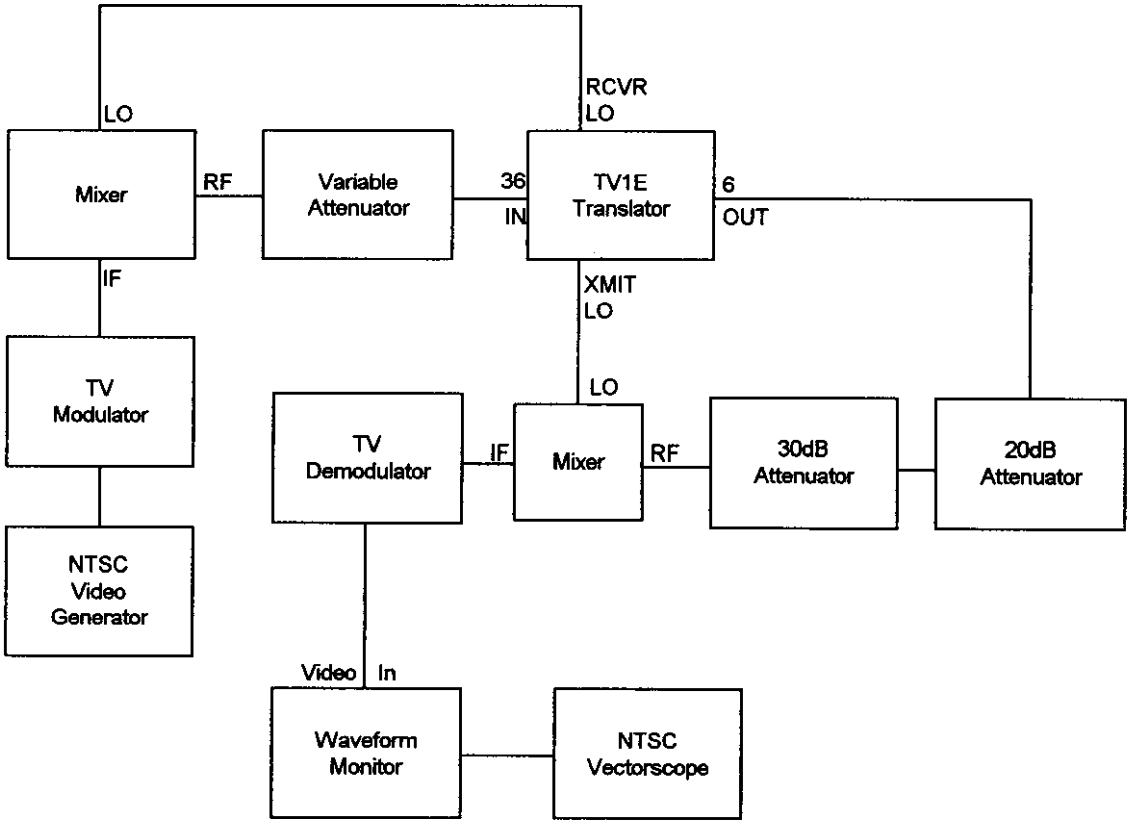
FREQUENCY RESPONSE TEST SETUP
Figure 2-1A

2.2 Differential Phase and Gain [73.682(a)(20)(vii)]

Test Equipment Setup	Figure 2–2A
Visual Output Power	1 watt peak
% Video Modulation	87.5%
Type Video Modulation	Standard 5-riser stairstep modulated with 3.58MHz color subcarrier
Aural Output Power	0.1 watt 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 Phase	=	+2.5°
Differential Gain	=	+1.8%



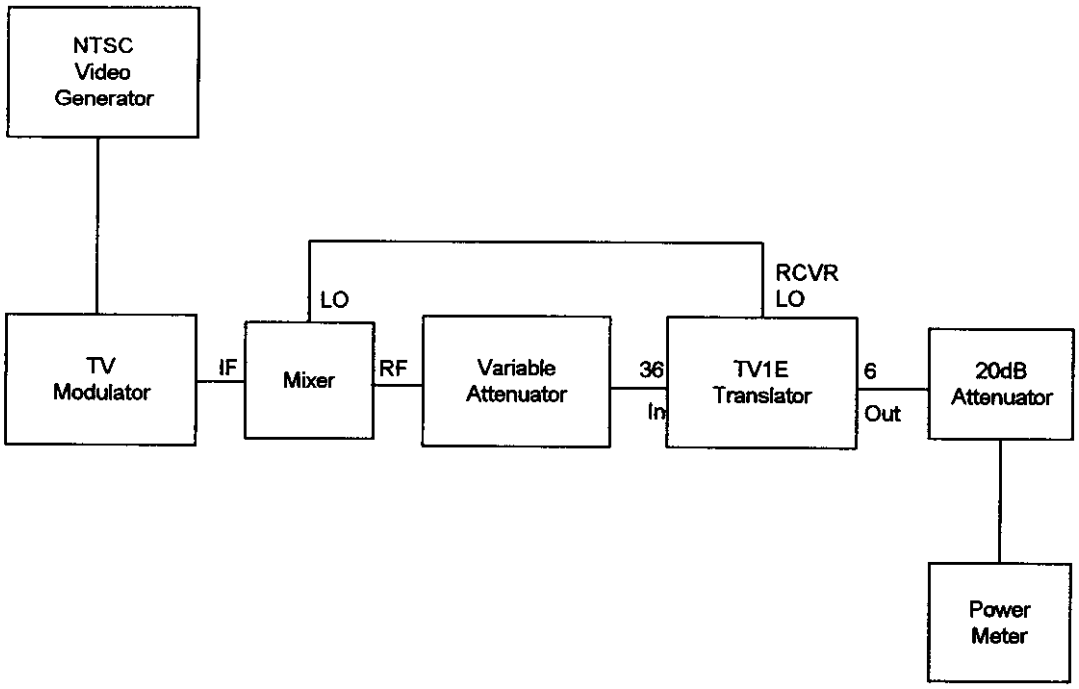
DIFFERENTIAL PHASE AND GAIN TEST SETUP
Figure 2-2A

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

Test Equipment Setup	Figure 2–3
Visual Output Power	1 watt peak
% Video Modulation	87.5%
Type Video Modulation	Standard 10-riser stairstep
Aural Output Power	0.1 watt 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 the power meter monitoring the output.

OUTPUT POWER CONTROL DATA

PEAK INPUT POWER (dBm)	PEAK OUTPUT POWER (dBm)
-20	+30.0
-25	+30.0
-30	+30.0
-35	+30.0
-40	+30.0
-45	+30.0
-50	+30.0
-55	+29.9
-60	+29.8



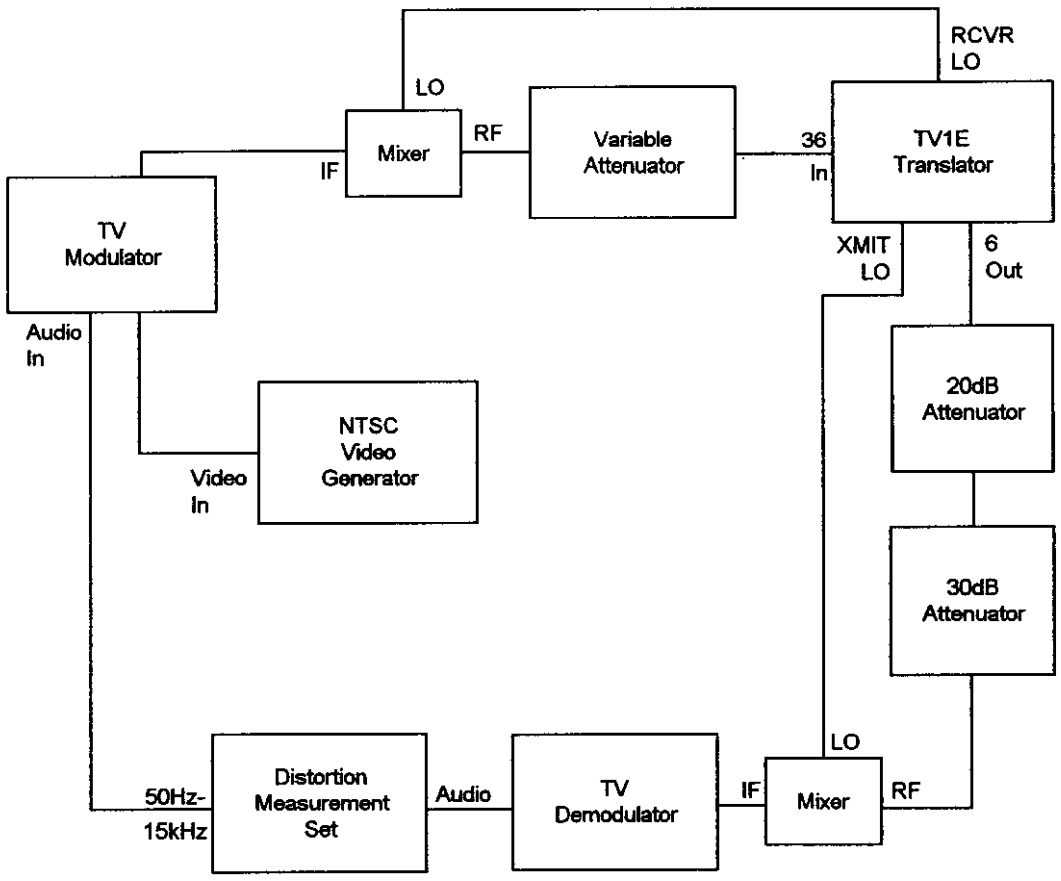
OUTPUT POWER CONTROL TEST SETUP
Figure 2-3

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

Test Equipment Setup	Figure 2–4
Visual Output Power	1 watt peak
% Video Modulation	87.5%
Type Video Modulation	Standard 10-riser stairstep
Aural Output Power	0.1 watt 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	0.40
100	0.25	0.32
400	0.21	0.25
1,000	0.15	0.21
5,000	0.20	0.25
7,500	0.28	0.32
10,000	0.35	0.41
15,000	0.41	0.45



AURAL DISTORTION TEST SETUP
Figure 2-4

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

Test Equipment Setup	Figure 2–5
Visual Output Power	1 watt
Aural Output Power	0.1 watt 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.

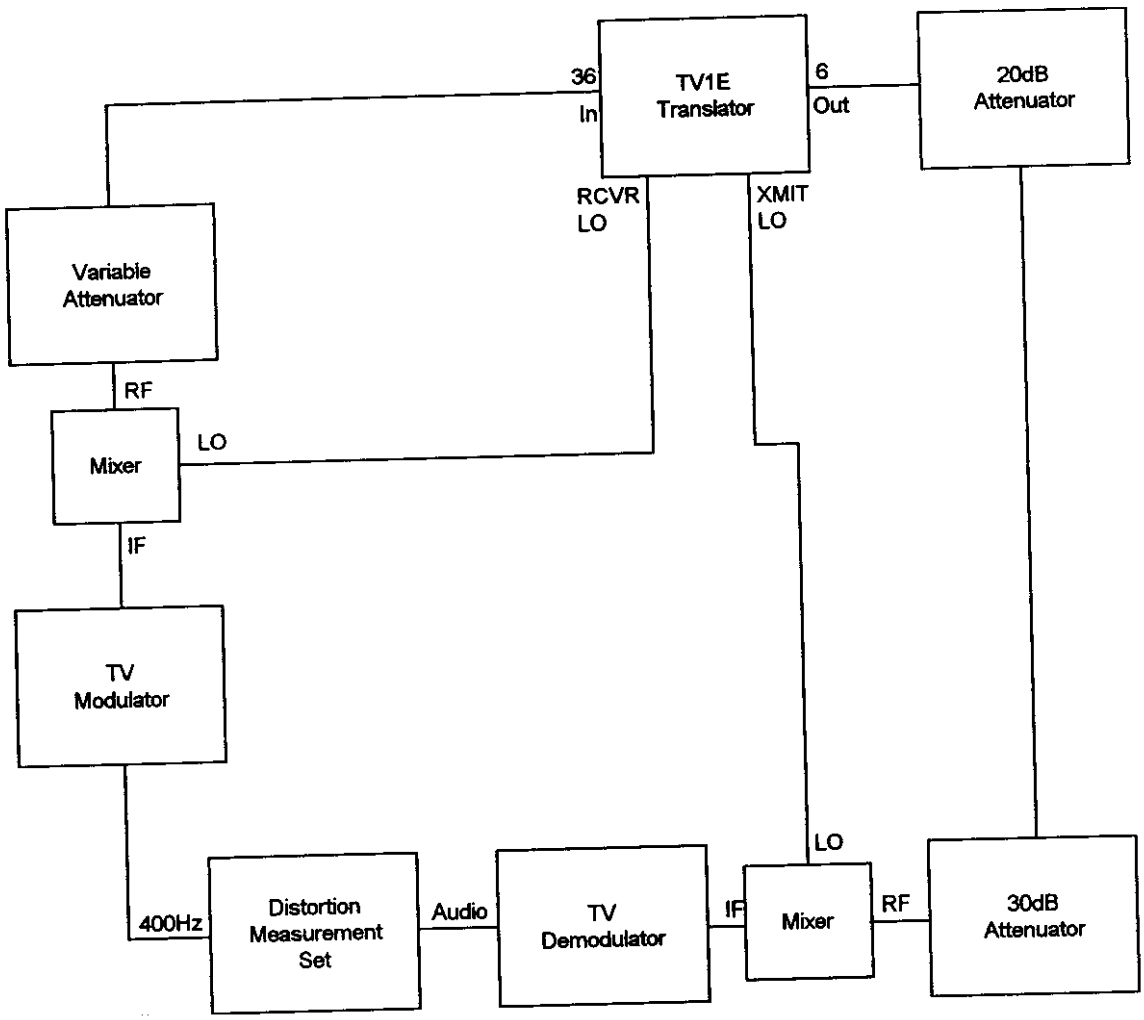
FM NOISE DATA

Detected Output w/o modulation = 1.8mV

Detected Output w/modulation = 2.0V

$$\text{FM Noise} = 20 \log \frac{\text{Output w/o modulation}}{\text{Output w/modulation}} = \frac{.0018V}{2.0V}$$

FM Noise = -60.9dB



FM NOISE TEST SETUP
Figure 2-5

2.6 Antenna Terminal Radio Frequency Voltage [74.936(c)(iii)]

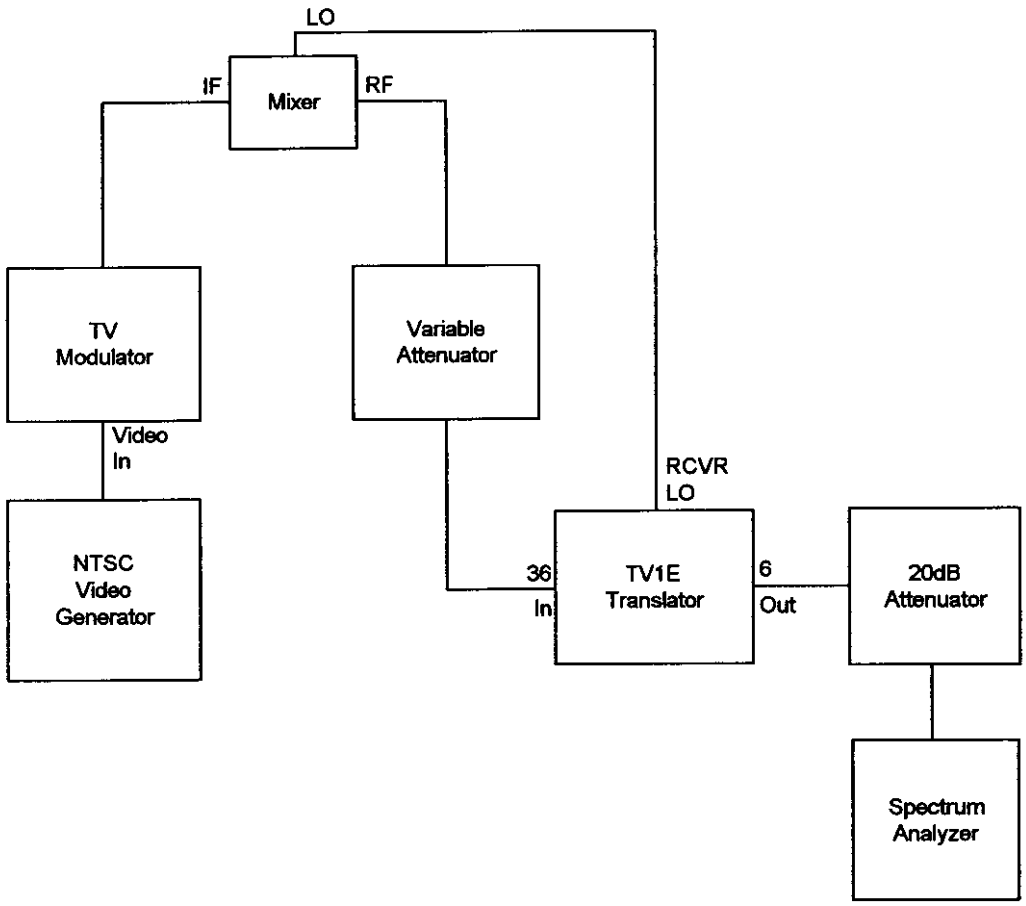
Test Equipment Setup	Figure 2–6
Visual Output Power	1 watt peak sync
% Video Modulation	87.5%
Type Video Modulation	Standard 10-riser stairstep
Aural Output Power	0.1 watt average
% Aural Modulation	0%
Method of Measurement	The spectrum analyzer display was adjusted for a zero reference level at the visual carrier using the following settings:

Frequency Span/Division	–	1MHz
Resolution Bandwidth	–	30kHz
Time/Division	–	20ms
Input Attenuation	–	10dB
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)	
83.25	0dB	Visual Carrier
87.75	-10dB	Aural Carrier
78.75	-52dB	Visual Carrier -4.5MHz
92.25	-52dB	Aural Carrier +4.5MHz
74.25	-64dB	Visual Carrier -9.0MHz
96.75	-66dB	Aural Carrier +9.0MHz
129.00	-56dB	Local Oscillator
166.50	-74dB	Visual 2nd Harmonic
175.50	-77dB	Aural 2nd Harmonic



ANTENNA TERMINAL RF VOLTAGE TEST
Figure 2-6

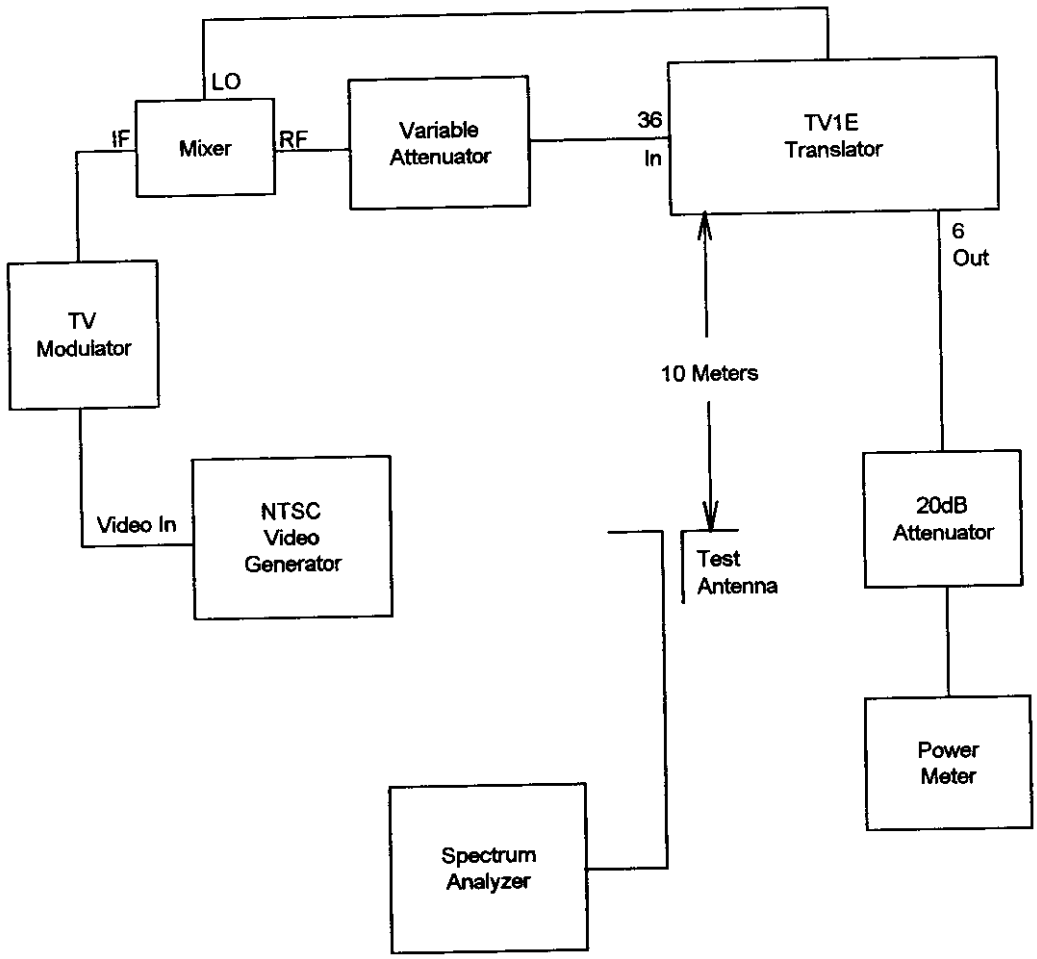
2.7 Spurious Radiation Field Strength [2.993]

Test Equipment Setup	Figure 2–7
Visual Output Power	1 watt peak sync
% Video Modulation	87.5%
Type Video Modulation	Standard 10-riser stairstep
Aural Output Power	0.1 watt 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 Output = $\sqrt{49.2P/R} = \sqrt{(49.2)(1)}/10 = .70$Volts/Meter

	FREQUENCY (MHz)	POWER MEASURED (dBm)	EQUIVALENT FIELD STRENGTH (VOLTS/METER)	RELATIVE FIELD STRENGTH (dB)
Visual	83.25	-63	3.34×10^{-4}	-66.4dB
Aural	87.75	-70	1.58×10^{-4}	-72.9dB
LO	129.00	Not Visible	———	———
2nd Harmonic	166.50	Not Visible	———	———



SPURIOUS CABINET RADIATION TEST SETUP
Figure 2-7

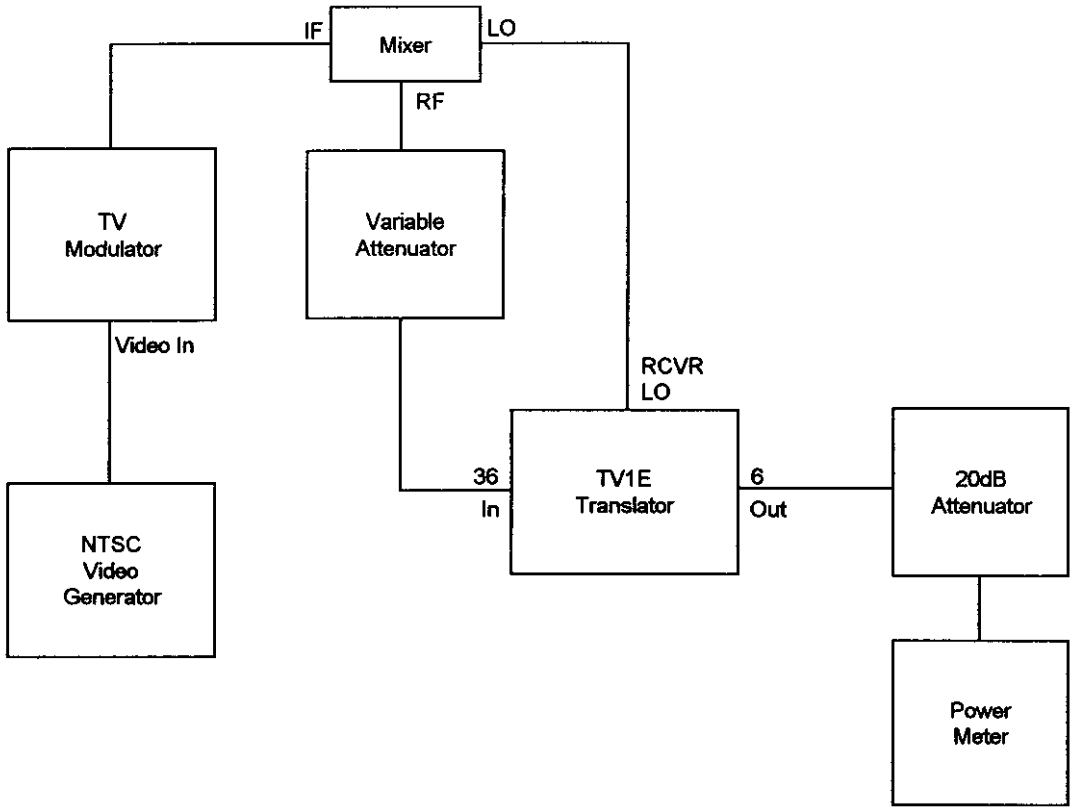
2.8 Power Output Meter Calibration [2.985]

Test Equipment Setup	Figure 2–8
Visual Output Power	1 watt peak sync
% 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.
Aural Output Power	0.1 watt average
% Aural Modulation	0%
Method of Measurement	The TV1E POWER ADJ was adjusted to obtain a 5.95mW average visual reading from the translator. This power level corresponds to 1 watt peak power when using the factor of 1.68 and compensating for the output attenuation as shown:

[5.95mW]	x	[10^2]	x	[1.68] = 1W
meter reading		attenuation		power factor

The test modulator AURAL LEVEL was then adjusted to obtain a 6.95mW indication on the external power meter (.595W average visual + 0.1W average aural -20dB = 6.95mW).

The PEAK PWR control (PC1R8) of the PWR Metering DC Amplifier, located in the TV1E Power Amplifier drawer, was adjusted to provide a 100% indication on the % POWER meter (M1) with the meter switch (M1S1) set to FWD. The % POWER meter and meter switch are also located on the front panel of the TV1E Power Amplifier drawer.



POWER OUTPUT METER CALIBRATION SETUP
Figure 2-8

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

Test Equipment Setup — Figure 2–9A

Method of Measurement — The EMCEE Synthesizers used for the UHF Downconverter and VHF 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 oscillator frequencies were noted at every 10°C increment. The results of these tests are shown in the following tables.

AC LINE VOLTAGE	CH 36 DOWNCONVERTER SYNTHESIZER (MHz)	CHANNEL ERROR (Hz)
95	649.000022	+22
115	649.000021	+21
135	649.000021	+21

TEMP C°	CH 36 DOWNCONVERTER SYNTHESIZER (MHz)	CHANNEL ERROR (Hz)
+50	648.999847	-153
+40	648.999931	-44
+30	648.999982	-18
+20	649.000020	+20
+10	649.000077	+87
0	649.000127	+117
-10	649.000189	+189
-20	649.000176	+176
-30	649.000114	+114

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

TEMP C°	CH 6 UPCONVERTER 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

Test Equipment Setup — Figure 2–9A

Method of Measurement — To provide the customer with ±10kHz precision offset, the Vectron CO-254D57 high stability oscillator will be used as a direct replacement for the EMCEE synthesizer in the TV1E Translator. The Vectron CO-254D57 oscillator has a stability of $\pm 5 \times 10^{-7}$ and will be used in both the Downconverter and Upconverter sections of the translator.

AC LINE VOLTAGE	CH 36 DOWNCONVERTER OSCILLATOR (MHz)	X16 MULTIPLIER (MHz)	CHANNEL ERROR (Hz)
95	40.562502	649.000032	+32
115	40.562502	649.000032	+32
135	40.562502	649.000032	+32

TEMP C°	CH 36 DOWNCONVERTER OSCILLATOR (MHz)	X16 MULTIPLIER (MHz)	CHANNEL ERROR (Hz)
+50	40.562481	648.999696	-304
+40	40.562488	648.999808	-192
+30	40.562494	648.999904	-96
+20	40.562500	649.000000	0
+10	40.562504	649.000064	+64
0	40.562511	649.000176	+176
-10	40.562518	649.000288	+288
-20	40.562509	649.000144	+144
-30	40.562498	648.999968	-32

AC LINE VOLTAGE	CH 6 UPCONVERTER 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 UPCONVERTER 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

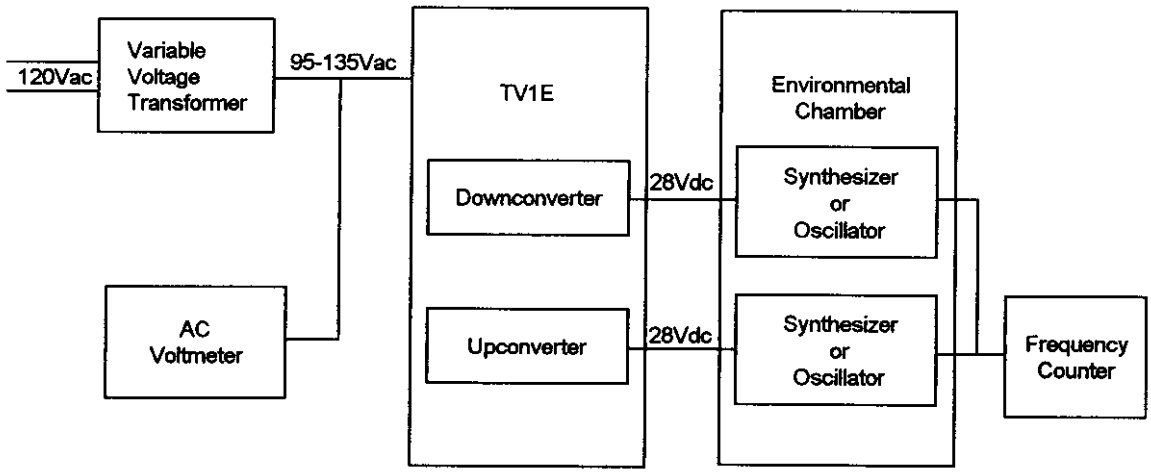
Adding the worst instances of frequency variations for the EMCEE Synthesizers, the TV1E carrier frequencies are well within the .02% FCC specifications for Low Power Television Transmitters and within the ±1kHz requirement for zero frequency offset. When using the Vectron high stability CO254D57 oscillator and X2, X4 or X16 Multiplier, the translator's frequency stability also falls within the ±1000Hz necessary for ±10kHz precision offset.

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: ±1 x 10^{-7} CO-252A58: ±5 x 10^{-8}	CO-254A57: ±5 x 10^{-8} CO-254A17: ±1 x 10^{-7}
(Temp. Range B) 0°C to +50°C:	CO-252B57: ±5 x 10^{-7} CO-252B27: ±2 x 10^{-7} CO-252B17: ±1 x 10^{-7}	CO-254B16: ±1 x 10^{-8} CO-254B57: ±5 x 10^{-8} CO-254B27: ±2 x 10^{-8}
(Temp. Range C) 0°C to +70°C:	CO-252C16: ±1 x 10^{-6} CO-252C57: ±5 x 10^{-7} CO-252C37: ±3 x 10^{-7}	CO-254C36: ±3 x 10^{-8} CO-254C16: ±1 x 10^{-8} CO-254C37: ±3 x 10^{-7}
(Temp. Range D) -20°C to +70°C:	CO-252D16: ±1 x 10^{-6} CO-252D57: ±5 x 10^{-7}	CO-254D56: ±5 x 10^{-8} CO-254D16: ±1 x 10^{-8} CO-254D57: ±5 x 10^{-7}
(Temp. Range E) -40°C to +75°C:	CO-252E56: ±5 x 10^{-6} CO-252E26: ±2 x 10^{-6} CO-252E16: ±1 x 10^{-6}	CO-254E56: ±5 x 10^{-8} CO-254E26: ±2 x 10^{-8} CO-254E16: ±1 x 10^{-8}
(Temp. Range F) -55°C to +85°C:	CO-252F56: ±5 x 10^{-6} CO-252F26: ±2 x 10^{-6} CO-252F16: ±1 x 10^{-6}	CO-254F56: ±5 x 10^{-8} CO-254F26: ±2 x 10^{-8} CO-254F16: ±1 x 10^{-8}
(Temp. Range G) -55°C to +105°C:	CO-252G56: ±5 x 10^{-6}	CO-254G56: ±5 x 10^{-8}
(Temp. Range H) -55°C to +125°C:	CO-252H15: ±1 x 10^{-6}	CO-254H15: ±1 x 10^{-8}
Aging Rate	≤5 MHz: 5 x 10^{-7}/year (3 x 10^{-9}/day avg) >5 MHz: 1 x 10^{-6}/year (5 x 10^{-9}/day avg)	
Short Term (Allan Variance)	1 x 10^{-9}/second under constant conditions	
Frequency vs Supply	2 x 10^{-9} per percent in supply with 10 to 28 Vdc input; 1 x 10^{-7} per percent change in supply for 5 to 9 Vdc input	

OUTPUT / SUPPLY	Output level	*Supply ±5%	Output level	Supply ±5%
Standard	>1 Vrms/1kΩ (1-20 MHz)	+15 Vdc, 4-15mA	>0.5 Vrms/50Ω	+15 Vdc, 20mA
Option "R"	>1 Vrms/50Ω (+13 dBm), 1-20 MHz	+15 Vdc, <30 mA	>1 Vrms/50Ω (+13 dBm)	+15 Vdc, <35 mA
**Option "J"	TTL	+15 Vdc, <10 mA & +5 Vdc, 10-50 mA	TTL (to 100 MHz)	+15 Vdc, <10 mA & +5 Vdc, <30 mA
**Option "K"	TTL	+5 Vdc, 15-60 mA	TTL (to 70 MHz)	+5 Vdc, <35 mA
**Option "M"			ECL (to 140 MHz)	+15 Vdc, 15 mA & -5.2 Vdc, 30-60 mA
Option "E"			ECL (to 70 MHz)	-5.2 Vdc, <60 mA
Other Options	HCMOS (50 kHz-20 MHz) CMOS (50 kHz-15 MHz)	+15 Vdc, 10-20 mA 5 to 15 Vdc, 3-15 mA	HCMOS (to 50 MHz)	+5 Vdc, 10-30 mA
	*Any supply in 10-24 Vdc range optional in lieu of +15 Vdc; current drain depends upon frequency **Options J and M are more economical than Options K and E respectively			
Harmonics and Sub-Harmonics (sine output)	20 dB below output. If internal multiplication is used (generally above 70 MHz but sometimes at lower frequencies) subharmonics are also down 20dB. Harmonics and subharmonic attenuation can be improved on special order.			
Phase Noise	See page 37 for standard and low noise Option L2 specifications			
FREQUENCY ADJUSTMENT Mechanical	Range sufficient to compensate for 5 to 10 years of crystal aging; settable to <1 x 10^{-7}			
Electronic Tuning Option "V"	VCXO operation permits remote frequency adjustment or locking onto an external frequency source. Add "V" to Model Number. Nominal range with 0 to +5 volt control input is 3 x 10^{-6} total (Wider deviations available). (For very wide deviation and/or linear voltage control, see TC/VCXOs in the VCXO section on page 76)			
SIZE/CONFIGURATION Standard (See drawings on page 37)	2" x 2" x 3/4" (51 x 51 x 19mm); pins on base for pc board mounting. Most models available with reduced height, to 1/2". For smaller models, with height as low as 0.2" (5.1 mm), see our TCXOs on preceding pages.			
Options	Option "SW": 2" x 2 1/4" x 3/4" (51 x 57 x 19 mm) SMA output connector on side, pins for pc board mounting on base. Option "W": 2" x 2" x 3/4" (51 x 51 x 19 mm) SMA output connector, solder header and mounting studs on base. Option "U": 2" x 2" x 3/4" (51 x 51 x 19 mm) SMC output connector, solder header and mounting studs on base.			
ENVIRONMENTAL	See page 98 for environmental specifications and screen test option.			
HOW TO ORDER	See page 37			



FREQUENCY STABILITY TEST SETUP
Figure 2-9A

2.10 Certification Identification Label [2.1003]

The certification identification label for the TV1E Translator is shown below. This label shall be displayed conspicuously on the translator's front panel.

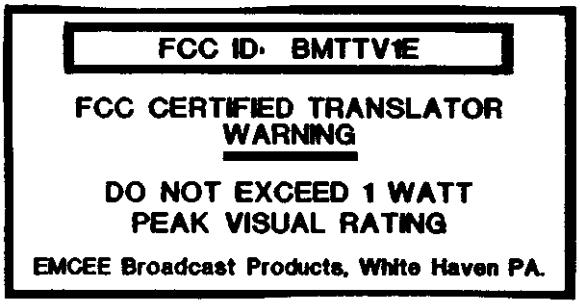


Figure 2–10

2.11 Photographs [2.983 (g)]

The following photographs will be used as part of the TV1E Instruction Manual.