



TAV-500L TEST REPORT

S/N: 01060376

Prepared by:
Date:

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June 9, 2005

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| Contents |
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| Contents | 2 |
| Test Equipment | 3 |
| Performance Specifications | 4 |
| Visual Power Output Rating | 4 |
| Visual Power Adjustment Capability | 5 |
| Aural Power Output Rating | 6 |
| Carrier Frequency Tolerance | 8 |
| Visual Frequency Response | 11 |
| Intermodulation Distortion | 14 |
| Spurious Emissions | 16 |
| Modulation | 18 |
| K Pulse to Bar (Kpb) Rating | 19 |
| 2T Pulse K (K2T) Rating | 20 |
| Chrominance-Luminance Gain Inequality | 21 |
| Chrominance-Luminance Delay Inequality | 22 |
| Differential Gain Distortion | 23 |
| Differential Phase Distortion | 24 |
| Group Delay Response | 25 |
| Horizontal Timing | 26 |
| Audio Amplitude Frequency Response | 27 |

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| Test Equipment |
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| Equipment | Manufacturer | Model Number | Serial Number |
|----------------------------|-----------------------|--------------|---------------|
| Test Signal Generator | Tektronix | TSG95 | B025497 |
| Test Signal Generator | Tektronix | 1910 | B022706 |
| Spectrum Analyzer | Advantest | R3162 | 110301419 |
| Spectrum Analyzer | Tektronix | 2710 | B021677 |
| Waveform Analyzer/Monitor | Tektronix | VM700A | B020283 |
| Radiation Meter | Narda | | |
| Network Analyzer | Agilent | 8753ET | US39170436 |
| Frequency Counter | HP | 5343A | 2428A01747 |
| Audio Generator | HP | 209A | 1045A06481 |
| Noise and Distortion Meter | HP | 334A | 1551U00970 |
| Coaxial Attenuator (30 dB) | Bird | 8329-310 | 258 |
| Coaxial Attenuator (30 dB) | Bird | 8323 | 2221 |
| Coaxial Attenuator (6 dB) | Weinschel | 58-6-43 | |
| RF Wattmeter | Bird | 4304A | 0811 |
| RF Wattmeter | Coaxial Dynamics | 81060A | 1034 |
| RF Load (1200 W) | Microwave Devices | 611.11 | |
| RF Load (600W) | Bird | 8402 | 1595 |
| Directional Coupler | HP | 778D | |
| Variable Autotransformer | Staco Energy Products | 3PN1010 | 122-0003 8645 |
| True RMS clamp on meter | Tenma | 72-6131 | 96082691 |
| Digital Multi-meter | Hung Chang | HC-5010EC | 15003374 |
| Oscilloscope (150 MHz) | Tektronix | 2445 | B021074 |
| Television Demodulator | Tektronix | 1450-1 | BO21566 |
| Tunable Down Converter | Tektronix | TDC-10 | BO10435 |
| Television Demodulator | MSI | MSI-320 | D-022 |
| Digital Camera | Sony | DSC-P73 | 7412902 |

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| Performance Specifications |
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Visual Power Output Rating

Definition: The visual power output rating of the television transmitting equipment shall be the peak envelope power. This is also the average power measured during a synchronizing pulse.

Requirement: Specified by the manufacturer as 500 watts peak.

Method: The visual carrier is modulated with a sync and blanking signal. The aural carrier is not present. An average reading RF wattmeter is placed between the transmitter output (directly on the directional coupler's N connector on the back panel) and the 50 Ω dummy load. The peak visual power is the measured average power multiplied by a factor of 1.68.

Due to the low level of the RF Output signal, a spectrum analyzer was used to measure the visual output rating.

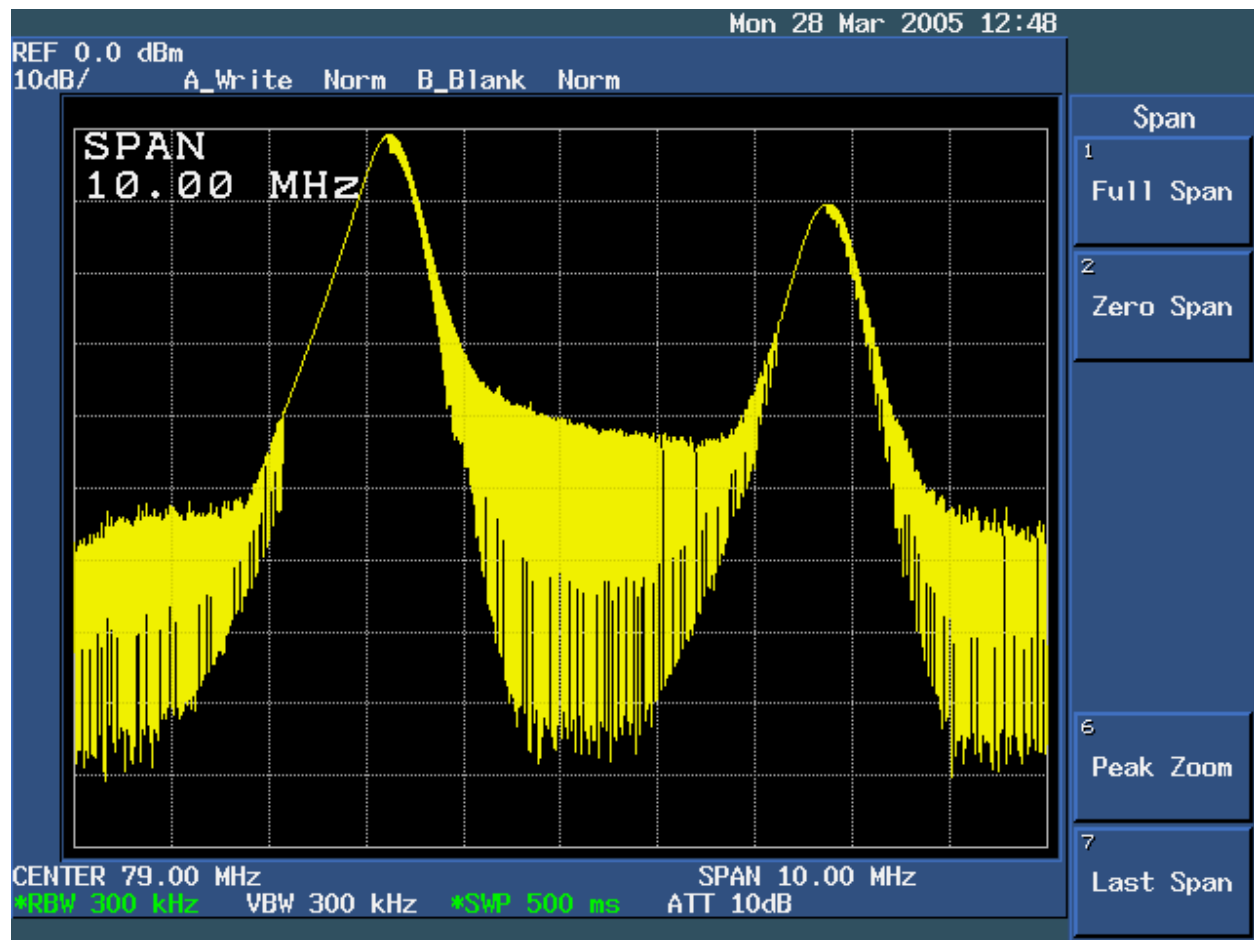
Measurement: The rated visual output power is 500 watts peak.

Visual Power Adjustment Capability

| | |
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| Definition: | The peak output power adjustment capability is the manual range by which the peak visual output power can be maintained within predetermined limits. |
| Requirement: | <p>Industry Canada – The equipment shall be capable of being adjusted to deliver the rated visual output power when the AC input voltage is 5% above or below rated value. Power output adjustment of the equipment shall permit operation to at least 3 dB below rated power output [BETS-4, section 6.1].</p> <p>FCC – The transmitter shall be adjustable to 80%, 100%, and 110% of peak visual power simply for the calibration of meters [section 73.663]. Except as operated in a reduced power operation, the visual output power of a TV transmitter or translator must be maintained as near as practicable to the authorized transmitter output power and may not be less than 80% nor more than 110% of authorized power [section 73.1560(c)]</p> |
| Method: | The visual carrier is modulated with a sync and blanking signal. The aural carrier is not present. An average reading RF wattmeter is placed between the transmitter output (directly on the directional coupler's N connector on the back panel) and the 50 Ω dummy load. The peak visual power is the measured average power multiplied by a factor of 1.68. While observing the external wattmeter, the output power is varied to ensure that is adjustable over the proper ranges. |
| Measurement: | Upper limit of visual output power adjustment <u>110</u> % Lower limit of visual output power adjustment <u>0</u> % |

Aural Power Output Rating

| | |
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| Definition: | The aural carrier power output is the power of the aural transmission section available at the output terminals of the equipment when connected to the standard test load. |
| Requirement: | <p>Industry Canada – The measured aural carrier output shall not be less than 10% nor more than 20% of the output power of the visual transmission section for standard power (> 50 watts VHF or > 500 watts UHF) and shall not be less than 5% nor more than 20% of the output power of the visual transmission section for standard low power (= 50 watts VHF or = 500 watts UHF) [BETS-4, section 6.2].</p> <p>FCC – Aural carrier must be at least 6.6 dB below visual carrier power [sections 73.682(a)(15) and 73.1560(c)(2)].</p> |
| Method: | The average power output of the unmodulated aural carrier is measured while operating into the standard test load either by using a power measuring device or by a calorimetric method. |
| Measurement: | The aural carrier is <u>10.0</u> dB below the tip of sync of visual carrier. |



Aural Power Output with Carrier at 10.0 dB

Carrier Frequency Tolerance

Definition: Frequency tolerance is a measure of the maximum permissible departure of the characteristic frequency of an emission from its assigned frequency.

Requirement: Industry Canada – The frequency stability of both visual and aural carriers shall remain within ± 500 Hz of the mean frequency for standard power and shall remain within $\pm 0.003\%$ of the mean frequency for standard low power [BETS-4, section 6.3].

FCC – The departure of the visual carrier frequency of a TV station may not exceed $\pm 1,000$ Hz from the assigned visual carrier frequency. The departure of the aural carrier frequency of a TV station may not exceed $\pm 1,000$ Hz from the actual visual carrier frequency plus exactly 4.5 MHz. The chrominance subcarrier frequency is 63/68 times precisely 5 MHz. The tolerance is ± 10 Hz and the rate of frequency drift must not exceed 0.1 Hz per second [section 73.1545(c)].

Method: After a warm up period of at least one hour at rated power, the frequency of the visual and aural carriers is measured at one-minute intervals during a period of fifteen minutes. From these measurements, the mean test frequency is determined of each carrier as well as inter-carrier separation. The operating frequencies are measured at ambient temperatures from -30°C to $+50^{\circ}\text{C}$ (in 10°C steps) and at the following three values of power supply voltage for each of these temperatures; 85%, 100%, and 115% of nominal AC supply voltage.

NOTE: *There are no frequency determining components within the power amplifier that is being certified. For reference, the frequency tolerance data for the TM-100 modulator used for these tests is included. The agile TM-100 modulator (channel 2-69) is certified (FCC ID: QH5TM100 and Form 731 Confirmation Number EA341653 and Industry Canada 3803A-TM100).*

Measurement: Mean visual carrier frequency is 187.249 869 MHz

| TEMPERATURE (°C) | AC VOLTAGE | VISUAL FREQUENCY (MHz) | VISUAL DEVIATION (Hz) |
|------------------|------------|------------------------|-----------------------|
| -30 | 100 | 187.249 762 | -107 |
| | 118 | 187.249 754 | -115 |
| | 136 | 187.249 752 | -117 |
| -20 | 100 | 187.249 703 | -166 |
| | 118 | 187.249 703 | -166 |
| | 136 | 187.249 701 | -168 |
| -10 | 100 | 187.249 698 | -171 |
| | 118 | 187.249 697 | -172 |
| | 136 | 187.249 697 | -172 |
| 0 | 100 | 187.249 696 | -173 |
| | 118 | 187.249 695 | -174 |
| | 136 | 187.249 695 | -174 |
| 5 | 100 | 187.249 701 | -168 |
| | 118 | 187.249 701 | -168 |
| | 136 | 187.249 702 | -167 |
| 10 | 100 | 187.249 711 | -158 |
| | 118 | 187.249 715 | -154 |
| | 136 | 187.249 715 | -154 |
| 20 | 100 | 187.249 729 | -140 |
| | 118 | 187.249 730 | -139 |
| | 136 | 187.249 737 | -132 |
| 30 | 100 | 187.249 754 | -115 |
| | 118 | 187.249 769 | -100 |
| | 136 | 187.249 777 | -92 |
| 40 | 100 | 187.249 813 | -56 |
| | 118 | 187.249 826 | -43 |
| | 136 | 187.249 831 | -38 |
| 45 | 100 | 187.249 850 | -19 |
| | 118 | 187.249 860 | -9 |
| | 136 | 187.249 878 | +9 |
| 50 | 100 | 187.249 894 | +25 |
| | 118 | 187.249 912 | +43 |
| | 136 | 187.249 925 | +56 |

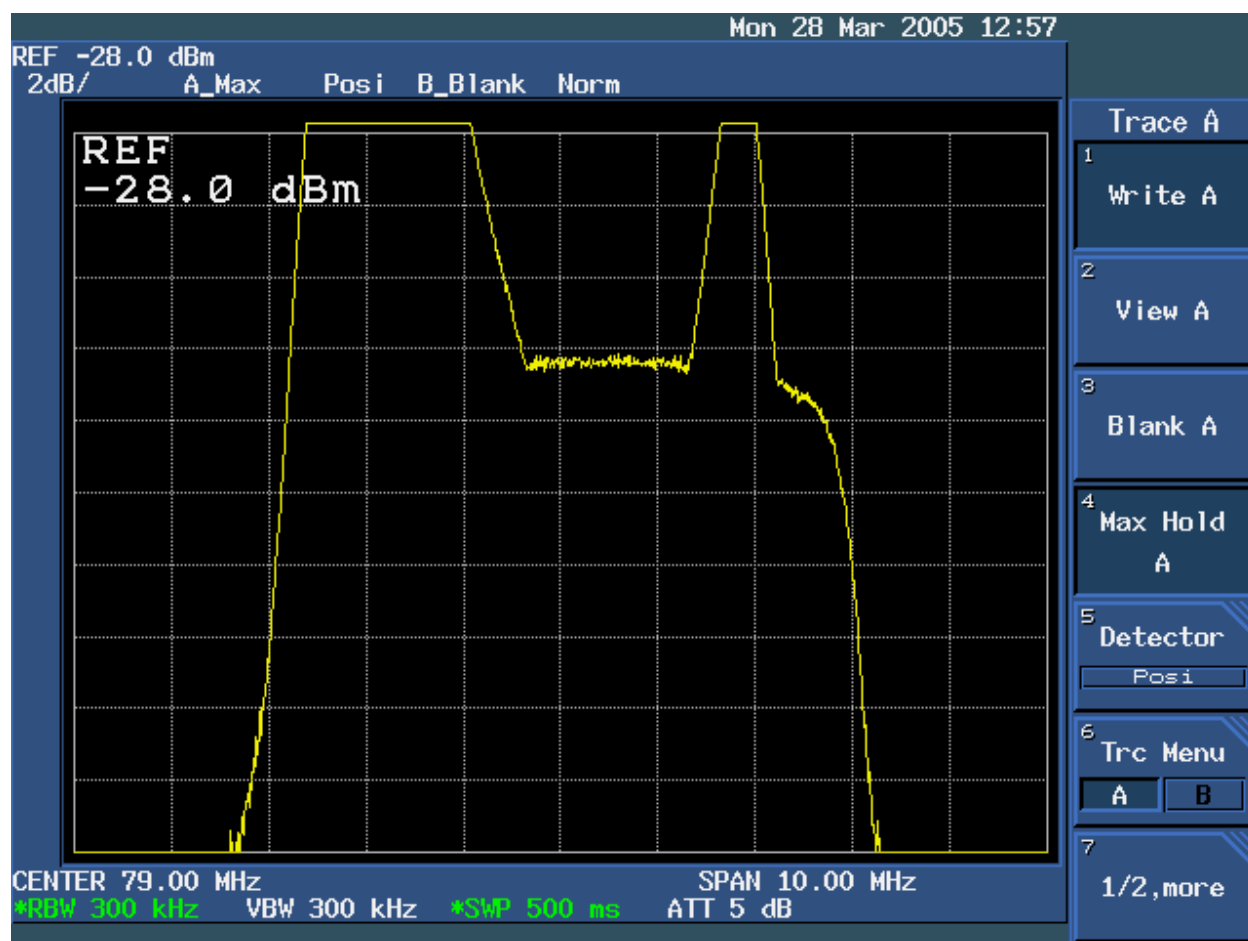
Measurement: Mean visual carrier frequency is 191.750 469 MHz

| TEMPERATURE (°C) | AC VOLTAGE | AURAL FREQUENCY (MHz) | AURAL DEVIATION (Hz) |
|------------------|------------|-----------------------|----------------------|
| -30 | 100 | 191.750 452 | -17 |
| | 118 | 191.750 449 | -20 |
| | 136 | 191.750 447 | -22 |
| -20 | 100 | 191.750 420 | -49 |
| | 118 | 191.750 419 | -50 |
| | 136 | 191.750 418 | -51 |
| -10 | 100 | 191.750 416 | -53 |
| | 118 | 191.750 416 | -53 |
| | 136 | 191.750 415 | -54 |
| 0 | 100 | 191.750 415 | -54 |
| | 118 | 191.750 416 | -53 |
| | 136 | 191.750 415 | -54 |
| 5 | 100 | 191.750 418 | -51 |
| | 118 | 191.750 420 | -49 |
| | 136 | 191.750 421 | -48 |
| 10 | 100 | 191.750 429 | -40 |
| | 118 | 191.750 428 | -41 |
| | 136 | 191.750 430 | -39 |
| 20 | 100 | 191.750 429 | -40 |
| | 118 | 191.750 432 | -37 |
| | 136 | 191.750 433 | -36 |
| 30 | 100 | 191.750 433 | -36 |
| | 118 | 191.750 430 | -39 |
| | 136 | 191.750 399 | -70 |
| 40 | 100 | 191.750 404 | -65 |
| | 118 | 191.750 410 | -59 |
| | 136 | 191.750 422 | -47 |
| 45 | 100 | 191.750 396 | -73 |
| | 118 | 191.750 446 | -23 |
| | 136 | 191.750 455 | -14 |
| 50 | 100 | 191.750 471 | +2 |
| | 118 | 191.750 481 | +12 |
| | 136 | 191.750 493 | +24 |

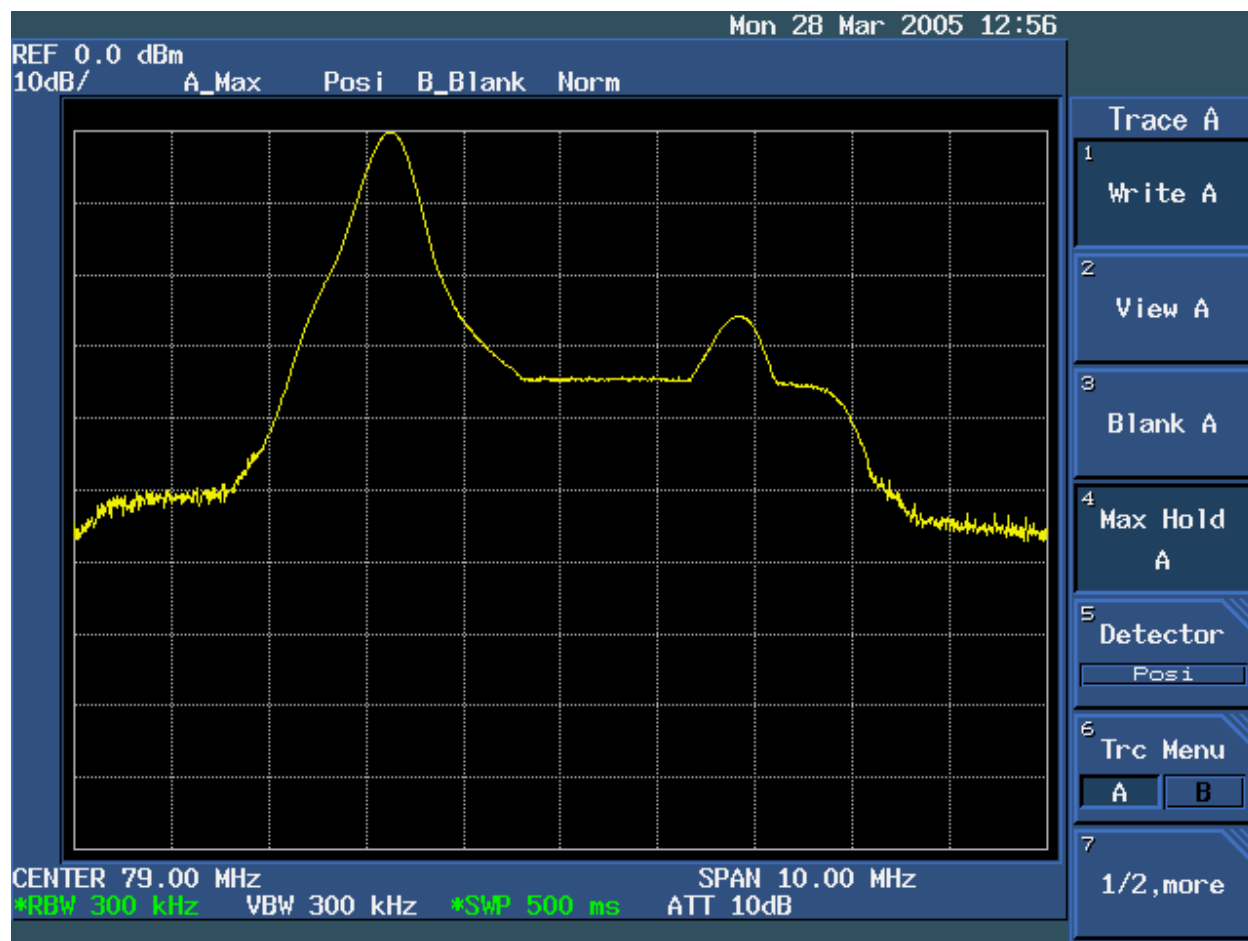
Measurement: Chrominance frequency tolerance deviation < 0.1 Hz

Visual Frequency Response

| | |
|--------------|---|
| Definition: | The visual frequency response provides a measure of the linearity of the channel passband. This test is completed with just the visual transmitter powered. |
| Requirement: | FCC – From -1.25 to +4.75 MHz, the visual frequency response should be within a 4 dB window to meet the 4dB window specification. The -3.58 MHz color subcarrier must be -42 dB down. Outside the -1.25 MHz and +4.75 MHz window, the response must be -20 dB. |
| Method: | The visual carrier is modulated with a $(\sin x)/x$ test signal with a test signal generator or with a Tektronix 1405 sideband adaptor with 50% APL and 50% sweep amplitude. The aural carrier is removed temporarily. Measure the visual passband frequency response across the channel using a spectrum analyzer in no more than a 2 dB per division scale and also using a 10 dB per division scale. |
| Measurement: | 2 dB and 10 dB responses are plotted on the following pages. |



Visual Frequency Response (2dB)



Visual Frequency Response (10dB)

Intermodulation Distortion

Definition: Intermodulation distortion (IMD) products are beat signals generated by various combinations of carriers of the nature $mf_1 \pm nf_2 \pm pf_3$ where m, n, and p are integers. The visual and aural carriers and color sub-carrier can combine to form IMD products. Six predominant products, with respect to visual carrier, are at ± 920 kHz, ± 2.66 MHz, $+ 5.42$ MHz, and $+ 7.16$ MHz.

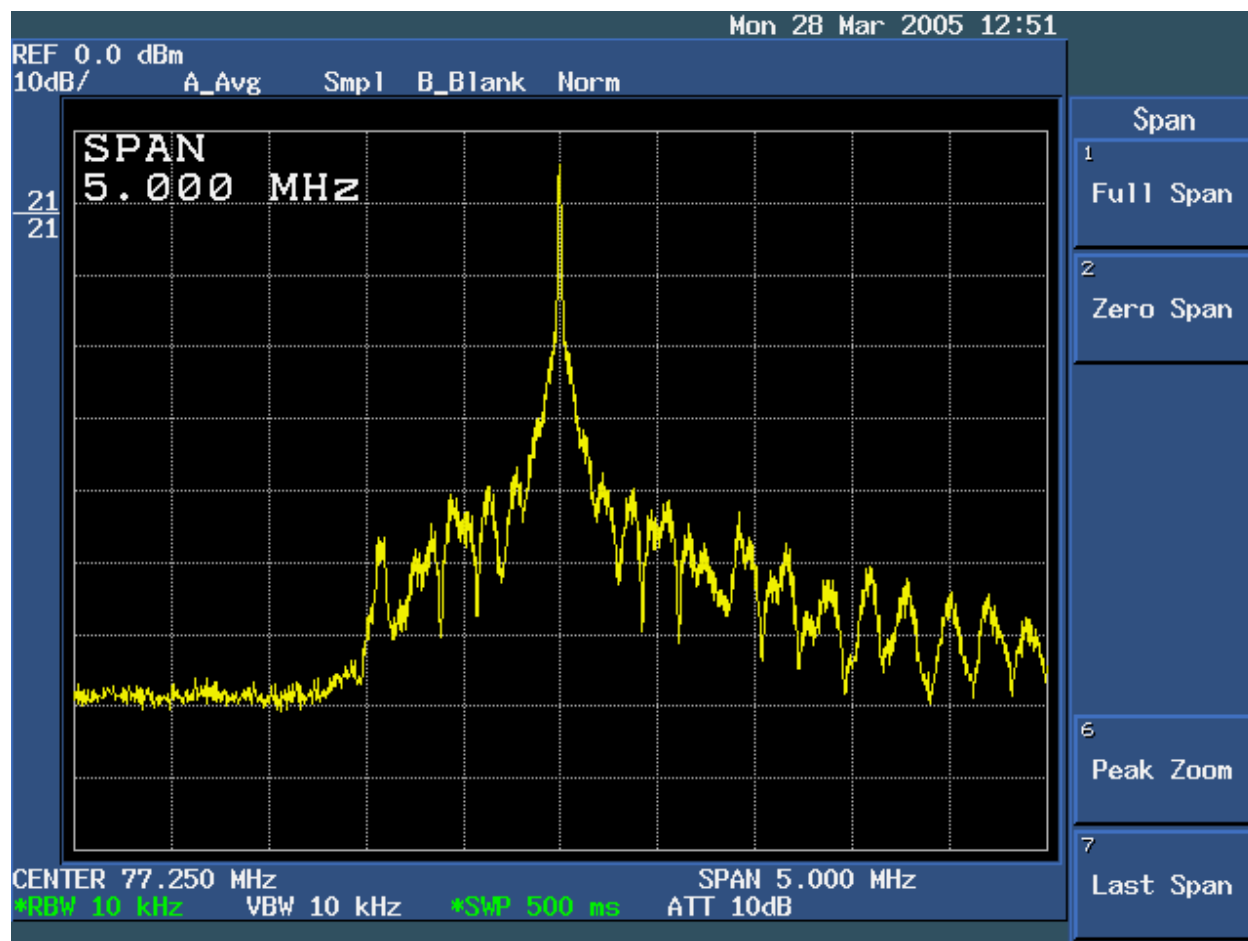
Requirement: Industry Canada – The level of the predominant IMD products shall be at least 53 dBc (dB referenced to visual carrier) for standard power (> 50 watts VHF or > 500 watts UHF) and shall be at least 50 dBc for standard low power ($= 50$ watts VHF or $= 500$ watts UHF) [BETS-4, section 6.4].

FCC – No FCC requirement.

Method: The visual carrier is modulated with a sync and blanking signal. The aural carrier is removed temporarily. An average reading RF wattmeter is placed between the transmitter output (directly on the directional coupler's N connector on the back panel) and the 50 Ω dummy load. The output power is set to the output power rating. With the power output set, an unmodulated aural carrier applied, the visual carrier is then modulated with a test signal, full field red with 50% APL. The resultant IMD products are measured with respect to the visual carrier.

Measurement:

| | <i>100% Rated Power</i> | <i>20% Rated Power</i> |
|------------|-------------------------|------------------------|
| + 920 kHz | <u>-55 dBc</u> | <u>-53 dBc</u> |
| - 920 kHz | <u>-56 dBc</u> | <u>-53 dBc</u> |
| + 2.66 MHz | <u>-63 dBc</u> | <u>-63 dBc</u> |
| - 2.66 MHz | <u>-78 dBc</u> | <u>-72 dBc</u> |
| + 5.42 MHz | <u>-65 dBc</u> | <u>-68 dBc</u> |
| + 7.16 MHz | <u>-65 dBc</u> | <u>-63 dBc</u> |



Intermodulation Distortion Products

Spurious Emissions

Definition: Spurious emissions are unwanted emissions occurring at the output terminals of the transmitting equipment, at frequencies other than those of the predominant IMD products.

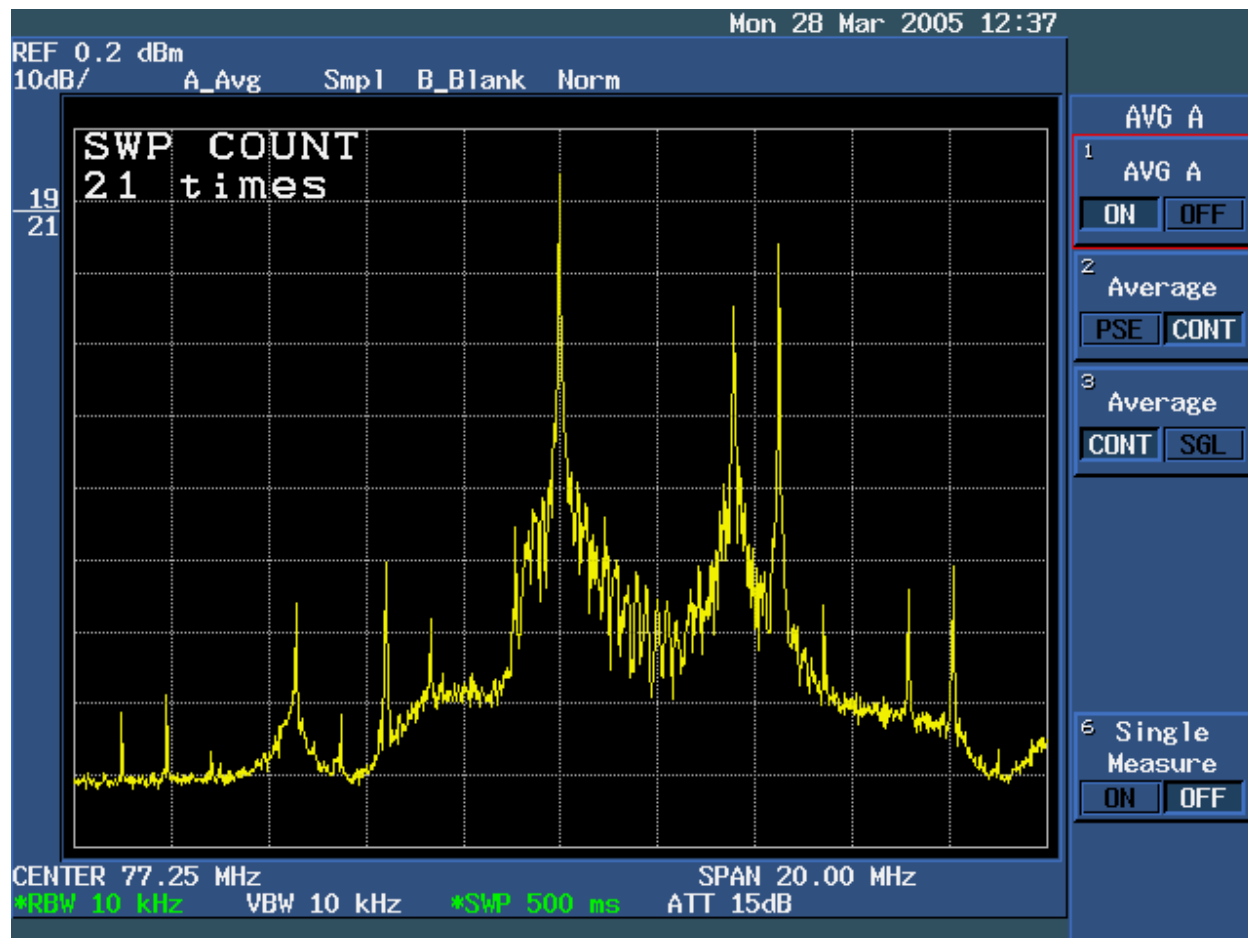
Requirement: Industry Canada – The –4.5 MHz and +9.0 MHz spurious emissions shall be –40 dBc. All other spurious and harmonic emissions shall be -15 dBm for transmitted power below 25 watts and 60 dBc when the transmitted power is above 25 watts [BETS-4, section 6.5.3].

FCC – Harmonics and lower/upper sideband spurious signals that are below/above 3 MHz of the channel edge shall be at least 60 dB below peak visual carrier [section 73.687(e)(1)].

Method: The visual carrier is modulated with a normal black level (with or without sync). The aural carrier is present and unmodulated. The 0 dB reference is established on the spectrum analyzer with the resolution bandwidth initially set to 3 MHz per division. The display is adjusted such that the tip of sync is on the first horizontal graticule line. Once the 0 dB reference is established, all spurious emissions are measured up to the tenth harmonic of the aural carrier frequency.

Measurement:

| | 100% Rated Power | 20% Rated Power |
|------------------|--------------------|--------------------|
| <u>Spurs</u> | | |
| -4.5 MHz | <u>-60 dBc</u> | <u>-60 dBc</u> |
| +9.0 MHz | <u>>-80 dBc</u> | <u>>-80 dBc</u> |
| All others | <u>>-80 dBc</u> | <u>>-80 dBc</u> |
| <u>Harmonics</u> | | |
| 2 nd | <u>-78 dBc</u> | <u>-80 dBc</u> |
| 3 rd | <u>-80 dBc</u> | <u>>-80 dBc</u> |
| 4 th | <u>>-80 dBc</u> | <u>>-80 dBc</u> |
| 5 th | <u>>-80 dBc</u> | <u>>-80 dBc</u> |
| 6 th | <u>>-80 dBc</u> | <u>>-80 dBc</u> |
| 7 th | <u>>-80 dBc</u> | <u>>-80 dBc</u> |
| 8 th | <u>>-80 dBc</u> | <u>>-80 dBc</u> |
| 9 th | <u>>-80 dBc</u> | <u>>-80 dBc</u> |
| 10 th | <u>>-80 dBc</u> | <u>>-80 dBc</u> |



Spurious Emissions

Modulation

| | |
|--------------|---|
| Definition: | Depth of modulation measurements indicate whether or not video signal levels are properly represented in the RF signal. The NTSC modulation scheme yields an RF signal that reaches its maximum peak-to-peak amplitude at sync tip (100%). In a properly adjusted signal, blanking level corresponds to 75%, and peak white to 12.5%. The zero carrier reference level corresponds to 0%. |
| Requirement: | <p>Industry Canada – With the blanking level at 75%, the maximum carrier level shall remain between 98% and 102% of the original, and the white level shall be at $12.5\% \pm 2.5\%$ [BETS-4, section 1.3].</p> <p>FCC – The reference white level shall be at $12.5\% \pm 2.5\%$ of peak carrier level [section 73.682(a)(13)]. The blanking level shall be at $75\% \pm 2.5\%$ of the peak carrier level [section 73.682(a)(12)]. The setup interval shall be at $7.5\% \pm 2.5\%$ of the video range from the blanking level to the reference white level [section 73.682(a)(17)].</p> |
| Method: | Modulation depth is measured at the output of a precision demodulator by verifying that the ratios between the parts of the signal are correct. Overall amplitude is not critical, but it should be adjusted in the system to be approximately 160 IRE from sync tip to zero carrier at 100% transmitter or translator power. This will minimize the effects of nonlinearities in the measurement system. |
| Measurement: | <p>The blanking level is at <u>75</u> %.</p> <p>The reference white level is at <u>12.5</u> %.</p> <p>The sync tip is at <u>100</u> %.</p> |

K Pulse to Bar (Kpb) Rating

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|--------------|---|
| Definition: | K factor is one method used to measure the transmitting equipment's ability to reproduce step functions or pulses to check for linear waveform distortion. Specifically, K factor describes the transmitter's or translator's ability to reproduce the 2T pulse and bar measurement signal. |
| Requirement: | Industry Canada – The K pulse to bar rating (Kpb) shall not exceed 2.5% [BETS-4, section 1.10.2]. FCC – No FCC requirement. |
| Method: | <p>A full field composite test signal (FCC Composite on the Tektronix TSG-95) is applied to the video input of the transmitter under test and the demodulated video output (using synchronous detection) is connected to a calibrated waveform monitor or video measurement system. The 2T pulse is centered on the Kpb scale and the vertical gain is adjusted to put the bar center point at 100 IRE and the blanking level at 0 IRE. The K pulse to bar rating is then measured on the graticule using the "Kpb" lines at the top center of the graticule. To extend the range of the measurement, set the vertical sensitivity of the waveform monitor so that the center point of the bar waveform has an amplitude of 100 IRE. Measure the peak amplitude of the 2T pulse and read the K pulse to bar rating from an industry standard nomogram designed for K factor. If the 2T pulse is greater than 120 IRE in amplitude, move the display down to put the blanking level at –40 IRE.</p> <p>Alternatively, a video measurement system is used to complete this measurement. Using the VM700A video measurement system, select K Factor in measure mode to obtain a measurement of K Pulse to Bar.</p> |
| Measurement: | The Kpb rating is at <u> -0.7 </u> % at 100% rated power and <u> -0.8 </u> % at 20% rated power. |

2T Pulse K (K2T) Rating

Definition: To evaluate the change in shape of the 2T pulse, the K2T measurement is used. The K2T rating is a time weighted measurement of the subjective impairments caused by close-in ratios on the TV signal and is measured with the standard NTSC type B graticule and expressed in percentage K.

Requirement: Industry Canada – The 2T pulse K rating shall not exceed 2.5% K [BETS-4, section 1.10.3].

FCC – No FCC requirement.

Method: The visual carrier is modulated with a full field composite test signal and the demodulated output of the transmitting equipment is connected to a calibrated waveform monitor or video measurement system. To use 'graticule B' to measure K2T, the waveform monitor is set with a sweep rate of 0.2 μ sec/div and the vertical sensitivity is adjusted to set the pulse height to 100 IRE. The lobe that most closely approaches the dotted K2T = 5% outline defines the K2T rating for the transmitter or translator under test. For small values of K2T, the vertical sensitivity is increased by a factor of 2 to increase the resolution of the measurement. In this case, the dotted outline becomes K2T = 2.5%. The K2T rating is estimated by subdividing an imaginary vertical line through the lobe peak into convenient units and expressing the lobe amplitude as a fraction of the distance between the blanking level reference line and the dotted K2T line.

Alternatively, a video measurement system is used to complete this measurement. Using the VM700A video measurement system, select K Factor in measure mode to obtain a measurement of 2T Pulse.

Measurement: The K2T rating is at 2.1 %K at 100% rated power and 2.1 %K at 20% rated power.

Chrominance-Luminance Gain Inequality

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| Definition: | The luminance and chrominance of a television signal should be transferred through a system with their relative amplitudes undistorted. The chrominance-luminance gain inequality is defined as the change in level of the chrominance component of the test signal relative to the luminance component and is measured with the modulated 12.5T pulse. |
| Requirement: | Industry Canada – The chrominance-luminance relative amplitude shall be less than 3 IRE units [BETS-4, section 1.11]. FCC – No FCC requirement. |
| Method: | <p>The chrominance-luminance gain inequality is measured by setting the waveform monitor so that the modulated pulse amplitude goes from blanking to the 100 IRE level. If only a gain inequality is present, the baseline of the pulse will describe a continuous curve. The peak amplitude is taken of this curve and is plotted against the vertical axis of a modulated \sin^2 pulse application nomograph for measuring this gain inequality. Then the chrominance-luminance gain inequality, or relative chroma level can be determined.</p> <p>Alternatively, a video measurement system is used to complete this measurement. Chrominance-luminance gain distortion can be measured by selecting CHROM/LUM GAIN DELAY with the Tektronix VM700A in measure mode. The graph plots error with respect to zero and the numeric results are displayed at the top of the screen.</p> |
| Measurement: | The chrominance-luminance relative amplitude is <u>95.8</u> % at 100% rated power and <u>93.7</u> % at 20% rated power when using the VM700A. |

Chrominance-Luminance Delay Inequality

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|--------------|---|
| Definition: | At the time of signal origination, the chrominance and luminance components of the television signal are correctly timed with respect to one another. If any delay is introduced in one component without an equal delay being introduced in the other, when the signal gets to a picture monitor, both components will be misregistered. This is most often noticed on red letters smeared to the right into a white or neutral background, or as bad as to make the received picture appear to have color ghosts. |
| Requirement: | Industry Canada – The chrominance-luminance relative delay shall be less than 50 nanoseconds [BETS-4, section 1.11] FCC – No FCC requirement. |
| Method: | <p>The chrominance-luminance delay inequality is measured with the 12.5T pulse. This signal consists of equal peak amplitudes of chrominance and luminance, and is usually transmitted as part of a composite test signal. The test signal is positioned as it was in chrominance-luminance gain measurements. The baseline of the waveform is observed. A sinusoidal shape on the baseline of the pulses indicates the presence of chrominance to luminance delay. The peak-to-peak excursions of the sinusoid are measured and plotted on the same nomograph as used for gain inequality. The intersection of these points indicates the chrominance-luminance delay.</p> <p>Alternatively, a video measurement system is used to complete this measurement. Chrominance-luminance delay distortion can be measured by selecting CHROM/LUM GAIN DELAY with the Tektronix VM700A in measure mode. The graph plots error with respect to zero and the numeric results are displayed at the top of the screen.</p> |
| Measurement: | The chrominance-luminance delay inequality is <u> -2.7 </u> nsec at 100% rated power and <u> -20 </u> nsec at 20% rated power. |

Differential Gain Distortion

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|--------------|---|
| Definition: | Differential gain distortion refers to a change in chrominance amplitude with changes in luminance level. The vividness of a colored object changes with variations in scene brightness. |
| Requirement: | <p>Industry Canada – The differential gain distortion shall not be greater than 7% for standard power (> 50 watts VHF or > 500 watts UHF) and shall not be greater than 15% for standard low power (= 50 watts VHF or = 500 watts UHF) [BETS-4, section 1.6].</p> <p>FCC – The angles of the subcarrier measured with respect to the burst phase, when reproducing saturated primaries and their complements at 75% of full amplitude, shall be within $\pm 10^\circ$ and their amplitudes be within $\pm 20\%$ of the values specified in 73.682(a)(20) [section 73.682(a)(20)(vii)].</p> |
| Method: | <p>The video signal is modulated with a full field five-riser modulated staircase signal (includes 3.58 MHz color subcarrier). The transmitting equipment is run to the specified visual output power level. The output of the transmitter or translator is then demodulated and run into the input of a calibrated vectorscope or video measurement system to observe the 3.58 MHz color subcarrier component of the test signal. Any deviation from a constant amplitude display of the 3.58 MHz signal, when viewed at the line rate frequency, is the differential gain variation. The differential gain is the difference between the maximum and minimum 3.58 MHz signal amplitude divided by the maximum amplitude. The differential gain is observed at 10%, 50%, and 90% APL conditions and the worse case result is recorded.</p> <p>To make an automatic measurement of differential gain with the VM700A, select DG/DP in the measure mode. Both differential phase and differential gain are shown on the same display (the upper graph is differential gain).</p> |
| Measurement: | The differential gain distortion is <u>6.01</u> % at 100% rated power and <u>6.58</u> % at 20% rated power. |

Differential Phase Distortion

| | |
|--------------|---|
| Definition: | Differential phase distortion occurs if a change in luminance level produces a change in the chrominance phase. If the distortion is severe, the hue of an object will change as its brightness changes. Differential phase distortion can change with changes in APL. |
| Requirement: | <p>Industry Canada – The differential phase distortion for standard power (> 50 watts VHF or > 500 watts UHF) shall be within $\pm 4^\circ$ of the color burst and the overall difference shall not exceed 5°. For standard low power (= 50 watts VHF or = 500 watts UHF), the differential phase shall be within $\pm 7^\circ$ of the color burst and the overall difference shall not exceed 10° [BETS-4, section 1.7].</p> <p>FCC – No FCC requirement (only cable systems Part 76 at 10 degrees)</p> |
| Method: | <p>The video signal is modulated with a full field five-riser modulated staircase signal (includes 3.58 MHz subcarrier). The transmitting equipment is run to the specified visual output power level. The output of the transmitter or translator is then demodulated and run into the input of a calibrated vectorscope or video measurement system suitable for measuring differential phase. The differential gain is observed at 10%, 50%, and 90% APL conditions and the worse case result is recorded.</p> <p>To make an automatic measurement of differential phase with the VM700A, select DG/DP in the measure mode. Both differential phase and differential gain are shown on the same display (the lower graph is differential phase).</p> |
| Measurement: | The differential phase distortion is <u>1.83</u> degrees at 100% rated power and <u>1.43</u> degrees at 20% rated power. |

Group Delay Response

Definition: The group delay of a transmitter or translator is defined as the relationship between the variation of group delay and the frequency of the sideband signal for frequencies within the limits of the output channel bandwidth; the sideband signal being produced by a sinusoidal input signal of given constant amplitude and variable frequency.

Requirement:

| | FCC [section 73.687(a)(3)] | Industry Canada [BETS-4 section 1.9] |
|-------------|---|---|
| 1.00 MHz | 0 ± 100 nsec relative to 200 kHz | 0 ± 50 nsec relative to 200 kHz |
| 2.00 MHz | 0 ± 100 nsec relative to 200 kHz | 0 ± 50 nsec relative to 200 kHz |
| 3.00 MHz | 0 ± 35 nsec relative to 200 kHz | 0 ± 35 nsec relative to 200 kHz |
| 3.58 MHz | -170 ± 25 nsec relative to 200 kHz | -170 ± 25 nsec relative to 200 kHz |
| 4.18 MHz | -346 ± 50 nsec relative to 200 kHz | -346 ± 50 nsec relative to 200 kHz |

Method: The transmitting equipment is operated at rated visual power into the standard test load. The measurement is made either on the transmitting equipment's output signal detected by the standard demodulator, or on the separate sideband signals as detected on a synchronous sweep receiver. The aural carrier is turned off and the video input consists of sync, blanking, and a variable pedestal, initially set to 25 IRE units. Composite video signals may be used if they are without a vertical interval since it obscures the measurement on some types of delay measurement equipment. The equipment output is sampled and is fed into a tracking receiver (sideband analyzer or spectrum analyzer). The 0 dB reference is set to the output level at visual carrier + 200 kHz. High rate group delay ripples as a result of saw filter triple transit effect are excluded.

Alternatively, group delay is measured using the $(\sin x)/x$ test signal from the TSG-95 generator and the automatic measurement system in the VM700A. Select Group Delay and Gain in the VM700A measure mode.

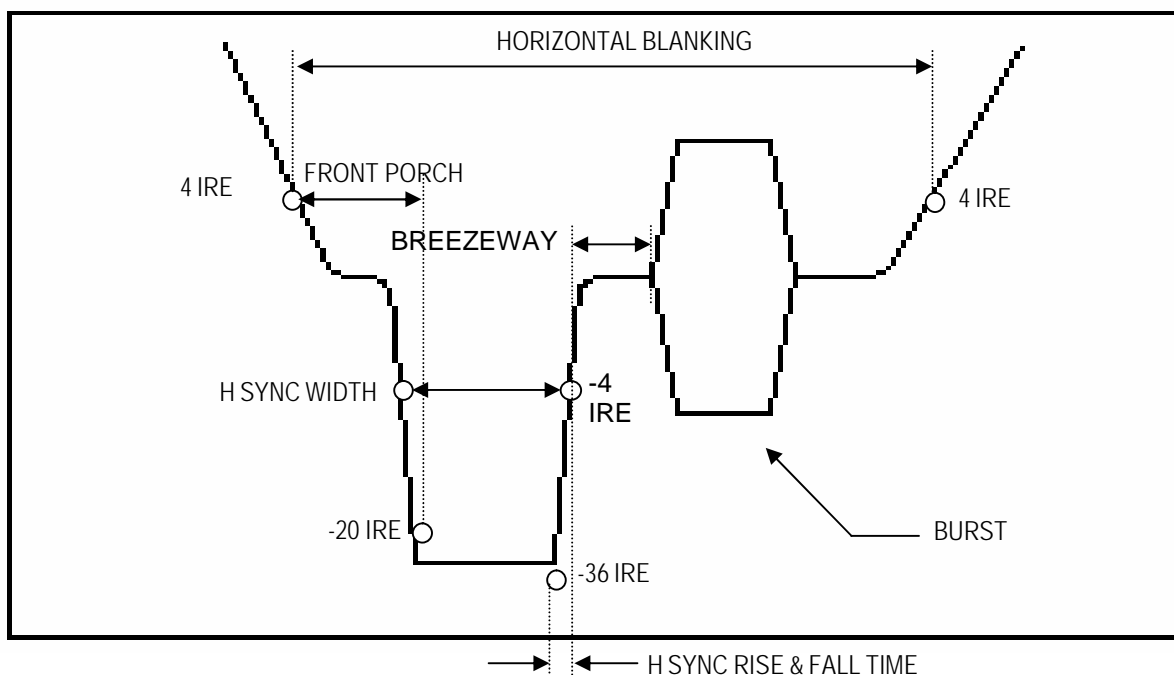
Measurement:

| | <i>100% Rated Power</i> | <i>20% Rated Power</i> |
|-----------|-------------------------|------------------------|
| 1 MHz: | <u>-50</u> | <u>-35</u> nsec |
| 2 MHz: | <u>-25</u> | <u>+5</u> nsec |
| 3 MHz: | <u>-5</u> | <u>-10</u> nsec |
| 3.58 MHz: | <u>-30</u> | <u>-30</u> nsec |
| 4.18 MHz: | <u>+50</u> | <u>+90</u> nsec |

All group delay measurements are relative to 200 kHz

Horizontal Timing

Definition:



Requirements:

| | EIA [RS-170A] | FCC [section 73.699, fig.6] |
|-----------------------|--|--|
| Front Porch | 1.5 $\mu\text{sec} \pm 0.1 \mu\text{sec}$ | 1.27 μsec min |
| H Sync Pulse | 4.7 $\mu\text{sec} \pm 0.1 \mu\text{sec}$ | 4.45 to 5.08 μsec |
| H Sync Rise/Fall Time | Not specified | 0.254 μsec max |
| Breezeway | 0.6 μsec | 0.38 μsec min |
| Burst Duration | 2.5 μsec | 8 to 11 cycles of chrominance subcarrier |
| Burst Amplitude | 40 IRE reference | 90% to 110% of H sync |
| Horizontal Blanking | 10.9 $\mu\text{sec} \pm 0.2 \mu\text{sec}$ | 10.49 to 11.49 μsec recommended |

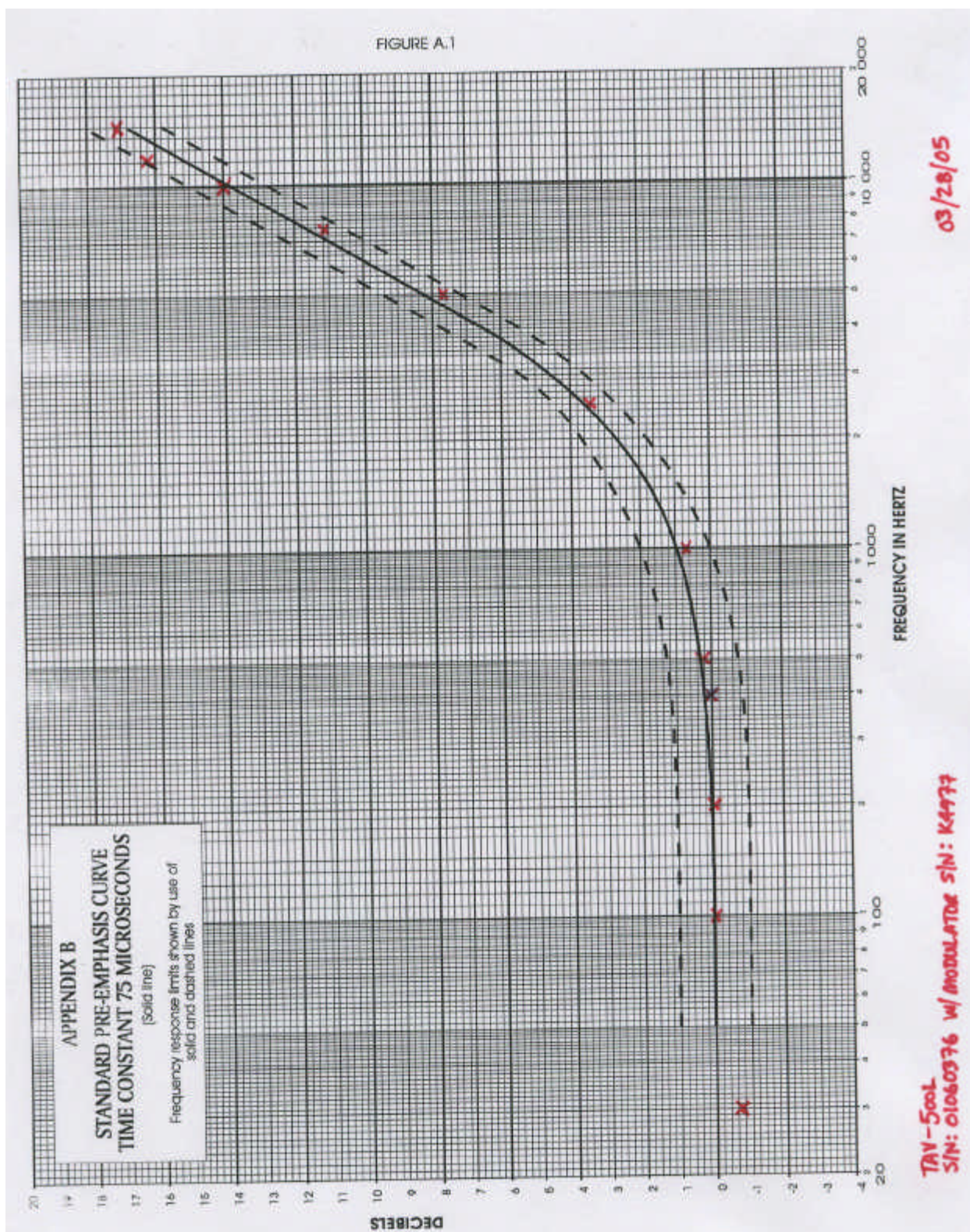
Measurement:

100% Rated Power 20% Rated Power

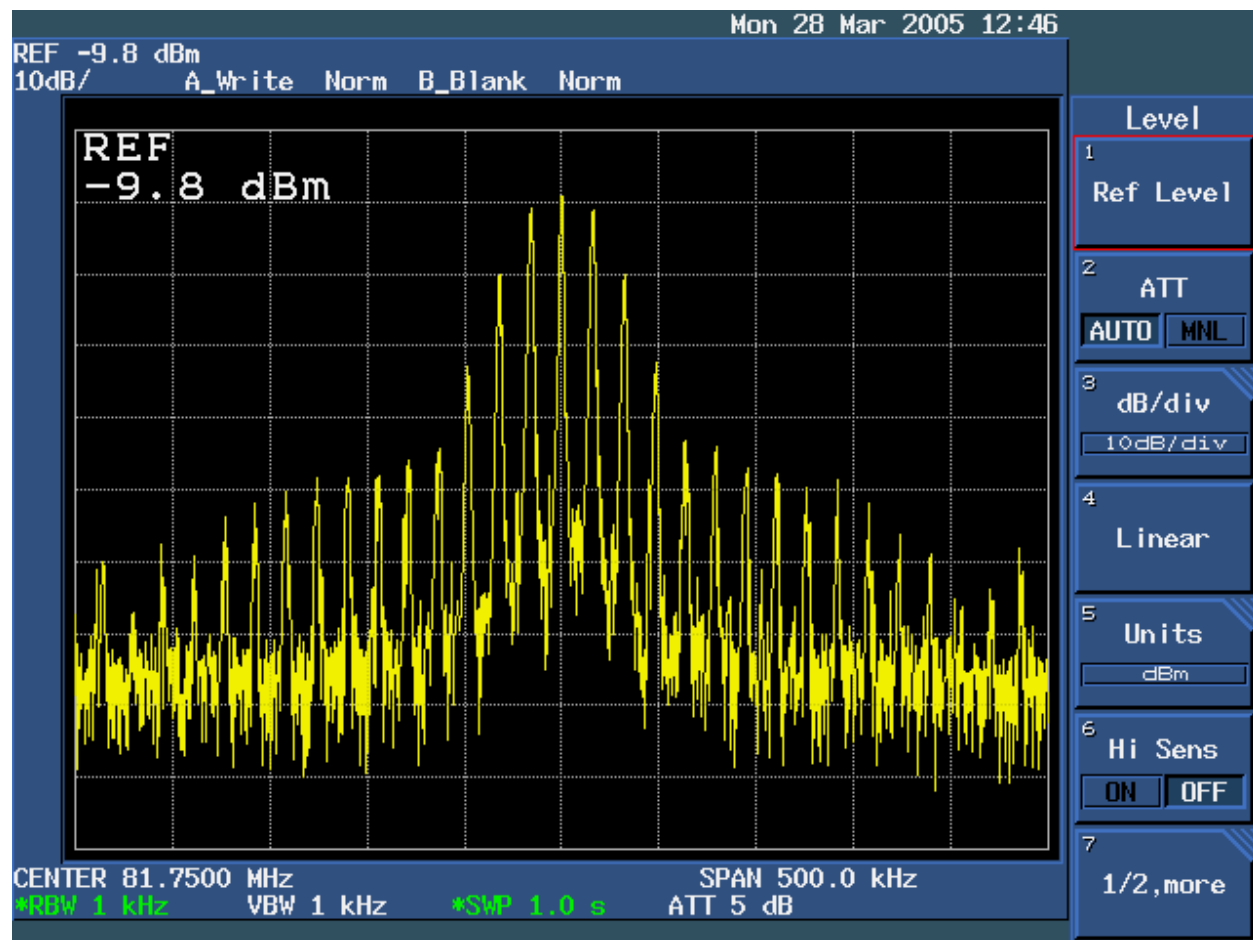
| | | |
|------------------------------|--------------|------------------------------|
| Front Porch: | <u>1.45</u> | <u>1.44</u> μsec |
| H Sync Pulse: | <u>4.78</u> | <u>4.79</u> μsec |
| H Sync Rise Time (leading): | <u>144</u> | <u>153</u> nsec |
| H Sync Rise Time (trailing): | <u>125</u> | <u>147</u> nsec |
| Breezeway: | <u>0.52</u> | <u>0.54</u> μsec |
| Burst Duration: | <u>9</u> | <u>9</u> cycles |
| Burst Amplitude: | <u>40.5</u> | <u>40.8</u> IRE |
| Horizontal Blanking: | <u>10.86</u> | <u>11.12</u> μsec |

Audio Amplitude Frequency Response

| | |
|--------------|--|
| Definition: | For the audio input channel, the audio amplitude frequency response of a television transmitter or translator is defined as the ratio of the input voltages at specific frequencies, referenced to a 400 Hz test tone of sufficient amplitude to result in 100% modulation required to obtain a constant percentage of modulation. The input voltages at specific frequencies are within the range from 30 Hz to 15 kHz and the ratio is expressed in dB. |
| Requirement: | <p>Industry Canada – For audio, the maximum departure of the amplitude response from the standard 75 μsec pre-emphasis curve over the range of 30 Hz to 15 kHz shall not exceed ± 0.5 dB up to ± 25 kHz deviation [BETS-4, section 2.3].</p> <p>FCC – Pre-emphasis shall be employed as closely as practicable in accordance with the impedance-frequency characteristic of a series inductance-resistance network having a time constant of 75 μsec [section 73.687(b)(1) and 73.699, figure 12].</p> |
| Method: | The visual carrier is unmodulated and turned on. A 400 Hz sinusoidal signal from a calibrated audio oscillator is applied to the audio input terminals at a level sufficient to produce 100% modulation. The aural section of the transmitter has the pre-emphasis turned on and a sample from the output is applied to the input of a modulation monitor. The audio oscillator's output level at 400 Hz is adjusted to achieve a ± 25 kHz deviation. This level is recorded and used as a reference. The audio output level of the audio oscillator is adjusted at 30, 100, 200, 500, 1000, 2500, 5000, 7500, 10000, 12000, and 15000 Hz to retain the ± 25 kHz deviation and the change in audio output level of the audio oscillator compared to the reference is recorded. |



Audio Pre-emphasis Curve



Aural Occupied Bandwidth