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Product Group 21

VM700A
OPTION 01 (NTSC)
OPERATOR'S MANUAL

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OPERATOR'S SAFETY SUMMARY

The general safety information in this part of the summary is for both operating and servicing personnel. Specific warnings and cautions will be found throughout the manual where they apply, but may not appear in this summary.

Terms In This Manual

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property or loss of data.

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

Terms As Marked on Equipment

CAUTION indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property, including the equipment itself. Refer to the manual for information.

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

Protective ground (earth) terminal.

SAFETY INFORMATION

Use the Proper Power Source. This product is intended to operate from a power source that will not apply more than 250 V rms between the supply conductors or between either supply conductor and ground. A protective-ground connection by way of the grounding conductor in the power cord is essential for safe operation.

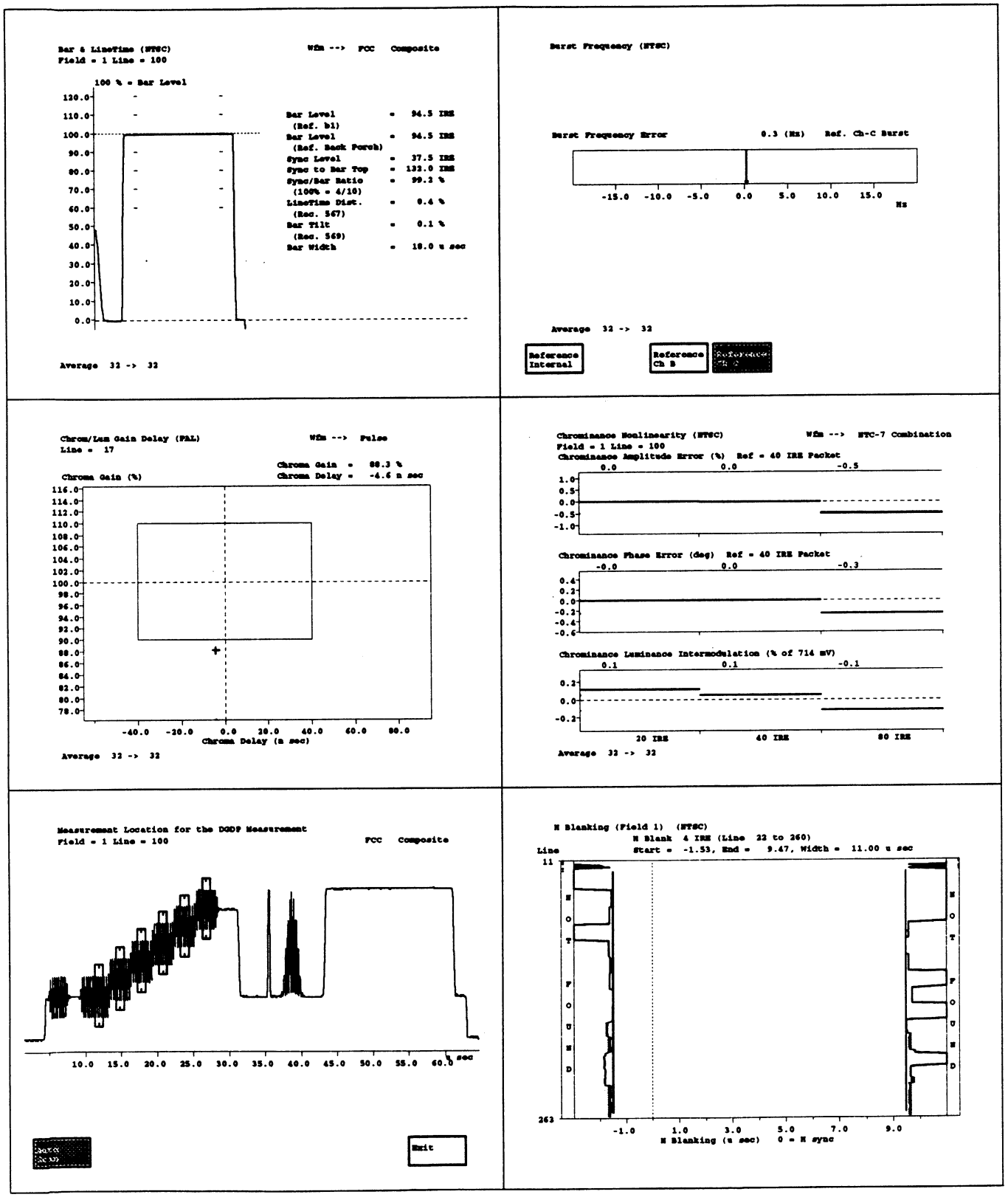
Ground the Product. This product is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting to the product input or output terminals. A protective-ground connection by way of the grounding conductor in the power cord is essential for safe operation.

Danger May Arise From Loss of Ground. Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulating) can render an electric shock.

Use the Proper Fuse. To avoid fire hazard, use only the fuse of correct type, voltage rating, and current rating as specified in the parts list for your product. Refer fuse replacement to qualified service personnel.

Do Not Operate in Explosive Atmospheres. To avoid explosion, do not operate this product in an explosive atmosphere.

Do Not Remove Covers. To avoid personal injury, do not remove the product covers or panels. Do not operate the product without the covers and panels properly installed.



VM700A Option 01 NTSC Measurements.

Section 1
INTRODUCTION

The VM700A Option 01 (NTSC) gives you access to a large variety of interactive ("Measure mode") and automatic ("Auto mode") measurements.

Measure mode measurements are user-selectable, interactive, graphical applications that make measurements on video signals. Chapter 2 of this manual describes each Measure mode measurement.

Pressing the VM700A's front-panel Measure button displays Measure mode, showing the names of available measurements.

Rotating the control knob scrolls the Measure mode display to show more measurements.

Touching the name of a measurement in the Measure mode display begins execution of that measurement.

Pressing any major mode button (for example, Waveform, Vector, Picture, Measure, or Auto) when a measurement runs ends that measurement and returns to the appropriate major mode display.

Auto mode measurements are measurements taken when the VM700A is in "Auto mode", wherein it continuously repeats a set of user-selectable measurements, and reports when a measurement falls outside user-defined limits. Auto mode is usually used to monitor video signals and alert someone when one or more parameters drifts out of pre-defined limits. *Section 3, AUTO MODE MEASUREMENTS* describes each Auto mode measurement.

Pressing the VM700A's front-panel Auto button displays Auto mode, showing the Auto mode measurements that will be performed continuously, until the VM700A is taken out of Auto mode.

Pressing any major mode button (for example, Waveform, Vector, Picture, Measure, or Auto) when a measurement runs ends that measurement and returns to the appropriate major mode display.

The specifications for the VM700A's NTSC measurements, in both Measure and Auto modes, are listed in the specifications section of this manual.

The VM700A may be programmed for remote operation. See the *VM700A Programmer's Reference Manual* for information on programming and operating the VM700A remotely.

Section 2
USING MEASURE MODE MEASUREMENTS

The VM700A's Measure Mode gives you a large selection of interactive, graphical measurements for video signals. Available Measure Mode measurements and the signal qualities they measure include those shown in Table 2-1.

Table 2-1
Measure Mode Measurements

Timing Measurements	
Burst Frequency	Color Burst subcarrier frequency error
H_Blank	Horizontal blanking over field
H_Timing	All horizontal timing parameters
Jitter	H Sync jitter within a frame
Jitter Long_Time	Frame jitter
Line Frequency	Line frequency error
SCH_Phase	SubCarrier-to-Horizontal (SCH) Phase
V_Blank	Vertical interval timing and pulse positions
Non-Linear Distortion Measurements	
Chrominance NonLinearity	Chrominance non-linear phase & gain
DGDP	Differential gain & phase
Luminance Non-Linearity	Differential luminance
Linear Distortion Measurements	
Bar LineTime	Bar and sync amplitudes and line time distortion
Bounce	Long time (low frequency) distortion
ChromLum GainDelay	Chrominance-to-luminance gain ratio and delay time
GroupDelay SinX_X	Frequency response, group delay (both with SinX/X signal)
K_Factor	Short Time Distortion (K_{2T} pulse/bar ratio)
MultiBurst	Frequency response (with MultiBurst signal)
ShortTime Distortion	Distortion in reference-to-bar level and bar-to-reference transitions of a bar signal
TwoField	Field time distortion

Table 2-1
Measure Mode Measurements (continued)

Noise Measurements	
Chrominance AMPM	Chrominance noise (amplitude-modulated and phase-modulated components)
Noise Spectrum	Signal-to-noise ratio (various weighting filters available)
Miscellaneous	
ColorBar	From color bar signal: luminance level, chrominance level, chrominance phase
ICPM	Incidental Carrier Phase Modulation
VITS ID	Identify signals in vertical interval

BAR LINETIME

The Bar LineTime measurement measures bar and sync amplitudes, as well as line time distortion.

Figure 2-1 shows the Bar LineTime display. The display plots the bar signal level on the y-axis, and time on the x-axis. The default y-axis level labeled "100%" is determined from the difference between the bar top, or level of the bar signal at the center of the bar (i.e., the time halfway between the 50% rising edge and 50% falling edge times of the bar) and the black-level reference position of the signal. Both the bar top position and the black-level reference position can be adjusted using softkeys on the Special Position submenu of the **Acquire** softkey.

Numerical readouts provide measurement results in mV, %, and µsec, as appropriate. The readouts provided are as follows:

Bar Level (ref. b1) gives the bar top amplitude relative to the Black Level Reference (b1) level.

Bar Level (ref. Back Porch) gives the bar top amplitude relative to the back porch.

Sync Level gives the sync tip amplitude relative to the back porch.

Sync to Bar Top is the Bar Level (ref. Back Porch) plus Sync Level value.

LineTime Dist. gives the percentage of maximum deviation from the bar level.

Bar Tilt (Rec. 569) gives the percentage of difference at the end points, which are measured 1 µs after the 50% level of the rising edge and 1 µs before the 50% level of the falling edge. A positive number means that the point near the falling edge is higher than the point near the rising edge.

Bar Width is the width in µsec of the bar from the 50% levels of the rising and falling edges.

The Bar LineTime measurement identifies FCC Composite, NTC-7 Composite, or 1410 TSG-5 type Pulse & Bar signals. The essential signal element for the Bar LineTime measurement is a bar signal.

The Bar LineTime measurement is made on the current system line. The System Default measurement location for the Bar LineTime measurement is field 1 of line 18.

The black-level reference and bar top positions can be changed by using the **Reference** and **Bar Pos** softkeys, respectively, in the Special Position submenu of the Acquire softkey.

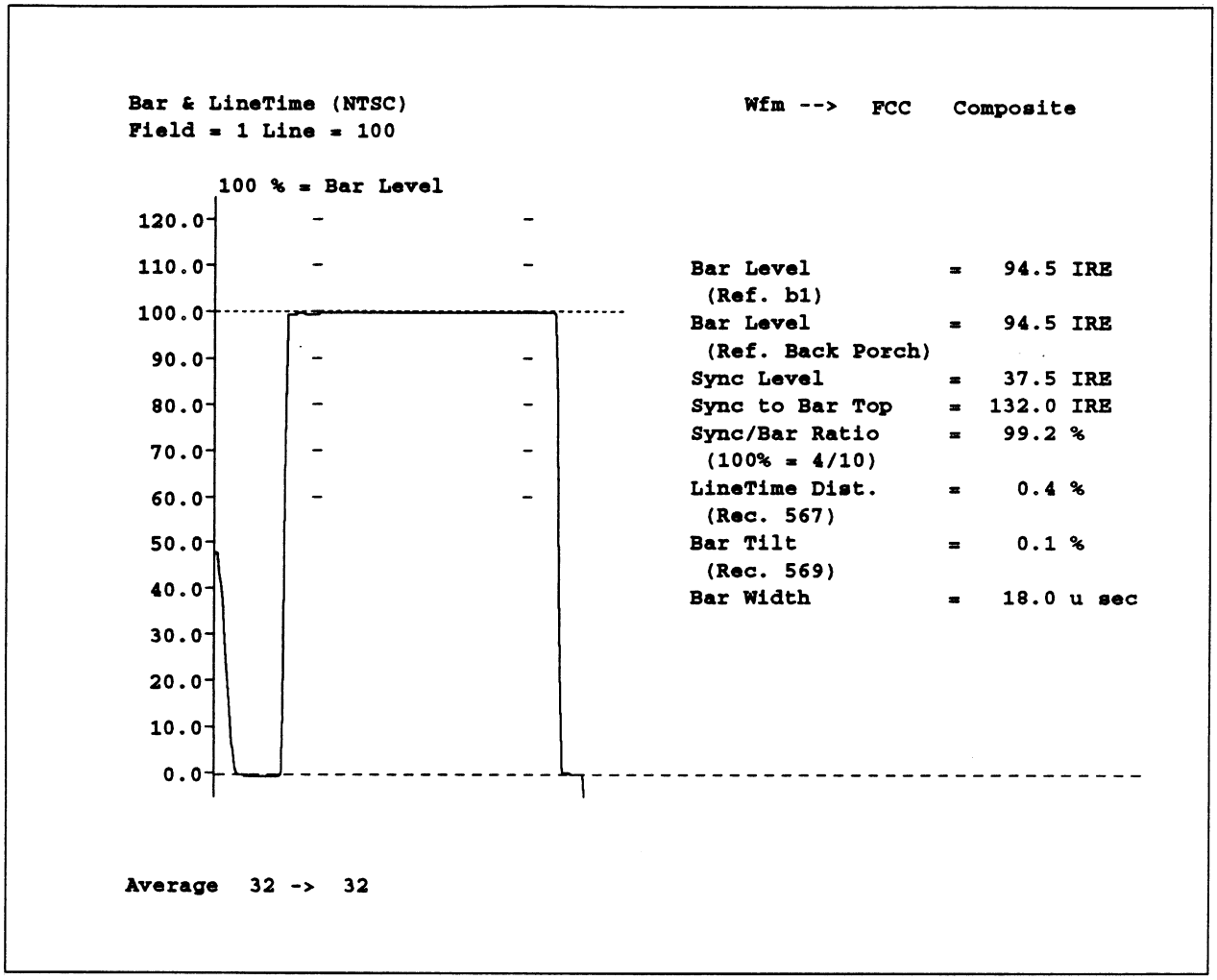


Figure 2-1. Bar LineTime display.

Bar LineTime Menu

Pressing the Menu button when the Bar LineTime measurement runs displays the Bar LineTime menu (Figure 2-2).

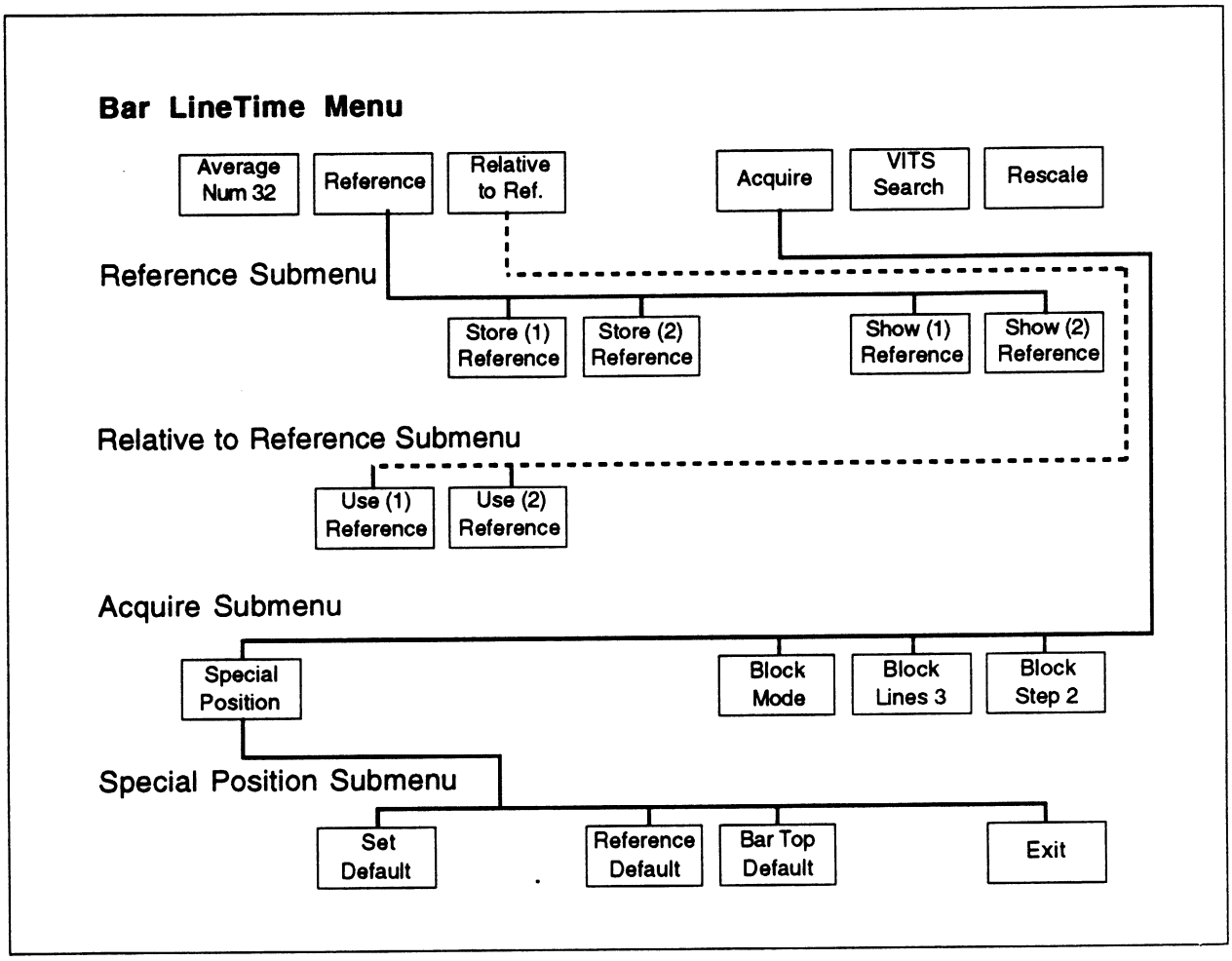


Figure 2-2. Bar LineTime menu tree.

MAIN MENU

`Average Num`

Average Num specifies the weighting factor to use for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the **Average Num** softkey to highlight it, rotate the knob until the desired weighting factor appears, then touch the **Average Num** softkey again.

`Reference`

Reference displays a submenu that (1) stores the currently displayed values for use as a reference; or (2) displays previously stored reference values.

`Relative to Ref`

Relative to Ref displays a submenu of softkeys that selects the reference to use for comparison in the measurement. When a stored reference is selected, the currently measured value is compared to the stored reference value.

Acquire

Acquire displays the Acquire submenu that controls how the signal is acquired for the specific measurement.

VITS Search

ITS Search searches the insertion test signals for a signal appropriate for the measurement. If an appropriate signal is not located, the message **Not found** displays briefly on the display.

Rescale

Rescale sets the expansion factor of the display to an appropriate scaling factor for the Bar LineTime measurement's display graticule. The x- and y-axes adjust to accommodate the rescaled display.

REFERENCE SUBMENU

Store (n) Reference

Store (1) Reference/Store (2) Reference saves the current measurement values as (1) Reference and (2) Reference, respectively. Selecting Store (1) Reference or Store (2) Reference overwrites previous (1) Reference or (2) Reference values. References are stored in nonvolatile memory and are retained when the VM700A is powered down.

Show (n) Reference

Show (1) Reference/Show (2) Reference displays the current values of (1) Reference and (2) Reference, respectively, plus the date and time the reference was stored and the channel the reference signal was on. If no reference value has been stored, touching either softkey displays a message that the reference is not defined.

RELATIVE TO REFERENCE SUBMENU

Use (n) Reference

Use (1) Reference/Use (2) Reference selects the stored reference to which measured values are compared. If no reference value has been stored, touching either softkey displays a message that the reference is not defined.

ACQUIRE SUBMENU

Special Position

Special Position displays the Special Position submenu and a waveform display (Figure 2-3) used to set the location on the waveform where the measurement is made.

Block Mode

Block Mode turns on Block mode. The block starts at the system line.

Block Lines 3

Block Lines sets the number of lines to average for the measurement. The default number of Block Lines to average is 3.

Block Step 2

Block Step sets the number of lines to step in the block. The default number of lines to step is 2.

SPECIAL POSITION SUBMENU

Set Default	**Set Default** reassigns the default values to the **Reference** and **Bar Position** softkeys. To reassign the default value to one of the position softkeys, select that softkey before touching **Set Default**.
Ref. (b1)	**Ref. (b1)** sets the black level, or zero, measurement location. The default measurement location varies with the signal type (FCC, NTC-7, etc.).
Bar Top	**Bar Top** sets the measurement location of the bar level. The default measurement location is the halfway point between the 50% rising edge and the 50% falling edge times of the bar.
Exit	**Exit** leaves the Special Position submenu and displays the Bar LineTime display.

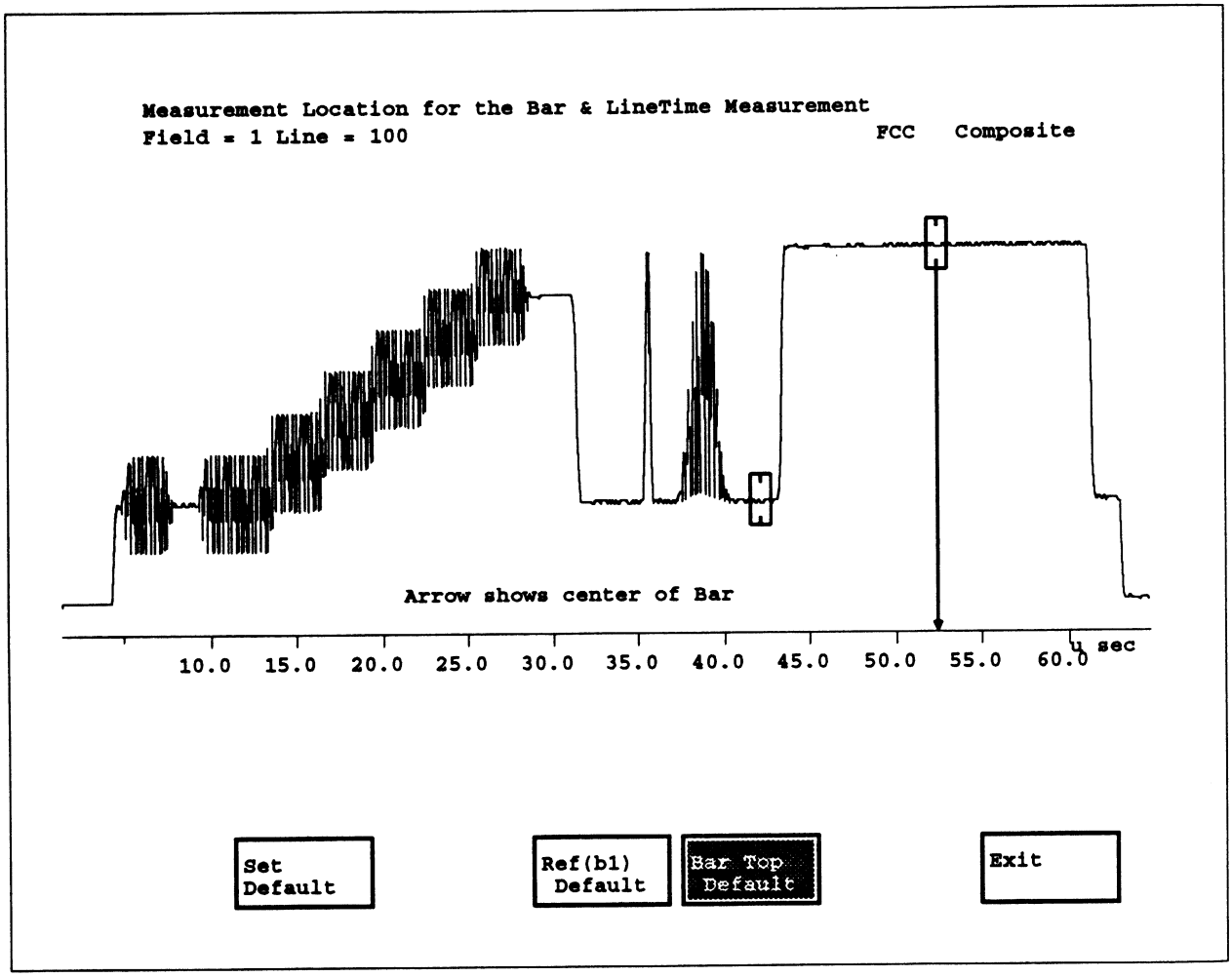


Figure 2-3. Bar LineTime special position display.

BOUNCE

The **Bounce** measurement measures low-frequency distortion.

Figure 2-4 shows a typical Bounce measurement display. The display graphs three signal levels: the Average Picture Level (APL) at the top, the back porch, or "burst" level (measured at center of burst) in the middle, and the sync tip level at the bottom. The < mark indicates the 0.0 Volts level.

Numerical readouts include:

- **PK. dev.** gives the % of bounce on the burst signal relative to the amplitude of the bounce signal.
- **Settle** to gives the time (in seconds) that the signal takes to settle to the reference percentage.
- **Expect** gives the expected low and high percentage of the average picture level (APL), based on the current pattern.

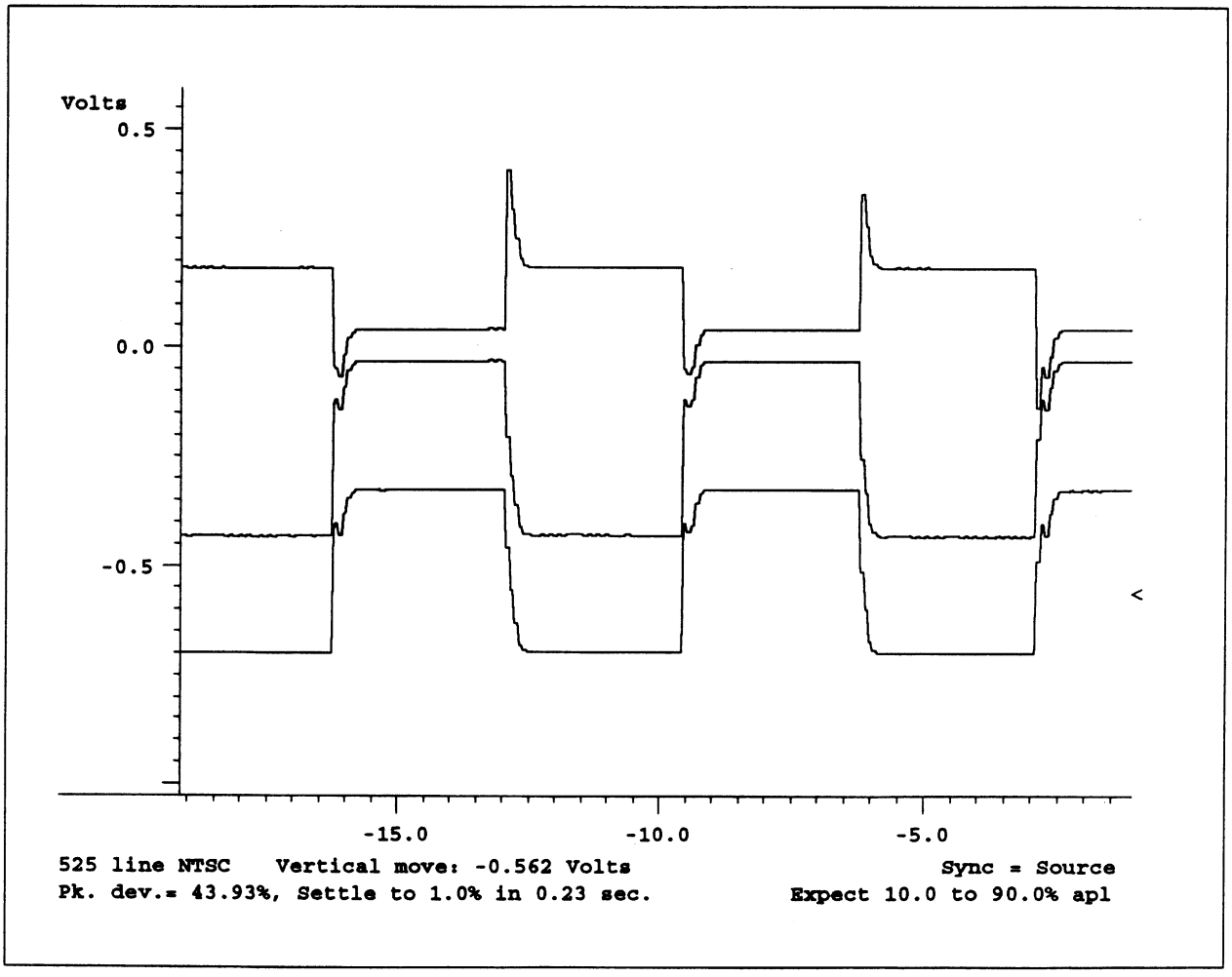


Figure 2-4. Bounce display.

Bounce Menu

Pressing the Menu button when the Bounce measurement runs displays the Bounce menu (Figure 2-5).

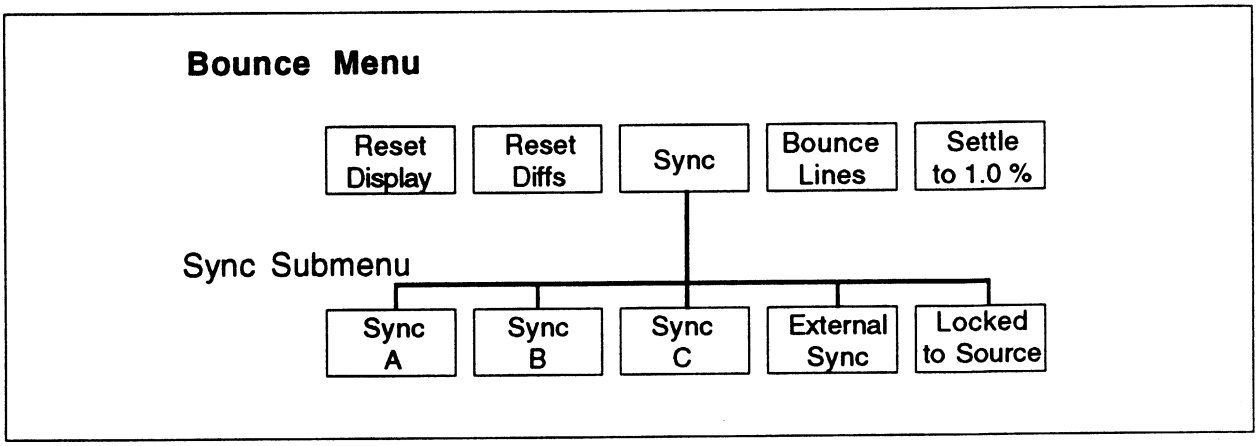


Figure 2-5. Bounce menu tree.

MAIN MENU

Reset Display	**Reset Display** restores the display to the initial scaling.
Reset Diffs	**Reset Diffs** resets the Vertical Move readout to 0.0, so that any vertical displacement of the Bounce waveform by the knob will be measured. This is useful for measuring amplitudes of features when Freeze is engaged.
Sync	**Sync** displays a group of softkeys that select the type of sync.
Bounce Lines	**Bounce Lines** causes only the bounce lines to display. (The usual Bounce signal includes three bounce lines to one 50% APL reference signal.)
Settle to %	**Settle to %** sets the reference percentage. When the Bounce signal source is a generator and the % reference is 0.6% or greater, the Settle to time could be less than 0.1 sec., and be displayed as 0.0 sec.

SYNC SUBMENU

Sync n

Sync A/Sync B/Sync C selects the corresponding input channel as the sync source.

Touching any of these softkeys also de-selects the ***Locked to Sync*** *softkey, so that subsequent input selection changes will not affect the sync source. This causes problems if the relative input timings of source and sync are not derived from the same video source.*

External Sync

External Sync selects external input as the sync source. This input cannot be displayed or measured. See warning above.

Locked to Source

Locked to Source when highlighted, ensures that sync and input sources are always the same. See warning above.

BURST FREQUENCY

Burst Frequency measures the Color Burst (subcarrier) frequency.

Figure 2-6 shows the Burst Frequency display. The display shows the difference between the currently measured Burst Frequency and a reference frequency. (In Figure 2-6, the Color Burst frequency of an incoming signal on Channel C was used as the reference.)

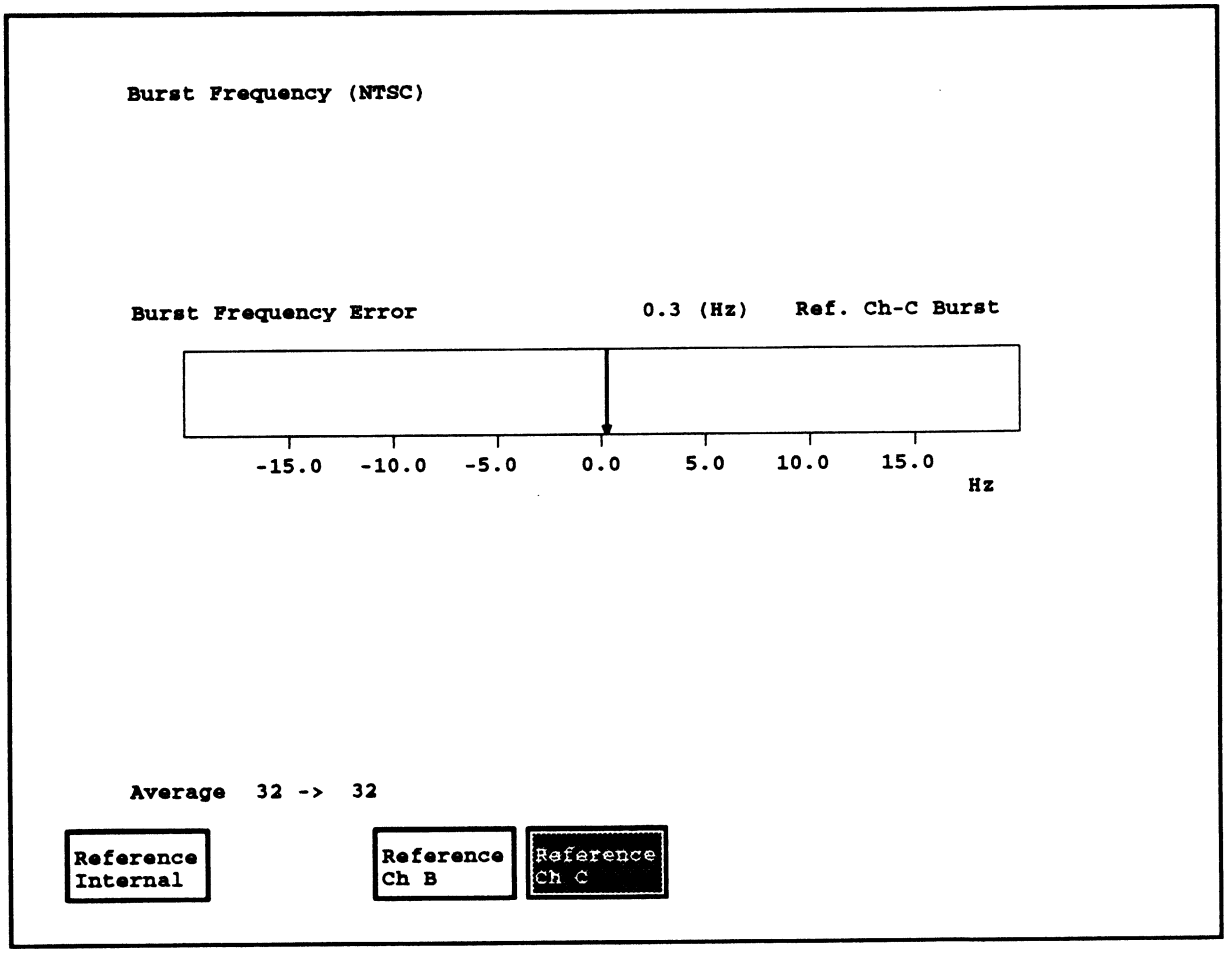


Figure 2-6. Burst Frequency display.

You can use the color burst frequency of the signal currently on another channel as a reference frequency, or you can store a reference frequency by using the Reference Internal and Zero Set softkeys that appear as a submenu under the Reference softkey. (See "Setting the Reference Burst Frequency," below.)

If you use another channel' s color burst (or the internal frequency reference) as a reference frequency on a Dual-Standard VM700A, both signals should use the same standard (NTSC or PAL).

Burst Frequency Menu

Pressing the Menu button when the Burst Frequency measurement runs displays the Burst Frequency menu (Figure 2-7).

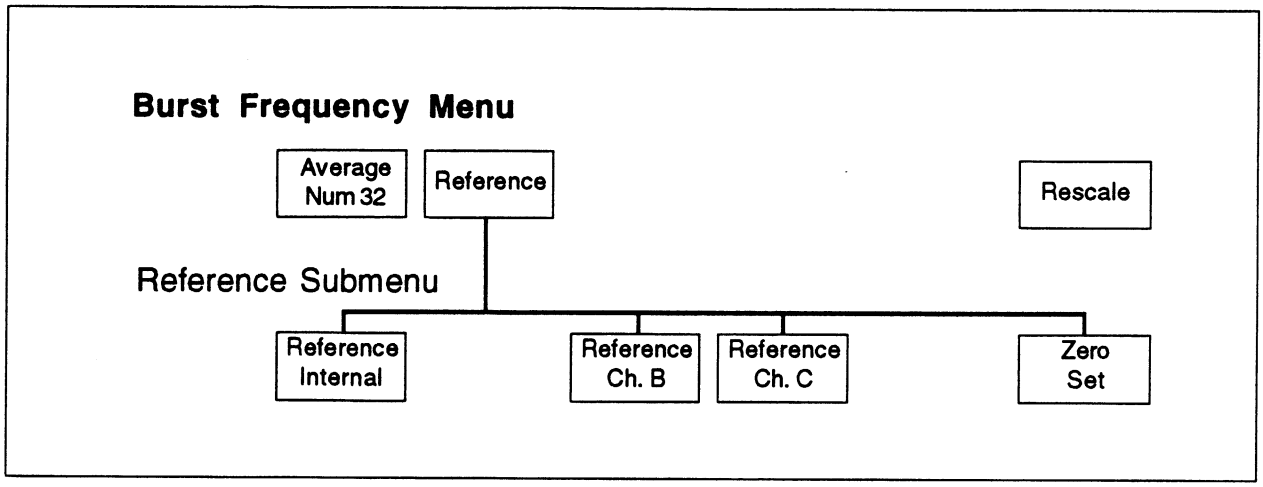


Figure 2-7. Burst Frequency menu tree.

MAIN MENU

Average Num

Average Num specifies the weighting factor to use for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the **Average Num** softkey to highlight it, rotate the knob until the desired weighting factor appears, then touch the **Average Num** softkey again.

Reference

Reference displays the Reference submenu which selects the reference source for the burst frequency.

Rescale

Rescale sets the expansion factor of the display to an appropriate scaling factor for the Burst Frequency measurement's display graticule. The x- and y-axes adjust to accommodate the rescaled display.

REFERENCE SUBMENU

Reference Internal

Reference Internal sets the reference burst frequency to that of the internal crystal. A reference frequency stored with the **Zero Set** softkey is required for calibration.

Reference Ch. B

Reference Ch. B sets the burst frequency reference to Channel B.

Reference Ch. C

Reference Ch. C sets the burst frequency reference to Channel C.

Zero Set

Zero Set stores the burst frequency of the current source as the reference.

Setting the Reference Burst Frequency

You can set the VM700A's reference burst frequency when the Reference sub-menu displays.

- To use the burst frequency of a signal on another channel as a reference, touch the softkey corresponding to that channel.
- To store the color burst frequency of a signal on another channel for later use as a reference, press that channel's button on the front panel, then touch the **Zero Set** softkey. The color burst frequency of the designated signal becomes the internal reference, and remains so until the VM700A is powered down or until another reference signal is stored.
- To use the frequency of the VM700A's internal crystal as a reference frequency without calibration, disconnect any signals from the current sync source, then touch the **Zero Set** softkey.

The VM700A displays "Zero Set," followed by the date and time, followed by the message "No CAL". The stored value becomes the internal reference, and remains so until the VM700A is powered down or until another reference signal is stored.(This method of measurement is not recommended, but may be accurate enough for some purposes.)

CHROMLUM GAIN DELAY

ChromLum GainDelay measures the Chrominance-to-Luminance gain ratio and delay time.

The ChromLum GainDelay measurement screen provides a graphic display of chrominance-to-luminance gain and delay values. This measurement is normally made on a modulated 12.5T pulse. Figure 2-8 shows a VITS signal measured by ChromLum GainDelay.

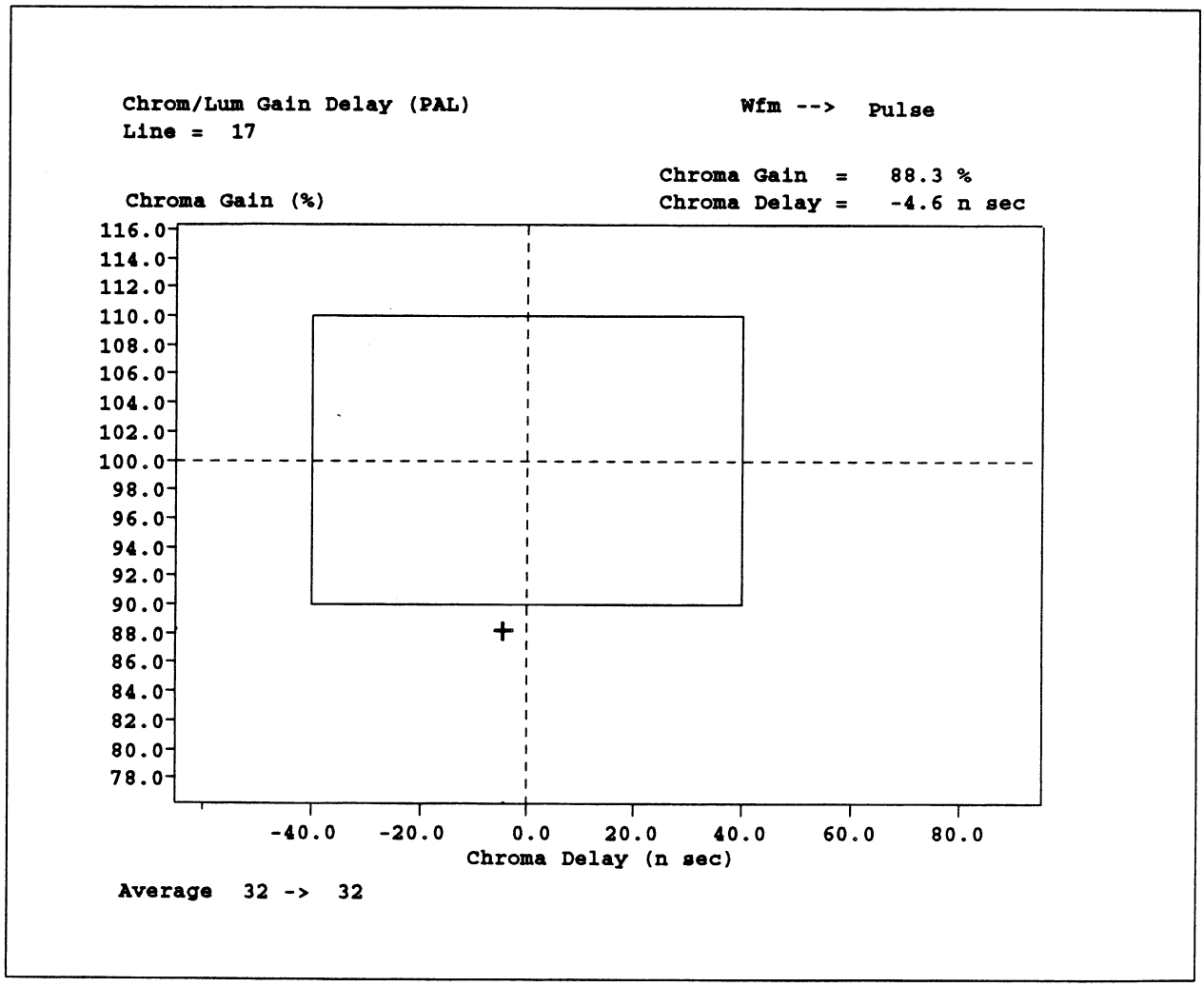


Figure 2-8. ChromLum GainDelay display.

The rectangle in the center of the display represents the upper and lower limits of the Chroma Gain (%) and Chroma Delay (ns) measurements. The left and right sides of the box correspond to the lower and upper limits of the chrominance-to-luminance delay measurement (Chroma-Lum Delay (ns) in the active Measure_Limits file). The top and bottom of the box represent the upper and lower limits of the chrominance-to-luminance gain error measurement (Chroma-Lum Gain (%) in the active Measure_Limits file). The position of the + within the box indicates delay (in ns) along the horizontal scale and gain (in %, relative to luminance) on the vertical scale.

The ChromLum GainDelay measurement is made on the current system line. The System Default measurement locations file specifies that the ChromLum GainDelay measurement is made on field 1, line 18.

ChromLum GainDelay Menu

Pressing the Menu button when the ChromLum GainDelay measurement runs displays the ChromLum GainDelay menu (Figure 2-9).

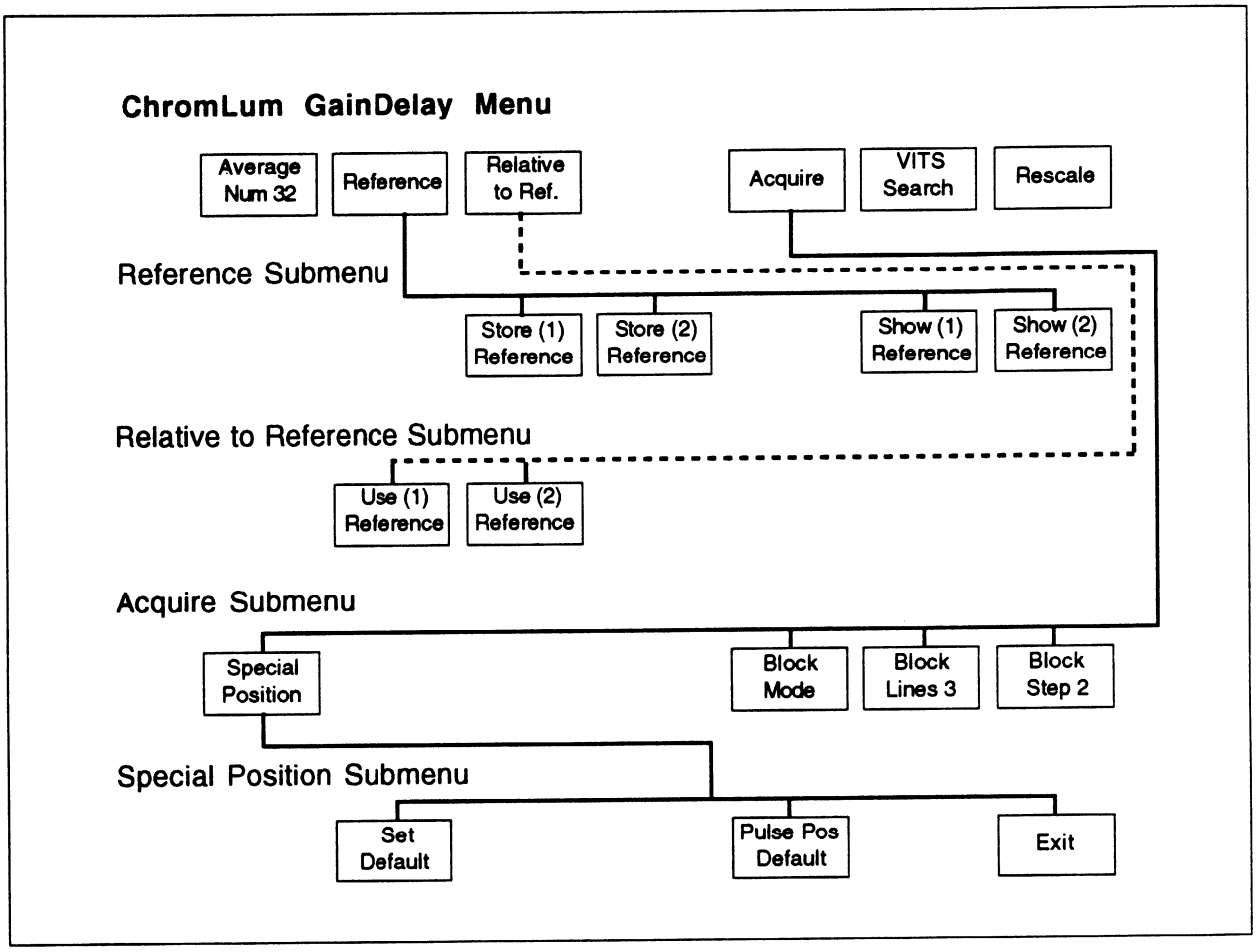


Figure 2-9. ChromLum GainDelay menu tree.

MAIN MENU

Average Num	**Average Num** specifies the weighting factor to use for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the **Average Num** softkey to highlight it, rotate the knob until the desired weighting factor appears, then touch the **Average Num** softkey again.
Reference	**Reference** displays the Reference submenu which stores the currently-displayed values for use as a reference or displays previously-stored reference values.
Relative to Reference	**Reference** displays the Relative to Reference submenu which selects the reference to use for comparison in the measurement. When a stored reference is selected, the currently measured value is compared to the stored reference value.

Acquire

Acquire displays the Acquire submenu that controls how the signal is acquired for the specific measurement.

VITS Search

VITS Search causes the VM700A to search the insertion test signals for a signal appropriate for the measurement. If an appropriate signal is not located, the message **Not found** displays briefly on the display.

Rescale

Rescale sets the expansion factor of the display to an appropriate scaling factor for the ChromLum GainDelay measurement's display graticule. The x- and y-axes adjust to accommodate the rescaled display.

REFERENCE SUBMENU

Store (n) Reference

Store (1) Reference/Store (2) Reference saves the current measurement values as (1) Reference and (2) Reference, respectively. Selecting Store (1) Reference or Store (2) Reference overwrites previous (1) Reference or (2) Reference values. References are stored in nonvolatile memory and are retained when the VM700A is powered down.

Show (n) Reference

Show (1) Reference/Show (2) Reference displays the current values of (1) Reference and (2) Reference, respectively, plus the date and time the reference was stored and the channel the reference signal was on. If no reference value has been stored, touching either softkey displays a message that the reference is not defined.

RELATIVE TO REFERENCE SUBMENU

Use (n) Reference

Use (1) Reference/Use (2) Reference selects the stored reference to which measured values are compared. If no reference value has been stored, touching either softkey displays a message that the reference is not defined.

ACQUIRE SUBMENU

Special Position

Special Position displays the Special Position submenu and a special waveform display used to set the location on the waveform where the measurement is made. Figure 2-10 shows the ChromLum GainDelay Special Position display and submenu.

Block Mode

Block Mode turns on Block mode. The block starts at the system line.

Block Lines

Block Lines sets the number of lines to average for the measurement. The default number of Block Lines to average is 3.

Block Step

Block Step sets the number of lines to step in the block. The default number of lines to step is 2.

SPECIAL POSITION SUBMENU

Set Default	**Set Default** reassigns the default value to the **Pulse Position** softkey.
Pulse Pos	**Pulse Pos** sets the measurement location of the pulse. The default pulse position is determined automatically by the type of signal being measured.
Exit	**Exit** leaves the Special Position submenu and displays the ChromLum GainDelay display.

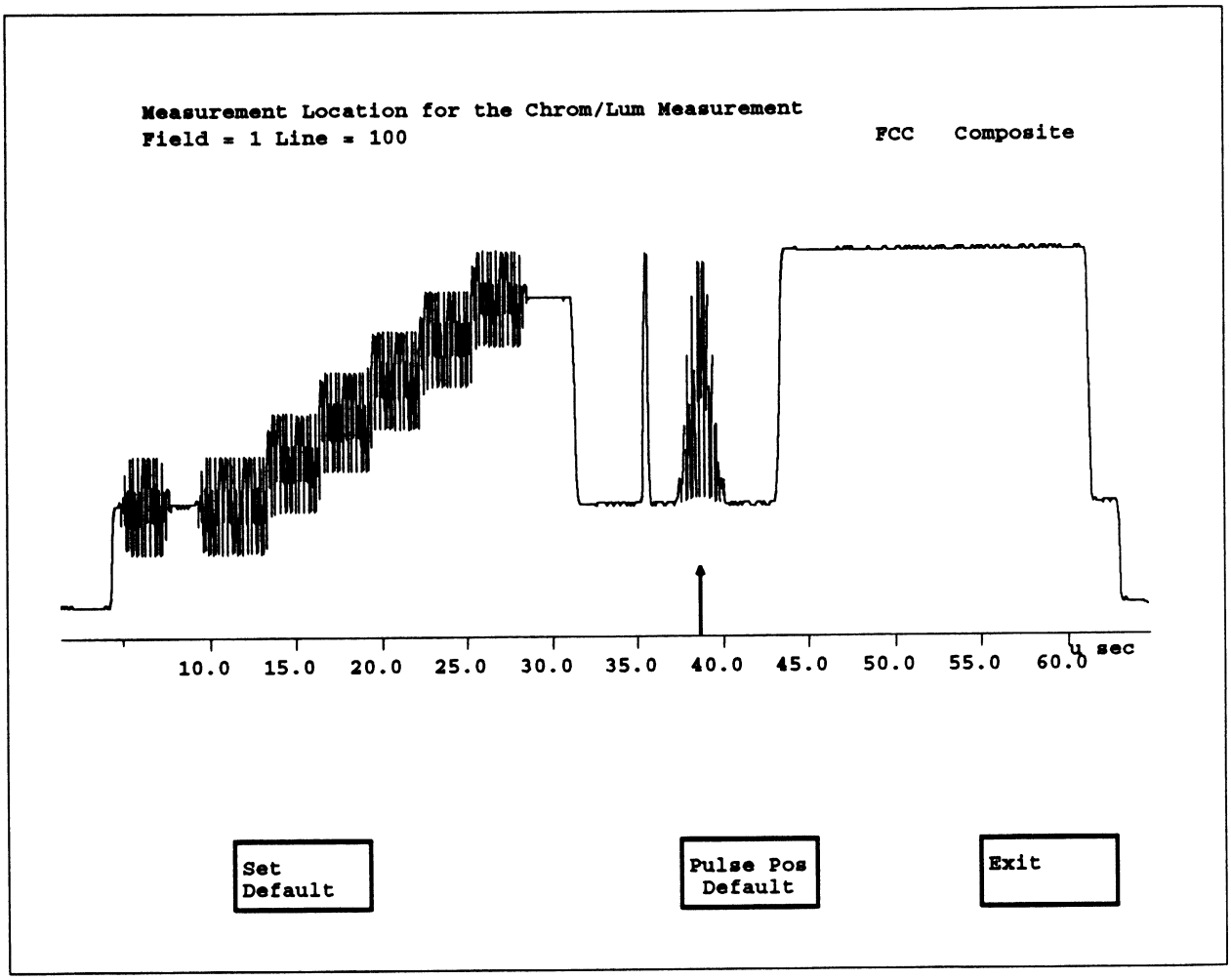


Figure 2-10. ChromLum GainDelay Special Position display.

CHROMINANCE AMPM

Chrominance AMPM measures two types of chrominance noise: the amplitude-modulated (AM) noise component and the phase-modulated (PM) noise component of the chrominance channel.

VTR's have separate chrominance and luminance channels. Most signal-to-noise measurements look only at noise in the luminance channel. Chrominance AMPM measures two types of chrominance noise: the amplitude-modulated (AM) noise component and the phase-modulated (PM) noise component of the chrominance channel. A software filter with a very sharp cut-off reduces intermodulation from the frequency-modulated fundamental of a VCR/VTR. This measurement can be made on a full field or single line of the Red Field test signal.

The default measurement bandwidth is 100 Hz to 500 kHz. High pass 100 hZ, 10 kHz, and 100 kHz filters, as well as low pass 100 kHz, 500 kHz, and 1.0 MHz filters are available by touching the Menu button and the **Filters Selection** softkey.

When using a single line for the measurement, the 100 Hz high pass filter becomes unavailable due to the lack of low-frequency components in a line.

When using Color Bursts for the measurement, 100 Hz high pass and 1.0 MHz low pass filters are automatically selected.

The values for Chrominance AM and PM are defined as follows:

$$\text{Chrominance AM} = 20 \log \frac{\text{AM noise}_{rms}}{V_{ref_{p\text{-}p}}}$$

$$\text{Chrominance PM} = 20 \log \frac{\text{PM noise}_{rms}}{V_{ref_{p\text{-}p}}}$$

where $V_{ref_{p\text{-}p}}$ denotes the chrominance voltage corresponding to 100% amplitude of the non-composite video signal.

Touching the **Chrominance AMPM** softkey from the Measure mode directory window displays the Chrominance AMPM screen (Figure 2-11). The display features:

- two graphic "meters" that show the measured values of AM and PM noise
- digital readouts of the measurements
- graphical indicators for the upper limit values for Chrominance AM and PM Noise as specified in the current Measure_Limits file. The lines controlling these values in the Measure_Limit file are labeled Chrominance AM Noise (dB rms) and Chrominance PM Noise (dB rms), respectively, in the current Measure_Limits file.

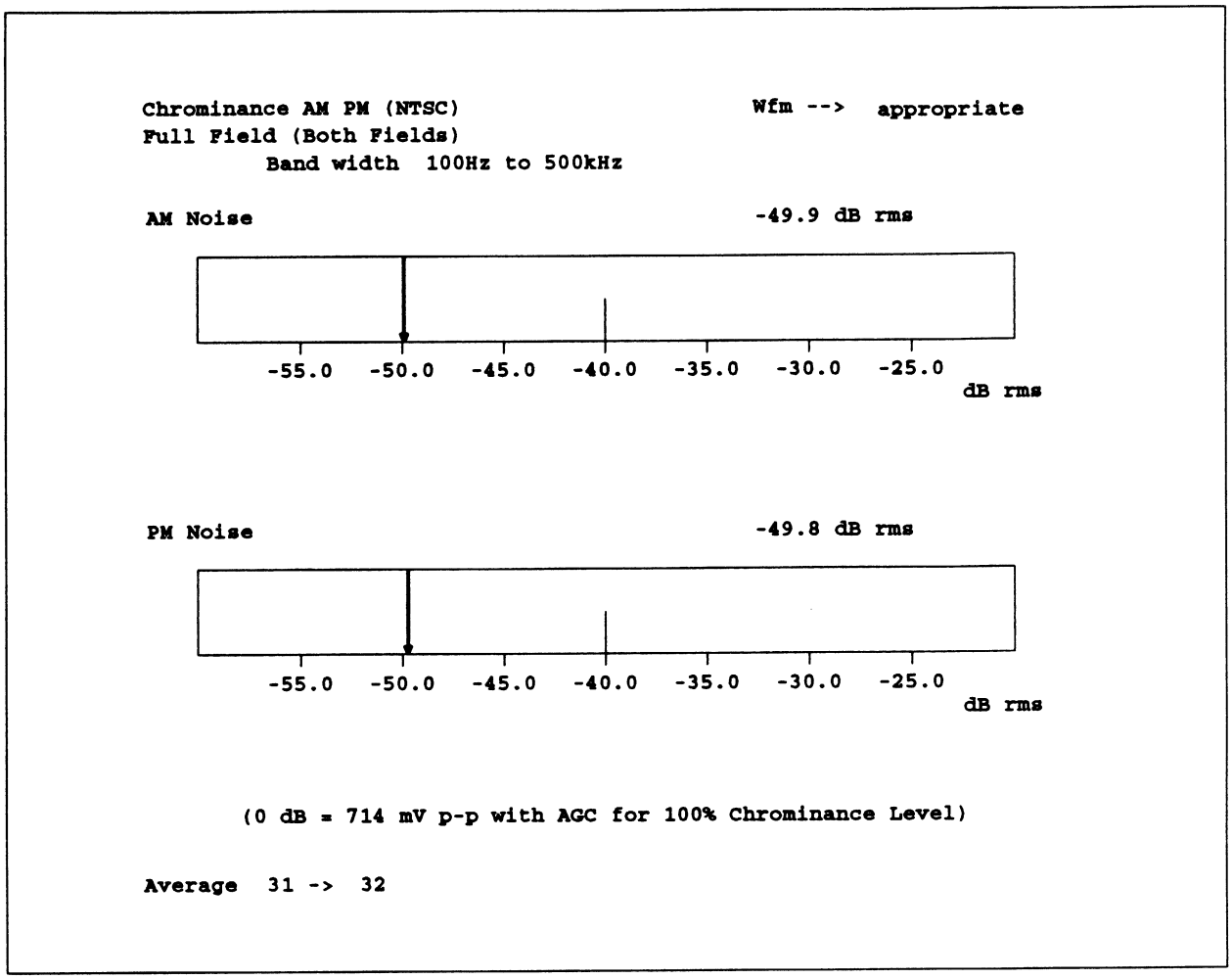


Figure 2-11. Chrominance AMPM display.

Chrominance AMPM Menu

Pressing the Menu button when the Chrominance AMPM measurement runs displays the Chrominance AMPM menu (Figure 2-12).

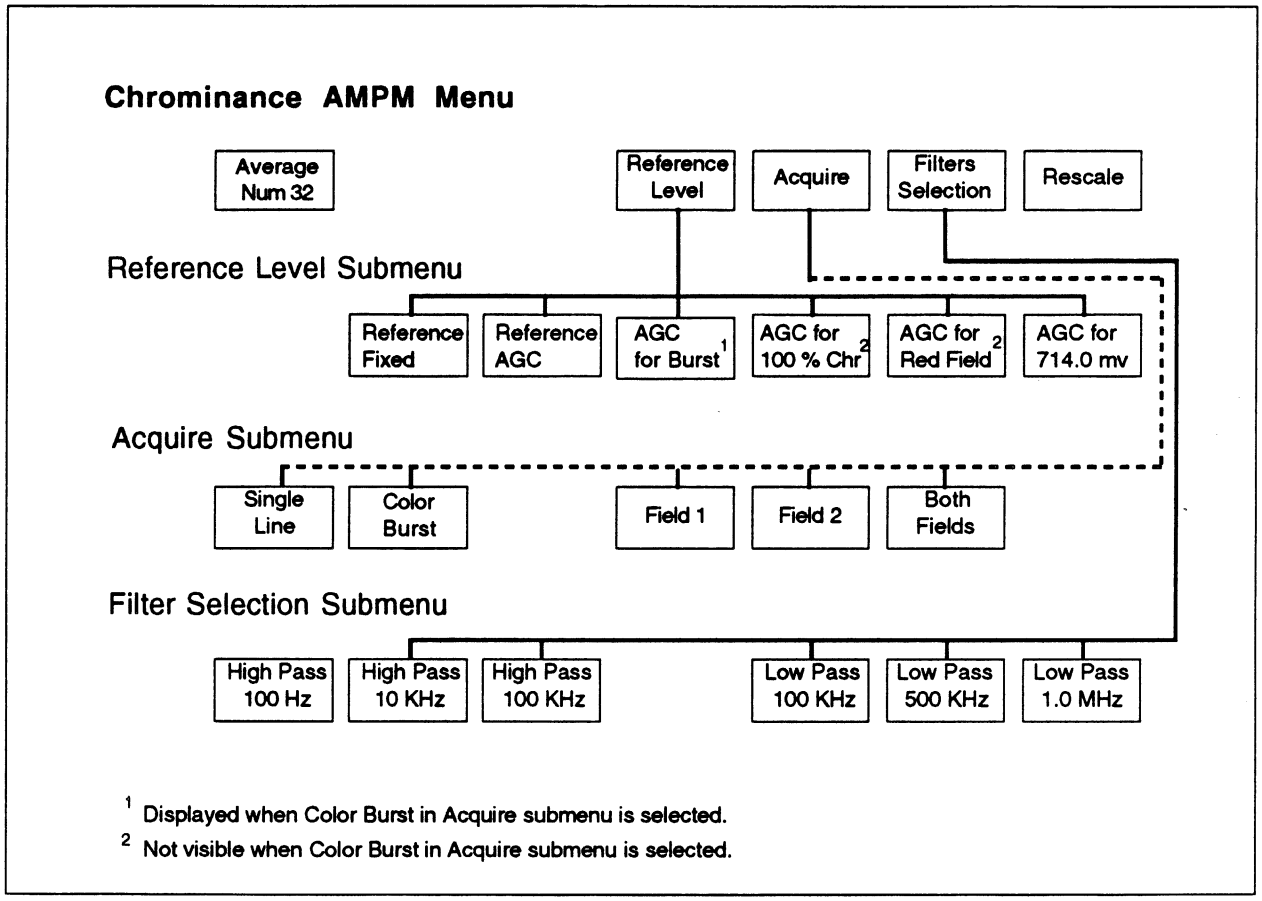


Figure 2-12, Chrominance AMPM menu tree.

MAIN MENU

Average Num	**Average Num** specifies the weighting factor to use for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the **Average Num** softkey to highlight it, rotate the knob until the desired weighting factor appears, then touch the **Average Num** softkey again.
Reference Level	**Reference Level** displays the Reference Level submenu which selects whether the measurement uses the chrominance signal amplitude as-measured, or compensates for degradation of chrominance signal amplitude (e.g., by a VCR).
Acquire	**Acquire** displays the Acquire submenu that select full field, burst, or single line acquisition, and to select field 1, field 2, or both fields.
Filters Selection	**Filters Selection** provides softkeys to select select high-pass or low-pass filtering for the input signal.
Rescale	**Rescale** restores the display to its default scale, with meters reading from -60 dB to -20 dB.

REFERENCE LEVEL SUBMENU

Reference Fixed	**Reference Fixed** measures chrominance noise using the chrominance signal amplitude as-measured.
Reference AGC	**Reference AGC** measures chrominance noise while compensating for degradation of chrominance signal amplitude according to the AGC option selected.
AGC for Burst	**AGC for Burst** displayed when Reference AGC is selected and a color burst is being acquired. Touching this softkey compensates for chrominance signal amplitude degradation by an amount relative to the level of the Color Burst signal (286 mV peak-to-peak); the effective chrominance signal amplitude becomes 286mV/measured chrominance signal amplitude.
AGC for 100% Chr	**AGC for 100% Chr.** displayed when Reference AGC is selected and a single line is being acquired. Touching this softkey compensates for chrominance signal amplitude degradation by an amount relative to the level of the average measured chrominance level; the effective chrominance signal amplitude becomes 714mV/measured chrominance signal amplitude.
AGC for Red Field	**AGC for Red Field** displayed when Reference AGC is selected and a single line is being acquired. Touching this softkey compensates for chrominance signal amplitude degradation by an amount relative to the level of the IEC 883 Red Field level (626mV); the effective chrominance signal amplitude becomes 626mV measured chrominance amplitude.
AGC for xxx mv	**AGC for xxx mV** compensates for chrominance signal amplitude degradation by an amount relative to a user-specified value (which can be set with the knob); the effective chrominance signal amplitude becomes a user-specified value measured chrominance amplitude.

ACQUIRE SUBMENU

Single Line

Single Line specifies that the measurement is to be made on a single line. The 100 Hz high pass filter is not available for this measurement.

Color Burst

Color Burst specifies that the measurement is to be made on the Color Burst signal. The 100 Hz high pass and 1 MHz low pass filters are automatically selected.

Field 1

Field 1 specifies that the measurement is to be made only on field 1.

Field 2

Field 2 specifies that the measurement is to be made only on field 2.

Both Fields

Both Fields displayed unless single line is being acquired. Specifies that the measurement is to be made on both field 1 and field 2.

FILTERS SUBMENU

HighLow Pass 100 Hz/10 kHz/ 100 kHz/

High Pass 100 Hz/10 kHz/100 kHz/Low Pass 100 kHz/500 kHz/1.0 MHz selects the specified filter. Signal information lower than the specified frequency (for high-pass filtering) or higher than the specified frequency (for low pass filtering) is filtered out.

Text in the Chrominance AMPM display tells you the name of the measurement, the line number or colour burst field number on which the measurement is being made, the band width specified for the measurement, the "appropriateness" of the signal for the measurement, the definition of the 0 dB level for the measurement, and whether Averaging is off or on; if on, it indicates the current weighting factor used for averaging, as well as the number of sampling points acquired.

CHROMINANCE FREQ RESP

The Chrominance FreqResp measurement measures frequency response near the subcarrier frequency.

This measurement is essentially the same as the MultiBurst measurement, except that five packets are used instead of six, and the 3.85-MHz packet is used as the reference.

Figure 2-13 shows the Chrominance FreqResp display, which plots signal amplitude as a function of difference from the reference frequency.

The Chrominance FreqResp measurements requires a multiple-burst signal. (The special Chrominance Frequency Response signal from a 1910 signal generator is recommended.)

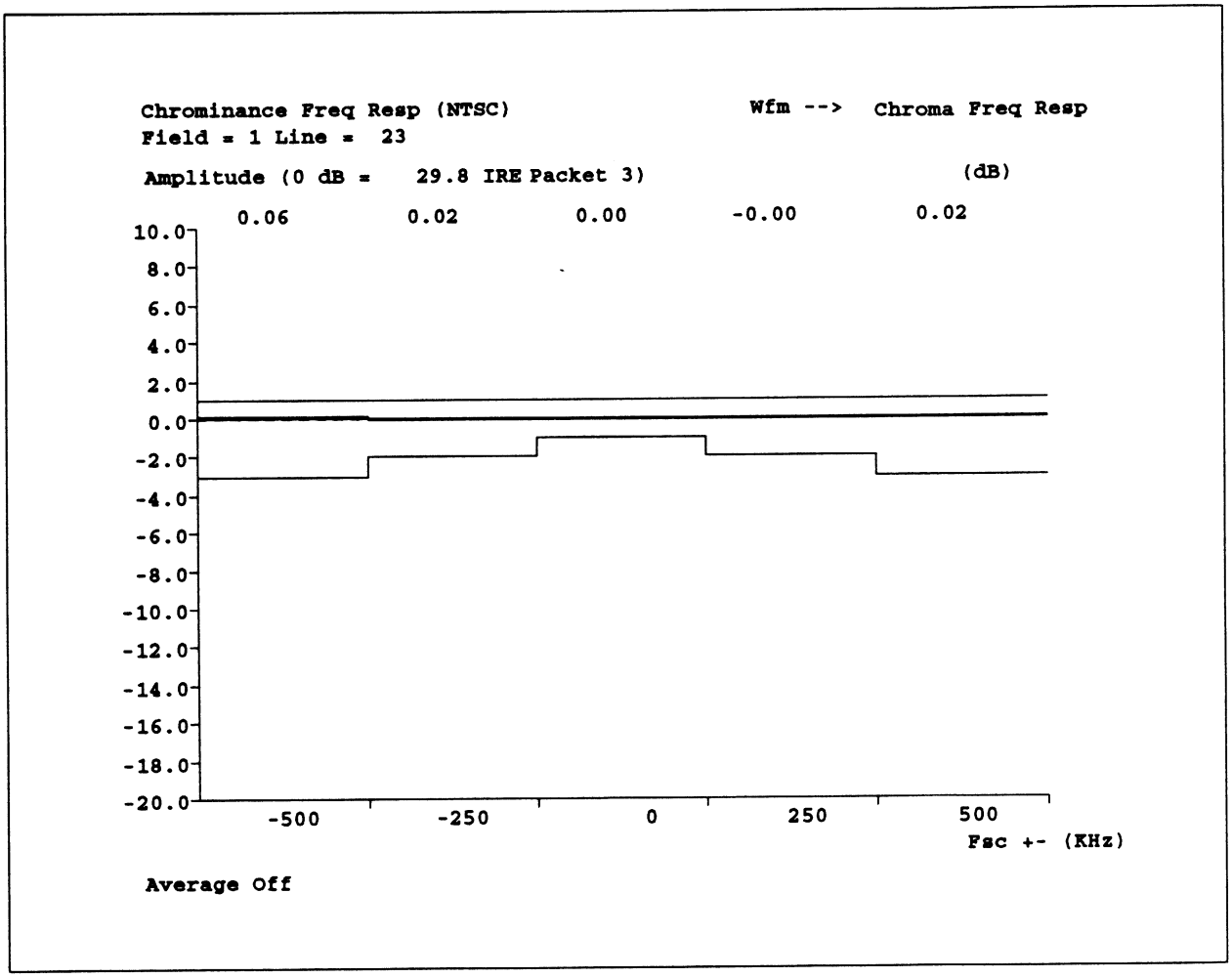


Figure 2-13. Chrominance FreqResp display.

Chrominance FreqResp Menu

Pressing the Menu button when the Chrominance FreqResp measurement runs brings up the Chrominance FreqResp menu (Figure 2-14).

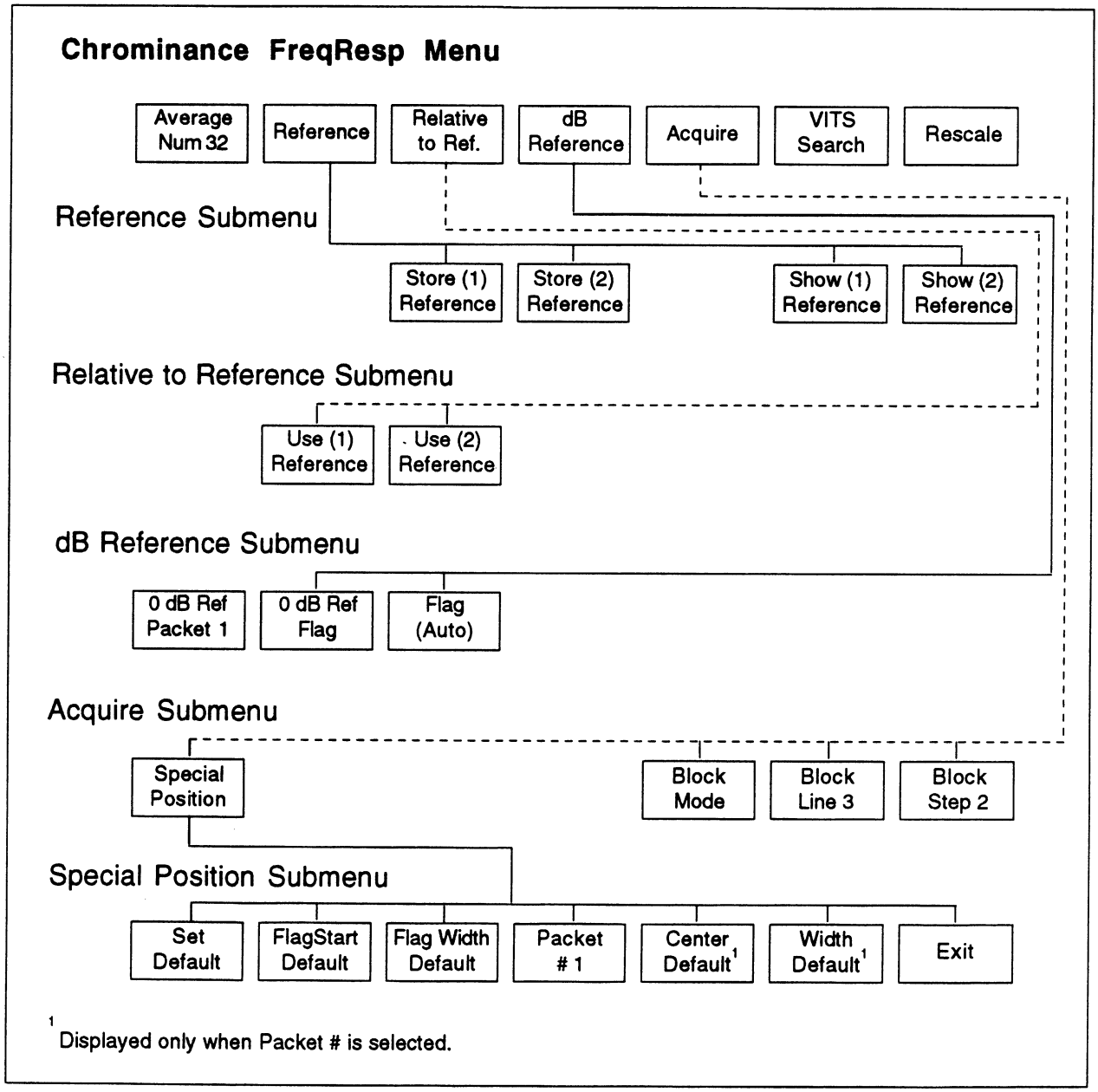


Figure 2-14. Chrominance FreqResp menu tree.

MAIN MENU

Average Num	**Average Num** specifies the weighting factor to use for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the **Average Num** softkey to highlight it, rotate the knob until the desired weighting factor appears, then touch the **Average Num** softkey again.
Reference	**Reference Level** displays the Reference submenu which stores the currently-displayed values for use as a reference or displays previously stored reference values.
Relative to Ref.	**Relative to Ref** displays the Relative to Ref. submenu which selects the reference to use for comparison in the measurement. When a stored reference is selected, the currently measured value is compared to the stored reference value.
dB Reference	**dB Reference** sets the reference position.
Acquire	**Acquire** displays the Acquire submenu that control how the signal is acquired for the specific measurement.
VITS Search	**VITS Search** causes the VM700A to search the insertion test signals for a signal appropriate for the measurement. If an appropriate signal is not located, **Not found** displays briefly on the screen.
Rescale	**Rescale** sets the expansion factor of the display to an appropriate scaling factor for the ChromaFreq measurement' s display graticule. The x- and y-axes adjust to accommodate the rescaled display.

REFERENCE LEVEL SUBMENU

Store (n) Reference	**Store (1) Reference/Store (2) Reference** saves the current measurement values as (1) Reference and (2) Reference, respectively. Selecting Store (1) Reference or Store (2) Reference overwrites previous (1) Reference or (2) Reference values. References are stored in nonvolatile memory and are retained when the VM700A is powered down.
Show (n) Reference	**Show (1) Reference/Show (2) Reference** displays the current values of (1) Reference and (2) Reference, respectively, plus the date and time the reference was stored and the channel the reference signal was on. If no reference value has been stored, touching either softkey displays a message that the reference is not defined.

RELATIVE TO REFERENCE SUBMENU

Use (n) Reference	**Use (1) Reference/Use (2) Reference** selects the stored reference to which measured values are compared. If no reference value has been stored, touching either softkey displays a message that the reference is not defined.

DB REFERENCE SUBMENU

0dB Ref Packet n

0dB Ref Packet n: when highlighted, allows you to set the amplitude reference level by rotating the knob. The reference position can be set to the measured amplitude of Packets 1 through 5, or "FLAG."

0dB Ref Flag

Flag displays when the 0 dB Ref softkey is set to "FLAG"; when highlighted, sets the amplitude reference level as a percentage of flag amplitude. By default, the amplitude reference level is set automatically. The default reference level percentage varies with the type of signal being measured. You can also set the percentage by rotating the knob; rotating it counterclockwise will (eventually) set the reference level back to "AUTO."

ACQUIRE SUBMENU

Special Position

Special Position displays the Special Position submenu and a special waveform display used to set the location on the waveform where the measurement is made. Figure 2-15 shows the Chrominance FreqResp Special Position display and submenu.

Block Mode

Block Mode turns on Block mode. The block starts at the system line.

Block Lines

Block Lines sets the number of lines to average for the measurement. The default number of Block Lines to average is 3.

Block Step

Block Step sets the number of lines to step in the block. The default number of lines to step is 2.

SPECIAL POSITION SUBMENU

Set Default

Set Default returns each measurement location to its default position as given in the Measurement Locations file. If any other softkey is highlighted, only that measurement location is changed.

Flag Start

Flag Start: allows you to set the location of the leading edge of the amplitude reference flag by rotating the knob.

Flag Width

Flag Width: allows you to set the width of the amplitude reference flag by rotating the knob.

Packet #

Packet #: allows you to select one of the six packets to set its measurement location and area. Cursors indicating the location, and width, and a readout of the frequency of the packet are displayed.

Center Default

Center Default: allows you to set the center location of the packet by rotating the knob.

Width Default

Width Default: allows you to set the measurement area of the packet by rotating the knob.

Exit

Exit leaves the Special Position submenu and displays the Chrominance FreqResp screen.

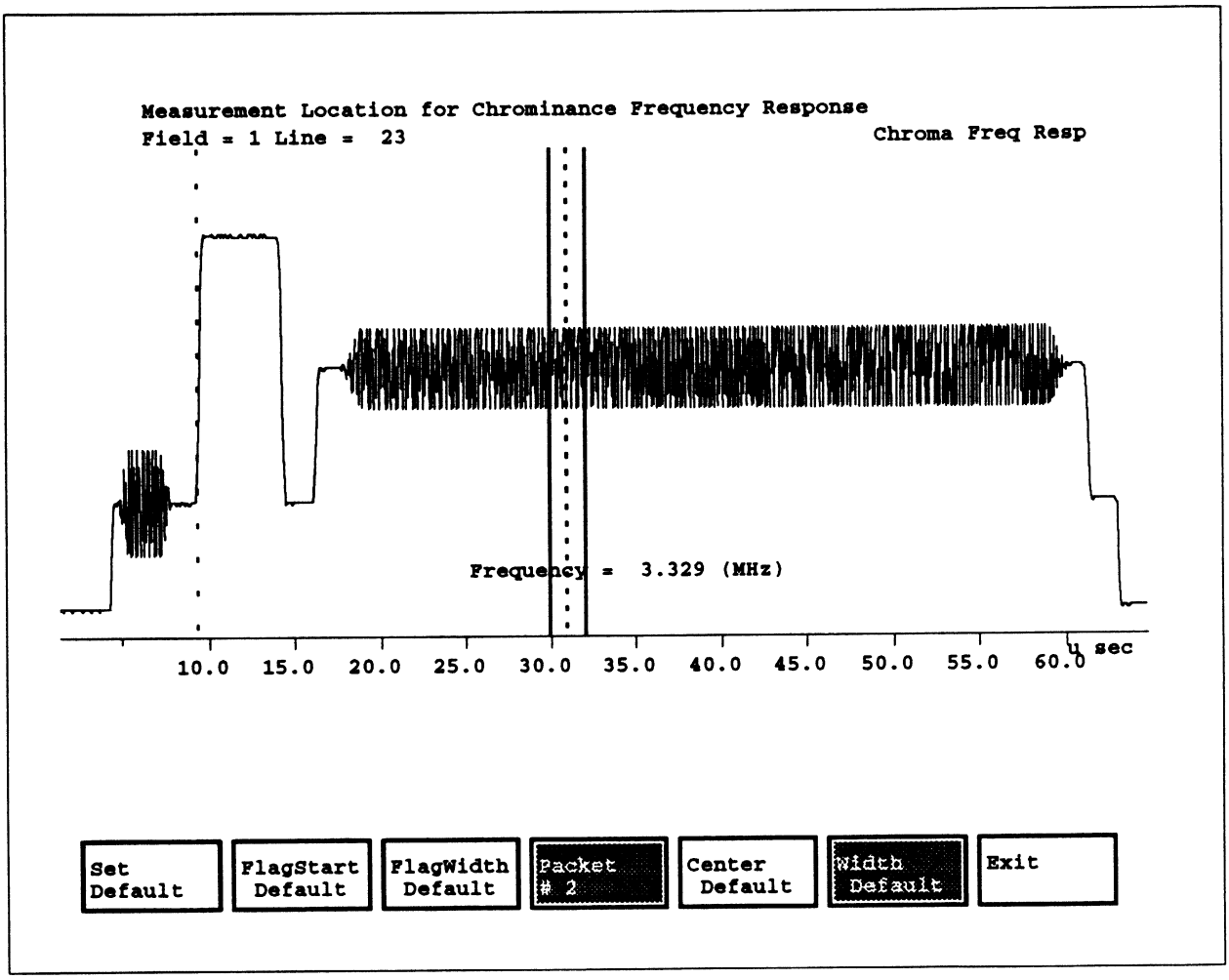


Figure 2-15. Chrominance FreqResp special position display.

CHROMINANCE NONLINEARITY

Chrominance NonLinearity measures nonlinear distortions of both gain and phase of the chrominance channel caused by differences in chrominance amplitudes. Intermodulation between chrominance and luminance is also displayed. Separate graphs are provided for each of the three measurements.

The Chrominance NonLinearity measurement requires a 3-Level Modulated Pedestal or NTC-7 Combination test signal. Figure 2-16 shows the Chrominance NonLinearity display.

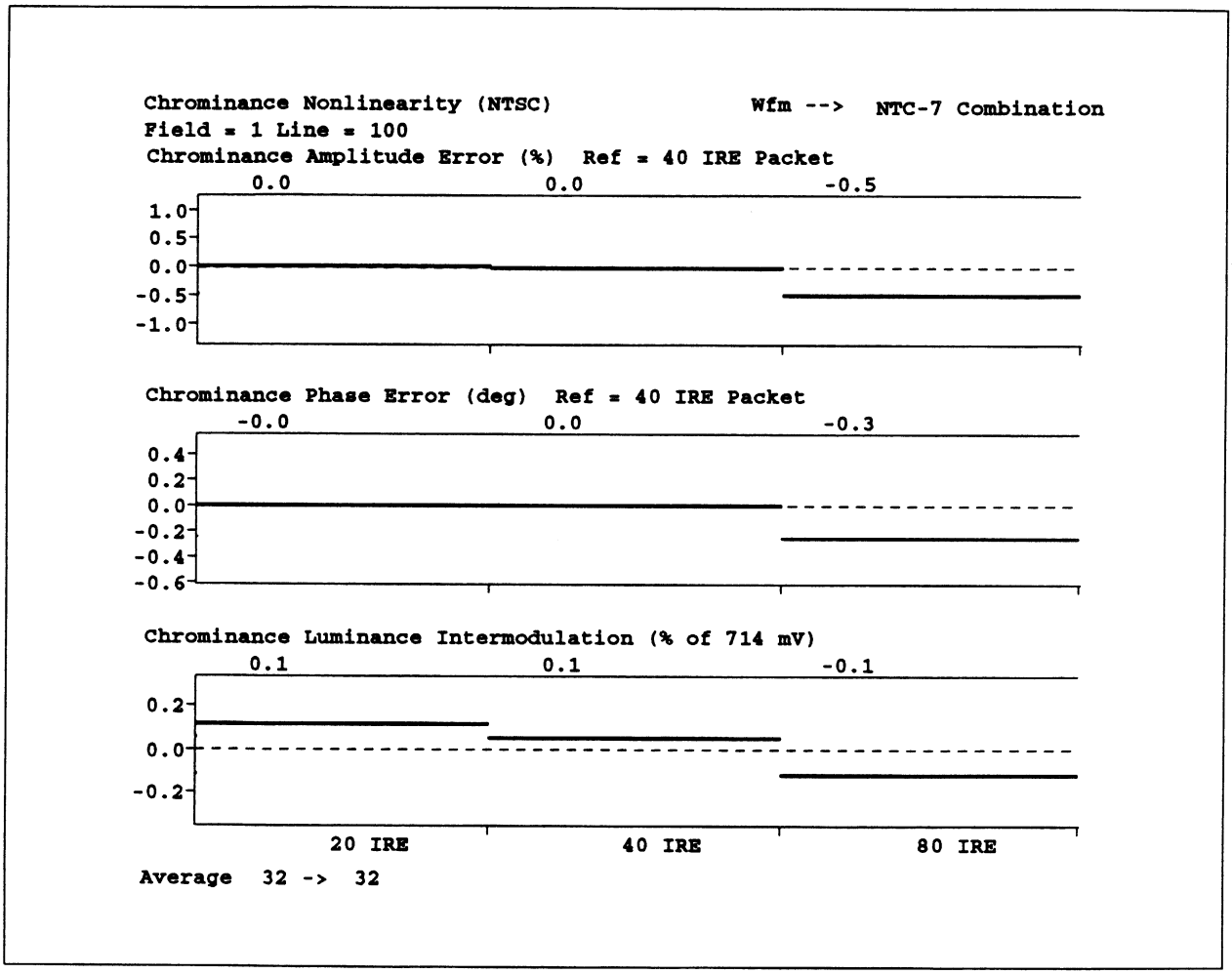


Figure 2-16. Chrominance NonLinearity display.

The Chrominance Amplitude Error (%) measurement is referenced to the center (40 IRE) packet. The Chrominance Phase Error (deg) measurement is also referenced to the center packet, and with a normal 3-Level Modulated Pedestal signal, the results should be near 0°. The Chrominance Luminance Intermodulation measurement notes the luminance level changes that are due to changes in chrominance amplitudes. The measurement is referenced to the 714 mV level, and is expressed as a percentage of 714 mV.

The Chrominance NonLinearity measurement is made on the current system line. The System Default Measurement Locations file specifies that the Chrominance NonLinearity measurement is made on field 1, line 17.

Chrominance NonLinearity Menu

Pressing the Menu button when the Chrominance NonLinearity measurement runs displays the Chrominance NonLinearity menu (Figure 2-17).

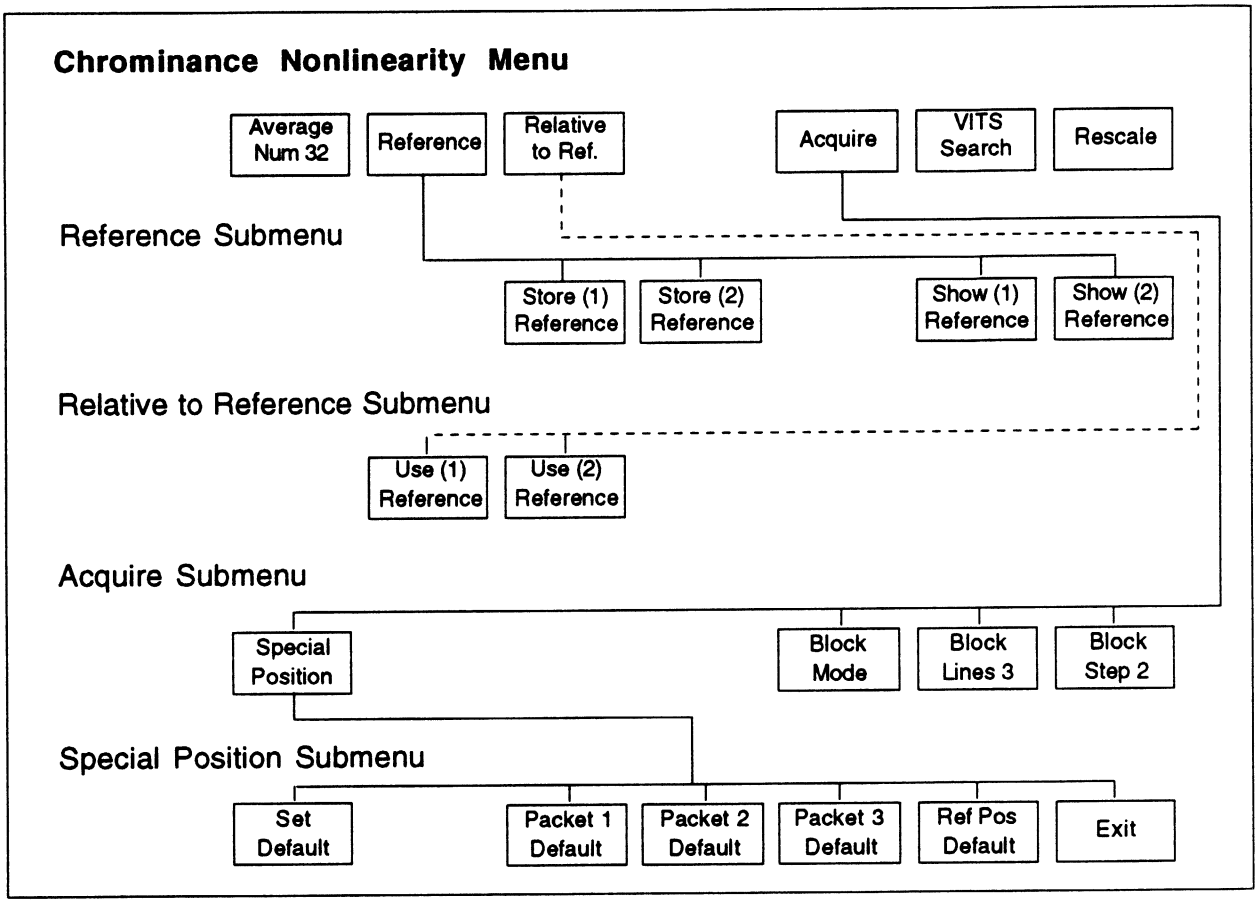


Figure 2-17. Chrominance NonLinearity menu tree.

MAIN MENU

Average Num	**Average Num** specifies the weighting factor to use for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the **Average Num** softkey to highlight it, rotate the knob until the desired weighting factor appears, then touch the **Average Num** softkey again.
Reference	**Reference** displays the Reference submenu which (1) stores the currently displayed values for use as a reference; or (2) displays previously stored reference values.
Relative to Reference	**Relative to Reference** displays the Relative to Ref submenu that selects the reference to use for comparison in the measurement. When a stored reference is selected, the currently measured value is compared to the stored reference value.

Acquire

Acquire displays the Acquire submenu that controls how the signal is acquired for the specific measurement.

VITS Search

VITS Search causes the VM700A to search the insertion test signals for a signal appropriate for the measurement. If an appropriate signal is not located, the message **Not found** displays briefly on the display.

Rescale

Rescale sets the expansion factor of the display to an appropriate scaling factor for the Chrominance NonLinearity measurement's display graticule. The x- and y-axes adjust to accommodate the rescaled display.

REFERENCE SUBMENU

Store (n) Reference

Store (1) Reference/Store (2) Reference saves the current measurement values as (1) Reference and (2) Reference, respectively. Selecting Store (1) Reference or Store (2) Reference overwrites previous (1) Reference or (2) Reference values. References are stored in nonvolatile memory and are retained when the VM700A is powered down.

Show (n) Reference

Show (1) Reference/Show (2) Reference displays the current values of (1) Reference and (2) Reference, respectively, plus the date and time the reference was stored and the channel the reference signal was on. If no reference value has been stored, touching either softkey displays a message that the reference is not defined.

RELATIVE TO REFERENCE SUBMENU

Use (n) Reference

Use (1) Reference/Use (2) Reference selects the stored reference to which measured values are compared. If no reference value has been stored, touching either softkey displays a message that the reference is not defined.

ACQUIRE SUBMENU

Special Position

Special Position displays the Special Position submenu and a special waveform display used to set the location on the waveform where the measurement is made. Figure 2-18 shows the Chrominance NonLinearity Special Position display and submenu.

Block Mode

Block Mode turns on Block mode. The block starts at the system line.

Block Lines

Block Lines sets the number of lines to average for the measurement. The default number of Block Lines to average is 3.

Block Step

Block Step sets the number of lines to step in the block. The default number of lines to step is 2.

SPECIAL POSITION SUBMENU

Set Default	**Set Default** reassigns the default values to the **Packet 1**, **Packet 2**, **Packet 3**, and **Ref Pos.** softkeys. To reassign the default value to one of the softkeys, select that softkey before touching **Set Default**.
Packet 1/2/3	**Packet 1/2/3** defines the measurement locations of the chrominance packets. The default measurement locations are automatically defined, depending on the type of signal being measured.
Ref Pos	**Ref Pos**: defines the measurement location of the reference level. The default reference measurement location is automatically defined for the type of signal being measured.
Exit	**Exit**: leaves the Special Position submenu and displays the Chrominance NonLinearity screen.

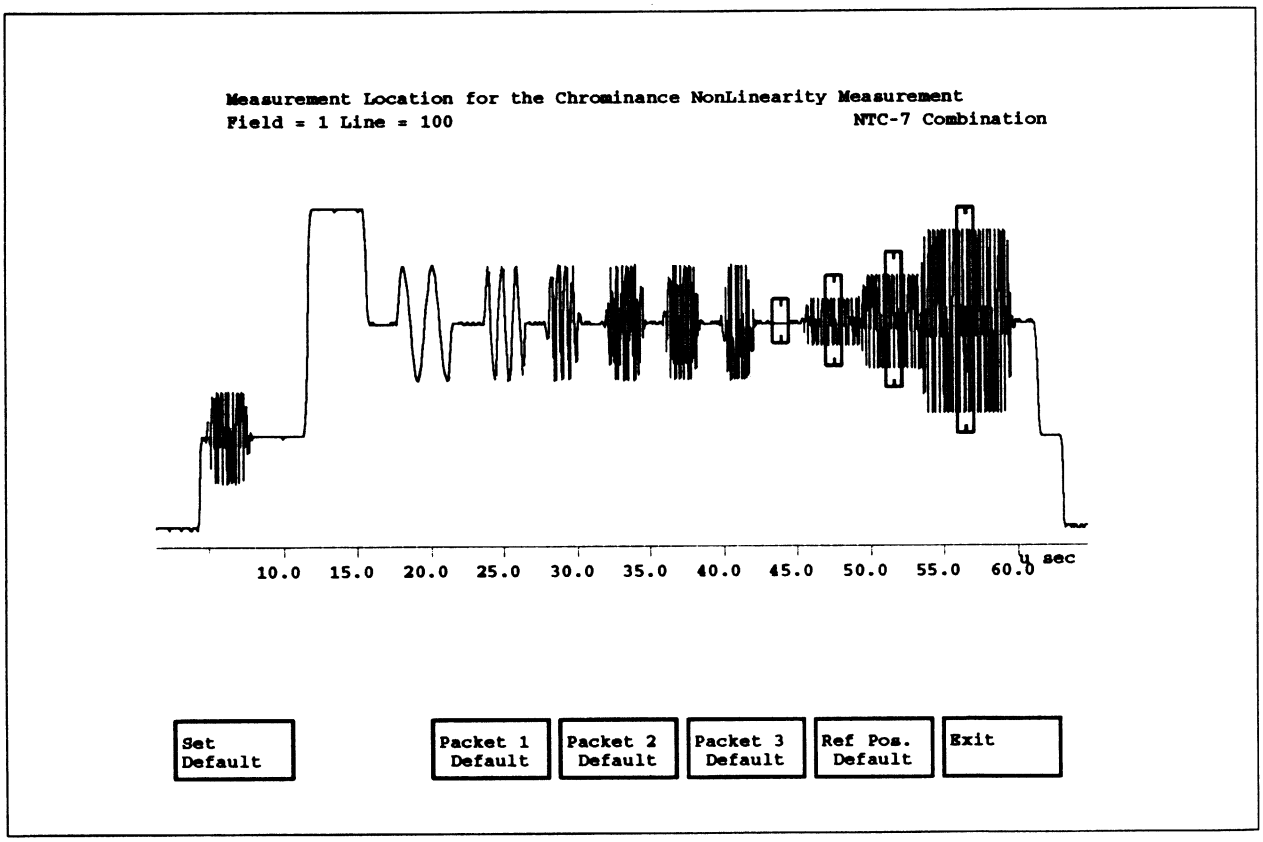


Figure 2-18. Chrominance NonLinearity special position display.

COLOR BAR

ColorBar measures the luminance level, chrominance level, and chrominance phase of each chroma packet, and displays them on three separate graticules.

ColorBar displays three measurements on three separate graticules. The top graticule shows the luminance level of each chroma packet. The middle graticule shows the chrominance level of each chroma packet. The bottom graticule shows the chrominance phase (in degrees) of each chroma packet. Each graticule includes the measurement limits (as set in the active Measurement Limits file) for each color; the limits are shown as horizontal lines that extend the width of each color. The ColorBar measurement display is shown in Figure 2-19.

The Chrominance Phase measurement is not made unless the chrominance amplitude is at least 35 mV (5 IRE). The message LOW CHROMA displays when chrominance amplitudes are less than this value.

The ColorBar measurement is made on the current system line. The System Default Measurement Locations file specifies that the Color Bar measurement is made on field 2, line 17.

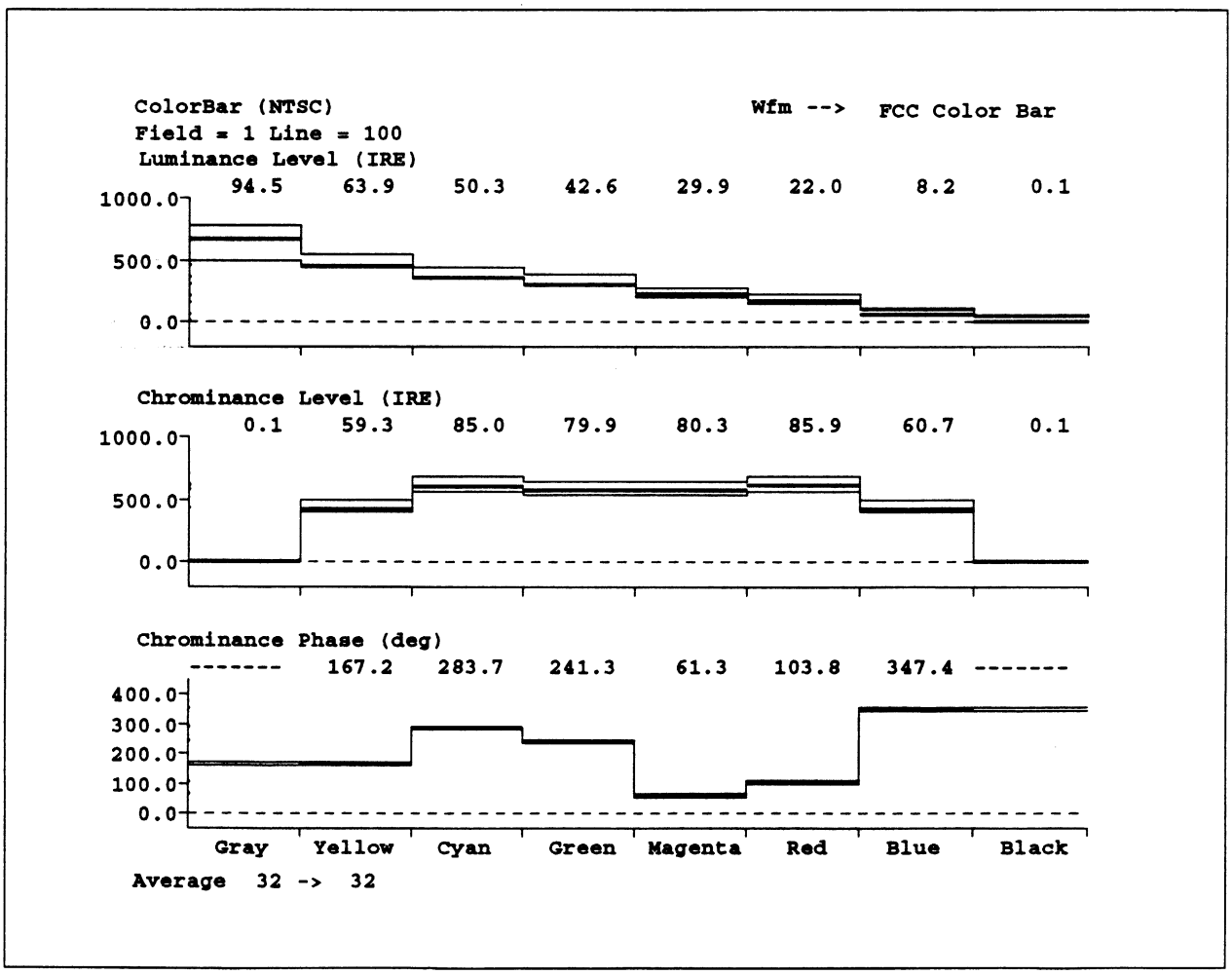


Figure 2-19. Color Bar display.

Pre-defined ColorBar References

In addition to the usual user-defined measurement references, the ColorBar measurement includes three pre-defined reference values. The pre-defined references are Ref. 100/0/75/0 (0 set-up color bars), Ref. 75/7.5/75/7.5 (EIA or SMPTE color bars), and Ref. 100/7.5/75/7.5 (FCC color bars). Table 2-2 lists the pre-defined color bar reference values.

Table 2-2
Pre-defined Color Bar Reference Values

Reference Values for 100/0/75/0 (0% Setup) Color Bars								
Parameters	White	Yellow	Cyan	Green	Magenta	Red	Blue	Black
Luma Level	714.3	476.8	375.0	316.1	219.6	160.7	58.9	0.0
Chroma Level	0.0	480.2	681.2	636.2	636.2	681.2	480.2	0.0
Chroma Phase	0.0	167.1	283.4	240.8	60.8	103.4	347.1	0.0
Reference Values for 75/7.5/75/7.5 (EIA or SMPTE) Color Bars								
Parameters	White	Yellow	Cyan	Green	Magenta	Red	Blue	Black
Luma Level	549.1	494.6	400.4	345.9	256.7	202.2	108.1	53.6
Chroma Level	0.0	444.2	630.1	588.5	588.5	630.1	444.2	0.0
Chroma Phase	0.0	167.1	283.4	240.8	60.8	103.4	347.1	0.0
Reference Values for 100/7.5/75/7.5 (FCC) Color Bars								
Parameters	White	Yellow	Cyan	Green	Magenta	Red	Blue	Black
Luma Level	714.3	494.6	400.4	345.9	256.7	202.2	108.1	53.6
Chroma Level	0.0	444.2	630.1	588.5	588.5	630.1	444.2	0.0
Chroma Phase	0.0	167.1	283.4	240.8	60.8	103.4	347.1	0.0

Color Bar Menu

Pressing the Menu button when the Color Bar measurement runs displays the Color Bar menu (Figure 2-20).

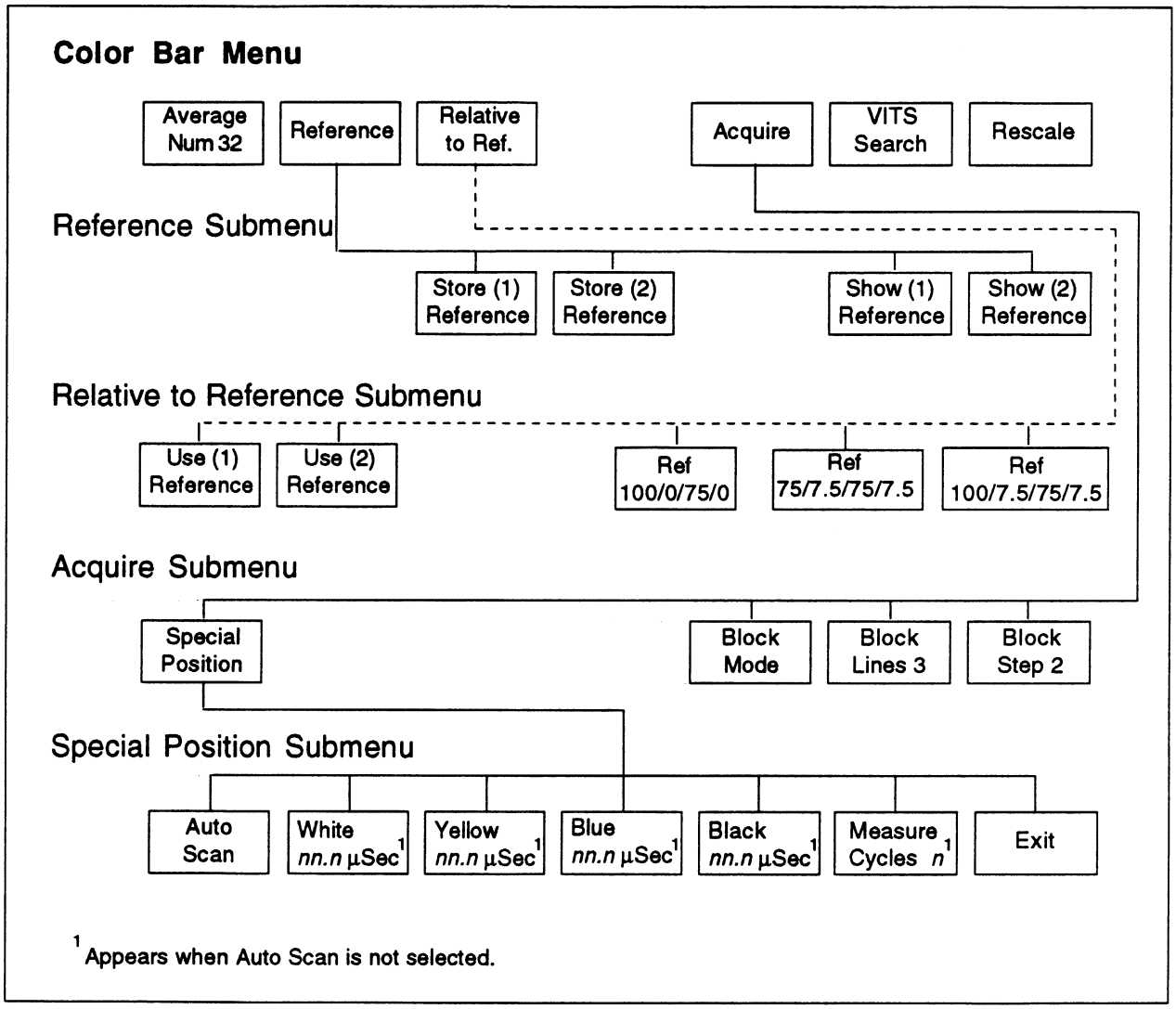


Figure 2-20. Color Bar menu tree.

MAIN MENU

Average Num	**Average Num** specifies the weighting factor to use for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the **Average Num** softkey to highlight it, rotate the knob until the desired weighting factor appears, then touch the **Average Num** softkey again.
Reference	**Reference** displays the Reference submenu which (1) stores the currently displayed values for use as a reference; or (2) displays previously stored reference values.

Relative to Reference	**Relative to Ref** displays the Relative to Ref submenu which selects the reference to use for comparison in the measurement. When a stored reference is selected, the currently measured value is compared to the stored reference value.
Acquire	**Acquire** displays the Acquire submenu that control how the signal is acquired for the specific measurement.
VITS Search	**VITS Search** searches the insertion test signals for a signal appropriate for the measurement. If an appropriate signal is not located, the message **Not found** displays briefly.
Rescale	**Rescale** sets the expansion factor of the display to an appropriate scaling factor for the Color Bar measurement's display graticule. The x- and y-axes adjust to accommodate the rescaled display.

REFERENCE SUBMENU

Store (n) Reference	**Store (1) Reference/Store (2) Reference** saves the current measurement values as (1) Reference and (2) Reference, respectively. Selecting Store (1) Reference or Store (2) Reference overwrites previous (1) Reference or (2) Reference values. References are stored in nonvolatile memory and are retained when the VM700A is powered down.
Show (n) Reference	**Show (1) Reference/Show (2) Reference** displays the current values of (1) Reference and (2) Reference, respectively, plus the date and time the reference was stored and the channel the reference signal was on. If no reference value has been stored, touching either softkey displays a message that the reference is not defined.

RELATIVE TO REFERENCE SUBMENU

Use (n) Reference	**Use (1) Reference/Use (2) Reference** selects the stored reference to which measured values are compared. If no reference value has been stored, touching either softkey displays a message that the reference is not defined.
Ref. 100/0/75/0	**Ref. 100/0/75/0:** selects the nominal 75% saturation, 0% setup colorbar reference for measurement comparison.
Ref. 75/7.5/75/7.5	**Ref. 75/7.5/75/7.5:** selects the nominal 75% saturation, 7.5% setup colorbar reference for measurement comparison.
Ref. 100/7.5/75/7.5	**Ref. 100/7.5/75/7.5:** selects the nominal 75% saturation, 75% setup colorbar with 100 IRE white flag for measurement comparison.

ACQUIRE SUBMENU

Field Toggle

Field Toggle behaves the same as the **Field Toggle** softkey in Select Line mode: the system line changes to the other field, an offset of ±313 lines. Field Toggle is provided in the Acquire sub-menu because at the sub-menu level, the Select Line button only activates line selection through the control knob. (The Select Line menu does not appear when a sub-menu is in effect.)

Special Position

Special Position provides a group of softkeys and a waveform display used to set the locations on the waveform where the measurement is made. Figure 2-18 shows the ColorBar Special Position display. Figure 2-21 shows the ColorBar Special Position display.

Block Mode

Block Mode turns on Block mode. The block starts at the system line.

Block Lines

Block Lines sets the number of lines to average for the measurement. The default number of Block Lines to average is 3.

Block Step

Block Step sets the number of lines to step in the block. The default number of lines to step is 2.

SPECIAL POSITION SUBMENU

Auto Scan

Auto Scan when selected, scans the waveform and automatically determines measurement locations. Deselecting this softkey displays the **White**, **Yellow**, **Blue**, **Black**, and **Measure** softkeys.

NOTE

If severe luminance nonlinear distortion is present, the VM700A may not be able to find all the color packets expected. In such cases, you must use manual positioning to set the location of each packet.

White

White when selected, allows you to adjust the center position of the white color packet with the knob.

Yellow

Yellow when selected, allows you to adjust the center position of the yellow color packet with the knob.

Blue

Blue when selected, allows you to adjust the center position of the blue color packet with the knob.

Black

Black when selected, allows you to adjust the center position of the black color packet with the knob.

Measure Cycles

Measure Cycles allows you to specify the number of chrominance subcarrier cycles measured in each chrominance packet. The width of the displayed boxes shows the entire measurement area determined by the selected number of cycles.

Exit

Exit leaves the Special Position display and returns to the ColorBar main measurement display.

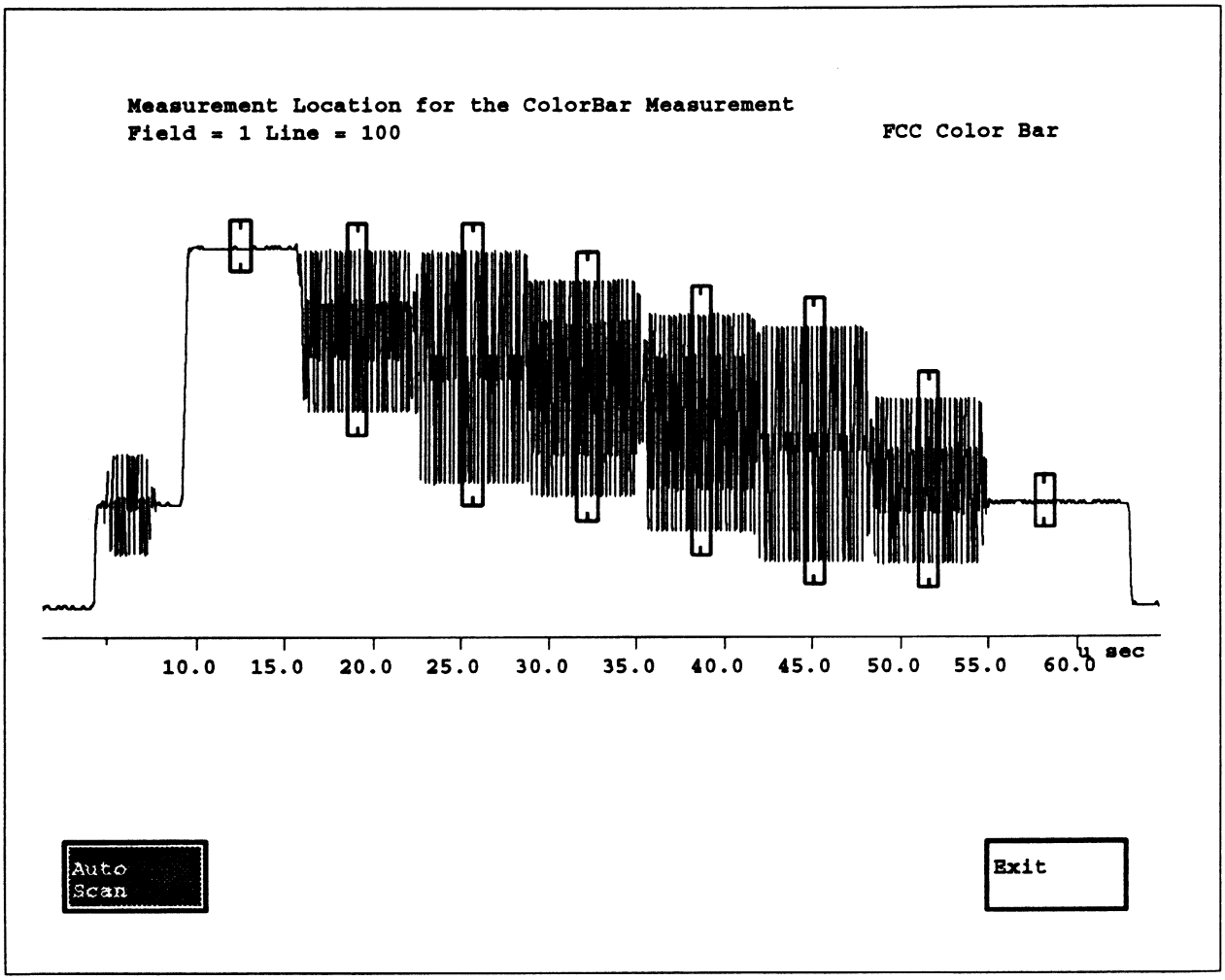


Figure 2-21. Color Bar special position display.

DGDP

The DGDP Measurement measures differential gain and phase.

DGDP Display

Figure 2-22 shows the DGDP display. The top half plots the differential gain for each packet. A digital readout for each packet shows the differential gain value, expressed as a percentage of the reference amplitude. Additional digital readouts show the minimum and maximum differential gain values, as well as the value of the peak-to-peak amplitude divided by the maximum packet value.

The lower half plots the differential phase for each packet, expressed in degrees of phase difference from the reference packet. Additional digital readouts show the mimimum, maximum, and peak-to-peak values for differential phase.

The DGDP measurement can use an FCC Composite, NTC-7 Composite, or 5- or 10-step modulated stair case signal. The essential signal element is a modulated stair case (up to 10 steps).

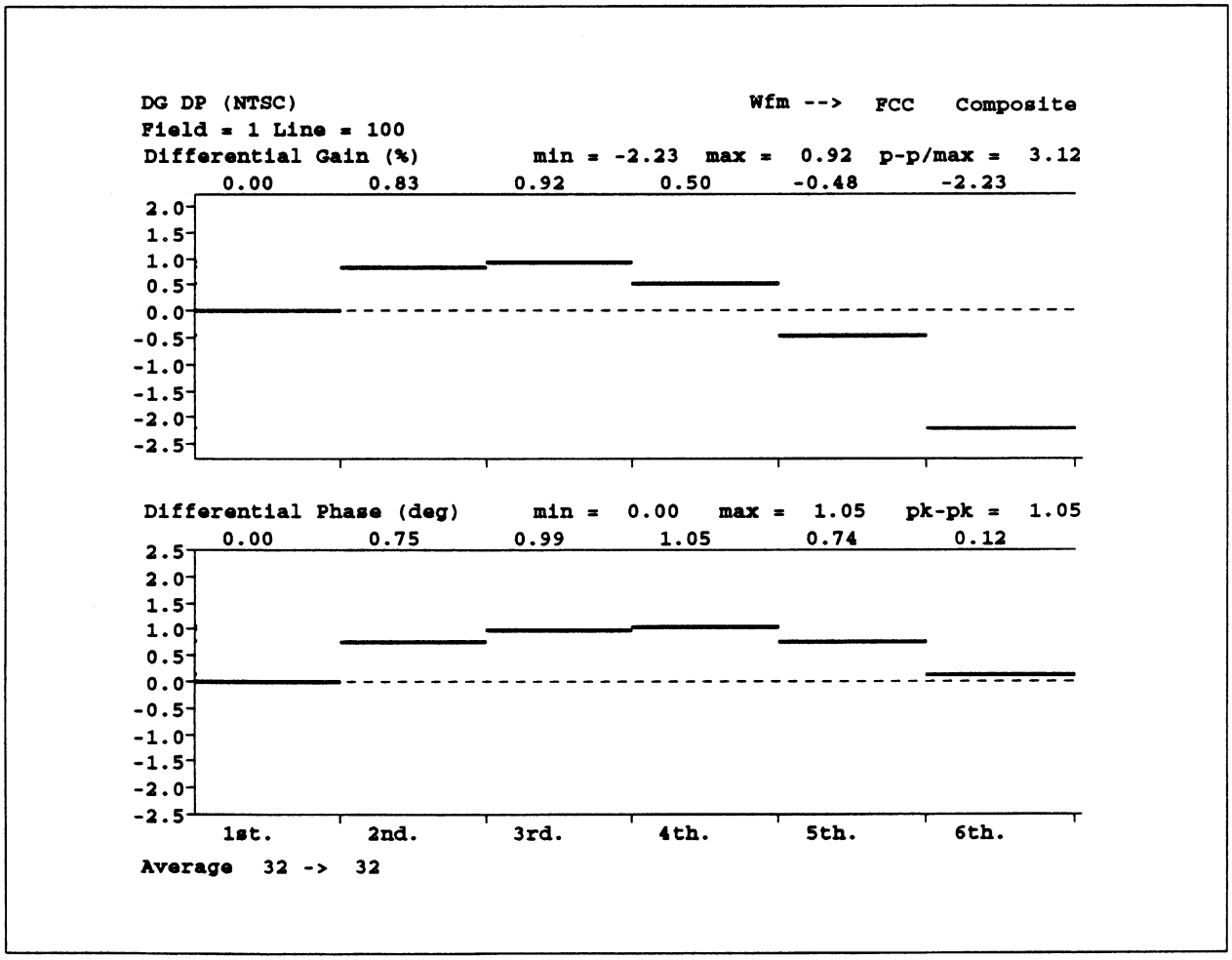


Figure 2-22. DGDP display.

DGDP Menu

Pressing the Menu button when the DGDP measurement runs displays the DGDP menu (Figure 2-23).

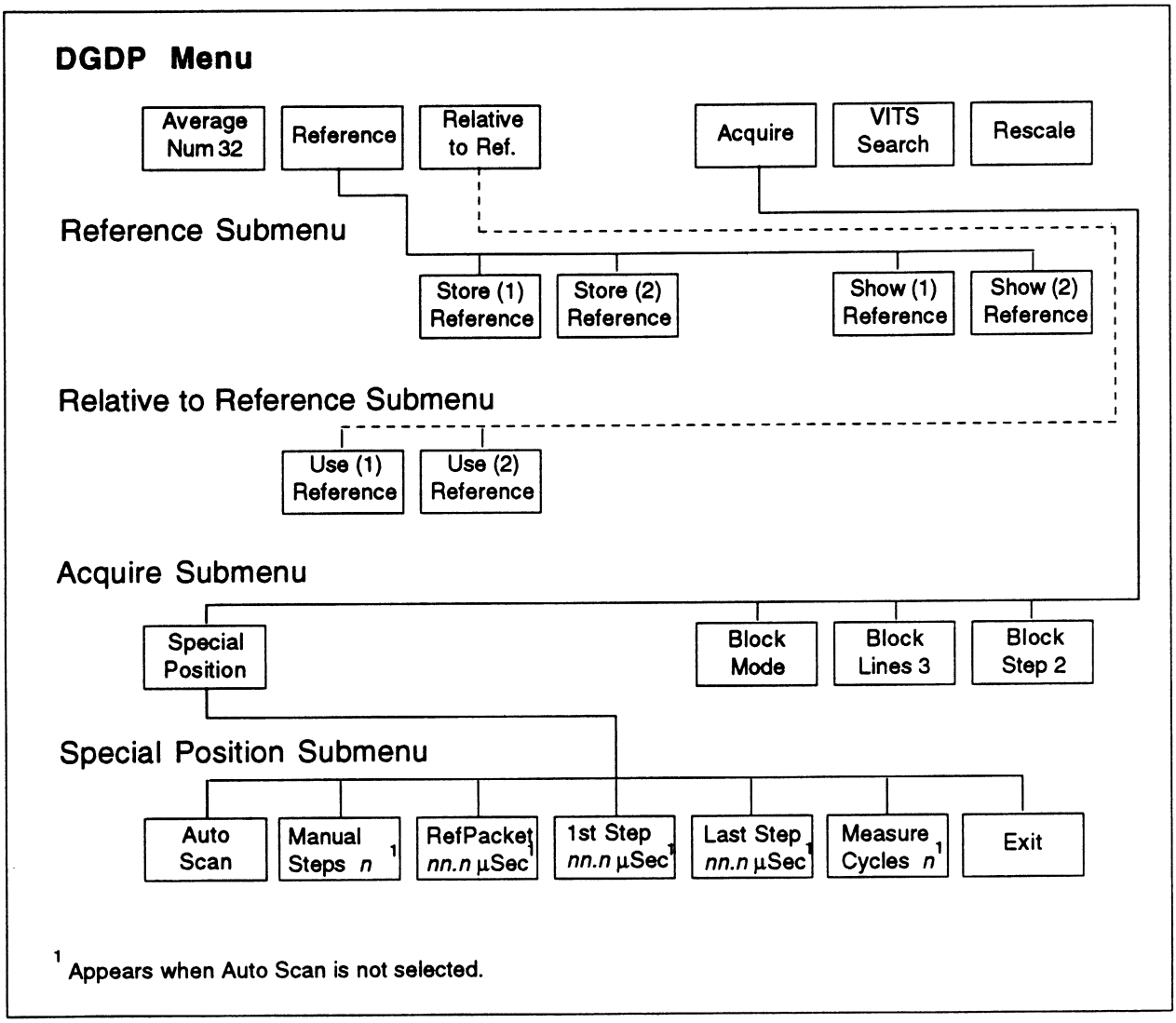


Figure 2-23. DGDP menu tree.

MAIN MENU

Average Num	**Average Num** specifies the weighting factor to use for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the **Average Num** softkey to highlight it, rotate the knob until the desired weighting factor appears, then touch the **Average Num** softkey again.
Reference	**Reference** displays the Reference submenu which (1) store the currently displayed values for use as a reference; or (2) display previously stored reference values.

Relative to Reference	**Relative to Reference** displays the Reference submenu which selects the reference to use for comparison in the measurement. When a stored reference is selected, the currently measured value is compared to the stored reference value.
Acquire	**Acquire** displays the Acquire submenu that controls how the signal is acquired for the specific measurement.
VITS Search	**VITS Search** searches the insertion test signals for a signal appropriate for the measurement. If an appropriate signal is not located, the message **Not found** displays briefly on the display.
Rescale	**Rescale** sets the expansion factor of the display to an appropriate scaling factor for the DGDP measurement's display graticule. The x- and y-axes adjust to accommodate the rescaled display.

REFERENCE SUBMENU

Store (n) Reference	**Store (1) Reference/Store (2) Reference** saves the current measurement values as (1) Reference and (2) Reference, respectively. Selecting Store (1) Reference or Store (2) Reference overwrites previous (1) Reference or (2) Reference values. References are stored in nonvolatile memory and are retained when the VM700A is powered down.
Show (n) Reference	**Show (1) Reference/Show (2) Reference** displays the current values of (1) Reference and (2) Reference, respectively, plus the date and time the reference was stored and the channel the reference signal was on. If no reference value has been stored, touching either softkey displays a message that the reference is not defined.

RELATIVE TO REFERENCE SUBMENU

Use (1) Reference	**Use (1) Reference/Use (2) Reference** selects the stored reference to which measured values are compared. If no reference value has been stored, touching either softkey displays a message that the reference is not defined.

ACQUIRE SUBMENU

Special Position	**Special Position** displays the Special Position submenu that sets the locations on the waveform where the measurement is made. Figure 2-24 shows the DGDP special position display.
Block Mode	**Block Mode** turns on Block mode. The block starts at the system line.
Block Lines	**Block Lines** sets the number of lines to average for the measurement. The default number of Block Lines to average is 3.
Block Step	**Block Step** sets the number of lines to step in the block. The default number of lines to step is 2.

SPECIAL POSITION SUBMENU

Auto Scan

Auto Scan when highlighted, measurement locations are automatically scanned and determined. When de-selected, the VM700A displays softkeys to set measurement locations manually.

NOTE

If severe luminance nonlinear distortion is present, the VM700A may not be able to resolve all the steps that were present in the original signal. In such cases, you must use manual positioning to set the location of each staircase step.

Manual Steps

Manual Steps allows you to select the number of luminance steps in the signal by rotating the knob.

Ref Packet

Ref Packet allows you to select the position of the reference packet by rotating the knob. Normally, the reference packet should be the center of the first packet of the modulated staircase.

1st Step

1st Step allows you to select the position of the first luminance step edge of the staircase by rotating the knob.

Last Step

Last Step allows you to select the position of the last luminance step edge of the staircase by rotating the knob.

Measure Cycles

Measure Cycles allows you to select the number of chrominance subcarrier cycles measured in each chrominance packet. The width of the displayed box shows the entire measurement area determined by the selected number of cycles.

Exit

Exit leaves the Special Position submenu and displays the DGDP screen.

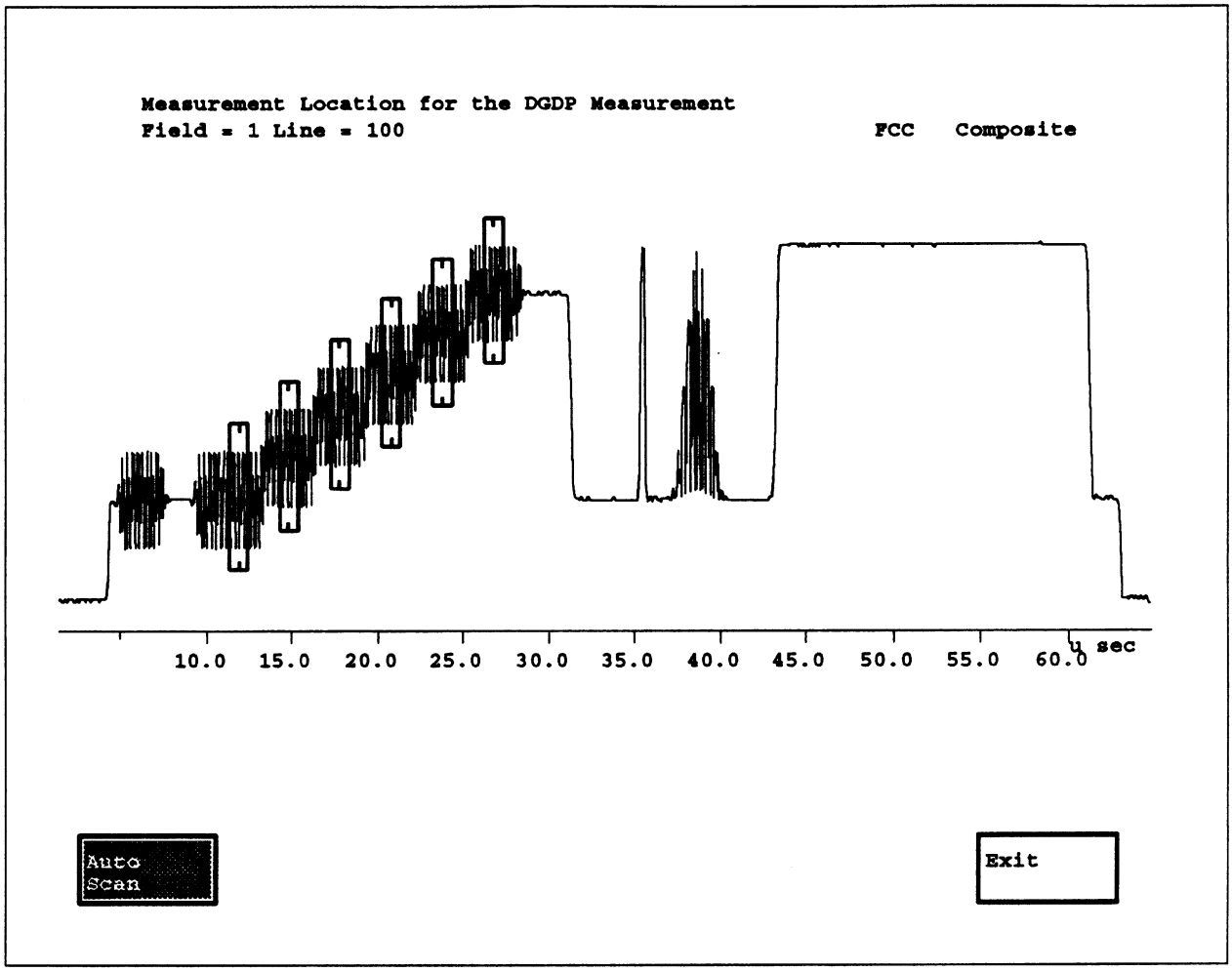


Figure 2-24. DGDP special position display.

GROUPDELAY SINX_X

GroupDelay SinX_X measures group delay and amplitude response versus frequency.

Figure 2-25 shows the GroupDelay SinX_X display. The top half of the display plots amplitude (in dB) vs frequency (in MHz). The bottom half of the display plots group delay (in ns) vs frequency (in MHz).

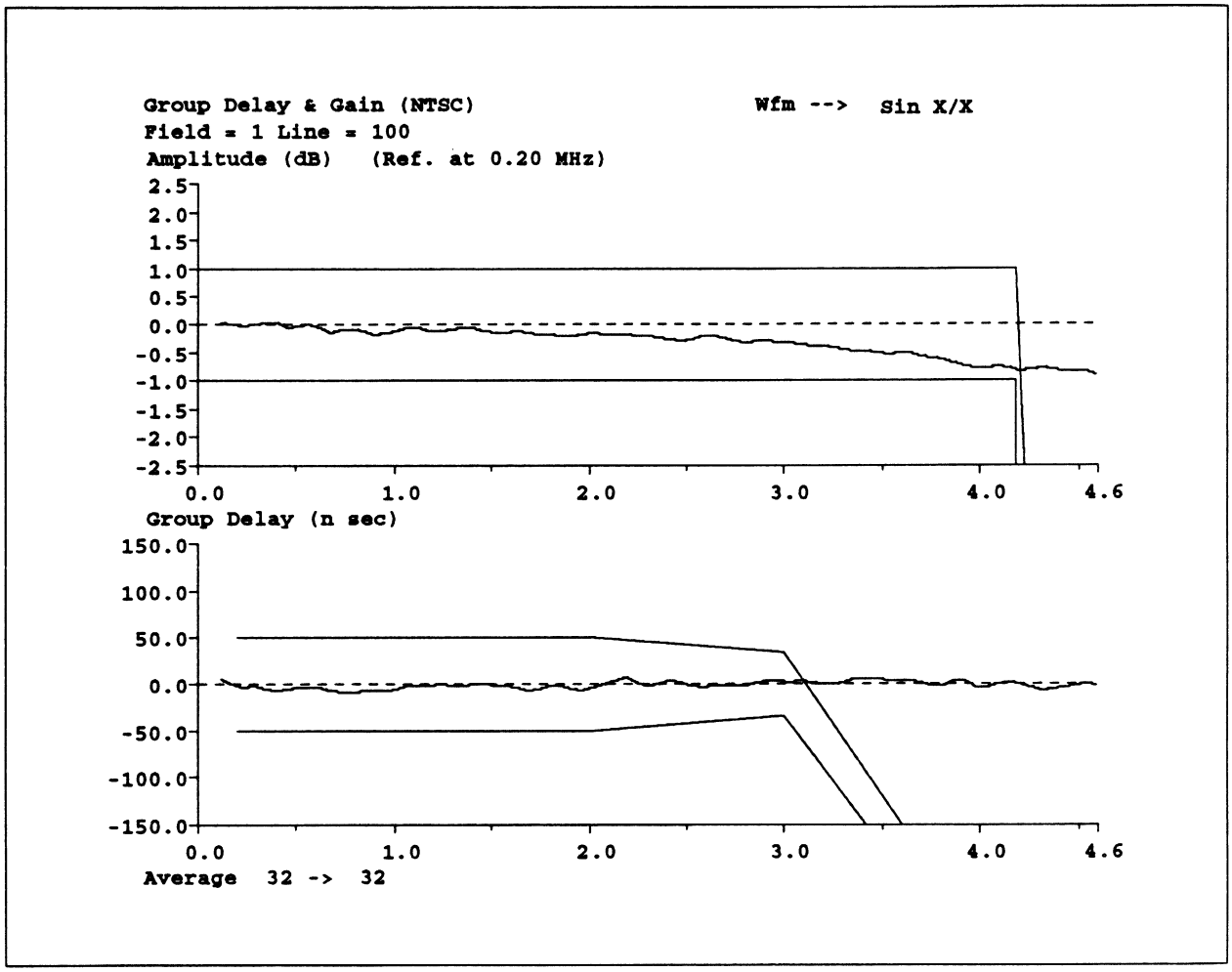


Figure 2-25. GroupDelay SinX_X display.

The GroupDelay SinX_X measurement requires a sin(x)/x signal. The measurement is set up to use a sin(x)/x signal from a 1910 signal generator by default; if the signal is generated by a different device, you will need to use the Special Position submenu of the Acquire softkey to specify the first and second pulse positions in the test signal. The time between the two pulses should always be a multiple of $1/(4 \times f_{SC})$.

GroupDelay SinX_X Menu

Pressing the Menu button when the GroupDelay SinX_X measurement runs displays the GroupDelay SinX_X menu (Figure 2-26).

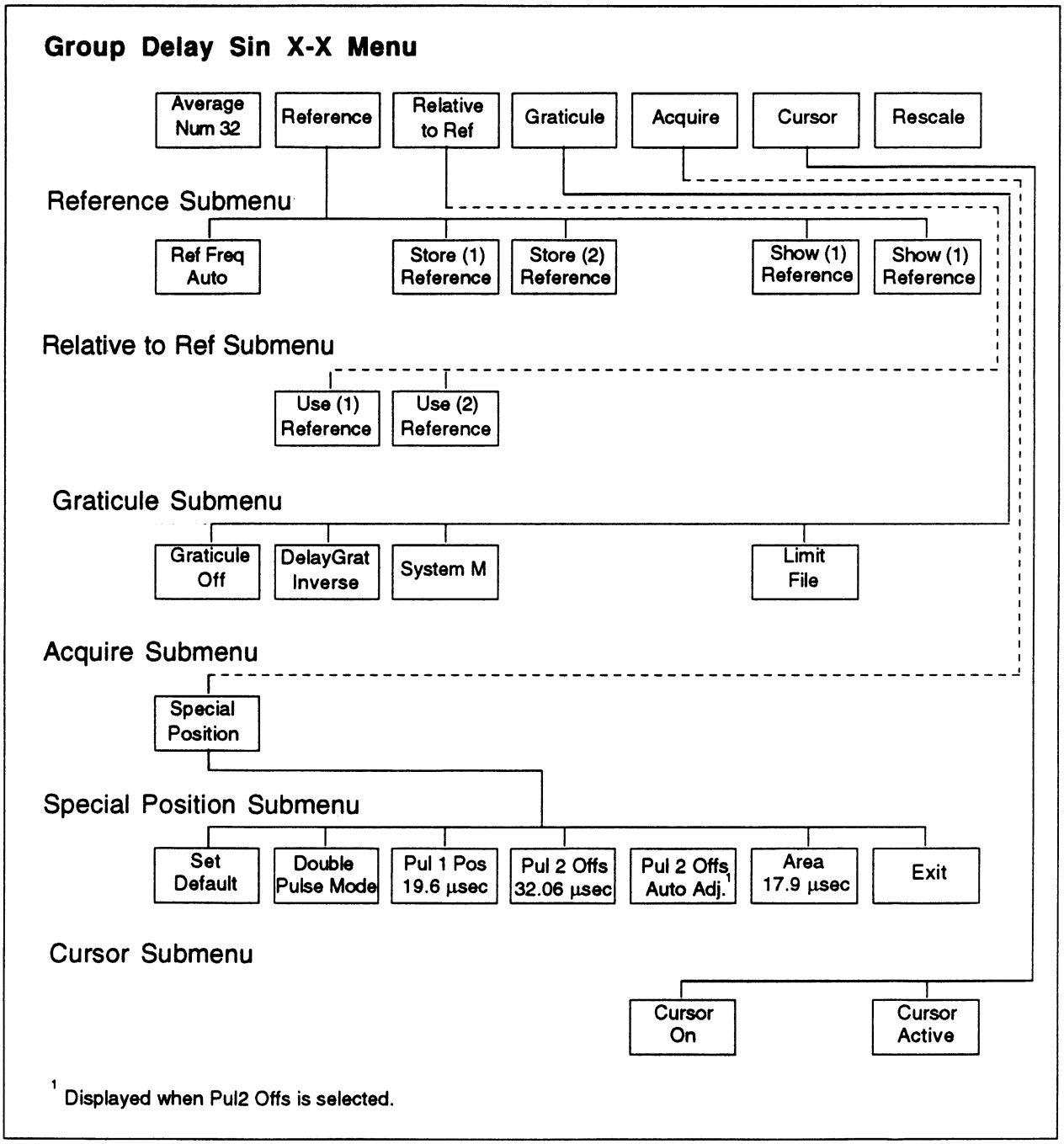


Figure 2-26. GroupDelay SinX_X menu tree.

MAIN MENU

Average Num	**Average Num** specifies the weighting factor to use for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the **Average Num** softkey to highlight it, rotate the knob until the desired weighting factor appears, then touch the **Average Num** softkey again.
Reference	**Reference** displays the Reference submenu which (1) stores the currently displayed values for use as a reference; or (2) displays previously stored reference values.
Relative to Reference	**Relative to Reference** displays the Reference submenu which selects the reference to use for comparison in the measurement. When a stored reference is selected, the currently measured value is compared to the stored reference value.
Graticule	**Graticule** displays the Graticule subment which selects the graticule.
Acquire	**Acquire** displays the Acquire submenu that controls how the signal is acquired for the specific measurement.
Cursor	**Cursor** displays the Cursor submenu that displays and activatesthe cursors. Readouts give the measurement values at the frequency location of the cursor.
Rescale	**Rescale** sets the expansion factor of the display to an appropriate scaling factor for the GroupDelay SinX_X measurement's display graticule. The x- and y-axes adjust to accommodate the rescaled display.

REFERENCE SUBMENU

Ref Freq.	**Ref. Freq.** set sthe reference value for delay and amplitude by turning the knob. Possible values are from 0.14 to 4.45 MHz. Below the 0.14-MHz level is "AUTO," which sets the reference position automatically.
Store (n) Reference	**Store (1) Reference/Store (2) Reference** saves the current measurement values as (1) Reference and (2) Reference, respectively. Selecting Store (1) Reference or Store (2) Reference overwrites previous (1) Reference or (2) Reference values. References are stored in nonvolatile memory and are retained when the VM700A is powered down.
Show (n) Reference	**Show (1) Reference/Show (2) Reference** displays the current values of (1) Reference and (2) Reference, respectively, plus the date and time the reference was stored and the channel the reference signal was on. If no reference value has been stored, touching either softkey displays a message that the reference is not defined.

RELATIVE TO REFERENCE SUBMENU

Use (n) Reference	**Use (1) Reference/Use (2) Reference** selects the stored reference to which measured values are compared. If no reference value has been stored, touching either softkey displays a message that the reference is not defined.

GRATICULE SUBMENU

Graticule Off

Graticule Off turns the graticule off.

DelayGrat Inverse

DelayGrat Inverse inverts the graticule so that it matches both the pre-correction in the transmitter and the group delay curve of the receiver.

System M

System M selects the System M graticule.

Limit File

Limit File uses the values in the Measurement Limits file to create the graticule.

ACQUIRE SUBMENU

Special Position

Special Position displays the Special Position submenu that sets the locations on the waveform where the measurement is made. Figure 2-27 shows the GroupDelay SinX_X display. shows the GroupDelay SinX_X special position display.

SPECIAL POSITION SUBMENU

Set Default

Set Default returns each measurement location to its default position as determined by the SinX/X signal generated by the Tektronix 1910 signal generator. If any other softkey is highlighted, only that measurement location is changed.

Double Pulse Mode

Double Pulse Mode when highlighted, the VM700A averages both upward and downward pulses, then computes the measurement. When de-selected, the VM700A uses a single upward pulse to enable this measurement with a sin^2 pulse. This softkey should normally be highlighted to avoid errors caused by nonlinear distortion.

Pul 1 Pos

Pul 1 Pos sets the location of the lefthand upward pulse. A dotted line on the display indicates the approximate position.

Pul 2 Offs

Pul 2 Offs sets the location of the righthand downward pulse, expressed as an offset from the lefthand upward pulse location. Use the default value, or touch the **Auto Adjust** softkey to precisely set this offset. This offset is critical for correct measurement of the signal.

Pul 2 Offs Auto Adj

Pul 2 Offs Auto Adj: precisely adjusts the location of the righthand downward pulse, expressed as an offset from the lefthand upward pulse location.

Area

Area changes the measurement area to allow the measurement to use on Composite Test Signals, etc. For best results, use the largest value possible. Smaller areas may result in lost low-frequency accuracy and reduced frequency resolution.

Exit

Exit leaves the Special Position submenu and displays the GroupDelay SinX_X screen.

CURSOR SUBMENU

Cursor On	**Cursor On** when highlighted, displays the cursor. It appears in the same position it was in the last time it was active.
Cursor Active	**Cursor Active** when highlighted, allows you to move the cursor by rotating the knob.

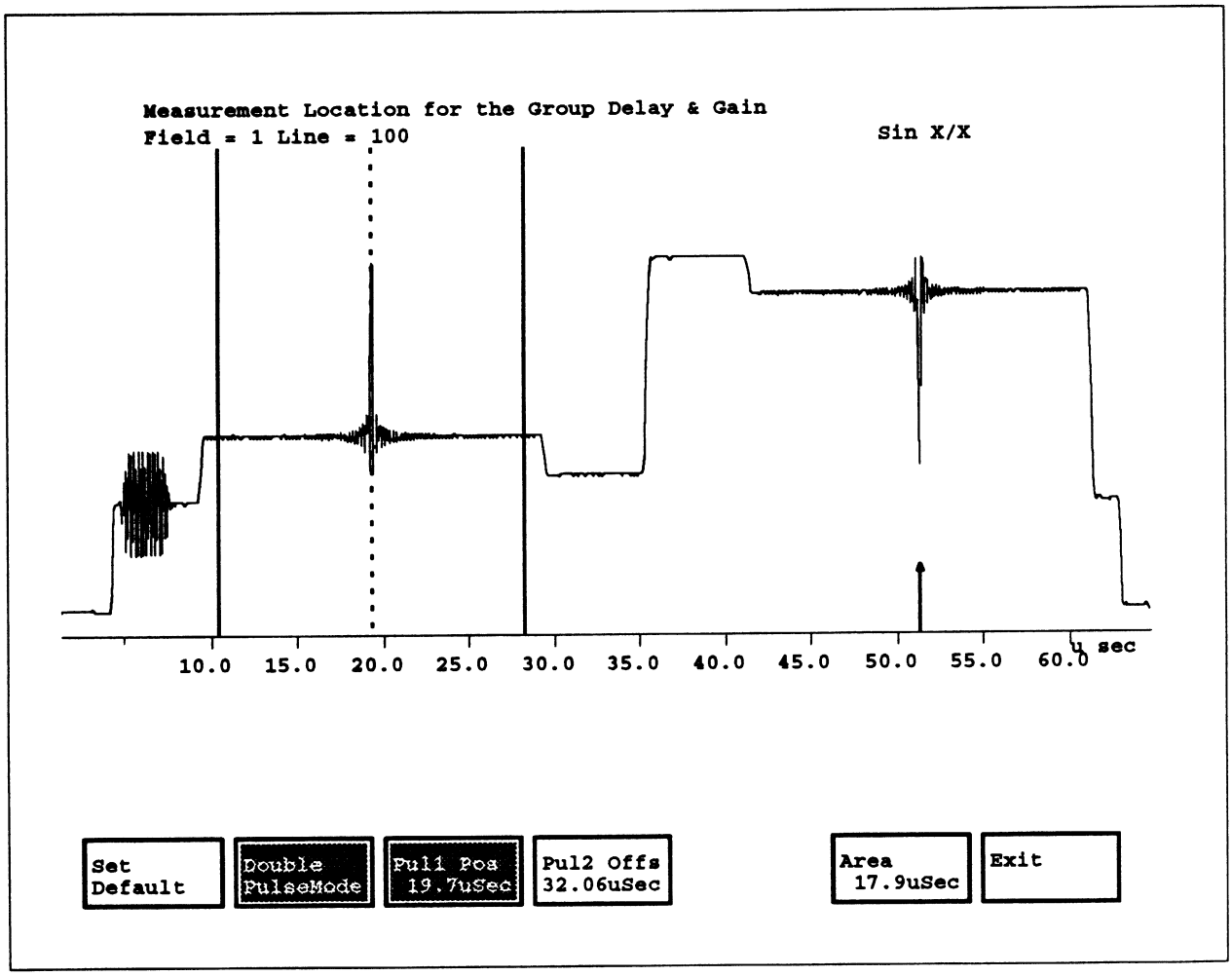


Figure 2-26. GroupDelay SinX_X special position display.

H_BLANK

The H_Blank measures where horizontal blanking starts and ends within a field.

H_Blank Display

Figure 2-28 shows the H_Blank display. The zero point of the x-axis is the leading edge of sync. The y-axis consists of all the lines in the measured area of the field (lines 11 to 263 for field 1, lines 11 to 262 for field 2). The display plots the times at which each line crosses the H_Blank measurement's "slice level."

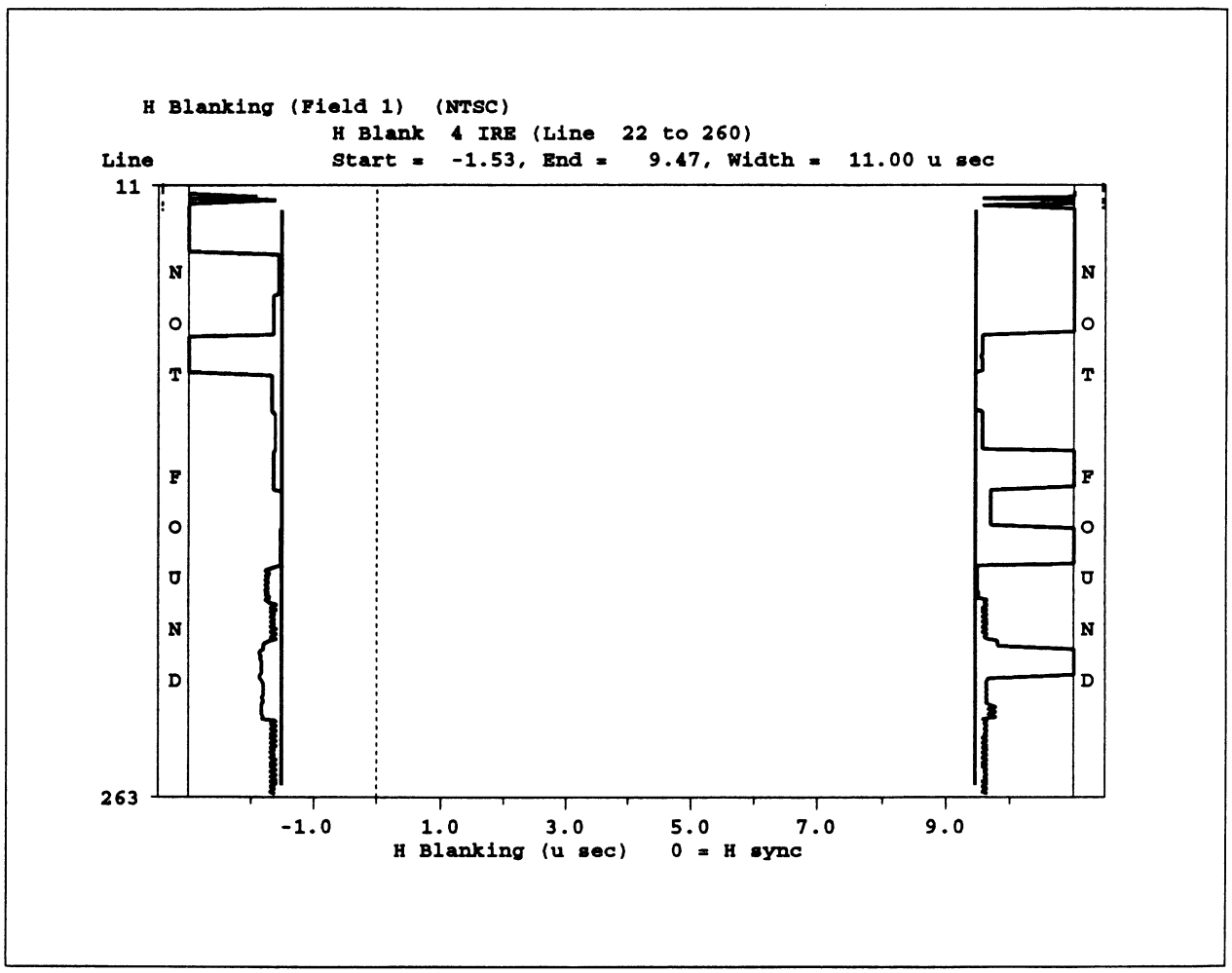


Figure 2-28. H_Blank display.

The "slice level," or threshold, is the voltage that defines the start or end of the horizontal blanking interval. The left side of the display shows the time at which each line crosses the slice level voltage at the beginning of its horizontal blanking interval. The right side of the display shows the time at which each line crosses the slice level voltage to end its horizontal blanking interval. Digital readouts above the display show the minimum values for horizontal blanking (i.e., the rightmost start time and the leftmost end time) over the range of lines selected.

The H_Blank measurement can use any NTSC video signal for input.

H_Blank Menu

Pressing the Menu button when the H_Blank measurement runs displays the H_Blank menu (Figure 2-29).

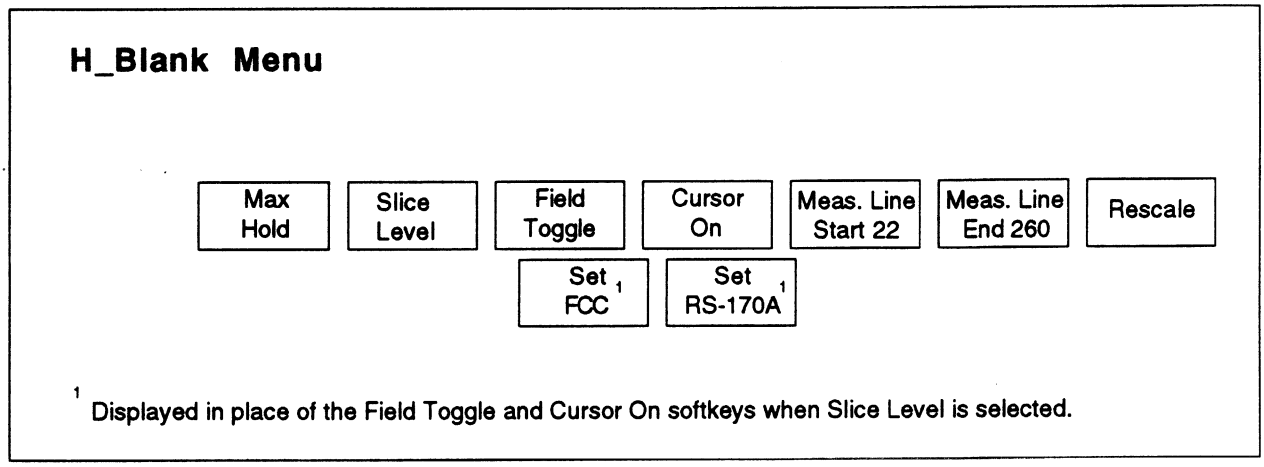


Figure 2-29. H_Blank menu tree.

MAIN MENU

Max Hold	**Max Hold** when highlighted, the measurement cursors hold the maximum unblanking positions. When de-selected, the measurement cursors move to reflect the current unblanking positions.
Slice Level	**Slice Level** sets the blanking search level in IRE by rotating the knob. Possible values range from 4 to 99 IRE. The 100 IRE level is computed as 250% of sync level.
Field Toggle	**Field Toggle** displays the system line in the other field from that currently displayed.
Set FCC	**Set FCC** displays when the Slice Level softkey is highlighted; sets the slice level to 4 IRE.
Cursor On	**Cursor On** when highlighted, the cursors show the minimum blanking interval over the range of lines being measured. On is the default.
Set RS-170A	**Set RS-170A** displays when the Slice Level softkey is highlighted; sets the slice level to 20 IRE.

Meas. Line Start

Meas. Line Start sets the measurement start line.

Meas. Line End

Meas. Line End sets the measurement end line.

Rescale

Rescale rescales the display graticule to an appropriate resolution.

H_TIMING

H_Timing makes various measurements around H_Sync.

Figure 2-30 shows the H_Sync display. The timing measurements made and displayed are: sync to blanking start, sync to blanking end, sync to burst start (RS-170A), sync to burst end (FCC), burst width, sync width, burst level, sync rise time, sync fall time, sync level, and breezeway (FCC).

The H_Timing measurement can use any video signal for input.

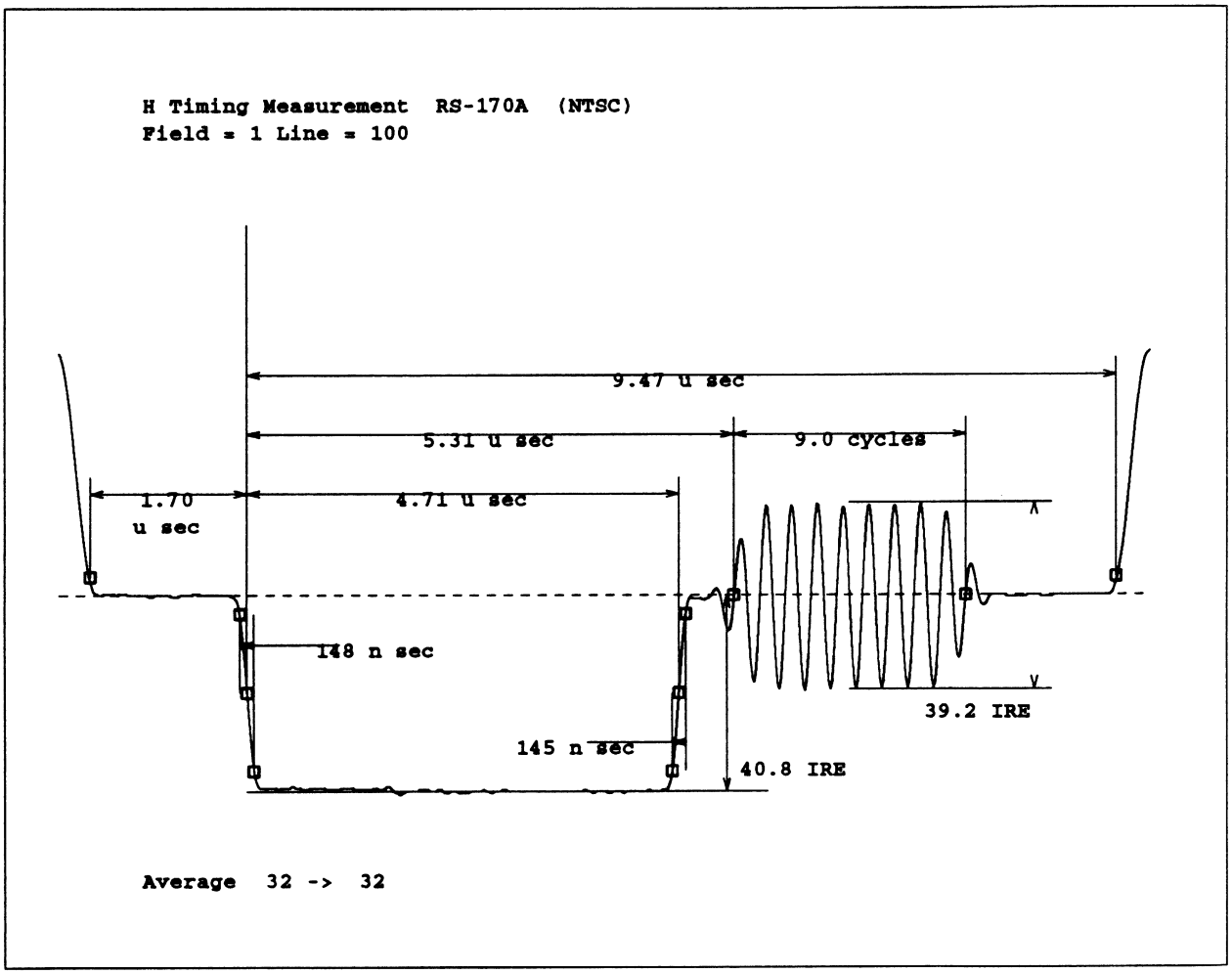


Figure 2-30. H_Timing display.

H_Timing Menu

Pressing the Menu button when the H_Timing measurement runs displays the H_Timing menu (Figure 2-31).

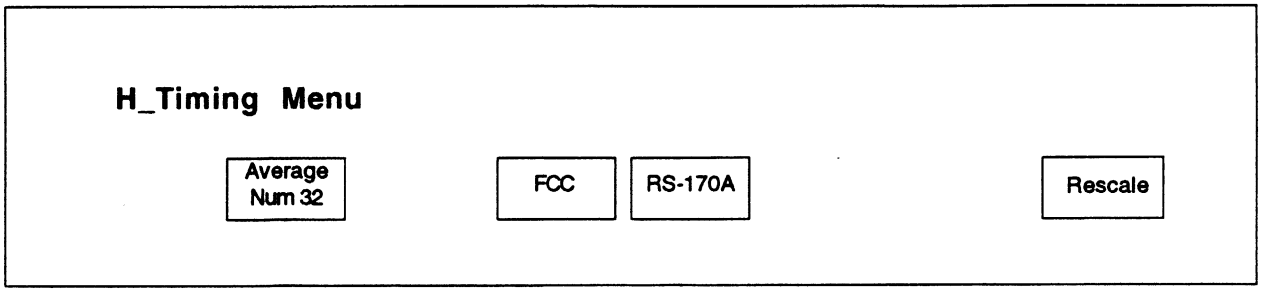


Figure 2-31. H_Timing menu tree.

MAIN MENU

Average Num	**Average Num** specifies the weighting factor to use for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the **Average Num** softkey to highlight it, rotate the knob until the desired weighting factor appears, then touch the **Average Num** softkey again.
FCC	**FCC** when highlighted, bases measurements on the FCC standard.
RS-170A	**RS-170A** when highlighted, bases measurements on the RS-170A standard.
Rescale	**Rescale** sets the expansion factor of the display to an appropriate scaling factor for the H_Timing measurement's display graticule. The x- and y-axes adjust to accommodate the rescaled display.

ICPM

The ICPM measurement measures Incidental Carrier Phase Modulation of an RF carrier, using the quadrature output of a demodulator such as the Tek 1450.

Incidental Carrier Phase Modulation (ICPM) is a distortion that occurs in the transmitter when the phase of the modulated carrier is affected by the level of the modulating video signal. The amount by which the carrier phase is shifted is the ICPM error.

ICPM error is expressed in degrees and is defined as:

ICPM = arctan(quadrature amplitude/video amplitude)

ICPM errors produce different effects, depending on the type of demodulation used to recover the baseband signal from the transmitted signal. ICPM errors appear in synchronously demodulated signals as differential phase and many other types of distortions, but the baseband signal is generally not as seriously affected when envelope detection is used. The effects of ICPM errors are therefore rarely seen in the picture in home receivers, which typically use envelope detection.

However, ICPM errors may manifest themselves as audio buzz at the home receiver. In the intercarrier sound system, the picture carrier is mixed with the FM sound carrier to form a 4.5 MHz sound IF. Audio rate phase modulation in the picture carrier can therefore be transferred into the audio system and heard as a buzzing noise.

ICPM Display

ICPM errors are measured by examining an XY plot of the VIDEO OUT versus QUADRATURE OUT outputs from a synchronous demodulator, using as input either a staircase signal of 5 or 10 steps, or a ramp. VIDEO OUT is plotted along the y axis with negative polarity (black is at the bottom, and indicates maximum transmitter output), while QUADRATURE OUT is plotted along the x axis. The origin of the system is in the horizontal center of the top of the display.

In the resulting plot, phase errors appear as a non-zero value from the QUADRATURE OUT output of the demodulator. If no ICPM errors are present, the plot appears as a succession of bright dots down the video-axis of the ICPM display output (Figure 2-32). When using a staircase test signal for the ICPM measurement, the curved lines that appear on the display are due either to transitions between successive levels of the test signal, or to the transition between the top of the staircase and the back porch. These curved lines can be ignored for purposes of this measurement.

If ICPM errors are present, phase errors will usually vary with amplitude, producing a tilted line of bright dots on the ICPM display (see Figure 2-33).

ICPM errors usually indicate a problem with the transmitter, or with modulator imbalance. (It is also remotely possible that a malfunctioning demodulator can give you a problem that looks like ICPM, but isn' t). Given that the demodulator is functioning correctly, however, ICPM errors generally indicate a linearity problem in the high-power stages of the transmitter.

Text on the left-hand side of the ICPM display tells you the name of the measurement (ICPM), the line on which the measurement is being made, and the percentage of the nominal carrier amplitude being used as a data exclusion threshold for the measurement (i.e., signal levels below the minimum or above the maximum percentage of the nominal carrier amplitude are excluded from the measurement).

Text on the right-hand side of the ICPM display tells you the minimum measured ICPM angle, the maximum measured ICPM angle, and the peak-to-peak measured ICPM angle (i.e., the difference between current maximum and minimum measured ICPM angles).

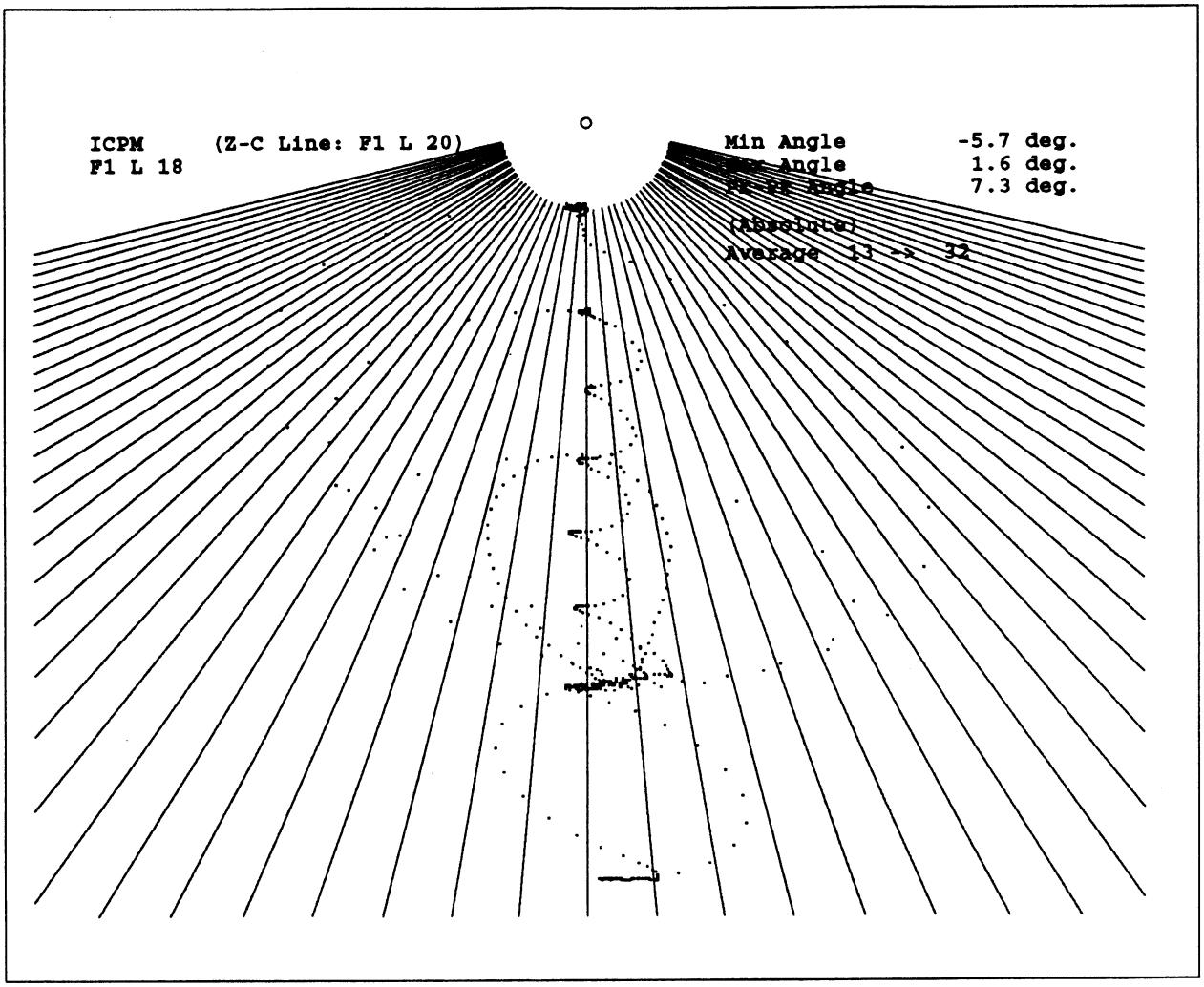


Figure 2-32. ICPM display; no ICPM errors present.

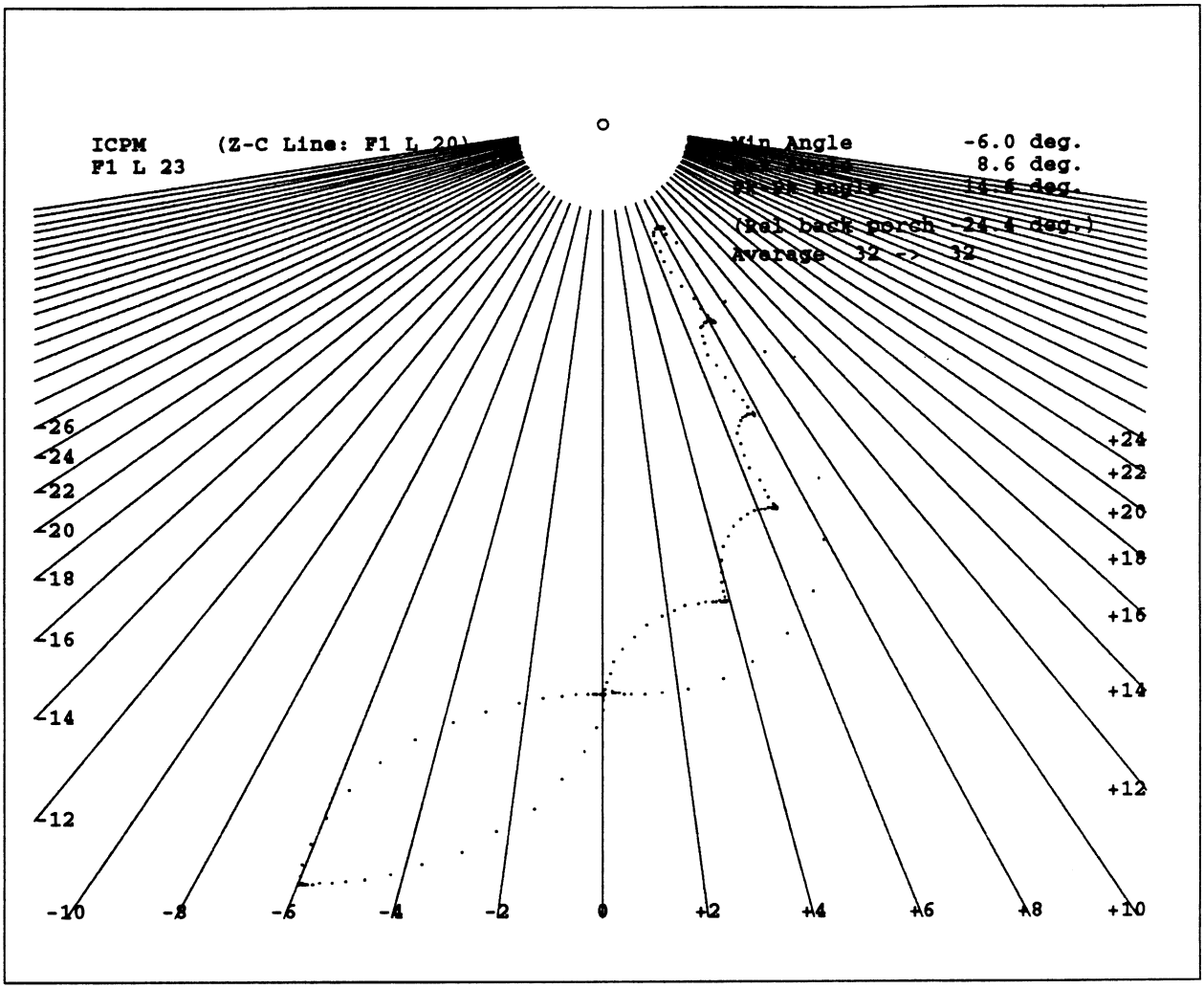


Figure 2-33. ICPM display; large ICPM error present.

ICPM Menu

Pressing the Menu button when the ICPM measurement runs displays the ICPM menu (Figure 2-34).

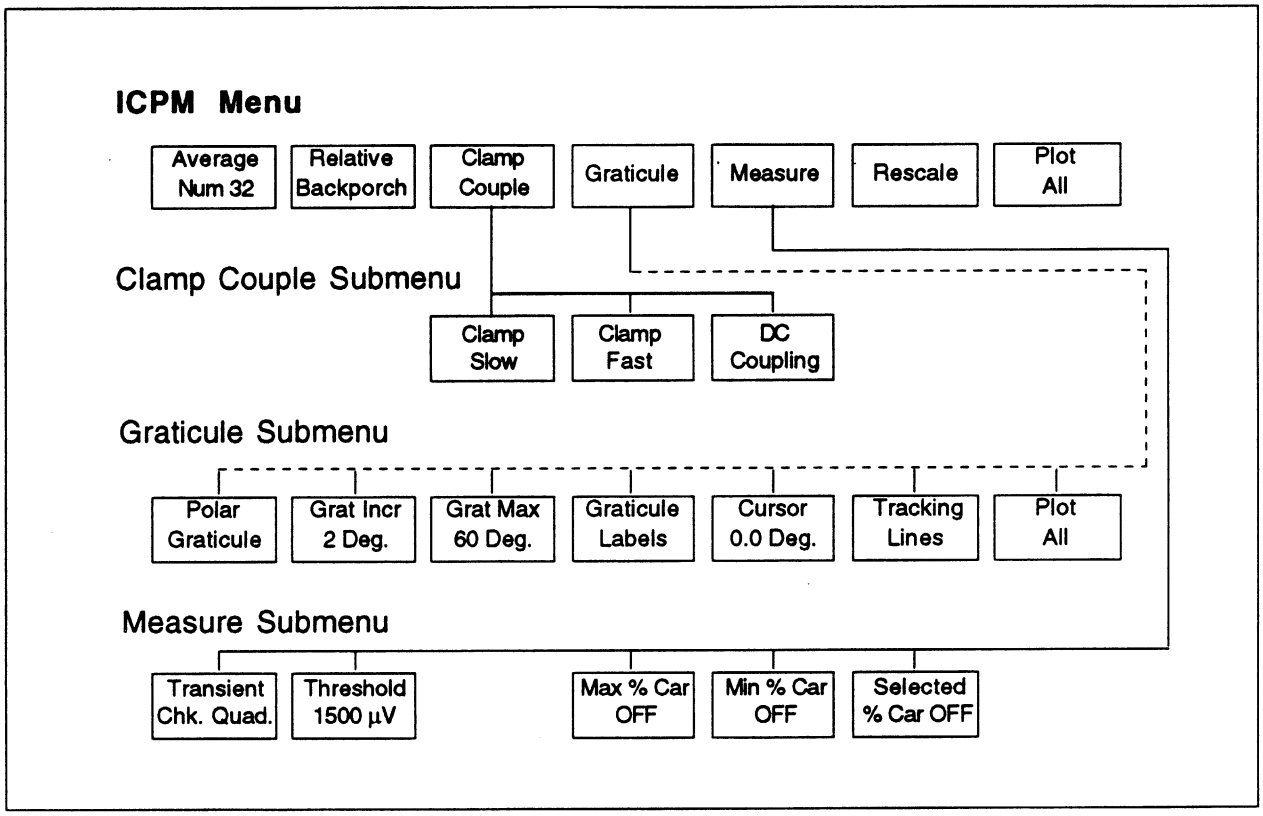


Figure 2-34. ICPM menu tree.

MAIN MENU

`Average Num`

Average Num specifies the weighting factor to use for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the **Average Num** softkey to highlight it, rotate the knob until the desired weighting factor appears, then touch the **Average Num** softkey again.

`Relative Backporch`

Relative Backporch when highlighted, the result angles are measured relative to the angle at burst center. In addition, displayed points are adjusted in the left-right direction (the quadrature axis) to maintain relevance with the cursor, tracking lines, and polar graticule.

`Clamp Couple`

Clamp Couple displays the Clamp Couple submenu that sets the Clamping mode used by the ICPM measurement.

`Graticule`

Graticule displays the Graticule submenu that control the displayed graticule and the maximum-angle tracking lines.

`Measure`

Measure displays the Measure submenu that determines which data points are used in the ICPM measurement.

Rescale	**Rescale** returns the reference point to the center of the screen, sets the left-right expansion for the quadrature axis to a comfortable value, and re-adjusts the top-bottom expansino for the video axis so that the sync level is at a pre-determined point.
Plot All	**Plot All** when highlighted, displays all sampled data points. When de-selected, only points used in computing the ICPM measurement result display.

CLAMP COUPLE SUBMENU

Clamp Slow	**Clamp Slow** selects slow clamp speed. This speed allows hum effects to be visible, but is useful in coping with large DC offsets on an input signal.
Clamp Fast	**Clamp Fast** selects fast clamp speed. This speed removes DC offset, hum, and bounce effects from the signal. This is the default clamp setting for the ICPM measurement.
DC Coupling	**DC Coupling** selects DC coupling (no clamping).

GRATICULE SUBMENU

Polar Graticule	**Polar Graticule** when highlighted, displays a polar graticule on the screen and displays the **Grat Incr**, **Grat Max**, and **Graticule Labels** softkeys.
Grat Incr 2 Deg.	**Grat Incr** adjusts the increment between individual lines of the polar graticule with the knob. Possible values range from 1 to 30 degrees. Below the 1-degree setting is "AUTO," which causes the graticule increment to be maintained at a "good" value based on the current expansion and position.
Grat Max 60 Deg.	**Grat Max** adjusts the maximum angle of displayed polar graticule lines. The maximum angle allowed is 89 degrees. Below the 1-degree setting is "AUTO," which causes the maximum graticule angle to be maintained at a "good" value based on the current expansion and position.
Graticule Labels	**Graticule Labels** when highlighted, the polar graticule applies labeling numbers to the ends of its lines as they fit.
Cursor 0.0 Deg.	**Cursor** when highlighted, the knob moves the displayed value by tenths of a degree; a cursor that reflects this value displays on the screen.
Tracking Lines	**Tracking Lines** when highlighted, displays lines that follow the maximum and minimum ICPM angles.
Plot All	**Plot All** when highlighted, all sampled data points display. When de-selected, only points used in computing the ICPM measurement display. The softkeys under the Measure sub-menu determine which points are used in the measurement.

MEASURE SUBMENU

Transient Chk. Quad.	**Transient Chk Quad** chooses which data input to check when discarding values around too-large point-to-point transients before measuring the maximum and minimum ICPM. Choices are the quadrature or the video input.
Threshold 1500 uV	**Threshold** sets the threshold (in microVolts) for data point exclusion from the ICPM measurement. When two consecutive sample points are not within this voltage of each other, several points around them are discarded.
Max % Car OFF	**Max % Car** sets the highest percent-of-carrier used in the ICPM measurement. When highlighted, any video input sample values above this percentage are discarded. When there is no maximum exclusion value, this key reads OFF.
Min % Car OFF	**Min % Car** sets the lowest percent-of-carrier used in the ICPM measurement. When highlighted, any video input sample values below this percentage are discarded. When there is no minimum exclusion value, this key reads OFF.
Selected % Car OFF	**Selected % Car** when highlighted, the currently highlighted **Min % Car** or **Max % Car** softkey is set to OFF, and the appropriate edge-value exclusion is removed.

JITTER

Jitter measures variation in horizontal sync timing over a single frame.

Figure 2-35 shows the Jitter display. Each line of the field is plotted along the y-axis, while time is plotted along the x-axis. The zero point of the x-axis is defined by the average position of the leading edge of sync over many frames for the range of lines being measured. The display plots the variation from this zero point for the leading edge of sync of each line in the measurement. A digital readout above the display shows the maximum value of jitter for the lines being measured.

The Jitter measurement can use any video signal as input.

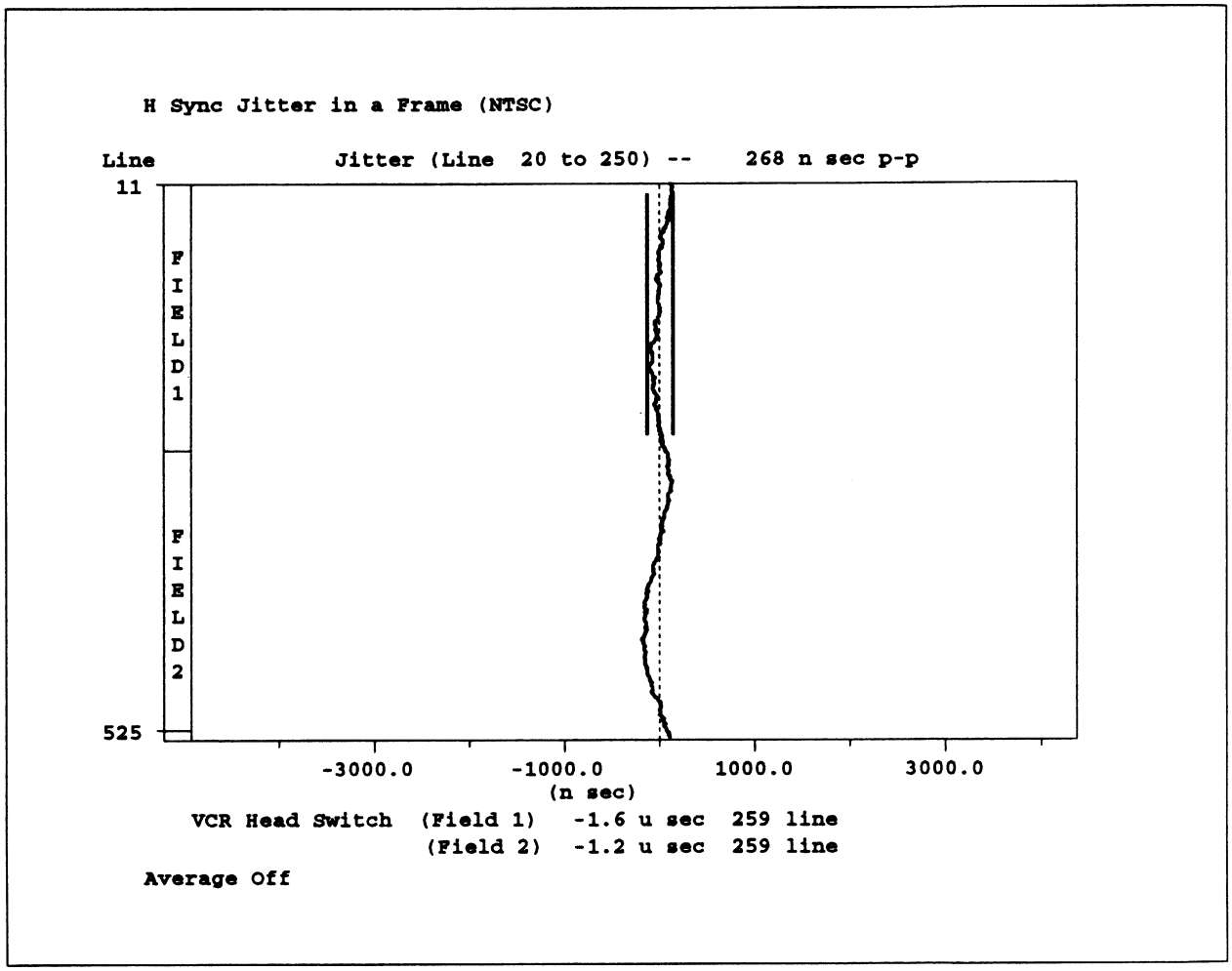


Figure 2-35. Jitter display.

Jitter Menu

Pressing the Menu button when the Jitter measurement runs displays the Jitter menu (Figure 2-36).

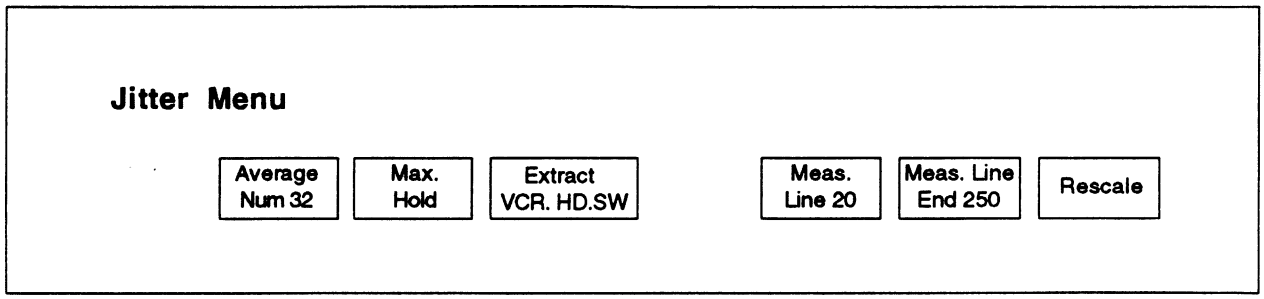


Figure 2-36. Jitter menu tree.

MAIN MENU

Average Num	**Average Num** specifies the weighting factor to use for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the **Average Num** softkey to highlight it, rotate the knob until the desired weighting factor appears, then touch the **Average Num** softkey again.
Max Hold	**Max Hold** when highlighted, the display's measurement cursors hold the positions of maximum jitter.
Extract VCR.HD.SW	**Extract VCR.HD.SW** searches the bottom of the picture area for horizontal timing errors exceeding 100 ns. This position is assumed to be the head switching position for a VCR. The error thus found is extracted from the Jitter display, and the resulting values and locations display.
Meas. Line Start	**Meas. Line Start** sets the measurement start line.
Meas. Line End	**Meas. Line End** sets the measurement end line.
Rescale	**Rescale** sets the expansion factor of the display to an appropriate scaling factor for the Jitter measurement's display graticule. The x- and y-axes adjust to accommodate the rescaled display.

JITTER LONG_TIME

Jitter Long_Time measures variations in frame period timing.

Figure 2-37 shows the Jitter Long_Time spectrum display, plotting the variation in frame period timing (in dB, where 0 dB = 1 H) on the y-axis and frequency (in Hz) on the x-axis.

Figure 2-38 shows the Jitter Long_Time waveform display, plotting frame period jitter (in µs or ns, depending on the scale of jitter) on the y-axis and time (in seconds) on the x-axis.

The Jitter Long_Time measurement can use any video signal as input.

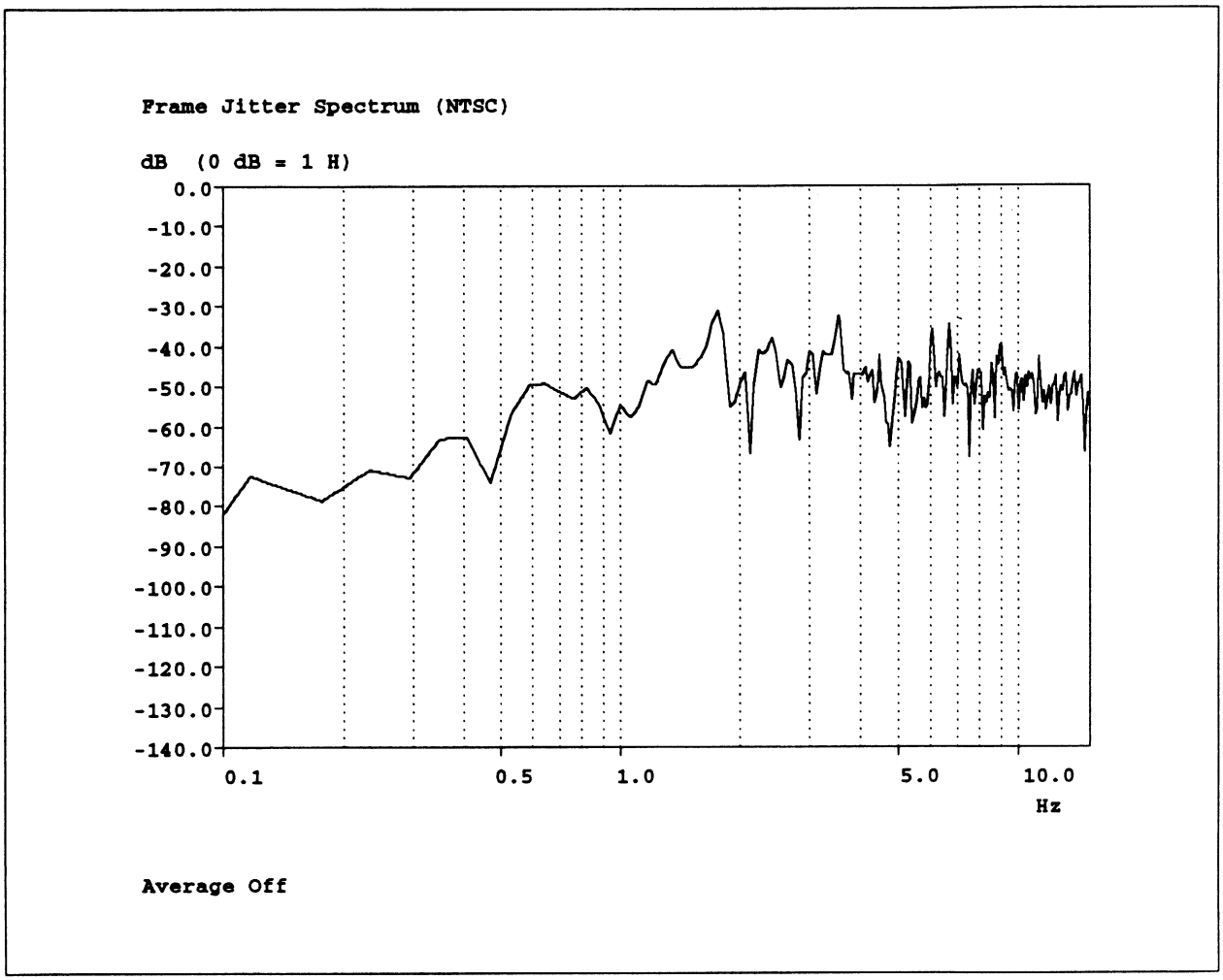


Figure 2-37. Jitter Long_Time spectrum display.

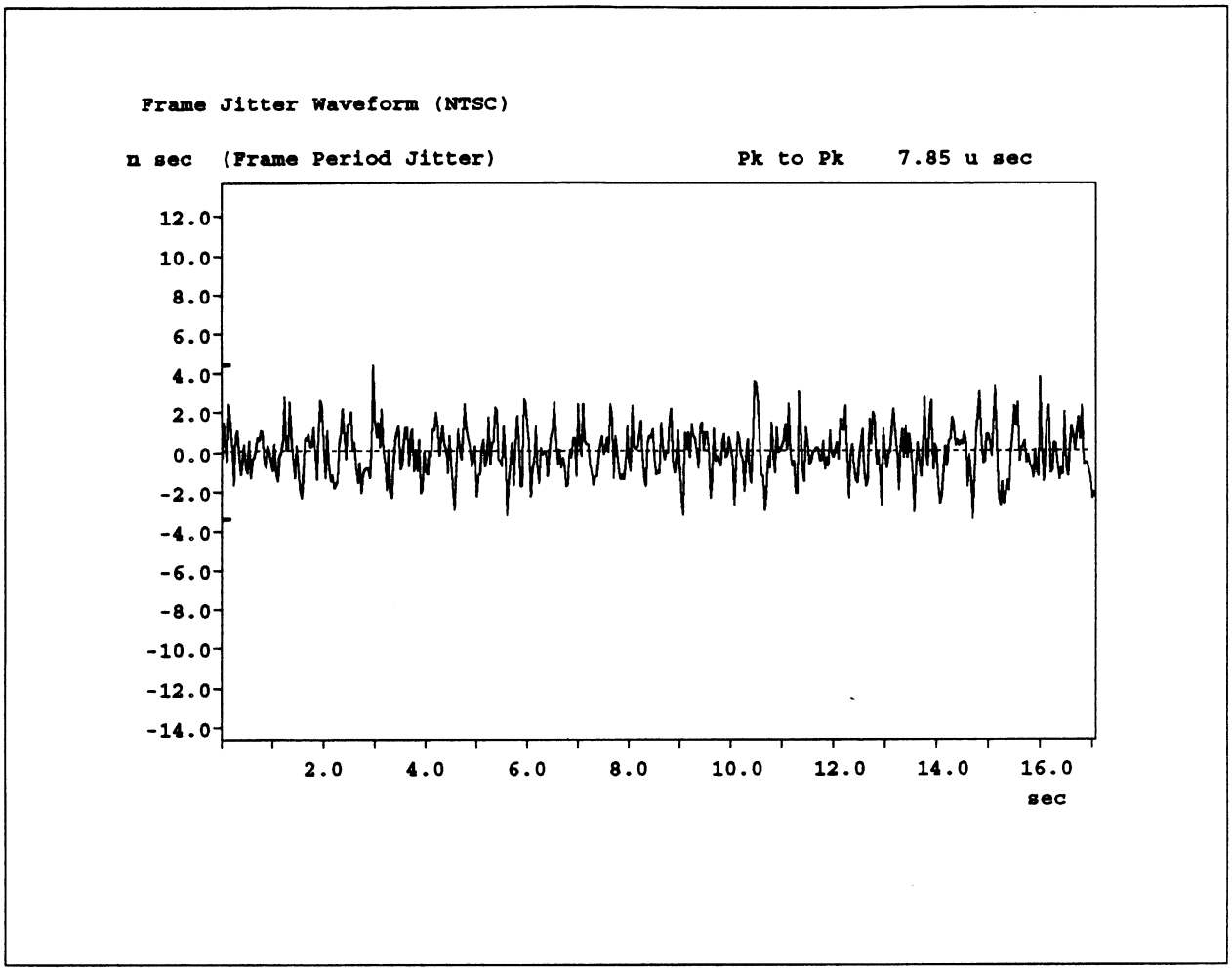


Figure 2-38. Jitter Long_Time waveform display.

Jitter Long_Time Menu

Pressing the Menu button when the Jitter Long_Time measurement runs displays the Jitter Long_Time menu (Figure 2-39).

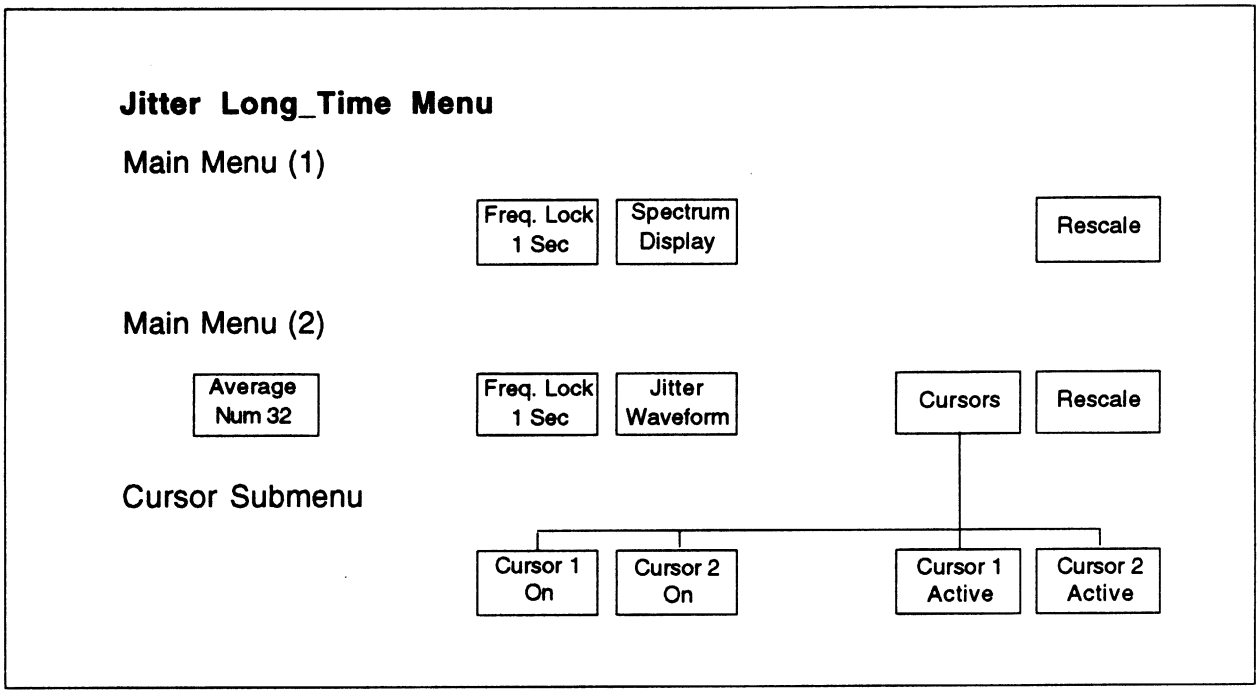


Figure 2-39. Jitter Long_Time menu tree.

MAIN MENU

Average Num

Average Num specifies the weighting factor to use for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the **Average Num** softkey to highlight it, rotate the knob until the desired weighting factor appears, then touch the **Average Num** softkey again.

Freq. Lock

Freq. Lock sets the time constant of the locking loop.

Spectrum Display

Spectrum Display shows the spectrum of the jitter waveform, using an FFT with a Hanning window.

Jitter Waveform

Jitter Waveform displays the "rolled" jitter waveform.

Cursors

Cursors provides softkeys to display and activate the two cursors. Readouts for the cursors give the value in decibels (peak-to-peak) at the frequency locations of the cursors.

Rescale

Rescale sets the expansion factor of the display to an appropriate scaling factor for the Jitter Long_Time measurement's display graticule. The x- and y-axes adjust to accommodate the rescaled display.

CURSORS MENU

Cursor 1/2 On

Cursor 1/2 On displays Cursor 1 or 2, as appropriate. The cursor appears in the position it was in the last time it was active.

Cursor 1/2 Active

Cursor 1/2 Active enables the knob to move Cursor 1 or 2, as appropriate.

K_FACTOR

K_Factor measures K-2T, K-PB, and Pulse-to-Bar Ratio.

Figure 2-40 shows a typical K_Factor measurement display. The display shows the signal superimposed on the K-Factor graticule. Digital readouts also show the measured values of K-2T, K-PB, Pulse-to-Bar ratio, and HAD.

The K_Factor measurement can use an FCC Composite, NTC-7 Composite, or 1410 TSG-5 type Pulse Bar for input. The essential element of the input signal is a 2T pulse; a bar is also needed for measured K-PB and Pulse-to-Bar ratio.

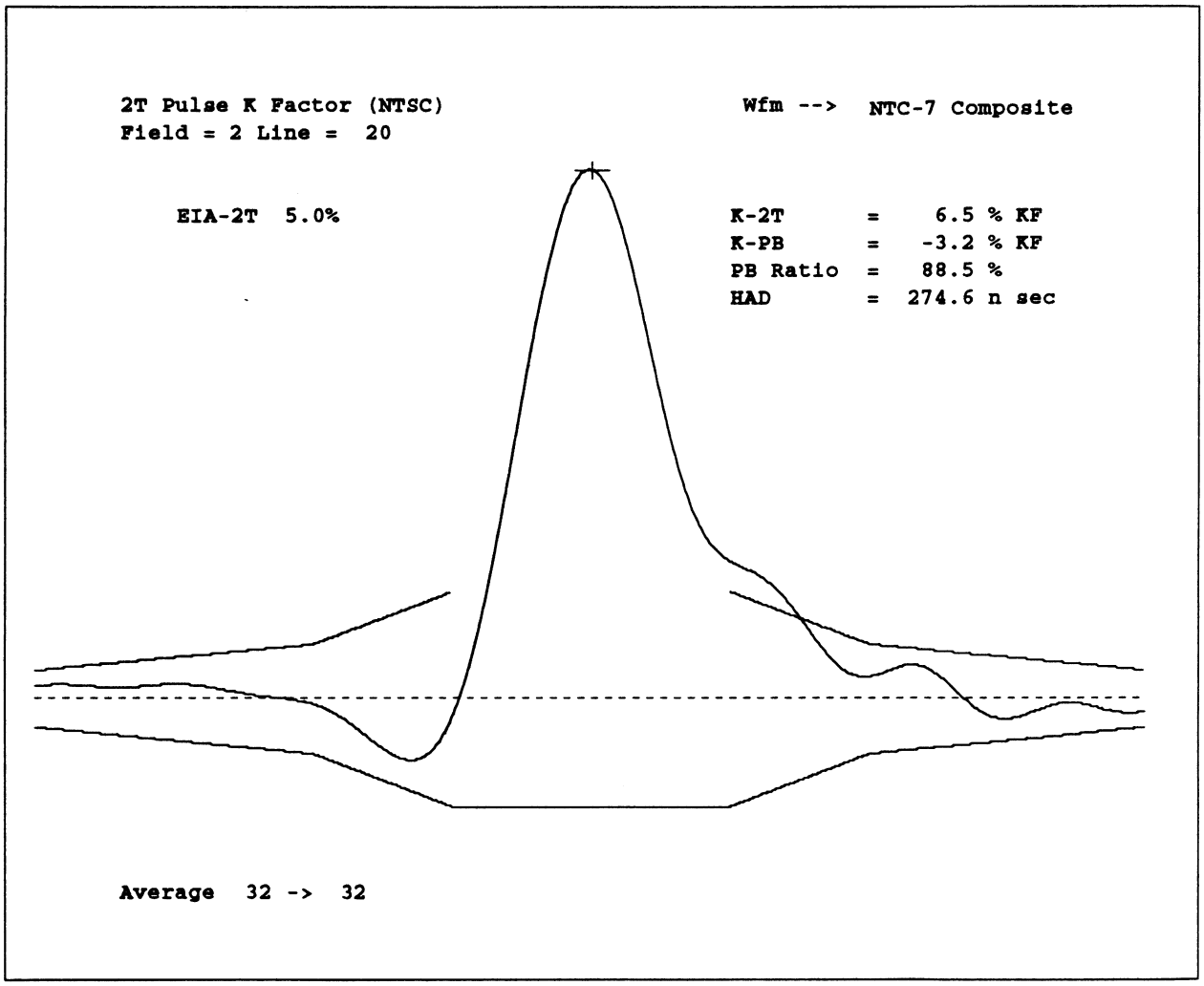


Figure 2-40. K-Factor display.

K_Factor Main Menu

Figure 2-41 shows the K_Factor menu tree structure. Pressing the Menu button when the K_Factor measurement is being executed brings up the K_Factor main menu.

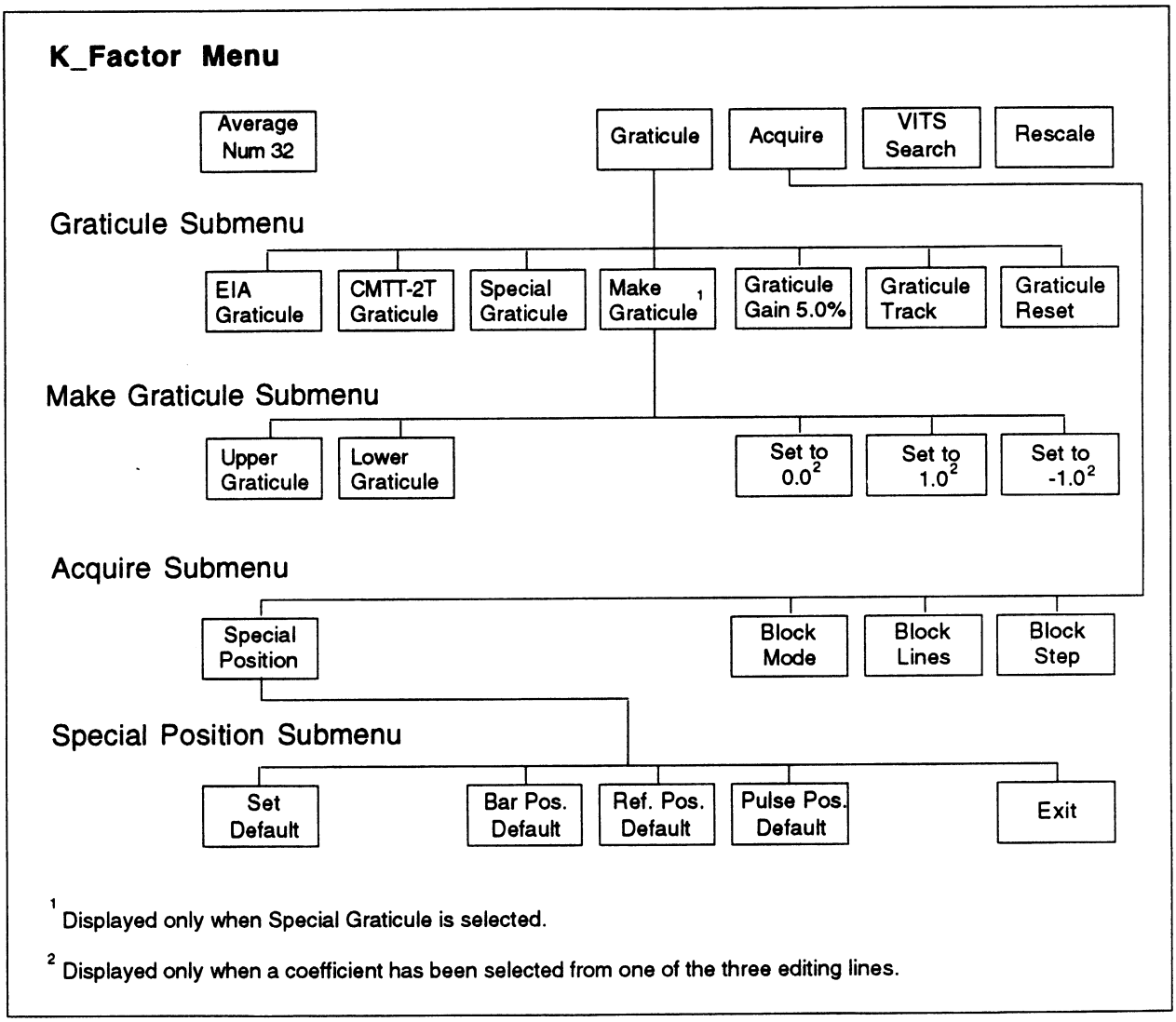


Figure 2-41. K-Factor menu tree.

MAIN MENU

Average Num	**Average Num** specifies the weighting factor to use for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the **Average Num** softkey to highlight it, rotate the knob until the desired weighting factor appears, then touch the **Average Num** softkey again.
Graticule	**Graticule** provides softkeys to control the graticule gain and tracking of the current graticule, and to change from a standard graticule to a user-created graticule.

Acquire	**Acquire** displays a submenu of softkeys that control how the signal is acquired for the K_Factor measurement.
ITS Search	**ITS Search** searches the insertion test signals for a signal appropriate for the measurement. If an appropriate signal is not located, the message **Not found** displays briefly on the screen.
Rescale	**Rescale** sets the expansion factor of the display to an appropriate scaling factor for the K_Factor measurement's display graticule. The x- and y-axes adjust to accommodate the rescaled display.

GRATICULE SUBMENU

EIA Graticule	**EIA Graticule** selects the standard EIA K_Factor Graticule.
CMTT-2T Graticule	**CMTT-2T Graticule** selects the standard CMTT (CCIR) K_Factor Graticule.
Special Graticule	**Special Graticule** selects the Special (user-defined) graticule for the K_Factor measurement.
Make Graticule	**Make Graticule** brings up the Make Graticule submenu, which provides softkeys to define the upper and lower graticules of the Special (user-defined) graticule. This softkey only appears when the Special Graticule softkey is highlighted.
Graticule Gain	**Graticule Gain** adjusts the graticule variable gain. The range is from 0.1% to 20.0%, with a resolution of 0.1%. To adjust the gain, highlight the softkey, turn the knob, then touch the softkey again.
Graticule Track	**Graticule Track** turns on graticule tracking mode. When graticule tracking is on, the size of the graticule tracks the actual waveform.
Graticule Reset	**Graticule Reset** turns off graticule tracking and resets the graticule gain to 5.0%.

MAKE GRATICULE SUBMENU

Upper Graticule	**Upper Graticule** selects the upper user-defined graticule for editing.
Lower Graticule	**Lower Graticule** selects the lower user-defined graticule for editing.
Set to 0.0	**Set to 0.0** sets the selected variable value to 0. This softkey is only displayed when a coefficient is selected from one of the three editing lines.

Set to 1.0	**Set to 1.0** sets the selected variable value to 1.0. This softkey is only displayed when a coefficient other than T is selected from one of the three editing lines.
Set to -1.0	**Set to -1.0** sets the selected variable value to -1.0. This softkey is only displayed when a coefficient is selected from one of the three editing lines.

ACQUIRE SUBMENU

Special Position	**Special Position** sets the locations on the waveform where the measurement is made. Figure 2-42 shows the K-Factor special position display.
Block Mode	**Block Mode** turns on Block mode. The block starts at the system line.
Block Lines	**Block Lines** sets the number of lines to average for the measurement. The default number of Block Lines to average is 3.
Block Step	**Block Step** sets the number of lines to step in the block. The default number of lines to step is 2.

SPECIAL POSITION SUBMENU

Set Default	**Set Default** resets the selected softkey (Bar Top, Ref Pos, or Pulse Pos) to its default location. If none are selected, all are reset.
Bar Top. Default	**Bar Top** allows you to choose the bar level measurement location in the signal, represented by a small rectangle on the display, by rotating the knob.
Ref. Pos. Default	**Ref. Pos. Default** allows you to choose the reference location of the blanking level in the signal by rotating the knob.
Pulse Pos. Default	**Pulse Pos** defines the default location of the center of the 2T pulse being measured. When this softkey is highlighted, the pulse position cursor, represented by a vertical line on the display, is shown, and you can rotate the knob to set the pulse position.
Exit	**Exit** leaves the Special Position display and returns to the main K_Factor measurement display.

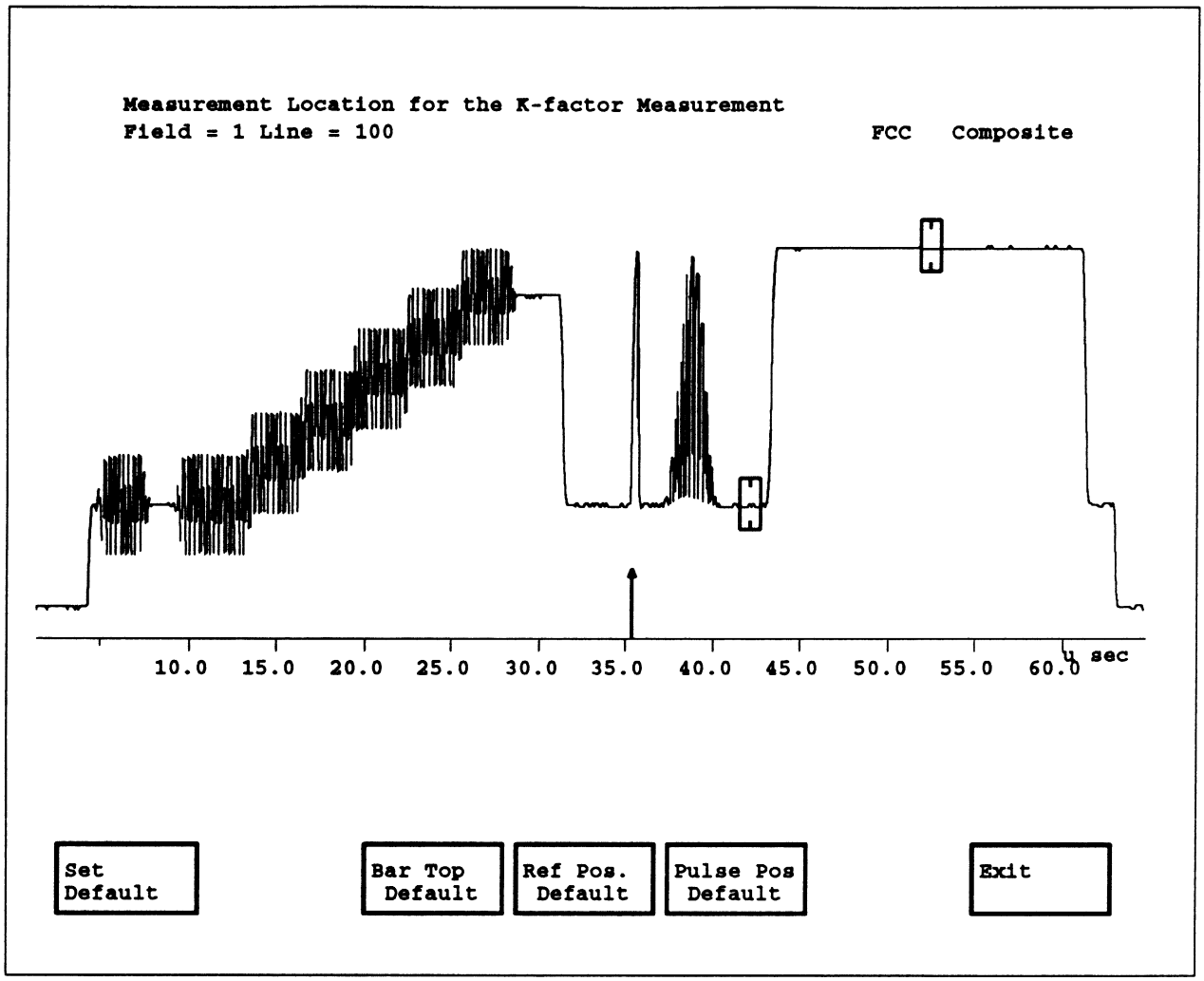


Figure 2-42. K-Factor special position display.

Defining Your Own Graticule

The K_Factor measurement's graticule defines the boundaries of the distortion envelope for a given graticule gain setting. The displayed graticule consists of an upper and a lower graticule.

You can define your own graticule for the K_Factor measurement by means of the Make Graticule submenu. To access the Make Graticule submenu, do the following:

1. Press the Menu button to bring up the K_Factor main menu.
2. Touch the **Graticule** softkey.
3. If it is not already highlighted, touch the **Special Graticule** softkey. When Special Graticule is highlighted, the **Make Graticule** softkey displays beside it.
4. Touch the **Make Graticule** softkey.

The Make Graticule submenu, consisting of the Upper Graticule and Lower Graticule softkeys, should be visible but not highlighted on the screen.

To change the shape of the upper or lower graticule, touch the corresponding softkey. This displays three editable lines of equations (Figure 2-43).

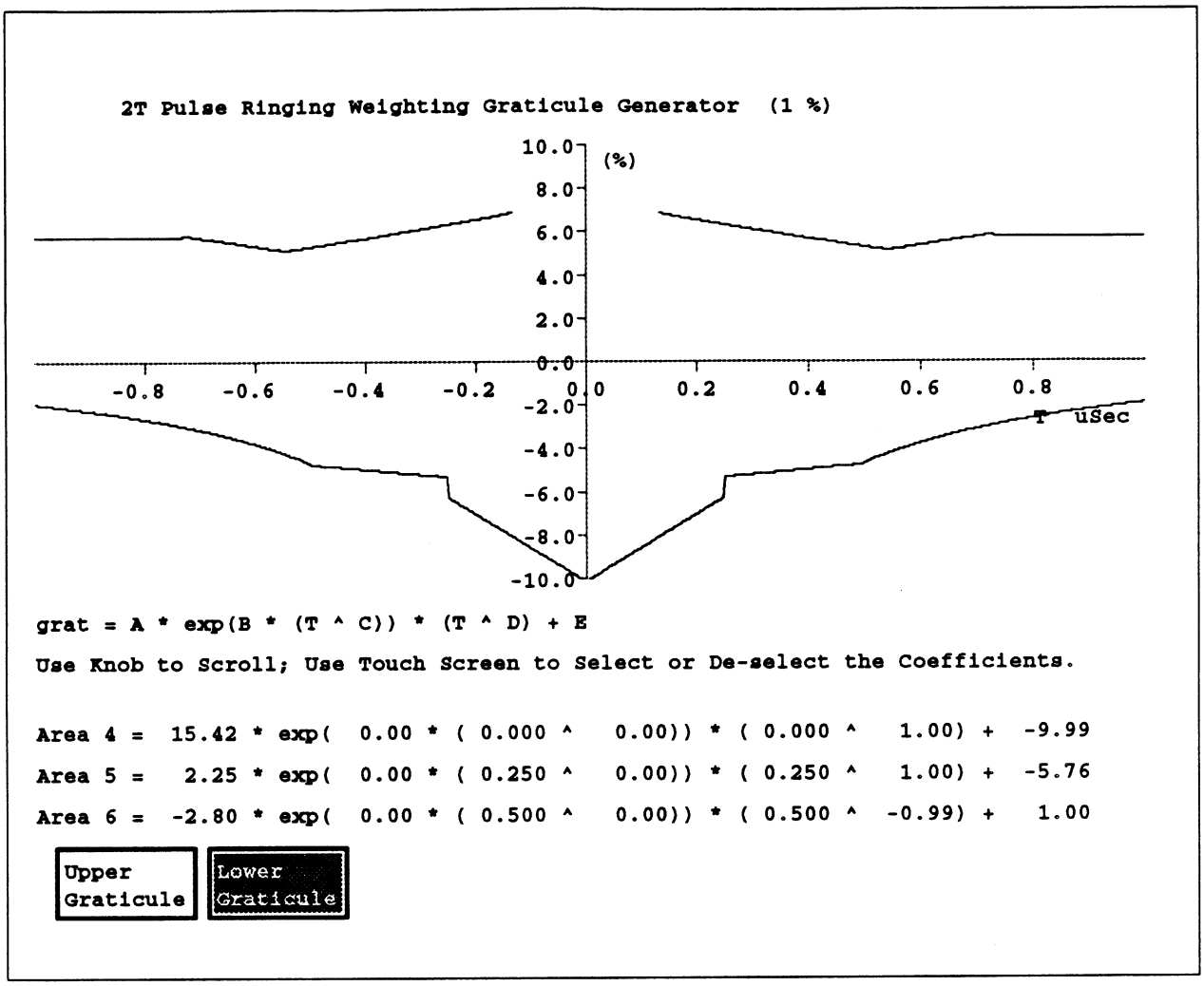


Figure 2-43. Make Graticule display with lower graticule selected.

Each graticule is divided into three areas. Area 1 is innermost, nearest the y-axis. Area 2 is the middle area. Area 3 is outermost, furthest away from the y-axis. The three lines of equations correspond to the three areas of the line being edited.

Editing the equations consist of changing the values of the coefficients in the equation

grat = A * exp(B * (T^C))*(T^D) + E.

To select a line to edit, turn the knob when no coefficient of a line is selected (i.e., no edit box is visible around any coefficient).

To edit a coefficient in the selected line, touch the coefficient you wish to edit. For coefficients A, B, C, D, or E, this brings up three more softkeys labeled "Set to 0.0", "Set to 1.0", and "Set to -1.0". (When the T coefficient is selected, only the "Set to 0.0" softkey is displayed.) To set the value of the coefficient, turn the knob or touch one of the softkeys. The effect of the change on the graticule is shown immediately.

To finish making changes to an equation, touch the selected coefficient. The edit box disappears, and you can then turn the knob to select a new line to edit, or press the Menu button to exit the Make Graticule submenu.

NOTE

The Make Graticule submenu defines the boundaries of the distortion envelope for 1% gain. The default gain for the main K_Factor display is 5%. You can adjust the gain value with the Graticule Gain softkey of the Graticule submenu.

To adjust the gain, highlight the softkey, turn the knob until the desired gain value is displayed, then touch the softkey again.

LEVEL METER

Level Meter measures the amplitude difference between two points on a television signal and displays the result in an easy-to-read bar graph. Examples of levels that may be monitored may be the sync amplitude, peak-to-peak amplitude, etc.

Level Meter Display

Figure 2-44 shows the typical Level Meter display monitoring the peak-to-peak amplitude of an NTC-7 Composite waveform. You can set the measurement for delta between two points in IRE units, delta between two points referenced to a value in percentage, or absolute between one point and zero (ground) in either IRE units or percentage.

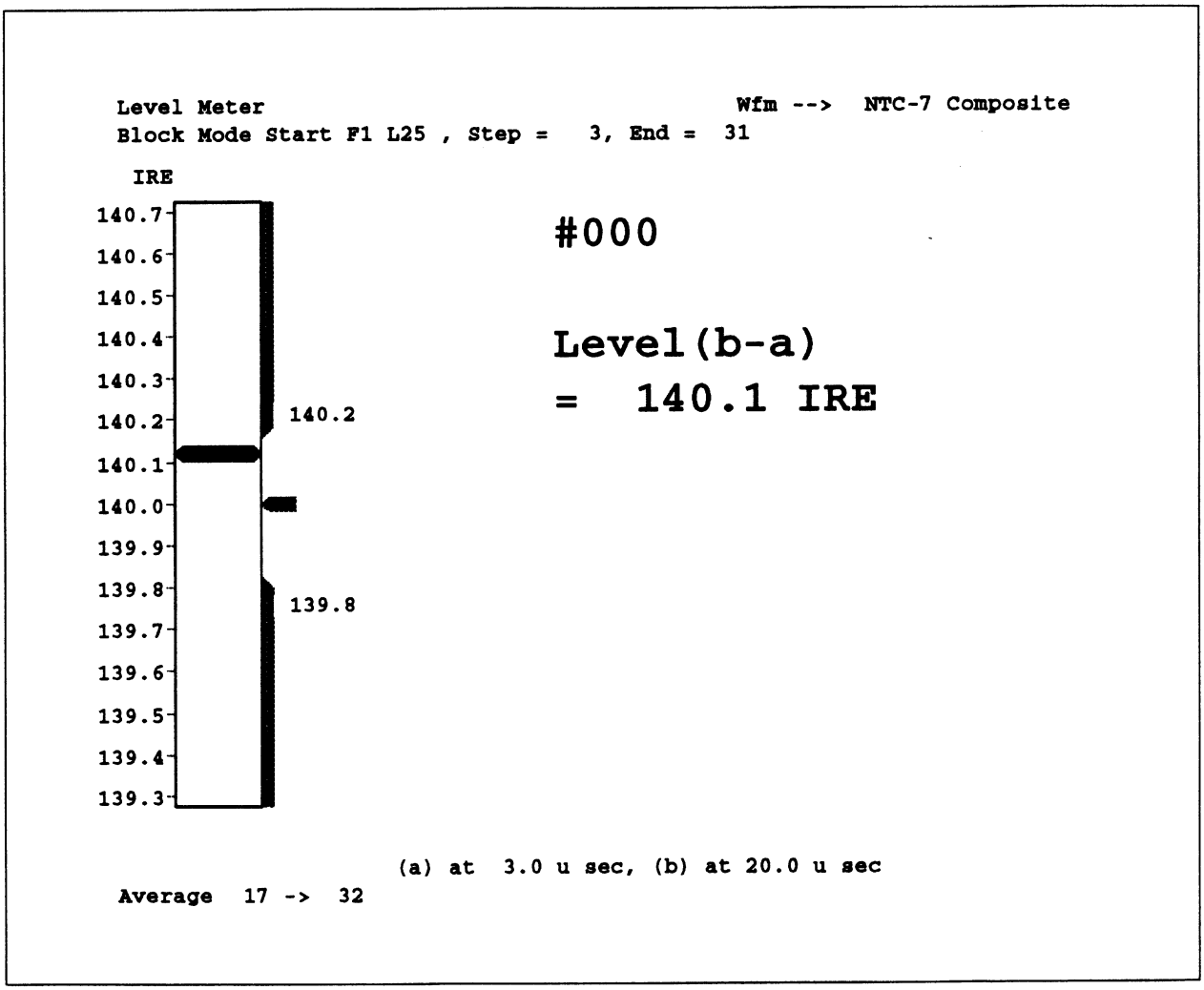


Figure 2-44. Level Meter display.

NOTE

Measurement units of IRE are the default when using the System Default Measurement Location file. If you want to see units in mV, you must create editable files for Measurement Locations and Video Source. In the editable Measurement Locations file, change the amplitude units to volts; in the editable Video Source file, change the source selection to the new Measurement Locations file name. See the VM700A Operator's Manual, Configuring the VM700A, for further information on creating, editing, and selecting user-created configuration files.

The Max and Min points of the measurement window and the reference pointer for the display are easy to set up using the menu choices under the Display Limits softkey, and the measurement points on a waveform are quickly selectable using the menu choices under the Measure Position softkey.

Level Meter Main Menu

Pressing the Menu button with the Level Meter running displays the Level Meter main menu (Figure 2-45).

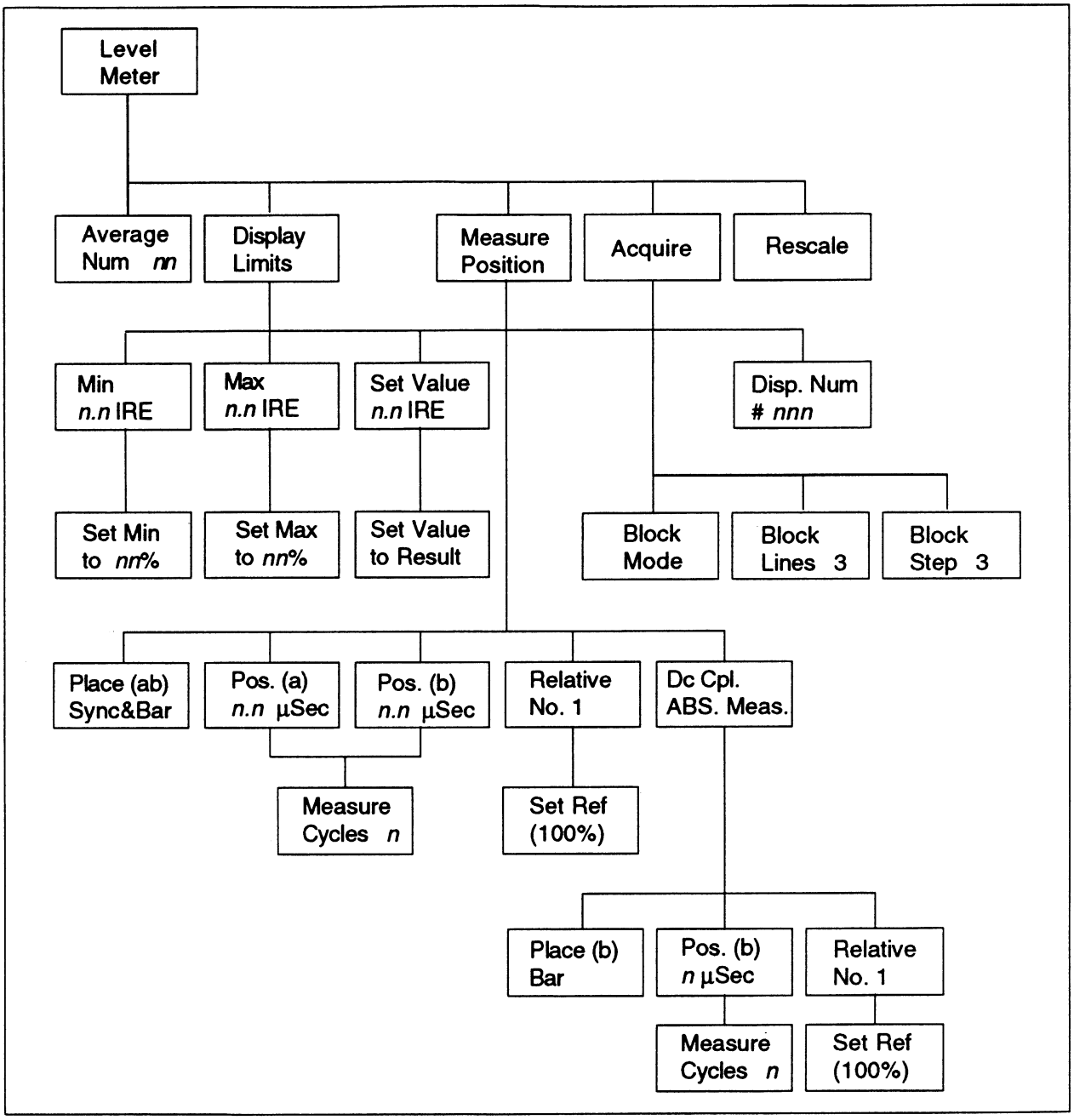


Figure 2-45. Level Meter menu tree.

LEVEL METER MENU

Average Num

Average Num specifies the weighting factor to use for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the **Average Num** softkey to highlight it, rotate the control knob until the desired weighting factor appears, then touch the **Average Num** softkey again. The effect of increasing the number used for averaging is that more time is required to arrive at a final value, but the readings become more stable as any noise variations of signal level are averaged out.

Display Limits

Display Limits displays a menu for setting the Level Meter reference limits seen in the Level Meter display. Provision are available for setting the minimum and maximum amplitude values for the measurement window, and for setting a measurement reference pointer. The Expand and Move feature works on the vertical axis to permit a Level Meter display to be set up to monitor a level measurement of a video signal over a wide range of resolution and amplitudes.

Measure Position:

Measure Position: displays a menu and waveform for positioning the measurement cursors. The amplitude measurement may be set for the cursor difference (b-a) in IRE units, cursor difference (b-a/reference) in percentage relative to a reference, or cursor position with respect to zero. The number of cycles over which the measurement is made is also selectable for each cursor. The **Measure Cycles n** display indicates the current selection for the active cursor. The measure position display is illustrated in Figure 2-47 showing the cursors positioned to measure the nominal peak-to-peak amplitude of the NTC-7 composite test signal. The active cursor has a vertical marker attached.

Acquire

Acquire displays a menu used to select block acquisition mode and control the number of lines in the block acquired and the number of lines to step in a block.

Rescale

Rescale readjusts the vertical scale position to place the measured value within the Level Meter viewing area. After adjusting the Max and Min display limits to new values, using Rescale will adjust the display for the optimum resolution using those new limits.

DISPLAY LIMITS SUBMENU

Min *n.n* IRE

Min selects the minimum display limit marker for adjustment. With the **Min** softkey selected, rotating the control knob sets the minimum display window marker to the number displayed in the softkey box. It cannot be set to a higher amplitude than the reference pointer level. The minimum limit is either –999 mV or –200%.

With the **Min** softkey selected another menu choice is added: **Set Min to –nn%**. This softkey provides a means to quickly set up a minimum percentage to monitor after the measurement points have been selected. See Setting Up a New Measurement Window for an example of how this softkey may be used. Also, the percentage setting of the softkey may be set between 0 and –10% by rotating the control knob while holding your finger on the **Set Min to –nn%** menu choice. The default is –10%.

Max *n.n* IRE

Max selects the maximum display limit marker for adjustment. With the **Max** softkey selected, rotating the control knob sets the maximum display window marker to the number displayed in the softkey box. It cannot be set to a lower amplitude than the reference pointer level. The maximum limit is either 2000 mV or 200%.

With the **Max** softkey selected another menu choice is added: **Set Max to nn%**. This softkey provides a means to quickly set up a minimum percentage to monitor after the measurement points have have been selected. See Setting Up a New Measurement Window for an example of how this softkey may be used. Also, the percentage setting of the softkey may be set between 0 and 10% by rotating the control knob while holding your finger on the **Set Max to nn%** menu choice. The default is 10%.

Set Value *n.n* IRE

Set Value selects the reference pointer for adjustment. With the **Set Value** softkey selected, rotating the control knob sets the reference pointer to the value displayed in the softkey box. The reference pointer may be positioned at any location within the measurement range, and may be used to mark the nominal measurement point for a quick visual reference of value changes in the amplitude being monitored. The reference pointer pushes the maximum and minimum display limit markers if the reference pointer setting is moved past the set display limits.

With the **Set Value** softkey selected, another menu choice is added: **Set Value to Result**. After the measurement points have been selected using the choices under the **Measure Position** softkey, using the **Set Value to Result** softkey quickly aligns the reference pointer to the measured value. This is near or at the value that will be monitored if the cursors positions have be adjusted to the correct points in the waveform. See *Setting Up a New Measurement Window* for an example of how this softkey may be used.

Disp. Num *#nnn*

Disp.Num #000 This number is user-selectable to provide an identification number for a screencopy of the display.

MEASURE POSITION SUBMENU

Place (ab) Sync&Bar

Place (ab) Sync&Bar: automatically positions the a and b cursors on valid sync and bar portions of the input signal display. Once positioned, you may move either cursor by selecting the cursor and rotating the knob.

Pos. (a) *n.n* µSec

Pos. (a) nn µSec selects cursor "a" for time positioning in the waveform display over a range of 0.7 to 64.2 µsec. This choice is not present when ASB. Meas. is active. The number displayed is the time position in waveform from the leading edge of the horizontal sync. If cursor "a" is at a higher amplitude than cursor "b," the sign of the resulting measurement is negative (–a being of a greater magnitude that b).

Pressing this softkey displays the **Measure Cycles n** softkey. Measure Cycles selects the number, from 1 to 50, of subcarrier frequency cycles over which the measurement is made. The default is 3 cycles. This setting is associated with the selected cursor, and the horizontal size of the cursor box changes as the number in the softkey box is changed to indicate the measurement area on the displayed waveform.

Pos. (b) *n.n* µSec

Pos. (b) nn µSec selects cursor "b" for time positioning in the waveform display over a range of 0.7 to 64.2 µsec. The number displayed is the time position in waveform from the leading edge of the horizontal sync. If cursor "b" is positioned before cursor "a" the waveform, the sign of the measurement readout reverses.

Pressing this softkey displays the **Measure Cycles n** softkey. Measure Cycles selects the number, from 1 to 50, of subcarrier frequency cycles over which the measurement is made. The default is 3 cycles. This setting is associated with the selected cursor, and the horizontal size of the cursor box changes as the number in the softkey box is changed to indicate the measurement area on the displayed waveform.

Measure Cycles *n*

Measure Cycles n selects the number, from 1 to 50, of sub-carrier frequency cycles over which the measurement is made. The default is 3 cycles. This setting is associated with the selected cursor, and the horizontal size of the cursor box changes as the number in the softkey box is changed to indicate the measurement area on the displayed waveform.

Relative No. 1

Relative No. 1 turns on the relative measurement units of percentage and displays the **Set Ref (100%)** softkey that sets the 100% reference. Position the "a" and "b" cursors to the minimum and maximum points that define the 100% amplitude to use as the reference amplitude, then touch the **Set Ref (100%)** softkey. The amplitude readout will then reflect the percentage difference between the position of cursor "b" and the 100% reference value.

In figure 2-48, the reference is set to 100 IRE as the 100% reference, and the measurement is based on the difference between the vertical position of the cursor and zero as a result of also selecting **DC Cpl. ABS. Meas.**

Set Ref (*nn*%)

Set Ref (nn%) sets the 100% reference.

Dc Cpl. ABS Meas.

DC Cpl. ABS. Meas. switches to dc coupling of the input signal and produces a measurement value based on the vertical position of cursor b with respect to zero volts (ground) as seen in Figure 2-48. The Level Meter display that results from setting up for a referenced and absolute amplitude is seen in Figure 2-49.

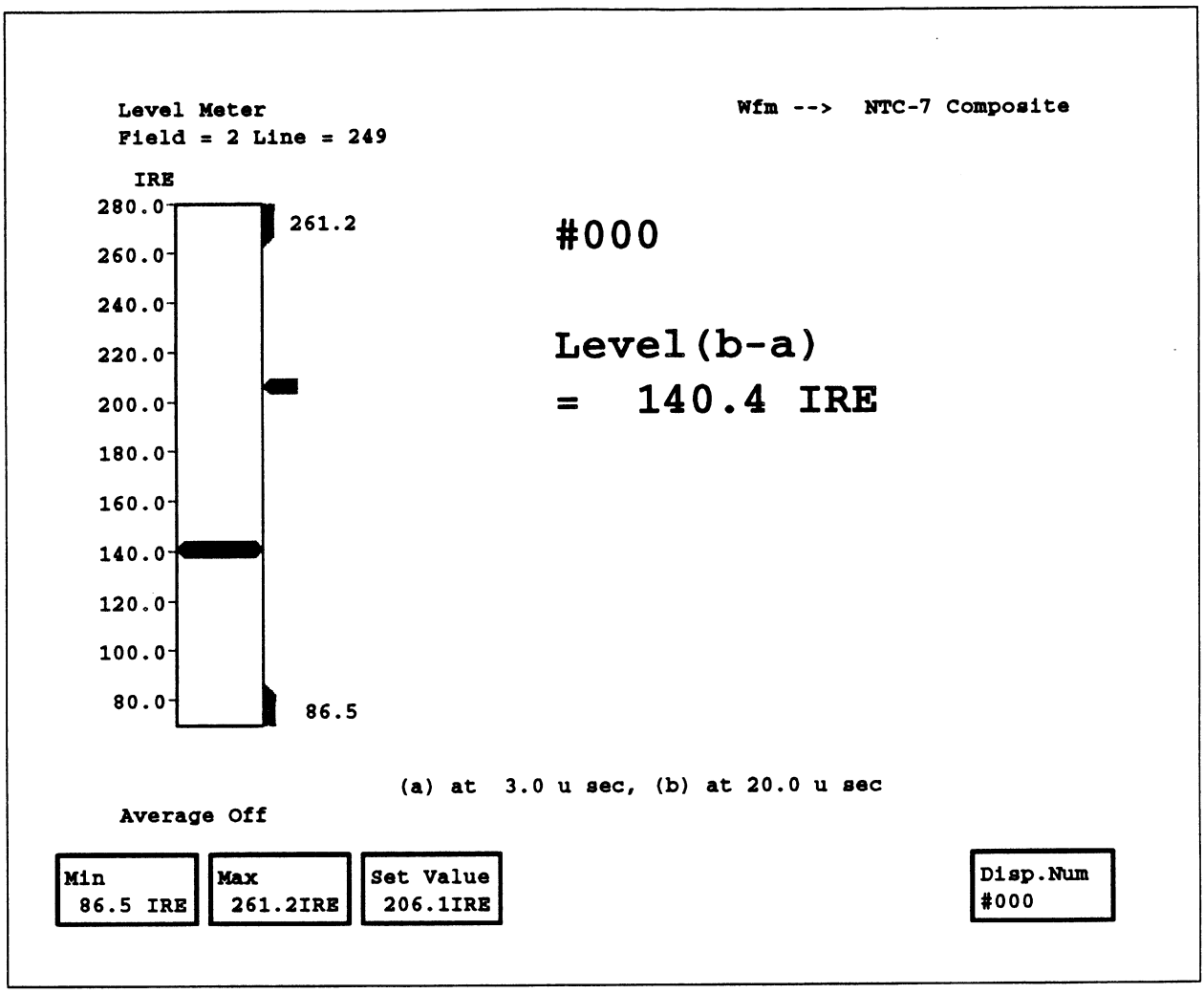


Figure 2-46. Display Limits menu showing undefined measurement points.

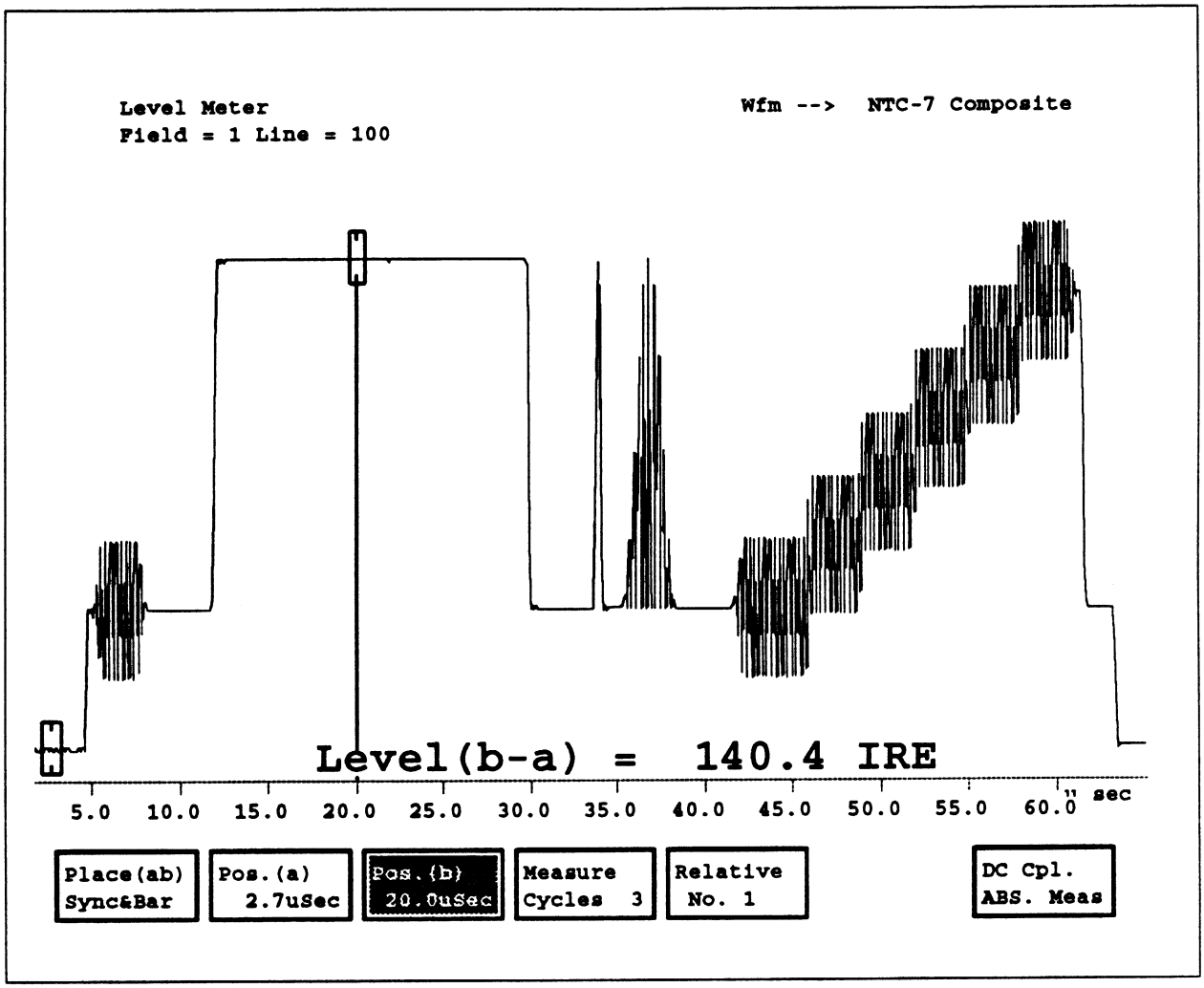


Figure 2-47. Measure Position display for locating the measurement points on a signal.

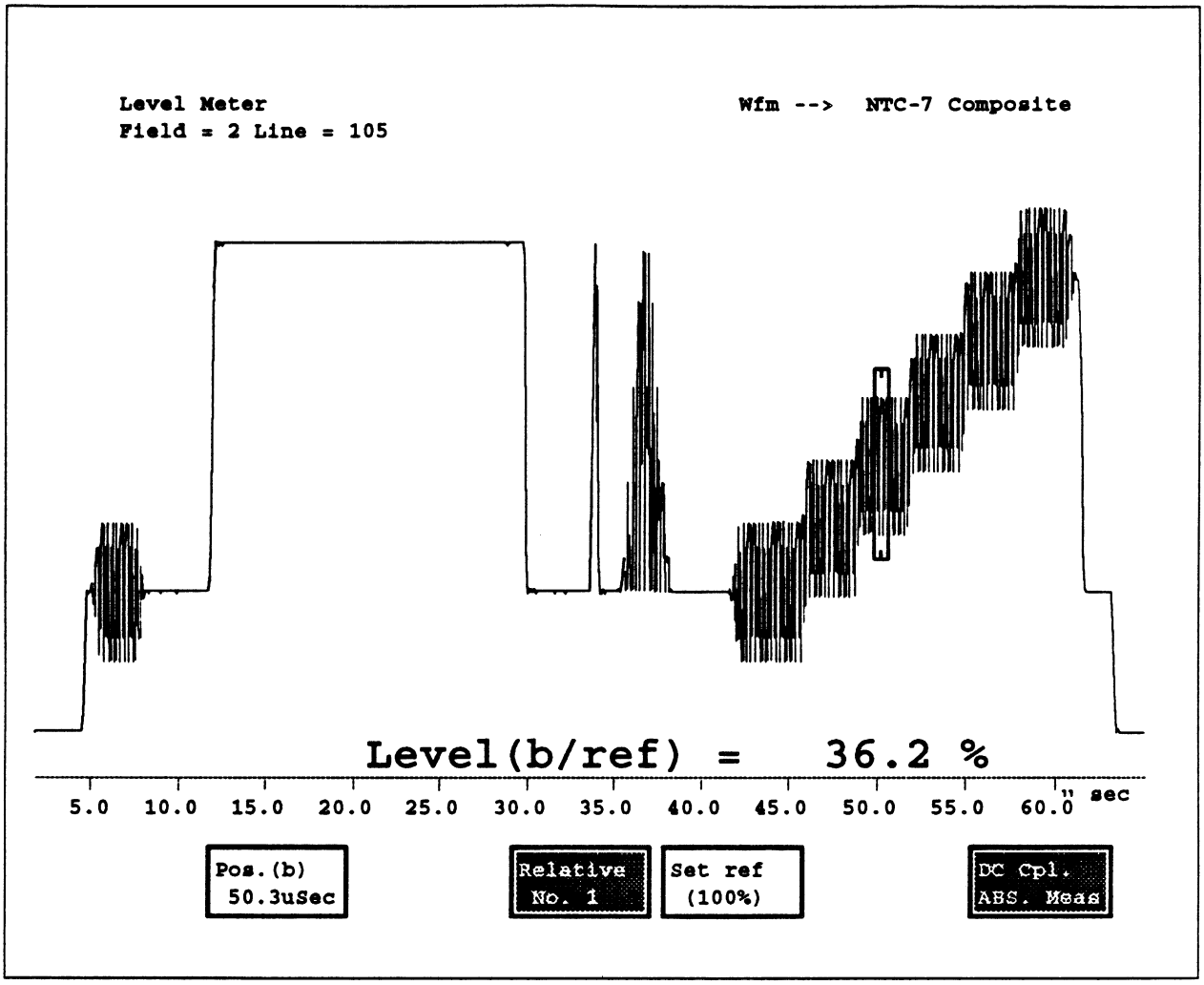


Figure 2-48. Display Position display showing absolute measurement referenced to 100 IRE as 100%.

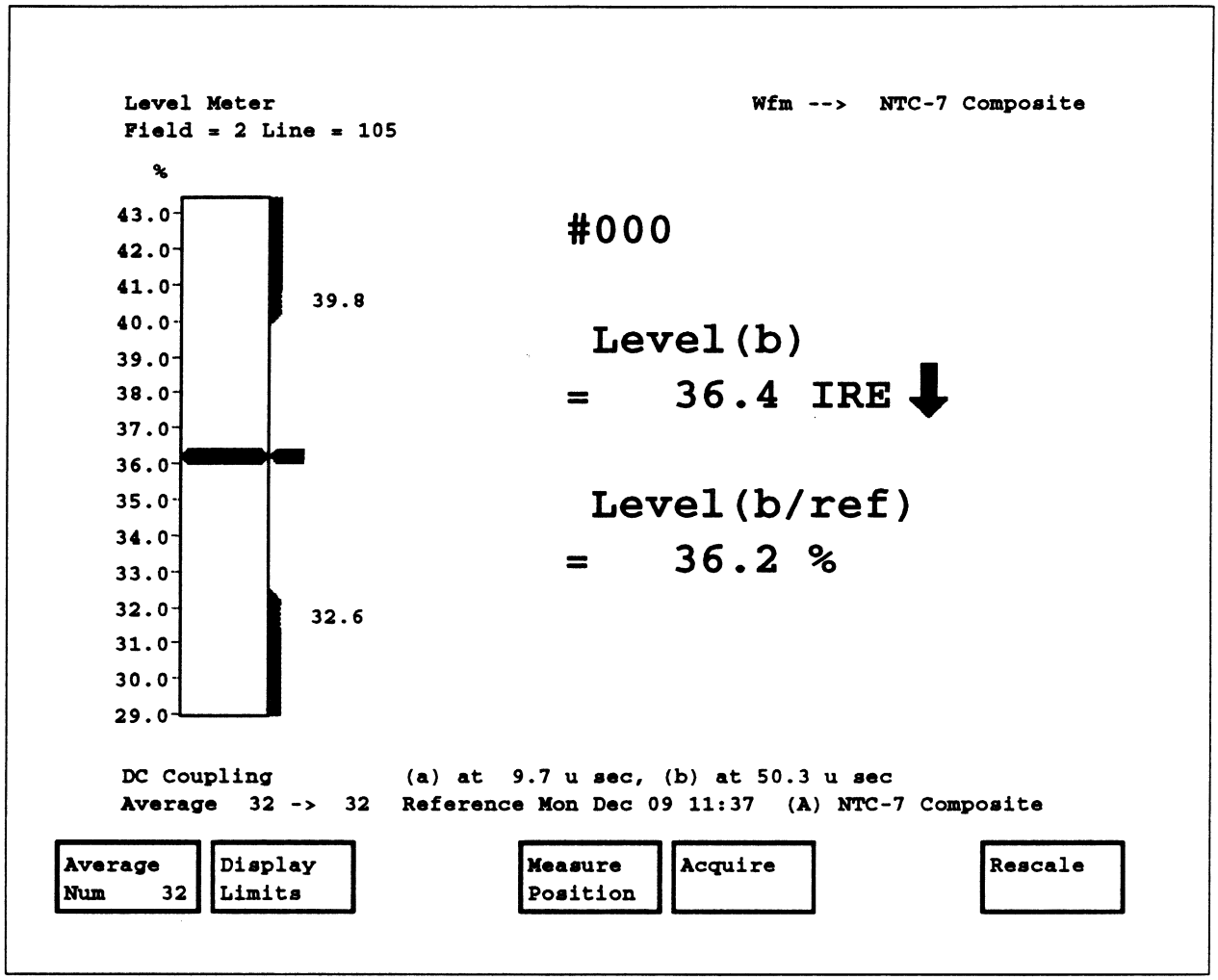


Figure 2-49. Level Meter display as a result of the setup shown in Figure 2-48.

ACQUIRE SUBMENU

Block Mode

Block Mode turns Block Mode acquisition on and off.When block acquisition is used, all the waveforms within a defined block are averaged to make the measurement. It is left to the user to ensure that all the waveforms within the selected block are the same. If only a single line is used for monitoring, Block Mode should be turned off to avoid mixing waveform types in the measurement.

Block Lines *n*

Block Lines *n* determines the number of lines in a Block Mode acquisition from 2 to 32 lines.

Block Step *n*

Block Step *n* determines the size of the step for a Block Mode acquisition from 1 to 263 lines.

Setting Up a New Measurement Window

When positioning the cursors to new measurement points on a waveform, you can quickly set up a new measurement window. Following the procedure described below produces a display limit window around the measured value. From that point you may quickly expand the display to increase the resolution of the measurement and adjust the max and min display limits to those needed. If you have specific percentage limits for the max and min display limits from 0 to 10, you may set those percentages in the **Set Min to -nn%** and **Set Max to nn%** softkeys in advance.

To set up a new measurement window:

1. From the Level Meter without a menu, press the Menu button and select **Measure Position**.
2. Select the a and b cursors in turn and position them to the new measurement points.

NOTE

If a is positioned to a higher amplitude than b, the amplitude difference will be negative.

3. Press the Menu button to return to the first level menu, then touch the **Display Limits** softkey.
4. Touch the **Set Value** softkey, then touch the **Set Value to Result** softkey. This sets the reference pointer to the measured difference between the cursors.
5. Touch the **Min** softkey and touch the **Set Min to -nn%** softkey that displays.
6. Select the **Max** softkey and touch the **Set Max to nn%** softkey that displays.
7. Press the Menu button to return to the first level menu and touch **Rescale**.

This sets the measurement window and the reference pointer in the Level Meter display. The vertical scale is adjusted to provide optimum viewing of the Level Meter for the limits just set. From this point, you access the Display Limits menu again and set the Max and Min display limits narrower or wider as needed for the value you are monitoring. After setting the limits exactly where you need them, return to the first level menu and press the Rescale softkey again to optimize the Level Meter display for the new display limits.

LINE FREQUENCY

The Line Frequency measurement measures horizontal line frequency and field frequency.

Figure 2-50 shows the Line Frequency display. Digital readouts show the line and field frequencies, while a graphical display shows the error from the nominal frequency.

The Line Frequency display can use any video signal as input.

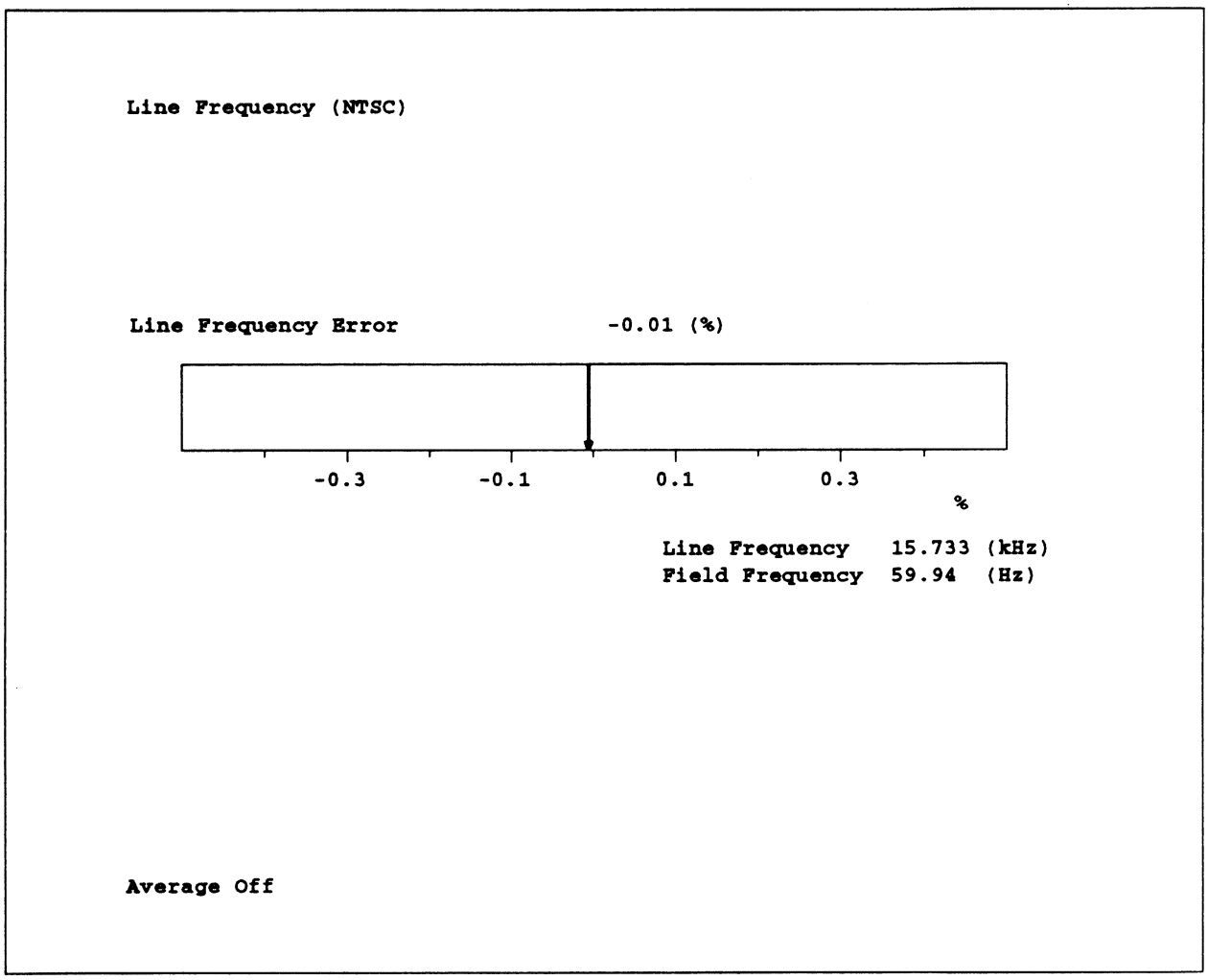


Figure 2-50. Line Frequency display.

Line Frequency Menu

Pressing the Menu button when the Line Frequency measurement runs displays the Line Frequency menu (Figure 2-51).

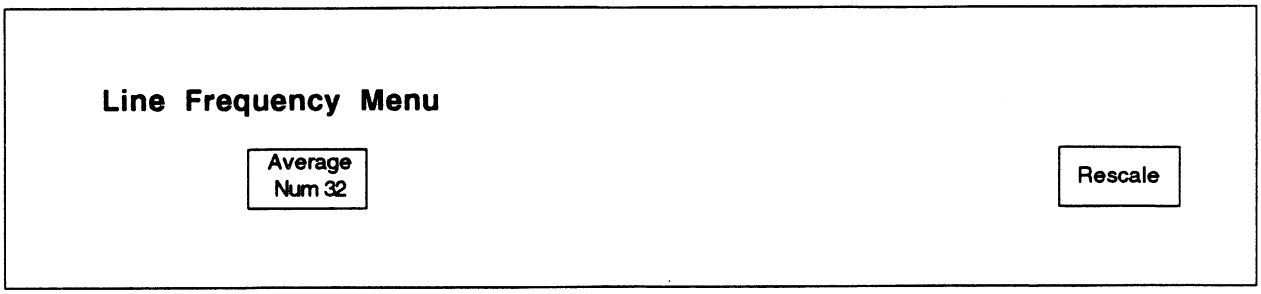


Figure 2-51. Line Frequency menu tree.

MAIN MENU

Average Num	**Average Num** specifies the weighting factor to use for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the **Average Num** softkey to highlight it, rotate the knob until the desired weighting factor appears, then touch the **Average Num** softkey again.
Rescale	**Rescale** sets the expansion factor of the display to an appropriate scaling factor for the Chrominance NonLinearity measurement's display graticule. The x- and y-axes adjust to accommodate the rescaled display.

LUMINANCE NONLINEARITY

The Luminance NonLinearity measurement measures luminance nonlinear distortion.

Figure 2-52 shows the Luminance NonLinearity display. The display plots the step height of each packet, as a percentage of the largest step-size packet. A digital readout of each packet's step size is also provided, as well as a peak-to-peak value showing the difference between the maximum and minimum step sizes.

The Luminance NonLinearity measurement can use an FCC Composite, NTC-7 Composite, or stair step signal for input. The essential elements in the input signal are up to ten stair steps.

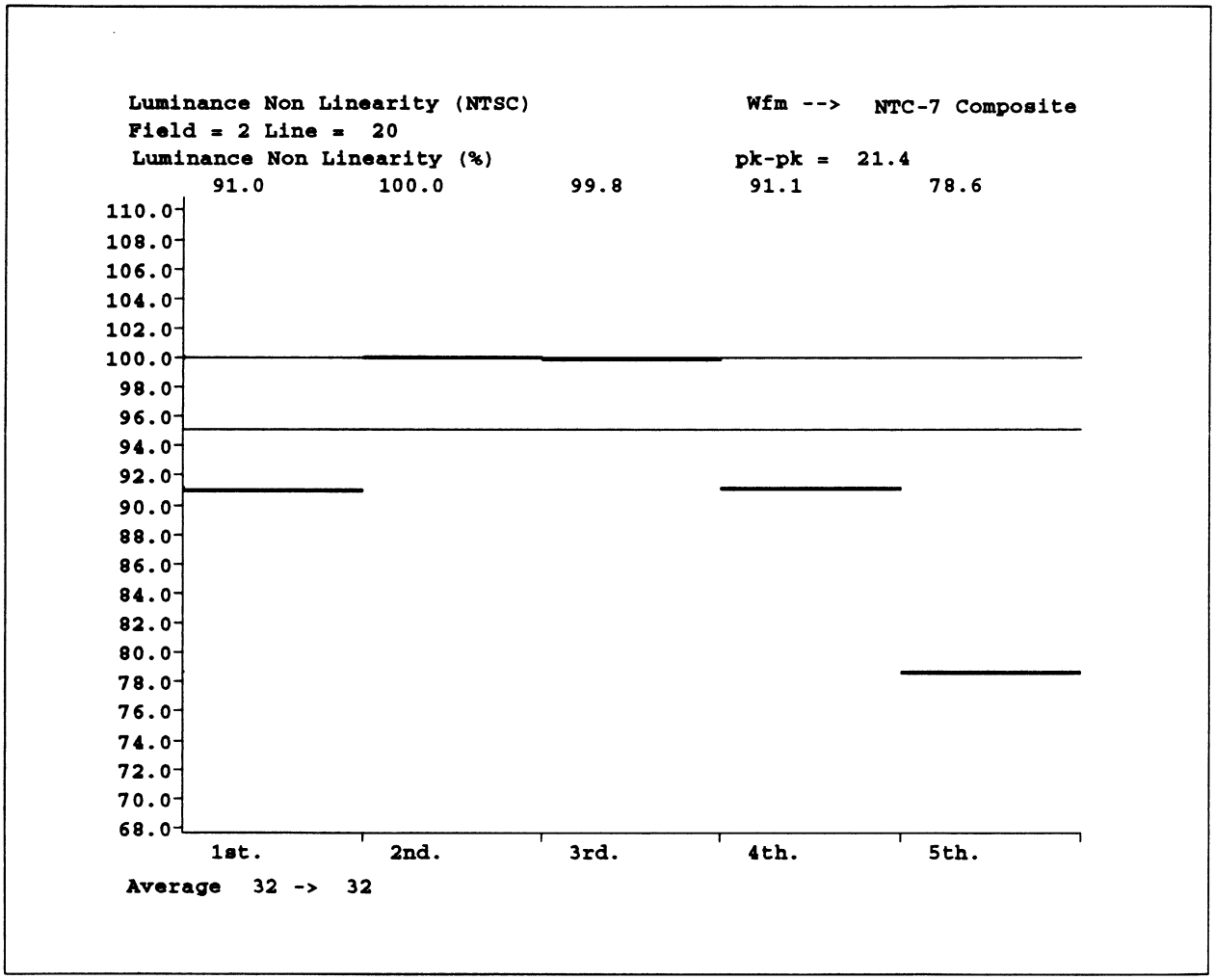


Figure 2-52. Luminance NonLinearity display.

Luminance NonLinearity Menu

Pressing the Menu button when the Luminance NonLinearity measurement runs displays the Luminance NonLinearity menu (Figure 2-53).

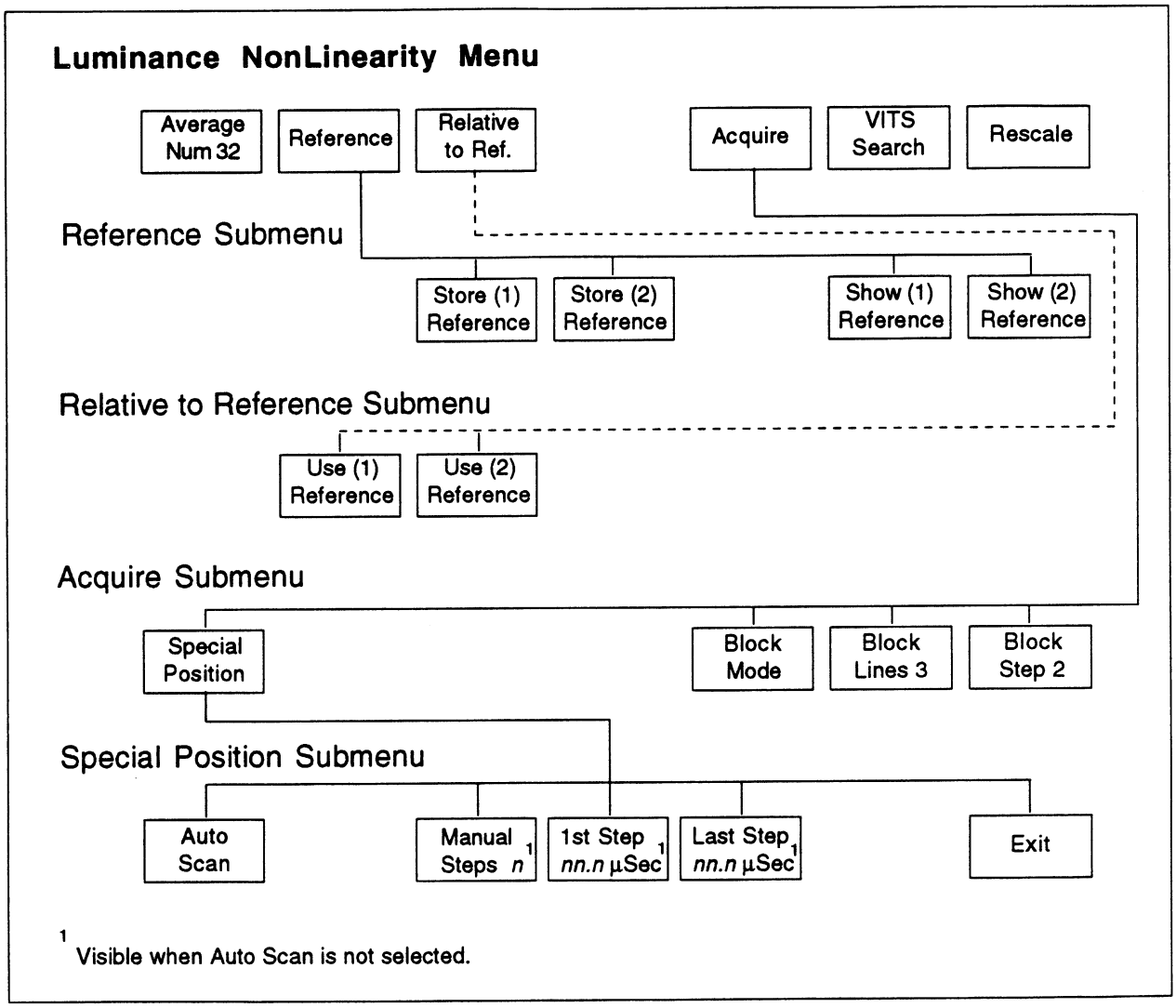


Figure 2-53. Luminance NonLinearity menu tree.

MAIN MENU

Average Num	**Average Num** specifies the weighting factor to use for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the **Average Num** softkey to highlight it, rotate the knob until the desired weighting factor appears, then touch the **Average Num** softkey again.
Reference	**Reference** displays the Reference submenu which (1) stores the currently displayed values for use as a reference; or (2) displays previously stored reference values.

Relative to Reference	**Relative to Ref** displays the Relative to Reference submenu that selects the reference to use for comparison in the measurement. When a stored reference is selected, the currently measured value is compared to the stored reference value.
Acquire	**Acquire** displays the Acquire submenu that controls how the signal is acquired for the Luminance NonLinearity measurement.
VITS Search	**VITS Search** searches the insertion test signals for a signal appropriate for the measurement. If an appropriate signal is not located, the message **Not found** displays briefly on the screen.
Rescale	**Rescale** sets the expansion factor of the display to an appropriate scaling factor for the Luminance NonLinearity measurement's display graticule. The x- and y-axes adjust to accommodate the rescaled display.

REFERENCE SUBMENU

Store (n) Reference	**Store (1) Reference/Store (2) Reference** saves the current measurement values as (1) Reference and (2) Reference, respectively. Selecting Store (1) Reference or Store (2) Reference overwrites previous (1) Reference or (2) Reference values. References are stored in nonvolatile memory and are retained when the VM700A is powered down.
Show (n) Reference	**Show (1) Reference/Show (2) Reference** displays the current values of (1) Reference and (2) Reference, respectively, plus the date and time the reference was stored and the channel the reference signal was on. If no reference value has been stored, touching either softkey displays a message that the reference is not defined.

RELATIVE TO REFERENCE SUBMENU

Use (n) Reference	**Use (1) Reference/Use (2) Reference** selects the stored reference to which measured values are compared. If no reference value has been stored, touching either softkey displays a message that the reference is not defined.

ACQUIRE SUBMENU

Special Position

Special Position provides softkeys to set the locations on the waveform where the measurement is made. Figure 2-54 shows the Luminance NonLinearity special position display.

Block Mode

Block Mode turns on Block mode. The block starts at the system line.

Block Lines

Block Lines sets the number of lines to average for the measurement. The default number of Block Lines to average is 3.

Block Step

Block Step sets the number of lines to step in the block. The default number of lines to step is 2.

SPECIAL POSITION SUBMENU

Auto Scan

Auto Scan when highlighted, automatically scans and determines measurement locations. When de-selected, other softkeys (described below) appear to allow you to set measurement locations manually.

NOTE

If severe luminance nonlinear distortion is present, the VM700A may not be able to resolve all the steps that were present in the original signal. In such cases, you must use manual positioning to set the location of each staircase step.

Manual Steps

Manual Steps allows the number of luminance steps in the signal to be adjusted by rotating the knob.

1st Step

1st Step allows you to adjust the position of the first luminance step edge of the staircase by rotating the knob.

Last Step

Last Step allows you to adjust the position of the last luminance step edge of the staircase by rotating the knob.

Exit

Exit leaves the Special Position display and returns to the Luminance NonLinearity display.

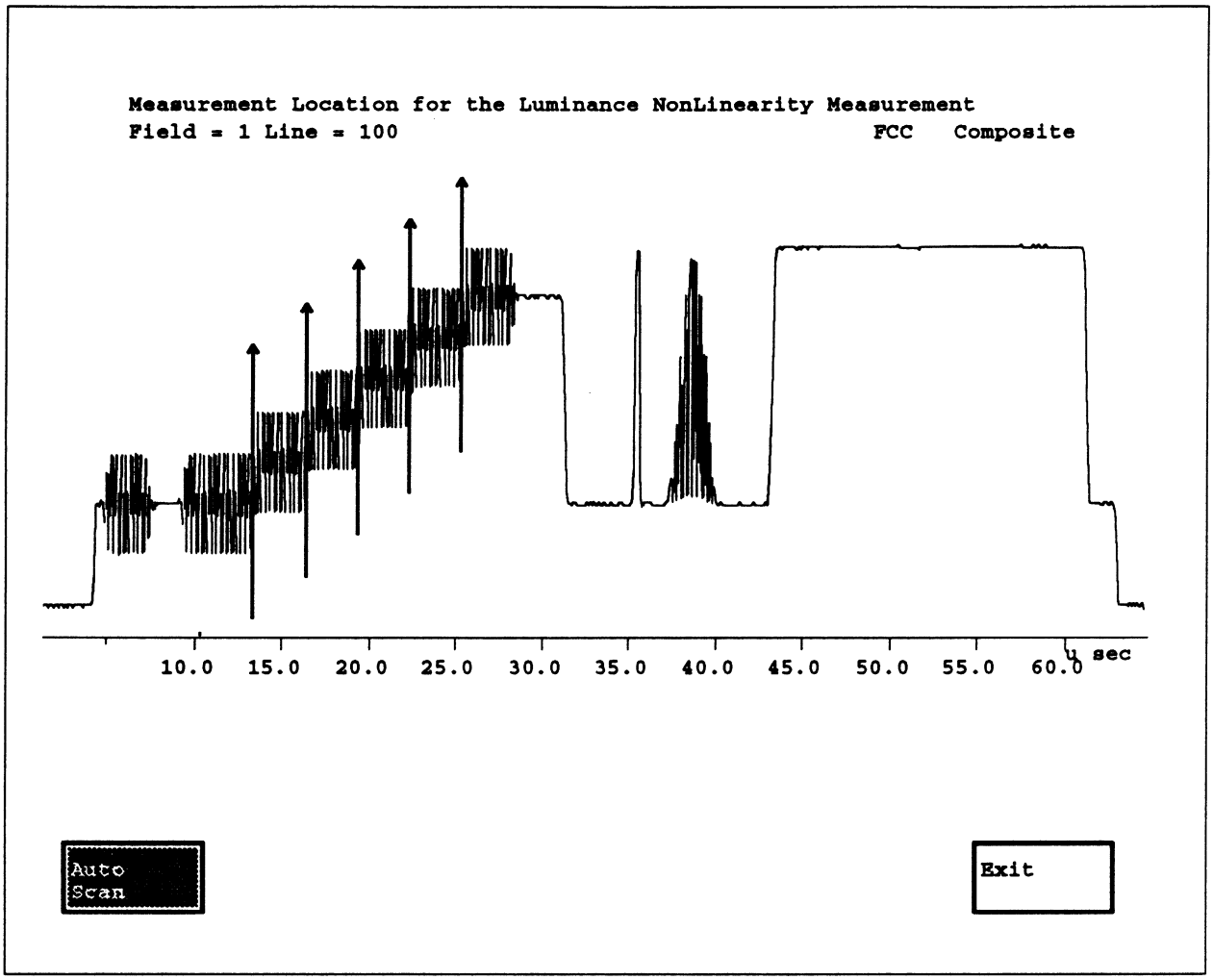


Figure 2-54. Luminance NonLinearity special position display.

MULTIBURST

The MultiBurst measurement measures frequency response.

Figure 2-55 shows the MultiBurst display, which plots signal amplitude as a function of difference from the reference frequency.

The MultiBurst measurement automatically identifies FCC MultiBurst, NTC-7 Combination, or 1410 TSG-6 type MultiBurst signals. The essential element in any signal used for the MultiBurst measurement is multiple bursts.

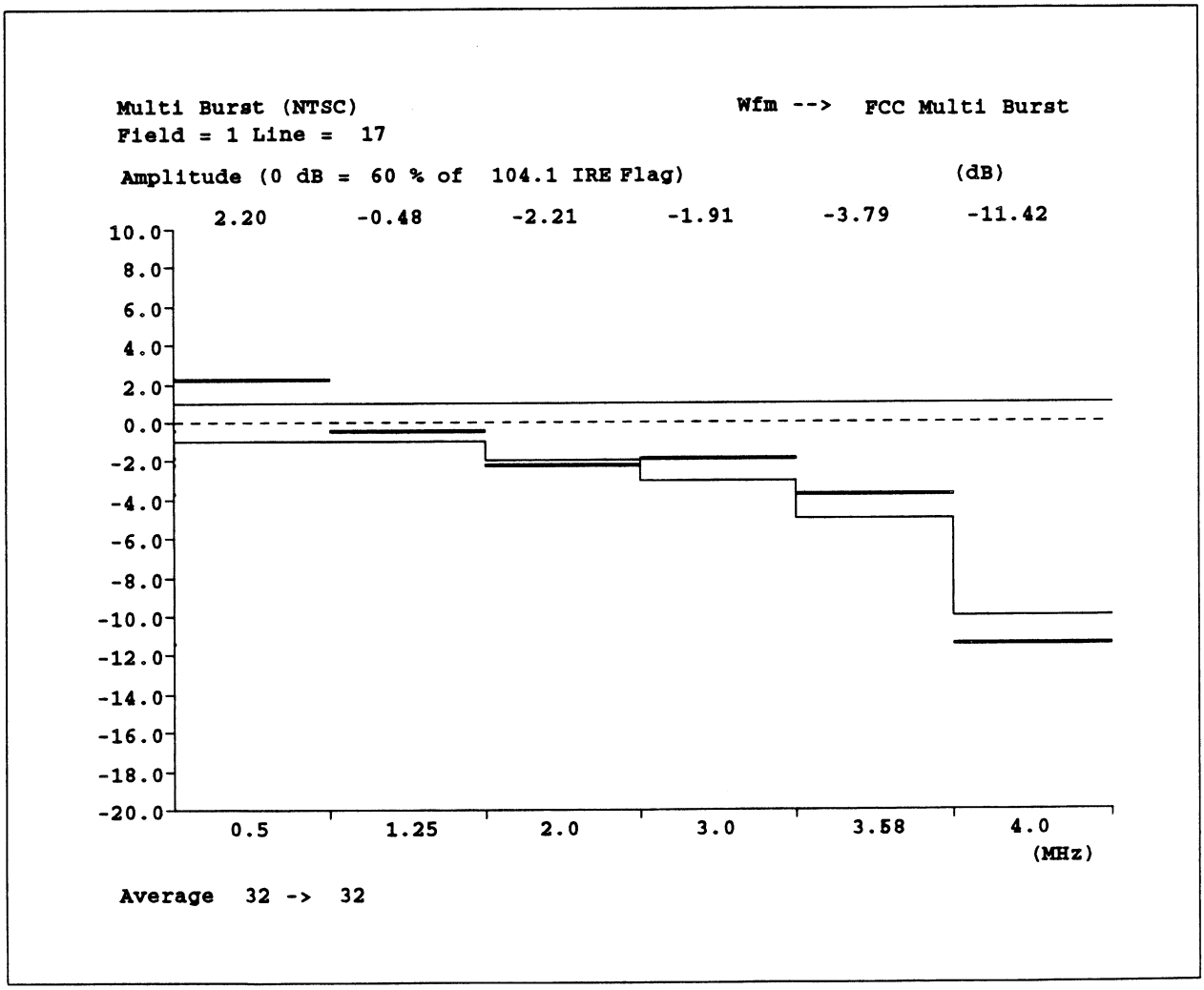


Figure 2-55. MultiBurst display.

MultiBurst Menu

Pressing the Menu button when the MultiBurst measurement runs displays the MultiBurst menu (Figure 2-56).

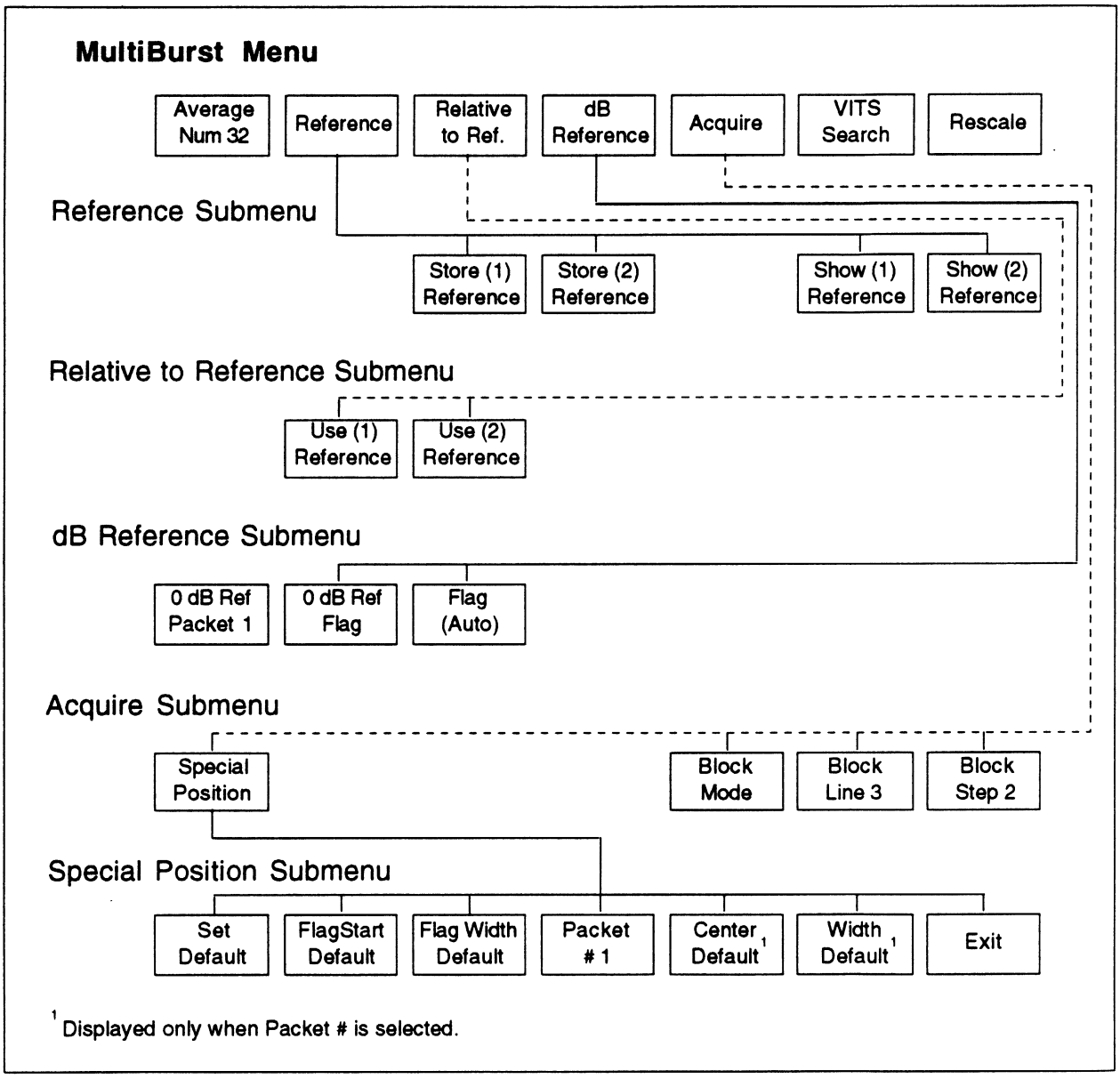


Figure 2-56. MultiBurst menu tree.

MAIN MENU

Average Num	**Average Num** specifies the weighting factor to use for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the **Average Num** softkey to highlight it, rotate the knob until the desired weighting factor appears, then touch the **Average Num** softkey again.
Reference	**Reference** displays the Reference submenu which (1) stores the currently displayed values for use as a reference; or (2) displays previously stored reference values.
Relative to Reference	**Relative to Reference** displays the Reference submenu which selects the reference to use for comparison in the measurement. When a stored reference is selected, the currently measured value is compared to the stored reference value.
dB Reference	**dB Reference** displays the dB Reference submenu that selects the 0dB reference position by rotating the knob and sets the 0dB reference scale for the percentage of the flag amplitude.
Acquire	**Acquire** displays the Acquire submenu that controls how the signal is acquired for the MultiBurst measurement.
VITS Search	**VITS Search** searches the insertion test signals for a signal appropriate for the measurement. If an appropriate signal is not located, the message **Not found** displays briefly on the screen.
Rescale	**Rescale** sets the expansion factor of the display to an appropriate scaling factor for the MultiBurst measurement's display graticule. The x- and y-axes adjust to accommodate the rescaled display.

REFERENCE SUBMENU

Store (n) Reference	**Store (1) Reference/Store (2) Reference** saves the current measurement values as (1) Reference and (2) Reference, respectively. Selecting Store (1) Reference or Store (2) Reference overwrites previous (1) Reference or (2) Reference values. References are stored in nonvolatile memory and are retained when the VM700A is powered down.
Show (n) Reference	**Show (1) Reference/Show (2) Reference** displays the current values of (1) Reference and (2) Reference, respectively, plus the date and time the reference was stored and the channel the reference signal was on. If no reference value has been stored, touching either softkey displays a message that the reference is not defined.

RELATIVE TO REFERENCE SUBMENU

Use (n) Reference	**Use (1) Reference/Use (2) Reference** selects the stored reference to which measured values are compared. If no reference value has been stored, touching either softkey displays a message that the reference is not defined.

DB REFERENCE SUBMENU

Ref Packet/Flag	**Ref Packet/Flag** allows you to select the 0dB reference position by rotating the knob. Displays a packet number or "Flag."
Flag (Auto)	**Flag (Auto)** sets the 0dB reference scale for the percentage of the flag amplitude.

ACQUIRE SUBMENU

Special Position	**Special Position** displays the Special Position submenu that sets the locations on the waveform where the measurement is made. Figure 2-57 shows the MultiBurst Special Position display.
Block Mode	**Block Mode** turns on Block mode. The block starts at the system line.
Block Lines	**Block Lines** sets the number of lines to average for the measurement. The default number of Block Lines to average is 3.
Block Step	**Block Step** sets the number of lines to step in the block. The default number of lines to step is 2.

SPECIAL POSITION SUBMENU

Set Default	**Set Default** resets each measurement location to its default position from the Measurement Location file. If another softkey is highlighted, only the location given by the softkey is changed.
Flag Start Default	**Flag Start Default** sets the location of the leading edge of the MultiBurst flag.
Flag Width Default	**Flag Width Default** sets the width of the MultiBurst flag.
Packet #	**Packet #** selects one of the six packets and sets its location and measurement area with two additional softkeys, **Center Default** and **Width Default**.
Center Default	**Center Default** sets the center location of the packet.
Width Default	**Width Default** sets the measurement area of the packet.
Exit	**Exit** leaves the Special Position submenu and displays the MultiBurst screen.

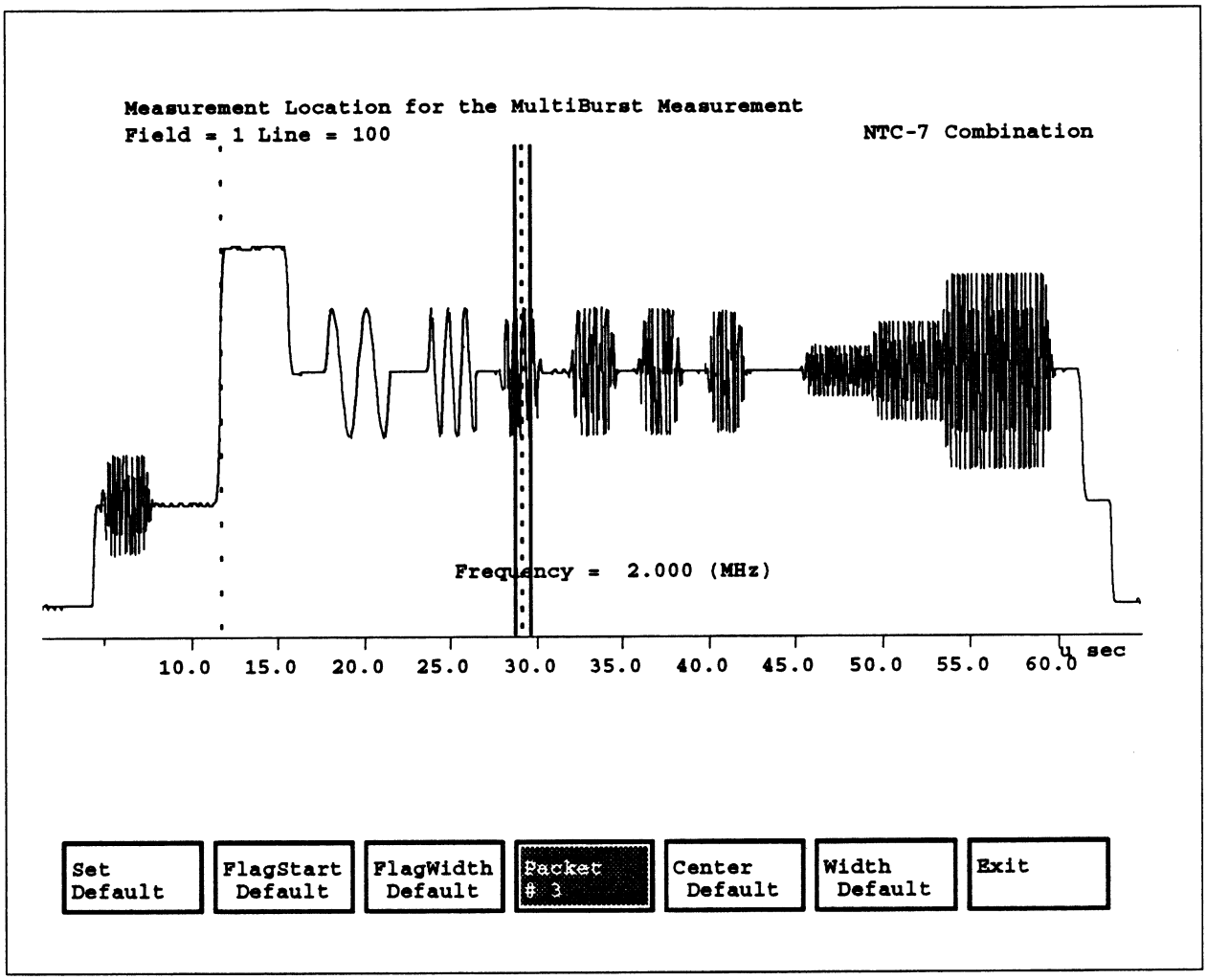


Figure 2-57. MultiBurst special position display.

NOISE SPECTRUM

Noise Spectrum measures noise level and performs spectrum analysis.

Figure 2-58 shows the Noise Spectrum display. The display plots noise level in decibels (where 0 dB = 714 mV) vs. frequency (in MHz). A digital readout also displays the rms noise level of the entire bandwidth.

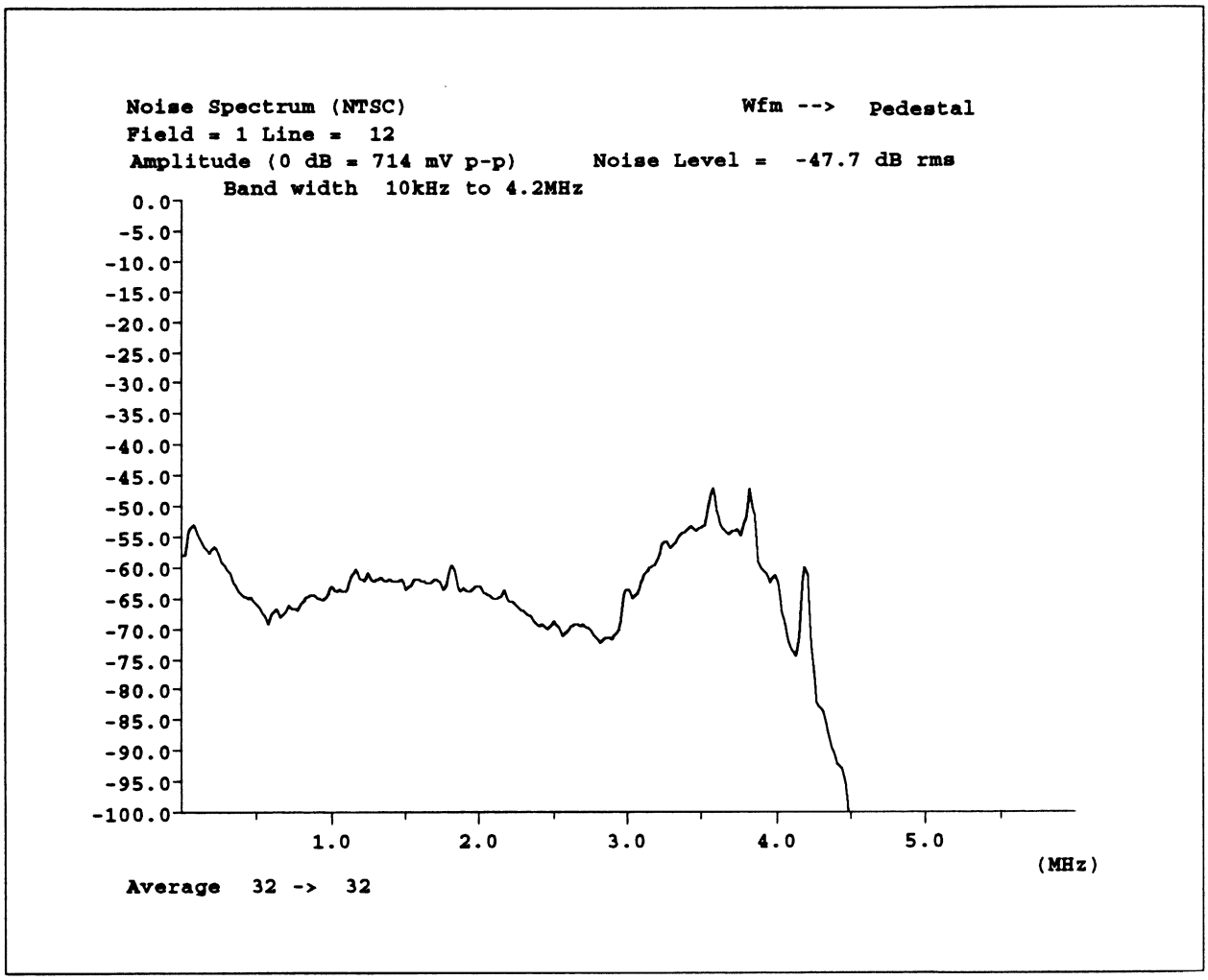


Figure 2-58. Noise Spectrum display.

Noise Spectrum Menu

Pressing the Menu button when the Noise Spectrum measurement runs displays the Noise Spectrum menu (Figure 2-59).

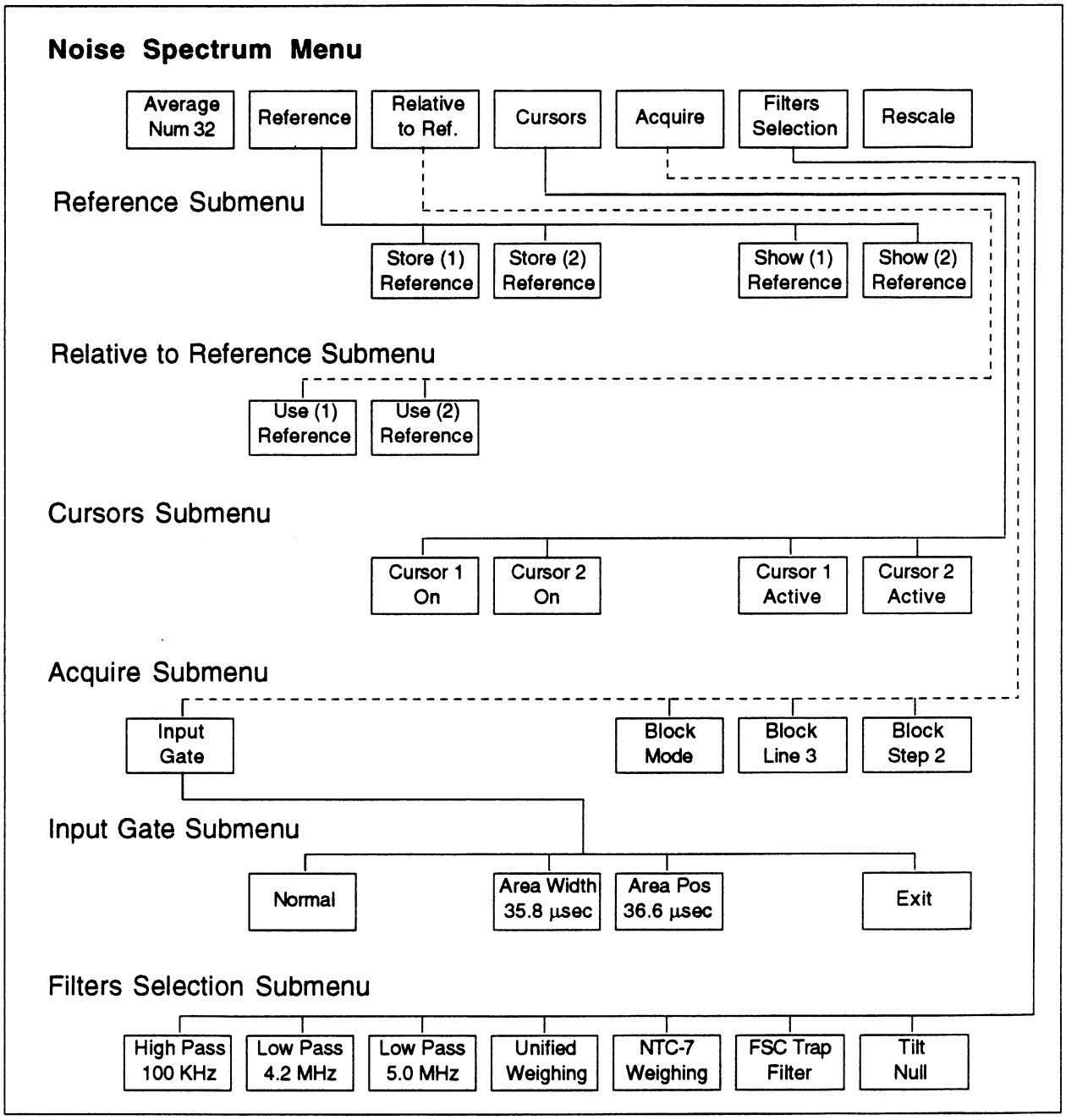


Figure 2-59. Noise Spectrum menu tree.

MAIN MENU

Average Num	**Average Num** specifies the weighting factor to use for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the **Average Num** softkey to highlight it, rotate the knob until the desired weighting factor appears, then touch the **Average Num** softkey again.
Reference	**Reference** displays the Reference submenu which (1) stores the currently displayed values for use as a reference; or (2) displays previously stored reference values.
Relative to Reference	**Relative to Reference** displays the Relative to Reference submenu which selects the reference to use for compensation in the measurement. When a stored reference is selected, the currently measured value is compared to the stored reference value.
Cursors	**Cursors** Provides softkeys to display and activate the two Noise Spectrum cursors. Readouts for the cursors give the peak-to-peak decibel value at the frequency location of the cursor(s) and the noise level in db (rms) between the cursors.
Acquire	**Acquire** displays the Acquire submenu that controls how the signal is acquired for the Noise Spectrum measurement.
InputGate	**Input Gate** controls the width and position of signal area used for the Noise Spectrum measurement.
Filters Selection	**Filters Selection** provides softkeys to select one or more noise filters or the Tilt Null feature.
Rescale	**Rescale** sets the expansion factor of the display to an appropriate scaling factor for the Noise Spectrum measurement's display graticule. The x- and y-axes adjust to accommodate the rescaled display.

REFERENCE SUBMENU

Store (n) Reference	**Store (1) Reference/Store (2) Reference** saves the current measurement values as (1) Reference and (2) Reference, respectively. Selecting Store (1) Reference or Store (2) Reference overwrites previous (1) Reference or (2) Reference values. References are stored in nonvolatile memory and are retained when the VM700A is powered down.
Show (n) Reference	**Show (1) Reference/Show (2) Reference** displays the current values of (1) Reference and (2) Reference, respectively, plus the date and time the reference was stored and the channel the reference signal was on. If no reference value has been stored, touching either softkey displays a message that the reference is not defined.

RELATIVE TO REFERENCE SUBMENU

Use (n) Reference	**Use (1) Reference/Use (2) Reference** selects the stored reference to which measured values are compared. If no reference value has been stored, touching either softkey displays a message that the reference is not defined.

CURSORS SUBMENU

Cursor 1/2 On	**Cursor 1/2 On** displays Noise Cursor 1 or 2. The cursor appears in the position it was in the last time the cursor was active.
Cursor 1/2 Active	**Cursor 1/2 Active** enables the knob to move Noise Cursor 1 or 2, and displays the **Nearest Peak** softkey.
Nearest Peak	**Nearest Peak** positions the active cursor on the nearest peak of the Noise Spectrum display.

ACQUIRE SUBMENU

Input Gate	**InputGate** displays the Input Gate submenu that controls the width and position of the signal area used for the Noise Spectrum measurement. Figure 2-60 shows the Noise Spectrum InputGate display.
Block Mode	**Block Mode** turns on Block mode. The block starts at the system line.
Block Lines	**Block Lines** sets the number of lines to average for the measurement. The default number of Block Lines to average is 3.
Block Step	**Block Step** sets the number of lines to step in the block. The default number of lines to step is 2.

INPUT GATE SUBMENU

Normal	**Normal** restores the **Area Width** and **Area Pos.** softkeys to their default values.
Area Width	**Normal** restores the **Area Width** and **Area Pos.** softkeys to their default values.

NOTE

Low-frequency characteristics and frequency resolution may be changed, depending on the width selected.

Area Pos	**Area Pos** controls the position of the signal area used for the Noise Spectrum measurement.
Exit	**Exit** leaves the InputGate menu and returns to the Noise Spectrum display.

FILTERS SUBMENU

High Pass 100 kHz	**High Pass 100 kHz** selects the 100 kHz high-pass filter. Signal information below 100 kHz is filtered out.
Low Pass 4.2 MHz	**Low Pass 4.2 MHz** selects the 4.2 MHz low-pass filter. Signal information above 4.2 MHz is filtered out.
Low Pass 5.0 MHz	**Low Pass 5.0 MHz** selects the 5.0 MHz low-pass filter. Signal information above 5.0 MHz is filtered out.
Unified Weighting	**Unified Weighting** selects the standard CCIR unified weighting filter.
NTC-7 Weighting	**NTC-7 Weighting:** selects the standard CCIR Rec. 421 weighting filter.
Fsc. Trap Filter	**Fsc. Trap Filter** selects the subcarrier trap filter.
Tilt Null	**Tilt Null** automatically compensates for tilt (horizontal sag) to enable the Noise Spectrum measurement to be taken on a ramp signal. (Note: the noise floor might be slightly higher because the auto gain increase is limited by the larger peak-to-peak amplitude of the signal.)

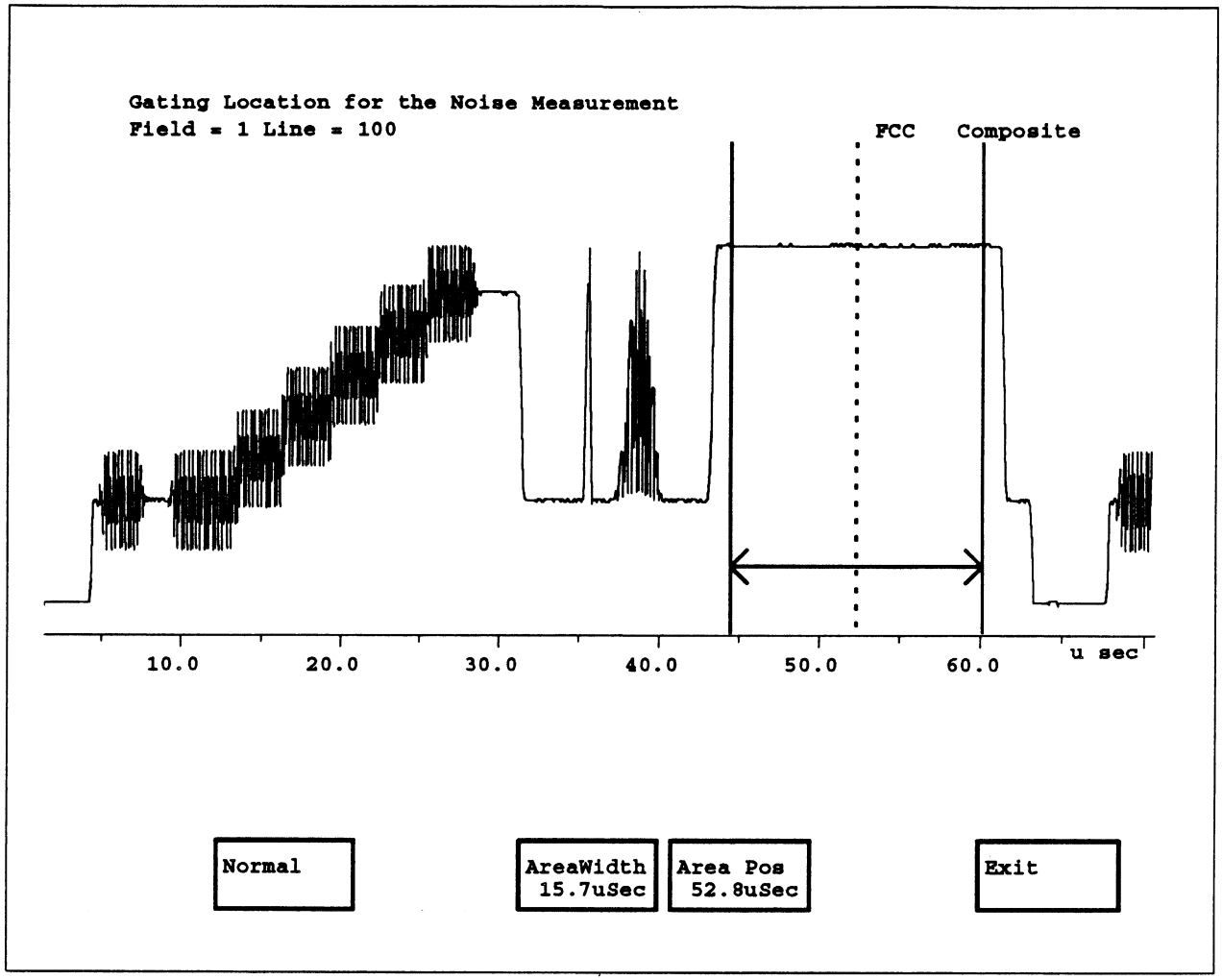


Figure 2-60. Noise Spectrum InputGate display.

SCH_PHASE

SCH_Phase measures subcarrier-to-horizontal phase.

Figure 2-61 shows the SCH_Phase main display.

Figure 2-62 shows the SCH_Phase full-field display.

The SCH_Phase measurement can use any composite video signal for input.

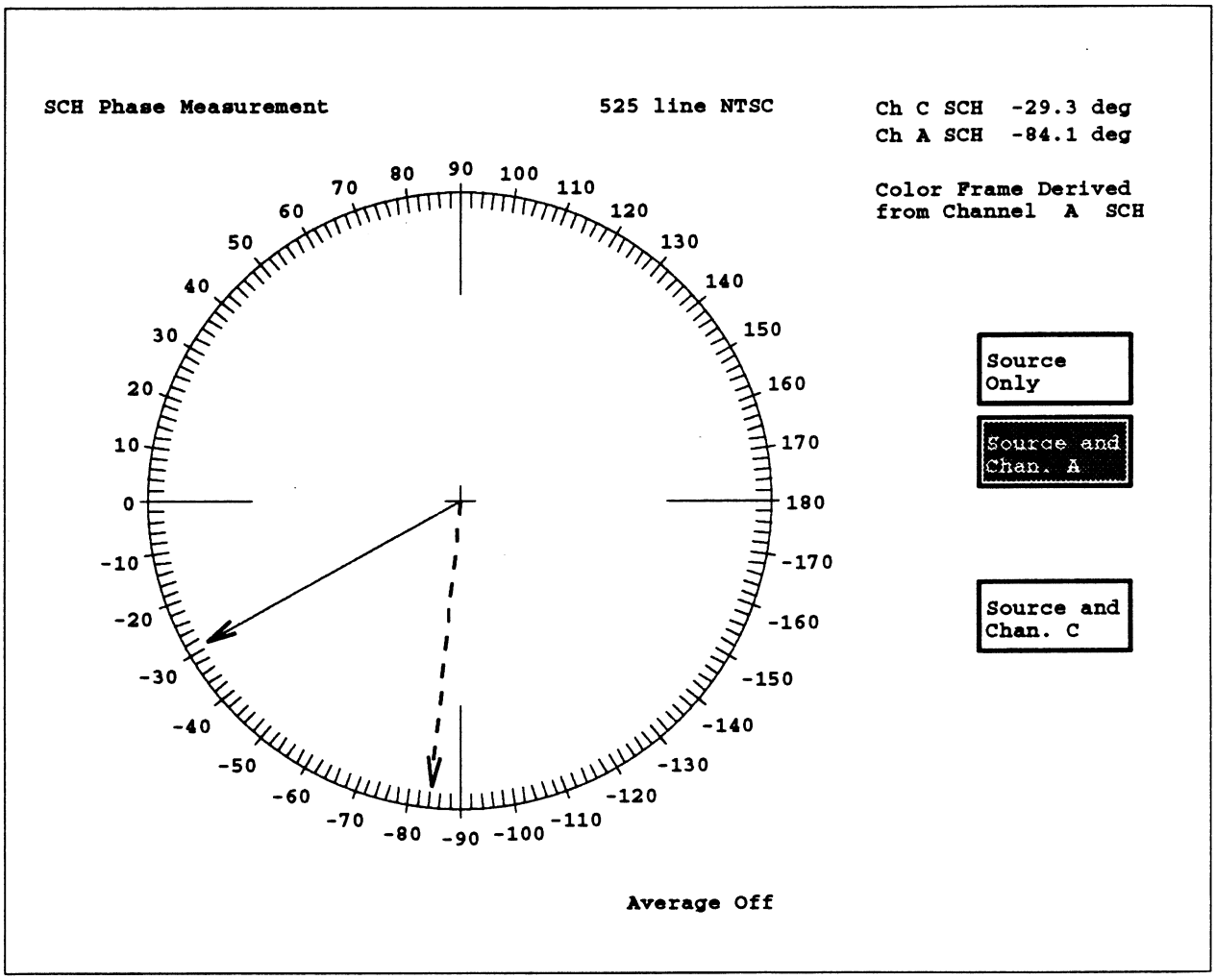


Figure 2-61. SCH_Phase main display.

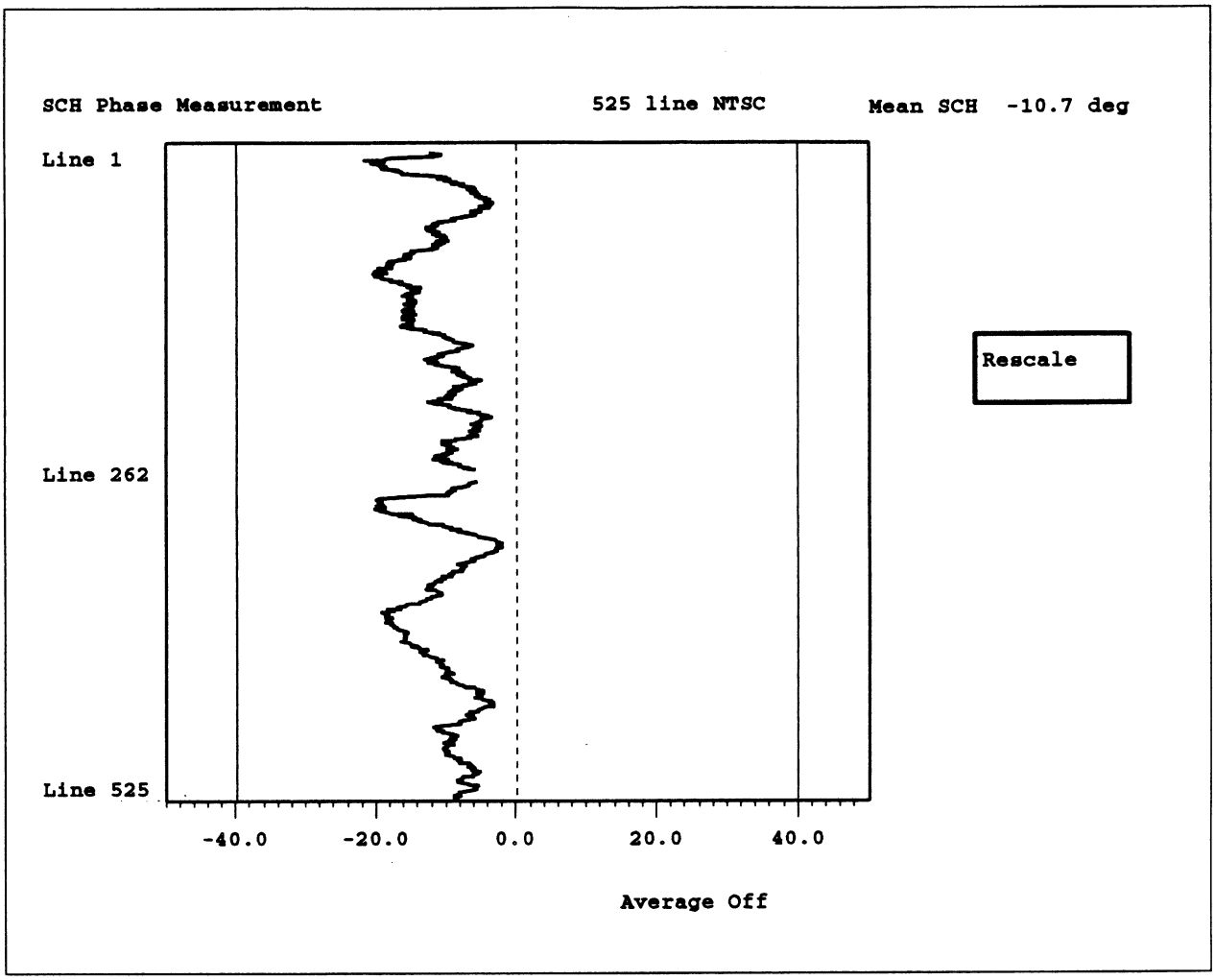


Figure 2-62. SCH_Phase full field display.

SCH_Phase Menu

Pressing the Menu button when the SCH_Phase measurement runs displays the SCH_Phase menu (Figure 2-63).

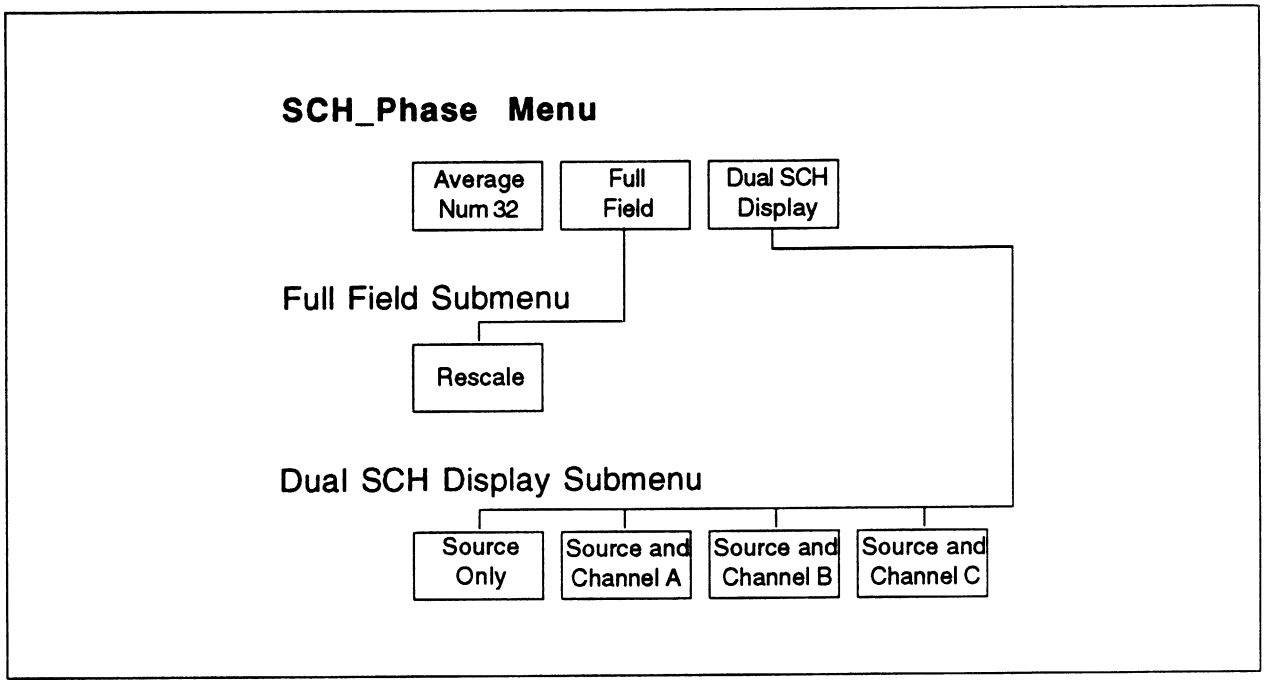


Figure 2-63. SCH_Phase menu tree.

MAIN MENU

Average Num	**Average Num** specifies the weighting factor to use for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the **Average Num** softkey to highlight it, rotate the knob until the desired weighting factor appears, then touch the **Average Num** softkey again.
Full Field	**Full Field** Puts up a display of the SCH values for each line in the frame.
Dual SCH Display	**Dual SCH Display** Selects the reference channel for color framing. The dual SCH display shows two lines: one for the source, another for the reference channel used for color framing. If the two lines appear on the same side of the vertical center line of the display, then the source and reference channel have the same color frame timing. If they appear on different sides, the source and reference channel have different color frame timing.

FULL FIELD SUBMENU

Rescale

Rescale sets the expansion factor of the display to an appropriate scaling factor for the SCH_Phase measurement's display graticule. The x- and y-axes adjust to accommodate the rescaled display.

DUAL SCH DISPLAY SUBMENU

Source Only

Source Only sets the color framing reference to the current signal source.

Source and Channel

Source and Channel A/B/C sets the color framing reference to Channel A, B, or C, as appropriate.

SHORTTIME DISTORTION

ShortTime Distortion measures the amount of distortion in the reference-to-bar level and bar-to-reference level transitions of a bar signal.

The ShortTime Distortion display (Figure 2-64) plots signal level as a percentage of the voltage difference between the reference level (0%) and the bar level (100%). When the ShortTime Distortion measurement is first invoked, a set of graticules appears on the display, indicating the 5% ShortTime Distortion limits for the IEEE-511 standard. The gain on the graticule can be modified by using the Graticule Gain softkey in the Graticule submenu. You can also define your own graticule with the softkeys in the Make Graticule submenu of the Graticule submenu. (See the *Defining Your Own Graticule* topic later in this section for more information.)

Text read-outs on the display show:

- Measurement name (Short Time Distortion)
- Signal standard being measured (NTSC)
- Waveform type
- Type (IEEE-511 or Special) and distortion percentage of graticule being used for the measurement
- Amount of distortion in the rising or falling edge of the signal, referenced to the graticule being used
- Rise and/or fall time of the signal in nanoseconds.

The ShortTime Distortion measurement requires a T Bar signal to return a valid ShortTime Distortion measurement. The location of a T Bar signal can be specified in the "T Bar (SD)" line of the Measurement Locations file.

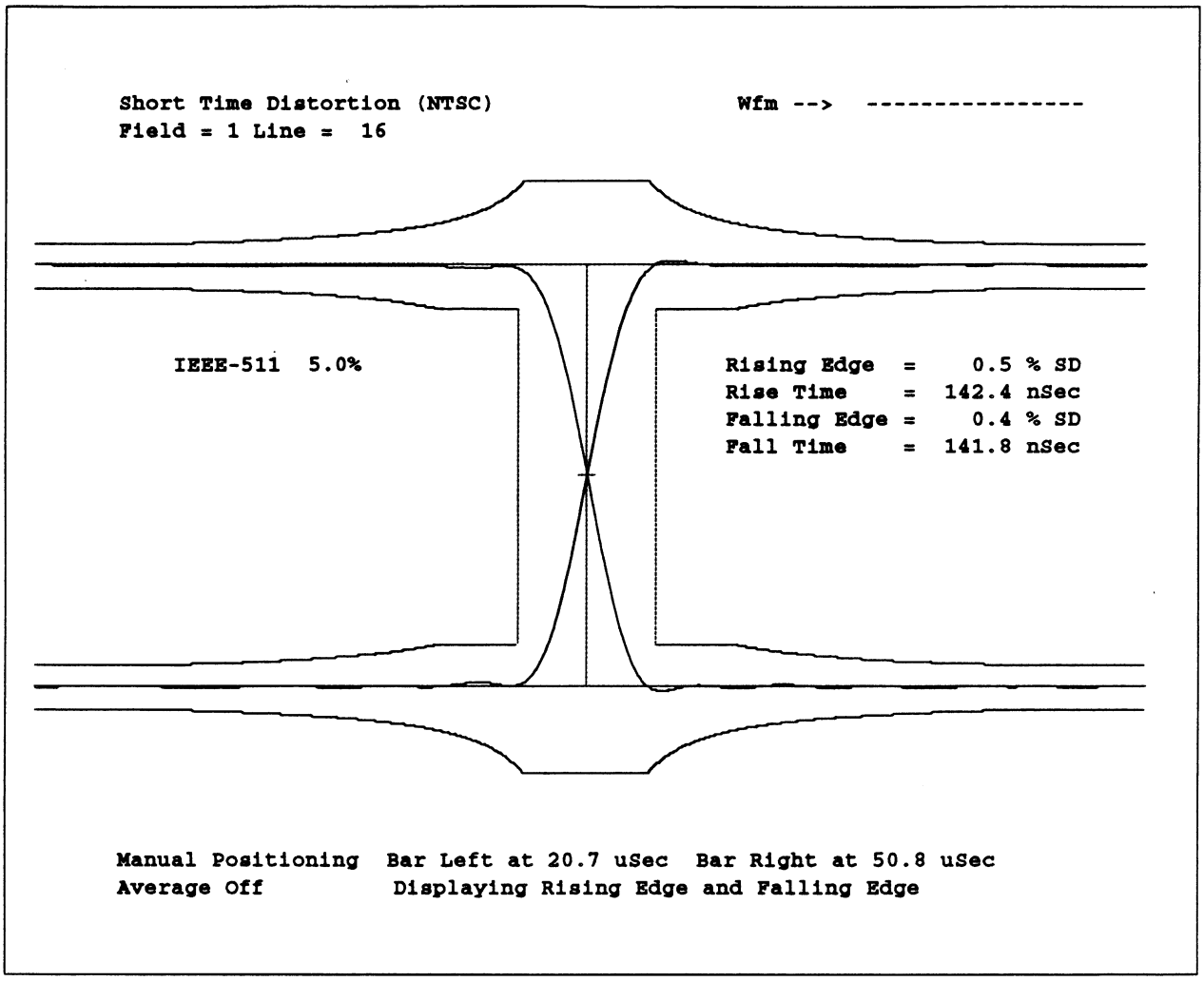


Figure 2-64. ShortTime Distortion display.

ShortTime Distortion Main Menu

Figure 2-65 shows the ShortTime Distortion menu tree structure. Pressing the Menu button when the ShortTime Distortion measurement runs displays the ShortTime Distortion main menu.

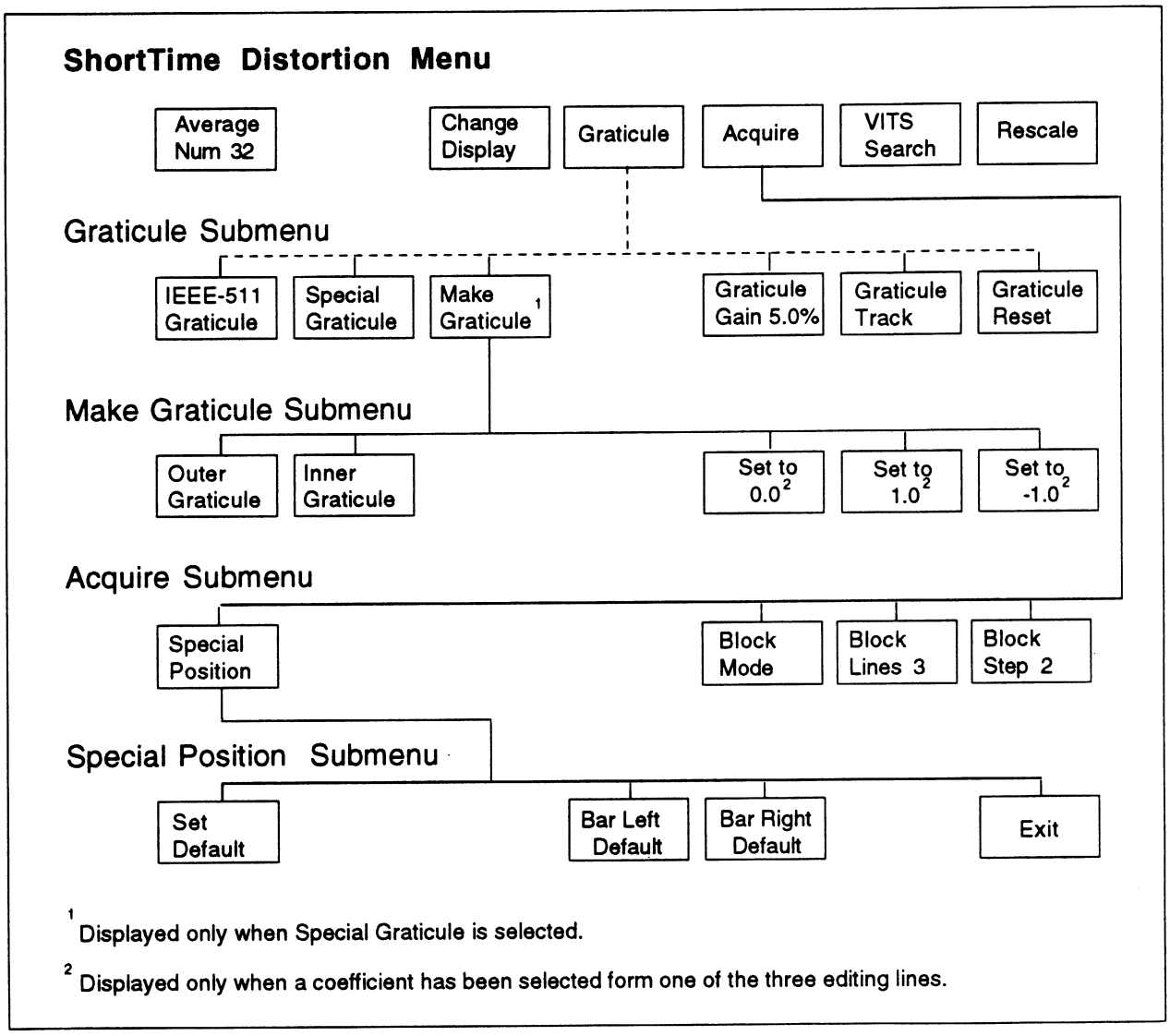


Figure 2-65. ShortTime Distortion menu tree.

MAIN MENU

Average Num	**Average Num** specifies the weighting factor to use for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the **Average Num** softkey to highlight it, rotate the knob until the desired weighting factor appears, then touch the **Average Num** softkey again.
Change Display	**Change Display** toggles the display between Rising Edge only, Falling Edge only, and both Rising Edge and Falling Edge. The text readout on the display follows the graph selected.
Graticule	**Graticule** displays the Graticule sub-menu, controls the graticule gain and tracking of the current graticule, and to create a user-defined graticule.
Acquire	**Acquire** displays the Acquire sub-menu, which controls signal acquisition for ShortTime Distortion.
VITS Search	**VITS Search** searches insertion test signals for a T Bar signal. If an appropriate signal is not located, the message Not found displays briefly on the screen.
Rescale	**Rescale** sets the expansion factor of the display to an appropriate scaling factor for the measurement's display graticule. The x- and y-axes adjust to accommodate the rescaled display.

GRATICULE SUB-MENU

IEEE-511 Graticule	**IEEE-511 Graticule** selects the IEEE-511 Standard Short-Time Distortion Graticule.
Special Graticule	**Special Graticule** selects the Special (user-defined) graticule for ShortTime Distortion measurements.
Make Graticule	**Make Graticule** displays the Make Graticule sub-menu, which provides softkeys to define the inner and outer graticules of the Special (user-defined) graticule. This softkey only appears when the **Special Graticule** softkey is highlighted.
Graticule Gain	**Graticule Gain** adjusts the graticule variable gain. The range is from 0.1% to 20.0%, with a resolution of 0.1%. To adjust the gain, highlight the softkey, turn the knob, then touch the softkey again.
Graticule Track	**Graticule Track** toggles to turn graticule tracking on or off. When the softkey is highlighted (graticule tracking on), the size of the graticule tracks the actual waveform.
Graticule Reset	**Graticule Reset** turns off graticule tracking and resets the graticule gain to 5.0%.

MAKE GRATICULE SUB-MENU

Outer Graticule	**Outer Graticule** selects the outer pair of user-defined graticules for editing.
Inner Graticule	**Inner Graticule** selects the inner pair of user-defined graticules for editing.
Set to 0.0	**Set to 0.0** sets the selected variable value to 0. This softkey is only displayed when a coefficient has been selected from one of the three editing lines.
Set to 1.0	**Set to 1.0** sets the selected variable value to 1. This softkey is only displayed when a coefficient other than T has been selected from one of the three editing lines.
Set to -1.0	**Set to -1.0** sets the selected variable value to -1. This softkey is only displayed when a coefficient other than T has been selected from one of the three editing lines.

ACQUIRE SUB-MENU

Special Position	**Special Position** displaysp the Special Position submenu which sets the measurement locations for the ShortTime Distortion measurement.

SPECIAL POSITION SUB-MENU

Set Default	**Set Default** resets the selected softkey (Bar Left or Bar Right) to its default location. If none are selected, all are reset. Default locations are specified in the current Measurement Locations file.
Bar Left	**Bar Left** defines the location of the leading edge of Bar, represented by an arrow in the graph. When this softkey is highlighted, use the knob to move the Bar Left position.
Bar Right	**Bar Right** defines the location of the trailing edge of Bar, represented by an arrow in the graph. When this softkey is highlighted, use the knob to move the Bar Right position.
Exit	**Exit** leaves the Measurement Locations display and returns to the ShortTime Distortion display.

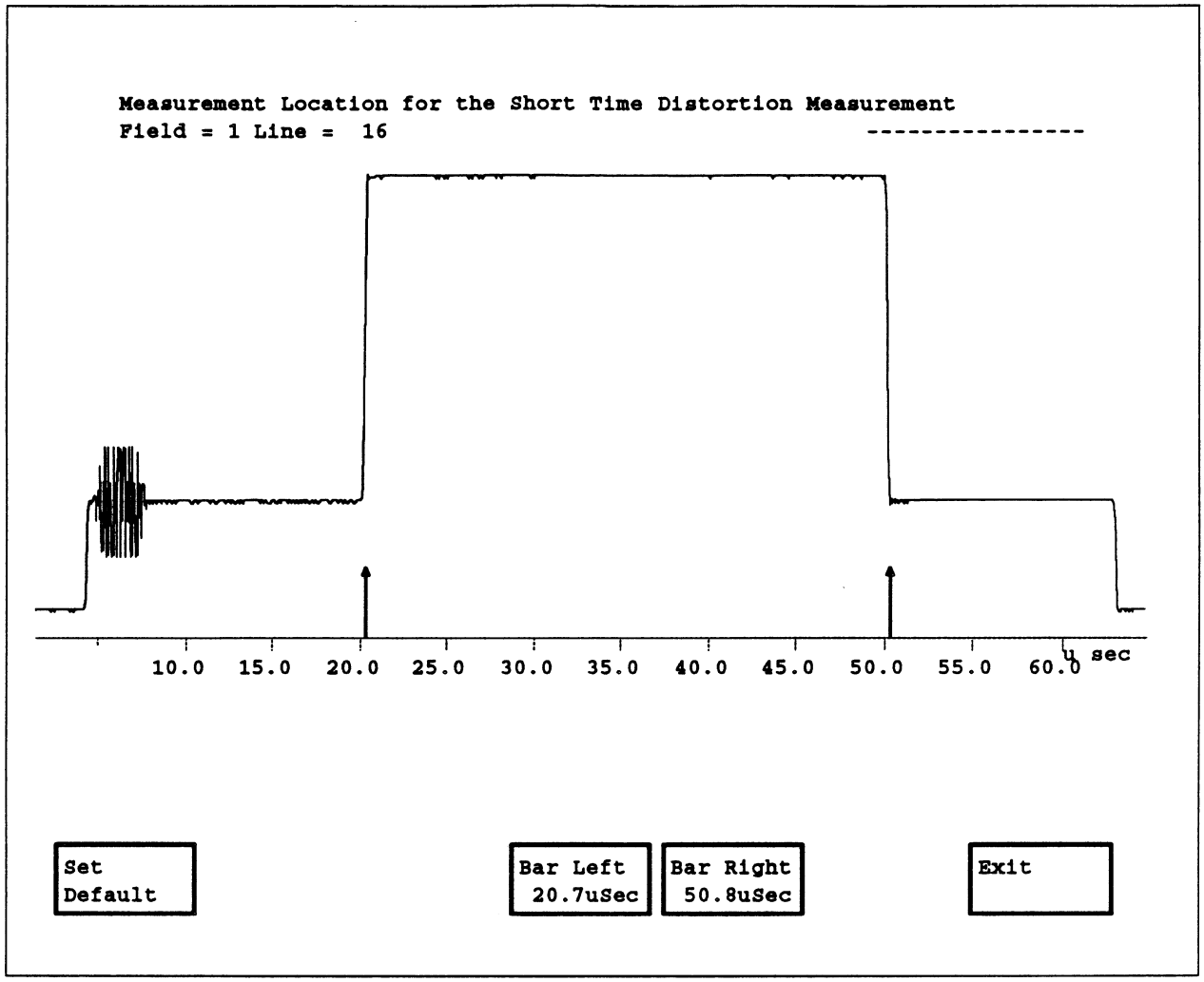


Figure 2-66. ShortTime Distortion Special Position display.

Defining Your Own Graticule

The ShortTime distortion measurement's graticule defines the boundaries of the distortion envelope for a given graticule gain setting. The displayed graticule consists of an outer graticule and an inner graticule, mirrored around the 50% level.

You can define your own graticule for the ShortTime Distortion measurement by means of the Make Graticule submenu. To access the Make Graticule submenu:

1. Press the Menu button to display the ShortTime Distortion main menu.
2. Touch the **Graticule** softkey.
3. Touch the **Special Graticule** softkey if it is not already highlighted. When **Special Graticule** is highlighted, the **Make Graticule** softkey displays beside it.
4. Touch the **Make Graticule** softkey. The Make Graticule sub-menu, consisting of the **Outer Graticule** and **Inner Graticule** softkeys, should be visible on the display and not highlighted. The top half of the inner and outer graticule pair (i.e., the graticule surrounding the bar-level region) should also display. Any changes made to the top half of the graticules are mirrored in the bottom half.

To change the shape of the outer or inner graticule, touch the corresponding softkey. This displays (Figure 2-67) three editable lines of equations.

Each graticule is divided into three areas. Area 1 is innermost, nearest the y-axis. Area 2 is the middle area. Area 3 is outermost, furthest away from the y-axis. The three lines of equations correspond to the three areas of the line being edited.

Editing the equations consist of changing the values of the coefficients in the equation

grat = A * exp(B * (T^C))*(T^D) + E.

To select a line to edit, turn the knob when no coefficient of a line is selected (i.e., no edit box is visible around any coefficient).

To edit a coefficient in the selected line, touch the coefficient you wish to edit. For coefficients A, B, C, D, or E, this brings up three more softkeys labeled "Set to 0.0", "Set to 1.0", and "Set to -1.0". (When the T coefficient is selected, only the "Set to 0.0" softkey is displayed.) To set the value of the coefficient, turn the knob or touch one of the softkeys. The effect of the change on the graticule is shown immediately.

To finish making changes to an equation, touch the selected coefficient. The edit box disappears, and you can then turn the knob to select a new line to edit, or press the Menu button to exit the Make Graticule submenu.

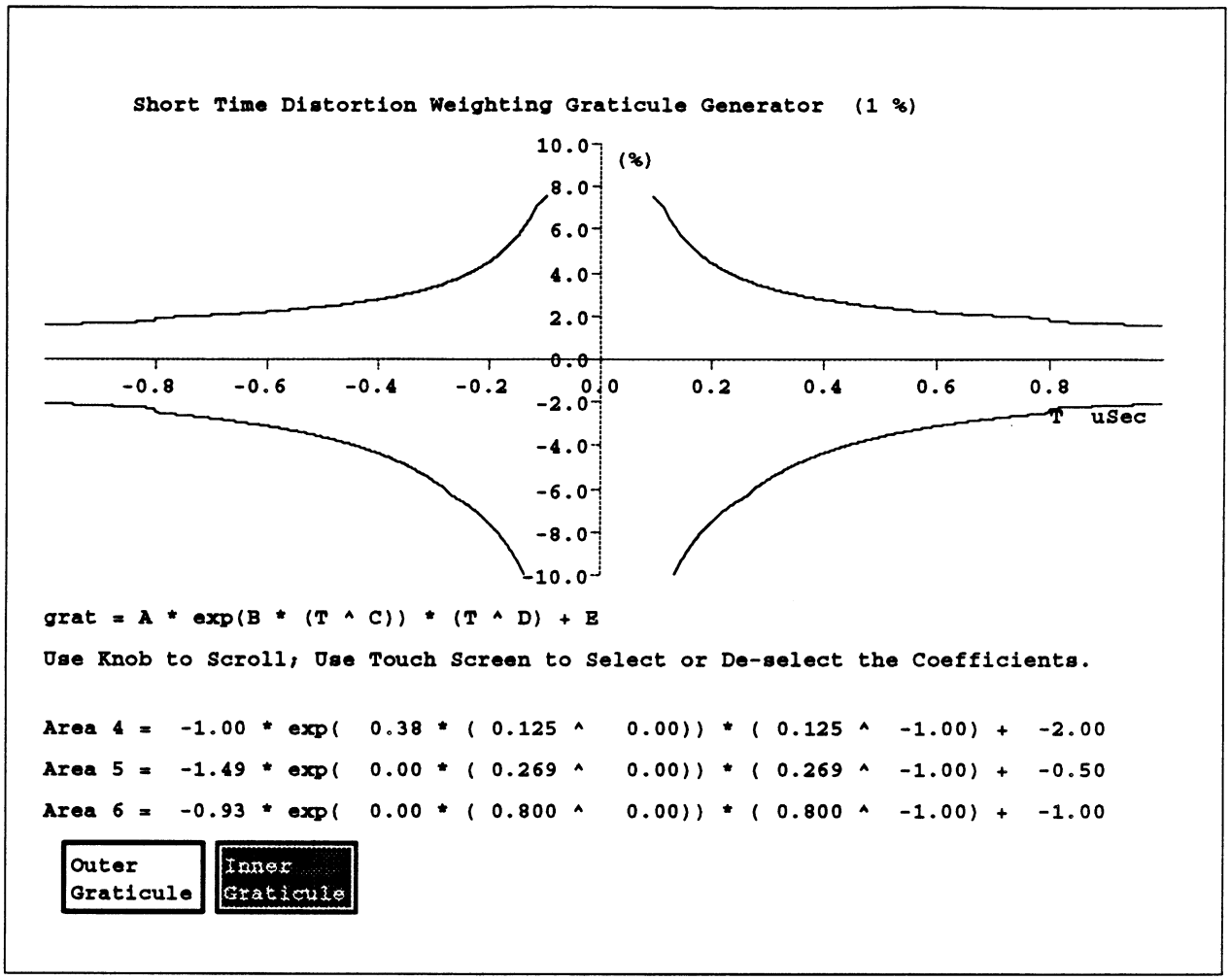


Figure 2-67. Make Graticule display with outer graticule selected.

NOTE

The Make Graticule sub-menu defines the boundaries of the distortion envelope for 1% gain. The default gain for the main ShortTime Distortion display is 5%. You can adjust the gain value with the ***Graticule Gain*** *softkey of the Graticule sub-menu.*

To adjust the gain, highlight the softkey, turn the knob until the desired gain value is displayed, then touch the softkey again.

TWOFIELD

TwoField measures field time distortion. It is also useful for quick viewing of certain waveform characteristics.

Figure 2-68 shows the TwoField display. The display plots the amplitude of any combination of sync tip, back porch, luminance, or peak-to-peak chrominance, showing 525 points for each. The items displayed are selected by means of the **TwoField Menu** softkeys; the default is to display sync tip, back porch, and luminance.

The TwoField measurement requires a field square wave as input.

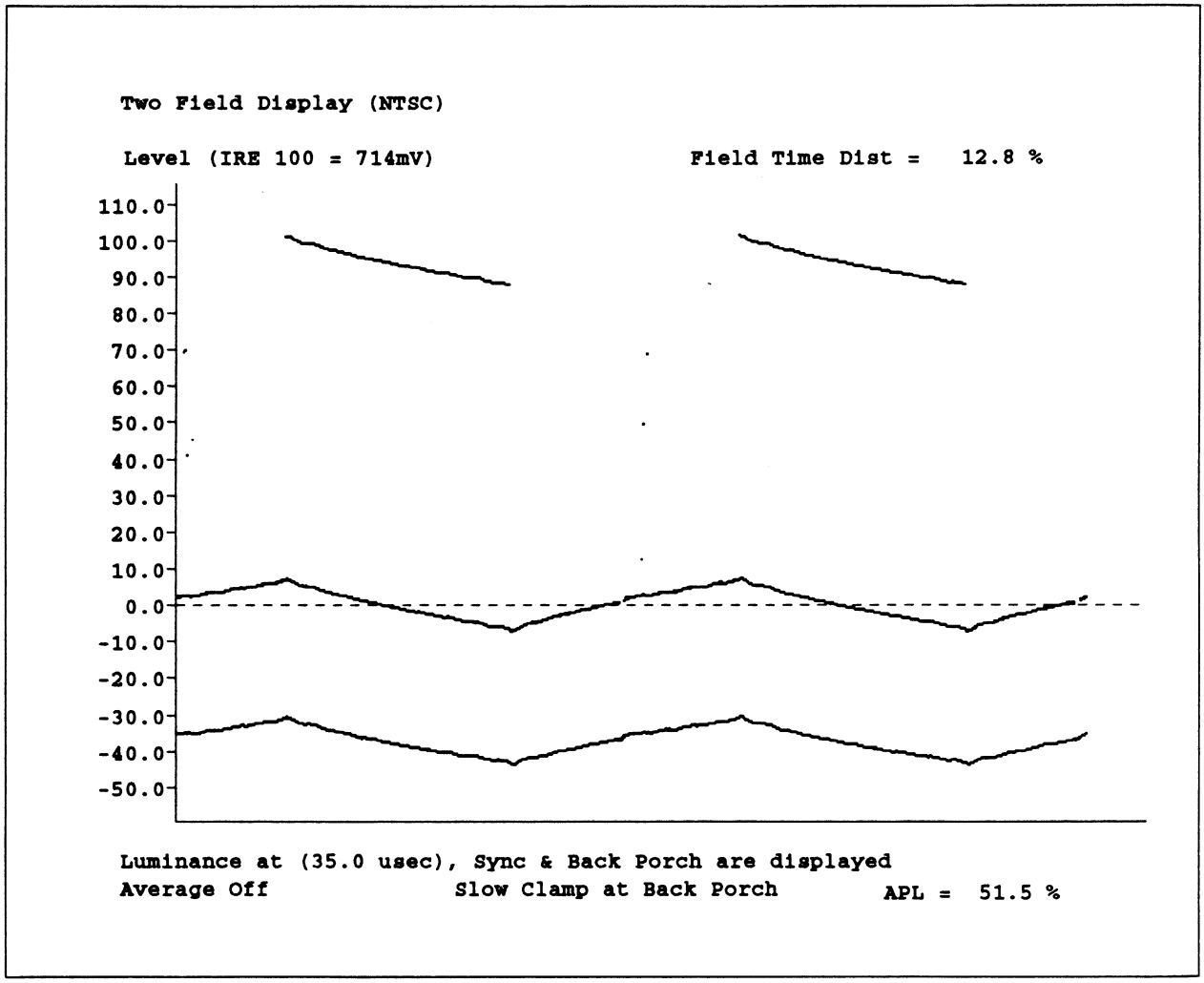


Figure 2-68. TwoField display.

TwoField Menu

Pressing the Menu button when the TwoField measurement runs displays the TwoField menu (Figure 2-69).

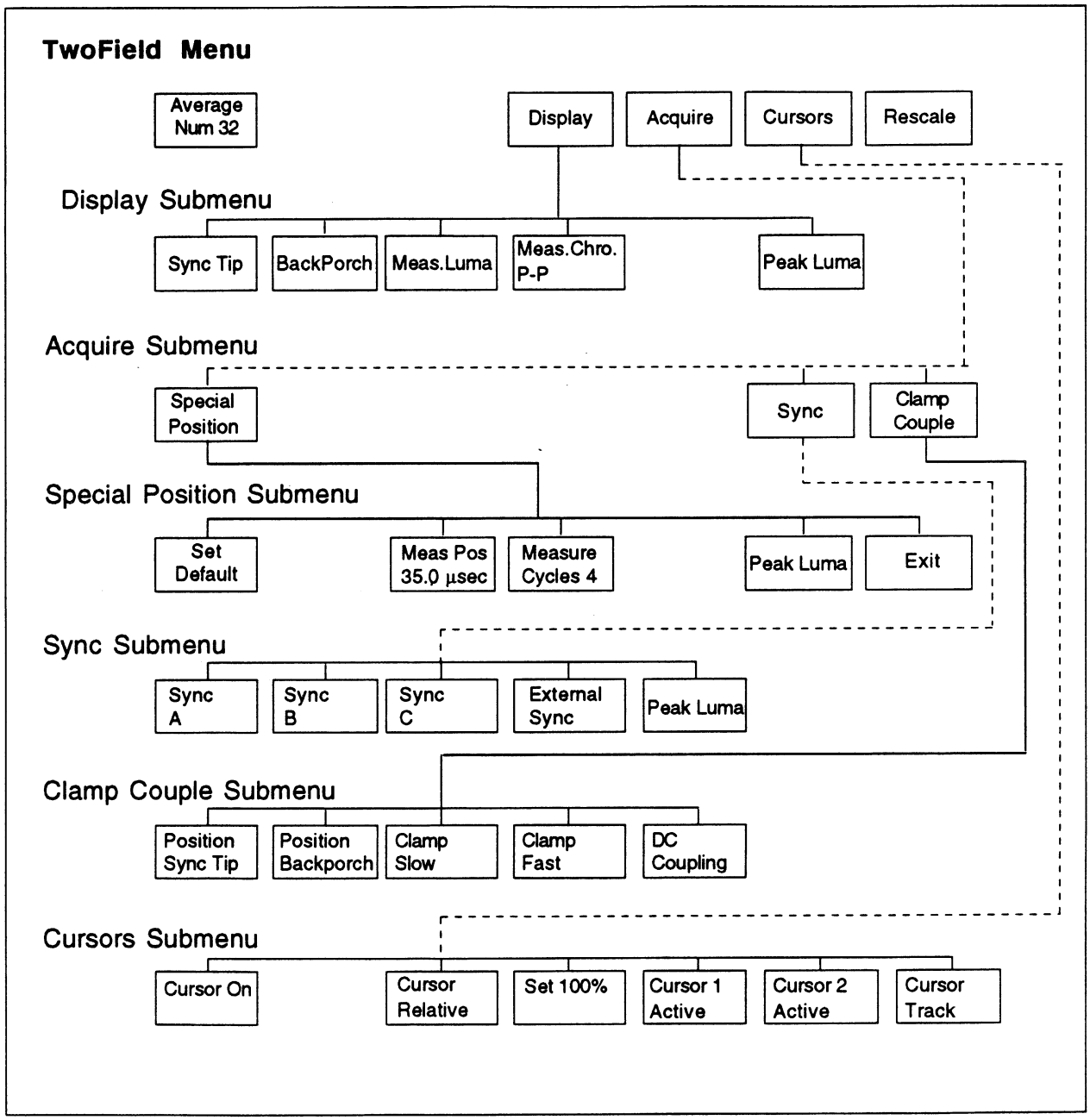


Figure 2-69. TwoField menu tree.

MAIN MENU

Average Num	**Average Num** specifies the weighting factor to use for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the **Average Num** softkey to highlight it, rotate the knob until the desired weighting factor appears, then touch the **Average Num** softkey again.
Display	**Display** displays the Display submenu for selection of waveforms.
Acquire	**Acquire** displays the Acquire submenu that provides acquisition control.
Cursors	**Cursors** provides softkeys to display and activate the cursors.
Rescale	**Rescale** sets the expansion factor of the display to an appropriate scaling factor for the TwoField measurement's display graticule. The x- and y-axes adjust to accommodate the rescaled display.

DISPLAY SUBMENU

Sync Tip	**Sync Tip** selects sync tip for the display.
Back Porch	**BackPorch** selects back porch for the display.
Meas. Luma	**Meas.Luma** selects averaged luminance level at the measurement position for the display.
Meas.Chro P-P	**Meas.Chro P-P** selects averaged chrominance level at the measurement position for the display.
Peak Luma	**Peak Luma** selects peak luminance level in the active area for the display.

ACQUIRE SUBMENU

Special Position	**Special Position** displays the Special Position menu that sets the locations on the waveform where the measurement is made.
Sync	**Sync** provides softkeys to set the sync source.
Clamp Couple	**Clamp Couple** displays a submenu that allows you to set the Clamping mode used by the TwoField measurement.

SPECIAL POSITION SUB-MENU

Set Default	**Set Default** resets the selected softkey to its default value, or resets all of the softkeys, if no softkey is currently selected at this level. Deselects peak luminance mode.
Meas. Pos *nn.n* µsec	**Meas. Pos** chooses where the measurement is made. The center tick of the displayed box shows the measurement position. Select and turn the knob to change the location from the horizontal sync.
Measure Cycles *n*	**Measure Cycles** chooses how many chrominance subcarrier cycles are averaged for the measurement. The width of the displayed box shows the measurement area determined by the selected number of cycles. Select and turn the knob to change the number of cycles.
Peak Luma	**Peak Luma** selects peak luminance level in the active area for the display.
Exit	**Exit** leaves the Special Position display and returns to the Two Field Distortion display.

SYNC SUBMENU

Sync A/B/C	**Sync A/B/C** selects the A, B, or C input for the sync source.
External Sync	**External Sync** selects the external input for the sync source.
Peak Luma	**Peak Luma** selects peak luminance level in the active area for the display.

CLAMP COUPLE SUBMENU

Position Sync Tip	**Sync Tip** selects sync tip for the display.
Position Back Porch	**Position BackPorch** selects back porch for the display.
Clamp Slow	**Clamp Slow** selects slow clamp speed. This speed allows hum effects to be visible, but is useful in coping with large DC offsets on an input signal.
Clamp Fast	**Clamp Fast** selects fast clamp speed. This speed removes DC offset, hum, and bounce effects from the signal. This is the default clamp setting for the TwoField measurement.
DC Coupling	**DC Coupling** selects DC coupling (no clamping).

CURSORS SUBMENU

Cursor On	**Cursor On** displays cursors. Two horizontal cursors appear in the position they were in the last time the cursor was active.
Cursor Relative	**Cursor Relative** selects relative cursor mode. The cursor delta displays relative to the reference.
Set 100%	**Set 100%** stores the current cursor delta as the reference.
Cursor 1/2 Active	**Cursor 1/2 Active** displays cursors and causes the knob to move cursor 1 or 2.
Cursor Track	**Cursor Track** displays cursors and causes the knob to move both cursors.

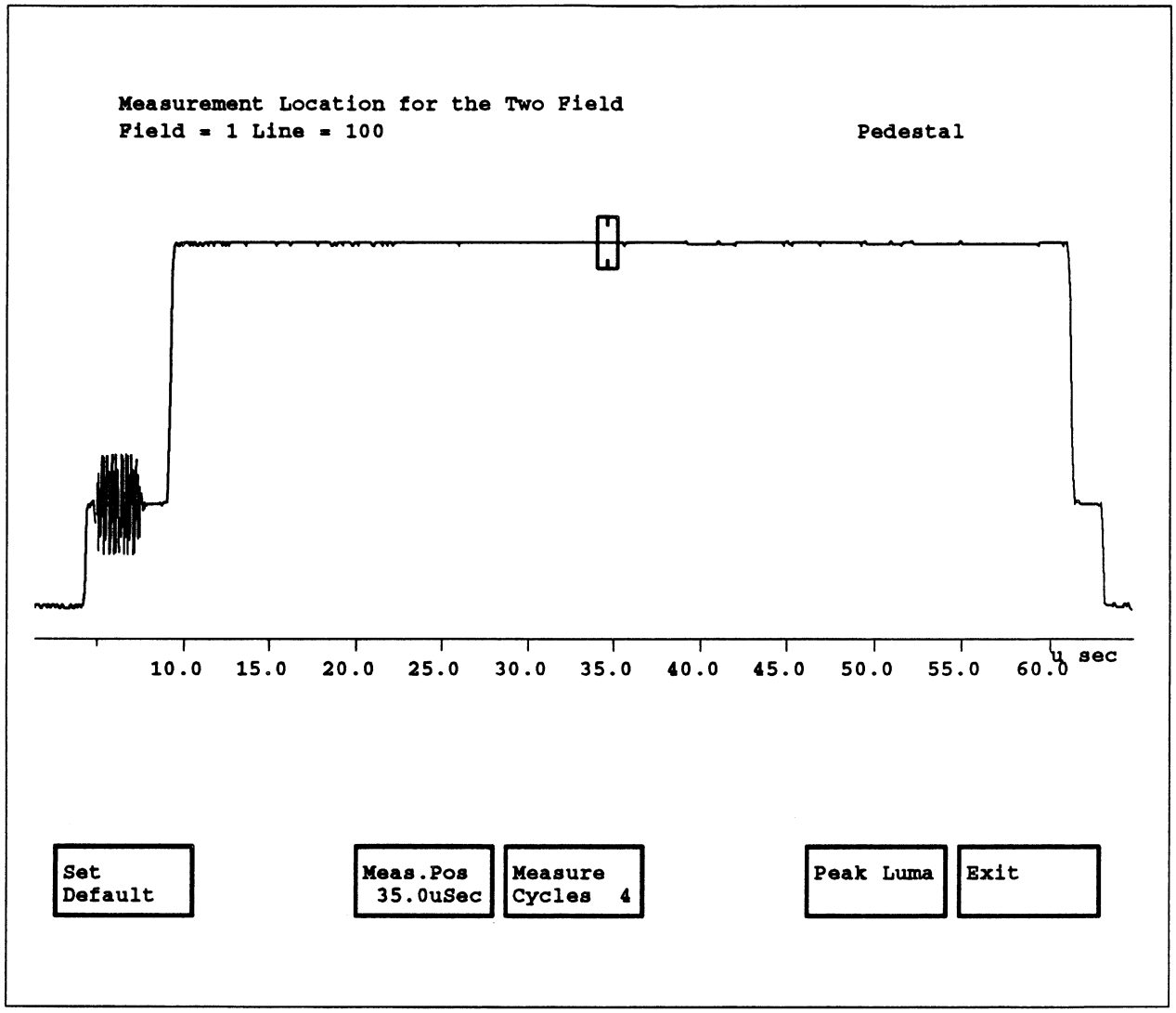


Figure 2-70. TwoField Special Position display.

VITS ID

VITS ID identifies and lists test signals in the vertical interval.

Figure 2-71 shows the VITS_ID signal ID display. It shows the name of any recognized signal in the vertical interval, and displays the waveform of the current system line. To select a new system line, touch the name of any signal in the upper portion of the display.

Figure 2-72 shows the VITS_ID VITS waveform display. It shows the waveform of all signals in the vertical interval for both fields. You can select a new system line by touching the position of any line shown on the display.

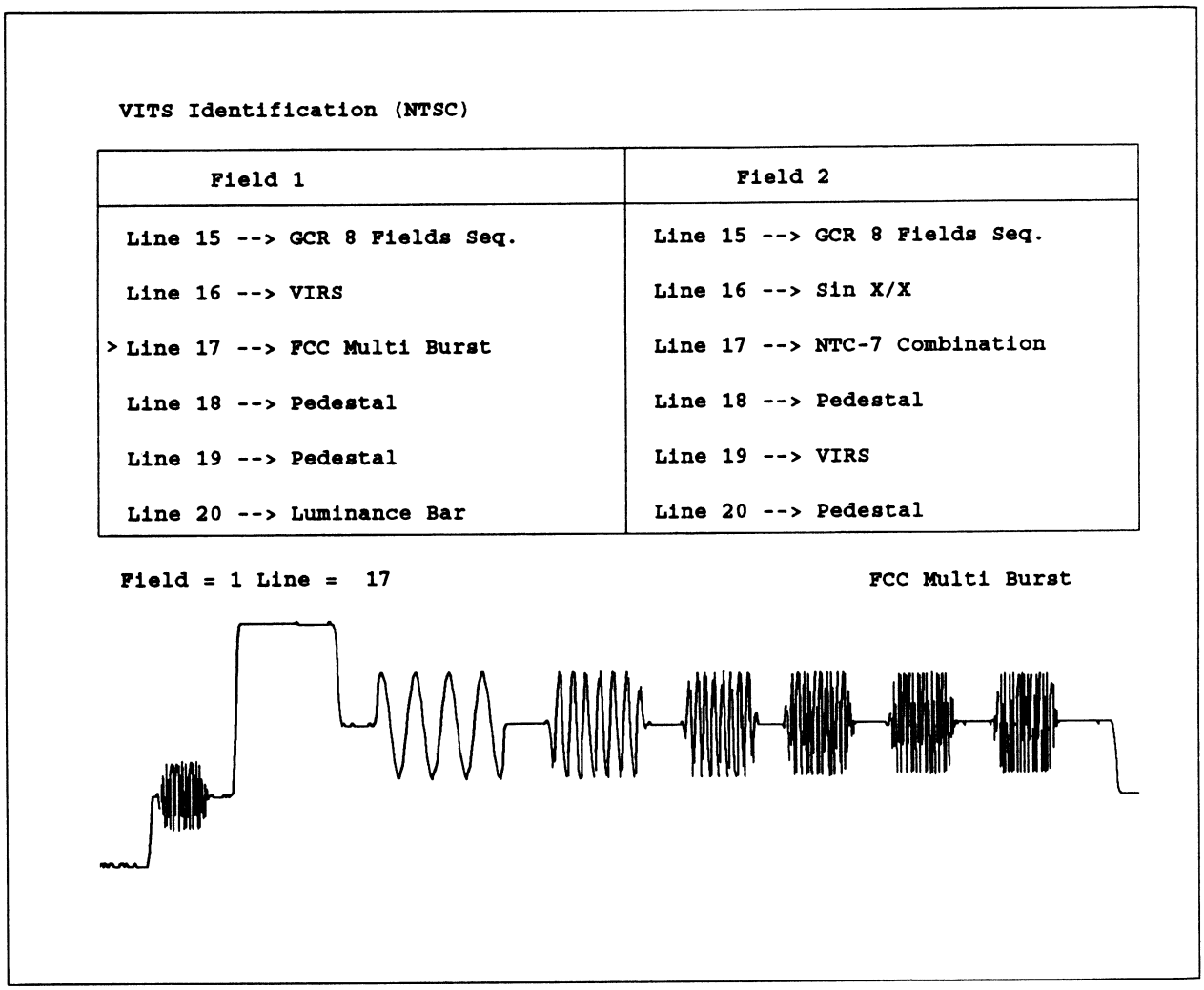


Figure 2-71. VITS ID signal ID display.

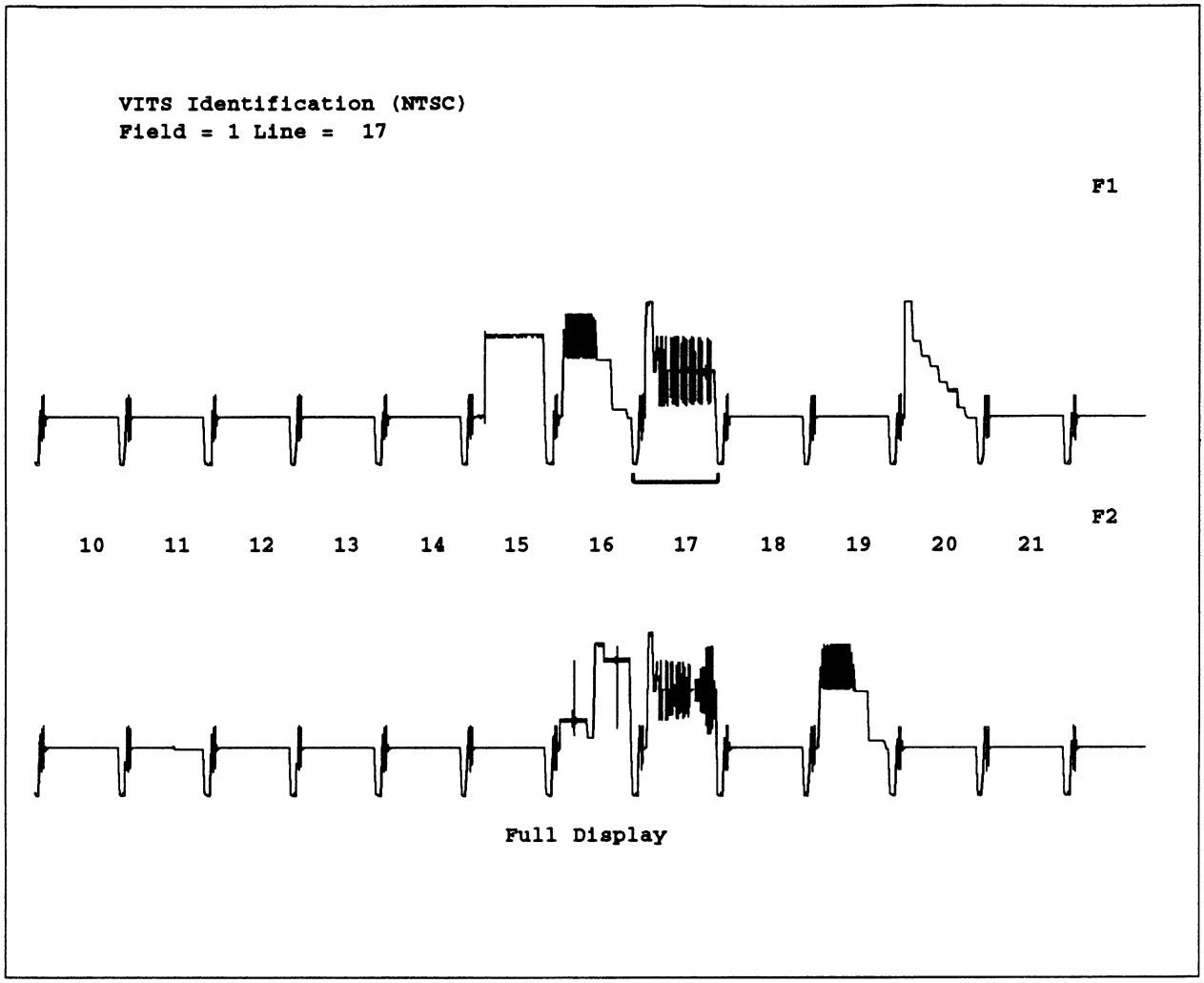


Figure 2-72. VITS ID full VITS waveform display.

VITS ID Menu

Pressing the Menu button when the VITS ID measurement runs displays the VITS ID menu (Figure 2-73).

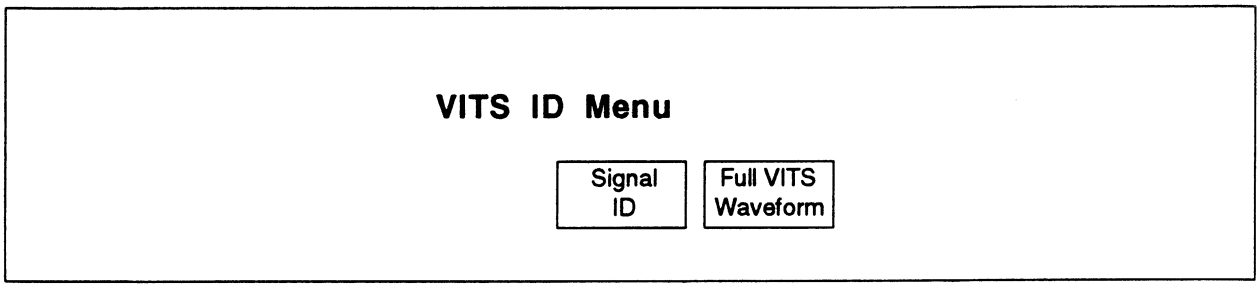


Figure 2-73. VITS ID menu tree.

MAIN MENU

Signal ID

Signal ID shows VITS names. The waveform of the system line is also displayed when menus are de-selected.

Full VITS Waveform

Full VITS Waveform: shows waveform lines 10 to 22 for both fields.

V_BLANK

V_Blank shows vertical blanking waveforms and measures pulse widths and rise and fall times for the equalizer and serration pulses.

Figure 2-74 shows the full V_Blank display, which diagrams the vertical blanking intervals of 32 lines from each of four color fields. The current system line is indicated by a bracket beneath it. You can select a new system line by touching any line on the display.

Figure 2-75 shows the V_Blank equalizer pulse display, showing the width, rise time, and fall time of the equalizer pulse in field 2, line 2.

Figure 2-76 shows the V_Blank serration pulse display, showing the width, rise time, and fall time of the serration pulse in field 2, line 5.

Figure 2-77 shows the V_Blank V-sync display. This is essentially the same as the full V_Blank display, except that the vertical sync area is shown.

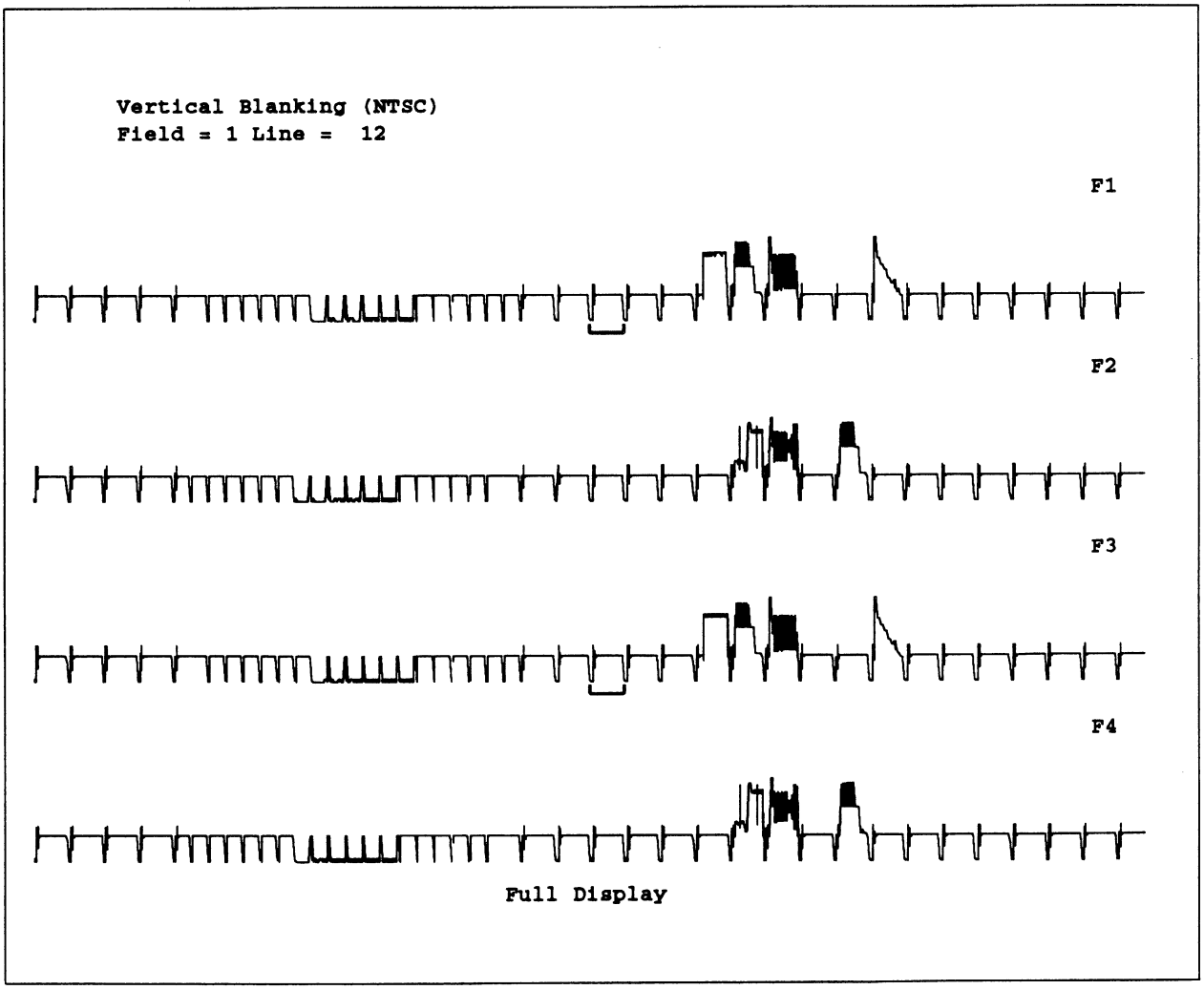


Figure 2-75. V_Blank full display.

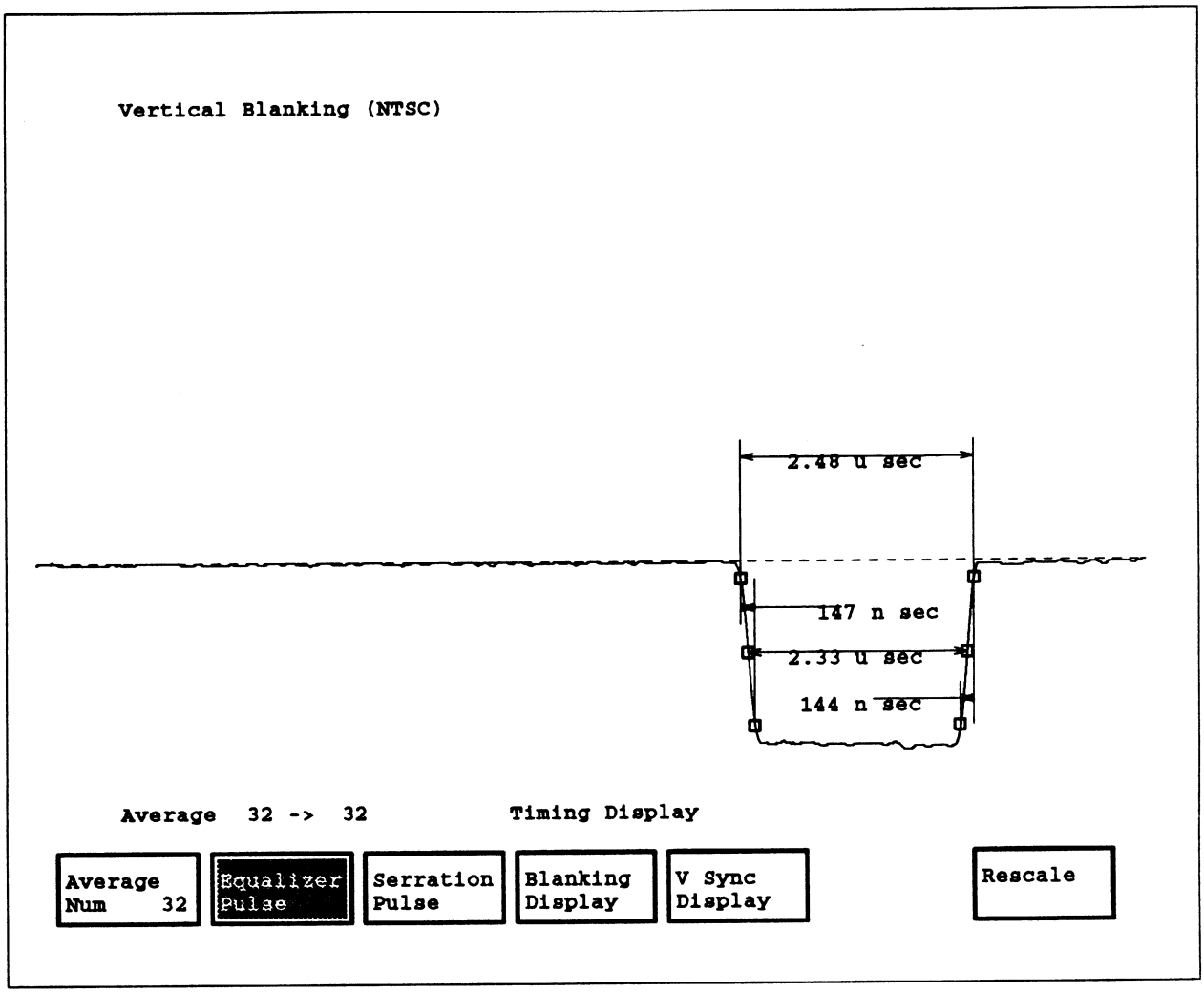


Figure 2-75. V_Blank equalizer pulse display.

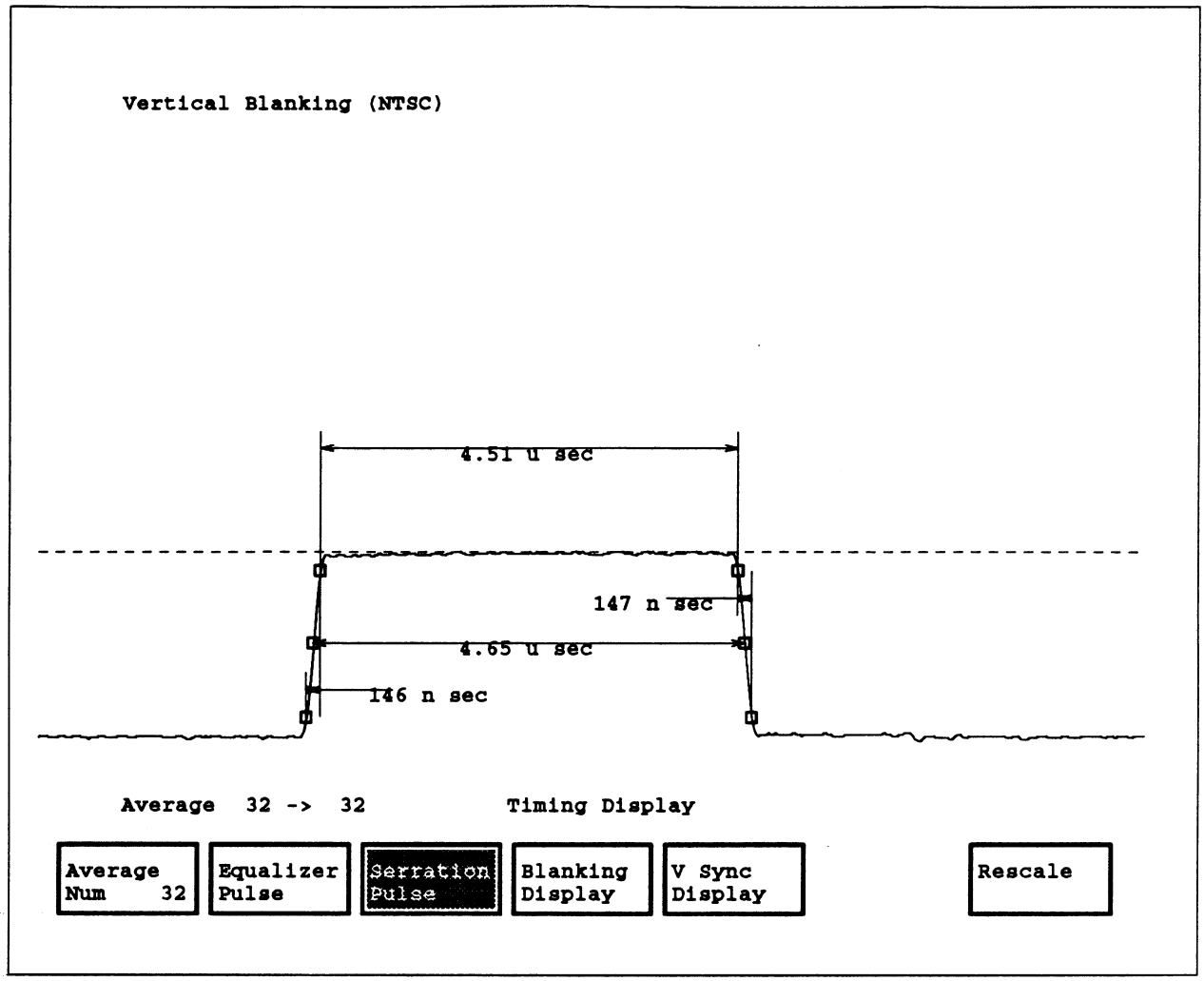


Figure 2-76. V_Blank serration pulse display.

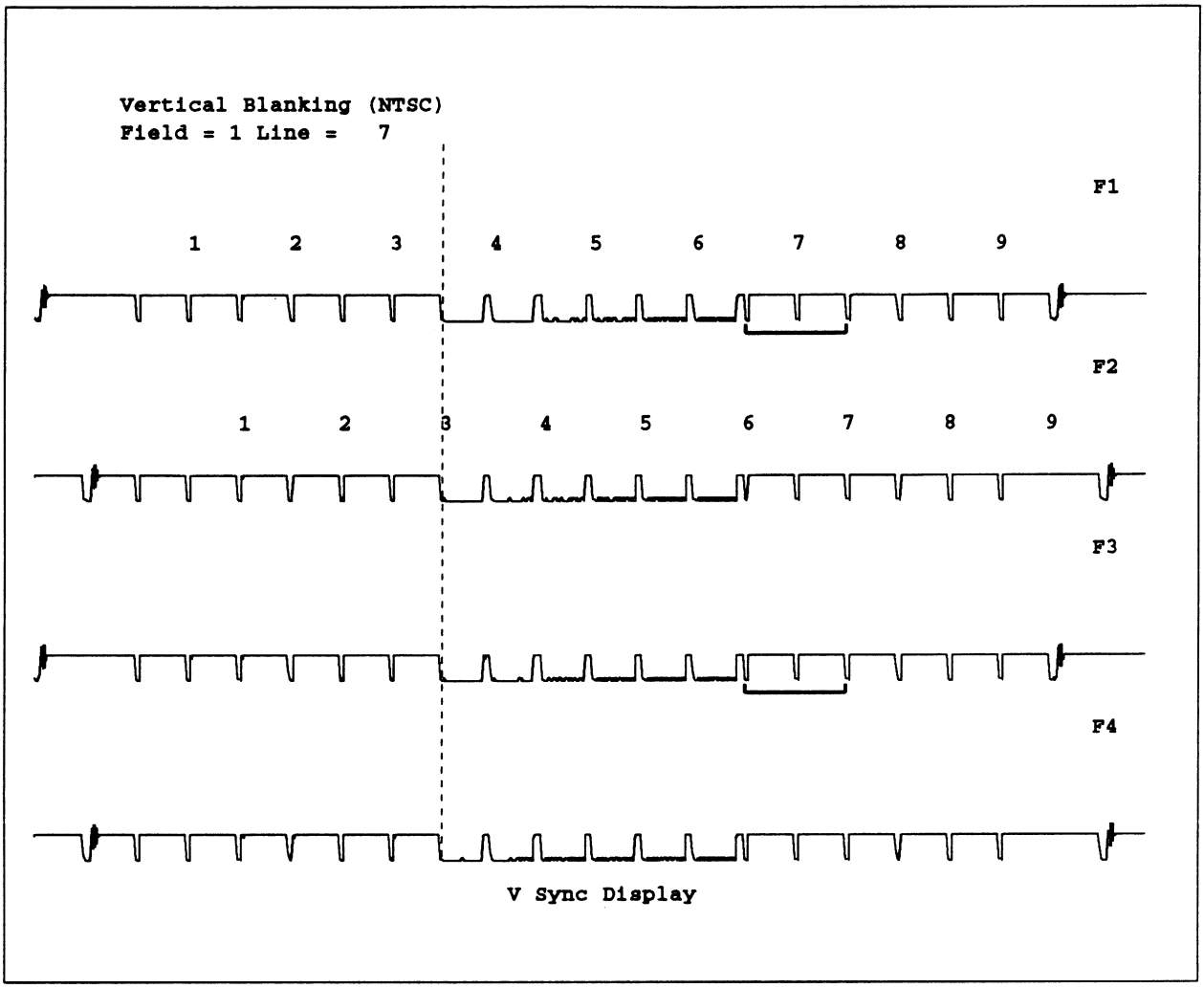


Figure 2-77. V_Blank V-sync display.

V_Blank Menu

Pressing the Menu button when the V_Blank measurement runs displays the V_Blank menu (Figure 2-78).

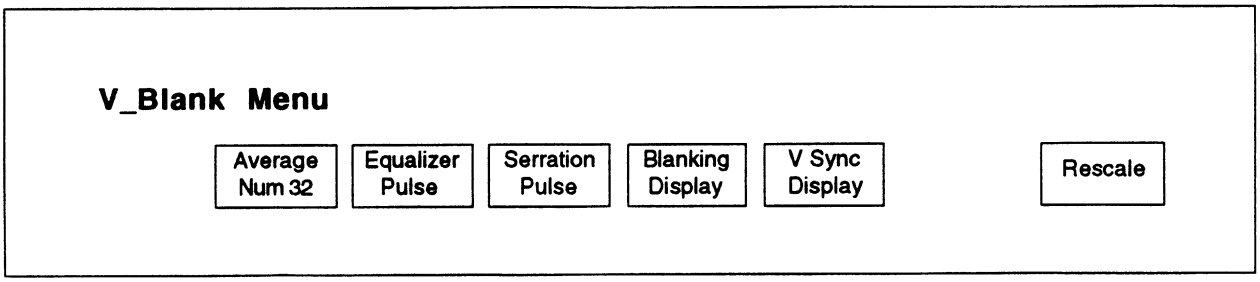


Figure 2-78. V_Blank menu tree.

MAIN MENU

Average Num

Average Num specifies the weighting factor to use for averaging. The Average Num range is 1 to 256. The default value is 32. To change the Average Num value, touch the **Average Num** softkey to highlight it, rotate the knob until the desired weighting factor appears, then touch the **Average Num** softkey again.

Equalizer Pulse

Equalizer Pulse displays an equalizer pulse and measures it.

Serration Pulse

Serration Pulse displays a serration pulse and measures it.

Blanking Display

Blanking Display displays the vertical blanking sections of four fields. Each field has 32 lines in the display area.

V Sync Display

V Sync Display displays the vertical sync sections of four fields. Each field has 11 lines in the display area.

Rescale

Rescale sets the expansion factor of the display to an appropriate scaling factor for the V_Blank measurement's display graticule. The x- and y-axes adjust to accommodate the rescaled display.

VIDEO STANDARD

Video Standard recognizes the standard of the current input source (NTSC or PAL).

When running a dual-standard VM700A (i.e., an instrument equipped with both Option 01, NTSC, and Option 11, PAL), it is possible to connect a signal of one standard to a channel that is expecting another. The Video Standard "measurement" guards against this error.

When you press the Measure button and touch the Video Standard softkey, the VM700A recognizes the standard of the incoming signal on the current channel, then uses the correct Video_Source File for that standard.

NOTE

When Video Standard changes the standard for a source, the change is NOT reflected in the display shown when you touch the ***Video Source*** *softkey. Also, executing a function that includes a RestoreConfig command may restore incorrect values into the Video Source file.*

Video Standard stores its measurement results in the "Measurement Results" directory in /nvram0/ConfigFiles. To view Video Standard's measurement results, press the Configure button, then touch **Configure Files**, **Measurement Results**, and **Video Standard**. The file shows the time that Video Standard was last executed, and lists the standard recognized for each input channel. If no standard was recognized for a channel, "----" displays as the measurement result.

Section 3
AUTO MODE MEASUREMENTS

INTRODUCTION

The VM700A's Auto mode performs many industry-standard measurements with great speed and accuracy.To do so, the VM700A selects portions of the video input signal, converts them from analog to digital representation, then analyzes the digitized values to produce numeric measurement results.

This section details the analysis methods for each Auto mode measurement that the VM700A is capable of making. In general, the analysis methods are similar to those currently used throughout the television industry.

Input Signals

Auto mode makes most of its measurements on the Vertical Interval Test Signals (VITS). The VITS that Auto mode can use include NTC-7 Composite and Combination VITS, FCC Composite and Multiburst VITS, FCC Color Bars, VIRS (Vertical Interval Reference Signal), and the Zero-Carrier pulse. Several measurements do not use any special test signals. For example, the Horizontal Blanking Width measurements use active video lines.

Test Signal Locations

Test signal locations for Auto mode measurements are given by the Measurement Locations file. The system default Measurement Locations file uses the following signal locations:

Zero-Carrier Pulse	Field 1, Line 16
FCC Composite VITS	Field 1, Line 18
FCC Multiburst VITS	Field 1, Line 17
VIRS	Field 1, Line 19
FCC Color Bars	Field 2, Line 17
Noise Line (Quiet)	Field 1, Line 12

Note that the default setting in the system default file in the Measurement Locations directory does not select Zero Carrier as the amplitude reference.

If the test signal is not located on the specified line when a measurement is performed that needs that test signal, then an error message is reported, such as **No Multiburst** or **No Composite VITS**.

MEASUREMENT METHODS

This section describes how each Auto mode measurement is made. Where applicable, a timing standard is also listed for each measurement.

APL

The Average Picture Level is determined by measuring the active video area of the analog input signal with an internal digital voltmeter. APL is measured on a single field of video at the beginning of each measurement cycle (each pass through the list of selected measurements).

Peak Carrier and Zero Carrier Pulse

The peak carrier and Zero Carrier Pulse amplitudes are not displayed by the VM700, but are measured and are used as a reference for the Bar Top, Blanking Level, Blanking Variation, Sync Variation, FCC Multiburst Flag, and NTC7 Multiburst Flag measurements. These measurements are reported as % Carr.

Zero-Carrier pulse amplitude and Peak Carrier amplitude are measured on the vertical interval line that includes the Zero-Carrier pulse

Eight occurrences of the vertical interval line carrying the Zero-Carrier pulse are acquired, one frame apart.

Zero-Carrier pulse amplitude is measured from back porch blanking level to the top of the Zero-Carrier pulse. The blanking level is the average of 28 consecutive samples (2 µs), beginning at the sample that is 6.0 µs after the sync pulse leading-edge 50% point. The Zero-Carrier pulse top level is the average of 32 consecutive samples (2.25 µs), centered around the sample that is at the estimated center of the Zero-Carrier pulse as defined in the appropriate Measurement Locations file in Configure (the default location is 25.5 µs after the 50% point of the leading-edge of sync).

Peak Carrier amplitude is measured from the sync tip level to the level at the top of the Zero-Carrier pulse. The sync tip level is the average of 28 consecutive sample values (2 µs), starting 1.5 µs after the sync pulse leading-edge 50% point. The Zero-Carrier pulse top level is the same as in the Zero-Carrier pulse amplitude measurement, described in the previous paragraph.

Bar Amplitude, Blanking Level, Bar Top, and Sync Amplitude

(FCC Rules and Regulations Part 73.682 and NTC Report Number 7)

32 occurrences, one frame apart, are acquired of the vertical interval line carrying the FCC or NTC-7 Composite test signal. Acquiring samples from one line per frame over 32 frames, summing, and then averaging, reduces the effects of noise on the measurement. This also filters out the chrominance component of the signal, which is not needed to make these measurements.

Bar Top

The Bar Top level is the average of 12 consecutive sample values, centered midway between the approximate 50% points of the leading and trailing edges of the bar.

This measurement is always expressed as % Carr and is not made unless Zero Carrier is selected as an amplitude reference in the appropriate Measurement Location file, and it is found on the designated line. Note that the default setting is for Zero Carrier to not be used as a reference.

Blanking Level

Blanking level is calculated as a function of the Peak Carrier and Zero-Carrier pulse amplitudes, which are determined with the method discussed previously under Peak Carrier and Zero Carrier Pulse topic. Then,

Blanking Level = Zero-Carrier pulse amplitude/Peak Carrier amplitude X 100

This measurement is always expressed as % Carr and is not made unless Zero Carrier is selected as an amplitude reference in the appropriate Measurement Location file, and it is found on the designated line. Note that the default setting is for Zero Carrier to not be used as a reference.

Bar Amplitude

Bar Amplitude is measured from blanking level to the center of the Bar Top level [NTC-7, Section 3.2]. The blanking level is the average of 12 consecutive samples. If FCC Composite VITS, then these samples are centered around the point that is 2.1 microseconds before the measured 50% point of the bar leading-edge. If NTC-7 Composite VITS, then these samples are centered around the point that is 10.9 microseconds after the measured 50% point of the bar trailing-edge. Bar Amplitude is reported in IRE.

Sync Amplitude

Sync amplitude is measured from blanking level to the center of the horizontal sync tip pulse. The blanking level is the average of 16 consecutive sample values, centered around the sample that is 6.55 microseconds after the 50% point of the leading-edge of the sync pulse (nominal center of burst). The sync tip level is the average of eight consecutive sample values, centered midway between the 50% points of the leading and trailing edges of the sync pulse. Sync amplitude is reported in % Bar (when bar is present on this line) or as IRE (when bar is not present).

Blanking Variation and Sync Variation

(FCC Rules and Regulations Part 73.682)

Blanking Variation and Sync Variation measurement results are expressed as both % Carr and IRE.

Parts of the sync tip and the back porch are acquired from 85 different active video lines in field 1. The samples are acquired from every third line, starting at field 1, line 10, and ending with field 1, line 262. The hardware low-pass filter is used.

Blanking Variation

Blanking variation is measured as the peak-to-peak variation of the blanking level within a field. [FCC 73.682(a)(16)]. A blanking level is calculated for each of the acquired back porches as the arithmetic mean of 16 consecutive sample values, starting 6.7 microseconds after the assumed position of the sync pulse leading-edge 50% point. Within the resulting set of 85 blanking levels, the maximum blanking level and the minimum blanking level are found. The blanking variation measurement result is the difference between the two extreme levels, reported as % Bar (when bar is present on the composite VITS line) or as IRE (when bar is not present).

Sync Variation

Sync variation is measured as the peak-to-peak variation of the horizontal sync pulse amplitude within a field. [FCC 73.682(a)(16)]. A sync tip level is calculated for each of the acquired sync tips as the arithmetic mean of 16 consecutive sample values, starting 1.8 microseconds after the assumed position of the sync pulse leading-edge 50% point. Within the resulting set of 85 sync tip levels, the maximum and the minimum sync tip levels are found. The difference between the two extreme levels, reported as % Bar (when bar is present) or as IRE (when bar is not present).

Burst Amplitude

(FCC Rules and Regulations Part 73.699)

The Burst Amplitude measurement is made on the line where the Composite VITS is expected. Thirty-two occurrences of the line are acquired, one line per frame over 32 successive frames.

Burst amplitude is measured as the peak-to-peak amplitude of the color burst at burst center. For each of the acquired lines, the average peak-to-peak amplitude is determined over four subcarrier cycles at the center of burst. (The center of burst is located midway between the 50% points on the leading and trailing edges of the sampled burst chrominance envelope.)

The 32 results are summed and averaged, and the average is the measurement result. The measurement result is reported twice, first as % Sync and secondly as % Bar (when bar is present) or as IRE (when bar is not present).

FCC Horizontal Blanking Interval Timing Measurements

(FCC Rules and Regulations Part 73.699)

Thirty-two occurrences of the horizontal blanking interval are acquired from the active picture area, starting at field 1, line 50, and acquiring 32 lines separated by one frame and six lines (i.e., the second acquisition would be field 2, line 56).

FCC H Blanking

Measured between the points on the leading and trailing edges of horizontal blanking that are equivalent to 10% of sync (nominally +4 IRE).

FCC Sync Width

Measured between the 10% points on the leading and trailing edges of horizontal sync (nominally -4 IRE).

FCC Sync-Setup

Measured from the 10% point on the leading-edge of sync (nominally -4 IRE) to the point on the trailing-edge of blanking that is equivalent to 10% of sync (nominally +4 IRE).

FCC Front Porch

Measured from the 10% point on the trailing-edge of setup (+4 IRE nominally) to the 10% point on the leading-edge of sync (nominally -4 IRE).

Sync to Burst End

Measured from the 10% point on the leading-edge of horizontal sync (nominally -4 IRE) to the half-amplitude point on the trailing-edge of the burst envelope.

Breezeway Width

Measured from the 10% point on the trailing-edge of horizontal sync (nominally -4 IRE) to the leading half-amplitude point of the burst envelope.

FCC Burst Width

Measured from the leading half-amplitude point on the chrominance envelope of burst to the trailing half-amplitude point on the chrominance envelope.

Sync Risetime and Sync Falltime

Measured between the 10% and 90% points on the leading and trailing edges of horizontal sync (nominally -4 IRE and -36 IRE).

Note that the RS170-A and FCC specifications for these two measurements are identical, so the measurements are displayed only once by Auto mode.

RS-170A Horizontal Blanking Interval Timing Measurements

(RS-170A)

Thirty-two occurrences of the horizontal blanking interval are acquired from the active picture area, starting at field 1, line 50 and acquiring 32 lines separated by one frame and six lines (i.e., the second acquisition would be field 2, line 56).

RS-170A H Blanking

Measured between the points on the leading and trailing edges of horizontal blanking that are equivalent to 50% of sync (nominally 20 IRE).

RS-170A Sync Width

Measured between the 50% points on the leading and trailing edges of horizontal sync (nominally -20 IRE).

RS-170A Sync-Setup

Measured from the 50% point on the leading-edge of sync (nominally -20 IRE) to the point on the trailing-edge of blanking that is equivalent to 10% of sync (nominally +4 IRE).

RS-170A Front Porch

Measured from the 10% point on the trailing-edge of setup (+4 IRE nominally) to the 50% point on the leading-edge of sync (nominally -20 IRE).

Sync to Burst Start

Measured from the 50% point on the leading-edge of horizontal sync (nominally -20 IRE) to the leading zero crossing of the first half-cycle of burst that exceeds 50% of burst amplitude to the trailing zero crossing of the last half-cycle of burst that exceeds 50% of burst amplitude.

RS-170A Burst Width

Measured from the leading zero crossing of the first half-cycle of burst that exceeds 50% of burst amplitude to the trailing zero crossing of the last half-cycle of burst that exceeds 50% of burst amplitude. [RS-170A Notes 13,14]. If burst is not locked to sync, then the envelope width is measured instead, and results are displayed in cycles along with the message Envelope Measured.

V Blank 4 IRE F1 and V Blank 4 IRE F2

(FCC Rules and Regulations Part 73.699)

Vertical blanking width is measured between the points on setup at a level equal to 10% of sync amplitude above blanking level (nominally +4 IRE), where setup immediately precedes and follows the vertical blanking interval. Two measurements are made, one for field 1 blanking (F1) and the other for field 2 blanking (F2).

Four successive occurrences of all the lines in the frame that may contain the beginning or end of field blanking, plus one "extra" line, are acquired:

- Field 2, line 258 through and including field 2, line 263 (start of field 1 blanking).
- Field 1, line 20 through and including field 1, line 25 (end of field 1 blanking).
- Field 1, line 259 through and including field 1, line 264 (start of field 2 blanking).
- Field 2, line 20 through and including field 2, line 25 (end of field 2 blanking).

Tilt on a blanked line could be erroneously identified as the beginning of video (end of blanking). If sync is present, each line has any tilt removed using the back porch of one line (line A for this example) and the front porch of the next line (line B). Line A's tilt is removed by pivoting line A around its back porch level to bring line B's front porch to the same level. The "extra" line is acquired in this measurement only so its front porch can be used for tilt correction.

The lines in the vertical blanking interval which never contain active video are not acquired and are always counted in the measurement result.

Only the active video area of the lines possibly containing the beginning or end of blanking is examined (from 10.4µs to 52.66µs after the start of sampling). The search level (amplitude considered to be blanking) is set as 10% of sync amplitude. If sync is not present, a default value is used.

On the line where blanking start or stop is found, the portion of the active video area of that line that is blanked is reported (in tenths of the possible active video area).

The measurement result is a summation of:

- The lines in the vertical blanking interval which never contain active video and are not acquired;
- The lines acquired where a blanking transition is not found;
- The portion (in tenths) of the active video area found to be blanked on lines containing a blanking transition.

V Blank 20 IRE F1 and V Blank 20 IRE F2

(RS-170A)

The measurement method is identical to V Blank 4 IRE F1 and V Blank 4 IRE F2, except the vertical blanking width is measured between the points on setup at a level equal to 50% (vs. 10%) of sync amplitude above blanking level, nominally +20 IRE (vs. +4 IRE), where setup immediately precedes and follows the vertical blanking interval.

FCC Equalizer and FCC Serration

(FCC Rules and Regulations Part 73.699)

Timing measurements made within the vertical interval are Equalizing Pulse Width and Serration Width. The middle half of two different lines within field 2 of the vertical interval are acquired from 32 successive frames: field 2, line 2 (which contains an equalizing pulse) and field 2, line 5 (which contains a serration).

FCC Equalizer

Measured between the 10%-points on the equalizing pulse (nominally -4 IRE). The sample values acquired from the middle pulse of field 2, line 2 are used. The result is expressed as a % of sync width, which is determined from 32 occurrences of sync taken one frame, six lines apart (the same sampling pattern as the Horizontal Timing measurements).

FCC Serration

Measured between the 90%-points of serration (nominally -36 IRE). The sample values acquired from the serration on field 2, line 5 are used. The result is expressed in microseconds.

RS-170A Equalizer and RS-170A Serration

(RS-170A)

Timing measurements made within the vertical interval are Equalizing Pulse Width and Serration Width. The middle half of two different lines within field 2 of the vertical interval are acquired from 32 successive frames: field 2, line 2 (which contains an equalizing pulse) and field 2, line 5 (which contains a serration).

RS-170A Equalizer

Measured between the 50%-points on the equalizing pulse (nominally -20 IRE). The sample values acquired from the middle pulse of field 2, line 2 are used. The result is expressed in microseconds.

RS-170A Serration

Measured between the 50%-points of serration (nominally -20 IRE). The sample values acquired from the serration on field 2, line 5 are used. The result is expressed in microseconds.

VIRS Measurements

(FCC 73.699)

Four measurements are made on VIRS: VIRS Setup, VIRS Luminance Ref, VIRS Chroma Ampl, and VIRS Chroma Phase. VIRS Chroma Ampl is reported as % Burst, and % Bar (when Bar is present on the composite VITS line) or in IRE. Samples are acquired from 32 consecutive occurrences of the VIRS, each separated by a frame.

VIRS Setup

Reference Black is measured from blanking level to setup level. Blanking level is the average of 16 consecutive sample values, centered around the sample located 2 microseconds before the 50% point of the pedestal leading-edge. Setup level is the average of 16 consecutive sample values, centered around the sample 42 microseconds after the 50% point of the pedestal leading-edge.

VIRS Luminance Ref.

Luminance Reference is measured from blanking level to the VIRS luminance reference level. Blanking level is the same as in the Setup measurement description above. The VIRS luminance reference level is the average of 16 sample values, centered around the sample located 30 microseconds after the 50% point on the pedestal leading-edge.

VIRS Chroma Ampl (Chrominance Amplitude)

Measured as the peak-to-peak amplitude of the VIRS chrominance packet. Peak-to-peak amplitude is the peak-to-peak amplitude of the four subcarrier cycles which are centered around the sample 12 microseconds after the 50% point on the pedestal leading-edge. The measurement result is reported as % Burst, and % Bar (when Bar is present on the composite VITS line) or in IRE.

VIRS Chroma Phase (Chrominance Phase)

Chrominance phase is measured as the difference between the VIRS chrominance packet phase and color burst phase. VIRS chrominance packet is measured over four subcarrier cycles centered around the sample 12 microseconds after the 50% point of the pedestal leading-edge. Burst phase is measured over four subcarrier cycles centered around the sample at the center of burst (which is midway between the 50% points on the leading- and trailing-edges of the sampled burst envelope).

Line Time Distortion and Pulse-to-Bar Ratio

(NTC Report Number 7 and CCIR Recommendation Number 569)

Line time distortion and pulse-to-bar ratio are measurements of linear waveform distortion. Samples are acquired from 32 occurrences of the NTC-7 or FCC Composite VITS, one frame apart.

Line Time Distortion

Line time distortion is measured as the peak-to-peak amplitude change along the bar top, excluding the first microsecond and the last microsecond. [NTC-7, Section 3.4]. Noise is reduced and any chrominance component eliminated from the signal by averaging 32 lines of video.

The line time distortion measurement is made along the average luminance signal bar top. A set of arithmetic means is calculated across the bar top, excluding one microsecond following the bar leading-edge 50% point and one microsecond before the bar trailing-edge 50% point. Each mean value summarizes the values of 12 consecutive samples (0.84 microseconds). The 12 samples used for each mean are overlapping, in that the last six samples of the first mean are also used as the first six samples of the second mean. For a typical bar top width, there will be 35 to 40 mean values calculated.

From the entire set of calculated means, the minimum and the maximum mean values are found. The peak-to-peak amplitude change along the bar top is the absolute difference between these two extreme mean values. Then,

Line time distortion = peak-to-peak amplitude difference/bar amplitude X 100

where bar amplitude is measured using the method previously explained.

Pulse-to-Bar Ratio

Pulse-to-bar ratio is measured as the peak amplitude of the 2T pulse, expressed as a % of the bar amplitude.

The peak amplitude of each of the 32 acquired 2T pulses is determined relative to blanking level. Blanking level is measured using the method previously explained. For FCC Composite VITS, the blanking level measurement is centered 2.1 microseconds before the bar leading-edge 50% point. For NTC-7 Composite VITS, the blanking level measurement is centered 10.9 microseconds after the bar trailing-edge 50% point.

Given the narrowness of the 2T pulse and the sampling frequency of the VM700 (four times subcarrier), only six to eight samples will be acquired from a 2T pulse. Also, in general, there will be no sample acquired exactly at the peak of the 2T pulse. An interpolation of the peak area is

performed for each pulse, and the result is used as the peak pulse amplitude. The 32 peak amplitude results are summed and averaged. Then,

Pulse-to-bar ratio = average 2T pulse peak amplitude/bar amplitude X 100

where bar amplitude is measured using the method previously explained.

2T Pulse K-factor and IEEE-511 ST Dist

(1T Leading-edge Short-time Distortion)

Thirty-two occurrences of the NTC-7 Composite VITS are acquired, each one frame apart.

2T Pulse K-factor

Measured as the greatest weighted amplitude of a positive-going or negative-going ringing half-wave, which either precedes or follows the 2T pulse and is within one microsecond of the center of the pulse.

The weighting graticule used is the CMTT International 2T Pulse Ringing graticule. The central vertical axis of the graticule is placed on the center line of the 2T pulse and extends one microsecond on either side of the 2T pulse. The central horizontal axis of the graticule (which separates positive ringing from negative ringing) is placed along a blanking level calculated as the arithmetic mean of four consecutive sample values centered at each point 1 ms to the left and to the right of the 2T pulse center.

IEEE-511 Short-Time Distortion

Measured as a weighted function of time, the results are the weighted peak deviation from flatness within 1 microsecond of the center of a lT bar transition. [ANSI/IEEE Std 511-1979, Section 4.4, Appendix B]. The measurements are made on the leading edge of the NTC-7 Composite VITS bar. Measurement results are reported in units of %SD.

S/N Measurements

(NTC Report Number 7 or CCIR Recommendation Number 567)

Five different signal-to-noise measurements are made by the VM700A using the CCIR Recommendations 567 Unified Filter Set: S/N NTC7 Unweighted, S/N NTC7 Lum-Weighted, S/N Unif Unweighted, S/N Unif Lum-Weighted, and S/N Periodic.

Acquisition and Analysis

The measurement routine acquires 32 full quiet lines from the vertical interval, the same line from each successive frame. The quiet line location is specified in the Measurement Locations file (the default location is field 1, line 12).

The data is analyzed for noise over all the data points in a 512 sample segment on each of the acquired lines. Each segment starts 20 microseconds past the 50% point on the leading-edge of line sync, which excludes sync from the analyses and uses only the data in the center of the quiet lines.

This provides 32 x 512, or 16,384 sample values for the noise analysis. This time-domain data is prepared and transformed by a Fast Fourier Transform (FFT) algorithm into the frequency domain. Values represented in the 1025 point frequency-domain array output by the FFT algorithm range from dc to 7.16 MHz.

Data "preparation" on the 16,384 samples prior to FFT transformation is performed differently on the S/N Periodic measurement than on the (random) S/N Unweighted and S/N Lum-Weighted measurements.

S/N Unweighted and S/N Lum-Weighted (Random Noise) Data Preparation

To significantly reduce periodic components from the S/N Unweighted and S/N Lum-Weighted measurements, the following processing techniques are employed:

The 512 sample arrays from the first four lines acquired are summed, which results in a 512 sample array with chrominance removed. The samples from the second four lines (acquired lines 5 through 8) are summed, the result is inverted, and then subtracted from the first four-line sum. This removes the luminance component and yields a resultant 512 sample array with virtually no chrominance or luminance components.

This sequence is repeated for the remaining three sets of eight lines. These four resultant 512 sample arrays are then set end to end to form the 2048 sample array on which an FFT is performed.

S/N Periodic Data Preparation

To enhance the periodic noise components of the signal for the S/N Periodic measurement, the following processing techniques are employed:

The 512 sample arrays from the first eight lines acquired are summed, which results in an intermediate 512 sample array with luminance component increased, but with the chrominance component removed.

The 512 sample arrays from the first eight lines acquired are summed again in the pattern "array#1 - array#2 + array#3 - array#4 ...." Because chrominance phase alternates 180° each frame, this increases the chrominance component to form a second intermediate 512 sample array.

The two intermediate arrays are summed to form a resultant 512 sample array with periodic noise components increased significantly more than the random noise component. This sequence is repeated for the remaining three sets of eight lines. The four resultant 512 sample arrays are then set end to end to form the 2048 sample array on which an FFT is performed.

Frequency Domain Array Filtering - Unweighted SNR

The frequency domain amplitude array for the Unweighted SNR measurement is multiplied by an unweighted noise filter, which is a software implementation of an industry-accepted hardware filter.

Frequency Domain Array Filtering - Luminance Weighted SNR

The frequency domain amplitude array for the Luminance Weighted SNR measurement is multiplied by a luminance weighted filter, which is also a software implementation of an industry-accepted hardware filter.

Frequency Domain Array Filtering - Periodic SNR

The frequency domain amplitude array for the Periodic SNR measurement is multiplied by an unweighted noise filter.

Frequency Domain Array Filtering - Unified Filter Set

The unweighted noise and luminance filters in this set comply with CCIR Recommendation 567.

The unweighted noise filter has a cutoff frequency of 5.0 MHz and is of the lumped-constant design. The filter is described in CCIR Rec. 567.

The Luminance Weighting filter has a much lower cutoff frequency than the Unweighted filter, and is derived directly from CCIR Rec. 567.

Measurement Results

Unweighted SNR and Periodic SNR are measured as the ratio, in dB, of bar amplitude to the unweighted rms amplitude of the noise on a quiet line. Luminance-Weighted SNR is measured as the ratio, in dB, of bar amplitude to the luminance-weighted rms amplitude of the noise on a quiet line. The results of the noise measurements are reported in dB, relative to bar amplitude, which is nominally 100 IRE. If the bar is not present on the composite VITS line, the results are scaled to 100 IRE, (100 IRE = 714 mV).

Chroma-Lum Delay and Chroma-Lum Gain

(NTC-7)

Samples are acquired from 32 occurrences of the Composite VITS, one frame apart. The location of Composite VITS, either FCC or NTC-7, is specified in the appropriate Measurement Locations file.

Chroma-Lum Delay

Measured as the time difference between the luminance component and chrominance component of the modulated 12.5T pulse. [NTC-7, Section 3.7].

The VM700 measures the time delay as the difference between the locations of the centers of the modulated 12.5T pulse luminance and chrominance components. The measurement result is positive if the chrominance pulse center location follows (lags) the luminance pulse center location.

To locate the center of the 12.5T pulse luminance component, the 32 acquired lines are averaged to eliminate the chrominance component and to reduce noise. The average luminance pulse is corrected for baseline tilt and is (software) low-pass filtered to insure the chrominance component is eliminated before the center of the luminance component is determined.

To locate the center of the 12.5T pulse chrominance component, the chrominance is summed over all 32 lines, band-pass filtered, and low-pass filtered (both software filters) to reduce noise and produce a chrominance envelope from which the center of the pulse chrominance component is determined.

Then, the chrominance/luminance delay inequality is computed as the difference between the chrominance envelope center location and the luminance pulse center location.

Chroma-Lum Gain

Measured as the peak-to-peak amplitude of the chrominance component of the modulated 12.5T pulse. [NTC-7, Section 3.6].

The peak-to-peak chrominance amplitude is measured on one subcarrier cycle at the center of the modulated 12.5T pulse after the luminance component has been removed.

Then,

C/L gain inequality = peak-to-peak chrominance amplitude/luminance amplitude X 100

Differential Gain, Differential Phase, Luminance Non-Linearity, Relative Burst Gain, and Relative Burst Phase

(NTC Report Number 7)

Video is routed through the hardware high-pass filter and then samples are acquired from 32 occurrences of the Composite VITS, one frame apart. The location of Composite VITS, either FCC or NTC-7, is specified in the appropriate Measurement Locations file.

The measurements are made at different locations on the linearity staircase part of the VITS. The measurement locations are determined by averaging eight of the 32 lines and locating the approximate centers of the six chrominance packets.

The actual measurements are made on 32 acquired lines, with each measurement window consisting of 16 consecutive samples (which represent four subcarrier cycles) centered in the chrominance packet.

Differential Gain

Differential Gain is measured as the difference between two peak-to-peak chrominance amplitudes: the amplitude of the modulated staircase chrominance packet with the largest such amplitude and the amplitude of the modulated staircase packet with the smallest such amplitude [NTC-7, Section 3.13]. The measurement result is expressed as a % of the largest packet amplitude.

Differential Phase

Differential phase is measured as the largest difference in phase between any two staircase chrominance packets [NTC-7, Section 3.14].

Lum Non-Linearity

[NTC-7, Section 3.9]

Video is routed through the hardware differential step filter and then samples are acquired from 32 occurrences of the Composite VITS, one frame apart. The location of Composite VITS, either FCC or NTC-7, is specified in the appropriate Measurement Locations file.

Luminance non-linearity is measured as the difference between the largest and smallest peaks. The peaks are created from the risers on the staircase by the differential step filter. The result is expressed as a % of the largest peak amplitude.

Relative Burst Gain

Relative burst gain is measured as the difference between the peak-to-peak chrominance amplitude of burst and the peak-to-peak chrominance amplitude of the chrominance packet that precedes the first riser of the staircase. [NTC-7, Section 5.2]. The result is expressed as a % of the packet amplitude.

The burst amplitude on a line is the peak-to-peak amplitude averaged over four subcarrier cycles in the center of burst.

Then,

Relative burst gain = (burst amplitude - packet amplitude)/packet amplitude x 100

Relative Burst Phase

Relative burst phase is measured as the difference in phase between the color burst and the packet that precedes the first riser of the staircase [NTC-7, Section 5.3].

Burst phase is measured over four subcarrier cycles in the center of burst, and is simply the difference in the phase angle of burst and the packet that precedes the first riser of the staircase.

Multiburst Measurements

Eight Multiburst measurement results are reported on either the FCC Multiburst or NTC-7 Combination test signals: multiburst flag amplitude (as a % Carr and % Bar) and the peak-to-peak amplitude of each of the six multiburst packets.

Samples are acquired from 32 occurrences of either the FCC Multiburst VITS or the NTC-7 Combination VITS, one frame apart.

The location of the multiburst test signal, either FCC or NTC-7, is specified by the Multiburst entry in the appropriate Measurement Locations file. Note that while the Auto mode display lists both groups of measurements (FCC and NTC-7), multiburst measurements can be made on only one of the two test signal at a time.

Multiburst Flag

The Multiburst flag measurements measure amplitude from back porch blanking level to the center point of the flag top [NTC-7, Section 3-8].

The back porch blanking level is the average of 16 consecutive sample values starting 1.5 microseconds before the 50% point of the flag leading edge. The flag top level is the average of 16 consecutive sample values starting with the sample midway between the 50% points of the flag leading and trailing edge. Flag amplitude is the difference between flag top level and blanking level.

Multiburst Packet

The multiburst packet amplitudes are measured as the peak-to-peak amplitude of each of the multiburst packets [NTC-7, Section 3-8]. The packet amplitudes are measured at fixed time offsets from the 50% point on the flag leading-edge.

NTC-7 20 IRE Chroma, NTC-7 80 IRE Chroma, NTC-7 Chr NL Phase, NTC-7 Chr-Lum Intmd

These four measurements are, respectively: chrominance non-linear gain distortion (20 IRE chroma and 80 IRE chroma with respect to the 40 IRE chroma), chrominance non-linear phase distortion, and chrominance-luminance intermodulation.

Samples are acquired from 32 occurrences of the NTC-7 Combination VITS, one frame apart. These measurements can only be made on the NTC-7 Combination VITS.

The measurements are made on the 20 IRE, 40 IRE, and 80 IRE chrominance packets. The location of the NTC-7 Combination VITS signal is specified by the NTC-7 Combination entry in the appropriate Measurement Locations file.

NTC-7 20 IRE Chroma, NTC-7 80 IRE Chroma

Measured as the peak-to-peak amplitude of the first (nominally 20 IRE) and third (nominally 80 IRE) chrominance packets in the 3-level chrominance test signal, referenced to the peak-to-peak amplitude of the middle packet (nominally 40 IRE) [NTC-7, Section 3-10].

The peak-to-peak amplitudes of each of the three packets is determined over eight subcarrier cycles on 32 lines.

NTC7 Chr NL Phase

Measured as the difference between the largest and the smallest phase values (measured relative to the phase of the 20 IRE packet) among the 3-level chrominance test signal subcarrier packets [NTC-7, Section 3-11].

The phase of each of the three packets is determined over eight subcarrier cycles on 32 lines.

NTC7 Chr-Lum Intmd

NTC-7 Chrominance-Luminance Intermodulation is measured as the maximum amplitude deviation of the 3-level chrominance test signal luminance pedestal from the part of the pedestal immediately preceding the 3-step chrominance packet [NTC-7, Section 3-15].

The luminance amplitudes of the filtered part of the pedestal is the average of 32 sample values centered around the sample at the center of each chrominance packet, after the chrominance component is removed. The luminance amplitude immediately preceding the 3-step chrominance packet is the average of 32 consecutive samples centered around the sample 1.5 microseconds before the 50% point of the 20-IRE chrominance packet leading edge.

ICPM

The Incidental Carrier Phase Modulation measurement is made on the staircase portion of either the FCC or NTC-7 Composite VITS signals. The Zero Carrier Pulse is required as an amplitude reference. This measurement requires that both the video output and the quadrature output of a demodulator be connected to the VM700. Video may be connected to either channel A or B, but the quadrature output must always be connected to the channel C input. The Zero Carrier Pulse must be enabled at the demodulator, and must be selected for use as a reference in the appropriate Measurement Locations file. The location of both the Zero Carrier Pulse and the Composite VITS, either FCC or NTC-7, are also specified in the appropriate Measurement Locations file.

Traditionally, ICPM has been an out-of-service measurement, made on a full field luminance staircase signal with no aural carrier present. The Auto mode ICPM measurement is an in-service measurement. To allow the ICPM measurement to be made in service, it is performed on an inserted Composite VITS signal with the demodulator's sound notch (sound trap) in, which eliminates the 4.5 MHz aural carrier.

Both the video and quadrature signals are routed through the hardware low-pass filter. The lines containing the Zero Carrier Pulse and the Composite VITS are acquired from 64 consecutive frames, for both the video input and the quadrature input. The pattern with which the lines are acquired is as follows.

The Zero Carrier Pulse and Composite VITS lines of the video input are acquired from the first frame.Next, the Zero Carrier Pulse and Composite VITS lines of the quadrature input are acquired from the second frame. This pattern repeats for 64 frames, resulting in the acquisition is four arrays, each containing 32 lines of data. Each set of 32 lines is then averaged.

Amplitudes of the sync tip, blanking at back porch, and each of the staircase steps are then determined by averaging 16 samples at the center of each of these areas. Amplitudes for the video signal's sync tip, blanking, and staircase steps are measured using video Zero Carrier level as the zero volts reference. Amplitudes for the quadrature signal's sync tip, blanking, and staircase steps are measured using quadrature Zero Carrier level as the zero volts reference.

The amount of ICPM (in degrees) for sync tip is the angle resulting from the vector sum of the quadrature sync tip amplitude and the video sync tip amplitude (ICPM = arctan [quadrature amplitude/video amplitude]). ICPM for blanking and each of the staircase steps is determined using the same method. Because the quadrature amplitude may be either positive or negative, the resultant angle may be either positive or negative.

Once the ICPM is determined for each point, the back porch ICPM value is subtracted from the ICPM value for each point, referencing the measurement to blanking. The ICPM value with the largest absolute value is then reported, in ÇMædegrees, by Auto mode.

SCH Phase

Subcarrier to horizontal sync phase is measured as the phase at the middle of burst relative to the 50% point on the leading-edge of sync.

Thirty-two full lines of active video are acquired, one line each from 32 successive frames. The first line acquired is field 1, line 50, and each successive acquisition occurs one frame plus 6 lines later (i.e., line 1 = frame 1 line 50, line 2 = frame 2 line 56). Sampling starts 160 samples earlier than normal (normal being 14 samples before the leading edge of sync).

To locate the 50% point on the leading-edge of sync, noise is reduced and any chrominance component eliminated by averaging the 32 acquired lines. The 50% point is located midway between blanking and sync tip levels on the average luminance signal. Blanking level is the arithmetic mean of eight consecutive sample values (0.56 microseconds), starting 3.6 microseconds after the approximate 50% point on the trailing-edge of sync. Sync tip level is the mean of 12 consecutive samples (0.84 microseconds) centered around the sample located midway between the approximate 50% points on the leading and trailing edges of sync.

To locate the subcarrier zero-crossing closest to the center of burst, the luminance component is filtered from one cycle of subcarrier (four sample values) at the center of burst. These four sample values are averaged over all 32 acquired lines, and are used to calculate the location of an average zero-crossing. Note that the reported result will always be between ±90°, and does not provide NTSC color field identification.

Field Time Distortion

Field Time Distortion is the only out-of-service measurement performed in Auto mode. Either the Field Square Wave or Window full field test signal is required.

Field Time Distortion is measured as the peak-to-peak deviation of the Field Square Wave or Window test signal pulse tops, excluding the first and last four lines of pulses, expressed as a per cent of the amplitude of the square wave located in the center of the field.

First, eight samples (at the approximate line center) of 128 lines per frame (every other line starting with field one line 25) are acquired over 32 frames. The 32 frames are summed and then the eight samples are averaged. This data is used to determine the start and stop lines of the square wave and the peak-to-peak deviation of the square wave amplitudes. The center line containing a square wave is determined from the start and stop lines.

Next, the center line containing a square wave is acquired over 32 frames. The 32 lines are summed and software low-pass filtered. Then the four samples at back porch are averaged to determine the back porch location. Then the four samples at the approximate square wave center are averaged to determine the center square wave amplitude relative to back porch. This value is used as the 100% square wave amplitude reference.

Then,

Field Time Distortion = Square Wave p-p deviation/Center Square Wave Amplitude x 100.

FCC Color Bars

(FCC Rules and Regulations Part 73.682)

Eighteen measurements are made on the FCC Color Bar VITS. All six color bars are measured for chrominance Amplitude Error, chrominance Phase Error, and Chr/Lum Ratio Error. Default limits for the FCC Color Bar measurement are contained in the End to End Auto limit file.

Thirty-two occurrences of the FCC Color Bar VITS are acquired, each one frame apart. Eight of these are used to determined the approximate locations of waveform features such as the center of burst, the center of the white bar, and the centers of the six color bars.

The approximate center locations of the color bars and the white bar are determined using one-sixth of the width of the color bar chrominance area as the width of each bar.

The white bar amplitude is measured as the difference between the arithmetic mean of sixteen consecutive sample values centered around the approximate center of the white bar and the arithmetic mean of sixteen consecutive sample values centered around the approximate center of the black step (7.5 IRE setup level).

Color Bar Amplitude Error

Each color bar amplitude error is measured as the deviation from nominal of the peak-to-peak chrominance amplitude of the color bar (expressed as a % of white bar amplitude). Each reported result is expressed as a % of the nominal value.

The peak-to-peak chrominance amplitude of each color bar is the average amplitude over the four cycles centered around the sample located at the approximate center of the color bar.

Color Bar Phase Error

Each color bar phase error is measured as the deviation from nominal of the sampled phase of the color bar (measured relative to burst phase). The reported result is expressed as degrees of deviation from the nominal phase. Burst phase and the phase of each color bar are measured over four cycles, centered around the approximate centers of burst and the color bar.

Chr/Lum Ratio Error

Each gain ratio error is measured as the deviation from nominal of the ratio of the peak-to-peak chrominance amplitude to the luminance level of each color bar relative to the black step. The reported result is expressed as a % of the nominal value.

The peak-to-peak chrominance amplitude of each color bar is determined as described in the color bar amplitude error measurement.

The luminance level of each color bar is the arithmetic mean of 16 consecutive sample values centered around the approximate center of the color bar luminance level relative to the black step.

Section 4
NTSC MEASUREMENT SPECIFICATIONS

This chapter lists the specifications for each NTSC measurement.

All accuracies shown for measurements with averaging capabilities assume the default averaging factor of 32.

All accuracies shown for measurements with "relative mode accuracy" assume an averaging factor of 256 was used to create the reference.

Table 4-1
Bar Line Time Measurement Specifications

Measurement	Range	Absolute Mode Accuracy	Relative Mode Accuracy
Bar Level	50 to 200 IRE	±0.5%	±0.2%
Sync Level	20 to 80 IRE	±0.5%	±0.2%
Sync to Bar Top	70 to 280 IRE	±0.5%	±0.2%
Sync/Bar Ratio	10% to 125% (100% nominal)	±0.5%	±0.2%
Bar Tilt (Rec 569)	0 to 20%	±0.2%	±0.1%
Line Time Distortion (Rec 567)	0 to 20%	±0.2%	±0.1%
Bar Width	10 µsec to 30 µsec	±100 nsec	NA

Table 4-2
Bounce Measurement Specifications

Measurement	Range	Accuracy
Peak Deviation	0 to 50%	±1%
Settling Time	0 to 10 sec	±100 msec

Table 4-3
Burst Frequency Measurement Specifications

Measurement	Range	Relative Mode Accuracy
Burst Frequency Error	±100 Hz	±0.5 Hz

Table 4-4
Chrominance-to-Luminance Gain and Delay Measurement Specifications

Measurement	Range	Absolute Mode Accuracy	Relative Mode Accuracy
Chrominance to Luminance Delay	±300 nsec	±5 nsec	±1.0 nsec
Chrominance to Luminance Gain Ratio	0 to 160%	±1.0%	±0.1%

Table 4-5
Chrominance Frequency Response Measurement Specifications

Measurement	Range	Absolute Mode Accuracy	Relative Mode Accuracy
Reference Amplitude	0 to 100 IRE	±1%	±0.5%
Frequency Response	0 to 100 IRE	±1%	±0.5%

Table 4-6
Chrominance Noise Specifications

Measurement	Range	Absolute Mode Accuracy
AM Noise	20 to 80 dB	±1 dB (20 to 60 dB)
PM Noise	20 to 70 dB	±1 dB (20 to 60 dB)

Table 4-7
Chrominance Non-Linearity Measurement Specifications

Measurement	Range	Absolute Mode Accuracy	Relative Mode Accuracy
Chrominance Amplitude	0 to 100%	1.0%	0.5%
Chrominance Phase	0 to 360°	1°	0.2°
Chrominance to Luminance Intermodulation	50 to 50%	0.2%	0.2%

Table 4-8
ColorBar Measurement Specifications

Measurement	Range	Absolute Mode Accuracy	Relative Mode Accuracy
Luminance Level	0 to 100 IRE (0 to 714.3 mV)	±0.5 IRE	±0.2%
Chrominance Level (excluding gray and black)	0 to 100 IRE (0 to 714.3 mV)	±1.0% of nominal	±0.2%
Chrominance Phase	±180° of nominal	±0.5° of nominal	±0.1°

Table 4-9
SMPTE Color Bar Nominal Values

Color	LUM (mV)	Chroma P-P (mV)	Phase (deg.)
Yellow	494.6	444.2	167.1
Cyan	400.4	630.1	283.4
Green	345.9	588.5	240.8
Magenta	256.7	588.5	60.8
Red	202.2	630.1	103.4
Blue	108.1	444.2	347.1

Table 4-10
Differential Gain and Phase Specifications

Measurement	Range	Absolute Mode Accuracy	Relative Mode Accuracy
Differential Gain	0 to 100%	±0.3%	±0.03%
Differential Phase	0 to 360°	±0.3°	±0.03°

Table 4-11
Frequency Response and Group Delay Specifications

Measurement	Range	Absolute Mode Accuracy	Relative Mode Accuracy
Frequency Response	±40 dB	±1.0 dB	±0.3 dB
Group Delay	±1.0 µsec	±20 nsec	±5 nsec

Table 4-12
Horizontal Blanking Specifications

Measurement	Range	Absolute Mode Accuracy
Blanking Start	0.1 to 4.2 µsec	±50 nsec
Blanking End	6.8 to 12.2 µsec	±50 nsec
Blanking Width	6.9 to 16.4 µsec	±50 nsec

Table 4-13
Horizontal Timing Specifications

Measurement	Range	Absolute Mode Accuracy
Burst Level	10 to 80 IRE	±0.5%
Horizontal Sync Rise and Fall Time	80 nsec to 1 µsec	±10 nsec
Horizontal Sync Width	3 to 7 µsec	±10 nsec
Burst Width	6 to 13 cycles	±0.1 cycles (FCC) ±0.5 cycles (RS-170A)
Sync to Burst Start (RS-170A)	4 to 10 µsec	±150 nsec
Sync to Burst End (FCC)	4 to 10 µsec	±25 nsec
Front Porch	0.1 to 3.5 µsec	±10 nsec (FCC) ±10 nsec (RS-170A)
Sync to Setup	8.8 to 13.0 µsec	±10 nsec
Breezeway (FCC)	0.1 to 5 µsec	±25 nsec
Sync Level	20 to 80 IRE	±0.5%

Table 4-14
Incidental Carrier Phase Modulation (ICPM) Measurement Specifications

Measurement	Range	Accuracy
ICPM (requires zero Carrier Pulse and the quadrature output of the demodulator on Channel C)	0 to 90°	±1.0°

Table 4-15
Jitter Measurement Specifications

Measurement	Range	Absolute Mode Accuracy
Jitter (2 Field)	±20 µsec	±10 nsec
Jitter Long Time	±20 µsec	±10 nsec

Table 4-16
K-Factor Measurement Specifications

Measurement	Range	Absolute Mode Accuracy
2T Pulse K-Factor	0 to 10% Kf	±0.3%
K_{PB}	-10 to +5% K_{PB}	±0.3%
Pulse to Bar Ratio	10 to 125%	±0.7%
Pulse Half Amplitude Duration (HAD)	100 to 500 nsec	±5 nsec

Table 4-17
Line Frequency Measurement Specifications

Measurement	Range	Accuracy
Line Frequency	±3%	±0.1%
Field Frequency	±3%	±0.1%

Table 4-18
Luminance NonLinearity Measurement Specifications

Measurement	Range	Absolute Mode Accuracy	Relative Mode Accuracy
Luminance Non-Linearity	0 to 100%	±0.4%	±0.2%

Table 4-19
Multiburst Measurement Specifications

Measurement	Range	Absolute Mode Accuracy	Relative Mode Accuracy
Reference Flag or Packet Amplitude	30 to 130 IRE	±1%	NA
Other Packets	–40 to +6 dB	±0.1 dB	±0.03 dB

Total Harmonic Distortion on packets must be ≤46 dB.

Table 4-20
Noise Spectrum Measurement Specifications

Measurement	Range	Absolute Mode Accuracy
Unweighted Signal-to-Noise Ratio (5 MHz Low Pass)	–20 to –80 dB	±0.4 dB (–20 to –60 dB) ±1.0 dB (–60 to –70 dB)
Weighted Signal-to-Noise Ratio (5 MHz Low Pass and Unified Weighting)	–20 to –80 dB	±1.0 dB (-20 to -60 dB) ±2.0 dB (-60 to –70 dB)

Table 4-21
SCH Phase Measurement Specifications

Measurement	Range	Absolute Mode Accuracy
SCH Phase	±90°	±5°

Table 4-22
Vertical Blanking Specifications

Measurement	Range	Absolute Mode Accuracy
Equalizing Pulse Width	80 nsec to 1 µsec	±10 nsec
Serration Pulse Width	80 nsec to 1 µsec	±10 nsec

AUTO MODE MEASUREMENTS

Table 4-23
RS-170A Horizontal Blanking Interval Timing Measurements

Measurement	Range	Accuracy	Test Signal
Color Burst Width	6 to 13 cycles	±0.1 cycles	Horizontal Blanking
Front Porch Duration	0.5 to 2 µsec	±20 nsec	Horizontal Blanking
Horizontal Blanking Width	6 to 30 µsec	±50 nsec	Horizontal Blanking
Horizontal Sync Rise Time and Fall Time	80 to 120 nsec 120 to 300 nsec 300 ns to 1.0 µsec	–10 to +30 nsec ±20 nsec ±30 nsec	Horizontal Blanking
Horizontal Sync Width	1 to 8 µsec	±10 nsec	Horizontal Blanking
SCH Phase	±90°	±5°	Horizontal Blanking
Sync to Setup	5 to 18 µsec	±20 nsec	Horizontal Blanking
Sync to Start of Burst	4 to 8 µsec	±140 nsec (0.5 cycles) ±20 nsec	Horizontal Blanking

Table 4-24
RS-170A Verticla Blanking Interval

Measurement	Range	Accuracy	Test Signal
Equalizing Pulse Width	1 to 20 µsec	±10 nsec	Vertical Blanking
Serration Width	1 to 20 µsec	±10 nsec	Vertical Blanking
Vertical Blanking Width	19 to 29 lines	–0.1 lines to +0.2 lines	Vertical Blanking

Table 4-25
FCC Horizontal Blanking Interval Timing Measurements

Measurement	Range	Accuracy	Test Signal
Breezeway Width	0.2 to 3.5 µsec	±25 nsec	Horizontal Blanking
Color Burst Width	6 to 13 cycles	±0.1 cycles	Horizontal Blanking
Front Porch Duration	0.5 to 2 µsec	±10 nsec	Horizontal Blanking
Horizontal Blanking Width	6 to 30 µsec	±10 nsec	Horizontal Blanking
Horizontal Sync Rise Time and Fall Time	80 to 120 nsec 120 to 300 nsec 300 ns to 1.0 µsec	–10 to +30 nsec ±20 nsec ±30 nsec	Horizontal Blanking
Horizontal Sync Width	1 to 8 µsec	±10 nsec	Horizontal Blanking
Sync to Setup	5 to 18 µsec	±20 nsec	Horizontal Blanking
Sync to End of Burst	6 to 15 µsec	±20 nsec	Horizontal Blanking

Table 4-26
FCC Vertical Blanking Interval Timing Measurements

Measurement	Range	Accuracy	Test Signal
Equalizing Pulse Width	25 to 100% of nominal horizontal sync pulse width	±0.3%	Vertical Blanking
Serration Width	1 to 20 µsec	±10 nsec	Vertical Blanking
Vertical Blanking Width	19 to 29 lines	–0.1 lines to +0.2 lines	Vertical Blanking

Table 4-27
Frequency Response Measurements

Measurement	Range	Accuracy	Test Signal
Multiburst Flag Amplitude	0 to 90% of Maximum Carrier (20 to 130% of Bar when Zero Carrier is not used and 20 to 130 IRE when Zero Carrier and Bar are not used)	±0.5% for Zero Carrier (±0.5% for Bar and ±0.5 IRE for no Zero Carrier and no Bar)	FCC Multiburst or NTC-7 Combination
Multiburst Packet Amplitudes	0 to 100% of Flag	±1% of Flag	FCC Multiburst or NTC-7 Combination

Table 4-28
Incedental Carrier Phase Modulation Specifications

Measurement	Range	Accuracy	Test Signal
ICPM (requires Zero Carrier Pulse and the quadrature output of the demodulator on channel C)	0 to 30°	±1.0°	FCC or NTC-7 Composite

Table 4-29
ColorBar Measurements

Measurement	Range	Accuracy	Test Signal
Color Bar Amplitude Errors	±100% of nominal	±1.0%	FCC Color Bars
Color Bar Phase Errors	±180° from nominal	±0.5°	FCC Color Bars
Color Bar Chrominance to Luminance Gain Ratio	0 to 200% of nominal	±2%	FCC Color Bars

Table 4-30
Out-of-Service Measurement Specifications

Measurement	Range	Accuracy	Test Signal
Field Time Distortion	0 to 40%	±0.5%	Field Square Wave

Table 4-31
Amplitude and Phase Measurement Specifications

Measurement	Range	Accuracy	Test Signal
Average Picture Level (APL)	0 to 200%	±3.0%	Full Field
Bar Top	0 to 90% of Maximum Carrier	±0.1%	FCC/NTC-7 Composite
Bar Amplitude	0 to 200 IRE	±0.3 IRE	FCC/NTC-7 Composite
Chrominance to Luminance Delay (Relative Chroma Time)	±300 nsec	±5 nsec	FCC/NTC-7 Composite
Chrominance to Luminance Gain (Relative Chroma Level)	0 to 160%	±1%	FCC/NTC-7 Composite
Differential Gain	0 to 100%	±0.3%	FCC/NTC-7 Composite
Differential Phase	0 to 360°	±0.3°	FCC/NTC-7 Composite
Luminance Non-linear Distortion	0 to 50%	±0.4%	FCC/NTC-7 Composite
Relative Burst Gain	±100%	±0.3%	FCC/NTC-7 Composite
Relative Burst Phase	±180°	±0.3°	FCC/NTC-7 Composite
Burst Amplitude (% of sync)	25 to 200% of sync	±1.0%	Horizontal Blanking
Burst Amplitude (% of Bar)	10 to 80% of Bar (10 to 80 IRE when Bar is not used)	±0.4% (±0.4 IRE)	Horizontal Blanking
Sync Amplitude (% of Bar)	20 to 80% of Bar (20 to 80 IRE when Bar is not used)	±0.3% (±0.3 IRE)	Horizontal Blanking
Blanking Level	0 to 90% of Maximum Carrier	±0.2%	Horizontal Blanking
Sync Variation	0 to 50% of Maximum Carrier (0 to 50% of Bar when Zero Carrier is not used and 0 to 50 IRE when Zero Carrier and Bar are not used)	±0.3% for Zero Carrier (±0.3% for Bar and ±0.3 IRE for no Zero Carrier and no Bar)	Horizontal Blanking
Blanking Variation	0 to 50% of Maximum Carrier (0 to 50% of Bar when Zero Carrier is not used and 0 to 50 IRE when Zero Carrier and Bar are not used)	±0.3% for Zero Carrier (±0.3% for Bar and ±0.3 IRE for no Zero Carrier and no Bar)	Horizontal Blanking

Table 4-32
Waveform Distortion Measurement Specifications

Measurement	Range	Accuracy	Test Signal
Line Time Distortion	0 to 40% of Bar	±0.2%	FCC or NTC-7 Composite
Pulse to Bar Ratio	10 to 125%	±0.7%	FCC or NTC-7 Composite
Short Time Waveform Distortion (IEEE 511)	0 to 25% SD	±0.5% SD	NTC-7 Composite
Chrominance Non-linear Gain Distortion	5 to 35 IRE (20 IRE chroma) 45 to 160 IRE (80 IRE chroma)	±0.4 IRE	NTC-7 Combination
Chrominance Non-linear Phase Distortion	0 to 360°	±1.0°	NTC-7 Combination
Chrominance to Luminance Intermodulation	±50 IRE	±0.2 IRE	NTC-7 Combination
2T K-Factor	0 to 10% Kf	±0.3% Kf	FCC or NTC-7 Composite

Table 4-33
VIRS Measurements

Measurement	Range	Accuracy	Test Signal
VIRS Setup (Reference Black)	–20 to +130% of Bar (–20 to +130 IRE when Bar is not used)	±0.2% (±0.5 IRE when Bar is not used)	VIRS
VIRS Chrominance Reference Amplitude	0 to 200% of burst amplitude (0 to 80% of Bar when burst is not used and 0 to 80 IRE when burst and bar are not used)	±1% (±0.1% when burst is not used and ±1 IRE when burst and bar are not used)	VIRS
VIRS Chrominance Phase Relative to Burst	±180°	±0.5°	VIRS
VIRS Luminance Reference	30 to 100% of Bar (30 to 100 IRE when bar is not used)	±0.2% (±0.2 IRE)	VIRS

Table 4-34
Signal-to-Noise Ratio Measurements

Measurement	Range	Accuracy	Test Signal
Unified Unweighted SNR	26 to 60 dB 61 to 70 dB	±1.0 dB ±2.0 dB	Quiet Line
Unified Luminance Weighted SNR	26 to 60 dB 61 to 70 dB	±1.0 dB ±2.0 dB	Quiet Line
NTC 7 Unweighted SNR	26 to 60 dB 61 to 70 dB	±1.0 dB ±2.0 dB	Quiet Line
NTC 7 Luminance Weighted SNR	26 to 60 dB 61 to 70 dB	±1.0 dB ±2.0 dB	Quiet Line
Periodic SNR	26 to 60 dB 61 to 70 dB	±1.0 dB ±2.0 dB	Quiet Line

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VM700A OPT 01 Problem Report Form

Name:

Company:

Address:

City: **State:** **Zip:**

Country:

Instrument Serial # (found on rear of instrument):

Firmware Version (found on rear of instrument):

Hardware Version (found on rear of instrument):

Problem Description:

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Manual
At
Perforation

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