OPERATING MANUAL

WAVETEK
ROCKLAND

MODEL 7530A
FFT SPECTRUM ANALYZER

WAVETEK
ROCKLAND

OPERATING MANUAL

MODEL 7530A

FFT SPECTRUM ANALYZER

Manual Part Number: 800-6301

[redacted]ROCKLAND, INC.

Ballantine
ROCKLAND
9 Saddle Rd. Cedar Knolls, NJ 07927
T: (201) 984-1900 F: (201) 984-1479

CERTIFICATION

Wavetek Rockland, Inc. certifies that this equipment was thoroughly tested and inspected prior to shipment and found to meet or exceed its published specifications.

WARRANTY AND ASSISTANCE

Wavetek Rockland, Inc. warrants this equipment to be free from defects in workmanship and material under normal use and service; and any part proving defective in workmanship or material within one year from the date of shipment will be repaired or replaced without charge, provided the equipment is returned to our factory with transportation charges prepaid and our examination discloses such part to be defective.

No equipment is to be returned to us without our prior authorization.

We are not responsible for work done, material furnished, or repairs made by others, unless agreed to by us in writing.

We do not warrant any other apparatus or attachment supplied by us which is not of our own manufacture, inasmuch as it is warranted by its own manufacturer.

No other warranty is expressed or implied. We are not liable for consequential damages.

For any assistance, contact your nearest Wavetek Rockland Sales Representative, or the factory.

TABLE OF CONTENTS

Paragraph | Page

SECTION I - GENERAL INFORMATION

1-1 Introduction 1-1
1-2 Inspection 1-1
1-3 Installation 1-2
1-4 Characteristics 1-2
1-5 Specifications 1-4

SECTION II - A TOUR OF THE FRONT PANEL CONTROLS

2-1 The 3-Knob Cluster: Sensitivity, Resolution (Span) and Starting Frequency 2-1
2-2 The Input Cluster 2-4
2-3 The Display Cluster 2-4
2-4 The Cursor Cluster 2-7
2-5 The Processing Cluster 2-11
2-6 The Triggering Cluster 2-12
2-7 The Data Sampling Control 2-16

SECTION III - INSTALLATION, ADJUSTMENTS AND INSTRUMENT VERIFICATION

3-1 Installation 3-1
3-2 Adjustments for Calibrating the Display 3-1
3-3 Instrument Verification 3-4

SECTION IV - A LESSON IN THE USE OF THE FRONT PANEL CONTROLS

4-1 Initial Set-Up 4-1
4-2 The 3-Knob Cluster: Sensitivity, Resolution and Starting Frequency 4-1
4-3 The Input Cluster 4-6
4-4 The Display Cluster 4-6
4-5 The Cursor Cluster 4-18
4-6 The Processing Cluster 4-21
4-7 The Triggering Cluster 4-23

SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION

The Rockland 7530A Spectrum Analyzer is a unique new instrument. It provides, in a compact plug-in module, the quantitative analytical capability of modern all-digital, FFT-based spectrum instrumentation, but with greatly simplified and streamlined operation.

When using the 7530A, there is no need for extensive study and training in the operating complexities of an FFT-based analyzer. In less than an hour, anyone familiar with any of the older types of spectrum analyzers can completely master the Model 7530A. A special effort has been made, in the design of the control interface, to create a one-to-one correspondence between the controls of a swept-filter analyzer and those on the Model 7530A...in name as well as function. This was achieved through the use of a separate microcomputer (distinct from the high-speed spectrum-processing computer) to provide an "intelligent interface" between the control-panel elements and the instrument's data-processing functions.

This second computer provides an unprecedentedly high degree of automation in control interpretation and display management, greatly simplifying initial setup, and reducing the operator's activity to the use of three knobs, familiar to any user of the conventional spectrum analyzer: Sensitivity, Span, and Tuning.

The basic capabilities of the Rockland 7530A may be summarized as follows: over the frequency range from 0 to 100 KHz, the components of the Fourier spectrum are quantitatively measured, and computed as a true power spectrum. The complete DC - 100 KHz spectrum is displayed as the Background, at deliberately reduced intensity, except for a brightened portion ("analysis window", or "Span") selected for detailed study. This recomputed, detailed spectrum is presented, at full intensity, as the Foreground display. Both spectra have 200-line resolution. At the normal internal clock rate of the instrument, and at the minimum span of 200 Hz, this provides foreground resolution of 1 Hz up to 100 KHz. At reduced processing rates (via external clock), resolution may be increased as a tradeoff against processing speed.

High-resolution analysis is performed at speeds one to two orders of magnitude faster than swept-filter analyzers. In addition, transient waveforms may be captured and analyzed.

1-2. INSPECTION

This instrument was carefully inspected and tested prior to shipment. It was operated for a number of hours to reduce the probability of early failure. After unpacking the unit, inspect it carefully for shipping damage. Check especially for broken controls and connectors,

1-2. INSPECTION - continued

and dented or scratched cabinet parts. Should the instrument show any signs of damage, file a claim with the carrier immediately. Preserve the carton and packing materials; they will be required by the carrier.

It is recommended that conformance to specifications be verified upon receipt. In case of discrepancies, refer to the warranty at the beginning of this manual.

1-3. INSTALLATION

Model 7530A is designed to operate as a three-bay plug-in for the Tektronix® Series 7000 Mainframes; in the case of Mainframes with four-bay capability, the 7530A is installed into the three left compartments. Ambient temperature should not exceed +40 °C while the system is in operation.

CAUTION
Insert and remove plug-in only with power off, otherwise serious damage to the mainframe or plug-in may result.

In keeping with standard safety practice, the case of the instrument is grounded through the mainframe. For complete instructions on installation and display calibration, refer to Section III of this Manual.

WARNING
7000 Series Oscilloscopes should not be transported with plug-in installed, otherwise the Mainframe/Plug-in mating connectors may be damaged.

1-4. CHARACTERISTICS

DISPLAY CHARACTERISTICS

TYPE: Unmodified Tektronix® Series 7000 Mainframe, all models.
DATA DISPLAYED: Instantaneous or smoothed power spectrum (Foreground/Background) or input time function.

SECTION II

A TOUR OF THE FRONT PANEL CONTROLS

This section describes the function of the front panel controls. When used in conjunction with Section IV - "A Lesson in the Use of the Front Panel Controls", it will help the operator familiarize himself with the operation of the 7530A.

2-1. THE 3-KNOB CLUSTER: SENSITIVITY, RESOLUTION (SPAN) and STARTING FREQUENCY (Fig. 2-1)

(1) Full Scale Sensitivity - V rms

Rotary control selects input sensitivity in 10 dB steps. The full scale ranges are:

Full Scale Sensitivity	(Readout)	Recommended Coupling
0.32 mV rms	(-70 dBV)	AC
1.0	(-60 dBV)	↓
3.2	(-50 dBV)	↓
10	(-40 dBV)	AC or DC
32	(-30 dBV)	↓
.10 V rms	(-20 dBV)	↓
.32	(-10 dBV)	↓
1	(0 dBV)	↓
3.2	(+10 dBV)	↓
10	(+20 dBV)	↓
TEST	(0 dBV)	↓

Center control is a continuous 10 dB attenuator which is calibrated in the fully CW detented direction. When it is not in the CAL position, the cursor amplitude readout and full scale amplitude on the CRT will have a " > " before these numbers. TEST position results in the 7530A generating a 2 KHz triangular waveform which is applied at the input of the instrument.

(2) Input Overload

LED indicates that the input signal exceeds about 95% full scale. In normal use, the FULL SCALE SENSITIVITY controls are adjusted until the LED extinguishes.

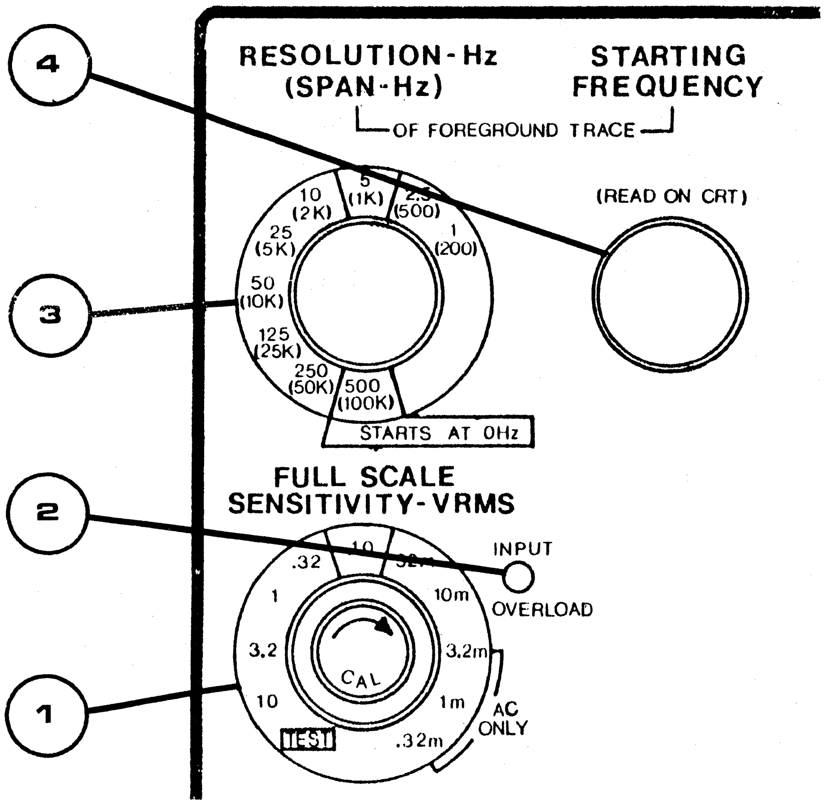


Fig. 2-1 The 3-Knob Cluster: Sensitivity, Resolution (Span) and Starting Frequency

(3) Resolution - Hz (Span - Hz)

Simultaneously selects analysis window and resolution bandwidth. The ranges are:

Resolution - Hz	Span - Hz
500	100K
250	50K
125	25K
50	10K
25	5K
10	2K
5	1K
2.5	500
1	200

As the SPAN is changed, the center frequency is held fixed. Exception: If the SPAN starts at 0 Hz, then 0 Hz starting frequency is maintained as the SPAN is changed.

(4) Starting Frequency

This knob allows the operator to set the starting frequency of the analysis window (SPAN) in 500 Hz increments on the 50 KHz and 25 KHz spans. The increments are 100 Hz on all other SPANS.

The processor alternates between analyzing the 0 - 100 KHz window, and the selected analysis window. The 0 - 100 KHz window can be displayed. It will appear dimmer, except for the region corresponding to the selected SPAN as seen in Fig. 2-2.

If the STARTING FREQUENCY or the SPAN is changed while processing data, only the 0 - 100 KHz background is displayed and processed, and the word (TUNING) will be written on the screen. When a time-out detects that the operator is not changing either control, (TUNING) is removed from the CRT. The averager memory of the foreground display is cleared, and processing for the active trace is started. The 0 - 100 KHz analysis continues undisturbed.

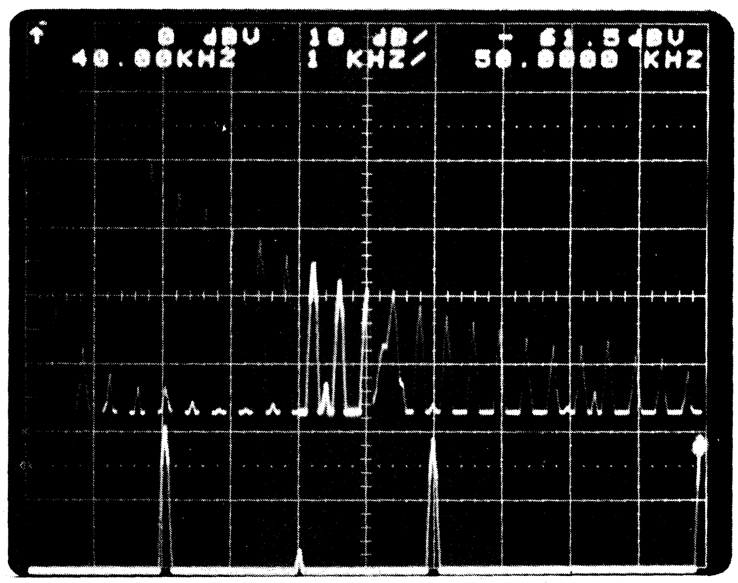


Fig. 2-2 BACKGROUND (dimmer intensity): 0 - 100 KHz with selected 10 KHz SPAN (brighter intensity)

FOREGROUND (brighter intensity): Starting Frequency at 40.0 KHz. Span 40.0 KHz to 50.0 KHz

2-2. THE INPUT CLUSTER (Fig. 2-3)

5 Input

Is a single-ended BNC with its ground tied to the chassis and power ground. The maximum input is ± 100 Volts dc.

6 Coupling

This switch permits the selection of input couplina to be either DC or AC with 0.5 Hz cutoff and a 12 dB/octave rolloff. DC is recommended when analyzing transient signals.

7 Impedance

This switch selects either 1 Megohm or 600 Ohm input resistance. In the 1 Megohm position, the amplitude reference is 1 V rms, while in the 600 Ohm position, it is 1 mW into 600 Ohm.

8 Option

Is a 20-pin connector to be used with future accessories.

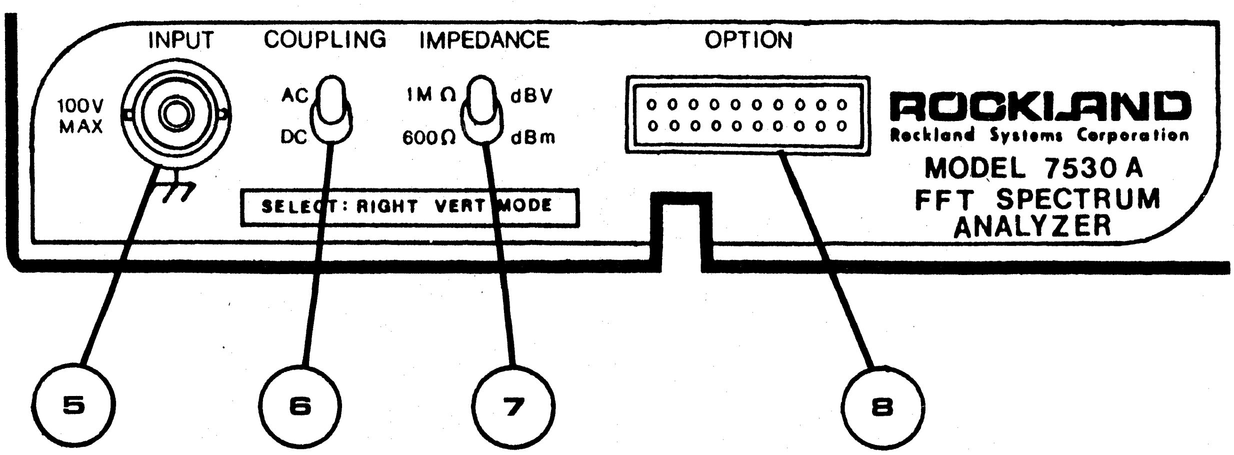


Fig. 2-3 The Input Cluster

2-3. THE DISPLAY CLUSTER (Fig. 2-4)

9 View

Selects spectrum or the input time function for viewing. Up to 2 spectra can be seen simultaneously. The foreground (brighter intensity) is the

2-3. THE DISPLAY CLUSTER (Fig. 2-4) - continued

(9) View - continued

active or most recently processed spectrum. The background (dimmer intensity) can be selected to be 0 - 100 KHz, a stored spectrum, or it can be blanked.

In the TIME position the unprocessed input time signal is observed when the SPAN is in the 0 - 100 KHz range. On all other SPANS, the displayed time function corresponds to the output of a filter whose bandwidth nominally equals the selected SPAN, and its lower edge corresponds to the STARTING FREQUENCY. The filter's output is then sampled at a rate equal to 2.56 times the SPAN setting, and is stored in the memory of the 7530A. The effect of sampling is described by the example in Section IV, 4-1. The displayed TIME also corresponds to the most recently acquired input signal.

Data is collected for a length of time equal to the reciprocal of the resolution. For example, on the 100 KHz SPAN, the resolution is 500 Hz and the data block is thus 2 msec long. This data block is displayed in the TIME position, except for the 200 Hz full SPAN, where only the first-half (1/2 second) is available for display.

(10) Spectrum Amplitude

Selects the vertical scale units for spectrum to be either 10 dB/div, 5 dB/div or LINEAR (V rms).

(11) Spectrum Gain

Is a momentary switch. Each jogging of the switch up will offset the display in 10 dB steps up to 40 dB on the 10 dB/div SPECTRUM AMPLITUDE setting, and 20 dB steps on the 5 dB/div setting. When LINEAR scale is selected, the vertical sensitivity can be increased from x 1 to x 5, x 10, x 50 or x 100.

The gain change will affect both spectra if the background is displayed. As the gain changes, the full scale readout also changes. The symbol G, written next to the full scale amplitude readout on the CRT, indicates that the offset is other than 0 dB or gain more than x 1.

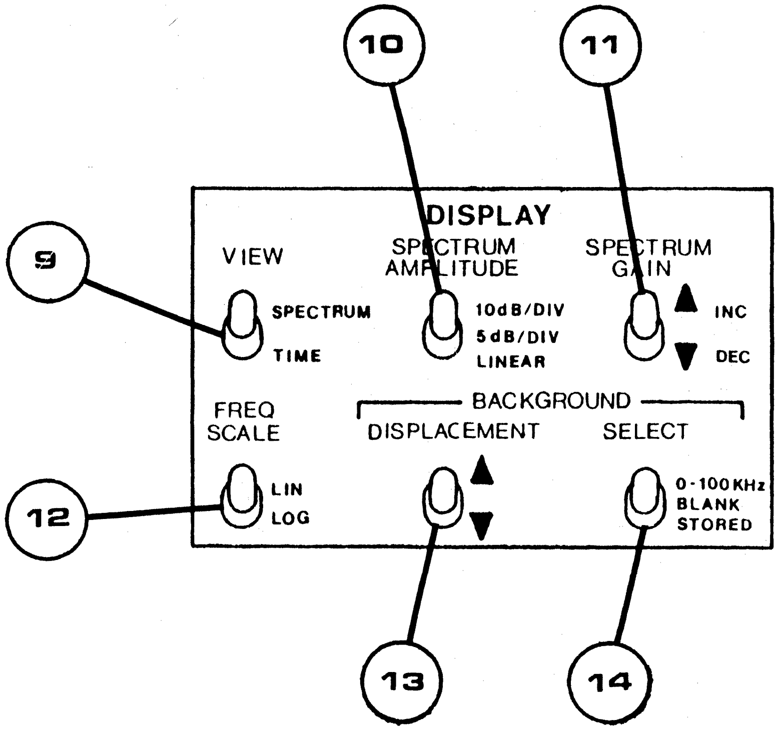
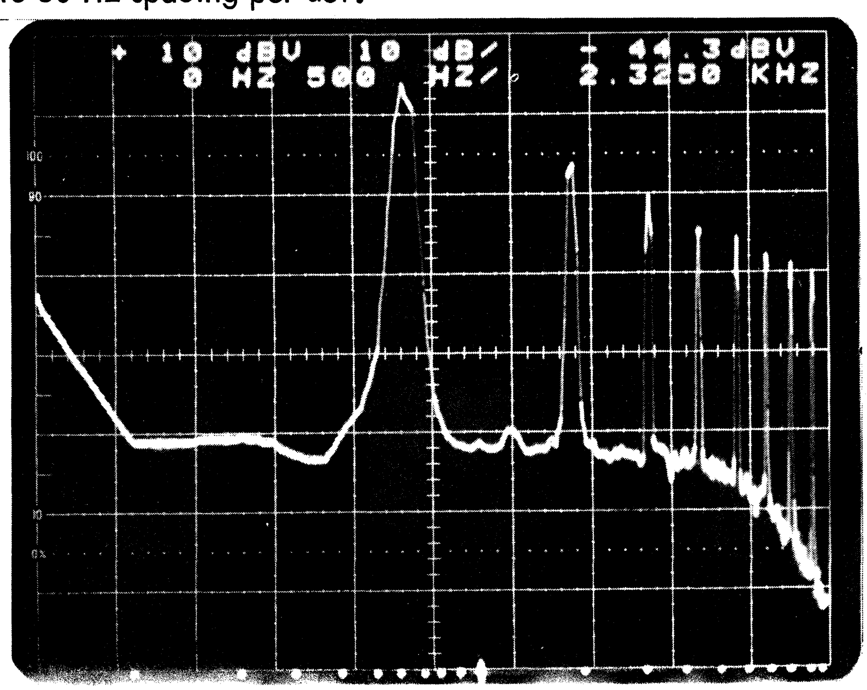


Fig. 2-4 The Display Cluster

(12) Frequency Scale

Selects either linear or logarithmic frequency axis. When LOG axis is selected, a frequency axis with two decades of markers is also displayed. See Fig. 2-5. The vertical tick mark on the frequency axis is equal to 1/10 of the Span plus the value of the Starting Frequency.

Since the linear axis was 500 Hz/DIV, this vertical tick mark is at 500 Hz. The dots to the right of the tick mark are 500 Hz apart. The dot markers to the left of the tick mark subdivide the 500 Hz decade into 50 Hz spacing per dot.



(13) Displacement

This is a 3-position momentary switch which is off in the center position. Moving the switch either up or down will correspondingly move the background spectrum display in order to avoid interference with the active display. An ↑ or ↓ appears next to the full scale amplitude readout indicating the direction that the background is displaced.

(14) Select

This switch permits choosing the spectrum corresponding to the background to be either the 0 - 100 KHz analysis, a blanked display, or a stored spectrum The background spectrum appears with dimmer intensity except in the region corresponding to the selected analysis region of the 0 - 100 KHz display.

2-4. THE CURSOR CLUSTER (Fig. 2-6)

(15) Position

Controls the direction of the cursor's marker. The marker is a short vertical line "riding " on the selected trace.

(16) Reads

Selects the cursor to read either the FOREGROUND, BACKGROUND or NEITHER spectrum display. All readouts on the CRT correspond to the selected trace.

Examples of the different readouts are shown in Fig. 2-7.

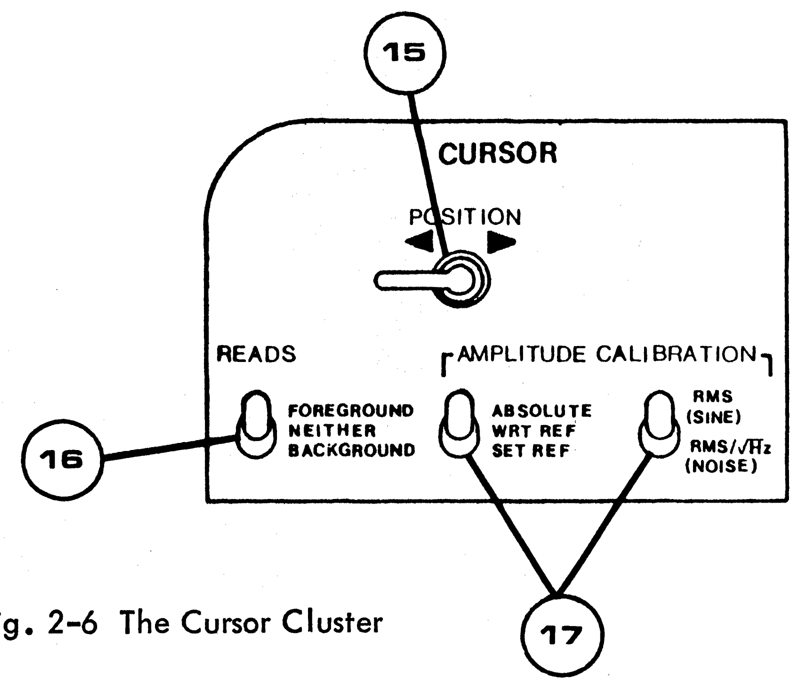


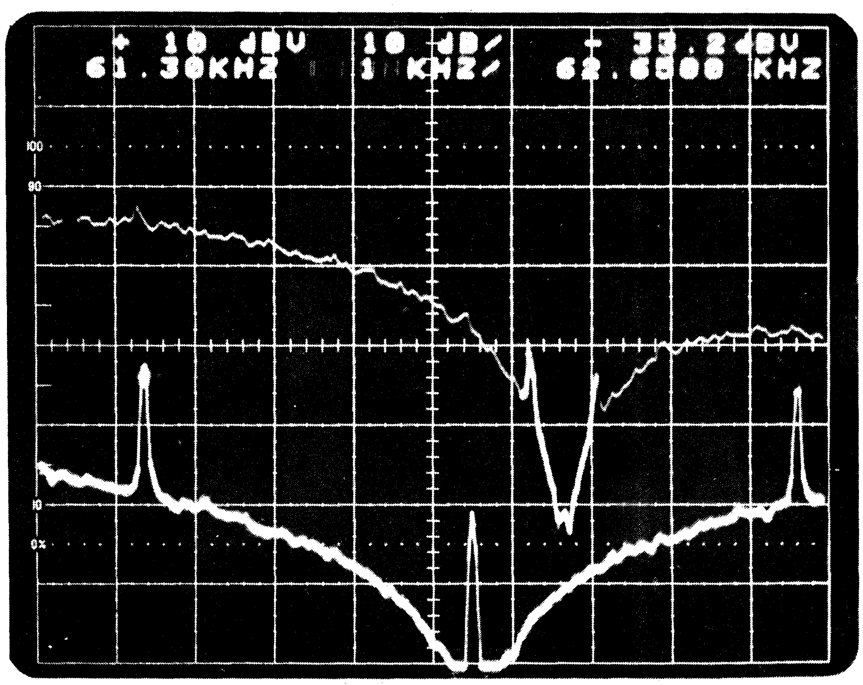
Fig. 2-6 The Cursor Cluster

(17) Amplitude Calibration

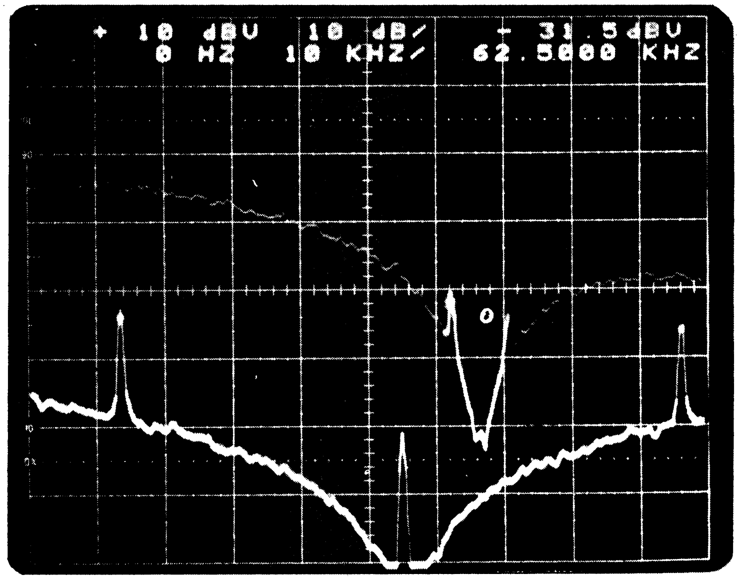
Consists of two switches. a) One switch establishes that the spectrum amplitude will be referenced to either 1 V rms (or 1 mW into 600 Ohm), or a reference signal defined by the cursor. In the ABSOLUTE position, the amplitude readout is relative to V rms (or 1mW) while in the WRT REF position, it is with respect to the amplitude selected when the toggleswitch was momentarily set to SET REF. The referenced amplitude will be set equal to the point where the cursor marker is positioned.

When TIME is displayed, and the switch is set to ABSOLUTE, the cursor readout is in volts. The display is bipolar as indicated by the $\pm$ sign next to the full scale amplitude reading. Selecting SET REF will define the cursor amplitude to be 1, and cursor readings will be relative to that reference.

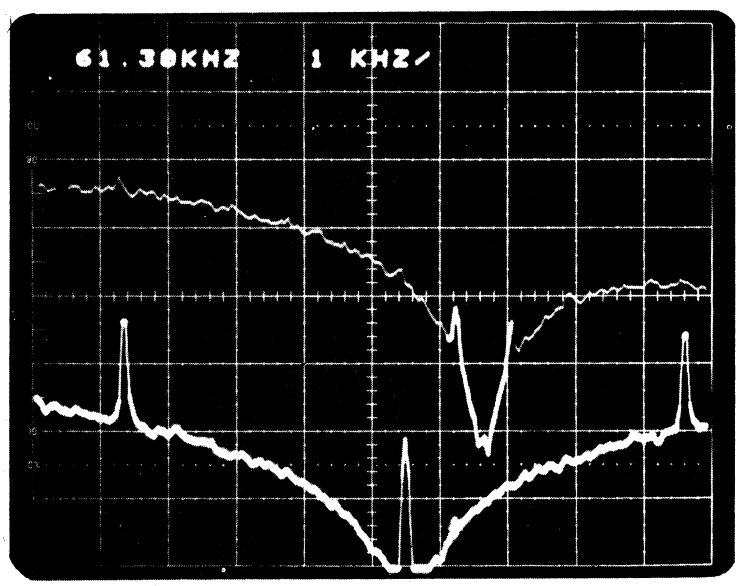
b) The second switch determines whether the readout is RMS units, or RMS units normalized to a 1 Hz bandwidth (RMS / $\sqrt{\text{Hz}}$). RMS readouts are appropriate for deterministic signals, e.g., sinewaves. RMS / $\sqrt{\text{Hz}}$ is useful for random signals, e.g., white noise, whose average spectrum over a resolution bandwidth is nearly flat. It permits comparison of measurements of random signals analyzed with different bandwidths.



a) Cursor Reads Foreground. Background is 0 - 100 KHz

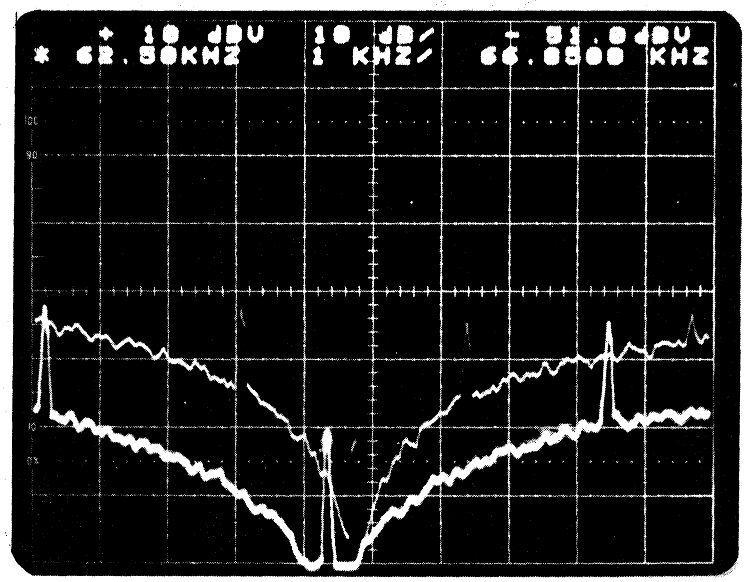


b) Cursor Reads Background

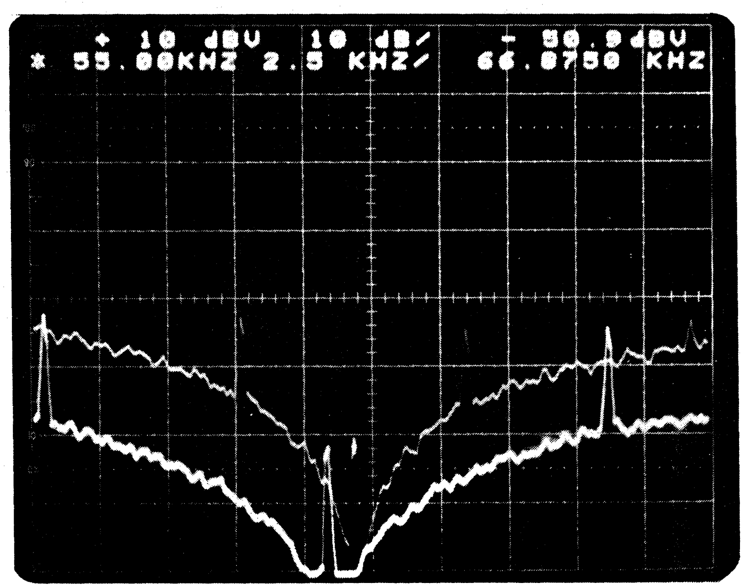


c) Cursor Reads Neither

Fig. 2-7 Continued



d) Cursor Reads Foreground. Stored Spectrum in Background. Asterisk (*) indicates Foreground was analyzed using different front panel settings from Background.



e) Same Display as d). Cursor Reads Background

2-5. THE PROCESSING CLUSTER (Fig. 2-8)

18 Smoothing

Determines the number of independent spectral samples that will be ensemble-averaged in order to improve the estimate of the average amplitude of each spectral element. It is also useful as an aid in the detection of periodic signals in noise. The smoothing is performed digitally and therefore, with high precision.

Two forms of smoothing are performed. The first corresponds to a linear average followed by an exponential average which is equivalent to low-pass RC smoothing filter. The change from linear to exponential averaging occurs when the number of spectra averaged equals the time constant selected. Moving clockwise, the time constants are NONE, 2, 8, 16, 32, 128 and MAX corresponds to 256. Typically, a time constant equal to 32 (pointer at 12 o'clock) is used to produce smooth displays.

The amount of smoothing obtained is related to the time constant selected. With respect to white noise, the effectiveness of smoothing can be expressed as the normalized standard error which is the ratio of the random error (standard deviation) to the true value. The following table summarizes the effectiveness of smoothing white noise when linear averaging is completed, and also after a number of time constants of exponential averaging have elapsed.

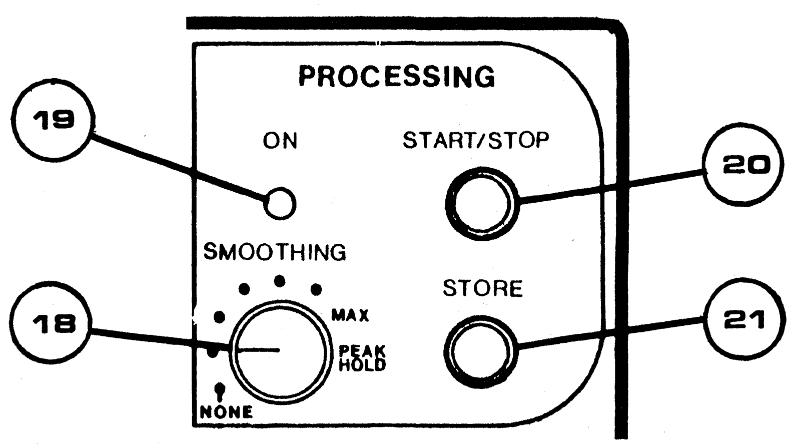


Fig. 2-8 The Processing Cluster

Table 2-A: EFFECTIVENESS OF SMOOTHING FOR WHITE NOISE

Time Constant	Standard Error For Linear Smoothing -%	Standard Error For Exponential Smoothing -%
None	100	100
2	71	50
8	35	25
16	25	17.7
32	17.7	12.5
128	8.8	6.25
256 (MAX)	6.25	4.4

The smoothing algorithm starts the average near its full value. As more measurements are averaged, the randomness is reduced. If smoothing is stopped during the linear average, the value displayed will be near its correct value.

PEAK HOLD position results in storing the maximum value at each frequency element from the time the processor was started until it is stopped by the operator.

19 On

LED will flash during the linear averaging cycle and stay on when in the exponential averaging mode. It goes off when averaging is stopped.

20 Start/Stop

When pressed it initiates processing of data; if the processor was already active, it stops processing.

21 Store

Stores the active or most recently processed spectrum when it is pressed. It can be initiated when the processor is active or stopped.

2-6. THE TRIGGERING CLUSTER (Fig. 2-9)

22 Source

Is a 3-position switch which determines the signal source which will initiate spectrum analysis.

FREE RUN permits continuous processing under internal control.

2-6. THE TRIGGERING CLUSTER (Fig. 2-9) - continued

(22) Source - continued

INPUT SIG corresponds to internally connecting the input signal to the triggering input.

EXT TRIG permits connecting an external signal to a BNC through which the triggering signal may be applied.

The INPUT SIG and EXT TRIG positions are generally used for analysis of transients.

(23) Arm Mode

Is a three position switch used to determine the state of the triggering circuitry when the trigger source is INPUT SIG or EXT TRIG.

SINGLE is a momentary position. This allows only one spectrum to be captured, analyzed and added to the smoothing algorithm each time it is depressed and a triggering signal occurs.

AUTO position automatically rearms the triggering circuitry after a transient is captured.

In either SINGLE or AUTO, data is collected for a fixed interval prior to the actual trigger point. The following table lists the pretrigger time for each SPAN; also, the length of the data block which will be collected corresponding to each triggering event.

Table 2-B: PRETRIGGER AND LENGTH OF DATA BLOCK COLLECTED

SPAN - KHz	PRETRIGGER - msec	DATA BLOCK - msec
100	0.25	2
50	0.5	4
25	1	8
10	2.5	20
5	5	40
2	12.5	100
1	25	200
0.5	50	400
0.2	62.5	1000

2-6. THE TRIGGERING CLUSTER (Fig. 2-9) - continued

23 Arm Mode - continued

Before a triggering signal can be recognized, the START/STOP must be activated, as well as the ARM MODE.

The captured spectra are averaged in SMOOTHING. The SMOOTHING is linear in these transient capture modes. When the ON LED extinguishes, smoothing is completed. When SMOOTHING is set at NONE, no averaging occurs. The LED is extinguished only when the PROCESSOR is stopped. To do this, press START/STOP.

24 Level/Slope

This sets the slope and the amplitude of the signal necessary to initiate a transient capture.

25 Ext Trig In

This is a BNC for applying an external triggering signal. The ground of the BNC is connected to the chassis.

26 Armed

This LED indicates the triggering circuit has been armed.

27 Captured

This LED indicates a transient has been captured.

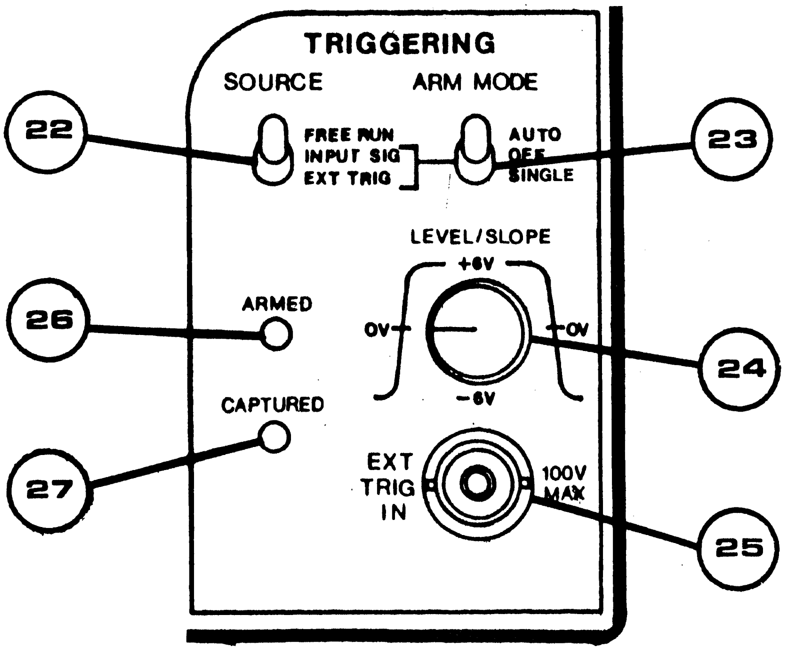


Fig. 2-9 The Triggering Cluster

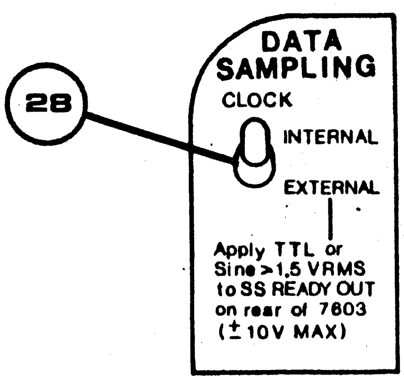


Fig. 2-10 The Data Sampling Control

2-7. THE DATA SAMPLING CONTROL (Fig. 2-10)

28 Data Sampling

This switch determines whether the internal or an external clock will control the collection of input data. Normally, the internal clock is used. However, an external clock can be used to normalize the frequency axis to another parameter. A useful example is the reduction of the effects of flutter on data analyzed from analog tape recorders. If a stable 25 KHz tone is recorded on one channel of the recorder, as data is recorded on another, then the 25 KHz tone can be used as the external clock. This will permit spectrum analysis up to 10 KHz bandwidth. At the same time flutter will be eliminated, because as the tape speed varies, its effect is the same on the data and the sampling clock.

The ratio of clock frequency to maximum SPAN (100 KHz) is 2.56 which results in an internal clock frequency of 256 KHz. The ratio also applies to the external clock frequency, so if 0 - 10 KHz is to be analyzed, the clock frequency must nominally be 25 KHz.

The maximum external clock frequency is limited to 220 KHz. If the maximum band to be analyzed is significantly different from 100 KHz, then the input signal must be band-limited by a low-pass filter, e.g., the Rockland Model 752A may be used.

The use of an external clock changes the calibration of the frequency axis: it will now equal the selected SPAN times the ratio of the external sampling frequency to 256 KHz. For example, if the external sampling clock is 25.6 KHz, then the 200 Hz SPAN becomes 20 HZ and 1 Hz RESOLUTION becomes 0.1 Hz. Thus, by using an external sampling clock and an external low-pass filter for the input signal, the resolution and span can be made arbitrarily small, limited only by the stability of the sampling clock.

With an external clock, the CRT readout of frequency is indicated by a filter element number. If the external sampling frequency is constant, then multiplying filter element number by $\left(\frac{\text{sampling frequency}}{512}\right)$ will convert any frequency readout to units of Hz.

The clock is connected through a rear panel BNC on the 7000 mainframe. For the Model 7603A, it is labeled SS READY OUT, while on the Model 7704A, it is labeled REMOTE RESET INPUT.

SECTION III

INSTALLATION, ADJUSTMENTS AND INSTRUMENT VERIFICATION

Installation and adjustments are simple and are described here with reference to the two most common Tektronix® Mainframes, Models 7603A and 7704A. A built-in test signal permits verifying general performance without using additional equipment.

3-1. INSTALLATION

CAUTION
Insert and remove plug-in only with power off, otherwise serious damage to the mainframe or plug-in may result.

Directly plug the Model 7530A into a three-bay plug-in 7000 Series Oscilloscope or into the three left (when facing front of oscilloscope) compartments of a four-bay plug-in 7000 Series Oscilloscope.

3-2. ADJUSTMENTS FOR CALIBRATING THE DISPLAY

The only adjustments needed are to match the Model 7530A to the Oscilloscope deflection sensitivity.

a. After securely installing the Model 7530A, connect the oscilloscope to a suitable line power source and turn the POWER ON.

b. Set the oscilloscope controls as follows:

Table 3-A: OSCILLOSCOPE SETTINGS

Model 7603A	Model 7704A
VERTICAL MODE: RIGHT	VERTICAL MODE: RIGHT
TRIG SOURCE: ANY	HORIZONTAL MODE: A
	TRIG SOURCE: ANY

3-2. ADJUSTMENTS FOR CALIBRATING THE DISPLAY - continued

c. On the Model 7530A, set all toggle switches to the up position and rotate the RESOLUTION, outer FULL SCALE SENSITIVITY knob, and SMOOTHING switches fully counter-clockwise. Set vernier (inner) FULL SCALE SENSITIVITY knob fully clockwise.

d. Adjust INTENSITY and GRAT Illumination. A typical display as seen in Fig. 3-1 will appear. It is the internal test signal and as shown here, it is not properly positioned with respect to the CRT graticule.

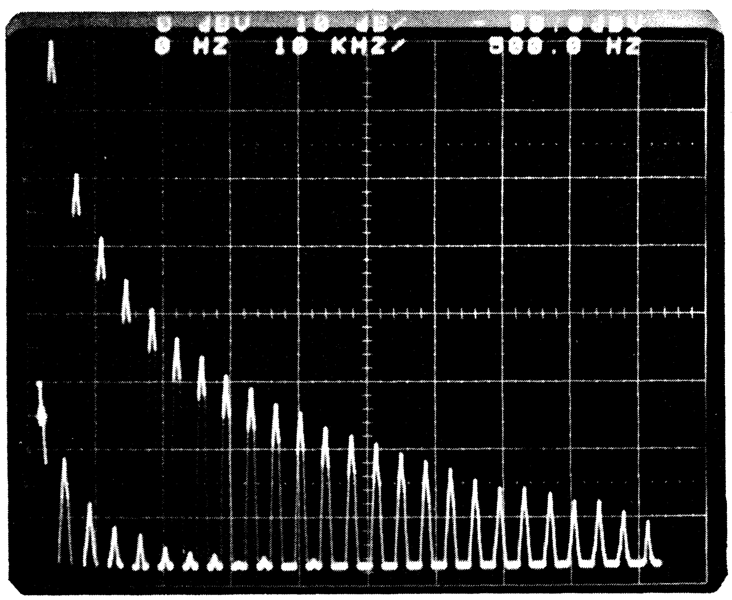


Fig. 3-1 Example of Uncalibrated CRT Display using Internal Test Signal

e. Remove right side panel (when facing the front) from the oscilloscope. Four adjustments in the 7530A, labeled as indicated in Fig. 3-2 will be seen.

3-2. ADJUSTMENTS FOR CALIBRATING THE DISPLAY - continued

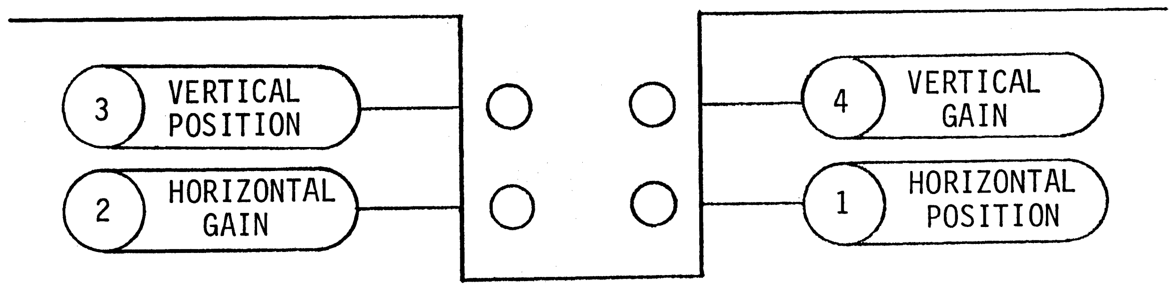


Fig. 3-2 Adjustments for Calibrating the Display

f. Set the SPECTRUM AMPLITUDE to 5 dB/div and frequency scale to LOG. Use a nonconducting screwdriver to adjust HOR POS potentiometer to place the start of the horizontal line at the vertical origin of the graticule. Then adjust the HOR GAIN potentiometer so the horizontal line ends at the vertical graticule line farthest to the right. Next, adjust the VERT POS so the horizontal line falls on top of the lowest horizontal graticule line.

g. Jog the SPECTRUM GAIN up once so the top of the display saturates. Adjust the VERT GAIN potentiometer so the top of display falls on the uppermost horizontal line. A properly calibrated display is shown in Fig. 3-3.

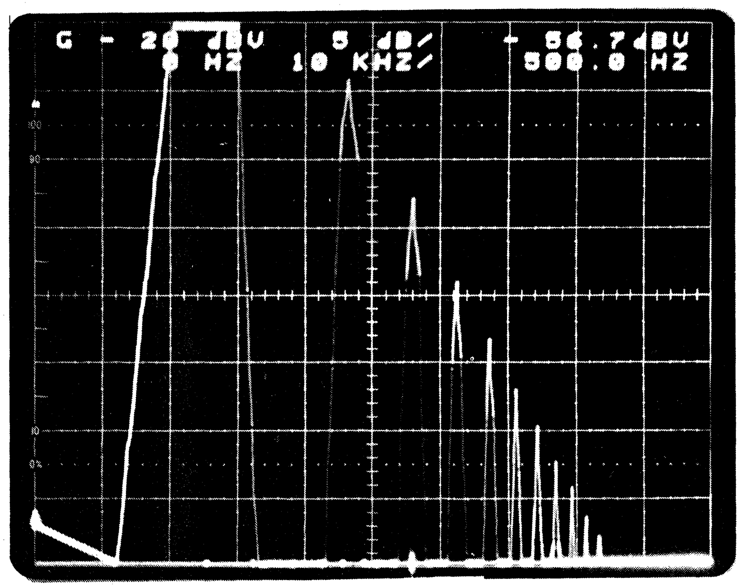


Fig. 3-3 Example of Calibrated CRT Display using the Internal Test Signal

3-3. INSTRUMENT VERIFICATION

Instrument verification should be routinely performed. The procedure is simple and quickly accomplished.

a. Set the oscilloscope controls as follows:

Table 3-B: OSCILLOSCOPE SETTINGS

Model 7603A	Model 7704A
VERTICAL MODE: RIGHT	VERTICAL MODE: RIGHT
TRIG SOURCE: ANY	HORIZONTAL MODE: A
	TRIG SOURCE: ANY

3-3. INSTRUMENT VERIFICATION - continued

b. Set the front panel of the 7530A as follows:

- All toggle switches to their up position
- FULL SCALE SENSITIVITY outer knob, fully counter-clockwise, inner knob, fully clockwise
- RESOLUTION, fully counter-clockwise
- SMOOTHING, twelve (12) o'clock

c. Turn power on. The 7530A then performs a series of self tests on its digital circuits during power-up. If any self test fails, the LED in the PROCESSING Cluster marked ON will flash continuously and possibly one line of letter m's will appear on the CRT. If it passes the self tests, the LED marked INPUT OVERLOAD will go on for a short time and then extinguish. The PROCESSING ON LED will stay on after first flashing for less than ten (10) seconds. The display will appear similar to Fig. 3-4.

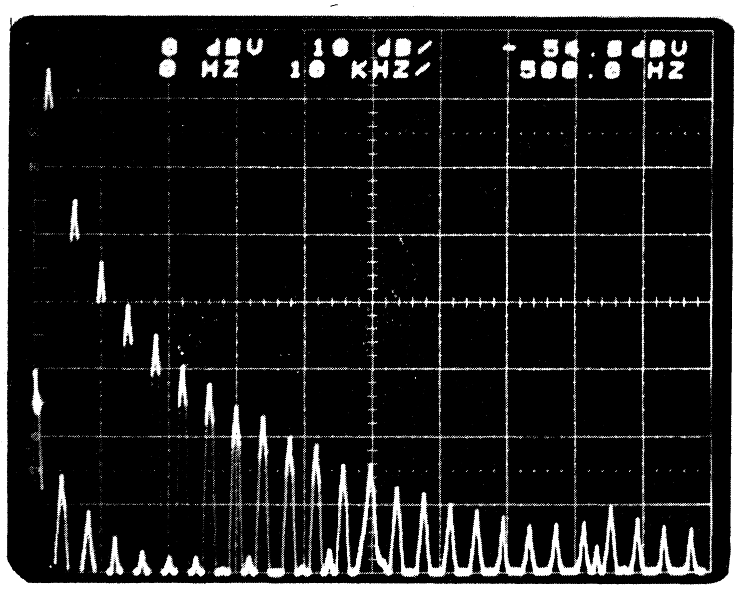


Fig. 3-4 Spectrum of Test Signal when Instrument is Operating Properly

3-3. INSTRUMENT VERIFICATION - continued

d. Push the CURSOR POSITION until it aligns the marker at 2.000 KHz. It will fall on the peak of a spectral line and have an amplitude readout between -5 and -7 dB V.

e. Next, set DISPLAY-FREQ SCALE to LOG. Display will look similar to Fig. 3-5. The rolloff of the spectral lines will appear to decay linearly down to about -70 dB wrt full scale. The display will reach -70 dB V near 62 KHz. Below -70 dB V, the lines do not necessarily fall within the straight line formed by the spectral lines above it.

If all the above tests are passed, then the instrument is properly processing the data in the 0 - 100 KHz frequency span.

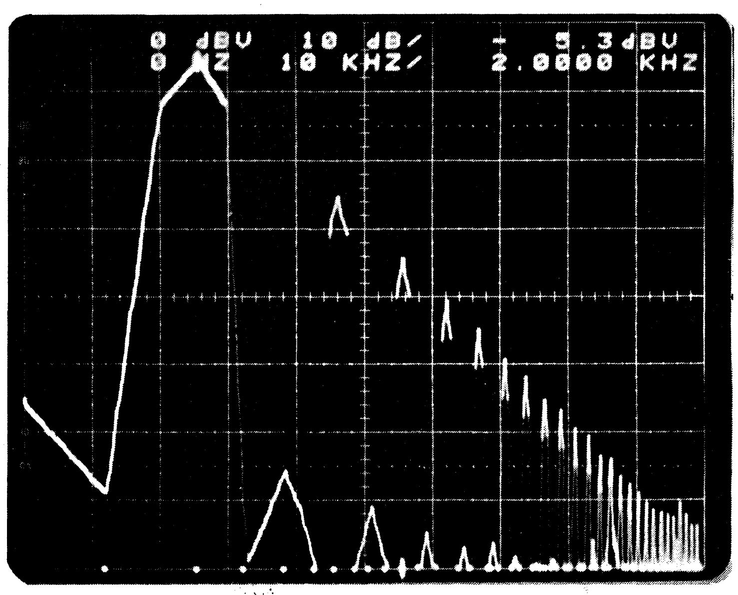


Fig. 3-5 Spectrum of Test Signal when Instrument is Operating Properly
Log Frequency Axis

3-3. INSTRUMENT VERIFICATION - continued

f. To verify that other frequency spans are performing properly, rotate RESOLUTION - (SPAN - Hz) to 25 (5 K), set FREQ SCALE to LIN position, and BACKGROUND SELECT to BLANK. A correct display is shown in Fig. 3-6.

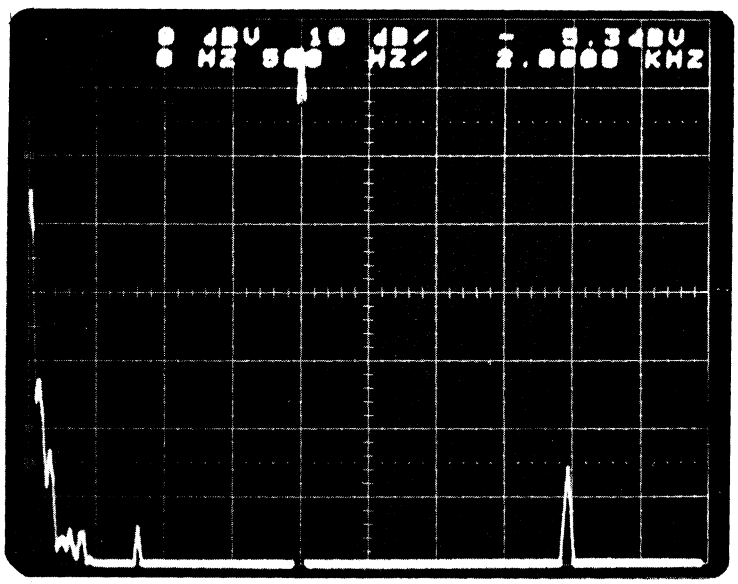


Fig. 3-6 Spectrum of Test Signal over the 0 - 5 KHz Span

SECTION IV

A LESSON IN THE USE OF THE FRONT PANEL CONTROLS

This section discusses in detail the use of the controls described in Section II and how to perform typical measurements with the aid of the internal test signal.

4-1. INITIAL SET-UP

a. Set the oscilloscope controls as follows:

Table 4-A: OSCILLOSCOPE SETTINGS

Model 7603A	Model 7704A
VERTICAL MODE: RIGHT	VERTICAL MODE: RIGHT
TRIG SOURCE: ANY	HORIZONTAL MODE: A
	TRIG SOURCE: ANY

b. Set the front panel of the 7530A as follows:

- All toggle switches to the up position
- FULL SCALE SENSITIVITY, outer knob fully counter-clockwise, inner knob, fully clockwise
- RESOLUTION, fully counter-clockwise
- SMOOTHING, twelve (12) o'clock

4-2. THE 3-KNOB CLUSTER: SENSITIVITY, RESOLUTION & STARTING FREQUENCY

4-2.1 Sensitivity

FULL SCALE SENSITIVITY is automatically set when in the TEST position. The TEST signal is a 2 KHz triangle applied at the input. Fig. 4-1 shows the correct display with annotations explaining the readout on the CRT.

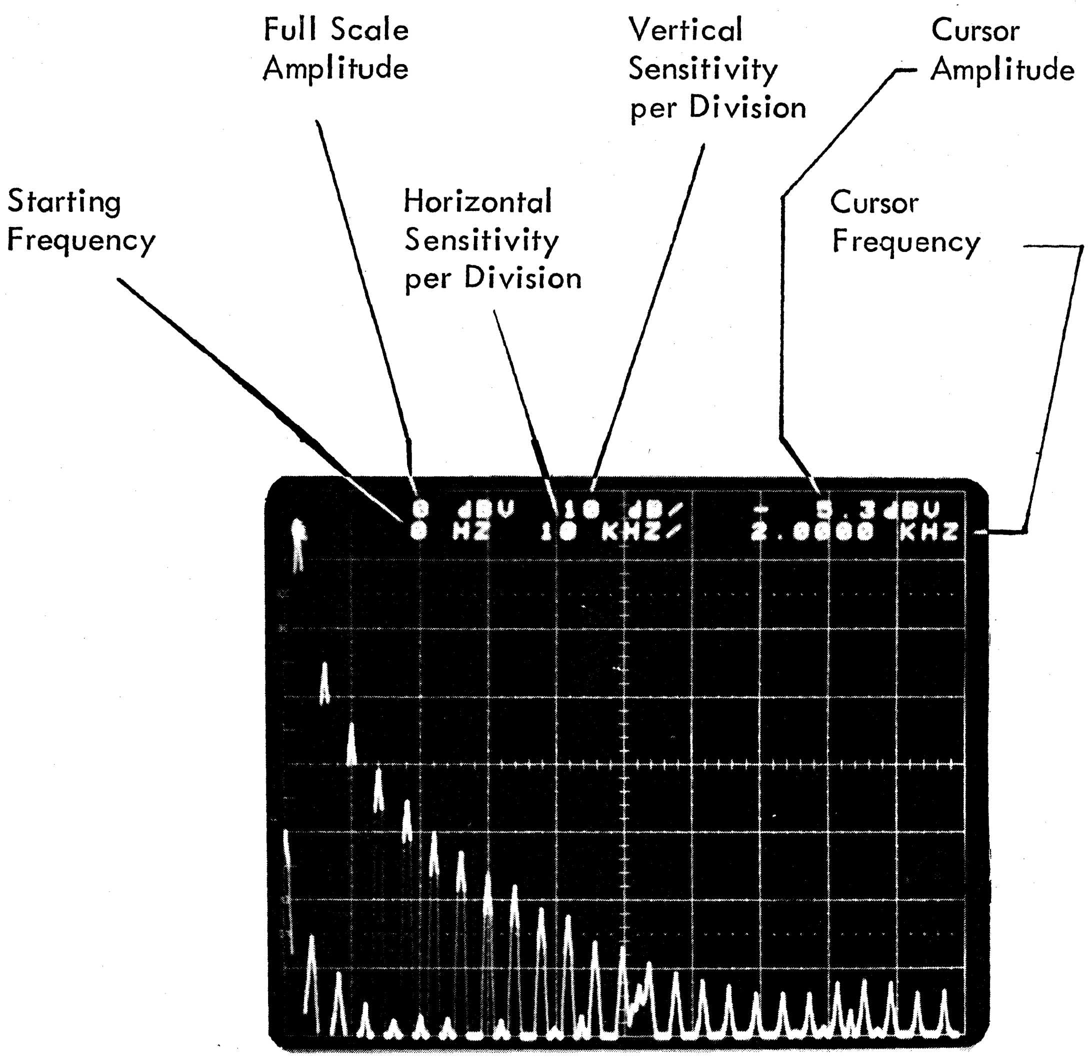


Fig. 4-1 Spectrum of the Test Signal

4-2. THE 3-KNOB CLUSTER - continued

4-2.2 Resolution

a. Rotate RESOLUTION to 250 Hz (50 KHz SPAN). The display from 0 - 50 KHz is intensified and TUNING is written on the CRT in place of 10 KHz/. The intensified portion, 0 - 50 KHz, corresponds to the SPAN that will be analyzed with 250 Hz resolution. The foreground soon appears, and the annotation TUNING is replaced by 5 KHz/. The display is seen in Fig. 4-2 and the foreground is the more intensified sweep.

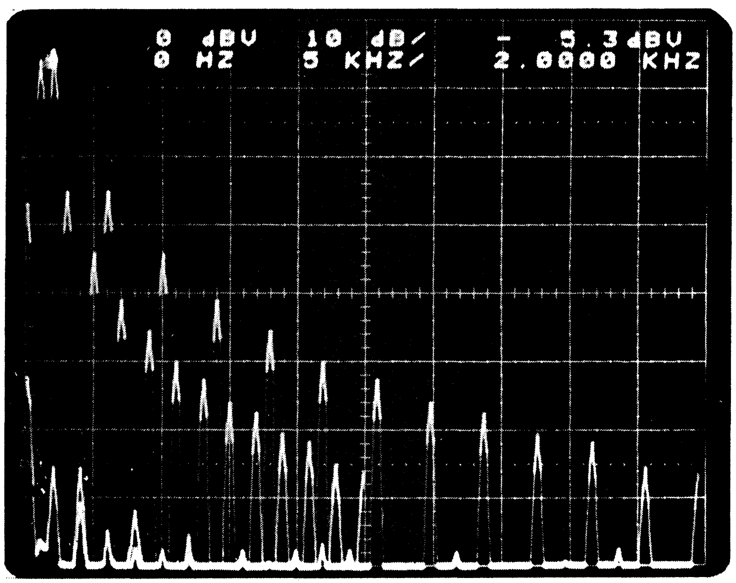


Fig. 4-2 Foreground (Intensified Sweep) Display of 0 - 50 KHz Analysis
Background (Partially Intensified Sweep) Display of 0 - 100 KHz

4-2. THE 3-KNOB CLUSTER - continued

4-2-2 <u>Resolution</u> - continued

b. Rotate RESOLUTION to 125 Hz (25 KHz SPAN). The intensified foreground disappears, and the 0 - 100 KHz span appears with the region 0 - 25 KHz intensified. TUNING replaces 5 KHz/ on the CRT. In a few seconds, the foreground analysis from 0 - 25 KHz will appear. Repeat process by rotating RESOLUTION to 50 Hz (10 KHz SPAN). Fig. 4-3 indicates the new display. If the interference between the background and foreground is annoying, then set the DISPLAY-BACKGROUND SELECT switch to BLANK. The background will disappear.

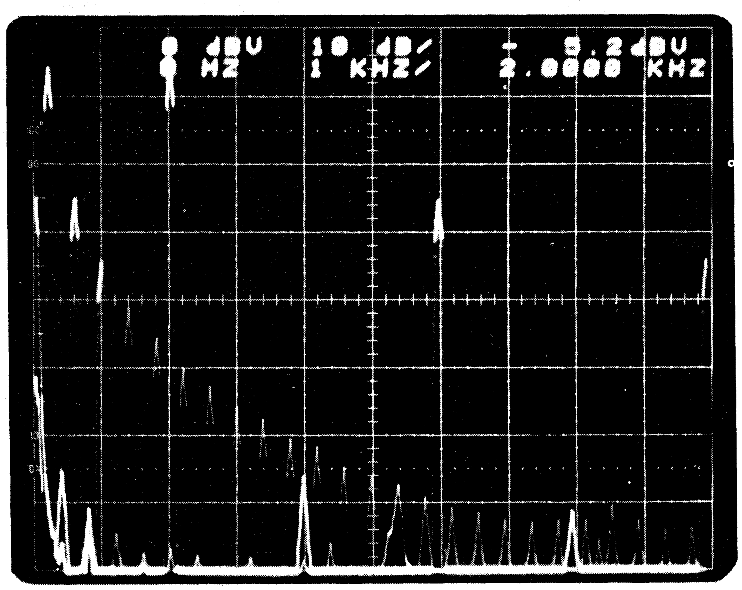


Fig. 4-3 Foreground (Intensified Sweep) Display of 0 - 10 KHz Analysis
Background (Partially Intensified Sweep) Display of 0 - 100 KHz Analysis

4-2. THE 3-KNOB CLUSTER - continued

4-2.3 Starting Frequency

a. Note, the starting frequency stayed at 0 Hz as the RESOLUTION (SPAN) was changed in item 4-2-2 b. If the starting frequency was other than 0 Hz, the SPAN zooms about its center frequency rather than the starting frequency.

b. Move the STARTING FREQUENCY knob until the starting frequency on the CRT is 79 KHz. The knob may be rotated clockwise or counter-clockwise to reach 79 KHz. The number of rotations required will be less if it is rotated counter-clockwise. As you rotate, the foreground will disappear, and the 0 - 100 KHz background will appear with a 10 KHz span intensified. The intensified region moves as the STARTING FREQUENCY knob is rotated.

Once the analyzer detects that the starting frequency is not changing, the 10 KHz foreground from 79 - 89 KHz will appear. The center of the frequency span is 84 KHz. Rotate the RESOLUTION knob to 25 Hz (5 KHz SPAN). The starting frequency will change to 81.5 KHz. The center of the span is still 84 KHz.

c. Set DISPLAY-BACKGROUND SELECT switch back to 0 - 100 KHz. Now push the DISPLAY-BACKGROUND DISPLACEMENT up. The background will interfere less with the foreground (Fig. 4-4). The ↑ on the readout indicates the background was displaced upward. Pushing the switch up again will further displace the background.

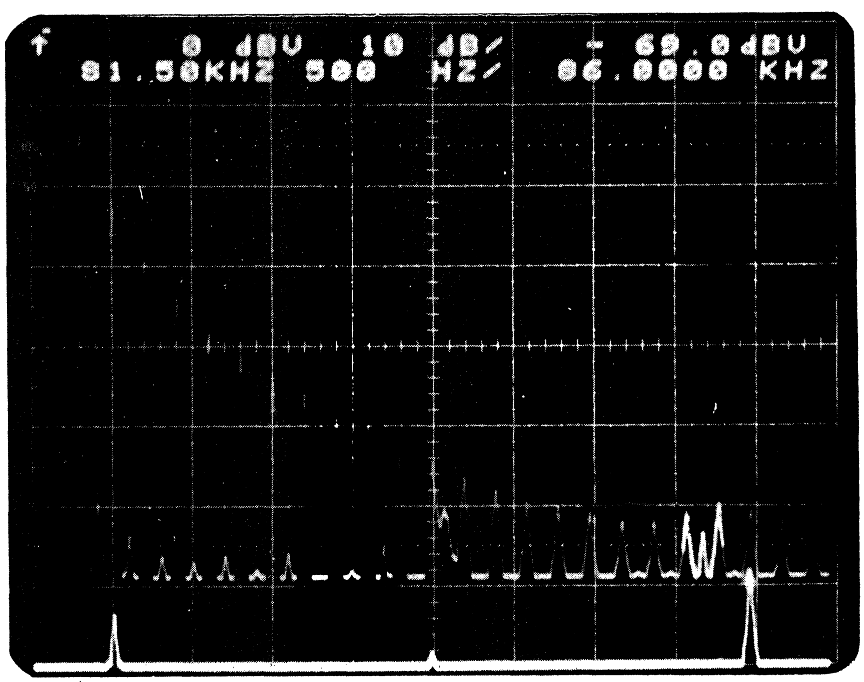


Fig. 4-4 Foreground 81.5 - 86.5 KHz, Background 0 - 100 KHz
Background Displaced UP

4-3. THE INPUT CLUSTER

Set the front panel controls as follows:

- All toggle switches to the up position
- FULL SCALE SENSITIVITY, outer knob, fully counter-clockwise; inner knob, fully clockwise
- RESOLUTION, fully counter-clockwise
- SMOOTHING, twelve (12) o'clock
- Turr . ower off and then on

4-3.1 Coupling

The INPUT BNC, AC - DC COUPLING are obvious and no tests are needed to familiarize the operator. Normally AC coupling should be used; DC coupling is recommended for the analysis of transients or impulse-type data. Also, DC coupling may be needed if external sampling control is used and for analysis below 1 Hz. AC coupling limits analysis to about 0.5 Hz.

4-3.2 Impedance

Changing the input IMPEDANCE will change the amplitude scale so the reference is 1 mW into 600 Ohms. Set the IMPEDANCE to 600 Ohms and move the cursor marker to 2.000 KHz. The units of the amplitude readouts change from dBV to dBm, and the signal component at 2.000 KHz increases by +2.2 dB.

4-4. THE DISPLAY CLUSTER

4-4.1 View

a. Set the front panel of the 7530A as follows:

- All toggle switches to the up position
- FULL SCALE SENSITIVITY, outer knob, fully counter-clockwise, inner knob fully clockwise
- RESOLUTION, fully counter-clockwise
- SMOOTHING, twelve (12) o'clock

4-4. THE DISPLAY CLUSTER - continued

4-4.1 <u>View</u> - continued

b. The averaged spectrum of the 2 KHz triangular TEST signal is shown on Fig. 4-5a. The spectrum display does not need any qualification: it is an accurate and unambiguous representation.

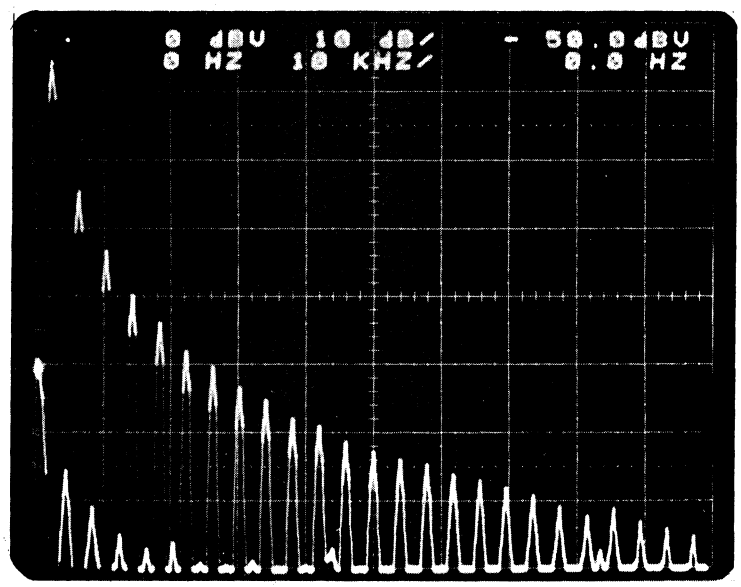


Fig. 4-5a Spectrum Display of TEST Signal, 0 - 100 KHz SPAN

c. Move VIEW to TIME (Fig. 4-5b). The display represents successive 2 msec-long blocks of the input waveform. The input signal was first bandlimited through a 100 KHz low pass filter, and then sampled at 256 KHz rate. The results are stored and then reconstructed to form an analog waveform for the CRT display. 128 samples per fundamental period of the triangle were taken so the reconstructed display is clearly defined.

4-4. THE DISPLAY CLUSTER - continued

4-4.1 <u>View</u> - continued

If the fundamental frequency had exceeded approximately one-third of the SPAN, i.e., 33 KHz, the time display would have an apparent amplitude ripple which results from too few samples per period. This phenomenon appears only in the time display. The reconstructed signal still contains all the necessary information to generate a correct spectral display.

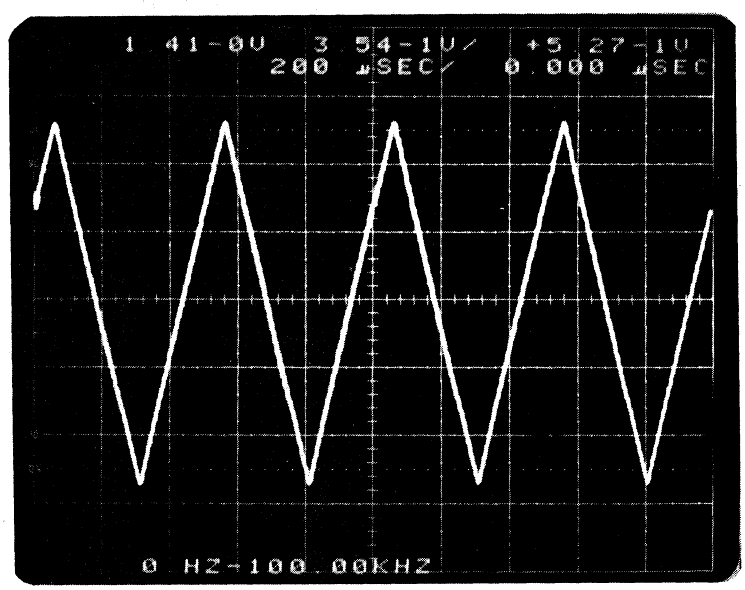


Fig. 4-5b Time Display of TEST Signal, 0 - 100 KHz SPAN

d. Rotate the RESOLUTION (SPAN) to 50 Hz (10 KHz). Set VIEW to SPECTRUM (Fig. 4-6a) and BACKGROUND SELECT to BLANK. Over the SPAN, 0 - 10 KHz, the signal consists of mainly three sinewaves at 2 KHz, 6 KHz and 10 KHz, with the 2 KHz fundamental having the largest amplitude level.

4-4. THE DISPLAY CLUSTER - continued

4-4.1 View - continued

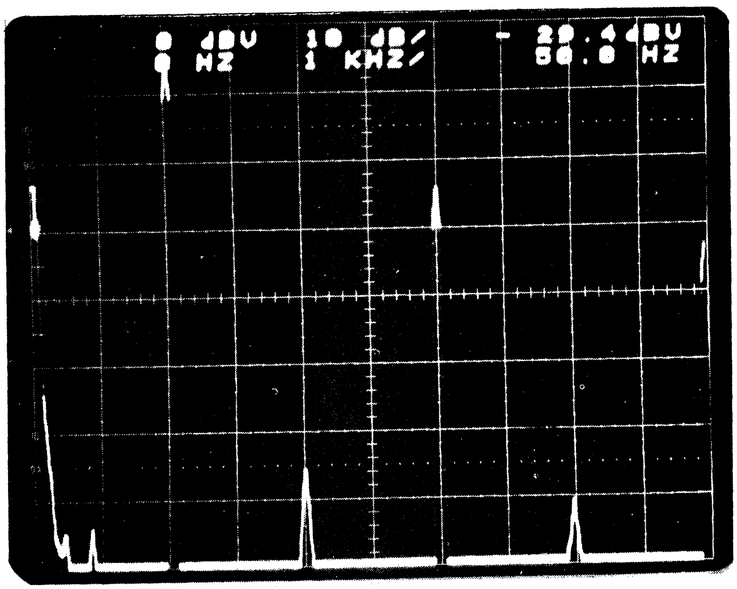


Fig. 4-6a Spectrum Display of Test Signal, 0 - 10 KHz SPAN

Set VIEW TO TIME (Fig. 4-6b). The waveform is approximately sinusoidal with a period of approximately 500 usec ($f \approx 2$ KHz) and with a slight amplitude ripple caused by sampling of the waveform. The ripple appears to repeat every 5 periods which can be explained as follows: The sampling frequency for analysis between 0 and 10 KHz is 25.6 KHz. As a result, an average of 12.8 samples per period (500 msec) are taken. Since there is a non-integer number of samples per period, the amplitude at which sampling occurs will be slightly different from period-to-period until an integer number of samples is taken. After 64 samples, corresponding to 5 periods, the pattern of sampling the analog waveform will repeat.

In addition to the effect of sampling on the appearance of the TIME display, the annotations are different when the span is less than 100 KHz: preceding each amplitude readout is a $>$ sign used to indicate that the amplitude scale is uncalibrated. Note, however, that the relative amplitude levels are correct.

4-4. THE DISPLAY CLUSTER - continued

4-4.1 View - continued

Next to the annotation of the band of analysis, 0 - 10.00 KHz, is written "SAMPLED BPF", where BPF denotes bandpass filter. This reminds the user that the data was filtered by a digital bandpass filter covering the range from 0 - 10 KHz. The output of this filter consists of samples at a rate of 2.56 (SPAN) or 25.6 KHz.

As in the case of the TIME display of the TEST signal on the 0-100 KHz span, the time function is clearly defined as long as many samples per period are taken. For the 0 - 10 KHz span, 3.3 KHz appears to be the nominal input frequency limit and it is clearly defined on the TIME display.

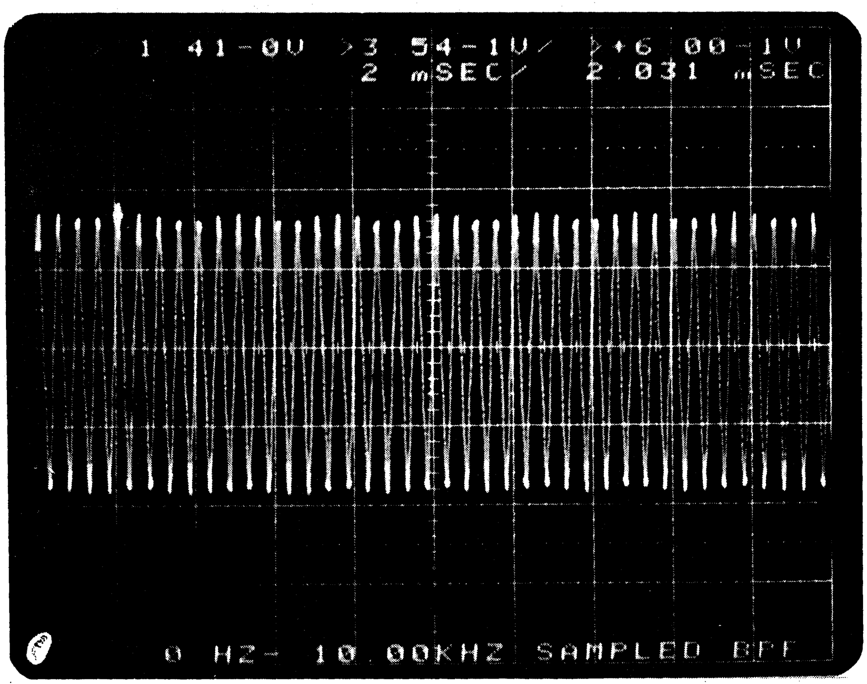


Fig. 4-6b Time Display of Test Signal, 0 - 10 KHz SPAN

e. The effect of sampling the output of the digital bandpass filter can make it difficult to interpret the TIME display if the starting frequency is not 0 Hz. This can be demonstrated as follows: rotate RESOLUTION (SPAN) to 10 Hz (2 KHz) and rotate STARTING FREQUENCY to 9.00 KHz. Wit

4-4. THE DISPLAY CLUSTER - continued

4-4.1 View - continued

VIEW at SPECTRUM, the display (Fig. 4-7a) shows a single sinewave at 10.0 KHz, while with VIEW at TIME, the display indicates a low frequency sinewave at approximately 240 Hz (Fig. 4-7b). This is not a mistake. The appearance of the lower frequency signal in the TIME display is a result of the translation process which occurs because the filtered data is undersampled; 240 Hz is an aliased sinewave. As far as the spectrum is concerned, the undersampling, is accounted for and the frequency axis is properly calibrated.

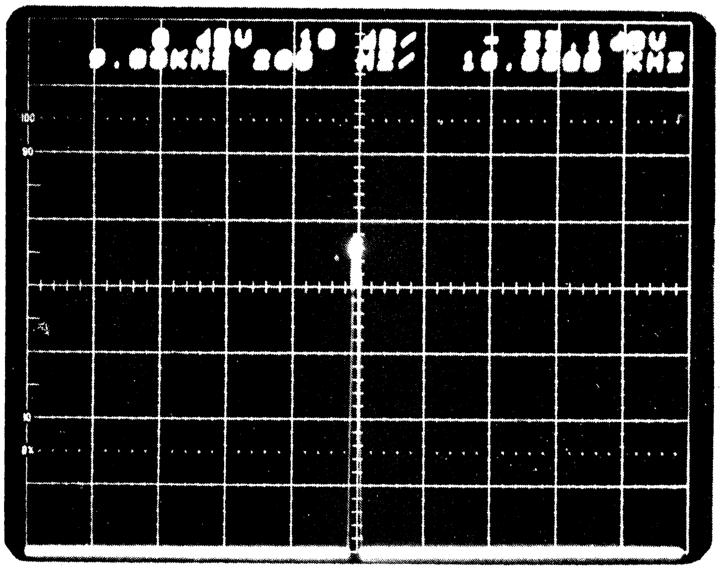


Fig. 4-7a Spectrum Display of Test Signal, 9 - 11 KHz SPAN

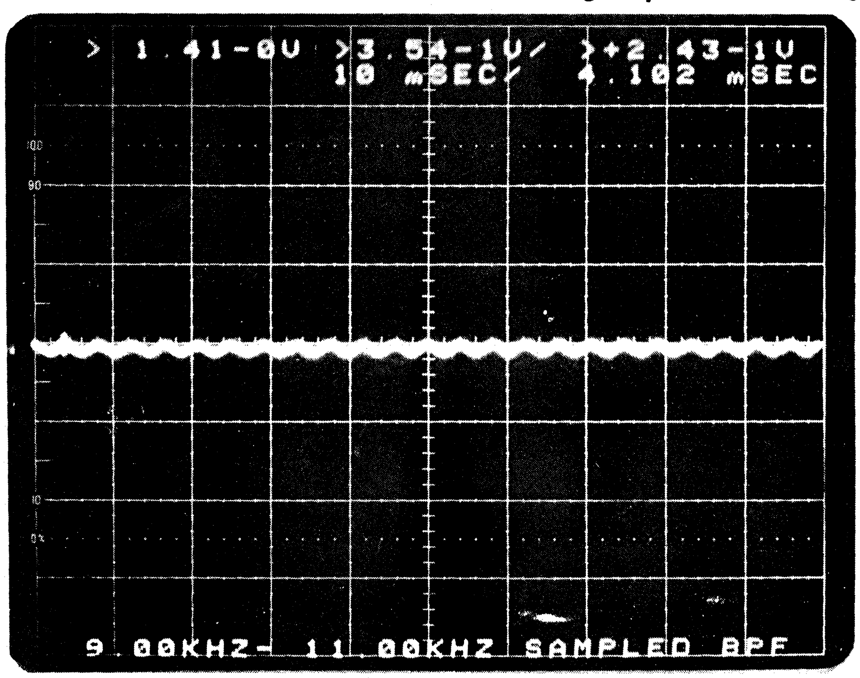


Fig. 4-7b Time Display of Test Signal, 9 - 11 KHz SPAN

4-4. THE DISPLAY CLUSTER - continued

4-4.1 View - continued

Is the TIME display useful for the 9 - 11 KHz SPAN? The answer is "Sometimes". The measurement of the period of a signal from the TIME display obviously cannot be performed; however, the decay rate of a damped sinewave can be.

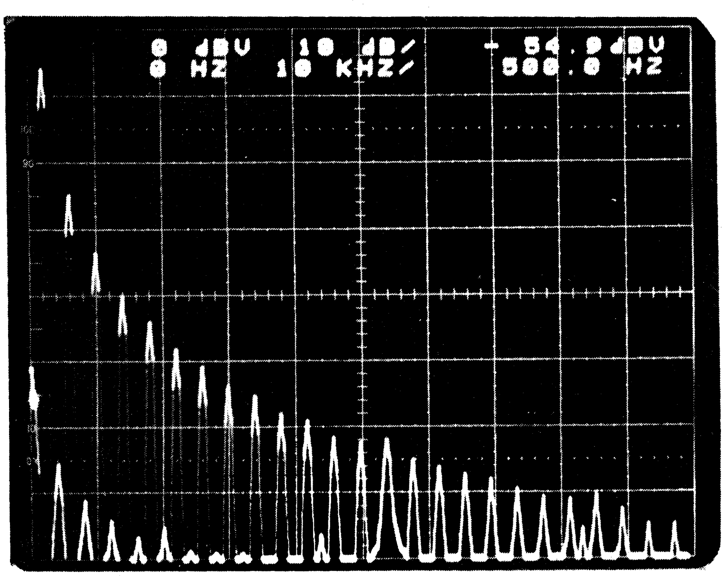
In summary, the displayed spectrum is accurate and can be used without qualification . Displayed time functions can be easily used if the starting frequency is 0 Hz and the signal's energy is concentrated below one-third of the SPAN. In all other cases, the TIME display may represent an aliased signal and must be used with caution.

4-4.2 Spectrum Amplitude and Spectrum Gain

Return all the front panel settings as used at the start of Section 4-4., THE DISPLAY CLUSTER.

a. The amplitude vertical scale is set at 10 dB/div., or 80 dB total, and the full scale value is at 0 dB V. Jog the SPECTRUM GAIN switch up once. It will offset the spectrum 10 dB, so the top of the display is at - 10 dB V and goes down to - 90 dB V. Fig. 4-8 a and b show the effect of the SPECTRUM GAIN; lower level signals are seen. The use of SPECTRUM GAIN is indicated by a "G" on the CRT.

Each time the switch is momentarily pressed, another 10 dB of offset is applied up to a maximum of 40 dB. Additional gain does not add any information about the TEST signal. SPECTRUM GAIN has no effect on the input sensitivity or any calculations. Its function is to select the 80 dB display out of 120 dB spectrum that is calculated. Repeatedly press the SPECTRUM GAIN downward until the letter "G" is removed from the CRT.



4-4. THE DISPLAY CLUSTER - continued

4-4.2 Spectrum Amplitude and Spectrum Gain - continued

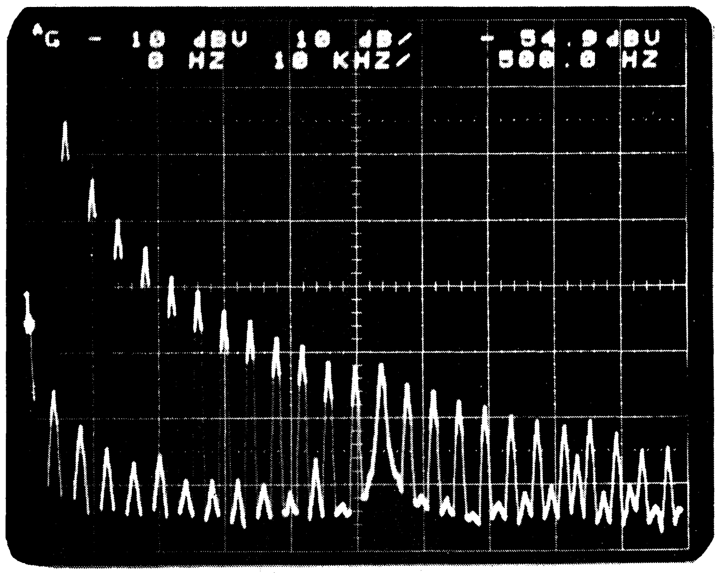


Fig. 4-8b Effect of 10 dB of Spectrum Gain; Spectrum Gain = 10 dB

b. Move the SPECTRUM AMPLITUDE to 5 dB/div , (Fig. 4-9a). Jog the SPECTRUM GAIN up three (3) times. The top of the display range will move from 0 dB V to - 60 dB V (Fig. 4-9b). The lower level signals are now seen with more detail. Jog the SPECTRUM GAIN down three (3) times, thus returning to the display without gain. "G" is also removed from the screen.

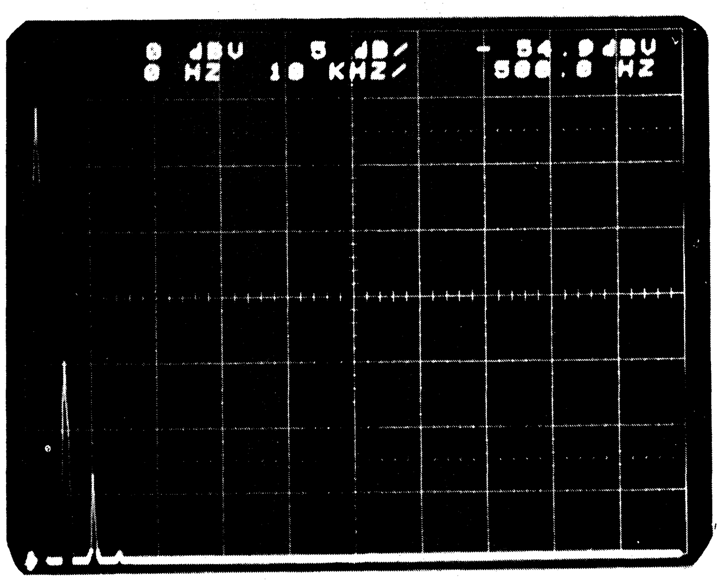


Fig. 4-9a Spectrum Amplitude Set at 5 dB/Div.; Spectrum Gain = 0 dB

4-4. THE DISPLAY CLUSTER - continued

4-4.2 Spectrum Amplitude and Spectrum Gain - continued

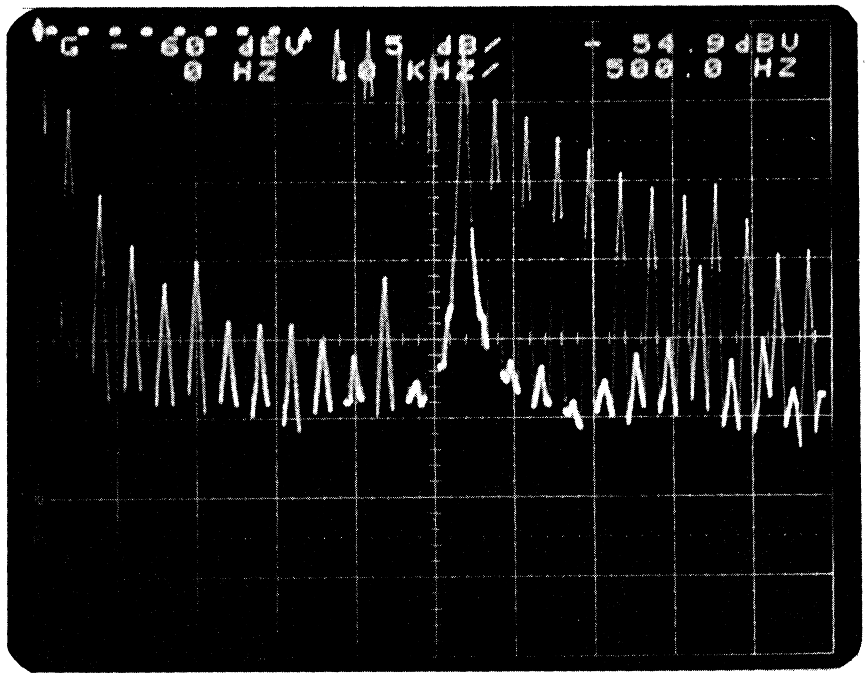


Fig. 4-9b Spectrum Amplitude Set at 5 dB/Div.; Spectrum Gain = 60 dB

c. Move the SPECTRUM AMPLITUDE switch to LINEAR (Fig. 4-10a). The vertical scale is in units of V rms. Press the SPECTRUM GAIN up once. The display will be expanded by 5x (Fig. 4-10b), and the full scale amplitude will go from 1.00 to 0.2 V rms. Press it upward again, and the display will expand by 10x. Other gain factors are x 50 and x 100.

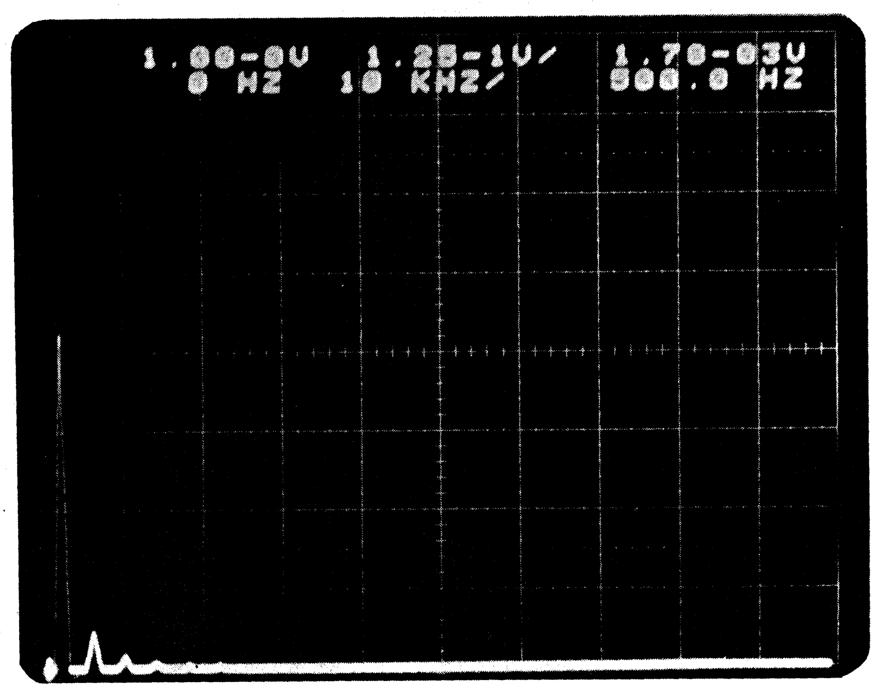


Fig. 4-10a Linear Amplitude Scale; Spectrum Gain = x 1

4-4. THE DISPLAY CLUSTER - continued

4-4.2 Spectrum Amplitude and Spectrum Gain - continued

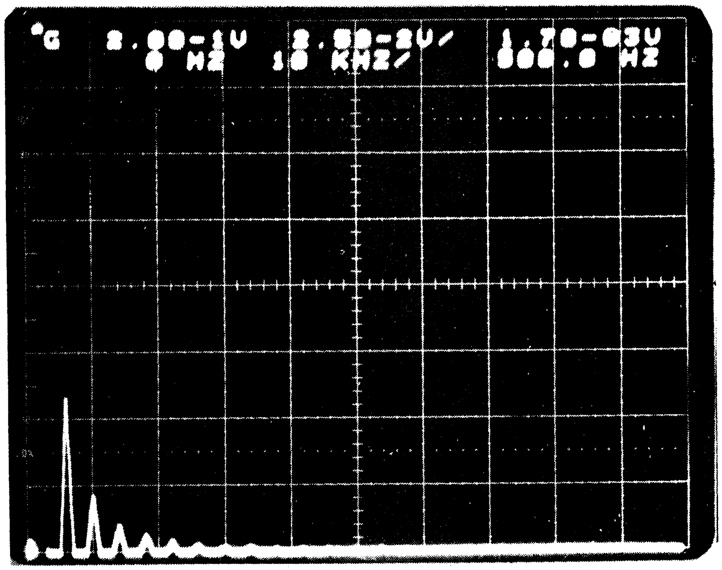


Fig. 4-10b Linear Amplitude Scale; Spectrum Gain = x 5

4-4.3 Frequency Scale

a. Move the SPECTRUM AMPLITUDE to 10 dB/div., and momentarily press the SPECTRUM GAIN repeatedly until "G" is removed from the CRT presentation.

b. Move FREQ SCALE to LOG. Press SPECTRUM GAIN up once so the bottom of the display clears the lowest vertical graticule (Fig. 4-11). The horizontal scale is calibrated over two decades. The vertical tick mark equals 10 KHz corresponding to the frequency scale annotation on the CRT. Each dot to the right of the tick mark is separated by 10 KHz and each one to the left is separated by 1 KHz. If the starting frequency is other than 0 Hz, the vertical tick mark is referenced to the starting frequency. Return FREQ SCALE to LIN.

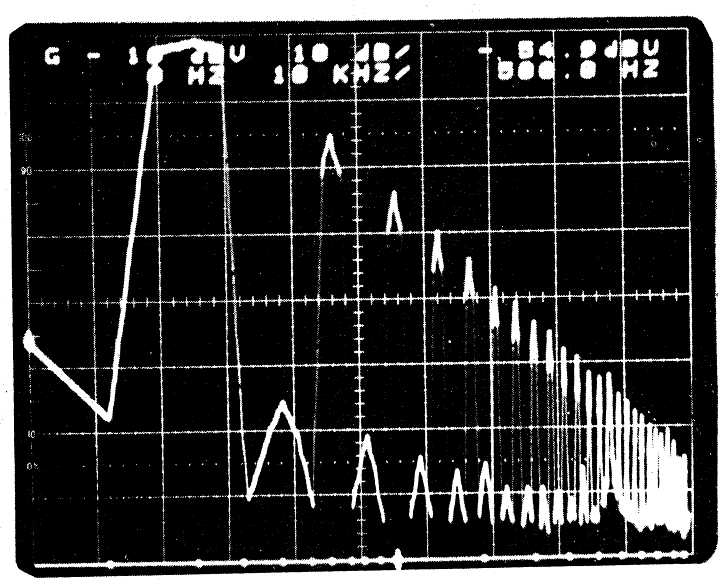


Fig. 4-11 Log Frequency Scale

4-4. THE DISPLAY CLUSTER - continued

4-4.4 Background

Return all the front panel controls to the positions indicated at the start of Section 4-4.

a. Rotate RESOLUTION to 25 Hz (5 KHz SPAN). Move STARTING FREQUENCY to 81.5 KHz. The display will appear as in Fig. 4-12a. There is some interference between the foreground and the background.

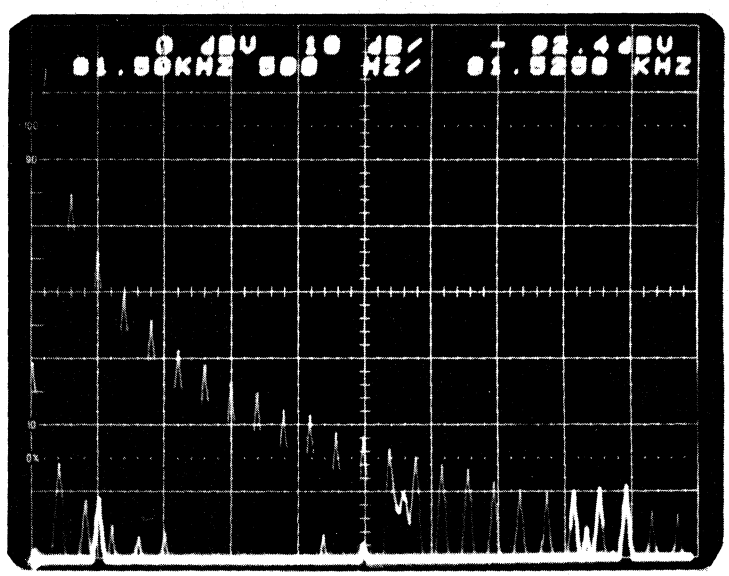
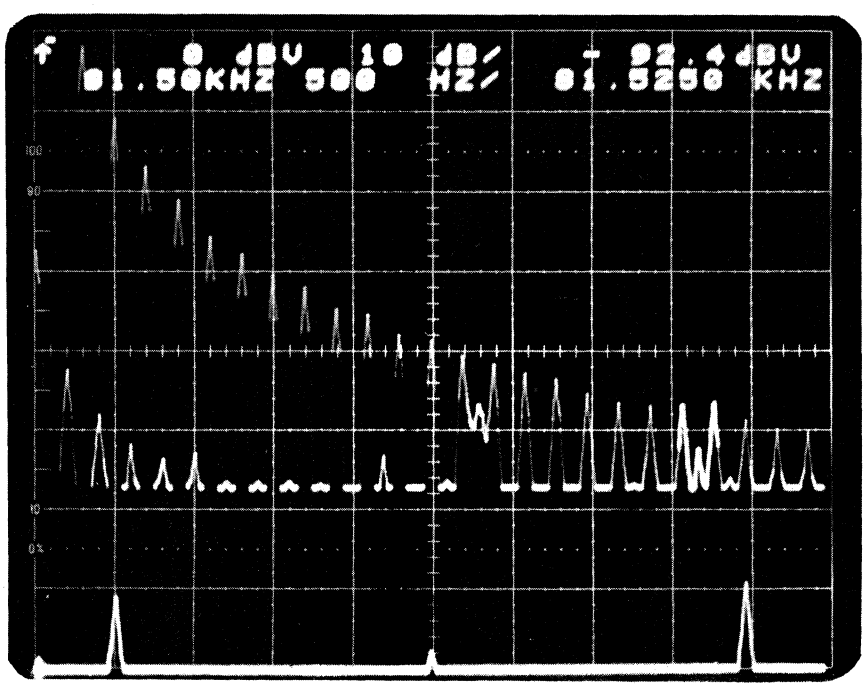


Fig. 4-12a The Use of Background Displacement; No Background Displacement

b. Jog the DISPLACEMENT toggle switch up once or twice. The two displays will separate and an arrow ↑ will be written near the top of the screen indicating vertical separation between the two traces (Fig. 4-12b).



4-4. THE DISPLAY CLUSTER - continued

4-4.4 <u>Background</u> - continued

c. Move BACKGROUND SELECT toggle switch from 0 - 100 KHz to BLANK.

d. Move BACKGROUND SELECT toggle switch from BLANK to STORE. Press the STORE button in PROCESSING cluster; the foreground (active) trace will be stored and displayed (Fig. 4-13a). Because the background was previously displayed upwards, the two identical traces are now separated in the vertical direction.

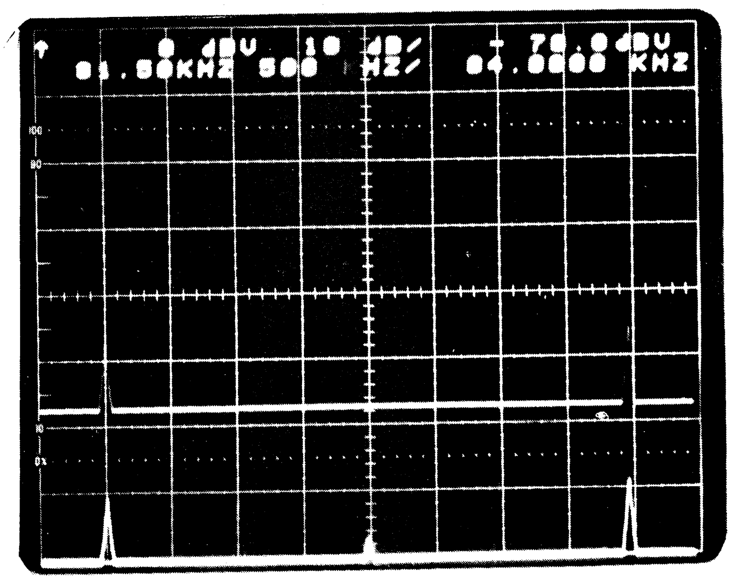


Fig. 4-13a Display of Foreground and Stored Trace
Both Spectral measurements made under same measurment condition

e. Move the CURSOR POSITION to the center of the screen at 84.000 KHz. Rotate the RESOLUTION knob to 50 Hz. The SPAN is now 10 KHz starting at 79.00 KHz, but still centered at 84.000 KHz (Fig. 4-13b). The asterisk (*) near the top of the screen, indicates that the two traces correspond to analysis with different front panel settings.

f. Move CURSOR READS toggle switch from FOREGROUND to BACKGROUND. The STARTING FREQUENCY and SPAN change from 79.00 KHz, and 1 KHz/ , respectively, to 81.50 KHz and 500 Hz/.

4-4. THE DISPLAY CLUSTER - continued

4-4.4 Background - continued

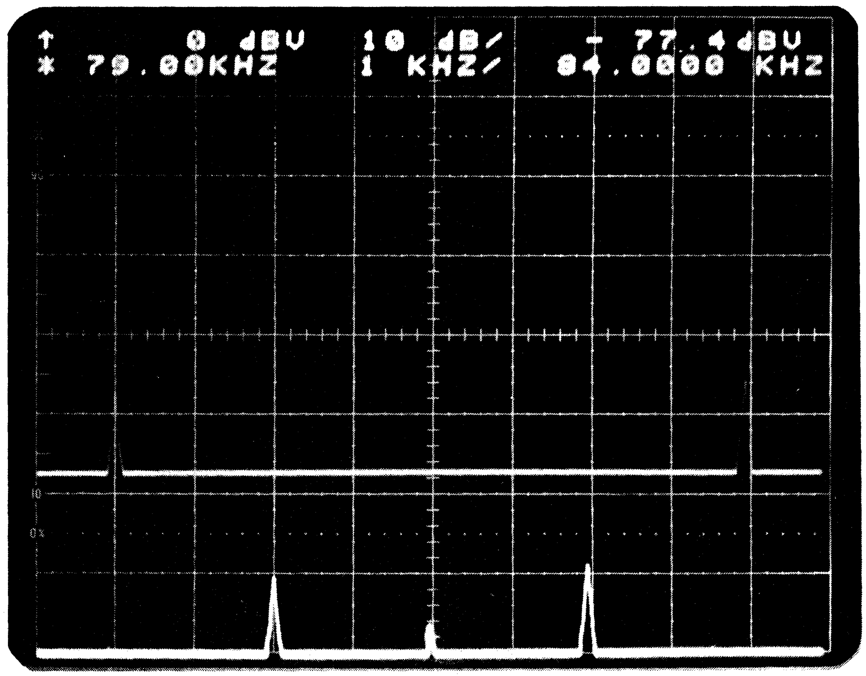


Fig. 4-13b Display of Foreground and Stored Trace
Different Frequency Span used for each measurement.

4-5. THE CURSOR CLUSTER

Set the front panel controls as follows:

- All toggle switches to the up position
- FULL SCALE SENSITIVITY, outer knob, fully counter-clockwise, inner knob, fully clockwise
- RESOLUTION, fully counter-clockwise
- SMOOTHING, twelve (12) o'clock

4-5.1 Cursor Position

a. After the display appears, turn power off and then on again. Move CURSOR POSITION till the marker falls on 2.000 KHz fundamental. Its amplitude (upper right-hand readout) will be between -5 dBV and -7 dBV.

4-5.2 Reads

a. Rotate RESOLUTION knob to 50 Hz (10 KHz SPAN) and rotate STARTING FREQUENCY to 69.5 KHz. Toggle the DISPLAY-BACKGROUND DISPLACEMENT up twice to separate the two traces. Move the CURSOR to 70.000 KHz (Fig. 4-14a). The readout corresponds to the foreground display for the span from 69.5 KHz to 79.50 KHz.

4-5. THE CURSOR CLUSTER - continued

4-5.2 Reads - continued

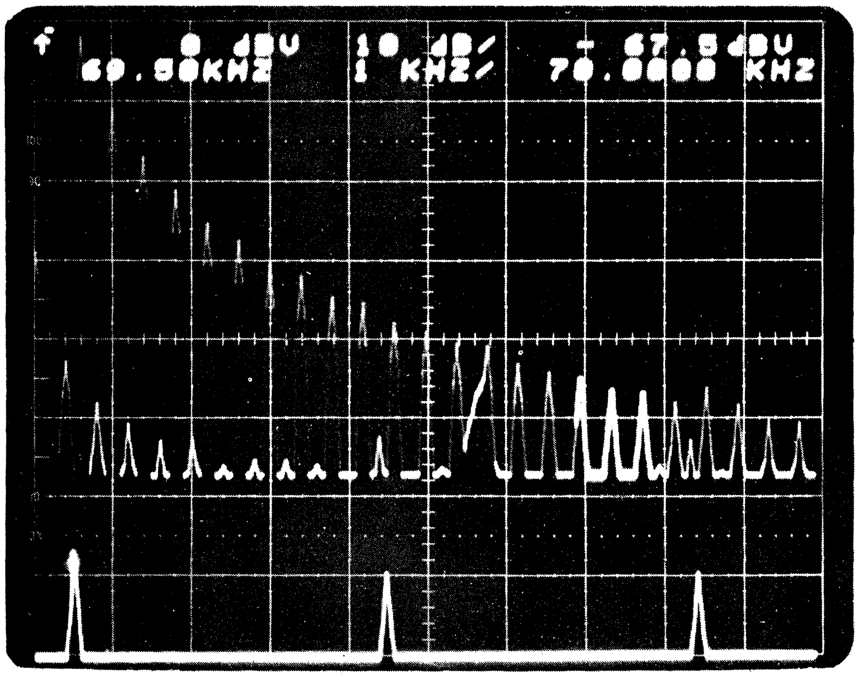


Fig. 4-14a Example of the Use of Cursor-Reads Switch. Cursor-Reads Switch Set at Foreground

b. Move READS switch to NEITHER (Fig. 4-14b) and note the readout corresponds to the starting frequency and span for the foreground.

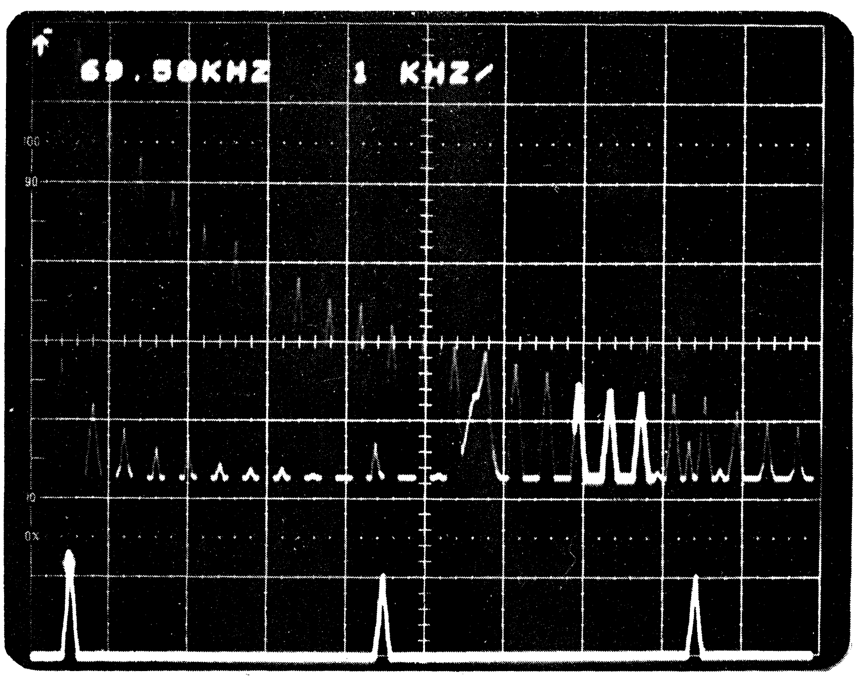


Fig. 4-14b Example of the Use of Cursor-Reads Switch. Cursor-Reads Switch Set at Neither

4-5. THE CURSOR CLUSTER - continued

4-5.2 Reads - continued

c. Set READS on BACKGROUND and move marker to 70.000 KHz (Fig. 4-14c). The readout of amplitude should be nominally the same as for the foreground. The readout corresponds to the background for the 0 - 100 KHz span.

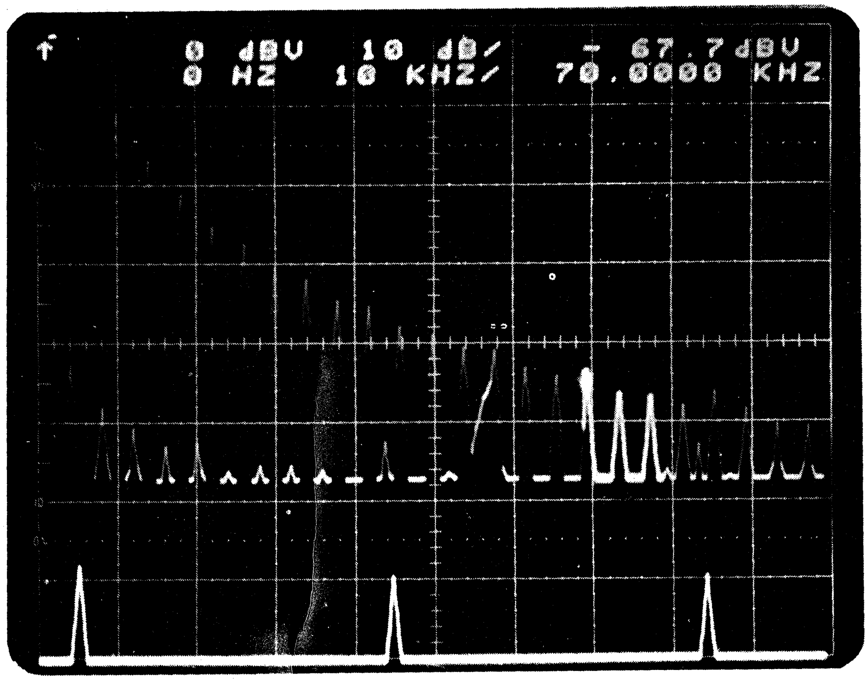


Fig. 4-14c Example of the Use of Cursor-Reads Switch. Cursor-Reads Switch Set at Background

4-5.3 Amplitude Calibration

a. Arbitrarily select the signal at 70.000 KHz on the background display as the reference amplitude; momentarily set the ABSOLUTE - WRT REF - SET REF toggle switch to SET REF. The amplitude indicated by the cursor will be 0 dB ($\pm$ 0.1 dB).

b. Move the cursor to 6.000 KHz. Note, the amplitude readout is referenced to the signal component at 70.000 KHz.

c. Move the READS toggle switch to FOREGROUND and move the marker to 70.000 KHz. Its amplitude will nominally be the same as set in the BACKGROUND. Thus, either the BACKGROUND or FOREGROUND can be used to establish the reference.

d. Set the AMPLITUDE CALIBRATION to ABSOLUTE. The amplitude readout is now wrt 1 V rms. Move the SPECTRUM GAIN toggle switch upwards

4-5. THE CURSOR CLUSTER - continued

4-5.3 Amplitude Calibration - continued

three (3) times. The baseline of the foreground display will now appear noisy. Move the cursor from the signal component at 70.000 KHz to a signal component that appears to represent noise. The amplitude corresponds to rms voltage of the noise measured in a nominal 50 Hz wide-filter centered about the cursor. Move the RMS-RMS/ $\sqrt{\text{Hz}}$ toggle switch to RMS/ $\sqrt{\text{Hz}}$. The amplitude readout now corresponds to the RMS noise measured in an ideal rectangular 1-Hz wide-filter.

4-6. THE PROCESSING CLUSTER

Set the front panel controls as follows:

- All toggle switches to the up position
- FULL SCALE SENSITIVITY, outer knob, fully counter-clockwise, inner knob, fully clockwise
- RESOLUTION, fully counter-clockwise
- SMOOTHING, none

a. Turn power on and off. The display, after it settles, corresponds to the spectrum of successive 2000 usec long data blocks; no ensemble averaging between the successive spectra is performed.

b. Press START/STOP. The PROCESSING ON LED will go off and the last spectrum displayed will be frozen on the CRT. Switch VIEW from SPECTRUM to TIME. A triangle waveform, corresponding to the frozen spectrum, is displayed. Switch VIEW back to SPECTRUM.

c. Rotate RESOLUTION to 125 Hz (25 KHz SPAN) and STARTING FREQUENCY to 61.5 KHz. Toggle the SPECTRUM GAIN switch upwards three (3) times. The word TUNING will appear on the CRT instead of the frequency scale sensitivity, and a "G" will also appear, indicating that the SPECTRUM GAIN is used. The word TUNING is used to indicate that either or both the RESOLUTION and STARTING FREQUENCY controls were moved. Press START/STOP and move BACKGROUND-DISPLACEMENT up twice. The baseline of spectrum will be noisy (Fig. 4-15a).

4-6. THE PROCESSING CLUSTER - continued

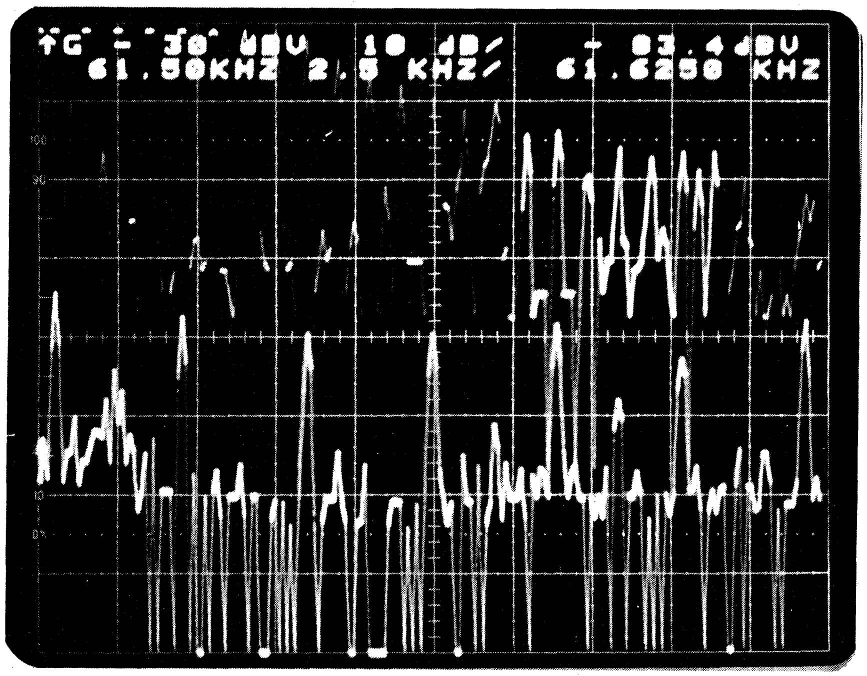
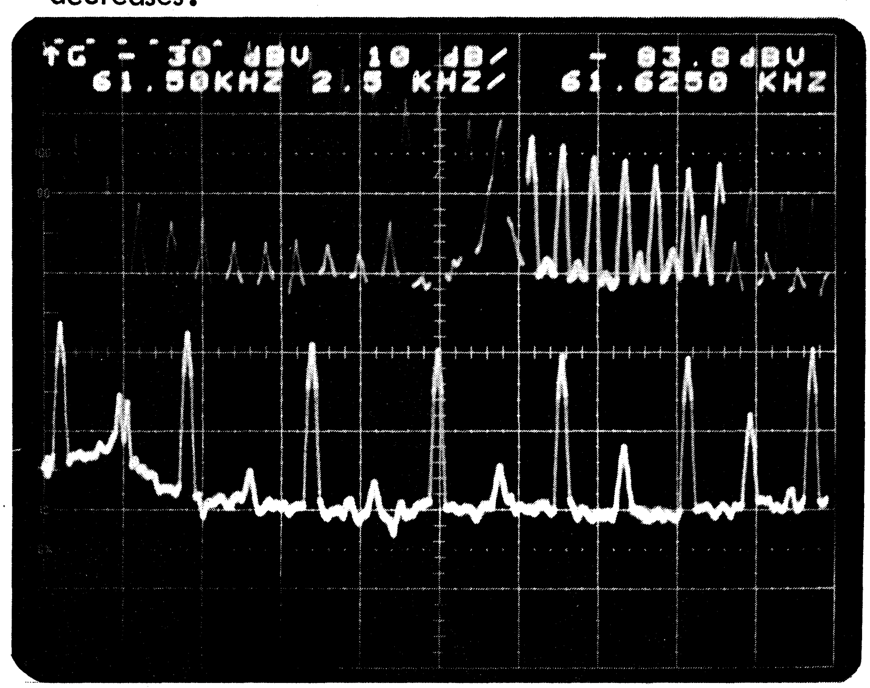


Fig. 4-15a Effects of Smoothing; Smoothing: None

d. Rotate SMOOTHING to the twelve (12) o'clock position, corresponding to smoothing time constant equal to thirty-two (32) independent spectra. The ON LED will flash indicating that linear averaging is being performed. When the LED glows steadily, the SMOOTHING has switched to the exponential averaging mode (Fig. 4-15b). Repeat the process. Press START/STOP twice; once to STOP the processing, the second to reinitiate it. Note how the spectrum initially appears at its full scale amplitude and is noisy. As processing continues, the variation in noise amplitude decreases.



4-6. THE PROCESSING CLUSTER - continued

e. Press STORE (processing can be off or on) and switch BACKGROUND SELECT from 0 - 100 KHz to STORED. The STORED spectrum is identical to the FOREGROUND, but displaced upwards because the BACKGROUND DISPLACEMENT had been previously toggled up.

4-7. THE TRIGGERING CLUSTER

Set the front panel controls as follows:

- All toggle switches to the up position
- FULL SCALE SENSITIVITY, outer knob, fully counter-clockwise, inner knob, fully clockwise
- RESOLUTION, fully counter-clockwise
- SMOOTHING, None

a. Rotate LEVEL/SLOPE so pointer is at twelve (12) o'clock and set SOURCE toggle switch to INPUT SIG. Spectrum display will appear frozen (Fig. 4-16a). Rotate LEVEL/SLOPE clockwise until spectrum display updates and each spectral component narrows (Fig. 4-16b), then rotate the knob back to the twelve (12) o'clock position.

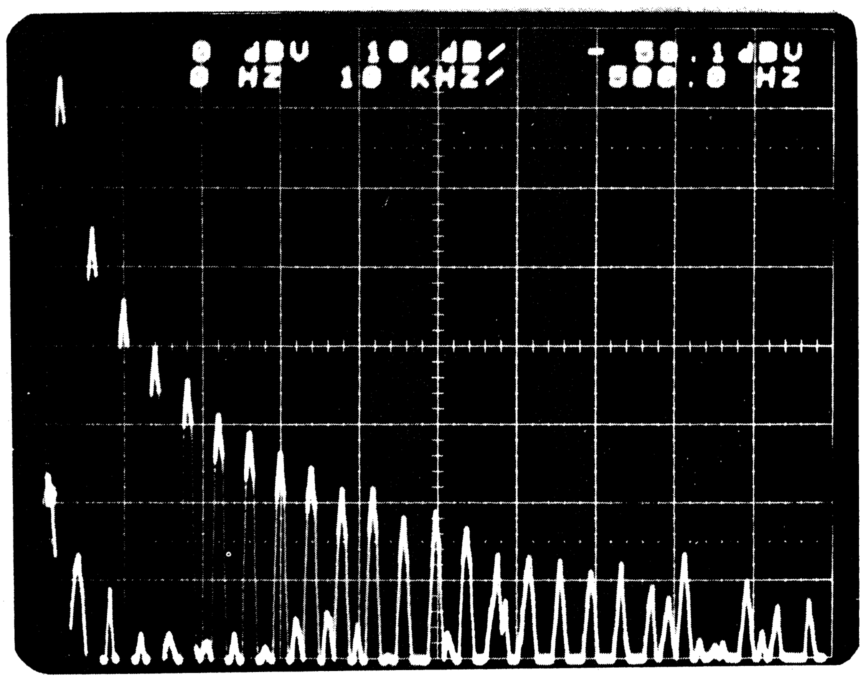


Fig. 4-16a Spectrum of Triangle Waveform when Triggering Source is in Free Run

4-7. THE TRIGGERING CLUSTER - continued

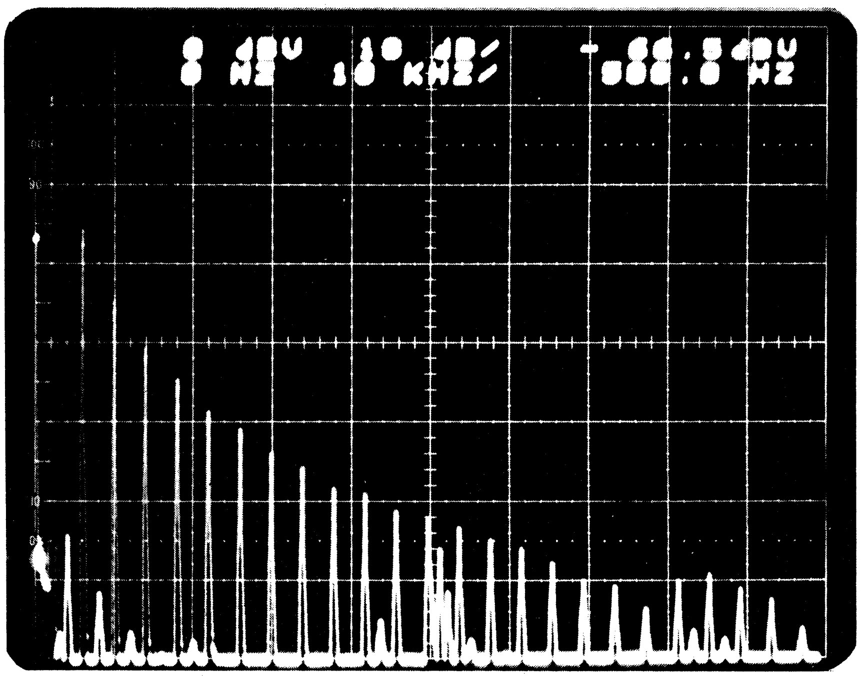


Fig. 4-16b Spectrum of Triangle Waveform when Triggering Source is in Input Sig

The difference in the shape of the spectral lines is due to the change in the shape of each synthesized filter of the spectrum analyzer. The change in the filter shape is achieved by weighting the input signal. In FREE RUN, the weighting function smoothly attenuates the input signal at the start and end of each data block that is processed. For continuous input data the loss of input data due to weighting is traded for the benefit of achieving synthesized filters with fast rolloff, but slightly wider passbands.

TRIGGERING SOURCE is either set to INPUT SIG, or EXT TRIG when transients are analyzed. The effect of non-uniform weighting for transients could severely attenuate the input data block. Therefore, uniform, i.e. no weighting, is used.

4-7. THE TRIGGERING CLUSTER - continued

b. Set DISPLAY VIEW to TIME and move the CURSOR till it is positioned at 250.0 usec which corresponds to the amplitude level which initiated a capture of that data block. Rotate the LEVEL/SLOPE knob slowly both clockwise and counter-clockwise. Note the change in the triggering level and slope.

As data is captured, the CAPTURED LED flickers. After each data block is captured, the triggering controls are automatically rearmed because the ARM MODE is at AUTO position. The ARMED LED appears to be on continuously.

c. Press START/STOP, stopping the PROCESSING. Now set VIEW to SPECTRUM. Rotate SMOOTHING to twelve (12) o'clock. Press START/STOP again. PROCESSING LED will slowly flash and go off after the selected number of averages is performed: thirty-two (32) at the twelve (12) o'clock setting.

d. Set SMOOTHING to nine (9) o'clock, corresponding to two (2) averages. Set the ARM MODE to OFF and press START/STOP. PROCESSING ON LED will flash, but since the triggering controls are not armed, no new data is captured.

Set ARM MODE to the momentary position SINGLE. The ARMED LED will flicker and one spectrum will be captured and stored in the averager. Press ARM MODE to SINGLE again. A second spectrum will be captured and averaged with the first spectrum and PROCESSING LED will go off, indicating the selected number of averages (SMOOTHING set at two (2) averages) was reached.

WAVETEK

ROCKLAND