SECTION IV

THEORY OF OPERATION

4-1. OVERALL FUNCTIONAL DESCRIPTION (figure 4-1)

4-2. Figure 4-1 is a simplified block diagram of the Model 762-2A spectrum analyzer, which is composed of the Model 809-2A Microwave Tuning Unit and the Model 712-2A Standard Persistence Display Unit.

4-3. Basically, the spectrum analyzer is an electronically tuned, multiple conversion, super-heterodyne swept receiver with a CRT display that indicates signal amplitude as a function of frequency. The frequency spectrum display along the horizontal axis of the CRT is produced by linearly sweeping the receiver local oscillator frequency in synchronism with the horizontal deflection voltage for the CRT. This dispersion sweep of the local oscillator is analogous to manually tuning a conventional receiver across a frequency band, and measuring received signal amplitude at each point in the tuning range. The automatic dispersion sweep of the Model 762-2A, synchronized with the horizontal deflection voltage for the CRT, produces a graphic portrayal of signal amplitude versus frequency over an operator-selected frequency range.

4-4. MODEL 809-2A MICROWAVE TUNING UNIT. This unit receives the RF signal input whose frequency spectrum is to be analyzed, and produces video whose amplitude is proportional to RF signal amplitude at any given frequency in the frequency range being examined. The frequency range of the Model 809-2A is from 10 MHz to 40 GHz, and is divided into 7 bands (bands 1 through 7).

4-5. RF inputs in bands 1 through 4 (.01 to 12.4 GHz) are applied to the 1st and 2nd IF circuits via the RF INPUT front panel jack.

4-6. RF inputs in bands 5 through 7 (12.4 to 40 GHz) are applied to an external mixer connected to the EXT MIXER front panel jack. The swept 1st local oscillator signal from the 1st local oscillator is coupled to the external mixer via the EXT MIXER jack, and the appropriate harmonic (determined by the frequency band) of the local oscillator signal is mixed with the RF input signal, producing a 2.05 GHz IF signal that is supplied back through the EXT MIXER jack to the 1st and 2nd IF circuits.

4-7. The RF signal fron the RF INPUT connector (bands 1 through 4) or from the external mixer (bands 5 through 7) is then processed by the first, second, third, and fourth IF circuits, and the fourth IF signal is applied to video circuits that produce the vertical deflection input to the Model 712-2A Display Unit.

4-8. The center frequency of the Model 809-2A is established by the FREQUENCY TUNE control on the front panel, and is indicated in the tuning dial window. This center frequency is related to the center frequency of the 1st local oscillator.

4-9. A derivative of the sweep sawtooth used to drive the horizontal deflection circuits in the display unit is supplied as the dispersion sweep signal to the Model 809-2A. Except in the fast sweep mode (no dispersion sweep), this dispersion sweep signal is applied to either the 1st or 3rd local oscillator, depending upon the setting of the SCANWIDTH switch. For scanwidths of 1 MHz per division or greater (wide-scan

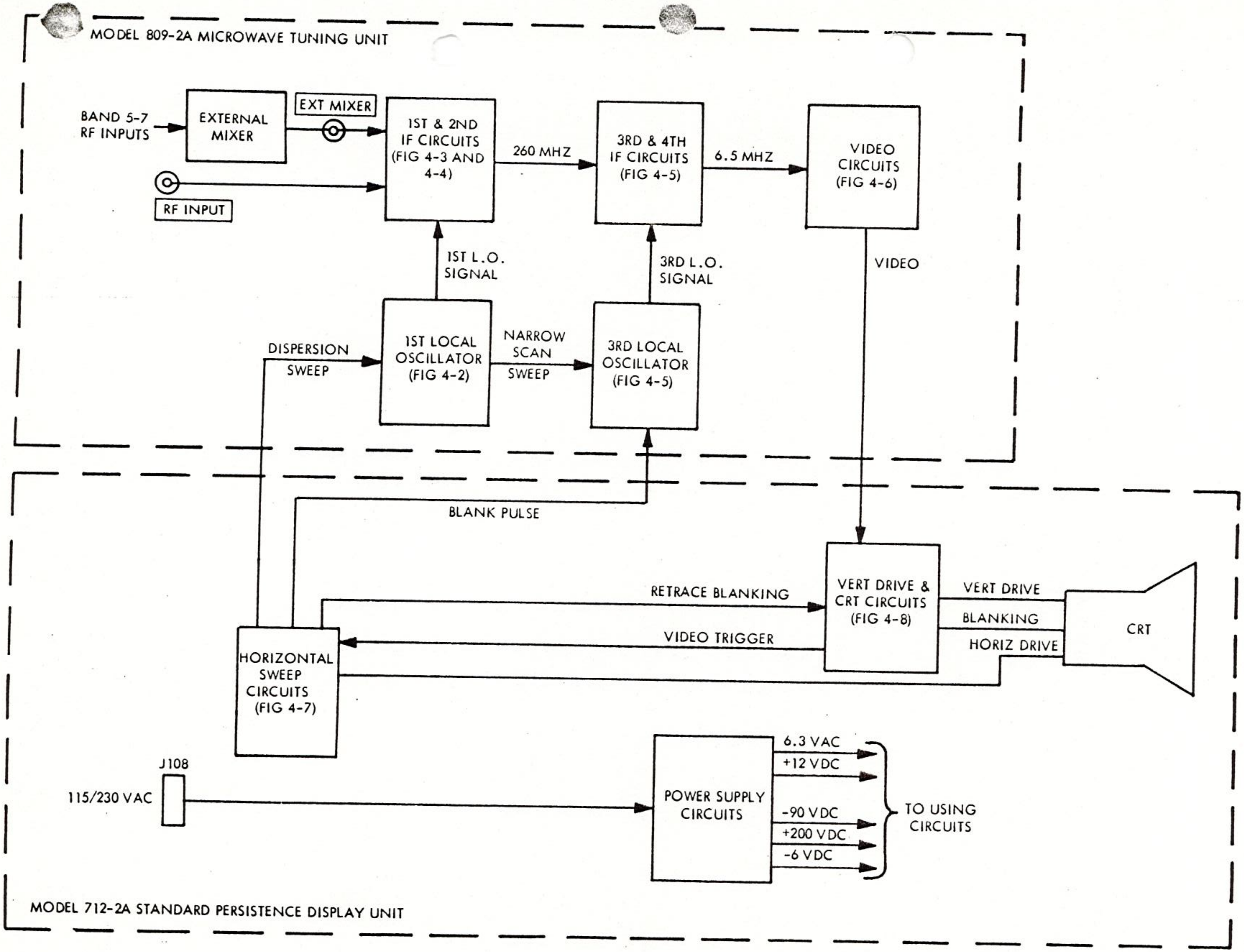

Figure 4-1. Overall Block Diagram

sweep), the dispersion sweep sawtooth is applied to the 1st local oscillator. For scanwidths of less than 1 MHz per division (narrow-scan sweep), the dispersion sweep sawtooth is applied to the 3rd local oscillator.

4-10. The local oscillator which receives the dispersion sweep signal is swept across a frequency range established by the SCANWIDTH switch setting. This dispersion sweep causes the local oscillator output frequency to increase linearly as the CRT beam is deflected from left to right across the display. The center position on the display corresponds to the center frequency established by the FREQUENCY TUNE control.

4-11. The swept local oscillator output is applied to a mixer where it is mixed with the input signal being analyzed. The mixing action produces sum and difference signal components. The difference signal products are defined as follows:

$$f_{dif} = f_{sig} - nf_{lo},\ nf_{lo} - f_{sig} \quad (1)$$

Where:

f_{dif} = the frequency of the difference signal

f_{sig} = the frequency of the RF input (signal being analyzed)

f_{lo} = the frequency of the swept local oscillator at any given instant

n = the harmonic of the local oscillator frequency (1st, 2nd, 3rd, etc., harmonic)

4-12. As the local oscillator sweeps across the frequency range established by the FREQUENCY TUNE control and the dispersion sweep signal, a point will be reached where a difference signal equal to the associated IF frequency is produced. The Model 809-2A produces a video output only when the difference signal is equal to the associated IF frequency, consequently, a video output is produced for each frequency component of the signal being analyzed which is in the range established by the first local oscillator center frequency and the dispersion sweep sawtooth.

4-13. The video output for each frequency component is applied to the vertical deflection circuits in the display unit, producing vertical deflections whose amplitudes are proportional to the relative power of each frequency component. The vertical deflection for a particular frequency component occurs at the point on the horizontal sweep where:

$$nf_{lo} = f_{sig} \pm f_{if} \quad (2)$$

Where:

f_{if} = the intermediate frequency associated with the mixer stage where the signal of interest is mixed with the swept local oscillator signal

f_{sig} = the frequency of a particular frequency component in the signal of interest

4-14. That is, when the swept local oscillator reaches a frequency (nf_{lo}) which is equal to the frequency of the signal of interest plus or minus the IF frequency (f_{if}), the resulting mixer output will produce a vertical deflection. Since the local oscillator and the CRT horizontal deflection are swept in synchronism, the horizontal position on the display defines the frequency of the signal of interest.

4-15. The tuning range of the 1st local oscillator is 2.0 to 4.1 GHz. To cover the frequency range from 10 MHz to 40 GHz, the first, second, third, fourth, sixth, and tenth harmonics (n = 1, 2, 3, 4, 6, 10) of the first local oscillator or utilized. The selected harmonic is determined by the external mixer connected to the EXT MIXER jack (bands 5 through 7), or by the position of the BAND SELECT control (bands 1 through 4), which selects the harmonic number being utilized. The band number (1 through 7) is indicated on the BAND SELECT switch. The selected harmonic number is indicated in the tuning window for each band, as follows:

Band	Harmonic (n =)
1	1-
2	2-
3	3-
4	3+
5	4+
6	6+
7	10+

The selected harmonic of the 1st local oscillator is mixed with the RF input to produce a first IF frequency of 2.050 GHz. In the wide-scan sweep positions of the SCANWIDTH switch (1 MHz per division or above), nf_{lo} in equation (2) is the frequency of the selected harmonic of the 1st local oscillator, f_{sig} in equation (2) has a frequency of 10 MHz to 40 GHz, and f_{if} is 2.050 GHz.

4-16. In the narrow-scan positions of the SCANWIDTH switch (less than 1 MHz per division), nf_{lo} in equation (2) is the fundamental frequency (n = 1) of the swept 3rd local oscillator, f_{sig} has a frequency of 260, and f_{if} is 60 MHz. The nominal tuning range of the 3rd local oscillator is 198 MHz to 202 MHz (200 ±2 MHz).

4-17. The width of the dispersion sweep is determined by the setting of the BAND SELECT (wide-scan only) and SCANWIDTH switches, and is varied by attenuating the dispersion sweep sawtooth applied to the local oscillator being swept. When the SCANWIDTH switch is set to 1 MHz per division or higher (wide scan sweep), and the FULL SWEEP/SIG IDENT switch is operated to the FULL SWEEP position, the 1st local oscillator is swept across the entire 2 - 4 GHz range, regardless of the setting of the SCANWIDTH switch. A 200 MHz per division display is produced.

4-18. The bandwidth of the final (4th) IF frequency (6.5 MHz) is determined by the setting of the BANDWIDTH switch. In the narrow bandwidth positions of this switch, higher resolution of discrete frequency components in the signal of interest can be accomplished. An IF attenuator, controlled by front-panel switches, permits the 6.5 MHz IF signal to be attenuated by as much as 51 dB before video detection is performed. Either linear or logarithmic video detection may be selected. A variable IF GAIN control is also provided.

4-19. The VIDEO DURATION - BW control on the front panel provides a video filter when set to the 1 KHz position. When set to SHORT or LONG positions, displays of narrow pulse signals can be enhanced.

4-20. When a signal of unknown frequency is being analyzed, the correct frequency band must first be determined. To aid in identifying the correct frequency band, a signal identification feature is incorporated. First, the FREQUENCY TUNE control is used to center the unknown signal on the CRT display. Then, with the SCANWIDTH switch set for 1 MHz per division (wide-scan sweep), and the FULL SWEEP/SIG IDENT switch is depressed. This action causes the following events to occur:

a. The third local oscillator is shifted up or down in frequency by 2 MHz.

b. The third IF signal is attenuated by 6 dB.

These actions cause a 6 dB down image of the signal of interest to appear on the display to the left of the center line where the real signal of interest is being displayed. The correct band is then determined by operating the BAND SELECT switch until the image appears two major divisions to the left of the center line.

4-21. MODEL 712-2A STANDARD PERSISTENCE DISPLAY UNIT. This unit (hereinafter called the display unit) contains the following elements:

a. The power supplies which supply d-c voltages to the Model 809-2A and the circuits in the display unit.

b. The horizontal sweep circuits which produce the horizontal sweep on the CRT, and the dispersion sweep signal for the Model 809-2A.

c. The vertical drive circuits which receive the video output of the Model 809-2A and produce the vertical drive for the CRT.

d. The circuits associated with the CRT, which include video blanking circuits, high-voltage power supplies, and the focus, intensity, astigmatism, and trace alignment controls. The CRT utilizes electrostatic deflection.

4-22. The video output of the Model 809-2A is converted to vertical drive signals for the CRT. Also, a video trigger is supplied to the horizontal sweep circuits when the horizontal sweep is being synchronized to a video trigger.

4-23. The horizontal sweep circuits produce the sweep sawtooth used for the CRT horizontal drive and the dispersion sweep. Depending upon the mode, the sweep can be synchronized to any of the following:

a. A video trigger from the vertical drive circuits.

b. A single sweep switch on the front panel, which initiates a sweep each time the switch is pressed.

c. A free-running mode.

d. Power line frequency.

4-24. The sweep rate (sweep time perdivision) is selected by means of front panel switches in either the standard or fast-sweep mode. Alternatively, a manual sweep can be selected, in which the operator controls the sweep by means of a front panel control.

4-25. MODES OF OPERATION

4-26. The spectrum analyzer can be operated in a number of different modes, as selected by the front panel controls. The succeeding subparagraphs describe major modes of operation.

4-27. SWEEP MODES

4-28. AUTOMATIC MODE. In this mode, the SWEEP MODE switch on the Model 712-2A is set to STD, the BANDWIDTH switch on the Model 809-2A is set to AUTO, and the STD SWEEP AUTO button on the Model 712-2A is activated. In the automatic mode, the IF bandwidth is determined by the SCANWIDTH/DIV switch setting. Also, the horizontal sweep rate (sweep time per division) in the Model 712-2A is optimized.

4-29. FAST SWEEP MODE. This mode is selected when the SWEEP MODE switch on the Model 712-2A is set to FAST, and one of the FAST SWEEP buttons is pressed. In the fast sweep mode, no dispersion sweep is produced, and the spectrum analyzer is used as an ordinary superheterodyne receiver that is tuned to the frequency of the signal of interest. The CRT display (amplitude on the vertical axis, time on the horizontal axis) is similar to that of a conventional oscilloscope, and consists of the detected video pulse whose carrier frequency is equal to the center frequency indicated on the tuning dial. Normally, the horizontal sweep of the CRT is synchronized to the video pulses themselves. Sweep times between 100 microseconds (10 microseconds per division) and 10 milliseconds (1000 microseconds per division) can be selected.

4-30. STANDARD SWEEP MODE. This is the most commonly used sweep mode for spectrum analysis. The SWEEP MODE switch on the Model 712-2A is set to STD, and one of the seven STD SWEEP pushbuttons is pressed to select a specific sweep rate (sweep time per division). The mode of sweep syncyronization is selected by the SYNC switches. Sweep times between 30 seconds (3 seconds per division) and 30 milliseconds (3 milliseconds per division) can be selected. By means of the SWEEP VAR/MAN control, sweep times may be varied between the fixed values selected by the pushbuttons.

4-31. MANUAL SWEEP MODE. The SWEEP MODE switch must be set to MAN. The SWEEP VAR/MAN control is used to move the horizontal beam on the CRT. This control varies the dispersion sweep signal applied to the Model 809-2A.

4-32. SINGLE SWEEP MODE. In this mode, the SYNC SINGLE SWEEP button must be pressed to initiate each horizontal sweep of the CRT. The sweep rate (sweep time per division) is determined by the settings of the SWEEP MODE and STD SWEEP or FAST SWEEP switches.

4-33. SCAN MODES

4-34. FULL SWEEP/SIGNAL IDENTIFICATION MODE. This mode is normally used to locate a video signal of interest in the 10 MHz to 40 GHz range. Initially, the settings of the SCANWIDTH, BAND SELECT, and FREQUENCY TUNE controls are irrelevant. The FULL SWEEP/SIG IDENT switch is first operated to the FULL SWEEP position. Each dispersion sweep will then cause the 1st local oscillator to sweep across the full 2GHz range. Harmonic mixing will cause any signal in the 10 MHz to 40 GHz range to appear on the CRT. The location (distance to the left or right of center) of the signal of interest can then be used to determine the approximate setting of the FREQUENCY TUNE control to center the signal on the CRT. After the signal of interest has been centered, the scanwidth is progressively reduced, and the signal of interest is recentered with the FREQUENCY TUNE control (closing in on the signal). Then, with the signal of interest centered, and with the SCANWIDTH switch set to 1 MHz per division, the FULL SWEEP/SIG IDENT switch is set to SIG IDENT. A reduced amplitude (6 dB down) image of the signal of interest will appear to the left of the centerline. The BAND SELECT switch is then operated to the position where the image signal is displaced two major divisions to the left of the centerline. Since the correct band has been chosen, the frequency of the signal of interest can then be read directly from the tuning dial.

4-35. WIDE-SCAN MODE. The wide-scan mode is always selected when the SCANWIDTH switch is set for a scanwidth of 1 MHz per division or greater. In this mode, the dispersion sweep signal from the display unit is attenuated by the appropriate amount (as determined by the settings of the BAND SELECT and SCANWIDTH switches) and applied as the main tuning signal to the 1st local oscillator. Phase-locked operation cannot be selected in the wide-scan mode. The center frequency of the dispersion sweep is determined by the setting of the FREQUENCY TUNE control, as indicated on the tuning dial. Fine tuning is accomplished by varying the FINE TUNE control, which adjusts the frequency of the 3rd local oscillator.

4-36. NARROW-SCAN MODE. The narrow-scan mode is always selected when the SCANWIDTH switch is set for a scanwidth of less than 1 MHz per division. In this mode, the dispersion sweep signal from the display unit is attenuated by the appropriate amount (as determined by the setting of the SCANWIDTH switch) and applied as the tuning signal to the 3rd local oscillator. The 1st local oscillator produces a fixed-frequency output established by the FREQUENCY TUNE control. Phase-locked operation is normally used, and is selected by setting the STAB switch to the up (on) position. This action causes the 1st local oscillator to be locked to a harmonic of a 1 MHz reference signal so as to stabilize the 1st local oscillator. When the 1st local oscillator is phase-locked, a STAB indicator lights.

4-37. LINEAR AND LOGARITHMIC VIDEO DETECTION MODES. Either linear or logarithmic video detection can be selected by means of the LIN/LOG switch on the Model 809-2A. When the linear detection mode is selected, the left-hand scale on the CRT graticule is utilized, and the video amplitude on the CRT is a linear function of signal voltage. When the logarithmic detection mode is selected the right-hand scale of the CRT graticule is utilized, and the video amplitude is compressed on a logarithmic (decibel) scale.

4-38. DETAILED FUNCTIONAL DESCRIPTIONS

4-39. MODEL 809-2A MICROWAVE TUNING UNIT (Figures 8-6 and 8-7). As shown in figure 4-1, the major functional elements of the Model 809-2A are the 1st local oscillator, the 1st and 2nd IF circuits, the 3rd local oscillator, the 3rd and 4th IF circuits, and the Video circuits. The detailed block diagram showing each of these elements is indicated in figure 4-1. The succeeding subparagraphs provide etailed block diagram descriptions for each of the major functional elements. The ion (reference designation) of each element is indicated on the detailed block iagrams.

-40. 1ST LOCAL OSCILLATOR (Figure 4-2). Oscillator Y201 is a YIG-tuned scillator whose frequency is controlled by the main tuning current and the phase ock tuning current (narrow-scan mode only). The 1st local oscillator output is upplied through 20 dB coupler DC201 to the 1st and 2nd IF circuits.

-41. OPERATION OF 1ST LOCAL OSCILLATOR IN WIDE-SCAN MODE. In the vide-scan mode, the oscillator center frequency is established by FREQUENCY TUNE control R201, and the wide-scan sweep signal controls the tuning range. The wide-scan sweep signal is derived as follows:

a. The dispersion sweep signal from the display unit is supplied to the harmonic attenuator (part of board A206)., which also receives switch selection signals from the BAND SELECT switch. The sawtooth-shaped dispersion sweep signal is attenuated in the harmonic attenuator by an amount (inversely proportional to the harmonic number) determined by the selected band, producing the wide-scan sweep signal.

b. The wide-scan sweep signal is then applied to the SCANWIDTH switch, scaled according to the selected scanwidth, and supplied to the sweep summing junction on board A208.

4-42. The sweep summing junction on board A208 receives the wide-scan sweep signal and the d-c output of the FREQUENCY TUNE control. The resulting input to the sweep driver (which produces the main tuning current) is a sawtooth voltage centered on the d-c voltage from the FREQUENCY TUNE control.

4-43. OPERATION OF 1ST LOCAL OSCILLATOR IN FULL SWEEP MODE. When the FULL SWEEP/SIG IDENT switch (S203) is set to FULL SWEEP, the harmonic attenuator is disabled, permitting the unattenuated sawtooth from the display unit to be applied (via the harmonic attenuator) through switch S203 to the sweep summing junction. The input from the FREQUENCY TUNE control to the sweep summing junction is disabled, thus the resulting input to the sweep driver is a sawtooth voltage centered on the d-c voltage that corresponds to the 3 GHz center frequency of the 1st local oscillator. The sawtooth voltage causes the 1st local oscillator to sweep across its entire frequency range (2 to 4 GHz).

4-44. OPERATION OF 1ST LOCAL OSCILLATOR IN NARROW-SCAN MODE. In the narrow-scan mode, the select narrow scan signal is at -15 VDC, disabling the harmonic attenuator to permit the unattenuated sawtooth from the display unit to be applied (via the harmonic attenuator) to the SCANWIDTH switch. The amount of attenuation of the sawtooth voltage is then determined by the setting of the SCANWIDTH switch. The resulting narrow-scan sweep signal is applied to the 3rd local oscillator. The wide-scan sweep signal from the SCANWIDTH switch is interrupted, thus no dispersion sweep signal is applied to the 1st local oscillator. Consequently, the main tuning current for the 1st local oscillator is controlled solely by the FREQUENCY TUNE control, and no frequency sweep occurs. If STAB switch S206 is set to the up (on) position, the phase lock detector (A209) is enabled, and a sample of the Y201 output is supplied as a feedback signal through isolator AT203 and 20 dB coupler DC201 to the phase lock detector. The phase detector compares the phase of the feedback signal with the phase of the nearest harmonic of of a 1-MHz reference oscillator. If the phase relationship is incorrect, the resulting error signal activates a search oscillator in the phase detector, producing a phase lock tuning current for Y201. This tuning current produces small changes in oscillator frequency. When the correct phase relationship is obtained, the search oscillator stops, and the STAB indicator lights to indicate that the 1st local oscillator is phase-locked. Selection of the narrow-scan mode also energizes a noise filter relay that is part of the sweep driver circuit on board A208. With the relay energized, the noise filter circuit eliminates fluctuations in the main tuning current.

4-45. 1ST AND 2ND IF CIRCUITS. The 1st and 2nd IF circuits receive the RF input and the output of the 1st local oscillator, and convert the RF input to a 260 MHz IF signal. The configuration of the 1st and 2nd IF circuits depends upon the selected band, as described in the succeeding subparagraphs.

4-46. 1ST AND 2ND IF CIRCUIT CONFIGURATION FOR BANDS 1, 2, 3, AND 4 (Figure 4-3). When band 1, 2, 3, or 4 is selected, the RF input is applied through the RF INPUT front panel jack through DC blocking capacitor Z204 to 1st IF mixer Z202. The 1st local oscillator signal is also applied to mixer Z202. The resulting 1st difference frequency output (2.050 GHz) from Z202 is applied through the normally closed contact of waveguide coaxial switch K201 to bandpass filter FL201. The resulting narrow-band 2.050-GHz 1st IF signal from FL201 is applied back to 2nd IF mixer Z203. Mixer Z203 also receives the 1.79 = GHz 2nd local oscillator signal from fixed-frequency oscillator Y202. The resulting 260-MHz difference frequency output of Z203 is applied through 260-MHz amplifier AR201 to the 3rd and 4th IF circuits.

4-47. 1ST AND 2ND IF CIRCUIT CONFIGURATION FOR BANDS 5 THROUGH 7 (Figure 4-4). For bands 5 through 7, the RF input is connected to an external mixer. The 1st local oscillator signal is applied through 1st IF mixer Z202, circulator HY201, external mixer bias block Z201, the EXT MIXER front panel jack and a 3 dB pad to the external mixer. The resulting 1st difference frequency output (2.050 GHz) produced by the mixing action in the external mixer is supplied back through the 3 dB pad and the EXT MIXER front panel jack to external mixer bias block Z201. The bias voltage applied to the bias block (a variable voltage from BIAS control R202) is set for optimum conversion efficiency of the external mixer. The 2.050-GHz IF signal from Z201 is applied through circulator HY201 and the normally open contact of waveguide coaxial switch K201 to bandpass filter FL201. The resulting narrow-band 2.050-GHz 1st IF signal from FL201 is applied back to 2nd IF mixer Z203. Mixer Z203 also receives the 1.79 GHz 2nd local oscillator signal from fixed-frequency oscillator Y202. The resulting 260-MHz difference frequency output of Z203 is applied through 260-MHz amplifier AR201 to the 3rd and 4th IF circuits.

4-48. 3RD AND 4TH IF CIRCUITS (figure 4-5). The 3rd and 4th IF circuits receive the 260-MHz IF signal from the 1st and 2nd IF circuits, and convert this input to a 6.5-MHz IF signal that is supplied to the video circuits.

4-49. 3RD LOCAL OSCILLATOR. The 3rd local oscillator, located on board A201, is a voltage controlled oscillator (VCO) having a nominal center frequency of 200 MHz. Fine adjustment of the center frequency is accomplished by the FINE TUNE control (A210R1). In the wide-scan mode, the 3rd local oscillator frequency is fixed at the frequency established by the FINE TUNE control. In the narrow-scan mode, the 3rd local oscillator executes narrow-scan sweeps under the control of the narrow-scan sweep signal. These narrow-scan sweeps are centered around the center frequency established by the FINE TUNE control. In the full sweep/signal identification mode, when the FULL SCAN/SIG IDENT switch is set to SIG IDENT, the following actions occur:

a. For bands 1 through 3, the 3rd local oscillator output is reduced by 2 MHz. For bands 4 through 7, the image decoder logic on board A208 causes the frequency to be increased by 2 MHz. The difference between bands 1 through 3 and bands 4 through 7 is caused by the fact that, for bands 4 through 7, the 1st local oscillator harmonic is below the frequency of the RF input, whereas for bands 1 through 3, the 1st local oscillator harmonic is above the RF input frequency.

b. After the FULL SCAN/SIG IDENT switch is returned to the center-off position, the blank pulse (from the display unit) produced during retrace blanking of the next sweep terminates the 2-MHz shift in the 3rd local oscillator frequency.

4-50. 3RD IF CIRCUITS. The 3rd IF mixer receives the 260-MHz IF signal from the 1st and 2nd IF circuits, and also receives the output of the 3rd local oscillator. The resulting 60-MHz difference signal produced by the mixing action is applied through the diode switch and 6 dB attenuator (on board A201) to the 60-MHz amplifier-filter on board A202. The resulting 60-MHz IF output is applied to the 4th IF mixer. The gain of the 60-MHz amplifier can be varied by the IF GAIN - VAR control, which supplies a dc gain control signal, via an operational amplifier on A202, to the 60-MHz amplifier.

4-51. In the full sweep/signal identification mode, when the FULL SWEEP/SIG IDENT switch is set to SIG IDENT, the diode switch is activated by the SIG IDENT level from the 3rd local oscillator. When the diode switch is activated, the 60-MHz output of the 3rd IF mixer is attenuated by 6 dB. The attenuated output is ultimately used to produce the image signal on the CRT, permitting identification of the correct frequency band for the signal of interest. After the FULL SWEEP/SIG IDENT switch is returned to the center-off position, the blank pulse (from the display unit) produced during retrace blanking of the next sweep terminates activation of the diode switch, removing the 6 dB attenuation of the 3rd IF mixer output.

4-52. 4TH IF CIRCUITS. The 60-MHz IF output of the 3rd IF mixer is applied to the 4th IF mixer on board A202. The 60-MHz IF signal is mixed with the 53.5-MHz output of the 4th local oscillator, also on board A202. The resulting difference frequency output is amplified by the 6.5-MHz amplifier, producing the 6.5-MHz IF signal. The gain of the 6.5-MHz amplifier is adjusted by the front-panel CAL screwdriver adjustment. The 6.5-MHz IF signal is then applied through an IF attenuator (AT202) to the video circuits. The IF attenuator, controlled by front panel switches, permits up to 51 dB of attenuation to be applied to the IF signal.

4-53. VIDEO CIRCUITS (Figure 4-6). When BANDWIDTH switch A210S1 is in any position except AUTO, switch A210S1 selects the IF bandwidth (1000 KHz, 100 KHz, 10 KHz, 1 KHz, or .3 KHz) of the 4th IF (6.5 MHz) signal. When switch A210S1 is in the AUTO position, the position of the SCANWIDTH switch selects the bandwidth, assurring that the optimum IF bandwidth is selected in automatic operation. The bandwidth selection lines control the 100 KHz filter (A203), the 6.5 MHz crystal filter (A204), and the video filter (A206).