

DESCRIPTION

2710 Tracking Generator generates a sweep frequency which tracks the frequency window of the 2710 Spectrum Analyzer with the following features:

- A microprocessor-controlled frequency adjustment for correlating the generator frequency with the Spectrum Analyzer's window.
- Optimum flatness
- Microprocessor-controlled output levels
- Excellent harmonic and spur performance
- 50 Ω nominal output impedance

Frequency Control

When the Tracking Generator is turned off, the instrument is restored to full performance with its full dynamic range. This is accomplished by disabling the 2110 MHz oscillator in order to prevent radiation into the Spectrum Analyzer's first IF. The Tracking Generator is turned on or off through the DET/GEN MENU.

Auto or manual frequency alignment is also selected via the DET/GEN MENU. The Tracking Generator's default mode is Auto.

Under auto selection, the instrument will set the Tracking Generator output frequency to correspond exactly to the Spectrum Analyzer's input frequency. Knowing the 10 MHz IF center frequency along with the internal reference frequency, the instrument can calculate where to position the Tracking Generator's 105.5 MHz VCO as follows:

Since the 2710's final IF is defined by

$$f_{if} = f_{yig} - f_{in} - 21 f_{ref}$$

Where f_{if} is the 2710 10 MHz IF center frequency, f_{yig} is the 2710 1st LO frequency, f_{in} is the 2710 input frequency, and f_{ref} is the 2710 100 MHz reference frequency.

$$f_{tg} = f_{yig} - f_{lo}$$

Where f_{tg} is the Tracking Generator's output frequency, f_{yig} is the Spectrum Analyzer's 1st LO frequency, and f_{lo} the Tracking Generator's LO frequency.

Since f_{in} must equal f_{tg} , then:

$$\begin{aligned} f_{in} &= f_{yig} - f_{if} - 21 f_{ref} \\ &= f_{yig} - f_{lo} \end{aligned}$$

This LO frequency is 20 times the Tracking Generator's Voltage Controlled Oscillator frequency (f_{vco}); therefore,

$$f_{vco} = f_{lo}/20$$

$$f_{vco} = (f_{if} + 21f_{ref})/20$$

Thus, when auto frequency alignment is selected, the Spectrum Analyzer sets the frequency of the Tracking Generator's VCO according to the last equation.

Output Level Control

There are two methods of controlling the output level: first, by keyboard entry via the DET/GEN MENU and second, via the Spectrum Analyzer LEVEL control. The LEVEL control allows dynamic level control, uncalibrated, while the instrument is sweeping. When using the LEVEL control, the Tracking Generator level displayed indicates that the level is not accurate. The keyboard entry method produces (with respect to 100 MHz) a calibrated output level and disables the Spectrum Analyzer LEVEL control.

ACCESSORIES

Standard Accessories

Item	Tektronix/No.
Data Sheet	062-9636-00
Adapter 50 Ω N Male to BNC Female	103-0045-00
75 Ω-to-50 Ω Minimum Loss Attenuator, N Male to BNC Female	131-4199-00

**Table 1
ELECTRICAL CHARACTERISTICS**

Characteristics	Performance Requirement	Supplemental Information
Frequency Range		
Nominal	100 kHz to 1.8 GHz, tracks the 2710 input	
TG TRACKING (Frequency Offset)	Sufficient to align Tracking Generator to Spectrum Analyzer window, typically -5 kHz to + 60 kHz	Auto Frequency correction for centering into Spectrum Analyzer window
Output Level		
Range	-48 dBm to 0 dBm	0.1 dB steps
Accuracy	±1.5 dB	At 100 MHz
Output Impedance		50 Ω nominal
VSWR	2:1 or better with output level ≤ -8 dBm	
Flatness		
Tracking Generator	±1 dB from 100 kHz to 1.0 GHz and ±1.5 dB to 1.8 GHz	Typically ±1 dB to 1.8 GHz
System*	±2.5 dB from 100 kHz to 1.0 GHz and ±3 dB to 1.8 GHz	With 10 dB of attenuation in the Spectrum Analyzer
User-Corrected	±0.2 dB	Using B C- Save A Flatness feature
System Dynamic Range	≥100 dB	Sensitivity ≥ -100 dBm
System Residual FM		
Option 01 Instruments		≤100 Hz _{pp} total excursion in 20 ms
Non-Option 01 Instruments		≤ 2 kHz _{pp} total excursion in 20 ms
Spurious Signals		
Harmonic	-20 dBc or better with respect to the fundamental	At frequencies ≥100 kHz
Non-Harmonic	-35 dBc or better with respect to the fundamental	

* System = Tracking Generator and Spectrum Analyzer combination.

CONTROLS, INDICATORS, AND CONNECTORS

CONTROLS

The Tracking Generator mode is initiated by selecting "TRACKING GENERATOR" in the DET/GEN MENU. The front-panel GEN LED lights at this time to indicate that the Tracking Generator is enabled.

The Tracking Generator is incompatible with the calibrator mode. Consequently, the calibrator mode is automatically turned off by the firmware when the Tracking Generator is enabled.

The output level of the Tracking Generator may be set from 0.0 to -48.0 dBm in 0.1 dB increments via the DET/GEN menu. This range is converted to match the current reference level units.

The front-panel LEVEL control may be enabled if continuous adjustment over a small range (several dB) is required. If the level CONTROL is enabled, the Tracking Generator level will be marked with a "*" symbol and the level cannot be guaranteed.

If the Tracking Generator frequency offset is not correct, due to long external lines, the signal may be "peaked up" by invoking "TG OFFSET" and setting the FREQ/MARKERS control for maximum signal response. The offset frequency has is set at a fixed rate for all instrument settings.

The Tracking Generator mode is exited by pressing DET/GEN MENU/#4. The calibrator mode is not restored if it had been automatically disabled when the Tracking Generator was enabled.

All Tracking Generator settings are recalled during a Power-Down/Power-Up cycle, including output on/off, manual adjust on/off, output level setting, output level offset, and frequency offset setting.

The following are the factory default settings for the Tracking Generator parameters:

- TG Enable = OFF
- TG Output Level = -48.0 dBm (or equivalent)
- TG Manual Adjust = OFF
- TG Frequency Offset = 0.0
- TG Amplitude Offset = 0.0

Tracking Generator on/off

The Tracking Generator is enabled and disabled via keypad sequence DET/GEN MENU/#4. The output level is automatically set at the last selected level when the Tracking Generator is enabled. The menu in Figure 1 exits to the spectral display after the Tracking Generator is enabled.

Output Level

The output level may be precisely set via keypad sequence DET/GEN MENU/#5 (GENERATOR LEVEL), or loosely set via the LEVEL control after selecting DET/GEN MENU/#6 (TG VARIABLE LEVEL). When DET/GEN MENU/#6 is selected, the LEVEL control on the front panel of the Spectrum Analyzer controls the output level of the Tracking Generator and the level indicator in the menu (and on the spectral display readout) is prefixed by a "*" symbol, indicating an unknown level condition. See Figure 2.

Also, when TG MANUAL LEVEL ADJUST is selected, the displayed amplitude drops down ≈ 2 dB and the LEVEL control then has a ± 2 dB offset range. If the LEVEL control is not centered, then the amplitude drops down [≈ 2 dB \pm (LEVEL control offset from center)]. The LEVEL control still has a total offset range of ≈ 2 dB.

The menu stays after selection.

Output Frequency Tracking

Sometimes the Tracking Generator frequency may not track the Spectrum Analyzer frequency window due to long external lines (group delay). The effect of group delay is readily apparent in narrow resolution bandwidth filters. To find out if group delay is present, select a narrow resolution bandwidth filter, e.g. 3 kHz, and check to see if the amplitude drops. If the amplitude does drop, invoke "TG TRACKING" (DET/GEN MENU/#7) and set the FREQ/MARKERS control for maximum amplitude (optimum tracking).

The Knob Function (MKR/FREQ MENU/#2) automatically defaults to TG TRACKING when TG TRACKING is invoked (via the DET/GEN MENU).

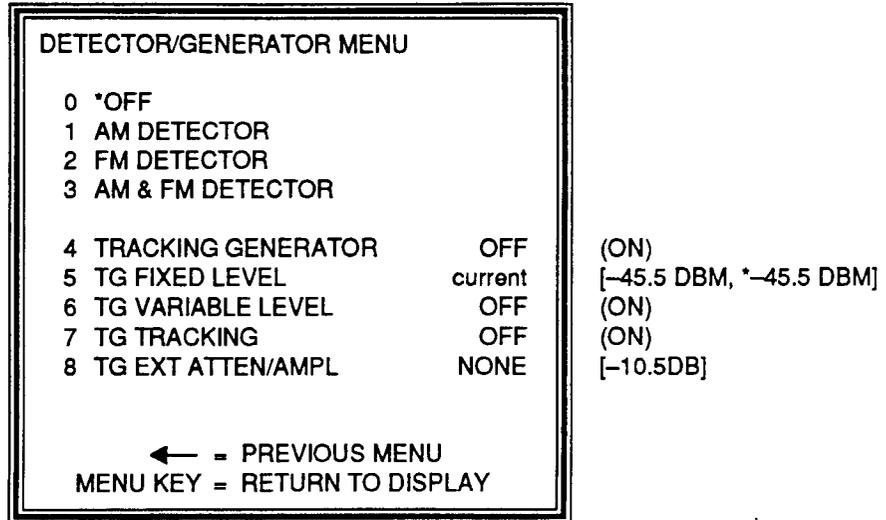


Figure 1. This menu is displayed when the DETECTOR/GENERATOR MENU is invoked.

Figure 1 Legend

- (XX) = Values within parentheses indicate alternate choices
- [kk] = Values within square brackets indicate setting examples
- * = An asterisk before any one of the first four items in the menu indicates a selection, and an asterisk before the generator's output amplitude indicates that the variable level (TG VARIABLE LEVEL) has been enabled.

External Attenuator/Amplifier Compensation – In certain cases, the user may wish to attenuate or boost the signal ahead of the RF INPUT. In these cases, the readout may be made to display the signal amplitude prior to the external attenuator or amplifier. The DET GEN MENU/#8 selection allows the user to enter offset values for an external attenuator or amplifier, such that the readouts indicate the true value of the signal. The menu in Figure 3 is displayed when selection 8 is invoked:

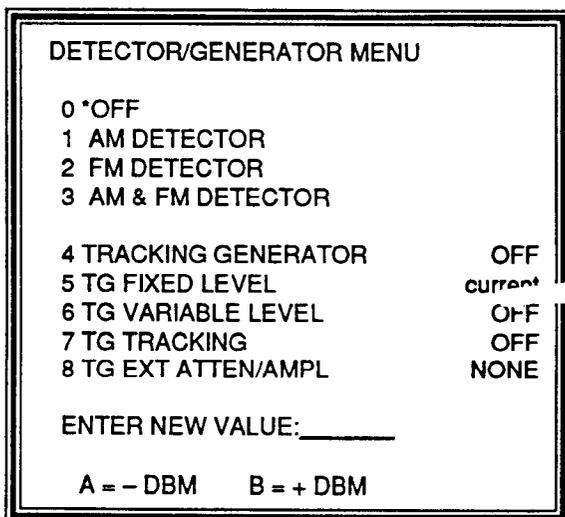


Figure 2. Menu displayed when keypad entered level adjustment (#5 GENERATOR LEVEL) is invoked.

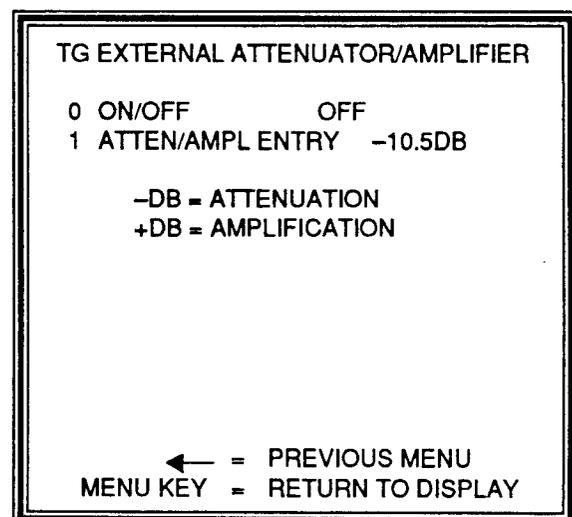


Figure 3. Menu displayed when TG EXT ATTEN/AMPL (DET/GEN MENU/#8) is invoked.

When #0 is selected in the preceding menu (Figure 3), the entered gain factor is applied to the output level readouts, and the menu reverts to the DETECTOR /GENERATOR MENU.

To enter an external attenuator or amplifier gain value, select #1 (ATTEN/AMPL ENTRY) in Figure 3. The following sub-menu will be displayed. The difference between this menu and that of Figure 3 is the prompt to enter a new value.

TG EXTERNAL ATTENUATOR/AMPLIFIER

0 ON/OFF OFF

1 ATTEN/AMPL ENTRY -10.5DB

 -DB = ATTENUATION

 +DB = AMPLIFICATION

ENTER NEW VALUE: _____

 A = - DBM B = + DBM

Figure 4. External attenuator/gain value entry Menu.

After the new value is entered, it is applied to the TG level readouts, and the menu reverts to the DETECTOR /GENERATOR MENU.

INDICATORS

There is only one indicator for the tracking Generator, namely GEN. It is illuminated only when the Tracking Generator is enabled.

CONNECTORS

The Tracking Generator output connector is an N-Type, 50 Ω connector at the front panel of the Spectrum Analyzer. See Figure 5.

NORMALIZATIONS

The term "normalization" derives from the intent of the functions to make a parameter normal with respect to a normalized internal reference.

The Spectrum Analyzer provides two sets of normalizations, namely:

- Operator Oriented Normalizations
- Service Normalizations

OPERATOR ORIENTED NORMALIZATIONS

The operator oriented normalizations are accessed via UTIL MENU/#3. When called up, the following menu is displayed:

There are three kinds of normalizations, viz:

Reference normalizations, amplitude normalizations, and frequency normalizations. For optimum results, normalizations should be performed in the following sequence.

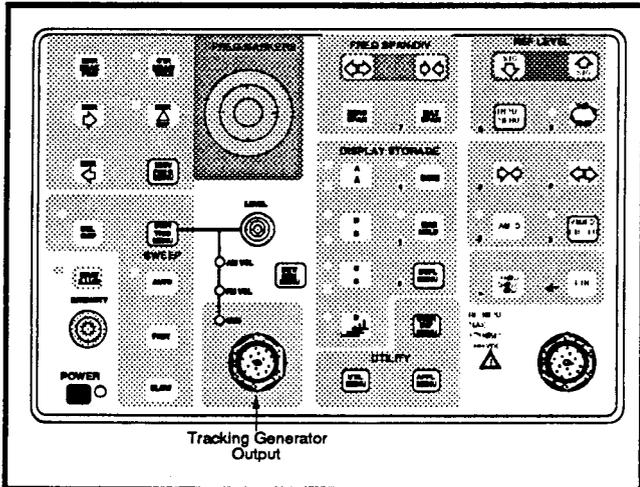


Figure 5. Spectrum Analyzer front panel.

3. Perform Tracking Generator normalizations by pressing UTIL MENU/#3/#3/C/C.

NOTE

The UTIL MENU is an existing menu that has been modified to accommodate the Tracking Generator.

NORMALIZATIONS

0 ALL PARAMETERS
 1 FREQUENCY ONLY
 2 AMPLITUDE ONLY
 3 TRACKING GENERATOR ONLY

FRQ NOT DONE, DEFLT VALUES USED
 REF NOT DONE, DEFLT VALUES USED
 AMP NOT DONE, DEFLT VALUES USED
 TG NOT DONE, DEFLT VALUES USED
 NORMALIZATION SUGGESTED

← = PREVIOUS MENU
 MENU KEY = RETURN TO DISPLAY

Figure 6. Menu displayed when UTIL MENU/#3 is pressed.

When #3 (TRACKING GENERATOR ONLY) in Figure 6 is selected, all of the Tracking Generator normalizations are executed.

1. Perform reference normalizations prior to frequency, amplitude, and Tracking Generator normalizations by pressing UTIL MENU/#5/#5/#1 and following screen prompts.

2. Perform frequency and amplitude normalizations by pressing UTIL MENU/#3/#0/C (Figure 6).

SERVICE ORIENTED NORMALIZATIONS

The service normalizations are accessed via UTIL MENU/#5/#5. When called up, the following menu is displayed:

SERVICE NORMALIZATIONS

0 FREQUENCY NORMALIZATIONS
 1 REFERENCE NORMALIZATIONS
 2 AMPLITUDE NORMALIZATIONS
 3 TRACKING GEN NORMALIZATIONS

4 NORMALIZATION VALUES
 5 PRINT ALL NORM VALUES
 6 NORM DEBUG TO PRINTER OFF

← = PREVIOUS MENU
 MENU KEY = RETURN TO DISPLAY

Figure 7. Menu displayed when UTIL MENU/#5/#5 is pressed.

When #3 in Figure 7 (TRACKING GEN NORMALIZATIONS) is selected, the following menu is displayed:

```

TRACKING GEN NORMALIZATIONS

0 TG FREQ OFFSET POS      NOT DONE
1 TG FREQ DAC              NOT DONE
2 TG ATTENUATORS          NOT DONE
3 TG AMPL DAC              NOT DONE

9 ALL TG NORMALIZATIONS

← = PREVIOUS MENU
MENU KEY = RETURN TO DISPLAY
    
```

Figure 8. Menu displayed when UTIL MENU/#3 is pressed.

This menu permits normalization of one of four or all Tracking Generator parameters at any one instance.

The Tracking Generator normalization values are accessed via UTIL MENU/#5/#5/#4/#9/#4, which displays the following submenu:

```

TRACKING GEN NORM VALUES

0 OUTPUT AMPLITUDE DAC

ATTENUATORS
  0.0   -4.0   -8.0  -12.0  -16.0
-20.0  -24.0  -28.0 -32.0  -36.0
-4.0   -44.0  -48.0

VCO MAX FREQUENCY      108.59HZ
VCO MIN FREQUENCY      100.79HZ
VCO CAL FREQUENCY      105.496635HZ

← = PREVIOUS MENU
MENU KEY = RETURN TO DISPLAY
    
```

Figure 9. Menu displayed when UTIL MENU/#3 is pressed.

PERFORMANCE CHECK

Introduction

The performance check procedures verify that the instrument is performing according to the characteristics specified under the Performance Requirement column in the Specification.

History Information

The instrument and manual are periodically evaluated and updated. If modifications require changes in the procedures, information applicable to earlier instruments will be included within a step or as a sub-part to a step.

Verification of Tolerance Values

Tests shall be performed only after the normalizations have occurred. If a test should fail, normalize the instrument by pressing UTIL MENU/#3/#0, then press UTIL MENU/#3/#3 and follow screen prompts. The normalization will correct for any changes in the operating environment due to time or temperature.

Measurement tolerance of test equipment should be negligible in comparison to the specification being tested. If not, the error of the measuring apparatus must be added to the specification tolerance.

Tracking Generator Settings

Tracking Generator parameters are set via DET/GEN MENU.

Equipment Required

Table 2 lists the test equipment recommended for the Performance Check. The characteristics specified are the minimum. If equipment is substituted, it must meet or exceed these specifications.

Table 2
RECOMMENDED TEST EQUIPMENT

Test Equipment	Characteristics	Recommendation
Spectrum Analyzer	Frequency range at least 2 GHz to 4 GHz	TEKTRONIX 492PGM
Tracking Generator	Frequency Range : 100 kHz to at least 1.8 GHz	TEKTRONIX TR503
Test Oscilloscope	Deflection Factor: 2 mV/Div to 5 V/Div; Bandwidth: DC to 100 Mhz, and X-Y display capability	TEKTRONIX 2236A-Series Oscilloscope and P6108A X10 Probes
10 dB and 1 dB Step Attenuators	Range : 132 dB in combination 10 dB and 1 dB steps Accuracy: ± 0.1 dB. Frequency Range: 100 kHz to at 1 GHz	Hewlett Packard 355C and 355D, calibrated using precision standard attenuators such as Weinchel Model AS-6
Power Meter with Power Sensors	-30 dBm to +20 dBm full scale; 100 kHz to 4.2 GHz	Hewlett Packard Model 436A with 8482A and 8484A Sensors
VSWR Bridge	10 MHz to 1 GHz	Wiltron VSWR Bridge 62BF50

PERFORMANCE CHECK PROCEDURE

Power Up Procedure

- a. Apply power to the Spectrum Analyzer.
- b. The instrument will initialize itself according to the configuration stored in the USR DEF (User Defined) Power Up settings. If this register is empty it will initialize to the configuration stored in the Factory Default Power Up settings.
- c. Allow a 30 minute warm up period before continuing this procedure.
- d. The Spectrum Analyzer/Tracking Generator system must be normalized before any measurements can be made. Invoke Spectrum Analyzer normalizations by pressing UTIL MENU/#3/#0. The instrument will begin normalizations and print progress messages on the CRT. After Spectrum Analyzer normalizations are complete, invoke Tracking Generator normalizations by pressing UTIL MENU/#3/#3 and follow screen prompts.
- e. After the instrument has completed normalization, press UTIL MENU/#5/#5/#0 to display frequency normalization results. Verify that all frequency related tests have passed.
- g. Press the backspace arrow (LIN) and #2 to display amplitude normalization results. Verify that all amplitude related tests have passed.
- h. Press UTIL MENU to exit.

1. Check Frequency Range (100 kHz to 1.8 GHz)

- a. Connect the Tracking Generator output to the RF INPUT.
- b. Select the following settings on the Spectrum Analyzer:

FREQUENCY	1 GHz
REFERENCE LEVEL	+10 dBm
FREQ SPAN/DIV	MAX SPAN
RESOLUTION BW	Auto
VERTICAL SCALE	10 dB/div

- c. Set the Tracking Generator output at 0 dBm by pressing DET/GEN MENU/#5 and entering 0 dBm. Press keypad #4 to enable the Tracking Generator.
- d. Check that the Spectrum Analyzer displays a sweep signal from 100 kHz to at least 1.8 GHz with a level of approximately 0 dBm.
- e. Recall default power-up settings by pressing UTIL MENU/#1/#1.

2. Check Tracking (Frequency Offset) (typically -5 kHz to +60 kHz)

Test equipment required:

- Test Spectrum Analyzer

- a. Monitor the Tracking Generator output with the test spectrum analyzer.
- b. Set the test spectrum analyzer as follows:

Center Frequency	900 MHz
Reference Level	0 dBm
Span/Div	20 kHz
Resolution Bandwidth	1 kHz

- c. Select the following Spectrum Analyzer /Tracking Generator system parameters:

FREQUENCY	900 MHz
FREQ SPAN/DIV	1 kHz
RESOLUTION BW	Auto

- d. Set the Tracking Generator output at 0 dBm by pressing DET/GEN MENU/#5 and entering 0 dBm. Press keypad #4 to enable the Tracking Generator.
- e. Press DET/GEN MENU/#7/DET/GEN MENU and tune the FREQ/MARKERS knob such that the tracking readout (lower right corner of system display) reads 0 Hz.
- f. Press SGL SWP on the Spectrum Analyzer. Center the display on the test spectrum analyzer with the center frequency control knob then save the display (in the test spectrum analyzer).
- g. Vary the FREQ/MARKERS control clockwise until the system beeps and indicates "OUT OF RANGE."

h. Check that the signal on the test spectrum analyzer has moved three divisions to the right of the center position.

i. Reset the test spectrum analyzer Span/Div to 5 kHz, and repeat parts e and f.

j. Vary the FREQ/MARKERS control counter-clockwise until the system beeps and indicates "OUT OF RANGE."

j. Check that the signal on the test spectrum analyzer has moved three divisions to the left of the center position.

3. Check Output Level Range and Accuracy

(Range: -48 dBm to 0 dBm)
(Accuracy: ±1.5 dB at 100 MHz)

Test equipment required:

- Power Meter

NOTE

This check step requires two power sensors; one to measure a level approximately -48 dBm and the other to measure a level approximately 0 dBm. The low power sensor must be calibrated using a precision 30 dB attenuator such as a Weinschell Model 50 - 30.

WARNING

Be sure to turn the power meter off before removing or connecting a power sensor.

a. Set the following Spectrum Analyzer/Tracking Generator system parameters:

FREQUENCY	100 MHz
REFERENCE LEVEL	-30 dBm
FREQ SPAN/DIV	ZERO
SWEEP RATE	AUTO
TG FIXED LEVEL	-48 dBm
TG VARIABLE LEVEL	OFF
TG TRACKING	OFF
TRACKING GENERATOR	ON

b. Connect the output of the Tracking Generator to the power meter using the low power sensor.

c. Check that the power meter indicates -48 dBm ±1.5 dB.

d. Turn off the power meter and replace the low power sensor with the high power sensor, then turn the power meter back on.

e. Reset the Tracking Generator output level to 0 dBm by pressing DET/GEN MENU/#5 and entering 0 dBm.

f. Check that the power meter reads 0 dBm ±1.5 dB.

g. Recall default power-up settings by pressing UTIL MENU/#1/#1.

4. Check Return Loss

(10 dB or better with output Level ≤-8 dBm)

Test equipment required:

- VSWR Bridge
- Test Spectrum Analyzer with Tracking Generator (Tektronix 492A and TR503)

a. Connect the test equipment as shown in Figure 10.

b. On the 2710 front panel, press DET/GEN MENU/#5 and enter -8 dBm (enables 8 dB of attenuation at the Tracking Generator output).

c. Set the following parameters on the test spectrum analyzer:

Span/Div	Max Span
Reference Level	0 dBm
Vertical Scale	10 dB/div

d. Set the TR503 output level at 0 dBm.

e. Disconnect the cable from the 2710 Tracking Generator output connector, and press [B-SAVE A] on the test spectrum analyzer. The resultant display is the measurement reference.

f. Reconnect the cable to the 2710 Tracking Generator output.

g. Check that the displayed response on the test spectrum analyzer is ≥1 division down from the reference established in part e. Ignore the spur that appears at the center frequency of the Spectrum Analyzer.

h. Recall default power-up settings by pressing UTIL MENU/#1/#1.

5. Check Tracking Generator Flatness

(±1 dB from 100 kHz to 1.0 GHz and ±1.5 dB to 1.8 GHz)

Test equipment required:

- Power Meter
- Test Oscilloscope

a. Connect the test equipment as shown in Figure 11.

b. Set the following Spectrum Analyzer/Tracking Generator system parameters:

FREQUENCY	500 MHz
REFERENCE LEVEL	0 dBm
FREQ SPAN/DIV	100 MHz
RESOLUTION BW	AUTO
VERTICAL SCALE	1 dB/div
TG FIXED LEVEL	0 dBm
TG VARIABLE LEVEL	OFF
TG TRACKING	OFF
TRACKING GENERATOR	ON

c. Set up the test oscilloscope for X-Y operation. The sweep signal from pin 7 of J104 drives the X-axis and the Tracking

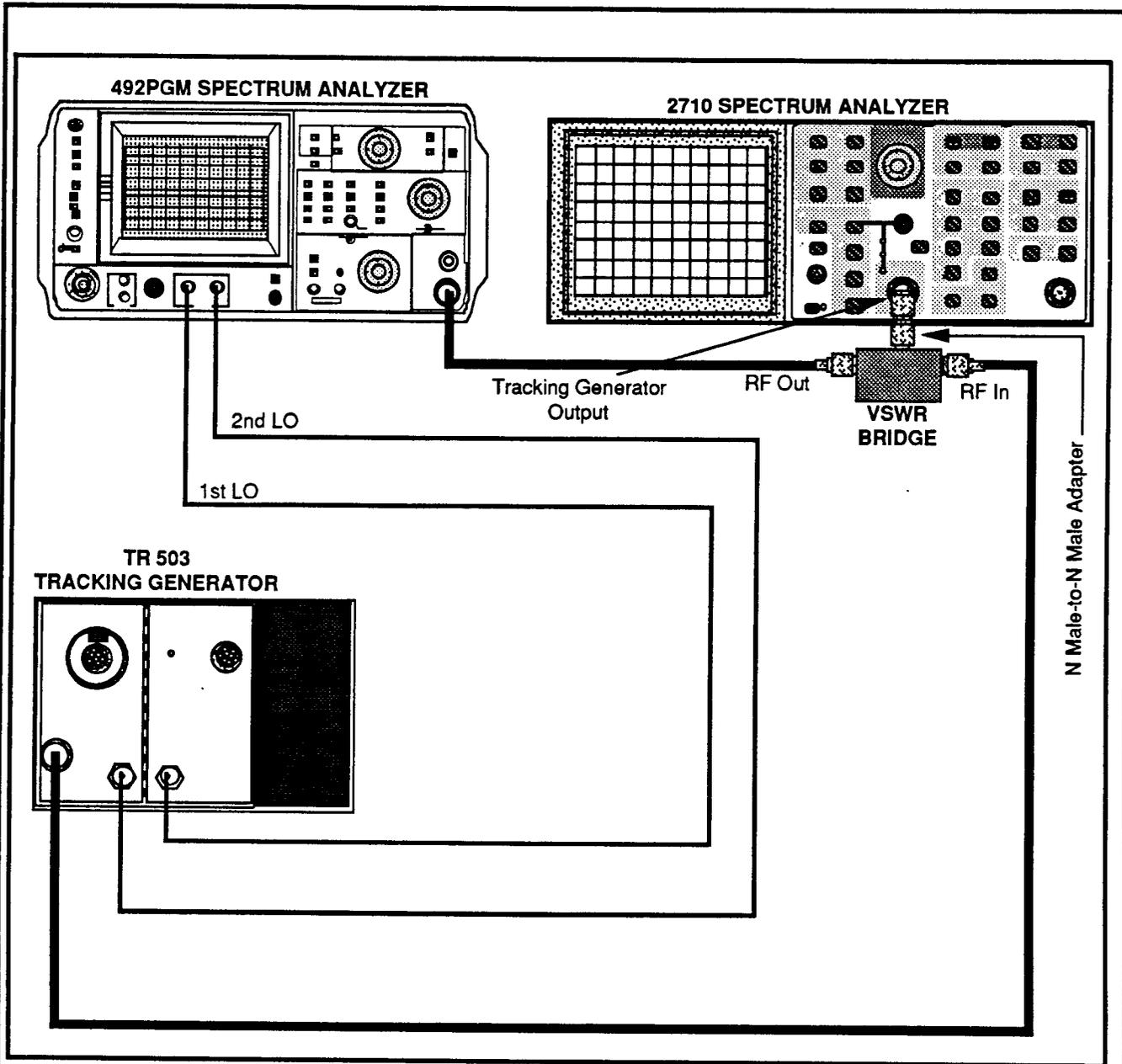


Figure 10. Test setup for measuring return loss.

Generator output (Recorder Output) drives the Y-axis. Set the Y-axis deflection factor (V/Div and Variable) for a full horizontal deflection.

d. Enable manual sweep on the Spectrum Analyzer/Tracking Generator system by pressing SWP/TRIG MENU/#7.

e. Manually sweep the Spectrum Analyzer slowly from 100 kHz to 1 GHz while viewing the flatness trace on the test oscilloscope. Make a note of the highest and lowest points on the flatness trace as read on the power meter.

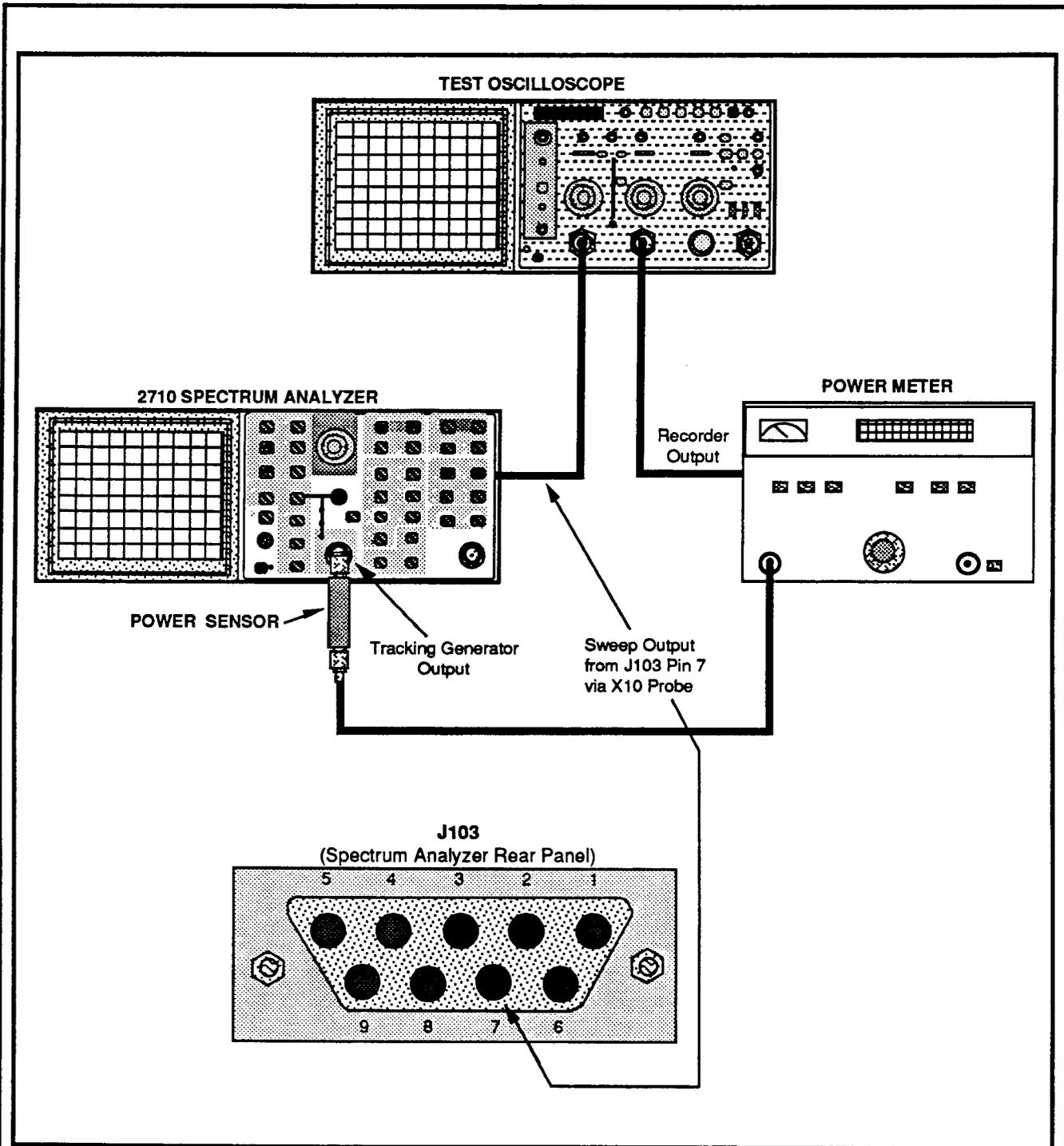


Figure 11. Test setup for measuring Tracking Generator flatness.

f. Check that the difference in amplitude between the highest and lowest points on the flatness trace excluding the start spur is ≤ 2 dB.

g. Manually sweep the Spectrum Analyzer slowly from 100 kHz to 1.8 GHz while viewing the flatness trace on the test oscilloscope. Make a note of the highest and lowest points on the flatness trace.

h. Check that the difference in amplitude between the highest and lowest points on the flatness trace is ≤ 3 dB from 1 GHz to 1.8 GHz.

i. Recall default power-up settings by pressing UTIL MENU/#1/#1.

6. Check System Flatness

(± 2.5 dB from 100 kHz to 1.0 GHz and 3 dB to 1.8 GHz)

a. Select the following settings on the Spectrum Analyzer:

FREQUENCY	500 MHz
REFERENCE LEVEL	2 dBm
FREQ SPAN/DIV	100 MHz
RESOLUTION BW	AUTO
VERTICAL SCALE	1 dB/div
SWEEP	AUTO
TG FIXED LEVEL	0 dBm
TG VARIABLE LEVEL	OFF
TG TRACKING	OFF
TRACKING GENERATOR	ON

b. Connect the output of the Tracking Generator to the RF INPUT.

c. Set the start frequency at 100 kHz and the stop frequency at 1 GHz by pressing MKR/FREQ MENU/#7, pressing #0 and entering 100 kHz, and pressing #1 and entering 1 GHz. Press MKR/FREQ MENU to exit.

d. Make a note of the highest and lowest points on the flatness trace from 100 kHz to 1.8 GHz. Ignore the start spur.

e. Check that the difference in amplitude between the highest and lowest points on the flatness trace excluding the start spur is ≤ 5 dB.

f. Make a note of the highest and lowest points on the flatness trace from 100 kHz to 1.8 GHz.

g. Check that the difference in amplitude between the highest and lowest points on the flatness trace is ≤ 6 dB.

h. Recall default power-up settings by pressing UTIL MENU/#1/#1.

7. Check Characterized Flatness

(± 0.2 dB)

a. Connect the output of the Tracking Generator to the RF INPUT.

b. Select the following settings on the Spectrum Analyzer:

FREQ SPAN/DIV	MAX SPAN
RESOLUTION BW	AUTO
VERTICAL SCALE	1 dB/div
TG FIXED LEVEL	0 dBm
TG VARIABLE LEVEL	OFF
TG TRACKING	OFF
TRACKING GENERATOR	ON

c. Set the reference for a visible display (≈ 2 dBm).

d. Enable single sweep on the Spectrum Analyzer by pressing SGL SWP. Press SGL SWP again to initiate a sweep.

e. Store the single sweep waveform in Register A by pressing SAVE and then A.

f. Enable the B display and ensure that all other displays are disabled.

g. Enable B, C MINUS A by pressing DISPLAY MENU/#2.

h. Initiate a single sweep on the Spectrum Analyzer by pressing SGL SWP.

i. Check for a flat trace across the screen. The Trace flatness must be within a minor division (± 0.2 dB). Ignore the start spur and switching transients.

j. Recall default power-up settings by pressing UTIL MENU/#1/#1.

8. Check Spurious Signals

(Harmonic: -20 dBc or better)

(Non-Harmonic: -35 dBc or better)

Test equipment required:

- Test Spectrum Analyzer (Tektronix 492PGM)

a. Set the following Spectrum Analyzer/Tracking Generator system parameters:

FREQUENCY	100 kHz
FREQ SPAN/DIV	ZERO SPAN
TG FIXED LEVEL	0 dBm
TG VARIABLE LEVEL	OFF
TG TRACKING	OFF
TRACKING GENERATOR	ON

b. Monitor the output of the Tracking Generator with the test spectrum analyzer.

c. Set the test spectrum analyzer parameters as follows:

Frequency	500 kHz
Reference Level	0 dBm
Freq Span/Div	100 kHz
Resolution BW	Auto
Vertical Scale	10 dB/Div
Min Noise	On
Peak Average	Fully counter-clockwise
Sweep Rate	Auto

d. The test spectrum analyzer will display harmonic spurs approximately one division apart. The signal at the left graticule line is the start spur (0 Hz), the signal to the right of the start spur is the fundamental, and all signals to the right of the fundamental signal are harmonic spurs. See Figure 12.

e. Check that the harmonic spurs are at least 20 dB down from the fundamental.

f. Reset the test spectrum analyzer span/div to Max Span, and enable MAX SPAN on the Spectrum Analyzer/Tracking Generator.

g. On the Spectrum Analyzer/Tracking Generator system, enable MANUAL SCAN by pressing SWP/TRIG MENU/#7.

h. Manually sweep the Spectrum Analyzer/Tracking Generator system slowly from 100 kHz to 1.8 GHz while observing the test spectrum analyzer display. The high signal moving from left to right as the system is manually swept is the fundamental. Other signals that move from left to right are harmonic spurs and signals that move from right to left are non-harmonic spurs.

i. Check that all harmonic spurs are at least 20 dB down from the fundamental.

j. Check that all non-harmonic spurs are at least 35 dB down from the fundamental.

k. Recall default power-up settings by pressing UTIL MENU/#1/#1.

9. Check 1st LO Output Level
(+5 dBm to +10 dBm)

NOTE

This check applies only to those Spectrum Analyzers that have Option 15 installed.

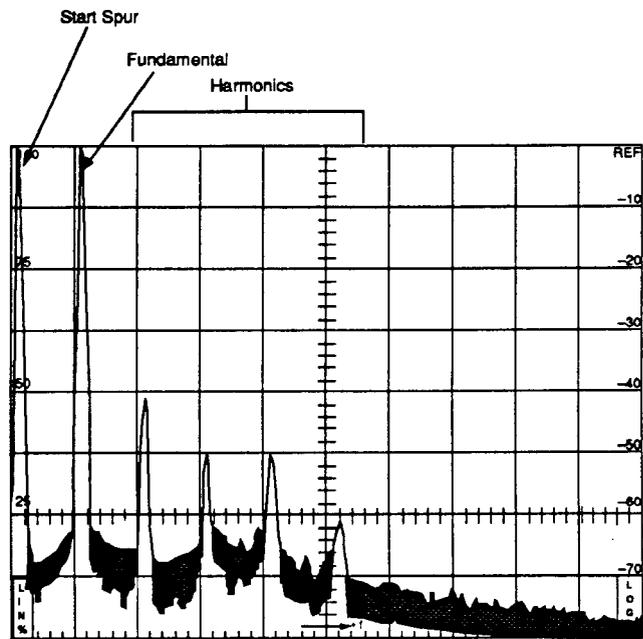


Figure 12. Harmonic spur distribution near the 100 kHz fundamental (10 dB/div display).

Test equipment required:

- Power Meter

a. Remove the 50 Ω terminator from J101 at the rear panel of the Spectrum Analyzer.

b. Monitor J101 with the power meter.

c. Select the following settings on the Spectrum Analyzer:

FREQ SPAN/DIV	MAX SPAN
RESOLUTION BW	Auto

d. Enable MANUAL SCAN by pressing SWP/TRIG MENU/#7.

e. Manually sweep the Spectrum Analyzer/Tracking Generator system slowly from 100 kHz to 1.8 GHz while observing the power meter.

f. Check that the power meter indicates a power level of at least +5 dBm and not greater than +10 dBm over the full span.

g. Disconnect the power meter from J101 and replace the 50 Ω terminator.

h. Recall default power-up settings by pressing UTIL MENU/#1/#1.

ADJUSTMENT

If the Tracking Generator performance is not within specified limits for a particular characteristic, determine the cause, repair if necessary, then use the appropriate adjustment procedure to return the instrument operation to performance specification. After any adjustment, verify performance by repeating the applicable part of the Performance Check.

In the adjustment procedure, System refers to the Spectrum Analyzer and Tracking Generator combination. The words Spectrum Analyzer with initial capital letters refers to the Spectrum Analyzer in which the Tracking Generator is installed.

Allow the instrument to warm up for at least 15 minutes, in an ambient temperature of 20° C to 30° C before making any adjustments. Waveform illustrations in the adjustment procedure are typical and may differ from one instrument to another. These waveforms should not be construed as being representative of specification tolerances.

CAUTION

Observe precautions for handling static-sensitive components as laid out in Section 5 of the Service Manual.

RECOMMENDED TEST EQUIPMENT

Table 3 lists test equipment and test fixtures recommended for the adjustment procedure. The characteristics specified are the minimum required for the checks. Substitute equipment must meet or exceed these characteristics.

Table 3
RECOMMENDED TEST EQUIPMENT

Test Equipment	Characteristics	Recommendation
Spectrum Analyzer	Frequency range at least 2 GHz to 4 GHz	TEKTRONIX 492PGM
Test Oscilloscope	Deflection Factor: 2 mV/Div to 5 V/Div; Bandwidth: DC to 100 Mhz, and X-Y display capability	TEKTRONIX 2236A-Series Oscilloscope and P6108A X10 Probes
Power Meter with Power Sensors	-30 dBm to +20 dBm full scale; 100 kHz to 4.2 GHz	Hewlett Packard Model 436A with 8482A and 8484A Sensors
Special Test Probe	Must be constructed	See Figure 13

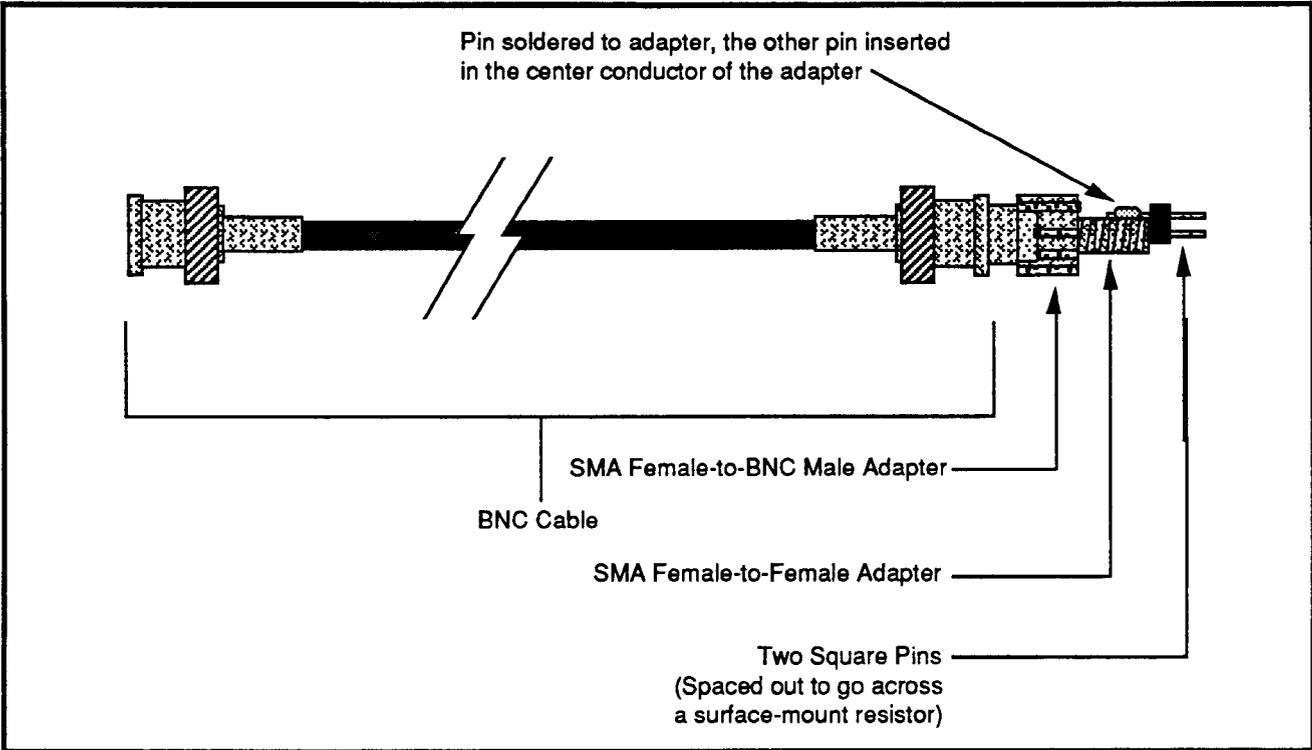


Figure 13. Special probe construction.

ADJUSTMENT PROCEDURE

PREPARATION

Remove the cabinet as follows:

1. Turn the power off and remove the power cord.
2. Set the instrument on its face with the front cover installed.
3. Remove the rear cover (two T15 Torx® head screws), two (front) top and bottom feet (four T15 screws), three pan-head screws from the bottom rear, and two pan-head screws from the top rear of the instrument.
4. Pull the cover up and off.
5. Place the instrument on the bench and reconnect the power cord.
6. Remove the Tracking Generator module from the Spectrum Analyzer as follows:
 - a. Disconnect three coaxial cables (two semi-rigid and one flexible) and a 50 Ω terminator from the module.

NOTE

In some instruments the 50 Ω terminator is replaced by a semirigid cable if Option 15 is installed. In those instruments, also disconnect the third cable. The 50 Ω terminator is at the rear panel of the Spectrum Analyzer.

- b. Remove four phillips head screws from the corners of the left side cover. See Figure 14.
- c. Carefully pull the Tracking Generator module out without disconnecting the power cable, and place it on the bench.
8. Remove the shield cover over the Isolation Amplifier board (10 T10 Torx screws).
9. Use a male to female SMA cable to connect the LO signal from the 1st LO Buffer to J100 on the Isolation Amplifier board.

POWER-UP PROCEDURE

- a. Apply power to the Spectrum Analyzer.
- b. The instrument will initialize itself according to the configuration stored in the USR DEF (User Defined) Power Up settings. If this register is empty it will initialize to the configuration stored in the Factory Default Power Up settings.
- c. Allow a 30 minute warm up period before continuing this procedure.
- d. Perform Spectrum Analyzer service normalizations (excluding Tracking Generator normalizations). Refer to Section 3 in the service manual for service normalization procedures.
- e. After the normalization routines are completed, press UTIL MENU/#3 and verify that all Spectrum Analyzer normalizations have passed (excluding Tracking Generator normalizations).
- f. Press UTIL MENU to exit.

1. Isolation Amplifier Gain and Flatness

Test Equipment Required:

- Power Meter (with Power Sensor)

a. Check Option 15 Output ($\geq +5$ dBm)

i. Monitor the 1st LO output (J110) on the Isolation Amplifier board with the power meter. See Figure 14 for the location of the 1st LO output.

ii. Set the following Spectrum Analyzer/Tracking Generator system parameters:

FREQ SPAN/DIV	MAX SPAN
RESOLUTION BW	AUTO
TG FIXED LEVEL	0 dBm
TG VARIABLE LEVEL	OFF
TG TRACKING	OFF
TRACKING GENERATOR	ON

iii. On the Spectrum Analyzer/Tracking Generator system, enable MANUAL SCAN by pressing SWP/TRIG MENU/#7.

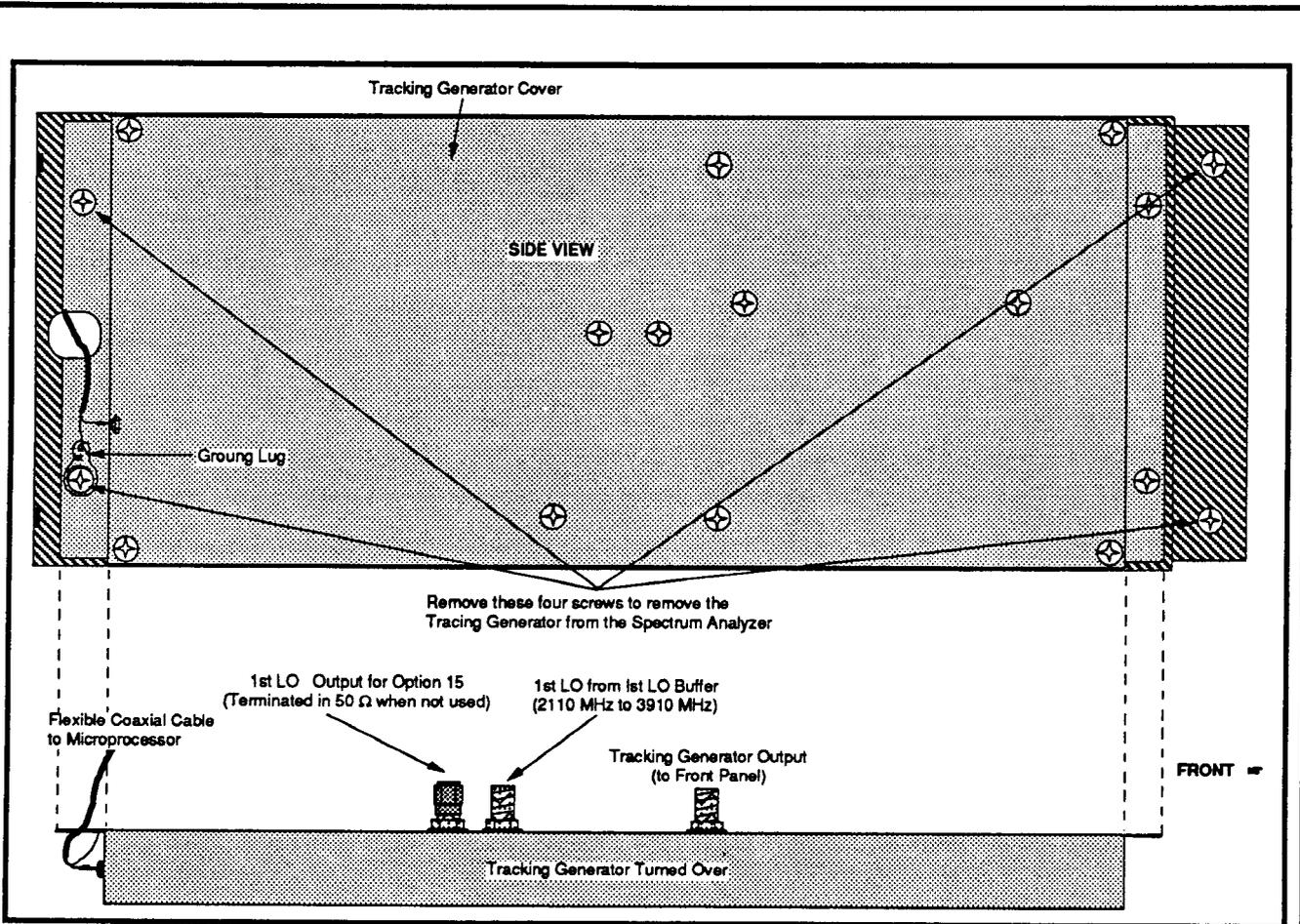


Figure 14. Removing the Tracking Generator from the Spectrum Analyzer.

iv. Manually sweep the Spectrum Analyzer/Tracking Generator system slowly from 100 kHz to 1.8 GHz while observing the power meter.

v. Make a note of the power meter reading of the lowest and highest points on the display.

vi. Check that the power meter indicates at least +5 dBm for the lowest point the display and no more than +10 dBm for the highest point. Use the method at the end of this procedure to account for any losses in the extension cable to the 1st LO input.

vii. Replace the 50 Ω terminator to J110 on the Isolation Amplifier board (or if Option 15 is installed, remove the 50 Ω terminator from J101 on the rear panel and install it on J110 on the Isolation Amplifier board).

viii. Recall default power-up settings by pressing UTIL MENU/#1/#1.

b. Adjust Isolation Amplifier Output Level (R421 on the Isolation Amplifier board)

i. Connect the test equipment as shown in Figure 15.

ii. Set the following Spectrum Analyzer/Tracking Generator system parameters:

FREQ SPAN/DIV	ZERO SPAN
RESOLUTION BW	AUTO
TG FIXED LEVEL	0 dBm
TG VARIABLE LEVEL	OFF
TG TRACKING	OFF
TRACKING GENERATOR	ON

iii. Set the Y-channel to .1 V/Div, DC-coupled with 0 Vdc at center-screen. Set the X-channel Variable Volts/Div control for full-screen horizontal deflection.

vii. Adjust R421 (Output Level) on the Isolation Amplifier board for -50 mV dc as viewed on the test oscilloscope. See Figure 16 for the location of R421.

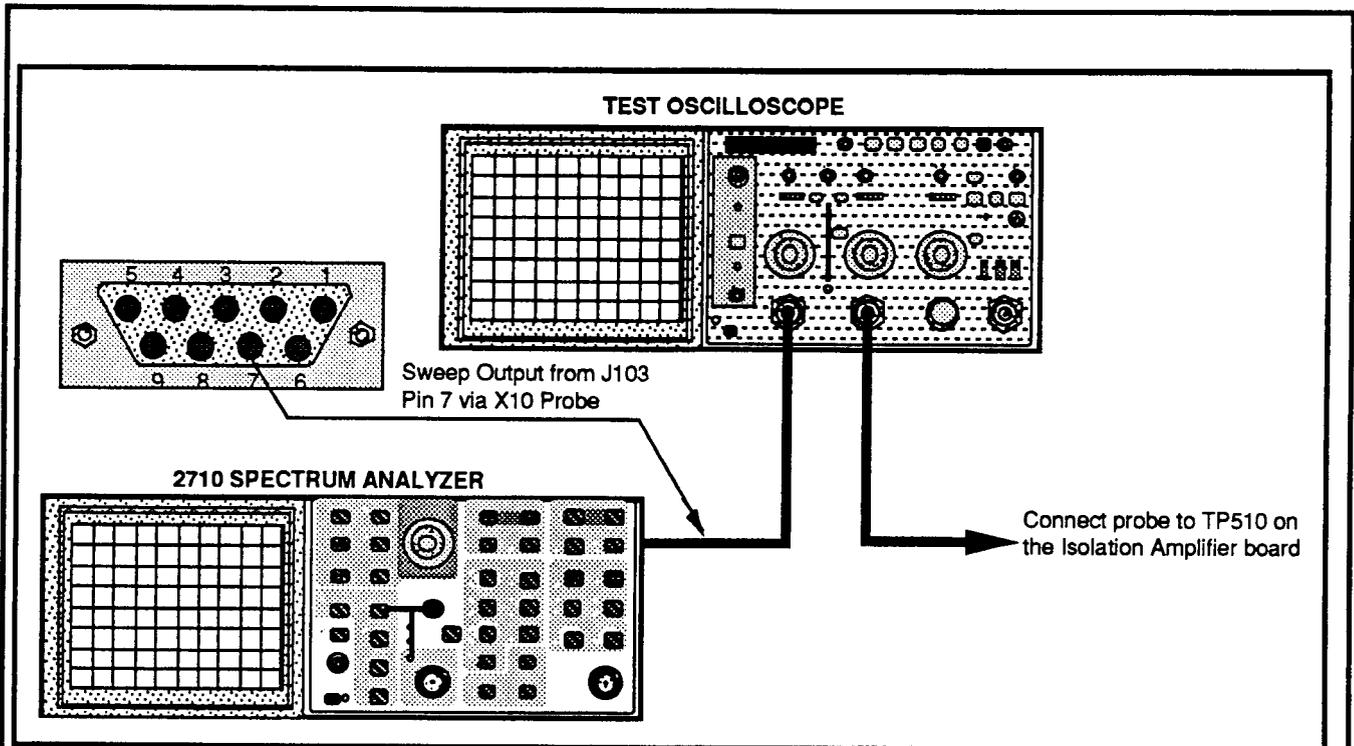


Figure 15. Test equipment setup for adjusting the Isolation Amplifier output level.

v. Recall default power-up settings by pressing UTIL MENU/#1/#1.

2. Adjust 105.5 MHz Oscillator Balance (C420 on the Phase Lock Loop board)

Equipment Required:

- Test Spectrum Analyzer
- Test Oscilloscope

a. Enable SPECTRAL DISPLAY IN MENUS mode by pressing UTIL MENU/#4/#3/#6.

b. Enable the 105.5 MHz oscillator by pressing UTIL MENU/#5/#7/#4, and set the frequency DAC value at 1600 by pressing #1 and entering 1600 (terminate with A).

c. Monitor the collector of Q420 on the Phase Lock Loop board with the test oscilloscope. Set the test oscilloscope vertical for 50 mV/div and ac-coupled, and set the sweep rate at 0.1 μ s/div.

d. Adjust C420 for peak amplitude on the test oscilloscope. See Figure 17 for the location of C420.

e. Press #9 (frequency count enable) and check that the counted frequency is \approx 105 MHz. If it is not, readjust C420 to the next signal peak and check again. Repeat this step until the count is \approx 105 MHz.

f. Set the frequency DAC value at 0 by pressing #1 and entering 0 (terminate with A).

g. Press #9 (frequency count enable) and check that the counted frequency is \approx 105.501 MHz.

h. Turn the FREQ/MARKERS knob counter-clockwise one click (frequency DAC value \approx 4095).

i. Press #9 (frequency count enable) and check that the counted frequency is \approx 105.496 MHz.

NOTE

If steps g and i do not yield the desired results, readjust C420 slightly.

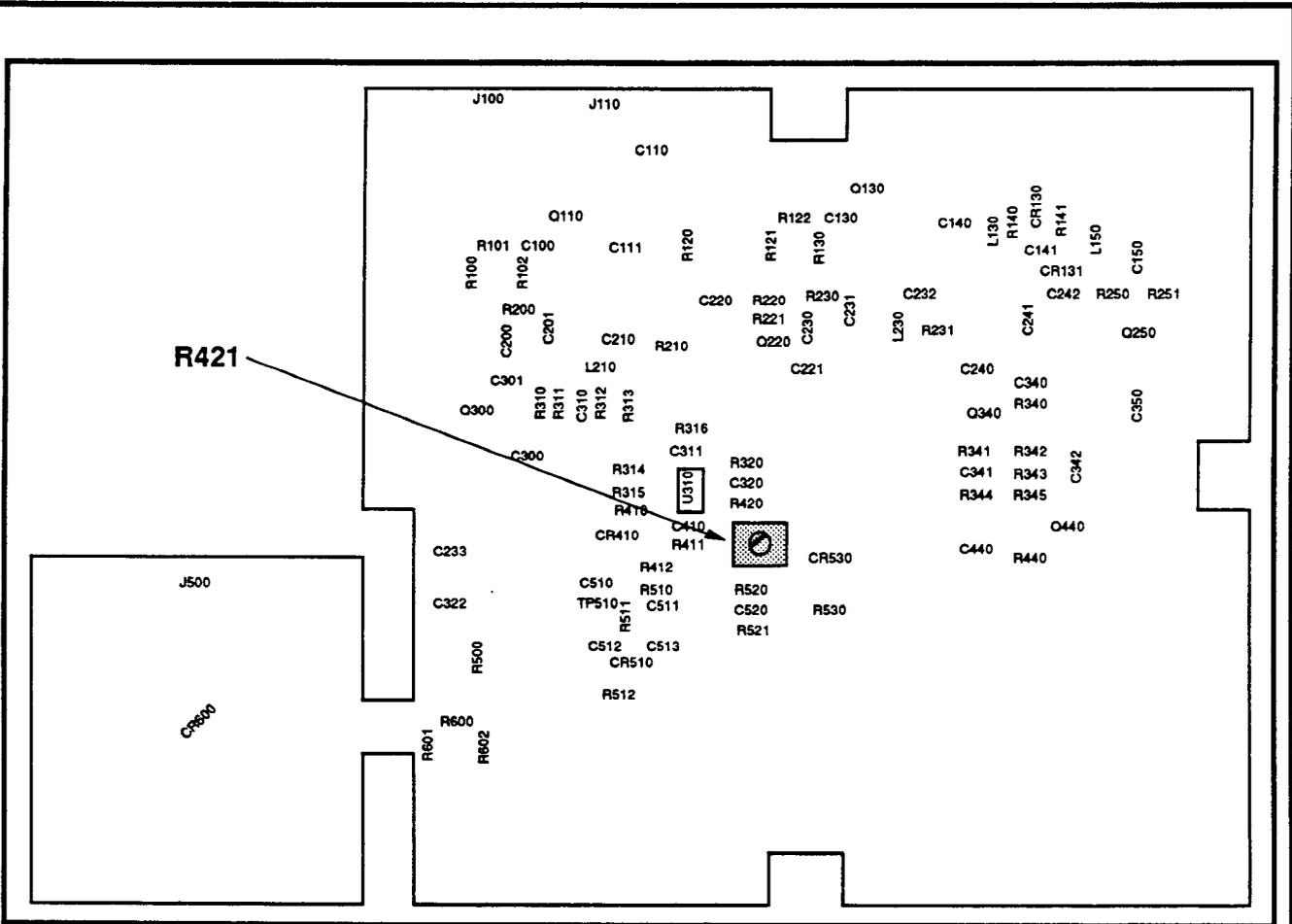


Figure 16. Adjustment location on the Isolation Amplifier board.

3. Adjust Phaselock

(C121 and R335 on the Phase Lock Loop board)

Equipment Required:

- Special Test Probe (Figure 13)
- Test Oscilloscope
- Test Spectrum Analyzer

a. Enable SPECTRAL DISPLAY IN MENUS mode by pressing UTIL MENU/#4/#3/#6.

b. Enable the 105.5 MHz oscillator by pressing UTIL MENU/#5/#7/#4. (This enables the Tracking Generator.)

c. Monitor TP240 on the Phase Lock Loop board with test oscilloscope. See Figure 17 for the location of TP240.

d. Adjust C121 (Figure 17) on the Phase Lock Loop board for 7 Vdc at TP 240. (C121 may be a wire loop, chip capacitor, or metal tab.)

e. Turn the power off and back on, and check for +7 Vdc at TP240.

f. Set the test spectrum analyzer parameters as follows:

Center Frequency	2110 MHz
Reference Level	-30 dBm
Span/Div	50 MHz
Resolution BW	Auto
Vertical Scale	10 dB/Div

g. Monitor the signal across R141 on the Phase Lock Loop board with the test spectrum analyzer using the Special Test Probe (Special Test Probe across R141). Locate a 2110 MHz signal across R141.

h. Reduce the Span/Div setting to 200 kHz while keeping the 2110 MHz signal centered with the FREQ/MARKERS knob.

i. Set R335 on the Phase Lock Loop board fully clockwise. See Figure 17 for the location of R335.

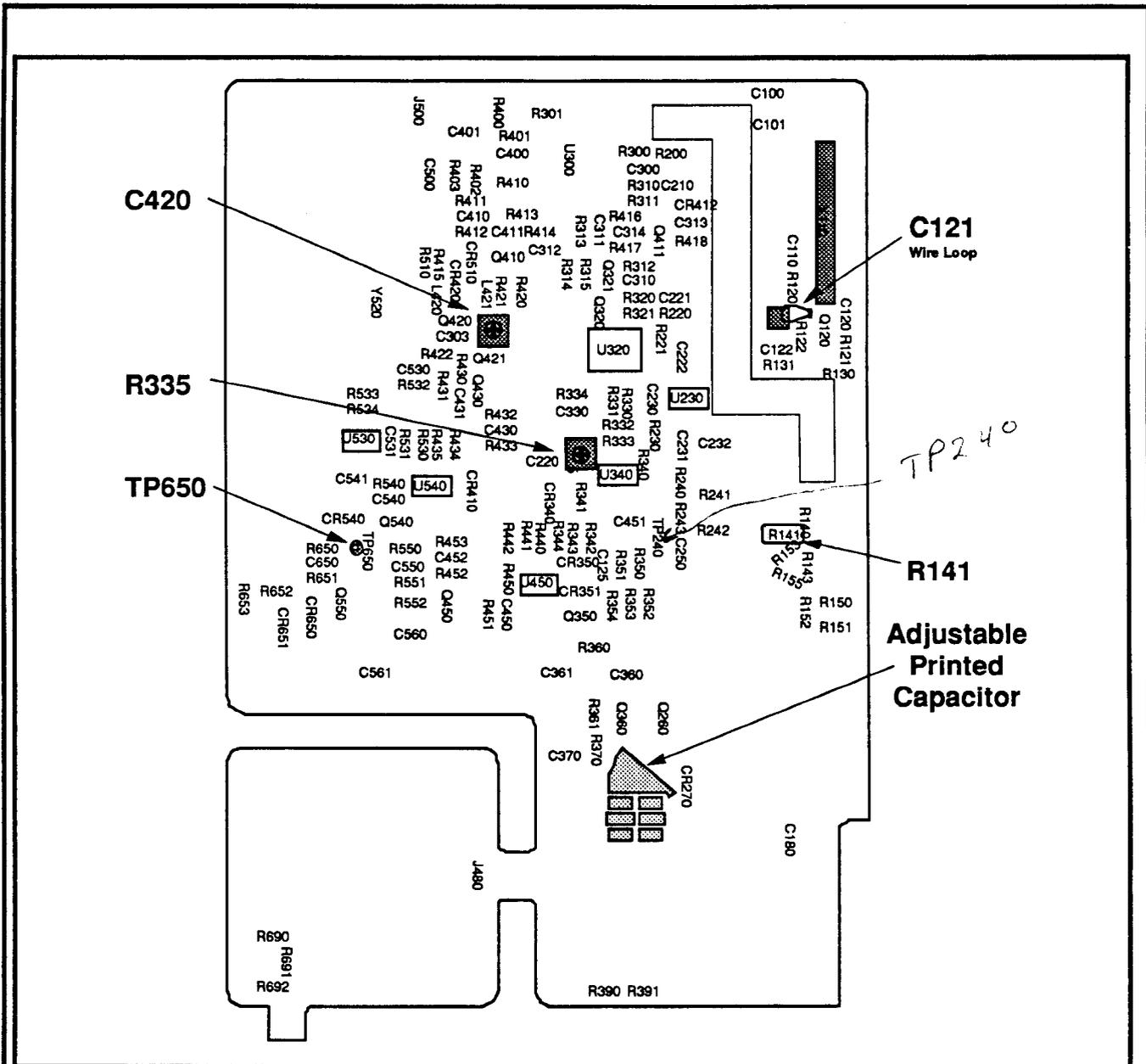


Figure 17. Adjustment locations on the PhaseLock Loop board.

- j. Use the test spectrum analyzer reference level control to set the 2110 MHz signal 10 dB above top screen.
- k. Make a note of the phase noise amplitude 300 kHz (1.5 divisions) away from the 2110 MHz signal.

- l. Adjust R335 on the Phase Lock Loop board to raise this phase noise by 3 dB.
- h. Recall default power-up settings by pressing UTIL MENU/ #1/#1.

4. Adjust Flatness

(R203, R214, and R329 on the Interface board)

Test Equipment Required:

- Power Meter (with Power Sensor)

NOTE

This procedure uses a saved instrument flatness display to cancel out any instrument contributions to flatness.

This method makes it easy to adjust and check flatness but has some error built in. If flatness is within 0.4dB of not being in spec it will have to be verified manually: Connect a power meter to the Tracking Generator output and watch the power level while sweeping the 2710 with manual scan. If normalizations are lost they will have to be redone and a flatness curve will have to be regenerated. See end of this procedure.

Preparation – Perform a flatness check for the Spectrum Analyzer only. Refer to performance check step 6 parts a through d in Section 3 of the service manual, except that the Spectrum Analyzer reference level must be set at +4 dBm and SWEEP RATE at 5 ms/div, and the sweeper output level must be set to 0 dBm @ 100 MHz.

Save the flatness display in the A register (SAVE A), then save instrument settings in NVRAM by pressing UTIL MENU/#1/#9/A.

- Enable the 105.5 MHz oscillator by pressing UTIL MENU/#5/#7/#4. (This enables the Tracking Generator.)
- Set the Tracking Generator output attenuation to 0 dB by pressing #0/#0/A.
- Set the AMPLITUDE DAC VALUE to 1600 by pressing #2/1600/A. Press UTIL MENU to exit the menu.
- Recall the saved flatness display by pressing UTIL MENU/#1/#9/A.
- Enable B, C MINUS A mode by pressing DSPL MENU/#2 and B, C MINUS A OFFSET TO CENTER by pressing DSPL MENU/#3. Turn off all displays except the B DISPLAY.
- Connect the Tracking Generator output to the RF INPUT.

g. Set R329 (Figure 18) on the Interface board for a signal near mid-screen.

h. Adjust R203 and R214 (Figure 18) on the Interface board for the flattest possible display.

i. Press MKR Δ OFF to enable a marker, and the marker to 100 MHz.

j. Adjust R329 (Figure 18) on the Interface board for 0 dBm at 100 MHz (marker position). (0 dBm is center screen.)

k. Monitor TP650 on the Interface board with a voltmeter.

l. Adjust the printed capacitor (Figure 17) on the Phase Lock Loop board as follows:

The capacitor is composed of a main element and six little squares printed on the circuit board. Connect one square at a time to the main element with a little dab of solder. As a square is connected to the capacitor, the voltage at TP650 will either increase or decrease. If the voltage starts to go negative as a square is connected, disconnect that square. The capacitor is now properly adjusted.

m. Set the Spectrum Analyzer SPAN/DIV in ZERO SPAN.

n. Set the AMPLITUDE DAC VALUE to 0 by pressing UTIL MENU/#5/#7/#2/0/A, then press UTIL MENU to exit the menu.

o. Use the power meter to check that the level at 100 MHz is $\geq +5$ dBm. ≤ -5 dBm

p. Turn the FREQ/MARKERS control one click counter-clockwise and check that the level at 100 MHz is ≤ -5 dBm.

q. Set the AMPLITUDE DAC VALUE to 1600 by pressing UTIL MENU/#5/#7/#2/1600/A, then press UTIL MENU to exit the menu.

r. Check flatness as follows:

i. Check that flatness, excluding the start spur, is ≤ 2 dB peak-to-peak from 100 kHz to 1 GHz.

ii. Check that flatness, excluding the start spur, is ≤ 3 dB peak-to-peak from 100 kHz to 1.8 GHz.

s. Press UTIL MENU/#5/ #7/ #2/ and enter amplitude DAC values until the level at 100 MHz is +3 dBm, then verify flatness as in step q.

t. Press UTIL MENU/#5/ #7/ #2/ and enter amplitude DAC values until the level at 100 MHz is -3 dBm, then verify flatness as in step q.

u. Recall default power-up settings by pressing UTIL MENU/#1/#1.

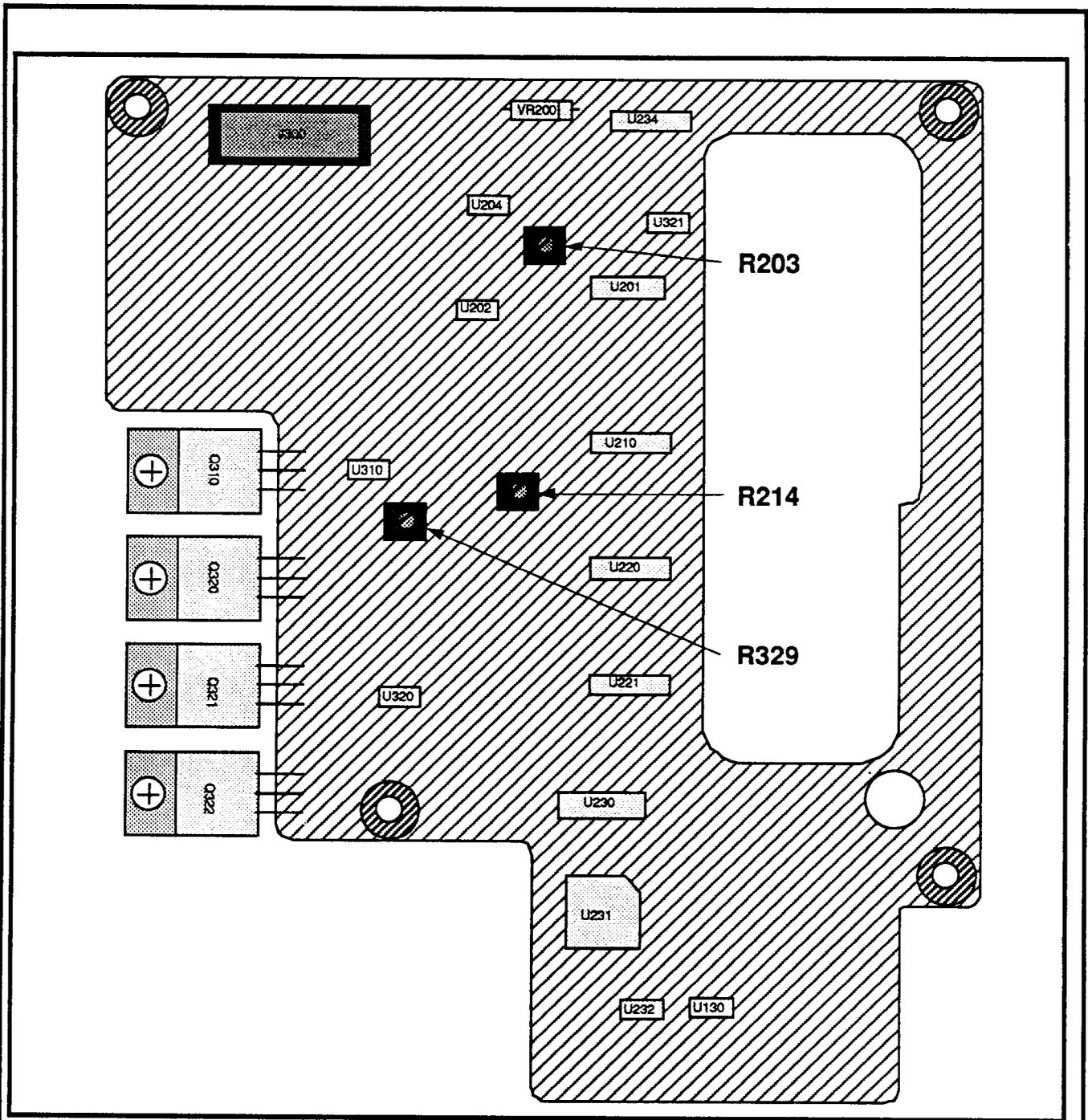


Figure 18. Adjustment locations on the Interface board.

5. Adjust Attenuator Flatness

a. Connect the Tracking Generator Output to the RF INPUT.

b. Enable the 105.5 MHz oscillator by pressing UTIL MENU/#5/#7/#4. (This enables the Tracking Generator.)

c. **RECALL DEFAULT NORMALIZATION VALUES FOR THE TRACKING GENERATOR BY PRESSING UTIL MENU/#5/#5/#3/#9/C.**

d. Set the Tracking Generator output attenuation to 0 dB by pressing #0/#0/A.

e. Set the AMPLITUDE DAC VALUE to 1600 by pressing #2/1600/A. Press UTIL MENU to exit the menu.

f. Set the following Spectrum Analyzer/Tracking Generator system parameters:

SPAN/DIV	MAX SPAN
RESOLUTION BW	AUTO
VERTICAL SCALE	1DB/DIV

g. Set the Spectrum Analyzer/Tracking Generator system reference level such that the entire trace is on screen.

h. Save the trace in the A register, then enable B, C MINUS A mode by pressing DSPL MENU/#2.

i. Turn off all displays except the B DISPLAY.

j. Note the ATTEN value at the upper right corner of the display. Enter the value noted by pressing INPUT MENU/#5 and entering the noted value, and terminating with A.

k. There should be a straight horizontal line at the center of the screen. If not, check to see that B, C MINUS A OFFSET is set to CENTER (DSPL MENU/#3).

l. Enable the 4 dB attenuator at the Tracking Generator output by pressing UTIL MENU/#5/#7/#4/A. Press UTIL MENU to exit the menu.

m. Increase the REFERENCE LEVEL by 4 dB.

n. Check that the trace is within 1 dB of center screen at 100 MHz, and check that the total excursion of the trace from 100 kHz to 1.8 GHz is no more than 1 dB.

o. If the trace is not within 1 dB of center screen, add a "bendy" tab (adjustment wire) to the attenuator pad. See Figure 19.

p. Adjust the bendy tab such that the trace is within 1 dB of center screen.

q. Enable the 8 dB attenuator at the Tracking Generator output by pressing UTIL MENU/#5/#7/#8/A. Press UTIL MENU to exit the menu.

r. Increase the REFERENCE LEVEL by 4 dB.

s. Check that the trace is within 1 dB of center screen at 100 MHz, and check that the total excursion of the trace from 100 kHz to 1.8 GHz is no more than 1 dB.

t. If the trace is not within 1 dB of center screen, add a bendy tab to the attenuator pad. See Figure 19.

u. Adjust the bendy tab such that the trace is within 1 dB of center screen.

v. Enable the 16 dB attenuator at the Tracking Generator output by pressing UTIL MENU/#5/#7/#16/A. Press UTIL MENU to exit the menu.

w. Increase the REFERENCE LEVEL by 8 dB.

x. Check that the trace is within 1 dB of center screen at 100 MHz, and check that the total excursion of the trace from 100 kHz to 1.8 GHz is no more than 1 dB.

y. If the trace is not within 1 dB of center screen, add a bendy tab to the attenuator pad. See Figure 19.

z. Adjust the bendy tab such that the trace is within 1 dB of center screen.

aa. Enable the 20 dB attenuator at the Tracking Generator output by pressing UTIL MENU/#5/#7/#20/A. Press UTIL MENU to exit the menu.

bb. Increase the REFERENCE LEVEL by 4 dB.

cc. Check that the trace is within 1 dB of center screen at 100 MHz, and check that the total excursion of the trace from 100 kHz to 1.8 GHz is no more than 1 dB.

dd. If the trace is not within 1 dB of center screen, add a bendy tab to the attenuator pad. See Figure 19.

ee. Adjust the bendy tab such that the trace is within 1 dB of center screen.

6. Perform Tracking Generator Normalizations

a. Connect a short cable from the Tracking Generator output to the RF INPUT.

b. Run Tracking Generator normalizations by pressing UTIL MENU/#5/#5/#3/#9/A/C.

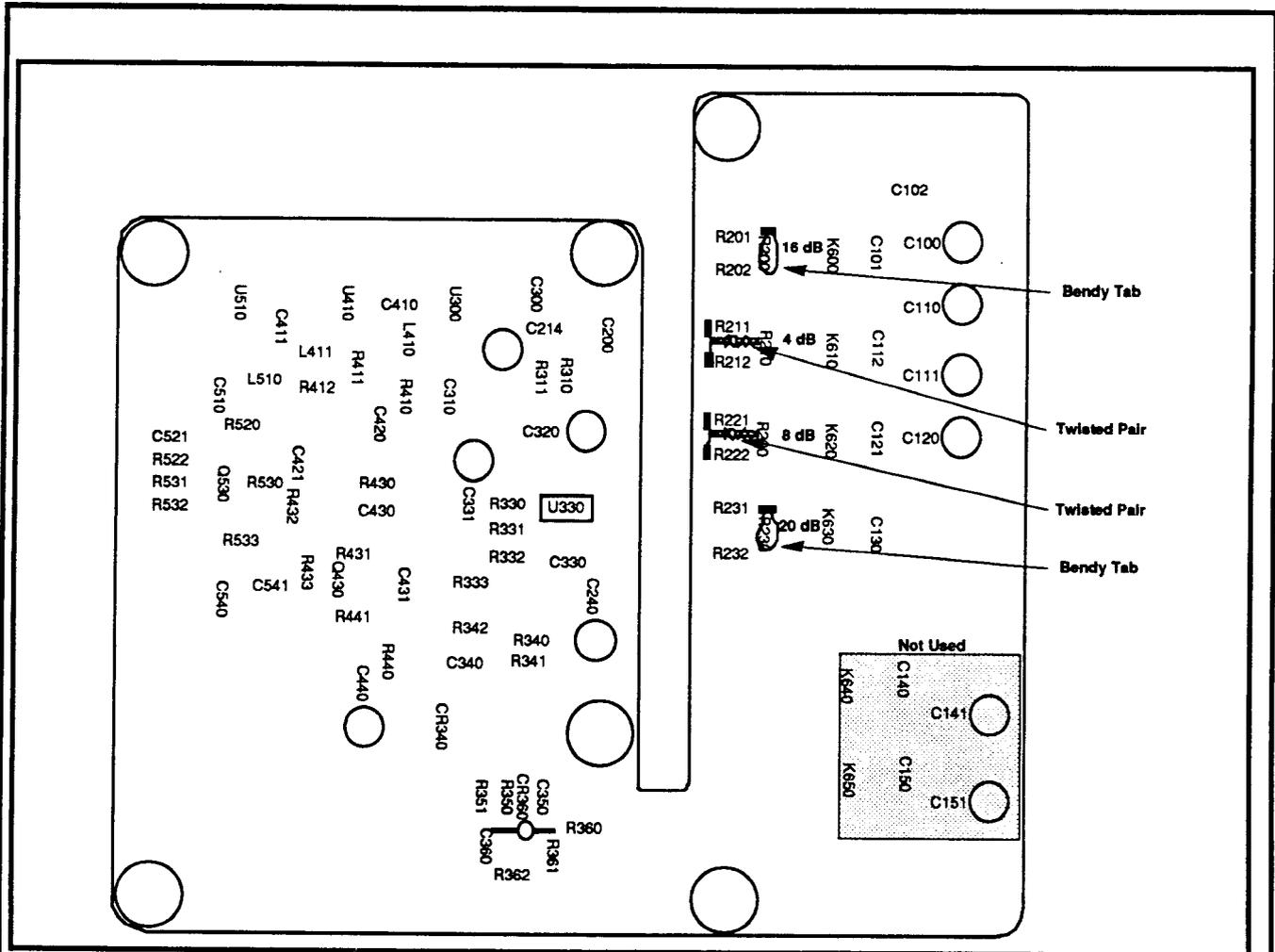


Figure 19. Twisted pairs and bendy tab locations on the Attenuator (Amplifier board).

ACCOUNTING FOR LO CABLE LOSSES

- a. With the setup in "ISOLATION AMP", connect the power meter directly to the 1st LO output of the Spectrum Analyzer.
- b. Enable manual scan by pressing SWP/TRIG MENU/#7, and enable MAX SPAN.
- c. Move the manual scan while watching the scope for the lowest swing in voltage (lowest power). Note the screen position on the Spectrum Analyzer.
- d. Verify on the power meter that this is the lowest L.O. power output.
- e. Write down the power meter reading at lowest power.
- f. Remove the power meter from the L.O. output.
- g. Put the low loss cable between the L.O. output and the power meter.
- h. Subtract the power meter reading from the one written down above. This is the cable loss (should be fractions of a dB).

BLOCK DIAGRAM DESCRIPTION

The tracking generator can be divided into three areas:

- Leveling,
- Conversion
- Interfacing

See Figure 20.

LEVELING

The leveling section of the tracking generator will regulate the Tracking Generator's output, keeping the amplitude flat across the 0 to 1.8 GHz output bandwidth. It can be subdivided into three sections, viz:

- RF amplifiers and filters
- Output attenuator and switches
- Detector with error amplifier.

CONVERSION

The converter section combines the Spectrum Analyzer's 1st LO with an offset frequency to produce an output frequency corresponding to the Spectrum Analyzer's input window. The converter section can be subdivided into four subsections, viz:

- Isolation amps and power divider
- Converter leveling amp
- 2110 MHz phase lock loop
- Crystal Oscillator.

The Isolation Amplifiers prevent 2110 MHz from feeding back into the Spectrum Analyzer's RF deck where it could reduce the Spectrum Analyzer's dynamic range. S12 from the mixer to the YIG input port should be approximately -60 dB at 2110 MHz. The amplifiers drive the mixer input at approxi-

mately +12 dBm. The converter's leveling amplifier should keep the converter drive power between +15 and +12 dBm. Keeping Option 15 available to users, allowing access to the 1st LO frequency, requires splitting off some power within the isolation chain. Option 15 needs power levels between +6 dBm and +10 dBm over the 2.11 to 3.91 GHz band.

The down converter mixes 2110 MHz to 3910 MHz from the leveling amplifier with a 2110 MHz offset frequency to produce 0 to 1800 MHz. The mixer has approximately 20 dB to 30 dB of isolation from the 2110 MHz port (LO port) to the 2110 to 3910 MHz port (Tracking Generator IF port). Note, these are labels only, the 2110 to 3910 MHz port is actually the driving port for controlling the diode switching and the 2110 MHz port will be the low level input, but the 2110 MHz input has been labeled previously as an LO frequency. The fixed 2110 MHz frequency should reach the mixer at a -20 dBm, assuming a 7 dB conversion loss. The converted product leaves the converter at a power level of -30 dBm after passing through a 3 dB pad.

The phase lock loop provides the source for the Down Converter's 2110 MHz input. This circuit is identical to the 2nd LO used in the Spectrum Analyzer's 2 GHz oscillator.

The 105.5 MHz VCO is a crystal oscillator with a 10 kHz tune range. This oscillator drives the phase lock loop's mixer with an amplitude of approximately 0 to +4 dBm. The oscillator receives its tune voltage from a 12 bit DAC. Finally, the module provides an output to the Spectrum Analyzer counter so the Spectrum Analyzer can accurately place the oscillator's frequency.

INTERFACING

This section provides an interface to the Spectrum Analyzer's microprocessor and supplies power to the various boards. The supplies provided are +20, +10, +5.2, and -11 volts DC with approximately 100 mVpp of 20 kHz noise. The supplies are re-regulated and filtered before being distributed throughout the Tracking Generator. The input communication from the microprocessor is three communication lines: serial data (Data0), data clock (Clko), and a register latch signal (Tglatch).

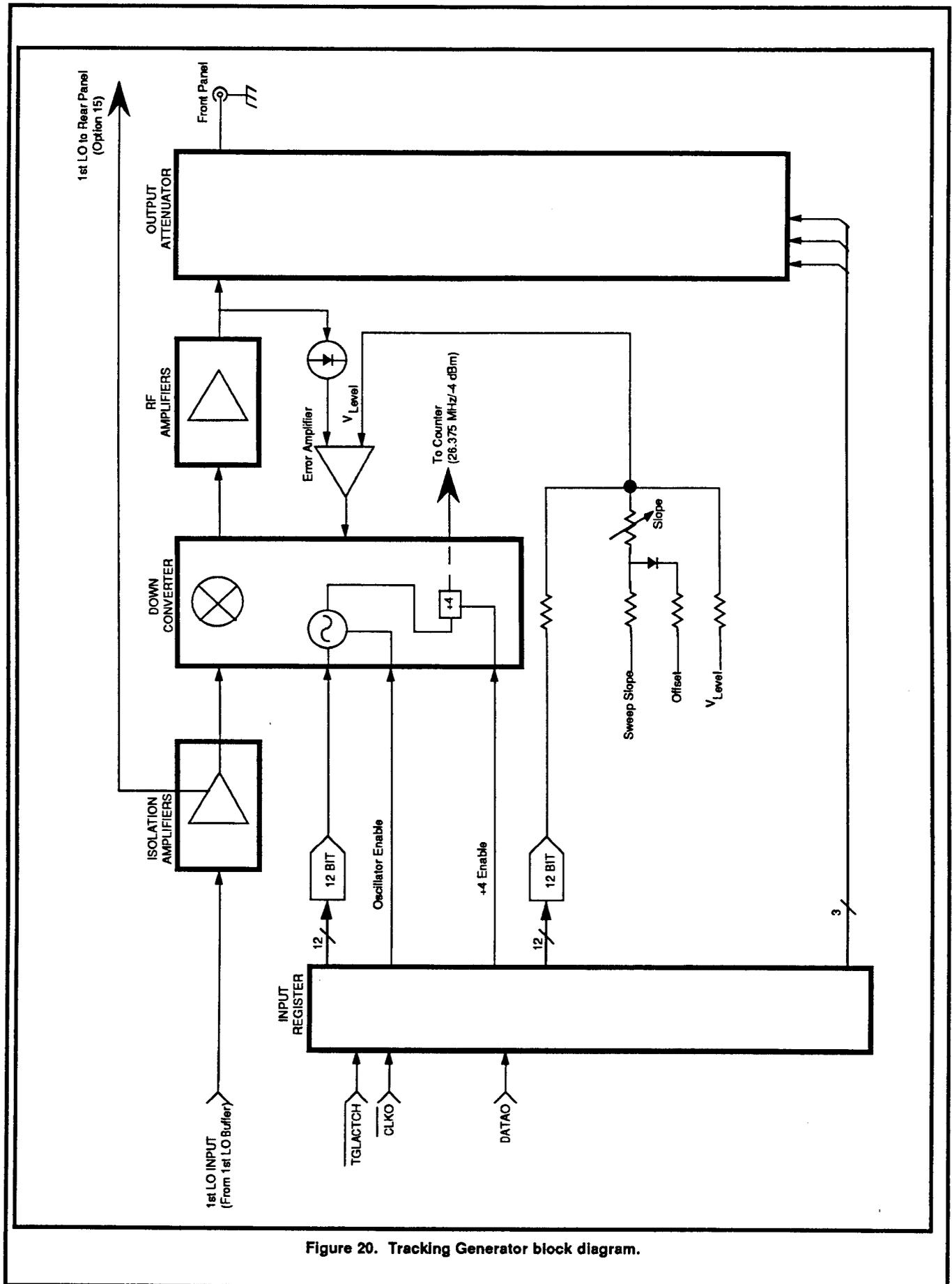


Figure 20. Tracking Generator block diagram.

CIRCUIT DESCRIPTION

ISOLATION AMPLIFIERS

The Isolation Amplifier Module performs the following three functions:

- amplifies the Spectrum Analyzer's 1st LO for driving the Tracking Generator's down converter
- provides partial leveling of the LO power level
- prevents 2110 MHz from feeding back into the Spectrum Analyzer's first IF.

AMPLIFIER CHAIN

The module consists of 3 amplifiers, an unbalanced power divider, a variable attenuator, 3 fixed attenuators, a 12 dB coupler, a detector, and an error amplifier.

Refer to the block diagram and schematic while reading this description.

The Isolation Amplifiers chain provides approximately +3 dB of forward gain and 85 dB of reverse attenuation at 2110 MHz. This reverse isolation is sufficient to prevent degradation of the Spectrum Analyzer's sensitivity when the Tracking Generator is operating.

The Tracking Generator receives the 1st LO (2110 MHz to 3910 MHz) from the Spectrum Analyzer's 1st LO Buffer Amp (at a power level of +6 dBm to +9 dBm) through an SMA connector. A 3 dB attenuator is placed between the input and the first isolation amplifier. This amplifier provides a forward gain of +6 dB and a reverse gain of -25 dB. The amplifier's output (LO) drives an unbalanced power divider. See Figure 21.

The unbalanced power divider taps the amplifier chain with 2.8 dB loss to provide an output for Option 15 when Option 15 is installed in the Spectrum Analyzer in combination with the Tracking Generator. This output provides an LO output of +6 dBm to +10 dBm over the 2110 MHz to 3910 MHz LO range, and is terminated in 50 Ω when Option 15 is not installed. A 4 pF capacitor has been placed between the output port and the power divider to provide dc blocking with approximately 10 dB of return loss.

The other branch of the unbalanced power divider (with a 4 dB loss) feeds the remaining amplifiers of the isolation chain. The LO signal (2110 MHz to 3910 MHz at +5 to +9 dBm) passes through a second 3 dB attenuator and a second isolation amplifier. This amplifier also provides 6 dB of forward gain

and -25 dB of reverse gain. The output of the second amplifier has an amplitude of +8 dB to +11 dBm going into the Variable Attenuator.

The Variable Attenuator provides 2 dB to 15 dB of attenuation according to the error voltage received from the Error Amplifier in the Leveling Loop.

An amplifier in the Leveling Loop provides +8 dB of gain in the forward direction and 30 dB of attenuation in the reverse direction. At the output of the Leveling Loop amplifier, -12 dB of the total power is coupled to the Leveling Loop's detector. The detector's output voltage, proportional to the LO power level, feeds an error amplifier which controls the amount of attenuation in the variable attenuator. The Leveling Loop regulates the LO power level and ensures that the mixer receives an LO drive power of +9 dBm to +11 dBm, after passing through a final 3 dB attenuator.

BIASING

All the amplifiers are provided with active bias networks. The bipolar amplifiers use PNP wrap-around biasing while the FET has a more involved structure. For the NE64535 bipolar transistors, a resistive voltage divider followed by a PNP emitter-follower assures that the amplifier's collector voltage is approximately +8 V. The resistive divider keeps the PNP's base voltage at approximately +7 V and the emitter voltage rise establishes \approx +8 V for the amplifier's collector. A 27.4 Ω resistor sets the amplifier's collector current at approximately 20 mA.

The FET bias works differently. Again, a resistive voltage divider in combination with a PNP emitter follower keeps the drain voltage at approximately +3.5 V. Since the gate is tied to ground through a 221 Ω resistor, an additional current buffer is used to keep the gate voltage at the desired voltage level without affecting the collector voltage. Therefore, the primary PNP keeps the drain voltage of the FET fixed while the second PNP alters the FET's gate voltage to ensure that the particular FET drain voltage is obtained. The 82.5 Ω resistor fixes the drain current at approximately 40 mA.

VARIABLE ATTENUATOR

Two PIN diodes, in combination with two 47.5 Ω resistors and some bias provisions, make up the variable attenuator. The PIN diodes, with an RF resistance of 50 Ω at 1 mA, provide 6 dB of attenuation for the variable attenuator when each

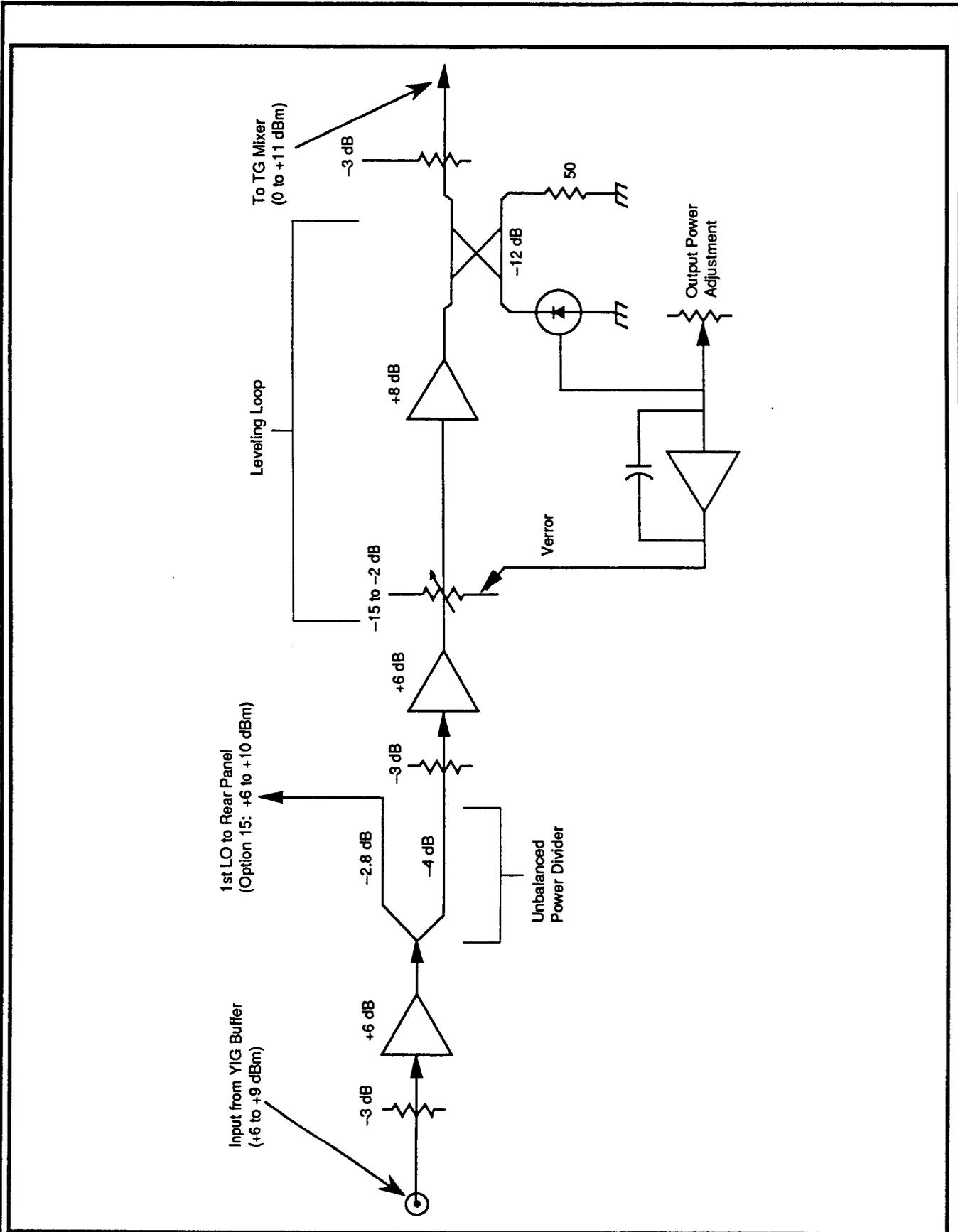


Figure 21. Isolation Amplifiers block diagram

diode is 50 Ω . An operational amplifier in combination with an additional biased diode ensure that the total voltage across both PIN diodes is two diode drops ($2V_{be}$'s). By altering the voltage between the two diodes, the PIN diodes' resistances change - one increases while the other decreases. This either increases or decreases the total attenuation of the variable attenuator.

SUPPLIES

The board supplies are available through feed-through capacitors from the interfacing board. The supply ripple is kept at a minimum in order to prevent modulation from reaching the YIG buffer module and producing sidebands. The +9 V supply requires approximately 93 mA and the -9 V supply requires 20 mA, producing 1.02 W dissipation.

PHASE LOCK LOOP

The Phase Lock Loop (PLL) provides an offset frequency (2110 MHz) for mixing with the Spectrum Analyzer's first LO frequency. The PLL is locked to the 5th harmonic of a crystal oscillator (105.5 MHz). The PLL's frequency is set to a frequency which assures that the output frequency of the Tracking Generator matches the input window of the Spectrum Analyzer. The PLL module is made up of the following:

- 105.5 MHz Oscillator
- 100 MHz Amplifier
- Phase Detector (mixer)
- Error Amplifier
- 2 GHz Voltage-Controlled Oscillator (VCO)
- +4 IC
- Variable Attenuator
- Shaper (for driving the Variable Attenuator)

See Figure 22.

105.5 MHz OSCILLATOR

The 105.5 MHz Oscillator can be divided into 5 elements:

- Tank
- Emitter Follower
- Crystal
- Common Base Amplifier
- Varactor Diodes

See schematic diagram S15b and Figure 23.

Tank

The Tank circuit serves as the collector load for the common base amplifier. Ignoring the parallel resistance, the capacitor and the inductor are tuned for resonance at 105.5 MHz.

The Tank circuit serves the following two purposes:

1. It guarantees that the oscillator is tuned to the 5th harmonic of the series resonant crystal. The crystal within the oscillator loop has a fundamental resonant mode at 21.1 MHz. The crystal can potentially oscillate at any of the odd harmonics of this fundamental mode: i.e. (21.1, 3(21.1), 5(21.1), 7(21.1), etc. The Tank circuit assures that the common base amplifier, within the oscillator loop, has a gain greater than unity only at the crystal's fifth overtone (105.5 MHz). A gain greater than unity is necessary to ensure that oscillation starts.
2. It establishes the oscillator's open loop gain, with a corresponding phase shift. The open loop gain is directly proportional to the parallel resistance of the Tank. With a gain greater than unity, the oscillator "starts" when power is applied, and noise within the circuitry is amplified around the loop and the amplitude increases, limited only by a transistor's bias current or voltage. Once the loop reaches steady state (i.e. the oscillation frequency and amplitude have been established), the loop's gain becomes unity and the phase shift around the loop zero. The final frequency is a function of the crystal's resonant frequency, the crystal Q, the Tank's resonant frequency, and the Tank's Q. The loop's two transistors also contribute additional phase shift. The amount of phase shift from these transistors changes according to the oscillation amplitude and temperature.

Emitter Follower

The emitter follower, following the Tank circuit, acts as a current buffer between the Tank circuit and the crystal. The voltage amplitude at the collector of the transistor is set according to the current level of the transistor bias and the collector loading of the transistor. The Oscillator output, 105.5 MHz, ~1 V_{pp} drives both a divide-by-four block along with an amplifier of the 2110 MHz phase lock loop.

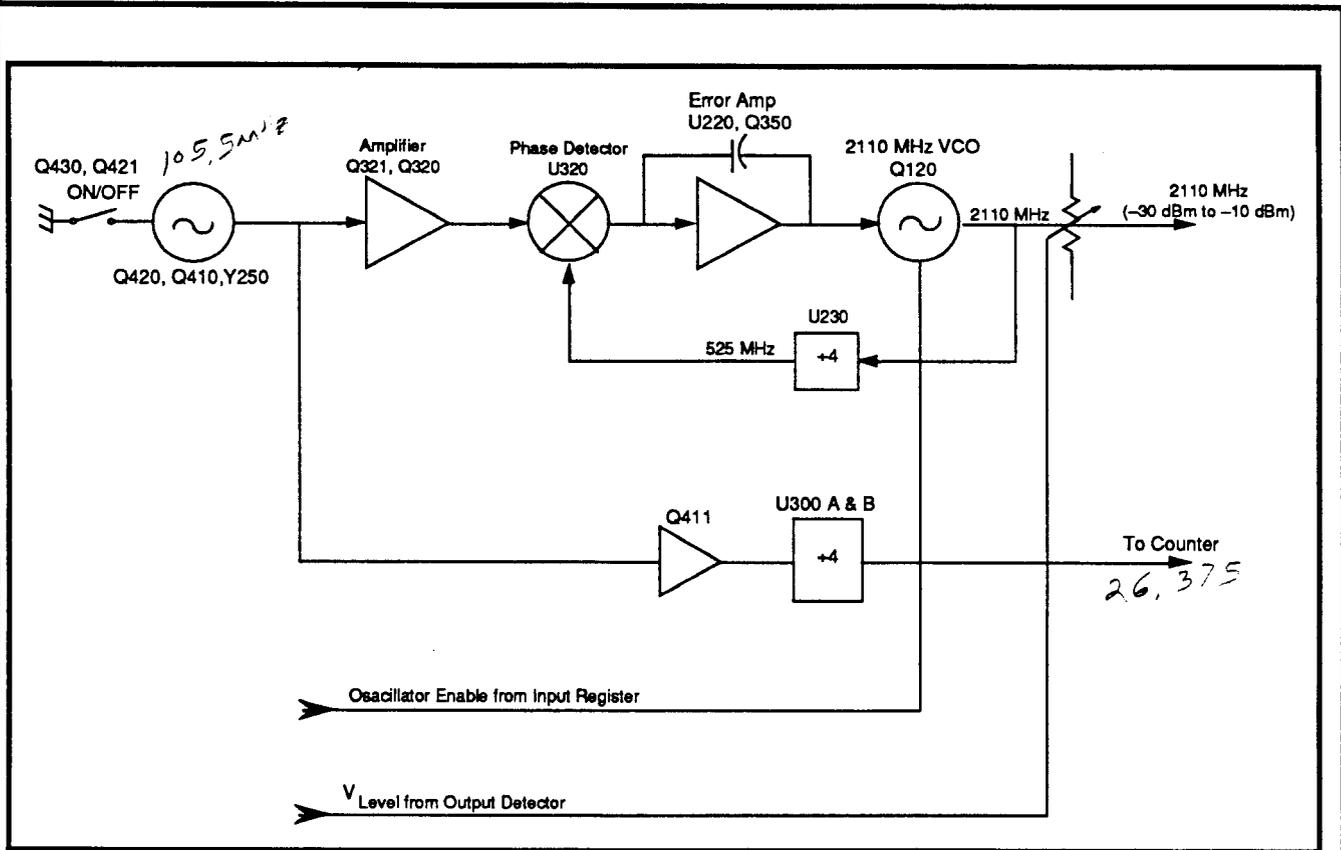


Figure 22. 2110 MHz Phase Lock Loop block diagram.

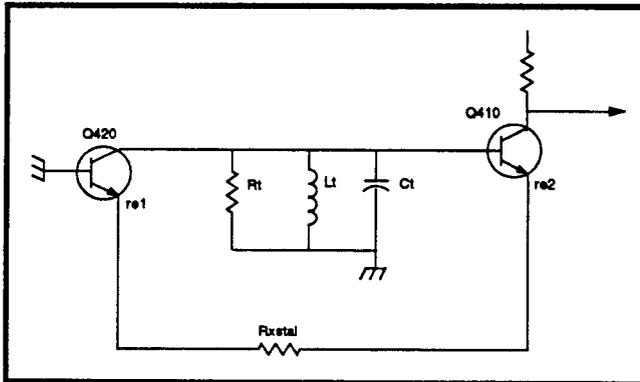


Figure 23. 105.5 MHz Oscillator ac equivalent.

Common Base Amplifier

The common base amplifier amplifies signals within the loop. At 105.5 MHz, the crystal and Tank circuit are at resonance, therefore, the reactive components can be ignored. The amplifier gain then approximates the ratio between the collector resistance and the emitter resistance. The collector resistance is the Tank circuit's resistor to ground. The emitter resistor is $(R_{xtal} + re1 + re2)$ - the crystal's series equivalent resistance, the output resistance of the emitter follower transistor, and the "re" (input) resistance of the common base amplifier. See Figure 23.

Crystal

The crystal within the oscillator loop acts as the stability device. It guarantees that the oscillation frequency will be centered about the resonant frequency of the crystal's 5th overtone as mentioned earlier. The mechanical modes of the crystal, combined with piezoelectric devices, can be modeled as series LC with series resistance. The equivalent series resistance of the crystal also contributes to the loop's open loop gain when presented to the common base amplifier of the loop.

Varactor Diodes

With the oscillator loop complete, an oscillation frequency would correspond to the crystal's resonant frequency; however, in order to tune the frequency, varactors are placed in series with the crystal. The varactor capacitance changes as a function of voltage. This capacitance change, in turn, alters the phase shift around the loop. The phase shift maintains a zero degree phase shift around the loop. The VCO receives the tune voltage, a voltage between +8 V and -8 V, comes from the interface board.

100 MHz AMPLIFIER

The Crystal Oscillator output (105.5 MHz at $\approx 1 V_{p-p}$) drives the PLL module. The 105.5 MHz signal is routed to a differential amplifier composed of Q310 and Q320 and associated circuitry. The output of the amplifier feeds the PLL's Phase Detector.

PHASE DETECTOR

Assembly U210 is a mixer being used as a phase detector. The switching of the mixer's diode generates a fifth harmonic of the 105.5 MHz driving signal. By mixing the 5th harmonic of the crystal oscillator (527.5 MHz) with the 4th subharmonic of the 2110 MHz VCO [527.5 MHz or (2110 MHz + 4)], the phase detector produces a dc level that is proportional to the phase difference between the two input signals.

ERROR AMPLIFIER

An operational amplifier (U220) and an output current buffer (Q150) make up the Error Amplifier. The output of the Phase Detector drives the Error Amplifier. The amplifier integrates the detector's error voltage and generates a tune voltage for the 2110 MHz VCO. A start-up circuit, C231, CR230, CR240, and associated resistors (located between the operational amplifier and the transistor that forms the Error Amplifier), keeps the tune voltage set high at power-up by holding the Error Amplifier control loop open. After power-up, the start-up circuit gradually releases the control loop.

2110 MHz VCO

The tune voltage from the Error Amplifier changes the collector voltage of Q160, the oscillator transistor. As the voltage changes, the transistor's collector to base capacitance changes

accordingly. As the voltage increases, the capacitance decreases. This change in capacitance changes the reactance which the negative-resistance, one-port transistor presents to the "resonating" element, resulting in a change in the oscillator frequency.

The 2110 MHz VCO output, approximately 0 dBm, is routed to a variable attenuator via a 12 dB coupler. The 12 dB coupler couples enough power to drive a +4 IC. The IC divides 2110 MHz by 4 to produce 527.5 MHz at an amplitude of ≈ -4 dBm. This 527.5 MHz signal is routed to the Phase Detector where its phase is compared with the 5th harmonic of the Crystal Oscillator; thus completing the loop around the phase lock loop.

VARIABLE ATTENUATOR

The PIN diode attenuator CR270 attenuates the 2110 MHz signal, then routes the signal off the board to drive the Down Converter. The attenuation, 0.5 to 13 dB, is proportional to the control voltage V_{Level} from the Output Detector. This voltage-variable attenuator is a part of the leveling control loop. A detector on another module, senses the output power and adjusts the variable attenuator to obtain the desired output amplitude. The attenuator has an adjustment range of approximately 12 dB. The 2110 MHz signal leaves the PLL module at an amplitude between -30 to -10 dBm.

SUPPLIES

The PLL module requires 30 mA from the +15 V supply, 35 mA from the +9 V, 26 mA from the +5 V, and 63 mA from the -9 V supplies. The total power consumption is ≈ 1.5 W. The supply ripple is kept below 8 mV_{p-p} for the +5 V supply, 1.2 mV_{p-p} for the +9 V and +15 V supplies, and 2.4 mV_{p-p} for the -9 V supply in order to minimize power supply switching sidebands at the output signal.

RF AMPLIFIER MODULE

The RF Amplifier Module gets its signal (100 KHz to 1.8 GHz) from the RF mixer and performs the following three functions:

- filters out signals above 1.8 GHz
- amplifies the signal
- detects the output signal amplitude to develop an amplitude correction voltage for the leveling loop.

See Figure 24.

GENERAL DESCRIPTION

The module consists of three cascaded amplifiers. The input signal (100 KHz to 1.8 GHz) passes through a 1.8 GHz low-pass filter into the first amplifier at a power level between -25 dBm and -40 dBm. The filter is a distributed element designed to retard the 2.110 GHz-to-3.910 GHz LO signal, thus preventing it from entering the amplifier stage.

The first three amplifier stages are monolithic, silicon integrated circuits (ICs) with approximately 10 dB of gain each. Because of output power limitations of the ICs the final amplifier stage is a discrete silicon bipolar amplifier. It has

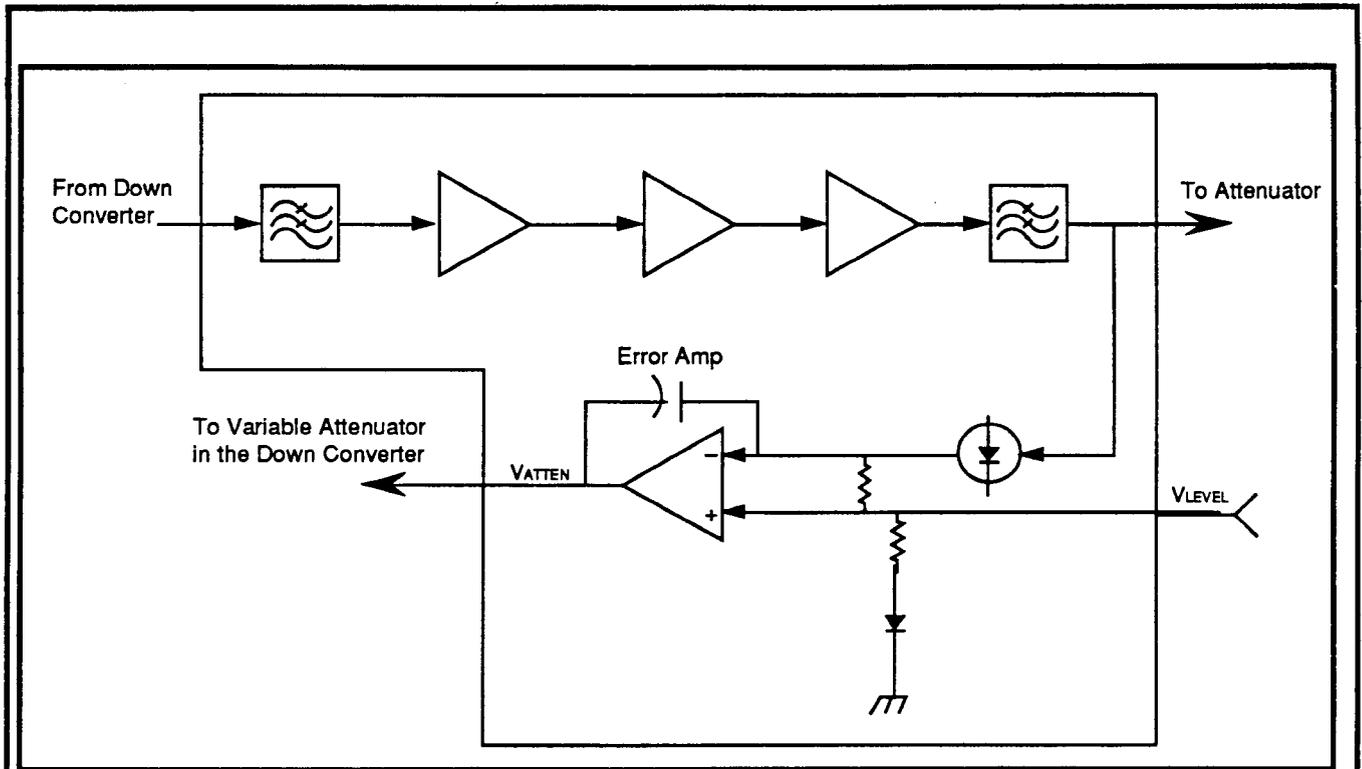


Figure 24. RF Amplifiers block diagram.

approximately 9 dB of gain with a 1 dB output power compression point at +12 dBm. The total gain of the four stages is approximately 39 dB with at least 10 dBm of output power.

The signal passes through a printed, five-pole filter to reduce any high frequency harmonics that may be generated by the amplifiers. It has an insertion loss of less than 0.5 dB at 1.8 GHz and approximately 10 dB at 3 GHz.

The amplified signal is routed to a peak detector whose output then goes to an error amplifier that compares the detected signal to a reference voltage provided by the interface board. The peak detector senses only the forward power but not reflected or reverse power, and the power loss through the detector is 6 dB. The forward power is load-independent. The error amplifier is also connected to, and provides a bias current for a temperature compensation diode for the detector diode. The detector output is sent to the leveling attenuator on the 2110 MHz Phase Lock Loop board via the interface board.

The total gain for the complete module from 100 KHz to 1.8 GHz is 32 dB and the output power is at least +4 dBm.

BIASING

The first three stages of the amplifier use a +9 V supply. The final output stage uses a +15 V supply. A resistor and inductor connected to the output of each stage set the bias for the ICs. A wrap-around circuit using a PNP transistor is used to bias the final output stage. A -9 V supply is connected to the error amp.

ATTENUATOR

The output attenuator provides 0 dB – 48 dB of output power level adjustment in 4 dB steps. The Attenuator consists of Microprocessor-controlled relays that switch in pads of 4, 8, 16, and 20 dB. A current from the interface board switches the attenuators in and out to provide the whole range of attenuation.

A single pole triple throw switch is also provided in the Attenuator module for future use.

TRACKING GENERATOR INTERFACE BOARD

INTRODUCTION

The Interface board provides a control path for the Microprocessor. The circuit board includes power supply regulators, Digital-to-Analog-Converters (DACs) for controlling frequency and amplitude, relay drivers for the output attenuator, along with a summing junction for the Leveling Loop's error amplifier.

The Interface board has the following five functional areas (see Figure 25):

- Input Registers
- Frequency Control
- Amplitude Control
- Power Supply Regulation
- Interconnecting

INPUT REGISTERS

The Microprocessor controls the operating conditions of the Tracking Generator via the Input Registers. Three serial-input/parallel-output (4094 CMOS) chips provide 24 control bits. The Tracking Generator requires 18 control bits as shown in Table 4.

The Microprocessor uses 3 control lines for loading the input registers. DATAO is the data line which the Microprocessor uses for sending out data. CLKO clocks the serial output data into the input of the registers. Once the stream of data has been delivered, the Microprocessor sets TGLATCH- low which latches the serial input data to the register's parallel outputs for the Tracking Generator board. Two single pulse multi-vibrators control the timing required for loading data into the dual DAC. The first multi-vibrator controls the data set-up time delay. The second multi-vibrator determines how long the pulse will remain low. The sequence is triggered by the TGLATCH- signal.

FREQUENCY CONTROL

The frequency control circuitry generates a DC voltage for tuning the 105.5 MHz crystal oscillator frequency. A DAC and a buffer amplifier generate a tune voltage ranging between -5 V to 0 V . A second amplifier amplifies and offsets this tune voltage to produce a control voltage between -8.9 V and $+9.4\text{ V}$. This is sent to the crystal oscillator on the PLL board.

AMPLITUDE CONTROL

The output amplitude is varied in two ways: using a variable output attenuator and an analog control voltage. The analog control voltage is established according to the sum and weighting of four different voltages (a DAC voltage, a sweep voltage, an offset voltage, and a selectable manual control voltage). The summed result produces the control current for the Leveling Loop's error amplifier. The DAC voltage ranges between -5 V to 0 V . The offset voltage compensates for the residual DC voltage from the "sweep voltage shaper" and will also allow some bipolar capability with the control DAC. The sweep voltage, proportional to the instrument's 1st LO frequency, compensates for any attenuator frequency roll-off. When the Spectrum Analyzer is sweeping in Max Span, this voltage sweeps from $+5\text{ V}$ to -5 V , proportional to the 1st LO's frequency. Before reaching the summing node, the sweep voltage passes through a shaper. The shaper clamps the sweep voltage according to the offset frequency at which the output attenuator's frequency roll-off begins. The offset frequency and gain of the slope correction are both adjustable. The last voltage controlling the output amplitude is the selectable manual control. The front-panel LEVEL control produces a control voltage between -8 V and $+8\text{ V}$. The Microprocessor controls whether or not to sum this into the summing node. Concerning the weighting of the various inputs, the DAC needs approximately 6 dB of control over the output amplitude, while the sweep needs approximately 1.5 dB and the manual adjust approximately 3 dB (from the system non-flatness).

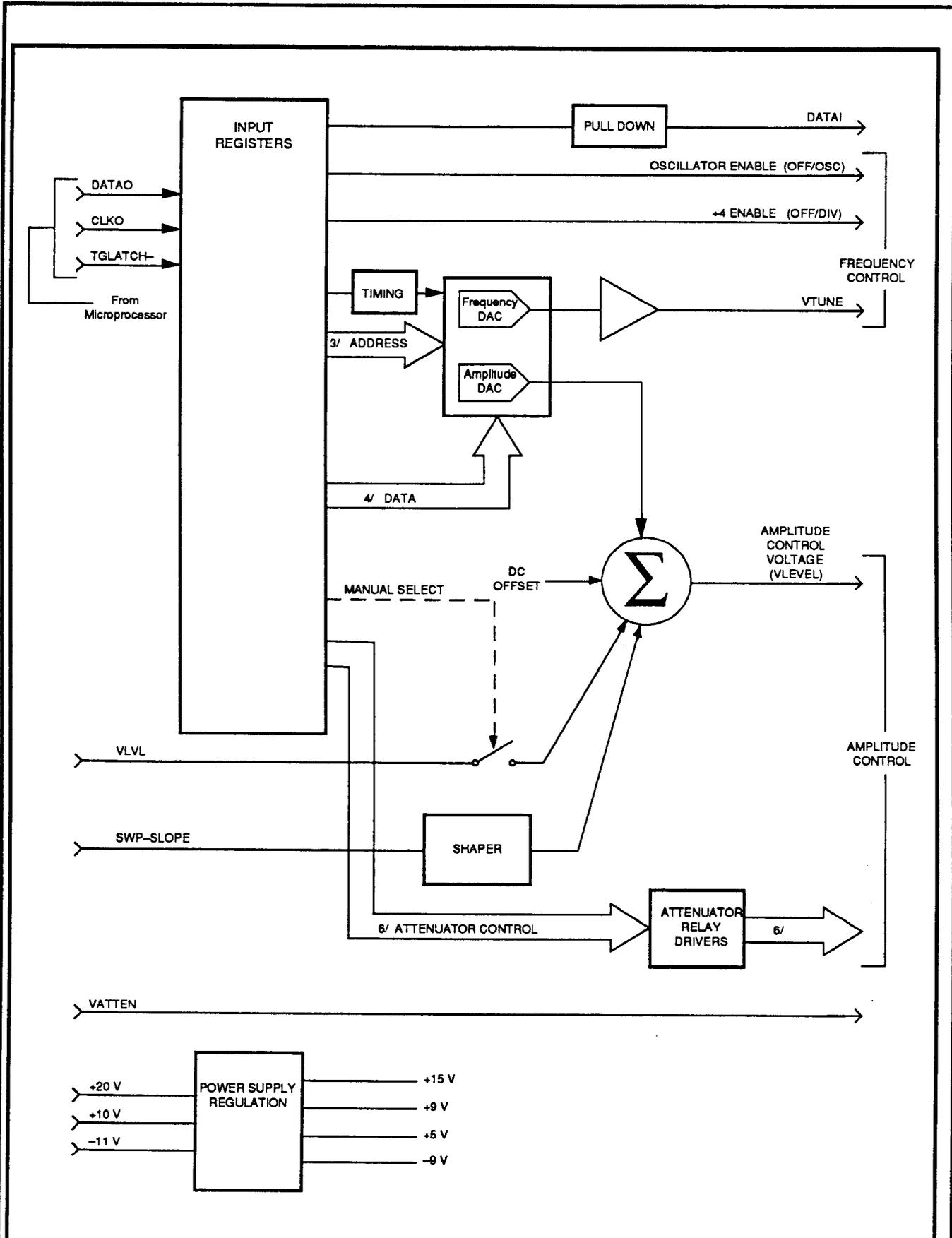


Figure 25. Tracking Generator Interconnect block diagram.

Table 4
CONTROL BITS

BIT	Name	Function
0	TG_check	Allows the Microprocessor to determine if the Tracking Generator module exists. When TG_check is set high, the instrument's DATAI line is pulled low, indicating that the Tracking Generator is present; otherwise, DATAI remains high.
1	Analog-	When set low, enables manual control of the Tracking Generator's output amplitude.
2 through 7		Not used.
8	4/0 dB-	When set high, selects the 4 dB attenuator.
9	8/0 dB	High enables the 8 dB output attenuator.
10	16/0 dB-	High enables the 16 dB output attenuator.
11	20/0 dB-	High enables the 20 dB output attenuator.
12		Future use
13		Future use
14	OscEn-	High turns off the Tracking Generator, Low enables the crystal oscillator in the 2110 oscillator.
15	DivEn-	High disables the +4 IC. Low enables the divider which is used when counting the crystal oscillator.
16	DB0	Data bits for loading the amplitude & frequency control DAC's.
17	DB1	
18	DB2	
19	DB3	
20	A0	Address bits for loading the DAC's.
21	A1	
22	A2	
23	UPD-	When set low, updates both the Amplitude & Frequency DAC's simultaneously.

Additional amplitude attenuation is provided via the Tracking Generator's output attenuator. The interface board controls the attenuator relays (within the programmable attenuator) by enabling or disabling the relay current drivers. The attenuator has 4 dB, 8 dB, 16 dB, and 20 dB attenuator steps. (Two other relays are available for future considerations.)

POWER SUPPLY REGULATION

The Interface board provides clean power supplies for the Tracking Generator. Line (60 Hz) and 20 kHz ripple levels of 0.1 Vrms are present in the +20 V, +10 V, and -11 V power supplies reaching the Tracking Generator. Four active regulators and a voltage reference re-regulate the supply voltages to +15 V, +9 V, +5 V, and -9 V. The power consumption is as follows:

Voltage	Current	Power
+20 V	74 mA	1.48 W
+10.8 V	660 mA	7.13 W
-11.4 V	130 mA	1.48 W
Total Power = 10.1 W		

INTERCONNECTING

The final function the board provides is routing the error voltage (Vatten) from the Leveling Loop's error amplifier to the variable attenuator on the PLL board. The voltage ranges between -4 V and -2 V. These levels correspond to minimum and maximum attenuation respectively.

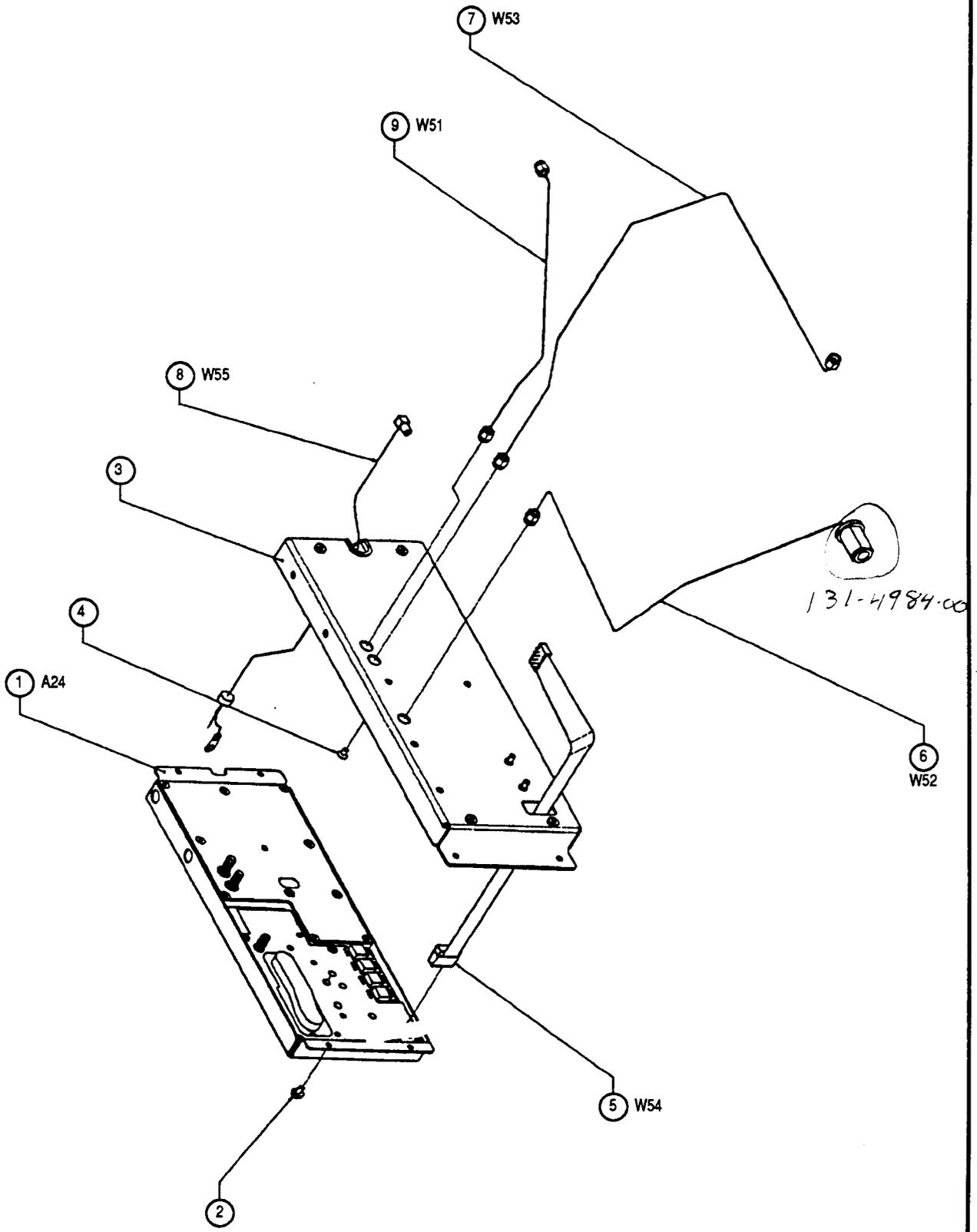


Figure 26. Tracking Generator wiring.

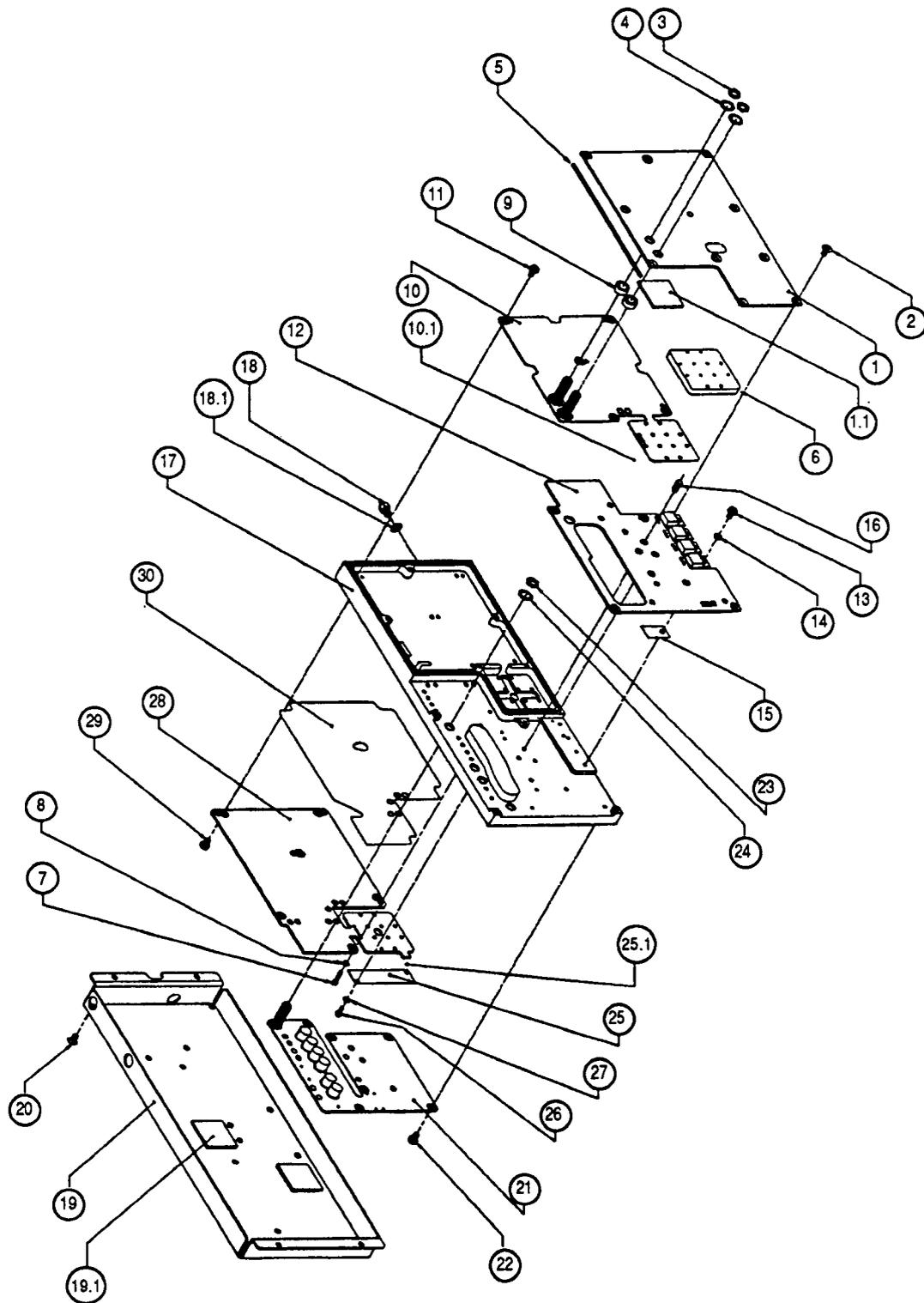


Figure 27. Tracking Generator exploded view.

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
24931	SPECIALTY CONNECTOR CO INC	2100 EARLYWOOD DR PO BOX 547	FRANKLIN IN 46131
77900	ILLINOIS TOOL WORKS SHAKEPROOF DIV	ST CHARLES RD	ELGIN IL 60120
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF DIV	ST CHARLES ROAD	ELGIN IL 60120
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001
83385	MICRODOT MFG INC GREER-CENTRAL DIV	3221 W BIG BEAVER RD	TROY MI 48098
83486	ELCO INDUSTRIES INC	1101 SAMUELSON RD	ROCKFORD IL 61101
86928	SEASTROM MFG CO INC	701 SONORA AVE	GLENDALE CA 91201-2431
93907	TEXTRON INC CAMCAR DIV	600 18TH AVE	ROCKFORD IL 61108-5181
TK0428	DLB INDUSTRIES		FRESNO CA

REPLACEABLE MECHANICAL PARTS
2710 OPTION 04

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective Discnt	Qty	12345	Name & Description	Mfr. Code	Mfr. Part No.
26-1	-----	-----	1		TRACK GEN ASSY (SEE A24 REPL) (ATTACHING PARTS)		
-2	211-0658-00		4		SCR,ASSEM WSHR:6-32 X 0.312,PNH,STL,POZ (END ATTACHING PARTS)	78189	S51-060545-0X
-3	441-1952-00		1		CHASSIS,SCOPE:TRACKING GENERATOR,AL (ATTACHING PARTS)	80009	441-1952-00
-4	211-0541-00		2		SCREW,MACHINE:6-32 X 0.25,FLH,100 DEG,STL (END ATTACHING PARTS)	93907	ORDER BY DESCR
-5	-----		1		CA ASSY, SP, ELEC (SEE W54 REPL)		
-6	-----		1		CA ASSY, RF (SEE W52 REPL)		
-7	-----		1		CA ASSY, RF (SEE W53 REPL)		
-8	-----		1		CA ASSY, RF (SEE W55 REPL)		
-9	-----		1		CA ASSY, RF (SEE W51 REPL) (OPTION 15 ONLY)		

REPLACEABLE MECHANICAL PARTS
2710 OPTION 04

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Discnt	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
27-	-----			1	TRACK GEN ASSY (SEE A24 REPL) T.G. INCLUDES:		
-1	200-3827-00			1	.COVER,REAR:TRACKING GENERATOR (ATTACHING PARTS)	80009	200-3827-00
-1.1	348-1224-00			1	.ABSORBER,RF:LOADED,SILICON RUBBER,1 X 1 0.0 .85	80009	348-1224-00
-2	211-0734-00			10	.SCREW,MACHINE:6-32 X 0.25,FLH,100 DEG,STL	83486	ORDER BY DESCR
-3	220-0787-00			2	.NUT,PLAIN,HEX:0.25-36 X 0.312 HEX,SST	24931	HN109-10
-4	210-0046-00			2	.WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL (END ATTACHING PARTS)	77900	1214-05-00-0541C
-5	348-1197-00			AR	.GSKT,SHLD ELEC:CE-BU W/TIN	80009	348-1197-00
-6	361-1557-00			1	.SPACER,MIXER:ALUMINUM (ATTACHING PARTS)	80009	361-1557-00
-7	211-0265-00			12	.SCREW,CAP:2-56 X 0.375,SCH,SST	83385	ORDER BY DESCR
-8	210-0053-00			12	.WASHER,LOCK:#2 SPLIT,0.02 THK STL (END ATTACHING PARTS)	78189	ORDER BY DESCR
-9	361-1558-00			2	.SPACER,SLEEVE:0.252 ID X 0.375 OD X 0.180 L .BRASS	80009	361-1558-00
-10	-----			1	.CKT BOARD ASSY: TG ISOLATION AMP (SEE A24A3 REPL) (ATTACHING PARTS)		
-10.1	119-3009-00	B032993		1	.JUMPER:DIODE TO CIRCUIT BOARD	80009	119-3009-00
-11	211-0408-00			5	.SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL TORX (END ATTACHING PARTS)	93907	ORDER BY DESCR
-12	-----			1	.CKT BOARD ASSY: TG INTERFACE (SEE A24A1 REPL) (ATTACHING PARTS)		
-13	211-0408-00			8	.SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL TORX	93907	ORDER BY DESCR
-14	210-1178-00			4	.WASHER,SHLDR: (END ATTACHING PARTS)	80009	210-1178-00
-15	342-0653-00			4	.INSULATOR,PLATE:SHIELD,POLYCARBONATE .CKT BOARD ASSY INCLUDES:	80009	342-0653-00
-16	-----			19	.CAP,FXD,CER DI: .005UF,+100-0%,100V (SEE A24C110,C120,C121,C122,C130,C132,C134, .C136,C137,C138,C202,C214,C220,C233,C236, .C237,C301,C310,C322 REPL)		
-17	380-0962-00			1	.HOUSING,TRKG GE:ALUMINUM	80009	380-0962-00
-18	-----			1	.100PF,FEED THROUGH CAP (SEE A24C500)		
-18.1	210-0008-00			1	.WASHER,LOCK:#8 INTL,0.02 THK,STL	77900	1208-00-00-0541C
-19	200-3823-00			1	.COVER,TOP:ALUMINUM (ATTACHING PARTS)	80009	200-3823-00
-19.1	348-1224-00			2	.ABSORBER,RF:LOADED,SILICON RUBBER,1 X 1 0.0 .85	80009	348-1224-00
-20	211-0734-00			12	.SCREW,MACHINE:6-32 X 0.25,FLH,100 DEG,STL (END ATTACHING PARTS)	83486	ORDER BY DESCR
-21	-----			1	.CKT BOARD ASSY: TG RF AMPLIFIER (SEE A24A4 REPL) (ATTACHING PARTS)		
-22	211-0408-00			6	.SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL TORX	93907	ORDER BY DESCR
-22.1	210-1002-00	B033186		6	.WASHER,FLAT:0.125 ID X 0.25 OD X 0.022,BRS	86928	5714-147-20N
-23	220-0787-00			1	.NUT,PLAIN,HEX:0.25-36 X 0.312 HEX,SST	24931	HN109-10
-24	210-0046-00			1	.WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL (END ATTACHING PARTS)	77900	1214-05-00-0541C
-25	-----			1	.CIRCUIT BOARD: LOW PASS FILTER (SEE FL1 REPL) (ATTACHING PARTS)		
-25.1	119-3009-00	B032993		2	.JUMPER:DIODE TO CIRCUIT BOARD	80009	119-3009-00
-26	211-0162-00			2	.SCREW,MACHINE:2-56 X 0.188,SCH,SST	TK0428	ORDER BY DESCR
-27	210-0053-00			2	.WASHER,LOCK:#2 SPLIT,0.02 THK STL (END ATTACHING PARTS)	78189	ORDER BY DESCR
-28	-----			1	.CKT BOARD ASSY: TG PHASE LOCK LOOP (SEE A24A2 REPL) (ATTACHING PARTS)		
-29	211-0408-00			10	.SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL TORX (END ATTACHING PARTS)	93907	ORDER BY DESCR
-30	342-0917-00			1	.INSULATOR,SHEET:VALOX FR,TRACKING GEN	80009	342-0917-00

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
00779	AMP INC	2800 FULLING MILL PO BOX 3608	HARRISBURG PA 17105
01121	ALLEN-BRADLEY CO	1201 S 2ND ST	MILWAUKEE WI 53204-2410
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS SECTOR	5005 E MCDOWELL RD	PHOENIX AZ 85008-4229
11532	TELEDYNE RELAYS TELEDYNE INDUSTRIES INC SUB OF TELEDYNE INC	12525 DAPHNE AVE	HAWTHORNE CA 90250-3308
14552	MICROSEMI CORP	2830 S FAIRVIEW ST	SANTA ANA CA 92704-5948
14674	CORNING GLASS WORKS	HOUGHTON PK	CORNING NY 14830
15542	MINI-CIRCUITS LABORATORY	2625 E 14TH ST	BROOKLYN NY 11235-3915
20932	KYOCERA INTERNATIONAL INC	11620 SORRENTO VALLEY RD PO BOX 81543 PLANT NO 1	SAN DIEGO CA 92121
24539	AVANTEK INC	3175 BOWERS AVE	SANTA CLARA CA 95051
24931	SPECIALTY CONNECTOR CO INC	2100 EARLYWOOD DR PO BOX 547	FRANKLIN IN 46131
25088	SIEMENS CORP	186 WOOD AVE S	ISELIN NJ 08830-2704
32997	BOURNS INC TRIMPOT DIV	1200 COLUMBIA AVE	RIVERSIDE CA 92507-2114
33095	SPECTRUM CONTROL INC	2185 W WEIGHT ST	ERIE PA 16505
54583	TDK ELECTRONICS CORP	12 HARBOR PARK DR	PORT WASHINGTON NY 11550
57668	ROHM CORP	8 WHATNEY PO BOX 19515	IRVINE CA 92713
59492	K AND L QUARTZTEK DIV OF K AND L MICROWAVE INC SUB OF DOVER CORP	20 S 48TH AVE	PHOENIX AZ 85043-3820
72982	ERIE SPECIALTY PRODUCTS INC	645 W 11TH ST	ERIE PA 16512
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001
81483	INTERNATIONAL RECTIFIER	9220 SUNSET BLVD	LOS ANGELES CA 90069-3501
95275	VITRAMON INC	BOX 544	BRIDGEPORT CT 06601-0544
TK1424	MARCON AMERICA CORP	3 PEARL CT	ALLENDALE NJ 07401
TK1483	TEKA PRODUCTS INC	45 SALEM ST	PROVIDENCE RI 02907

REPLACEABLE ELECTRICAL PARTS
2710 OPTION 04 SERVICE

Component No.	Tektronix Part No.	Serial/Assembly No. Effective Discort	Name & Description	Mfr. Code	Mfr. Part No.
A24	119-3889-00		TRACK GEN ASSY:ISO AMP,RF AMP,TG PHASE LL,T G INTERFACE	80009	119-3889-00
A24A1	671-1547-00		CIRCUIT BD ASSY:TG INTERFACE,389-0750-XX WI RED	80009	671-1547-00
A24A2	671-1544-00		CIRCUIT BD ASSY:TG PHASE LOCK LOOP,389-0748 -XX WIRED	80009	671-1544-00
A24A3	671-1543-00		CIRCUIT BD ASSY:TG ISOLATION AMP,389-0747-X X WIRED	80009	671-1543-00
A24A4	671-1541-00		CIRCUIT BD ASSY:TG RF AMPLIFIER,389-0746-XX WIRED	80009	671-1541-00
A24	119-3889-00		TRACK GEN ASSY:ISO AMP,RF AMP,TG PHASE LL,T G INTERFACE	80009	119-3889-00
A24C110	281-0825-00		CAP,FXD,CER DI:0.005UF,+100-0%,100V	33095	51-726-008
A24C120	281-0825-00		CAP,FXD,CER DI:0.005UF,+100-0%,100V	33095	51-726-008
A24C121	281-0825-00		CAP,FXD,CER DI:0.005UF,+100-0%,100V	33095	51-726-008
A24C122	281-0825-00		CAP,FXD,CER DI:0.005UF,+100-0%,100V	33095	51-726-008
A24C130	281-0825-00		CAP,FXD,CER DI:0.005UF,+100-0%,100V	33095	51-726-008
A24C132	281-0825-00		CAP,FXD,CER DI:0.005UF,+100-0%,100V	33095	51-726-008
A24C134	281-0825-00		CAP,FXD,CER DI:0.005UF,+100-0%,100V	33095	51-726-008
A24C136	281-0825-00		CAP,FXD,CER DI:0.005UF,+100-0%,100V	33095	51-726-008
A24C137	281-0825-00		CAP,FXD,CER DI:0.005UF,+100-0%,100V	33095	51-726-008
A24C138	281-0825-00		CAP,FXD,CER DI:0.005UF,+100-0%,100V	33095	51-726-008
A24C202	281-0825-00		CAP,FXD,CER DI:0.005UF,+100-0%,100V	33095	51-726-008
A24C214	281-0825-00		CAP,FXD,CER DI:0.005UF,+100-0%,100V	33095	51-726-008
A24C220	281-0825-00		CAP,FXD,CER DI:0.005UF,+100-0%,100V	33095	51-726-008
A24C233	281-0825-00		CAP,FXD,CER DI:0.005UF,+100-0%,100V	33095	51-726-008
A24C236	281-0825-00		CAP,FXD,CER DI:0.005UF,+100-0%,100V	33095	51-726-008
A24C237	281-0825-00		CAP,FXD,CER DI:0.005UF,+100-0%,100V	33095	51-726-008
A24C301	281-0825-00		CAP,FXD,CER DI:0.005UF,+100-0%,100V	33095	51-726-008
A24C310	281-0825-00		CAP,FXD,CER DI:0.005UF,+100-0%,100V	33095	51-726-008
A24C322	281-0825-00		CAP,FXD,CER DI:0.005UF,+100-0%,100V	33095	51-726-008
A24C500	281-0875-00		CAP,FXD,CER DI:100PF,20%,200V	72982	2425001X5U101M
A24FL1	389-0742-01		CIRCUIT BOARD:LOW PASS FILTER	80009	389-0742-01
A24A1	671-1547-00		CIRCUIT BD ASSY:TG INTERFACE,389-0750-XX WI RED	80009	671-1547-00
A24A1C131	290-5002-00		CAP,FXD,ELCTLT:10UF,20V	TK1424	20MC100M-TER
A24A1C133	283-5004-00		CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A1C135	283-5004-00		CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A1C200	283-5004-00		CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A1C201	283-5014-00		CAP,FXD,CER DI:330PF,5%,50V	80009	283-5014-00
A24A1C210	283-5004-00		CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A1C211	283-5014-00		CAP,FXD,CER DI:330PF,5%,50V	80009	283-5014-00
A24A1C212	283-5004-00		CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A1C221	283-5004-00		CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A1C230	283-5004-00		CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A1C231	283-5004-00		CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A1C232	283-5001-00		CAP,FXD,CER DI:100PF,5%,50V	80009	283-5001-00
A24A1C233	283-5004-00		CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A1C234	283-5004-00		CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A1C235	283-5001-00		CAP,FXD,CER DI:100PF,5%,50V	80009	283-5001-00
A24A1C300	283-5004-00		CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A1C302	283-5004-00		CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A1C303	283-5004-00		CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A1C304	290-5002-00		CAP,FXD,ELCTLT:10UF,20V	TK1424	20MC100M-TER
A24A1C305	283-5112-00		CAP,FXD,CER DI:0.33UF,10%,25V	80009	283-5112-00
A24A1C306	283-5004-00		CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A1C307	290-5002-00		CAP,FXD,ELCTLT:10UF,20V	TK1424	20MC100M-TER
A24A1C308	283-5004-00		CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02

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Component No.	Tektronix Part No.	Serial/Assembly No. Effective Dscnt	Name & Description	Mfr. Code	Mfr. Part No.
A24A1C320	283-5112-00		CAP,FXD,CER DI:0.33UF,10%,25V	80009	283-5112-00
A24A1C321	290-5002-00		CAP,FXD,ELCTLT:10UF,20V	TK1424	20MC100M-TER
A24A1C322	290-5002-00		CAP,FXD,ELCTLT:10UF,20V	TK1424	20MC100M-TER
A24A1C323	283-5112-00		CAP,FXD,CER DI:0.33UF,10%,25V	80009	283-5112-00
A24A1C324	283-5004-00		CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A1C325	283-5112-00		CAP,FXD,CER DI:0.33UF,10%,25V	80009	283-5112-00
A24A1C326	290-5002-00		CAP,FXD,ELCTLT:10UF,20V	TK1424	20MC100M-TER
A24A1C327	283-5004-00		CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A1C328	283-5004-00		CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A1CR300	152-5004-00		SEMICON DVC,DI:SI,SW,SER PR,70V	25088	BAV99T
A24A1CR323	152-5004-00		SEMICON DVC,DI:SI,SW,SER PR,70V	25088	BAV99T
A24A1J300	131-3718-00		CONN,PLUG,ELEC:CKT BD,STR,MALE	00779	103309-1
A24A1L130	108-5009-00		COIL,RF:FXD,82UH	80009	108-5009-00
A24A1Q130	151-5000-00		TRANSISTOR:PMP,SI,SOT-23	04713	MMBT3906LT1
A24A1Q131	151-5000-00		TRANSISTOR:PMP,SI,SOT-23	04713	MMBT3906LT1
A24A1Q132	151-5000-00		TRANSISTOR:PMP,SI,SOT-23	04713	MMBT3906LT1
A24A1Q133	151-5000-00		TRANSISTOR:PMP,SI,SOT-23	04713	MMBT3906LT1
A24A1Q134	151-5000-00		TRANSISTOR:PMP,SI,SOT-23	04713	MMBT3906LT1
A24A1Q135	151-5000-00		TRANSISTOR:PMP,SI,SOT-23	04713	MMBT3906LT1
A24A1Q200	151-5000-00		TRANSISTOR:PMP,SI,SOT-23	04713	MMBT3906LT1
A24A1Q201	151-5002-00		TRANSISTOR:JFET,N-CH,RDS=60	80009	151-5002-00
A24A1Q220	151-5000-00		TRANSISTOR:PMP,SI,SOT-23	04713	MMBT3906LT1
A24A1Q221	151-5001-00		TRANSISTOR:NPN,SI,SOT-23	80009	151-5001-00
A24A1Q310	151-1127-00		TRANSISTOR:MOSFE,N CHANNEL,SI,TO-220	81483	IRF511
A24A1Q320	151-1128-00		TRANSISTOR:MOSFE,P-CHANNEL,SI,TO-220	81483	IRF9521
A24A1Q321	151-1127-00		TRANSISTOR:MOSFE,N CHANNEL,SI,TO-220	81483	IRF511
A24A1Q322	151-1128-00		TRANSISTOR:MOSFE,P-CHANNEL,SI,TO-220	81483	IRF9521
A24A1R130	321-5026-00		RES,FXD,FILM:4.75K,1%,0.125W	01121	BCK4751FT
A24A1R131	321-5026-00		RES,FXD,FILM:4.75K,1%,0.125W	01121	BCK4751FT
A24A1R132	321-5026-00		RES,FXD,FILM:4.75K,1%,0.125W	01121	BCK4751FT
A24A1R133	321-5026-00		RES,FXD,FILM:4.75K,1%,0.125W	01121	BCK4751FT
A24A1R134	321-5026-00		RES,FXD,FILM:4.75K,1%,0.125W	01121	BCK4751FT
A24A1R135	321-5002-00		RES,FXD,FILM:15 OHM,1%,0.125W	57668	MCR18EZHFW 15E0
A24A1R136	321-5026-00		RES,FXD,FILM:4.75K,1%,0.125W	01121	BCK4751FT
A24A1R137	321-5018-00		RES,FXD,FILM:1.00K,1%,0.125W	01121	BCK1001FT
A24A1R138	321-5006-00		RES,FXD,FILM:100 OHM,1%,0.125W	01121	BCK1000FT
A24A1R139	321-5006-00		RES,FXD,FILM:100 OHM,1%,0.125W	01121	BCK1000FT
A24A1R140	321-5030-00		RES,FXD,FILM:10.0K,1%,0.125W	01121	BCK1002FT
A24A1R141	321-5027-00		RES,FXD,FILM:5.62K,1%,0.125W	01121	BCK5621FT
A24A1R142	321-5023-00		RES,FXD,FILM:2.74K,1%,0.125W	01121	BCK2741FT
A24A1R200	321-5018-00		RES,FXD,FILM:1.00K,1%,0.125W	01121	BCK1001FT
A24A1R201	321-5036-00		RES,FXD,FILM:33.2K,1%,0.125W	01121	BCK3322FT
A24A1R202	321-5041-00		RES,FXD,FILM:82.5K,1%,0.125W	01121	BCK8252FT
A24A1R203	311-5038-00		RES,VAR,NONMW:TRMR,20K OHM,25%,0.1W	32997	3314A-1-203E
A24A1R204	321-5006-00		RES,FXD,FILM:100 OHM,1%,0.125W	01121	BCK1000FT
A24A1R205	321-5047-00		RES,FXD,FILM:100K,1%,0.125W	01121	BCK1003FT
A24A1R206	321-5029-00		RES,FXD,FILM:8.25K,1%,0.125W	01121	BCK8251FT
A24A1R207	321-5030-00		RES,FXD,FILM:10.0K,1%,0.125W	01121	BCK1002FT
A24A1R208	321-5027-00		RES,FXD,FILM:5.62K,1%,0.125W	01121	BCK5621FT
A24A1R210	321-5030-00		RES,FXD,FILM:10.0K,1%,0.125W	01121	BCK1002FT
A24A1R211	321-5030-00		RES,FXD,FILM:10.0K,1%,0.125W	01121	BCK1002FT
A24A1R212	321-5030-00		RES,FXD,FILM:10.0K,1%,0.125W	01121	BCK1002FT
A24A1R213	321-5034-00		RES,FXD,FILM:22.1K,1%,0.125W	01121	BCK2212FT
A24A1R214	311-5038-00		RES,VAR,NONMW:TRMR,20K OHM,25%,0.1W	32997	3314A-1-203E
A24A1R215	321-5030-00		RES,FXD,FILM:10.0K,1%,0.125W	01121	BCK1002FT
A24A1R220	321-5047-00		RES,FXD,FILM:100K,1%,0.125W	01121	BCK1003FT
A24A1R221	321-5030-00		RES,FXD,FILM:10.0K,1%,0.125W	01121	BCK1002FT
A24A1R222	321-5030-00		RES,FXD,FILM:10.0K,1%,0.125W	01121	BCK1002FT
A24A1R223	321-5049-00		RES,FXD,FILM:1 MEG,1%,0.125W	01121	BCK1004FT

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Component No.	Tektronix Part No.	Serial/Assembly No. Effective Discort	Name & Description	Mfr. Code	Mfr. Part No.
A24A1R230	321-5035-00		RES, FXD, FILM:27.4K, 1%, 0.125W	01121	BCK2742FT
A24A1R231	321-5041-00		RES, FXD, FILM:82.5K, 1%, 0.125W	01121	BCK8252FT
A24A1R232	321-5006-00		RES, FXD, FILM:100 OHM, 1%, 0.125W	01121	BCK1000FT
A24A1R233	321-5047-00		RES, FXD, FILM:100K, 1%, 0.125W	01121	BCK1003FT
A24A1R234	321-5006-00		RES, FXD, FILM:100 OHM, 1%, 0.125W	01121	BCK1000FT
A24A1R235	321-5006-00		RES, FXD, FILM:100 OHM, 1%, 0.125W	01121	BCK1000FT
A24A1R300	321-5012-00		RES, FXD, FILM:332 OHM, 1%, 0.125W	01121	BCK3320FT
A24A1R301	321-5030-00		RES, FXD, FILM:10.0K, 1%, 0.125W	01121	BCK1002FT
A24A1R302	321-5018-00		RES, FXD, FILM:1.00K, 1%, 0.125W	01121	BCK1001FT
A24A1R303	321-5026-00		RES, FXD, FILM:4.75K, 1%, 0.125W	01121	BCK4751FT
A24A1R304	321-5018-00		RES, FXD, FILM:1.00K, 1%, 0.125W	01121	BCK1001FT
A24A1R305	321-5006-00		RES, FXD, FILM:100 OHM, 1%, 0.125W	01121	BCK1000FT
A24A1R306	321-5023-00		RES, FXD, FILM:2.74K, 1%, 0.125W	01121	BCK2741FT
A24A1R307	321-5006-00		RES, FXD, FILM:100 OHM, 1%, 0.125W	01121	BCK1000FT
A24A1R309	321-5023-00		RES, FXD, FILM:2.74K, 1%, 0.125W	01121	BCK2741FT
A24A1R310	321-5006-00		RES, FXD, FILM:100 OHM, 1%, 0.125W	01121	BCK1000FT
A24A1R311	321-5032-00		RES, FXD, FILM:15.0K, 1%, 0.125W	01121	BCK1502FT
A24A1R312	321-5028-00		RES, FXD, FILM:6.81K, 1%, 0.125W	01121	BCK6811FT
A24A1R313	321-5031-00		RES, FXD, FILM:12.1K, 1%, 0.125W	01121	BCK1212FT
A24A1R314	321-5033-00		RES, FXD, FILM:18.2K, 1%, 0.125W	01121	BCK1822FT
A24A1R315	321-5018-00		RES, FXD, FILM:1.00K, 1%, 0.125W	01121	BCK1001FT
A24A1R316	321-5030-00		RES, FXD, FILM:10.0K, 1%, 0.125W	01121	BCK1002FT
A24A1R317	321-5038-00		RES, FXD, FILM:47.5K, 1%, 0.125W	01121	BCK4752FT
A24A1R318	321-5035-00		RES, FXD, FILM:27.4K, 1%, 0.125W	01121	BCK2742FT
A24A1R319	321-5006-00		RES, FXD, FILM:100 OHM, 1%, 0.125W	01121	BCK1000FT
A24A1R320	321-5018-00		RES, FXD, FILM:1.00K, 1%, 0.125W	01121	BCK1001FT
A24A1R321	321-5006-00		RES, FXD, FILM:100 OHM, 1%, 0.125W	01121	BCK1000FT
A24A1R322	321-5026-00		RES, FXD, FILM:4.75K, 1%, 0.125W	01121	BCK4751FT
A24A1R323	321-5026-00		RES, FXD, FILM:4.75K, 1%, 0.125W	01121	BCK4751FT
A24A1R324	321-5006-00		RES, FXD, FILM:100 OHM, 1%, 0.125W	01121	BCK1000FT
A24A1R325	321-5006-00		RES, FXD, FILM:100 OHM, 1%, 0.125W	01121	BCK1000FT
A24A1R326	321-5006-00		RES, FXD, FILM:100 OHM, 1%, 0.125W	01121	BCK1000FT
A24A1R327	321-5034-00		RES, FXD, FILM:22.1K, 1%, 0.125W	01121	BCK2212FT
A24A1R328	321-5033-00		RES, FXD, FILM:18.2K, 1%, 0.125W	01121	BCK1822FT
A24A1R329	311-5038-00		RES, VAR, NONW: TRMR, 20K OHM, 25%, 0.1W	32997	3314A-1-203E
A24A1R330	321-5026-00		RES, FXD, FILM:4.75K, 1%, 0.125W	01121	BCK4751FT
A24A1R331	321-5018-00		RES, FXD, FILM:1.00K, 1%, 0.125W	01121	BCK1001FT
A24A1R332	321-5049-00		RES, FXD, FILM:1 MEG, 1%, 0.125W	01121	BCK1004FT
A24A1R333	321-5018-00		RES, FXD, FILM:1.00K, 1%, 0.125W	01121	BCK1001FT
A24A1R334	321-5018-00		RES, FXD, FILM:1.00K, 1%, 0.125W	01121	BCK1001FT
A24A1R335	321-5030-00		RES, FXD, FILM:10.0K, 1%, 0.125W	01121	BCK1002FT
A24A1R336	321-5018-00		RES, FXD, FILM:1.00K, 1%, 0.125W	01121	BCK1001FT
A24A1R337	321-5035-00		RES, FXD, FILM:27.4K, 1%, 0.125W	01121	BCK2742FT
A24A1R338	321-5018-00		RES, FXD, FILM:1.00K, 1%, 0.125W	01121	BCK1001FT
A24A1R339	321-5006-00		RES, FXD, FILM:100 OHM, 1%, 0.125W	01121	BCK1000FT
A24A1R340	321-5006-00		RES, FXD, FILM:100 OHM, 1%, 0.125W	01121	BCK1000FT
A24A1R341	321-5023-00		RES, FXD, FILM:2.74K, 1%, 0.125W	01121	BCK2741FT
A24A1R343	321-5030-00		RES, FXD, FILM:10.0K, 1%, 0.125W	01121	BCK1002FT
A24A1R344	321-5030-00		RES, FXD, FILM:10.0K, 1%, 0.125W	01121	BCK1002FT
A24A1R345	321-5026-00		RES, FXD, FILM:4.75K, 1%, 0.125W	01121	BCK4751FT
A24A1R346	321-5026-00		RES, FXD, FILM:4.75K, 1%, 0.125W	01121	BCK4751FT
A24A1R347	321-5026-00		RES, FXD, FILM:4.75K, 1%, 0.125W	01121	BCK4751FT
A24A1U130	156-5018-00		MICROCKT, LINEAR: BIPOLAR, DUAL OP-AMP	80009	156-5018-00
A24A1U201	156-5155-00		IC, DIGITAL: HCMOS, GATES; HEX INV; 74HC04, S014 .150, TUBE	80009	156-5155-00
A24A1U202	156-5018-00		MICROCKT, LINEAR: BIPOLAR, DUAL OP-AMP	80009	156-5018-00
A24A1U204	156-5018-00		MICROCKT, LINEAR: BIPOLAR, DUAL OP-AMP	80009	156-5018-00
A24A1U210	156-5227-00		MICROCKT, DGTL: CMOS, DUAL RETRIG MONOSTABLE M ULTIVIBRATOR W/RESET	80009	156-5227-00

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Component No.	Tektronix Part No.	Serial/Assembly No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Discnt			
A24A1U220	156-5021-01			IC,DIGITAL:	80009	156-5021-01
A24A1U221	156-5021-01			IC,DIGITAL:	80009	156-5021-01
A24A1U230	156-5021-01			IC,DIGITAL:	80009	156-5021-01
A24A1U231	156-5300-00			MICROCKT,INTFC:DAC,DUAL 12 BIT,MPU COMPATIB	80009	156-5300-00
A24A1U232	156-5018-00			LE MICROCKT,LINEAR:BIPOLAR,DUAL OP-AMP	80009	156-5018-00
A24A1U234	156-5274-01			MICROCKT,DGTL:CMOS,ANALOG SWITCH	80009	156-5274-01
A24A1U310	156-5018-00			MICROCKT,LINEAR:BIPOLAR,DUAL OP-AMP	80009	156-5018-00
A24A1U320	156-5018-00			MICROCKT,LINEAR:BIPOLAR,DUAL OP-AMP	80009	156-5018-00
A24A1U321	156-5018-00			MICROCKT,LINEAR:BIPOLAR,DUAL OP-AMP	80009	156-5018-00
A24A1VR200	152-0526-00			SEMICOND DVC,DI:ZEN,SI,6.35V,1%,0.4W,DO-7	14552	DT840615A
A24A2	671-1544-00			CIRCUIT BD ASSY:TG PHASE LOCK LOOP,389-0748 -XX WIRED	80009	671-1544-00
A24A2C100	283-5002-00			CAP,FXD,CER DI:1000PF,10%,50V	14674	12061A102KAT050R
A24A2C101	283-5002-00			CAP,FXD,CER DI:1000PF,10%,50V	14674	12061A102KAT050R
A24A2C110	283-5002-00			CAP,FXD,CER DI:1000PF,10%,50V	14674	12061A102KAT050R
A24A2C120	283-5011-00			CAP,FXD,CER DI:33PF,5%,50V	95275	VJ1206A330JXA
A24A2C122	283-5002-00			CAP,FXD,CER DI:1000PF,10%,50V	14674	12061A102KAT050R
A24A2C125	283-5003-00			CAP,FXD,CER DI:0.01UF,10%,50V	14674	12065C103KAT060R
A24A2C180	283-5005-00			CAP,FXD,CER DI:4PF,+/- 0.25PF,50V	54583	C3216COG1H040C
A24A2C210	283-5004-00			CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A2C220	283-5004-00			CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A2C221	283-5004-00			CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A2C222	283-5001-00			CAP,FXD,CER DI:100PF,5%,50V	80009	283-5001-00
A24A2C230	283-5004-00			CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A2C231	283-5011-00			CAP,FXD,CER DI:33PF,5%,50V	95275	VJ1206A330JXA
A24A2C232	283-5001-00			CAP,FXD,CER DI:100PF,5%,50V	80009	283-5001-00
A24A2C250	283-5005-00			CAP,FXD,CER DI:4PF,+/- 0.25PF,50V	54583	C3216COG1H040C
A24A2C300	283-5002-00			CAP,FXD,CER DI:1000PF,10%,50V	14674	12061A102KAT050R
A24A2C303	283-5003-00			CAP,FXD,CER DI:0.01UF,10%,50V	14674	12065C103KAT060R
A24A2C310	283-5004-00			CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A2C311	283-5002-00			CAP,FXD,CER DI:1000PF,10%,50V	14674	12061A102KAT050R
A24A2C312	283-5004-00			CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A2C313	283-5002-00			CAP,FXD,CER DI:1000PF,10%,50V	14674	12061A102KAT050R
A24A2C314	283-5002-00			CAP,FXD,CER DI:1000PF,10%,50V	14674	12061A102KAT050R
A24A2C330	283-5002-00			CAP,FXD,CER DI:1000PF,10%,50V	14674	12061A102KAT050R
A24A2C360	290-5002-00			CAP,FXD,ELCTLT:10UF,20V	TK1424	20MC100M-TER
A24A2C361	290-5002-00			CAP,FXD,ELCTLT:10UF,20V	TK1424	20MC100M-TER
A24A2C370	283-5005-00			CAP,FXD,CER DI:4PF,+/- 0.25PF,50V	54583	C3216COG1H040C
A24A2C400	283-5004-00			CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A2C401	283-5003-00			CAP,FXD,CER DI:0.01UF,10%,50V	14674	12065C103KAT060R
A24A2C410	283-5004-00			CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A2C411	283-5002-00			CAP,FXD,CER DI:1000PF,10%,50V	14674	12061A102KAT050R
A24A2C420	281-0283-00			CAP,VAR,CER DI:6.5-30PF,100V,TOP ADJUST	80009	281-0283-00
A24A2C430	283-5004-00			CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A2C431	283-5004-00			CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A2C450	283-5004-00			CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A2C451	283-5004-00			CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A2C452	283-5004-00			CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A2C500	283-5004-00			CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A2C530	283-5004-00			CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A2C531	283-5004-00			CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A2C540	283-5004-00			CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A2C541	283-5004-00			CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A2C550	283-5004-00			CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A2C560	290-5002-00			CAP,FXD,ELCTLT:10UF,20V	TK1424	20MC100M-TER
A24A2C561	290-5002-00			CAP,FXD,ELCTLT:10UF,20V	TK1424	20MC100M-TER
A24A2C650	283-5005-00			CAP,FXD,CER DI:4PF,+/- 0.25PF,50V	54583	C3216COG1H040C

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Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Discort	Name & Description	Mfr. Code	Mfr. Part No.
A24A2CR270	152-5066-00			DIODE, SIG., PIN; 100V, 0.35PF, 1200 OHMS, 800NS; HSMP-3800, SOT-23, TR	80009	152-5066-00
A24A2CR340	152-5004-00			SEMICON DVC, DI:SI, SW, SER PR, 70V	25088	BAV99T
A24A2CR350	152-5000-00			SEMICON DVC, DI:SW, SI, 70V, COM CATHODE	80009	152-5000-00
A24A2CR351	152-5000-00			SEMICON DVC, DI:SW, SI, 70V, COM CATHODE	80009	152-5000-00
A24A2CR412	152-5004-00			SEMICON DVC, DI:SI, SW, SER PR, 70V	25088	BAV99T
A24A2CR420	152-5057-00			SEMICON DVC, DI:VVC, SI, 30V, 2.3PF @25V, SOT23	80009	152-5057-00
A24A2CR440	152-5000-00			SEMICON DVC, DI:SW, SI, 70V, COM CATHODE	80009	152-5000-00
A24A2CR510	152-5057-00			SEMICON DVC, DI:VVC, SI, 30V, 2.3PF @25V, SOT23	80009	152-5057-00
A24A2CR540	152-5000-00			SEMICON DVC, DI:SW, SI, 70V, COM CATHODE	80009	152-5000-00
A24A2CR650	152-5004-00			SEMICON DVC, DI:SI, SW, SER PR, 70V	25088	BAV99T
A24A2CR651	152-5004-00			SEMICON DVC, DI:SI, SW, SER PR, 70V	25088	BAV99T
A24A2L420	108-5005-00			COIL, RF: FXD, 560NH	80009	108-5005-00
A24A2L421	108-5030-00			COIL, RF: FXD, 100NH	80009	108-5030-00
A24A2Q120	151-5010-00			TRANSISTOR: NPN, SI, SOT-89	80009	151-5010-00
A24A2Q260	151-5005-00			TRANSISTOR: PNP, SI, SOT-89	04713	BCX69T1
A24A2Q320	151-5011-00			TRANSISTOR: NPN, SI, SOT-23	80009	151-5011-00
A24A2Q321	151-5011-00			TRANSISTOR: NPN, SI, SOT-23	80009	151-5011-00
A24A2Q350	151-5001-00			TRANSISTOR: NPN, SI, SOT-23	80009	151-5001-00
A24A2Q360	151-5004-00			TRANSISTOR: NPN, SI, SOT-89	04713	BCX68
A24A2Q410	151-5011-00			TRANSISTOR: NPN, SI, SOT-23	80009	151-5011-00
A24A2Q411	151-5011-00			TRANSISTOR: NPN, SI, SOT-23	80009	151-5011-00
A24A2Q420	151-5011-00			TRANSISTOR: NPN, SI, SOT-23	80009	151-5011-00
A24A2Q421	151-5000-00			TRANSISTOR: PNP, SI, SOT-23	04713	MMBT3906LT1
A24A2Q430	151-5001-00			TRANSISTOR: NPN, SI, SOT-23	80009	151-5001-00
A24A2Q450	151-5004-00			TRANSISTOR: NPN, SI, SOT-89	04713	BCX68
A24A2Q540	151-5000-00			TRANSISTOR: PNP, SI, SOT-23	04713	MMBT3906LT1
A24A2Q550	151-5000-00			TRANSISTOR: PNP, SI, SOT-23	04713	MMBT3906LT1
A24A2R120	321-5008-00			RES, FXD, FILM: 150 OHM, 1%, 0.125W	01121	BCK1500FT
A24A2R121	321-5042-00			RES, FXD, FILM: 39.2 OHM, 1%, 0.125W	57668	MCR18FWEA39E2
A24A2R122	321-5015-00			RES, FXD, FILM: 562 OHM, 1%, 0.125W	01121	BCK5620FT
A24A2R130	321-5008-00			RES, FXD, FILM: 150 OHM, 1%, 0.125W	01121	BCK1500FT
A24A2R131	321-5008-00			RES, FXD, FILM: 150 OHM, 1%, 0.125W	01121	BCK1500FT
A24A2R140	321-5050-00	B032293	B032999	RES, FXD, FILM: 33.2 OHM, 1%, 0.125W	57668	MCR18FWEA33E2
A24A2R140	321-5051-00	B033000		RES, FXD, FILM: 0 OHM, 1%, 0.125W	80009	321-5051-00
A24A2R141	321-5009-00			RES, FXD, FILM: 182 OHM, 1%, 0.125W	01121	BCK1820FT
A24A2R143	321-5043-00			RES, FXD, FILM: 47.5 OHM, 1%, 0.125W	57668	MCR18FWEA47E5
A24A2R152	321-5051-00			RES, FXD, FILM: 0 OHM, 1%, 0.125W	80009	321-5051-00
A24A2R153	321-5043-00			RES, FXD, FILM: 47.5 OHM, 1%, 0.125W	57668	MCR18FWEA47E5
A24A2R155	321-5043-00			RES, FXD, FILM: 47.5 OHM, 1%, 0.125W	57668	MCR18FWEA47E5
A24A2R200	321-5014-00			RES, FXD, FILM: 475 OHM, 1%, 0.125W	01121	BCK4750FT
A24A2R220	321-5043-00			RES, FXD, FILM: 47.5 OHM, 1%, 0.125W	57668	MCR18FWEA47E5
A24A2R221	321-5004-00			RES, FXD, FILM: 22.1 OHM, 1%, 0.125W	57668	MCR18FWEA22E1
A24A2R230	321-5000-00			RES, FXD, FILM: 10 OHM, 1%, 0.125W	57668	MCR18EZHFW10E
A24A2R240	321-5050-00			RES, FXD, FILM: 33.2 OHM, 1%, 0.125W	57668	MCR18FWEA33E2
A24A2R241	321-5012-00			RES, FXD, FILM: 332 OHM, 1%, 0.125W	01121	BCK3320FT
A24A2R242	321-5012-00			RES, FXD, FILM: 332 OHM, 1%, 0.125W	01121	BCK3320FT
A24A2R243	321-5002-00			RES, FXD, FILM: 15 OHM, 1%, 0.125W	57668	MCR18EZHFW 15E0
A24A2R300	321-5018-00			RES, FXD, FILM: 1.00K, 1%, 0.125W	01121	BCK1001FT
A24A2R301	321-5012-00			RES, FXD, FILM: 332 OHM, 1%, 0.125W	01121	BCK3320FT
A24A2R310	321-5018-00			RES, FXD, FILM: 1.00K, 1%, 0.125W	01121	BCK1001FT
A24A2R311	321-5012-00			RES, FXD, FILM: 332 OHM, 1%, 0.125W	01121	BCK3320FT
A24A2R312	321-5012-00			RES, FXD, FILM: 332 OHM, 1%, 0.125W	01121	BCK3320FT
A24A2R313	321-5043-00			RES, FXD, FILM: 47.5 OHM, 1%, 0.125W	57668	MCR18FWEA47E5
A24A2R314	321-5050-00			RES, FXD, FILM: 33.2 OHM, 1%, 0.125W	57668	MCR18FWEA33E2
A24A2R315	321-5012-00			RES, FXD, FILM: 332 OHM, 1%, 0.125W	01121	BCK3320FT
A24A2R320	321-5017-00			RES, FXD, FILM: 825 OHM, 1%, 0.125W	01121	BCK8250FT
A24A2R321	321-5043-00			RES, FXD, FILM: 47.5 OHM, 1%, 0.125W	57668	MCR18FWEA47E5
A24A2R330	321-5008-00			RES, FXD, FILM: 150 OHM, 1%, 0.125W	01121	BCK1500FT

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Discont	Name & Description	Mfr. Code	Mfr. Part #
A24A2R331	321-5000-00			RES, FXD, FILM: 10 OHM, 1%, 0.125W	57668	MCR18EZHFW10E
A24A2R332	321-5008-00			RES, FXD, FILM: 150 OHM, 1%, 0.125W	01121	BCK1500FT
A24A2R333	321-5022-00			RES, FXD, FILM: 2.21K, 1%, 0.125W	01121	BCK2211FT
A24A2R334	321-5008-00			RES, FXD, FILM: 150 OHM, 1%, 0.125W	01121	BCK1500FT
A24A2R335	311-5011-00			RES, VAR, NONMW: 5K OHM, 20%, 0.2W	80009	311-5011-00
A24A2R340	321-5030-00			RES, FXD, FILM: 10.0K, 1%, 0.125W	01121	BCK1002FT
A24A2R341	321-5024-00			RES, FXD, FILM: 3.32K, 1%, 0.125W	01121	BCK3321FT
A24A2R342	321-5018-00			RES, FXD, FILM: 1.00K, 1%, 0.125W	01121	BCK1001FT
A24A2R343	321-5037-00			RES, FXD, FILM: 39.2K, 1%, 0.125W	01121	BCK3922FT
A24A2R344	321-5030-00			RES, FXD, FILM: 10.0K, 1%, 0.125W	01121	BCK1002FT
A24A2R350	321-5022-00			RES, FXD, FILM: 2.21K, 1%, 0.125W	01121	BCK2211FT
A24A2R351	321-5008-00			RES, FXD, FILM: 150 OHM, 1%, 0.125W	01121	BCK1500FT
A24A2R352	321-5047-00			RES, FXD, FILM: 100K, 1%, 0.125W	01121	BCK1003FT
A24A2R353	321-5047-00			RES, FXD, FILM: 100K, 1%, 0.125W	01121	BCK1003FT
A24A2R354	321-5047-00			RES, FXD, FILM: 100K, 1%, 0.125W	01121	BCK1001FT
A24A2R360	321-5018-00			RES, FXD, FILM: 1.00K, 1%, 0.125W	01121	BCK1001FT
A24A2R361	321-5018-00			RES, FXD, FILM: 1.00K, 1%, 0.125W	01121	BCK1001FT
A24A2R370	321-5008-00			RES, FXD, FILM: 150 OHM, 1%, 0.125W	01121	BCK1500FT
A24A2R390	321-5043-00			RES, FXD, FILM: 47.5 OHM, 1%, 0.125W	57668	MCR18FWEA47E5
A24A2R391	321-5043-00			RES, FXD, FILM: 47.5 OHM, 1%, 0.125W	57668	MCR18FWEA47E5
A24A2R400	321-5012-00			RES, FXD, FILM: 332 OHM, 1%, 0.125W	01121	BCK3320FT
A24A2R401	321-5043-00			RES, FXD, FILM: 47.5 OHM, 1%, 0.125W	57668	MCR18FWEA47E5
A24A2R402	321-5018-00			RES, FXD, FILM: 1.00K, 1%, 0.125W	01121	BCK1001FT
A24A2R403	321-5017-00			RES, FXD, FILM: 825 OHM, 1%, 0.125W	01121	BCK8250FT
A24A2R410	321-5012-00			RES, FXD, FILM: 332 OHM, 1%, 0.125W	01121	BCK3320FT
A24A2R411	321-5018-00			RES, FXD, FILM: 1.00K, 1%, 0.125W	01121	BCK1001FT
A24A2R412	321-5047-00			RES, FXD, FILM: 100K, 1%, 0.125W	01121	BCK1003FT
A24A2R413	321-5014-00			RES, FXD, FILM: 475 OHM, 1%, 0.125W	01121	BCK4750FT
A24A2R414	321-5020-00			RES, FXD, FILM: 1.50K, 1%, 0.125W	01121	BCK1501FT
A24A2R415	321-5047-00			RES, FXD, FILM: 100K, 1%, 0.125W	01121	BCK1003FT
A24A2R416	321-5043-00			RES, FXD, FILM: 47.5 OHM, 1%, 0.125W	57668	MCR18FWEA47E5
A24A2R417	321-5014-00			RES, FXD, FILM: 475 OHM, 1%, 0.125W	01121	BCK4750FT
A24A2R418	321-5010-00			RES, FXD, FILM: 221 OHM, 1%, 0.125W	01121	BCK2211FT
A24A2R420	321-5018-00			RES, FXD, FILM: 47.5 OHM, 1%, 0.125W	57668	MCR18FWEA47E5
A24A2R421	321-5011-00			RES, FXD, FILM: 274 OHM, 1%, 0.125W	01121	BCK2740FT
A24A2R422	321-5043-00			RES, FXD, FILM: 47.5 OHM, 1%, 0.125W	57668	MCR18FWEA47E5
A24A2R430	321-5018-00			RES, FXD, FILM: 1.00K, 1%, 0.125W	01121	BCK1001FT
A24A2R431	321-5025-00			RES, FXD, FILM: 3.92K, 1%, 0.125W	01121	BCK3921FT
A24A2R432	321-5018-00			RES, FXD, FILM: 1.00K, 1%, 0.125W	01121	BCK1001FT
A24A2R433	321-5018-00			RES, FXD, FILM: 1.00K, 1%, 0.125W	01121	BCK1001FT
A24A2R434	321-5030-00			RES, FXD, FILM: 10.0K, 1%, 0.125W	01121	BCK1002FT
A24A2R435	321-5030-00			RES, FXD, FILM: 10.0K, 1%, 0.125W	01121	BCK1002FT
A24A2R440	321-5039-00			RES, FXD, FILM: 56.2K, 1%, 0.125W	01121	BCK5622FT
A24A2R441	321-5047-00			RES, FXD, FILM: 100K, 1%, 0.125W	01121	BCK1003FT
A24A2R442	321-5047-00			RES, FXD, FILM: 100K, 1%, 0.125W	01121	BCK1003FT
A24A2R450	321-5040-00			RES, FXD, FILM: 68.1K, 1%, 0.125W	01121	BCK6812FT
A24A2R451	321-5050-00			RES, FXD, FILM: 33.2 OHM, 1%, 0.125W	57668	MCR18FWEA33E2
A24A2R452	321-5030-00			RES, FXD, FILM: 10.0K, 1%, 0.125W	01121	BCK1002FT
A24A2R453	321-5031-00			RES, FXD, FILM: 12.1K, 1%, 0.125W	01121	BCK1212FT
A24A2R510	321-5047-00			RES, FXD, FILM: 100K, 1%, 0.125W	01121	BCK1003FT
A24A2R530	321-5026-00			RES, FXD, FILM: 4.75K, 1%, 0.125W	01121	BCK4751FT
A24A2R531	321-5026-00			RES, FXD, FILM: 4.75K, 1%, 0.125W	01121	BCK4751FT
A24A2R532	321-5025-00			RES, FXD, FILM: 3.92K, 1%, 0.125W	01121	BCK3921FT
A24A2R533	321-5030-00			RES, FXD, FILM: 10.0K, 1%, 0.125W	01121	BCK1002FT
A24A2R534	321-5030-00			RES, FXD, FILM: 10.0K, 1%, 0.125W	01121	BCK1002FT
A24A2R540	321-5043-00			RES, FXD, FILM: 47.5 OHM, 1%, 0.125W	57668	MCR18FWEA47E5
A24A2R550	321-5026-00			RES, FXD, FILM: 4.75K, 1%, 0.125W	01121	BCK4751FT
A24A2R551	321-5018-00			RES, FXD, FILM: 1.00K, 1%, 0.125W	01121	BCK1001FT
A24A2R552	321-5018-00			RES, FXD, FILM: 1.00K, 1%, 0.125W	01121	BCK1001FT

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Component No.	Tektronix Part No.	Serial/Assembly No. Effective Dscnt	Name & Description	Mfr. Code	Mfr. Part No.
A24A2R650	321-5043-00		RES,FXD,FILM:47.5 OHM,1%,0.125W	57668	MCR18FWEA47E5
A24A2R651	321-5043-00		RES,FXD,FILM:47.5 OHM,1%,0.125W	57668	MCR18FWEA47E5
A24A2R652	321-5015-00		RES,FXD,FILM:562 OHM,1%,0.125W	01121	BCK5620FT
A24A2R653	321-5014-00		RES,FXD,FILM:475 OHM,1%,0.125W	01121	BCK4750FT
A24A2R690	321-5012-00		RES,FXD,FILM:332 OHM,1%,0.125W	01121	BCK3320FT
A24A2R691	321-5002-00		RES,FXD,FILM:15 OHM,1%,0.125W	57668	MCR18EZHFV 15E0
A24A2R692	321-5012-00		RES,FXD,FILM:332 OHM,1%,0.125W	01121	BCK3320FT
A24A2U230	156-5838-00		MICROCKT,DGTL:BIPOLAR,2.5GHZ PRESCALER,	80009	156-5838-00
A24A2U300	156-5221-00		MICROCKT,DGTL:ECL DUAL D TYPE MASTER SLAVE FF	80009	156-5221-00
A24A2U320	119-5001-00		MIXER,RING:+7DBMLO,SMD	15542	RMS-1
A24A2U340	156-5095-01		MICROCKT,LINER:OP AMP,LOW NOISE	80009	156-5095-01
A24A2U450	156-5018-00		MICROCKT,LINER:BIPOLAR,DUAL OP-AMP	80009	156-5018-00
A24A2U530	156-5018-00		MICROCKT,LINER:BIPOLAR,DUAL OP-AMP	80009	156-5018-00
A24A2U540	156-5018-00		MICROCKT,LINER:BIPOLAR,DUAL OP-AMP	80009	156-5018-00
A24A2W110	174-2082-00		CABLE,RESONATOR:0.141 SEMIRIGID COAX,50 OHM .0.950 L X 0.125 STRIP	80009	174-2082-00
A24A2Y520	158-0383-00		XTAL UNIT,QTZ:105.4923MHZ,SER	59492	150-21290
A24A3	671-1543-00		CIRCUIT BD ASSY:TG ISOLATION AMP,389-0747-X X WIRED	80009	671-1543-00
A24A3C100	283-5012-00		CAP,FXD,CER DI:1PF,100V,0805 PKG,SMD	80009	283-5012-00
A24A3C110	283-5005-00		CAP,FXD,CER DI:4PF,+/- 0.25PF,50V	54583	C3216COG1H040C
A24A3C111	283-5005-00		CAP,FXD,CER DI:4PF,+/- 0.25PF,50V	54583	C3216COG1H040C
A24A3C130	283-5012-00		CAP,FXD,CER DI:1PF,100V,0805 PKG,SMD	80009	283-5012-00
A24A3C140	283-5005-00		CAP,FXD,CER DI:4PF,+/- 0.25PF,50V	54583	C3216COG1H040C
A24A3C141	283-5005-00		CAP,FXD,CER DI:4PF,+/- 0.25PF,50V	54583	C3216COG1H040C
A24A3C150	283-5005-00		CAP,FXD,CER DI:4PF,+/- 0.25PF,50V	54583	C3216COG1H040C
A24A3C200	283-5005-00		CAP,FXD,CER DI:4PF,+/- 0.25PF,50V	54583	C3216COG1H040C
A24A3C201	283-5005-00		CAP,FXD,CER DI:4PF,+/- 0.25PF,50V	54583	C3216COG1H040C
A24A3C210	283-5005-00		CAP,FXD,CER DI:4PF,+/- 0.25PF,50V	54583	C3216COG1H040C
A24A3C220	290-5002-00		CAP,FXD,ELCTLT:10UF,20V	TK1424	20MC100M-TER
A24A3C221	283-5005-00		CAP,FXD,CER DI:4PF,+/- 0.25PF,50V	54583	C3216COG1H040C
A24A3C230	283-5005-00		CAP,FXD,CER DI:4PF,+/- 0.25PF,50V	54583	C3216COG1H040C
A24A3C231	283-5005-00		CAP,FXD,CER DI:4PF,+/- 0.25PF,50V	54583	C3216COG1H040C
A24A3C232	283-5005-00		CAP,FXD,CER DI:4PF,+/- 0.25PF,50V	54583	C3216COG1H040C
A24A3C240	283-5005-00		CAP,FXD,CER DI:4PF,+/- 0.25PF,50V	54583	C3216COG1H040C
A24A3C241	283-5005-00		CAP,FXD,CER DI:4PF,+/- 0.25PF,50V	54583	C3216COG1H040C
A24A3C242	283-5005-00		CAP,FXD,CER DI:4PF,+/- 0.25PF,50V	54583	C3216COG1H040C
A24A3C300	290-5002-00		CAP,FXD,ELCTLT:10UF,20V	TK1424	20MC100M-TER
A24A3C301	283-5005-00		CAP,FXD,CER DI:4PF,+/- 0.25PF,50V	54583	C3216COG1H040C
A24A3C310	283-5004-00		CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A3C311	283-5004-00		CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A3C320	283-5003-00		CAP,FXD,CER DI:0.01UF,10%,50V	14674	12065C103KAT060R
A24A3C340	283-5005-00		CAP,FXD,CER DI:4PF,+/- 0.25PF,50V	54583	C3216COG1H040C
A24A3C341	283-5004-00		CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A3C342	283-5005-00		CAP,FXD,CER DI:4PF,+/- 0.25PF,50V	54583	C3216COG1H040C
A24A3C350	283-5005-00		CAP,FXD,CER DI:4PF,+/- 0.25PF,50V	54583	C3216COG1H040C
A24A3C410	283-5004-00		CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A3C440	290-5002-00		CAP,FXD,ELCTLT:10UF,20V	TK1424	20MC100M-TER
A24A3C510	283-5004-00		CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A3C511	283-5001-00		CAP,FXD,CER DI:100PF,5%,50V	80009	283-5001-00
A24A3C512	283-5001-00		CAP,FXD,CER DI:100PF,5%,50V	80009	283-5001-00
A24A3C513	283-5001-00		CAP,FXD,CER DI:100PF,5%,50V	80009	283-5001-00
A24A3C520	283-5004-00		CAP,FXD,CER DI:0.1UF,10%,25V	20932	W1206X104K1B02
A24A3CR130	152-5066-00		DIODE,SIG:,PIN:100V,0.35PF,1200 OHMS,800NS; HSMP-3800,SOT-23,TR	80009	152-5066-00
A24A3CR131	152-5066-00		DIODE,SIG:,PIN:100V,0.35PF,1200 OHMS,800NS; HSMP-3800,SOT-23,TR	80009	152-5066-00
A24A3CR410	152-5004-00		SEMICONV DVC,DI:SI,SW,SER PR,70V	25088	BAV99T

REPLACEABLE ELECTRICAL PARTS
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Component No.	Tektronix Part No.	Serial/Assembly No. Effective Discart	Name & Description	Mfr. Code	Mfr. Part No.
A24A3CR510	152-0962-00		SEMICON DVC,DI:SCHOTTKY,SI,CER STRIPLINE C ASE	80009	152-0962-00
A24A3CR530	152-5011-00		SEMICON DVC,DI:ZENER,6.2V,5%,225MW,SOT-23	80009	152-5011-00
A24A3CR600	152-1063-00		SEMICON DVC,DI:SCHOTTKY,SI,STAR QUAD,450MV	80009	152-1063-00
A24A3J100	131-4203-00		CONN,RCPT,ELEC:SMA JACK TO SPCL END CONFIG	24931	39JR226-1
A24A3J110	131-4203-00		CONN,RCPT,ELEC:SMA JACK TO SPCL END CONFIG	24931	39JR226-1
A24A3J500	131-1857-00		TERM SET,PIN:36/0.025 SQ PIN,ON 0.1 CTRS	TK1483	082-3643-SS10
A24A3L130	108-5013-00		COIL,RF:FXD,40NH	80009	108-5013-00
A24A3L150	108-5013-00		COIL,RF:FXD,40NH	80009	108-5013-00
A24A3L210	108-5013-00		COIL,RF:FXD,40NH	80009	108-5013-00
A24A3L230	108-5013-00		COIL,RF:FXD,40NH	80009	108-5013-00
A24A3Q110	151-0608-00		TRANSISTOR:NPN,SI,MICRO-STRIPLINE PKG	80009	151-0608-00
A24A3Q130	151-0608-00		TRANSISTOR:NPN,SI,MICRO-STRIPLINE PKG	80009	151-0608-00
A24A3Q220	151-5000-00		TRANSISTOR:PNP,SI,SOT-23	04713	MMBT3906LT1
A24A3Q250	151-1221-00		TRANSISTOR:MESFET,GAAS,N CHANNEL	80009	151-1221-00
A24A3Q300	151-5000-00		TRANSISTOR:PNP,SI,SOT-23	04713	MMBT3906LT1
A24A3Q340	151-5000-00		TRANSISTOR:PNP,SI,SOT-23	04713	MMBT3906LT1
A24A3Q440	151-5000-00		TRANSISTOR:PNP,SI,SOT-23	04713	MMBT3906LT1
A24A3R100	321-5014-00		RES,FXD,FILM:475 OHM,1%,0.125W	01121	BCK4750FT
A24A3R101	321-5000-00		RES,FXD,FILM:10 OHM,1%,0.125W	57668	MCR18EZHFW10E
A24A3R102	321-5014-00		RES,FXD,FILM:475 OHM,1%,0.125W	01121	BCK4750FT
A24A3R120	321-5006-00		RES,FXD,FILM:100 OHM,1%,0.125W	01121	BCK1000FT
A24A3R121	321-5012-00		RES,FXD,FILM:332 OHM,1%,0.125W	01121	BCK3320FT
A24A3R122	321-5002-00		RES,FXD,FILM:15 OHM,1%,0.125W	57668	MCR18EZHFW 15E0
A24A3R130	321-5012-00		RES,FXD,FILM:332 OHM,1%,0.125W	01121	BCK3320FT
A24A3R140	321-5043-00		RES,FXD,FILM:47.5 OHM,1%,0.125W	57668	MCR18FWEA47E5
A24A3R141	321-5043-00		RES,FXD,FILM:47.5 OHM,1%,0.125W	57668	MCR18FWEA47E5
A24A3R200	321-5018-00		RES,FXD,FILM:1.00K,1%,0.125W	01121	BCK1001FT
A24A3R210	321-5004-00		RES,FXD,FILM:22.1 OHM,1%,0.125W	57668	MCR18FWEA22E1
A24A3R220	321-5036-00		RES,FXD,FILM:33.2K,1%,0.125W	01121	BCK3322FT
A24A3R221	321-5025-00		RES,FXD,FILM:3.92K,1%,0.125W	01121	BCK3921FT
A24A3R230	321-5018-00		RES,FXD,FILM:1.00K,1%,0.125W	01121	BCK1001FT
A24A3R231	321-5001-00		RES,FXD,FILM:12.1 OHM,1%,0.125W	57668	MCR18EZHFW 12E1
A24A3R250	321-5010-00		RES,FXD,FILM:221 OHM,1%,0.125W	01121	BCK221FT
A24A3R251	321-5010-00		RES,FXD,FILM:221 OHM,1%,0.125W	01121	BCK221FT
A24A3R310	321-5036-00		RES,FXD,FILM:33.2K,1%,0.125W	01121	BCK3322FT
A24A3R311	321-5025-00		RES,FXD,FILM:3.92K,1%,0.125W	01121	BCK3921FT
A24A3R312	321-5001-00		RES,FXD,FILM:12.1 OHM,1%,0.125W	57668	MCR18EZHFW 12E1
A24A3R313	321-5004-00		RES,FXD,FILM:22.1 OHM,1%,0.125W	57668	MCR18FWEA22E1
A24A3R314	321-5018-00		RES,FXD,FILM:1.00K,1%,0.125W	01121	BCK1001FT
A24A3R315	321-5018-00		RES,FXD,FILM:1.00K,1%,0.125W	01121	BCK1001FT
A24A3R316	321-5000-00		RES,FXD,FILM:10 OHM,1%,0.125W	57668	MCR18EZHFW10E
A24A3R320	321-5048-00		RES,FXD,FILM:332K,1%,0.125W	80009	321-5048-00
A24A3R340	321-5010-00		RES,FXD,FILM:221 OHM,1%,0.125W	01121	BCK221FT
A24A3R341	321-5030-00		RES,FXD,FILM:10.0K,1%,0.125W	01121	BCK1002FT
A24A3R342	321-5044-00		RES,FXD,FILM:56.2 OHM,1%,0.125W	01121	BCD56R2FT
A24A3R343	321-5046-00		RES,FXD,FILM:82.5 OHM,1%,0.125W	01121	BCK82R5FT
A24A3R344	321-5006-00		RES,FXD,FILM:100 OHM,1%,0.125W	01121	BCK1000FT
A24A3R345	321-5038-00		RES,FXD,FILM:47.5K,1%,0.125W	01121	BCK4752FT
A24A3R410	321-5030-00		RES,FXD,FILM:10.0K,1%,0.125W	01121	BCK1002FT
A24A3R411	321-5000-00		RES,FXD,FILM:10 OHM,1%,0.125W	57668	MCR18EZHFW10E
A24A3R412	321-5030-00		RES,FXD,FILM:10.0K,1%,0.125W	01121	BCK1002FT
A24A3R420	321-5013-00		RES,FXD,FILM:392 OHM,1%,0.125W	01121	BCK3920FT
A24A3R421	311-5037-00		RES,VAR,MONMW:TRMR,100 OHM,0.1W,LINEAR	80009	311-5037-00
A24A3R440	321-5036-00		RES,FXD,FILM:33.2K,1%,0.125W	01121	BCK3322FT
A24A3R500	321-5043-00		RES,FXD,FILM:47.5 OHM,1%,0.125W	57668	MCR18FWEA47E5
A24A3R510	321-5036-00		RES,FXD,FILM:33.2K,1%,0.125W	01121	BCK3322FT
A24A3R511	321-5006-00		RES,FXD,FILM:100 OHM,1%,0.125W	01121	BCK1000FT
A24A3R512	321-5043-00		RES,FXD,FILM:47.5 OHM,1%,0.125W	57668	MCR18FWEA47E5

REPLACEABLE ELECTRICAL PARTS
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Component No.	Tektronix Part No.	Serial/Assembly No. Effective Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A24A3R520	321-5020-00		RES, FXD, FILM: 1.50K, 1%, 0.125W	01121	BCK1501FT
A24A3R521	321-5008-00		RES, FXD, FILM: 150 OHM, 1%, 0.125W	01121	BCK1500FT
A24A3R530	321-5011-00		RES, FXD, FILM: 274 OHM, 1%, 0.125W	01121	BCK2740FT
A24A3R600	321-5002-00		RES, FXD, FILM: 15 OHM, 1%, 0.125W	57668	MCR18EZHFW 15E0
A24A3R601	321-5012-00		RES, FXD, FILM: 332 OHM, 1%, 0.125W	01121	BCK3320FT
A24A3R602	321-5012-00		RES, FXD, FILM: 332 OHM, 1%, 0.125W	01121	BCK3320FT
A24A3U310	156-5017-01		MICROCKT, LINEAR: DUAL 741 OP AMP, 1MZ	80009	156-5017-01
A24AA	671-1541-00		CIRCUIT BD ASSY: TG RF AMPLIFIER, 389-0746-XX WIRED	80009	671-1541-00
A24A4C101	283-5004-00		CAP, FXD, CER DI: 0.1UF, 10%, 25V	20932	W1206X104K1B02
A24A4C102	283-5010-00		CAP, FXD, CER DI: 0.22UF, 10%, 25V	95275	VJ1210YR22KXA
A24A4C112	283-5004-00		CAP, FXD, CER DI: 0.1UF, 10%, 25V	20932	W1206X104K1B02
A24A4C121	283-5004-00		CAP, FXD, CER DI: 0.1UF, 10%, 25V	20932	W1206X104K1B02
A24A4C130	283-5004-00		CAP, FXD, CER DI: 0.1UF, 10%, 25V	20932	W1206X104K1B02
A24A4C140	283-5004-00		CAP, FXD, CER DI: 0.1UF, 10%, 25V	20932	W1206X104K1B02
A24A4C150	283-5004-00		CAP, FXD, CER DI: 0.1UF, 10%, 25V	20932	W1206X104K1B02
A24A4C200	290-5002-00		CAP, FXD, ELCTLT: 10UF, 20V	TK1424	20MC100M-TER
A24A4C300	283-5010-00		CAP, FXD, CER DI: 0.22UF, 10%, 25V	95275	VJ1210YR22KXA
A24A4C310	283-5010-00		CAP, FXD, CER DI: 0.22UF, 10%, 25V	95275	VJ1210YR22KXA
A24A4C330	283-5004-00		CAP, FXD, CER DI: 0.1UF, 10%, 25V	20932	W1206X104K1B02
A24A4C340	283-5112-00		CAP, FXD, CER DI: 0.33UF, 10%, 25V	80009	283-5112-00
A24A4C350	283-5017-00		CAP, FXD, CER DI: 1PF, +/-0.25PF, 50V	80009	283-5017-00
A24A4C360	283-5010-00		CAP, FXD, CER DI: 0.22UF, 10%, 25V	95275	VJ1210YR22KXA
A24A4C410	283-5010-00		CAP, FXD, CER DI: 0.22UF, 10%, 25V	95275	VJ1210YR22KXA
A24A4C411	283-5010-00		CAP, FXD, CER DI: 0.22UF, 10%, 25V	95275	VJ1210YR22KXA
A24A4C420	283-5010-00		CAP, FXD, CER DI: 0.22UF, 10%, 25V	95275	VJ1210YR22KXA
A24A4C421	283-5004-00		CAP, FXD, CER DI: 0.1UF, 10%, 25V	20932	W1206X104K1B02
A24A4C430	283-5010-00		CAP, FXD, CER DI: 0.22UF, 10%, 25V	95275	VJ1210YR22KXA
A24A4C431	290-5002-00		CAP, FXD, ELCTLT: 10UF, 20V	TK1424	20MC100M-TER
A24A4C510	283-5010-00		CAP, FXD, CER DI: 0.22UF, 10%, 25V	95275	VJ1210YR22KXA
A24A4C521	283-5000-00		CAP, FXD, CER DI: 10PF, 5%, 50V	80009	283-5000-00
A24A4C540	283-5010-00		CAP, FXD, CER DI: 0.22UF, 10%, 25V	95275	VJ1210YR22KXA
A24A4C541	283-5010-00		CAP, FXD, CER DI: 0.22UF, 10%, 25V	95275	VJ1210YR22KXA
A24A4CR340	152-5010-00		SEMICON DVC, DI: SCHOTTKY, SI, 50V, 1PF, SOT-23	80009	152-5010-00
A24A4CR360	152-0962-00		SEMICON DVC, DI: SCHOTTKY, SI, CER STRIPLINE C ASE	80009	152-0962-00
A24A4J600	131-4203-00		CONN, RCPT, ELEC: SMA JACK TO SPCL END CONFIG	24931	39JR226-1
A24A4K600	148-0198-00		RELAY, REED: DPDT, 98 OHMS, 6V	11532	712-6
A24A4K610	148-0198-00		RELAY, REED: DPDT, 98 OHMS, 6V	11532	712-6
A24A4K620	148-0198-00		RELAY, REED: DPDT, 98 OHMS, 6V	11532	712-6
A24A4K630	148-0198-00		RELAY, REED: DPDT, 98 OHMS, 6V	11532	712-6
A24A4L410	108-5001-00		COIL, RF: FXD, 70NH	80009	108-5001-00
A24A4L411	108-5001-00		COIL, RF: FXD, 70NH	80009	108-5001-00
A24A4L510	108-5001-00		COIL, RF: FXD, 70NH	80009	108-5001-00
A24A4Q430	151-5000-00		TRANSISTOR: PNP, SI, SOT-23	04713	MMBT3906LT1
A24A4Q530	151-0608-00		TRANSISTOR: NPN, SI, MICRO-STRIPLINE PKG	80009	151-0608-00
A24A4R200	321-5008-00		RES, FXD, FILM: 150 OHM, 1%, 0.125W	01121	BCK1500FT
A24A4R201	321-5045-00		RES, FXD, FILM: 68.1 OHM, 1%, 0.125W	01121	BCD68R1FT
A24A4R202	321-5045-00		RES, FXD, FILM: 68.1 OHM, 1%, 0.125W	01121	BCD68R1FT
A24A4R210	321-5004-00		RES, FXD, FILM: 22.1 OHM, 1%, 0.125W	57668	MCR18FWEA22E1
A24A4R211	321-5010-00		RES, FXD, FILM: 221 OHM, 1%, 0.125W	01121	BCK221FT
A24A4R212	321-5010-00		RES, FXD, FILM: 221 OHM, 1%, 0.125W	01121	BCK221FT
A24A4R220	321-5044-00		RES, FXD, FILM: 56.2 OHM, 1%, 0.125W	01121	BCD56R2FT
A24A4R221	321-5007-00		RES, FXD, FILM: 121 OHM, 1%, 0.125W	01121	BCK1210FT
A24A4R222	321-5007-00		RES, FXD, FILM: 121 OHM, 1%, 0.125W	01121	BCK1210FT
A24A4R230	321-5010-00		RES, FXD, FILM: 221 OHM, 1%, 0.125W	01121	BCK221FT
A24A4R231	321-5044-00		RES, FXD, FILM: 56.2 OHM, 1%, 0.125W	01121	BCD56R2FT
A24A4R232	321-5044-00		RES, FXD, FILM: 56.2 OHM, 1%, 0.125W	01121	BCD56R2FT
A24A4R310	321-5000-00		RES, FXD, FILM: 10 OHM, 1%, 0.125W	57668	MCR18EZHFW10E

Component No.	Tektronix Part No.	Serial/Assembly No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Discort			
A24A4R311	321-5000-00			RES,FXD,FILM:10 OHM,1%,0.125W	57668	MCR18EZHFW10E
A24A4R330	321-5047-00			RES,FXD,FILM:100K,1%,0.125W	01121	BCK1003FT
A24A4R331	321-5006-00			RES,FXD,FILM:100 OHM,1%,0.125W	01121	BCK1000FT
A24A4R332	321-5024-00			RES,FXD,FILM:3.32K,1%,0.125W	01121	BCK3321FT
A24A4R333	321-5026-00			RES,FXD,FILM:4.75K,1%,0.125W	01121	BCK4751FT
A24A4R340	321-5024-00			RES,FXD,FILM:3.32K,1%,0.125W	01121	BCK3321FT
A24A4R341	321-5047-00			RES,FXD,FILM:100K,1%,0.125W	01121	BCK1003FT
A24A4R342	321-5034-00			RES,FXD,FILM:22.1K,1%,0.125W	01121	BCK2212FT
A24A4R350	321-5006-00			RES,FXD,FILM:100 OHM,1%,0.125W	01121	BCK1000FT
A24A4R351	321-5018-00			RES,FXD,FILM:1.00K,1%,0.125W	01121	BCK1001FT
A24A4R360	321-5046-00			RES,FXD,FILM:82.5 OHM,1%,0.125W	01121	BCK82R5FT
A24A4R361	321-5044-00			RES,FXD,FILM:56.2 OHM,1%,0.125W	01121	BCD56R2FT
A24A4R362	321-5005-00			RES,FXD,FILM:27.4 OHM,1%,0.125W	57668	MCR18EZHFW 27E4
A24A4R410	321-5007-00			RES,FXD,FILM:121 OHM,1%,0.125W	01121	BCK1210FT
A24A4R411	321-5007-00			RES,FXD,FILM:121 OHM,1%,0.125W	01121	BCK1210FT
A24A4R412	321-5007-00			RES,FXD,FILM:121 OHM,1%,0.125W	01121	BCK1210FT
A24A4R430	321-5025-00			RES,FXD,FILM:3.92K,1%,0.125W	01121	BCK3921FT
A24A4R431	321-5020-00			RES,FXD,FILM:1.50K,1%,0.125W	01121	BCK1501FT
A24A4R432	321-5011-00			RES,FXD,FILM:274 OHM,1%,0.125W	01121	BCK2740FT
A24A4R433	321-5030-00			RES,FXD,FILM:10.0K,1%,0.125W	01121	BCK1002FT
A24A4R440	321-5002-00			RES,FXD,FILM:15 OHM,1%,0.125W	57668	MCR18EZHFW 15E0
A24A4R441	321-5042-00			RES,FXD,FILM:39.2 OHM,1%,0.125W	57668	MCR18FWEA39E2
A24A4R520	321-5030-00			RES,FXD,FILM:10.0K,1%,0.125W	01121	BCK1002FT
A24A4R522	321-5042-00			RES,FXD,FILM:39.2 OHM,1%,0.125W	57668	MCR18FWEA39E2
A24A4R530	321-5042-00			RES,FXD,FILM:39.2 OHM,1%,0.125W	57668	MCR18FWEA39E2
A24A4R531	321-5042-00			RES,FXD,FILM:39.2 OHM,1%,0.125W	57668	MCR18FWEA39E2
A24A4R532	321-5042-00			RES,FXD,FILM:39.2 OHM,1%,0.125W	57668	MCR18FWEA39E2
A24A4R533	321-5007-00			RES,FXD,FILM:121 OHM,1%,0.125W	01121	BCK1210FT
A24A4U300	156-2403-00			MICROCKT,LINER:MICROWAVE AMPLIFIER AVANTEK	24539	MSA-0335-21
A24A4U330	156-5017-01			MICROCKT,LINER:DUAL 741 OP AMP,1MZ	80009	156-5017-01
A24A4U410	156-2403-00			MICROCKT,LINER:MICROWAVE AMPLIFIER AVANTEK	24539	MSA-0335-21
A24A4U510	156-2403-00			MICROCKT,LINER:MICROWAVE AMPLIFIER AVANTEK	24539	MSA-0335-21
W51	174-2077-00			CABLE ASSY,RF:50 OHM COAX,SEMI RIGID (OPTION 15 ONLY)	80009	174-2077-00
W52	174-2083-00			CABLE ASSY,RF:50 OHM COAX,SEMI RIGID,13.0L	80009	174-2083-00
W53	174-2084-00			CABLE ASSY,RF:50 OHM COAX,SEMI RIGID,20.0L	80009	174-2084-00
W54	174-2141-00			CA ASSY,SP,ELEC:10,28 AWG,5.0 L,FLAT,W/STRA IN RELIEF	80009	174-2141-00
W54	174-1818-00	B020319	B022992	CA ASSY,RIBBON:IDC,.,:15.0 L,28 AWG,10 INCH SINGLE 0.125 STRIP X 5 INCH 40 POS PCB X 10 POS BOX (2710F04 ONLY)	80009	174-1818-00
W55	174-1811-00			CABLE ASSY,RF:50 OHM COAX,DUAL SHLD,18.0 L, SMB X LUG,TIP TIN	80009	174-1811-00

