# OPERATIONS and MAINTENANCE MANUAL 

## Swept Frequency Generator Model 1520A

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## 1520

## SWEPT FREQUENCY GENERATOR

# 1520 SWEPT FREQUENCY GENERATOR <br> OPERATOR'S MANUAL 

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## SECTION I

## GENERAL NFORMATION

### 1.1 INTRODUCTION

The Model 1520 is a wideband, solid state, sweep generator with a frequency coverage of 50 KHz to 1200 MHz in six overlapping bands. The unit delivers a full 0.5 V rms signal into $50 \Omega$ from 50 KHz to 300 MHz and 1.0 V rms from 275 to 1200 MHz . The 1520 will provide accurate wide or narrow sweeps at center frequencies, determined by the operator, throughout the specified frequency range.

A general purpose lab type instrument, the Model 1520 is used for alignment, test, or calibration applications.

### 1.2. SPECIFICATIONS

1.2.1 FREQUENCY RANGE: 50 KHz to 1200 MHz in 6 switchable bands. ${ }^{-}$
1.2.2 RF OUTPUT: 0.5 V rms into 505, , 50 KHz to 300 MHz ;

1. 0 V rms into $50 \Omega, 275 \mathrm{MHz}$ to 1200 MHz .
1.2.3 OUTPUT FLATNESS: $\pm 0.5 \mathrm{db}, 50 \mathrm{KHz}$ to $800 \mathrm{MHz} ; \pm 1.0 \mathrm{db}, ~ \equiv 00 \mathrm{MHz}$ to 1200 MHz . (maximum sweep width)
1.2.4 OUTPUT MPEDANCE: $50 \Omega$.
1.2.5 FREQUENCY DRIFT: at $25^{\circ} \pm 2^{\circ} \mathrm{C}$ per ten minute interval after 30 minute warm up
on each band: $\quad .05-10 \mathrm{MHz}$ Band $\pm 10 \mathrm{KHz}$ or $\pm 0.3 \%$, whichever is greater $1-300 \mathrm{MHz}$ Band $\pm 50 \mathrm{KHz}$ or $\pm 0.3 \%$, whichever is greater $255-1200 \mathrm{MHz}$ Bands $\pm 0.3 \mathrm{C}$
1.2.6 SWEEP WIDTH: 50 KHz to $300 \mathrm{MHz} ; 10 \mathrm{KHz}$ minimum to 300 MHz maximum.
(variable) $\quad 275 \mathrm{MHz}$ to $1200 \mathrm{NHz} ; 10 \mathrm{KHz}$ minimum to $> \pm 20 \%$ of center.
1.2.7 FREQUENCY LINEARITY: $5 \%$ of full sweep.
1.2.8 SPURIOUS OUTPUT: $>20 \mathrm{db}$ below fundamental output.
1.2.9 HARNIONIC DISTORTION: $>30 \mathrm{db}$ beiow fundamental output. .
1.2.10 RF ATTENUATION: 0 to 70 db in 10 db steps; 0 to 10 db vernier.
1.2.11 ATTENUATION ACCURACY: $\pm 1 \mathrm{db}$.
1.2.12 SWEEP RATE: 0.5 to 6 Hz , variable; 6 to 60 Hz , variable; Line Triggered; CW.
1.2.13 HORIZONTAL OUTPUT: 5 volts peak-to-peak sawtooth at the sweep repetition rate.
1.2.14 EXTERNAL MARKER INPUT: Provision for two, at any frequency from 100 KHz to 1200 MHz . Input voltage - 20 mv minimum. Amplitude continuously variable via front panel control.

1.2.15 INTERNAL MARKERS: Harmonic birdies at 1,10 , and 100 MHz . Variable birdies from 100 KHz to 100 MHz . Marker Accuracy: . $005 \%$ for Harmonic; . 02\% for Variable. Marker Amplitude: approximately 0.1 V peak-to-peak.

1.2.16 BLANKING: Switchable, unit's vertical output returned to zero reference level.
1.2.17. ELECTRICAL REQUIREMENTS: $115 \mathrm{~V} \pm 10 \%, 60 \mathrm{~Hz}, 65 \mathrm{~W}$ approximately.

### 1.3 INSTALLATION

1.3.1 UNPACKING

Upon receipt of the Model 1520, visually inspect it for any damage that may have occured in shipment. Pay particular attention to the condition of the cabinet, switches, connectors, and dial faces.

### 1.3.2 INITIAL INSTALLATION

The unit may be installed in any environment that is reasonably free from extremes in temperature, humidity, or vibration. Adequate ventilation is provided by the cabinet, however it should not be obstructed. Rack mounted models also require an adequate amount of air flow to prevent overheating.

## SECTION II

## OPERATION

## 2. 1 INTRODUCTION

The information contained in this section is intended to familiarize the operator with the various controls and their functions. A detailed operating procedure is included and provides the basic interconnections and control settings necessary to operate the equipment.

## 2. 2 FUNCTION OF CONTROLS AND SWITCHES

| CONTROL | POSITION | FUNCTION |
| :---: | :---: | :---: |
| BANDWIDTH VARIABLE | VARIABLE | Controls the amount of sweep frequency deviation. |
| WIDE/NARROW SWITCH | WIDE | Controls the maximum sweep width that is available. |
|  | NARROW | The maximum sweep width available is approximately $1 \%$ of the wide sweep. |
| CALIBRATE | VARIABLE | Provides a means of accurately calibrating the CENTER FREQUENCY dial to a specific wide band frequency (optimum accuracy insured only when the screwdriver slot is in the vertical position). |
| CENTER FREQUENCY (Ten Turn Pot) | VARIABLE | Used to set the CENTER FREQUENCY as read on the dial. |
| COUNTER SWITCH | ON/OFF | In the OFF position, the counter circuits are disabled, reducing the amount of display flicker. |
| COUNTER DISPLAY | 3 POSITION SWITCH | Indicates whether the counter is reading in KHz or MHz . Resolution is decreased as switch is rotated clockwise See Figure 2. 1. |
| DC BALANCE | VARIABLE | Adjusts for a minimum DC level shift in VERT output when the VERTICAL. GAIN control is varied through its range. Usually only necessary to adjust when changing RF detectors.s |


| CONTROL | - POSITION | FUNCTION |
| :---: | :---: | :---: |

FREQUENCY BAND
$\qquad$

6 POSITION SWITCH: Selects any one of six frequency bands. Band in use is indicated by a light on the CENTER FREQUENCY dial.

| HARMONIC MARKERS | 4 POSITION SWITCH | Selects either the 1,10 , or 100 MHz harmonic birdie markers. An OFF position is provided. |
| :---: | :---: | :---: |
| MARKER SIZE | HARMONIC EXTERNAL VARIABLE | These three controls are used to determine the marker amplitude of the corresponding marker type. |
| NARROW BAND CENTERING | VARIABLE | This control is activated by placing the SWEEP WDTH switch in NARROW. It is used to locate the exact center frequency (set under wide band conditions). |
| POWER SWITCH | ON | AC power is applied to all circuits of the Model 1520. |
|  | OFF | The Model 1520 is completely deenergized. |
| RF ATTENUATION SWITCH | VARIABLE | Selects fixed amounts of attenuation from 0 to 70 db in 10 db steps. |
| RF LEVEL | VARIABLE | Adjusts the level of the RF output over a 10 db range. |
| SWEEP RATE | SWITCH | Selects any one of the following sweep functions: 0.5 to $6 \mathrm{~Hz}, 6$ to 60 Hz , Line Triggered, or CW. |
|  | VARIABLE | Provides adjustment of the variable repetition rates over the range set by the selector switch ( 0.5 to 6 , 6 to 60 ). |
| VARIABLE MARKER POSITION |  | Determines the horizontal position of the variable marker between 0.05 and 100 MHz . The FINE and COARSE controls provide precise settings of frequency ins read on the counter) or position. |

CONTROL

| VERTICAL BLANKEVG | ON/OFF | When in the ON position, the VERTICAL OUT channel is blanked during sweep retrace time resulting in a zero signal output reference. The RF is not internally blanked. |
| :---: | :---: | :---: |
| VERTICAL GAIN | VARIABLE | Amplification of approximately 0 to 32 db of gain is provided for the VERT LNPUT signal. This permits low level signals to amplitied before being displayed on the scope. |

Figure 2.1... COUNTER RESOLUTION

|  |  | RESOLUTION |  |
| :--- | :---: | :---: | :---: |
|  | GATE TIME | $.05-10 \mathrm{NHz}$ BAND | $1-300 \mathrm{MHHz}$ BAND* |
| MHz (Fully CW) | 1 ms | 1 KHz | 10 kHz |
| MHz (Middle) | 10 ms | 100 Hz | 1 KHz |
| KHz (Fully CCW) | 100 ms | 10 Hz | 100 Hz |

${ }^{*}$ Counter operates at 100 NrHz and below only.

| CONNECTOR | FUNCTION |
| :--- | :--- |
| EXTERNAL MARKERS | These two jacks provide a means of applying a CW signal <br> to the Model 1520 to form center frequency and side band <br> markers in the frequency range of 100 KHFz to 100 MHz. <br> The input signal should be 20 mv or greater. Signals can <br> be applied at greater than 100 MHz if desired. |
| HORIZ OUT | Provides a means of coupling the horizontal sweep drive <br> voltage to the oscilloscope. |
| RF DETECTOR | This connector is part of the plug-in detector and provides <br> a $50 \Omega$ input impedance for the RF signal. |
| RF OUT | Provides a means of coupling out the leveled, RF signal. |
| VERTICAL INPUT |  |
| means of coupling detected signals into the vertical |  |
| channel. |  |

### 2.4 OPERATION

NOTE: The equipment is operable immediately after the power is turned on and the accuracy and stability are acceptable. To insure optimum specified accuracy, allow a one half hour warm up period. The center frequency is affected the same way when switching from band to band.
2.4.1 Interconnect the equipment as shown in Figure 2.1


FIGURE 2.1 GENERAL TEST SET-UP
2.4.2 Set the oscilloscope controls as follows:
2.4.2.1 VERT GAIN: 0.5 volts $/ \mathrm{cm}$.
2.4.2.2 HORIZ GAIN: Adiust so that a 10 volt $\dot{p} / \mathrm{p}$ input signal gives 10 cm of horizontal deflection.
2.4.3 Set the Model 1520 front panel controls as follows:
2.4.3.1 FREQUENCY BAND switch: desired band.
2.4.3.2 CENTER FREQUENCY control: center of selected band.
2.4.3.3 RF LEVEL: fully clockwise.
2.4.3.4 RF ATTENUATION: as required.
2.4.3.5 BAND WIDTI: WIDE, variable control fully clockwise.
2.4.3.6 NARROW BAND CENTERING: not operable.
2.4.3.7 SWEEP RATE: 6 to 60 Hz position, variable fully clockwise.
2.4.3.8 VERTICAL GAIN: mid-range.
2.4.3.9 DC BALANCE: set at factory to match RF detector; or mid-range.
2.4.3.10 VERTICAL BLANKING: ON.
2.4.3.11 COUNTER ON/OFF: OFF.
2.4.3.12 HARMONIC MARKER: OFF.
2.4.3.13 MARKER SIZE: All three controls fully CCW.
2.4.4 With the controls set as above, the indicated frequency band will be swept with the center as indicated on the CENTER FREQUENCY dial. A frequency response curve should be observed if the VERTICAL GAIN control is properly adjusted.
2.4.5 The desired frequency band is selected as follows:
2.4.5.1 Place the FREQUENCY BAND selector in the desired range.
2.4.5.2 Allow the unit to stabilize.
2.4.5.3 The selected band will be indicated by a light in the CENTER FREQUENCY dial.
2.4.6 CENTER FREQUENCY selection:
2.4.6.1 The frequency may be read directly from the dial.
2.4.6.2 Below 100 MHz , higher center frequency accuracy is obtained by using the variable marker to indicate the center frequency.
2.4.6.3 The calibration of the CENTER FREQUENCY dial for greater accuracy or narrow band operation is as follows:
2.4.6.3.1. Determine the dynamic center frequency of the swept RF by centering an EXTERNAL or harmonic marker on the scope trace while reducing the bandwidth (use the VARIABLE BANDWIDTH control) to a minimum.
2.4.6.3.2 Adjust the bandwidth controls ior maximum bandwidth.
2.4.6.3.3 Adjust the horizontal controls of the oscilloscope so as to place the marker exactly at the center of the display. The scope is now calibrated to read center frequency at any bandwidth.)
2.4.6.3.4 Calibration of the dinl is accomplished as folloivs:
(a) For EXTERNAL or HARMONIC markers: Select a marker frequency and set the CENTER FREQUENCY dial for the same frequency. Adjust the CALIBRATE control to place the marker exactly at the center of the sweep.
(b) For the VARLABLE marker: Place the marker at the center of the sweep, the CENTER FREQUENCY dial at the desired frequency, and adjust the CALIBRATE control until the counter reads the desired frequency.

NOTE: Best accuracy for the above procedure is obtained when operating at reduced sweep widths. For best overall dial accuracy; the CALIBRATE control slot should always be returned to the vertical position. With the control in any other position the specified accuracy may be affected.

TABLE 2.2 CENTER FREQUENCY. ACCURACIES

| FREQUENCY BAND |  |  | FREQUENCY ACCURACY |
| :---: | :---: | :---: | :---: |
|  | DIAL* |  | Using Counter as center Frequency Indicator |
| . $05-10 \mathrm{MHz}$ | $\pm 100 \mathrm{KHz}$ |  | $\pm .02 \%$ |
| 1-300 MHz | $1-100 \mathrm{MHz}$ | $100-300 \mathrm{MHz}$ | $1-100 \mathrm{MHz} \quad 100-300 \mathrm{MHz}$ |
|  | $\pm 3 \mathrm{MHz}$ | $\pm 2$ \% | $\pm .02 \%$ |
| $255-510 \mathrm{MHz}$ | $\pm 2 \%$ |  | : |
| $340-680 \mathrm{MHz}$ | $\pm 2 \%$ |  |  |
| $450-900 \mathrm{MHz}$ | $\pm 2 \%$ |  |  |
| $600-1200 \mathrm{MHz}$ | $\pm 2 \%$ |  |  |

*NOTE: Dial accuracy within specifications when CALIBRATE control slot is lined up with VERTICAL calibration marks.

| FREQUENCY BAND |  |  | FREQUENCY ACCURACY |
| :---: | :---: | :---: | :---: |
|  | DIAL* |  | Using Counter as center Frequency Indicator |
| . $05-10 \mathrm{MHz}$ | $\pm 100 \mathrm{KHz}$ |  | $\pm .02 \%$ |
| 1-300 MHz | $1-100 \mathrm{MHz}$ | $100-300 \mathrm{MHz}$ | $1-100 \mathrm{MHz} \quad 100-300 \mathrm{MHz}$ |
|  | $\pm 3 \mathrm{MHz}$ | $\pm 2 \%$ | $\pm .02 \%$ |
| 255-510MIHz | $\pm 2 \%$ |  | and ${ }^{\text {a }}$ |
| $340-680 \mathrm{MHz}$ | $\pm 2 \%$ |  | 이 |
| $450-900 \mathrm{MHz}$ | $\pm 2 \%$ |  | (2) |
| $600-1200 \mathrm{MHz}$ | $\pm 2 \%$ |  | Seb: |

*NOTE: Dial accuracy within specifications when CALIBRATE control slut is lined up with VERTICAL calibration marks.

### 2.4.7 SWEPT RF LEVEL adjustment:

2.4.7.1 The output level may be adjusted by varying the RF level through its range ( $0-10 \mathrm{db}$ ).
2.4.7.2 The RF attenuator provides fixed 10 db steps of attenuation up to a total of 70 db .

### 2.4.8 SELECTION of BANDWIDTH:

2.4.8.1 Set the BANDWIDTH selector to WIDE and adjust the VARIABLE control for the desired width. Any one of the three marker systems can be used to establish an exact width.
2.4.8.2 For bandwidths of $1 \%$ or less, smaller amounts of residual FM and drift will be encquntered if the narrow function is used as follows:
2.4.8.2.1 Establish an acceptable sweep under wide band conditions.
2.4.8.2.2 Center the response on the oscilloscope.

### 2.4.8.2.3 Select the NARROW sweep function.

2.4.8.2.4 Rotate the NARROW BAND CENTERING control in the direction of the indicator light that is extinguished until the crossover point between the two lights bein ON is reached. At the crossover point, and depending on the center frequency, bandwidth, and sweep rate, the lights will either be both ON or both OFF or will alternate being OFF and ON. In the last two cases, the operator should tune for equal brightness between the two lights.
2.4.8.2.5 The desired bandwidth may be set by adjusting the VARIABLE BANDWIDTH control while using any of the three marker systems to indicate the frequency.
2.4.8.3 Establish a narrow bandwidth sweep at a known center frequency.
2.4.8.3.1 For frequencies from 50 KHz to 100 MHz , proceed as follows:
(a) Place the VARIABLE MARKER in the center of the swept display.
(b) Turn the VARIABLE BANDWIDTH control fully counterclockwise.
(c) Adjust the NARROW SWEEP CENTERING control for the desired center frequency reading on the counter. (See section on VARIABLE MARKER operation.)
(d) OPTIONAL METHOD: Adjust the center frequency control for the crossover point of the indicator lights (see section 2.4.8.2.4). The CENTER FREQUENCY dial may now be used for noting the initial center frequency and is also set up to provide the same center frequency for wide sweeps.
(e) Adjust the VARIABLE BANDWIDTH control for the desired bandwidth. The use of any of the three marker types is useful for insuring accuracy.
2.4.8.3.2 For frequencies above 100 MHz proceed as follows:
(a) Set the CENTER FREQUENCY dial for any desired center frequency and proceed with steps 2.4.8.2.4 and 2.4.8.2.5.

### 2.4.9 SWEEP RATE ADJUSTMENT

2.4.9.1 The variable ranges ( 0.5 to 6 Hz and 6 to 60 Hz ) are normally selected for the fastest rate that produces the least distortion of the response curve. The faster rates will produce the least flicker. At any given sweep rate, the amount of distortion depends on the response time of the unit under test and the detector; some high Q circuits will ring if swept too fast.
2.4.9.2 When operating at very narrow bandwidths, residual FM picked up by the system may become noticeable as a back and forth bobble of the signal. To reduce this FM bobble, proceed as follows:
(a) Switch to NARROW BANDWIDTH (set up as for section 2.4.8.2.4).
(b) If the bobble is still objectionable, switch to the LINE TRIGGERED range. All line frequency related FM will disappear.

NOTE: With the COUNTER ON/OFF switch in the ON position, residual FM will remain to the right of the variable marker (no counting error will be noted). The COUNTER switch should, therefore be OFF except when actually counting.

If the LINE TRIGGERED function should produce distortion, it is advisable to operate in one of the variable ranges which produces the minimum distortion.

### 2.4.10 DC BALANCE ADJUSTMENT

2.4.10.1 Turn the three MARKER SIZE controls fully counterclockwise. -
2.4.10.2 Disconnect the RF signal from the detector while maintaining the connection between the detector and the Model 1520 (detector plugged into the 1520 or connected to the VERTICAL INPUT jack).
2.4.10.3 Set the oscilloscope's vertical gain to $10 \mathrm{mv} / \mathrm{div}$ and center the zero input reference level on the trace.
2.4.10.4 Vary the VERTICAL GAIN control through its entire range and see that the trace does not deflect vertically.
2.4.10.5 Eliminate any deflection of the trace by adjusting the DC BALANCE control.
2.4.10.6 Repeat this procedure any time the detector is changed.

### 2.4.11 VERTICAL GAIN ADJUSTMENT

2.4.11.1 Set the oscilloscope's vertical gain for $0.5 \mathrm{~V} / \mathrm{cm}$.
2.4.11.2 Adjust the VERTICAL GALN control for a convenient amplitude. Very low level signals may make it necessary to increase the vertical sensitivity of the scope.
2.4.11.3 Adjust the MLARKER SIZE controls as necessary.

### 2.4.12 VERTICAL BLANKING:

2.4.12.1 To establish a no-signal reference line place the VERTICAL BLANKING switch in the ON position. This blanks the signal at the VERTICAL OUT jack to zero.
2.4.12.2 With the VERTICAL BLANKING switch in the OFF position, both the forward and reverse sweeps are displayed on the scope.

### 2.4.13 VARIABLE MARKER OPERATION (. $05-100 \mathrm{MHz}$ )

NOTE: The accuracy of the variable marker is $\pm .02 \%$ for swept frequency bandwidths of $8 \%$ or less of marker frequency. (An $8 \%$ bandwidth is approximately the maximum bandwidth at which $\pm .02 \%$ can be discerned on a 10 cm scope display; $\pm .25 \mathrm{~mm}$ or $.01^{\prime \prime}$. A $2 \%$ bandwidth is more useable). At bandwidths above $8 \%$ of the marker frequency, the variable marker accuracy is $\pm 0.25 \%$ of bandwidth.
2.4.13.1 Set the COUNTER DISPLAY switch to the desired counter resolution, Resolution obtained is indicated by the decimal point on the display or may be determined from the chart in the section concerning the function of controls and switches.

NOTE: Setting a resolution greater than the specified accuracy of the reading is not recommended. Reduced flicker when counting is insured by working at the minimum useful frequency resolution.
2.4.13.2 Turn the COUNTER ON/OFF switch to ON and read the frequency directly from the counter. The marker being counted is indicated by a bright dot at the peak.
2.4.13. 3 Adjust the VARIABLE MARKER POSITION controls to place the marker at its desired point or frequency.
2.4.13.4 Adjust the MARKER SIZE - VARIABLE control for a convenient marker amplitude.
2.4.13.5 Read the marker frequency directly from the counter.
2.4.13.6 If counting produces objectionable flicker, turn the counter OFF when it is not necessary to count the frequency.
2.4.13.7 When the SWEEP RATE, BANDWIDTH, or COUNTER DISPLAY controls are varied, the counter frequency may vary slightly. This variation will be within specifications. Counter variation is minimized by setting the resolution of the counter within its specified limits.

### 2.4.14 HARMONIC MARKER OPERATION

2.4.14.1 Select any one of the harmonic marker frequencies ( 1,10 , and 100 MHz ) by means of the HARMONIC MARKER switch.
2.4.14.2 Vary the MARKER SIZE - HARMONIC control until the desired amplitude is obtained.

### 2.14.15 EXTERNAL MARKER OPERATION:

NOTE: External markers may be generated at any point in the frequency range although they are only specified from 100 KHz to 100 MHz .
2.14.15.1 To generate a center frequency marker, connect an external signal generator to the EXTERNAL MARKER input jack.
2.14.15.2 Select the desired frequency from this signal generator and adjust its $R F$ level for some value less than 0.5 V rms .
2.14.15.3 Adjust the MARKER SIZE - EXTERNAL control for a useable marker.
2.14.15.4 To minimize harmonics, keep the RF input level as low as possible and the setting of the MARKER SIZE control as high as possible without introducing excess noise into the scope display.
2.14.15.5 A sideband marker can be generated by feeding a signal into the remaining marker input at the proper frequency.
2.14. 15.6 The marker level may be adjusted by regulating the relative signai level of the two generators. -15-

## SECTION III

## CHECK-OUT PROCEDURE

### 3.1 INTRODUCTION

The information contained in this section can enable the operator of the 1520 Sweep Frequency Generator to perform a general, overall check of his instrument. If desired, these check-outs can be applied whenever:

1. The unit is initially received.
2. The unit undergoes preventative maintenance.
3. Any components have been replaced.

For actual alignment procedure and troubleshooting information, reference should be made to the Maintenance Manual.

### 3.2 PROCEDURE

### 3.2.1 TEST EQUIPMENT REQUIREMENTS:

NOTE: It is suggested that the test equipment listing be closely adhered to and that any necessary substitution meet or exceed the accuracy specifications of substituted unit.

| ITEM | MINIMUM PERFORMANCE SPECIFICATIONS | DENTIFICATION |
| :---: | :---: | :---: |
| Power Meter | Power Range: 0.1 to 10 Mm Instrumentation Accuracy: $\pm 1 \%$ <br> Frequency Capability: $10-1200 \mathrm{siHz}$ | Hewlett-Packard 432A. <br> 431C. |




### 3.2.2 INITIAL CONDITIONS

### 3.2.2.1 Factory Ambient Condition (Room Temperature)

+3.2.2.2 Power: $115 \mathrm{~V}, 60 \mathrm{cps}, \mathrm{AC}$

### 3.2.2.3 Warm up: 30 minutes.

### 3.2.3 FREQUENCY ACCURACY, AND LINEARITY

### 3.2.3.1 DIAL FREQUENCY ACCURACY

A. Test Conditions
(1) $1 / 2$ hour warm-up for each frequency band.
(2) Bandwidth selector WIDE.
(3) Calibrate Control - screwdriver slot set to vertical position.
(4) RF Level Control set to MAXIMUM.
(5) RF attenuation switch set to 10 db .
(6) Harmonic marker selector switch set to 10 MHz position 1 MHz for $.05-10 \mathrm{NHz}$ band and the $1-10 \mathrm{MHz}$ region of the $1-300 \mathrm{MHz}$ band.)
(7) Sweep Rate Control - $6-60 \mathrm{~Hz}$. VARLABLE to MiAXIMUM.
(8) Vertical Blankiner control to ON.
(9) Establish a swept display on oscilluscope, as per Figure 3.1,of 5 to 6 CM amplitude.
B. Test Procedure
(1) Adjust bandwidth displayed on oscilloscope to 6 harmonic markers with 2 CM spacing between markers. $10^{\circ} \mathrm{CM}$ between markers on . 0510 MHz band.
(2) Introduce external known signal to external marker input to verify frequency.
(3) Adjust harmonic marker size to approximately three CM and external marker to approximately five CM peak-to-peak.
(4) Turn dial and bandwidth to frequency and band to be measured taking care to eliminate parallax error.
(5) Read the subdivisions between the oscilloscope center and the harmonic marker. They represent the residual dial errors. Convert to frequency.

### 3.2.3.2 LINEARITY

A. Initial Conditions
(1) Variable Bandwidth control set fully clockwise.
(2) Bandwidth selector to WIDE.
(3) RF Level control set to MAX.
(4) RF attenuator switch set to 10 db .
(5) Sweep Rate switch to $6-60 \mathrm{~Hz}$, VARIABLE fully clockwise.
(6) Counter switch to OFF.
(7) Vertical Blanking switch to ON
(8) Marker Size controls - EXTERNAL \& VARLABLE completely CCW.
(9) Set up the equipment as shown in Figure 3.1.
(10) Adjust the VERTICAL GAIN control for about 4 CM response amplitude on the scope screen.
B. Test Procedure
(1) Turn on the appropriate Harmonic Markers as shown in Table 3.1.
(2) Adjust the Variable Bandividth control so that the RF is swept between the markers indicated in Table 3. 2.
(3) Adjust the Variable Bandividth and Center Frequency controls so as to place the sweep limit markers exactly on the scope extreme left and right hand graticules, see Figure 3.2.
(4) The mid frequency marker should now fall within $0.5 \mathrm{C} 1 \mathrm{I}(5 \mathrm{c})$ of the center graticule.
(5) Check linearity at frequencies indicated in Table 3.2.



FIGURE 3.1 LINEARITY TEST SET-UP

TABLE 3.1 HARMONIC MARKER USED FOR LINEARITY CIECKS

| BAND <br> (MHz) | HARMONIC MARKER <br> (MHz) |
| :---: | :---: |
| $.05-10$ | 1 MHz |
| $1-300$ |  |
| $255-510$ |  |
| $340-680$ | 10 MHz |
| $450-900$ |  |
| $600-1200$ | 10 MHz |
|  | 100 MHz |

TABLE 3.1 HARMONIC NIARKER USED FOR LINEARFTY CHECKS

| BAND <br> $(\mathrm{MHz})$ | HARMONIC MARKER <br> $(\mathrm{MHz})$ |
| :---: | :---: |
| $.05-10$ | 1 MHz |
| $1-300$ | 10 MHz |
| $255-510$ |  |
| $340-680$ | 10 MHz |
| $450-900$ | 100 MHz |
| $600-1200$ |  |
|  |  |

TABLE 3.2

| BAND | $\begin{aligned} & \text { CENTI } \\ & \text { FREQ } \\ & \text { (MHZ) } \end{aligned}$ | SWEE P RANGE |
| :---: | :---: | :---: |
| . $05-10 \mathrm{MHz}$ |  |  |
| . $05-10 \mathrm{MHz}$ | 5 | 'zero beat' \& 2 MHz |
| . $05-10 \mathrm{MHz}$ | 9 | 4 and 6 MHz |
| $1-300 \mathrm{MHz}$ | 30 | 8 \& 10 MHz |
| $1-300 \mathrm{MHz}$ | 150 | 'zero beat' \& 60 MHz |
| $1-300 \mathrm{MHz}$ | 270 | 120 \& 180 MHz |
| $255-510 \mathrm{MHz}$ | 280 | 240 \& 300 MHz |
| $255-510 \mathrm{MHz}$ | 380 | 260 \& 300 MHz |
| $255-510 \mathrm{MHz}$ | 490 | 360 \& 400 MHz |
| $340-680 \mathrm{MHz}$ | 370 | $470 \& 510 \mathrm{MHz}$ |
| $340-680 \mathrm{MHzz}$ | 510 | $340 \& 400 \mathrm{MiHz}$ |
| $340-680 \mathrm{MHz}$ | 650 | 480 \& 540 Miliz |
| $450-900 \mathrm{MIHz}$ | 490 | 620 \& 680 MHz |
| 450-900. MHz | 680 | 450 \& 530 Mmz |
| 450-900 MHz | 860 | 640 \& 720 Mmz |
| 600-1-010 MILz | 700 | 820 \& 900 AlHz |
| 600-1200 MHz | 900 | 600 \& 500 Sth |
| 600-1200 MH | 1100 |  |



TABLE 3.2

| BAND | CENTER <br> FREQUENCY <br> (MHZ) | SWEEP RANGE |
| :---: | :---: | :---: |
| . $05-10 \mathrm{MHz}$ | 1 | 'zero beat' \& 2 MHz |
| . $05-10 \mathrm{MHz}$ | 5 | - 4 and 6 MHz |
| . $05-10 \mathrm{MHz}$ | 9 | $8 \& 10 \mathrm{MHz}$ |
| $1-300 \mathrm{MHz}$ | 30 | 'zero beat' \& 60 MHz |
| $1-300 \mathrm{MHz}$ | 150 | 120 \& 180 MHz |
| $1-300 \mathrm{MHz}$ | 270 | 240 \& 300 MHz |
| $255-510 \mathrm{MHz}$ | 280 | 260 \& 300 MHz |
| 255-510. MHz | 380 | 360 \& 400 MHz |
| $255-510 \mathrm{MHz}$ | 490 | 470 \& 510 MHz |
| $340-680 \mathrm{MHz}$ | 370 | 340 \& 400 MHz |
| $340-680 \mathrm{MHz}$ | 510 | 480 \& 540 MHz |
| $340-680 \mathrm{MHz}$ | 650 | 620 \& 680 MHz |
| $450-900 \mathrm{MHz}$ | 490 | 450 \& 530 MHz |
| $450-900 \mathrm{MHz}$ | 680 | 640 \& 720 MHz |
| $450-900 \mathrm{MHz}$ | 860 | 820 \& 900 MHz |
| $600-1200 \mathrm{MHz}$ | 700 | 600 \& .800 MHz |
| $600-1200 \mathrm{MHz}$ | 900 | $800 \& 1000 \mathrm{MHz}$ |
| $600-1200 \mathrm{MHz}$ | 1100 | $1000 \& 1200 \mathrm{MHz}$ |

### 3.2.4 OUTPUT VOLTAGE AND OUTPUT VOLTAGE VARLATION

### 3.2.4.1 TEST CONDITIONS

(1) Bandwidth selector - WIDE.
(2) RF Level control to MAX.
(3) RF Attenuation switch set to 0 db .
(4) Sweep Rate switch to CW.

### 3.2.4.2 TEST PROCEDURE

(1) Set the Frequency Band selector and the Center Frequency control so as to obtain the frequency to be measured at the RF OUT jack.
(2) At the RF OUT jack measure the RMS RF voltage and see that it falls within the limits of the specifications at the frequencies given in Table 3.3.
(3) For frequencies below 10 MHz use an accurate RMS RF voltmeter; at 10 MHz and above use a power meter.

### 3.2.5 ATTENUATOR ACCURACY

### 3.2.5.1 TEST CONDITIONS

(1) Bandwidth selector WIDE.
(2) RF Level control - MAX.
(3) Sweep Rate selector to CW.

### 3.2.5.2 TEST PROCEDURE

The attenuator can be checked within the unit by the substitution method. The substituted attenuators must provide $\pm 0.2 \mathrm{db}$ or better accuracy over the frequency range irom. 05 to 1200 NLHz . A spectrum analyzer or any sensitive RF detector having a sensitivity of -70 DBM or better may is used. Proceeci as follows:
(1) Set RF Attenuator to 10 db and adjust spectrum analyzer for a measureable response.
(2) Set RF Attenuator to 0 db and substitute the external 10 db standard attenuator. Read the change in level from Step (1). The level should be within -1 db of Step (1).
(3) Kepeat steps 1 and 2 for attenuator values of $20,30,40,50,51$, and 70 db .
(4) The 1520 A should be checked at the following frequencies: $10,300,510$, 680, 900, and 1200 Mhez.

TABLE 3.3


## ' 3.2.6. SPURIOUS AND HARMONIC DISTORTION

### 3.2.6.1 TEST CONDITIONS

(1) Bandwidth selector - WDE.
(2) RF Level control - MLAX.
(3) Sweep Rate selector - CW.
(4), RF Attenuator - 10 db .

### 3.2.6.2 TEST PROCEDURE

(1) Connect a spectrum analyzer that covers the frequency range of .05 to 3600 MHz to the RF OUT connectors.
(2) At the frequency being tested, scan the entire spectrum of, 05 to 3600 MHz looking for harmonics and spurious responses. Harmonics and spurious are to be down equal to or greater than 30 and 20 db respectively.
(3) Be sure to identify all responses less than 30 db below the fundamental so

- spectrum analyzer generated images and spurious are not confused with the 1520 output.
(4) Check for harmonics and spurious at the fundamental frequencies given in Table 3.4.


### 3.2.7 SWEEP REPETITION FREQUENCY

3.2.7.1 Connect the HORIZ OUT jack to the vertical input of the scope.
3.2.7.2 Set the Sweep Rate to $6-60 \mathrm{~Hz}$ range.
3.2.7.3 Using the scope as a reference, and by adjusting the Variable control, see that the sweep rate varies between 6 and 60 Hz or greater.
3.2.7.4 Check the $0.5-6 \mathrm{~Hz}$ range as above.
3.2.7.5 Set the scope to line synchronization and see that the Line Triggered range is synchronized to the line frequency (no drift on the scope) at a 60 Hz rate.

### 3.2.8 HORIZONTAL DEFLECTION VOITAGE

With tie 1520 connected as in Sention 3.2.7, check the amplitude of the sweep voltage and see that it is greater than 5 V peak-to-peak on the $0.5-6,6-60$, and Line Triggered ranges.

TABLE 3.4


### 3.2.9 DETECTOR OPERATION

### 3.2.9.1 FLATNESS

A. Test Conditions
(1) Bandwidth selector - WIDE .
(2) Variable Bandwidth - fully clockwise.
(3) RF Level control - MAX.
(4) Center Frequency control -. 5 MHz (will now be centered for all bands).
(5) Sweep Rate selector to $0.5-6 \mathrm{~Hz}$, Variable - completely clockwise.
(6) RF Attenuator - 10 db .
(7) Vertical Blanking - ON.
(8) Scope vertical channel to $0.1 \mathrm{v} / \mathrm{cm}$ sensitivity.
B. Test Procedure
(1) Connect the equipment as shown in Figure 3.3
(2) Use an attenuator which has $\pm 0.2 \mathrm{db}$ flatness, or better, in any of the six bands.
(3) For optimum results it is best to connect the attenuator directly to the RF OUT jack of 1520 at one end and directly to the detector at the other end.

(4) Starting with the 600 MHz to 1200 MHz band, sweep the entire frequency range using markers to ascertain that the frequency response measured is within the band limits.
(5) Adjust the Vertical Gain control for a reasonable scope presentation.
(6) Switch in 1 db of attenuation in the added attenuator and note the change in level corresponding to the 1 db change. Check to see if the unattenuated variations are within the 1 db limit ( +0.5 db ).
(7) Repeat this procedure on all other bands.
(8) On the . $05-10 \mathrm{MHz}$ band, the bandwidth should be reduced when checking the detector in the . 05 MHz to 1 MHz region. Also the Low Frequency Detector Adaptor should be used below 1 MHz . The Variable Marker may be used for frequency identification.

### 3.2.9.2 VSWR

A. Initial Conditions
(1) Same as 3.2.9.1 (Flatness).
(2) Use a VSWR bridge at the RF OUT jack of the 1520. Refer to manufacturer's manual for this test procedure.
B. Test Procedure

Sweep all six bands and see that the detector VSIVR is less than or equal to $1.3: 1$ for . $05-900 \mathrm{MHz}$ and $1.4: 1$ for $900-100 \mathrm{MHz}$ ranges.

### 3.2.10 MARKER INPUT OPERATION

### 3.2.10.1 INITIAL CONDITIONS

Same as section 3.2.9A except Sweep Rate to be $6-60 \mathrm{~Hz}$ range, and bandwidth to be set to 100 MHz in $1-300 \mathrm{MHz}$ range.

### 3.2.10.2 TEST PROCEDURE

(1) Connect the equipment as in Figure 3.1.
(2) Connect a 20 mv level signal to the EXT MARKERS input jack, at the frequency to be measured.
(3) Adjust the External Marker Size control and see that a marker of at least. 03 volts peak-to-peak is ohtained.
(4) Check at 0.1 and 10 MHz on the $.05-10 \mathrm{MHz}$ band and at 1 and 100 MHz on the $1-300 \mathrm{Mritz}$ band.
(5) It will be necessary to reduce the Bandwidth so the . 05 and 1 MHz marker may be seen properly. The low frequency detector adaptor (981A) should be used for this check.

### 3.2.11 INTERNAL MARKER CAPABILITY

### 3.2.11.1 CRYSTAL HARMONIC MARKERS

A. Accuracy
(1) Remove top cover of the instrument.
(2) Locate the unused BNC connector (T Pl) on the harmonic marker module in the center of the instrument.
(3) Connect a cable between the connector (TPl) and a frequency counter capable of reading 1,10 , and 100 MHz to $\pm .001 \%$ ( 10 PPM ) accuracy.
(4) Turn the Harmonic Marker switch to 1 MHz and read the frequency. on the counter. The marker accuracy should be $\pm .005 \%$ or better. Refer to Table 3.5 for specifications.
(5) Repeat for the 10 and 100 MHz markers.

- B. Minimum Amplitude
(1) Initial Conditions
a. Bandwidth selector - WIDE.
b. Variable Bandwidth fully clockwise (initial).
c. RF Level control - MAX.
d. RF Attenuator - 10 db .
e. Vertical Blanking - ON.
f. Sweep Rate selector - 6-60 Hz Variable fully clockwise.
g. Counter - OFF.
h. Harmonic Markers - OFF.
i. Harmonic Marker Size - completely CCW.
j. Scope Vertical Channel - $0.1 \mathrm{v} / \mathrm{cm}$ sensitivity.
(2) Test Procedure
a. Turn on the 1 MHz Harmonic Markers.
b. Adjust Harmonic Marker Size for a 0.1 voll peak-to-peak or more marker.
c. Adjust Bandwidth control for approximately one CMI between markers.
d. Turn Cenier Frequency control (if necessary) so that the marker height over the whole band is checked. A $U .1 \mathrm{~V}$ pp marker should be obtainable.)
e. Check all siz bands.
f. Repeat for 10 and 100 MIIz markers on all applicable bands. (100 atha markers wre to be checked at iull bancividth.)

TABLE 3.2.11.1

| CRYSTAL HARMONIC MARKER SPECIFICATIONS |  |  |  |
| :---: | :---: | :---: | :---: |
| FREQUENCY <br> (FUNDAMENTAL <br> OSCILLATOR) <br> (MHz) | ACCURACY (MHz) |  |  |
| LIMITS $\pm .005 \%-50$ PPM) |  |  |  |
|  | LOW | HIGH | SPEC |
|  | 0.999950 | 1.000050 | 0.1 |
| 100 | 9.999500 | 10.000500 | $\because$ |

TABLE 3.2.11.2

| VARIABLE MARKER SPECIFICATIONS |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| BAND <br> (MHz) | FREQUENCY (MHz) | COUNTER <br> DISPLAY <br> SWITCH | ACCURACY (MHz) LIMITS ( $+.02 \%$ ) |  |  |
| . 05-10 |  | KHz <br> CENTER <br> MHz | $\begin{array}{\|l\|} \hline \text { LOW } \\ 0.399300 \end{array}$ | HIGH1.000200 | S.PEC |
|  | 1 |  |  |  | 0.1 V |
|  | 10 |  | 9. 3933000 | 10.002000 | " |
| 1-300 | 50 | CENTER <br> MHz | 49.900000 | 50.010000 | " |
|  | 100 | $\begin{aligned} & \text { CENTER } \\ & \mathrm{MHz} \end{aligned}$ | 99. 9830000 | 100.020000 | " |

### 3.2.11.2 VARIABLE MARKER

A. Initial Conditions
(1) Bandwidth selector - NARROW.
(2) Sweep Rate selector - CW.
(3) RF Level control - MAX.
(4) RF Attenuator -0 db .
(5) Counter - ON.
(6) Connect freouency Counter capable of reading from . 05 to 100 NHHz with $\pm .005 \%$ accuracy to the RF OUT jack.
(7) Terminate $50 \Omega$ RF cable at counter input with $50 \Omega$ if the counter input is a high impedance.
B. Test Procedure
(1) Switch to the . 05-10 MHz band and compare the frequency on the Variable Marker counter with that read on the external frequency counter.
(2) Check the Variable Marker counter at 1 and 10 MHz by adjusting the Narrow Sweep Centering control.
(3) Repeat for the $1-300$ NHz band and check at 50 and 100 NHz .
(4) The limits and Counter Display switch settings are grven in Taile 3. 8.
(5) Set Sweep Rate selector to 6-60 Hz range.
(6) Set upequipment as in Figure I,
(7) Set scope to $0.1 \mathrm{v} / \mathrm{cm}$ sensitivity.
(8) Set counter display to right hand $7[H z$ position.
(9) Adjust the Variable Mariner Position and Variable Marlier Size controls for a marker and see that a marker of greater amplituid than 0.1 V is ortained.
(10) Chech both the $0.5=10 \mathrm{MHHz}$ and the $1-300 \mathrm{MHz}$ bands.

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## SECTION I

## PRELIMINARY INFORMATION

## I.I INTRODUCTION

This manual provides the necessary information for the maintenance and alignment of the Kay Elemetrics Model 1520 Sweep Generator. A functional description and block diagram are included in this section. These, in conjunction with the waveshape and schematic drawings, should prove helpful in troubleshooting the unit. It is suggested that the Check-out Procedure, in the Operator's Manual, be performed as a prerequisite to any maintenance action. This will also help in ascertaining whether the out-of-specification indication or inoperative condition is caused by a component breakdown or by misalignment.

Any assistance required in maintenance or part procurement should be requested from Kay Elemetrics Corp. Pine Brook, New Jersey.

### 1.2 FUNCTIONAL DESCRIPTION AND BLOCK DIAGRAM

### 1.2.1 . 05 to 1200 MHz Module

The . 05-1 200 MHz Module contains four octave sweeping oscillators, a Local Oscillator, a Mixer, a PIN Diode Leveler, an External. Marker Mixer and an ALC Detector. Microwave techniques, with the circuitry printed on a fiberglass teflon substrate, are used throughout this modulle.

The four varactortuned oscillators cover the 255 to 510,340 to 680, 450 to 900 and 600 to 1200 MHz frequency ranges. The RF level at the output of these oscillators is about 60 mw nominal, but variations of 3 DB are not uncommon for an octave bandwidth sweep.

The desired octave oscillator signal is selected by the PIN Diode switch. The signal then passes through the PIN Diode Leveling Attenuator, which is capable of about a 15 DB leveling range. The diodes are biased by the ALC AMPLIFIER so as to maintain a reasonable RF match at all levels of attenuation.

At this point the signal passes through a high frequency teflon swltch which selects for the output circuits, either the octave bands or the hetrodyned (.05 to 10 and 1 to 300 MHz ) bands.

Before leaving the module the RF signal is sampled by the Harmonlc Marker circuits, the External Marker Mixer and the ALC Detector. The External Marker Mixer mixes an external CW signal with the swept RF signal for the generation of an audio frequency "Birdie," which is amplified in the vertical channel amplifier. The ALC detector samples and detects the RF voltage. The detected voltage, being amplified in the ALC AMPL!FIER, is fed back to the PIN Diode Leveler for automatic level control purposes.

The ALC circuit keeps the RF voltage constant at the input to the $50 \Omega$ output resistor, thus producing a true $50 \Omega$ frequency source.

The 600 to 900 MHz frequency range of the 450 to 900 MHz oscillator is sampled and fed into the mixer. The 900 MHz Local Oscillator drives the doubly balanced mixer. The 900 MHz Local Oscillator drlves the mixer hard, so that the low level swept signal is c.learly chopped, thus, keeping distortion to a minimum.

The 1 to 300 MHz signal from the mixer is filtered and amplified externally (In the . 05 to 300 MHz amplifier*) and fed back to the teflon swltch of the . 05 to 1200 MHz MODULE. With the swiltch in the hetrodyned bands position, the RF slignal passe's through the output circults as is in the octave ranges.

## *NOTE

The . 05 to 300 MHz signal will pass into the AMPLIFIER only if the switch in the .05 to 10 MHz MODULE is correctly set. If it is set to the . 05 to 10 MHz position, the . 0510 MHz signal will pass through the output clrcults. For the hetrodyned bands, leveling is accomplished by means of an FET transistor in the . 05 to 300 MHz AMPLIF|ER.

## 1.2 .2 .05 to 10 MHz MODULE

The . 05 to 10 MHz Module contains a 40 MHz Local Oscillator, a 30 to 40 MHz Sweeping Osclllator, a doubly balanced Mixer, a filter network, and a switching reed relay.

The Oscillators utillze. low drift FET translstors, with a varactortuned Sweeping Oscillator. The Mixer is driven hard by the Local Oscillator, while the swept signal is kept low, to minimize distortion.

The filter, consisting of a 12 MHz lowpass elyptic function filter in series with a 34 MHz lowpass elyptlc function filter, must reject the Local. Oscillator and swept fundamental frequencles by more than 30 DB below the hetrodyned output since no filtering can occur in: the . 05 to 300 MHz AMPLIFIER.

A voltage actuated reed switch selects either the . 05 to 10 MHz or the 1 to 300 MHz signal (from the .05 to 1200 MHz MODULE) for the . 05 to 300 MHz AMPLIFIER.

### 1.2.3 300 MHz Lowpass Filter

The filter is of a stripline design with printed capacitive and inductive components.

## $1.2 .4 \quad .05-300 \mathrm{MHz} \mathrm{AMPLIFIER}$

The amplifler, being of a wide band design, uses emitter RF degeneration and peaking techniques. Collector current stabillzation transistors keep the current in the RF transistors constant. Since DC collector current stablllzation and emltter degeneration is provided, the amplifler gain is quite stable with respect to temperature changes and transistor variations.

A FET transistor leveling stage provides varlable attenuation from zero to greater than 20 DB. The FET transistor is driven from the ALC AMPLIFIER.

### 1.2.5. RF ATTENUATOR

The RF attenuator is of turret deslgn and uses precision $\pi$ pads.

### 1.2.6 HARMONIC MARKER MODULE

Switchable crystal controlled Oscillators at 1,10 and 100 MHz provide the driving slgnals for the step-recovery diode $D_{1}$.

The step-recovery diode produces a signal rlch in harmonlcs at frequencies of up to 1200 MHz and beyond. These harmonlcs are mixed with the sampled swept frequency in mixer diode $D_{2}$,
producing audio frequency birdies corresponding to every harmonic frequency contained in the sweep. The birdies are then amplified for display in the VERTICAL CHANNEL and Narrow Sweep board.

### 1.2.7 SWEEP BOARD

Referring to the Block Dlagram, the sweep waveform is generated in an integrating Operational. Amplifier. The Schmitt Trigger clrcult senses the amplltude of the sweep waveform and when it is large enough, its output changes state. The output of the Schmitt Trigger is fed back to the Operational Amplifier input VIA the SWEEP RATE control and the Sweep Hold circuit. The change in direction of the Schmitt Trigger output causes the capacitor to change direction of charge thus causing a ramp in the opposite direction.

The Sweep Hold circuit stops the capacitor from charging during the time the counter is counting the RF irequency. The Swaep Hold circuit is activated during counting by a pulse from the Variable Marker board.

## NOTE

At this point, reference should be made to the Sweep Board schematic.

In the LINE TRIGGERED Mode, the Line Trigger circult sampies the sweep voltage waveform and when the waveform reaches approximately +5 volts, a comparator changes state and sends a pulse to the Sweep Hold circuit. The sweep is held until a pulse synchronized to the $A C$ line frequency causes the Schmitt Trigger to change state. When the Schmitt Trigger changes state, a signal is fed to the comparator causing it to revert to its original state. This in turn releases the Sweep Ho!d circuit allowlng the sweep to continue through one complete cycle at the end of which the sweep is stoppoc and the sequence repeated.

The following are a few secondary but necessary sweep functions and features:

The Sweep Expand Diode circuit being switched in during LINE TRIGGERED operation would allow the sweep voltage waveform $E$ to rise higher than under non-line triggered operation. The voltage is not allowed to rise hlgher since it is stopped by the comparator and Sweep Stop clrcuits. The diode provides stopping stability by allowing a full level sweep voltage waveform with the Schmitt Trigger still not ready to change state. However, the line trigger pulse, when it arrives at the input, has sufficient energy to change the state of the Schmitt Trigger. The Line Trigger Enable Dlode circuit boosts the DC level of the line trigger pulse, only when the sweep is stopped, allowing the Schmltt Trigger to be triggered at this time only. The Line Trigger Enable Diode circuit is energized by the comparator.

The Sweep Ratio Dlode circuit causes the Schmitt Trigger output voltage to be non-symmetrical about ground. The rising and falling slopes of the sweep voltage waveform, thus, have different rates of change since the timing capacitor's rate of charge is changed.

Finally, it should be mentioned that the Field Effect translstor CA does the actual stopplng of the Timing capacitor's charging. Field Effect transistors 04 and $Q 5$ provide very low leakage during sweep hold operatlon.

The siveep voltage waveform, after passing through the BANDWIDTH control, is applisd to the input of the operational type linearity amplifier. A nonlinear network in the feedback loop gives the amplifier its desired output characteristic. Depending on the smept Osciliator's requilrements, the nonlinear linearity network will provide as much as a 50 to 1 slope variation, in the output weveform, over the output voltage range.

Individuai Linearity networks are used for each band. The pots lin these networks allow for precise shaping so as to match, almost perfectly, the Osclllator requirement's. The shaped output of the Linearity network is applled directly to the Oscillator varactor diodes under WIDE band operation.

### 1.2.9 Narrow Band Centering Newtork

During narrow band operation, the sweed voltage is applied to the Narrow Band Centering network instead of the Llnearity board. The output of the Narrow Band Centering network is applied directly to the varactors of the 0scillators. A maximum of about $l_{\%}^{\%}$ bandwidth is obtainable, but a greater degree of stabllity is achieved.

### 1.2.10 Voltage Comparator

Under NARROW band operation the CENTER FREQUENCY dial does not track the NARROW EAND CENTERING control and the Linearity board output is disconnected from the Oscillator varactors. However, the Linearity board output voltage stlll corresponds to the setting of the CENTER FREQUENCY dial. Then, as under * wideband conditions, if we set the Oscillator varactor voltage the same as the Linearlty board output voltage, then the output frequency will correspond to that read on the CENTER FREQUENCY dial. The Voltage comparator detects when the voltages are equal and, therefore, indicates that the output frequency Is the same as the CENTER FREQUENCY dial reading. The proper setting of the NARROW BAND CENTERING control is that. polnt where the crossover point between the two indicator lights is reached.

### 1.2.11 Variable Marker Board

The sweep voltage waveform from the 5 weep board is fed into the Marker Generator. The Marker Generator consists of two high-gain operational amplifiers in parallel but of opposite phase. Except.during the short interval for marker generation, the amplifiers are in saturation and the net output is zero.

A large amount of gain, during marker generation, allows the amplifiers to go from one state of saturation to the other very rapldy. Due to a slight offset in timing between the nonsaturated status of the operational amplifiers, the net output during marker generation ls not zero but is a triangular marker. Also essential in producing a symmetrical marker is the fact that one amplifier has twice the gain of the other.

In the Sweep and Counter Control Section, the voltage comparator samples a fast changing ramp voltage from the Marker Generator and initiates the sweep stop and Counter operation sequence at time $\dagger_{1}$ 。
. NOTE
The waveform as called out on the schematic of the Varlable Marker board may be helpful to the understanding of this section.

A oulse from the voltage comparator causes the 0 \& O output of A4-A flip-flop to change state at time $t_{1}$. The O outout goes to
a logic 0 and the O output to a logic I. The o output feeds the Sweep Stop clrcuit of the Sweep board stopping it during the logic o time. The o output controls the time-base AND gate, inhibiting the Counter's strobe pulses while 0 is in the 0 state. But at time $t_{1}$. When 0 goes to a logic 1, the AND gate will
feed strobe signals through an inverter to clock flip-flop A4-B. Flip-flop A4-B is set up for pare binary toggling and its 0 output is normally a logic 0 , prior to time $t_{1}$. At time $t_{2}$, the
first strobe pulse allowed through the AND gate falls to a logic 0 and clocks fllp-flop A4-B to its complementary state (after inversion to a logic 1 ).
$A t$ time $t_{3}$ a second strobe pulse falls to a logic o which
again complements filp-flop A4-Breturning it to its normal state. $A t t_{3} w i t h$ O output of flip-flop A4-B going to a logic 0 and driving the clock input of flip-flop A4-A, the o output of flip-flop A4-A is set to a logicl. The o output of flip-flop A4-B is also used to initiate the storage transfer within the counter at $t_{3}$, updating the readout to the frequency count just performed.

### 1.2.12 VERTICAL CHANNEL

In the VERTICAL CHANNEL the External, Harmonic, and Varlable markers and the vertical input (detector output) signals are combined and amplified. Before appearing at the VERTICAL OUT jack, the amplified signals are blanked when the VERTICAL BLANKING switch is turned on. An FET translstor is used for the jurpose of blanking. Before combing the Harmonlc and External marker, signals are preamplified.

## SECTION II

## ALIGNMENT PROCEDURE

## 2.1

INTRODUCTION
This section provides the information necessary for the performance of a complete alignment of the 1520 Sweep Generator. Should any difficulties be experienced in meeting the specifications, the troubleshooting guide in the Malntenance Section should be utilized and the discrepancy cleared before proceeding with the alignment.
2.2

TEST EQUIPMENT REQUIREMENTS
NOTE

> It is suggested that the test equlpment listing be closely adhered to and that any necessary substitution meet or exceed the accuracy specifications of substituted unlt.

| ITEM | MINIMUM PERFORMANCE SPECIFICATIONS | IDENTIFICATION |
| :---: | :---: | :---: |
| $\begin{aligned} & \text { D.C. Volt- } \\ & \text { meter } \end{aligned}$ | Range: $1 \mathrm{Mv}-\mathrm{KV}$. <br> Accuracy: $\pm 1 \%$ <br> Input Z: TMeg-OHM | $\begin{aligned} & \text { Millivac } \\ & \text { Instruments } \\ & \text { MV-778 } \end{aligned}$ |
| Power Meter | Power Range: 0.1 to 10 Mw Accuracy: $+1 \%$ | Hewlett-Packard 432 A or 431 C . |
| Thermistor Mount | $\text { VSWR: } \begin{aligned} & 1.75 \mathrm{Max} 10-30 \mathrm{MHz} \\ & 1.35 \mathrm{Max} 30-100 \mathrm{MHz} \\ & 1.1 \mathrm{Max} 0.1-1 \mathrm{GHz} \\ & 1.35 \mathrm{Max} 1-1.2 \mathrm{GHz} \end{aligned}$ <br> Limit of Error: $\pm 4 \%$ of affixed value <br> Type: Temperature compensated <br> Frequency range: 10 to 1200 MHz | Hewlett-Packard 84783 or 478 B . |


| 1 TEM | MINIMUM PERFORMANCE SPECIFICATIONS | IDENT IFICATION |
| :---: | :---: | :---: |
| RF Voltmeter | VSWR: 1.3 Max 50 ohm Frequency Range: . 05 to 50 MHz <br> Limit of Error: $+3 \%$ <br> Voltage Range: $\overline{0} .25$ to 1.25 VRMS | Hewlett-Packard $4 \mid 1 A$ |
| Oscllloscopes | Range: $\mathrm{DC}-300 \mathrm{KHz}$ Sensitivity: 10 Mv Horizontal external Input linearity: Less or equal to $2 \%$ | Tektronix 547 or Tektronic 545 with Type \|Al preamplifier. |
| Signal <br> Generators | Range: $1-300 \mathrm{MHz}$ <br> Accuracy: $\pm 1 \%$ <br> Output: $0 . \overline{0} 2$ to ©.l VRMS | * See Note |
|  | Range: $255-1200 \mathrm{MHz}$ <br> Accuracy: $+1 \%$ <br> Output: . $0 \overline{2}$ to 0.1 VRMS | *See Note |
| *NOTE |  |  |
| The recommended Signal Generator in both cases is the Kay Model I520A or equivalent. To calibrate to required accuracy, use the harmonic and variable (counter). marker systems. Locate the desired frequency birdie, reduce sweep width to zero while keeping the blrdie on the screen and swltch to CW operation. Below 100 MHz , read the frequency on the counter to . $02 \%$ accuracy. |  |  |
| Frequency Counter | Range: . 05 to 1200 MHz Accuracy: $\pm 0.001 \%$ ( 10 PPM) | Hewlett-Packard 5245L (Std.) with the 5253B and 5254C Converter. |
| Spectrum Analyzer | Frequency Response: $+2 \mathrm{db}$ <br> Range: . 05-3600 MHz | Hewlett-Packard 8553B/85528 in I4IS Display Section ( $1 \mathrm{KHz}-110 \mathrm{MHz}$ ) $8551 \mathrm{~B} / 851 \mathrm{~B}$ ( $10 \mathrm{MHz}-40 \mathrm{GHz}$ ) |

Oscilloscope Probe

Direct non-attenuating, shielded

Compatible with
oscilloscope
"In Shop" produced item. This can be made up with a 2-1/2 to 3 foot length of shielded cable. One end fitted \%ith a male connector, compatible with the oscilloscope vertical input connector. The other end should have approximately //2 inch of the center conductor exposed. The bared end of the center conductor should.be bent into a hook, to facilitate connectlon to test points.

### 2.3 ALIGNMENT PROCEDURE

2.3.1 RIPPLE CHECK

Set oscilloscope for imv/cm sensitivity. Set sweep time for $5 \mathrm{~ms} / \mathrm{cm}$. Scope should be A. C. coupled. Using the non-attenuating probe, check the ripple voltage at the following points: ( goard \# 12,616 )

Test Point
TP 5
TP 1
TP 4
TP 3
TP 2.

## Maximum Ripple

| 1.5 | mv | peak | to | peak |
| ---: | :---: | :---: | :---: | :---: |
| 1 | mv | $"$ | $" 1$ | $"$ |
| 2 mv | $" 1$ | $"$ | $" 1$ |  |
| 2.5 | mv | $" 1$ | $"$ | $" 1$ |
| 1 | mv | $"$ | $"$ | $"$ |

### 2.3.2 POWER SUPPLY VOLTAGE

## NOTE

Any adjustment of the power supply voltages will necessitate the recalibration of the complete Instrument. Therefore, it is best to leave the supplies slone, especially if the voltage is within 5\% of the desired voltage.
2.3.2.1 Using the D. C. voltmeter check and/or adjust the following voltages:

## NOTE

The P. C. Externder Board should be inserted between the "Mother" board (\#|2,6|6) and the board under test.

| Board | Voltage | Adjust |
| :---: | :---: | :---: |
| 12072 | +15VDC | R3 |
| " | +90VDC | R! |
| " | -15VDC | R2 |
| 12073 | $+5 \mathrm{VDC}$ | RI |
| " | -30VDC | R2 |

### 2.3.3 ALC BOARD $(12,015)$

2.3.3.1 INITIAL CONDITIONS
A. Insert board extender between board and unit.
B. Set CENTER FREQUENCY control to 5 MHz on the .05 to $10 M H z$ Band (Do not Not move the CENTER FREQUENCY control during the performance of this procedures.)
C. Set SWEEP RATE control to CW.
D. Set all Board controls to midrange.
2.3.3.2 PROCEDURE . 05 TO $10 \mathrm{MHZ} \& 1$ TO 300 MHZ BANDS
A. Set RF ATTENUATION to O DB.
B. Set RF. LEVEL to MAX (fully clockwise).
C. Set FREQUENCY BAND to 1 to 300 MHz .
D. Place power meter on RF OUT jack.
E. Set O.5VRMS ADJ (R3I) to obtain 5 mw on power meter.
2.3.3.3 PROCEDURE 255 TO 510, 340 TO 680, 450 TO 900 , 600 TO 1200 MHZ BANDS
A. Set RF ATTENUATION to 10 DB.
B. Set FREQUENCY BAND to 450 to 900 MHz .
C. By use òf a clip lead, short Tp-l (test point) to ground.
D. Adjust the SERIES LEVEL control (RI8) for $0.4 V$ at TP-3.
E. By use of an external power supply, place 10 volts on TP-I.
F. The voltage on TP-j should be 0.90. If it is too high adjust the SERIES SENSITIVITY control (R22) counterclockwise somewhat. If too low adjust R22 clockwise.
G. Repeat $C$ through $F$ untll no further adjustments are necessary.
H. Short TP-l with the clip lead and adjust the SHUNT LEVEL control (R28) for +4.5 volts on TP-2.

1. Remove short on TP-1.
J. Connect power meter to RF OUT Jack.
K. Adjust IVRMS ADJ (R32) for $2 m w$ reading on the power meter ( 20 mw RF output before attenuation).
L. Calibration completed, remove board extender and reinsert board.

### 2.3.4 DIVIDE-BY-TEN BOARD (11,678)

2.3.4.1 INITIAL CONDITIONS
A. CENTER FREQUENCY control to 100 MHz .
B. FREQUENCY•BAND (MHz) switch to I to 300 MHz .
C. SWEEP RATE control to CW.
D. RF ATTENUATION to IO DB.
E. BANDWIDTH control to WIDE.
F. COUNTER switch to ON.

### 2.3.4.2 CALIBRATION PROCESS

A. Check that the decimal point appears to the right of the center digit of the counter.
8. Set RंF LEVEL control fully clockwise.
C. Using a power meter on the RF OUT jack as an indicator, by means of the RF LEVEL control reduce the output power by 10 DB.
D. Adjust the TRIG LEVEL adjust (R3) until a steady reading is observed on the counter. Rock R2 and set to the center of the steady counter reading pot area. If the -l0DB RF output operation is not obtainable at 30 MHz and above see Secflon.
E. Throw in 20 DB of RF ATTENUATION for isolation and see that the counter reads properly from 1 to 103 MHz .
F. Set RF LEVEL fully clockwise and check for proper counter reading from 1 to 103 MHz .

## 2.3 .5 LINEARITY BOARD $(12,070)$

## NOTE

```
Make Ilnearlty board adjustments only after the
oscillators are properly calibrated. See
appropriate calibration process. All cabinet
panels should be left on the unit except the
panel that covers the LINEARITY BOARD. The unit
must be turned on for an half hour prior to this
procedure, thus allowing for temperature vari-
ations. Calibration should be achieved to
wlthin one half of the specified accuracy. When
progressing from band to band, a period of ten
minutes should be allowed for stabllization.
```

2.3.5.1 INITIAL CONDITIONS
A. Set CALIBRATE screw driver control to vertical positon.
B. Set CENTER FREQUENCY to center of dial.
C. BANDWIDTH switch to WIDE.
D. BANDWIDTH - VARIABLE control fully counterclockwise.
E. SWEEP RATE - switch to 6 to 60, VARIABLE fully clockwise.
F. RF LEVEL - MAX.
G. RF ATTENUATION - IO DB.
H. VERTICAL BLANKING - ON.

1. COUNTER - OFF.
J. VARIABLE MARKER SIZE - completely counterclockwise.
K. Set all SHAPING ADJ pots to maximum resistance (fully clockwise.
L. Set all LAST KNEE, FIRST KNEE, POSITION and SENSITIVITY controls to midrange.
M. Connect the equipment as in Figure 2. . . .
2.3.5.2 CALIBRATION PROCESS

## NOTE

The Linearity Board (Board $\# 12,070$ ) circultry ls set up in six vertical rows, each corresponding to a particular frequency band, and running consecutively from Band \#l (0.5-10MHz) at the left to Band \#6 (600-| 200 MHz ) at the right. The test points deslgnated "TP-A" are situated at the tops of their respective rows, these designated "TP-B" are at the bottoms.
A. Set the FIRST KNEE adjust for zero voltage at the TP-A for the band undergoing alignment. (l. e. Band \#| (.05-|0MHz) R32, TP-Al, Band \#2 (|-300MHz), R34, TP-A2 etc.) See Table , In the case oi complete alignment proceed from Band 31 thru Band \#6 setting all approximate FIRST KNEE adjusts for zero at their respectlve test points.
B. Set the LAST KNEE adjusts for 4.35 volts at the approximate TP-E's. See Table
C. Repeat Steps $A$ and $B$, if necessary.
D. Set the FIRST KNEE adjusts for maximum position voltage at the TP-A's. (fully counterclockwise)
E. Using 10 MHz HARMONIC MARKERS (IMHz markers on .05 to 10 MHz band), adjust the VARIABLE BANOWIDTH and the CENTER FREQUENCY CONTROLS for an expanded birdie which covers most of the horizontal scope display.

F. Turn the VARIABLE BANDWIDTH control completely clockwise while observing the birdie. If necessary position the scope's horizontal display so that the birdie fall exactly on the center vertical graticule.

## NOTE

The SWEEP RATE should be reduced slightly during this and the following calibration so as to reduce the birdie "ring."
G. Octave ranges (255 to 510, 340 to 680,450 to 900 , 600 to 1200 MHz )
I. Set CENTER FREQUENCY control so that the lowest specifled frequency in band is observed on the scope.
2. Set BANDWJDTH - VARIABLE control so as to set the first 10 MHz excursion in the band to cover exactly two horizontal scope divisions. (An external marker may be used to locate the beginning of the band.). See Figure 2.2.
3. Set CENTER FREQUENCY dial to the beginnlng of the band frequency. Set the POSITION ADJ (int) so that the beginning of the band marker is positioned on the center vertical graticule. See Figure 2.2.
4. Determine the linear portion of the sweep. It will usually be no more than 10 or 20 MHz wide starting from the lowest frequency in the band. See Figure 2.2.
5. Select the highest frequency birdie in the llnear region of the swept RF (work at 5 MHz intervals by using the small 5 MHz sub-harmonics). See Figure 2.2.
6. Set the CENTER FREQUENCY dial to the frequency of the birdle selected in the previous step.
7. Set the SENSITIVITY ADJ (int) pot (R233) to place the selected birdie exactly on the center vertical scope graticule. See Figure 2.3.
8. Return the CENTER FREOUENCY dial to the low end of the band and repeat Steps $3,5,7$, and 8 if necessary.


Figure 2.2
A. Larger external marker denotes beginning of band.
B. First 10 MHz excursion $\ln$ band covers exactly two divisions.
C. . Beginning of band marker is positioned exactly on center graticule.
D. Linear portion of sweep starting from beginning of band marker.
E. Highest frequency birdie. In the linear region of sweep ( 5 MHz sub-harmonic here).
F. Birdie in non-linear region shown away from its proper graticule line.


Figure 2.3
A. Highest frequency birdie in the linear region centered on center vertical graticule.
B. Linear region . lomHz birdies fall on every other vertical graticule lines.
C. Linear region.
D. Beginning of band birdie.
9. Adjust BANDWIDTH so that in the linear region 10 MHz birdies will fall on every other vertical graticule line when the CENTER FREQUENCY control is properly set. See Figure 2.3.
10. Set CENTER FREQUENCY dial to the frequency of the highest frequency linear region birdie (the birdie should now be at the scope's center graticule line as shown in Figure 2.3.)
11. Set the lowest frequency SHAPING ADJ (RI32, RI62, R192, or R222) to midrange.
12. Adjust the FIRST KNEE adjust (int) so that the highest frequency linear region birdie (see Figure 2.3) just misses being pulled by the shaplng network. See Figure 2.4.
13. Set the lowest frequency SHAPING ADJ (RI32, RI62, R192, or R222) so that the next two higher frequency 10 MHz birdies fall on their respective alternate graticule lines. It may be necessary to compromise this control. with the FI:ST KNEE ADJUST control. See Figure 2.4.
14. Set the CENTER FREQUENCY dial to the frequency of the next higher loMHz blrdie (after the highest frequency linear region birdie) and adjust the lowest frequency SHAPING ADJ to center the birdie if necessary. See Figure 2.5.
15. Continue up in frequency in lomhz intervalls as in Step 10 untll the next higher SHAPING ADJ begins to have affect ltest by turning the SHAPING ADJ pot). See Flgure 2.5.
16. Quickly check the dial accuracy in 10 MHz intervals back to the starting frequency. Compromise the settings of the lowest frequency SHAPING ADJ and LOWER KNEE AOJ if necessary, Return to where left off in step 15.
17. Continue up in frequency as in Step it but use the next higher frequency SHAPING ADJ untll the next SHAPING ADJ starts to have effect. Again compromise and give a quick recheck of the lower frequencies.
18. Continue as in step 17 until completed.


Figure 2.4
A. Hlghest frequency Ilnear reglon birdie just misses being puilao by shaping network.
B. Next two higher frequency 10 MHz birdies set on their respective llnes by SHAPING ADJ.
C. Llnear non-shaped region.
D. Beginning of band birdie.


Flgure 2.5
A. Highest frequency non-shaped linear region birdie.
B. Next higher 10 MHz birdie on vertical graticule.
C. $10 M H z$ interval birdies.
H. Hetrodyned Ranges (.05 to 10 MHz and 1 to zoOMHz)
I. Set CENTER FREOUEilCY control so that the highest specified frequency in band is observed on the scope.
2. Set BANDWIDTH - VARIABLE control so as to set the last lomHz excursion in the band to cover exactly two horizontal scope divisions. (An external marker may be used to locate the end of the band.j See Figure 2.6.

## NOTE

For the . 05 to 10 MHz band divide the. frequency as glven in this procedure by 10 (i. e. 5, 10 , and 20 become 0.5 , 1 , and 2 , respectively).
3. Set CENTER FREQUENCY dial to the end of band frequency. Set the POSITION ADJ (int) so that the end of the bant marker is positioned on the center vertical graticule. See Figure 2.6.
4. Determine the linear portion $\therefore$ f the sweep. it is usually no mire than lo or 20 MHz wide starting down from the highest frequency in the band. See Figure 2.6.
5. Select the lowest frequency birdle in the linear region of the swept RF. (Work at 5 MHz intervals by using the small 5 MHz sub-harmonlcs.) See Figure 2.6 .
6. Set the CENTER FREQUENCY dial to the frequency of the birdie selected in the previous step.
7. Set the SENSITIVITY ADJ (int) pot to place the selected birdie exactly on the center vertical scope graticule. See Figure 2.7.
8. Return the CENTER FREQUENCY dial to the high end of the band and repeat Steps $3,6,7$, and 8 , if necessary.
9. Adjust BANDWIDTH so that in the linear region lOMHz birdies will fall on every other vertical gratlcule line when the CENTER FREQUENCY control is properly set. See Figure 2.7 .
10. Set CENTER FREQUENCY dial to the freq…en=y ot the lowest frecuency i inear rejion birdi $\because$ (the oiraia should now be at the scope's center gra-icule line as shoun in Figure 2.7.


Figure 2.6
A. Larger external marker denotes end of band.
5. Last 10 MHz excursion in band covers exactly two divisions.
C. End of band marker is positioned exactly on center graticule.
D. Linear portion of sweep starting down from end of band marker.
E. Lowest frequency blrdie in the linear region of the sweep
( 5 MHz sub-harmonic here).
F.. Birdie in non-linear region shown away from its proper graticule Iine.


Figure 2.7
A. Lowest frequency birdie in the linear region centered on center vertical graticule.
B. Linear region 10 MHz blrdies fall on every other vertical graticule line.
C. Linear region.
D. End of band birdie.
II. Set the highest frequency SHAPING ADJ (R63 or R93) to midrange.
12. Adjust the FIRST KNEE ADJ (int) so that the lowest irequency linear region birdie (see Figure 2.7) just misses being fulled by the shaping netiorks. See Figure 2.8.
13. Set the highest frequency SHAPING ADJ (R63 or R93) so that the next two lower frequency 10 MHz birdies fall on their respective alternate graticule lines. It may be nscessary to compromise this control with the FIRST KNEE ADJ (int) control. See Flgure 2.8 .
14. Set the CENTER FREQUENCY dial to the frequency of the next lower loMHz birdie (after the lowest frequency linear reglon birdie) and adj st the highest frequency SHAPING ADu to center the birdle if necessary. See Figure 2.9.
15. Continue down in frequency in $10 M H z$ intervals as in Step 14 untll the next lower SHAPING ADJ beglns to have effect (test by turning the SHF:ING ADJ pot). Se Figure 2.9.
16. Quickly: check the dial accuracy in lOMHz intervals back to the starting frequency. Compromise the settings of the hlghest frequency SHAPING ADJ and FIRST KNEE ADJ if necessary. Return to where left off in Step 15.
17. Continue down in frequency as in Step 15 but use the next lower frequency SHAPING ADJ until the next SHAPING ADJ starts to have eifect. Again compromise and give a quick recheck of the upper frequencies.
18. Continue as in Step 17 until completed.
2.3.6 SWEEP BOARD ( 12,036 )
2.3.6.I INITIAL CONDITIONS
A. COUNTER switch is OFF.
B. SWEEP RATE $(H z)$ to 6 to 60 , VARIABLE control - fully clockwise.
C. VERTICAL BLANKING switch to UN.
D. Set board mounted pots as follows: R22 completely clockwise (shorted) and R26 to midrange.


Figure 2.8
A. Lowest frequency linear region birdie just misses being pulled by shaping network.
B. Next two lower frequency 10 MHz birdies set on their respective IInes by SHAPING ADJ.
C. Linear non-shaped region.
0. End of band birdie.


Figure 2.9
A. Lowest frequency non-shaped linear region birdie.
B. Next lowest loMHz birdie on vertical graticule.
C. IOMHz interval birdies.


FIGURE 2.10 TP-A WAVEFORM
TABLE 2.1 LINEARITY ADJUSTMENT CONTROLS


| BAND | POSITION ADJUST $\cdots$ | SENSITIVITY ADJUST |
| :---: | :---: | :---: |
| $\# 1$ | R224 | R225 |
| $\# 2$ | R228 | R229 |
| $\# 4$ | R232 | R233 |
| $\# 5$ | R236 | R237 |
| $\# 6$ | R244 | $\mathrm{R241}$ |

E. Connect the HORIZONTAL OUT jack to the vertical oscilloscope input.
F. Set the scope's VERT gain to $2 \mathrm{v} / \mathrm{cm}$ sensitivity.
G. Set the scope's INTERNAL SWEEP RATE to $5 \mathrm{~ms} / \mathrm{cm}$.

### 2.3.6.2 CALIBRATION PROCESS

A. Note the sweep voltage waveform on the scope. Its amplltude should be between 8 and $12 \mathrm{~V} p-\mathrm{p}$ and its mean voltage should be within $\pm 0.75$ volt of true zero. Its ratio should be between 2.5:I and 3.5:1 rise to full time.
B. Using the scope as a reference, vary the VARIABLE SWEEP RATE control and see that the sweep voltage perlod varies between 167 ms and 16.6 ms ( 6 to 60 Hz ) or wider.
C. Change the SWEEP RATE switch to 0.5 to 6 Hz and as in Step 8 see that the period is varlable between 2 sec and 167 ms or wider.
D. Set COUNTER switch to ON and SWEEP RATE to CW, see that the sweep voltage period on pin 7 is between. 0.5 and 0.26 seconds.
E. Set COUNTER switch OFF, change the SWEEP RATE switch to 6 to 60 Hz , VARIABLE fully clockwise and observe the sweep voltage again at the HORIZ OUT Jack.
F. Change SWEEP RATE switch to LINE LOCK and note the change in amplitude of the positive going excursion. Adjust the LINE=TRIGGERED SWEEP STOP ADJ R26 so that the flat top occurs at the same amplitude as the positive peak of the 6 to 60 Hz range of Step $E$.
G. Working with a 60 Hz line frequency, adjust the LINE TRIGGER SWEEP TIME ADJ R22 so that a 4 ms flat occurs on the positive peak of the sweep voltage. waveform.
H. Throw COUNTER to ON. Yary COARSE - VARIABLE MAPKEP POSITION control and observe that a flat sten moves up and down the complete excursion of sweed voltage waveform.
2.3.7 VARIABLE MARKER BOARD $(12,037)$
A. FREOUENCY BAND to .05 to 10 MHz .
B. CENTER FREQUENCY to 5 MHz .
C. BANDWIDTH to HIDE, VARIABLE fully clockwlse.
D. SWEEP RATE switch to 6 to 60, VARIABLE about $75 \%$ of full clockwise, until flicker just stops.
E. VERTICAL PLANKING - ON.
F. P.F LEVEL - fully clockwise.
G. RF ATTENUATION - IO DB.
H. YERTICAL GAIN - Mid range.

1. COUNTER - OFF.
J. HARMONIC MARKER - OFF.
K. MARKER SIZE controls: HARMONIC and EXTERNAL - comaletely counterclockwise; VAR|ABLE - mld range.
2. VAPIABLE MARKER POSITION - mid range,
M. Use extender card with the board (12,037).
N. Set both the COUNT POINT ADJ R5 and the SHAPE ADJ R25 trimmers to midrange.
2.3.7.2. CALIBRATION PROCESS
A. Probe test point TP-A while sweeplng the scooe horizontal channel with the 1520 HORIZ OUT signal.
B. Set the SHAPE control R25 for a waveform that is symmetrical about zero voltage as shown in Figure 2. 10.
C. Set up the equipment as in Figure 4.5.1 with the vertical scope sensitivity setat $0.1 \mathrm{~V} / \mathrm{cm}$.
D. Adjust the YERTICAL GAIN for about 4 cm of detected RF disolay.
E. Adjust the VARIARLE - MARKER SIZE control for about 3 cm of marker amplitude.
F. SMitch COUNTER ON.
G. Set the COUNT POINT ADJ, R5 (int) so that the bright dot falls exactly on the marker peak.
H. By means of the VARIABLE MARKER POSITION - COARSE control, vary the marker from the left end to the right end of the sweep and see that the marker shape and dot position remain constant.
3. Throw on the I MHz HARMONIC MARKERS and read the center of each marker and see that a proper count Is obtained on the counter.
2.3.8 VERTICAL CHANNEL \& NARROW SWEEP BOARD (I 2035)
2.3.8.I INITIAL CONDITIONS
A. FREQUENCY BAND to 600 to 1200 MHz .
B. RF ATTENUATION to 10 DB .
C. RF LEVEL - fully clockwise.
D. VARIABLE BANDWIDTH - fully clockwise.
E. VARIABLE SWEEP RATE - fully clockwise.
F. VERTICAL BLANKING to ON.
G. VERTICAL GAIN - midrange.
H. COUNTER to OFF.
2.3.8.2 CALIBRATION PROCESS
A. Narrow Sweep Comparator Circult
4. Set CENTER FREQUENCY to $\mid 200 \mathrm{MHz}$.
5. Set BANDWIDTH. to NARROW.
6. Set SWEEP RATE to CW.
7. Measure the voltage on TP I ( 55 to 80 V ) and adjust the NARROW BAND CENTERING control (F.P.) for the same voltage on TP 2.
8. By means of a clip-lead short together TP 1 and TP 2.
9. Adjust the BALANCE control RI to the exact crossover polnt of the NARROW BAND CENTERING indicator lamps.
10. Disconnect the short.
11. Set up the equipment as in. Figure 2.1.
12. Set the SWEEP RATE to 6 to 60 Hz .
13. Set VERTICAL GAIN for a 4 cm detected response.
14. Set the CENTER FREQUENCY to $900 \mathrm{MH} z$ and BANDWIDTH to WIDE.
15. Turn on the 100 MHz HARMONIC MARKERS and adjust the HARMONIC MARKER SIZE for about $2 \mathrm{~cm} p-\mathrm{p}$ marker.
16. Reduce the bandwidth to near zero while keeping the 900 MHz marker centered. Return to full bandwldth.
17. Switch to NARROW BANDWIDTH and the 900 MHz marker should be centerable within t turn of the NARFOW BAND CENTERING CONTROL. I $\ddagger$ This is not possible, recheck the BALANCE adjustment made in Step 5.
B. Vertical. Channel Clrcuits
I. Set CENTER FREQUENCY to 900 MHz , BANDWIDTH to WIDE, and SWEEP RATE to 6 to 60 Hz .
18. Set up the equipment as in Figure 2.1.
19. Turn on 1 MHz HARMONIC MARKERS and reduce the bandwidth that one cm spacing is obtalned between markers.
20. Turn the HARMONIC SIZE control fully clockwise and check that the birdies are at least 0.l $V$ peak-to-peak ( 1 cm ). Change CENTER FREQUENCY and check the complete band.
21. Set FREQUENCY BAND to 1 to 300 MHz , CENTER FREQUENCY to 50 MHz and BANDHIDTH to sweep from 1 to 100 MHz .
22. Turn off HARMONIC MARKERS and turn completely counterclockwise the HARMONIC MARKER SIZE control.
23. Connect a 20 mv (into 50 ohms) slgnal between 10 and 90 MHz to an EXTERNAL MARKERS input jack and turn the EXTERNAL MARKERS SIVE control completelyc.lockwise. (20 mv = 1VRMS - 34 db )
24. Check to see that at least a. C3 volt peak-topeak marker is obtained.
25. Check the other EXTERNAL MARKERS input jack as in the previous step.

### 2.3.10 PF ATTENUATOR (9272)

NOTE

No alignment required. See Section 3.2.5 in The Operator's Manual for a check-out procedure. See Section 3.5 in this manual for maintenance procedures.
2.3.11 PLUG-IN DETECTOR ( 12147 )

NOTE

No allgnament required. See Section 3.2.9 in the Operator's Manual for a check-out procedure.
2.3.12 AMPLIFIER, .05 to $300 \mathrm{MHz}(12 \mid 90)$

NOTE

Amplifier adjustments should onlv be made if adequate RF output level is not obtainable on the 1 to 300 MHz range, or $1 f$ there is excessive waveform distortion on the 1 to 300 MHz range.
2.3.12.1 INITIAL CONDITIONS
A. Set FREOUENCY BAND to 1 to 300 MHz and CENTER FREQUENCY to 150 MHz .
B. BANDWIDTH to WIDE.
C. SWEEP RATE switch to 60 to 60, YARIABLE - fully clockwise.
D. VErtical blanking - on.
E. RF LEVEL - fully clockwlse.
F. RF ATTENUATION - 10 DB.
E. COUNTER - OFF.
H. HARMONIC MARKERS $\div 0-100 \mathrm{MHz}$, HARMCNIC MARKER SIZE - midrange.

1. MARKER SIZE - EXTERNAL \& VARIABLE - fully counterclockwise.
J. Connect the equipment as in Figure 2.1.

### 2.3.12.2 CALIBRATION PROCESS

A. Adjust the VERTICAL GAIN control (FP) for about 4 cm scope display.
B. Ascertain that the RF output is a full 0.5 V RMS before attenuation (See Section 2.3.3) and note the scope level. The RF output level is adequate if 0.5 V RMS is obtained over the full 1 to 300 MHz range. If RF output level is adequate do not proceed unless there is excessive distortion (See Step D).
C. If the RF level IO MHz and below is adequate, proceed as follows:

1. Turn off the POWER and disconnect the wire from egress 3 (C42 feedthru capacitor) on the . 05 to 300 MHz module.
2. By means of an external power supply, apply from 0 to $\pm 4$ volts on the feedthru capacltor. Turn on the 1520 power and adjust the external power supply so that the detected RF is somewhat below the 0.5 V level at 10 MHz (See Step B).
3. Obtain the flatest posslble trace by adjusting trimmers LI, L6, and L8.
4. Slowly increase the external supply voltage until a maximum level is obtained without any portions of the display reversing direction and beginning to fall.
5. For adequate ALC action the minimum level should be greater than 0.55 V RMS. (See step.B).
6. Reconnect wire.
D. If the 30 DB distortion spec is met below 10 MHz but not at some frequencles above 10 MHz , proceed as follows: (RF LEVEL fully clockwise).
7. Switch to $C W$ and use spectrum analyzer to observe the worst case distortion.
8. Adjust LI, L6, and $L 8$ and see if the distortion is reasonably affected. If it is, adjust LI, L6, and L8 to minimize distortion. Check Section $B$ to see if 0.5 V RMS output level is still obtained. Compromise steps $C$ and $D$ if necessary.
E. If the 10 DB dovin counter operation is not obtalned at 30 MHz and above, proceed as follows:
9. Set up as in Section 2.3.4.2C.
10. Adjust Lli in the amplifier to maximize the sensitlvity. Start by setting the RF LEVEL control at the lowest level at which the counter. will work over the whole frequency range from 1 to 100 MHz .
11. Continue to reduce the RF level until the least sensitlve frequency fails to operate the counter. Work between LII and R3 (of the Divide-By-10 board) so as to obtain adequate sensitivity. Check the full frequency range at 10 DB down level.

### 2.3.13 HARMONIC MARKER MODULE ( 12161 )

2.3.13.1 Connect a cable between connector TP-1 and a frequency counter capable of reading 1,10 , and 100 MHz to $\pm .001 \%$ ( 10 PPM) or better accuracy.
2.3.13.2 Turn the HARMONIC MARKER switch to 1 MHz and tune LI for best accuracy and stable operation as read. on the external counter. The accuracy should be $\pm .005 \%$ or better.
2.3.13.3 Repeat 2.3 .13 .1 and 2.3.13.2 for the 10 and 100 MHz markers using L2 and lj respectively for tuning.
2.3 .14 MODULE, .05 to 10 MHz (12049)
2.3.14.1 INITIAL CONDITIGNS
A. Set up the equipment as In Figure 2.1.
e. Set CENTER FREQUENCY to 150 MHz and FREQUENCY BAND to 1 to 300 MHz .
C. BANDWIDTH to HIDE, VARIABLE fully clockwise.
O. SWEEP RATE to CH, YARIAELE fully clocinise.
E. VERTICAL BLANKING- ON.
F. . RF LEVEL - fully clockwise.
G. RF ATTENUATION - 10 DB.
H. HARMONIC MARKERS to 100 MHz .
I. MARKER SIZE: HARMONIC - midrange, EXTERNAL \& VARIABLE - completely counterclockwlse..
J. COUNTER - OFF.
K. CALIBRATION CONTROL - screwdriver slot set to vertical position.
2.3.1.4.2 ASCERTAINING THE NECESSITY OF CALIBRATION

NOTE

Adjustment of either C6, ClO, or R4 will necessitate the recallbration of the . 05 to 10 MHz circuit on the LIINEARITY EOARD. Do not adjust the controls unless absolutely necessary.

A: Adjust VERTICAL GAIN for a reasonable (about 4 cm ) scope presentation.
B. Ascertain that there is a full 0.5 V RMS output on the 1 to 300 MHz range at 150 MHz (See Section 2.3.3.2).

NOTE
Power is measured on the 1 to 300 MHz band at 1.50 MHz since most Power Meters are inaccurate at 10 MHz and below. Since the RF DETECTOR remalns flat at 150 MHz and below, one can switch from the 1 to 300 MHz band to the . 05 to 10 MHz band and use the RF DETECTOR as an RF level reference.
C. Swltch to . 05 to 10 MHz band using I MHz harmonlc markers. If the detected level remains constant with no holes across the band, the ALC is holding and RF level is adequate. R4 should be adjusted only if the RF level is not adequate on the . 05 to 10 MHz band.
D. After $1 / 2$ hour warmup on the .05 to 10 MHz band with all cabinet panels left on the unit, check d!al accuracy in $\mid \mathrm{MHz}$ increments as follows:
E. Switch to CW operation and measure the frequency on the counter. If accuracy is within $\pm 100 \mathrm{KHz}$, do not adjust C6, ClO, or R4. If dial äccuracy is out of specification, proceed as follows:
F. Switch again to 6 to 60 Hz SWEEP RATE. with COUNTER - ON $\qquad$
G. Set VARIABLE MARKER position so that the counter reads 0 MHz . If O MHz is unobtainable, crank the CEETER FREQUENCY lower until 0 MHz is read on the counter. The bright dot seen on the scope trace is at. 0 MHz .
H. Examine egress 1 (feedthru capacitor C|4) of the .05 to 10 MHz module with the vertical channel of the oscilloscope. The bright dot seen corresponds to the $0 . \mathrm{MHz}$ tuning voltage. This voltage should be between 52 and 62 volts. If the voltage is within specifications, stop here and proceed with. the appropriate Ilnearlty adjustments of Section 2.3.5.2. If not, proceed with the calibration process.

### 2.3.14.3 CALIBRATION PROCESS

A. Remove :05 to 10 MHz MODULE cover.
B. Whilg sweeping, adjust CENTER FREQUENCY so that the zaro frequency beat is visible.
C. Loose!y couple, by means of a loop, a $40 \mathrm{MHz} \pm 0.5 \mathrm{MHz}$ signal into the mixer area and turn fully clockwise the EXTERNAL MARKER SIZE control. Adjust slightly C6 and note extra birdies (moving) generated by the external 40 MHz signal.
D. Adjust C6 (using non-metallic.tool) so that these extra blrdies move into the zero beat anc dlsappear. The local oscillator is now set to 40 MHz . Remove the external 40 MHz probe.
E. Probe egress $\mid(C \mid 4)$ and display the swept voltage on the oscllloscope.
F. With the COUNTER GN adjust the VARIABLE MARKER position so that the bright dot occurs at 57 volts on the sweep voltage.
G. Adjust Clo (Using non-metalllc tool) so that the counter reads 0 细z.
H. Check 2.3.14.2 A and $C$ and ascertain that the RF level is adequate. If not, decraase the value of R4 until adequate power is obtrained.

## NOTE

Too much power may cause distortion at .05 MHz and excessive locking in the zero beat region, therefore, do not reduce R4 more than necessary.
I. Proceed with the appropriate linearlty adjustments (Section 2.3.5.2).
2.3 .15 MODULE, . O5-1200 MHz (12192).
2.3.15.1 ASCERTAINING THE NECESSITY OF ALIGNMENT

## NOTE

Any adjustment made to this module wlll necessltate the calibration of the appropriate LINEARITY BOARD networks. Do not make adjustments unless absolutely necessary, as explalned below.
A. If the dlal frequency accuracy specifications are met (See Operator's Manual, Section 3.2.3.i for procedure), no adjustments are necessary in this module.
B. If the dial is out of calibration, most likely the appropriate LINEARITY BOARD circuits need to be reset.
C. Before resetting tine LINEARITY BOARD, probe the varactor bias voltage as in Section 2.3.15.3 A to E. Ascertaln that the lowest specified frequency of the band corresponds to a voltage greater than zero, and that the highest speciflad frequency of the band corresponds to a voltage less than 70. If these conditions are not met, proceed with the procedure.

NOTE
On the I to 300 MHz band, I MHz should correspond to a voltage of 70 or lower and 300 MHz to a voltage of 5 or higher.
2.3.15.2 INITIAL CONDITIONS

Same as Section 2.3.14.1 except set FREQUENCY BAND to desired range.

### 2.3.15.3 CALIBRATION PROCESS

A. Probe the varactor tuning voltage on any one of the four varactor circuit feed-thrus (egress point 8, 9, 10 , or 11 ) and display the approximately 0 to 80 y swing on the osci!loscope. (DC coupled.)
B. To determine the frequency vs voltage characteristics, turn the VERTICAL GAIN control fully counterclockwise and couple the VERTICAL OUT signal by means of a .05 fd capacitor to the scope vertical channel. (Remain coupled as in Step A above.) (A differentia! input scope or a dual channel scope using the "add" function may be used.)
C. Adjust the HARMONIC MARKER SIZE control so as to produce birdies of reasonable size. The varactor tuning voltage wlll now have the frequency marker. birdies superimposed upon it.
D. Locate the lowest speclfied frequency of the band, using the 10 MHz harmonic markers if necessary, (an accurately known external marker is useful as a referencel and see that it corresponds to zero volts or. greater. Increase the galn of the scope to be sure it. is not a negative voltage.
E. Locate the highest speclfied frequency of the band and see that $1 t$ corresponds to 70 V or less.

## NOTE

On the 1 to 300 MHz band, 1 MHz should correspond to a voltage of 70 or lower and 300 MHz to a voltage of 5 or higher.
F. If the conditions of 4.15.3.4 and 4.15.3.5 are not met, take the cover off the oscillator section and proceed as follows:
G. On any of the four octave ranges, the tank coll (L5, Lil, LI7, L23) inductance must be adjusted to change frequency. To raise the frequency, spread the coil sllghtly in a symmetrical (about blas tap) manner. To lower the frequency, squeeze the coll turns slightly in a symmetrical way. With the 600 to 1200 MHz oscillator, the loop must be unsoldered and shortened (to raise frequency) or lengthened (to lower frequency) in symmetrical way.
H. On the 1 to 300 MHz range, loosely couple by means of a loop a $900 \pm 5 \mathrm{MHz}$ signal into the mixer area and turn fully cTockwise the EXTERNAL MARKER SIZE control. Adjust sllghtly C 27 of the 900 MHz local oscillator so that the extra birdies generated move into the zero beat and dlsappear. If no birdies are noted at first, C27 may be perfectly set or coupling too loose or external oscillator power too low.
I. The conditions of 2.3.15.3 D and E should now be met if the 450 to 900 MHz oscillator was set properly in 2.3.15.3 G.

## SECTION III

## MAINTENANCE

## $3 \therefore$ INTRODUCTION

This section provides the information necessary for the servicing of the Model 1520 Sweep Generator.
it is advised that the Check-Out Procedure (Operator's Manual) and the Alignment Procedure (Maintenance Manual Section |l) be performed as a prerequisite to any action taken under this section. What is, seemingly, a component failure may in reality be an out-of-alignment condition or an error in the test hook-up.

### 3.2 VISUAL INSPECTION

The 1520 Swept Frequency Generator should be visually inspected on a regular basls. The cabinent panels should be removed and the unit checked for loose boards, fittings, wires, connectors etc. This check should also be performed after any sort of harsh transport.

### 3.3 COMPONENT REPLACEMENT

Some of the solid-state components used may be damaged when subjected to intense heat, avoid overneating when soldering the leads of these components. Longnose pliers may be used as a heat slnk between the component and the tip of the soldering iron. Tine soldering iron should be hot before touching the solder joint, and removed immediately after the solder flows. The tip of the iron should be electrically at ground potential so that semiconductor components having low. voltage ratings will not be damaged. The unit should be OFF with the line power disconnected.

Any replacement and or repair performed in the Micro strip circuitry of the 1520 should be done with a silver bearing solder. Two grades used in the production of the unit are as follows:

1. "Kestor" --
$62.5 \%$ Tin
35.1 Lead
$1.4 \%$ Silver
"44" Resin

## 2. "Kestor" --

61.5\% Tin
35.5\% Lead
3.0\% Silver
"44" Resin

Circuit and component placement are very critical and all replacements should be made In a manner that duplicates the original positioning. Particular attention should be pald to lead lengths, coils and proximity to grounded areas.

The Parts Listing in Section 3.7 should be utilized in conjunction with the Schematics in 3.6 to insure that the correct, exact, replacement part is used.

### 3.4 TROUBLESHOOTING GUIDE

This section contains information for the localization of unit malfunctions. The Check-Out Procedure in the Operator's Manual and the Alignment Procedure in Section ll, of this manual, should be performed before any repair action. Certain abnormalities can be compensated for, by utilizing the adjustments called for $i n$. These procedures.

The guide nas been set up with references to approprlate sections of the text, these sections, the repair actlon(s) to be taken.

SYMBOL CODE: Operator's Manual = OP.

$$
\text { Maintenance Manual }=\text { M. }
$$

Dlal Frequency accuracy outside of spectifled - 11 mits .

1. RF LEVEL control not fully clockwise loctave ranges only.d
2. Signal generator working into a high YSWR load (octave ranges only.)
3. Power supply voltages wrong or have been altered.
4. Linearlty circultry has aged or the pots have been moved.
5. Oscillator circultry has aged or the colls have been moved.
6. Defective or poorly odjusted pin diode leveling eireult.

Frequency less stable than specifled |lmits.

1. Equipment Overheating
2. Less than $1 / 2$ hour warm-up perlod.
3. Poor Power Supply regulation. adjust Oscillator coil.
4. Repalr and/or recallbrate.'M-2.3.15
5. Provide adequate
6. Observe $1 / 2$ hour warm-up requirements.
7. (a) Ascertaln IIne voltage is within 103.5 to 126.5 YRMS limits.
(b) Check Power supply M-2.3.1 Regulation and A.C. ripple.
8. Check components and solder conrections in oselliator module, on LInearlty Board (wide Band problems) and In the Narrow-Band elreuits.
9. Unstable Center Frequency NOTE: Ascertaining whether the Instability is on only one or on - all bands should determine whether the control pot or its related clrcultry is at foult.
10. Correct

0p-2.4.7
2. Use a precision 50 ohm termination or isolate the load by swltcining 10 or 20 o8 of output attenuation.
3. Check Power Supply M-2.3.2 voltages.
4. Recalibrate Llnearity M-2.3.5

Board cireuits.

5: Adjust Llnearity Board $\quad$ M-2.3.5 clrcuits or if necessary

$$
0-2.2 .2
$$

15

## MALFUNCTION

## POSSIBLE CAUSE

CORRECTIVE ACTION
SEE SECTION

Linearity out of specifled limits.

Maximum RF'Level
and flatness
are out of' specifled $\mid 1 \mathrm{mits}$.

1. Poor Osclllloscope
. IInearity.
2. See "Dia! Frequency
Accuracy" this Section.
I. At RF LEVEL control not tully clockwlse.
3. Improper termination at RF. voltmeter.
4. Poor RF Cables used.
5. ALC CIrcults have aged or are improperly adjusted.
6. AlC detectors not flat.
7. ALC detector damaged.
8. Internal connectors loose:
9. RF Attenuator defective.
10. Improper cobling and terminations used in test hookup.
11. Loose cabling in unlt.
12. Contacts of attenuator Intermittant.
13. Damaged attenustor reslstor.
I. Use Oscllloscope with $\pm 2 \%$ or better horlzontal Ilnearity.
14. See nolal frequency Accuracy", this Section.
15. Set control fully clockyise.
16. If meter has a hlgh Impedance input use a preclsion 50 ohm termination at the meter Input.
17. Use short low V'sWR cables and connectors.
18. Adjust ALC potentiometer.
19. If there is trouble only at the higher frequencles, adjust
the copper tab across the resistor Ris at the ALC detector Input. pushling the fab closer to the resistor wlll lower the high trequency end. If there is an overall non-flatness replace diodes OlO and DIl oi the ALC detector. (.05-1200MHz module.)
20. Replace damaged compenents.
21. Tighten connectors.
22. Repalr RF Attenuator.
23. Uso low VSWR cables, connectors and terminations.
24. Tighten all connectors.
25. Inspect attenuator contects and repairs and/or repair it nocessary.
26. Locate and replace M-3.5 defectjve resistors.

M-3. 5
M-2.3.3

M-3. 3

$M-3.5$

MALFUNCTION
POSSIBLE CAUSES
CORRECTIVE RCTION
SEE SECTIO:A $\%$ stde of spocifled llmits.

Spurious and Harmonic distortion outside of
ree impedance speclfled $|l m| t s$.
A. Generial
B. . $05-10 \mathrm{MHz}$ band only

1. Local Osclllator power
low (Q1 of . 05-10.MHz modules.
2. Hixer defective
(.05-300::Hz)

Amplifler.
C. Both $\begin{aligned} & \text {. } 05-10 \mathrm{MHz}\end{aligned}$
and
1-300MHz
1: Defective . 05-300MHz
D. $1-300 \mathrm{MHz}$ band only.
E. Al!

255-1200
MHz
bands.

1. Attenuator and Cable problems.
2. Poor AlC action.
3. 50 ohm output resistor
(R44 of .05-1200:! Hz module) damaged.
4. RF LEVEL control not set to maximum clockwlse positicn.
5. Higher than spectifled RF output obtalned.
6. Improper power supply voltages.
7. Defective ALC detector.
. Defective Mixer
8. Defective Local Osclllator.

1: ALC Board clrcuits Improperly adjustod.
2. PIN diode modulator defective $(A n$. C5-1 2 COR. Hz module).

1. Defective Oscllletor.
F. Speciflc bano botween 255 and 1200 MHz nolv.
2. See "Attenuator Accuracy", (Thls Section)
3. See "Maximum RF Level and Flatness". (Thls section)
4. Check and replace if necessary.
5. Set PF LEVEL control to maximim clockwise position.
6. Adjust ALC board potentlometer R3I and R32 where necessary.
7. Check and adjust only if necessary.
8. Replace diodes.
9. Examine. Oscillator and mixer sections and replace components as necessary.
10. See preceeding number.
11. If distortion is refused rapld!y when RF LEVEL is reduced, check the translstor stages after the FET leveling transistor. (Q3) If distortion is unaffected by the RF LEVEL setting ctieck the tronsistor stages before the FET leveling translator Q3.
12. Examine Oscillator and and mixer sections and replace components as necessary.
13. Sce preceeding number.
14. Adjust R18, R22, and 828.
15. Examine, repair, or replace compenents as necossary. Tien adjust R18, R22 and R28 on the ALC Boarg.
16. Inspoct, repair. and

M-2.3.3

M-2.3.3 \& 3.3

M-2.3.153 3.5
OP-2.4.7

M-2.3.2

M-2.3.14
$M-2.3 .12$

M-2.3.15.3H

M-2.3.3

M-2.3.3
replace components as. nocessary.

Sweep rates do not cover specifled range.

1. Dofective range swltch S4.
2. Sweep Board clrcuits out of callbration.
3. Defective components in Sweep clrciult.
4. Repalr or replace.
5. Cellbrate the clrcults.

M-2.3.6
3. Check and repalr as necessary.

1. Defective Sweep circult.
2. Defectlve Sweep Output Driver Amplifler A3 of Sweep Board.
I. BANDWIDTH selector set to NARROW.
3. Interconnections between

Pin 19 of the sweep
Board and Pin 7 of the Llnearlty Board defectlve.

1. Instrument covers loose.
2. Loose Internal connectors.
3. RF modules have loose covers or broken or missing gaskets.
4. Screws on the dial or counter window loose or gasketting defective.
5. Loose screws in general
6. Uncapped EXTERNAL MARKERS Jacks.
7. Seo "Detector.Flatness", thls Section. outside of spectited $||m| t s$.

Detector has little or no output.

1. Dlode damaged.
2. Remove and replace.

M-3. 3

The lnput to the detector should be limited to 20min maximum. Also statle discharge should be ovolde'f.

Detector.Filatness tside of peclfled |lmits.

1. Improper cabies or connectors used.
2. Type $N$ Coninector damaged.
3. Terminatlng Resistor damaged.

External Markers fall to meet speciflcatilons.

Internal Harmonic Markers fall to meat specificatlons.
4. Diode damaged.

1. Improper input levels.
2. Internal connectors.
3. Marker Amplifier defective.
4. Marker Mixer defective.
5. Crystal oscillator
6. Step Recovery or Mixer diode defective.
7. Harmonlc Marker Amplifler
B. Frequency out of tolerance.
8. Crystal Osclilator dztuned.
9. Defective crystal.
I. Use short low VSWR cables and connectors.
10. Repalr or replace.
11. Check that. resistance of RI is between 52.4 and 53.6 ohms. To chack remove the Type $N$ connector by loosening the set screw. Rl will be found soldered to the connector pin. Rl should be measured Wlthout unsoldering. If RI is to be replaced the leadiength should bo adjusted for maximum YSWR (Note the leadlangth and position of the orlginal RI.d
12. Remove as above and replace.
13. Use proper input.levels.
14. Tighten all interna! connectors.
15. Examine, repalr, and replace components on Board 1.2035 and assoclated circuits as necessary.
16. Examlne, repalr and replace components as necessary in Marker Mixer sectlon of .05I200MHz module.
17. Tune the approprlate Harmonle Marker osclilators coil. (Harafonlc Marker Module)
2.. Replace dlode DI or diode 02 of the Harmonie Marker Module.
18. Examine, repair, and replace comporients as necessary In the

- Harmonic Marker Amplifler Section of Board 12035.

1. Tune the appropriate Harmonle Marker osclllator coll. (Harmonlc Marker module)
2. Replace crystal and
retune oscllilatir coll.

M-2.3.13
M-2.3.13
$M-2.3 .13$
$M-2.3 .13$

M-2.3.13

| ALFUNCTION | POSSIBLE CAUSES | CORRECTIVE ACTION | SEE SECTION |
| :---: | :---: | :---: | :---: |
| Varlable Marker falls to meet specifications. | 1. R25 1mproperly adjusted. | 1. Adjust R25 of Board 12037. | M-2.3.7 |
| A. Level <br> Inadequate but counter operates properly. | 2. Ql circuit of Board 12037 or A2 clrcult of Board 12035 defective. | 2. Replace defective components. | M-2.3.783.3. |
| .B. Level Inadequate and counter operates Improperly. | 1. A5 and AS clrcult of Board 12037 defective. | 1. Replace defectlve components. | M-2.3.7 \& 3.3 |
|  | . | . . |  |
| C. Bright dot on marker Swhen counter operation is displaced trom the marker peak. | 1. R5 improperly set on Board 12087. | 1. Adjust R5. | M-2.3.7 |
|  | 1. Sweep width too great. <br> 2. Bright dot not at peak of the marker. | 1. Reduce sweep width to proper values. <br> 2. AdJust R5 of Board 12037. | OP-2.4.13 $M-2.3 .7^{\circ}$ |
|  | 3. Counter timebase reference Oscillator detunad. | 3. AdJust Ci5 of Board 12076. | M-2.3.9 |

BOTTC.. VIEW

FRONT
figure 3:Ta MODULE AND P.C.bOARD LOCATíon

### 3.5 ATTENUATOR MAINTENANCE

Because of simplicity in design, Rotary Attenuator should require little or no maintenance. If, however, it is determined that repair is necessary, extreme care should be taken in the removal and insertion of. switch assembly. A schematic is provided in Section 3.6.

1. Remove attenuator from 1520 by disconnecting connecting cables, front panel knob and mounting nut.
2. Remove (4) \#4-40 binding head screws holding TNC connectors in place and remove connectors. Care must be taken to prevent damage to wiper contracts.
3. Remove (3) \#2-56 round head screws from front edge of housing.
4. Remove switch assembly by pulling forward, belng careful that inner finger material does not catch on connector holes.
5. Examine switch assembly, and reslstors for defects and repair accordingly. Components must be positioned exactly as orginally.
6. Reverse steps 1 thru 5 to reinstall attenuator.

NOTE

Before switch assembly is replaced in housing observe that the first area CW from the $O$ DB step (stralght through) has been beveled for the installation of connectors. Connectors must be installed with these beveled areas up.

## PARTS LIST

## 1520 SWEPT FREQUENCY GENERATOR

FINAL ASSEMBLY \#| 2250
Pane! Assembly \#l2244
Indicator Drive Assembly \#|2240W
Narrow Band Circuit Assembly \#l2241W
Attenuator Assembly \#8212-50
Detector \#12237W
Cable Assemb|y (13) \#12757
Adaptor Model 981A \#12150W
Main Frame Assembly \#| 2249 (Mechanical)
Chassis Assembly \#| 2243
Module, Power Supply Assembly \#l2858W
Mother Power Supply Board Assembly \#12616W
P. C. Board (Less Wired) \#| 2616

Power Supply P. C. Board Assembly \#12072-3W
P. C. Board (Less Wired) \#12072-3

Power Supply Regulator P. C. Board Assembly \#| 2073 W
P. C. Board (Less Wired) \#| 2073

Module, Line Filler Assembly \#| 2247 W
Module, . 05-300 MHz \#12l90W
P. C. Board Assembly \#|2332AW
P. C. Board (Less Wired) \#l2332
P. C. Board Assembly \#| 2333 BW
P. C. Board (Less Wired) \#|2333B

Module, .05-10 MHz \#12049W
P. C. Board (Less Wired) \#|2049B

Module, . $05-1200 \mathrm{MHz} \#|2| 92 \mathrm{~W}$
P. C. Board (Less Wired) \#|2090B
P. C. Board (Less Wired) \#| 2038 B
P. C. Board (Less Wired) \#| $2334 E$
P. C. Board (Less Wired) \#|2355C
P. C. Board (Less Wired) \#| 2336 C
P. C. Board (Less Wired) \#| 2702 A

Module, L. P. Filter Assembly 300 MHz \#| 2248 W
P. C. Board \#2, Circuit \# 12081
P. C. Board \#3, Dielectric \#12080

Harmonic Marker Circuit \#|2l6|W

## ATTENUATOR 60-0 Cat. No. 435-A

Dwg.
Symbol No.
Description
(All resistors are $\frac{1}{4}$ watt, $1 \%$ tolerance)
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
-R20
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30

863
5.81

863
436.1
11.62
436.1

292
17. 63

292
221
23. 85

221
178.4
30.43
178.4

150
37.4

150
131
44.8

131
116
52.8

116
105
61.5

105
96.15
71.17
96.15

Comnector (TNC), 8011-1

Kay
Part No.

6558-189
6558-124
6553-189
6558-186
6558-131
6558-186
6558-101
6558-102
6558-101
6558-181
6558-152
6558-181
6558-176
6558-133
6558-176
6558-5.9
6558-58
6558-91
6558-172
6558-136
6558-172
6558-169
6558-142
.6558-169
6558-165
6ร558-143
6558-165
6558-99
6558-100
6558-99
J1 \& J2
All resistors are MEPCO Type C10

## 1520 SWEPT FREQUENCY GENERATOR

```
    P. C. Board Assembly #|3768W
    P. C. Board (Less Wired) #\3768
P. C. Board Assembly, Divide by l0 #|l678W
    P. C. Board (Less WIred) #||678
P. C. Board Assembly, Linearity #12070#
    P. C. Board.(Less Wired) #l2070
P. C. Board Assembly, Sweep Generator #l2036W
    P. C. Board (Less Wired) #l2036
P. C. Board Assembly, ALC #l2015W
    P. C. Board (Less Wired) #l2015
P. C. Board Assembly, Varlable Marker #12037W
    P. C. Board (Less Wired) #|2037
P. C. Board Assembly, Vertical Channel #|2035y
    P. C. Board (Less iNired) #12035
```


## NOTE

```
Units with serial number l-2 through l-76 ultilize asterlsk entrles.
For units with serlal number \(2-1\) and above disregard Asterlsk (*) entries.
```


## PARTS LIST

## 1520 SWEPT FREQUENCY GENERATOR

Frequency Counter Assembly \#12076W
P. C. Board Assembly \#| 2076 CW
P. C. Board (Less WIred) \#12076C
P. C. Board Assembly, Divide by 10 \#ll 678 W
P. C. Board (Less Wired) \#1|678
P. C. Board Assembly, Linearlty \#12070W
P. C. Board (Less Wired) \#12070
P. C. Board Assembly, Sweep Generator \#12036W
P. C. Board (Less Wired) \#|2036
P. C. Board Assembly, ALC \#| 2015 W
P. C. Board (Less Wired) \#|2015
P. C. Board Assembly, Varlable Marker \#|2037W
P. C. Board (Less Wired) \#| 2037
P. C. Board Assembly, Vertical Channel \#l2035W P. C. Board (Less Wired) \#|2035

## 1520 SWEPT FREQUENCY GENERATOR <br> SCHEMATICS

1/17/77

## TITLE

MAIN SCHEMATIC ..... D12,193G
DIVIDE BY 10 BOARD SCHEMATIC ..... B13828B
IINEARITY BOARD SCHEMATIC ..... D12,070D
FREQUENCY COUNTER SCHEMATIC ..... Cl3768B
POWER SUPPLY SCHEMATIC ..... D12,071H
.05-300 MHZ MODULLE SCHEMATIC ..... D12,190E
HARMONIC MARKER CIRCUITS SCHEMATIC ..... C12,161E
VARIABLE MARKER SCHEMATIC ..... C12,037C
.O5-1200 MHZ MODULE SCHEMATIC ..... D12,192E
SWEEP BOARD SCHEMATIC ..... C12, 036E
ALC BOARD SCHEMATIC ..... C12,015D
.05-10 MHZ MODULE SCHEMATIC ..... C12, 049C
VERTICAL CHANNEL AND NARROW SWEEP BOARD ..... C12,035D
RF DETECTOR SCHEMATIC ..... A12237-2A
300 MHZ LP FILTER SCHEMATIC ..... B1.2078A
0-70DB ROTARY ATTENUATOR MODEL 436B SCHEMATIC ..... B9272B
BLOCK DIAGRAM ..... Cl2618B
LOF FREQUENCY ADAPTER SCHEMATIC ..... A12150-2A
HAVEFORMS ..... D12610B

## SWEPT FREQUENCY GENERATOR MODEL 1520 A <br> ATTENUATOR ASSEM8LY \#8212-50, DRAWING \#B9272日

| Dwa. Sym. No. | O+y. | Description | Kay Part No. | Manufacturer and Part No. |
| :---: | :---: | :---: | :---: | :---: |
| R23 |  | 443 ohms | 6558-95 | Mepco Type HFIO-443 |
| R24 |  | Same as R22 |  |  |
| R25 |  | Same as R22 |  |  |
| R26 |  | Same as R23 |  |  |
| R27 |  | Same as R22 |  |  |
| R28 |  | 53.3 ohms | 6558-93 | Mepco Type HFIO-53.3 |
| R29 |  | 790 ohms | 6558-96 | Mepco Type HF10-790 |
| R30 |  | Same as R28 |  |  |
| R31 |  | Same as R28 |  |  |
| R32 |  | Same as R29 |  |  |
| R33 |  | Same as R28 |  |  |
| R34 |  | 51.8 ohms, 1/4W | 6588-287 | Mepco Type HFIO-51.8 |
| R35 |  | 1407.1 ohms, 1/4W | 6558-195 | Mepco Type HF10-1407.1 |
| R36 |  | Same as R34 |  |  |
| R37 |  | Same as R34 |  |  |
| R38 |  | Same as R35 |  |  |
| R39 |  | Same as R34 |  |  |
| R40 |  | Same as RI |  |  |
| R41 |  | Same as R2 |  |  |
| R42 |  | Same as RI |  |  |

Dwg. Sym. No. Qty.

CAPACITORS:
Cl
DIODES:
01
CONNECTORS:
JI
J
COILS:
LI
RESISTORS:

RI
R2
R3

SWEPT FREQUENCY GENERATOR MODEL I520A
DETECTOR, 50 OHMS \#|2237W, DRAWING \#Al2237-2A

## Description

Kay Part No.
Manufacturer and Part No.

000pf, 500v, feedthru

IN4|68, Crystal
6357-103

$$
\text { UG } 185 / U, \bmod 1+1 e d
$$

UG 680/U

Special $3 / 8^{\prime \prime}$ lead of RI
|2237A-L|
KEC

53 ohms, $1 / 8 \mathrm{~W}, 1 \% \mathrm{Tol}$
47 K ohms, $1 / 4 \mathrm{~W}, 10 \%$ Tol
100 ohms, I/2W, 5\% TOI.
Mepco HF5-53
6558-298
4701 - C
A-8 C8470
A-E EBIOI।

SWEPT FREQUENCY GENERATOR MODEL IS2OA
NARROW BAND CIRCUIT ASSEMBLY $\# \mid 2241 W$, DRAWING $\$ D 12193 F$


| Owg. Sym. No. | Oty. | Descript.lon | Kay Part No. | Manufacturer and Part No. |
| :---: | :---: | :---: | :---: | :---: |
| CAPACITORS: |  |  |  |  |
| C4 |  | 30pf, 500v, Mica | 6359-58 | Elmenco DMI5-300 |
| LAMPS : |  |  |  |  |
| 17 |  | Lamp Assembly wlth Iamp Same as 17 | 12957 | Display Devices \#\| 70 SW01|WIC |
| CONNECTORS: |  |  |  |  |
| $\checkmark 2$ |  | UG 625/U | 6909-81 | Dage UG 625/U |
| 33 |  | Same as J2. |  |  |
| 」 24 |  | Same as ${ }^{\text {d }}$ |  |  |
| RESISTORS : |  |  |  |  |
| RI |  | 20K ohm, 2W, Pot. | 9122-37 | A-B JA2NO48S 203UE |
| R2 |  | look ohm, $1 / 2 \mathrm{~W}, \mathrm{Pot}$ | 9122-147 | A-B WA2GO40S104UA |
| R3 |  | Same as R2 |  |  |
| R 4 |  | Same as R2 |  |  |
| R6 |  | 10K ohm, 2 W, Pot | 9\|22-3| | A-B JA2N048S 030 LE |
| R7 |  | 2.7K ohm, 1/2W, 5\% Tol. | 2725-E | A-B EB2725 |
| R10 |  | lok ohm, 2 W, fot | 9122-148 | Spectrol Mod. 532 |
| R17 |  | 22 K ohm, $1 / 2 \mathrm{~W}, 10 \% \mathrm{Tol}$, | $2231-\mathrm{E}$ | A-日 E82231 |
| R18 |  | 25K orim, 1/2W, Pot | 9122-146 | A-8 WA2GO40S 253 UA |
| R19 |  | 680K ohm, $1 / 2 \mathrm{~W}, 5 \%$ Tol. | $6815-\mathrm{E}$ | A-b EB68। 5 |
| R20 |  | 390K ohm, 1/2W, 5\% Tot. | 39.15-E | A-8 E83915 |
| R21 |  | 820K ohm, 1/2W, 5\% Tol. | 8215-E | A-B E882i5 |
| R22 |  | $33 \mathrm{Kohm}, 1 / 4 \mathrm{~W}, 10 \%$ Tol. | $3331-\mathrm{C}$ | A-8 C83331 |
| R23 |  | 2 K ohm, $2 \mathrm{~W}, \mathrm{pot}$ | 9122-22 | A-B JA 2NO48S202UE |
| R24 |  | 1 Meg ohm, 2 W, Pot | 9122-63 | A-B JA2N048S105UE |
| R25 |  | look ohm, $1 / 4 \mathrm{~W}, 10 \%$ Tol. | 1041 -C | A-8 CB1041 |
| 826 |  | 5K ohm, 1/2W, pot | 9122-145 | - A-B WA2GO-40S502UA |
| R27 |  | Same as R26 |  |  |
| R28 |  | Same as R26 |  |  |
| R32 |  | lok ohm, 1/2W, 10\% Tol. | $1031-\mathrm{E}$ | A-B EBIO31 |
| SWITCHES: |  |  |  |  |
| SI |  | 6 Position, 8 Deck, Rotary | 12242 | KEC |
| S2 |  | 2 Positlon, 1 Deck, Rotary | 176 | KEC |
| S3 |  | S.P.D.T. Toggle | 6393-4 | C \& K 7101 |
| S4 |  | 4 Position, 5 Deck, Rotary | 12245 | KEC |
| * S5 |  | 3 Position, 2 Deck, Rotary | 12251 | KEC |
| 56 |  | 4 Position, I Deck, Rotary | 12246 | KEC |
| S7 |  | D. P. D. T. Toggle | 6393-5 | C \& K 7201 |
| 58 |  | S.ame as 53 |  |  |

## LAMPS:

11 thru 16
Lamp Assembly
12958
Marco-0ak 99-33080-17--46-009

RESISTORS:

# SWEPT FREQUENCY GENERATOR MODEL I520A 

CABLE ASSEMBLY \#12757-1, DRAWING \#D|2193F


# SWEPT FREQUENCY GENERATOR MODEL 1520 A 

 CABLE ASSEMBLY \$12757-1, DRAWING \#D12193FDwg. Sym. No. Dty. Kascriotion Part No. Manufacturer and Part No.

P19 J 20

F17

Connector 8000-1 6909-1
Connector 8000-1 6909-1 Conector (6") 6909-95

CABLE ASSEMBLY \#|2757-10

| Connector 29091-1 | $6909-130$ |
| :--- | :--- |
| Connector 8000-1 | $6909-11$ |

Connector 8000-1
6909-11
Cable RG55/U (6")

CABLE ASSEMBLY \#|2757-11
Connector UG 88/U 6909-76

Cable RG58/U (11")

CABLE ASSEMBLY \#|2757-12

Connector 27-7 (16") 6909-127
Cable RGI74/U (16)

CABLE ASSEMBLY \#12757-13

CAPACITORS:

| C 1 | . 02 uf , 400v, Myler-paper | 6899-9 | Elmenco 40P-2-203 |
| :---: | :---: | :---: | :---: |
| CONNECTORS: |  |  |  |
| J P1 | $\begin{aligned} & \text { UG } 185 / U, \text { Coax } \\ & 3150 \end{aligned}$ | $\begin{aligned} & 6909-77 \\ & 6909-126 \end{aligned}$ | Dage UG $185 / \mathrm{U}$ <br> Amphenol 3150 |
| RESISTORS: |  | , |  |
| RI | 3.9 ohms, $1 / 4 \mathrm{~W}, ~ 10 \%$ TOI. | 3PG\|-E | $A-B E 839 \mathrm{Cl}$ |

# SIWEPT FREQUENICY RENERATOR MODEL I 520A 

CHASSIS ASSEMELY I2243, DPAMING \#12103F

| Dwg. Sym. No. Oty. | Descrintion | Kay Part No. | Manufacturer and Part No: |
| :---: | :---: | :---: | :---: |
| CAPACITORS: |  |  |  |
| $\begin{array}{lll} C 12 \\ C & 3 \end{array}$ | . 1 MFD., 50v, Myiar Same as CI | 6411-20 | Paktron mbeoo |
| FUSE: |  |  |  |
| * F 2 | 1/4 Amo, 250 V | 6908-16 | LIttel Fuse Af 1/4A |
| CONNECTORS: |  |  |  |
| J 28 | Female, 22 contacts | 6909-115 | EIco \#00-6022-022-940-002 |
| 329 | Same as J 28 |  |  |
| 130 | Female, 22 contacts | 6009-106 | Amphenol \#143-002-01 |
| 」31 | Same as J 28 |  | Aptenol $143-002-01$ |
| 132 | Same as J 28 |  |  |
| . 33 | Same as J 28 |  |  |
| 134 | Female, 10 contacts |  | Amphenol \#143-010-01 |
| COILS: |  |  |  |
| LI | 12 HH | 6394-49 | Jeffers 4445-3k |
| PESISTORS: |  | . |  |
| R29 | 51 ohm, 1/4W, 5\% Tol. | 5105-C | A-B CB5 105 |
| TRANSISTORS: |  |  |  |
| $n 1$ | 40250 | K-160 | RCA 40250 |
| INTECRATED CIRCUIT: |  |  |  |
|  | LM309 Volt, Reg. |  | National LM309K |

## SWEPT FREOQUENCY GENERATOR MODEL $1520 A$

POWER SUPPLY MODULF ASSEMBLY \#12858W, DRAWINF \#DI $2071 H$
Dwg. Sym. No. Oty.
CAPACITORS:
Cl A \& B
$C 2$
$C 3$
$C$
$\begin{array}{llll}C 3 & A & \& & B \\ C 4 & & \\ C 5 & \& & C & \end{array}$
$\begin{array}{lll}C 5 & \& & C 6 \\ C 5 & \& & C 6\end{array}$
DIODES:
DI thru DIO
RECEPTACLES:
J1 \& J2
DESISTORS:
91
82
R. 2
R 3

R4
R. 6
P. 7
9.8

Descriotion
Kay Part No.
Manufacturer and Part No.

TRANS FORMERS:
150/150uf, 250v, Elect.
500uf. 50v, Elect ect.
1000/I500uf, 35v, Elect.
1000/1500u
500uf, 25v, Elect.

F6, sillcon
6357-3
6355-173
6355-174 6355-175

Mallory Sp031-5120
Mallory Spozi-5119
Mallory PサPO68
Cornell Dubiller CDE BR-500-25

Sarkes Tarzian F6

Female, 22 contacts
6009-|3|
Elco 00-6022-022-938-002
4.7 ohms, $2 \mathrm{~W}, 10 \%$ Tol.
2.2 ohms, $2 \mathrm{~W}, 5 \%$ Tol.
10 ohms, $2 \mathrm{~W}, 10 \%$ Tol.
100 ohms, $1 / 2 \mathrm{~W}, 10 \%$ Tol.
6.8 ohms, $1 / 2 \%, 10 \%$ Tol.
Same as R5
Same as R5
27 ohms, $1 / 2 \mathrm{~W}, 10 \%$ Tol.

| $9292-19$ | IRC BWH |
| :--- | :--- |
| $9292-18$ | IRC BWH |
| $1001-H$ | A-B HB1001 |
| $1041-E$ | A-B EB1041 |
| $6821-E$ | $A-B$ EB6821 |
|  |  |
| $2731-E$ | $A-B E B 2731$ |

Transformer, Power
12170 A
KEC

SWEPT FREQUENCY GENERATOR MODEL I520A
POWER SUPPLY MOOULE ASSEMBLY


## SWEPT FREQUENCY GENERATOR MODEL I520A

POWER SUPPLY MODULE ASSEMBLY \＃｜ 2858 W ，DRAWING \＃D12071H

Owg．Sym．No．Oty．
DescriptIon
Kay Part No．
Manufacturer and Part No：

CAPACITORS：
C 1
C 2
C 3
C 4
C 5
C 6

DIODES：
01
02
03
03

TRANS ISTORS：

RESISTORS：

260uf， 15 v ，Electroyltic
2uf，50v，Electroyltic 35uf， 50 v, Electroyltic ．O5uf，loov，Myler－paper
Same as C3
Same as C2

IN4446（Sub．ING（4A）
IN4728，Zener，（ $3.3 v$ ）
Same as DI
in4734，Zener，（5．6v）

40250 v 1
2N3566
Same as Q2
Same as Q2
Same as Q2
$2 N 3740$
2N3740
2N3645
Same as p6
Same as Q 6
Same as Q6

$9 \mid 22-130$
9｜22－13｜
9292－19
$9292-19$
$1011-E$
1011－E
9125－E
$9125-E$
$9125-\varepsilon$
9292－34
9292－33
5115－E 311－8
$3311-E$
3311－E
9292－34．
3635－E
$4721-E$
3935－E
9292－20
$4711-E$
9292－13
1021－E
9292－16

GE 76F02FM261
GE 76FO2LC280
GE 76FO2LK350
Elmenco 10P－2－503

Fairchlld IN4446
Motorola IN4728
Motorola IN4734

RCA 40250 VI
Falrchild 2N3566

Motorola $2 N 3740$
Fairchlid 2N3645

Beckman 72PMIK
Beckman 72PM5K
IRC 日WH
A－EB1011
$\begin{array}{ll}A-8 \\ A-B & E B S 125\end{array}$
AB－EB9। 25
Corning riass Tvoe C5 Corning
IRC BWH
A－B EB5I। 5
A－B EBSII
Cornlng Class TVoe CS
A－8 EB3ろ1।
Corning Glass Tyoe C5

A－8 ع日3635
A－B EB4721
A－B EB3935
IRC BWH
A－B EB47।।
Corning rilass Type C5
A－B EB1021
Corning Filass Type C5

SWEPT FREQUENCY GENERATOR MODEL I520A LINE FILTER MODULE ASSEMBLY \#12274W, DRAWING \#DI 2071 H

Dwg. Sym. No. Qty.
Description
Kay Part No.
Manutacturer and Part No.

CAPACITORS:

| Cl thru C4 | NOT USED |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| C 5 | 8500pf, 500v, feedthru | 6356-14 | Erie | 032710-X5V0-852V |
| C6 | Same as C5 |  |  |  |
| C7 | Same as Cs |  |  |  |
| C8 | Same as C5 |  |  |  |
| C9 | 4000pf, 500v, feedthru | 6356-5 | Erle | 2443-000-25U0-402M |
| Clo | Same as C9 |  |  |  |
| FUSE: |  |  |  | . |
| $F 1$ | 1/2 Amp, 1 25 v , Slow glow | 6908-18 |  | Littel Fuse 313.500 |
| COILS: |  |  |  |  |
| L। | Choke, 280 uH | 12732 |  | KEC |
| L2 | Same as LI |  |  |  |
| L3 | Choke, 0.9 uH | 485 |  | KEC |
| L4 | Same as L3 |  |  |  |
| PLUGS: |  |  |  | . |
| P) | AC Line Cord and Plug | 7\|66-| |  | Belden 17237S |

SWEPT FREQUENCY GENERATOR MODEL I 520A
$0.05-300 \mathrm{MHZ}$ MODULE ASSEMBLY \#|2190W, DRAWING \#D12190E
DwG. Sym. No. Qty.

Descriotion
Kay Part No.
Manufacturer and Part No.

CAPACITORS
C14 thru C27
C42 \& C43
CONNECTORS:
P21 thru P23
$1000 p f, 500$
Same as C14
6356-11
A-B FA5C-102W

27-9
6909-108
Amphenol 27-9
P. C. BOARD ASSEMELY \#| $2332 A-W$

KEC
P. C. BOARD (LESS W|RED) \#| $2332 A$

KEC

CAPACITORS:
$C 1$
$C 1$
$C 2$
$C 3$
$C 4$
$C 5$
$C 6$
$C 7$
$C B$
$C 9$
$C 10$
$C 11$
$C 12$
$C 13$
$C 44$
$C 45$
$C 46$
$C 47$

| 0.39uf, 35v, Electrolytic | 6355-180 |
| :---: | :---: |
| 0.002uf, 100y, Myler-paper | 6899-24 |
| Same as Cl |  |
| Same as Cl |  |
| 0.022uf, 75v, Cer. Disc | 6360-32 |
| 10pf, 500v, Mica | 6359-53 |
| O.1uf, 75v, Cer. DIsc | 6360-17 |
| Same as C6 |  |
| Same as C7 |  |
| 50pt, 500v, Mica | 6359-60 |
| Same as C! |  |
| Same as C7 |  |
| Same as C7 |  |
| 390f, 500v, Mica | 6359-59 |
| 24pf, 500v, Mlca | 6359-81 |
| Same as C45 |  |
| 3pf, 500v, Mica | 6359-51 |

Kemet K3RgJ35KS
Elmenco IDP-1-2す2
ulton MIN-M-022-M
Elmenco DM15-100 Gulton MIN-V-.l-Z

Elmenco DMI5-500

Elmenco DM15-390
Elmenco DM15-240
Elmenco DMI5-020

## COILS：

$L 1$
$L 2$
$L 3$
L4
L5
L6
L7
L8
L9
L10
L11
LI2
Speclal，Slug－tuned
Speclal，Slug－tuned
Special，Flxed
Same as L3
Same as L3
Speclal，Slug－tuned
Same as l3
Speclal，Slug－tuned
Speclal，Flxed，S2 uH
Speclal，Fixed
Speclal，Slug－tuned
Speclal，Flxed，． 25 H

| $11552-8$ | KEC |
| :--- | :--- |
| $11552-8$ | KEC |
| $12845-4$ | KEC |
|  |  |
| $11552-11$ | KEC |
|  |  |
| $8624-23$ | KEC |
| $12845-5$ | KEC |
| $8624-24$ | KEC |
| $8624-24$ | KEC |
| $12845-6$ | KEC |

2N5179／MMI941
Same as QI
MFE 3007
A485
2N3866（Grade
2N5109（Grade

K－202
Same as Ql
A 485
2N5109（Grade 5）
K－213
K－208
K－170－5
$\mathrm{K}-170-5$
$\mathrm{~K}-199-5$
RGA 2N51790RMOTOROLAMM1941

Same as Q5

| 100 ohms， $1 / 4 \mathrm{~W}, 10 \%$ Tol． | 1011－C | A－B CBl011 |
| :---: | :---: | :---: |
| 120 ohms，1／4W，lo\％Tol． | $1211-\mathrm{C}$ | A－8 CB1211 |
| 39 ohms， $1 / 4 \mathrm{~W}, 10 \% \mathrm{Tol}$ ． | $3901-\mathrm{C}$ | A－B CB3901 |
| 1 onm， $1 / 4 \mathrm{~W}, \mathrm{log} \mathrm{Tol}$. | $1021-\mathrm{C}$ | A－B CBl021 |
| 150 ohms， $1 / 4 \mathrm{~W}, 10 \%$ Tol． | 1511－C | A－B C8I511 |
| Same as R2 |  |  |
| Same as R3 |  |  |
| Same as R4 |  |  |
| 180 ohms， $1 / 4 \mathrm{~W}, \mathrm{lo} \mathrm{\%} \mathrm{Tol}$. | $1811-C$ | A－B CBI8！ |
| Same as R2 |  | A－b ${ }^{\text {cbir }}$ |
| 470 ohms， $1 / 4 \mathrm{~W}, ~ 10 \%$ Tol． | 4711－C | A－B CB4711 |
| Same as R2 |  | Аーロ |
| 15 ohms，1／4W，lo\％Tol． | 1501－C | A－B CBI501 |
| 22 ohms，1／4W，lo\％Tol． | 2201－C | A－B CB2201 |
| Same as R4 |  | Аーヨ Cb2201 |
| Same as R9 |  |  |
| Same as R2 |  |  |
| Same as R13 |  |  |
| Same as Ri4 |  |  |
| Same as R4 |  |  |
| Same as R5 |  |  |
| Same as R5 |  |  |
| 220 ohms， $1 / 4 \mathrm{~W}, 10 \%$ Tol． | $2211-C$ | A－8 CB22） 1 |
| Same as Rl4 |  |  |
| Same as R4 |  |  |
| Same as R2 |  |  |
| 330 ahms， $1 / 4 \mathrm{~W}, \mathrm{l}$ O\％Tal． | $3311-C$ | A－B C83311 |
| Same as R2 |  | A－b Ca3アト |
| 27 ohms，1／4W，10\％Tol． | $2701-\mathrm{C}$ | A－B CB2701 |
| Same as R4 |  |  |
| Same as R2 |  |  |
| Same as R70 |  |  |

# SWEPT FREQUENCY GENERATOR MODEL IS20A 

0.05-300MHZ MODULE ASSEMELY \#12190W, DRAWING \#DI2190E


CAPACITORS :

| C28 | 4.7ut, 35v, | Electrolytic | 6355-133 | Kame $\dagger$ K | K4R7J35KS |
| :---: | :---: | :---: | :---: | :---: | :---: |
| C29 | Same as C28 |  |  |  |  |
| C30 | Same as C28 |  |  |  |  |
| R31 | Same as C28 |  |  |  |  |
| C32 | . 27 ff , 100v, | Myler-paper | 64।\|-26 | Paktron | ก MPC |
| C33 | Same as C28 |  |  |  |  |
| C34 | Same as C28 |  |  |  |  |
| C35 | Same as C28 |  |  |  |  |
| C36 | Same as C28 |  |  |  |  |
| C37 | Same as C28 |  |  |  |  |
| C38 | Same as C28 |  |  |  |  |
| C39 | Same as C28 |  |  |  |  |
| C40 | Same as C28 |  |  |  |  |
| C41 | Same as C28 |  |  |  |  |

TRANS I STORS:


SWEPT FREQUENCY GENERATOR MODEL I520A
$0.05-300 \mathrm{MHZ}$ MODULE ASSEMBLY \#|2190W, DRAWING \#D|2190E

| Dwg. Sym. No. | Qty. | Description | Kay Part No. | Manufacturer and Part No. |
| :---: | :---: | :---: | :---: | :---: |
| R 56 |  | Same as Ri |  |  |
| R57 |  | Same as R33 |  |  |
| R58 |  | Same as R 52 |  |  |
| R59 |  | Same as R33 |  |  |
| R60 |  | 2.2 ohms, $1 / 4 \mathrm{~W}, 10 \%$ Tol. | 2221-C | A-B CB2221 |
| R61 |  | 680 ohms, $1 / 4 \mathrm{~W}, 10 \%$ Tot. | 6811-C | A-8 CB6811 |
| R62 |  | 75 ohms, 1/4W, 5\% Tol. | 7505-C | A-8 CB7505 |
| R63 |  | Same as R33 |  |  |
| R64 |  | 1.8 ohms, $1 / 4 \mathrm{~W}, 10 \%$ Tol. | $1821-C$ | $A-8 \mathrm{CBI} 821$ |
| R65 | . | Same as R33 |  | . ${ }^{\text {a }}$ |
| R66 |  | Same as R32 |  |  |
| R67 |  | Same as R4 |  |  |
| R68 |  | Same as Ri |  |  |
| R69 |  | Same as R33 |  |  |
| R70 |  | 10 ohms, 1/4W, 10\% Tol. | $1001-\mathrm{C}$ | A-B CBIOOI |
| R71 |  | Same as R70 |  |  |

SWEPT FREQUENCY GENERATOR MODEL I520A
$0.05-10 \mathrm{MHZ}$ MODULE ASSEMBLY \#|2049W, DRAWING \#CI2049C
Description Kay Part No.

Manufacturer and Part No.
P. C. BOARO (LESS WIRED) \#| $2049 B$

CAPACITORS:
$C 1$
$C 2$
$C 3$
$C 4$
$C 5$
$C 5$
$C 7$
$C 8$
$C 9$
$C 10$
$C 11$
$C 12$
$C 13$
$C 14$
$C 15$
$C 16$
$C 17$
$C 18$
$C 19$
$C 20$
$C 21$
$C 22$
$C 23$
$C 24$
$C 25$
$C 26$
$C 27$
$C 2 B$

| 1000pf, 500v, feedthru . O05uf, 100v, Myler pape |
| :---: |
| Same as Cl |
| 39pf, 500v, Mlca |
| Same as Cl |
| 2-8pf, Trimmer |
| $24 \mathrm{pf}, 500 \mathrm{v}, \mathrm{Mlca}$ |
| 200pf, 500v, Mlca |
| NOT USED |
| Same as C6 |
| 50,0pf, 500v, Mica |
| Same as C2 |
| VA 129, Varlcup |
| Same as Cl |
| Same as Cl |
| Same as C4 |
| Same as Cl |
| Same as Cl |
| 30 f , 500v, Mica |
| 7pí, 500v, Mica |
| 680pf, 500v, Mlca |
| I5pf, 500v, Mlca |
| 50 pf , 500v, Mica |
| 470pf, 500v, Mlca |
| 100pf, 500v, feedthru |
| 91pf, 500v, Mica |
| Same as C20 |
|  |


| $\begin{aligned} & 6356-11 \\ & 6899-14 \end{aligned}$ |  | A-B FA5C-IO2W <br> Elmenco IDP-1-502 |
| :---: | :---: | :---: |
| 6359-59 |  | Elmenco DM/5-390 |
| 6358-12 | Erle | NPO 538-000A2-8 |
| 6359-81 |  | Elmenco DM\|5-240 |
| 6359-63 |  | Elmenco DM15-201 |
| .. |  |  |
| 6359-66 |  | Elmenco DM\|5-501 |
| 6357-127 |  | Crystalonics VAl29 |

Same as C
Same as C4
Same as Cl
Same as ch 500 p ,


SWEPT FREQUENCY GENERATOR MODEL 1520 A
$0.05-10 \mathrm{MHZ}$ MODULE ASSEMBLY $\# 12049 \mathrm{~W}$ ，DRAWING \＃C12049C
Dwg．Sym．No．Description Kay Part No．Manufacturer and Part No．

| C29 | Same as CI |
| :--- | :--- |
| C30 | Same as CI |
| C31 | Same as CII |
| DIODES： |  |


| 01 | IN82A | 6357－38 | General | Ins．｜N82A |
| :---: | :---: | :---: | :---: | :---: |
| D2 | Same as DI |  |  |  |
| D3 | Same as DI |  |  |  |
| D4 | Same as DI |  |  |  |
| COILS： |  |  |  |  |
| LI | $12 \mathrm{uH}, \mathrm{Choke}$ | 6394－49 | Jeffers | 4445－3K |
| L2 | ． $68 \mathrm{uH}, \mathrm{Choke}$ | 6398－52 | Jeffers | 441）－6k |
| L3 | Same as L2 |  |  |  |
| $\llcorner 4$ | Same 35 LI |  |  |  |
| L5 | .253 uH，Speclal | $12049 \mathrm{C}-\mathrm{L} 5$ | KEC |  |

CONNECTORS：
Pl thru P5

| P6 |
| :--- |
| 7 |

TRANSISTORS：
21

RESISTORS：

| $R 1$ |  |
| :--- | :--- |
| $R 2$ |  |
| $R 3$ |  |
| $R 4$ |  |
| $R 5$ |  |
| $R 6$ |  |
| $R 7$ |  |
| $R 8$ |  |
| $R 9$ |  |
| $R 1$ | 0 |
| $R 11$ |  |
| $R 12$ |  |


| 1 Meg ohm， $1 / 4 \mathrm{~W}, \mathrm{l}$ \％Tol． | $1051-\mathrm{C}$ | A－B CB1051 |
| :---: | :---: | :---: |
| 820 ohms，1／2W，10\％Tol． | 8211－E | A－b EB8211 |
| 1.5 ohms，1／2W，10\％Tol． | 1521－E | A－B EB\521 |
| 390 ohms， $1 / 4 W, 5 \%$ Tol． | 3915－C | A－B CB3915 |
| 100 ohms，1／4W，10\％Tol． | 5601 －C | A－日 C85601 |
| 33 ohms，1／4W，lo\％Tol． | 3331 －C | A－B CB3331 |
| Same as RI |  |  |
| 1.2 ohms，1／2W，10\％Tol． | $\|22\|-\varepsilon$ | A－日 E日｜221 |
| Same as R3 |  |  |
| 1．8 ohms， $1 / 2 \mathrm{~W}, 10 \% \mathrm{Tol}$ ． | ｜82｜－E | A－8 EB\821 |
| 10 ohms，1／4W，10\％Tol． | 1001 －C | A－B CB1001 |
| Same as RII |  |  |
| Read Swltch SPST 12 V | 12596 | Elect．Inst． 2275 |
| Speclal | 12487－1 | KEC |
| Speclal | 12487－2 | KEC |
| Special | 12196 | KEC |

SWEPT FREQUENCY GENERATOR MODEL $\mid 520 A$ 0.05-1200 MHZ MODULE ASSEMBLY \#| 2192 W , DRAWING \#DI2192E

| Description |  | Kay | Part No. | Manufact |
| :---: | :---: | :---: | :---: | :---: |
| P. C. BOARO | (LESS | W(RED) | \#12090日 | KEC |
| P. C. BOARD | (LESS | W(RED) | \#120388 | KEC |
| P. C. BOARD | (LESS | W(RED) | \#12834E | KEC |
| F. C. BOARD | (LESS | W(RED) | \#12355C | KEC |
| P. C. BOARD | (LESS | W(RED) | \#\| 2336 C | KEC |
| P. C. BOARO | (LESS | WIRED) | \#!2702A | KEC |

CAPACITORS:


SWEPT FREQUENCY GENERATOR MODEL 1520 A
$0.05-1200 \mathrm{MHZ}$ MODULE ASSEMBLY \#12192W, DRAWING \#D12192E

Dwg. Sym. No. Oty.
Description
Kay Part No.

COILS:
$L I$
$L 2$
$L 3$
$L 4$
$L 5$
$L 6$
$L 7$
$L 8$
$L 9$
$L 10$
$L I 1$
$L 12$
$L I 3$
$L I 4$
$L I 5$
$L I 6$
$L I 7$
$L I 8$
$L I 9$
$L 20$
$L 21$
$L 22$
$L 23$
$L 24$
$L 25$
$L 26$
$L 27$

CONNECTORS:

| Pl |
| :--- | :--- |
| P1 |

P14
P15
P16
TRANSISTORS:

## 01 02 <br> Q2 <br> Q4 05

RESISTORS:

| $R 1$ |  |
| :--- | :--- |
| $R 2$ |  |
| $R 3$ |  |
| $R 4$ |  |
| $R 5$ |  |
| $R 6$ |  |
| $R 7$ |  |
| $R 8$ |  |
| $R$ | 1 |
| $R 1$ | 0 |
| $R 1$ | 1 |
| $R 1$ | 2 |
| $R 13$ |  |
| $R 1$ | 4 |

$0.35 \mathrm{uH}, \mathrm{Choke}$
Same as LI
Same as LI
Same as LI
Sooclal, Fixed
Speclal, Fix
Same as L!
Same as Ll
Same as L!
Same as Ll
Same as
Spectal, Flxed
Speclal, Fi
Same as LI
Same as LI
Same as LI
Same as LI
Same as $L 1$
Same as Ll
Special, Flxed
Same as LI
Same as Ll
Same as LI
Same as LI
Same as LI
Special, Fixed 12845-3 KEC
Same as L!
Same as L!
Same as LI
Same as LI

Plug, 27-9
Same as Plo
Same as Plo
Same as PlO
Same as Plo

2N5109 (Grade 6
2N3553
Same as Q1
Same as Q!
Same as Ql

130 ohms, 2W, 2\% Tol
NOT U.SED
750 ohms, $1 / 2 \mathrm{~W}, 2 \%$ To
820 ohms, $1 / 2 \mathrm{~W}, 2 \% \mathrm{TO}$
10 ohms, $1 / 4 \mathrm{~W}, 5 \% \mathrm{TOl}$
Same as R5
22 ohms, $1 / 4 \mathrm{~W}, 5 \%$ Tol
22 ohms, $1 / 4 \mathrm{~W}, 5 \%$ Tol.
$\begin{array}{ll}22 & \text { ohms, } 1 / 8 \mathrm{~W}, 5 \mathrm{~m} \text { Tol } \\ \text { Same as R7 }\end{array}$
gl ohms, $2 W, 2 \%$ Tol.
Same as R8
Same as R8
Same as R3
Same as R3
Same as R7
Same as R7
I ohm, $1 / 2 W, 2 \%$ Tol.
292-46
12856
KEC

2685-7
KEC

12845-2
KEC

2845-1

KEC
.

KEC<br>

12845-1

9292-55
9292-56
9292-57
1005 -C
2205-C
2205-B
9292-58
к-199-6
K-164

Manufacturer and Part No.

Amphenol 27-9

RCA 2N5109
RCA 2N3552

Cornlng Glass C425
Cornling Glass C-5
Corning Glass C-5
A-b CB1005
A-B CB2205
A-B B82205
Corning Glass C425

Corning Glass C-5

SWEPT FREQUENCY GENERATOR MODEL I520A
0.05-1200 MHZ MODULE ASSEMBLY \#|2192W, DRAWING \#DI2192E

| Dws. Sym. No. | Q+y. | Description | Kay Part No. | Manufacturer and Part No. |
| :---: | :---: | :---: | :---: | :---: |
| C54 |  | Same as Cl |  |  |
| C 55 |  | 4700pf, 50v, Cer. Chip | 6360-49 | Monolythic Dielectrics 50RI 6W4 72 K |
| C56 |  | Same as C53 |  |  |
| C57 |  | 0.01uf, 100v, Cer, Disc | 6360-50 | Erie 8\|2|-100-657-1032 |
| C58 |  | 5pf, 500v, Mlca | 6359-52 | Elmenco DM15-050 |
| C59 |  | Same as C42 |  |  |
| C60 |  | 20pf, 500v, Button 10\% | 6707-10 | Erle 666-003-20pf |
| C61 |  | Part of PCB 12090 B |  |  |
| C62 |  | 100pf, l00v, Cer. Chlp | 6360-43 | JFD WYOI-IOIK |
| C63 |  | Part of PCB 12090日 |  |  |
| C64 |  | Same as CI |  |  |
| C65 |  | Same as Cl |  |  |
| C66 |  | Same as C! |  |  |
| C 67 |  | Same as Cl |  |  |
| C68 |  | Same as Cl |  |  |
| C69 |  | Same as Cl |  |  |
| C70 |  | 30pf, 500v, Button 10\% | 6707-17 | Erie 666-003-30pf |
| C71 |  | Part of PCB 12702A |  |  |
| C72 |  | Same as C53 |  |  |
| C73 |  | 0.47 pf , 500v, Ceramlc | 6361-70 | Quallty Components MC . 47 |
| C74 |  | Part of PCB 12702A |  |  |
| C75 |  | Same as Cl |  |  |
| C76 |  | Same as Cl |  |  |
| C77 |  | Same as Cl |  |  |
| C78 |  | Same as Cl |  |  |
| C79 |  | Same as C |  |  |
| C80 |  | Same as CI |  |  |
| C81 |  | 0.68pf, 500v, Ceramic | 6361-71 | Quality Components MC . 68 |
| C82 |  | VA5139, Varactor | 6357-128 | Crystalonles VA 5319 |
| C83 |  | Same as C82 |  |  |
| C84 |  | VAll6, Varactor | 6357-134 | Crystalonlcs VA 1/6 |
| C85 |  | Same as C.84 |  |  |
| C86 |  | Same as c82 |  |  |
| C87 |  | Same as C82 |  |  |
| C88 |  | VA5l40 Varactor | 6357-129 | Crystalonlcs VA 5140 |
| C89 |  | Same as c88 |  |  |
| C90 |  | $0.0075 \mathrm{pf}, 100 \mathrm{v}$, Myler-paper | 6899-19 | Elmenco IDP-I-752 |
| C91 |  | Same as C 90 |  |  |
| C92 |  | Same as C42 |  |  |
| C93 |  | 3 ff , 500v, Mlca | 6359-51 | Elmenco DM15-030 |
| DIODES: |  |  |  |  |
| 01 |  | HP 3080 | 6357-122 | Hewlett Packard 5082-3080 |
| 02 |  | Same as DI |  |  |
| D3 |  | Same as DI |  |  |
| 04 |  | Same as DI |  |  |
| D 5 |  | Same as DI |  |  |
| D6 |  | Same as 01 |  |  |
| 07 |  | Same as D |  |  |
| D8 |  | . 1 N82A | 6357-38 | SyIvanla 1N82A |
| -9 |  | Same as D8 |  |  |
| 010 |  | Same as D8 |  |  |
| D11 |  | Same as D8 |  |  |
| D12 |  | Same as 08 |  |  |
| 013 |  | Same as 08 |  |  |
| D14 |  | Same as D8 |  |  |
| 015 |  | Same as D8 |  |  |
| CONNECTORS : |  |  |  |  |
| J17 |  | Jack, 142-0293-001 | 6909-132 | Johnson 142-0293-001 |

SWEPT FREQUENCY GENERATOR MODEL I520A

| Dwg. svm. No. | O+y. | Description | Kay Part No. | Manufacturer and Part No. |
| :---: | :---: | :---: | :---: | :---: |
| R15 |  | Same as R5 |  |  |
| R16 |  | 10 ohms, 1/2W, 5\% Tol. | $1005-\mathrm{E}$ | A-B E81005 |
| R17 |  | Same as R8 |  |  |
| R18 |  | Same as R7 |  |  |
| R19 |  | 150 ohms, $1 / 8 \mathrm{~W}, 5 \% \mathrm{Tol}$. | 1505-B | A-8 881505 |
| R20 |  | 300 ohms, $1 \mathrm{~W}, 2 \%$ Tol. | 9292-59 | Corning Glass C23 |
| R21 |  | Same as R5 |  |  |
| R22 |  | Same as R5 |  |  |
| R23 |  | Same as R5 |  |  |
| R24 |  | Same as R5 |  |  |
| R25 |  | Same as R 5 |  |  |
| R26 |  | Same as R 5 |  |  |
| R27 |  | 1 ohm, 1/4W, 5\% Tol. | $1021-\mathrm{C}$ | A-8 C81021 |
| R28 |  | Same as R27 |  |  |
| R29 |  | 1.2 ahms, $1 / 4 W$, 5\% Tol. | $1221-\mathrm{C}$ | A-8 C81221 |
| R30 |  | Same as R29 |  |  |
| R31 |  | Same as R29 |  |  |
| R32 |  | Same as R29 |  |  |
| R33 |  | 51 ohms, 1/8W, 5\% Tol. | 5105-8 | A-8 885105 |
| R34 |  | 1 ohm, 1/8W, 5\% Tol. | 1025-8 | A-B BBIO25 |
| R3'5 |  | 56 ohms, 1/4W, 5\% Tol. | $5605-\mathrm{C}$ | A-8 CB5605 |
| R36 |  | Same as R35 |  |  |
| Rコ7 |  | 220 ohms, 1/4W, 5\% Tol. | 2215-C | A-B CB2215 |
| R38 |  | 220 onms, $1 / 8 \mathrm{~W}, 5 \%$ Tol. | 2215-8 | A-B 8B2215 |
| R39 |  | 150 ohms, $1 / 8 \mathrm{~W}, 5$ 5 Tol. | 1515-日 | A-B 881515 |
| R40 |  | 2.2 ohms, $1 / 8 \mathrm{~W}, 5 \%$ Tol. | 2225-8 | A-8 882225 |
| R41 |  | l ohm, 1/8w, 5\% Tol. | 1025-8 | A-B BE1025 |
| R42 |  | Same as R33 |  |  |
| 843 |  | 820 ohms, $1 / 2 \mathrm{~W}, 5 \%$ Tol. | 8215-8 | A-8 888215 |
| R44 |  | 47 ohms, 1/8W, 5\% Tol. | 4705-B | A-B 684705 |
| R45 |  | Same as R38 | . |  |
| R4. 5 |  | Same as R8 |  |  |
| R47 |  | Same as R38 |  |  |
| R48 |  | Same as R8 |  |  |
| R49 |  | Same as R8 |  |  |
| R50 |  | Same as R8 |  |  |
| R51 |  | Same as R8 |  |  |
| R 52 |  | Same as R7 |  |  |
| R53 |  | Same as RI |  | , |
| R54 |  | NOT USED |  |  |
| R 55 |  | Same as R3 |  |  |
| R56 |  | Same as R5 |  |  |
| R57 |  | 820 ohms, $1 W, 2 \%$ Tol. | 9292-60 | Corning Glass Type C23 |
| R58 |  | Same as R5 |  |  |
| R59 |  | Same as R7 |  |  |
| R60 |  | Same as R8 |  |  |
| R61 | . | Same as R7 |  |  |
| R62 |  | 100 ohms, $2 \mathrm{~W}, 2 \%$ Tol. | 9292-61 | Corning Glass C425 |
| R63 |  | NOT USEO |  |  |
| R64 |  | Same as R3 |  |  |
| R65 |  | Same as R 5 |  |  |
| R66 |  | Same as R4 |  |  |
| R6.7 |  | Same as R5 |  |  |
| R68 |  | 4.7 ohms, $1 / 4 W$, 5\% Tol. | 4P75-C | A-B CB47G5 |
| R69 |  | Same as R68 |  |  |
| R70 |  | 6 ohms, Thermistor | 9292-62 | Fenwal Elect. JA36Jl |
| R71 |  | 750 ohms, 1/2W, 2\% Tol. | 9292-56 | Corning Glass Type C5 |
| R72 |  | 820 ohms, 1/2W, 2\% Tol. | 9292-57 | Corning Glass Type C5 |
| R73 |  | 39 ohms, 1/4W, 5\% Tol. | 3905-C | A-8 C83105 |
| SWITCHES: |  |  |  |  |
| SI |  | O.P.O.T., Toggle, Nylon Hande | 254 TXII | KEC |
| TRAN SFORMERS: |  |  |  |  |
| TIA \& B |  | Speclal | 12196 | KEC |

SWEPT FREQUENCY GENERATOR MODEL 1520 A
300 MHZ L. P. FILTER ASSEMELY 12248 F , DRAWING \#B12078A
Owg. Sym. No. Qty.
Description
Kay Part No.
Manufacturer and Part No.
P. C. BOARD \#2, CIRCUIT Fl208। KEC
P. C. BOARD \#3, DIELECTRIC \#12080 KEC

CAPACITORS:

| CI thru C4 | Part of PCB 12081 |
| :--- | :--- |
| COILS: |  |
| LI thru L3 | Part of PCB 12081 |
| CONNECTORS: |  |

SWEPT FREQUENCY GENERATOR MODEL I520A
HARMONIC MARKER CIRCUIT \# $216 I W$, DRAWING $\# C I 216 I E$
Dwg. Sym. No. Oty.

Description
Kay Part No.
Manufacturer and Part No.

CAPACITORS:
$C 1$
$C 2$
$C 2$
$C 3$
$C 4$
$C 5$
$C 6$
$C 7$
$C 8$
$C 9$
$C 10$
$C 11$
$C 12$
$C 13$
$C 14$
$C 15$
$C 16$
$C 17$
$C 18$
$C 19$
$C 20$
$C 21$
$C 22$
$C 23$
$C 24$
$C 25$
$C 26$

DODES:
D 2



General Inst. INE2A

# SWEPT FREQUENCY GENERATOR MODEL I 520A 

Owg. Sym. No. Oty.
Qescrlotion
Kay Part No.
Manufacturer and Part No.

COILS:
L1
L2
L3
L4
L5
L6

TRANSISTORS:
$Q 1$
$Q 2$
$Q 3$
$Q 4$
$Q 5$
$Q 6$
RESISTORS:

CRYSTALS :

CONNECTORS:
l7-28 uH, Slug-tuned
Speclal, Slug-tuned
Speclal, Slug-tuned
Speclal, Alr Core
Speclal, Alr Core
I2 uH, Fixed
$6394-46$
$8624-21$
$8624-28$
$12685-5$
$12685-6$
$6394-49$
Caddel Burns 40015
KEC
KEC
KEC
KEC
$M M 1941$
Same as $Q!$
Same as $Q!$
Same as $Q!$
Same as $Q!$
Same as Q I
$k-157$
Motorola MMIg41
Same as Q
Same as $?$
Same as $Q$

I ohm, $1 / 4 \mathrm{w}$, log Tol.

1.8K ohms, $1 / 4 \mathrm{~W}, 10$ Tol.

47 onms, $1 / 4 \mathrm{~W}, 10 \%$ Tol.
680 ohms, $1 / 4 \mathrm{~W}, 10 \%$ Tol.
680 ohms, $1 / 4 \mathrm{~W}, 10 \% \mathrm{TOl}$.
150 ohms, $1 / 4 \mathrm{~W}, 10 \% \mathrm{Tol}$.
22 ohms, $1 / 4 \mathrm{~W}, 10 \% \mathrm{Tol}$.
10 ohms, $1 / 4 \mathrm{~W}$, lo Tol
I ohm, $1 / 2 \mathrm{~W}, ~ l o \% ~ T a l . ~$
same as R5
Same as R
Same as R3
Same as R2
Same as R4
27 ohms, $1 / 4 \mathrm{~W}, 10 \% \mathrm{TOI}$. $2701-\mathrm{C}$
Same as R6
Same as R8
Same as Rg
Same as Rlo
Same as R9
Same as R8
4.7 ohms, $1 / 4 \mathrm{~W}, 10 \% \mathrm{Tol}$.

| $4721-C$ | $A-B C B 4721$ |
| :--- | :--- |
| $6801-C$ | $A-B C B 6801$ |
| $2201-C$ | $A-B C B 2201$ |
| $4711-C$ | $A-B C B 471$ |

22 ohms, $1 / 4 \mathrm{~W}, 10^{\circ} \mathrm{Tol}$
$4711-\mathrm{C}$
A-B CB680
22 ohms, $/ 4 \mathrm{~N}, 10 \% \mathrm{TOl}$
4711-C
A-B CB4711
Same as R8
Same as R9
Same as Rlo 100 , low Tol
Same as R. 6 . $1 / 8 \mathrm{~W}, 10 \%$ Tol
56 ohms, $1 / 4 \mathrm{~W}, 10 \%$ Tol.

| $1011-B$ |
| :--- | :--- |
| $5601-C$ |
| $2211-C$ |$\quad A-B$ BEIO11

220 ohms $, 1 / 4 \mathrm{~W}, 10 \%$ Tol.
100 ohms, $1 / 4 \mathrm{~W}, 10 \% \mathrm{TOl}$.
2211-C
1001-C
A-B C81021
A-B CB222
$\begin{array}{ll}A-B & C B 8221\end{array}$
$\begin{array}{ll}A-B & C B \\ A & \text { C821 }\end{array}$
$\begin{array}{ll}A-8 & C 81821 \\ A-B & C B 4701\end{array}$
A-B CB4701
$\begin{array}{ll}A-B & C B 6811 \\ A-B & C B 1511\end{array}$
A-日 CBI5I।
A-B CB2221
A-B CBlO31

| $2221-C$ |  |
| :--- | :--- |
| $1031-C$ |  |
| $1021-C$ | $A-B C B 1031$ |
| $A-B E B 1021$ |  |

$11653-10$
$11653-11$
KEC
1 MHz
100 MHz
|1653-12
KEC

6909-18
6909-8।

## SWEPT FREOUENCY REENERATOR I520A

FREQUENCY COUNTER ASSEMBLY \#13768-3
Dwq. Sym. NO. Otv.
INTEGRATED CIRCUITS:


Signetlcs N7400
signetics N7490

Signetics N7492
Slgnetics N7420
Texas Inst. 74132
Texas Inst. 74143

Falrchild U6B902459x

Elmenco DM15
Elmenco DMI5
Arco 3Mcr-C-104
Arco 3MCri-C-103H4

XCliton XAN52
ame as 11
Same as II
Same as 11
Same as 1
Same as 1

2112563

1K ohm, $1 / 4 \mathrm{~W}, 10 \%$
5 ohm, 1/4W, 5\%
3.9K ohm, $1 / 4 \mathrm{~W}, 10 \%$
1.2K ohm, 1/4W, 10

270 ohm, $1 / 4 \mathrm{~W}, 10 \%$
$100 \mathrm{hm}, 1 / 4 \mathrm{~W}, 10 \%$
Same as R5
150 ohm, $1 / 4 \mathrm{~W}$, 10\%
Same as R8

1 MHz
3770-3

| Owg. Sym. No. Qty. | Description | Kay Part No. | Manufacturer and Part No. |
| :---: | :---: | :---: | :---: |
| RESISTORS: |  |  |  |
| RI | 56 ohm, 1/4w, 10\% |  | Alfen Bradley |
| R2 | 390 ahm, $1 / 4 \mathrm{~W}, 10 \%$ |  | Allen Bradley |
| R3 | 200 ohm, Trlm Pot. |  | Beckman 72XwR200 |
| R4 | 10K, 1/4W, 10\% |  | Allen Eradley |
| INTEGRATED CIRCUITS: |  |  |  |
| AI | MC 1023P |  | Motorala MCl023A |
| A 2 | SP 6408 |  | Plessey SP640B |
| CAPACITORS: |  |  |  |
| CI |  |  | Arco 3MCG-C-104 |
| C 2 | Same as Cl |  |  |
| C3 | Same as Cl |  |  |
| DIODES: |  |  |  |
| 01 | 1N4446 |  | Falrchlld IN4446 |
| COILS: |  |  |  |
| LI | 10 uh Choke |  | Jeffers 4446-4 |
| TRANSI.STORS: | - . |  |  |
| 91 | 2N 3563 |  | Falrchild 2 N3563 |

sym. No. Oty.
Descrlation
Kay Part No.
Manufacturer. and Part No.
P. C. BOARD (LESS WIRED) \#12070

KEC

INTEGRATED CIRCUITS:
$A 1$
$A 2$
$A 3$
A3
CAPACITORS:
$C 1$
$C 2$
$C 3$
$C 4$
D100ES:
D 1
03
D4
05
06
07
D7
08
08
010
010
D 1
D1
D 13
D1
D
D15


SWEPT FREQUENCY GENERATOR MODEL I520A
LINEARITY F. C. BOARD ASSEMBLY \#| $2070 W$, DRAWING \#DI 20700

| Dwg. Sym. No. | Q+y. | Qescription | Kay Part No. | Manufacturer and Part No. |
| :---: | :---: | :---: | :---: | :---: |
| 016 |  | Same as |  |  |
| D17 |  | Same as ${ }^{\text {g }}$ |  |  |
| D18 |  | Same as D |  |  |
| 019 |  | Same as 0 |  | , |
| 020 |  | Same as 0 |  |  |
| 021 |  | Same as 0 |  |  |
| 022 |  | NOT USED |  |  |
| 023 |  | NOT USED |  |  |
| D24 |  | NOT USED |  |  |
| 025 |  | Same as 09 | . | . |
| 026 |  | Same as |  |  |
| 027 |  | Same as D9 |  |  |
| 028 |  | Same as D9 |  |  |
| D29 |  | Same as D9 |  |  |
| 030 |  | Same as 09 |  | . |
| 031 | . | Same as D9 |  |  |
| D32 |  | NOT USED |  |  |
| D33 |  | NOT USED |  |  |
| D34 |  | NOT USED |  |  |
| 035 |  | Same as D9 |  |  |
| 036 |  | Same as 09 |  | - |
| 037 |  | Same as D9 |  |  |
| 038 |  | Same as D9 |  |  |
| 039 |  | Same as D9 |  |  |
| 040 |  | Same as D9 |  |  |
| D41 |  | Same as D9 |  |  |
| 042 |  | Same as D9 |  |  |
| D43 |  | Same as D9 |  |  |
| D44 |  | Same as D9 |  |  |
| D45 |  | Same as 09 |  |  |
| D46 |  | Same as D9 |  |  |
| D47 | . | Same as D9 |  |  |
| D48 |  | Same as 0 |  | . |
| D49 |  | Same as 09 |  |  |
| 050 |  | Same as 09 |  |  |
| 051 |  | Same as 09 |  |  |
| D52 |  | Same as 09 |  |  |
| D53 |  | Same as 09 |  |  |
| D54 |  | Same as D9 |  |  |
| D55 | , | Same as D9 |  | . |
| D56 |  | Same as 09 |  |  |
| D57 |  | 'Same as D9 |  |  |
| D58 |  | Same as D9 |  |  |
| 059 |  | Same as D9 |  |  |
| D60 |  | Same as 09 |  |  |
| 061 |  | . Same as 09 |  |  |
| D62 |  | Same as D9 |  |  |
| D63 |  | Same as 09 |  |  |
| 064 |  | Same as D9 |  |  |
| D65 |  | Same as D9 |  |  |
| D66 |  | Same as D9 |  |  |
| D67 |  | Same as D9 |  |  |
| 068 | . | Same as 09 |  |  |
| D69 |  | Same as 09 |  |  |
| 070 |  | Same as D9 |  |  |
| 071 |  | Same as D9 |  |  |
| 072 |  | Same as D9 |  |  |
| D73 |  | Same as D9 |  |  |
| D74 |  | Same as 09 |  |  |
| TRANSISTORS: |  |  |  |  |
| Q1 Q2 |  | $2 N 4889$ $2 N 4410$ | $\begin{aligned} & K-182 \\ & K-214 \end{aligned}$ | Falrchlid 2N4889 Motorola 2N4410 |

## SWEPT FREQUENCY GENERATOR MODEL I520A

| 13 ohms, $1 / 4 \mathrm{~W}, 2 \% \mathrm{Tol}$. | 9292-63 |
| :---: | :---: |
| 10 ohms, 1/4W, 2\% Tol. | 9292-64 |
| Same as R2 |  |
| Same as R2 |  |
| I Meg ohm, l/2W, 2\% Tol. | 9292-65 |
| Same as R2 |  |
| 82 ohms, $1 / 4 \mathrm{~W}, 2 \%$ Tol. | 9292-51 |
| 47 ohms, $1 / 4 \mathrm{~W}, ~ 2 \% ~ T o l . ~$ | 9292-50 |
| 20 ohms, $1 / 4 \mathrm{~W}, 2 \%$ Tol. | 9292-66 |
| NOT USED |  |
| I ohm, $1 / 4 \mathrm{~W}, 2 \%$ Tol. | 9292-67 |
| 1.5 ohms, $1 / 4 \mathrm{~W}, 2 \% \mathrm{TOL}$. | 9292-68 |
| 8.2 ohms, $1 \mathrm{~W}, 2 \%$ Tol. | 9292-69 |
| Same as R12 |  |
| 51 ohms, $1 / 4 \mathrm{~W}, 2 \% \mathrm{Tol}$. | 9292-70 |
| 3.3 ohms, $1 / 4 \mathrm{~W}, 2 \%$ Tol. | 9292-72 |
| 27 ohms, 1/4W, 2\% Tol. | 9292-71 |
| Same as Rl2 |  |
| 270 ohms, 1/2W, 2\% Tol. | 9292-73 |
| 100 ohms, 1/2W, Pot | 9122-133 |
| Same as R19 |  |
| Same as R20 |  |
| Same as Rl9 |  |
| Same as R20 |  |
| Same as R19 |  |
| Same as R20 |  |
| Same as Rl9 |  |
| Same as R20 |  |
| Same as Ry9 |  |
| Same as R20 |  |
| 430 ohms, $1 / 2 \mathrm{~W}, 2 \%$ Tol. | 9292-74 |
| 100 ohms, $1 / 2 \mathrm{~W}$, Pot | 9122-132 |
| Same as R31 |  |
| Same as R32 |  |
| Same as R31 |  |
| Same as R32 |  |
| Same as R31 |  |
| Same as 832 |  |
| Same as R31 |  |
| Same as R32 |  |
| Same as R31 |  |
| Same as R32 |  |
| Same as R15 |  |
| Same as R12 |  |
| 5 ohms, $1 / 2 \mathrm{~W}$, Pot | 9\|22-13| |
| 12 ohms, $1 / 4 W, 2 \%$ Tol. | 9292-75 |
| Same as R12 |  |
| Same as R 45 |  |
| 18 ohms, 1/4W, 2\% Tol. | 9292-76 |
| 510 ohms, $1 / 4 \mathrm{~W}, 2 \% \mathrm{Tol}$. | 9292-81 |
| Same as R45 |  |
| 20 ohms, $1 / 4 \mathrm{~W}, 2 \%$ Tol. | 9292-77 |
| 1.2 ohms, $1 / 4 W, 2 \$ \%$ Tol. |  |
| 10 ohms, $1 / 2 \mathrm{~W}, \mathrm{Pot}$ | 9122-134 |
| 22 ohms, 1/4W, 2\% Tol. | 9292-78 |
| Same as R53 |  |
| 20 ohms, 1/2W, Pot | 9122-135 |
| 27 ohms, $1 / 4 \mathrm{~W}, ~ 2 \%$ Tol. | 9292-79 |
| Same as Rl2 |  |
| Same as R57 |  |
| Same as R58 |  |
| Same as R12 |  |
| 50 ohms, $1 / 2 \mathrm{~W}, \mathrm{Pot}$ | 9122-136 |
| 68 ohms, $1 / 4 W, 2 \%$ Tol. | 9292-80 |
| NOT USED |  |

Corning Glass Type C4 Corning Glass Type C4

Corning Giass Type C5
Cornlng Glass Type C4 Cornlng Glass Type C4 Cornlng Glass Type C4

Corning Glass Type C4 Corning Glass Type C4 Corning Glass Type C32

Corning Glass Type C4 Corning Glass Type C4 Corning Glass Type C4

Cornlng Glass Type Cs Beckman 72PM100

Corning Glass Type Cs Beckman $72 \times W 100$
same as R31
ame as R31
ame as R32
Same as R31
Same as R31
Same as R32
Same as R32
ame as R15
2 ohms, $1 / 4 \mathrm{~W}, 2 \%$ Tol.
9122-13|
9292-75

9292-76
9292-77

9122-134
9292-78
9122-135
27 ohms, $1 / 4 \mathrm{~W}, 2_{\text {d }}$ TOL.
ame as R12
Same as RJ7
Same as Rl2
$\begin{array}{ll}50 \text { ohms, } 1 / 2 \mathrm{~W}, \mathrm{Pot} & 9122-136 \\ 68 \text { ohms, } 1 / 4 \mathrm{~W}, \text { 2\% TOI. } & 9292-80\end{array}$
NOT USED
Beckman 72PM50k
Corning Glass Type C4

SWEPT FREQUENCY GENERATOR MODEL I520A
LINEARITY P. C. BOARD ASSEMBLY \#|2070W, DRAWING \#DI20700

| Owg. Sym. No. | Q+y. | Descrlption | Kay Part No. | Manufacturer and Part No. |
| :---: | :---: | :---: | :---: | :---: |
| R66 |  | NOT USED |  |  |
| R67 |  | NOT USED |  |  |
| R68 |  | NOT USED |  |  |
| R69 |  | NOT USED |  |  |
| R70 |  | NOT USED |  |  |
| R71 |  | NOT USED |  |  |
| R72 |  | NOT USED |  |  |
| R73 |  | Same as Ris |  |  |
| R74 |  | Same as R12 |  |  |
| R75 |  | Same as R45 |  |  |
| R76 |  | 15 ohms, $1 / 4 \mathrm{~W}, 2 \%$ Tol. | 9292-82 | Cornlng Glass Type C4 |
| R77 |  | 5.6 ohms, $1 / 4 W, 2 \%$ Tol. | 9292-83 |  |
| R78 |  | Same as R45 |  |  |
| R79 |  | Same as R49 |  |  |
| R80 |  | Same as R50 |  |  |
| R81 |  | Same as R45 |  |  |
| R82 |  | Same as R49 |  |  |
| R83 |  | Same as R53 |  |  |
| R84 |  | Same as R54 |  |  |
| R85 |  | Same as R55 |  |  |
| R86 |  | Same as R53 |  |  |
| R87 |  | Same as R57 |  |  |
| R88 |  | Same as R58 |  |  |
| R89 |  | Same as Rl2 |  |  |
| R90 |  | Same as R 57 |  |  |
| R91 |  | Same as R58 |  |  |
| R92 |  | Same as R12 |  |  |
| R93 |  | Same as R63 |  |  |
| R94 |  | Same as R64 |  |  |
| R95 |  | NOT USED |  |  |
| R96 |  | NOT USED |  |  |
| R9.7 |  | NOT USED |  |  |
| R98 |  | NOT USED |  |  |
| R99 |  | NOT USED |  | . |
| R100 |  | NOT USED |  |  |
| R101 |  |  |  |  |
| R102 |  | NOT USED |  |  |
| R103 |  | Same as R15 |  |  |
| R104 |  | Same as R12 |  |  |
| R105 |  | 2 ohms, 1/2W, Pot | 9122-128 | Beckman 72PM2K |
| R106 |  | Same as R46 |  |  |
| R107 |  | Same as R53 |  |  |
| R108 | . | Same as R105 |  |  |
| R109 |  | Same as R49 |  |  |
| RI\| 0 |  | Same as R 50 | . |  |
| R1! |  | Same as R45 |  |  |
| R1I2 |  | Same as R52 |  |  |
| R113 |  | Same as R53 |  |  |
| R114 |  | Same as R54 |  |  |
| R\|| 5 |  | Same as R55 |  |  |
| RI! 5 |  | Same as R53 |  |  |
| R1: 7 |  | Same as R57 |  |  |
| R:18 |  | Same as R58 |  |  |
| R119 |  | Same as Rl2 |  | . |
| R120 |  | Same as R57 |  |  |
| R121 |  | Same as R58 |  |  |
| R1 22 |  | Same as R12 |  |  |
| R123 |  | Same as R63 |  |  |
| R124 |  | Same as R58 |  |  |
| R125 |  | Same as R77 |  |  |
| R126 |  | Same as R63 |  |  |
| R127 |  | Same as R55 |  |  |
| R128 |  | Same as R2 |  |  |
| R129 |  | 100 ohms, $1 / 2 \mathrm{~W}$, Pot | 9122-137 | Beckmán 72FMlook |
| R130 |  | Same as RS's |  |  |
| R131 |  | Same as R2 |  |  |
| R132 |  | Same as Rl29 |  |  |
| R133 |  | Same as Rl5 |  |  |
| R134 |  | 33 ohms, 1/4W, 2\% Tol. | 9292-85 | Cornlng Glass Type C5 |
| R135 |  | 500 ohms, $1 / 2 W$, Pot | 9122-138 | Beckman 72PM500k |

## SWEPT FREQUENCY GENERATRO MODEL I520A

LINEARITY P. C. BOARD ASSEMBLY \#|2070W, DRAWING \#D| 20700


SWEPT FREQUENCY GENERATOR MODEL I520A
LINEARITY P. C. BOARD ASSEMBLY \#:2070W, DRAWING \#D: 20700

| Dwg. Sym. No. | Oty. | Description | Kay Part No. | Manufacturer and Part No. |
| :---: | :---: | :---: | :---: | :---: |
| R207 |  | Same as R57 |  | . |
| R208 |  | Same as R58 |  |  |
| R209 |  | Same as R!2 |  |  |
| R210 |  | Same as R57 |  |  |
| R211 |  | Same as R59 |  |  |
| R212 |  | Same as Rl2 |  |  |
| R2:3 |  | Same as R63 |  |  |
| R214 |  | Same as R58 |  |  |
| R215 |  | Same as R77 |  |  |
| R216 |  | Same as R63 |  |  |
| R217 |  | Same as R55 | . |  |
| R218 |  | Same as R2 |  |  |
| R219 |  | Same as R129 |  |  |
| R220 |  | Same as R55 |  |  |
| R221 |  | Same as R77 |  |  |
| R222 |  | Same as Rl29 |  |  |
| R223 |  | 300 ohms, 1/4W, 2\% Tol. |  |  |
| R224 |  | 1 Meg ohm, 1/2W, Pot | $9122-139$ | Beckman 72 PMIMeg |
| R2.25 |  | Same as R57 |  |  |
| R226 |  | Same as R!2 |  |  |
| R227 |  | 120 ohms, 1/4W, 2\% Tol. | 9292-87 | Cornlng Glass Type C4 |
| R228 |  | Same as R224 |  |  |
| R229 |  | Same as R45 |  |  |
| R231 |  | Same as R223 |  |  |
| R232 |  | Same as R224 |  |  |
| R233 |  | Same as R129 |  |  |
| R234 |  | 18 ohms, $1 / 4 \mathrm{~W}, 2 \%$ Tol. | 9292-88 | Corning Glass Type C4 |
| R235 |  | Same as R223 |  |  |
| R236 |  | Same as R224 |  |  |
| R237 |  | Same as Rl29 |  |  |
| R238 |  | Same as R234 |  |  |
| R239 |  | Same as R223 |  |  |
| R240 |  | Same as R224 |  |  |
| R241 |  | Same as R129 |  |  |
| R242 |  | Same as R234 | . |  |
| R243 |  | Same as R223 |  |  |
| R244 |  | Same as R224 |  |  |
| R245 |  | Same as R129 |  |  |
| R246 |  | Same as R234 |  |  |
| R247 |  | 470 ohm, $1 / 2 \mathrm{~W}, 2 \%$ Tol. | 9292-89 | Corning Glass Type Cs |
| R248 |  | Same as R247 |  | Corning Glass Type Cs |
| R249 |  | Same as R247 |  |  |
| R250 |  | Same as R247 |  | . |
| R251 |  | Same as R223 |  |  |
| R252 |  | Same as R247 |  |  |

## SWEPT FREQUENCY GENERATOR MODEL I520A

SWEEP P. C. BOARD ASSEMBLY \#| $2036 W$, DRAWING \#C|233EE

KEC

INTEGRATED CIRCUITS:
A1

A 3
A4
CAPACITORS:
C1
C2
C3
C4
C5 .

DIODES:
01
02
D4

TRANSI STORS :
$Q 1$
$Q 2$
$Q 3$
$Q 4$
$Q 5$
$Q 6$

Same as Q।
2N4889
K-159
$k-182$
$K-210$
$\mathrm{K}-203$
K-134
40467 A
2 N 1377

| 1.5 ohms, $1 / 4 \mathrm{~W}, 10 \% \mathrm{Tol}$. | 1521 -C | A-B CBI521 |
| :---: | :---: | :---: |
| 4.7 ohms, $1 / 4 \mathrm{~W}, 10 \% \mathrm{Tol}$. | 4721 -C | A-8 CB472! |
| Same as RI |  |  |
| 10 ohms, 1/4W, 10\% Tol. | $1031-\mathrm{C}$ | A-8 CB1031 |
| 15 ohms, 1/4W, 10\% Tol. | \| $531-\mathrm{C}$ | A-日 CBI531 |
| Same as R4 |  |  |
| 100 ohms, $1 / 4 \mathrm{~W}, 10 \% \mathrm{Tol}$. | 1041-C | A-8 CB1041 |
| 10 Meg ohms, $1 / 4 \mathrm{~W}, 10 \% \mathrm{Tol}$. | $1061-\mathrm{C}$ | A-B C81061 |
| 7.5 ohms, $1 / 4 \mathrm{~W}, 5 \% \mathrm{TOl}$. | 7525-C | A-8 C87525 |
| I ohm, 1/4W, lo\% Tol. | 1021 -C | A-8 CEIO21 |
| Same as R4 |  |  |
| 3.3 ohms, $1 / 4 \mathrm{~W}, 10 \%$ Tol. | 3321-C | A-B CB3321 |
| Same as Rlo |  |  |
| 180 ohms, $1 / 4 \mathrm{~W}, 10 \%$ TOI. | 18410 C | A-B CBI841 |
| Same as R10 |  |  |
| 18 ohms, $1 / 4 \mathrm{~W}, 10 \% \mathrm{Tol}$. | $1831-C$ | A-B CBI831 |
| Same as R12 |  |  |
| Same as R12 |  |  |
| Same as R4 |  |  |
| 24 ohms, $1 / 4 \mathrm{~W}, 5 \% \mathrm{Tol}$. | 2435-C | A-B C82435 |
| Same as R4 |  |  |
| 20 ohms, $1 / 2 \mathrm{~W}, \mathrm{Pot}$ | 9122-140 | Beckman $72 \times W 20 \mathrm{~K}$ |
| Same as R2 |  |  |
| Same as Ri6 |  |  |
| 8.2 ohms, $1 / 4 \mathrm{~W}, 10 \%$ Tol. | 8221-C | A-日 CE8221 |
| 5 ohms, 1/2w, Pot | 9\|22-|4| | Beckman 72 XW 5 K |
| Same as R25 |  |  |
| Same as Rl |  |  |
| Same as Rl2 |  |  |
| Same as R4 |  |  |
| Same as Ri2 |  |  |
| Same as Riz |  |  |
| 8.2 ohms, $1 / 4 \mathrm{~W}, 5 \%$ Tol. | 8225-C | A-B C88225 |
| Same as R33 |  |  |
| Same as R4 |  |  |
| Same as R5 |  |  |

Falrchlid 2N4889
Motorola 2N5464
RCA 40467 A
Texas Inst. 2N1377

RESISTORS:

## SWEPT FREQUENCY GENERATOR MODEL I520A

ALC P. C. BOARD ASSEMBLY \#| $2015 W$, DRAWING \#C| 2015 D

| Dwg. Sym. No. Qty. | Description | Kay Part No. | Manufacturer and Part No. |
| :---: | :---: | :---: | :---: |
|  | P. C. BOARD (LESS | W\|RED) \#12015 | KEC |
| INTEGRATED CIRCUITS: |  |  |  |
| A 1 | SN72709N | 11652-26 | Texas lnst. SN72709N |
| CAPACITORS: |  |  |  |
| Cl | 0.01uf, loov, Myler-paper | 6899-12 | Elmenco IDP-1-103 |
| C2 | 0.003 uf, 60.0v, Myler-paper | 6899-15 | Elmenco 6DP-1-302 |
| C3 | O.05uf, l00v, Myler-paper | 6899-1 | Elmenco IDP-2-503 |
| C4 | NOT USED |  |  |
| C5 | 3 f , 500v, Mlca | 6359-51 | Elmenco DM15-030 |
| C6 | 100pf, 500v, Mica | 6359-46 | Elmenco DM15-101 |
| C 7 | O.luf, 50v, Mylar | 6899-20 | Paktron MW600 |
| C8 | 0.001uf, 600v, Myler-paper | 6899-10 | Elmenco 6DP-1-102 |
| C9 | $500 p f, 500 v$, Mlca | 6359-66 | Elmenco DM\|5-501 |
| C10 | O.5uf, 100v, Myler-paper | 6899-21 | Elmenco IDP-3-504 |
| DIODES: |  |  |  |
| DI | IN4446 (Sub. ING\|4A) | 6357-125 | Fairchild IN4446 |
| D2 | Same as DI | . |  |
| TRANSISTORS: |  |  |  |
| Q1 | 2N3566 | K-159 | Faltchlld 2N3566 |
| Q2 | Same as Ql |  |  |
| Q3 | 2N3638A | K-178 | Falrchild 2N3638A |
| Q4 | Same as Q3 |  |  |
| 05 | 2N3565 | K-173 | Falrchlid 2N3565 |
| RES ${ }^{\text {STORS }}$ |  |  |  |
| R1 | 4.7 ohms, $1 / 4 W, 10 \%$ Tol. | 4721-C | A-B C84721 |
| R2 | 220 ohms, $1 / 4 \mathrm{~W}, 2 \% \mathrm{Tol}$. | 9292-52 | Corning Glass Type C4 |
| R3 | 47 ohms, $1 / 4 \mathrm{~W}, 2 \% \mathrm{Tol}$. | 9292-50 | Corning Glass Type C4 |
| R4 | 270 ohms, $1 / 4 \mathrm{~W}, 2 \% \mathrm{Tol}$. | 9292-53 | Corning Glass Type Cu |
| R5 | 4.7 Meg ohms, $1 / 4 \mathrm{~W}, 10 \mathrm{~d} \mathrm{Tol}$. | 4751-C | A-B CB4751 |
| R6 | 1.5 ohms, $1 / 4 \mathrm{~W}, 10 \%$ TO1. | 1521-C | A-B C81521 |
| R7 | Same as R! |  |  |
| R8 | 18 ohms, 1/4W, 10\% Tol. | $1831-C$ | A-8 CB\| 831 |
| R9 | Same as R! |  |  |
| R10 | 470 ohms, $1 / 4 W, 10 \%$ Tol. | 4711-C | A-8 C84711 |
| R11 | 1 ohm, 1/4W, lo\% Tol. | 1021-C | A-B CB1021 |
| R12 | 22 ohms, $1 / 4 \mathrm{~W}, ~ 10 \%$ TOI. | 2201-C | A-8 C82201 |
| R13 | 2.7 ohms, $1 / 4 \mathrm{~W}, 5 \%$ Tol. | 2725-C | A-B CB2725 |
| R14 | 10 ohms, $1 / 4 \mathrm{~W}, 10 \%$ Tol. | $1031-\mathrm{C}$ | A-B CB1031 |
| R15 | 5.6 ohms, $1 / 4 W, 5 \%$ Tol. | 5625-C | A-B CB5625 |
| R16 | 18 ohms, $1 / 4 \mathrm{~W}, 10 \% \mathrm{Tol}$. | $1801-\mathrm{C}$ | A-8 CE!801 |
| R17 | 2.2 ohms, $1 / 4 \mathrm{~W}, 10 \%$ Tol. | 2221 -C | A-B CB2221 |
| R18 | 10 ohms, 1/2W, Pot | 9122-129 | Beckman $72 \times W 10 \mathrm{~K}$ |
| R19 | Same as R8 | . |  |
| R20 | Same as Rl3 |  |  |
| R21 | 6.2 ohms, $1 / 4 \mathrm{~W}, ~ 10 \% \mathrm{Tol}$. | $6221-\mathrm{C}$ | A-8 CB6221 |
| R22 | 20 ohms, 1/2W, Pot | 9122-140 | Beckman 72XW20K |
| R23 | Same as R!! |  |  |
| R24 | Same as Rll |  |  |
| R25 | Same as Rll |  |  |
| R26 | Same as R6 |  |  |
| R27 | 9.1 ohms, $1 / 4 W$, 5\% Tol. | 9125-C | A-B C89125 |
| R28 | Same as R22 |  |  |
| R29 | 3.3 ohms, $1 / 4 \mathrm{~W}, \mathrm{lo} \mathrm{\%} \mathrm{Tol}$. | 3321-C | A-8 C83321 |
| R30 | Same as Rl |  |  |
| R31 | 100 ohms, $1 / 2 \mathrm{~W}$, Pot | 9122-142 | Beckman 72XW100K |
| R32 | Same as R31 |  |  |
| $R 33$ $R 34$ | 24 ohms, $1 / 4 \mathrm{~W}, ~ 2 \%$ Tol. 680 ohms, $1 / 4 W, 5 \%$ Tol | $\begin{aligned} & 9292-90 \\ & 68: 5-C \end{aligned}$ | Corning Glass Type C4 A-BCB68/5 |

SWEPT FREQUENCY GENERATOR MOOEL I520A
VARIABLE MARKER P. C. BOARD ASSEMBLY \#12037W, DRAWING \#C12037C
Dwq. Sym. No. Qty. Kay Part No. Manufacturer and Part No.
P. C. BOARO (LESS WIRED) \#|2037 KEC

INTEGRATED CIRCUITS:

| A 1 | U6E7741393 | 11652-28 | Falrchild U6E7741393 |
| :---: | :---: | :---: | :---: |
| A 2 | U58771039 (UA10) | 11652-27 | Falrchlld U53771039 |
| A3 | SN 7400 | 11652-14 | Texas !nst. SN7400 |
| A 4 | SN7473 | 11652-29 | Texas \|nst. SN7473 |
| A5 | SN72709N | 11652-26 | Texas lnst. SN72709N |
| A6 | Same as A5 |  |  |
| CAPACITORS: | , |  |  |
| C 1 | 2uf, 25v, Electroyltic | 6355-169 | GE 76FOKC 2 R0 |
| C2 | $50 \mathrm{pf}, 500 \mathrm{v}, \mathrm{Mica}$ | 6359-60 | Elmenco DMI5-500 |
| C3 | 7pf, 500v, Mlca | 6359-76 | Elmenco DM15-070 |
| C4 | 15pf, 500v, Mica | 6359-55 | Elmenco DM15-150 |
| C5 | Same as C4 |  |  |
| c6 | Same as C2 |  |  |
| C7 | 12pf, 500v, Mlca | 6359-54 | Elmenco DM15-120 |
| C8 | 10pf, 500v, Mlca | 6359-53 | Elmenco DMI5-100 |
| C9 | 2pf, $500 \mathrm{v}, \mathrm{Mtca}$ | 6359-50 | Elmenco DM15-020 |
| DIODES: |  |  |  |
| D | IN4735, Zener, (62v) | K-126 | Motorola IN4735 |
| 02 | IN4446 (Sub. INgI4A) | K-125 | Falrchlld IN4446 |
| TRANSISTORS: |  |  |  |
| Q1 | 2N3645 | K-189 | Falrchlld 2N3645 |
| RESISTORS: |  |  |  |
| R1 | 10 ohms, 1/4W, lo\% Tol. | 1031-C | A-B.C81031 |
| R2 | Same as RI |  |  |
| R3 | 820 ohms, $1 / 4 \mathrm{~W}, 10 \%$ Tol. | $8211-\mathrm{C}$ | A-3 CB821। |
| $R 4$ | 2.2 ohms, $1 / 4 \mathrm{~W}, 10 \% \mathrm{Tol}$. | 2221-C | A-B C82221 |
| R5 | 1 ohm, 1/2W, Pot | 9122-143 | Beckman $72 \times W 1 K$ |
| R6 | Same as R3 |  |  |
| R7 | 270 ohms, $1 / 4 \mathrm{~W}, 10 \% \mathrm{Tol}$. | 2711-C | A-8 CB2711 |
| R8 | 2.7 ohms, $1 / 4 \mathrm{~W}, 10 \%$ Fol. | 2721-C | A-B CB2721 |
| $R 9$ | 390 ohms, $1 / 4 \mathrm{~W}, 10 \%$ Tol. | 3911-C | A-B CB3.911 |
| R10 | I ohm, 1/4W, 10\% Tol. | $1021-\mathrm{C}$ | A-B CBl021 |
| R1! | 1.5 ohms, $1 / 4 \mathrm{~W}, 10 \%$ Tol. | $1521-\mathrm{C}$ | A-B CBl521 |
| R12 | 1.8 ohms, $1 / 4 \mathrm{~W}, 10 \% \mathrm{Tol}$. | $1821-\mathrm{C}$ | A-B C81821 |
| R13 | 27 ohms, $1 / 4 \mathrm{~W}, 10 \%$ Tol. | $2731-\mathrm{C}$ | A-8 CB2731 |
| R14 | 150 ohms, $1 / 4 \mathrm{~W}, 10 \%$ Tol. | 1541 -C | A-B CB:541 |
| R15 | 4.7 ohms, $1 / 4 \mathrm{~W}, 10 \%$ Tol. | $4721-\mathrm{C}$ | A-B CB4721 |
| R16 | 470 ohms, $1 / 4 \mathrm{~W}, 10 \% \mathrm{Tol}$. | 4741 -C | A-B CB474) |
| R17 | 470 ohms, $1 / 4 \%, 10 \%$ Tol. | 4711-C | A-B CB4711 |
| R18 | Same as Rlo |  |  |
| R19 | 100 ohms, $1 / 4 \mathrm{~W}, 10 \%$ Tol. | 1011-C | A-B C8IOII |
| R20 | Same as Rlo |  |  |
| R21 | Same as Ril |  |  |
| R22 | Same as Rlo |  | - |
| R23 | I Meg ohm, $1 / 4 \mathrm{~W}, \mathrm{lo} \mathrm{\%}$ Tol. | 1051-C | A-b Cal05 |
| R24 | 120 ohms, $1 / 4 \mathrm{~W}, 10 \%$ Tol. | 1241-C | A-B C8\| 241 |
| $R 25$ | 100 ohms, $1 / 2 \mathrm{~W}$, Pot | 9\|22-144 | Beckman 72XWl00 |
| R26 | 150 ohms, $1 / 4 W, 10 \%$ Tol. | $1511-\mathrm{C}$ | A-B Cal511 |
| R27 | 22 ohms, 1/4w, 10\% Tol. | 2231-C | A-B CB2231 |
| R28 | 15 ohms, 1/4W, 10\% Tol. | $1531-C$ | A-B CBl531 |

SWEPT FREQUENCY GENERATOR MODEL $1520 A$
VERTICAL CHANNEL AND NARROW SWEEP P. C. BOARD ASSEMBLY \# $2035 W$, DRAWING \#C120350

INTEGRATED CIRCUITS:


# SWEPT FREQUENCY GENERATOR MODEL I520A 

VERTICAL CHANNEL AND NARROW SWEEP P. C. BOARD ASSEMBLY \#| $2035 W$, DRAWING \#CI 20350

| Dwg. Sym. No. | Q+y. | Description | Kay Part No. | Manufacturer and Part No. |
| :---: | :---: | :---: | :---: | :---: |
| R24 |  | 1 Meg ohm, $1 / 4 \mathrm{~W}, \mathrm{l}$, $0 \%$ TOI. | 1051-C | A-B CB1051 |
| R25 |  | 10 Meg ohms, $1 / 4 \mathrm{~W}, 10 \%$ Tol. | $1061-\mathrm{C}$ | A-B CBl061 |
| R26 |  | Same as Rig |  |  |
| R27 |  | 10 ohms, $1 / 4 \mathrm{~W}, 10 \% \mathrm{Tal}$. | $1031-\mathrm{C}$ | A-B CB\|021 |
| R29 |  | Same as Rl4 |  |  |
| R30 |  | Same as Rlf |  |  |
| R31 |  | Same as Ris |  |  |
| R32 |  | Same as RI.7 |  |  |
| R33 | . | Same as Rig |  |  |
| R34 |  | 4.7 ohms, $1 / 4 \mathrm{~W}, 10 \%$ Tol. | 4.71-C | A-B CB47GI |









R4/



KAY ELEMETRICS CORP PINE BROOK, N. J.


UNLESS INDICATED OTHERWISE
ALL CAPACITANCES ARE IN $\mu \mu f$
ALL RESISTANCES ARE IN OHMS













* USED WITH:

SWEPT FREQUENCY GENERATOR IS2C

SCHEMATIC-LOW FREQ ADAPTOR

MAT.
FINISH:
TOLERANCES UNLESS OTHERWISE SPECIFIED:
DECIMAL 士. 005
FRACTIONAL $\pm 1 / 64$
ANGULAR $\pm 30$ MIN.

| CHANGE | DATE | APP. |
| :---: | :---: | :---: |
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NOTE: UNLESS INDICATED OTHEXWISE
ALL RESISTANCES ARE IN OHMS I/AW
ALL CAPACVTPNCE゙S ARE IN PO


NOTF : UNLESS INDKATED OTHERWLSM
ALL JUESISTANCES AREF IN OWNS, $114 \mathrm{~W}, \pm 10 \%$
HLL QARHCITANCAS AREE IN PI
ALL CMMEION COIL FORMS AEFR REO DOT SLUGS

Cor MAN CHASSIS NUMBERS
$\triangle+5 V$ MIN ATTENUATION [RF LEVEL POT F/P]

- $3 V$ MAX ATTENUATION [RF LEVELPOTF/P]


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SWEEP VOLTAGE S-Z
    SECC
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+ +NOV (WIPCR


NOTE: UNLESS INDICATED OTHTHEWIS
ALL RESISTANCES AREE IN OHMS I/AW
ALL CADA CITANCES AREF IN PR
ALLO. تु Hh CHOKES MRFF DO TURNS, \# 38 WIEE ON IOK I/BW RESISTORS

* ANCT:OEV SELNCT

ALL P/C/O COMPONENT NOS ARE INDEPENDENT
OF MAIN CHASSIS COMPONENT NOS.
N REFER TO WAVEFORMS DWG DIZ6IOA

| $\begin{aligned} & e 75 \\ & c 100 \\ & 015 \\ & \angle 34 \end{aligned}$ | SCHEMATIC-05-1200MHZ MODULE SWEPT FREQ GENERATOR I520 A - - |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | \% |  | scale: $f$ |
|  |  |  |  | KAY elemetrics corp <br> PINE ENOOK, N. J. |  |
|  | emamor | oart | APr. |  |  |
|  |  | $\frac{\text { gre }}{}$ | ut | DWN. Br Axpatary | Date te.15.76 |
|  |  | 号等 | (1) | APP. UY Whtoan (ave) Date 6.7 .71 |  |
|  |  |  |  | DWG. NO. | DI2, 192E |
|  |  |  |  |  |  |









UNLESS INDICATED OTHERWISE, THE FRONT PINEL CONTRRS

| FREQUENCY BAND....-.-....05-10 |  |
| :---: | :---: |
| CENTER FREQUENCY --.------5 WHX |  |
| RF ATTENUATION..........-. 1008 |  |
|  |  |
| VERTICAL BLANAING_-.....- |  |
| BANDWIDTH.-............- WIAE, VARIABLLE CONTROL FULLY CLOCKWISE |  |
| SWEEP RATE.-.-.-.-.-. LINE TRIGGERED |  |
| VERTICAL GAIN.-.-.-.- HID RANGE |  |
| COUNTER,---------- ON |  |
| VARIABLE NARKER POSITION-- SET SO AS TO POSITION t, PQINT AS. SHOWN |  |
| COUNTER DISPLAK_-_----RIGHT HAND HHE POSITION |  |
| MARKER SIZE $\qquad$ - HARMONIC S EXTERNAL COWPLETELY COUNTER-CLOCKWNSE VARIAELE FULLY CLOCAWISE |  |
|  |  |
| HARMONIC MARKERS | OfF |

1. THE FLAT AND WAVEFORM CHANGES EETMEEN $t$, 4 ty WHL OS APPEAR WHEN THE "COUNTER" SWITGH IS TURNEO "OFF" 青 WHEN THE VARIABLE MARKER POSITION SWITCH IS SETP.AF: EXTRENE ENDS OF ITS ROTATION.
2. THE FLAT BETWEEN $t_{f}$ है $t_{5}$ WILL DISAPPFAR WHEN UNIT 15 MOT IN THE LINE TRIGEERES MODE.









NOTE:UNLESS INDICATED OTHERWISE
ALL RESISTORS ARE IN OHMS, $1 / 4 \mathrm{~W}$
ALL CAPACITORS ARE IN $\mu x$

