SIGNAL LEVEL METER

MODEL 7271

Texscan

2-6,3 Q-7,4 (259,25)
4-5,9 S-7,5 (271,25)
6-5,7 U-7,7 (283,25)
A-6,6 (121,25)
C-6,6 (133,25)
F-6,1 (151,25)
H-6 (163,25)
7-6 W-7,6 (293,25)
9-5,5
11-5,9 6-22-82
13-5,9
K-6,8 (223,25)
M-7,2 (235,25)
O-7,3 (247,25)

SIGNAL LEVEL METER

MODEL 7271

SET +10 DB

IF → 52 mHz 5.58 mV

NORMAL {VHF / UHF} 15.7 mV

CAUTION:

THIS UNIT HAS BEEN FACTORY SET FOR 115 V rms 60 Hz OPERATION. IF OPERATION FROM 230 V rms 50 Hz IS DESIRED CONSULT THE MANUAL FOR PROPER SETTING OF THE LINE VOLTAGE SWITCH.

DAMAGE TO ANY UNIT WHICH IS CONNECTED TO A 230-VOLT POWER SOURCE, BUT WHICH IS SET INTERNALLY FOR 115-VOLT OPERATION CONSTITUTES "MISUSE", AND IS NOT COVERED BY THE TEXSCAN WARRANTY. CONSULT THE INSTRUCTION MANUAL FOR THE PROPER INTERNAL POWER-SOURCE SETTING, IF THERE IS ANY QUESTION ABOUT THE INTENDED USE. NOTE: THE LINE FUSE MUST ALSO BE CHECKED FOR THE CORRECT RATING AND TYPE.

IMPORTANT NOTICE
HANDLE WITH CARE

THIS ELECTRONIC INSTRUMENT WAS DESIGNED FOR NORMAL OPERATING AND STORAGE CONDITIONS ENCOUNTERED IN FIELD USE. IT SHOULD BE HANDLED AND TRANSPORTED WITH CARE TO AVOID DAMAGE TO DELICATE COMPONENTS AND CIRCUITS. PERSONNEL UNFAMILIAR WITH ELECTRONIC INSTRUMENTS SHOULD BE INSTRUCTED TO AVOID DROPPING, THROWING, BOUNCING, STRIKING, OR OTHERWISE MISHANDLING THE UNIT. WHEN TRANSPORTING THE UNIT IN A VEHICLE, CARE SHOULD BE TAKEN TO CUSHION IT AGAINST SEVERE SHOCKS THAT MIGHT OCCUR.

WARRANTY

Texscan Corporation warrants that each part of this product (except vacuum tubes and batteries) will be free from defects in material and workmanship under normal use and service. Texscan Corporation's obligation under this warranty shall be limited to repairing or replacing, F.O.B. Indianapolis, Indiana, each part of the product (except vacuum tubes and batteries) which is defective, provided that buyer gives Texscan written notice of such defect within a period of one year commencing with the delivery of the product by Texscan Corporation. The remedy set forth herein shall be the only remedy available to the buyer for breach of this warranty, and in no event shall Texscan Corporation be liable for incidental or consequential damages for such breach. This warranty shall not apply to any part of the product which, without fault of Texscan Corporation, has been subject to alteration, failure caused by a part not supplied by Texscan Corporation, accident, fire or other casualty, negligence or misuse, or to any part rather than as a result of defect.

Except for warranties set forth above, and the warranties, if any, available to the buyer from the persons who supply Texscan Corporation any vacuum tubes or batteries contained in the product, there are no warranties, express or implied (including, without implied limitation, any implied warranties of merchantability or fitness), with respect to the condition of the product or their suitability for the use intended for them by the buyer or by a purchaser from the buyer.

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1.1 DESCRIPTION

Model 7271 is a tunable r-f voltmeter designed for measuring signal levels between -35 dBmV and +70 dBmV in the frequency range from 5 to 216 MHz.

An accessory plug-in converter is available on special order for extending the operating range into the 470 to 890 MHz UHF band.

The instrument consists essentially of a tuner local oscillator unit, a balanced mixer, an i-f amplifier, and a peak detector measuring circuit. A step attenuator in the input circuit permits setting the measurement range. Frequencies can be tuned in four switch-operated ranges.

The 7271 includes a built in volt-ohm meter, a video detector whose output is available at a front panel terminal, a discriminator, an audio amplifier, and a loudspeaker to help in the identification of interfering signal sources. The metered signal current is also available at a rear panel phone jack for application to a strip chart recorder or similar device.

Model 7271 may be powered from a 115V or 230V, 50 Hz or 60 Hz line source, from an external 12 to 15 volt battery, or from its own internal, rechargeable, nickel-cadmium battery. Each instrument is accompanied by a calibration chart in the lid; the compensator calibration points are factory-inserted on the chart.

1.2 SPECIFICATIONS

The specifications of Model 7271 are listed in Table 1-1.

TABLE 1-1. SPECIFICATIONS

FREQUENCY RANGE Tuning Range A B C D	5 to 50 MHz, 54 to 216 MHz, in 4 bands 5 to 50 MHz 54 to 108 MHz 108 to 162 MHz 162 to 216 MHz
MEASUREMENT RANGE full scale reading	—20 to +70 dBmV in 10 ranges
ACCURACY OF LEVEL READINGS	±1.5 dB at 25°C, ±3 dB from —18°C to +60°C. CW or video.
VIDEO OUTPUT CAPABILITY	0.8 V p-p for +10 dBmV input, with compensator control set for no overload.
MAXIMUM SENSITIVITY	—35 dBmV
SELECTIVITY	I-F bandwidth of 0.6 MHz at 3-dB points.
REJECTION OF ADJACENT SOUND CARRIER	46 dB down from level of received video carrier.
INPUT IMPEDANCE AND MATCH above —20 dBmV	75 ohms, VSWR 1.22:1 (20 dB min. return loss); not matched below —20 dBmV.
INTERMEDIATE FREQUENCY	52 MHz.
POWER REQUIREMENTS	A-C line: 2 W, 115 V or 230 V (±10%). 0.3 A max. Internal Battery: 12 V, 0.6 Ah, 60-90 mA. External Battery: 12-15 V, at least 0.6 Ah.
AMBIENT OPERATING TEMPERATURE RANGE	—18°C to +60°C.
AMBIENT STORAGE TEMPERATURE RANGE	—40°C to +60°C.
NET WEIGHT	15 lbs.
DIMENSIONS	8 1/2" H x 13 1/4" W x 8 1/4" D.

TABLE 2-1. OPERATING CONTROLS AND CONNECTIONS

LOCATION	NAME	TYPE AND SCHEMATIC DESIGNATION	POSITION	FUNCTION
FRONT PANEL	CHARGE	Lamp, DS2	——	Indicates unit is operating to charge internal battery
	VIDEO OUTPUT	Coaxial fitting, J5	——	For connection of an oscilloscope.
	AC	Neon Lamp, DS1	——	Indicates unit is operating from a-c line.
	PUSH—TUNER COMP	Potentiometer and switch, R210/S201	Pushed in, 0-10	Permits calibration of unit over its frequency range.
	PULL—MAN GAIN		Pulled out	Provides uncalibrated 27 dB range control for the i-f amplifier; the meter readings are relative with the control in this position.
	FUNCTION SELECTOR	Rotary switch S-1	Off INT BATT EXT BATT CHG OHMS ACV DCV	De-energizes the Instrument. Connects internal battery. Connects external battery. Permits charging Int. battery. Permits ohms measurement. Permits AC volt measurement. Permits DC volt measurement.
	DIAL LIGHTS	Pushbutton switch, S2	——	Controls tuning dial lights and meter lights.
	UHF/VHF	Slide switch, S101	UHF	Connects the UHF converter output for measurement.
			VHF	Connects the VHF input for measurement.
	VHF INPUT	Coaxial fitting, J801		For connecting VHF signal source.
	METER RANGE		Set for on scale reading	Indicates meter sensitivity.
	METER	0-200 μA meter MI	—5 to +10 dB scale 0 to ∞ ohm scale 0 to 120 VAC scale 0 to 60 VDC scale	Indicates dB levels Indicates ohm value Indicates AC voltage level Indicates DC voltage level
	FUSE	1/4 A Fast BLO	——	Volt-ohm meter fuse.
	TIP JACK	J10 & J11	——	Volt-ohm test lead jacks.
	TUNING	Inductive, L402, L405, L408, L411	Clockwise and Counter-clockwise	Permits tuning to the desired frequency.
		Dial	A,B,C, and D scales	Indicate tuning ranges; black bands indicate ranges between video and sound carrier of each VHF TV channel.
	BATT CHECK	Pushbutton switch, S5	Depressed	Permits checking charge on internal battery, and output voltage of internal power supply when unit is connected to a-c line.
	VOLUME	Potentiometer and spst switch, R7/S6	OFF	De-engergizes audio amplifier.
			——	Controls audio volume
	Frequency Range Selector	Rotary switch, S701	A/5-50 MHz B/54-108 MHz D/108-162 MHz C/162-216 MHz UHF	Selects 5- 50 MHz range. Selects 54-108 MHz range. Selects 108-162 MHz range. Selects 162-216 MHz range. Selects operation with UHF adapter.
REAR PANEL	RECORDER	Phone jack, J1	——	Permits connection of a recording device.
	Fuse 0.5A	3AG, F1	——	Protects instrument against surge currents.
	—(BLK) EXT +(RED) BATT	Tip jack, black J4 Tip jack, red J3	—— ——	Permits connection of instrument to external battery.
	115/230 VAC 50/60	Recessed, 3 prong male jack, J1	——	Accepts female plug of line cord.
INTERNAL	Power Selector (115/230)	Slide switch, S7	115	Permits operating unit from 115 V a-c line.
			230	Permits operating unit from 230 V a-c line.

2.1 OPERATING CONTROLS AND CONNECTIONS

The operating controls and connections of Model 7271 are listed in Table 2-1.

2.2 SETTING THE MEASUREMENT RANGE

Table 2-2 lists all the measurement ranges obtainable from settings of the meter range switch.

Each measurement range can be identified simply by observing the setting of the METER RANGE switch. The METER RANGE indicates the signal level for a 0 (zero) reading on the dB scale.

TABLE 2-2. MEASUREMENT RANGES

METER RANGE SETTING	MEASUREMENT RANGE	
	dBmV	dBmV
-30	-35	-20
-20	-25	-10
-10	-15	0
0	- 5	+10
+10	+ 5	+20
+20	+15	+30
+30	+25	+40
+40	+35	+50
+50	+45	+60
+60	+55	+70

2.3 MEASURING VHF SIGNAL LEVELS

1. Set the function switch according to the power source to be used.
2. If a-c line source is to be used, remove the line cord from its compartment at the rear of the instrument and connect the cord there to the recessed 3-prong jack.
3. If an external battery is to be used, connect the battery leads to the red (positive) and black (negative) tip jacks at the rear of the instrument. Take care in observing polarity and heed the caution on the label.
4. When using an internal or external battery, press the BATT CHECK switch to see that the meter needle points to the red BATT mark on the meter scale. This check will also indicate the correctness of the internal power supply output voltage when the instrument is operated from the a-c line.
5. Connect the VHF signal source to the VHF INPUT terminal on the front panel.
6. Set the UHF/VHF switch to VHF.
7. Set the tuning range selector switch as required.
8. Push in the compensator control and turn it to the setting indicated on the calibration chart in the lid of the 7271 for the frequency nearest that of the signal under test.
9. Tune the 7271 back and forth past the signal frequency, adjusting the meter range until the meter indicates between 0 and +10 on the dB scale when the 7271 is tuned for maximum reading (this condition will not be attainable for readings below -30 dBmV).
10. Observe the METER RANGE switch and note the measurement range indicated.
11. Read the signal level.
12. Add the meter range setting to the meter reading to obtain the signal level in dBmV.

2.4 RESISTANCE MEASUREMENT

1. Set the function switch to ohms.
2. Connect the red and black test leads to the tip jacks located above the meter.
3. Connect the test leads to the item to be measured.
4. Read the resistance in ohms from the ohms scale.

2.5 A.C. VOLTAGE MEASUREMENT

1. Set the function switch to A.C. volts.
2. Connect the red and black test leads to the tip jacks located above the meter.
3. Connect the test leads to the voltage to be measured.

Note:

Highest accuracy is always obtained when using the 0 to +10 portion of the dB scale.

4. Read the A.C. voltage reading from the A.C. volt scale.

2.6 D.C. VOLTAGE MEASUREMENT

1. Set the function switch to D.C. volts.
2. Connect the red and black test leads to the tip jacks located above the meter.
3. Connect the test leads to the voltage to be measured.
4. Read the D.C. voltage from the D.C. volt scale.

2.7 OPERATING FROM A 230V A-C LINE

The meter is shipped from the factory with the Power Selector switch set to 115. To operate the unit from a 230 V line, first remove the chassis from the cabinet by removing the four binding-head screws at the rear of the cabinet and pulling the chassis out from the front. Then set the switch, located at the rear of the chassis near the lower right corner, to the 230 V position. Return the chassis to the cabinet.

2.8 RECHARGING THE INTERNAL BATTERY

The 7271 is equipped with a rechargeable nickel cadmium battery. Because the state of charge of the battery when the instrument is received by the customer cannot be known, the battery must be charged for 14 to 24 hours before the instrument is operated on battery power.

When a nickel cadmium battery with series connected cells, such as the one used in the 7271 is discharged too deeply, the weak cells are reverse-charged by the stronger ones. If recharging of the battery is attempted under this condition, the reverse-charged cells will be damaged by the charging current. For this reason, it is essential that the battery not be allowed to discharge too deeply.

Texscan recommends that for cases where the meter is operated only occasionally on battery power, a 14 to 24 hour charge be given every two weeks. Where the unit is battery-operated frequently, it should be left on charge every night.

The battery is charged as follows:

1. Use the line cord to connect the instrument to an a-c source.
2. Open the lid.
   The lid must remain open during the charging period; when the lid is closed, an interlock switch disconnects the battery.
3. Set the power selector switch to CHG.
4. The initial charge should extend over a period of from 15 to 20 hours. Since the charging current flows through the CHARGE lamp, the lamp will glow brightly at first and grow dimmer gradually as the battery approaches full charge. If the lamp does not light the battery is not charging.
5. After this initial charge, follow the procedure outlined on the line cord compartment lid, remembering to keep the front lid open during the charging period.

3.1 GENERAL

Model 7271 has applications where measurements of relative or absolute r-f signal levels are to be made. In addition, the video detector in the unit allows application in the measurement of a detected signal on a calibrated oscilloscope. This section of the manual describes how to use the instrument for various kinds of r-f measurements.

3.2 FIELD INTENSITY SURVEYS

Model 7271 can be used together with a 75-ohm resonant dipole (Texscan Model AFS-1) for plotting detailed field intensity contour maps necessary for choosing antenna sites for CATV systems. For these measurements the 7271 and the antenna are moved about on an area map. These readings are then converted to field strength indications using the following equation:

$E = 0.021\ fV$ Where: E = the field strength in NV/M (microvolts per meter)
f = frequency in MHz
V = signal strength in μV or $_{10}((\frac{d\ Bm\ V/20)}{20} + 3)\ \mu V$

Table 3-1 is the result of using this equation to obtain conversion factors (C) for the video carrier frequency of every VHF television channel. Using these factors, the above equation reduces to: E = CV

TABLE 3-1. CONVERSION FACTORS FOR FIELD INTENSITY SURVEYS

CHANNEL	C	CHANNEL	C
2	1.20	8	3.84
3	1.32	9	3.97
4	1.45	10	4.10
5	1.66	11	4.22
6	1.79	12	4.35
7	3.72	13	4.47

If an antenna other than a resonant dipole is used for making the measurements, the gain factor (G) of the antenna must be taken into account (for example, for an antenna with 20 dB of gain, the gain factor G = 10) and the equations become:

$$E = \frac{0.021\ fV}{G} \text{ and } E = \frac{CV}{G}$$

3.3 ORIENTING ANTENNAS

Model 7271 can be employed for orienting antennas for best reception. The antenna down lead is connected to the VHF INPUT terminal (if necessary, through a matching transformer) and the antenna is then oriented for maximum reading of the video carrier signal on the 7271.

For the case of a single-channel antenna, the 7271 is tuned to the video carrier of the channel and the antenna is oriented according to the reading of the 7271.

For the case of broadband antennas, the 7271 reading is maximized for the video carrier of each channel to be received, noting the reading and orientation for each channel. A compromise orientation is then selected on the basis of these readings and orientations. Readings are repeated for each channel with the antenna in the compromise orientation to assure that adequate signal strength is available for each channel. The procedure for f-m antennas is the same as that for broadband antennas.

3.4 MEASUREMENT OF GAIN AND LOSS

For measuring gain or loss of a circuit at specific frequencies proceed as follows:

1. Set up the equipment as shown in Fig. 3-1.
2. Tune the 7271 and the signal generator to the test frequency.
3. Measure and record the signal level at the input to the circuit under test.
4. Measure and record the signal level at the output of the circuit under test.
5. The gain or loss is the difference between the two readings obtained. For example, if the input signal level is 5 dBmV and the output signal is 1 dBmV, the circuit has a loss of 4 dB. If the output level is 40 dBmV for an input level of 5 dBmV, the circuit has a gain of 35 dB.
6. Readings are obtained at a number of points across the passband of the circuit and the results are plotted to obtain an approximation of the response curve.

3.5 MEASUREMENT OF NOISE LEVELS

Although the 7271 meter scale is not calibrated for noise level readings, with proper correction of readings taken the instrument can be used for measuring noise levels in CATV systems. The corrections are necessary for two reasons: First, since noise levels in CATV systems are usually specified for a bandwidth of 4 MHz while the i-f bandwidth of the 7271 is only 0.6 MHz, the meter readings would be about 8 dB low (noise power is proportional to bandwidth, hence a power ratio of 4:0.6 equals 6.7 which corresponds to 8.2 dB).

The second error source, having an effect opposite to that above, is the response to noise of the peak detector in the 7271. Since the detector is designed to respond to the peak of the television picture signal, the instrument indicates peak noise rather than rms noise. As noise has a higher peak-to rms ratio than a c-w signal, the detected output reads high, reducing the correction required.

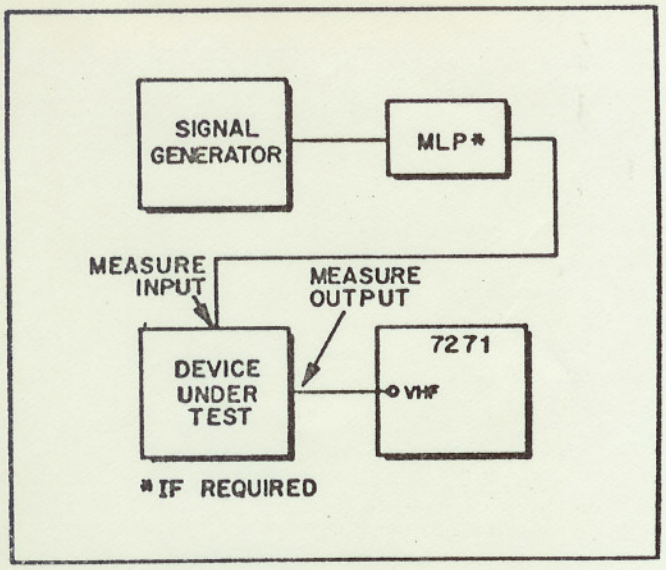
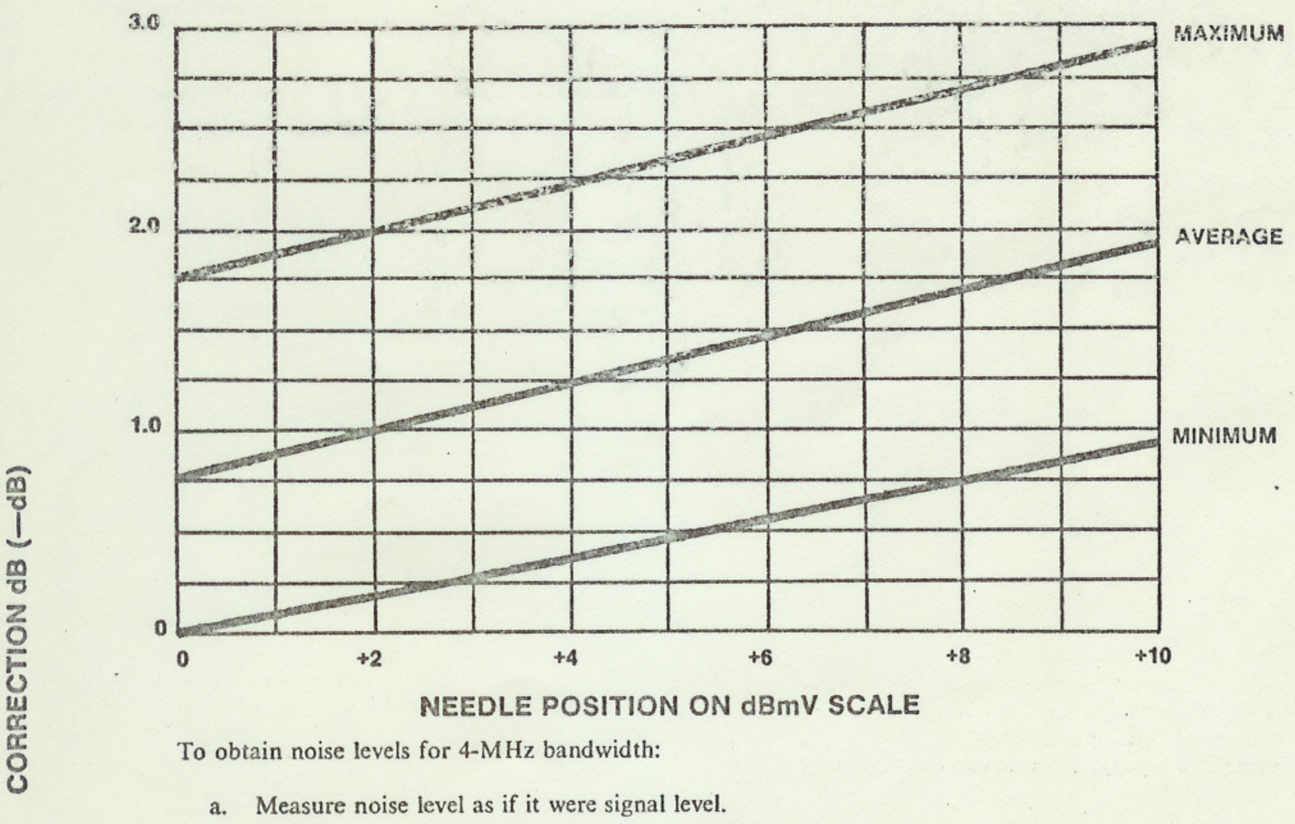


Fig. 3-1. Setup for Gain and Loss Measurements

With these considerations in mind, noise calibration tests were made on a number of Model 7271's chosen at random. The resulting correction curves are shown in Fig. 3-2. The curves indicate the maximum and minimum corrections found necessary for the tested units and the resultant average curve. The latter is sufficient for corrections of noise level measurements where an accuracy of plus or minus 1.0 dB is acceptable. For greater accuracy, the individual instrument would have to be calibrated from an accurately known noise source (Section 3.6).

For using the average curve in determining, for example, the S/N ratio in a trunk line, proceed as follows:

1. Connect the output of the last trunk line amplifier to the VHF INPUT terminal on the 7271.
2. Disconnect the head-end output from the input to the first amplifier in the trunk line; but do not disconnect the standby carrier signal, which is needed for normal AGC operation.
3. Tune the 7271 to the highest and the lowest channel carried on the system and record the meter readings as if a signal were measured.
4. Obtain the correct noise level for both channels by adding the corrections taken from the average curve; or, for greater accuracy, from the noise calibration record of the particular Model 7271.
5. Subtract the corrected noise levels from the signal levels of both channels at the output of the last amplifier to obtain the S/N ratio at that point.



To obtain noise levels for 4-MHz bandwidth:

a. Measure noise level as if it were signal level.
b. To meter reading add the average correction shown opposite needle position.

Fig. 3-2 Correction Curves for Noise Level Measurements

3.6 NOISE CALIBRATION OF A MODEL 7271

This section describes a convenient method of calibrating a 7271 by using an amplifier whose noise figure is accurately known. Fig. 3-3 shows the equipment setup. The input to the amplifier with known noise figure is terminated accurately in 75 ohms and its output is connected through a variable attenuator to the input of a second amplifier. The output of the latter is then connected to the VHF INPUT terminal of the field strength meter.

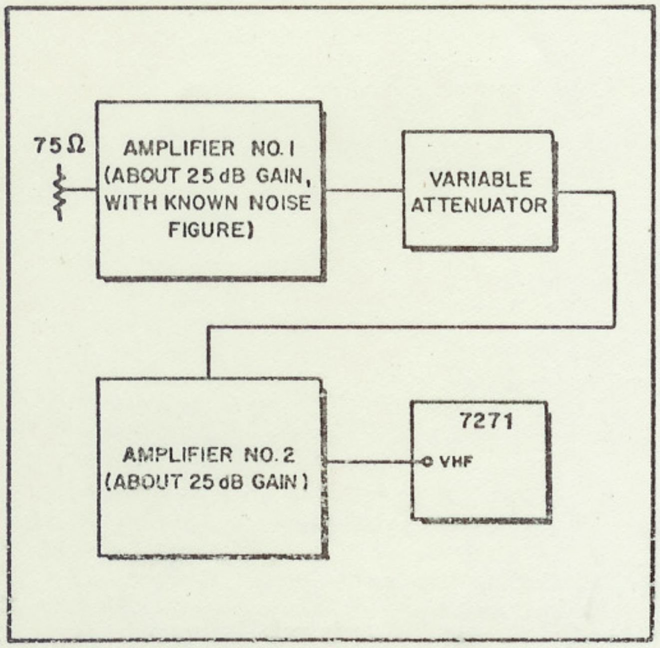


Fig. 3-3. Setup for Noise Calibration of a 7271

Calibration is done as follows:

1. Tune the 7271 to a convenient channel having no local signal. Set the 7271 meter range switch to —20 dBmV. then adjust the tuner compensator to the calibrated point.
2. Adjust the variable attenuator for full-scale reading on the meter.
3. Now measure the gain from the input to the first amplifier to the output of the second amplifier, then measure the noise figure at the input of the first amplifier. If the net gain from the input of the first amplifier to the input of the second amplifier is over 15 dB, it is safe to assume that the noise figure of the combination is the same as that of the first amplifier.
4. As the minimum noise level in any 75-ohm system is —59.2 dBmV, the noise output of the combination into the field strength meter is: —59.2 + N.F. + Gain. If for example, the noise figure measured were 8.4 dB and the net gain combination would be: —59.2 + 44.5 + 8.4 = 6.3 dBmV.
5. The correction for the 7271 at full scale is the number of dB that must be added to the reading to equal this calculated noise level. In our example: —6.3 = —10 + X, and X = 10 — 6.3 = 3.7 dB.
6. Find the corrections required at other points of the scale by adding attenuation in 1 dB steps, noting after each step how far below the dB marks the meter needle reads.

3.7 MEASUREMENT OF PERCENT CROSS-MODULATION

Model 7271 can be employed in a simple test setup for making reasonably accurate percent cross-modulation measurements in the field, using the signals available in a TV distribution system. While the method described here is sensitive enough for measurements in an operating distribution amplifier, it is not sensitive enough for measurements in individual trunk line amplifiers operating at their normal system levels.

Fig. 3-4 shows the equipment set-up. The required signals are obtained from the system or directly from the head-end converters (for example from Channel Commanders). The c-w signal is obtained from a c-w generator or from the standby carrier condition of the converter concerned.

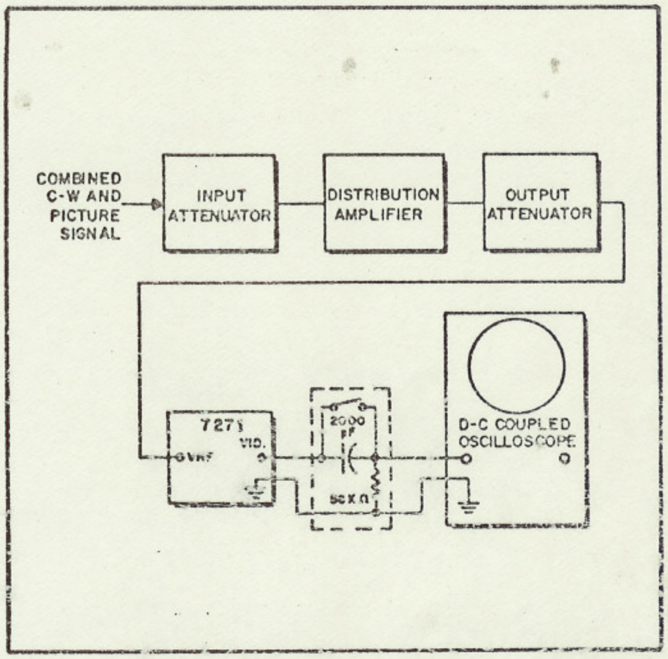


Fig. 3-4. Setup for Percent Cross-Modulation Measurements

To obtain meaningful results, modulation on all channels other than the one under test should be synchronous. Where tunable converters are used, this can be accomplished by tuning them all to receive the same channel.

The high-pass filter in the set-up passes any cross-modulation components (around 15 KHz) but blocks hum components (round 60 Hz) so that the latter will not obscure the measurement of cross-modulation. Operating the 7271 on battery power will eliminate one possible source of hum contribution.

Measurement is done as follows:

1. Introduce the c-w signal on one channel, and interfering signals on other channels as required, through the input attenuator to the input terminal of the distribution amplifier, or the first trunk line amplifier of the system under test.
2. Connect the 7271 through a second attenuator to the output of the distribution amplifier or the last trunk line amplifier of the system; set the channel levels and the input attenuator to give rated output on each channel; note the meter reading.
3. Tune the 7271 to the c-w signal frequency. Reduce the attenuation in the output attenuator by 20 dB and set the 7271 manual gain control to obtain the same meter reading as in Step 2.

4. Close the filter bridging switch. Set the oscilloscope for operation in the d-c mode and in the 0.1 V/cm vertical sensitivity range. Position the reference trace on the bottom line of the oscilloscope screen and increase the input to the 7271 by reducing attenuation in the output attenuator until reference signal and c-w signal differ by 0.8 V; the 7271 manual gain control can be used for fine adjustment.

5. Switch the oscilloscope to the next higher sensitivity range and adjust the oscilloscope gain until the c-w trace is 10 divisions above the reference trace; each division now represents 10% cross-modulation.

6. Open the filter bridging switch and change the oscilloscope to a-c operation, increase the vertical sensitivity 10 times; one division on the screen now represents 1% cross-modulation. The c-w trace can now be observed for exhibiting any modulation due to the presence of other channels in the system.

With one interfering channel, or when all interfering channels have a common sync source, the indicated cross-modulation will vary somewhat with the degree of white in the interfering picture signal. Exact percentage of cross-modulation is therefore determined by observing the oscilloscope until a maximum of cross-modulation is seen; this will occur when there is maximum variation in the interfering signal.

When the interfering signals derive their sync from various sources, their horizontal line frequencies will differ slightly so that relative timing of the various horizontal sync pulses will change constantly. In this case, maximum cross-modulation will occur when a number of sync pulses coincide; it will be necessary to observe the oscilloscope for a longer period to see this happen and to arrive at a reasonably exact percent cross-modulation corresponding to this condition.

To be sure that there is no cross-modulation in the 7271 circuits or in the mixing networks in which the various input signals are combined, it is advisable to test for cross-modulation first without the amplifier or system in the circuit. Adjust for equal levels at the 7271 input, tune to the c-w signal and then measure for cross-modulation as above.

Note:

The video output of the 7271 is specified at 0.8 volt p-p with no overload. When using an oscilloscope with a sensitivity of 1 mV/cm, the gain can generally be increased up to 25 times for a maximum sensitivity of 0.4% cross-modulation per division.

When picture signals are not available, the signals from the laboratory signal generators with sine-wave modulation can be used for measuring cross-modulation. Because of the different form of modulation, corrections must be made if the results of this measurement method are to agree with those obtained when using television signals.

Table 3-2 lists the corrections to be applied and Fig. 3-5 diagrams the test set-up.

1. Tune one signal generator to the picture carrier of channel 2 (55.25 MHz), the other to that of channel 13 (211.25 MHz).

2. Combine the outputs of the two generators in a Jerrold Model LHS-76 high-band/low-band mixer to prevent cross-modulation between the two bands.

3. Apply the LHS-76 output to the input of a variable attenuator, the output of this attenuator to the input of the amplifier under test, the output of the amplifier to the input of a second variable attenuator and the output of this attenuator to the VHF INPUT terminal on the 7271; finally the VIDEO OUT terminal of the 7271 is connected to the vertical input of the oscilloscope.

4. Preferably use the 7271 on internal battery power to avoid hum pick-up. If the instrument has to be used on a-c power, use a 2-pin adapter on the 7271 line cord plug.

5. Set the oscilloscope to operate in the d-c mode.

6. Apply a modulation of 1 KHz to the 55.25 MHz signal, then set the input attenuator for 10 dB and the output attenuator for 20 dB.

7. Adjust the generator outputs for rated output levels of the amplifier at both frequencies, taking into consideration the attenuation in the output attenuator.

8. Disconnect the oscilloscope input signal and set the oscilloscope vertical sensitivity and centering controls so that 0 signal reference is on the bottom line of the screen.

9. Reconnect the oscilloscope input signal and tune the 7271 to the modulated signal (55.25 MHz); then adjust the oscilloscope vertical gain control so that the top of signal trace is at the top of the screen (an oscilloscope with a 10 cm grid is assumed).

10. Select a convenient percent modulation figure from Table 3-2; e.g. 30%. Adjust the modulation control on the 55.25 MHz generator so that the bottom of the signal trace is 5.4 divisions (for 30% modulation) above the reference trace, while keeping the top of the signal at the 10th division by adjusting the oscilloscope vertical gain control.

11. Maintain the general output levels as in Step 7 while adjusting the modulation control on the 55.25 MHz generator. Then reduce the meter range setting by 20 dB, pull the 7271 TUNER COMP/MAN GAIN control to the MAN GAIN position and set it for the same meter reading as in Step 7.

12. Set the oscilloscope vertical sensitivity to the calibrated 0.1 V/cm range, remove the oscilloscope input signal and reset the vertical centering to the place the 0 signal reference on the bottom line of the screen. Then reconnect the oscilloscope input signal.

TABLE 3-2. CORRECTIONS FOR CROSS-MODULATION MEASUREMENTS

On Interfering Signal		To Obtain Cross-Mod. Corresponding to TV Signal Modulation:	
% Modulation (for symmetrical Mod.)	Modulation Ratio E min / E max	Multiply Indicated % Cross-Mod. by	or Add dB to Indicated Cross-Mod.
10	0.818	2.97	9.5
20	0.666	1.77	4.9
30	0.538	1.39	2.9
40	0.429	1.21	1.7
50	0.333	1.11	0.9
60	0.250	1.06	0.5
70	0.177	1.02	0.2
77.8**	0.125	1.00	0.0
80	0.111	1.00	0.0
90	0.053	0.99	—0.1
100	0.000	0.99	—0.1

* The derivation of the correction figures is explained in TECHNICAL HANDBOOK FOR CATV SYSTEMS by Ken Simons.
** Corresponding to full modulation of a TV signal.

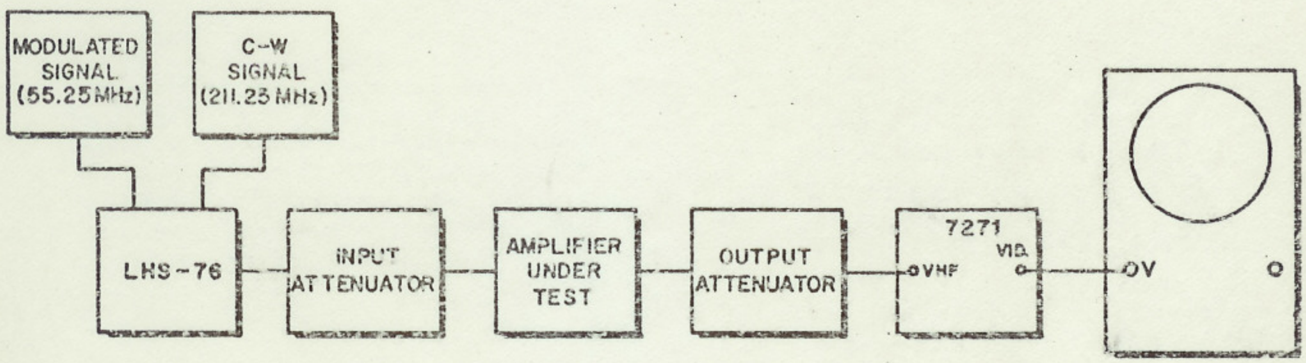


Fig. 3-5. Setup for Cross-Modulation Measurements When Using Signal Generators With Sinewave Modulation

13. Remove attenuation from the output attenuator until the 7271 video output reads 0.8 V on the oscilloscope; fine adjustment can be made with the 7271 MAN GAIN control.

14. Switch the oscilloscope to the next higher gain range and check for modulation as in Step 10. If the modulation is not the same as in Step 10, push the 7271 TUNER COMP/MAN GAIN control to the TUNER COMP position and repeat the procedure from Step 7 onwards.

15. With the 7271 video output at 0.8 V peak modulation level, adjust the oscilloscope vertical sensitivity so that the top of the signal trace is on the 10th division of the screen; each major screen division new represents 10% apparent cross-modulation.

16. Switch the oscilloscope to operate in the a-c mode and increase vertical sensitivity 10 times; each major screen division now represents 1% apparent cross-modulation.

17. Tune the 7271 to the c-w signal frequency (211.25 MHz); since the 7271 meter will now read off scale, tune for maximum deflection of the oscilloscope display.

18. Obtain true percent cross-modulation by multiplying the measured apparent cross-modulation by the correction factor for the percent modulation of the interfering (modulated) signal. Hence, for our example true percent cross-modulation is 0.8% x 1.39 = 1.1%.

3.8 MEASUREMENT OF HUM MODULATION

Since most r-f amplifiers are powered with 60 Hz a-c, the possibility exists that power supply ripple will modulate the signal passing through the amplifier. To measure this type of modulation with the 7271 proceed as follows:

1. Connect the equipment as diagrammed in Fig. 3-6. Use a General Radio Type 274-MB twin banana plug at the vertical input of the oscilloscope and

insert a 20,000 pf. capacitor between the input and the oscilloscope chassis ground for filtering out noise. Also, to minimize stray hum loops, be certain that there is no ground connection to the oscilloscope chassis other than the input cable shield. If the oscilloscope has a 3-pin plug on its cord, attach a 2-pin adapter. Operate the 7271 on battery power, eliminating the possibility of the meter itself contributing hum.

2. Sync the oscilloscope to the line frequency, then tune the generator and the 7271 to a convenient frequency; the center of the amplifier pass band is a good choice.

3. Set the oscilloscope to d-c coupling and the 0.1 V/cm range. Adjust the input to the amplifier or system under test so that the output is at normal operating level, keeping the 7271 meter range at — 20 dBmV minimum.

4. Remove 20 dB from the output attenuator then pull the TUNER COMP/MAN GAIN control to the MAN GAIN position and set it for the same meter readings as in Step 3.

5. Remove the oscilloscope input signal and adjust vertical centering so that the 0 signal trace is displayed on the bottom line of the screen.

6. Reconnect the oscilloscope input signal and remove attenuation from the output attenuator until the trace of the modulated signal is 8 divisions above the reference trace; indicating 0.8 V (assuming a 10 cm grid on the screen); fine adjustment can be made with the 7271 MAN GAIN control. If appreciable modulation is present, center the trace on the 8th grid line.

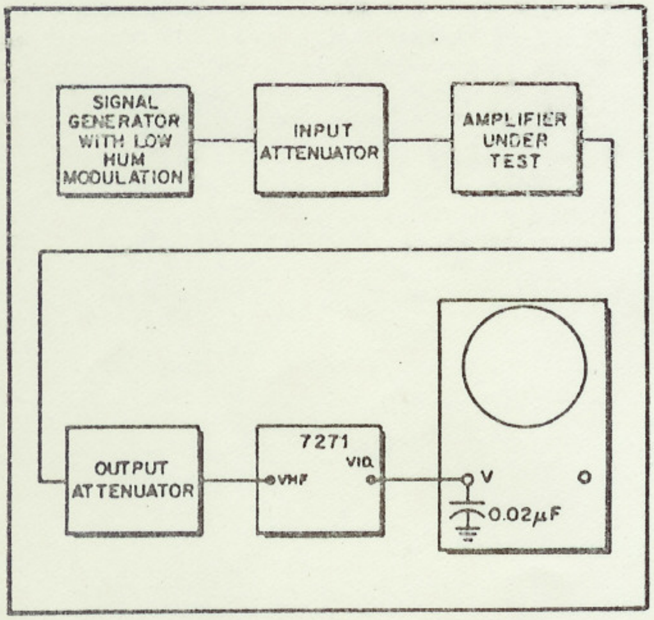


Fig. 3-6. Setup for Measuring Hum Modulation

7. Switch the oscilloscope vertical sensitivity to the next higher range and remove the oscilloscope input signal. Then adjust vertical centering to reset the 0 signal trace on the bottom line of the screen.

8. Reconnect the oscilloscope input signal and adjust the oscilloscope gain until the modulated signal trace is centered on the 10th grid line. Then set the oscilloscope for a-c coupling and center the trace for convenient measurement of the peak-to-peak amplitude. Each major division on the screen now represents 5% modulation (or 26 dB down from a 100% modulated signal) Since a 5% modulated signal has a 5% excursion in both directions from its zero modulation level.

9. For example, if the peak-to-peak amplitude of the trace covers 1.5 major screen divisions, the hum modulation is 1.5 x 5% = 7.5% (or 22.5 dB down from a 100% modulated signal).

10. If the modulation is less than 5%, increase the oscilloscope vertical sensitivity 10 times; each major division on the screen now represents 0.5% modulation (or 46 dB down from a 100% modulated signal). By a further sensitivity increase of 5 times, modulation as low as 0.1% can be displayed on the screen.

3.9 MEASUREMENT OF SYNC CLIPPING

The normal sync signal accounts for approximately 25% of the total amplitude of a composite television video signal. Determining whether or not an amplifier or system of amplifiers is clipping the sync signal can be done with the 7271 as follows:

1. Connect the equipment as diagrammed in Fig. 3-7.
2. Tune the 7271 to the video carrier of a TV channel and adjust the amplifier or system for normal operational output.
3. Set the oscilloscope for d-c coupling and vertical sensitivity to calibrated 0.1 V/cm.
4. Increase the input to the 7271 by removing attenuation from the input attenuator and by fine adjustment of the 7271 MAN GAIN control until the meter reads the same as in Step 2.
5. Increase the signal input to the 7271 by adjusting the input attenuator until the sync pulse tips are 8 divisions above the reference trace, corresponding to 0.8 V.
6. Insert 2.5 dB in the input attenuator and note the position of the sync tip on the screen; it represents 25% amplitude.
7. Set the input attenuator to 0 dB and observe the position of the sync pedestal back porch on the screen. If the back porch falls appreciably above the line noted in Step 6, the signal is being compressed.

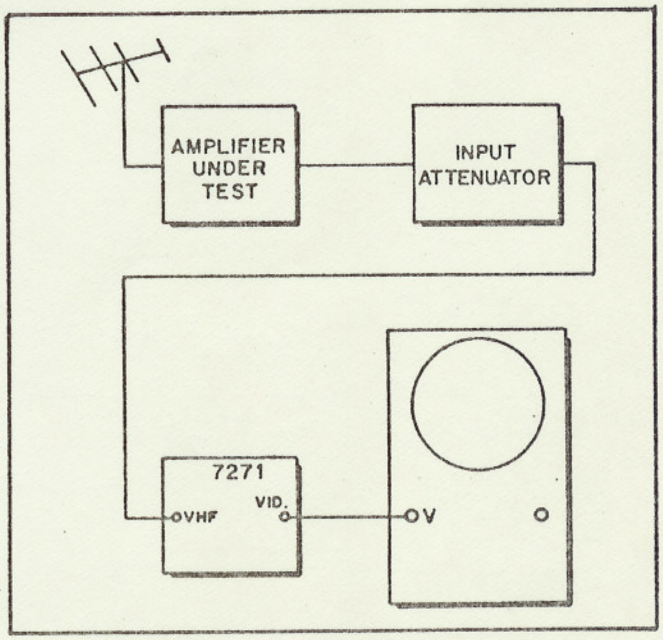


Fig. 3-7 Setup for Measuring Sync Clipping

4.1 GENERAL

The signal to be measured is applied to the front panel VHF INPUT terminal. With the UHF/VHF switch in the VHF position, the signal passes through the switch contacts to a multi-step attenuator which serves to adjust the measurement range of the unit (Fig. 4-1).

From the attenuator the signal passes through one of the four bandpass filters, selected by the frequency range selector switch. The signal is then applied to a balanced mixer circuit where it beats with the signal from one of the tuner oscillators to give the i-f signal. The tuner assembly consists of four oscillators, one for each tuning range. The appropriate oscillator is energized through the frequency range selector switch.

The mixer output is applied through contacts of the frequency range selector switch to the i-f amplifier. The input and the output of the first amplifier stage are sharply tuned with 52 MHz coaxial resonator bandpass filters. The signal is passed through two additional amplification stages and, then takes two paths.

Part of the signal is amplified, detected, and then fed to the front panel VIDEO OUTPUT terminal. The other portion of the signal is detected by a phase discriminator and then amplified to drive a small panel-mounted speaker. A-m as well as f-m signals pass through the discriminator so that sync buzz and intelligible a-m transmissions can be heard.

The signal at the input of the discriminator is also fed to a peak detector circuit. The detected signal drives the 7271 meter and is brought out to a rear panel phone jack for application to a recording device if desired. The COMP control in the i-f amplifier calibrates the unit across its frequency range, when in the pushed-in position, and acts as a manual gain control for sync compression and hum measurements when in the pulled-out position.

The 7271 may be powered from its own rechargeable 12 V battery, from an external 12-15 battery, or from a 115 V or 230 V a-c line. The power source is selected with a front panel switch which also provides for recharging the internal battery at a 10% rate from the 115 V or 230 V line; the battery is trickle-charged while the unit is operating from the line.

4.2 METER RANGE ATTENUATOR

The VHF input signal is applied through the VHF INPUT terminal J101 and the UHF/VHF switch S101 to the attenuator. The attenuator consists of 0 through 90 dB pads switched into or out of the signal path, thus giving the attenuator a range of 0-90 dB in 10 dB steps. The attenuator settings determine the level of the signal applied to the measuring circuit and thus the measurement range of the unit. The measurement range is indicated by the position of the METER RANGE switch.

The signal from the attenuator is applied through contacts of the frequency range selector switch S701 to one of four bandpass filters.

4.3 BANDPASS FILTERS

The 7271 employs four bandpass filters, one for each of the VHF tuning ranges. Selection of one of the filters is done by setting the frequency range selector switch S701 which passes the output of the selected filter through J801 on the mixer.

4.4 VHF TUNER

The VHF tuner consists of four permeability-tuned Colpitts oscillators, one for each tuning range. They are energized by —10 V applied through contacts of S701. The oscillators operate at 52 MHz above the associated tuning frequency to give a 52 MHz i-f signal at the mixer.

Oscillator tuning is accomplished by changing the position of the iron cores in L402, L405, L408, and L411. The cores are mounted on a bracket and are moved through the coils by a rack and pinion mechanism. The cores are attached to flexible, threaded shafts, which permit individual adjustment of each core and compensate for any misalignment between the core mounting bracket and the coils.

Each oscillator has three alignment adjustments: trimmers C405, C412, C419, and C425 tune the low-frequency ends of the oscillator ranges; coils L403, L406 L409, and L412 adjust the high-frequency ends; coils L402, L405, L408, and L411 also serve to adjust scale tracking.

The oscillator output signals are coupled through C406, C413, C420, and C426 to a common feed-through on the mixer module.

4.5 MIXER

The signals from the bandpass filters and the VHF tuner are transformer-coupled to a balanced mixer employing diodes CR801, CR802, CR803, and CR804 where they beat to give the 52 MHz i-f signal. The mixer output is coupled to J802 and from there through T201 to the i-f amplifier.

4.6 I-F AMPLIFIER

The i-f amplifier input signal is applied to a low-pass filter consisting of L201, L202, L203, C201, and C202, which provides input match and attenuates unwanted signals above 52 MHz. From the input circuit the signal is passed through a 52 MHz coaxial resonator filter to the first amplifier stage, employing Q201 in a neutralized, common-emmiter, single-tuned circuit. Neutralization is controlled by trimmer C201; tuning is accomplished through trimmer C211. The amplified signal is coupled to another 52 MHz coaxial resonator filter. It is the bandwidth of these two filters that chiefly determines the bandwidth and adjacent-channel rejection of the i-f stages.

The signal from the second filter is amplified by two common-base, single-tuned stages Q202 and Q203. Tuning is accomplished through L204 and L215 respectively. The input level at Q203 is adjusted with potentiometer R238 and the COMP control R210/S201. With the COMP knob pushed in, S201 is open and the control acts with R238 to calibrate the 7271 over its operating frequency range by adjusting the gain of the i-f amplifier at specific frequencies across the range. With the knob pulled out, S201 is closed and the COMP control functions as an uncalibrated gain control. The output of Q203 is coupled to Q205 in the video detector circuit and to Q204 in the discriminator circuit.

4.7 VIDEO DETECTOR

The signal from the i-f stages is amplified by Q205 and coupled to the video detector CR201. The detected signal

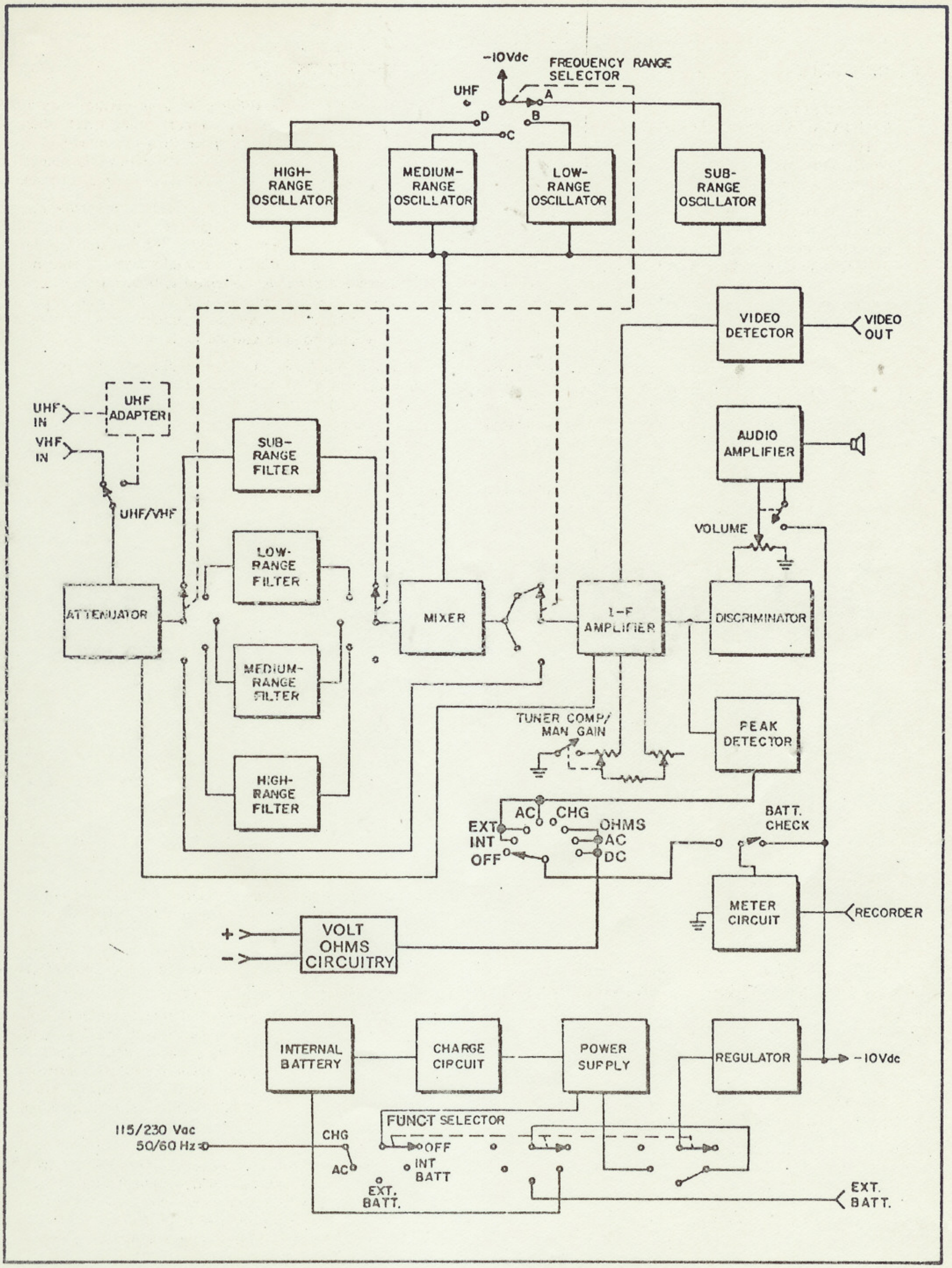


Fig. 4-1. Model 7271 Fuctional Block Diagram

is coupled to J204 and then, through a jumper, to the VIDEO OUTPUT terminal J5. The amplifier stage Q205 is tuned to 52 MHz through L218.

4.8 DISCRIMINATOR

The other portion of the i-f signal is amplified by Q204 and coupled to discriminator CR202/CR203 where the f-m signals are detected. The amplifier output is tuned through the primary, L216-A, of the discriminator transformer.

The audio signal developed by the discriminator is fed through J205 and P205 to an audio amplifier. The undetected output of Q204 is coupled through C224 to a peak detector.

4.9 AUDIO AMPLIFIER

The audio amplifier input signal is applied across VOLUME control R7. The audio signal is passed through an integrated circuit amplifier which drives the panel-mounted speaker. The amplifier is energized through switch S6 mounted on the volume control shaft.

4.10 PEAK DETECTOR

The undetected signal from Q204 is amplified by IC201 and is full wave detected by CR204 and CR205. The detected signal is coupled to IC 202 a sample and hold circuit which stores the peak amplitude of the detected waveform. IC204 and Q208 form a high input impedance meter drive circuit. Potentiometer R234 determines the current through the meter with no input signal and thereby determines meter calibration. R239 sets the gain of IC204 and thereby controls the meter sensitivity to input change. The current through M1 is made available at jack J1 for operation of a recording device.

4.11 POWER SUPPLY

Power for the 7271 may be selected by switch S1 for one of three sources. With S1 in INT BATT position, the negative terminal of the internal battery is connected through the interlock switch S3 and contacts of S1 to the DIAL LIGHTS switch S2 and regulator Q601, Q602 and Q603. Potentiometer R604 in the regulator circuit sets the supply output at —10 V. The interlock switch helps to prevent accidental discharge or overcharge of the internal battery when the panel cover is closed.

In the EXT BATT position, S1 connects the negative terminal of the external battery to S2 and to the regulator. The external battery connections are made at J3 (positive terminal) and J4 (negative terminal) at the rear of the 7271.

With S1 in the AC position, the primary circuit of transformer T1 is complete, and the voltage generated across the secondary is applied to the fullwave rectifier CR601, CR602. The rectified voltage is filtered by C603 and applied through contacts of S1 to the regulator. In addition, the unregulated —18 V at the junction of CR601 and CR602 is coupled through CR1, R2 and S3 to the negative terminal of the internal battery to trickle-charge the battery. The AC lamp DS1 indicates that the unit is under power from the a-c line. Power selector switch S7 permits operation from a 115 V or 230 V a-c line.

The fourth position of S1, CHG, is provided to permit charging the internal battery. The contacts of S1 apply — 18 V to the battery through the CHARGE lamp DS2, and through R3 and S3.

5.1 GENERAL

This section contains procedures for minor realignment of the i-f section and for recalibrating the instrument. In addition, schematic diagrams are included as aids for the maintenance of the unit.

If for some reason repairs cannot be made in the field, the unit may be returned to Texscan Corp., Service Dept., 2446 North Shadeland, Indianapolis, IN 46219. After notifying Texscan of your intention to return the unit for repair, carefully pack the unit and ship it (with freight and insurance prepaid) together with a note stating the serial number of the unit and listing the difficulties encountered. Repairs will be made free of charge under conditions of the warranty; otherwise nominal charges will be invoiced.

Because alignment of the tuner requires special test fixtures, the procedure for this module is not given here. If the tuner requires realignment or if the i-f section becomes grossly misaligned, the 7271 should be returned to Texscan for realignment.

Recalibration should be performed routinely at six-month intervals or when the calibration is suspect. The i-f section should be realigned whenever a transistor is replaced.

Note:

The location of calibration and alignment adjustments and test points is shown in Figs. 5-8 and 5-9.

5.2 CALIBRATION

5.2.1 EQUIPMENT REQUIRED

The equipment required to calibrated Model 7271 is listed below. A discussion of the requirements of the equipment follows the list.

1. A r-f signal generator.
2. A power meter, Hewlett Packard Model 431A or B, with Model 478A thermistor mount.
3. A 6 dB splitter, Jerrold Model 1502.
4. One or two 50/75-ohm minimum loss matching pads, such as Texscan Model ZM-57.
5. A vacuum-tube voltmeter.
6. A 0-15 dB variable attenuator, Texscan Model SA 70.

A good quality r-f signal generator with a calibrated output attenuator is required for calibrating the 7271. Generators that meet these requirements include; Texscan VS60Z, Measurements Model 80, Hewlett-Packard Model 608A, and Boonton Radio Model 202B.

The preferred "power meter" method uses a Hewlett-Packard Model 431 A or B power meter with a Model 478A thermistor mount and the 6 dB splitter.

For accurate calibration it is important that the output impedance of the signal generator be 75 ohms. Where an r-f signal generator with an output impedance of 50 ohms is used, a 50/75-ohm minimum loss pad must be inserted between the generator and the splitter (Fig. 5-2). As the input impedance of the HP power meter is 50 ohms, a similar minimum loss pad is required for the power meter method. Fixed 7.78 dB matching pads may be used in place of the minimum loss pads, bearing in mind that the signal attenuation will differ. (The circuit for a "do-it-your-self" pad is given in Fig. 5-1). In the calibration procedure, wherever level settings depend on the type of pad employed, the settings for both types are given.

Furthermore, keep in mind that some r-f signal generators are calibrated working into an open circuit. When the generator is working into a matched load, the signal level at the load is half the level indicated at the generator (Table 5-1).

5.2.2 SETTING THE REGULATED VOLTAGE LEVEL

1. Open the line cord compartment and remove the cord.
2. Remove the four screws at the rear of the cabinet.
3. Slide the chassis out through the front of the cabinet.
4. Set the power selector switch to INT BATT (be certain that the battery is fully charged).
5. Connect the vtvm between the hot terminal of the VOLUME control and ground. If necessary, adjust R604 on the power supply so that the meter reads —9.9 to —10.0 V.
6. Press the BATT CHECK switch and see that the meter needle points to the red BATT mark.

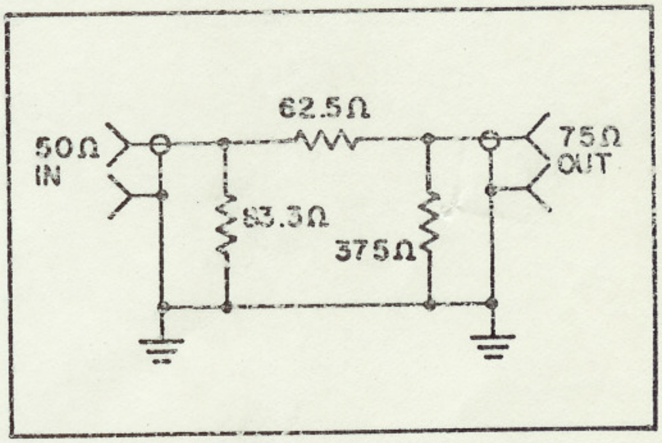


Fig. 5-1. Circuit of 7.78 dB Pad

5.2.3 TUNER COMPENSATOR CALIBRATION (POWER METER METHOD)

1. With the 7271 off, set the meter mechanical zero to "0" on the D.C. volt scale.
2. Power the 7271 from the a-c line.
3. Set the power selector switch to AC.
4. Set the UHF/VHF switch to VHF.
5. Set the frequency range switch to UHF.
6. Push the COMP control and turn it to the UHF setting listed on the calibration chart.
7. Set the meter range to +40 dBmV.
8. Connect equipment as shown in Fig. 5-2.
9. Tune the signal generator to 52 MHz; the 7271 meter should show maximum deflection.

10. Adjust the generator output level to give a power meter reading of —13.43 dBm (—15.51 dBm when using 7.78 dB pads).

11. Adjust R238 on the i-f chassis for full-scale deflection on the 7271 meter; this adjustment is made with a small screwdriver inserted through the hole in the i-f chassis bottom cover.

12. Increase the variable attenuator setting by 10 dB and then 5 dB more, observing that the meter reads first 0 and then —5 on the dB scale.

13. If the meter reads off these marks, loosen the lock-nut on the zero-adjust control (R234 nearest the front on i-f chassis) and adjust it to bring the meter pointer toward these marks.

14. Return the variable attenuator setting to 0 dB and readjust R238 for full scale meter deflection.

15. Repeat Steps 11, 12, and 13 until best agreement is obtained between the meter pointer and the +10, 0 and —5 dB marks; then tighten the lock-nut on R234.

Note:

In severe cases of misalignment it may be necessary to adjust R239 for proper tracking at 0 on the meter scale. If readings are high at zero decrease the meter deflection with R239 and repeat Steps 10 through 14 as necessary to provide the best possible meter tracking. If the meter reading is low at 0 on the meter scale increase the meter deflection with R239 and repeat Steps 10 through 14 for best meter tracking.

16. Record the COMP control setting next to UHF on the calibration chart.

17. Set the frequency range switch to B.

18. Tune the generator and the 7271 to the center frequency on TV channel 2.

19. Adjust the COMP control for full-scale meter deflection while the power meter reads 4.43 dBm (6.51 dBm if 7.78 dB pads are used) be certain that the generator is tuned for maximum deflection on the 7271 meter.

    At this point, repeat Step 11, observing the meter readings. If there is a significant difference between these readings and those first obtained in Step 11, readjust R234 for a compromise setting. Use the COMP control, not R238 for making full-scale adjustments.

    If the setting of R234 is changed, it will necessary to repeat Steps 5 through 10, 16, 17, and 18.

20. Record the COMP control setting next to CH2 on the calibration chart.

21. Repeat Steps 17, 18, and 19, tuning the 7271 and the generator to all of the calibration points in the B, C, and D ranges.

22. Set the 7271 frequency range switch to A.

23. If necessary, replace the signal generator with one that will cover this range.

24. Repeat Steps 17, 18, and 19 for all A-range calibration points except 5 MHz.

25. Set the COMP control to the position determined for 10 MHz, and tune the 7271 and the generator to 10 MHz.

26. Calibrate the generator and observe the setting of its attenuator when the 7271 meter reads full scale.

27. Tune the 7271 and the generator to 5 MHz.

28. Calibrate the generator and adjust its attenuator to the same reading as in Step 25.

29. Adjust the COMP control for full-scale deflection in the 7271 meter.

30. Record the control setting next to 5 MHz on the calibration chart.

31. Disconnect the line cord from the unit.

32. Return the chassis to the cabinet and fasten it with the four screws.

5.2.4 TUNER COMPENSATOR CALIBRATION (SIGNAL GENERATOR METHOD)

1. With 7271 off, set the meter zero to "0" on the DC volt scale.
2. Power the 7271 from the a-c line.
3. Set the power selector switch to AC.
4. Set the UHF/VHF switch to UHF.

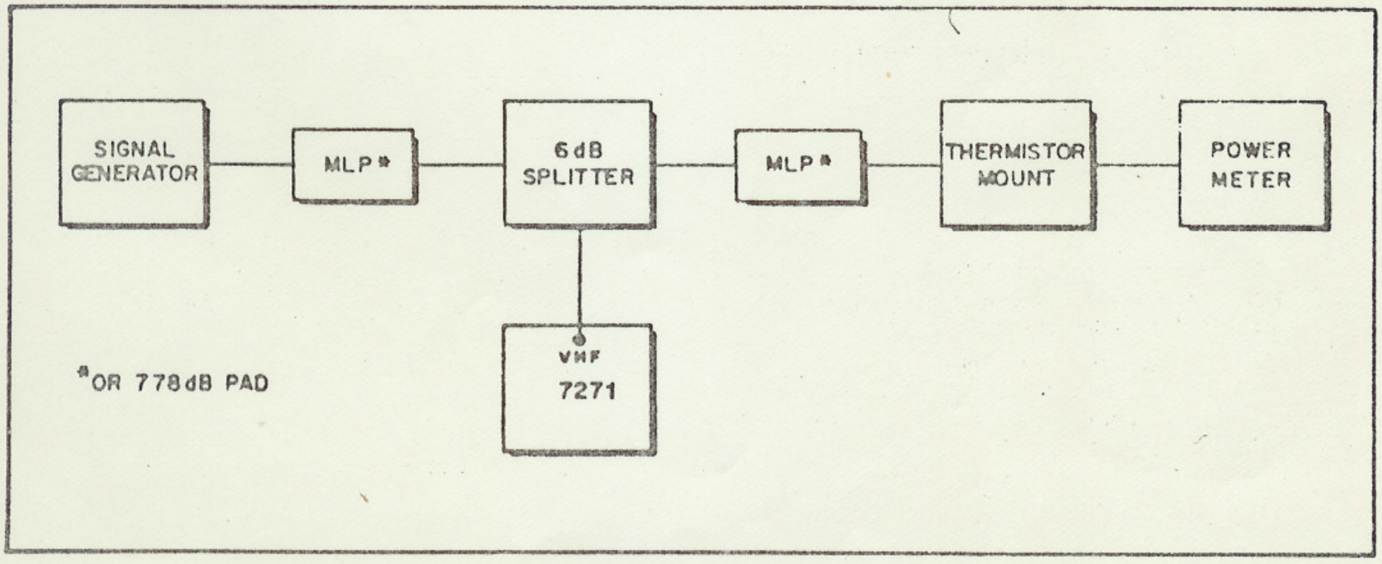


Fig. 5-2. Setup for Tuner Compensator Calibration by the Power Meter Method

5. Set the frequency range switch to UHF.

6. Push in the COMP control and set it to the VHF check point COMP figure on the factory-supplied calibration chart.

7. Set the meter range to +10 dBmV.

8. Connect equipment as shown in Fig. 5-3.

9. Tune the signal generator to 52 MHz; the 7271 meter should show maximum deflection.

10. Calibrate the generator and set its output level at 0.355 times the level listed in Table 5-1 for +10 dBmV and the appropriate generator.

11. Adjust R238 on the i-f chassis for full-scale deflection on the 7271 meter; this adjustment is made with a small screwdriver inserted through the hole in the i-f chassis bottom cover.

12. Increase the variable attenuator setting by 10 dB and then 15 dB more, observing that the meter reads first 0 and then —5 on the dB scale.

13. If the meter reads off these marks, loosen the lock-nut on the zero-adjust control (R234 is nearest the front on i-f chassis) and adjust the control to bring the pointer toward these marks.

14. Return the variable attenuator to 0 dB and readjust R238 for full-scale deflection.

15. Repeat Steps 11, 12, and 13 until best agreement is obtained between the meter pointer and the 0 and —5 dB marks; then tighten the lock-nut on R234.

Note:

In severe cases of misalignment it may be necessary to adjust R239 for proper tracking at 0 on the meter scale. If readings are high at zero decrease the meter reading slightly with R239 and repeat Steps 10 through 14 as necessary to provide the best possible meter tracking. If the meter reading is low at 0 in the meter scale increase the meter deflection with R239 and repeat Steps 10 through 14 for best meter tracking.

16. Record the COMP control setting next to UHF on the calibration chart.

17. Set the frequency range switch to B.

18. Tune the generator and the 7271 to the center frequency of TV channel 2.

19. Calibrate the generator and set its output at the level listed in Table 5-1 for +10 dBmV.

20. Adjust the COMP control for full-scale meter deflection; be certain that the generator is tuned for maximum deflection on the meter.

At this point, repeat Step 11, observing the meter readings. If there is a significant difference between these readings and those first obtained in Step 11, readjust R234 for a compromise setting. Use the COMP control, not R238 for making full scale adjustments.

If the setting of R234 is changed it will be necessary to repeat Steps 4, 5, 6, 8, 9, 10 and 16 through 19.

21. Record the COMP control setting next to CH2 on the calibration chart.

22. Repeat Steps 17 through 20, tuning the generator and the 7271 to all of the calibration points in the B, C, and D ranges.

23. Set the frequency range switch to A.

24. If necessary, replace the signal generator with one that will cover this range.

25. Repeat Steps 17 through 20 for all A-range calibration points.

26. Disconnect the line cord from the unit.

27. Return the chassis to the cabinet and fasten it with the four screws.

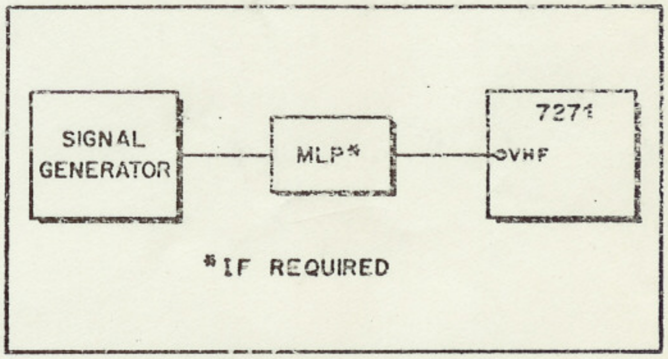


Fig. 5-3 Setup for Tuner Compensator Calibration by the Signal Generator Method

TABLE 5-1. SIGNAL GENERATOR OUTPUT LEVELS

7271 METER RANGE dBmV	GENERATOR OUTPUT*			
	MATCHED 75-OHM	UNMATCHED 75-OHM	MATCHED 50-OHM	UNMATCHED 50-OHM
−20	300 µV	600 µV	600 µV	1200 µV
−10	1000 µV	2000 µV	2000 µV	4000 µV
+10	3000 µV	6000 µV	6000 µV	12 mV
+20	10 mV	20 mV	20 mV	40 mV
+30	30 mV	60 mV	60 mV	120 mV
+40	100 mV	200 mV	200 mV	400 mV
+50	300 mV	600 mV	600 mV	1.2 V
	1.0 V	2.0 V	2.0 V	4.0 V
+60	3.0 V	6.0 V	6.0 V	12.0 V

* 1. If a Model ZM57 (5.7 dB) is used instead of a 7.78 dB pad, the voltage listed for 50-ohm output must be multiplied by 0.785 for the appropriate full scale readings.

2. For the UHF position of meter range switch, all tabulated voltages must be multiplied by 0.355. If a model ZM57 (5.7 dB) pad is used instead of a 7.78 pad, all voltages listed for 50-ohm output must be multiplied by 0.279.

5.3 I-F SECTION ALIGNMENT

5.3.1 GENERAL

The need for realigning the i-f amplifier is indicated when, in attempting to calibrate the unit, it is noted that the COMP settings have moved appreciably toward the high end of the control range. Complete realignment of the i-f amplifier requires test equipment not normally available in the field.

For this reason, if the section is grossly misaligned, the unit should be returned to Texscan for realignment. However, it is possible to perform minor realignment (or to determine if factory realignment is necessary) with satisfactory results by using relatively common items of test equipment. The procedure for this realignment is described below.

Note that two procedures for aligning the discriminator are also described. The first (sweep generator) method is the preferred one. After aligning the i-f amplifier, it will be necessary to align the discriminator and then calibrate the unit.

5.3.2 EQUIPMENT REQUIRED

1. An r-f sweep generator, Texscan Model VS-60Z or equivalent.
2. A crystal-calibrated marker generator, RCA Model WR-99A or equivalent.
3. A variable attenuator, Texscan Model SA-70 or equivalent.
4. An oscilloscope.

5.3.3 I-F AMPLIFIER ALIGNMENT

1. Open the line cord compartment and remove the cord.
2. Remove the four screws at the rear of the cabinet.
3. Slide the chassis out through the front of the cabinet.
4. Power the 7271 from the a-c line.
5. Set the power selector switch to AC.
6. Set the UHF/VHF switch to VHF.
7. Set the frequency range switch to UHF.
8. Set meter range to 0 dBmV.
9. Set up equipment as shown in Fig. 5-4; test point No. 2 is accessible through a hole in the chasis rear panel near the lower left corner (Fig. 5-8).
10. Check that the index mark on the COMP control knob points to 10 when the control is in its maximum clockwise position; it if does not, loosen the setscrew and set the index mark on 10.
11. Push in the COMP control and turn it to the UHF setting listed on the calibration chart.
12. Set the marker and the sweep center frequency at 52 MHz.
13. Set the oscilloscope vertical sensitivity control for maximum gain. Use the variable attenuator for controlling the amplitude of the oscilloscope display.
14. Adjust L214, L215, and C211 for maximum response at 52 MHz (Fig. 5-5). Use a hexagonal alignment tool similar to General Cement No. 8606 for the inductors and a Walsco No. 2519 tool for the trimmer.

Note:

All adjustments are accessible through holes in the bottom cover of the i-f chassis (Fig. 5-9).

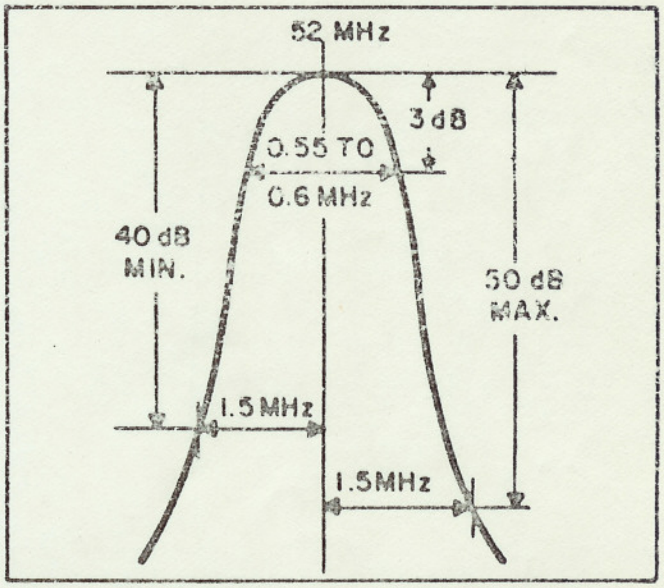


Fig. 5-5. Response of I-F Amplifier at Test Point No. 2

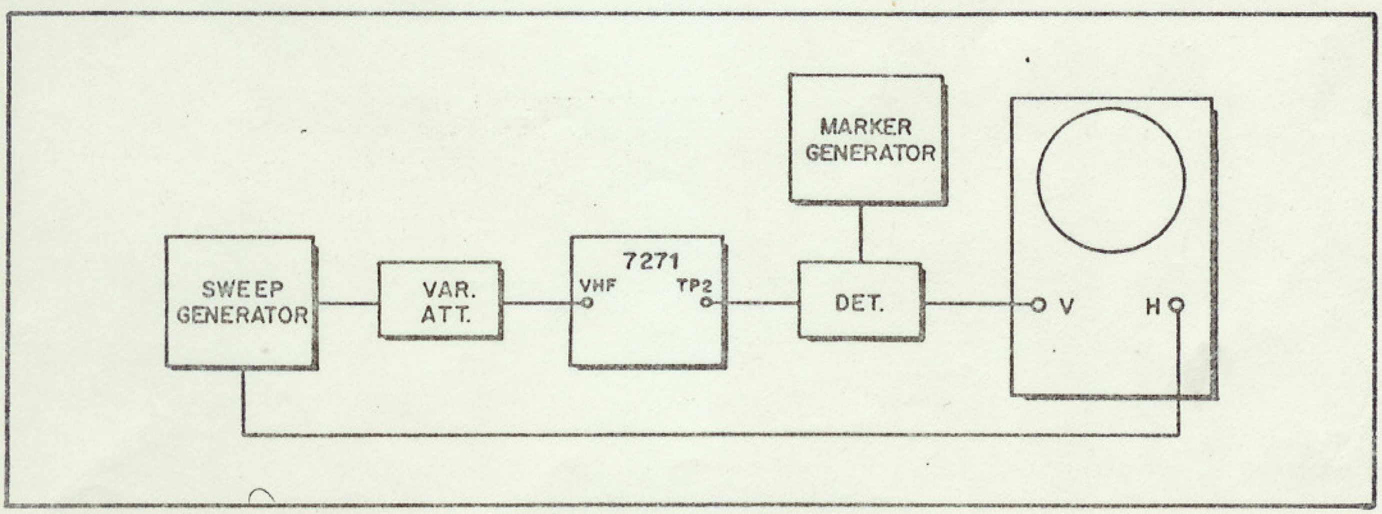


Fig. 5-4. Setup for I-F Amplifier Alignment

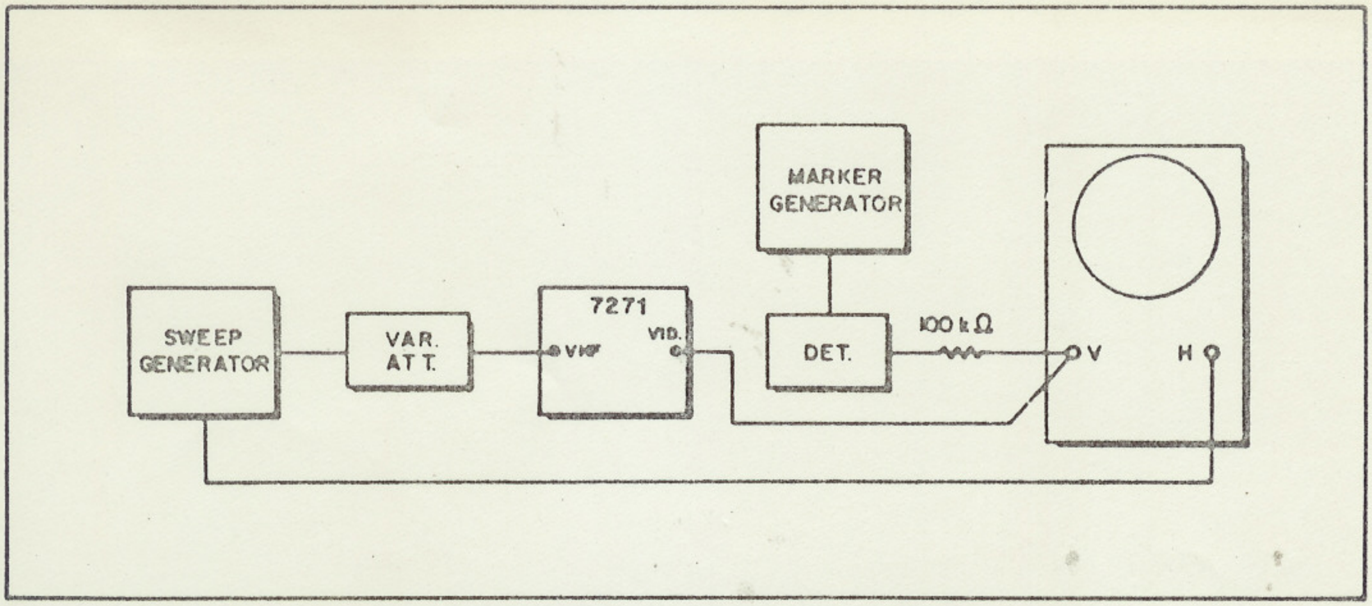


Fig. 5-6. Setup for Video Amplifier/Detector Alignment

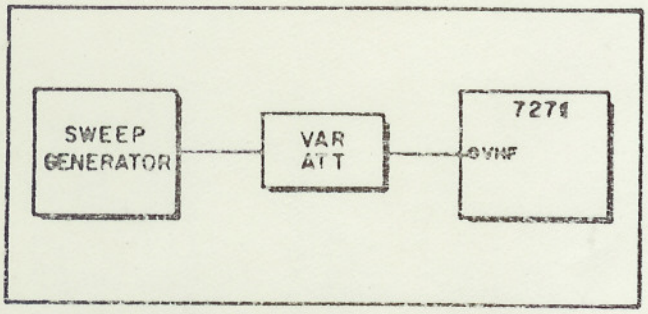


Fig. 5-7. Set up for Discriminator Alignment

15. Trimmers C240/C241 and C242/C243 form double-tuned pairs, but the bandwidth of the i-f amplifier is so narrow that they too are tuned for maximum response at 52 MHz.

16. If a response similar to that shown in Fig. 5-5 cannot be obtained with the adjustments in Steps 14 and 15, C201, C202, C205, and C214 may be adjusted; however, since these trimmers affect the input match of the amplifier, they should be disturbed only as a last resort. If one or more of these trimmers is obviously misaligned. adjust one at a time, being careful to return the adjustment screw to its original position if no improvement on the response is seen.

5.3.4 VIDEO AMPLIFIER/DETECTOR ALIGNMENT

1. Connect equipment as shown in Fig. 5-6.
2. Adjust the amplitude of the oscilloscope display with the variable attenuator, not with the oscilloscope vertical sensitivity control.
3. Adjust L218 for maximum response at 52 MHz.

5.3.5 DISCRIMINATOR ALIGNMENT (SWEEP GENERATOR METHOD)

1. Connect equipment as shown in Fig. 5-7.
2. Set the sweep width as narrow as possible so that the generator output is essentially at one frequency.
3. Set the sweep center frequency at 52 MHz, as indicated by maximum deflection on the 7271 meter.
4. Adjust the variable attenuator for a reading of 4 dB on the 7271 meter.
5. The discriminator coil windings are on opposite ends of a common coil form. The tuning core of the primary winding, L216-A, is positioned toward the chasis hole and the tuning core of the secondary winding, L216-B, is positioned in the top of the coil form. To adjust L216, use a hexagonal tool that will pass through the core of L216-A.
6. Tune L216-A for maximum indication on the meter, readjusting the variable attenuator as necessary to keep the maximum reading at 4 dB.
7. Tune L216-B to the null point: the point where turning the core in either direction increases the meter deflection.

5.3.6 DISCRIMINATOR ALIGNMENT (AIR-SIGNAL METHOD)

1. If a steady television signal is available it can be used for aligning the discriminator. Apply the signal through the variable attenuator to the VHF INPUT terminal on the 7271.
2. Tune the 7271 to a carrier (video or sound) of the signal and adjust the variable attenuator for a 4 dB reading on the meter.
3. Switch on the 7271 audio amplifier.
4. The discriminator coil windings are on opposite ends of a common coil form. The tuning core of the primary winding, L216-A, is positioned toward the chassis hole and the turning core of the secondary winding, L216-B, is in the top of the coil form. To adjust L216-B, use a hexagonal tool that will pass through the core of L216-A.
5. Tune L216-A for a maximum indication on the meter, readjusting the variable attenuator as necessary to keep the maximum meter reading at 4 dB.
6. Tune L216-B to the null point: the point where turning the core in either direction increases the meter deflection. This should correspond to the

point where minimum sync buzz is heard, when a video carrier is the signal source, or where best quality sound is heard, when a sound carrier is the signal source.

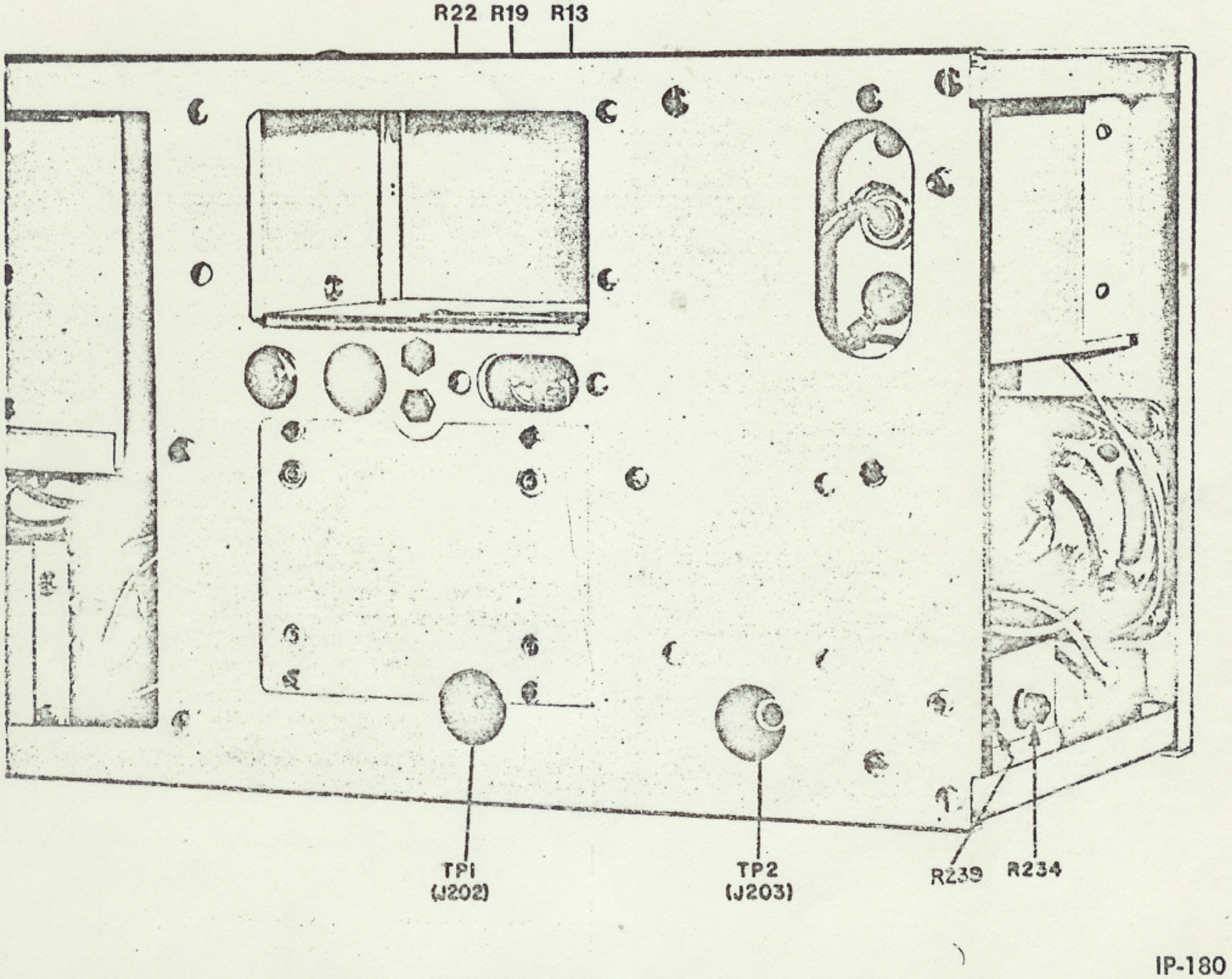


Fig. 5-8. Location of R234, TP1, and TP2

5.4 VOLT-OHM CALIBRATION

5.4.1 OHMS CALIBRATION

1. Remove the 7271 from the case by removing the four screws in the rear of the case.
2. With the 7271 off, set the meter zero to "0" on the D.C. volt scale.
3. Make certain that the 7271 internal battery is fully charged.
4. Check the meter fuse and replace if necessary with ¼A Fast BLO.
5. Connect the red and black test leads to the front panel tip jacks.
6. Set the function switch to ohms position.
7. Short the test leads together and set R13 the ohms zero. Adjust for a zero reading on the ohms scale.

5.4.2 A.C. VOLTAGE CALIBRATION

1. Remove the 7271 from the case by removing the four screws in the rear of the case.
2. With the 7271 off, set the meter zero to "0" on the D.C. volt scale.
3. Connect the red and black test leads to the front panel tip jacks.
4. Check the meter fuse and if necessary replace with a ¼A Fast BLO.
5. Set the function switch to A.C. volts position.
6. Apply a known AC voltage to the test leads.
7. Adjust R19 the A.C. Calibration Pot to achieve an accurate reading on the 7271 A.C. volt scale.

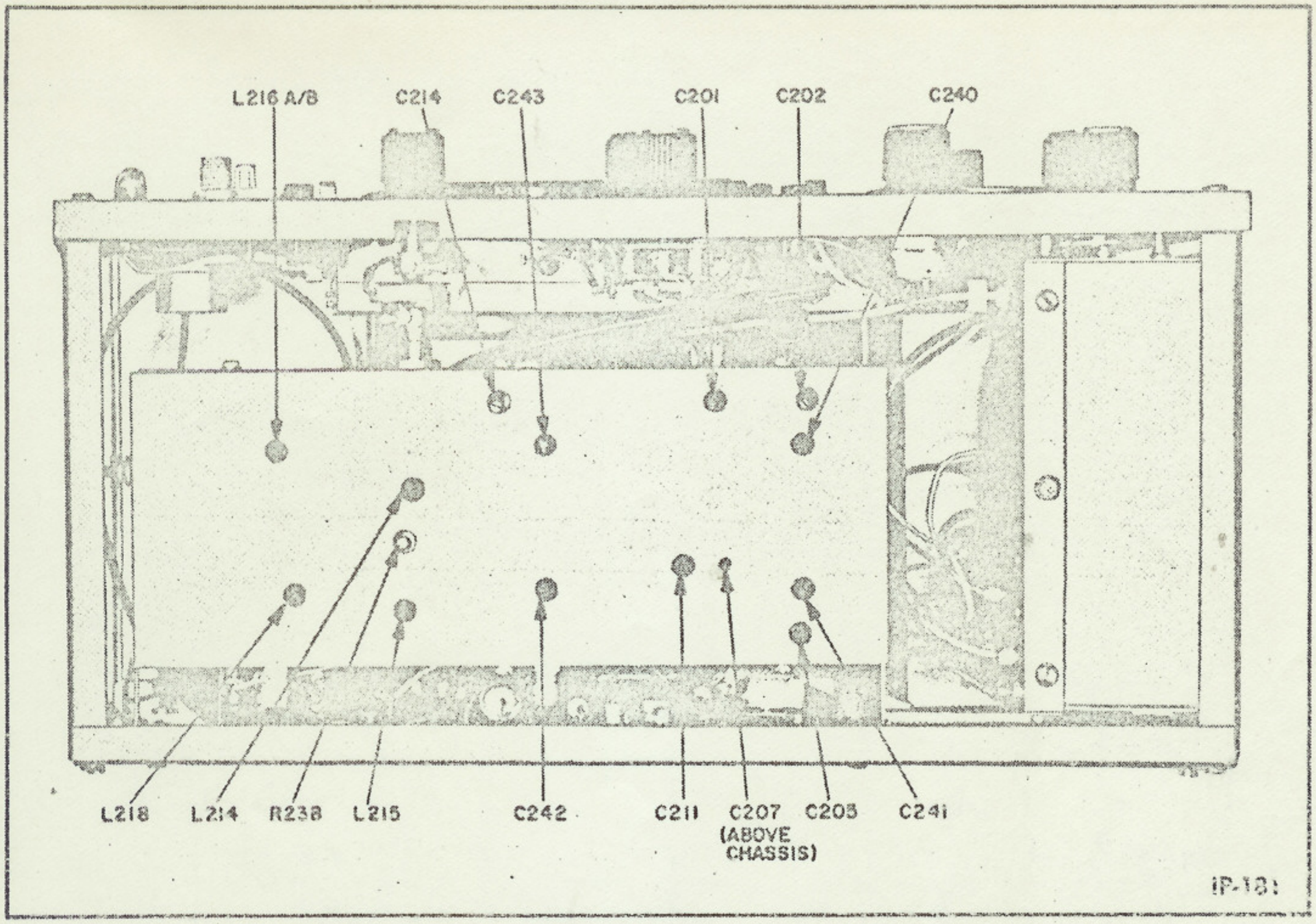


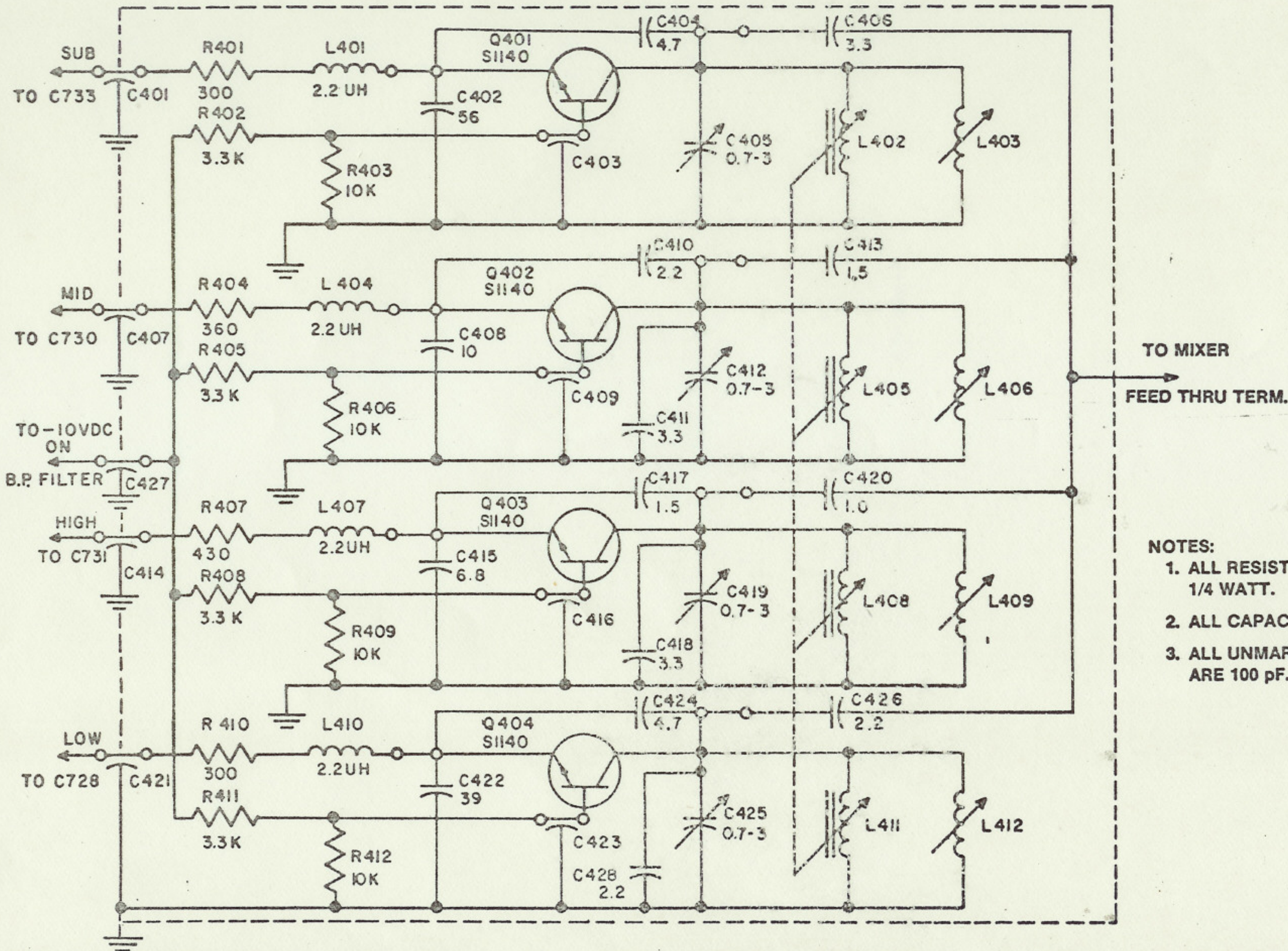
Fig. 5-9. Location of Calibration and Alignment Adjustments on Bottom of I-F Section

5.4.3 D.C. VOLTAGE CALIBRATION

1. Remove the 7271 from the case by removing the four screws in the rear panel.
2. With the 7271 off, set the meter zero to "0" on the D.C. volts scale.
3. Connect the red and black test leads to the front panel tip jacks.
4. Check the meter fuse and if necessary replace with a ¼A Slo BLO.
5. Set the function switch to the D.C. volt position.
6. Apply a known D.C. voltage to the test leads.
7. Adjust R22, the D.C. Calibration Pot for a correct reading on the D.C. volt scale.

SCHEMATIC

VHF TUNER FOR MODEL 7271



NOTES:

1. **ALL RESISTORS ARE 5%, 1/4 WATT.**
2. **ALL CAPACITORS ARE IN pF.**
3. **ALL UNMARKED CAPACITORS ARE 100 pF.**

REPLACEMENT PARTS LIST

Note:

Parts are arranged alphabetically by circuit reference and numerically by increasing part value.

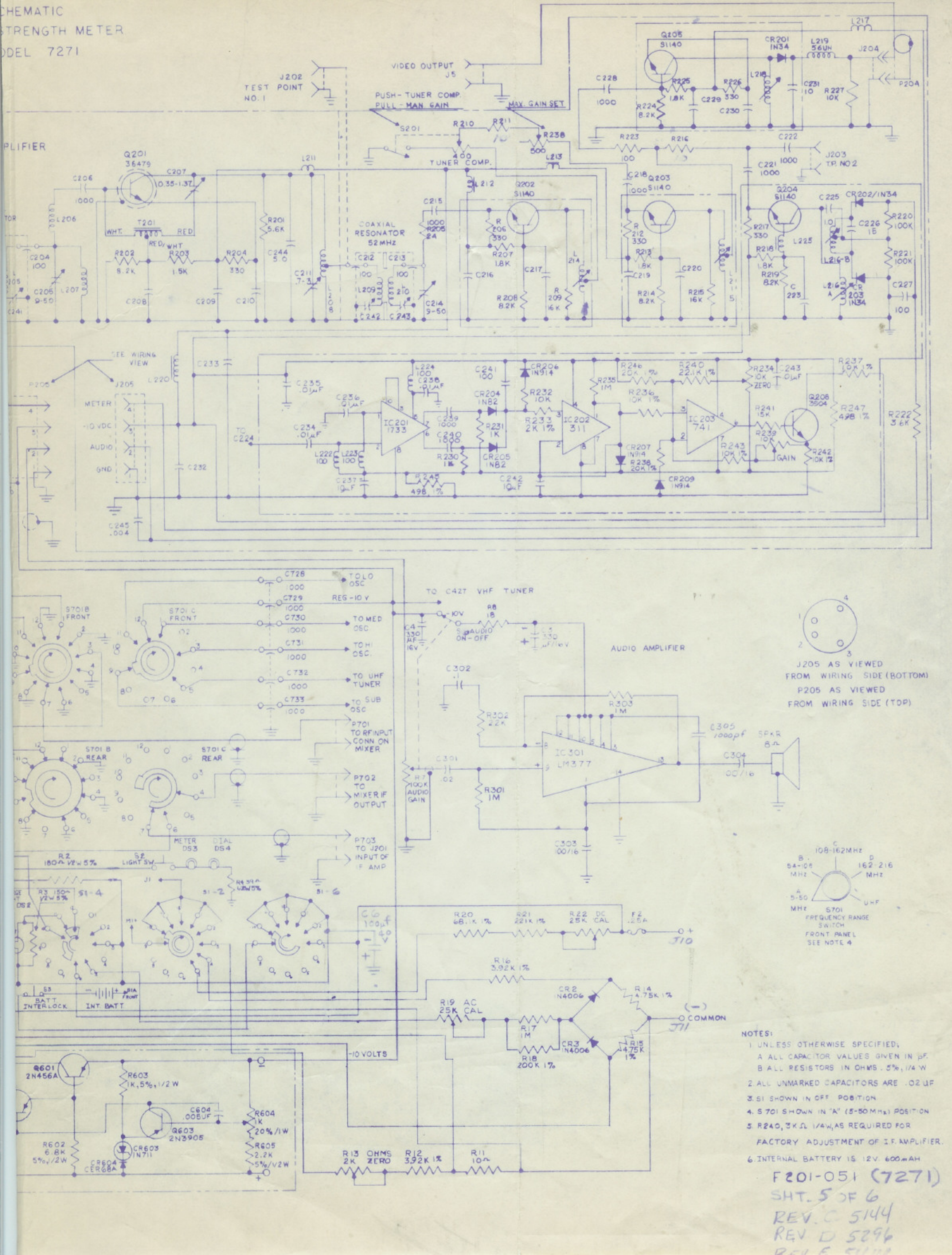
PARTS LIST

CIRCUIT REF. NO.	VALUE	REPLACEMENT PART NO.
	BATTERY	
B1	12 V, .600 AH	009-005
	CAPACITORS, FIXED	
C225	1 pf.	012-330
C102	1.2 pf.	012-314
C714, C718, C722	3.3 pf.	012-337
C17, C723	3.6 pf.	012-344
C724, C725, C726, C727	3.9 pf.	012-343
C719, C721	4.7 pf.	012-338
C244	5.0 pf.	012-324
C702	5.6 pf.	012-342
C231	10 pf.	012-325
C713	15 pf.	012-135
C226	15 pf.	012-326
C706, C711, C716	22 pf.	012-339
C704	30 pf.	012-340
C707	36 pf.	012-341
C701	47 pf.	012-347
C712, C715	51 pf.	012-346
C705	62 pf.	012-348
C703	68 pf.	012-230
C241	100 pf.	012-068
C801	100 pf.	012-328
C227	100 pf.	012-333
C203, C204, C212, C213	100 pf.	012-335
C709	270 pf.	012-349
C708, C710	560 pf.	012-345
C728, C729, C730, C731	1000 pf.	012-001
C732, C733	1000 pf.	012-001
C206, C215, C218, C221	1000 pf.	012-009
C222, C224, C228, C239, C240	1000 pf.	012-009
C1, C2	1000 pf.	012-332
C245	.004 μf	012-239
C804	.005 μf	012-310
C101, C601, C602	.01 μf	012-005
C234, C235, C236, C238, C243	.01 μf	012-050
C208, C209, C210, C216, C217	.02 μf	012-309
C219, C220, C223, C229, C230	.02 μf	012-309
C232, C240, C241, C301	.02 μf	012-309
C302	.1 μf	012-132
C237, C242	10 μf @ 25 V	012-276
C605	25 μf @ 25 V	012-313
C303, C304	100 μf @ 16 V	012-060
C5	100 μf @ 40 V	012-016
C603	250 μf @ 25 V	012-312
C3, C4	330 μf @ 16 v	012-323
	CAPACITORS, VARIABLE	
C207	.35-1.37 pf.	015-029
C211	.7-3 pf.	015-032
C720	2-8 pf.	015-033
C201, C202	4-12 pf.	015-031
C205, C214	9-50 pf.	015-030
	DIODES	
CR201, CR202, CR203	1N34	025-095
CR204, CR205, CR801, CR802	1N82AG	025-002
CR803, CR804	1N82AG	025-002
CR603	1N711	035-093
CR206, CR207, CR209	1N914	025-084
CR1, CR2, CR3, CR4	1N4006	025-044
CR5, CR601, CR602, CR604	1N4006	025-044
	INDICATOR LIGHTS	
DS1	NE-2H	011-009
DS2	6.3 V	011-008
DS3, DS4	T3¼	011-002
	FUSE	
F2	¼A. FAST BLO	034-005
F1	½A. FAST BLO	035-006

CIRCUIT REF. NO.	VALUE	REPLACEMENT PART NO.
	INTEGRATED CIRCUITS	
IC202	LM311	076-043
IC301	LM377	076-116
IC201	NA733M	076-105
IC203	NA741	076-002
	JACK, CONNECTOR	
J1	Phone Jack	054-039
J2	3 Pin	054-040
J3, J10	RED, Pin	054-038
J4, J11	BLACK, Pin	054-037
J5, J101, J202, J203	"F" Conn	020-222
J101, J103, J201, J204	Sub Min.	020-208
J801, J802	Sub Min.	020-208
J702, J703, J704	Sub Min.	020-206
	INDUCTORS	
L704, L705	2.2 μh	035-097
L202	5.6 μf	035-093
L201, L203	12 μh	035-094
L219	12 μh	035-095
L222, L223, L224	100 μh	035-041
L718	3T	036-008-01
L716	3½T	035-099-01
L720	4T	036-008-18
L719	5T	035-100-16
L717	5T	035-098-03
L706, L707, L710, L713	5¼T	035-101-03
L703	5¼T	035-101-04
L715, L721	6T	035-100-15
L712	7¼T	035-101-02
L207	8T	036-009-01
L711, L714	9T	036-009-02
L801	9½T	036-007-07
L702, L705, L708	10T	035-098-02
L206	11T	036-008-04
L701	12T	035-098-04
	METER	
M1	200 μA	043-014
	PLUG, CONNECTOR	
P1	Line cord	019-104
P103, P104, P105, P704	Amp 27-19	020-206
P205	4 Pin	020-227
	TRANSISTORS	
Q601	2N456A	062-097
Q202, Q203, Q204, Q205	S1140	062-093-00
Q208	2N3904	062-083
Q602, Q603	2N3905	062-096
Q201	36479	062-095
	RESISTOR, FIXED	
R11	10 Ω ¼ w 10%	045-626
R8	18 Ω ½ w 5%	046-036
R4	33 Ω ½ w 5%	046-047
R223	100 Ω ¼ w 5%	045-667
R10	100 Ω 1 w	046-368
R3	150 Ω ½ w 5%	046-074
R2	180 Ω ½ w 5%	046-078
R204, R206, R212, R217, R226	330 Ω ¼ w 5%	045-688
R245, R247	498 Ω ¼ w 1%	047-503
R230, R231	1 K Ω ¼ w 1%	047-462
R603	1 K Ω ½ w 5%	046-109
R203	1.5 K Ω ¼ w 5%	045-716
R601, R606	1.6 K Ω ¼ w 5%	045-719
R207, R218, R213, R225	1.8 K Ω ¼ w 5%	045-720
R233	2 K Ω ¼ w 1%	045-449
R605	2.2 K Ω ½ w 5%	046-123
R222	3.6 K Ω ¼ w 5%	045-733
R12, R16	3.92 K Ω ¼ w 1%	047-445
R14, R15	4.75 K Ω ¼ w 5%	047-476

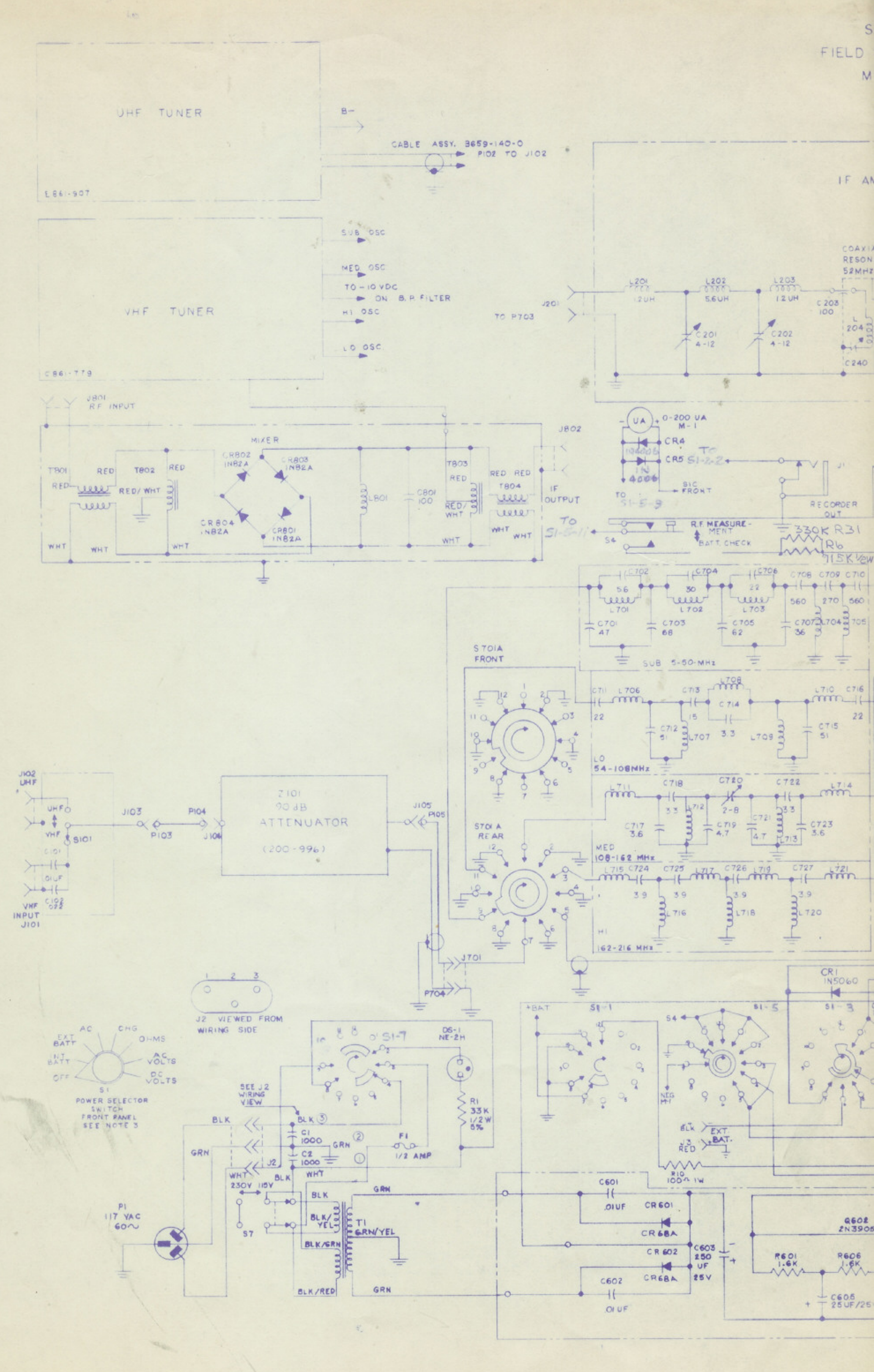
CIRCUIT REF. NO.	VALUE	REPLACEMENT PART NO.
	RESISTOR, FIXED Continued	
R201	5.6 K Ω ¼ w 5%	045-741
R602	6.8 K Ω ½ w 5%	046-144
R202, R208, R214	8.2 K Ω ¼ w 5%	045-748
R219, R224	8.2 K Ω ¼ w 5%	045-748
R227	10 K Ω ¼ w 5%	045-751
R236, R237, R242, R243	10 K Ω ¼ w 1%	047-440
R232	10 K Ω ¼ w 10%	045-752
R241	15 K Ω ¼ w 10%	045-759
R209, R215	16 K Ω ¼ w 5%	047-761
R246, R250	20 K Ω ¼ w 1%	047-459
R302	22 K Ω ¼ w 10%	045-766
R240	22.1 K Ω ¼ w 1%	047-443
R1	33 K Ω ½ w 5%	046-173
R20	68.1 K Ω ¼ w 1%	047-446
R6	71.5 K Ω ½ w 1%	047-555
R220, R221	100 K Ω ¼ w 5%	045-793
R18	200 K Ω ¼ w 1%	047-477
R21	221 K Ω ¼ w 5%	046-448
R5	510 K Ω ½ w 5%	046-224
R17	1 M Ω ¼ w 1%	047-463
R235, R301, R303	1 M Ω ¼ w 10%	045-836
	RESISTOR, VARIABLE	
R201, R210	400 Ω	048-213-01
R238	500 Ω	048-214
R604	1 K	048-217
R13	2 K	048-183
R234, R339	10 K	048-215
R19, R22	20 K	048-207
R7	100 K/SP ST	048-216
	SWITCHES	
S1	7P12T	057-240
S2	1P2T	057-163
S3	Momentary	057-164
S5	1P2T	057-165
S7	2P2T	057-147
S101	1P2T	057-161
S701A	1P5T	057-167
S701B	1P5T	057-168
S701C	1P5T	057-169
	TRANSFORMER	
T1	Power	061-036
T801, T804	F.S.V.	061-039
	ATTENUATOR	
2101	0-90 dB	200-006
	TEST LEADS	
N/Z	Set of two	068-004

CHEMATIC
TRENGTH METER
DEL 7271



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
A. ALL CAPACITOR VALUES GIVEN IN pF.
B. ALL RESISTORS IN OHMS. 5%, 1/4 W
2. ALL UNMARKED CAPACITORS ARE .02 UF
3. S1 SHOWN IN OFF POSITION
4. S701 SHOWN IN "A" (5-50 MHz) POSITION
5. R240, 3K Ω 1/4W, AS REQUIRED FOR FACTORY ADJUSTMENT OF I.F. AMPLIFIER.
6. INTERNAL BATTERY IS 12V. 600mAH

F201-051 (7271)
SHT. 5 OF 6
REV. C 5144
REV D 5296



UHF TUNER
E861-907
B-
CABLE ASSY. 3659-140-0
P102 TO J102
VHF TUNER
C861-779
SUB OSC
MED OSC
TO -10 VDC
ON B.P. FILTER
HI OSC
LO OSC
J801
RF INPUT
MIXER
TB01
T802
CR802
1N82A
CR803
1N82A
CR804
1N82A
CR801
1N82A
LB01
C801
100
T803
T804
J802
IF
OUTPUT
IF AM
J201
TO P703
L201
12UH
L202
5.6UH
L203
12 UH
C201
4-12
C202
4-12
C203
100
C240
0-200 UA
M-1
CR4
CR5
TO S1-5-9
RECORDER OUT
R.F. MEASUREMENT
BATT. CHECK
S4
330K R31
R6
SUB 5-50 MHz
S701A
FRONT
LO
54-108MHz
MED
108-162 MHz
HI
162-216 MHz
S701 A
REAR
J102
UHF
UHF
VHF
S101
C101
.01UF
C102
VHF
INPUT
J101
J103
P104
P103
J104
Z101
90 dB
ATTENUATOR
(200-996)
J105
P105
J701
P704
J2 VIEWED FROM
WIRING SIDE
AC
CHG
EXT BATT
OI-MS
INT BATT
AC VOLTS
OFF
DC VOLTS
S1
POWER SELECTOR
SWITCH
FRONT PANEL
SEE NOTE 3
S1-7
DS-1
NE-2H
R1
33K
1/2W
5%
SEE J2
WIRING
VIEW
C1
1000
C2
1000
F1
1/2 AMP
J2
230V 115V
S7
P1
117 VAC
60~
T1
GRN/YEL
BLK/YEL
BLK/GRN
BLK/RED
+BAT
S1-1
S1-5
S1-3
CR1
1N5060
EXT.
BAT.
R10
100 1W
C601
.01UF
CR601
CR68A
CR602
CR68A
C603
250
UF
25V
C602
.01 UF
Q602
2N3905
R601
1.6K
R606
1.6K
C605
25UF/25