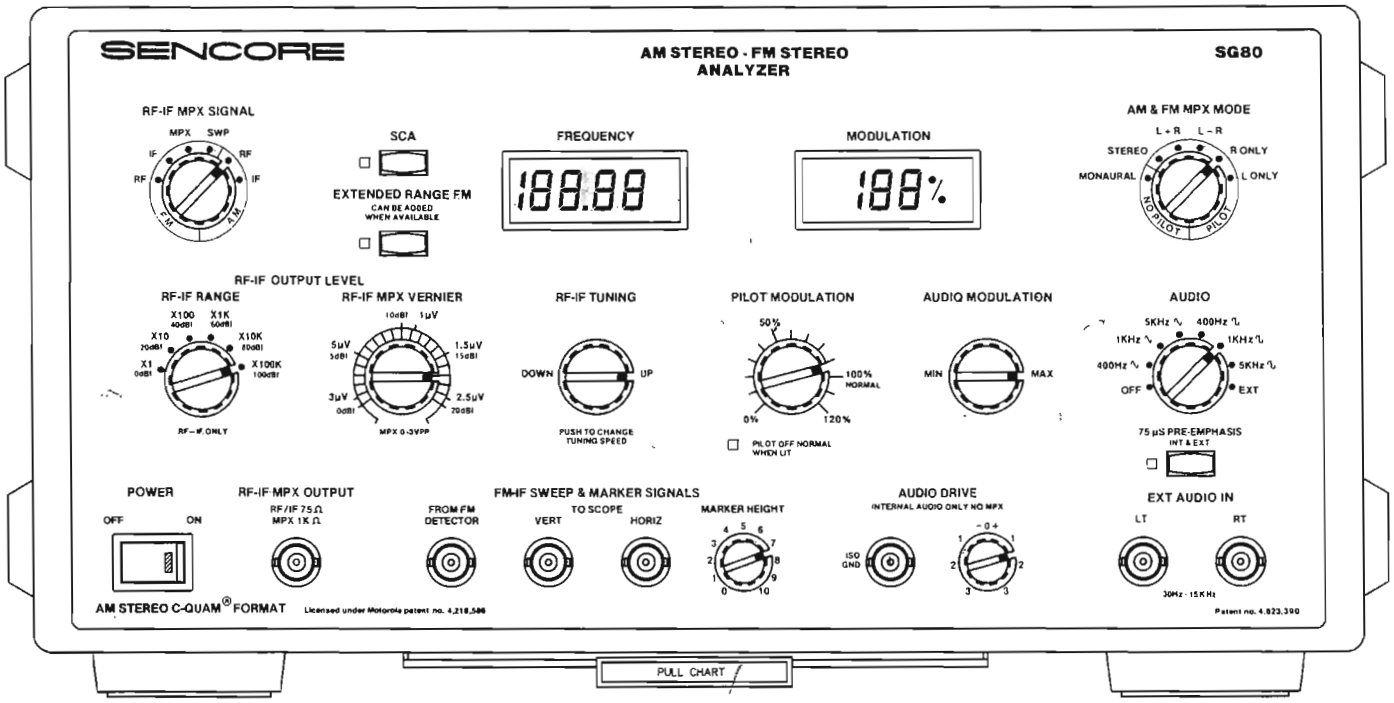
SG80

AM STEREO - FM STEREO ANALYZER

Operation and Application Manual



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SENCORE
3200 Sencore Drive, Sioux Falls, South Dakota 57107

WARNING

PLEASE OBSERVE THESE SAFETY PRECAUTIONS

There is always a danger present when testing electronic equipment. Unexpected high voltages can be present at unusual locations in defective equipment. Every precaution has been taken in the design of your instrument to insure that it is as safe as possible. However, safe operation depends on you, the operator. Become familiar with the equipment you're working with, and observe the following safety precautions:

1. Never exceed the limits of this instrument as given in the specifications section and the additional special warnings in this manual.

2. A severe shock hazard can result if the chassis of the equipment being serviced is tied to the "hot" side of the AC line. An isolation transformer should always be used with hot-chassis equipment. Also, be sure that the top of your workbench and the floor underneath it are dry and made of non-conductive materials.

3. Remove the circuit power before making connections to high voltage points. If this cannot be done, be sure to avoid contact with other equipment or metal objects. Place one hand in your pocket and stand on an insulated floor to reduce the possibility of shock.

4. Discharge filter capacitors (after removing power) before connecting to any part of the circuit requiring power to be removed.

5. Be sure your equipment is in good order. Broken or frayed test leads can be extremely dangerous and can expose you to dangerous voltages.

6. Remove the test lead immediately after the test has been completed to reduce the possibility of shock.

7. Do not work alone when working on hazardous circuits. Always have another person close by in case of an accident. Remember, even a minor shock can be the cause of a more serious accident, such as falling against the equipment, or coming in contact with high voltages.

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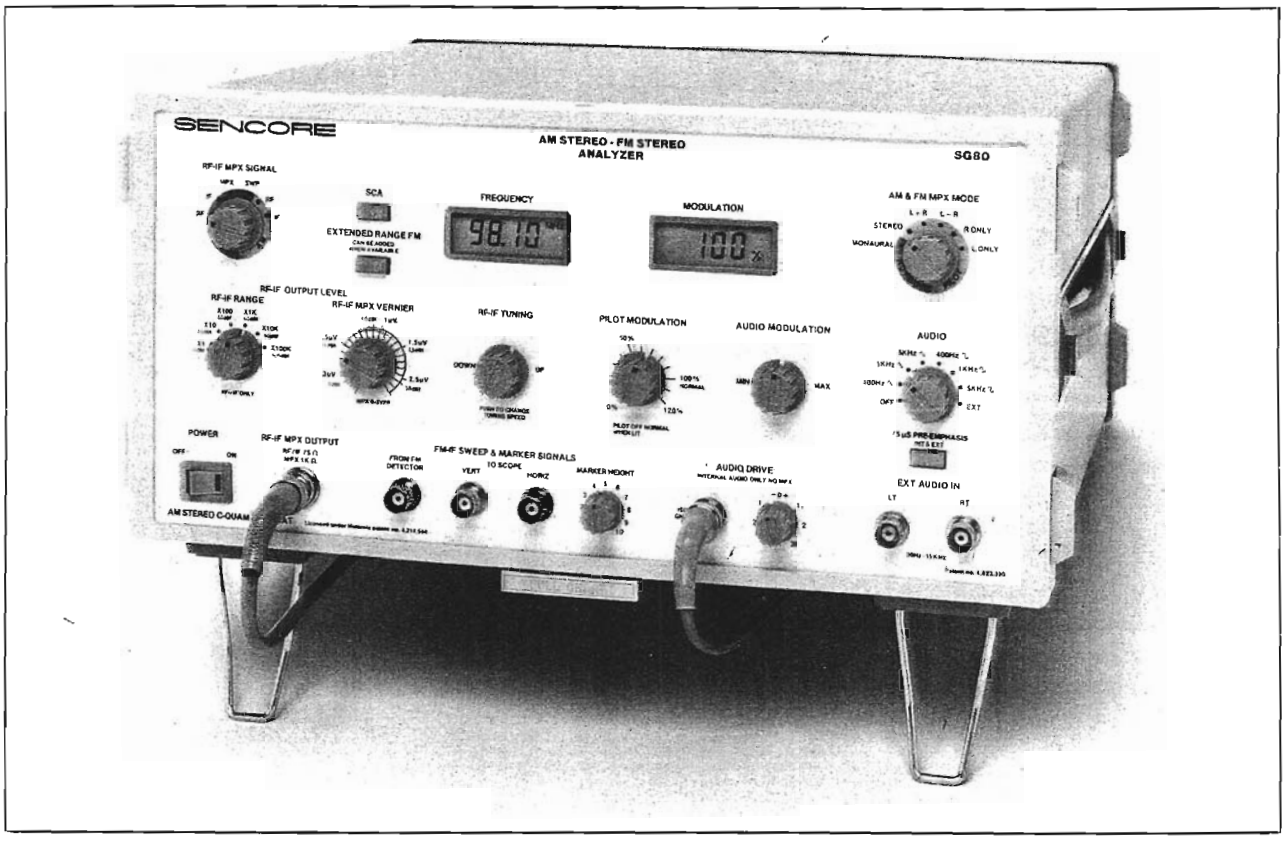

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SENCORE

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DESCRIPTION

Introduction

The SG80 is a patented stand alone stereo receiver analyzer that provides known good signals for testing today's complex audio circuitry. By injecting the SG80's signals into the stereo under test, performance tests, alignments and troubleshooting can be done with complete confidence.

Features

Many features combine to make the SG80 a total stereo receiver analyzer:

The SG80 RF-IF generator has the tuning range and accuracy needed to service tuners and receivers.

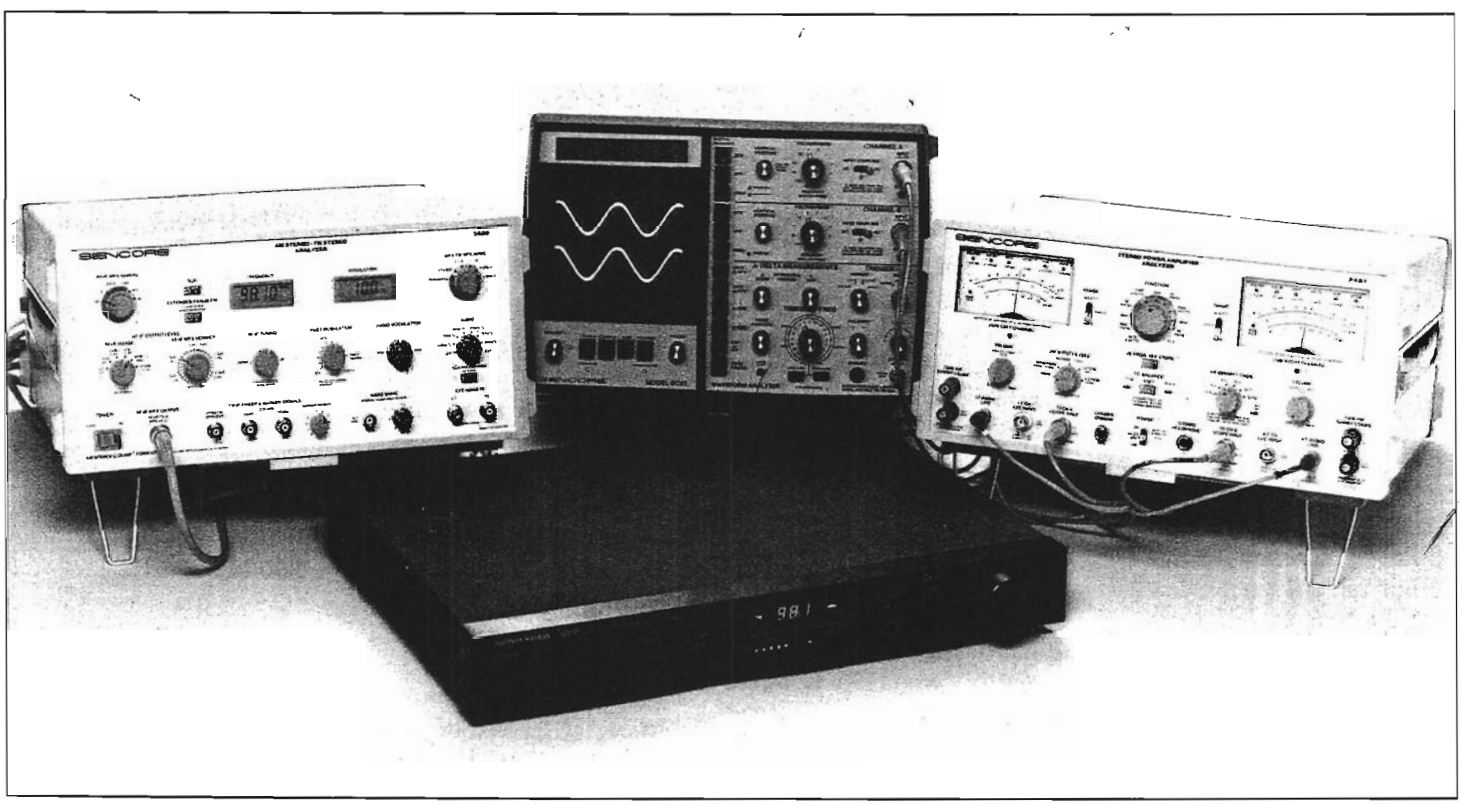
The SG80 provides precision RF and IF signals for testing and aligning FM tuners and receivers. RF and IF tuning is selectable as follows:

RF/IF Signal	Coarse Tuning Steps	Fine Tuning Steps
FM RF	200 kHz	10 kHz
AM RF	10 kHz	1 kHz
FM IF	100 kHz	10 kHz
AM IF	10 kHz	1 kHz
SWP	100 kHz	10 kHz

Modulation distortion of less than 0.01% for FM and 0.5% for AM allows you to test the most modern high-fidelity receivers as well as older stereo receivers.

The FM SWP function equips you for sweep alignment of FM receivers. The SG80 provides external vertical and horizontal sweep for the scope using the TO SCOPE VERT and HORIZ connectors. Plus, a tuneable center marker (9.7 to 11.7 MHz) with markers at 100 kHz intervals from center lets you check amplifiers and filters quickly and accurately.

Analyze AM mono and C-QUAM ® AM Stereo. The RF-IF generator allows testing and aligning of AM receivers. You can tune RF frequencies from 520 kHz to 1720 kHz with 1 kHz tuning steps. IF frequencies from 200 kHz to 500 kHz with 1 kHz steps allows you to do AM IF alignments.



SCA Capability: The SG80 generates a modulated 67 kHz signal for setting Subsidiary Communication Authority (SCA) filters and testing the operation of SCA tuners and receivers,

An adjustable pilot level from 0% to 120% allows you to test and adjust the pilot threshold of AM and FM Stereo tuners and receivers.

Adjustable audio output signals let you test the amplifier section of receivers. An audio level control is provided to adjust the output of the audio generator from 0 VPP to 3 VPP, with 0 or 180 degree phase inversion.

Specifications

All specifications allow for 20 minutes of warmup and are guaranteed at 15-45 degrees C (59-113 degrees F).

FM RF GENERATOR

Tuning Range	87.9 to 108 MHz
Tuning steps	
Coarse	200 kHz steps
Fine	10 kHz steps
Accuracy	+/- 20 PPM
Modulation Percentage	100% = +/- 75 kHz Deviation +/- 2 kHz
Modulation Distortion	< or equal to 0.01% THD with a 1 kHz sinewave @ 100% mod.
Stereo Separation	> 63 dB @ 98.1 MHz and 1 kHz sinewave modulation

FM IF GENERATOR (Specs guaranteed from 10.2 MHz to 11.2 MHz)

Tuning Range	9.7 to 11.7 MHz
Tuning Steps	
Coarse	100 kHz
Fine	10 kHz
Accuracy	+/- 20 PPM
Modulation Percentage	100% = +/- 75 kHz deviation +/- 2 kHz
Modulation Distortion	< or equal to 0.01% THD with a 1 kHz sinewave @ 100% mod.

FM MULTIPLEX GENERATOR

Pilot Frequency	19 kHz +/- 2 Hz
Pilot Level	0 to 10% of overall 11% ± 1% modulation continuously variable
Stereo Separation	Through Composite > 65 db at 1 kHz

SCA

Frequency	53 to 95 kHz internally adjustable. Preset at factory to 67 kHz
Accuracy of Carrier	+/- 1.5 KHz
Modulation	2.5 kHz audio sine wave
Modulation Distortion	< or equal to 3% at 2.5 kHz

INTERNAL FM MODULATION

Modulation Frequency	Off, 400 Hz, 1 kHz, and 5 kHz ±20 PPM Sine and Squarewave

EXTERNAL FM MODULATION

Freq. Range	30 Hz to 15 kHz (flat to within +/- 1.5 dB)
Input Impedance	600 ohms +/- 15%
Level for 100% Mod.	3 VPP audio sinewave signal at 1 kHz without pre-emphasis +/- 10%
Pre-emphasis	75 usec front panel selectable

FM SWEEP GENERATOR

Sweep Width	+/- 600 kHz
Center Marker Frequency	Selectable between 9.7 and 11.7 MHz in 100 kHz steps (Coarse) and 10 kHz steps (Fine)
Accuracy	+/- 20 PPM
Amplitude	1.2 VPP Minimum
Markers	Every 100 kHz from center marker to +/- 600 kHz

AM RF GENERATOR

Frequency Range	520 kHz to 1720 kHz minimum
Tuning steps	
Coarse	10 kHz steps
Fine	1 kHz steps
Accuracy of Carrier	+/- 20 PPM
Modulation Percentage	0% to 125% +/- 2% in Mono, L+R, L-R, and Stereo 0% to 65% in R and L
Modulation Distortion	< or equal to 0.5% THD with a 1 kHz audio sine wave signal @30% mod.

AM IF GENERATOR

Frequency Range	200 to 500 kHz
Tuning Steps	
Coarse	10 kHz steps
Fine	1 kHz steps
Accuracy of Carrier	+/- 20 PPM
Modulation Percentage	0% to 125% +/- 2% in Mono, L+R, L-R, and

	Stereo 0% to 65% in R and L
Modulation Distortion	< or equal to 0.5% THD with a 1 kHz audio sine wave signal @ 30% mod.

AM INTERNAL MODULATION

Frequencies	Off, 400 Hz, 1 kHz, and 5 kHz ± 20 PPM Sinewave and Square wave

AM EXTERNAL MODULATION

Frequency Range	30 Hz to 15 kHz (flat to within +/- 1.5 dB)
Input Impedance	600 ohms +/- 20%
Level for 100% Mod.	3Vpp at 1 kHz

C QUAM AM STEREO

Main Channel Mod. Dist.	< or equal to 0.5% with a 1 kHz audio sine wave signal @ 30% mod.
Sub-Channel Mod. Dist.	< or equal to 0.5% with a 1 kHz audio sine wave signal @ 30% mod.
Stereo Separation	> or equal to 35 dB from 200 Hz to 7.5 kHz at 50% modulation
ID Pilot Frequency	25 Hz +/- 0.25 Hz

RF/IF/MPX ATTENUATOR

Range	0 to 120 dBf Continuously Variable (0.27 uV to 0.27V)
Accuracy	+/- 1 dB at 98.1 MHz at 65 dBf +/- 1.5 dB over 20 dBf-120 dBf ranges, +/- 2.5 dB over 0dB range
Output Impedance	75 Ohm RF, 1 k Ohm MPX
Output Protection	Protected from externally applied voltages up to +/- 400 V(DC + Peak AC)

AUDIO OUTPUT

Frequencies	Off, 400 Hz, 1 kHz, and 5 kHz ± 20 PPM Sinewave and Square wave
Sinewave Distortion	< 0.02% THD at 1 kHz into 100 ohms
Output Amplitude	0 to 3 VPP continuously variable into 100 ohms
Output Impedance	100 ohms
Output Protection	Protected from externally applied voltages +/- 500 volts (DC + Peak AC)
Floating Ground	(-) ground isolated to +/- 500V (DC + Peak AC)

GENERAL SPECIFICATIONS

Operating Temperature	15 to 45 degrees C
Humidity	< 90% RH with no condensation
AC Power	105 to 130 VAC, 60 Hz, 35 watts
Size	7 1/4" x 13 3/4" x 15" HWD (18.4 cm x 34.9 cm x 38.1 cm)
Weight	20 pounds (10.8 kg)
Warm-up Time	20 minutes

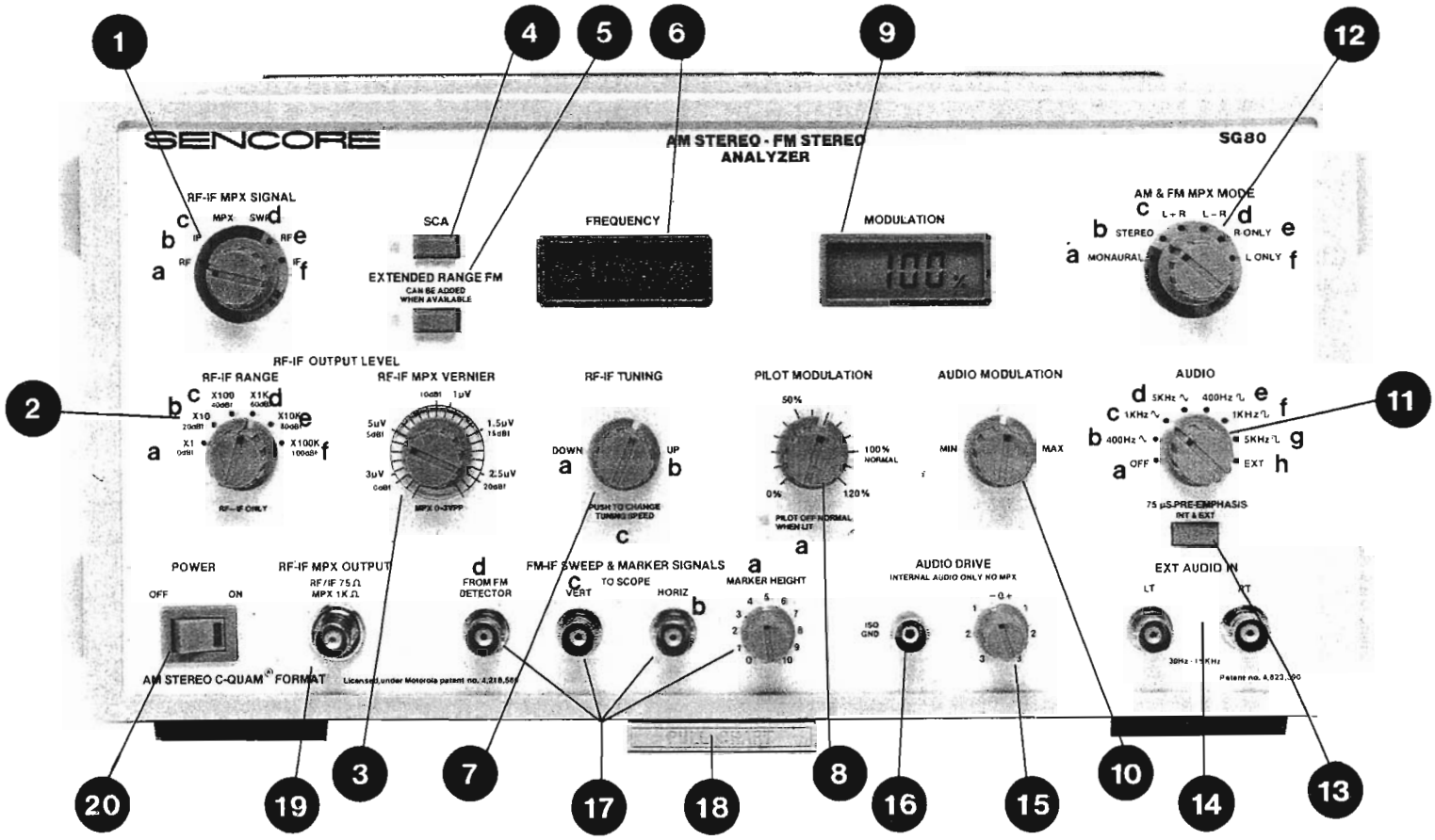
Recommended Recalibration interval is one year.
All specifications subject to change without notice.

SUPPLIED ACCESSORIES:

39G227 AUTO RADIO ANTENNA TEST LEAD
39G72 75-300 MATCHING TRANS.
39G220 BNC-TO-F CABLE
39G221 TEST LEAD
39G222 FM DETECTOR PROBE
39G223 VERT BNC-TO-BNC CABLE
39G224 HORIZ BNC-TO-BNC CABLE
39G226 AM MATCHING PAD

OPTIONAL ACCESSORIES:

PC259 Protective Cover/Lead storage
IB72 IEEE 488 Bus Interface Accessory
IB78 RS232 Interface Accessory



Controls

1. RF-IF MPX SIGNAL - Selects four FM and two AM output signals to performance test, troubleshoot, and align receivers.

1a. FM RF - Provides an FM RF signal tunable from 87.9 MHz to 108 MHz with frequency modulation adjustable from 0 to 125%. Modulation is controlled by the AM & FM MPX MODE (12), AUDIO (11), and AUDIO MODULATION (10) controls. The FM RF signal is available at the RF-IF MPX OUTPUT connector (19).

1b. FM IF - Provides an FM IF signal tunable from 9.7 MHz to 11.7 MHz with frequency modulation adjustable from 0 to 125%. Modulation is controlled by the AM & FM MPX MODE (12), AUDIO (11), and AUDIO MODULATION (10) controls. The FM IF signal is available at the RF-IF MPX OUTPUT connector (19).

1c. FM MPX - Provides the MPX signal selected by the AM & FM MPX MODE switch (12). The FM MPX signal is available at the RF-IF MPX OUTPUT connector (19). The MPX output level is adjusted by the RF-IF MPX VERNIER (3).

1d. FM SWP - Provides a sweep signal with a center frequency tunable from 9.7 MHz to 11.7 MHz with the RF-IF TUNING control (7), and a fixed sweep width of +/- 600 kHz. A center marker and 100 kHz side markers are generated and added to the sweep response at the TO SCOPE VERT output jack (17c).

1e. AM RF - Provides an AM RF signal tunable from 520 kHz to 1720 kHz with amplitude modulation adjustable from 0 to 100% (0 to 65% R only and L only). Modulation is controlled by the AM & FM MPX MODE (12), AUDIO (11), and AUDIO MODULATION (10) controls. The AM RF signal is available at the RF-IF MPX OUTPUT connector (19).

1f. AM IF - Provides an AM IF signal tunable from 200 kHz to 500 kHz with amplitude modulation adjustable from 0 to 100% (0 to 65% R only and L only). Modulation is controlled by the AM & FM MPX MODE (12), AUDIO (11), and AUDIO MODULATION (10) controls. The AM IF signal is available at the RF-IF MPX OUTPUT connector (19).

2. RF-IF RANGE switch - Sets the RF-IF output in 20 dBf steps from 0 to 100 dBf (Has no effect in MPX).

2a. 0 dBf, X 1 - In this position, the output level is adjusted by the RF-IF MPX VERNIER (3) from 0 dBf to 20 dBf (.27 to 2.7 microvolts).

2b. 20 dBf, X 10 - In this position, the output level is adjusted by the RF-IF MPX VERNIER (3) from 20 dBf to 40 dBf (2.7 to 27 microvolts).

2c. 40 dBf, X 100 - In this position, the output level is adjusted by the RF-IF MPX VERNIER (3) from 40 dBf to 60 dBf (27 to 270 microvolts).

2d. 60 dBf, X 1 K - In this position, the output level is adjusted by the RF-IF MPX VERNIER (3) from 60 dBf to 80 dBf (270 to 2,700 microvolts).

2e. 80 dBf, X 10 K - In this position, the output level is adjusted by the RF-IF MPX VERNIER (3) from 80 dBf to 100 dBf (2,700 to 27,000 microvolts).

2f. 100 dBf, X 100 K - In this position, the output level is adjusted by the RF-IF MPX VERNIER (3) from 100 dBf to 120 dBf (27,000 to 270,000 microvolts).

3. RF-IF MPX VERNIER - Varies the level of the RF-IF output from 0 to 20 dBf. This output is in addition to the level selected by the RF-IF RANGE switch (2).

4. SCA switch - Selects the 67 kHz SCA signal for aligning and testing FM receivers.

5. EXTENDED RANGE FM switch - Selects the Extended Range FM signal, for testing extended range FM receivers.

6. FREQUENCY display - 4 1/2 digit LCD with kHz and MHz annunciators. Displays the frequency of the RF, IF, and MPX output signals.

7. RF-IF TUNING control - Controls the RF-IF generator frequency in both coarse and fine steps. Switches between coarse and fine when control is pushed.

7a. DOWN direction - Turning the RF-IF TUNING control (7) counter-clockwise decreases the RF-IF generator frequency. Wrap around feature speeds servicing by allowing tuning through from lowest to highest frequency.

7b. UP direction - Turning the RF-IF TUNING control (7) clockwise increases the RF-IF generator frequency. Wrap around feature speeds servicing by allowing tuning through from highest to lowest frequency.

7c. PUSH TO CHANGE TUNING SPEED - When pushed, the RF-IF TUNING control (7) changes between 200 kHz and 10 kHz steps for FM RF signals, 100 kHz and 10 kHz steps for FM IF and SWP signals, and 10 kHz and 1 kHz steps for AM RF and IF signals.

8. PILOT MODULATION control - Adjusts the pilot level from 0% to 125% of normal pilot level for both AM and FM Stereo. Disabled when the AM & FM MPX MODE switch (12) is in the MONAURAL (12a) position.

8a. PILOT OFF NORMAL WHEN LIT indicator - When lit, alerts you that the pilot is adjusted to a level other than the normal modulation level.

9. MODULATION display - Displays the level of total modulation in FM including pilot in the FM Stereo mode and audio modulation in AM mode as adjusted by AUDIO MODULATION control (10).

10. AUDIO MODULATION control - Adjusts audio modulation level from 0 to 100% for AM (0 to 65% in R only and L only), and 0 to 125% for FM. Level is displayed on the MODULATION display (9).

11. AUDIO switch - Provides no modulation, sine or squarewave modulation signals at 400 Hz, 1 kHz, or 5 kHz, or modulation with external audio.

11a. OFF - Turns off audio modulation.

11b. 400 Hz sine wave - Provides 400 Hz sine wave modulation on the RF-IF MPX OUTPUT and 400 Hz sine wave audio at the AUDIO DRIVE output.

11c. 1 kHz sine wave - Provides 1 kHz sine wave modulation on the RF-IF MPX OUTPUT and 1 kHz sine wave audio at the AUDIO DRIVE output.

11d. 5 kHz sine wave - Provides 5 kHz sine wave modulation on the RF-IF MPX OUTPUT and 5 kHz sine wave audio at the AUDIO DRIVE output.

11e. 400 Hz square wave - Provides 400 Hz square wave modulation on the RF-IF MPX OUTPUT and 400 Hz square wave audio at the AUDIO DRIVE output.

11f. 1 kHz square wave - Provides 1 kHz square wave modulation on the RF-IF MPX OUTPUT and 1 kHz square wave audio at the AUDIO DRIVE output.

11g. 5 kHz square wave - Provides 5 kHz square wave modulation on the RF-IF MPX OUTPUT and 5 kHz square wave audio at the AUDIO DRIVE output.

11h. EXT - Provides external modulation on the RF-IF MPX OUTPUT with the audio signals connected to the EXT AUDIO input jacks (14). There is no signal at the AUDIO DRIVE output when using external modulation.

12. AM & FM MPX MODE switch - Controls the type of MPX signal produced by the SG80. This signal modulates the RF-IF MPX OUTPUT or is available directly at

the RF-IF MPX OUTPUT (FM only), when the RF-IF SIGNAL switch is in the MPX position (1c). The type of audio signal is controlled by the AUDIO switch (11).

12a. MONAURAL - Provides a monaural signal at the frequency selected by the AUDIO switch (11). No pilot is produced with this signal.

12b. STEREO - Provides a stereo signal with the right channel equal to (in phase with) the left channel when using internal signals. You can inject different signals using the EXT inputs. The pilot level is adjustable with the PILOT MODULATION control (8).

12c. L+R - Provides L+R and pilot MPX signals. The pilot level is adjustable with the PILOT MODULATION control (8).

12d. L-R - Provides L-R and pilot MPX signals. The pilot level is adjustable with the PILOT MODULATION control (8).

12e. R ONLY - Provides right channel modulation only. The pilot level is adjustable with the PILOT MODULATION control (8).

12f. L ONLY - Provides left channel modulation only. The pilot level is adjustable with the PILOT MODULATION control (8).

13. 75 uS PRE-EMPHASIS switch - Provides 75 microsecond pre-emphasis when the switch is in. When the switch is out, there is no pre-emphasis of the audio signals.

14. EXT AUDIO IN jacks - Input connectors for left and right external audio signals for use in the EXT position of the AUDIO switch (11h).

15. AUDIO DRIVE control - Adjusts the AUDIO DRIVE output level from 0 to +/-3 VPP. Phase is 180 degrees on the left half of center detent and 0 degrees on the right, CW, half of the detent.

16. AUDIO DRIVE connector (has floating ground) - Supplies audio signal selected by the AUDIO switch (11).

17. FM-IF SWEEP & MARKER SIGNALS - Use this section to test and align FM IF circuits.

17a. MARKER HEIGHT control - Adjusts the amplitude of the IF markers at the scope vertical marker output.

17b. TO SCOPE HORIZ connector - Provides sweep signal to an oscilloscope's horizontal input (Ch. B when using the scope's vector mode) for use with the FM SWP (1d) function.

17c. TO SCOPE VERT connector - Provides signal to an oscilloscope's vertical input (Ch. A) for use with the FM SWP (1d) function. This output signal is the same as the signal applied to the FROM FM DETECTOR connector (17d) with the center and 100 kHz side markers added.

17d. FROM FM DETECTOR connector - Provides input from the receiver under test when the FM SWP function is in use.

18. PULL CHART - Provides simplified operating instructions for quick reference.

19. RF-IF MPX OUTPUT connector - Provides an output for all RF, IF, and MPX signals.

20. POWER switch - Applies power to the unit. Switch is illuminated when on.

Rear Panel Features

21. INTERFACE ACCESSORY JACK - This jack connects either the IEEE 488 Bus Accessory or the RS232 accessory to the SG80.

22. AC LINE fuse - This fuse protects the SG80 from damage should a failure occur causing the unit to draw excessive current. Replace the fuse with the correct type and rating. (1 Amp, 3AG, 250V, Slo-Blo)

23. AC LINE CORD - Connect the AC line cord to a 105-130 VAC, 60 Hz, 35 W source only when operating the SG80.

Supplied Accessories

24. 39G227 ANTENNA TEST LEAD - Use when connecting the SG80 to the antenna input of car radios.

25. 39G72 75-300 MATCHING TRANSFORMER - The 39G72 transformer is used to convert from the standard 75 ohm output of the SG80 to 300 ohm antenna terminals. (Output level correction must be used when changing load impedances.)

26. 39G220 BNC-TO-F CABLE - This cable is for use when connecting the SG80 to the component under test. Connect the BNC end to the RF-IF MPX OUTPUT (19) connector, and the F connector end to the tuner or receiver.

27. 39G221 TEST LEAD - Use the 39G221 TEST LEAD for injecting audio from the AUDIO DRIVE (16) connector on the SG80.

28. 39G222 FM DETECTOR PROBE- The detector probe is used when aligning and troubleshooting FM IF circuits. The probe uses three leads for connecting to the IF circuits; black is the ground, red is an isolated direct connection, and blue is the detector lead.

29. 39G223 VERT BNC-TO-BNC CABLE- This cable is to be connected to the left EXT AUDIO input on the SG80, when supplying an external audio source.

30. 39G224 HORZ BNC-TO-BNC CABLE- Connect this cable to the right EXT AUDIO input of the SG80, when supplying an external audio source.

31. 39G226 AM MATCHING PAD - 75 ohm to 50 ohm; voltage out equals voltage in divided by 10. Use the 39G226 with the SG80 when connecting an AM signal to a tuner/receiver, which supplies AM antenna terminals.

Optional Accessories

32. IB72 IEEE 488 1: BUS INTERFACE ACCESSORY- Connects between the INTERFACE ACCESSORY JACK (21) and IEEE 488 port of a bus controller to allow the SG80 to be used on an IEEE 488 bus system.

33. PC259 PROTECTIVE COVER/LEAD STORAGE- Snap on cover to protect the front panel of the SG80 and to provide a storage space for the leads during transportation.

34. IB78 RS232 INTERFACE ACCESSORY- Connects between the INTERFACE ACCESSORY JACK (21) and the serial RS232 port of a controller to allow the SG80 to be used for automated testing.

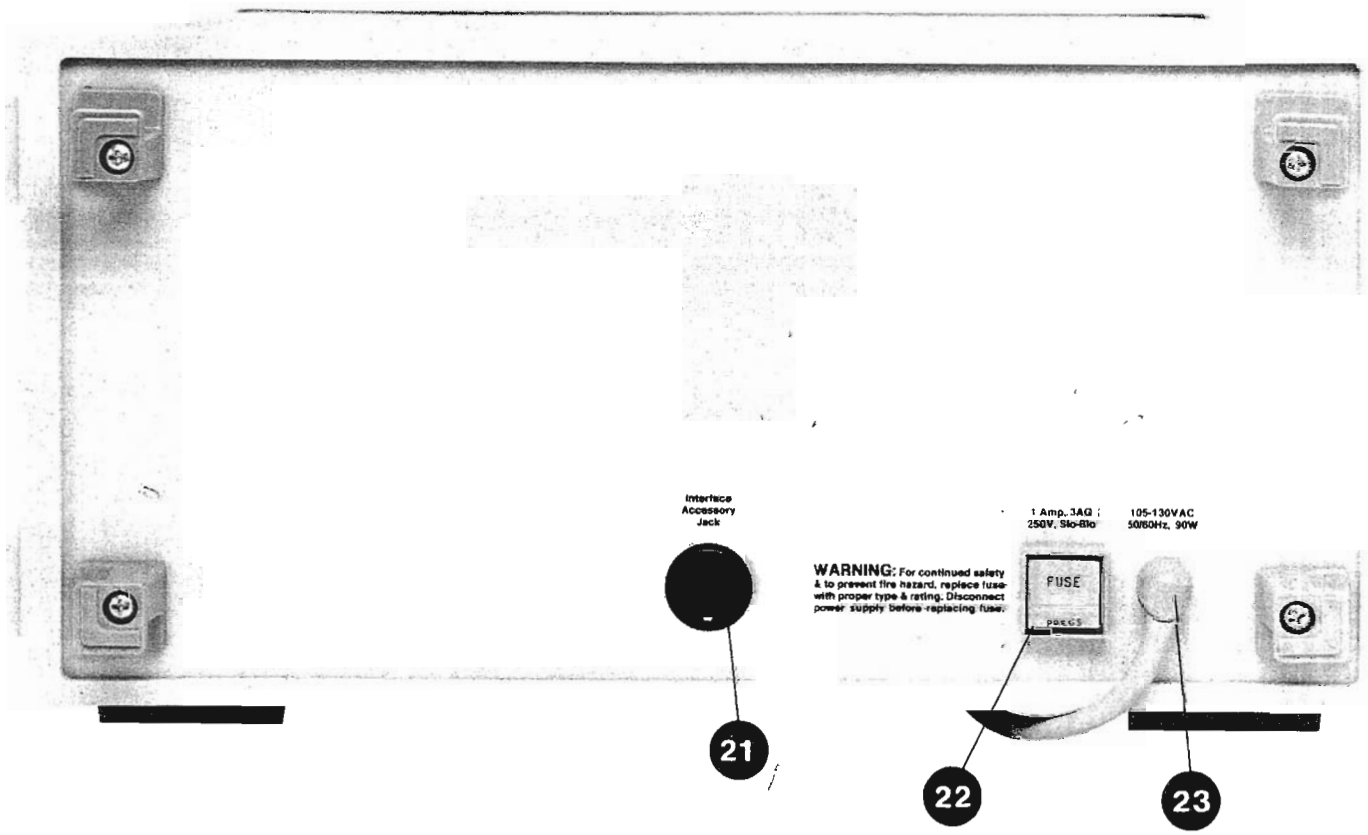


Fig. 2. Rear Panel Features of the SG80

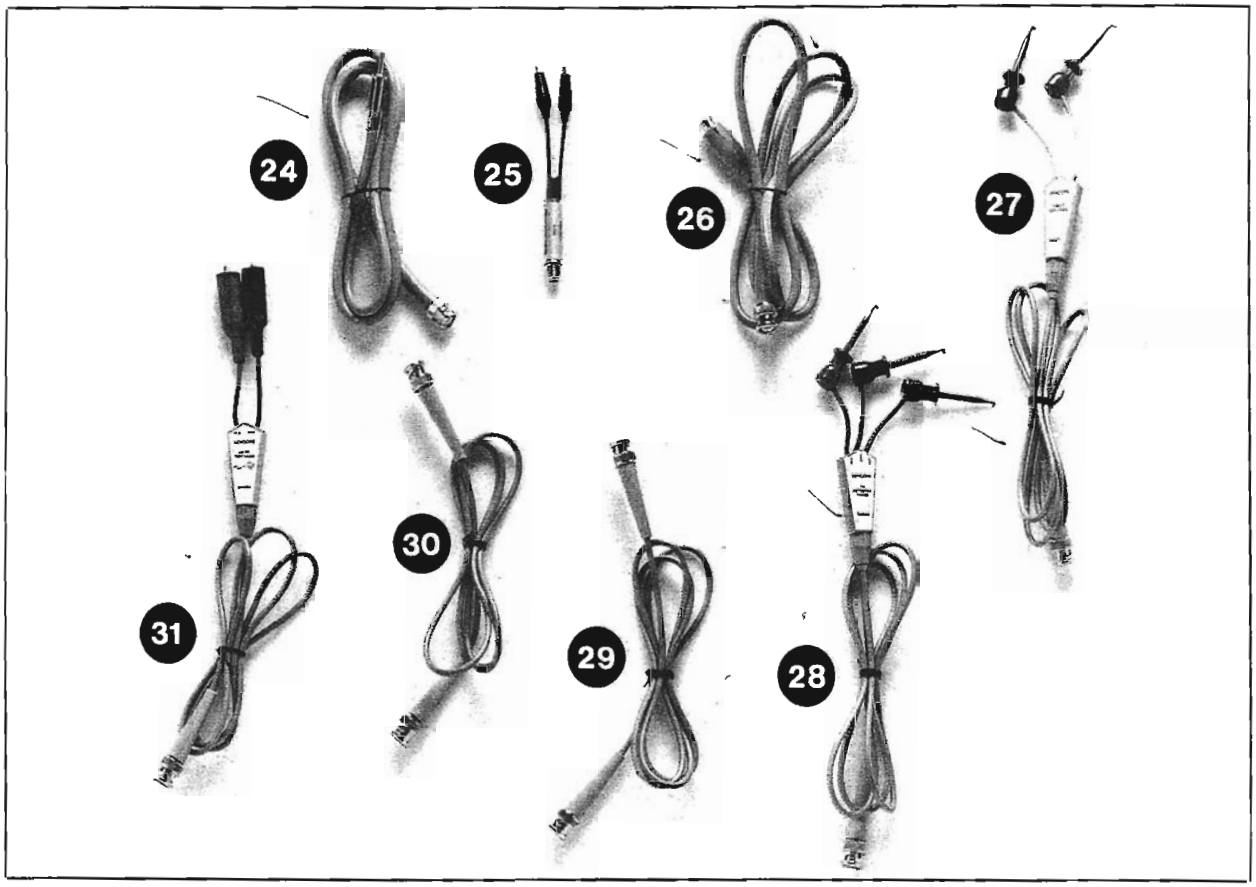


Fig. 3: Supplied Accessories

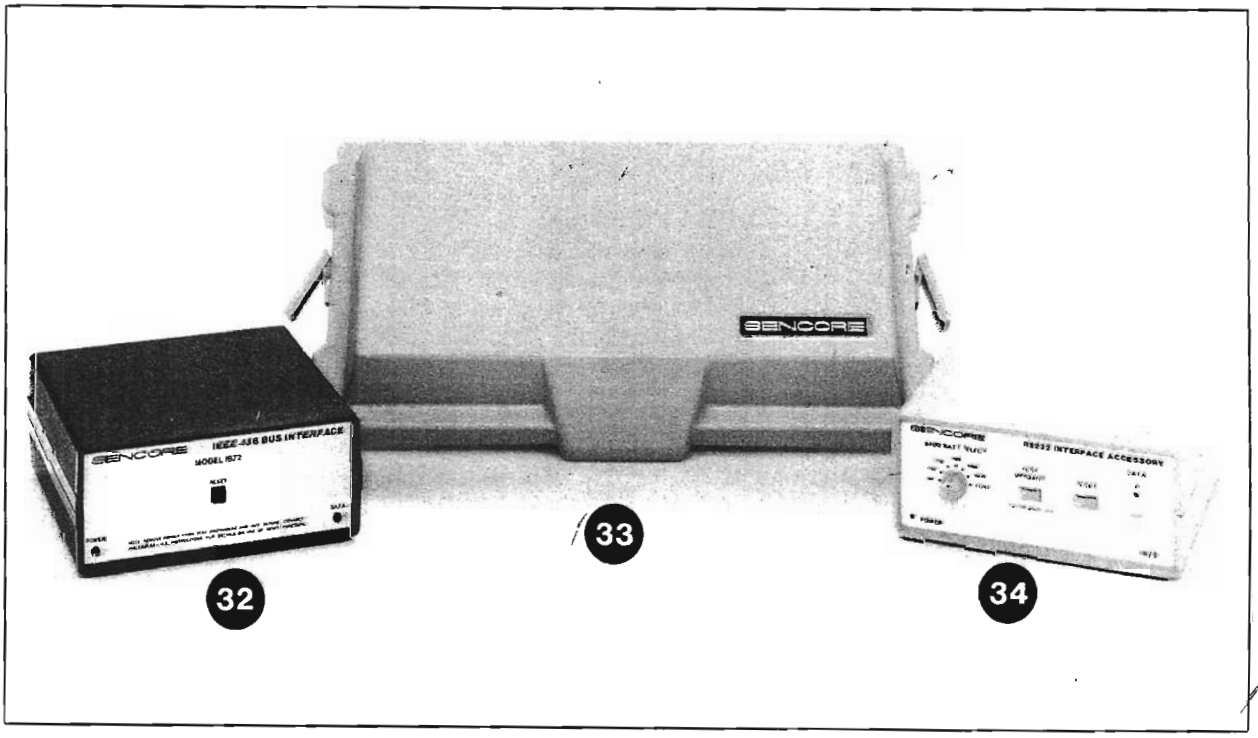


Fig. 4: Optional Accessories

A review of both AM C-QUAM and FM Stereo theory is given in Appendix B on page 47. Review the Appendix section prior to using the SG80.

OPERATION

Introduction

This section will help you understand the operation of the SG80. For details on how to test tuners or receivers, refer to the APPLICATION section of this manual.

Before using your SG80 AM STEREO- FM STEREO ANALYZER for the first time, take a few minutes to read the OPERATION and APPLICATION sections of this manual. The PULL CHART, located under the unit, provides quick reference information for day to day operation.

Power Connections

The SG80 is powered by a standard 105-130V AC line. The power cord, connected to the rear of the unit, uses a 3rd wire ground pin. Do not defeat the 3rd wire ground, it provides for proper shielding, operation, and safety. Always verify that the AC source has a properly grounded outlet.

To operate the SG80 from an AC line:

1. Connect the AC cord on the rear of the SG80 to a properly grounded AC source (105-130V, 50-60 Hz).

2. Press the POWER switch on the front of the SG80 to the on position. A light in the power switch will come on, confirming that the unit is receiving power.

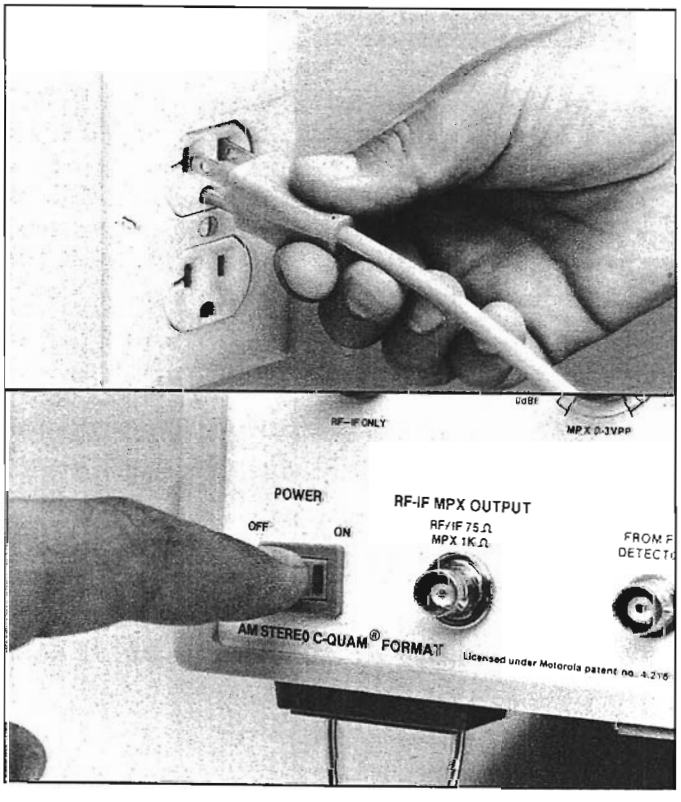


Figure 5: Connect the SG80's AC line cord to a properly grounded 105-130 VAC 60 Hz source, and press the POWER button to the on position.

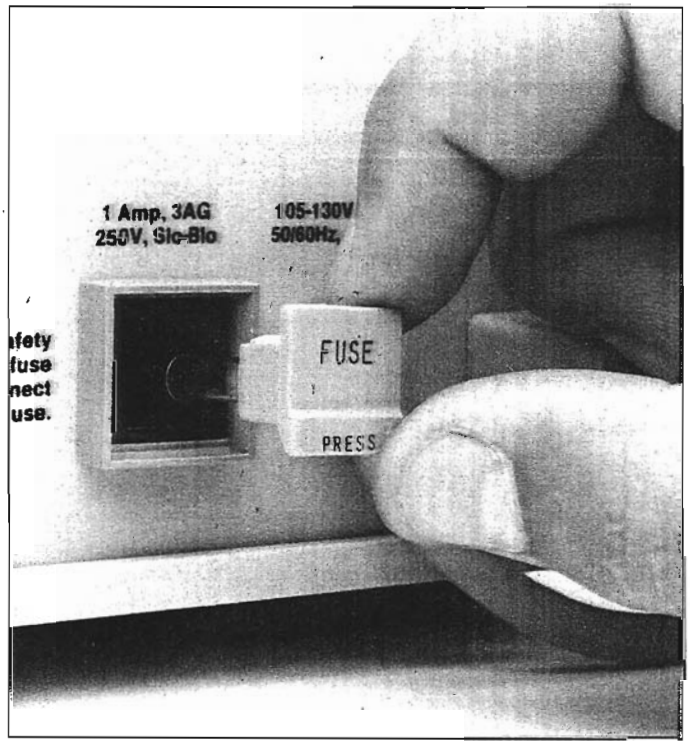


Figure 6: The AC line fuse is located next to the line cord, and is easily removed.

3. The SG80 is ready for use immediately after applying power. If precise measurements are required, allow the unit to operate for 20 minutes to reach the specified accuracy.

WARNING

The SG80 must be operated by a properly grounded 3rd wire outlet supplying 105-130V AC at 50-60 Hz for safe operation and minimal interference. Defeating the ground pin on the SG80 voids all warranties.

AC Line Protection Fuse

The SG80 uses a 1 Amp, 3AG, 250V, Slo-Blo type AC line fuse. If the fuse should open, find the cause prior to replacing the fuse. Replace the fuse only with the correct type and rating. Incorrect fuses void all warranties.

WARNING

Improper fuses void all warranties. Always replace the AC line fuse with the proper type and rating (1 Amp, 3AG, Slo-Blo).

To replace the AC line fuse:

1. Press to release the snap in fuse holder.

2. Carefully withdraw the holder and fuse.

3. Replace the fuse with a new one of the correct type and rating.

4. Reinsert the fuse holder and press to snap in place.

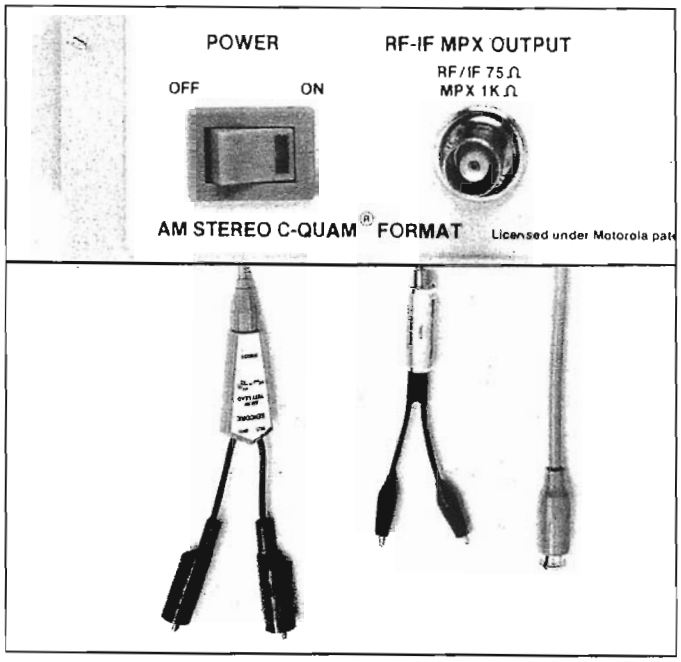


Figure 7: Connect the poper leads and accessories to match the signal being used.

RF-IF Signal Connections

Many modern tuners and receivers permit a 50, 75, or 300 ohm antenna to be connected. The SG80 can be used to supply a signal for any of these input impedances. Use the following procedures when connecting to the RF terminals.

50 Ohm Impedance Connections - Use the 39G226 AM Matching Pad and divide the microvolt RF-IF MPX microvolt level by 10. (-20 dBf is approximately equal to dBf out).

The SG80 can be connected to 50 ohm antenna inputs as used by most AM antennas using the 39G226 AM Matching Pad. The output level of the SG80 must be compensated to match the change in output impedance from 75 ohms. Simply divide the front panel microvolt readings by 10 (or subtract 20 dBf), to obtain the correct level readings.

To connect the SG80 to a 50 ohm terminal:

1. Connect the supplied 39G226's BNC connector to the RF-IF MPX OUTPUT jack.

2. Connect the alligator clips on the other end of the 39G226 cable to the AM radio's antenna terminals. (GND to GND, signal input to antenna input.)

3. Divide the microvolt output levels on the front panel of the SG80 by 10 (or subtract 20 dBf).

75 Ohm Impedance Connections:

The SG80 supplies an RF signal calibrated for a 75 ohm input using the supplied 39G220 cable. When connecting to a 75 ohm input, the calibration of the SG80 RF output level is as marked on the front panel.

To connect the SG80 to a 75 ohm RF terminal:

1. Connect the supplied 39G220 cable's BNC end to the SG80's RF-IF MPX OUTPUT.

2. Connect the F connector end of the 39G220 cable to the tuner or receiver antenna input.

3. The output levels marked on the RF-IF MPX OUTPUT LEVEL switches are calibrated for the 75 ohm impedance. Read the level directly from the SG80.

300 Ohm Impedance Connections - Use the 39G72 MATCHING TRANS and multiply the RF-IF MPX microvolt level by 2. dBf equals the front panel reading.

The SG80 may also be used to connect to antenna terminals having a 300 ohm impedance. When using a 300 ohm impedance, it is necessary to use the supplied 39G72 MATCHING TRANS. The matching transformer converts the SG80's unbalanced 75 ohm output to a 300 ohm balanced output. The microvolt output levels marked on the SG80's front panel must be modified to supply proper signal levels; however, power levels are correct. Simply, multiply the microvolt levels marked on the front panel by 2.

To connect the SG80 to a 300 ohm antenna terminal:

1. Connect the supplied 39G220's BNC connector to the RF-IF MPX OUTPUT jack.

2. Connect the other end of the 39G220 cable to the supplied 39G72 MATCHING TRANS.

3. Connect the balanced output of the matching transformer to the 300 ohm antenna terminal of the tuner or receiver under test.

Selecting The RF-IF Output Range

The SG80 provides signal levels from 0.27uV to 0.27V (0 to 120 dBf), for simulating fringe and overload signal conditions. The RF-IF RANGE and RF-IF MPX VERNIER are used to set the output level. The RF-IF RANGE control is used as a multiplier for the RF-IF VERNIER control. When testing a tuner or receiver, set the level to that specified in the service literature - or follow the procedure in the APPLICATION section of this manual.

NOTE: Remember to compensate for the terminating impedance of the antenna terminals. When connected to a 75 ohm load, the markings on the front panel are read directly. If connected to a 300 ohm antenna terminal, you must multiply the microvolt level by 2 (read dBf directly). If using the 39G226 AM MATCHING PAD, divide the microvolt settings by 10 (or subtract 20 dBf).

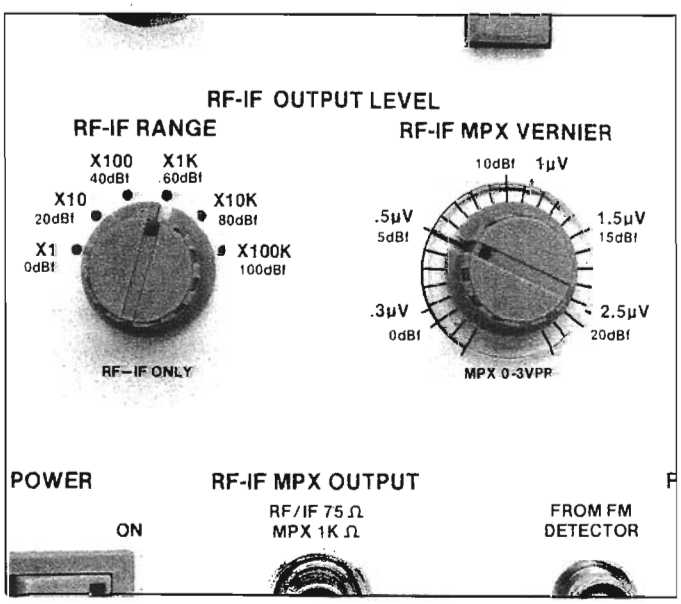


Figure 8: Match the SG80's output level to the circuit under test.

To set the RF-IF output level:

1. Set the coarse RF-IF RANGE control to the closest range below the level you wish to achieve (in the MPX position, the control has no effect).

2. Adjust the RF-IF MPX VERNIER control so that when it is added to the level set in step 1, the result is equal to the desired output level.

RF-IF Tuning

The SG80 provides a digitally tuned RF or IF signal in both AM and FM modes. This permits easier and more accurate servicing of modern digital tuners/receivers.

Turning the RF-IF TUNING control clockwise increases the tuned frequency, while turning the control counter-clockwise decreases the tuned frequency. The wrap around feature lets you continue through the band limits to the upper (or lower) frequencies. The SG80 permits tuning in either of two speeds. Pressing the RF-IF TUNING control changes the tuning from the normal tuning to the fine tuning speed. Pressing the control again returns the tuning to the normal tuning speed.

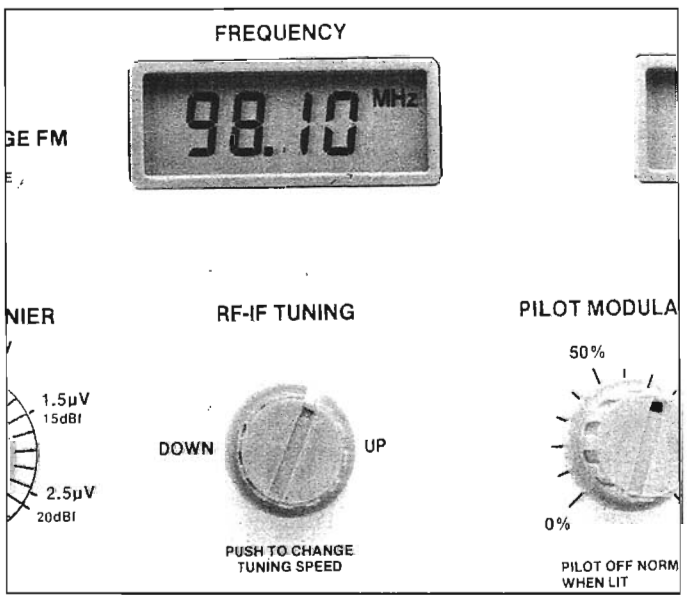


Figure 9: The SG80 provides digital tuning for the FM RF, FM IF, AM RF, and AM IF formats.

	Fine Tuning	Standard Tuning
FM RF	10 kHz steps	200 kHz steps
FM IF	10 kHz steps	100 kHz steps
SWP	10 kHz steps	100 kHz steps
AM RF	1 kHz steps	10 kHz steps
AM IF	1 kHz steps	10 kHz steps

Using The RF-IF MPX Signals

FM RF

The FM RF output is used to inject a signal with monaural or composite stereo modulation, as selected by the AM & FM MPX MODE switch, into the antenna input of FM receivers. The tuning range of the FM RF is from 87.9 MHz to 108 MHz. The signal is tuneable in either 200 kHz or 10 kHz steps.

To set the FM RF signal for a standard RF output:

NOTE: The standard RF output level, according to IHF standards, is 65 dBf with 1 kHz modulation.

1. Set the SG80 RF-IF MPX SIGNAL switch to the FM RF position.

2. Connect the 75 ohm cable to the RF-IF MPX OUTPUT jack and to the receiver under test. The cable should be properly terminated for connection to the SG80.

3. Set the AM & FM MPX MODE switch to the monaural or stereo position.

4. If stereo operation is selected, adjust the PILOT MODULATION to 100%. The red light at the lower left of the PILOT MODULATION control will turn off when the control is at the 100% level.

5. Set the AUDIO switch to 1 kHz.

6. Turn the AUDIO MODULATION CONTROL up until the MODULATION display reads 100%.

7. Adjust the RF-IF TUNING control to the desired output frequency. The frequency is displayed in the FREQUENCY LCD readout in MHz for FM signals.

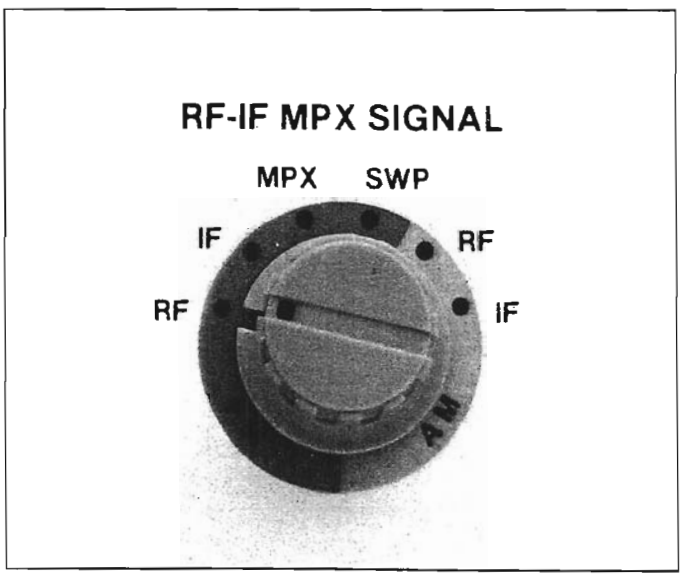


Figure 10: Use the FM RF, IF, MPX, And SWP signal for testing and troubleshooting an FM tuners and receivers.

Each click of the RF-IF TUNING control changes the frequency by 200 kHz (the unit may power up in Fine or Course tuning steps). To change tuning steps, press the control knob once. To return, press the control knob a second time.

8. Set the RF-IF RANGE control to the 60 dBf range. Set the RF-IF MPX VERNIER control to the 5 dBf setting. This gives a standard 65 dBf output level into 75 ohms.

FM IF

The FM IF output is used to inject a signal with monaural or composite stereo modulation, as selected by the AM & FM MPX MODE switch, into the IF amplifiers of FM receivers. This signal is used for IF testing and troubleshooting. The output frequency is variable using the RF-IF TUNING control and has a range from 9.7 MHz to 11.7 MHz.

To use the FM IF signal:

1. Set the SG80 RF-IF MPX SIGNAL switch to the FM IF position.

2. Connect the 75 ohm cable (39G220) to the RF-IF MPX OUTPUT jack. Connect the 39G72 MATCHING TRANS to the other end of the 39G220 cable.

3. Set the AM & FM MPX MODE switch to the desired position.

4. If a stereo receiver is being tested, turn the PILOT MODULATION control to 100%. When set at 100%, the red light below the PILOT MODULATION control will turn off.

5. Set the AUDIO switch to 1 kHz and the AUDIO MODULATION to 100%.

6. Adjust the RF-IF TUNING control to 10.7 MHz. The frequency is displayed in the FREQUENCY LCD readout in MHz. Each click of the RF-IF TUNING control changes the frequency (the unit may power up in Fine or Course tuning steps. To change tuning steps, press the control knob once. To return, press the control knob a second time.

7. Adjust the RF-IF MPX OUTPUT LEVEL controls for 65 dBf.

NOTE: Remember to compensate for the terminating impedance:

1. 50 ohm 39G226 AM MATCHING PAD — divide by 10
2. 75 ohm load — read directly
3. 300 ohm impedance — use the matching trans former andmultiply the microvolt reading by 2. Read dBf directly.

MPX

The MPX signal from the SG80 provides a composite FM baseband audio signal for injection into the stereo multiplex circuits of the FM receiver. This signal can be used to align and/or troubleshoot receivers that have poor stereo operation and/or separation.

To use the MPX signal:

1. Set the SG80 RF-IF MPX SIGNAL switch to the MPX position.

2. Connect the 39G221 TEST LEAD to the SG80 and the circuit under test.

3. Set the AM & FM MPX MODE switch to STEREO.

4. Set the AUDIO switch to 1 kHz and the AUDIO MODULATION to 100%.

5. Adjust the RF-IF MPX VERNIER to match the circuit's signal level. Note: The RF-IF RANGE switch has no effect when using RF-IF MPX.

FM-IF SWP

The sweep and marker test is becoming very popular not only as an alignment procedure, but as a troubleshooting aid. Sweep tests on the IF can be used to isolate defects to the RF or IF stages. The SG80 provides a simplified process to quickly test and troubleshoot the alignment of the IFs.

The alignment of FM Stereo tuners and receivers is critical, because the multiplexed FM stereo signal requires a greater bandwidth than an FM mono signal.

To use the SWP signal for IF alignment/troubleshooting:

1. Set the RF-IF MPX SIGNAL control to the SWP position.

2. Connect one end of the 39G221 TEST LEAD to the RF IF MPX OUTPUT jack and the other end to the mixer input of the FM stereo receiver.

3. Connect the 39G222 FM DETECTOR PROBE accessory to the SG80's FROM FM DETECTOR jack. Connect the VERT and HORIZ TO SCOPE jacks to the oscilloscopes vertical and horizontal inputs.

4. Select the vector mode on the oscilloscope.

NOTE: Adjustment of the MARKER HEIGHT control will be required for viewing of the markers on the scope's CRT.

5. For adjustment procedures, follow the tuner's or receiver's service literature or TROUBLESHOOTING section of this manual.

AM RF

The AM RF output is used to inject a signal with monaural or composite stereo modulation, as selected by the AM & FM MPX MODE switch, into the antenna input of AM receivers. The tuning range of the AM RF is from 520 kHz to 1720 kHz. You can push the RF-IF TUNING control to change the tuning speed from 10 kHz steps to 1 kHz steps.

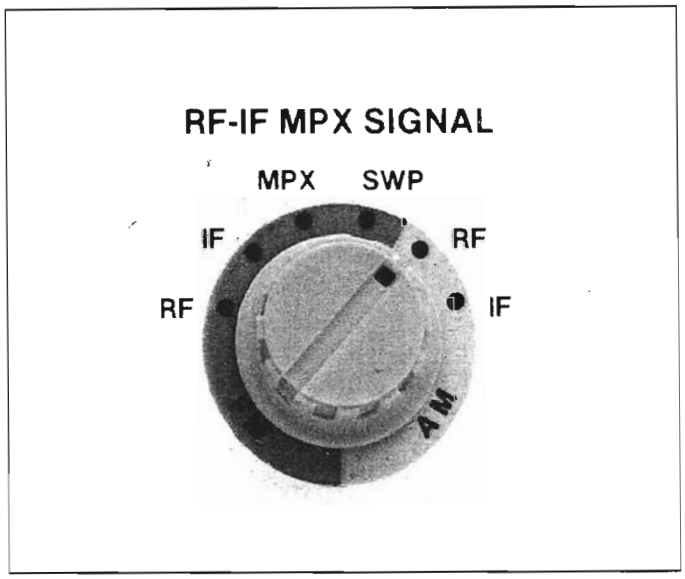


Figure 11: Select the proper AM signal to match the circuit under test.

To use the AM RF output:

1. Set the SG80 RF-IF MPX SIGNAL switch to the AM RF position.

2. Connect the 75 ohm cable (39G220) to the RF-IF MPX OUTPUT jack and the receiver under test. (If a 50 ohm connection is required, you should use the 39G226 AM MATCHING PAD.)

3. Set the AM & FM MPX MODE switch to STEREO, and the PILOT MODULATION control to the 100% level (pilot is not used in AM monaural).

4. Set the AUDIO switch to 1 kHz and the AUDIO MODULATION to 30%.

5. Adjust the RF-IF TUNING control to the desired output frequency. The frequency is displayed in the FREQUENCY LCD readout and automatically reads kHz for AM signals. Each click of the RF-IF TUNING control changes the frequency by 10 kHz (the unit may power up in Fine or Course tuning steps). For 1 kHz steps, push the control knob once. To return to 10 kHz steps, push the control knob a second time.

6. For an output level of 65 dBf, adjust the RF-IF RANGE control to 60 dBf. Adjust the RF-IF MPX VERNIER for 5 dBf.

NOTE: Remember to compensate for the marked output level when using the 39G226 AM MATCHING PAD's unbalanced output. Refer to the Appendix section or pull chart for output levels.

AM IF

The AM IF output is used to inject a signal with monaural or composite stereo modulation, as selected by the AM & FM MPX MODE switch, into the IF amplifiers of AM receivers. This signal is used for IF testing and troubleshooting. The frequency is variable using the RF-IF TUNING control and has a range from 200 kHz to 500 kHz.

To use the AM IF signal:

1. Set the SG80 RF-IF MPX SIGNAL switch to the AM IF position.

2. Connect the 39G221 TEST LEAD to the RF-IF MPX OUTPUT jack and the circuit under test.

3. Set the AM & FM MPX MODE switch to STEREO, and the PILOT MODULATION to the 100% level (the pilot is not used in AM MONAURAL).

4. Set the AUDIO switch to 1 kHz and the AUDIO MODULATION to 30%.

5. Adjust the RF-IF TUNING control to the desired output frequency. The frequency is displayed in the FREQUENCY LCD readout and automatically reads kHz for AM signals. When the unit is first turned on, each click of the RF-IF TUNING control changes the frequency by 10 kHz (the unit may power up in Fine or Course tuning steps). For 1 kHz steps, push the control knob once. To return to 10 kHz steps, push the control knob a second time.

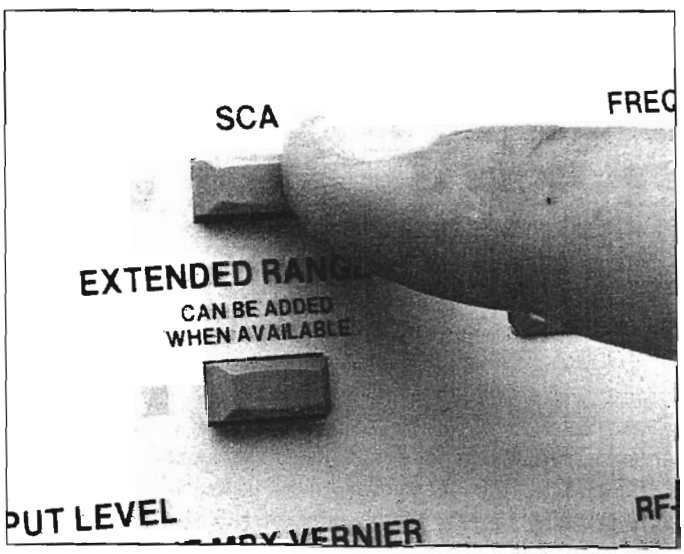


Figure 12: The SCA feature can be added to an FM signal by pressing the SCA button. The indicator light will be on if the SCA signal is being added.

6. For an output level of 65 dBf, adjust the RF-IF RANGE control to 60 dBf. Adjust the RF-IF MPX VERNIER for 5 dBf.

SCA 67 kHz

The SCA 67 kHz function provides a factory set 67kHz output (adjustable internally from 53 kHz to 95 kHz), for testing SCA traps and SCA capable tuners and receivers. The SG80 supplies the 2.5 kHz modulated SCA signal on either the FM RF, IF, or MPX positions of the RF-IF MPX SIGNAL control when the SCA indicator LED is lit.

To supply an SCA signal to the tuner or receiver:

1. Connect the 39G220 test lead's BNC connector to the SG80's RF-IF MPX OUTPUT jack; connect the other end of the test lead to the receiver's test point.

2. Select the FM RF, IF, or MPX position on the RF-IF MPX SIGNAL control.

3. Press the SCA button. If the SCA is on, the indicator LED will be lit.

4. Adjust the RF-IF MPX OUTPUT LEVEL controls to match the signal level required by the tuner or receiver.

75 uS PRE-EMPHASIS

The SG80 permits you to test the de-emphasis circuits in both tuners and receivers by supplying a pre-emphasized signal. Most FM transmitted signals use the pre-emphasis of high frequencies to reduce noise.

To test the audio de-emphasis circuits in a tuner or receiver, you need to compare a non-emphasized signal to one that has been emphasized. By monitoring the output signal level of the component under test and switching the 75 uS PRE-EMPHASIS button on and off, you will be able to see if the high frequencies are being de-emphasized or not.

NOTE: Some tuners and receivers will mute the output with a modulation level in excess of 100%. Always verify that the AUDIO MODULATION control is set for the proper level with the highest audio tone used.

To use the 75 uS PRE-EMPHASIS feature:

NOTE: To prevent over modulation, always set the percentage of modulation with PRE-EMPHASIS ON.

1. Set the SG80 to produce a 65 dBf, 98.1 MHz, MONAURAL signal modulated 100% with 1 kHz audio.
2. Monitor the output of the component under test with an oscilloscope or level meter.

Note: The output levels should be the same for 400 Hz, 1 kHz, and 5 kHz if the receiver's de-emphasis circuits are working.

3. Select the 5 kHz sine function with the AUDIO control.

4. Turn the pre-emphasis feature off by pressing the 75 uS PRE-EMPHASIS button. (The LED located on the left side of the button should not be lit.)

5. Note the signal level on the scope.

6. Press the 75 uS PRE-EMPHASIS button to turn it on. You should see an increase in high frequency signal level.

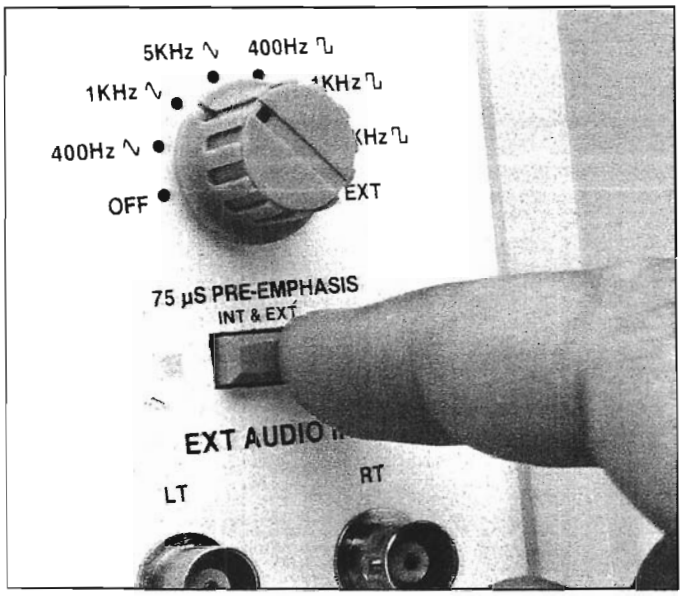


Figure 13: You can test the FM circuits operation with both pre-emphasized signals.

USING THE AUDIO DRIVE

The amplifier section of the receiver under test can be tested by using the SG80's AUDIO DRIVE section. Six audio signals are selected with the AUDIO switch:

1) 400 Hz sine,
2) 1 kHz sine,
3) 5 kHz sine,
4) 400 Hz square,
5) 1 kHz square,
6) 5 kHz square.

The three frequencies have matching sine and squarewaves. Use the sinewave for testing noise and distortion and the squarewave for checking frequency response. The audio output level of the SG80 (0 to 3 VPP) is controlled by the AUDIO DRIVE level control. The AUDIO DRIVE jack provides connection from the SG80 to the receiver under test.

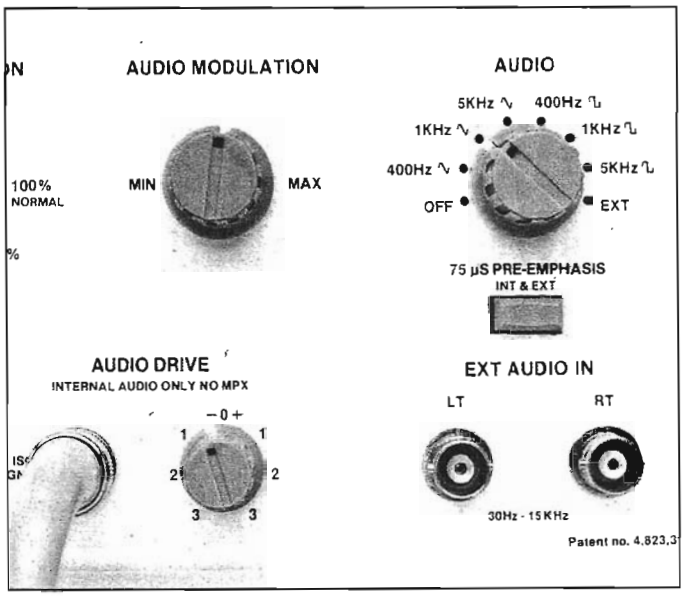


Figure 14: Select the type of audio signal to be used with the AUDIO control and set the level to match the circuit under test.

To use the AUDIO DRIVE:

1. Set the SG80's AUDIO control to the desired frequency with either the sine or square waveshape.

2. Connect the 39G221 TEST LEAD to the AUDIO DRIVE jack and to the receiver under test. Connect to the point in the amplifier section of the receiver for the desired test.

3. Adjust the AUDIO LEVEL for the correct signal level, while monitoring the output of the receiver.

USING THE EXTERNAL MODULATION INPUTS

There may some instances where you will need a frequency other than 400, 1000, or 5000 Hz, or if you wish to perform a frequency response test without using the computer interface. The SG80 provides EXT AUDIO IN jacks, which allow an external audio generator to modulate both the AM and FM output.

In order for the SG80's AUDIO MODULATION control to be properly calibrated, you must supply a 3 VPP signal from 30 Hz to 15 kHz. You may also supply different audio tones to the LT and RT inputs, for intermodulation distortion and audible separation tests.

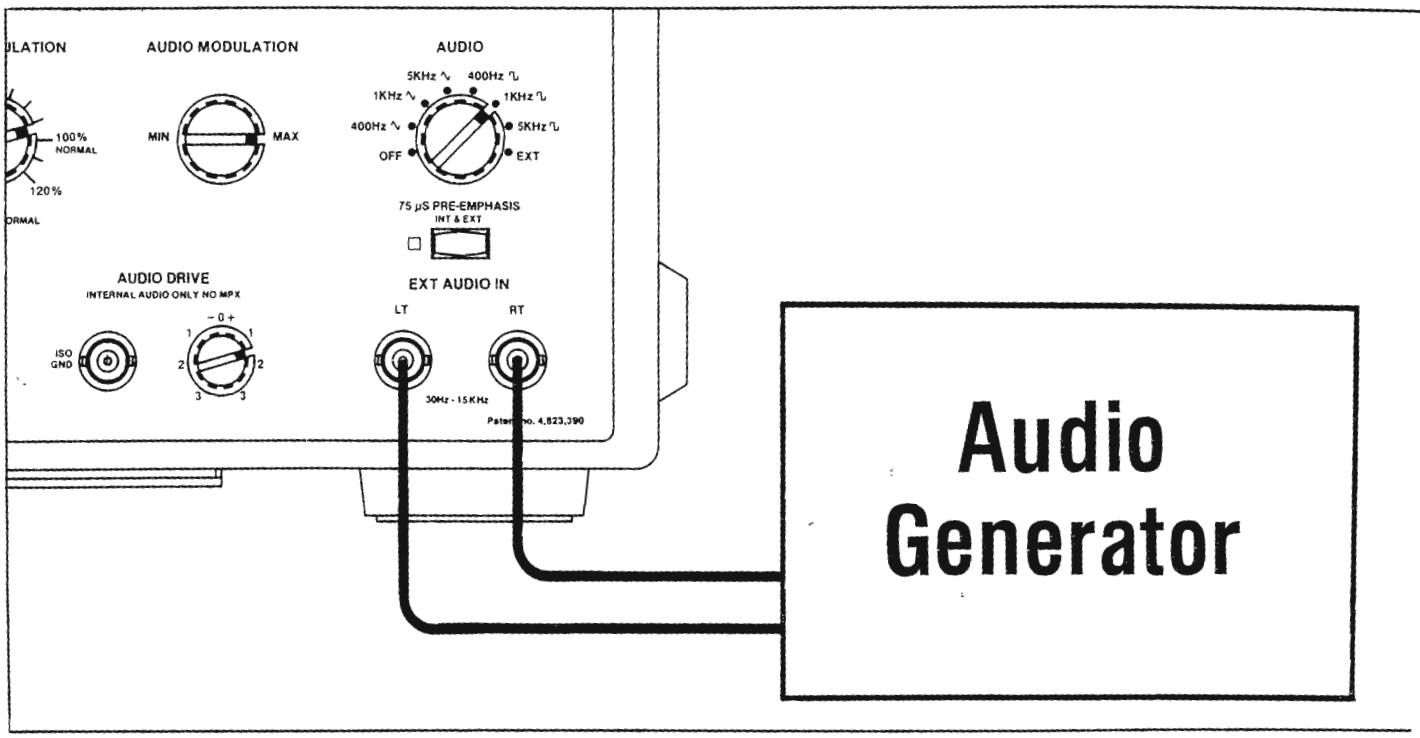


Figure 15: Connect an external audio generator to modulate the SG80.

To supply the SG80 with an external audio signal:

1. Connect an external audio generator to the LT or RT or both inputs.

2. Set the external audio generator to supply a signal 3 VPP and between 30 and 15000 Hz.

3. Select the EXT position of the AUDIO control.

4. Use the SG80 as normal.

AUTOMATED BUS OPERATION

Introduction

The SG80 AM STEREO-FM STEREO ANALYZER can be used for computer controlled automated testing. A simple program can control the front panel setup for automated performance testing. The SG80 can be used with either the IEEE-488 Bus or the RS232 formats, with the correct accessory connected to the INTERFACE ACCESSORY JACK on the rear of the unit.

NOTE: When using the SG80 with the IB72 IEEE 488 Bus Interface, check if EPROM IC4 is version 2.0. If your IB72 has version 2.0, contact the Sencore Service Department for a replacement.

The SG80 can be used in either of two modes; the "talker" or the "listener".

TALKER- The front panel settings of the SG80 can be read by the controller. The controller must ask for the information in order for the SG80 to be used as a talker.

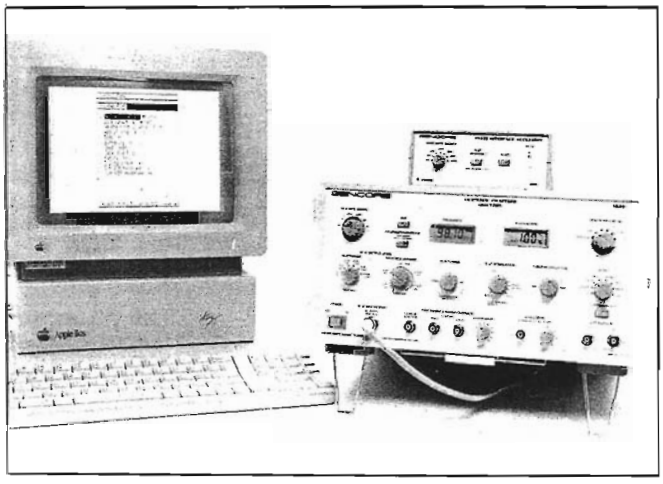


Figure 16: The SG80 can be used for automatic testing by connecting an Interface Accessory and a computer/ controller.

LISTENER- A controller can be used to set the SG80's controls to any desired position. You can use the SG80 in the listener mode to automatically set the SG80 to the standard signal format, to vary the settings to match the testing to be done, or both.

CONNECTING THE SG80 TO THE INTERFACE BUS

The SG80 produces a special Sencore formatted signal which must be supplied to the interface accessory before it can be placed on the bus. The interface accessory, either the IEEE-488 or the RS232, is connected in series with the controller and the SG80. A standard cable is used for connection from the controller to the interface accessory.

WARNING

Connect only the Sencore interface bus accessories to the INTERFACE ACCESSORY JACK on the rear of the SG80. Do not connect other instruments or interface bus equipment to the SG80 even if the connectors may fit.

When using the SG80 with an IEEE-488 automated bus system, it must have an address in order for the controller to send and receive information. When using the SG80 in conjunction with other products on the IEEE-488 bus system, each instrument must have its own address separate from the other products in the system. This allows the controller to select which instrument it is talking or listening to. (Follow the individual instructions for the controller and interface accessory for connection and address requirements.)

WARNING

Do not apply power to the SG80 or interface accessory until all connections have been made.

To connect the SG80 to an automated test system:

1. Remove all power from the SG80, interface accessory, and the computer/controller.

2. Set the slide switch on the rear of the IB72 IEEE-488 Bus Interface Accessory for the proper address assigned to the SG80.

3. Connect the interface accessory's male DIN connector to the INTERFACE ACCESSORY JACK located on the rear of the SG80.

4. Connect the proper cable from the interface accessory to the controller.

5. Supply power to all units in the automated system, and verify all units have been turned on.

USING THE SG80 AS A LISTENER

The main operation of the SG80, in an automated test system, is that of a listener. The controller sends settings of the front panel controls to aid in performance testing and troubleshooting tuners and receivers. The controller can set all functions of the SG80 including setting the audio frequency in 100 hertz increments from 100 hertz to 15 kHz.

The front panel controls are automatically locked out (when the SG80 receives a command from the interface accessory) until a "CPO" (control panel on) command is received or the SG80 is turned off and back on. This prevents the SG80's controls from being varied accidentally during a test. The SG80 will continue to produce an output while the controls are being set by the computer/controller.

COMMAND DESCRIPTIONS

The SG80 uses an extensive series of commands to control the front panel setup. The entire command must be sent in order for the SG80 to properly respond. The following is a listing the control commands recognized by the SG80:

LEARN

Panel Setting Modulation ..... CPSMOD
Panel Setting RF-IF Sig. ..... CPSSIG
Panel Setting SCA ..... CPSSCA
Panel Setting FMX ..... CPSFMX
Panel Setting Tuning ..... CPSRFT
Panel Setting Pilot Mod ..... CPSPLM
Panel Setting Audio Mod ..... CPSAUM
Panel Setting Audio Signal ..... CPSAUS
Panel Setting Audio Level ..... CPSAUL
Panel Setting Pre-emphasis ..... CPSPRE
Panel Setting All ..... CPSALL

SETUP

Control Panel On ..... CPO
Output Level To UV ..... UVT
Output Level To dBf ..... DBF
Freq Notation To Alpha ..... ALF
Freq Notation To Scientific ..... EXP
Select RF FM Signal ..... SIGFMR
Select IF FM Signal ..... SIGFMI
Select Sweep IF FM Signal ..... SIGSWP
Select MPX FM Signal ..... SIGMPX
Select RF AM Signal ..... SIGAMR
Select IF AM Signal ..... SIGAMI
Tune Frequency ..... RFTxxxxxxaaa
..... RFTxxx
Turn SCA On or Off ..... SCAbbb
Turn FMX On or Off ..... FMXbbb
Set RF Range ..... RNGx
Set RF Level Vernier ..... RFVxxxxxxccc
Set Pilot Modulation ..... PLMxxx
Set Audio Modulation ..... AUMxxx
Select Mono Modulation ..... MODMON
Select Stereo Modulation ..... MODSTR
Select L+R Modulation ..... MODL+R
Select L-R Modulation ..... MODL-R
Select R Only Modulation ..... MODRCH
Select L Only Modulation ..... MODLCH
Select Sinewave + Freq ..... AUSxxxxSIN
Select Squarewave + Freq ..... AUSxxxxSQR
Select External Source ..... AUSEXT
Turn Audio Off ..... AUSOFF
Set Audio Drive Level ..... AULxx.xx
Set Audio Drive Level Invert Phase ..... AUL-xx.xx
Turn Pre-emphasis On or Off ..... PREbbb
Overall Level ..... RFLxxxxxccc
Change Freq Only ..... AUSxxxx
Change Waveshape To Square ..... AUSSQR
Change Waveshape To Sine ..... AUSSIN

Where: aaa = E03, E06, kHz or MHz
bbb = ON or OFF
ccc = UV or DBF or V
xxx = Digits (1-6)

The first group of commands is used by the controller to learn the settings of the SG80. These commands are also used if you want to store the settings for future comparison or reference.

CPO - Control Panel On- A CPO command is used to reset the SG80 for manual operation. If the SG80 does not receive a CPO command, the front panel controls will not effect the SG80's operation.

CPSALL - Panel Settings All- Send this command if you want the SG80 to send the settings of all the controls. Returns 10 lines of information.

CPSAUL - Panel Setting Audio Level- To read the level produced by the AUDIO DRIVE control, send this command to the SG80.

CPSAUM - Panel Setting Audio Mod- This command causes the SG80 to supply the percent of audio modulation being produced by the SG80.

CPSAUS - Panel Setting Audio Signal- When this command has been sent to the SG80 it will send the audio frequency and waveshape to the controller.

CPSFMX - Panel Setting FMX- The CPSFMX command will cause the SG80 to send the status of the FMX button to the controller.

CPSMOD - Panel Setting Modulation- When this command is sent from the controller the SG80 will return the setting of the AM & FM MPX MODE switch to the controller.

CPSPLM - Panel Setting Pilot Mod- To read the pilot modulation level set on the SG80, send this command.

CPSPRE - Panel Setting Pre-emphasis- This command allows the controller to receive the status of the 75 uS PRE-EMPHASIS button.

CPSRFT - Panel Setting Tuning- This command will return the frequency of the output signal from the SG80.

CPSSCA - Panel Setting SCA- The SG80 will send the status of the SCA button back to the controller when it receives this command.

CPSSIG - Panel Setting RF-IF Sig- This command will cause the SG80 to send the position of the RF-IF MPX SIGNAL control back to the controller.

The following commands are used for setting the front panel controls to a desired position to produce the correct output.

ALF - Freq Notation To Alpha- The ALF command places the SG80 into the alpha-numeric frequency mode to match your controller. The SG80 can receive frequency input in either the alpha-numeric or scientific notation formats, but will output in the alpha-numeric format only.

AULxx.xx - Set Audio Drive Level- To set the audio drive level send this command. The xx.xx represents the level you wish to output. Add a minus sign to change phase, for example: AUL -x.xxx

AUMxxx - Set Audio Modulation- The audio modulation level is set by sending the AUM command followed by the level.

AUSxxxxxx - Change Freq Only- To change the audio frequency only send this command.

AUSxxxxSIN - Select Sinewave + Freq- To set a sinewave audio frequency on the SG80 you should send the AUS and SIN portion. The xxxx represents the desired frequency.

AUSxxxxSQR - Select Squarewave + Freq- You can cause the SG80 to produce a square wave with the desired frequency by sending this command.

AUSEXT - Select External Source- This command will use the EXT AUDIO IN signal as the audio source.

AUSSIN - Change Waveshape- This command changes the audio waveshape to the sinewave.

AUSOFF - Turn Audio Off- This command turns the audio off.

AUSSQR - Change Waveshape- This command changes the audio waveshape to the squarewave.

DBF - Output Level To DBF- This command will place the output in the dBf format.

EXP - Freq Notation To Scientific- This command places the SG80's frequency in the scientific notation mode to match your controller. The SG80 can receive frequency input in either the alpha-numeric or scientific notation formats, but will output in the scientific notation format only.

FMXbbb - Turn FMX On or Off- This command changes the status of the FMX button. The FMX portion of the command selects the FMX button and the bbb changes the state.

MODL+R - Select L+R Modulation- You can put the SG80 in the L+R modulation mode by sending this command.

MODL-R - Select L-R Modulation- To produce a L-R modulated signal with the SG80, send this command from your controller.

MODLCH - Select L Only Modulation- This command causes the SG80 to produce an output signal with left only modulation.

MODMON - Select Mono Modulation- This command selects mono modulation of the output signal from the SG80.

MODRCH - Select R Only Modulation- This command will cause the SG80 to produce an output signal with right only modulation.

MODSTR- Select Stereo Modulation - To select stereo modulation send this command to the SG80.

PLMxxx - Set Pilot Modulation- To set the pilot modulation, send PLM followed by the percent of pilot you wish the SG80 to produce.

PREbbb - Turn Pre-emphasis On or Off- This command turns the 75 uS PRE-EMPHASIS either ON or OFF as directed.

RFLxxxxxxccc - Overall Level- This command can be used to replace the individual commands to the range and vernier output level, by setting both in one command.

RFT - Tune Frequency- By sending this command followed by a frequency in either alpha-numeric or scientific notation, the SG80 will automatically tune the output to that frequency.

RFVxxxxxxccc - Set RF Level Vernier- Send this command to fine adjust the output level produced by the SG80.

RNGxx - Set RF Range- You can set the RF output level range by sending the RNG command. The additional information tells the SG80 which range.

SCAbbb - Turn SCA On or Off- The SCA part of this command selects the SCA button, and the bbb part causes the SCA circuits to turn ON or OFF.

SIGAMI - Select IF AM Signal- The AM IF signal is produced when the SG80 receives the SIGAMI command.

SIGAMR - Select RF AM Signal- The SG80 produces the AM RF signal when it receives this command.

SIGFMI - Select FM IF Signal- This command places the SG80 in the FM IF signal format.

SIGFMR - Select FM RF Signal- This command places the SG80 in the FM RF signal format.

SIGMPX - Select FM MPX Signal- This command causes the SG80 to produce the MPX format signal.

SIGSWP - Select Sweep FM IF Signal- When the SG80 receives this command it will output the sweep signal used for sweeping the IFs.

UVT - Output Level To UV- By sending this command to the SG80 the output level is in microvolts.

NOTE: Refer to the instructions for the controller in your system to verify the commands listed can be used in this alpha numeric format. Most systems will require the information in a "string variable" that becomes part of a "Print" statement, a "Write" statement, or a subroutine call.

ERROR CODES

If the SG80 receives an invalid command it will return an error code. The code can be triggered by an erroneous frequency, bus command, or level. The following section lists each of the error codes and provides a brief description of each.

E0- Valid command has been processed.

E1- Frequency beyond range of signal selected.

Example: sending "RFT120 MHZ" after an "AMI" command
sending any "RFT" command after an "MPX" command
sending an "RFT" 150000 Hz" command

E2- Invalid bus command.
Example: other than "on" or "off" with "SCA x" command.
code that is not an SG80 bus command.

E3- RF-IF level beyond range of unit.

Example: entry other than 0,2,4,6,8, or 10 in "RNG x" command; entry larger than 20 in "RFV xx" command; entry less than 0 or larger 120 in "RFL x" command

E4- Modulation beyond range of unit.

Example: entry less than 0 or larger then 125 in "PMO x" command;
entry less than 0 or larger than 100 in "AMO x" command; ccc other than MON, L+R, RON, LON, "MOD ccc";
AUM less than pilot setting.

E5- Audio signal beyond range of unit.

Example: frequency less than .1 in "AUD ccc xx.x" command; frequency larger than 20 in "AUD ccc xx.x" command; level greater than 3.00 in "ADL x.xx" command.

E6- Function not allowed in signal selected by RF/IF signal select.

USING THE SG80 AS A TALKER/ LISTENER

The SG80 can be used as a talker/listener to control and store the front panel settings for later or special use. The

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
RF/IF Signal	S	I	G	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	F	M	R
SCA Setting	S	C	A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	N
	S	C	A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	F	F
XRF Setting	X	R	F	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	N
	X	R	F	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	F	F
Frequency (Default)	R	F	T	—	—	—	—	—	—	—	1	0	1	.	0	0	E	+	0	6	—	H	Z
(Default)	R	F	T	—	—	—	—	—	—	—	—	9	8	.	1	0	E	+	0	6	—	H	Z
	R	F	T	—	—	—	—	—	—	—	—	—	—	—	1	0	1	.	0	0	M	H	Z
	R	F	T	—	—	—	—	—	—	—	—	—	—	—	—	9	8	.	1	0	M	H	Z
(Default)	R	F	T	—	—	—	—	—	—	—	—	—	1	1	0	0	E	+	0	3	—	H	Z
(Default)	R	F	T	—	—	—	—	—	—	—	—	—	—	7	8	0	E	+	0	3	—	H	Z
	R	F	T	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	0	0	K	H	Z
	R	F	T	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7	8	0	K	H	Z
RF Level	R	F	L	—	—	—	—	—	—	—	—	—	—	—	2	7	3	0	0	0	—	U	V
	R	F	L	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	2	D	B	F
Pilot Mod Level	P	M	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	0	0	—	—	%
Audio Mod Level	A	M	O	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6	1	—	—	%
MPX Modulation	M	O	D	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	L	—	R
Audio Signal	A	U	S	—	—	—	—	—	—	—	—	—	—	—	—	—	1	0	0	0	S	I	N
	A	U	S	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4	0	0	S	Q	R
	A	U	S	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	E	X	T
Audio Drive Level	A	U	L	—	—	—	—	—	—	—	—	—	—	—	—	1	.	2	7	5	—	—	V
Pre-emphasis	P	R	E	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	N
	P	R	E	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	O	F	F

Figure 17: This is the data format sent to the computer from the SG80.

commands discussed earlier can be used to set the SG80 to a set standard, then by sending a CPO command, manual operation can be restored to the SG80. When the special test set-up is complete, you can read the front panel and store the information.

The SG80 lets you read the front panel controls all at once, or one at a time. By sending one of the individual feature commands, the controller can read that control. By sending the Panel Setting All command, all front panel settings will be read. Your controller must be able to receive 10 data fields, one after another with a CR or LF between them.

Figure 17 shows the data field format sent from the SG80. The data field is 23 characters long and is followed by a carriage return or line feed. The first 3 characters represent the SG80 control. These are followed by 17 spaces used for numeric position representation. The final 3 characters identify the status of the control, or they may be used as annunciators.

APPLICATIONS

NTRODUCTION

'he SG80 is a patented analyzer that does a complete ɔb of servicing any AM-FM or new AM Stereo receiver, rom the lowest to highest priced, faster and more ıccurately than ever before. It is the only instrument hat combines an AM and FM generator into one unit, naking the signals look similar, even though they are ntirely different. This greatly simplifies the operation f the analyzer and reduces your chance of costly errors.

t is the only tester that has signal injection trou- ıleshooting capabilities to isolate any problem to the unctional section of the receiver. The SG80's superior pecifications enable top notch performance tests of all ıM-FM receivers to manufacturer requirements assur- ng you the job was done right.

'he APPLICATIONS section has been split into two lifferent categories for your convenience, PERFORM- ıNCE TESTING, and TROUBLESHOOTING. For a ısting of categories within each section refer to the ollowing table of contents.

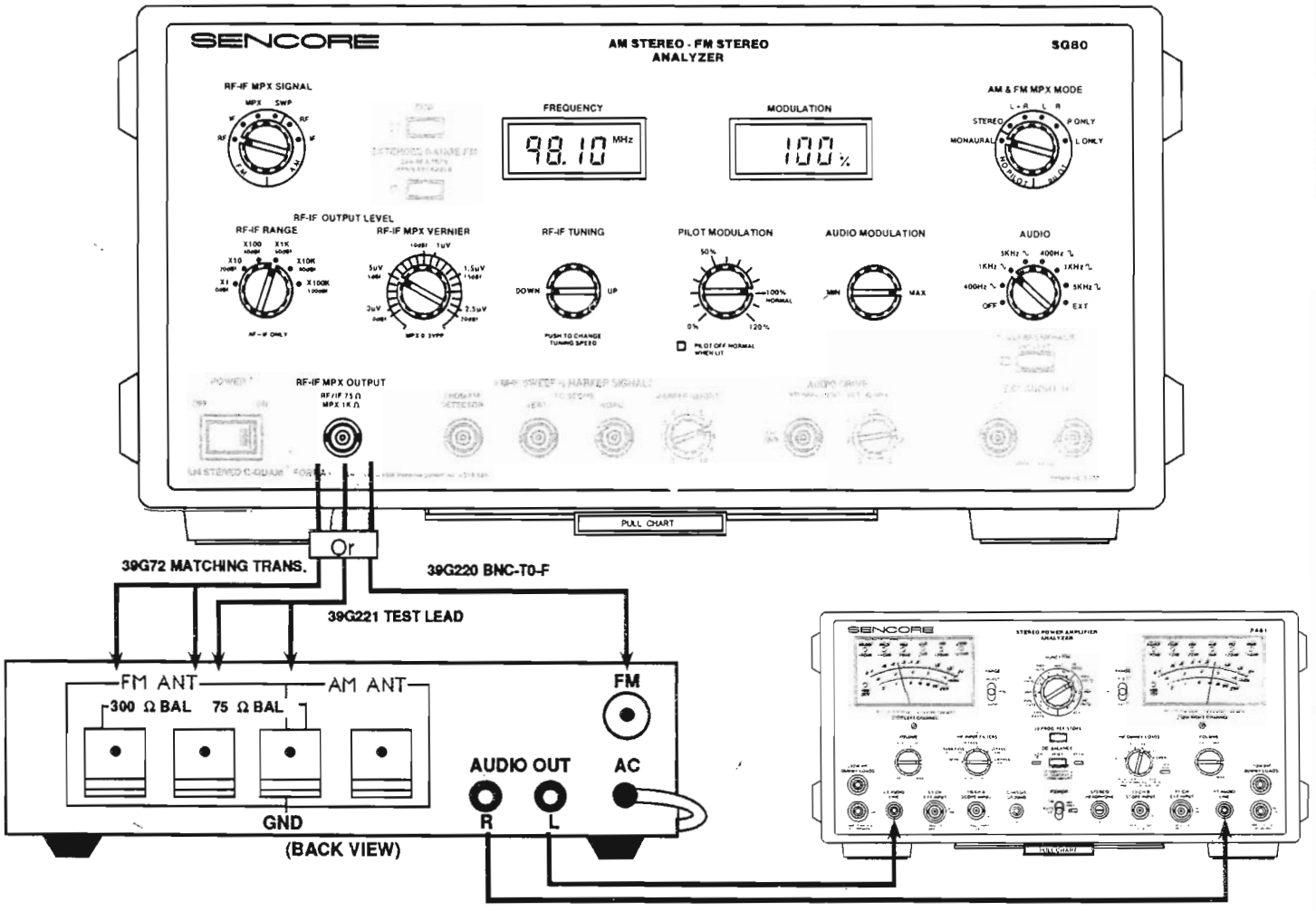
'he following application section covers many of the ommon uses of the SG80. All procedures covered in his section are generic and designed to work with all uners and receivers.

ıOTE: The following test are performed at a midrange uning frequency. For complete testing of tuners and eceivers you should repeat the test procedures at three ılaces within the tuning range, low, middle, and high.

NDEX

USING STANDARD FM INPUT REFERENCE SIGNALS

For the majority of the FM tuner/receiver testing and servicing, you will be required and want to start with a standard input signal. The IEEE/IHF Fm receiver test standards uses a standard signal format as a starting point on many of its recommended tests. The following listing explains how to set the SG80 to produce the standard output signal format for FM mono and Stereo testing.



To set the SG80 to produce a standard FM mono signal:

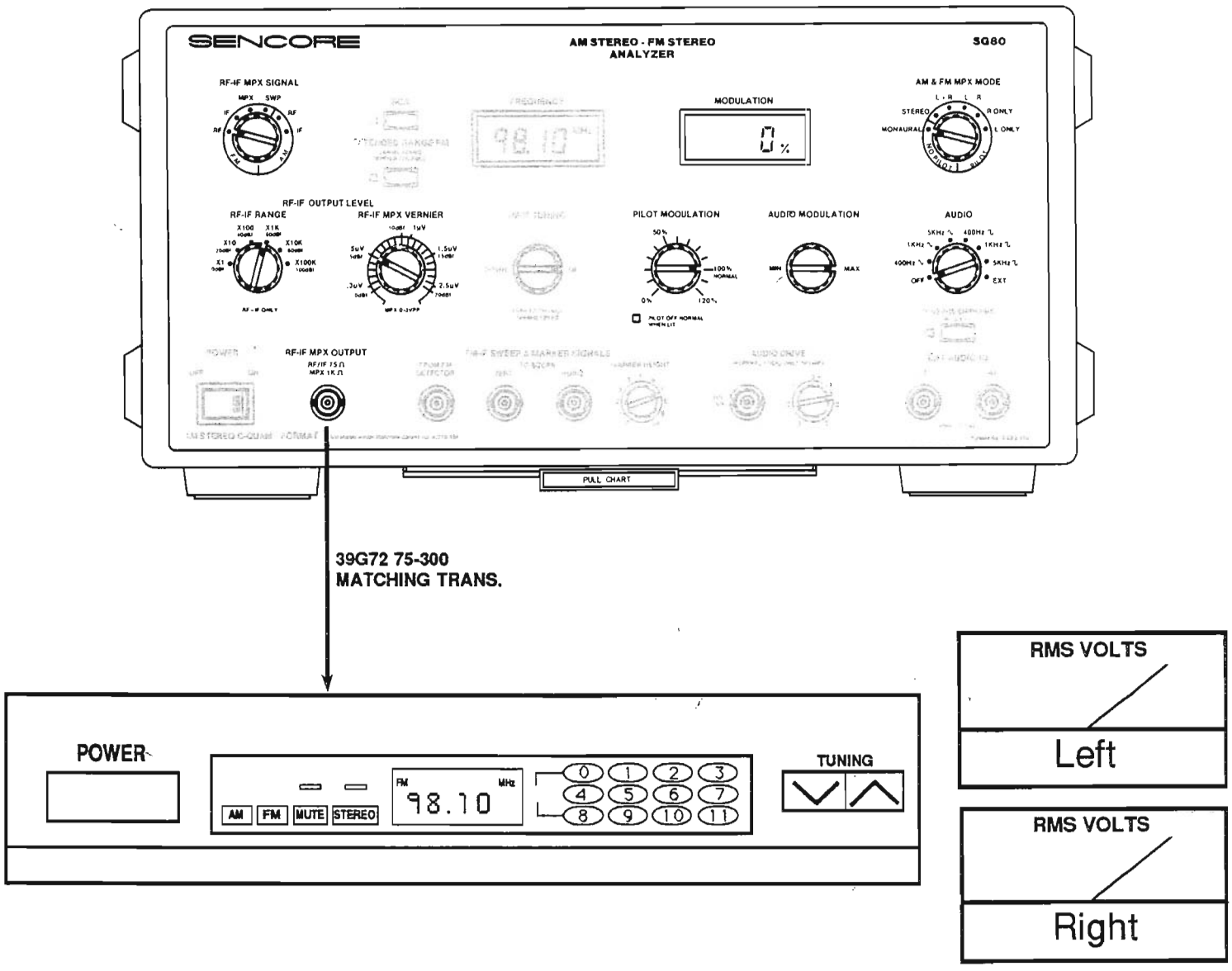
1. Connect the SG80's RF-IF MPX OUTPUT jack to the tuner/receiver's antenna terminals. (If the receiver has selectable IF bandwidths, set it to the widest mode.)
2. Set the following SG80 controls;
   A. RF-IF MPX SIGNAL to the FM RF position.
   B. RF-IF OUTPUT LEVEL to produce a 65 dBF output.
   C. Ensure SCA is turned off.
   D. RF-IF TUNING control to 98.1 MHz.
   E. AM & FM MPX MODE to MONAURAL.
   F. AUDIO control to 1 kHz sine.
   G. AUDIO MODULATION to 100%.
3. Set the tuner/receiver to 98.1 MHz.

To set the SG80 to produce an FM Stereo output:

1. Connect the SG80's RF-IF MPX OUTPUT jack to the antenna terminals of the tuner/receiver under test. (If the receiver has selectable IF bandwidths, set it to the widest mode.)
2. Select the FM Stereo mode on the tuner/receiver; set its tuner to 98.1 MHz.
3. Set the SG80's controls as follows:
   A. RF-IF MPX SIGNAL to FM RF.
   B. RF-IF OUTPUT LEVEL controls for 65 dBF.
   C. Ensure SCA is off.
   D. RF-IF TUNING for 98.1 MHz.
   E. PILOT MODULATION for 100% NORMAL.
   F. AM & FM MPX MODE to STEREO
   G. AUDIO to 1 kHz sine.
   H. AUDIO MODULATION for 100%.

50 dB QUIETING FM SENSITIVITY

The 50 dB quieting sensitivity specification of tuners and receivers is used to identify the relative freedom from internal noise when a low signal level is received. This noise is most noticeable during pauses in modula tion, when the tuner/receiver is not masking the noise with modulation. The sensitivity requirements are similar to that of signal-to-noise (S/N) testing, but is referenced to the input signal level.



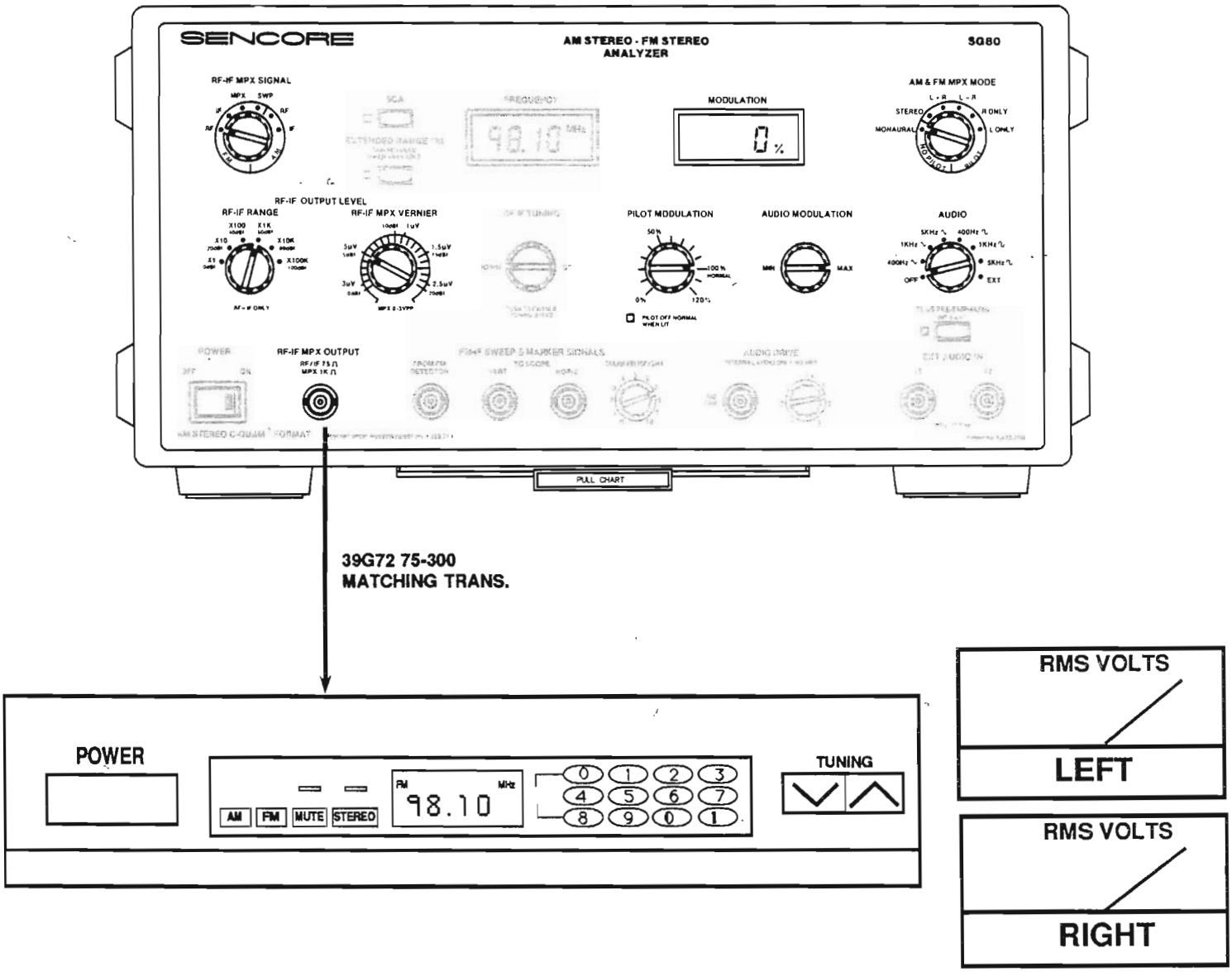
To test the 50 dB quieting sensitivity of a FM tuner/ receiver:

1. Set the SG80 and receiver according tothe "Using Standard Input Reference Signals" section on page 25.
2. Measure the receiver's output in RMS volts or dBm.
3. Set the AUDIO control to the OFF position and again measure the output of the tuner/receiver.
4. Calculate the S/N ratio with the following formula: dB = 20 log rms step 2/rms step 3, or subtract step 3 from step 2 if using dBm.
5. If the S/N ratio is greater than 50dB reduce the SG80's RF level and repeat steps 1-4. The level at which a 50 dB S/N is obtained is the 50 dB quieting sensitivity.

FM SIGNAL-TO-NOISE

One of the problems with FM tuners and receivers is that of noise. Because of the higher frequencies and more complex circuitry, FM Stereo reproduction is more susceptible to noise then mono. Of all the problems that can affects the quality of FM reception, noise is the most bothersome to listeners. The SG80 provides a quick test of the signal-to-noise capabilities of FM tuners and receivers.

This test is done on FM mono and Stereo tuners and receivers, using a standard input signal level of 65 dBF. The test compares the output level when there is modulation and when there is no modulation (noise). In the mono mode, most tuners and receivers should produce 70 to 90 dB S/N. In the stereo mode you may see 60 to 80 dB.



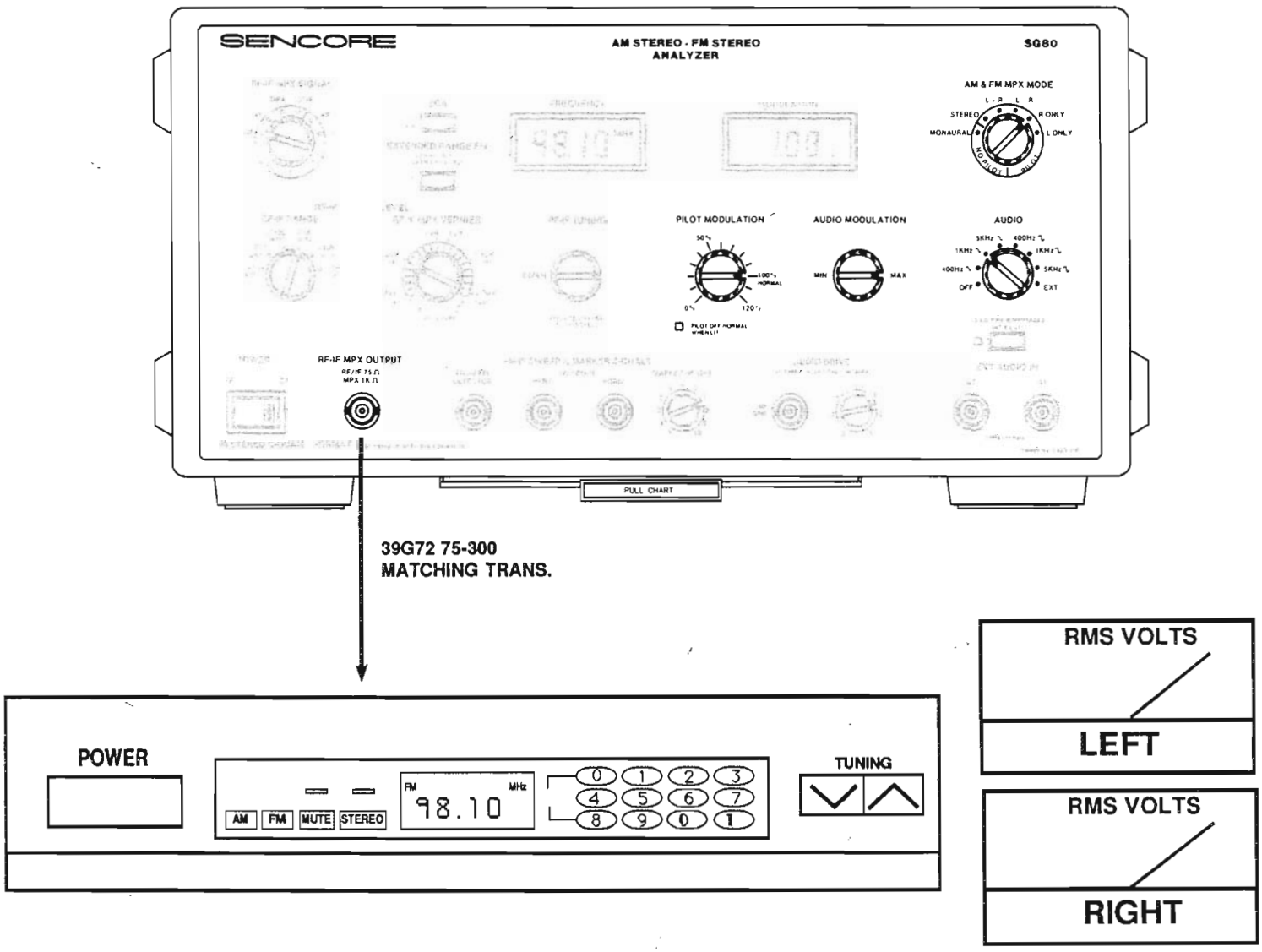
To measure the S/N ratio of a tuner/receiver with the SG80:

1. Set the SG80 and the receiver according to the "Using Standard Input Reference Signals" section on page 25.
2. Measure the receiver's output in RMS volts or dBm.
3. Turn the AUDIO control to the OFF position and measure the receiver's output RMS volts.
4. Calculate the S/N ratio with the following formula: dB = 20 log RMS step 2/RMS step 3, or subtract step 3 form step 2 when using dBm.

FM STEREO SEPARATION

Separation is a test to see how much of the left channel's signal inside the tuner/receiver crosses over into the right channel, or vise versa, when a stereo format signal is being received. Specifications on separation for different tuners/receivers will vary dramatically. Most tuner/receivers typically give the highest separation when supplied with a 1 kHz sinewave.

When testing separation with the SG80, you will supply either a "Right or Left ONLY" signal and measure the difference between the right and left output levels. Most tuners/receivers specify the separation in decibel form, so an output monitoring meter should be able to directly display decibels.



To measure separation with the SG80:

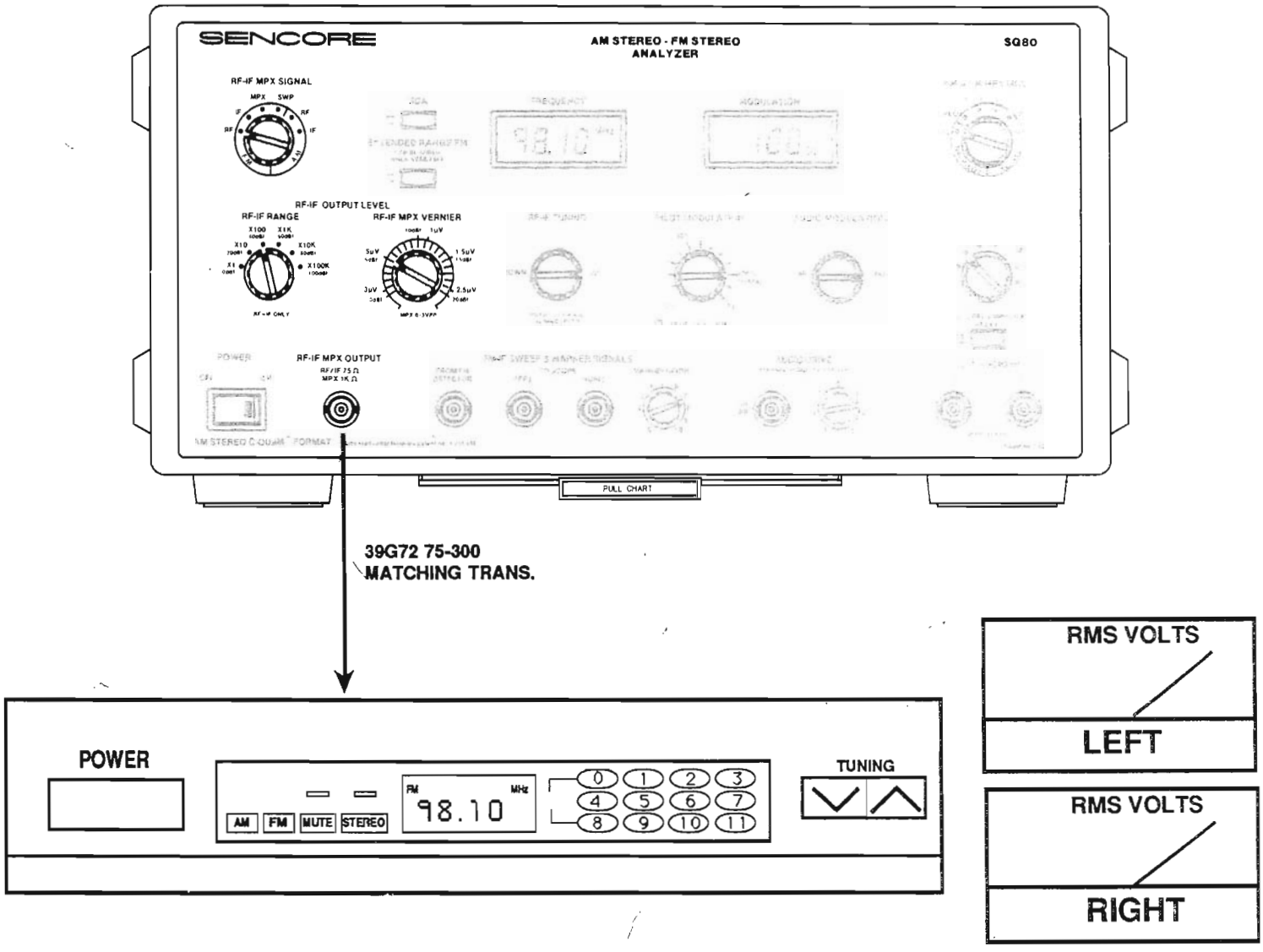
1. Set the SG80's controls to produce the FM Stereo standard signal format discussed earlier in the " Using Standard Input Reference Signals" section on page 25.
2. Select the R ONLY position of the AM & FM MPX MODE control.
3. Compare or calculate the difference in the left and right output of the tuner/receiver under test. This is the right to left separation.
4. Select the L ONLY position of the AM & FM MPX MODE control.
5. Compare or calculate the difference in the left and right output of the tuner/receiver under test. This is the left to right separation.

FM MUTING THRESHOLD

In an effort to provide clean noise free tuning, many tuner/receivers now use a muting circuit. The muting circuit blanks the output while tuning between stations and when excessively noisy signals are received.

Modern tuners and receivers may use a factory set mute level, a user adjustable mute level, and/or a user-controlled muting on-off switch. Some tuners and receivers also mute a poor signal. When testing units with mute feature, you will need to test all possible combinations of the switches; mute on, mute off, mute level at maximum, and mute level at minimum.

Use the SG80's variable RF output to test for the proper response from the muting circuits. Start with the standard signal level (65 dBF) and slowly decrease it until the output of the tuner/receiver is muted. Most tuners and receivers have a muting sensitivity that is fairly close to the stereo switching threshold as tested on the next page.



To test the muting threshold level of a tuner or receiver:

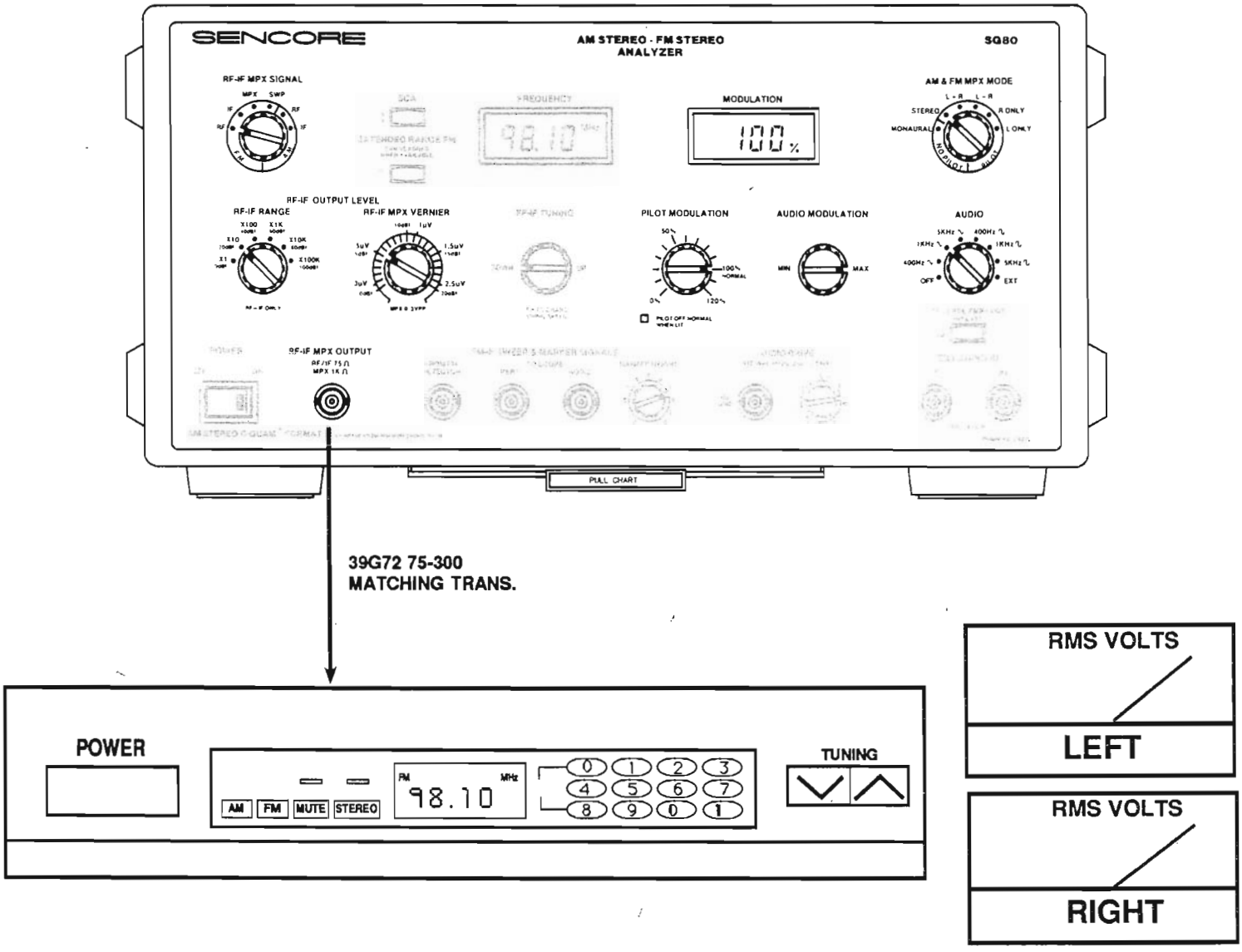
1. Set the SG80 to produce a standard FM signal, as discussed in the "Using Standard Input Reference Signals" section on page 25.
2. Slowly decrease the output level of the SG80 with the RF-IF MPX OUTPUT LEVEL controls. Note the level on the SG80 when the output of the tuner/receiver is muted.
3. Slowly increase the SG80's output level until the receiver unmutes.
4. The average between steps 2 and 3 is the is the muting threshold.

FM STEREO SWITCHING THRESHOLD

Variations in the received signal strength may cause the tuner/receiver to switch in and out of the stereo mode or to mute the output. This is most evident in car radios, as you drive from a strong signal area to a weak signal area.

When the signal level decreases, the S/N ratio decreases and the noise information becomes more dominant. To prevent this from happening, the tuners and receivers use an AGC circuit in the RF sections. The AGC circuit tries to maintain a sufficient signal level for proper detection. When the level drops far enough the pilot is no longer detected and the tuner or receiver will switch to the mono mode.

The SG80's stereo switching threshold test involves starting with the standard 65 dBF output level from the SG80 and decreasing the level until the tuner/receiver switches from the stereo mode to mono or mutes the output.



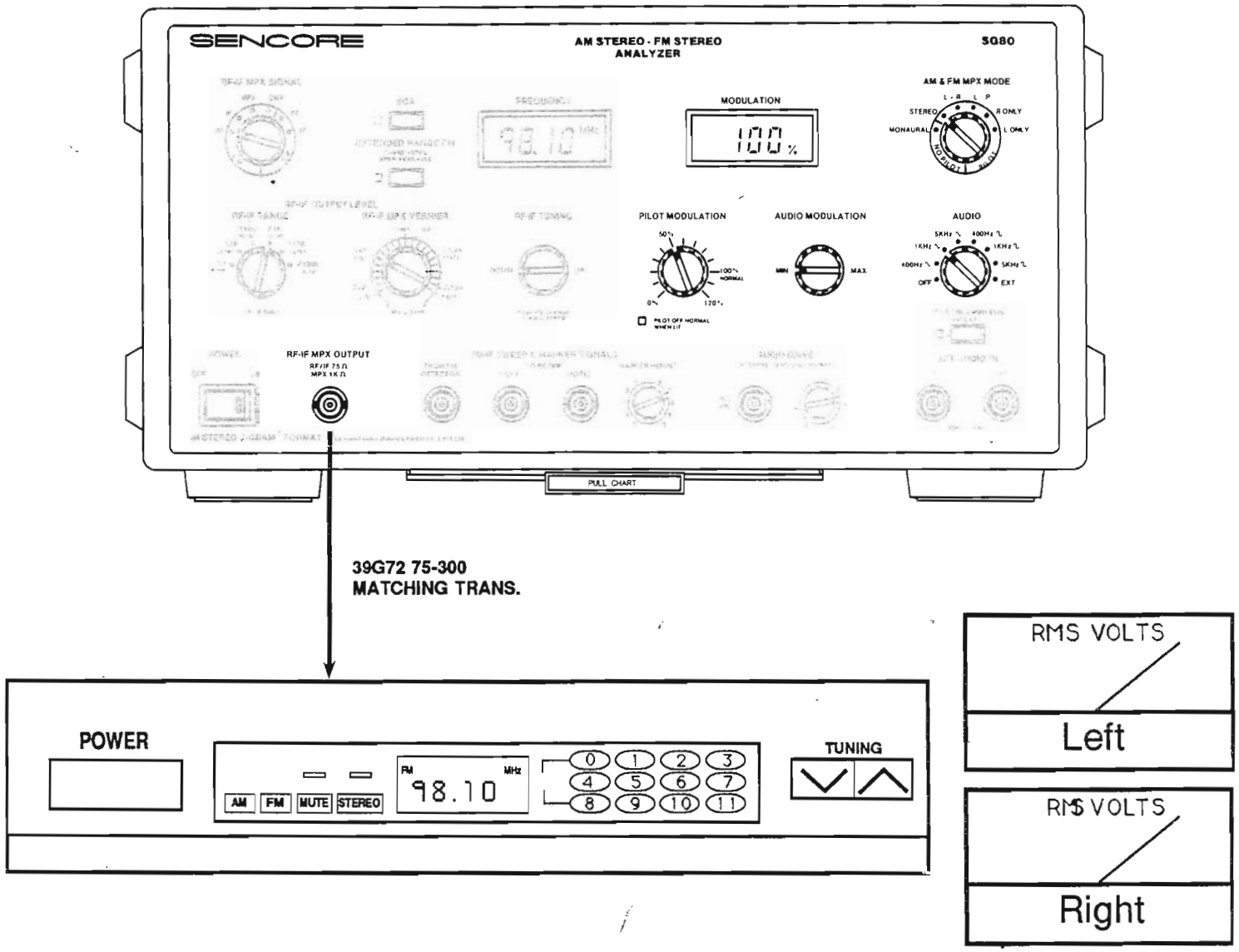
To test a tuner/receiver for FM Stereo switching threshold:

1. Set the SG80 and receiver as described in the "Using Standard Input Reference Signals" section on page 25. (stereo).
2. Reduce the SG80's RF signal level until the receiver's stereo light goes off. Record the RF signal level.
3. Slowly increase the SG80's RF signal level until the stereo indicator light turns on.
4. The switching threshold level is the average of the signal levels in steps 2 and 3.

FM STEREO PILOT DETECT SENSITIVITY

In order for the FM tuner/receiver to receive and reproduce a stereo signal, it must detect the stereo pilot signal. The stereo pilot typically is transmitted at 10% of the total modulation. This 10% level represents a 100% pilot modulation level. (The FM Stereo tuner/receiver should reproduce an FM Stereo signal with an input signal level of 65 dBF.)

Often, when in fringe areas or when picking up cross-over signals, the stereo circuits can turn on and off (flicker). For this reason FM Stereo tuners/receivers are sensitive to changes in pilot level, and will switch out of the stereo mode when the pilot level drops too low. The SG80 varies the pilot modulation level to test the stereo pilot switching threshold.



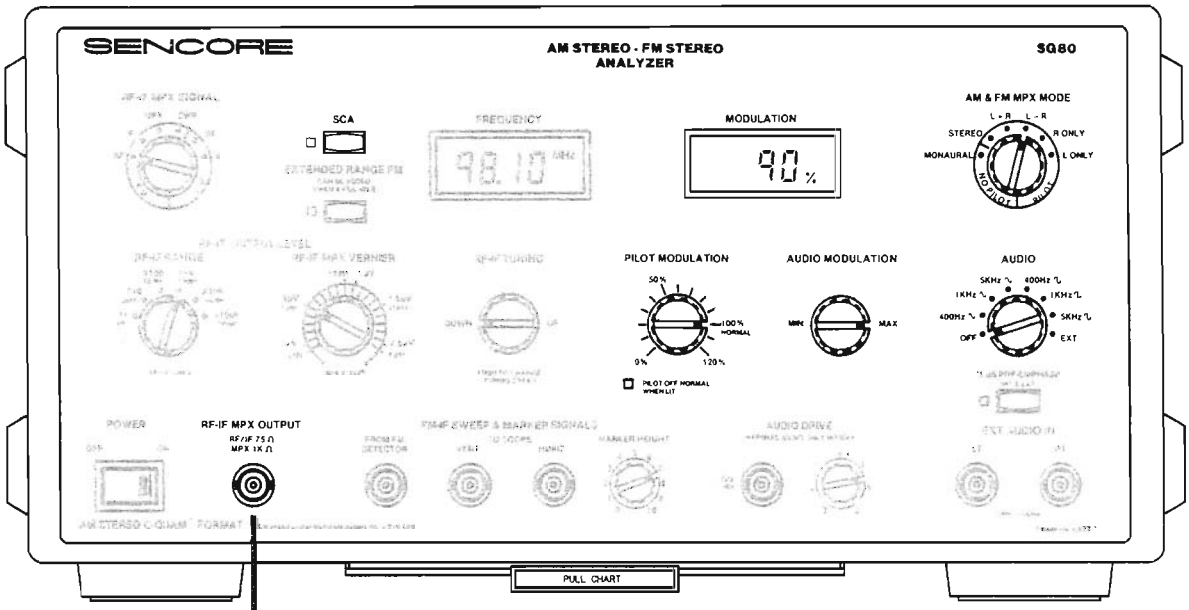
To test stereo pilot switching threshold with the SG80:

1. Set the SG80 and the receiver as discussed in the "Using Standard Input Reference Signals" section on page 25. (stereo)
2. Reduce the SG80's PILOT MODULATION control until the receiver's stereo indicator light goes off and record the level.
3. Slowly increase the PILOT MODULATION level until the receiver's stereo indicator light turns on.
4. The pilot detect sensitivity is the average of the recorded pilot modulation levels in steps 2 and 3.

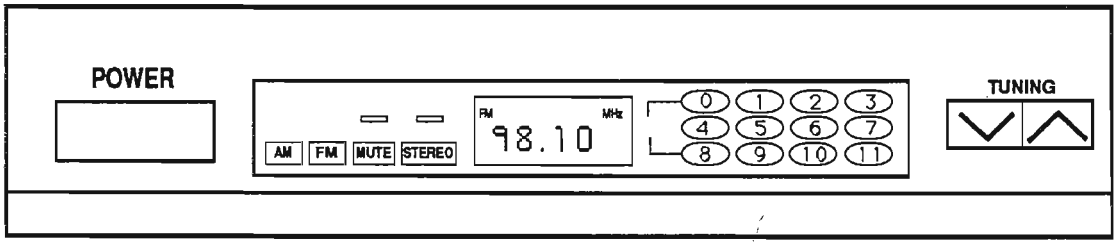
SCA REJECTION

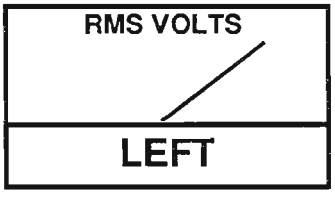
The SCA signal is used some broadcast stations to carry background music, data, or paging signals. Most tuners and receivers do not allow for the reception of the SCA signal, and use a filter to remove the signal. The SCA signal can cause interference with normal programing by intermodulating with the 38 kHz subcarrier frequency. This effect is especially noticeable during quiet points in the normal programming.

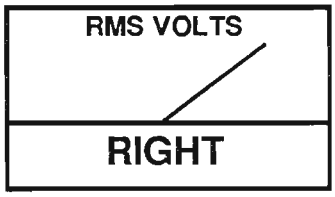
The SG80 provides a 67 kHz SCA carrier with 2.5 kHz sinewave modulation. The SCA signal can be added or removed by simply pressing the SCA button on the SG80. This is used to determine the amount of SCA leakage in a receiver.



39G72 75-300
MATCHING TRANS.







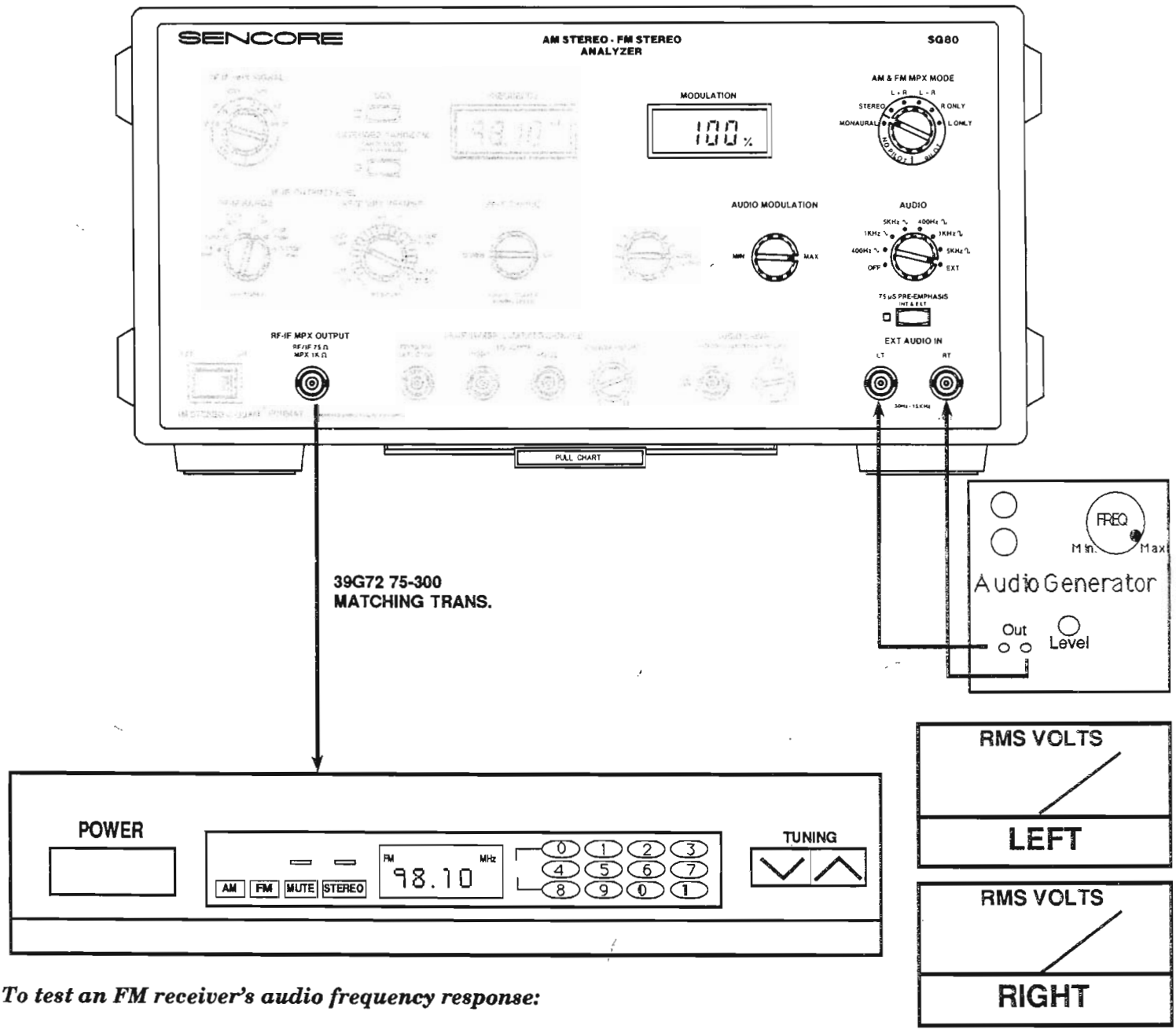
To test the SCA rejection of a tuner or receiver:

1. Set the SG80 and the receiver's as discussed in the "Using Standard Input Reference Signals" section on page 25. (stereo)
2. Set the AM & FM MPX MODE control to the L-R position and the AUDIO MODULATION control for 90%.
3. Turn the AUDIO control to the OFF position.
4. Measure the left and right output level of the receiver in either RMS volts or dBm.
5. Press the SCA button to add the SCA signal. (The SG80's SCA indicator light should be on.)
6. Measure the left and right output levels of the receiver.
7. Calculate the SCA rejection by using the following formula: dB = 20 log (lowest reading in step 6/ reading in step 4), or when using dBm subtract step 6 from step 4.

FM RECEIVER AUDIO FREQUENCY RESPONSE

This test indicates the receivers response to receiving and amplifying the full range of audio frequencies from 30 Hz to 15 Khz. It will identify problems with receiver circuits or de-emphasis network which can alter frequency response.

Choices of internal or external modulation and selectable pre-emphasis enable comprehensive frequency response testing.



To test an FM receiver's audio frequency response:

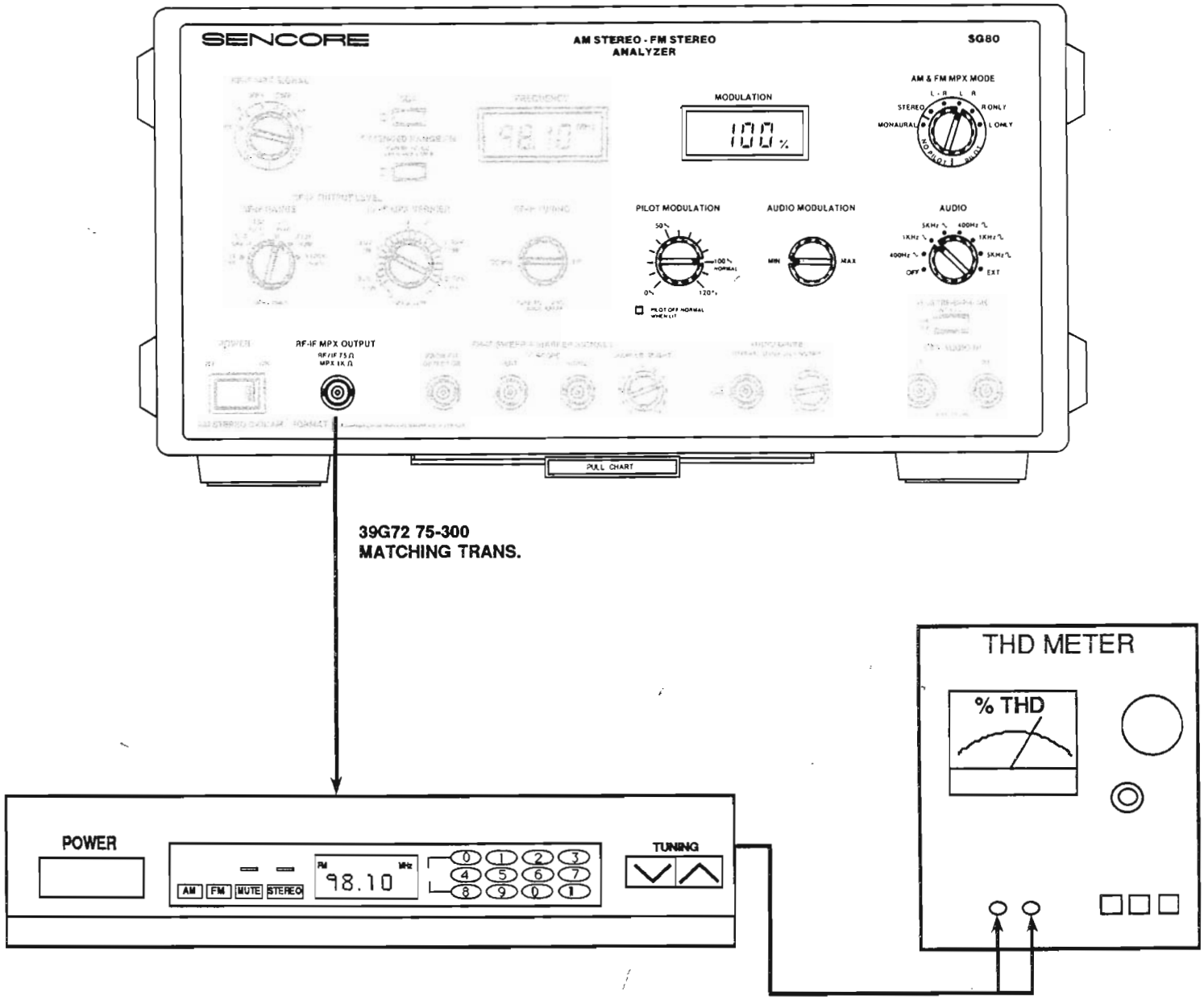
1. Set SG80 and receiver as discussed in the "Using Standard Input Reference Signals" on page 25.
2. Set the AUDIO switch to EXT position.
3. Turn the 75 uS PRE-EMPHASIS on.
4. Connect an external audio generator to the EXT AUDIO IN jacks.
5. Set audio generator for maximum audio frequency.
6. Set the AUDIO MODULATION control for 100% modulation, and measure the receiver's output level. in dBm.
7. Vary audio generator frequency. Do not readjust the AUDIO MODULATION control. Measure left and right output level at each frequency desired.
8. The frequency response of the receiver is between the frequencies whose level is +/- 1/2dB of the level at 1kHz.

FM RECEIVER DISTORTION TEST

This test indicates the receiver's ability to receive and decode the audio signal without adding distortion.

The SG80's low distortion FM RF signals allow you to performance test high quality receivers and isolate the cause of distorted audio to the tuner section.

To make this test you'll need a THD meter to monitor the receiver output while supplying an FM signal to the receiver with the SG80.



To test FM receiver distortion:

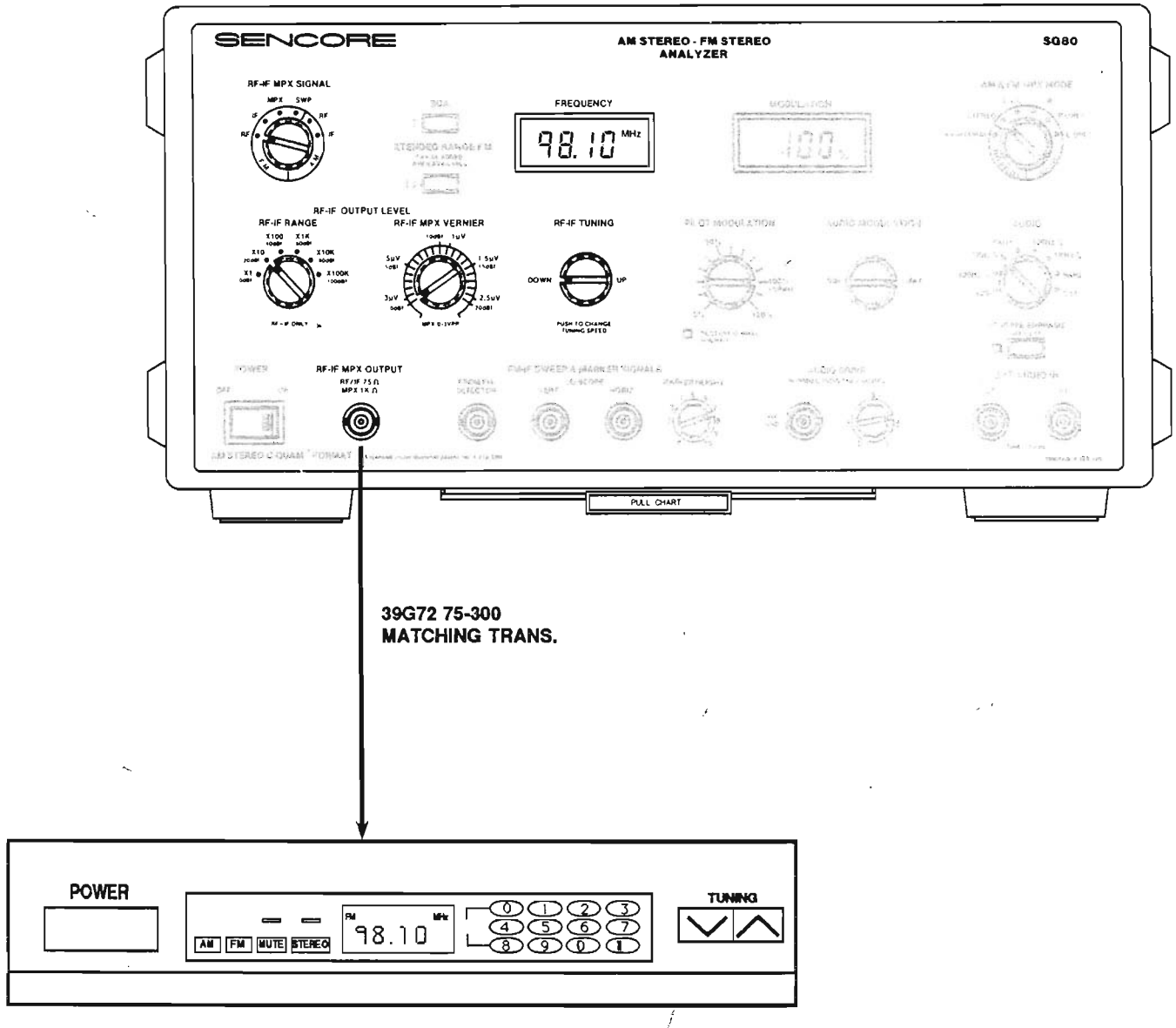
1. Set SG80 and receiver according to procedures discussed in the" Using Standard Input Reference Signals" section on page 25.
2. Connect a distortion meter to right output of receiver and read the distortion.
3. Connect a distortion meter to left output of receiver and read the distortion.
4. Set the AM & FM MPX MODE switch to L-R position.

FM AUTOMATIC SEEK LEVEL TEST

This test indicates the RF signal level required to lock-in the automatic seek tuning circuits.

The SG80's calibrated output vernies allow you to perform accurate level testing of the receiver's seek circuits with the transmitter quality FM signals and calibrated output verniers.

Note: this test is only for receivers that have automatic "seek" or "scan" tuners.



To test automatic seek level:

1. Set both the SG80 and receiver as discussed in the "Using Standard Input Reference Signals" section on page 25.
2. Set the RF-IF OUTPUT LEVEL control to produce a 20 dBf signal level.
3. Place receiver in auto search mode. The receiver should stop at 98.10 MHz.
4. If it doesn't lock at 98.1 MHz, slowly increase the RF-IF OUTPUT LEVEL until the receiver locks.

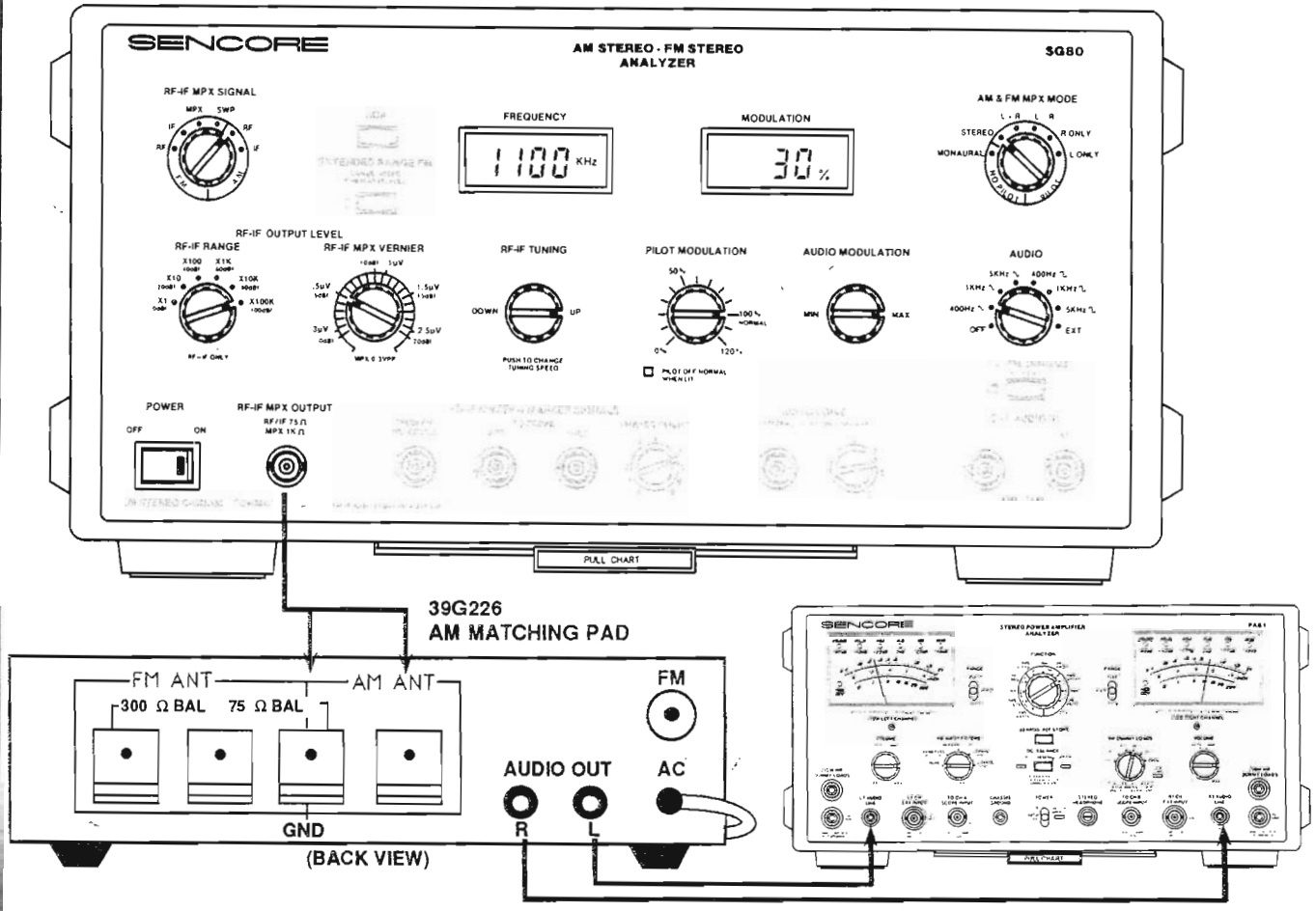
NOTE: *The RF level that just causes the receiver to lock at 98.10 is the auto-seek level.*

PERFORMANCE TESTING AM MONO AND STEREO TUNER/RECEIVERS

USING A STANDARD AM MONO AND STEREO SETUP

Most tests on AM tuners/receivers can be done or at least started, by supplying a standard format AM signal from the SG80. Each of the following tests will inform you if there are any special setup adjustments or modifi

cations to the standard setup. Use the following setup to supply an accurate, clean signal when performance testing AM tuners and receivers.



To set the SG80 to supply a standard AM mono signal:

1. Connect the RF-IF MPX OUTPUT jack to the antenna terminals of the tuner/receiver.
2. Set the following SG80 controls:
   A. Set the RF-IF MPX SIGNAL control to the AM RF position.
   B. Set the RF-IF OUTPUT LEVEL to 50k uV- home or 5k uV- auto.
   C. Set the RF-IF TUNING to 1100 kHz.
   D. Set the AM & FM MPX MODE control to MONAURAL.
   E. Set the AUDIO control to 400 Hz sine.
   F. Adjust the AUDIO MODULATION control to 30%.
3. Set the receiver to 1100 kHz.

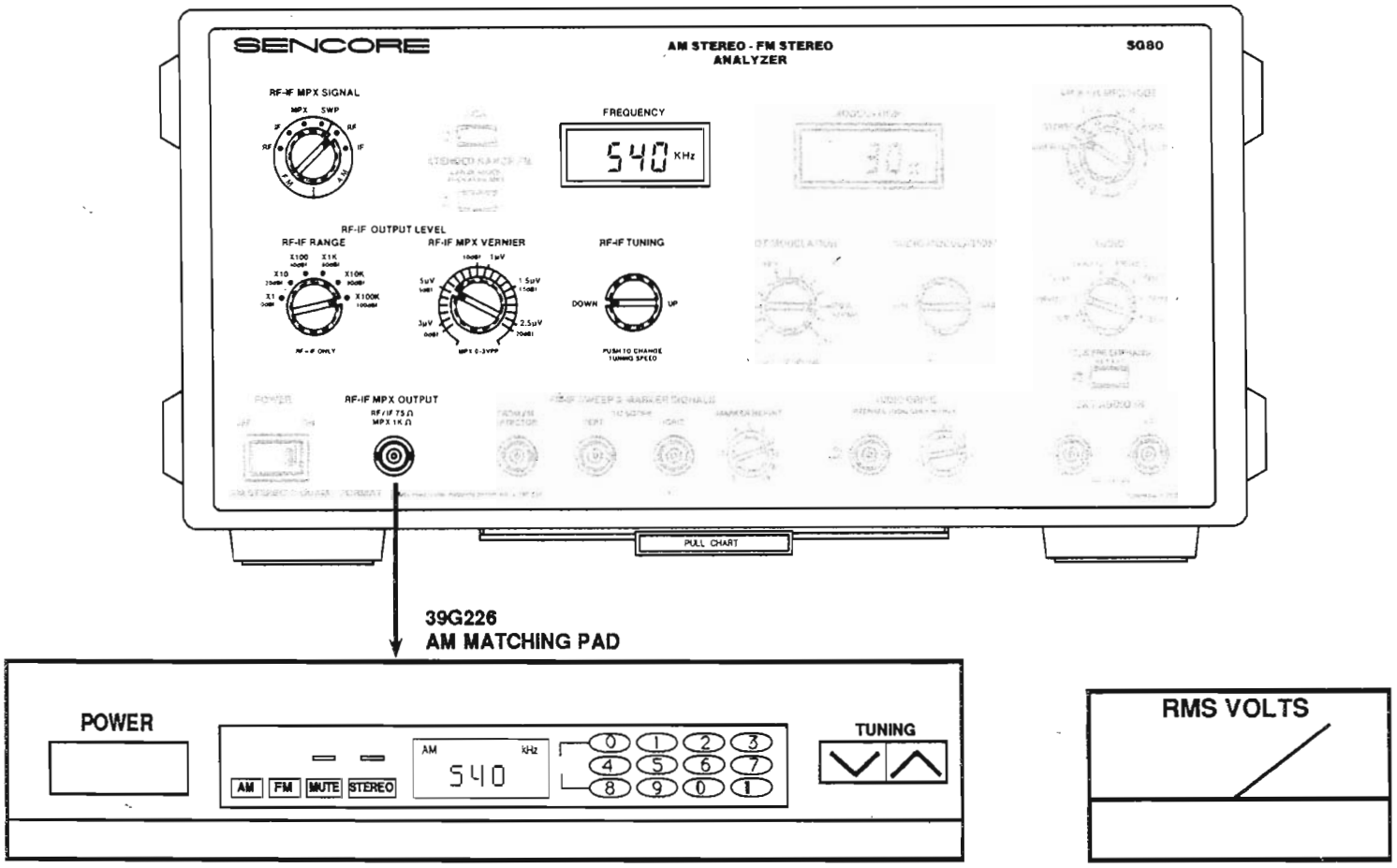
To set the SG80 to produce a standard AM Stereo output:

1. Connect the SG80's RF-IF MPX OUTPUT jack to the antenna terminals of the tuner/receiver.
2. Set the following SG80 controls:
   A. Set the RF-IF MPX SIGNAL control to the AM RF position.
   B. Set the RF-IF OUTPUT LEVEL controls to 50k uV- home or 5kuV- auto.
   C. Set the RF-IF TUNING control to 1100 kHz.
   D. Set the AM & FM MPX MODE to the STEREO position.
   E. Set the PILOT MODULATION control to 100%.
   F. Set the AUDIO control to 400 Hz sine.
   G. Adjust the AUDIO MODULATION control to 30%.
3. Set the receiver to 1100 kHz.

AM TUNING RANGE AND INDICATOR ACCURACY

This test checks the ability of the receiver to tune to each AM broadcast channel and checks the accuracy of the receiver's tuning indicator to identify tuning problems.

The SG80 provides transmitter accurate signals with precision digital steps to positively identify tuning problems and indicator error. 10 kHz tuning steps provide direct tuning to each AM channel with smaller 1 kHz steps for fine-tuning. Wrap around tuning from the highest AM channel to lowest adds convenience and saves time.

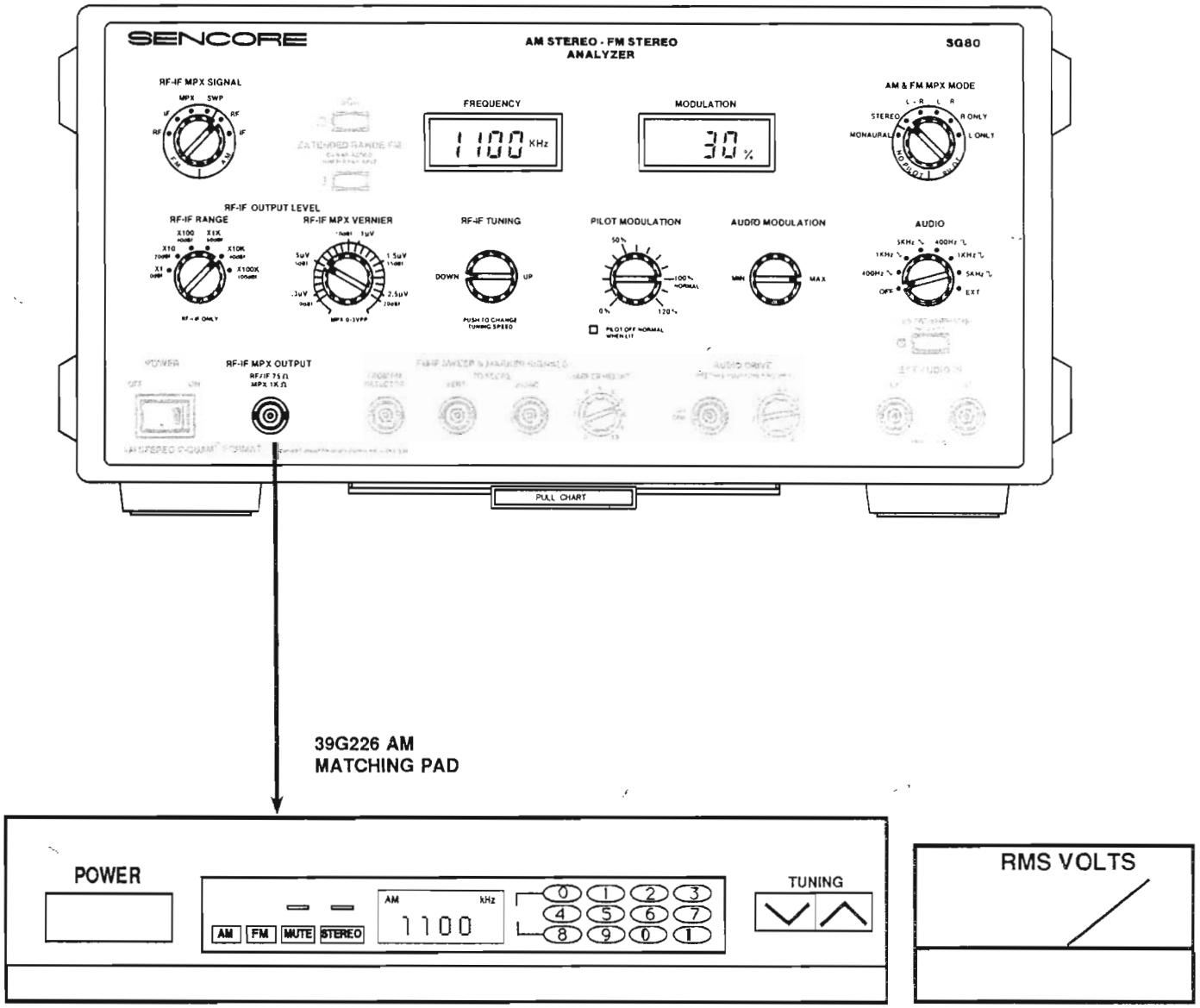


To test tuning range and indicator accuracy:

1. Set the SG80 and receiver as listed in the "Using A Standard AM Mono And Stereo Setup" section on page 36.
2. Tune the SG80 to 540 kHz with the RF-IF TUNING control.
3. Tune receiver to 540 kHz.
4. Adjust the RF-IF TUNING control in the fine tuning mode for the highest receiver output. The highest output level is the exact receiver tuned frequency.
5. Tune the SG80's RF-IF TUNING control for 1600 kHz.
6. Set the receiver to 1600 kHz.
7. Repeat step 4.

AM USABLE SENSITIVITY TEST

The sensitivity test of an AM tuner determines how much input signal level is required to produce a quality output signal. (Refer to the manufacturers published specification of the tuner/receiver you are servicing to find the S/N ratio of the unit.)



To test sensitivity of AM tuner/receiver:

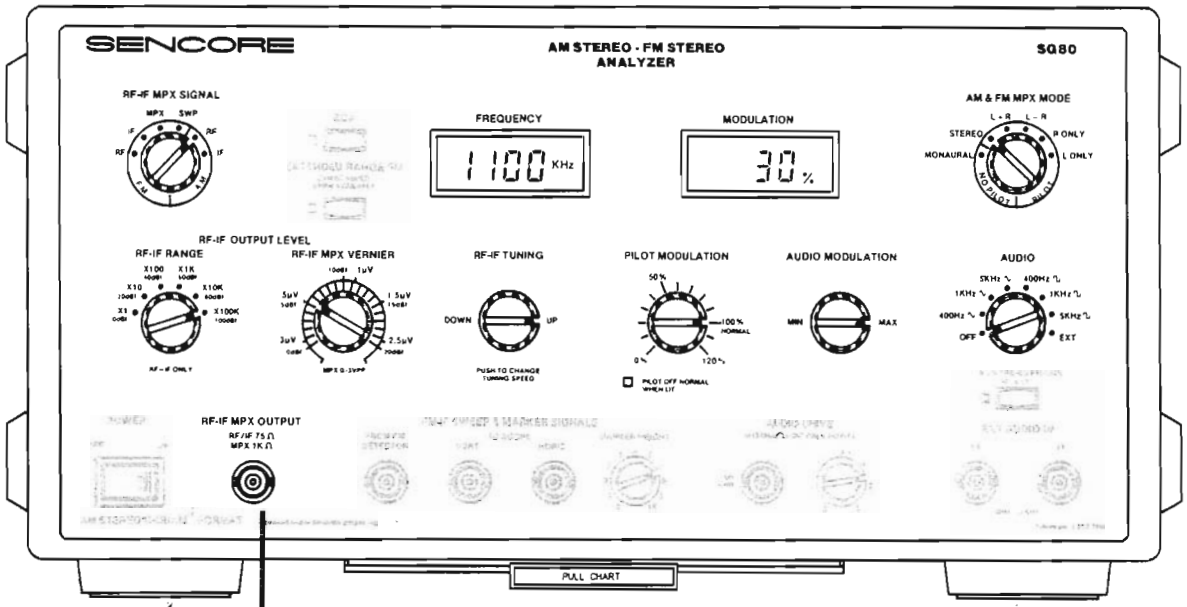
1. Set the SG80 and receiver as explained in the "Using A Standard AM Mono And Stereo Setup" section on page 36.
2. Reduce the RF-IF OUTPUT LEVEL by one range. (20 dBf)
3. Measure the output level in RMS volts or dBm.
4. Turn the AUDIO control to the OFF position.
5. Record the receivers output level in RMS volts, and calculate the S/N: dB= 20 log reading in step 3/ reading in step 5, or if using dBm subtract step 5 from step 3.
6. If S/N is less than 20 dB, increase the SG80's RF signal level and repeat steps 3-5.
7. If the S/N ratio is greater than 20 dB, decrease the SG80's output and repeat steps 3 to 5.

***NOTE**: The RF level that produces a 20 dB S/N is the receivers' (usable) sensitivity. Remember you must divide the SG80's RF level settings by ten when using the 39G226 AM MATCHING PAD.*

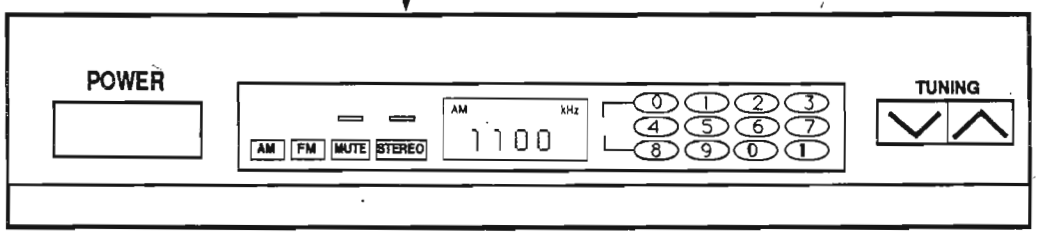
AM SIGNAL-TO-NOISE

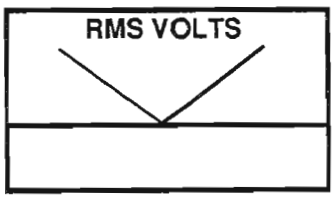
This test indicates how well of the AM receiver to processes the received signal without adding noise.

The SG80 provides an AM signal with a signal to noise ratio of better than 55 dB enabling accurate S/N tests of any AM receiver.



39G226 AM MATCHING PAD





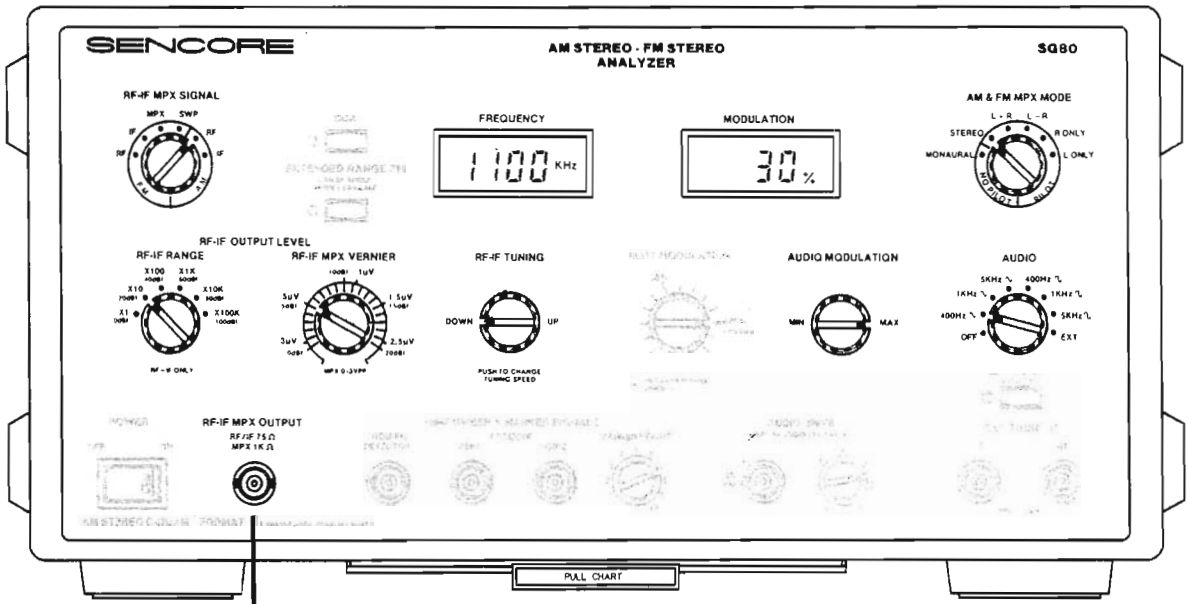
To measure the S/N ratio with the SG80 of an AM tuner/receiver:

1. Set the SG80 and receiver as described in the "Using A Standard AM Mono And Stereo Setup" on page 36.
2. Measure and record the RMS volts or dBm output level of the receiver.
3. Turn the AUDIO control to the OFF position and again measure the output level. Calculate the the signal-to-noise using the following formula: dB = 20 log step 2/step 3, or if using dBm subtract step3 from step 2.

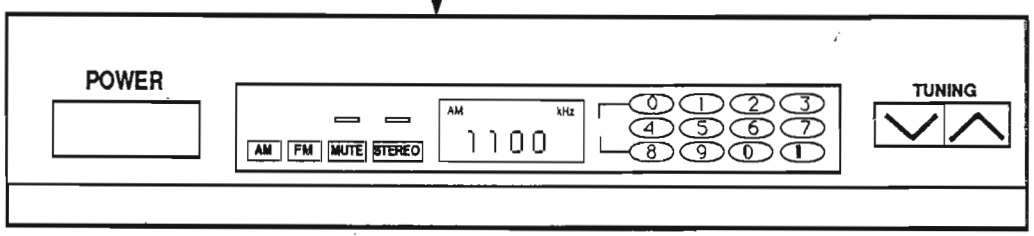
AM ADJACENT CHANNEL SELECTIVITY

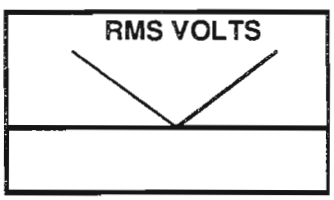
One of the major parameters of an AM tuner/receiver is the ability to lock to the desired channel and ignore the adjacent channels. This is called the selectivity of the tuner/receiver.

The SG80 provides digital tuning steps that will directly tune the SG80 to an adjacent channel or fine tuning steps to closely analyze the receivers alignment and attenuation of the RF-IF bandpass circuits.



39G226 AM MATCHING PAD





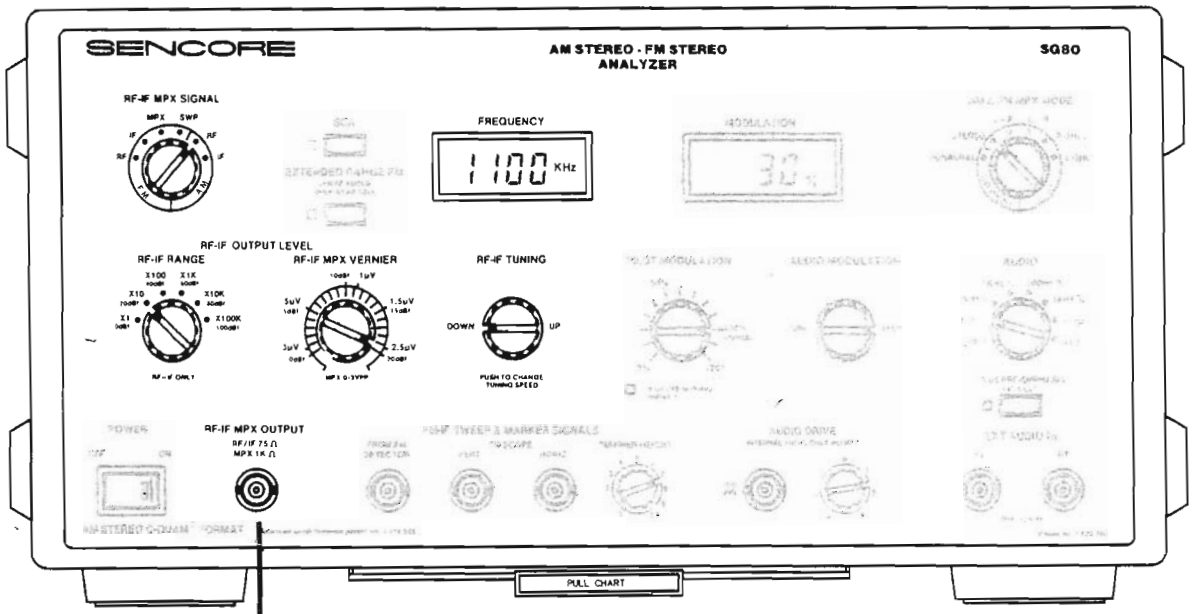
To test AM tuners/receivers for selectivity:

1. Set the SG80 and receiver as shown in the "Using A Standard AM Mono And Stereo Setup" section on page 36.
2. Set the SG80 and the receiver to 1100 kHz using the RF-IF TUNING control and the receiver tuner.
3. Set the SG80's output level to match the level of the "Sensitivity Test" performed earlier on page 38.
4. Record the output of the receiver in RMS volts or dBm.
5. Tune the SG80's RF-IF TUNING control to 1090 kHz and measure the receiver's output level. Calculate the selectivity with the following formula: dB = 20 log Step 4/ step 5, or subtract step 5 from step 4 when using dBm.
6. Tune the SG80 to 1110 kHz and repeat step 3-5.

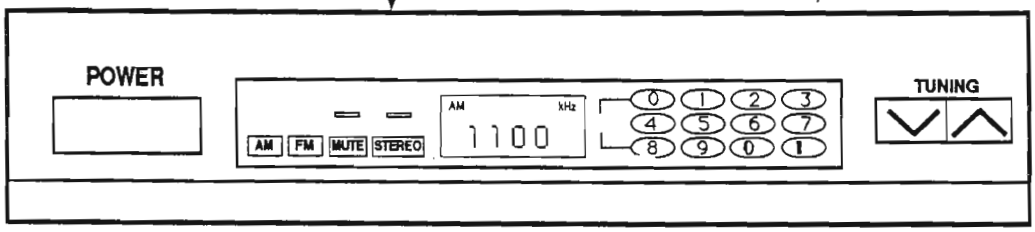
AM AUTOMATIC SEEK LEVEL

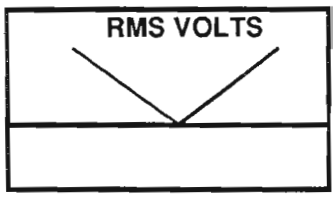
This test indicates the signal level required to stop and lock-in the automatic-seek/scan tuning circuits.

Perform accurate, error free analysis of the receivers automatic seek/scan circuits with the transmitter quality AM signal and calibrated output verniers.



39G226 AM
MATCHING PAD





To test the automatic seek level of an AM receiver:

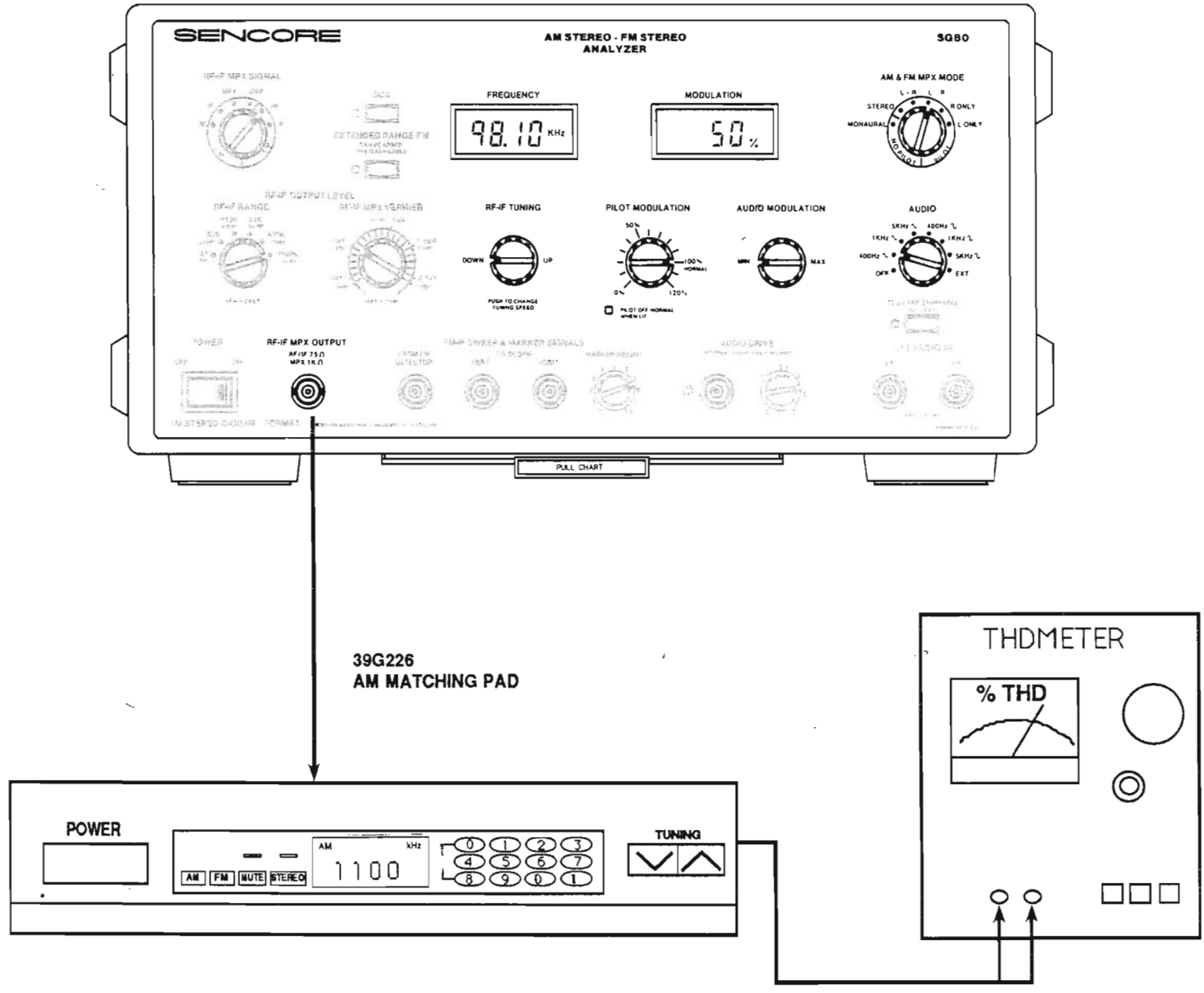
1. Set the SG80 and receiver as explained in the "Using A Standard AM Mono And Stereo Setup" as shown on page 36.
2. Set the RF-IF OUTPUT LEVEL for 2.5 uV.
3. Place the receiver in the auto search mode and note if it stops at 1100 kHz. If it doesn't slowly increase the SG80's output level until the receiver does lock-in. This the auto search level.

AM RECEIVER DISTORTION

This test indicates the ability of the receiver to receive and detect the audio signal without adding distortion.

Performance test high quality receivers and isolate distortion problems to the receiver in a component sound system with low audio distortion AM RF signals of the SG80 (less than .5%).

To make this test you'll need a THD meter to monitor the receiver output while supplying an FM signal to the receiver with the SG80.



To test an AM receiver's distortion:

1. Set the SG80 and the receiver as shown in the "Using A Standard AM Mono And Stereo Setup" on page 36.
2. Connect a distortion meter to the output of the receiver.
3. Read the distortion of both the left and right receiver outputs.

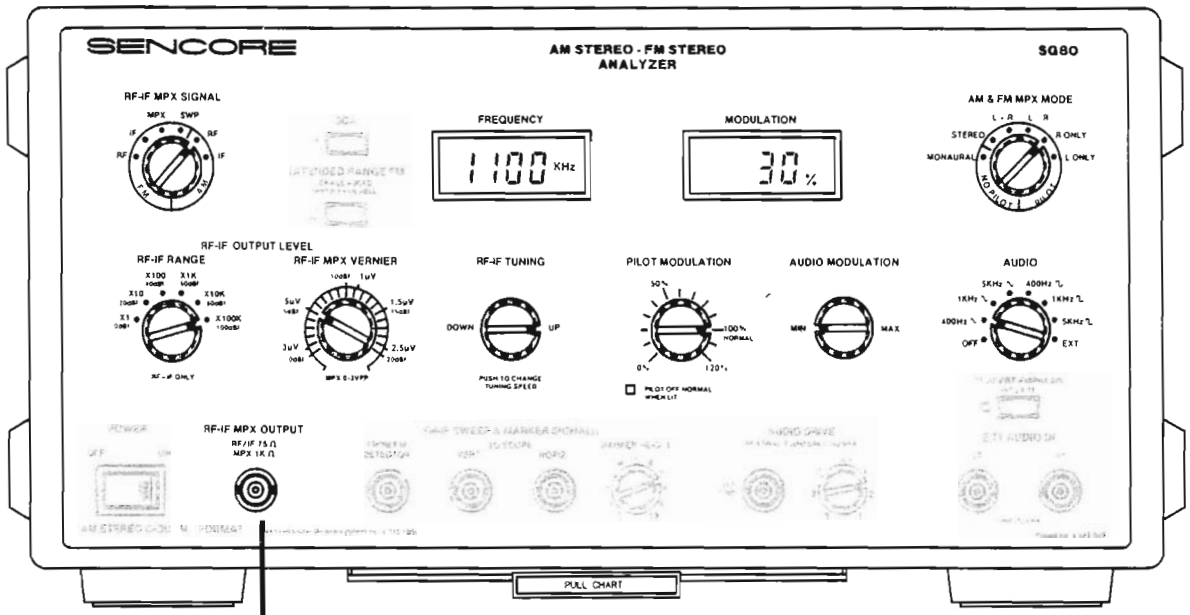
Stereo:

4. Set the AM & FM MPX MODE control to the L-R position.
5. Set the AUDIO MODULATION to 50%.
6. Read the distortion of both the left and right receiver outputs.

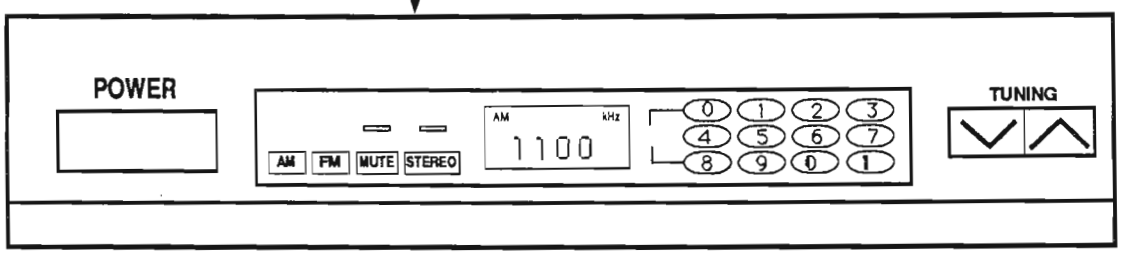
AM STEREO SEPARATION

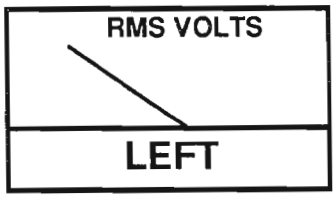
Separation is a test to see how much of the right channel's signal crosses over into the left channel, or vise versa, when a stereo signal is being produced. Some units are now reaching high levels of separation. Specification on separation for different tuners/receivers will vary dramatically.

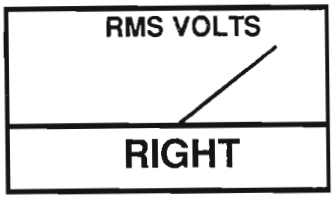
When testing separation with the SG80, you will supply either a right or left only signal and measure the difference between the output levels. Most tuners specify the separation in decibels, so an output monitoring meter should be able to directly display dB.



39G226
AM MATCHING PAD







To measure separation with the SG80:

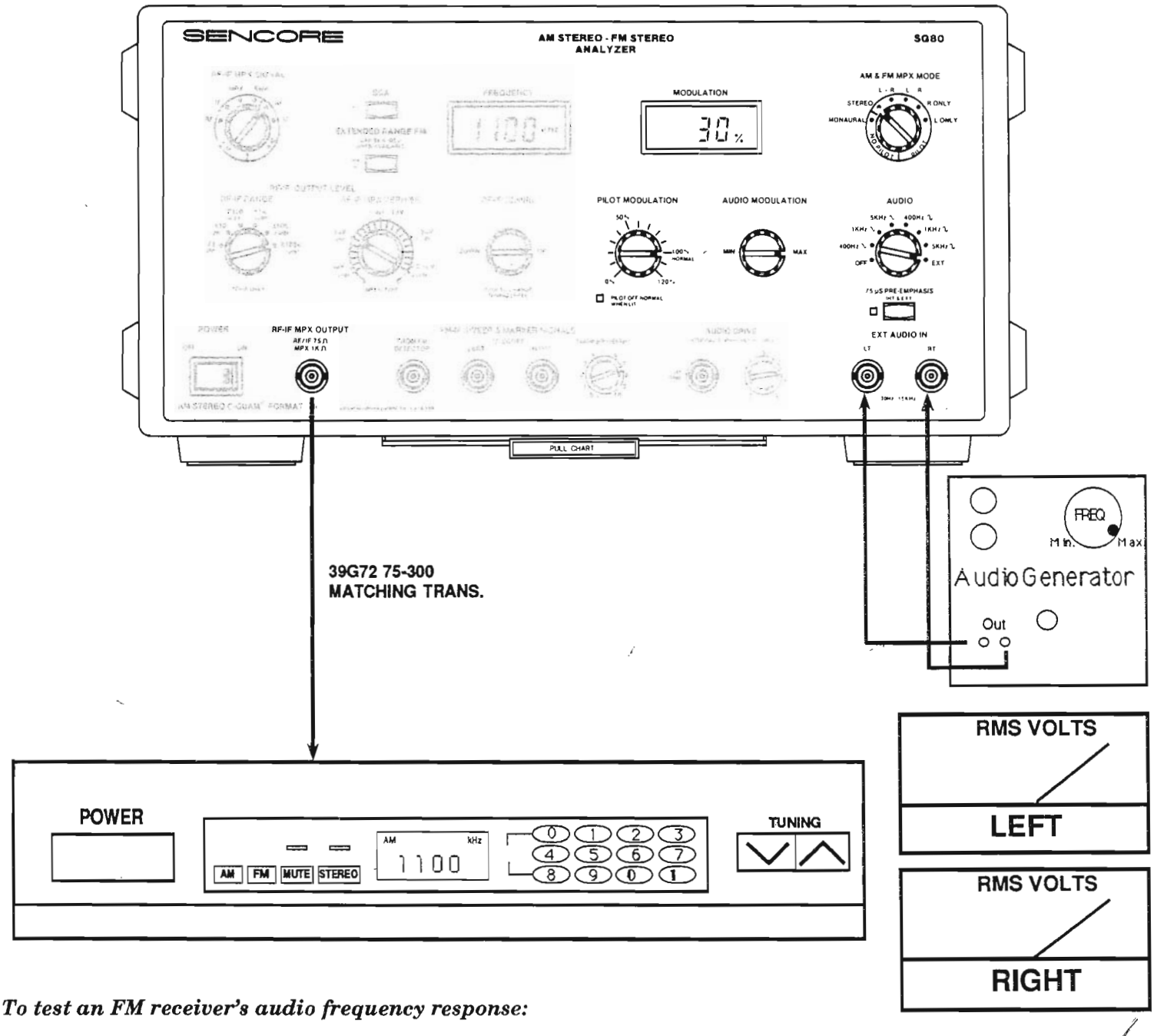
1. Set the SG80 and the receiver as described in the "Using A Standard AM Mono And Stereo Setup" on page 36.
2. Ensure the receiver stereo pilot indicator is on.
3. Select the R ONLY position of the AM & FM MPX MODE control.
4. Measure the right and left channel outputs of the receiver and calculate the separation: dB = 20 log left channel/right channel, or subtract the dBm level of both channels.
5. Select the L ONLY position of the AM & FM MPX MODE control.
6. Compare the difference in the left and right output of the tuner/receiver under test. Calculate the left to right separation: dB = 20 log right channel/ left channel, or subtract the dBm level of both channels.

AM RECEIVER AUDIO FREQUENCY RESPONSE

This test indicates the receivers response to receiving and amplifying the full range of audio frequencies from 20 Hz to 15 Khz.

This test identifies any response problems that may show in symptoms ranging from no stereo to poor audio.

Use the EXT AUDIO IN to supply the signal from a standard generator providing 3 volts RMS.



To test an FM receiver's audio frequency response:

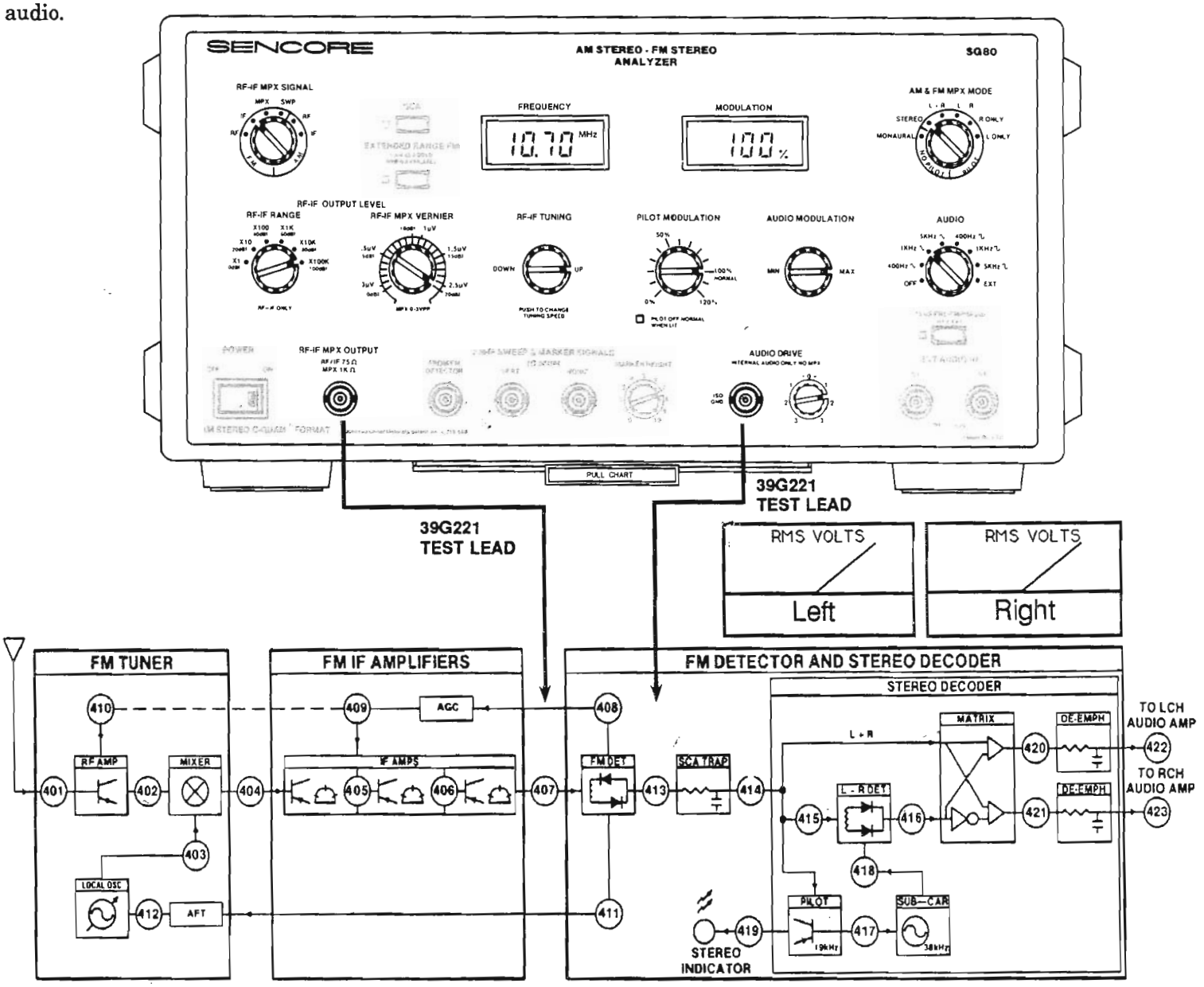
1. Set SG80 and receiver as discussed in the "Using A Standard AM Mono And Stereo Setup" on page 36.
2. Set the AUDIO switch to EXT position.
3. Connect an external audio generator to the EXT AUDIO IN jacks.
4. Set audio generator for maximum audio frequency.
5. Set the AUDIO MODULATION control for 30% modulation and measure the receiver's output level in dBm.
6. Vary the audio generator frequency. Measure left and right output level at each frequency desired.
7. The frequency response of the receiver is between the frequencies whos level is +/- 1/2 dB of the level at in step 5.

FM STEREO RECEIVER TROUBLESHOOTING AND ALIGNMENT

TESTING THE FM DETECTOR

The FM detector is responsible for converting the IF signal to a standard MPX signal. A defective FM detector can cause defects ranging from no audio to noisey audio.

The SG80 allows you to prove the FM detector stage is good or bad, without a doubt and gain confidence while you save time and money.



To test FM detector stages:

1. Set the AUDIO DRIVE control to the +1 position.
2. Set the AUDIO control to 1 kHz sine.
3. Connect the 39G221 TEST LEAD to the SG80's AUDIO DRIVE output and to the output of the FM detector as shown above.
4. Monitor the receiver output for improvement in audio.
5. Set the RF-IF MPX SIGNAL control to FM IF.
6. Adjust the RF-IF OUTPUT LEVEL controls to produce to 250k uV.

NOTE: *If an improved audio tone is heard, then all stages after the audio detector are good.*

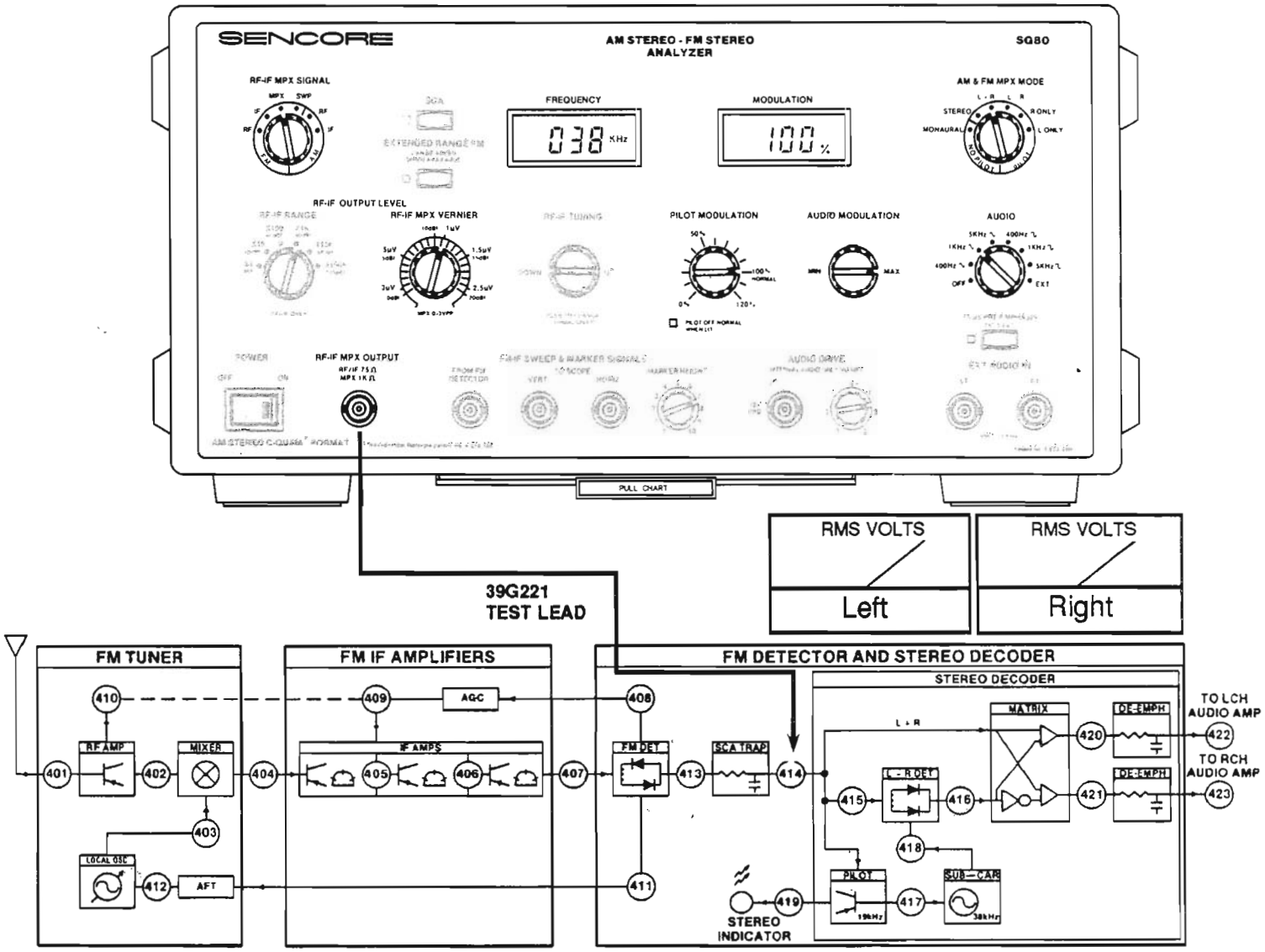
7. Adjust the PILOT MODULATION to 100%.
8. Connect 39G221 TEST LEAD from the RF-IF MPX OUTPUT to the input of FM detector.
9. Monitor output of the receiver for an improvement in audio.

NOTE: *If improvement in the audio tone is heard, then the FM detector is good.*

IDENTIFYING DEFECTIVE FM DECODER STAGES

The FM decoder converts the MPX signal to stereo audio. The decoder is the primary circuit responsible for the reproduction of stereo audio and controls the stereo separation.

The SG80 allows you to positively identify the FM decoder bad and take the frustration out of stereo servicing. Exclusive variableFM MPX drive signal and stereo mode selections make decoder troubleshooting a snap.



To identify defective FM decoder stages:

1. Set the RF-IF MPX SIGNAL control to FM MPX.
2. Adjust the RF-IF MPX VERNIER to 1 V. (1uV)
3. Connect the 39G221 TEST LEAD to the RF-IF MPX OUTPUT.
4. Set the AUDIO control to 1 kHz and the AUDIO MODULATION to 100%.
5. Set AM & FM MPX MODE control to the L+R position.
6. Set to the PILOT MODULATION control for 100% modulation and note if the receiver's stereo pilot indicator is on.
7. Connect the test lead to the MPX input of the receiver.
8. Monitor the receiver's left and right output for sound.

NOTE: *Equal output should be obtained from both outputs*

9. Set the AM & FM MPX MODE control to the L-R position.
10. Monitor the receiver's left and right output for sound.

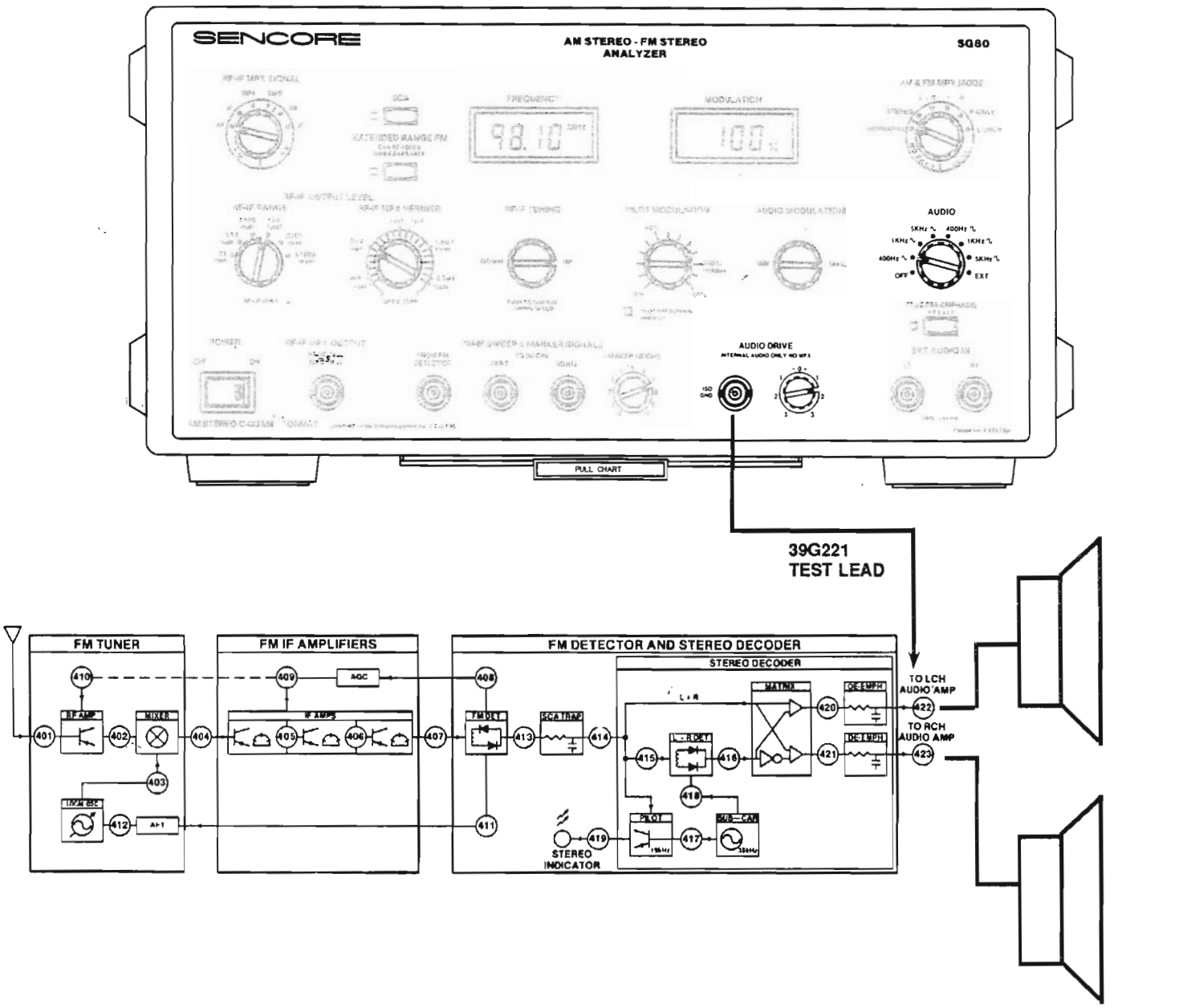
NOTE: *No change in output should be seen from step 8.*

11. Set the AM & FM MPX MODE control to the R only position.
12. Monitor the receiver's left and right output for sound.

NOTE: *Audio should come from the right channel only*

SIGNAL INJECTION INTO AUDIO STAGE

Isolate audio amplifier problems faster with the SG80 than ever before with audio drive signals to any audio stage. Test audio amplifier stages with sine or square waves provided or use external generator for more complete analysis. Low distortion audio sinewave output of less than .02% can be used to test amplifier distortion.



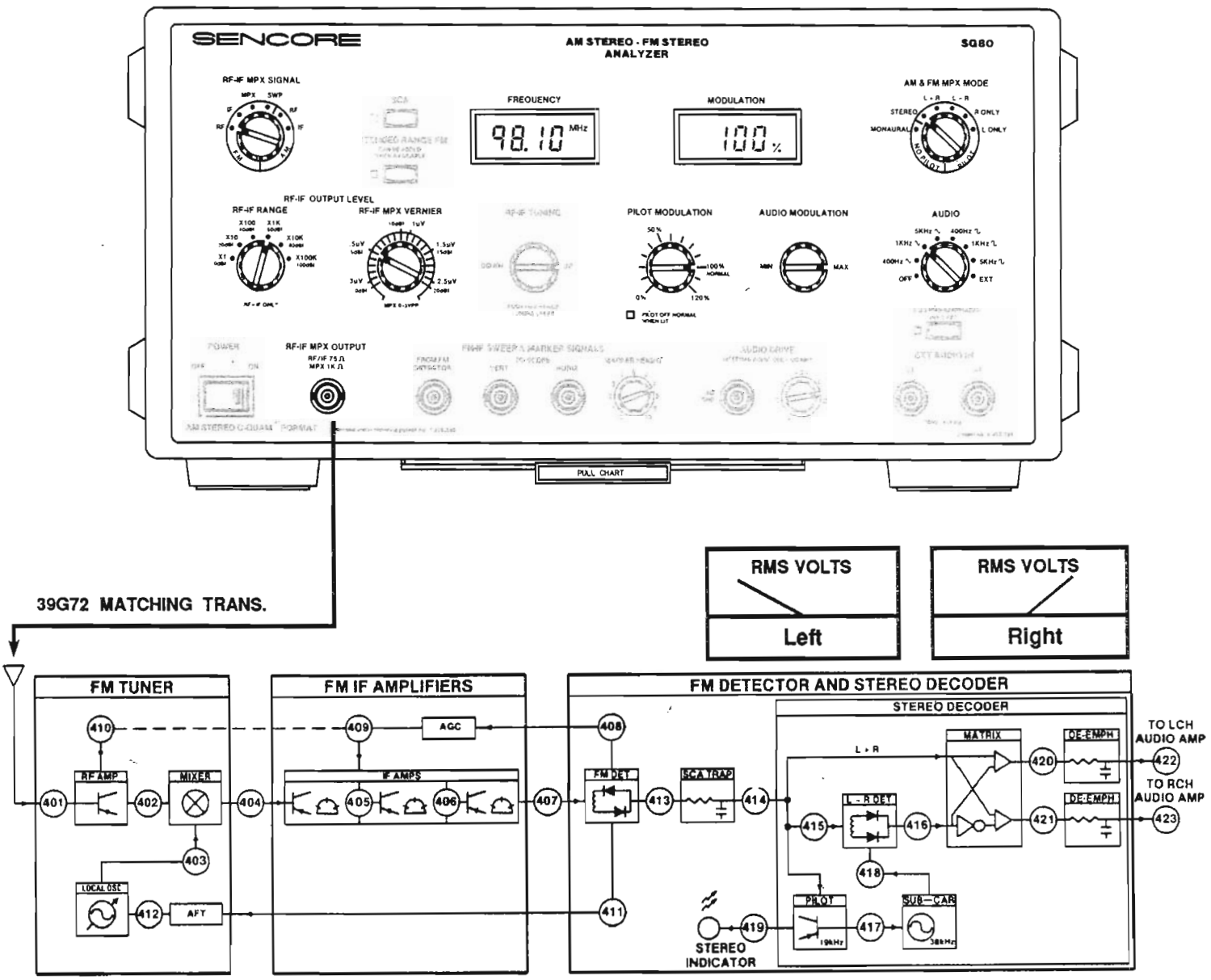
To signal inject into audio stage:

1. Set the AUDIO control to 400 Hz.
2. Set the AUDIO DRIVE to 1 or match the circuit's signal level.
3. Connect the 39G221 TEST LEAD to the audio amplifier.
4. Adjust the AUDIO DRIVE level for undistorted sound.

ADJUSTING FM STEREO SEPARATION

This adjustment aligns the stereo decoder circuit for maximum separation between left and right audio signals.

Superior stereo separation specifications of the SG80 to 65dB enable highly accurate adjustments on even the most expensive FM stereo receivers.



To adjust FM stereo separation:

1. Set the SG80 and the FM receiver according to the procedure under "USING STANDARD INPUT REF ERENCE SIGNALS" on page 25.
2. Switch the AM & FM MPX MODE to STEREO.
3. Set the PILOT MODULATION control to 100% at 1kHz.

NOTE: *Check to see that the receiver's stereo indicator light is on and the receiver has equal output from both channels.*

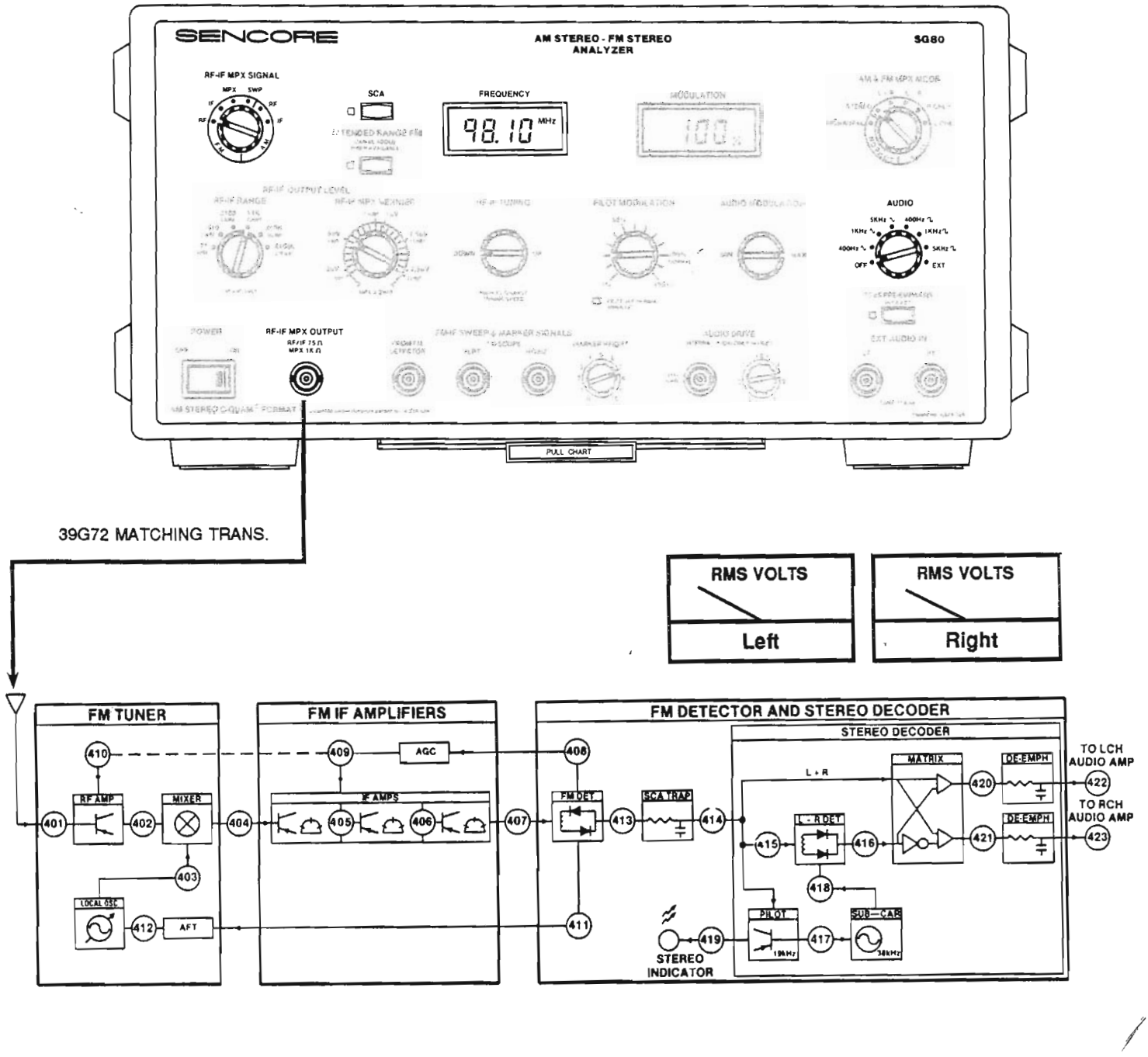
4. Set the AUDIO MODULATION to 100%.
5. Switch the AM & FM MPX MODE to R ONLY.
6. Measure Right and Left Channel outputs.
7. Turn separation controls for maximum separation.
8. Switch the AM & FM MPX MODE to L ONLY.
9. Fine adjust separation controls for maximum separation.

NOTE: *Repeat steps 5 through 9 for best compromise in setting*

ADJUSTING FM SCA TRAPS

This adjustment filters out the SCA signal so it does not cause interference to the stereo signal.

The SG80 ynamically aligns the SCA trap with an EIA standard 67 Khz SCA signal added to the stereo MPX signal automatically by the SG80. This dynamic method insures minimal interference to FM reception and give you added peace of mind knowing its right.



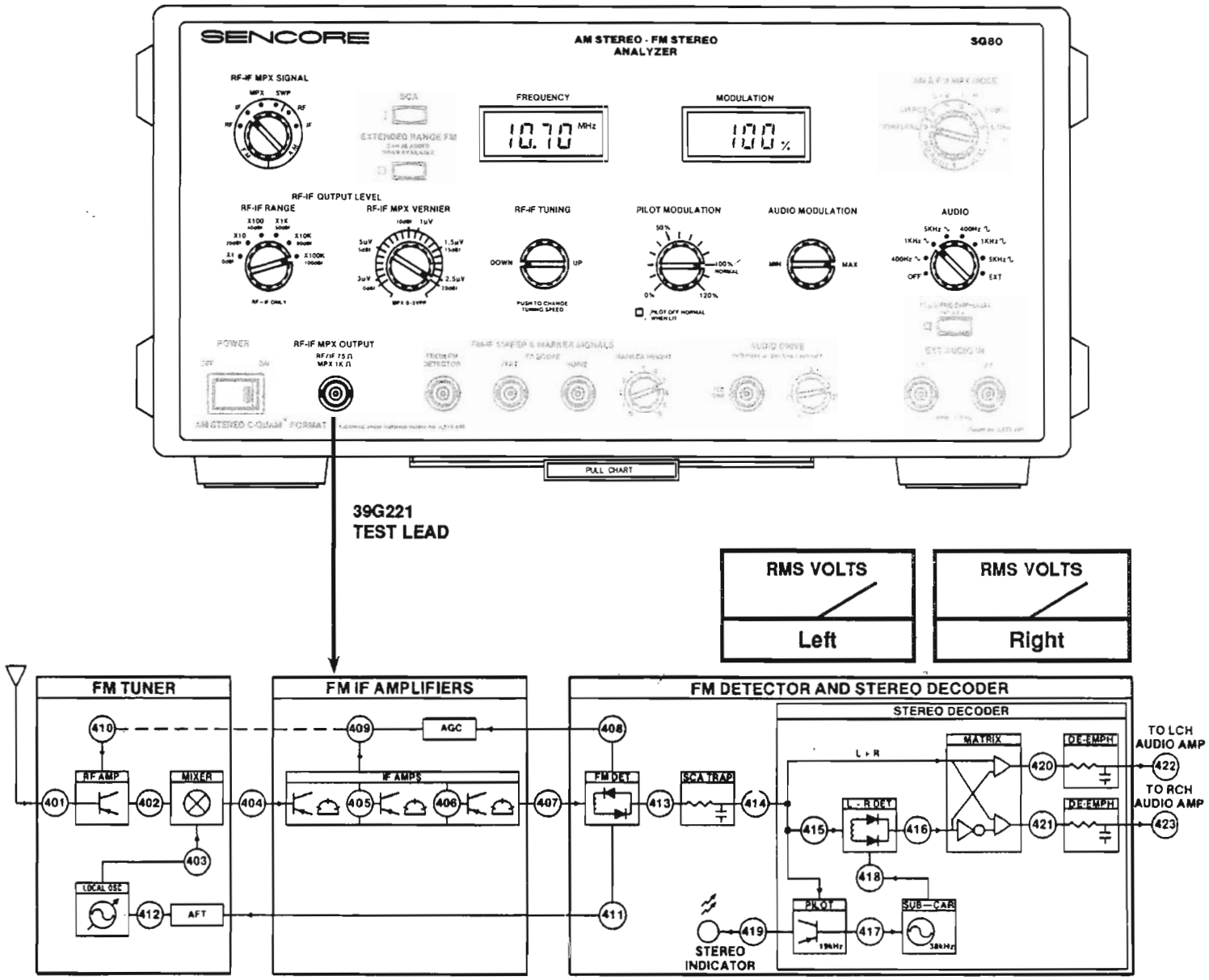
To set SCA traps:

1. Set the SG80 and the FM receiver according to the procedure under "Using Standard Input Reference Signals".
2. Check to see that the receiver's stereo indicator is on.
3. Switch the AUDIO to OFF.
4. Push the SCA button ON.
5. Monitor left and right channel outputs.
6. Adjust SCA trap for minimum audio in outputs.

IDENTIFYING DEFECTIVE FM IF STAGES

Use the SG80 to positively isolate defective or misaligned FM IF stages before you begin replacing parts. A crystal accurate 10.7 Mhz FM IF drive signal, variable in frequency and level to match any IF stage, provides the versatility to isolate and conquer any bad IF stage.

A defective If stage can produce noisey audio, poor separation, or have no output at all. Simply connect the SG80 to the separate IF stages and monitor the receiver's output for improvement.

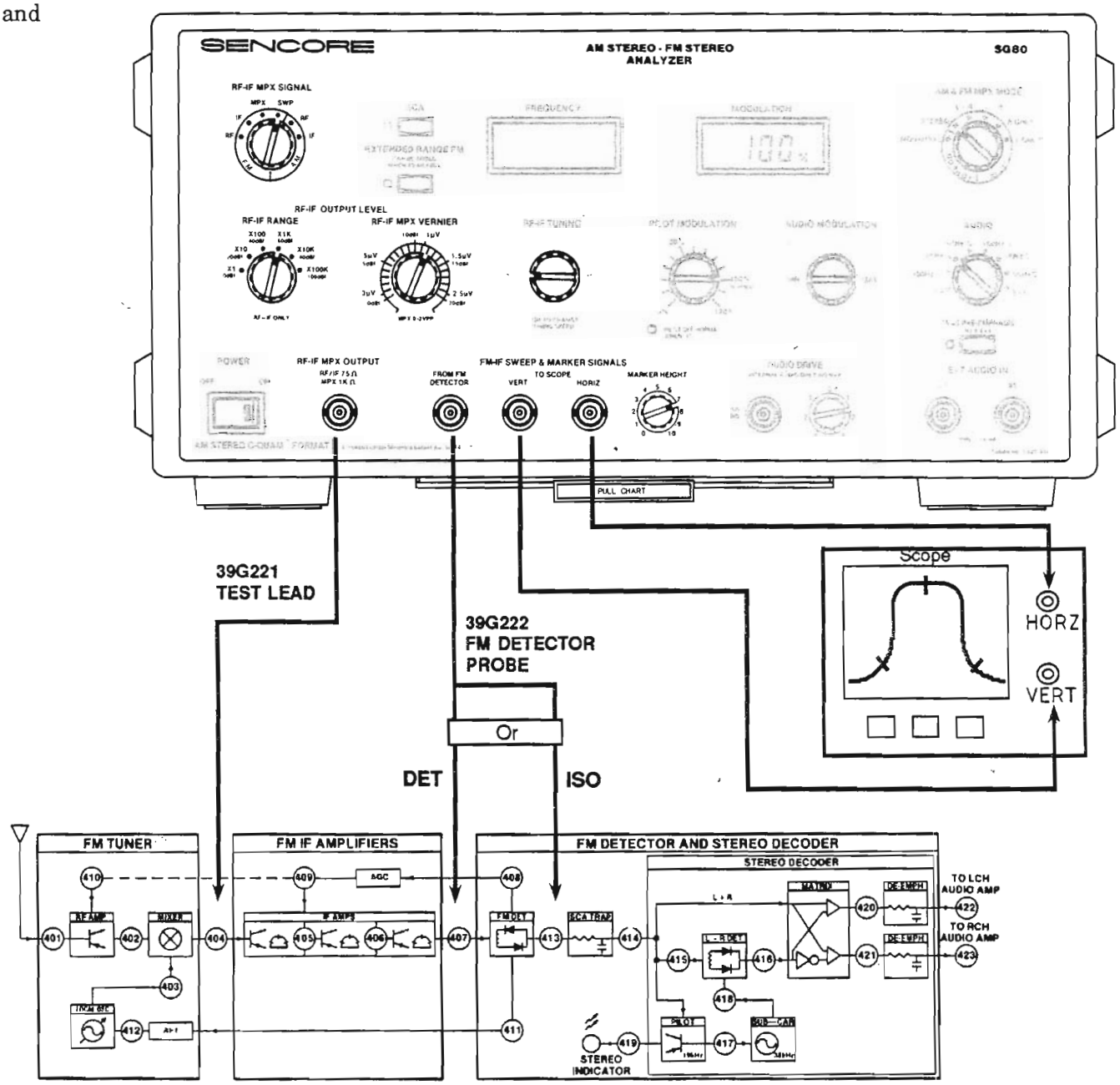


To identify defective FM IF stages:

1. Set the RF-IF MPX SIGNAL control to FM IF
2. Set the AUDIO to 1 KHz.
3. Set the PILOT MODULATION control and the AUDIO MODULATION control to 100% modulation.
4. Adjust the RF-IF OUTPUT LEVEL controls for 250k uV.
5. Connect 39G221 TEST LEAD to the output of last IF stage.
6. Monitor the receiver's output for an improvement in audio NOTE: If an audio tone is heard, all stages after the injection point are good.
7. Reduce the RF-IF OUTPUT LEVEL controls level just above noise.
8. Connect to input of preceding IF stage.
9. Monitor for output NOTE: If no audio tone is heard, then the IF stage is defective.
10. Repeat steps 7 through 9 up to the output of the mixer to isolate defective stage.

SWEEP TEST AND ALIGN FM IF STAGES

Use the SG80 to restore the receiver to a factory fresh condition and eliminate adjustment errors with precise adjustments made possible by a comprehensive sweep test of the IF and FM detector. Test and adjust critical IF and Detector stages for best receiver performance and ensure customer satisfaction. A wide FM-IF sweep lets you see the complete IF and detector response with crystal accurate markers to identify sweep points. The sweep center frequency is adjustable to match ceramic IF stages or to identify alignment problems.



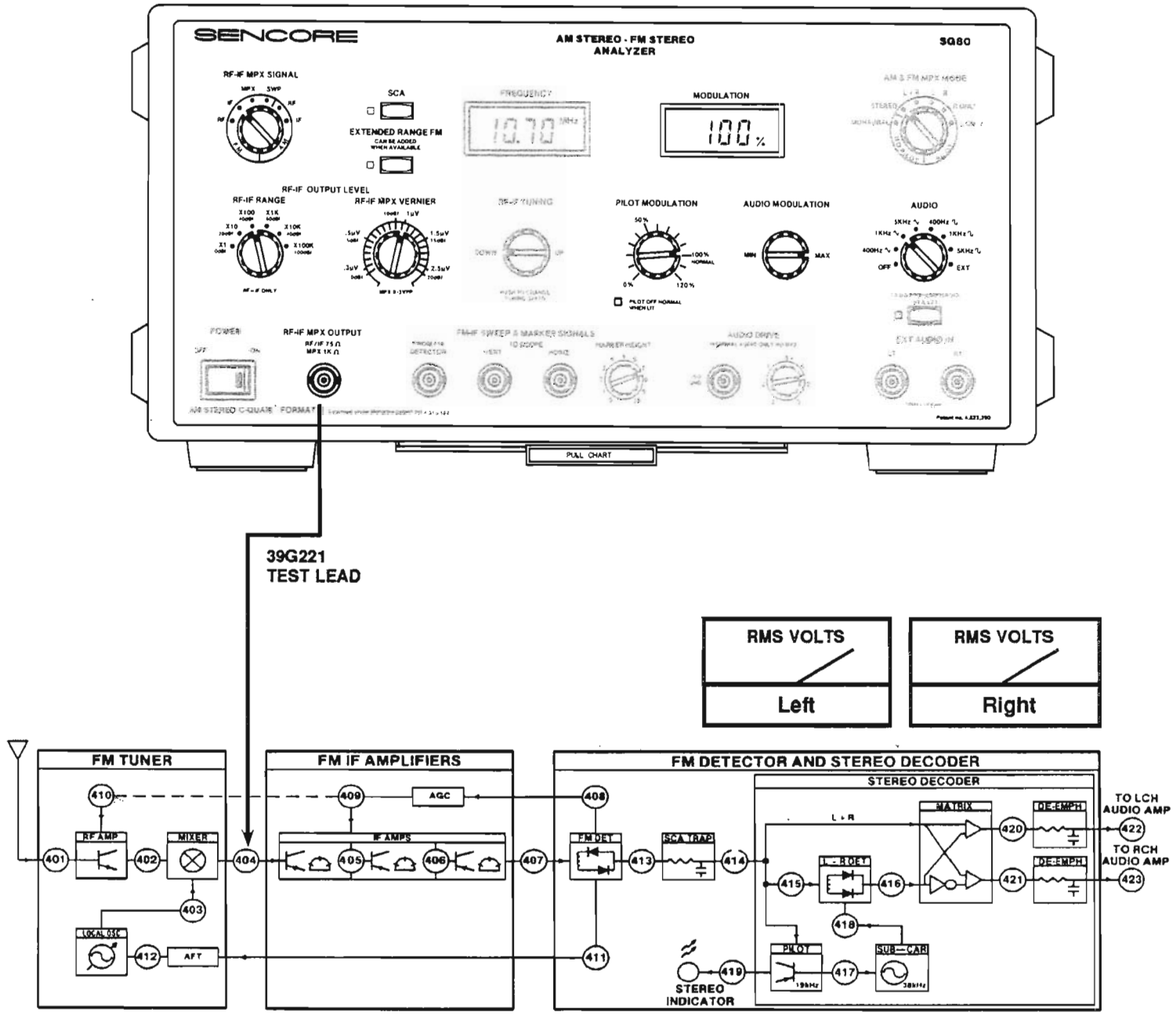
To sweep test and align FM IF stages:

1. Set the RF-IF MPX SIGNAL control to FM SWP.
2. Connect the TO SCOPE VERT and HORIZ to an oscilloscope.
3. Connect the DET lead of the 39G222 FM DET PROBE to last stage of IF amp section of the re ceiver.
4. Connect the 39G221 TEST LEAD to the input of IF stages.
5. Adjust the RF-IF OUTPUT LEVEL controls for the lowest level yeilding a response curve.
6. Adjust the MARKER HEIGHT control for the best viewable marker height. (If overdriven the response curve will flatten.)
7. Tune the RF-IF TUNING control for best centering of response curve. (The frequency display represents the largest marker.)
8. Adjust IF interstage transformers for symmetrical response.

***NOTE**: Some receivers may use several IF bandwidths. Repeat the procedures for each bandwidth.*

IDENTIFYING DEFECTIVE FM RF/MIXER STAGES

The SG80 pinpoints the trouble to the RF or Mixer stage and eliminate confusing signal tracing in the receiver's tuner.



To identify defective FM RF mixer stages:

1. Set the RF-IF MPX SIGNAL control to FM IF.
2. Set the AUDIO to 1 KHz.
3. Set the PILOT MODULATION control and AUDIO MODULATION control for 100% modulation.
4. Set the RF-IF OUTPUT LEVEL controls for 100 uV.
5. Connect the 39G221 TEST LEAD to the input of the first IF stage.
6. Monitor the output of the receiver for audio.

NOTE: *If an audio tone is heard, then all stages after the injection point are good.*

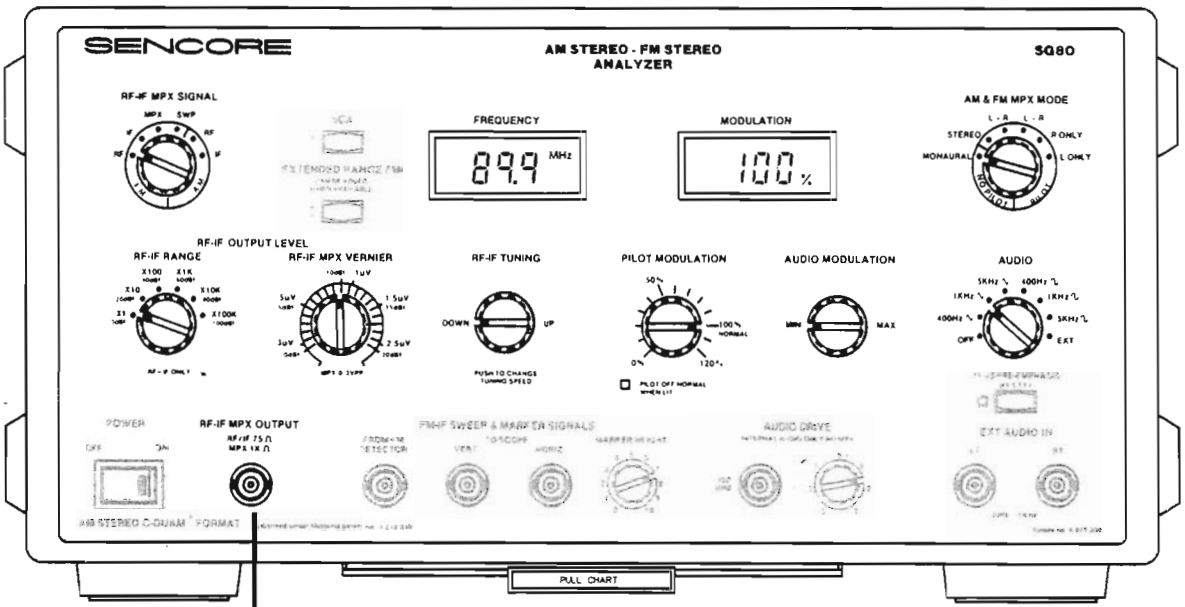
If the audio is good:

7. Set the RF-IF OUTPUT LEVEL controls for 65 dBf.
8. Switch the RF-IF MPX SIGNAL control to FM RF.
9. Connect the SG80 to the receiver's antenna terminals.
10. Monitor the receiver for audio output. NOTE: If no audio tone is heard, then the RF amp/Mixer stage is defective.

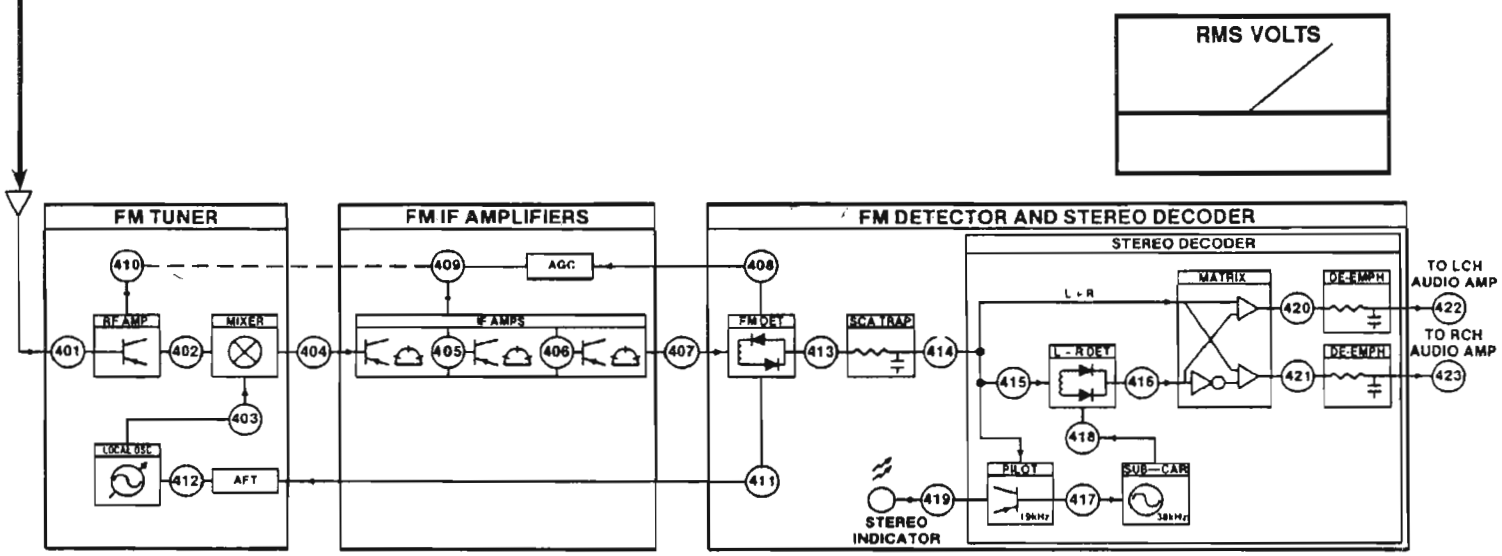
PEAK ALIGN FM RF STAGES

This alignment procedure produces peak performance from the tuner across the entire FM band.

The SG80 makes these RF alignments easy with highly stable and accurate RF signals and the ease of digital tuning and calibrated level verniers.



39G72 MATCHING TRANS.



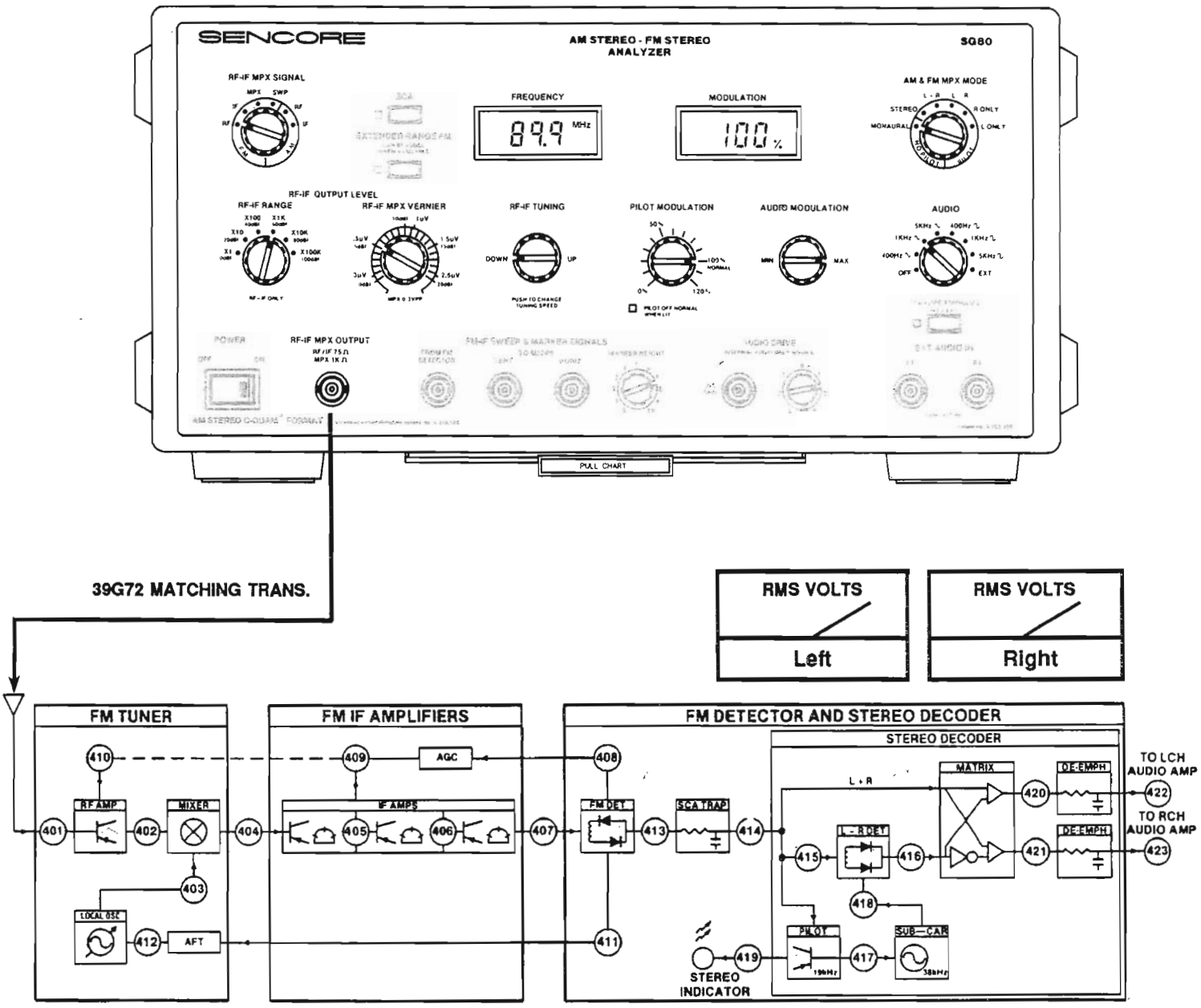
To peak align an FM RF stage:

1. Follow the "Using Standard Input Reference Signals" section on page 25.
2. Set the RF-IF OUTPUT LEVEL controls for 10 dBf or the sensitivity of the receiver. (see page 27 for test)
3. Tune the RF-IF TUNING control for 89.9 MHz.
4. Switch the AUDIO to 1 kHz.
5. Set the AM & FM MPX MODE to MONAURAL.
6. Set the PILOT MODULATION control and AUDIO MODULATION control to 100% modulation.
7. Tune receiver to 89.9 MHz.
8. Monitor the output of the receiver
9. Tune interstage transformer between RF amp and Mixer for highest receiver output.
10. Tune the RF-IF TUNING control to 106.1 MHz.
11. Tune receiver to 106.1 MHz.
12. Reduce RF-IF MPX VERNIER until noise is just heard in the output audio.
13. Tune antenna coupling capacitor for maximum output.

ADJUSTING FM TUNING RANGE

This adjustment insures accurate FM band tuning from the lowest to highest FM channel.

The SG80's transmitter accurate FM RF signals, with wrap-around digital tuning steps provide ease of use to get the job done quickly and know its done right.

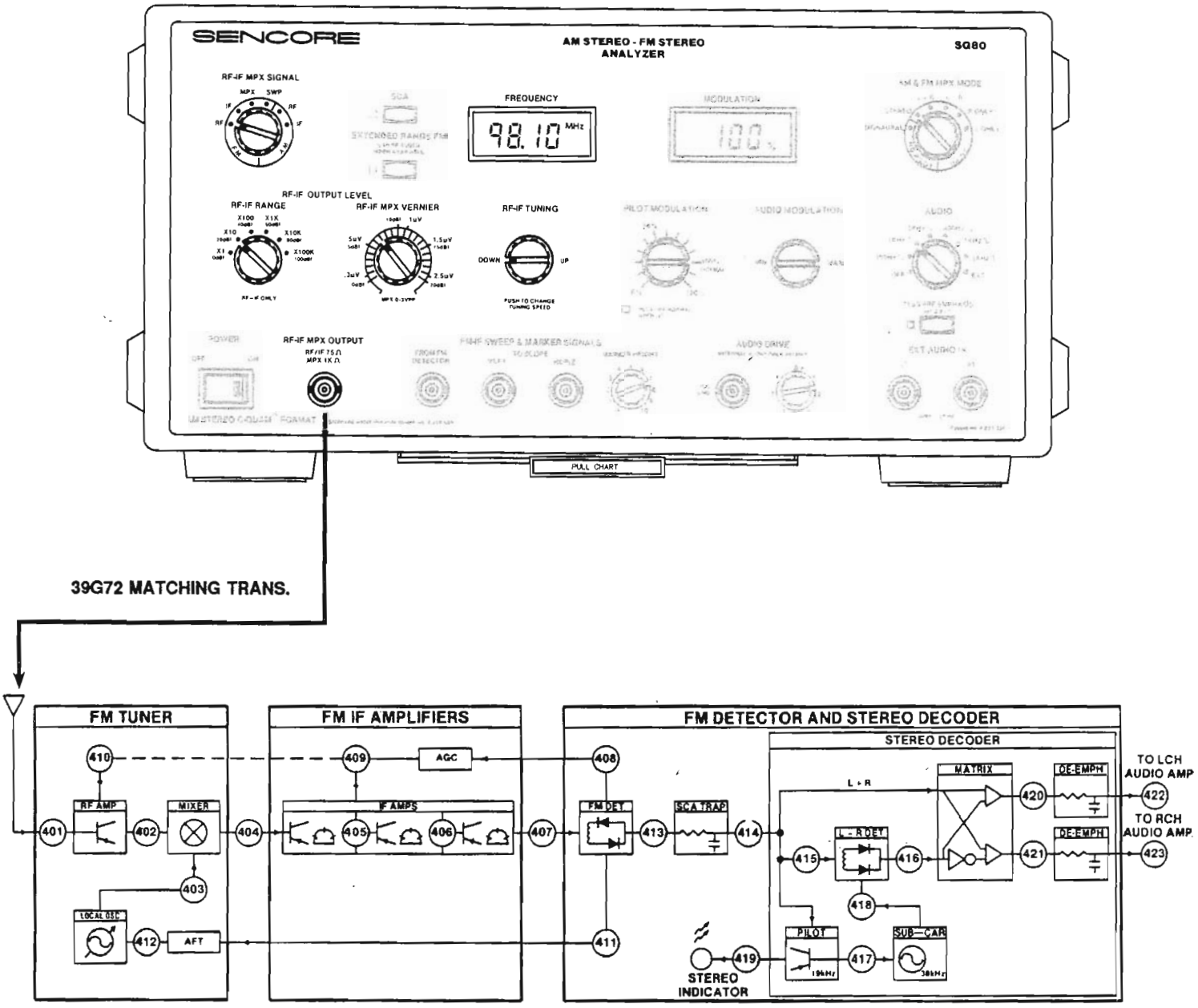


To adjust FM tuning range:

1. Switch the RF-IF MPX SIGNAL control to FM RF.
2. Set the RF-IF OUTPUT LEVEL controls for 65 dBf.
3. Set the RF-IF TUNING control to 89.9 MHz.
4. Set the AM & FM MPX MODE to MONAURAL.
5. Set the AUDIO to 1 KHz.
6. Set both the PILOT MODULATION and AUDIO MODULATION controls to 100% modulation.
7. Connect 39G72 MATCHING TRANS. to the SG80 and receiver antenna terminals.
8. Tune radio to 89.9 MHz.
9. Monitor audio output.
10. Adjust low tuning adjustment for max audio output.
11. Tune the RF-IF TUNING control to 106.1 MHz.
12. Tune radio to 106.1 MHz.
13. Tune high tuning adjustment for max audio output.

ADJUSTING FM AUTO-SEEK CIRCUITS

This alignment insures that the auto seek tuning circuits are properly aligned and trigger at the proper level. The SG80's accurate calibrated output vernier allows quick adjustment of the receiver to the manufacturers specified level.



To adjust FM auto seek circuits:

1. Set the RF-IF MPX SIGNAL control to FM RF.
2. Set the RF-IF OUTPUT LEVEL controls to match the level specified in the receiver's service manual.
3. Set the RF-IF TUNING control to 98.10 MHz.
4. Connect 39G72 MATCHING TRANS. to the receiver's antenna terminals.
5. Place receiver in auto search mode.

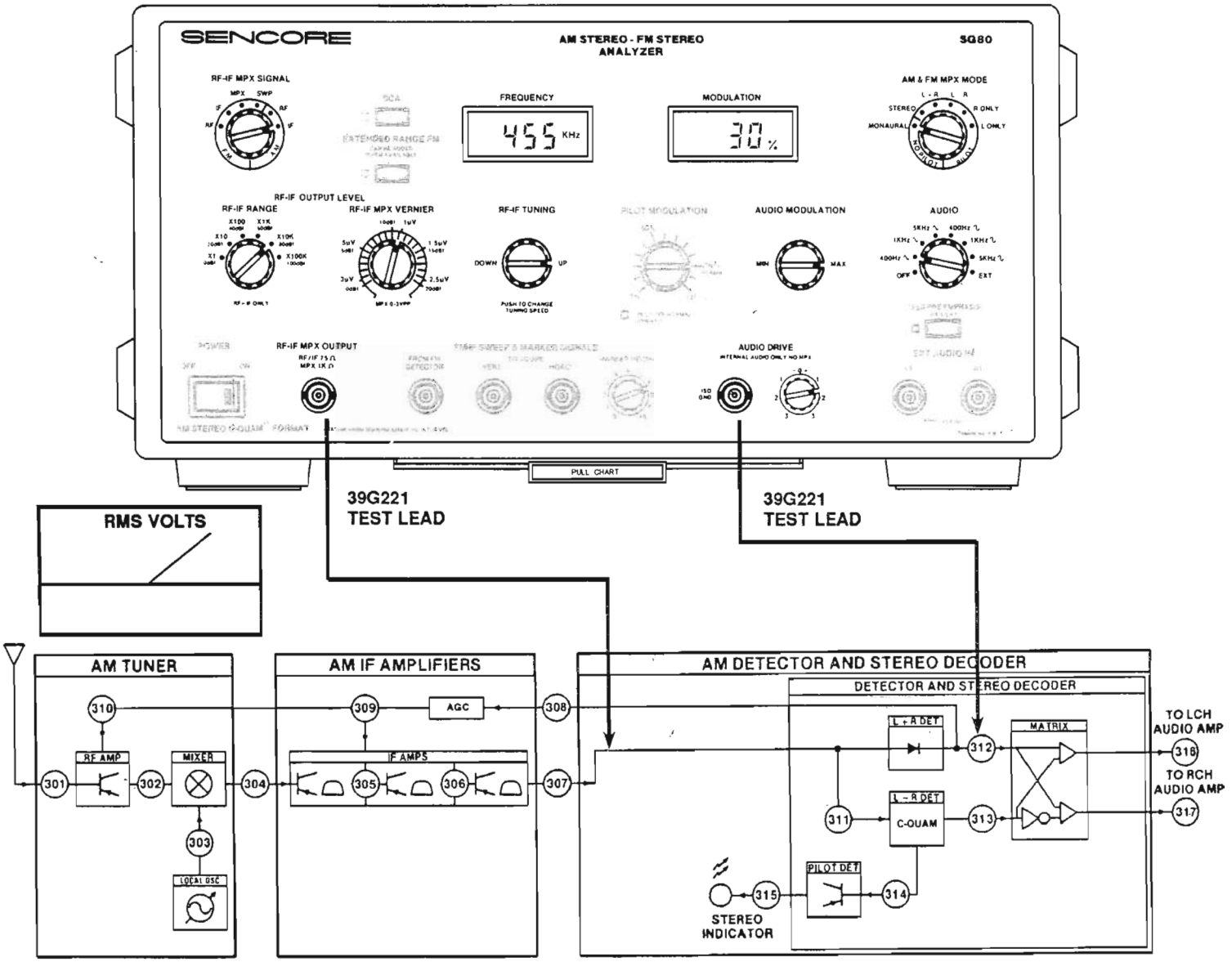
NOTE: *Determine if tuning stops at 98.1 MHz.*

6. Adjust level of auto search control until the receiver just locks onto 98.1 MHz when placed in the auto search mode.

AM STEREO RECEIVER TROUBLESHOOTING AND ALIGNMENT

TESTING AM DETECTOR STAGE

The SG80 allows you to quickly isolate the problem to the AM detector and eliminate costly guess work or unnecessary alignments.



To isolate an AM detector stage:

1. Set the AUDIO DRIVE control to +1.
2. Set the AUDIO control to 400 Hz.
3. Connect the 39G221 TEST LEAD to the output of the AM detector.
4. Monitor the audio output. Adjust the AUDIO DRIVE control for the clearest audio output.

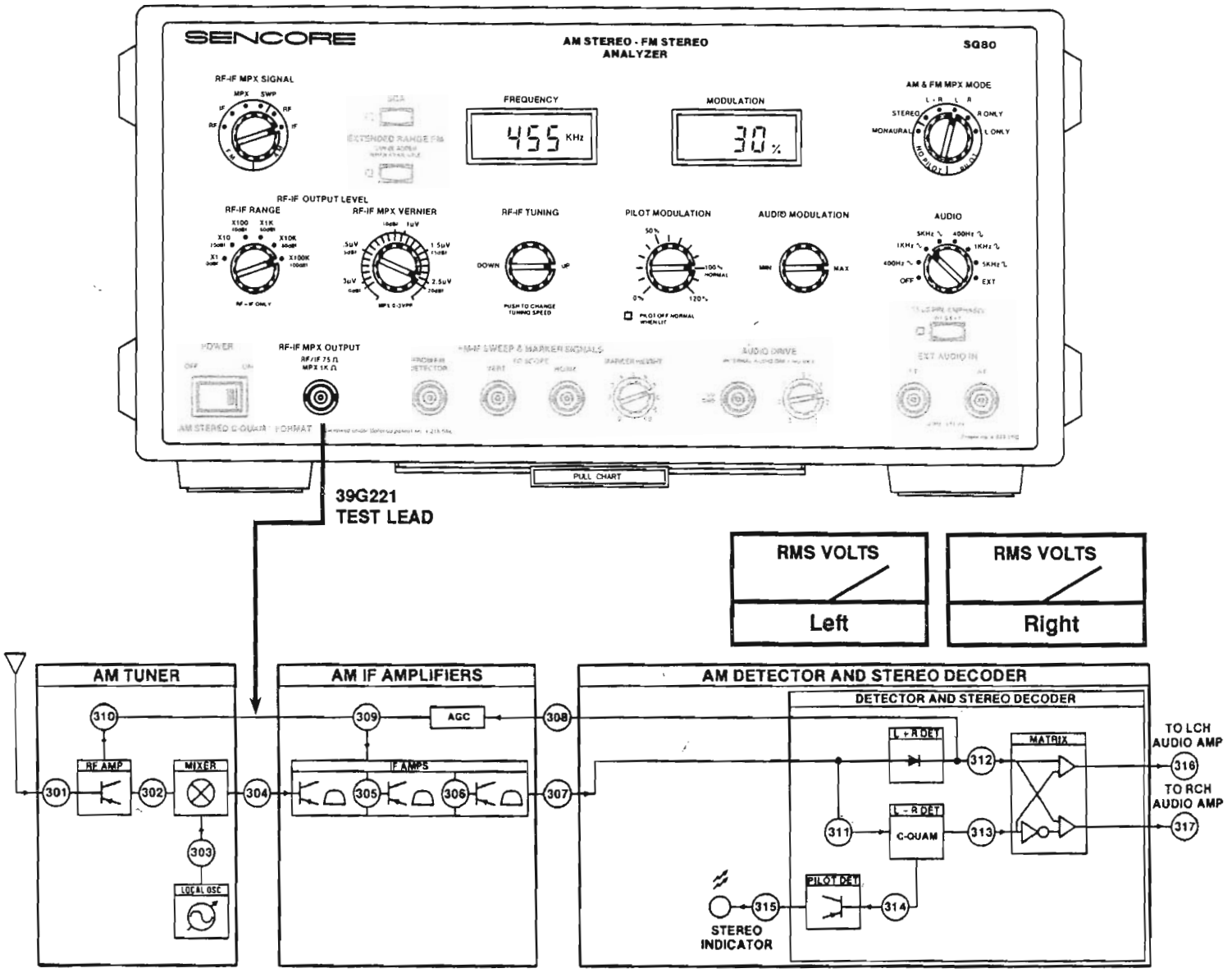
NOTE: *If a good audio tone is heard all stages after the detector are good. If not, troubleshoot the audio amplifier stages.*

5. Set the RF-IF MPX SIGNAL control to AM IF.
6. Tune the RF-IF TUNING control to the IF frequency of AM receiver. (455 or 262 kHz)
7. Set the AM & FM MPX MODE control to MONAURAL.
8. Set the AUDIO MODULATION control to 30%.
9. Set the RF-IF OUTPUT LEVEL controls for 10kuV.
10. Connect the 39G221 TEST LEAD to the detector input.
11. Monitor the receiver's audio output.

NOTE: *If a good audio tone is heard AM detector is good.*

IDENTIFYING DEFECTIVE AM STEREO DECODER STAGE

Isolate tough stereo problems to the decoder circuit or prove it good in seconds with exclusive IF C-Quam stereo drive signal and choice of MPX AM stereo mode.



To identify a defective AM stereo decoder stage:

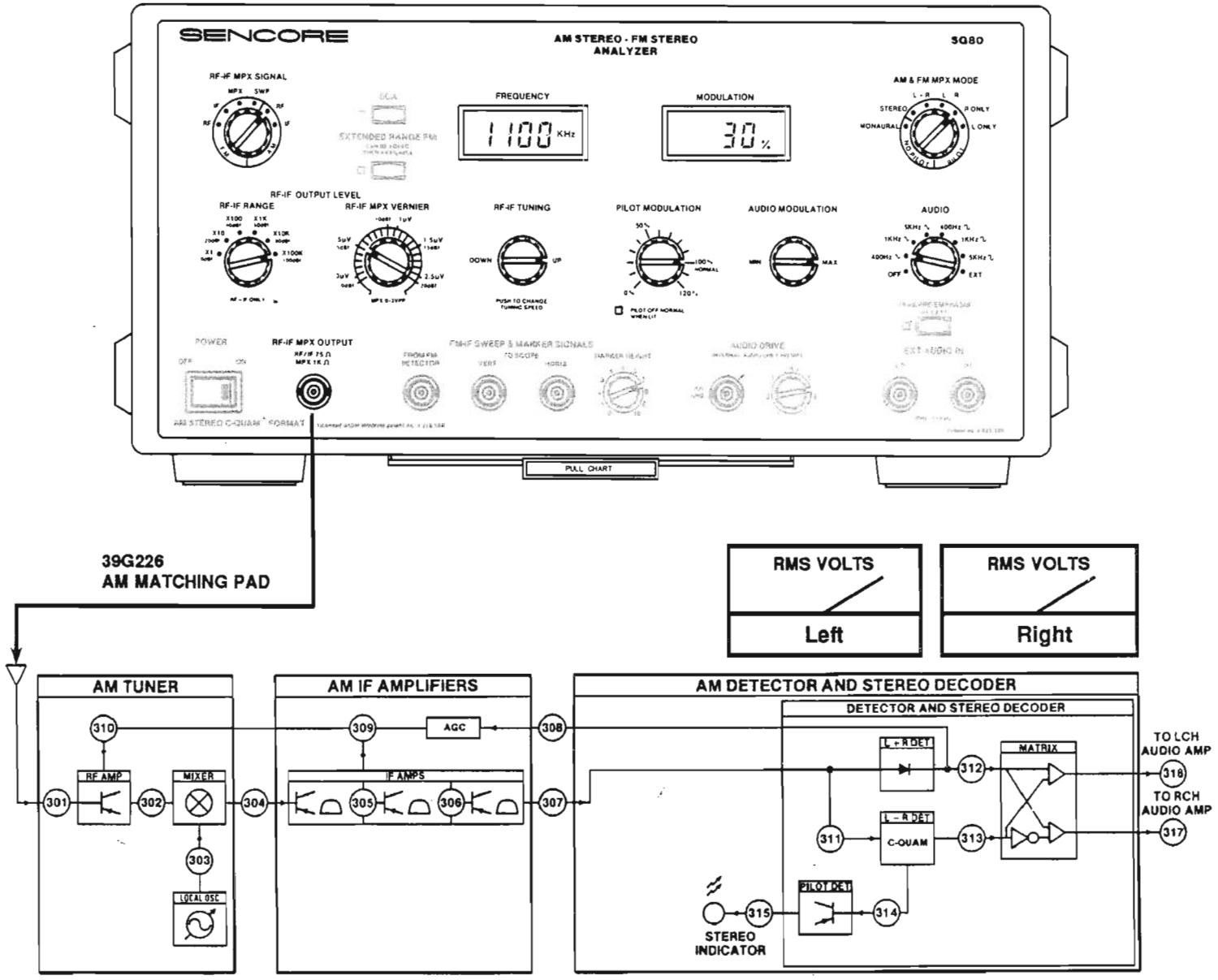
1. Set the RF-IF MPX SIGNAL control to AM IF.
2. Tune the RF-IF TUNING control to the receiver's to IF frequency.
3. Connect the 39G221 TEST LEAD to the IF input of the receiver.
4. Set the AUDIO control to 1 kHz.
5. Set the RF-IF OUTPUT LEVEL controls for 250K uV.
6. Set the AM & FM MPX MODE control to L+R.
7. Set the PILOT MODULATION control to 100%.
8. Set the AUDIO MODULATION control to 30% modulation.
9. Ensure that the receiver's stereo pilot light is on.
10. Monitor the receiver's audio output for equal left and rightoutput.
11. Switch the AM & FM MPX MODE control to L-R.
12. Monitor for equal left and right output.
13. Switch the AM & FM MPX MODE control to R only.
14. Monitor for right output only.
15. Switch the AM & FM MPX MODE control to L only.
16. Monitor for left output only.

***NOTE**: Failure to provide stereo separation indicates defective decoder stage.*

ADJUSTING AM STEREO SEPARATION

This adjustment aligns the C-Quam decoder circuit for maximum separation between left and right output signals.

Superior C-Quam stereo separation specifications of the SG80 enable accurate alignment of all AM C-Quam receivers.

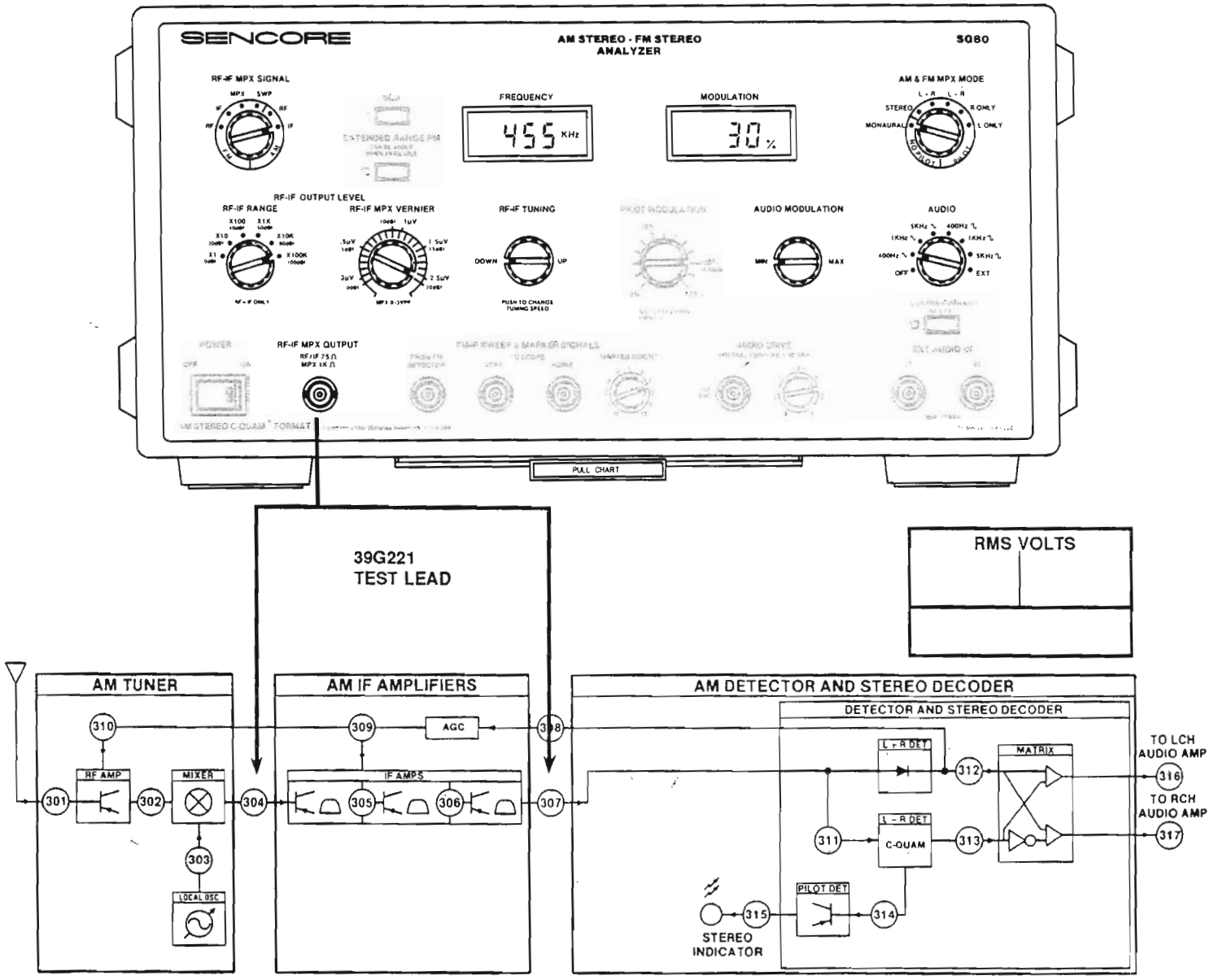


To adjust AM stereo separation:

1. Set the SG80 and the AM receiver according to the procedure under "Using A Standard AM Mono And Stereo Setup" as shown on page 36.
2. Ensure that the receiver's Stereo Pilot indicator on receiver is on.
3. Switch the AM & FM MPX MODE control to R ONLY.
4. Measure Right and Left Channel outputs. Turn the receiver's separation controls for maximum separation.
5. Switch the AM & FM MPX MODE control to L ONLY.
6. Fine adjust the receiver's separation control for maximum separation.
7. Repeat steps 3 through 6 for best compromise in setting.

IDENTIFYING DEFECTIVE AM IF STAGES

Usxe the SG80 to isolate the cause of weak or noisy signal to the defective AM IF stage in half the time with exclusive transmitter quality IF drive signals. Tuneable AM IF, with crystal accuracy, isolates IF problems or misalignment in any AM receiver. Adjustable output drive level matches the input level to any IF stage.



To identify defective AM IF stages:

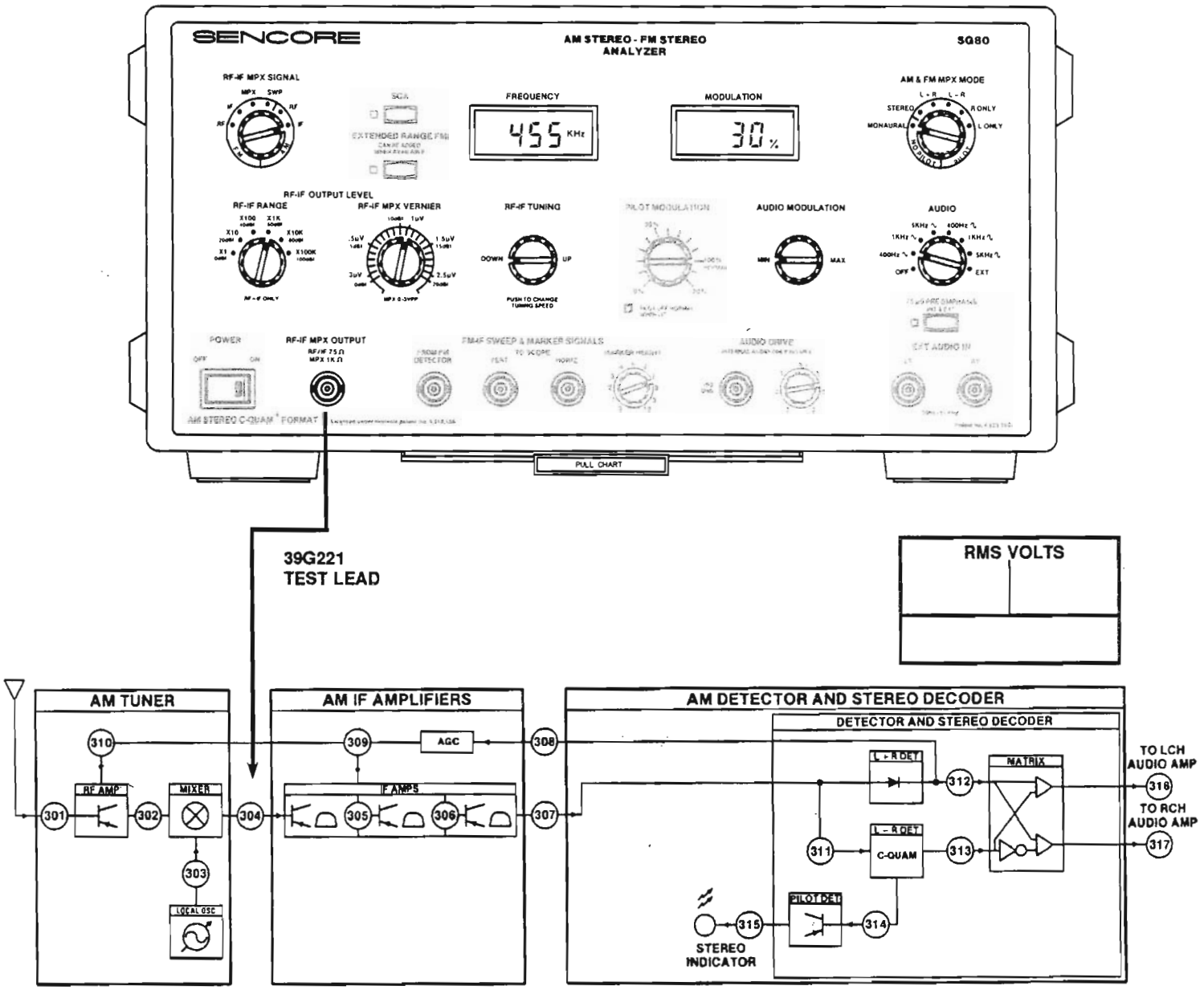
1. Set the RF-IF MPX SIGNAL control to AM IF.
2. Tune the RF-IF TUNING control to the IF frequency of receiver.
3. Set the AUDIO control to 400Hz.
4. Set the AM & FM MPX MODE control to MONAURAL.
5. Set the AUDIO MODULATION control to 30% modulation.
6. Set the RF-IF OUTPUT LEVEL controls for 250K uV.
7. Connect 39G221 TEST LEAD to input of AM detector.
8. Monitor the receiver for audio output. If tone is heard, all stages after injection point are good.
9. Reduce the SG80's RF-IF level to just above noise.
10. Connect to input of preceding IF stage in the receiver.
11. Monitor for a noise free audio output. Noise indi cates a defective IF stage.
12. If noise free, repeat steps 9 through 11 up to the output of the mixer.

NOTE: *The level obtained in Step 9 should be less than the level of the IF amplifier stages closer to the mixer if the stage is amplifying properly.*

AM IF ALIGNMENT

This alignment insures best receiver sensitivity and selectivity to provide peak receiver performance.

The SG80's highly stable and accurate IF signals prevent adjustment errors. IF signal can be varied to locate any misaligned IF stages.



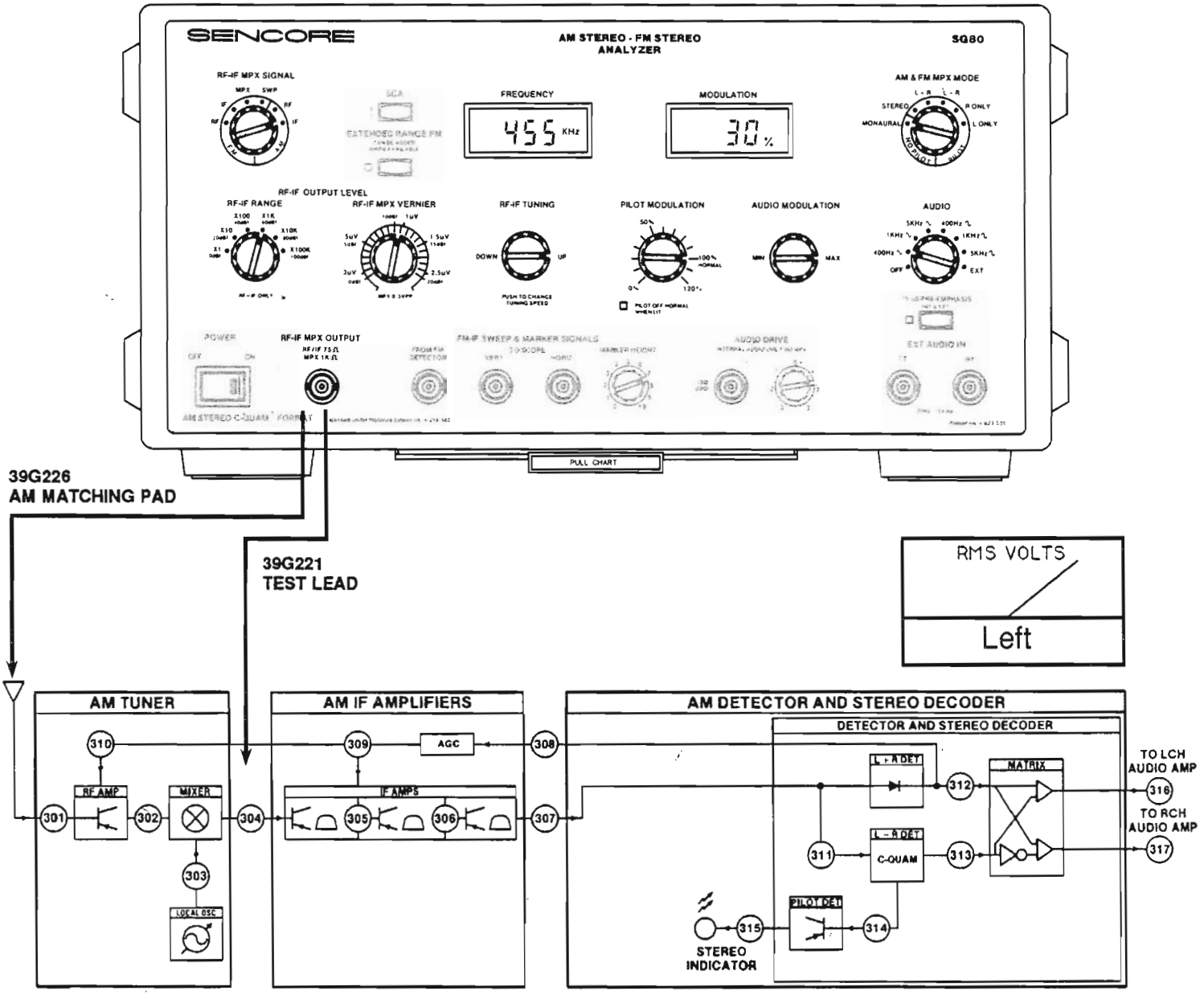
To peak align AM IF stages:

1. Set the RF-IF MPX SIGNAL control to AM IF.
2. Tune the RF-IF TUNING control to the IF frequency of the receiver. (Adjust the RF-IF TUNING for maximum output form the receiver.)
3. Set the RF-IF OUTPUT LEVEL controls for 1 kuV.
4. Set the AUDIO control to 400 Hz.
5. Set the AM & FM MPX MODE control to MONAURAL.
6. Tune receiver to quiet spot on band.
7. Set the AUDIO MODULATION control to 30% modulation.
8. Connect the 39G221 TEST LEAD to the SG80 and loosely couple it to the input of AM IF stage.
9. Monitor the audio output.
10. Reduce the SG80's output level to just above noise.
11. Tune the receiver stages from the detector to the mixer for maximum output.

NOTE: *Some AM wideband receivers may require IF stagger tuning. Consult manufacturer's alignment*

IDENTIFYING DEFECTIVE AM RF/MIXER STAGES

The SG80 allows you to determine if the problem is a defective or misaligned RF/Mixer stage without guessing and swapping parts.



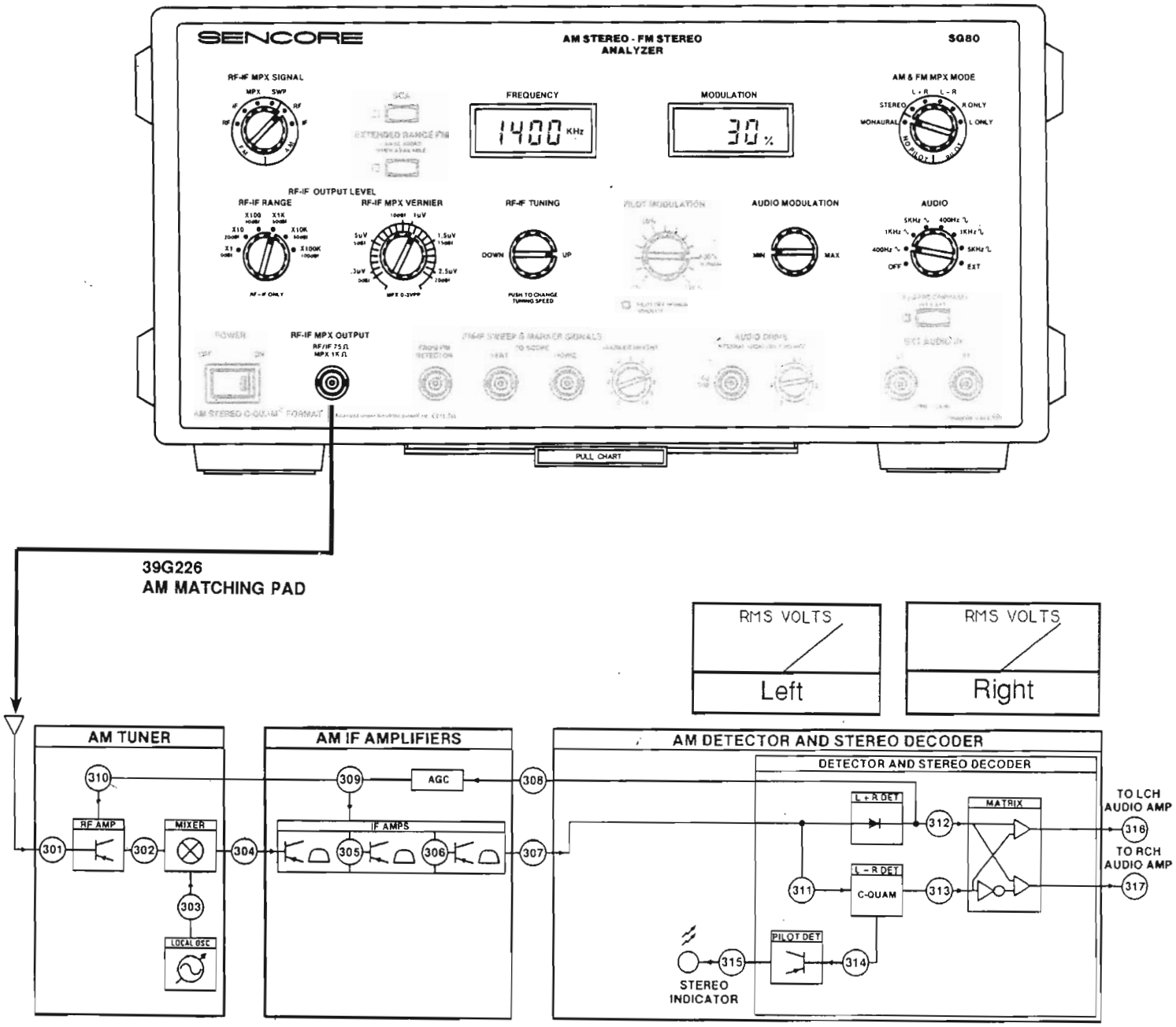
To identify defective AM RF/mixer stages:

1. Set the RF-IF MPX SIGNAL control to AM IF.
2. Tune the RF-IF TUNING control to the receiver's IF frequency.
3. Set the AUDIO control to 400 Hz.
4. Set the AM & FM MPX MODE control to MONAURAL.
5. Set the AUDIO MODULATION control to 30%.
6. Set the RF-IF OUTPUT LEVEL controls for 1 kuV.
7. Connect the 39G221 TEST LEAD to the input of the receiver's first IF stage.
8. Monitor for audio output. If a tone is heard, all stages after injection point are good. If no tone, troubleshoot later stages.
9. Switch the RF-IF MPX SIGNAL control to AM RF.
10. Tune the RF-IF TUNING control to 1100 kHz.
11. Tune receiver to 1100 kHz.
12. Connect the SG80 to the receiver's antenna terminals.
12. Monitor for any audio output, no tone indicates defective RF amp or mixer stage.

ADJUSTING AM TUNING RANGE

This adjustment insures accurate AM band tuning to enable reception of all AM stations.

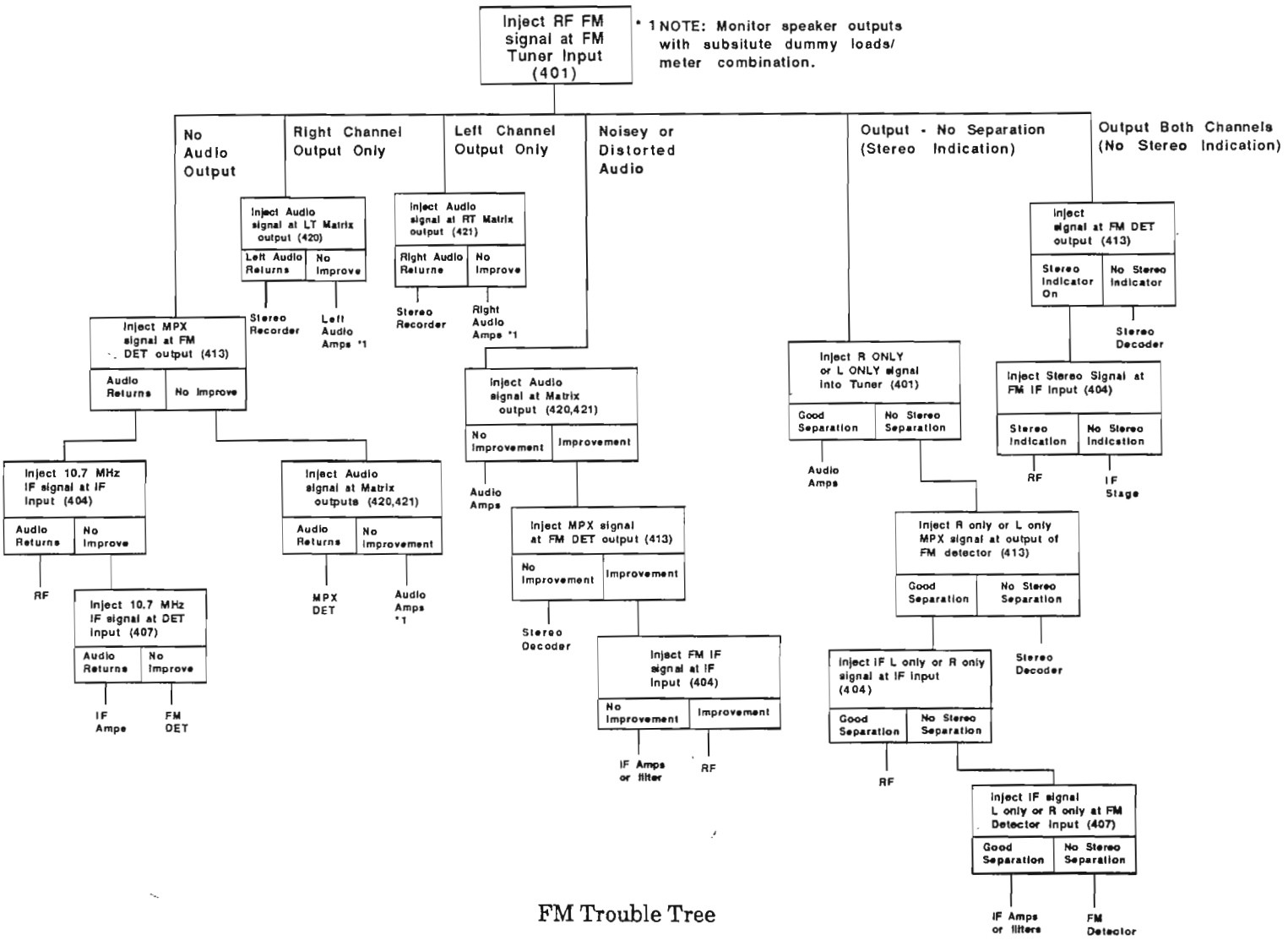
The SG80 allows you to tune precisely to each end of the AM tuning band with wrap-around tuning and digital steps for speed and highly accurate alignment results.



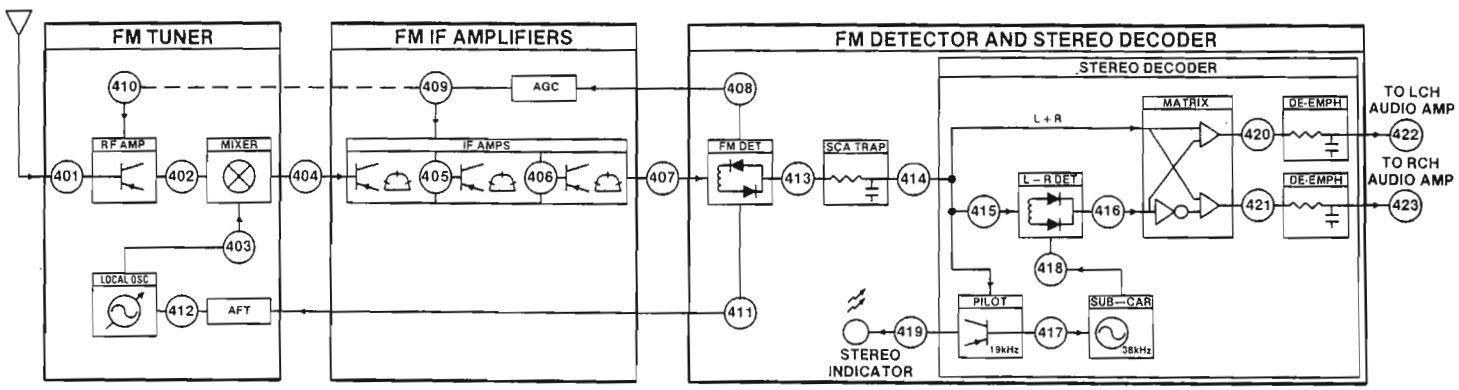
To adjust the AM tuning range:

1. Set the RF-IF MPX SIGNAL control to AM RF.
2. Set the RF-IF TUNING control to 1400 kHz.
3. Switch the AUDIO control to 400 Hz.
4. Set the AM & FM MPX MODE control to MONAURAL.
5. Set the AUDIO MODULATION control to 30% modulation.
6. Set the RF-IF OUTPUT LEVEL controls for the sensitivity of the receiver. (see page 26)
7. Connect the 39G226 AM MATCHING PAD to the receiver's antenna terminals.
8. Tune radio to 1400 kHz.
9. Monitor audio output. Adjust high tuning adjustment for maximum audio output.
10. Tune the RF-IF TUNING control to 600 kHz
11. Tune radio to 600 kHz.
12. Tune low tuning adjustment for maximum audio output.

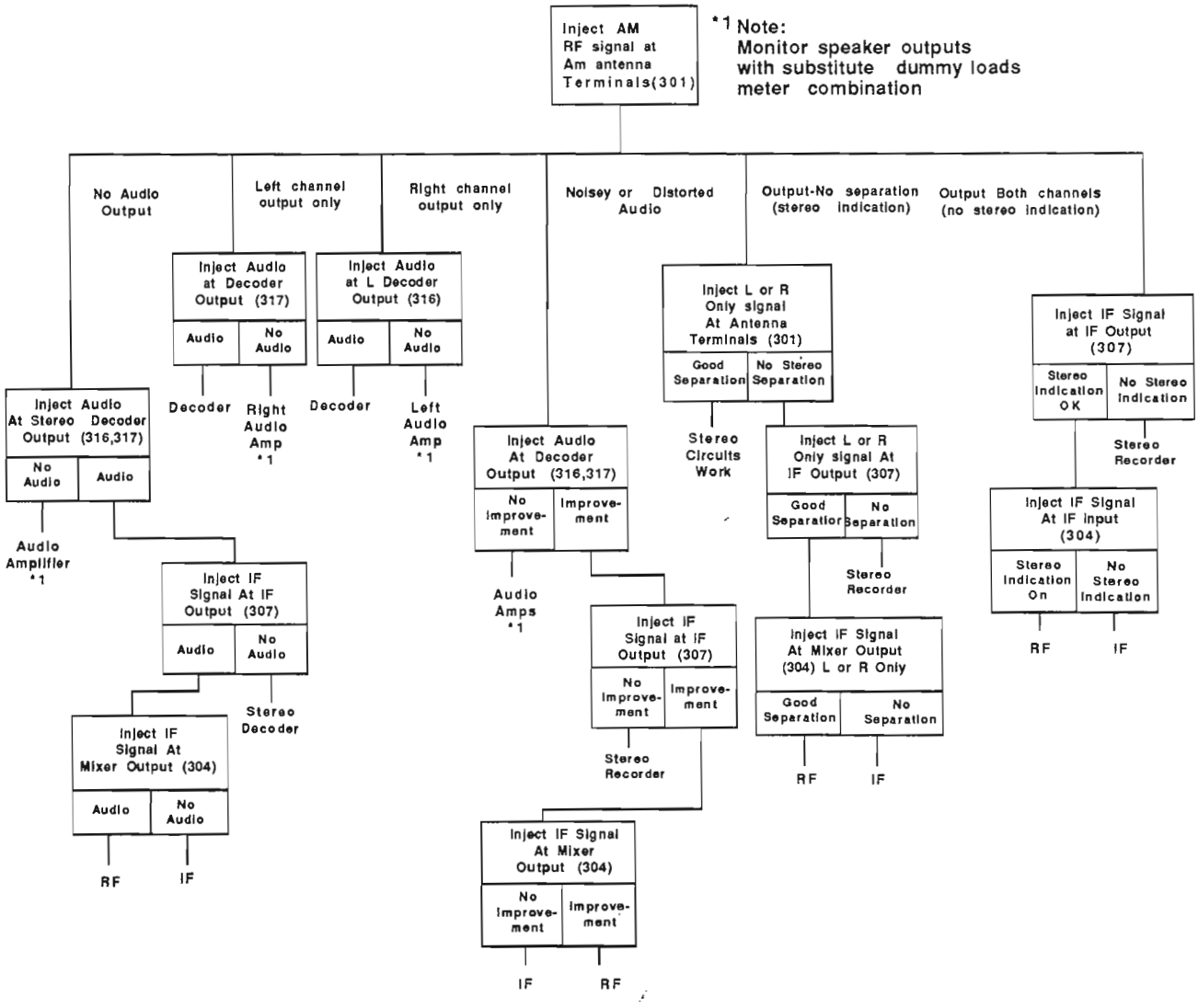
APPENDIX A



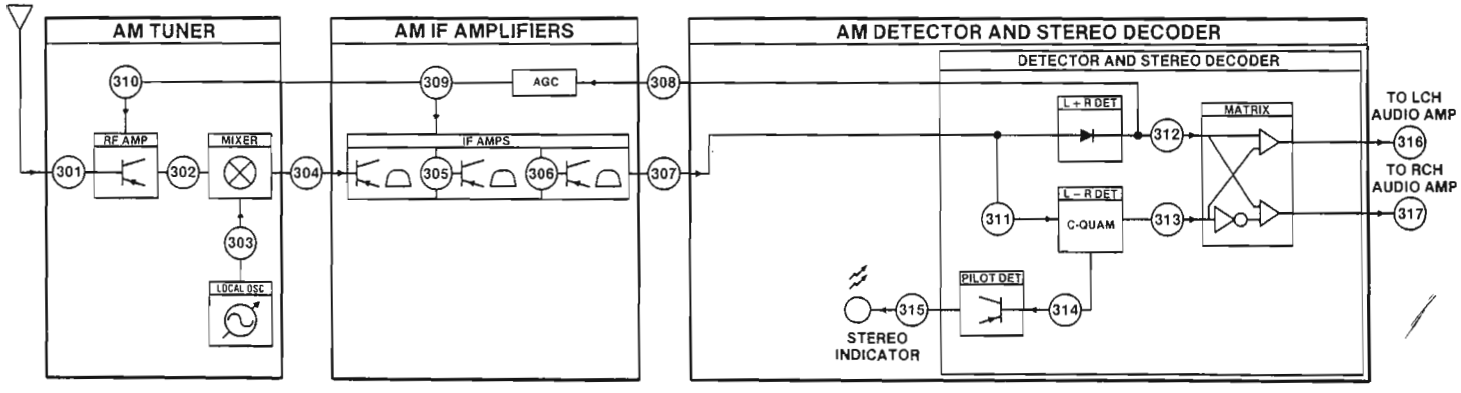
FM Trouble Tree



FM Block



AM Trouble Tree



AM Block

50, 75, 300 Ohm RF Level Chart

SG80 Settings	50 Ohm Impedance (39G226)	75 Ohm Impedance	300 Ohm Impedance (39G72)
uV	uV	uV	uV
.27	.027	.27	.54
.48	.048	.48	.96
.86	.086	.86	1.72
1.53	.153	1.53	3.06
2.7	.27	2.7	5.4
4.8	.48	4.8	9.6
8.6	.86	8.6	17.2
15.3	1.53	15.3	30.6
27	2.7	27	54
48	4.8	48	96
86	8.6	86	172
153	15.3	153	306
270	27	270	540
480	48	480	960
860	86	860	1720
1530	153	1530	3060
2700	270	2700	5400
4800	480	4800	9600
8600	860	8600	17200
15300	1530	15300	30600
27000	2700	27000	54000
48000	4800	48000	96000
86000	8600	86000	172000
153000	15300	153000	306000
270000	27000	270000	540000

What is dB?

The decibel (dB) is used extensively in the audio field.

It can be expressed in many forms:

1. dB - ratio of power in to power out.
2. dBm - 1 milliwatt
3. dBu - 1 microvolt
4. dBf - 1 femtowatt
5. dBs - 10 log (mVrms2/600/1mW)

to name a few. So what really is a dB?

A dB is a unit of measurement denoting a ratio of power in to power out. A dB ratio is calculated from the formula: dB = 10 Log (Pin/Pout) or 20 Log (Vin/Vout).

This type of dB is used only for ratio measurements, and does not relate to common reference point.

A dB with a letter or series of letters following it gives you the reference level. A dBm is used to reference a signal level to a 1 milliwatt standard. The formula for calculating dBm is: dBm = 10 Log (XmW/1 mW).

An often used 1 microvolt reference level is the dBu. This measurement is similar to the dBm, but since it deals with voltage and the formula changes slightly; dBu = 20 Log (XuV/1 uV).

The SG80 uses the commonly accepted dBf output level markings.

The dBf is a standard measurement of power referenced to 1 femtowatt (10^{-15}). The dBf eliminates many of the load impedance questions that a voltage output may have. The dBf levels can be calculated by the formula: dBf = 10 Log (XW/1 X 10-15W)

DBs use a slightly more complex formula to determine the level. It references 0dBs to .774 Vrms into 600 ohms. To calculate dBs, use the formula: dBs = 10 Log

$$\left(\frac{\text{mVrms}^{\,2}/600}{1\text{mW}} \right)$$

Voltage to dB Conversion Chart

Voltage Ratio	dB Equivalent	Voltage Ratio	dB Equivalent
1.0:1	0.0	24:1	27.6
1.2:1	1.6	26:1	28.3
1.4:1	2.9	28:1	28.9
1.6:1	4.1	30:1	29.5
1.8:1	5.1	35:1	30.9
2.0:1	6.0	40:1	32.0
2.2:1	6.8	45:1	33.1
2.4:1	7.6	50:1	34.0
2.6:1	8.3	60:1	35.6
2.8:1	8.9	70:1	36.9
3.0:1	9.5	80:1	38.1
3.2:1	10.1	90:1	39.1
3.4:1	10.6	100:1	40.0
3.6:1	11.1	120:1	41.2
3.8:1	11.6	140:1	42.9
4.0:1	12.0	160:1	44.1
5.0:1	14.0	180:1	45.1
6.0:1	15.6	200:1	46.0
7.0:1	16.9	220:1	46.8
8.0:1	18.1	240:1	47.6
9.0:1	19.1	260:1	48.3
10:1	20.0	280:1	48.9
12:1	21.6	300:1	49.5
14:1	22.9	320:1	50.1
16:1	24.1	340:1	50.6
18:1	25.1	360:1	51.1
20:1	26.0	380:1	51.6

APPENDIX B

FM Stereo Theory

The FM stereo system is really quite simple when broken down into its basic parts. It compares quite closely with the system of transmitting color television. Let's take a close look and see how it is done.

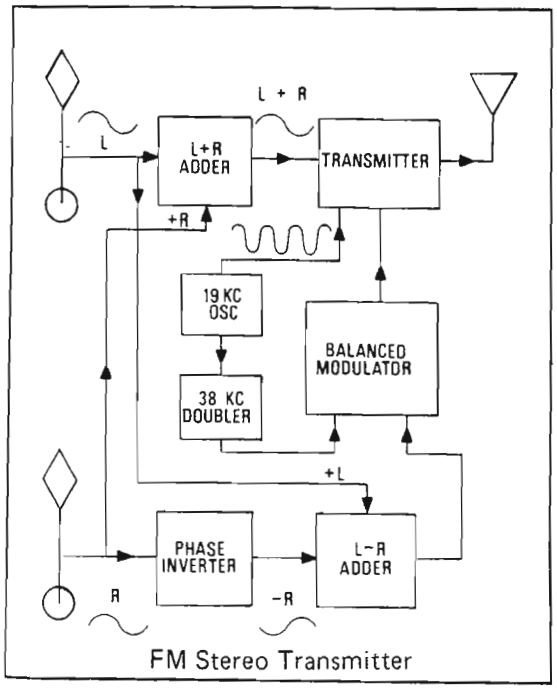


Fig. A- FM Stereo Transmitter

The block diagram shown here is typical of the basic FM stereo transmitter. Since the transmission is to be stereo (or two channel), we must have two sound sources. This can be microphones, tape heads, or the pickup cartridge of a turntable. The two signals are added together, in phase, to produce what is called the L+R signal. The L+R signal (Left channel input plus Right channel input, in phase) is the monophonic FM signal. This part of the transmission makes FM stereo "compatible". By compatible, we mean that FM stereo receivers must be able to receive and reproduce either stereo or mono broadcasts. The mono receiver must also be able to receive and reproduce a mono broadcast, and reproduce the stereo broadcast in monophonic.

The stereo portion of the broadcast is a frequency multiplexed signal. It is made up of the left channel signal with the right channel signal phase shifted 180 degrees and added to the left channel information. This produces an L-R signal — Left channel with minus (180 degree phase-shifted) Right channel added. Both the L+R and L-R signals are audio, in the range of 20 Hz to 15 kHz.

Obviously if they were simply added together and applied to the transmitter, there would be no way to separate the signals in the receiver to reproduce the original two channels of information. Therefore, it is necessary to treat one of the signals in a different manner, so it can be identified and separated by the receiver. This is the L-R signal. It is applied to a balanced modulator where it modulates a 38 kHz subcarrier, producing double sideband, suppressed carrier sidebands that correspond to the audio information. The L-R signal now has a completely different identity compared to the L+R signal. The double sideband, suppressed carrier, L-R signal is now applied to the FM modulator along with the L+R audio signal.

Since the L-R signal is sideband information only, we must have some way for the receiver to reconstruct the 38 kHz subcarrier for use in demodulation. To permit the regeneration of the 38 kHz subcarrier, a 19 kHz pilot signal (one-half the subcarrier frequency) is added to the L+R and L-R signals at the FM modulator. The FM broadcast multiplex spectrum is shown in Figure XX. Note the relationship of the L+R, L-R, suppressed 38 kHz carrier, and Pilot signals.

The stereo receiver tuner, IFs and detector are little different from the monophonic FM receiver. The only real difference is the greater sensitivity needed for good FM stereo reception and a wider IF bandpass to pass the full stereo signal. The major difference comes in the addition of the stereo decoder in the signal path from the FM detector to the audio amplifiers. This decoder must demodulate the signals and recover the original right and left channel information.

The signal present at the output of the FM detector is a composite signal made up of the L+R signal, the 38 kHz sidebands of the L-R signal, and the 19 kHz pilot signal.

The 19 kHz pilot signal is removed from the composite signal by sharply tuned circuits. The pilot signal is amplified and doubled to reproduce the 38 kHz subcarrier necessary for L-R demodulation. The composite stereo signal is injected into the secondary of the 38 kHz demodulation transformer, containing a quad diode demodulator. The L+R signal, being audio, is unaffected by the 38 kHz demodulating signal and is passed through the switching diodes as they are turned on by the 38 kHz signal. Therefore, the L+R signal will be present in the output of both sets of diodes. The L-R signal is demodu-

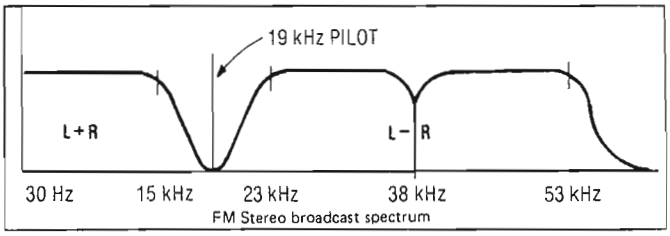


Figure B- FM Stereo broadcast spectrum

lated by the 38 kHz signal. When the 38 kHz signal causes the upper end of the transformer secondary to be positive, the lower end will be negative, due to the transformer secondary.

The diodes tied to the top of the secondary will conduct and pass the L-R signal into the output. Here it is added algebraically to the L+R signal, producing 2L or left channel output. The next alternation of the 38 kHz signal will turn off the upper diodes and open the diodes connected to the lower end of the transformer. These diodes will conduct and pass the L-R signal present during their on time. This signal will be 180 degrees out of phase with the L-R signal present at the top of the transformer and the diode output will be -(L-R) or -L+R.

This signal is added to the L+R present in the output producing 2R or the right channel signal. The outputs are fed through a de-emphasis network and then on to the audio amplifiers.

AM Stereo (C-QUAM) Theory

AM mono radios should not be a stranger to most servicers. These units have been around for over 6 decades. There have been minor variations in the operation of the AM receivers over the past years. However, the main new innovation is that of AM Stereo. AM Stereo took on a different format than that used by the broadcast FM Stereo signal due to the limited bandwidth of the broadcast AM channel spectrum.

This forced the developers of AM Stereo to find an alternate method of producing 2 channel AM modulated audio. The solution Motorola developed uses angular modulation (shifting one channel carrier to 90 degrees of the other channels). Lets walk through a typical AM Stereo transmitter and receiver to help us understand their operation.

The standard monaural AM receiver starts with the local oscillator, running at 455 kHz (home) or 262 (auto) above the incoming signal, a mixer/converter stage, generally one or two IF stages, a detector, and audio or audio power amplifiers. The AM Stereo receivers employ the same basic circuits and stages as the mono receivers with the addition of the C-QUAM decoder stage.

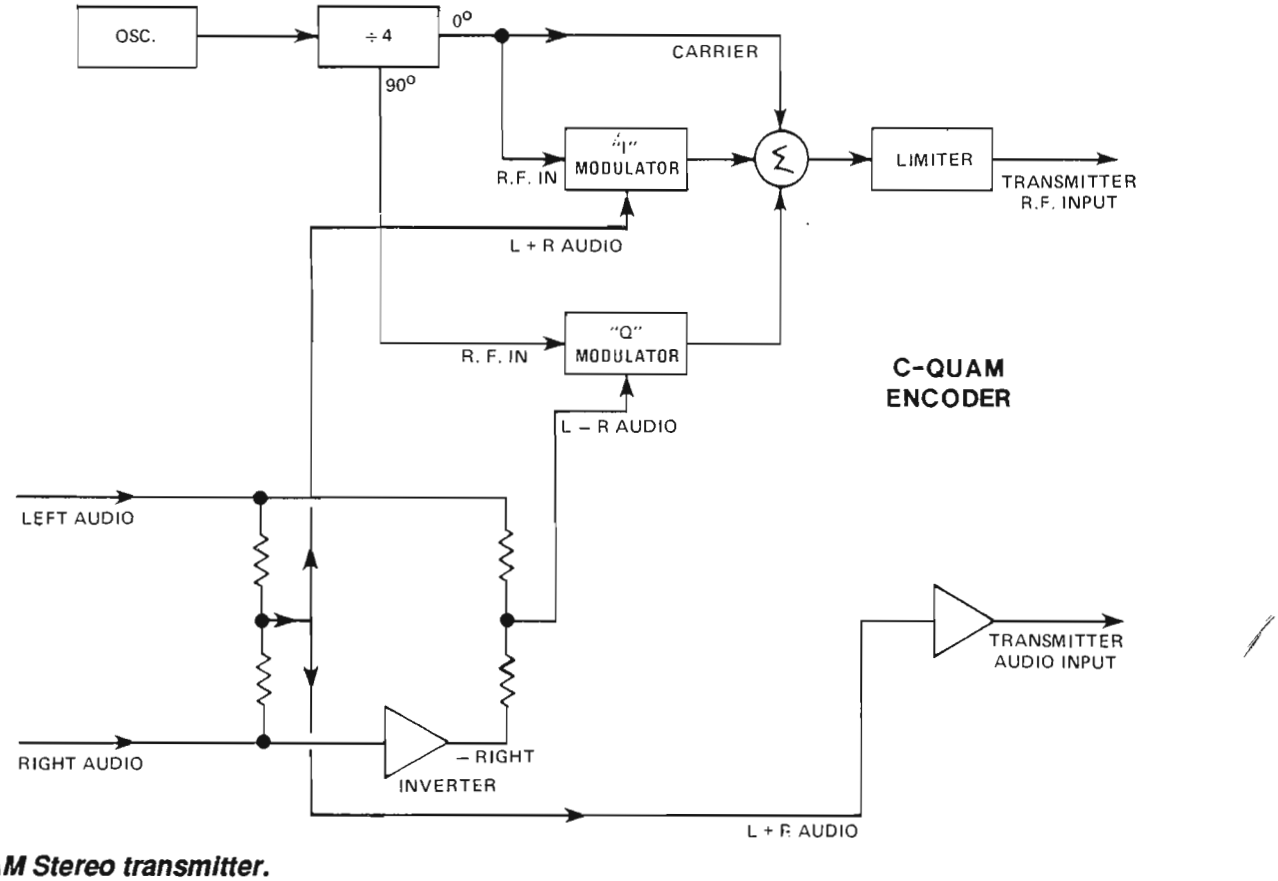


Figure C- AM Stereo transmitter.

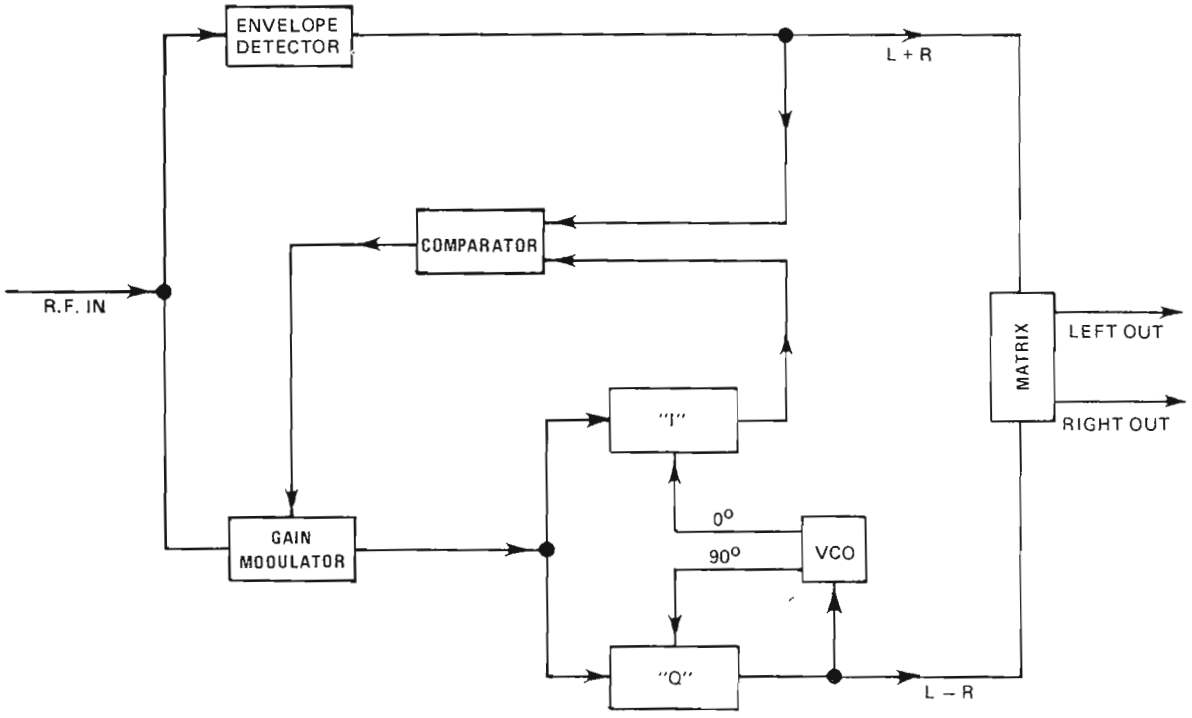


Figure D- AM Stereo (C-QUAM) decoder.

Let's take a quick look at the structure of an AM Stereo quadrature transmitter in order to help understand how the receiver reproduces audio from the complex signal.

First off, since we are talking about stereo or 2 channel audio, you must start with two separate audio signals. This is done through the use of 2 microphones, a left and a right. A matrix IC takes the signals from the microphones, and produces the two separate audio channels (L+R and L-R). The L+R audio is fed to the "I" modulator. The carrier is used directly from the oscillator with zero phase shift.

The L-R audio is fed to the "Q" modulator and modulates a 90 degree phase shifted signal (compared to the L+R carrier). The output of both the "I" and "Q" modulators and a carrier signal is then fed to an adder; producing a pure quadrature AM stereo signal. This signal is in turn fed to a limiter, which removes any of the non-compatible AM components from the signal. The signal at the output of the limiter is used as the carrier, which is modulated by a L+R audio signal. (This maintains compatibility with non-stereo receivers.)

At the receiver the RF is picked up by the antenna and routed through an envelope detector as normal. The output of the envelope detector is the L+R audio. The RF signal is also fed through a gain modulator which uses the recovered L+R signal as the source of modulation. The output of the gain modulator follows two paths; one for feedback and correction, the other for "Q" demodulation.

The feedback path is used for proper amplitude recovery from the effects of the limiter in the transmitter by comparing the L+R and demodulated "I" signals. Then, the output of the comparator is used for modulating the RF in the gain modulator.

The "Q" signal uses the same VCO as was used to demodulate the "I" signal, but 90 degrees phase shifted. The output of the "Q" demodulator is the L-R audio. The L+R and L-R audio signals are then fed to the matrix, which produces left and right audio outputs.

GLOSSARY FOR SG80 MANUAL

Alignment - The process of adjusting components of a system for proper interrelationship, including the adjustment of tuned circuits for proper frequency response and the time synchronization of the components of a system.

Amplifier - Any device which acts to increase the magnitude of an applied signal. It receives an input signal and delivers a larger output signal which, in addition to its increased amplitude, is a replica of the input signal.

Amplitude Modulation (AM) - A method of modulation in which the amplitude of the carrier voltage is varied in proportion to the changing audio frequency value of an applied voltage, the carrier frequency remaining unaltered by the process.

Analog Tuner - A circuit or device capable of tuning to a specific frequency using a continuously variable method of tuning, usually a dial and pointer.

Audio - Normally audible sound waves ranging in frequencies from approximately 20 Hz to 20 kHz.

C-QUAM (Compatible Quadrature Amplitude Modulation) - Registered trademark of Motorola Corporation. Identifies their method of producing and transmitting AM Stereo.

dBf - A power standard with a reference level of 1 femtowatt (10^{-15}).

Decibel (dB) - A numerical expression of acoustical or electrical ratios, such as the relative intensity of a sound or the relative intensity of a sound or the relative strength of a signal a person can hear.

Demodulation - The process of retrieving information voltage from a modulated carrier voltage.

Detector - The circuit and stage in a receiver where demodulation takes place.

Digital Tuner - A circuit or device capable of tuning to a specific frequency in small increments using numeric readouts as an indicator.

Distortion - Any undesired change in the waveform of an electrical signal passing through a circuit or other transmission medium.

Femtowatt - A unit of low power. One femtowatt equals 10^{-15} W.

Frequency Modulation (FM) - A method of modulation in which the frequency of the carrier voltage is varied with the frequency of the modulation voltage, the amount of variation determined by the amplitude of the modulating signal.

Fringe Area - The region in which a signal falls to the minimum field strength necessary for satisfactory communication.

Ground - Refers to the common or return point (usually negative) in a circuit.

Horizontal (HORIZ) - The input of an oscilloscope that controls the frequency of how fast the CRT beam is swept from left-to-right.

Impedance - The total opposition offered by a circuit or device to the flow of alternating current.

Intermediate Frequency (IF) - The frequency of the signal in a superheterodyne circuit that results from beating the incoming signal with the signal produced by the local oscillator.

L + R - The main channel audio, or the sum of the left and right channel audio signals.

L - R - The subchannel audio, or the difference between the left and right channel audio information.

Listener - A device in a computer interface operation that can only receive commands.

Marker - A pip indicating a particular frequency on a response curve displayed on an oscilloscope screen.

Modulation - The varying of frequency, amplitude, or phase of a signal for the purpose of transmission.

Monaural - The production, transmission, and reproduction of sound in which all the program material is carried by a single channel.

MPX (multiplex) - The process of combining two or more signals onto a single line or radio carrier for the simultaneous transmission of separate information.

Pilot (AM) - A 25 Hz 5% phase modulated signal transmitted with the AM envelope to indicate the presence of a stereo signal.

Pilot (FM) - A 19 kHz 9% frequency modulated signal transmitted with the FM envelope to indicate the presence of a stereo signal and phase lock the transmitter to the receiver.

Pre-emphasis - A process which increases the magnitude of higher frequency signals to reduce the effects of noise introduced in subsequent parts of the system.

Quieting - Standard of separation between background noise and program material produced by a radio tuner.

Radio Frequency (RF) - The frequency of a radio carrier wave. AM covers 520 to 1720 kHz; FM covers 88 to 108 MHz.

Receiver - An audio product capable of receiving modulated radio waves and converting them into a low level audio output which is delivered to an audio power amplifier.

Rejection - The ability of a circuit to repel an unwanted signal.

Selectivity - The ability of a radio receiver to separate a desired signal frequency from other signal frequencies, some of which may differ only slightly from the desired value.

Separation - The degree to which two stereo signals in separate channels are kept apart, which is measured in decibels and is necessary for producing the stereo image.

Signal-to-noise - A number, usually expressed in decibels, which shows the difference between the signal and the unwanted noise.

Stereo - The production, transmission, and reproduction of two independent audio channels on a single carrier.

Subsidiary Communication Authority (SCA) - A second program transmitted by an FM station within its assigned bandwidth usually consisting of commercial-free background music on a subcarrier which can be detected only with a special receiver or with a special adapter attached to a standard FM receiver.

Sweep (SWP) - To generate a radio-frequency voltage whose frequency varies back and forth through a given frequency range at a constant rate; used to produce an input signal for circuits or devices whose frequency response is to be observed on an oscilloscope.

Talker - A device in a computer operation that can put information on a computer interface bus.

Threshold - The sensing point at which a circuit changes in operation.

Tuner - A device used to receive broadcast FM or AM, process it, and produce an audio signal.

Vertical (VERT) - The input of an oscilloscope that controls the up and down movement of the electron beam.

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