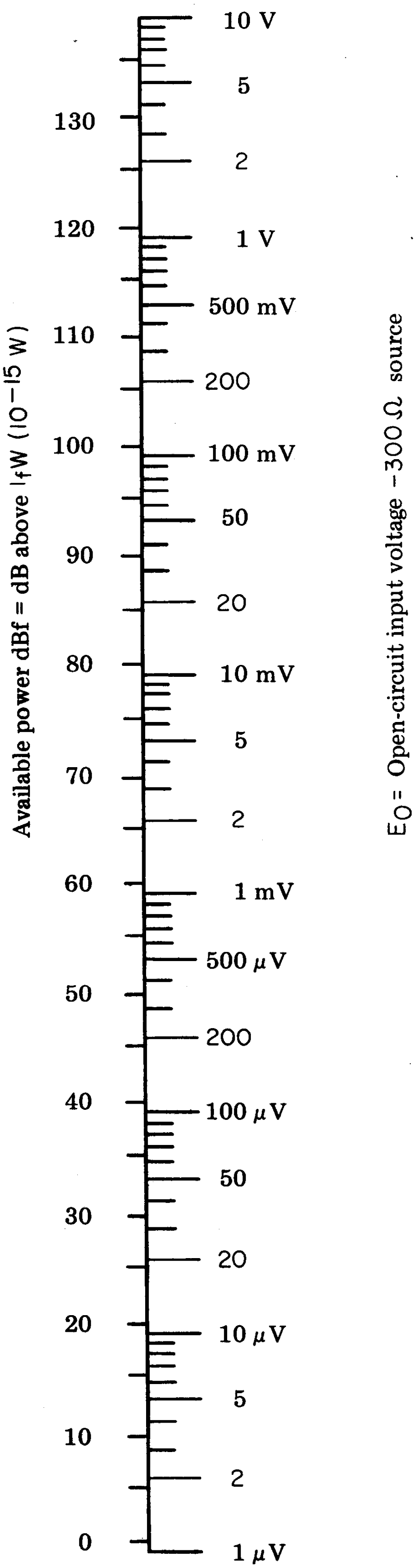
**Fig 1**
**Available Power versus Equivalent Microvolts**




**Available Power From Dummy Antennas (Section 3.6) in Terms of Terminated 50 Ω Generator Output $E_G$**

| Impedance Dummy | 300 Ω (2),(4) | 300 Ω (1),(5) | 300 Ω (3),(6) |
|---|---|---|---|
| Impedance Dummy | 75 Ω (7),(8) | | |
| dBf | | | |
| 0 | 0.55 μV | 1.1 μV | 2.2 μV |
| 5 | 0.97 μV | 1.9 μV | 3.9 μV |
| 10 | 1.7 μV | 3.5 μV | 6.9 μV |
| 15 | 3.1 μV | 6.2 μV | 12 μV |
| 20 | 5.5 μV | 11 μV | 22 μV |
| 25 | 9.7 μV | 19 μV | 39 μV |
| 30 | 17 μV | 35 μV | 69 μV |
| 35 | 31 μV | 62 μV | 120 μV |
| 40 | 55 μV | 110 μV | 220 μV |
| 45 | 97 μV | 190 μV | 390 μV |
| 50 | 170 μV | 350 μV | 690 μV |
| 55 | 310 μV | 620 μV | 1.2 mV |
| 60 | 550 μV | 1.1 mV | 2.2 mV |
| 65 | 970 μV | 1.9 mV | 3.9 mV |
| 70 | 1.7 mV | 3.5 mV | 6.9 mV |
| 75 | 3.1 mV | 6.2 mV | 12 mV |
| 80 | 5.5 mV | 11 mV | 22 mV |
| 85 | 9.7 mV | 19 mV | 39 mV |
| 90 | 17 mV | 35 mV | 69 mV |
| 95 | 31 mV | 62 mV | 0.12 V |
| 100 | 55 mV | 0.11 V | 0.22 V |
| 105 | 97 mV | 0.19 V | 0.39 V |
| 110 | 0.17 V | 0.35 V | 0.69 V |
| 115 | 0.31 V | 0.62 V | 1.2 V |
| 120 | 0.55 V | 1.1 V | 2.2 V |

$E_0$ = open-circuit voltage

$= \sqrt{4 \times 10^{-15} R \times 10^{dBf/10}}$

R = impedance level

dBf = available power for a 1 fW reference level

$= 10 \log (E_0^2 / 4R \times 10^{-15})$

**5.2 Standard Test Frequencies.** The standard mean carrier frequency for use when measurements are to be made at a single frequency is 98 MHz. The standard group of three carrier frequencies is 90, 98, and 106 MHz. When measuring receivers with preset or fixed channel selection, these principal test frequencies become 90.1, 98.1, and 106.1 MHz.

**5.3 Standard Modulation**

**5.3.1** *Monophonic Modulation.* Standard monophonic test modulation refers to a signal that is frequency modulated at 1000 Hz with 100 percent of maximum system deviation (± 75 kHz).

**5.3.2** *Stereophonic Modulation.* The standard test modulation for stereophonic measurements consists of the components described in Section 2, with a 1 kHz sine wave as the encoded audio information for all of the standard modes:

(1) L = −R, subcarrier (L−R) only, main channel (L+R) = 0

(2) L = R, main channel (L+R) only, subcarrier (L−R) = 0

(3) L only, R = 0

(4) R only, L = 0

Except where otherwise indicated, the L = −R mode will be used.

The 19 kHz ± 2 Hz pilot signal frequency modulates the RF carrier 9 percent (± 6.75 kHz). The peaks of the modulating signal, including the pilot as specified above in (1), (2), (3), and (4) shall in each case modulate the carrier 100 percent (± 75 kHz).

**5.4 Standard Tuning.** A receiver is tuned accurately to a desired signal by first tuning it approximately and then adjusting the controls so the distortion of the audio frequency output is at a minimum. This point may be readily located by using a signal with the deviation temporarily increased to a value that the receiver will not accept without significant distortion. Correct tuning will then tend to show equal clipping on positive and negative half-cycles as observed on the output monitoring oscilloscope. In practice, the finetuning adjustment is accomplished by varying the generator since the vernier and incremental tuning controls allow more precise tuning. When input levels are small, and the noise becomes a significant part of the output, minimum distortion is interpreted as minimum noise content.

At higher input levels some receivers will give ambiguous results in tuning for minimum distortion due to complementary matching of the modulation and detection transfer characteristics, or to the normal reaction of some detector circuits. Zero-center-tuning meters may be used for tuning such receivers if the indication coincides with minimum distortion at lower inputs.

When the receiver has been tuned for minimum distortion or correct meter indication as described above, the tuning should not be readjusted to favor the particular parameter under measurement. When the input signal level is changed, tuning is readjusted as necessary.

**5.5 Standard Test Output.** The standard output for receivers with amplifiers for driving loudspeakers is chosen about 10 dB below rated output or clipping, for a convenient meter reading such as a zero or integral dB calibration on the audio voltmeter scale. This level is selected so that the audio distortion from the amplifier has minimum effect on the measurements.

A standard output level for tuners with level controls is chosen similarly, about 10 dB below maximum output level with 100 percent modulation and sufficient input for full limiting action. Alternatively, full output may be used.

**5.6 Control Settings.** Unless otherwise called for in the measurement procedures, the controls will be set as described below.

*Tuning:* The receiver is set to 98 MHz according to the dial calibration, the generator is adjusted to the receiver (Section 5.4) with standard monophonic modulation, and the input to the receiver is as stated in the test description. If two generators are used, this setting is made using generator *A*, with zero output from generator *B*.

*Volume:* Volume may be marked "Loudness." Set for standard output when the receiver is tuned as above.

*Tone:* Set for flattest measured electrical response on a pre-emphasized signal at the volume setting above. This applies to all controls that affect the frequency response, including those marked bass, treble, timbre, or tone.

*Filters:* Set in off or inactive position if this is the one giving nearest flat response. This applies to those marked high, low, scratch, rumble, etc.

*Voice/Music:* Set controls to music position, or that giving flattest response, before tone controls are adjusted as above.

*Loudness Countour:* Set in off or inactive position.

*Balance:* Set for equal measured output from each channel at the volume setting above.

*AFC (Automatic Frequency Control):* Set in off, inactive, or minimum position for AFC. Some measurements will be repeated with AFC turned on.

*Mode:* Set in monophonic or stereophonic position, as required for the particular test.

*Mute:* The muting control may be marked "squelch." Set in off, defeated, or minimum effect position.

*Sensitivity:* The sensitivity control may be marked "local/distant." Set in most sensitive or distant position.

*Separation:* Set for greatest separation at all audio frequencies. Separation may be marked "blend" or "stereo noise filter."

*Selectivity:* Set in broadest or least selective position.

*Monitor:* Set in off or "source" position.

*Speakers:* Set in the position directing the output to the terminals used for testing.

Any controls for special functions or automatic circuits not listed above should be in the off or not-effective position, but without internal receiver modification.

For all stereophonic measurements, the mode switch should be in the stereo position and the automatic stereo switching should be monitored to be sure it is in the stereo position. This may be checked by using L = −R modulation, which gives no output if the mode is set for monophonic reception.

Any exception to these settings should be entered as part of the test results.

## 6. Monophonic Performance Tests

The monophonic performance of a receiver is determined by measurement of the individual characteristics described in the following sections. The foregoing sections specify the setup of the measuring apparatus and the receiver under test.

**6.1 Tuning Range and Calibration.** The tuning control is set for the respective minimum and maximum carrier frequencies in each tuning range that the receiver is capable of receiving with normal operation. At each setting, the signal generator is tuned to the resonant frequency of the receiver and the carrier frequency recorded, preferably using a frequency counter, as described in Section 3.5. This procedure may be extended to obtain a frequency calibration of the dial. If an error in frequency calibration is found, the maximum error in megahertz shall be stated.

**6.2 Monophonic Usable Sensitivity.** This test is performed at the three standard test frequencies. With a standard matching dummy antenna, standard monophonic test modulation, standard tuning, standard control settings, and standard output, the signal input level is reduced to the least value that will produce a 30 dB drop in indicated output when the output is measured through a 1000 Hz null filter. This is the monophonic usable sensitivity. This serves to indicate the relative freedom of the tuner from objectionable internal receiver noise during pauses in modulation when receiver noise is not masked by the modulation. The test also serves to indicate the relative freedom of the tuner from objectionable distortion during periods of maximum modulation.

The input signal levels are expressed in available power. The rated monophonic usable sensitivity is defined in Section 6.3.

**6.3 Volume Sensitivity.** This test is performed at 98 MHz with standard monophonic operating conditions. The output is noted as the input signal level is reduced below 100 dBf. The input signal level at which the output falls by 20 dB below the output for an input of 100 dBf is the volume sensitivity. The rated monophonic usable sensitivity shall be equal to the usable sensitivity or the volume sensitivity, whichever is poorer, and is expressed in dBf.

**6.4 Monophonic 50 dB Quieting Sensitivity.** This test is performed at 98 MHz, using a similar procedure to that in Section 6.2, but omitting the 1000 Hz null filter. The input signal level is reduced until there is a 50 dB increase in output when the standard test modulation is turned on. This test is a measure of how high an input signal level is required to attain a signal-to-noise ratio of 50 dB.

The rated monophonic 50 dB quieting sensitivity shall be the input signal level determined in this test, expressed in available power (dBf).

**6.5 Monophonic Signal-to-Noise Ratio at 65 dBf.** This test is performed at 98 MHz with an input signal level of 65 dBf under standard conditions with standard monophonic test modulation. The output obtained with the test modulation removed is measured, and the resultant signal-to-noise ratio is expressed in dB. This test is a measure of the signal-to-noise ratio attained for relatively strong input signals. The rated monophonic signal-to-noise ratio, termed the monophonic signal-to-noise ratio at 65 dBf, shall be the ratio obtained in this test, expressed in dB.

**6.6 Hum and Noise at 65 dBf.** This test is similar to that in Section 6.5 except that the output filter is changed from the 200 to 15 000 Hz bandpass filter to a 15 000 Hz low-pass filter to include power supply components (hum). The resultant signal-to-(hum and noise) ratio is expressed in dB.

**6.7 Minimum Volume Hum and Noise.** This test measures the total residual output under the same conditions as given in Section 6.6, except that the volume control is set at minimum and the measurement is made with no modulation. The minimum-volume output, including hum and noise, is referred to the standard test output and expressed as a signal-to-(minimum volume output) ratio in dB. The absolute output in microwatts should also be noted for speaker output terminations.

**6.8 Muting Threshold.** Many tuners and receivers are equipped with muting or squelch circuits designed to reduce output noise normally heard when tuning between FM station signals. These tests are designed to measure the signal intensity required to overcome these muting circuits. For receivers with abruptly applied muting, apply an input signal of mean carrier frequency at a level of 65 dBf and with standard monophonic test modulation. Gradually decrease the input until muting is observed. Record this input in dBf, and the output decrease with muting as the "muting ratio." Gradually increase the input until the muting action is overcome and record this input level in dBf. The difference of the signal levels for switching muting in and out is called the muting hysteresis. Reduce the input signal to zero with full muting action, recording the residual output in dB below standard output as the muting attenuation.

Rated muting threshold is the mean of the two levels of signal input (in dBf) observed above and is stated in dBf.

For receivers with gradually applied muting, gradually decrease the input to a level causing a 3 dB reduction in output when the muting is turned on. Record this input in dBf and further reduce the input until a 30 dB reduction is observed. This input is also recorded, and the difference in the two inputs, expressed in decibels, is called the differential muting sensitivity.

Rated muting threshold in this case is the mean of the two readings observed and is expressed in dBf.

For receivers having an external control capable of varying the muting threshold, measurements described above shall be made at each extreme position of this control and both results, stated in dBf, shall be the rated muting threshold range.

**6.9 Frequency Response.** The frequency response test shows the manner in which the audio output depends upon the modulating frequency. It takes into account all the characteristics of the receiver. The receiver is tuned to a signal at standard mean carrier frequency and a signal level of 65 dBf, frequency modulated with standard monophonic test modulation. Output is measured with all controls set to the standard control settings. The output variation is observed while the modulation frequency is varied continuously from 30 to 15 000 Hz. The results are compared to the response of the standard de-emphasis curve unless pre-emphasis was used (Section 3.2) and are expressed in dB with reference to the 1000 Hz output.

If the frequency response of the receiver varies with the volume-control setting because of fixed loudness compensation, then the curve should be repeated at 10 dB steps in the control setting. The modulation percentage may be reduced if necessary for measurements of higher volume settings.

The response should be repeated with tone controls at maximum and minimum settings in addition to the standard setting for flattest response. If overloading is observed, the curve may be plotted at a lower output level. The overload condition should be recorded with the data. Additional curves should be plotted with all other controls that affect response in their active position, particularly filters. If the receiver is equipped with any automatic controls that affect the response other than those above, the effects should be determined by additional tests. Rated frequency response shall be stated as: From 30 Hz to 15 000 Hz $\pm X$ dB.

**6.10 Distortion.** Harmonic distortion tests evaluate the spurious AF harmonics in the audio output of the receiver under various operating conditions. The THD (total harmonic distortion) is the rms value of the harmonics expressed as a percentage of the total electrical output. The maximum modulation frequency at which harmonic distortion can be detected by the ear in the output is 7.5 kHz.

For measurement of intermodulation distortion from simultaneous modulation, two tones separated by several hundred hertz (typically 1000 Hz) are used, and the nonlinear distortion is evaluated in terms of the spurious 1000 Hz difference output (Section 6.12).

**6.10.1** *Distortion at 50 dB Quieting.* The test is performed at 98 MHz with an input signal level equal to the 50 dB monophonic quieting sensitivity. Under standard conditions with standard monophonic test modulation, the total harmonic distortion is measured.

The measurement is repeated with the modulation frequency at 100 Hz and 6000 Hz.

The rated values of THD at the 50 dB quieting sensitivity level shall be the total harmonic distortion as measured with 1000 Hz, 100 Hz, and 6000 Hz modulation, expressed in percent.

**6.10.2** *Distortion at 65 dBf.* The procedure for this test is identical with that described in Section 6.10.1, except that the input signal level is increased to 65 dBf, corresponding to 1950 $\mu$V, open circuit, at 300 $\Omega$.

The rated distortion at 65 dBf is the total harmonic distortion (rms) measured with an input signal level of 65 dBf at the three modulation frequencies used in Section 6.10.1, expressed in percent.

**6.11 Distortion versus Operating Parameters.** The following series of tests shows the effect of the operating parameters on distortion. Unless otherwise stated, standard monophonic operating and test conditions are assumed, and distortion is expressed in percent.

**6.11.1** *Variation of Output.* With an input signal level of 65 dBf at 98 MHz, the THD is noted as the output is varied by means of the volume control.

This test is repeated for several modulation frequencies between 30 and 7500 Hz.

**6.11.2** *Variation of Modulation.* With the input signal level for 50 dB quieting (Section 6.4) at 98 MHz, the distortion is noted as the modulation is varied from 30 percent to 120 percent ($\pm$ 90 kHz) of maximum system deviation. The volume is readjusted as necessary to maintain standard test output. This test evaluates the effects of modulation including overmodulation on infrequent peaks as allowed by the FCC.

The test may be repeated for other modulation frequencies between 30 and 7500 Hz, and at other input levels between usable sensitivity and 65 dBf.

**6.11.3** *Variation of Modulation Frequency.* With an input signal level of 65 dBf at 98 MHz, the distortion is noted as the frequency is varied from 30 to 7500 Hz, maintaining standard test output with the volume control, or as near standard output as de-emphasis and system gain will allow.

**6.11.4** *Variation of Input Signal Level.* The THD is noted as the 98 MHz input signal level is varied over the operating range in 20 dB steps, starting with the 50 dB quieting sensitivity level.

**6.11.5** *Variation of Tuning.* With the input signal level for 50 dB quieting at 98 MHz, the distortion is noted as the generator frequency is varied in small increments in each direction from standard tuning until the distortion rises sharply. This test evaluates the effects of drift (Section 6.18) and the correction needed by AFC (Section 6.19). The distortion in percent may be plotted versus the frequency deviation from standard tuning in kilohertz.

**6.12 Intermodulation Distortion.** Rated intermodulation distortion is measured at 98 MHz with an input signal level of 65 dBf. Test modulation consists of two signals of equal amplitude at 14 000 Hz and 15 000 Hz, with an instantaneous peak deviation of 100 percent (± 75 kHz). The 1000 Hz intermodulation component is measured using a 200 to 1500 Hz bandpass filter and expressed as a percentage of the output that would be obtained when 1000 Hz modulation with a deviation of ± 75 kHz is used.

**6.13 Capture Ratio.** Capture ratio describes the capability to receive a stronger signal in the presence of a weaker interfering signal having the same carrier frequency.

Two signal generators are required only one of which need be capable of frequency modulation. Both generators are connected to the receiver through a (dual) dummy antenna (Section 3.6) and are set accurately to the same frequency (nominally 98 MHz) by zero beating or by counter measurement.

The output of the unmodulated interfering signal generator *B* is initially set at zero output. With standard monophonic test modulation on the desired signal generator *A* and an input signal level corresponding to the 50 dB quieting sensitivity, the controls are adjusted for standard test conditions. The output level of generator *B* is now advanced until its interfering signal causes the receiver output to drop by 1 dB as the interfering signal begins to capture the channel; this output level of generator *B* is noted in dB. The output level of generator *B* is further advanced until the receiver output falls by a total of 30 dB, indicating that the interfering signal has substantially captured the channel; this output level of generator *B* is again noted in dB. The difference in the two dB readings of generator *B* divided by two is defined as the capture ratio. During the above procedure, the receiver tuning should be readjusted slightly as necessary for maximum reduction in output. Monitoring the output with an oscilloscope is helpful since correct tuning is indicated by equal notching of the positive and negative peaks of the output waveform.

The smaller the spread between the output levels of generator *B* which causes the 1 dB and 30 dB drop in receiver output, the less vulnerable the receiver is to cochannel interference. The capture ratio is normally small enough so that the two generators can be assumed to have equal output at a point (geometrically) midway between the 1 dB and 30 dB levels, so that the capture ratio indicates the ratio of desired to undesired signal required for approximately 30 dB suppression of the undesired signal.

The measurement is repeated at input signal levels of 45 dBf, 65 dBf, 80 dBf, and 100 dBf.

The rated capture ratio is the greater (poorer) of the two capture ratios measured at the 45 dBf and 65 dBf input signal levels.

**6.14 Adjacent and Alternate Channel Selectivity.** This measurement describes a receiver's capability to receive a signal without interference in the presence of an interfering signal which is relatively close to the desired signal.

Test conditions are similar to those for the measurement of capture ratio, except that the interfering signal generator *B* is separated from the desired signal by one or more standard channel separations. With generator *B* at zero output, standard monophonic modulation is applied to generator *A* and the input level adjusted initially to 45 dBf with all controls adjusted for standard test conditions. The modulation is removed from generator *A*, applied to generator *B*, and the output of generator *B* is increased until the interference produced is 30 dB below the standard test output. The ratio of the generator outputs is noted in dB. The procedure is repeated with generator *B* offset a like amount on the opposite side of the desired signal. The average of the two ratios in dB is the selectivity ratio. A 1 kHz bandpass filter is used at the output to reduce errors from noise.

The ratio corresponding to a separation of one channel (200 kHz) is called the adjacent channel selectivity ratio. The ratio corresponding to a separation of two channels (400 kHz) is called the alternate channel selectivity ratio. The rated values of these two ratios are the values for a desired input level of 45 dBf.

The procedure is repeated for other values of the desired signal, starting with the usable sensitivity level, and continuing at levels of 65 and 80 dBf.

Table 2 is useful in tabulating the data.

**Table 2**
**Adjacent and Alternate Channel Selectivity**

| Input (dBf) | Channels from Desired Signal −2 (dB) | −1 (dB) | +1 (dB) | +2 (dB) |
|---|---|---|---|---|
| 15 | 69 | −6 | 8 | 71 |
| 25 | 75 | −4 | 1 | 61 |
| 35 | 58 | −3 | −1 | 57 |
| 45 | 48 | −3 | 0 | 47 |
| 55 | 38 | −3 | 0 | 37 |
| 65 | 28 | −3 | −1 | 27 |

When measuring receivers with preset or fixed channel selection, the generators are set to the exact channel frequencies within ± 2 kHz.

Complete selectivity measurements may require signal levels beyond the capability of generator *B*. An amplifier may be used as described in Section 3.1.3.

**6.15 Spurious Responses**

**6.15.1** *Spurious Response Ratio.* With the receiver tuned to the desired frequency, the signal generator frequency should be continuously varied over a wide range to determine whether the receiver is responsive at frequencies other than the frequency to which it is tuned. Because the generation of these spurious responses may involve a multiplication in the observed signal deviation, the spurious response sensitivity is measured with an unmodulated signal, the signal input being increased for each spurious response noted until the noise output of the receiver is reduced to the same level as that used when the monophonic usable sensitivity is measured, as described in Section 6.2. The spurious response ratio is the ratio, expressed in dB, of the input signal level at the interfering frequency to the monophonic usable sensitivity input level at the desired frequency (to which the receiver is tuned), both giving this same (reduced) noise output.

The harmonic output of the signal generator must be attenuated sufficiently so that it does not affect the spurious responses.

The rated spurious response ratio is the poorest of those measured, as described in Sections 6.15.4 and 6.16, or found by scanning the frequencies, as described in this section.

**6.15.2** *Image Response Ratio.* Using the procedure described in Section 6.2, the monophonic usable sensitivity is measured at 98

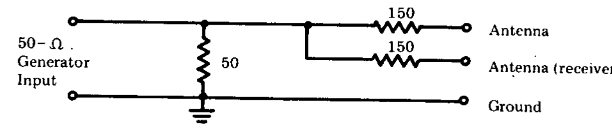



**Fig 2**
**Dummy Antenna for Unbalanced IF Response Measurement**

MHz and the noise output noted with the modulation off. Without altering test conditions, the generator frequency is changed to the image response frequency (98 MHz + 2 × 10.7 MHz) and the input level increased until the same noise level is obtained. The ratio of this input to the monophonic usable sensitivity input, in dB, is the rated image response ratio. The measurement may be repeated at 90 and 106 MHz.

**6.15.3** *IF Response Ratio.* The balanced IF response ratio is measured as described in Sections 6.15.1 and 6.15.2, but with the generator frequency changed from 98 MHz to 10.7 MHz.

To measure the unbalanced IF response ratio, the usable sensitivity is first measured and expressed in terms of the open-circuit input voltage (Fig 1). The standard dummy antenna is then changed to the dummy shown in Fig 2 and the increased generator open-circuit input required to produce the reference noise input is measured. The ratio of the two generator levels in dB is the unbalanced IF response ratio.

**6.15.4** *Characteristic Frequency Tests.* In addition to the image and IF responses, superheterodyne receivers are susceptible to spurious responses at characteristic frequencies involving harmonics of the local oscillator and signal frequency. Particular frequencies of interest are $f_s + (f_i/2)$, $f_s + (2f_i/3)$, $2f_s + f_i$, where $f_i$ is the IF frequency. The measurement procedure is the same as for image response and the figures of merit are expressed in the same way. The rated value for this test is the $f_s + (f_i/2)$ spurious response ratio measured at 103.35 MHz, with $f_s = 98$ MHz.

**6.16 RF Intermodulation.** Intermodulation spurious responses are generated in a receiver when two or more undesired signals are mixed in a nonlinear portion of the receiver. Interference results when the generated spurious response is of sufficient amplitude and on or near the desired frequency to which the receiver is tuned.

An important response due to two interfering signals $f_1$ and $f_2$ occurs when these frequencies are related by the equation $f_S = 2f_1 - f_2$ where $f_S$ is the desired frequency to which the receiver is tuned. This relationship is satisfied, for example, when $f_2$ = 99.6 MHz and $f_1$ = 98.8 MHz, and the interfering signals are separated by 800 kHz from the desired frequency, corresponding to possible channel assignments in a given locality.

To measure this spurious response, both generators are connected to the receiver through a dual dummy antenna. The monophonic usable sensitivity is first measured at 98 MHz with generator *A* and the noise output noted with the modulation off. Generator *B* is unmodulated throughout. Generators *A* and *B*, both unmodulated, are next adjusted to 99.6 and 98.8 MHz, respectively. Keeping their outputs equal, their common output level is increased until the (usable sensitivity input) reference noise level is obtained. Generator *A* frequency may be varied slightly for maximum reduction of noise. The ratio of this output level to the usable monophonic sensitivity level at 98 MHz is the spurious response ratio.

The rated two-signal spurious response ratio is the ratio defined above when the two interfering frequencies are at 98.8 and 99.6 MHz and the desired signal frequency is 98 MHz.

Other spurious responses will occur with sufficiently strong interfering signals when sum and difference combinations of harmonics of the signals and harmonics of the local oscillator are equal to the tuned signal frequency, its image frequency, or the IF frequency.

**6.17 AM Suppression.** The AM suppression ratio is a measure of the receiver's ability to suppress response to amplitude modulation components in the signal. The AM may result from fading, multipath effects, airplane flutter, incidental transmitter AM, or a relatively narrow or misaligned receiver passband. Note that any oscillator shift due to signal level change results in FM at the detector which will not be removed. Also, multipath effects may result in external phase modulation which cannot be eliminated. In this case, the distortion increases with modulation frequency which can seriously degrade stereo reception.

The AM suppression ratio is defined in terms of the relative disturbance caused by amplitude modulation when the carrier is simultaneously amplitude and frequency modulated.

The AM suppression ratio = FM caused output (100 percent modulation, 1 kHz)/AM caused output (30 percent modulation, 400 Hz), expressed in dB.

**6.17.1** *Measurements.* With a 45 dBf input signal at 98 MHz, simultaneously modulate the generator as defined by the AM suppression ratio: 100 percent FM at 1 kHz and 30 percent AM at 400 Hz.

Refer to Section 3.1.5 for precautions to avoid incidental phase modulation. Do not change the volume control setting. A nulled notch filter is used to remove the 1 kHz output. A 200 to 1500 Hz bandpass filter should be used to reject harmonic distortion and hum components. The remaining AM output, principally at 400 Hz, 600 Hz, and 1400 Hz, is recorded in dB below standard output. Normalize the reading if de-emphasis is other than −0.7 dB from 400 Hz to 1 kHz. Repeat the test at each standard signal level, since the suppression varies widely with input. To verify that the reading is due to AM modulation, it is useful to remove the 400 Hz modulation, checking for the drop in output.

**6.17.2** *Supplementary Measurements.* For more complete analysis, AM suppression should be measured at AM frequencies from 3 Hz to 50 kHz, but particularly at the lower frequencies where receiver time constants may be a factor. The electronic filter described in Section 3.8 may be used. A wave analyzer or spectrum analyzer is convenient for distinguishing between AM intermodulation components and harmonic distortion components.

Some receivers have a multipath indicator that may be monitored during the above tests to check its response characteristics. As an additional test, the AM depth may be increased, even though this may add some incidental FM or phase modulation. A useful test is to simultaneously AM and FM modulate with approximately (but not exactly) the same modulation