How to make audio measurements on stereo receivers and amplifiers

- Test forms included

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*Sound Technology, Inc., 1978
HOW TO INCREASE YOUR SALES

Many dealers are using performance tests on the sales floor to sell customers up to a more expensive item. Such performance tests also impress the customer with your store's technical competence.

In addition, more and more retailers are running clinics as sales promotion events. And clinics do increase sales. They also build your service volume.

MAKING MEASUREMENTS

We've prepared this booklet to assist you in making up-to-date receiver and amplifier measurements and in running sales clinics.

The information here assumes that you have available the following Sound Technology instruments:
(a) Model 1000A FM Alignment Generator
(b) Model 1200A Stereo Test Panel
(c) Model 1700A/B Distortion Measurement System

These instruments are arranged as indicated by the following diagram. More details are given in the instruction manuals for these instruments, particularly the Model 1200A Manual.

CLINIC FORMS

On the last two pages are forms that are useful in recording measurements for your customers. These forms are of a quality that permits direct reproduction by your printer. A space is provided for adding your name. This can easily be done by affixing your letterhead on the master.

While the forms are copyrighted, Sound Technology releases them to users of its equipment.
AMPLIFIER MEASUREMENTS

TO MEASURE TOTAL HARMONIC DISTORTION VS. FREQUENCY AT RATED POWER

(1) Set controls as stated in SET UP 1 on p. 7.

(2) Adjust 1700 OSCILLATOR LEVEL until amplifier rated output power (read on 1700 meter) is reached.

(3) Adjust oscilloscope controls for convenient display of amplifier output signal and distortion. NOTE: If amplifier output power rating is unknown, increase 1700 OSCILLATOR LEVEL until “clipping” or other signs of amplifier overload become evident. Then reduce OSCILLATOR LEVEL slightly until signs of overload disappear.

(4) Reset 1200A MEASUREMENT to RIGHT CHANNEL.

(5) Adjust TEST SIGNAL RIGHT LEVEL control until right channel amplifier output matches the left channel output. Recheck scope display for signs of overload from either channel, and reduce oscillator level if necessary. The output power measured at this point may be used as the rated power output of the amplifier.

(6) Reset 1700 FUNCTION switch to DISTORTION. Read the amplifier’s right channel distortion on the meter of the 1700.

(7) Set 1200A MEASUREMENT to LEFT CHANNEL. Read amplifier’s left channel distortion.

(8) Repeat above measurements at other frequencies, and plot a curve showing amplifier distortion vs. frequency at rated power. NOTE: The test may also be run with a 4 or 16 ohm load by pressing the appropriate button on the 1200 front panel.

CAUTION:
Before switching loads, turn down 1700 OSCILLATOR LEVEL. After switching loads, repeat steps (2) and (3) above.

TO MEASURE TOTAL HARMONIC DISTORTION VS. POWER AT 1 kHz

(1) Set controls as stated in SET UP 1 on p. 7.

(2) Set 1700 to 1 kHz, and drive amplifier to rated power output from both channels as described in steps (2)-(5) above.

(3) Record (plot) distortion of both channels.

(4) Reduce amplifier output power in 3 dB (½ power) increments, recording left and right channel distortion at each step. NOTE: The minimum output power level at which distortion need be recorded is 250 mW. Also, if desired, the amplifier may be driven slightly above rated power to record the increase in distortion as overload occurs.
TO MEASURE INTERMODULATION DISTORTION VS. POWER

(1) Set controls as stated in SET UP 1 on p. 7.
(2) Set 1700 to PK EQUIV V/PWR.
(3) Drive amplifier to rated power output from both channels. NOTE: Refer to 1700 Instruction Manual for determination of IM output power as compared to a single frequency power level.
(4) Set 1700 to IMD and record left and right channel distortion at amplifier's rated power output. Reduce power in 3 dB (½ power) increments, recording distortion at each step. NOTE: The minimum power level at which distortion need be measured is 250 mW. If desired, the amplifier may be driven slightly above rated power to record the increase in distortion as overload occurs.
(5) The test may be repeated with other loads by pressing the appropriate button on the 1200 front panel.

CAUTION:
Before switching loads, turn down 1700 OSCILLATOR LEVEL.

TO MEASURE SIGNAL-TO-NOISE RATIO REFERRED TO RATED POWER

(A) To measure using AUX Input:
(1) Set controls as stated in SET UP 1 on p. 7.
(2) Drive amplifier to rated power as described in step (2)-(5) at top of p. 3.
(3) Reset 1700 controls as follows:
   FUNCTION: dB VOLTS
   RATIO: 0 dB
   ADJUST: Set for full scale meter reading
(4) Reset 1200A controls as follows:
   MEASUREMENT: CHANNEL: RIGHT
   FILTERS: A preferred (B, C, OUT, may be used as desired)
   TEST SIGNAL: CHANNEL: OFF
(5) Range 1700 RATIO switch down until on-scale reading is obtained. Read right channel signal-to-noise ratio directly in dB.
(6) Reset 1200A MEASUREMENT to LEFT CHANNEL. Read left channel signal-to-noise ratio.
(B) To measure using PHONO input:
(1) Reset 1200A TEST SIGNAL to PHONO and repeat above test.

TO MEASURE RIAA PHONO EQUALIZATION ACCURACY

(1) Set controls as stated in SET UP 1 on p. 7.
(2) Reset 1200A controls as follows:
   MEASUREMENT: AMPLIFIER OUTPUT: RCDR
   TEST SIGNAL: BUFFERED 1700, MONO INV RIAA, PHONO
(3) Reset 1700 controls as follows:
   INPUT: 0.3 V range
   OSCILLATOR: FAST RESPONSE
(4) Reset amplifier to PHONO input, and drive that input to obtain a reading of approximately 0.15 volts on the 1700 meter.
(5) Reset 1700 controls as follows:
   FUNCTION: dB VOLTS
   RATIO: 0 dB range
   ADJUST: Set for -3 dB meter reading
(6) Program 1700 FREQUENCY switches over the RIAA phono equalization range noting any change in reading at each frequency. Changes in meter readings are errors in phono preamp equalization. Record (plot) meter deviations.
(7) Repeat test for left channel.

![RIAA Equalization Error vs. Frequency](image_url)

Typical curve

- 4 -
TO MEASURE AMPLIFIER TONE CONTROL RESPONSE

NOTE: This section describes treble cut response as an example of all bass and treble boost or cut responses.

(1) Set controls as stated in SET UP 1 on p. 7.
(2) Reset these 1700 controls as follows:
   - **INPUT**: Proper range to measure 1/10 rated power output of amplifier
   - **OSCILLATOR**: FAST RESPONSE
   - **FREQUENCY**: 500 Hz
(3) Set amplifier treble control for maximum cut. Drive amplifier to 1/10 rated power output.
   If 1700B meter reading goes off scale, turn INPUT switch one position clockwise. Now the —10 dB point on the meter is 0 dB. For example, an indication of —8 dB on the meter is actually +2 dB.
(4) Reset 1700 controls as follows:
   - **FUNCTION**: dB VOLTS
   - **RATIO**: 0 dB range
   - **ADJUST**: Set for 0 dB meter reading
(5) Increase 1700 **FREQUENCY** in a sequence such as 1:2:5, plotting meter readings as a function of frequency.
(6) Repeat measurements for left channel.

![Graph of Treble Cut Response vs. Frequency](image)

TUNER MEASUREMENTS

TO MEASURE HARMONIC DISTORTION AT 65 dBf

(1) Set controls as stated in SET UP 2 on p. 7.
(2) Measure THD using 1700.
(3) Set 1200A to RIGHT CHANNEL and repeat test.
NOTE: IEEE/IHF test requirements specify repeating test at 100 Hz and 6 kHz. Test may also be repeated in Mono.

TO MEASURE SIGNAL-TO-NOISE RATIO

(1) Set controls as stated in SET UP 2 on p. 7.
(2) Reset 1000A to MONO.
(3) Set receiver to MONO.
(4) Reset 1200A controls as follows:
   - **FM MOD**: LEFT
   - **FILTERS**: BAND PASS
(5) Reset 1700 controls as follows:
   - **FUNCTION**: dB VOLTS
   - **RATIO**: 0 dB range
   - **ADJUST**: Set for full scale meter reading.
(6) Reset 1000A to CW.
(7) Range 1700 **RATIO** switch down to obtain an on-scale meter reading.
(8) Read signal-to-noise ratio directly in dB on 1700 meter.
TO MEASURE SENSITIVITY FOR 30 dB QUIETING

1. Set controls as stated in SET UP 2 on p. 7.
2. Reset 1700 controls as follows:
   - FUNCTION: DISTORTION
   - RATIO: 3% (~30 dB) range
3. Reduce 1000A RF LEVEL until distortion reading rises to 30 dB. Sensitivity for 30 dB (3%) quieting is the RF LEVEL dial reading in microvolts or dBf. NOTE: This test is very sensitive to receiver tuning. Receiver may be more sensitive in MONO.

TO MEASURE HUM AND NOISE AT 65 dBf

1. Set controls as stated in SET UP 2 on p. 7.
2. Reset 1000A to MONO.
3. Reset receiver to MONO.
4. Reset 1200A controls as follows:
   - FM MOD: LEFT
   - FILTERS: LOW PASS
5. Reset 1700 controls as follows:
   - FUNCTION: dB VOLTS
   - RATIO: 0 dB range
   - ADJUST: Set for full scale meter reading
6. Reset 1000A to CW.
7. Range 1700 RATIO switch down to obtain an on-scale meter reading.
8. Read hum and noise at 65 dBf directly in dB on 1700 meter.

TO MEASURE SENSITIVITY FOR 50 dB QUIETING

1. Set controls as stated in SET UP 2 on p. 7.
2. Reset 1000A to MONO.
3. Reset receiver to MONO.
4. Reset 1200A FM MODULATION to LEFT.
5. Reset 1700 controls as follows:
   - FUNCTION: dB VOLTS
   - RATIO: 0 dB range
6. Reset 1000A to CW.
7. Reset 1700 RATIO switch to ~50 dB range.
8. Reduce 1000A RF LEVEL until meter reads full scale. 50 dB quieting is the RF LEVEL dial reading in microvolts or dBf.

TO MEASURE CHANNEL SEPARATION AT 65 dBf

1. Set controls as stated in SET UP 2 on p. 7.
2. Reset 1200A FM MODULATION to LEFT.
3. Reset 1700 controls as follows:
   - FUNCTION: dB VOLTS
   - RATIO: 0 dB range
   - ADJUST: Set for 0 dB meter reading
4. Reset 1200A MEASUREMENT to RIGHT CHANNEL.
5. Range 1700 RATIO switch down to obtain an on-scale reading on 1700 meter. Read left separation directly in dB.
6. Reset 1200A FM MODULATION to RIGHT CHANNEL.
7. Reset 1700 RATIO switch to 0 dB range. Set ADJUST control for 0 dB meter reading.
8. Reset 1200A MEASUREMENT to LEFT CHANNEL.
9. Range 1700 RATIO switch down to obtain an on-scale reading on 1700 meter. Read right separation directly in dB.

TO MEASURE SUBCARRIER REJECTION

1. Set controls as stated in SET UP 2 on p. 7.
2. Reset 1200A FILTERS to HIGH PASS.
3. Reset 1700 controls as follows:
   - FUNCTION: dB volts
   - RATIO: 0 dB range
4. Press 1700 SIGNAL OFF button. Range RATIO switch down to obtain an on-scale reading on 1700 meter. Read subcarrier rejection directly in dB.
Below is a form useful for a mini-clinic. On the next page is a larger form suited to more detailed testing. These forms can be easily reproduced by your printer. Just have him place your name, address, etc., in the space provided (your letterhead can serve as a suitable master). While the forms are copyrighted, Sound Technology releases them to users of its equipment.

### AMPLIFIER PERFORMANCE

<table>
<thead>
<tr>
<th>Total Harmonic Distortion</th>
<th>At Rated Power of _____ Watts at 1 kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left Channel _____ %</td>
<td>Right Channel _____ %</td>
</tr>
</tbody>
</table>

### INTERMODULATION DISTORTION AT RATED POWER

| Left Channel _____ %      | Right Channel _____ %                   |

### SIGNAL-TO-NOISE RATIO REFERRED TO RATED POWER ('A' WEIGHTED)

| Left Channel _____ dB on aux input | Right Channel _____ dB on aux input |

The undersigned hereby authorizes the company to perform the above tests and assumes the risk of loss or damage to the equipment being tested.

**Signed**

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### WARNING

**FOR YOUR SAFETY, THE CHASSIS OF THE RECEIVER OR AMPLIFIER UNDER TEST SHOULD ALWAYS BE CONNECTED TO THE 1200A CHASSIS (†) BEFORE CONNECTING THE RECEIVER/AMPLIFIER TO A POWER SOURCE. THIS CHASSIS CONNECTION SHOULD BE MAINTAINED AT ALL TIMES.**

---

### BASIC SET UP 1

**CAUTION:** Reduce all signal levels to minimum before connecting equipment.

**Set Model 1200A controls as follows:**

<table>
<thead>
<tr>
<th>Oscilloscope:</th>
<th>EXT, TRIGGER: 1700 INPUT MON, 1700 A-INPUT/B-DIST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement:</td>
<td>AMPLIFIER OUTPUT: SPKRS, CHANNEL: LEFT, FILTERS: OUT</td>
</tr>
<tr>
<td>Test Signal:</td>
<td>BUFFERED 1700, AUX/TAPE, CHANNEL: BOTH</td>
</tr>
<tr>
<td>Load:</td>
<td>8 ohms</td>
</tr>
</tbody>
</table>

**Set Model 1700 controls as follows (see 1700 Manual):**

<table>
<thead>
<tr>
<th>Frequency:</th>
<th>1000 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filters:</td>
<td>80 kHz</td>
</tr>
<tr>
<td>Function:</td>
<td>VOLTS/POWER</td>
</tr>
<tr>
<td>Input:</td>
<td>To desired power range</td>
</tr>
</tbody>
</table>

---

### BASIC SET UP 2

**CAUTION:** Set receiver volume at minimum before switching to FM band.

**Set receiver controls as follows:**

<table>
<thead>
<tr>
<th>Function:</th>
<th>FM STEREO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muting:</td>
<td>OFF</td>
</tr>
<tr>
<td>Loudness:</td>
<td>OFF</td>
</tr>
<tr>
<td>Bass/Trebble:</td>
<td>FLAT</td>
</tr>
<tr>
<td>Speakers:</td>
<td>ON</td>
</tr>
<tr>
<td>AFC:</td>
<td>OFF</td>
</tr>
<tr>
<td>Sensitivity:</td>
<td>DISTANT</td>
</tr>
<tr>
<td>Filters:</td>
<td>OUT</td>
</tr>
<tr>
<td>Tuning:</td>
<td>Dead spot in FM band</td>
</tr>
</tbody>
</table>

---

**Set Model 1200A controls as follows:**

<table>
<thead>
<tr>
<th>Oscilloscope:</th>
<th>EXT, TRIGGER: 1700 INPUT MON, 1700 A-INPUT/B-DIST</th>
</tr>
</thead>
<tbody>
<tr>
<td>FM Level:</td>
<td>1700 L-R</td>
</tr>
<tr>
<td>Load:</td>
<td>8 ohms</td>
</tr>
</tbody>
</table>

**Set Model 1000A controls as follows:**

| RF Level:  | 65 dBf (970 microvolts with a S-T Model 100 Transformer) |
| Function:  | STEREO |
| Pilot Level: | 9% (see 1000A Manual) |
| Input:     | EXT |
| Frequency: | Tune to receiver setting |

---

**Set Model 1700 controls as follows:**

<table>
<thead>
<tr>
<th>Function:</th>
<th>VOLTS/POWER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input:</td>
<td>Proper range to drive amplifier to 1/10 rated power</td>
</tr>
<tr>
<td>Frequency:</td>
<td>1000 Hz</td>
</tr>
<tr>
<td>Filters:</td>
<td>80 kHz</td>
</tr>
<tr>
<td>Oscillator:</td>
<td>Set for 100% modulation as read on 1000A meter</td>
</tr>
<tr>
<td>Adjust:</td>
<td>AUTO SET LEVEL position</td>
</tr>
<tr>
<td>Inter:</td>
<td>LOW DISTORTION</td>
</tr>
<tr>
<td>VOLUME:</td>
<td>For 1/10 rated power output.</td>
</tr>
</tbody>
</table>
# Sound Technology Performance Evaluation Form

**AMPLIFIER PERFORMANCE**

<table>
<thead>
<tr>
<th>TOTAL HARMONIC DISTORTION</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• AT JUST BELOW CLIPPING LEVEL _____ WATTS</td>
<td></td>
</tr>
<tr>
<td>• AT RATED POWER OF _____ WATTS AT 1 kHz</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Left Channel</th>
<th>Right Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>@ 20 Hz</td>
<td>_____ %</td>
<td>_____ %</td>
</tr>
<tr>
<td>@ 2000 Hz</td>
<td>_____ %</td>
<td>_____ %</td>
</tr>
<tr>
<td>@ 20,000 Hz</td>
<td>_____ %</td>
<td>_____ %</td>
</tr>
</tbody>
</table>

**INTERMODULATION DISTORTION AT RATED POWER**

<table>
<thead>
<tr>
<th></th>
<th>Left Channel</th>
<th>Right Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>@ 1 Watt</td>
<td>_____ %</td>
<td>_____ %</td>
</tr>
<tr>
<td>@ 10 Watts</td>
<td>_____ %</td>
<td>_____ %</td>
</tr>
<tr>
<td>@ Rated Power</td>
<td>_____ %</td>
<td>_____ %</td>
</tr>
</tbody>
</table>

**SIGNAL-TO-NOISE RATIO REFERRED TO RATED POWER (‘A’ WEIGHTED)**

<table>
<thead>
<tr>
<th></th>
<th>Left Channel</th>
<th>Right Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>dB on aux input</td>
<td>_____</td>
<td>_____</td>
</tr>
</tbody>
</table>

**RIAA EQUALIZATION ACCURACY**

<table>
<thead>
<tr>
<th></th>
<th>Left Channel</th>
<th>Right Channel</th>
</tr>
</thead>
<tbody>
<tr>
<td>± _____ dB</td>
<td>± _____ dB</td>
<td></td>
</tr>
</tbody>
</table>

**TUNER PERFORMANCE**

**MONO**

<table>
<thead>
<tr>
<th>TOTAL HARMONIC DISTORTION</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>@ 970 μV (65 dBf)</td>
<td>_____ %</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SENSITIVITY FOR 30 dB QUIETING</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>μV</td>
<td>dBf</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SIGNAL-TO-NOISE RATIO</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>@ 970 μV (65 dBf)</td>
<td>_____ dB</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SENSITIVITY FOR 50 dB QUIETING</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>μV</td>
<td>dBf</td>
</tr>
</tbody>
</table>

**STEREO**

<table>
<thead>
<tr>
<th>SEPARATION</th>
<th>Left</th>
<th>Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>dB</td>
<td>dB</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TOTAL HARMONIC DISTORTION</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>@ 970 μV (65 dBf) Left</td>
<td>_____ dB</td>
</tr>
<tr>
<td>Right</td>
<td>_____ dB</td>
</tr>
</tbody>
</table>

The undersigned hereby authorizes the company to perform the above tests and assumes the risk of loss or damage to the equipment being tested.

Comments

Signed

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Test Technician's Signature