How to make audio measurements on stereo receivers and amplifiers

- Test forms included

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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.

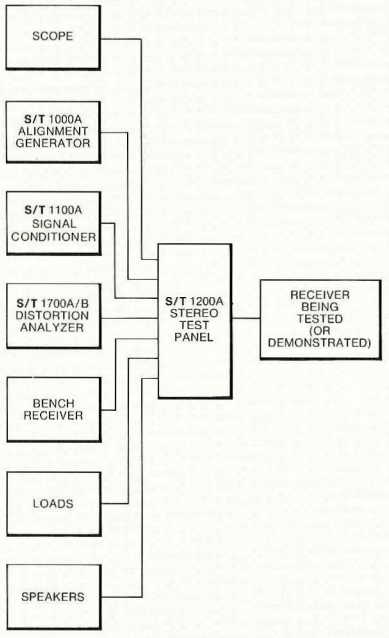
MAKING MEASUREMENTS

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.

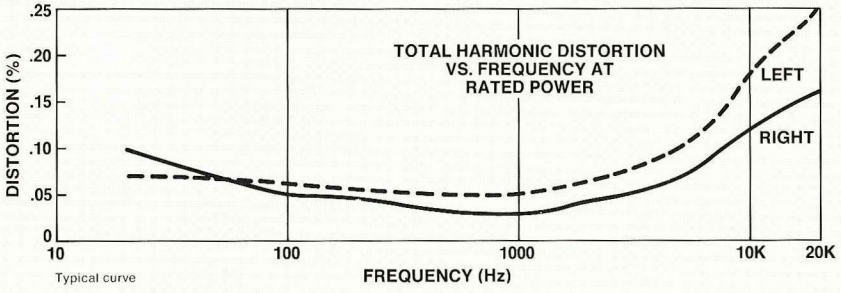
(6) Reset **1700 FUNCTION** switch to **DISTORTION.** Read the amplifier's right channel distortion on the meter of the 1700.

(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.



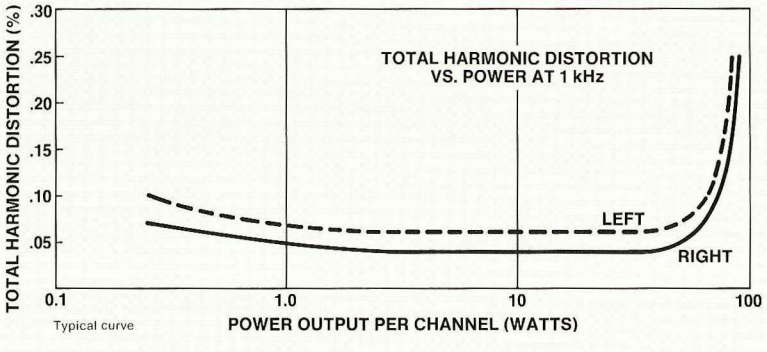
TO MEASURE TOTAL HARMONIC DISTORTION VS. POWER AT 1 kHz

(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:

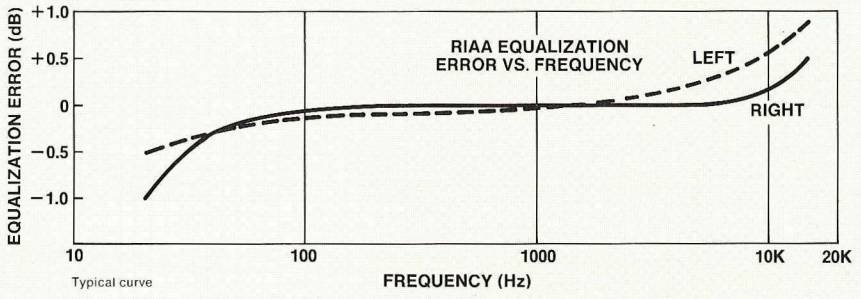
FUNCTION: dB VOLTS

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.



Typical curve

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:

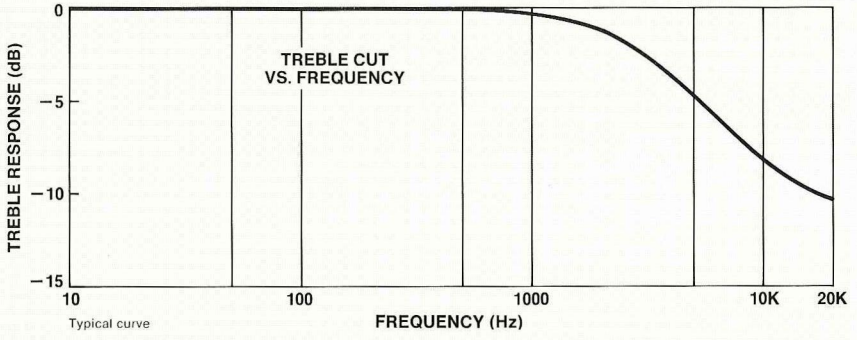
FUNCTION: dB VOLTS

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.



Typical curve

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

ADJUST: Set for full scale meter reading

(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

ADJUST: Set for full scale meter reading

(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.

FORMS YOU MAY REPRODUCE

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.

(DEALER: IMPRINT YOUR NAME HERE)

Customer Name _____ **Date** _____

Street _____ **City** _____

State _____ **Zip** _____ **Phone** _____

Receiver Make _____ **Model No.** _____

S® SOUND TECHNOLOGY T PERFORMANCE EVALUATION FORM

AMPLIFIER PERFORMANCE

TOTAL HARMONIC DISTORTION AT RATED POWER OF _____ WATTS AT 1 kHz

Left Channel _____ % Right Channel _____ %

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

TUNER PERFORMANCE

TOTAL HARMONIC DISTORTION IN MONO

@ 970 μv (65 dBf) _____%

SENSITIVITY FOR 30 dB QUIETING

_____ μv _____dBf

SEPARATION Left _____dB

Right _____dB

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 _____

Comments _____

Test Technician's Signature _____

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:

OSCILLOSCOPE:	EXT. TRIGGER: 1700 INPUT MON, 1700 A-INPUT/B-DIST
MEASUREMENT:	AMPLIFIER OUTPUT: SPKRS, CHANNEL: LEFT, FILTERS: OUT
TEST SIGNAL:	BUFFERED 1700, AUX/TAPE, CHANNEL: BOTH
LOAD:	8 (ohms)

Set Model 1700 controls as follows (see 1700 Manual)

FREQUENCY:	1000 Hz
FILTERS:	80 kHz
FUNCTION:	VOLTS/POWER
INPUT:	To desired power range
ADJUST:	AUTO SET LEVEL position
OSC LEVEL:	Minimum
OSCILLATOR:	LOW DISTORTION

Set controls of amplifier under test as follows:

BASS/TREBLE:	FLAT
LOUDNESS:	OFF
INPUT:	AUX
BALANCE:	Approximately centered
SPEAKERS:	ON
VOLUME:	Maximum

BASIC SET UP 2

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

Set receiver controls as follows:

FUNCTION:	FM STEREO
MUTING:	OFF
LOUDNESS:	OFF
BASS/TREBLE:	FLAT
SPEAKERS:	ON
AFC:	OFF
SENSITIVITY:	DISTANT
FILTERS:	OUT
TUNING:	Dead spot in FM band

Set Model 1200A controls as follows:

OSCILLOSCOPE:	EXT. TRIGGER: 1700 INPUT MON, 1700 A-INPUT/B-DIST
MEASUREMENT:	AMPLIFIER OUTPUT: SPKRS, CHANNEL: LEFT, FILTERS: BAND PASS
FM MOD:	1700 L-R
LOAD:	8 (ohms)

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:

FUNCTION:	VOLTS/POWER
INPUT:	Proper range to drive amplifier to 1/10 rated power
FREQUENCY:	1000 Hz
FILTERS:	80 kHz
OSC LEVEL:	Set for 100% modulation as read on 1000A meter
ADJUST:	AUTO SET LEVEL position
OSCILLATOR:	LOW DISTORTION

Set receiver VOLUME for 1/10 rated power output.

(DEALER: IMPRINT YOUR NAME HERE)

Customer name _____ Date _____

Street _____ City _____

State _____ Zip _____ Phone _____

Receiver Make _____ Model No. _____

SOUND TECHNOLOGY
PERFORMANCE EVALUATION FORM

AMPLIFIER PERFORMANCE

TOTAL HARMONIC DISTORTION

- **AT JUST BELOW CLIPPING LEVEL _____ WATTS**
- **AT RATED POWER OF _____ WATTS AT 1 kHz**

Left Channel	@ 20 Hz _____ %	@ 2000 Hz _____ %	@ 20,000 Hz _____ %
Right Channel	@ 20 Hz _____ %	@ 2000 Hz _____ %	@ 20,000 Hz _____ %

INTERMODULATION DISTORTION AT RATED POWER

Left Channel	@ 1 Watt _____ %	@ 10 Watts _____ %	@ Rated Power _____ %
Right Channel	@ 1 Watt _____ %	@ 10 Watts _____ %	@ Rated Power _____ %

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

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

RIAA EQUALIZATION ACCURACY

Left Channel ± _____ dB Right Channel ± _____ dB

TUNER PERFORMANCE

MONO

TOTAL HARMONIC DISTORTION

@ 970 μv (65 dBf) _____ %

SENSITIVITY FOR 30 dB QUIETING

_____ μv _____ dBf

SIGNAL-TO-NOISE RATIO

@ 970 μv (65 dBf) _____ dB

SENSITIVITY FOR 50 dB QUIETING

_____ μv _____ dBf

STEREO

SEPARATION Left _____ dB

Right _____ dB

TOTAL HARMONIC DISTORTION

@ 970 μv (65 dBf) Left _____ dB

Right _____ dB

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 _____

Comments _____

_____

_____

Test Technician's Signature _____