1. Visual Inspection

Conditions: This inspection must be done before any tools or setup are applied to the product.

Test: Check to make sure the front panel and meter face are free from scratches, stains, discolorations, silkscreen errors, etc.. See that all appearance parts are properly aligned and free from defects in their appearance and functional behavior. Also check to see that there is no loose hardware and that all workmanship standards for soldering have been met.

Inspect all the power supply electrolytic capacitors and diodes along with all the product's i.c.'s to be installed with the correct polarity BEFORE turning the unit on. Also check the fuse value to be 250 volts, .25 amps, 3AG slow blow.

If any of the above requirements are not met send the unit to be reworked and notify the leadperson who delivered the products to the test department of the unit's failure.

2. Power Supply

CAUTION: DO NOT lean over the product when the power is first applied if the top cover is off the unit. Be ready to quickly turn off the power if a destructive condition should manifest itself.

Conditions: No input signal and no output load on the unit.
Set the line voltage with an autotransformer to 120 Vac.

Test: Place a d.c. voltmeter probe on the input to the power supply regulator VR1 and then switch on the power to the unit. Measure the voltage to be according to the following table along with all other specified measurements and tolerances.

Test Point	d.c. Voltage	Tolerance
input of VR1	+40.5	+ or - 1.5 Volt
anode of CR6	-10.0	+ or - .5 Volt
output of VR1	+30.0	+ or - 1.0 Volt
+ terminal of C15	+14.0	+ or - 1.0 Volt

Place a d.c. voltmeter probe on the input to the VR1 regulator and switch the line voltage switch, on the back of the unit, to the 230 position. Measure the voltage to be approximately +19.5 Vdc. Remember to set the line voltage switch back to the 115 position.

Vary the line voltage level with the autotransformer from 100 Vac to 140 Vac and measure the difference between these two voltage levels at the output of VR1 to be no more than 500 millivolts. Also, check to make sure that the red power LED is properly illuminated when the power is switched on.

Note: For all the following tests that do not involve limiting be sure to have the Attack pot switched off in the full counterclockwise position.

3. Power Consumption

Conditions: No input signal or load on the output.
Set the line voltage with an autotransformer to 120 Vac.

Test: Measure the input power of the unit at it's line cord to be less than 10 watts. If a power meter is not available then the average power can be determined by measuring the r.m.s. voltage and the r.m.s. current, and multiplying their product by the cosine of the phase angle between them.

4. Gain

Conditions: No load on the output.
Input and output pots full clockwise.

Test: Apply a -25 dbu, 2 kHz input signal then measure the output level to be within +1 or -1 dbu of +22 dbu.

Note: Units without their FET's will have this gain however units that have been properly biased and have the limiting switched off will have approximately 1 db less gain.

5. Common Mode Rejection

Conditions: No load on the output.
Input pot full clockwise.
Make sure the reference signal does not clip.

Test: Apply a -10 dbu, 2 kHz input signal and set an output reference level with the output pot. Connect the signal to both the + and - input terminals at the same time then adjust trimpot R2 for a minimum output level. Measure the output level at 60 Hz and 20 kHz to be more than 70 db below the 2 kHz reference level that was set before tying the + and - together.

6. Input Impedence

Conditions: Use an a.c. voltmeter with an input impedence > 1 MOhm.
The shield and common wires on the input must not be shorted to each other or to any ground.

Note: This test requires two 10 kOhm, 1% resistors in series with the input of the 1176LN. One from the (+) output of the generator to the (+) input terminal of the 1176LN, and another in series from the (-) terminal of the generator to the (COM) input terminal of the 1176LN.

Test: With the 1176LN disconnected from the series resistors, place the a.c. voltmeter on the output of the 10 kOhm source resistors and set the generator for a reference level of 0 dbu at 2 kHz. Connect the input of the 1176LN to the output side of the source resistors and see that the level drops 6.0 db with + or - .25 db tolerance.

7. Output Impedence

Conditions: Square wave generator is needed for this test.
No load on the output.
Make sure the reference signals do not clip.

Test: Place an a.c. voltmeter directly across the + and - output terminals of the limiter and set a reference level of +20 dbu at 2 kHz using a sine wave. Connect a 600 Ohm resistor and see that the level drops .55 db with + or - .1 db tolerance.

Set the sine wave generator for an output reference level from the limiter to have a +10 dbu output at 2 kHz with no load. Connect a 150 Ohm resistor and see that the level drops 2 db with + or - .1 db tolerance.

Apply a 2 kHz square wave to the input of the limiter and check the output waveform on an oscilloscope to have no ringing on either the positive or negative tops after the leading and trailing edges. This should be done using no load and a 600 Ohm load on the output.

Note: The load resistors should have at least a .5 watt rating with a 1% tolerance on their values of resistance.

8. Frequency Response

Conditions: Make sure the reference signal does not clip.
600 Ohm load on the output.

Test: Apply a 2 kHz input signal and set an output reference level of 24 dbu. Sweep the signal generator from 20 Hz to 20 kHz and check to see that the output level changes no more than +.5 db and -1 db from the reference level.

Increase the frequency of the input signal until the output level drops to 3 db below the reference level then measure this frequency to be approximately 55 kHz with + or - 10% tolerance.

Note: Be sure to monitor the input signal level so as to insure that the reference input level does not vary. Some generators need to settle, especially at low freqencies, before a measurement can be made.

9. Maximum Input and Output Levels

Conditions: Input pot full clockwise.
150 Ohm load on the output.

Test: Apply a -10 dbu, 2 kHz input sine wave signal then adjust the output pot so that the signal just starts to clip. This level should be greater than 20 dbu.

Set the input pot so that the output level drops 40 db. Increase the input signal until the output waveform shows clipping then measure the input signal to be greater than +20 dbu (7.75 Vrms).

10. Bias

Conditions: Trimpot R81 full counterclockwise.
Attack pot full counterclockwise. (Switched off.)
Release pot full clockwise.
Ratio switch set to 20:1.

Test: Apply a -10 dbu, 2kHz input signal and adjust the input and output pots for a 10 dbu output reference level. Adjust R81 so that the output level drops exactly 1.0 db.

Note: If the FET (Q1) is installed in the 1176LN then it is necessary to remove it after setting a reference level in order to make sure that it is not conducting and thereby giving a false reference level. After it is determined that there is no change in level then the FET should be reinstalled for the calibration to be made.

11. Meter Calibration

Conditions: 600 Ohm load on the output.
Attack pot full counterclockwise. (Switched off.)
Release pot full clockwise.
Ratio switch set to 20:1.
Set the meter switch to the GR position.

Test: Before power is applied to the unit make sure the mechanical zero adjustment on the face of the meter is set on the mark just below the -20 Vu on the meter then apply a 2 kHz, -10 dbu input signal and set an output reference level of 10 dbu with the input and output pots. Set trimpot R55 (through the hole in the front panel) so that the meter on the 1176LN reads exactly 0 Vu.

Switch the attack pot full on and use the output pot to set an output level at 0 dbu then switch the attack pot full off and use the input pot to set an output reference of 10 dbu. Repeat this process until there is exactly a 10 db drop from the 10 dbu reference level when the attack switch is full on.

With the attack pot full on set the trimpot R54 for exactly a -10 db Vu on the meter on the 1176LN. Switch the attack off and reset 0 Vu with R55 then keep repeating this on/off calibration until it is no longer needed (usually 2 or 3 times).

Apply a 2 kHz, -10 dbu input signal and set an output reference level of 4 dbu with the output pot. Set the meter switch to the +4 position and see that the meter on the 1176LN reads 0 Vu within + or - .5 db. Repeat this setup for an output level of 8 dbu and the meter switch set to the +8 position.

Check to make sure that the lamps inside the meter of the 1176LN have the proper illumination and that they are matched in brightness to each other. Also the needle in the meter should have smooth motion throughout it's range of operation.

12. Noise

Conditions: 600 Ohm load on the output.
600 Ohm terminator on the input terminal.
Input and Output pots full clockwise.

Test: Using a 30 Hz to 15.7 kHz bandpass pass filter on the input of an a.c. voltmeter measure the output level of the limiter to be less than -57 dbu. Rotate the input pot full counterclockwise and measure the level to be less than -63 dbu.

Use an oscilloscope that is triggered on the line frequency and set for 5 mSec/div to measure the output of the voltmeter. Look for a continuous white noise level that has no more than 1 db jumps in level. There should be no burst (popcorn) noise and maybe only small level spikes (60 and/or 120 Hz) induced from the power transformer.

Note: The bandpass filter that is specified in this test has slope rates for the high pass and low pass sections of 6 db/octave.

Also the specification sheet says that there must be greater than 81 db signal to noise ratio at at the threshold of limiting. This number is calculated by adding the limiter's gain to the absolute value of the noise level and then subtracting the amount of the difference of 0 dbu and the threshold of limiting. Typically however, given the limit of -57 dbu and the threshold of limiting for the 4:1 ratio setting is specified at -30 dbu the s/n ratio will be 74 db. This improves at the 20:1 setting with the specified threshold at -24 dbu and therefore a s/n ratio of 80 db.

13. Ratios

Conditions: 600 Ohm load on the output.
Attack pot full counterclockwise. (Switched off.)
Release pot full clockwise.
Ratio switch set to 20:1.
Set the meter switch to the GR position.

Note: The meter on the 1176LN will have to be calibrated before this test is done in order to determine the 1 db of limiting point easily.

Test: Apply a 2 kHz, -10 dbu input signal and set an output reference level of 10 dbu with the input and output pots for each channel. Set the attack switch full on and set the 1176LN into 1 db of limiting using the meter on the limiter. Also, set an output reference level with the output pot.

Use the above setup for each of the ratio settings of 20:1, 12:1, and 8:1. The 4:1 ratio setting will need to be set for 3 db of limiting because of the soft knee in the threshold circuit for this ratio. A new output reference level must be made for each new ratio setting.

Increase the input signal 20 db and see that the output level will increase, from the new output reference level that must be set for each ratio, 1 db, 1.66 db, 2.5 db, and 5 db for each ratio setting respectively with a 20% tolerance for each ratio setting. Repeat this setup and test using 20 Hz and 20 kHz input signals. The 20 Hz test will need to be done with the release pot in the full CCW position.

Conditions: Tone Burst generator is needed.
Attack pot full counterclockwise. (Switched off.)
Release pot full clockwise.
Ratio switch set to 20:1.
Set the meter switch to the GR position.

Test: Apply a 2 kHz, -10 dbu, sine wave input signal and set an output reference level of 10 dbu with the input and output pots for each channel. Set the attack full on and adjust the 1176LN for 10 db of limiting. Set an output reference level with the output pot.

Apply a tone burst signal that has the same amplitude as the sine wave setup signal along with a gated output of a duration of 1 msec on and 1.5 seconds off and that also has several cycles of a 20 kHz signal. With an oscilloscope measure the time duration from the peak amplitude on the leading edge of the gated signal to the smallest amplitude (which should be the same as the reference level) to be less than 20 usec when the attack pot is full clockwise and greater than 800 usec when the attack is counterclockwise (but not switched off).

Repeat the sine wave setup above with 10 db of limiting. With an oscilloscope measure the time duration for the signal level to increase to 63% of the final amplitude of the output signal after quickly switching the input signal down to -30 dbu to be no less than 50 msec with the release pot full clockwise and no greater than 1.1 seconds when the release pot is full counterclockwise.

Note: For best resolution of the measurement use the full scale grid of the oscilloscope for the amplitude measurement.

A square wave generator can be used to determine that the attack and release circuit is working by using a 20 Hz input signal with about 10 db of limiting however this method should only be used to compare a known good unit to the device under test but the accuracy of the measurement is not precise.

If this measurement technique is used then it should be observed that when the release pot is full counterclockwise that the amount of difference in the leading edge overshoot, when the attack time is tested through the full range of the pot, will be the greatest and therefore the best means for measuring. When the release time is tested through the full range of the pot there should be a substantial difference in the amplitude and tilt of the square wave.

15. Ratio Switching Envelope

Conditions: 600 Ohm load on the output.
Attack pot full counterclockwise. (Switched off.)
Release pot full clockwise.
Ratio switch set to 20:1.
Set the meter switch to the GR position.

Test: Apply a 2 kHz, -10 dbu input signal and set an output reference level of 10 dbu with the input and output pots. Set the attack switch full on and set the 1176LN into 1 db of limiting using the meters on the limiter. Also, set an output reference level with the output pot.

Set the ratio switch to each of the 12:1, 8:1, and 4:1 settings and see that the output level drops 1 db, 1.5 db, and 2.5 db for each setting respectively. Increase the input signal 20 db and measure the maximum difference in output levels for all ratio settings to be less than 1.5 db.

16. Total Harmonic Distortion

Conditions: Attack pot full clockwise.
Release pot full counterclockwise.
Ratio switch set for 20:1.
600 Ohm load on the output.

Test: For each input signal of 30 Hz, 200 Hz, 2 kHz, and 15 kHz measure the THD at 1 db below clip to be less than .3% if Q1 is removed from the unit. When Q1 is in the 1176LN and it is biased correctly the THD is typically less than .3% when the limiting is switched off. The specification for distortion is from 50 Hz to 15 kHz in limiting at any level up to rated output to be less than .5% THD.

Note: Since the amount of limiting was not specified, and the THD is a function of the amount of limiting, then an amount of 5 db of limiting is what could be used for a typical real world measurement.

Make sure that the signal generator that is used has distortion less than .01% in order to insure an accurate measurement.

17. Threshold of Limiting

Conditions: Input, attack, and release pots full clockwise.
Ratio switch set for 20:1.
Meter switch set for GR.

Test: Apply a -20 dbu, 2 kHz input signal and see that the meter on the 1176LN is showing limiting. Decrease the input signal to the point where the meter is showing only -1 db Vu reading and measure the input signal at this point to be -24 dbu, with + or - 2 db tolerance. Change the frequency of the input signal to 20 Hz and 20 kHz and see that this threshold remains at the same level.

Repeat this test for the 12:1, 8:1, and 4:1 ratio settings that have -25 dbu, -26 dbu, and -30 dbu thresholds of limiting respectively with + or - 2 db of tolerance for each setting.

Note: It is important that the meter on the 1176LN has been calibrated and tested before this test is done.

18. Contamination

Conditions: Attack pot full clockwise.
Release pot full clockwise.
Ratio switch set for 20:1.
Meter switch set for GR.

Test: Apply a -10 dbu, 2 kHz input signal and adjust the input pot so that there is 5 db of limiting (use the meter on the 1176LN) then use a hot moist breath for about 5 seconds on Q1 and see that there is no change in level.

Note: The hot breath can be produced by keeping your mouth wide open and gently forcing air from your throat. Also if a change in level does occur after the moist air is applied it is probably due to flux residues from the soldering process and should be cleaned with an isopropyl alcohol and distilled water solution with a 75% alcohol to 25% water mixture.