

Introduction

The Loopback self-test procedure can be used to evaluate the performance of the USB Box, Duet, USB Jr., Solo, and USBLite hardware for systems that include the SmartEP program. By connecting the sound output of the unit to the signal input of the amplifier, it is possible to assess the proper operation of most of the components. Note that this test does not evaluate the transducers, electrode leads, and electrodes; as these will be disconnected during the procedure.

During this procedure, a 1000 Hz rectangular tone burst is delivered through the sound output port of the device. This signal is then routed using the Loopback accessory and read by the amplifier, then displayed on the screen. A certain peak-to-peak amplitude value is expected from these recordings, as the stimulus level changes.

Setting up the hardware

Performing this procedure requires the use of a special Loopback accessory. One of these devices, appropriate for each specific hardware type, is supplied with each system:

For Duet



Fig.1 - Loopback cable for the Duet system.

To Connect this cable:

1. Disconnect the insert earphones from the Duet.
2. Plug the red Fischer connector of the Loopback cable in that socket (labeled "Earphones").



Fig.2 - Loopback connection to Duet.

3. Disconnect the patient cable from the Duet.
4. Plug the six-pin rectangular connector of the Loopback Cable in that socket (labeled "Electrodes")



Fig.3 - Loopback connection to Duet.

For Aria or Solo



Fig.4 - Loopback box for the Aria system.



Fig.5 - Loopback box for the Solo system.

To Connect this box:

1. Disconnect the insert earphones from the Aria or Solo.
2. Plug the three-pin rectangular connector of the Loopback Box in that socket (labeled "Earphones")
3. Disconnect the patient cable from the Aria or Solo.
4. Plug the six-pin rectangular connector of the Loopback Box in that socket (labeled "Electrodes")

For USB Box and USB Jr.

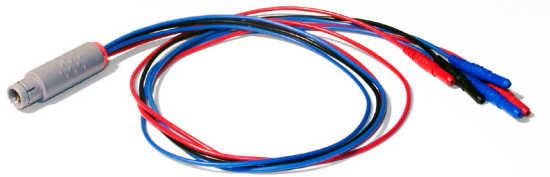


Fig.6 - Loopback cable for a 2-channel system.

To connect this cable:

1. Disconnect the insert earphones from its socket on the USB box
2. Plug the Fischer connector of the Loopback cable to the 300 Ohm insert earphone socket (red ring).



Fig.7 - Loopback connection to USB.

3. Unplug any and all electrode leads (patient cables) from the amplifier
4. Plug the Loopback cable to the electrode lead sockets, matching the colors of the plug to the socket.

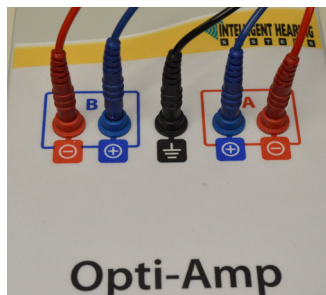


Fig.8 - Loopback cable connection to amplifier.

For USB devices with more than two channels, connect first into the A and B channels, then test the other channels later as needed.

For USBLite



Fig.9 - Loopback cable for the USBLite system.

The USBLite Loopback cable has two Fischer connectors. Simply match the colors of the plugs to the sockets.

For units inside a cart tray, you may run the test once while connected to the Sound Output Electrode Box (SOEB), and a second time while connected directly to the USBLite; this will help determine if the SOEB is working properly.

Running the Loopback test

Once the cable is connected, perform the loopback test following these steps:

1. For Duet, USB and USBjr. switch the device ON. The Solo and USBLite do not have an ON switch.
2. For USB and USBjr, turn the knob on the amplifier to the ON position.
3. Open the SmartEP program.
4. Click on **[AMPLIFIER]** in the side panel, then adjust the 'Level' slider to the maximum value (100%).
5. In the control panel, set the **[EAR]** to 'Right', the **[MODE]** to 'Ipsi'. Also make sure the **[PHASE]** is set to rarefaction.
6. From the **[SET PAGE]** button on the right of the screen, make sure the "Scale" option is set to "Normalized"
7. From the main menu, choose **[PROTOCOL > EXECUTE PROTOCOL]**.
8. From the list of protocols, choose the file corresponding to your device:
 - For Duet, Aria, USB, and USBjr. choose the file named "Loopback.pse2", then click **[OPEN]**.
 - For the Solo and USBLite, choose the file named LoopbackSoloUSBLite.pse2, then click **[OPEN]**
9. The protocol will acquire four or five recordings from the max of 80 dB or 90 dB respectively, to 50 dB in 10 dB steps, wait for it to finish acquisition of all waveforms.
10. Set the **[EAR]** to 'Left' on the control panel, then run the protocol again (steps 7 - 9). For units with a single acquisition channel such as the Aria, Solo or USBLite this will serve to test the sound output. For units with two or more channels such as the Duet, USB and USBjr this will server to test the channel as well as the sound output.

For systems with 3 or more channels

If the unit has more than two channels, connect the red and blue leads to the additional channels (e.g. Channel C and Channel D), making sure these additional channels are designated as Right or Left in the EEG and Amplifier window (i.e. set Channel C to Right and Channel D to Left, while setting Channels A and B to OFF). Then run the loopback protocol again for both Left and Right ears to acquire additional loopback recordings.

Evaluation by IHS Technicians

Once all results have been acquired, you may have them reviewed by an IHS technician by:

- Saving the report to PDF and sending it in an e-mail to support@ihsys.com.
- Printing the results and faxing them to +1.305.668.6103.

Expected results

The waveforms resulting from acquisition should have a sinusoidal structure. The structure will look smoother at the higher intensities (90 dB) and deteriorate slightly at the lower intensities (50 dB).

Current values for the peak-to-peak amplitudes (PP) of the waveforms are listed here. Values acquired do not need to be exact, and are expected to be within the range indicated below

Expected values for the Duet and Aria platforms:

- **90 dB:** 100 μ V (90 - 110 μ V).
- **80 dB:** 31 μ V (27 - 33 μ V).
- **70 dB:** 10 μ V (9 - 11 μ V).
- **60 dB:** 3.1 μ V (2.7 - 3.3 μ V).
- **50 dB:** 1 μ V (0.8 - 1.2 μ V).

Expected values for Solo, USB Box, USB Jr. and USBLite platforms:

- **90 dB:** 100 μ V (90 - 110 μ V).
- **80 dB:** 33 μ V (29 - 35 μ V).
- **70 dB:** 10 μ V (9 - 11 μ V).
- **60 dB:** 3.3 μ V (2.9 - 3.5 μ V).
- **50 dB:** 1 μ V (0.8 - 1.2 μ V).

Note that results for the Solo and USBLite hardware will only include the last four values on the list above, the 90 dB response will not be acquired.

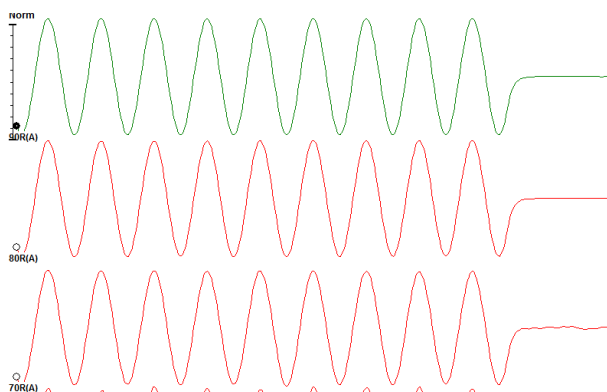


Fig.10 - Sample Loopback test results.

If the results are still not sinusoidal, or the values are outside the indicated range, contact IHS support for service. IHS will issue a Repair order (RMA).

Troubleshooting Steps for USB and USB Jr.

- If the results of the loopback do not look sinusoidal, make sure both the USB box and the amplifier are ON and then run it again. Also verify the fiber optic cable is properly connected to both ends, including the power connection if available.
- If the results are still not sinusoidal, or the values are too far from the ones indicated, contact IHS support for service. IHS will issue an RMA.

For units with 2 or more channels, if the problem is only showing in a single channel, additional troubleshooting steps can help determine the source of the problem, while still having the loopback cable connected.

1. Switch the optical cables at both the USB box and amplifier ends. (E.g. This will make the Channel A receiver collect data from the Channel A amplifier using the Channel B fiber optic cable)
2. In the Auditory Stimulus Generation window, choose a 1000 Hz tone of 10000 μ s duration, using a rectangular envelope. Make sure the stimulus is set to insert earphones and the presentation is set to 'Continuous'.
3. Open the EGG & Amplifier window.
4. Toggle between channels and see if the 1000 Hz sine wave is now present on the channel that had the problem.

If the problem switches channel when the fiber optic cable is switched on both ends, then the problem lies with the fiber optic cable. In this case, you may contact IHS to purchase a new fiber optic cable.

If the problem persists in the same channel, switch the fiber optic cable only on one end. This will make the receiver of the affected channel collect data from a known good amplifier channel (e.g. the Channel A receiver will collect data from the Channel B amplifier).

- If the issue seems to be resolved in the affected channel, then there is a faulty amplifier channel. Contact the IHS service department for further instructions. You may be required to send the Opti-Amp transmitter (possibly the entire unit) to IHS for repair.
- If the issue remains in the same channel, the problem may be due to an internal component in the USB Box. Call IHS service department for instructions on how to ship back the entire system for repair.