Maker Audio Cable White Paper

Let's begin with a little background on what an audio cable needs to do and what it should not do.

In a perfect world, a cable would transfer your audio signal from point A to point B with no loss or degradation in the original signal, from 1 Hz to 25 kHz. Sounds simple enough, but in the real world things are not so simple. We have capacitance of the cable, DC resistance of the cable, inductance in the cable, etc., all acting against the original signal.

On top of that, we have to keep the cable from becoming an expensive antenna. Yes, even cables costing hundreds or thousands of dollars can pick up and carry every radio frequency in your house, from 50 Hz to 9 GHz – whether it is coming from your light dimmer, microwave, Wi-Fi router, baby monitor, Bluetooth receiver or radio – and delivering that noise to your next component in your system. Some cables may even have been designed to propagate and amplify these unwanted signals by accident by the cable manufacturer. Even shielded cables are not immune.

When we approached the design on our new Reference Series cables, we wanted to look at the signal path from the cable's point of view. Our first step was to use a cable conductor that was good at transmitting audio frequencies but not good at transmitting very high frequencies. That's different from what most designers do. They look for a conductor with high bandwidth, which actually entices the RF energy to jump onto the cable, not what we want. Just as in designing a crossover in a speaker, we want to limit the range the driver – in this case the wire – has to operate in. We also wanted to keep capacitance low, to have good direct current resistance and low inductance, and to promote good propagation though the copper wire.

To those ends, we had a custom wire manufactured to our specifications and had the wire cryogenically treated. The wire is subjected to -273 degree temperature for 48 hours. During the process, the wire is not in spool form, further enhancing the molecular alignment in the wire.

Once the wire is processed, each piece is cut to length based on capacitance. So for a 1-meter interconnect cable set, the left or right wire may be 1/4-inch to 3/8-inch longer or shorter, depending on the capacitance. Basically, we are building the cables in matched sets, so that each cable behaves the same.

We next add null points on the cable to break up standing waves and propagation that may develop on the outer skin of the cable. By breaking up this wave, we reduce its amplitude and help it dissipate naturally. We also add an RF null block mid-cable to dissipate and remove any lower (radio) frequencies traveling along the outside of the cable. These energies are dissipated as micro heat in the RF null block.

The goal is to prevent the RF energy from traveling to the shield of the cable and dumping that energy to the chassis or ground plane of the audio equipment.

We then add a special layer of conductive foam to the outer conductor of the cable. This layer dissipates RF energy from 1 GHz to around 10 GHz, where most Wi-Fi routers and other devices operate. The foam removes this energy in the form of micro heat. The foam also dissipates any energy reflected back from the cable shield. Next comes another layer of conductive silicone to dissipate mid/lower frequencies in the 100 MHz to 1 GHz range, a big advantage for cables being used for phono applications.

Finally, the cable assembly is wrapped in a special coated conductive loom that acts as an external RF shield. Termination on cables is done with high quality OFC silver-plated connectors or gold contacts. Special terminations, connectors and cable lengths are available on request.