HELIAX® Coaxial Cable for Low Intermodulation Generation

With today's rapidly expanding demand for communications of all types, and particularly for wireless systems such as paging, two-way, trunking and cellular, increasing pressure is being put on available spectrum bandwidth. Channel bandwidths are being realigned to yield more channels from existing frequency ranges, and new frequency spectrum is being reassigned to these applications. These additional channels will alleviate system capacity problems, but in many cases these new frequency plans also create further technical challenges, especially regarding intermodulation.

When multiple signals at differing, but usually closely spaced, frequencies are present in an electronic circuit, any nonlinearity will cause generation of harmonics of these frequencies, and still more signals at the sum and difference frequencies of these harmonics. Depending on the original generating frequency values, some of the large number of additional spurious signals can appear in the system receive bands, and if they are of sufficient magnitude will cause increased noise, and serious degradation of system performance. Some of the frequency plans for new wireless systems give the potential for intermodulation problems, and thus require that levels of intermodulation generation be closely controlled.

Usually, the most serious contributors in a radio system are the active elements in the transmitters and receivers, but after appropriate techniques have been applied to deal with these, there will still remain passive circuitry common to many, or all, channels where generated levels must be suitably low. Thus contributions from combining elements, antennas, and interconnecting cables and connectors must be controlled.

In passive components such as coaxial cables and connectors, intermodulation generation is usually caused by either ferromagnetic materials (e.g., nickel plating), or by thin surface oxide layers at junctions between conductors. Where currents have to cross a junction between one conducting element and another (these may be, for example, components of a connector, separate wires in a cable or the cable-connector interface) the oxide layer which is always present provides some rectifying action. Significant intermodulation generation will follow unless the potential problem is recognized and overcome at the component design stage. Junctions between elements are obviously necessary at connectors and connector attachments, and the designs should be such that contact pressures are high and true metal-to-metal contact is established.

The best practice in selecting coaxial cable for low intermodulation generation is to use one with solid conductors. HELIAX cables have a single inner conductor and a single outer conductor, eliminating conductor junctions for current to cross, which are sources of intermodulation.

Figures 1 and 2 compare typical intermodulation performance for a foil-braided cable and a HELIAX cable.

Figure 1 shows measured intermodulation generation for a foil-braided cable having a diameter over the jacket of about 0.6 in. Incident carriers were +45 dBm (31.6 W) at 1825 and 1875 MHz. The third order intermodulation product was measured to be -78 dBm at 1775 MHz.

Figure 2 shows the intermodulation generation for a superflexible HELIAX assembly (FSJ4-50B) measured under the same conditions. The measured level is -113 dBm, that is, 35 dB lower than for the foil braided cable. Both cable assemblies were fitted with Type N male connectors.

Tests at other frequencies, including 900 MHz, 4.5 GHz and higher microwave frequencies, show similar performance differences between braid or foil-braid and HELIAX cables. This is to be expected, since the non-linear generating mechanism is substantially independent of frequency.

The substantially lower level intermodulation generation of HELIAX cables will significantly lessen system noise and degradation.

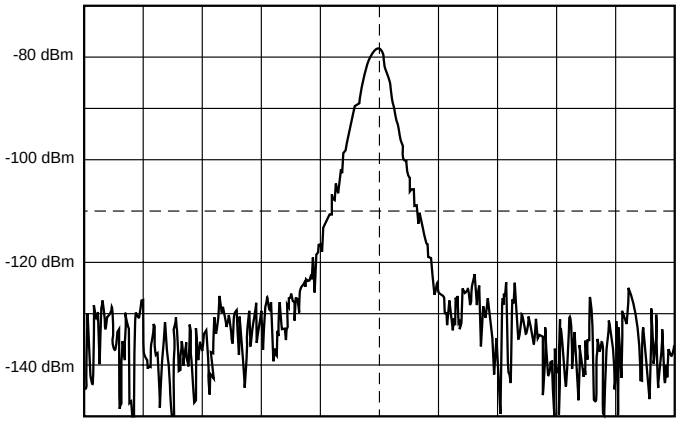

Figure 1

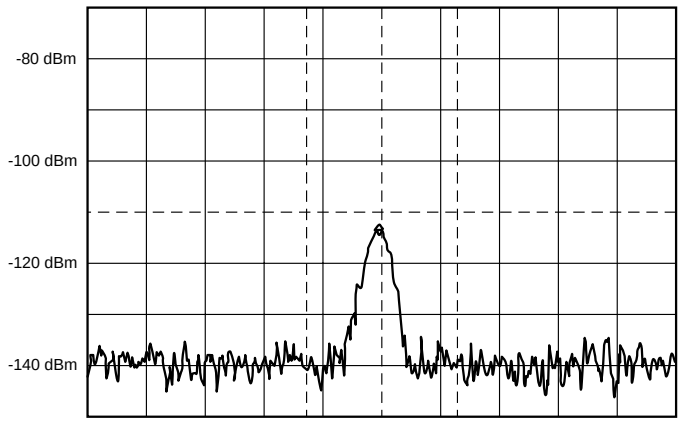

Figure 2