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SOME THOUGHTS ON LTE INTERFACE (PART 2)

By RON HRANAC

Shortly after writing October's column, I had an opportunity to team with several colleagues and head out to the field to look for signal leakage in the 700 MHz spectrum. I obtained a loaner Rohde & Schwarz PR100, a HE300 active directional antenna and a 500 MHz – 7.5 GHz antenna module (www.rohde-schwarz.com/product/pr100.html). This is the same setup Verizon's field engineers use to look for interference to their LTE service.

Other test equipment included a conventional signal-leakage detector tuned to the VHF aeronautical band, a home-brewed, near-field probe (something I put together on the workbench), a couple 750 MHz antennas and a spectrum analyzer. Here are a few highlights of our field work:

First, some not-so-good news: It was fairly easy to find signal leakage in the 698 MHz-806 MHz LTE band. Some good news: Active device locations — nodes and amplifiers — were pretty much the only places where any leakage was measureable, at least in our limited field tests. Even more good news: Most of what I'll refer to as 750 MHz leakage was very low level, not of sufficient field strength to cause harmful interference and relatively easy to fix.

"The main takeaway from all of this is that 750-MHz leakage can exist even when aeronautical-band leakage can't be measured."
A mix of good and not-so-good news: In all but two instances where we did find 750 MHz leakage with the PR100, the conventional leakage detector showed absolutely nothing in the aeronautical band. The good news part of this? With the exception of two test locations, there was no aeronautical band leakage. Zip. Nada. The not-so-good-news part: There was 750 MHz leakage. In other words, we confirmed that leakage can exist at 750 MHz even when the 108 MHz-139 MHz aeronautical band is leak-free.

Yet more good news: The 750 MHz leakage we observed was low enough in all cases to be well-below the Federal Communications Commission's (FCC's) limit of 15 µV/m at 30 meters (100 feet) for that frequency range.

A quick editorial comment regarding the latter: Even if signal leakage at any frequency is at or below relevant FCC field strength limits, if that leakage causes harmful interference it must be fixed. §76.613 of the FCC's rules is quite clear about this.

The accompanying figure is a captured screen shot from the PR100, showing leakage observed at one of the locations checked. Leaking QAM signals are evident across about three-quarters of the 698 MHz-806 MHz measurement span, although they are low level. The large haystack in the middle of the screen is Verizon's 746 MHz-756 MHz downlink signal (tower to LTE device), and the carriers on top of the last QAM haystack and just to its right are uplink signals from LTE devices to the tower. A leaking unmodulated analog-TV channel can be seen partially covered by the compass display. There was no measureable leakage in the aeronautical band at this particular location. Here the fix was a simple tightening of a slightly loose 90-degree connector in the pedestal, which completely eliminated the 750-MHz leakage.

Another location checked was a metal cabinet housing an active device and assorted passives. No leakage at any frequency was apparent until the cabinet was opened, at which point we could see low-level 750-MHz leakage but nothing in the aeronautical band. Here we used my home-brewed, near-field probe connected to the PR100 to sniff around various devices, connectors, and so forth in the cabinet in an attempt to localize the leakage source. The probe got us to within a couple inches of what turned out be a loose center-conductor seizure-screw access cap on a 90-degree adapter. Tightening that cap eliminated most of the 750-MHz leakage. When the PR100 and its antenna were more than about three feet from the equipment in the cabinet, nothing could be seen.

FIGURE 1: A captured screen shot from the Rohde & Schwarz PR100, showing leakage observed at one of the locations checked by the author.

The next location checked was a plastic pedestal housing an active device. Here we found both aeronautical-band and 750-MHz leakage. Just for grins, I plugged the 20 MHz-200 MHz antenna module into the HE300 and compared the PR100's measured aeronautical-band leakage field strength with the conventional leakage detector's reported value. The two instruments were within 1 dB-2 dB of each other. The culprit here turned out to be a loose KS-port chassis terminator. Tightening that eliminated all of the leakage.

As you can see, the sources of leakage — whether 750 MHz-only or a combination of aeronautical band and 750 MHz — proved to be nothing out of the ordinary. One active device location we checked did have some rather nasty measured leakage field strengths in the aeronautical band and at 750 MHz. Tightening some loose pieces and parts in the pedestal dropped the leakage field strengths about 6 dB, but follow-up work by the cable company had to be scheduled to fix the remainder of the leakage. I was told that a damaged underground cable was found.

The main takeaway from all of this is that 750-MHz leakage can exist even when aeronautical-band leakage can't be measured. While most of the 750-MHz leakage we found was fairly low level, the point is there was leakage (to be fair, other locations we checked had no leakage at any frequency). During the past several weeks I've chatted with folks at a handful of cable companies, and many indicated Verizon's field engineers have visited some of their systems. Let me reiterate what I said in last month's column: If field engineers from a carrier like Verizon contact you about suspected signal leakage interfering with their LTE or other over-the-air services, by all means work with them to figure out what's going on and get the problem fixed.

One other point from my October column bears repeating: Cable operators should seriously consider checking for leakage in the vicinity of 750 MHz in addition to the measurements being performed in the VHF aeronautical band. Just because your aeronautical-band leakage-detection gear indicates a tight plant does not mean that there isn't leakage at much higher frequencies.

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