

## Keep on truckin'



**A**t our truck-manufacturing facility, the technicians in production called up engineering and said they couldn't fix a problem fault code, something that we had to fix before we could ship the trucks to the customer. Our transmitter was shutting down due to high VSWR (voltage-standing-wave ratio). Production replaced the failed transmitters as well as the antennas, but the fault returned. We had seen some of

these intermittent failures in the field so were hoping to find a number of production trucks with the same problem. We armed ourselves with as much test equipment as we could think of—a few spare antennas, a couple of PCs to monitor the transmitter software, and a 75-lb network analyzer—and drove for two hours to our production facilities.

The first thing we did was set up the PCs to tell us the VSWR in the transmitter and reproduce the problem. Bingo! The first time it transmitted, we hit the high VSWR; the software fortunately shut down the system to prevent any more damage.

When we unbolted the antenna from the roof of the truck—read: “removed the ground”—the VSWR improved dramatically.

Our specialties are electrical and software engineering, not antenna design. We leave this black art to the antenna manufacturers. We specify only the antenna characteristics, keeping the VSWR as close as possible to 1-to-1 at about 145 MHz. We were stumped but knew that, without a ground plane, we would kill the system's performance. Out came the network analyzer.

We set up the analyzer to read VSWR over the transmitter's receiv-

ing and transmitting frequencies of 138 to 150 MHz. We saw a well-shaped VSWR, although high on the transmitting side. We measured this VSWR with and without the antenna on the ground plane. The results showed why we were seeing faults. I opened up the display span to 100 to 200 MHz to see a bit more of the antenna bandwidth. We saw some significant differences and then realized that the antenna was not tuned to our 145-MHz requirement.

We took lots of pictures but still wondered why this problem had begun to show up. The antenna design wasn't supposed to change without our approval. Upon returning to the engineering center, we reviewed this work with another system engineer. He quickly disassembled the antenna because it “didn't look right.” We found that the antenna manufacturer had changed the circuitry at the base of the antenna. We put a few of these antennas through the network-analyzer test and found that they were indeed different, even though the part numbers were the same.

Our system engineer quickly called the antenna rep, who told us that the designs did change from time to time—in this case “only twice” since the original design, the rep said, stating that one of our sister companies had requested a new design for a shorter antenna. The antenna engineers thought that they could redesign the base a little bit and have a common base between both our companies, saving a bit of money.

A seemingly small change greatly affected our “fault-free” system. Now we had to chase down and repair possibly hundreds of trucks. After a few trials, I found that cutting an inch off the antenna whip got the VSWR back in line; a few days later, we shipped the customer some fault-free trucks. **EDN**

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