Recent Soil Measurements At N6LF

Rudy Severns, N6LF, February 2015

At my last QTH I'd made extensive measurements of soil electrical characteristics which were written up in a Nov/Dec 2006 QEX article. This is available at: www.antennasbyn6lf.com. Two years ago I moved to a new QTH with very different soils. I went from a forested mountain hillside to flat farmland beside the coast fork of the Willamette River where the soil is a rich river sediment.

Recently I finally had a chance to measure the soil electrical characteristics at my new QTH. I used the same technique as outlined in the QEX article except by this time I had a vector network analyzer (VNA2180) replacing the AEA analyzer which represents a very substantial improvement in measurement accuracy! I used a single 18" probe with a 36"x36" ground screen as shown in figure 1.

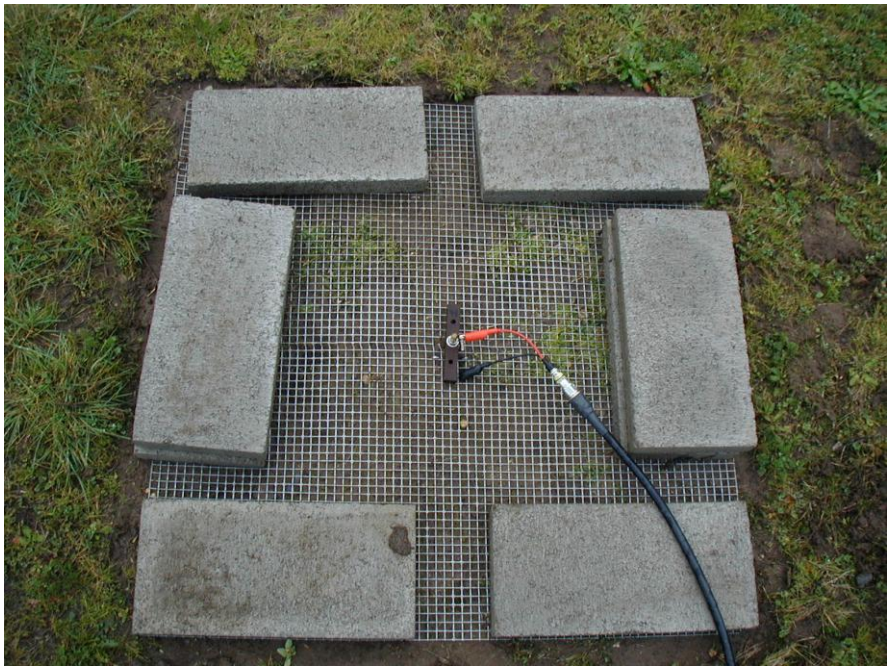

Figure 1 - Test probe and screen.

A measurement of the impedance at the probe is taken with the VNA (at the other end of a pre-calibrated cable) and that information is converted to

conductivity and relative permittivity (Er) with a simple calculation on a spreadsheet (see QEX article for the conversion equations).

I made the measurements over a period of several days. On January 30th there had been no rain for ten days or more so the soil was a bit on the dry side. Over the next few days however, it rained quite a bit, first 0.1", then 0.5" and finally another 1.5" on February 3rd. I repeated the soil measurements daily with the results shown in figures 2 and 3.

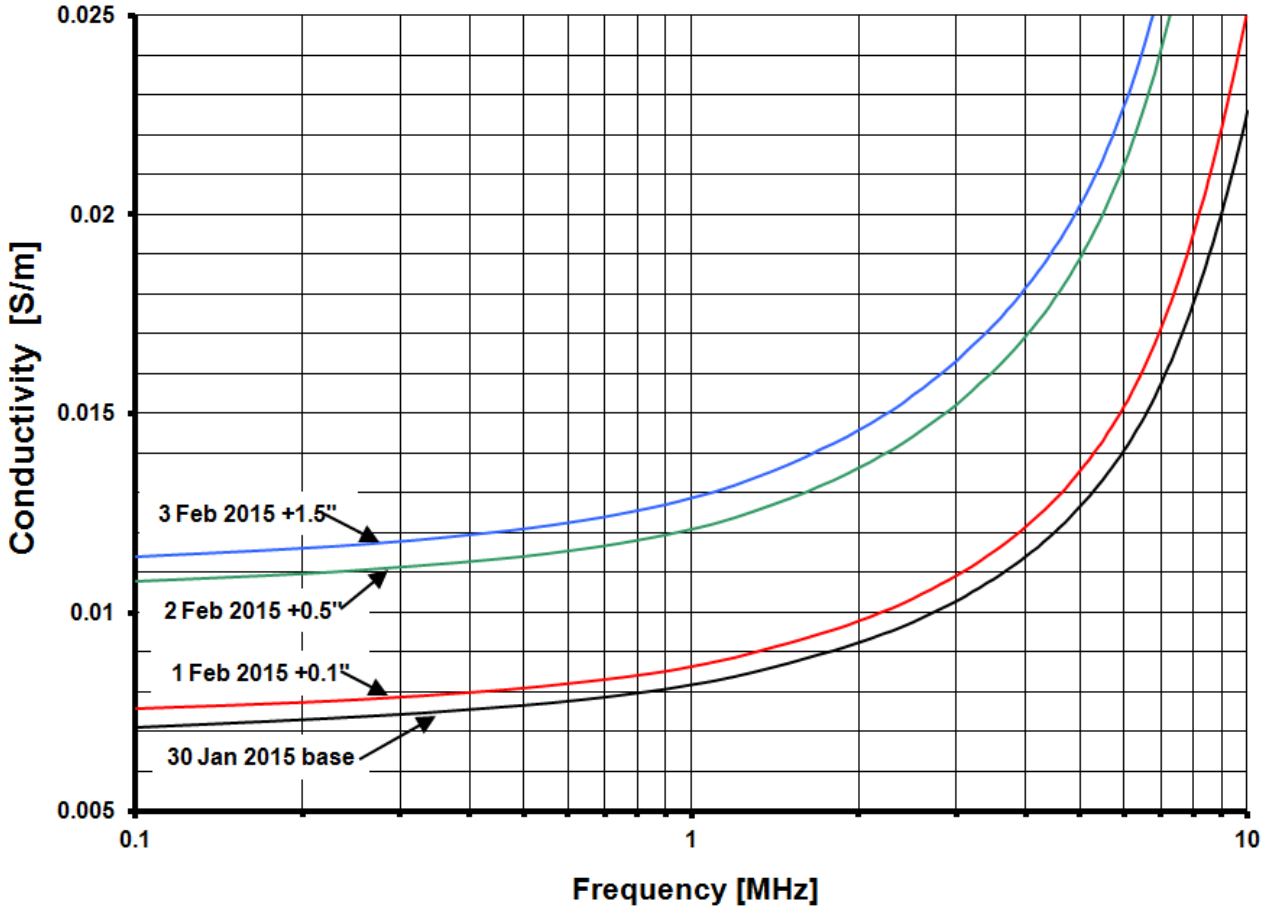

Figure 2 - Soil Conductivity.

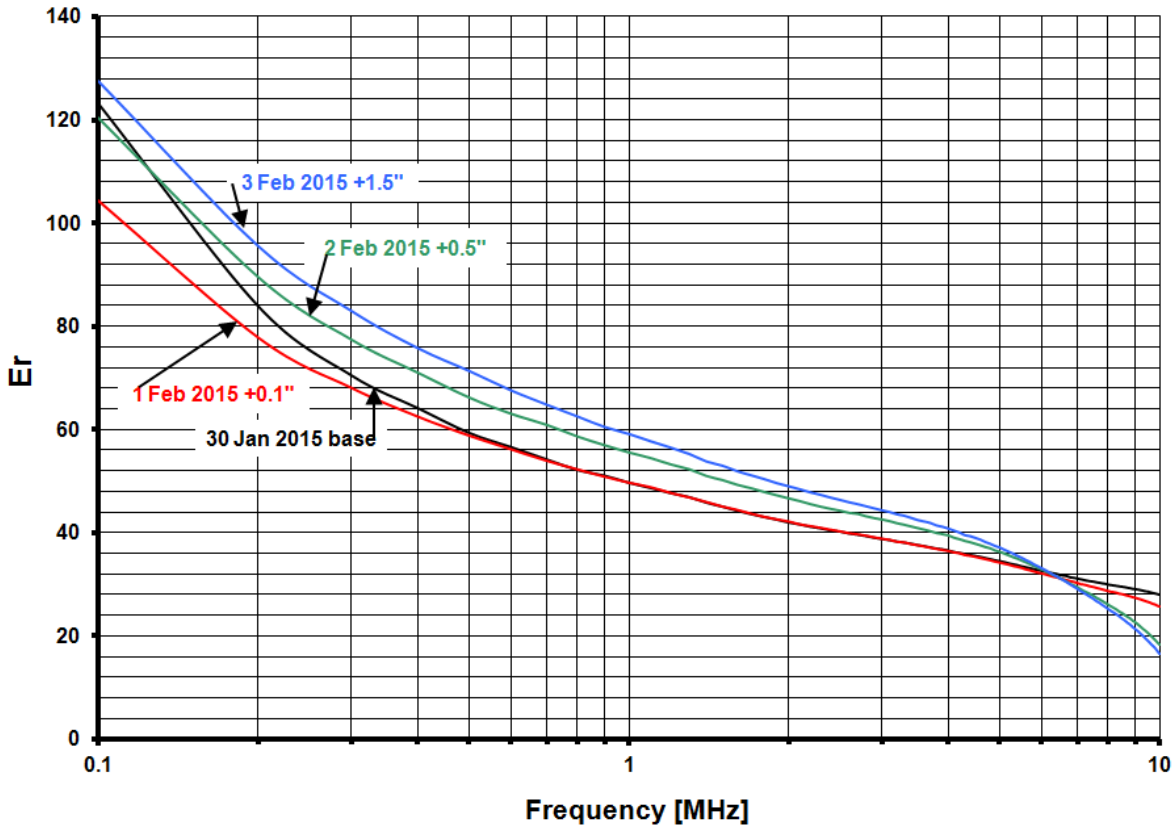

Figure 3 - Soil relative permittivity.

The variations with frequency are normal for most soils but what's interesting are the significant variations with rainfall. The conductivity at 475 kHz went from 0.007 S/m to 0.012 S/m, almost double!. There was also a substantial increase in Er. Since the 3 Feb measurement we've had another dry spell and the soil characteristics have moved back towards the January 30th base line.

I had noticed the resonant frequency of my 630m antenna was very sensitive to rainfall, moving steadily downward as rainfall accumulated and then rising again when the soil dried out. In summer especially, the resonant frequency was well above 475 kHz requiring me to readjust the matching network to transmit. I think the large variations in soil characteristics pretty much explain what was going on. These measurements will be continued through the summer to get a better feeling for the full range of variation.