A Blast from the Past – The DX-O-Graph
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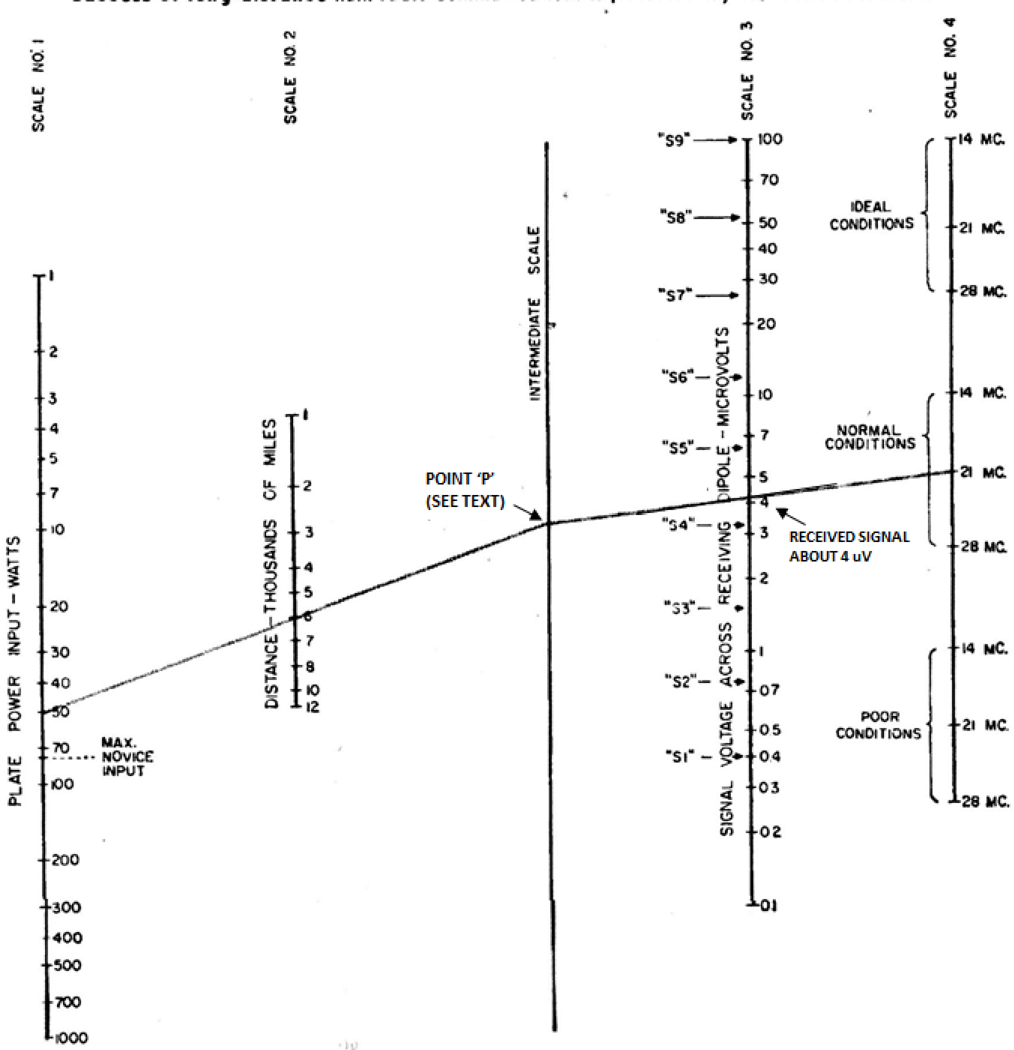
Last month we went to Mars. This month we'll stay on Earth, but we'll go back in time to the late 1950s. We'll look at a method of predicting propagation on the 20-Meter, 15-Meter and 10-Meter bands. This method is crude by today's standard, but remember back then there weren't any computers available to most Amateur Radio operators to crunch numbers – and the model of the ionosphere was still evolving into worldwide maps of E region and F2 region monthly median critical frequencies and MUFs (maximum useable frequencies).

This old method was named the DX-O-Graph [*note 1*], and it was described by C. F. Rockey W9SCH in the July 1959 issue of the old *Popular Electronics* magazine. Note that this was even before the sophisticated manual prediction method that came out of the Institute for Telecommunication Sciences in Boulder in 1971, which used the aforementioned monthly median worldwide maps. The following shows the chart for DX-O-Graph predictions.

Success of long-distance ham radio communications is predicted by the "DX-O-GRAPH."



How do you use the DX-O-Graph? It's pretty simple, but there is some antiquated terminology used.

For example, the first step is to put a dot on Scale No. 1 at your plate power input. Of course this is antiquated terminology – the FCC changed us from 'plate power input' to 'output power' many years ago. Digging through the text of the DX-O-Graph article indicates that the DX-O-Graph assumes an overall efficiency of 33%. In other words, it assumed around 50% efficiency in converting plate DC input power to RF output power (50% is a reasonable assumption for Class C power amplifiers of the day) and around 2 dB loss in the coax from the rig to the antenna.

To translate this scale to modern output ratings, multiply your output power by 3 and enter this value on Scale No. 1. If you're running 100 Watts out, put a dot at 300. For 1500 Watts out (which is off the scale), put a dot at 1000 and add one S-unit to the ultimate signal strength result.

Next connect a line from the power dot to the distance to the target location on Scale No. 2. Remember that 1000 miles = 1610 km if you like to work in the metric system. Note that this method only includes distances from 1000 miles (1610 km) to 12000 miles (19,320 km – about halfway around the world).

Next, note where the extended line from Scale No. 1 to Scale No. 2 crosses the Intermediate Scale (annotated as Point P). From Point P draw a straight line to Scale No. 4 at the desired frequency under the appropriate conditions. The text in the article does not elaborate on the 'conditions' parameter, but from the change in signal strength from Ideal to Poor at a given frequency appears to be loosely based on where we are in a solar cycle. Thus Poor conditions should be used when we're at the low phase of a solar cycle. Normal conditions should be used when we're at the mid phase of a solar cycle. Ideal conditions should be used when we're at the high phase of a solar cycle. I realize this is kind of subjective, but it's all I have to go on.

Now note where this line from Point P to Scale No. 4 crosses Scale No. 3. This is the predicted signal strength in uV (microvolts) and in S-units. A good question is "why is S9 equated to 100 uV?" The standard (which wasn't followed by everyone – and still isn't) was S9 = 50 uV. The predicted value in the DX-O-Graph is across the receiving antenna, and half of it will get to the receiver – thus S9 really is 50 uV at the receiver.

The DX-O-Graph was set up assuming a half-wave dipole or equivalent. For a small Yagi, add one S-unit to the final result. For a big Yagi, add one and a half S-units.

Another fundamental question is "what are the DX-O-Graph predictions based on?" As stated earlier, the Ideal/Normal/Poor conditions appear to be based on where we are in a solar cycle. As for the change in signal strength from 14 MHz to 21 MHz to 28 MHz for a given condition, it looks like this is based solely on the free space path loss (spherical spreading of the wave). If the frequency is doubled, the free space path loss increases by 6 dB – which means the signal strength will go down by 6 dB, and this is what happens on the DX-O-Graph.

The final question is "how well does DX-O-Graph compare to VOACAP?" Let's run a prediction on 20-Meters in February 2017 (Poor condition for DX-O-Graph). We'll go with 100 Watts output to a dipole antenna. Our path will be from K9LA in Fort Wayne, IN to Germany (4246 miles) during the day. The following table compares signal strengths for the two prediction methods.

<table>
<tr><th>UTC</th><th>VOACAP S-units</th><th>DX-O-Graph S-units</th></tr>
<tr><td>1300</td><td>S3</td><td rowspan="5">S5</td></tr>
<tr><td>1400</td><td>S3.5</td></tr>
<tr><td>1500</td><td>S3.5</td></tr>
<tr><td>1600</td><td>S3.5</td></tr>
<tr><td>1700</td><td>S3.5</td></tr>
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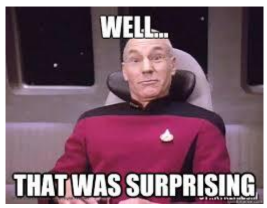
Son of a gun – DX-O-Graph is in the ballpark of VOACAP for when VOACAP says the band is open.



Of course, this is only one comparison. But still . . .

In closing, I can't stress enough that the DX-O-Graph predictions are crude compared to predictions from today's methods. For example, North-South propagation is assumed to be the same as East-West propagation. And the predictions are for all intents and purposes only for daytime propagation, when the MUFs on these higher bands are generally high enough to support propagation. But as we just saw, the DX-O-Graph may give you a general idea of what 20-Meters, 15-Meters and 10-Meters may be doing during the best times of the day.

Notes

1) The name 'DX-O-Graph' is kind of unusual, with two common words on either side of the letter 'O'. Apparently this was somewhat typical of the late 1950s. For example, G. R. Norberg WØORZ had an article in the August 1957 issue of QST. He described an audio filter using a single 12AU7 vacuum tube to improve selectivity of receivers of the day. He called it the Crud-O-Ject (since it rejected crud). Another example is National Radio's Select-O-Ject that they offered in the early 1950s. National bought the design from W6QYT and W6VQL (see the November 1949 QST).