TECHNICAL ARTICLE

Why can't Jim in the next suburb hear me on 40m ?

Ever wondered why you perfectly tuned 40m dipole doesn't work into the next suburb but can get 59 from a station at the other end of the country ..

Briefly here are two reasons why, **Antenna Radiation Angle** and **Propagation**.

Figure 1 is a plot of my (VK4PQ) 40m dipole mounted horizontally 7m above ground.
The plot shows the circular RF cardioid pattern (donut, easier to see the donut shape in fig 3.) of the antenna, on this plot we are looking into the end of the antenna and seeing the RF radiation pattern produced by the antenna.
The radiation angle of the antenna is between the two purple lines which are at about 45 deg, with the maximum radiation angle represented by the green line which is straight up at 90 deg.
This then means that our maximum radiation is going straight up and even at the lower angle of the radiation pattern (less efficient) we will still be shooting over the top of our neighbouring ham that we are trying to contact.

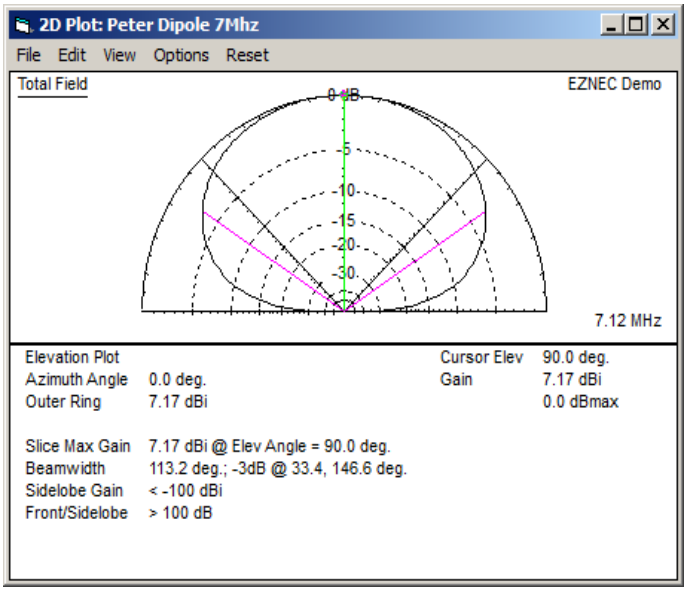

Figure 1.

Watch what happens if I can raise the antenna to a quarter wave (10m) above ground figure 2 and then a half wave (20m) above ground figure 3.

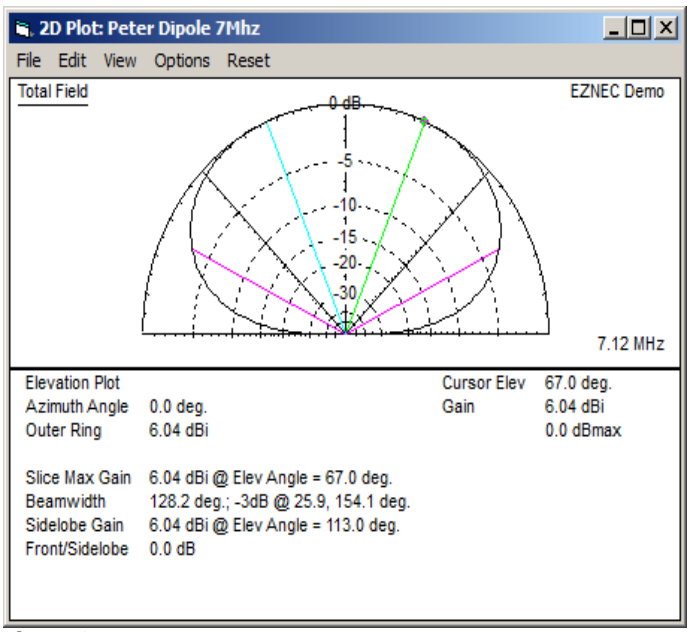

Figure 2.

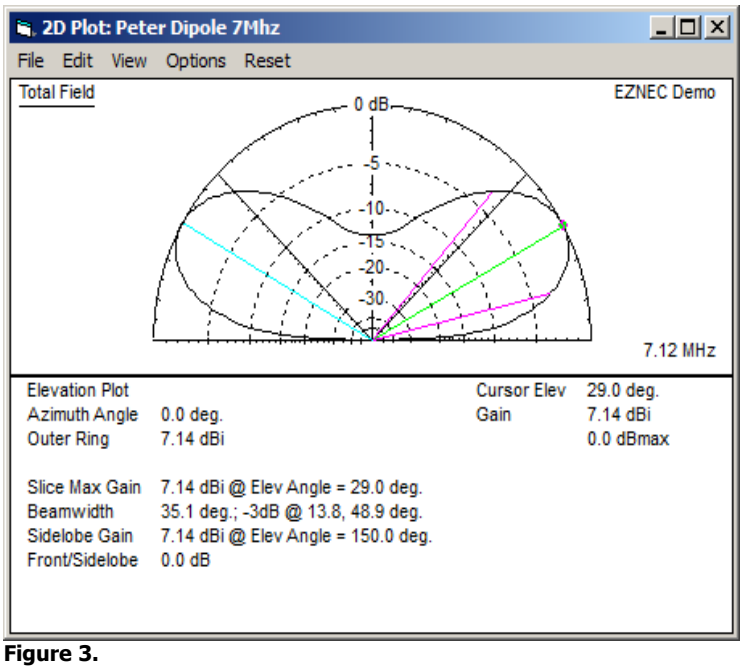

Figure 3.

See what is happening with the radiation angle, the two purple lines and the green line, they are getting closer together and the radiation angle is getting lower, so looking at figure 3 (right hand side) the chances of talking to your ham friend in the next suburb is getting better but the lower purple line is still about 15 deg therefore you will most likely still be shooting over the top of your neighbouring ham but other features around like hills etc may bounce some signal to him.

Which brings me to one of the other main factors governing the skip distance of your radiated signal, **PROPAGATION**.

During daylight hours the ionosphere layers (D, E, F,) we are particularly looking at the D layer in this instance is charged by the suns rays and thereby absorbs lower frequencies (your 40m radiated signal which is going straight up and into it) which is why 40 and 80m propagation begins to get better of an evening and night as the D layer discharges at which time the signal is going higher into the E layer (less absorption of HF in this layer) for example and is then refracted back to earth giving you a longer skip distance as well as some of the signal reflected straight back down allowing you to talk to your neighbouring ham.

So a 80/40m dipole in most ham stations will only be between 5 and 10m above ground we need to look at figures 1 and 2 and realise that most of our radiated signal goes straight up but some of our signal at a less efficient factor is radiated at a lower angle and gives us our skip distance remembering that during daylight hours most of our radiated signal is absorbed by the D layer in the ionosphere.

Back to the original question and with respect to the Friendly Afternoon Net on 40m, why cant Snow (VK4ME) in Kirwan hear me (VK4PQ) but I get 59 from Fred in Brisbane; well the ionosphere is still highly charged at 4pm but starts to decay rapidly as the sun sets, therefore my main radiated signal is still being absorbed but my lower angle radiated signal is starting to get refracted by the ionosphere (E layer), this will get better as the sun sets and eventually Snow will hear me at some time during the evening depending of course on how charged the ionosphere was during the day and the decay rate of the D layer.

Much more to this story but I hope this clears up some of the mystery of HF a little bit.

Radiation patterns with thanks to EZnec Demo program.

De VK4PQ Peter @ Kelso.

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