Mount Climie 395, 5425, 730 and 860 Propagation Signal differences explained.

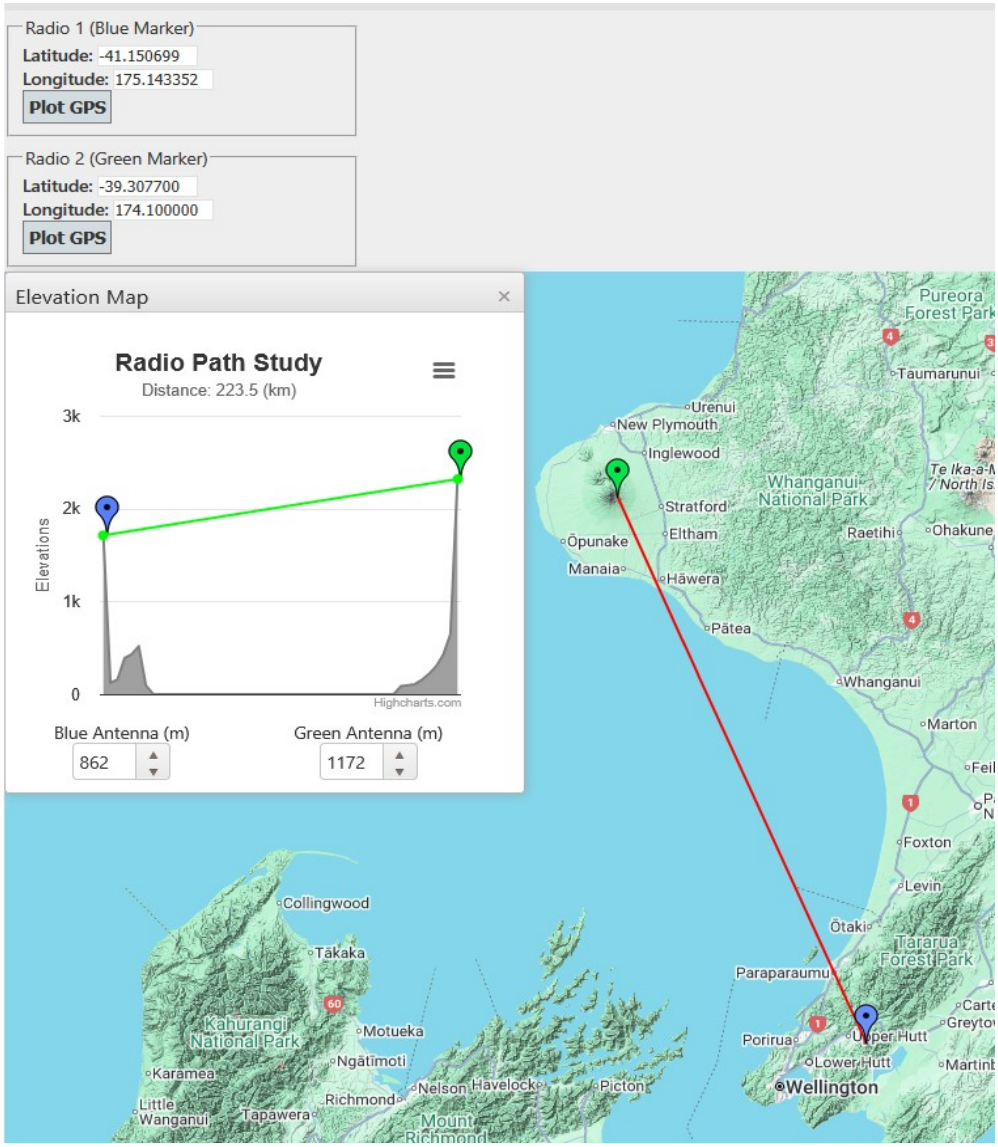
By John M. Wysocki ZL2TWS - July 2025

Operators sometimes find that signals received are different, but they don't know if this is normal, or what they should expect from almost identical powered repeaters at the same site.
I hear some saying 5425 is S-9 and 860 is S-5 almost as if there is something wrong.

Why an S-Meter reading was not identical when signal is received from these three Mount Climie repeaters, seems puzzling. The transceiver used was a multiband rig with a common multiband antenna.
This must assume that the transceiver is correctly calibrated by the manufacturer. Usually, they are close because the IF stages are normally common to all bands for the same S-Meter circuit.

On the 2nd of July 2025 Dave ZL2TLF was operating his mobile radio from the Stratford Plateau Mountain House car park. This has an altitude Above Sea Level (ASL) of 1172 m.
Dave worked Mark ZL2UFI via Mount Climie (MCL) 53.950 MHz (395) repeater and then 147.300 MHz (730) repeater. Signals reported to Mark on 395 was S-9 and 730 was S-5. MCL is 862 m ASL.
Dave did not have his D-Star radio with him and was not aware that 5425 and 860 can operate in FM mode providing the CTCSS tone is enabled in the FM mode. 5425 and 860 were not checked over this path.

According to distance calculations from https://www.scadacore.com/tools/rf-path/rf-line-of-sight/
the distance from Stratford Plateau Mountain House car park to MCL is 223 kms. See *Picture-1.*



Picture-1

To explain further, with signal reports from Dave ZL2TLF for 395 at S-9 and 730 at S-5 we assume 0 dB gain whip mobile antenna used for each.

Both repeaters are using 0 dB gain antenna (single dipole) and the same cable loss the ERP should be similar.
730, with the current in service single dipole, has a bad SWR and with cable loss the ERP is around 28 watts.
395 with cable loss has around 45 watts ERP due to a better SWR and higher output power.
So, 395 should be slightly stronger anyway.
An addition signal reduction is also caused by the path loss on 730 being 2.75 times greater than 395.

What is path loss?
A radio wave's path loss is the decrease in power attenuation that occurs as signal travels through space. It depends on the frequency used and distance between stations. This is impacted by a variety of physical conditions, including reflection, refraction, abortion and diffraction. As frequency increases so does the path loss effect. 3 cm band operators using 10365 MHz, over long-distance paths, often find signals are totally attenuated when it rains however can still QSO over the same path if using a lower VHF frequency.

The 1292 MHz FM repeater at MCL has noticeable wild swings of signal depending on weather conditions.

This web site has an excellent web site calculator to determine point to point path loss.

https://www.everythingrf.com/rf-calculators/free-space-path-loss-calculator

Path loss over the 223 kms distance from MCL to Stratford Plateau for 395 is -114.0 dB and 730 is -122 dB.
730 will be weaker by 8 dB.
Path lift or enhancement can influence signal more on 730 than 395 so the levels during
normal Line Of Sight (LOS) propagation for 730 would always be lower.

730 using a 4-dipole antenna would give +6 to +8 dB gain and overcome the loss.
730 using the 2-dipole antenna would give +3 to +5 dB gain.
(pole spacing and diameter determines the overall pattern and gain)
Note: 730 usually uses a two stacked dipole antenna but was down for maintenance which then made this path loss test very useful and valid as both repeaters used a single 0 dB gain folded dipole antenna.

The reasons for lower signal levels as the frequency rises is not only due to free space attenuation but also the losses that occur in both coax and connectors associated with the feed line to the antenna.

If 730 was used as a reference signal level, then 395 will be stronger and 860 weaker using the same multiband transceiver along with identical gain antenna. Many of these rigs have additional preamplifier functions that can help bring received signal levels higher to overcome background noise.
When using D-Star DV this is neither here nor there. All that happens is the S-meter increases or decreases depending on the preamplifier being enabled or disabled. The preamplifier makes the noticeable difference when using FM or SSB modes.

Hams I QSO with often say 5425 and 730 are about the same signal level but 860 is weaker.
For example, 5425 / 730 is S-9 and 860 is S-5. They expect for the same power of the
D-Star repeaters at 25 watts, and almost identical dipole antenna, that the signal will be the same.
The difference between 5425 and 860 is 3 times, so 860 will be weaker and that is normal.

Jeff ZL2JST in Masterton monitors the LOS propagation from MCL with noticeable variations during summer temperature inversion enhancement or during heavy rain events.

Jeff reports 860 is always lower than 5425 and 730 but some days lifts in signal caused by the path lift of enhancement known as tropospheric ducting. *Reference-1*

The LOS distance between MCL and Masterton is 49 kms.

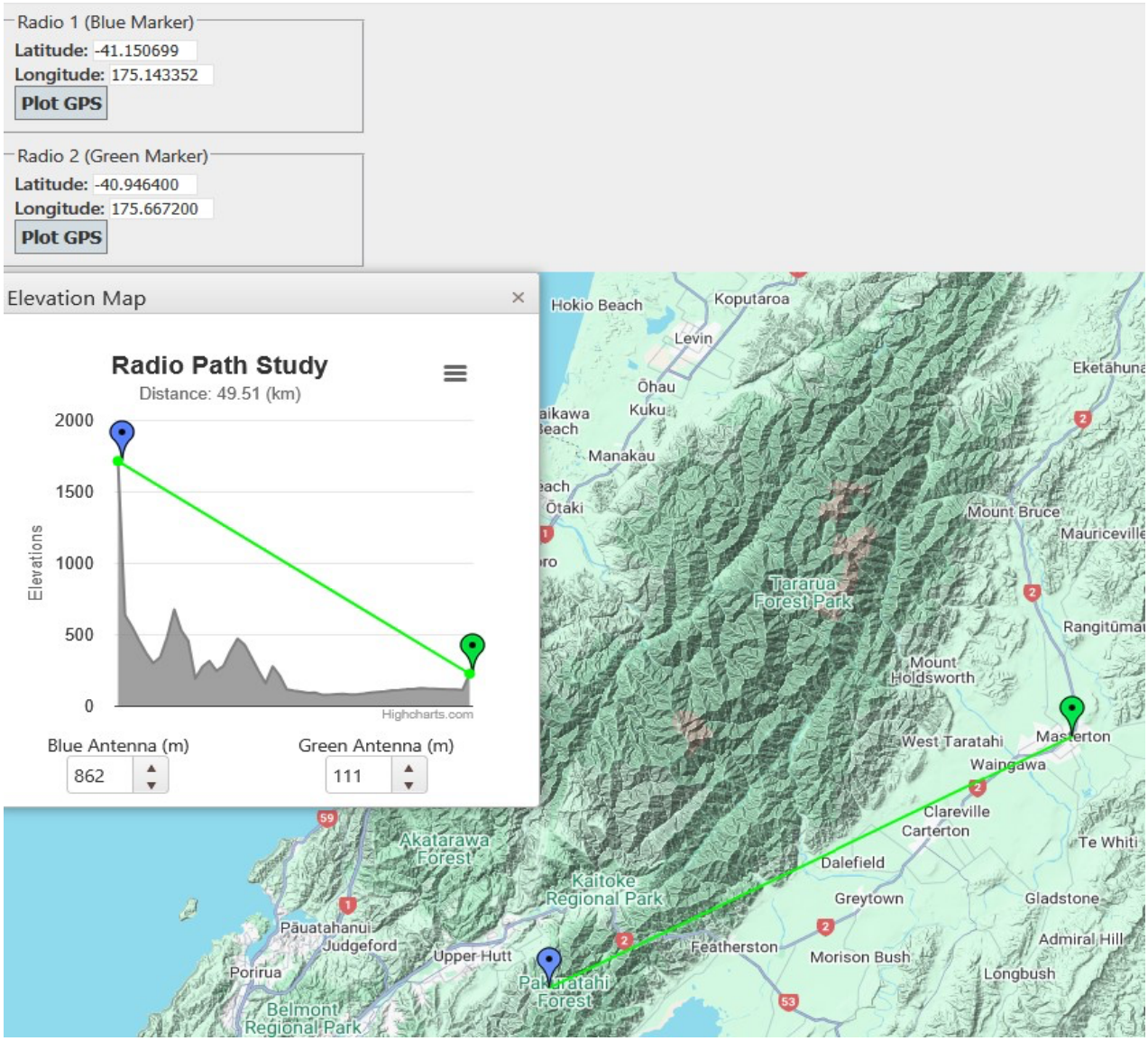
Path loss on 5425 and 730 is -109 dB with 860 weaker again at -119 dB.

That is a difference of 10 dB and the equivalent difference between using a 10-Watt transceiver or a 100-Watt transceiver. Another example would be the difference between a 1-Watt handheld and a

10W transceiver both connected using the same gain antenna.

To make up for this path loss and coax cable loss is to use a +10 dB gain receiver preamplifier that is often built into modern transceivers. So, Jeff can push his preamplifier button when he uses 860 to have an equivalent S-9 signal on both 5425 and 860.

See *Picture-2* for MCL to Masterton path details.



Picture-2

<u>In conclusion:</u>

Knowing a lot more about RF signal propagation and cable loss, depending on the frequency in use, can save a lot of embarrassment and head scratching.

If your transceiver shows a lower or higher signal than you expected, then it could of course be a failing antenna or water getting into the coax or simply normal and expected due to path loss.

I hope that the calculator web sites are of use for not only plotting a LOS path, to work DX, but also to check if a path is workable using modest power levels and antenna gain.

73 and good DX. John ZL2TWS

Reference:

1) http://zl2vh.nz/assets/pdf/dx-records/what-propagation-mode-did-you-use-2025.pdf