The basis of distance-based scoring for the VHF-UHF Field Days

Roger Harrison VK2ZRH

As advised in the May issue, the Winter and Spring 2014, and the Summer 2015 VHF-UHF Field Days include alternative rules with distance-based scoring, called Division 2.

The general principles behind the introduction of this distance-based scoring system are to:

(a) educate newcomers to the VHF-UHF bands in the capabilities that the bands afford beyond the myth of "line-of-sight" propagation,
(b) encourage self-education in VHF-UHF operation by contest participation, and
(c) to continue the tradition of so many VHF-UHF pioneers who sought to establish 'what could be done' on the bands above 30 MHz.

Since the days of the early VHF-UHF pioneers early last century, through to the current era, a prime measure of achievement for operators and their stations has been distances worked, given the technologies employed. The recognised doyen of VHF pioneers is Ross Hull VK3JU (1902-1938), who encouraged the use of ever-improved equipment and antennas to achieve ever-greater distances [1]. Ross Hull discovered, and was the first to record and describe, the effect of tropospheric refraction ("air mass bending") on VHF waves under favourable atmospheric conditions [1].

Scoring distances worked

The distance scoring table – Table 1 – needs a little explanation. You will note immediately that principal scoring is based on one point per kilometre, but the three lower bands – 6 m, 2 m and 70 cm – each have a distance cutoff of 700 km, after which scoring is one point per 100 km or part thereof. This deals with the issue of serendipitous long-distance propagation on the lower three bands. Such DX may be supported by ionospheric propagation – principally sporadic E on 6 m and occasionally 2 m [2], or transequatorial propagation (TEP) on those two bands from the TEP zones in the north of the continent [3, 4] – or tropospheric refraction or ducting [5], principally on 2 m and 70 cm.

Any operator who has spent a few "seasons" on 6 m and 2 m will

have experienced such DX, been regaled with tales of such DX, or pored over the regular reports in *VHF-UHF – An Expanding World* in *AR* every month.

The issue that arises is that a "good opening" on one or more of the three lower bands can yield 1500 to 3000 points per contact, or more, thus "creaming" the point-scoring for the lucky few at the expense of other operators. A sporadic E opening on 6 m and/or 2 m between VK4 and VK7 that affords five or six contacts will enable contestants to readily amass 8000 - 12,000 points – per band!

It is not possible to construct a rule that precludes ionospheric and tropospheric propagation. So a distance limit was determined after a deal of research, which here is set at 700 km. This was chosen because it is generally the sort of distance that can be achieved by tropospheric scatter, the most common form of over-the-horizon propagation on VHF-UHF, or by aircraft enhancement, or through a "lift" in conditions by tropospheric refraction or ducting, which is often confined to a limited geographic region. Further, the 700 km cutoff takes into account "short skip" sporadic E (Es) on 6 m.

Given a typical sporadic E layer height of 100 km, for an MUF of 52 MHz, the vertical penetration frequency of the Es (foEs) at the point of reflection (as seen on an ionogram) would be about 16.1 MHz; the raypath elevation angle is around 15^{O} [2]. From my experience of viewing tens of thousands of ionograms over the years, this doesn't happen too frequently. When it does, the MUF over a 1900 km path via that reflection point would be above 90 MHz, or just below 180 MHz if the Es was rippled ("spread Es") [2].

Of course, tropospheric ducts can result in contacts on the bands above 1000 MHz over distances of 1000 km to 2000 km, or more [5]. However, they aren't common (even in summer) and it takes some skill

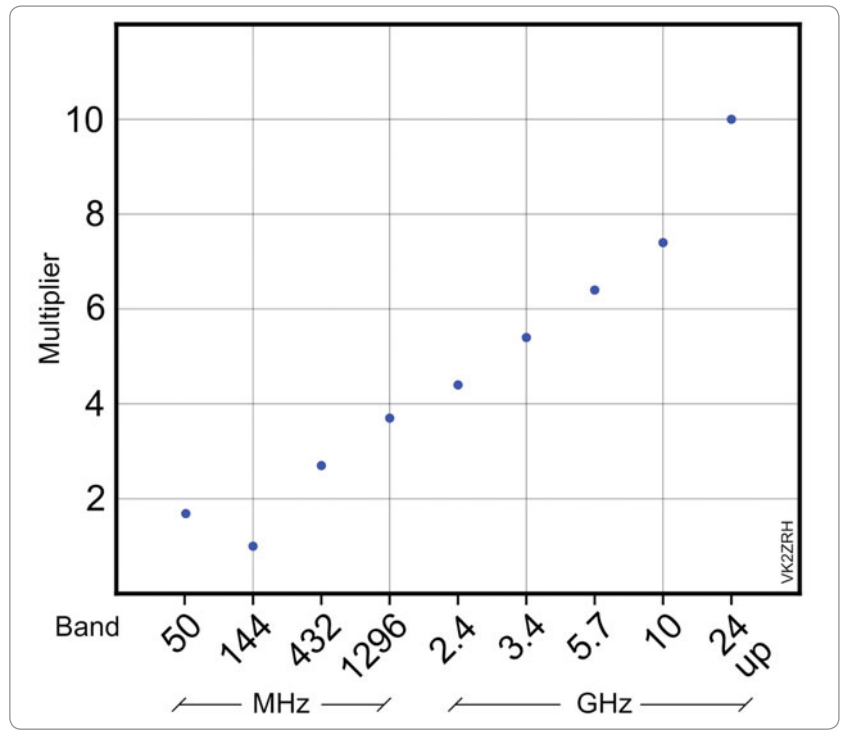

Figure 1: Distribution of the band multipliers.

(in both planning and execution) to take advantage of them. Hence, the 700 km limit does not apply on the bands from 1296 MHz upwards. For those who manage to exploit serendipitous tropo on the bands 23 cm and up, more power to their portable elbows.

Band multipliers

The first VHF-UHF band all licensees are permitted to use is 144 MHz. It is also the most populous, given the ubiquity of 2 m rigs. This is the "pivot point", or fulcrum, for the band multiplier figures, as is evident from Table 1. Hence, the multiplier is one.

So, why is the multiplier for 6 m equal to 1.7? Firstly, 6 m is not a very popular band among Field Day contestants operating portable (going from past logs) and this is intended to encourage more portable operation on 6 m, as well as more use of the band. There are a number of reasons for 6 m lack of popularity, perhaps related to availability of rigs, but chiefly to the logistical difficulties with antennas, it seems. To deploy an antenna of modest gain – say, a 2- or 3-element Yagi – requires poking quite a bit of metal in the air and having it stay up under field day conditions. A 5- or 6-element Yagi on 2 m provides modest gain for roughly the same "amount" of hardware in the air, but is mechanically more manageable. So, deploying a 2 m antenna of modest gain has perhaps a 5:3 advantage over a 6 m antenna of modest gain. That ratio is near to 1.7. So, I have awarded the advantage to 6 m.

So, balanced by the fulcrum of 144 MHz, the next two band multipliers are weighted by 1.7 with a linear step added – yielding 2.7 for 432 MHz and 3.7 for 1296 MHz. This covers the span of commercial-off-the-shelf VHF-UHF rigs. The bands from 13 cm up are weighted by 1.4, because antenna gain is relatively easier, with again a linear step added for each higher band and so on up to 10 GHz. All bands from 24 GHz up get a multiplier of 10. In part, this is to encourage use of the bands above 10 GHz and to reward operators who go to the effort of assembling rigs for these

bands and deploying them in the field. Figure 1 provides an overview of the band multiplier scheme.

References

[1] *Ross A. Hull – VHF Pioneer,* by John Martin VK3KWA (now VK3KM), at: *www.wia.org.au/members/contests/rosshull/documents/Ross%20Hull%20-%20VHF%20Pioneer.pdf*

[2] *On sporadic E VHF propagation and solving a mystery about maximum usable frequencies*, Roger Harrison VK2ZRH, *Amateur Radio*, Part 1 April, and Part 2 May 2012.

[3] *Afternoon Transequatorial VHF Propagation*, Roger Harrison VK2ZRH, at: *http://home.iprimus.com.au/toddemslie/aTEP-Harrison.htm*

[4] Evening Transequatorial VHF Propagation, Roger Harrison VK2ZRH, at: *http://home.iprimus.com.au/toddemslie/eTEP-Harrison.htm*

[5] *VHF and Microwave Characteristics of Ducts*, Andrew L. Martin VK3KAQ (now VK3OE), at: *http://vhfdx.radiocorner.net/docs/GTPaper2004V2-1.pdf*

Band	Multiplier	Distance Scoring
50 MHz	1.7	1 point / km to 700 km; thereafter 1 point / 100km or part thereof
144 MHz	1	1 point / km to 700 km; thereafter 1 point / 100km or part thereof
432 MHz	2.7	1 point / km to 700 km; thereafter 1 point / 100km or part thereof
1296 MHz	3.7	1 point / km.
2.3/2.4 GHz	4.4	1 point / km.
3.4 GHz	5.4	1 point / km.
5.7 GHz	6.4	1 point / km.
10 GHz	7.4	1 point / km.
24 GHz & up	10	1 point / km.

Table 1. Distance scoring and band multipliers for Division 2 Field Day rules.

Over to you

Masts Planning

Dear Peter,

I was glad to read President Phil's advice about the decision of the NSW Government regarding its State Environment Planning Policy as it applies to "Aerials, antenna and communication dishes" (WIA comment AR Jan/Feb 2014). Ideally, similar policy and regulations need to be in place in all other states and territories of Australia.

About 10 years ago I applied for a building permit to erect a 14.7 m Nally radio tower at my QTH in the Moorabool Shire Council (MSC) municipality, about 70 km west of Melbourne. This was rejected due to objections from surrounding neighbours. I subsequently appealed decision at the Victorian Building Appeals Board (VBAB). At the VBAB hearing, I appealed the MSC's decision not to grant a building permit, ably supported by Amateur Radio Victoria's (ARV) Jim Linton VK3PC. This appeal was rejected on grounds that (a) the tower would reduce the visual amenity of the neighbour, and (b) I did not justify why I needed a tower of 14.7 m in height.

There are many other structures extant in my township that exceed the State of Victoria's statutory permit-free height limits for masts and the like of 8 m free standing, and 3 m above the highest point of the adjoined building. None of these arguments were accepted by the VBAB.

Readers should note that in Victoria a precedent exists eliminating the need for a planning permit for towers up to 14.7 m high resulting from a Victorian Civil and Administrative Tribunal decision some years ago brought about by a Victorian radio amateur appealing his local council's decision not to grant a permit. Also note that Planning permission is about land use, whilst Building permission is about structures.

Subsequently I successfully applied for another building permit from the MSC, which was granted with the condition that the tower not be extended beyond 8 m to the full height of 14.7 m for more than three hours in any given week. Town planning and building surveying professionals I have discussed this with subsequently have questioned the rationale around this decision and the arbitrary time limit imposed on the tower height. Of note is that WICEN is specifically mentioned in the MSC's Emergency Management Plan (EMP). Citing this in my applications to the MSC and appeal to VBAB had no effect.

Working across government in Australia is like working for the United Nations. We have three levels of government to deal with across eight states and territories. Planning and building policies, acts, regulations and codes are inconsistent. Compounding the problem further are the opinions and interpretations applied by local and state/territory governments of their own policies, acts, regulations and codes. My example perhaps exemplifies the irrational and tortuous path one sometimes has to negotiate when dealing with these authorities.

While I congratulate and thank all concerned involved in the NSW outcome, which can be cited as a precedent in other jurisdictions, the matter nationally is unresolved. I can only encourage the WIA and the various state and territory based representative bodies such as ARV to pursue this matter elsewhere. This is a tangible example of the value of membership to peak body organisations that represent our hobby, and provide services and advocate for outcomes beyond those achievable by individuals. While the NSW victory appears to be planning specific, be aware that in VK3 the Victorian Building Act also applies for structures above statutory heights, and as demonstrated above can be a pitfall to radio amateurs in a similar situation to my own.

73

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See Response on page 61