

Relating to draft District Plan submission #175 (William Michael Arnold).

I am providing further information on amateur radio antennas in the GRZ as suggested by Louise White, as well as some additional aspects relating to the reasons for enabling an activity such as amateur radio, specifically in the more technically-challenging higher-frequency bands in which the antennas discussed are used.

My first submission relates to AR-S5 Dish aerals, paragraph 3:

"All zones. 3. There must not be more than two dish aerals per site"

My original submission stated why full use of the available amateur bands, as licenced by central government (RSM), requires more than two dishes. I still regard this as an important point, as it will enable examination of the radio wave propagation in the various frequency bands, which have different characteristics depending on humidity, precipitation, electrical storms etc.

Louise White wrote that: *" The submitter may wish to provide additional evidence at the hearing regarding the appropriateness of the additional aerals and support structures in being compatible with the character of the rural zone."*

In the case of the GRZ, several dishes of 1.2 m diameter each mounted at 2 m height would not present any greater visual impact than a utility shed, which I believe to be a permitted activity. In fact the dishes could be operated inside such a shed, if built of radome material.

(In the GRZ, but possibly not elsewhere, such microwave dish antennas can be at a low height because of the short wavelength and the absence of any nearby buildings.)

The shorter wavelength microwave bands (12 mm and less) need proportionately smaller dishes, so that for wavelengths of 6mm or less, dish diameters of 0.35m or less will normally be sufficient.

Therefore I suggest that paragraph 3 not apply to the GRZ, and that instead a new paragraph 4 should be added to AR-S5:

"In the GRZ no more than nine dishes are permitted, no more than two of these may have their centres above 2.5m height, and no more than four shall exceed 0.4m diameter."

The stipulations of paragraphs 1 and 2 would still apply.

The existing paragraph 4 would become paragraph 5.

I would like to add that radio amateurs are at the forefront of the use in NZ of the shorter wavelength and technically challenging microwave frequency bands (12 mm, 6 mm, 4mm, 2.4mm, 2.1mm, 1.2mm). These exceed the frequencies used by cell-phones (4G or even 5G in NZ), microwave links or civilian radars. New insights into radio-wave propagation at these frequencies are still being made by radio amateurs. It seems undesirable that any unnecessary restriction be placed on this useage. Furthermore, as cheaper microwave technology becomes available every month, the new District Plan should be future-proofed with regard to permitting free uptake and use of the shorter-wavelength microwave bands.

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My second submission relates to AR-S6 Yagi aerials (but only to rope Yagis).

General Rural Zone	2. The element length must not exceed 14.9m.
Rural Lifestyle Zone	3. The boom length must not exceed 13m.
Future Urban Zone	

The "Rope Yagi" is used internationally for very-high frequency (50MHz and 144MHz) amateur radio communication where long distances are to be covered.

Photographs of two such rope Yagi antennas are supplied to the panel for their information (copyright may apply). There is no rigid boom, but instead two or three ropes in tension run the length of the antenna.

The elements are considerably shorter than 14.9m.

However, such a rope Yagi often has a length exceeding 13 metres, in fact up to 90 metres can be foreseen to be both useful and practical. Whilst it has no boom, it might still be "caught" under an interpretation of AR-S6 by virtue of the structural nature of the ropes.

In answer to Louise White's suggestion that *typical dimensions should be quoted*, then I can say that to my knowledge:

neither the ropes nor the metal elements used have exceeded 9mm in diameter. As they are end-supported the elements can in fact be 6.4 mm or less in diameter. The ropes, if made of a high-strength material such as Kevlar, also need not exceed 6.3 mm diameter.

Accordingly the visual impact of such structures is likely to be extremely small. The support structures would not exceed those already covered in AR-S8.

Such a rope Yagi is clearly of far less impact than a conventional Yagi antenna optimised for long-distance 50MHz operation [1], used in both Europe and the USA. That antenna uses 15.9 mm diameter elements and a 76.2mm square (107.8mm diagonal) boom.

My specific suggestion is that if a rope Yagi complies with all of:

- 1) elements not exceeding 6.0 m in length and not exceeding 6.4 mm in diameter;
- 2) no rigid boom, but up to three support ropes not exceeding 6.4 mm in diameter;
- 3) support structures conforming with ARS-8;

then in the case of the GRZ no length limit should be imposed. This is consistent with rural practice where electric fence supply wires can span valleys of 200 m or more width and be of 3.3 mm diameter (No. 8 wire), or greater if insulated.

In practice a length limit of 100m would cover any practical rope Yagi antennas that I can envisage.

I would also like to note that Yagi was the name of one co-inventor of this type of antenna. so it should be referred to as a Yagi (not yagi) antenna. (The other co-inventor was Uda. Therefore "Yagi-Uda antenna" might also be used, but seldom is by radio engineers, except in academic journals.)

[1] <https://www.innovantennas.com/en/shop-page/301/3/vhf-uhf-ham-radio-antennas/50mhz-yagis-all/11-element-50mhz-lfa-bv-yagi-21mInnovAntennas%20shop.html>