Section 12

TECHNICAL SERVICES

Updated 26 March 2013

Technical advice regarding Yagi Stack Arrays

Two or more yagis can be stacked or bayed in vertical or horizontal columns in varying configurations to achieve increased gain or a particular formation. The centre to centre stacking distance of two antennas should be such that their respective capture areas do not overlap one another. Under these conditions the stacking of two antennas will produce a theoretical gain increase of 3dB over a single antenna, whilst stacking four antennas will produce a theoretical gain increase of 6dB.

Theoretical stacking gain of 3dB for doubling of array size is not necessarily realised in practice and allowance should be made for a realised stacking gain reduced in line with published research.

Viezbike, (yagi antenna design, NSB Tech. note 688), obtained these figures for a pair of stacked 7 element yagis.

Spacing (wavelength)	Measured increase over single antenna (dB)
0.99	1.9
1.20	2.34
1.40	2.53
1.50	2.65

Powlishen, “Stacking Yagis is a science” (Ham radio) suggested 2.5 dB as a maximum stacking gain realised for a pair of stacked yagis.

Alignment of antennas within the array is critical, with any misalignment being a potential cause of reduced gain and formation of unwanted sidelobes. The feed harness or power divider must provide signal to each antenna exactly in phase, unless beam tilt is a design feature.

Closer spacings other than the optimum will result in less than ideal gain increase and could cause main beam distortion. It should be remembered that stacking antennas only reduces the beamwidth of the radiation in the plane of the array. This should be considered when choosing between a four stack array and a two bay two stack array.

Power dividers and phasing harnesses:

Our PDY series of cable harnesses to suit base station applications are fully listed in our catalogue along with power dividers for FM and TV broadcast applications. Please contact the ZCG Scalar sales team for more information.

ADVICE to customers:

It is established that theoretical stacking gain is not generally realised in practice. Establishment and maintenance of any stacking gain will require a totally stable electrical and mechanical environment. Specifically, the imbalance in mutual interaction in vertical four stacks will make gain and pattern formation vary considerably from that expected.

ZCG Scalar therefore offers the preceding advice on stacking on a general advisory basis only. No specific indication of expected gain or pattern formation resulting from stacking is offered. Increased gain may often best be achieved by using a single antenna of higher gain. Often the cheapest and most effective way to increase gain is to reduce system losses, particularly in the transmission cables.

The table below shows the recommended stacking distance in the E and H planes for a few ZCG Scalar Yagis.

Model	E & H beam widths in degrees	Stacking distance E plane in mm	Stacking H plane in mm.
Y206	46/50	3600	3100
Y309	36/43	2300	1800
Y406	36/44	811	706
Y809	34/42	576	441
Y815	30/32	700	618

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Contact your ZCG Scalar sales team for the correct stacking details for other ZCG Scalar yagi antennas.

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