THE MINUTEMAN

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TECHNICAL TOPICS

MY HAT IS 3 dB BIGGER THAN YOURS!

Engineers are accused of complicating things unnecessarily and I guess I can't argue with that. They will say "an increase of 3 dB" rather than saying "double in size" and be convinced that they have said it better. It's not much different than a doctor saying that you have "cephalodynia" rather than saying that you have a headache.

There are really valid reasons why dB's are used and the most important is that it's easier to add than to multiply, but this article is not intended to justify the use of dB's, but rather to give some simple rules on how to use them (or rather, to misuse them like everyong else does). First of all, don't look dB's up in a book because it will tell you all about "Bels" (a power ratio) and tenths of Bels (decibels) and that has but little to do with how dB's are used. There was a good article written a couple of years ago proposing that a new name for dB's be accepted which would represent dB's as they are really used. I lost the article, but it's of no consequence - the term dB will continue to be misused rather than be renamed. But that in no way diminishes it's usefulness. Let me define dB's in a new way that will never appear in a text book:

$$\text{dB} = 10 \log \frac{\text{Something}}{\text{Something Else}}$$

Now the "Something" can be anything, like my hat size, and the "Something Else" can be your hat size. If my hat size is 12 (I have been told that I have a swelled head), and your hat size is 6, then:

$$\text{dB} = 10 \log \frac{12}{6} = 10 \log 2 = 10\ (0.3010)$$

$= \underline{3\text{ dB}}$, or my hat is 3 dB bigger than yours, right?

So what does all this mean? Well, it means that I can compare hats or attenuations or antenna gains or speed or distance or bosoms or anything by using dB's. But you have to get used to them and get a feel for how many dB's represent how much larger or smaller. The following rules will help. Learn them and you won't have to carry around a set of log tables. For Power:

1. +10 dB is 10 times larger. (10 watts is 10 dB larger than 1 watt)
   -10 dB is one-tenth (1/10). (1 watt is 10 dB less than 10 watts)

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"THE MINUTEMAN" is the official Newsletter of the Minuteman Repeater Association and is published monthly. Letters to the Editor are strongly encouraged, but they must be signed. Name and Address will be withheld if requested. Material for the "MINUTEMAN" should be sent to the Editor, Dan Heather, WA1VOK, 7 Darren Dr., Brockton, Ma. 02401.

The Minuteman Repeater Association supports three repeaters in the eastern Massachusetts area. They are: 146.01/146.61 in Marlboro, 146.07/146.67 in Quincy and 146.22/146.82 in Weston. All Amateur Radio Operators are invited to use the machines and join the fun and fellowship of our Association. General correspondence to MMRA should be sent to P. O. Box 2282, Wayland, Ma. 01778.

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2. Each additional 10 dB is equivalent to moving the decimal point one place, that is:

   10 dB is 10 times (rule 1.)
   20 dB is 100 times
   30 dB is 1000 times
   -10 dB is 1/10 (rule 1.)
   -20 dB is .01
   -30 dB is .001
   etc.

3. Each additional 3 dB is twice as much. (10 watts is 3 dB larger than 5 watts) Each 3 dB is less is one-half as much. (5 watts is 3 dB less than 10 watts)

4. Each 1 dB is approximately 25% more (1 dB more than 10 ft is 12.5 ft., (actually 12.6)). Each 1 dB less is approx. 25% less (1 dB less than 100 ft is 75 ft., (actually 79)).

   Let's try some examples:

   27 dB is 30 dB - 3 dB
   or (1000) times (1/2) = 500 times

   43 dB is 40 dB + 3 dB
   or (10,000) times (2) = 20,000 times

   -13 dB is -10 dB - 3 dB
   or (1/10) times (1/2) = 1/20th

   24 dB is 30 dB - 6 dB = 30 dB - 3 dB - 3 dB
   or (100) times (1/4) = 0.25

   21 dB is 20 dB + 1 dB
   or (100) times (1.25) = 125 times

   22 dB is 20 dB + 1 dB + 1 dB
   or (100) times (1.25) times (1.25) = 156 times (actual value: 158)

One note of caution, the above rules don't hold if you are comparing voltages. In that case the rules are changed by a factor of two. (This is because of the mathematical relationship between voltage and power, and power ratio is the original definition of dB's.) The voltage rules are:

20 dB is 10 times larger

6 dB is twice as large

2 dB is 25% more

etc.

de WA1OJX, Rod

THE UPS AND DOWNS OF TOWERS (PART II)

In Part I we calculated the loads on an array of antennas. Remember there are three frames of reference, with wind action different in each case.

1. Horizontal elements and stacking booms parallel to them.
2. Vertical elements and stacking booms parallel to them.
3. Horizontal booms to which elements (either vertical or horizontal) are attached.

We are also assuming a maximum condition or worse case. For example, we will assume that all adverse effects occur simultaneously, we will consider all conditions acting against us and ignore some complex calculations that apply to some factors acting in our favor. This will insure a minimum safety factor of at least 2 to 1.

For those who had trouble relating the sketch to the text in Part I, my apologies, the article was condensed for the Newsletter, unfortunately the sketch was not. Also TAN^{-1} is equivalent to ARCTANGENT.

So starting with a new sketch, we will calculate wind loads on the mast and tower.

Assuming a 15 foot mast 2" in diameter, and that it extends 12 feet above the apex of the tower, 3 feet into the tower, and attached to a rotator at the low end (rather obvious!) -

1. Find the area of the mast

   $$\frac{2''}{12} \times 15' = 2.5 \text{ square feet}$$

2. Add 0.5 square feet for the rotator
3. Multiply the total obtained (3 sq. ft.) by 40# to get wind load on mast

   3 x 40# = 120#

4. Assume that this force acts at a point 1/4 of the length of mast above the tower (3 feet). This allows for rotator and the portion of the mast within the tower.

So much for the mast and rotator! Easy wasn't it?

Now for the tower itself:

1. We will use a Rohn #25 for this exercise. Look up a typical section of your tower (or obtain the following dimensions - measuring if necessary)

   a) Section length
   b) Number of sections
   c) Leg diameter
   d) Total leg length per face of section (section length x 2)
   e) Brace diameter
   f) Brace length per face (total)

a) thru e) should be easy CONTINUED

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For a Rohn #25

a = 10'

b = 6 (assuming a 60 foot tower)

c = 1 1/4"

d = 10' x 2 = 20'

e = 5/16"

f) can be calculated as follows:

a) Determine the number of horizontal braces per section and the length of each: multiply length x number.

b) Determine the number of diagonal braces and the length of each: (Note - square the length of horizontal braces obtained earlier, add this to the square of the spacing between horizontal braces and take the square root - this should give the length of the diagonal brace).

For a Rohn #25

a) 10" length x 8 braces per section = 80"

b) $\sqrt[2]{(12\ 1/2'')^2 + (15\ 3/4'')^2} = 18.7''$

18.7" x 7 braces per section = 131"

Adding both 80" + 131" = 211" total brace length.

2. Now calculate the projected area of one face of your tower section:

Using dimensions previously determined

Leg Area $= \frac{c}{12} \times d = \frac{1.25}{12} \times 20 = 2.08$ sq. ft.

Brace Area $= \frac{e}{12} \times \frac{f}{12} = \frac{0.3125}{12} \times \frac{211}{12} = 0.46$ sq. ft.

Adding leg area to brace area = 2.54 sq. ft.

3. This figure is the projected area of one face of one section of tower exposed to the wind. E.I.A. specs allow you to account for the other faces by multiplying the area of one face by 1.5 (1.75 for a square tower).

2.54 x 1.5 = 3.81 sq. ft.

4. Multiply this figure by the number of tower sections:

3.81 x 6 = 22.86 sq. ft.

5. Multiply this figure by 40# for wind load:

22.86 sq. ft. x 40#/sq. ft. = 914#

6. Assume that this load acts at 1/2 tower height.

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7. Construct a table as follows:

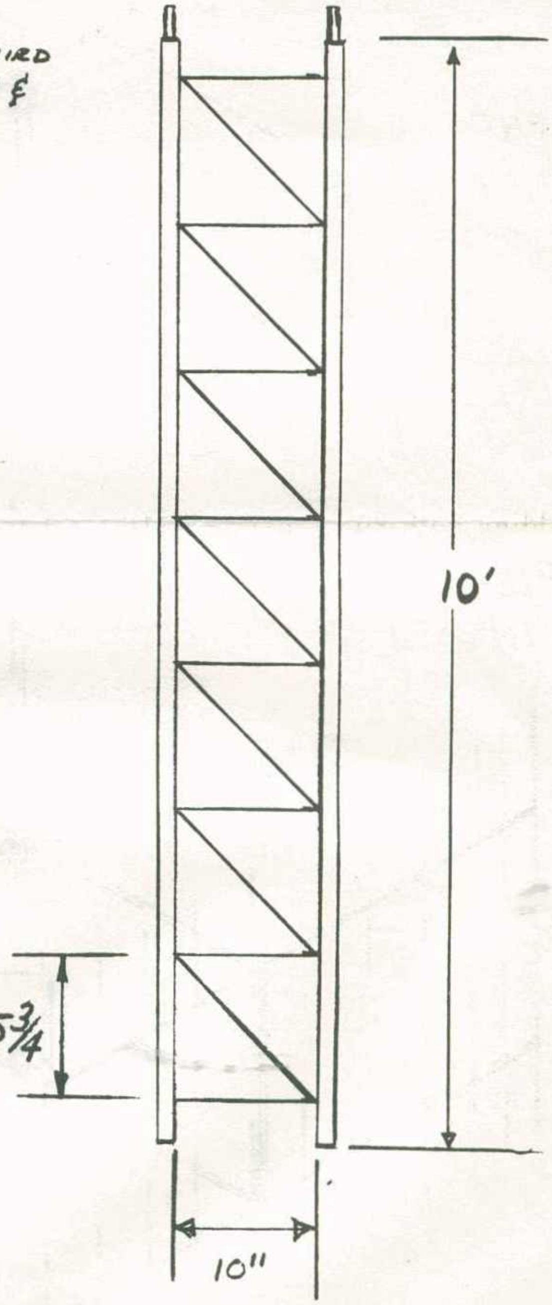
Item	Wind Load	Height*	Wind Load x Height
Antennas	526#	68.2'	35873 ft. lbs.
Mast	120#	63.0'	7560 " "
Tower	914#	30.0'	27420 " "
*Height above ground		Total	70853 ft. lbs.

This is the force trying to overturn your tower!!!

73's - Dick, WA1IMS

— Ed. Note - Next month is the third & final article "The Foundation & Guy Wire Discussion".

TYPICAL SECTION ROHN 25



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