Antenna Input Capacitance

Estimating the input capacitance and total loss resistance of NDB antenna systems

The installation of antenna tuning units at NDB antennas can proceed much more quickly when the approximate value of the antenna's input capacitance and resistance are known. Both values can be readily estimated with an accuracy of better than 10 percent by inputting some physical details of the antenna structure together with the operating carrier frequency in the spreadsheet linked below. Proceed as follows:

Determine which elements of the antenna form part of its radiating structure. This generally refers to those sections that are insulated from ground and are electrically connected to the high voltage that occurs at the top of the system's principle loading coil. For antennas such as whips with a built-in loading coil this would refer to the sections that are connected to the top, high voltage end, of that coil. Note that the pf/ft decreases where two or more elements compete with each other for capacitance to space.

1. **Separate these "hot" radiating parts into elements that are physically similar i.e. tower sections, guy wires, whip sections etc.**
2. **Determine the total number of feet contributed by each element.**
3. **Determine the capacitance per ft. for each element type using Table 1.**
4. **Enter this element data into the spreadsheet**

Table 1 – Capacitance per ft. of various radiating elements

Element	Capacitance pf/ft
18 inch Lattice Tower	5
36 inch Lattice Tower	6
4 inch diameter Whip	3.7
Single Wire of any diameter	2.5
2 wires with 3ft separation	1.75
Vertical wire feeding T antenna	2
3 top loading guy wires	1.5
6 top loading guy wires	1.2
3 top loading horizontal spokes	2
6 top loading horizontal spokes	1.6

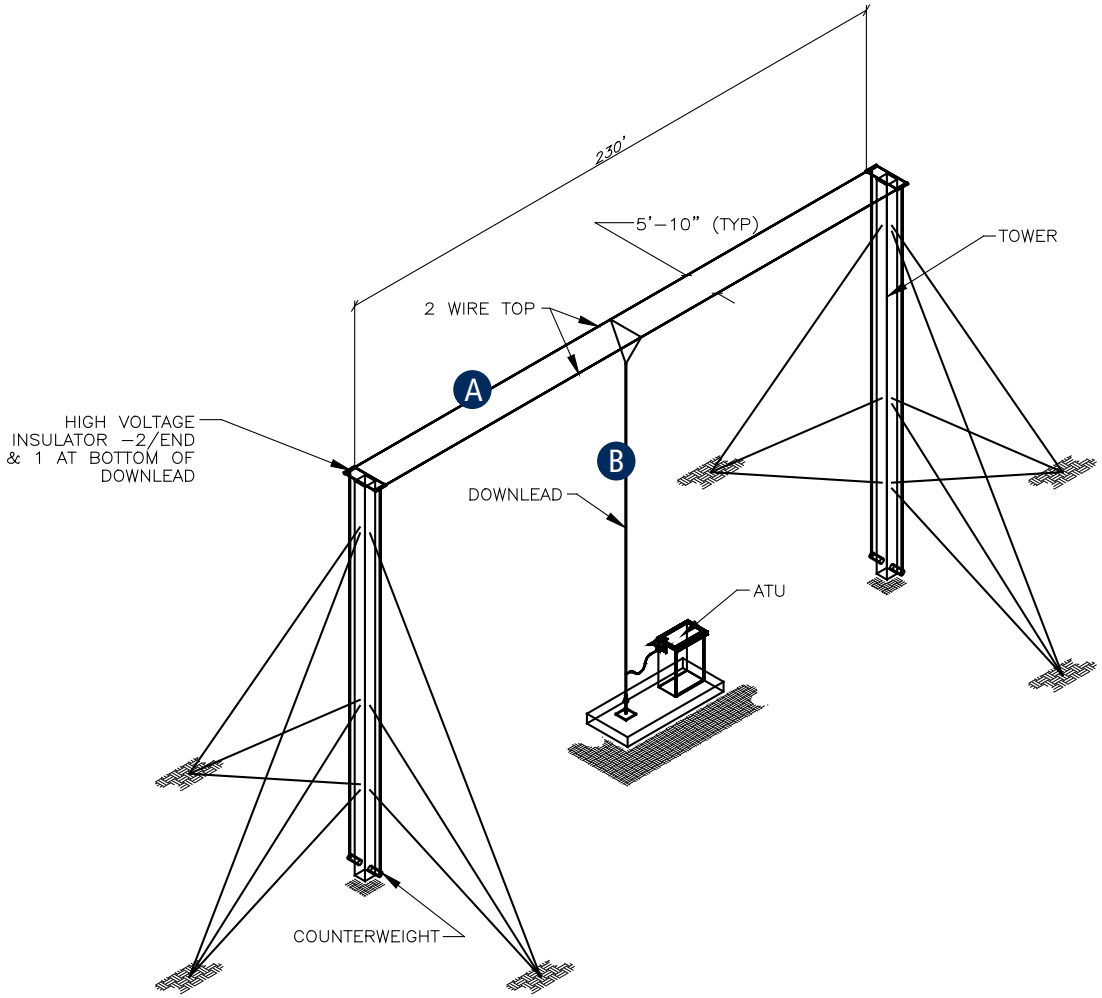
5. **Enter the operating carrier frequency in kHz.**
6. **Enter the ATU loading coil(s) Q value from manufacturer's data**
7. **Enter estimate for ground loss resistance in ohms (If not known, enter 2 ohms. This can be subsequently updated when total resistance is determined during installation process).**
8. **Use the output values for loading coil inductance and total resistance for initial ATU installation settings.**

Example 1

Determining total capacitance for elements in a 'T' antenna

1. **Separate these "hot" radiating parts into elements that are physically similar i.e. tower sections, guy wires, whip sections etc.**
   - A Wire Top
   - B Downlead
2. **Determine the total number of feet contributed by each element.**
   - A 230'
   - B 100'
3. **Determine the capacitance per ft. for each element type using Table 1.**
   - A 2 wires with 3ft separation: 1.75 pf/ft x 230 = 402.5
   - B Vertical wire feeding T antenna: 2 pf/ft x 100 = 200

Use these values, along with carrier frequency, Q value and estimated ground loss resistance, to populate the table above and calculate your antenna capacitance.



Example 2

Determining total capacitance for elements in a Helideck antenna

1. **Separate these "hot" radiating parts into elements that are physically similar i.e. tower sections, guy wires, whip sections etc.**

   A Antenna Radiating element

   B Downlead

2. **Determine the total number of feet contributed by each element.**

   A 162.5'

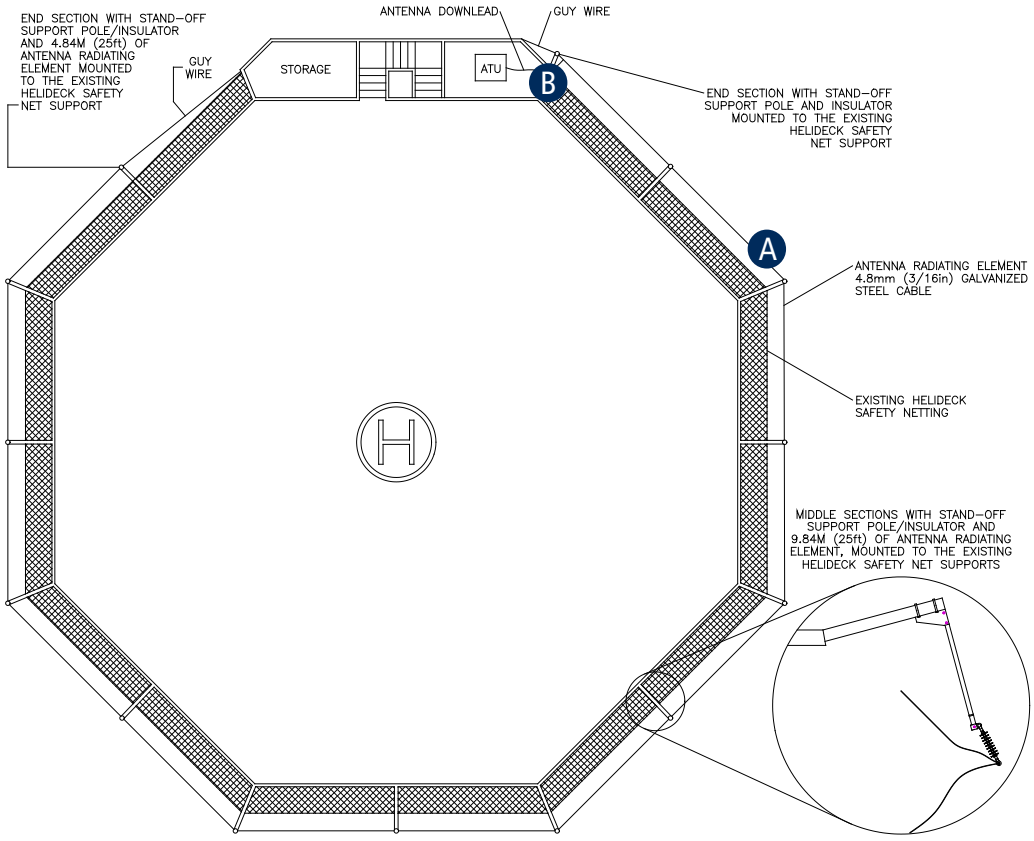
   B 10'

3. **Determine the capacitance per ft. for each element type using Table 1.**

   A Single Wire of any diameter: 2.5 pf/ft x 162.5 = 406.25

   B Single Wire of any diameter: 2.5 pf/ft x 10 = 25

Use these values, along with carrier frequency, Q value and estimated ground loss resistance to populate the table above and calculate your antenna capacitance.



Example 3

Determining total capacitance for elements in a whip antenna

1. **Separate these "hot" radiating parts into elements that are physically similar i.e. tower sections, guy wires, whip sections etc.**

   Ⓐ Whip Antenna

2. **Determine the total number of feet contributed by each element.**

   Ⓐ 25'

3. **Determine the capacitance per ft. for each element type using Table 1.**

   Ⓐ 4 inch diameter Whip: 3.7 pf/ft x 25 = 92.5

Use these values, along with carrier frequency, Q value and estimated ground loss resistance to populate the table above and calculate your antenna capacitance.