The $\lambda/2$ Dipole

* The dipole with length $\ell = \lambda/2$ is <u>very</u> popular because $Z_A \approx 75\ \Omega$ (specifically, $73\ \Omega$).

* The directivity D_0 of a $\lambda/2$ dipole is

$$\underline{\underline{D_0 = 1.643}}$$

⇒ Not very large! Note the directivity of an isotropic radiator is 1.0!

* The effective Aperture of a $\lambda/2$ dipole is:

$$A_{em} = \frac{\lambda^2}{4\pi} D_0 = \frac{\lambda^2}{4\pi}(1.643)$$

$$= \underline{\underline{0.13\ \lambda^2}}$$

Note as λ gets bigger (f is smaller) the length ℓ of a $\lambda/2$ dipole increases ($\ell = \lambda/2$), and the effective apterure A_{em} gets bigger!

$\Rightarrow$ A physically larger antenna typically results in larger A_{em}.

Q: What other reasons are there for selecting a dipole??

A: Its light weight and has low wind load.

Q: So a dipole has no problems??

A: No! The main problem with a $\lambda/2$ dipole is that an antenna length ℓ will be a half wavelength at one frequency only!

For example, a dipole with length $\ell = 1m$ is a half wavelength at frequency:

$$1 = \ell = \frac{\lambda}{2} = \frac{c}{2f} \Rightarrow f = \frac{c}{2(1)} = \underline{150 MHz}$$

In other words the dipole length $\ell = 1\,m$ is a half-wave ($\lambda/2 = \ell$) dipole for a signal at $f = 150$ MHz ONLY!

⇒ Thus, the impedance of the dipole is $Z_A = 75 + j0\ \Omega$ only at one frequency.

As we move from the "resonant" frequency, the antenna impedance will become more reactive - the antenna will no longer be matched.

A dipole is a narrow-band antenna!