

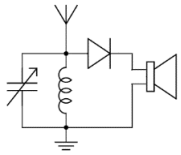
E157 Lecture 18 Day Plan

See 16 and 17 for other ideas, this class rounds up some loose ends from those classes.

Antenna size constraints:

- Chu limit – $Q \geq (1/(ka)^3 + 1/ka)$ for linear polarized, where a is radius of containing sphere & k is wave #
- Why is path loss frequency dependent?
Isotropic antenna gets smaller & so does yours. Dish aperture $\gg \lambda$ vs. resonant $\sim \lambda$.
- Dish antenna gain is $G = (\pi D/\lambda)^2$ b/c aperture is $A_e = \pi D^2/4$ & $A_{iso} = \lambda^2/4\pi$
Gain/Directivity is $\sim 0.6-0.7$ b/c of surface deviations, cross-polarization, aperture blockage from feed, misplaced feed (phase center)
- Half-power beam width for dish – $\theta = k\lambda/D$
where D is earth station diameter, k is aperture illumination factor

Review receive antenna in a circuit and LC model for Xrad by discussing AM radio and matching network examples



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Review monopole – why don't car antennas or other whip antennas look like dipoles? Image charge.

Far field for two antennas – How far apart do a (antenna 1) 10GHz $\lambda/2$ dipole and a (antenna 2) 20GHz $\lambda/2$ patch need to be so that we don't see near field effects in our link?

- $c = \lambda f \rightarrow \lambda_1 = 3\text{cm}, \lambda_2 = 1.5\text{cm}$. $2D^2/\lambda_1 = 2(\lambda_1/2)^2/\lambda_1 = \lambda_1/2 \rightarrow$ far field at 3cm, 1.5cm
- Really limited by $10\lambda \rightarrow 30\text{cm}, 15\text{cm}$.
- Don't need to sum far field distances. "Am I in the far field of antenna X?"

Look at these datasheets – what type of antenna? What is gain?

- <http://www.schwarzbeck.de/en/antennas/broadband-horn-antennas/double-ridged-horn-antenna/408-bbha-9120-lf-double-ridged-broadband-horn-antenna.html>
- <https://cdn.taoglas.com/datasheets/AP.25F.07.0078A.pdf>
- https://www.l-com.com/Images/Downloadables/Datasheets/ds_HG2402PU-UFL.pdf
- https://www.l-com.com/Images/Downloadables/Manuals/M_RE1208P-SM.pdf

Group research (find field pattern, input impedance, bandwidth, common application) for:

- Loop antennas
- Slot antennas
- Horn antennas
- Yagi-Uda antennas
- * Parabolic reflectors (dish antennas)
- * Helical antennas
- * PIFA