Exercise 4

4.12

Two directional antennas are aligned facing each other in the boresight direction at 1800 MHz in free-space conditions, as shown in Figure 4.26. Antenna A is a parabolic dish with 65 % radiation efficiency, and antenna B is a horn antenna which has a gain of 15 dBi.

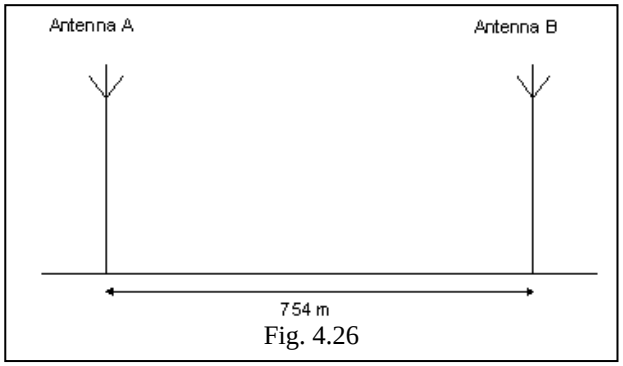

Fig. 4.26

The text book provides the following two equations for reflector antennas where D is the reflector antenna diameter and η the efficiency:

$$P = \frac{\sin\left(\frac{\pi D \cos\phi}{\lambda}\right)}{\frac{\pi D \cos\phi}{\lambda}} \quad \text{and} \quad G = \eta\left(\frac{\pi D}{\lambda}\right)^2$$

Determine:

a) The radiation pattern cuts of azimuth and elevation angel for Antenna A, assuming a vertical beamwidth of 45° and a horizontal beamwidth of 55°. You can assume that some side and back lobes for both azimuth and elevation planes are significant.
b) The directivity for antenna A, in decibels.
c) The power received at antenna B, given that antenna A has an input power of 1 W. State clearly any assumptions made.
d) The distance at which antenna B is considered to be in the far-field, if this antenna has a diagonal distance in its mouth of 10 cm.
e) If antenna B s used as a transmit antenna, what is the power received at antenna A given an input power of 1 W? Explain your answer.

5.7ed

A satellite is operated at C-band (6 GHz in the uplink and 4 GHz in the downlink) for video broadcasting. Calculate the free-space loss experienced at the receiver if the satellite is in GEO-stationary orbit (36 000 km over the equator) and the receiver is located at 60 latitude, but same longitude as the satellite. What is the minimum EIRP needed to provide adequate reception assuming the receiver has a sensitivity of -120 dBm, 20 dBi antenna gain, and wanted fade margin of 4 dB.

5.new

At the website of Norwegian Post and Telecommunications Authority there is a field strength calculator (www.finnsenderen.no), apparently only in Norwegian. Use the advanced version and choose a UMTS system, said to operate at 2100 MHz with transmit power of 40 W.

a) The calculated EIRP is 798.1 W. What has been assumed in the calculation with respect to transmit amplifier and losses?
b) At distance 30 m the power density is 70.6 mW/m^2. Which path loss model has been used?
c) Show that the field strength is 134.2 dBμV/m at this distance.
d) Calculate the free space loss in dB at this distance?