

TLT-6306: RF Equipment for Wireless Networks
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 Calculators are allowed in this exam.

Answer to all questions!
Total maximum points: 30 (+ exercise bonus)

1. Explain shortly:

- + a) Noise figure (2 p)
- + b) Grating lobes (2 p)
- + c) Circular polarization (2 p)

2.

+ a) Show by calculation (provide also the explanation) what is the power ratio in decibel scale between the first output port and the input port in:

2-way splitter, 3-way splitter, 4-way splitter.

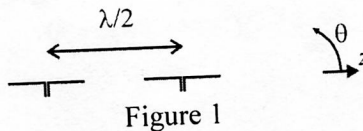
Assume that the splitters are ideal (e.g. no internal losses). (2 p)

+ b) How does the taper differ from splitter? Consider a 2-way taper. What is the power ratio in decibel scale between the output port #2 and the input port, if the power ratio between output port #1 and the input port is set to -5 dB. (3 p)

+ c) Draw/sketch an example of a radio system where you could use these kind of components. (1 p)

3.

Two collinear, z-directed, and short dipoles are placed at a distance of half wavelength as depicted in Figure 1. The amplitude gain of each element is 1 (i.e., 0 dB) and the feeding phase difference between each element is 0°. Formulate the normalized radiation pattern as a function of elevation angle θ produced by such antenna array.



(6 p)

4.

+ a) Describe and explain three different ways to produce antenna diversity. (3 p)

+ b) Consider a mobile receiver (operating bandwidth 200 kHz). Calculate, how strong should be the input signal level to the receiver if the signal-to-noise requirement at the output is 9 dB? The receiver noise figure is 7 dB. Assume that the input signal does not experience attenuation when inside the receiver structure. (3 p)

5.

Explain, how the following parameters affect the radiation properties of linear antenna array

- a) Number of array elements (with fixed inter-element spacing) (2p)
- b) Element spacing (2p)
- c) Phase difference between the feeding current of different elements (2p)