Wireless PHY/MAC Fundamentals

Subject: 9 (Multiple Access Principles)
Date: Monday, November 7
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Exercises

a) A receiver in a GSM system will receive a frequency multiplex of signals, either broadcasted by the base station in downlink or by multiple terminals transmitting in the uplink. Nominally, the signals are transmitted at the same power level.

To enable detection, we require that the interference arising from neighbour channel activity is attenuated. The selectivity of the GSM receiver is assumed to be modelled by a filter with bandwidth *B* of 310 kHz and filter attenuation slope α of 18 dB per octave. Answer the following questions:

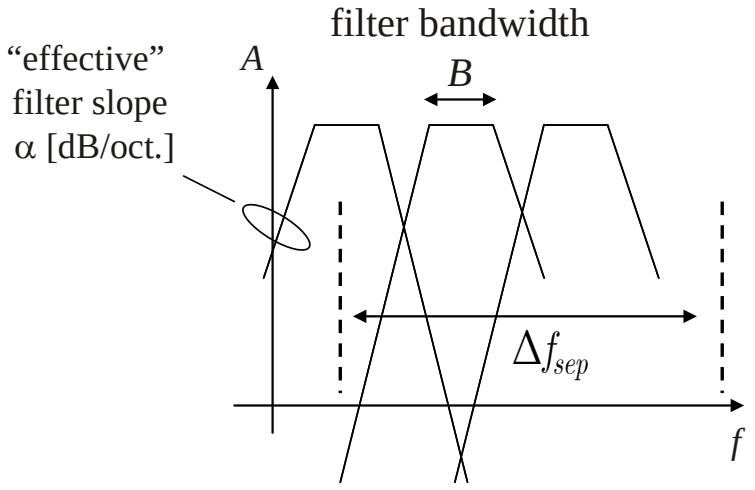
1) What is the basic form of multiple access and duplexing scheme used in the GSM system?

2) If the multiple access signals were in fact transmitted at the same power level, what propagation effects could possibly cause the signals to have different reception level, and hence justify the use of a selective filter? (if the signals were in fact equal power in reception, the signal to interference S/I would be 30 dB, which is much higher than actually required for the GSM receiver to work). Try to argue the situation from both uplink and downlink perspective.

3) The channel raster in the GSM system is 200 kHz; what is the channel separation (center–to-center Δf_{sep}), in number of channels, we need to the closest neighbour channel in order to fulfil the requirement for a minimum average attenuation of 30 dB in the downlink?

4) What does the result of 3) imply for a practical GSM system?

5) Actual filter selectivity is typically almost double the amount stated here; in the case of double attenuation, what is the corresponding filter order and how does it change the channel spacing requirement?



A: Logarithmic attenuation