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Paper Title: Mobile Telephony – Wide Area Coverage – Case 20564

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Open questions for discussion in class:

-How does antennae height and power affect this system?

-What is a car transmitter? What are cars transmitting (aren't the stations the ones doing the transmitting?)

The topic areas covered by the paper are:

-Wide Area Mobile Telephone Coverage

-Amplitude Discrimination due to Distance

-Frequency plans for wide area coverage, minimum distance ratio and number of primary frequencies

-How primary area size affects number of channels per area

The previous approaches to this problem were:

-There were only solutions for local coverage, which was not sufficient a satisfactory mobile service.

Outline the basic new approach or approaches to this problem:

-Use a frequency band allocated to mobile communication, divided into *m* bands that are assigned to *m* primary stations located appropriate to give coverage to a large secondary area (combination of primary station areas). Each primary station carries *n* telephone channels, allowing for *m*n* telephone channels. The same primary frequency bands can then be used in adjacent secondary areas, allowing us to extend the coverage indefinitely.

-Each primary station is given a different frequency band, so frequency discrimination (FD) is used to avoid interference between adjacent primary stations.

-Primary stations in adjacent secondary areas have the same frequency so FD cannot be used, instead amplitude discrimination (AD) is used to avoid interference. The basis of AD lies on the fact that attenuation of a signal transmitted by a primary station is directly correlated to distance travelled by the signal.

-Arrange the primary stations in a hexagonal structure, which also forms secondary areas in the shape of parallelograms.

-For this hexagonal arrangement, there is a minimum ratio of distances, D2/D1. D2 is the distance from the perimeter of a primary station's coverage to the nearest primary station operating as the same frequency band (in an adjacent secondary area). D1 is the coverage radius of each primary station. The minimum value of D2/D1 determines the amount of primary stations we need in a single secondary area. Larger D2/D1 means more primary stations (makes intuitive sense, since more primary stations means a larger secondary area).

-Depending on the geography, different values of D2/D1 may work better than others. Practical considerations must be made.

Critical assumptions made include:

-The paper does not explicitly state any assumptions, but it does discuss the possibility of using time discrimination to avoid interference. Time discrimination is refuted because of the lack of capability to create highly directive beams, but this could be an outdated assumption.

The performance of the techniques discussed in the paper was discussed in what manner:

-Metrics included were: Number of channels per primary area, number of primary areas (and thus total number of channels), total area taken by all primary areas.

-These metrics can be affected by varying the primary area size and number of primary frequencies.

-Using New York as an example, the paper shows how a smaller primary area radius with more primary frequencies can reduce the total number of channels required as well as take less coverage space in adjacent secondary areas, such as New Jersey.

The following terms were defined:

-Wide area coverage: Not explicitly defined, but implied that it is coverage that can be extended to cover several states or an entire country

-Primary station: a station allocated a single frequency band

-Primary area: coverage of a primary station

-Telephone channel: the channels carried by a primary station

-Secondary area: the coverage area covered by the combination of *m* primary stations each with a different frequency band

-Frequency discrimination: avoiding interference due to difference in operating frequency between primary areas

-Amplitude discrimination: avoiding interference due to the attenuation between same frequency signals from two primary stations in adjacent secondary areas

-Channels per area, total number of primary stations, minimum distance ratio (discussed above).

I rate and justify the value of this paper as:

-Looks like a very valid attempt at laying the foundation of how wide area coverage should be implemented. Not super technical, very conceptual. A bit hard to read. 7/10