

E1-E2 UPGRADATION COURSE –CONSUMER MOBILITY

RF Planning and Drive Test

CHAPTER-THREE

RF Planning and Drive Test

A cell can be defined as the area covered by one sector. A practical network will have cells of no geometric shapes. Main elements involved in radio Network are Mobile station and base transceiver station.

Process of Radio Network planning:

- Collection of the input parameters like requirement of capacity, coverage and quality
- Pre planning is done (which involves calculation of no. of BTS's with the objective to obtain maximum coverage at minimum cost.)
- Site survey involves selection of candidate sites based on feasibility study of constructing by Civil engineers
- Frequency allocation is done on the basis of Cell to Cell channel to interference ratio(C/I)
- Parameter planning is done which involves channel configurations, power control and network specific parameters
- The final radio network plan involves rest of the parameters like power budget calculations and considering path loss calculations.

Radio Network planning and optimization:

Optimization involves monitoring, verifying and improving the performance of the radio network.

- Study of methods required for optimization:
- Traffic estimation in terms of erlangs
- Configuration of Time slots of TRX
- Calculation of frequency re use factor
- Application of suitable propagation model
- Methods to improve signal received by MS
- Study of RRM (Radio resource management)
- Study of KPI's(Key performance parameters)

Traffic in the network is given in terms of erlangs.

One erlang (Erl) is defined as the amount of traffic generated by the user when he or she uses one traffic channel for one hour. Commonly used Erlang tables are Erlang B and Erlang C. Erlang B assumes that if calls cannot go through then they get dropped (i.e. no queuing possible). Erlang C considers that if a call does not get through then it will wait in a queue. These tables give information about the traffic generated by X No. of TRXs. Blocking describes the situation when a user is trying to make a call and is not able to reach a dialed subscriber owing to lack of resources. By observing this parameter, resources will be enhanced.

Configuration of Time slots of TRX:

Generally, two transceivers (TRX) would have 15 TCH and one SCH (signalling channel). In a single TRX, first TS is meant for signalling and rest of the TSs for traffic. According to the requirement, TRX's will be configured.

Calculation of frequency re use factor:

- Frequency re-use basically means how often a frequency can be re-used in the network. If the average number of the transceivers and the total number of frequencies are known, the frequency re-use factor can be calculated.
- Calculation of frequency re use factor: *If there are 3 TRX that are used per base station and the total number of frequencies available is 27. The total number of frequencies available for re-use is $27/3 = 9$*

Application of suitable propagation model

By studying the radio propagation conditions at a given place, either their own propagation models or any one of the available existing available propagation model is used. Propagation models: OKAmura-Hata model(for Macro Cell) and Walfish-ikegami model(for Micro Cell).

Study of methods required for optimisation

Power amplifiers are located near the transmission antennas while the boosters are located near the base station. Diversity is the most common way to improve the reception power of the receiving antenna. Major diversity techniques are space diversity. frequency diversity. and polarization diversity(In our field polarisation diversity is being used)

Study of RRM:

The management of radio resources, functions related to mobile location update, communication management issues such as handover and roaming procedure handling, come under radio resource management (RRM). For these management functions to happen, information flow (traffic and signalling) takes place via three protocols, known as link protocols. LAPDm is present over the MS-BTS connection and LAPD over the BTS-BSC connection. MTP (message transfer protocol) is used for signalling transport over the SS7 network.

Study of KPI's(key performance indicators):

Once a radio network is designed and operational, its performance is monitored. The performance is compared against chosen key performance indicators (KPIs). After fine-tuning, the results (parameters) are then applied to the network to get the desired performance.

KPIs can be subdivided according to the areas of functioning, such as area level, cell level (including the adjacent level), and TRX level. Area-level KPIs can include SDCCH requests, the dropped SDCCH total, dropped SDCCH Abis failures, outgoing MSC control handover (HO) attempts, outgoing BSC control HO attempts, intra-cell HO attempts, etc.

Drive Test:

The testing process starts with selection of the 'live' region of the network where the tests need to be performed, and the drive testing path. Before starting the tests the engineer should have the appropriate kits that include mobile equipment (usually three mobiles), drive testing software (on a laptop), and a GPS (global positioning system) unit.

Procedure of Drive Test: When the drive testing starts, two mobiles are used to generate calls with a gap of few seconds (usually 15-20 s). The third mobile is usually used for testing the coverage. It makes one continuous call, and if this call drops it will attempt another call. The purpose of this testing is to collect enough samples at a reasonable speed and in a reasonable time. If there are lots of dropped calls, the problem is analysed to find a solution for it and to propose changes.

Optimisation solution :**Moving antenna locations**

- Altering antenna heights

- Changing ARFCNs
- Antenna orientation adjustment
- Rectifying the faults in the steps followed before finalisation of Radio network planning.

DRIVE TEST TOOL (TEMS PRODUCTS)

TEMS Optimization Solutions offers solutions to problems associated with wireless network optimization. Regardless of network technology, the TEMS Optimization Solutions product family helps during every stage of the network life cycle, making the network perform at the high level expected by the subscribers. TEMS offers solutions for planning, development, optimizing, troubleshooting and expanding mobile networks. TEMS Optimization Solutions provides every tool needed in order to maximize the Quality of Service and get the most out of the network investment. Optimized networks also mean lower operational costs. As the network evolves through their lifecycles and into new technologies, TEMS products will support these changes. TEMS products increase network quality by helping operators plan and implement the best network configuration possible. They also enable engineers to troubleshoot problems quickly. Further TEMS products allow efficient monitoring, diagnosing and benchmarking in order to make best use of available resources. The products' interoperability makes it possible to share data between different tools, further increasing the benefit of using TEMS products.

TEMS CELLPLANNER UNIVERSAL: TEMS Cell Planner Universal is Ericsson's tool for mobile radio network planning. It is a highly graphical, easy-to-use, PC-based tool for design, realization, and optimization of mobile radio networks. TEMS CellPlanner Universal helps the user to roll out and expand mobile radio networks, and optimize radio network regarding service availability and service quality. It assists the user in a number of complex tasks, including network dimensioning, traffic planning, site configuration, and frequency planning. TEMS CellPlanner Universal is the key to successfully competing in the market place. TEMS CellPlanner Universal provides support for WCDMA, GSM 850, GSM 900, GSM 1800, GSM 1900, iDEN, CDMA, CDMA2000 1xRTT, TDMA/AMPS, NMT 450, NMT 900, TACS, and E-TACS. TEMS CellPlanner Universal also provides support for GPRS and EGPRS (EDGE), implemented in GSM system.

Questions

- 1) Write the process of Radio Network Planning ?
- 2) What are the commonly used Erlang tables?
- 3) What are the requirements for a Drive test?.
- 4) Write some Optimisation solutions?