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Analysis of GSM Network for Different Transmission Powers

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Abstract: *To set up the GSM mobile network the basic task is to analyze the effect of the transmission power on proposed network. This paper describes the GSM (Global System for Mobile Communications) network simulation for 4 users. The network is simulated in Qualnet Software. The paper shows the effect of transmission power on signal received, signal transmitted, channel assignment and location update. The frequency band of 900 MHz is used with two ray propagation model to simulate the network.*
Keywords: *- Frequency band, GSM, Qualnet Software, Transmission power.*

I. INTRODUCTION

GSM is a digital mobile telephony system that is widely used in Europe and other parts of the world. The modulation technique used by GSM is Gaussian Minimum Shift Keying (GMSK) which is a variant of the Phase Shift Keying (PSK) with Time Division Multiple Access (TDMA) signaling over Frequency Division Duplex carriers (FDD) [1, 2]. GSM operates at either on 900 MHz or 1800 MHz. GSM service is provided by 690 mobile networks across 213 countries. GSM represents 82.4% of all global mobile connections. China is a largest signal GSM market with 370 million users, followed by Russia with 145 million, India with 83 million [3]. Figure 1 shows the basic GSM Architecture.

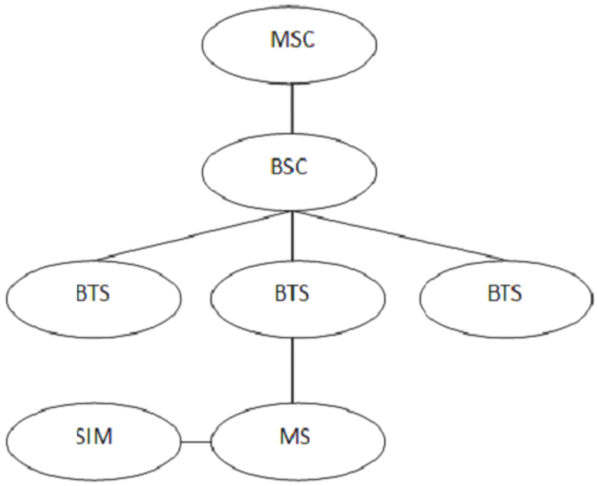


Fig. 1 GSM network architecture

This architecture consists of MSC, BSC, and BTS, MS. These elements of GSM network have following working principle.

1.1 Mobile Station (MS): MS consists of equipment, such as transceiver, display and digital signal processors and SIM card. It provides the air interface named U_m to use in GSM networks.

1.2 Base Transceiver station (BTS): BTS usually placed in the center of a cell. The size of cell is defined by the transmitting power of BTS. Each BTS have 1 to 16 transceivers. The number of transceivers depends on the density of users in the cell.

1.3 Base Station Controller (BSC): BSC manages the radio resources for one or more BTSs. It handles radio channel setup, frequency hopping and handovers. The BSC is the connection between the mobile and MSC.

1.4 Mobile Switching Center (MSC): MSC performs the switching of calls between the mobile and other fixed or mobile network users, as well as the management of mobile services such as authentication[4, 5].

II. GSM MODEL NETWORK GENERATION

The GSM model is generated and simulated in Qualnet Software version 5.0.2. The Figure 2 shows the model generated in the software.

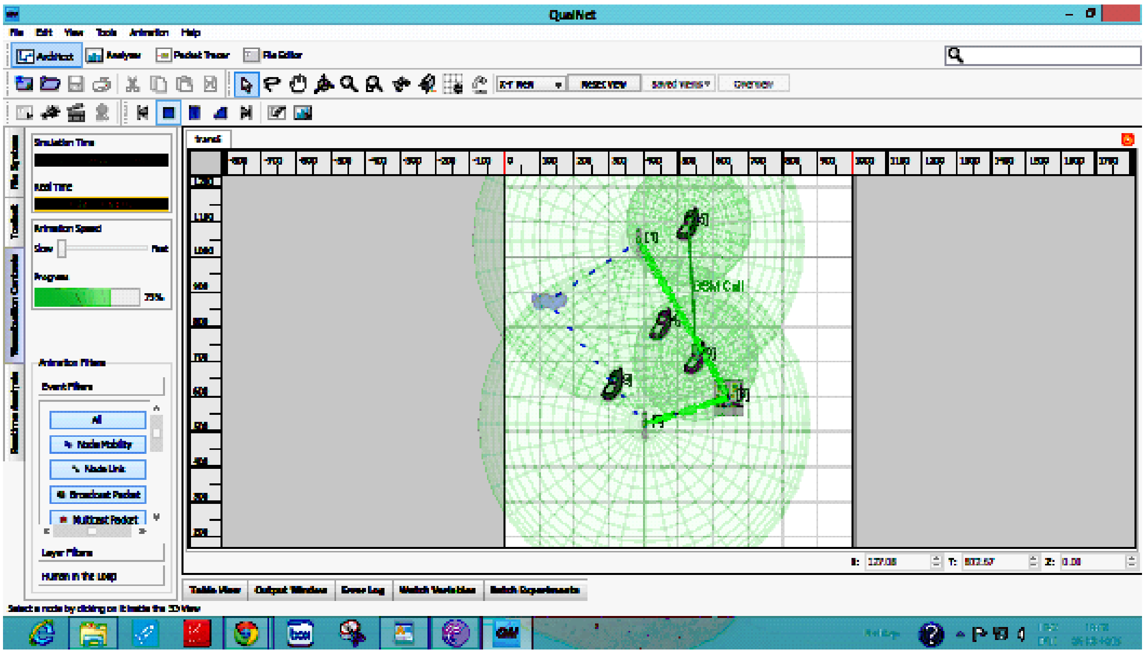


Fig. 2. simulating network of GSM

The above Figure. 2 shows the proposed network of GSM in Qualnet Software. The elements of proposed network are: MCS, BTS, MS. Figure. 2 shows GSM Scenario developed with coverage area 1500m X1500m. It contains 7 nodes out of which, nodes 4 through 7 are Mobile Stations (MS), 1 and 2 are Base Stations (BS), and node 9 is a Mobile Switch Center (MSC). GSM call is setup between node 5 and 8.The BS nodes are placed to cover the desired area and are fixed in location, as the MSC has been placed. The BS's are connected via wired links to the MSC and a default route file needs to be specified to ensure messaging between them [6]. The setup uses the 8 channels for traffic and control process. The Figure 3 shows the channel properties.

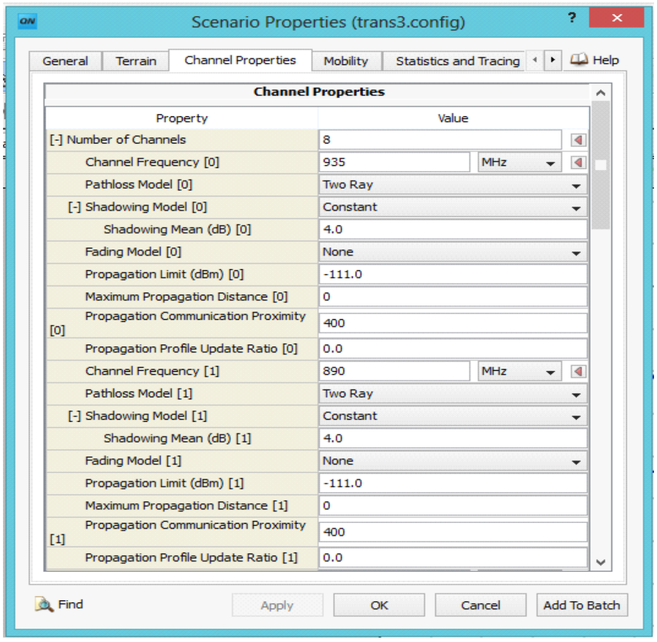
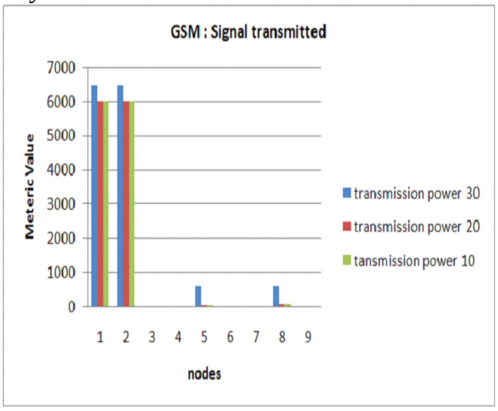


Fig. 3 channel properties

III. SIMULATION RESULTS

This section discusses the simulation results for different layers.

3.1 Physical layer results:



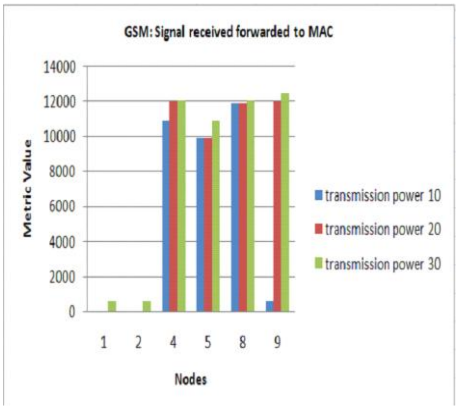


Fig. 4 signal transmitted (dBm) Fig. 5 signal received forwarded to MAC (dBm)

Figure 4 shows the comparison of value of signal transmitted at different transmission powers at node 1 and 2 which are BTSs. Metric value at transmission power 30 is higher than transmission power 10 and 20 but metric value at transmission power 10 and 20 is same. Figure 5 shows the comparison of merit values of signal received forwarded to MAC at different transmission powers at node 4, 5, 8 and 9 which are MSs. Metric value changes with change in transmission power at all MSs. At node 4, metric value at transmission power 20 and 30 is same. At node 5 and 8 metric value of transmission power 10 and 20 is same but metric value of transmission power 30 is higher than both other transmission powers. Thus, by increasing transmission power signal transmission increases.

3.2Network layer results:

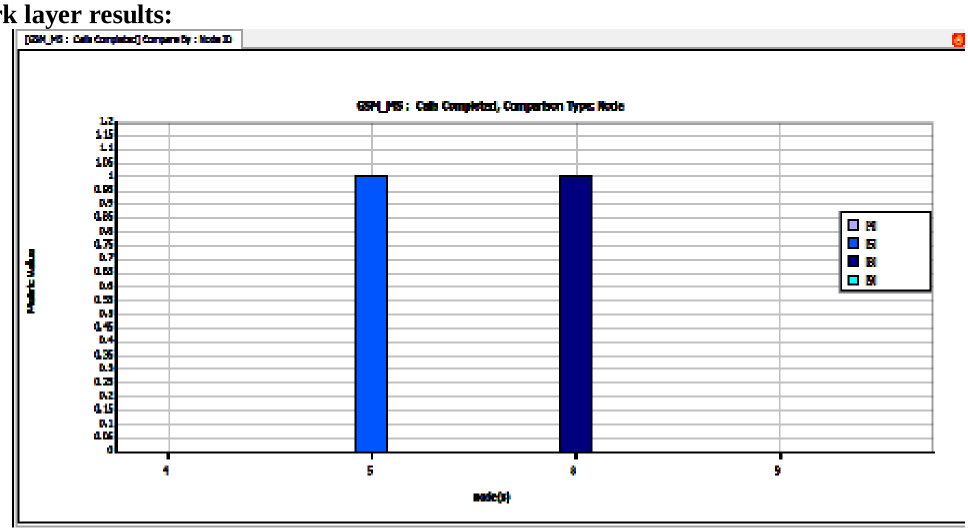


Fig. 6 call completed

Figure 6 shows the call completed between node 5 and 8 which are MSs. Call duration is 10s and simulation time is 30s.

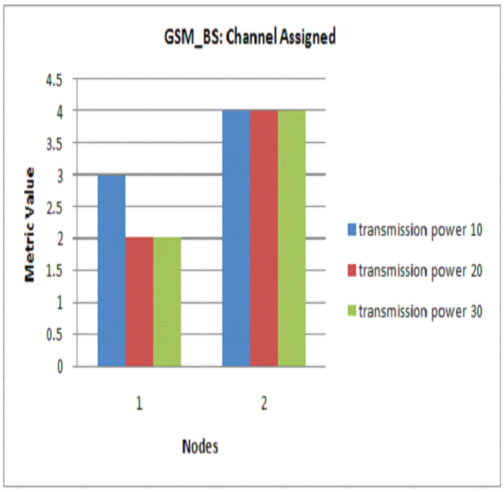


Fig.7 GSM_BS channel assigned (dBm)

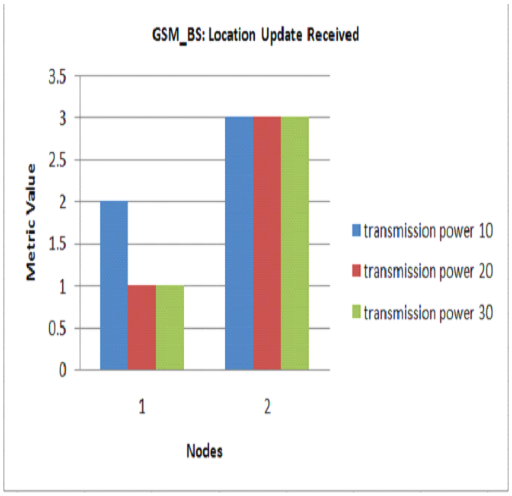


Fig. 8 GSM_BS location update (dBm)

Figure 7 shows the comparison of metric value of GSM_BS channel assigned at different transmission powers at node 1 BTS and 2 BTS. Metric value at node 1 at transmission power 10 is higher than metric value at transmission power 20 and 30. But at node 2 metric values at transmission power 10, 20 and 30 is same. Figure 8 shows the comparison of GSM_BS location update received at different transmission powers. At node 1 metric value at transmission power 20 and 30 is same, but less than the metric value of transmission power 10.

3.3 Application layer results:

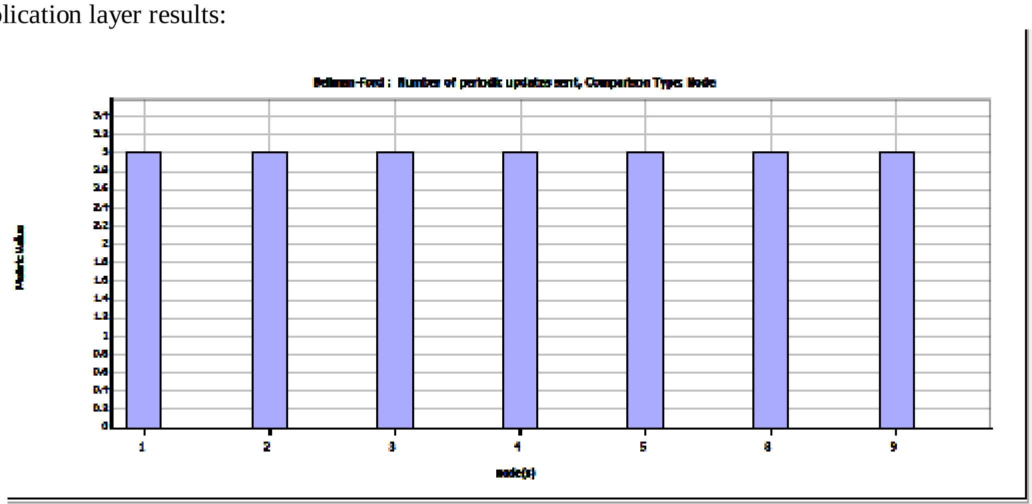


Fig.9 number of periodic updates sent

Figure 9 shows the numbers of periodic updates sent to all nodes. The MS, BS and MSC received continuous updates.

IV. CONCLUSION

In this paper authors conclude that with increase in transmission power, GSM signal transmitted strength at working nodes increases but ideal nodes remains unaffected and GSM signal received forwarded to MAC also increases for all nodes. GSM BS channel assigned increases for first BTS and remains constant for other BTS. Similarly, GSM BS location update increases for first BTS and remains constant for second BTS.

V. ACKNOWLEDGEMENT

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