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Mobile Network Area Selection and Analysis of 3G GSM Network Site

Ms.Neetu Sharma[#1], Ms. Neelkamal Chaudhary[#2]
#1 Govt. Engineering College, Ajmer
#2, Govt. Engineering College, Ajmer
[1]neetu_com10@gmail.com [2]neelkamal.chaudhary26@gmail.com

Abstract: Paper includes the proper selection process of area for mobile computing parameter analysis. So there can be a process so that the site around and area is selected and then the features of mobile network are analyzed on the basis of recent applications. The features or parameters on the basis of Performance of GSM network can be as follows: Blocked Call Analysis, Drop Call Analysis, Speech Quality Parameters, and Speech Quality Analysis, Handover Analysis, Coverage Analysis, Quality of SFH & Non-SFH network, Drop Call Rate, Call setup success rate, Blocked Call Rate, Hopping C/I.

I. INTRODUCTION

Coverage in GSM network stands for the geographical area covered by the network from which mobile is accessible to the network. The Global System for Mobile communications (GSM) is a huge, rapidly expanding and successful technology. Less than five years ago, there were a few 10's of companies working on GSM. GSM is quickly moving out of Europe and is becoming a world standard. In this report we will understand the basic GSM network elements and some of the important features. Since this is a very complex system, we have to develop the knowledge in a step by step approach.

"*A cellular network or mobile network is a wireless network distributed over land areas called cells, each served by at least one fixed-location transceiver, known as a cell site or base station.*"

In a cellular network, each cell uses a different set of frequencies from neighboring cells, to avoid interference and provide guaranteed bandwidth within each cell.

In GSM Coverage area is planned in division of cells. Each cell covers a particular geographical area, the size of which depends on the terrain and other system configurations. Generally the more the number of cells, the better the coverage but by just creating cells may not give good quality of coverage[1] [2].

Troubleshooting can be done on the basis of: Blocked Calls, Poor Quality and Drop calls, abnormal handovers, Interference, and Termination Failures. These are the real variables on which a call can be dependent.

II. SPEECH CODING PROCESS

Speech is captured in blocks of 20ms and coded into 260 bits, which are then ordered accordingly into Type 1a - 50 bits, Type 1b - 132 bits and Type 2 - 78 bits. These 260 bits give out a data rate of 13kbps which is the GSM speech rate. These bits are then channel coded for error correction and converted to 456 bits which yields out a data rate of 22.8kbps, which is data rate on Air interface. These 456 bits/20ms is decoded down to 260 bits at the BTS which again gives the original speech rate of 13Kbps. These 260 bits speech are again bit stuffed with 60 bits by the transcoder handler which gives out a rate of 16kbps, which is mapped on Abis.

III. CALL TROUBLESHOOTING

Call drops are identified through SACCH message, a Radio Link Failure Counter value is broadcast on the BCH, the counter value may vary from network to network. At the establishment of a dedicated channel, the counter is set to the broadcast value (which will be the maximum allowable for the connection).

The mobile decrements the counter by 1 for every FER (unrecoverable block of data) detected on the SACCH and increases the counter by 2 for every data block that is correctly received (up to the initial maximum value). If this counter reaches zero, a radio link failure is declared by the mobile and it returns back to the idle mode. If the counter reaches zero when the mobile is on a SDCCH then it is an SDCCH Drop. If it happens on a TCH, it is a TCH drop. Sometimes an attempted handover, which may in it have been an attempt to prevent a drop, can result in a dropped call. When the quality drops, a mobile is usually commanded to perform a handover.

Sometimes however, when it attempts to handover, it finds that the target cell is not suitable. When this happens it jumps back to the old cell and sends a Handover Failure message to the old cell. At this stage, if the handover was attempted at the survival threshold, the call may get dropped anyway. If on the other hand the thresholds were somewhat higher, the network can attempt another handover [4] [5] [6].

Coverage

Poor non-contiguous coverage will reduce C/N and hence will reduce the Ec/No and will result into call drops.

Network Initiated Drops

Network initiated drops means, sometimes a network do kill some processes to provide connection to some emergency subscriber calls. A handover is the key to survival from dropping calls. But if there are problems in the Handover process itself, then this will not avoid a drop.

SDCCH Drop

Coverage, Co- Channel Interference, Adjacent Channel Interference, SDCCH Drop - Uplink TCH Drop – Coverage, Co-Channel Interference, Adjacent Channel Interference, Uplink Problem, Handover Failure.

Poor Quality

Poor Speech Quality could be due to , Patchy Coverage (holes), No Target cell for Handover, Echo , Audio holes, Voice Clipping, Interference like as , Co-channel, Adjacent channel, External, Multipath, Noise.

IV. SPEECH QUALITY PARAMETERS

FER: Measured on the basis of BFI (Ping -Pong effect) Preferred under Frequency Hopping situation

Echo and Distortion: Generally caused by the Transmission and switching system.

Audio holes: Blank period of speech, due to malfunctioning of Tran coder boards or PCM circuits.

Voice Clipping: Occurs due to improper implementation of DTX.

V. CLUSTER DETAILS

For checking the call drop and other mobile network parameters, one should have to select and area first of all. So here the area has been selected and it has been divided into clusters. In the table shown below the details of the cluster has been given like its type, drive test routes, hotspots and landmarks.

Town Name	District	Co-ordinates	
		Lat	Long
Town name	District Name	22 13 35.97	84 50 46.78

Sector	Cluster type	Drive-test routes/Hotspots/Landmarks
405-11364	Dense area	Market place near site, Residential area
405-21364	Dense area	Market place near site, Residential area
405-31364	Dense area	Market place near site, Residential area

There are some critical network implementation features. They should be first considered and then network implementation or network analysis will start Dynamic

- Power Control
- Discontinuous Transmission
- Frequency Hopping
- Intra-cell Handover

Mobile is commanded to change its Transmit Power and then the power will be changed with the proportionate to the path loss and the change in power is done in the steps of 2 DBs. In that case the dynamic MS power control will be maximum.

VI. SITE DETAILS

After the selection of the area, one site has been created or selected around that area in any of the one cluster. So that the parameters can be measured and

Physical details

Location details

Antenna Height			Antenna Orientation			Antenna Model No/Type		
Sect-1	Sect-2	Sect-3	Sect-1	Sect-2	Sect-3	Sect-1	Sect-2	Sect-3
30	30	30	30	160	235	90	90	90

Weak Neighbors: Total Attempted Calls, Total Dropped Calls, Total Blocked Calls, RxQUAL Full, RxLeve Full, RLT Current Value, ARFCN, Neighbor Cell Measurements, RR Message, Phone State, Sequency number.

VII. RF DETAILS

Here Radio Frequency details (BSIC) of all the three sectors of the area are shown in the tables: So it can be seen that the area is divided into three sectors

	Sec1	Sec2	Sec3
BSIC	39	39	39

Site ID	BSC Name	BSC ID	Sector	Cell Id
405-1364	Site	BSC-6	1	405-11364
			2	405-21364
			3	405-31364

VIII. AMR Call Results

For both uplink and downlink, the AMR call results are shown in the table:

Uplink

BTS Conf	Transmit Power(dbm) Sec-1	Sec-2	Sec-3	SECTOR-1 BCCH	TCH-1	TCH-2	TCH-3	SECTOR-2 BCCH	TCH-1	TCH-2	TCH-3	BCCH	SECTOR-3 TCH-1	TCH-2	TCH-3
4/4/4	43	43	43	51	33	39	45	98	35	41	47	60	37	43	49

Description	Measured Results			Remarks/ Recommendations
AMR call Results	Coding Scheme	C/I value	Threshold Percentage Samples	
	7.40kbps	96	0	
	6.70kbps	01	26	
	5.90kbps	03	18	

	5.15kbps			

In the case of UPLINK, it can be easily analyzed that the C/I value is highest in the case of the 7.40 kbps coding scheme and the threshold is highest in the case of 6.70 kbps coding schemes. And now it can easily be compared with the downlink that it will be the sane case with downlink also. But in 6.70 kbps the C/I value is more as compared to 5.90 kbps coding in downlink but in uplink the case is opposite.

Downlink

Description	Measured Results			Remarks/ Recommendations
AMR call Results	Coding Scheme	C/I Threshold value	Percentage Samples	
	7.40kbps	65 0		
	6.70kbps	22 26		
	5.90kbps	13 18		
	5.15kbps			

IX. Plots of Coverage Analysis

The coverage area plots has been created and analyzed for the purpose of checking the Rx valus and Rx value quality Sub parameters. These plots are created using the mapinfo simulation tool.

1. Rx Level.
2. Rx Qual.
3. SQI.
4. FER.

Rx Level plots

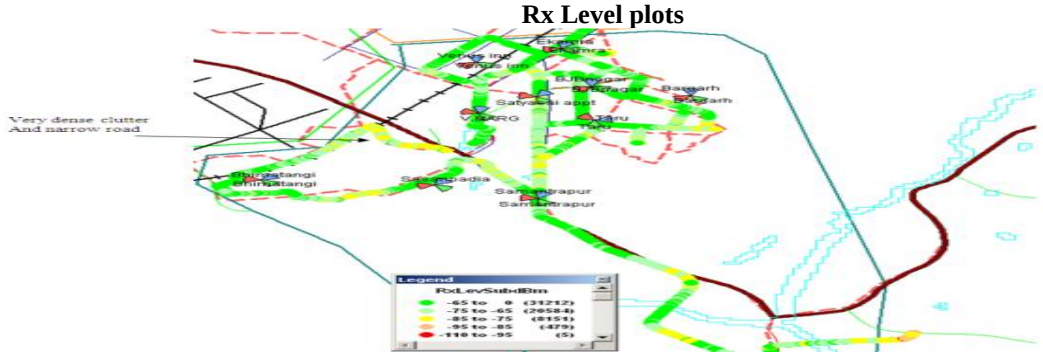

Fig 8: Represent plots of Rx Level Sub

Rx Qual Plot

Fig 9: Represent plots of Rx Quality Sub

X. CONCLUSION

There can be any area for the purpose of mobile network analysis but the analysis is totally dependent on the area selected during data collection. There are different sites of 3G wireless mobile network that has been analyzed on the basis of call drop troubleshooting and quality of calls. After analysis we have found that bad Spot 1 has poor quality and Call Drop that can easily be seen in the maps. This spot is covered by Cell 47450. There has seen a Poor Coverage Level i.e below -97 db, But Call should not Drop.

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