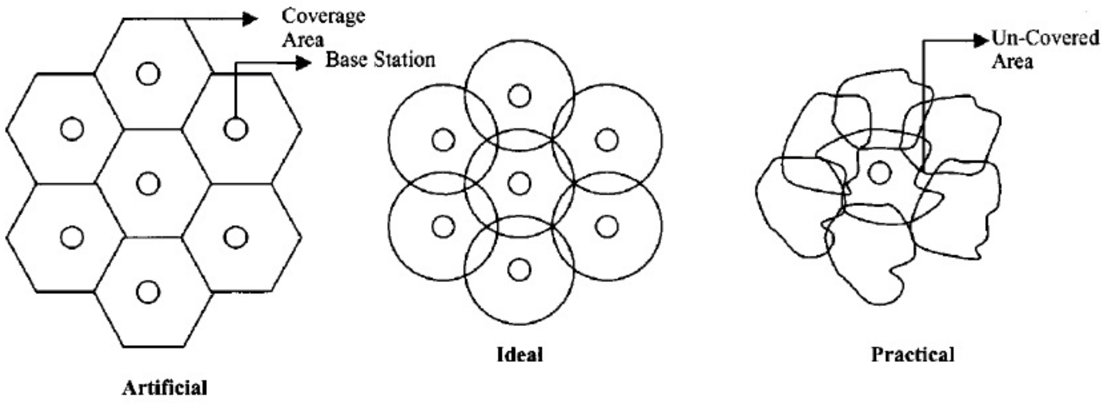
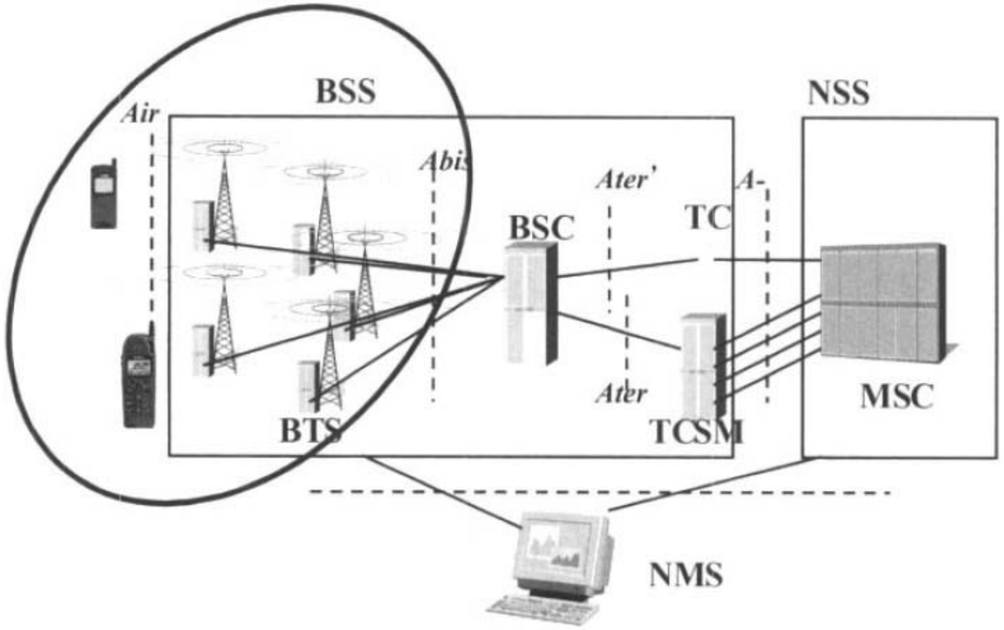
Radio Network Planning & Optimization of 2G

Scope of RNP

- RNP includes MS , BTS and their Interfaces.

- Cell Shape





Elements in a Radio network

Mobile Station (MS)

A Mobile Station consists of two main elements:

- **The mobile equipment or terminal**

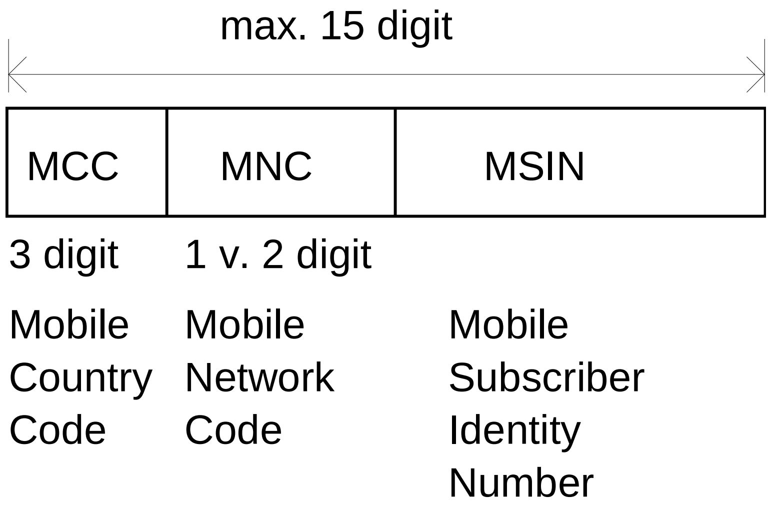
There are different types of terminals distinguished principally by their power and application:

- The `fixed' terminals are the ones installed in cars. Their maximum allowed output power is 20 W.
- The GSM portable terminals can also be installed in vehicles. Their maximum allowed output power is 8W.
- The handhelds terminals have experienced the biggest success thanks to their weight and volume, which are continuously decreasing. These terminals can emit up to 2 W. The evolution of technologies allows decreasing the maximum allowed power to 0.8 W.

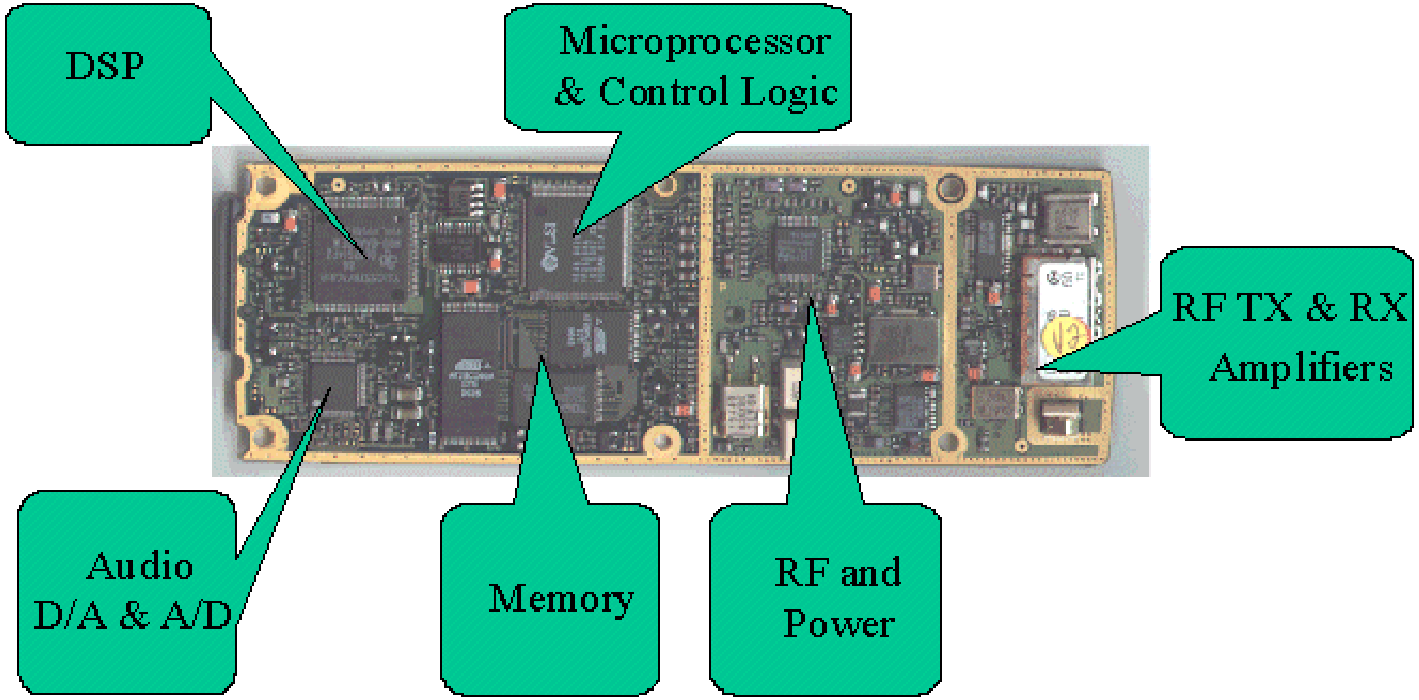
- **The Subscriber Identity Module (SIM)**

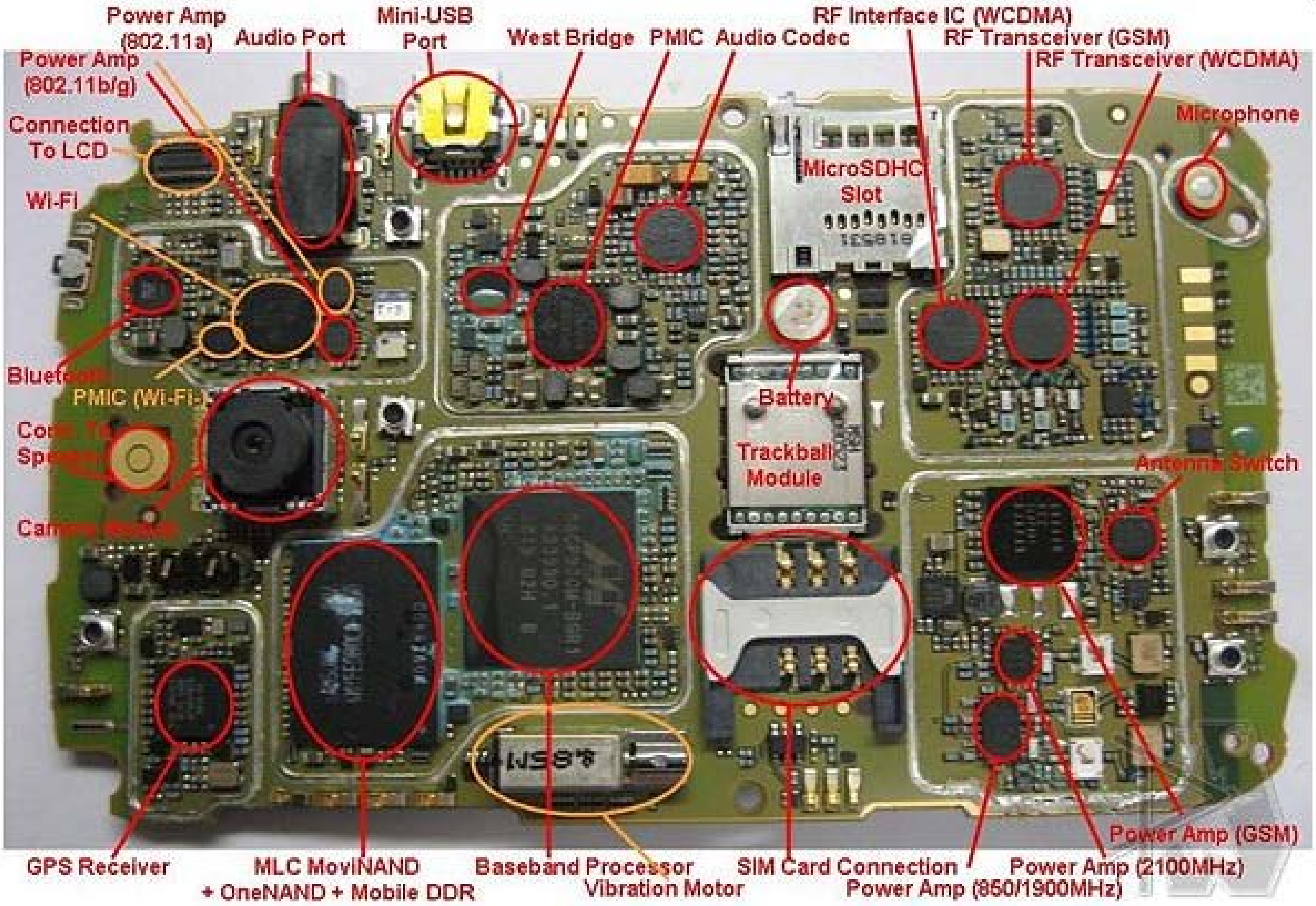
The Subscriber Identity Module (SIM)

- The SIM is a smart card that identifies the terminal. By inserting the SIM card into the terminal, the user can have access to all the subscribed services. Without the SIM card, the terminal is not operational.
- The SIM card is protected by a four-digit Personal Identification Number (PIN). In order to identify the subscriber to the system, the SIM card contains some parameters of the user such as its International Mobile Subscriber Identity (IMSI).
- Another advantage of the SIM card is the mobility of the users. In fact, the only element that personalizes a terminal is the SIM card. Therefore, the user can have access to its subscribed services in any terminal using its SIM card.

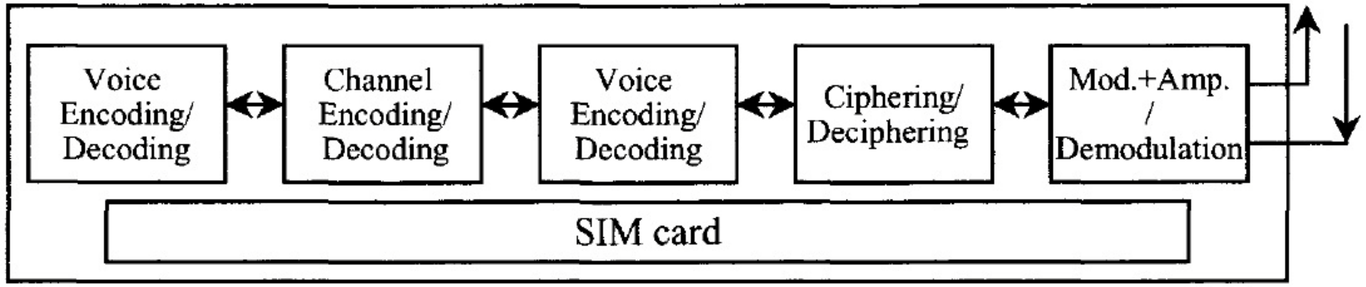


Cell phone Inside

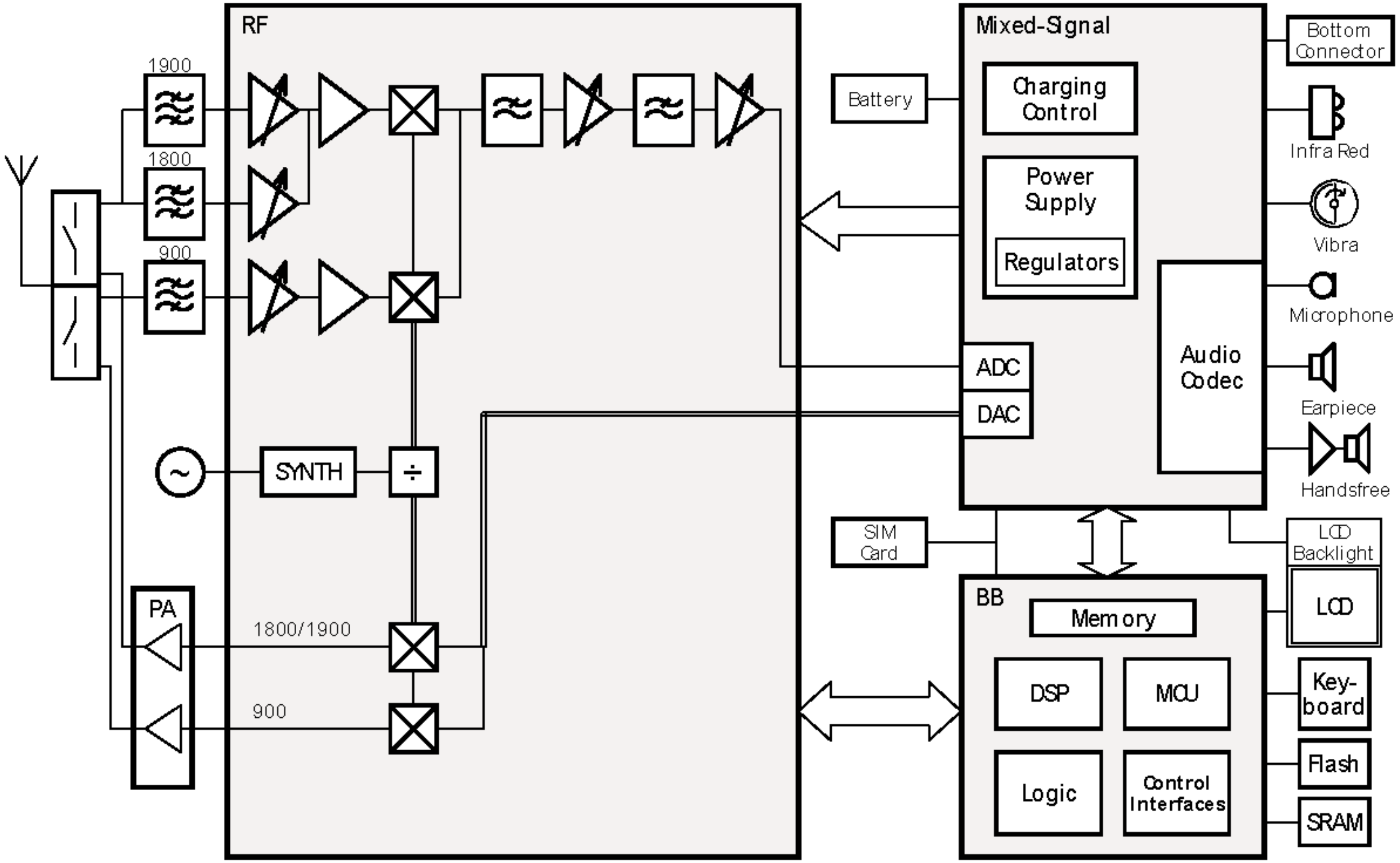




Power Amp (802.11a)
Audio Port
Mini-USB Port
West Bridge
PMIC
Audio Codec
RF Interface IC (WCDMA)
RF Transceiver (GSM)
RF Transceiver (WCDMA)
Power Amp (802.11b/g)
Connection To LCD
Microphone
Wi-Fi
MicroSDHC Slot
Battery
PMIC (Wi-Fi)
Trackball Module
Antenna Switch
Power Amp (GSM)
GPS Receiver
MLC MoviNAND + OneNAND + Mobile DDR
Baseband Processor
Vibration Motor
SIM Card Connection
Power Amp (2100MHz)
Power Amp (850/1900MHz)



Voice Encoding/ Decoding
Channel Encoding/ Decoding
Voice Encoding/ Decoding
Ciphering/ Deciphering
Mod.+Amp. / Demodulation
SIM card

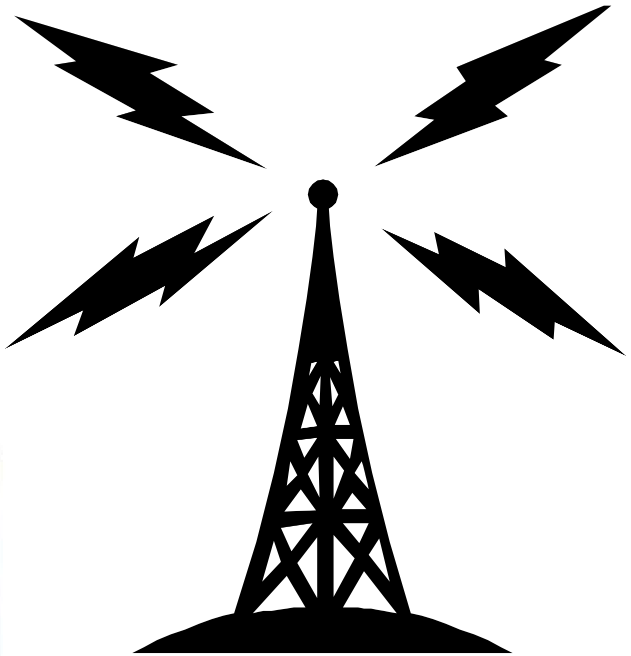


RF
1900
1800
900
SYNTH
÷
PA
1800/1900
900
Mixed-Signal
Battery
Charging Control
Power Supply
Regulators
ADC
DAC
Audio Codec
Bottom Connector
Infra Red
Vibra
Microphone
Earpiece
Handsfree
SIM Card
LCD Backlight
LCD
BB
Memory
DSP
MCU
Logic
Control Interfaces
Key-board
Flash
SRAM

Base *Transceiver Station (BTS)*

- The BTS corresponds to the transceivers and antennas used in each cell of the network. A BTS is usually placed in the center of a cell. Its transmitting power defines the size of a cell. Each BTS has between one and sixteen transceivers depending on the density of users in the cell.

- Controls the radio link
  - encryption
  - error control
  - signal strength
- 1 - 6 duplex carriers, for example:
  - two layers
  - 120^o sectors
  - (6+8)*3 = 42 voice calls
- Cost ~ 100 – 200 k$

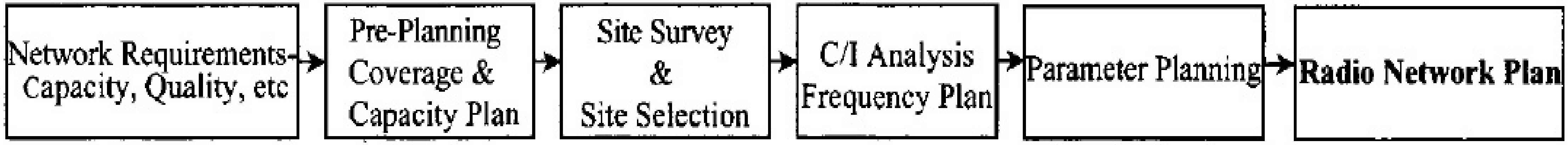


- There are two types of channels in the air interface:
- Physical channels and logical channels.
- The physical channel is all the time slots (TS) of the BTS. There are again two types in this: half-rate (HR) and full-rate (FR). The FR channel is a 13 kbps coded speech or data channel with a raw data rate of 9.6,4.8 or 2.6 kbps, while the HR supports 7,4.8 or 2.4 kbps.
- 'Logical channel' refers to the specific type of information that is carried by the physical channel. Logical channels can also be divided into two types: traffic channels (TCH) and control channels (CCH). Traffic channels are used to carry user data (speech/data) while the control channels carry the signaling and control information. The logical control channels are of two types: common and dedicated channels.

Control channels

Channel	Abbreviation	Function/application
Access grant channel (DL)	AGCH	Resource allocation (subscriber access authorisation)
Broadcast common control channel (DL)	BCCH	Dissemination of general information
Cell broadcast channel (DL)	CBCH	Transmits the cell broadcast messages
Fast associated control channel (UL/DL)	FACCH	For user network signalling
Paging channel (DL)	PCH	Paging for a mobile terminal
Random access channel (UL)	RACH	Resource request made by mobile terminal
Slow associated control channel (UL/DL)	SACCH	Used for transport of radio layer parameters
Standalone dedicated control channel (UL/DL)	SDCCH	For user network signalling
Synchronisation channel (DL)	SCH	Synchronisation of mobile terminal

RADIO NETWORK PLANNING PROCESS



The pre-planning process results in theoretical coverage and capacity plans.

- The average cell capacity requirement per service area is estimated for each phase of network design.
- Coverage-driven to a capacity-driven process.
- To find the minimum number of sites for producing the required coverage, radio planners often have to experiment with both coverage and capacity, as the capacity requirements may have to increase the number of sites, resulting in a more effective frequency usage and minimal interference.

Sites are then searched for, and one of these is selected based on the inputs from the transmission planning and installation engineers. Civil engineers are also needed to do a feasibility study of constructing the base station at that site.

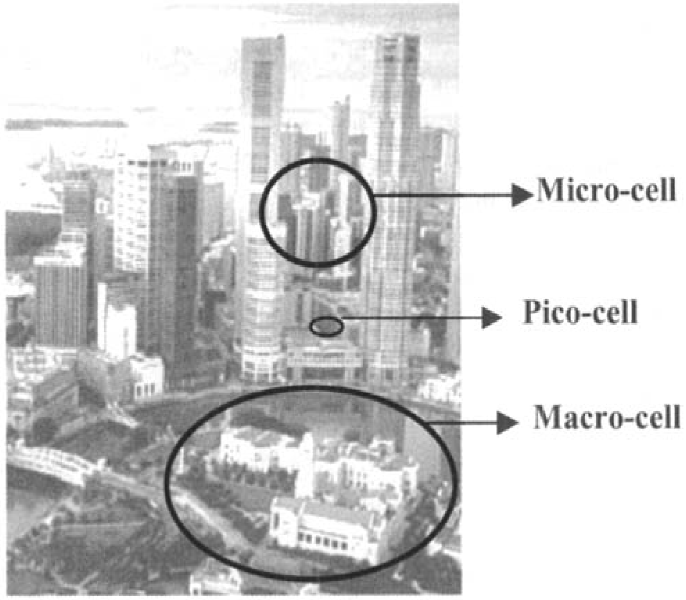
Frequency allocation is based on the cell-to-cell channel to interference (C/I) ratio. The frequency plans need to be fine-tuned based on drive test results and network management statistics.

Parameter plans are drawn up for each of the cell sites. This may include cell service area definitions, channel configurations, handover and power control.

The radio plan consists of the coverage plans, capacity estimations, interference plans, power budget calculations, parameter set plans, frequency plans, etc.

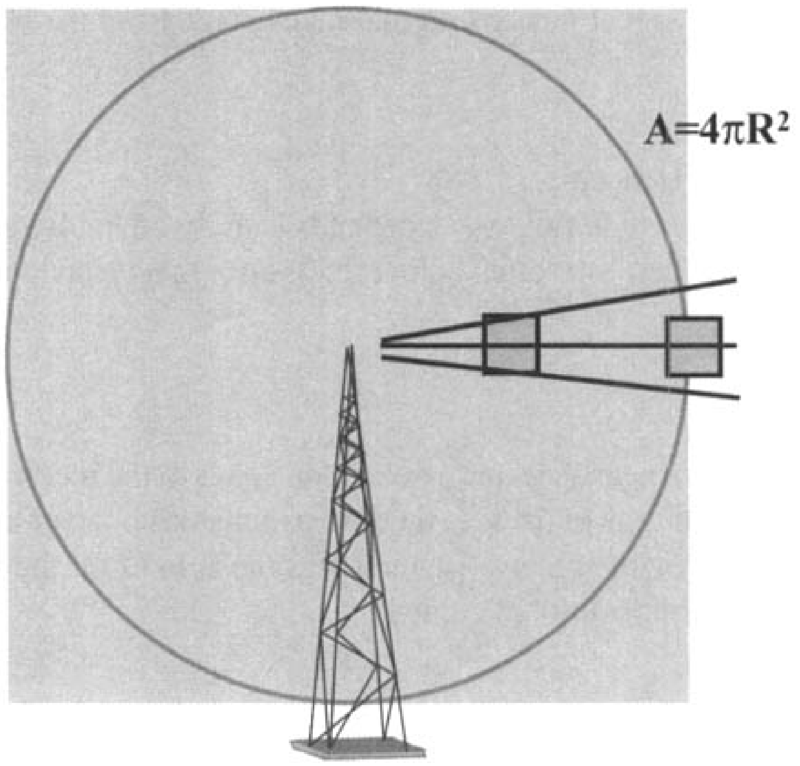
Radio Cell and Wave Propagation

- The requirement from the radio planners is generally a network design that covers 100% of the area.
- The whole land area is divided into three major classes - urban, suburban and rural - based on human-made structures and natural terrains. The cells (sites) that are constructed in these areas can be classified as outdoor and indoor cells. Outdoor cells can be further classified as macro-cellular, micro-cellular or pico cellular.



Wave Propagation Effects and Parameters

- The signal that is transmitted from the transmitting antenna (BTS/MS) and received by the receiving antenna (MS/BTS)
- Free-space Loss
- Multi-path propagation
- Interference (ISI)
- Fading
- Refraction
- Signal Over Vegetation (Foliage Loss)



Free-space Loss

$$A = 4\pi R^2$$

The power density S at any point at a distance R from the antenna can be expressed as:

$$S = P^* G / A$$

where P is the power transmitted by the antenna, and G is the antenna gain. Thus, the received power P_r at a distance R is:

$$P_r = P^* G_t^* G_r^* (\lambda / 4\pi R)^2$$

where G_t and G_r are the gain of the transmitting and receiving antennas respectively. On converting this to decibels we have:

$$P_r(\text{dB}) = P(\text{dB}) + G_t(\text{dB}) + G_r(\text{dB}) + 20\log(\lambda/4\pi) - 20\log d.$$

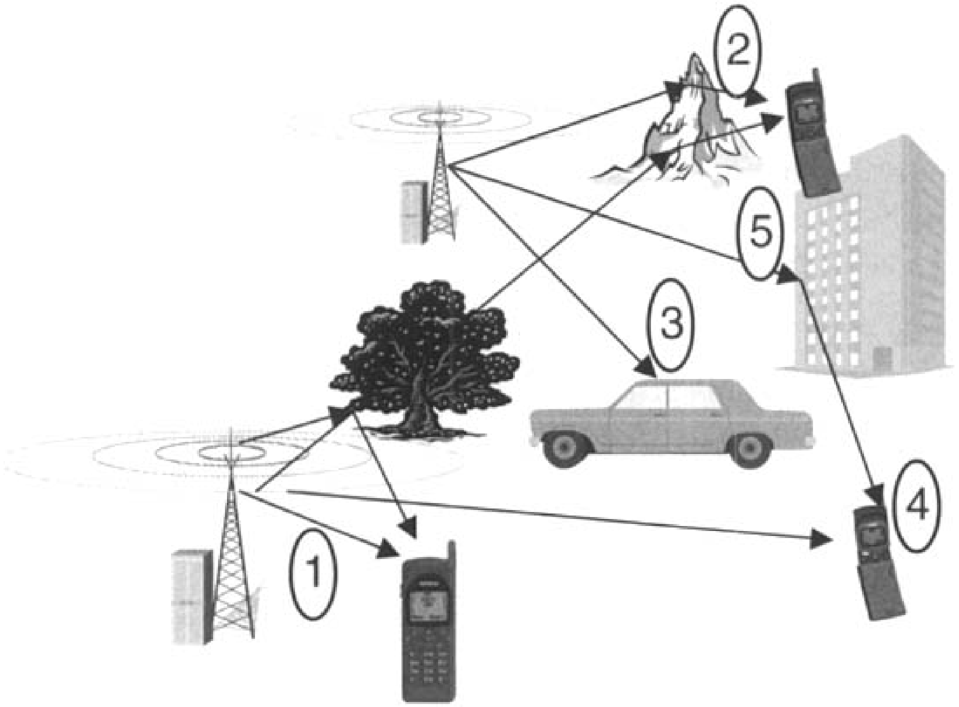
Last two terms in equation 2.4 are together called the path loss in free space, or the free-space loss. The first two terms (P and G_t) combined are called the effective isotropic radiated power, or EIRP. Thus:

$$\text{Free-space loss (dB)} = \text{EIRP} + G_r(\text{dB}) - P_r(\text{dB}).$$

The free-space loss can then be given as:

$$L_{\text{dB}} = 92.5 + 20\log f + 20\log d$$

Propagation Effects



Factors affecting wave propagation: (1) direct signal; (2) diffraction; (3) vehicle penetration; (4) interference; (5) building penetration

Dimensioning

- The dimensioning exercise is to identify the equipment and the network type (i.e. technology employed) required in order to cater for the coverage and quality requirements, apart from seeing that capacity needs are fulfilled for the next few years (generally 3-5 years).

The inputs that are required for the dimensioning include:

- The geographical area to be covered
- The estimated traffic in each region
- Minimum requirements of power in each region and blocking criteria
- Path loss
- The frequency band to be used and frequency re-use.

RADIO NETWORK PRE-PLANNING

- **Calculation of number of sites required in a region**
- **Site Survey and Site Selection**

There are some points to remember during the process of site selection:

The process of site selection, from identifying the site to site acquisition, is very long and slow, which may result in a delay of network launch.

The sites are a long-term investment and usually cost a lot of money.

Result of the Site Survey Process

There are two types of report that are generated in the site survey process. One is at the beginning of the search and the other at the end, which is a report on the site selected. The report made after site selection should have more detailed information. This may contain the height of the building / green-field, coordinates, antenna configuration (location, tilt, azimuth, etc.), maps, and a top view of the site with exact location of the base station and the antennas (both radio and transmission).

RADIO NETWORK DETAILED PLANNING

The detailed radio network plan can be sub-divided into three sub-plans:

- Link budget calculation,
- Coverage, capacity planning and spectrum efficiency,
- Parameter planning.

Important Components of Link Budget Calculations

- MS sensitivity: This factor is dependent upon the receiver noise and minimum level of *Eb/No* (i.e. output signal to noise ratio) needed. This is calculated by using the GSM specifications (ETSI GSM recommendation 05.05). The recommended values of MS sensitivity in GSM 900 and 1800 are -102 dBm and -100 dBm respectively.
-
- BTS sensitivity: The sensitivity of the base station is again specified by the ETSI's GSM recommendations 05.05 and is calculated in the same manner as the MS sensitivity. The recommended value of BTS sensitivity is -106 dBm. However, when doing power budget calculations, the value given by the manufacturer (or measured value) should be used.

- Fade margin: This is the difference between the received signal and receiver threshold. Usually a fast fade margin is of importance in power budget calculations. Different values are used for different types of regions, such as 2 dB for dense urban or 1 dB for urban.

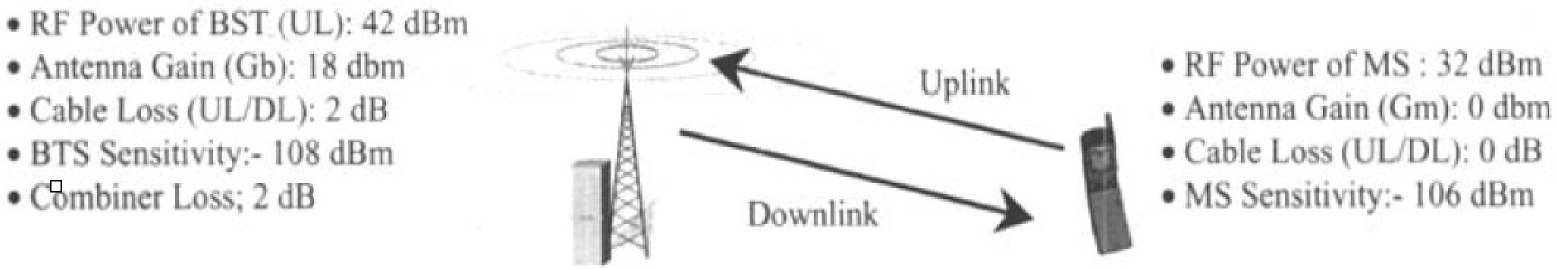
- Connector and cable losses: As cables and connectors are used in power transmission, the losses incurred therein should be taken into account. Cable attenuation figures are usually quoted in loss (dB) per 100 m.

- MS and BTS antenna gain: The antennas used for MS and BTS have significantly different gain levels.

Link Budget & Power Budget

Power budget calculation

Consider a BTS and MS along with the parameters as shown in Figure 2.9.



Example of a power budget

Link Budget

- Link budget calculations give the loss in the signal strength on the path between the mobile station antenna and base station antenna.
- Link budget calculations are done for both the uplink and downlink.
- Effective Isotropic Effective power

Uplink calculations

PLu (Path Loss in uplink) = EIRPm (Peak EIRP of Mobile) − Prb (Power Received by the base station)

$$
\begin{aligned}
EIRPm &= \text{Ptm (Power transmitted from the MS)} - \text{Losses} + \text{Gm} \\
Losses &= \text{Lcm (cable loss at mobile)} + \text{Lom (any other loss)} \\
Prb &= -\text{Gb (antenna gain)} - \text{Losses} + \text{Bs (BTS sensitivity)} \\
Losses &= \text{Lcb (cable loss at BTS)} + \text{Lob (any other loss)} \\
PLu &= \text{EIRPm} - \text{Prb} \\
&= [Ptm - Lcm - Lom + Gm] - [-Gb + Lcb + Lob + Bs] \\
&= [32 - 0 + 0 + 0] - [-18 + 2 + 0 + (-108)] \\
&= 32 + 124 = 156\,dB
\end{aligned}
$$

Downlink calculations

PLd (Path Loss in downlink) = EIRPb (peak EIRP of BTS) − Prm (Power received by the MS)

$$
\begin{aligned}
EIRPb &= Ptb\ (\text{Power transmitted by BTS}) + Gtb\ (\text{antenna gain}) - Losses \\
Losses &= Lcb\ (\text{cable loss at BTS}) + Lccb\ (\text{combiner loss at BTS}) \\
Prm &= Ms\ (\text{Mobile sensitivity}) + Losses - Gm\ (\text{mobile antenna Gain}) \\
Losses &= Lcm\ (\text{cable loss}) + Lom\ (\text{any other loss}) \\
PLd &= EIRPb - Prm \\
&= [Ptb + Gtb - Lcb - Lccb] - [Ms - Lcm - Lom - Gm] \\
&= [42 + 18 - 2 - 2] - [-106 - 0 - 0 - 0] \\
&= 56 + 106 = 162\ dB
\end{aligned}
$$

There is an obvious difference in the results of the uplink and downlink power budget calculations, where the downlink path loss exceeds the uplink power loss. This is an indication that the area covered by the base station antenna radiation is more than the area covered by the mobile station antenna, thereby giving more coverage in the downlink direction. Reducing the power in the downlink direction can reduce this difference but results in a loss of coverage.

The link budget is the table recording the power loss in the uplink or downlink of the network. Below is an example of the link budget from GSM 900 MHz. The link budget results can be improved by adopting some techniques like frequency hopping or using receiver diversity. (Ref. ETSI)

TRANSMITTING END		**MS**	**BS**	
TX RF-output peak power	W	2.00	6.00	
(mean power over RF cycle)	dBm	33.00	38.00	K
Isolator + combiner + filter	dB	0.00	3.00	L
RF-peak power, combiner output	dBm	33.00	26.00	M=K-L
Cable loss + connector	dB	0.00	4.00	N
TX-antenna gain	dBi	0.00	12.00	O
Peak EIRP	W	2.00	20.00	
(EIRP = ERP + 2dB)	dBm	33.00	34.00	P=M-N+O
Path loss due to ant./body loss	dBi	9.00	9.00	Q
Isotropic path loss	dB	133.00	133.00	R=P-F-Q

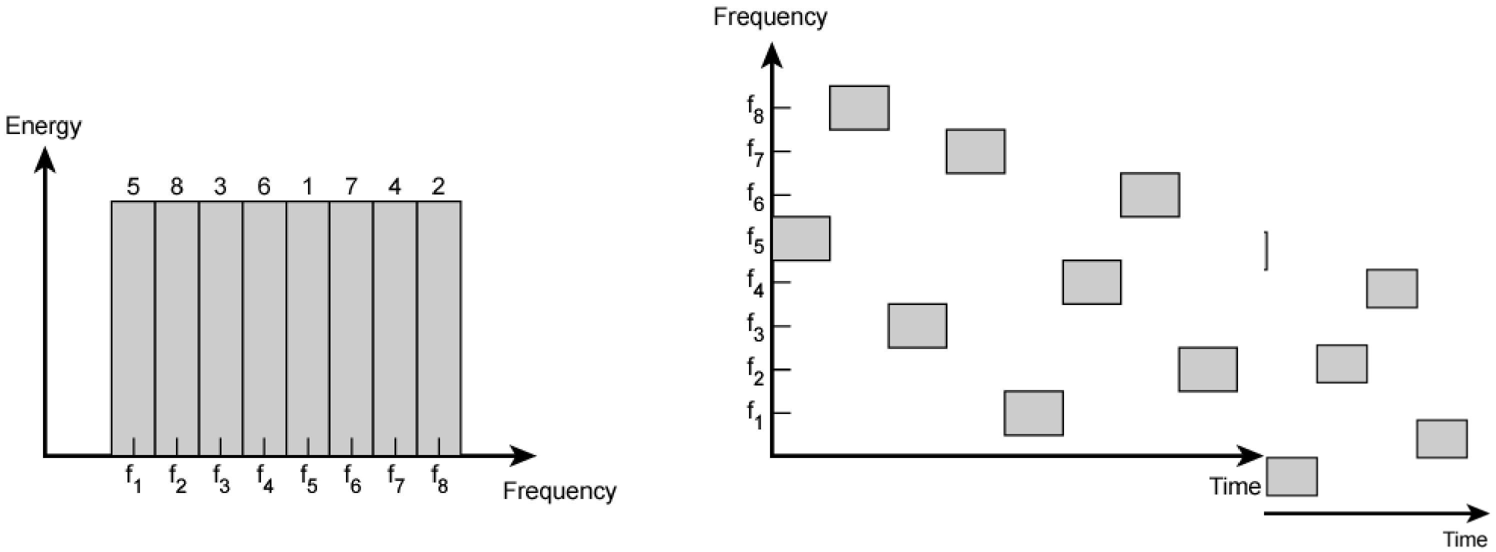
RECEIVED END		BS	MS	
RX RF-input sensitivity	dBm	-104.00	-102.00	A
Interference degrading margin	dB	3.00	3.00	B
Cable loss + connector	dB	4.00	0.00	C
Rx antenna gain	dBi	12.00	0.00	D
Isotropic power	dBm	-109.00	-99.00	E=A+B+C+D
Field strength	dBV/m	20.24	30.24	F=E+Z
				Z=77.2+20*log(freq/MHz)

The output and effects of link budget calculations:

- Path loss and Rx Power: Main output of the link budget. The better the Input data accuracy the more accurate the results.
- Cell range: If the path loss is lessened, the signal from the transmitter (BTS) antenna will cover more distance, so increasing the area covered by one BTS. Thus, the power budget calculations play a direct role in determining the covered area, and so deciding on the number of base stations that will be required in a network.
- Coverage threshold: The downlink signal strength at the cell border for a given location probability is known the coverage threshold. Although slow fade margin and MS isotropic power can be used to calculate this value, power budget calculations are used for this purpose. Propagation models are used for more accurate calculation of the cell range and coverage area (Cost-hata, Ericsson, SUI).

Frequency Hopping

•Technique that basically improves the channel to interference (C/I) ratio by utilizing many frequency channels. two types of frequency diversity technique: random FH and sequential FH. Sequential FH is used more in practical network planning as it gives more improvement to the network quality.



(a) Channel assignment (b) Channel use

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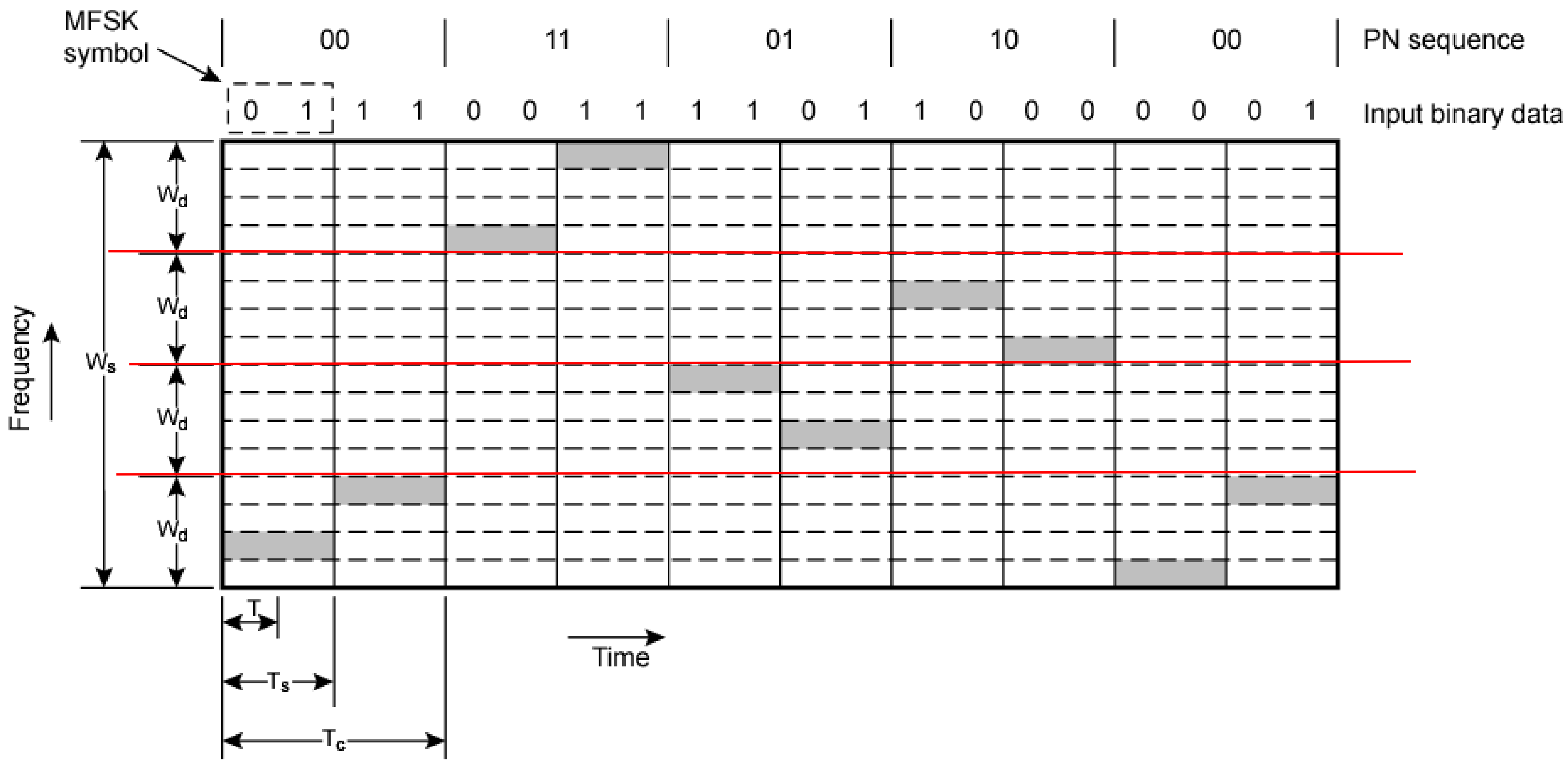


Equipment Enhancements

- Receiver Diversity: Major diversity techniques are space diversity, frequency diversity, and polarization diversity.
- Low-noise Amplifiers (LNA)
- Power Boosters

- **Propagation Models:** There are two ways in which radio planners can use propagation models. They can either create their own propagation models for different areas in a cellular network, or they can use the existing standard models.
- 2 types of model : Micro cell and Macro cell

The Okumara-Hata model is the most commonly used model for macro-cell coverage planning.

$$L = A + B\log f - 13.82\log h_{\text{bts}} - a(h_{\text{m}})(44.9 - 6.55\log h_{\text{b}})\log d + L_{\text{other}}$$

where f is the frequency (MHz), h is the BTS antenna height (m), $a(h)$ is a function of the MS antenna height, d is the distance between the BS and MS (km), L_{other} is the attenuation due to land usage classes, and $a(h_{\text{m}})$ is given by:

$$a(h_{\text{m}}) = (1.1\log f_{\text{c}} - 0.7)h_{\text{m}} - (1.56\log f_{\text{c}} - 0.8).$$

For a small or medium-sized city:

$$a(h_{\text{m}}) = 8.25(\log 1.54h_{\text{m}})^2 - 1.1$$

For a large city:

$$a(h_{\text{m}}) = 3.2(\log 11.75h_{\text{m}})^2 - 4.97$$

The value of the constants A and B varies with frequencies as shown below:

$$A = 69.55 \quad \text{and} \quad B = 26.16 \text{ for } 150\text{–}1000\,\text{MHz}$$

$$A = 46.3 \quad \text{and} \quad B = 33.9 \text{ for } 1000\text{–}2000\,\text{MHz}.$$

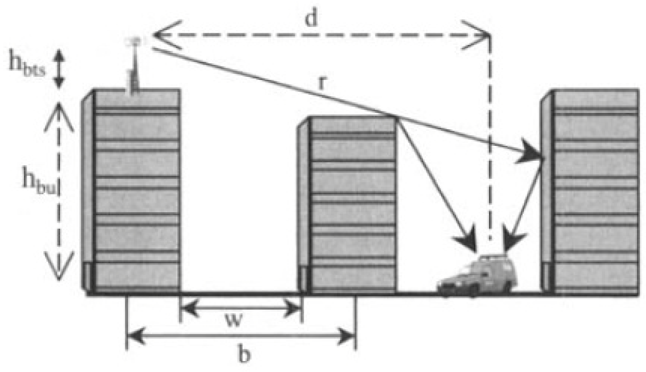
The most commonly used micro-cellular propagation model is the Walfish-Ikegami model. This model talks about two conditions: line-of-sight (LOS) and no-line-of-sight (NLOS).

For LOS

$$P = 42.6 + 26 \log d + 20\log f.$$

For the NLOS

$$P = 32.4 + 20 \log f + 20 \log d + L_{\text{rds}} + L_{\text{ms}}.$$



W–I model:
d: distance in km
f: frequency in MHz
Lrds: rooftop-street diffraction and scatter loss
Lms: multi-screen diffraction loss
w: road width
b: distance between the centres of two buildings
H_{bu}: height of the building

Capacity Planning

- Traffic Estimation
- Frequency re-use
- Avg. Antenna Height

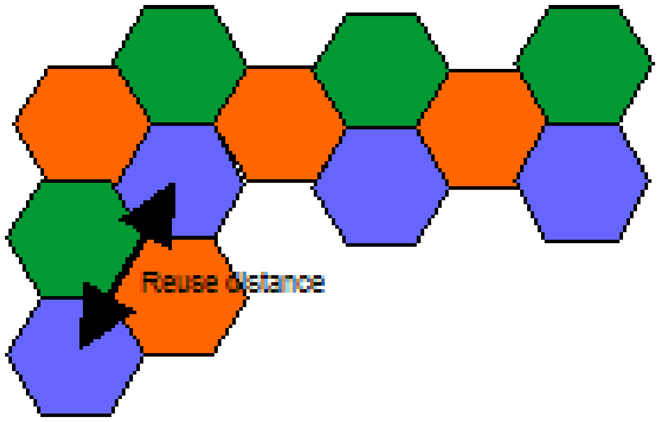
Traffic Estimation

- The amount of traffic is expressed in Erlangs, which is the magnitude of telecommunications traffic. An Erlang describes the amount of traffic in one hour :

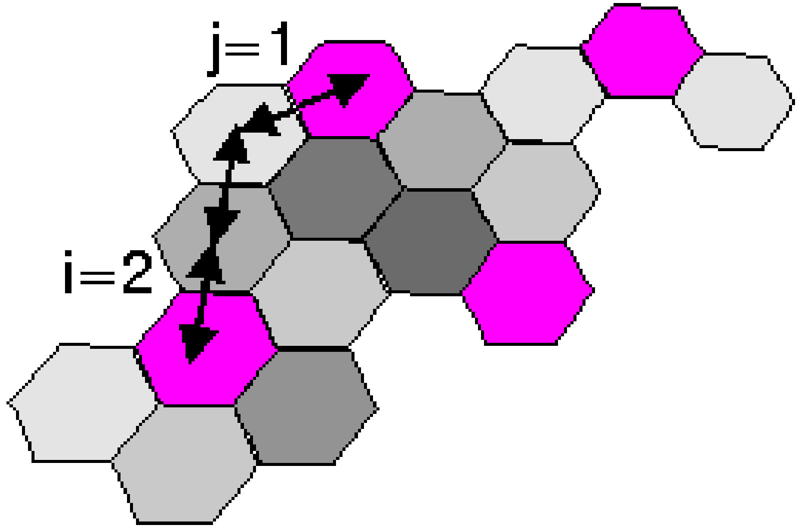
Erlang=(number of calls in hour)(average call length)/3600 s

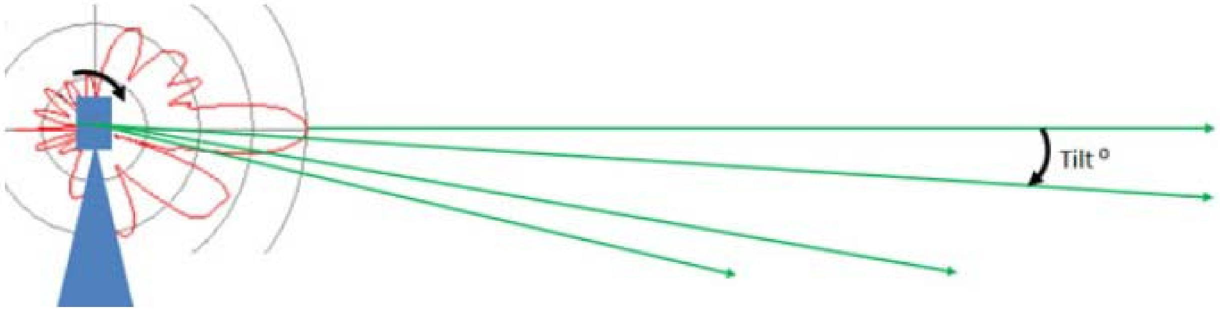
Frequency Reuse

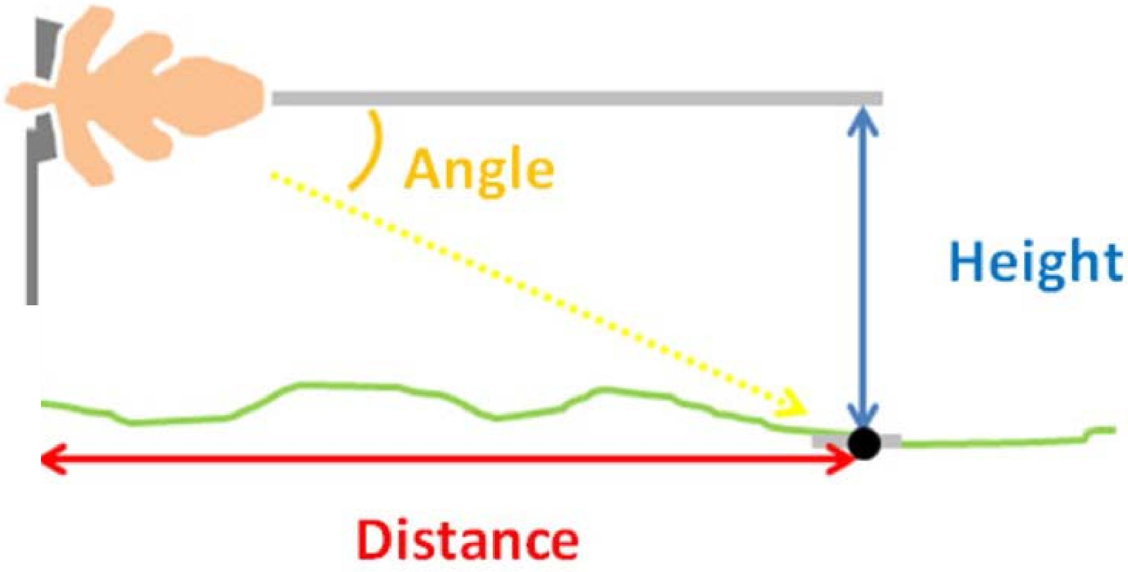
$$D = \sqrt{3N}\,R$$



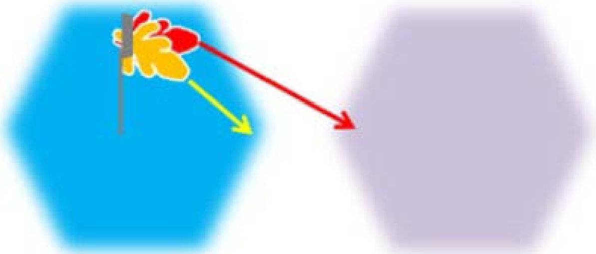
$$N = i^2 + ij + j^2$$







Angle = ArcTAN (Height / Distance)



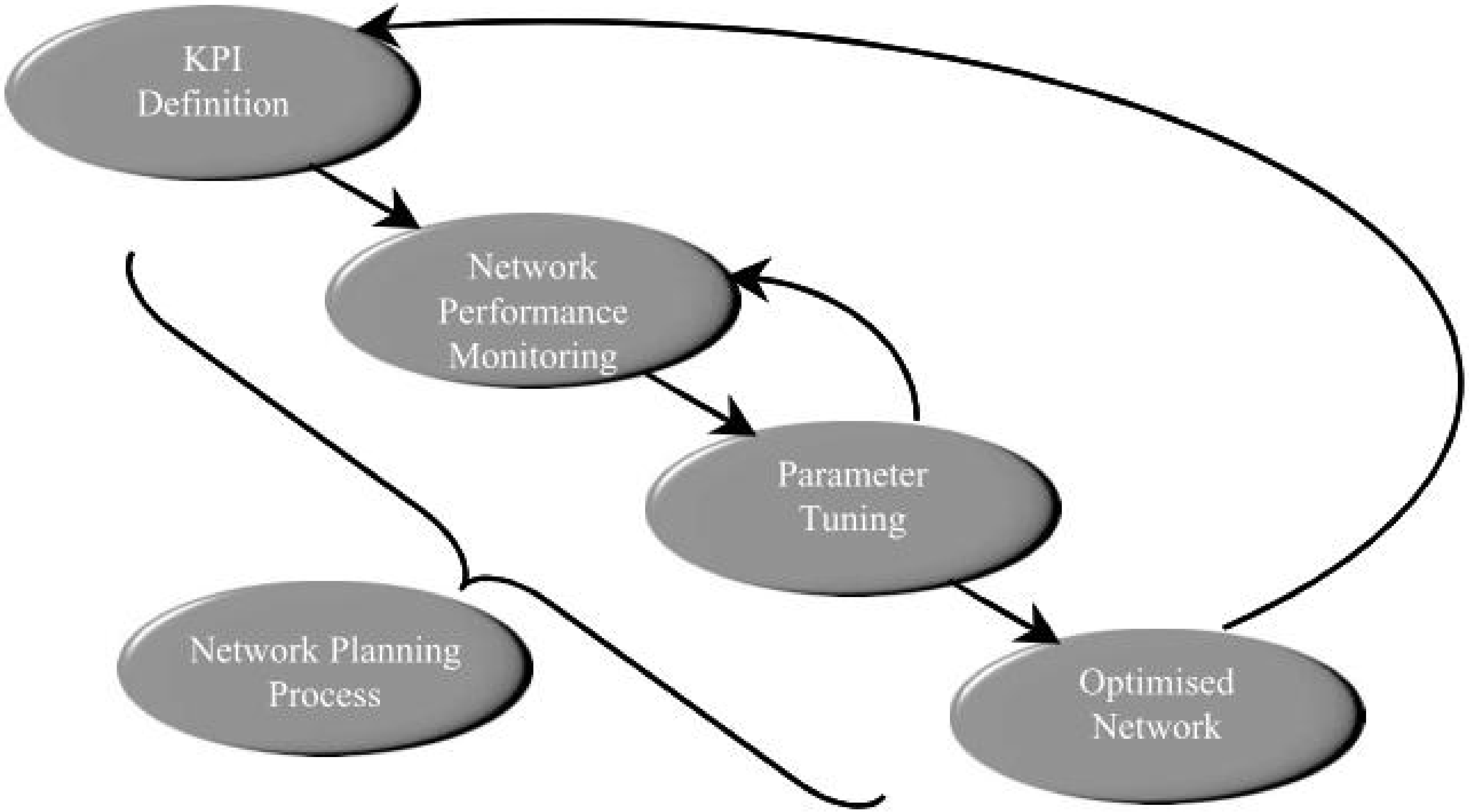
- ❑ Optical line of sight

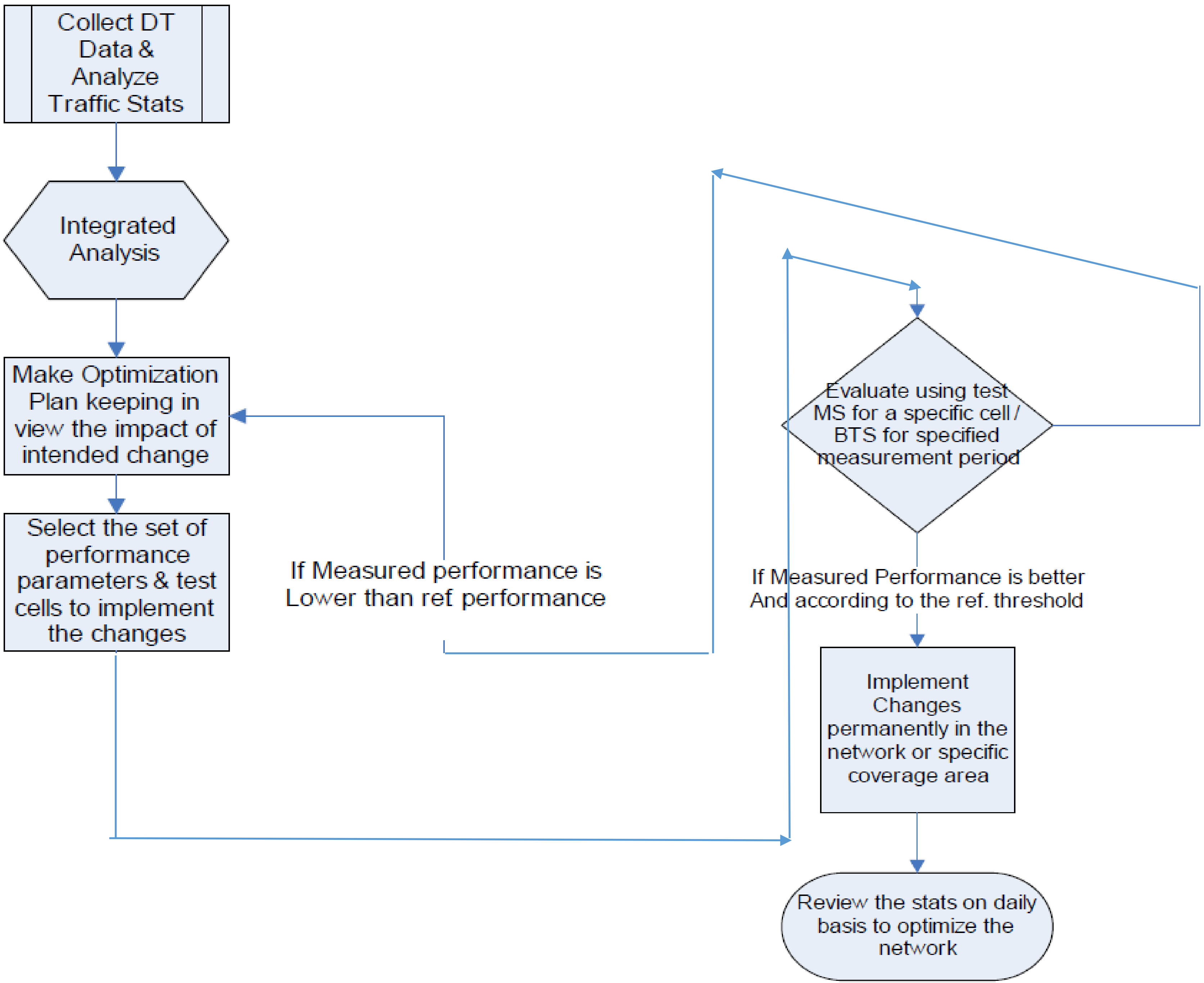
$$d = 3.57\sqrt{h}$$

- ❑ Effective, or radio, line of sight

$$d = 3.57\sqrt{Kh}$$

- **RADIO NETWORK OPTIMISATION**

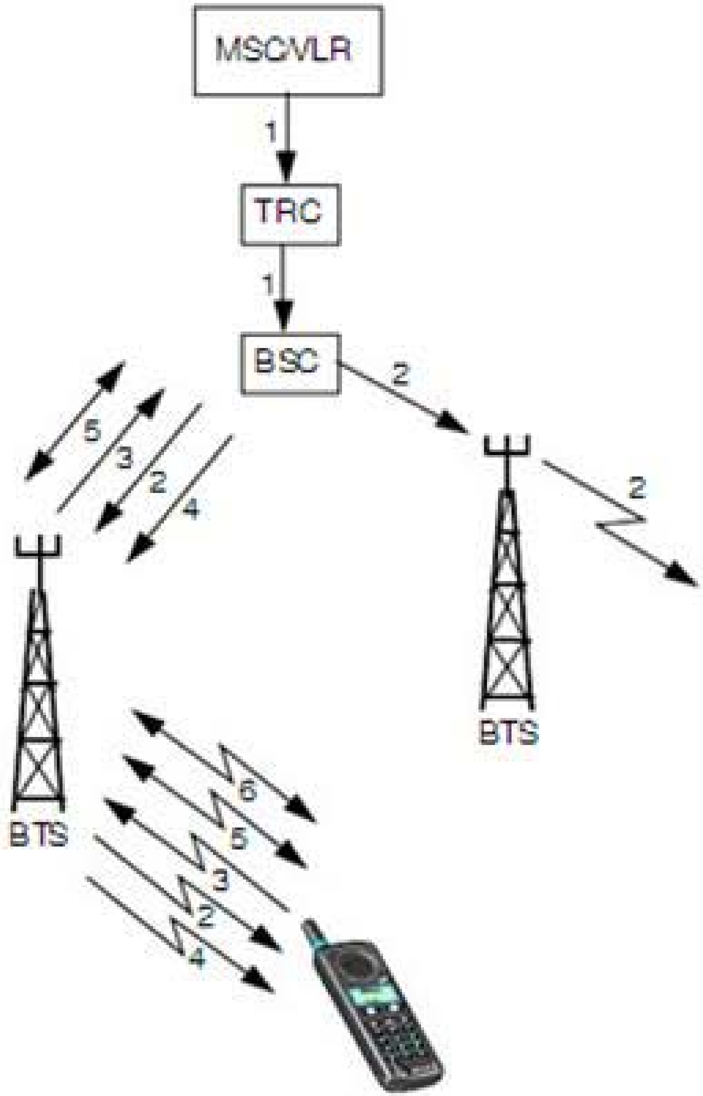



Collect DT Data & Analyze Traffic Stats
Integrated Analysis
Make Optimization Plan keeping in view the impact of intended change
Select the set of performance parameters & test cells to implement the changes
If Measured performance is Lower than ref performance
Evaluate using test MS for a specific cell / BTS for specified measurement period
If Measured Performance is better And according to the ref. threshold
Implement Changes permanently in the network or specific coverage area
Review the stats on daily basis to optimize the network

KPIs are more important for GSM radio network optimization & benchmarking to achieve remarkable QoS:

- Accessibly
- Paging Success Rate
- CSSR (Call Set up Success Rate).
- CDR (Call Drop Rate).
- HSR (Handover Success Rate).
- TCH (Traffic Channel) Congestion Rate.

Call to an MS



1. MSC/VLR sends paging command to all BSCs belonging to the location area (LA) where MS is located

2. BSC forwards the paging command to all BTSs in that LA, and the BTSs in their turn page the MS on the PCH

3. The MS responds to the BTS on the RACH and the BTS forwards the response to the BSC (forward to MSC)

4. The BSCs checks with the BTS if it has an SDCCH available and the BTS grants the MS an SDCCH by using the AGCH

5. The MS and the BTS signal on the SDCCH, measurement reports sent on SACCH are forwarded from the BTS to the BSC and once the signalling is done the BSC decides which TCH to use

6. TCH connection established between MS and BTS

Accessibility

Acessibility=*Total No of Successful Calls Setup / Total Calls Accesses to Network*

Paging Success Rate

The paging success rate measures the percentage of how many paging attempts that have been answered, either as a result of the first or the second repeated page .

- PSR=$PSR\ Time\ of\ Paging\ Responses$ / $Time\ of\ Paging$

Possible reasons for poor Paging Performance could be:

- Paging congestion in MSC, BSC and MSC
- Poor paging strategy
- Poor parameter setting
- Poor coverage and high interference.

The call setup success rate measures successful TCH assignments of total number of TCH assignment attempts

$$\text{CSSR}= 1-(SDCCH\ CR)(TCH\ ASR)$$

$$\text{CSSR}= \left(1-\frac{SDCCH\ Overflows}{SDCCH\ Call\ Attempts}\right)(1-TCH\ CR)(1-TCH\ ASR)100$$

CSSR might be affected and degraded due to following issues:

- Due to radio interface congestion.
- Due to lack of radio resources allocation (for instance: SDCCH).
- Increase in radio traffic in inbound network.
- Faulty BSS Hardware.
- Access network Transmission limitations (For instance: abis expansion restrictions

Improvement Methodologies:

- Transmission media Expansion to enhance hardware additions (such as TRX).
- Faulty Hardware Replacement (such as TRX) in order to ensure the resources availability in live network.

CDR might be affected due to following issues:

- Interference. Internal interference corresponds to in-band (900/1800 MHz) while external interference corresponds to other wireless (usually military) networks.
- Coverage limitation is also one of the factors, which increase CDR values.
- Hardware faults (such as BTS transceiver).

Improvement Methodologies:

- Faulty Hardware Replacement in order
- Frequency plans review
- Frequency hopping technique is also incorporated to minimize the effect of interference.
- Change of antenna orientation (azimuth/tilt) i.e., increase the down tilt of interferer cell antenna.

HSR might be affected and degraded due to following issues:

- Interference (either external or internal)
- Hardware faults (such as BTS transceiver)
- Location area code (LAC) boundaries wrongly planned
- Coverage limitation is also one of the factors, which decrease HSR values.

Improvement Methodologies:

- Interference free band i.e., Spectrum analysis might be done to ensure it.
- Coverage improvement is also a vital factor of HSR enhancement.
- Parameter modification such as Handover margin, traffic handover, power budget parameters to assist better cell handovers.

TCH (traffic channel) congestion might arise due to following issues:

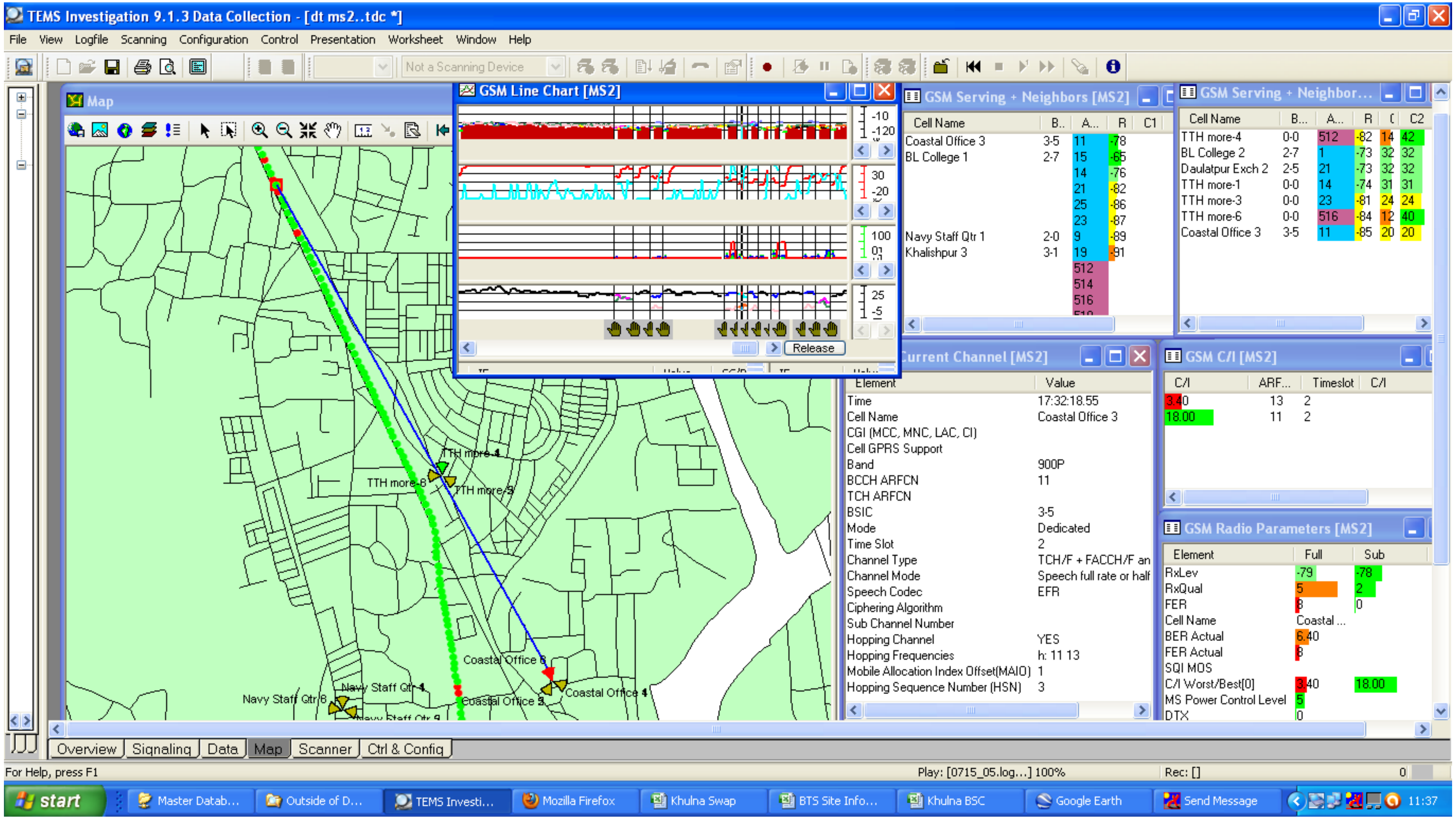
- TRX Hardware faults can also be incorporated as an increasing factor in TCH congestion.
- Increasing number of subscribers and/or traffic in a certain area also causes congestion.
- Lesser capacity sites

Improvement Methodologies:

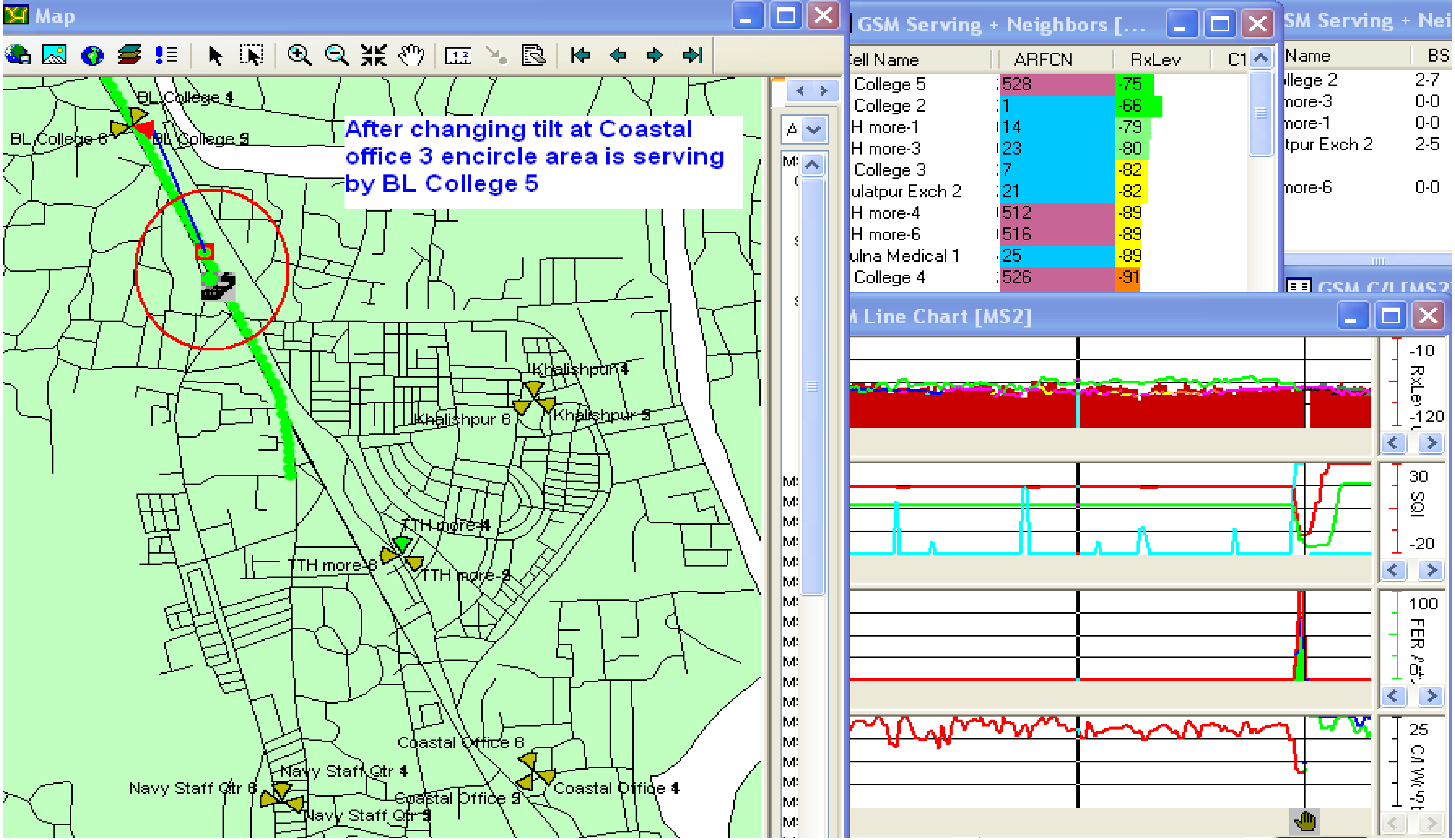
- BSS Resources addition and expansion (including transceivers and transmission media) are important factors for TCH congestion improvement.
- Faulty hardware maintenance or replacement can also minimize TCH congestion.
- Deployment of moving/portable BTS (commonly called COW BTS) can be used as a better solution to improve congestion in case of foreseeable special events such as sports events, important meetings, festivals and exhibitions etc.

Radio Network Optimization


Image © 2009 DigitalGlobe

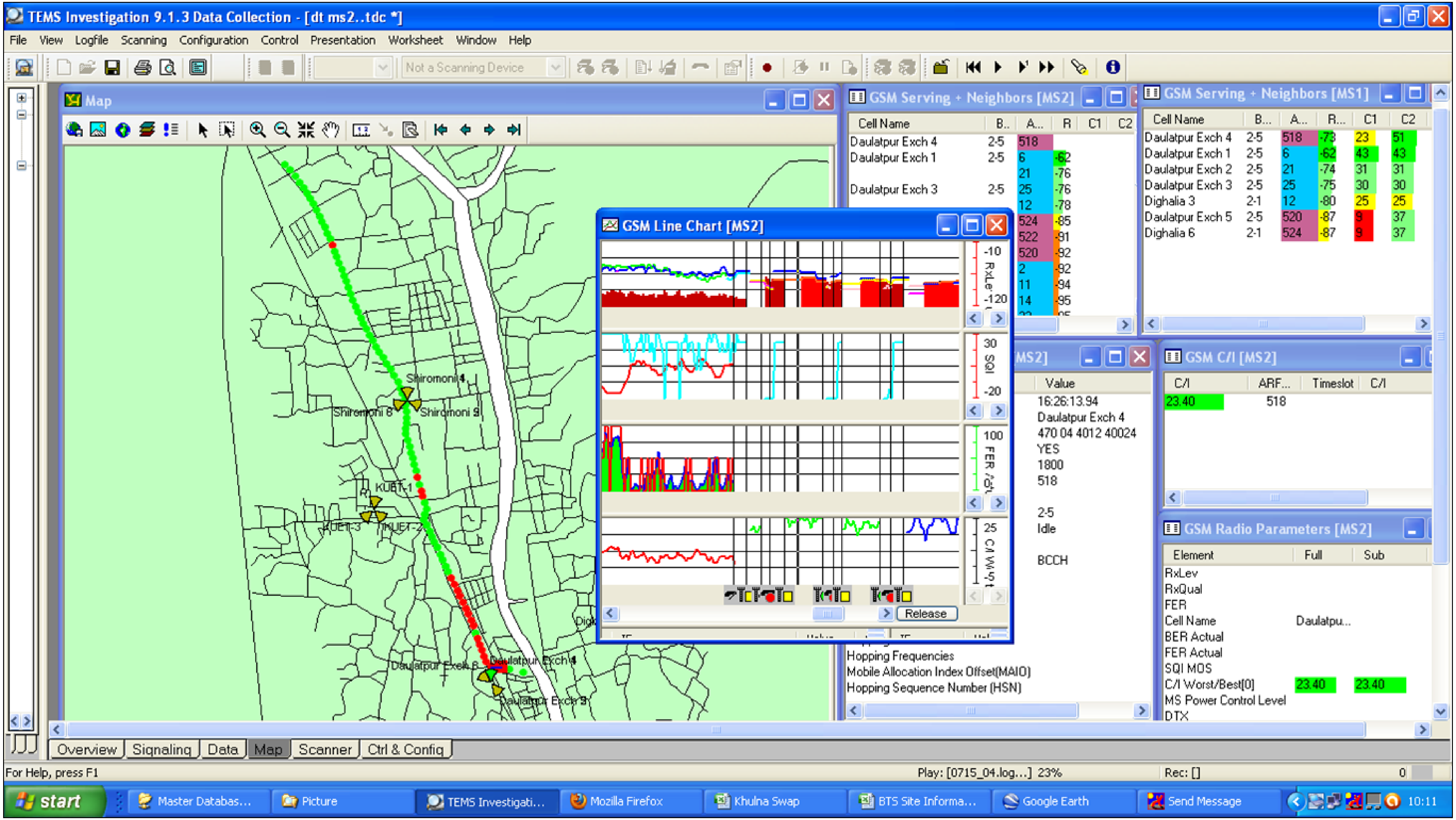


At this site previous tilt was 0/0/0 and after rectification present tilt is 0/0/2. This reduces ping-pong handover which improves voice quality.

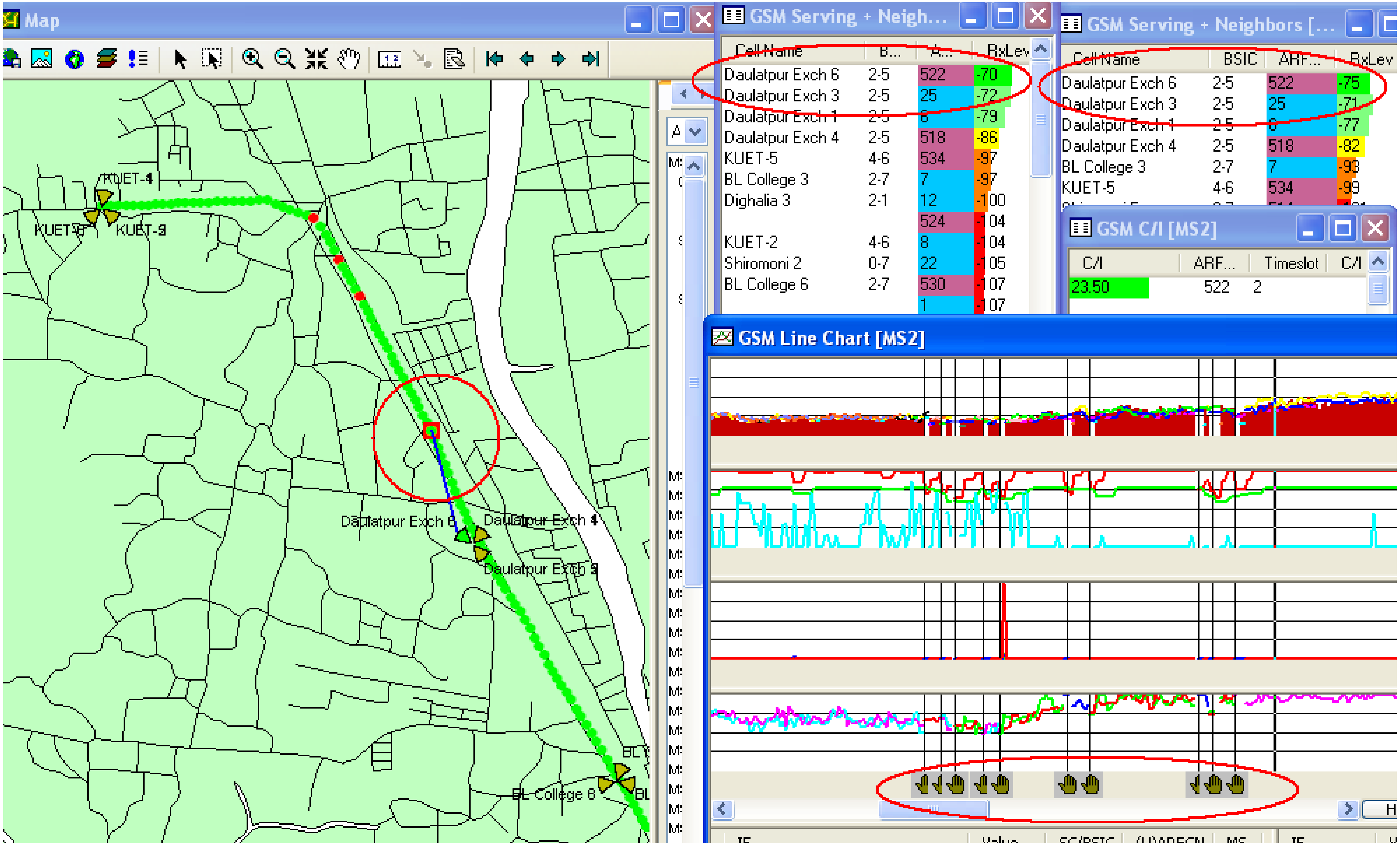


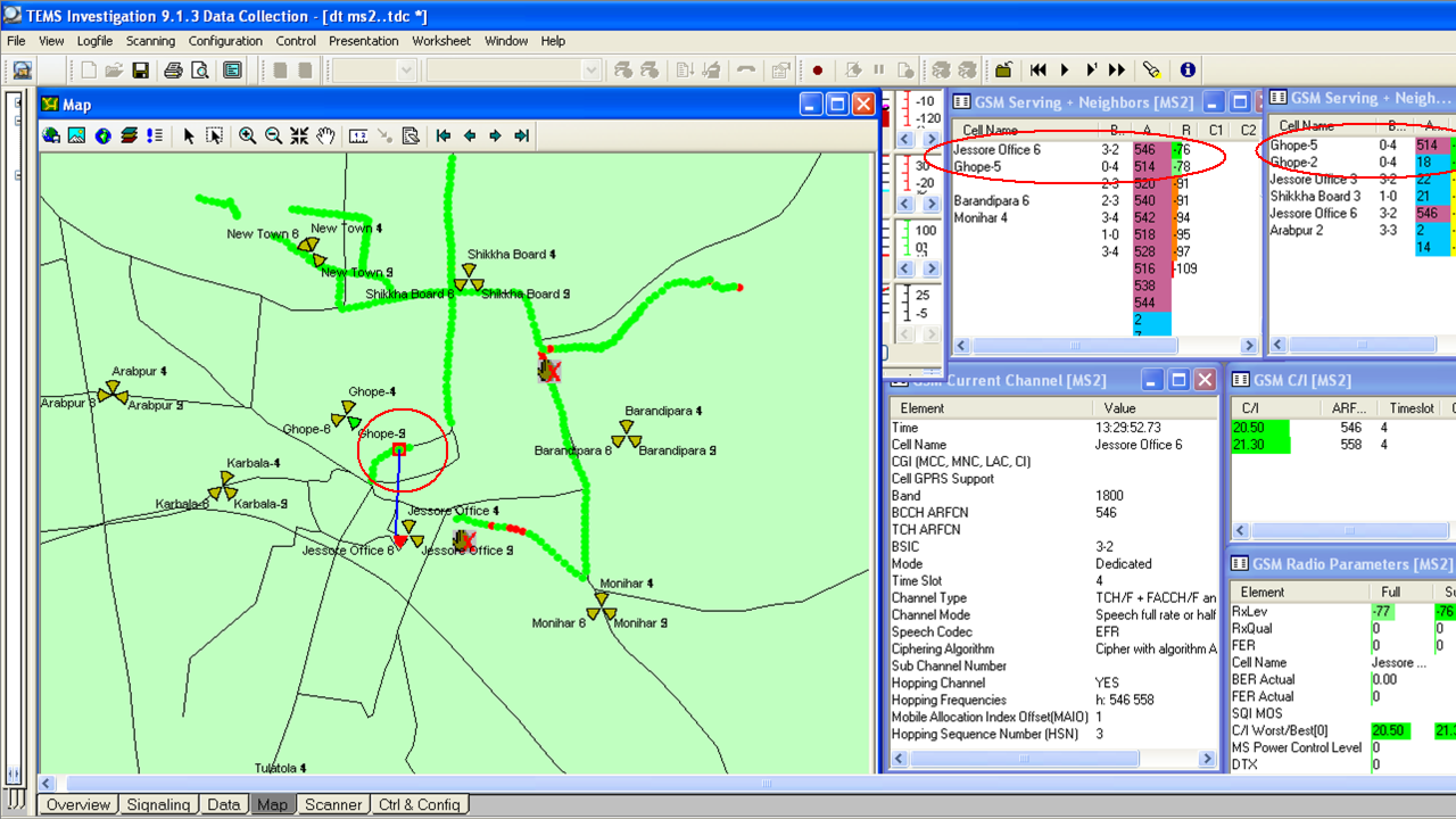
Map
After changing tilt at Coastal office 3 encircle area is serving by BL College 5
BL College 4
BL College 6
BL College 5
Khalishpur 4
Khalishpur 6
Khalishpur 5
TTH more-4
TTH more-6
TTH more-5
Coastal Office 6
Coastal Office 4
Coastal Office 5
Navy Staff Qtr 4
Navy Staff Qtr 6
Navy Staff Qtr 5
GSM Serving + Neighbors [...
ell Name
ARFCN
RxLev
C1
College 5 528 -75
College 2 1 -66
H more-1 14 -79
H more-3 23 -80
College 3 7 -82
ulatpur Exch 2 21 -82
H more-4 512 -89
H more-6 516 -89
ulna Medical 1 25 -89
College 4 526 -91
SM Serving + Nei
Name
BS
llege 2 2-7
more-3 0-0
more-1 0-0
tpur Exch 2 2-5
more-6 0-0
GSM C/I [MS2
Line Chart [MS2]
-10
RxLev
-120
30
SQI
-20
100
FER
25
C/I

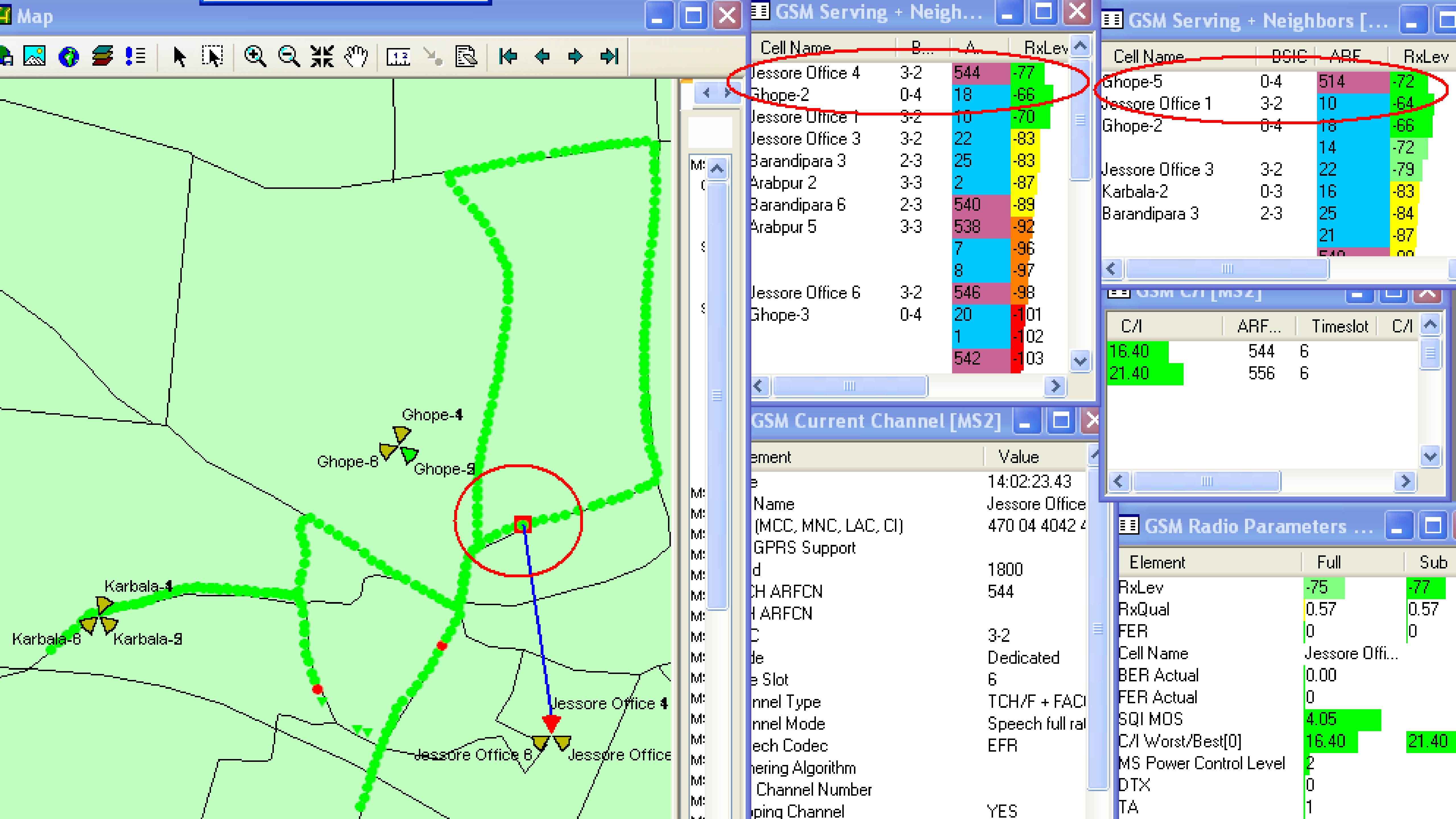
Handover relation needs to check which leads to interference and abnormal calldrop.

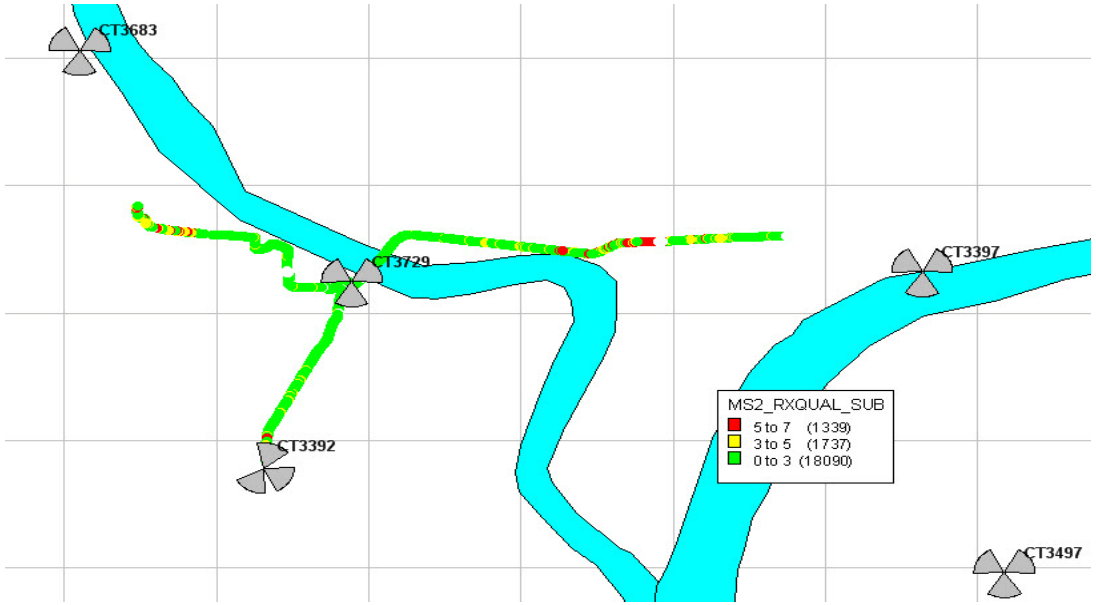


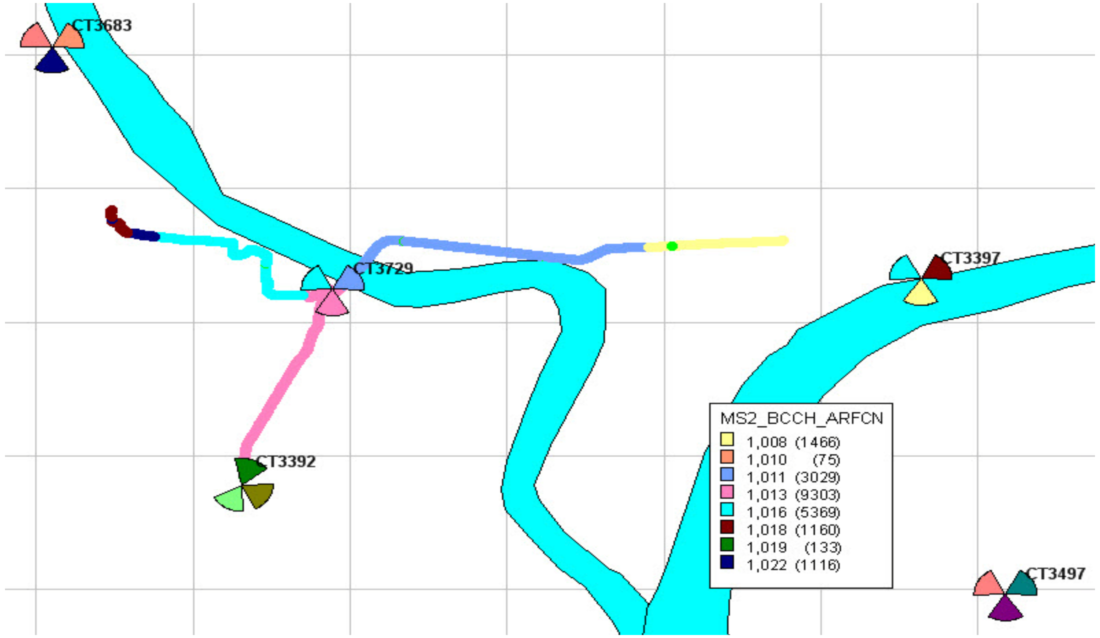
After activity: handover relation created

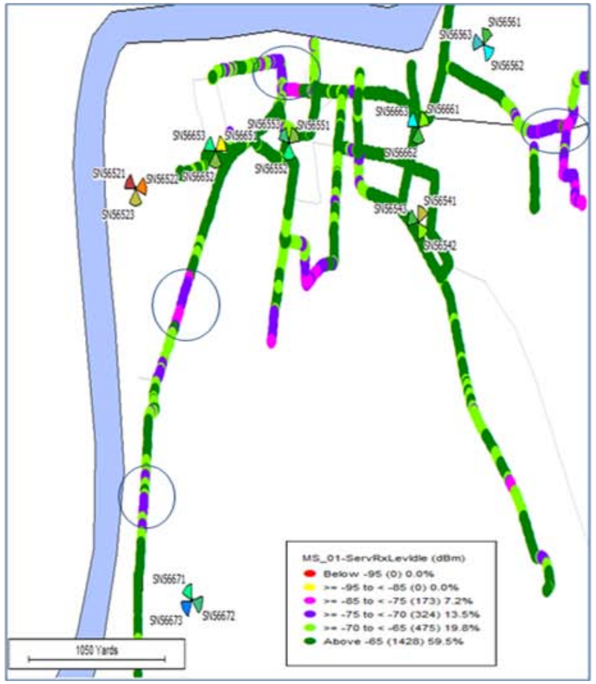


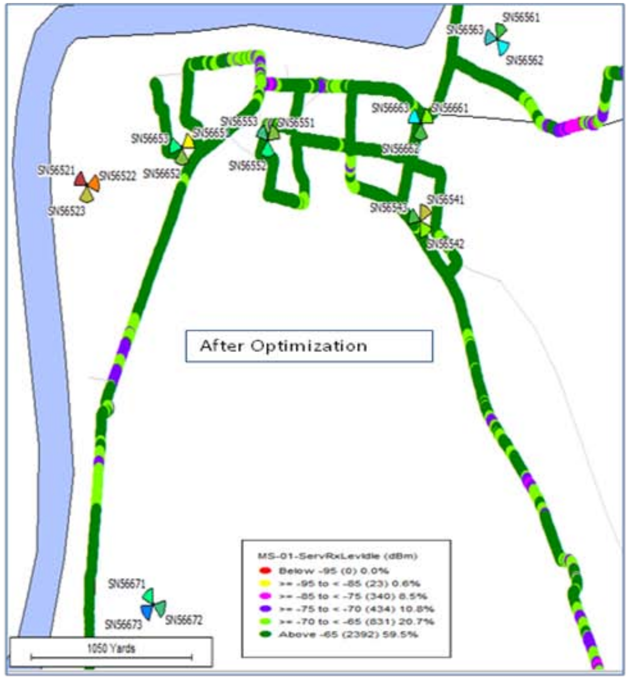

TEMS Investigation 9.1.3 Data Collection - [dt ms2..tdc *]
File View Logfile Scanning Configuration Control Presentation Worksheet Window Help
Map
New Town 6
New Town 4
New Town 5
Shikkha Board 4
Shikkha Board 6
Shikkha Board 5
Arabpur 4
Arabpur 6
Arabpur 5
Ghope-4
Ghope-6
Ghope-5
Barandipara 4
Barandipara 6
Barandipara 5
Karbala-4
Karbala-6
Karbala-5
Jessore Office 4
Jessore Office 6
Jessore Office 5
Monihar 4
Monihar 6
Monihar 5
Tulatola 4
GSM Serving + Neighbors [MS2]
Cell Name B... A R C1 C2
Jessore Office 6 3-2 546 -76
Ghope-5 0-4 514 -78
2-3 520 -91
Barandipara 6 2-3 540 -91
Monihar 4 3-4 542 -94
1-0 518 -95
3-4 528 -97
516 -109
538
544
2
GSM Serving + Neigh...
Cell Name B... A...
Ghope-5 0-4 514
Ghope-2 0-4 18
Jessore Office 3 3-2 22
Shikkha Board 3 1-0 21
Jessore Office 6 3-2 546
Arabpur 2 3-3 2
14
Current Channel [MS2]
Element Value
Time 13:29:52.73
Cell Name Jessore Office 6
CGI (MCC, MNC, LAC, CI)
Cell GPRS Support
Band 1800
BCCH ARFCN 546
TCH ARFCN
BSIC 3-2
Mode Dedicated
Time Slot 4
Channel Type TCH/F + FACCH/F an
Channel Mode Speech full rate or half
Speech Codec EFR
Ciphering Algorithm Cipher with algorithm A
Sub Channel Number
Hopping Channel YES
Hopping Frequencies h: 546 558
Mobile Allocation Index Offset(MAIO) 1
Hopping Sequence Number (HSN) 3
GSM C/I [MS2]
C/I ARF... Timeslot
20.50 546 4
21.30 558 4
GSM Radio Parameters [MS2]
Element Full Su
RxLev -77 -76
RxQual 0 0
FER 0 0
Cell Name Jessore ...
BER Actual 0.00
FER Actual 0
SQI MOS
C/I Worst/Best[0] 20.50 21.3
MS Power Control Level 0
DTX 0
Overview Signaling Data Map Scanner Ctrl & Config


Map
Ghope-4
Ghope-6
Ghope-5
Karbala-4
Karbala-6
Karbala-5
Jessore Office 4
Jessore Office 6
Jessore Office
GSM Serving + Neigh...
Cell Name
RxLev
Jessore Office 4 3-2 544 -77
Ghope-2 0-4 18 -66
Jessore Office 1 3-2 10 -70
Jessore Office 3 3-2 22 -83
Barandipara 3 2-3 25 -83
Arabpur 2 3-3 2 -87
Barandipara 6 2-3 540 -89
Arabpur 5 3-3 538 -92
7 -96
8 -97
Jessore Office 6 3-2 546 -98
Ghope-3 0-4 20 -101
1 -102
542 -103
GSM Serving + Neighbors [...
Cell Name
BSIC
ARF
RxLev
Ghope-5 0-4 514 -72
Jessore Office 1 3-2 10 -64
Ghope-2 0-4 18 -66
14 -72
Jessore Office 3 3-2 22 -79
Karbala-2 0-3 16 -83
Barandipara 3 2-3 25 -84
21 -87
C/I
ARF...
Timeslot
16.40 544 6
21.40 556 6
GSM Current Channel [MS2]
Value
14:02:23.43
Name Jessore Office
(MCC, MNC, LAC, CI) 470 04 4042 4
GPRS Support
1800
CH ARFCN 544
H ARFCN
3-2
Dedicated
Slot 6
Channel Type TCH/F + FACI
Channel Mode Speech full ra
Speech Codec EFR
Channel Number
YES
GSM Radio Parameters ...
Element
Full
Sub
RxLev -75 -77
RxQual 0.57 0.57
FER 0 0
Cell Name Jessore Offi...
BER Actual 0.00
FER Actual 0
SQI MOS 4.05
C/I Worst/Best[0] 16.40 21.40
MS Power Control Level 2
DTX 0
TA 1


CT3683
CT3729
CT3397
CT3392
CT3497
MS2_RXQUAL_SUB
5 to 7 (1339)
3 to 5 (1737)
0 to 3 (18090)


CT3683
CT3729
CT3397
CT3392
CT3497
MS2_BCCH_ARFCN
1,008 (1466)
1,010 (75)
1,011 (3029)
1,013 (9303)
1,016 (5369)
1,018 (1160)
1,019 (133)
1,022 (1116)


1050 Yards
MS_01-ServRxLevIdle (dBm)
Below -95 (0) 0.0%
>= -95 to < -85 (0) 0.0%
>= -85 to < -75 (173) 7.2%
>= -75 to < -70 (324) 13.5%
>= -70 to < -65 (475) 19.8%
Above -65 (1428) 59.5%


After Optimization
1050 Yards
MS-01-ServRxLevIdle (dBm)
Below -95 (0) 0.0%
>= -95 to < -85 (23) 0.6%
>= -85 to < -75 (340) 8.5%
>= -75 to < -70 (434) 10.8%
>= -70 to < -65 (831) 20.7%
Above -65 (2392) 59.5%

Summery:

- The success of GSM network depends on its three factors: coverage, capacity and quality.
- Capacity is based on an assessment of dropped calls and congestion that has been removed by proper optimization. Quality has been improved by eliminating interference from both external and internal sources.
- Drive test is performed to asses capacity and coverage.
- The quality of the radio network depends on its coverage, capacity and frequency allocation. Most severe problems in a radio network can be attributed to signal interference, dropped calls and the amount of congestion.
- KPI needs to attain the optimal values on completion of the process.